

USER MANUAL



E-RM ERFINDUNGSBÜRO

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Simply play together.

Introduction

Hello Stranger!

Congratulations for purchasing your *multiclock*. You have just purchased an avant-garde machine: you are now able to solve sync and timing issues in the studio and on stage once and for all.

This multi-format sync box builds a bridge between DAWs and external MIDI, DIN/sync24 and analog modular gear. It allows tight integration of external instruments into your digital production workflow without having to worry about timing.

Also as a standalone master clock generator for hardware-only setups it cuts a dash. Start shifting your clocks, start shuffling the beat, we are sure you will enter unknown territories.

Please read this manual carefully and follow the advice to be rewarded from the beginning with a great and powerful tool. And be assured, the *multiclock* is a game changer!

Have fun and start making music,

The team of E-RM

The Purpose of the Multiclock

The *multiclock* is a multi-format sync box which is built to overcome all well known problems with tight synchronization of external sequencers, drummachines, arpeggiators and other external gear with each other and especially in the workflow with a DAW.

The key feature of the *multiclock* is it's ability to derive a variety of sync signals from a special Audio Sync track instead of using for example a MIDI Clock signal.

With this technique, the *multiclock* is able to generate MIDI Clock, DIN/sync24 and analog modular clock signals to sync your slaves with a jitter as low as $\pm 20 \mu\text{s}$. This finally ensures seamless integration of all of your external instruments with your computer.

20.83 μs is the length of **one** sample at an audio sampling frequency of 48 kHz

The second important feature of the multiclock is it's ability to shift all output clock channels against each other and relative to the master clock back and forth in realtime. Up to $\pm 300 \text{ ms}$ of shift range ensure easy compensation of machine delay, audio buffer latencies and leave more than enough headroom to shift just to get the groove.

The *multiclock* is not built to be synchronized by a master DAW using MIDI or USB MIDI, nor does it correct your MIDI Note timing; it probably also can not fly to the moon.

But instead you can finally start bending time, play with the phase of your sounds and adjust microtiming of your arrangements. Let's start today, it's a lot of fun!

Machine Overview

The front panel of the *multiclock* can be roughly divided into a real-time and a configuration section.

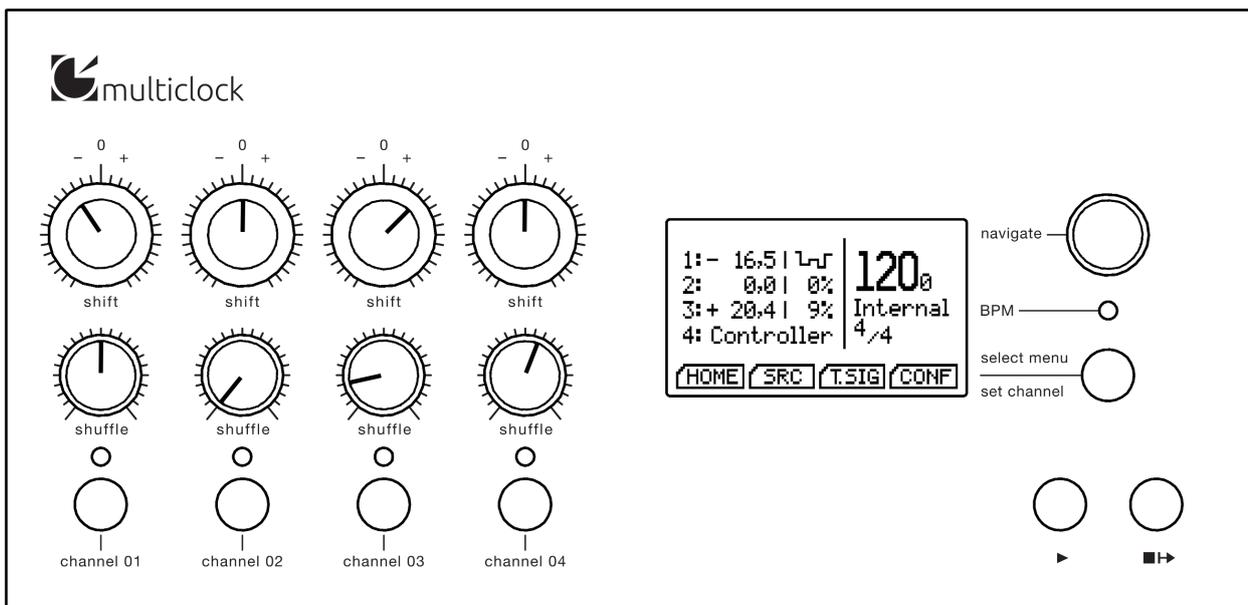
On the left half, there are **four identical channel stripes** for real-time control of each output channel. They consist of a shift and a shuffle knob, a status led and a start/stop button.

