MUTEC

Manual
REF 10



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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.

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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 three (3) 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 extended 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 REF 10, an audiophile 10 MHz reference master clock generator.

The REF 10 is an audiophile reference master clock generating 10 MHz signals with industry-leading low phase noise (i.e. jitter) to significantly improve digital playback systems. As the conductor of your digital audio orchestra at home, the REF 10 will inspire you with unheard-of clarity, graceful dynamics, and pure music. It is also the most flexible, most compatible 10 MHz clock on the market allowing you to spend less time worrying about integration and leaving you with more hours to enjoy blissful playback.

In contrast to so-called "atomic clocks", clocks based on a rubidium or cesium normal, the REF 10 is engineered around MUTEC's handcrafted, oven-controlled oscillator (OCXO) made in Germany, featuring significantly higher clock stability in the time domain relevant for audiophile digital audio performance. Newly developed ultra-low noise clock distribution and amplification circuits based on sub-1 Hz optimized, lowest noise voltage sources transfer the reference signal to the REF 10's eight outputs with virtually no losses.

As a result and unlike any other currently available reference generator the REF 10 fulfills both of the critical requirements for an extraordinary audiophile reference master clock:

- Lowest possible phase noise for unmatched audio
- Highest clock precision for most accurate synchronization

Due to its revolutionary clock reference and its unrivaled flexibility the REF 10 can enhance the audio quality of compatible D/A converters (DACs), music servers, and re-clockers to the highest possible level. Unlock a more dynamic, more transparent sound stage with exceptional spatiality and level of detail, free from any digital blur. As the quasi conductor of your digital audio orchestra at home, we are sure the REF 10 will inspire you with unheard-of clarity, graceful dynamics, and pure music!

Features

- Audiophile 10 MHz reference generator with industry's lowest phase noise
- Improves and enhances compatible DACs, audio re-clockers, music servers, and master clocks
- Engineered around a handcrafted, ultra-low phase noise OCXO made in Germany
- Revolutionary, sub-Hz optimized, lowest noise power supply for every circuit section
- Generates a very high slew-rate square wave signal for superior lock precision compared to the sine wave signals used by competing brands
- Provides simultaneous reference outputs with 50 and 75 Ω impedance for maximum compatibility with clocks and DACs by other manufacturers
- Eight galvanically isolated, individually switchable BNC clock outputs
- Highly efficient power line filtering
- Integrated, highest-quality international linear power supply
- Intuitive user interface with noble aesthetics
- Rack-mountable with optional mounting brackets for studio use (2 RU)

Matching MUTEC Products

- MC-3+ Smart Clock
  The MC-3+ Smart Clock is an audio re-clocker and master clock that can enhance digital audio devices in two ways: by providing low-jitter clock signal for external synchronization and by aggressively re-clocking using MUTEC's REVIVE technology.
- MC-3+ Smart Clock USB
  As the successor of the MC-3+ Smart Clock , the MC-3+USB offers significantly improved audio performance and additionally acts as an isolating USB interface for audio computers and music servers.
- iClock & iClock dp
  iClock and iClock dp are both synchronizable, highest precision clock synthesizers with extremely low jitter for applications in audio/video production studios and broadcast.

Accessories

- MW-07/19: rack mount kit consisting of two mounting brackets for installing the REF 10 in 19" racks (item no. 8020-046).

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 three 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

pinterest.com/mutecpro

https://plus.google.com/
116705378800155548696

Installation

Shipping Contents

Your REF 10 was packaged carefully. Nevertheless we recommend checking the contents directly after opening the package:

1 x REF 10
1 x Power cable
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 2U (rack units). Therefore, we offer an optional rack mounting kit called MW-07/19. 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 rubber 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 commonly be found among units by Japanese 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 REF 10 provides clock outputs with both 50 and 75 Ω termination that can be used simultaneously.

