

More About Mixers

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

- The mute button allows quick removal of one channel from a mix.
- The solo button allows quick removal of all other channels from a mix. Several channels can be soloed at once, and most mixers which have solo buttons also have a master solo level and an LED which blinks continuously while in solo mode.
- Many mixers have preamplifiers built into every channel.
- Insert jacks allow you to extract the entire signal from a channel after it has gone through the preamplifier and send it to outboard equipment for processing before returning it to the channel. This is accomplished through the use of an insert cable which has a 3-conductor 1/4" plug at one end, and two 2-conductor 1/4" plugs at the other.
- Almost all mixers have shelving EQ units built into each channel. One can typically find two or three-band EQ on each channel, but larger consoles feature 5-6 bands of fully parametric EQ (i.e. EQ in which you can adjust not only the gain of certain frequency bands, but also exactly which frequencies will make up that band.)
- Aux Sends are knobs located on each channel which allow you to send a copy of that channel's signals out a jack which is also labeled 'aux send.' Large consoles usually have upwards of six aux sends per channel, while smaller mixers may have as few as two sends per channel. The number of aux sends and aux returns found on a mixer usually matches.
- Aux Returns are inputs with few features other than gain control. They are usually found in stereo pairs; 2-8 stereo pairs per mixer. Aux returns are often used as inputs for effects boxes (see Unit Two) or for line-level instruments such as synthesizers that require no special processing such as EQ, panning, effects, etc.
- Phantom Power sends +48 Volts DC down a microphone's cable to provide the microphone with power. Only certain types of microphones require phantom power. Phantom power is usually activated by a switch either labeled 'phantom' or '+48 VDC.' Larger consoles allow you to switch phantom power on and off per channel.

Glossary for this Lesson:

Auxiliary Return - A set of inputs which usually have only a gain control. It is not unusual to find one knob controlling two inputs, each permanently panned hard left and hard right, respectively. (Aux returns are usually a stereo connection).

Auxiliary Send - The aux send take a copy of the channel's input and passes it to the aux send jack. The amount of signal being sent to this jack is determined by an aux send knob on each channel. It is not unusual to find upwards of six discreet aux sends per channel, although most smaller mixers have 2-4.

Insert - A 1/4 connector which accepts TRS stereo 1/4" plugs. When a cable is plugged into this jack, the channel's normal signal flow is interrupted and the signal flows out of the insert jack for processing in external equipment. The insert jack also allows the signal to be returned to the channel so that it may flow through the rest of the mixer and emerge from the mixer's output.

Insert Cable - An insert cable has a 3-conductor (TRS) 1/4" plug at one end, and two 2-conductor (TS) 1/4" plugs at the other. When connected to a mixer's input jack, signals from the channel flow out the insert cable via one conductor to external equipment, and are returned to the channel via the other conductor.

Mute - A latching button switch which allows a channel to be removed from a mixer's output bus. This control is usually found near the channel's gain control.

Phantom Power - +48 VDC sent down a microphone cable from a mixer to provide power to a condenser microphone. Dynamic and ribbon microphones do not need phantom power to operate. In fact, phantom power can destroy a ribbon microphone.

Solo - A latching button switch which allows all channels but the one on which the solo button is pressed to be removed from the mix. The level at which this channel is heard when soloed is determined by the solo level control. Several channels may be soloed at once.

Trim - A knob used to control the gain of a mic preamp built into a mixer.

HELP YOUR STUDENT EXPLORE AND LEARN MORE

There are many kinds of music that are rarely played on radio stations. Many students don't get exposed to some kinds of electronic music. Public libraries often have many different art music CD's which you can borrow. You might check out the ever popular "Switched-On Bach" by Wendy Carlos (1969) which was the top selling classical album of all time until 1999. For something a little wilder, you might check out the works of Pierre Boulez, John Taverner, Steve Reich, and Phillip Glass. You don't have to spend hours and hours listening, maybe just 5 minutes of each. Encourage students to think about the music and internalize it rather than to decide if they like it or not. Most 20th century electronic art music is not nearly as palatable as the pop music found on most radio stations. You might ask students how the music makes them feel. Another excellent exercise is to ask students, "what kind of movie do you think this music came from?" This provides the student with a context in which to think about emotional mood and texture presented in the piece.

