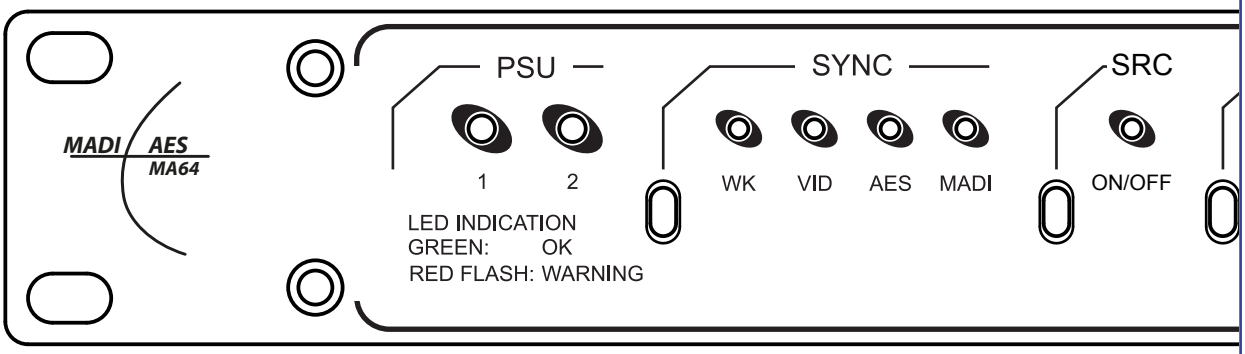
MA64

MADI to Multi-format AES interface



Installation and User Guide

Reference To Statement Of Conformity

This document confirms that products bearing the CE label meet all the requirements in the EMC directive 2004/108/EC and LV directive 2006/95/EC laid down by the Member States Council for adjustment of legal requirements. Furthermore the products comply with the rules and regulations from 30 August 1995 referring to the electromagnetic compatibility of devices. Bel MA64 units bearing the CE label comply with the following harmonised or national standards:

EMC:

BS EN 55103-1 :2009

BS EN 55103-2 :2009

Safety:

BS EN 60950-1: 2006 (ed. 2) + A1:2010

Insulation:

Class1

Instructions for Disposal of WEEE by Users in the European Union

The symbol shown here is on the product or on its packaging, which indicates that this product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for recycling of waste electrical and electronic equipment.

The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.

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This appliance has a serial number located on the rear panel. Please record the serial number here for your records.

Model Number.....MA64

Serial Number.....

Contents

1. Read these instructions
2. Keep these instructions
3. Heed all warnings
4. Follow all instructions
5. Do not use this apparatus near water
6. Do not expose this apparatus to rain or moisture.
7. Clean only with a dry cloth
8. Do not block any ventilation openings. Install with accordance with the manufacturer's instructions.
9. No naked flames, such as lighted candles, should be placed on the apparatus.
10. Do not install near any heat sources such as radiators, heat registers, stoves or other apparatus (including amplifiers) that produce heat.
11. There are no user-adjustments, or user-servicable items, inside this apparatus. Do not remove the covers of this apparatus; doing so will invalidate your warranty.
12. Adjustments or alterations to this apparatus may affect the performance such that safety and/or international compliance standards may no longer be met.
13. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally or has been dropped.

Caution

14. Hazardous voltages may be present inside this apparatus.
15. Do not operate this apparatus with the covers removed.
16. To reduce the risk of electric shock, do not perform any servicing other than that contained in these Installation Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel and ensure that all power cords are disconnected when servicing this apparatus.
17. Only use attachments/accessories specified by the manufacturer.

