

/*

* Programa Final

*

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*/

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inicio:

```
LDI r16,LOW(RAMEND) ;
OUT SPL,r16 ;Permitimos el uso de subrutinas
LDI r16,HIGH(RAMEND) ;
OUT SPH,r16
```

```
ldi r16,0x00
out porta,r16
out portb,r16
out portc,r16 ;Configuramos entradas y salidas
out portd,r16 ;Entradas serán las respectivas a 'echo' de los sensores
ldi r16,0xff
out ddra,r16
out ddrb,r16
out ddrd,r16
ldi r16,0b00001001
out ddrc,r16
```

start:

```
.....
;.....
programa:
sbi portc,0; activar sensor1
ldi r16,0x00
loop10us:
inc r16
cpi r16,0x02
brne loop10us
cbi portc,0;desactivar sensor1

ldi r20,0x00;contador1=r20
.....
;loop prueba:esperar a que echo pase a alta antes de medir distancia
....
;rcall loopydelay100us
.....
loopprueba:
in r18,pinc
andi r18,0b000000010
cpi r18,0b000000010
brne loopprueba
.....
;.....
```

```

deteccion:
inc r20
in r18,pinc
andi r18,0b00000010
cpi r18,0b00000000;echo en cero al detectar sensor 1
breq sensor2 ;si hay detección pasamos a activar el sensor 2
rcall delay29us ;guardamos la distancia 1 en r20
rcall delay29us
cpi r20,0xFF
brne deteccion ;pasamos al sensor dos cuando se llega al maximo del registro
.....
sensor2:
sbi portc,3;activar sensor 2
ldi r16,0x00
loop10ussensor2:
inc r16
cpi r16,0x02
brne loop10ussensor2
cbi portc,3;desactivar sensor

ldi r21,0x00;contador2=r21
.....
;loop prueba:esperar a que echo pase a alta antes de medir distancia
....
;rcall loopydelay100us
.....
looppruebasensor2:
in r18,pinc
andi r18,0b0000001000
cpi r18,0b0000001000
brne looppruebasensor2
.....
deteccionsensor2:
inc r21
in r18,pinc
andi r18,0b0000001000; distancia de sensor 2 en r21
cpi r18,0b00000000;echo en cero al detectar sensor 2
breq salirsensor2
rcall delay29us
rcall delay29us
cpi r21,0xFF
brne deteccionsensor2

salirsensor2:
cpi r20,0xFF
brne compararcontadores
cpi r21,0xFF
brne compararcontadores ;si alguno es diferente a 255, se asegura haber detección
rjmp nodetecta

compararcontadores:
cp r20,r21
breq salidadetec
brsh salidadetecder;si r20 es mayor que r21, izquierda más lejos que derecha
rjmp salidadeteciz; si r21 es mayor que r20, derecha más lejos que izquierda

```

```

salidadetec:
;r17:contador=distancia
;cbi portd,0;apagar motor derecha
;cbi portd,1;apagar motor izquierda
mov r17,r20
mov r22,r17;r22 contador por seguridad
;out ocr0,r17;PWM
rcall terminarciclo
rjmp distanciaLCD;programa

```

```

salidadeteciz:
;cbi portd,0;apaga motor derecha
;sbi portd,1;prende motor izquierda
;out ocr0,r17;PWM
mov r17,r20
mov r22,r17
rcall terminarciclo
rcall configLCD

```

```

ldi r18,0x49;l
out porta,r18
rcall envia
ldi r18,0x7a;z
out porta,r18
rcall envia
ldi r18,0x71;q
out porta,r18
rcall envia
ldi r18,0x75;u
out porta,r18
rcall envia
ldi r18,0x69;i
out porta,r18
rcall envia
ldi r18,0x65;e
out porta,r18
rcall envia
ldi r18,0x72;r
out porta,r18
rcall envia
ldi r18,0x64;d
out porta,r18
rcall envia
ldi r18,0x61;a
out porta,r18
rcall envia

```

```

rcall linea2
rcall digitomayor
out porta,r18
rcall envia
rcall digitomedio
out porta,r18

