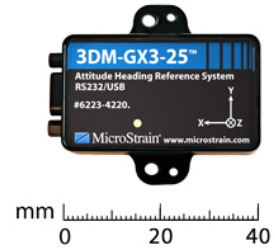


## Using the 3DM-GX3<sup>®</sup>-25 Capture Gyro Bias Function

### 3DM-GX3<sup>®</sup>-25

#### Overview

MicroStrain's 3DM-GX3<sup>®</sup>-25 is a high-performance miniature Attitude Heading Reference System, utilizing MEMS sensor technology. It combines a triaxial accelerometer, **triaxial gyro**, triaxial magnetometer, temperature sensors, and an on-board processor running a sophisticated sensor fusion algorithm to provide static and dynamic orientation, and inertial measurements.



This technical note explains *gyro bias*, how gyro bias may affect the 3DM-GX3<sup>®</sup>-25, and how the user can correct for gyro bias. The user should have some familiarity with the 3DM-GX3<sup>®</sup>-25, its Monitor software, and the 3DM-GX3<sup>®</sup>-25 Data Communications Protocol.

#### Gyro and Gyro Bias

The gyro (gyroscope) on the 3DM-GX3<sup>®</sup>-25 is a 3-axis (X, Y and Z) angular rate sensor. It measures the rate of rotation of the 3DM-GX3<sup>®</sup>-25 and provides the on-board algorithm with a vector in radians/second. The algorithm uses this measurement in parallel with acceleration and magnetic vectors to calculate orientation. The gyro is calibrated over its temperature range at the factory, the calibration coefficients are written to non-volatile memory on the 3DM-GX3<sup>®</sup>-25, and the coefficients are used by the algorithm during operation to insure accuracy.

The bias (or bias error) of a gyro is the signal output from the gyro when it is NOT rotating. Even the best gyros in the world have error sources and bias is one of these errors. Bias can be expressed as a voltage or a percentage of full scale output, but essentially it represents a rotational velocity (in radians/second). In a perfect world, one could make allowance for a fixed bias error. Unfortunately bias error tends to vary, both with temperature and over time. The bias error of a gyro can be due to a number of reasons including calibration errors, switch-on to switch-on, bias drift, effects of shock (g level), circuit noise, etc.

When the 3DM-GX3<sup>®</sup>-25 is calibrated at the factory, any gyro bias is measured and corrected by the calibration. However, for all the reasons mentioned above, the bias may change once in use. To provide for this possibility, the 3DM-GX3<sup>®</sup>-25 has an on-board *Capture Gyro Bias* function. The function will cause the 3DM-GX3<sup>®</sup>-25 to sample the gyro for a specified time, calculate a new coefficient, and from there on, use the new coefficient to correct the gyro output.

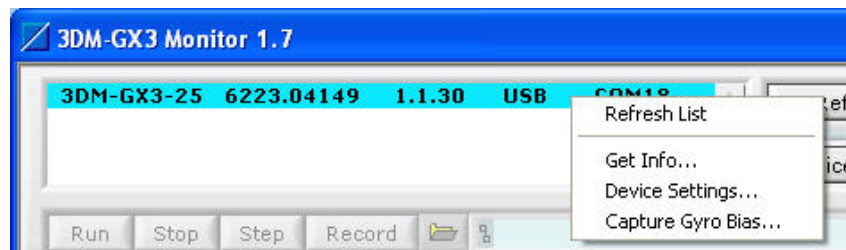
## Recommended Procedure

We recommend that you perform Capture Gyro Bias when you first install the new 3DM-GX3<sup>®</sup>-25 in your application. In continued use, we have no particular recommendation as to how often to perform the function. If you suspect that a bias has crept in as a result of observing drift, physical shock, etc., go ahead and perform the function. There is no downside to performing Capture Gyro Bias.

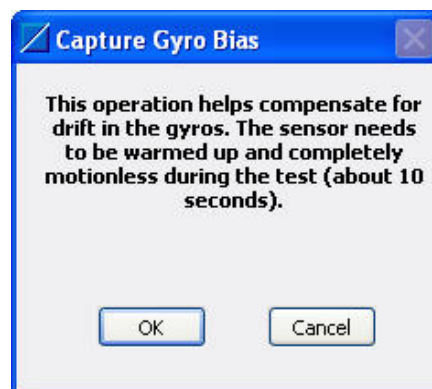
## Monitor Software

The [Monitor software](#) shipped with each starter kit is a full-featured utility for the 3DM-GX3<sup>®</sup>-25. In addition to configuration, data acquisition, display and file writing, it allows the user to perform the Capture Gyro Bias function. Here is a step-by-step method:

- Launch Monitor software and establish communication with the 3DM-GX3<sup>®</sup>-25.
- If the 3DM-GX3<sup>®</sup>-25 is acquiring and displaying data, click the Stop button.
- Right-click the 3DM-GX3<sup>®</sup>-25 as shown in *Figure 1*.
- The Capture Gyro Bias window will appear as shown in *Figure 2*.
- Insure that the 3DM-GX3<sup>®</sup>-25 is **absolutely stationary (motionless, not moving)** and click the OK button.
- The Capture Gyro Bias window will disappear and be replaced by the cursor hourglass for approximately 10 seconds.
- During the 10 seconds, the 3DM-GX3<sup>®</sup>-25 is sampling the gyro thousands of times and making a determination of the gyro bias and calculating a new coefficient.
- After 10 seconds, the Save Gyro Bias window will appear as shown in *Figure 3*.
- Click OK. The new gyro bias coefficient will be written to non-volatile memory and the Save Gyro Bias window will disappear.



*Figure 1 – Right-click menu*



*Figure 2 – Capture Gyro Bias window*



*Figure 3 – Save Gyro Bias window*

The new coefficient will now be used by the 3DM-GX3<sup>®</sup>-25 to correct gyro bias. The new coefficient will survive power cycling and be used until Capture Gyro Bias is again run.

### **Data Communication Protocol**

For those users wishing to implement Capture Gyro Bias in their own application, the function is described in detail on page 22 of the [Data Communications Protocol](#) manual. Additionally, the 3DM-GX3<sup>®</sup>-25 [Software Development Kit](#) (SDK) has sample code in several languages demonstrating the function.

### **Support**

MicroStrain support engineers are always available to expand on this subject and support you in any way we can.