Performing power tests at Scan-Speak

From time to time we get questions on how to interpret our datasheets with respect to power test results for our drivers. We have occasionally seen misinterpretations which can lead to erroneous use of other parts, such as tweeters, which can result in damaged drivers.

A power test is usually performed for a new driver to ascertain that it can withstand the intended use in our customer's loudspeaker system. We also perform power tests before new materials or adhesives are implemented.

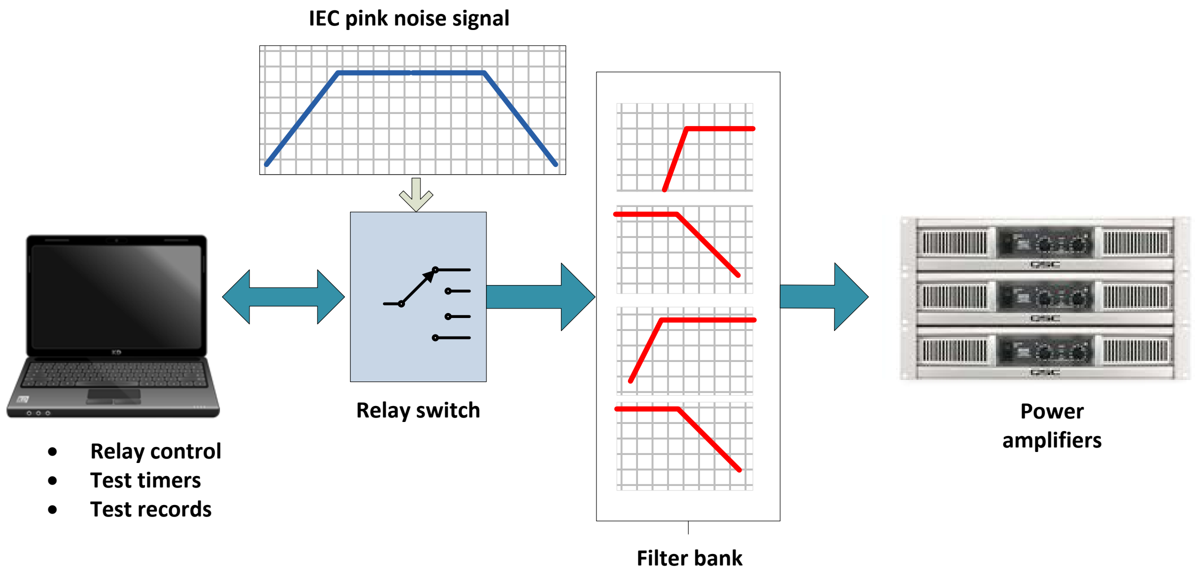
Standardized test conditions

The power handling tests are done in accordance with IEC 60268-5. We perform one, two or three of the tests depending on the need. The test signal is always a weighted (IEC 268-1) pink noise signal with a crest factor of two.

The tests are specified as below:

- 100 hour RMS – 100 hours with continous signal.
  - (IEC 268-5, cl 18.4 Rated noise test)
- Long Term Power Handling – 10 times alternating between signal for one minute and pause for 2 min. Total test time is 28 min.
  - (IEC 268-5, cl 18.2)
- Short Term Power Handling – 60 times alternating between signal for one second and pause for 1 min. Total test time one hour.
  - (IEC 268-5, cl 18.1)

Fig 1. Test setup



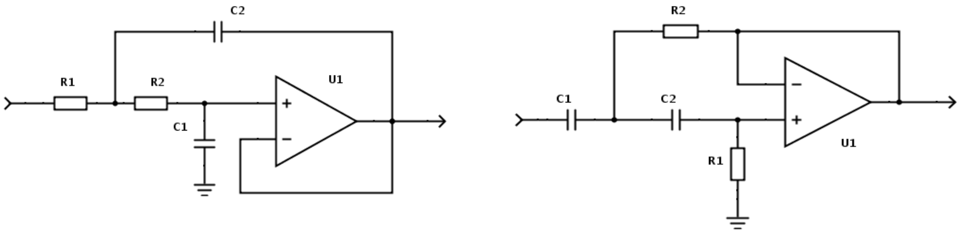
The use of crossovers for power tests

Crossovers are used to make sure that we test the drivers in a frequency interval corresponding to their normal working range. All loudspeaker drivers can be destroyed if an inappropriate/unsuitable signal level is applied but that is of little interest for real use of a loudspeaker.

