



Instruction Manual

Kelvin Probe S / Kelvin Probe S compact
and
Kelvin Control 07

1. Company profile

The company was founded in 1980 by Karl Besocke as a spin off enterprise of his patents. It started with a simple version of a Kelvin Probe.

During the following years more and more products came on the market establishing the reputation of the company as a cradle for new reliable instruments based on simple and unconventional principles. For example the unique Scanning Tunneling Microscope, known as the Besocke BEETLE-STM.

The spectrum of products includes mainly instruments used in the field of modern research and development in physics, chemistry, engineering and biology.

The principle of operation applies mostly piezoelectric elements.
Main products are: Kelvin Probes, STM, AFM, Choppers and Gas sensors.

Furthermore the Besocke Delta Phi GmbH serves as a consulting company for the solution of unconventional technical and scientific problems.

2. Kelvin System

Work function analysis system

Consisting of piezoelectric driven Kelvin Probe S / Kelvin Probe S compact and Kelvin Control 07.

2. 1 Introduction

Work function measurements provide valuable information on the physical, chemical, electrical and structural state of surfaces. Many different investigation methods have been developed in the past *.

The **Kelvin Probe method** however, proved to be the most advantageous and versatile one. This method is sensitive and absolutely non disturbing the surface state of the specimen. It is based on measuring the Contact Potential Difference (CPD) between the sample and a reference electrode.

Our work function analysis system consists of the Kelvin Probe S, which can be installed easily in any experimental chamber, and the Kelvin Control 07, which drives the Kelvin Probe S and measures the Contact Potential Difference.

The **Kelvin Probe S** features are high sensitivity, small dimensions and easy handling. The installation is extremely simple, flexible and in any desired position possible. Operation in various environments and in a wide temperature range renders many fields of application.

The **Kelvin Probe S compact** is developed for customers who prefer smaller dimensions. All features and advantages of this version are identical with the Kelvin Probe S.

The **Kelvin Control 07** electronics includes all components needed for sensitive, fast response and low noise CPD measurements. The combination of electronics for Kelvin Probe drive and signal processing in one unit offers an easy and uncomplicated operation. Usual problems like tuning, frequency drift and unstable signal-phase relations are eliminated. CPD changes can be registered continuously in calibrated units.

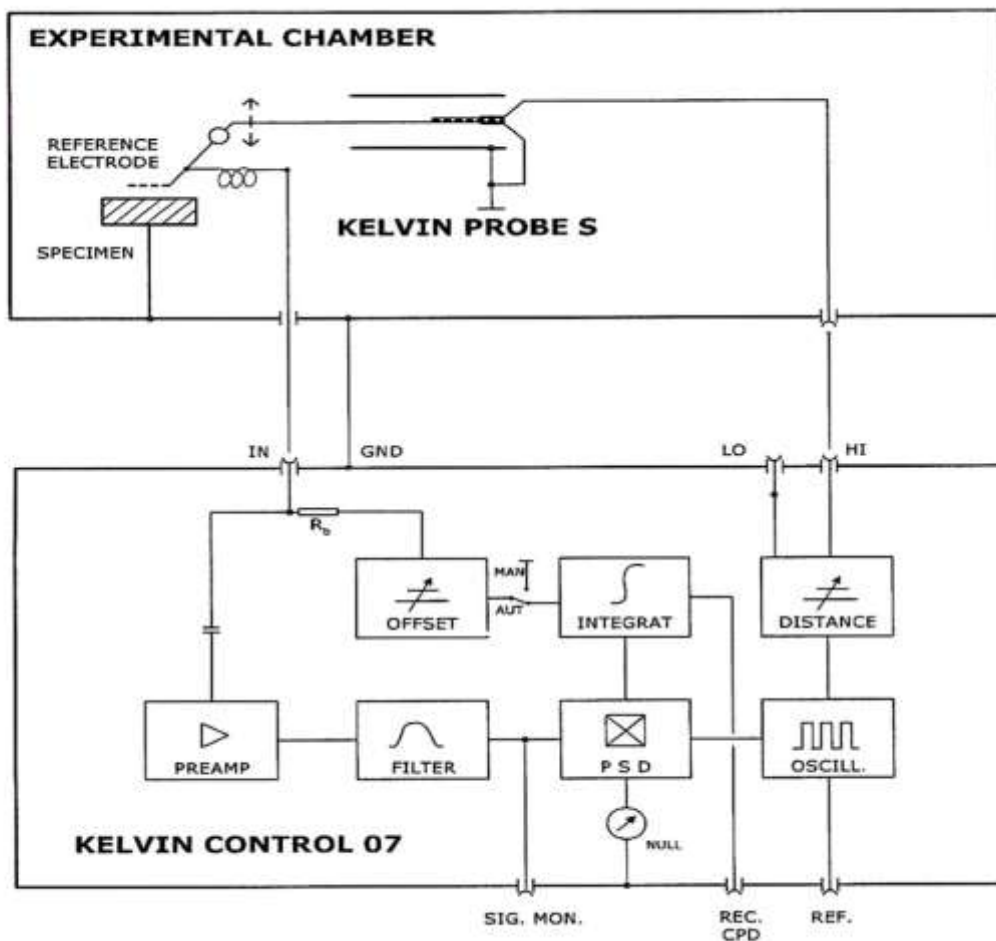
For registration of the Contact Potential Difference you need in addition: Voltmeter or strip chart recorder or a commercial available AD converter card for your computer.

