Frequency Response, Crossovers and Drivers

Crossover: A pair of roll off filters that when ganged together produce a smooth acoustic "crossover" from one speaker driver to another

Active and passive crossover do the same thing. What mainly differs is where they are in the signal chain. Active is before the amps, passive is after the amps. Active allows using a separate amp for each frequency pass band, passive uses one amp. Active allows easy manipulation of the filter frequencies and slopes, passive has fixed values.

In a full active system **some horns require what's called CD horn eq** (constant directivity) to help flatten the response of the horn. It varies from horn to horn but it's something like a gentle high shelf boost starting around 3khz.
Some passive crossover have the EQ as part of the crossover.

Analog active crossovers have adjustable frequency but not slope. The advantage to higher slopes is better protection for high frequency devices and less pass band overlap of the driver outputs.

Active Crossover Settings

With analog crossovers at least there are always 1 fewer crossover frequencies than speaker bands, so a 2-way speakers system has 1 crossover frequency, a 3-way has 2 crossovers, a 4-way has 3 crossovers, etc. No they would not be set at the same frequency obviously,

For stereo 2-way operation first set the Mode switch to Stereo 2-way, and the Range switches on each channel in the out position so the crossovers can be set in the 40-800hz range.
Start with the Input and Output level controls at the U position, set the Crossover Frequency control to the position marked 1k(that is actually 100hz now), and the Response control to 6.

Power everything up and play some music at a comfortable SPL, adjust the relative balance between the subs and mains with the low and high gain controls. In general we like it when the bass level is a little higher then everything else, but try to end up with these controls somewhere close to the U positions.. +/- 30% for example

Move the Crossover Frequency control up and down just to hear the effect it has, the common sub/main crossover is in the 80-120hz range which is a bit hard to precisely set on an analog crossover like this, but because it's a logarithmic scale it will be in the range between the two tic marks either side if the 1K position.

The crossover between subs and mains will almost always be in the 80-100Hz range. The crossover between midbass and high frequency driver could be anywhere between 500Hz and 5kHz.

As for hi hats about 15khz is where they are going to top out at, most of the fundamentals are in the 500hz to around 4khz. Where concert sound is concerned 12kHz is sufficient.

Don't get too obsessed on reaching 20khz and even more so if we're talking about PA system components here, getting out to 16khz or so some what flat is fine.

Humidity in the air will attenuate 20khz at most distances a PA system would be trying to cover and not to mention very few middle aged people are even going to be able to hear out to 20khz, loud music aside just daily noise. driving in the car with the windows down, factory work, lawn mowing, city street noise, ect all takes it's toll
as well as just the aging process of the ear itself.

Analog and DSP's

DSP's offer more flexibilitiy than Analog. You're not going to hear much if any difference at low frequencies, all the detail is in the mid and high frequencies.

DBX Driverack like the 260 Model can work too so don't absolutely need to get the much higher priced DSP's. The DR260 is generally accepted as a very good piece of gear with good flexibility and sound quality. The speakers are going to have a far greater influence on the final results so spend most of your time and money there instead.

With a digital crossover it is often possible to set each filter individually allowing for more complex configurations.

Filter: An electronic circuit or algorithm(in the digital realm) that affects the frequency response of a signal. Filters come in many flavors, they can boost or cut a range of frequencies like an EQ control, or they can roll off or boost frequencies above or below a certain corner frequency.

With most digital processors you can set all parameters differently for each filter if you want, but they also allow settings to be mirrored to a second channel if you are doing a stereo setup for example.

Steeper filters offer more protection but also add more phase shift.. that is the catch with all of this, and phase shift is difficult to deal with as it tends to not behave linearly... it varies with frequency. Digital processors often can adjust for phase shift at the crossover frequency but that doesn't fix the problem everywhere so often a compromise is made and we use a medium filter slope like 4th order(24db/oct) to get good out of band rejection without too much phase shift. An added benefit is that even order filters sum flat and a generally flat response is the target anyway.

To highlight certain items in a recording is difficult, if the recording engineer wanted that instrument to be prominent at that time he would have raised the instruments level in the recording. The best you can do with a finished recording is boost the frequency range of the instrument with a parametric EQ, but if there are other instruments or sounds in the same range they will get boosted too so it doesn't work quite as well.

FWIW most of the pros who regularly post on my forum use 48dB slope if their crossovers allow it. They can do so because a good DSP employs linear phase filters that eliminate phase shift issues.

Understanding Driver Specs

The Peavey driver spec means that in the frequency range from 500hz to 3,200hz the the peaks and dip in the response only vary by 2db, the range from
3200hz on out to 8000hz the response is dropping in level by 3db, beyond 8000hz the response is dropping at a rate of 6db per octave. An octave equals doubling
of a frequency so that would mean say if at 8000hz the level was 106db at 16,000hz it would be down to 100db.

The response graph on the spec sheet you linked to kind of follows the numbers in the spec.

In theory and going by the numbers on the spec you can see that you would need to apply upwards to 20db
of boost towards the top end of that driver to get to a somewhat flat to 20,000hz response, not something you really want to do.

The response spec of newer one inch drivers are better but they still start getting peaky and dropping off around
16,000hz look at some B&C drivers for example.

Different diaphragm materials, shapes and sizes all play into a drivers response as well as the the drivers exit throat and phase plug.
standing waves/reflections can build up in the driver throat causing cancellation at different frequencies.

Crossover and EQ

Crossover and EQ are separate functions even with DSP, the control on that Rane is for a crossover frequency and it would be unusual to set one higher than 7khz, for driver response shaping parametric EQ is what you want. Some analog crossovers have CD horn correction EQ but there is often very little control over it sometimes just an on or off switch so it's not of much use, taming a compression driver/horn combo typically requires multiple filters.

DSP really isn't optional with these components. The difference this makes to the sound produced is not subtle, **an unprocessed CD typically sounds very midrange heavy with poor high end but after EQ would be very natural sounding with good to great high end extension.**