While you are visiting the library, you might also look for other books on the subject of music technology. Libraries usually have at least one or two on the shelves. Do not be disappointed if they are old and dusty looking. Even books which are 20 years old can still provide important information about music technology.

More About Mixers

In Lesson One, we learned about very basic mixers. We learned that a basic line mixer allows us to control the volume and panning of several different sound sources, and mix them all together. We learned that mixers have several channels, each of which has an input, a pan knob, and a gain control. In this lesson, we will take another look at our old friend, the line mixer, and learn about a few more parts that are found in each channel. In the center of this page, you will see part of the drawing that was on the cover of this unit. At the time, it looked pretty scary, but now, we know what almost every control does!

THE STRAIGHT MUTE

The **mute** button is a very useful control found on many mixers (smaller mixers may not have mute buttons). The mute button is a small button which is usually found near the gain control on a mixer. (It is red on the picture of the channel near the center of the page.) Mute buttons usually have the word ‘mute’ written on them, so they are hard to miss.

When you press the mute button, it stays pushed in until you push it again. When the mute button is pushed in, it has the same effect as turning the gain control all the way down. It mutes the channel. This is really helpful if you want to take one instrument out of a mix for a moment to hear details of another instrument better. You *could* just turn down the gain instead of pressing the mute button, but you would lose all of your gain settings on all of the channels you mute. On a small mixer, this might not be such a big deal, but it wastes a lot of time on a mixer with 128 channels! The mute button is a much better way to take a channel out of the mix for just a moment.

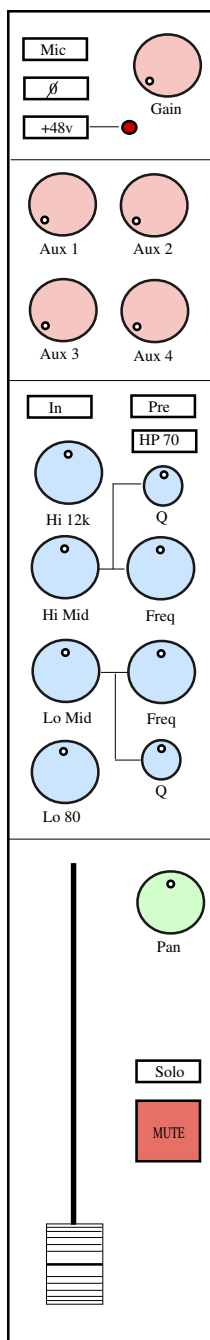
TAKE A SOLO

The mute button is really useful, but what if you want to mute all of the channels but one so that you can hear just one channel? It would be a big hassle to press all of the mute buttons on a large console (there are sometimes as many as 128!) The **solo** button provides us with a much better solution. The solo button mutes all channels except the one you pushed the solo button on. You can push the solo button on more than one channel at a time if you want to, and hear any combination of channels like this. Like the mute button, the solo button is found on every channel, usually near the mute button. It stays pressed in the first time you push it. To release it, you just have to press it a second time. You can see the solo button just above the mute button on the channel in the middle of this page. The solo button almost always has the word ‘solo’ written on it, so it is easy to see.

Most mixers which have a solo button also have a **solo level** knob. This is so you can set a different volume level for the soloed mix. Many mixers also have a light that will flash continuously when you have a channel soloed to remind you that the mixer is not functioning the way it normally would.

MIC PRES AND JACKS

In Lesson Two, we learned that we cannot connect microphones and other instruments that aren’t line level directly to a mixer. These signals must be preamplified using a preamplifier before we can connect them to a mixer channel’s input. Because we use so many signals that are not line level in the studio, most mixers have preamplifiers built into some or all channels. You can tell if a mixer channel has preamps built into it,



because it will usually have an XLR connector. Many mixers also have 1/4" jacks on their channels. Only one jack on each channel should be used at a time.

It is very useful to have preamps on every channel because we can then connect microphones, guitars, basses, and other instruments to the mixer. You can control the preamplifier's gain using a knob labeled **trim**. The trim knob is usually found high on the channel, near the XLR input. The trim knob is sometimes labeled "gain" as you can see on the mixer channel on page 18. This is because we are adjusting the gain of the built-in microphone preamplifier.

