SEND Signal Elektronik GmbH

GPS-RTS

GPS Receiver with Time Code Output

Installation and Basic Operation Guide

Description

The GPS-RTS is a rugged GPS receiver which produces time pulses in addition to the GPS time and GPS coordinates. The receiver electronics and the antenna are integrated in a small, sealed case. Therefore, it can be mounted in a place which provides optimal receiver performance, like a ship's mast or on top of seismic recording trucks. The system includes a RS485/RS422 cable and a connector box with plugs for the external power supply, time pulse output, and serial link to PC. Optionally, an GPD20 eight port connector box can be aquired instead of the standard connector box. For the Geolon MCS there also is a GPD30 connector box which supports IEEE1394 interfacing and the self test capabilities of that recorder.

Applications

- Synchronisation of clock oscillators in Ocean Bottom Seismographs (e.g. GEOLON-MES of SEND)
- Delivery of time references for combining different recording systems which could read GPS time pulses

Technical Data

GPS Receiver	Motorola M12 Plus Oncore
Time to first fix	< 60 seconds
Positoning Accuracy	100m 2dRMS with SA as per DoD specification < 25m SEP without SA 1-5m typical in differential mode
GPS Interface	RS485 and RS422 for connections via cable up to 1200m length 4800 bps, 8N1
GPS output	1 pps and NMEA string
Power consumption	1,8 Watts
Size	GPR11: 97 x 97 x 80mm, GPD10: 117 x 91 x 34mm, GPD20: 205 x 120 x 60mm
Case	Durable aluminium, weather sealed
Protection	IP65, EMI
Weight	GPR11: 0,68 kg, GPD10: 0,31 kg, GPD 20: 0,68 kg
Power Supply	12V (+/- 25%)
Operating temperature	-40 to +85 °C

PC software for reading GPS data via RS232 is available from http://www.cnssys.com/.

Installation

When you receive the GPS-RTS you should find the following hardware items:

- The GPS-RTS receiver box (GPR11 or GPR12) itself
- One of the GPD Distributor Boxes GPD10, GPD20, or GPD30
- One custom length GPC10 cable to connect the RS485/422 connector of your GPS-RTS with the GPD10
- One cable to connect the output port of the GPD10 with the auxiliary port of the GEOLON recorder for the synchronisation procedure. The Version with the GPD20 ships with eight cables, one for each output port.
- One cable to connect the RS232 output connector of the GPD10 or GPD20 to a serial port (COM1 or COM2) of your PC for maintenance and third party applications.
- This Installation Guide

You will need to provide the following hardware for using the GPS-RTS in combination with a PC based application:

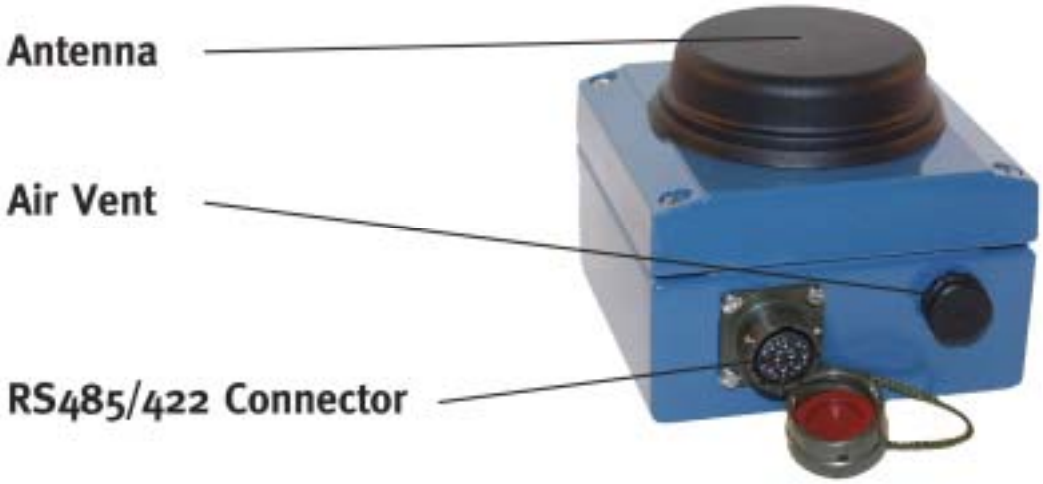
- A standard PC clone computer running Windows 95,98 or higher, NT V4.0 or 5.0., Windows 2000 or Windows XP. It should have a CD-R drive, a hard drive with at least 5 MB space free, and one or more available serial ports (any port from COMI to COM32 will work including RIST and ASIC board ports).

