User guide

Logging NMEA 0183 weather data using Septentrio PolaRx5 GNSS receivers

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Contents

1. Introduction

This document is the step-by-step guide to successfully connect a NMEA 0183 weather station to a Septentrio PolaRx5 GNSS receiver. Although this guide shows this receiver and a specific weather station model, it also applies to any instrument that meets the NMEA 0183 standards as well as other GNSS receivers (it has been tested using a Trimble NetR9).

This guide was designed to provide documentation for users that need to record both weather and GNSS data into a single device.

2. The NMEA 0183 communication standard

The National Marine Electronics Association developed the NMEA 0183 Interface Standard which defines electrical signal requirements, data transmission protocol and time, and specific sentence formats for a 4800-baud serial data bus. The data may include different types of information, such as time, speed, temperature, atmospheric pressure, position, etc. and it is in printable ASCII form[1].

2.1. Electrical standard

NMEA 0183 devices are designated as either talkers or listeners (with some devices being both), employing an asynchronous serial interface with the following parameters:

- Baud rate: 4800
- Number of data bits: 8 (bit 7 is 0)
- Stop bits: 1 (or more)
- Parity: none
- Handshake: none

NMEA 0183 allows a single talker and several listeners on one circuit.

2.2. Protocol structure

All transmitted data using NMEA 0183 standard are printable ASCII characters. However, some characters are reserved for the following uses:

ASCII character	Use

[1] www.nmea.org

<CR>	Carriage return
<LF>	Line feed, end delimiter
!	Start of encapsulation sentence delimiter
$	Start delimiter
*	Checksum delimiter
,	Field delimiter
\	TAG block delimiter
^	Code delimiter for HEX representation of ISO/IEC 8859-1 (ASCII) characters
~	Reserved

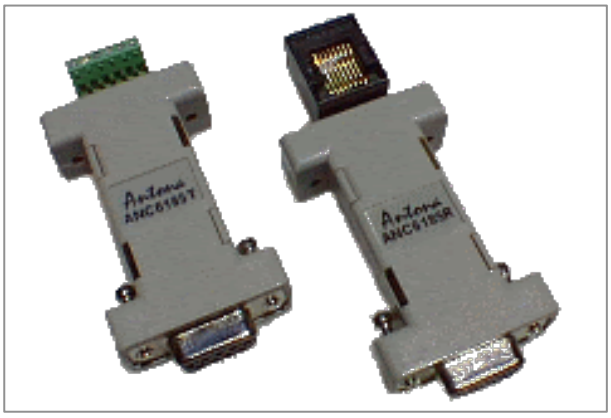
All data is transmitted in the form of sentences. Only printable ASCII characters are allowed, plus CR (carriage return) and LF (line feed). Each sentence starts with a $ sign and ends with CRLF. There are three basic kinds of sentences: talker sentences, proprietary sentences and query sentences. The general format for a talker sentence is:

$ttsss,d1,d2,....CRLF

The first two letters following the $ sign are the talker identifier. The next three characters (sss) are the sentence identifier, followed by a number of data fields separated by commas, followed by an optional checksum, and terminated by carriage return/line feed. The data fields are uniquely defined for each sentence type[2].

3. Converting RS-422 to RS-232

If one needs to connect a NMEA 0183 device to a computer or GNSS receiver without a RS-422 port, then it is necessary to convert the RS-422 signals levels to those of RS-232.
In this guide we use an Antona ANC-6185-R Interface Adapter (see Figure 1)



[2] www.freenmea.net

Figure 1. Antona ANC-6185-R Interface Adapter

The ANC-6185 adapter converts the RS-232C level signals into a bipolar-current noise immune RS-485 or RS-422 compatible signals[3].

The adapter allows transmitting data at distances up to 4,000 feet (1,219.2 m), with baud rates up to 1.2Mbps. It is powered by the serial port and it has LED lights (optional feature) for Transmit and Receive, which makes it easier to test the data transfer.

