

MARENIUS

ELEKTRONIKUTVECKLING

A2B TO MADI INTERFACE

64 CHANNELS

2x A2B BUSSES

AUTOMATIC clock SYNCHRONIZATION

MADI clock RECOVERY

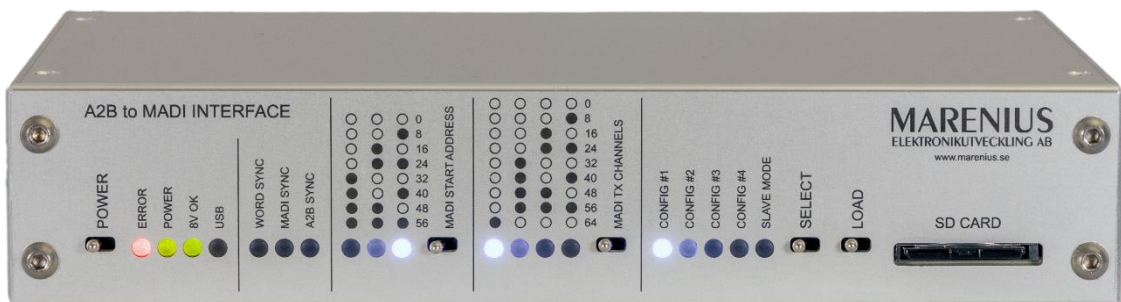
USB SD CARD READER

EXTERNAL A2B PROGRAMMING

Multiple CONNECTION options

| MANUAL |

FW 1.0.0
Version 1.00



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1. General description

The A2B-MADI interface is a 64 channel A2B to MADI and MADI to A2B bidirectional full duplex interface. The device can be used for synchronizing analog audio signals with a third-party PC sound interface with MADI capabilities and A2B transferred analog audio signals. Other third-party MADI interfaces can also be used when synchronized analog audio signals is needed.

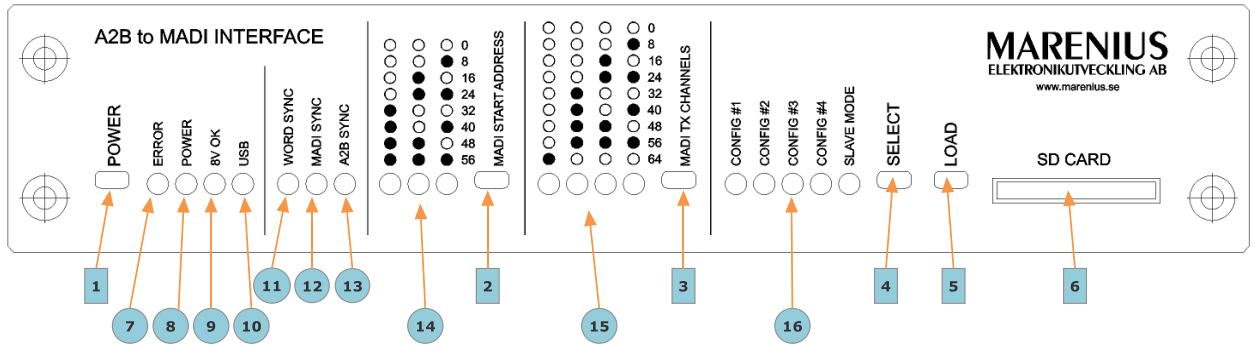
The device holds two A2B interfaces carrying 32 channels each. Word clock in and out is supported on BNC. Each A2B interface has three different connectors to choose from allowing the user to use the connector that fits the application.

The MADI interface is optical and the device can sync the internal sample clock to the incoming MADI stream. Both A2B master and A2B slave is supported. The MADI start channel and active channels can be configured via the front panel of the unit. The setup is done thru Sigma Studio (ADI property) via USB and can be stored on a SD card for offline configuration of the A2B bus. All settings done by the user interface is stored to the device allowing the user to initialize a complete system on power-up.

The A2B-MADI interface is housed in a heavy-duty aluminum cabinet.



2. Front panel



1 **Power switch / word clock input disable.**

This switch power-ups the device. To toggle word clock input disable, hold the switch for at least 3 seconds. The word clock input LED is flashing when the word clock input is disabled. To power of the device toggle the switch fast.

