Foundations of Audio Engineering:
Audio Mixer

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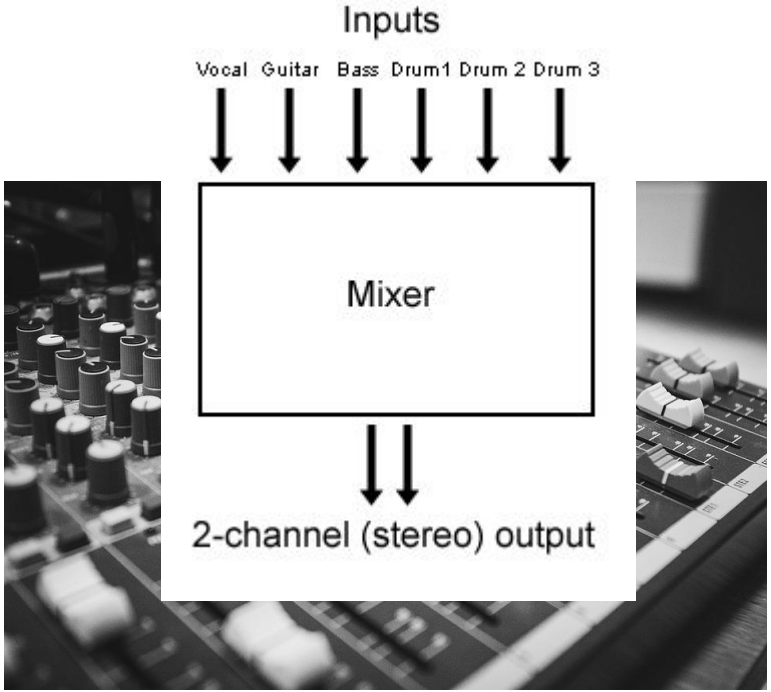
Partially based on:

- Christopher Ariza. 21M.380 Music and Technology: Recording Techniques and Audio Production. Spring 2012. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.edu. License: Creative Commons BY-NC-SA.
- Digital Audio Production IT3038PA, NITEC Digital Audio & Video Production. 2013. Institute of Technical Education College West.

Audio mixer

- Takes two or more audio signals, mixes them together and provides one or more output signals.
- Key functions are: signal control, processing, combination, and routing.
  - Adjust levels, enhance sound with equalisation and effects, create monitor feeds, record various mixes, etc.



Common uses for audio mixers

- Music studios and live performances:
  - Combining instruments into a master mix and additional monitoring mixes.
- Television studios:
  - Combining sound from microphones, tape machines and other sources.
- Field shoots:
  - Combining multiple microphones into 2 or 4 channels for easier recording.

Form factor of audio mixers

- Mixers come in a wide variety of sizes and designs, from small portable units to massive studio consoles.
- The terms sound desk and sound console refer to mixers which sit on a desk surface as in a studio setting.

Primary components of audio mixers

- A mixer can be seen as having two primary components
- Channel strips
  - A number of commonly used routing and processing tools bundled together
  - Should be called a “track strip”: may be applied to one or more channels
  - Physical mixers are made of numerous (4, 12, 16, 32, 64) channel strips
- Busses
  - A signal destination (a repository that signals lead in to, output may go to another channel or physical output)
  - May be called mains or main bus, groups or subgroups, or auxiliaries, aux sends, aux

