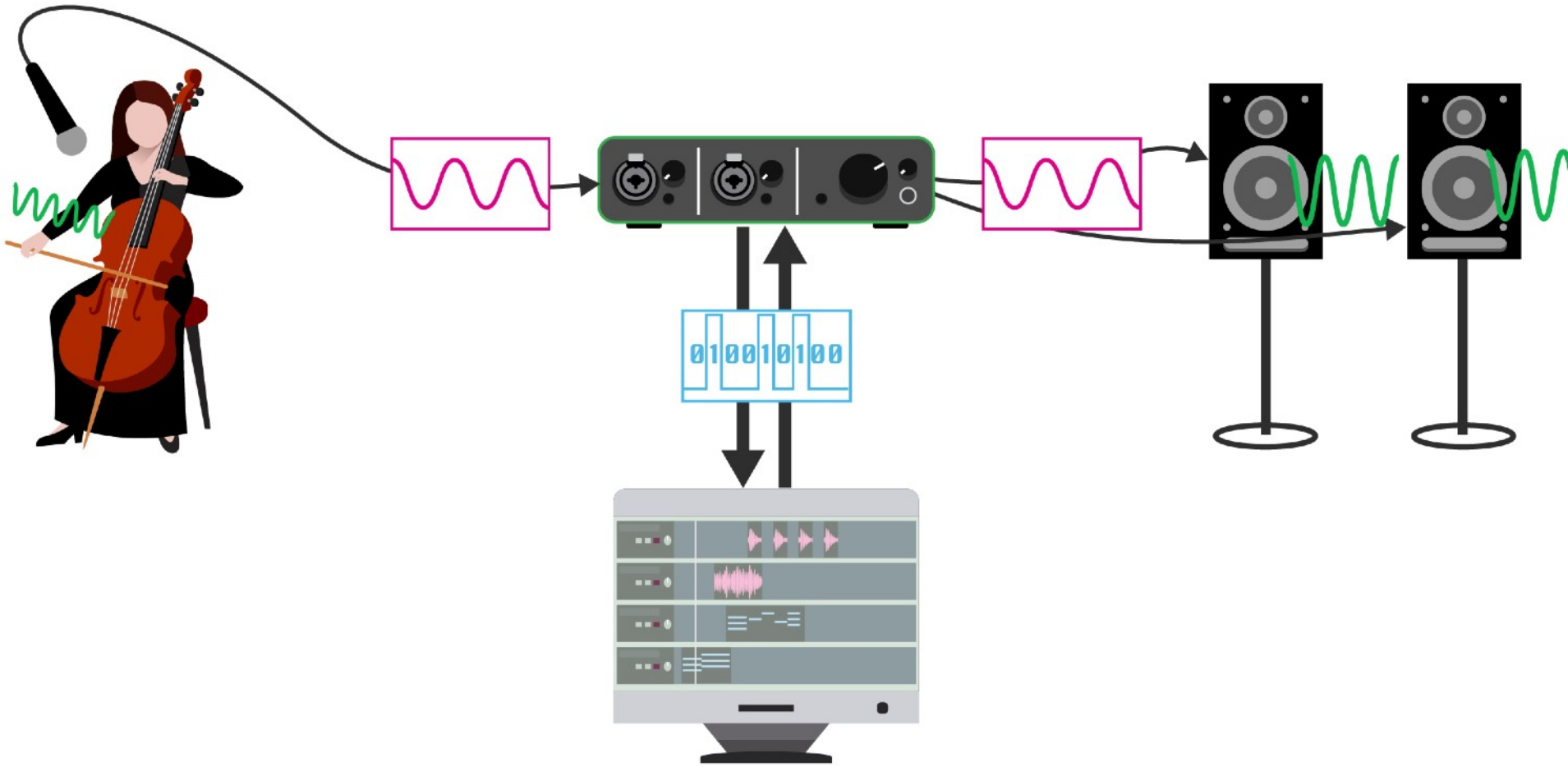
ELECTROACOUSTIC SYSTEMS - DIGITAL

COMPUTER
AUDIO INTERFACE
MONITOR
FILES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Computer

Computer plays the role of the brain of the digital system, because its job is to collect and process the data coming from all of the input devices and then deliver the results to the output devices.

