How to Calibrate 0g Offset for the MMA745xL Family

The offset can be calibrated by storing the offset values in the designated offset drift registers $10 to $15 in the accelerometer. These values will be stored here until the part loses power. It is a very simple to store these values written to the registers in the memory of a microcontroller, if used in conjunction with the sensor. This will provide automatic calibration of the sensor each time the sensor is turned back on.

In order to calibrate the MMA745xL 0g offset, the predetermined digital offset values should be subtracted from the reading of the actual digital sensing values. The following procedure is a recommendation for how this can be accomplished:

1. After power up, set up the "Mode Control Register" (Register $16) to be in "measurement mode" by writing $05 into Register $16. Then read the X, Y and Z offset values from the Registers $00-$08. The first 6 registers of the 9 are 10-bit XYZ output values: LSB, first; MSB, second. Please verify with the data sheet for detailed register information.
2. In this step, the offset compensation is calculated to shift the offset to zero.

For example, if the 0g offset is calibrated sitting flat (where X = 0g, Y = 0g and Z = +1g) in 2g mode (64LSB/g sensitivity), the outputs from Registers $00-$08 are the following: X = -30, Y = -20, Z = +20. In this case,

- X must be shifted by +30 to get X back to zero
- Y must be shifted by +20 to get to zero
- Z must be shifted by (+64-20) = +44 to get to +64 (since Z is in the +1g orientation)

3. These compensation values can be written in hexadecimal into the "Offset Drift Registers" $10-$15. The Offset Drift Registers require each value to be ½ LSB, therefore the calibration values calculated in Step 2 must be multiplied by two. Note that there will still be a bit of offset shift, and you may need to multiply by a bit more than two to exactly subtract the offset.

Therefore, for this example, you should:

- Write +60 (3C Hex) into the X drift Register $10
- Write +40 (28 Hex) into the Y drift Register $12
- Write +88 (2C Hex) into the Z drift Register, $14

In the example used above, the compensation values were all positive values. If the compensation requires negative values, remember that 2's complement is always used in hexadecimal for storing the signed value. If you are using 10-bit mode, and the calibrated values are greater than 8 bits, then there is another register for up to 3 more bits:

- Register $10 and $11 are for X
- Register $12 and $13 are for Y
- Register $14 and $15 are for Z

These registers follow signed byte data using 2's complement. Reading or writing low byte (X, Y or Z) OUTL latches high byte data (X, Y, or Z) OUTH to allow coherent 10-bit reads or writes. (X, Y, or Z) OUTH should be read/written directly following (X, Y or Z) OUTL.

4. After this compensation process is complete, you can continue to modify the values by overcompensating until you get the final output to be right at 0 for X and Y and at 64 for Z. Note this is an iterative process.
5. Now the calibrated values are stored in the "Offset Drift Registers". To avoid the values being erased when the power is turned off, it is recommended to store these values in flash or a nonvolatile memory in the main processor or external to the processor. It is also recommended to include a short start-up sequence to write the compensation values stored in flash or nonvolatile memory to the registers $10-$15 in the accelerometer on start-up. If a microcontroller is used, a recursive program is available to autocalibrate the device.

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