

Remote RGA operation via ultra-long (100 meters) extender cables

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Residual gas analyzers (RGA) are regarded as essential gas-composition monitoring instrumentation for both high and ultra-high vacuum processes. High Energy Physics vacuum installations often place RGA sensors within ionizing radiation environments, which can degrade semiconductor and other components of their control/analysis modules. Radiation sensitive electronics components can be protected from such harsh radiation exposure, positioning the electronics control unit (ECU) at a remote location - away from the quadrupole mass filter (QMF) subsystem - and through an extender cable connection between both modules. Extender cables include mixed connection paths for conveying (1) mass spectrometry signals (mass setting and ion currents), (2) control signals (electrode biases), (3) power lines (filament current supply) and (4) high-amplitude radiofrequency signals for mass selection (coaxial transmission line.) Critical to the operation is the delivery of precisely controlled dual-phase RF supply signals to the QMF assembly, as required to achieve repeatable mass spectra. The RF supply signal amplitude is of the order of hundreds of volts peak-to-peak (Vpk) and its frequency is typically a few MHz. With modern vacuum installation projects demanding cable lengths exceeding 50 meters, our engineering team recently developed a patented methodology for (1) conveying a time-varying voltage signal from ECU to QMF including (2) monitoring and adaptively controlling the amplitude of the time-varying voltage signal at the QMF. A physical length of the transmission line configured to correspond to an electrical length substantially equal to a positive integer multiple of one-half wavelength of the time-varying voltage signal allows the transmission line to operate resonantly and adaptively control the amplitude of the time-varying voltage signal from the ECU for cable lengths exceeding 100 meters. Ultra-long extender cables, specifically designed to match customer specified lengths, are presently a reality and the preferred solution for the operation of RGA under hard radiation environments.

Summary

Ultra-long Extender cables for RGA Installations in large vacuum systems with hard radiation are now a reality thanks to a patented technology from MKS Instruments, Inc.

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