Power Safety

18. This apparatus is fitted with a universal power supply, approved and certified for operation in this apparatus. There are no user-replaceable fuses.
19. An external over-current protection device is required to protect the wiring to this apparatus. This protection device must be installed according to current wiring regulations. In certain countries this function is supplied by use of a fused plug.
20. If an extension power cable or adaptor is used, ensure that the total power rating of the power cable and/or adaptor is not exceeded.
21. An external disconnect device is required for this apparatus; a detachable power cord is a suitable disconnect device.
22. The apparatus should be located close enough to an AC outlet so that you can easily grasp the power cord plug at any time.
23. This apparatus is a Class I construction and shall be connected to an AC outlet with a protective grounding connection.
24. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
25. Unplug this apparatus during lightning storms or when unused for long periods of time.
26. All power cords must be disconnected to isolate this apparatus completely.
27. Caution: To reduce the risk of electric shock, plug each power supply cord into separate branch circuits employing separate service grounds
28. This equipment is not supplied with a detachable power cord. The device should be connected to a power supply only of the type described in the Installation Guide or as marked on the device. The power cord must be earthed and precautions should be made so that the grounding is not defeated. A mains cord, fitted with an IEC 60320 C13 type socket, appropriate sized conductors and plug to suit local electrical requirements.
29. The power supply cord (i.e. conductor, coupler (IEC60320 C13) and plug combination) must be suitably rated for apparatus and the country of use (meeting local electrical requirements). A power supply cord with a rating of not less than 125% of current rating is suitable. The minimum rating for the power supply cord at 110 / 230V ac to be 1A.

Installation

30. When installing this apparatus, either fix it into a standard 19" rack or place the apparatus on a secure level surface. When this apparatus is rack mounted, fit all rack screws.

31. Ensure that no strain is placed on the cables connecting to this apparatus. Ensure also that such cables are not placed where they can be stepped on, pulled or tripped over.

32. Do not operate this apparatus whilst it is covered or boxed in any way.

Important Safety Precautions

CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL

CAUTION: RISK OF ELECTRIC SHOCK. THIS EQUIPMENT HAS MORE THAN ONE POWER CORD. TO REDUCE THE RISKS OF ELECTRIC SHOCK DISCONNECT BOTH POWER SUPPLY CORDS BEFORE SERVICING

The lightning flash with arrowhead symbol, within equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating instructions and maintenance (servicing) instructions in the literature accompanying the appliance.

Important Safety Information

This apparatus has no mains switch or other user-operated control for disconnecting the AC mains power. The mains plugs or the appliance couplers (IEC sockets) are used as the disconnect devices. Either device must remain readily operable and accessible when the apparatus is installed for use.

This unit includes thermally resettable fuses that are integral to the power supply circuitry, but the unit must always be powered from a supply fitted with an HRC type (High In-Rush Current) fuse with a rating of 1 A.

Thank you for buying this Bel product. The MA64 MADI to Multi-format AES converter is designed to provide a space-conscious method of reliably converting up to 64 channels from a MADI source to both balanced and unbalanced AES formats. The MA64 is a very high quality product, engineered for maximum reliability in professional broadcast, live and production environments. It is intended to be "installed and forgotten", and left in permanent operation. It requires virtually no configuration on installation, or adjustment in normal use.

This manual covers the MA64's connections and indications, including its various options for synchronisation. Please keep the manual in a safe place once you have installed the MA64.

Important – Please register your MA64 with Bel Digital Group Ltd., at info@beldigital.com. Registering your unit will help us in providing you with after-sales service should the need arise, and may also be of assistance in the event of the unit being stolen.

Environment – The MA64's range of operating temperature and relative humidity (RH) are as follows:

Temperature: 5°C to 40°C

RH: Operating 20 to 80%

What's In The Box

Unpacking

Unpack the MA64 with care. It is always a good idea to store all packaging (if practical), in case you ever need to return the unit to Bel for any reason.

