MUTEC | PERFECTING DIGITAL AUDIO

Manual
REF10 NANO

Content

Precautions

General Instructions

To reduce the risk of fire or electrical shock, do not expose this device to rain or moisture, direct sunlight or excessive heat from sources such as radiators or spotlights. There are no user-serviceable parts inside.

Any repair and maintenance may only be carried out by qualified personnel authorized by MUTEC GmbH. The device was designed for operation in a standard domestic environment. Do NOT expose the unit and its accessories to rain, moisture, direct sunlight or excessive heat produced by heat sources such as radiators or spotlights! A free flow of air inside and in close proximity to the unit must always be ensured.

Initial Operation

Prior to the initial operation of the device, the unit itself, its accessories and packaging must be inspected for any signs of physical damage that may have occurred during transit. If the unit has been damaged mechanically or if liquids have been spilled inside the enclosure, the device may not be connected to the mains power or must be disconnected from the mains immediately. If the unit is damaged, please do NOT return it to MUTEC GmbH, but notify your dealer and the shipping company immediately. Otherwise, any liability claims will not be granted.

If the device is left in a low-temperature environment for a long time and is then moved to a room-temperature environment, condensation may occur on the inside and the exterior of the device. To avoid short-circuits and electric shocks, make sure to wait one or two hours before putting the device back into operation.

Power Supply

The device contains a self-adapting, wide-range power supply supporting the majority of global standard line voltages within a range of 90-250 V, with no need for any user adjustments.

Make sure that your line voltage source provides a supply voltage within the specified range. In addition, make sure that the device is properly grounded via the local electric installation. Please use the enclosed power cable (see packaging) to connect the unit to the mains power. Switch the unit off before you attempt to connect it to the mains. Firstly, connect the power cord to the device, then to a standard 3-pin mains outlet. To remove the power cord never pull on the cable but on the mains plug!

The unit must be grounded during operation! For information on the power input module wiring, refer to the »Wiring of connectors« section in the appendix. Disconnect the device from the mains when not using it for an extended period.

Trademarks

MUTEC GmbH assumes no liability for any incorrect information provided in this manual. Please note that all software/hardware product names are registered trademarks of their respective owners. No part of this manual may be reproduced, copied or converted to a machine-readable form or electronic media without written permission by MUTEC GmbH. We reserve the right to change or improve our products without further notice.

This symbol, a flash of lightning inside a triangle, alerts you to the presence of non-insulated dangerous voltage inside the enclosure - voltage that may be sufficient to constitute a risk of shock.

This symbol, an exclamation mark inside a triangle alerts you to important operating or safety instructions in this manual.

Declaration of Conformity

We herewith confirm that this product complies with the European Commission's standards on electromagnetic compatibility.

Interference emission:

EN 50081-1, 1992, Resistance to interference: EN 50082-1, 1992. Presupposed as operation condition is that all signal outputs are connected with high-quality and well shielded cables.

Warranty Regulations

§1 Warranty

MUTEC GmbH warrants the flawless performance of this product to the original buyer for a period of two (2) years from the date of purchase. If any failure occurs within the specified warranty period that is caused by defects in material and/or workmanship, MUTEC GmbH shall either repair or replace the product free of charge within 90 days. The customer is not entitled to claim an inspection of the device free of charge during the warranty period. If the warranty claim proves to be justified, the product will be returned freight prepaid by MUTEC GmbH within Germany. Outside Germany, the product will be returned with the additional international freight charges payable by the customer. Warranty claims other than those indicated above are expressly excluded.

§2 Warranty Transferability

This warranty is extended exclusively to the original buyer who purchased the product from a MUTEC GmbH specialized dealer or distributor, and is not transferable to anyone who may subsequently purchase this product. No other person (retail dealer, distributor, etc.) shall be entitled to give any warranty promise on behalf of MUTEC GmbH.

§3 Warranty Regulations

The return of the completed registration card, or online registration on one of the websites specified below, is a condition of warranty. Failing to register the device before returning it for repair will void the warranty.

The serial number on the returned device must match the one stated on the registration card or entered during online registration. Otherwise, the device will be returned to the sender at the sender's expense. Any returned device must be accompanied by a detailed error description and a copy of the original sales receipt issued by a MUTEC dealer or distributor.

The device must be returned free of shipping expenses and in the original package, if possible; otherwise, the sender has to provide comparably protective packaging. The sender is fully responsible for any damage or loss of the product when shipping it to MUTEC GmbH.

§4 Limitation of Warranty

Damages caused by the following conditions are not covered by this warranty:

- Damages caused by every kind of normal wear and tear (e.g. displays, LEDs, potentiometers, faders, switches, buttons, connecting elements, printed labels, cover glasses, cover prints, and similar parts)..
- Functional failure of the product caused by improper installation (please observe CMOS components handling instructions), neglect or misuse of the product, e.g. failure to operate the unit in compliance with the instructions given in the user or service manuals.
- Damage caused by any form of external mechanical impact or modification.
- Damage caused by the user's failure to connect and operate the unit in compliance with local safety regulations.
- Damage caused by force majeure (fire, explosion, flood, lightning, war, vandalism, etc.).
- Consequential damages or defects in products from other manufacturers as well as any costs resulting from a loss of production.
- Repairs carried out by personnel which is not authorized by MUTEC GmbH.

