

**INSTITUTO POLITÉCNICO NACIONAL
ESCUELA SUPERIOR DE CÓMPUTO**

ESCOM

Ejercicio 13

“Servomotor”

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Grupo:3CM15

24/05/2021

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Problema

Hacer un programa el cual reciba por medio de 8 botones una entrada y haga girar un servomotor dependiendo de la entrada que reciba.

Código

```
.include "m8535def.inc"
```

```
.def aux = R16
```

```
.macro pulse
```

```
sbi PORTA,0
```

```
ldi aux,@0
```

```
loop1:
```

```
rcall delay
```

```
dec aux
```

```
brne loop1
```

```
cbi PORTA,0
```

```
ldi aux,@1
```

```
loop2:
```

```
rcall delay
```

```
dec aux
```

```
brne loop2
```

```
rjmp otro
```

```
.endm
```

```
main:
```

```
ldi aux, LOW(RAMEND)
```

```
out SPL,aux
```

```
ldi aux, HIGH(RAMEND)
```

out SPH,aux

ser aux

out DDRA,aux

out PORTD,aux

otro:

sbis PIND,0

rjmp cero

sbis PIND,1

rjmp uno

sbis PIND,2

rjmp dos

sbis PIND,3

rjmp tres

sbis PIND,4

rjmp cuatro

sbis PIND,5

rjmp cinco

sbis PIND,6

rjmp seis

sbis PIND,7

rjmp siete

rjmp otro

cero:

pulse 7,38

uno:

pulse 65,146

dos:

pulse 70,146

tres:

pulse 82,146

cuatro:

pulse 94,147

cinco:

pulse 104,147

seis:

pulse 108,147

siete:

pulse 130,150

delay:

ldi r17, \$02

L1:

dec r17

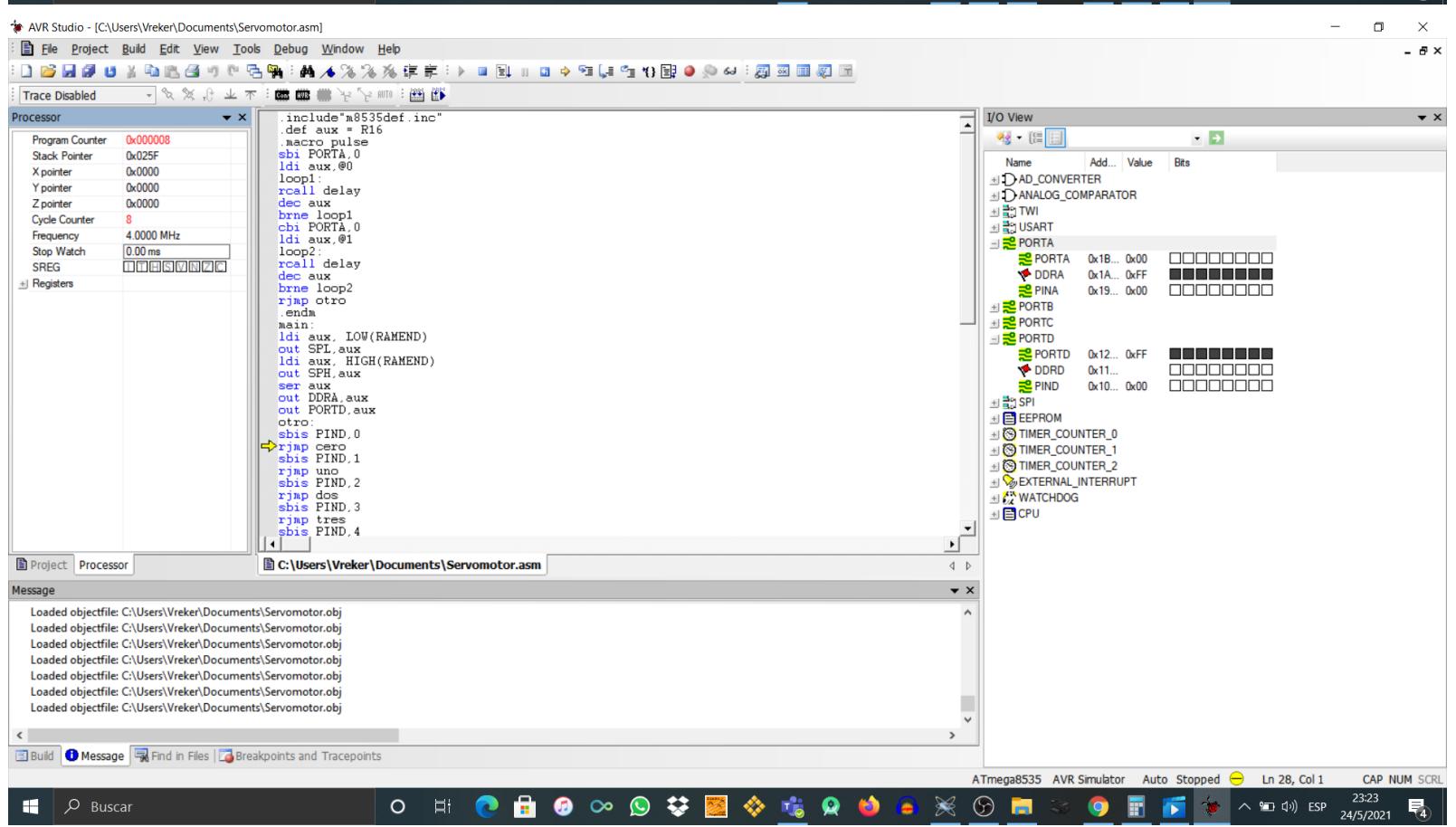
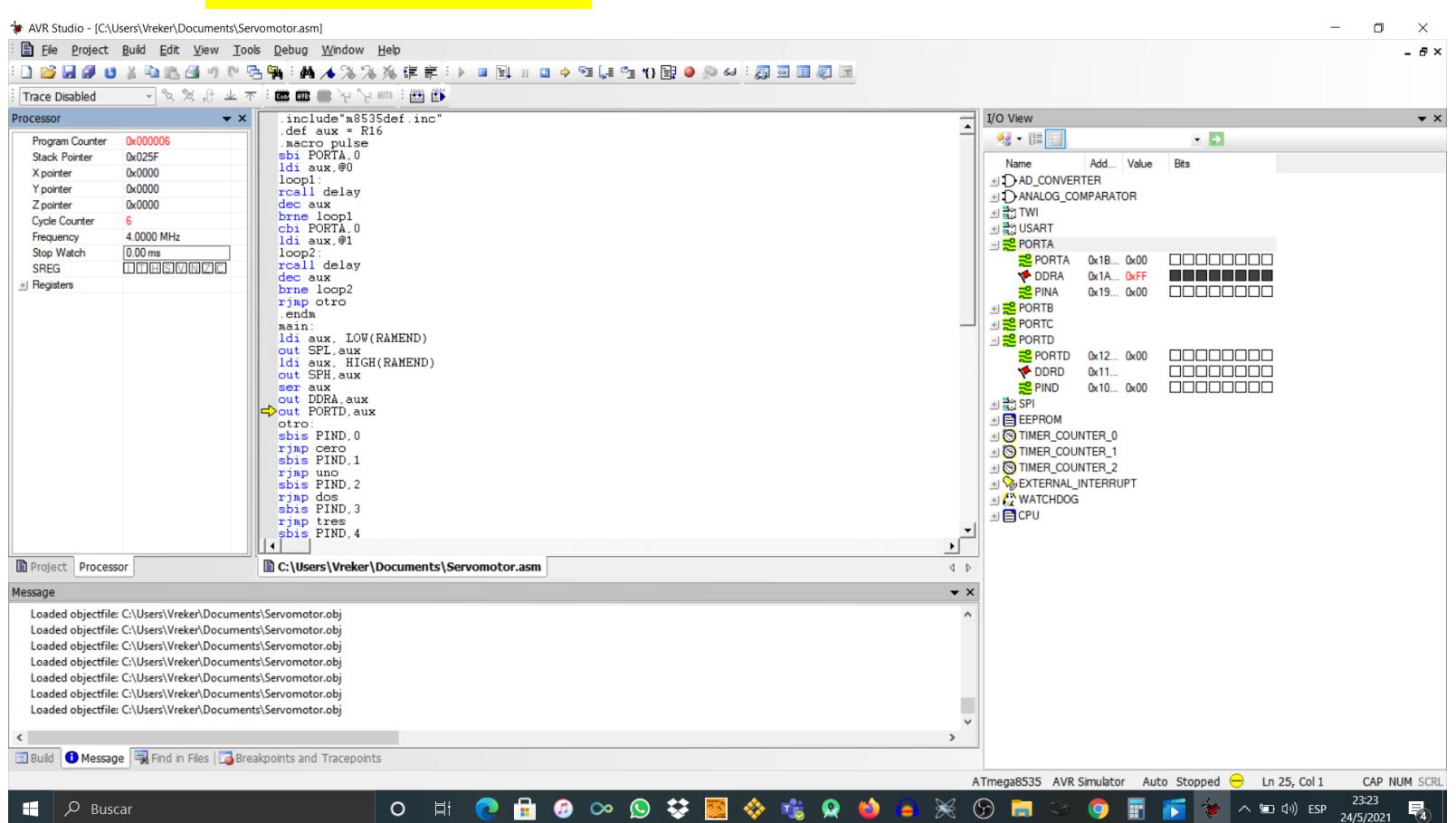
brne L1