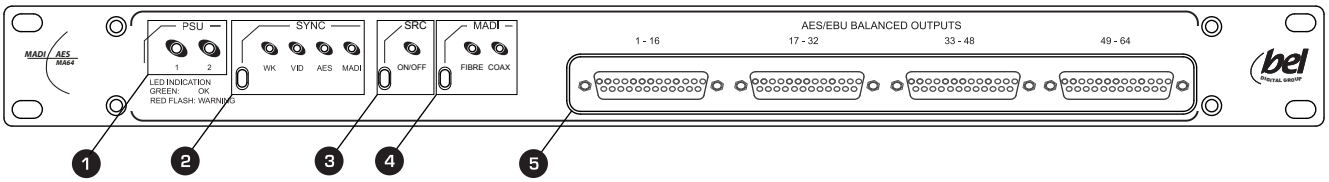
The shipping carton should contain the items listed below. Please contact your distributor immediately if any of them are missing or damaged.

- MA64 audio interface
- Instruction manual
- 2 x IEC connector retaining clamp

MA64 Main Features

- Converts all MADI channels to balanced (AES/EBU) and unbalanced (AES3-id) outputs from 44.1 kHz to 96 kHz
- Operates with both SMUX and High Speed MADI protocols
- MADI input available as both copper (BNC) and optical (SC)
- MADI loop-through outputs provided (simultaneously on copper and fibre)
- MADI output conforms to AES10id-2008; AES3 output to AES3-1992
- Transparent to Dolby® D/E (with SRC OFF)
- Switchable sample rate conversion (SRC) on all AES outputs
- Sync to external wordclock, external AES3, video black-and-burst or MADI
- Sync reference outputs in wordclock and AES3 formats
- Two independent PSUs with separate IEC inputs

Front Panel Description



1 **PSU status** – two bi-colour LEDs confirming the current status of each PSU. The LEDs are green in normal operation and flash red if a PSU fault condition is detected

2 **Sync source selection** – a 3-position toggle switch for selecting the audio sync source.

The switch's 'down' position is latching, while its 'up' position is momentary. Repeated 'upward' presses on the switch scroll through the possible external sync sources. The adjacent amber LEDs indicate the currently-selected source. When the LED for the desired source is on, the switch may be placed in the latching 'down' position to prevent inadvertent further changes of sync source.

SWITCH POSITION	FUNCTION
CENTRE	NO ACTION
UP (MOMENTARY)	INCREMENTS SYNC SOURCE SELECTION
DOWN (LATCHES)	LOCKS SYNC TO CHOSEN SOURCE

The switch is also used to toggle between High Speed and SMUX MADI modes (88.1 kHz and 96 kHz only).

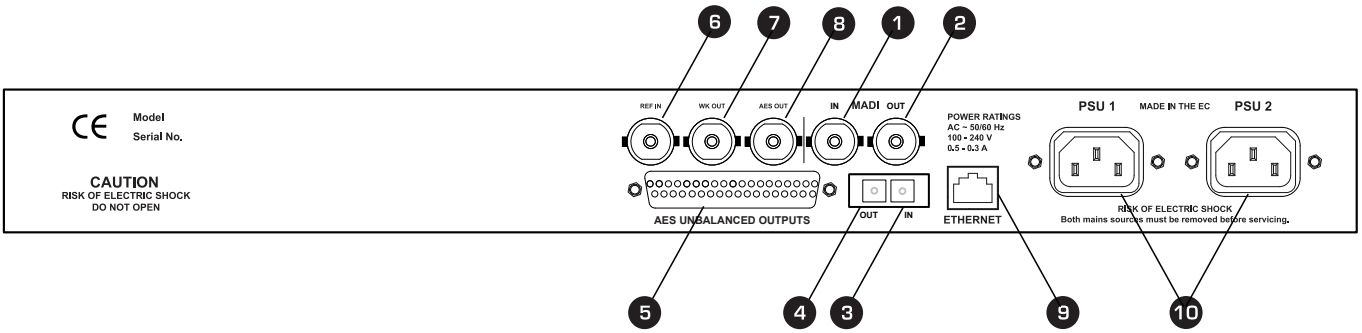
3 **SRC control** – 2-position toggle switch controlling internal SRCs across all channels.

