Theory of Operation

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Abstract

How Things Work

1 Electronics

1.1 Pin Connections

J1-2	PTC3	MSGEQ7 Reset
J1-2	PTC4	MSGEQ7 Strobe
J1-14	ADC0-4	MSGEQ7 Out
J2-2	PTB18	Encoder Phase A
J2-4	PTB19	Encoder Phase B
J2-6	PTD0	Encoder Button
J2-13	I2C0-SCL	HT16K33 SCL
J2-15	I2C0-SDA	HT16K33 SDA
J4-2	ADC1-10	Equalizer Band 0
J4-4	ADC1-11	Equalizer Band 1
J4-6	ADC1-12	Equalizer Band 2
J4-8	ADC1-13	Equalizer Band 3
J4-7	ADC1-16	Equalizer Band 4
J6-4	SPI1-PCS0	MAX7219 CS
J6-6	SPI1-SOUT	MAX7219 MOSI
J6-5	SPI1-SCK	MAX7219 SCK

A Timer Configuration

The BARS task is designed to run at a fixed frequency of 60Hz (or a period of 16.6 ms). One of the K66's Flex Timer modules is used as a simple timer.

An interrupt will fire when the timer overflows. The ISR will send a signal releasing the task.

The timer's CNT (count) register is 16 bits. Therefore, the maximum value the counter can hold is 0xFFFF (65,535). The timer "ticks" at the frequency of the supplied clock. The supplied bus clock has a frequency of 60MHz. Therefore, the period of a tick is $\frac{1}{60000000} = 1.6 \times 10^{-8}$. Even if the maximum value (0xFFFF) were used as the MOD (modulo) value for the counter, it would overflow every $\frac{1}{60000000} \times 65353 = 0.00109225$, or roughly 1.09 ms. $\frac{1}{0.00109225} = 915.54$ or roughly 915Hz. Way too fast.

The solution is to divide the timer's clock signal. Various powers of two are available as clock dividers. If the clock is divided by 16 then the frequency is $\frac{60000000}{16} = 3750000$ or 3.75MHz. The period of the clock is then $\frac{1}{3750000} = 2.66 \times 10^{-7}$. It is then a matter of determining the correct modulo value to achieve 60Hz overflow frequency. The problem may be expressed generally as the following. Where P_t is the target period, P_c is the input clock frequency, and t is the requisite ticks:

$$P_t = P_c \times t$$

Substituing a target frequency of 60Hz, and an input clock of 3.75MHz,

$$\frac{1}{60} = \frac{1}{3750000} \times t$$

$$\frac{\frac{1}{60}}{\frac{1}{3750000}} = t$$

$$\frac{3750000}{60} = t$$

$$62500 = t$$

To summarize, the timer module's input clock must be divided in order to provide a suitable time base. Once divided, a modulo of 62500 will cause an overrun every 16.6 ms or 60Hz.