OPERATING MANUAL





Digital Audio + SD/HD Video Sync Master Clock Generator



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 roomtemperature 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.

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!



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

Declaration of Conformity

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

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
- 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 Confu
- 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.

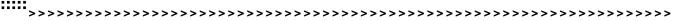
To obtain warranty service, the buyer must call or write to MUTEC GmbH before returning the unit. All inquiries must be accompanied by a description of the problem and the original buyer's invoice. Devices shipped to MUTEC GmbH for repair without prior notice will be returned to the sender at the sender's 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.de • www.MUTEC-net.de

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INTRODUCTION

Thank you for purchasing a MC-3.2 SMART CLOCK HD, Digital Audio & SD/HD Video Sync Master Clock Generator from MUTEC GmbH.

Please keep this manual for future reference!

General Function Description

MC-3.2 SMART CLOCK HD is a unique, extremely high-flexible audio and video sync reference clock generator.

The unit offers three simultaneously useable reference signal generators in one box which generate standard definition (SD) bi-level video, high definition (HD) tri-level video and the most common audio clock signals like Word Clock, so-called Super Clock, AES/EBU and S/PDIF blank frames for synchronization of digital audio and SD/HD video devices such as hard-disk recorders, A/V workstations, video recorders, digital mixing consoles, AD/DA converters, musical instruments. Simultaneous use of all available clock signals enables each device in the recording studio to be individually synchronized. In addition, different clock rates of all audio-related clock signals can be simultaneously output. Thus, new devices with higher clock rates may be integrated into an existing studio set-up without difficulty.

The SD bi-level video sync reference generator of MC-3.2 SMART CLOCK HD supports PAL 24fps, PAL 25fps, NTSC 29.97fps and NTSC 30fps as Black+Burst, composite sync and color bar. Especially for the PAL 24fps standard a pull down factor of 0.1% can be set additionally to output PAL 23.98fps.

The MC-3.2's HD tri-level video sync reference generator offers 720p, 1080i and 1080p formats with frame rates at 24Hz, 25Hz, 30Hz, 50Hz, 60Hz and the respective pull down factors of 0.1%.

The audio clock generator of SMART CLOCK HD offers 7 basis Ultra low-jitter Word Clocks from 32.0kHz up to 192.0kHz, which are then independently distributed to four clock output pairs with multipliers of x1, x2 and x4 for a maximum clock rate of 768.0kHz. For the synchronization of older digidesign ProTools™ systems, the respective Word Clock frequencies can be transferred as Word Clock x 256 (also called Super Clock). AES/EBU and S/PDIF (optical + coaxial) blank frame sync signals are available from 32.0kHz up to 192.0kHz. Additionally all common pull up and down factors can be adjusted freely for film/video and audio transfers.

All reference signal generators can be set independently. Phase relations between the individual generators are recognized and adjusted automatically by the system.

The design advantage of the MC-3.2 SMART CLOCK HD is its high-precision clock frequency basis, from which all reference signals are simultaneously derived. As a result, the individual clock signals generated feature the same frequency accuracy and time base! The frequency generation is accurate to $<\pm0.5$ ppm and thus complies with AES 11, Grade 1, as well as broadcast specifications.

This all makes MC-3.2 SMART CLOCK HD without doubt the most flexible A/V clock generator in a ½ 19" case currently available in the industry!

The 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.

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.

Features

- Three independent reference clock generators in one box.
- Generation of SD bi-level video sync and HD tri-level video reference sync signals with different frames rates simultaneously.
- Audio and video signals coupled to one common AES11, Grade 1, basis clock.
- Generation of 7 Ultra low-jitter basis Word Clock rates up to 192.0kHz.
- ─ Word Clock outputs can be multiplied with factors x1, x2, x4 and x256 for a total of 16 different Word Clock rates.
- Simultaneous output of different audio clock rates.
- Phase-synchronized generation of S/PDIF and AES/EBU blank frames.
- All adjustments are retained after power-down.
- Simple, new user interface.
- Built-in international power supply.

Applications

- A/V synchronization
- Ultra low-jitter clock supply for entire studio
- Acoustical improvement of AD/DA converters
- Elimination of »clicks and pops« in audio recordings
- Stellate clock signal supply
- Multiple clock rate synchronization
- Film, video and audio transfers

Peripheral Products

→ MC-2

For larger equipment set-ups, which require more AES/EBU clock outputs than are provided by the MC-3.2 SMART CLOCK HD, MUTEC offers a complementary 6-channel AES/EBU signal distribution amplifier and converter which is called: MC-2.