SWITCH POSITION	FUNCTION
UP	SRC ON
DOWN	SRC OFF

4 **MADI input selection** – 2-position toggle switch controlling the input MADI source (fibre or coaxial).

5 **AES/EBU output ports** – Four 25-way female Dsub connectors, wired to Tascam format.

Rear Panel Description



1 **IN** - Coaxial MADI input (BNC)

2 **OUT** - Coaxial MADI output (BNC) providing a loop-through output of the selected input MADI source

3 **IN** - Optical MADI input (SC)

4 **OUT** - Optical MADI output (SC) providing a loop-through output of the selected input MADI source

5 **AES UNBALANCED OUTPUTS** - 37-way female Dsub connector providing unbalanced AES3-id outputs of all available MADI channels

6 **REF IN** - External synchronisation reference input (BNC)

7 **WK OUT** - Derived wordclock output from selected reference input (BNC)

8 **AES OUT** - Derived AES3 sync output from selected reference input (BNC)

9 **ETHERNET** - Ethernet port (RJ45)

10 **PSU** - AC inputs, 2 x IEC sockets

Hardware Considerations

The MA64 is built in a 1U 19" enclosure. It is intended to be permanently installed in a standard 19" equipment rack. There are ventilation grilles in the top, bottom and both sides of the enclosure, and care must be taken to ensure that these are not blocked by cables or other equipment when the unit is installed. Do not install any other items of equipment immediately above or below to the MA64; the use of 1U blanking panels is recommended.

Power Supply Considerations

The MA64 is fitted with two separate, auto-ranging switch-mode power supplies (PSUs). The operating voltage range is 100 to 240 V AC, 50/60 Hz. The internal power rails are diode-paralleled to the two supplies, and the unit will operate normally if only one PSU is powered or functional. For maximum protection when using both PSUs, the two AC inlet cables should be connected to mains circuits which are as independent of each other as possible.

If redundant operation is not required, only one AC supply cable need be connected; either AC inlet may be used.

Fuses And Ratings

Each of the MA64's PSUs has an internal resettable fuse for PSU protection. These fuses are not accessible to the user. The unit should be powered from a mains supply (supplies) fitted with an external HRC-type fuse (High Inrush Current) rated at 1 A.

Unit Connections

MADI Inputs and Outputs

The MA64 can simultaneously convert up to 64 audio channels embedded in the MADI stream and provide them as both AES/EBU and AES3-id outputs.

MADI inputs are provided as fibre on an SC type connector (multi-mode) and coaxial (on BNC). The characteristic impedance of the coaxial input is 75 ohm.

Each MADI input has an active MADI loop-through output to simplify the connection of further equipment. The co-axial MADI output is on a BNC socket, and is compliant with AES10id-2008. The characteristic impedance is 75 ohms, at a nominal data rate of 125Mbps. Transmission distances up to 50 m are generally achievable. The fibre loop-through output is provided on an SC type connector.. Recommended fibre types are 62.5/125 µm or 50/125 µm, multi-mode. Transmission distances of at least 1000 m are achievable.

Note: A single-mode fibre option is available, but only at time of order.

AES/EBU Outputs

The 64 audio channels converted from the MADI input are available as 32 AES/EBU digital audio output pairs on four front panel 25-way female Dsub connectors. Appropriate channel numbers are screenprinted on the front panel above each connector. The outputs are balanced and are compliant with AES3-1992. The diagram below provides the pinout (which is Tascam digital compatible):

CHANNEL PAIR	PIN	OUTPUT
n+1	25	Gnd
	12	Cold
	24	Hot
n+2	11	Gnd
	23	Cold
	10	Hot
n+3	22	Gnd
	9	Cold
	21	Hot
n+4	8	Gnd
	20	Cold
	7	Hot
n+5	19	Gnd
	6	Cold
	18	Hot
n+6	5	Gnd
	17	Cold
	4	Hot
n+7	16	Gnd
	3	Cold
	15	Hot
n+8	2	Gnd
	14	Cold
	1	Hot

n=0, 8, 16, 24

To aid installation, an optional AES/EBU breakout panel (BOB/0-32) is available from Bel. This consists of a 1U 19" panel with 16 XLR3M connectors fitted (32 channels).