2 **MADI start channel switch**

To select MADI start channel toggle the switch until the correct setup is shown by the MADI start channel LEDs. (See MADI START CHANNEL LEDs).

3 **MADI TX channels switch**

To select MADI TX (transmit) channels toggle the switch until the correct setup is shown by the MADI TX channels LEDs. (See MADI TX CHANNELS LEDs).

4 **Configuration selection switch**

To select configuration toggle the switch until the correct setup is shown by the configuration LEDs. (See configuration LEDs).

5 **Load configuration switch**

To load the selected configuration, toggle the load configuration switch.

6 SD Card slot

The SD card slot accepts SDHC and SDXC cards. The card must be placed in the connector facing upwards. The socket is a push-push socket. *Note: do not use force when inserting or removing card.*

7 Error LED

The error LED is indicating if an error has occurred. The table below describes different error

☹ OFF	No error detected
☹ ON	Sync error internal or external
☹ 1Hz	Start-up error
☹ 5Hz, 5 times	SD-Card load error

8 Power LED

The power LED is lit when the device is on.

☹ OFF	Not powered up
☺ ON	Powered up

9 8V Phantom LED

The power LED is lit when 8V phantom power to the A2B bus internally generated.

☹ OFF	8V not powered up
☺ ON	8V Powered up

10 USB LED

The USB LED is on when the device is connected to a USB host.

☹ OFF	No USB detected
☺ 10Hz	USB detected

11 Word clock sync LED

The word clock sync LED is indicating external word clock feed thru the BNC word clock input.

☹ OFF	No external word clock detected
☺ ON	Word clock input detected
☺ 2Hz	Word clock input disabled by the user

12 MADi sync detected LED

The MADi clock sync LED is indicating sync thru MADi, this sync is internally generated from the MADi sample rate.

☹ OFF	No MADi sync detected
☺ ON	MADi sync detected

13 A2B sync LED (Slave mode only)

The A2B clock sync LED is indicating sync thru A2B, this LED is only valid in slave mode.

☹ OFF	No A2B sync detected
☺ ON	A2B sync detected

14 MADI start channel LEDs

These LEDs is indicating the MADi start channel in binary format.

LED3	LED2	LED1	
			Start channel 0
		☀	Start channel 8
	☀		Start channel 16
	☀	☀	Start channel 24
☀			Start channel 32
☀		☀	Start channel 40
☀	☀		Start channel 48
☀	☀	☀	Start channel 56

15 MADi channel count LEDs

These LEDs is indicating the number of channels transmitted on the MADi interface by the device.

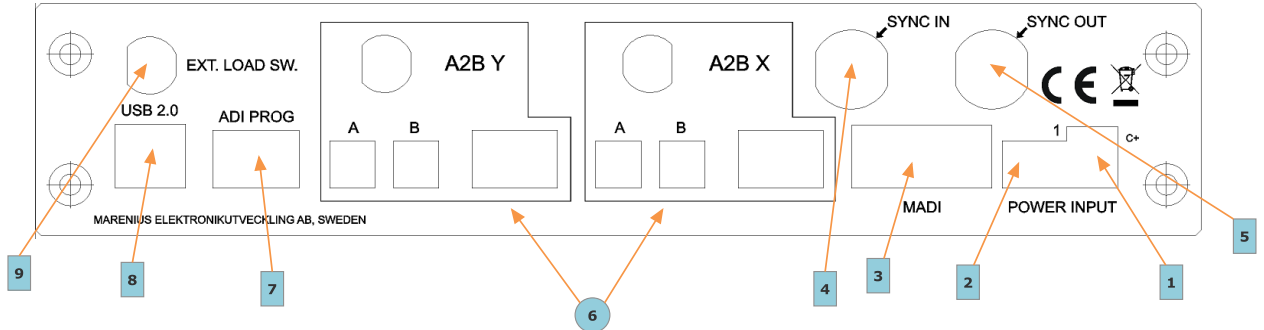
LED4	LED3	LED2	LED1	
				0 TX Channels
			☀	8 TX Channels
		☀		16 TX Channels
		☀	☀	24 TX Channels
	☀			32 TX Channels
	☀		☀	40 TX Channels
	☀	☀		48 TX Channels
	☀	☀	☀	56 TX Channels
☀				64 TX Channels

16 Configuration LEDs

These LEDs is selecting the configuration of the device. The configuration has to be loaded to the device with the load switch. Each master configuration is connected to a configuration file loaded from the SD-card.

