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Section M

Lab 1 Homework

Old Computers

MITS Altair 8800

Input: Flip switches
Output: LED’s on the light panel
Min RAM (Kilobytes/Bytes/Bits): 0.256 Kilobytes, 256 Bytes, 2048 Bits
Max RAM (Kilobytes/Bytes/Bits): 64 Kilobytes, 64000 Bytes, 512000 Bits
CPU: Intel 8088

MOS KIM-1

Input: On-board hexadecimal keypad
Output: 6 digital LED display
Min RAM (Kilobytes/Bytes/Bits): 1 Kilobyte, 1000 Bytes, 8000 Bits
Max RAM (Kilobytes/Bytes/Bits): 1.024 Kilobytes, 1024 Bytes, 8192 Bits
CPU: MOS 6502

Apple 1

Input: Keyboard
Output: Composite video
Min RAM (Kilobytes/Bytes/Bits): 4 Kilobytes, 4000 Bytes, 32000 Bits
Max RAM (Kilobytes/Bytes/Bits): 65 Kilobytes, 65000 Bytes, 520000 Bits
CPU: MOS 6502

IBM Personal Computer (PC) 5150

Input: Keypad
Output: 5” Monochrome monitor
Min RAM (Kilobytes/Bytes/Bits): 16 Kilobytes, 16000 Bytes, 128000 Bits
Max RAM (Kilobytes/Bytes/Bits): 64 Kilobytes, 64000 Bytes, 512000 Bits
CPU: IBM Proprietary

Apple Macintosh

Input: Keypad and Mouse
Output: 9” monochrome screen
Min RAM (Kilobytes/Bytes/Bits): 128 Kilobytes, 128000 Bytes, 1024000 Bits
Max RAM (Kilobytes/Bytes/Bits): 512 Kilobytes, 512000 Bytes, 4096000 Bits
CPU: Motorola 68000

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Base Conversions

1) Decimal: $1_{(10)}$

Binary: $01_{(2)}$

2^1	2^0
(2) 0	1 (1)
0	1

Oct: $01_{(8)}$

8^1	8^0
(8) 0	(1) 1
0	1

Hex: $01_{(16)}$

16^1	16^0
(16) 0	(1) 1
0	1

2) Decimal: $10_{(10)}$

Binary: $01010_{(2)}$

2^4	2^3	2^2	2^1	2^0
(16) 0	(8) 1	(4) 0	(2) 1	(1) 0
0	1	0	1	0

Oct: $012_{(8)}$

8^2	8^1	8^0
(64) 0	(8) 1	2 (1)
0	1	2

Hex: $0A_{(16)}$

16^1	16^0
(16) 0	(1) 10
0	10 = A

3) Decimal: $42_{(10)}$

Binary: $0101010_{(2)}$

2^6	2^5	2^4	2^3	2^2	2^1	2^0
(64) 0	(32) 1	(16) 0	(8) 1	(4) 0	(2) 1	(1) 0
0	1	0	1	0	1	0

Oct: $052_{(8)}$

8^2	8^1	8^0
(64) 0	(8) 5	(1) 2
0	5	2

Hex: $02A_{(16)}$

16^2	16^1	16^0
(256) 0	(16) 2	(1) 10
0	2	10 = A

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4 Decimal: $255_{(10)}$

Binary: $011111111_{(2)}$

$$\begin{array}{ccccccccc} 2^8 & 2^7 & 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ (256)0 & (128)1 & (64)1 & (32)1 & (16)1 & (8)1 & 1(4) & (2)1 & 1(1) \\ \hline 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{array}$$

oct: $0377_{(8)}$

$$\begin{array}{cccc} 8^3 & 8^2 & 8^1 & 8^0 \\ (512)0 & 64(3) & (8)7 & (1)7 \\ \hline 0 & 3 & 7 & 7 \end{array}$$

Hex: $0FF_{(16)}$

$$\begin{array}{ccc} 16^2 & 16^1 & 16^0 \\ (256)0 & (16)15 & (1)15 \\ \hline 0 & 15_{=F} & 15_{=F} \end{array}$$

