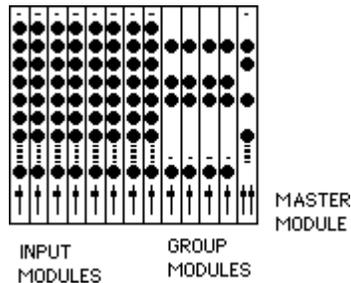


Mixers



The mixer is the central device in any sound studio. Although you can do a lot without it, sooner or later you are going to want to bring all of your materials together to make a piece of music, and for that the mixer is essential.

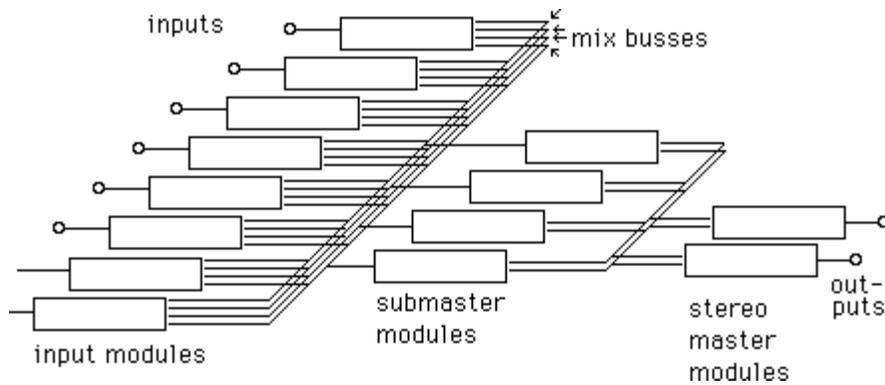
The mixer is also the most formidable looking device in the studio. Pictures of recording studios always show the mixer because there is nothing more impressive than a couple of acres of knobs. The functions of a mixer are actually quite simple; all you are doing is combining a few channels of signal into one or more outputs. Along the way, the signals are amplified and equalized if necessary. The mixer looks complicated only because these functions are repeated many times.

The functions of a mixer are simple: 1) Process input signals with amplification and EQ, and 2) Combine those signals in a variety of ways.

ORGANIZATION

Although most mixers have similar features and organization, there is some variety to meet special purposes. This is generally a matter of which features are duplicated. Thus a "stage mixer" has several auxiliary outputs, a "studio mixer" has very low noise, a "broadcast mixer" has cue functions and stereo faders, etc. The basic layout of the mixer is described in terms of the number of main inputs and outputs, such as 8X4.

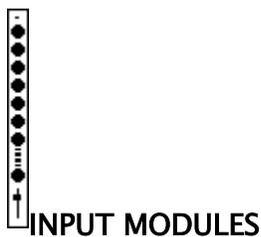
A very popular configuration is 8 or 12 inputs with four subgroups^[1] and a stereo master (8X4X2).



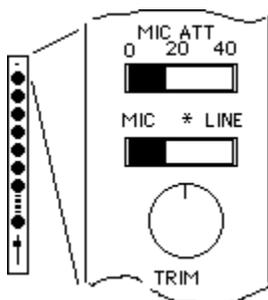
A mixer is really a traffic manager. A signal is connected to an input, and you steer it to one of several possible outputs. Some mixers have several stages of mixing, where inputs are mixed to submixes, or GROUPS, and then the groups are further mixed to a stereo output. For instance, you might have five mics on a drum set, and group these so one fader controls all drums. Trombone, tuba and trumpet might go to a group for horns, etc. Groups usually have the same assignment flexibility as individual inputs.

There are several parallel mixers, (called busses), to allow different combinations of inputs at once. You might send piccolo, clarinet and bass to the right channel, clarinet and xylophone to the left channel, and the clarinet and tuba to a reverb unit. The output of the reverb may then be brought back and sent to the left and right channels in equal amounts.

When you look closely at a mixer you will usually see three kinds of module: **INPUT MODULES**, **GROUP MODULES**, and **MASTER MODULES**.