LED1	LED2	LED3	LED4	LED5	
☀					A2B Master configuration 1
	☀				A2B Master configuration 2
		☀			A2B Master configuration 3
			☀		A2B Master configuration 4
				☀	A2B Slave
☀	☀	☀	☀		A2B Master, USB control
				☀	A2B Slave, USB control

3. Back panel



1 External power input (plug)

An external power source must be connected to the unit. The voltage level must be between 9V and 18V. The power supply shall be able to source at least 2A for handling current transients drawn by the unit. If the voltage is too low the 8V phantom LED will turn off. The polarity is shown below.



2 External power input (screw terminal)

The external DC can be supplied through a screw socket. The DC input can either be connected as normal switch-on from the front panel or be switched on and off directly with the power supply input.

Pin 1 is located closest to the DC input plug. To use automatic power on, place a wire jumper from pin 1 to pin 3.

PIN 1	PIN 2	PIN 3
V+	GND	Connect to pin 1 to power on

Note: Do not use both power supply inputs at the same time.

3 MADI optical connector (SC connector)

The MADI optical connector has one TX connector and one RX connector. The MADI interface is preconfigured for 48KHz, 64 channels.

4 Word clock input (BNC 75Ω)

The word clock input can be used to synchronize the unit to an external word clock, the level of the signal must be within 4 and 5.5V and the external transmitter has to be able to drive 75 ohms.

5 **Word clock output (BNC 75Ω)**

The word clock output is intended to drive an external word clock input accepting 5V word clock and has an output impedance of 75 ohms.

6 **A2B interface connectors**

The unit holds two A2B interfaces, each interface has three different connector options. The A2B X interface can function as both master and slave while the A2B Y interface only supports A2B master mode. The pinning for each connector type is listed below.

	LEMO EGG.0B.304.CLL	MOLEX MINI50 349128040
PIN 1	B-	A-
PIN 2	B+	A+
PIN 3	A+	B+
PIN 4	A-	B-

	MOLEX 5023520200
PIN 1 (A Connector)	A-
PIN 2 (A Connector)	A+
PIN 1 (B Connector)	B+
PIN 2 (B Connector)	B-

Note: Do not use multiple connector types for each interface at the same time.

Mating parts:

LEMO FGG.0B.304.CLAD52Z

MOLEX MINI50 347910040 Polarization A

MOLEX DuraClick 5601230200, Terminal 5601240101

7 **A2B programming connection**

The unit can program external A2B chips thru the 10p header. This connector is configured according to analog devices EVAL-ADUSB2EBZ. The pinout for the A2B programming header is shown in the table below.

PIN 1	SCL	PIN 2	-
PIN 3	SDA	PIN 4	ADI DETECT
PIN 5	-	PIN 6	USB RESET
PIN 7	-	PIN 8	-
PIN 9	-	PIN 10	-

8 **USB Connector (USB B)**

The USB connector is intended to connect to a USB host. The device is a composite device containing three different USB devices, SD card reader, A2B programming chipset and a virtual com port. The virtual com port is a future function that could be used for remote setup.

9 **External load input**

To load a configuration via an external switch this input can be used. The switch should be connected between the two pins. The user can also connect both pins to ground to trigger the external load function.

4. Powering up the A2B to MADi interface

To power up the unit connect a 9 to 18V power supply to the back of the unit. Toggle the power switch. At start-up the device tries to load the last configuration if this is not working the error LED will flash with 2Hz five times. This is normally the case when starting up a new device.

5. Setup the A2B configuration

The user must use sigma studio to setup the device or write own XML files to setup the A2B bus.

Preceding steps:

1. Install Sigma Studio revision 4.4 or later (See analog devices homepage for information).
2. Install the A2B sigma studio DLL.
3. A MADi interface is needed and has to be setup correctly, the unit has been tested with RME Madiface USB and RME Madiface XT.