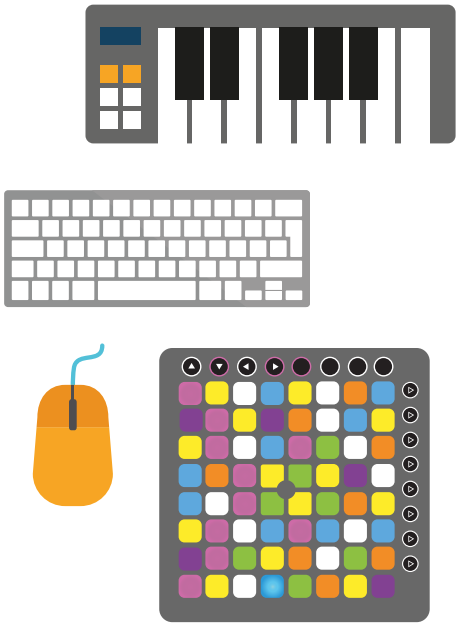
HARDWARE

SOFTWARE

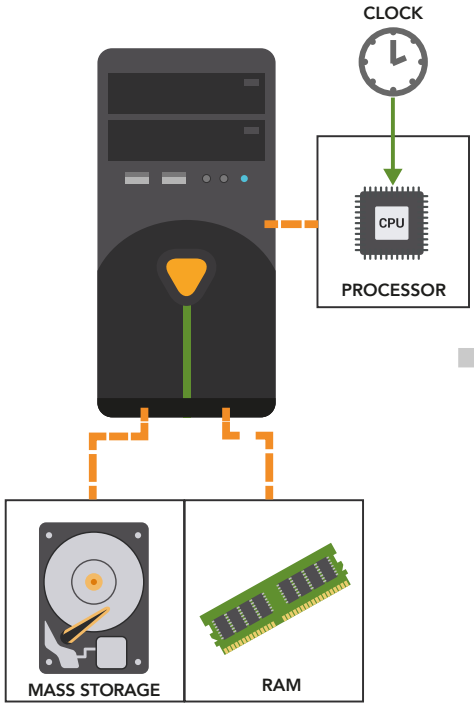
Computer

Hardware

INPUT



PROCESSING



OUTPUT

Computer

Hardware Hard Disk

HDD

Hard Disk Drives use magnetized disks and a read head, leading to higher power consumption, fragility, and slower speeds. However, they offer lower costs and larger capacities.

SSD

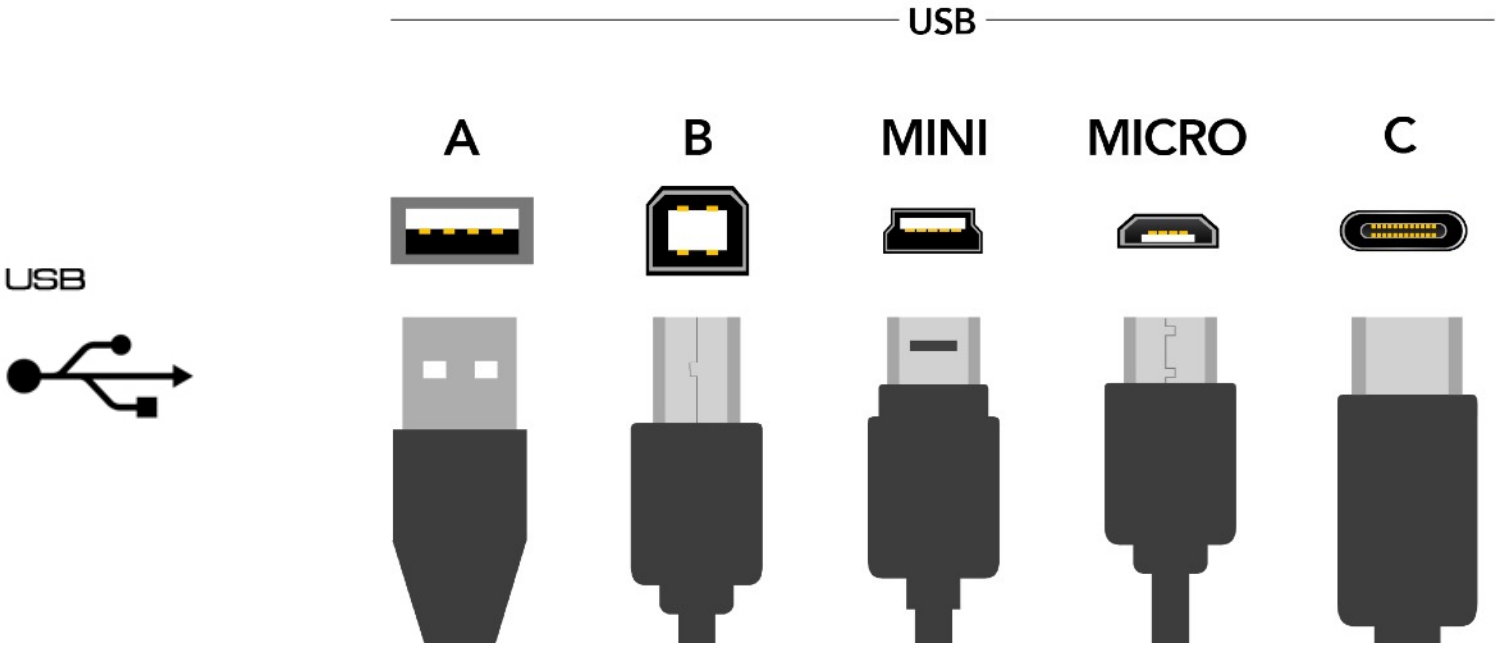
Sold State Drives have no moving parts, offering faster read/write speeds, lower fragility, and reduced power consumption. These features are essential for portable devices like laptops, tablets, and smartphones. SD cards and USB drives use the same technology as SSDs.