§5 Repairs

To obtain warranty service, the customer must call or write to MUTEC GmbH before returning the unit. All inquiries must be accompanied by a problem description and the original buyer's invoice. Devices shipped to MUTEC GmbH for repair without prior notice will be returned to the sender at the sender's expense. In case of a functional failure please contact:

MUTEC Gesellschaft für Systementwicklung
und Komponentenvertrieb mbH
Siekeweg 6–8, 12309 Berlin, Germany
Phone: +49 (0)30 746880-0
Fax: +49 (0)30 746880-99
E-Mail: tecsupport@mutec-net.com
Web: www.mutec-net.com

Introduction

General Description

Thank you very much for your purchase of the MUTEC REF10 NANO an audiophile 10 MHz reference master clock generator.

The REF10 NANO is the focused version of an audiophile 10 MHz reference master clock in the superior quality you should expect from clocking specialist MUTEC. It is based on the already well-established REF10, but transfers its technology, praised by many customers and reviewers, into a new and significantly lower price range.

With the REF10 NANO, dedicated music lovers are for the first time able to significantly improve the sound performance of their home digital audio system for a moderate investment. Likewise, thanks to this MUTEC reference master clock, aspiring studio owners can guarantee their customers maximum sound quality when mastering and recording their music productions. No matter which kind of playback setup the REF10 NANO is used in, a noticeable increase in transparency, spatiality and dynamics will be clearly audible in general.

The REF10 NANO can be directly connected to up to four 10 MHz compatible devices. DACs (D/A converters), network switches, re-clockers, clock generators, CD players, servers or streamers are perfect partners. In case these components do not have a dedicated 10 MHz input, an MC3+ or MC3+USB interface from MUTEC provides the necessary interconnection between the REF10 NANO and the audio equipment to be synchronized. On the other hand, the REF10 NANO is the perfect partner to an existing MC3+ or MC3+ USB. Together they raise the signal's audiophile quality – already improved and re-clocked by the MC3+/MC3+ USB interface – to an even higher level.

Features

- Audiophile 10 MHz reference generator with outstanding low phase noise
- Improves and enhances compatible DACs, audio re-clockers, music servers and master clocks
- Handcrafted outstanding low phase noise OCXO, made in Germany
- Four simultaneous usable reference clock outputs with 50 Ω (2x) and 75 Ω (2x) impedance for maximum compatibility
- Galvanic isolation of the independently switchable BNC clock outputs for optimum interference immunity
- Sub-Hz optimized, lowest noise power supplies for every section of the circuitry
- Integrated international power supply
- DC power input to improve the REF10 NANO's noise performance with help of an appropriate external power supply unit
- Power supply redundancy by using mains and DC voltage supply simultaneously
- Self-explanatory user interface
- Optional mounting kit for installation in a 19" studio rack (1RU)
- Developed and manufactured in Germany

Matching MUTEC Products

- MC3+
  An audio re-clocker and master clock that provides low-jitter clock audio signal generation and aggressive audio re-clocking using MUTEC's REVIVE technology.
- MC3+ USB
  As the successor of the MC3+ , the MC3+ USB offers significantly improved audio performance and an isolating USB interface for audio computers and music servers.
- iClock & iClock dp
  iClock and iClock dp are both synchronizable, highest precision clock synthesizers for audio/video production studios and broadcast.

Accessories

- MUTEC's Prime Select Cables line of 50 Ω and 75 Ω clock cables in various lengths, exclusively approved by the REF10 developer. Ask your retailer for further details!

Product Registration for Warranty and Support

We kindly ask you to register your MUTEC product through our website immediately after buying. This ensures full warranty services over a period of two years after purchasing the product. Additionally, we provide free technical support for all registered products. We will also inform you about new products and product updates (you may opt-out at any time of course).

Please register your product at:

www.mutec-net.com > Service > Product Registration

Or for direct access type in the following URL into your browser:

http://www.mutec-net.com/produktregistrierung.php?lng=en

Social Media

facebook.com/mutecpro

Installation

Shipping Contents

Your REF10 NANO was packaged carefully. Nevertheless we recommend checking the contents directly after opening the package:

1 x REF10 NANO
1 x Power cable
1 x DC cable connector
1 x Manual

In the unexpected event that there are any visible damages or missing items, please refer to the chapter »Safety Instructions« and »Warranty Regulations« for further details.

Placing the Device

The unit should be set up as closely as possible to the devices to which it will be connected to avoid excessive cable lengths. The four custom-designed case feet include a rubber ring protecting the ground's surface from being damaged and reducing any structure-borne vibrations interfering with the unit. It is recommended to keep the device away from vibrating or mechanically moving devices in close proximity.

The device can be mounted into a standard 19" rack and will require 1U (rack unit). Therefore, we offer an optional rack mounting kit. This includes two rack brackets which need to be screwed to each side of the device's case. Before mounting the device into a 19" rack, please unscrew the four case feet with a suitable screwdriver. Install the device so that 1U of rack space is left open both above and below the device to allow for sufficient ventilation! For extra secure installation we further recommend an additional rack mounting plate that will prevent any long-term mechanical deformation of the enclosure.