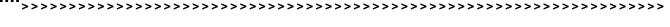
MC-5

For set-ups, which require more SD/HD video sync outputs than are provided by the MC-3.2 SMART CLOCK HD, MUTEC offers a complementary 12-channel SD/HD video routing matrix and signal distribution amplifier which is called: MC-5.

■ MC-7

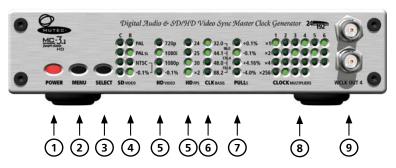
The MC-7 is a flexible, high-performance 8-channel Word Clock distribution amplifier and audio clock converter.

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



CONTROL ELEMENTS

MC-3.2 SMART CLOCK HD Front Panel



1 POWER

This red LED lights up when the unit is switched on with the rear panel POWER switch (on condition that the adjusted voltage matches your local

2 MENU

Use this key to access the different functional menus.

Use this key to select a function from a specific functional menu.

This functional menu lets you choose between different SD video standards, output formats and frame rates.

5 HD VIDEO + HD FPS

These two functional menus are working simultaneously together and let you choose between different HD tri-level video standards (HD VIDEO) in combination with different and frame rates (HD FPS).

6 CLK BASIS

This functional menu enables the setting of the basis audio clock rate between 32.0kHz and 192.0kHz which applies to all Word Clock, AES/EBU and S/PDIF outputs.

7 PULLs

This functional menu allows for adding the common pull up and pull down frequency factors to the basis audio clock rate setting for film/video and audio transfers.

8 CLK MULTIPLIERS

This functional menu lets you determine the factor by which the basis audio clock rate is multiplied additionally. This setting can be made individually for every Word Clock pair of outputs as well as for the AES/EBU and S/PDIF outputs.

9 WCLK OUT 4

This pair of Word Clock outputs transfers either all standard Word Clock rates as well as Word Clock x 256 for older digidesign ProTools™ systems. Their numbering is aligned to the corresponding functional menu on the front panel. For adjusting these outputs see chapter OPERATION.

Refer to the OPERATIONS chapter for more information.

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

GONTROL ELEMENTS

MC-3.2 SMART CLOCK HD Rear Panel



1 HD VIDEO OUT

This pair of outputs transfers HD tri-level video sync reference clock signals. The individual BNC connectors of the output pair are marked as A and B; this allows, for example, for a simple documentation of the connected devices. For adjusting these outputs see chapter OPERATION.

2 SD VIDEO OUT

This pair of outputs transfers SD video sync reference clock signals. The individual BNC connectors of the output pair are marked as A and B; this allows, for example, for a simple documentation of the connected devices. For adjusting these outputs see chapter OPERATION.

3 WCLK OUT 1-3

These 3 pairs of Word Clock outputs transfers either all standard Word Clock rates as well as Word Clock x 256 for older digidesign ProTools™ systems. Their numbering is aligned to the corresponding functional menus on the front panel. The individual BNC connectors of an output pair are marked as A and B; this allows, for example, for a simple documentation of the connected devices. For adjusting these outputs see chapter OPERATION.

4 AES/EBU OUT 5

These 2 AES/EBU outputs transmit a transformer-balanced electrical blank-frame clock signal. Their numbering is aligned to the corresponding functional menu on the front panel. The individual XLR connectors of this output pair are marked as A and B; this allows, for example, for a simple documentation of the connected devices. For adjusting these outputs see chapter OPERATION.

5 S/PDIF OUT 6

This 2 S/PDIF outputs, available as optical and coaxial interfaces, transmit an optical S/PDIF blank frame signal and an unbalanced electrical S/PDIF blank frame signal. Their numbering is aligned to the corresponding functional menu on the front panel. For adjusting these outputs see chapter OPERATION.

6 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...260V with a frequency of 50 or 60 Hz can be applied. The internal power supply will automatically make all necessary adjustments.

Heed the SAFETY INSTRUCTIONS at the beginning of this manual!

Refer to the »Technical Data« section in the APPENDIX for a full list of all available SD and HD video format and frame rate combinations.