Computer

Hardware Hard Disk

Internal plugged directly into the computer's motherboard

External a cable is needed to connect the storage to the computer



Computer

Software

Operating systems

large programs that manage the machine's hardware and software resources and provide essential services to the application software that is installed on the computer.

Windows | MacOS | Linux

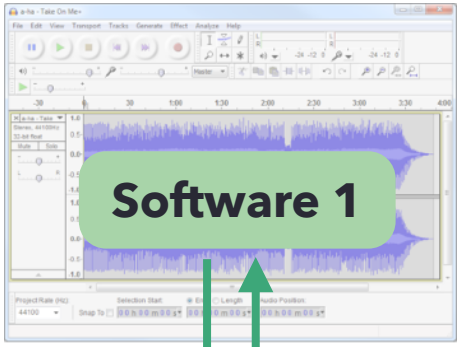
Application Softwares

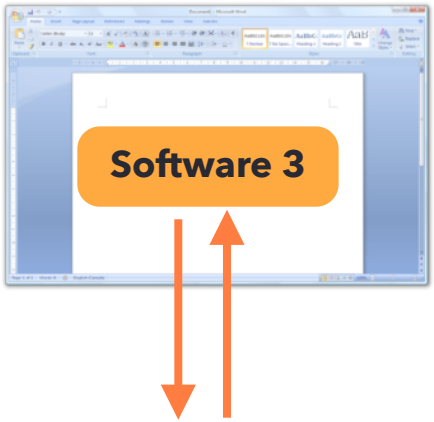
all the applications we install on our computers, smartphones, or tablets that we interact with to do a particular task.

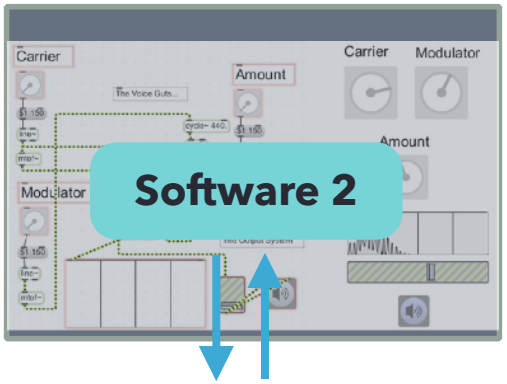
Audacity | Reaper | Word

Computer

Software







Operating System

Windows | MacOS | Linux

Computer

The computer language

The only language that computer uses is called **binary code**. It's based on digits that can have only 2 states:

0 1

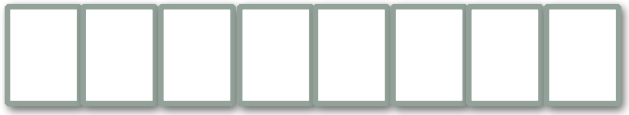
Decimal	Binary
0	0
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

Computer

The computer language

bit One digit only

byte A group of 8 bits.



