# LOCALIZADOR GEOGRAFICO PARA AUTOSTAR (GLA)

# GEOGRAPHIC LOCATOR for AUTOSTAR

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We go by parts ....
.
## 1. - Description of the device.

This device consists of a basic Programmer for Autostar via port series RS232 and an aid for the putting in station of the telescope.
With him we can program in the Autostar the following parameters:

      A. - Extracted local time of the information of the GPS. (Time UTC)
      B. - extracted present Date of the information of the GPS
      C. - Length, Geographical coordinates of the Observatory or the extracted Telescope
of the information of the GPS
      D. - Latitude, Geographical coordinates of the Observatory or the extracted Telescope of the information of the GPS

ATTENTION: this port series requires the adaptation of levels since the out of the microprocessor is TTL, reason why will be necessary to include an adapter type MAX232 so that it works correctly.

**Sensors Including:**

**Generic GPS** (Not the one of Parallax) that generates plot GPRMC by second e once indication of PPS (Pulse per second, used to indicate to the user the validation of the data received via satellite by part of the GPS)

**Digital compass** I2C (CMPS03) bought or made by one same one, which I do not recommend if the sufficient knowledge of Hardware and Software are not had

**Accelerometers**: ADXL320 (2 Units).
First it will indicate the inclination to us of the axis of latitude of the telescope….in my case     41º 40' (My house, Zaragoza, Spain)

The second, indicates the planitud to us of the positioned one of the Tripod, essential for a pursuit in suitable conditions.
A converter AD of 16 bits DS2450 read these accelerometers. Thermometers can be included 1-wire of Dallas type DS1920 in case it interests to know to the temperature of some point of the telescope or the room temperature to us, modifying a little the software of the microprocessor.
Almost all the used components are "normal" and they are possible to be obtained in any distributor of BASIC STAMP (Parallax for example) since the objective of the

project is to simplify in the greater measurement the programming and construction of the equipment…

Not to spend much money and to do it one same one to it are the best thing than it can happen to you…

**Labor improbus omnia vincit** (Virgilio)

**Operation:**
The equipment shows all the information in display of 4 lines incorporated of the following way…
        Screen 1. - Inclinometers. Information on Planitud of the Tripod, inclination of the axis latitude. The angle marked by the inclinometer and the Latitude read by the GPS must be identical, more or less….
        Screen 2. -  Information Time/date (Always that the information of  GPS this validating). Information of Geographic Location, Length and Latitude (Whenever the information of  GPS this validating). Digital compass. Information on the deviation with respect to the magnetic Earth pole
        Screen 3. - Autostar Update. It allows to introduce information GPS in the Autostar

**How To:**
First we must position the tripod correctly, for as we will go to screen 1

        1. - We will move the tripod until in display we read the following indication:
                CMPS: 000,00 Degrees

        This indicates that the compass to us this  aiming towards the magnetic north, therefore, our tripod also, by all means whenever we correctly have the placed compass in the tripod ☺.
        Also we could validate the direction with values like  CMPS: 359,35 Degrees for example, since it will be difficult to orient the tripod so that it marks 0 exactly degrees…
        It is necessary to remember that the resolution and the precision are different concepts….
        We can have an error of 0.2° or more due to the proximity of some electromagnetic field like for example a laying of high tension or an important iron mass….
        2. - To put the tripod at level. We must read in the screen a 1 information similar to which is down, with changing values:
For example:

        X-axis: 089.7g--39712
        Y-axis: 091.2g--39057

         First value (X-axis: 089.7g) - value in inclination degrees x-axis.
        Second value (39712) ----------value of the converter (0-65535)

These two values raising or lowering based on how we move the tripod, until it appears the following information

It is practically impossible to obtain the following reading due to the noise that appears in converter AD….but an example is single.

X-axis: 090.0g--39945

Axis and: 090.0g--38756

At this moment, we correctly have at level the tripod.

3. - To hope to that the GPS validates the information satellite.

The Geographic for Locator Autostar (**GLA**) it indicated to us with LED "GPS OK" that the information is correct .....

It will appear in screen 2 the latitude read by the GPS .....

We will change the angle of the wedge of the telescope until the reading of the inclinometer, Screen 1, is the same one, more or less, that the indicated one by the GPS.

We already have the parallel angle of latitude to the one of the Earth.

Arrived at this point, already we can update the Autostar with information GPS.

3. - We pressed the button "Update" to update the Autostar or PageUp if we want to cancel the action and to return to screen 1

Either it is, or we can align the telescope and begin to watch the sky….

I understand that the apparatus can turn out complex to make by the type of components that takes, but I have worked to do all but simple the possible one .....