Attention
Before installing the unit the section Safety Instructions located at the beginning of this manual should be read carefully! Never expose the device and accessories to rain, moisture, direct sunlight, or excessive heat produced by radiators, heaters, or spot lights! Sufficient air circulation in the proximity of the device must be ensured!

Interface Connections

There are two standards with respect to interfaces and cable termination for 10 MHz reference signals:

- 50 Ω Impedance Termination
  This standard can mainly be found among units by Asian Hi-Fi manufacturers, and for measurement devices in laboratory applications.

- 75 Ω Impedance Termination
  This termination is more common for devices used in recording, mixing and broadcast studio applications.

For audiophile Hi-Fi and high-end consumer audio applications both standards are currently in use by different manufacturers. For this reason, the REF10 NANO provides clock outputs with both 50 Ω and 75 Ω termination that can be used simultaneously.

MUTEC's Prime Select Cables line offers with the PSC 50 BNC and the PSC 75 BNC excellent matching clock cables with 50 Ω and 75 Ω characteristic impedance in various lengths, exclusively approved by the REF10 developer.

Additionally, MUTEC's Prime Select Cables of the PSC 50 BNC series keep the specifications aligned to the CLF200/HDF200 standards, while the cables of the PSC 75 BNC series keep the RG-59/U, RG-598/U as well as RG-216/U standards.

Ask your retailer for further details!

All interfaces of the devices in a given setup need to be properly connected with each other. Always ensure the clock output of the REF10 NANO is connected to an appropriate input of the receiving device. Make sure the clock input of the receiving device has the correct internal impedance termination. This internal termination can sometimes be adjusted via an external switch on the device or via a software setting. We recommend double-checking the operating manual of any device that you are planning the REF10 NANO to be connected to. A mismatched termination of the system will cause losses in signal quality and clock precision!

We further recommend keeping the cable lengths as short as possible to minimize signal losses and interferences. Cables at 0.5 m to 1.0 m, or a maximum of 2.0 m length are ideal. The longer the cable needs to be, the higher the quality should be to avoid excessive losses!

BNC tee adapters are often used to daisy-chain clock signals between several devices. Usually this is necessary if the clock master does not provide a sufficient number of clock outputs. Since the REF10 NANO generates low phase noise, i.e. highest quality signals, any additional elements in the signal path can have an attenuating effect that negatively affects the crucial slew rate of the signal. Consequently and considering that the REF10 NANO provides a total of four clock outputs we advise against daisy-chaining 10 MHz clock signals.

Any device that is supposed to be clocked by the REF10 NANO and benefit from its audiophile performance must be connected to a dedicated clock output!

Usage of the DC Voltage Input (»DC IN 15 V | 1 A«)

Audiophile Sound Enhancement
The DC voltage input can be used alternatively to the mains input. Depending on the characteristics of the connected DC voltage source with regard to its low noise level, the noise performance of the clock signals generated by the REF10 NANO can be further improved (lowered), which increases the audiophile quality of connected devices. Therefor, the mains switch must be switched off or the mains cable disconnected. This also has the advantage that no mains voltage interferences can be induced into the circuitry.

Power Supply Redundancy
The DC voltage can also be applied in parallel with the mains voltage if, for example, redundancy is required. In this case, the mains voltage and the DC voltage are connected in parallel to the REF10 NANO. The mains voltage always has priority over the DC voltage supply of the device. If the mains voltage fails, the system automatically switches to the DC voltage. During this process, the clock signals are output without interruptions. When the mains voltage returns, the system automatically switches back to it.

Attention
The LEDs on the front indicating the type of power supply in use (»Mains«, »DC«), switch over with a delay if the power supply has changed. This is not a system error, but is caused by the very high filter capacities of the circuitry.

A matching DC voltage cable connector is included in the scope of delivery to speed up the assembly of the required DC power cable for customers able to solder cables themselves.

We do not take over any functional guarantee when using self-soldered DC cables for powering the REF10 NANO!

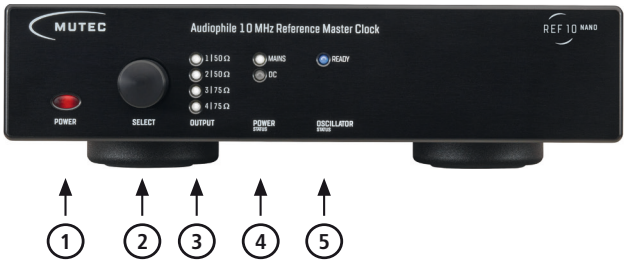
10 MHz compatible Products

To help you getting started in the »10 MHz universe« we have put together a comprehensive list of currently available 10 MHz compatible devices on our website. Please go to the REF10 NANO's description page to view the full list:

https://www.mutec-net.com/product_ref10_nano.php#description***!***

Control Elements and Terminals

Front Panel



1) »POWER«
This red LED illuminates when the device has been powered up. First engage the rear panel power switch next to the mains terminal.

2) »SELECT«
This combined push button rotary encoder is used to select the individual outputs and to disengage or re-engage them.

3) »OUTPUT«
These four white LEDs represent the four rear panel clock outputs and reflect if the respective output has been turned on or off. An illuminated LED means the output is active, i.e on.

