

# Inertial+

**Inertial  
and GPS  
Measurement  
System**



## **Inertial+ Novatel OEM3 Integration**

**Confidently. Accurately.**



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## Introduction

This manual explains how the Novatel OEM3 product family can be used with the Inertial+. The Novatel OEM3 product range has been superseded by the OEM4 and now the OEM-V products. Using an Inertial+ with an OEM3 can still lead to very good results since the OEM3 GPS receiver is a very capable product.

The Novatel OEM3 products range in accuracy from the Standard Positioning Service (typically 1.8m) to 2cm RTK positioning. Tight integration has been performed with the Novatel OEM3 receivers and the Inertial+ is optimised to give maximum performance using this product range.

The Inertial+ is also designed to work with the Beeline product range. The Beeline products should be used with caution because they are not easy to use. When the processor is heavily loaded they are not stable. The Inertial+ will continue to output while the Beeline reboots but there will be drift while the Beeline recovers.



## Products Covered

The OEM3 GPS receivers were available in a PowerPak or a ProPak. A software license for differential GPS (OEM3-3151) or RT20 (20cm, OEM3-RT20) or RT2 (2cm, OEM3-RT2) can be activated on the OEM3 GPS card. The latest version of the software for the OEM3 GPS cards is V4.503 and this is unlikely to change in the future since the product is now obsolete.



## Connection Details

The Inertial+ should be connected to the Novatel GPS card using RS232 Serial Ports. On the Inertial+ the “External GPS” connector is used. On the Novatel GPS receiver either of the serial ports can be used. Note that the configuration description assumes that COM1 is used.

Most Novatel GPS Enclosures come with a cable that has a 9-way female serial connector. This can be connected directly to the “External GPS” connector on the Inertial+.

Power to the GPS receiver and power to the Inertial+ are wired separately to each product. A common ground should be used to avoid ground problems.



## Configuration

For best results you should return the Novatel card to the factory default settings before using it with the Inertial+. Any changes to the tracking loop or carrier phase smoothing may affect the timing degrade the performance of the Inertial+.

Consult the Novatel documentation to find out how to communicate and configure the GPS cards.

To return the card to factory defaults enter the command:

```
freset
```

This will reboot the GPS card. The serial ports will return to their default states and it may be necessary to reconfigure the terminal (if applicable) before being able to communicate with the card again.

Configure the card with the following commands:

```
COM1 115200 N 8 1 N OFF OFF
LOG COM1 TM1B ONTIME 1.0
LOG COM1 PRTKB ONTIME 0.5
LOG COM1 DOPB ONTIME 1.0
LOG COM1 VLHB ONTIME 0.25
SAVECONFIG
```

If the Inertial+ is connected to a different serial port then change COM1 to the other serial port (COM2). It is possible to use other baud rates; be sure to change both the OEM3 and the Inertial+ so that the baud rate matches. The Inertial+ does not identify the baud rate automatically.

It is essential to only use the binary logs from the Novatel GPS card. Sending any ASCII logs will prevent the Inertial+ from working properly.

It may be necessary to configure other parts of the GPS card, for example WAAS or Differential Corrections, etc. These can be saved using the SAVECONFIG command.

Do not use faster data rates than the ones proposed above. This does not result in higher accuracy but may overload the processor in the Inertial+.



## Fault Diagnosis

The Inertial+ gets different information from the different messages that the OEM3 card outputs. Table 1 lists the information decoded in each message.

**Table 1. OEM3 Message Information**

Message	Data Rate	Description
PRTKB	2Hz	Required for Latitude, Longitude, Altitude
VLHB	4Hz	Required for North, East and Down Velocity
DOPB	1Hz	Required for DOP information and Number of Satellites
TM1B	1Hz	Required for Time, the other messages do not have a Time Validity flag.

In addition, the internal GPS *must* have found time and position so that it can accurately synchronise the IMU to the external GPS. An antenna must be fitted to the Primary GPS port in order to get the Inertial+ to work.

To trouble shoot the interface between the Inertial+ and the external GPS receiver, refer to Table 2.



**Table 2. Troubleshooting**

Problem	Description
The system appears to work even though the External GPS is not connected	The Inertial+ is configured to use the Internal GPS, which is not as accurate.
The GPS LED is off	There is no data being received from the OEM3. (If corrupt data was being sent then the LED would be flashing red).
The “External GPS Skipped Chars” field is increasing	Check that the baud rate is correct. Check that the binary, not ASCII logs are being output.
The software shows that there are some skipped chars from the External GPS	This is normal. As long as the number is not increasing then there is nothing to worry about.
The Position Mode is “None”	The PRTKB or TM1B log is not being sent by the OEM3. The Inertial+ will not decode position until it has confirmed that the time is valid using the TM1B log.
The Velocity Mode is “None”	The VLHB or TM1B log is not being sent by the OEM3. The Inertial+ will not decode velocity until it has confirmed that the time is valid using the TM1B log.
The Number of Satellites is not being displayed	The DOPB log is not being sent by the OEM3.
The Inertial+ does not initialise when driving forwards	If all the data is being received from the OEM3 then the Internal GPS is not working correctly. Check the antenna that is connected to the primary port of the Inertial+.
GPGSA and GPGSV messages are incomplete	The information for the GPGSA and GPGSV messages are not supported on the Novatel OEM3 binary interface to the Inertial+ so most fields in these messages are blank.



## Accuracy Specification

**Table 3. Performance Specification for Inertial+ using Novatel GPS cards**

Parameter	2cm L1/L2 GPS	20cm L1 Float GPS	DGPS	SPS
Positioning	RT2	RT20 OmniStar HP	Differential GPS OmniStar VBS	SPS
Position Accuracy	2cm 1 $\sigma$	20cm (10cm for HP)	0.4m CEP	1.8m CEP L1 1.5m CEP L1/L2
Velocity Accuracy	0.08 km/h RMS	0.08 km/h RMS	0.1 km/h RMS	0.1 km/h RMS
Acceleration				
– Bias	10 mm/s <sup>2</sup> 1 $\sigma$	10 mm/s <sup>2</sup> 1 $\sigma$	10 mm/s <sup>2</sup> 1 $\sigma$	10 mm/s <sup>2</sup> 1 $\sigma$
– Linearity	0.01%	0.01%	0.01%	0.01%
– Scale Factor	0.1% 1 $\sigma$	0.1% 1 $\sigma$	0.1% 1 $\sigma$	0.1% 1 $\sigma$
– Range	100 m/s <sup>2</sup>	100 m/s <sup>2</sup>	100 m/s <sup>2</sup>	100 m/s <sup>2</sup>
Roll/Pitch	0.04° 1 $\sigma$	0.05° 1 $\sigma$	0.06° 1 $\sigma$	0.06° 1 $\sigma$
Heading	0.1° 1 $\sigma$	0.1° 1 $\sigma$	0.1° 1 $\sigma$	0.1° 1 $\sigma$
Angular Rate				
– Bias	0.01°/s 1 $\sigma$	0.01°/s 1 $\sigma$	0.01°/s 1 $\sigma$	0.01°/s 1 $\sigma$
– Scale Factor	0.1% 1 $\sigma$	0.1% 1 $\sigma$	0.1% 1 $\sigma$	0.1% 1 $\sigma$
– Range	100°/s	100°/s	100°/s	100°/s
Track (at 50km/h)	0.1° RMS	0.1° RMS	0.15° RMS	0.15° RMS
Update Rate	100 Hz			
Calculation Latency	3.9 ms			



## Revision History

**Table 4. Revision History**

Revision	Comments
080314	Initial Version.
100716	Information about GPGSA and GPGSV messages.