1 **kB** (kilobyte)	=	1000 byte
1 **MB** (Megabyte)	=	1.000.000 byte
1 **GB** (Gigabyte)	=	1000 MB = 1.000.000.000.000 byte
1 **TB** (Terabyte)	=	1000 GB = 1.000.000.000.000.000 byte

Computer

The computer language Files

The data handled by the computer are contained in **files**

extension tells someone what kind of software application is needed to properly open a file.

It is usually three characters

NameOfTheFile.doc **Text**

NameOfTheFile.avi **Video**

NameOfTheFile.wav **Audio**

NameOfTheFile.mp3 **Audio**

Computer

Il linguaggio del Computer Files audio

Tipi di
Files Audio

Lineari
conservano tutte le informazioni del campionamento

- wav
- aif

Compressi
tengono conto dei limiti della nostra percezione e togliendo le cose che non possiamo sentire (e non solo), riducono la dimensione del file

loseless
Senza perdita di qualità

- flac
- wma
- m4a

lossy
Con perdita di qualità

- mp3
- wma
- m4a

Computer

Il linguaggio del Computer Files audio Mp3

Mp3

MPEG1 Layer3

Introduced in 1997, MP3s revolutionized music by enabling easy distribution with good audio quality and small file sizes. The compression level, set by the **bitrate**, directly affects audio quality; a higher bitrate results in better sound. MP3s could be freely shared online and stored in portable devices.

We can choose a **constant bitrate (CBR)** for uniform quality or a **variable bitrate (VBR)** that adjusts based on the waveform's complexity, optimizing file size and quality.