AES3-id Outputs

The 64 audio channels converted from the MADI input are available as 32 AES3 digital audio outputs on the rear panel 37-way female Dsub connector. The outputs are unbalanced (AES3-id), but are compliant with AES3-1992 in all other respects. The table below gives the pinout:

PIN	OUTPUT	AUDIO CHANNELS
1	AES 1	Chs 1 & 2
2	AES 2	Chs 3 & 4
3	AES 5	Chs 9 & 10
4	AES 6	Chs 11 & 12
5	AES 9	Chs 1 & 2
6	AES10	Chs 3 & 4
7	AES 13	Chs 9 & 10
8	AES 14	Chs 11 & 12
9	AES 17	Chs 1 & 2
10	AES 18	Chs 3 & 4
11	AES 21	Chs 9 & 10
12	AES 22	Chs 11 & 12
13	AES 25	Chs 1 & 2
14	AES 26	Chs 3 & 4
15	AES 29	Chs 9 & 10
16	AES 30	Chs 11 & 12
17	n/c	
18	n/c	
19	GND	
20	AES 3	Chs 5 & 6
21	AES 4	Chs 7 & 8
22	AES 7	Chs 13 & 14
23	AES 8	Chs 15 & 16
24	AES 11	Chs 5 & 6
25	AES 12	Chs 7 & 8
26	AES 15	Chs 13 & 14
27	AES 16	Chs 15 & 16
28	AES 19	Chs 5 & 6
29	AES 20	Chs 7 & 8
30	AES 23	Chs 13 & 14
31	AES 24	Chs 15 & 16
32	AES 27	Chs 5 & 6
33	AES 28	Chs 7 & 8
34	AES 31	Chs 13 & 14
35	AES 32	Chs 15 & 16
36	n/c	
37	GND	

