micro WAVE SYNTHESIZER

micro WAVE XT SYNTHESIZER

XT k ADVANCED WAVETABLE SYNTHESIZER

Bedienungsanleitung

User's Manual

waldorf

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Waldorf Electronics reserves the right to upgrade the unit with the latest technological advances if necessary.
This warranty does not cover defects due to abuse, operation under other than specified conditions, or repair by unauthorized persons. The warranty covers only those malfunctions caused by material or workmanship defects that occur during normal operation.

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Waldorf Electronics
Support Department
Neustraße 9-12
53498 Waldorf
Germany

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Straße / Street:

PLZ, Wohnort / ZIP Code, City:

Land / Country:

Telefon / Telephone:

Telefax / Facsimile:

Produkt / Product:

☐ micro WAVE II SYNTHESIZER ☐ micro WAVE XT SYNTHESIZER

☐ XTk

Sonstige verwendete Geräte / Other used equipment:

Sonderausstattungen / Custom features:

Seriennummer / Serial number:

Kaufdatum / Purchase date:

Name Ihres Händlers / Name of your dealer:

Ort Ihres Händlers / City of your dealer:

Produktunterstützung / Product Support

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1 Schicken Sie uns eine E-Mail. Das ist der mit Abstand effizienteste und schnellste Weg, uns zu erreichen. Ihre Fragen können sofort an die richtige Stelle weitergeleitet und innerhalb kürzester Zeit beantwortet werden.

info@waldorf-gmbh.de

Send us an e-mail message. This is the most efficient and fastest way to contact us. Your questions will be forwarded immediately to the resident expert and you will quickly receive an answer.

2 Senden Sie uns ein Telefax. Fast so schnell wie E-Mail, allerdings für Sie und uns weniger komfortabel.

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Send us a fax. This is as fast as e-mail, but not quite as comfortable for you and us.

3 Schicken Sie uns einen Brief. Etwas langsamer, dafür jedoch genauso zuverlässig wie ein Telefax.

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Send us a letter. It will take a bit longer, but it is just as dependable as a fax.

4 Und wenn es ganz dringend ist, rufen Sie uns an. Wir versuchen, Ihre Fragen möglichst sofort zu beantworten.

+49-(0)2636-976464

If you're in big hurry, call us, we'll try to answer your questions right away.

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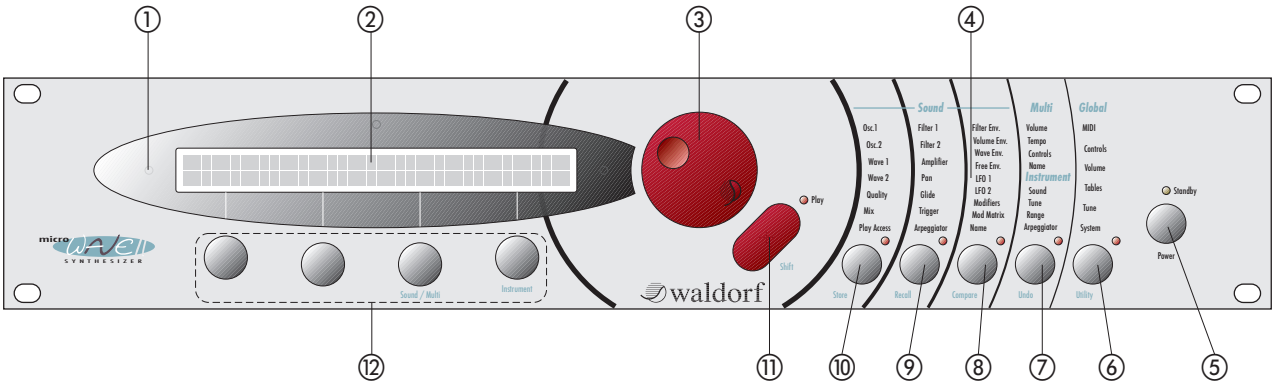

① MIDI status LED

② Display

③ Page dial for selecting sounds and parameter pages

④ Parameter pages

⑤ Power switch with **Standby** LED

⑥ Select key for sound parameters
Alternate function **Utility**

⑦ Select key for sound parameters
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⑧ Select key for sound parameters
Alternate function **Compare**

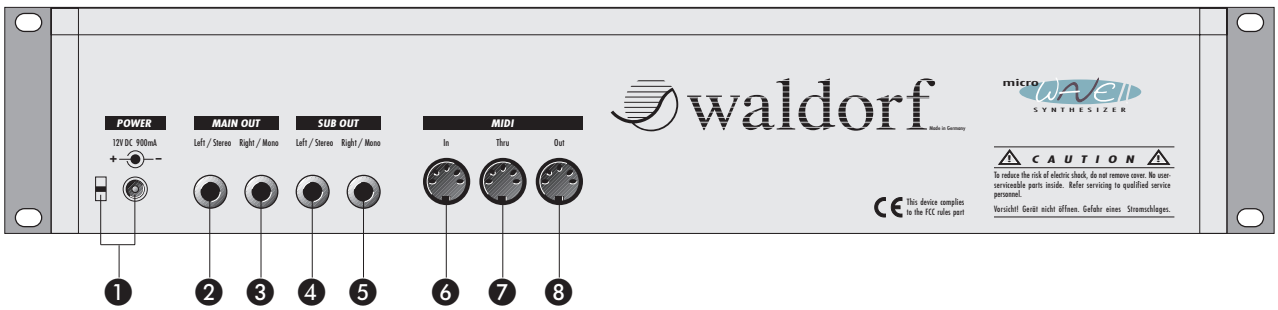
⑨ Select key for multi-/instrument parameters
Alternate function **Recall**

⑩ Select key for global parameters
Alternate function **Store**

⑪ **Play** button for selecting the play mode
Alternate function **Shift**

⑫ Value dials for adjusting parameters

Rear Panel



❶ **Power** supply socket DC 12V with cable clip

❷ **Main Out Left/Stereo**

❸ **Main Out Right/Mono**

❹ **Sub Out Left/Stereo**

❺ **Sub Out Right/Mono**

❻ **MIDI In** jack

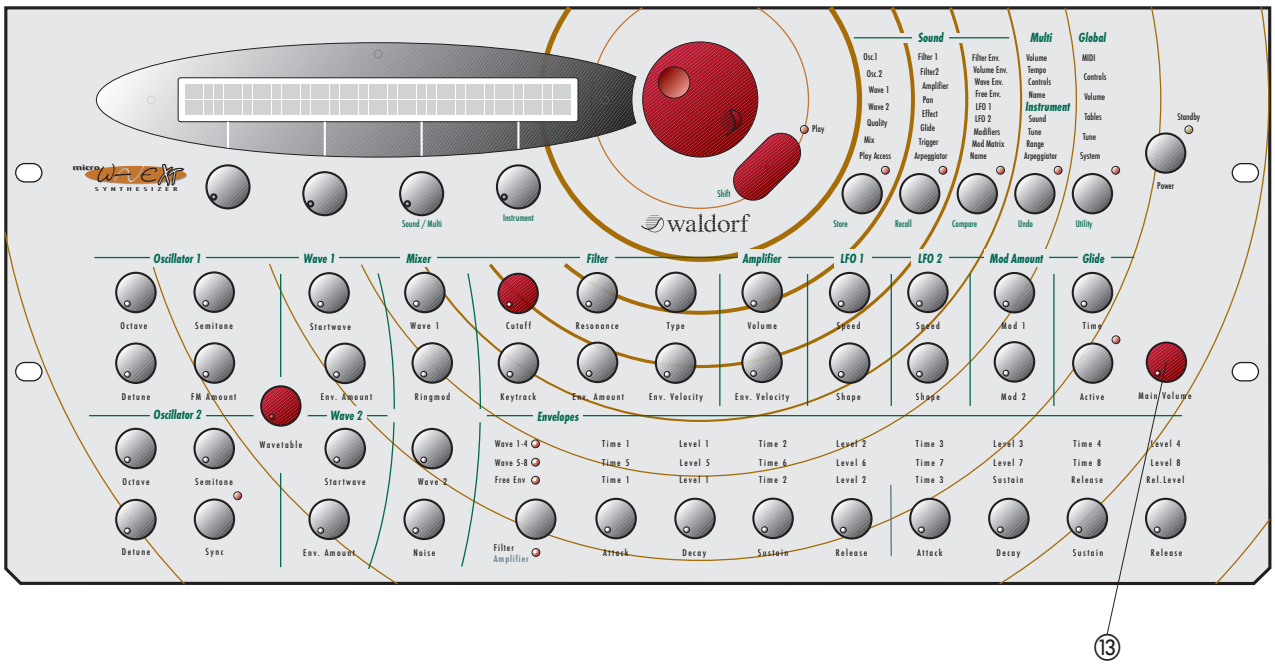
❼ **MIDI Thru** jack

❽ **MIDI Out** jack

Additional Controls and Connectors of the MicroWave XT

The MicroWave XT features the same controls and connectors as the MicroWave II. In addition it offers individual controls for the most parameters. The items labeled on this page indicate special features that are available on the MicroWave XT only.

Front Panel



⑬ **Main Volume** rotary control for setting the overall volume.

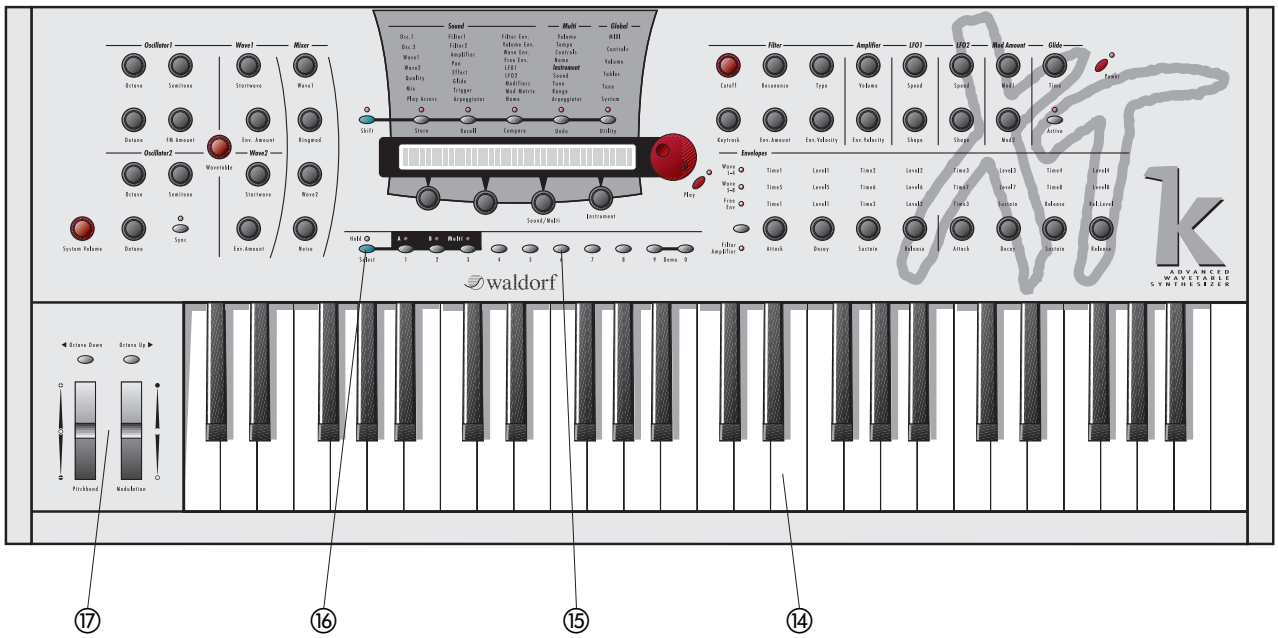
Rear Panel

❾ **Analog In** jack for processing external audio signals

Additional Controls and Connectors of the XTk

The XTk features the same controls and connectors as the MicroWave XT. In addition it offers a 4 octave keyboard, a pitchbend and a modulation wheel, as well as numeric keys and a select button for easy program access. The items labeled on this page indicate special features that are available on the XTk only.

Front Panel



⑭ Keyboard Section

⑮ Numeric keys for selecting programs

⑯ **Select** key with **Hold** led

⑰ Controller Section with pitchbend wheel, modulation wheel and **Octave Up / Octave Down** buttons

Rear Panel

⑩ **Pedal / CV In** jacks for connecting foot controllers or analog voltages

Foreword

Thank you for purchasing the MicroWave II/XT/XTk. You now own a wavetable synthesizer featuring a wide range of unique sounds.

To ensure your instrument functions properly and enjoys a long life, please read and heed the instructions in this manual.

Software development:	Stefan Stenzel, Niels A. Moseley, Jürgen Fornoff
Hardware development:	Thomas Kircher
Design:	Axel Hartmann
Manual:	Oliver Rockstedt
Revision Date:	25.10.99

We would like to thank:

Wolfgang Düren, Axel Hartmann, Frank Schneider, Wolfram Franke, Erna Moormann, Beate Walkowiak, Achim Lenzgen, Claudia Nähring, Martin Neideck, Philipp Dahlhausen, Birger Degen, Michael Haydn, Dr. Georg Müller, Drew Neumann, Holger "Tsching" Steinbrink, Gunther Gräfe, Kurt "Lu" Wangard, H.-P. "Bonni" Bonnenberg, Frank Müller, Hubertus "Hubi" Weller, Sigi Barishi, Holger Bahr, Jörg Hüttner, Piera Caccia, Evi Mognol, Mike Caroll, Steffi vom Berg, Cordula Müller, Sabine Weiland, Achim Flor, Thilo Kloft, Martin Herbst, Alex Sauff, Geoff Farr… and anyone we have forgotten.

Very special thanks to the FSF for the GNU Compiler gcc.

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About this Manual

This manual was written to help you become familiar with the Waldorf MicroWave II/XT/XTk. It will also help experienced users with routine tasks.

To avoid confusion, the terminology in this manual is based on the MicroWave II/XT/XTk parameter names. You will find a glossary at the end of the manual; it explains the various terms used herein.

We also used a uniform set of symbols to alert you to topics of particular interest or significance. Important terms are highlighted in bold letters.

Symbols

⚠ Caution: The comments that follow this symbol will help you avoid errors and malfunctions.

☞ Instructions: Follow these guidelines to execute a desired function.

Info: Additional information on a given topic.

Paragraphs marked with this symbol refer to the additional functions of the MicroWave XT.

Paragraphs marked with this symbol refer to the additional functions of the XTk.

Highlighted Control Features and Parameters

All of the MicroWave II/XT/XTk's keys, pots and parameters are highlighted in **bold** letters throughout the manual. Also every control element has an unique position no. ①…⑰ which refers to the diagrams at the beginning of this manual. The connectors on the rear panel are referenced by position no. ❶…❿. We suggest you make a copy of this page to have it at hand when necessary.

Example: • Press the **Play** key ⑪.

The MicroWave II/XT/XTk's diverse modes and parameter pages are illustrated in a depiction of the display:

```
Octave 1|Semitone | Detune  |Keytrack
  -2    |   +07   |   +00   |  +100%
```

A given parameter's value range is indicated from low to high with the two values shown in italic letters, separated by three dots.

Example: **Semitone** *-12…+12*

General Safety Guidelines

⚠ **Please read the following safety tips carefully!**
They include several precautions you should always observe when dealing with electronic equipment.
Read all of the instructions before operating your device.

Suitable Operating Conditions

- Use the device in enclosed rooms only.
- Never use the device under damp conditions such as in bathrooms, washrooms or around indoor swimming pools.
- Do not use the device in extremely dusty or dirty environments.
- Ensure adequate ventilation is available at all sides of the device, especially when you mount it in a rack.
- Do not place the device near heat sources such as radiators.
- Do not expose the device to direct sunlight.
- Do not expose the device to extreme vibrations.

Power Supply

- Use only the included AC adapter (MicroWave II and XT only).
- Plug the adapter only into wall sockets that are properly grounded.
- Make sure the available power supply has the required rating indicated on the adapter. If you have any doubts, consult a qualified electrician.
- Never install a different plug. If the included cable is not equipped with a suitable plug for your local sockets, take it to a qualified electrician.
- Unplug the device when you are not using it for longer periods.
- Never touch the plug with wet hands.
- Always pull the plug when unplugging the device, never the cable.

Operation

- Never place objects containing liquids on or near the device.
- Place the device on a stable base only. Use a suitable platform or rack.
- Make sure no foreign objects find their way into the chassis. If for some reason this should occur, switch the power off, unplug the device and consult a qualified repair center.
- This device, used on its own or with amplifiers, speakers or headphones, can generate volume levels that may do irreparable damage to your hearing. For this reason you should keep the volume at tolerable levels.

Maintenance

- Do not open the device or remove the cover. Refer all service and repair tasks to qualified personnel. The interior of the chassis contains no components that require user maintenance.
- Use only a dry, soft cloth or brush to clean the device.
  Never use alcohol, cleaning solutions or similar chemicals. They will damage the surface of the chassis.

Proper Use

This device is designed exclusively to produce low-frequency audio signals for the purpose of generating sound. Any other use is prohibited and voids the warranty extended by Waldorf Electronics GmbH. Waldorf Electronics GmbH is not liable for damages due to incorrect use.

Setup and Operation

Inventory

The Waldorf MicroWave II/XT/XTk comes complete with:

- the MicroWave II or MicroWave XT or XTk
- 12V/1000mA DC adapter (MicroWave II or XT only)
- warranty card (inside the manual)
- this manual

Please ensure all the items above were included. If something is missing, contact your local dealer.

We recommend that you save the original packing material for future transport.

⚠ Make sure you fill out the warranty card and send it to the appropriate distributor or the address printed on the registration card. This is the only way we can keep you informed of upgrades and updates. Other available services are listed on the warranty card.

Setup

Place the MicroWave II/XT/XTk on a clean, even surface. If you choose to take the device on the road, we suggest you mount it in a 19" rack or keyboard case. The MicroWave II takes up 89mm, equivalent to 2 rack spaces, the MicroWave XT takes up 222mm, equivalent to 5 rack spaces.

Connections

In order to get started with your MicroWave II/XT/XTk you will need an AC wall socket, a MIDI keyboard, a mixing console, an amp and an audio monitor such as a speaker cabinet. You can also use a computer or sequencer rather than a MIDI keyboard.

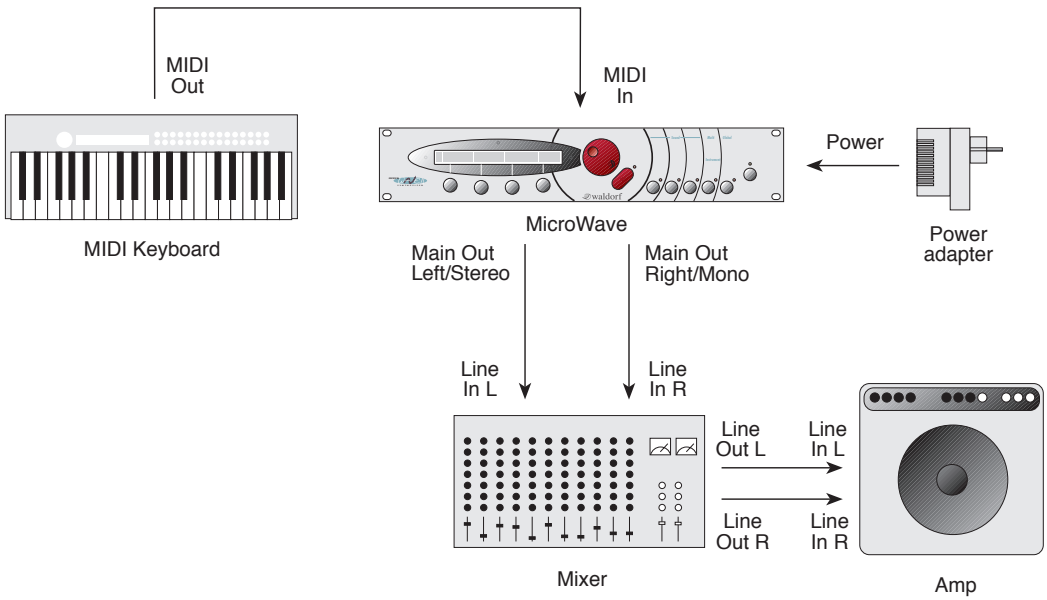


Diagram 1: Connections

☞ Follow these steps to connect the devices:

- Turn all units off.
- Connect the MicroWave II/XT/XTk's main audio outputs **Main Out Left/Stereo ❷** and **Main Out Right/Mono ❸** to your mixing console. Optionally connect the two auxilliary audio outputs **Sub Out Left/Stereo ❹** and **Sub Out Right/Mono ❺** too.
- Connect your keyboards **MIDI Out** jack to the MicroWave II/XT/XTk's **MIDI In** jack ❻. If you own a XTk, you can use the internal keyboard.
- Connect the included adapter to the MicroWave II/XT's **Power Supply ❶** socket and fix the wire with the cable clip beside the socket. The XTk model does not need an ac adapter an can be connected to a wall outlet directly.
- Insert the adapter plug in a suitable wall outlet (MicroWave II or XT only).
- First switch on the connected MIDI keyboard (if any) and then the mixing console and amp.

If you do not choose to connect a mixing console, you can patch the MicroWave II/XT/XTk's output signals directly to an amp. Use an input usually called Aux or Tape input. If you do not want to send a stereo signal, use the **Main Out Right/Mono ❸** output. If you do not insert a plug into **Main Out Left/Stereo ❷,** then the mono master signal is routed via the right output.

⚠ **Before connecting and disconnecting the MicroWave II/XT/XTk to a power supply source, turn your amp's volume control all the way down to avoid damage due to on/off switching noise.**

The MicroWave II/XT/XTk produces a high level output signal (see technical data). Please take care that the connected playback device is suitable for the high level of an electronic instrument.

Never use the mic or phono input of the connected amp!

Analog Input

The MicroWave XT and XTk provides an **Analog In** jack ❾ that can be used to feed in an external signal into the mixer section. Therefore, the signal can be processed via the filters and the effects section in the same way as the oscillators.

As the external signal is treated like any other sound source within the MicroWave XT/XTk, it is necessary to trigger the Amplifier Envelope to get the signal passed through. To do so, notes must be sent to the MicroWave XT/XTk's sound generation, either by receiving MIDI notes, the XTk's keyboard or via the internal arpeggiator.

Quick Start

This chapter gives you a quick introduction into the MicroWave II/XT/XTk and its features. It is written for those people that want to get a quick success without reading tons of manual stuff. Although the MicroWave II/XT/XTk is a very complex device with many capabilities, its basic operation is quite easy to understand. But there are also more complicated things that make it necessary to take a deeper look into this manual from time to time.

Basic Setup

1. Press the **Power** button ⑤ to switch on the MicroWave II/XT/XTk. The display ② will show a startup message which disappears after a few seconds.
2. When you want to switch off the power, press and hold the **Power** button ⑤ again. The display now shows a countdown from 10 to 0. When 0 is reached, the MicroWave is switched off. If you release the **Power** button before, nothing will happen. This is just a precaution to prevent data loss by accidently hitting the button.
3. Before you can start playing the MicroWave II/XT/XTk, you have to ensure that its MIDI receive channel is set properly. When you power up for the very first time, channel 1 is selected. To change the setting, press the **Utility** button ⑥. The display now shows:

```
Channel |PrgChange|BendRange|Device ID
  01    |  multi  |   012   |   000
```

Use the first value dial ⑫ below the display to change the MIDI receive channel.

Sound Mode

In Sound mode, the MicroWave II/XT/XTk can play one sound at a time. You can select between 256 Sound programs, which are organised in two banks *A001…B128* and *B001…B128*.

Selecting Sound Programs

1. Press the **Play** button ⑪ to return to the program select page. The display now shows the program number and the name of the currently selected program:

```
Play Sound A001  |  Mode   |Main Vol.
Saw Repeat   WMF |  Sound  |   100
```

Play some notes on your MIDI keyboard and listen to the sound.

2. If you want to adjust the MicroWave II/XT/XTk's volume, use the rightmost value dial, labeled **Main Vol.**
3. Use the Page Dial ③ to select other sound programs. Turning the dial clockwise increases the program number, turning the dial counterclockwise decreases it. On the XTk, you can also use the numeric keys ⑮ to enter a 2 or 3 digit program number in the range 001…128.

Editing Sound Parameters via Play Access

Now it is time to do some edits on a sound program. The easiest way for editing sound parameters is using the so-called **Play Access** page.

1. First, switch back to program *A001 Saw Repeat WMF*.
2. Press the **Play** button ⑪ again to access this page. The display then shows 4 sound parameters that by adjusted directly via the corresponding value dials:

3. Use the value dials to change the sound parameters and listen to the effect on the generated sound. Actually, you can define the parameter set in this page on your own. This is described later in the manual.

Comparing edited and original Program

You may always check your modifications against the original version of the program. Though you can decide whether editing is going the right way or not.

1. Press the **Compare** key ⑧ while holding the **Shift** key ⑪.
2. The MicroWave II/XT/XTk now uses the original parameter values as they were set before editing was applied. The display also shows these values. Play some notes to listed to the unedited sound.
3. Press the **Compare** key ⑧ while holding the **Shift** key ⑪ again. This brings you back to the edited sound program.

Recalling Edits

If you don't like the changed sound program, you can void the edits at any time and return to the original.

To do so, press the **Recall** key ⑨ while holding the **Shift** key ⑪.

Storing Programs

After editing the program you have to store it to keep the changes permanent.

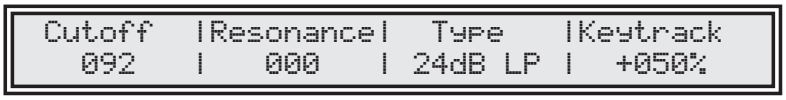
1. Press the **Store** key ⑩ while holding the **Shift** key ⑪. The display now shows:

2. Use the rightmost value dial to select a memory location for the edited sound. You can also leave the setting as it is. In this case you're going to overwrite the original sound program. Don't do it here, we will need it further on in this tour.
3. Press the **Store** key ⑩ while holding the **Shift** key ⑪ again. Your program is now permanently memorized.

Doing further Edits

We are now moving deeper into the sound editing capabilities of the MicroWave II/XT/XTk. In the next steps we will show you how specific parameters act on the MicroWave II/XT/XTk's behaviour. At first we like to play along with the filter.

1. Switch back to sound program *A001 Saw Repeat WMF*.
2. Press the second parameter select key ⑦. This is the same key that is used for the Recall function, but in this case, it is used without the **Shift** key ⑪. The display changes to show the parameter page for Filter 1:



3. Use the first value dial to change the cutoff frequency of the filter. Play some notes to hear the effect. Reduce the value to get a darker sound. Also change the resonance setting. The sound gets a narrow character the more you turn up the control. Rise the setting to its maximum value. You will notice that an additional tone is generated. This is the self oscillation of the filter!
4. After playing around a little, turn the cutoff down to *70* and the resonance to *20*. This should give you a good starting point for the next step.
5. Turn the Page Dial ③ clockwise to select the next parameter page. The display shows:

6. Press a note on your keyboard and hold it down for a few seconds. You may notice, that the sound starts very bright but then gets darker more and more. This is the effect of the Filter Envelope that modulates the cutoff frequency. The modulation depth is controlled here by the **Cutoff Env. Amount** parameter.
7. Turn its setting down to *0* and look what happens: The sound starts in its dark state and no cutoff change can be heard.
8. Now set the value to a negative value, e.g. *-10* and press any note again. The sound then starts much darker than before and gets a little more brilliant after a while (you may raise the cutoff setting to get better results).
9. After playing around recall the original sound to get prepared for the next step.

The heart of the MicroWave II/XT/XTk are its wavetables. They build the sound source from which everything derives. In this step we are going to change the sound program's wavetable.

1. First, call the first parameter page for Wave 1. To do so, press the first parameter select key ⑥, then use the Page Dial ③ to select the page. The display must look like this:

2. Change the wavetable via the third value dial and play some notes. You may notice that the sound changes dramatically when moving from one wavetable to the next. Try to check out the following wavetables: *014 Clipper, 021 Robotic, 028 FmntVocal, 054 Wavetrip2* and *060 Xmas Bell*.
3. After checking out the different wavetables, set the parameter back to the original wavetable *036 PulSync 1*.

The next feature we want to explore is the ring modulation. It is useful to add non-harmonic components to the sound that gives it a metallic character.

1. Use the page dial to select the **Mixer** page. The display now shows:

2. As you can see, the **Ringmod** parameter is already set to its maximum value. This is the reason why the basic sound character is so hard. Turn it down and play some notes. The sound gets much softer.

3. To understand what the ring modulation does, you should listen at its pure signal. Turn the level of **Wave 1** down to *0* and raise **Ringmod** to *127* again. Play some notes and listen to the result.

As you have seen in the mixer page, the level of **Wave 2** is down at *0*, which means that the whole sound is made upon one wave. We are now going to use the second wave, too.

1. Initially, turn the levels of **Wave 1** and **Ringmod** down to *0* to get a better impression what's going on.

2. Raise the value for the **Wave 2** parameter and play some notes. You will notice a total different „fall down" sound.

3. Mix in **Wave 1** again. Now both sound components are audible. Try to find a good balance for the levels.

The two waves are driven by two independent oscillators, that means they can have different pitch setting. Try out the following:

1. Use the page dial to select the **Osc 2 1** page. The display now shows:

2. Change the **Octave** setting and play some notes. Check out *-2* as a value.

The last thing we want to do in our little tour is to work with the envelopes. They determine the time characteristic of the sound program.

1. Select the Filter Envelope page. You must use the third selection key ⑧ to do this. The display shows:

2. Play some notes on the keyboard and decrease the **Decay** parameter. You will notice that the sound gets darker more quickly now.

3. Increase the **Attack** parameter. The effect you get is that the sound now starts dark and gets more brilliant. Finally it falls down to its dark state again.

To change the whole sound to a short and percussive hit, we have to use the Volume Envelope.

1. Select the Volume Envelope page. It is the next page after the Filter Envelope, so just turn the page dial one step clockwise. The display shows:

2. Decrease the setting of the **Decay** parameter. The whole sound gets shorter and shorter. At very low settings you will just hear a kind of click.

Multi Mode

In Multi mode, you can combine up to 8 sounds. Each sound in a Multi program is called an Instrument because it has some additional settings that belong to the Multi and therefore are not stored in the Sound program itself.

The are two main reasons for using a Multi program:

1. Using the MicroWave II/XT/XTk with a sequencer. In that case you want to use several Sound programs at once, each assigned to a different MIDI channel.
2. Building layered sounds. By doing this you can get interesting combinations e.g. a chord sound that fades into a string pad.

Of course, you can use both methods in combination.

Selecting Multi Mode

The first thing we have to do is to switch from Sound to Multi mode.

1. Press the **Play** button ⑪ to return to the program select page. The display now shows the program number and the name of the currently selected program:

2. Turn the third value dial ⑫ clockwise. The **Mode** setting changes to *Multi*. The display now looks like this:

3. Use the Page Dial ③ to select other Multi programs. Turning the dial clockwise increases the program number, turning the dial counterclockwise decreases it.

On the XTk, you can also select Multi mode by pressing the key labeled **Multi** in the numeric keys section ⑮ while holding the **Select** button ⑯.

Initializing a Multi Program

The best method to create a new Multi program is to initialize an unused program and adjust the disired parameters.

