



```
*****
;          ROGRAMA PARA CONTAR PULSOS DE LA ONDA QRS DE LA ONDA ECG
;          DE LA PRIMERA DERIVACION BIPOLAR DE EINTHOVEN
;          23 de Marzo 2005
;          DALCAME
*****

listp=16F84A
;-----
;-----REGISTROS DE PROPOSITO ESPECIFICO (SFR)-----
;
tmro      equ 0x01
pcl       equ 0x02
status    equ 0x03
porta     equ 0x05
portb     equ 0x06
pclath    equ 0x0A
intcon    equ 0x0B

;-----REGISTROS DE PROPOSITO GENERAL-----
;
retardo1  equ 0x0C
retardo2  equ 0x0D
retardo3  equ 0x0E
resul     equ 0x0F
inter     equ 0x10
segundos  equ 0x11
minuto    equ 0x12
rata      equ 0x13
unidades  equ 0x14
decenas   equ 0x15
centenas  equ 0x16
aux       equ 0x17
t         equ 0x18
cinco     equ 0x19
ret1      equ 0x1A
ret2      equ 0x1B
ret3      equ 0x1C
dato_a    equ 0x1D
dato_b    equ 0x1E
A4        equ 0x1F
zumba     equ 0x20

;-----VECTORES DE DIRECCIONAMIENTO-----
;
org       0
goto     INICIO
org       4
goto     INTERRUPCION
org       5
```



----- INICIO DEL PROGRAMA -----

```
;
;
INICIO    bsf      status,5
          movwf   portb
          movlw   b'00001000'
          movwf   porta
          movlw   b'00000111'
          movwf   tmro
          bcf     status,5
          bcf     porta,0
          bcf     porta,2
          clrf    rata
          movlw   b'00001010'
          movwf   unidades
          movwf   decenas
          movwf   centenas
          movlw   b'00111100'
          movwf   minuto
          clrf    porta
          clrf    portb
          clrf    t
          movlw   b'01010000'
          movwf   cinco
          goto    START
```

----- INFORMACIÓN -----

```
;
;
D1        addwf   pcl,1
          DT"INGENIERIA",00

D2        addwf   pcl,1
          DT"BIOMEDICA",00

D3        addwf   pcl,1
          DT"MODULO MEDICION",00

D4        addwf   pcl,1
          DT"RATA CARDIACA",00

D5        addwf   pcl,1
          DT"PULSE INICIO",00

D6        addwf   pcl,1
          DT"LECTURA EN",00

D7        addwf   pcl,1
          DT"PROCESO...",00

D8        addwf   pcl,1
```



```
DT"SUS PPM SON:",00

D9      addwf    pcl,1
        DT"NORMAL",00

D10     addwf    pcl,1
        DT"TAQUICARDIA",00

D11     addwf    pcl,1
        DT"BRADICARDIA",00

D12     addwf    pcl,1
        DT"09876543210",00

D13     addwf    pcl,1
        DT"HECHO POR",00

D14     addwf    pcl,1
        DT"DALCAME",00

D15     addwf    pcl,1
        DT"REVIZAR CONEXION",00

D16     addwf    pcl,1
        DT"OPRIMA RESET",00
```

```
;----- INTERRUPTIÓN -----
INTERRUPCION  decfsz    cinco,1
               goto     PRO
               goto     MIRAR
PRO           decfsz    segundos,1
               goto     SEGUIR
               movlw    b'00010000'
               movwf    segundos
               decfsz    minuto,1
               goto     SEGUIR
               movlw    b'00111100'
               movwf    minuto
               call     TOTAL
               movlw    b'00000000'
               iorwf    t,0
               btfss    status,2
               goto     TAQUI
               movf     rata,0
               sublw    b'00111100'
               btfsc    status,0
               goto     BRADI
               movf     rata,0
               sublw    b'01100100'
```