```



```
rcall envia
rcall digitomenor
out porta,r18
rcall envia
ldi r18,0x63;c
out porta,r18
rcall envia
ldi r18,0x6D;m
out porta,r18
rcall envia
rjmp nodetectaLCD
.....
salidadetecder:
;sbj portd,0;prende motor derecha
;cbj portd,1;apaga motor izquierda
;out ocr0,r17;PWM
mov r17,r21
mov r22,r17;r22 contador por seguridad
rcall terminarciclo
```

```
rcall configLCD
```

```
ldi r18,0x44;D
out porta,r18
rcall envia
ldi r18,0x65;e
out porta,r18
rcall envia
ldi r18,0x72;r
out porta,r18
rcall envia
ldi r18,0x65;e
out porta,r18
rcall envia
ldi r18,0x63;c
out porta,r18
rcall envia
ldi r18,0x68;h
out porta,r18
rcall envia
ldi r18,0x61;a
out porta,r18
rcall envia
```

```
rcall linea2
rcall digitomayor
out porta,r18
rcall envia
rcall digitomedio
out porta,r18
rcall envia
rcall digitomenor
out porta,r18
rcall envia
ldi r18,0x63;c
out porta,r18
```



```
rcall envia
ldi r18,0x6D;m
out porta,r18
rcall envia
rjmp nodetectaLCD
;
;
;
nodetecta:
;cbi portd,0;apaga motores
;cbi portd,1
;ldi r17,0xff;apagar pwm
;out ocr0,r17;PWM
rcall configLCD
ldi r18,0x4E;N
out porta,r18
rcall envia
ldi r18,0x41;A
out porta,r18
rcall envia
ldi r18,0x44;D
out porta,r18
rcall envia
ldi r18,0x41;A
out porta,r18
rcall envia
;
;
rjmp nodetectaLCD
```

```
distanciaLCD:
rcall configLCD
mostrarmensaje:
ldi r18,0x43;C
out porta,r18
rcall envia
ldi r18,0x65;e
out porta,r18
rcall envia
ldi r18,0x6e;n
out porta,r18
rcall envia
ldi r18,0x74;t
out porta,r18
rcall envia
ldi r18,0x72;r
out porta,r18
rcall envia
ldi r18,0x6f;o
out porta,r18
rcall envia
```

```
rcall linea2
rcall digitomayor
out porta,r18
rcall envia
rcall digitomedio
out porta,r18
rcall envia
```



```
rcall digitomenor  
out porta,r18  
rcall envia  
ldi r18,0x63;c  
out porta,r18  
rcall envia  
ldi r18,0x6D;m  
out porta,r18  
rcall envia
```

```
nodetectaLCD:  
ldi r16,0x00
```

```
delayfinal:  
inc r16  
;rcall delaylcdms  
cpi r16,0x20  
brne delayfinal  
rjmp programa
```

```
delay29us:  
ldi r16,0x06;original 0x07  
delay_sub:  
dec r16  
brne delay_sub  
reti
```

```
configLCD:  
cbi portb,2;RS=0  
ldi r16,0x01  
out porta,r16  
rcall comando  
ldi r16,0x0c  
out porta,r16  
rcall comando  
ldi r16,0x3c  
out porta,r16  
rcall comando  
sbi portb,2;RS=1  
reti
```

```
linea2:  
cbi portb,2;RS=0  
ldi r16,0xc0  
out porta,r16  
rcall comando  
sbi portb,2;RS=1  
reti
```

```
comando:  
sbi portb,0  
rcall delaylcdms  
rcall delaylcdms  
cbi portb,0  
rcall delaylcdms
```



reti

```
delaycdms::1,53ms
ldi r18,0x00
loopdelaycdms:
rcall delay100us
inc r18
cpi r18,0xb
brne loopdelaycdms
reti
```

```
delay100us:
ldi r16,0x00
loopdelay100us:
inc r16
cpi r16,0x13
brne loopdelay100us
reti
```

```
envia:
sbi portb,2;RS=1
rcall comando
reti
```