Always, or almost always, I will be in [flamarca@able.es](mailto:flamarca@able.es)

..... Hour European ....

Good luck to all and I hope that you enjoy this small aid….

If somebody constructs it, please, send me a mail.

**Información adicional:**

Module Basic Stamp : http://www.parallax.com/detail.asp?product_id=BS2P24-IC

Compass Digital: http://www.robot-electronics.co.uk/htm/cmps3doc.shtml

Inclinometers: http://www.analog.com/en/prod/0,2877,ADXL320,00.html

GPS: http://www.deluoelectronics.com/customer/89-DGM-100_GPS_Module

Display: http://character-lcd-lcds.shopeio.com/inventory/details.asp?id=1196&cat=Lcds&sub=Character%20Lcd

Max232 y DS2450: http://www.maxim-ic.com/quick_view2.cfm/qv_pk/1798

Software desarrollo esquema y PCB: http://www.cadsoft.de/

Telescope: http://www.meade.com/ por supuesto

Mi trabajo: http://www.teltronic.es/ Departamento R&D

**Photographs: General**
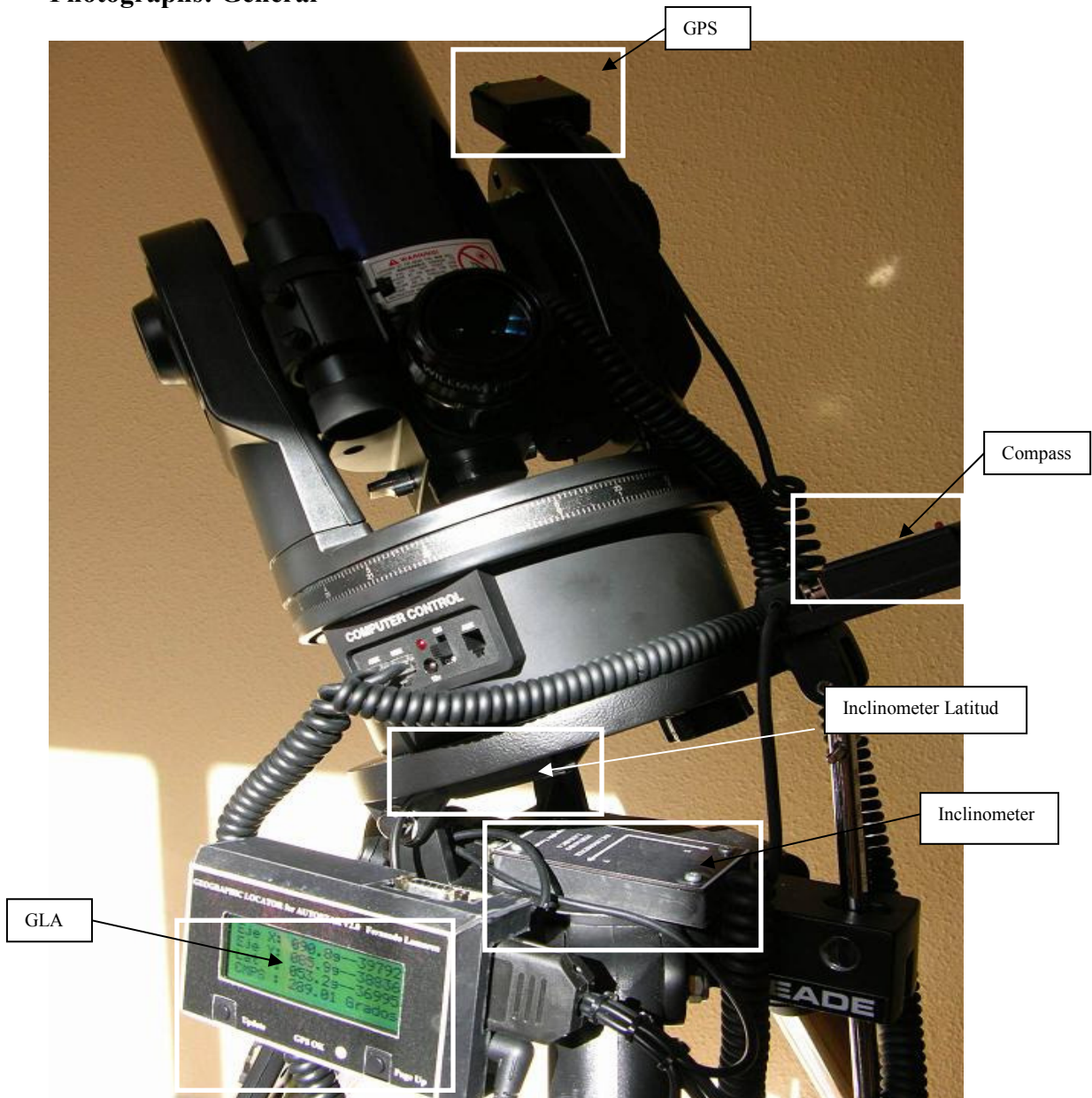
## Inclinometers Detail:
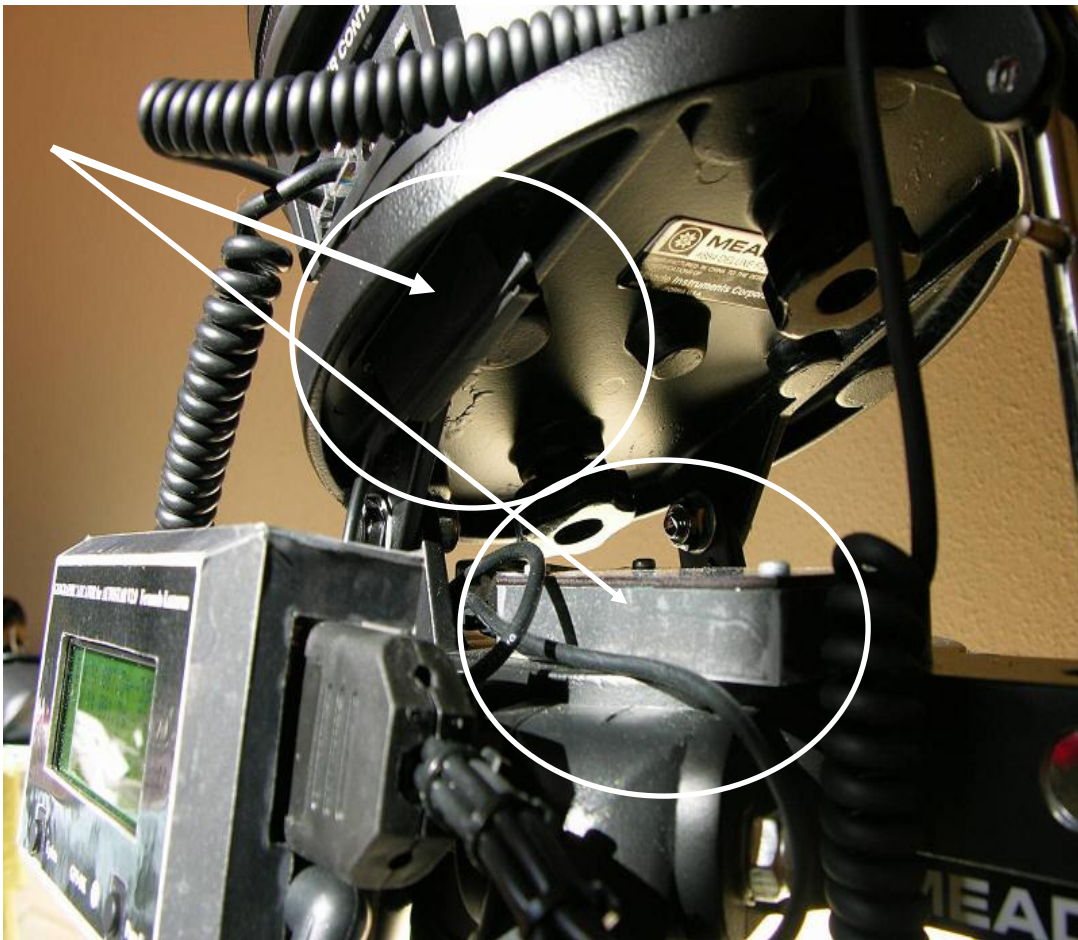


