I2C address translation

This document will hold a table with XOR configurations and their output.

Since each sensor has the same 4 starting addresses the output is defined as the starting address XOR the translation byte.

In order to find out which settings we can and cannot use we need to take the following into account:

* There should be no conflicts in the entire system
* The minimum address is 0x03 for the Raspberry (you can find this by doing the command “sudo i2cdetect -y 1” from the raspberry terminal)
* The maximum address should not exceed 0x77 (again found by doing the command in the terminal)

The maximum address is 0x77 due to 3 reasons.

1. The i2c addresses of the sensors are 7 bit addresses.
2. An i2c address that starts with 111 10xx defines that the address is a 10 bit address
3. An i2c address that starts with 111 11xx is set apart for future purposes

We want as many possible configurations to get a high number of sensors.

At the end of this document is a table with all the values for the XOR translation byte followed by the corresponding addresses. The discussion of these results will take place here since it is not handy to go through all of these tables. I have added the table for completeness. (Appendix A)

The lines in the table that are strike through are lines that do not meet the above set of requirements. An X at the end means at least one value is below the minimum and an Y means that at least one value is above the maximum

After taking this into account we are left with a total of 80 different combinations. It makes sense that some if not most of these will cause conflicts with others.

In order to generate as many combinations it is handy to not have it in Hexadecimal representation instead of binary.

You can calculate the hexadecimal Values of the correct values with the program on the usb stick called “HexI2CCalculator.jar”

If you run this it generates a text file called “I2CValidHex.txt”, this file has 5 columns;

* The first column is the translation byte in binary (use this since the data sheet also uses binary for the translation byte)
* The second column is the resulting Accelerometer address.
* The third column is the resulting Gyroscope address.
* The fourth column is the resulting Magnetometer address.
* The fifth column is the resulting Barometer address.

After a quick look by hand we found 20 different translation addresses which do not conflict with each other. We do not know if this is the optimal solution but seeing as the project will have less than 20 nodes this does not matter.

The correct translation bytes and their resulting addresses are written below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Translation Byte | Accelerometer Address | Gyroscope Address | Magnetometer Address | Barometer Address |
| 000 0000 | 0x53 | 0x69 | 0x1E | 0X77 |
| 000 0001 | 0X52 | 0X68 | 0X1F | 0X76 |
| 000 0010 | 0X51 | 0X6B | 0X1C | 0X75 |
| 000 0011 | 0X50 | 0X6A | 0X1D | 0X74 |
| 000 0100 | 0X57 | 0X6D | 0X1A | 0X73 |
| 000 0101 | 0X56 | 0X6C | 0X1B | 0X72 |
| 000 0110 | 0X55 | 0X6F | 0X18 | 0X71 |
| 000 0111 | 0X54 | 0X6E | 0X19 | 0X70 |
| 100 0000 | 0X13 | 0X29 | 0X5E | 0X37 |
| 100 0001 | 0X12 | 0X28 | 0X5F | 0X36 |
| 100 0010 | 0X11 | 0X2B | 0X5C | 0X35 |
| 100 0011 | 0X10 | 0X2A | 0X5D | 0X34 |
| 100 0100 | 0X17 | 0X2D | 0X5A | 0X33 |
| 100 0101 | 0X16 | 0X2C | 0X5B | 0X32 |
| 100 0110 | 0X15 | 0X2F | 0X58 | 0X31 |
| 100 0111 | 0X14 | 0X2E | 0X59 | 0X30 |
| 101 0100 | 0X07 | 0X3D | 0X4A | 0X23 |
| 101 0101 | 0X06 | 0X3C | 0X4B | 0X22 |
| 101 0110 | 0X05 | 0X3F | 0X48 | 0X21 |
| 101 0111 | 0X04 | 0X3E | 0X49 | 0X20 |

These are all valid addresses and do not conflict with each other, using the datasheet [D001-page 9] we can then setup the resistors to the correct values.

