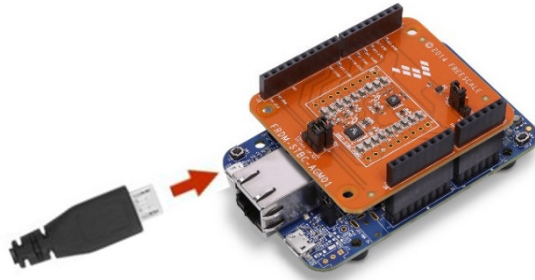
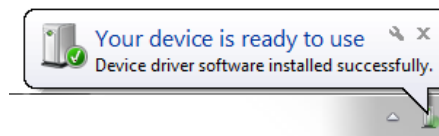
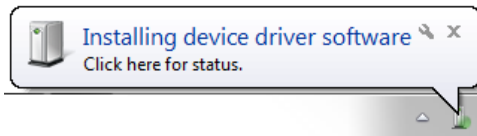


How to set your FRDM-K64F-AGM01 with Freedom Sensor Fusion Toolbox

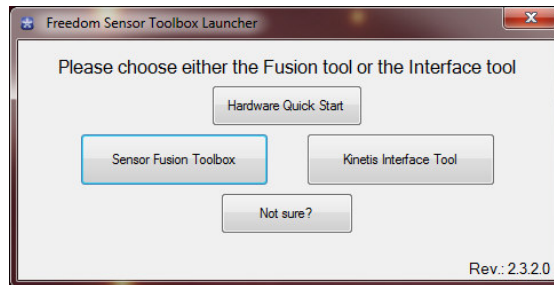
1. Unpack your FRDM-K64F-AGM01
 - a. You should find a FRDM-K64F board, a FRDM-STBC-AGM01 board and a USB cable.
2. Connect the USB cable to your PC and to the “Open SDA” port of the FRDM-K64F-AGM01 board.



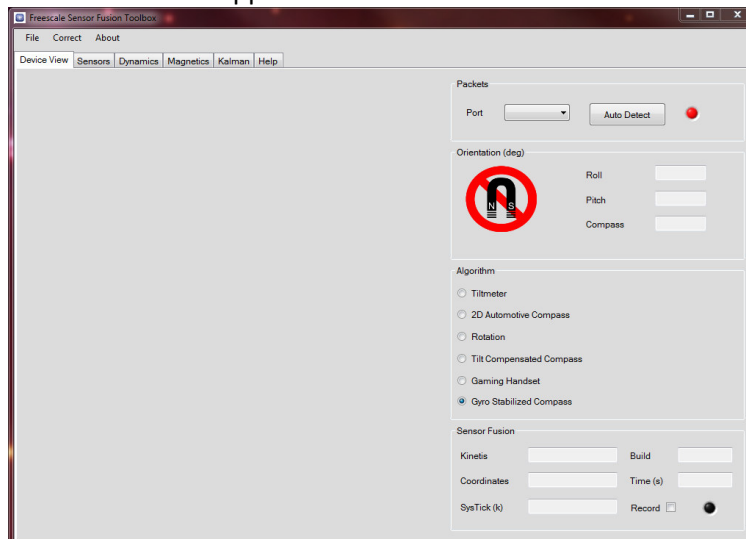
3. Let the device driver to install.



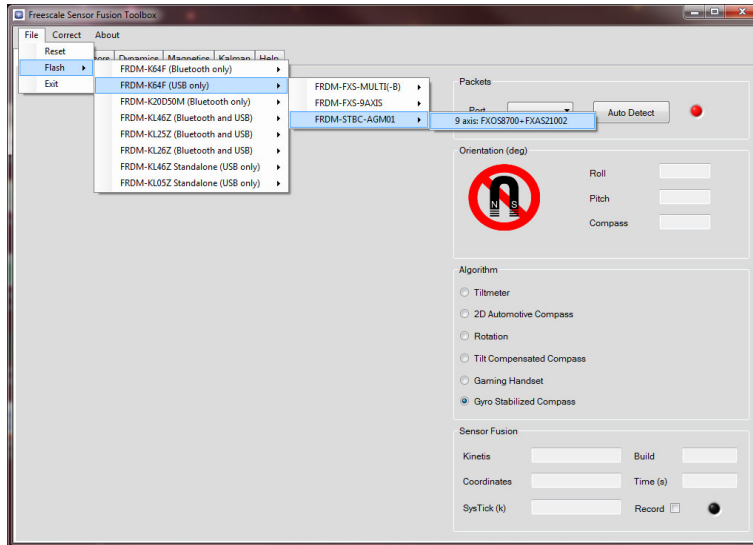
4. Open the “Freedom Sensor Toolbox” GUI and select “Sensor Fusion Toolbox”.



