LX-MADI

Multichannel MADI PCI Express Sound Card

User Manual

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1 INFORMATION FOR THE USER

This device complies with part 15 of FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a CLASS B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions contained in this data sheet, may cause harmful interference to radio and television communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient or relocate the receiving antenna
- increase the separation between the equipment and the receiver
- connect the equipment into an outlet on a circuit different from that of the receiver
- consult the dealer or an experienced radio / television technician.

Note: *Connecting this device to peripheral devices that do not comply with CLASS B requirements or using an unshielded peripheral data cable could also result in harmful interference to radio or television reception.*
To ensure that the use of this product does not contribute to interference, it is necessary to use shielded I/O cables.
The user is cautioned that any changes or modifications not expressly approved by Digigram could void the user's authority to operate this equipment.

Warning:

	*Electrostatic discharge (ESD) can damage several components on the board. To avoid such damage in handling the board, take the following precautions:* *Bring the device and everything that contacts it to ground potential by providing a conductive surface and discharge paths. As a minimum, observe these precautions:* ● *Disconnect all power and signal sources.* ● *Place the device on a grounded conductive work surface.* ● *Ground yourself via a grounding wrist strap or by holding a grounded object.* ● *Ground any tool that will contact the device.*	

2 IMPORTANT NOTICE

This card has been tested and found to comply with the following standards:

- International: CISPR22 Class B.
- Europe: EMC 89/336/CEE (1992) specifications.
- United States: FCC Rules-Part 15-Class B (digital device).

3 FEATURES

Main hardware features

- PCI EXPRESS™ x1 (PCIe®) bus, compatible with PCIe® x1, x4, x8 or x16 slots.
- 1 optical connector for MADI I/O
- 1 BNC connector for WordClock In or Out
- Sampling frequency:
  From internal clock: 44.1 kHz, 48 kHz, 88.2 kHz and 96 kHz
  From MADI: 44.1 kHz, 48 kHz, 88.2 kHz and 96 kHz
  From Word Clock: 44.1 kHz, 48 kHz, 88.2 kHz and 96 kHz

3.2 Main software features

- Low latency WDM DirectSound, ASIO, and Linux Alsa drivers.
- Card can be used through the following programming interfaces (APIs): DirectSound kernel streaming, DirectSound, WASAPI, ASIO, Alsa.
- 32 stereo DirectSound playback devices / 32 stereo DirectSound recording devices up to 48 kHz.
  16 stereo DirectSound playback devices / 16 stereo DirectSound recording devices at 88.2 kHz and 96 kHz.
- 32 stereo ASIO playback channels / 32 stereo ASIO recording channels up to 48 kHz.
  16 stereo ASIO playback devices / 16 stereo ASIO recording devices at 88.2 kHz and 96 kHz.
- 64 mono Alsa playback channels/ 64 mono Alsa recording channels up to 48 kHz.
  32 stereo Alsa playback devices / 32 stereo Alsa recording devices at 88.2 kHz and 96 kHz.
- Real-time, simultaneous record and playback in PCM (16 and 24 bits) of 64 mono I/O channels

3.3 MADI features

- Support of 64 channels mode in the NFS range (Normal Frequency Sampling): 44.1 kHz and 48 kHz
- Support of 32 channels mode in DFS range (Dual Frequency Sampling): 88.2 kHz and 96 kHz sampling frequency
- Synchronization on the MADI stream

Note about DFS mode
When running at dual sampling frequencies (88.2 kHz and 96 kHz), LX-MADI works in the High Speed mode. High Speed mode means that the MADI-embedded reference signal has a frequency of 88.2kHz to 96kHz.
SMUX2 mode is not supported (in SMUX2 mode, the frequency is 44.1kHz to 48kHz).

4 REQUIREMENTS

4.1 Minimum hardware requirements

- PC with one free PCI Express slot (x1, x2, x4, x8, x16).
- Required CPU power and memory depend on the operating system and on the software applications used.
- Multi-mode optical fiber
- If necessary, cable with BNC connector for the WordClock input or output

Software requirements

LX-MADI requires installation of the drivers included in the LXMADI-Kit. This kit includes:

- a WDM DirectSound driver
- an ASIO driver, which installation is optional

Supported operating systems

LX-MADI runs under Windows 7, Windows 8, Windows 10, Windows 2008 Server, 32-bit and 64-bit versions, and Windows Server 2012, and Linux.

