OPERATING MANUAL

MC-3+ smart clock

Synchronizable Digital Audio Sync Master Clock Generator

1G CLOCK

MUTEC

Professional A/V Technology
Germany

MUTEC part no. 8015-100

SAFETY INSTRUCTIONS

General instructions
To reduce the risk of fire or electrical shock, do not expose this appliance to rain or moisture, direct sunlight or excessive heat from sources such as radiators or spotlights. No user serviceable parts are inside. Repair and maintenance must be carried out by qualified personnel authorized by MUTEC GmbH! The unit has been 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 such heat sources as radiators or spotlights! The free flow of air inside and around the unit must always be ensured.

Initial operation
Prior to the initial operation of the unit, the appliance, 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 appliance may not be connected to the mains 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 claims for damage or replacement may not be granted.

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

This symbol, a flash of lightning inside a triangle, alerts you to the presence of uninsulated 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.

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 making 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 cord (see packaging) to connect the unit to the mains. Switch the unit off before you attempt to connect it to the mains. Connect the power cord to the unit, then to a standard 3-pin mains outlet. To draw 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-inlet 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!

Declaration of Conformity
We herewith confirm that the 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 clock outputs are connected with high-quality and good shielded BNC 75 ohms cable.

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 purchaser 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 bought 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 Waranty 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 from MUTEC GmbH will void the warranty. Adaptations and modifications to the device made with regard to national, technical, or safety regulations in a country or of the customer do not constitute a warranty claim and should be set with MUTEC GmbH in advance.

§5 Repairs
To obtain warranty service, the buyer must call or write to MUTEC GmbH before returning the unit. All inquiries must be accompanied by a description of the problem 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 fuer Systementwicklung und Komponentenvertrieb mbH
Siekeweg 6/8 • 12309 Berlin • Germany • Fon 030-746880-0 • Fax 030-746880-99 • Tecsupport@MUTEC-net.com • www.MUTEC-net.com

CONTENT

INTRODUCTION

CONTROL ELEMENTS AND TERMINALS

INSTALLATION

GENERAL OPERATION

OPERATING THE MC-3+

APPENDIX

INTRODUCTION

Thank you very much for purchasing the MC-3+ Smart Clock, Synchronizable Digital Audio Master Clock Generator, from MUTEC!

General Description

The new MUTEC MC-3+ Smart Clock is especially designed to improve the acoustical quality of digital audio devices in two ways: At first by clocking external devices with ultra-low jitter Word Clock signals and secondly by aggressively re-clocking incoming digital audio signals. Therefore, we have developed a totally new clocking technology, which we are calling the »MUTEC 1G-Clock«. That means in practice, we are running – for the first time in the audio industry – an audio clock synthesis process with a basis clock rate in the gigahertz area! Together with new ultra-low-noise power supplies and new PCB design rules aligned to high-speed communication technologies, the MUTEC 1G-Clock brings jitter and electrical noise down to unique low levels, which leads to unprecedented transparency in your audio recordings.

Also working as a clock distributor and unlike other products, the MC-3+ effectively regenerates incoming clock signals to higher purity as the signal source. Thus, the MC-3+ enables to improve already existing clock systems and helps to raise the standard of sound reproduction in every studio environment.

Additionally, the MC-3+ Smart Clock locks to so-called atomic clocks or GPS receivers to raise its timing accuracy to the highest possible level. For use during live events or in mobile trucks, the MC-3+ features an anytime fail-safe clock generation in every operation mode. Entering the hold-over mode and re-synchronization of returning clock references is carried out so smoothly that live recordings surely will not affected.

The new MUTEC MC-3+ Smart Clock and its unique 1G-Clock add with the most aggressive jitter reduction a significant improvement in sound to any studio set-up, while ensuring flawless synchronization of connected devices at any time!

Features

- **Incorporates MUTEC's unique 1G-Clock technology for lowest jitter possible**
- **Improves audiophile quality of any connected digital audio device**
- **Re-clocks digital audio most aggressively**
- **Offers unique asynchronous audio re-clocking**
- **Raises clearly audible the sound quality of any DA converter**
- **Eliminates digital "Clicks and Pops"**
- **Enhances existing master clocks**
- **Digitally-compensated clock accuracy for highest precision of the generated clocks**
- **Locks to 10MHz clock signals of so-called Atomic clocks or GPS receivers**
- **Outputs clock signals fail-safe in any state of operation**
- **Generates Word Clocks, Super Clocks, AES3 + S/P-DIF blanks simultaneously**
- **Converts between AES3 and S/P-DIF as well as between AES11 and Word Clock**
- **New-designed, simple user interface**
- **Front panel lock-out for preventing misuse**
- **Rack-space-saving 9.5" housing**
- **Built-in, internationally useable power supply**

Information Boxes

Boxes which contain a triangle with an exclamation mark inside should be read carefully! These include additional information which are of major importance for the functional descriptions in the text column.

Standard grey boxes contain supplementary informationen for the corresponding sections in the text columns. The content of the individual box refers to the description in the text column beside the box.

Register your MUTEC Product for Warranty and Support!

We ask you to be so kind to register your MUTEC product through our website immediately after purchasing. This ensures full warranty services over a period of two years after purchasing the product. Moreover, for all registered products we offer to our customers technical support. We also will inform you about product updates and new products which may of interest for you (on voluntary base, of course).