.....

```
;r17=distancia(total)
;r18=dato a entregar
;r19=digito mayor
digitomayor:
ldi r18,0x32;ascii=2
ldi r19,0xC8;200
cpi r17,0xc8
brsh salidamayor
ldi r18,0x31;ascii=1
ldi r19,0x64;100
cpi r17,0x64
brsh salidamayor
ldi r18,0x00;ascii=null
ldi r19,0x00
salidamayor:
reti
```

```
digitomedio:
sub r17,r19;eliminamos centenas
ldi r18,0x39;9
ldi r19,0x5A;90
cp r17,r19
brsh salidamedio
ldi r18,0x38;8
ldi r19,0x50;80
cp r17,r19
brsh salidamedio
ldi r18,0x37;7
```

ldi r19,0x46;70
 cp r17,r19
 brsh salidamedio
 ldi r18,0x36;6
 ldi r19,0x3C;60
 cp r17,r19
 brsh salidamedio
 ldi r18,0x35;5
 ldi r19,0x32;50
 cp r17,r19
 brsh salidamedio
 ldi r18,0x34;4
 ldi r19,0x28;40
 cp r17,r19
 brsh salidamedio
 ldi r18,0x33;3
 ldi r19,0x1E;30
 cp r17,r19
 brsh salidamedio
 ldi r18,0x32;2
 ldi r19,0x14;20
 cp r17,r19
 brsh salidamedio
 ldi r18,0x31;1
 ldi r19,0x0A;10
 cp r17,r19
 brsh salidamedio
 ldi r18,0x30;0
 ldi r19,0x00
 salidamedio:
 reti

digitomenor:
 sub r17,r19;eliminamos decenas
 ldi r18,0x39;9
 ldi r19,0x09;9
 cp r17,r19
 brsh salidamenor
 ldi r18,0x38;8
 ldi r19,0x08;8
 cp r17,r19
 brsh salidamenor
 ldi r18,0x37;7
 ldi r19,0x07;7
 cp r17,r19
 brsh salidamenor
 ldi r18,0x36;6
 ldi r19,0x06;6
 cp r17,r19
 brsh salidamenor
 ldi r18,0x35;5
 ldi r19,0x05;5
 cp r17,r19
 brsh salidamenor
 ldi r18,0x34;4
 ldi r19,0x04;4



cp r17,r19
brsh salidamenor
ldi r18,0x33;3
ldi r19,0x03;3
cp r17,r19
brsh salidamenor
ldi r18,0x32;2
ldi r19,0x02;2
cp r17,r19
brsh salidamenor
ldi r18,0x31;1
ldi r19,0x01;1
cp r17,r19
brsh salidamenor
ldi r18,0x30;0
ldi r19,0x00
salidamenor:
reti

terminarciclo:
loopterminar:
inc r22
rcall delay29us
rcall delay29us
cpi r22,0xFF
brne loopterminar
reti



```
/*
 * Detector. Solo un sensor
 *
 *
 * Author: Magno Parra
 */
```

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inicio:

```
LDI r16,LOW(RAMEND) ;
OUT SPL,r16 ;permitimos el uso de subrutinas
LDI r16,HIGH(RAMEND) ;
OUT SPH,r16
```

```
ldi r16,0x00 ;;configuramosentradas y salidas:
out porta,r16;;Unicas entradas son las respectivas a echo del sensor ultrasónico
out portb,r16;; y la correspondiente al pulsador que nos permitirá una mejor apreciación de la
distancia en el LCD
out portc,r16
out portd,r16
ldi r16,0xff
out ddra,r16
out ddrb,r16
out ddrd,r16
ldi r16,0b00000101
out ddrc,r16
```

start:

```
.....
programa:
sbi portc,0;activar sensor
loop10us:
inc r16
cpi r16,0x02
brne loop10us
cbi portc,0;desactivar sensor

ldi r17,0x00;contador=r17
;loop prueba:esperar a que echo pase a alta antes de medir distancia
loopprueba:
in r18,pinc
andi r18,0b00000010
cpi r18,0b00000010
brne loopprueba
```

```

.....
deteccion:
inc r17
in r18,pinc
andi r18,0b00000010
cpi r18,0b00000000;echo en cero al detectar
breq salidadetec
rcall delay29us
rcall delay29us;; retraso para conseguir exactitud adecuada

