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# Chapter 13

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# DRUM SEQUENCER CIRCUITS

## CHAPTER SECTIONS

What is a Drum Sequencer?

13-2

## CHAPTER OBJECTIVES

After studying this chapter, you should understand:

- ✓ What is a drum sequencer?
- ✓ The drum sequence matrix.

Workbook Chapter 13 exercises should be completed for hands-on experience.

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## What is a Drum Sequencer

A *Drum Sequencer* steps (rotates) through a set of potential output bit patterns that are represented as channels. Drum sequencers are best suited for repetitive processes that consist of a finite number of steps that do not change.

A drum sequencer operates similar to mechanical sequencers like those found on older music boxes or pianos. Essentially, a motor turns a drum (wheel) with holes spaced evenly on the edge. Pegs were placed in these holes. As the wheel would rotate, these pegs would actuate micro-switches. See Figure 13-1.

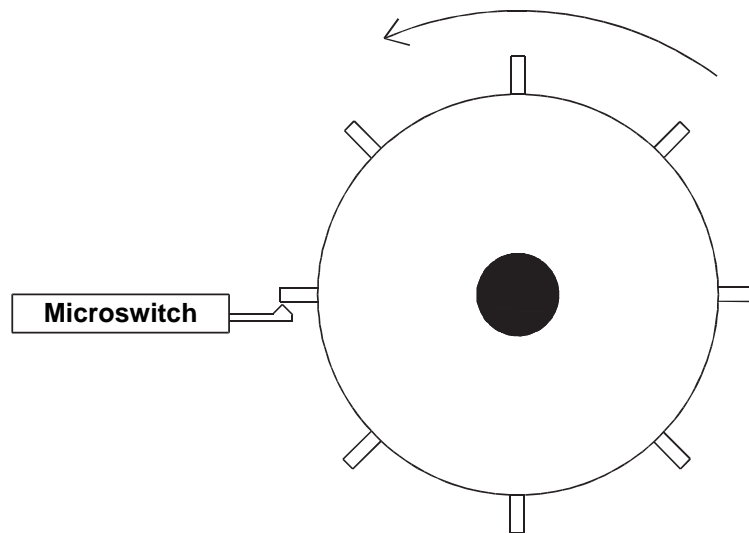


Figure 13-1 - Single Channel Drum Sequencer.

Figure 13-1 is a single channel drum with one micro-switch. Additional channels can be added by increasing the number of drums (wheels). Each drum represents an additional channel. All drums have synchronized rotation. Figure 13-2 shows a three-channel drum sequencer.

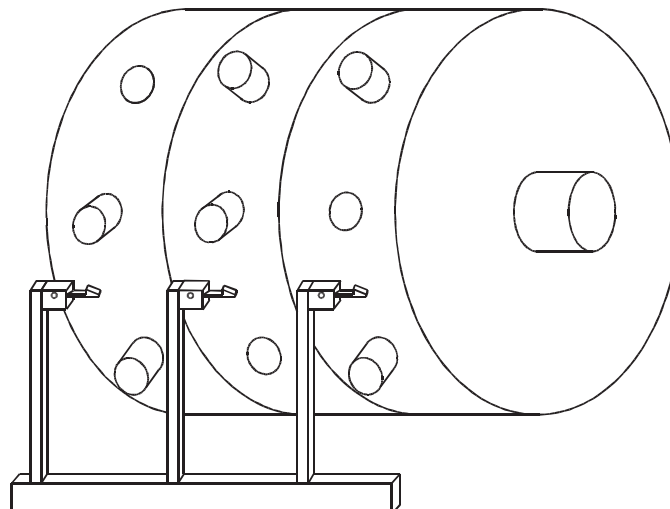


Figure 13-2 - 3-Channel Drum Sequencer.

