1 Test clock settings

Clock Settings [MHz]	2	12	33	48	66
PLL Frequency [MHz]	48	48	66	96	132
PLLMUL	3	3	10	15	10
PLLDIV	0	0	1	1	1
PLL_FREQ [MHz]	48	48	66	96	132
PLL_DIV2	1	1	1	1	0
PBADIV	1	1	1	1	1
PBASEL	0	0	0	0	0
PBBDIV	1	1	1	1	1
PBBSEL	0	0	0	0	0
HSBDIV	1	1	1	1	1
HSBSEL (CPUSEL)	3	1	0	0	0
Works as expected?	Yes	Yes	Yes	Yes	
Approximate blinking freq. [Hz]	1/4	1	3	4	5
Measured power consumption [mW]	515	545	620	680	730

Conclusion
Power consumtion and blink frequency seems to be increasing proportionally to the clock frequency.

2 Using support functions

a. The Slow Clock is called *RCSYS* in the header file. It is called from the function $pcl\_configure\_clocks\_rcsys(pc\_freq\_param\_t * param)$.
b. The struct has definition

```
typedef struct
{
  //! CPU frequency (input/output argument).
  unsigned long cpu_f;

  //! PBA frequency (input/output argument).
  unsigned long pba_f;

  //! Oscillator 0's external crystal(or external clock)
      frequency (board dependant) (input argument).
  unsigned long osc0_f;

  //! Oscillator 0's external crystal(or external clock)
      startup time: AVR32_PM_OSCCTRL0_STARTUP_x_RCOSC (
      input argument).
  unsigned long osc0_startup;
} pm_freq_param_t;
```

, where $osc0\_f$ is set to $FOSC0$ and $osc0\_startup$ is set to $OSC0\_STARTUP$.

3 Real Time Clock

d. When using the 32kHz crystal, $RTC\_PSEL\_32KHZ\_1HZ = 14$ gives RTC at 1 Hz.
e. Using the equation in the header file *rtc.h* to choose $PSEL$, one can calculate the desired frequency. For a 2.5 second interrupt frequency, using 2 Hz and interrupting at every 5 ticks would give the correct interrupt time. Choosing $PSEL$ is done by using

$$PSEL = \frac{\log \frac{f_{osc}}{f_{rtc}}}{\log 2} - 1. \tag{1}$$

g. The LED switches at the same frequency. Power consumtion is lower than before. The RTC is not dependant on CPU speed, which makes it more general. It is also more exact.
b. Power consumtion in described in table below. Note that the display is on.

Clock speed [MHz]	Power consumtion sleep [mW]	Power consumtion software [mW]
12	560	585
33	580	645
66	610	715

c./d. The following table displays modes that are working and what power consumption they have.

Sleep modes	Blinking?	Power Consumtion [mW]
Idle	Yes	505
Frozen	Yes	465
Standby	Yes	425
Stop	Yes	425
Deep stop	Yes	435
Static	No	435

Since the LED is running on interrupts, as long as there is a clock that generates them, the LED should blink. In stop and deep stop, the CPU is in sleep but the RC clock is still running which generates the interrupts. In static, only an external interrupt can wake the micro-controller.

4 Power hogs

Hardware	Power Consumtion
USART	11.55
All LEDs	150
LCD	105