4) »POWER«
These two white LEDs indicate which of the two possible power sources is active. The REF10 NANO can be powered by mains or DC power.

5) »OSCILLATOR«
This blue LED reflects the status of the oscillator heat-up process. Upon powering the device up this LED will be flashing until the oscillator has reached its correct operating temperature. Once the temperature has been established, the LED will be permanently lit.

Rear Panel

1) »50 Ω, Outputs 1–2«
These two clock outputs are equipped with a 50 Ω termination. Use only BNC cables with the appropriate 50 Ω impedance with these outputs.

We recommend using the MUTEC PSC 50 BNC cable.

2) »75 Ω, Outputs 3–4«
These two clock outputs are equipped with a 75 Ω termination. Use only BNC cables with the appropriate 75 Ω impedance with these outputs.

We recommend using the MUTEC PSC 75 BNC cable.

3) »DC IN 15 V | 1 A«
This is the DC voltage input connector accepting 15 V DC voltage. If a working DC voltage source is connected to this input, the mains switch must be switched off, as the mains supply always has priority over the DC voltage supply. In addition, switching off the mains also ensures no interferences from the mains voltage can be induced into the circuitry.

A matching DC voltage cable connector is included in the scope of delivery.

4) »MAINS IN«, Power Switch + Mains Connector (IEC)
This is the main switch for switching the device on and off. Connect the supplied IEC power cable to the device's mains connector. Make sure the power switch is turned off before connecting the device to your power source finally. Line voltages within the range of 90…260 V with a frequency of 50 or 60 Hz can be applied. The internal power supply will automatically make all necessary adjustments.

Read the Safety Instructions at the beginning of this manual!

Attention
For detailed specifications of all interfaces, please refer to the »Pin Assignment of the Connectors« and »Technical Data« sections in the Appendix chapter.

Operation

General System Operation

Operating the REF10 NANO is very straight-forward! Apart from the power switche there is only a single push button rotary encoder (»SELECT«) used to individually turn the four outputs on or off. Per factory default all outputs are active upon powering up the device for the first time, so all four white front panel LEDs will light up accordingly.

Selecting and toggling the outputs
The front panel encoder's action is stepped and each step will evoke a new setting. The push button function of the encoder is used to toggle features.

Rotate the encoder by one step to select an output and the first LED will start flashing. Turning the encoder by another step now will cause the next LED to flash while the previous one returns to a steady light. Thus, it is only possible to select one output at a time.

As long as an LED is flashing, the respective output can be toggled with a push of the encoder. When the LED is on, the output is active. When the LED is off, the output has been disengaged. Any setting will have immediate effect - it is not necessary to take any further actions.

The last setting of the REF10 NANO will be stored and preserved after the device has been powered down.

Recommendations for the REF10 NANO

To ensure a long-lasting performance with optimum clock signal quality that will best enhance your connected devices we would like to share a few recommendations for using the REF10 NANO.

- For best sound performance of the connected devices it is useful to let the REF10 NANO burn-in for at least 14 days. Thus, we recommend to leave the unit switched on for that period of time.
- Prior to enjoying an in-depth listening session we recommend pre-heating the REF10 NANO for about 20-30 minutes. While the heater generally reaches its operating temperature in about five minutes, the entire oscillator section takes longer to fully warm up. To ensure optimal performance and highest frequency stability, you should grant your REF10 NANO this additional warm-up time.
- Keeping the REF10 NANO permanently powered up is generally not required as long as you observe the extended warm-up period described above. We do however advise against power cycling the unit in short, repeated intervals!
- As a matter of principle, the REF10 NANO should not be set up near mechanically vibrating devices. Although the unit's case feet are equipped with isolating rubber rings, excessive structure-borne vibrations can nonetheless interfere with the oscillator and negatively affect the clock performance and signal quality.

  The REF10 NANO should furthermore not be placed in close proximity to devices emitting strong electromagnetic fields (such as fluorescent lamps). Even though the electronics of the unit are encapsulated in a steel enclosure these strong electric fields can interfere with the sensitive electronics and also negatively affect the signal quality.
- We generally recommend disengaging all clock outputs that are not used for your given set-up to reduce potential interference as much as possible. Additionally, unused and disengaged outputs can be fitted with so-called BNC caps. These are available from various retailers and can be used regardless of the termination impedance of the REF10 NANO's outputs.

  Please note:
  The use of so-called BNC terminators is not recommend as these are straining the system unnecessarily. Thus, to protect or close BNC outputs not in use, please use BNC caps only without internal termination resistor!

Applications

Using the REF10 NANO with other Products

This chapter serves to illustrate several possible applications for the REF10 NANO and will help you achieve the best possible sonic results. In general the units can be used for the following applications:

