

M2TECH JOPLIN

384kHz/32BIT ANALOG-TO-DIGITAL CONVERTER

USER MANUAL



--- PRELIMINARY ---

REV. PRB – 9/2012

Warning!

Changes or modifications not authorized by the manufacturer can invalidate the compliance to CE regulations and cause the unit to be no more suitable to use. The manufacturer refuses every responsibility regarding damages to people or things due to the use of a unit which has been subject to unauthorized modifications or to misuse or to malfunction of a unit which has been subject to unauthorized modifications.



This unit is compliant with the following CE regulations when an USB cable less than 3m is used: CEI EN 55022:2009 Class B (Radiated Emissions), CEI EN 55024:1999, CEI EN 55024:A2/2003, CEI EN 55024:IS1/2008 (Radio Frequency Electromagnetic Fields, 50Hz Magnetic Field Immunity Test and Electrostatic Discharges – ESD).

For a proper operation of this unit, all connections to other equipment in the system must be done when all equipment are off. Failing to comply to this advice may lead to damage to the unit.

Recycling



The label above, printed on the product case, indicates that the product, when no more usable, can't be treated as generic garbage, but must be disposed of at a collection point for recycling of electrical and electronic equipment, in compliance with the WEEE regulation (Waste of Electrical and Electronic Equipment).

By making sure that this unit is correctly recycled, you will help preventing potential damages to environment and human health, which could be caused by a wrong treatment of this product as generic garbage. Materials recycling helps saving natural resources. For more in-depth information about recycling this product, please contact M2Tech Srl.

WARNING: the information contained in this manual are considered to be reliable and accurate. M2Tech reserves the right to change or modify the information any time, without prior advice. It's up to the customer to ensure that the manual being consulted is the latest version.

Dear customer,

thank you for purchasing JOPLIN. What you have is a first-rate analog-to-digital converter with many unique features conceived to obtain the best audio performance out of an analog source.

Even if sending music to a PC or a Mac is nowadays quite simple, much harder is to obtain the best sonic performance while doing it, due to intrinsic limits in digital audio interfaces in computers. Please visit M2TECH website (www.m2tech.biz) to find extensive literature about this topic.

JOPLIN overcomes all the limits of your computer's audio card by implementing the latest generation HiFACE TWO technology, which uses proprietary drivers and asynchronous data transfer, along with a sophisticated electronic design.

JOPLIN features a comprehensive set of output connections which suit virtually all digital equipment around.

JOPLIN is provided with a very complete set of equalization and filtering options to accommodate all kind of analog signals.

We feel that your expectations will be fulfilled by JOPLIN: you'll hear your analog sources turned into music files or digital streams in a way like never before, prepare for a whole new experience!

Nadia Marino, CEO

Please annotate here your JOPLIN serial number for future reference:

S/N: _____

Date of purchase: _____

INDEX

1. Unpacking and placing the unit.....	6
2. Front Panel	7
3. Back Panel.....	8
4. Remote Control.....	9
5. Connecting and powering the unit	10
6. Driver installation	11
6.1. Obtaining the driver	11
6.2. Installing the driver on a Windows-based PC	11
6.3. USB Control Panel	16
6.4. Uninstalling the driver	17
6.5. True plug'n'play operation with Mac	19
6.6. True plug'n'play operation with Linux	19
7. Configuring the computer to use the JOPLIN.....	20
7.1. Configuring a PC with Windows XP	20
7.1.1. Configuring for Direct Sound with Windows XP	20
7.1.2. Configuring for ASIO with Windows XP	21
7.2. Configuring a PC with Windows Vista or Windows 7.....	21
7.2.1. Configuring for Direct Sound with Windows Vista or Windows 7	22
7.2.2. Configuring for Kernel Streaming with Windows Vista or Windows 7	22
7.2.3. Configuring for ASIO with Windows Vista or Windows 7	23
7.2.4. Configuring for WASAPI with Windows Vista or Windows 7	23
7.3. Configuring a Mac	23
8. Configuring the JOPLIN	24
8.1. Navigating the menu by the front panel controls	24
8.2. Navigating the menu by the IR remote	24
8.3. Parameters meaning and choices	25
8.3.1. Input gain	25
8.3.2. Input choice	25
8.3.3. Sampling frequency	26
8.3.4. Resolution.....	26
8.3.5. Equalization curve	27
8.3.6. Display dimming	27
8.3.7. High pass (anti-rumble) filter.....	27
8.3.8. Low pass (anti-hiss) filter	27
8.3.9. MPX filter	28
9. Notes on equalization	30
9.1. Why equalization is needed for records?	30
9.2. List of phono equalization curves available on the JOPLIN and notes on their usage.....	33
9.2.1. RIAA	33
9.2.2. AES	33
9.2.3. Angel (ANG)	34
9.2.4. Audiophile (AUDP).....	34
9.2.5. Capitol (CAP).....	34
9.2.6. Columbia (COL).....	34
9.2.7. HMV.....	34
9.2.8. Decca/London FFRR	34
9.2.9. MGM.....	34

9.2.10. NAB	35
9.2.11. Oiseau-Lyre (OYLR)	35
9.2.12. Pacific Jazz (PACJ)	35
9.2.13. Philips	35
9.2.14. RCA (RCA1, RCA2 and RCAO)	35
9.2.15. Brunswick	35
9.2.16. Columbia 1925, Columbia 1938 and Columbia England (CO25, CO38 and COLE).....	35
9.2.17. Decca FFRR 78rpm (DEC).....	36
9.2.18. MGM 78rpm (MGM7).....	36
9.2.19. Victor 1938-47 and Victor 1947-52 (VIC3 and VIC4).....	36
9.3. Equalizing tapes: why and when	36
9.3.1. CCIR/IEC for 9.5cm/s and 19cm/s (3¾ ips and 7½ ips) and CCIR/IEC for 38cm/s (15 ips) (IEC1 and IEC3).....	37
9.3.2. NAB for 9.5cm/s (3¾ ips) and NAB for 19cm/s (7½ ips).....	37
9.4. Acquiring with equalization.....	37
9.5. Interfacing a cartridge or a tape head.....	37
9.6. Recording programs.....	38
10. Using a power supply different from the standard one.....	39
11. Cleaning the unit.....	39
12. Technical Specifications	40

1. Unpacking and placing the unit

Place the carton box on a table and open it by removing or cutting the adhesive tape. Extract the foam upper cover. You should find the following items:

- one JOPLIN ADC;
- one wall adapter;
- one A-B USB cable;
- a remote control.

Should one or more items be missing, please contact your dealer or local distributor.

Extract the JOPLIN from the foam container and place it on a stable base, far from heat sources. Avoid the direct sunlight on the unit. Allow for enough room around the unit for venting. The JOPLIN is a high efficiency design so little heat is produced during normal operation; anyway, it's better allow for adequate venting. Avoid smoke, humidity, moisture and water from reaching the unit.

Do not place the unit on thick carpets or inside a box or piece of furniture, or in close contact with curtains.

2. Front Panel

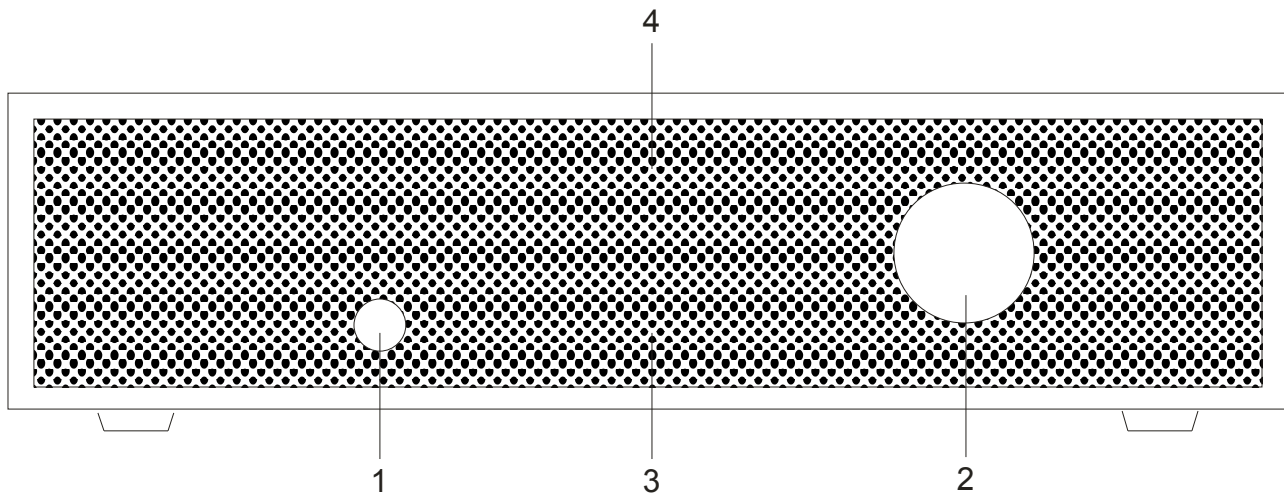


Figure 1

1) Standby/Exit button. This button has two function. When in standby, the unit is silent and the display is off. Standby ends when this button is pressed. When the unit is operative and the menu is not being accessed, press this button to put the unit in standby. When accessing the menu, press this button to exit the menu without changing the selected option.

2) Encoder knob and switch. Push the knob to access the menu. More pushes allow to navigate the various menu items. When the desired item is accessed, rotate the knob to choose the desired value for that item. Push the knob one last time to select the desired value and exit the menu.

3) Display. Multifunction six digits led matrix display. During normal operation, it indicates the sampling frequency. When accessing the menu, it indicates the menu item and current value. When clipping is reached on the analog input, it indicates the status by displaying "CLIP". When in standby, a single led is on at the center of the display area. Its intensity is set by menu.

4) VU-meter. It indicates the peak value for both channels. Left channel is top, right channel is immediately below left channel. Its intensity is set by menu.

3. Back Panel

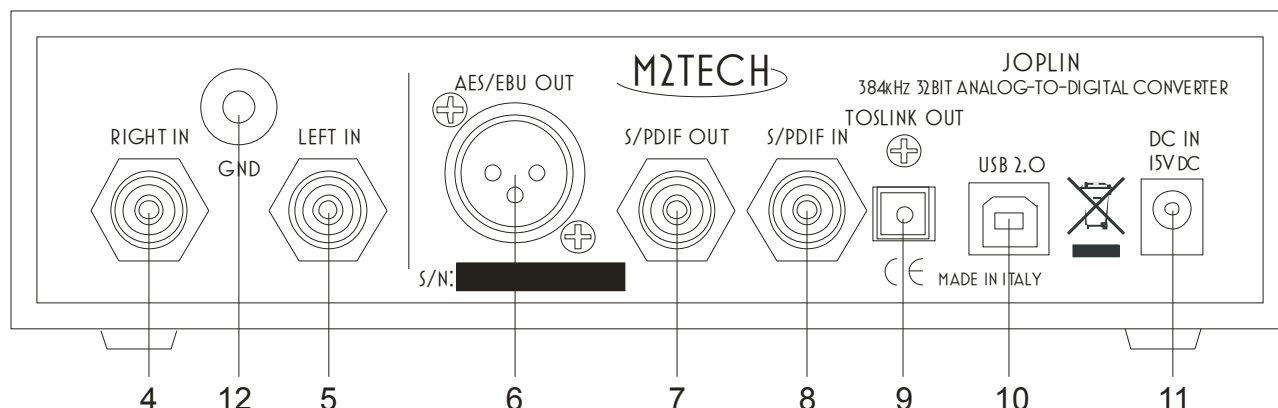


Figure 2

4) Right channel analog input. Connect to right channel of the analog source output. RCA female connector.