Steps:

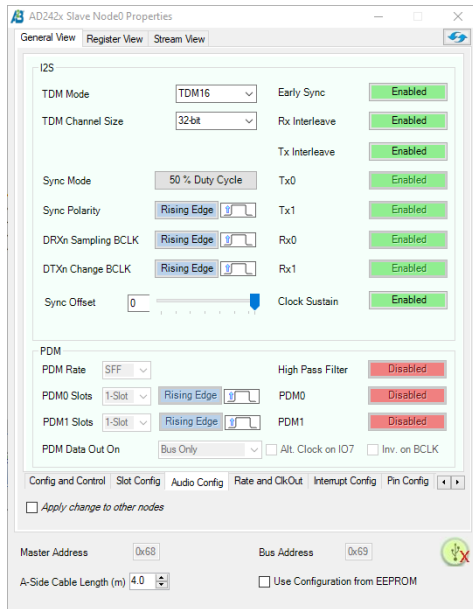
1. Connect the device to the computer that has Sigma Studio is installed via USB.
2. The USB LED shall be flashing fast.
3. Setup the A2B system that the A2B interface is connected to, example files are provided for PDM mics, Analog devices sound card (Slave mode) and Analog devices EVAL-AD2428WG1BZ.
4. **Make sure that the configuration diodes are correctly indicating A2B master or slave mode.**
5. **To work correctly the device must be connected to an A2B bus before the configuration of the A2B bus is loaded.**
6. To compile and download a configuration, press LINK COMPILE DOWNLOAD in sigma studio.
7. If the download is successful, the A2B channels is now mapped into the MADi channels and vice versa.

The TDM interface between the internal A2B chips and the internal processing unit must be configured correctly to work. Below the TDM configuration for master mode is illustrated.



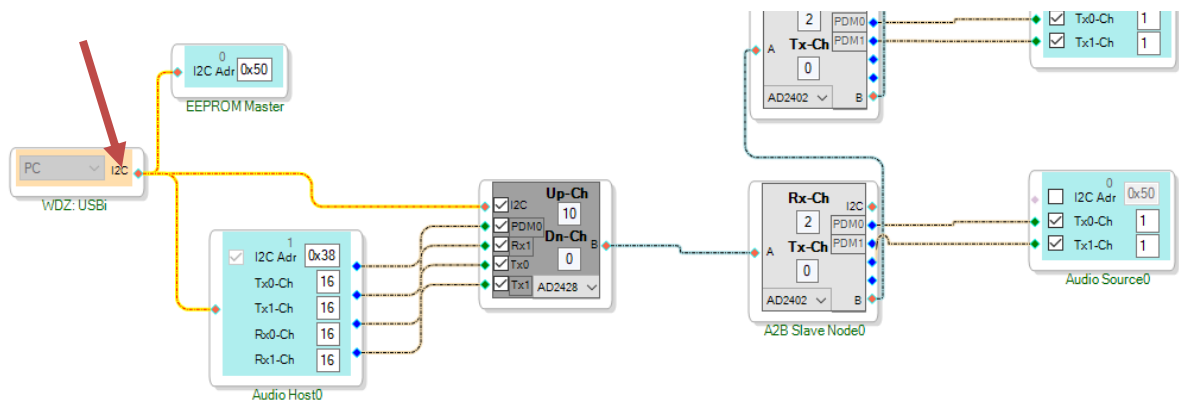
Master mode TDM configuration

When the A2B interface of the device is operating as slave the TDM interface must be configured as illustrated below (When using A2B soundcard v2 for testing, de-solder R42 on the soundcard since the programming input on the soundcard is very sensitive to EMC which easily causes the soundcard to reset).