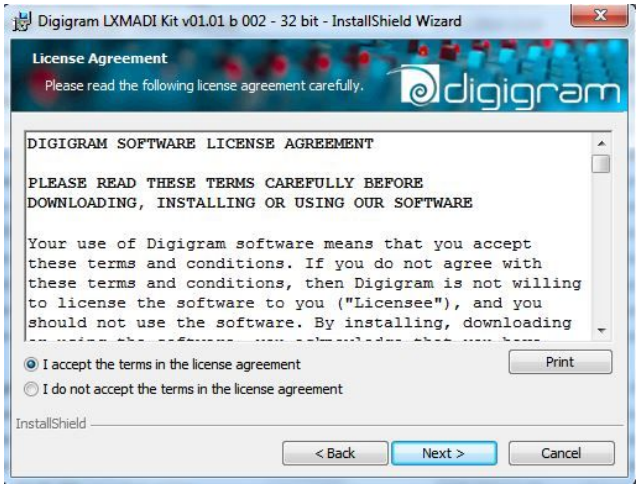
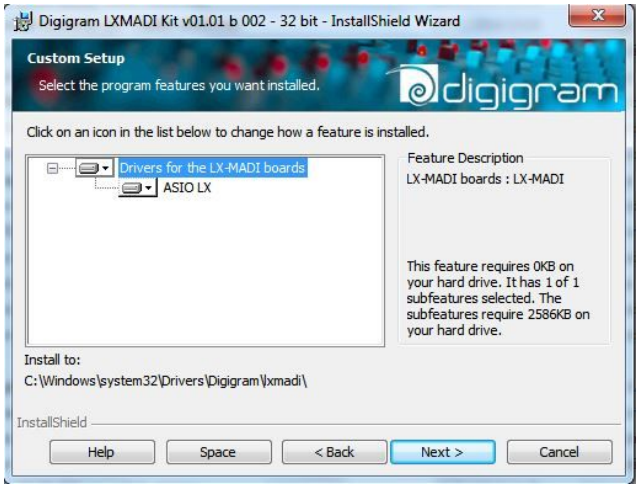
5 SOFTWARE INSTALLATION AND CONFIGURATION UNDER WINDOWS

The installation of the software requires administrator rights on your computer.

Please visit the Digigram web site at **www.digigram.com** for the most recent driver.
In case you run a specific application developed or installed by a Digigram Partner, this application might require the use of a given driver version. In this case, make sure that the updated driver has been approved by your supplier.

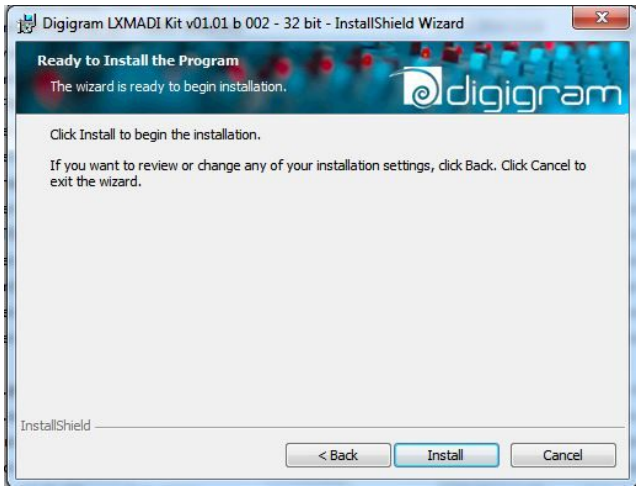
5.1 Installation under Windows operating systems

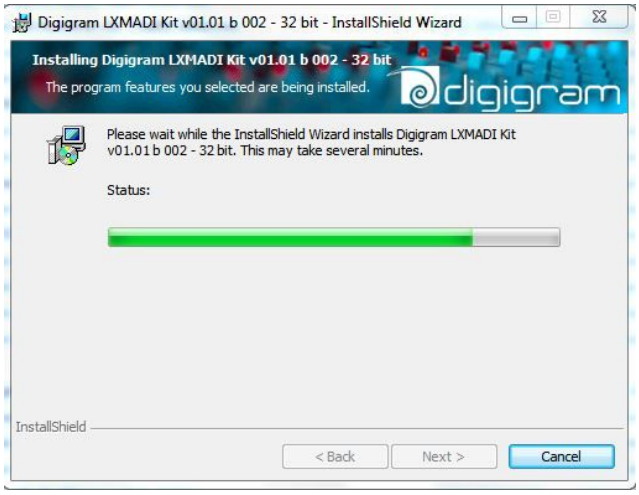
- Shut down your computer, insert the LX-IP card in a free PCI EXPRESS™ slot, and screw it on the frame of the computer.
- Start the computer.
- Once the Windows session is opened, click on “Cancel” when the “Found New Hardware” Wizard appears.
- Double-click on the ***LXMADI-Kit vxx.msi*** icon to launch the driver installation.