## Other Tips:

**ADXL320**
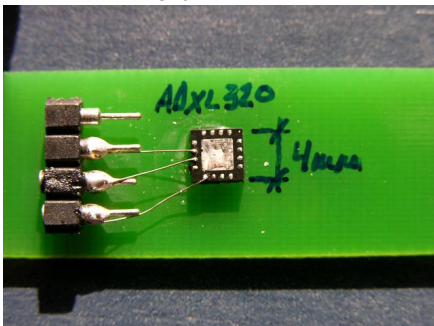


**CARCASE WITH Circuit Board**
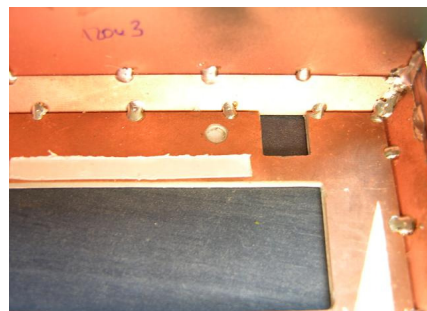


## Screen 1 Inclinometers & Compass



```
Eje X: 091.8g--39850
Eje Y: 092.2g--39225
Lat : 058.8g--37311
CMPS : 276.64 Grados
```

## Screen 2 GPS data



```
UTC : 19h14m42s 00
Date: 11/08/2007
Lat : 042g33.8625m N
Long: 000g33.6819m W
```



```
********************
   Pulse Update!!
or Page UP to cancel
********************
```
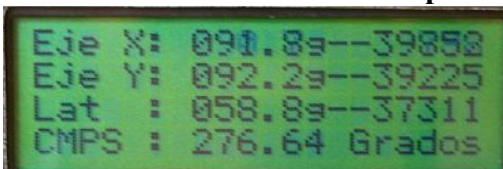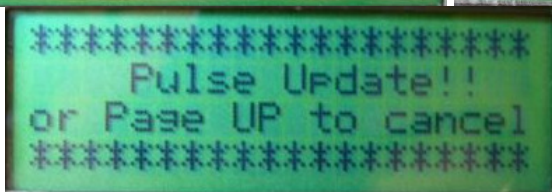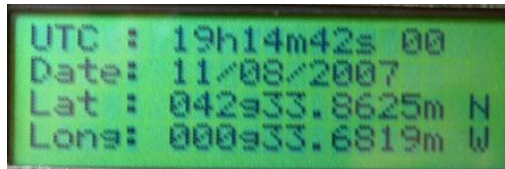
**Software Basic Stamp BS2P24:**
       **V2.0 Geographic Locator for Autostar:   "Copy and Paste"**

```
' {$STAMP BS2p}
' {$PBASIC 2.5}

'****************************************************************
'****************************************************************
'-----------GEOGRAPHIC LOCATOR FOR AUTOSTAR------------------------
'-------Software desarrollado por Fernando Lamarca----------------
'----------------------flamarca@able.es------------------------------
'-------Labor Improbus omnia vincit (Virgilio I 144,145)-----------
'----------------------Zaragoza España----------------------------
'****************************************************************
'****************************************************************


'*****************************************
'Definicion de pines
OWpin        CON     10    ' 1-Wire bus
SDA          PIN    8     ' I2C SDA
SCL          PIN    9     ' I2C SCL
Lcd          PIN    1     ' Pin inicial LCD
GPS_IN       PIN    0     ' Pin GPS
'*****************************************
'*****************************************
'Constantes Puertos serie
GPS_BaudRate   CON    500    ' 4800 BS2P
Autostar_Baud  CON    240    ' 9600 BS2P
'*****************************************
'*****************************************
' Constantes 1-Wire
OW_NoRst       CON    %0000 ' no Reset
OW_FERst       CON    %0001 ' Front-End Reset
OW_BERst       CON    %0010 ' Back-End Reset
SkipROM        CON    $CC   ' pasando del SN!!!
'*****************************************
'*****************************************
' Especifico DS2450 control
ReadMem        CON    $AA   ' Leer memoria
WriteMem       CON    $55   ' Escribir memoria
Convert        CON    $3C   ' Convertir
'*****************************************
'*****************************************
'Variables generales
IDX          VAR     Byte
valor_A      VAR    Word
valor        VAR    Word(11)
'*****************************************
'*****************************************
'Constantes LCD
LcdCls       CON     $01    ' Borrar LCD
LcdHome      CON     $02    ' Mueve cursor  al inicio
LcdCrsrL     CON     $10    ' Mueve cursor izquierda
LcdCrsrR     CON     $14    ' Mueve cursor derecha
LcdDispL     CON     $18    ' Desplaza caracter izquierda
LcdDispR     CON     $1C    ' Desplaza caracter derecha
LcdDDRam     CON     $80    ' Presenta datos RAM
LcdCGRam     CON     $40    ' generador de caracteres RAM

LcdLine1     CON     $80    ' DDRAM Direccion Linea 1
LcdLine2     CON     $C0    ' DDRAM Direccion Linea 2
LcdLine3     CON     $94    ' DDRAM Direccion Linea 3
LcdLine4     CON     $D4    ' DDRAM Direccion Linea 4

MoveCrsr     CON    %10000000
IncCrsr      CON    %00000110
'****************************************************
'****************************************************
'inicializacion del LCD
  LCDCMD Lcd, %00110000       ' Despierta!!!!!
  PAUSE 5                ' Pausa
  LCDCMD Lcd, %00110000
  PAUSE 5                ' Pausa
  LCDCMD Lcd, %00110000
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```
    PAUSE 5                    ' Pausa
    LCDCMD Lcd, %00100000        ' Configura modo 4 bit
    LCDCMD Lcd, %00101000        ' Configura 2 lineas
    LCDCMD Lcd, %00001100        ' Enciende display sin cursor
    LCDCMD Lcd, IncCrsr     ' auto-incremento cursor
    LCDCMD Lcd, lcdcls          'Borra LCD


'********************************************************************
   inicio:
'********************************************************************

'inicializamos el Puerto del Autostar
   SEROUT 11, Autostar_Baud,["#"]

'Pantalla inicial
