



 **JANDEL**

**Accuracy and Precision**

# JANDEL THE COMPANY

Jandel Engineering is a private Ltd Company, established in 1967. Our first product was an electrolytic hygrometer cell, incorporating a screwcut quartz former bifilar wound with 0.05mm diameter platinum wire (designed to measure moisture in gases). This cell, in various forms, is still supplied today and we are the only British manufacturer.

In 1968 we ventured into the semiconductor industry designing and manufacturing manually operated semiconductor and thin film measuring systems, including the electronic current supply and voltmeter.

The 4-point resistivity probe head, now our main product, is built in a variety of differently shaped bodies enabling it to fit our equipment and all other systems known to us.

Building probe heads of the quality and accuracy we produce is highly skilled work carried out by our engineers, none of whom has less than 9 years training, and some who have 15 years experience. The Managing Director, a trained horologist, has communicated his skills and knowledge of watch making to all those involved in manufacture to ensure the probe heads are built to perform with the utmost accuracy and precision.



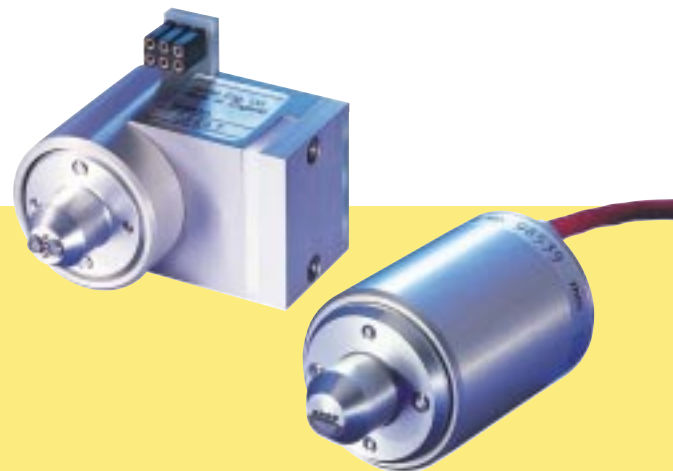
*Design, manufacture, sales and accounts are all undertaken at our Leighton Buzzard location.*



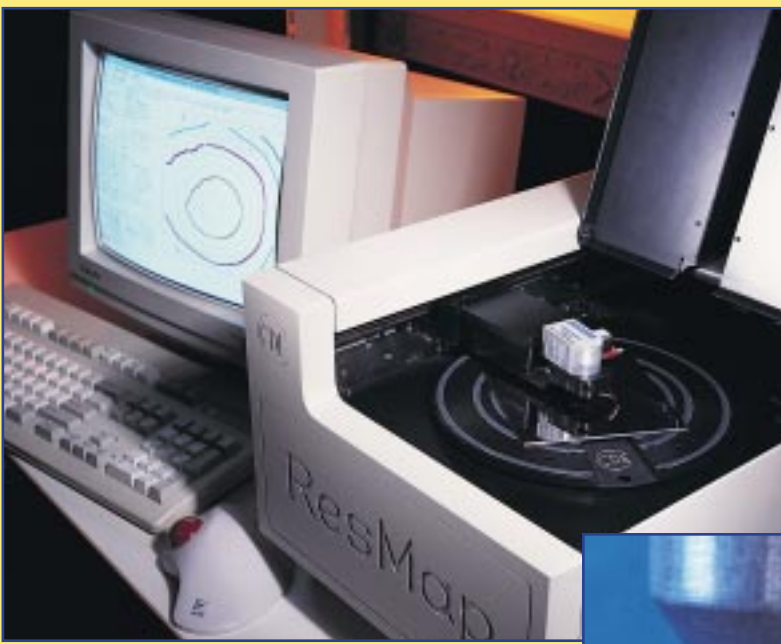
*Electrolytic Hygrometer element and its stainless steel housing.*