Please regsiter your product at:

www.MUTEC-net.com

> Service > Product Registration

Applications

- **Audiophile sound improvement of digital audio devices**
- **Elimination of »clicks and pops« in audio recordings**
- **Enhancing and stabilization of existing clock chains**
- **Stellate, ultra-low-jitter clock signal supply**
- **Addition of redundancy to clock chains in use**
- **Increase of clock signal reliability during live events**
- **Multiple clock rate synchronization**

Peripheral MUTEC Products

Signal Distribution Amplifiers:

- MC-2
  The MC-2 is a high-performance digital audio and reference sync signal distribution amplifier for AES3/11 and AES3/11id signals. The unit distributes and converts between the mentioned AES signals and interface standards.
- MC-7
  The MC-7 is a flexible, high-performance 8-channel Word Clock distribution amplifier and audio clock converter.

Format and Sampling Rate Converters with internal Master Clock:

- MC-4
  The MC-4 is a high-performance digital audio multichannel format and sampling rate converter for ADAT™, AES3 and S/P-DIF
- MC-6
  The MC-6 is a high-performance digital audio dual channel format converter for AES3, AES3id and S/P-DIF.
- MC-8 + MC-8.1
  The MC-8 and MC-8.1 are 8 channel, high-performance digital audio and sampling rate converters for AES3 and AES3id.

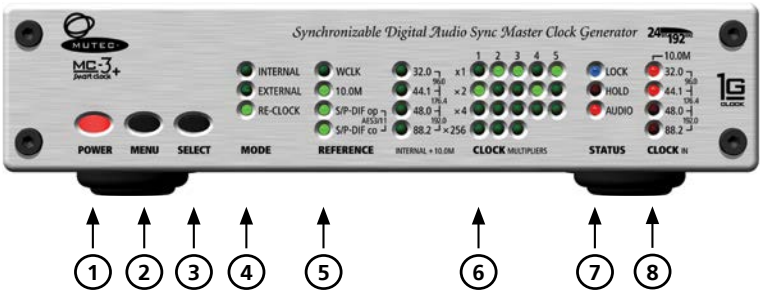
Accessories:

- Optical cables in different lenghts from 0.5 m to 20 m for S/P-DIF and ADAT™ transfers.
- MW-05/19
  Set of two rack mounting angles to install one MC product frontally into one unit of a 19" rack.
- MW-03/19
  Set of two rack mounting angles to install one MC product on the rear side of a 19" rack.
- MW-02/19
  Mounting plate to install two MC products side by side into one unit of a 19" rack.

For all peripheral products please have a look on our website:
www.MUTEC-NET.com

CONTROL ELEMENTS AND TERMINALS

MC-3+ SMART CLOCK Front Panel



1 »POWER«
This red LED lights up when the unit is switched on with the rear panel POWER switch.

2 »MENU«
Use this key to access the different functional menus.

3 »SELECT«
Use this key to select a function within a specific functional menu.

4 »MODE«
This function menu allows to select the clock references for internal and external synchronization as well as the reference for asynchronous digital audio re-clocking. All three LED rows act in functional dependence.

5 »REFERENCE INTERNAL + 10.0M«
This function menu allows to select the clock references for internal or external synchronization and the reference for synchronous and asynchronous digital audio re-clocking.

6 »CLOCK MULTIPLIERS«
This function menu lets you determine the factor by which the basis clock rate is multiplied additionally. Settings can be made individually for every pair of Word Clock outputs (»1-3«) as well as for the AES3 (»5«) and S/P-DIF (»4«) outputs.

7 »STATUS«
This menu indicates various signal status of the incoming reference clock or digital audio signal.

8 »CLOCK IN«
This menu indicates the clock rates of the incoming reference clock or digital audio signal.

Refer to the OPERATIONS chapter for more information.

MC-3+ Smart Clock Rear Panel

1 »WCLK OUT 1–3«
These 3 pairs of Word Clock outputs transfer all standard Word Clock rates and Word Clock x256 for older digidesign ProTools™ systems. Their numbering is aligned to the corresponding functional menus on the front panel. The individual BNC connectors are pairwise marked as »A« and »B«, which allows for, e.g. simple documentation of the connected devices. The impedances of all connectors are 75Ω (BNC connectors, female).

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

For a full list of all Word Clock, AES3 and S/P-DIF clock rates that can be generated, please refer to the »Generatable Word Clock Frequencies« and »Generatable AES3 and S/P-DIF Frequencies« sections in the APPENDIX chapter.

2 »S/P-DIF OUT 4«
These two S/P-DIF outputs, available as optical and coaxial interfaces, transmit an optical (»OP«) and unbalanced electrical (»CO«) S/P-DIF digital audio or blank frame signal in compliance with the IEC 60958 standard. The coaxial interface impedance is 75Ω. (RCA connector), the optical interface offers a Toshiba Toslink™ connector, EIAJ standard.

3 »AES3/11 OUT 5«
This AES/EBU output transmits a transformer-balanced electrical digital audio or blank-frame clock signal in compliance with AES3–1992 (R1997) or AES11–1997/2003. Its numbering is aligned to the corresponding functional menu on the front panel. The output impedance is 110Ω (XLR connector, male).

4 »AES3/11 IN«
This AES/EBU input can receive a balanced digital AES3 or AES11 signal in compliance with AES3–1992 (R1997) or AES11–1997/2003. The input impedance is 110Ω (XLR connector, female).

5 »S/P-DIF IN«
These two S/P-DIF inputs, available with optical (»OP«) and coaxial (»CO«) interfaces, can receive an optical and an unbalanced electrical S/P-DIF digital audio or blank frame signal in compliance with the IEC 60958 standard. The coaxial interface impedance is 75Ω. (RCA connector), the optical interface offers a Toshiba Toslink™ connector, EIAJ standard.