* References on Methods and Work Function of Materials: Article by Hölzl in Springer Tracts in Modern Physics 85 (1979)

2. 2 Typical application

- Surface reactions
- Adsorption and desorption processes
- Catalytic activity
- Sensorics
- Surface states of liquids (Langmuir-Blodgett films)
- Photovoltaic effects
- Micro-topography
- Surface charging
- Charge transfer
- Coverage
- Surface dipole moments
- High-Low pressure experiments
- Temperature related effects
- Phase Transitions

2. 3 Function diagram (Fig. 1)

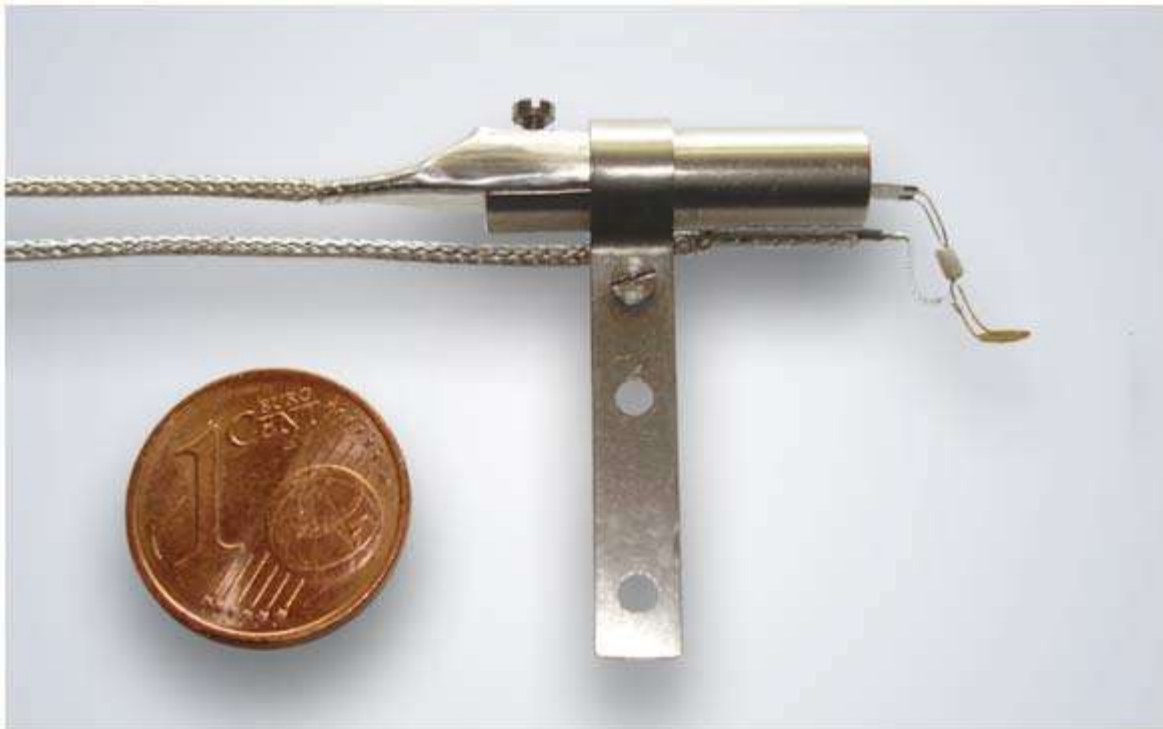


3. Kelvin Probe S and Kelvin Probe S compact

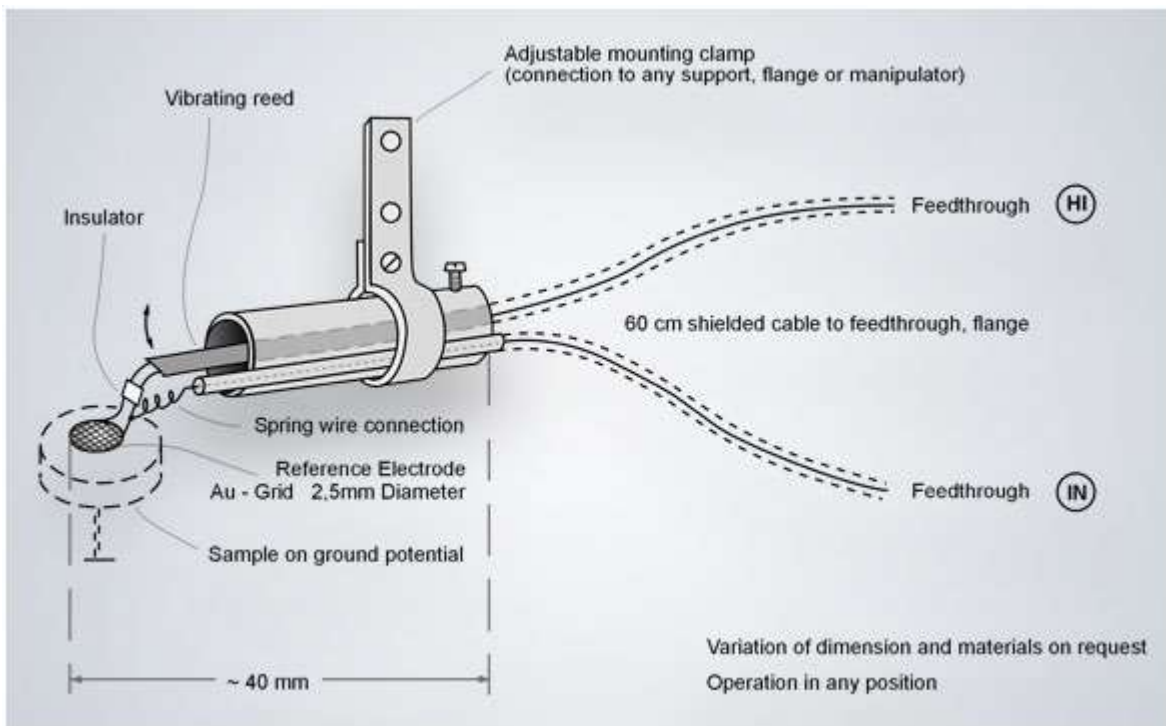
3.1 Features and specifications

- Piezoelectric drive
- Sensitivity < 0,1 mV
- Non destructive to the surface state of the sample
- Supplied ready for operation with two shielded cables
- Operation in any desired position possible
- Simple and extremely flexible installation in any experimental chamber
- Mountable on any flange or manipulator of your choice (NW 16, NW 25 ...)
- Compact construction: diameter 6 mm, length 30 mm
- Low-High pressure experiments ranging from UHV up to 10 bar
- Operation in air and other gaseous environments
- UHV compatible, bakeable up to 220 C
- Temperature operation range from liquid Helium to 220 C
- Sample temperature up to 800 C with simple heat sink connection
- Reference electrode: Au grid, diameter 3 mm, transparency 60 %
- Well suited for photovoltaic experiments
- Mean distance between reference electrode and sample about 1mm
- Automatic operation with Kelvin Control 07 unit
