Calibration Certificate

14A0054A-CC-215-120410-1

Oxford Technical Solutions

This certificate states the performance of the product after any change to the internal IMU sensor model. This certificate may not be reproduced other than in full.

Overview

Issued by	Oxford Technical Solutions Ltd.
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	Registered in England and Wales No. 3534778
Confidentiality	Confidential customer information

Calibration Information

Calibration by	Sample Person
Calibration ID	14A0054A-CC-215-120410
Calibration method	14A0054A
Calibration software	OxTS Calibrate, 120320.14g
Calibration date	2012-04-10
Document revision	1

Certificated Item

This calibration only applies to the product listed here:

Model	RT3102
Serial number	215
Result	Pass

IMU Calibration

The performance of the RT3102 after calibration.

Values

Measured alignment matrix and bias vector for the accelerometers and gyroscopes:

$$M_{\mathrm{acc}} = \begin{pmatrix} +.999712 & +5.77480 \cdot 10^{-11} & -3.47950 \cdot 10^{-11} \\ -1.73477 \cdot 10^{-5} & +.999730 & -3.01018 \cdot 10^{-11} \\ +1.86725 \cdot 10^{-6} & +2.05923 \cdot 10^{-6} & +.999704 \end{pmatrix} \qquad B_{\mathrm{acc}} = \begin{pmatrix} +2.24315 \cdot 10^{-4} \\ -5.66539 \cdot 10^{-4} \\ -3.16899 \cdot 10^{-4} \end{pmatrix}$$

$$M_{\mathrm{gyr}} = \begin{pmatrix} +1.00019 & +1.09739 \cdot 10^{-4} & -6.85871 \cdot 10^{-5} \\ -1.09739 \cdot 10^{-4} & +1.00010 & -1.37174 \cdot 10^{-4} \\ +9.60219 \cdot 10^{-5} & -2.88066 \cdot 10^{-4} & +.999945 \end{pmatrix} \qquad B_{\mathrm{gyr}} = \begin{pmatrix} +5.05873 \cdot 10^{-4} \\ -.0617306 \\ -.0345440 \end{pmatrix}$$

The matrices M_{acc} and M_{gyr} are dimensionless. The units of B_{acc} are $\mathrm{m\,s^{-2}}$ and B_{gyr} are $\mathrm{^\circ s^{-1}}$.

Difference of measured alignment matrices and bias vectors from ideal:

$$\delta M_{\text{acc}} = \begin{pmatrix} -.0287502 & +3.30872 \cdot 10^{-9} & -1.99361 \cdot 10^{-9} \\ -9.93951 \cdot 10^{-4} & -.0270446 & -1.72471 \cdot 10^{-9} \\ +1.06985 \cdot 10^{-4} & +1.17985 \cdot 10^{-4} & -.0296139 \end{pmatrix} \qquad \delta B_{\text{acc}} = \begin{pmatrix} +2.24315 \cdot 10^{-4} \\ -5.66539 \cdot 10^{-4} \\ -3.16899 \cdot 10^{-4} \end{pmatrix}$$

$$\delta M_{\text{gyr}} = \begin{pmatrix} +.0192044 & +.00628760 & -.00392975 \\ -.00628760 & +.00960219 & -.00785950 \\ +.00550165 & -.0165050 & -.00548697 \end{pmatrix} \qquad \delta B_{\text{gyr}} = \begin{pmatrix} +5.05873 \cdot 10^{-4} \\ -.0617306 \\ -.0345440 \end{pmatrix}$$

The units of δM_{acc} and δM_{gyr} are % for on-diagonal elements and ° for off-diagonal elements. The units of δB_{acc} are m s^{-2} and δB_{gyr} are $° \text{s}^{-1}$.

Allowable difference of measured alignment matrices and bias vectors from ideal:

$$\Delta M_{\text{acc}} = \begin{pmatrix} .050 & .010 & .010 \\ .010 & .050 & .010 \\ .010 & .010 & .050 \end{pmatrix} \qquad \Delta B_{\text{acc}} = \begin{pmatrix} .010 \\ .010 \\ .010 \end{pmatrix}$$

$$\Delta M_{\text{gyr}} = \begin{pmatrix} .30 & .050 & .050 \\ .050 & .30 & .050 \\ .050 & .050 & .30 \end{pmatrix} \qquad \Delta B_{\text{gyr}} = \begin{pmatrix} .50 \\ .50 \\ .50 \end{pmatrix}$$

The units of ΔM_{acc}, ΔM_{gyr}, ΔB_{acc} and ΔB_{gyr} are, respectively, the same as δM_{acc}, δM_{gyr}, δB_{acc} and δB_{gyr}.

Acceptance

The alignment matrices and bias vectors acceptance are given in the following table.

Description	Result
Accelerometer Alignment	Pass
Accelerometer Bias	Pass
Gyroscope Alignment	Pass
Gyroscope Bias	Pass

Remarks

The accuracy of the navigation measurements output by the RT3102 will change with the dynamic motion of the product. These accuracies are also output by the product and should be monitored to ensure that the measurements are within the accuracy required.

The output accuracies are computed analytically using a sensor model managed by the Kalman filter. A successful calibration ensures that the accuracy of the accelerometers and gyroscopes is sufficient to meet the requirements of the sensor model. This, in turn, ensures that the output accuracies are correct and that the RT3102 achieves the specifications described in the user manual.

The recommended recalibration period is two years.

Authorization

Authorization details regarding revision 1 of this calibration certificate:

Name   Sample Person

Date   2012-04-10