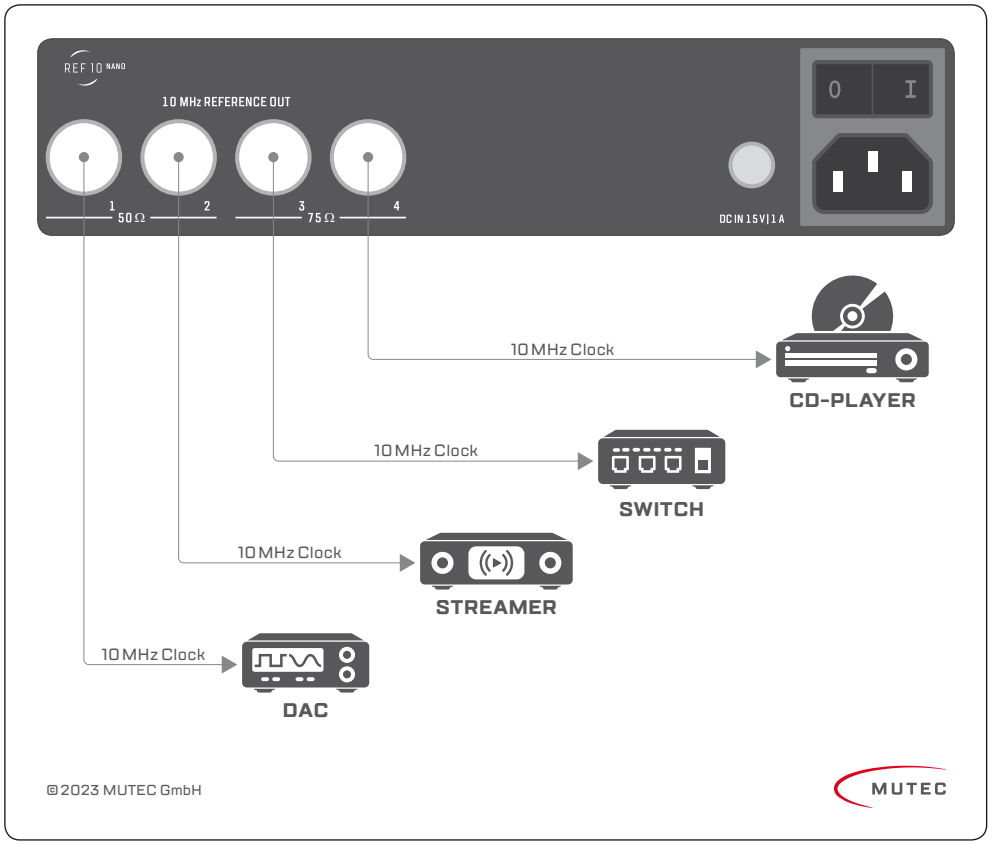
- As an audiophile performance enhancement for compatible DACs, master clocks and audio re-clockers.
- As an low noise, high stability clock reference for the entire digital audio chain at home or in the studio.
- As an ideal high-end upgrade for MUTEC's own MC3+, MC3+ USB and iClock/iClock dp audio re-clockers and master clocks.
- To stabilize existing audio clock generators.

To explain these applications it is important to understand the REF10 NANO is a reference master clock exclusively generating highest quality 10 MHz clock signals. Compatible devices can use this precise reference clock signal to perform their own signal processing with more accuracy and fewer errors, yielding a better sound quality. It is crucial to understand that these 10 MHz clock signals are entirely independent from the audio clock (typically 44.1 kHz up to 192.0 kHz) of the playback! As a consequence, the unit's clock signal is not compatible with the common Word Clock audio clock that is also transmitted via 75 Ω BNC cables.

There are two possible routes to harness the superior clock precision of the REF10 NANO in your digital audio system:

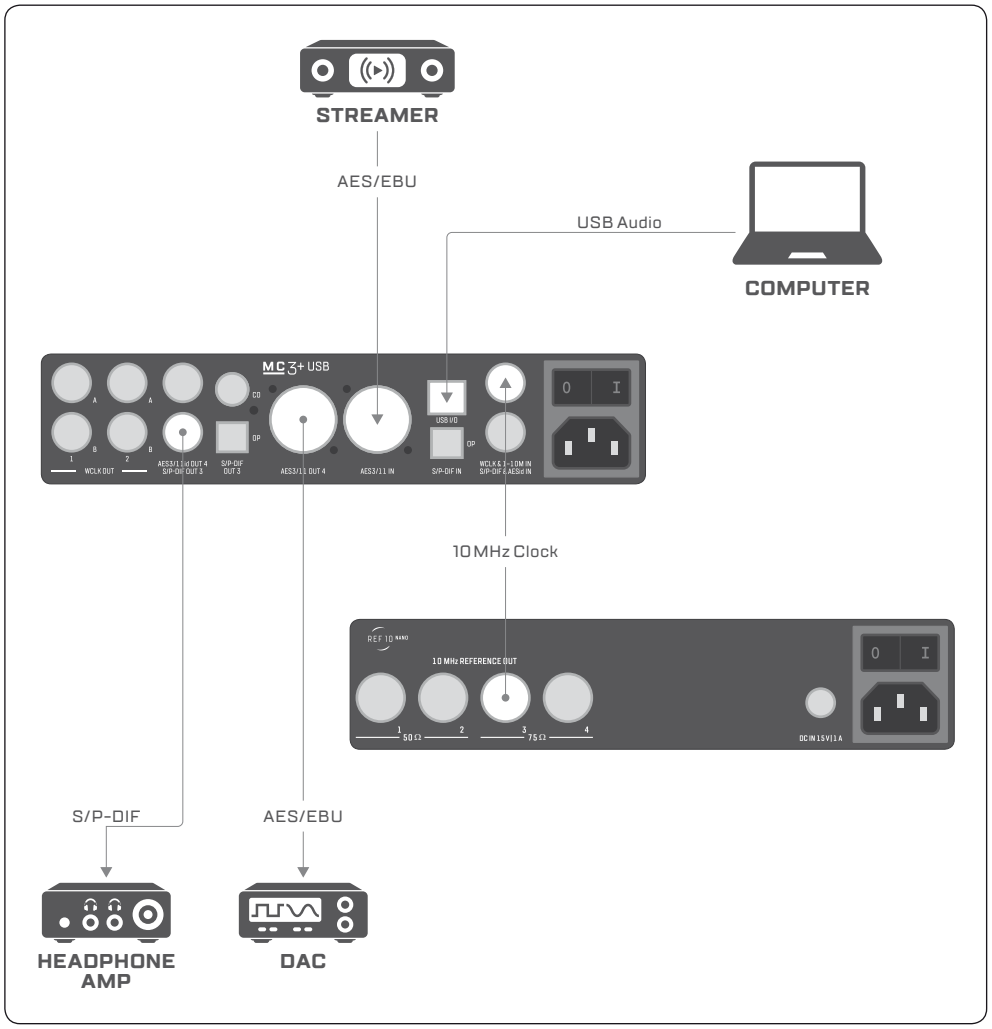
- You have a DAC, network bridge, streamer or audio re-clocker with its own 10 MHz compatible input.
- You have an audio master clock that can take the 10 MHz clock from the REF 10 NANO and convert it into a standard Word Clock audio clock to be distributed to other devices.

