

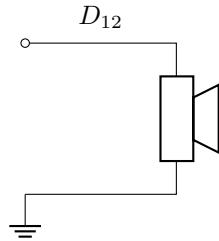
Lab 5

Timers

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Circuit



Data

Note	Target Frequency(Hz)	Measured Frequency(Hz)
A	440	436.44
B	494	489.49
C	523	518.02
D	587	580.76
E	659	651.11
F	698	689.14
G	784	772.85

Questions

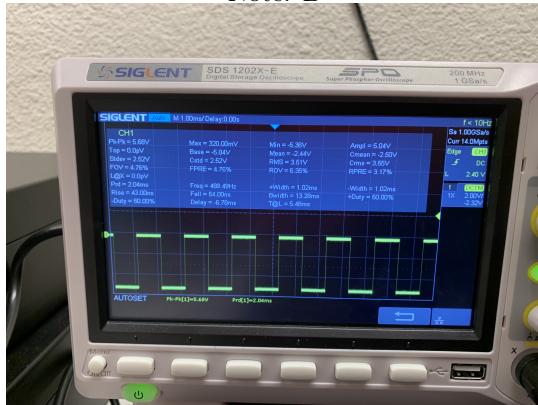
1. The measured frequency seems to separate from the target frequency with an increasing margin. This could be due to the clock being slightly under 16Mhz and therefore being increasing more offset the more clock pulse we wait for.

Images

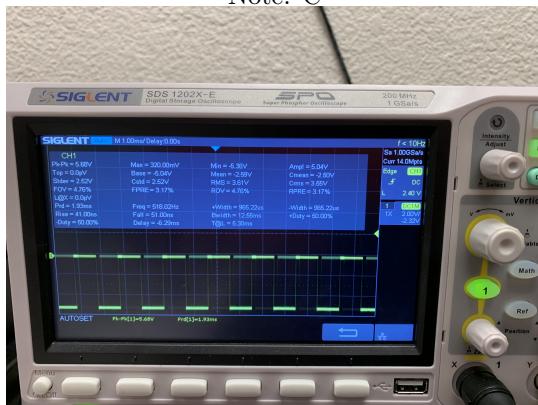
Note: A



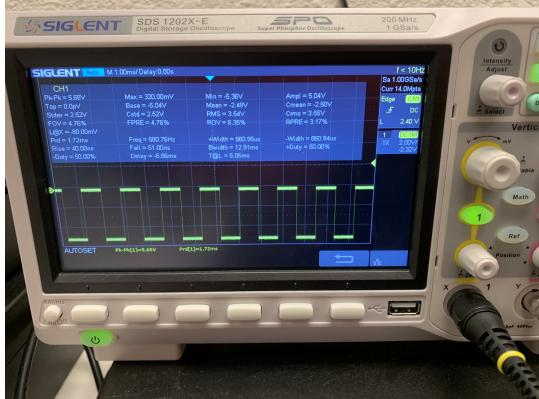
Note: B



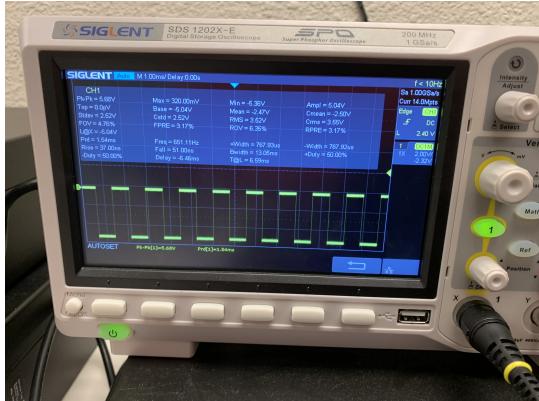
Note: C



Note: D



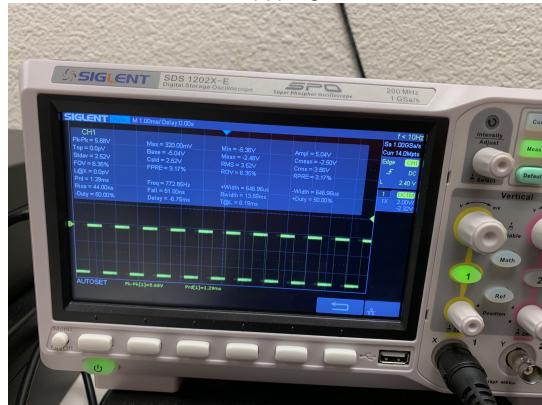
Note: E



Note: F



Note: G



```

1 #include <avr/io.h>
2 #include <stdio.h>
3 #include "io.h"
4
5 #define TIMER_RESET(C) TCCR1B &= 0xF8;TIFR1 |= 0x01;TCNT1
6     = (uint16_t)(0xFFFF - freq_table[C]);TCCR1B |= 0x01
7 #define TIMER_WAIT while (!(TIFR1 & 0x01))
8 #define TICKS(F) (uint16_t)(F_CPU/(2*F))
9
10 uint16_t freq_table[256] = {
11     [ 'A' ] = TICKS(440),
12     [ 'B' ] = TICKS(494),
13     [ 'C' ] = TICKS(523),
14     [ 'D' ] = TICKS(587),
15     [ 'E' ] = TICKS(659),
16     [ 'F' ] = TICKS(698),
17     [ 'G' ] = TICKS(784),
18 };
19
20 int main () {
21     uart_init(9600);
22     pin_t out = new_pin(12);
23     char c = 'A';
24     for (;;) {
25         if (uart_available())
26             c = uart_read();
27         TIMER_RESET(c);
28         TIMER_WAIT;
29         toggle_pin(out);
30     }
31 }
```