1. Use the Page Dial ③ to select an unused program location (e.g. no. *100*).
2. Press the **Utility** key ⑥ while holding the **Shift** key ⑪.
3. Turn the Page Dial ③ clockwise, until the display shows the Multi Init page:

4. Press the **Utility** key ⑥ while holding the **Shift** key ⑪ again. Your program is now permanently initialized. The display shows:

The initialization causes the Multi's parameters to be set to default values. Each Instrument is assigned to Sound program *A001* and its MIDI receive channel is set to the same value as the Instrument no. E.g. Instrument no. 5 is set to receive on MIDI channel 5. This default setting is optimal for sequencer setups.

Selecting Sound Programs for the Instruments

The next step is to select Sound programs for each instrument of the Multi.

1. Press the Multi key ⑦ to call the Multi/Instrument parameter pages. The display now shows the first page of the Multi parameters:

   You can set the overall volume for the Multi program here. For now, leave it at its default value.

2. Use the Page Dial ③ to select the **Sound 1** page:

3. Select a Sound program for Instrument 1 via the second value dial. In our example we select Program *A018*. Play some notes on the keyboard to listen to the sound.

4. We are now selecting a Sound program for Instrument 2. You can switch between the Instruments via the fouth value dial. Turn the dial one step clockwise. The display shows:

5. Select Sound program *B003* for the second Instrument. To change the Bank from *A* to *B*, use the first value dial.

6. To play Instrument 2, ensure that your master keyboard or sequencer is sending on MIDI channel 2. Play some notes on the keyboard.

You don't hear anything? Don't worry, everything went well, but you have to activate the Instrument before it works as expected. As default, only Instrument 1 is active after initializing.

Activating the Instrument

Each Instrument has a **Status** parameter, where you can turn it on or off. This enables you to activate only those Instruments, that you really need.

1. Use the Page dial ③ to select the **Sound 2** page:

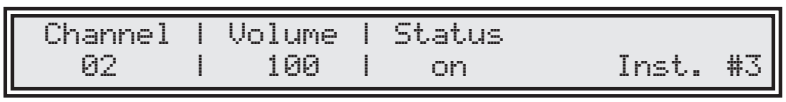
2. Change the **Status** setting to *on*. Now the Instrument is active and you can listen to it when playing on the keyboard.

The XTk has an extended status setting which allows you to determine whether an Instrument can be played by MIDI, the internal keyboard or both.

Building a layered Sound

Another exciting feature the Multi mode offeres is the capability to layer sounds. Such a layered sound consists of two or more Sound programs that are used in combination.

1. Select Instrument 3 and activate it as described above.
2. Choose a Sound program for the Instrument, e.g. *A008 chaOSC*.
3. As expected, you can play the Sound program *A008* on MIDI channel 3. But this is not what we want to do here. In this case we want to combine it with Instrument 2 which is already setup.
4. The only thing you have to do is to change the MIDI receive channel of Instrument 3 in the Sound 2 page. Use the first value dial to set it to 2.

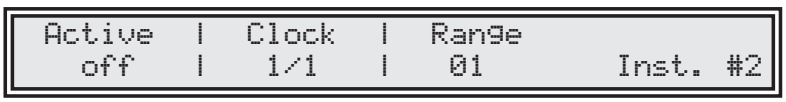


Both Instruments 2 and 3 now receive on MIDI channel 2 and therefore two Sound programs are played when you use this MIDI channel. You can layer more Instruments if you want.

Using an Instrument Arpeggiator

One of the outstanding features of the MicroWave II/XT/XTk is its arpeggiator. In addition to the arpeggiator that can be used in a Sound program, each Instrument has an arpeggiator, too. That makes it possible to use arpeggios in a Multi program without editing any Sound program. You can even use the arpeggiator on Sound programs that normally don't use one.

1. Select the **Arpeggiator 1** page via the Page dial.
2. Select Instrument 2 via the fourth value dial. The display now shows:



3. To activate the arpeggiator, change the **Active** parameter to on.
4. Now press and hold some keys on the keyboard. Make sure that is sends on MIDI channel 2 first.
5. You will notice that the sound changes every 2 seconds. This time period is determined mainly by two parameters: the **Clock** setting in the currently selected page and the **Multi Arpeggiator Tempo** in the **Tempo** page. Change the Clock setting to *1/8* and listen what happens: The arpeggio gets faster.
6. Play along with the other arpeggiator parameters and listen to the results.

That's okay for now. You have seen the basic things, but there is a lot of stuff left. The best approach to the MicroWave II/XT/XTk is learning by doing and so should you.

Operation

Power Switching

The MicroWave II/XT/XTk is equipped with a software-based power control, which means it is initially in standby mode when you supply the device via the AC adapter.

Powering up

Press the **Power** button ⑤ to switch on the MicroWave II/XT/XTk. The **Standby** LED will go out.

First, the version number of the MicroWave II/XT/XTk's operating software will appear in the display:

After several seconds, the display will change to show the sound program; the MicroWave II/XT/XTk is now ready to be played.

Switching off

The MicroWave II/XT/XTk has a special shutdown feature, that prevents data loss by accidently pressing the power button. When you want to switch off the power, press and hold the **Power** button ⑤ again. The display now shows a countdown message from 10 to 0:

After counting down to 0 the MicroWave II/XT/XTk will switch. If you release the **Power** button ⑤ before, the shutdown process is cancelled.

Adjusting the Master Volume

You can use the rightmost value dial ⑫ to adjust the MicroWave II/XT/XTk's master volume via the **Main Vol.** parameter. This setting is global and therefore valid for all programs.

The MicroWave XT and XTk has a dedicated **Main Volume** rotary control ⑬, that can be used to setup the overall volume. Unlike the other dials, this control is made of a potentiometer. Adjusting the volume directly affects the global **Main Vol.** parameter.

Selecting Programs

The MicroWave II/XT/XTk has an internal memory, which is is divided into two different types of locations:

- 256 Sound programs (Program A001…B128)
  In a Sound program, the MicroWave II/XT/XTk can play one sound at a time.
- 128 Multi programs (Program 001…128)
  In a Multi program, the MicroWave II/XT/XTk can play up to 8 Sounds (Instruments) simultaneously, each with individual settings.

All memory locations are freely programmable, so there is no separation into preset and user programs.

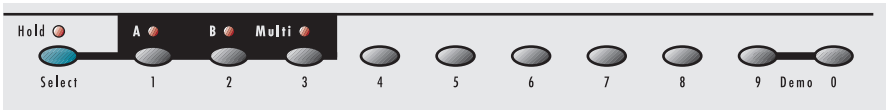
☞ This is how you select a program:

1. Use the **Page Dial** ③ to select the appropriated program. Turning the dial clockwise increases the program number, turning the dial counterclockwise decreases it.
2. The display shows the program type (Sound or Multi), the program number and the name of the selected program (name may be different depending on the soundset loaded):

```
Play Sound A001   |  Mode    |Main Vol.
Saw Repeat   WMF |  Sound   |    100
```

Numerical Program Select

On the XTk, you can also select programs via the numeric keyboard section. Entering a two digit or three number will select the corresponding program within the current bank. E.g. to select program no. *014*, press **1** followed by **4**. To select program no. *109*, press **109**.



Bank Hold

The Bank Hold function gives further enhancement to the numerical program select. By "freezing" the two leftmost digits of the program number, programs can be changed by typing one single digit of the number. This feature is useful especially in live situations.

☞ This is how you use the Bank Hold function:

- Press the numerical keys ⑮ section's **Select** button ⑯. The **Hold** LED above to the **Select** button will go on.
- By pressing one of the numerical keys, you can select the last digit of the program no. E.g. if program no. *A021* was selected before, you can switch from *A020* to *A029* by pressing the corresponding numerical key.
- To terminate the Bank Hold function, press the **Select** button ⑯ again. The LED above the button will go off again.

Switching Banks

By pressing the corresponding numeric key labeled **A** or **B** while holding the **Select** button ⑯, you can easily switch from Bank A to B and vice versa. Before the bank switch is performed, you have to enter a new 2 or 3 digit program number. This is just a precaution to avoid "jumping" between programs.

Selecting Sound and Multi Mode

As mentioned before, the MicroWave II/XT/XTk can operate in Sound or Multi mode. When the MicroWave II/XT/XTk is first powered up, Sound mode is selected.

☞ This is how you select the Multi mode:

1. Turn the third value dial ⑫, labeled **Mode**, clockwise:
2. The display now shows the program number and the name of the selected Multi program (name may be different depending on the soundset loaded):

```
Play Multi  001  |  Mode   |Main Vol.
Hit Me Bigga     |  Multi  |   100
```

When Multi mode is selected, you can play and edit the multi programs and the single sounds each program is based upon.

☞ This is how you switch back to Sound mode:

1. Turn the third value dial ⑫, labeled **Mode**, counterclockwise:
2. The display shows the program number and the name of the selected Sound program again (name may be different depending on the soundset loaded):

```
Play Sound A001  |  Mode   |Main Vol.
Saw Repeat WMF   |  Sound  |   100
```

You can also switch between Sound and Multi mode when you are not in Play mode e.g. when editing in a parameter page. To do so, you have to turn the third value dial ⑫, also labeled **Sound / Multi**, while holding down the **Shift** key ⑪.

XTk The XTk features another method to switch between Sound and Multi mode. Similar to switching banks, you can activate the Multi mode by pressing the numeric key labeled **Multi** while holding the **Select** button ⑯. Switching back to Single mode is done in the same way by pressing the numeric button **A** or **B** while holding **Select**. Remember that you still have to enter a 2 or 3 digit program number before the switch is performed.

Editing Parameters

In order to change or edit a sound or multi in the MicroWave II/XT/XTk, you must access the appropriate parameters. These parameters are arranged in various pages. The front panel shows the headlines for each parameter page:

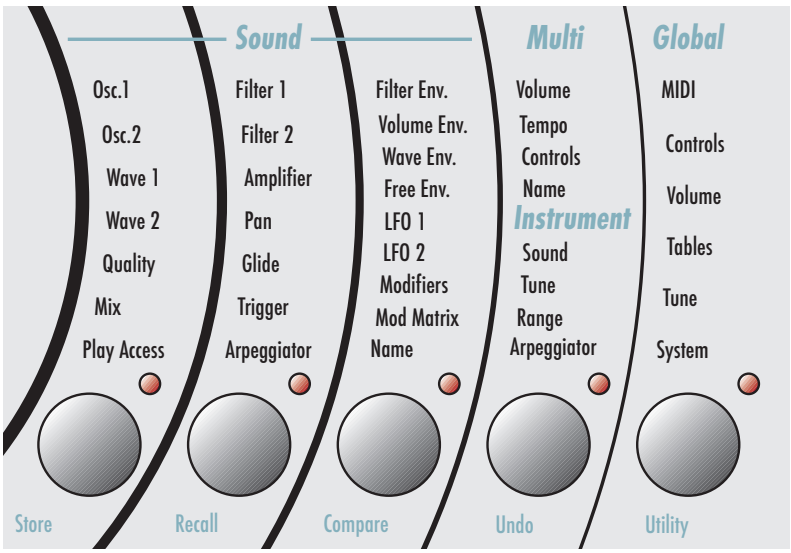


Diagram 2: Parameter pages

The picture shows five page groups, divided into the sections **Sound, Multi, Instrument** and **Global.** Each group has a select key ⑥…⑩ and an activation LED below.

- The **Sound** parameters refer to a Sound program. If you are in Sound mode, you will edit the currently played program. If you are in Multi mode, the Sound program for the currently selected Instrument will be edited.
- The **Multi** parameters refer to a Multi program. They determine the common setting for all instruments in the Multi program. Obviously, you can access these parameters only when the MicroWave II/XT/XTk is in Multi mode.
- The **Instrument** parameters also refer to a Multi program. They determine the individual setting of each instrument in the Multi program. Again, you have to be in Multi mode to access these parameters.
- The **Global** parameters provide the basic settings of the MicroWave II/XT/XTk, valid for all programs.

☞ This is how you access a specific parameter:

1. Locate the page group on the front panel and press the corresponding select key ⑥…⑩ below.
2. The display changes to a set of 4 parameters from the first page of the selected group. For example, if you press the leftmost select button ⑩ the parameters for Oscillator 1 will be shown:

```
Octave 1|Semitone | Detune  |Ke[Osc1 1]
  -1    |   +07   |   +00   |  +100%
```

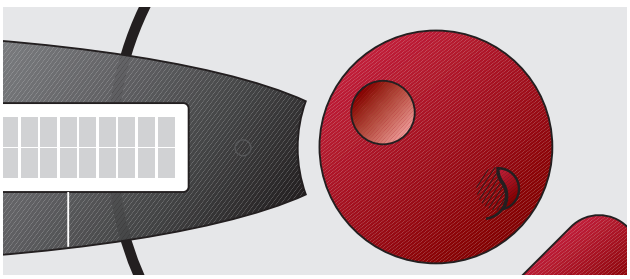
   For a few seconds the page name is shown in the upper right corner of the display. In our given example `[Osc1 1]` will be displayed for "Oscillator 1 Page 1". Some units of the MicroWave II/XT/XTk, e.g. the oscillators, have several parameter pages which are indexed by a page number.

When single mode is selected, you can only play and edit sound programs. If you try to access a Multi mode parameter, you will get an error message in the upper right corner:

```
Play Sound A001[Multi Mode not active]
Saw repeat   WMF |  Sound  |   100
```

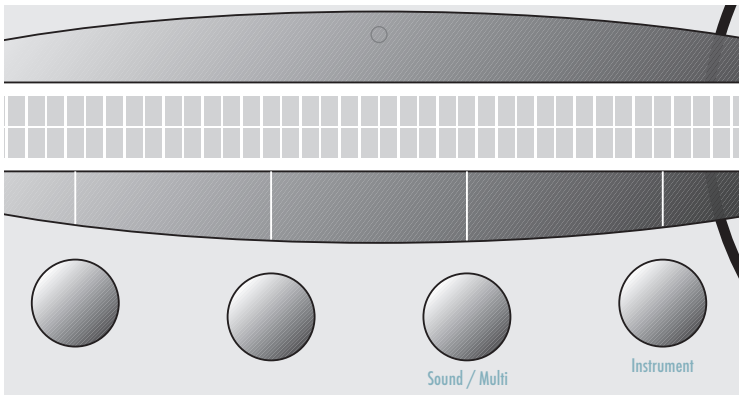
If you did some editing before the MicroWave II/XT/XTk was last powered on, the display may show a different page than the first after pressing the select key. This is an important feature: The MicroWave II/XT/XTk memorizes the last selected page to speed up editing. When you re-enter the page group, you will find yourself where you had left it last time.

3. Use the page dial ③ to scroll through the page group:



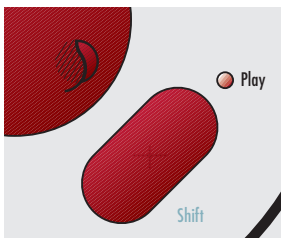
Turning the dial clockwise selects the next page, turning it counterclockwise selects the previous page.

4. Use the value dials ⑫ to adjust the corresponding parameters in the display ②:



Turning a dial clockwise increases the corresponding value, turning it counterclockwise decreases it. The dials have a built-in dynamic response feature. If you turn the control slowly, the value changes very smoothly, too. If you turn it faster, it accelerates as well. This gives you the chance of adjusting the whole value range in just one turn without losing accurate control when nessessary.

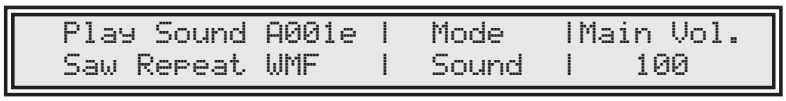
5. When you have finished all your edits you should save the program. Please read the next topic for further information.
6. Press the **Play** key ⑪ to return to the Play mode:



Edit Buffers

Whenever you edit a Sound or Multi program on the MicroWave II/XT/XTk, the program is internally copied to an edit buffer. When you use the **Store** function to save the edits, the program is copied back from the edit buffer to the internal memory. The MicroWave II/XT/XTk has 8 separate edit buffers, so you can edit up to 8 programs simultaneously without storing them. The display shows an **e** after the program name for every program that is actually in an edit buffer:

Edit Status



Note that all edit buffers are cleared when switching off the MicroWave II/XT/XTk. Use the **Store** function as soon as possible after finishing your edits.

The Compare Function

The Compare function allows you to compare the currently edited sound to its original stored in the internal memory.

☞ This is how you use the Compare function:

1. Press and hold the **Shift** key ⑪.
2. Briefly press the **Compare** key ⑧.
3. Release the **Shift** key ⑪.
4. The display now shows a **c** after the program name:

Compare Status

You will now hear the unedited version of your program when you play your MIDI keyboard.

5. Briefly press the **Compare** key ⑧ while holding the **Shift** key ⑪ again.
6. The **c** in the display changes to **e** again. The edited version of the program is now active again.

Please note that no parameters can be edited when the Compare function is active. You can only view the original settings. If you select a new program while the Compare function is active, the Compare status is automatically terminated.

Recalling Edits

You can void edits at any time and return to the original program.

☞ This is how you recall an edited program:

1. Press and hold the **Shift** key ⑪.
2. Briefly press the **Recall** key ⑨.
3. Release the **Shift** key ⑪.
4. The **e** or **c** in the the display after the program name is cleared.

All edits have been recalled and the program is back in its original state.

Storing Programs

After you have finished editing a program, you must save it if you intend to use it again. All memory locations of the MicroWave II/XT/XTk are available for this purpose.

☞ This is how you store a program:

1. Press and hold the **Shift** key ⑪.
2. Briefly press the **Store** key ⑩.
3. Release the **Shift** key ⑪.
4. The display shows a page where you can select the store type, the source and the destination:

Store

5. Use the second value dial to select the store type:
    - If *Sound* is selected, the current Sound program will be stored. When used in Multi Mode, the Sound program of the currently selected instrument will be stored.
    - If *Multi* is selected, the current Multi Program will be stored. The Sound programs that built the Multi are not stored by this task. You must do this separately or by using the *All Edits* option. This setting is available in Multi mode only.
    - If *All Edits* is selected, the MicroWave will store back all edit buffers into their original memory locations. Use this setting to save all edited programs with a single task.
6. Select the destination program. The default value is the currently selected program but you may want to change it to store your edits under a different location. This setting is not available if you choose *All Edits* for the store type.
7. Briefly press the **Store** key ⑩ while holding the **Shift** key ⑪ again.

⚠ Whenever you store a program, the selected memory location is overwritten. Therefore, any previously stored program under this location will be erased and there is no way to get it back. So, if you want to keep your factory presets you should dump them to a computer for external storage.

You now have stored the program. When you activate the store function, the Edit or Compare status of the stored program is terminated.

By pressing any key before performing the last step, you can discard the Store process at any time.

ℹ Use the Store function also if you want to copy programs. There is no need to edit a program before storing it.

The Play Access Page

The Play Access page is a very exciting feature that gives you an easy accessible control over 4 freely definable Sound parameters. To select these parameters, please read the corresponding paragraph in the chapter "Sound Parameters" later on in this manual.

☞ This is how you access the parameters in the Play Access page:

1. When in Play mode, press the **Play** button ⑪ again to call the Play Access page. The display now shows:

Play Access

2. Use the value dials ⑫ to change each parameter's value.
3. Press the **Play** button ⑪ again to leave the Play Access page and return to the program select page. You can also you turn the page dial ③ to select another program directly.

When the MicroWave II/XT/XTk is in Multi mode, the Play Access page always corresponds to the Sound program of the currently selected Instrument.

Please note that – like any usual edits – you have to store your modified programs to make the changes permanent.

Panic Function

The Panic function sends and executes an "All Notes Off" command. It is used to terminate stuck notes. To activate this function, briefly press the **Power** button ⑤. Note that using Panic will also stop the arpeggiator playing when running in Hold mode. Panic will immediately set all envelopes to their release phases. When holding the button a bit longer, all sound is suppressed and the release phases are overridden.

Randomizing a Program

This functions initializes all parameters of a Sound Program with random values.

☞ This is how you randomize a program:

1. Press and hold the **Shift key** ⑪.
2. Briefly press the **Utility** key ⑥.
3. Release the **Shift** key ⑪.
4. The display shows a page where you can select some utility functions. Most of them are dump functions. Turn the page dial ③ clockwise until the display shows:

Randomize

```
Randomize  A001  Saw Repeat   WMF ?
[confirm with <Shift-Utility>]
```

5. Briefly press the **Utility** key ⑥ while holding the **Shift** key ⑪ again.

The selected program is now randomized.

When you randomize a program, all action takes place inside an edit buffer. Therefore no data will be lost until you store the program.

Initializing Programs

The MicroWave II/XT/XTk provides a special function for setting all parameters of a Sound or Multi program to initial values. You can use it to create a program from the scratch.

☞ This is how you initialize a program:

1. Press and hold the **Shift key** ⑪.
2. Briefly press the **Utility** key ⑥.
3. Release the **Shift** key ⑪.
4. The display shows a page where you can select some utility functions. Most of them are dump functions. Turn the page dial ③ clockwise until the display shows:

Init Sound

```
Init Sound A001  Saw Repeat   WMF ?
[confirm with <Shift-Utility>]
```

If you are in Multi mode, there is a corresponding function to init a Multi program. You can select it by turning the page dial ③ one step clockwise again:

Init Multi

5. Briefly press the **Utility** key ⑥ while holding the **Shift** key ⑪ again.

The selected program is now initialized.

When you initialize a program, all action takes place inside an edit buffer. Therefore no data will be lost until you store the program.

Editing Parameters on the MicroWave XT

In addition to the sound editing capabilities of the MicroWave II/XT/XTk, the XT features individual control elements for most parameters. This extended user interface offers you a comfortable way of sound programming.

Dials

When turning a dial on the MicroWave XT panel, the corresponding sound parameter will be changed. The parameter currently edited is shown in the upper right corner of the display for a short period of time:

If the parameter is already shown in the display, only the value change will be displayed.

In the envelope section, you can select the active parameter set via the **Env. Select** button.

When holding the **Shift** key ⑪ while turning a dial, the display changes to the page that contains the edited parameter. Instead of the **Shift** key ⑪, you can also use the **Sync** key in the lower left of the panel.

Buttons

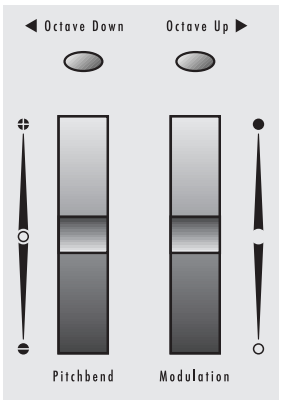
The MicroWave XT features three additional buttons: **Sync**, **Glide** and **Env. Select**.

- The **Sync** key enables or disables the synchronisation of oscillator 2. Its state is not shown in the display but via a dedicated LED next to the key. Also, when holding this key while turning a dial, the corresponding parameter page is called into the display, as described above.

- The **Glide** button enables or disabled the glide function. It also uses a dedicated LED to show the glide state.
- The **Env. Select** key selects one of four parameter groups for the envelope dials. The currently selected group is indicated by a LED. The parameters for each group are printed on the XT panel.

Switching the Octave Setting on the XTk

The XTk features a built-in 4 octave keyboard that can be used to play internal sounds as well as to generate MIDI notes for external devices. As a default, C1 is the lowest note on the keyboard, C3 is the middle note and C5 is the highest. To cover a wider octave range, the whole keyboard can be shifted one octave up or down via the corresponding buttons in the Controller Section ⑰.



☞ This is how you change the keyboard's octave setting:

1. Press the **Octave Down** key. The keyboard is shifted one octave down from the normal setting now, i.e. the whole range is from C0 to C4.
2. Now press the **Octave Up** key. The keyboard is shifted one octave up from the normal setting now, i.e. the whole range is from C2 to C6.
3. To return to the default setting, press **Octave Down** and **Octave Up** simultaneously. Now the range is from C1 to C5 again.

About Wavetable Synthesis

Basics

The sound generation of the MicroWave II/XT/XTk is based on wavetable synthesis. This type of synthesis combines analog access and digital flexibility in a simple way. Although wavetable synthesis is a form of "sample playback" in principle, you should avoid this term because functionality, operation and results are totally different.

The ROM area of the MicroWave II/XT/XTk currently consists of 65 wavetables, 31 locations are reserved for future ROM wavetables. The RAM area contains 32 user wavetables, which can be manipulated over MIDI via appropriate computer software.

A wavetable is a list made up of 64 entries. Each entry represents one wave, that can be either located in the ROM or RAM area of the MicroWave II/XT/XTk or calculated by an algorithm after selecting the wavetable. For the purpose of using a wavetable inside a sound program, it doesn't matter what source the wavetable comes from.

A wavetable itself contains no wave data, but is in fact a collection of up to 64 entries referencing up to 64 waves. Not all entries of the wavetable have to contain entries. When one or several sequential entries contain no reference, the MicroWave II/XT/XTk calculates the waves for these locations automatically. The algorithm producing these "imaginary" waves uses an interpolation scheme that crossfades the "real" ones. E.g. when a wavetable cointains entries in entry 1 and 5, the positions 2 to 4 are generated based on interpolation between the existing waves in entry 1 and 5.

⚠ Please keep the terms "wavetable" and "wave" in mind. Don't bring them into confusion.

Introduction

Wavetable synthesis gives the MicroWave II/XT/XTk the unique sound character which makes it different from all other synthesizers and samplers. The principle of wavetable synthesis is not new, the PPG synthesizer "Wavecomputer 360", "Wave 2", "Wave 2.2" and "Wave 2.3" and also the Waldorf MicroWave (the first one) and Waldorf Wave use this concept. The MicroWave II/XT/XTk contains some enhancements to wavetable synthesis which improve the sonic quality in a remarkable way.

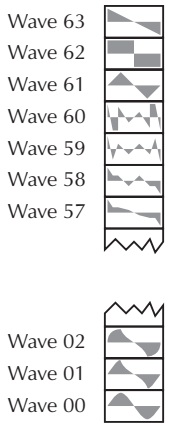
An introduction to wavetable synthesis needs some attention because its operation principle is different to other sound generating systems. Nevertheless you should spend a little time in understanding the basics. You will gain more than the effort it takes.

⚠ Please note that you cannot create your own wavetables or waves with the MicroWave II/XT/XTk itself. To do so, you need a wavetable editor, a special computer program, that allows you to create and edit wavetables and waves. Please ask your local dealer for such an editor software.

Overview

To illustrate the principle of wavetable synthesis, we start with an overview that is correct in a scientific way:

A wavetable is a list consisting of 64 waveforms. Each waveform is classified by its own very special sound character. Some wavetables contain waveforms with a similar sound character in between, others include waves with extremely different timbres. The following diagram shows a part of a wavetable.



You will notice, that the upper three entries in the wavetable consist of the classic analog type waveforms triangle, pulse and sawtooth. These three waves are identical in every wavetable. You can always use these classic synthesizer waves, independent of which wavetable is currently selected.

Both oscillators of a MicroWave II/XT/XTk's voice use a common wavetable. However each oscillator can play a different waveform inside the list. E.g. oscillator 1 can play a sine wave from position 1 of the list while oscillator 2 is playing a sawtooth wave from position 63.

The main difference of wavetable synthesis compared to other sound generation principles is the facility not only to play one waveform per oscillator, but also to walk through the wavetable via different modulations. Therefore you can create wavetable sweeps. E.g. an oscillator can start with an sine wave and blend over to a sawtooth wave after some time. According to the wavetable used, the results can be very drastic – much more than any sample playback based system could ever produce. That is a unique feature of wavetable synthesis.

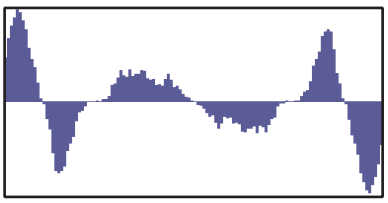
The capabilities of this principle are very strong. To give some examples:

- Each note on a 5 octave keyboard can access a different wave of the wavetable because such a keyboard has 61 keys, 3 less than the number of wavetable items.
- Different waves can be played depending on key velocity.
- An LFO can modulate the position inside the wavetable. Depending on the wavetable you can create subtle to drastic sound changes.
- Random controllers like e.g. the modwheel can change the position inside the wavetable. When you turn the wheel while playing a chord, each note's wave will be modified instantly.

These are just a few examples of the capabilities the MicroWave II/XT/XTk's wavetable synthesis offers. In the following paragraphs we move deeper into the subject, and by the way we get a little more specific.

Wave

A wave is the digitally stored image of a single wave cycle. From this point of view a wave is identical to a sample that is looped exactly after one cycle. The difference to a sampler or ROM sample player is that all waves have the same length and they are played at the same pitch. A typical wave looks like this:



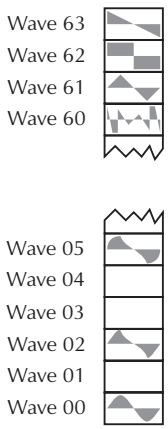
The diagram shows the symmetry of the waveform which is mirrored in its middle. In fact most waves in the MicroWave II/XT/XTk are made up in this way so that only the first half of the cycle is stored in memory. The MicroWave II/XT/XTk calculates the missing part on its own. At this point we see one extension to the classic PPG systems and the first MicroWave: The MicroWave II/XT/XTk can also store whole wave cycles. This feature becomes interesting in all those cases where analog-type waveforms with different pulse width or additive created waveforms with different phase shifts of the harmonics should be generated. These sophisticated timbres were especially not realizable with the first generation wavetable synthesizers.

Wavetable

In fact a wavetable does not consist of waves but of references to them. The MicroWave II/XT/XTk stores wavetables and waves separately, numbered from 001…128 for the wavetables , 000…299 for the waves and 1000…1249 for the user waves.

In a wavetable up to 64 of these references are combined, each pointing at one of the 500 waves. The term "up to 64" means that a wavetable can contain even less references. In this case the missing entries are filled automatically by the MicroWave II/XT/XTk as soon as the wavetable is selected. At least 5 references must be present in every wavetable, one at the first position and 4 at the last. Three of the four positions represent – as already described above – the classic synthesizer waveforms triangle, pulse and sawtooth.

E.g. the wavetable shown below contains references to waves at positions 00, 02, 05, 60 plus the three classic waves at positions 61…63. We will ignore these three last ones for now.



Now imagine an oscillator sweeping through these wavetable to play one of the waves:

- When position 00 is selected, the oscillator plays the wave referenced by the wavetable.
- When position 01 is selected, the oscillator plays a wave which is calculated by the MicroWave II/XT/XTk without being stored in memory directly. The shape of this wave is interpolated between the shapes of the previous and the next existing wave, both mixed with different amplitude settings. In the given example a wave with an amplitude relation of 50% to 50% from the waves on position 00 and 02 would be the result.
- When position 02 is selected, the MicroWave II/XT/XTk plays a "real" wave again, the one referenced by the list position.
- Position 03 and 04 work similarly to position 01. Again, the waves to be played are calculated by the MicroWave. In this case the gap is bigger because two positions in the wavetable are empty. As a result a wave mix of 2/3 to 1/3 (i.e. approx. 66% to 33%) is generated for wave position 03. As you can see, the previous existing wave is more weighted here. At position 04 the calculation works vice versa, i.e. 1/3 of wave 02 amplitude and 2/3 of wave 05 amplitude.
- On position 05 a stored wave is played again.

If the oscillator would move up and down between positions 02 and 05, a continious change of the timbre would be noticed. It is a little bit oversized to call this "continuous" when not more than 4 positions are available but imagine no further wave references are stored between position 05 and 60. Then you will get a very smooth timbre change by moving from position 05 to 60.

And what about hard timbre changes? Now take a look at the classic waveforms on positions 61…63. As there are not any blank positions between these waves the resulting timbre changes are very hard.

What else can we do?

