Learning Objectives

- By the end of this chapter, students should be able to:
  1. State the function of the audio mixer in the sound studio.
  2. Explain the function of each section of the audio mixer.
  3. List the steps taken to set up the optimal input signal level of a microphone connected to the audio mixer.
  4. Demonstrate the correct steps to setup the optimal levels for various input signal to the audio mixer.
What We Will Be Learning

- Chapter 3 - Audio Mixer:
  1. Applications
  2. Parts of a Mixer
  3. Microphone and Mixer Setup
  4. Signal Routing for Monitoring
  5. Signal Routing for Cue Monitoring & Talkback
3.1 Overview

- An **audio mixer** is a device which takes two or more audio signals, mixes them together and provides one or more output signals.

- The diagram on the right shows a simple mixer with six inputs and two outputs.

- Mixers allow you to adjust levels, enhance sound with equalization and effects, create monitor feeds, record various mixes, etc.
3.1 Overview

- Mixers come in a wide variety of sizes and designs, from small portable units to massive studio consoles.

- The term mixer can refer to any type of sound mixer; the terms sound desk and sound console refer to mixers which sit on a desk surface as in a studio setting.
3.1.1. Applications

Some of the most common uses for sound mixers include:

- **Music studios** and **live performances**: Combining different instruments into a stereo 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.
3.1.2. Advanced Mixing

- The diagram shows how a mixer can provide additional outputs for monitoring, recording, etc.
3.2. Parts of a Mixer

Input Section

- It is important to note the type of input sockets available.

- The most common types are **XLR**, **6.5mm Jack** and **RCA**.

- Input sockets are usually located either on the rear panel of the mixer or on the top above each channel.
3.2. Parts of a Mixer
Microphones and some audio devices. Usually balanced audio, but XLRs can also accommodate unbalanced signals.
6.5mm Jack

- Musical instruments such as electric guitars, as well as various audio devices.
- Mono jacks are unbalanced.
- Stereo jacks can be either unbalanced stereo or balanced mono.
Musical devices such as disc players, effects units, etc.
3.2.1.1. Input Levels

The **level** of an audio signal refers to the voltage level of the signal.

Signals can be divided into three categories:

- Microphones produce a **Mic-level** (low) signal

- Disc players produce a **line-level** (a bit higher)

- Amplifiers produced **loudspeaker-level** (very high).

- Never plug a loudspeaker-level signal into anything else.
3.2.1.2. Input Sockets and Controls

- The example on the right shows the input connections on a typical mixer. This mixer has two input sockets —
  - XLR mic-level inputs
  - 6.5mm jack line-level inputs.

- Pad button which reduces the input level (gain) by 20dB. This is useful when you have a line-level source that you want to plug into the mic input.

- Some mixers also offer RCA inputs or digital audio inputs for each channel. Some mixers provide different sockets for different channels, for example, XLR for the first 6 channels and RCA for the remainder.
3.2.1.3. Input Gain

**Phasing:**
- Some equipment and cables are wired with different phasing, the wires in the cable which carry the signal are arranged differently.
- This will kill any sound from that source. To fix this problem, some mixers have a *phase* selector which will change the phasing at the input stage.

**Phantom Power:**
- Some mixers have the option to provide a small voltage back up the input cable to power a microphone or other device.
3.2.2. Equalizer Section

- Most mixers have some sort of equalization controls for each channel.

- Channel equalizers use knobs rather than sliders.

- This is a simple 2-way equalizer, sometimes referred to as bass/treble or low/high.

- The upper knob adjusts high frequencies (treble) and the lower knob adjusts low frequencies (bass). This is a fairly coarse type of equalization, suitable for making rough adjustments to the overall tone but is not much use for fine control.
3.2.2. Equalizer Section

This is a 4-way equalizer.

- The top and bottom knobs are for high and low frequency adjustments (HF and LF).
- The middle knobs are parametric equalizers —The brown knob selects the frequency range and the green knob makes the adjustment.

- The top pair works in the high-mid frequency range (0.6KHz to 10KHz).
- The lower pair works in the low-mid range (0.15 to 2.4KHz).