Hex to decimal table

A - 10　C - 12　E - 14

B - 11　D - 13　F - 15

5 Hex: $F_{(16)}$

Decimal: $15_{(10)}$　$15 \times 16^0 = 15$

Binary: $01111_{(2)}$

$$\begin{array}{ccccc} 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ (16)0 & (8)1 & (4)1 & (2)1 & (1)1 \\ \hline 0 & 1 & 1 & 1 & 1 \end{array}$$

Oct: $017_{(8)}$

$$\begin{array}{ccc} 8^2 & 8^1 & 8^0 \\ (64)0 & (8)1 & (1)7 \\ \hline 0 & 1 & 7 \end{array}$$

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(6) Hex: $DF_{(16)}$

Decimal: $223_{(10)}$

$$\begin{array}{ccc} 16^2 & 16^1 & 16^0 \\ (256) & (16)D & (1)F \\ \hline \leftarrow & \multicolumn{2}{c}{16(13)+1(15)} \end{array}$$

$208+15=223$

Binary: $011011111_{(2)}$

$$\begin{array}{ccccccccc} 2^8 & 2^7 & 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ (256)0 & (128)1 & (64)1 & (32)0 & (16)1 & (8)1 & (4)1 & (2)1 & (1)1 \end{array}$$

Oct: $0337_{(8)}$

$$\begin{array}{cccc} 8^3 & 8^2 & 8^1 & 8^0 \\ (512)0 & (64)3 & (8)3 & (1)7 \\ \hline & 3 & 3 & 7 \end{array}$$

(7) Hex: $81_{(16)}$

Decimal: $129_{(10)}$

$$\begin{array}{ccc} 16^2 & 16^1 & 16^0 \\ (256)0 & (16)8 & (1)1 \\ \hline \multicolumn{3}{c}{0+128+1=129} \end{array}$$

Binary: $010000001_{(2)}$

$$\begin{array}{ccccccccc} 2^8 & 2^7 & 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ (256)0 & (128)1 & (64)0 & (32)0 & (16)0 & (8)0 & (4)0 & (2)0 & (1)1 \\ \hline 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{array}$$

Oct: $0201_{(8)}$

$$\begin{array}{cccc} 8^3 & 8^2 & 8^1 & 8^0 \\ (512)0 & (64)2 & (8)0 & (1)1 \\ \hline 0 & 2 & 0 & 1 \end{array}$$

(8) Hex: $04_{(16)}$

Decimal: $4_{(10)}$

$$\begin{array}{cc} 16^1 & 16^0 \\ (16)0 & (1)4 \\ \hline \multicolumn{2}{c}{0+4=4} \end{array}$$

Binary: $0100_{(2)}$

$$\begin{array}{cccc} 2^3 & 2^2 & 2^1 & 2^0 \\ (8)0 & (4)1 & (2)0 & (1)0 \end{array}$$

Oct: $04_{(8)}$

$$\begin{array}{cc} 8^1 & 8^0 \\ (8)0 & (1)4 \\ \hline 0 & 4 \end{array}$$

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9. Binary: $10010011_{(2)}$

Decimal: $147_{(10)}$

$$\begin{array}{cccccccc} 2^7 & 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ (128)\,1 & (64)\,0 & (32)\,0 & (16)\,1 & (8)\,0 & (4)\,0 & (2)\,1 & (1)\,1 \\ \hline \end{array}$$

$128 + 0 + 0 + 16 + 0 + 0 + 2 + 1$

$= 128 + 19 = 147$

Oct: $0223_{(8)}$

$$\begin{array}{cccc} 8^3 & 8^2 & 8^1 & 8^0 \\ (512)\,0 & (64)\,2 & (8)\,2 & (1)\,3 \\ \hline 0 & 2 & 2 & 3 \end{array}$$

Hex: $093_{(16)}$

$$\begin{array}{ccc} 16^2 & 16^1 & 16^0 \\ (256)\,0 & (16)\,9 & (1)\,3 \\ \hline 0 & 9 & 3 \end{array}$$

10. Binary: $111111_{(2)}$

Decimal: $63_{(10)}$

$$\begin{array}{ccccccc} 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ (64)\,0 & (32)\,1 & (16)\,1 & (8)\,1 & (4)\,1 & (2)\,1 & (1)\,1 \\ \hline \end{array}$$

