

An Ultrasonic System for Remote Gas Monitoring

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Abstract

The system has been designed for monitoring the gas composition inside the big Cherenkov counter of the HARP experiment at CERN. This is necessary for controlling the filling gas (C4F10) purity as well as for safety reasons. The principle of measurement is based on the relationship between the speed of sound in a gas and its (effective) molecular mass. The speed of sound is obtained by two complementary methods which differ in their dynamic range and resolution: a) measurement of the propagation delay of the sound signal over a fixed distance and b) phase comparison of the emitted and received waves. For higher noise immunity and precision ultrasonic emitter and receiver, working at 40 kHz are used. Besides, an electrochemical oxygen sensor with high selectivity and a temperature sensor are used to complement the measured data for better precision when resolving air and pure nitrogen. The transducers and sensors are mounted on a rail inside the gas chamber. They are connected via a gas-tight feed-through to an electronics unit placed outside. The latter is connected to a host computer by a 30 m twisted-pair cable. The computer interface is comprised of three control logic outputs and one analogue input. The four measured signals are multiplexed and sent for analysis to the computer using a single 4-20 mA current loop.