---

```
        btfsc    status,0
        goto     NORMAL
        goto     TAQUI

BRADI   bsf      status,5
        bcf      portb,3
        bcf      status,5
        bcf      portb,3
        movlw   b'00001101'
        movwf   retardo3
        call    RETARDO
        bsf      portb,3
        bsf      status,5
        bsf      portb,3
        bcf      status,5
        movlw   b'11000010'
        call    LCD_REG
        movlw   b'00101100'
        call    LCD_REG
        call    MEN11
        call    PARPADEO
        goto    MAS

NORMAL  bsf      status,5
        bcf      portb,3
        bcf      status,5
        bcf      portb,3
        movlw   b'00000101'
        movwf   retardo3
        call    RETARDO
        bsf      portb,3
        bsf      status,5
        bsf      portb,3
        bcf      status,5
        movlw   b'11000101'
        call    LCD_REG
        movlw   b'01011100'
        call    LCD_REG
        call    MEN9
        goto    MAS

TAQUI   bsf      status,5
        bcf      portb,3
        bcf      status,5
        movlw   b'00001101'
        movwf   retardo3
        call    RETARDO
        bsf      portb,3
        bsf      status,5
        bsf      portb,3
```



```
        bcf      status,5
        movlw   b'11000010'
        call    LCD_REG
        movlw   b'00101100'
        call    LCD_REG
        call    MEN10
        call    PARPADEO
```

```
MAS      call    RESET1
```

```
MIRAR   movlw   b'11111111'
        andwf   rata,0
        btfss   status,2
        goto    PRO
        call    LETRERO
        clrfs   retardo3
        call    RETARDO
```

```
SEGUIR  movlw   b'10100000'
        movwf   intcon
        movwf   tmro
        retfie
```

```
;-----RUTINAS LCD-----
```

```
;
```

```
;Chequea la bandera busy del LCD
```

```
LCD_BUSY bsf      porta,1
        bsf      status,5
        movlw   b'11111111'
        movwf   portb
        bcf      status,5
        bsf      porta,2
        nop
```

```
L_BUSY  btfsc   portb,7
        goto    L_BUSY
        bcf      porta,2
        bsf      status,5
        movlw   b'00001111'
        movwf   portb
        bcf      status,5
        bcf      porta,1
        return
```

```
;Activa el módulo LCD
```

```
LCD_E   bsf      porta,2
        nop
        bcf      porta,2
        return
```



---

;Visualiza un dato en el LCD o para escribirlo en la CGRAM

```
LCD_DATOS    bcf      porta,0
              movwf   portb
              call    LCD_BUSY
              bsf     porta,0
              goto    LCD_E
```

;Lleva un comando al LCD

```
LCD_REG      bcf      porta,0
              movwf   portb
              call    LCD_BUSY
              goto    LCD_E
```

;Inicialización del módulo

```
LCD_INI      movlw   b'00110000'
              call    LCD_REG
              call    DELAY_5MS
              movlw   b'00110000'
              call    LCD_REG
              call    DELAY_5MS
              movlw   b'00110000'
              call    LCD_REG
              call    DELAY_5MS
              movlw   b'00100000'
              call    LCD_REG
              call    DELAY_5MS
              movlw   b'00101000'
              call    LCD_REG
              call    DELAY_5MS
              movlw   b'10000010'
              call    LCD_REG
              call    DELAY_5MS
              movlw   b'00001000'
              call    LCD_REG
              call    DELAY_5MS
              movlw   b'10000000'
              call    LCD_REG
              call    DELAY_5MS
              call    BORRA
              call    DELAY_5MS
              call    LCDON
              call    DELAY_5MS
              return
```