$0 + 32 + 16 + 8 + 4 + 2 + 1$

$= 48 + 12 + 3 = 63$

Oct: $077_{(8)}$

$$\begin{array}{ccc} 8^2 & 8^1 & 8^0 \\ (64)\,0 & (8)\,7 & (1)\,7 \\ \hline 0 & 7 & 7 \end{array}$$

Hex: $03F_{(16)}$

$$\begin{array}{ccc} 16^2 & 16^1 & 16^0 \\ (256)\,0 & (16)\,3 & (1)\,15 \\ \hline 0 & 3 & 15 = F \end{array}$$

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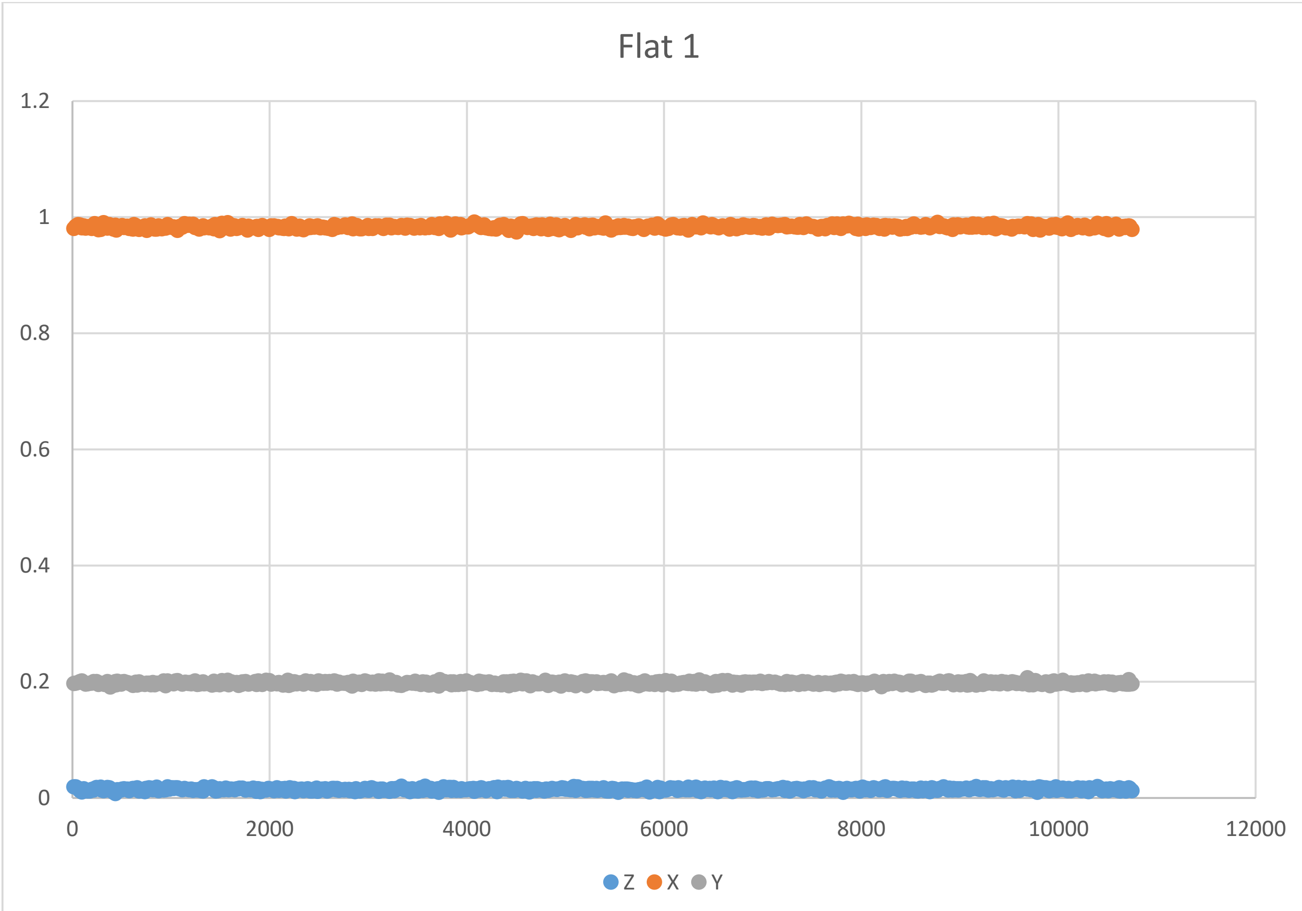
Exploration



