

FOUR STEP ERROR CHECKER

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Low Level Measurements Handbook
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HOW TO AVOID COMMON MEASUREMENT ERRORS

1 Measurement Type and Typical Applications		2 Error Symptoms	3 Likely Causes	4 How to Avoid
Low Voltage	Standard Cell Intercomparison Microcalorimetry Hall Voltage Thermometry Relay/Connector Contact Voltage Low Voltage Sensors	Offset Voltage	Thermoelectric EMF	Keep all connections at same temperature.
		Noisy Readings	Thermoelectric EMF	See above.
			Magnetic Interference	Arrange leads as twisted pairs. Remove/shield from magnetic fields.
			Ground Loop	Connect to ground at only one "star" point.
Low Current	Diode Reverse Leakage Current MOSFET Gate Leakage Current MOSFET Sub-Threshold Current Single Electron Devices Ion/Electron Currents IC Quiescent Currents MOS Charge Pumping Current Photodetector Currents	Offset Current	Insulator Leakage	Guard/choose good insulator/clean well.
			Meter Bias Current	Choose picoammeter/electrometer.
			Detector Dark Current	Suppress or subtract with REL.
		Noisy Readings	Electrostatic Coupling	Shield and avoid high voltage and movement nearby.
			Vibration / Deformation High Input Capacitance Offset Current Drift	Isolate room vibration. Use low noise cables. Use shunt ammeter or add series resistance. Stabilize temperature or DUT and meter.
Gain Error at Low Voltage	Voltage Burden	Use feedback ammeter. Use higher range.		
Low Resistance	Superconductor Resistance Material Conductivity Relay/Connector Contact Resistance Conductive Inks Silicon Nanowires	Offset Resistance	Lead Resistance	Four-wire method (Kelvin connections).
		Drift in Readings	Thermoelectric EMF	Pulse test signal (Delta mode/offset compensate).
		Noisy Readings	Magnetic Interference	Remove shield from magnetic fields. Arrange leads as twisted pairs.
High Resistance	Insulation Resistance Material Resistivity Polymer Conductivity Surface/Volume Resistivity Spreading Resistance Semiconductor Resistivity Van der Pauw Resistivity	Reading Too Low	Fixture Resistance in Parallel with DUT	Use fixture and cables with higher insulation R.
			Low Voltmeter Input R	Use force voltage / measure current method.
			Offset Current	Suppress or REL the current offset with test voltage off. Use alternating voltage.
		Noisy Readings	Electrostatic Coupling	Shield and avoid movement and fluctuating voltages nearby. Use alternating voltage.
			Common Mode Current	Ground one side of DUT. Use analog filter.
Voltage from a High Resistance Source	pH or Ion Selective Electrode Dielectric Absorption Gate Voltage Hall Effect Voltage	Reading Too Low (Loading Error)	Shunt Resistance	Fixture and cables with higher insulation R. Guarding will effectively increase shunt R.
			Offset Current	Use electrometer.
		Noisy Readings	Electrostatic Coupling	Shield and avoid movement and fluctuating voltages nearby.
			Fluctuating Current Generated by Instrument	Use electrometer.