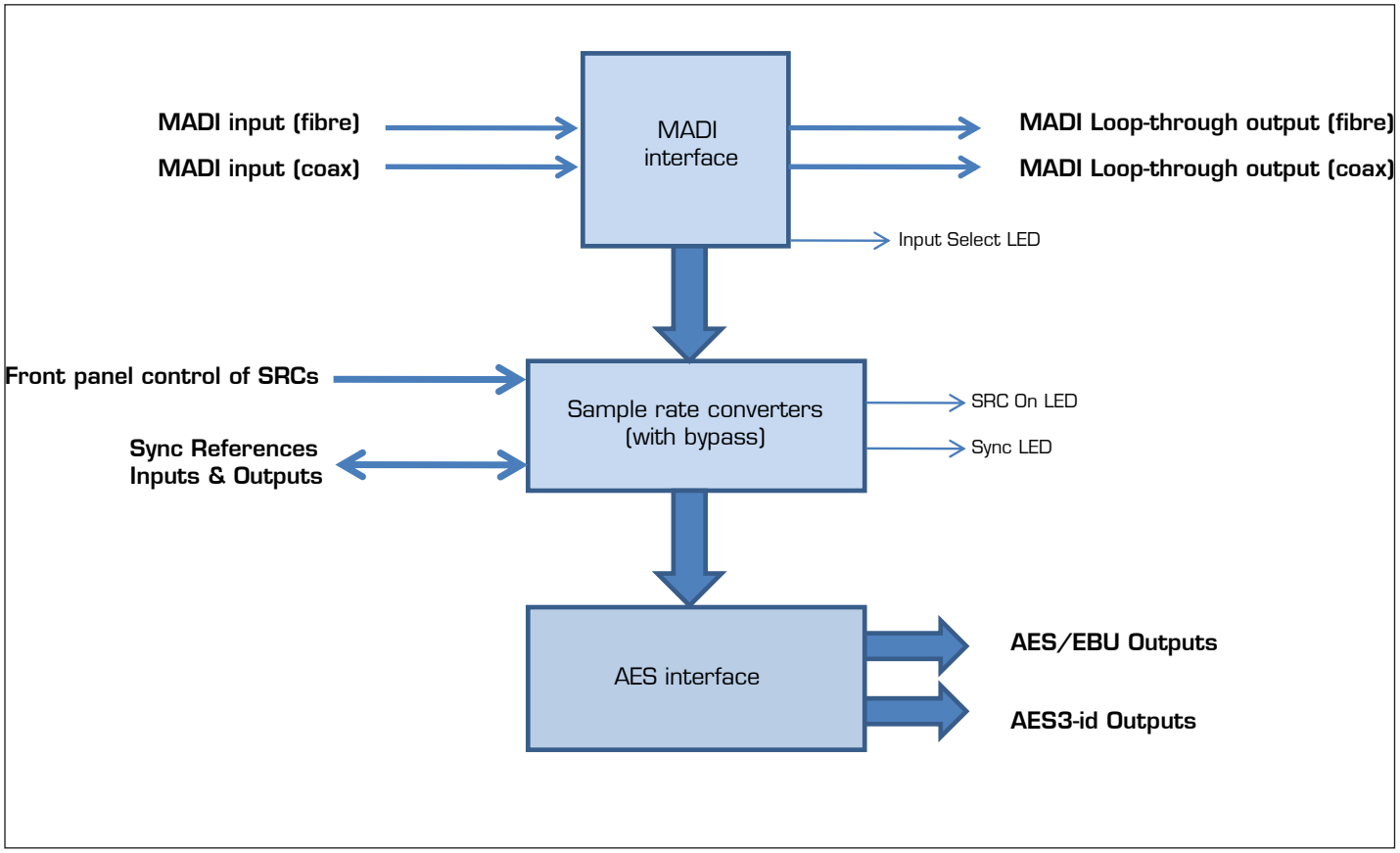
Note that each AES3 output carries 2 audio channels.

To aid installation, an optional AES3-id Signal Break Out accessory (ASBO) is available from Bel. This consists of a 1U 19" panel with 32 BNC sockets, prewired to a 37-way Dsub plug. This may be mounted at the front or rear of the rack and greatly simplifies wiring.

ETHERNET Port

The MA64 includes a standard Ethernet port (an RJ45 socket). This functionality is for firmware updates.

Block Diagram



High Speed and SMUX protocols

The MA64 is capable of automatically sensing the incoming sample frequency from 44.1 kHz to 96 kHz. There are, however, two recognised MADI protocols used for the transmission of 88.2 kHz and 96 kHz material. These are known as 'High Speed' and the historic legacy SMUX protocols.

The MA64 is capable of working with both.

In Auto detect mode the MA64 will automatically detect the more recent 88.2 and 96 kHz high speed protocols, in addition to 44.1 kHz and 48 kHz material.

If receiving legacy SMUX MADI then the MA64 will require switching into SMUX mode.

It is possible to tell at a glance which mode the unit is set to by looking at the MADI input selection LEDs on the front panel [4] (see *Front Panel Description on page 7*). If either the Coax or Fibre LED indicator is flashing, it confirms that the unit is in SMUX mode. If the LED illumination is constant, then the MA64 is set to Auto detect mode and will accept the High Speed MADI sources.

To select which mode to operate in, just hold the Sync Source Selection switch [2] in its uppermost position for 4 seconds. The state of the MADI input selection LED will then toggle between:

- Solid: Auto detect mode. Auto detect sample rates from 44.1 kHz to 96 kHz (High Speed)
- Flashing: SMUX mode. Select this when receiving 88.2 kHz or 96 kHz sources using the SMUX protocol

Note: When in SMUX MADI mode, the MA64 can be used to convert from incoming SMUX to High Speed format at the AES outputs.