Refer to the »Generatable Word Clock Frequencies« and »Generatable AES/EBU and S/PDIF Frequencies« sections in the APPENDIX for a full list of all Word Clock, AES/EBU and S/PDIF clock rates that can be generated.

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-3.2 SMART CLOCK HD

1 x Power cable

1 x Manual

4 x Rubber feets

1 x Registration card

The condition of the packaging material and the device should be checked carefully additionally.

If there are any damages please refer to SAFETY INSTRUCTIONS, Initial Operation, 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, so as to avoid excessive cable lengths. Use the 4 rubber feets enclosed with the appliance and stick them symmetrically on the bottom side of the unit to protect the enclosure and supporting surface from being damaged. When the unit is installed in a rack, the rubber feets cannot be attached to save space.

The device can be mounted into a standard 19" rack and will require one unit. For this installation MUTEC offers an optional set of rack ears (MW-05/19, order no. 8020-035). The mounting depth including the terminals is 175mm/6.9". Another 150mm/5.9" should be added for the required cables.

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 Word Clock and Video 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 outputs of the MC-3.2 SMART CLOCK HD to the corresponding input of the devices 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 or video signals electrical, unsymmetrical cables with a resistance of 75 $\!\Omega$ and BNC connectors on both ends are used. Typically, such cables are marked »RG-59U, RG59B/U«.

Additionally, you should make sure that the Word Clock or video inputs to be connected to the MC-3.2 SMART CLOCK HD's outputs have a 75Ω terminating resistor! Most Word Clock or video 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 Lightbridge. 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 MC-3.2 SMART CLOCK HD to one of the lateral connectors, and the other connector of the BNC-T piece to a 75 Ω 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!

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).

Please make sure that the cable used has a resistance of 75 Ω , in compliance with the specifications! If a cable with a different resistance is used, a dramatic deterioration of the signal quality can be the result! In this case, the perfect synchronization of all devices involved could be impaired.

We recommend using high-grade cables with a good shielding for your clock signal leads, in particular, if you need to transmit Word Clock x 256 (so-called Super Clock) signals over greater distances. In any case, a length of max. 10 meters (approx. 30 feets) should never be exceeded!

INSTALLATION

Since some manufacturers offer optimized cables for the transmission of digital S/PDIF and AES/EBU audio signals, it will be a good idea to ask your retailer for specific cables.

Especially when working with high AES/EBU clock rates well shielded clock lines are imperative to avoid increased radiation! Standard cables are normally useable for clock rates up to 50.0kHz. Special shielded cable material should be used for transfer of higher clock rates.

MUTEC offers optical cables of various lengths that have been specifically tested for the transmission of S/PDIF and ADAT™ signals (retailers and distributors only)!

Wiring the AES/EBU and S/PDIF Interfaces

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 resistance of 110Ω (ask your retailer for a confirmation of this value when purchasing the cables).

Connect the coaxial S/PDIF interface with the help of unbalanced electrical cables equipped with cinch connectors on both ends. The specifications stipulate a specific cable resistance of 75Ω (ask your retailer for a confirmation of this value when purchasing the cables).

Connect the optical S/PDIF 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.

GENERAL OPERATION

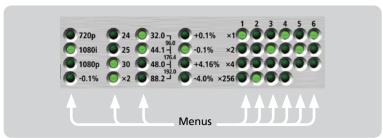
Selecting Function Menus and setting Functions

Operating the MC-3.2 SMART CLOCK HD is very simple! The device is fully operated using the 2 keys at the front panel.

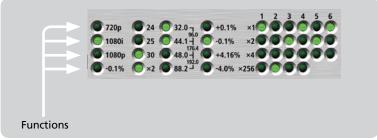
- 1 Switching the MENU key toggles between different basic function menus.
- 2 Switching the SELECT key activtes individual functions within one function menu.



MENU + SELECT operation



Menus



Functions

Steps of Operation

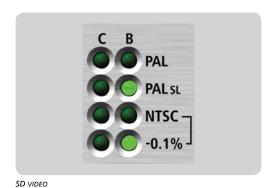
- 1 First press on MENU or SELECT key enables the last selected function within the last selected function menu. The corresponding LED is beginning to flash.
- 2 Every press on SELECT key will select a new function. The LED of every selected function will flash accordingly and the corresponding function is available at once.
- **3** When the needed function is selected, do not press the switches again! After a period of approx. 4 seconds the LED in front of the selected function will stop flashing.