Connectors: female DB9 to PC RS-232 serial port

In this guide we use this adaptor with its default factory settings.

4. The Airmar 150WX and 110WX weather stations

We use two types of multisensor-ultrasonic weather stations: Airmar 150WX and Airmar 110WX. Both of them record:

- Apparent wind speed an angle
- Barometric pressure
- Ultrasonic wind readings
- Air temperature plus calculated wind chill
- Relative humidity

The Airmar 150WX also counts with:

- Integrated 10 Hz GPS
- Two-axis solid state compass
- Three-axis accelerometer for pitch and roll,

The extra features of Airmar 150WX allow a better orientation with respect to true North. The integrated GPS feature is also useful if the user has to record the data directly into a USB external disk, since it includes the GPS timestamp on each measurement (see Section XXXX).

[3] www.antona.com

Figure 2. Airmar weather stations set up testing site and field deployment.

5. Septentrio configuration

One of the most important tasks -perhaps the most important one- is to ensure a successful transfer and data storage. Setting up a Septentrio PolaRx5 GNSS receiver is rather simple through its user-friendly interface. It can be accessed wirelessly following these steps:

1. Connect the receiver to a power source
2. Connect the Wi-Fi antenna to the rear panel
3. Connect the Airmar 110WX/150WX weather station to the COM2 port, using the Antona ANC-6185-R Interface Adapter
4. Turn on the receiver Wi-Fi by firmly pressing the Wi-Fi button on the front panel
5. Using a computer or tablet, find the PolaRx5 Wi-Fi signal and connect to it
6. Open a web browser using the IP address 192.168.20.1. This will open the web interface to configure the receiver and monitor its activity.
7. Open the menu Communication→Serial Port, and set up the COM2 Port with the values shown in Figure 3. The Flow control field must be set to RTS / CTS to ensure the Antona converter is correctly powered.

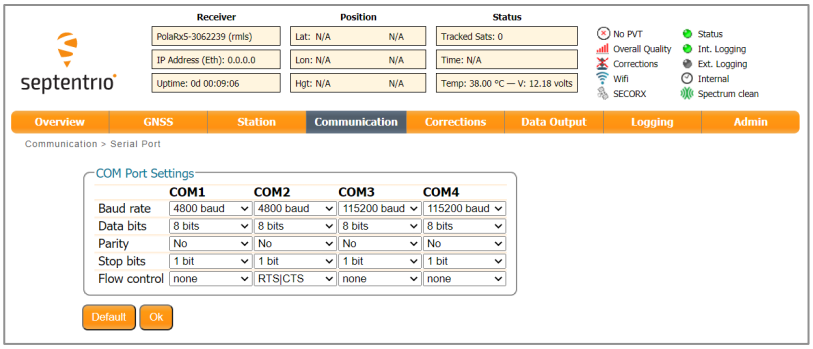


Figure 3

8. Open the menu Corrections→Corrections Input, and set up the Input type as ASCIIIN, as shown in Figure 4. Auto should also detect the data stream if the receiver was used with a serial stream before.

