



 **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.



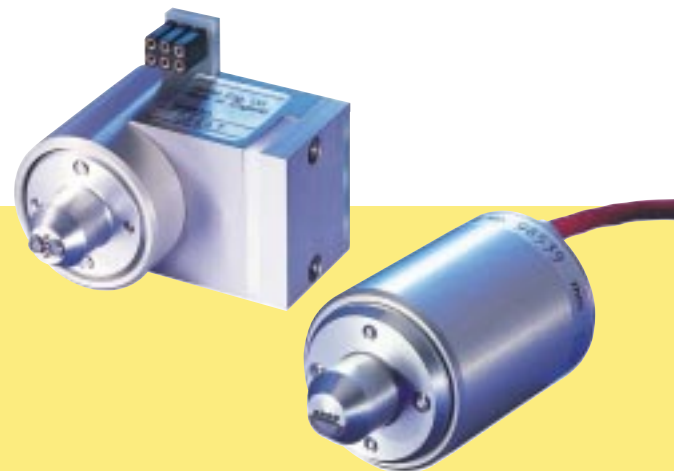
Design, manufacture, sales and accounts are all undertaken at our Leighton Buzzard location.



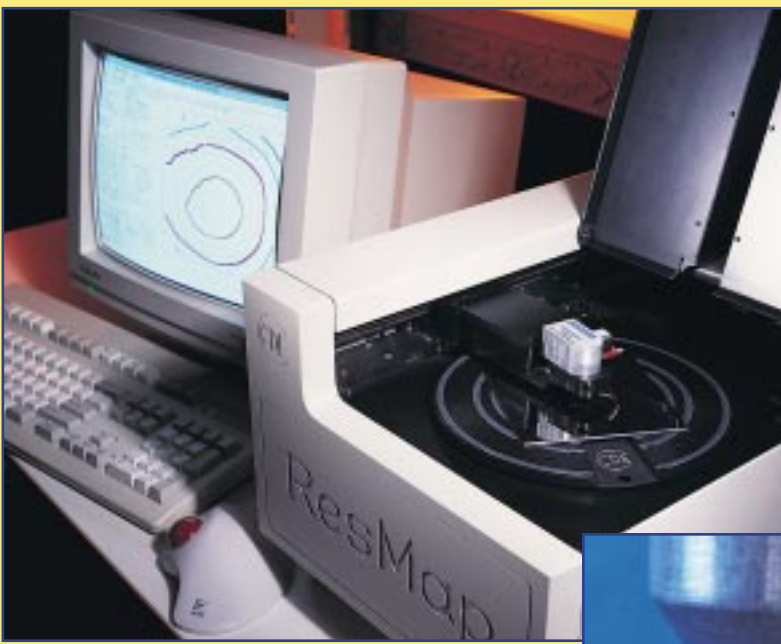
Electrolytic Hygrometer element and its stainless steel housing.



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.



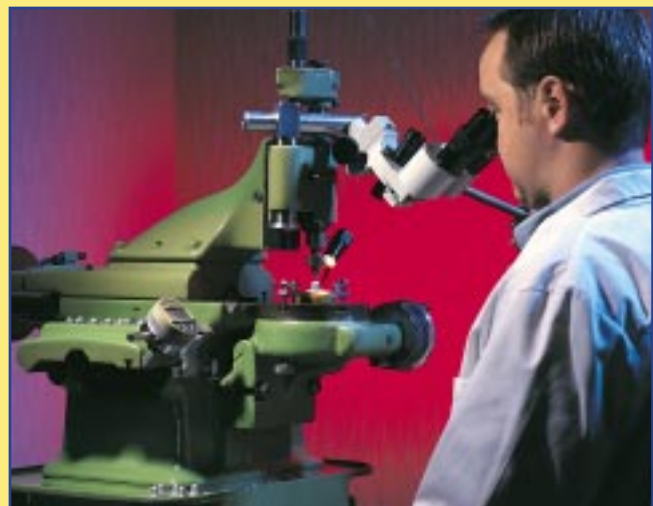
A Jandel probe head being qualified using a specially adapted automated Resistivity Mapping Machine.