Nx Audio OPERA Series

Channel strip

XLR Audio Inputs

TS Audio Inputs

Specifies if the input is mic- or line-level

XLR Audio Inputs

On-board compressor

EQ section; HF/LF boost/cut and a sweepable mid

Aux Sends for monitors/outboard FX

On-board FX Send

Pan Pot

Mute Switch

Solo Switch

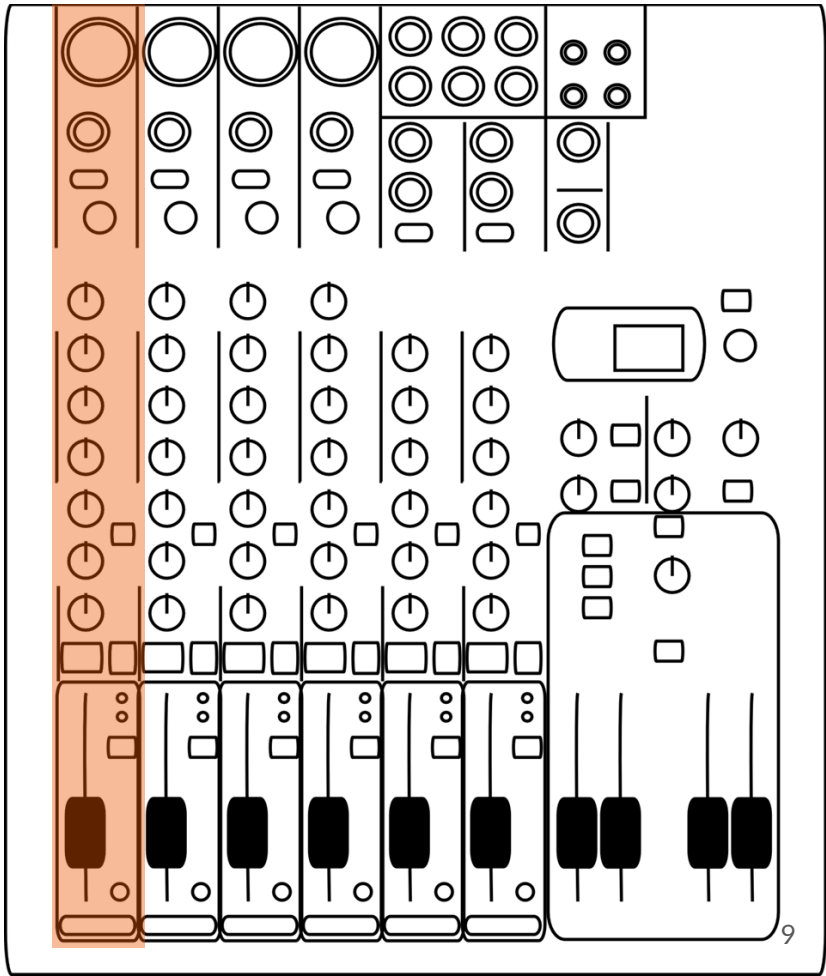
Sub Group Switch

Main Out Switch

Fader for channel volume

Channel strip

- Amplifiers, processors, and distributors (bus assignment)
- Common vertical orientation is not the same as signal flow
- Not necessarily always vertical



Channel strip components

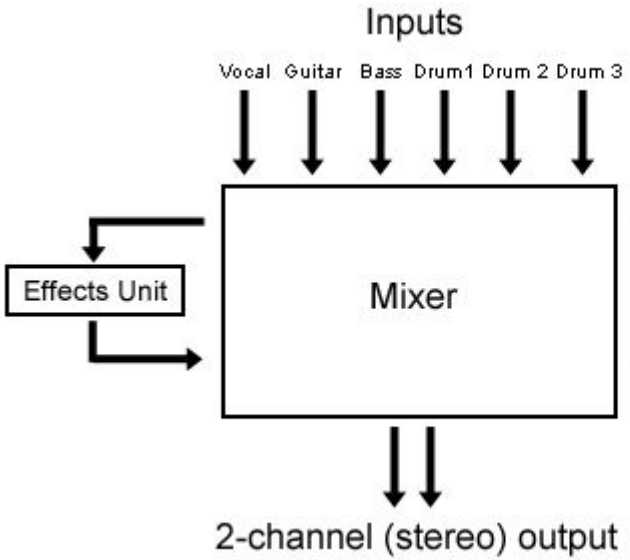
- Input or input selector
- Preamp, trim, line/mic level switch, pad, phase
- Low cut filter
- Eq and dynamics (serial processors)
  - Shelves and parametric eq
  - Dynamic effects such as limiters, compressors, gates, and expanders
- Mute and solo control
- Fader
- Insert:
  - serial processing slot
- Auxiliary sends:
  - For parallel processing or fader-controlled bus assignment
- Panning and bus assignment
  - Bus assignments may be stereo or multichannel
  - May use panning to assign to one channel of a stereo bus

