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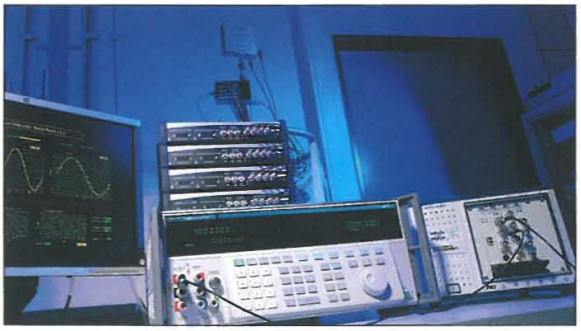
PTB, esz AG and supracon Developing Commercial AC Quantum Voltmeter



A commercial high-precision calibrator (center) is being calibrated by means of the AC quantum voltmeter in the AC voltage mode.

Under a technology transfer program with two partners from industry, Physikalisch-Technische Bundesanstalt (PTB) of Germany is developing a new AC quantum voltmeter in order to establish quantum-based AC voltage standards for use in industrial calibration laboratories. A prototype has been successfully tested for AC voltage at frequencies up to 4 kHz.

The new Josephson measuring system for both DC and AC voltages offers considerable advantages for electrical standards based on quantum effects, including very low measurement uncertainties without the need for re-calibration of standards. The complete system consists of a 10 V Josephson array in a cryoprobe, helium dewar, a 70 GHz microwave synthesizer, a 20 channel bias source, a PXI null detector, and a computer (see photo).

The system, which is based on programmable Josephson arrays manufactured at PTB, is designed for peak voltages of up to ±10 V and frequencies up to 10 kHz. Using a prototype, AC voltages from 10 Hz to 4 kHz have been measured with uncertainties of a few μV/V within a measuring time of one minute. This makes the new AC quantum voltmeter approximately 20 times more accurate than conventional calibrators and 60 times faster than the measurement process with thermal converters.

In addition, the AC quantum voltmeter can also calibrate commercial DC voltage standards. During a direct 10 V comparison between a conventional DC quantum voltmeter and the new AC prototype, no significant deviation was observed within a measuring time of 15 minutes within the uncertainty limit of 0.1 nV/V.

The new AC quantum voltmeter is now being optimized by means of on-site tests at an accredited calibration laboratory. With this valuable end-user input, the system should become fully automated and user-friendly. The primary objective is to reach a relative uncertainty of 2.5 μV/V at 1 kHz.

The system is being developed in a modular approach so that future extension of the system will result in a universal "quantum calibrator" for voltage, resistance and current. Supracon AG, one project partner, will be in charge of the subsequent marketing.

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