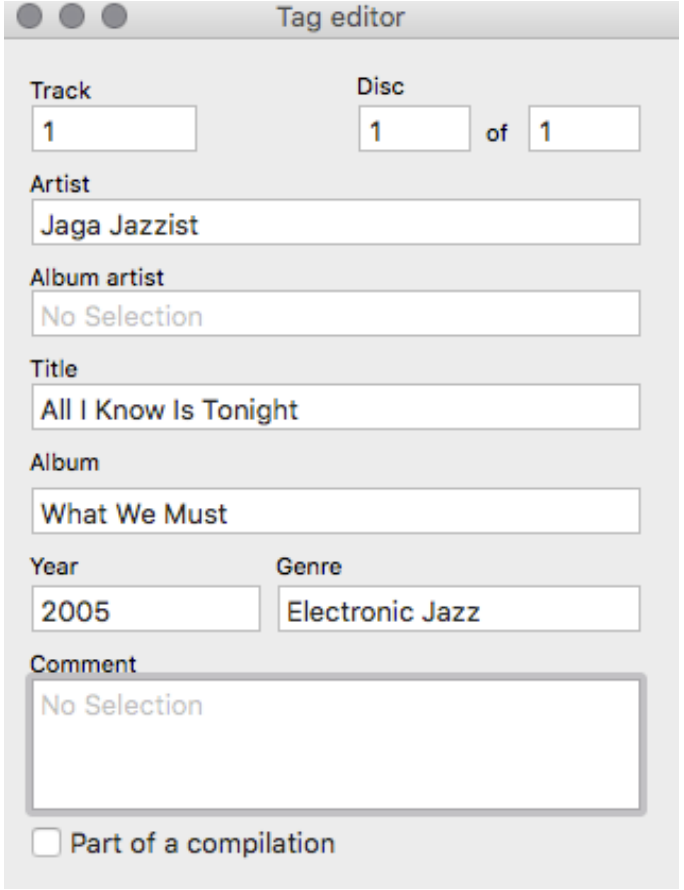
Computer

The computer language Files audio Mp3

Mp3

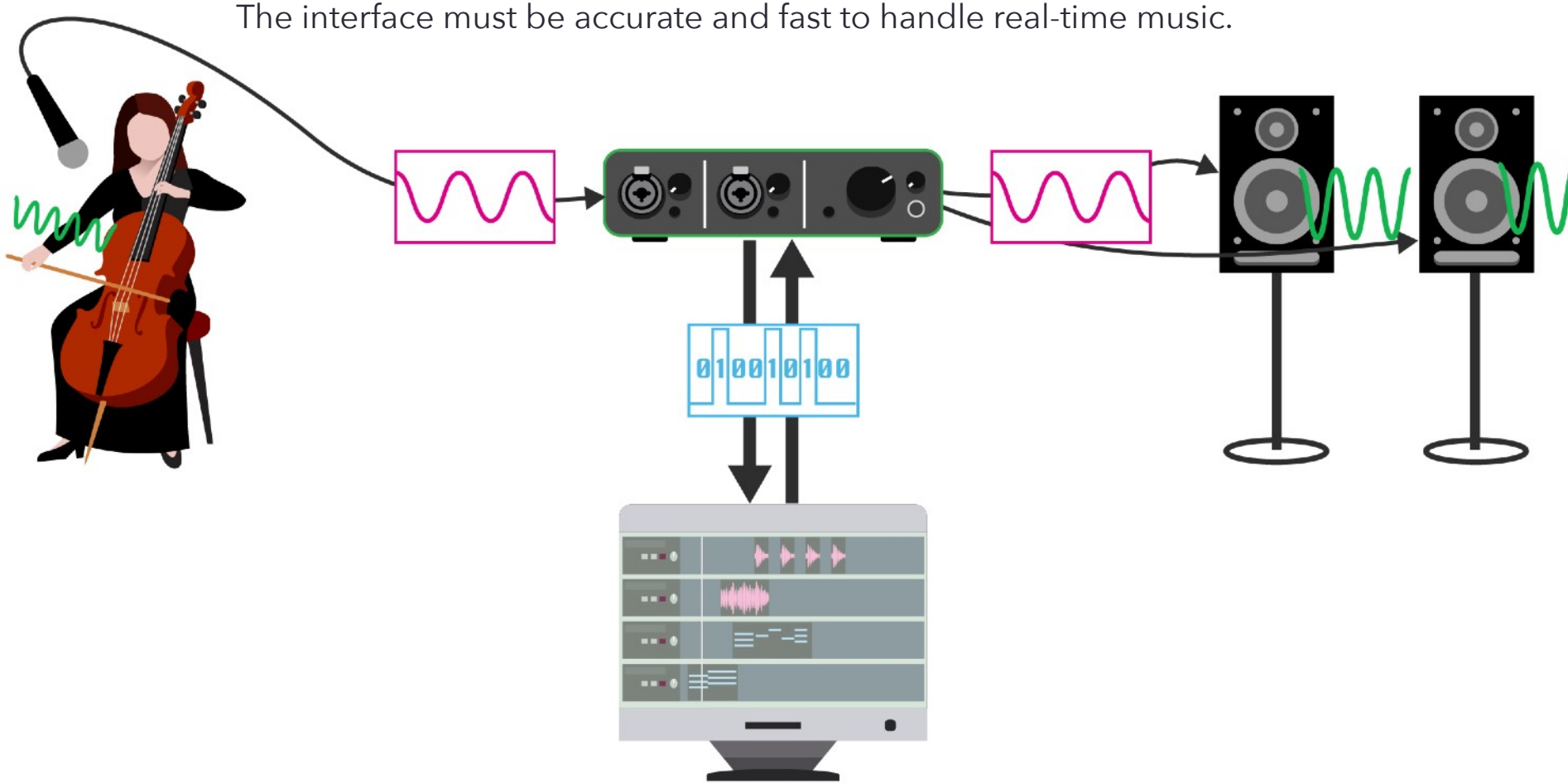
MPEG1 Layer3

MP3s feature **ID3 tags**, allowing storage of metadata like title, artist, album, genre, and track number. This metadata is displayed during playback, enhancing the listening experience.



Audio Interface

An audio interface is crucial for music production and performances, converting analog signals to digital for the computer and vice versa. These conversions are essential as computers only process binary code. The interface must be accurate and fast to handle real-time music.