Channel strip components

- Pad button
  - reduces input level (gain) by 20dB
  - useful to plug a line-level source into the mic input
- Phase selector
  - change the phasing at the input stage
  - for equipment and cables wired with different phasing
- Phantom Power
  - provide a small voltage back up the input cable to power a microphone or other device

Channel strip components

- Inserts Section:
  - A direct send/return or insert access point can be used to send the line level audio signal to an external processing device.
  - Dynamic processors, equalization, and effects processing only affects the signal passing through the selected I/O channel.
  - Console-wide signal processing (such as reverb and effects) are often controlled through an auxiliary effects send section.



Channel strip components

- Faders Section:
  - Each channel has its own fader (slider or knob) to adjust the volume of the channel's signal.
  - A fader is a potentiometer, or variable resistor.
  - There are two ways to adjust a channel's level: the input gain and the output fader.
  - Make sure the input gain provides a strong signal level to the channel without clipping and leave it at that level.
  - Use the fader for finer ongoing adjustments.

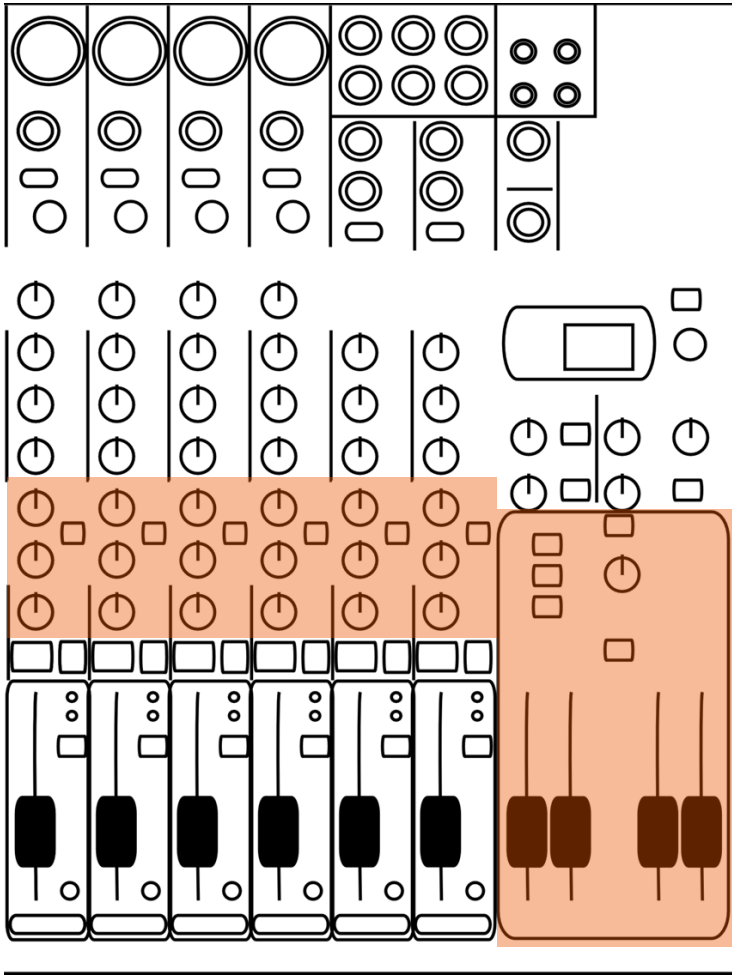
Channel strip components

- Audio Metering:
  - Metering means using a visual display to monitor audio levels.
  - Helps maintain audio signals at their optimum level and minimise distortion.
  - Two common types of meters to measure audio levels: VU meter and PPM Meter
  - Peak Program Monitor (PPM) meters are very good for reading fast, transient sounds where pops and distortion are a problem.

