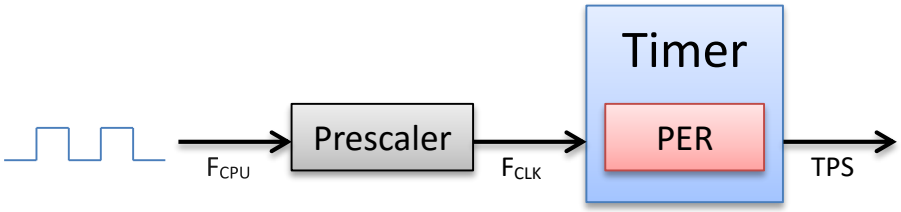
Timers and Counters

Please do the following exercises individually.

Problem specification

An Atmel XMEGA A Microcontroller has several 16 bit timer/counters. The system operates at a frequency of 2.5 MHz. Possible values for the prescaler are *off*, *1*, *2*, *4*, *8*, *64*, *256* and *1024*. An overflow interrupt is generated **after** *PER* clock ticks. Therefore they are generated at a rate of *TPS* interrupts per second.

$$TPS = \frac{f_{CLK}}{PER + 1}$$



Ticks per second

The timer configuration is prescaler = 8, PER = 24999. How many timer interrupts are generated per second?

Calculating *PER*

The timer configuration is prescaler = 4. You want to have 10 timer interrupts per second. Calculate the necessary value for TOP.

Timer configuration

You want to have 2 interrupts as exactly as possible. Please configure the timer as accurately as possible.

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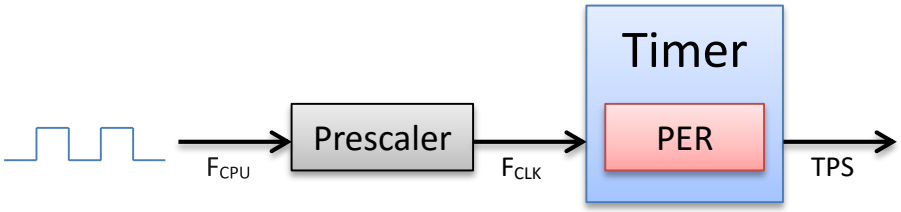

Ticks per second

The timer configuration is prescaler = 8, PER = 24999. How many timer interrupts are generated per second?

TPS = F_{CLK} / PER+1 = F_{CPU} / n / PER+1 = 2500000 / 8 / 24999+1 = 12.5 Hz

Hence 12½ Interrupts per second are generated.

Calculating *PER*

The timer configuration is prescaler = 4. You want to have 10 timer interrupts per second. Calculate the necessary value for TOP.

TPS = F_{CLK} / PER+1 → PER = F_{CLK}/TPS – 1 = F_{CPU} /n·TPS - 1 = 2500000/4·10 - 1 = 62499

A *PER* value of 62499 is necessary in order to generate 10 timer interrupts per second.

Timer configuration

You want to have 2 interrupts as exactly as possible. Please configure the timer as accurately as possible.

TPS = F_{CLK} / PER+1 → PER = F_{CLK}/TPS – 1 = F_{CPU}/n·TPS - 1 = 2500000/4·10 - 1 = 62499

n=1: TPS = F_{CPU}/TPS - 1 = 2500000/2 – 1 = 1249999 → overflow
n=8: TPS = F_{CPU}/TPS - 1 = 2500000/16 – 1 = 156249 → overflow
n=64: TPS = F_{CPU}/TPS - 1 = 2500000/128 – 1 = 19530

The configuration *prescaler* = 64, *PER* = 19530 is the best one possible.