```

```

.....
deteccion:
cpi r17,0xFF
brne deteccion
rjmp nodetecta

```

```

salidadetec:
;r17:contador=distancia
mov r22,r17;r22 contador por seguridad
ldi r16,0b01111001;activamos PWM
out tccr0,r16 ;de tal manera que mayor sea el contador
out ocr0,r17 ;menor el ciclo de trabajo

```

```

rcall terminarciclo
rjmp distanciaLCD;programa
nodetecta:
ldi r16,0b01111000; se desactiva PWM si no hay detección
out tccr0,r16
cbi portd,1
ldi r18,0x6e;n
out porta,r18
rcall envia
ldi r18,0x61;a
out porta,r18
rcall envia
ldi r18,0x64;d
out porta,r18
rcall envia
ldi r18,0x61;a ;Se envia el mensaje que no se detectó 'nada'
out porta,r18
rcall envia
.....
rjmp nodetectaLCD

```

```

distanciaLCD:
rcall configLCD ; Se envía 'Distancia'
mostrarmensaje: ; en la primera línea
ldi r18,0x44;D
out porta,r18
rcall envia
ldi r18,0x69;i
out porta,r18
rcall envia
ldi r18,0x73;s
out porta,r18
rcall envia
ldi r18,0x74;t

```

```
out porta,r18
rcall envia
ldi r18,0x61;a
out porta,r18
rcall envia
ldi r18,0x6e;n
out porta,r18
rcall envia
ldi r18,0x63;c
out porta,r18
rcall envia
ldi r18,0x69;j
out porta,r18
rcall envia
ldi r18,0x61;a
out porta,r18
rcall envia
```

```
rcall linea2
rcall digitomayor ;Se envía la distancia en cm al LCD
out porta,r18
rcall envia
rcall digitomedio
out porta,r18
rcall envia
rcall digitomenor
out porta,r18
rcall envia
ldi r18,0x63;c
out porta,r18
rcall envia
ldi r18,0x6D;m
out porta,r18
rcall envia
```

```
nodetectaLCD:
ldi r16,0x00
```

```
delayfinal:
inc r16
;rcall delaylcdms
cpi r16,0x20
brne delayfinal
```

```
verenLCD:
```

```
in r16,pinc
andi r16,0b10000000 ;Se procederá a otra medición cuando PC7 pase a '1'
cpi r16,0b10000000
brne verenLCD
rjmp programa
```

```
delay29us:
ldi r16,0x06;original 0x07
```

```
delay_sub:  
dec r16  
brne delay_sub  
reti
```

```
configLCD:  
cbi portb,2;RS=0  
ldi r16,0x01  
out porta,r16  
rcall comando  
ldi r16,0x0c  
out porta,r16  
rcall comando  
ldi r16,0x3c  
out porta,r16  
rcall comando  
sbi portb,2;RS=1  
reti
```

```
linea2:  
cbi portb,2;RS=0  
ldi r16,0xc0  
out porta,r16  
rcall comando  
sbi portb,2;RS=1  
reti
```

```
comando:  
sbi portb,0  
rcall delaylcdms  
rcall delaylcdms  
cbi portb,0  
rcall delaylcdms  
reti
```

```
delaylcdms::1,53ms  
ldi r18,0x00  
loopdelaylcdms:  
rcall delay100us  
inc r18  
cpi r18,0xb  
brne loopdelaylcdms  
reti
```

```
delay100us:  
ldi r16,0x00  
loopdelay100us:  
inc r16  
cpi r16,0x13  
brne loopdelay100us  
reti
```

```
envia:  
sbi portb,2;RS=1  
rcall comando
```