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

operation

SD + HD VIDEO SETTINGS



SD VIDEO

This menu enables you to set the internal standard definition (SD) video sync reference generator to different standards. It is a multifunctional menu which means, the two LED rows indicate together the different possible settings. The adjusted video standard is transfered to both SD video sync outputs at the rear.

The names of the LEDs in this menu:

PAL: 25fps, 625 lines PAL st.: 24fps, 625 lines NTSC: 29.97fps, 525 lines

-0.1%: Pull down for PALsL with 0.1%, 23.98fps, 625 lines

C: Composite Sync, this function outputs a SD video composite

sync signal without color bust.

B: Black+Burst, this function outputs a SD video composite sync

signal with inserted color bust.

C+B: Color Bar, this function outputs a SD video color bar signal.

Both LEDs in front of a video standard light simultaneously.

You can choose the different functions within this menu by pressing the SELECT button repeatedly.

C B PAL O PAL SL O NTSC O -0.1%	This setting outputs a PAL composite video sync reference signal.	C B PAL PAL SL PALSL NTSC 0 0.1%	This setting outputs a so-called 'Slow-PAL' Black + Burst video sync reference signal pulled down with 0.1%.
C B PAL O PAL SL O NTSC O -0.1%	This setting outputs a PAL Black + Burst video sync reference signal.	C B PAL PALsL NTSC -0.1%	This setting outputs a so-called 'Slow-PAL' color bar video reference signal pulled down with 0.1%.
C B PAL O PAL SL O NTSC O -0.1%	This setting outputs a PAL color bar video reference signal.	C B PAL O PALsL O NTSC O -0.1%	This setting outputs a NTSC composite sync video reference signal with 29.97fps.
C B PAL PAL SL NTSC -0.1%	This setting outputs a so-called 'Slow-PAL' composite video sync reference signal.	C B PAL O PAL SL O NTSC O -0.1%	This setting outputs a NTSC Black + Burst video sync reference signal with 29.97fps.
C B PAL O PAL SL O NTSC O -0.1%	This setting outputs a so-called 'Slow-PAL' Black + Burst video sync reference signal.	C B PAL O PAL SL O NTSC O -0.1%	This setting outputs a NTSC color bar video reference signal with 29.97fps.
C B PAL PAL SL NTSC -0.1%	This setting outputs a so-called 'Slow-PAL' color bar video reference signal.	C B PAL O PALsL O NTSC O -0.1%	This special setting outputs a NTSC composite sync video reference signal with 30fps (black + white).
C B PAL PAL SL NTSC -0.1%	This setting outputs a so-called 'Slow-PAL' composite video sync reference signal pulled down with 0.1%.		

operation

HD VIDEO + HD FPS

This menu enables you to set the internal HD tri-level (HD) video sync reference generator to different standards. It is a multifunctional menu which means, the two LED rows 'HD VIDEO' and 'HD FPS' indicate together the different possible settings. The selected video standard is transfered to both HD video sync outputs at the rear.

The names of the LEDs in this menu:

720p: 720 lines, progressive

1080i: 1080 lines, interlaced + progressive segmented frame

1080p: 1080 lines, progressive

−0.1%: Pull down for all HD tri-level standards with 0.1%

24: 24fps rate25: 25fps rate30: 30fps rate

HD VIDEO HD FPS

x2: Doubling of the previously mentioned frame rates

You can choose the different functions within this menu by pressing the SELECT key repeatedly.



