Hardware

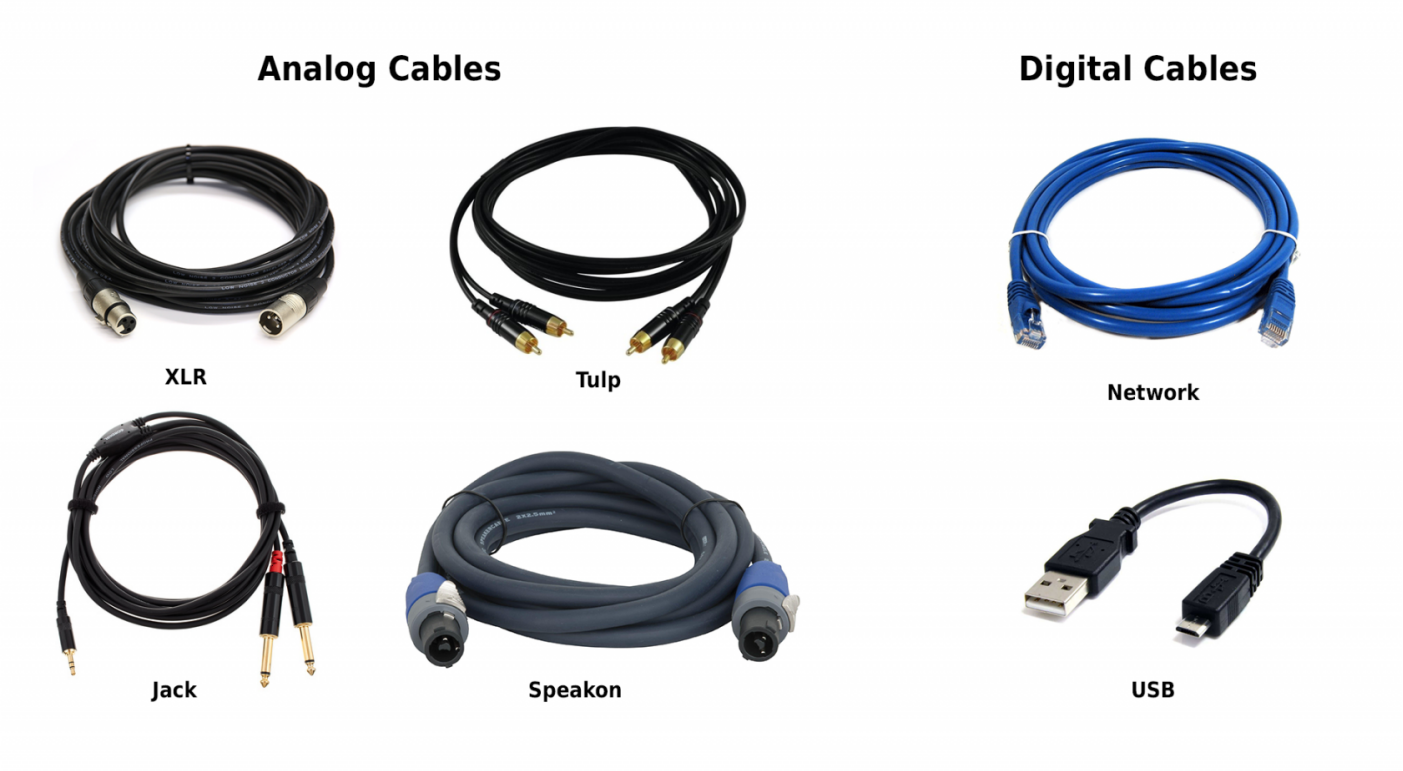
- Types of Audio Cables
- Using Audio Interfaces
- Basic Stereo Speaker Setup
- Quadrophonic Speaker Setup
- Zoom recorder

Types of Audio Cables

There's a difference between analog and digital audio cables:

- Analog Cables are using electricity to transmit information
- Digital Cables use strings of data (1's and 0's) to transmit information

In the Blackbox, you will find both of these types of cables, for most setups we use analog cables such as Jacks, XLR, Tulp, and sometimes Speakon. Digital cables are used more as 'interface cables' and common ones are USB and Network cables.