nop

nop

ret

Simulación en AVR Studio 4



AVR Studio - [C:\Users\Vreker\Documents\Servomotor.asm]

File Project Build Edit View Tools Debug Window Help

Trace Disabled

Processor

Program Counter	0x000018
Stack Pointer	0x025F
Xpointer	0x0000
Ypointer	0x0000
Zpointer	0x0000
Cycle Counter	10
Frequency	4.0000 MHz
Stop Watch	0.00 ms
SREG	0000 0000

Registers

```
rjmp seis  
sbis PIND,7  
rjmp siete  
rjmp otro  
cero:  
    pulse 7,38  
uno:  
    pulse 65,146  
dos:  
    pulse 70,146  
tres:  
    pulse 82,146  
cuatro:  
    pulse 94,147  
cinco:  
    pulse 104,147  
seis:  
    pulse 108,147  
siete:  
    pulse 130,150  
  
delay:  
    ldi r17, $02  
L1:  
    dec r17  
    brne L1  
    nop  
    nop  
    ret
```

I/O View

Name	Add...	Value	Bits
PORTA	0x1B...	0x00	██████████████
DDRA	0x1A...	0xFF	██████████████
PINA	0x19...	0x00	██████████████
PORTB	0x12...	0xFF	██████████████
DDRB	0x11...	0x00	██████████████
PINB	0x10...	0x00	██████████████
PORTC	0x13...	0x00	██████████████
PORTD	0x14...	0x00	██████████████
DDRD	0x13...	0x00	██████████████
PIND	0x12...	0x00	██████████████
SPI	0x15...	0x00	██████████████
EPPROM	0x16...	0x00	██████████████
TIMER_COUNTER_0	0x17...	0x00	██████████████
TIMER_COUNTER_1	0x18...	0x00	██████████████
TIMER_COUNTER_2	0x19...	0x00	██████████████
EXTERNAL_INTERRUPT	0x1A...	0x00	██████████████
WATCHDOG	0x1B...	0x00	██████████████
CPU	0x1C...	0x00	██████████████

Project Processor C:\Users\Vreker\Documents\Servomotor.asm

Message

Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj

ATmega8535 AVR Simulator Auto Stopped Ln 45, Col 1 CAP NUM SCRLL 23:23 24/5/2021

AVR Studio - [C:\Users\Vreker\Documents\Servomotor.asm]

File Project Build Edit View Tools Debug Window Help

Trace Disabled

Processor

Program Counter	0x000070
Stack Pointer	0x025D
Xpointer	0x0000
Ypointer	0x0000
Zpointer	0x0000
Cycle Counter	16
Frequency	4.0000 MHz
Stop Watch	0.00 ms
SREG	0000 0000

Registers

```
rjmp seis  
sbis PIND,7  
rjmp siete  
rjmp otro  
cero:  
    pulse 7,38  
uno:  
    pulse 65,146  
dos:  
    pulse 70,146  
tres:  
    pulse 82,146  
cuatro:  
    pulse 94,147  
cinco:  
    pulse 104,147  
seis:  
    pulse 108,147  
siete:  
    pulse 130,150  
  
delay:  
    ldi r17, $02  
L1:  
    dec r17  
    brne L1  
    nop  
    nop  
    ret
```