;Borra el display y retorna el cursor a la posición 0

```
BORRA        movlw   b'00000001'
              call    LCD_REG
              movlw   b'00010000'
              call    LCD_REG
              return
```



```
;Control del display y cursor. Activa el display y desactiva el cursor
LCDON      movlw      b'00001100'
           call       LCD_REG
           movlw      b'11000000'
           call       LCD_REG
           return
```

```
;Incrementa la dirección del cursor(I/D).Modo normal(S)
IDS        movlw      b'00000110'
           call       LCD_REG
           movlw      b'01100000'
           call       LCD_REG
           return
```

```
;----- RETARDO -----
;
RETARDO    clr        retardo1
           clr        retardo2
RETAR1     decfsz     retardo1,1
           goto      RETAR1
           decfsz     retardo2,1
           goto      RETAR1
           decfsz     retardo3,1
           goto      RETAR1
           return
```

```
;Efectua 90 milisegundos de retardo
```

```
DELAY50    movlw      0x01
           movwf      ret3
TRES       movlw      0x80
           movwf      ret2
DOS        movlw      0x80
           movwf      ret1
UNO        decfsz     ret1,1
           goto      UNO
           decfsz     ret2,1
           goto      DOS
           decfsz     ret3,1
           goto      TRES
           return
```

```
;Efectua 100 milisegundos de retardo
```

```
DELAY100   movlw      0x01
           movwf      ret3
           clr        ret1
           clr        ret2
D50        decfsz     ret1,1
```



```
Goto      D50
decfsz   ret2,1
goto     D50
decfsz   ret3,1
goto     D50
return
```

;Efectua cinco milisegundos de retardo

```
DELAY_5MS    movlw    0x1A
              movwf    dato_b
              clrf     dato_a
DELAY_1      decfsz   dato_a,1
              goto     DELAY_1
              decfsz   dato_b,1
              goto     DELAY_1
              return
```

;----- MENSAJES -----

;\*\*\*\*\*"INGENIERIA"\*\*\*\*\*

```
MEN1        clr     A4
              clr     resul
MEN1_1      mov     resul,0
              call    D1
              iorlw   0
              btfsc   status,2
              return
              movwf   A4
              call    LCD_DATOS
              swapf   A4,0
              call    LCD_DATOS
              incf    resul,1
              call    DELAY100
              call    IDS
              goto    MEN1_1
```

;\*\*\*\*\*"BIOMEDICA"\*\*\*\*\*

```
MEN2        clr     A4
              clr     resul
MEN2_1      mov     resul,0
              call    D2
              iorlw   0
              btfsc   status,2
              return
              movwf   A4
              call    LCD_DATOS
              swapf   A4,0
```





```
call    LCD_DATOS
incf    resul,1
call    DELAY100
call    IDS
goto    MEN2_1
```

```
*****"MODULO MEDICION"*****
```

```
MEN3      clr     A4
          Clrf    resul
MEN3_1    movf    resul,0
          call   D3
          iorlw  0
          btfsc  status,2
          return
          movwf  A4
          call   LCD_DATOS
          swapf  A4,0
          call   LCD_DATOS
          incf   resul,1
          call   DELAY100
          call   IDS
          goto   MEN3_1
```

```
*****"RATA CARDIACA"*****
```

```
MEN4      clr     A4
          clr     resul
MEN4_1    movf    resul,0
          call   D4
          iorlw  0
          btfsc  status,2
          return
          movwf  A4
          call   LCD_DATOS
          swapf  A4,0
          call   LCD_DATOS
          incf   resul,1
          call   DELAY100
          call   IDS
          goto   MEN4_1
```

```
*****"PULSE INICIO"*****
```

```
MEN5      clr     A4
          clr     resul
MEN5_1    movf    resul,0
          call   D5
          iorlw  0
          btfsc  status,2
          return
          movwf  A4
```



```
        call    LCD_DATOS
        swapf   A4,0
        call    LCD_DATOS
        incf    resul,1
        call    DELAY100
        call    IDS
        goto    MEN5_1

;*****"LECTURA EN"*****
MEN6      clr    A4
          clr    resul
MEN6_1    mov    resul,0
          call   D6
          iorlw  0
          btfsc  status,2
          return
          movwf  A4
          call   LCD_DATOS
          swapf  A4,0
          call   LCD_DATOS
          incf   resul,1
          call   DELAY100
          call   IDS
          goto   MEN6_1

;*****"PROCESO"*****

MEN7      clr    A4
          clr    resul
MEN7_1    mov    resul,0
          call   D7
          iorlw  0
          btfsc  status,2
          return
          movwf  A4
          call   LCD_DATOS
          swapf  A4,0
          call   LCD_DATOS
          incf   resul,1
          call   DELAY100
          call   IDS
          goto   MEN7_1

;*****"SUS PPM SON:"*****

MEN8      clr    A4
          clr    resul
MEN8_1    mov    resul,0
          call   D8
          iorlw  0
```



```
    btfsc    status,2
    return
    movwf   A4
    call    LCD_DATOS
    swapf   A4,0
    call    LCD_DATOS
    incf    resul,1
    call    DELAY100
    call    IDS
    goto    MEN8_1
```

```
;*****"NORMAL"*****
```

```
MEN9      clr    A4
           clr    resul
MEN9_1    movf   resul,0
           call   D9
           iorlw  0
           btfsc  status,2
           return
           movwf  A4
           call   LCD_DATOS
           swapf  A4,0
           call   LCD_DATOS
           incf   resul,1
           call   DELAY100
           call   IDS
           goto   MEN9_1
```

```
;*****"TAQUICARDIA"*****
```

```
MEN10     clr    A4
           clr    resul
MEN10_1    movf   resul,0
           call   D10
           iorlw  0
           btfsc  status,2
           return
           movwf  A4
           call   LCD_DATOS
           swapf  A4,0
           call   LCD_DATOS
           incf   resul,1
           call   DELAY100
           call   IDS
           goto   MEN10_1
```

```
;*****"BRADICARDIA"*****
```

```
MEN11     clr    A4
```



```
MEN11_1      clrfr      resul
             movfr      resul,0
             call       D11
             iorlw     0
             btfsc     status,2
             return
             movwf     A4
             call      LCD_DATOS
             swapf     A4,0
             call      LCD_DATOS
             incf     resul,1
             call      DELAY100
             call      IDS
             goto     MEN11_1
```