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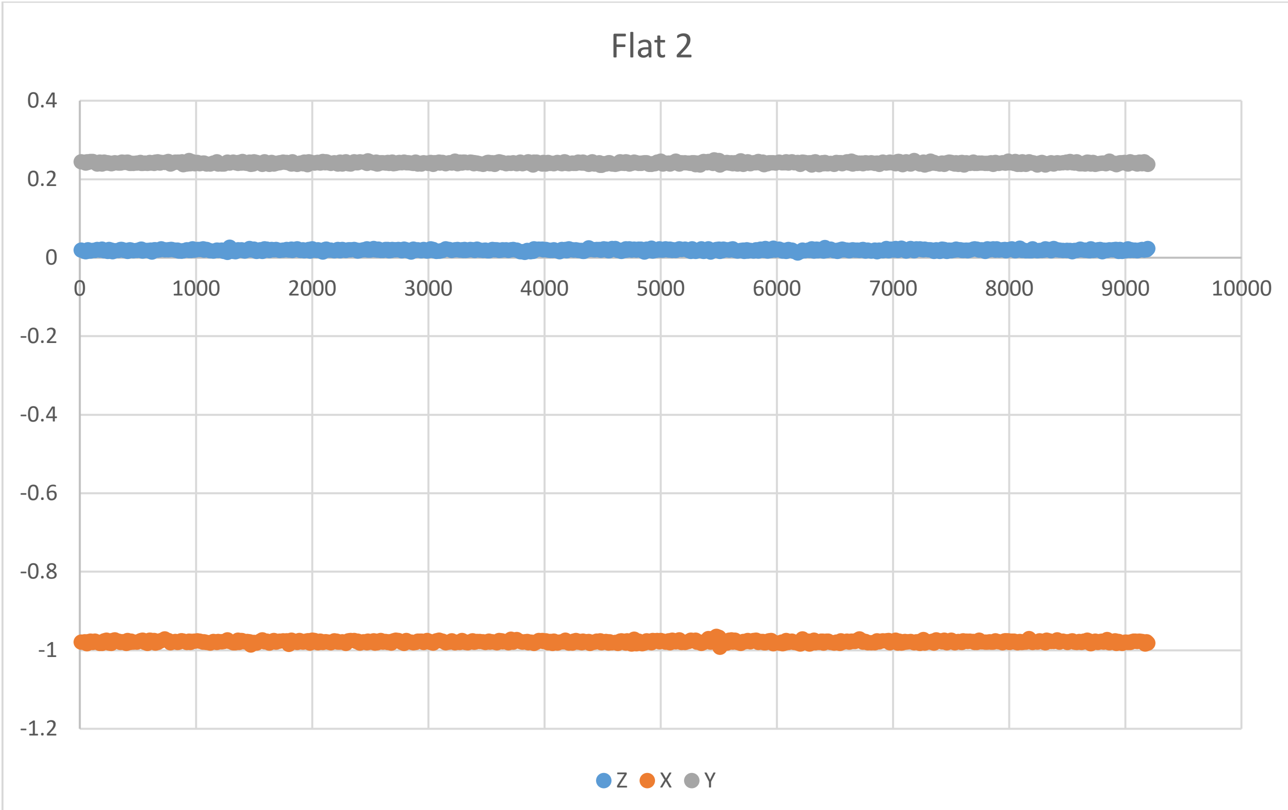