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

Probe Spacings:

0.500, 0.635, 1.000, 1.591mm (20, 25, 40, 62.6mils)
Tolerance ± 0.01 mm

Arrangement:

linear or square array
square array not available on compact, miniature cartridge versions and 0.500mm (20mils) spacing

Needles:

Solid tungsten carbide $\varnothing 0.40$ mm
($\varnothing 0.30$ mm for spacing less than 1.0mm)
45° included angle, phosphor-bronze connecting ligament

Other Material:

50% osmium alloy tips available

Radii:

12.5-500 μ (0.5mil to 20mils) (polished above 25 μ -1mil)

Projection:

0.50mm (20mils) or to user's specification

Planarity:

better than 0.025mm (1mil)

Loads:

Cartridge
(preset 10g min. to 250g max. per needle not user adjustable)

Cylindrical and Compact

user adjustable within three ranges
Low: 10-30g
Medium: 30-60g
High: 60-150g

Leads:

4-way cable P.T.F.E. insulated
(screened on cylindrical)

Leakage:

10¹³ 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

Dimensions	
Length:	approximately 125mm front to rear
Width:	75mm
Height:	approximately 80mm (Wire from probe head projects additional 30mm upwards)
Weight:	approximately 1.6kg
Downward force:	approximately 1.1 kg (sufficient to retract 4 needles with 200g load easily)
Material: weight to accept Jandel	Virgin P.T.F.E. body with nickel plated brass cylindrical probe \varnothing 25.4mm
Electrical:	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 ± 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 $\pm 0.01\text{mm}$, 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

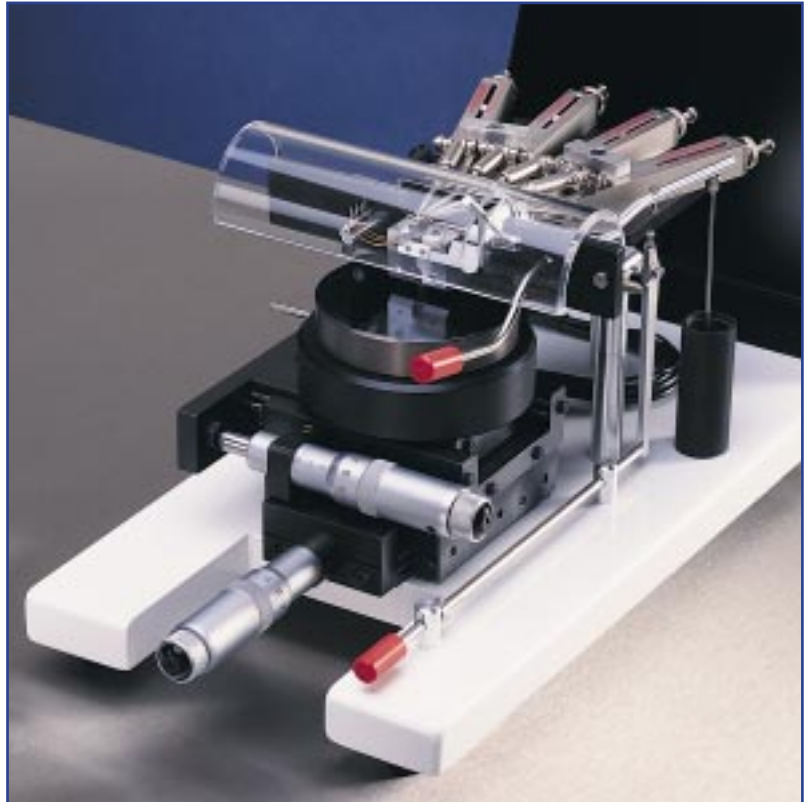
Velocity Control

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

<p>Probe Needles</p> <p>Material:</p>	0.5mm diameter tungsten carbide, 26mm long, 45° included angle, 25 micron tip radius (or larger up to 500 microns)
<p>Spacings:</p>	1.00mm, 1.27mm, 1.59mm - tolerance $\pm 0.01\text{mm}$
<p>Travel:</p>	4mm
<p>Insulation resistance:</p>	$2 \times 10^5 \text{ M}\Omega$ at 500 volts
<p>Load:</p>	0-100g applied by adjustable individual tension gauges
<p>Specimen:</p>	slices only, 76mm diameter is normal maximum
<p>Mounting table:</p>	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
<p>Packed for shipment:</p>	480mm x 320mm x 320mm high
<p>Net weight:</p>	7kg
<p>Gross weight:</p>	9kg