# Appendix A XOR |Accel |Gyro |Magnet |Pressure 0000000|1010011|1101001|0011110|1110111 0000001|1010010|1101000|0011111|1110110 0000010|1010001|1101011|0011100|1110101 0000011|1010000|1101010|0011101|1110100 0000100|1010111|1101101|0011010|1110011 0000101|1010110|1101100|0011011|1110010 0000110|1010101|1101111|0011000|1110001 0000111|1010100|1101110|0011001|1110000 ~~0001000|1011011|1100001|0010110|1111111Y 0001001|1011010|1100000|0010111|1111110Y 0001010|1011001|1100011|0010100|1111101Y 0001011|1011000|1100010|0010101|1111100Y 0001100|1011111|1100101|0010010|1111011Y 0001101|1011110|1100100|0010011|1111010Y 0001110|1011101|1100111|0010000|1111001Y 0001111|1011100|1100110|0010001|1111000Y 0010000|1000011|1111001|0001110|1100111Y 0010001|1000010|1111000|0001111|1100110Y 0010010|1000001|1111011|0001100|1100101Y 0010011|1000000|1111010|0001101|1100100Y 0010100|1000111|1111101|0001010|1100011Y 0010101|1000110|1111100|0001011|1100010Y 0010110|1000101|1111111|0001000|1100001Y 0010111|1000100|1111110|0001001|1100000Y~~ 0011000|1001011|1110001|0000110|1101111 0011001|1001010|1110000|0000111|1101110 0011010|1001001|1110011|0000100|1101101 0011011|1001000|1110010|0000101|1101100 ~~0011100|1001111|1110101|0000010|1101011X 0011101|1001110|1110100|0000011|1101010X 0011110|1001101|1110111|0000000|1101001X 0011111|1001100|1110110|0000001|1101000X~~ 0100000|1110011|1001001|0111110|1010111 0100001|1110010|1001000|0111111|1010110 0100010|1110001|1001011|0111100|1010101 0100011|1110000|1001010|0111101|1010100 0100100|1110111|1001101|0111010|1010011 0100101|1110110|1001100|0111011|1010010 0100110|1110101|1001111|0111000|1010001 0100111|1110100|1001110|0111001|1010000 ~~0101000|1111011|1000001|0110110|1011111Y 0101001|1111010|1000000|0110111|1011110Y 0101010|1111001|1000011|0110100|1011101Y 0101011|1111000|1000010|0110101|1011100Y 0101100|1111111|1000101|0110010|1011011Y 0101101|1111110|1000100|0110011|1011010Y 0101110|1111101|1000111|0110000|1011001Y 0101111|1111100|1000110|0110001|1011000Y~~ 0110000|1100011|1011001|0101110|1000111 XOR |Accel |Gyro |Magnet |Pressure 0110001|1100010|1011000|0101111|1000110 0110010|1100001|1011011|0101100|1000101 0110011|1100000|1011010|0101101|1000100 0110100|1100111|1011101|0101010|1000011 0110101|1100110|1011100|0101011|1000010 0110110|1100101|1011111|0101000|1000001 0110111|1100100|1011110|0101001|1000000 0111000|1101011|1010001|0100110|1001111 0111001|1101010|1010000|0100111|1001110 0111010|1101001|1010011|0100100|1001101 0111011|1101000|1010010|0100101|1001100 0111100|1101111|1010101|0100010|1001011 0111101|1101110|1010100|0100011|1001010 0111110|1101101|1010111|0100000|1001001 0111111|1101100|1010110|0100001|1001000 1000000|0010011|0101001|1011110|0110111 1000001|0010010|0101000|1011111|0110110 1000010|0010001|0101011|1011100|0110101 1000011|0010000|0101010|1011101|0110100 1000100|0010111|0101101|1011010|0110011 1000101|0010110|0101100|1011011|0110010 1000110|0010101|0101111|1011000|0110001 1000111|0010100|0101110|1011001|0110000 1001000|0011011|0100001|1010110|0111111 1001001|0011010|0100000|1010111|0111110 1001010|0011001|0100011|1010100|0111101 1001011|0011000|0100010|1010101|0111100 1001100|0011111|0100101|1010010|0111011 1001101|0011110|0100100|1010011|0111010 1001110|0011101|0100111|1010000|0111001 1001111|0011100|0100110|1010001|0111000 ~~1010000|0000011|0111001|1001110|0100111X 1010001|0000010|0111000|1001111|0100110X 1010010|0000001|0111011|1001100|0100101X 1010011|0000000|0111010|1001101|0100100X~~ 1010100|0000111|0111101|1001010|0100011 1010101|0000110|0111100|1001011|0100010 1010110|0000101|0111111|1001000|0100001 1010111|0000100|0111110|1001001|0100000 1011000|0001011|0110001|1000110|0101111 1011001|0001010|0110000|1000111|0101110 1011010|0001001|0110011|1000100|0101101 1011011|0001000|0110010|1000101|0101100 1011100|0001111|0110101|1000010|0101011 1011101|0001110|0110100|1000011|0101010 1011110|0001101|0110111|1000000|0101001 1011111|0001100|0110110|1000001|0101000 ~~1100000|0110011|0001001|1111110|0010111Y 1100001|0110010|0001000|1111111|0010110Y 1100010|0110001|0001011|1111100|0010101Y 1100011|0110000|0001010|1111101|0010100Y~~ XOR |Accel |Gyro |Magnet |Pressure ~~1100100|0110111|0001101|1111010|0010011Y 1100101|0110110|0001100|1111011|0010010Y 1100110|0110101|0001111|1111000|0010001Y 1100111|0110100|0001110|1111001|0010000Y 1101000|0111011|0000001|1110110|0011111X 1101001|0111010|0000000|1110111|0011110X 1101010|0111001|0000011|1110100|0011101X 1101011|0111000|0000010|1110101|0011100X~~ 1101100|0111111|0000101|1110010|0011011 1101101|0111110|0000100|1110011|0011010 1101110|0111101|0000111|1110000|0011001 1101111|0111100|0000110|1110001|0011000 1110000|0100011|0011001|1101110|0000111 1110001|0100010|0011000|1101111|0000110 1110010|0100001|0011011|1101100|0000101 1110011|0100000|0011010|1101101|0000100 ~~1110100|0100111|0011101|1101010|0000011X 1110101|0100110|0011100|1101011|0000010X 1110110|0100101|0011111|1101000|0000001X 1110111|0100100|0011110|1101001|0000000X~~ 1111000|0101011|0010001|1100110|0001111 1111001|0101010|0010000|1100111|0001110 1111010|0101001|0010011|1100100|0001101 1111011|0101000|0010010|1100101|0001100 1111100|0101111|0010101|1100010|0001011 1111101|0101110|0010100|1100011|0001010 1111110|0101101|0010111|1100000|0001001 1111111|0101100|0010110|1100001|0001000