INSERT JACKS

When is a jack not quite an input, but not quite an output? An **insert jack** looks just like a normal 1/4" jack, but they serve a very special purpose. From time to time, we need to do different things to sounds after they are preamplified, but before they go through the entire channel. An insert jack lets us route the signal out of the mixer so that it can be processed, and lets us return it so that it can go through the rest of the channel. For the time being, we will not worry about exactly how we would process sounds leaving the channel. We will learn much more about that in Unit Two. For now, it is just important to understand how an insert jack works.

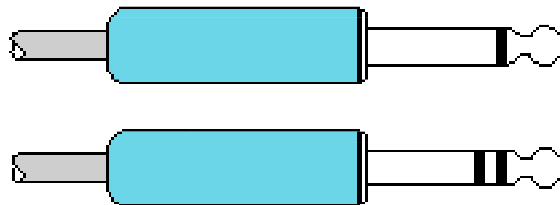
First, an insert jack needs a special kind of cable. This cable is commonly called an **insert cable**. Most instrument cables have 1/4" connectors on them. You can see a picture of a standard 1/4" plug in the top picture in the middle of this page. Now look at the insert plug (below the normal 1/4" plug). Do you see anything different? The difference is that the insert plug has an extra black ring on it. The other end of an insert cable has two normal 1/4" plugs. One is the output from the mixer, and one is an input to the mixer. The extra ring on the plug allows signals to get sent out the plug and to return along another part of the plug. This is how an insert jack

works both as an input and as an output.

To use the insert cable, we plug the end with the two black rings into the insert jack on the mixer's channel that we want to use. We connect the insert cable's output end into the input of another device like an external EQ unit, and we connect the insert cable's input end into the output of the EQ unit.

EQUALIZATION

In Lesson Three, we learned about EQ and how it helps us to shape sound. Because EQ is so important to people who work in a recording studio, most mixers have EQ on every channel. Small mixers usually have only two bands of shelving EQ on each channel. Larger mixers have up to five bands of shelving EQ on each channel. (Shelving EQ is usually used on channels, because it takes up less space than graphic EQ.)



Only a few mixers have graphic EQ on them. These mixers have shelving EQ on each channel, but also have a graphic EQ in the master control section which affects all of the channels. Mixers with this kind of EQ are usually used for live concert situations. The master graphic EQ allows the person running the mixers to turn down the same high or low sounds on every channel at once. This is good because it allows the sound person to turn down the sounds that would cause feedback.

We can also use external EQ units with a mixer if we want better control than the built-in EQ allows. By connecting an external EQ unit to a channel's insert jack, we can use any EQ we want on a channel.

AUX SENDS

Insert jacks are very helpful when we want to take a signal out of a channel, send it somewhere else, and then bring it back into the channel. However, there are times when we just want to make a copy of a signal to send to another device instead of

taking all of the signal out of the channel and putting all of it back.

Auxiliary sends (or **aux sends** for short) are knobs that allow you to send a copy of a signal from a channel out a special output jack which is also called an aux send. Most mixers have two or more aux sends on every channel. Larger mixers have six or more sends per channel. The more you turn this knob up, the more this channel's signal will appear at the aux send jack. In this way, we can send different amounts of signal from each channel to the aux send jack. Aux sends are usually labeled AUX and then a number. Sometimes mixers have this control labeled **foldback**. You can think of the aux sends as a mixer in the mixer. The aux sends act like gain knobs for the aux send jack, which acts like a master output.

HOW DO WE USE AUX SENDS?

Aux sends are used in many different ways. One important thing that aux sends can be used for is to create a monitor mix. In a concert, musicians on stage can hear themselves and other band members through speakers on the stage floor that face up to the performers. These speakers are called **monitors**. Musicians often want to hear more of one instrument in the monitor mix than the sound going out to the audience (which would come from the main outputs). The person running the sound for the show could easily use the aux sends on the mixer to create a separate mix for the musicians on stage.

Another important use of aux sends involves special pieces of equipment called effects boxes. We will learn all about effects boxes in Unit Two. In

order to use an effects box, we need to take a copy of a signal from a channel (or from several channels at once) and send them to the effects box.

AUX RETURNS

Auxiliary returns (also called **aux returns**) are input channels on a mixer which do not have very many features. Aux returns usually have only a gain knob. There is no pan knob, EQ, preamplifier, or any other features on an aux return. Aux returns are also frequently stereo channels. This means that there is just one gain knob for two inputs (one for left and one for right).