A “Welcome” message is displayed, click ***Next*** to continue.	
The “License Agreement” window appears: read it, and select ***“I accept the terms in the license agreement”*** to approve it. Click ***Next***.	
In the “*Custom Setup*” window, the “Drivers for the LX board” are displayed. The WDM driver is always installed. The ASIO driver installation is optional and can be selected/unselected. It is selected by default. Click ***Next***.	

In the "*Ready to Install the Program"* window, click on ***Install*** to start copying the files.

A Windows message may appear asking for the authorization to install the driver. Confirm the installation.

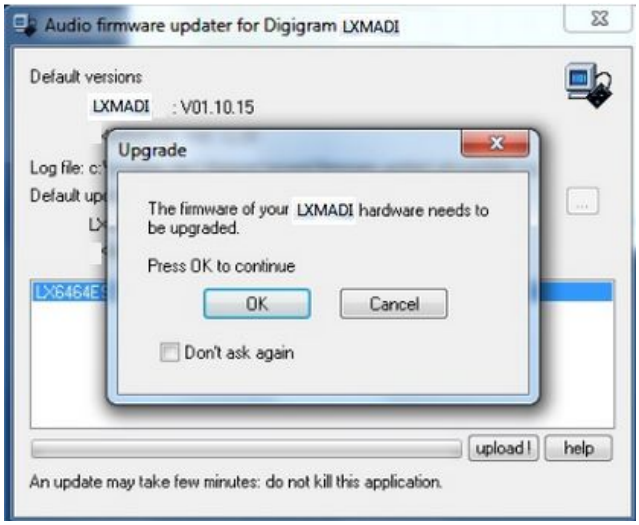




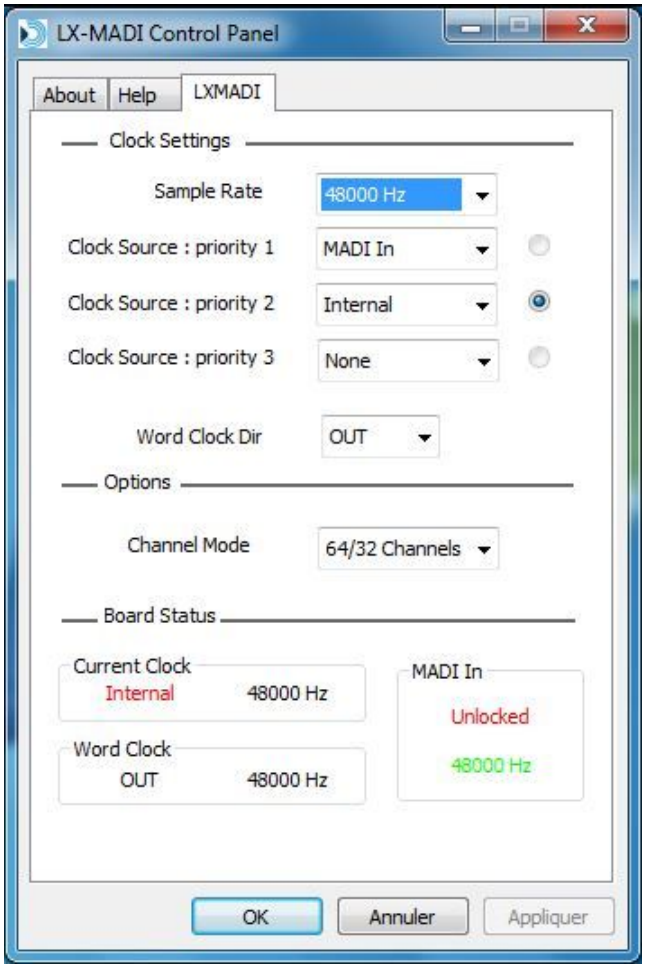
Once the driver files have been copied to your disk and the driver has been started, the firmware version of the LX-MADI card is compared with the firmware version included in the driver package.

If the firmware of your card requires an update, the firmware update application starts. You are then prompted to continue the firmware update.
The update is recommended so that the driver runs with the appropriate firmware version for optimal performance.
Press **'Ok'** to continue the firmware update procedure.

The update MUST IN NO CASE BE INTERRUPTED. If you do so, the card may have to be returned to our After Sales Service.



The LX-MADI control panel window is displayed during the driver installation process so that you can configure its parameters.



Clock settings

- *Sample rate:* Sampling frequency value of the internal clock. In case the clock source is MADI or WordClock, make sure the selected frequency value matches the frequency of the external clock (see section Board Status)
- *Clock source:priority 1:* Select the clock source that is to be used in top priority (MADI, Wordclock, internal). If an external clock is selected (MADI or Wordclock), another clock source can be defined on a lower priority.
- *Clock Source: priority 2*: Select the clock source that is to be used if the clock defined on the first priority fails or is not defined.
- *Clock Source: priority 3*: Select the clock source that is to be used if the clock defined on priorities 1 and 2 are both in failure or not defined.