I/O View

Name	Add...	Value	Bits
PORTA	0x1B...	0x01	██████████████
DDRA	0x1A...	0xFF	██████████████
PINA	0x19...	0x01	██████████████
PORTB	0x12...	0xFF	██████████████
DDRB	0x11...	0x00	██████████████
PINB	0x10...	0x00	██████████████
PORTC	0x13...	0x00	██████████████
PORTD	0x14...	0x00	██████████████
DDRD	0x13...	0x00	██████████████
PIND	0x12...	0x00	██████████████
SPI	0x15...	0x00	██████████████
EPPROM	0x16...	0x00	██████████████
TIMER_COUNTER_0	0x17...	0x00	██████████████
TIMER_COUNTER_1	0x18...	0x00	██████████████
TIMER_COUNTER_2	0x19...	0x00	██████████████
EXTERNAL_INTERRUPT	0x1A...	0x00	██████████████
WATCHDOG	0x1B...	0x00	██████████████
CPU	0x1C...	0x00	██████████████

Project Processor C:\Users\Vreker\Documents\Servomotor.asm

Message

Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj

ATmega8535 AVR Simulator Auto Stopped Ln 62, Col 1 CAP NUM SCRLL 23:23 24/5/2021

AVR Studio - [C:\Users\Vreker\Documents\Servomotor.asm]

File Project Build Edit View Tools Debug Window Help

Trace Disabled

Processor

Program Counter	0x000009
Stack Pointer	0x025F
X pointer	0x0000
Y pointer	0x0000
Z pointer	0x0000
Cycle Counter	9
Frequency	4.0000 MHz
Stop Watch	0.00 ms
SREG	0000 0000

Registers

```

include "m8535def.inc"
def aux = R16
macro pulse
    sbi PORTA, 0
    ldi aux, @0
loop1:
    rcall delay
    dec aux
    brne loop1
    cbi PORTA, 0
    ldi aux, @1
loop2:
    rcall delay
    dec aux
    brne loop2
    rjmp otro
.endm
main:
    ldi aux, LOW(RAMEND)
    out SPL, aux
    ldi aux, HIGH(RAMEND)
    out SPH, aux
    ser aux
    out DDRA, aux
    out PORTD, aux
otro:
    sbis PIND, 0
    rjmp cero
    sbis PIND, 1
    rjmp uno
    sbis PIND, 2
    rjmp dos
    sbis PIND, 3
    rjmp tres
    sbis PIND, 4

```

I/O View

Name	Add...	Value	Bits
AD_CONVERTER			
ANALOG_COMPARATOR			
TWI			
USART			
PORTA			
PORTA	0x1B...	0x00	██████████████
DDRA	0x1A...	0xFF	██████████████
PINA	0x19...	0x00	██████████████
PORTB			
PORTC			
PORTD			
PORTD	0x12...	0xFF	██████████████
DDRD	0x11...	0x00	██████████████
PIND	0x10...	0x01	██████████████
SPI			
EEPROM			
TIMER_COUNTER_0			
TIMER_COUNTER_1			
TIMER_COUNTER_2			
EXTERNAL_INTERRUPT			
WATCHDOG			
CPU			

Project Processor C:\Users\Vreker\Documents\Servomotor.asm

Message

Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj
 Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj

Build Message Find in Files Breakpoints and Tracepoints

ATmega8535 AVR Simulator Auto Stopped Ln 29, Col 1 CAP NUM SCRL 23:24 24/5/2021

AVR Studio - [C:\Users\Vreker\Documents\Servomotor.asm]

File Project Build Edit View Tools Debug Window Help

Trace Disabled

Processor

Program Counter	0x000023
Stack Pointer	0x025F
X pointer	0x0000
Y pointer	0x0000
Z pointer	0x0000
Cycle Counter	12
Frequency	4.0000 MHz
Stop Watch	0.00 ms
SREG	0000 0000

Registers

```

rjmp siete
rjmp otro
cero:
    pulse 7.38
    uno:
    pulse 65.146
    dos:
    pulse 70.146
    tres:
    pulse 82.146
    cuatro:
    pulse 94.147
    cinco:
    pulse 104.147
    seis:
    pulse 108.147
    siete:
    pulse 130.150

delay:
    ldi r17, $02
L1:
    dec r17
    brne L1
    nop
    nop
    ret

```

I/O View

Name	Add...	Value	Bits
AD_CONVERTER			
ANALOG_COMPARATOR			
TWI			
USART			
PORTA			
PORTA	0x1B...	0x00	██████████████
DDRA	0x1A...	0xFF	██████████████
PINA	0x19...	0x00	██████████████
PORTB			
PORTC			
PORTD			
PORTD	0x12...	0xFF	██████████████
DDRD	0x11...	0x00	██████████████
PIND	0x10...	0x01	██████████████
SPI			
EEPROM			
TIMER_COUNTER_0			
TIMER_COUNTER_1			
TIMER_COUNTER_2			
EXTERNAL_INTERRUPT			
WATCHDOG			
CPU			

Project Processor C:\Users\Vreker\Documents\Servomotor.asm

Message

Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj
 Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj

Build Message Find in Files Breakpoints and Tracepoints

ATmega8535 AVR Simulator Auto Stopped Ln 47, Col 1 CAP NUM SCRL 23:24 24/5/2021

AVR Studio - [C:\Users\Vreker\Documents\Servomotor.asm]

File Project Build Edit View Tools Debug Window Help

Trace Disabled

Processor

Program Counter	0x000013
Stack Pointer	0x025F
X pointer	0x0000
Y pointer	0x0000
Z pointer	0x0000
Cycle Counter	19
Frequency	4.0000 MHz
Stop Watch	0.00 ms
SREG	0000 0100 0000 0000

Registers

```
rjmp uno
sbis PIND,2
rjmp dos
sbis PIND,3
rjmp tres
sbis PIND,4
rjmp cuatro
sbis PIND,5
rjmp cinco
sbis PIND,6
rjmp seis
sbis PIND,7
rjmp siete
rjmp otro
cero:
pulse 7.38
uno:
pulse 65.146
dos:
pulse 70.146
tres:
pulse 82.146
cuatro:
pulse 94.147
cinco:
pulse 104.147
seis:
pulse 108.147
siete:
pulse 130.150
delay:
    ldi r17, $02
L1:
    dec r17
```