Analog Cables

Most analog cables are used to transmit 3 types of signals:

- Line level: is the standard strength we use with audio equipment
- Mic/Microphone level: needs to be boosted to line level, because it's a low signal.
- Instrument level: such as coming from guitars/synths, also need to be boosted to line level.

This 'boosting' of the signal can be accomplished using amplifier equipment such as mixers, audio interfaces, and DI (Direct-In) Boxes.

UNBALANCED cables have only 2 wires:

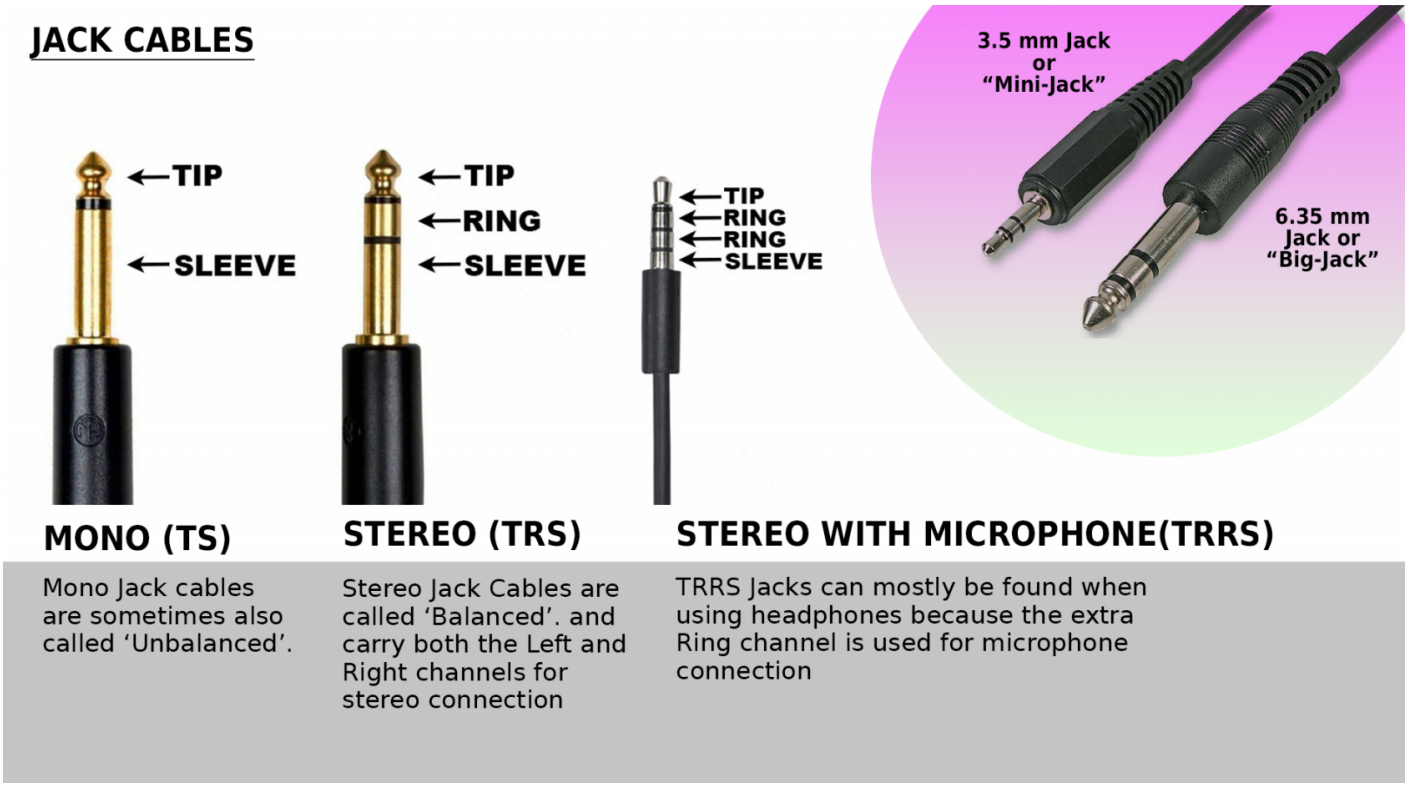
1. Signal
2. Ground

BALANCED cables have 3 wires:

1. Signal (+)
2. Signal (-)
3. Ground

Balanced cables are generally better for noise cancellation, we're not going to deep dive into this for now, but the use of 2 Signal (+) and (-) makes that the interfering noise that occurs between sender and receiver is canceled out.

Jack Cables



A TRS cable consists of:

- Tip (Signal +)
- Ring (Signal -)
- Sleeve or Ground

When working with Jack cables, you can choose between unbalanced and balanced cables. A lot of instruments such as guitars and keyboards have unbalanced connections. When building sound setups over longer distances, we always advise balanced (TRS) cables.

XLR Cables



XLR cables are always balanced and are also used commonly as microphone cables and also have 3 contact points. (Signal +, Signal -, Ground)

XLR connectors are much sturdier and the cables are generally better shielded than Jack connectors.

Tulp/Cinch cables

Tulp cables are not that common anymore to use, but they are mentioned in some of the patch setups in the submenu (<-). Tulp cables are also called **RCA** or '**phono**' connectors and you can find them still used in audio hi-fi systems, turntables, DJ controllers, and some audio interfaces.
Example:
We can use two 2x RCA -> 2x Jack cables to connect 4 different outputs of the Focusrite Scarlett 2i4 Audio interface to 4 different speakers for a quadraphonic speaker setup. (SEE PAGE)



Speakon

Speakon connectors and cables are used for connecting more power-hungry speaker equipment and amplifiers together. They are used for bigger systems and can be found in theaters and at festivals. Generally, you will only use these cables in bigger setups.



Using Audio Interfaces

Use an audio interface for recording sounds onto your computer, or to play sound from the computer back into the space.



Example with the Focusrite Scarlett 2i4

For recording some simple sounds you can use the Focusrite Scarlett 2i4 that is available in most Blackboxes and uitleen, or any other similar audio interface. For now we stay to the Scarlett 2i4, since it's been used the most in the workspace. An audio interface lets us interact with sound in different ways, you can use the interface for example to:

- Connect instruments and/or microphones to a Speaker setup (no computer)
- Connect instruments and microphones to the computer via USB for recording
- Play sounds from your computer via USB to speakers using the audio interface

Different audio interfaces vary in number of inputs and/or outputs. Also some might include software for recording your sounds with, this is called a **DAW** (Digital Audio Workstation). Some popular DAW's are AbetlonLive, Reaper or StudioOne.
Depending on the audio interface, you will need to install additional **Drivers** (group of files that enable hardware devices to communicate with the computer). You can check if your operating system needs a driver by going to the website of the interface's manufacturer. In this case for the Focusrite Scarlett 2i4, no additional drivers are needed on Mac.

Focusrite Scarlett 2i4



Front

Inputs:
microphone, guitar, instrument



Jack



XLR



USB connector to computer/PC

Back

Outputs:
Speakers, Mixer, Exiters



Jack



Tulp

Connecting everything!

- Connect the Scarlett 2i4 to your Mac using the included USB cable
- In system preferences on your laptop/pc select "Scarlett 2i4" as the input and output device
- You can also select the "Scarlett 2i4" from your preferred Audio Software DAW (Digital Audio Workstation) such as AbeltonLive, StudioOne, Reaper.

Basic Stereo Speaker Setup

Making a stereo speaker setup using 2 speakers, an audio interface and computer.