In addition to the described structure, the MicroWave II/XT/XTk can generate wavetables and their corresponding waves via mathematical calculations. Such wavetables are called "algorithmic wavetables". The speciality about these wavetables is that they don’t need any real waves to generate interesting timbre changes.

E.g. the calculation scheme for an algorithmic wavetable can be as follows: Take a pulse wave for position 00 and remove the last samples for every step, so that a single sample remains on position 60. The result is a wavetable with pulse waves of different pulsewidth.

The different base algorithms for such wavetables are:

- synchronisation
- pulse width modulation
- FM
- waveshaping

Further information regarding algorithmic wavetables is available via internet:

ftp://ftp.waldorf-gmbh.de/pub/waldorf/microwave/upaw/

Summary

You should keep the following sentence in mind because it describes the essentials of the wavetable synthesis:

A wavetable is a list of references to up to 64 waves, in between you can move randomly.

Creating own Wavetables

Sooner or later you want to create your own wavetables and waves. The user interface of the MicroWave II/XT/XTk is not effective for doing such complex things. Therefore we refer to corresponding computer software products.

Nevertheless we would like give you a short introduction into the basics of creating wavetables.

The biggest part of the MicroWave II/XT/XTk's wavetables contain between 8 and 16 waves, some of them consist of fewer, some have more. As you can see, you don't need to fill all positions of a wavetable with waves to get interesting sweeps. Take your wavetable editor and look into some of the ROM wavetables. E.g. wavetable 01 is made up of very few waves while wavetable 28 contains a lot of them.

When you want to create a wavetable that simply fades from a pulse wave to a sawtooth waveform, you need exactly two waves: The first one, a pulse wave, on position 00 and the second one, a sawtooth wave, on position 60.

Look into the ROM waves. Consider these waves as a big collection for your own wavetables. E.g. you will find a sawtooth, a pulse, a triangle and a sine wave already there. So you can construct a whole new wavetable out of the ROM waves.

History

At the end of 1970, Wolfgang Palm, the founder of PPG, had the idea of recreating the sound and behaviour of analog circuitries through a digital representation of oscillator waveforms with different filter settings. He then stored these waveforms sequentially into a so-called wavetable and added features to scan through this wavetable by envelope, LFO and the like. The result was a sound that changed its timbre without using any kind of analog filtering or other processing like FM or ring modulation. These individual timbre changes that were different from anything else known at that time made up the typical "wave sound". The first synthesizers built in the early 80s that used this technique were the PPG 340/380 - Wave Computer and the PPG 360 Wave Computer. Both models yet without analog filters.
Wolfgang Düren, responsible for the distribution of the PPG synthesizers at that time, was able to convince Palm to set up analog filters after the oscillators on the follow-up models PPG Wave 2 and PPG Wave 2.2. The result was synthesizers that wrote history and influenced the sound of a whole generation.

In the late 80s, PPG discontinued their work and therefore the production of the Wave, but in the meantime Wolfgang Düren, now manager at Waldorf Electronics, initiated the rebirth of the Wave's technology. Based on an extensive cooperation contract with Wolfgang Palm, the Waldorf MicroWave became the official successor of Wave technology in 1989. The MicroWave was one of the most influental synthesizers of the late 80s and the 90s, right up to today. You can find it on almost any important music production from disco through pop and rock to experimental music. However, the availability of this great synthesizer was not as immediate as was needed, so it was decided in 1995 to further enhance it and to only use those electronic parts that we knew were available. This led to the idea of developing digital filters, and we think we've done a pretty good job.

However, we have not forgotten the past: you can still find the original wavetables of the PPG Wave Computer (Wavetables 001…008), of the PPG Wave 2.2 (009…030, plus the first 8 wavetables) and of the classic MicroWave (031…064, plus 001…030) in the MicroWave II/XT/XTk, ensuring that you can still create all famous sounds of those times.

Sound Parameters

Overview of Functions

The Waldorf MicroWave II/XT/XTk consists of numerous sound-shaping components. The following overview gives you an idea of how the individual components interact:

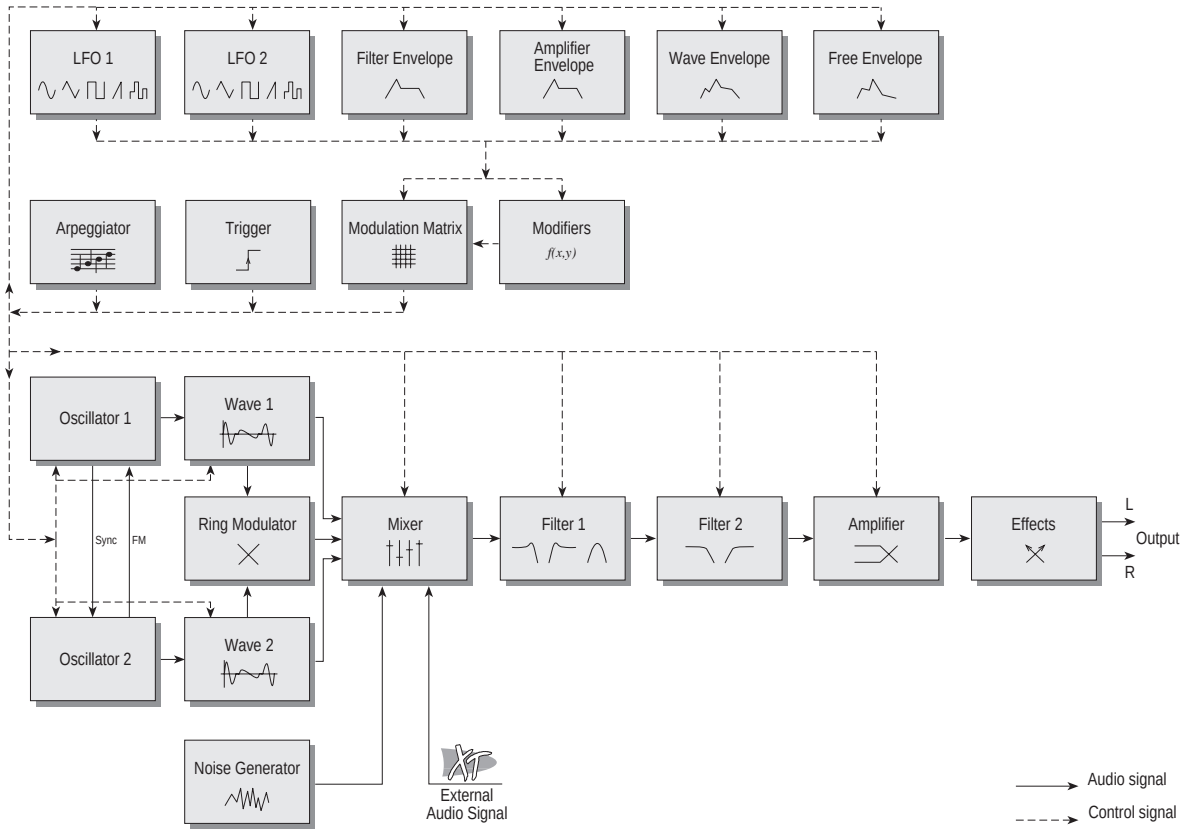


Diagram 3: Block schematic diagram for single sounds

As you can see, the MicroWave II/XT/XTk consists of two different types of components for sound generation and sound shaping:

- Oscillators, Waves, Mixer, Filter, Amplifier:
  Sound generation actually occurs within the Waves, which are driven by the Oscillators. They produce a waveform according to the selected wavetable. The Mixer follows the Waves in the signal chain, which is where the Waves' output signals are mixed. Pink noise can also be added to the mix. The Filter then shapes the sound by amplifying (boosting) or attentuating (dampening) certain frequencies. The Amplifier is located at the end of the signal chain. It determines the overall volume and position of the signal within the stereo panorama.
- Modulators: LFOs, Envelopes, Modifiers, Modulation Matrix:
  The Modulators are designed to manipulate or modulate the sound generating components to add dynamics to sounds. The Low-frequency Oscillators (LFOs) are designed for periodic or recurring waveshapes and Envelopes for modulations that occur once within a given time frame. These generators are assigned to parameters via the Modulation Matrix and influence these parameters to alter a sound. In addition, the Modifier unit can process various mathematical operations and functions on the modulation signals.

Oscillators

The oscillators are the first unit in the chain of the MicroWave II/XT/XTk's sound generation. In comparison to a classic analog synthesizer, the oscillator's output signal itself is not used as a sound source. It is the driving element for the wavetable synthesis.

Oscillator 1

Osc 1 / 1

Osc 1 / 2

Octave *-4…+4*

Determines the octave setting of the oscillator. The reference pitch for the oscillator is generated at MIDI note A3 (note no. 69) when **Octave, Semitone** and **Detune** is set to *0* and **Keytrack** is *100%*. In this case the oscillator's frequency will be the same as set in the global **Tune** parameter (normally 440Hz). Set this parameter to *0* if you are creating a typical keyboard sound, set it to *-1* for bass sounds. If you are programming strings or other high pitched sound, set Octave to *+1*. The following table shows the relationship between the Octave setting and its corresponding register value, a common measurement based on the length of organ pipes.

Setting	Register
-4	128ft.
-3	64ft.
-2	32ft.
-1	16ft.
0	8ft.
+1	4ft.
+2	2ft.
+3	1ft.
+4	1/2ft.

Semitone *-12...+12*

Determines the pitch of the oscillator in semitone steps. The standard setting for this parameter is *0*, but there are cases where different values are required: Most organ sounds include a quint, therefore one oscillator's semitone parameter must be set to *+7*. There are also many lead sounds with an interval, e.g. a quart (+5 semitones). When making ring modulated sounds, try to use *+11* for the setting.

Detune *-64…+63*

Fine-tunes the oscillator in increments of 128ths of a semitone. The audible result of detuning oscillators is a flanging. Use a positive setting for one oscillator and an equivalent negative setting for the other. A low value of *±1* results in a slow and soft flange effect. Mid-ranged settings of *±5* are optimal for pads and other fat sounding programs. High values of *±12* or above will give a strong detune that can be used for accordeons or effect sounds.

Keytrack *-100%...+200%*

Determines how much the pitch of the oscillator depends on the MIDI note number. The reference note for Keytrack is E3, note number 64. For positive settings, the oscillator pitch rises on notes above the reference note, for negative settings the oscillator pitch falls up to higher notes and vice versa. A setting of *+100%* correspondes to a 1:1 scale, e.g. when an octave is played on the keyboard the pitch changes for the same amount. Other settings than *+100%* make sense especially when using ring modulation or oscillator synchronisation. Try to use values in the range *0...+75%* or even negative settings for one oscillator while leaving the second at *+100%* Keytrack.

Pitchbend Range *0...120 / harmonic / global*

Determines the intensity of the pitchbend via MIDI Pitchbend messages in semitones.

- If *harmonic* is selected, the pitchbend is performed in steps of the harmonic and the subharmonic scale. The harmonic scale is used when pitch is bended upwards and built upon multiples of the base pitch. If the base pitch e.g. is 1000Hz, the harmonic scale consists of 2000Hz, 3000Hz, 4000Hz, 5000Hz... and so on. The subharmonic scale is used when pitch is bended downwards and built upon divisions of the base pitch. If the base pitch e.g. is 1000Hz, the subharmonic scale consists of 500Hz, 333.3Hz, 250Hz, 200Hz, 166.7Hz and so on. The following example illustrates the harmonic and the subharmonic scale for the note C3:

  Harmonic scale: C3, C4, G4, C5, E5, G5, ~A#5, C6, ...

  Subharmonic scale: C3, C2, F1, C1, G#0, F0, ~D0, C0, ...

  Please note that the pitches of the harmonic and subharmonic scales differ from the tempered scale in a considerable way.

- If *global* is selected, the setting in the global parameter **BendRange** is used.

FM Amount *0...127*

Sets the amount that oscillator 2 modulates the frequency of oscillator 1. The sound will get more metallic and sometimes even drift out of tune, especially if oscillator 2 is synced to oscillator 1. To avoid unusable detune, use a triangular or sine like wave for oscillator 2.

Oscillator 2

Osc 2 / 1

Octave 2	Semitone	Detune	Keytrack
+0	+07	+00	+100%

Osc 2 / 2

Pitchbend Range 2	Sync	Link
02	off	on

Octave *-4...+4*

Determines the octave setting of the oscillator. The reference pitch for the oscillator is generated at MIDI note A3 (note no. 69) when **Octave, Semitone** and **Detune** is set to *0* and **Keytrack** is *100%*. In this case the oscillator's frequency will be the same as set in the global **Tune** parameter (normally 440Hz). Set this parameter to *0* if you are creating a typical keyboard sound, set it to *-1* for bass sounds. If you are programming strings or other high pitched sound, set Octave to *+1*.

Semitone *-12...+12*

Determines the pitch of the oscillator in semitone steps. The standard setting for this parameter is *0*, but there are cases where different values are required: Most organ sounds include a quint, therefore one oscillator's semitone parameter must be set to *+7*. There are also many lead sounds with an interval, e.g. a quart (+5 semitones). When making ring modulated sounds, try to use *+11* for the setting. The semitone setting also becomes very important when oscillator synchronisation is enabled. Then, Oscillator 1 determines the pitch of the generated sound, Oscillator 2 determines the colour. Try to use a random semitone setting while **Octave** is at *+2*.

Detune *-64…+63*

Fine-tunes the oscillator in increments of 128ths of a semitone. The audible result of detuning oscillators is a flanging. Use a positive setting for one oscillator and an equivalent negative setting for the other. A low value of *±1* results in a slow and soft flange effect. Mid-ranged settings of *±5* are optimal for pads and other fat sounding programs. High values of *±12* or above will give a strong detune that can be used for accordeons or effect sounds.

Keytrack *-100%...+200%*

Determines how much the pitch of the oscillator depends on the MIDI note number. The reference note for Keytrack is E3, note number 64. For positive settings, the oscillator pitch rises on notes above the reference note, for negative settings the oscillator pitch falls up to higher notes and vice versa. A setting of *+100%* correspondes to a 1:1 scale, e.g. when an octave is played on the keyboard the pitch changes for the same amount. Other settings than *+100%* make sense especially when using ring modulation or oscillator synchronisation. Try to use values in the range *0…+75%* or even negative settings for one oscillator while leaving the second at *+100%* Keytrack.

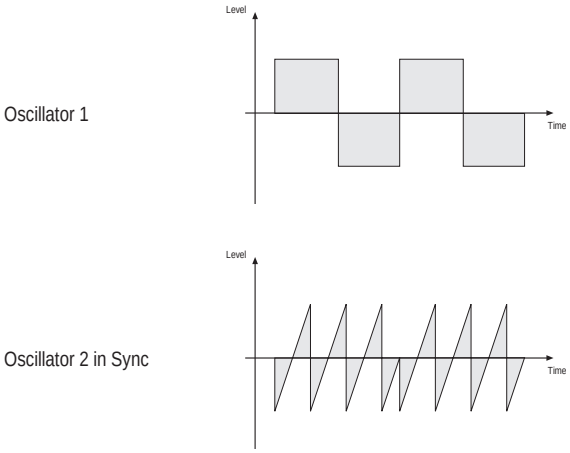
Pitchbend Range *0...120 / harmonic / global*

Determines the intensity of the pitchbend via MIDI Pitchbend messages in semitones.

- If *harmonic* is selected, the pitchbend is performed in steps of the harmonic and the subharmonic scale. Please refer to the description for Oscillator 1 to get further information.
- If *global* is selected, the setting in the global parameter **BendRange** is used.

Sync *off / on*

Enables or disables oscillator synchronisation. When enabled, oscillator 2 acts as a slave that is controlled by oscillator 1, the master. Each time oscillator 1 starts a new period, it sends a trigger signal to oscillator 2, forcing it to restart the wave signal, too. As a result, interesting sound effects may be generated, especially when both oscillators are operating at different pitch settings. Using additional pitch modulation by envelopes, LFOs or pitchbend will bring further movement into sync sounds. The following diagram illustrates the principle of oscillator synchronisation in a simplified way:



Link *off / on*

Allows the same modulation settings for both oscillators to be used. When enabled, oscillator 2 uses the modulation parameters of oscillator 1 for all modulation matrix settings and pitchbend messages. That means, whenever a modulation is applied to oscillator 1, it is also applied to oscillator 2. When disabled, each oscillator uses its own individual modulation settings.

Waves

The waves are the sound sources of the MicroWave II/XT/XTk. They are driven by the oscillators' output signal and define the basic spectrum of the generated sound. Please refer to the corresponding topic of this manual to get further information about the wavetable synthesis.

Wave 1

Wave 1 / 1

Wave 1 / 2

Although the Wavetable parameter is the third entry in the Wave 1 / 1 page, it will be explained as the first parameter of these pages. This is because the wavetable defines the basic character of the complete sound. The selected wavetable is used for both wave generators, although it is only displayed in the Wave 1 / 1 page.

Wavetable *001...128*

The Wavetable parameter selects the wavetable for both waves 1 and 2. Each wavetable has a number and a name. The following table shows an overview of all available wavetables and their names:

001	*Resonant*	*018*	*Polated*	*035*	*SawSync 3*	*052*	*19/twenty*
002	*Resonant 2*	*019*	*Transient*	*036*	*PulSync 1*	*053*	*Wavetrip1*
003	*MalletSyn*	*020*	*ElectricP*	*037*	*PulSync 2*	*054*	*Wavetrip2*
004	*Sqr-Sweep*	*021*	*Robotic*	*038*	*PulSync 3*	*055*	*Wavetrip3*
005	*Bellish*	*022*	*StrongHrm*	*039*	*SinSync 1*	*056*	*Wavetrip4*
006	*Pul-Sweep*	*023*	*PercOrgan*	*040*	*SinSync 2*	*057*	*MaleVoice*
007	*Saw-Sweep*	*024*	*ClipSweep*	*041*	*SinSync 3*	*058*	*Low Piano*
008	*MellowSaw*	*025*	*ResoHarms*	*042*	*PWM Pulse*	*059*	*ResoSweep*
009	*Feedback*	*026*	*2 Echoes*	*043*	*PWM Saw*	*060*	*Xmas Bell*
010	*Add Harm*	*027*	*Formant 2*	*044*	*Fuzz Wave*	*061*	*FM Piano*
011	*Reso 3 HP*	*028*	*FmntVocal*	*045*	*Distorted*	*062*	*Fat Organ*
012	*Wind Syn*	*029*	*MicroSync*	*046*	*HeavyFuzz*	*063*	*Vibes*
013	*High Harm*	*030*	*Micro PWM*	*047*	*Fuzz Sync*	*064*	*Chorus 2*
014	*Clipper*	*031*	*Glassy*	*048*	*K+Strong1*	*065*	*True PWM*
015	*Organ Syn*	*032*	*Square HP*	*049*	*K+Strong2*		
016	*SquareSaw*	*033*	*SawSync 1*	*050*	*K+Strong3*		
017	*Formant 1*	*034*	*SawSync 2*	*051*	*1-2-3-4-5*		

Table 1: Wavetable overview

The wavetables *065...128* contain no factory presets. The locations *065...096* are reserved for future use. Memory locations *097...128* are User Wavetables.

Although the selected wavetable is used for both waves, it is only displayed in the currently explained parameter page.

The Wavetables are the real power of the MicroWave II/XT/XTk. To make sure that you have access to all this power, you should make yourself familiar with the sound and the characteristic of each wavetable. The best way to do so is to set up a kind of test sound to

listen to the wavetables: Start with an initialized sound and turn down the mix level of Oscillator 2. In the Mod Matrix, setup a modulation that uses the ModWheel to modulate **Wave1Pos** and set the amount to *+62* (the setting of *+62* instead of *+63* prevents that you accidentally access the "analog" waveforms explained below). Now you can use the Modulation Wheel to sweep through the whole selected wavetable. Change the **Wavetable** parameter to see how the different wavetables sound. You will notice that they cover an extremely wide range of interesting spectral timbres, including analog, FM-like, bell-type or vocal.

Startwave *00...60 / triangle / square / sawtooth*

Determines the start point of the wavetable that is used when the sound starts. As an alternative to the waves of the currently selected wavetable, you can select the basic waveforms *triangle*, *square* with 50% duty cycle or *sawtooth*.

When you want to create a sound with a wave sweep, you should roughly set the Startwave parameter onto the desired wave, before you apply any modulations to the corresponding Wave module. This helps you to find the basic waveform where all modulations start from.

Note that you can apply unipolar and bipolar modulation sources to the Wave module as with any other module. For example, set the Startwave parameter to *29*, which is almost the middle of the wavetable and apply a slow running LFO to the Wave module to sweep through the whole wavetable (except the three waveforms triangle, square or sawtooth). Try it with one of the PWM wavetables.

The basic waveforms triangle, pulse and sawtooth correspond to entry *61…63* of each wavetable. Please notice, that these waveforms are also used when an appropriate wave modulation is applied. To avoid this, you will have to activate the **Limit** parameter. Please read this corresponding topic to get further information. Use the basic waveforms to generate traditional, analog synthesizer sounds.

Phase *free / 3...357°*

By means of this parameter you can define the startsample and, as a result, the phase of the generated wave. Alternative to a fixed value, you can use *free* to set the phase to a different, random value each time a note is generated. The setting is scaled in degrees.

EnvAmount *-64…+63*

Determines the amount of influence the wave envelope has on the wavetable modulation.

EnvVelAmt *-64…+63*

Determines the amount of influence the wave envelope has on the wavetable modulation, based on key velocity. In conjunction with EnvAmount you can create nice effects when you set one of the two parameters to a negative setting while the other one is set to a positive setting.

Keytrack *-200%…+197%*

Determines the amount of wavetable modulation depending on the received MIDI note number. Reference note for this parameter is E3, note number 64. For positive settings the modulation amount is increased for notes above to reference note, for negative settings the amount is decreased. A setting of *+100%* corresponds to a 1:1 scale. This means that each note above or below the reference note plays a different wave. E.g., when you set **Startwave** to *29* and **Keytrack** to *+100%*, it means that E3 plays wave 29, F3 plays wave 30, F#3 plays wave 31 and so on.

Limit *off / on*

This setting prevents, if enabled, accessing the analog type waveforms triangle, square and sawtooth in any case of modulation. When disabled, the full modulation amount will be calculated and applied so that the whole wavetable will be used for tone generation.

Wave 2

Wave 2 / 1

Wave 2 / 2

Startwave *00...60 / triangle / square / sawtooth*

Determines the start point of the wavetable that is used when the sound starts. As an alternative to the waves of the currently selected wavetable, you can select the basic waveforms *triangle*, *square* with 50% duty cycle or *sawtooth*.

When you want to create a sound with a wave sweep, you should roughly set the Startwave parameter onto the desired wave, before you apply any modulations to the corresponding Wave module. This helps you to find the basic waveform where all modulations start from.

Note that you can apply unipolar and bipolar modulation sources to the Wave module as with any other module. For example, set the Startwave parameter to *29*, which is almost the middle of the wavetable and apply a slow running LFO to the Wave module to sweep through the whole wavetable (except the three waveforms triangle, square or sawtooth). Try it with one of the PWM wavetables.

The basic waveforms triangle, pulse and sawtooth correspond to entry *61…63* of each wavetable. Please notice, that these waveforms are also used when an appropriate wave modulation is applied. To avoid this, you will have to activate the **Limit** parameter. Please read this corresponding topic to get further information. Use the basic waveforms to generate traditional, analog synthesizer sounds.

Phase *free / 3...357°*

By means of this parameter you can define the startsample and, as a result, the phase of the generated wave. Alternative to a fixed value, you can use *free* to set the phase to a different, random value each time a note is generated. The setting is scaled in degrees.

Link *off / on*

Allows the use of the same modulation settings for both waves. When enabled, wave 2 uses the modulation parameters of wave 1 for all Modulation Matrix settings, **EnvAmount, EnvVelAmt** and **Keytrack.** That means, whenever a modulation is applied to wave 1, it is also used for wave 2. When disabled, each wave uses its own individual modulation settings.

EnvAmount *-64…+63*

Determines the amount of influence the wave envelope has on the wavetable modulation.

EnvVelAmt *-64…+63*

Determines the amount of influence the wave envelope has on the wavetable modulation, based on key velocity. In conjunction with EnvAmount you can create nice effects when you set one of the two parameters to a negative setting while the other one is set to a positive setting.

Keytrack *-200%…+197%*

Determines the amount of wavetable modulation depending on the received MIDI note number. Reference note for this parameter is E3, note number 64. For positive settings the modulation amount is increased for notes above to reference note, for negative settings the amount is decreased. A setting of *+100%* corresponds to a 1:1 scale. This means that each note above or below the reference note plays a different wave. E.g., when you set **Startwave** to *29* and **Keytrack** to *+100%*, it means that E3 plays wave 29, F3 plays wave 30, F#3 plays wave 31 and so on.

Limit *off / on*

This setting prevents, if enabled, accessing the analog type waveforms triangle, square and sawtooth in any case of modulation. When disabled, the full modulation amount will be calculated and applied so that the whole wavetable will be used for tone generation.

Quality

The quality parameters control the input stage of the Mixer. They determine the amount of Aliasing and Time Quantization applied to the sound as well as the type of distortion generated when the signal raises the clipping level.

Quality

Aliasing *off / 1…5*

Aliasing is a digital artefact that is audible as soon as a wave has harmonics higher than half the sampling frequency. Usually, aliasing is reduced to a minimum by some magical mathematics, but here you can override this and listen to aliasing distortion just like in the dawn of the first digital musical instruments like the PPG Wave or the first MicroWave. Use a setting other than *off* for sounds that expressionally should have a "digital" character.

TimeQuant *off / 1…5*

With a wave, 64 harmonics including the fundamental frequency can be represented, and a clever interpolation algorithm makes sure only these 64 harmonics are generated, even at low pitches. However, sometimes one might wish to add additional harshness at the lower end, just like the first MicroWave did, and this is what Time Quantization is for: The wave interpolation is overridden in five steps to get this extra fizziness. Note that pitch accuracy is a bit diminished when using a value other than "off". The audible result of Time Quantization is a very sharp sound character when playing at low pitches. Use this e.g. for sawtooth based sounds.

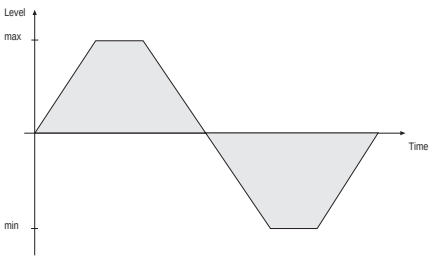
Accuracy *off / on*

If disabled, voices are detuned very slightly to give more vivid sound, especially when playing chords or sounds with long release. If enabled, the tuning is done as accurate as possible.

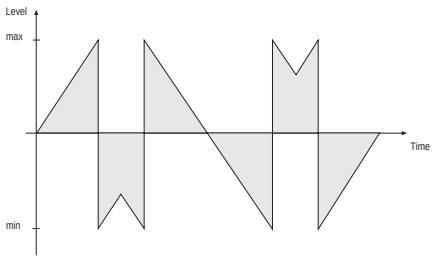
Clipping *saturate / overflow*

Selects the type of distortion that is applied when the signal raises the clipping level. Clipping is always generated when the sum of all mixer input volumes (i.e. Wave 1, Wave 2 Noise and Ringmodulation) exceeds 128.

- If *saturate* is selected for this parameter, the signal will be limited to the maximum level. This is the kind of distortion classic analog circuits will generate.
- If *overflow* is selected, distortion is proceeded in the same way as a numerical overflow in a digital system: The polarity of the signal's part above the maximum level will be negated.



saturate



overflow

Mixer

In the mixer you control the volumes of both waves and the noise generator. An optional ring modulation extends the tonal range of the MicroWave II/XT/XTk.

Mixer

```
 Wave 1 |  Wave 2 | Ringmod | Noise
  113   |    56   |     0   |   13
```

Mix 2

```
External
  123
```

Wave 1 *0…127*

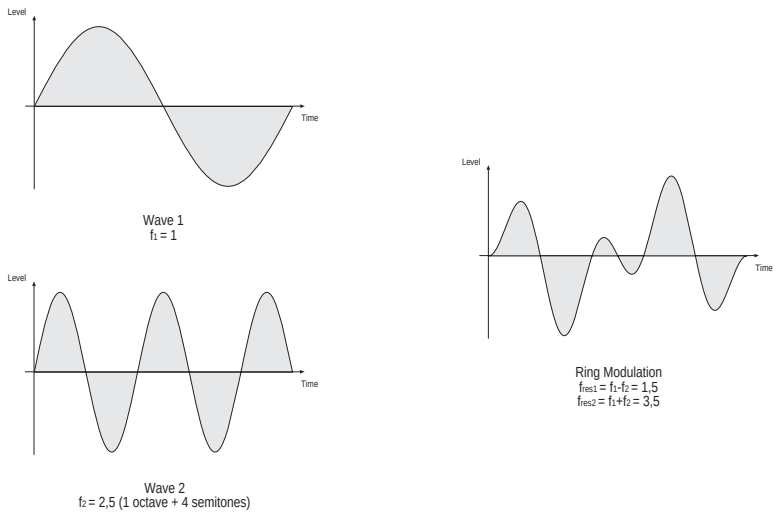
Volume of Wave 1.

Wave 2 *0…127*

Volume of Wave 2.

Ringmod *0…127*

Volume of the ring modulation between Wave 1 and 2. From a technical point of view ring modulation is the multiplication of the waves' signals. The result of this operation is a waveform that contains the sums and the differences of the source frequency components. Since the ring modulation generates disharmonic components, it can be used to add metallic distorted sound characteristics. This is useful e.g. when generating synth percussion. The following diagram illustrates what happens when two sine waves are ring modulated. Please note that in a complex waveform all harmonic component behave like interacting sine waves, resulting in a wide spectral range of the ring modulated sound. The following diagram illustrates the ring modulation of two sine waves:



Noise *0…127*

Volume of the noise generator. The noise generator produces pink noise and features no other controls. Noise is a fundamental source for any kind of analog-type percussion. Also wind and other sound effects can be created by using the noise generator.

External *0…127*

Volume of the external audio input **Analog In** ❾. Please note that if you use an external sound source, you still have to trigger the MicroWave XT's envelopes to get the signal passed through. Though you have to generate MIDI notes either by a connected sequencer or the internal arpeggiator.

Play Access

The Play Access page is a very exciting feature that gives you an easy accessible control over 4 freely-definable Sound parameters. This can be extremly useful in adapting a sound very quickly as well as having easy realtime control in performance situations.

In fact the Play Access function consists of two parts:

- Defining the parameters for the Play Access page.
- Accessing the previously defined parameters.

Defining the parameters

Play Access

Par #1…Par #4 *sound parameters*

Use the value dials ⑫ to select the desired parameters. Turning the dials will scroll the view through a list of the most important single sound parameters that are available on the MicroWave II/XT/XTk. Some parameter names are abbreviated to fit in the display area. E.g. *AE Attack* stands for the Amplifier Envelope Attack parameter. The following table shows an overview of the used abbreviations.

Abbreviation	Description	Abbreviation	Description
Osc1	Oscillator 1	*Oct*	Octave
Osc2	Oscillator 2	*Semi*	Semitone
W1	Wave 1	*Det.*	Detune
W2	Wave 2	*Bend*	Pitchbend Range
Mix	Mixer	*Keyt / Keytrk.*	Keytrack
F1	Filter 1	*StartW*	Startwave
F2	Filter 2	*EnvAmt*	Envelope Amount
Amp	Amplifier	*VelAmt*	Velocity Amount
Arp	Arpeggiator	*Ring*	Ring Modulation
FE	Filter Envelope	*Reso*	Resonance
AE	Amplifier Envelope	*Vol*	Volume
		Pan	Panning
		Patt.	Pattern
		Dir.	Direction
		Velo	Velocity
		Alloc.	Allocation
		Sust.	Sustain
		Shpe	Shape
		Dlay	Delay
		Sync	Synchronisation
		Sym.	Symmetry
		Hum.	Humanize
		Phas	Phase

Table 2: Play Access abbreviations

Here are some examples of useful parameter sets for the Play Access page.

