GPS Programming Interface for the DRIACS-G2 Controller

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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 signalling, direct from a GPS module with no RS232 level conversion 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 signalling levels. The MAX-232 or its equivalent on the input to the module is perfectly happy with this signalling 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.

Format for data sent to the DRIACS-G2

!z0010	(Year, two digit only)
!y0008	(Month 1 - 12)
!x0018	(Day 01 - 31)
!w0021	(Hour 00 - 23)
!v0031	(Minute 00 - 59)
!u0034	(Second 00 - 59)
!k1813	(Longitude value)
!l1409	(Latitude value)

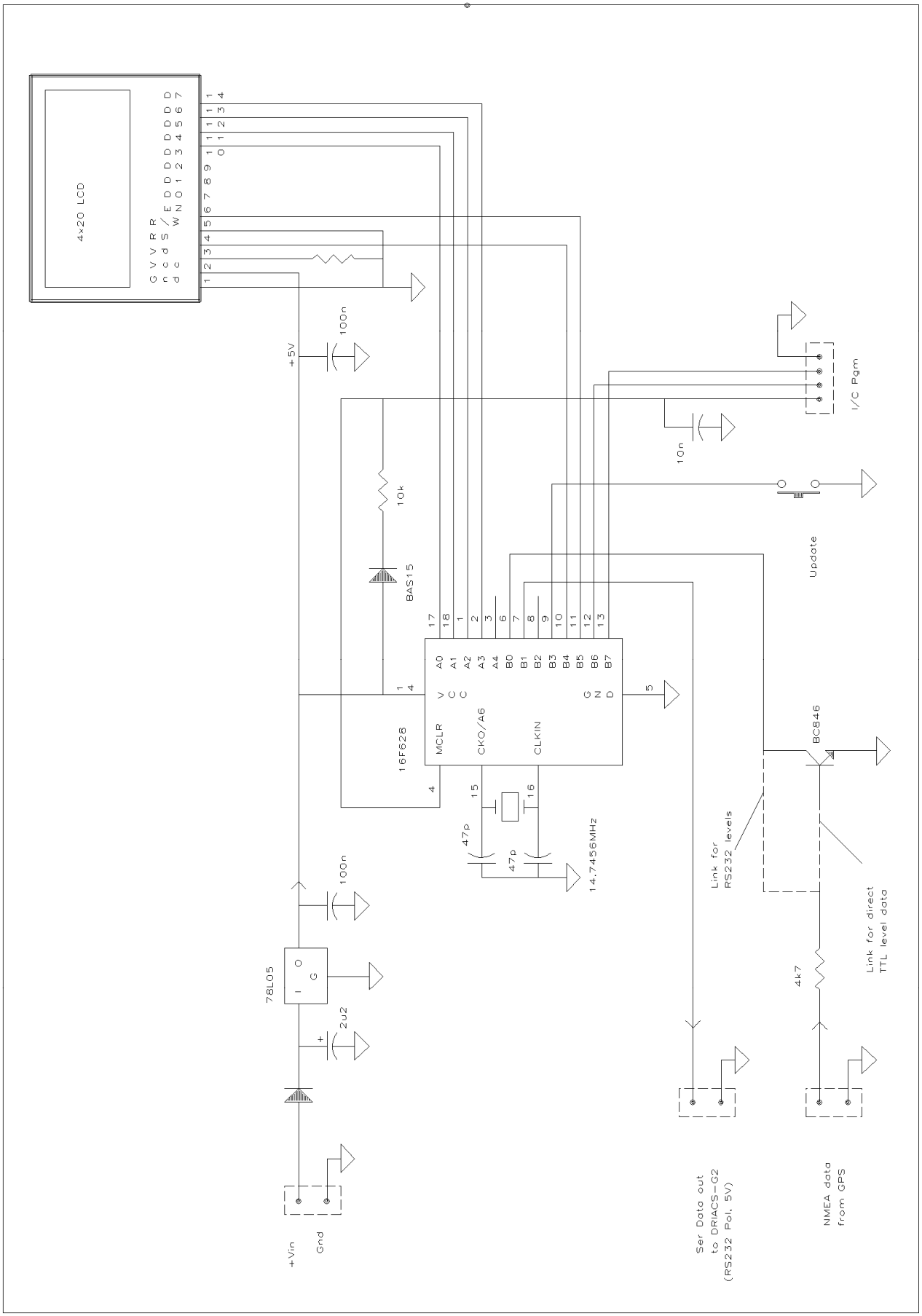

Figure 1 Circuit Diagram of the DRIACS-G2 GPS Interface