INPUT MODULES contain circuits that modify the signals before they are mixed. Usually the following[2] are available:

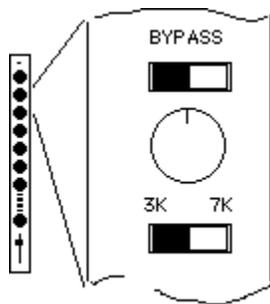


MICROPHONE PREAMPS boost the signal from microphones to levels compatible with the rest of the studio. The quality of the preamps separates the tools from the toys in the mixer world. (So-called keyboard mixers do not have mic preamps.)

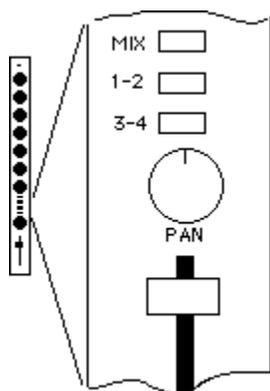
PADS or ATTENUATORS. A pad is a simple push button that cuts the microphone signal by a fixed amount, usually 20 db. An attenuator is another name for the same thing, and sometimes offers a choice of attenuation. This is necessary because when you put mics close to an instrument you often get an output strong enough to overload the mic preamp.

MIC/LINE SWITCHES allow you to choose either a microphone or signal from the patch bay as the input. Sometimes a third position selects the outputs of a multitrack tape deck.

TRIM adjusts the signal coming from the mic preamp and/or the line input to be compatible with the rest of the mixer. This should be set so that there is no distortion when the fader is all the way up.



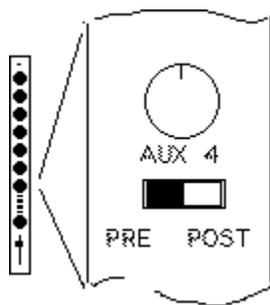
FILTERS and EQ adjust the frequency response of the input modules. These may range from a simple high cut to several parametric sections. EQ adds a lot to the cost of the mixer. There is often an EQ BYPASS, because even the best eqs always change the signal slightly.



PAN KNOBS and ASSIGN BUTTONS make the actual connections between the input modules and the group or master modules. In most modern mixers the PAN function gives a continuous sweep from one output to another, with various combinations possible depending on how the ASSIGN switches are set. Some mixers allow

an input to be assigned directly to the stereo master^[3] , others only allow assignment to the groups.

FADERS conveniently control the relative levels of the various input signals. This is where you control the balance of the mix.



EFFECTS, FOLDBACK, ECHO or AUX are all examples of auxiliary SENDS, which mix signals from the input modules to special outputs independently of what is happening on the main busses. There is a trend in modern mixers to add a switch which connects a tape output to the cue mix, to reduce patching with multitrack tape decks.

Auxiliary sends may be PREFADER, meaning the signal will get through even if the fader for that input is down, or POSTFADER, where the fader controls the amount of signal sent.

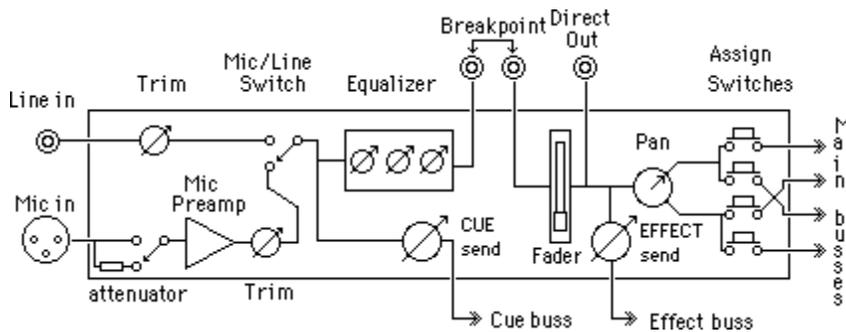
SOLO is a button that connects the input module output to the monitor output (see below) to the exclusion of all else. This is very useful for checking on the operation of a single microphone. PFL or prefade listen, is similar to solo, except that the signal is monitored at full volume. On some broadcast consoles, this feature is called CUE, and may be triggered by pulling back on the fader.

Connections

Each input module has its own set of connections. There are line and/or microphone INPUTS, and possibly these outputs:^[4]

DIRECT OUT carries the input signal as it appears at the assignment switches, processed by the eq and fader. This allows you to use the functions of the input module as if it were a totally independent device. This is a common way to connect mics to each track of a multi-track tape deck, and is useful any time you need a line level microphone signal for electronic music tricks.