Example 1

```
 Par #1  | Par #2  | Par #3  | Par #4
F1 Cutoff|F1 Reso  |F1 EnvAmt|FE Decay
```

Example 2

```
 Par #1  | Par #2  | Par #3  | Par #4
W1 StartW|W2 StartW|Mix Ring |Glide
```

Example 3

```
 Par #1  | Par #2  | Par #3  | Par #4
ArpActive|Arp Tempo|Arp Clock|Arp Patt.
```

Example 4

```
 Par #1  | Par #2  | Par #3  | Par #4
 Effect  | Assign  |Panning  |Glide
```

Please note that the Play Access setting is stored in the sound program like the other sound parameters. Therefore you must save your program even if you only changed the Play Access definitions. By handling them as part of a sound, you will get the chance of having different settings for each program.

Accessing the previously defined parameters

This is how you access the selected parameters in the Play Access page:

1. Press the **Play** button ⑪ twice to switch back to performance mode and call the Play Access page. The display now shows:

```
F1 Cutoff|F1 Reso  |F1 EnvAmt|FE Decay
   092   |   000   |   +29   |   084
```

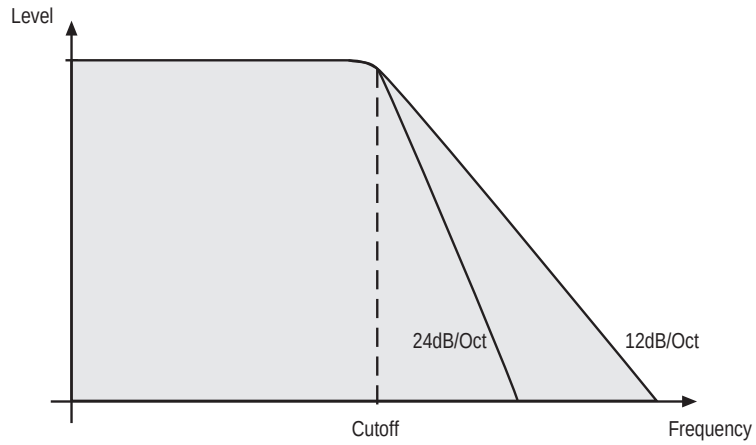
2. You can now use the value dials ⑫ to change each parameter's value.

Please note that – like any usual edits – you have to store your modified program to make the changes permanent.

Filter

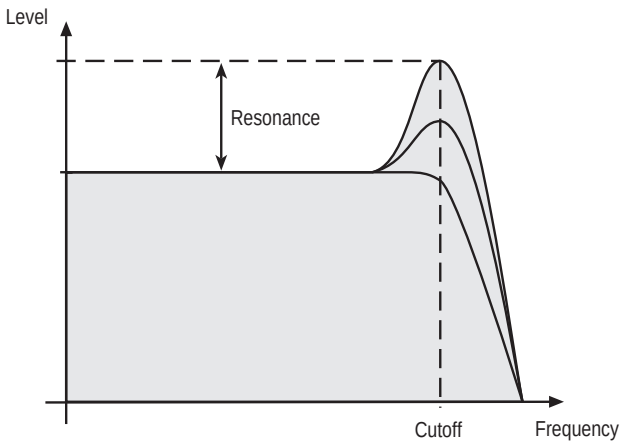
Once the audio signal leaves the mixer, it is sent to the filters. The MicroWave II/XT/XTk has two independent filter units, each with its own individual settings. Both filters are routed in series. The filters are components that have significant influence on the MicroWave II/XT/XTk's sound characteristics.

The filter type most commonly used in synthesizers is a low pass filter. This type dampens frequencies that lie above a specified cutoff frequency. Frequencies below this threshold are hardly affected. The frequency below the cutoff point is called the pass band range, the frequencies above are called the stop band range. The MicroWave II/XT/XTk's filter dampens frequencies in the stop band with a certain slope. The slope is selectable between 12dB and 24dB per octave. This means that the level of a frequency that lies an octave above the cutoff point will be 12dB or 24dB less than those frequencies of the signal that fall into the pass band. The following diagram shows the basic principle of a low pass filter:



To give you an idea of the extent of damping, consider this: A reduction of 24dB reduces the original level by approx. 94%. The damping factor two octaves above the cutoff point reduces the original level by more than 99%, which in most cases means this portion of the signal is no longer audible.

The MicroWave II/XT/XTk's filter also features a resonance parameter. Resonance in this context means that a narrow frequency band around the cutoff point is emphasised. The following diagram shows the effect of the resonance parameter on the filter's frequency curve:

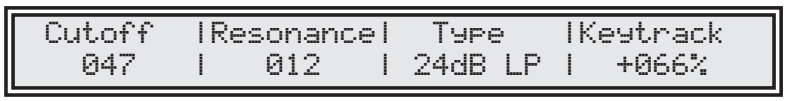


If the resonance is raised to a great extent, then the filter will begin self-oscillation, i.e. the filter generates an audible sine wave even when it does not receive an incoming signal.

Filter 1

Filter 1 gives you the most flexibility by offering low pass, high pass and band pass types. In addition, there is an sine waveshaping filter with an 12dB low pass following. You can select the slope between 12dB and 24dB per octave for the low pass and band pass. Further types might be added in the future.

Filter 1 / 1



Filter 1 / 2

Cutoff *0...127*

Determines the cutoff frequency for the low pass and high pass filter types and the mid frequency for the band pass type. When a low pass is selected via the **Type** parameter, all frequencies above the cutoff frequency are damped. When high pass is selected, all frequencies below the cutoff frequency are damped. In a band pass only frequencies near the cutoff setting will be passed through. You can bring more movement into the sound by modulating the cutoff frequency via the LFOs, the envelopes or the **Keytrack** parameter. At a value of *64* and a **Resonance** value of *114*, the filter oscillates with 440Hz, which is equal to A3. Tuning is scaled in semitone steps. When **Keytrack** is set to *+100%*, the filter can be played in a tempered scale.

Resonance *0...127*

Filter resonance parameter. Determines the amplification of the frequencies around the cutoff point. Use lower values in the range *0...80* to give more brilliance to the sound. At higher values of *80...113* the sound gets the typical filter character with a strong boost around the cutoff frequency and a loss in the other range. When the setting is raised to values above *113*, the filter starts to self-oscillate, generating a pure sine wave. This feature can be used to create solo sounds like the traditional "moog lead" or analog-style effects and percussion like electronic toms, kicks, zaps etc.

Type *see Table*

Selects the filter type. Further information on the different filter types is given at the end of this chapter.

Keytrack *-200%...+197%*

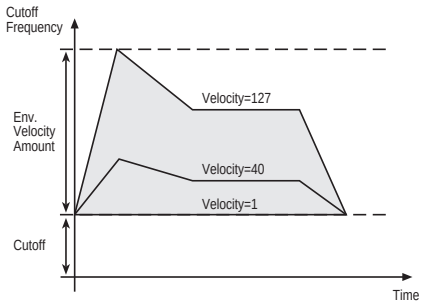
Determines how much the cutoff frequency depends on the MIDI note number. The reference note for Keytrack is E3, note number 64. For positive settings, the cutoff frequency rises on notes above the reference note, for negative settings the cutoff frequency falls up to higher notes and vice versa. A setting of *+100%* corresponds to a 1:1 scale, so e.g. when an octave is played on the keyboard the cutoff frequency changes for the same amount. If you want to play the filter in a tempered scale, e.g. for a solo sound with self-oscillation, set the value to *+100%*. On most bass sounds lower settings in the range *+60...+75%* are optimal to keep the sound smooth at higher notes.

Cutoff Env. Amount *-64…+63*

Determines the amount of influence the filter envelope has on the cutoff frequency. For positive settings, the filter cutoff frequency is increased by the modulation of the envelope, for negative settings, the cutoff frequency is decreased. Use this parameter to change the timbre of the sound over time. Sounds with a hard attack usually have a positive envelope amount that makes the start phase bright and then closes the filter to get a darker sustain phase. On the other side string sounds usually use a negative envelope amount that gives a slow and dark attack before the cutoff rises in the sustain phase.

Env. Velocity Amount *-64…+63*

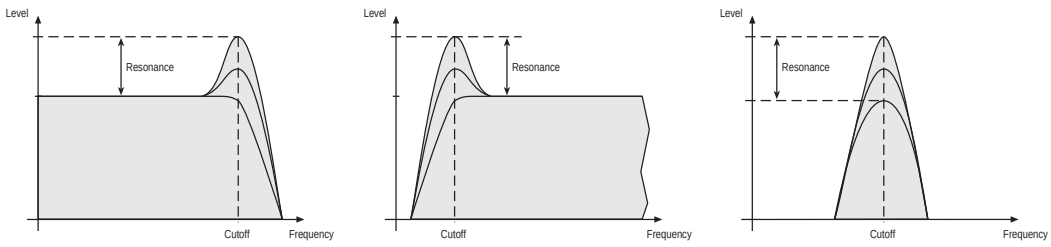
Determines the amount of influence the filter envelope has on the cutoff frequency, based on key velocity. This parameter works similarly to the **Cutoff Env. Amount** parameter with the difference that its strengh is velocity based. Use this feature to give a more expressive character to the sound. When you hit the keys smoothly, only few modulation is applied. When you hit them harder, the modulation amount also gets stronger. The following diagram illustrates the functionality of this parameter:



The overall modulation applied to the filter's cutoff frequency is calculated as the sum of both parameters **Cutoff Env. Amount** and **Env. Velocity Amount**. Therefore you should always bear in mind what the result is, especially when the filter does not behave as you expect. You can also create interesting effects by setting one parameter to a positive amount and the other to a negative.

Filter Types

This paragraph describes the MicroWave II/XT/XTk's different filter types. Most types are based on traditional low pass, high pass or band pass structures. The following diagram illustrates the frequency plots of these types:



The filter types have the following display designations:

Setting	Filter Type
24dB LP	24dB low pass
12dB LP	12dB low pass
24dB BP	24dB band pass
12dB BP	12dB band pass
12dB HP	12dB high pass
Sin(x)>LP	Sine waveshaper followed by a 12dB low pass
WaveShapr	12dB low-pass filter with wave shaper
Dual L/BP	Parallel 12dB lowpass/bandpass filters
FM-Filter	12dB low-pass filter with frequency modulation
S&H>L12dB	Sample-and-hold in front of 12dB low-pass filter
24dBNotch	24dB notch filter
12dBNotch	12dB notch filter
Band Stop	Parallel 12dB low and high pass

When some of the above types are selected, an extra parameter appears on the *Filter 1 / 2* page. Exactly what this parameter is for depends on the type of filter selected. The extra parameter is therefore described together with every new filter type.

Modulation of the "Extra" Parameter

The "extra" parameter of the filter types described below may be selected in the modulation matrix and is designated as *F1 Extra*. (An abbreviation of "Filter 1 Extra Parameter")

⚠ Do not mistake "FM Amount" for filter FM amount. The filter FM amount is the *F1 Extra* modulation destination whenever the FM-filter is selected on the *Filter 1 / 1* page. The *FM Amount* destination in the modulation matrix is for oscillator FM.

24db Low Pass and 12dB Low Pass

The low pass types *24dB LP* and *12dB LP* are suitable for the most usual applications. Use the 24dB slope if you want to create sounds with a typical audible filtered character, use the 12dB slope if you want to get softer results.

24db Band Pass and 12dB Band Pass

The band pass filters *24dB BP* and *12dB BP* remove frequencies both below and above the cutoff point. As a result, the sound character gets narrow. Use these filter types for programming effect and percussion-like sounds.

12db High Pass

The high pass filter *12dB HP* is useful to thin out a sound's bass frequencies. This may give interesting results also in conjunction with cutoff frequency modulation. By doing this you can e.g. "fly-in" a sound starting at its high harmonics and then coming up to its full frequency range.

Sine Waveshaper with 12dB Low Pass

The *Sin(x)>LP* Type consists of a sine waveshaper followed by a 12dB low pass filter with resonance. The sine waveshaper usually adds some harmonics and intermodulation frequencies to the signal.

12dB Low Pass followed by Wave Shaper

This new filter type consists of two components, the first being a normal 12dB low pass filter as described in the user manual. The second component is a wave-shaper much like the sine wave-shaping filter *Sin(x)>LP* also described in the manual. The difference between the sine wave shaper and this new shaper is that the shaping wave is no longer a sine wave but a wave from the wavetable used by the sound. Also, wave shaping is performed after the filter in this case.

The extra parameter *Wave*, on the *Filter 1 / 2* page is used to select the desired shaping wave from the sound's wavetable (e.g. a triangle wave):

Filter 1 / 2

For a nice gritty sound, try a square wave as shaping wave! Nice for organ grinders.

12 dB parallel Low-pass and Band-pass Filters

This filter type consist of two filters parallel to each other. The first filter being of the low-pass type and the second of the band-pass type. As with the new wave shaping filter, the 12 dB low-pass filter can be adjusted the usual way as described in the user manual.

The band-pass filter's cutoff frequency is the same as the cutoff frequency of the low-pass filter cutoff setting except for the extra parameter *BP Offset*, which adds to the band-pass filter's cutoff frequency. The band-pass filter's resonance is equal to that of the low-pass filter.

Filter 1 / 2

To select a low-pass/band-pass with the latter set to one octave above the other, do the following:

1. Go to the *Filter 1 / 1* page and select the *Dual L/BP* filter type.
2. Then go to the *Filter 1 / 2* page. The third parameter should now read *BP Offset*. Change this setting so that it reads *+12*.

Because the BP offset is in semitones, the band-pass filter's cutoff frequency is now an octave above the low-pass filter's cutoff frequency.

12 dB Low-pass Filter with Frequency Modulation

The FM-filter type is a 12dB low-pass filter where the cutoff frequency can be modulated by the output of oscillator 2. The filter may be setup exactly like a normal low-pass filter as described in the user manual.

The modulation amount *Osc2 FM* is the extra parameter and can be found on the *Filter 1 / 2* page:

Filter 1 / 2

Sample-and-hold 12dB Low-pass Filter

The S&H-filter has a sample-and-hold (S&H) circuit with adjustable rate in front of the 12 dB low-pass filter. The S&H circuit effectively lowers the sampling rate so that the harmonics are reflected to another frequency producing a harsh sound.

The rate of the S&H circuit is the extra parameter and appears on the *Filter 1 / 2* page as *S&H Rate*. When the S&H rate is set to maximum (127), the circuit passes the sound untouched.

Filter 1 / 2

If you like nice clean sounds, the S&H filters are definitely **not** for you.

24dB Notch Filter

This filter damps a single frequency while all other frequency are passed through unaffected. Resonance is inaudible on this filter type as long as its setting is not so high that the filter begins to self-oscillate.

12dB Notch Filter

Same as 24dB notch filter, but lower slopes of 12dB/octave.

Bandstop Filter

This filter type uses a 12dB high pass and a 12dB low pass in parallel. By means of the extra parameter **Bandwidth** the frequency of the high pass can be increased relative to the low pass. If **Bandwidth** has a value of *0*, this filter is identical to the 12dB notch filter. The resonance setting applies to both filters in the same way.

Filter 2

The second filter is capable of performing a low pass or high pass. The slope is always 6dB per octave, there is no resonance parameter and therefore no self-oscillation. You can use Filter 2 in several ways. Since its slope is more flat than those of Filter 1, the effect filtering has on the sound is very subtle.

Filter 2

Cutoff *0...127*

Determines the cutoff frequency. Note that you can also modulate the filter's cutoff frequency in the modulation matrix.

Type *6dB LP / 6dB HP*

Selects the filter type.

- Use the low pass setting *6dB LP* to get a warm sound without cutting of too much of the higher frequencies.

- Use the high pass setting *6dB HP* to thin out the bass frequencies in order to get a cleaner and more precious sound.

Keytrack *-200%…+197%*

Determines how much the cutoff frequency depends on the MIDI note number. The reference note for Keytrack is E3, note number 64. For positive settings, the cutoff frequency rises on notes above the reference note, for negative settings the cutoff frequency falls up to higher notes and vice versa. A setting of *+100%* corresponds to a 1:1 scale, so e.g. when an octave is played on the keyboard the cutoff frequency changes for the same amount.

If you don't want to use Filter 2, select the low pass and set the cutoff frequency to *127*.

Volume and Pan

This unit is the last part in the MicroWave II/XT/XTk's signal routing. Its purpose is to set the volume and the pan position of the sound. After that the signal passes the D/A converter and can be taken from the audio jacks on the rear panel.

To understand the operation of this unit, it is important to know that the Amplifier Envelope is always acting as a modulation source for the volume. This means that an audio signal can only pass through if the Amplifier Envelope is triggered and opened.

Finally a chorus effect can be added to enhance the sound.

Volume

Amplifier

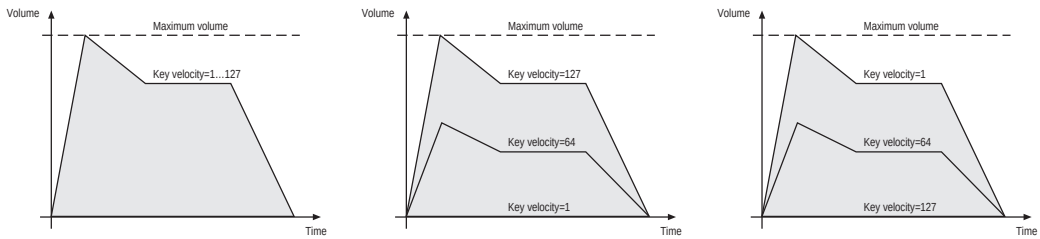
```
Volume  |Velocity |Keytrack | Chorus
  090   |   +40   |  +000%  |   on
```

Volume *0…127*

Determines the master volume of the sound program.

Velocity *-64…+63*

Specifies how much volume will be affected by keyboard velocity. Use this feature to give more expression to the sound. With a setting of *0*, velocity will have no effect on the volume. Classic organs work in this way because they do not have dynamic response. For positive settings, the volume rises up to higher velocities. This is the most commonly used setting which gives a piano-like character. For negative settings, the volume falls up to higher velocities. This gives an untypical character suitable for effect sounds. As the Amplifier always works in conjunction with the Amplifier Envelope, this parameter actually determines the envelope velocity amount. The following diagram illustrates this functionality:



Keytrack *-200%…+197%*

Determines how much the volume depends on the MIDI note number. The reference note for Keytrack is E3, note number 64. For positive settings, the volume increases on notes above the reference note, for negative settings the volume decreases up to higher notes and vice versa. This setting can be useful to adjust a sound's volume over the whole keyboard range. Especially when extensive filtering is used, the sound can be louder on the lower or the upper part of the keyboard. On the other side, you can apply this effect intentionally e.g. for effect sounds.

Chorus *off / on*

Enables the chorus effect. The chorus consists of two short delays where delay time is modulated with a sine wave of about 0.5 Hz. It spreads the stereo image of the program by giving it a wide sounding character.

Pan

Pan

Panning *left 64…center…right 63*

Determines the position in the stereo panorama. When the setting is *left 64*, the sound is panned far left, when the setting is *right 63*, it is panned far right. If you want to set the sound into the middle of the stereo panorama, use the *center* setting. To give further movement to the sound, set this parameter to a basic value and apply some modulation to it e.g. via an LFO or the **Keytrack** parameter.

Keytrack *-200%…+197%*

Determines how much the pan position depends on the MIDI note number. The reference note for Keytrack is E3, note number 64. For positive settings, the panning moves to the right on notes above the reference note, for negative settings the panning moves to the left up to higher notes and vice versa. This feature enables you to give a typical piano-like panning, where lower notes are on the left side and higher notes on the right. To achieve this, set the **Panning** parameter to *center* and **Keytrack** to *+197*.

Effects

The Microwave II and Microwave XT have the ability to change the timbre of a sound by way of effects processing. In the table below the types of effects are shown together with the availability for the two types of Microwave.

MicroWave II	MicroWave XT
Chorus	*Chorus*
Flanger 1	*Flanger 1*
Flanger 2	*Flanger 2*
AutoWahLP	*AutoWahLP*
AutoWahBP	*AutoWahBP*
Overdrive	*Overdrive*
Amp. Mod	*Amp. Mod*
	Delay
	Pan Delay
	Mod Delay

All the effect parameters are available on the *Effect* page which is located between the *Amplifier* and *Pan* page. The first parameter on the *Effect* page is always the effect type parameter. The other three parameters change according to the type of effect which has been selected.

Please note that only Instruments 1…3 of a Multi program can use effects.

Some Words about Effects

It is very difficult to describe effects such as chorus and flanger. Therefore, the description of the exact timbre changes induced by the effects has been omitted. As it would serve no purpose to clutter the manual with subjective obscurity. Just have a play with the effects!

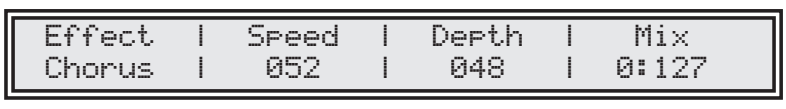
The Mix Parameter

Most of the effects have a mix parameter. This parameter determines the volume ratio between the original signal and the effect output. To further stress the fact that this is a ratio, the mix parameter is display as two numbers. The first number is the original or dry signal amount. The second number is the effect's output amount, or wet signal amount. The two numbers are separated by a colon (see chorus display example).

Chorus

Below, the display of the Microwave is shown with the Chorus effect selected:

Effect



Speed *0…127*

Determines the oscillator speed of the chorus effect.

Depth *0…127*

Determines the amount of the chorus.

Mix *127:0…0:127*

Determines the volume ratio of the dry and wet signal.

Flanger 1

Effect

Speed *0...127*

Determines the oscillator speed of the flanger effect.

Depth *0...127*

Determines the amount of flanging.

Mix *127:0...0:127*

Determines the volume ratio of the dry and wet signal.

Flanger 2

Effect

Speed *0...127*

Determines the oscillator speed of the flanger effect.

Feedback *0...127*

Determines the amount of feedback.

Mix *127:0...0:127*

Determines the volume ratio of the dry and wet signal.

AutoWahLP

Effect

The AutoWahLP is basically a low-pass filter of which the cutoff is determined by the signal's strength.

Sense *0...127*

Controls the filter's sensitivity according to the signal's strength.

Cutoff *0...127*

The minimal cutoff frequency of the filter.

Resonance *0...127*

Filter resonance.

AutoWahBP

Effect

The AutoWahBP is basically a band-pass filter of which the cutoff is determined by the signal's strength.

Sense *0...127*

Controls the filter's sensitivity according to the signal's strength.

Cutoff *0...127*

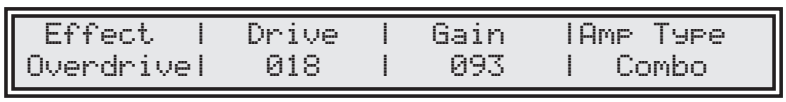
The minimal cutoff frequency of the filter.

Resonance *0...127*

Filter resonance.

Overdrive

Effect



Drive *0...127*

Determines how much distortion is applied.

Gain *0...127*

Determines the output volume of the distortion.

Amp Type *0...127*

Allows one to select the speaker simulation setting. These settings are available:

Setting	Type of Simulation
Direct	No speaker simulation
Combo	Simulation of a small speaker with small bandwidth
Medium	Simulation of a larger speaker with medium bandwidth
Stack	Simulation of an array of speakers with large bandwidth

Amp. Mod

Effect

The Amplitude Modulator can be used as a tremolo or as a low-frequency ring modulator. For use as a tremolo, the dry signal (the first number of the Mix parameter) must be kept above *63*. For use as a ring modulator, the dry signal must be kept below *64*.

Speed *0…127*

Oscillator speed of the amplitude modulator.

Spread *0…127*

Amount of lag between the left and right channel.

Mix *127:0…0:127*

Determines the volume ratio of the dry and wet signal.

Delay

Effect

Time

Delay time. This parameter is displayed as a note type followed by a Beats-Per-Minute number. So *1/4 [74]* means that the delay time is a quarter-note at 74 BPM.

Feedback *0…127*

Determines the amount of delayed signal being fed back into the delay.

Mix *127:0…0:127*

Determines the volume ratio of the dry and wet signal.

Pan Delay

Effect

The only difference between Delay and Pan Delay is that the delayed signal seems to bounce from the left channel to the right and back again.

Mod Delay

Effect

The modulated delay is a delay type effect where the delay time is modulated by a low frequency oscillator. The speed of the oscillator and the amount of change caused by the oscillator are parameters of this effect.

Time

Delay time. This parameter is displayed as a note type followed by a Beats-Per-Minute number. So *1/4 [74]* means that the delay time is a quarter-note at 74 BPM.

Speed *0…127*

The speed of the modulating oscillator.

Depth *0…127*

Amount of change in the delay time caused by the oscillator.

Portamento and Glissando

The term "portamento" describes the continuous gliding from one note to the next like strings or some brass instruments (e.g. trombone) can do. A glissando is a similar effect with one difference: The pitch does not change continuously but in note steps. On acoustic instruments a glissando can be performed e.g. on a piano when you play very fast over a wide key range. The MicroWave II/XT/XTk offers some different effect types that can be trimmed for each situation. The term "glide" is used for all different types of effect in common.

Glide

Active	Type	Mode	Time
on	Gliss	exp.	25

Active *off / on*

Enables or disables the glide effect.

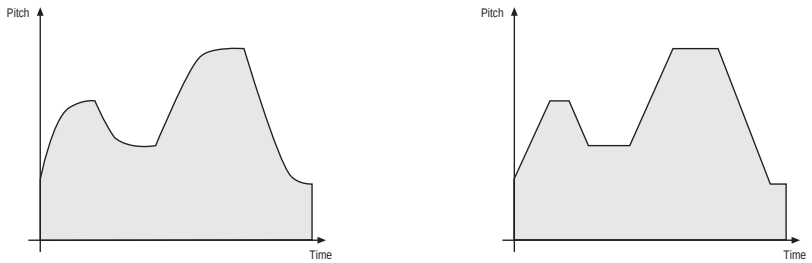
Type *porta / glissando / fingered / f.gliss*

Determines the effect type.

- *Porta* selects a normal portamento effect with all notes gliding continously from one to the next.
- Similar to that, *gliss* selects the normal glissando effect with all notes gliding in semitone steps.
- When *fingered* or *f.gliss* is selected, the portamento or glissando is only applied on legato played notes and so the first note played is not influenced. This feature is useful especially for solo sounds, when it is often undesireable to slide into the beginning.

Mode *exp. / linear*

Selects whether the pitch is changed in an *exponential* or *linear* style. On classic analog synthesizer the *exponential* style was used mainly since it could be easily created with analog circuits. The *linear* setting produces a more accurate gliding with better audible results. The following diagram illustrates the difference between the two modes:



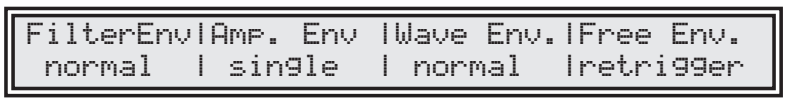
Time *0…127*

Determines the glide time. Low values will give a short glide time in the range of milliseconds that gives a special character to the sound. High values will result in a long glide time up to several seconds which can be useful for solo and effect sounds.

Trigger

The Trigger parameters define how the various envelopes are started. In addition, you can activate special dual and unisono modes to stack the MicroWave II/XT/XTk's voices.

Trigger 1



Trigger 2

FilterEnv *normal / single / retrigger*

Determines the way of triggering the Filter Envelope.

- If *normal* is selected, every note triggers the envelope of its own voice.
- If *single* is selected, the envelopes of all voices act as one. The envelope is started, when the first note is played. The sustain phase is held until the last note is released. Then the release phase is performed.
- If *retrigger* is selected, the envelope acts as in single mode except that each note triggers the envelope again from its current value.

Amp. Env *normal / single / retrigger*

Determines the way of triggering the Amplifier Envelope.

- If *normal* is selected, every note triggers the envelope of its own voice.
- If *single* is selected, the envelopes of all voices act as one. The envelope is started, when the first note is played. The sustain phase is held until the last note is released. Then the release phase is performed. This setting is only valid, if **Mode** is set to *Mono*. Otherwise the envelope works as if *normal* is selected.
- If *retrigger* is selected, the envelope acts as in single mode except that each note triggers the envelope again from its current value. This setting is only valid, if **Mode** is set to *Mono*. Otherwise the envelope works as if *normal* is selected.

Wave Env. *normal / single / retrigger*

Determines the way of triggering the Wave Envelope.

- If *normal* is selected, every note triggers the envelope of its own voice.
- If *single* is selected, the envelopes of all voices act as one. The envelope is started, when the first note is played. The sustain phase is held until the last note is released. Then the Key-off phase is performed.
- If *retrigger* is selected, the envelope acts as in single mode except that each note triggers the envelope again from its current value.

Free Env. *normal / single / retrigger*

Determines the way of triggering the Free Envelope.

- If *normal* is selected, every note triggers the envelope of its own voice.
- If *single* is selected, the envelopes of all voices act as one. The envelope is started, when the first note is played. The sustain phase is held until the last note is released. Then the release phase is performed.
- If *retrigger* is selected, the envelope acts as in single mode except that each note triggers the envelope again from its current value.

Mode *Poly / Mono*

Selects whether the sound can be played polyphonic or monophonic.

- Use the *Poly* setting for normal applications when you where to play chords.
- If *Mono* is selected, the MicroWave II/XT/XTk playes only the last incoming note. Use this mode for solo sounds, especially in combination with the Glide effect.

Assign *normal / dual / unisono*

Defines who the sound's voices are assigned to the played notes.

- If *normal* is selected, every played note uses one of the MicroWave II/XT/XTk's voices.
- If *dual* is selected, every note uses two voices which can be detuned by the **Detune** parameter described below.
- If *unisono* is selected, all voices are used, divided to the notes played. That means, if you play just one note, all 10 voices of the MicroWave II/XT/XTk are used for this note. If you play two notes, 5 voices are used for each note and so on. The **Detune** parameter is also active in this mode.

Detune *0…127*

Determines the amount of oscillator detune when *dual* or *unisono* is selected in the **Assign** parameter. The setting always represents the maximum detune range of all used voices. E.g. in dual mode a value of *40* means a detune of *-20* for the first voice and *+20* for the second.

De-Pan *0…127*

If *dual* or *unisono* is selected, the voices are spread in panorama according to this parameter. Use *127* to get a full spread or *0* to get no spread at all. If neither *dual* nor *unisono* is selected, the setting of this parameter has no audible effect.

Arpeggiator

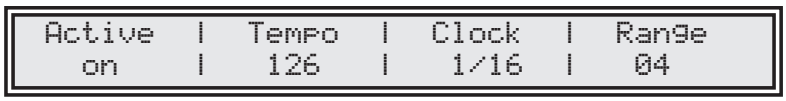
An arpeggiator is a device that splits an incoming MIDI chord into its single notes and repeats them rhythmically. Different sequence modes can be defined for the arpeggiator to cover a wide range of applications.
In addition to the synthesis features, the MicroWave II/XT/XTk offers a separately programmable arpeggiator for every sound program. The arpeggiator can be used independently or synced to MIDI clock. It can play a wide range of different rhythm patterns, including a user programmable.