And last but not least you will also need to provide:

- A Power supply, which provides DC 12V and 600 mA
- Outdoor place for the GPS-RTS in a location that can see the sky

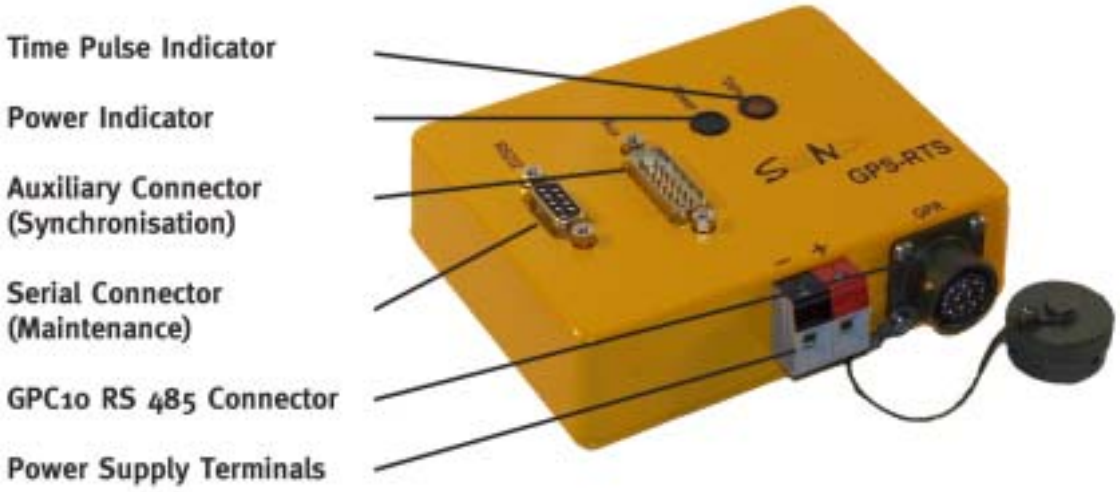
The GPS-RTS is delivered pre-configured for use with SEND´s GEOLON recorders, so normally no further configuration is necessary. For information about the synchronisation procedure and signal requirements of your GEOLON data recorder, please also consult the product manual that came with the device.