Transferring clock signals with 50 Ω termination is typically done with coaxial cables according to the RG-58/U standard. However, we recommend using cables manufactured to the RG-400/U or CLF200/HDF200 standards, because they are double-shielded and offer reduced attenuation in contrast to the RG-58/U norm. Cables specified as CLF200/HDF200 further feature a stronger inner copper conductor.

For clock signals with 75 Ω termination it is common to use coaxial cables specified by the RG-59/U and RG-598/U standards. As an alternative, we recommend using cables manufactured to the RG-216/U standard, which are usually also double-shielded, feature reduced attenuation, and a stronger inner conductor.

A wide range of coaxial cables with BNC connectors and the appropriate termination by specialized manufacturers are available at Hi-Fi retailers. Depending on their price range they are manufactured using premium materials and will have superior transfer characteristics than the aforementioned standard cables.

All interfaces of the devices in a given setup need to be properly connected with each other. Always ensure that the clock output of the REF 10 are connected to an appropriate input of the receiving device. Make sure that 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 REF 10 to be connected to. A mismatched termination of the system will cause losses in signal quality and clock precision!

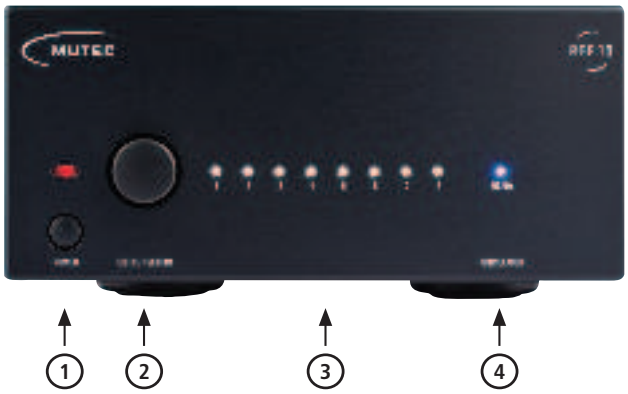
We further recommend keeping the cable lengths as short as possible to minimize signal losses and interference. Cables at 0.5 m, 1 m, or a maximum of 2 m length are ideal. The longer the cable needs to be, the higher the quality should be to avoid excessive losses!

Useage of so-called BNC tee adapters
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 REF 10 generates exceptionally 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 REF 10 provides a total of eight clock outputs we advise against daisy-chaining 10 MHz clock signals.

Any device that is supposed to be clocked by the REF 10 and benefit from its audiophile performance must be connected to a dedicated clock output!

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. Always ensure the appropriate choice of line voltage »115 V / 230 V«! Then, depress the front panel power switch and the red LED will light up.

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

3) »LEDs 1 – 8«
These eight white LEDs represent the eight 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) »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.

2) »75 Ω, Outputs 3 – 8«
These six clock outputs are equipped with a 75 Ω termination. Use only BNC cables with the appropriate 75 Ω impedance with these outputs.

3) »110/120 V & 220/240 V«
This is is the line voltage selector that also serves as the holder for the mains fuse.

Attention

It is imperative to make sure the proper line voltage has been selected prior to powering up the device for the first time!

Information on how to change the line voltage can be found in the chapter "Changing the line voltage" on page 15 in the appendix.

4) Mains Connector
Connect the supplied IEC power cable here. Make sure that the power switch is turned off before connecting the device to your power source.

5) Mains Power Switch
The mains power switch engages the power supply for the device. Do not turn the unit on before completing the wiring and installation, particularly with respect to the choice of line voltage according to you country's power grid. Please make sure to read the safety instructions at the beginning of this manual!

Operation

General System Operation

Operating the REF 10 is very straight-forward! Apart from the two power switches there is only a single push button rotary encoder (»OUTPUT SELECT«) used to individually turn the eight outputs on or off. Per factory default all outputs are active upon powering up the device for the first time, so all eight 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 REF 10 will be stored and preserved after the the device has been powered down.

Recommendations for the REF 10

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 REF 10.