*Original Goldsmith Cell elements.*



*Every probe head undergoes stringent tests to ensure it meets the highest standard of quality and reliability that has become our trade mark.*



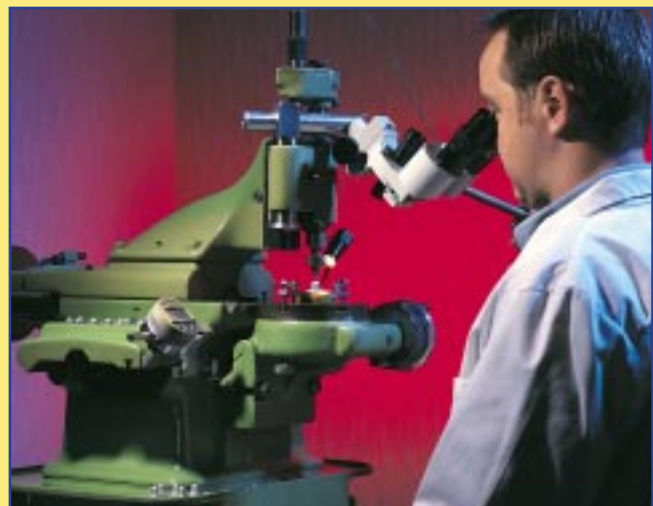
*A Jandel probe head being qualified using a specially adapted automated Resistivity Mapping Machine.*



*Contrast between our smallest and largest spacing probe heads 0.500 and 1.591mm (shown approx x 10)*



*Measuring system comprising a Multiposition Probe and Test Unit.*



*A high precision jigborer in use during manufacture of jewelled guide components.*

# 4- POINT RESISTIVITY PROBE HEADS

Manufactured by Jandel to fit all known mountings and systems

## Exclusive Features

- Aluminium alloy upper and lower guides are both jewelled
- Solid tungsten carbide needles offer superior durability
- P.T.F.E. insulation gives minimum leakage
- Loads checked by electronic force gauge
- Spacing and tip radii optically checked for accuracy by interferometer



*Jandel Cylindrical Probe Head used in Jandel and other equipments (top view showing load adjustment screw)*

## SPECIFICATIONS

<b>Probe Spacings:</b>	0.500, 0.635, 1.000, 1.591mm (20, 25, 40, 62.6mils) Tolerance $\pm 0.01$ mm
<b>Arrangement:</b>	linear or square array square array not available on compact, miniature cartridge versions and 0.500mm (20mils) spacing
<b>Needles:</b>	Solid tungsten carbide $\varnothing 0.40$ mm ( $\varnothing 0.30$ mm for spacing less than 1.0mm) 45° included angle, phosphor-bronze connecting ligament
<b>Other Material:</b>	50% osmium alloy tips available
<b>Radii:</b>	12.5-500 $\mu$ (0.5mil to 20mils) (polished above 25 $\mu$ -1mil)
<b>Projection:</b>	0.50mm (20mils) or to user's specification
<b>Planarity:</b>	better than 0.025mm (1mil)
<b>Loads:</b>	<b>Cartridge</b> (preset 10g min. to 250g max. per needle not user adjustable)  <b>Cylindrical and Compact</b> user adjustable within three ranges Low: 10-30g Medium: 30-60g High: 60-150g
<b>Leads:</b>	4-way cable P.T.F.E. insulated (screened on cylindrical)
<b>Leakage:</b>	10 <sup>13</sup> ohms resistance between needles at 500 volts

**All probe heads can be refurbished to as new condition**

**Miniature Cartridge**

with top retaining screw and positioning key.  
Plastic housing.  
Other parts as standard models.  
23.6 x 28 x 39mm long  
(0.9" x 1.1" x 1.54") weight 28g



**Miniature Cartridge**

with 6-32 screw-holes. Plastic housing.  
Other parts as standard models.  
23.6 x 28 x 37mm long  
(0.9" x 1.1" x 1.45") weight 28g