5) Left channel analog input. Connect to left channel of the analog source output. RCA female connector.

6) AES/EBU digital output. Generate AES/EBU data streams in consumer format. XLR male connector.

7) S/PDIF digital output. Generate S/PDIF data streams. RCA female connector.

8) S/PDIF digital input. Accept S/PDIF data streams. RCA female connector.

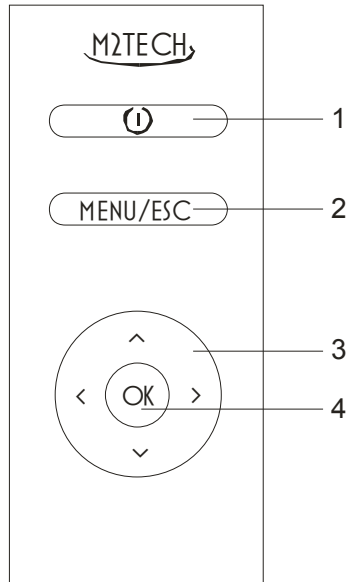
9) Toslink™ optical digital output. Optical output for Toslink™ cables. Toslink™ connector.

10) USB 2.0 output. Connect to a PC with Windows or Linux or MacIntosh with an USB 2.0 compliant A-B cable. USB 2.0 B female connector.

11) Power supply input. Connect the wall adaptor provided with the unit or any other power supply capable of 15V/500mA. 5.5mm/2.1mm supply jack (female, tip is positive).

12) Ground (chassis) post. When necessary, connect this post to the chassis wire from the source, to reduce hum and noise pickup.

4. Remote Control



1) Standby. Push this button to put the unit in standby and to activate it.

4) Menu/Esc. Push this button to access the menu and to exit the menu without changing the current item.

4) Menu navigation arrows. When accessing the menu, push arrow up and arrow down to scroll through the various menu items. Push arrow left and arrow right to choose the value for the selected item.

4) OK. When accessing the menu, push this button to update the current item with the displayed value.

5. Connecting and powering the unit

ADVICE: all connections to other equipment in the system must be done when all equipment are off. Failing to comply to this advice may expose the JOPLIN to the risk of damages.

ADVICE: Windows users must install the driver prior to connecting the JOPLIN to the PC (please refer to section 6).

Please refer to section 3, “Back Panel Description”.

Connect the “B” plug of a 2.0 USB A-B cable to the USB connector (Figure 2, 10) of the JOPLIN.

Connect the “A” plug of the cable to a 2.0 USB port of your computer.

Connect two interconnects to the analog inputs of the JOPLIN (Figure 2, 4/5) and to the outputs of your analog source (be it a turntable, a tuner, a tape recorder or even the tape rec output of your amplifier).

Connect a digital cable with suitable termination (RCA, XLR or optical Toslink™) from the JOPLIN to your amplifier’s digital inputs or to a DAC (Figure 2, 6/7/9).

If you need to route the output of a digital source to your computer or to the amplifier, you may connect the source to the JOPLIN using an RCA digital interconnect (Figure 2, 8).

Connect the wall adaptor provided with the JOPLIN or any other 15V/500mA power supply to the supply connector (Figure 2, 11) of the JOPLIN.

6. Driver installation

The JOPLIN is USB 2.0 Audio compliant. This means that no driver is needed with Apple computers, nor with Linux-based PC's. The latter will need ALSA to operate the JOPLIN.

Windows is presently not compatible with USB 2.0 Audio, so no native support is available. In this case, M2Tech provides a driver which needs to be installed prior to access the JOPLIN via USB.

6.1. Obtaining the driver

The Windows driver for the JOPLIN is available on the M2Tech website, in the page dedicated to the JOPLIN (www.m2tech.biz/joplin.html). The driver is contained in self-extracting file.

6.2. Installing the driver on a Windows-based PC

The procedure is almost the same for Windows XP, Windows Vista and Windows 7. Double-click on the 7-Zip folder to automatically extract the files in a directory of your choice (Figure 4).

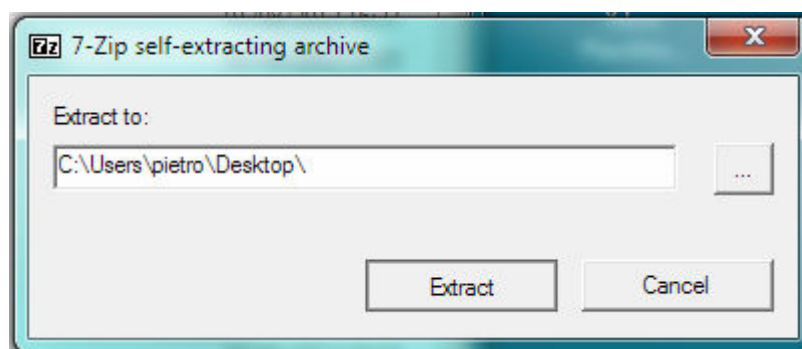


Figure 4

Amongst the files extracted is “setup.exe”. Double-click on its icon to launch it and follow the indications provided by the setup program (Figure 5).



Figure 5

In Windows 7, the installation wizard will ask for authorization to start installation. Accept. Then, the wizard will check for system features. At a certain point, it will ask you to connect the JOPLIN in one of the USB ports (Figure 6).

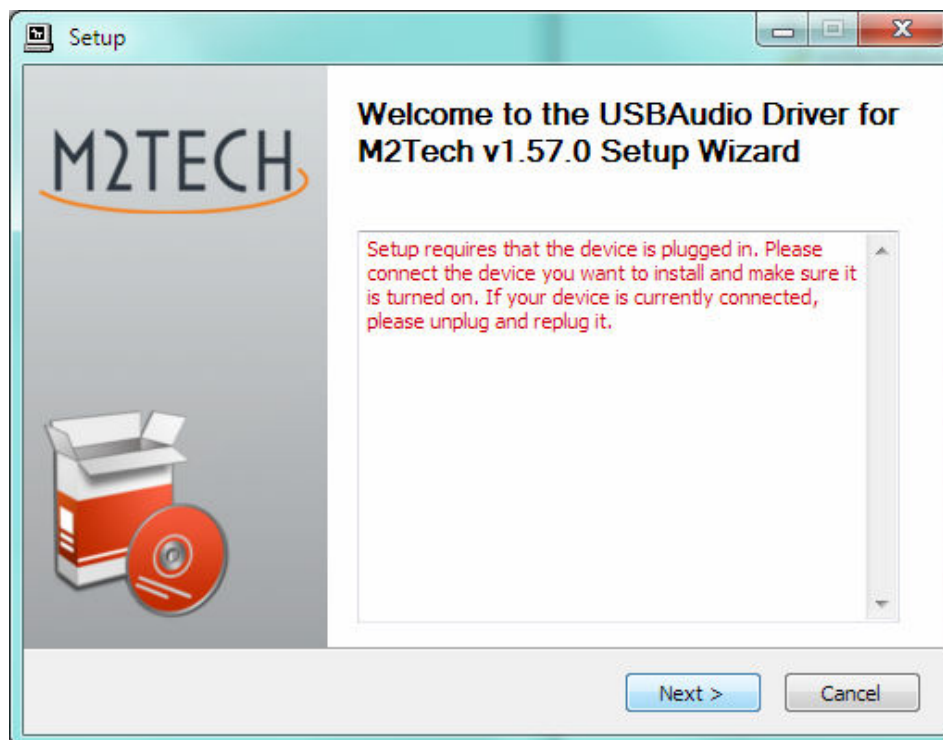


Figure 6

Follow the indications and plug the device in one port, then click on “Next”. You’ll be asked to choose the installation directory (Figure 7). After choosing it, click on “Install”.

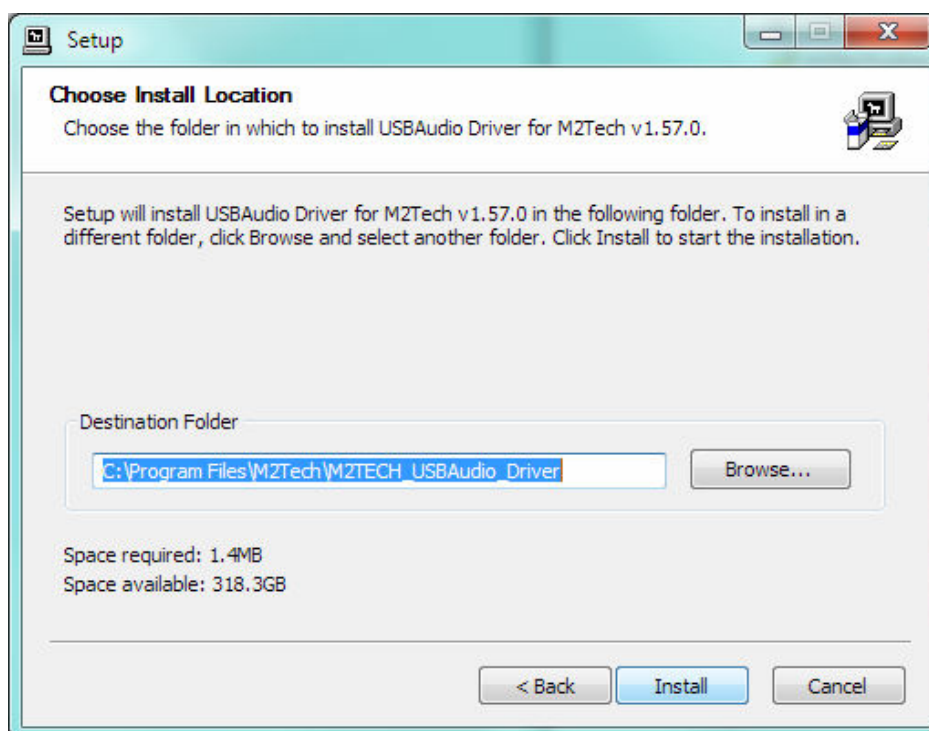


Figure 7

The installation process continues showing the progress (Figure 8).

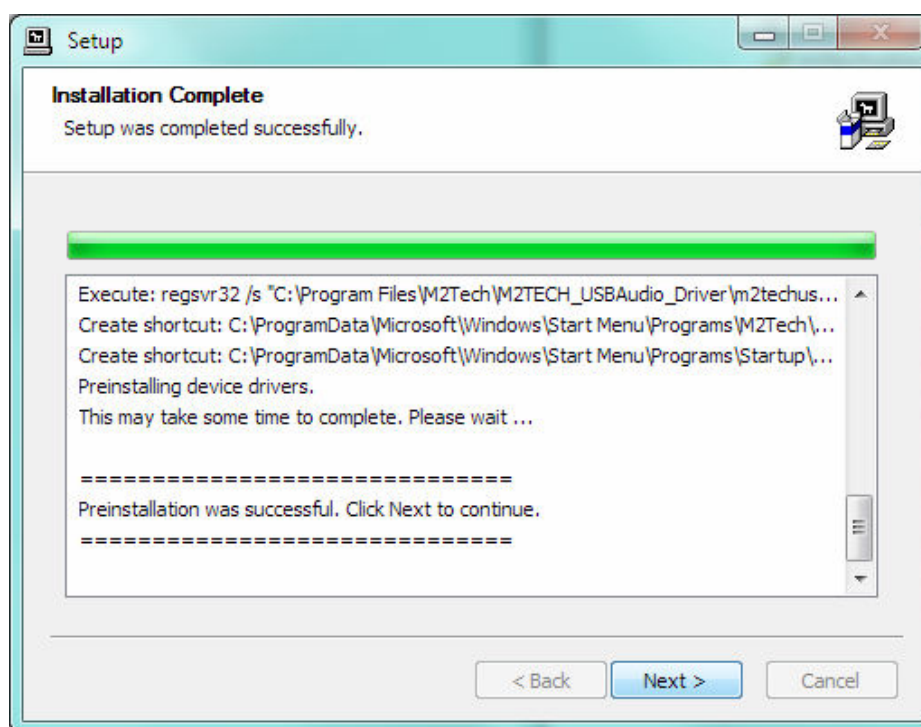


Figure 8

At the end of the installation process, the wizard notify the completion (Figure 9). Click on “Finish” to complete the installation.