A BREAK POINT or INSERTION POINT is a direct out normalled right back into the module. If there is no plug in the jack nothing is affected. If a plug is inserted into this jack, the signal comes out of the module instead of to the fader. This allows the insertion of outboard processors such as delays or noise gates between the mic preamp and the mix buss. These are usually before the fader. The signal must eventually be patched back into the module-- sometimes this is handled by the same jack with a stereo type plug.[5]



Functions of a typical input module

BUSSES

The circuitry that actually combines signals from the input modules is usually referred to as a buss. (A buss is literally a wire that connects to several points-- modern mixing circuits are actually somewhat more complicated than that.) Most mixers have several busses to provide a wide variety of features. The labeling of each buss is according to the manufacturer's notion of which features sell mixers, but each buss works the same way electrically. If two busses are provided for a function, they are often labeled left and right. If there are more than two, they are numbered.

Usually, each buss has a master level control somewhere on the mixer and an output on the patch bay. There will often be direct inputs to the busses (inputs in addition to the input module connections) to allow the interconnection of two mixers or the return of processed signals from effect devices. (If such an input has a level control, it is usually called ECHO RETURN or a similar name.) Since many signals come together on the buss, the possibility of overload is great-- to prevent this, meters are usually provided to indicate buss levels.

BUSS INPUTS are extra connections from the patch bay directly to the buss. They are intended to be used to connect two mixers together for complex operations, but they are handy any time "just one more input" is required.

Some common buss names are:

MAIN BUSSES

MAIN BUSSES are intended to be the most used busses. Each has its own output module to give control of at least level, and often EQ.

ECHO BUSSES

ECHO BUSSES are meant to be used with a reverberation device, in conjunction with ECHO RETURN on the master or group modules, but they may be used any time you need an extra output.

EFFECTS

EFFECTS means the same as echo.

CUE

The CUE buss is usually connected before the faders (prefader) on the input modules. This mix allows the operator to listen to channels that are off as far as the main mix is concerned. This began as a feature on broadcast consoles, where the DJ has to find cuts on the records without sending the sounds over the air.

MONITOR

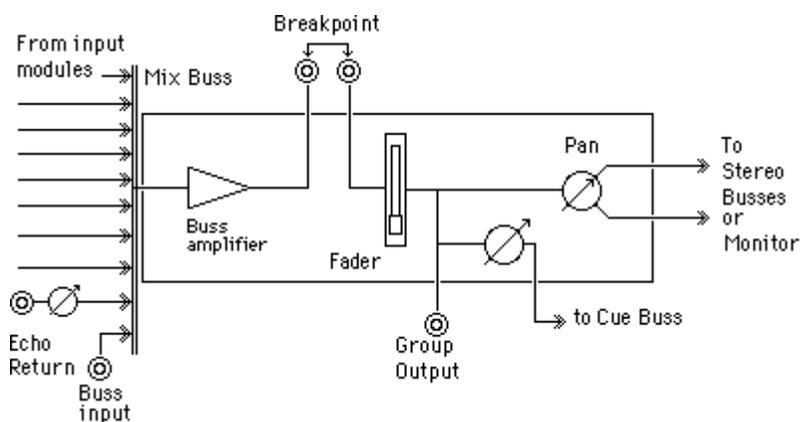
STAGE MIX or STUDIO MONITOR is a mix intended to be sent to the performers so they can hear what is going on. In a live performance, the musicians often have on-stage speakers to hear each other. A musician playing with prerecorded tracks will wear headphones and will need a mix of the recorded material and his own playing.

Each buss is part of a mix or output module. These may be very simple or elaborate, depending on the presumed function of the buss.

GROUP MODULES

Group modules may function as output modules or may be intermediate control points in complex mixes. In large mixers, the subs may even be used as simple input modules. (This adds flexibility- a 12 input stereo out mixer with 8 submaster modules may be used as a 20 to 2 or a 12 to 10 mixer depending on requirements.)

There should be level and pan controls on each module. These feed the stereo mix (if there is one) or the monitor speakers. There will also often be some kind of effects return.