**Cylindrical**

25.4mm diameter x 48.5mm high  
(1" x 1.9") weight 40g

**Cartridge with 6-way Connector Socket**

25.4mm diameter x 41mm high  
(1" x 1.6") weight 55g



**Macor Glass-Ceramic High/Low Temperature Probe**

with ceramic fibre leads.  
21 x 20 x 48mm high  
(0.8" x 0.8" x 1.9") weight 55g



**Cartridge with lead**

25.4mm diameter x 40.5mm high  
(1" x 1.6") weight 50g



**Compact**

19 x 16 x 37.5mm high  
(0.75" x 0.625" x 1.475") weight 18g



**Cartridge with 4 - Pin Connector**

25.4mm diameter 40.5mm high  
(1" x 1.6") weight 50g



**Cartridge with 6 - way Connector Socket**

with black nosepiece and 1.5mm needle projection.  
For use only on CDE ResMap mapping systems.  
25.4mm diameter x 43mm high  
(1" x 1.6") weight 55g

**Cylindrical Hall/Resistivity Probe**

(2.00mm square array)  
25.4mm diameter x 18.5mm high  
(1" x 0.73")



# HAND APPLIED PROBE

## Incorporating a 4-point Cylindrical Probe

### Principal Features

- P.T.F.E. Body
- 4-point cylindrical probe head can be easily changed
- Shorting switch to prevent sparking
- Easy placement by hand

### Application

1. Measurement of bulk resistivity of large ingots unable to be mounted on a normal probe station.
2. Measurement of sheet resistivity of very large wafers or deposited films on large substrates.

### General Description

The unit comprises a P.T.F.E. body containing a cylindrical brass mass sufficient to cause the probe needles of the 4-point head (loaded up to 200g each) to be completely retracted. The P.T.F.E. body incorporates a lead about 1m long to connect to the associated electronic measuring equipment. There is a toggle switch marked 'S' (shorted) and 'R' (read) which permits the probe head to be raised off the sample, or placed on it, with no sparking.

The current source is shorted at position 'S' on the hand applied probe independent of the FWD, SBY, REV switch on the power supply. Of course, when the probe head is in position the FWD/REV positions can be used in the usual way to observe forward and reverse readings.

### Operation

The probe head should be installed so that its acrylic insulating pad (adjacent to the projecting probe needles) lies in the same plane as the lower P.T.F.E. surface. Rotate the probe head so that its needles lie at right angles to the longitudinal axis of the P.T.F.E. holder, and clamp firmly with the two red screws. To present the probe head to the specimen it is best to make contact with the rear end of the block (where the switch is) and rock the block downwards so that it effectively pivots about the rear. In this way the probe points will retract without scrubbing on the specimen surface. The actual position of the probe can be seen via the cutaway.



## SPECIFICATIONS

<b>Dimensions</b>	
<b>Length:</b>	approximately 125mm front to rear
<b>Width:</b>	75mm
<b>Height:</b>	approximately 80mm (Wire from probe head projects additional 30mm upwards)
<b>Weight:</b>	approximately 1.6kg
<b>Downward force:</b>	approximately 1.1 kg (sufficient to retract 4 needles with 200g load easily)
<b>Material:</b> weight to accept Jandel	Virgin P.T.F.E. body with nickel plated brass  cylindrical probe $\varnothing$ 25.4mm
<b>Electrical:</b>	4-point probe with P.T.F.E. screened lead and Lemo 5-way plug and socket. Toggle shorting switch. P.T.F.E. screened lead to 180° x 5-way DIN plug

# MULTIPOSITION WAFER PROBE

## Application

Measurement of wafer resistivity using a JANDEL probe head

## Principal Features

- Simply pre-set to measure wafer from one to 25 positions
- Eight inch wafer capacity on vacuum chuck - six inch model available
- Lever-operated probe with switched current leads to prevent sparking
- Repositioning accuracy within  $\pm 1$  mm
- Precision low maintenance slides
- Shrouded measuring area to eliminate light and electrical interference

## General Construction

The instrument comprises a white powder coated metal base carrying an acetal column supporting the vertical slide, operating lever shaft, and micro-switch. The vertical slide carries the probe head, secured by a clamp screw. The probe head is positioned so that the micro-switch does not pass current until the probes have made contact, lost motion ensures that the current is switched off before the probes are raised.