    LCDOUT lcdcls,LcdLine2,[" Geographic Locator "]
    LCDOUT lcdcls,LcdLine3,["Fernando Lamarca V-2"]
    PAUSE 2000
'inicializamos el DS2450
    OWOUT OWpin, OW_FERst, [SkipROM, WriteMem, $08, $00]          'Inicializacion DS2450

'Configurar los conversores (solo empleo 3)
   FOR idx = 1 TO 3                              'Para los 3 canales empleados
    OWOUT OWpin, OW_NoRst, [$0F]                       'Conversor a 16-bit
    OWIN  OWpin, OW_NoRst, [valor_A.LOWBYTE, valor_A.HIGHBYTE, valor_A]'CRC
    OWOUT OWpin, OW_NoRst, [$01]                       'Fondo escala 5.12
    OWIN  OWpin, OW_NoRst, [valor_A.LOWBYTE, valor_A.HIGHBYTE, valor_A]'CRC
   NEXT
'********************************************************************
'********************************************************************
   LCDCMD Lcd, lcdcls          'Borra LCD
'********************************************************************
Main:
  INPUT 14
'********************************************************************
 'AD2
    FOR IDX=1 TO 10                     '10 lecturas para minimizar el ruido del sistema
     OWOUT OWpin, OW_FERst, [SkipROM, Convert, $02, $00]     'Activamos la conversion del AD 1
     OWIN  OWpin, OW_NoRst, [valor_A.LOWBYTE, valor_A.HIGHBYTE]'CR
     'PAUSE 10
     OWOUT OWpin, OW_FERst, [SkipROM, ReadMem, $02, $00]       'Leemos el registro del conversor  1
     OWIN  OWpin, OW_BERst, [valor_A.LOWBYTE,valor_A.HIGHBYTE] 'CRC
     valor(IDX)=valor_A/10                    'Decima parte del valor leido
    NEXT

    valor_A=valor(1)+valor(2)+valor(3)+valor(4)+valor(5)+valor(6)+valor(7)+valor(8)+valor(9)+valor(10)'Media aritmetica de las 10 medidas
    valor(11)=valor_A     'Valor RAW del conversor
    valor_A=valor_A/2     'Conversion a grados
    valor_A=valor_A-17300 'Valor minimo leido por el conversor
    valor_A=valor_A**$5990'Conversion a grados

    LCDOUT Lcd,LcdLine1,["Eje X: ",DEC3 (valor_A/10),".", DEC (valor_A//10),"g--",DEC5 valor(11)]      'Valor hacia LCD         . Version LCD
'********************************************************************
'********************************************************************
 'AD1
    FOR IDX=1 TO 10                      '10 lecturas para minimizar el ruido del sistema
     OWOUT OWpin, OW_FERst, [SkipROM, Convert, $01, $00]      'Activamos la conversion del AD 2
     OWIN  OWpin, OW_NoRst, [valor_A.LOWBYTE, valor_A.HIGHBYTE]'CRC
     'PAUSE 10
     OWOUT OWpin, OW_FERst, [SkipROM, ReadMem, $00, $00]       'Leemos el registro del conversor  2
     OWIN  OWpin, OW_BERst, [valor_A.LOWBYTE,valor_A.HIGHBYTE] 'CRC
     valor(IDX)=valor_A/10                    'Decima parte del valor leido
    NEXT

    valor_A=valor(1)+valor(2)+valor(3)+valor(4)+valor(5)+valor(6)+valor(7)+valor(8)+valor(9)+valor(10)'Media aritmetica de las 10 medidas
    valor(11)=valor_A     'Valor RAW del conversor
    valor_A=valor_A/2     'Conversion a grados
    valor_A=valor_A-16800 'Valor minimo leido por el conversor
    valor_A=valor_A**$5400 'Conversion a grados

    LCDOUT Lcd,LcdLine2,["Eje Y: ",DEC3 (valor_A/10),".", DEC (valor_A//10),"g--",DEC5 valor(11)]      'Valor hacia LCD         . Version LCD
'********************************************************************
'********************************************************************
 'AD3
    FOR IDX=1 TO 10                      '10 lecturas para minimizar el ruido del sistema
     OWOUT OWpin, OW_FERst, [SkipROM, Convert, $04, $00]      'Activamos la conversion del AD 3
```

```
    OWIN  OWpin, OW_NoRst, [valor_A.LOWBYTE, valor_A.HIGHBYTE]'CRC
    'PAUSE 10
    OWOUT OWpin, OW_FERst, [SkipROM, ReadMem, $04, $00]     'Leemos el registro del conversor 3
    OWIN  OWpin, OW_BERst, [valor_A.LOWBYTE,valor_A.HIGHBYTE] 'CRC
    valor(IDX)=valor_A/10                       'Decima parte del valor leido

   NEXT

   valor_A=valor(1)+valor(2)+valor(3)+valor(4)+valor(5)+valor(6)+valor(7)+valor(8)+valor(9)+valor(10)'Media aritmetica de las 10 medidas
   valor(11)=valor_A     'Valor RAW del conversor
   valor_A=valor_A/2     'Conversion a grados
   valor_A=valor_A-17000 'Valor minimo leido por el conversor
   valor_A=valor_A**$5B00'Conversion a grados