Functions of a Group Module

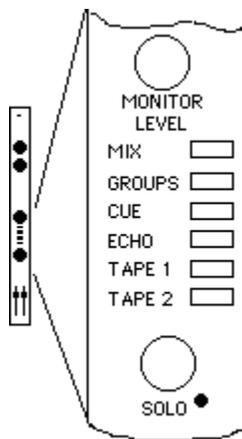
OUTPUT MODULES

The Output Modules (often known simply as "the mix", "main", or "program") combine signals from the inputs and/or groups into a final stereo mix. Not much is required at this point except a pair of faders, so you often find other controls on the spare panel space. These might include the master levels for auxiliary sends,

talkback functions, or the control room monitor controls (see below).

If a mixer does not have a stereo master module, you can usually get the same function by recording the monitor outputs.

MONITOR SYSTEM



MONITORING allows the operator to listen to what is going on. Monitoring has no effect on the program going through the mixer, it is simply the connection of selected signals to the control room speakers or headphones. On the more complex boards, there is provision for listening to practically any point in the system, from a single input module (SOLO) to a special mix of the outputs with provisional reverb. There will often also be aux or tape inputs to allow monitoring of devices outside the mixer. Most recording studio control rooms are set up so everything is controlled at the board.

Monitoring has no effect on the group or stereo outputs, which means you can usually check on various signals without disturbing whatever is being recorded.

Typical monitor systems have two sets of outputs: CONTROL ROOM monitors connected to the speakers above the console, and STUDIO monitors, connected to speakers in the studio proper. There will be level controls for each.

COMMON MONITOR FUNCTIONS:

The BUSS MATRIX is a group of knobs that determine how the busses will be monitored. Usually, there is a level and pan control for each buss, which connect that buss to the stereo monitor. Since this does not affect any outputs, it is possible to monitor with a stereo placement totally different from what is being recorded.

TAPE/BUSS switches select either the internal mixer signals or the output of a multitrack tape deck for monitoring. This is the equivalent of the tape/source switch

on tape decks or home stereos, as it allows the quick comparison of the recorded to original sounds.

Consoles that are designed for use with 24 track (or more) decks often have the tape monitor controls on the input modules. Then flipping a switch connects the deck for mixdown. This is known as an IN-LINE setup.

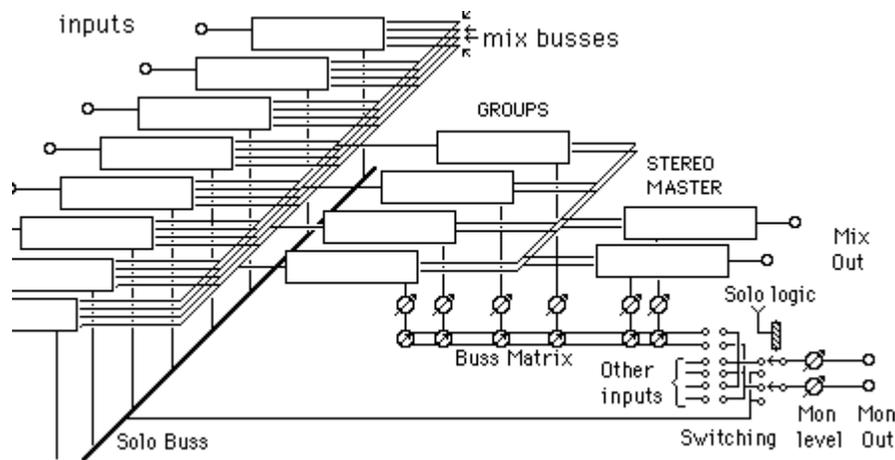
SOLO. As mentioned earlier, this is activated by buttons on the input modules. When pressed, only the selected inputs are heard. A variation of this, called PREFADE LISTEN or PFL bypasses the input faders. There is usually a light to indicate solo is active because it is often hard to notice a single pressed button^[6]. There should be a special knob to set the level of solo monitoring so you don't mess up any settings trying to check a quiet source.

METERING. VU meters may be connected to various parts of the mixer. Meters must be available for the groups and main outputs, can often be switched to the echo outputs, and are sometimes provided for the inputs (although we usually have to make do with an overload light).

TALKBACK allows the console operator to speak to the musicians in the studio. When the button is pushed, the control room speakers are shut off and a small microphone built into the console is activated; that mic is connected to the studio speakers. Shutting off the control room speakers prevents feedback through the recording mics.

