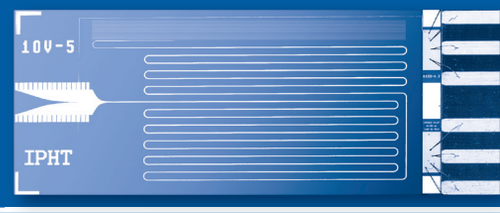
supraVOLTcontrol

Josephson Voltage Standard



DESCRIPTION

supraVOLTcontrol is a complete 3-channel microprocessor controlled 10V Josephson voltage standard (**JVS**) system developed in the Institute for Physical High Technology Jena (IPHT). It facilitates a variety of dc voltage calibrations and measuring functions:

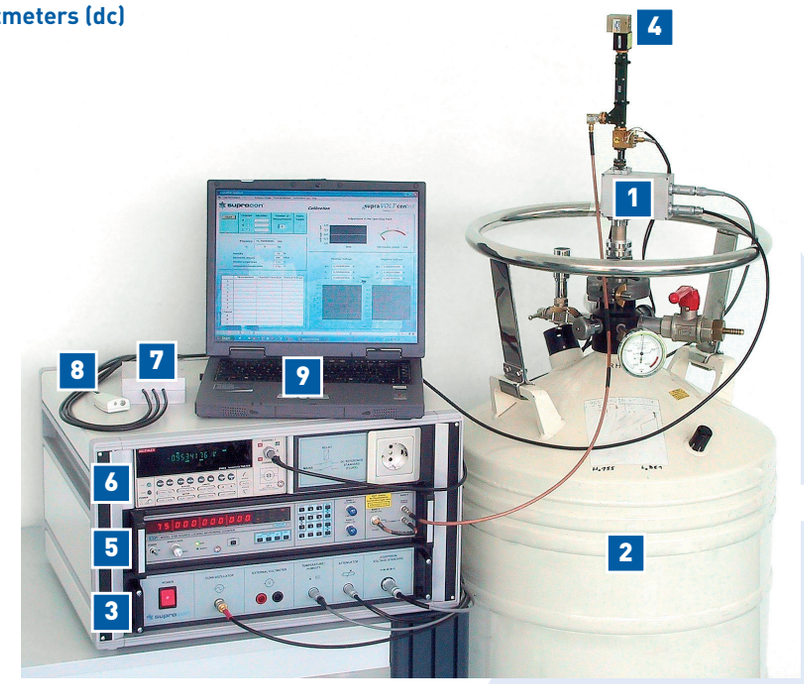
- **Calibration of secondary voltage standards**
- **Calibration of linearity and accuracy of voltmeters (dc)**

in the voltage range of 0 to +/-10V.

supraVOLTcontrol consists of the following components:

1. **Cryoprobe with JVS circuit**
2. Liquid **He Dewar** or **Cryocooler** (optional)
3. **JVS Electronics** unit
4. **Microwave electronics** unit includes: 75GHz Gunn oscillator, isolator, directional coupler, mixer, voltage controlled attenuator
5. **EIP source locking microwave counter**
6. Keithley nanovoltmeter as **Null detector**
7. 3-channel **Polarity reversal switch**
8. Sensors for temperature, humidity and barometric pressure
9. Host computer with IEEE interface

GPS 10 MHz reference frequency receiver (optional)



SPECIFICATIONS

Typical calibration accuracy
(direct comparison to a second Josephson voltage standard)

± 4nV @ 10V $AV/V_{10V} = 4 \times 10^{-10}$

Typical calibration accuracy of secondary voltage standards
(limited by the noise of the secondary voltage standard)

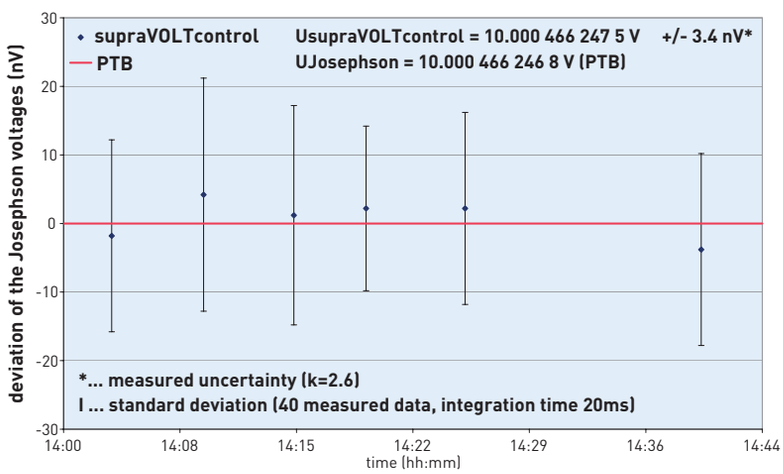
± 20 nV @ 1V $AV/V_{1V} = 2 \times 10^{-8}$

± 100 nV @ 10V $AV/V_{10V} = 1 \times 10^{-8}$

Thermal voltage of wires and reversal switch
< 10nV @ all 3 channels

Typical gain factor g of external voltmeter
(depends on the type of voltmeter)

$Ag/g < 3 \times 10^{-7}$



Direct comparison of supraVOLTcontrol with the Josephson voltage standard of the Physikalisch-Technische Bundesanstalt (PTB) @ 10V. The measured voltage difference corresponds to an accuracy of 7×10^{-11} with a measurement uncertainty of 3.4×10^{-10}.