;\*\*\*\*\*"09876543210 CENTENAS DECENAS Y UNIDADES"\*\*\*\*\*

```
MEN12      clrfr      A4
             clrfr      resul
MEN12_1     movfr      resul,0
             call       D12
             iorlw     0
             btfsc     status,2
             return
             movwf     A4
             call      LCD_DATOS
             swapf     A4,0
             call      LCD_DATOS
             incf     resul,1
             call      DELAY100
             call      IDS
             goto     MEN12_1
```

;\*\*\*\*\*"HECHO POR"\*\*\*\*\*

```
MEN13      clrfr      A4
             clrfr      resul
MEN13_1     movfr      resul,0
             call       D13
             iorlw     0
             btfsc     status,2
             return
             movwf     A4
             call      LCD_DATOS
             swapf     A4,0
             call      LCD_DATOS
             incf     resul,1
             call      DELAY100
             call      IDS
             goto     MEN13_1
```



\*\*\*\*\*"DALCAME"\*\*\*\*\*

```
MEN14      clrfr      A4
           clrfr      resul
MEN14_1    movfr      resul,0
           call       D14
           iorlw     0
           btfsc    status,2
           return
           movwf     A4
           call      LCD_DATOS
           swapf     A4,0
           call      LCD_DATOS
           incf      resul,1
           call      DELAY100
           call      IDS
           goto     MEN14_1
```

\*\*\*\*\*"REVIZAR CONEXION"\*\*\*\*\*

```
MEN15      clrfr      A4
           clrfr      resul
MEN15_1    movfr      resul,0
           call       D15
           iorlw     0
           btfsc    status,2
           return
           movwf     A4
           call      LCD_DATOS
           swapf     A4,0
           call      LCD_DATOS
           incf      resul,1
           call      DELAY100
           call      IDS
           goto     MEN15_1
```