6 »WCLK + 10.0M IN«
This input can receive a Word Clock, a Word Clock x 256 as well as a 10.0MHz reference clock signal. The impedance of the connector is 75Ω (BNC connector, female).

7 »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 that 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!

INSTALLATION

Content of the Box

The unit was packed carefully. Nevertheless we recommend to check the content directly after opening the package:

1 x MC-3+ Smart Clock
1 x Power cable
1 x Manual

The condition of the packaging material and the device should be checked carefully additionally. If there are any damages please refer to SAFETY INSTRUCTIONS and WARRANTY REGULATIONS.

Placing the Device

The unit should be set up as closely as possible to the devices to which it will be connected with to avoid excessive cable lengths. The four custom-designed case feets include a rubber ring to protect the ground's surface from being damaged.

The device can be mounted into a standard 19" rack and will require one unit. Therefore, we offer an optional rack mounting kit, called MW-05/19. This includes two rack angles which need to be screwed at each side of the device's case. Before mounting the device into a 19" rack, please unscrew the four rubber feets with a suitable screwer. Install the device so that one unit of rack space is left free both above and below the device to allow for sufficient ventilation! Additional slide-in rails on the rack inside are recommended for safe installation. This will also avoid long-term mechanical deformation of the housing.

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 environment of the device must be ensured!

Wiring the AES/EBU and S/P-DIF Interfaces

AES/EBU
Connect the AES/EBU interfaces with the help of balanced electrical cables equipped with XLR connectors on both ends. The specifications stipulate a specific cable impedance of 110Ω (ask your retailer for a confirmation of this value when purchasing the cables).

S/P-DIF
Connect the coaxial S/P-DIF interfaces with help of unbalanced electrical cables equipped with RCA connectors on both ends. The specifications stipulate a specific cable impedance of 75Ω. Ask your retailer for a confirmation of this value when purchasing the cables.

Connect the optical S/P-DIF interface with the help of Toshiba TOSLINK™ compliant optical fiber cables. Here, you can use both plastic and glass fiber-based cables. When using plastic fiber cables, lengths of 10 meters should not be exceeded, so as to ensure the reliable transmission of signals. Glass fiber cables can transfer data reliably even over greater distances.

MUTEC offers optical cables of various lengths that have been specifically tested for the transmission of ADAT™ and S/P-DIF signals. Ask your local dealer for such cables!

Cables for High Sampling Rates

When working with high sampling rates for AES3/-11 or S/P-DIF, well shielded electrical cables are imperative to avoid increased radiation! Standard cables are normally useable for sampling rates up to 50.0kHz. Special shielded cables should be used for transfer of higher sampling rates.

Wiring the Word Clock Interfaces

To allow for the synchronization of signals, the interfaces of all devices involved must be properly connected to each other, so as to ensure a logical signal flow. Always be sure to connect the Word Clock output(s) to the corresponding input(s) of the device(s) you wish to synchronize. Cable lengths should be kept as short as possible to minimize signal losses and/or interferences!

For the transmission of Word Clock signals, unsymmetrical cables with a impedance of 75Ω and BNC connectors on both ends are used. Typically, such cables are marked with »RG-59U, RG59B/U«.

Additionally, make sure that the Word Clock input(s) has/have got a 75Ω terminating resistor! Most Word Clock inputs allow for enabling/disabling the termination with a so-called »termination-switch«, which may be located on the outside or inside of the device.

For devices which have no termination of the Word Clock input, e.g. RME Hammerfall with Word Clock i/o, Alesis BRC or M-Audio ProFire Light

Cables for Word Clock

If a cable with a different impedance than 75Ω is used, a dramatic deterioration of the signal quality is the result! In this case, the sound quality and synchronization of all devices involved can be impaired.

It is imperative that the lengths of all cables connected are largely the same, as this is the only way to ensure that all devices will be synchronized in phase (exception: cable tolerances).

We recommend using high-grade cables with a good shielding. A length of max. 10 meters (approx. 30 feets) should not be exceeded!

bridge, you can use an additional BNC-T piece to terminate the input. Plug the T piece with its center connector into the input of the receiving device. Then, connect the cable coming from the Word Clock output to one of the lateral connectors, and the other connector of the BNC-T piece to a 75Ω resistor forming the BNC termination.

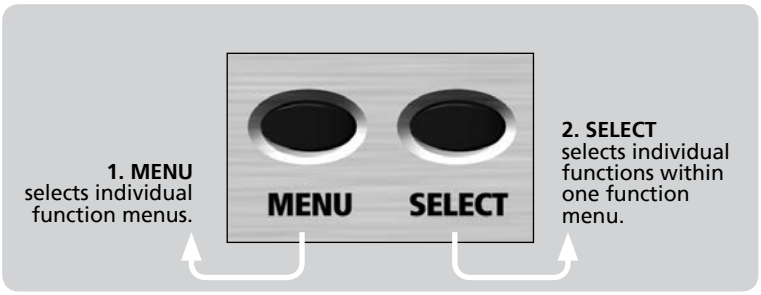
Basically, you should avoid »looping through« Word Clock leads by means of passive BNC-T pieces to preserve the signal quality, as level drops will be the result. If there is no other way to wire your set-up, please make sure that all Word Clock inputs (except for the last device in the chain) have their terminations disabled! In a serial Word Clock chain only the last clock input should have a termination! Never connect more than three devices in series to one output!