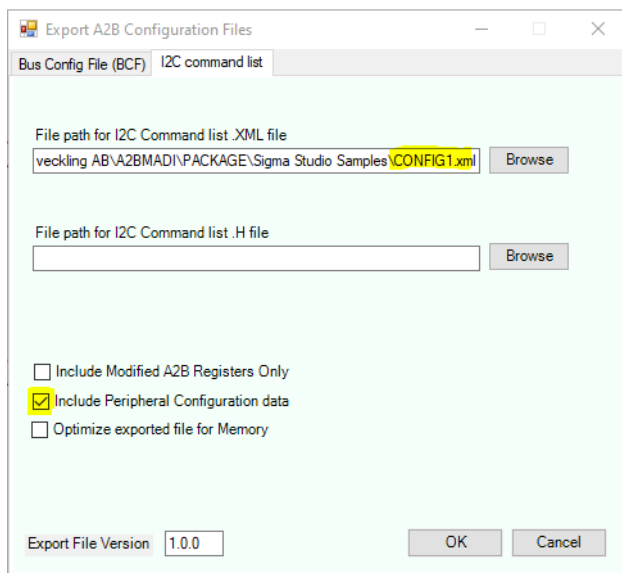


Slave mode TDM configuration

The user can save the settings when compiled to the SD card as a configuration file. To generate the configuration file the user right clicks the process block (red arrow) in the sigma studio schematic and selected "Export System Config Files".



To export a XML system config file choose the I2C command list tab and select a path for the .XML file (not the .H file). The file shall be named CONFIGx.XML where the x is a number between 1 and 4. This number is representing the config LED on the front panel. Make sure to select "Include Peripheral Configuration data".



Press OK.

The file is now ready to be put onto the SD card. The device has a built in SD card reader interface, if the USB is plugged in and a SD card is inserted, the device shall appear in the file explorer. Copy the file to the SD card.

6. SD Card reader

The internal SD card reader support SD, SDHC and SDXC card. The card has to be formatted according to FAT32.

Normally SD cards can be formatted into FAT32 directly under windows, however when using larger SDXC cards a formatting utility must be used. A free copy of *EaseUS partition master* can be downloaded from <http://www.easeus.com/download/epmf-download.html>.

Important notes on SD cards:

1. Do not store any other files than the CONFIG files on the SD card.
2. Always begin with a clean card.
3. Format the SD card into FAT32 only.
4. SD cards are electrostatic sensitive.
5. Do not delete single files on the cards, this will end up in fragmented volume.
6. If the card is fragmented, errors may occur.
7. Do not remove the SD card when reading or writing to the card.

7. Clock synchronization






The interface holds an advanced clock synchronization functionality and can be clocked from different master clocks. There is also an internal clock fallback if no external clock is provided. There flowing clock modes can be used and the device is automatically switching between clocks if a clock is detected. The clocking scheme is prioritized. When a higher priority clock is detected the device automatically switch to this clock. If the clock is removed the device is falling back to a lower prioritized clock. The word clock output always reflects the used clock. The priority of the different clocks is listed below where a higher number is representing a higher priority.

A2B Master mode clocking scheme		
Valid clock input	Priority	Word clock output signal
<i>Word clock input</i>	3	<i>Word clock input*</i>
<i>MADI clock recovery</i>	2	<i>MADI clock recovery</i>
<i>Internal clock</i>	1	<i>Internal clock</i>
<i>A2B clock (Not valid in this mode)</i>	0	<i>Internal clock</i>

*The user can manually disable the word clock input, the device fall back to nearest priority valid clock.

A2B Slave mode clocking scheme		
Valid clock input	Priority	Word clock output signal
<i>A2B Clock</i>	2	<i>A2B Clock</i>
<i>Internal clock</i>	1	<i>Internal clock</i>
<i>Word clock input (Not valid in this mode)</i>	0	<i>Internal clock</i>
<i>MADI clock recovery (Not valid in this mode)</i>	0	<i>Internal clock</i>

The table below shows valid clock indications.

<i>WCLK SYNC</i>	<i>MADI SYNC</i>	<i>A2B SYNC</i>	
			The device is in sync, however no valid MADI data is presented. The MADI face is down.
			Device is in synchronization to word clock and MADI sync is presented.
			Device is synchronized to MADI and MADI sync is detected.
			Device functions as slave and is synchronized to A2B X clock.

