Software Document

Usage Guide for Bosch Accelerometer (BMA2x2 UMDF2.0) Driver

Bosch Sensortec

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BMA:UMDF Driver User Guide	
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1 General Description

This document is intended for using the UMDF 2.0 driver for Bosch accelerometer sensors (BMA2x2 series). It guides the users to install the Bosch Accelerometer (BMA2x2 UMDF2.0) driver in Windows 10 and gives tips to check if the driver is successfully installed.

2 Convention

For ease of description, we have following conventions.

Table 1: Convention

Convention	Description
$variable	This denotes to a variable.
>cmd	A line of windows cmd command starts with a '>'

3 Windows UMDF driver principle

The Bosch Accelerometer (BMA2x2 UMDF2.0) driver is for Bosch BMA2x2 sensors that are connected to an I2C bus (different I2C slave addresses) permanently. The ACPI system for the hardware platform describes the sensor devices' bus connections. The Plug and Play manager obtains the bus connections' information from the ACPI driver, creates connection IDs to represent the bus connections, and passes the connection ID to the Bosch accelerometer driver as hardware resources. The driver uses the connection IDs to open logical connections to the sensor devices, and obtains handles to the connections. The driver specifies the handle as the target for I/O requests that it sends to the device.
The Bosch Accelerometer driver communicates with upper layer applications via sensor class extension in Windows 10. The sensor class extension will report sensor events to the sensor and location platform, so the applications can talk with the UMDF driver. The UMDF driver cannot give I/O control requests to sensor directly, it's the SPB that is in kernel mode send I/O request to sensor, and SPB will communicate with sensor device via I2C.

4 ACPI Configuration in Windows 10

To make the driver implemented in Windows 10, users need to modify and configure the ACPI table before the driver installation. A device node needs to be added to the ACPI table, and some configurations need to be done in the device node. Then, the UMDF driver can be installed on this device node. Here is a sample for adding device node for accelerometer in ACPI talbe:

Step1: download the iasl compiler to modify the ACPI table, users should use the iasl.exe to do the ACPI table modification and configuration (refer to appendix for download links).

Step2: In cmd prompt w/ Admin privileges run command: >iasl.exe –g, then a $filename.dsl file will be produced. This dsl file is the ACPI code of current system. The BMA2x2 device node needs to be added into this dsl file.

Step4: Add new device node in the dsl file of step2 and then recompile dsl by running this command: >iasl.exe $filename.dsl. An .aml file will be produce, rename the .aml output file as ACPITABL.DAT.

Step5: Copy the ACPITABL.DAT of step4 to C:\WINDOWS\SYSTEM32.
Run the following commands in cmd prompt w/ Admin privileges.
>bcdedit /set testsigning on

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>bcdedit /set nointegritychecks on

Step6: Reboot and Device node has been added into the current ACPI.

As for how to add the device node to the .dsl file, the following sample code is for reference. The device node differs from platform to platform. Modifications need to be taken according to the corresponding platforms.

```
Device (ACC)
{
    Name (_ADR, Zero)  // _ADR: Address
    Name (_HID, "BOSC0200")  // _HID: Hardware ID
    Name (_CID, "BOSC0200")  // _CID: Compatible ID
    Name (_DDN, "Accelerometer")  // _DDN: DOS Device Name
    Name (_UID, One)  // _UID: Unique ID
    Method (_CRS, 0, NotSerialized)  // _CRS: Current Resource Settings
    {
         Name (RBUF, ResourceTemplate ()
         {
             GpioInt (Level, ActiveHigh, Exclusive, PullNone, 0x0000,
             "\\_SB.GPO0", 0x00, ResourceConsumer, ,
             )
             {   // Pin list
                 0x0026
             }

             I2cSerialBus (0x0010, ControllerInitiated, 0x00061A80,
                 AddressingMode7Bit, "\\_SB.I2C3",
                 0x00, ResourceConsumer, ,
                 )
         })
         Return (RBUF)
    }
    Method(ROTM, 0x0, NotSerialized)
    {
        Name(RBUF, Package(){
            "0 -1 0",
            "1 0 0",
            "0 0 1"
        })
        Return (RBUF)
    }
    Method (_STA, 0, NotSerialized)  // _STA: Status
    {
        Return (0x0F)
    }
}
```

(For more information about modifying the .dsl file, refer to appendix of ACPI5.0 and the readme of dsl modification.)

Note 1: There two mode supported for Bosch Accelerometer driver retrieving sensor data from hardware: Interrupt mode and Polling mode. In the sample above, the section GpioInt with gray shading is for interrupt configuration. When the configuration is valid, Bosch Accelerometer driver will work in interrupt mode. If there is not interrupt configuration in ACPI table, Bosch Accelerometer will work in polling mode.