reti

.....

```

;r17=distancia(total)
;r18=dato a entregar
;r19=digito mayor
digitomayor:
ldi r18,0x32;ascii=2
ldi r19,0xC8;200
cpi r17,0xC8
brsh salidamayor
ldi r18,0x31;ascii=1
ldi r19,0x64;100
cpl r17,0X64
brsh salidamayor
ldi r18,0x00;ascii=null
ldi r19,0x00
salidamayor:
reti

digitomedio:
sub r17,r19;eliminamos centenas
ldi r18,0x39;9
ldi r19,0x5A;90
cpi r17,0X5A
brsh salidamedio
ldi r18,0x38;8
ldi r19,0x50;80
cpi r17,0x50
brsh salidamedio
ldi r18,0x37;7
ldi r19,0x46;70
cpi r17,0x46
brsh salidamedio
ldi r18,0x36;6
ldi r19,0x3C;60
cpi r17,0x3C
brsh salidamedio
ldi r18,0x35;5
ldi r19,0x32;50
cpi r17,0x32
brsh salidamedio
ldi r18,0x34;4
ldi r19,0x28;40
cpi r17,0x28
brsh salidamedio
ldi r18,0x33;3
ldi r19,0x1E;30
cpi r17,0x1E
brsh salidamedio
ldi r18,0x32;2
ldi r19,0x14;20
cpi r17,0x14
brsh salidamedio
    
```



ldi r18,0x31;1
ldi r19,0x0A;10
cpi r17,0x0A
brsh salidamedio
ldi r18,0x30;0
ldi r19,0x00
salidamedio:
reti

