A Serial Control Word Generator for the STM Z-Box

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This document describes the use of a Digilent Nexsys 2 development board to generate and transmit a serial control word to the STM Z-Box for test purposes. Normally the control word is generated and sent to the Z-Box by the computer used to control the entire STM system, but for checking for proper operation of the Z-Box it is convenient to have a simpler, independent means for generating the control word.

The several devices (Boxes) of the STM system are each controlled by a control word that is transmitted as a serial data word by some central computer. In addition to the serially transmitted control word, each Box also receives a two bit Box address, so that, although all Boxes receive all of the control words, only the Box with the matching address saves and interprets the control word.

1 Input Timing

Three input signals, data, strobe, and latch, effect the transfer of the control word to the Z-Box. As each of the serial data bits is received by the Z-Box, the rising-edge of the strobe (or clock) signal shifts the bits into an input shift register until all 30 bits of the Z-Box control word have been received. A high level of the latch signal then transfers the contents of the shift register to an operations register to activate the control word. Fig.1 shows the timing of the input data, and the strobe and latch signals as generated by the Nexsys 2.

There is no explicit specification of timing for these signals, but the input data should be stable before the rising-edge of the strobe signal. A bit rate
up to at least 5 MHz should be acceptable; there is no minimum bit rate. The latch signal should remain high for at least 80 nS or it may not be recognized by the Z-box.

2 Using the Nexsys 2

The Nexsys 2 board is powered by a small AC adapter. A slide switch next to the power plug is used to turn the board on and off. When the board is turned on, there is a delay of about 2 seconds before it is operational.

Two output ports, JA1 and JB1 are used to connect to the DB9 connector that is plugged into the Z-box.

Fig. 2 shows the details of the 30 bit control word used by the Z-Box. For purposes of using the Nexsys 2 to generate a Z-Box control word, the control word is divided into eight parameters shown as 0 through 7 in Fig.2. Three switches, sw2, sw1, and sw0, are used to select each of these parameters; LED’s just above the switches also indicate the switch positions. The following switch coding is used for the 8 parameters:

<table>
<thead>
<tr>
<th>sw2 sw1 sw0</th>
<th>Parameter #</th>
<th>Parameter</th>
<th>Possible values</th>
</tr>
</thead>
<tbody>
<tr>
<td>dn dn dn</td>
<td>0</td>
<td>A1-A4</td>
<td>Integrator gain 0 to F (hex)</td>
</tr>
<tr>
<td>dn dn up</td>
<td>1</td>
<td>CL</td>
<td>Clear bit 0 or 1</td>
</tr>
<tr>
<td>dn up dn</td>
<td>2</td>
<td>RN</td>
<td>Run bit 0 or 1</td>
</tr>
<tr>
<td>dn up up</td>
<td>3</td>
<td>R1-R2</td>
<td>-Z range 0, 1, 2, 3</td>
</tr>
<tr>
<td>up dn dn</td>
<td>4</td>
<td>IN</td>
<td>Invert bit 0 or 1</td>
</tr>
<tr>
<td>up dn up</td>
<td>5</td>
<td>B1-B3</td>
<td>+Z range 0 to 7</td>
</tr>
<tr>
<td>up up dn</td>
<td>6</td>
<td>C1-C2</td>
<td>Monitor gain 0, 1, 2, 3</td>
</tr>
<tr>
<td>up up up</td>
<td>7</td>
<td>D1-D16</td>
<td>DAC value 0000 to FFFF hex</td>
</tr>
</tbody>
</table>

For each selected parameter, the four 7-segment display characters show the current value. Pushing the button under the character increments the value of the parameter. Note that the least significant display character is used for parameters 0 through 6; only parameter 7, the DAC value, uses all four display characters.

Changing the value of any of the parameters does not send the new value to the Z-Box. Setting switch sw3 to ON is required to cause the complete 30-bit control word to be sent to the Z-Box. When this happens, the LED
above sw3 will blink briefly. To send another control word, set sw3 to OFF
and then to ON again.

The values of the seven control word parameters are always zero when
the board is powered up, but user-made changes to the values remain stored
in the Nexsys 2 until they are changed again or until the board is turned
off. Sending the control word to the Z-box consists of sending these stored
parameters without clearing them, allowing the same control word to be sent
multiple times without having to re-enter the parameter values.

3 Miscellaneous

The 16-bit DAC parameter uses 2’s complement format. This means that
for the maximum positive offset, parameter 7 should be set to 7FFF hex and
for the maximum negative offset, it should be set to 8000 hex. A value of
0000 gives zero offset.

Fig. 3 shows the signal connections between the DB9 connector and the
JA1 and JB1 ports.
Fig. 1 Data, strobe, and latch timing generated by the Nexsys 2
30 bit control word for the Z–BOX

Fig. 2
Fig. 3  Connections from the Nexsys 2 to the DB9 connector