Generic Stereo Speaker Setup

To make a basic stereo setup with your computer you need the following items:

- An audio interface
- A USB cable (*USB cable type depends on your computer and audio interface*)
- A pair of audio cables for each channel (*Depending on the output type the audio interface you need the following connectors: RCA - mono Jack / mono Jack - mono Jack / mono mono Jack - XLR*)
- A pair of active speakers





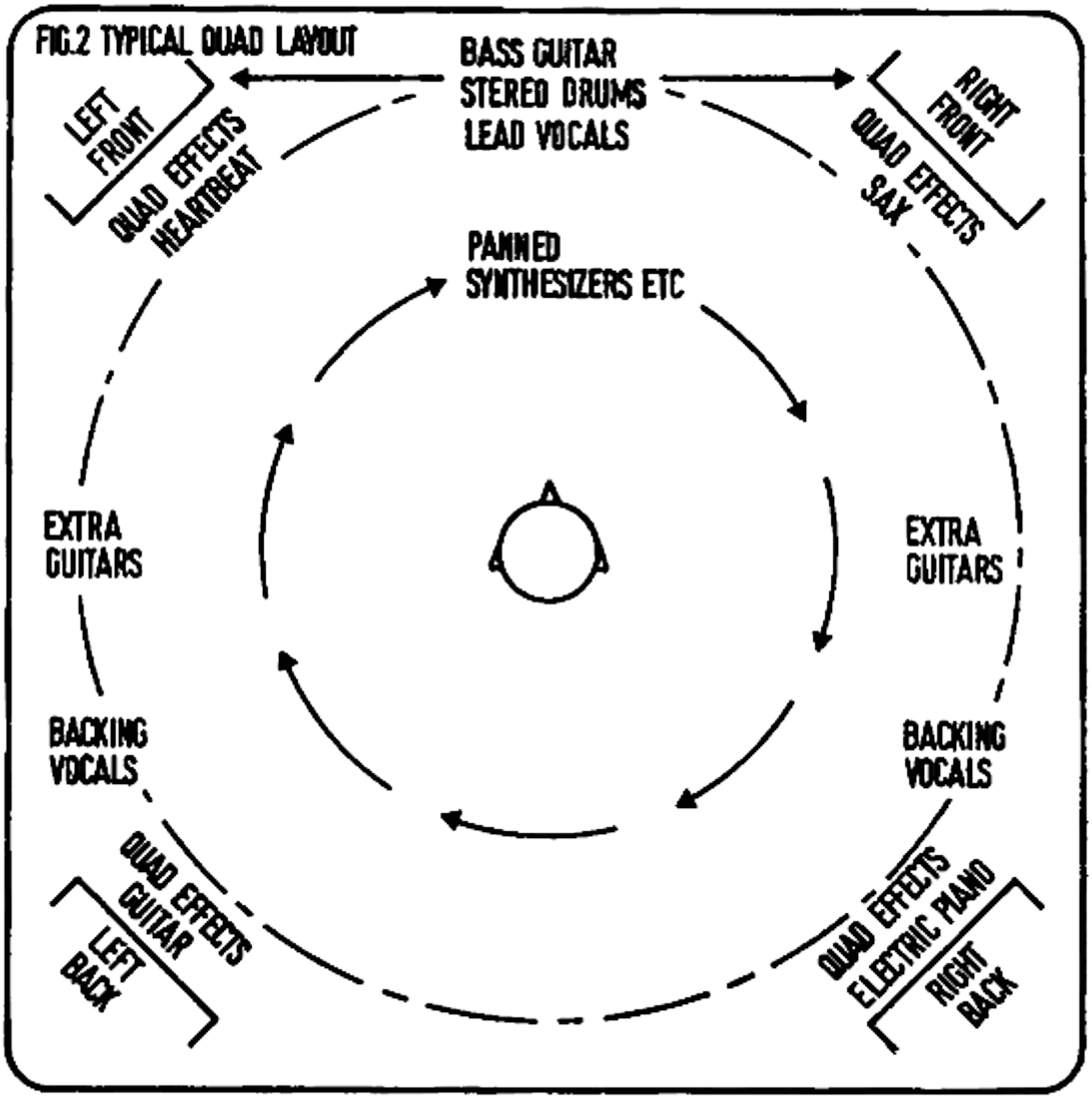
Quadrophonic Speaker Setup

Making a quadrophonic speaker setup using 4 speakers, audio interface, pc

Quadraphonic audio and speaker set-up

What is a quadraphonic audio and speaker set-up?