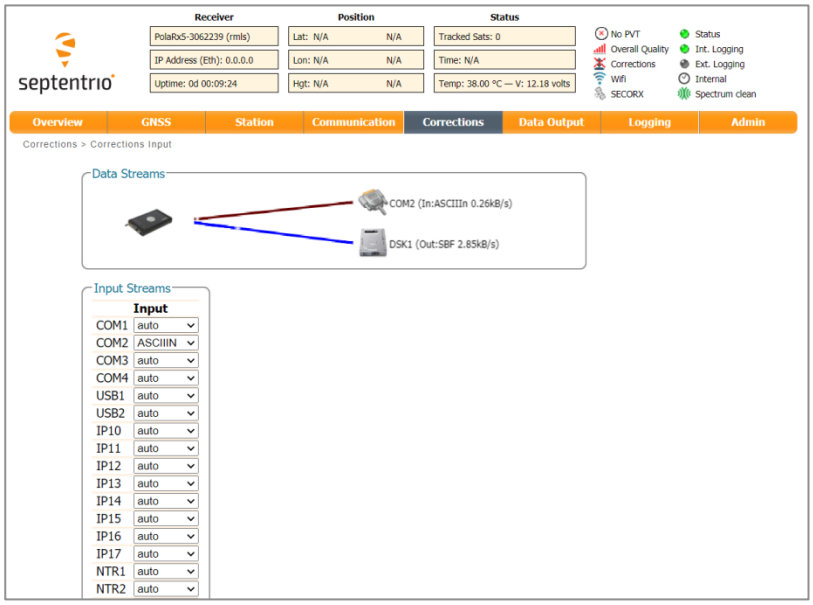


Figure 4

Verify that the Data Streams diagram shows an input stream into the receiver.

9. Open the menu Station→External Sensor, enable the ASCII Input through COM2 and verify that the weather station is in fact transmitting data with the format described in Section 2.2 “Protocol Structure”, as shown in Figure 5.

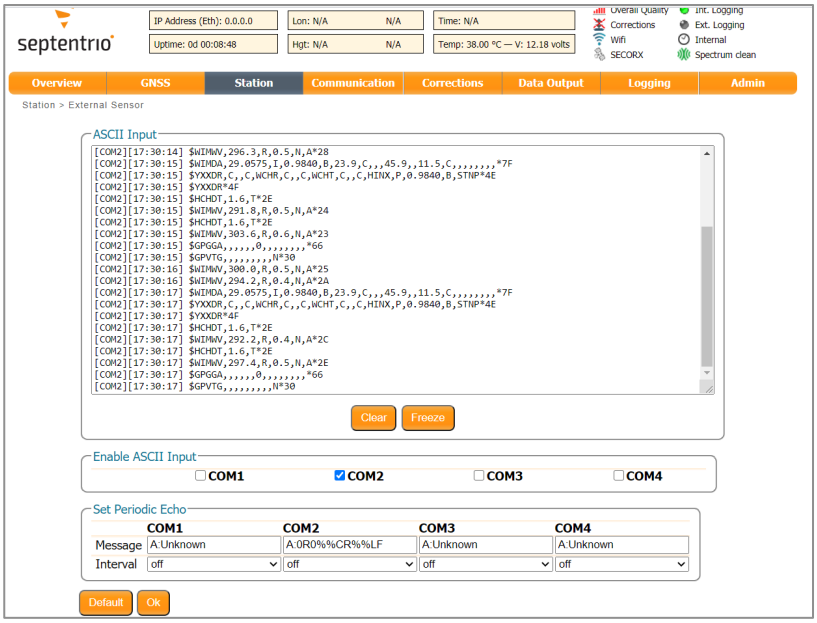


Figure 5

10. Open the menu Logging→Log Sessions (see Figure 6), press the Edit button for LOG4 and set it up with the values shown in Figure 7.