Sample Rate Converters

As with all operations involving digital audio, it will generally be desirable for the audio outputs of the MA64 to be synchronised (in frequency and/or phase) with a master reference clock, which will also synchronise all other digital audio processing in the facility. It may also be that the incoming MADI stream could require re-synchronising to a different house clock - such as that on an outside broadcast vehicle for example.

To achieve this, MA64 includes a Sample Rate Converter (SRC) for each converted AES pair. The SRCs may be switched in or out by a front panel switch [3] (see *Front Panel Description on page 7*). When the SRCs are active, a red LED illuminates.

When enabled, the SRCs re-clock the audio data against the sync reference at the REF IN connector, ensuring that the word blocks in the data are phase-

locked exactly to the reference clock. The MA64 allows the user to select a reference clock source to suit the infrastructure of the facility and the nature of the transfer process. See following section on "*Synchronisation*".

Note: Passing Dolby-encoded material through sample rate converters will corrupt the Dolby bitstream.

Synchronisation

The MA64 should normally be used as a slave device, synchronised to an external clock reference. MA64 offers a choice of synchronisation sources. Selection is made from the front panel, and the array of LEDs confirms the currently-selected source. The selected source is used as reference for all four output SRCs, thus ALL audio outputs, both in AES/EBU and AES3-id formats, will be locked to the selected reference.

The various clock sources are discussed below:

Sync To Wordclock

Sync to an external wordclock is indicated by illumination of the 'WK' front panel LED. The clock source should be connected to the REF IN connector (a BNC socket) on the rear panel and the SRC front panel switch should be set to ON. Clock pulses should be of 5 V amplitude, positive-going.

Note: The wordclock input includes integral 75 ohm termination. Use the wordclock output connector to daisy-chain wordclock to other devices.

Note: When working with SMUX sources, Wordclock should be set to 48 kHz for 96 kHz operation and 44.1 kHz for 88.2 kHz operation.

Sync To Video Black-And-Burst

The MA64 can also synchronise to a standard (SD) 1 V black-and-burst video signal. The video signal should be connected to the REF IN connector on the rear panel. The sync input auto-detects NTSC or PAL standard video.

Note: Video sync also includes an internally generated 48 kHz clock if internal sync is required.

Sync To AES3

An AES3-compliant digital audio source may be used as the clock reference source. The internal 48 kHz wordclock source is phase-locked to the incoming AES3 signal. Any audio data contained in the AES3 word will be ignored. The audio source should be compliant with AES3-id for 75 ohm coaxial transmission and connected to the REF IN connector on the rear panel.

Sync To MADI

The MA64 can also synchronise to the incoming MADI stream.

Clock Outputs

A reference clock output is available at the rear panel WK OUT connector [7] and at the AES OUT connector [8]. These are derived from whichever synchronisation source is selected.

Power:

Q: Can I run MA64 with just one PSU (AC inlet) cable?

A: Yes, although it is always recommended that two AC inlet cables are connected in order to provide a level of redundancy. The two AC inlet cables should be connected to mains circuits which are as independent of each other as possible.

SDI:

Q: How do you select between MADI inputs?

A: Use the front panel MADI input selector switch, to select fibre or coaxial MADI input.

Synchronisation:

Q: MA64 is not synchronising to wordclock.

A: Ensure that the incoming wordclock is derived from a 75 ohm terminated source, as per the AES-11 standard.

Q: What is the most commonly recommended configuration for synchronisation?

A: The most commonly used and recommended synchronisation method for MA64 is slaving it to wordclock via the Ref In connector. Ensure that wordclock sync has been selected using the front panel selection switch (WK LED should illuminate).

Q: Can I daisy-chain other devices to MA64 to when synchronising to Wordclock?

A: This is possible by using the wordclock loop-through connector (WK Out). WK Out is a buffered copy of the incoming wordclock.

Q: Can MA64 be used as a master sync generator?