digitomenor:
sub r17,r19;eliminamos decenas

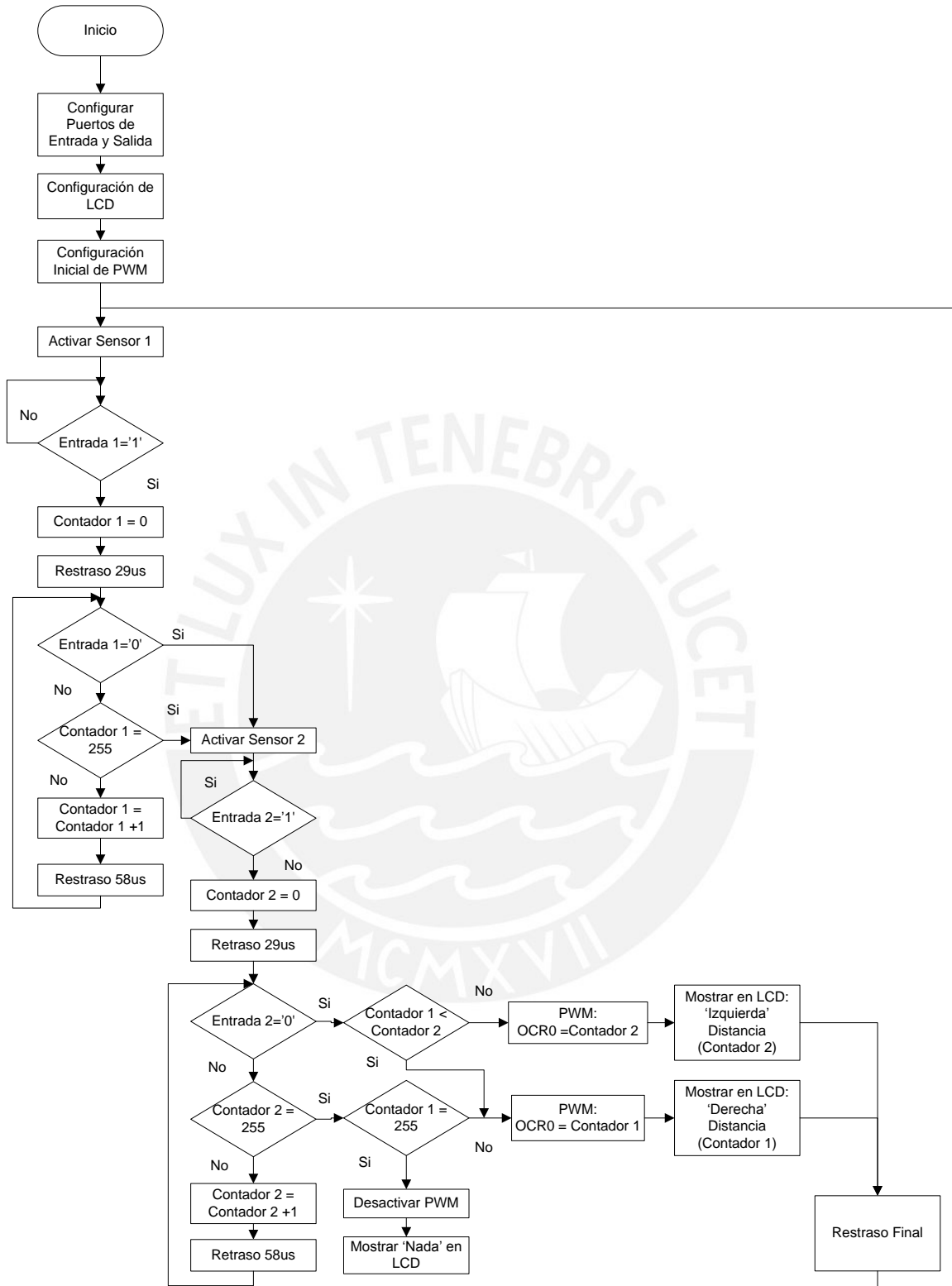
ldi r18,0x39;9
ldi r19,0x09;9
cp r17,r19
brsh salidamenor
ldi r18,0x38;8
ldi r19,0x08;8
cp r17,r19
brsh salidamenor
ldi r18,0x37;7
ldi r19,0x07;7
cp r17,r19
brsh salidamenor
ldi r18,0x36;6
ldi r19,0x06;6
cp r17,r19
brsh salidamenor
ldi r18,0x35;5
ldi r19,0x05;5
cp r17,r19
brsh salidamenor
ldi r18,0x34;4
ldi r19,0x04;4
cp r17,r19
brsh salidamenor
ldi r18,0x33;3
ldi r19,0x03;3
cp r17,r19
brsh salidamenor
ldi r18,0x32;2
ldi r19,0x02;2
cp r17,r19
brsh salidamenor
ldi r18,0x31;1
ldi r19,0x01;1
cp r17,r19
brsh salidamenor
ldi r18,0x30;0
ldi r19,0x00
salidamenor:
reti

terminarciclo:
loopterminar:
inc r22
rcall delay29us

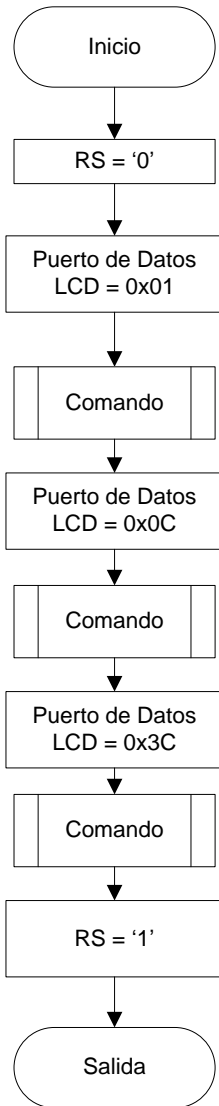


rcall delay29us
cpi r22,0xFF
brne loopterminar
reti

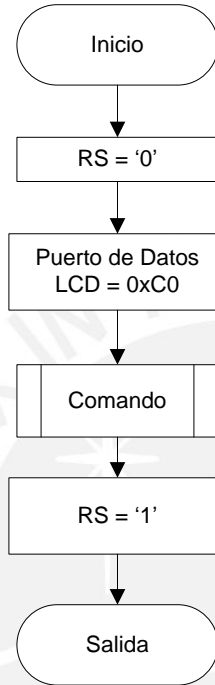




Configurar LCD



Para acceder a segunda línea:



Comando