The arpeggiator uses an internal buffer that can store up to 20 notes. The buffer is cleared each time a new chord is played. There are two ways of entering a chord:

- Press all keys of the chord simultaniously.
- Press and hold the first key of the chord. While holding this key, enter the other keys sequentially. After playing all keys, release the first key again. On one hand this method is practicable for playing difficult chords, on the other hand it is essential when using the *as played* setting of the **Direction** parameter. This setting allows you to create arpeggios in the sequence of played notes.

⚠ When you use the sound as part of a multi program, you can either use the sound's arpeggiator described here, or the dedicated arpeggiator of the multi program's instrument. Use the instrument parameter **Arpeggiator Active** to select which one to use. As a default the sound's arpeggiator is not activated and therefore no arpeggio will be generated when turning on the arpeggiator here.

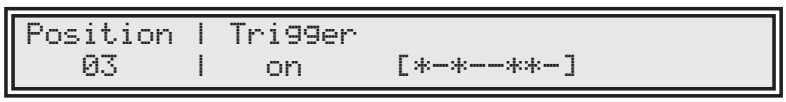
Arpeggiator 1



Arpeggiator 2

Arpeggiator 3

Arpeggiator User Pattern



Active *off / on / hold*

Enables or disables the arpeggiator or activates the *hold* mode. When *hold* is activated, incoming MIDI chords generate continuous arpeggios even when the chord is released. The MicroWave II/XT/XTk will continue to do so until you play a new chord or this parameter is set back to *off* or *on*. You can also stop the arpeggiator by performing the panic function or sending an All Notes Off message from your sequencer.

Tempo *extern / 50…300*

Sets the arpeggiator's basic tempo. Can be defined manually in BPM (beats per minute) or via MIDI clock, if *extern* is selected.

The arpeggiator can be used as a master as well as a slave via the MIDI clock:

- When you use the arpeggiator as the master, set its speed via the Tempo parameter. Set the global parameter **MIDI Clock Send** to *on*. This enables the sending of MIDI clock signal via the MicroWave II/XT/XTk's MIDI out jack ❽.
- When you use the arpeggiator as a slave, an external device (e.g.sequencer) determines the tempo of the arpeggiator. Set the **Tempo** parameter to *external* as described above. Here, too, notes and MIDI clock information can be used to control other devices. In this mode, the MIDI Song Position Pointer is also recognized.

Clock *1/1…1/32*

Determines the note value for whole notes to thirty-second notes. The basis is a 4/4 beat. Triplets (e.g. *1/8T*) and dotted notes (e.g. *1/16.*) are available for every value.

Range *1…10*

Determines the range of the single notes in octaves.

Pattern *off / user / 1…15*

Determines whether an rhythm pattern is played and which one.

- If *off* is selected, the arpeggiator playes its notes in regular steps, specified by the **Clock** parameter.
- If *user* is selected, the arpeggiator uses the free programmable pattern defined in the *Arpeggiator User Pattern* page.
- Additionally, the arpeggiator features 15 preset rhythm patterns. These are numbered from *1* through *15*. Here is an overview of the arpeggiator preset patterns:

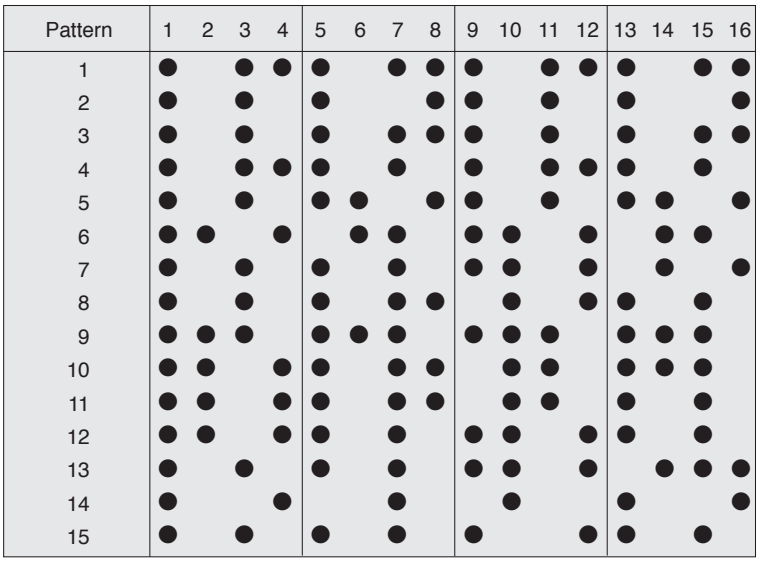


Diagram 4: Arpeggiator patterns

Direction *up / down / alternate / random*

Determines the sequence of generated notes according to pitch.

- If *up* is selected, the arpeggio starts at the lowest note and sweeps up through the notes until it reaches the highest note. It then starts at the bottom again.
- If *down* is selected, the arpeggio starts at the highest note and sweeps down through the notes until it reaches the lowest note. It then starts at the top again.
- If *alternate* is selected, the arpeggio starts at the lowest note and sweeps up through the notes until it reaches the highest note. It then starts to sweep back down.
- If *random* is selected, the arpeggio plays any of the notes in a random order.

NoteOrder *by note / note rev. / as played / reversed*

Determines the sequence of generated notes according to note order.

- If *by note* is selected, the arpeggio sequence is sorted by the MIDI note number. This is the standard mode, used by most arpeggiators.
- If *note rev.* is selected, the arpeggio sequence is sorted in the exactly reversed order to the *by note* setting.
- If *as played* is selected, the arpeggio is generated in the order of the incoming notes. In combination with the user programmable pattern this feature offers a small but effective step sequencer.
- If *reversed* is selected, the arpeggio is generated in the reverse order of the incoming notes.

To understand the difference of the individual settings, it is nessessary to "step-input" the notes of the chord as described at the beginning of this chapter.

Velocity *root note / last note*

Determines how the velocity values of the generated notes are calculated.

- If *root note* is selected, every generated note inherits its velocity from its base note. E.g. if the base chord for the arpeggio contains an E with a certain velocity, all generated E notes also have this velocity value, independent of their octave setting.
- If *last note* is selected, every generated note has the same velocity as the last incoming note.

Reset on Pattern Start *off / on*

Selects if the arpeggiator is reset each time the rhythm pattern starts again. If the setting is disabled, the arpeggiator plays all chord notes from the first to the last and over again, regarding the sequence determined by **Direction** and **Note Order**. If the setting is enabled, the arpeggiator only plays the number of chord notes that correspond to the pattern length. Then it starts with the first chord note at its basic octave again. The result is similar to pressing the chord again each time the pattern restarts. If no pattern is selected, this parameter has no function.

Length *1…16*

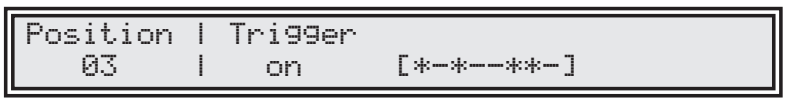
Determines the length of the user programmable rhythm pattern.

Position *1…pattern length*

Trigger *off / on*

These two parameters are used to define the user programmable rhythm pattern. Before entering the pattern, you must set its length via the **Length** parameter. Use the **Position** parameter to select the position of the pattern you want to edit. Then use the **Trigger** parameter to define the state of the selected position. All active positions are marked with a "*" in the display, all inactive positions show a "-". Note that you can also create triplet rhythms by setting the pattern length to 3, 6 or 12 and selecting a triplet value for the **Clock** parameter.

Arpeggiator User Pattern

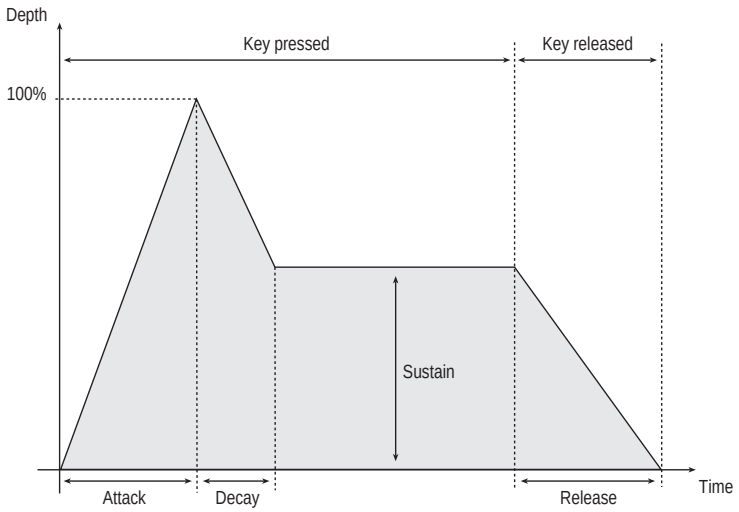


Envelopes

The MicroWave II/XT/XTk's envelopes allow you to manipulate sound parameters via rate or timed modulations. The MicroWave II/XT/XTk offers four independent programmable envelopes for every sound program:

- A filter envelope with ADSR characteristic
- A volume envelope with ADSR characteristic
- A wave envelope with 8 different times and levels (multi segment envelope)
- An additional free multi segment envelope with 3 different times and levels and a release time and release level

Most traditional synthesizers feature ADSR envelopes. These envelopes are made up of four parameters that determine their response: **Attack, Decay, Sustain** and **Release.** The following diagram illustrates the structure of an ADSR envelope:



The envelope is started by pressing a key. It ascends to its maximum value at the rate determined by the **Attack** parameter. It then descends at the rate determined by the **Decay** value until it reaches the predetermined **Sustain** value. It remains at this value until the key is released. The envelope then descends to zero at the rate determined by the **Release** parameter.

Filter Envelope

This envelope is designed to control the filter but can also be used for other modulations. The following parameters determine the envelope's response.

Filter Env

Attack *0...127*

Determines the attack rate or amount of time it takes for a signal to go from zero to maximum level.

Decay *0...127*

Determines the decay rate or amount of time it takes for a signal to reach the **Sustain** level.

Sustain *0…127*

Determines the sustain level which is held until a note ends.

Release *0…127*

Once the note has ended, the release phase begins. During this phase, the envelope fades to zero at the rate determined by the Release value.

Amplifier Envelope

This envelope is designed to control the sound volume, but can also be used for other modulations. The following parameters determine the envelope's response.

Amplifier Env

Attack *0…127*

Determines the attack rate or amount of time it takes for a signal to go from zero to maximum level.

Decay *0…127*

Determines the decay rate or amount of time it takes for a signal to reach the **Sustain** level.

Sustain *0…127*

Determines the sustain level which is held until a note ends.

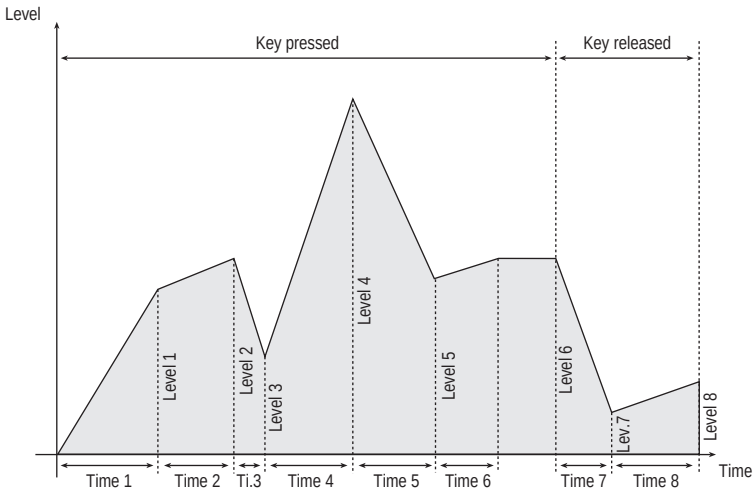
Release *0…127*

Once the note has ended, the release phase begins. During this phase, the envelope fades to zero at the rate determined by the Release value.

Wave Envelope

The MicroWave II/XT/XTk's wave envelope features a multi segment characteristic with 8 separately adjustable times and levels.

Multi segment envelopes are extremely flexible modulation sources. Their structure is made of grouped time/level parameters that allows one to generate an almost free modulation amount over several time segments. The following diagram illustrates the structure of a multi segment envelope:



As shown in the diagram, the envelope consists of several single segments. Also the figure can be divided into a sustain and a release phase. The crossover point between these two phases can be determined by selecting the corresponding segment number. The envelope is started by pressing a key. It ascends to the **Level 1** value at the rate determined by the **Time 1** parameter. In the next time segment **Time 2** the amplitude moves to the **Level 2** value. The same procedure is processed for the following segments until the end of the sustain phase is reached. In the shown example **Level 6** is the last value of the sustain phase. The amplitude remains at this value until the key is released. The envelope then moves on to process the remaining segments until it finally ends with its last value **Level 8.** In fact you can reduce the number of processed segments to get things easier. Additionally you can repeat specific segments by installing loops in the sustain phase as well as in the release phase.

Wave Env / 1...4

```
 Time 1  | Level 1 |  Time 2 | Level 2
   020   |   100   |   115   |   063
```

Wave Env / 5

```
Key On Loop        |Loop Start|Loop End
                   |          |
```

Wave Env / 6

```
Key Off Loop       |Loop Start|Loop End
                   |          |
```

Time 1...8 *0...127*

Determines the time for the individual segment to reach its end level.

Level 1...8 *0...127*

End level that the corresponding segment finally reaches.

Key On Loop *off / on*

Selects whether a loop is performed in the envelope's sustain phase or not.

Loop Start *1...8*

Defines the starting point for the sustain loop if **Key On Loop** is enabled.

Loop End *1...8*

Defines the ending point for the sustain loop if **Key On Loop** is enabled. It further determines the end of the sustain phase and the beginning of the release phase. Note that this feature is also valid when **Key On Loop** is disabled.

Key Off Loop *off / on*

Selects whether a loop is performed in the envelope's release phase or not.

Loop Start *1...8*

Defines the starting point for the release loop if **Key Off Loop** is enabled.

Loop End *1...8*

Defines the ending point for the release loop if **Key Off Loop** is enabled. It further determines the last segment of the whole envelope. No segment beyond the selected number will be used. Note that this feature is also valid when **Key Off Loop** is disabled.

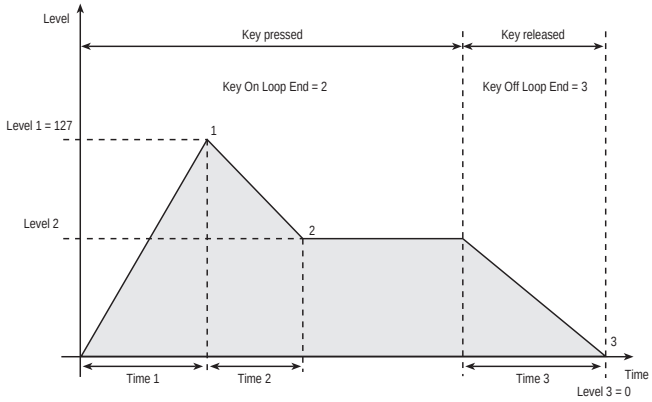
⚠ The loop points are numbered from 1 to 8. Each number represents the end of the corresponding segment, e.g. **no. 3** means the point of **Level 3** after **Time 3**. As you can see, the first loop point is at the end of segment 1. Therefore segment 1 can not be looped.

The following examples illustrate the use of the Wave Envelope:

☞ This is how you setup an classic ADSR-like envelope:

1. Set **Key On Loop** and **Key Off Loop** to *off*. This ensures that no loops are performed.
2. Set **Level 1** to *127*.
3. Specify the Attack time via the **Time 1** parameter.
4. Specity the Decay time via **Time 2**.
5. Use **Level 2** to setup the Sustain level.
6. Set **Key On Loop Start** to *1* and **Key On Loop End** to *2*. This specifies segment 2 of the envelope as last segment in the sustain phase.
7. Set **Level 3** to *0*.
8. Specify the Release time via **Time 3**.
9. Set **Key Off Loop End** to *3*. This causes the envelope to stop after segment 3.

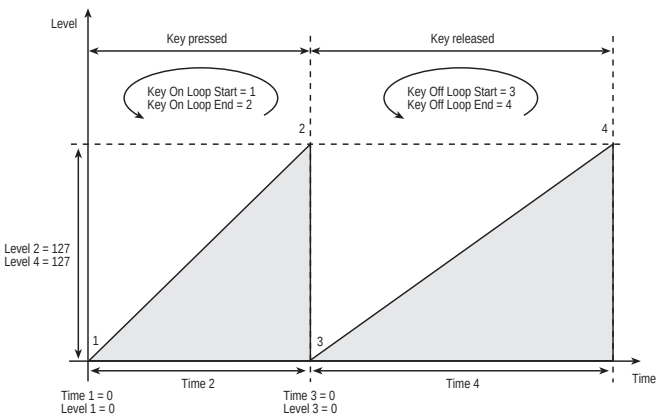
The following diagram shows how this example works:



☞ This is how you setup an envelope that it works like a sawtooth LFO with different rates in the sustain and release phase:

1. Set **Key On Loop** and **Key Off Loop** to *on*. This causes both loops in the sustain and in the release phase to be activated.
2. Set **Level 1** and **Time 1** to *0*. This deactivates segment 1 because it can not be looped.
3. Set **Level 2** to *127*. This defines the maximum value of the sawtooth's amplitude.
4. Specify the rate of the sawtooth for the sustain phase via the **Time 2** parameter.
5. Set **Key On Loop Start** to *1* and **Key On Loop End** to *2*. This will repeat segment 2 of the envelope as long as the key is pressed.
6. Set **Level 3** to *0*. This defines the minimum setting of the sawtooth's amplitude.
7. Set **Time 3** to *0*. This causes the envelope abruptly to minimum level after releasing the key and sets the minimum value of the sawtooth's amplitude in the release phase.
8. Set **Level 4** to *127*. This defines the maximum value of the sawtooth's amplitude in the release phase.
9. Specify the rate of the sawtooth for the release phase via the **Time 4** parameter.
10. Set **Key Off Loop Start** to *3* and **Key Off Loop End** to *4*. This will repeat segment 4 of the envelope in the release phase.

The following diagram shows how this example works:



Free Envelope

In addition to the previously described envelopes, the MicroWave II/XT/XTk offers a Free Envelope which can be used for modulation purposes. This envelope also features a multi segment structure. It consists of 4 segments and has no loop functionality. The first 3 segments always belong to the sustain phase, the last one always belongs to the release phase. The main difference to the other envelopes is that the Free Envelope features bipolar levels. Therefore it can generate modulation amounts in the range -1…0…+1.

Free Env / 1

Free Env / 2

Time 1…3 *0…127*

Determines the time for the individual segment to reach its end level.

Level 1…3 *-64…+63*

End level that the corresponding segment finally reaches.

Release *0…127*

Determines the length of the release phase when the key is released. The envelope then descends to the **R. Level**.

R. Level *-64…+63*

Last level that is reached when the release phase ends.

Low-frequency Oscillators (LFOs)

In addition to the main oscillators, the MicroWave II/XT/XTk is equipped with two low-frequency oscillators which can be used for modulation purposes. Each LFO generates a periodic waveform with adjustable frequency and shape.

LFO 1

LFO 1 / 1

LFO 1 / 2

Rate *0…127 (128 Bars…1/64)*

Determines the frequency of the generated signal. If **Sync** is set to *Clock*, the value is shown in musical notation. The basis is a 4/4 beat. Triplets (e.g. *1/8T*) and dotted notes (e.g. *1/16.*) are available for some values.

Shape *sine / triangle / square / sawtooth / random / S & H*

Determines the type of waveshape to be generated. Sample & Hold samples a random value and holds it until the next LFO cycle begins. If **Rate** has a value of *0*, then a random value is generated for each new incoming MIDI note. More variations can be achieved by means of the **Symmetry** parameter. Please read the corresponding paragraph later on in this chapter.

Delay *off / retrigger / 1…126*

Determines the start of the LFO cycle after an incoming MIDI note.

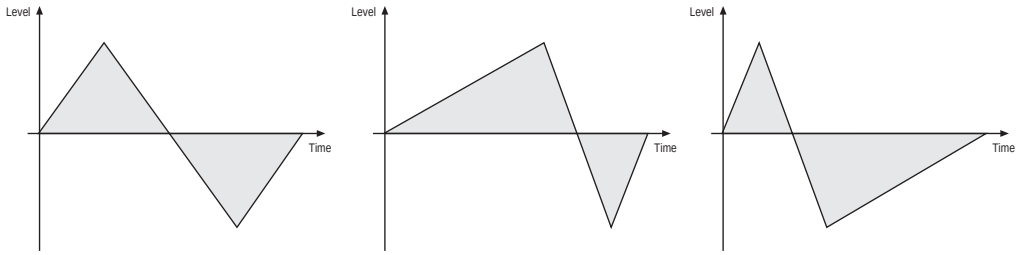
- If *off* is selected, the LFO runs completely free, which means its cycle is not synchronised to the note start. Use this setting e.g. when modulating the filter cutoff of a sound that should be different each time you play it.
- If *retrigger* is selected, the LFO starts its cycle after receiving a note. This is also known as "key sync" feature. This setting is useful when the LFO must always start at a fixed value, e.g. when creating an alert sound.
- If *1…126* is selected, the LFO is works like in *retrigger* mode, but is delayed with the specified amount. This setting is useful e.g. for solo sounds with a vibrato or tremolo that is only applied on long notes.

Sync *off / on / Clock*

Selects if the LFO is synchronised. If *off* is selected, the LFO runs completely independent. If *on* is selected, all LFOs of the MicroWave's voices used by the sound program behave as one. If *Clock* is selected, the LFO is synchronised to an incoming MIDI Clock signal.

Symmetry *-64…+63*

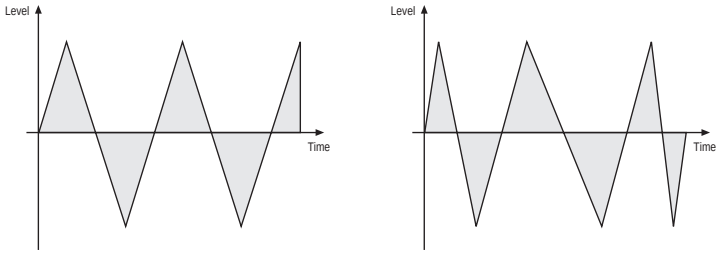
Adjusts the relationship between the rising and the falling edge of the signal. When set to 0 the generated waveshape is symmetrical. When set to positive values, the positive cycle becomes longer and the negative cycle becomes shorter and vice versa. Use this parameter to change to pulsewidth of the square signal. When using it on a triangle waveshape, you can get a sawtooth wave with a soft rising or falling slope. The following diagram illustrates this effect:



Symmetry = 0 Symmetry = +40 Symmetry = -40

Humanize *off / 1…127*

Allows one to add a random variation to the LFO speed. When disabled, the LFO remains at its initial speed, preset by the **Rate** parameter. Low settings add a human touch to the sound, high settings are useful when creating effect sounds with an irregular character e.g a wind sound where the filter frequency is modulated by an LFO. The following diagram shows the effect of the Humanize setting:



Humanize = off Humanize = 127

LFO 2

The second LFO offers the same functionality as the first one. In addition it can be linked with LFO 1.

LFO 2 / 1

LFO 2 / 2

Rate *0…127*

Determines the frequency of the generated signal.

Shape *sine / triangle / square / sawtooth / random / S & H*

Determines the type of waveshape to be generated. Sample & Hold samples a random value and holds it until the next LFO cycle begins. If **Rate** has a value of *0*, then a random value is generated for each new incoming MIDI note. More variations can be achieved by means of the **Symmetry** parameter. Please read the corresponding paragraph later on in this chapter.

Delay *off / retrigger / 1…126*

Determines the start of the LFO cycle after an incoming MIDI note.

- If *off* is selected, the LFO runs completely free, which means its cycle is not synchronised to the note start. Use this setting e.g. when modulating the filter cutoff of a sound that should be different each time you play it.
- If *retrigger* is selected, the LFO starts its cycle after receiving a note. This is also known as "key sync" feature. This setting is useful when the LFO must always start at a fixed value, e.g. when creating an alert sound.
- If *1…126* is selected, the LFO is works like in *retrigger* mode, but is delayed with the specified amount. This setting is useful e.g. for solo sounds with a vibrato or tremolo that is only applied on long notes.

Sync *off / on*

Selects if the LFO is synchronised. If *off* is selected, the LFO runs completely independent. If *on* is selected, all LFOs of the MicroWave's voices used by the sound program behave as one.

Symmetry *-64…+63*

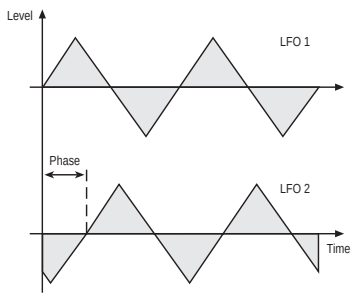
Adjusts the relationship between the rising and the falling edge of the signal. When set to 0 the generated waveshape is symmetrical. When set to positive values, the positive cycle becomes longer and the negative cycle becomes shorter and vice versa. Use this parameter to change to pulsewidth of the square signal. When using it on a triangle waveshape, you can get a sawtooth wave with a soft rising or falling slope. Please refer to the description of LFO 1 to get further information.

Humanize *off / 1…127*

Allows one to add a random variation to the LFO speed. When disabled, the LFO remains at its initial speed, preset by the **Rate** parameter. Please refer to the description of LFO 1 to get further information.

Phase *off / 3…357*

If disabled, LFO 2 operates independently from LFO 1. If enabled, the frequency of the generated signal is determined by LFO 1. The Phase parameter defines the angle in degrees from which LFO 2's signal is phase shifted to LFO 1. The use of this function only makes sense when using a regular waveshape like sine, triangle, sawtooth or square.



Modifiers and Modulation Matrix

The modifiers allow you to perform mathematical functions on modulation signals. Depending on the function type selected, calculation is done between two source signals or between a source signal and a constant parameter. You can use up to four independent modifier units. The result of each operation is not processed directly but can be used as input source for the modulation matrix described in the next chapter. Also you can use it again as source for another modifying process. In addition a separate delay line can be used to process a modulation source.

The following table shows an overview of all modulation sources available on the MicroWave II/XT/XTk:

Setting	Description
off	Modulation off
LFO1	LFO 1 signal
*LFO1*Modw*	LFO 1 signal multiplied with Modwheel
*LFO1*Prs.*	LFO 1 signal multiplied with Aftertouch
LFO2	LFO 2 signal
FilterEnv	Filter Envelope signal
Ampl. Env	Amplifier Envelope signal
Wave Env	Wave Envelope signal
Free Env	Free Envelope signal
KeyFollow	Same as *Keytrack*, but with pitchbend and glide
Keytrack	MIDI note number
Velocity	MIDI note velocity
Rel. Velo	MIDI note release velocity
Pressure	MIDI aftertouch
Poly Prs.	MIDI polyphonic pressure
PitchBend	MIDI pitchbend signal
Modwheel	MIDI modulation wheel (controller #1)
Sust. Ctr.	MIDI sustain pedal (controller #64)
Foot Ctr.	MIDI foot control (controller #4)
BreathCtr.	MIDI breath control (controller #2)
Control W	Assignable MIDI-Controller 1
Control X	Assignable MIDI-Controller 2
Control Y	Assignable MIDI-Controller 3
Control Z	Assignable MIDI-Controller 4
Ctr Delay	Modifier Delay
Modify #1	Modifier #1 result
Modify #2	Modifier #2 result
Modify #3	Modifier #3 result
Modify #4	Modifier #4 result
MIDIClock	MIDI clock signal
Minimum	constant for minimum modulation (equals 0)
Maximum	constant for maximum modulation (equals +1)

Table 3: Modulation sources

Modifier Delay

This function allows one to delay a freely-definable modulation source for an adjustable period of time.

Modifier Delay

Control Delay Time *0…127*

Determines the time for which the modulation signal is delayed.

Source *see Table 3*

Selects the modulation source whose signal is used as input for the delay line.

Modifier Units

Modifier 1…4

Source #1 *see Table 3*

Selects the first source signal used for the calculation. Table 2 shows all possible settings.

Source #2 *see Table 3*

Selects the second source signal when two sources are required for the calculation. See description of modifier functions for further details. The possible settings are the same as for **Source #1.**

Type *see Table 4*

Determines which kind of operation will be performed on the selected input sources. The following types are available:

Setting	Description
+	Addition
-	Subtraction
***	Multiplication
/	Division
XOR	Exclusive OR function
OR	OR function
AND	AND function
S & H	Sample & Hold
Ramp	Triggered ramp
Switch	Switch
abs value	Absolute value
min value	Minimum value
max value	Maximum value
lag proc.	Ramp function
filter	Low pass filter
diff.	Differential function

Table 4: Modifier functions

The result of a modifier operation always lies within the range *-1…0…+1*. When it is assigned to a parameter in the Modulation Matrix, it is scaled to the range of the selected parameter.

The following paragraph describes the function and the result of each modifier function in detail:

+ Returns the sum of **Source #1** and **Source #2**.

- Returns the difference of **Source #1** and **Source #2**.

*** Returns the product of **Source #1** and **Source #2**.

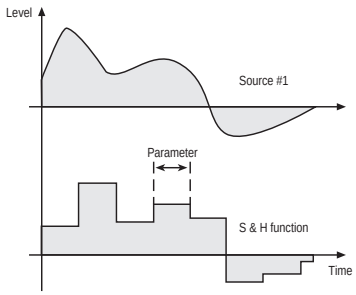
/ Returns the quotient of **Source #1** and **Source #2**.

XOR Returns the binary exclusive-or operation of **Source #1** and **Source #2**.

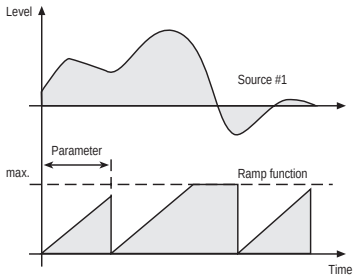
OR Returns the binary or operation of **Source #1** and **Source #2**.

AND Returns the binary and operation of **Source #1** and **Source #2**.

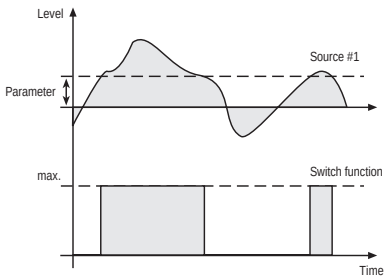
S & H Samples and holds the value of **Source #1** in regular intervals, determined by the value of **Parameter**. You can use this function to create rhythmcally modulations based on a definable source.



Ramp Creates a linear ramp from minimum to maximum. The ramp is triggered each time **Source #1** has a positive transition. The rise time is specified by **Parameter**. You can use this e.g. to get an additional sawtooth source from an LFO while another waveform is selected.



Switch Returns maximum, if the value of **Source #1** is above the value of **Parameter**. Otherwise minimum is returned. Use this function to trigger an action depending on a source signal's value. E.g. applying ring modulation when notes are played with maximum velocity. You can use this also to create a pulse signal out of an LFO, where **Parameter** determines the pulse width.

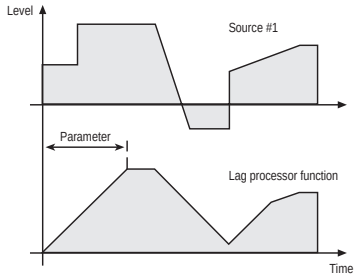


abs value Returns the value of **Source #1** without its sign. Negative values are converted to their corresponding positive amounts. **Parameter** has no function here. This function can be used e.g. for converting a bipolar modulation source to a unipolar one, like opening the filter via Pitchbend independent of the bending direction.