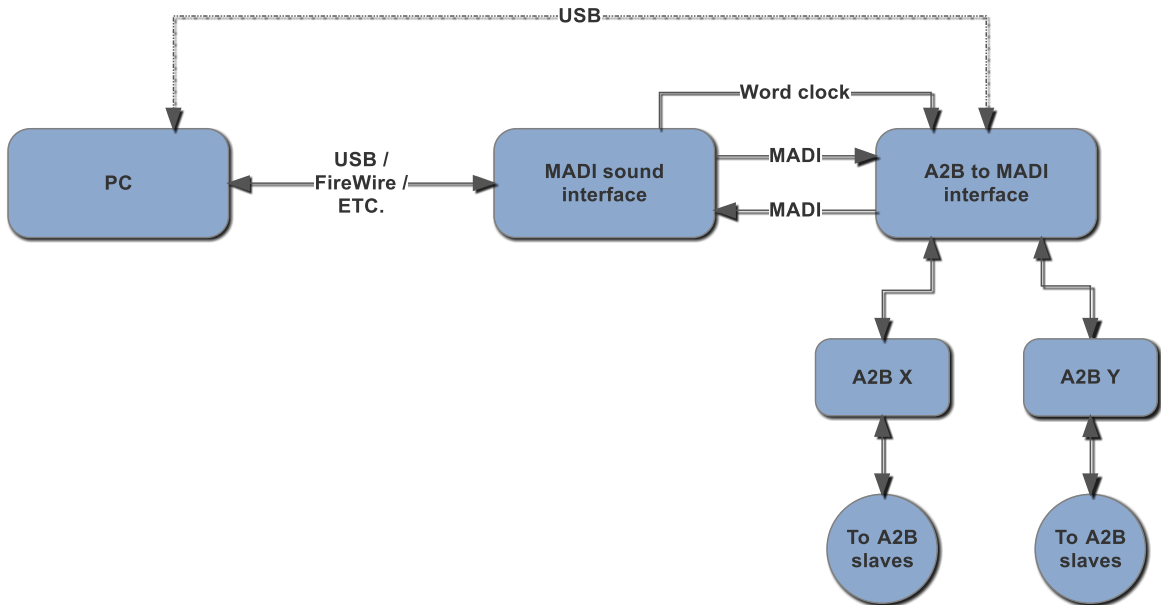
To function properly the third party MADI sound interface needs to be in sync with the device the recommended connection diagrams is shown in the next chapter.

Note: The A2B bus is very sensitive to jitter on the clock, therefor a configuration load may be needed when the device is switching between clocks.

