**Objective**

- To use Multiplexing Display technique to reduce the number of decoder/drivers.
- To connect a 555 timer as a clock generator and measure its frequency.

**References**

Garrod & Borns: Digital Logic: Analysis, Application & Design

**Component**

1-74LS04 hex-inverter (NOT) TTL IC
1-74LS47 TTL IC
1-74LS157 TTL IC
2-Common-Anode 7-Segment Display
1-NE555 Timer
7-330Ω Resistor
1-1kΩ Resistor
1-33kΩ Resistor
1-0.1µF Capacitor
1-DC Voltmeter
1-+5V Power supply

**Introduction**

**Timer Sizing**

The 555 timer IC is one of the most widely used ICs. It can be used in three modes; monostable, one-shot; astable, oscillator; and time delay.

In this experiment, you are going to use the 555 IC as a stable (clock generator) and the period can be calculated using the following formula:

\[ t_1 = 0.693(RA + RB)C \]
\[ t_2 = 0.693RB/C \]

The period \( T = t_1 + t_2 = 0.693(RA + 2RB)C \)

The frequency \( f = 1/T \)
Calculation example:

Given $R_A=1k\Omega$, $R_B=6.8k\Omega$, and $C=0.1\mu F$. Then:

$t_1 = 0.693RB C$

$= 0.693 \times 6.8k\Omega \times 0.1\mu F$

$= 0.47 ms$

$t_2 = 0.693(R_A+R_B)C$

$= 0.693(1k\Omega+6.8k\Omega) \times 0.1\mu F$

$= 0.54 ms$

$T = t_1 + t_2$

$= 0.693(R_A + 2R_B)C$

$= 0.47 ms + 0.54 ms$

$= 1.01 ms$

$\frac{1}{T} = f$

$= 989 Hz$

Procedure

1) Connect the circuit in Fig 4-1 below.

2) Apply to the clock input
   a) 0Vdc
      b) +5Vdc

Record the output on the 7-segment display in Table 1.

3) Apply clock from the TTL output mode on your digital trainer.
   Start with 1 Hz frequency. Notice the display operation.

4) Increase the frequency until you get a standing display. Record the frequency as displayed on the digitalab training kit.
5) Replace the clock generator by implementing the 555 timer circuit shown in Fig 3-2 below to deliver the same frequency as that measured above. Before that, calculate the value of $R_A$ knowing that $C = 0.1 \mu F$ and $R_B = 33 \Omega$ and verify for proper operation. Record the results in Table 2.
## Table 1

<table>
<thead>
<tr>
<th>A input</th>
<th>B Input</th>
<th>Ten Digit Display</th>
<th>One Digit Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>2A</td>
<td>3A</td>
<td>4A</td>
</tr>
</tbody>
</table>

## Table 2

<table>
<thead>
<tr>
<th>A input</th>
<th>B Input</th>
<th>Ten Digit Display</th>
<th>One Digit Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>2A</td>
<td>3A</td>
<td>4A</td>
</tr>
</tbody>
</table>
Questions

Design an interface to operate four 7-segment displays by using the minimum number of following IC’s {74157, 7447 and usual gate IC’s like 7404, 7408, 7432….}

Pin Connection Diagram

74LS04 hex-inverter (NOT) TTL IC
74LS47 TTL IC

74LS157 TTL IC

Common Anode 7-Segment Display