I/O View

Name	Add...	Value	Bits
AD_CONVERTER			
ANALOG_COMPARATOR			
TWI			
USART			
PORTA	0x1B...	0x00	████████████████
DDRA	0x1A...	0xFF	████████████████
PINA	0x19...	0x00	████████████████
PORTB			
PORTC			
PORTD	0x12...	0xFF	████████████████
DDRD	0x11...		███████████████
PIND	0x10...	0x3F	███ ██████████
SPI			
EEPROM			
TIMER_COUNTER_0			
TIMER_COUNTER_1			
TIMER_COUNTER_2			
EXTERNAL_INTERRUPT			
WATCHDOG			
CPU			

Project Processor C:\Users\Vreker\Documents\Servomotor.asm

Message

Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj
Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj

Build Message Find in Files Breakpoints and Tracepoints

ATmega8535 AVR Simulator Auto Stopped Ln 39, Col 1 CAP NUM SCRL 23:27 24/5/2021

AVR Studio - [C:\Users\Vreker\Documents\Servomotor.asm]

File Project Build Edit View Tools Debug Window Help

Trace Disabled

Processor

Program Counter	0x000014
Stack Pointer	0x025F
X pointer	0x0000
Y pointer	0x0000
Z pointer	0x0000
Cycle Counter	20
Frequency	4.0000 MHz
Stop Watch	0.01 ms
SREG	0000 0100 0000 0000

Registers

```
rjmp uno
sbis PIND,2
rjmp dos
sbis PIND,3
rjmp tres
sbis PIND,4
rjmp cuatro
sbis PIND,5
rjmp cinco
sbis PIND,6
rjmp seis
sbis PIND,7
rjmp siete
rjmp otro
cero:
pulse 7.38
uno:
pulse 65.146
dos:
pulse 70.146
tres:
pulse 82.146
cuatro:
pulse 94.147
cinco:
pulse 104.147
seis:
pulse 108.147
siete:
pulse 130.150
delay:
    ldi r17, $02
L1:
    dec r17
```

I/O View

Name	Add...	Value	Bits
AD_CONVERTER			
ANALOG_COMPARATOR			
TWI			
USART			
PORTA	0x1B...	0x00	████████████████
DDRA	0x1A...	0xFF	████████████████
PINA	0x19...	0x00	████████████████
PORTB			
PORTC			
PORTD	0x12...	0xFF	████████████████
DDRD	0x11...		███████████████
PIND	0x10...	0x3F	███ ██████████
SPI			
EEPROM			
TIMER_COUNTER_0			
TIMER_COUNTER_1			
TIMER_COUNTER_2			
EXTERNAL_INTERRUPT			
WATCHDOG			
CPU			

Project Processor C:\Users\Vreker\Documents\Servomotor.asm

Message

Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj
Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj

Build Message Find in Files Breakpoints and Tracepoints

ATmega8535 AVR Simulator Auto Stopped Ln 40, Col 1 CAP NUM SCRL 23:27 24/5/2021

AVR Studio - [C:\Users\Vreker\Documents\Servomotor.asm]

Processor

Program Counter	0x00005A
Stack Pointer	0x025F
Xpointer	0x0000
Ypointer	0x0000
Zpointer	0x0000
Cycle Counter	22
Frequency	4.0000 MHz
Stop Watch	0.01 ms
SREG	0000 0100 0000 0000

Registers

```

pulse 7.38
uno
pulse 65.146
dos:
pulse 70.146
tres:
pulse 82.146
cuatro:
pulse 94.147
cinco:
pulse 104.147
seis:
pulse 108.147
siete:
pulse 130.150
delay:
    ldi r17, $02
L1:
    dec r17

```

I/O View

Name	Add...	Value	Bits
PORTA	0x1B...	0x00	████████████████
DDRA	0x1A...	0xFF	████████████████
PINA	0x19...	0x00	████████████████
PORTB			
PORTC			
PORTD	0x12...	0xFF	████████████████
DDRD	0x11...	0x00	████████████████
PIND	0x10...	0x3F	███████████████
SPI			
EPPROM			
TIMER_COUNTER_0			
TIMER_COUNTER_1			
TIMER_COUNTER_2			
EXTERNAL_INTERRUPT			
WATCHDOG			
CPU			

Message

```

Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj

```

Build **Message** **Find in Files** **Breakpoints and Tracepoints**

ATmega8535 AVR Simulator Auto Stopped Ln 57, Col 1 CAP NUM SCR 23:27 24/5/2021

AVR Studio - [C:\Users\Vreker\Documents\Servomotor.asm]

Processor

Program Counter	0x000070
Stack Pointer	0x025D
Xpointer	0x0000
Ypointer	0x0000
Zpointer	0x0000
Cycle Counter	28
Frequency	4.0000 MHz
Stop Watch	0.01 ms
SREG	0000 0100 0000 0000

Registers

```

pulse 7.38
uno
pulse 65.146
dos:
pulse 70.146
tres:
pulse 82.146
cuatro:
pulse 94.147
cinco:
pulse 104.147
seis:
pulse 108.147
siete:
pulse 130.150
delay:
    ldi r17, $02
L1:
    dec r17
    brne L1
    nop
    nop

```

I/O View

Name	Add...	Value	Bits
PORTA	0x1B...	0x01	████████████████
DDRA	0x1A...	0xFF	████████████████
PINA	0x19...	0x01	████████████████
PORTB			
PORTC			
PORTD	0x12...	0xFF	████████████████
DDRD	0x11...	0x00	████████████████
PIND	0x10...	0x3F	███████████████
SPI			
EPPROM			
TIMER_COUNTER_0			
TIMER_COUNTER_1			
TIMER_COUNTER_2			
EXTERNAL_INTERRUPT			
WATCHDOG			
CPU			