>>>>>>>>>>>>

HD VIDEO + HD FPS

SEEECT RESTE	peaceary.		
 720 p 24 1080 i 25 1080 p 30 −0.1% ×2 HD video HD FPS 	This setting outputs a 720 lines progressive HD tri-level reference signal with 23.98fps.	720 p 24 1080 i 25 1080 p 30 -0.1%	This setting outputs a 1080 lines progres- sive segmented frame (PsF) HD tri-level reference signal with 23.98fps.
↑ 720 p	This setting outputs a 720 lines progressive HD tri-level reference signal with 24fps.	720 p 24 1080 i 25 1080 p 30 -0.1% x2 HD video HD FPS	This setting outputs a 1080 lines progres- sive segmented frame (PsF) HD tri-level reference signal with 24fps.
 720 p	This setting outputs a 720 lines progressive HD tri-level reference signal with 25fps.	720 p	This setting outputs a 1080 lines interlace HD tri-level reference signal with 50fps.
 720 p	This setting outputs a 720 lines progressive HD tri-level reference signal with 29.97fps.	720 p 24 1080 i 25 1080 p 30 -0.1%	This setting outputs a 1080 lines interlace HD tri-level reference signal with 59.94fps.
 720 p 24 1080 i 25 1080 p 30 −0.1% x2 HD video HD FPS 	This setting outputs a 720 lines progressive HD tri-level reference signal with 30fps.	720 p 24 1080 i 25 1080 p 30 -0.1% x2 HD VIDEO HD FPS	This setting outputs a 1080 lines interlace HD tri-level reference signal with 60fps.
 720 p	This setting outputs a 720 lines progressive HD tri-level reference signal with 50fps	720 p 24 1080 i 25 1080 p 30 -0.1% x2 HD VIDEO HD FPS	This setting outputs a 1080 lines progressive HD tri-level reference signal with 23.98fps.
 720 p	This setting outputs a 720 lines progressive HD tri-level reference signal with 59.94fps.	720 p	This setting outputs a 1080 lines progressive HD tri-level reference signal with 24fps.
720 p 24 1080 i 25 1080 p 30 -0.1% x2	This setting outputs a 720 lines progressive HD tri-level reference signal with 60fps.	720 p	This setting outputs a 1080 lines progressive HD tri-level reference signal with 25fps.

HD VIDEO HD FPS

Generally, there is no difference between the standards 1080i and 1080PsF when using them for sync signals only. The progressive frame is devided into two segments. These segments are comparable to interlaced fields, but there is no motion between the two fields which make the video frame.

720 p 2 1080 i 2 1080 p 3 1080 p 5 1080 p HD FI	1080 lines progressive HD tri-level reference signal with 29.97fps.
720 p 2 1080 i 2 1080 p 3 1080 p 4 HD VIDEO HD FF	1080 lines progressive HD tri-level reference signal with 30fps.
720 p 2 1080 i 2 1080 p 3 1080 p 3 -0.1%	1080 lines progressive HD tri-level reference signal with 50fps.
720 p 2 1080 i 2 1080 p 3 1080 p 3 1080 p 4 1080 p	1080 lines progressive HD tri-level reference signal with 59.94fps.
720 p 2 1080 i 2 1080 p 3 -0.1% x x	1080 lines progressive HD tri-level reference signal with 60fps.

Video and Audio Signal Relations

MC-3.2 SMART CLOCK HD let's you set the SD and HD video sync reference generators independently from each other. But both video generators are always frequency-locked to one common AES11, Grade 1, clock basis, even when their frame rates are different.

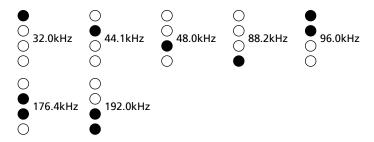
When adjusting video frame rates of equal basis rates, the system automatically phase-locks both video generators. Due to this, the vertical sync patterns of the SD and HD video sync reference signal start exactly at the same position.

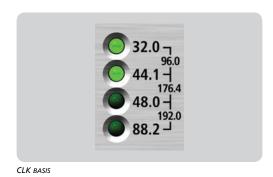
Furthermore, MC-3.2 auto-detects integer relationsships between the adjusted video standards and the basis audio clock rate (CLK BASIS). This applies especially when 24fps or 25fps based video standards are selected and the basis audio clock rate is set to 48.0kHz, 96.0kHz or 192.0kHz. In that case, the AES/EBU and S/PDIF generators use the video frame to lock the Z-preamble of the AES channel block start, aligned to AES11-1997/2003 and EBU R83-1996.

AUDIO CLOCK SETTINGS

CLK BASIS

Within this function menu you may select the required basis clock frequency for your studio set-up. This selection serves as the basic setting for all WCLK output pairs as well as the AES/EBU and S/PDIF outputs. There are 7 different basis clock rates adjustable by pressing the SELECT key for different times. The LEDs display the selected clock rate as follows:





The factory default is set at 44.1kHz.