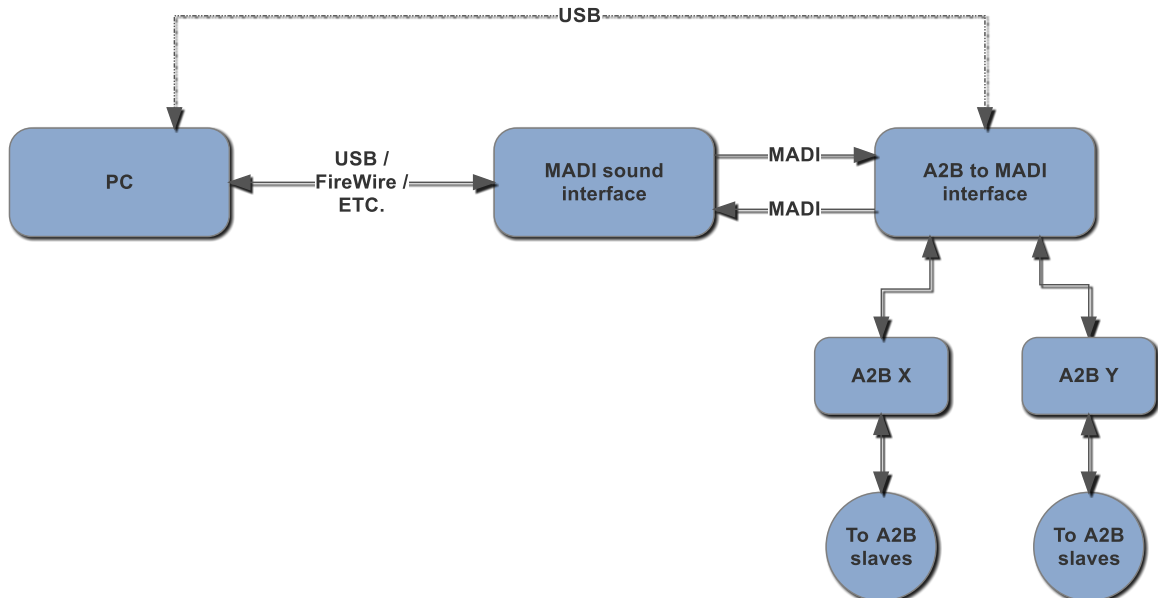
8. Recommended connection diagrams

8.1 A2B Master mode, recommended connection diagram

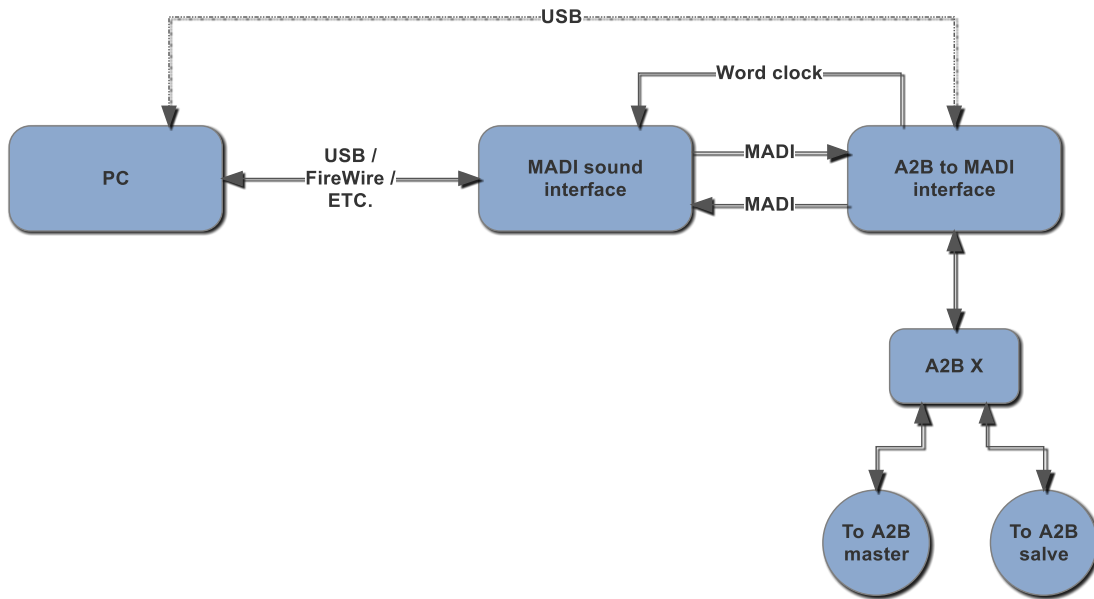
The USB connection is optional, if the USB is disconnected the device functions in standalone operation mode.



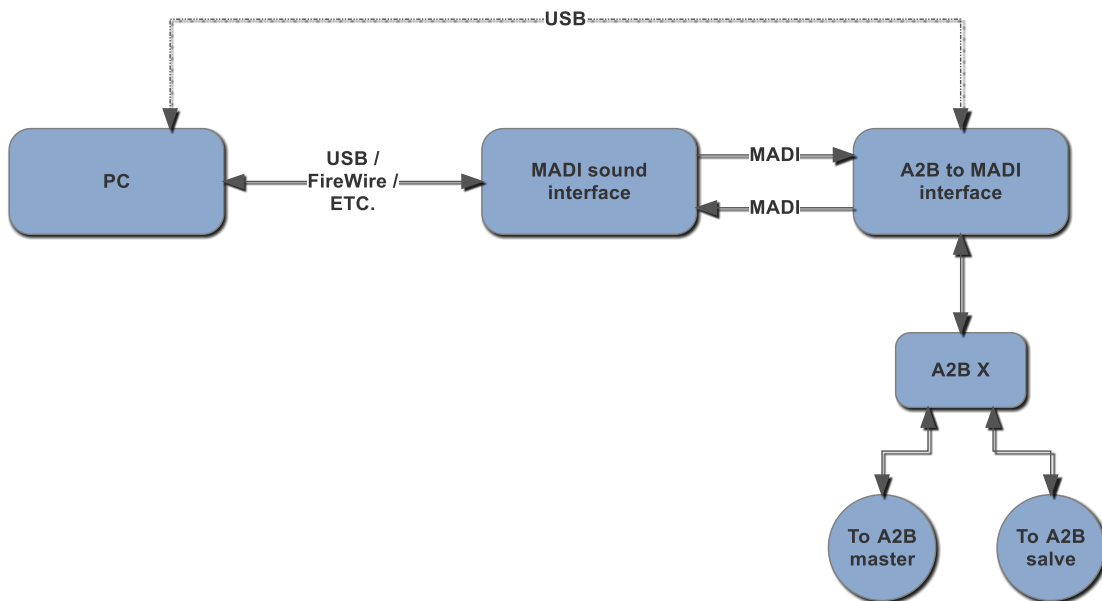
8.2 A2B Master mode, alternative connection diagram



