Lynx E12

Faraday Cage Electrometer

Super-fast, ultra-low noise charge measurement
SEADM offers a Faraday cage electrometer (Figure 1) with exceptional noise level (~0.1 mV with 1 s of signal accumulation, Figure 2) and rise time (~22 ms; Figure 3). It operates based on capturing gas-suspended charged particles or ions on a filter, and sensing them with an amplifier circuit with $10^{12}$ V/A. The long time drift of the signal is considerably less than 1 mV in several hours (Figure 4), removing the need for a zero current correction. A faster electrometer with rise time <13 ms and amplification of $10^{11}$ V/A (LYNX E11) is also available.

SEADM electrometer can be supplied with accessories, including a 16-bit, 50 kHz DAQ system as well as software allowing for the programming of tests and analysis of results.

**Reference values at your fingertips: 100 ms response time and rms noise level of 0.1 fA**

Figure 1: Lynx E12 electrometer (bottom, right) and system accessories (available under request): DAQ system and laptop with control software. (Battery charger not shown)

**Figure 2.** Time dependence of amplified background signal for two data series containing 255 data, each accumulating signal for 1 s. Both series include 5 isolated events points departing drastically from the general trend. These events are isolated and readily distinguished from the rest of the signal. The standard deviation $s$ is 0.23 mV and 0.13 mV, including or excluding these five events, respectively.

**Figure 3.** Oscilloscope trace for the electrometer showing a half rise time of approximately 22 ms. An initial 20 ms time delay with no response is primarily due to the aerosol pulse generator.

**Figure 4: Long time drift signal of electrometer.** Each datum is accumulated for 250 s.
Operation and basic architecture
The electrometer includes a Swagelok inlet connecting to a ¼” tube for entry of the charged particles to be sensed. An identical fitting at the outlet is normally used (whenever inlet pressure is higher than atmospheric) for sample disposal. The analog inverted amplified signal is delivered through an output BNC, for direct reading or connection to a computer. The saturation voltage is ±2 V, corresponding to ±2 pA. The amplifier is powered by an internal rechargeable Li-ion battery. Due to security transport reasons the battery is not included; recommended model is Nitecore 18650 3400mAh. Battery charger (Nitecore D2) is included.

Technical characteristics
• Dimensions: 113 mm box diameter; 134 mm box cover diameter; height: 104 mm; excluding connectors
• Weight: 4 lb
• Power: Internal 3.7 V Li rechargeable battery (battery not included)
• Half height rise-time: ≈22 ms
• Rms noise: 0.1 fA (with event suppression)
• Drift current: less than 1 mV/hour after initial stabilization. The base signal may increase by up to 0.5% of the maximum signal attained following a large current input
• Amplification: -10^{12} V/A±10% (inverting amplifier). May vary by ±10% from model to model. Precise calibration is available upon request
• Measurement range: from ±0.1 fA to ±2000 fA
• Sample inlet and outlet ports: ¼” tube Swagelok connectors with nylon ferrules.
• Amplified output signal range: ±2 V
• Display in charger shows battery charge level.

For more information

Developed in collaboration with Yale Professor Juan Fernandez de la Mora