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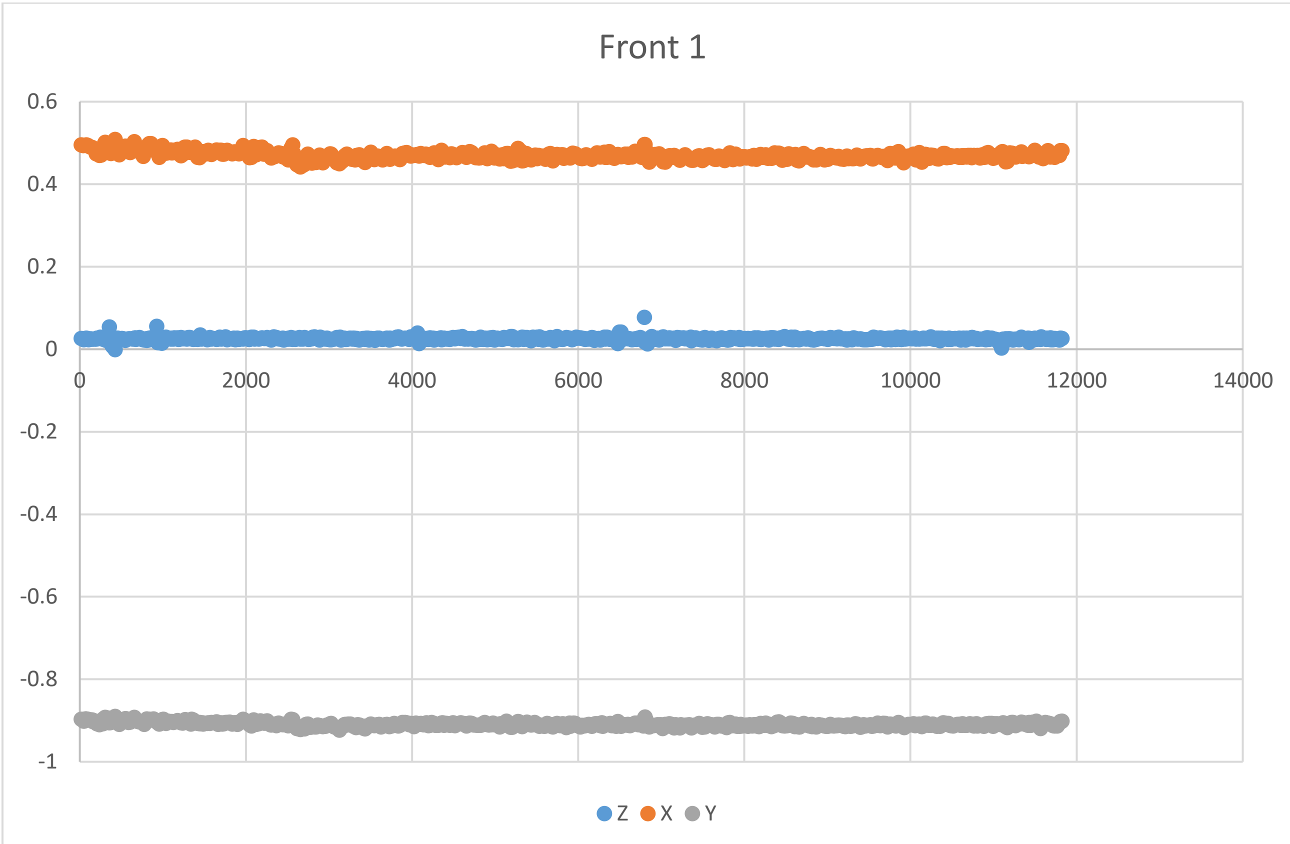