Message

```

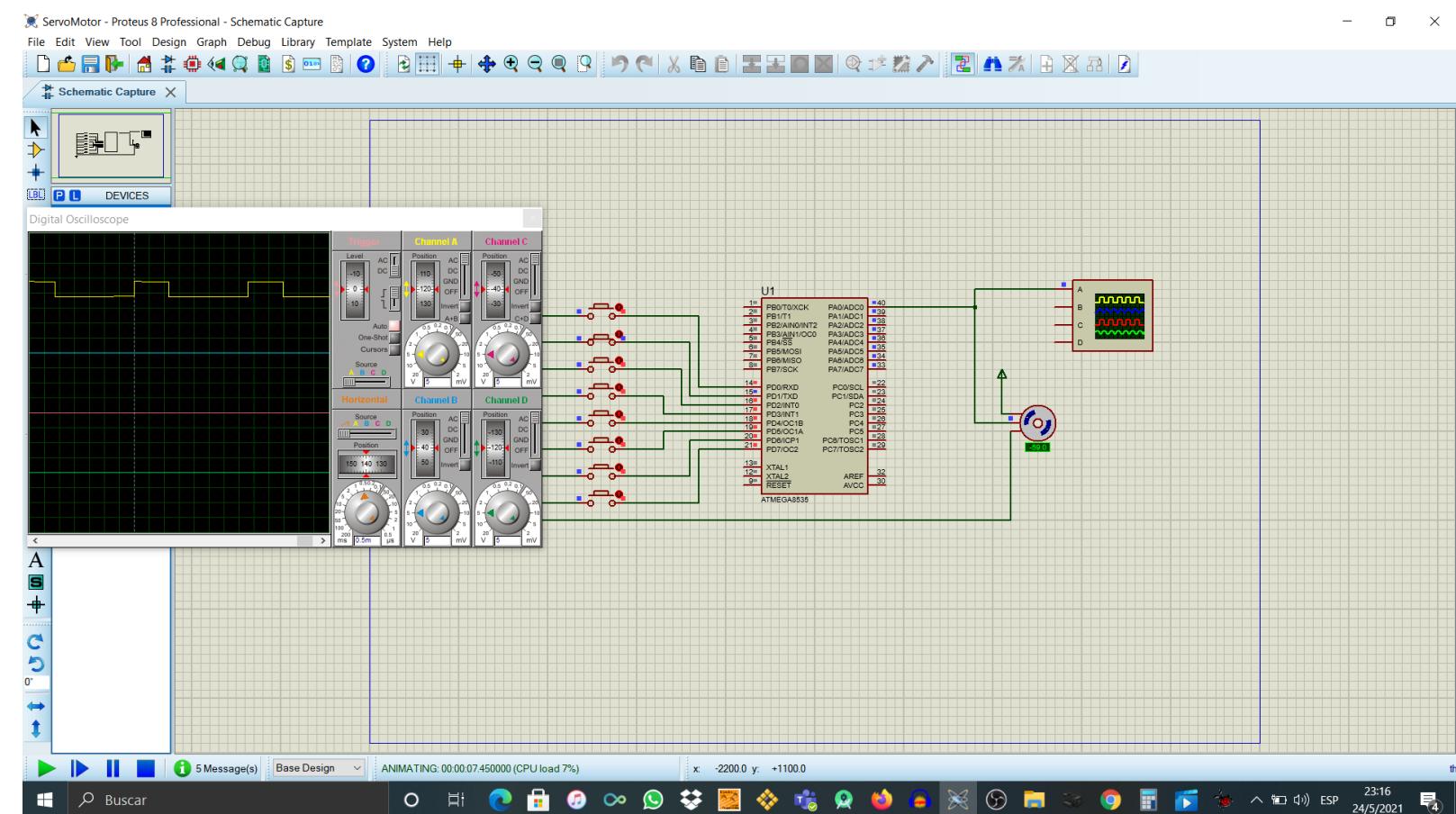
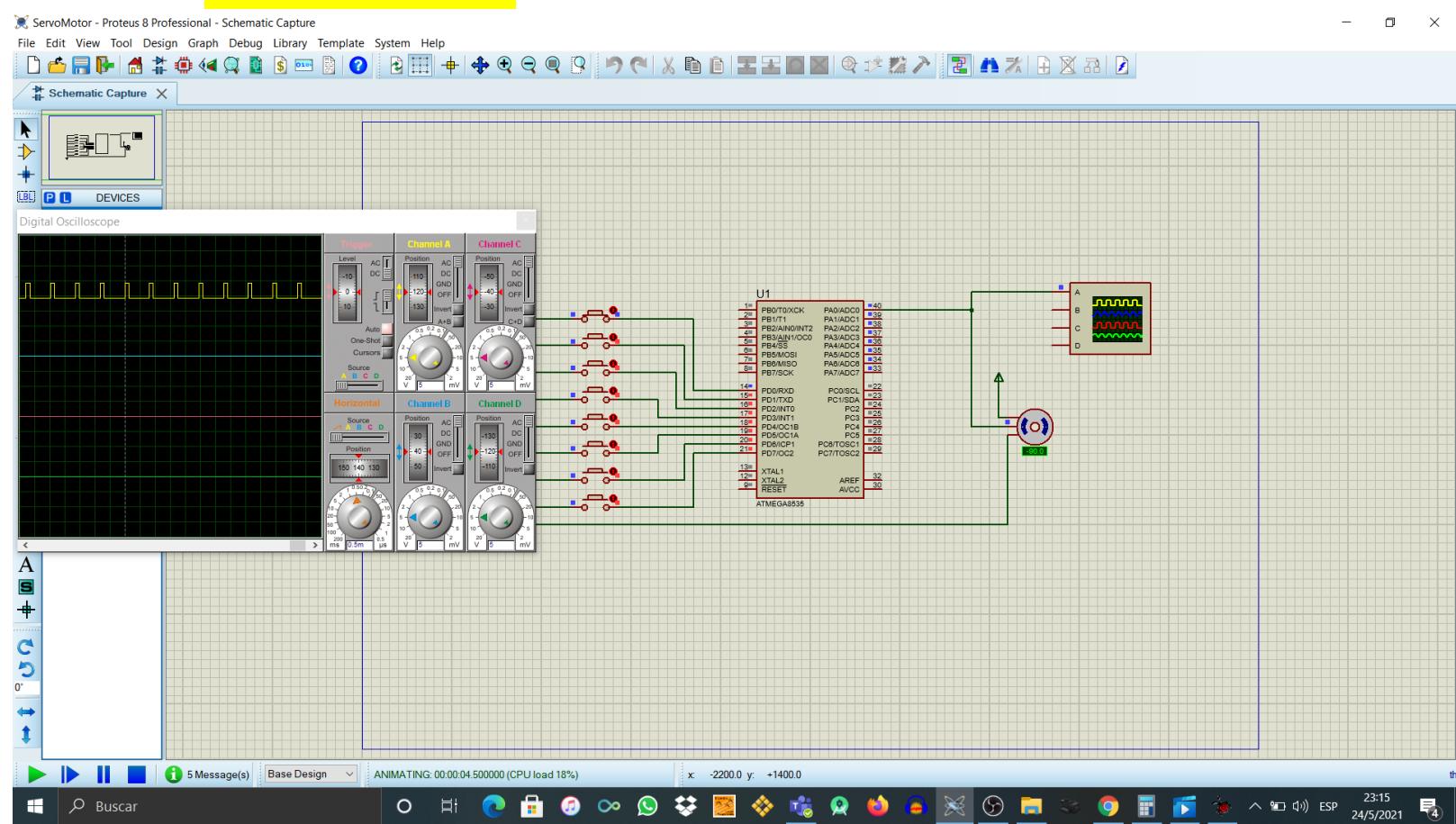
Loaded objectfile: C:\Users\Vreker\Documents\Servomotor.obj

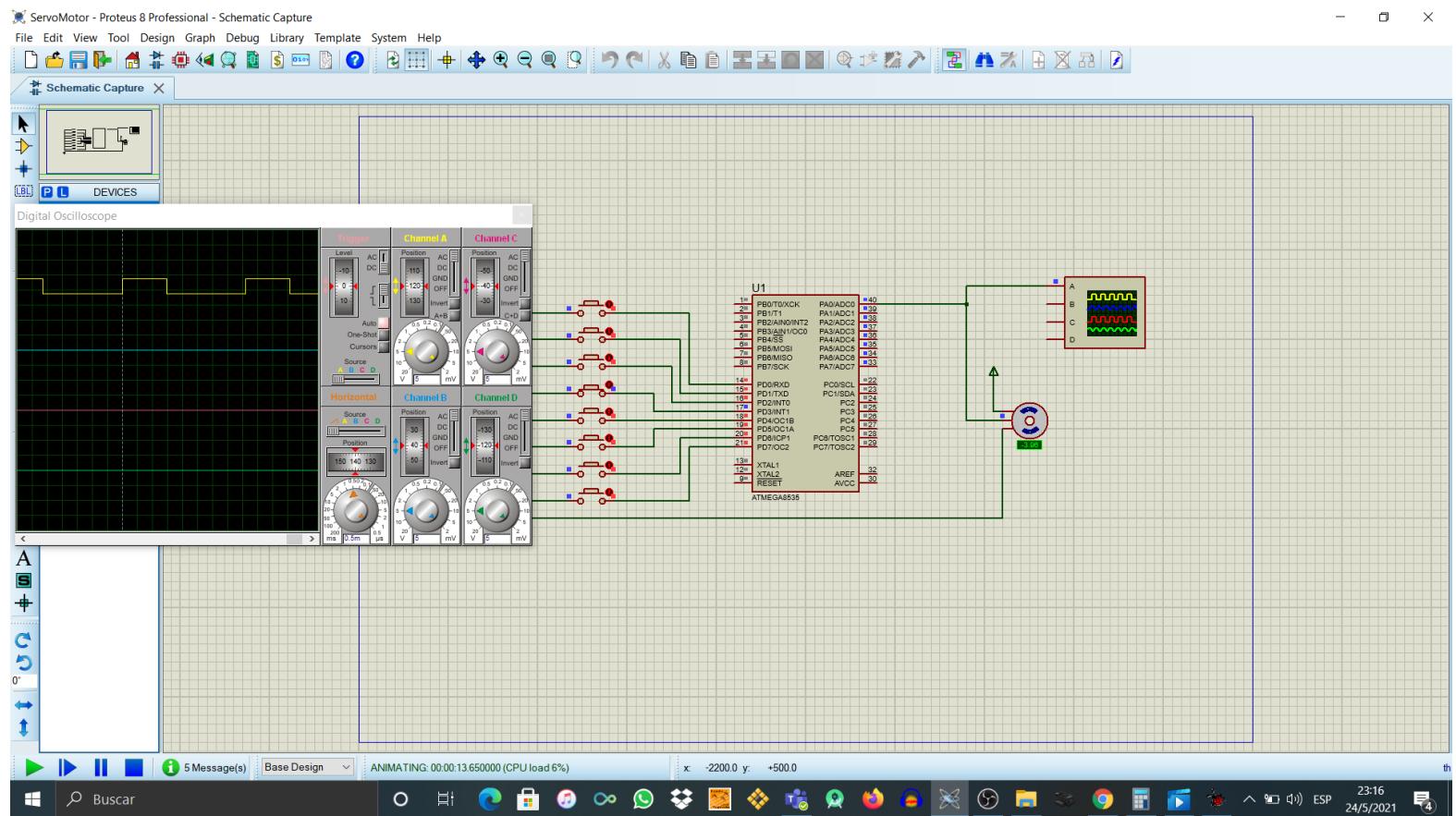
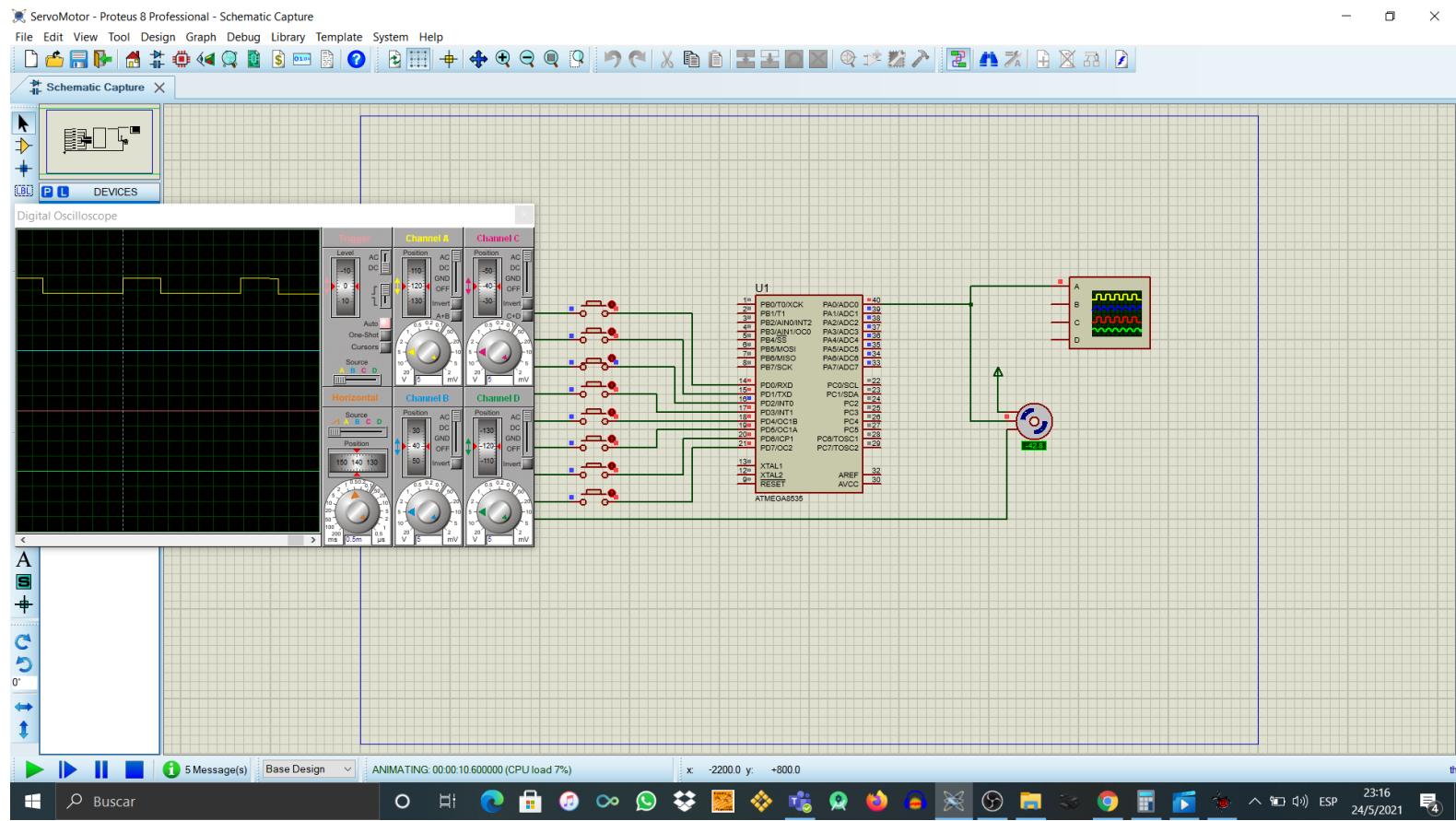
```