The following bullet point is displayed in front of the clock that is in use .

The switching between the clock source priorities is automatic.

- *Word Clock Dir* : Allows selecting the direction of the Word Clock BNC connector. If Word Clock is selected in a clock source priority, Word Clock Dir is automatically set to IN; the Word Clock signal received from this input is decoded and filtered by LX-MADI in order to synchronize the MADI receiver and transmitter clock.
  Select OUT so that the LX-MADI generates a Word Clock signal synchronous of the LX-MADI clock source.

Options

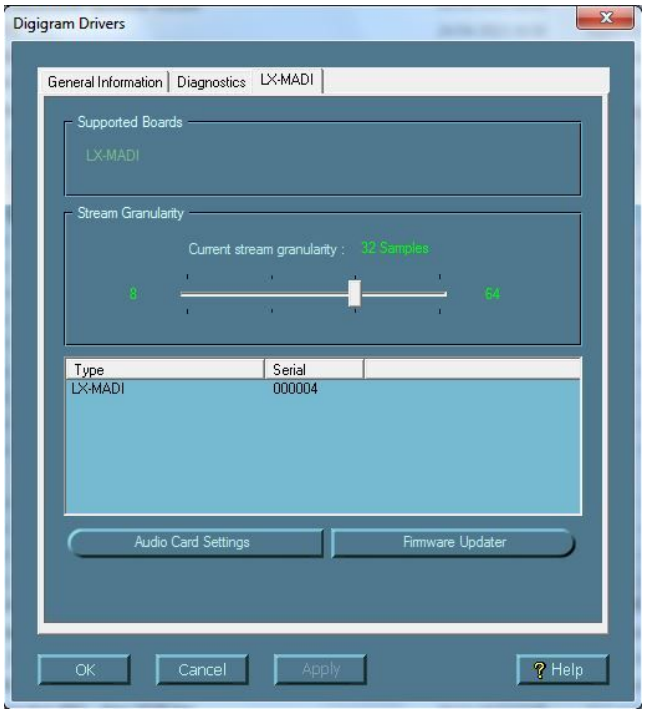
- *Channel Mode*: channel mode of the MADI output.
  64 / 32 channels or 56/28 channels (at 44.1 & 48 kHz / 88.2 & 96 kHz)
  Note that LX-MADI card works at “High Speed” mode at 88.2 kHz and 96 kHz. “SMUX2” mode is not supported.

Board Status

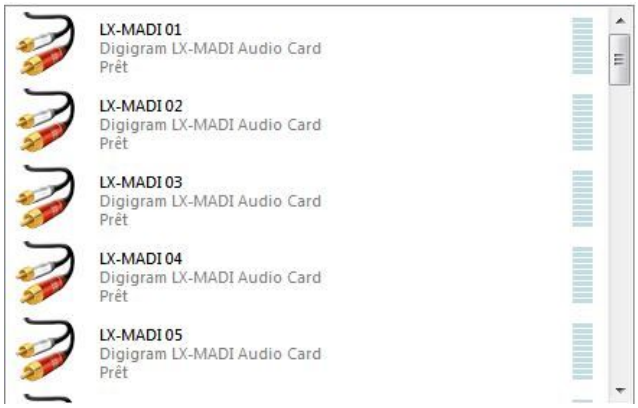
This section displays information reported from the card.

- *Current clock*: displays the current clock source and its frequency.
- *Word clock*: displays the direction of the Word clock signal and its sampling frequency.
- *MADI In*: displays the status of the MADI connection.
  Locked/Unlocked: means that valid MADI frames are detected
  Frequency: displays the sampling frequency detected on the MADI input.

Note: parameters displayed in red mean there is a mismatch between the requested value and the detected value/status

Click on “OK” to confirm the parameters.	
From the displayed “Digigram drivers” window, you can select the Stream granularity[1] of the card (number of samples processed at a time). The lower the granularity, the lower the audio latency. Default value is 32 samples. When using DirectSound/Wasapi based software applications, the selection of a lower value may produce audio dropouts, depending on the PC configuration. When using the card, if audio dropouts are experienced, it may be necessary to increase the granularity. Granularity can be: 8, 16, 32, or 64 samples. Note: Button “Audio Card Settings” allows displaying the LX-MADI control panel Click on ***Ok***.	
Click on the ***Finish*** button of the next window to complete the driver installation.	