GENERAL OPERATION

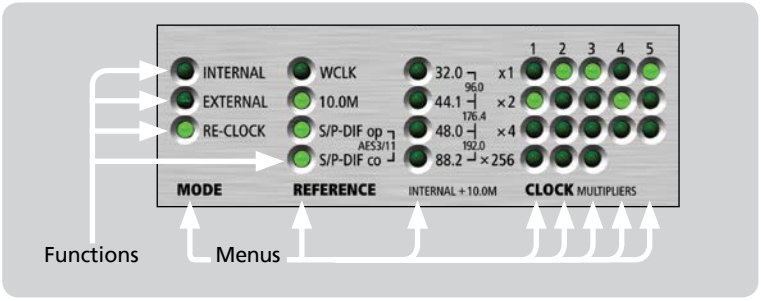
Selecting Function Menus and setting Functions

Operating the MC-3+ SMART CLOCK is very easy! The device is fully operated using the two keys at the front panel.

1 Pressing the »MENU« key toggles between different basic function menus.
2 Pressing the »SELECT« key activates individual functions within one function menu.



MENU + SELECT operation



Function Menus + Functions

Steps of Operation

1 The first press on »MENU« or »SELECT« key enables the last selected function within the last selected function menu. The corresponding LED starts flashing.
2 Every press on »SELECT« button will select a new function within a menu. The LED of the selected function flashes accordingly. After the LED stops flashing, the function is activated.
3 When the needed function is selected, do not press the switches again! After a period of approx. 4 seconds the LED of the selected function stops flashing.

The »STATUS« area is not accessible by using the »MENU« and »SELECT« keys, it only shows different operating conditions of the device.

Safety Instructions

For safety reasons, be sure to read the SAFETY INSTRUCTIONS and INSTALLATION chapters before first powering-up!
We also recommend reading the CONTROL ELEMENTS AND TERMINALS chapter for information on how to connect MC-3+!

OPERATING THE MC-3+ Smart Clock

Shut-Down of Outputs

All digital audio outputs are shut-down during function selection! After a function is finally selected and the corresponding LED lights constantly again, the digital audio outputs are activated for signal transfer.

User Settings Remain

All user-specific function settings are available furthermore when power is restored.

Main Function Menus

These three main function menus offer access to the whole functionality of your MC-3+ Smart Clock.

The »MODE« menu allows to select for the general operation mode of the MC-3+. It has to be selected first. The factory default is set to »INTERNAL«.

The »REFERENCE« menu including the sub menu »INTERNAL + 10.0M« allow to select all external acceptable references, the references for synchronous and asynchronous audio re-clocking as well as the internal clock generator. The factory default is set to »INTERNAL« with 44.1kHz.

Within the »CLOCK MULTIPLIERS« menu you can select additional multipliers, individually for each pair of Word Clock and the digital audio outputs. Their numberings are assigned to the output numbers on the rear. Select the prefered output with the »MENU« key and the needed multiply factor by pressing the »SELECT« key accordingly. The factory default is set to x 1.

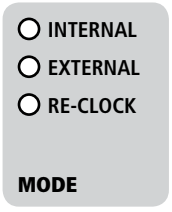
The menus »STATUS« and »CLOCK IN« are for control of the MC-3+'s operation status only. They are not accessable for adjustments.

General Operation Procedure

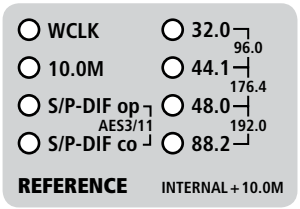
The menu of your MC-3+ is strictly organized aligned to general handling procedures when inserting the MC-3+ into your studio set-up. Thus, you can split up all of the necessary adjustments in three steps only, which leads to the following three questions for the basic operation of your MC-3+:

1) Which operation mode is basically needed? → MODE

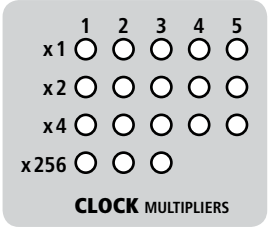
Should my MC-3+ work as clock generator (»INTERNAL«), as clock distributor (»EXTERNAL«) or as audio signal re-clocker (»RE-CLOCK«)?



2) Which reference do I need for my clocking application? → REFERENCE



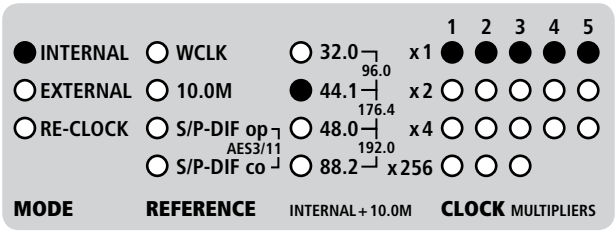
3) Do I need different clock rates at the same time? → CLOCK MULTIPLIERS



After these general decisions are made, your MC-3+ is configured for optimal operation in your set-up. Due to the fact that the system monitors for useful function combinations, maloperation is not possible.

So, let's have a look to the individual functions on the next pages.

Selecting Modes



This setting example shows the MC-3+ locked to its internal ultra-low-jitter clock base generating output clocks of 44.1kHz at any available output. This is the factory default setting.

There are three basic operation modes of your MC-3+ Smart Clock:

»INTERNAL«
The MC-3+ runs as a clock generator and is locked to its internal ultra-low-jitter master clock. The basis clock rate for all outputs is selected in the »REFERENCE« menu under »INTERNAL + 10.0M« (see next page).

»EXTERNAL«
The MC-3+ is locked to an externally applied reference signal, which can be a Word Clock, a 10.0MHz reference from a so-called atomic clock or GPS receiver and an AES3/11 or S/P-DIF digital audio signal, selected in the »REFERENCE« menu.

