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FAQ: Suggested deoxidizer/contact cleaner to minimize thermoelectric EMFs and voltage offsets in test connections

When 2 dissimilar materials are placed in contact with each other, a voltage offset is generated across the boundary of the interface.

While this property is used to advantage in some cases like the p-n diode, this same effect can cause significant errors in measurement systems if not controlled properly. This type of error becomes more noticeable in particular when measuring with nanovolt resolution, such as when using the Keithley 2182A nanovoltmeter.

One particularly problematic situation occurs when it is believed there is a Cu-Cu interface between leads and connectors in the connections going from the instrument to the device under test, when in fact it is a Cu-CuO connection due to unplanned oxidation of the surfaces. Because Cu-CuO has 5000x higher Seebeck coefficient than Cu-Cu, this creates a large, unanticipated voltage offset and potential measurement error:

TABLE 3-1: Seebeck Coefficients

Paired Materials*	Seebeck Coefficient, Q_{AB}
Cu - Cu	≤0.2 µV/°C
Cu - Ag	0.3 µV/°C
Cu - Au	0.3 µV/°C
Cu - Pb/Sn	1–3 µV/°C
Cu - Si	400 µV/°C
Cu - Kovar	~40–75 µV/°C
Cu - CuO	~1000 µV/°C

* Ag = silver Au = gold Cu = copper CuO = copper oxide
Pb = lead Si = silicon Sn = tin

See Keithley's Low Level Measurements Handbook, 6th edition, for more information.

To remove such oxidation on connectors in test leads, Keithley has used with good success the DeoxIT™ product from Caig Laboratories, for example:
http://store.caig.com/s.nl/it.A/id.1701/.f?sc=2&category=188