- The "EQ" button below the controls the equalization on and off for this channel. This lets you compare the treated and untreated sound.

- It is common for mixers with parametric equalizers to combine each pair of knobs into a single 2-stage knob with one on top of the other.
Most sound desks include one or more aux channels. This allows you to send a secondary feed of an input channel's audio signal to another destination.

The example shows an auxiliary channel control knob — this adjusts the level of the signal sent to the auxiliary output (shown in blue).
3.2.3. Auxiliary Section

- The auxiliary output is sent to a monitoring system. There are many other applications for auxiliary channels, including:
  - Multiple separate monitor feeds.
  - Private communication, e.g. between the sound desk and the stage.
  - Incorporating effects.
  - Recording different mixes.
Mixers are not limited to a single auxiliary channel, in fact it is common to have up to four or more. The following example has two auxiliary channels — "Aux 1" is used for a monitor and "Aux 2" is used for an effects unit.
3.2.4. Pre / Post Fader

- The auxiliary output from each channel can be either **pre-fader** or **post-fader**.

- A **pre-fader** auxiliary 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. The pictured shows a mixer channel with four auxiliary channels and two pre/post selectors.

- Each selector applies to the two channels above it, so for example, the button in the middle makes both Aux 1 and Aux 2 either pre-fader or post-fader.
3.2.5. Faders Section

- Each channel has its own fader (slider) to adjust the volume of the channel's signal.

- A slider 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.
3.2.6. Inserts Section

- Many mixer and console designs provide 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.

- The send and return jacks may be accessible at the rear panel of the console as two separate jacks or on the console’s patch bay.
3.2.7. Metering

- **Audio Metering** means using a visual display to monitor audio levels.
- This helps maintain audio signals at their optimum level and minimise distortion.
- There are two common types of meters to measure audio levels. They are **VU meter** and **PPM Meter**.
3.2.7.1. VU Meter

- **A VU (volume unit) meter** is an audio metering device. It is designed to visually measure the "loudness" of an audio signal.

- VU meters measure average sound levels and are designed to represent the way human ears perceive volume.

- **The rise time** of a VU meter (the time it takes to register the level of a sound) and the **fall time** (the time it takes to return to a lower reading) are both 300 milliseconds.

- The optimum audio level for a VU meter is around 0VU or "0dB". 0VU is equal to +4 dBm, or 1.228 volts RMS across a 600 ohm load.
3.2.7.2. Peak Program Meter (PPM)

- A Peak Program Monitor (PPM), also known as a Peak Reading Meter (PRM), is an audio metering device.

- The **rise time** of a PPM is much faster than a VU meter, 10 milliseconds compared to 300 milliseconds.

- The **fall time** of a PPM is much slower.

- PPM meters are very good for reading fast, transient sounds where pops and distortion are a problem.

- The **scale** which defines which units are being measured.

- The **ballistics** of the meter which determine how fast it responds to sound and returns to a lower level.
The monitor section of the mixer is the control center for the various audio monitoring functions.

None of the controls found in the monitor section affect the signals going to recording devices; ie. Adjustment of the Control Room volume will not affect the volume going to the DAT recorders although it will cause a volume change in the studio speakers.
3.2.8. Monitor/Tape Return Section

- There is usually one tape return for every channel on the desk.
- It is found within the normal channel section on 'in-line' desks, or in a dedicated tape return section to the right of the L-R faders in 'split' consoles.
- The tape return section is essentially a mini channel with EQ, Pan and level controls.
- When we talk about tape it means whatever medium you are recording onto whether analogue tape, hard drive, ADAT etc..
3.2.9. Master Section

- Holds the controls that modify overall functions.
- Master fader — controls the level of the main stereo output.
- Subgroup and main output fader controls are often found on the right hand side of the mixer.
  - On large consoles, they are found in the center.
Talkback is usually achieved using a small microphone built into the console, which can be routed to a number of destinations.

Talkback is used to allow communication between a control room and a performer in the recording studio, or in a live environment.
3.3. Microphone and Mixer Setup
3.4. Signal Routing for Monitoring

Block diagram of a recording system