Status leds flash green for activated and shine red for running channels.

Shift knobs feature a center detent to easily set the channel offset to the zero position. The status leds light up in different colours to indicate running mode during playback or highlight the current channel under configuration.

On the right half, you can find the **configuration display**, a rotary encoder with click to navigate the menus, a function key and a BPM led. Moreover, global start/stop buttons are available for playback control when running on the internal masterclock.

During normal operation, the display presents all significant information on the **homescreen**.

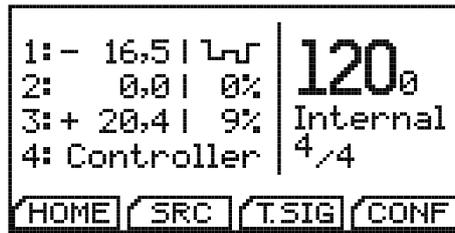


multiclock front panel overview.

You see the clock source, time signature and current BPM on the right part of the screen.

On the left part is one line for each output channel to display shift offset, shuffle amount or additional information like channel mode and LFO waveform.

On the bottom of the screen is a virtual button section which allows you to change the global machine configuration. Use the **select menu** button to toggle the cursor between the virtual buttons and the upper main part of the screen.



Example Homescreen. Notice the different Channel Modes shown here: Channel 1 is configured as LFO, Channel 2+3 work in sync mode and Channel 4 is used as a MIDI controller.

The rear panel of the *multiclock* provides **connectivity** and input for the power supply. It can also be divided into two sections: inputs on one side, outputs on the other. DC input and a power switch are located on the rightmost edge.

Synchronisation inputs are available in the form of a 1/4" jack for Audio Sync and a DIN socket for MIDI, sync24 and analog modular sync. Audio Sync can be fed as a balanced or unbalanced signal but is internally treated unbalanced in both cases.

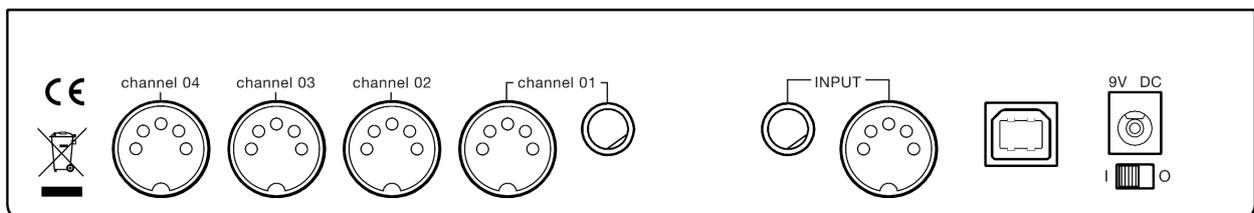
On the left, there is one DIN socket for each output. Any of them can provide MIDI, sync24 and analog modular sync, depending on the channel settings in the menu.

Channel 1 additionally has a 1/4" TRS output jack to provide analog clock or analog LFO.

Channel settings can be reached by holding the **set channel** button and pressing the button of the respective channel.

Modular Synth connectivity is easily accomplished by using a E-RM modular whip to convert from all DIN sockets to 2 mini jacks for clock & run signals.

Tip = Clock/LFO, Ring = Start



multiclock connector overview.