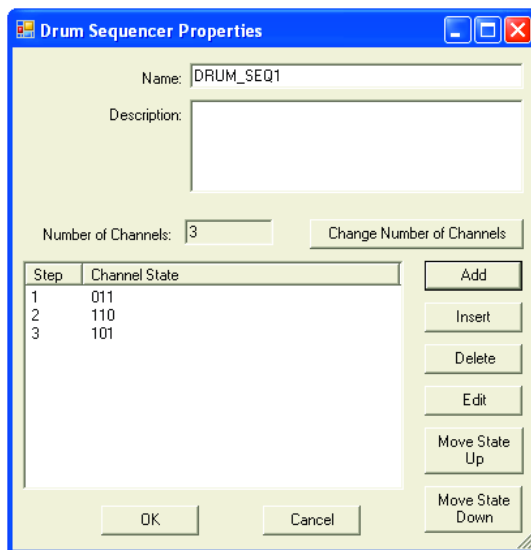
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In Figure 13-2, each row of pegs across the entire drum is called a *step*. Each column (drum) is a *channel*. As the drum rotates, each step, one at a time, will trigger the micro-switches. For each micro-switch trigger, the channel is considered energized or true. When the step does not have a peg, then it is considered deenergized or false.

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EZ LADDER converts this mechanical drum sequencer into a software function block. The **DRUM-SEQ** function operates the same as the mechanical drum sequencer. There are steps and channels; and combined, they create a *matrix*. This matrix is similar to a spreadsheet table, with steps along the left hand size and channels across the bottom. Simply place 0s or 1s in the matrix to represent a true or false (peg) for each step. When the drum sequence operates, the step will increment; and the channel status will be updated. Contacts for each channel are available and can be used to drive other functions in the ladder diagram.

The *Drum Sequencer Properties* dialog opens when placing the DRUM\_SEQ function. This dialog is where the number of channels is specified. Steps are added using the **ADD** button. One at a time, each step's channel status (0 or 1) is set by checking the box for the channel (check equals 1). Steps may be inserted, added, deleted, and the order can be changed here. Figure 13-3 shows the Drum Sequencer Properties dialog.



**Figure 13-3 - Drum Sequencer Properties.**

An inserted drum sequencer has two inputs and one output. The inputs are *RST* for reset and *ST* for step. When *RST* is true, the drum sequencer resets to the first step. Each false-to-true transition on *ST* causes the drum sequencer to increment its current step. When the last step is complete, the drum will start over with step one. The output *Q* identifies when the function is active.

There are logic outputs of this function, but are not connected directly to it. After a drum sequencer is inserted, new Boolean variables will appear in the variables list. These can be used as contacts to connect to other functions and I/O. They will begin with *DRUM\_SEQ#\_*, with the # being the drum sequencer number and followed by the channel number.

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Figure 13-4 shows a drum sequencer circuit. When *GPI0* is true, the drum sequencer is reset to the first step. According to the matrix in Figure 95, channel 2 and channel 3 are both true causing *GPO3* and *GPO4* to be energized. With *GPI0* false, each time *GPI1* sees a transition of false to true, the step is incremented. The first pulse increments to step 2. In step 2, the matrix shows channel 1 and channel 2 true, causing *GPO2* and *GPO3* to be energized. The next pulse increments to step 3. In step 3, the matrix has channel 1 and channel 3 true, causing *GPO2* and *GPO4* to be energized. Another pulse on *GPI1* will cause the drum sequencer to wrap-around back to step 1.