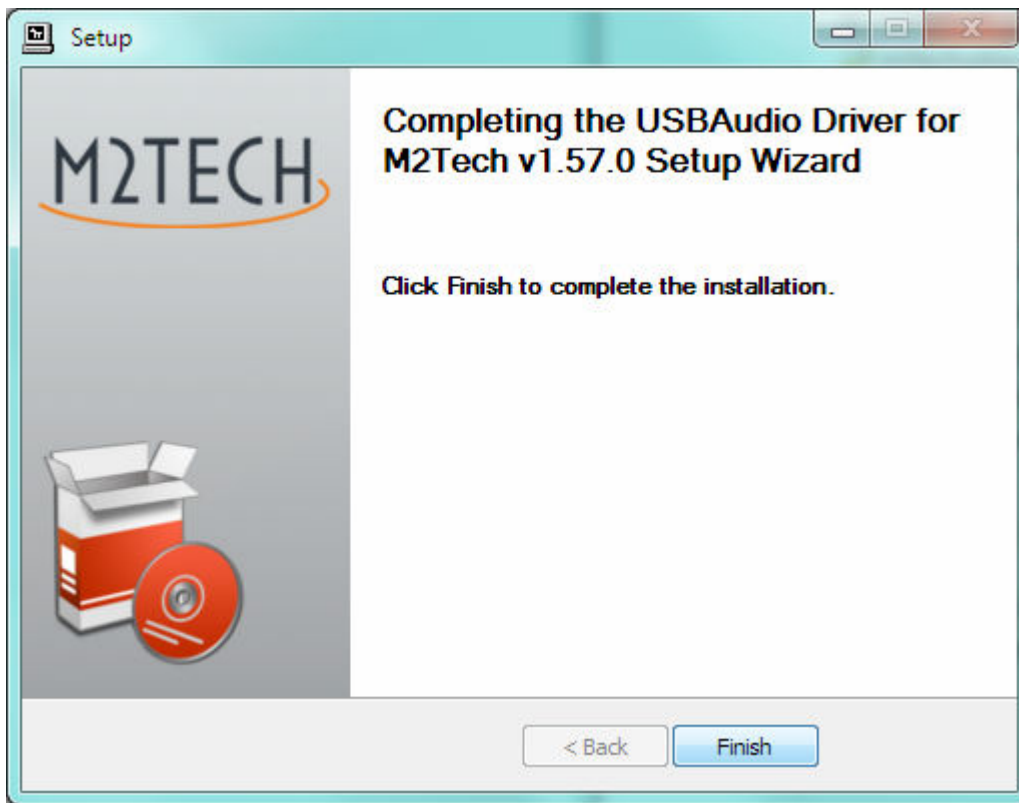


Figure 9

To ensure that installation has correctly completed, the Device Manager should be checked. The Joplin will be listed under “Audio, Video and Games Controllers” (Figure 10 on next page).

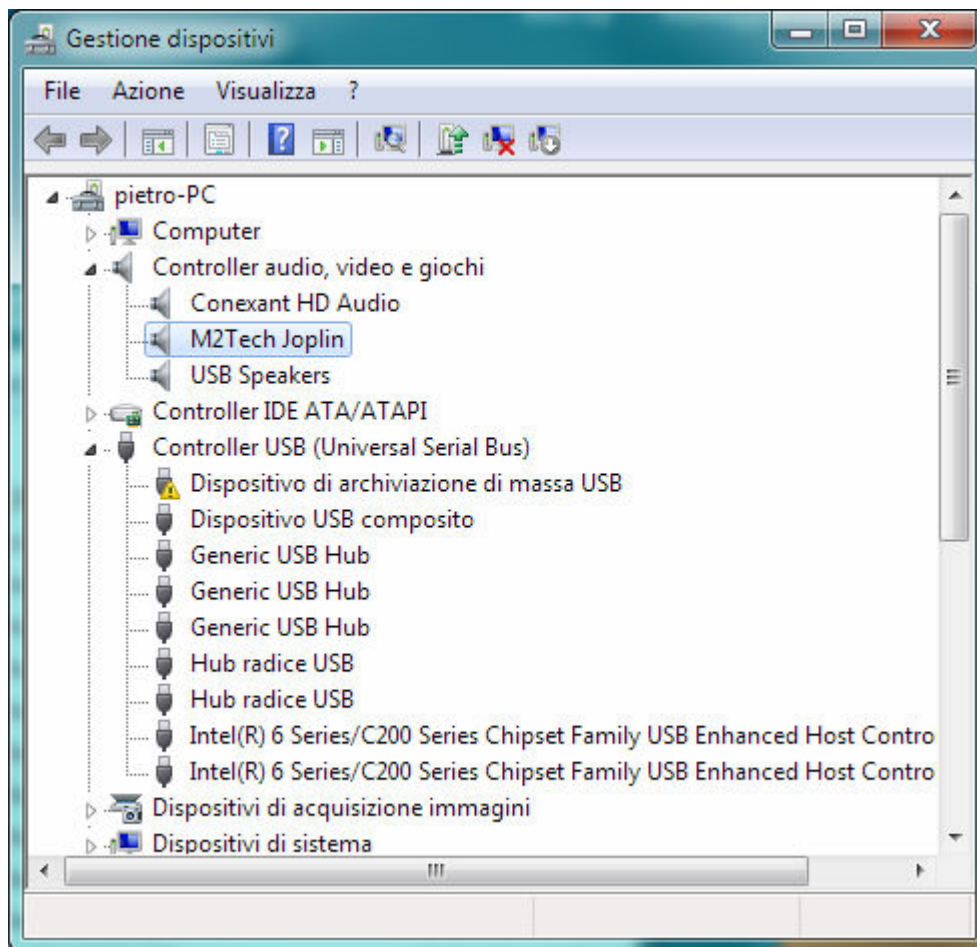


Figure 10

6.3. USB Control Panel

A control panel is installed together with the driver, which can be used to optimize Joplin's USB port performance (Figure 11). More details on the Control Panel's features in the application note App002.

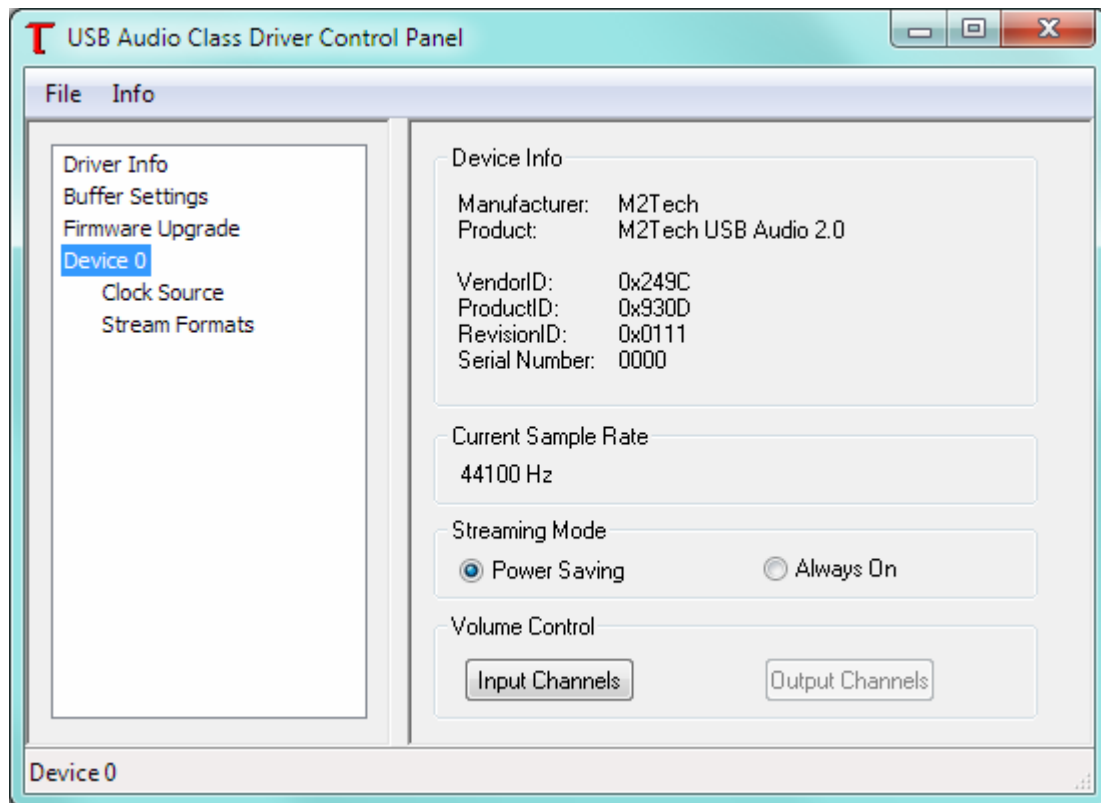


Figure 11

6.4. Uninstalling the driver

Sometimes it is necessary to uninstall the driver to roll back to a previous version. Uninstall is a quite simple procedure.

Go to the control panel and launch the “Application Installation” utility (Figure 12). Look for the JOPLIN driver item in the list. Double-click on it to launch uninstalling.

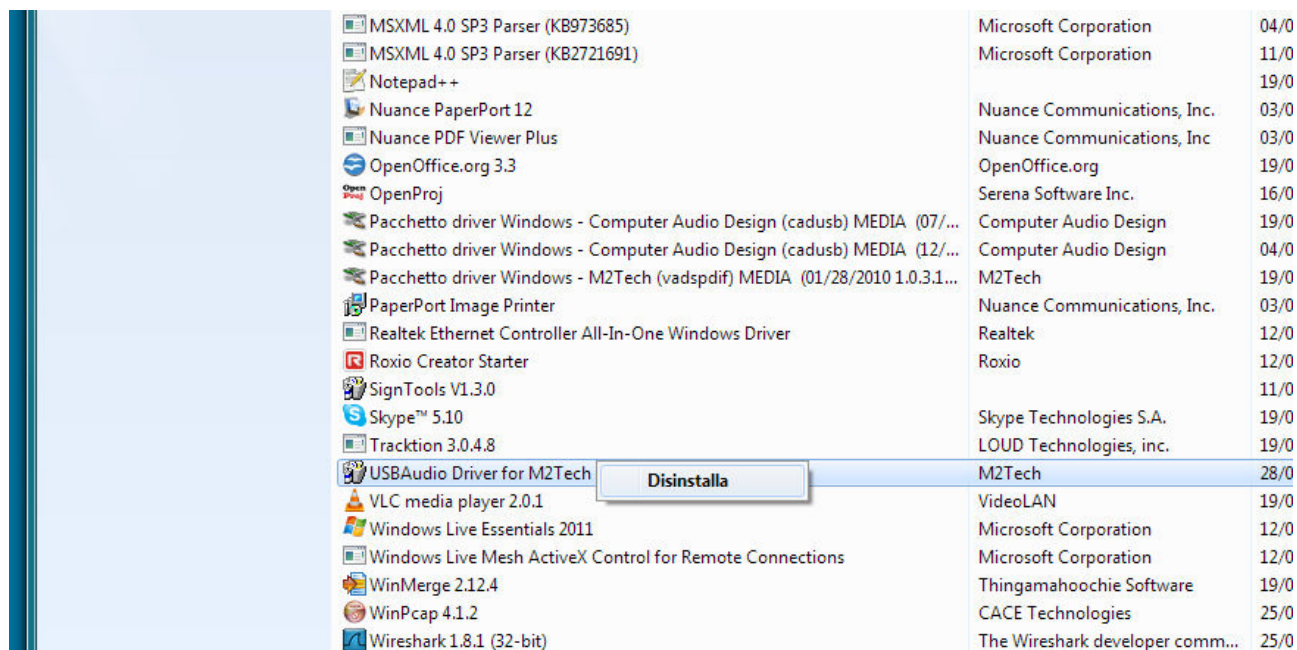


Figure 12

The installation wizard, which also handles uninstalling, will show up (Figure 13 on next page). Click on “Uninstall” to start uninstalling.