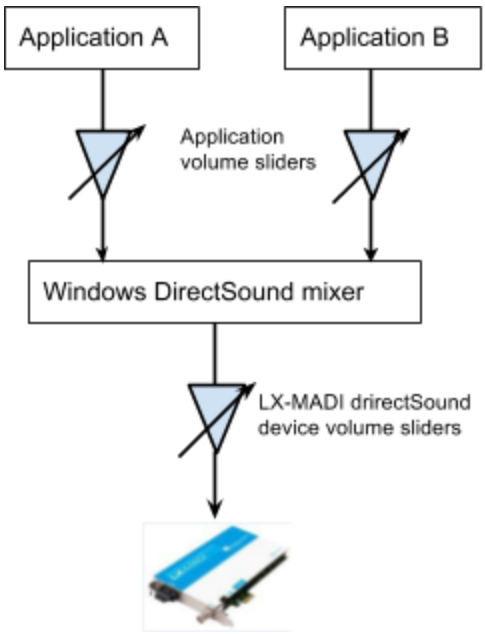
[1] *The granularity corresponds to the computing unit of the card. It is expressed in samples.*

Once the driver is installed, the 32 stereo DirectSound devices are visible from the Windows “Sound” control panel, by clicking on the “Playback” tab, and “Recording” tab. The VU meters are displayed in front of each device. Note that depending on the Windows flavour, the DirectSound devices may be displayed disordered.	

5.2 Microsoft volume mixer panel

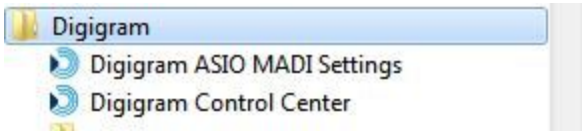
The Windows volume mixer can be displayed from the loudspeaker icon in the Wiindows task bar.

The volume slider associated to the LX-MADI DirectSound device applies a digital gain to the audio samples sent to the card. In case some applications use the device, they appear in the “Applications” section of the Volume Mixer GUI, with a volume slider for each application.	

The volume slider associated to an application allows applying a digital gain to the audio samples played by the application, right before the Windows DirectSound mixer. The volume slider associated to the LX DirectSound device applies a digital gain to the audio samples coming from the DirectSound mixer, before they are sent to the card.	

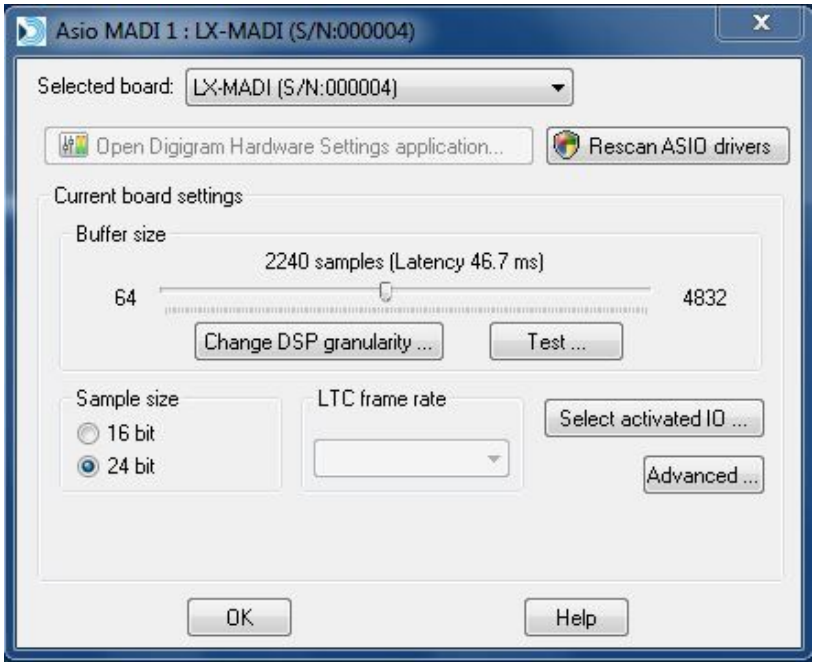
5.3 ASIO driver configuration

To use the card through an ASIO based application, make sure the *ASIO* driver option has been checked during the installation, as describe above. installed, the card's settings can be adjusted through its *ASIO* control panel. This panel can started from **<Start>**, **<Programs>**, **<Digigram>**, **<Digigram ASIO MADI Settings>**.



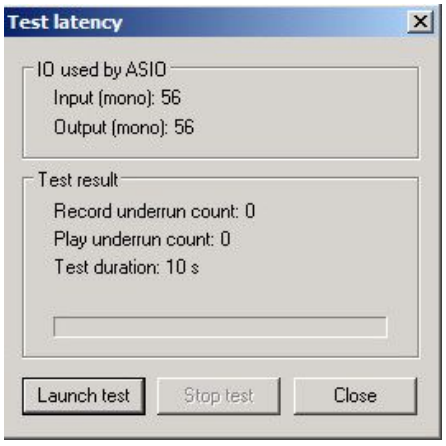
It can also be launched directly from the ASIO software applications, as most of them feature a "Preferences" or equivalent menu allowing to configure the ASIO devices to be used.

