There are two distinct types of controllers designed to match either a [brushed motor](https://en.wikipedia.org/wiki/Brushed_DC_electric_motor" \o "Brushed DC electric motor) or [brushless motor](https://en.wikipedia.org/wiki/Brushless_DC_electric_motor" \o "Brushless DC electric motor). 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" \o "Hall sensor) commutation for speed and angle measurement. An [electronic controller](https://en.wikipedia.org/wiki/Electronic_speed_control" \o "Electronic speed control) 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" \o "Crank shaft) featuring a ring of magnets coupled with a [Hall sensor](https://en.wikipedia.org/wiki/Hall_sensor" \o "Hall sensor) 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" \o "Pulse-width modulation) to regulate the power to the motor. Sometimes support is provided for [regenerative braking](https://en.wikipedia.org/wiki/Regenerative_brake" \o "Regenerative brake) 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://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" \o "Hall sensor) feedback and are typically designed to be open-loop controllers. Some controllers can handle multiple voltages.