\*\*\*\*\*"OPRIMA RESET"\*\*\*\*\*

```
MEN16      clrfr      A4
           clrfr      resul
MEN16_1    movfr      resul,0
           call       D16
           iorlw     0
           btfsc    status,2
           return
           movwf     A4
           call      LCD_DATOS
           swapf     A4,0
           call      LCD_DATOS
           incf      resul,1
```



```

        call    DELAY100
        call    IDS
        goto    MEN16_1

;----- PARPADEO -----
;
PARPADEO    movlw    b'00001010'
            movwf    retardo3
            call    RETARDO
            movlw    b'00000101'
            movwf    inter

PARPADEO1  movlw    b'00001000'
            call    LCD_REG
            movlw    b'10000000'
            call    LCD_REG
            movlw    b'00000011'
            movwf    retardo3
            call    RETARDO
            movlw    b'00001100'
            call    LCD_REG
            movlw    b'11000000'
            call    LCD_REG
            movlw    b'00000011'
            movwf    retardo3
            call    RETARDO
            decfsz  inter,1
            goto    PARPADEO1
            return

;*****Configuración pantalla*****
START      call    LCD_INI
            call    BORRA
            call    LCDON

;letrero INGENERIA BIOMEDICA
            movlw    b'10000011'
            call    LCD_REG
            movlw    b'00111000'
            call    LCD_REG
            call    MEN1
            movlw    b'11000100'
            call    LCD_REG
            movlw    b'01001100'
            call    LCD_REG
            call    MEN2

;----- CORAZÓN -----
;Datos del Corazón
            call    BORRA
```



```
call    IDS
call    LCDON
movlw   b'01000000'
call    LCD_REG
movlw   b'00000100'
call    LCD_REG
movlw   b'00000000'
call    LCD_DATOS
movlw   b'00000000'
call    LCD_DATOS
movlw   b'00001010'
call    LCD_DATOS
movlw   b'10100000'
call    LCD_DATOS
movlw   b'00011111'
call    LCD_DATOS
movlw   b'11110001'
call    LCD_DATOS
movlw   b'00011111'
call    LCD_DATOS
movlw   b'11110001'
call    LCD_DATOS
movlw   b'00001110'
call    LCD_DATOS
movlw   b'11100000'
call    LCD_DATOS
movlw   b'00000100'
call    LCD_DATOS
movlw   b'01000000'
call    LCD_DATOS
movlw   b'00000000'
call    LCD_DATOS
movlw   b'00000000'
call    LCD_DATOS
movlw   b'00000000'
call    LCD_DATOS
movlw   b'00000000'
call    LCD_DATOS
movlw   b'00000000'
call    LCD_DATOS
```

;Posicionamiento del corazón

```
movlw   b'10000000'
movwf   resul
COR     movf   resul,0
call    LCD_REG
swapf   resul,0
call    LCD_REG
movlw   b'00000000'
call    LCD_DATOS
movlw   b'00000000'
call    LCD_DATOS
```



```
call    DELAY100
movlw   b'00000001'
call    LCD_REG
movlw   b'00010000'
call    LCD_REG
incf    resul,1
movlw   b'10010000'
xorwf   resul,0
btfss   status,2
goto    COR
movlw   b'11001111'
movwf   resul
COR1    movf    resul,0
call    LCD_REG
swapf   resul,0
call    LCD_REG
movlw   b'00000000'
call    LCD_DATOS
movlw   b'00000000'
call    LCD_DATOS
call    DELAY100
movlw   b'00000001'
call    LCD_REG
movlw   b'00010000'
call    LCD_REG
decf    resul,1
movlw   b'10111111'
xorwf   resul,0
btfss   status,2
goto    COR1
```

;----- LETREROS -----

;Letrero MODULO MEDICION RATA CARDIACA

```
call    BORRA
call    LCDON
movlw   b'10000000'
call    LCD_REG
movlw   b'00000001'
call    LCD_REG
call    MEN3
movlw   b'11000001'
call    LCD_REG
movlw   b'00011100'
call    LCD_REG
call    MEN4
```