Audio interface

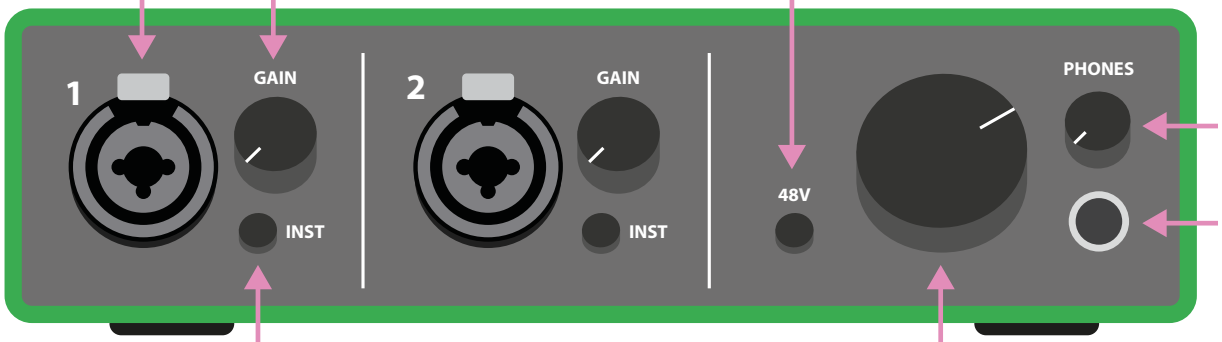
Internal meant for general audio tasks like music playback or calls, offer lower quality and limited inputs and outputs.

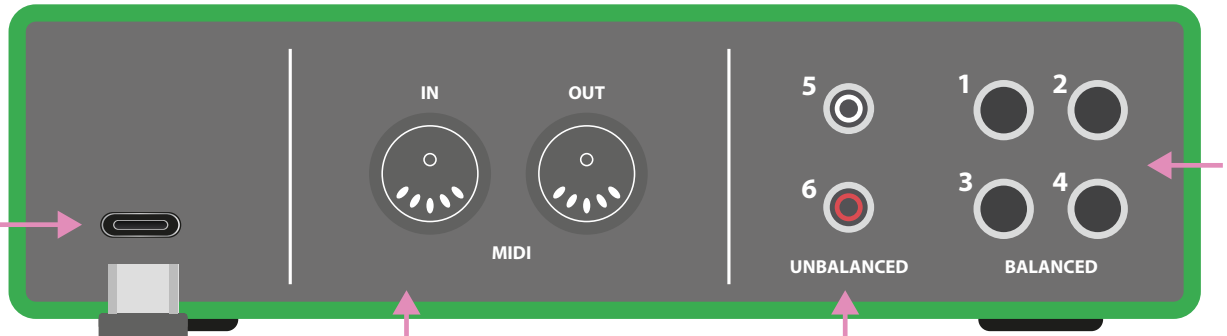
External External audio interfaces, designed for musical use, offer higher-quality preamps and ADC/DAC converters, along with more input/output ports. Thus, we will focus on external audio interfaces in the following descriptions.

The value of an audio interface is related to:

:: **number of inputs and outputs**
:: **type of input** (Combo, Instruments…) **and output** (balanced, unbalanced, XLR, RCA…)
:: **converter quality** (A/D e D/A)
:: **preamplification quality**
:: **Maximum sample rate** (96Khz in the professional audio interfaces)
:: **Maximum bit depth** (48bit in the professional audio interfaces)

Audio interface





input
combo
analog input
(XLR-TS)

gain
adjusts the preamplification
of the input signal, essential for
mic level such as those of microphones

+48V
activates the phantom power (+48V),
essential for condenser microphones

phones
controls the output
volume of the
headphones

headphones output

inst or Hi-Z
switches between an
instrument-type
signal with high impedance
(guitars or electric basses)
and mic level signals with
low impedance
(microphones)

master vol
controls the output
volume of the main
outputs

USB
communicates with
the computer via USB

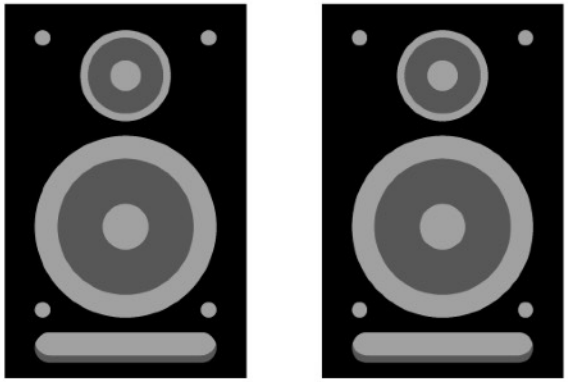
balanced
balanced outputs
via TRS cable
(3-pin)

in/out MIDI
MIDI input and output (digital)
via MIDI cable (5-pin)

unbalanced
unbalanced outputs
via RCA connector (2-pin)