So when the power handling spec on the datasheet states that a tweeter will handle 150 Wrms pink noise for 100 hours it is the combination of tweeter and crossover that has that capability. NOT the tweeter alone! The specified power handling capacity should be seen as a "system" effect.

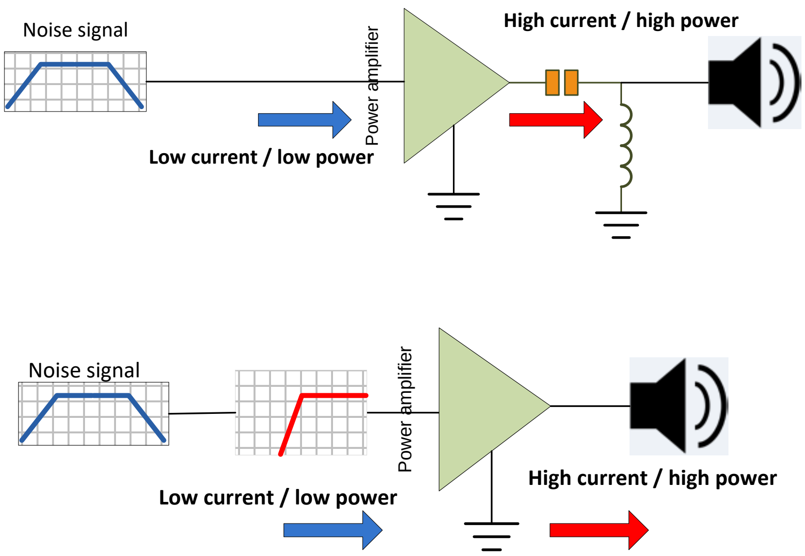
If there are no remarks on the datasheet about a crossover, the loudspeaker has been power tested without any filtering.
All the standard crossovers used at Scan-Speak are built as Sallen & Key second order active filters with a Q of 0,707 (Butterworth). We can test with other types of crossover if required by designing the filter on a DSP.

Fig. 2. Sallen & Key 2. order lowpass and highpass filter topology



It would, of course, be possible to build the crossover filters with passive components but this method has challenges. A passive crossover is placed between the power amplifier and the driver, and must, therefore, be able to sink large amounts of power. The other thing is that a passive filter must always be adjusted to match the particular driver. By using active crossovers there is no loss of power in the signal path and we know exactly how much power is dissipated in the loudspeaker driver.

Fig. 3. Principle of using active vs. passive crossovers respectively



Tweeters

Tweeters are built to be used for high frequencies only but the definition of "high frequencies" can vary depending on the tweeter type. You will find systems in the market where the crossover frequency to the tweeter is lower than we would normally recommend but different philosophies of system design have their own requirements.
The crossover protects the tweeter from moving too much and from overheating the voice coil. For most of our 1" tweeters we use a crossover frequency of 2.5 kHz that allows us to compare the power handling capacity directly.

Fig 4: Typical power handling data from tweeter datasheet

Power Handling

- 100h RMS noise test (IEC 18.4)* 150 W
- Long-term max power (IEC 18.2)* 460 W

*Filter: 2. order HP Butterworth, 2.5 kHz

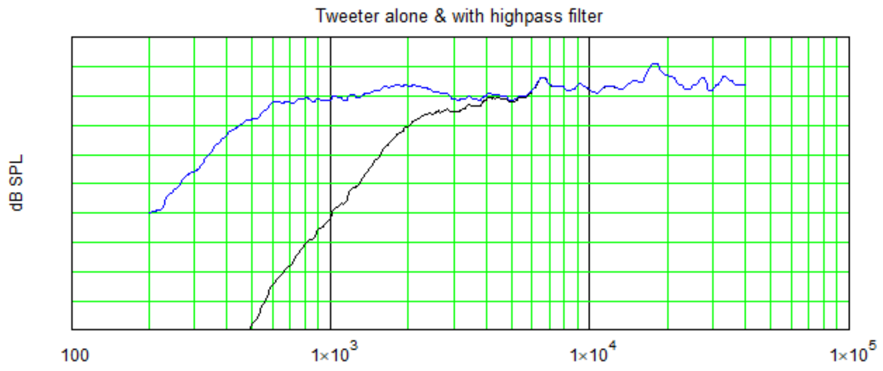


Fig 5: An example of a tweeter sound pressure response as is (blue) and with a 2,5 kHz crossover (black).

