

JANDEL Engineering Ltd  
 Model PN01

## P/N Typing Unit

The Jandel model PN01 P/N Typing Unit plugs into a standard four point probe to determine whether a material is P type or N type. It uses the rectification method as described on page 2. The PN01 can be connected to an existing Jandel four point probe stand or it can plug into a hand held probe head. An AC adaptor is included.



### Operating instructions:

- 1) Plug the AC adaptor into the back of the PN01 Typing Unit. Once powered up, the "READY" light should be illuminated.
- 2) Plug the four point probe unit into the 5 pin DIN connector located in the back of the PN01 as show here:

5 pin DIN connector from probe unit plugs into female 5 pin DIN connector here



The universal AC adaptor plugs in here

- 3) Lower the probe into contact and press the "TEST/ Clear" button. Either the "P-Type" or "N-Type" light should illuminate, indicating type. If neither of the lights illuminates, it could be a contact issue, or it may be that the PN01 is not capable of measuring that particular material. Usually a probe with relatively sharp tips (40 micron radii) and strong springs (200 grams per tip) works best at measuring various materials. Using the rectification method, lower resistance materials are not as easily measured for P/N type as are higher resistance materials. The PN01 sits flat with the back slightly thicker than the front so that it is angled towards the user. Dimensions are 5" x 5.5"



The Jandel Cylindrical probe fitted with the small nosepiece shroud can be used with the PN01 to make a complete system

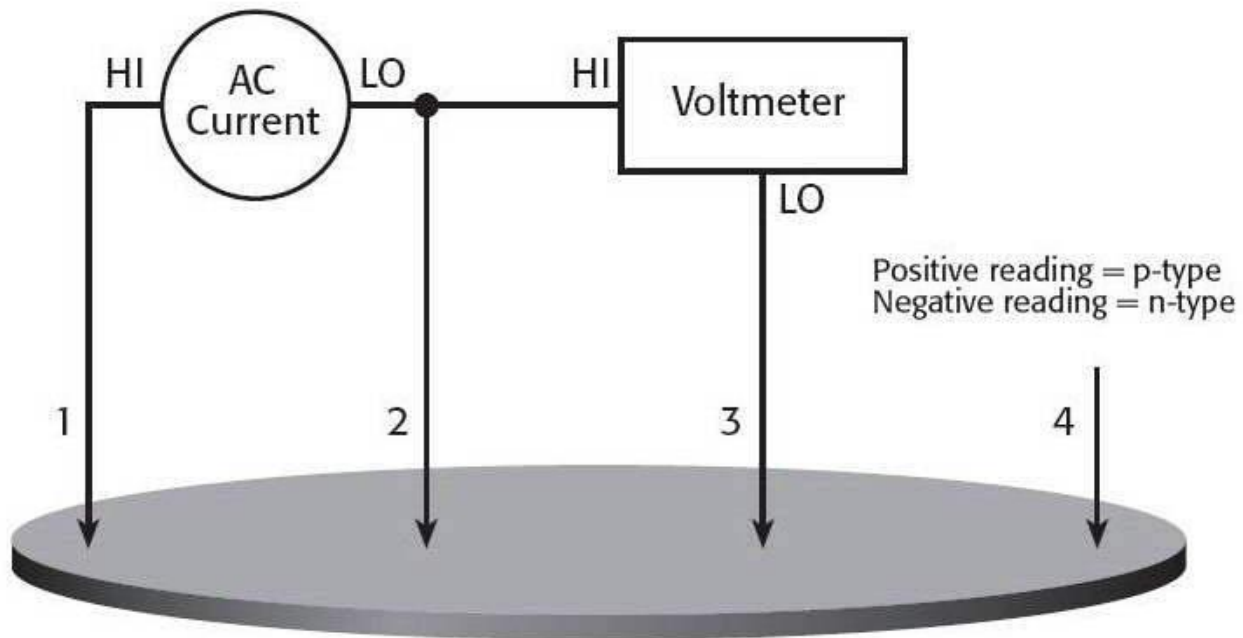


The PN01 can be used with the Multi Height Probe or with any of the various Jandel probe models.

## Determining Conductivity Type of a Semiconductor Material

There are several methods for determining conductivity type. The **rectification** method is used on high resistivity material; the **thermoelectric method** is used on low resistivity materials. Both methods involve using a four-point collinear probe, an AC current source, and a DC voltmeter. **The Jandel PN01 P/N Typing Unit uses the rectification method.**

The Rectification Method involves determining the sign of the majority carrier based on the polarity of a rectified AC signal at the point of contact with the semiconductor material. The image shown below illustrates this setup. When the four point collinear probe comes in contact with the wafer, a metal semiconductor “diode” is created at the interface between each probe and the wafer. An AC current is sourced between the first two probes and a DC voltmeter is used to sense the polarity of the voltage between probes 2 and 3. The metal-semiconductor Schottky “diode” at probe 2 will be either forward- or reversed biased depending on the polarity of the current as well as the conductivity type. As a result, the voltmeter will read a positive voltage for p-type material and a negative voltage for n-type material.



**Circuit for Determining Conductivity Type Using the Rectification Mode**