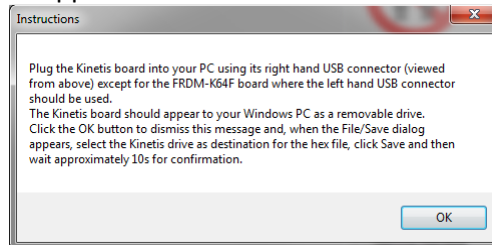
- a. A Window like this should appear:



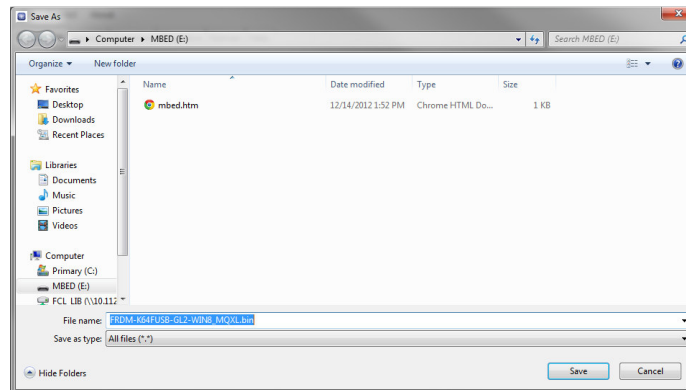
- To program this board go to File -> Flash -> FRDM-K64F (USB only) -> FRDM-STBC-AGM01 -> 9-axis FXOS8700 + FXAS21002



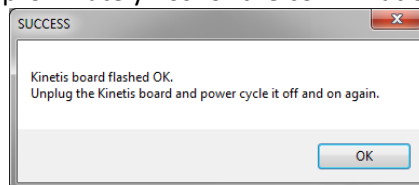
- An "Instructions" window will appear. Read the instructions mentioned here:



- The Kinetis board should appear as a removable drive
- Click "OK" and select the Kinetis drive as destination for save the HEX file