- First customers have told us that for best sound performance of the connected devices it is useful to let the REF 10 burn-in for approx. 14 days. Thus, we recommend to leave your REF 10 switched on for that period of time.
- Prior to enjoying an in-depth listening session we recommend pre-heating the REF 10 for about 20-30 minutes. While the heater generally reaches its operating temperature in about one minute, the entire oscillator section takes longer to fully warm up. To ensure optimal performance and highest frequency stability, you should grant the REF 10 this additional warm-up time.
- Keeping the REF 10 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 REF 10 in short, repeated intervals!
- The REF 10 should always be placed away from mechanically vibrating devices (such as turn tables). Although the REF 10's case feet of the 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 REF 10 should furthermore not be placed in close proximity to devices emitting strong electromagnetic fields (such as fluorescent lamps). Even though the electronics of the REF 10 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 setup 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 REF 10's outputs. The use of so-called BNC terminators is not necessary to protect the outputs.

Applications

Using the REF 10 With Other Products

This chapter serves to illustrate several possible applications for the REF 10 and will help you achieve the best possible sonic results. In general, the REF 10 can be used for the following applications:

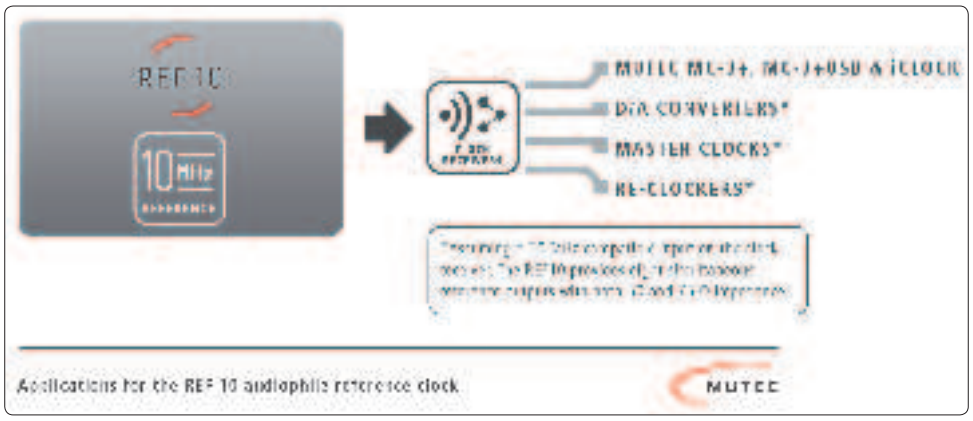
- As an audiophile performance enhancement for compatible DACs, master clocks, and audio re-clockers.
- As an ultra-low noise, high stability clock reference for the entire digital audio chain at home or in the studio.
- As an ideal high-end upgrade for MUTEC's own MC-3+, MC-3+USB, and iClock/iClock dp master clocks.
- To stabilize existing audio clock generators.

To explain these applications it is important to understand that the REF 10 is a reference master clock exclusively generating highest quality 10 MHz clock signals. Compatible devices can use this ultra 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 kHz) of the playback! As a consequence, the REF 10'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 REF 10 in your digital audio system:

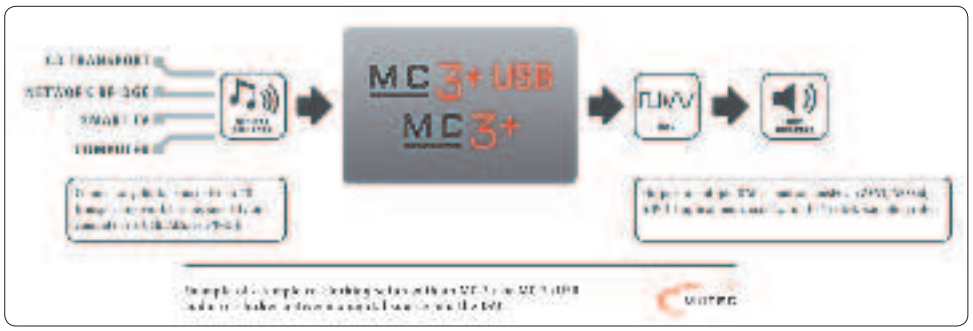
- You have a DAC, network bridge, streamer or audio re-clocker with its own 10 MHz compatible input.
- You have an audio master clock that can take the 10 MHz clock from the REF 10 and convert it into standard a Word Clock audio clock to be distributed to other devices.