The wafer table slides towards the operator to enable the wafer to be centrally positioned, after which the vacuum control valve can be operated to secure it in position. Annular rings allow each wafer size to be centred. When the table is pushed to the limit of its travel a measurement can be made at its centre.

Four radial positions at right-angles are denoted by a spring-loaded index ball incorporated in the rotary table. The radial distance of measurement is denoted by a similar arrangement on the linear slide index plate. Unwanted settings can be blocked off by easily removed screws. So that, for example, one could choose to measure at the centre and four points at 50mm radius.

A grounded metal shield screens the wafer from light and electrical noise during measurement. It is arranged that the shield rises when the probe head is fully lifted to permit loading.



## SPECIFICATIONS

### 8" Model

**Table:** Hard anodised aluminium alloy with vacuum hold, centering grooves, and tweezer notch

**Wafer Capacity:** 5, 6, and 8" nominal diameters

**Preset Measurement Positions:** Centre and four radii at right angles  
32, 38, 50, 57, 68, and 94mm

Wafer	1/2 R	6mm from edge
5"	32mm	57mm
6"	38mm	68mm
8"	50mm	94mm

ASTM F81-89 Sampling Plan C

### 6" Model

**Wafer Capacity:** 3,4,5, and 6" nominal diameters

**Preset Measurement Positions:** Centre and four radii at right angles  
15,20,25,35,50, and 60mm

**Services:** Vacuum line or pump required

**Dimensions:** 355mm x 215mm x 195mm high

**Net Weight:** 6" 3.5kg 8" 4.0kg

# UNIVERSAL PROBE

## Applications

- 4-point measurement of wafer resistivity
- 3-point spreading resistance measurements

## Principal Features

- Highly repeatable needle contact conditions owing to controlled velocity of descent
- Individually adjustable needle loadings with direct indication of set load
- Kinematic needle guidance system employing precision ruby ball guides and polished tungsten carbide
- Solid needles with precision radiused tips
- Accuracy of needle spacing  $\pm 0.01$ mm, no side play
- Needles can be replaced/changed in the Guidance Unit in situ without fear of derangement or loss of accuracy, or the Guidance Unit complete with needles can be replaced
- Micrometer controlled slice displacement for determination of resistivity gradient or junctions on a bevelled slice
- Hinged steel cover to eliminate effects of light and electrical interference during measurement