Configuring the machine

Configuring the settings of your *multiclock* is as easy as following the menu on the screen if you keep two things in mind:

- The screen is always divided into a main and a bottom section. To toggle the cursor between both sections, simply push the **select menu** button.
- Turn the encoder to move the cursor or change settings. Click it to select an option or submit a change.

Clock Source

Before using the *multiclock* in your setup, probably the most important setting is the selection of the clock source. You can reach the configuration page from the homescreen by selecting the SRC button.

Clock source selection. *USB MIDI channel can be chosen after selection.*



Choose between several input formats or use the internal masterclock generator. The recommended way to synchronize external gear to a DAW is using **Audio In** and the plugin provided on our website. Please refer to section 4 (p. 17) for further instructions.

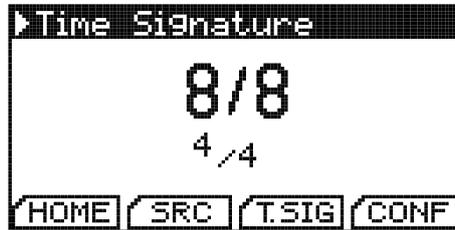
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Time Signature

To be able to start slaves always in sync with the downbeat of the next bar, the *multiclock* needs to know which time signature you are playing in. Select the T.SIG button from the homescreen to

get to the respective configuration page. Set all machines in your setup to the same value.

You can change the signature from 3/8 to 32/8, changes are saved automatically.



Configuration of Time Signature. Values are shown in reduced fraction form beneath.

Channel Setup

All changes concerning the different channels are configured on the Channel Setup pages. You can reach each channel's setup page by holding the **set channel** button and additionally pressing the button of the respective channel.

Shift Range



Channel Setup Page. Notice the preset name on top of the screen.

Shift Range configures the min/max value of shift amount that you can reach by turning the shift knob to the limits.

You can lock and unlock the shift parameter of each channel during playback (and only during playback!) to brace yourself against unintended knob movement. To do so, simply hold the **set channel** button and push the button of the channel you intend to lock. The channel number on the homescreen is replaced by an "L" to indicate locking status.

All knob ranges are internally divided into 1000 steps. You should always fit the shift range to your usecase to gain best performance.

Offset Calibration

To compensate audio delay of connected slaves, buffer latency of software monitoring or other sources which cause a constant offset to a channel, you can set a constant offset as the channel's zero position.

It is recommended to program a simple percussive sound on every full note of the machines involved in the calibration process.

Offset calibration process is initiated by selecting Offset in the menu. You are asked to start the clock source first. If you are using the internal generator, please press the global play button, otherwise start the master clock.

First, adjust the offset roughly until both sounds play at the same instant. Afterwards you can get into microtiming by holding the **set channel** button and adjust in steps of 20 μ s.

Offset Calibration. Used to set the zero position in time for each channel.



Change the value until you are happy with the result. Stop the master clock and submit your value by clicking the encoder.

Channel Mode

Each channel can be configured under Chn Mode to emit either MIDI Clock (MIDI), DIN Sync/sync24 (DIN) or analog modular clock (Analog).

If MIDI is selected, a sub-menu is available to enable Song Position Pointer forwarding. In this mode, song position data received on either the physical MIDI In or via USB MIDI is forwarded to the selected channel. Make sure to send SPP information only to one of the four USB MIDI ports or DIN MIDI In.

Enable MIDI Song Position Pointer Forwarding for a MIDI output channel. Correct offsets are added to compensate the 1 bar count in for POS/NEG mode.



Unused channels can further be used as a MIDI controller (Ctrl1). A special function is available on Channel 1 which features an analog LFO on it's TRS output jack (LFO).

Channel Dividers

Clock dividers are fun to create polyrhythmic patterns, thus you can set them on all output ports.



Channel Divider Configuration.

For MIDI and DIN, you can set Chn Divider to Knob and use the shuffle knob anytime to change the divider between 1,2,3 & 4.

For Analog mode, you can either set Chn Divider to Knob to use the shuffle knob to change between 1, 3, 6, 8, 12, 16, 24 & 32 on the fly or set an integer value between 1-96 directly.

