

# Unit One: Building the Mixer

In this unit, you will be introduced to the most basic and necessary device in any studio: a mixer. After you learn about the most basic kind of mixer (a line mixer) in Lesson One, you will learn about some of the components found in fancier and larger mixers in Lessons Two and Three. In Lesson Four, you will see how all of these components interact together to form a working mixer, and how they will interface with the effects units in Unit Two.

# Basic Mixers

After completing this lesson, the student should be familiar with the following concepts:

- The physical size of a mixer
- Basic mixing tasks: Adjusting levels, panning, mixing several signals to a stereo pair
- Sound waves cannot be manipulated directly; they must be represented by voltage fluctuations in an electronic circuit before a mixer can manipulate them
- Understand the effect of master faders on every channel
- Understand the input-output aspects of signal flow
- Basic connections between line-level instruments and a mixer
- The purpose of gain and pan controls
- The use of the headphone jack and headphone volume control on a mixer

## Glossary for this Lesson:

**Cable** - A wire or pair of wires usually encased in a rubberized coating. Special plugs have been attached at the ends of cables to allow them to make an electrical connection between two jacks. In this way, two different devices can be connected together.

**Channel** - A group of controls and jacks on a mixer that make up a channel. At the bare minimum, each channel has an input, gain control (a fader or knob), and a pan control (usually a knob). Channels are situated vertically on a mixer. Most mixers have 8-16 identical channels.

**Console** - Another name for a mixer.

**Desk** - Another name for a mixer

**Fader** - A control which allows you to determine a value by moving it in a linear fashion (i.e. up and down in a line). A fader is like a dimmer for a light. Faders are frequently used on larger mixers to control gain on each channel.

**Gain** - The volume of a particular channel on a mixer.

**Headphones** - Small speakers which can be worn over a listener's ears which allow for private listening of sounds.

**Input** - A jack which accepts incoming signals. Inputs must be connected to outputs.

**Jack** - A small hole on a device which grips the plug on a cable and makes an electrical connection. By connecting the other end of the cable to a jack on another device, you can connect two devices together.

**Knob** - A control which allows you to determine a value by moving it in a rotary fashion (i.e. turning it clockwise or counter clockwise). A knob is like the volume control on your car radio. Knobs are frequently used on mixers to control panning on each channel, and are used to control gain on smaller mixers.

**Master Gain Controls** - The master gain controls (also referred to as “master controls” or simply “master”) are knobs or faders which allow you to change the gain of all channels simultaneously. These controls can be thought of as a master volume control. Many mixers offer two sliders for master gain controls: one for their right output, and one for their left output.

**Mixer** - A device which allows you to mix the outputs of several different devices together. The incoming signals are combined inside the mixer, then emerge from two output jacks on the mixer. On the most basic level, mixers allow you to control the apparent volume level of each incoming sound (see gain), and allow you to position each sound in the perceived stereo field (see pan).

**Output** - A jack from which signals emerge. Outputs must be connected to inputs.

**Pan** - A knob which allows you to determine how much of an incoming signal is output to the mixer’s left output and right output. When the outputs are connected to speakers, you can make a sound seem to move side to side (left or right) by moving the pan knob.

**Rack** - A box, 19” across, which allows you to mount several rack-mountable devices for easy transportation and/or use. Metal rack rails along the sides allow equipment to be secured in place with screws. Rack rails are tapped at 1 3/4” increments, which is referred to as one “rack space.” Racks are measured and sold according to the number of rack spaces they offer. Racks typically come in 4, 6, 8, 12, 16, 21, 48, and 64 space configurations, but it is possible to find other sizes. Devices which are mounted in racks are also measured in rack spaces.

**Rack Screws** - 9/16” narrow-thread screws used to mount devices in a rack. They usually have a fairly large head to provide a larger surface area and thus less stress on rack-mounted equipment.

**Stereo** - A technique used to broaden the perceived aural image coming from speakers. When a slightly different signal is sent to each of two speakers, the listener will perceive a wider aural image.

**Synthesizer** - A musical instrument which often looks like a keyboard. It generates sound electronically. The sound it puts out is represented by voltage fluctuations from its output jack. (The sound is output in an electrical form).

### HELP YOUR STUDENT REVIEW

Students tend to remember concepts that they deal with at least a little bit each day rather than ideas presented once a week. Take a few minutes to review glossary terms each day. Making flashcards is one fun way to review. Another excellent way to help your student review is to ask them to be your teacher, and actually teach the material to you. Simply asking your student to tell you about what he or she learned during each lesson is a great start!