Monitor and Headphones

Once the output signal leaves the audio interface, it's analog again, heading to studio **monitors** or **headphones**. Studio monitors are high-quality, full-range speakers, typically active and positioned to form an equilateral triangle with the listener. The room's acoustic design, including size, wall shape, materials, and reverberation time, is crucial for accurate sound.

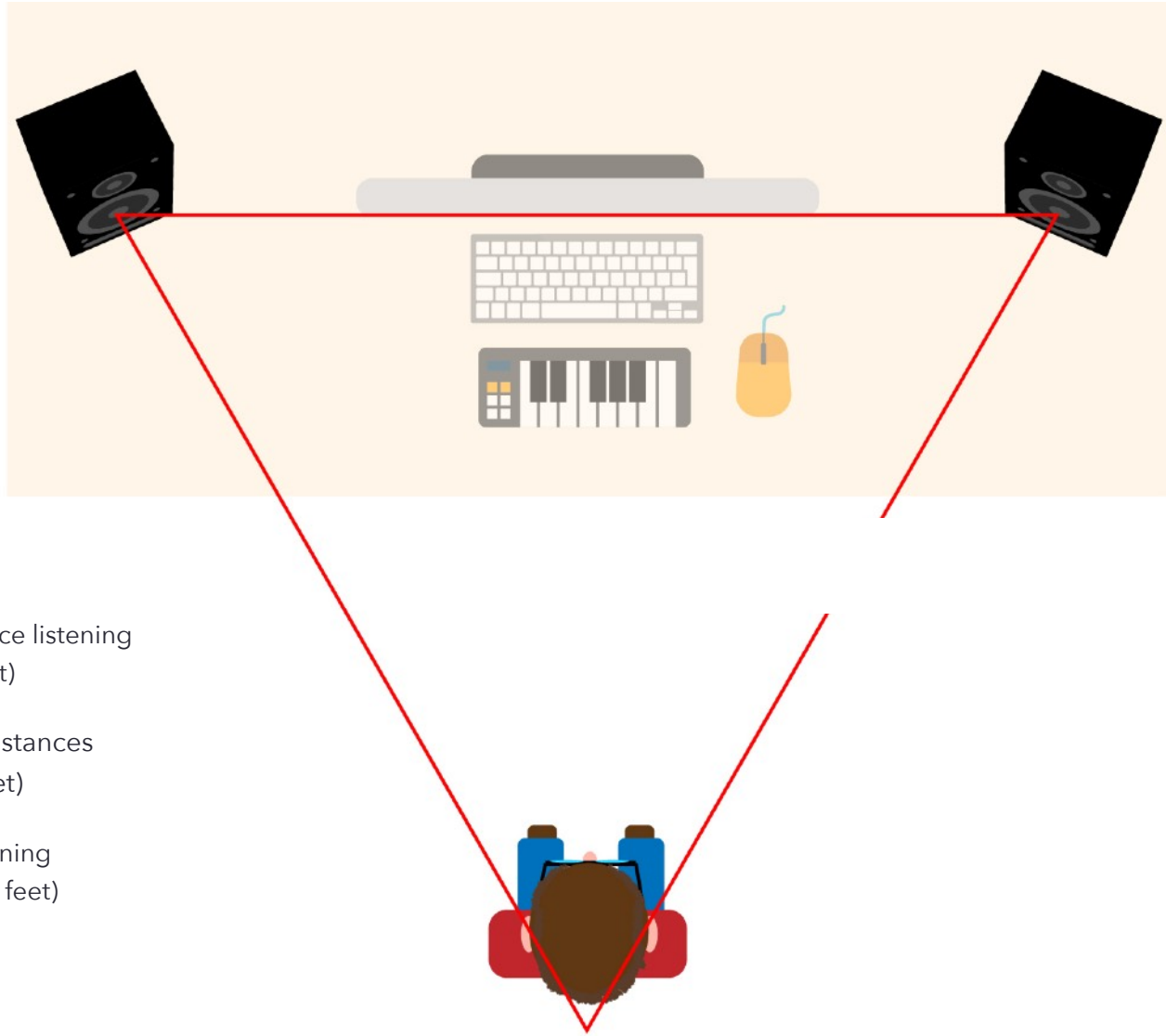


Monitor

Speakers

Active Amplified

Passive Not amplified



near-field monitors for short-distance listening (about 150 cm or 3-5 feet)

mid-field monitors for medium distances (150-250 cm or 5-10 feet)

far-field monitors for spaced listening (more than 250 cm or 10 feet)