A change of the clock divider by turning the knob during playback is always carried out in sync with the next bar. Shuffle is automatically set to zero in all modes when Knob is selected and the current divider is shown instead of the shuffle value on the homescreen.

Please note that due to the internal structure of the algorithms, in analog mode shuffle only sounds with a divider of 1 and 6 like you are used to it; but try other dividers with shuffle, they return interesting results!

LFO Configuration

When Chn Mode is set to LFO on Channel 1, an analog LFO signal is emitted on the tip of the ¼" TRS output jack.



LFO Configuration.

The waveform can be selected between Saw Up, Saw Down, Sine, Pulse and Random and is displayed on the homescreen. The LFO Frequency is changed during performance with the shuffle knob.

Frequency and reset behaviour of the LFO can be configured in three different modes:

The first mode, *free*, gives you a completely free running LFO with continuous frequency and no reset behaviour while running. The phase is only reset on a clock start.

In the second mode, *quant*, the LFO frequency is quantized and synced to the current tempo.

The LFO is obviously also completely shiftable in time. Try it, you will like it!

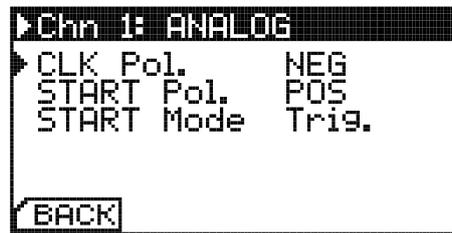
The last mode, *rst x/16*, combines both former modes for a continuously controllable, free running frequency with a periodic reset in multiples of 16th notes.

Analog Configuration

Due to an enormous variety of clock polarities, start/stop behaviour and necessary dividers in the modular world, you can fully configure all settings when Chn Mode is set to Analog.

START Mode can be set to emit a trigger pulse (Trig.), optionally skip the first clock pulse after start (Trig sk) or simply act as a gate (Gate). Be sure to check your modular sequencers manual if you are in doubt.

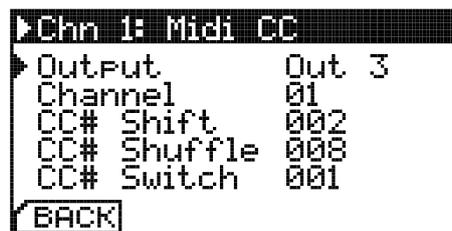
Analog Configuration. *This mode can also be used with DIN Sync instruments to implement clock dividers.*



Midi Controller Configuration

If you happen to have unused clock channels on your *multiclock* and need a basic MIDI Controller for one of your synths, simply configure the knobs to emit MIDI Control Change commands by setting Chn Mode to Ctrl.

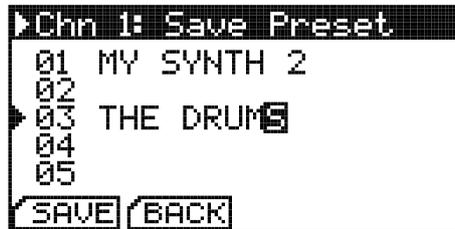
Midi CC Configuration. *Messages can be routed to different outputs.*



You can configure the output port, MIDI Channel and control change number. Knobs send values between 0 and 127, buttons toggle between the min and max value, button state is indicated by the channel's status led.

Presets

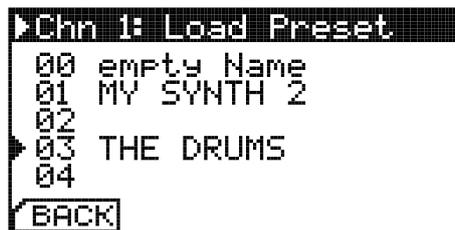
To maintain channel settings for your different instruments, they can be saved as presets once they are configured. Presets are based on a per channel basis, not as a whole machine configuration.



Save Presets. Numbers and characters are accessible in an infinite loop.

Simply select the virtual SAVE button on the Channel Setup page, choose a preset number and name them. 30 preset cells are available.