Figure 13

At this point, the wizard will show up the installation progress (Figure 14), up to the end.

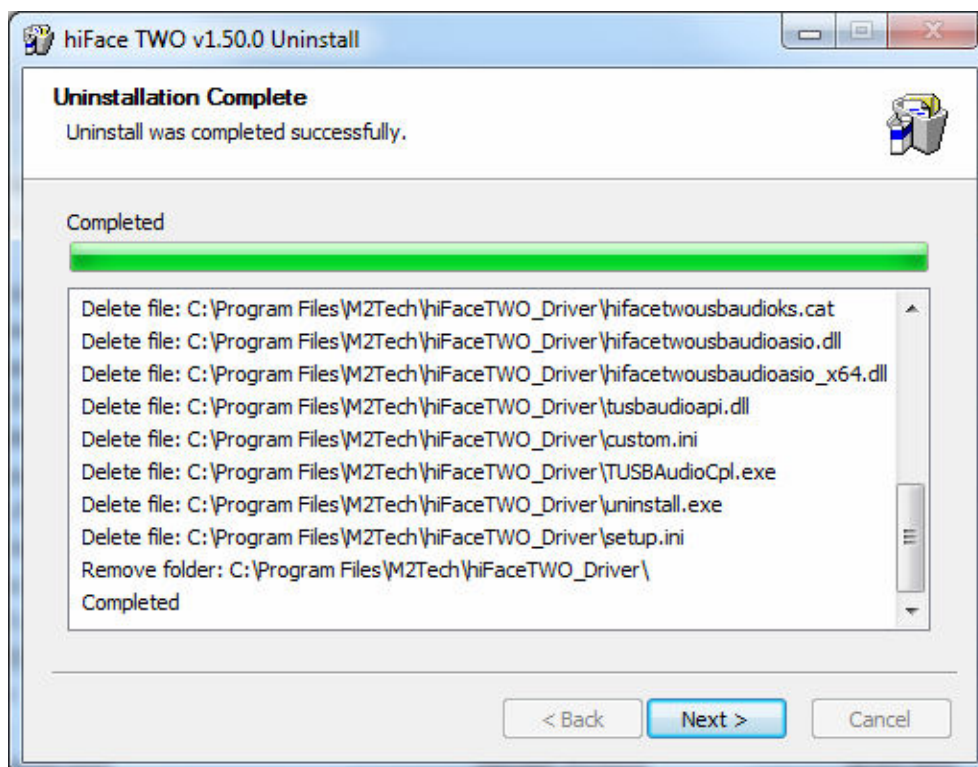


Figure 14

After the uninstalling of all files related to the driver is complete, the “Next” button will be enabled. Click on it. The final message will appear (Figure 15). Click on “Finish” to complete uninstalling.

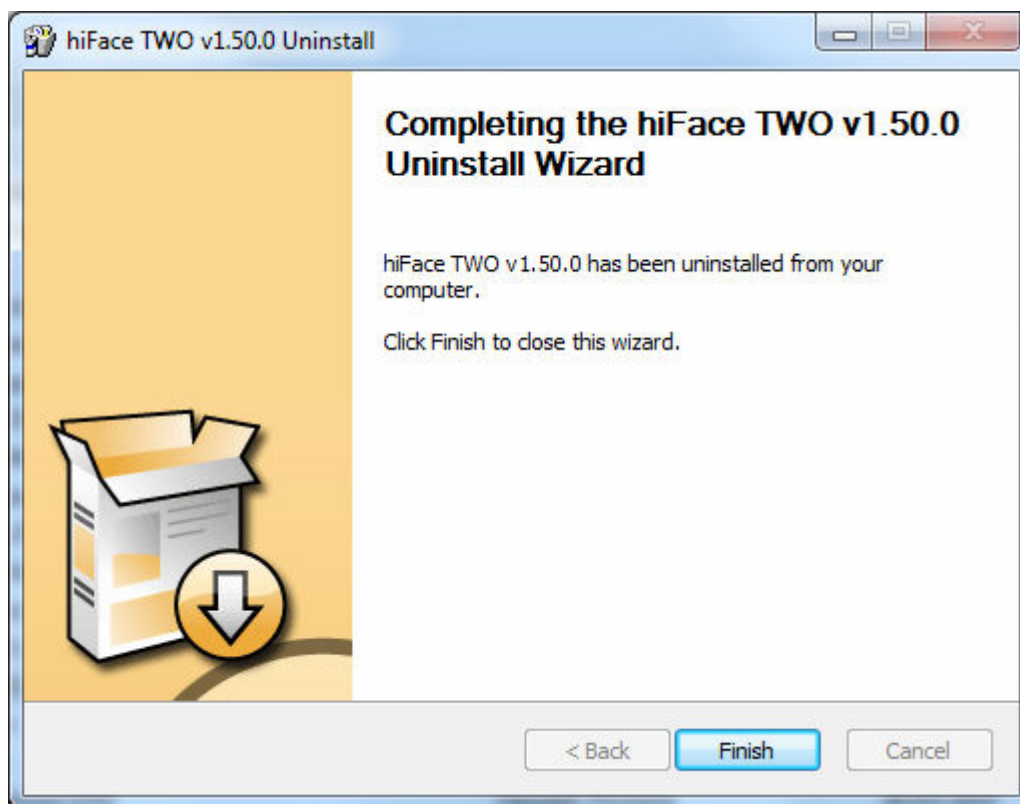


Figure 15

6.5. True plug’n’play operation with Mac

Mac computers with OSX 10.6.4 and later have a native support for audio devices compliant with USB 2.0 Audio class. This means that the driver is already included in the operating system and the user needs not to install anything: just connect the JOPLIN to your Mac and it will be immediately recognized by the OS and ready to use. Macs with older OS need update to use the JOPLIN.

6.6. True plug’n’play operation with Linux

Linux has a native support for audio devices compliant with USB 2.0 Audio class based on ALSA. This means that the driver is already included in the operating system and the user needs not to install anything: just connect the JOPLIN to your PC with Linux and it will be immediately recognized by the OS and ready to use. ALSA version needs to be 1.0.24 or later.

7. Configuring the computer to use the JOPLIN

7.1. Configuring a PC with Windows XP

A PC with Windows XP can use the JOPLIN in two different ways: Direct Sound (DS) and ASIO. The former is suitable for recorders which can't operate in ASIO mode, while the latter can be chosen (for better performance) with players which can operate in ASIO mode. Please consider that bit-perfect operation is ensured in ASIO mode only.

7.1.1. Configuring for Direct Sound with Windows XP

Connect the JOPLIN to your PC. Then, go to the Control Panel and launch the Sound and Audio Peripherals utility.

Select the Audio tab. In the Predefined Peripheral drop-down menu of the Record area, select "M2Tech Audio 2.0 Input" (see figure 16).



Figure 16

Then, select the “Voice” Tab (Figure 17). Again, select “M2Tech Audio 2.0 Input” in the drop-down menu of the Record area. Click on OK button.

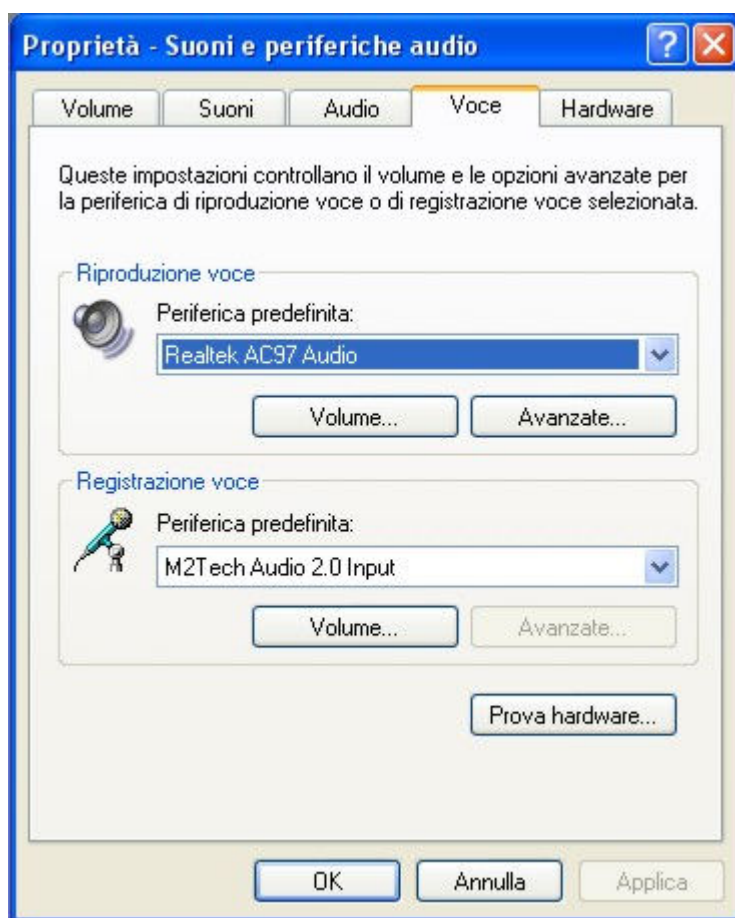


Figure 17

From now on, unless the JOPLIN is disconnected or settings are changed again, JOPLIN is the audio peripheral all audio programs will use when operating in direct sound mode for recording.

7.1.2. Configuring for ASIO with Windows XP

ASIO has no standard setting in Windows XP. ASIO must be selected in the specific recorder you choose to use.

7.2. Configuring a PC with Windows Vista or Windows 7

A PC with Windows Vista or Windows 7 can use the JOPLIN in four different ways: Direct Sound (DS), Kernel Streaming (KS), ASIO and WASAPI. DS is suitable for recorders which can't operate in Kernel Streaming mode nor with WASAPI; KS can be chosen (for better performance) with recorders which can operate in Kernel Streaming mode. WASAPI (Windows Audio Standard API) is a standard interface for audio players which allows to

get the same performance of KS with applications which can't operate in KS mode, at the cost of higher CPU load. More or less the same can be said about ASIO

7.2.1. Configuring for Direct Sound with Windows Vista or Windows 7

Open control Panel and select Hardware and Sounds. Under Audio, click on Manage Audio Devices. The following windows will appear. Click on the “Recording” tab and select “M2Tech Joplin” as predefined device. Then, click on OK.