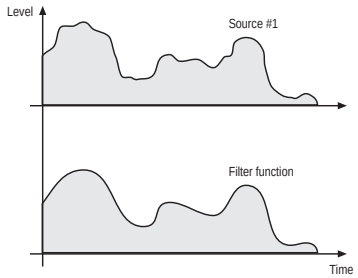
min value Returns the minimum value of either **Source #1** or **Parameter**.

max value Returns the maximum value of either **Source #1** or **Parameter**.

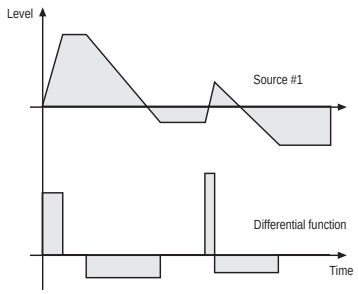
lag proc. The lag processor creates a linear ramp from its current value, which is initially minimum, to the value of **Source #1**. Then the ramp is stopped until **Source #1** changes again. The ramp time is specified by **Parameter**. This function is useful when you want to apply a definable modulation over a specified time, e.g. Modwheel controlled ramp for oszillator sweeps.



filter Performs a low pass filter function on **Source #1**. The filter frequency is determined by **Parameter**'s value. Use this function to smooth a signal.



diff. Performs a differential function on **Source #1**. The result of this function represents the speed of value change in the selected source. **Parameter** has no function here. This function is useful to detect if a source signal has changed, e.g. the Modwheel was turned.



Parameter *0…127*

Defines a value for modifier functions that require a constant parameter. See the **Type** parameter described above for further details.

Modulation Matrix

A modulation can be described as influencing a sound parameter by a signal generating unit. The terms used in this context are "source" and "destination". The MicroWave II/XT/XTk offers 16 independent modulation units each with individual settings of source, destination and amount.

Mod 1...16

Source *see Table 3*

Defines the modulation source. See Table 3 for the list of available sources.

Amount *-64...+63*

Determines the amount of modulation applied to the destination. Since the modulation is in fact a multiplication of the source signal and this parameter, the resulting amplitude depends on the type of modulation source you select:

- For the so-called unipolar modulation sources, the resulting amplitude lies within the range of *0...+1*, if Amount is positive or *0...-1*, if Amount is negative. These sources are: Filter Envelope, Amplifier Envelope, Wave Envelope, all MIDI controllers including Modwheel, Foot control etc., Velocity, Release Velocity, Aftertouch, Polyphonic Pressure and MIDI clock.
- For the so-called bipolar modulation sources, the resulting amplitude lies within the range of *-1...0...+1*. These sources are: Free Envelope, both LFOs, Keytrack, Keyfollow and Pitchbend.

For the modulation sources Keytrack and Keyfollow, a value of *+56* represents 100% of the scale.

Destination *see Table 5*

Defines the modulation destination. The table below shows all possible settings for this parameter:

Setting	Description
Pitch	Global pitch off all oscillators
Osc1 Pit.	Oscillator 1 pitch
FM Amount	Amount of frequency modulation
Osc2 Pit.	Oscillator 2 pitch
Wave1 Pos	Wave 1 startposition
Wave2 Pos	Wave 2 startposition
Wave1 Mix	Mixer input level Wave 1
Wave2 Mix	Mixer input level Wave 2
Ringmod	Mixer ringmodulation level
Noise Mix	Mixer noise level
Cutoff	Filter 1 cutoff frequency
Resonance	Filter 1 resonance
Filter 2	Filter 2 cutoff frequency
Volume	Amplifier master volume
Panning	Amplifier pan position
FE Attack	Filter Envelope attack
FE Decay	Filter Envelope decay
FE Sustain	Filter Envelope sustain
FE Release	Filter Envelope release
AE Attack	Amplifier Envelope attack
AE Decay	Amplifier Envelope decay
AE Sustain	Amplifier Envelope sustain
AE Release	Amplifier Envelope release
WE Times	All Wave Envelope times
WE Levels	All Wave Envelope levels
Free Env T	All Free Envelope times
Free Env L	All Free Envelope levels
LFO1 Rate	LFO 1 rate
LFO1 Level	LFO 1 level
LFO2 Rate	LFO 2 rate
LFO2 Level	LFO 2 level
M1 Amount	Amount of modulation assignment 1
M2 Amount	Amount of modulation assignment 2
M3 Amount	Amount of modulation assignment 3
M4 Amount	Amount of modulation assignment 4

Table 5: Modulation destinations

Program Name

This page is designed to name the Sound program. You can use up to 16 characters for this purpose.

Name

First select the character to be modified via the first value dial. Then change its setting via the second value dial.

Multi Mode

Multi parameters

The **Multi** parameters consist of settings which are common to all instruments in a multi program.

Volume

Tempo

Controls

Keyboard Control

Name

Multi Volume *0…127*

Determines the master volume for the multi program.

Arpeggiator Tempo *extern / 50…300*

This setting allows one to define a master tempo for all instruments in the multi program. If *extern* is selected, the tempo is determined by MIDI clock.

Control W…Control Z *0…120 / global*

These parameters are used to define modulation sources that are freely definable MIDI controllers. Each value represents a MIDI controller number that is used when you assign its parameter as modulation source in the Modifiers or the Modulation Matrix. If *global* is selected, the corresponding settings made in the global parameter section are used.

XTk **MIDI Send** *global / specific*

This setting determines the MIDI channel used for sending notes generated by the XTk's keyboard. If *global* is selected, notes are sent on the basic channel selected in the global parameters section. If *specific* is selected, notes are sent according to the settings of the specific instruments.

Name

Use this page to set the multi program's name. First select the character to be modified via the first value dial. Then change its setting via the second value dial.

Instrument parameters

The **Instrument** parameters consist of individual settings for each Instrument in a multi program.

Selecting an instrument for editing

Before you apply any edits to an Instrument's parameter, you have to select the Instrument to which the edits belong. Use the rightmost **value dial** ⑫ to switch between the Instruments.

Instrument Select (e.g. 1)

The instrument no. is always displayed when a parameter page with Instrument relating settings is selected. This is also valid when editing a sound program in Multi Mode because the sound program belongs to an Instrument. The no. is not displayed while editing **Multi** or **Global** parameters.

When editing an Instrument's Sound program, you can also switch among the Instruments by turning the rightmost value dial ⑫ when the **Shift** key ⑪ is hold.

Sound

Sound 1

Sound 2

Sound 3

Bank *A / B*

Selects the bank from which the sound program is taken.

Sound *001…128*

Selects the instrument's sound program.

Channel *global / omni / 1…16*

Determines the MIDI receive channel for the instrument.

- If *omni* is selected, the Instrument receives on all channels.
- If *global* is selected, the MIDI channel defined in the global parameters is used.

Volume *0…127*

Determines the master volume for the instrument.

Status *off / on*

Status *off / Keys/MIDI / Keys / MIDI*

Determines whether the instrument is disabled or enabled. On the XTk, you can determine whether the selected instrument is played from the internal keyboard, incoming MIDI notes or both.

Panning *left 64…center…right 63*

Determines the position of the instrument within the stereo panorama. The value range extends from *left 64*, which means far left, over the *center* position to *right 63*, which means far right.

PanMod *off / normal / inverse*

This setting decides whether panning modulation is applied or not.

- When set to *off*, no panning modulation is done at all.
- When set to *normal*, panning modulation is applied as defined in the single program that is used for the instrument.
- When set to *inverse*, panning modulation is done as before, but the modulation signal is negated and, as a result, the stereo sides are exchanged.

Output *Main Out / Sub Out*

Selects the audio output on which the instrument's signal will appear. *Main* routes the instrument to the main outputs **Main Out Left/Stereo** ❷ and **Main Out Right Mono** ❸, *Sub* routes it to the sub outputs **Sub Out Left/Stereo** ❹ and **Sub Out Right Mono** ❺.

Tune

Tune

Transpose *-48…+48*

Allows one to transpose the instrument in steps of a semitone.

Detune *-64…+63*

Fine-tunes the instrument in increments of 64ths of a semitone.

MIDI Send *off / on*

This XTk parameter is accessible only if the Multi parameter **MIDI Send** is set to *specific*. If set to *on*, this instrument will send notes on the instrument's selected MIDI channel.

Range

Range 1

Range 2

Lowest Velocity *1…127*

This parameter allows you to limit the velocity range in which the instrument is played. Only notes with a velocity higher or equal to the selected value are passed through. Set this parameter to *1*, if you want to turn velocity switching off.

Highest Velocity *1…127*

Counterpart to the **Lowest Velocity** parameter. Only notes with a velocity lower or equal to the selected value are passed through. Set this parameter to *127*, if you want to turn velocity switching off.

Lowest Key *0…127*

Equivalent to the velocity switching parameters, you can restrict the key range used for the instrument's tone generation. Only notes with a key number higher or equal to the selected value are passed through. Set this parameter to *0* if you want to use the full keyboard range.

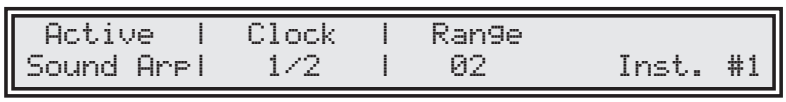
Highest Key *0…127*

Counterpart to the **Lowest Key** parameter. Only notes with a key number lower or equal to the selected value are passed through. Set this parameter to *127* if you want to use the full keyboard range.

Arpeggiator

Every Instrument in a Multi mode program is capable of using its own arpeggiator. The settings made in this section override the settings defined in the Instrument's Sound program. All Instruments will use the tempo setting defined in the **Multi Arpeggiator Tempo** parameter, because it makes no sense to use different settings for each Instrument. Alternatively, you can use the original settings of the Sound program by using the corresponding option in the **Active** parameter.

Arpeggiator 1



Arpeggiator 2

Arpeggiator 3

Active *off / on / hold / Sound Arp*

Enables or disables the arpeggiator or activates the *hold* mode. When *hold* is activated, incoming MIDI chords generate continuous arpeggios even when the chord is released. If *Sound Arp* is selected, the arpeggiator uses the settings defined in the Sound program that builds the instrument.

Clock *1/1…1/32*

Determines the note value for whole notes to thirty-second notes. The basis is a 4/4 beat. Triplets (e.g. *1/8T*) and dotted notes (e.g. *1/16.*) are available for every value.

Range *1…10*

Determines the range of the single notes in octaves.

Pattern *off / user / 1…15*

Determines whether an rhythm pattern is played and which one.

- If *off* is selected, the arpeggiator playes its notes in regular steps, specified by the **Clock** parameter.
- If *user* is selected, the arpeggiator uses the free programmable pattern defined in the *Arpeggiator User Pattern* page of the sound program. The instrument itself does not provide a user pattern.
- Additionally, the arpeggiator features 15 preset rhythm patterns. These are numbered from *1* through *15*.

See diagram 4 in chapter "Sound Parameters" to get detailed information about patterns.

Direction *up / down / alternate / random*

Determines the sequence of generated notes according to pitch.

- If *up* is selected, the arpeggio starts at the lowest note and sweeps up through the notes until it reaches the highest note. It then starts at the bottom again.
- If *down* is selected, the arpeggio starts at the highest note and sweeps down through the notes until it reaches the lowest note. It then starts at the top again.
- If *alternate* is selected, the arpeggio starts at the lowest note and sweeps up through the notes until it reaches the highest note. It then starts to sweep back down.
- If *random* is selected, the arpeggio plays any of the notes in a random order.

NoteOrder *by note / note rev. / as played / reversed*

Determines the sequence of generated notes according to note order.

- If *by note* is selected, the arpeggio sequence is sorted by the MIDI note number. This is the standard mode, used by most arpeggiators.
- If *note rev.* is selected, the arpeggio sequence is sorted in the exactly reversed order to the *by mode* setting.
- If *as played* is selected, the arpeggio is generated in the order of the incoming notes. In combination with the user programmable pattern this feature offers a small but effective step sequencer.
- If *reversed* is selected, the arpeggio is generated in the reverse order of the incoming notes.

To understand the difference of the individual settings, it is nessessary to "step-input" the notes of the chord as described in the chapter "Arpeggiator" of the sound parameters.

Velocity *root note / last note*

Determines how the velocity values of the generated notes are calculated.

- If *root note* is selected, every generated note inherits its velocity from its base note. E.g. if the base chord for the arpeggio contains an E with a certain velocity, all generated E notes also have this velocity value, independent of their octave setting.
- If *last note* is selected, every generated note has the same velocity as the last incoming note.

Reset on Pattern Start *off / on*

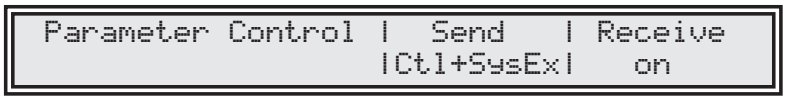
Selects if the arpeggiator is reset each time the rhythm pattern starts again. If the setting is disabled, the arpeggiator plays all chord notes from the first to the last and over again, regarding the sequence determined by **Direction** and **Note Order**. If the setting is enabled, the arpeggiator only plays the number of chord notes that correspond to the pattern length. Then it starts with the first chord note at its basic octave again. The result is similar to pressing the chord again each time the pattern restarts.

Global Parameters

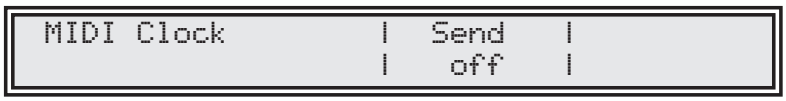
Global parameters are settings that influence the MicroWave II/XT/XTk's general response. These are determined separately from the programs and stored in a special memory location. Global parameters are stored automatically when switching off the device.

MIDI 1

MIDI 2



MIDI 3



Controls

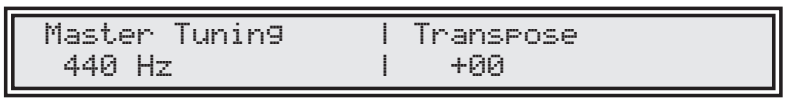
Keyboard

Sustain Pedal

Volume

Volume

Tune



System

Channel *omni / 1…16*

Sets the basic send and receive channel for the MicroWave II/XT/XTk. This setting is valid for all Sound programs and for Instruments of a Multi program whose **Channel** parameter is set to *global*. If *omni* is selected, the MicroWave II/XT/XTk sends on channel 1 and receives on all channels.

PrgChange *sound / multi / combined*

Determines the way MIDI Program Change messages are processed.

- If *sound* is selected, program changes are used to select Sound programs for the Instrument that receives on the corresponding MIDI channel.
- If *multi* is selected, the whole Multi program is switched by program changes, that are received on the basic channel set above.
- If *combined* is selected, Instrument programs can be changed by using the Instrument's channel, the Multi can be changed by using the basic channel.

BendRange *0…120 / harmonic*

Determines the intensity of the pitchbend via MIDI Pitchbend messages in semitones. If *harmonic* is selected, the pitchbend is performed in steps of the harmonic and subharmonic scale. Please refer to the chapter "Oscillator" to get further information about the harmonic scale. This setting is valid for all programs whose oscillator **Pitchbend Range** parameter is set to *global*.

Device ID *0…126*

Defines the device identification number for system exclusive data transmission. Transmission will only be executed successfully if the sender and receiver setting coincide. Device ID *127* is a so-called broadcast ID that addresses all connected MicroWave II/XT/XTks. The MicroWave II/XT/XTk can receive this from other devices, but cannot send it itself. This function is limited to special computer software.

Par. Control Send *off / Ctl only / SysEx / Ctl+SysEx*

Determines which type of data is sent from the MicroWave II/XT/XTk via MIDI.

- If *off* is selected, no data is sent.
- If *Ctl only* is selected, only controller messages are sent. Parameters without dedicated controller assignment are not sent at all.
- If *SysEx* is selected, only system exclusive data is sent. This has the advantage that the parameter change is not channel based but instrument based, which can avoid unwanted parameter changes of layered sounds. The disadvantage is a larger amount of data that is transferred.
- If *Ctl+SysEx* is selected, both controller messages and system exclusive data is sent.

Par. Control Receive *off / on*

Enables or disables the receiving of parameter control messages via MIDI. These messages include controller and system exclusive data.

MIDI Clock Send *off / on*

Enables or disables the sending of MIDI clock. This setting should be enabled in those cases, where you want to use the MicroWave II/XT/XTk's arpeggiator as master for controlling the tempo.

⚠ When MIDI Clock Send is enabled while the MicroWave II/XT/XTk's MIDI In and Out are connected to your sequencer, you will probably get a MIDI loop. A total hangup of your system may result. Ensure to disable the MicroWave II/XT/XTk's MIDI clock sending feature in such a case.

Control W…Control Z *0…120*

These parameters are used to define modulation sources that are freely definable MIDI controllers. Each value represents a MIDI controller number that is used when you assign its parameter as modulation source in the Modifiers or the Modulation Matrix. The settings made here are only valid for Sound programs because each Multi program has its own set of **Control W…Control Z** parameters.

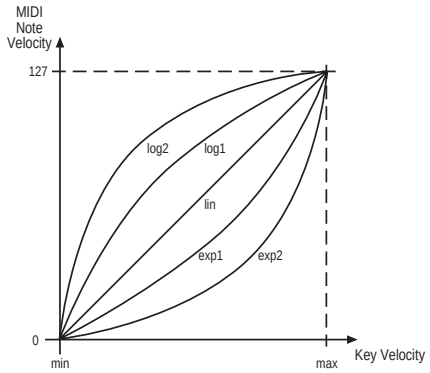
☞ Example: You want to control the LFO1 speed via MIDI controller #49. To do so, set **Control W** to *49* first. Then, setup an entry in the Modulation Matrix of your sound program with *Control W* as source and *LFO1 Rate* as destination and apply an suitable amount. In the same way you can use **Control X…Control Z** for further assignments.

XTk **KB Send** *off / 1…16*

Sets the MIDI send channel for the XTk keyboard. If the XTk is in Multi mode, the Multi parameter **MIDI Send** determines whether the *global* channel set by this parameter is used or the *specific* channel of the currently selected instrument.

XTk **Vel.Curve** *exp2 / exp1 / lin / log1 / log2 / fix32…fix127*

Determines the dynamic response curve of the XTk's keyboard velocity. By selecting one of the *fix* values, the dynamic velocity will be disabled and all notes are sent with the same velocity. E.g. if you select *fix100*, each note played on the keyboard will have a velocity of *100*.



XTk **R-Vel. C.** *off / exp2 / exp1 / lin / log1 / log2 / fix32…fix127*

Same as **Vel.Curve** but determines the response of the keyboards release velocity. If *off* is selected, the release velocity feature is disabled and a '90' message is sent for 'Note off' instead of the '80' message that is sent if release velocity is enabled.

XTk **Prs. Curve** *exp2 / exp1 / lin / log1 / log2*

Determines the dynamic response of the XTk's keyboard aftertouch.

XTk **Pedal Type** *closing / opening*

Sets the polarity of the sustain pedal connected to the **Pedal / CV In 1** ⑩ jack. If you are not sure what type of pedal you have, try to use the *closing* option first. If the sustain feature works in the opposite direction, i.e. notes are sustained without pressing the pedal, try to use the *opening* setting.

Main Volume *0…127*

Adjusts the master volume of all MicroWave II/XT/XTk's programs on both outputs. This setting is also accessible from the **Play** page.

Input Gain *1…4*

Sensitivity of the external audio input **Analog In** ❾.

Master Tuning *430…450 Hz*

Determines the MicroWave II/XT/XTk's overall pitch. The value specified here is the reference pitch for MIDI note A3. The default setting is 440Hz, which is commonly used by most instruments.

⚠ You should only change this setting if you really know what you're doing. You will have to adjust all your other instruments, too. Don't forget to set it back again!

Transpose *-12…+12*

Allows one to set a global pitch transpose for all programs of the MicroWave II/XT/XTk.

Display timeout *0…127*

Determines how long the page names are displayed in the upper right corner when calling a parameter page via the page dial ③. You may want to decrease the value or set it to *0* after you have got some experience with the MicroWave II/XT/XTk.

Contrast *0…127*

Sets the display contrast.

MIDI Control

This chapter describes the MIDI control options of the MicroWave II/XT/XTk.

Selecting Programs

Calling Programs via Program Change

All of the MicroWave II/XT/XTk's Sound and Multi programs can be called via MIDI Program Change messages and MIDI Bank Select messages. As the device contains 128 programs in each bank, it recognizes program number *0…127*. To select the bank, you have to use a Bank Select message:

- Bank 0 contains Sound Programs *A001…A128*
- Bank 1 contains Sound Programs *B001…B128*

When the MicroWave II/XT/XTk is in Multi mode, you have three options, how Program Change and Bank Select messages work. By means of the Global parameter **PrgChange** you can determine if a Sound program inside the current Multi Program is changed, the whole Multi program is changed, or if both methods are used in combination.

Influencing Sounds via MIDI Messages

Controllers as Modulation Sources

The controllers Modwheel and Breath Control are always used as modulation sources. The freely-definable **Control X…Z** can also be used as a modulation source. X…Z stands for definable controller numbers *1…120*. Use these controllers in the Modifiers and the Modulation Matrix.

Changing Sound Parameters via Controllers

Every important parameter is assigned a controller number through which the parameter can be changed. If a parameter is changed at the device, then this change is sent along with the appropriate controller number via MIDI. This is especially helpful when you want to record changes you made at the MicroWave II/XT/XTk to a sequencer.

All controller messages are sent and received via the channel defined in the global parameters or, if in Multi mode, selected for the corresponding Instrument. The appendix of this manual contains a table listing the controller numbers and the sound parameters they are assigned to.

Pitchbending

The **Pitchbend Range** parameter of the oscillators lets you define to what extent a pitchbend message influences the pitch of the MicroWave II/XT/XTk. Pitchbend is also available as a modulation source.

Aftertouch and Poly Pressure

Aftertouch and Poly Pressure are available as modulation sources in the MicroWave II/XT/XTk. They can be used for any application where control change messages are accepted.

System Exclusive Data

All parameters of the MicroWave II/XT/XTk can be controlled by system exclusive data. You can find a detailed description of the commands and data formats in the appendix.

System Exclusive Data Transmission

System exclusive data transmission lets you send and receive the contents of the MicroWave II/XT/XTk's memory via MIDI (dump).

Sending System Exclusive Data

When you activate the send functions, the MicroWave II/XT/XTk sends the contents of its memory to the **MIDI Out** jack ❽. Using a sequencer, you can record and archive this data.

☞ This is how you activate the dump function:

1. Press and hold the **Shift key** ⑪.
2. Briefly press the **Utility** key ⑥.
3. Release the **Shift** key ⑪.
4. The display shows a page where you can select the dump type:

Dump

5. Use the page dial ③ to select the desired dump function:
   - If *Sound* is selected, the current Sound program will be sent. When used in Multi mode, the Sound program of the currently selected instrument will be sent.
   - If *Multi* is selected, the current Multi program will be sent. The Sound programs that made up the Multi are not sent. This function is only available in Multi mode.
   - If *Arrangement* is selected, the current Multi program with all its used Sound programs is sent. Use this function to dump all settings of a Multi. This function is only available in Multi mode.
   - If *All Sounds* is selected, all Sound programs of the MicroWave II/XT/XTk are sent.
   - If *All Multis* is selected, all Multi programs of the MicroWave II/XT/XTk are sent.
   - If *All Wavetables & Waves* is selected, all Wavetables & Waves are dumped.
   - If *Global Parameters* is selected, all Global parameters are dumped.
   - If *Everything* is selected, all previous mentioned dumps are sent sequentially.
   - If *Sound Controller Data* is selected, the parameters of the currently selected Sound that have an associated MIDI controller are all sent via MIDI out. This is useful when working with some editing software.
   - If *System* is selected, the Operating System is sent via MIDI out. Use this function to update another MicroWave II/XT/XTk. You can also update an XT/XTk using a MWII or any other combination because the operating system is the same for all devices. Furthermore, you can record the data using a sequencer.
   - If *Reorganize Memory* is selected, the file system is reorganized. Use this function before sending numerous dump messages to the MicroWave.

6. Briefly press the **Utility** key ⑥ while holding the **Shift** key ⑪ again.

See appendix for detailed information on system exclusive specifications.

Depending on the selected type, the dump may take some time. The MicroWave II/XT/XTk cannot be played during this time.

Receiving System Exclusive Data

You are not required to activate a special receive mode at the MicroWave in order to receive system exclusive data via MIDI. The transmission is activated via a Dump Request command originating at the device that is sending the messages. However there are a few things you should check prior to the transmission:

- Check out the parameter **Device ID**. Data transmission will only be executed successfully if the sender and receiver setting coincide.
- Make sure none of the MicroWave II/XT/XTk's programs are in Edit mode. All edit buffers are cleared via data transmission and therefore all edits that were not stored prior to the dump will be irretrievably lost!

After activating the dump command at the sender device, the MicroWave II/XT/XTk will receive data and store these in its memory.

When the MicroWave II/XT/XTk receives a Sysex dump with the device ID *127*, it will always accept the dump, regardless of the setting of its **Device ID** parameter. Device ID *127* is a so-called "Broadcast ID" that addresses all connected MicroWave II/XT/XTks. The MicroWave II/XT/XTk can receive this from other devices, but it cannot send a Broadcast ID to other devices. This function is limited to special computer software.
Also a checksum of *127* is always accepted as valid.

Other Functions

Updating the System Software

The MicroWave II/XT/XTk has an service-friendly feature that makes it possible to update the system software without changing any parts.

All software updates come in the form of a standard MIDI file that can be read by every sequencer. The fastest way to get this file is by downloading it from our web site at

http://www.waldorf-gmbh.de/mw2/system.html.

If you don't have Internet access, please ask your local dealer for a disk copy.

XTk ⚠ **Software version 2.1.8 or later is required for the XTk model. Do not under any circumstances try to dump an earlier version into the XTk. A total loss of data may occur and there is no way to make the XTk work again!**

☞ This is how you update the MicroWave II/XT/XTk's system software:

1. Load the standard MIDI file with the system software into your sequencer. Follow the instructions from your sequencer's manual.
2. The MIDI file consists of one single track with several sysex messages within. Make sure that this track is assigned to the MicroWave II/XT/XTk so that it can receive the data.
3. Start the sequencer to play the file and send the track data to the MicroWave II/XT/XTk.
4. The MicroWave II/XT/XTk will display a message that informs that update is in progress:

5. Wait until the operation is completed. If updating was successful, the MicroWave II/XT/XTk will show the following message:

⚠ **Do not under any circumstances turn off the MicroWave II/XT/XTk when this step is in progress. A total loss of data may occur and there is no way to make it work again!**

6. After a few seconds the message disappears. The MicroWave II/XT/XTk is now ready to work again.

If something goes wrong with updating, the MicroWave II/XT/XTk displays an error message. If such a thing happens, try updating again. In some cases it can be necessary to adjust the sequencer tempo before playing the file so that the data events are sent more slowly. You should also deactivate the transmission of MIDI Timecode and MIDI Clock.

Converting MicroWave Sounds

The MicroWave II/XT/XTk can also use Sound and Multi programs made for the first MicroWave. It has a built-in converting feature to import these programs via MIDI dump.

Currently only the conversion of single sound programs is supported.

The MicroWave II/XT/XTk identifies such data by its model ID defined in the Sysex header. Although conversion takes place automatically, there are some points you should keep in mind:

- A converted program may not sound exactly the same as played in an original MicroWave. Since the first MicroWave uses analog circuits, which may differ from device to device, its impossible to make programs sound exactly the same.
- The MicroWave II/XT/XTk uses a Modulation Matrix with 16 slots. Theoretically, it is possible that an "old" program uses more modulation assignments so that some entries would get lost. Actually, there is only a little chance to get into trouble.
- The Filter Envelope of the MicroWave II/XT/XTk has no delay parameter. When an imported program uses a delay setting other than *0* for this envelope, the MicroWave II/XT/XTk will setup the **Modifier Delay** unit to handle this situation.
- The converted sound will reside in the current edit buffer, so it needs to be stored manually.

