



# Decade Counter through AVR-Assembly



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	<i>Abstract</i> —This manual shows how to build a decade counter through AVR-Assembly.	

## 1 COMPONENTS

Component	Value	Quantity
Breadboard		1
Resistor	$\geq 220\Omega$	1
Arduino	Uno	1
Seven Segment Display	Common Anode	1
Decoder	7447	1
Flip Flop	7474	2
Jumper Wires		20

TABLE 0

## 2 USING THE 7474 D-FLIP FLOPS

- 1) Connect the Arduino, 7447 and the two 7474 ICs according to Table 1 and Fig. 1.
- 2) Intelligently use the codes in [1], [2] to realize the decade counter in Fig. 1.

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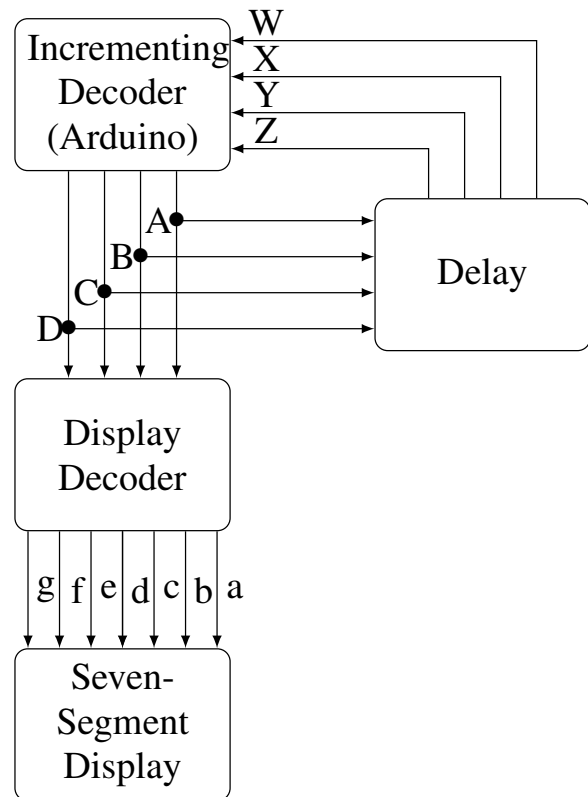


Fig. 1

## 3 USING INTERNAL MEMORY AND AND LOOP

1. Execute the following code by connecting the Arduino to 7447 through pins 2,3,4,5. The seven segment display should be connected to 7447.

```
wget https://raw.githubusercontent.com/gadepall/arduino/master/assembly/7447/codes/mem_cntr.asm
```

2. Explain the following instructions

```
ldi x1,0x00
ldi xh,0x01
```

	INPUT				OUTPUT				CLOCK	5V				
	W	X	Y	Z	A	B	C	D						
Arduino	8	9	10	11	2	3	4	5	13					
7474	5	9			2	12			CLK1	CLK2	1	4	10	13
7474			5	9			2	12	CLK1	CLK2	1	4	10	13
7447					7	1	2	6			16			

TABLE 1

```
ldi r16,0b000000000
st x,r16
```

loaded into R0 which is used to write to the display with a delay.

**Solution:** X=R27:R26, Y=R29:R28, and Z=R31:R30 where R27:R26 represents XH:XL. The above instructions load 0b000000000 into the memory location X=0x0100.

3. What does the **loop\_cnt** routine do?

```
ldi r16,0b000000000
ldi r17,0x09
loop_cnt:
inc r16
inc xl
st x,r16
dec r17
brne loop_cnt
```

**Solution:** The routine loads the numbers 1-9 in memory locations 0x0101 - 0x0109.

4. What is happening in the following loop?

```
Start:
ldi r17,0x0A
clr xl
loop_inc:
ldi r16,0b000000010
ld r0,x
loopw:
lsl r0
dec r16
brne loopw
out PORTD,r0
call wait
inc xl
dec r17
brne loop_inc
rjmp Start
```

**Solution:** R17=10 is used as a counter. The numbers 0-9 from 0x0100-0x0109 are repeatedly

REFERENCES

[1] G. V. V. Sharma. 7447 through AVR-Assembly. [Online]. Available: [https://github.com/gadepall/arduino/raw/master/assembly/7447/io/gvv\\_ard\\_assembly\\_7447.pdf](https://github.com/gadepall/arduino/raw/master/assembly/7447/io/gvv_ard_assembly_7447.pdf)

[2] ——. Boolean Logic through AVR-Assembly. [Online]. Available: [https://github.com/gadepall/arduino/raw/master/assembly/7447/count/gvv\\_ard\\_assembly\\_7447\\_count.pdf](https://github.com/gadepall/arduino/raw/master/assembly/7447/count/gvv_ard_assembly_7447_count.pdf)