»RE-CLOCK«
The MC-3+ allows to receive digital audio signals of the AES3 or S/P-DIF format (selected in the »REFERENCE« menu) especially for re-clocking to improve their acoustical quality.

With selection of the »RE-CLOCK« mode, the first available digital audio input »S/P-DIF op« is selected under »REFERENCE« automatically as default. Press the »MENU« key for once and you enter the »REFERENCE« menu. Here press repeatedly the »SELECT« key to select the desired digital audio input.

You have three re-clocking options per selected audio input which support two different types of audio re-clocking:

Synchronous Re-Clocking of Digital Audio Signals

Selecting one of the three available digital audio inputs only, re-clocks the incoming audio signal with a phase-synchroniszed, new generated ultra low-jitter clock signal, embedded in the outgoing audio signal at the incoming audio signal's sampling rate.

Asynchronous Re-Clocking of Digital Audio Signals

This is a very special function only available in the MC-3+ Smart Clock! When selecting one of the digital audio inputs, you will notice that for each input you have two additional options when pressing the »SELECT« key furthermore:

Selected Audio Input + WCLK
Selected Audio Input + 10.0M

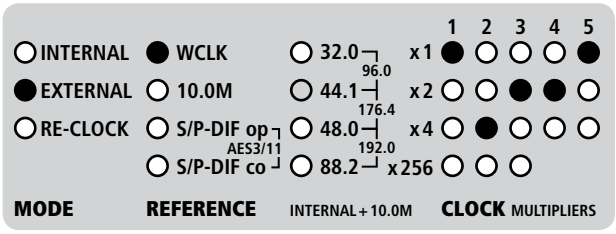
Selecting one of these re-clocking options enables you to re-clock your digital audio signal with an additional clock reference of a different master clock device. E.g., when selecting your desired audio input + »WCLK«, you must feed in at the Word Clock input an addiitional Word Clock reference signal with a clock rate between 32.0kHz and 192.0kHz. When selecting your desired audio input + »10.0M«, the Word Clock input accepts a 10.0MHz reference signal from e.g. a so-called Atomic Clock or GPS receiver. In both ways, the outgoing digital audio and Word Clock signals have got the same basis clock rate like the incoming digital audio signal, but phase-aligned (not phase-synchronized, of course!) to the additionally applied external reference clock.

In the »CLOCK IN» menu the clock rate of the incoming digital audio signal is displayed and with help of the »CLOCK MULTIPLIERS« menu the Word Clock output signals can be multiplied as described in the »Selecting Clock Multipliers« section.

Digital Audio Format Conversion

When running the MC-3+ in the »Re-CLOCK« mode and applying a digital audio signal of the AES3 or S/P-DIF format as reference, all digital audio outputs will transmit the sourse signal. The signals at the outputs which are not of same format as the reference signal will be format converted in realtime aligned to the AES3–1992/2003 and IEC60958 digital audio format standards. Thus, your MC-3+ Smart Clock works also as digital audio format converter for you!

Selecting References



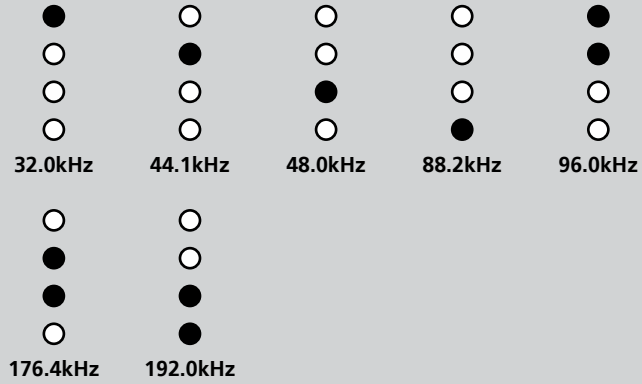
Selection of references is mainly used when the MC-3+ is set under »MODE« to »EXTERNAL« or »RE-CLOCK«

The above setting example shows the MC-3+ locked to an external Word Clock signal. Its clock rate is then displayed in the »CLOCK IN« menu on the right hand side of the front panel. Within the »REFERENCE« menu you can select the other available inputs by presssing the »SELECT« key repeatedly. The example shows furthermore, that in the »CLOCK MULTIPLIERS« menu multiplication factors are set for the indivdual outputs as follows:

Word Clock output pair 1: Reference clock x 1
Word Clock output pair 2: Reference clock x 4
Word Clock output pair 3: Reference clock x 2
S/P-DIF output 4: Reference clock x 2
AES3/11 output 5: Reference clock x 1

When working in the »INTERNAL« mode, only the LED bar marked with »INTERNAL + 10.0M« is available for selecting the basis clock rate of all outputs. There are seven different basis clocks adjustable by pressing the »SELECT« key repeatedly. The LEDs display the selected clock rate as follows:

Supported Clock Rates for »INTERNAL + 10.0M«



Selecting 10.0M as Clock Reference

When stepping through the »REFERENCE« menu and selecting »10.0M« as reference, simultaneously the first LED of the »INTERNAL + 10.0M« sub menu starts lighting and you can select with the »SELECT« key one of the seven clock rates provided by the internal ultra-low-jitter clock generator. The outgoing clock signals are now of the selected clock rate, but phase-aligned to the externally applied 10.0MHz reference signal. Also in that mode, clock multipliers can be adjusted freely, as mentioned in the »Selecting Clock Multipliers« section.

