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In the next video we will show the software to initialize and sample the ADC.

CAPTURING A SAMPLE



DR. RAMESH YERRABALLI: So we looked at the two steps.

One is the initialization step, which is what this routine is doing.

The initialization ritual, which we do one, which is a 13 step sequence.

You can look at all the details here.

We talked about it.

This part here is simply making the GPI pin be an alternate pin and an input.

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Program 14.2 gives a function that performs an ADC conversion. There are four steps required to perform a software-start conversion. The range is 0 to 3.3V. If the analog input is 0, the digital output will be 0, and if the analog input is 3.3V, the digital output will be 4095.

$$\text{Digital Sample} = (\text{Analog Input (volts)} \cdot 4095) / 3.3\text{V(volts)}$$

Step 1. The ADC is started using the software trigger. The channel to sample was specified earlier in the initialization.

Step 2. The function waits for the ADC to complete by polling the RIS register bit 3.

Step 3. The 12-bit digital sample is read out of sequencer 3.

Step 4. The RIS bit is cleared by writing to the ISC register.

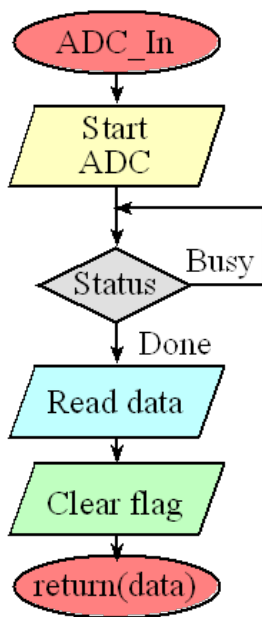


Figure 14.3. The four steps of analog to digital conversion: 1) initiate conversion, 2) wait for the ADC to finish, 3) read the digital result, and 4) clear the completion flag.

```

//-----ADC_InSeq3-----
// Busy-wait analog to digital conversion
// Input: none
// Output: 12-bit result of ADC conversion
unsigned long ADC0_InSeq3(void){  unsigned long result;
    ADC0_PSSI_R = 0x0008;          // 1) initiate SS3
    while((ADC0_RIS_R&0x08)==0){}; // 2) wait for conversion done
    result = ADC0_SSIFIFO3_R&0xFFF; // 3) read result
    ADC0_ISC_R = 0x0008;          // 4) acknowledge completion
    return result;
}
  
```

Program 14.2. ADC sampling using software start and busy-wait (C14_ADCSWTrigger).

There is software in the book *Embedded Systems: Real-Time Interfacing to ARM® Cortex™-M Microcontrollers* showing you how to configure the ADC to sample a single channel at a periodic rate using a timer trigger. The most accurate sampling method is timer-triggered sampling (**EM3**=0x5). An example of timer-triggered ADC sampling can be found at the software download site for the book, [ADCT0ATrigger_4F120.zip](http://users.ece.utexas.edu/~valvano/arm/ADCT0ATrigger_4F120.zip) (http://users.ece.utexas.edu/~valvano/arm/ADCT0ATrigger_4F120.zip).

Unfortunately, the TExaS simulator does not simulate this important sampling mode, so you will not be able to use it for Lab 14. For Lab 14 you must use software triggered ADC sampling with sequencer 3.

CHECKPOINT 14.1

If the input voltage is 1.5V, what value will the TM4C 12-bit ADC return?

Hide Answer

Approximating the 12-bit ADC is linear, either $Dout = 4096 \cdot Vin / 3.3$ or $4095 \cdot Vin / 3.3 = 1862$.

CHECKPOINT 14.2

If the input voltage is 0.5V, what value will the TM4C 12-bit ADC return?

Hide Answer

Approximating the 12-bit ADC is linear, either $Dout = 4096 \cdot Vin / 3.3$ or $4095 \cdot Vin / 3.3 = 621$.



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