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SQUID and Microfabrication Technologies

supraVOLTcontrol

Josephson Voltage Standard

JOSEPHSON VOLTAGE STANDARD CIRCUIT

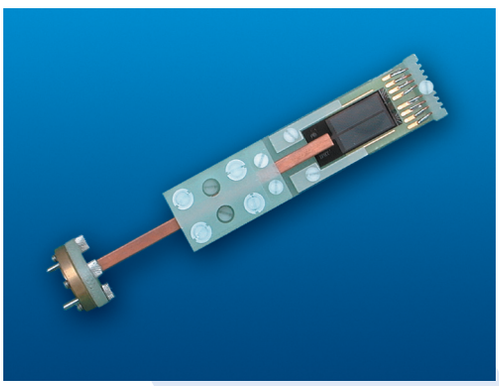
- Chip carrier with a 10 Volt Josephson voltage standard circuit.
- 10 Volt Josephson voltage standard circuit with 19700 SIS Josephson junctions (JJ), the operating frequency is 75 GHz.

$$V = n / K_{J90} \times f$$

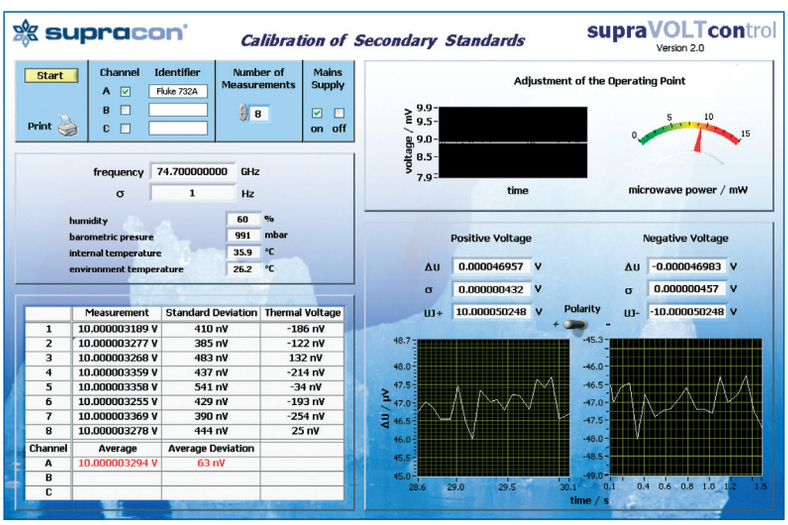
definition in 1990: $K_{J90} = 483.597{,}9\ \mathrm{GHz/V}$

V	Josephson voltage	**K_{J90}**	Josephson constant
n	integer	**f**	operating frequency

With this formula the voltage will be traced back to a frequency, and frequencies can be controlled extraordinary precisely.

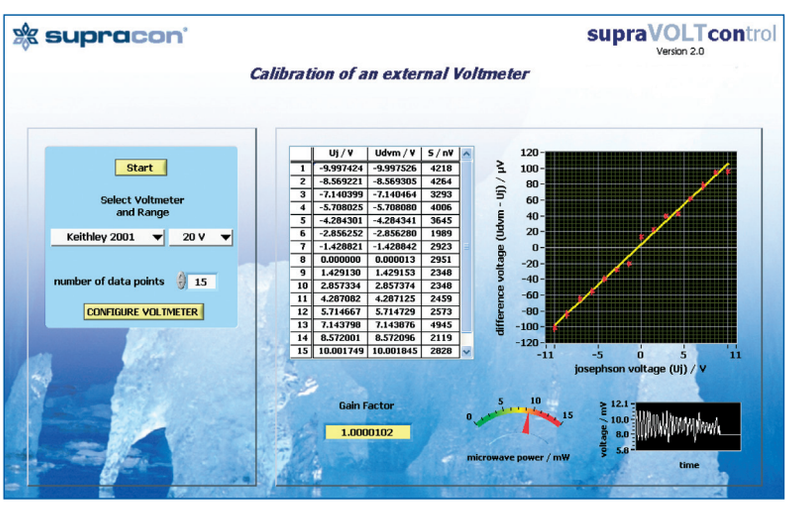


CALIBRATION MODES



▲ DC reference standards
(e.g. FLUKE 732A)

supraVOLTcontrol
calibration of dc reference voltages



▲ external voltmeters
(e.g. Keithley 2001)

supraVOLTcontrol
calibration of linearity and gain factor

TÜV CERT
DIN EN ISO 9001:2008
Certificate 15 100 21403

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