The simplest possible application for the REF 10 NANO would look like this:



Thanks to a total of four clock outputs on the REF10 NANO any 10 MHz compatible device in a setup can and should receive its own dedicated clock supply. We strongly advise against daisy-chaining multiple devices using so-called BNC tee adapters (more about this on page 9).

Particularly, the combination of the REF10 NANO with MUTEC's own MC3+ or MC3+ USB Smart Clocks offers exciting applications to achieve the best-possible quality enhancements by re-clocking digital music sources. To understand this scenario, please imagine the following setup as a starting point:

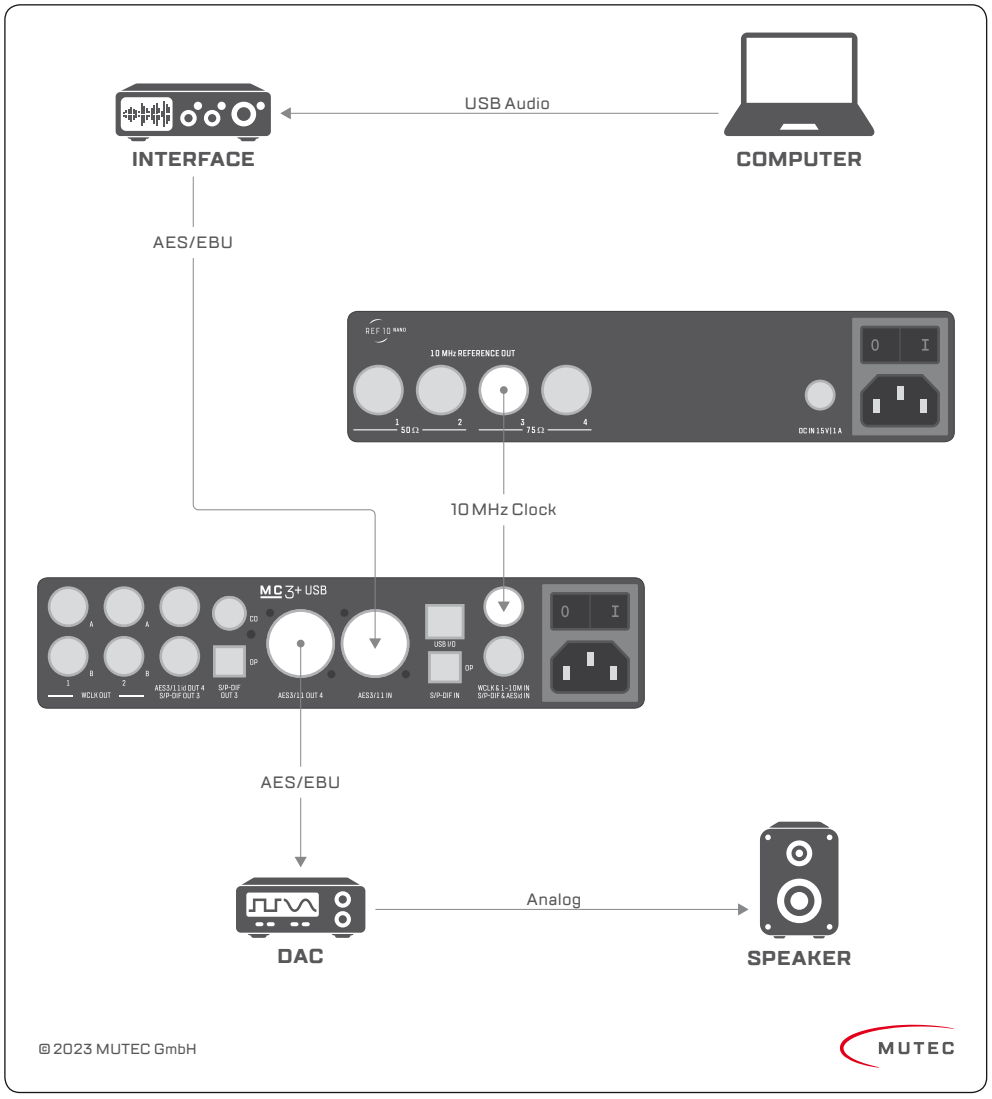


In this application example we have two digital sources that are used to play back music via AES/EBU and USB interfaces. The MUTEC MC3+ USB acts as audio re-clocker to enhance the audio signal and removes jitter before passing the audio into a DAC (D/A converter) and a digital headphone amplifier. This is a simple closed system in which the audio clock rate is determined by the music source. All other devices following in the chain (MC3+ USB, DAC, headphone amplifier) will adapt to the sampling rate set by the source.