Busses

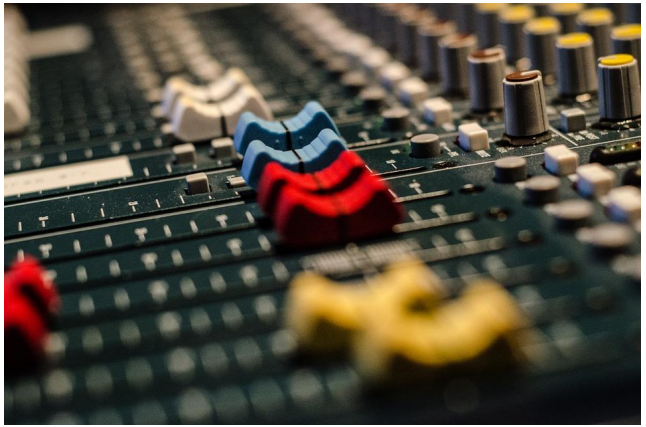
Busses

- Channels may output to one or more bus
- Other channels may take a bus as an input
- Used for
  - grouping and processing related channels
  - distributing sub-mixes to other processors or outputs



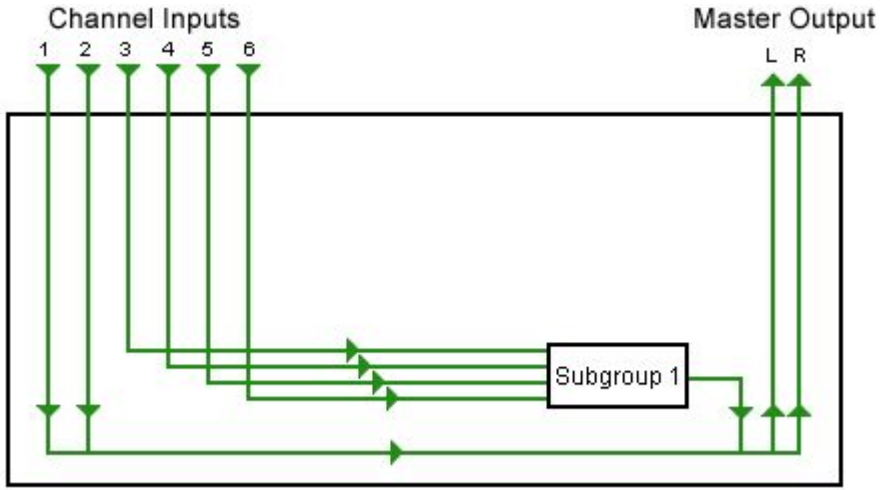
Busses

- Main Outs:
  - final output destination to a physical output; may be stereo or multiple channel
- Sub Outs:
  - busses to alternative physical outputs (e.g. for stage monitors)
- Control Room:
  - a bus designed to deliver audio to the engineer, not the main outs



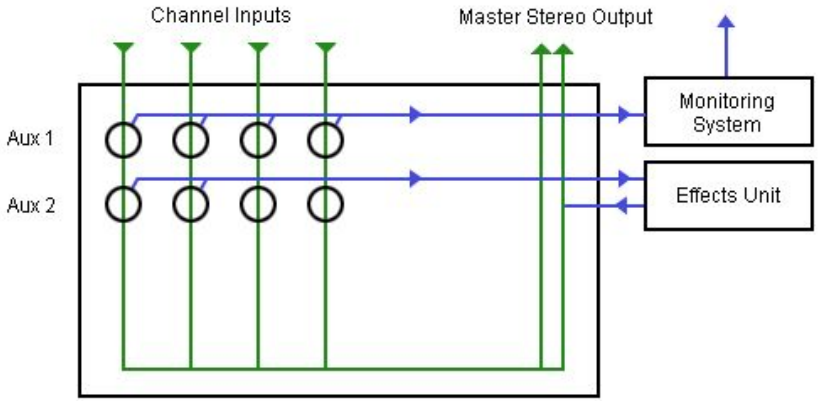
Busses: Grouping

- Assign a number of channels to a group channel
- Use the group channel for shared processing or fader control
- Then, assign the group to the main output



