**ADC calculations**

The CPU of the ATmega2560 clocks at a frequency of , but the safe operating frequency of the ADC is between 50kHz and 200kHz. A prescaler value of 128 is selected so that the ADC clock frequency is equal to .

**timer 3 calculations**

The CPU of the ATmega2560 clocks at a frequency of , so the period of each tick is . The period of a standard PWM signal is 20ms, and the number of CPU ticks in a PWM signal period can be calculated as . The size of the timer is 65536, though, and the timer must not tick more than 65536 times. To maintain the maximum possible resolution without exceeding the size of the timer, a prescaler value of 8 is selected such that .

PWM pulse widths vary between 1ms and 2ms, which are represented by 2000 ticks and 4000 ticks respectively.

**timer 4 calculations**

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**UART calculations**

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**RPM sensor calculations**

The CPU of the ATmega2560 clocks at a frequency of , so the period of each tick is . The number of CPU ticks in 1µs is . For the timer to have a resolution of 1µs and to cover the widest possible range, a prescaler value of 8 is selected. Thus, the number of timer ticks in 1µs is . Therefore, 1µs is equal to 2 timer ticks, and the maximum time is .

At its most basic level, the RPM sensor outputs a value for duration that corresponds to a distance covered. Thus, the data can be mapped to a value in m/s.

The diameter of the kart tires is approximately 267mm, so their circumference can be described by . Three magnets are mounted equidistantly on the drive shaft, so three sensor inputs represent a full revolution. Therefore, .

The equation for velocity is , if tsensor is measured in s. However, each timer tick actually represents 500ns. To convert the value to s, it must be divided by 200000. Also, to avoid floating point math on the ATmega2560, the value of 280mm can be rewritten as (28/100)m. Therefore, the final form of the equation becomes . Since possible timer values range from 1 to 65535, the code will provide an accurate velocity reading for speeds between 855mm/s and 56m/s.

**steering potentiometer calculations**