PmodENC™ Demo Project

Overview

This document describes a VHDL demo project that interfaces with a PmodENC. The project was developed on a Nexys3 board in Xilinx ISE Design Suite 13.2, but it can be easily retargeted to any other FPGA.

Functional Description

PmodENC is a rotary encoder which consists of a rotary push-button shaft and a slide switch. The shaft can be turned either to the right or to the left and has 20 detent positions. The PmodENC demo project demonstrates the ability to display the position of the rotary shaft onto the seven segment display on the Nexys3 board. The position displayed is relative to the starting position of shaft when the program is loaded. To change the starting position, turn the shaft to the desired position and press on the rotary push button. The project also shows the turning direction of the shaft with LED0 (right) and LED1 (left) on the Nexys3 board.

The PmodENC connects to the lower row of connector JA on a Nexys3 board.

Figure 1: State diagram for the Encoder

Block Description

Encoder Behavior

The shaft on the PmodENC operates two push-button switches. These buttons output signals A and B on the PmodENC. Depending on the direction the shaft is being rotated, A or B is driven low one before the other. If the rotation continues, A or B is driven high in the same order it was driven low. The state machine shown in Figure 1 is designed to implement this behavior. The Encoder module uses this state machine to determine whether the shaft is rotating right or left. If the shaft is rotating clockwise the Encoder adds 1 to the output and turns on LED0 to signal that the shaft is being rotated right. If the shaft is rotating counterclockwise the Encoder subtracts 1 from the output and turns on LED1 to signal that the shaft is being rotated left. When the rotary push-button is being pressed the count is reset back to zero.
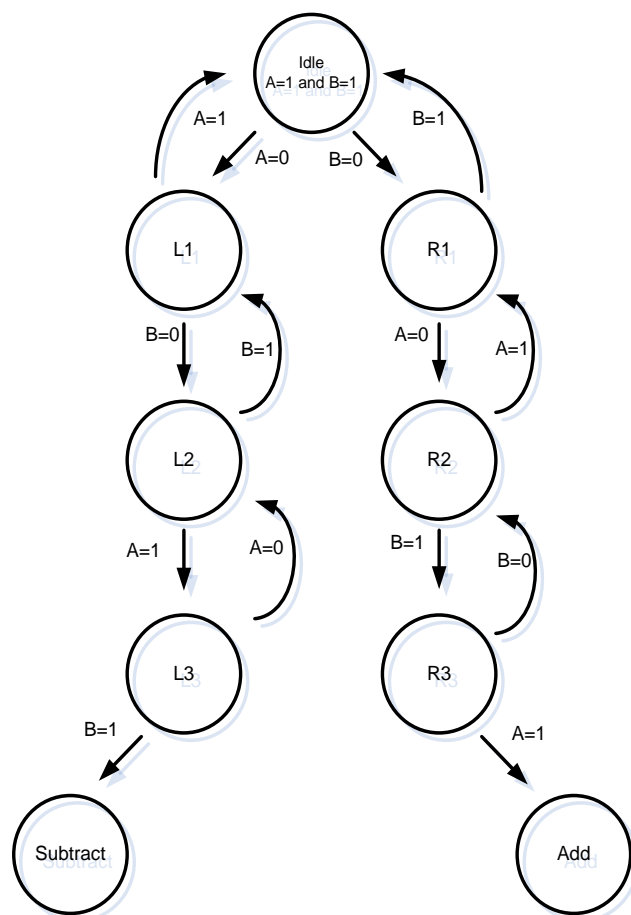
Debouncer Behavior

The encoder module requires a software debounce process to eliminate the noise due to the fact that logic noise is present at the opening and the closing of the switches when the shaft is being rotated. The Debouncer reads at 10MHz and outputs the signal if the current input matches the previous sampled input.

DisplayController Behavior

The DisplayController is used to display the output of the Encoder onto the seven segment display on the Nexys3 board. The switch on the PmodENC turns the seven segment display on or off.