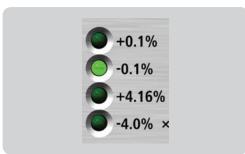
PULLS

This function menu enables you to set different so-called 'pull factors'. These correction factors are used in post production environments where frame rate differences between film and video standards need to be compensated. The pull factors influence the adjusted clock rates of all Word Clock, AES/EBU and S/PDIF outputs. The frequencies of the video reference generators are, however, unaffected.

Select the percentage by which the output clock rates are to be corrected by repeatedly pressing the SELECT key. No correction factors are generated when no LED lights! The individual values result from the below mentioned mathematical relationships (put into brackets).

The names of the LEDs in this menu:

+0.1%: Pull up with 0.1% (1001/1000)
-0.1%: Pull down with 0.1% (1000/1001)
+4.1666%: Pull up with 4.1666% (25/24)
-4.0%: Pull down with 4.0% (24/25)



PULLS

A

During normal operation of MC-3.2 SMART CLOCK HD, all LEDs must be off!

CLK MULTIPLIERS

These multiply functions are separately available for all 4 Word Clock output pairs as well as for the AES/EBU and S/PDIF outputs. Their numberings are aligned to the output numbers. Select the prefered output with the MENU key and choose the needed multiply factor by pressing the SELECT key accordingly. The factory default is set to x 1.

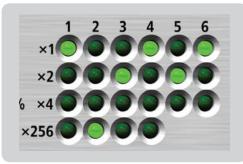
WCLK multipliers 1-4

For every of these Word Clock output pairs are 4 multipliers available:

x1, x2, x4, x256

The multiply functions »x1, x2, x4« multiply all available basis clocks up to the highest possible Word Clock rate of 768.0kHz (192.0kHz basis clock x 4). The function »x256« multiplies only the basis clocks 44.1kHz and 48.0kHz to output the so-called Super Clock rates necessary for older digidesign ProToolsTM MX systems. If a different basis clock is selected, the »x256« function is not accessible.

The factory default is set at x 1.



CLK MULTIPLIERS

WCLK multiplier 5

For the AES/EBU output pair are 3 multiply functions available:

x1, x2, x4

Due to the maximum possible AES/EBU clock frequency of 192.0kHz, the functions of these multipliers are dependent on the adjusted basis clock.

Example 1

The basis clock runs at 32.0kHz, 44.1kHz or 48.0kHz:

x 1: AES/EBU outputs run at 32.0kHz, 44.1kHz or 48.0kHz x 2: AES/EBU outputs run at 64.0kHz, 88.2kHz or 96.0kHz x 4: AES/EBU outputs run at 128.0kHz, 176.4kHz or 192.0kHz

Example 2

The basis clock runs at 88.2kHz or 96.0kHz:

x1: AES/EBU outputs run at 88.2kHz or 96.0kHz
x2: AES/EBU outputs run at 176.4kHz or 192.0kHz
x4: AES/EBU outputs run at 176.4kHz or 192.0kHz

Example 3

The basis clock runs at 176.4kHz or 192.0kHz:

x 1: AES/EBU outputs run at 176.4kHz or 192.0kHz x 2: AES/EBU outputs run at 176.4kHz or 192.0kHz x 4: AES/EBU outputs run at 176.4kHz or 192.0kHz

The factory default is set at x 1.

WCLK multiplier 6

Both S/PDIF outputs, optical and coaxial, receive same clock rate settings. For the S/PDIF output pair are 3 multiply functions available:

x1, x2, x4

Due to the maximum possible S/PDIF clock frequency of 192.0kHz, the functions of these multipliers are dependent on the adjusted basis clock.

Example 1

The basis clock runs at 32.0kHz, 44.1kHz or 48.0kHz:

x1: S/PDIF outputs run at 32.0kHz, 44.1kHz or 48.0kHz
x2: S/PDIF outputs run at 64.0kHz, 88.2kHz or 96.0kHz
x4: S/PDIF outputs run at 128.0kHz, 176.4kHz or 192.0kHz

Example 2

The basis clock runs at 88.2kHz or 96.0kHz:

x1: S/PDIF outputs run at 88.2kHz or 96.0kHz x2: S/PDIF outputs run at 176.4kHz or 192.0kHz x4: S/PDIF outputs run at 176.4kHz or 192.0kHz

Example 3

The basis clock runs at 176.4kHz or 192.0kHz:

x1: S/PDIF outputs run at 176.4kHz or 192.0kHz
x2: S/PDIF outputs run at 176.4kHz or 192.0kHz
x4: S/PDIF outputs run at 176.4kHz or 192.0kHz

The factory default is set at x 1.