Midranges

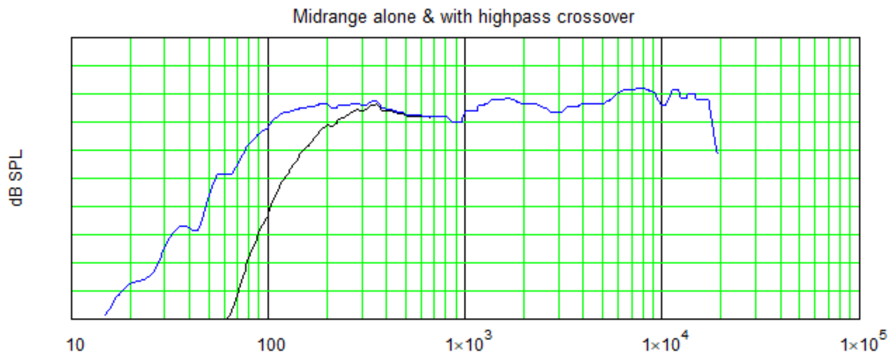
For smaller midranges we normally use a crossover frequency of 200 Hz. An exception is the 15M/4531K00 midrange which is tested without a crossover.

Fig 6: Typical power handling data from midrange datasheet

Power Handling

- 100h RMS noise test (IEC 18.4)* 80W
- 80 W Long-term max power (IEC 18.2)* 150 W

*Filter: 2. order HP Butterworth, 200 Hz



Subwoofers

Under normal conditions one wouldn´t expect a subwoofer to need a crossover while being power tested but the purpose of power testing a subwoofer is to mechanically stress the moving parts to their limit. If we feed a fullband signal to a big woofer that can withstand up to 1000 Wrms for 100 hours there is a big risk that the voice coil will burn long before the mechanical parts give in. Such a situation would never occur in “real life” in a loudspeaker system as the subwoofer will have a lowpass filter implemented to cross over to a midrange. So we implement a lowpass filter to the subwoofer that allows us to test the mechanics to its limit.

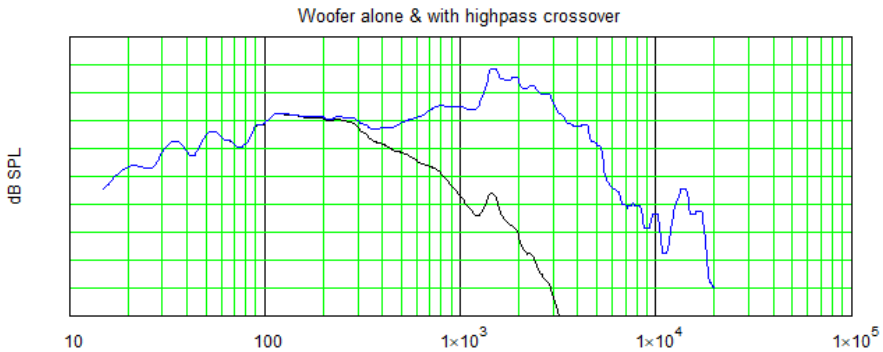
Fig 7: Typical power handling data from subwoofer datasheet

Power Handling:

- 100h RMS noise test (IEC 18.4)* 200 W
- Long-term max power (IEC 18.2)* 500 W *

Filter: 2. order LP Butterworth, 200 Hz

Fig 8: An example of a woofer sound pressure response as is (blue) and with a lowpass crossover (black)



Summary

Power testing our transducers is an important part of documenting that our designs meet expectations. But the “expectations” of a driver can vary a great deal and it is not always an objective to be able to handle a lot of power. A desire for a certain tonal balance created by specific soft parts or a desire for certain box tuning capabilities may decrease the power handling capacity. As always, building electroacoustic transducers is a matter of making the right compromises.