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



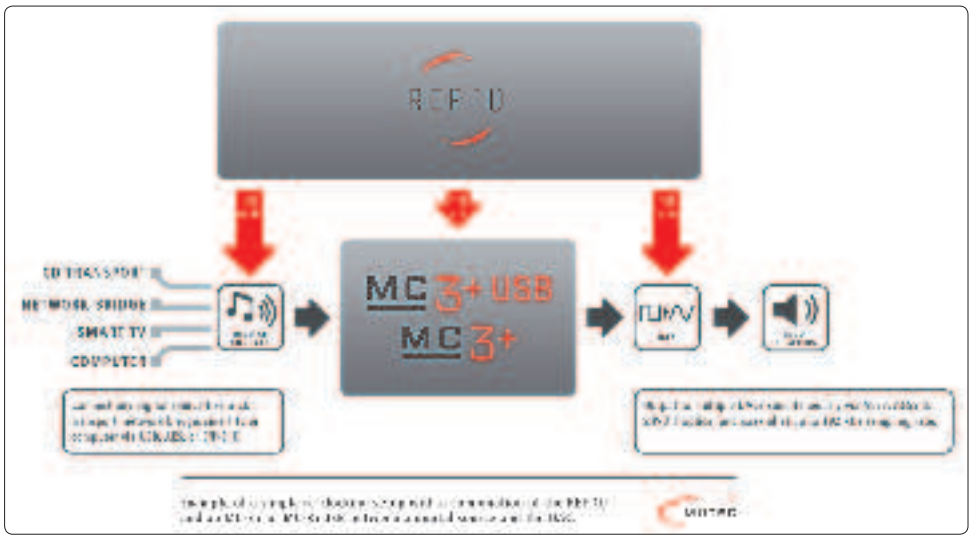
Thanks to a total of eight clock outputs on the REF 10 any 10 MHz compatible device in a setup can and should receive its own dedicated clock supply. We strongly advise against daisy-chaining multiple devices using so-called BNC tee adapters (more about this on page 9).

Particularly the combination of the REF 10 with MUTEC's own MC-3+ and MC-3+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 several digital sources on the left that are used to play back music via several digital interfaces (e.g. AES3, S/P-DIF or USB). The MUTEC MC-3+ or MC-3+USB act as audio re-clockers to enhance the music signal and remove jitter before passing the signal on to the DAC (d/a converter) and the loudspeakers. 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 (audio re-clocker and DAC) will adapt to the sampling rate set by the source.

This particular system can be enhanced by the REF 10 in up to three places, depending on how many of the digital devices offer a 10 MHz compatible input. In the best possible case, all of the digital sources (e.g. BlueRay player, streamer, network bridge), the audio re-clocker, and the DAC can receive their own 10 MHz clock supply from the REF 10.



It is helpful 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 REF 10 is strictly used to enhance the performance of the connected devices and 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.

Of course this application example is also conceivable without using an audio re-clocker between the digital sources and the DAC. In this case, the REF 10 can still yield a significant improvement in sound quality, as long as at least one of the other devices is equipped with a 10 MHz compatible clock input.

To help you getting started in the "10 MHz" universe we have put together a comprehensive list of currently available 10 MHz compatible devices.