Presets are loaded by selecting the LOAD button. Choose the preset you need and click the encoder to load it. Presets containing LFO settings can only be loaded on Channel 1.



Load Presets. 'empty Name' loads a factory default preset.

Advanced Settings

By hitting the virtual CONF button on the homescreen, you can configure some advanced settings which affect the *multiclock's* general behaviour.



Advanced Settings.

With Machine Mode you can choose between NEG/POS and POS.

Please note: the Offset Parameter is saved separately in the channel presets for both machine modes!

The former allows you to shift sync signals back and forth with respect to the masterclock. This implies one bar forerun before all slaves start when you initiate the master clock. The latter mode skips this one bar and starts everything as you hit play on the master in exchange to allow only positive delays. There is a nice trick for some cases to circumvent this behaviour, check section 7 (p. 23) for more information.

The `Free Wheel` option is implemented for stage. If you set it to `On`, the multiclock will automatically turn on it's internal masterclock generator when the external master clock source is interrupted. This prevents headache when DAWs crash or cables break during performance. All slaves continue to run and there is plenty of time to set everything up again. To be able to stop the *multiclock* on purpose when `Free Wheel` is activated and clock source is set to `Audio In`, you can send MIDI Stop commands over any MIDI or USB MIDI input. This way it is ensured that the multiclock can distinguish between a missing sync signal and an intended stop.

Remote and MIDI Mapper are treated in sections 6.2 and 5.1 respectively.

System Setup

Some fundamental system settings can be changed by entering the sub-menu `Setup`. LCD brightness and contrast are self explaining. `Factory Reset` restores the default configuration and purges all presets.

Setup Screen. *Be careful with 'LCD Contrast'. The pixels may vanish on the parameter's limits!*



Audio Threshold can be used to adjust the *multiclock's* input stage to the level of your Audio Sync signal. Under normal circumstances, no changes are required here - the default value is 7. See section 4 (p. 17) for further information.

Using Audio Sync

To synchronize the *multiclock* to a master DAW, you should always use the Audio Input and avoid MIDI or USB MIDI under all circumstances.

This requires in all cases the following prerequisites:

- A computer running your favourite DAW
- 1 mono audio output channel of the soundcard, exclusively connected to the *multiclock*
- The ability to load our VST/AU plugin or to generate a sync track with a special sample provided on our website

Both balanced and unbalanced outputs work fine.

You can also use the methods described here to sync the *multiclock* to hardware samplers while avoiding MIDI Clock.

Plugin

The easiest way to set everything up is to use our VST/AU plugin:

- Get the plugin for your operating system on our website and install it according to the instructions of your DAW
- Pull it on an empty track in your DAW
- The plugin interface is simple, the only thing you can configure is time signature. Open the plugin window and set it to the same value that you have configured for all other machines
- Assign the track's audio output to the soundcard channel you have connected your *multiclock* to and set the fader initially to 0 dB

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Please take care not to send any other audio to this channel, this will render everything useless.

Here you go, that's it. Set the *multiclock* to accept Audio In according to section 3.1 and hit play on your DAW.

The BPM led on the *multiclock* starts to flash and the display shows the actual tempo.

Sync Track

Another simple method to synchronize the *multiclock* to DAWs and hardware samplers is to use a sync track. All you need is one mono

audio output, a synchronization sample and a way to program a loop.

- Get the sync sample from our website and load it onto your desired hardware sampler or DAW.
- Create a new track and assign the track's audio output to the audio channel you have connected your *multiclock* to. Set the output level initially to 0 dB
- Now program a loop to play the sync sample on 24 notes per beat

24 notes per beat = 24 ppq =
64th note triplets = 64T

Set the *multiclock* to accept Audio In according to section 3.1 and hit play on the master you have just programmed.

The BPM led on the *multiclock* starts to flash and the display shows the actual tempo.

Using MIDI In

MIDI Mapper

Due to the fact that the *multiclock* features more than one MIDI Out, there is a MIDI Mapper to route incoming messages on the MIDI In conveniently to the outputs.