   LCDOUT Lcd,LcdLine3,["Lat : ",DEC3 (valor_A/10),".", DEC (valor_A//10),"g--",DEC5 valor(11)]     'Valor hacia LCD        . Version LCD
'********************************************************************
'********************************************************************
'brujula Digital
    FOR IDX=1 TO 10                      '10 lecturas para minimizar el ruido del sistema
    I2CIN SDA, $C0, 2,[valor_A.HIGHBYTE,valor_A.LOWBYTE] 'Leemos los registros 2 y 3 del CMPS03
    valor(IDX)=valor_A                  'Almaceno el valor medido
    PAUSE 30                            'Pausa de 30ms
    NEXT
      valor_A=valor(1)+valor(2)+valor(3)+valor(4)+valor(5)+valor(6)+valor(7)+valor(8)+valor(9)+valor(10)'Media aritmetica de las 10 medidas
      'valor_A=valor_A/10                  'Decima parte del valor leido

   LCDOUT Lcd,LcdLine4,["CMPS : ",DEC3 (valor_A/100),".", DEC2 (valor_A//100)," Grados"]   'Valor hacia LCD        . Version LCD
'********************************************************************
'********************************************************************
   IF (IN14 = 1) THEN Main                      ' Repito mientras Pin 14 esta a 1
   LCDCMD Lcd, lcdcls       'Borra LCD
   PAUSE 1000
'********************************************************************
'********************************************************************
'Fin de Datos Inclinometro
'********************************************************************


'********************************************************************
'Comienzo del Datos GPS
'********************************************************************
'********************************************************************
 GPS:
'********************************************************************
'Numero de satelites y Tiempo GPGGA
'********************************************************************
 SERIN GPS_IN, GPS_BaudRate,[WAIT("$GPGGA"),SKIP 38,valor_A(8),valor_A(9)]


'********************************************************************
'Tiempo GPS UTC + Navegacion valida/invalida
'********************************************************************
 SERIN GPS_IN, GPS_BaudRate,[WAIT("GPRMC,"),valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6),SKIP 4,valor_A(7)]
 IF valor(7)="V" THEN
  LCDOUT lcdcls,LcdLine1,["UTC : ",valor_A(1),valor_A(2),"h",valor_A(3),valor_A(4),"m",valor_A(5),valor_A(6),"s OK  "]
 ELSE
  LCDOUT lcdcls,LcdLine1,["UTC : ",valor_A(1),valor_A(2),"h",valor_A(3),valor_A(4),"m",valor_A(5),valor_A(6),"s ",valor_A(8),valor_A(9)]
 ENDIF
'********************************************************************
'Fecha GPS
'********************************************************************
 SERIN GPS_IN, GPS_BaudRate, [WAIT("GPRMC,"),SKIP 46,valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6)]
 LCDOUT lcdcls,LcdLine2,["Date: ",valor_A(1),valor_A(2),"/",valor_A(3),valor_A(4),"/20",valor_A(5),valor_A(6),"   "]
'********************************************************************
'Latitud GPS
'********************************************************************
 SERIN GPS_IN, GPS_BaudRate, [WAIT("GPRMC,"),SKIP
12,valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6),valor_A(7),valor_A(8),valor_A(9),SKIP 1,valor_A(10)]
 LCDOUT lcdcls,LcdLine3,["Lat : 0",valor_A(1),valor_A(2),"g",valor_A(3),valor_A(4),valor_A(5),valor_A(6),valor_A(7),valor_A(8),valor_A(9),"m
",valor_A(10)]
'********************************************************************
'Longitud GPS
'********************************************************************
 SERIN GPS_IN, GPS_BaudRate, [WAIT("GPRMC,"),SKIP 24,valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),SKIP
1,valor_A(6),valor_A(7),valor_A(8),valor_A(9),SKIP 1,valor_A(10)]
 LCDOUT lcdcls,LcdLine4,["Long:
",valor_A(1),valor_A(2),valor_A(3),"g",valor_A(4),valor_A(5),".",valor_A(6),valor_A(7),valor_A(8),valor_A(9),"m ",valor_A(10)]
 IF (IN14 = 1) THEN GPS                      ' Repito mientras Pin 14 esta a 1
```

```
     LCDCMD Lcd, lcdcls            'Borra LCD
      PAUSE 1000


'*********************************************************************
'Programacion Autostar
'*********************************************************************

Autostar:
  PAUSE 250
    LCDOUT lcdcls,LcdLine1,["******************"]
    LCDOUT lcdcls,LcdLine2,["    Pulse Update!!  "]
    LCDOUT lcdcls,LcdLine3,["or Page UP to cancel"]
    LCDOUT lcdcls,LcdLine4,["******************"]
   INPUT 13
   INPUT 14

   IF (IN14 = 0) THEN Main                     ' Repito mientras Pin 14 esta a 0
    PAUSE 500
    LCDCMD Lcd, lcdcls                         'Mensaje Intermitente....

   IF (IN13 = 1) THEN autostar                 ' Repito mientras Pin 13 esta a 1
    PAUSE 500
    LCDCMD Lcd, lcdcls

'*********************************************************************
'Autostar?? estas ahi???  :GVD# ****************************************
  SEROUT 11, Autostar_Baud, [":GVD#"]
'respuesta version Autostar
'*********************************************************************
  SERIN 12, Autostar_Baud, 100, Autostar_2,
[valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6),valor_A(7),valor_A(8),valor_A(9),valor_A(10),valor(11),valor_A]
'*********************************************************************
  LCDOUT lcdcls,LcdLine1,["
",valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6),valor_A(7),valor_A(8),valor_A(9),valor_A(10),valor(11),valor_A ,"  "]
  PAUSE 500
'*********************************************************************
'Nombre del sitio (Fernando)  :SM<string># *****************************
  SEROUT 11, Autostar_Baud, [":SMFernando#"]
  PAUSE 500
'*********************************************************************
'Latitud GPS   :StsDD*MM# **********************************************
  SERIN GPS_IN, GPS_BaudRate, [WAIT("GPRMC,"),SKIP
11,valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6),valor_A(7),valor_A(8),valor_A(9),SKIP 1,valor_A(10)]
  SEROUT 11, Autostar_Baud, [":Sts",valor_A(2),valor_A(3),"*",valor_A(4),valor_A(5),"#"]
'*********************************************************************
'Longitud GPS  :SgDDD*MM# **********************************************
  SERIN GPS_IN, GPS_BaudRate, [WAIT("GPRMC,"),SKIP 24,valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),SKIP
1,valor_A(6),valor_A(7),valor_A(8),valor_A(9),SKIP 1,valor_A(10)]
  SEROUT 11, Autostar_Baud, [":Sg0",valor_A(2),valor_A(3),"*",valor_A(4),valor_A(5),"#"]
'*********************************************************************
'Fecha GPS    :SCMM/DD/YY# *********************************************
  SERIN GPS_IN, GPS_BaudRate, [WAIT("GPRMC,"),SKIP 46,valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6)]
  SEROUT 11, Autostar_Baud, [":SC",valor_A(3),valor_A(4),"/",valor_A(1),valor_A(2),"/",valor_A(5),valor_A(6),"#"]
  SERIN 12, Autostar_Baud, 100, Autostar_2,
[valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6),valor_A(7),valor_A(8),valor_A(9),valor_A(10)]

  LCDOUT lcdcls,LcdLine2,[" ",valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6),valor_A(7),valor_A(8),valor_A(9)," Autostar"]
  PAUSE 1000
  LCDCMD Lcd, lcdcls
'*********************************************************************
'Tiempo GPS UTC + Navegacion valida/invalida  :SLHH:MM:SS# *****************
  SERIN GPS_IN, GPS_BaudRate,[WAIT("GPRMC,"),valor_A(1),valor_A(2),valor_A(3),valor_A(4),valor_A(5),valor_A(6),SKIP 1,valor_A(7)]
  SEROUT 11, Autostar_Baud,[":SL",valor_A(1),valor_A(2),":",valor_A(3),valor_A(4),":",valor_A(5),valor_A(6),"#"]
  PAUSE 500
'*********************************************************************
'Modo ecuatorial   :AP# ************************************************
  SEROUT 11, Autostar_Baud,[":AP#"]
  PAUSE 500

  LCDOUT lcdcls,LcdLine3,["Autostar  Programado"]
  LCDOUT lcdcls,LcdLine4,["******      *******"]
  PAUSE 3000
  LCDCMD Lcd, lcdcls
  GOTO Main
'*********************************************************************
'*********************************************************************
```

```
   LCDOUT lcdcls,LcdLine3,["Autostar  Not Found "]
   PAUSE 2000
   LCDCMD Lcd, lcdcls
 GOTO Main
'**********************************************************************
'**********************************************************************
'************************Fin del Programa*******************************
'**********************************************************************
```

