GP 4-TEST PRO

OFFLINE CHARACTERISATION UNIT FOR SHEET RESISTANCE AND SPECIFIC, CONTACT AND LINE RESISTIVITY

CONSULTING CELL TECH MODULE TECH **INSPECT**

SITUATION

Four point probe measurements for the determination of sheet resistances are a versatile tool used in microelectronics, semiconductor, and photovoltaics industry. The primary application is the determination of the sheet resistance of a diffused emitter, and nearly all commercially available four point probers also allow for the calculation of the specific resistivity if the wafer thickness is known. Where the latter value serves for sampling of the incoming material quality, the regular measurement of the sheet resistance after diffusion is useful to identify problems that occur during the diffusion process. By applying the 4-point measurement system to other types of samples, a wide range of further parameters can be determined as derivations from the basic four point measurement. Examples for these applications are line resistance measurements, and contact resistance measurements based on the transfer length method (TLM). Both of these values become important when checking and optimizing the screen printing and firing process: the line resistance indicates the quality of the electrical conductance along the fingers or busbars, whereas the contact resistance shows whether the contact to the silicon has been formed correctly during firing.

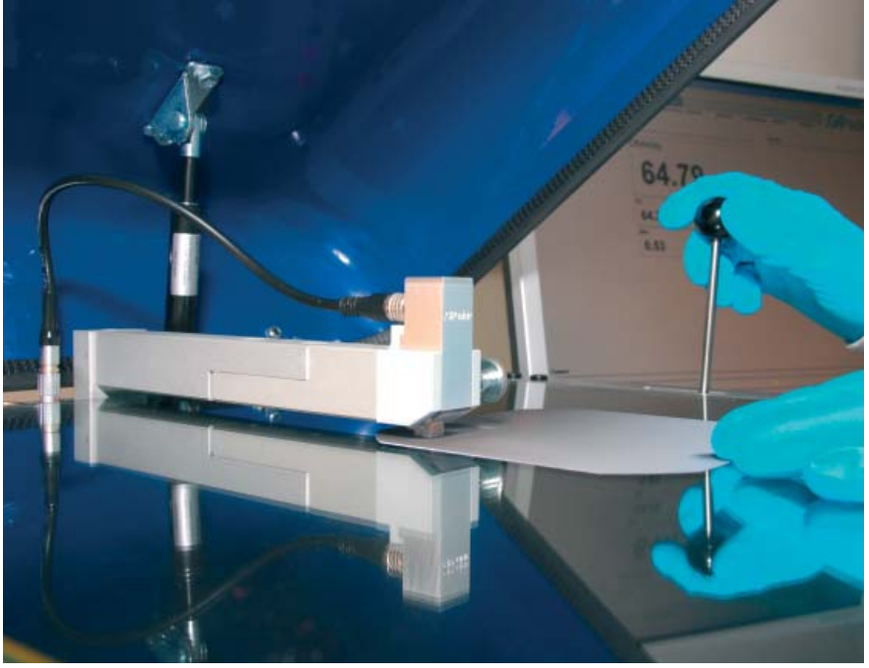
DESCRIPTION

The GP 4-TEST Pro is a four-point-probe tool for reliable testing of all types of resistance measurements, and a wide range of probe heads suits all typical applications in solar cell processing like sheet resistance, specific resistivity, line resistance, and contact resistance. For sheet resistance control in the processing line, an optional 5-fold holder for automatic contacting in 5 points is available. All probe tips inside the sensor head are independently spring mounted. For measurements of sheet resistance and specific resistivity, tips with rhodium coating are available. As a brand new option, tips made of tungsten carbide are also available. These tips give better contact especially on low-doped material and show lower wear-out. For the measurements after metallisation (finger and contact resistance), all probe tips are rhodium coated. Probe heads from other suppliers can also be used if necessary. The measurement principle for sheet resistance is based on the well-known theory of four-point probing of thin layers with equally spaced tips. A similar model that also considers the wafer thickness is used for resistivity measurements. Line resistance is measured with four tips contacting one finger, where the inner tips have a distance of 5 cm. The contact resistance is measured based on the transfer length method, measuring resistance from one finger to adjacent fingers and then extrapolating the fitted curve to zero. The contact resistance head features 6 tip pairs, where each of the pairs contacts adjacent contact fingers. To match different finger distances, standard probe heads with different tip distances can be ordered to cover the full range from 1.9 to 2.8 mm finger distance.

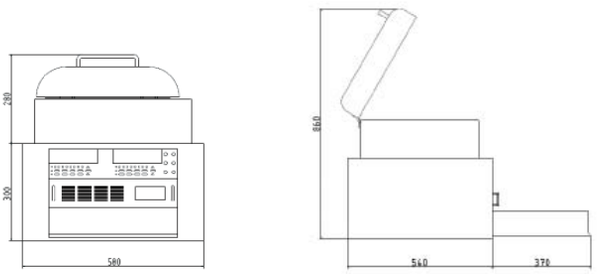
The GP 4-TEST comes with a 19" rack including an industrial PC and all measurement electronics, and a separate sample stage with glass plate and cover. High quality measurement electronics from Keithley are used for current sourcing, voltage measurement and switching of the tip pairs in contact resistance mode. The operator-friendly control software offers many functions for statistic analysis, production control, and data logging and export, and features a basic MES interface. A loss analysis software will be available to combine the GP 4-TEST with the GP SUN-TEST Pro and the GP SR-TEST. This will give industrial users a fast access to most of the cell data needed to optimise the production processes.

WAFER › TEXTURE › DIFFUSION › EDGE ISOLATION › AR COATING › GRID › FINAL CLASSIFICATION

.GPsolar
INSPECT



Measurement of sheet resistance with GP 4-TEST Pro



front view side view

GP 4-TEST Pro

TOPIC	DESCRIPTION
Samples to be measured	› Mono- and multi-crystalline wafers › Square or pseudo square › Textured or non-textured surface
Wafer size	100 ... 210 mm
Measurements	› Specific bulk resistivity › Emitter sheet resistance › Contact & line resistivity after firing
Measurement range	› 8...300 Ohms/sqr (Emitter sheet resistance) › 0.01...10 Ohmcm (specific bulk resistivity) › 0.,025...25 Ohm (contact & line resistivity)
Sample preparation	As-cut, textured or after diffusion for specific resistivity/sheet resistance Processed solar cells for contact and line resistance measurements. For contact and line resistance measurements, the pieces need to be cut in small pieces to prevent parasitic influences of adjacent contact fingers. A small dicing tool can be included in the delivery if no chip dicing saw is available.
Measurement probes	› R_{sheet} sensor with 4 tips, d = 1.5 mm › R_{spec} sensor with 4 tips, d = 2.5 mm › $R_{contact}$ sensor for contacting 6 fingers (12 tips) › R_{line} sensor with 4 tips (50 mm length) › Optional 5 R_{sheet} sensors and 5-.fold holder
Repeatability	+/- 3%
Measurement Time	2 - 15 sec. (depending on measuring technique)
Data interface (to factory network or automation)	XML file via network drive access
Optional setup	Automatic probe placing 5-point industry mode
System dimensions (W x H x D)	450 mm x 450 mm x 500 mm Height info: 300 mm (19" electronics rack), 200 mm measurement setup, Separable if needed
Order Information/Article Number	04.01.0001

Note: some of the mentioned features are optional. Technical details subject to change without prior notice.
Only technical specifications in quotations and duty books are binding.

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301_GP-4-TEST-Pro_10v1 Design: www.conactor.com