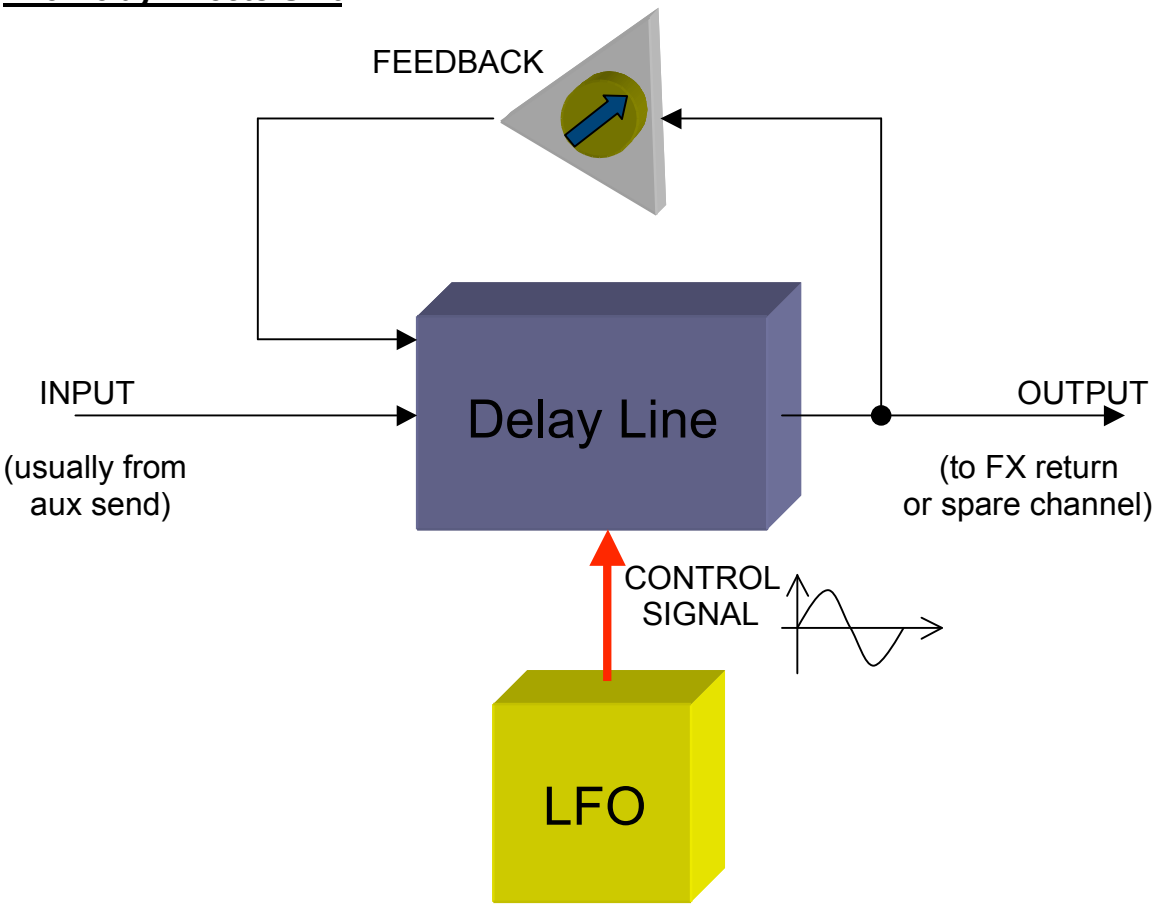
DELAY and PHASE

Delay has been used as an effect in recordings since the 1950s when it was achieved by feeding a signal to a tape machine in record, The signal passed through the record head onto the tape, and then a short time later reached the playback head and reproduced. The delay signal would then be mixed back with the music as desired. The earliest use was to create the rock'n'roll 'slapback' effect on vocals and lead instruments (ref. Elvis Presley's early recordings for Sun Records)

More recently other electronic devices have been used as a delay line, the modern day version being simply digital audio stored in a memory then the required time later recalled.

The Delay Effects Unit



The basic principle is the signal is delayed by the **delay line** and then returned to the mixer to be blended with the original.

The **feedback** path allows an attenuated delay to pass through the delay line again producing a lower level repeat ... and again ... and again, diminishing (and often deteriorating in quality) each successive time.
If the full level from the delay line output is fed back, then the signal will (theoretically) repeat continually.
If some amplification is introduced, then each repeat will increase in level (resulting in distortion, speaker breakage and/or ear damage if unchecked!). Of course this can be used as a special effect but needs to be carefully controlled.

The **low frequency oscillator (LFO)** is used to modulate (i.e. vary) the delay time, usually in small increments.
The frequency of the generated waveform (usually a sine or triangle wave) controls the **speed** or **rate** of change of the delay time, its amplitude (or level) controls the **depth** or **strength** of the resultant modulation effect.

Delay Effects

The following are commonly used delay effects:

Try these out for yourself on a convenient simple delay plug-in or hardware unit, listen carefully and learn to recognise these sound on your favourite commercial tracks.

EFFECT NAME	DELAY TIME (mS)	CONTROL SETTINGS
Long Delay	> 100	
Spin, Repeat	> 100	+ feedback
Slapback	~ 100 – 200	
Automatic Double Tracking (ADT)	30 – 40	
Chorus *	10 – 20	+ LFO
Phase Shifting *	1 – 2	+ LFO
Flanging *	1 – 2	+ feedback + LFO

[* the precise settings to hear these exact effects is critical (including the balance with the original signal ... usually 50:50), but varies with the unit used.

In effects units with dedicated 'algorithms' for these sounds, multiple delays are often used to make the effect richer and deeper.]

Of course more than a single delay can be used for any of these effects, if for no other reason than to fill the stereo image.

These are well-used fairly standard settings today, but many permutations are possible ... limited only by your imagination!

Phase

We have considered various length delays as effects, but what of the minute delays that occur with signals generally?
These are known as **phase differences**, when the time values are such that the waveforms are just out of alignment with each other.
Humans are very sensitive to this **relative phase** (it provides our ears and brains with valuable information to determine direction and distance), whereas when it's just a single pure sound varied in small increments of time (**absolute phase**) then we don't seem to notice.

In fact, as far as sound is concerned, we are bombarded by phase differences,
- we have two ears (to resolve the previously mentioned direction/distance information)
- our stereos have two speakers (to present us the spatial information embedded in mixed music tracks, etc.)
- any reflective surface will produce a delayed (and tonally altered) copy of sounds that hit it
- sounds themselves can be thought of as a summation of simple components (usually sine waves each having their own frequency, level and relative phase)

So there are natural or inherent phase relationships in sounds, and as recordists we have the power to preserve these or alter them by the techniques we use
e.g. think of a sound generated in a room with two microphones each at a slightly different distance from the sound source
ALSO with digital delay systems today we often have the ability to correct, or "improve" (!!??), this relative phase difference situation.

We have also discussed phase reverse (or polarity reverse to be more accurate), which can be useful when combining multiple mic combinations.
A simple way of hearing this would be to reverse the wiring on one speaker on your home stereo, then when some music is played as one speaker moves outward the other goes inward.
The audible result is:
- a drop in volume (now you hear the 'difference' between the left and right channels)
- a loss of bass (as this part of the signal is usually common to both left and right)
- a weird "hollow" sound/feeling if you're listening between the speakers (due to phase cancellations).

It's surprising how many home systems (and home studios for that matter!) are wired up this way!

PRACTICAL: Practice creating delay effects and applying them to a variety of sounds. Listen to examples of signals with reverse polarity and phase differences (hence comb filtering), and be able to identify.