1
GAIN
INST
AIR
PAD
2
GAIN
INST
AIR
PAD
48V
MIDI
MONITOR
Scarlett 4i4


MIDI
OUT
IN
3
1
3
LINE OUTPUTS
LINE INPUTS
4
2
4
Focusrite

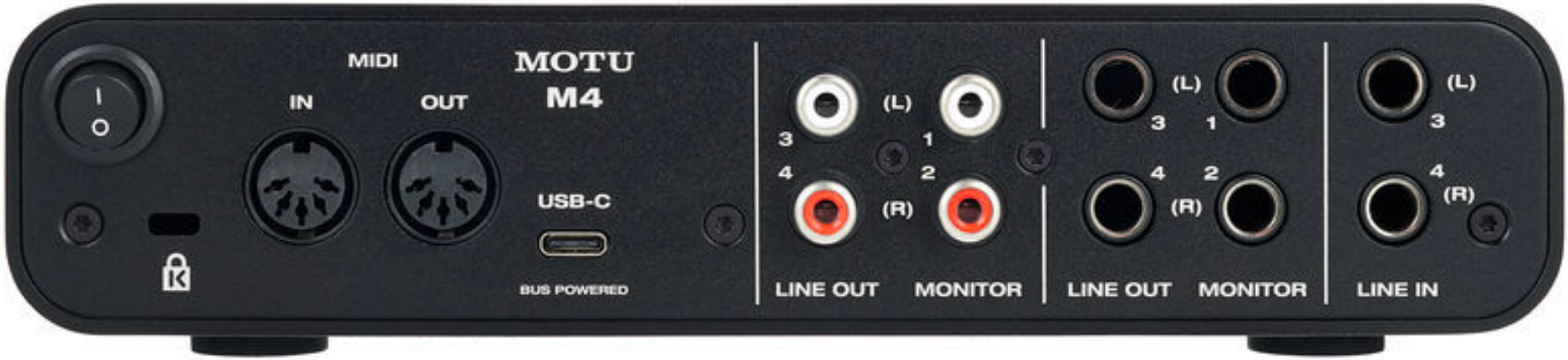

apollo twin | x
CH1 CH2
MIC
PREAMP
MONITOR
INPUT
+48V
PAD
Ø
LINK


apollo twin | x
OPTICAL IN
POWER
OFF
ON
12VDC
LINE OUT
MONITOR
MIC/LINE 2
MIC/LINE 1


MIC/LINE
CLIP
SIG
48V
1
2
INPUTS
3
4
CH
LEV
push
toselect
FIREFACE UCX
WC
SPDIF
ADAT
HOST
STATE
IN1
IN2
OUT1
OUT2
MIDI
PHONES
7/8


POWER
12 Watt
8 - 18 V DC
Center Pin +
ON OFF
POWER
USB
FW 400
REMOTE
MIDI
WORD
OUT
INP
ADAT
OUT
IN
SPDIF
IN
OUT
Made in Germany
6 5 4 3 2 1
BALANCED LINE OUTPUTS
8 7 6 5
BALANCED LINE INPUTS


IN 1L
GAIN
48V
MON
MIC / LINE / GUITAR
IN 2R
GAIN
48V
MON
MIC / LINE / GUITAR
INPUT
PLAYBACK
INPUT MONITOR MIX
3-4
1 2 3-4
1 2 3 4
IN
OUT
MOTU
MONITOR


MIDI
IN
OUT
MOTU
M4
USB-C
BUS POWERED
3
4
(L)
1
2
(R)
LINE OUT
MONITOR
3
1
(L)
4
2
(R)
LINE OUT
MONITOR
3
(L)
4
(R)
LINE IN

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