;Letrero PULSE INICIO

```
call    BORRA
call    LCDON
```





```
        movlw    b'10000010'
        call     LCD_REG
        movlw    b'00101000'
        call     LCD_REG
        call     MEN5

;Configuración para pulso de inicio
        bsf      status,5
        bsf      porta,4
        bcf      status,5
COMIENZO btfsc      porta,4
        goto     COMIENZO
        bsf      status,5
        bcf      porta,4
        bcf      status,5

;Letrero LECTURA EN PROCESO...
        call     BORRA
        call     LCDON
        movlw    b'10000011'
        call     LCD_REG
        movlw    b'00111000'
        call     LCD_REG
        call     MEN6
        movlw    b'11000011'
        call     LCD_REG
        movlw    b'00111100'
        call     LCD_REG
        call     MEN7

;Configuración tmro
        movlw    b'10100000'
        movwf    intcon
        movlw    b'00010000'
        movwf    segundos
        movlw    b'00001100'
        movwf    tmro

;----- TESTEO PULSO -----
;
BUCLE   btfss    porta,3
        goto     BUCLE
        clrf     aux
BUCLE1  decfsz   aux,1
        goto     BUCLE1

;----- CONTADOR DE LOS PULSOS -----
;
CONTADOR  incf     rata,1
        btfsc    rata,7
```



```
incf      t,1
bsf       status,5
bcf       portb,1
bcf       status,5
bcf       portb,1
call      DELAY50
bsf       portb,1
bsf       status,5
bsf       portb,1
bcf       status,5
decfsz   unidades,1
goto     BUCLE
movlw    b'00001010'
movwf    unidades
decfsz   decenas,1
goto     BUCLE
movlw    b'00001010'
movwf    decenas
decfsz   centenas,1
goto     BUCLE
goto     BUCLE
```

```
;----- PPM -----
TOTAL      call      BORRA
           call      LCDON
           movlw    b'10000000'
           call      LCD_REG
           movlw    b'00001000'
           call      LCD_REG
           call      MEN8
           movlw    b'10001101'
           call      LCD_REG
           movlw    b'11011000'
           call      LCD_REG
           movf     centenas,0
           call      D12
           movwf   A4
           call      LCD_DATOS
           swapf   A4,0
           call      LCD_DATOS
           movlw    b'10001110'
           call      LCD_REG
           movlw    b'11101000'
           call      LCD_REG
           movf     decenas,0
           call      D12
           movwf   A4
           call      LCD_DATOS
           swapf   A4,0
           call      LCD_DATOS
```



```
movlw    b'10001111'  
call     LCD_REG  
movlw    b'11111000'  
call     LCD_REG  
movf     unidades,0  
call     D12  
movwf    A4  
call     LCD_DATOS  
swapf    A4,0  
call     LCD_DATOS  
return
```

;-----"REVIZAR CONEXION"-----

```
LETRERO   call     BORRA  
          call     LCDON  
          movlw    b'10000000'  
          call     LCD_REG  
          movlw    b'00001000'  
          call     LCD_REG  
          call     MEN15  
          movlw    b'11000010'  
          call     LCD_REG  
          movlw    b'00101100'  
          call     LCD_REG  
          call     MEN16  
          bsf     status,5  
          bcf     portb,0  
          bcf     status,5  
LOOP      bcf     portb,0  
          call     DELAY50  
          bsf     portb,0  
          call     DELAY50  
          goto    LOOP  
          return
```

;Configuración para pulso de Reset

```
RESET1    bsf     status,5  
          bsf     porta,4  
          bcf     status,5  
RESET     btfsc   porta,4  
          goto    RESET  
          bsf     status,5  
          bcf     porta,4  
          bcf     status,5
```

;Letrero HECHO POR DALCAME

```
call     BORRA  
call     LCDON  
movlw    b'10000100'  
call     LCD_REG
```



---

```
movlw    b'01001000'  
call     LCD_REG  
call     MEN13  
movlw    b'11000101'  
call     LCD_REG  
movlw    b'01011100'  
call     LCD_REG  
call     MEN14  
movlw    b'00001010'  
movwf    retardo3  
call     RETARDO  
call     BORRA  
goto     INICIO  
end
```