



FIG. 9.11 Three methods of controlling current for critical-current measurements: (a) continuous ramp, with a slower ramp rate used at high currents near the critical current I_c ; (b) step and hold, wherein the current is ramped quickly to a value, held there while the voltage is recorded, and then ramped quickly to the next value, where the procedure is repeated; (c) pulse, wherein the current is returned to zero between each voltage reading. For all three methods, current is increased more quickly in the regime where changes in the superconductor voltage are small, say up to 70 % of the estimated I_c , then more slowly (and carefully) through the superconductor-to-resistive transition. The point where the $V-I$ curve is reversed (to avoid quenching the sample, as illustrated in Fig. 9.1) is usually set by the sample voltage reaching some predetermined level (e.g., $10 \mu\text{V}/\text{cm}$ for high-current samples).