

$$F_{\text{timer}} = \frac{F_{\text{cpu}}}{\text{prescaler}} = \frac{4000 \text{ kHz}}{8} = 500 \text{ kHz}$$

سری ۴
(سوال ۱)

$$T_{\text{timer}} = \frac{1}{F_{\text{cpu}}} = \frac{1}{500 \text{ kHz}} = 2 \mu\text{s}$$

$$\text{تعداد شمارش} = \frac{100 \text{ ms}}{2 \mu\text{s}} = 50000 = 250 \times 200$$

$$TCNT0 = 256 - 200 = 56$$

```

• include "m64DEF.inc"
• ORG 0x0000
  jmp main
• ORG 0x0002
  jmp INTO_ISR
• ORG 0x0004
  jmp INT1_ISR
• ORG 0x0006
  jmp INT2_ISR
• ORG 0x0008
  jmp INT3_ISR
• ORG 0x0020
  jmp Timer0_ISR
• ORG 0x0050

main: ldi R16, low(RAMEND)
      out SPL, R16
      ldi R16, high(RAMEND)
      out SPH, R16

      ldi R16, 0xFF
      out DDRA, R16
      out DDRB, R16

      out DDRC, R16
      out DDRD, R16

      ldi R16, 0x0F ; 00001111
      out EIMSK, R16

      ldi R16, 0xAA ;
      sts EICRA, R16
  
```

LDI R16, 0x02 ; prescaler = 8

out TCCR0, R16

LDI R16, 56 ; 256 - 200 = 56

out TCNT0, R16

LDI R16, 0x01 ; enable Timero

out TIMSK, R16

CLR R17 ; Value C

CLR R18 ; Value D

CLR R21 ; Interrupt counter

SEI ; enable interrupts

loop: jmp loop

INT0_ISR:

push R17

IN R17, PINC

INC R17

out PORTC, R17

pop R17

RETI

INT1_ISR:

PUSH R17

IN R17, PINC

DEC R17

out PORTC, R17

POP R17

RETI

INT2_ISR:

PUSH R18

IN R18, PIND

INC R18

out PORTD, R18

POP R18

RETI

INT3_ISR:

PUSH R18

IN R18, PIND

DEC R18

out PORTD, R18

POP R18

RETI

Timero ISR:

LDI R20, 56

Out TCNT0, R20

INC R21 ; count of fms

CPI R21, 250 ; (100ms)

BRNE END_Timer

IN R17, PINC

IN R18, PIND

ADD R17, R18

Out PORTA, R16

MUL R17, R18 ; R1:R0

Out PORTB, R0

END_Timer: RETI

$$F_{\text{timer}} = \frac{F_{\text{CPU}}}{\text{prescaler}} = \frac{1024 \text{ kHz}}{1024} = 1 \text{ kHz}$$

(سوال ۲)

$$F_{\text{timer}} = \frac{1}{F_{\text{CPU}}} = \frac{1}{1 \text{ kHz}} = 1 \text{ ms}$$

$$\text{تعداد بار} = \frac{25 \text{ ms}}{1 \text{ ms}} = 25$$

. Include "M64DEF.INC"

• ORG 0x0000

JMP main

• ORG 0x0002

JMP INTO_ISR

• ORG 0x0020

JMP Timero_ISR

• ORG 0x0050

main:

LDI R16, low(RAMEND)

out SPL, R16

LDI R16, High(RAMEND)

out SPH, R16

LDI R16, 0x00

out DDRA, R16

LDI R16, 0x0FF

out DDRB, R16

LDI R16, 0x01 ; set INTO

out EIMSK, R16

LDI R16, 0x02 ; falling

STS EICRA, R16 edge

LDI R16, 0x07 ; prescaler : 1024

out TCCR0, R16

CLR R24 ; Trigger Flag

SETI

CLR R17

OUT PORTC, R17

CLR R21 ; Trigger Flag

SETI

loop: jmp loop

INT0_ISR:

IN R17, PINA
ANDI R17, 0x03

CPI R17, 0x00

BREQ Case_00

CPI R17, 0x01

BREQ Case_01

CPI R17, 0x02

BREQ Case_10

RETI

; Case_00 → 1ms → 1ms = 1000 : $254 - 1000 = 154$

; Case_01 → 20ms → 1ms = 20 : $254 - 20 = 234$

; Case_10 → 100ms → 1ms = 100 : $254 - 100 = 154$

Case_00:

LDI R22, 0 ; Flag for mode

LDI R24, 20 ; مقدار شمار

LDI R25, 231

JMP Next

Case_01:

LDI R22, 1 ; Flag for mode

LDI R24, 10 ; مقدار شمار → $10 \times 20 = 200$

LDI R25, 206

JMP Next

Case_10:

LDI R22, 2 ; Flag for mode

LDI R24, 5 ; مقدار شمار → $5 \times 100 = 500$

LDI R25, 156

Next: out TCNT0, R25

LDI R16, 0x01

out TIMSK, R16

RETI

Timer0_ISR: out TCNT0, R25 ;

بسته به شرایط یکی از

Timer0_ISR: out IN R18, PINB ;

مقادیر

CPI R22, 0

BREQ Do_00

CPI R22, 1

BREQ Do_01

JMP Do_10

Do_00:  R18, R18, 10

COM R18

Out PORTB, R18

DEC R24

BRNE END_Timer

LDI R16, 0x00

out TIMSK, R16

Do_01:  R18, R18, 10

INC R18

out PORTB, R18

DEC R24

BRNE END_Timer

LDI R16, 0x00

out TIMSK, R16

Do_10:  IN R18, PORTB

DEC R18

out PORTB, R18

DEC R24

BRNE END_Timer

LDI R16, 0x00

 out TIMSK, R16

END_Timer: RETI