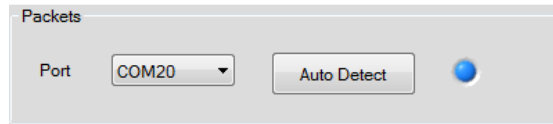


- Click "Save" and wait approximately 10s for the confirmation

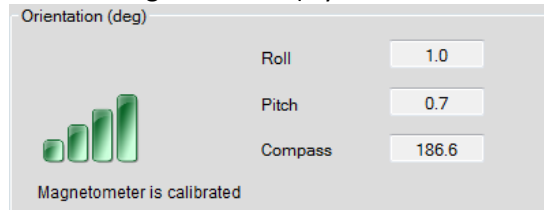


- Click "OK" and unplug the USB and plug it again

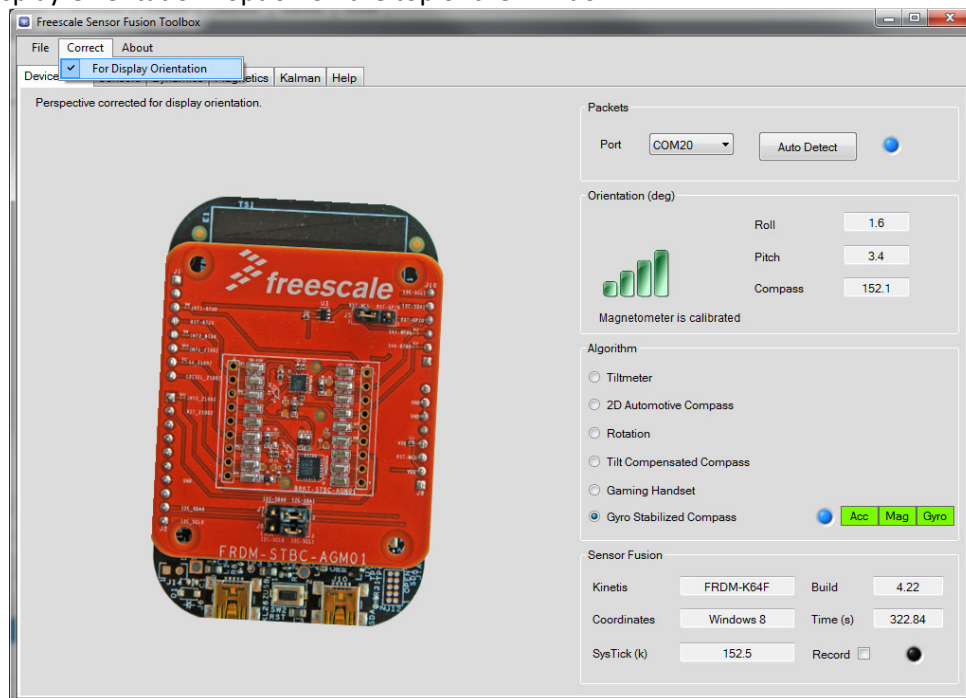
7. Click on “Auto Detect” button and wait for a few seconds until the board is detected.



8. Rotate the board to calibrate the Magnetometer (try not to disconnect the USB cable).

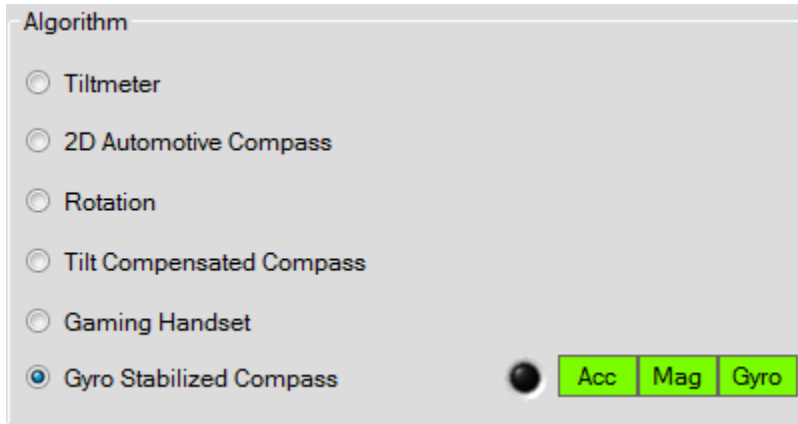


9. Align your board with the screen to correct the image for display Orientation. Use the “Correct” -> “For Display Orientation” option on the top of the Window.



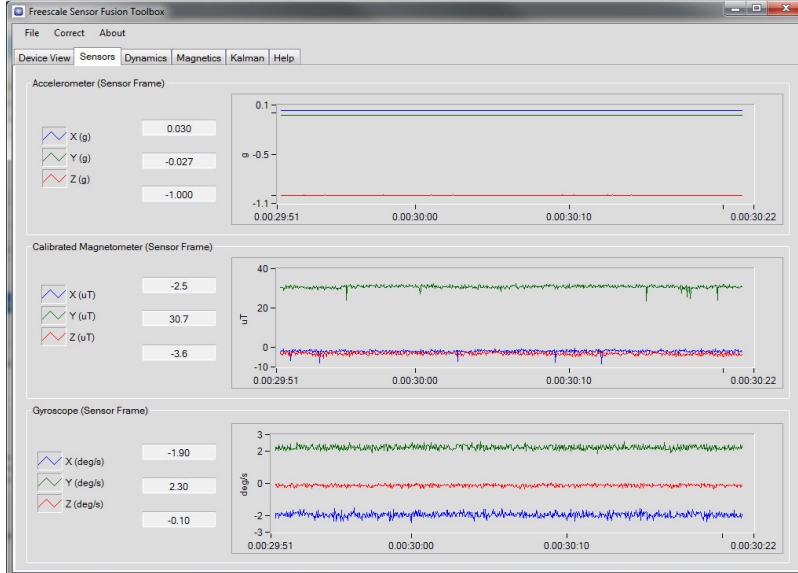
Getting to know the Freescale Sensor Fusion Toolbox:

10. Algorithms:



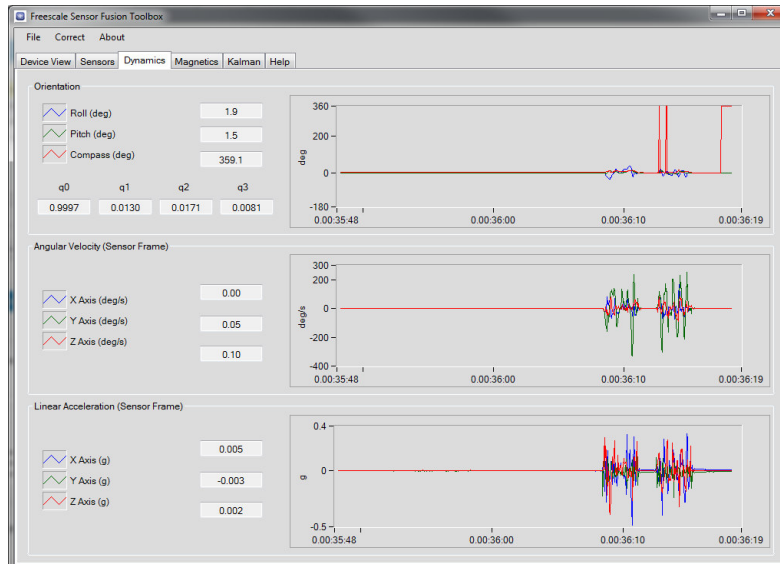
- a. Tiltmeter (Accelerometer only):
 - i. The accelerometer can measure the earth's gravitational field rotated according to its orientation.
- b. 2D Automotive Compass (Magnetometer only):
 - i. The 2D eCompass algorithm is targeted at automobile electronic compass applications since the vehicle is nearly always level.
 - ii. You will notice that the compass heading changes and becomes inaccurate when the FRDM uC board has significant roll or pitch away from horizontal.
- c. Rotation (Gyroscope Only):
 - i. A gyroscope sensor measures angular rotation rate. It has no ability to sense orientation but only changes in orientation.
 - ii. Gyroscope sensor has a small zero signal offset which leads to a non-zero output when the gyroscope is not rotating.
 - iii. In the absence of supporting sensors, the gyroscope display simply rotates with a rate and a rotation axis corresponding to its zero rotation rate offset.
 - iv. A gyroscope sensor operating alone is therefore limited to detection of changes in angular rotation rate
- d. Tilt Compensated Compass (Accelerometer and Magnetometer):
 - i. The combination of accelerometer and magnetometer implements the 3D tilt compensated eCompass.
 - ii. The accelerometer provides roll and pitch angles away from horizontal and the magnetometer sensor provides the compass heading angle.
- e. Gaming Handset (Accelerometer and Gyroscope):
 - i. Computer gaming consoles very commonly use an accelerometer paired with a gyroscope. The accelerometer performs functions like:
 1. Stabilizes the gyroscope's zero rate offset using the earth's downwards pointing gravity vector
 2. Provides a reference for roll and pitch orientation angles
- f. Gyro Stabilized Compass (Accelerometer, Magnetometer and Gyroscope):
 - i. Provides an accurate orientation estimate even in the presence of high linear acceleration and the presence of an external magnetic disturbance.