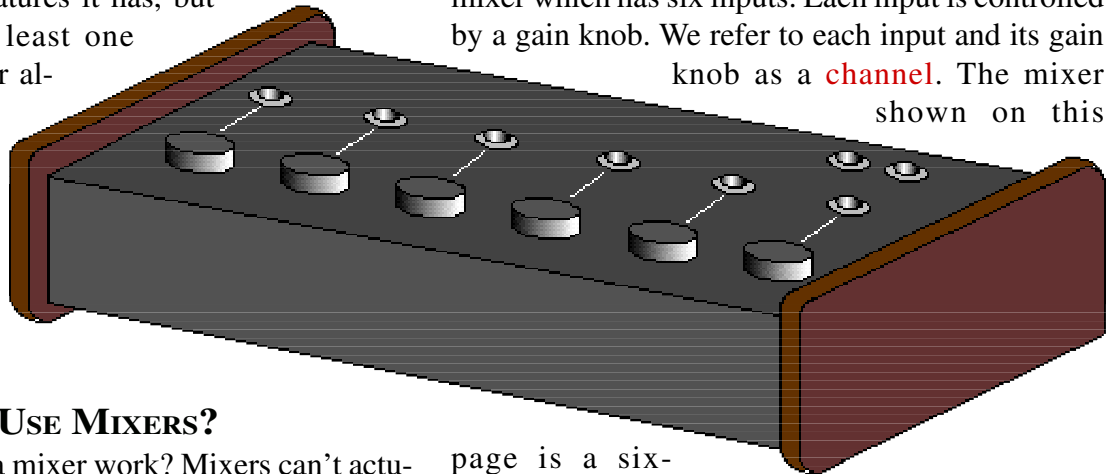
Take time to learn more about the concepts in this book by using the internet. Research with your student, and enjoy the time you spend together! Most importantly, keep music technology a fun experience and remind your students that technology lessons are a fun and exciting privilege!

# Basic Mixers

## WHAT IS A MIXER?

A **mixer** is one of the most useful devices in any studio. Mixers are sometimes called **consoles** or **desks**. A mixer can be as small as a few inches across, or as large as several feet across. Small mixers sit on top of tables, or get mounted in a special box called a **rack**. When mixers are mounted in a rack, **rack screws** are used to hold it in place. Large mixers usually have their own stand, so they don't need to sit on a table.

A mixer can do many different things depending on the features it has, but all mixers do at least one thing: Every mixer allows you to combine different sounds. Using the mixer's controls, you can also adjust the volume of these sounds.



an input to an input because this wouldn't do anything. It would be like talking into the earpiece of a telephone.

Mixers usually have several input jacks. This means that it is possible to connect several output jacks from several different synthesizers to one mixer. The volume of each incoming signal can then be controlled using a **knob**. This volume setting is called **gain**. By changing gain throughout a song, we can control the entire mix of a song.

In the picture below, you can see a simple mixer which has six inputs. Each input is controlled by a gain knob. We refer to each input and its gain knob as a **channel**. The mixer shown on this

## HOW DO YOU USE MIXERS?

How does a mixer work? Mixers can't actually mix different sound waves together in the air. They can only mix sound waves which are in electrical form. One instrument that puts out sound waves in electrical form is a musical instrument called a **synthesizer**.

To get the synthesizer's sounds into the mixer, we must connect the two together. To connect these instruments, we use small holes on the back of the synthesizer called **jacks**. When a cable with the correct connector is plugged into the jack, the sounds from the synthesizer will go down the cable in electrical form. Jacks that put sound out are called **outputs**. Jacks that accept incoming sounds are called **inputs**. By connecting the synthesizer's output to an input jack on the mixer, we can get the sounds from the synthesizer into the mixer. You wouldn't want to connect an output to an output or

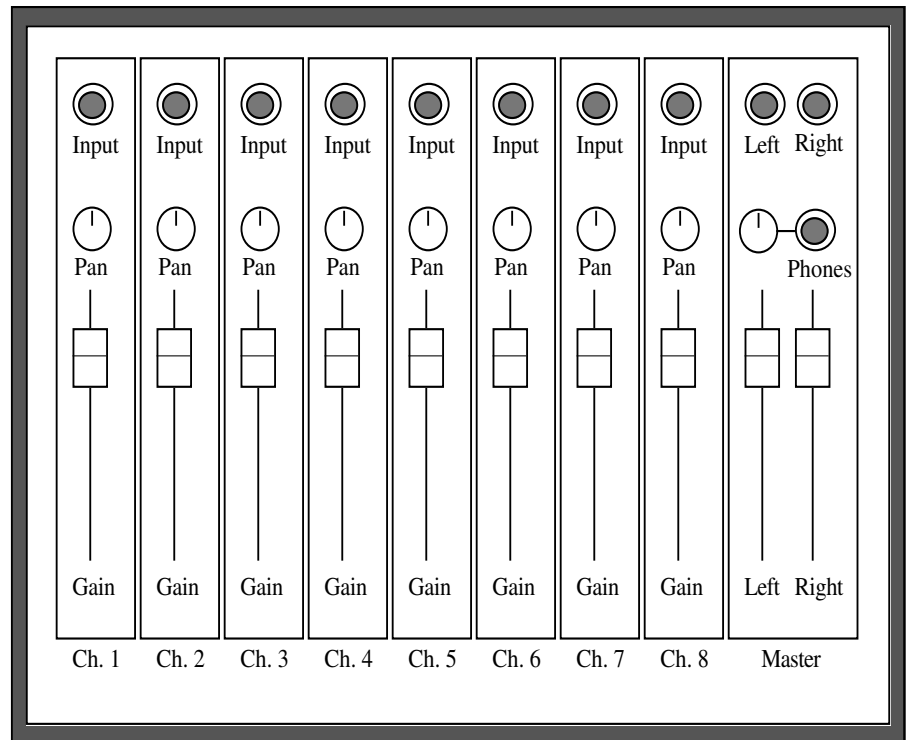
page is a six-channel mixer. Some mixers have as many as 128 channels on them, but most mixers are a lot smaller (between eight and sixteen channels).