The GPR11/GPR12 Receiver Unit

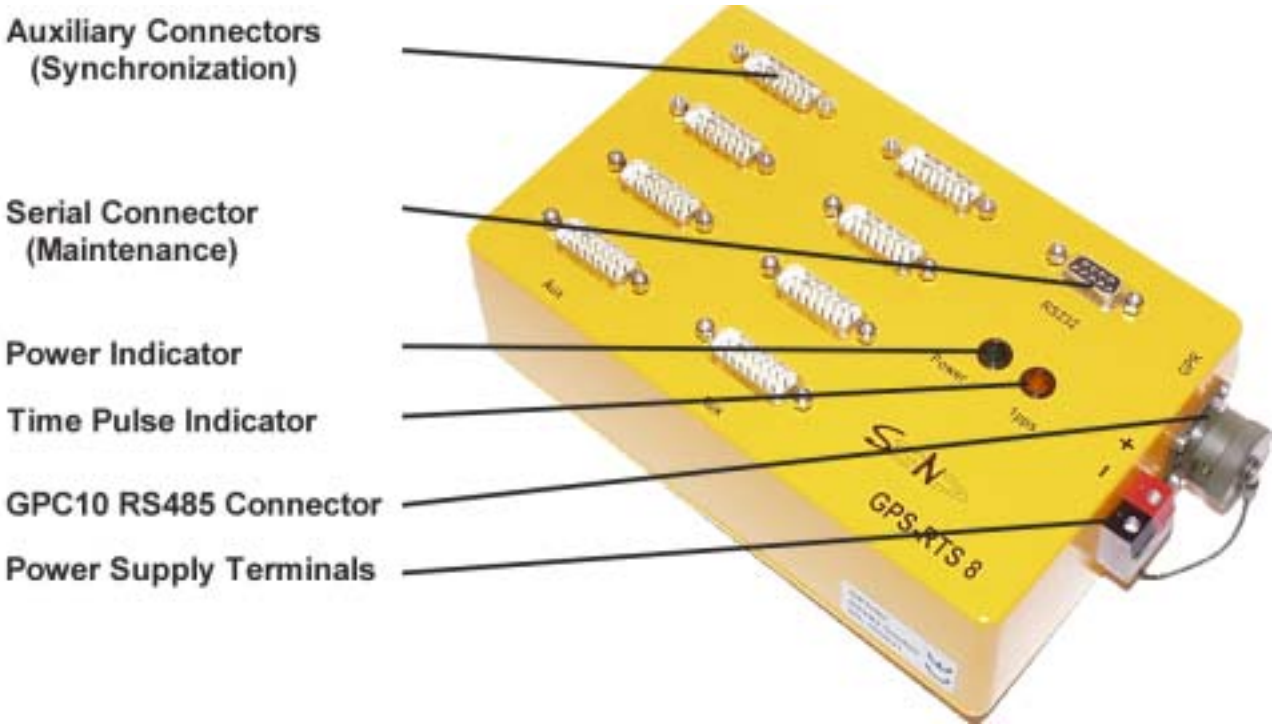


The housing may be opened to access the screw holes for mounting the GPR11 to a mast or other permanent location.

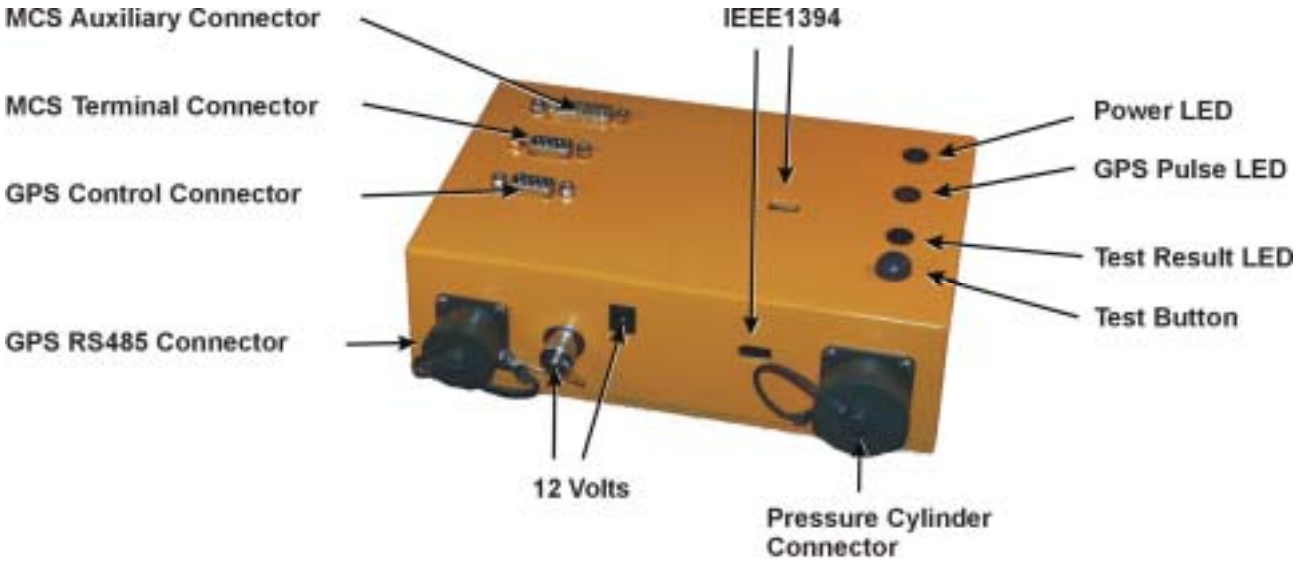
The GPD10 Cable Distributor Box



The GPD20 Cable Distributor Box



The GPD30 Cable Distributor Box



Connecting the GPS-RTS

All connections for the GPS-RTS run through the GPD10 cable distributor box, as shown above. Please note, that for regular operation, not all possible connections have to be established.

Step 1: Find a suitable place for the GPR11/12 receiver box in a location that allows free reception of the GPS-satellite signals.

Step 2: Use the GPC10-cable supplied to connect the GPR11/12 receiver box to the GPD10 or GPD20 distributor box.

Step 3: Use the auxiliary cable (DB15 connectors) to connect the GPD10 or GPD20 distributor box to the GEOLON recorder(s).