Busses: Auxiliaries

- Channel strip bus assignment with a rotary fader
- Used for creating a sub-mix different from the channel fader position
- Used to provide a different mix to monitors or outboard processors
- Can be pre- or post-fader



- On a physical mixer, physical output might be labeled auxiliary or auxiliary send
- On a virtual mixer, auxiliaries are tracks that receive a bus as input

Aux: Pre- & Post-fader

- Auxiliary output from each channel can be either pre-fader or post-fader.
- A pre-fader output stays the same level whatever the fader is set to.
- A post-fader output is dependent on the fader level. If you turn the fader down the auxiliary output goes down as well.
- Many mixers allow you to choose which method to use with a selector button.

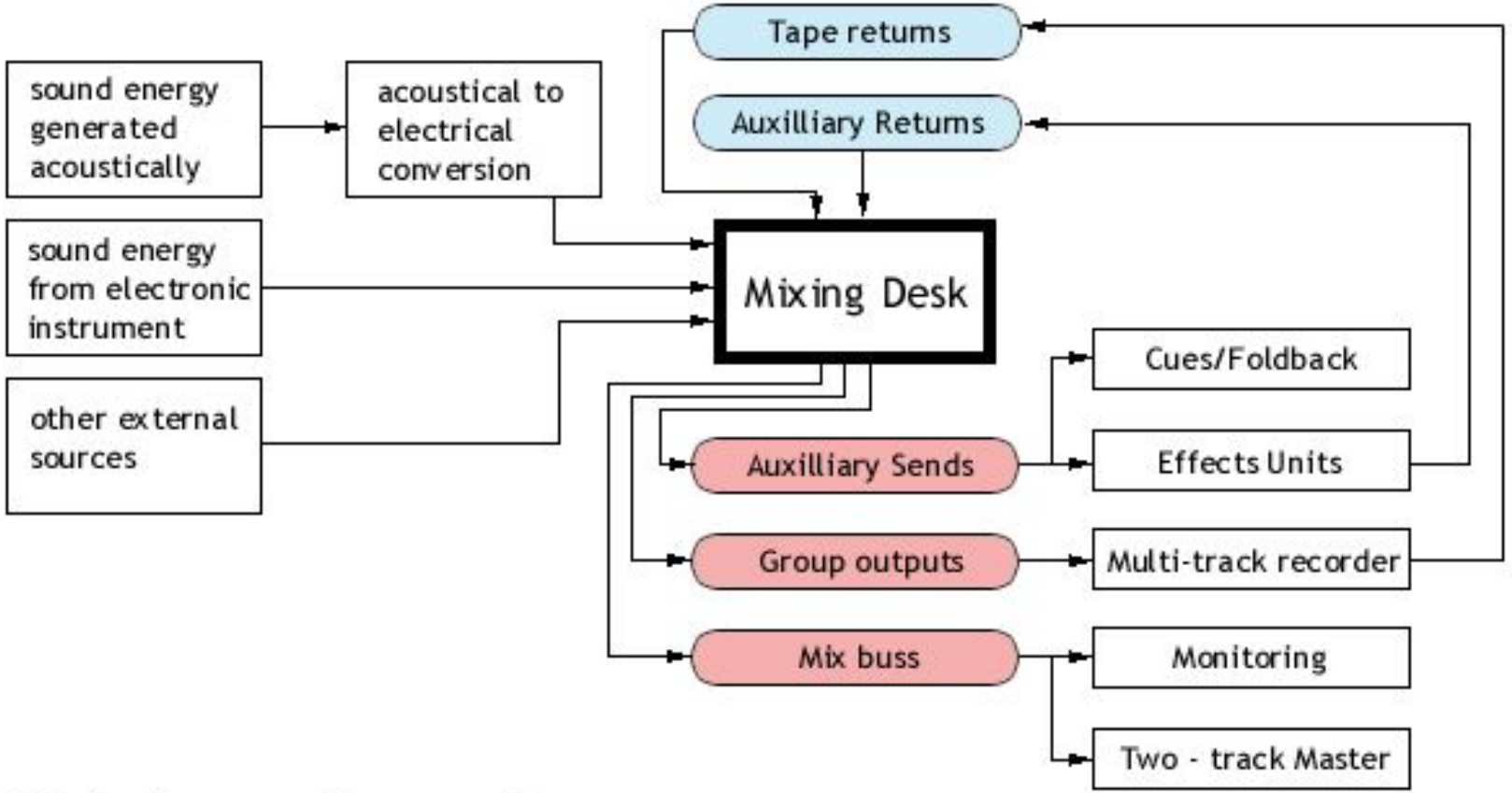
Outputs

Outputs from an audio mixer

- Master Section:
  - Holds the controls that modify overall functions.
  - Master fader controls the level of main stereo output.