Within this particular system the MC3+ USB acts as core part to improve the system's overall sound quality. It exclusively is connected to the REF 10 NANO to get its audio re-clocking performance enhanced even further.

Applications

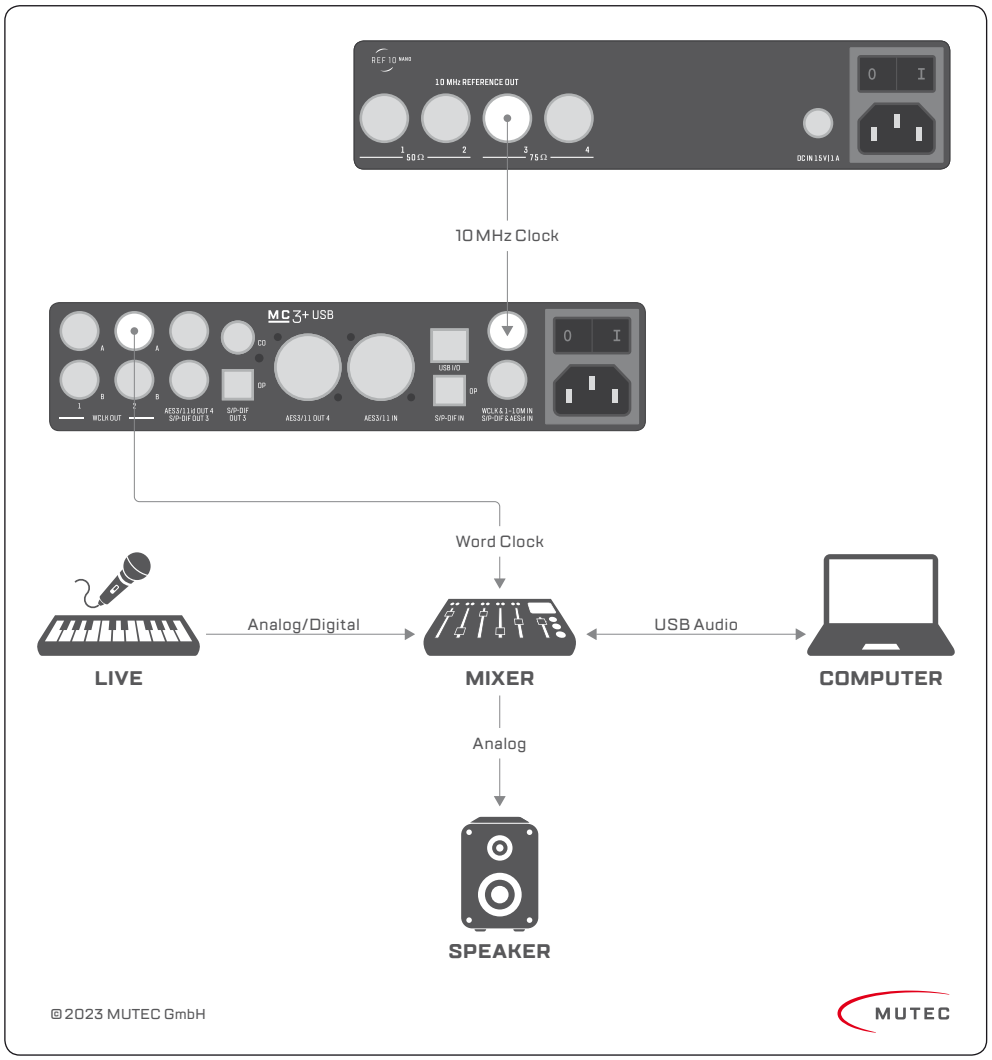
We now look to pro-audio applications using the REF10 NANO as central master clock device.



The combination of the REF10 NANO with MUTEC's own MC3+ or MC3+ USB Smart Clocks offers also within studio environments various possibilities of significant sound improvements for digital monitoring systems or the audio processing signal chain.

Within this application the REF10 NANO clocks the MC3+ USB to further improve the unit's noise performance. That enhances the audiophile re-clocking process of the source signal supplied by the computer through the audio interface. Thus, excellent monitoring quality for the sound engineer is achieved.

It is important to understand that the hierarchy with respect to the audio clock (i.e. the sampling rate) of the system remains unchanged. The 10 MHz signal from the REF10 NANO does not make changes to the audio clock of the system. The sampling rate of the system is still determined by the music source, which is important to know when playing back playlists with mixed sampling rates.