APPENDIX

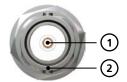
Pin Assignment of the Connectors

Mains



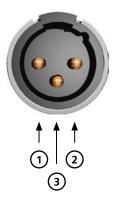
- 1 Neutral (blue; USA: white)
- 2 Protective earth (green/yellow; USA: green)
- 3 Live, phase (brown; USA: black)

Word Clock + SD Video BNC Output



- 1 Signal
- 2 Ground

AES/EBU XLR Output



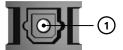
- 1 Ground
- 2 a conductor (hot / +)
- 3 b conductor (cold / -)

S/PDIF Cinch Output



- 1 Audio signal
- 2 Audio ground

S/PDIF Optical Output TOSLINK Standard



1 Optical signal

<u>>>>>>>></u> 19



Technical Data

WORD CLOCK SYNC OUTPUT 1-	4
Interface	8 x BNC female, unbalanced, individually buffered, adjustable in pairs
Output Levels	3.5 V (p-p) @ 75Ω , output impedance 22Ω
AES/EBU SYNC OUTPUT 5	
Interface	2 x XLR male, transformer balanced, 3.5 Vpp @ 110 Ω , output impedance 110 Ω , individually buffered
Format	AES11-1997/2003
Resolution	24bits
S/PDIF SYNC OUTPUT 6	
Interfaces	1 x Coaxial (Cinch/RCA female), unbalanced, 0.5 V (p-p) @ 75 Ω , output impedance 75 Ω , individually buffered
	1 x Toshiba Toslink™, EIAJ RC-5720
Format	IEC 60958 blank frame
Resolution	24 bits
VIDEO SYNC OUTPUTS	
SD bi-level Video Interface	2 x BNC female, unbalanced, output impedance 75 Ω , individually buffered 300 mVpp ±7 mV burst level @ 75 Ω , 300 mVpp ±7 mV H/V sync level @ 75 Ω
HD tri-level Video Interface	2 x BNC female, unbalanced, output impedance 75 Ω , individually buffered +/- 300 mVpp ±7 mV sync high/low @ 75 Ω
VIDEO GENERATOR SPECIFICATION	ONS
Generated SD bi-level	PAL 24fps, 625 lines, ITU-R.BT470 PAL 23.98fps, 625 lines, ITU-R.BT470, so-called 'Slow-PAL' PAL 25fps, 625 lines, ITU-R.BT470
Video Sync Standards	NTSC 29,97 fps, 525 lines, SMPTE170M NTSC 30 fps, 525 lines, SMPTE170M
Generated SD bi-level Video Sync Formats	Black + Burst, Composite video sync 100/75 EBU PAL + 100/7.5//75/7.5 NTSC Color bar
Generated HD tri-level	720p/23.98fps, 720p/24fps, 720p/25fps, 720p/29.97fps, 720p/30fps, 720p/50fps, 720p/59.94fps, 720p/60fps
Video Sync Standards	1080PsF/23.98fps, 1080PsF/24fps, 1080i/50fps, 1080i/59.94fps, 1080i/60fps
	1080p/23.98fps, 1080p/24fps, 1080p/25fps, 1080p/29.97fps, 1080p/30fps
INTERNAL REFERENCE CLOCK SP	
Oscillator type	TCXO, temperature compensated crystal oscillator
Clock accuracy (shipped)	<±0.5ppm
Clock stability vs. temperature	<±0.5ppm within -10°C to +60°C
Operating temperature	-10°C to +60°C
Clock jitter	<10ps (RMS)
POWER SUPPLY	
Туре	Internal switching power supply
Input voltage	90 V – 260 V (automatic adjustment), 47 Hz – 440 Hz
Power consumption	max. 10W
SYSTEM UNIT COVER	
Cover size/material/color	196 x 42 x 156mm without connectors (WxHxD), aluminium sheet 1mm, black
Front panel size/material	198 x 44 x 2mm (WxHxD), aluminium
Weight	~1356g

Generatable Word Clock (WCLK) Frequencies

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

Generatable AES/EBU and S/PDIF Frequencies

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