For help on how to use this control panel, please refer to its online help.



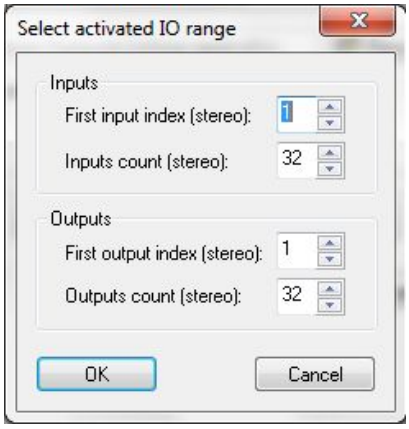
Buffer size
The buffer size determines the size in samples per buffer used by the Asio driver to transfer audio data from/to the board's Input/Output. The lower the buffer size, the lower the latency.
The range of the buffer size settings depends on the stream granularity defined in the Digigram Control Center.
You can access this parameter by clicking on the "***Change DSP granularity***" button.
Note that, audio dropouts may be experienced when using very small buffer size.

It is possible to check if audio dropouts are experienced. First of all start the ASIO based. Allocate the ASIO channels in this application. Open this ASIO control panel, and click on the "**Test**" button.



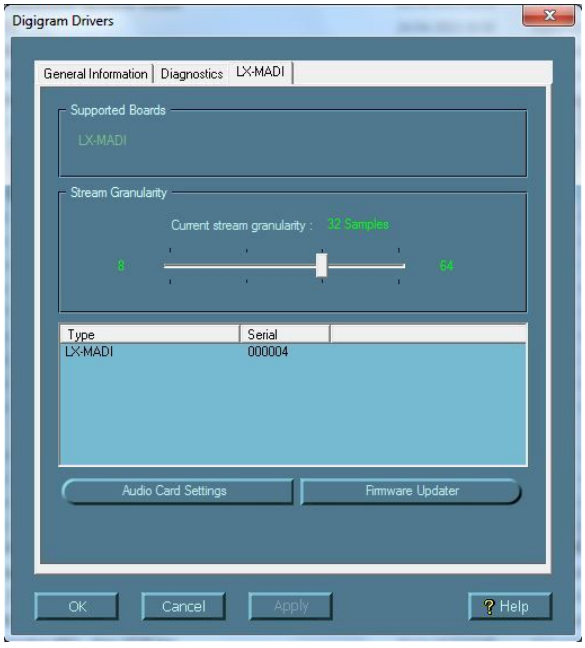
Click on **"Launch test"** to start the test. Errors are listed in the window. Stop the test by clicking on "**Stop test**".
In case errors are reported, buffer size has to be increased.

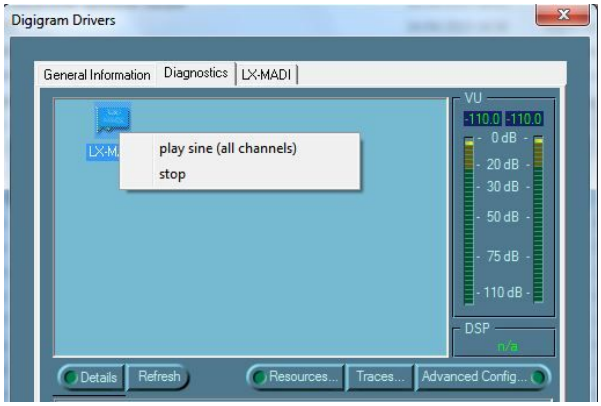
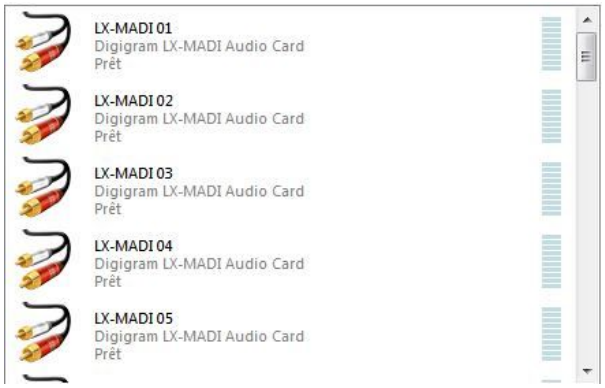
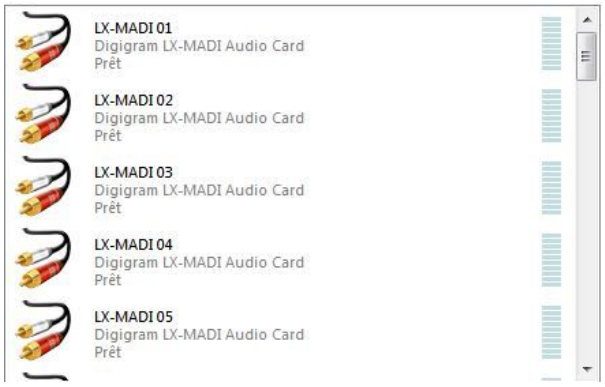
Select Activated IO
Clicking on this button allows selecting the channels that are managed by the ASIO driver. By default, all the channels are enabled.