## Esquema Electrico:
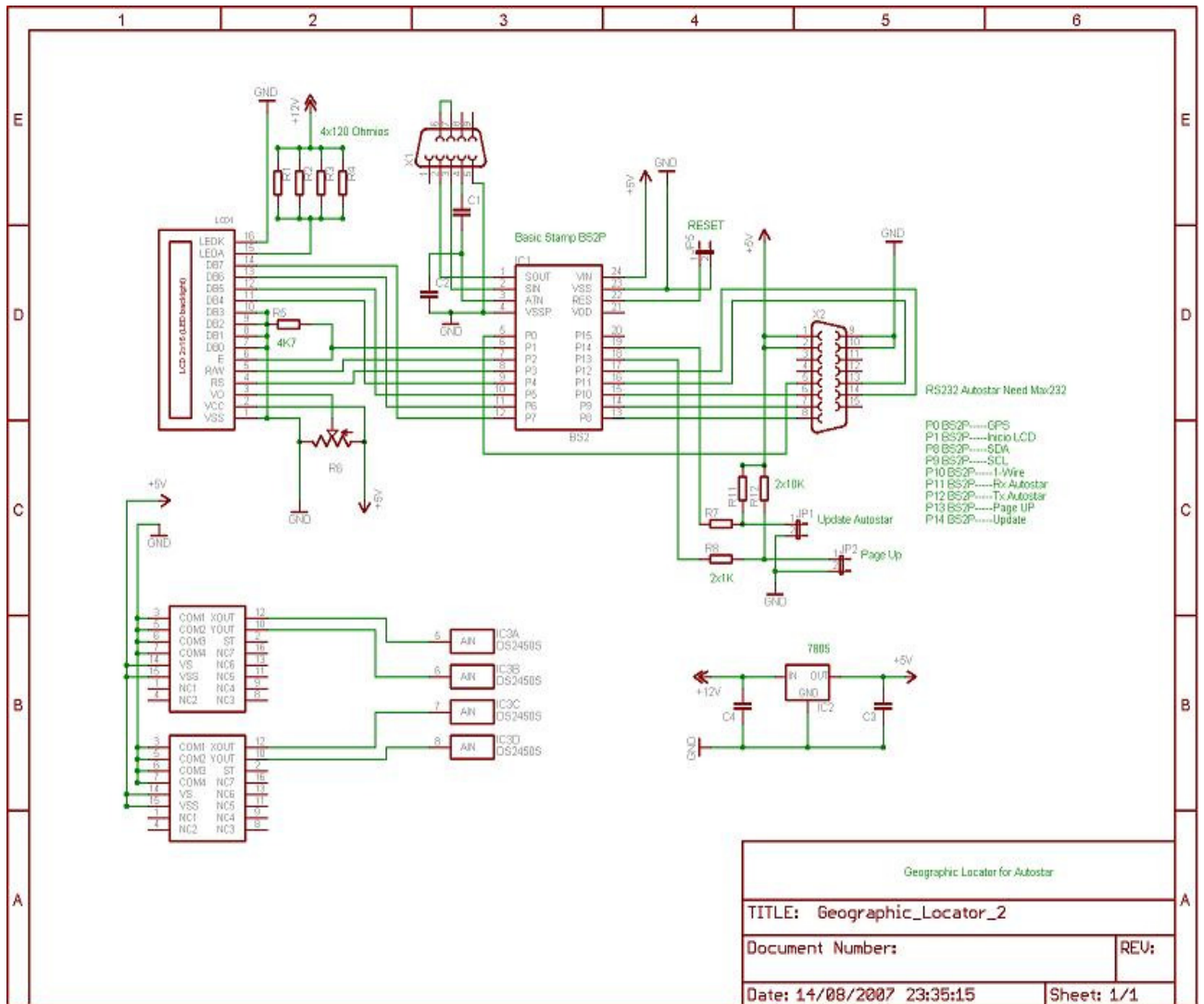


**Buenos cielos para todos………**

**Fernando Lamarca Belanche       EXPO 2008   Zaragoza       España**….