MIDI In Mapper. You can both replace MIDI Channel numbers and select output ports.

The MIDI Mapper is organised from the left to the right: All 16 incoming MIDI Channels are available in the leftmost column. In the column next to it, you can substitute an incoming MIDI Channel number with another outgoing MIDI Channel number. The matrix on the right holds items for all physical MIDI Out ports on the back of the *multiclock* (1, 2, 3, 4), as well as USB MIDI (U). Just select all desired outputs that should receive the respective incoming MIDI channel.

All supported MIDI messages can be found in section 6.1 (p. 20). MIDI Sysex commands don't contain a channel number and can thus only be assigned to an output port.

Using USB MIDI

MIDI Forwarding

If your *multiclock* has a USB module installed, you are able to add other MIDI commands from a DAW to the timing accurate MIDI clock streams.

There is one virtual USB MIDI output for every physical channel. MIDI data transmitted to one of them get's merged with priority for the clock ticks into the MIDI clock stream of the respective channel. A complete table of supported commands can be found below:

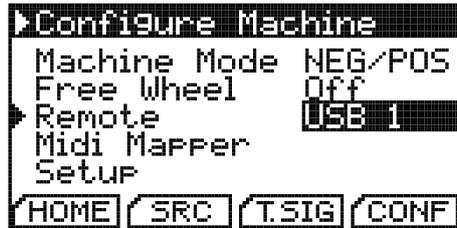
USB MIDI Forwarding Table. *Please note that a small n as in 0x9n specifies the MIDI channel number. All 16 channels are supported but might be used by MIDI Remote or other functions as configured.*

MIDI Command		Forwarded	Comment
Note On	0x9n	✓	
Note Off	0x8n	✓	
Aftertouch	0xA _n	✓	
Control Change	0xB _n	✓	
Programm Change	0xC _n	✓	
Channel Pressure	0xD _n	✓	
Pitch Bend	0xE _n	✓	
Sysex	0xF0	✓	
Song Select	0xF3	✓	
MIDI Time Code	0xF1	-	
Song Position Pointer	0xF2	-	
Tune Request	0xF6	-	
MIDI Clock	0xF8	-	generated by multiclock
MIDI Start	0xFA	-	
MIDI Stop	0xFC	-	
MIDI Continue	0xFB	-	
MIDI Tick	0xF9	-	
Active Sensing	0xFE	-	
Reset	0xFF	-	

As the USB module is a standard class compliant MIDI device, usual MIDI timing applies. Transmitted data can not be shifted in any direction in time.

Parameter Remote Control

In addition to control shift and shuffle amount on the respective knobs, those parameters can also be changed and read remotely over USB using MIDI commands. To enable this feature, switch `Remote` in the advanced settings to your desired USB MIDI port.



Enable MIDI Remote Control

To send a snapshot of the current parameter settings to your DAW you need to lock the respective channel. Channels are locked by pressing **set channel** and the respective channel number during playback.

All current channel settings are then transmitted over USB MIDI and the channel number on the home screen changes to L.

This snapshot can be recorded and replayed to the multiclack each time you want the same shift and shuffle settings again. Details on the snapshot structure can be found in the table below. Please note that all controls can also be sent independently.

Remote function	MIDI Command
Controlled sync channel	MIDI Channel n=1-4
Shift amount	Pitch Bend 0xE _n 0xv _v 0xu _u
Shuffle amount	Mod Wheel (CC1) 0xB _n 0x01 0xw _w
Start channel	Note #36 On 0x9 _n 0x24 0x7F
Stop channel	Note #38 On 0x9 _n 0x26 0x7F

Refer to section 3.3.1 (p. 11) for further information on channel lock.

USB MIDI Remote Control Implementation. *Shift uses the top 12 bits of uuvv, shuffle uses ww from 0-99.*

When the multiclack has received a snapshot or your own automations, the L on the homescreen changes to R to indicate the remote operation.

To exit remote operation and return to the knobs, simply unlock the channel by pressing **set channel** and the respective channel number during playback again.

