xNAV650 QUICK START GUIDE

The high performance, lightweight, INS for multiple applications

OXTS
Survey

Key Points

LED states

LED states	
Power	🟢 **Green**. Power applied to system 🟠 **Orange**. Traffic present on Ethernet
Status	🔴 **Red and green flash**. The system is asleep. Contact OxTS support for further information 🔴 **Red flash**. The operating system has booted but the GNSS receiver has not yet output a valid time, position, or velocity 🔴 **Red**. The GNSS receiver has locked-on to satellites and has adjusted it's clock to valid (1 PPS output now valid). The INS is ready to initialise 🟠 **Orange**. The INS has initialised and data is being output, but the system is not yet real-time 🟢 **Green**. The INS is running and the system is real-time
GNSS	🔴 **Red flash**. The GNSS receiver is active but has not yet determined heading 🔴 **Red**. The GNSS receiver has a differential heading lock 🟠 **Orange**. The GNSS receiver has a floating (poor) calibrated heading lock 🟢 **Green**. The GNSS receiver has an integer (good calibrated heading lock

Why warm up?

/ Georeferencing requires accurate time, position and orientation.

/ To achieve accurate output of these measurements, the xNAV Kalman filter monitors states of:
1. GNSS antenna position
2. GNSS antenna orientation (dual antenna)
3. IMU sensor scale factor and biases
4. Live position and velocity errors

/ As a result, the raw data provided by the GNSS receiver and IMU needs to provide a varied range of data to give the best opportunity to improve all those states.

Key considerations

/ Excitation of the IMU sensors is the essential requirement of a warm-up. To encourage optimum performance, the warm-up should be performed in a similar style as the survey but with more manoeuvres (without saturating). This is needed for the Kalman filter to make the correct decisions for scaling the sensor output during the survey.

/ If the Kalman filter has not experienced dynamics of a certain type before, the output is likely to be scaled incorrectly as it estimates what the scaling should be. It is unlikely to estimate perfectly at the first attempt.

Setup

Install hardware

/ Mount the INS in/on the vehicle.

/ Position the GNSS antennas and measure the lever arms to the INS measurement point.

/ Connect the GNSS cables and user cable.

/ Supply power.

/ Set up IP connection to the device on the same IP range.

Con igure in NAVcon ig

/ Configure your orientation settings to match the vehicle or the coordinate system in which you want the INS to output. Make sure the "forward" axis matches between the INS and your relevant coordinate system.

NOTE: These orientation settings will define the axis directions for all lever arm measurements later in the NAVconfig process.

/ Set up the remainder of your configuration, ensuring that you set up your LiDAR/camera sensor synchronisation settings if using. Most settings can be optimised in post-processing, but the synchronisation must be correct in real-time.

/ Maximise the separation of GNSS antennas for the best heading performance.

Initialise

/ If using a land vehicle use "dynamic initialisation" and accelerate up to the initialisation speed (5 m/s). Ensure you maintain trajectory until initialisation is complete.

/ If using a UAV ideally use "static initialisation" offered by the dual antenna setup, as this will enable the most reliable heading output with respect to due north.

/ Ensure you are in a clear GNSS environment, if using "static initialisation".

/ If using single antenna to initialise, accelerate your vehicle to exceed the initialisation speed (5 m/s by default). Try to avoid initialising the system with a significant pitch or roll value (ideally these angles should be less than 5°).

Warm-up

Warm-up

/ During the opening 1-3 minutes (3 minutes for a new installation, 1 minute for an optimised setup) the Kalman filter will optimise several real-time states to refine the data output to be as accurate as possible.

NOTE: This warm-up period can be further reduced by using OxTS' combined post-processing solution.

/ During this warm-up period, it is important to exert the INS to dynamic motion that will help to resolve any errors and unknowns in the configuration, particularly GNSS lever arm errors.

/ Perform suitable manoeuvres in your test area that exert significant 'but safe' values of acceleration on the accelerometers and gyroscopes (linear and angular acceleration are needed in both positive and negative directions of every sensor).

/ Try to take advantage of the 3D freedom of motion that a UAV has; perform vertical manoeuvres as well as horizontal "figure-8" style movements.

/ Monitor the real-time states of the system in NAVdisplay's performance template, if a data link is available, to know when you are ready to survey.