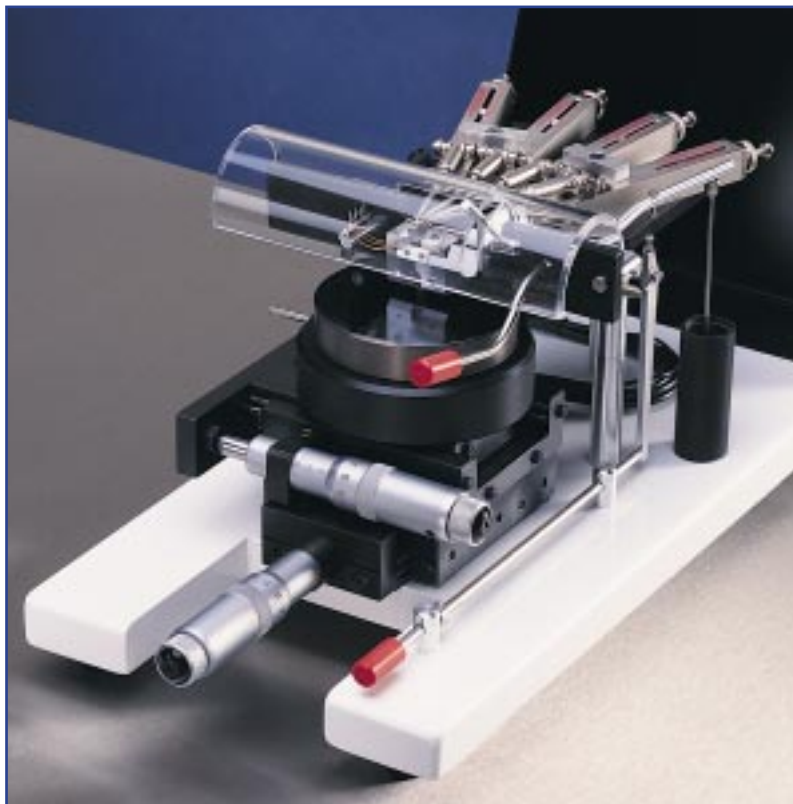
## Velocity Control

An air dashpot controls the velocity of needle descent and thus offers uniform contact conditions from one measurement to the next. A spring is applied to the raising and lowering lever, tending to lower the needles. The dashpot is attached to the lever so that the lever is retarded by the piston.

## Method of Operation

A cam shaft operated by a small lever projecting through the perspex cover sets the machine for either four probe or three probe operation:

- 1) During four probe operation all four needles rise and fall normally.
- 2) During three probe operation the tension on the first probe should be reduced to zero and the lever pulled down. This lifts the first probe tension gauge finger so that it is inoperative. The central probe finger is raised slightly so that this probe contacts the specimen last.



## SPECIFICATIONS

<b>Probe Needles</b> <b>Material:</b>	0.5mm diameter tungsten carbide, 26mm long, 45° included angle, 25 micron tip radius (or larger up to 500 microns)
<b>Spacings:</b>	1.00mm, 1.27mm, 1.59mm - tolerance $\pm 0.01$ mm
<b>Travel:</b>	4mm
<b>Insulation resistance:</b>	$2 \times 10^5$ M $\Omega$ at 500 volts
<b>Load:</b>	0-100g applied by adjustable individual tension gauges
<b>Specimen:</b>	slices only, 76mm diameter is normal maximum
<b>Mounting table:</b>	ball bearing co-ordinate table with 0-25mm x 0.01mm micrometer screws (others available to order) carries a rotary table with 76mm diameter vacuum slice adaptor 14mm high
<b>Packed for shipment:</b>	480mm x 320mm x 320mm high
<b>Net weight:</b>	7kg
<b>Gross weight:</b>	9kg

