DRIGPS-1

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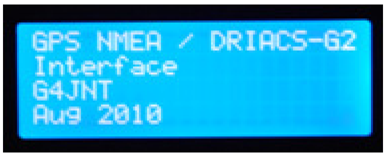
GPS Programming Interface for the DRIACS-G2 Antenna Control System



INTRODUCTION

The DRIGPS-1 is a Microprocessor application oriented to update parameters on your DRIACS-G2 without using the normal push buttons or any computer. Based on the fact than the DRIACS-G2 have limited capacity for introduce a GUI or something more user friendly for introducing parameters the DRIGPS-1 take care about that.

When Hannes, OE5JFL design the DRIACS-G2 he introduce a very important feature compared with the generation 1 (G1). A set of ASCII characters can be send to the controller via the RS-232 interface for update time, date, LAT/LON, and any other parameter you need to configure properly your DRIACS-G2.

The essential of the DRIACS-G2 is his stand-alone capability, the controller don't need any additional computer to work or to be programmed. The DRIACS-G2 ha an internal RTC (Real time clock) chip with a backup battery to keep parameters if the unit is not connected to DC. During normal operation I found a little difficult to tune the capacitor trimmer on the 32 KHz crystal (this is the clock reference for the RTC), the result was always some seconds off, sometimes minutes.

For tracking the moon some errors in minutes are not critical but I prefer to have the clock of my DRIACS-G2 running the most accurate as possible without using a PC or internet connection, for that reason I decide to implement the DRIGPS-1, essentially this unit take the GPS data from the $GPRMC string (NMEA protocol) extract time, date and LAT/LON information, convert that information in ASCII commands and send via RS-232 to DRIACS-G2 each 15min. The upload can be manually trigger by the operator whenever you want.

The code for this project was develop by Andy Talbot G4JNT, Andy have a lot of experience in GPS application based on PIC's.

Even if the DRIGPS-1 is not a essential part to work with your DRIACS-G2 you will have the advantage to don't care anymore about your time and you will have the UTC time displayed in a second LCD with GPS precision.

73 de Alex, HB9DRI

DESCRIPTION

GPS Programming Interface for the DRIACS-G2 Controller

(by Andy Talbot, G4JNT)

Andy Talbot G4JNT August 2010
ACS design by Hannes OE5JFL
DRIACS-G2 and DRIGPS-1 implementation by Alex, HB9DRI

Overview

This PIC based module receives NMEA data at 4800 baud contained within the GPRMC sentence from a standard GPS receiver module, and decodes the Latitude, Longitude, Time and date information embedded with the string. This is displayed on a 4 line x 20 LCD screen, together with the calculated eight digit Maidenhead Locator. The Lat / Long and Epochinformation are assembled into the format needed for remote programming of the DRIACS-G2 antenna positioner and can be sent to this on a serial interface at 115200 Baud. Complete epoch and location information are uploaded at turn-on (once the GPS signal has been acquired) or by the user pressing a button at any time. Additionally, time and date are sent regularly at 15 minute intervals.

Circuit Diagram

Figure 1 , also available as the file DRIACS_GPS.GIF shows the circuit diagram of the PIC, LCD and interfacing. NMEA data from the GPS receiver at RS232 standard voltage levels (+/- 5 to 12V) are applied directly to the 16F628 PIC input pin via a 4k7 current limiting resistor. Internal clamp diodes within the device look after the excess voltage excursions. TTL and LV-TTL signaling, direct from a GPS module with no RS232 level conversions pass through a one transistor inverter. This allows operation from the latest generation of low voltage/power receiver modules.

The 115200 baud output to the DRIACS-G2 is transmitted using RS232 polarity, but with 0/5V signaling levels. The MAX-232 or its equivalent on the input to the module is perfectly happy with this signaling non-standard..
The PIC requires a 14.7456MHz crystal, giving a processor clock speed of 3.6864MHz.

Operation

The PIC monitors the incoming NMEA data, looking for the $GPRMC header at the start of the wanted string sent (usually) every second from the GPS receiver. When the header is detected the following data, up to its terminating [cr][lf] pair, is read into RAM. When the terminator is received this data is then searched for each item of information needed. Once the GPS data is determined as valid, the locator is calculated from the Lat/Long, and is also converted into the format needed by the DRIACS controller, then data can be sent. The status of the GPS receiver is determined from the flag contained in the GPRMC message, if the GPS data is shown as invalid this is indicated on the LCD and no update is sent to the DRIACS . If the GPS subsequently loses lock, this fact is shown on the display and updating, either manual or timed, is inhibited.

At initial turn on, an introductory message appears for three seconds, after which the NMEA data is examined. The software will only proceed beyond this point once valid NMEA data has been found. If valid, complete epoch and location information is transmitted once on the 115200 interface, with each individual item separated by a delay of 50ms – in accordance with the DRIACS-G2 remote programming instructions.

The format of the data is shown below. With no further manual intervention, time and date are repeated every 15 minutes, sent at the zero seconds point. Each timed update is shown by the letter 'T' appearing for one second on the right hand side of Line 2 on the display. At any time, provided valid GPS data is being received, a press of the ***Update*** button will send both time/date and location. The data transmission at 115200 baud is shown by a 'U' appearing briefly on the RHS of Line 2 on the LCD. It may be necessary to hold the button pressed for up to one second before this takes place.

Lat / Long Formatting

The lat/long information is shown on the display in the most commonly accepted format of Integer degrees and decimal minutes ie DDMM.MM – this is the format put out in the NMEA stream from the GPS receiver. The DRIACS-G2 requires decimal degree values, but in the form of integers containing he values in units of tenths of a degree.

To prevent the need for negative numbers, the values are offset by adding 900 (90 degrees) to the latitude to give a range of values from 0 to 180 degrees. 1800 (180 degrees) is added to the longitude to give 0 – 3600.

Perversely, satellite and many celestial applications measure longitude such that degrees west are positive, and this standard is followed in the DRIACS. So westerly longitudes lead to numbers in the range 900 – 1800. The following example illustrates this :

*Lat 50.91° N rounded to 50.9 * 10 + 900 = 1409*
*Long 1.29° W rounded to 1.3 * 10 + 1800 = 1813*

For information, the lat/long values sent to the DRIACS are shown on the display, to the right of the traditional presentation.

Few recommendations to install your DRIGPS-1

1- Your GPS need to send the information at 4800 bauds.
2- Some GPS modules refresh the data at frequency's from 1Hz to 10 Hz, for example my Garmin GPS12 is configure by factory with a 2Hz refresh interval, this create a small behavior on the seconds displayed in my DRIGPS-1, I see seconds going in increment by 2 and not each second, this is only cosmetic but I prefer GPS units with a 1Hz interval. The Garmin 12 is a very old GPS but today most of the commercial units and modules can change the refresh rate some ones up to 10Hz.
3- The display used in the DRIGPS-1 is the same type used on the DRIACS-G2 BUT you cannot exchange without doing the cabling again. A small error on the PCB omit the 47ohms resistor used for the backlight, the resistor is installed direct in to the display and need to be connected to 10 to 12 VDC for properly illumination. The error is only a cosmetic error and will be corrected as soon the actual stock of PCB's are out.
4- If for any reason your display show like that:

This means the DRIGPS-1 unit is not receiving data from your GPS, maybe because the cabling is not correct or because satellites are not yet lock, check if your GPS output is RS-232 or TTL and configure that on your DRIGPS-1 with the correct jumper position.

5- As soon the DRIGPS-1 receive valid data from your GPS your display will looks like that:

The time is UTC time already corrected from the Atomic clocks on the GPS satellites, the rest information speak by them self.