Step 4: Attach a DC 12 V, 600mA power supply to the GPD10 connector box. The green status light indicates a working power supply. The yellow status light will flash synchronously to the GPS 1pps time pulse if the system ist working properly. Please note, that it might take a few moments after power on, until the time pulse is available.

Step 5: Optionally, connect a PC serial port to the GPS control connector to check/update the GPS settings with the TAC32 Software. You may also use any serial terminal program and SEND's SendCom 2 and 3 programs to check the GPS strings. **GPD30 only:** Also optionally, perform a self-test (see MCS manual) by pushing the test button once. This test can only be performed using the pressure cylinder connector while the MCS is already mounted for the experiment.

Step 6: Synchronize your GEOLON recorder according to the instructions in the recoder manual and start your measuring campaign.

Troubleshooting

The information i n this section relates to the GPR11 receiver only, the GPR12 receiver will not need any reconfiguration at all, except after factory repair.

Though the GPS-RTS is delivered preconfigured to work with SEND´s GEOLON recorders and stores its configuration in buffered memory, it may occasionally happen that this information becomes corrupted or altered, especially when the GPS-RTS also is used with third party software to perform tasks besides synchronizing GEOLON recorders or stored for several months, which may exceed the buffer battery´s capacity.

You can easily check what information is actually being sent by the GPR10/11 by connecting it to a PC and starting a serial terminal program like minicom on Linux systems or HyperTerminal on Windows computers. Just set it to operate at 4800 bps with eight data bits, one stop bit and no parity. If you see anything besides the two alternating NMEA

messages **$GPZDA** and **$GPGGA**, then one or more settings of the GPS-RTS have been corrupted.

If you are working with a Linux computer and have the the Kermit communication system installed, you can easily reconfigure the GPS-RTS with a little shell script called "gpsrtsinit.sh" which is provided with every new GPS-RTS. Just run the script from a console command line and the device is ready for operation. If you are an experienced Kermit user, please feel free to modify the script according to your needs. The script requires the path to the serial device to which the GPS-RTS is connected as a parameter, typically this is */dev/ttyS0.* A sample command line thus would be:

```
#
gpsrtsinit.sh /dev/ttyS0 <enter>
```

The output on StdOut then should look like this:

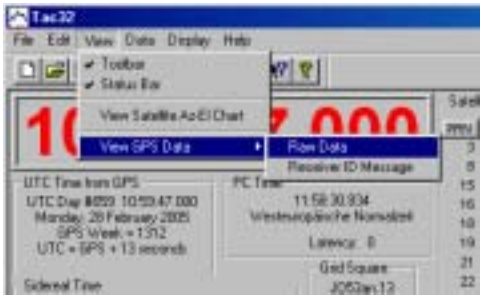
```
open serial port /dev/ttyS0
set the Mot bin mode
setup GPS               -> sets to GPS time (UTC-14s)
set Mot NMEA mode
setup NMEA strings
$PMOTG,RMC,0000*1D      -> switch off RMC Message
$PMOTG,GLL,0000*06      -> switch off GLL Message
$PMOTG,GGA,0001*01      -> switch on GGA Message
$PMOTG,GSA,0000*14      -> switch off GSA Message
$PMOTG,GSV,0000*03      -> switch off GSV Message
$PMOTG,VTG,0000*04      -> switch off VTG Message
$PMOTG,ZDA,0001*1F      -> switch on ZDA Message

The End
```

The GPS Receiver will then be in NMEA-Mode, sending only the messages required to synchronize the recorder and giving plain GPS time, i.e. UTC minus 14 seconds.

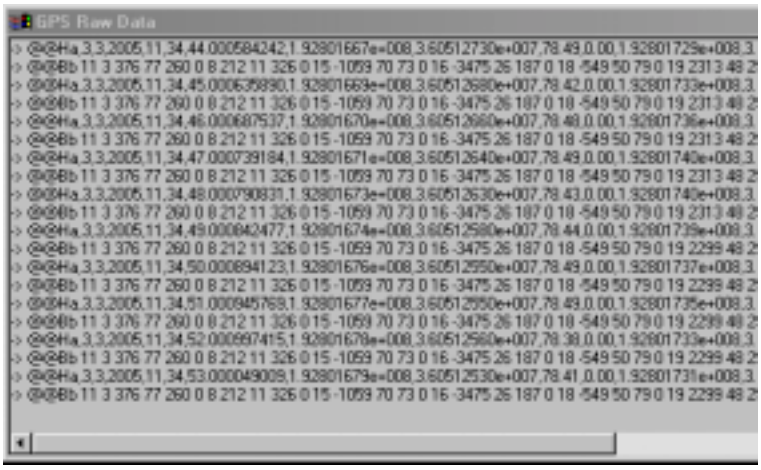
If you are working with a Windows computer, GPS-RTS can only be reconfigured to work properly with GEOLON recorders by using the TAC32 program for Windows which can be aquired from http://www.cnssys.com/.