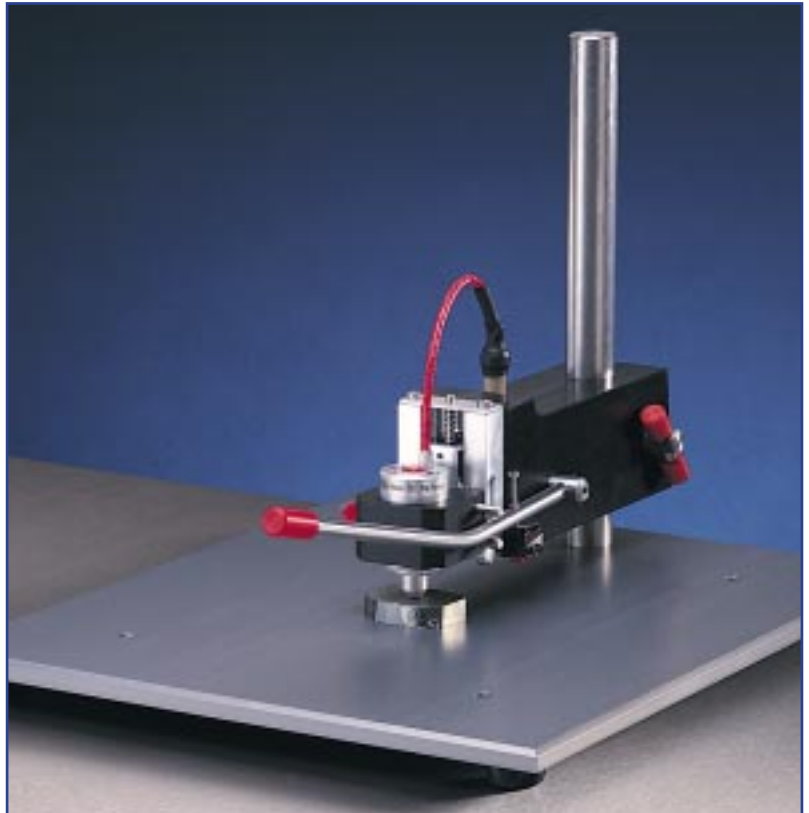
# MULTI HEIGHT PROBE

## Application

Measurement of resistivity of samples by the four point technique. From wafers to ingots up to 10" deep by 6" high. Width is limited only by need to support the ends.

## Construction

The unit comprises a hard anodised aluminium alloy plate 8mm thick with a vertical column, on which is mounted a Jandel raising and lowering mechanism with a cylindrical probe. This assembly can be clamped at any height on the column. If desired an adjustable micro-switch enables an interlock to operate to prevent sparking when the probe is lowered onto the specimen. The connection to a measuring system is made via a 9-way socket on the raising and lowering assembly. The probe head can be changed by releasing a single clamp screw and unplugging from a 5-way socket. The probe head and lead is identical to that used on the Jandel Multiposition probe.



## SPECIFICATIONS

<b>Base:</b>	29cm x 25cm x 0.8cm thick hard anodised aluminium alloy usable area for sample 25cm x 25cm
<b>Column:</b>	20cm high or to special order max. height of sample 15cm
<b>Net Weight:</b>	3kg.

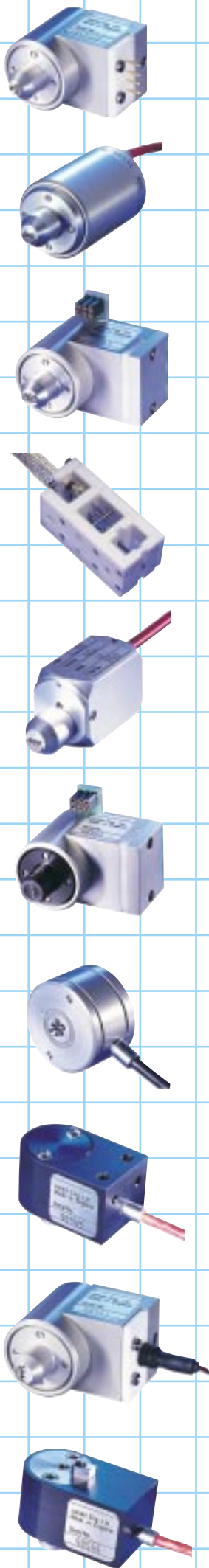
# MICROPOSITION PROBE

The latest addition to the Jandel range is the Microposition Probe. This incorporates the ease of use of the Multiposition Wafer probe raising and lowering mechanism, with the Universal Probe's x, y,  $\theta$  stage. The sample can be retained by vacuum if necessary. It is ideal for very small samples especially when used in conjunction with the 0.500mm spacing probe. An optional probe head shroud affords the opportunity of shielding light from any sample up to 2" diameter.



## SPECIFICATIONS

<b>Base:</b>	33 x 18 x 20cm high
<b>Height:</b>	20cm
<b>Mounting Table:</b>	ball bearing coordinate stage with 0-25mm x 0.01 micrometer screws and rotary stage which has a vacuum slice adaptor 14mm high Maximum height of sample = 14mm (without adaptor)
<b>Net Weight:</b>	4.5kg



**Manufactured in U.K. by: Jandel Engineering Ltd.**

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