- Operation with sample on ground potential
- No insulation and shielding of sample required
- No interference with other components connected to the sample (heater, thermocouple)
- Easy combination with other analysis tools
- Variation of dimensions and materials on request

3. 2 Kelvin Probe S



3. 3 Sketch Kelvin Probe S



4. Kelvin Control 07

4.1 Features and Specifications

Amplifier

- Sensitivity: < 0.1 mV
- Current sensitive preamplifier
- Low noise phase sensitive detector (Lock-in amplifier)
- Variable gain
- Tuneable band pass filter
- Overload indicator
- Signal monitor output
- Automatic signal-phase correction
- No frequency and phase tuning required

Signal processing

- Automatic or manual compensation of CPD signal
- Calibrated CPD output
- Continuous recording of work function changes
- Resolution < 1 mV
- Dynamic range 10 V
- Variable time constant
- Null indicator
- Precision offset potential adjustment
- Compensation, simulation and calibration of work function changes

Oscillator

- Self maintaining oscillator circuit
- Automatic lock to resonance frequency of Kelvin Probe S
- No frequency and phase tuning required
- Variable oscillation amplitude between 0.1 and 2 mm
- Constant signal-phase relation
- Piezoelectric fine adjustment at the Distance between sample and reference electrode in the range of $\pm 0,2$ mm

4. 2 Kelvin Control 07



Power supply: 110 – 240 V, 50 – 60 Hz

Dimension, weight: 25 x 20 x 10 cm, 2,8 kg

Please ask if you have any questions.

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