Note 2: In the sample above, the method “ROTM” describes relationship between the sensor's X,Y and Z axes and the device's X,Y and Z axes (defined by OEM). This is known as the Rotation Matrix. Each row represents the transformation applied to the X, Y and Z axis respectively. Each entry is a decimal number between -1 and 1 with each number having a max of 3 decimal places.

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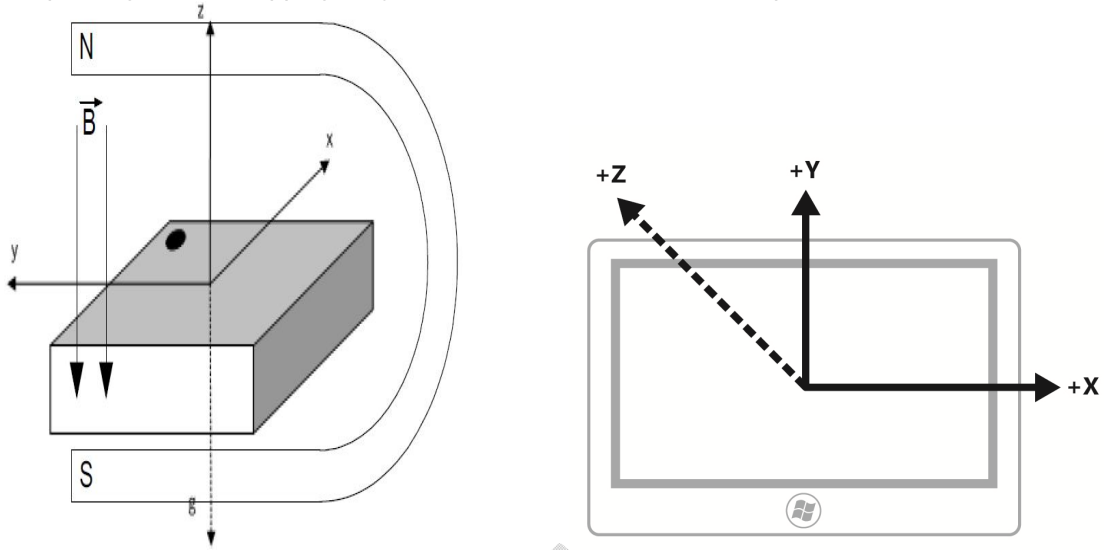
Remapping is to unify hardware components' axis in the approperate coordinate of target platform according to the placement and target platform definition. The following figure shows the target hardware corresponding to the remapping array in the method "ROTM" in the sample above.



$X_{target}=-Y_{sensor}$; $Y_{target}=X_{sensor}$; $Z_{target}=Z_{sensor}$;

Figure 1 Axis Remapping

5 Files in Bosch Accelerometer driver release package

The directory structure of the release package for Bosch Accelerometer (BMA2x2 UMDF2.0) driver is shown as bellow:

```
|-- Doc
|   |-- Usage Guide for BMA2x2 UMDF2 Driver.doc
|
|-- Tool
|   |-- BoschAccelerometer_Tool.exe
|
|-- x64
|   |-- package
|       |   |-- boschaccelerometer.cat
|       |   |-- boschaccelerometer.dll
|       |   |-- boschaccelerometer.inf
|   |-- BoschAccelerometer.pdb
|
|-- x86
|   |-- package
|       |   |-- boschaccelerometer.cat
|       |   |-- boschaccelerometer.dll
|       |   |-- boschaccelerometer.inf
|
|-- ReleaseNotes.txt
```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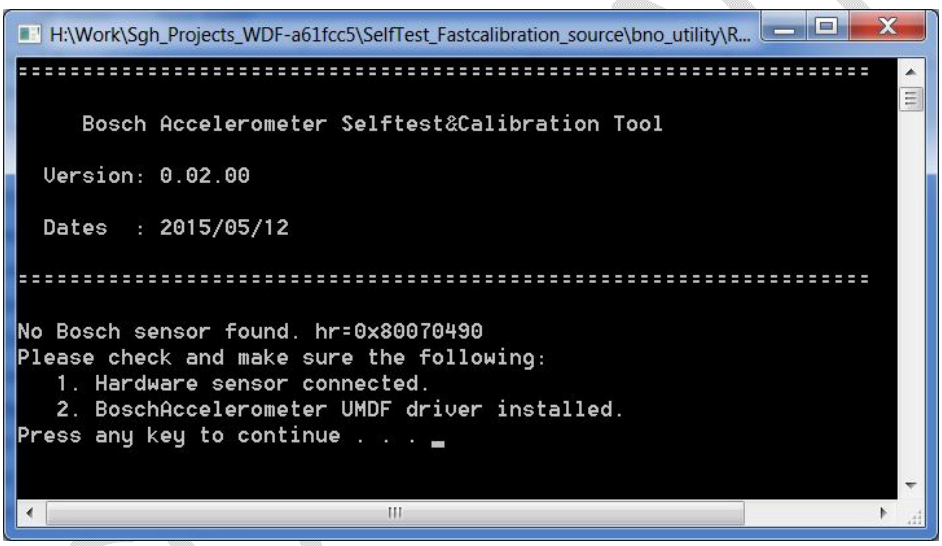
User can find this document in directory “Doc” and BoschAccelerometer_Tool.exe in directory “Tool”. Bosch Accelerometer drivers for both x64 and x86 are supplied in the generic release package at same time. It is recommended user refer to the ReleaseNotes.txt for the details of the release.

