To guarantee smooth running of live programs, the technology in a television studio must work absolutely reliably. To ensure this for all electrical components, a certain voltage quality of the supply network must be maintained.

**Simple television studio**

In a television studio, the main components used are dimmers for lighting, LED ballast units and frequency-controlled motors. All these devices have one thing in common: they subject the electricity network to non-sinusoidal currents. In addition, the loads on the mains voltage is not identical on all 3 phases, due to the changing lighting of the studio, but depends very strongly on the current situation in the studio. All these factors result in a poor voltage quality in the supply network, which in turn can have an adverse effect on sound and video technology.

To prevent adverse effects on the audio and video technology, the following measures for improving the voltage quality are introduced:

- Reduction of the non-sinusoidal currents in the supply network
- Even distribution of the load on all 3 phases
- Reduction of the neutral conductor current

To implement these measures, an ECOsine® active from Schaffner that combines all 3 functions in a single device was used. Since lighting technology is the biggest cause of interferences, the ECOsine® active was built into the subdistribution of the lighting technology. This almost completely eliminates interferences, before they can have an adverse effect on other electronic equipment. We chose a 60-A filter of the FN3430 series, which can compensate single-phase loads by virtue of its 4-conductor technology and has enough reserves to master all possible load situations.
Load balancing and compensation of the phase cuts

Figure 1: Current curve without compensation by ECOsine® active

Figure 2: Current curve with compensation by ECOsine® active

Figure 1 clearly shows the different loads on the 3 phases. The current curves also show the typical effects of the phase control by dimmers. In Figure 2, they are eliminated by the ECOsine® active. As can be seen, all 3 phases have the same load, thus substantially reducing the peak load of phase 2. The phase cuts have almost disappeared, resulting in a considerable reduction of the existing harmonics. The amplitudes of the individual harmonics are shown on the following figures.
Figure 3: Spectrum of the mains currents without ECOsine® active

Figure 4: Spectrum of the mains currents with ECOsine® active

Figure 3 shows the clear presence of the 3rd and 5th harmonics. The amplitudes diminish very quickly with increasing ordinal number and are hardly measurable any more at higher frequencies. For this reason, the ECOsine® active is only used here to compensate the harmonics up to the 19th harmonic. Figure 4 shows the spectrum of the compensated current, where the harmonics all have almost disappeared. This can also already be seen from Figure 2, since here the current curve is approximately sinusoidal.

The currents of the 3rd harmonic (150 Hz) and of the 5th harmonic (250 Hz) are frequently perceived with a buzzing noise, due to the fact that they are in the audible range and occur with a noticeable amplitude.
Compensation of neutral conductor currents

The 3rd order harmonic currents (150 Hz) flowing in the outer conductors add up arithmetically due to the phase location in the neutral conductor. This is also true of the other harmonics that can be divided by 3. This subjects the neutral conductor to an excessive load (Figure 5). The symmetrical load of the network after filtration by ECOsine® active results in a low current flowing through the neutral conductor. The neutral conductor current is lower than the original neutral conductor current without active filter by a factor of 8–10 (Figure 6).
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