Connect the GPS-RTS to the PC with a straight serial cable and start the TAC32 program. Once the TAC32 has started and initialised, it will display the GPS data from the GPS-RTS. Unfortunately, the program will always reset the GPS receiver to its factory default settings which in turn have to be changed to the proper values again. Of course, in case you actually need to use the TAC32 program, it definitely will be a good idea to first reset the GPS-RTS to a defined state and start work from there.

First, go to the VIEW menu and select “View GPS DATA – Raw Data”.



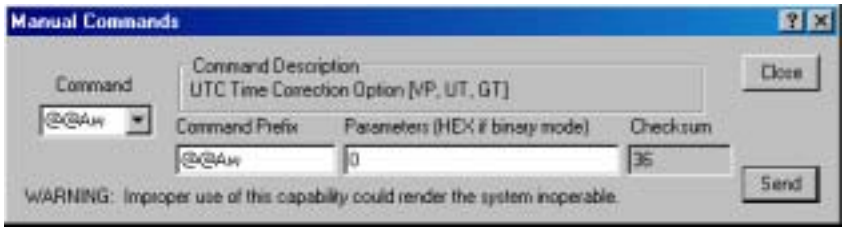
The Raw Data Window opens and displays the messages from the GPS in “Mot Binary” format, as shown below.



The GPS receiver can provide the time information either as UTC or GPS time. GPS time is strictly counted in seconds since 6.1.1980, 0:00h and does not reflect the leap seconds which are used to adjust UTC to siderial time about every 18 months. As of January 2006, the difference between UTC and GPS time has amounted to 14 seconds, i.e. UTC = GPS +14 seconds.

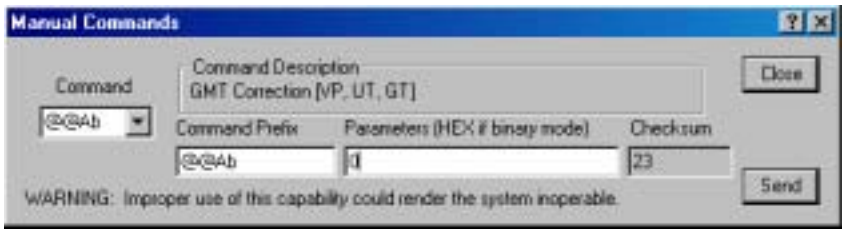
You will probably want to utilize the GPS time only, to avoid problems with leap seconds during recording, so you should first set the GPS-RTS to report within the proper time base. To do so, please navigate to the “Data” menu, select “Advanced GPS Receiver Commands” and then “Manual GPS Receiver Commands” as shown below:

This will pop up a dialogue box where you can enter the desired value as shown below. First, set the “@@Aw” parameter to zero to set the GPS-RTS to GPS time mode:

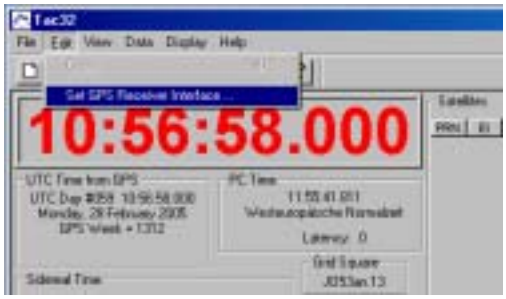


To receive the corrected UTC (GPS time plus 14 seconds), enter a value of "FF" for this command instead and click on send. The receiver will report the corresponding change of settings in the "GPS Raw Data" window.