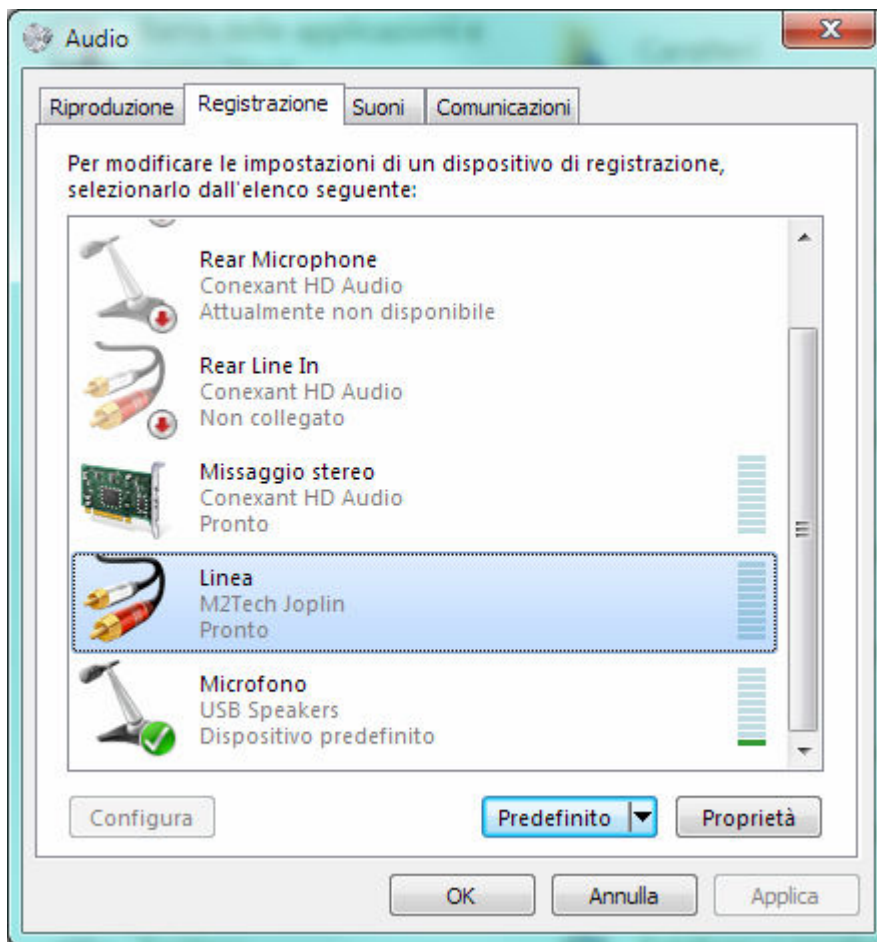


Figure 18

7.2.2. Configuring for Kernel Streaming with Windows Vista or Windows 7

As for Windows XP, Kernel Streaming has no standard setting in Windows Vista and Windows 7. KS must be selected in the specific recorder you choose to use.

7.2.3. Configuring for ASIO with Windows Vista or Windows 7

As it happens with Kernel Streaming, ASIO cannot be directly accessed. ASIO must be selected in the specific recorder you choose to use.

7.2.4. Configuring for WASAPI with Windows Vista or Windows 7

As it happens with Kernel Streaming, WASAPI cannot be directly accessed. WASAPI must be selected in the specific recorder you choose to use.

7.3. Configuring a Mac

Go to System Preferences and select Sounds. The following windows will appear. Select “M2Tech USB 2.0 Audio In” for input as indicated in Figure 19.

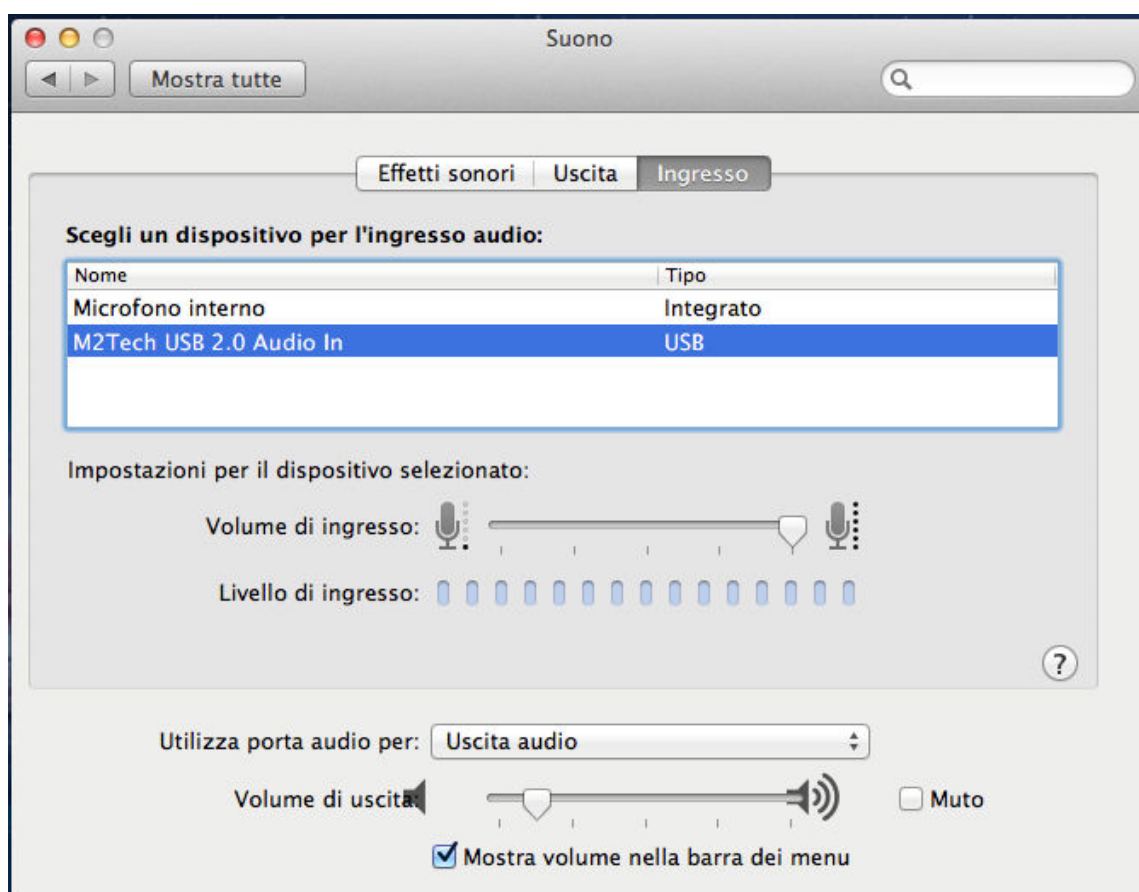


Figure 19

8. Configuring the JOPLIN

The JOPLIN is a very versatile unit, with plenty of features to tailor its behaviour to the source being used and the music program being played back. To configure all the features and parameters, a menu can be accessed from both the front panel controls and the remote.

The menu has a simple one-level structure in which all the parameters are accessed sequentially. The following parameters can be set:

- Input gain;
- Input choice;
- Sampling frequency;
- Resolution;
- Equalization curve;
- Display dimming;
- High-pass (anti-rumble) filter;
- Low-pass (anti-hiss) filter;
- MPX filter.

All parameters are stored in a non-volatile memory, so that they are recalled after every power-on.

8.1. Navigating the menu by the front panel controls

The menu is accessed by pressing the encoder knob once (Figure 1, 2). The first parameter (Input gain) is displayed along with its current value. Successive pushes on the encoder knob without rotating it will allow to access other parameter, in the order listed above.

When the desired parameter is displayed, its value can be changed by simply rotating the encoder knob. To confirm the new value for the current parameter, press the encoder knob one last time.

To exit the menu without changing the displayed parameter value after the knob has been rotated, press the Standby/Exit button once (Figure 1, 1). Anyway, the system resets to the idle state after some seconds from the last operation on the knob.

8.2. Navigating the menu by the IR remote

The menu is accessed by pressing the Menu/Exit button on the remote once (Figure 3, 2). The first parameter (Input gain) is displayed along with its current value.

To display other parameters, use the arrow up and arrow down buttons (Figure 3, 3).

When the desired parameter is displayed, its value can be changed using the arrow left and arrow right buttons (Figure 3, 3). To confirm the new value for the current parameter, press the OK button (Figure 3, 4).

To exit the menu without changing the displayed parameter value, press the Menu/Exit button once again (Figure 3, 2). Anyway, the system resets to the idle state after some seconds from the last operation on the knob.

8.3. Parameters meaning and choices

8.3.1. Input gain

The JOPLIN is provided with an analog front-end which gain can be set to 0dB or to any value between 10dB and 65dB in 1dB steps. 0dB means that an input voltage of 1.7Vrms produces an output of 0dBFS (that is the full dynamic of the ADC).

Sources with lower output levels (such as turntable, but also many cassette tape recorders and also reel-to-reel tape recorders and tuners) may require a higher sensitivity to fully exploit the dynamic of the JOPLIN. For example, a tuner with a nominal output voltage of 500mVrms would require a gain of 3, that is 10dB, to achieve the full ADC dynamic. As well, a phono cartridge with 5mV output level would need 40dB gain. 65dB gain means that the full dynamic is achieved with an input voltage as low as 0.95mVrms. This means that even MC cartridges with output voltages as low as 0.5mV can be directly connected to the JOPLIN, at the cost of a slight loss of dynamic.

The optimal gain is a matter of the source output level but also of the chosen equalization curve. Rely on the VU meter and the clip indication to set the gain to the best setting for the used source. Too high a gain, the unit will saturate and clip and the noise floor will be higher than desired. Too low a gain and a part of the ADC dynamic will be lost.

8.3.2. Input choice

The JOPLIN has two inputs: one analog (called “line”) and one coaxial digital (called “coax”). The use of the former is straightforward, the latter has been included to allow users to connect a digital source to a computer which is not provided with a digital input, making a bridge between the S/PDIF and the USB. Please note that the input sampling frequency on the coax input (set by the digital source) is generally not the same as the output sampling frequency (set by either the USB driver or the user via the configuration menu). An asynchronous sample rate converter performs the sampling rate conversion between input and output. When such an operation is not desired, user needs to set the output sampling frequency to the same value as the incoming stream sampling frequency.

8.3.3. Sampling frequency

The JOPLIN can operate at the following sampling frequencies: 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz, 192kHz, 352.8kHz and 384kHz. The higher the sampling frequency, the larger the files produced when recording the data out of the ADC, but also the higher the sound quality. Thus, the choice of the sampling frequency is a trade-off between disk usage and quality.

On the other hand, when using the JOPLIN to drive a digital amplifier, a DAC or a streaming player for real-time playback, the best choice is always the highest sampling frequency possible.

NOTE: The sampling frequency set by the user via the menu is used when the JOPLIN is not connected to any computer, otherwise the parameter is ignored and the actual sampling frequency is the one set by the computer audio control panel or by the recorder program. The value set via the menu is restored as soon as the computer is disconnected from the JOPLIN or it is shutdown.

NOTE: the highest sampling frequencies available (352.8kHz and 384kHz) are not settable by the user via the menu. This is because in standalone use the only usable outputs are the S/PDIF, AES/EBU and Toslink™ ones, which cannot operate at sampling frequencies higher than 192kHz.

8.3.4. Resolution

The JOPLIN can operate at the following resolutions: 16 bits, 20 bits, 24 bits, 32 bits. As for the sampling frequency, the higher the resolution, the larger the files produced when recording from the source but also the higher the sound quality.

The ADC works natively at 32 bits. Thus, when a lower resolution is chosen, it is necessary to get rid of some bits from each sample acquired by the ADC. This operation generates distortion in the sound.

For this reason, The three lower resolution settings are available in two flavours: with dithering and without dithering. The dither is a small random noise which is added to the sound before reducing the resolution. The dither turns the distortion due to the resolution cut into white noise, which is far more pleasant to the ear.

When SNR is a main goal and a little distortion can be tolerated, dither should be avoided. On the other hand, when the best sound is desired at the cost of a little added noise, dither is mandatory.

It should also be considered that the S/PDIF, AES/EBU and Toslink™ outputs can only transfer 24 bits per channel. Thus, the “24_D” value should be chosen to obtain the best audio performance out of the digital outputs.