As the word quadra in quadraphonic implies it is a 4 channel audio format and speaker set-up. It is a basic configuration to achieve a simpel immersive audio experience and is considered to be the predecessor of surround sound like the Dolby 5.1 set-up. Within this book we wil show you some examples with different software. The quadraphonic set-up can be used as a classic 4 channel listening experience for 4 channel music pieces, or as a simple immmersive set-up for art installations or performances.



source https://stereosociety.com/foursides/

Required equipment for a quadraphonic audio and speaker set-up.

The following is a list of required equipment. In this configuration we make use of active/powered speakers. It is possible to make a quadraphonic set-up with passive speakers, but it involves 2 extra stereo amplifiers. For more info about that you can contact one of the Blackbox managers at the HKU.

- A computer with a suitable DAW or other type of capable software
- An audio interface with at least 4 audio outputs
- An USB cable for connection to your computer
- 4 x balanced jack to XLR cables (this depends on the type of output and inputs from interface to speakers)
- 4 x XLR cables to extend the jack to XLR cables
- 4 x active speakers[1] + power cables
- 4 x stands to place the speakers from the ground up to hearing level

[1]**Important!** *Always make sure that the volume settings of the interface and in the software are low and controllable and the sound is not playing before you power-up the speakers. Connecting the power or powering up the speakers is a last step after you checked the former steps. Active speakers translate the soundsignal directly into full loudness and have no controllable gain or volume knob. It may cause hearing damage if the volume settings are full open.*

Quadraphonics in software

To distribute a single sound channel over 4 or more channels it is useful to use a dedicated tool or plugin for that. Within most DAW's a surround panning effect or plugin is available. But if you want to add it as an interactive element within an spatial installation, you might need to construct one yourself. Node based environments like Max, TouchDesigner and Isadora let you build these tools within the software.

If you want to set-up audio tracks to different outputs within a DAW or Node software without using a panner, check these links:

https://bookstack.hku.nl/books/audio-hardware-software/page/multichannel-audio-in-isadora-and-reaper

https://bookstack.hku.nl/books/audio-hardware-software/page/4-speaker-setup-with-reaper

https://bookstack.hku.nl/books/audio-hardware-software/page/touchdesigner-audio-multichannel-output

The following link wil lead you to different quadrophonic or spatial panner examples within DAW or Node software:

https://bookstack.hku.nl/books/audio-hardware-software/page/quadraphonics-in-software

Thoughts about quadraponic set-ups

A quadraphonic set-up where conventional conical directed speakers are placed in each corner of a room in a 90 degree pattern from one another might nog be the optimal way to listen to a music piece sinds it leaves big acoustic gaps in between the conventional speakers. This creates a lack of overlap between the sounds which are displaced over the channels. An Omniwave speaker might be a better solution, but the character of these speakers are different and are not readily available for most users. So be aware of that when designing your soundscape or music project. But if you want to use a whole space to tell a story, a 90 degree spaced speaker set-up will fulfill the needs.

A step up from a quadrophonic set-up is a dolby 5.1 or 7.1 set-up.

Resources

https://www.wendycarlos.com/surround/surround.html

https://en.wikipedia.org/wiki/Surround_sound

https://en.wikipedia.org/wiki/5.1_surround_sound

https://en.wikipedia.org/wiki/7.1_surround_sound

Zoom recorder

Quick guide: https://zoomcorp.com/media/documents/E_H4n_Pro_QuickGuide.pdf

https://www.youtube.com/embed/NK3GTaSH8CQ