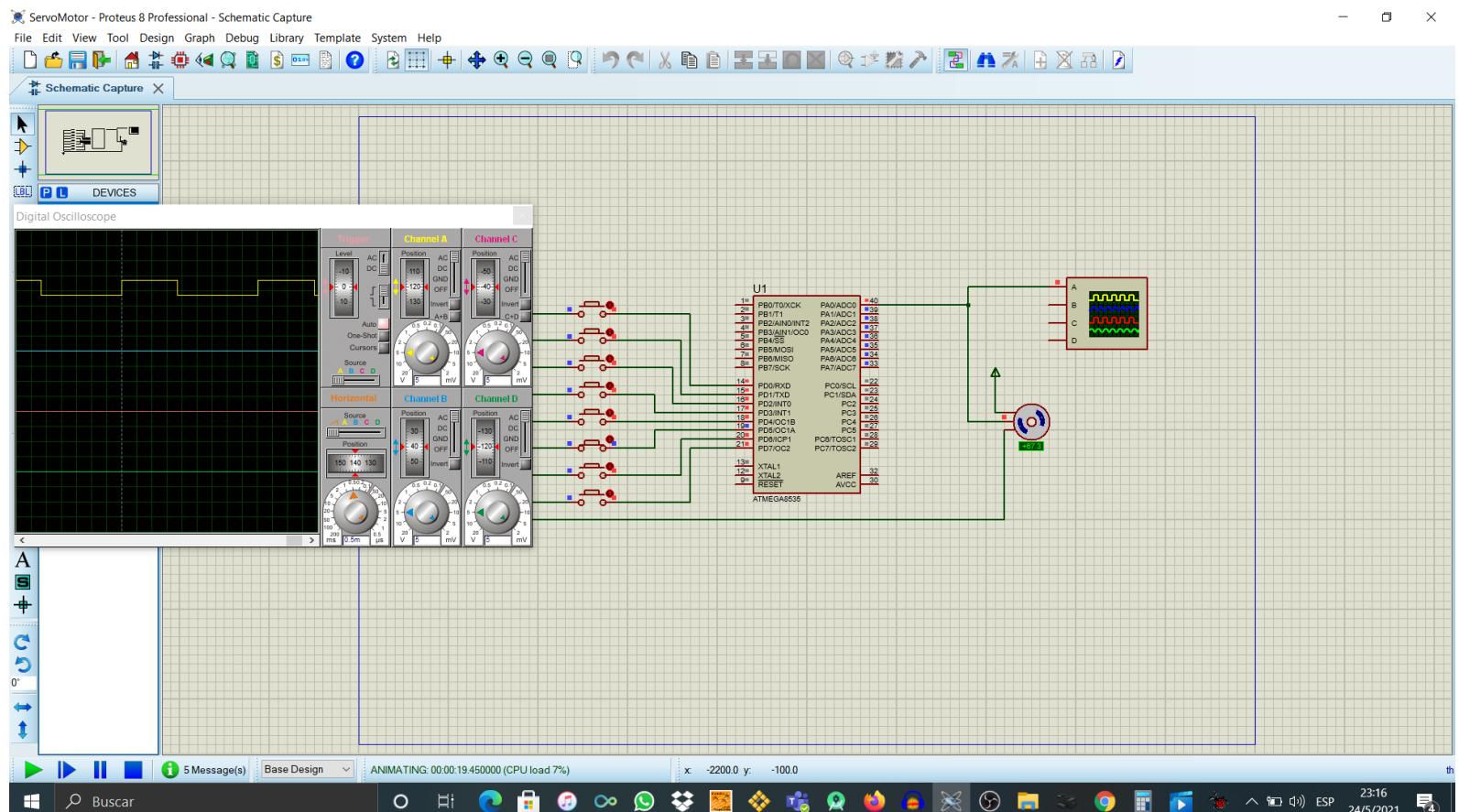
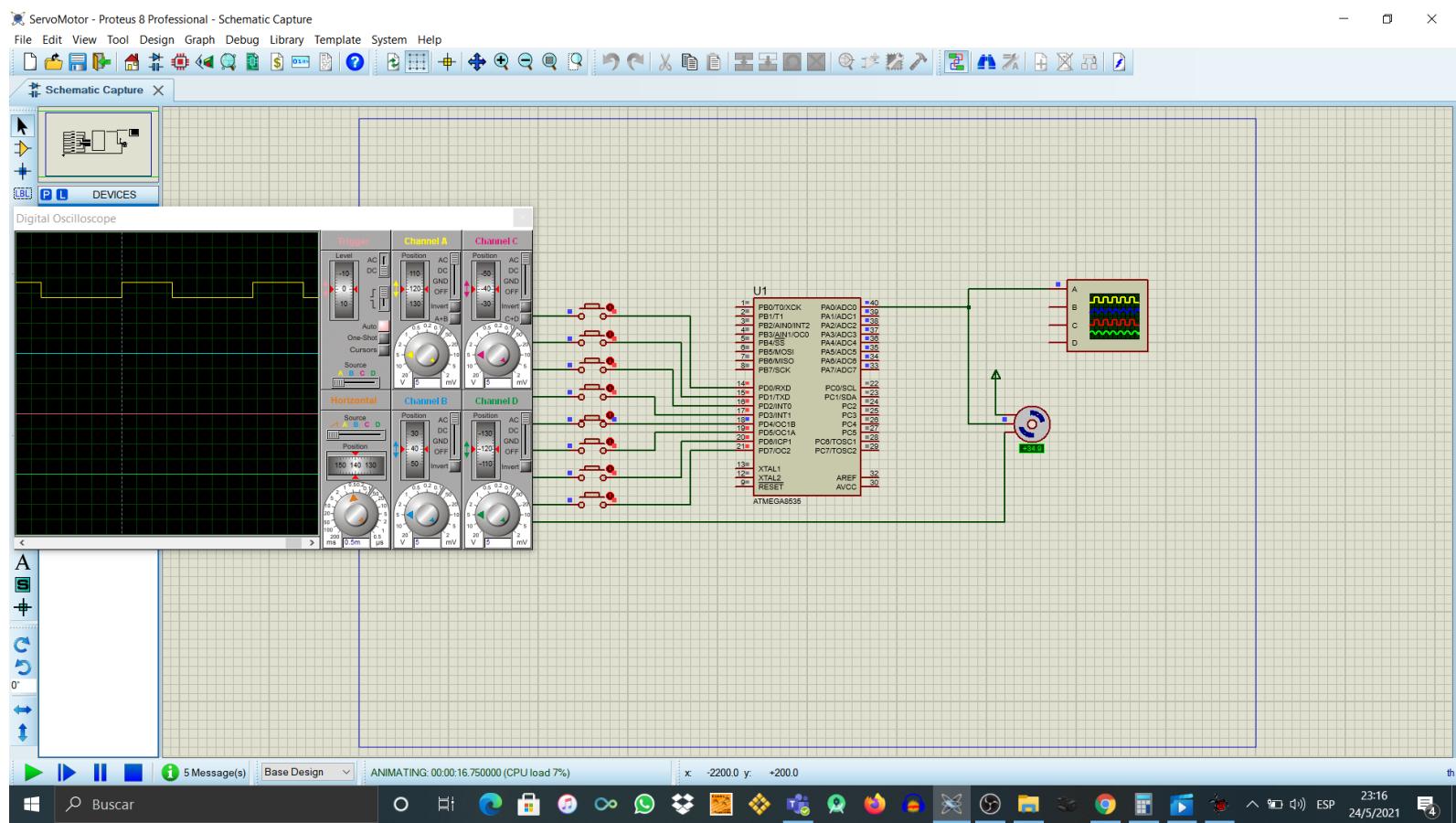
Build **Message** **Find in Files** **Breakpoints and Tracepoints**