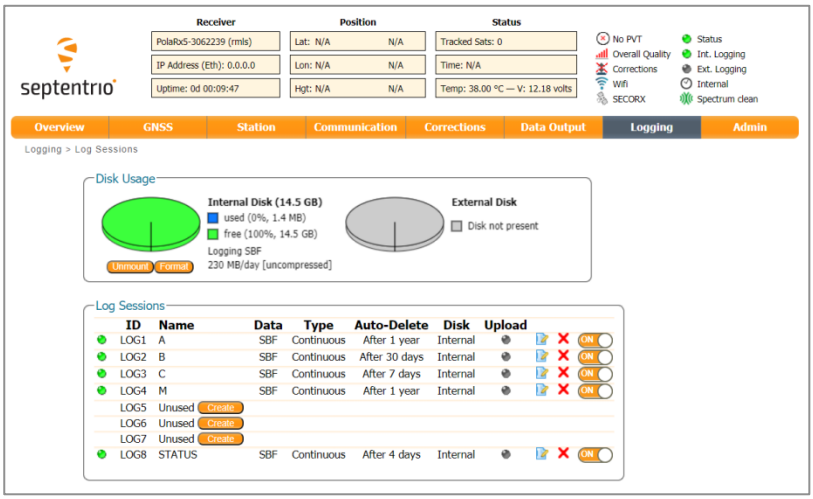


Figure 6

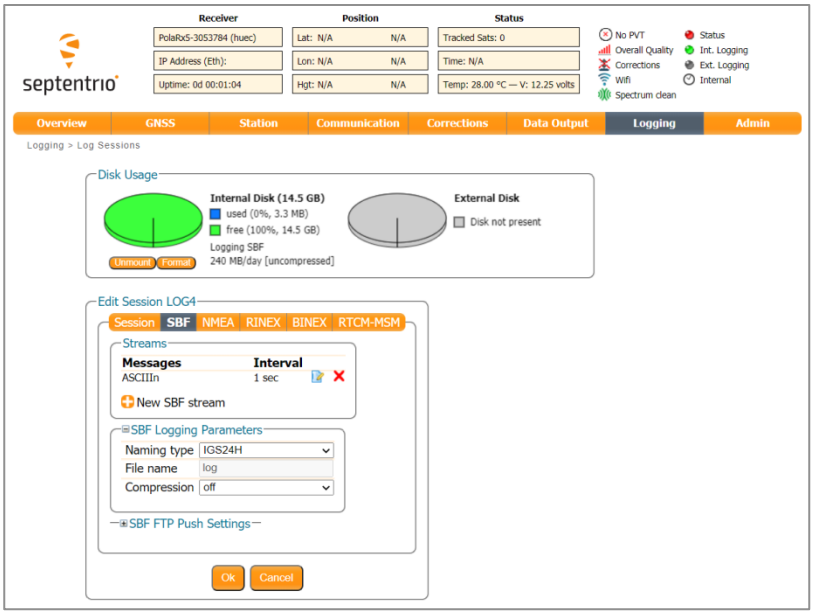


Figure 7

6. List of materials

The materials required to build an integrated Weather+GNSS observation device are the following:

- 1 Septentrio PolaRx5 GNSS receiver
- 1 Compatible GNSS antenna and connection cable
- 1 Airmar 150WX/110WX weather station
- 1 Antona ANC-6185-R interface adapter
- 1 2-meter-high robust tripod to hold the weather station
- 1 mast or tripod to hold the GNSS antenna (depending application)
- 1 Weatherproof case
- 1 12-V battery
- 1 solar panel to charge the battery
- 1 solar charge controller
- IPX6 waterproof connectors