Appendix

Technical Data

Model	MicroWave II	MicroWave XT	XTk
Audio Outputs			
Maximum level:	+10dBm	+10dBm	+10dBm
Signal-to-noise ratio:	100dB	100dB	100dB
Frequency range:	5Hz…20kHz	5Hz…20kHz	5Hz…20kHz
Audio Inputs			
Maximum level:	n/a	0dBm	0dBm
Dynamic Range:	n/a	86dB	86dB
Frequency Range:	n/a	5Hz…20kHz	5Hz…20kHz
CV Inputs			
Pedal:	n/a	n/a	0…5V
CV In:	n/a	n/a	0…5V
Power Supply			
Nominal voltage:	DC 12V	DC 12V	AC 100…240V
Maximum current consumption:	1A	1A	1,2A
Maximum power consumption:	12W	12W	30W
Dimensions and Weight			
Width:	483mm	483mm	830mm
Height:	89mm (2HE)	223mm (5HE)	115mm
Depth (w. control features):	220mm	102mm	350mm
Total weight:	3,4kg	4,5kg	11kg

MIDI Controller Assignments

Waldorf Microwave 2/XT/XTk Controller Number Assignment

Software release 2.28

Contr. No.	Range	Parameter	Value Range
1	0…127	Modulation wheel	0…127
2	0…127	Breath control	0…127
4	0…127	Foot controller	0…127
5	0…127	Glide Time	0…127
7	0…127	Channel Volume	0…127
10	0…127	Panning	left 64…center…right 63
12	0…1	Chorus	0:off 1:on
13	0..127	FM Amount	0..127
14	0…127	Filter Env Attack	0…127
15	0…127	Filter Env Decay	0…127
16	0…127	Filter Env Sustain	0…127
17	0…127	Filter Env Release	0…127
18	0…127	Amp Env Attack	0…127
19	0…127	Amp Env Decay	0…127
20	0…127	Amp Env Sustain	0…127
21	0…127	Amp Env Release	0…127
22	0…3	Glide Type	0:portamento 1:fingered port. 2:glissando 3:fingered gliss.
23	0…1	Glide Mode	0:exp. 1:linear
24	0…127	LFO1 Rate	0…127
25	0…5	LFO1 Shape	0:sin 1:tri 2:square 3:saw 4:random 5:S&H
26	0…127	LFO2 Rate	0…127
27	0…127	LFO2 Delay	0:off 1:retrigger 2…127:1…126
28	0…5	LFO2 Shape	0:sin 1:tri 2:square 3:saw 4:random 5:S&H
29	0…2	Filter Env Trigger	0:normal 1:single 2:retrigger
30	0…127	LFO1 Delay	0:off 1:retrigger 2…127:1…126
31	0…2	Amp Env Trigger	0:normal 1:single 2:retrigger
32	0…1	Bank Select	0:Bank A 1:Bank B
33	0…8	Osc 1 Octave	-4…+4
34	0…24	Osc 1 Semitone	-12…+12
35	0…127	Osc 1 Detune	-64…+63
36	0…121	Osc 1 Pitchbend Scale	0…120:semitones 121:harmonic 122:global
37	0…127	Osc 1 Keytrack	-100%…+200%
38	0…8	Osc 2 Octave	-4…+4
39	0…24	Osc 2 Semitone	-12…+12
40	0…127	Osc 2 Detune	-64…+63
41	0…1	Osc 2 Sync	0:off 1:on

42	0…121	Osc 2 Pitchbend Scale	0…120:semitones 121:harmonic 122:global
43	0…127	Osc 2 Keytrack	-100%…+200%
44	0…1	Osc 2 Link	0:off 1:on
45	0…127	Wave 1 Level	0…127
46	0…127	Wave 2 Level	0…127
47	0…127	RingMod Level	0…127
48	0…127	Noise Level	0…127
50	0…127	Filter 1 Cutoff	0…127
51	0…127	Filter 1 Keytrack	-200%…+197%
52	0…127	Filter 1 Env Amount	-64…+63
53	0…127	Filter 1 Env Velocity	-64…+63
54	0…5	Filter 1 Type	0:24dB LP 1:12dB LP 2:24dB BP 3:12dB BP 4:12dB HP 5:Sin(X)>LP 6:Waveshaper 7:Dual 8:FM-Filter 9:S&H->L12dB
55	0…127	Amp Keytrack	-200%…+197%
56	0…127	Filter 1 Resonance	0…127
57	0…127	Amp Volume	0…127
58	0…127	Amp Env Velocity	-64…+63
60	0…127	Filter 2 Cutoff	0…127
61	0…1	Filter 2 Type	0:6dB LP 1:6dB HP
62	0…127	Filter 2 Keytrack	-200%…+197%
64	0…127	Sustain Switch	0…127
65	0…127	Glide on/off	0…127
70	0…127	Wavetable	Wavetable 001…128
71	0…63	Wave 1 Startwave	00…60 61:triangle 62:square 63:saw
72	0…127	Wave 1 Phase	0:free 1…127:3°…357°
73	0…127	Wave 1 Env Amnt.	-64…+63
74	0…127	Wave 1 Env Vel. Amnt.	-64…+63
75	0…127	Wave 1 Keytrack	-200%…+197%
76	0…1	Wave 1 Limit	0:off 1:on
77	0…63	Wave 2 Startwave	00…60 61:triangle 62:square 63:saw
78	0…127	Wave 2 Phase	0:free 1…127:3°…357°
79	0…127	Wave 2 Env Amnt.	-64…+63
80	0…127	Wave 2 Env Vel. Amnt.	-64…+63
81	0…127	Wave 2 Keytrack	-200%…+197%
82	0…1	Wave 2 Limit	0:off 1:on
83	0…1	Wave 2 Link	0:off 1:on
85	0…127	Free Env Time 1	0…127
86	0…127	Free Env Level 1	-64…+63
87	0…127	Free Env Time 2	0…127
88	0…127	Free Env Level 2	-64…+63
89	0…127	Free Env Time 3	0…127
90	0…127	Free Env Level 3	-64…+63
91	0…127	Free Env Release Time	0…127
92	0…127	Free Env Release Level	-64…+63
93	0…2	Free Env Trigger	0:normal 1:single 2:retrigger

94	0..127	Mod 1 Amount	-64..+63
95	0..127	Mod 2 Amount	-64..+63
102	0…2	Arp Active	0:off 1:on 2:hold
103	0…9	Arp Range	1…10 Octaves
104	0…15	Arp Clock	1/1…1/32
105	0…127	Arp Tempo	0:external 1…127:50…300BPM
106	0…3	Arp Direction	0:up 1:down 2:alternate 3:random
107	0…16	Arp Pattern	0:off 1:user 2…16:Pattern 1…15
108	0…3	Arp Note Order	0:by note 1:note rev 2:as played 3:reversed
109	0…1	Arp Velocity	0:root note 1:last note
110	0…1	Arp Reset	0:off 1:on
111	0…15	Arp Pattern Length	1…16
112	0…3	LFO 1 Sync	0:off 1:on 3:Clock
113	0…127	LFO 1 Symmetry	-64…+63
114	0…127	LFO 1 Humanize	0…127
115	0…3	LFO 2 Sync	0:off 1:on 3:Clock
116	0…127	LFO 2 Symmetry	-64…+63
117	0…127	LFO 2 Humanize	0…127
118	0…127	LFO 2 Phase	0:free 1…127:3°…357°
120	0	All Sound Off	
121	0	Reset All Controllers	
123	0	All notes off	

System Exclusive Data Format

```
See ftp://ftp.waldorf-gmbh.de
/pub/waldorf/microwave2/doc/mw2_sysex.txt
-------------------------------------------------------

Waldorf Microwave 2 System Exclusive Specifications,
Software release 2.28

Changes from 2.01 to 2.09 marked with !!
Changes from 2.09 to 2.16 marked with !!!

If you find any documemtation bug herein, please mail
it to
bugs@waldorf-gmbh.de

1. General
*******************************************************
**************
Sys-Ex dumps and requests will always be in the
following form:

F0h IDW DEV IDM LOC --------Data--------- CHKSUM F7h

where

h         : Hex
IDW       : Waldorf MIDI ID = 3Eh
IDE       : Equipment ID = 0Eh for MicroWave 2
DEV       : Device number, 00h to 7Eh, 7Fh = broadcast
IDM       : Message ID
LOC       : Location
Data      : whatever data bytes, 00h to 7Fh
CHKSUM    : Sum of all databytes truncated to 7 bits.
            The addition is done in 8 bit format, the
            result is masked to 7 bits (00h to 7Fh). A
            checksum of 7Fh is
            always accepted as valid.
            IMPORTANT: the MIDI status-bytes as well
            as the ID's are not used for computing the
            checksum. If there are no data-bytes in
            the message (simple request), the checksum
            will always be 00h.
*******************************************************

1.1 Message IDs (IDM)
*******************************************************
Message IDs (IDM) are organized in a matrix where the
row defines the data type and the column identifies
the type of dump. The data type is coded in the four
least significant bits of the IDM. Following data
types are currently defined:

Label   Value   Description
-----------------------------------------------------
SNDx    x0h     Sound data type
MULx    x1h     Multi data type
WAVx    x2h     Wave data type
WCTx    x3h     Wave control table data type
GLBx    x4h     Global Parameters
DISx    x5h     Display
RMTx    x6h     Remote control
MODx    x7h     Mode (sound/Multimode)
INFx    x8h     Information
-----------------------------------------------------

The dump type is coded in the upper three bits of IDM,
note that bit seven cannot be used. Following dump
types are currently defined:



Label   Value   Description
-----------------------------------------------------
xxxR    0xh     Request
xxxD    1xh     Dump
xxxP    2xh     Parameter Change
xxxS    3xh     Store command
xxxL    4xh     Recall Command
xxxC    5xh     Compare command
-----------------------------------------------------

Not all combinations of dump types and data types are
currently supported, only those given below:

Request (xxxR = 0x)
 | Dump (xxxD = 1x)
 |  | Parameter Change (xxxP = 2x)
 |  |  | Store (xxxS = 3x)
 |  |  |  | Recall (xxxL = 4x)
 |  |  |  |  | Compare (xxxC = 5x)
 |  |  |  |  |  |  Data Type
-----------------------------------------------------
00 10 20           SNDx x0   Sound
01 11              MULX x1   Multi
02 12              WAVx x2   Wave
03 13              WCTx x3   Wavetable
04 14 24           GLBx x4   Global Parameters
05 15 25    45     DISx x5   Display
      26           RMTx x6   Button / Dial remote
07 17              MODx x7   Mode !!!
-----------------------------------------------------


So follwing valid IDM exist:

Label   Value   Description
-----------------------------------------------------
SNDR    00h     Sound Request
SNDD    10h     Sound Dump
SNDP    20h     Sound Parameter Change
MULR    01h     Multi Request
MULD    11h     Multi Dump
WAVR    02h     Wave  Request
WAVD    12h     Wave  Dump
WCTR    03h     Wave  Control Table Request
WCTD    13h     Wave  Control Table Dump
GLBR    14h     Global Parameter Request
GLBD    14h     Global Parameter Dump
DISR    05h     Display Request
DISD    15h     Display Dump
DISP    25h     Display Parameter Change
DISL    45h     Display Recall
RMTD    26h     Remote Dump
MODR    07h     Mode Request
MODD    17h     Mode Dump
-----------------------------------------------------
*******************************************************

2. Details


2.11 SNDR
*******************************************************
SNDR    00h     Sound Request

Upon reception of a valid sound request the MW2 will
dump the selected Sound(s). The location is given in
two bytes with following conventions:

BB NN           Location
-------------------------------------------------
00 00 .. 00 7F  Locations A001..A128
01 00 .. 01 7F  Locations B001..B128
10 00           All Sounds
20 00           Sound Mode Edit Buffer
30 00 .. 30 07  Multi Instrument Edit Buffers
-------------------------------------------------

So the full format of a SNDR Dump is:

Index   Label   Value           Description
-------------------------------------------------------
0       EXC     F0h             Marks Start of SysEx
1       IDW     3Eh             Waldorf Electronics
GmbH ID
2       IDE     0Eh             Microwave 2 ID
3       DEV                     Device ID
4       IDM     00h             here SNDR (Sound
                                request)
5       BB      see Text        Location
6       NN      see Text        Location
7       XSUM    (BB+NN)&7Fh     Checksum
8       EOX     F7h             End of SysEx
-------------------------------------------------------
*******************************************************
```

2.12 SNDD

****

SNDD 10h Sound Dump

A sound dump is used to transfer sound data from and to the Microwave 2. The location is given in two bytes with following conventions:

BB NN	Location
00 00 .. 00 7F	Locations A001..A128
01 00 .. 01 7F	Locations B001..B128
10 00	All Sounds
20 00	Sound Mode Edit Buffer
30 00 .. 30 07	Multi Instrument Edit Buffers

So the full format of a SNDD Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	10h	here SNDD (Sound Dump)
5	BB	see above	Location
6	NN	see above	Location
7-262	SDATA	see 3.1	Sound data
263	XSUM	(BB+NN+SDATA)&7Fh	Checksum
264	EOX	F7h	End of SysEx

Or in case of All Sounds Dump:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	10h	here SNDD (Sound Dump)
5	BB	see above	Location
6	NN	see above	Location
7-65542	SDATA[256]	see 3.1	256 times Sound data from A001 to B128
65543	XSUM	(BB+NN+SDATA)&7Fh	Checksum
65544	EOX	F7h	End of SysEx

****

2.13 SNDP

****

SNDP 20h Sound Parameter Change

Upon reception of a valid Sound Parameter Change dump, the specified parameter will change its value immediately according to the given value. The ocation is given in one byte with following conventions:

LL	Location
00h	Sound Mode Edit Buffer or...
00h..07h	Multi Mode Instrument 1..8 sound buffer

The Parameter index is given in two bytes:

HH PP	Parameter index
00h 00..7Fh	Parameters with indices 0 to 127
01h 00..7Fh	Parameters with indices 0 to 127

See 3.1 for a detailed list of parameters and indices.

So the actual Format is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	20h	here SNDP (Sound Parameter change)
5	LL	see above	Location
6	HH	see above	Parameter index high bit
7	PP	see above	Parameter index
8	XX	see 3.1	New Parameter value
9	EOX	F7h	End of Exclusive

Note that the checksum is omitted here.

****

2.21 MULR

****

MULR 11h Multi Request

Upon reception of a valid multi request the MW2 will dump the selected Multi(s). The location is given in two bytes with following conventions:

BB NN	Location
00 00 .. 00 7F	Locations 001..128
10 00	All Multis
20 00	Edit Buffer

So the full format of a MULR Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	01h	here MULR (Multi request)
5	BB	see Text	Location
6	NN	see Text	Location
7	XSUM	(BB+NN)&7Fh	Checksum
8	EOX	F7h	End of SysEx

****

2.22 MULD

****

MULD 21h Multi Dump

A multi dump is used to transfer multi data from and to the Microwave 2. The location is given in two bytes with following conventions:

BB NN	Location
00 00 .. 00 7F	Locations 001..128
10 00	All Multis
20 00	Edit Buffer

So the full format of a MULD Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	11h	here MULD (Multi Dump)
5	BB	see above	Location
6	NN	see above	Location
7-38	MDATA	see 3.2	Multi data
39-66	IDATA	see 3.3	Instrument #1 data
67-94	IDATA	see 3.3	Instrument #2 data
95-122	IDATA	see 3.3	Instrument #3 data
123-150	IDATA	see 3.3	Instrument #4 data
151-178	IDATA	see 3.3	Instrument #5 data

179-206	IDATA	see 3.3	Instrument #6 data
207-234	IDATA	see 3.3	Instrument #7 data
235-262	IDATA	see 3.3	Instrument #8 data
263	XSUM	(BB+NN+DATA)&7Fh	Checksum
264	EOX	F7h	End of SysEx

****

2.23 MULP

****

MULP 20h Multi Parameter Change

Upon reception of a valid Multi Parameter Change dump, the specified parameter will change its value immediately according to the given value. In Sound Mode, all MULP messages will be ignored. The location is given in one byte with following conventions:

LL	Location
20h	Multi Edit Buffer
01h..07h	Multi Mode Instrument 1..8 buffer

The Parameter index is given in one byte:

PP	Parameter index
00..1Fh	Parameters with indices 0 to 31

See 3.2 for a detailed list of Multi parameters and indices, or 3.3 for a detailed list of Instrument parameters and indices.

The actual Format is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	21h	here MULP (Sound Parameter change)
5	LL	see above	Location
7	PP	see above	Parameter index
8	XX	see 3.2/3.3	New Parameter value
9	EOX	F7h	End of Exclusive

****

2.31 WAVR

****

WAVR 02h Wave Request

Upon reception of a valid wave request the MW2 will dump the selected Wave. The location is given in two bytes with following conventions:

HH LL	Location
00 00 .. 00 7F	ROM Waves 000..127
01 00 .. 01 7F	ROM Waves 128..255
01 00 .. 01 2B	ROM Waves 256..299
07 68 .. 07 7F	User Waves 1000..1023
08 00 .. 08 7F	User Waves 1024..10151
09 00 .. 09 61	User Waves 1152..1249

So the full format of a WAVR Request is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	02h	here WAVR (Wave request)
5	HH	see Text	Location
6	LL	see Text	Location
7	XSUM	(HH+LL)&7Fh	Checksum
8	EOX	F7h	End of SysEx

****

2.32 WAVD

****

WAVD 12h Wave Dump

A wave dump is used to transfer wave data from and to the Microwave 2. The location is given in two bytes with following conventions:

HH LL	Location
00 00 .. 00 7F	ROM Waves 000..127
01 00 .. 01 7F	ROM Waves 128..255
02 00 .. 02 2B	ROM Waves 256..299
07 68 .. 07 7F	User Waves 1000..1023
08 00 .. 08 7F	User Waves 1024..10151
09 00 .. 09 61	User Waves 1152..1249

So the full format of a WAVD Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	12h	here WAVD (Wave Dump)
5	HH	see above	Location
6	LL	see above	Location
7-134	WDATA	see 3.4	Wave data
135	XSUM	(HH+LL+WDATA)&7Fh	Checksum
136	EOX	F7h	End of SysEx

****

2.41 WCTR

****

WCTR 03h Wave Control Table Request

Upon reception of a valid wave control table request, the MW2 will dump the selected Table. The location is given in two bytes with following conventions:

HH LL	Location
00 00 .. 00 7F	Control Table of Wavetables 001..128

Note that some Wavetables are generated algorithmically and have no control table, an attempt to request such a table will fail.

The full format of a WCTR Request is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	03h	here WCTR (Wavetable request)
5	HH	see Text	Location
6	LL	see Text	Location
7	XSUM	(HH+LL)&7Fh	Checksum
8	EOX	F7h	End of SysEx

****

2.42 WCTD

****

WAVD 13h Wave ControlDump

A Control Table dump is used to transfer Wavetable Control Table data from and to the Microwave 2. The location is given in two bytes with following conventions:

HH LL	Location
00 00 .. 00 7F	Control Table of Wavetables 001..128

Note that only Wavetables 96 to 128 are User Wavetables, an attempt to overwrite a wavetable outside this range will fail.

The full format of a WAVD Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	13h	here WCTD (Wavetable Dump)
5	HH	see above	Location
6	LL	see above	Location
7-262	WCTDATA	see 3.5	Wave control table
263	XSUM	(HH+LL+WCTDATA)&7Fh	Checksum
264	EOX	F7h	End of SysEx

2.51 GLBR

WCTR 04h Global Parameter Request

Upon reception of a valid Global Parameter request, the MW2 will dump the Global Parameters. No location is given.

The full format of a GLBR Request is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	04h	here GLBR (Global Parameter request)
7	XSUM	0	Checksum
8	EOX	F7h	End of SysEx

2.52 GLBD

GLBD 14h Global Parameter Dump

A Global Parameter dump is used to transfer Global Parameter date from and to the Microwave 2.

The full format of a GLBD Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	14h	here GLBD (Global Parameter Dump)
5-36	GDATA	see 3.6	Global Parameter Data
37	XSUM	GDATA&7Fh	Checksum
38	EOX	F7h	End of SysEx

2.53 GLBP

GLBP 24h Global Parameter Change

Upon reception of a valid Global Parameter Change dump, the specified parameter will change its value immediately according to the given value.

See 3.6 for a detailed list of parameters and indices.

The actual Format is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	24h	here GLBP (Global Parameter change)
5	PP	see above	Parameter index
6	XX	see 3.1	New Parameter value
7	EOX	F7h	End of Exclusive

Note that the checksum is omitted here.

2.61 DISR

DISR 05h Display Request

Upon reception of a valid Display Request request, the MW2 will dump the contents of the LCD. No location is given.

The full format of a DISR Request is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	05h	here DISR (LCD request)
7	XSUM	0	Checksum
8	EOX	F7h	End of SysEx

2.62 DISD

DISR 15h Display Dump

A Display Dump message is used to transfer LCD contents from and to the Microwave 2.

The full format of a DISD Request is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	15h	here DISD (LCD dump)
5-84	LCDDATA	ASCII	Upper and lower row of LCD
85	LEDDATA		LEDs Bitmask: 01: MIDI 02: Column #1 04: Column #2 08: Column #3 10: Column #4 20: Column #5 40: Play
86	XSUM	0	Checksum
87	EOX	F7h	End of SysEx

2.63 DISP

DISP 25h LCD Parameter change

A LCD Parameter Change is used to change a single character in the LCD of the the Microwave 2.

The full format of a DISP Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	25h	here DISP (LCD Parameter change)
5	LOC	0-79	Index of character in LCD
6	CHAR	ASCII	New character
7	XSUM	(LOC+CHAR)&7Fh	Checksum
8	EOX	F7h	End of SysEx

2.64 DISL

DISL 45h LCD Recall

Upon receprion of a Display Recall message, the LCD and the LEDs will be updated in order to discard a possibly previously dumped LCD content.

The full format of a DISL Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	45h	here DISL (LCD Recall)
5	XSUM	0 Checksum	
6	EOX	F7h	End of SysEx

2.71 RMTP

RMTP 26h Remote Control Parameter Change

The remote control Parameter change is used to remotely control the encoders and buttons of the Microwave 2. Operation might still introduce bugs.

The Element to move is coded in one byte:

UU	Element
00	Encoder #1 (left)
01	Encoder #2
02	Encoder #3
03	Encoder #4
04	Encoder #5 (big red one)
05	Play/Shift button
06	Soundpar #1/Store button
07	Soundpar #2/Recall button
08	Soundpar #3/Compare button
09	Multipar/Undo button
0A	Global/Utility button
0B	Power button

Annother byte defines the movement to be simulated:

MM	Encoder	Button
00	encoder left turn -64	released
01	encoder left turn -63	pressed
2-63	encoder left by MM	pressed
64	no encoder move	pressed
65	encoder right by one	pressed
66-127	encoder right by MM	pressed

The full format of a RMTP Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	26h	here RMTP
5	UU	see text	Element
6	MM	see text	Simulated movement
7	XSUM	(UU+MM)&7Fh	Checksum
8	EOX	F7h	End of SysEx

2.81 MODR

MODR 07h Mode Request

The full format of a MODR Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	07h	here MODR
5	EOX	F7h	End of SysEx

2.82 MODD

MODD 17h Mode Dump

The full format of a MODD Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	17h	here MODD
5	Mode	0-1	0: Sound 1:Multi
6	EOX	F7h	End of SysEx

3. Data Formats

3.1 SDATA - Sound Data

****

Note: All Parameters marked as "reserved" should be set to 0 for future compatibility.

Index	Range	Value	Parameter
0	0-1	1	Sound Format Version, currently 1, Format 0 is unpublished
1	16-112	-4...+4	Osc 1 Octave in Steps of 12
2	52-76	-12..+12	Osc 1 Semitone
3	0-127	-64..+64	Osc 1 Detune
4	reserved		
5	0-122	0-120,harmonic, global	Osc 1 Pitch Bend Range
6	0-76	-100%..+200%	Osc 1 Keytrack
7	0-127		Osc 1 FM Amount !!
8	reserved		
9	reserved		
10	reserved		
11	reserved		
12	16-112	-4...+4	Osc 2 Octave in Steps of 12
13	52-76	-12..+12	Osc 2 Semitone
14	0-127	-64..+64	Osc 2 Detune
15	reserved		
16	0-1	off/on	Osc 2 Sync
17	0-122	0-120,hm.,gl.	Osc 2 Pitch Bend Range
18	0-76	-100%..+200%	Osc 2 Keytrack
19	0-1	off/on	Osc 2 Link
20	reserved		
21	reserved		
22	reserved		
23	reserved		
24	reserved		
25	0-127	0..127	Wavetable
26	0-63	0..60,tri,sqr, saw	Wave 1 Startwave
27	0-127	free, 3-257 deg.	Wave 1 Start Phase
28	0-127	-64..+64	Wave 1 Envelope Amount
29	0-127	-64..+64	Wave 1 Envelope Velocity Amount
30	0-127	-200%...+197%	Wave 1 Keytrack
31	0-1	off/on	Wave 1 Limit
32	reserved		
33	reserved		
34	reserved		
35	reserved		
36	0-63	0..60,tri,sqr, saw	Wave 2 Startwave
37	0-127	free,3-257 deg.	Wave 2 Start Phase
38	0-127	-64..+64	Wave 2 Envelope Amount
39	0-127	-64..+64	Wave 2 Envelope Velocity Amount
40	0-127	-200%...+197%	Wave 2 Keytrack
41	0-1	off/on	Wave 2 Limit
42	0-1	off/on	Wave 2 Link
43	reserved		
44	reserved		
45	reserved		
46	reserved		
47	0-127	0..127	Mix Wave 1
48	0-127	0..127	Mix Wave 2
49	0-127	0..127	Mix Ringmod
50	0-127	0..127	Mix Noise
51	0-127	0..127	Mix External [XT only] !!
52	reserved		
53	0-5	off,1-5	Aliasing
54	0-5	off,1-5	Time Quantization
55	0-1	saturate/overfl.	Clipping
56	reserved		
57	0-1	off/on	Accuracy !!
58	0-82	see List 3.11	Play Param. #1 !!
59	0-82	see List 3.11	Play Param. #2 !!
60	0-82	see List 3.11	Play Param. #3 !!
61	0-82	see List 3.11	Play Param. #4 !!
62	0-127	0..127	Filter 1 Cutoff
63	0-127	0..127	Filter 1 Resonance
64	0-9	see List 3.15	Filter 1 Type !!
65	0-127	-200%..+197%	Filter 1 Keytrack
66	0-127	-64..+63	Filter 1 Envelope Amount
67	0-127	-64..+63	Filter 1 Envelope Velocity Amount
68	reserved		
69	reserved		
70	0-127	Context Sens.	Filter 1 Special Parameter !!
71	reserved		
72	reserved		
73	0-127	0..127	Filter 2 Cutoff
74	0-1	6dB LP,6dB HP	Filter 2 Typ
75	0-127	-200%..+197%	Filter 2 Keytrack
76	0-7[MW2] 0-35[XT]		Effect Type (still subject to Change) !!
77	0-127	0..127	Amplifier Volume
78	reserved		
79	0-127	-64..+63	Amplifier Envelope Velocity Amount
80	0-127	-200%..+197%	Amplifier Keytrack
81	0-127		Effect Param. #1 !!
82	0-1	off/on	Chorus !!
83	0-127		Effect Param. #2 !!
84	0-127	left 64-center-right 63	Panning
85	0-127	-200%..+197%	Panning Keytrack
86	0-127		Effect Param. #3 !!
87	0-1	off/on	Glide Active
88	0-3	porta,gliss, fp.,fg.	Glide Type
89	0-1	exp./linear	Glide Mode
90	0-127	0..127	Glide Time
91	reserved		
92	0-2	off,on,hold	Arpeggiator Active
93	1-127	extern,50-300BpM	Arpeggiator Tempo
94	0-15	1/1..1/32	Arpeggiator Clock
95	1-10	1..10	Arpeggiator Range
96	0..16	off,user,1..15	Arpeggiator Pattern
97	0-3	up,dn,alt,rand.	Arpeggiator Direction
98	0-3	note,n.rev, played,p.rev	Arpeggiator Note Order
99	0-1	root note/ last note	Arpeggiator Velocity
100	0-1	off/on	Arpeggiator Reset on Pattern Start
101	0-15	1..16	Arpeggiator User Pattern Length
102	0-15	----,---*,--*-,--**	Arpeggiator User Pattern Pos 1-4
103	0-15	-*--,-*-*,-**-,-***	Arpeggiator User Pattern Pos 5-8
104	0-15	*---,*--*,*-*-,*-**	Arpeggiator User Pattern Pos 9-12
105	0-15	**--,**-*,***-,****	Arpeggiator User Pattern Pos 13-16
106	reserved		
107	reserved		
108	0-1	Poly/Mono Allocation Mode	
109	0-2	normal/dual/ unisono	Assignment
110	0-127	0..127	Detune
111	reserved		
112	0-127		De-Pan !!
113	0-127	0..127	Filter Env Attack
114	0-127	0..127	Filter Env Decay
115	0-127	0..127	Filter Env Sustain
116	0-127	0..127	Filter Env Release
117	0-2	normal,single, retrigger	Filter Env Trigger
118	reserved		
119	0-127	0..127	Amplifier Env Attack
120	0-127	0..127	Amplifier Env Decay
121	0-127	0..127	Amplifier Env Sustain
122	0-127	0..127	Amplifier Env

			Release
123	0-2	normal,single, retrigger	Amplifier Env Trigger
124	reserved		
125	0-127	0..127	Wave Env Time 1
126	0-127	0..127	Wave Env Level 1
127	0-127	0..127	Wave Env Time 2
128	0-127	0..127	Wave Env Level 2
129	0-127	0..127	Wave Env Time 3
130	0-127	0..127	Wave Env Level 3
131	0-127	0..127	Wave Env Time 4
132	0-127	0..127	Wave Env Level 4
133	0-127	0..127	Wave Env Time 5
134	0-127	0..127	Wave Env Level 5
135	0-127	0..127	Wave Env Time 6
136	0-127	0..127	Wave Env Level 6
137	0-127	0..127	Wave Env Time 7
138	0-127	0..127	Wave Env Level 7
139	0-127	0..127	Wave Env Time 8
140	0-127	0..127	Wave Env Level 8
141	0-2	normal,single, retrigger	Wave Env Trigger
142	0-1	off/on	Wave Key On Loop
143	0-7	1..8	Wave Key On Loop Start
144	0-7	1..8	Wave Key On Loop End
145	0-1	off/on	Wave Key Off Loop
146	0-7	1..8	Wave Key Off Loop Start
147	0-7	1..8	Wave Key Off Loop End
148	reserved		
149	0-127	0..127	Free Env Time 1
150	0-127	-64..+63	Free Env Level 1
151	0-127	0..127	Free Env Time 2
152	0-127	-64..+63	Free Env Level 2
153	0-127	0..127	Free Env Time 3
154	0-127	-64..+63	Free Env Level 3
155	0-127	0..127	Free Env Release Time
156	0-127	-64..+63	Free Env Release Level
157	0-2	normal,single, retrigger	Free Env Trigger
158	reserved		
159	0-127	0..127 (or Notation)	LFO 1 Rate !!
160	0-5	sin,tri,sqr,saw, rnd,S&H	LFO 1 Shape
161	0-127	0..127	LFO 1 Delay
162	0-3	off/on/on/Clock	LFO 1 Sync !!
163	0-127	-64..+63	LFO 1 Symmetry
164	0-127	0..127	LFO 1 Humanize
165	reserved		
166	0-127	0..127 (or notation)	LFO 2 Rate !!
167	0-5	sin,tri,sqr,saw, rnd,S&H	LFO 2 Shape
168	0-127	0..127	LFO 2 Delay
169	0-3	off/on/on/Clock	LFO 2 Sync !!
170	0-127	-64..+63	LFO 2 Symmetry
171	0-127	0..127	LFO 2 Humanize
172	0-127	free,3-357 deg.	LFO 2 Phase
173	reserved		
174	0-31	see List 3.12	Modifier Delay Source
175	0-127	0..127	Modifier Delay Time
176	0-31	see List 3.12	Modifier 1 Source 1
177	0-31	see List 3.12	Modifier 1 Source 2
178	0-15	see List 3.14	Modifier 1 Type
179	0-127	0..127	Modifier 1 Param.
180	0-31	see List 3.12	Modifier 2 Source 1
181	0-31	see List 3.12	Modifier 2 Source 2
182	0-15	see List 3.14	Modifier 2 Type
183	0-127	0..127	Modifier 2 Param.
184	0-31	see List 3.12	Modifier 3 Source 1
185	0-31	see List 3.12	Modifier 3 Source 2
186	0-15	see List 3.14	Modifier 3 Type
187	0-127	0..127	Modifier 3 Param.
188	0-31	see List 3.12	Modifier 3 Source 1
189	0-31	see List 3.12	Modifier 3 Source 2
190	0-15	see List 3.14	Modifier 3 Type
191	0-127	0..127	Modifier 3 Param.
192	0-31	see List 3.12	Mod 1 Source
193	0-127	-64..+63	Mod 1 Amount
194	0-33	see List 3.13	Mod 1 Destination
195	0-31	see List 3.12	Mod 2 Source
196	0-127	-64..+63	Mod 2 Amount
197	0-33	see List 3.13	Mod 2 Destination
198	0-31	see List 3.12	Mod 3 Source
199	0-127	-64..+63	Mod 3 Amount
200	0-33	see List 3.13	Mod 3 Destination
201	0-31	see List 3.12	Mod 4 Source
202	0-127	-64..+63	Mod 4 Amount
203	0-33	see List 3.13	Mod 4 Destination
204	0-31	see List 3.12	Mod 5 Source
205	0-127	-64..+63	Mod 5 Amount
206	0-33	see List 3.13	Mod 5 Destination
207	0-31	see List 3.12	Mod 6 Source
208	0-127	-64..+63	Mod 6 Amount
209	0-33	see List 3.13	Mod 6 Destination
210	0-31	see List 3.12	Mod 7 Source
211	0-127	-64..+63	Mod 7 Amount
212	0-33	see List 3.13	Mod 7 Destination
213	0-31	see List 3.12	Mod 8 Source
214	0-127	-64..+63	Mod 8 Amount
215	0-33	see List 3.13	Mod 8 Destination
216	0-31	see List 3.12	Mod 9 Source
217	0-127	-64..+63	Mod 9 Amount
218	0-33	see List 3.13	Mod 9 Destination
219	0-31	see List 3.12	Mod 10 Source
220	0-127	-64..+63	Mod 10 Amount
221	0-33	see List 3.13	Mod 10 Destination
222	0-31	see List 3.12	Mod 11 Source
223	0-127	-64..+63	Mod 11 Amount
224	0-33	see List 3.13	Mod 11 Destination
225	0-31	see List 3.12	Mod 12 Source
226	0-127	-64..+63	Mod 12 Amount
227	0-33	see List 3.13	Mod 12 Destination
228	0-31	see List 3.12	Mod 13 Source
229	0-127	-64..+63	Mod 13 Amount
230	0-33	see List 3.13	Mod 13 Destination
231	0-31	see List 3.12	Mod 14 Source
232	0-127	-64..+63	Mod 14 Amount
233	0-33	see List 3.13	Mod 14 Destination
234	0-31	see List 3.12	Mod 15 Source
235	0-127	-64..+63	Mod 15 Amount
236	0-33	see List 3.13	Mod 15 Destination
237	0-31	see List 3.12	Mod 16 Source
238	0-127	-64..+63	Mod 16 Amount
239	0-33	see List 3.13	Mod 16 Destination
240	32-127	ASCII	Name 1
241	32-127	ASCII	Name 2
242	32-127	ASCII	Name 3
243	32-127	ASCII	Name 4
244	32-127	ASCII	Name 5
245	32-127	ASCII	Name 6
246	32-127	ASCII	Name 7
247	32-127	ASCII	Name 8
248	32-127	ASCII	Name 9
249	32-127	ASCII	Name 10
250	32-127	ASCII	Name 11
251	32-127	ASCII	Name 12
252	32-127	ASCII	Name 13
253	32-127	ASCII	Name 14
254	32-127	ASCII	Name 15
255	32-127	ASCII	Name 16

****

3.11 Play Parameters

****

Value	Index	Parameter
0	1	Osc 1 Octave
1	2	Osc 1 Semitone
2	3	Osc 1 Detune
3	5	Osc 1 Pitchbend
4	6	Osc 1 Keytrack
5	12	Osc 2 Octave
6	13	Osc 2 Semitone
7	14	Osc 2 Detune
8	17	Osc 2 Pitchbend
9	18	Osc 2 Keytrack
10	25	Wavetable
11	26	Wave 1 Startwave
12	27	Wave 1 Phase
13	28	Wave 1 Env Amount
14	29	Wave 1 Velo Amount
15	30	Wave 1 Keytrack
16	36	Wave 2 Startwave
17	37	Wave 2 Phase

18	38	Wave 2 Env Amount
19	39	Wave 2 Velo Amount
20	40	Wave 2 Keytrack
21	47	Mix Wave 1
22	48	Mix Wave 2
23	49	Mix Ringmod
24	50	Mix Noise
25	53	Aliasing
26	54	Quantize
27	55	Clipping
28	62	Filter 1 Cutoff
29	63	Filter 1 Resonance
30	64	Filter 1 Type
31	65	Filter 1 Keytrack
32	66	Filter 1 Env Amount
33	67	Filter 1 Velo Amount
34	73	Filter 2 Cutoff
35	74	Filter 2 Type
36	75	Filter 2 Keytrack
37	77	Sound Volume
38	79	Amp Envelope Velo Amount
39	80	Amplifier Keytrack
40	81	Chorus
41	84	Panning
42	85	Pan Keytrack
43	87	Glide on/off
44	88	Glide Type
45	92	Arpeggiator on/off/hold
46	93	Arp Tempo
47	94	Arp Clock
48	95	Arp Range
49	96	Arp Pattern
50	97	Arp Direction
51	98	Arp Note Order
52	99	Arp Velocity
53	108	Allocation
54	109	Assignment
55	113	Filter Env Attack
56	114	Filter Env Decay
57	115	Filter Env Sustain
58	116	Filter Env Release
59	119	Amlifier Env Attack
60	120	Amlifier Env Decay
61	121	Amplifier Env Sustain
62	122	Amplifier Env Release
63	159	LFO1 Rate
64	160	LFO1 Shape
65	161	LFO1 Delay
66	162	LFO1 Sync
67	163	LFO1 Symmetry
68	164	LFO1 Humanize
69	166	LFO2 Rate
70	167	LFO2 Shape
71	168	LFO2 Delay
72	169	LFO2 Sync
73	170	LFO2 Symmetry
74	171	LFO2 Humanize
75	172	LFO2 Phase
76	7	Osc 1 FM Amount !!
77	70	Filter 1 Special !!
78	90	Glide Time !!
79	--	Control W !!
80	--	Control X !!
81	--	Control Y !!
82	--	Control Z !!