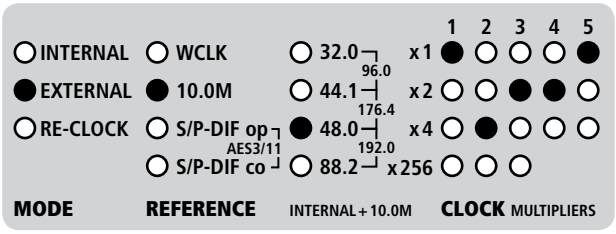
See further setting examples on next page.

Audio to Blank Frame Conversion

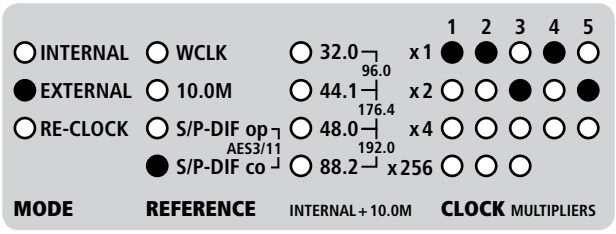
Running the MC-3+ in the »EXTERNAL« mode and applying a digital audio signal of the AES3 or S/P-DIF format as reference causes a conversion of the audio signal into a blank frame signal available at the digital audio outputs. Only when running the MC-3+ in the »RE-CLOCK« mode, the audio outputs will transmit the incoming audio signal in its original format, but re-clocked, of course.

In both operation modes, the Word Clock outputs transmit phase-aligned and de-jittered clock signals.

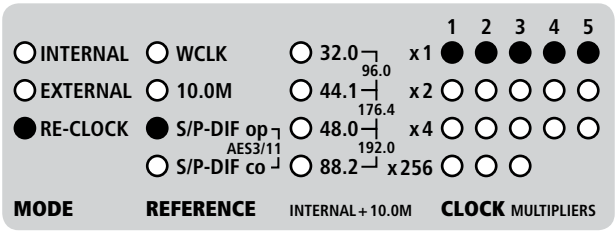
Further Setting Examples



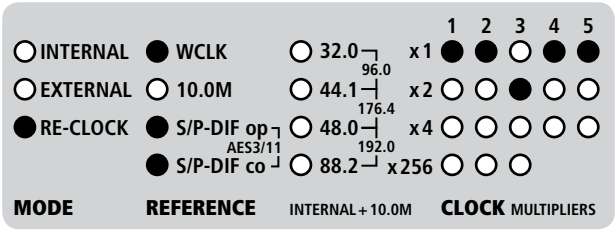
A 10.0MHz clock signal is applied as reference and the basis clock of all outputs is set to 48.0kHz. The outputs provide different multiples of the basis clock rate due to the adjustments of the clock multipliers. All four red LEDs in the »CLOCK IN« area light to show that a 10.0MHz reference comes in.



A coaxial S/P-DIF digital audio signal is applied as reference. All outputs provide their clock rates aligned to the selected multiplication factors. The S/P-DIF (»4«) and AES3/11 (»5«) outputs supply blank frame signals.



An optical S/P-DIF digitalaudio signal is synchronous re-clocked. All outputs provide their signals on the same clock rate like this one of the incoming optical S/P-DIF digital audio signal.



An AES3 signal is asynchronous re-clocked with an additional Word Clock signal. All outputs provide their signals with same clock rate like this one of the incoming AES3 digital audio signal, except the Word Clock output 3 is set to output the double clock rate of the reference signal.

Selecting Clock Multipliers

Pressing the »MENU« key changes from the »REFERENCE» to the »CLOCK MULTIPLIERS« menu. Here you can select for every pair of Word Clock and the digital audio outputs individual clock rate multiplication factors of x1, x2, x4 and x256 by pressing the »SELECT« key repeatedly. The multiplication factors refer always to the basis clock rate of the incoming reference signal or the clock rate selected of the internal ultra-low-jitter clock generator (»INTERNAL + 10.0M«). Thus, dependently of the incoming or selected basis clock rate, the MC-3+ covers a range auf audio related clock rates from 32.0kHz up to 768.0kHz plus the two so-called Super Clocks (see below).

The setting »x256«, or so-called Super Clock, is only available for the three pairs of Word Clock outputs. It transmits either a clock rate of 11,289.6MHz (44.1kHz x 256) or 12,288.0MHz (48.0kHz x 256). The system analysis in any way the basis clock rate of the incoming or the generated reference clock signal, 44.1kHz or 48.0kHz, and outputs the corresponding Word Clock x256 for use with older digidesign ProTools™ systems.

The multiplication of the digital audio outputs S/P-DIF (»4«) and AES3/11 (»5«) is limited to a maximum clock rate of 192.0kHz, regardless of the clock rate of the reference signal.

Multiplying Digital Audio Signals

When having a digital audio input selected as reference and setting the multiplication factor to higher than »x1«, the MC-3+ outputs a blank frame signal only at the audio outputs. A sampling rate conversion of the incoming digital audio signal is not carried out.

Status Information

»STATUS« Area
This area displays different system conditions of your MC-3+. There is no access for changing settings.

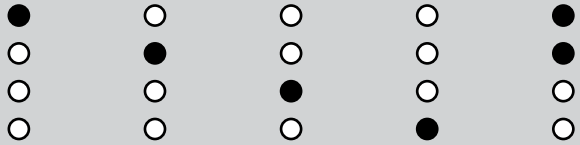
»LOCK«
This blue LED lights when the internal PLL circuit has detected the incoming clock reference signal as valid. If the reference signal is unstable or lost, the »LOCK« LED does not light.

»HOLD«
This red LED lights when the external reference clock signal is interrupted or lost. The frequency synthesizer of the MC-3+ keeps generating all output signals continuously, based on the last incoming clock rate. Thus, your studio set-up receives non-interrupted clock supply, regardless if a valid external referecne signal is present, unstable or lost. Re-synchronization is carried out without affecting any of the outputs signals critically.