ATmega8535 AVR Simulator Auto Stopped Ln 62, Col 1 CAP NUM SCR 23:27 24/5/2021

Simulación en Proteus





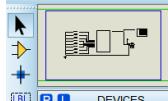


ServoMotor - Proteus 8 Professional - Schematic Capture

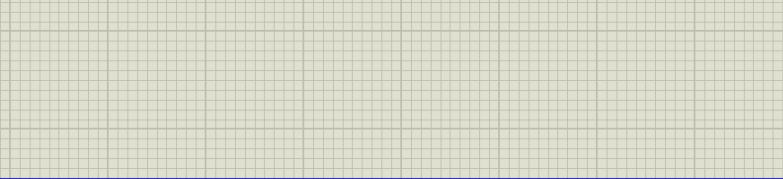
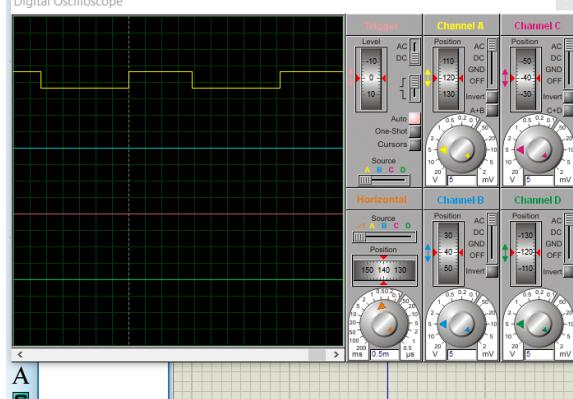
File Edit View Tool Design Graph Debug Library Template System Help



Schematic Capture X



Digital Oscilloscope



ANIMATING: 00:00:22.200000 (CPU load 7%)

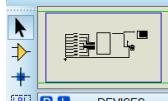


ServoMotor - Proteus 8 Professional - Schematic Capture

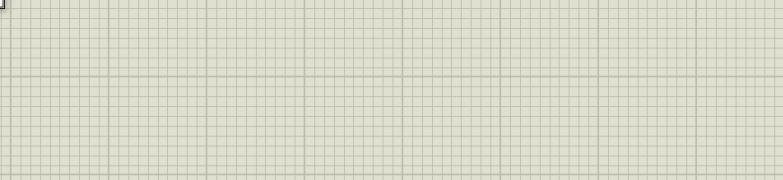
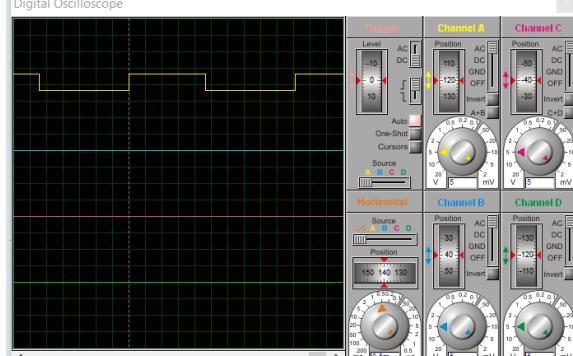
File Edit View Tool Design Graph Debug Library Template System Help



Schematic Capture X



Digital Oscilloscope



ANIMATING: 00:00:24.700000 (CPU load 6%)