Aux returns are used when we need line-level inputs which we intend to use as-is. Many times, effects boxes's outputs are connected to aux returns. We can also use aux returns to connect the outputs of CD players or computers. Most small mixers have only two aux returns, while larger consoles have six or more. Mixers almost always have a matching number of aux sends and aux returns.

THE PHANTOM MENACE

While it might not be terribly menacing, **phantom power** is very important in a studio. The high-quality microphones used in professional recording studios often need electric power to operate. They can actually get that power from the mixer through the microphone cable. To activate this power, we must flip the switch labeled "phantom power." It is also sometimes labeled +48 VDC on some mixers, because it sends 48 volts of electricity down the microphone cable.

DID YOU KNOW?

During a recording session in a big studio, three people sit at the console. The engineer sits at the middle, and controls the master section (it is really quite large and complicated on a large console). The assistant engineer sits at the left side of the mixer, working some of the channels. The producer sits at the right side of the mixer. Some producers actually mix while others prefer to leave this job to the engineers. The producer's job is to act as a go-between for a record company and the artist. The producer must make sure that both the artist and the record company are happy in the end, which sometimes makes this the hardest job of all in the music industry!

Words to Know:

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

Aux Return	Insert Cable
Aux Send	Phantom Power
EQ	Mute
Equalization	Solo
Insert	Trim

Student Tips!

Be passionate about your work! Find out all that you can about music technology. There are thousands of books, magazines, web sites, and people who can tell you more about music technology. Your public library is a great place to find some of these resources at no charge to you! Music technology is a cool field because the more you know about it, the more you'll want to know about it!

Experiments:

1. Connect a signal to a channel on a mixer. Turn up the gain on that channel and listen to the signal using a pair of speakers. Push the mute button on the channel. What happens to the signal? How does it feel to push the mute button?
2. Connect several signals to a mixer and adjust the gain on each channel so that you can hear all of the sounds. Now press the solo button on one channel. What happens? What happens when you press several solo buttons at once? How does it feel to press the solo button? Can you find the solo level knob? What can you see happen when you press the solo button on a channel?
3. Can you find the microphone input on the mixers your teacher shows you? Do you see the trim knob on each channel? Does every channel have a preamplifier built into it? Why? Can you spot the phantom power switch?
4. Can you find the insert jacks on the mixers your teacher shows you? While listening to a signal through a channel, plug an instrument cable into the insert jack. What happens? What signal is now coming down the instrument cable? How could this help us in the studio? What happens when you plug an insert cable into the insert jack? What can we do with the other two ends of the insert cable?
5. Can you find the EQ on the different mixers your teacher shows you? How are they different from the EQ units we learned about in Lesson Three?
6. Now find the Aux Sends on each mixer. How many does each mixer have? Can you find the Aux Send Jacks? Connect the aux send jack to a speaker with a built-in amplifier and a signal to that channel. Find out what happens as you turn the knob up and down. How could this jack help us in the studio? At a concert?
7. Find the Aux Return jacks on the mixer and the level knobs for those returns. Connect a CD player to these jacks and change the return amount. How else could we use these inputs?

On the Web:

If you would like to see pictures of some real mixers, 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.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/>

Try It At Home:

Design your own mixer. Make a drawing that shows off your design. Show the channels and the master section. You can add as many features to it as you like. Remember to at least put gain and pan knobs on every channel! Have fun, and be sure that you give your mixer colors so that it is easy to see the different kinds of controls. You can even use a computer to draw your mixer if you want.

Let's Review

1. What does the mute button do, and where is it on most mixers? Do all mixers have mute buttons? Why are mute buttons very helpful to us?
2. What does the solo button do, and where is it on most mixers? Do all mixers have solo buttons? How do we adjust the level of soloed channels? Why are solo buttons helpful to us?
3. How do we adjust the built-in preamp's gain on each channel of the mixer?
4. What does an insert jack allow us to do? What kind of cable do we need to plug into an insert jack? What kinds of equipment can we connect with an insert jack? Is an insert jack an input or an output?
5. How can we connect an external EQ unit to a channel?
6. What do auxiliary sends do? How do we use them? What can we do with the aux send jacks in the studio? On stage?
7. What do auxiliary returns do? What kind of controls do we usually see with aux returns? Are aux returns usually mono or stereo channels? What can we do with aux return jacks?
8. What is phantom power and when do we use it?