# Timing requirements

The timing requirement for the system aren’t that complex, but they are important for proper operations of the system, namely cascade level control in a single tank.

## Prioritization

There will be four interrupts with priority in the system. Level alarm high, level alarm low, PID calculations, and analogue to digital conversion. They will be implemented to get priorities to match the order of this list, with level alarm high getting the highest priority. A PWM timer will also be used, but because it won’t use the CPU, its priority isn’t that important to consider.

## Scheduling

There will be no scheduling beyond using interrupts. In this system, the use of interrupts should be more than enough to guarantee proper function.

## Event periodicity

The PID calculations must be periodic to get a proper result and the PWM must be periodic to be able to properly control the servo. Making the PWM periodic won’t be a challenge as it is a hardware timer which automatically resets and little or no impact from the CPU. Making the PID periodic should also be strait forward, as the only other interrupt which triggers during normal operations has a lower priority, and the period is quite long at one second. If the time to calculate the results is less than one second, the PID should stay periodic, and PID calculations are not very resource intensive to do.

## WCET

The worst-execution time for the PID controllers must be less than one second. This will be achieved by having everything it relies on controlled by a single timer interrupt. No other timers used will have higher priority. The only parts of the system with higher priority will be the alarm inputs, and when they are triggered, something is wrong with the levels.

The only other parts of the system which cares about execution time is the PWM, which doesn’t use CPU, and the ADC, which only uses a small amount of CPU when it has completed a conversion.

Updating the LCD is a slow process which will take a long time, but it’s not in any way critical for the operation of the system, so it’s not necessary to worry about its WCET.

## Programmable timers.

Only two programable timers are used, timer 1 and timer 3.

* Timer 1 is set up with an output compare march interrupt. This interrupt causes the PID calculations to run and the output to be updated. The exact duration this timer should be tuned for the individual application, but it is important that it is periodic.
* Timer 3 is set up as fast PWM. As such it doesn’t need to generate an interrupt as the PWM automatically outputs to Port E bit 3 & 4.