- Monitor Feed:
  - A dedicated monitor feed which can be adjusted independently of the master output.
- Headphones:
  - The headphone output may be the same as the monitor feed, or you may be able to select separate sources to listen to.

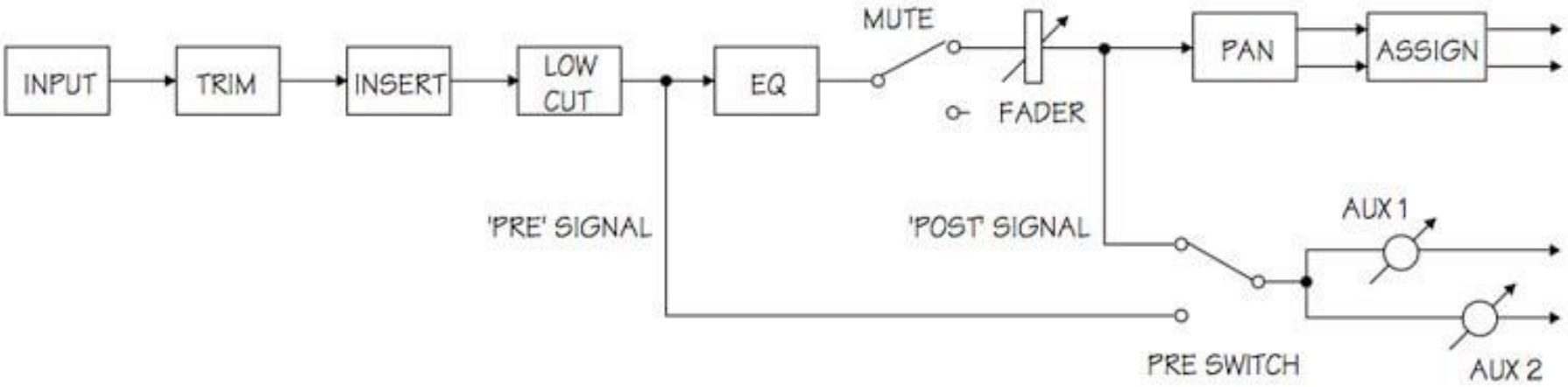
Outputs from an audio mixer

- Auxiliary Sends:
  - The output(s) of the mixer's auxiliary channels.
- Subgroup Outputs:
  - Some consoles have the option to output each subgroup independently.
- Communication/Talkback Channels:
  - Some consoles have additional output channels available for communicating with the stage, recording booths, etc.



Block diagram of a recording system

Audio signal flow through a mixer



Practicals

Practicals

- Hands-on with Soundcraft Si Impact
- Useful references:
  - https://www.soundcraft.com/products/si-impact
  - https://www.youtube.com/watch?v=InItrdACIcA
  - https://www.youtube.com/watch?v=mx43VY0j5h8
  - https://www.youtube.com/watch?v=BJdvO34IY8c