

THERMO COUPLES FOR TEMPERATURE MEASUREMENT AND CONTROL NEAR ROOM TEMPERATURE

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ABSTRACT

Because thermocouples are measuring inherently temperature differences between two connection points of different metal wires, they are tailored for measuring and control of small temperature gradients in precision engineering equipment without calibration of two resistance thermometers. Despite of this advantage they are rarely used for this application due to the low thermal sensitivity. A multi channel measurement system based on mechanical relays and a newly developed high sensitive voltage amplifier is presented, which allows for a noise level of 0.2 mKp-p using type T thermocouples for average times of a few seconds. For the test of the zero point stability of thermo couples near room temperature a set of 32 thermocouples of different types with wires from various manufacturers and with different wire dimensions and connection techniques were placed in good thermal contact between the two measurement points of each thermo couple at a copper block in a well isolated oil bath for many month. During this time additionally the effect of stress and temperature gradients on the wires outside of the box were investigated. For a test period of six month all thermocouples which have been directly soldered to the circuit board of the relay box were stable in a range of +/-0.3 mK. These measurement shows that it is possible to use thermocouples in an environment with small temperature variations and an electrically clean environment without the need for individual calibration down to sub-mK accuracy.

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