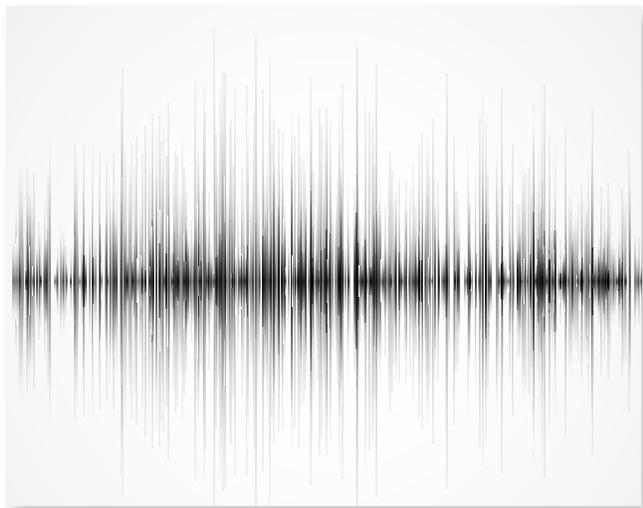

Low Noise Electronics from High End Audio Technology, Introduced into SP6800 Spectral Cell Analyzer

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Abstract: Reducing electronic noise is central to achieving high sensitivity in a flow cytometer. This technical note will explain the engineering behind Sony audio electronics design used in the entertainment industry and how this technology helps Sony analyzers achieve the very low noise electronics.

Background

Sony has consistently brought purer, truer sound to music lovers. Audio sound is generated by the vibration of membranes in speakers controlled by an electric current to form music. To achieve a sound experience that rivals the purity of the original, signal noise from electric circuit currents needs to be reduced.

In flow cytometers, light signals emitted from cells are captured by a photo-detector (PD) or a photo-multiplier tube (PMT) and converted into electric current. The electric current is then converted into digital signal with an analog-digital converter (ADC) and subsequently processed by a computer. By introducing know-how that Sony accumulated in the audio industry, Sony engineering reduced the electric noise on the detected signal to achieve very low noise electronics in the SP6800 cytometer.

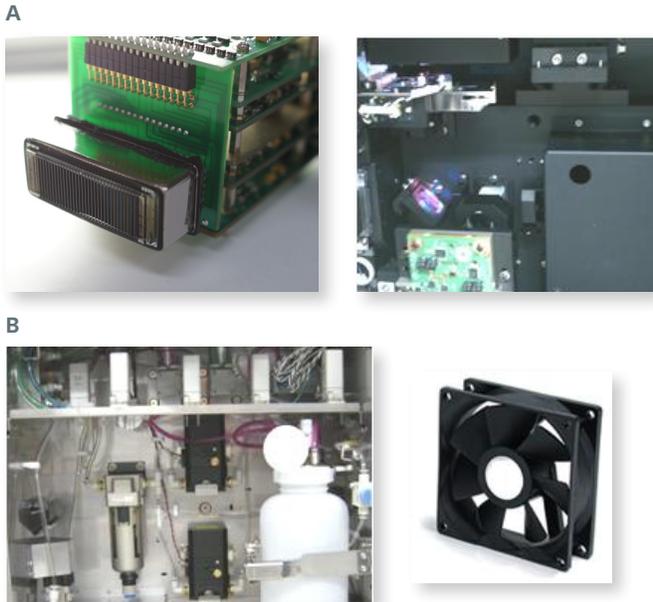


Figure 1. Electric devices found in a flow cytometer.

A Optical devices such as photomultiplier tubes (PMTs) are very sensitive to noise. **B** A number of devices such as electric valves, pump, fan and motor generate noise.

Classification of devices based on noise

Electronic noise reduction begins by determining the source of the noise contamination. Figure 1 shows examples of electrical devices used in flow cytometers. Optical detectors are particularly sensitive to noise and are a starting point to decrease electronic noise level (A).

In addition, mechanical parts such as the motors, valves, pumps, and fans, are likely to produce noise when in operation. Preventing noise contamination from these devices is achieved by isolating their electric circuits. Figure 2 shows how noisy devices are separated from the power supply and allocated to a different branch in the circuit to minimize their noise contamination from clean devices.

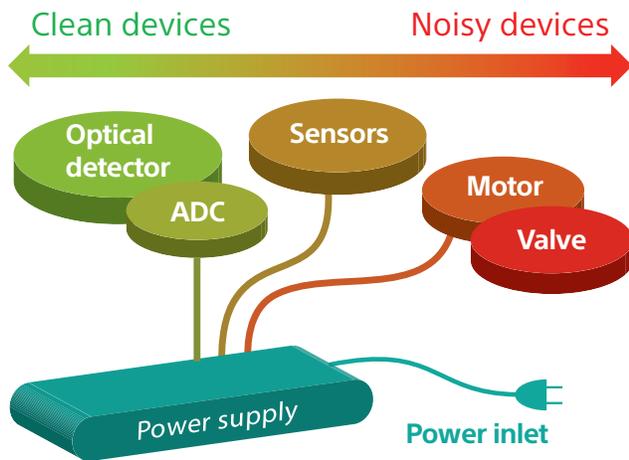


Figure 2. Power source isolation separates noisy devices by allocating them to a different branch in the circuit to minimize impact.

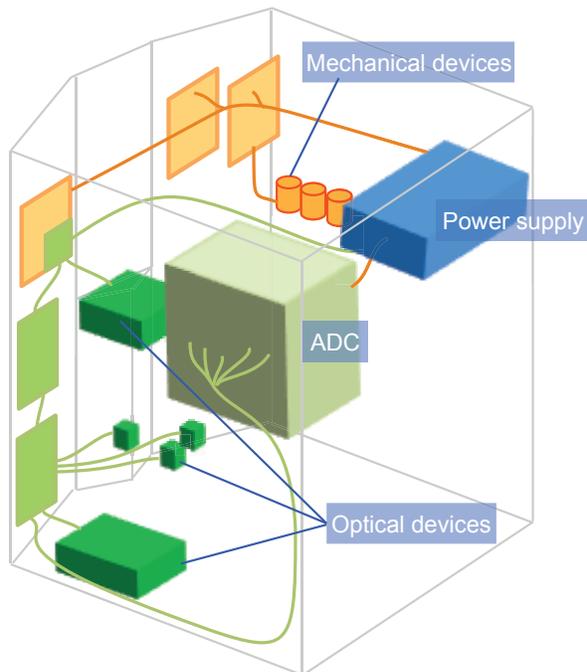


Figure 3. Circuit separation.

This diagram illustrates the electric circuit of the SP6800 spectral cell analyzer showing how noisy devices and circuits (in red) are separated from clean devices and circuits (in green). This design which separates the circuits, prevents noise induction from noisy circuits to clean circuits.

Physical separation of noise

Even with this separation, some noise contamination can persist. That's because as electric current flows, it raises electromagnetic induction and causes noise induction to nearby circuits. Thus, if noisy circuit lines and clean circuit lines are aligned side-by-side, noise will contaminate the clean circuit. To prevent this, clean circuits and noisy circuits are physically separated in the SP6800 design. Figure 3 illustrates how the SP6800 design minimizes the impact of noise induction from noisy circuits.

Conclusion

As a global leader in the design of audio electronics in the entertainment industry, Sony has developed technologies to ensure low noise sound signal production. These advancements are incorporated into Sony Spectral Analyzers to deliver high sensitivity to help scientists achieve more accurate results.

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