SLATE is a similar function that allows the engineer to record his voice on the tape. "Slating" is the announcement of take number and other information on the tape. This is very useful when the tape is played later.

TONE provides a sine tone of calibrated amplitude on the main busses. This simplifies the adjustment of levels on the tape recorders (set levels so the VU meters on the deck match the board), and provides a reference for later playback. The tone is usually available at the patch bay as well.



MONITOR FUNCTIONS OF A MIXER

USING MIXERS

Mixing is no less of an art than playing the piano. This art involves two vital skills-- knowing reflexively where everything is on the console, and hearing exactly what is going on. As with any musical instrument, virtuoso ability with a mixer is only acquired through long practice. To get this practice, you should use the mixer for monitoring any time you are in the studio, and you should make several mixdowns of all of your multitrack work.

There are many ways to set up a console for mixdown, and they will all produce pretty much the same electrical results. As you try various approaches, you will find some easier to use than others. Eventually, you will develop a fairly standard working technique that will make mixdowns almost instinctive.

This is how I usually work:

SETUP

Generally, I patch the multitrack outputs to the mixer inputs in order, starting at either end of the input modules. That way the meters on the deck relate to the input levels nicely. The only exception to this is when I am mixing orchestral music, when I put the instruments in score order, no matter what track they are on.

If I am adding reverb, I use the auxiliary send that is closest to the the front to feed the reverb. I bring it back on aux return or a spare set of inputs.

I don't use EQ unless I am extremely provoked. I set the EQ listening to single tracks, trying to get the most natural sound. Later, I may change EQ to get a special effect.

A professional secret-- when I am recording live musicians, I set the EQ by listening to the performers talk-- when I have an irresistible urge to answer back, I know the EQ is right.

At the same time that I am checking EQ, I set the PAN. I try for a natural image (no ten foot keyboards please) with the important parts near the center. I seldom pan anything hard left or right.

Practice

Next, I listen to the entire mix with the faders up to the "normal" mark. [7] I set the TRIMS to get a good balance of sound. To me, a good balance means each part is distinct and it is always obvious where the important material is. I am a fanatic about being able to understand lyrics.

Another secret-- you can use EQ to bring a part out without turning it up. Boost the 2k-5k frequency range by about 3dB. Then reduce the same band in the other parts by the same amount. You can do this during a mix if you have to.

I add reverb last, after listening to several runs dry to make sure all is really clean and balanced. I don't use much (if you hear it there's probably too much), and I generally apply less to the lead parts to get a feeling of front to back.

Now I write every setting down.

I have a bad memory, so I make a cue list that shows all of the changes and the time they happen. Naturally this list gets changed a lot as I practice mixing the piece.

1:54	⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙	fader to 5, for drum solo
2:12 (on WOW)	⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙	fader 7 back to 7
2:14	⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙	cut 3 for garbage
	⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙	pan 5 to R3
2:37	⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙	3 back on

I practice with this list until I don't really need it. (It's my security blanket.)

Mix

Then I hit record and do it. Then I listen to the result and do it over...again..... and again.....believe me, it often takes 7 or 8 tries before it is even close to right.

As I believe I mentioned, you will eventually develop your own style of mixing. There is no right or wrong, there is only a job to get done.

Here is some review and a few hints on making mixing easy.

Always "clear" the mixer before starting. Disconnect all the assigns and switch out or flatten all the EQ settings so you get no accidental funny effects left over from the last user. Keep the faders of any unused inputs down.

Try to connect items to the mixer in a consistent configuration so that you can develop reflexive knowledge of where things are.

On most mixers, adjust the TRIM controls so that you can use the entire length of the fader. (Set the fader full on and turn the trim down until there is no overload with the loudest part of your signal.) If you try to work with just the bottom half of the fader, you will not produce very smooth fades.

Always practice your mixes several times before recording. You will find that red lights add a lot of tension to mixer operation. Writing down what you plan to do is an excellent idea.

Always time your mixes, but don't mix to the clock, mix to the music. If you don't know what is coming next you are not ready to mix.

Take frequent breaks to keep your ears fresh.

Source: http://www.co-bw.com/Audio_mixers.htm