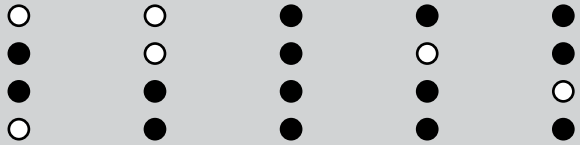
»AUDIO«
This red LED lights when a valid AES3/11 or S/P-DIF optical or coaxial digital audio reference signal is detected at the corresponding input.

»CLOCK IN« Area
This area displays the clock rate of the incoming clock or digital audio reference signal. The following basis reference clock rates are supported and will be analyzed:

Supported Input Clock Rates



32.0kHz	44.1kHz	48.0kHz	88.2kHz	96.0kHz



176.4kHz	192.0kHz	10.0MHz	11,289.6MHz	12,288.0MHz

Generic Functions

There are two additional functions which influence the working of your whole MC-3+ Smart Clock:

Front Panel lock out + LED shut down

When pressing both front panel keys together at one time, all LEDs will shut down except the »POWER« and »LOCK« LEDs. Additionally, the functions of both keys are also blocked to prevent unauthorized operation, which is important during e.g. live events.

To reactivate the keys and the LEDs, please press both keys for apperox. four seconds until all LEDs light again.

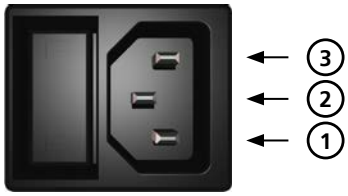
Factory Reset

You can reset the operating system of your MC-3+ Smart Clock to the initial status by switching on the unit while pressing the »MENU« key simultaneously.

APPENDIX

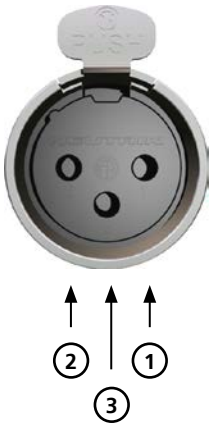
Pin Assignment of the Connectors

Mains



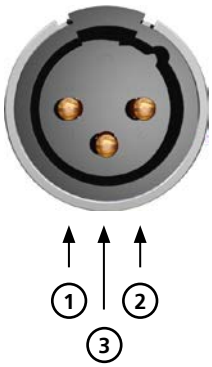
1 Live, phase (brown; USA: black)
2 Protective earth (green/yellow; USA: green)
3 Neutral (blue; USA: white)

AES/EBU, XLR, Input



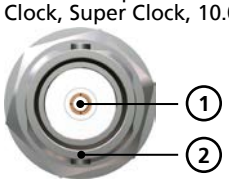
1 Audio ground
2 a conductor (hot / +)
3 b conductor (cold / -)

AES/EBU, XLR, Output



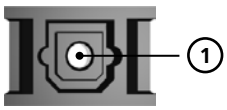
1 Ground
2 a conductor (hot / +)
3 b conductor (cold / -)

BNC In-/Output for Word Clock, Super Clock, 10.0MHz



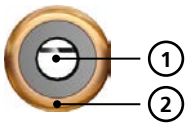
1 Signal
2 Ground

S/P-DIF, Optical, Input/Output TOSLINK Standard



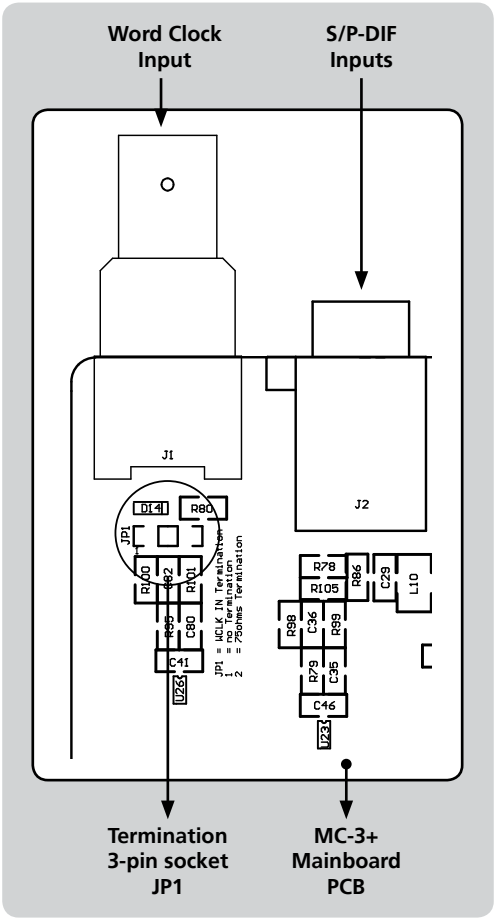
1 Optical signal

S/P-DIF, Coaxial, Input/Output



1 Audio signal
2 Audio ground

NOTE:
The coaxial S/P-DIF inputs and outputs are not galvanically isolated, due to IEC60958.

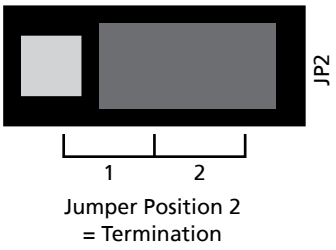


Word Clock Termination

Switching-off the Termination of the Word Clock Input

CAUTION! Disconnect the unit from the mains before opening! Remount the aluminium cover thoroughly before you attempt to operate the unit!