8.3.5. Equalization curve

The JOPLIN has been conceived to be used with a wide variety of different sources: tuners, recorders, turntables. Some of these sources require an equalization to enjoy their sound. The JOPLIN is provided with a wealth of equalization curves to satisfy even the most requiring vinyl collector or reel-to-reel tapes enthusiast. Of course, equalization can be disabled when the source doesn't require it. This is obtained by choosing the "FLAT" value for this parameter.

16 different curves for microgroove LP's, 7 curves for 78rpm, 4 curves for reel-to-reel tapes are available. Please see Section 9 for more details on equalization.

8.3.6. Display dimming

The JOPLIN display intensity can be set on 5 different levels. In addition, an automatic dim mode allows for keeping the display off every time it's not necessary to read it. When the automatic mode (value "A") is chosen, the display activates at the highest intensity every time a control is accessed, then it remains active for 5 seconds after the last control is accessed, finally turning off.

8.3.7. High pass (anti-rumble) filter

When acquiring a noisy source, it is sometimes desirable to cut some low frequencies. For example, warped records or the output of a mike preamp or a mixer when recording live in a windy setup. Two high-pass cut-off frequencies are available: 16Hz (for microgroove LP's and also for modern era stereo LP recorded with RIAA curve when the extra 16Hz high pass is known to be used for the LP making) and 50Hz (for most 78rpm records which have generally poor music contents below 50Hz). See Figure 20 for more details on high-pass filter effect on frequency response.

8.3.8. Low pass (anti-hiss) filter

When acquiring a noisy source, it is sometimes desirable to cut some high frequencies. For example, many 78rpm records have poor music contents above 5kHz and a strong surface noise. Using a low-pass filter allows for a more intelligible sound. Two low-pass cut-off frequencies are available: 5kHz and 10kHz. See Figure 20 for more details on low-pass filter effect on frequency response.

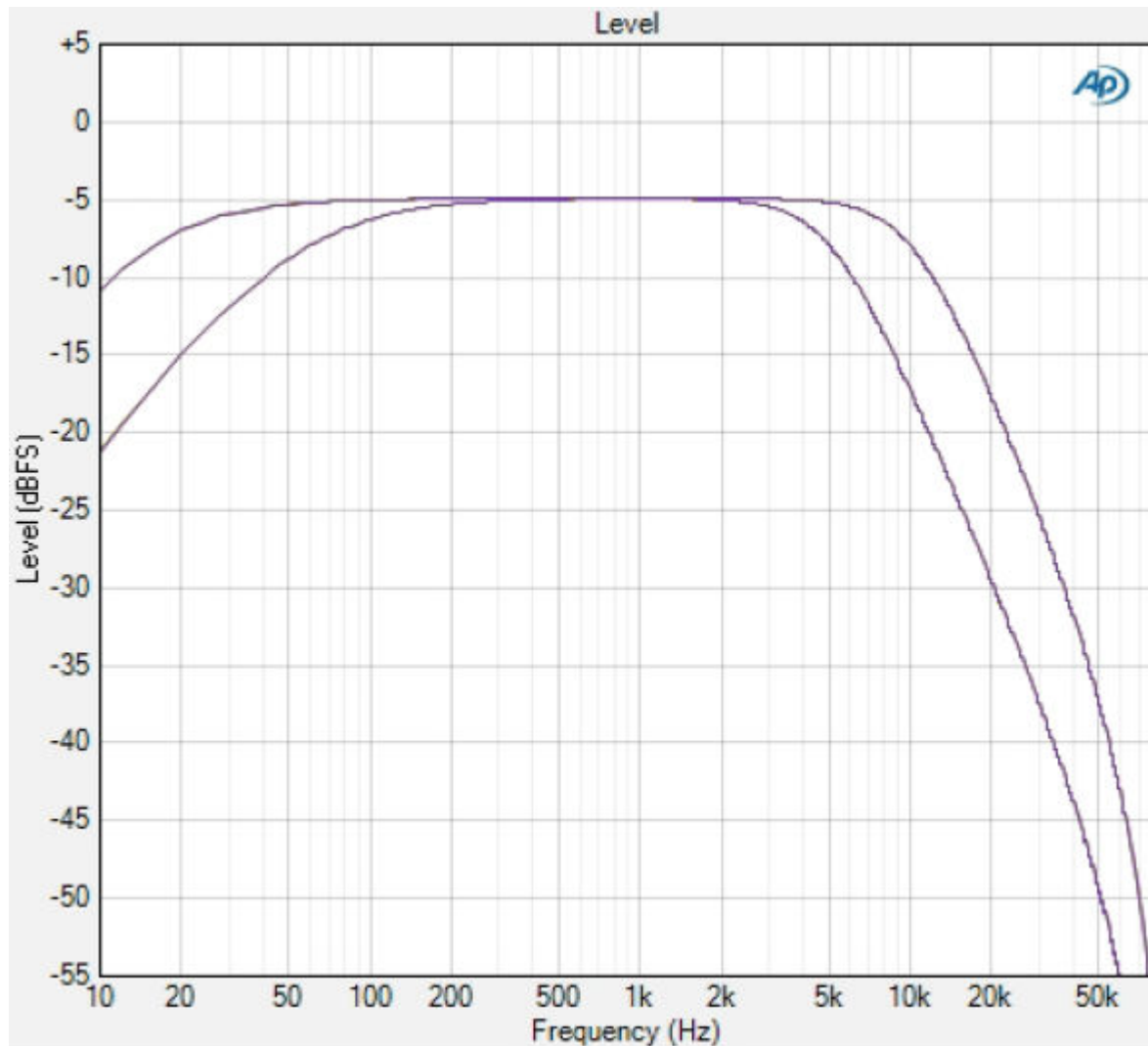


Figure 20

8.3.9. MPX filter

Stereo is obtained in FM broadcast by carrying the difference (L-R) information modulated on a 38kHz carrier, while the sum information (L+R, that is the mono sound) is placed in the channel's baseband. Tuner are aware of receiving a stereo broadcast because of a pilot tone of 19kHz which is also used to recreate the 38kHz frequency necessary to demodulate the difference information to be blended with the sum information to get the two stereo channels (in fact, $(L+R)+(L-R) = 2L$, while $(L+R)-(L-R) = 2R$). The 19kHz tone is beyond the bandwidth of the FM tuner (which is limited to 16kHz), but is well into the ADC bandwidth even at 44.1kHz sampling frequency. A 19kHz tone can be heard by a young ear, and may also generate intermodulation distortion, so it could be useful to eliminate it. The MPX filter does this by cutting away a very narrow band around 19kHz (Figure 21). Its presence is quite inaudible, but the effect on the overall sound can be surprisingly good.

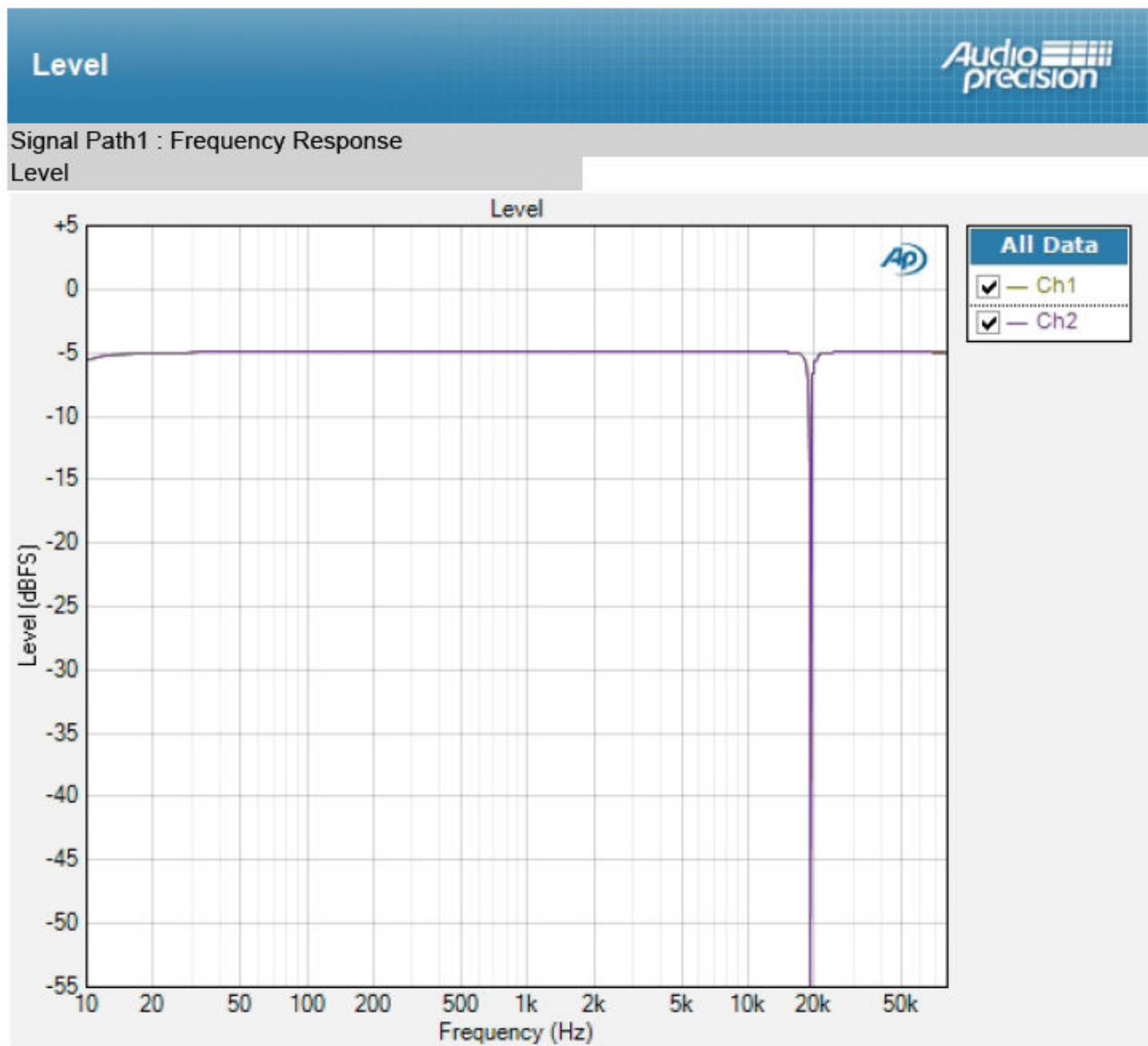


Figure 21

9. Notes on equalization

9.1. Why equalization is needed for records?

When cutting a record, two problems must be faced: the dynamic of the media, which is related to the groove width and depth, thus to the record diameter and thickness, and the surface noise. As low frequency tones tend to cut large, deep grooves, dynamic limits are likely to be hit due to the low frequency content of the music being cut into the vinyl. On the other hand, high frequency tones have generally low amplitude, thus they are likely to be covered by surface noise.

To solve the above problems, an equalization is applied to the signal before sending it to the cutting lathe: low frequencies are attenuated to reduce their dynamic and high frequencies are amplified to elevate them over the surface noise floor.

Of course, the reversed equalization is applied to the signal coming out of a cartridge while reading a disc: low frequencies are amplified and high frequencies are attenuated (together with the surface noise which becomes less apparent).

Presently, all records are cut using the RIAA curve (Figure 22), which has been proposed as a standard back in 1954. Both low frequencies amplification and high frequencies attenuation for playback are clearly visible.

