



Application Note on Using a Wheel Sensor with SPAN

NovAtel's SPAN system supports wheel sensor updates. The wheel sensor, also known as the Distance Measurement Instrument (DMI), is external to the SPAN system. SPAN, with the iMAR iIMU-FSAS IMU, has an optional wheel sensor, the iMWS, that is fully integrated. Other SPAN IMU variants (for example, HG1700 and LN-200), and users requiring a higher resolution wheel sensor, require extra hardware (not supplied by NovAtel) to integrate a wheel sensor.

SPAN accepts properly formatted **WHEELVELOCITY** commands at 1 Hz derived from a user-supplied wheel sensor system. It is the user's responsibility to issue the **WHEELVELOCITY** commands to the receiver. Using the **WHEELVELOCITY** commands, SPAN creates an update measurement for its filter and can output on request **TIMEDWHEELDATA** and **WHEELSIZE** logs.

The *SPAN Technology for OEMV User Manual* describes the commands and logs in this application note. User manuals are available from our website at:

<https://portal.hexagon.com/public/Novatel/assets/Documents/Manuals/om-20000104>

WHEELVELOCITY Command Format

The **WHEELVELOCITY** command, in either ASCII or binary format, inputs wheel sensor information to the OEMV (or OEM4) receiver. Send this command through one of the OEMV COM ports with receive **INTERFACEMODE** set to "NovAtel".

Timing and Frequency

Typical wheel sensor hardware accumulates wheel ticks constantly as the wheel rotates. The SPAN interface, configured to accept cumulative tick counts at a rate of 1 Hz, aligns with the GPS one second boundaries. The GPS second boundary is available from the OEMV 1PPS pulse. Use this pulse to trigger DMI hardware to send the accumulated tick count back to the OEMV through the **WHEELVELOCITY** message.

SPAN does not accumulate raw measurement ticks from a wheel sensor device. Additional hardware is required to accumulate the tick counts and pass the accumulated count to the SPAN system at 1 Hz, triggered by the 1PPS.

If you are using the iMAR-FSAS with the iMWS option, the wheel sensor integration is done for you. If the iMWS is connected and powered, SPAN automatically uses the wheel sensor information and provides **TIMEDWHEELDATA** and **WHEELSIZE** on request.

DMI Update Logic

The SPAN system receives the **WHEELVELOCITY** command through the COM port and applies a time to the message based on the time of the last 1PPS pulse and the latency reported in the log. This timed data passes to the SPAN filter to perform the update. The timed data is available to the user through the **TIMEDWHEELDATA** log. Use the **TIMEDWHEELDATA** log to apply wheel sensor updates in post-processing.

When wheel sensor information is available, the SPAN filter includes a wheel-scale-factor state. The wheel circumference is estimated accurately throughout the run because of the wheel-scale-factor state. Wheel circumference can change due to tire pressure changes, changes in dynamics, or because the setup has changed. Also, if you do not have an accurate measure of the ticks per revolution and/or wheel circumference, the wheel scale factor state adjusts for that and allows you to use the wheel sensor information effectively.

The **SETWHEELPARAMETERS** command lets you set the number of ticks per revolution, the nominal wheel circumference, and resolution of your wheel sensor. The resolution of the wheel sensor can be approximate, as it uses it to weight the wheel sensor information. The conversion of tick counts to a distance in metres uses the ticks per revolution and nominal wheel circumference.

If you do not use the **SETWHEELPARAMETERS** command, the default ticks per revolution is 58 and the default wheel circumference is 1.96 m. If these are close to your actual setup, the estimated wheel scale factor (available in the **WHEELSIZE** log) is close to unity. If the scale factor is much different from unity, it means the wheel parameters you entered (or defaulted to) do not represent how your setup actually is. The wheel sensor information is not useless in this case, but it is not optimal. It means the scale factor state has much more to model, rather than just modeling a residual amount.

The modeled wheel circumference is available in the **WHEELSIZE** log. Information on how the wheel sensor updates apply in real time is available in the **INSUPDATE** log. Refer to the *SPAN Technology for OEMV User Manual* for the descriptions of these logs.

Final Points

If you require further information, regarding the topics covered by this document, please contact:

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