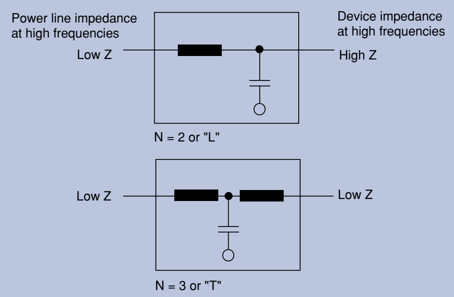
Figure 5 Impedance conditions for power line filters



4. Insertion Loss

The selection criteria for a filter is its insertion loss. It is defined as the logarithmic ratio of the power delivered into a defined output impedance with and without filter.

$$A = 10 \times \log \frac{P_{Ref.}}{P}$$

$P_{Ref.}$: Power between energy source and load without filter (Figure 6)

P: Power between source and load with filter inserted (Figure 7)

Figure 6 Measurement of insertion values without filter

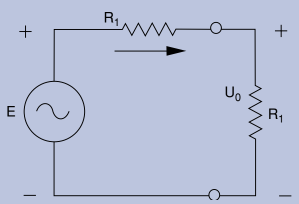
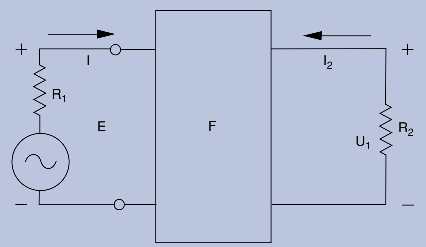


Figure 7 Measurement of insertion values with filter



The insertion loss can also be directly specified as voltage ratio

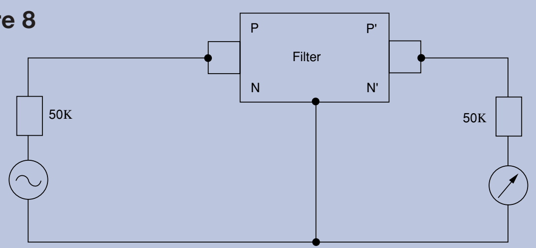
$$A = 20 \times \log \left(\frac{U_0}{U_1}\right)$$

When measuring attenuation it can usually be distinguished between

Symmetrical attenuation (differential mode) and
Asymmetrical attenuation (common mode).

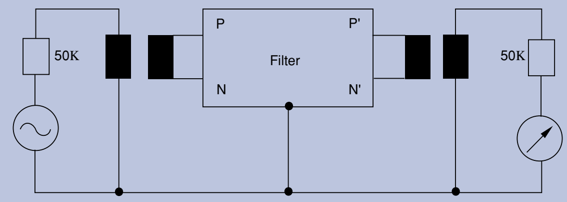
a) Measurement of the asymmetrical component (common mode)

Figure 8



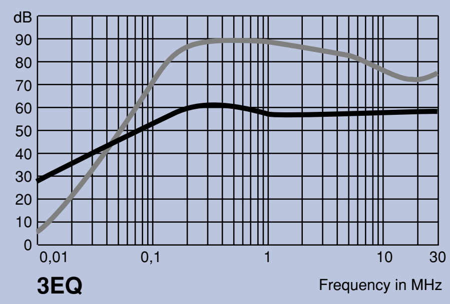
b) Measurement of the symmetrical component (differential mode)

Figure 9



Measurements of attenuation are being performed over a wide frequency range. Figure 10 shows the typical attenuation curves resulting for the Corcom filter type 3EQ3.

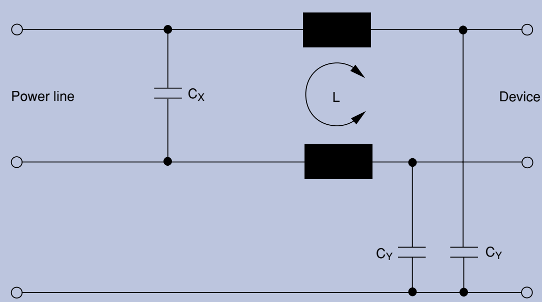
Figure 10 **asym.** — **sym.** —



The predictability of the actual performance of insertion loss in a real application is not very accurate. The reason for this is the measuring method in a closed 50 Ohm system. In reality it is quite doubtful that line impedance as well as device impedance will stay at 50 Ohms over an extended frequency range. Therefore the true performance of a filter can only be measured empiricly within a device or system by the user. For quality assurance however the insertion loss is an important tool. This measurement can certainly be used to prove a product's quality and consistency.

5. Typical Filter Network

Figure 11



This network is the most frequently used type in real applications. It serves for both asymmetrical as well as symmetrical interference suppression. Symmetrical interferences are being suppressed by the capacitor showing the suffix X. If these capacitances are not sufficient, additional inductances (e.g. linear inductors) will be neccessary. Asymmetrical interferences are being reduced by shown inductances and the capacitors carrying the suffix Y. The Y-capacitors connected to safety ground are acting as HF-shunts. The value of the capacity is determined by the maximum permissible leakage current of the device. The inductivities shown in the network above are usually current compensated inductances. For operating current these inductivities are of very low values. According to its winding technique the magnetic flux in the core is being neutralized, when operating