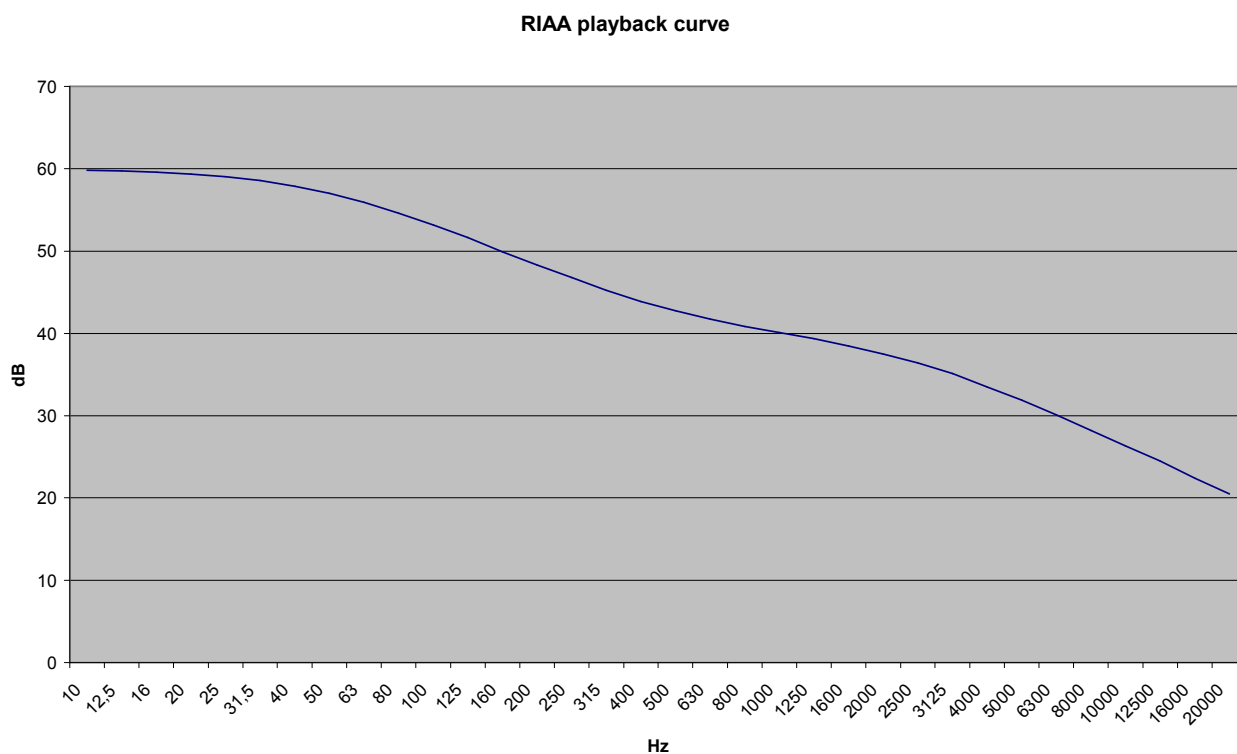


Figure 22

The curve has three parameters:

1. the turnover frequency, that is the frequency below which the low frequencies start to be attenuated during the recording and amplified during the playback (500Hz for RIAA);
2. the roll-off, that is the value of the high frequency amplification at 10kHz during recording and attenuation during playback (16dB for RIAA);
3. the shelving frequency, that is the frequency below which the low frequency attenuation during recording and high frequency amplification during playback are limited to a fixed value (50Hz for RIAA).

Before the introduction of the RIAA standard curve, each recording company used her own “secret” curve (FFRR from Decca/London, HMV, Capitol, Columbia...), with big troubles for music lovers, because no amplifier could be provided with all equalization circuits to accommodate all the different curves. For this reason, all amplifiers were provided with tone controls: not to compensate speakers response nor room acoustics, but to adapt the one and only phono curve provided with the amp to the different curves of the various LP's. Not only LP's are equalized: equalization was used for 78rpm, too, as well with great variety of choices.

A good phono preamplifier, or an ADC suitable for direct phono acquiring as is the JOPLIN, should allow the vinyl collector to choose the right curve for each LP pressed before 1954 (but it's known that many recording companies adopted the RIAA curve years after the official introduction date. It seems that some eastern Europe labels only adopted RIAA around 1975!).

Most collectors use the RIAA curve to listen to all their records, often resulting in a sound which is not the one really recorded on master tape. To show the reason of that, Figure 23 on next page shows some of the most famous playback curves superimposed on the same graph.

Differences are not subtle!

Note the different low frequency amplification due to different turnover frequencies and the different high frequency attenuation due to different roll-offs. Also, note that no shelving is applied to HMV and Capitol curves. In fact, shelving is a relatively recent choice to avoid phono preamps excessively amplifying the turntable rumble, thus saturating. Older curves were thought for playback systems in which the low frequency limit was relatively high (50-80Hz) and for recordings with poor low frequency content, setups in which the turntable rumble was not a problem.

Eq comparison

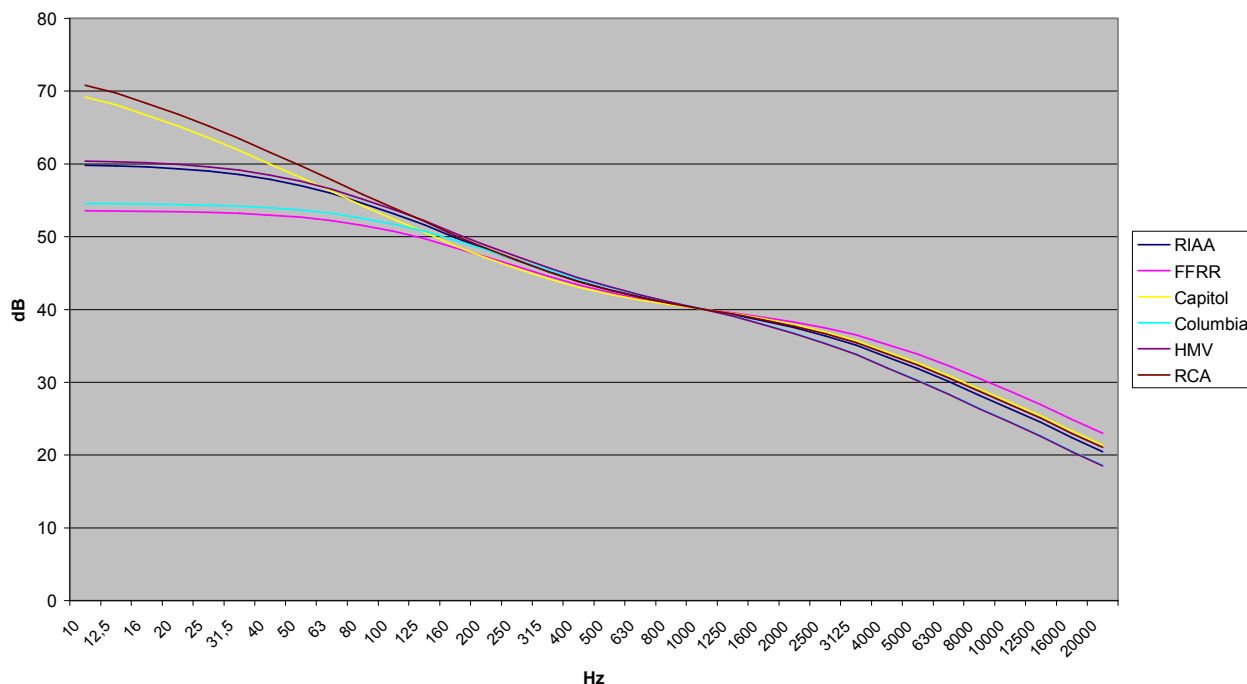


Figure 23

To better understand the effect of using the wrong equalization curve to play a record, Figure 24 shows the relative level versus frequency of the music on a Decca FFRR record when it is played through a RIAA phono input of a modern amplifier.

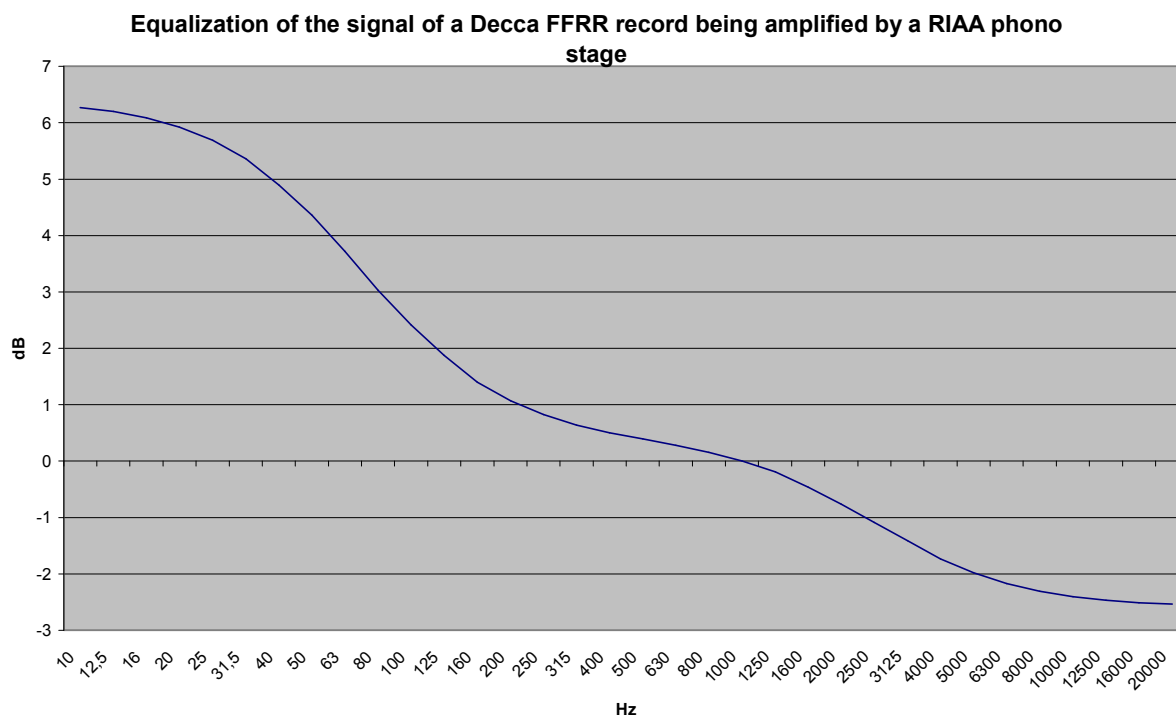


Figure 24

See how low frequencies are excessively exalted due to the different turnover frequency (50Hz for RIAA, 100Hz for FFRR), while high frequencies are attenuated more than required due to the different roll-off (13.7dB for RIAA, 10.5dB for FFRR).

The sound of this setup would be much heavier and darker than intended by the recording engineer, with booming low frequencies and muffled highs. A good recording would be turned into a terrible one!

Now the need for a large collection of phono equalization curves is apparent.

9.2. List of phono equalization curves available on the JOPLIN and notes on their usage

The JOPLIN is provided with 16 curves for microgroove LP's and 7 curves for 78rpm's. A quick search on the Internet will allow you to find that the old record labels were more than the figures above and that sometimes the same record label used different curves during the years. Actually, it can be seen that some labels used the same curve as other labels (e.g. Mercury used the same curve as Capitol), so the curve set provided with the Joplin is the one which covers almost all the labels producing records between 1925 and 1954.

To find out more about which curve to use with a specific record, extensive literature may be found on the Internet (for example: <http://www.shellac.org/wams/wequal.html>, <http://midimagic.sgc-hosting.com/mixcurve.htm>).

9.2.1. RIAA

It's the standard curve of present days, used from almost all the record labels since 1954. Its use is generally indicated on the record label and/or on the cover. It is actually the same curve as the RCA's "New Orthophonic", so it can be used to play RCA records claiming the use of that curve also.