A: In the majority of installations MA64 should not be used as a master sync generator. The only situation that would dictate use as a master clock reference would be when MA64 is synchronised to an incoming MADI source that contains Dolby® bitstreams. In this situation the Sample Rate Converter switch should be set to OFF and all other external audio equipment should be synchronised to the MA64's wordclock output (WK Out).

Q: Is the wordclock input terminated?

A: Yes, it is internally terminated at 75 ohms.

Sample Rate Converters:

Q: What are the Sample Rate Converters for?

A: In the traditional sense, Sample Rate Converters (SRCs) do as they say; convert an incoming or outgoing audio source from one sample rate to another. In the case of the MA64, when switched on the SRCs synchronise the incoming MADI source to that of the wordclock, AES or video reference inputs (whichever of the three is selected).

Q: When should an SRC switch be set to OFF?

A: The only time an SRC switch should be set to OFF is when Dolby® content is embedded within the MADI stream. If this situation does arise then MA64 synchronisation must be set to reference the MADI input (unless all equipment is syncronised to a house clock). MA64 will then become the sync master reference source. Ensure that other equipment then synchronises to the unit's Wordclock output (WK Out).

Q: Can Sample Rate Conversion be applied to the MADI outputs?

A: No. The MADI Loop-through outputs are a regenerated copy of the MADI input stream.

Audio Outputs:

Q: Is there an easier way to access the AES outputs than wiring directly to the 25-way and 37-way Dsubs?

A: Yes, Bel also manufacture a 1U AES3-id breakout unit (ASBO) that connects directly to MA64 and provides the 32 unbalanced AES outputs on BNC connectors (75 ohm). Likewise, each 1U BOB/O-32 breakout panel can be used to connect to two of the 25-way AES/EBU output connectors, thus providing 16 AES output pairs on XLR connectors. Contact your Bel dealer for further information.

Q: Are the audio outputs always available?

A: Yes, both balanced and unbalanced AES are simulteniously available.

Q: What fibre optic MADI cable should I use?

Recommended fibre types are 62.5/125 µm or 50/125 µm, multi-mode. An SC type fibre optic connector is fitted to MA64. Single-mode can be specified at time of order.

MADI	
Input	1 x SC socket multi-mode (single-mode option available) 1 x Coaxial 75Ω BNC
Loop-through output	1 x SC socket multi-mode (single-mode option available) 1 x Coaxial 75Ω BNC
Format	64 channel, compliant with AES10id-2008
Sample frequency	44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz
Higher frequency protocols	SMUX and High Speed (for 88.2 kHz and 96 kHz sample frequencies)
Data Rate	125 Mbps ±25ppm
AES	
AES/EBU outputs*	4 x Dsub-25 female (TASCAM format) 110Ω balanced
AES3-id outputs*	1 x Dsub-37 female 75Ω unbalanced
Sampling frequency	44.1 kHz to 96 kHz (SMUX and High Speed)
Synchronisation	
Sample Rate Conversion	SRC available for all channels, switchable
Sources	Word clock, AES, Video Black-and-Burst, MADI
Video Sync input	PAL/NTSC 50/60 Hz (SD)
Word clock input	44.1 kHz to 96 kHz, DC coupled, positive going pulses
Word clock output	Follows Word clock input, DC coupled, positive going pulses (derived from incoming reference signal)
AES input	44.1 kHz to 96 kHz
AES output	44.1 kHz to 96 kHz (derived from incoming reference signal)
Power supply	
Type	2 x independent switch-mode regulated, auto-ranging
Inputs	2 x 90 to 264 V AC, 50/60 Hz
Power consumption	16 W
Connectors	2 x IEC with retaining clips
Physical	
Dimensions (w x d x h)	483 x 200 x 44.5 (mm) / 19" x 7.87" x 1.75" [1U]
Weight	4 kg / 8.8lbs

* Breakout panels are available.

TASCAM is a trademark of TEAC Corporation.

Specifications and information contained in this manual are subject to change at any time without notice.

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