Select activated IO range
Inputs
First input index (stereo):
1
Inputs count (stereo):
32
Outputs
First output index (stereo):
1
Outputs count (stereo):
32
OK
Cancel

6 HOW TO CHECK THE INSTALLATION UNDER WINDOWS

Once the card and the driver are installed according to the procedure described here-beforel, you can check that the card works correctly as follows.

Start the “Digigram Control Center” panel from the menu **<Start><Programs><Digigram>**. The “General Information” tab lists all the Digigram driver packages installed on the computer, and their versions.	
The LX-MADI tab displays information about the LX-MADI cards installed in the computer: card type, serial number. If the card is listed in the LX-MADI tab, the driver is correctly installed and it has found the card.	

You can check that the card plays audio by selecting the “Diagnostics” tab. The icon of the installed card is displayed. Right click on the card icon, and select “Play sine (all channels)”. This plays in loop a sine signal on all the outputs of the card. The VU meters on the right should indicate a 0dB level. To stop the playback, right click on the card icon, and select “stop”.	
The presence of the playout DirectSound devices can be checked from the Windows “Sound” control panel, in the “Playback” Tab. Under Windows Seven and 8, the name of a device can be modified by right clicking on its name and selecting “Properties”.	
The presence of the recording DirectSound devices can be checked from the Windows “Sound” control panel, in the “Record” Tab. Under Windows Seven and 8, the name of a device can be modified by right clicking on its name, and selecting “Properties”.	

Installation troubleshooting

If the LX-MADI card is not listed in the LX-MADI tab

- Please check from the Windows Device Manager if the card is detected by the operating system.
- Right click on the icon “My computer” (from the Desktop, or from the Windows file browser).
- Select “Manage”, and “Device Manager”.
- The LX-MADI card should be listed in the “Sound, video and game controller” section.
- If there is an exclamation mark in front of the card, this means that the driver is not installed correctly. Remove the LX-MADI Kit driver from the Windows Control Panel, Add/Remove programs, and install it again.
- If it is not listed, check in the “Other devices” section of the “device Manager”.

If the card is not listed at all in the “Device Manager”, proceed as follows:

- Shut down the computer and remove the LX-MADI card.
  Please be careful with electrostatic discharge when handling the card *(read section "Information for the user" of this document for more information)*.
- Make sure the golden tracks of the LX-MADI card PCI Express interface are clean; if not, you may use a dry rag to clean them.
- If there is another free PCI Express slot, insert the card in it, and power on the computer.
- Check again if the card is detected as described above.
- If the card is not detected in any PCI Express slot of this computer, you may try it in another computer.
- If the card is not detected, please contact your card supplier.

7 UNINSTALLING THE DRIVERS UNDER WINDOWS

- Open the **Windows Control Panel** and double-click on the **Programs and Features** icon.
- Select **"*Digigram LXMADI Kit …*"**, and **Change/Remove**.
- Select **Uninstall**.
- Follow the instructions to finish removing the driver.

8 SPECIFICATIONS

8.1 Configuration

Bus/Format	PCI EXPRESS™ (PCIe®) x1 (x2, x4, x8, x16 compatible)
Size	169 mm x 99 mm x 20 mm
Power requirements (+3.3 V / +12 V)	0.4 A / 0.12 A
Operating: temp / humidity (non-condensing)	0°C / +50°C • 5% / 90%
Storage: temp / humidity (non-condensing)	-5°C / +70°C • 0% / 95%

8.2 Inputs/Outputs

MADI	64 I/O (Mono) at 44.1 kHz or 48 kHz 32 I/O (Mono) at 88.2 kHz or 96 kHz, High Speed mode Optical fiber to be used: multi-mode
External synchronization	MADI input stream Word clock
Clock sources and sampling frequencies	Internal clock: 44.1 kHz, 48 kHz 88.2 kHz, 96 kHz Word Clock: 44.1 kHz, 48 kHz, 88.2 kHz and 96 kHz MADI: 44.1 kHz, 48 kHz, 88.2 kHz and 96 kHz

