# Technical note

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## The Convertible Power Amplifier -Minimum Load Select (MLS-switches)

### The problem:

Assume that a power amplifier can deliver 1000 watts into 8 ohms, and it should be able to run also into 2 ohms. Theoretically and according to the physical laws, it should be able to deliver 4000 watts into 2 ohms. Very few professional power amplifiers are able to do this, as all conventional power amplifier designs are compromises between power dissipation, costs, size etc. Most amplifiers deliver only 70% or less of its theoretical power into 2 ohms. This is due to resistive losses in the power supply and the use of current limiting to protect the output semiconductor devices from damages due to too high current.

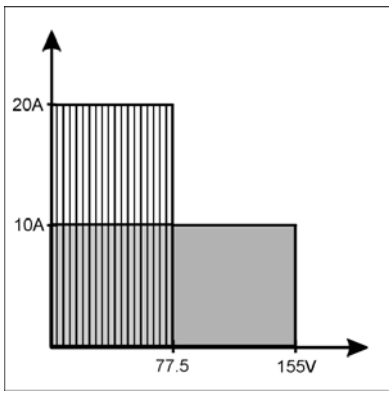
Current limiting is definitely not the best way to reduce the power at low impedance, as the limiting can produce very nasty distortion and glitches. The reason is that the impedance curve of a loudspeaker driver is not a straight line and therefore shows a reactive load to the amplifier. This reactive load produces back energy that can trigger the current protection and produce glitches in the signal.

### The solution:

The solution is to use a "Constant Power Converter". This converter is connected in between the power supply and the linear power amplifier. The nice thing with the power Constant Power Converter is that it can produce more current than it takes from the power supply, and this way overcome the losses in the power supply then driving low impedance like 2 ohms. As the power is the product of current and voltage, an increase in current require a reduction in voltage. This reduction in voltage also makes the dissipation in the output devices lower and the current limit protection can be adjusted for a much higher current so it can't interfere with the requirement from the loudspeaker impedance curve.

### How it's done:

The "Constant Power Converter" is a class D amplifier that is feeding a linear class B amplifier with a voltage, which exactly tracks the signal that is to be amplified. The class D amplifier has also the property to store energy and thanks to this it can convert the power to either high current/ low voltage or high voltage/ low current. By controlling the behavior of the converter which is done by the MLS-switches, the user can tell the amplifier if high current is needed to drive low impedance's to high power levels or if there is a high voltage requirement to drive 8 ohms load for example.




**The graph shows the two extreme MLS-settings for highest current (low impedance) and highest voltage (high impedance) mode. Note that the area of the blocks represent the power. The blocks have the same area, and therefore shows "constant power".**

## Features:

The MLS-switch feature can create multiple combinations of power ratings from one single power amplifier. Whilst other brands offers dozens of models with different power ratings for special purpose, like Bi-amping, high voltage, low impedance and mono blocks etc., a couple of Lab.Gruppen standard models covers the whole range.

The fP 2400Q (LAB 1200C) and the fP 2600 (LAB 1600) has a common MLS-switch with two positions –low and high impedance. The fP 3400 (LAB 2000C) and fP 6400 (LAB 4000) has independent switches for each channel, each having four positions, with all the combinations possible, each amplifier can offer at least twenty different usable power ratings.

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