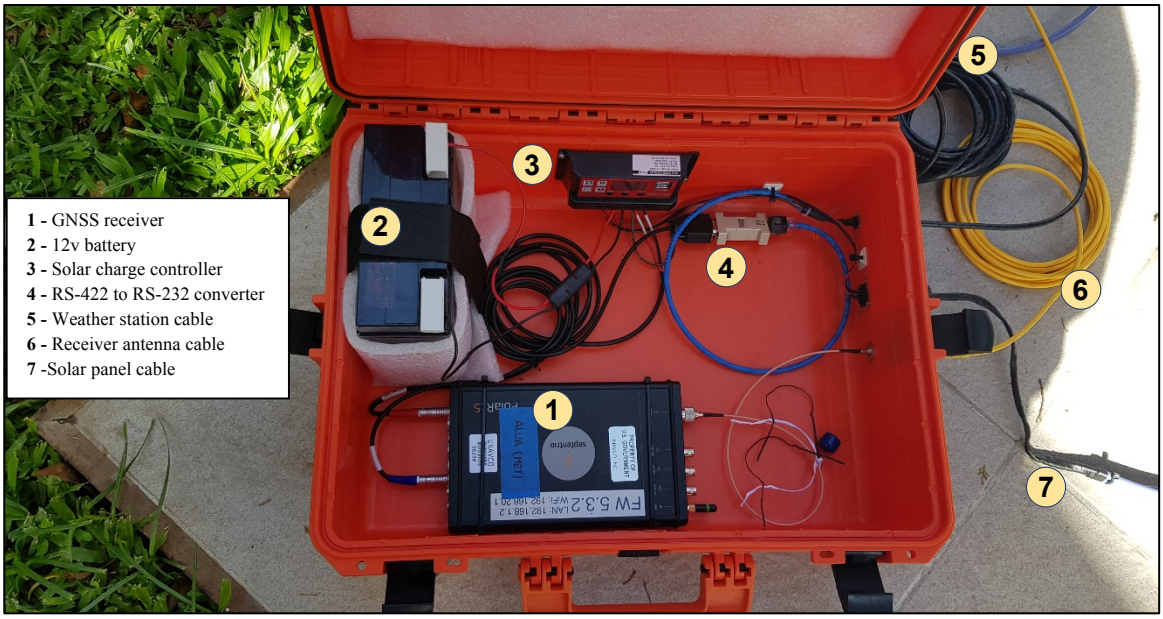


Figure 8. Weatherproof field case with the components to log NMEA 0183 data into GNSS receiver (solar panel not shown in this picture)

7.Setup without GNSS receiver

It is also possible to log NMEA 0183 from the weather station directly into a USB drive using a TeamSurv NMEA Data Logger (see Figure 9).

Figure 9. TeamSurv NMEA Data Logger

In this case it is not necessary to use the Antona ANC-6185-R converter to convert from RS-422 to RS-232 since the TeamSurv NMEA Data Logger already has an RS-422 port.
It is important to note that the TeamSurv NMEA Data Logger does not timestamp to the observations. Therefore, only the Airmar 150WX weather station must be used in this case, since it has an internal GPS that timestamps the observations.

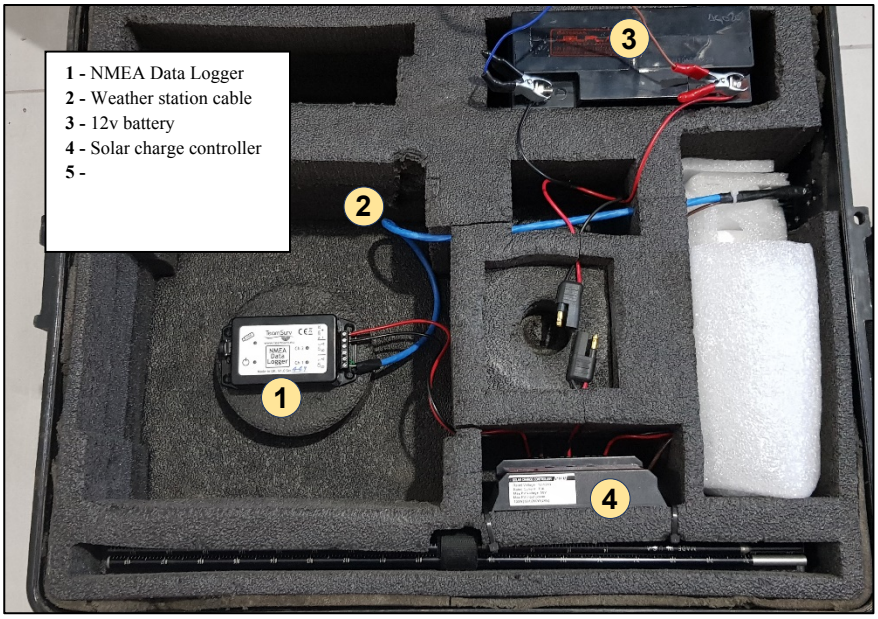


Figure 10. Weatherproof case with the components to log NMEA 0183 data directly into NMEA data logger, without a GNSS receiver.