11. Sensor Tab



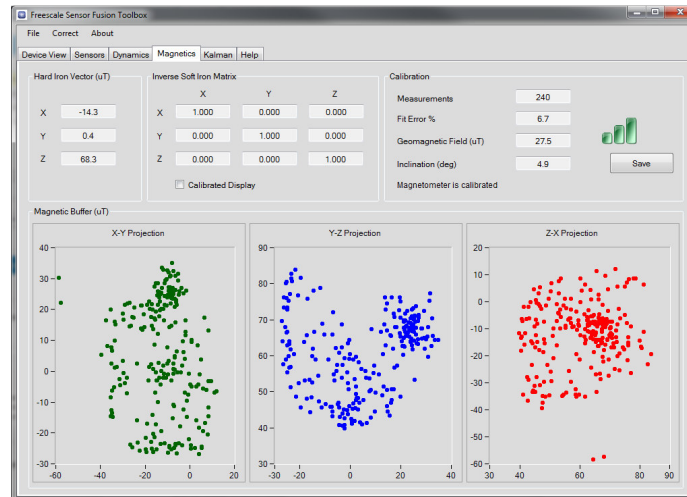
- The Accelerometer group lists and plots the three accelerometer axes measurements in units of gravity g.
- The Calibrated Magnetometer group lists and plots the three calibrated magnetometer axes measurements in units of μT .
- The Gyroscope group lists and plots the three gyroscope axes measurements in units of deg/s .

12. Dynamics tab



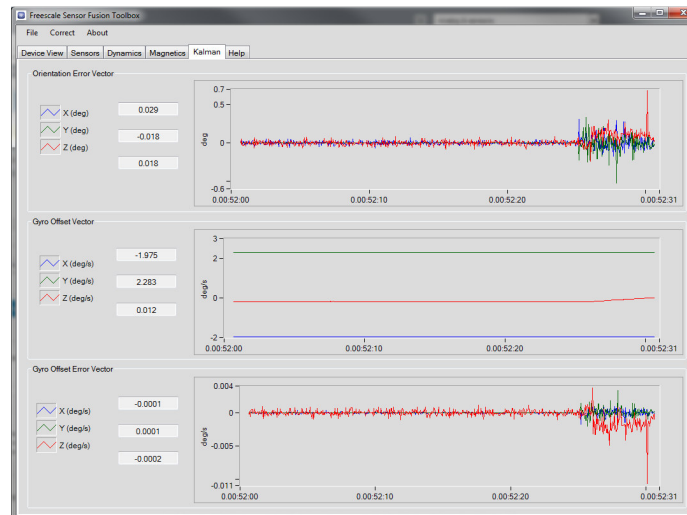
- The Orientation group duplicates the Roll (deg), Pitch (deg) and Compass (deg) display from the Device View tab and also plots these values.
 - The Quaternion q_0 , q_1 , q_2 and q_3 values show the orientation in quaternion format.
- The Angular Velocity group lists and plots the angular velocity in deg/s .
- The Linear Acceleration tab lists and plots the physical acceleration of the FRDM uC board obtained by removing the gravity vector from the accelerometer measurement.

13. Magnetics tab



- a. The Hard Iron Vector (uT) and Inverse Soft Iron Matrix groups list the magnetic calibrated terms computed by the FRDM uC board and applied to the raw magnetic measurements.
- b. The Calibration group provide additional information on the quality of the magnetic calibration:
 - i. Measurements value shows the number of measurements in the magnetic buffer.
 - ii. Fit Error % and the related icon provide a numerical value for the calibration. The quality of the magnetic calibration increases as the fit error decreases and the number of green bars increases.
 - iii. Geomagnetic Field (uT) value shows the estimated value of the local geomagnetic field.
 - iv. Inclination (deg) value shows the angle of the local geomagnetic field downwards from horizontal. This value requires both a magnetometer and accelerometer.
- c. The Magnetic Buffer (uT) shows two-dimensional projections of the magnetic measurement buffer.

14. Kalman tab



- a. Kalman tab lists and plots metrics from the underlying Kalman filters powering some variants of the sensor fusion algorithms.
 - i. Orientation Error Vector displays the orientation corrections applied as a function of time as computed by the Kalman filter.
 - ii. Gyro Offset Vector displays the current gyro zero rate offset correction being applied to orientation rate estimates produced by the Gyroscope sensor.
 - iii. The gyroscope offset vector is updated using the Gyro Offset Error Vector corrections computed by the Kalman filter.