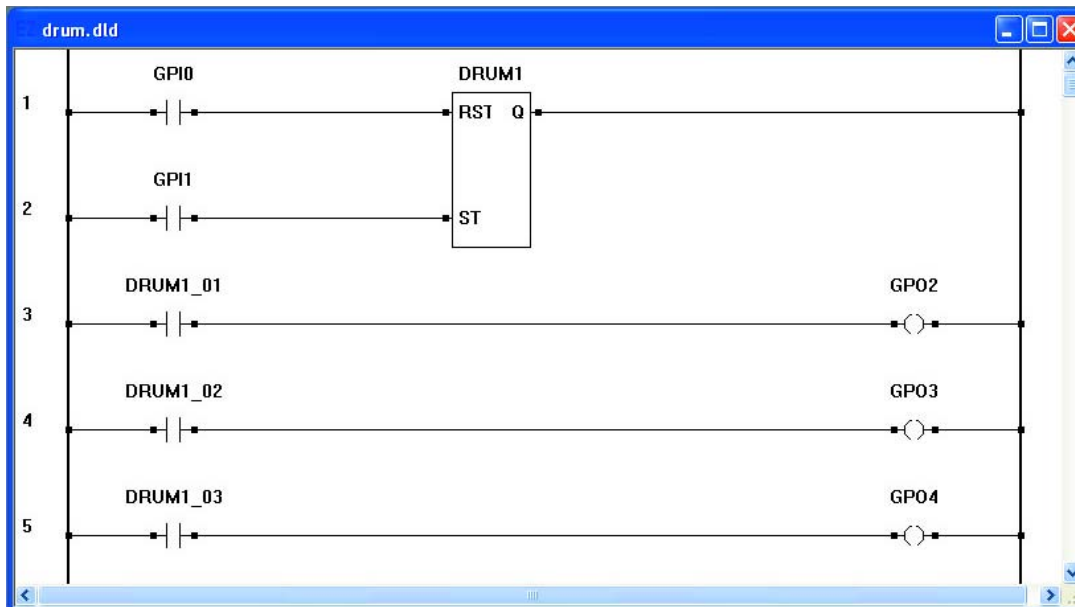


Figure 13-4 - Drum Sequence Circuit.



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**CHAPTER  
13  
EXERCISES**

**DRUM SEQUENCER  
CIRCUITS**

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Please complete the following questions and exercises related to the Student Manual, Chapter 13- Drum Sequencer Circuits. These questions and exercises were developed to gauge the student's understanding of drum sequencers covered in Chapter 13.



1. What is a drum sequencer? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

2. What is a drum sequencer step? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

3. What is a drum sequencer channel? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

4. What are the possible states of a drum sequencer channel? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

5. What happens to a drum sequencer after the last step? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

6. Draw the drum sequencer circuit using the I/O as described. Program and run this circuit using the Solves-It! Trainer.

#### Inputs

GPI0 - Drum Sequencer Time Base Select

#### Outputs

GPO1 - Light 1

GPO2 - Light 2

GPO3 - Light 3

GPO4 - Light 4

GPO5 - Light 5

#### Descripon of Operation

Using a drum sequencer, create a pattern of marquee lighting. Use at least 20 steps. The drum sequencer should automacally step at a 1 second interval. If GPI0 is true, the step rate will be .5 seconds.

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# WORKBOOK KEY

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## CHAPTER 13 EXERCISES

## DRUM SEQUENCER CIRCUITS

Please complete the following questions and exercises related to the Student Manual, Chapter 13- Drum Sequencer Circuits. These questions and exercises were developed to gauge the student's understanding of drum sequencers covered in Chapter 13.



1. What is a drum sequencer?

A Drum Sequencer steps (rotates) through a set of potential output bit patterns that are represented as channels.

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2. What is a drum sequencer step?

Each row of channel states is a step (or pegs across the wheel).

3. What is a drum sequencer channel?

A channel is a column of states (or pegs on a wheel).

4. What are the possible states of a drum sequencer channel?

True (1, on) or False (0,off)

5. What happens to a drum sequencer after the last step?

It resets back to step 1 and starts again.

6. Draw the drum sequencer circuit using the I/O as described. Program and run this circuit using the Solves-It! Trainer.