During the years, RIAA made some amendments to the curve. The most relevant, after an indication from IEC, was the addition of a 16Hz high pass to cope with the rumble produced by warped records or noisy turntables. Not all cutting plants adopted this amendment and it's very difficult to tell whether or not it's been adopted for a certain pressing, as the curve is always indicated as RIAA.

The JOPLIN has not a specific RIAA/IEC curve, but it can be obtained by selecting RIAA and the high-pass filter at 16Hz (see Section 8.3.7).

9.2.2. AES

AES (Audio Engineering Society) proposed a phono equalization curve back in 1951. As far as we know, no label explicitly adopted it, but the discerning record collector may be aware of its use, so it's been included for completeness.

9.2.3. Angel (ANG)

Angel was a record label incorporated by EMI who produced great records.

9.2.4. Audiophile (AUDP)

Audiophile is known amongst record collectors for her great recordings, on both 78rpm and microgroove LP. Acoustic Sounds proposed the reissue of some Audiophile recordings on coloured heavy weight vinyl some 15 years ago. The label was mainly devoted to jazz and blues.

9.2.5. Capitol (CAP)

Capitol had a large production of very good mono recordings.

9.2.6. Columbia (COL)

Columbia is the inventor of microgroove LP, which got to success after a market war against RCA, who was sponsoring a 45rpm microgroove standard.

9.2.7. HMV

HMV (His Master's Voice, after the painting with the dog Nipper listening to a gramophone), formerly The Gramophone Company, is one of the oldest record labels ever. It later became part of EMI when the latter bought Capitol, and had RCA as shareholder for a certain time. From 1948 to 1954 recorded a lot of jazz, pop and classical music, pressing LP's with her proprietary curve.

9.2.8. Decca/London FFRR

The English Decca developed her FFRR LP curve based on the 78rpm eq curve with the same name. Most of the great recordings of the stereo era (after 1954) were also produced in mono and used to make the mono LP's cut using the FFRR curve.

9.2.9. MGM

The famous entertainment company also produced LP's during the mono era using her proprietary curve.

9.2.10. NAB

NAB (National Association of Broadcasters) was founded by commercial radio companies to address many aspects of their activity. Amongst these, the technical issue related to broadcasting. NAB proposed a phono curve to be used for the records which were made at the time especially for broadcasting, with live and rare recordings of famous artists. The record collector who own these records should use this curve to play them.

9.2.11. Oiseau-Lyre (OYLR)

Before being purchased by Decca, Oiseau-Lyre made many great recordings of classical music.

9.2.12. Pacific Jazz (PACJ)

Jazz was a great business in USA after WWII, so some specialized labels chose to develop their eq curves to press their microgroove LP's. Pacific Jazz was one of them.

9.2.13. Philips

Of course, Philips, one of the greatest European brands related to music, developed its eq curve.

9.2.14. RCA (RCA1, RCA2 and RCAO)

RCA developed many equalization curves, to be used with her 45rpm's and, later, for the microgroove LP's after losing the format war against Columbia, so it's difficult to say which curve was used for a certain record. The JOPLIN offers three choices, based on record's year of cutting. RCA1 is the oldest. The newest, RCA Orthophonic, is the one on which the "New Orthophonic" was developed, thus leading to RIAA.

9.2.15. Brunswick

Brunswick is a very old record company who mainly produced 78rpm's. The curve offered with the JOPLIN is the one used for the 78rpm's.

9.2.16. Columbia 1925, Columbia 1938 and Columbia England (CO25, CO38 and COLE)

Columbia was very active cutting 78rpm's before introducing the microgroove LP. She used different curves in different years: one between 1925 and 1938 and one from 1938

on. Not only: her English branch, Columbia England, developed her own curve for 78rpm's cut in Great Britain.

9.2.17. Decca FFRR 78rpm (DEC)

This is the equalization curve for 78rpm used by Decca, from which the LP FFRR was later developed.

9.2.18. MGM 78rpm (MGM7)

Before cutting LP's, MGM produced 78rpm's, which were cut using MGM proprietary curve for 78rpm.

9.2.19. Victor 1938-47 and Victor 1947-52 (VIC3 and VIC4)

Victor is an old company, later purchased by RCA, who produced 78rpm since 1925. The curve adopted between 1925 and 1938 is same as Columbia type 1925 (See 9.2.16), later curves are offered with specific choices.

9.3. Equalizing tapes: why and when

Recording and playback heads used in tape recorders have a frequency response which is strongly non linear and heavily dependent on the magnetic flux in the tape. Moreover, the tape hiss increases with frequency. For this reason, also tapes are equalized. Two equalization standards exist: NAB, mainly used in USA and Japan, and CCIR (later IEC), mainly used in Europe. To make things more complicated, each standard has different curves for different tape speeds, as flux changes with speed.

The main difference between records and tapes is that almost no turntable is provided with a built-in phono amplifier/equalizer, while almost all reel-to-reel tape recorders are. Thus, providing tape equalizations could seem to be useless.

Not always. Reel-to-reel recorders lovers know that most of the machines around, built between '60 and the beginning of '80, have generally great transports and heads but barely adequate, if not poor, electronics. For this reason, some recorders owners ask technicians to jump the playback circuit of the recorder, taking the signal right out of the playback head and feeding a dedicated external amp/equalizer.

Same thing can be done with the JOPLIN, connecting the playback head of a tape recorder to its analog inputs (eventually via an impedance adaptor), adjusting the gain as required and selecting the appropriate equalization curve for the tape being played back. The signal is acquired, equalized in digital domain and sent to a computer for recording or to a DAC or digital amplifier for real-time listening. The ample bandwidth of the JOPLIN set to 96, 192 or 384kHz, and its high resolution are more than adequate to accommodate the tape recorder performance.

The JOPLIN is provided with 4 curves for tapes, 2 for NAB and 2 for CCIR/IEC.

9.3.1. CCIR/IEC for 9.5cm/s and 19cm/s (3¾ ips and 7½ ips) and CCIR/IEC for 38cm/s (15 ips) (IEC1 and IEC3)

CCIR (Comité Consultatif International pour la Radio) was an European Committee similar to NAB. They proposed an equalization for reel-to-reel tape recorders which was adopted by most European manufacturers. It has been said by many that the CCIR equalization is better than the NAB one. Anyway, the choice of one or the other standard is only an option when recording, as some tape recorders have both equalizers. For playback, the choice depends on the standard used to record the tape. For the record, all commercial pre-recorded tapes available on eBay or other auction sites are made using NAB.

9.3.2. NAB for 9.5cm/s (3¾ ips) and NAB for 19cm/s (7½ ips)

NAB proposed two equalization curves for tapes, one for 3¾ ips (curve B) and one for 7½ ips (curve A), plus an amendment for 15 ips which, anyway, was suggested to avoid (7½ ips was the preferred speed for tape recorders used in broadcasts). The JOPLIN offers both curve A and curve B.

9.4. Acquiring with equalization

When no equalization curve is used, then the rightmost led of each VU-meter bar turn on right before clipping (that is, when the input signal is -1dBFS). Should the input signal further increase its amplitude, the ADC saturates and the “CLIP” warning is displayed on the display. User should avoid getting the “CLIP” warning appear at any time during acquisition.

When an equalization curve is used, then the VU meter is not consistent with the effective risk of saturation, as it indicates the signal downstream the equalization. User should then pay attention to “CLIP” warning appearing even when the bar is not completely lit. As a general rule, ADC clipping may occur when using equalization at a VU meter level such as the 4-5 rightmost leds are still off (this indicates a post-equalization level of -5/-8dB).

9.5. Interfacing a cartridge or a tape head

The JOPLIN has an input impedance of 47 kOhms, that is a standard value that fits all line-level sources and also MM cartridges. On the other hand, MC cartridges and also tape heads may need a different load impedance.

Due to the small size of the JOPLIN back panel, no room was available to add some impedance matching switches. Should an impedance matching be necessary, we suggest users to use a “T” adaptor and RCA plugs in which tip and ring are connected with a resistor or a capacitor of the required impedance value.

9.6. Recording programs

When acquiring on a computer with the JOPLIN, a suitable program of application needs to be used. Several different programs or packages are available for Windows, Mac and Linux, some of them are freeware, others need to be purchased.

M2TECH cannot be aware of all the available programs, nor specifically recommend any of them, nevertheless some indications are useful for the JOPLIN owner in order to have a glance of the available features and the possibilities offered by the various programs.

A free package for Windows is Audacity (<http://audacity.sourceforge.net/?lang=en>) which allows for recording up to 192kHz 24bits and generates files in WAV, FLAC and other compressed formats. Several options dedicated to the vinyl are available, as automatic tracks cut to divide the acquisition of an LP side into the single tracks, and de-clicking.

A much more professional package, Cubase, is sold by Steinberg (<http://www.steinberg.net/en/products/cubase/start.html>) and can operate up to 192kHz 32bits.

Mac users may take advantage from PureVinyl (<http://www.channld.com/pure-vinyl.html>) by Channel D, as well as from SoundBlade by Sonic Studio (http://www.sonicstudio.com/sonic/products/sonic_productoverview.html). For sure, free apps are available as well.

For a very complete list of ripping programs, please check <http://www.recordcollectorsguild.org/modules.php?op=modload&name=sections&file=index&req=viewarticle&artid=6&page=1>.

10. Using a power supply different from the standard one

The JOPLIN comes with a 15V/1A wall adapter. This unit has been tested to comply with the JOPLIN's power and supply quality requirements and allows for very high performance. Nevertheless, a better (and more expensive) unit could squeeze the last degree of performance from the JOPLIN.

M2TECH manufactures a high-quality, battery-powered power supply to be used with the JOPLIN, called PALMER POWER STATION (www.m2tech.biz/palmer.html). It is the best choice to push the JOPLIN performance to the highest level possible.

We advice users that using a different power supply than the one included in the package or the PALMER POWER STATION will void the warranty: no warranty claim will be acknowledged for damages due to the use of power supply different from the one included in the package or other units specifically designed by M2TECH for the JOPLIN.

Should the user decide to use another power supply, the specifications listed in section 12 must be observed.

11. Cleaning the unit

The JOPLIN should be cleaned with a soft, damp cloth. Do not use alcohol or other cleaning liquids to avoid damaging the unit.

12. Technical Specifications

Sampling frequencies:	44.1, 48, 88.2, 96, 176.4, 192, 352.8*, 384kHz*
Resolution:	16 to 32 bits**
USB:	2.0 high speed (USB 2.0 Audio compliant)
Clock precision:	+/-10ppm 0 to 60°C, 2ppm typical @ 25°C
Analog input sensitivity:	1.7V _{rms} (0dBFS, gain = 0dB) 0.95mV _{rms} (0dBFS, gain = 65dB)
Analog input impedance:	47 kOhms
Analog input gain	0, 10-65dB (1dB steps)
S/PDIF input sensitivity:	0.5Vpp +/-0.1V
S/PDIF input impedance:	75 Ohms
S/PDIF output voltage:	0.5Vpp +/-0.1V
S/PDIF output impedance:	75 Ohms
AES/EBU output voltage:	2Vpp +/- 0.5V
AES/EBU output impedance:	110 Ohms
THD+N:	0.0004% (1kHz @ 0dBFS, f _s =192kHz, 0-20kHz)
S/N ratio:	122dB (A-weighted, f _s =384kHz)
Minimal requirements:	1.3GHz CPU clock, 1GB RAM, 2.0 USB port
Supply voltage:	15V _{DC}
Power consumption:	290mA
Size:	200x50x200mm (w x h x d, cabinet) 200x55x210mm (w x h x d, with connectors and feet) 360x120x260mm (w x h x d, box)
Weight:	1.7kg (ADC only) 2.5kg (box)

* USB only.

** 32 bits are provided on USB output only.