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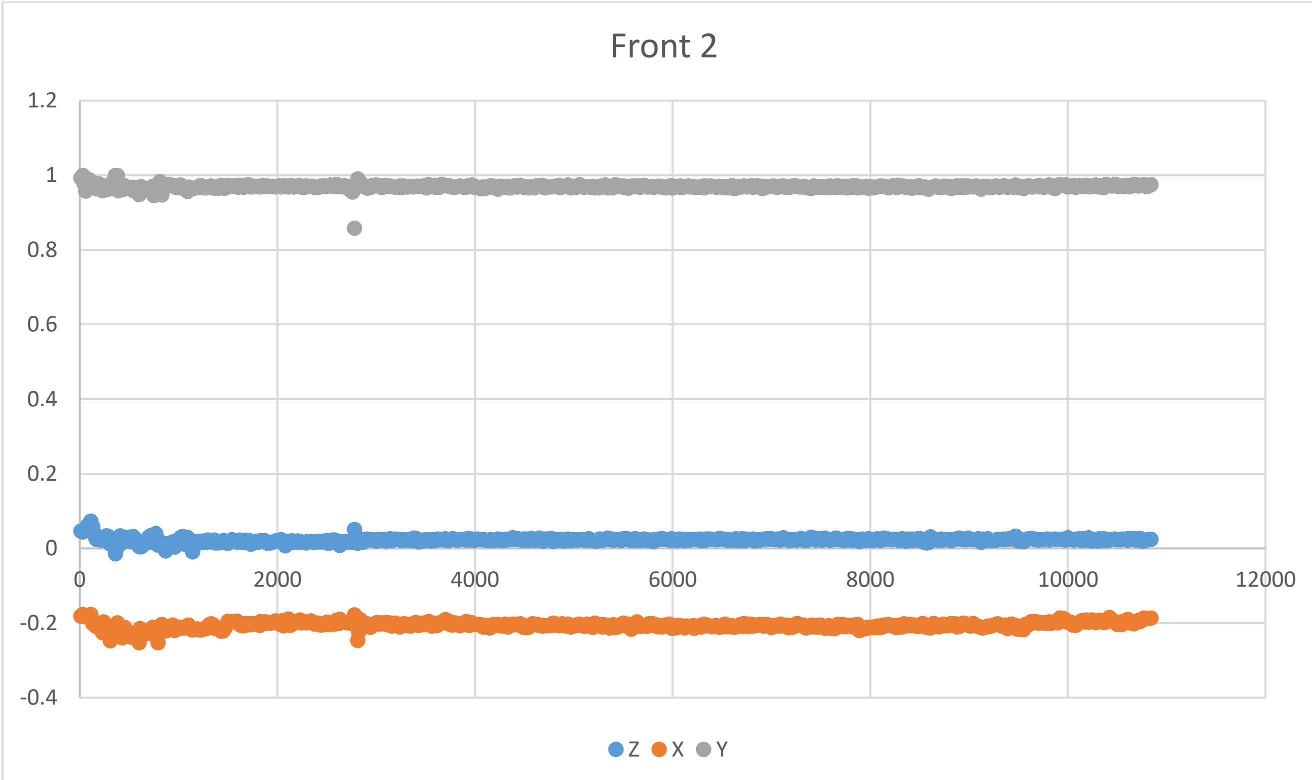

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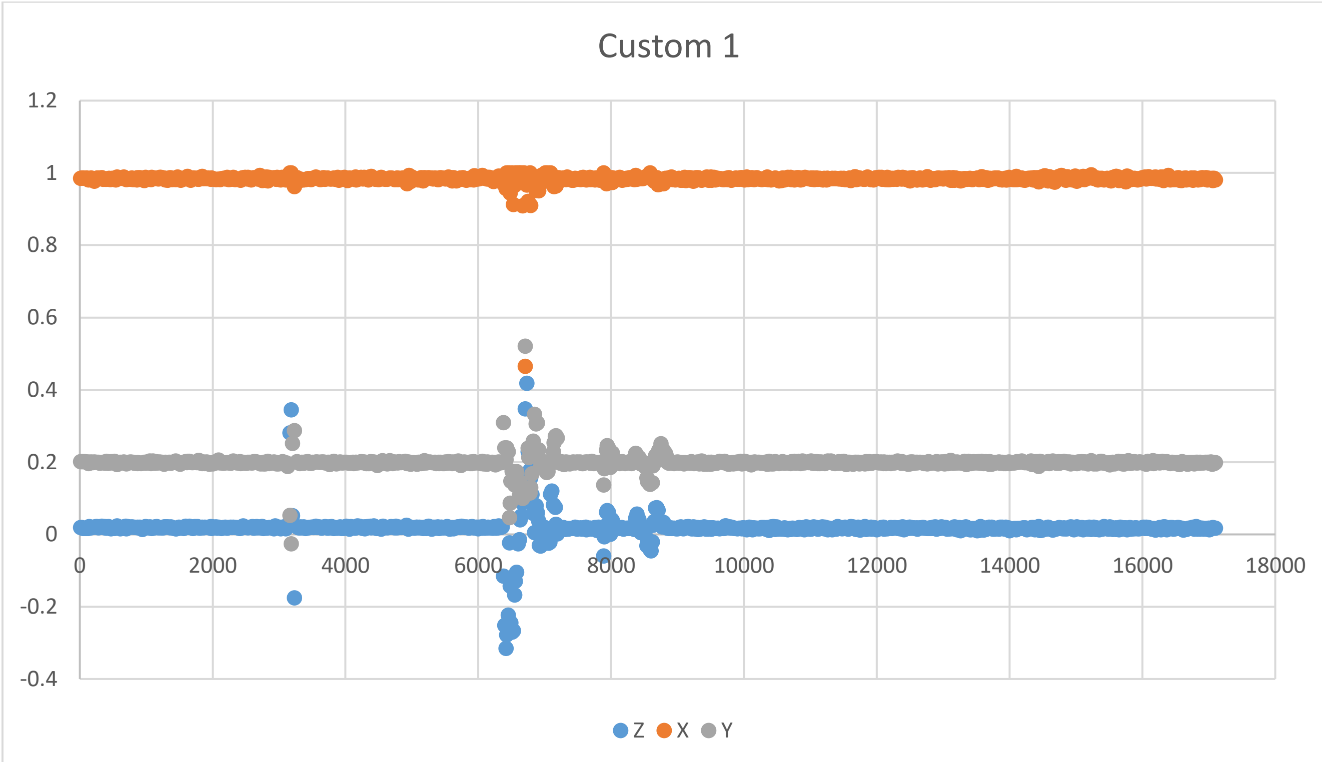