10 MHz Compatible Products

Manufacturer	Product	Impedance (Ω)	Type
MUTEC	MC-3+ Smart Clock	75	Audio Re-Clocker, -Clock Generator
	MC-3+ Smart Clock USB	75	Audio Re-Clocker, -Clock Generator, USB Interface
	iClock, iClock dp	75	Audio/Video Clock Generator
Abendrot Audio	Hengst	50	DAC
Antelope Audio	Zodiac Platinum	75	DAC
	Rubicon	75	DAC
	LiveClock	75	Audio Clock Generator
	Isochrone OCX, OCX HD, OCX-V, Trinity	75	Audio/Video Clock Generator
	Pure 2	75	ADC/DAC
Audio Design	SyncroGenius HD-Pro	75	Audio/Video Clock Generator
Aurender	W20	n/a	Music Server
Brainstorm	DCD-12 (discontinued)	75	Audio/Video Clock Generator
	DCD-24	75	Audio/Video Clock Generator
	DXD-8	75	Audio/Video Clock Generator
	DXD-16	75	Audio/Video Clock Generator
CH Precision	C1	75	DAC
	D1	75	SACD Transport, DAC
dCS	Vivaldi Master Clock	75	Audio Clock Generator
	Paganini Master Clock, Scarlatti Master Clock (discontinued)	75	Audio Clock Generator
Esoteric	Grandioso G1	50	Audio Clock Generator
	Grandioso K1	50	SACD Player
	Grandioso P1/D1	50	SACD Transport, DAC
	K-01X, K-03X, K-05X, K-07X	75	SACD Player
	P-02X, P-05X	50	SACD Transport
	D-02X, D-05X	50	DAC
	N-05	75	Network Player
	G-01X, G-02X	50	Audio Clock Generator
Evertz	5601MSC	n/a	Audio/Video Clock Generator
M2TECH	EVO DAC TWO PLUS	75	DAC
	HIFACE EVO TWO	n/a	DAC
Phasetech/Phase-mation	HD-7A	50	DAC
RATOC	RAL-DSDHA2	50	DAC
Rostec	ASD16HD	75	Audio/Video Clock Generator
Sforzato	DSP-00EX	50	Network Player
	DSP-010EX, DSP-030EX	50	Network Player, DAC
	DSP-04EX	50	DAC
Soul Note	D-2	50	DAC
Sound Warrior	SWD-CL10	50/75	Audio Clock Generator

Disclaimer: Compatibility of the REF 10 with the above listed products is assumed based on the specifications published by the respective manufacturers and subject to change.

MUTEC is not liable for compatibility issues with third-party products operating outside of industry standards.

10 MHz Compatible Products

Manufacturer	Product	Impedance (Ω)	Type
SOtM	sMS-1000SQ (with sCLK-EX Expansion)	50/75	Musik Server
	sMS-200ultra (with sCLK-EX Expansion)	50/75	Network Player
	tX-USBultra (with sCLK-EX Expansion)	50/75	USB Regenerator
SPEC	RMP-X1	50	Network Player
Studio Technologies	M5401 Dante® Master Clock	75	Network Master Clock
Tascam	CG-1000, CG-1800, CG-2000	50/75	Audio/Video Clock Generator
Teac	UD-503, UD-505	50	DAC
Teac	NT-503, NT-505	50	Network Player, DAC
TechDAS	D-7, D-7i	50	DAC

Disclaimer: Compatibility of the REF 10 with the above listed products is assumed based on the specifications published by the respective manufacturers and subject to change. MUTEC is not liable for compatibility issues with third-party products operating outside of industry standards.

Appendix

Changing the Line Voltage



Triangles Fuse Holder

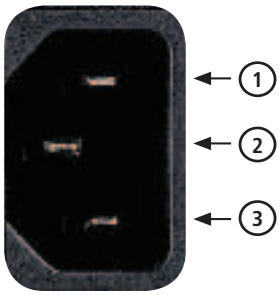
Always unplug the mains cable before changing the line voltage fuse!

On the left hand side of the mains power module on the rear you will see two small triangles facing each other (see left arrow in picture above). The respective line voltage »110-120 V« or »220-240 V« is printed above the right triangle. If this setting should not be appropriate for your power grid, the fuse holder (see right arrow in picture above) needs to be pulled out, rotated by 180° around its own axis, and be put back in place. You should then see that the triangle now indicates the correct line voltage. It is easiest to remove the fuse holder by inserting a small flat screwdriver in the groove on the right side of the fuse holder to pull it outwards.