8.3 A2B Slave mode, recommended connection diagram



8.4 A2B Slave mode, alternative connection diagram



9. Device functionality

The MAD I-A2B basic functionality is to convert two A2B busses (A2B X and A2B Y) into one MAD I interface. The user can choose MAD I start address and how many channels the device occupies. This enables the user to link the MAD I interface to multiple MAD I devices.

When running in standalone mode a config file can be loaded from the SD card to configure the A2B busses. Sigma studio 4.4 and 4.5 has issues dealing with two interfaces but workarounds exists. Later versions may be handling this issue better. The XML file can manually be edited to support two interfaces.

The A2B chips is located at the following I2C addresses: **these addresses must be used in sigma studio and/or the XML file for correct operation.**

Chip / Connectors	I2C Address	A2B functionality
A2B X	0x6A	Master or Slave
A2B Y	0x6C	Master only

The device is able to configure external A2B interfaces thru the programming header if these chips are located at address 0x68 or 0x6E.

When the device is connected according to one of the connection diagrams illustrated in the previous chapter the user can load a configuration to the device via USB or SD card. The configuration files must be named CONFIG1.XML, CONFIG2.XML, CONFIG3.XML or CONFIG4.XML, each configuration is connected to the configuration LEDs at the front panel.

The device can indicate both word clock sync and MAD I sync, however since external word clock sync has higher priority the external word clock is used.

The A2B to MAD I interface automatically tries to program the A2B buss(es) on power up, if this fail the user can load another configuration or adjust the configuration. When programing the device from sigma studio the user has to manually select if the A2B bus shall be in slave mode or master mode. To change between master and slave mode when the USB is connected push the config select switch.

The USB can be disconnected by removing the cable or hold the load button for 3 seconds, the configuration LEDs is flashing when exiting USB mode. To re-connect the USB bus hold the load button for 3 seconds (only valid if a USB cable is connected).

The MAD I interface is fixed to 64 channels 48kHz.

The A2B channels is default mapped to the MAD I interface according to the table below.

MADI START ADDR	MADI START ADDR + 8	MADI START ADDR + 16	MADI START ADDR + 24	MADI START ADDR + 32	MADI START ADDR + 40	MADI START ADDR + 48	MADI START ADDR + 56
A2B X Channel 0-7	A2B X Channel 8-15	A2B X Channel 16-23	A2B X Channel 24-31	A2B Y Channel 0-7	A2B Y Channel 8-15	A2B Y Channel 16-23	A2B Y Channel 24-31

If the start address is set to anything else than 0, the 64 channels is truncated and the channels before the start address will be replaced with incoming MAD I data. If the MAD I channel count is lower than 64 the interface will replace the channels from the end with the incoming MAD I data. This means that channels can be passed thru the device in a MAD I daisy chain configuration.

10. Technical specification

Power supply voltage.....	9-18V
Power consumption (Average).....	3.5W
MADI channels	64
MADI supported sampling rates.....	48kHz
MADI connector	SC
A2B channels.....	64
A2B supported sampling rates	48kHz
A2B supported modes	master/slave
SD card support.....	SD, SDHC, SDXC
File systems supported.....	FAT32
Latency, MADI input to A2B bus master.....	1 sample
Latency, A2B bus slave to MADI output.....	1 sample
Latency, A2B master to A2B slave.....	50uS
Latency, A2B slave to A2B master.....	50uS
Hight	44mm
Width	219mm
Depth.....	155mm
Weight	TBD