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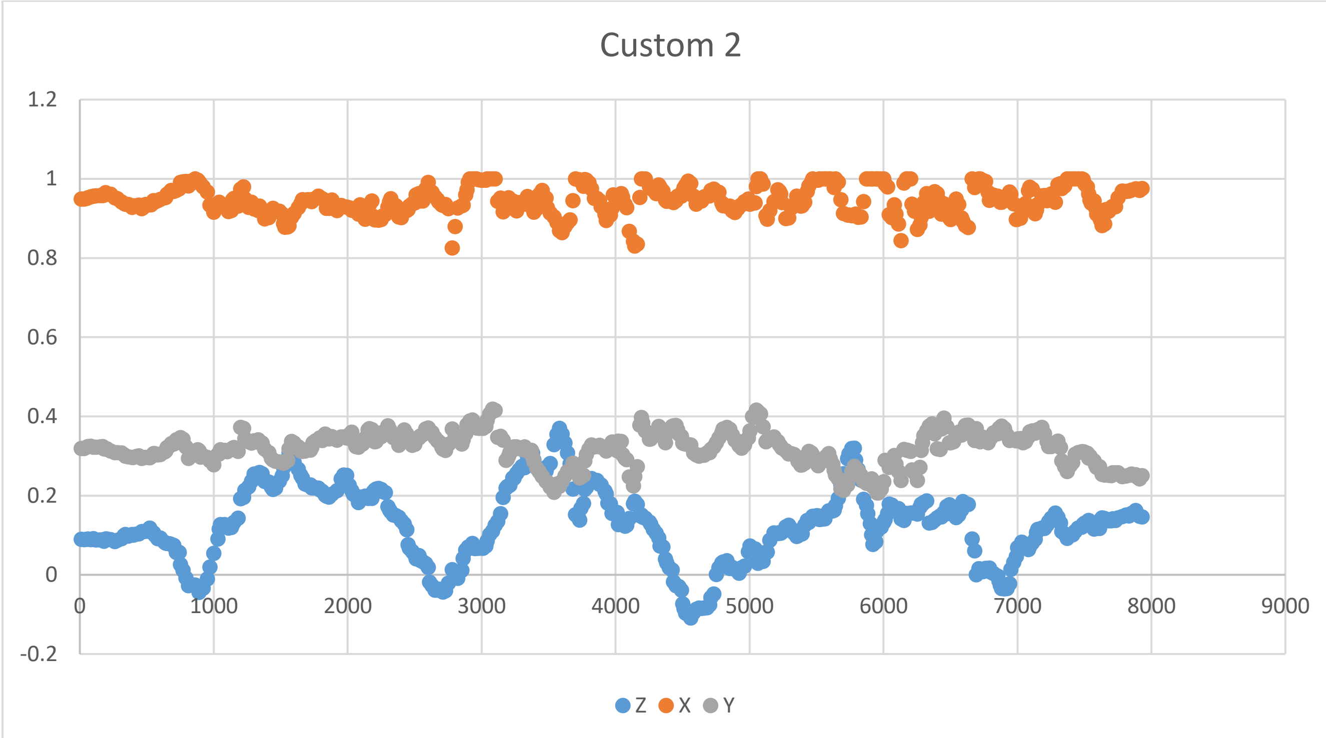

