LINEAR OR LOGARITHMIC?

The question often arises as to which signal processing technique is better: an output linearly or logarithmically proportional to the input optical power.

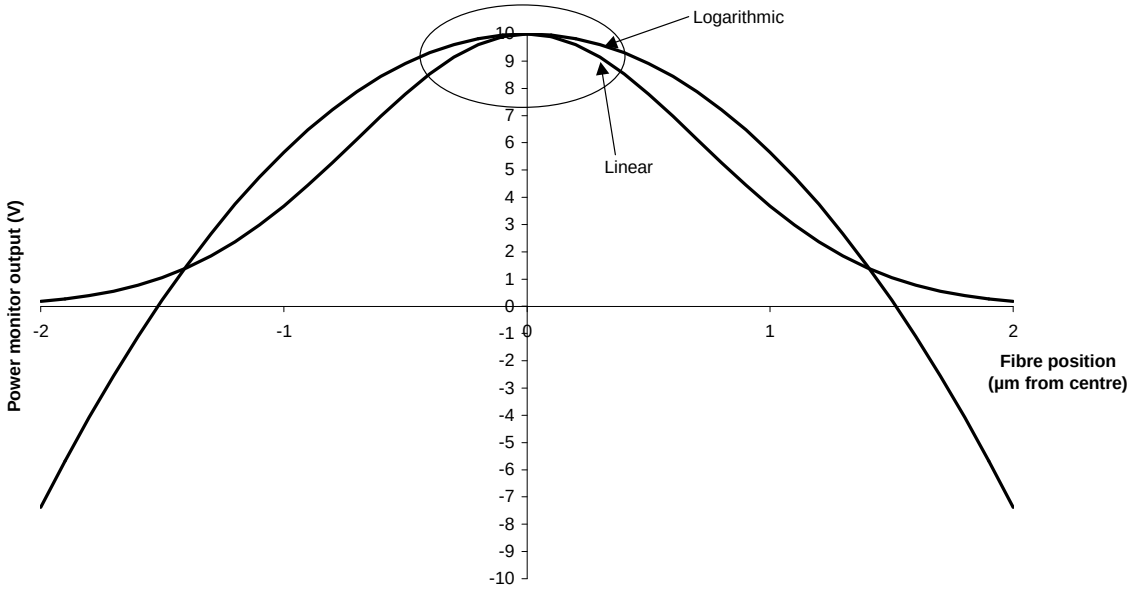
The use of logarithmic amplifiers for optical power monitoring results from the large dynamic range of relevant powers. For example, the OPM500 series can measure from 1mW to 30pW: more than 7 decades of optical power. This dynamic range is far beyond the capabilities of a linear amplifier in a single gain range.

However, by breaking the measurement into range subgroups, linear amplifiers can easily cover the same dynamic range as a logarithmic amplifier. This method is slightly more complicated than using a logarithmic amplifier with a single gain, but it brings several advantages:

1. Linear amplifiers are **more stable** than logarithmic amplifiers
2. Linear amplifiers are **faster** than logarithmic amplifiers and **settle more quickly** following sudden input changes
3. Linear amplifiers are **more accurate** than logarithmic amplifiers at higher outputs

Consider an application example: a fibre optic power monitor is used to measure the power coupled into a device in an automated confectioning system. The device being confectioned may be a laser being pigtailed or fibre being connected to an AWG, for example.

Now the automated positioning system takes the measured value of the coupled power (measured by the power monitor) and uses this value to control the motion stages positioning the fibre. The system searches for the position giving the maximum coupled optical power. Obviously, the accuracy of the positioning will depend on the accuracy of the measurement at the **highest** powers measured. Since the logarithm function compresses data, the position dependance of a logarithmic amplifier is flatter than for the linear amplifier at higher power. Thus, the linear amplifier will allow the system to achieve better results in this application. This point is depicted in the following diagram:



Comparison of linear and logarithmic outputs in a fibre positioning application. The linear output results in a sharper peak allowing more accurate positioning.

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