There are two distinct types of controllers designed to match either a [brushed motor](https://en.wikipedia.org/wiki/Brushed_DC_electric_motor%22%20%5Co%20%22Brushed%20DC%20electric%20motor) or [brushless motor](https://en.wikipedia.org/wiki/Brushless_DC_electric_motor%22%20%5Co%20%22Brushless%20DC%20electric%20motor). Brushless motors are becoming more common as the cost of controllers continues to decrease.

Controllers for brushless motors: E-bikes require high initial torque and therefore models that use brushless motors typically have [Hall sensor](https://en.wikipedia.org/wiki/Hall_sensor%22%20%5Co%20%22Hall%20sensor) commutation for speed and angle measurement. An [electronic controller](https://en.wikipedia.org/wiki/Electronic_speed_control%22%20%5Co%20%22Electronic%20speed%20control) provides assistance as a function of the sensor inputs, the vehicle speed and the required force. The controllers generally allow input by means of potentiometer or Hall Effect twist grip (or thumb-operated lever throttle), closed-loop speed control for precise speed regulation, protection logic for over-voltage, over-current and thermal protection. Bikes with a pedal assist function typically have a disc on the [crank shaft](https://en.wikipedia.org/wiki/Crank_shaft%22%20%5Co%20%22Crank%20shaft) featuring a ring of magnets coupled with a [Hall sensor](https://en.wikipedia.org/wiki/Hall_sensor%22%20%5Co%20%22Hall%20sensor) giving rise to a series of pulses, the frequency of which is proportional to pedaling speed. The controller uses [pulse width modulation](https://en.wikipedia.org/wiki/Pulse-width_modulation%22%20%5Co%20%22Pulse-width%20modulation) to regulate the power to the motor. Sometimes support is provided for [regenerative braking](https://en.wikipedia.org/wiki/Regenerative_brake%22%20%5Co%20%22Regenerative%20brake) but infrequent braking and the low mass of bicycles limits recovered energy. An implementation is described in an [application note](https://web.archive.org/web/20110718160416/http%3A//www.zilog.com/docs/z8encoremc/appnotes/AN0260.pdf) for a 200 W, 24 V Brushless DC (BLDC) motor.

Controllers for brushed motors: Brushed motors are also used in e-bikes but are becoming less common due to their intrinsic lower efficiency. Controllers for brushed motors however are much simpler and cheaper due to the fact they don't require [hall sensor](https://en.wikipedia.org/wiki/Hall_sensor%22%20%5Co%20%22Hall%20sensor) feedback and are typically designed to be open-loop controllers. Some controllers can handle multiple voltages.