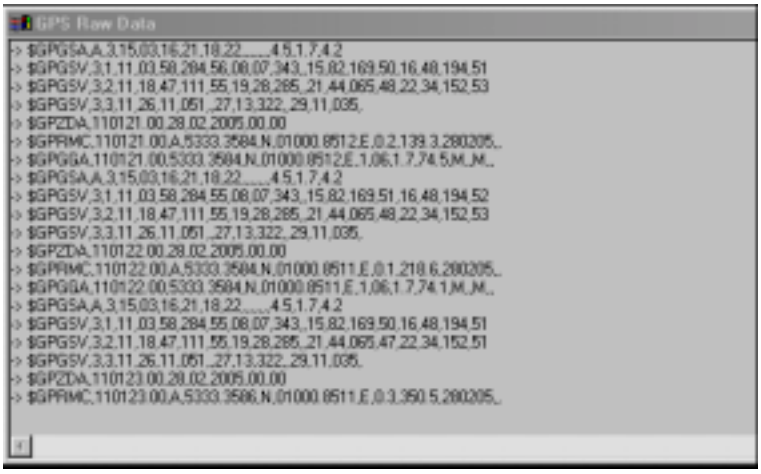
Another setting that might affect the accuracy of the GPS receiver is the GMT correction value. This is needed for proper use of the satellite ephemeris which give updated information about the current positions and orbits of the GPS satellite. This value should also be set to zero for proper operation, using the "@@Ab" command:



So far, the GPS receiver was set to binary command mode to allow changing the time base information. It now needs to be put into NMEA messaging mode for proper communication with GEOLON recorders. Please go to the EDIT menu, select "Set GPS Receiver Interface" and change the settings to "Mot NMEA" as shown below.

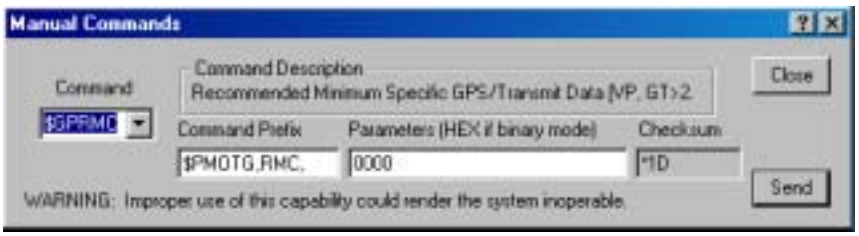


Click ok to store the settings. It will take a few moments for the GPS-RTS to process the changes. The Raw Data Window should now look like this:



Please note the different types of NMEA messages displayed, and write down the message types. This might look different from this screenshot with your setup. Since there are only two NMEA commands that have to be passed to the GEOLON recorder by the GPS-RTS, **$GPZDA** and **$GPGGA**, all unnecessary messages have to be switched off in the next step with manual commands. Please select the command mode:

The Command Mode Window looks like this:

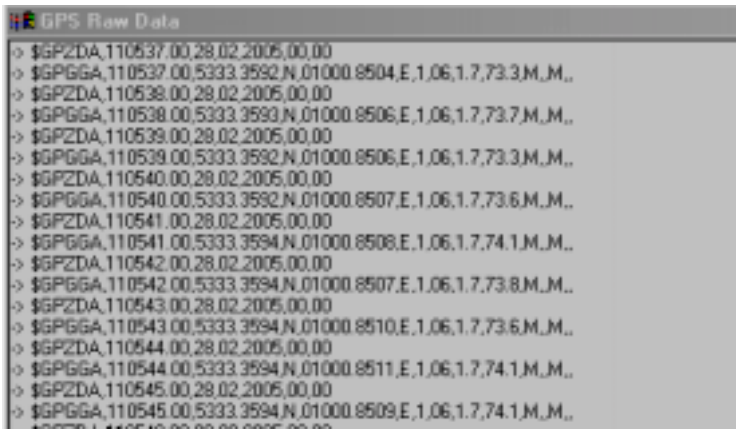


In this example, on the left side the NMEA message $GPRMC has been selected, the parameter field shows a value of zero. Since this value indicates the repeat rate for the messages, setting it to zero will turn it off alltogether. The Command Prefix and Checksum will be filled in automatically, you don´t have to take care of these fields.

Click the send button and watch in the Raw Data Window, whether the command is repeated and the corresponding NMEA message disappears from display. This might take a few

seconds. If you incidentally switch off one of the required messages **$GPZDA** and **$GPGGA**, or they are missing, just turn them on by entering a value of 0001 as the parameter

Repeat this step for all unwanted NMEA messages until only the **$GPZDA** and **$GPGGA** messages are still being displayed. The Raw Data Window now should look like this:



And done. The GPS-RTS now is ready again for operation with the GEOLON recorders.

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