8.3 Connectors

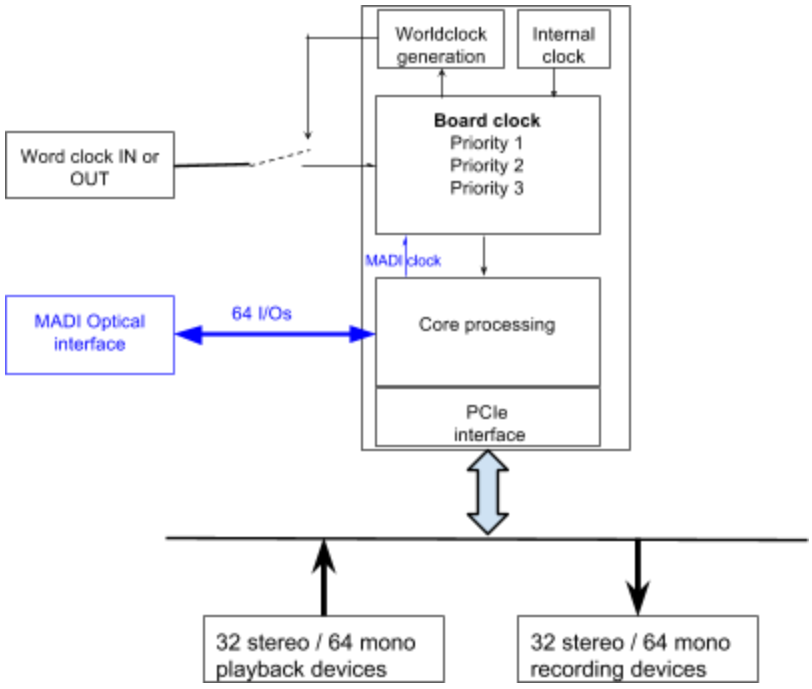
MADI I/O	1 optical connector for MADI I/O
Word Clock IN or OUT	BNC

8.4 Development environments

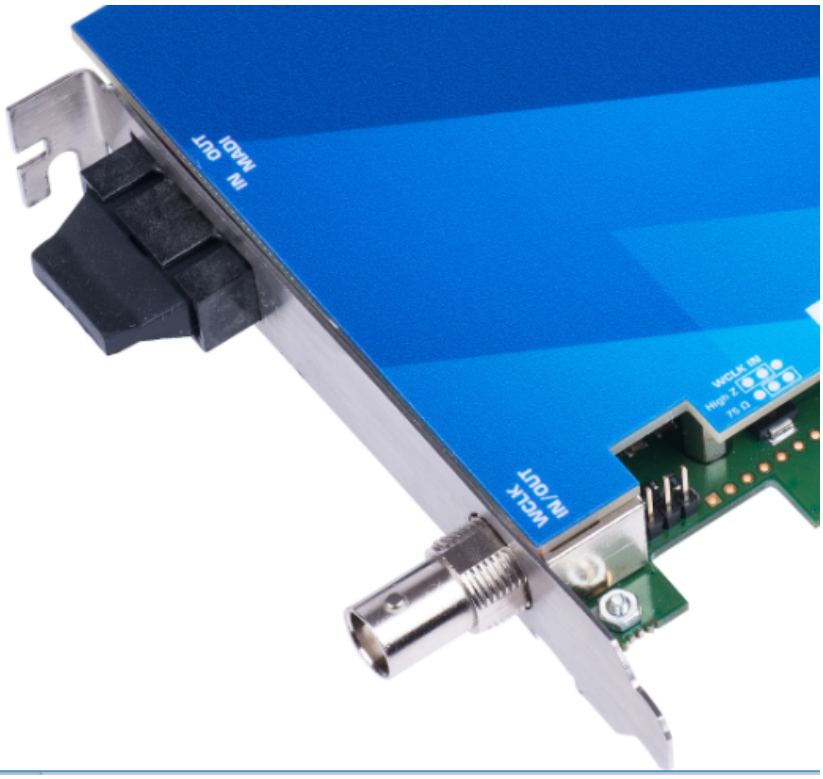
Audio devices	Up to 64/64 simultaneous Record/Play (Mono) channels to/from PC
Latency	Round trip time down to 1.8 ms
Management	Windows: WDM Kernel Streaming, DirectSound, WASAPI, ASIO, Linux: Alsa
Supported operating systems	Windows 7 / Windows 8 / Windows 10 / Windows 2008 Server & 2012 Server (32-bit and 64-bit versions) Linux

9 APPENDIX

9.1 LX-IP schematic diagram



9.2 Connectors



- **Optical fiber**: MADI in and MADI out
- **BNC 75**: WordClock in or out (set by software)
  Hardware selection through a jumper of the impedance: 75 Ohms or High impedance.
  High impedance:
  75 Ohms:

For technical support,
please contact your card supplier

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