DAW Transport Control

To control the transport of your DAW from the multiclock buttons even when using the audio sync solution, MIDI control change messages are sent via USB MIDI at all times.

USB MIDI Transport Control Messages.
Map these MIDI messages to your DAW to control the transport.

Multiclock Button	MIDI Command
Start button	CC 08 0xB0 0x08 0xF
Stop button	CC 09 0xB0 0x09 0xF

Tips and Limitations

This section can be considered the FAQ part of this manual. It is both a random compilation of tips & tricks and useful advice to cure little ailments.

Nice to know

- If you are playing at a fixed tempo and want to be able to shift a channel by a 16th note, simply calculate the duration of a 16th note and set the maximum shift range to this value. The formula is:

$$\text{Shift Range} = \frac{15000}{\text{BPM}}$$

- An huge number of *multiclocks* can be fed paralell by the same Audio Clock source. Simply use a passive audio splitter to feed the signal to as many clocks as you need.
- You can set machine mode on the *multiclock* to POS and keep the ability to perform negative shifts using Audio Sync if you are able to configure a negative track delay on the Plugin or Sync Track audio output on the DAW. Example: Set the track delay to -100 ms on the DAW and the shift range of the channels to +200 ms. The zero position in time on the *multiclock* is at +100 ms then and you can move back and forth from there.
- DIN Sync and shuffle at the maximum tempo of 300 BPM can cause some old machines to stutter - they are old, please be a bit tolerant about their quirks.
- Of course the *multiclock* follows a tempochange of the master-clock seamlessly under normal circumstances. Nevertheless, if you try too jump from 30 to 300 BPM within an instant it might react with a little hiccup before getting back on track.
- Please be very careful with machines/eurorack modules which offer a frequency multiplier internally. Due to the internal structure of their algorithms, unpredictable offsets will occure when you shift clocks around!

Audio Sync

- The displayed tempo on the *multiclock* might be subject to roundoff deviation on the last decimal place. This does not affect synchronization at all.
- You can also use a percussive sound at 24 ppq or an analog LFO as the master clock. Please make sure that the positive pulse width is at least 1.5 ms, don't exceed 300 BPM.
- If the display shows ERR instead of the actual tempo or the BPM led flashes irregularly, please check your wiring. Ground loops and exceptionally high noise floor might distort the sync signal as well as excessive levels above 10 dBu.

If you have ensured proper wiring, you can adjust both the Audio Threshold of the *multiclock* (p. 15) or audio level on the sound-card.

Updating the System Software

To update the system software of your *multiclock*, it is vital to ensure steady power supply for at least 10 minutes.

Then follow the instructions below to update the software using the internal MIDI Sysex bootloader:

- Make sure you have a computer and a proper way to replay MIDI Sysex files
- Download the latest system software from our website and load it into your sysex tool
- Hold down the leftmost (**channel 1**) and rightmost (■) button while turning on your *multiclock* to enter the bootloader
- Now connect your sysex tool with the *multiclock*:
 - for the classic version, simply connect MIDI Out from your computer to MIDI In on the machine
 - for the USB version, use a USB cable to connect your computer and the machine
- Configure the correct MIDI output in your sysex tool. USB versions take software updates on USB Midi Output 1
- Start the transmission according to the manual of your sysex tool. The bootloader on the *multiclock* will indicate the progress and start the new software when it is fully loaded

There are Sysex dumpers for all operating systems available as freeware on the internet: SysEx Librarian, MIDI-OX or Simple Sysexer. *Set a waiting time of 60ms between packages.*

Declaration of Conformity



It is hereby confirmed, that the *multiclock* meets all rules and regulations regarding EU-directive 2004/108/EG for electromagnetic compliance to protect humans and the environment.



The *multiclock* is compliant with the RoHS directive.



If you wish to dispose your *multiclock*, please contact your local dealer for recycling. Do not put it in your household waste.

Contact

We, that is E-RM Erfindungsbüro, make the *multiclock* to meet our own high expectations on value and functionality of a product.

If you have any questions or suggestions, do not hesitate to contact us.

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