/ If any accuracy value looks poor, try to perform a manoeuvre that would excite the INS in that way. To overcome poor heading, perform "figure-8" motion.

Validate and Commit

Validate config

/ Stop the vehicle and review the live system accuracies in NAVdisplay to ensure every state is optimised.

/ If a configuration has been validated in previous surveys then the user will build confidence in their warm-up procedure, allowing for the survey to start almost straight away.
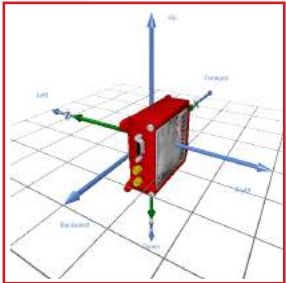
(Optional) Commit optimised settings

/ With the system fully warmed up, you can reopen NAVconfig and commit the real-time optimised settings back to the xNAV650 to use them from startup in every future data collection.

/ It is important that this feature is only used if you are leaving the xNAV650 permanently installed in the vehicle. If the xNAV650 is moved, then this process will become void and future data may not relate correctly to the vehicle in which it is mounted. This step can be completed after the survey is finished or even back at the office.
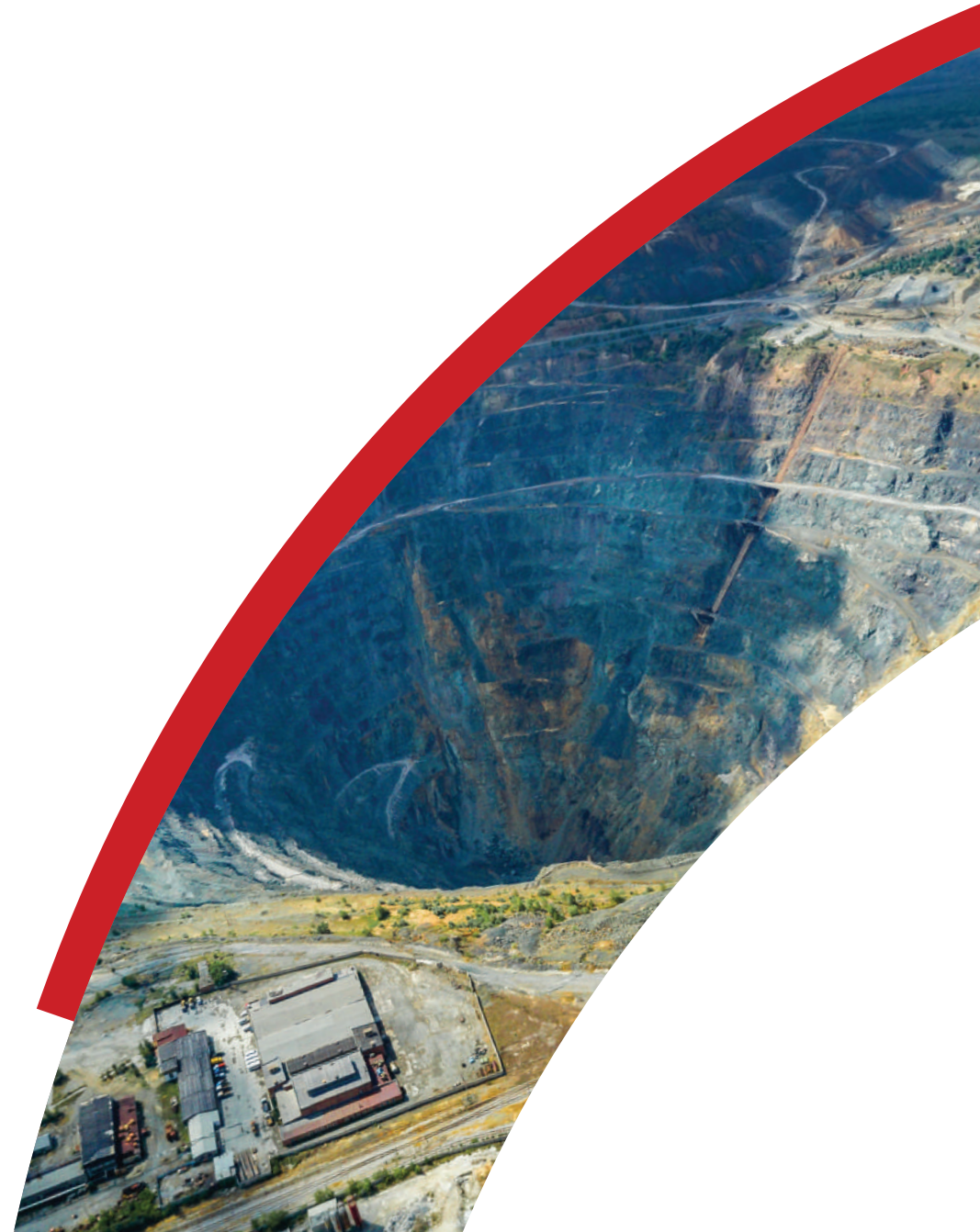
Warm-down