When the MC-3+ Smart Clock is shipped, the BNC-based Word Clock input connector is terminated internally with 75Ω. Therefore, one jumper is put on two pins - Position 2 - of the 3-pin socket JP1.

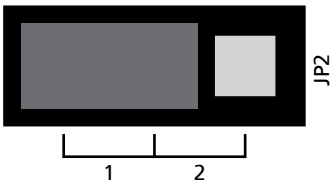


Jumper Position 2
= Termination

Jumper:

Free Pin:

When moving the jumper from position 2 to position 1, the input termination will be switched-off. Therefore, the MC-3+ must be connected in a chain, in which a device with terminated input follows. Otherwise you need to use a BNC-T piece in combination with a 75Ω BNC resistor for terminating the MC-3+'s input.



Jumper Position 1
= no Terminaltion

For additional information regarding this issue, please refer to page 11 under »Wiring the Word Clock Interfaces«.

Technical Data

WORD CLOCK + 10.0M INPUT	
Interface	1 x BNC, 200 mV-7 V, unbalanced, input impedance 75Ω (can be switched off, see above)
Lock Range	25.0kHz to 200.0 kHz, 10.0MHz, 11.2896MHz + 12.288MHz (so-called Super Clocks)
AES3 AUDIO INPUT	
Interface	1 x XLR female, transformer balanced, input impedance 110Ω, 200 mV – 7.0 V
Format, Resolution	AES3 – 1992/2003, AES11 – 1997/2003, IEC 60958, 16 – 24 bits
Lock Range	25.0kHz to 200.0kHz
S/P-DIF OPTICAL AUDIO INPUT (OP)	
Interface	1 x Toslink™, EIAJ RC-5720
Format, Resolution	IEC 60958, 16 – 24 bits
Supported Sampling Rates	25.0kHz to 200.0kHz
S/P-DIF COAXIAL AUDIO INPUT (CO)	
Interface	1 x Coaxial (RCA female), unbalanced, 0.5 – 1.0Vpp @ 75Ω, output impedance 75Ω
Format, Resolution	IEC 60958, 16 – 24 bits
Supported Sampling Rates	25.0kHz to 200.0kHz
WORD CLOCK OUTPUTS (WCLK)	
Interface	1 x BNC, 3,0 V @ 22Ω, unbalanced, buffered
Transmitted Clock Rates	25.0kHz to 768.0kHz, 11.2896MHz + 12.288MHz (so-called Super Clocks)

AES3 AUDIO OUTPUT	
Interface	1 x XLR male, transformer balanced, 3.5Vpp @ 110Ω, output impedance 110Ω, buffered
Format, Resolution	AES3–1992/2003, AES11–1997/2003, 24 bits
Transmitted Clock Rates	25.0kHz to 200.0kHz
S/P-DIF OPTICAL OUTPUT (OP)	
Interface	1 x Toshiba Toslink™, EIAJ RC-5720
Format, Resolution	IEC 60958, 24 bits
Transmitted Clock Rates	25.0kHz to 200.0kHz
S/P-DIF COAXIAL OUTPUT (CO)	
Interface	1 x Coaxial (RCA female), unbalanced, 0.5Vpp @ 75Ω, output impedance 75Ω
Format, Resolution	IEC 60958, 24 bits
Transmitted Clock Rates	25.0kHz to 200.0 kHz
SIGNAL PROCESSING	
Digital Audio Format and Clock Signal Conversion	AES3 + AES11 + S/P-DIF (optical + coaxial) conversion in every combination and direction Word Clock + AES11 conversion in every combination and direction 10.0MHz to Word Clock and AES11 conversion
FREQUENCY SYNTHESIS + REFERENCE CLOCK SPECIFICATIONS	
Frequency Synthesis	MUTEC's propritary 1G-Clock technology based on highest clocked DDS process
Oscillator Type	XO, digitally-compensated crystal oscillator
Clock Accuracy (shipped)	<±0.1ppm
Clock Jitter	<1ps (RMS)
Operating Temperature	0°C to +50°C
POWER SUPPLY	
Type	Internal, switching power supply
Input Voltage	85V–264V (automatic adjustment), 47Hz–440Hz
Power Consumption	max. 10W
SYSTEM UNIT COVER	
Cover Size/Material/Color	196 x 42 x 156mm without connectors (W x H x D), aluminium sheet 1mm, black
Front Panel Size/Material	198 x 44 x 2mm (W x H x D), aluminium
Weight	~1260g

Generatable Word Clock (WCLK) Frequencies

WCLK BASIS	x 1	x 2	x 4	x 256
32.0kHz	32.0kHz	64.0kHz	128.0kHz	–
44.1kHz	44.1kHz	88.2kHz	176.4kHz	11.2896MHz
48.0kHz	48.0kHz	96.0kHz	192.0kHz	12.2880MHz
88.2kHz	88.2kHz	176.4kHz	352.8kHz	–
96.0kHz	96.0kHz	192.0kHz	384.0kHz	–
176.4kHz	176.4kHz	352.8kHz	705.6kHz	–
192.0kHz	192.0kHz	384.0kHz	768.0kHz	–

Generatable AES/EBU and S/PDIF Frequencies

WCLK BASIS	x 1	x 2	x 4
32.0kHz	32.0kHz	64.0kHz	128.0kHz
44.1kHz	44.1kHz	88.2kHz	176.4kHz
48.0kHz	48.0kHz	96.0kHz	192.0kHz
88.2kHz	88.2kHz	176.4kHz	176.4kHz
96.0kHz	96.0kHz	192.0kHz	192.0kHz
176.4kHz	176.4kHz	176.4kHz	176.4kHz