Manual four-point probe measurements — NSF Lab

Sample_____. Date_____. Name_____.

Operating procedure:
1. Place wafer in desired position and carefully lower the probes to contact the surface.
2. Turn on the current source (Keithley 220) and voltmeter (Fluke 8842A). Set the voltmeter to read DC volts.
3. Set the voltage compliance of the current source to a reasonable value. (20 V is probably reasonable for most silicon measurements.) Do not exceed 30 V without first consulting with the lab supervisor.)
4. Set the current to the desired value. You must set both the mantissa and the exponent. Press the "output" button to send current through the sample. A blinking voltage compliance light indicates that the compliance is too low for the desired current. You must reduce the current or increase the voltage compliance. Also check for bad connections at the probes or in the wiring.
5. Read the voltage and record the voltage and current.
6. Repeat for other current settings.
7. When finished, turn off the current source and voltmeter.

position_____		position_____		position_____		position_____		position_____	
I (mA)	V(mV)	I (mA)	V(mV)	I (mA)	V(mV)	I (mA)	V(mV)	I (mA)	V(mV)
R = _____		R = _____		R = _____		R = _____		R = _____	
ρ = _____		ρ = _____		ρ = _____		ρ = _____		ρ = _____	
R_S = _____		R_S = _____		R_S = _____		R_S = _____		R_S = _____	

Probe spacing: $s = 40$ mils $= 0.1016$ cm.

Wafer (or layer thickness): $t =$ _____.

Correction factor: $F = \left\{ \dfrac{2s}{t} \ln\left[\dfrac{\sinh\left(t/s \right)}{\sinh\left(t/2s \right)} \right] \right\}^{-1} =$ _____.

Resistivity: $\rho = 2\pi{\cdot}s{\cdot}R{\cdot}F$ Sheet resistance: $R_S \approx \rho/t$.

Notes:
For 15 mil thick wafers, $F = 0.264$.

If t << s, then $F = \dfrac{t}{2s\ln(2)}$, $\rho = \dfrac{\pi}{\ln(2)} tR$, and $R_S = \dfrac{\pi}{\ln(2)} R$.

(The sheet resistance formula is correct only for uniform material.)