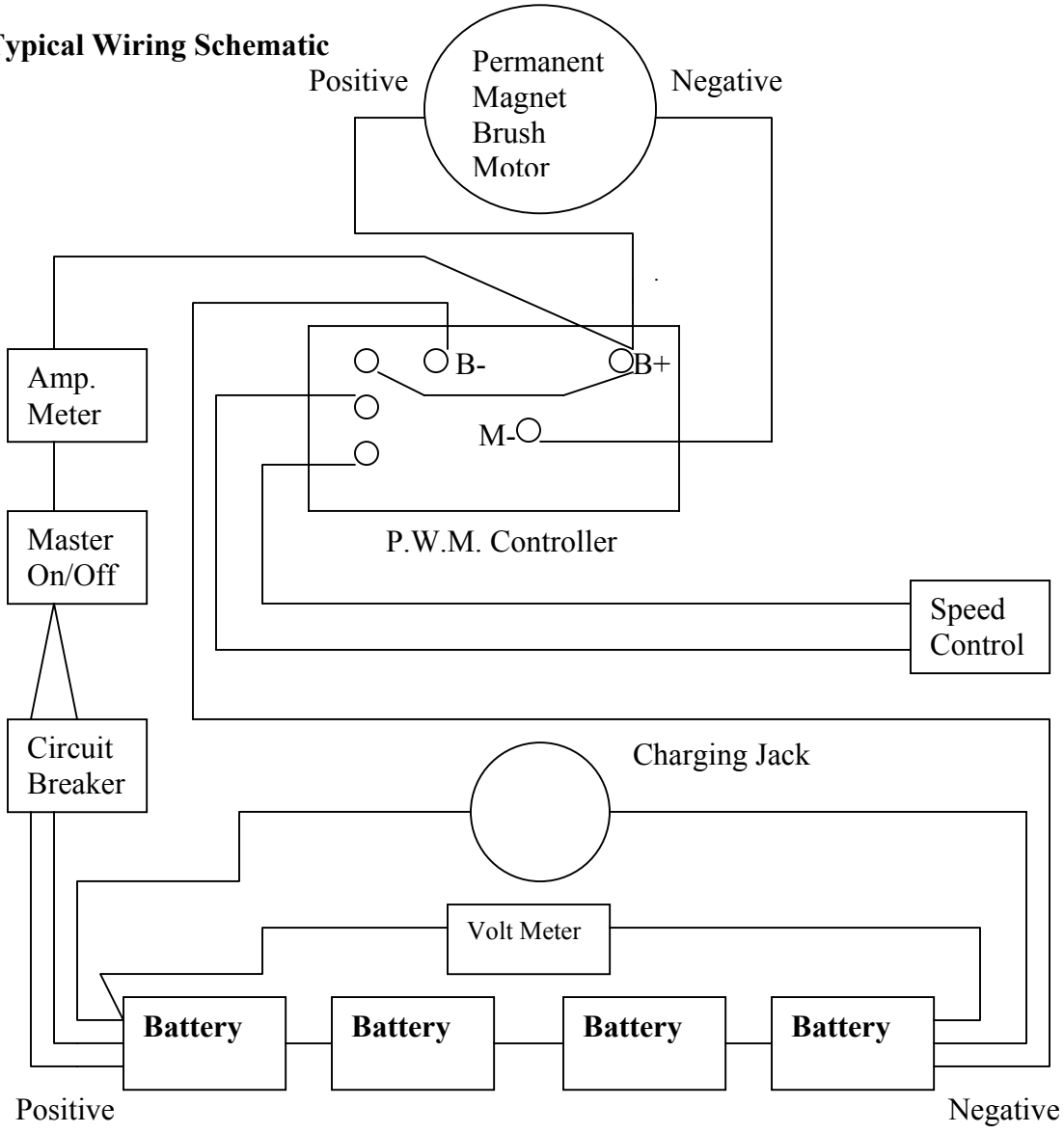
Electrical Systems, Drive Train, and Brakes

Electrical and drive train systems on the first year car are probably the most likely items to be off the shelf. Refer to the parts source list available from Iowa Electrathon. Spend some time at junkyards, local electrical supply houses, (some of the schools from smaller towns might want to call around to the larger towns and make a trip), local electricians, etc. Make sure the motor fits the specs from the rulebook. Most Electrathon participants utilize a one or two-horsepower motor. A controller, the device that responds to your throttle and sends information to your battery about how much power is needed to throttle your car, will also have to be purchased.

Typical Wiring Schematic



*Any number of batteries may be used provided total weight does not exceed 64 pounds.

The drive train can be as simple or complex as you want to make it. For a first year effort, we suggest that a single reduction motorcycle chain and sprocket be used. Bicycle chains are not strong enough. In doing this, you will probably want to keep a given target speed in mind and allow for easy changing of the sprockets to adjust for optimizing battery drain vs. speed. The speeds we have been seeing are typically in the high 20's to low 40's mph range (averaging over an hour) and the national record is just under 50 mph average over an hour.

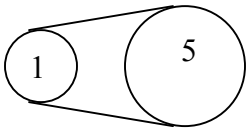
One successful Electrathon School, Cedar Rapids Kennedy, suggests a 4/1 or 5/1 ratio when selecting gears. Weight, batteries, and aerodynamics will affect your gear choice. They use a 35 pitch chain and go-cart gears. If a 12 or 15 tooth front gear can be adapted to your car, a 219 chain might be a good choice for you EV.

Calculating Velocity (v):

- Battery = (2) 22nf = 32 amps for 60 minutes
- Losses = 0.05 lb per mph ^{2}
- Gear Ratio = 5 to 1
- Motor = See spec sheet. Rated 1 HP = 35 in-lb torque at 1800 rpm, gives approximately 33 amps in draw.

$F_{Drag} = F_{Traction}$

$K_D \times v^2 = T_{motor} \cdot \frac{\text{gear ratio}}{\text{Radius Wheel}}$



Example:

$v^2 = \frac{35 \text{ in-lb}}{0.05 \text{ lb/mph}^2} \cdot \frac{5}{10\text{in}}$ v = 19mph

*Developing amps vs. speed curve for your car is suggested for fine-tuning.

Calculating Motor RPM:

- $\frac{\text{Speed (mph)}}{\text{Wheel Diameter}} \cdot 336.14 = \text{Wheel RP}$
- Motor RPM = Wheel RPM · Gear Ratio

- So: Motor RPM = $\frac{\text{Speed (mph)}}{\text{Wheel Diameter}} \cdot 336.14 \cdot \text{Gear Ratio}$

Example:

Motor RPM = $\frac{19 \text{ mph}}{20\text{in}} \cdot 336.14 \cdot 5 = 1600$ RPM

Brakes

Brakes can be built or purchased. If you are using moped wheels, brakes may already be in place. There are certain requirements for brakes in the rulebook. We do check and ask for prior certification to ensure that your braking performance meets the rules. Do not use caliper brakes! This is beyond their capacity. Check the go-cart supply sources for brakes or check the “parts and suppliers” section below. It is also possible to make your own disk brakes. Other schools have done this.