## MASTER CONTROLS

Once sounds have been mixed together in a mixer, they come out the mixer's output jacks. Mixers usually have two output jacks: a right output and a left output. Mixers have a left and a right output because you have to send slightly different sounds to each of two speakers to hear sounds in **stereo**. You can control the volume of each of the output jacks with the **master gain controls** on most mixers. Some mixers use **faders** instead of knobs. You can see some faders on the picture of the second mixer shown on page 5. When you move the master faders up and down, it is like moving all of the gain faders

up and down at once. (They don't actually move.) The master faders affect every channel equally.

From the outputs of the mixer, the sounds can go to many different devices. The sounds could go to a tape recorder or to a speaker system so that you can hear all of the instruments. Most mixers also have a **headphone jack** on them so that you can hear the mixer's output without having to connect it to speakers. There is usually a separate volume knob for the headphones so that you can control the headphone volume separately from the main output's volume.



## OF POTS AND PANS

Another control found on most mixers is a **pan** knob. The pan knob is very important. It allows you to change how much of a sound comes out the right output jack, and how much comes out the left output jack. If we have the left and right outputs connected to two different speakers, we can make the sound seem to move back and forth between the two speakers. When the pan knob is set in the middle,

the sound will come out of each speaker equally.

It is possible to use the pan knobs to use the mixer like two separate mixers. You could pan channels 1-4 all the way to the left, and channels 5-8 all the way to the right. Now, 1-4 will be mixed together and will come out the left output, and channel 5-8 will be mixed together and will come out the right output.

## Experiments:

1. Look at the mixer and see if you can find the inputs and outputs. See if you can find the headphone jack, too.
2. Connect a synthesizer to a mixer using a cable. How does it feel when the cable is plugged into the jacks correctly?
3. Try connecting headphones to the mixer. Can you find the headphone volume knob?

4. Play the synthesizer and adjust the gain on the channel you connected it to. What do you hear?
5. While you play the synthesizer, try moving the pan knob. What do you hear?
6. While you play the synthesizer, try moving the master faders or master volume knob. What happens to the sound?
7. Does the mixer have a power switch? Why?

## Words to Know:

Can you tell your parents what each of these words means?

Cable	Headphones	Output
Channel	Input	Pan
Console	Jack	Rack
Desk	Knob	Rack Screws
Fader	Master	Stereo
Gain	Mixer	Synthesizer

## DID YOU KNOW?

Some mixers are *very* expensive. The SSL corporation makes one mixer that costs over a million dollars, and is over 7 feet long! Two years after they started making it, they had sold only 9 of these mixers!

## Let's Review

1. How big or small is a mixer?
2. What is main function of a mixer? How do you operate it?
3. Can a mixer make it seem like sounds are moving from side to side? How?
4. What do the master controls do?
5. What is the difference between inputs and outputs?
6. How would we connect something like a synthesizer to a mixer?
7. Can a mixer change sound waves while they are in the air, or do they have to be in electrical form first?

## Student Tips!

The students who are best at music technology take time to write out definitions to all of the "Words to Know" and write out answers to all of the review questions. These two easy exercises will help you to do much better on the quiz for this lesson!

## On the Web:

If you would like to see pictures of some real mixers or read more about them, check out the following sites online:

<http://www.mackie.com>  
<http://www.behringer.com/>  
<http://www.spirit-by-soundcraft.co.uk/>  
<http://www.samsontech.com/audio/mixers.html>  
<http://www.rolls.com/new/frame2.html>  
<http://www.fostex.com/product.html>  
<http://www.tascam.com/products.cfm>  
<http://www.rolandus.com/>  
<http://www.yamaha.com/>  
<http://www.allen-heath.co.uk/>  
<http://www.solid-state-logic.com/>