Make sure that the fuse holder is properly seated in its housing with its top flush to the power!

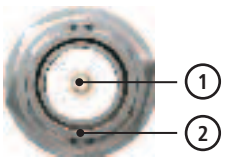
Pin Assignment of the Terminals

Mains In



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

BNC-Ausgang 50/75 Ω



1) Signal
2) Ground

Technical Data

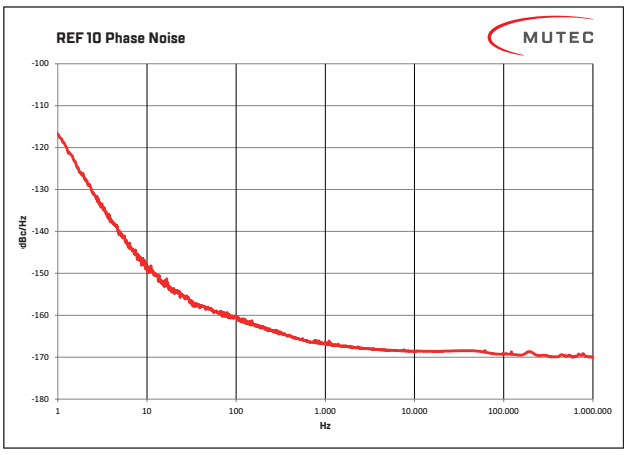
Interfaces:
- 2 x BNC, unbalanced, 50 Ω terminated, buffert
- 6 x BNC, unbalanced, 75 Ω terminated, buffert

Signal format of all clock outputs
- Square wave, 10.000 MHz, 2 Vpp, 50:50 duty cycle

Clock Generation:
- Type: 10.000 MHz ultra-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): 1×10^{-12} (typically, Tau = 1s)
- 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

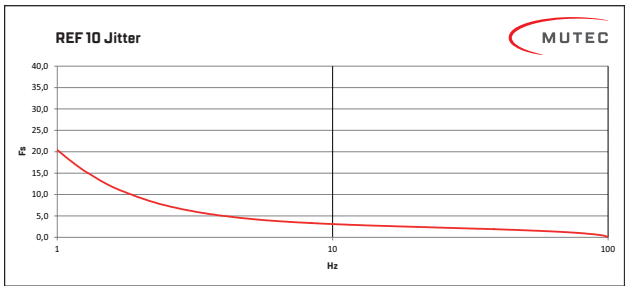
Phase noise, measured at REF 10's outputs (!):
- 1 Hz: ≤ -116 dB/c
- 10 Hz: ≤ -145 dB/c
- 100 Hz: ≤ -160 dB/c
- 1000 Hz: ≤ -166 dB/c
- Noise Floor: ≤ -170 dB/c

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



Jitter, measured at REF 10's outputs (!):

- 1-100 Hz: ≈ 22 fs



Power Supply:

- Type: internal, linear dual power supply
- Input voltages: 90-125 V / 200-240 V, 50-60 Hz
- Power consumption: 12 W during oscillator warm-up, 8 W nominal operation
- Fuse of power entry module: 2 x FST1,0B,1B, slow-blow, 250 V / 1 A, 20 x 5 mm

Mechanical Details:

- Enclosure size/material/color: 196 x 84 x 300 mm (W x H x D, without connectors and case feet), 1,5mm steel, black powder-coated
- Front panel size/material/surface/color: 198 x 88 x 8 mm (W x H x D), aluminium, anodized incl. anodic printing or silk screening, aluminium- or black-colored
- Weight: approx: 4350 g (9 lb, 9.5 oz)

REF 10 Order Information:

- Front Aluminum-colored: Item No. 8015-105, EAN Code: 4260342461044
- Front black-colored: Item No. 8015-106, EAN Code: 4260342461051