3.12 Modulation Sources

Index	Modulation Source
0	off
1	LFO1
2	LFO1 * Modwheel
3	LFO1 * Aftertouch
4	LFO2
5	Filter Envelope
6	Amplifier Envelope
7	Wave Envelope
8	Free Envelope
9	Key Follow
10	Keytrack
11	Velocity
12	Release Velocity
13	Aftertouch
14	Poly Pressure
15	Pitch Bend
16	Modwheel
17	Sustain Control
18	Foot Control
19	Breath Control
20	Control W
21	Control X
22	Control Y
23	Control Z
24	Control Delay
25	Modofier #1
26	Modofier #2
27	Modofier #3
28	Modofier #4
29	MIDI Clock
30	minimum
31	Maximum

3.13 Modulation Destinations

Index	Modulation Destination
0	Pitch
1	Osc 1 Pitch
2	Osc 2 Pitch
3	Wave 1 Pos
4	Wave 2 Pos
5	Mix Wave 1
6	Mix Wave 2
7	Mix Ringmod
8	Mix Noise
9	Filter 1 Cutoff
10	Filter 1 Resonance
11	Filter 2 Cutoff
12	Volume
13	Panning
14	Filter Env Attack
15	Filter Env Decay
16	Filter Env Sustain
17	Filter Env Release
18	Amlifier Env Attack
19	Amlifier Env Decay
20	Amplifier Env Sustain
21	Amplifier Env Release
22	Wave Envelope Times
23	Wave Envelope Levels
24	Free Envelope Times
25	Free Envelope Levels
26	LFO1 Rate
27	LFO1 Level
28	LFO2 Rate
29	LFO2 Level
30	Mod #1 Amount
31	Mod #2 Amount
32	Mod #3 Amount
33	Mod #4 Amount
34	FM Amount
35	F1 Extra (Wave/BP offset/Osc2 FM/S&H Rate)

3.14 Modifiers

Index	Operand	Operation
0	+	Addition
1	-	Subtraction
2	*	Multiplication
3	/	Division
4	XOR	Bitwise exclusive-or
5	OR	Bitwise inclusive-or
6	AND	Bitwise and
7	S&H	Sample & Hold
8		Ramp
9		Switch

10	Abs value
11	Min value
12	Max value
13	Lag processor
14	Control filter
15	Differentiator

3.15 Filter 1 Types

Index	Filter Type
0	24 dB Lowpass
1	12 dB Lowpass
2	24 dB Bandpass
3	12 dB Bandpass
4	12 dB Highpass
5	Sine Waveshaper followed by 12 dB Lowpass
6	12 db Lowpass followed by Waveshaper !!
7	Dual 12 dB Low/Bandpass parallel !!
8	12 db Lowpass FM-Filter !!
9	12 db Lowpass with Sample & Hold !!

3.2 MDATA - Multi Data

Index	Range	Value	Parameter
0	0-127	0..127	Multi Volume
1	0-121	0..120,global	Control W
2	0-121	0..120,global	Control X
3	0-121	0..120,global	Control Y
4	0-121	0..120,global	Control Z
5	1-127	ext.,50..300BpM	Arpeggiator Tempo
6	0-1	on/off	MIDI Send (Xtk only)
7	reserved		
8	reserved		
9	reserved		
10	reserved		
11	reserved		
12	reserved		
13	reserved		
14	reserved		
15	reserved		
16	32-127	ASCII	Name 1
17	32-127	ASCII	Name 2
18	32-127	ASCII	Name 3
19	32-127	ASCII	Name 4
20	32-127	ASCII	Name 5
21	32-127	ASCII	Name 6
22	32-127	ASCII	Name 7
23	32-127	ASCII	Name 8
24	32-127	ASCII	Name 9
25	32-127	ASCII	Name 10
26	32-127	ASCII	Name 11
27	32-127	ASCII	Name 12
28	32-127	ASCII	Name 13
29	32-127	ASCII	Name 14
30	32-127	ASCII	Name 15
31	32-127	ASCII	Name 16

3.3 IDATA - Instrument Data

Index	Range	Value	Parameter
0	0-1	A/B	Sound Bank
1	0-127	1..128	Sound Number
2	0-17	global,omni,1-16	MIDI Channel
3	0-127	0..127	Volume
4	16-112	-48..+48	Transpose
5	0-127	-64..+63	Detune
6	0-1	Main Out/Sub Out	Output
7	0-1	off/on	Status
8	0-127	left64..center ..right63	Panning
9	0-2	off/on/inverse	Pan Mod
10	reserved		
11	reserved		
12	1-127	1..127	Lowest Velocity
13	1-127	1..127	Highest Velocity
14	0-127	0..127	Lowest Key
15	0-127	0..127	Highest Key
16	0-2	off,on,hold, Sound Arp	Arpeggiator Active
17	0-15	1/1..1/32 Arpeggiator Clock	
18	1-10	1..10	Arpeggiator Range
19	0..16	off,user,1..15	Arpeggiator Pattern
20	0-3	up,down,alt, random	Arpeggiator Dir.
21	0-3	note,n.rev, played,p.rev	Arpeggiator Note Order
22	0-1	root note/ last note	Arpeggiator Velocity
23	0-1	off/on	Arpeggiator Reset on Pattern Start
24	0-18	off/Ch1-16/ Inst/global	Arpeggiator Notes out !!
25	reserved		
26	0-1	off/on	MIDI Send (XTk only)
27	reserved		

3.4 WDATA - Wave Data

A Wave consists of 128 eight Bit samples, but only the first 64 of them are stored/transmitted, the second half is same as first except the values are negated and the order is reversed:

```
Wave[64+n] = -Wave[63-n]        for n=0..63
```

Not that samples are not two's complement format, to get a signed byte, the most significant bit must be flipped:

```
signed char s = Wave[n]^0x80;
```

Index	Range	Value	Parameter
0	0-15	00h..F0h	Sample 1, most significant nibble
1	0-15	00h..0Fh	Sample 1, least significant nibble
2	0-15	00h..F0h	Sample 2, most significant nibble
3	0-15	00h..0Fh	Sample 2, least significant nibble
4	0-15	00h..F0h	Sample 3, most significant nibble
5	0-15	00h..0Fh	Sample 3, least significant nibble
[...]			
126	0-15	00h..F0h	Sample 64, most significant nibble
127	0-15	00h..0Fh	Sample 64, least significant nibble

3.5 WCTDATA - Wave Control table Data

A Wave control table consists of 64 entries that indicate a wave for the specific position. If the index is not valid, the position will be filled with a spectral interpolation of the neighbour waves.
The last three Waves will always be triangle, square and sawtooth, and the first index must be valid. Valid indices are currently:

0-200	for ROM Waves 0 to 299,
1000-1249	for User Waves 1000 to 1249

Index	Range	Value	Parameter
0	0-15	0000h..F000h	Index 1, most significant nibble, upper half
1	0-15	0000h..0F00h	Index 1, least significant nibble, upper half
2	0-15	0000h..00F0h	Index 1, most significant nibble, lower half
3	0-15	0000h..000Fh	Index 1, least significant nibble, lower half
4	0-15	0000h..F000h	Index 2, most significant nibble, upper half
5	0-15	0000h..0F00h	Index 2, least significant nibble, upper half
6	0-15	0000h..00F0h	Index 2, most significant nibble, lower half
7	0-15	0000h..000Fh	Index 2, least significant nibble, lower half
[...]			
252	0-15	0000h..F000h	Index 64, most significant nibble, upper half
253	0-15	0000h..0F00h	Index 64, least significant nibble, upper half
254	0-15	0000h..00F0h	Index 64, most significant nibble, lower half
255	0-15	0000h..000Fh	Index 64, least significant nibble, lower half

****

3.6 GDATA - Global Parameters
****

Note: Global Parameters are very unordered.

Index	Range	Value	Parameter
0	reserved		
1	1		version of GDATA, currently 1 !!!
2	0-2	A,B,Multi	Startup Soundbank or 2:Multi Mode
3	0-127	1..128	Startup Sound Number
4	1-17	omni,1-16	MIDI Channel
5	0-2	sound,multi, combined	Program Change Mode
6	0-126	0..126	Device ID DEV
7	0-121	0..120, harmonic	Bend Range
8	0-120	0..120	Controller W
9	0-120	0..120	Controller X
10	0-120	0..120	Controller Y
11	0-120	0..120	Controller Z
12	0-127	0..127	Main Volume
13	reserved		
14	reserved		
15	52-76	-12..+12	Transpose
16	54..74	430Hz..450Hz	Master Tune
17	0-127	0..127	Display Timeout
18	0-127	0..127	LCD Contrast
19	1-9	exp2,exp1,lin, log1,log2,fix32, fix64,fix100, fix127	Velocity Curve
20	0-9	off,exp2,exp1, lin,log1,log2, fix32,fix64, fix100,fix127	Release Velocity
21	1-5	exp2,exp1,lin, log1,log2	Pressure Curve
22	reserved		
23	0-127	1..128	Startup Multi Number
24	0-16	off/Chnl1-16	Arpeggiator Note out Channel !!
25	0-1	off/on	MIDI Clock output
26	0-3	off/Ctl/SysEx/ Ctl+SysEx	Parameter send
27	0-1	off/on	Parameter receive
28	0-3	1..4	Input Gain [XT only] !!
29	0-16	off,Chnl1-16	Keyboard Send
30	reserved		
31	0-1	closing/opening	Pedal Type

****

****

4.) Device Inquiry

The Microwave 2 responds to the Universal Device Inquiry message F0,7E,<channel>,06,01,F7 if <channel> is set to 7F or if <channel> matches the specific Device ID. The Microwave 2 will respond with the following:

F0,7E,06,02	Universal Device Header
3E,	Waldorf Electronics Manufacturer ID
0E,00,	Device family code : Microwave 2
XX,YY,	Device family member code, see below
VV,VV,VV,VV,	Software revision, ASCII, e.g. "2.09"
F7	EOX

Device family member codes (XX,YY):

00,00	Microwave 2
01,00	Microwave 2 with XT Mainboard (has Delay Effects !)
03,00	Microwave XT
05,00	Microwave PC on Terratec EWS Frontmodule
09,00	MW2/XT with expandable Mainboard, 10 Voices !!!
19,00	Expanded MW2/XT, 30 Voices !!!

!!! All features are coded as bitmask, so more combinations are possible. The bitmask values:

01	Mainboard 2.0
02	XT Frontboard
04	MWPC
08	Expandable Mainboard
10	Voice Expansion

****

2.82 INFR
****
INFR 07h Information Request

This only works for Microwave PC on Terratec EWS Frontmodule !

The full format of a INFR Dump is:

Index	Label	Value	Description
0	EXC	F0h	Marks Start of SysEx
1	IDW	3Eh	Waldorf Electronics GmbH ID
2	IDE	0Eh	Microwave 2 ID
3	DEV		Device ID
4	IDM	08h	here INFR
5	Typ	xx	Typ of information
6	EOX	F7h	End of SysEx

```
------------------------------------------------------
******************************************************

2.83 INFD
******************************************************
INFD    18h     Information Dump

The full format of a INFD Dump is:

Index   Label   Value             Description
------------------------------------------------------
0       EXC     F0h               Marks Start of SysEx
1       IDW     3Eh               Waldorf Electronics
                                  GmbH ID
2       IDE     0Eh               Microwave 2 ID
3       DEV                       Device ID
4       IDM     18h               here INFD
5       Typ     xx                Typ of Information
                                  give
6...            ii...             Information specific
6+N     EOX     F7h               End of SysEx
------------------------------------------------------
******************************************************

Information types

xx       Information      N        ii
------------------------------------------------------
00:     Sampling rate     1        0: 32000 1:40000
                                  2:44100 3:48000
01:     Routing           3        out1,out2,out3
                                  :triple output
                                  assignments
                                  bitvectors
02:      MIDI Switches    1        bit 0: Serial MIDI
                                  in on/off 1: IIC
                                  MIDI in 2: IIC MIDI
                                  out
03:      Ext In Select    1        0: Digital input 1
                                  1:Digital input2
                                  (Dream 9407)

Output assignments:

out1 (ESSI0 TX0) (digital out 1)
Bit 3       Bit 2          Bit 1          Bit 0
In1         In2 / 9407     MW Main        MW Sub
(ESSI0 Rx)  (ESSI1 RX)

out2 (ESSI1 TX0) (digital out 2)
Bit 3       Bit 2          Bit 1          Bit 0
In1         In2            MW Main        MW Sub
(ESSI0 Rx)  (ESSI1 RX)

out3 (ESSI1 TX1)(Dream Input)
Bit 3       Bit 2          Bit 1          Bit 0
In1         In2            MW Main        MW Sub
(ESSI0 Rx)  (ESSI1 RX)

So a complete routing dump is
F0,3E,0E,DEV,18,1,out1,out2,out3,F7

Default routing:
out1 = 0Fh
out2 = 0Fh
out3 = 0Fh
That is all signals to all outputs.


MIDI Switches:
0: off , else on

So a complete MIDi Switch dump is
F0,3E,0E,DEV,18,2,MM,F7

Default switching:
MM = 7, That is all in-/outputs on MIDI IIC in is
currently ignored to ensure all others can be turned
on again.
```

Glossary

Aftertouch

The majority of contemporary keyboards are capable of generating aftertouch messages. On this type of keyboard, when you press harder on a key you are already holding down, a MIDI Aftertouch message is generated. This feature makes sounds even more expressive (e.g. through vibrato).

Aliasing

Aliasing is an audible side effect arised in digital systems as soon as a signal contains harmonics higher than half the sampling frequency.

Amount

Describes to which extent a modulation influences a given parameter.

Amplifier

An amplifier is a component that influences the volume level of a sound via a control signal. This control signal is often generated by an envelope or an LFO.

Arpeggiator

An arpeggiator is a device that splits an incoming MIDI chord into its single notes and repeats them rhythmically. Most arpeggiators feature different sequence modes to cover a wide range of applications. Typical controls for an arpeggiator are the octave range, the direction, the speed and the clock, which means the repetition interval. Some arpeggiators also feature preset or programmable rhythm patterns.

Attack

An envelope parameter. "Attack" is a term that describes the ascent rate of an envelope from its starting point to the point where it reaches its highest value. The Attack phase is initiated immediately after a trigger signal is received, i.e. after you play a note on the keyboard.

Band Pass Filter

A band pass filter allows only those frequencies around the cutoff frequency to pass. Frequencies both below and above the cutoff point are damped.

Band Stop Filter

A band stop filter does the opposite to a band pass filter, i.e. it dampens only the frequencies around the cutoff point and lets all other frequencies pass through.

Clipping

Clipping is a sort of distortion that occurs when a signal exceeds its maximum value. The curve of a clipped signal is dependent of the system where the clipping takes place. In the analog domain, clipping works like limiting the signal to its maximum level. In the digital domain, clipping is similar to a numerical overflow and so the polarity of the signal's part above the maximum level is negated.

Control Change (Controllers)

MIDI messages enable you to manipulate the response of a sound generator to a significant degree.

This message essentially consists of two components:

- The Controller number, which defines the element to be influenced. It can be between 0 and 120.
- The Controller value, which determines the extent of the modification.

Controllers can be used for effects such as slowly swelling vibrato, changing the stereo panorama position and influencing filter frequency.

CV

CV is the abbreviation for control voltage. In analog synthesizers, control voltages are used to control sound parameters like pitch, cutoff frequency etc. E.g. to get a tremolo effect, the output signal of a LFO must be routed to the CV input of an (or several) oscillator(s).

Decay

"Decay" describes the descent rate of an envelope once the Attack phase has reached its zenith and the envelope drops to the level defined for the Sustain value.

Filter

A filter is a component that allows some of a signal's frequencies to pass through it and dampens other frequencies. The most important aspect of a filter is the filter cutoff frequency. Filters generally come in four categories: low pass, high pass, band pass, and band stop. A low pass filter dampens all frequencies above the cutoff frequency. A high pass filter in turn dampens the frequencies below the cutoff. The band pass filter allows only those frequencies around the cutoff frequency to pass, all others are dampened. A band stop filter does just the opposite, i.e. it dampens only the frequencies around the cutoff frequency. The most common type is the low pass filter.

Filter Cutoff Frequency

The filter cutoff frequency is a significant factor for filters. A low pass filter dampens the portion of the signal that lies above this frequency. Frequencies below this value are allowed to pass through without being processed.

Envelope

An envelope is used to modulate a sound-shaping component within a given time frame so that the sound is changed in some manner. For instance, an envelope that modulates the cutoff frequency of a filter opens and closes this filter so that some of the signal's frequencies are filtered out. An envelope is started via a trigger, usually a fixed trigger. Normally, the trigger is a MIDI Note. The classic envelope consists of four individually variable phases: Attack, Decay, Sustain and Release. This sequence is called an ADSR envelope. Attack, Decay and Release are time or slope values, and Sustain is a variable volume level. Once an incoming trigger is received, the envelope runs through the Attack and Decay phases until it reaches the programed Sustain level. This level remains constant until the trigger is terminated. The envelope then initiates the Release phase until it reaches the minimum value.

Gate

The term „Gate“ has different meanings in a technical context. Like a real gate, it describes something, that can be open or closed, or - to use a technical term - active or inactive. A gate in sense of a device is a unit, that damps a throughpassing signal corressponding to some specific conditions. E.g. in a noise gate a signal is cut off, when its level falls above a predetermined threshold.
Gate stands also for a control signal of analog synthesizer systems. A keyboard generates an active gate signal as long as a key is held down. When the key is released, the gate signal becomes inactive again. An envelope generator can use this signal for its trigger purposes, and as a result a VCA unit can be controlled.

High Pass Filter

A high pass filter dampens all frequencies below its cutoff frequency. Frequencies above the cutoff point are not affected.

LFO

LFO is an acronym for low-frequency generator. The LFO generates a periodic oscillation at a low frequency and features variable waveshapes. Similar to an envelope, an LFO can be used to modulate a sound-shaping component.

Low pass Filter

Synthesizers are often equipped with a low pass filter. A low pass filter dampens all frequencies above its cutoff frequency. Frequencies below the cutoff point are not affected.

MIDI

The acronym MIDI stands for "musical instrument digital interface." It was developed in the early '80s so that diverse types of electronic musical instruments by different manufacturers could interact. At the time a communications standard for heterogeneous devices did not exist, so MIDI was a significant advance. It made it possible to link all devices with one another through simple, uniform connections.
Essentially, this is how MIDI works: One sender is connected to one or several receivers. For instance, if you want to use a computer to play the Pulse, then the computer is the sender and the Pulse acts as the receiver. With a few exceptions, the majority of MIDI devices are equipped with two or three ports for this purpose: MIDI In, MIDI Out and in some cases MIDI Thru. The sender transfers data to the receiver via the MIDI Out jack. Data are sent via a cable to the receiver's MIDI In jack.
MIDI Thru has a special function. It allows the sender to transmit to several receivers. It routes the incoming signal to the next device without modifying it. Another device is simply connected to this jack, thus creating a chain through which the sender can address a number of receivers. Of course it is desirable for the sender to be able to address each device individually. Consequently, there is a rule which is applied to ensure each device responds accordingly.

MIDI Channel

This is a very important element of most messages. A receiver can only respond to incoming messages if its receive channel is set to the same channel as the one the sender is using to transmit data. Subsequently, the sender can address specific receivers individually. MIDI Channels 1 through 16 are available for this purpose.

MIDI Clock

The MIDI Clock message determines the tempo of a piece of music. It serves to synchronize processes based on time.

Modulation

A modulation influences or changes a sound-shaping component via a modulation source. Modulation sources include envelopes, LFOs or MIDI messages. The modulation destination is sound-shaping component such as a filter or a VCA.

Note on / Note off

This is the most important MIDI message. It determines the pitch and velocity of every generated note. The time of arrival is simultaneously the start time of the note. Its pitch is derived from the note number, which lies between 0 and 127. The velocity lies between 1 and 127. A value of 0 for velocity is similar to „Note Off“.

Panning

The process of changing the signal's position within the stereo panorama.

Pitchbend

Pitchbend is a MIDI message. Although pitchbend messages are similar in function to control change messages, they are a distinct type of message. The reason for this distinction is that the resolution of a pitchbend message is substantially higher than that of a conventional Controller message. The human ear is exceptionally sensitive to deviations in pitch, so the higher resolution is used because it relays pitchbend information more accurately.

Program Change

These are MIDI messages that switch sound programs. Program numbers 1 through 128 can be changed via program change messages.

Release

An envelope parameter. The term "Release" describes the descent rate of an envelope to its minimum value after a trigger is terminated. The Release phase begins immediately after the trigger is terminated, regardless of the envelope's current status. For instance, the Release phase may be initiated during the Attack phase.

Resonance

Resonance is an important filter parameter. It emphasizes a narrow bandwidth around the filter cutoff frequency by amplifing these frequencies. This is one of the most popular methods of manipulating sounds. If you substantially increase the resonance, i.e to a level where the filter begins self-oscillation, then it will generate a relatively clean sine oscillation.

Sustain

An envelope parameter. The term "Sustain" describes the level of an envelope that remains constant after it has run through the Attack and Decay phases. Sustain lasts until the trigger is terminated.

System Exclusive Data

System exclusive data allow access to the heart of a MIDI device. They enable access to data and functions that no other MIDI messages are able to address. "Exclusive" in this context means that these data pertain only to one device type or model. Every device has unique system exclusive data. The most common applications for SysEx data include transfer of entire memories and complete control of a device via a computer.

Trigger

A trigger is a signal that activates events. Trigger signals are very diverse. For instance, a MIDI note or an audio signal can be used as triggers. The events a trigger can initiate are also very diverse. A common application for a trigger is when it is used to start an envelope.

VCA

VCA is the acronym for voltage-controlled amplifier. A VCA is a component that influences the volume level of a sound via a control voltage. This is often generated by an envelope or an LFO.

VCF

VCF is the acronym for voltage-controlled filter. It is a filter component that allows you to manipulate the filter parameters via control voltages.

Volume

The term describes a sound's output level.

Wave

A wave is the digitally stored image of a single wave cycle. From this point of view a wave is identical to a sample that is looped exactly after one cycle. The difference to a sampler or ROM sample player is that all waves have the same length and they are played at the same pitch.

Wavetable

A wavetable consists of pointers to waves, which are stored separately. In a wavetable a number of these pointers are combined, each pointing at one of the waves. A wavetable can contain less pointers then available positions. In this case the missing entries are filled automatically with interpolated waveforms, which are generated out the existing ones.

MIDI Implementation Chart

MIDI-Implementation Chart Date: 16.08.99
Model: Waldorf MicroWave II/XT/XTk Version: 2.18

Function		Transmitted	Recognized	Remarks
Basic Channel	Default	1	1	
	Changed	1 - 16	1 -16	
Mode	Default	x	x	
	Messages	x	x	
	Altered	**********	x	
Note Number		0 - 127	0 - 127	
	True Voice	**********	0 - 127	
Velocity	Note ON	o	o	
	Note OFF	x	o	
After Touch	Key's	x	o	
	Ch's	o	o	
Pitch Bender		x	o	
Control Change*	1	o	o	Modwheel
	2	x	o	Breath Control
	5	o	o	Portamento Time
	7	x	o	Master Volume
	10	o	o	Panning
	32	x	o	Bank Select
	64	o	o	Sustain Pedal
Prog Change		x	o	
	True #	**********	0 - 127	
System Exclusive		o	o	
System Common	: Song Pos	x	o	
	: Song Sel	x	x	
	: Tune	x	x	
System Real Time	: Clock	o	o	Start, Stop,
	: Commands	o	o	Continue
Aux Mes-sages	: Local ON/OFF	x	x	
	: All Notes Off	x	o	
	: Active Sense	x	o	
	: Reset	x	x	
*Note: See MIDI Controller Assignments for more information.				

Mode 1: OMNI ON, POLY Mode 2: OMNI ON, MONO o : Yes
Mode 3: OMNI OFF, POLY Mode 4: OMNI OFF, MONO x : No

CE

Konformitätserklärung
Declaration of Conformity

Für das folgend bezeichnete Erzeugnis

For the following named product

Waldorf MicroWave II Synthesizer
Waldorf MicroWave XT Synthesizer
Waldorf XTk Synthesizer

wird hiermit bestätigt, daß es den Schutzanforderungen entspricht, die in der Richtlinie 89/336/FWG des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit festgelegt sind; außerdem entspricht es den Vorschriften des Gesetzes über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 30. August 1995.

will be hereby declared that it conforms to the requirements of the Council Directive 89/336/FWG for radio frequency interference. It also complies with the regulations about radio interference of electronic devices dated on August 30th, 1995.

Zur Beurteilung des Erzeugnisses hinsichtlich der elektromagnetischen Verträglichkeit wurden folgende einschlägige harmonisierte Normen herangezogen:

The following standards have been used to declare conformity:

- EN 50 082-1 : 1992 , EN 50 081-1 : 1992 , EN 60065 : 1993

Diese Erklärung wird verantwortlich für den Hersteller abgegeben:

This declaration has been given responsibly by the manufacturer:

Waldorf Electronics GmbH
Neustraße 12
D-53498 Waldorf

Waldorf, 16.08.99

Wolfgang Düren, Geschäftsführer
Wolfgang Düren, Managing Director

FCC Information (U.S.A.)

1. IMPORTANT NOTICE: DO NOT MODIFY THIS UNIT! This product, when installed as indicated in the instructions contained in this Manual, meets FCC requirements. Modifications not expressly approved by Waldorf may void your authority, granted by the FCC, to use this product.
2. IMPORTANT: When connecting this product to accessories and/or another product use only high quality shielded cables. Cable/s supplied with this product MUST be used. Follow all installation instructions. Failure to follow instructions could void your FCC authorisation to use this product in the USA.
3. NOTE: This product has been tested and found to comply with the requirements listed in FCC Regulations, Part 15 for Class „B“ digital devices. Compliance with these requirements provides a reasonable level of assurance that your use of this product in residential environment will not result in harful interference with other electronic devices. This equipment generates/uses radio frequencies and, if not installed and used according to the instructions found in the users manual, may cause interference harmful to the operation of other electronic devices. Compliance with FCC regulations does not guarantee that interference will not occur in all installations. If this product is found to be the source of interference, which can be determinated by turning the unit „OFF“ and „ON“, please try to eliminate the problem by using one of the following measures:
Relocate either this product or the device that is being affected by the interference.
Utilise power outlets that are on branch (Circuit breaker or fuse) circuits or install AC line filter/s.
In the case of radio or TV interference, relocate/reorient the antenna. If the antenna lead-in is 300 ohm ribbon lead, change the lead-in to co-axial type cable.
If these corrective measures do not produce satisfactory results, please contact the local retailer authorised to distributed this type of product.

The statements above apply ONLY to products distributed in the USA.

CANADA

The digital section of this apparatus does not exceed the „Class B“ limits for radio noise emissions from digital apparatus set out in the radio interference regulation of the Canadian Department of Communications.

Le present appareil numerique n’emet pas de briut radioelectriques depassant les limites apllicables aux appareils numeriques de la „Classe B“ prescrites dans la reglement sur le brouillage radioelectrique edicte par le Ministre Des Communications du Canada.

This only applies to products distributed in the USA.
Ceci ne s’applique qu’aux produits distribués dans Canada.

Other Standards (Rest of World)

This product complies with the radio frequency interference requirements of the Council Directive 89/336/EC.

Cet appareil est conforme aux prescriptions de la directive communautaire 89/336/EC.

Dette apparat overholder det gaeldenda EF-direktiv vedrørendareadiostøj.

Diese Geräte entsprechen der EG-Richtlinie 89/336/EC.

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Waldorf Electronics GmbH • Neustraße 12 • D-53498 Waldorf • Germany • http://www.waldorf-gmbh.de

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