#### Inputs

GPI0 - Drum Sequencer Time Base Select

#### Outputs

GPO1 - Light 1

GPO2 - Light 2

GPO3 - Light 3

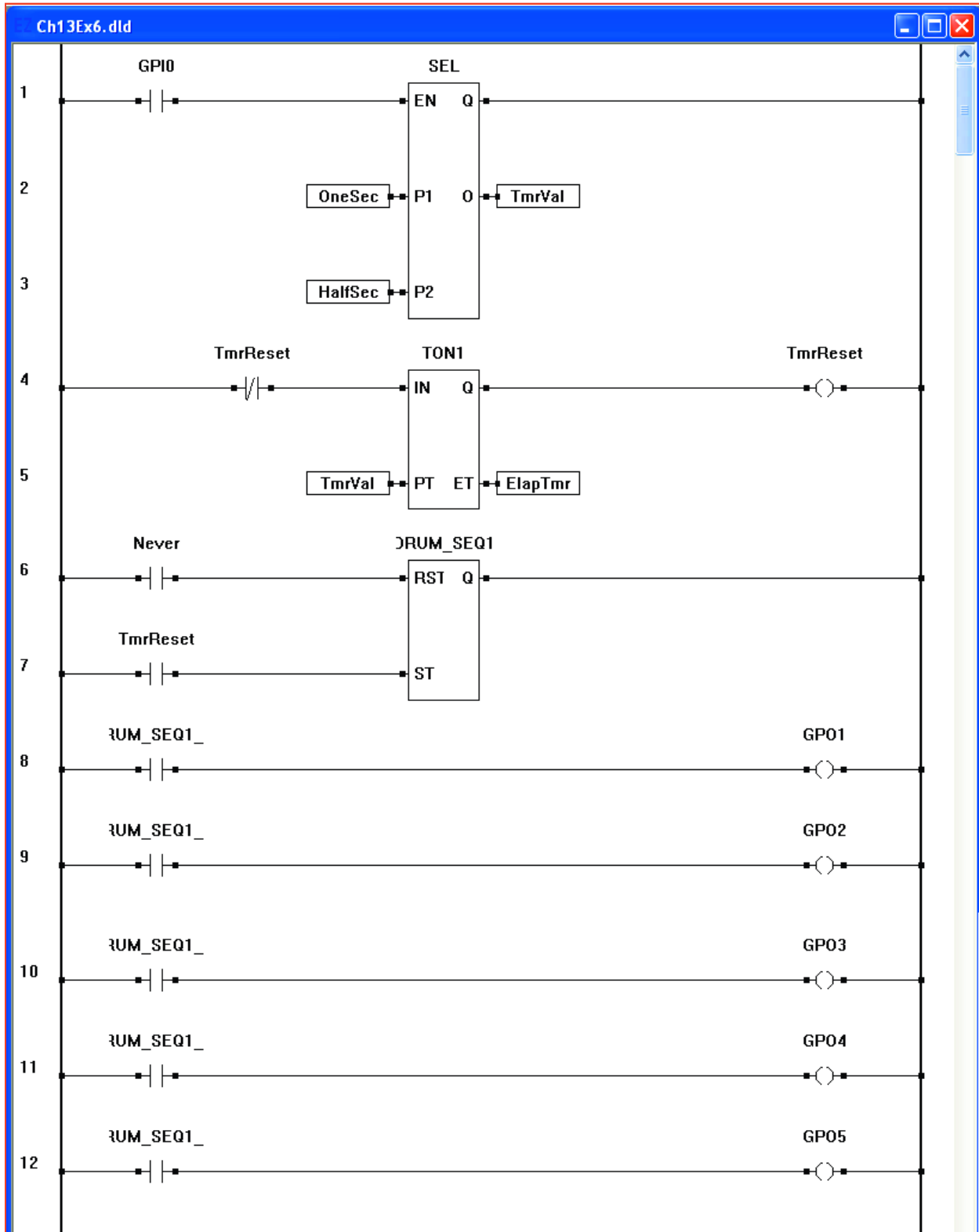
GPO4 - Light 4

GPO5 - Light 5

#### Descripon of Operation

Using a drum sequencer, create a pattern of marquee lighting. Use at least 20 steps. The drum sequencer should automacally step at a 1 second interval. If GPI0 is true, the step rate will be .5 seconds.

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**Teacher Notes:**