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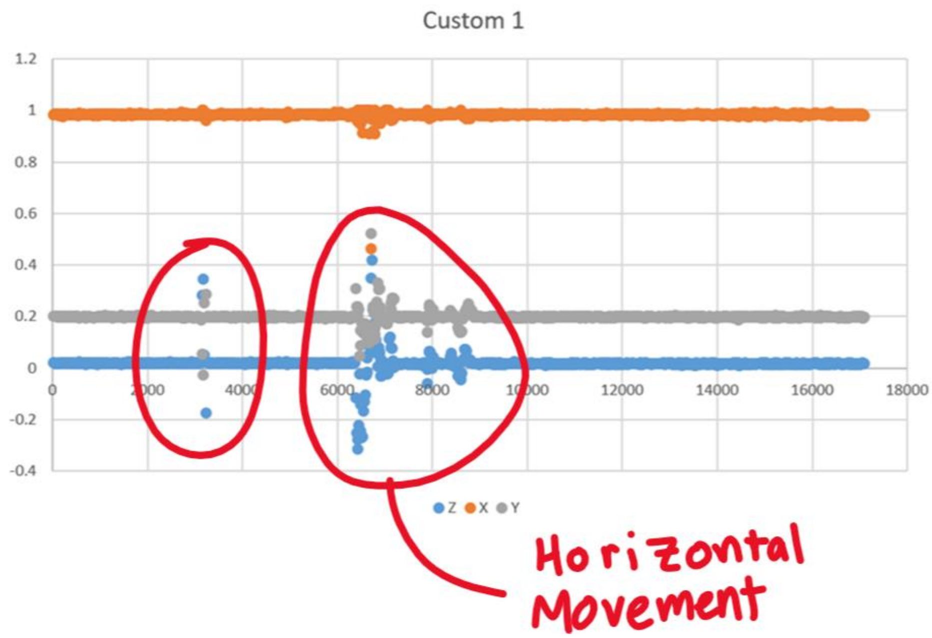
1. I think that each of the columns in the data that was collected represents a different axis, the first column is the x axis, followed by the y axis, and then the y axis. The fourth column would most likely be the accelerometer.
2. The flags help distinguish the direction that the accelerometer is picking up movement.
3. I think the unit of measure is in g's
4.
    a. Flat 1
        i. The axis remain unchanged because the controller was just set on the table with nothing touching it.
    b. Flat 2
        i. The axis remain unchanged, but the x and y axis were both multiplied by -1 because the controller was flipped over.
    c. Front 1
        i. All the axis remained constant because the controller was not being moved.
    d. Front 2
        i. All the axis remained constant because the controller was face down, and not moving.
    e. Custom 1
        i. The y and z axis change because the controller was moved back and forth in the y direction (away from the player).



    f. Custom 2
        i. The z axis creates something like a sine curve because the controller was lifted up and down repeatedly.

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Joystick Calibration

1. After analyzing the data we collected, we found that the max value in any direction was 128 and the minimum value in any direction was -128; therefore by dividing the number by 128 we could get a maximum value of 1 and a minimum value of -1.
   a. For the horizontal direction $f(x)= (x/128)$
   b. For the vertical direction $f(y)= -(y/128)$
2. The center point was at 0,0,0,0 but the controller did not always get exactly there, it got numbers close to it.
3. Small variations in the exact location of where to controller thinks zero is located at.
4. Allow for more variation in the location of the origin, which would result in a loss of sensitivity for the controller.