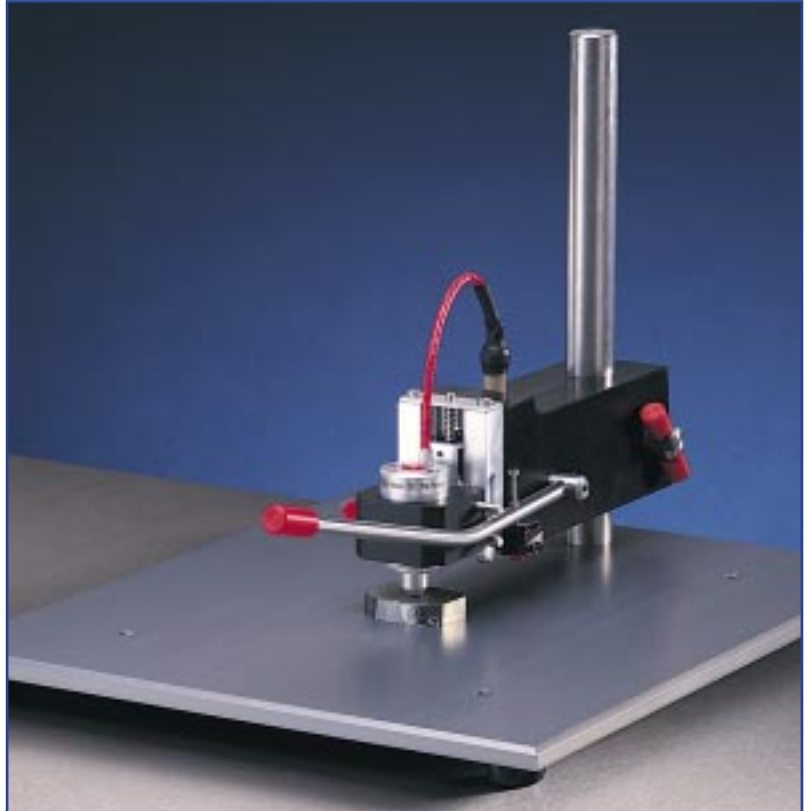
MULTI HEIGHT PROBE

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

Base:	29cm x 25cm x 0.8cm thick hard anodised aluminium alloy usable area for sample 25cm x 25cm
Column:	20cm high or to special order max. height of sample 15cm
Net Weight:	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, θ 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

Base:	33 x 18 x 20cm high
Height:	20cm
Mounting Table:	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)
Net Weight:	4.5kg

RESISTIVITY TEST UNIT RM3

**Combined Constant Current Source
and Digital Voltmeter CE Marked**

Applications

4-point resistivity measurement
Spreading resistance measurement

Principal Features

- Constant current source and digital voltmeter combined in one case
- Currents dialled with soft touch pad in mA, μ A or nA
- Single cable connection to probe
- USB or RS-232 connectivity
- Ohms/square readout option
- Self test function
- 0.3% accuracy (high sensitivity mode)
- Automatic compliance voltage setting
- Error messages for measurements outside range, excessive contact resistance, illegal current and calibration errors

General Construction

The instrument is a solid state constant current source providing direct current chosen by the user. Front feet offer a tilting facility. The lightweight durable plastic unit allows simple internal access via a removable top cover, so there is no need to dismantle the housing.

Front Panel Controls

- Keypad for inputting desired current
- Buttons for choice of mA, μ A or nA
- DEL button to delete errors inputting current
- Ohms/square button
- Forward, Standby & Reverse current buttons
- Zero button to eliminate offset voltages
- 4 preset current buttons
- User adjustable High or Low sensitivity
- Send button for remote storing
- Test button for self test



SPECIFICATIONS

Supply:	240v or 110v AC 50-60Hz
Current Source Output:	DC 10nA - 99mA
Accuracy:	0.2% +/- 200pA of any indicated output
Digital Voltmeter Range:	0.1 - 1500mV (Low) 1 μ V - 150mV (High)
Accuracy:	Typical accuracy 1% +/- 5 μ V
Indication:	4½ decimal places minimum
Polarity:	automatic, sign displayed
Read rate:	0.7Hz
Input impedance:	10 ¹² ohms
Connectivity:	USB or RS-232
Output Terminals:	Current source output and DVM input is via a 5-way 180° DIN socket Two 4mm sockets permit an independent DVM to monitor voltage
Dimensions:	250mm x 100mm x 250mm
Weight:	2kg