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Design and development of a constant current power source WILLIAM MENDOZA, STEPHEN FLYNN, JEREMY JOHNSTON, Jacksonville University — The design and development of a low cost, lab built constant current power source to be used in the DC electrical resistivity testing of high temperature superconductors is described. The power source must generate a test current which varies little if at all as the load resistance R_L of a cuprate superconductor sample varies from about $2\,k\Omega$ at room temperature to zero below the critical temperature T_C. A constant voltage source provides a variable current as R_L changes and needs a series resistor to prevent an overload condition as $R_L \rightarrow 0$. A constant current source provides a variable potential and does not need a protecting series resistor whose presence may introduce extraneous thermal noise into the resistivity data. The output current is regulated by the use of a current mirror device, which when thermodynamically stable gives adequate results. A change from $R_L = 45\,\Omega \pm 0.1\%$ to a short circuit condition results in a current $\Delta\%$ of about 10%. Construction of such a device can be used as a project in an electronics or solid-state physics laboratory for advanced undergraduates in addition to being part of a low cost undergraduate superconductor test facility.

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