In the package in directory “x86” and “x64”, the boschaccelerometer.inf file contains information that the system Windows components use to install support for the device. Windows copies this file to the %*SystemRoot*%*inf* directory when it installs the driver.

The driver catalog file (.cat) contains digital signatures. All driver packages should be signed in formal release version (After Version 1.x).

6 Self test & calibration tool

A tool for the usage of self test and calibration is supplied with BoschAccelerometer driver. It’s a console application named “BoschAccelerometer_Tool.exe“. It should be opened with administrator priviledge. If the BoschAccelerometer driver is not installed or not installed successfully in the platform, it will show the prompt as following:



When Bosch Accelerometer driver has been installed and enabled, the tool will retrieve and get the sensor information as below:

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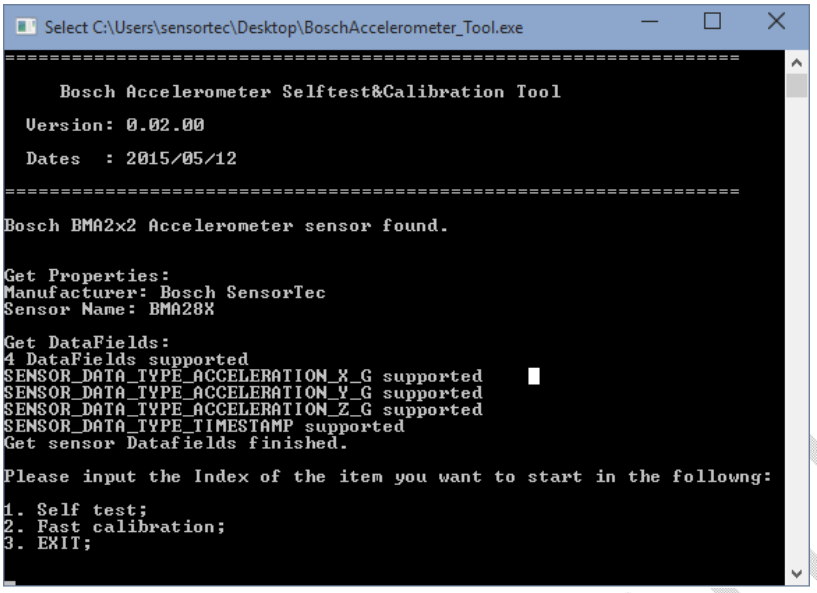

Then follow the intructions, fulfill the self test or calibration and get the coresponding result.

7 The UMDF Driver Installation

After the ACPI table configuration done, users can install the UMDF driver using devcon.exe. To get the devcon.exe, you can refer to the appendix.
Run the following command in admin privilege to install the driver.

> devcon [/r] install Filepath\ BoschSensorCollectionDriver.inf BOSC0200

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9 Appendix

https://www.acpica.org/downloads/binary-tools (iASL compiler and Windows ACPI tools link)

http://msdn.microsoft.com/enus/library/windows/hardware/ff544707%28v=vs.85%29.aspx (link for devcon.exe)

http://www.acpi.info/spec50.htm (link for ACPI spec)

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9. Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
0.1	Document creation	The initial version.	April 16th, 2015
0.2	6 Self test & calibration tool	Added self test & calibration tool related. Added the directory structure figure for release package.	May 15th, 2015
0.2.1	Chapter 4 modified.	Changed the ACPI device node sample: Recover the device node name From "BMA2x2" to "ACC".	May 21st, 2015

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