In that application example the REF10 NANO acts as master clock for the MC3+ USB. But this time not for improving the unit's audiophile re-clocking capabilities, but for enhancing its Word Clock generation in two ways:

- Lowering the jitter of the generated Word Clock signals
- Increasing the unit's clock accuracy

The MC3+ USB now works as Word Clock master clock for the audio mixer supplying a Word Clock signal not only of lowest jitter, but also with highest timing accuracy.

In this application, the audio clock rate is determined by the MC3+ USB, setting the master clock rate for the mixer, who then supplies the master clock for the whole music mix.

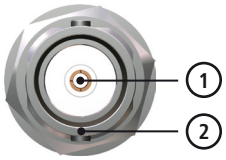
Appendix

Pin Assignment of the Terminals

Mains

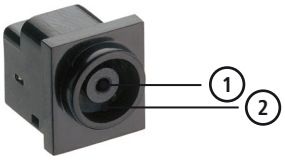
1) Neutral (N)
2) Protective Earth (E)
3) Live, Phase (P)

BNC Output 50/75 Ω



1) Signal
2) Ground

DC Voltage Input



1) Signal
2) Ground

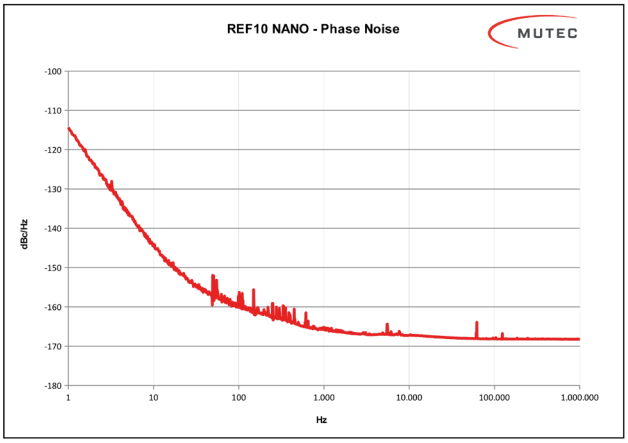
Technical Data

Clock Outputs:
- 2 x BNC, unbalanced, 50 Ω terminated, galvanically isolated, buffert
- 2 x BNC, unbalanced, 75 Ω terminated, galvanically isolated, buffert

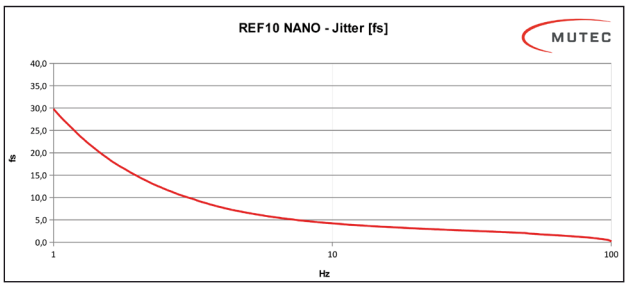
Clock Signal Format of all Outputs
- Square wave, 10.000 MHz, ≈2 Vpp, ≈1 V RMS, 50:50 duty cycle

Clock Generation:
- Type: 10.000 MHz low phase noise oven-controlled crystal oscillator
- Frequency accuracy when shipped: < ±0.01 ppm
- Frequency stability vs. temperature range: < ±0.01 ppm within -20 °C to +70 °C (-4 °F to +158 °F)
- Short term stability (Allan Deviation, typically Tau = 1s): 2×10^{-12}
- Aging after 30 days operation: : < +/-0.0002 ppm (per day), < +/-0.03 ppm (first year), < +/-0.2 ppm (ten years)
- Warm-up time at +25 °C (+77 °F): <5 min

Phase Noise measured at REF10 NANO's Clock Outputs (!):
- 1 Hz: ≤ -112 dB/c
- 10 Hz: ≤ -142 dB/c
- 100 Hz: ≤ -158 dB/c
- 1000 Hz: ≤ -164 dB/c
- Noise Floor: ≤ -167 dB/c



Jitter measured at REF10 NANO's Clock Outputs (!):
- 1-100 Hz: ≈30 fs



(Disclaimer: All measurement figures represent average values. Minor production related deviations will be expected.)

Mains Power Supply:
- Type: internal, self-switching power supply
- Input voltages: 85-305 V, 50-60 Hz
- Power consumption: 7 W during oscillator warm-up, 4 W nominal operation (all outputs terminated)

DC Voltage Supply:

- Input voltage: 15 V, +/-0.5 V
- Power consumption: 7 W during oscillator warm-up, 4 W nominal operation (all outputs terminated)

Mechanical Details:

- Enclosure size/material/color: 196 x 42 x 300 mm (W x H x D, without connectors and case feet), 1.0 mm steel, black powder-coated
- Front panel size/material/surface/color: 198 x 44 x 6 mm (W x H x D), aluminium, anodized incl. anodic printing or silk screening, color: silver or black
- Weight: approx: 2070 g (4.6 lb, 73 oz)

REF10 NANO Order Information:

- Silver Front: Item No. 8015-115, EAN Code: 4260342461242
- Black Front: Item No. 8015-116, EAN Code: 4260342461259