Survey

/ Fly your survey route, intermittently review system accuracies in NAVdisplay if a data link is available.

NOTE: Avoid spending extended periods in GNSS-denied environments so that the IMU does not drift.

/ Try to include acceleration throughout the survey to keep the Kalman filter up to date.

Survey

Warm-down (for post-process)

/ Repeat the warm-up procedure at the end of the survey to provide similar linear and angular acceleration to the system as the initial warm-up.

/ Be sure to recreate the "reverse" of the initialisation process (for backwards post-processing), i.e. for "static initialisation" allow the vehicle to remain stationary for at least 1 minute before powering down (ideally leave more time, especially in a poor GNSS environment).

/ If using single antenna dynamic initialisation, brake to a stop in a straight line from above the configured initialisation speed (5 m/s by default).

Download data

/ It is possible to download the data from the system immediately, via NAVsolve or FTP, or later. The onboard storage will save the raw data automatically.
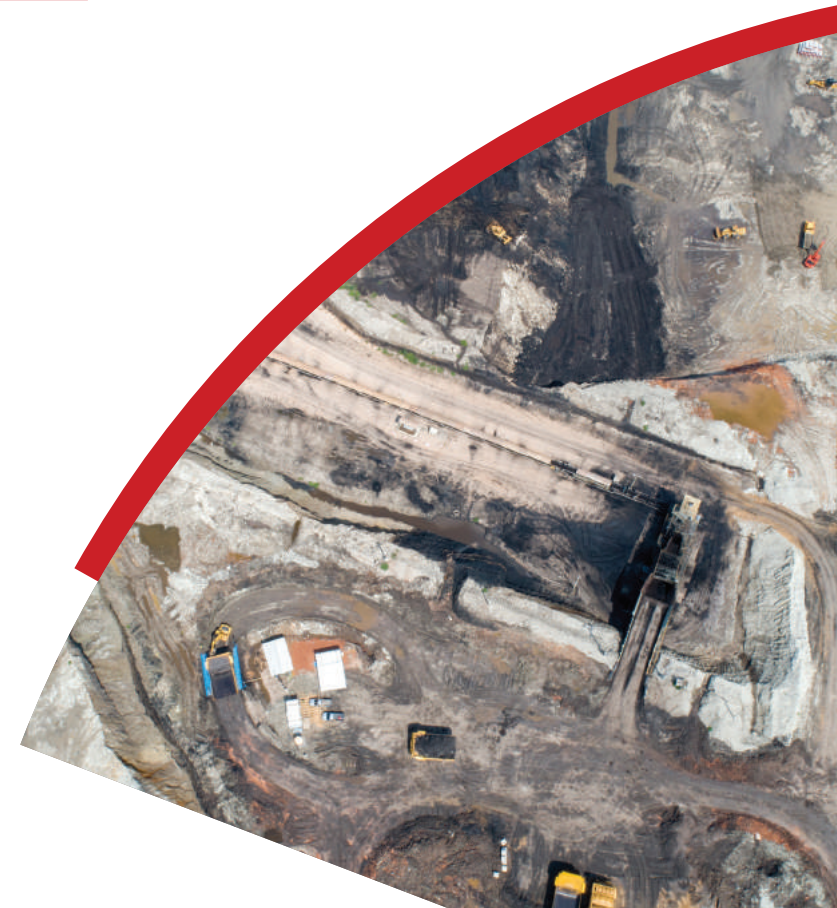
Need further assistance?

Visit the support website:
support.oxts.com

Get in touch if you can't find what you need:
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