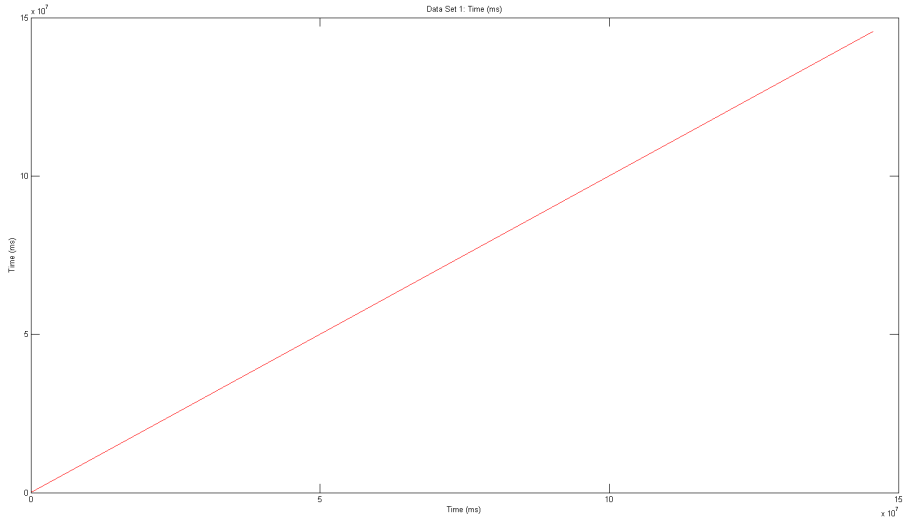
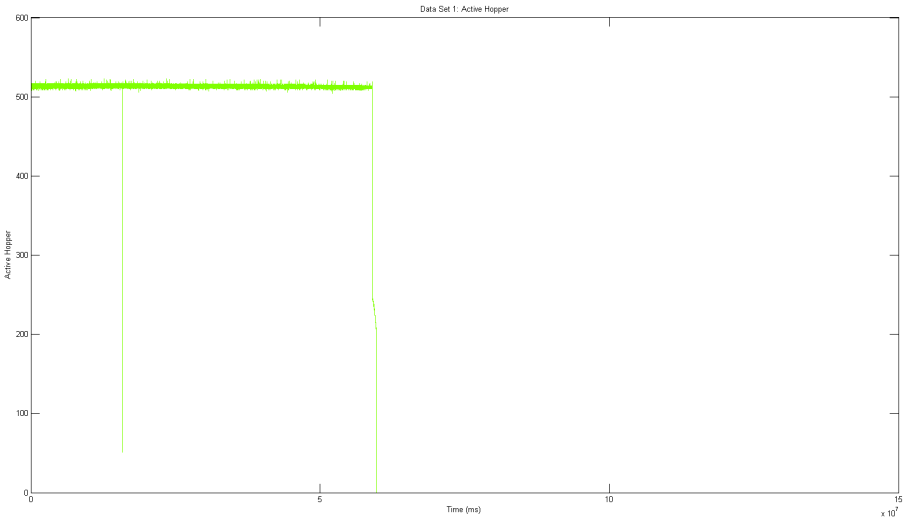
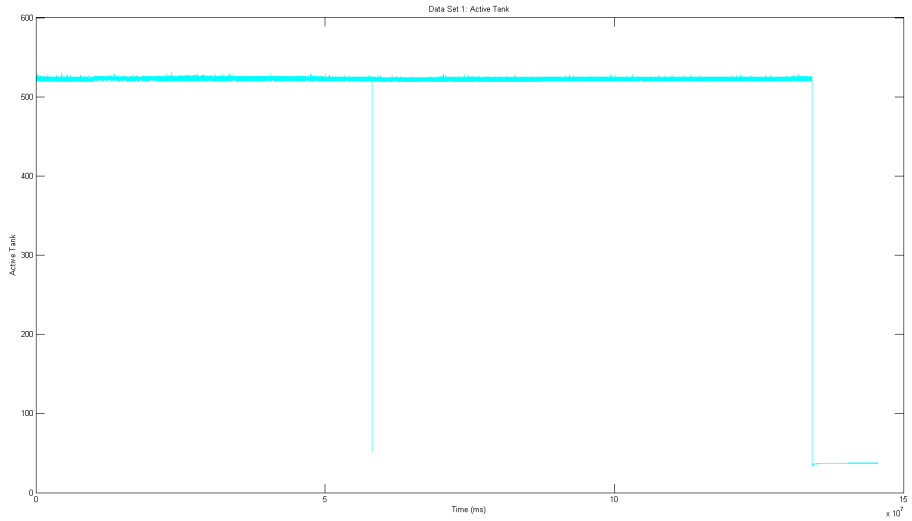
Plotting Experimental Data Set

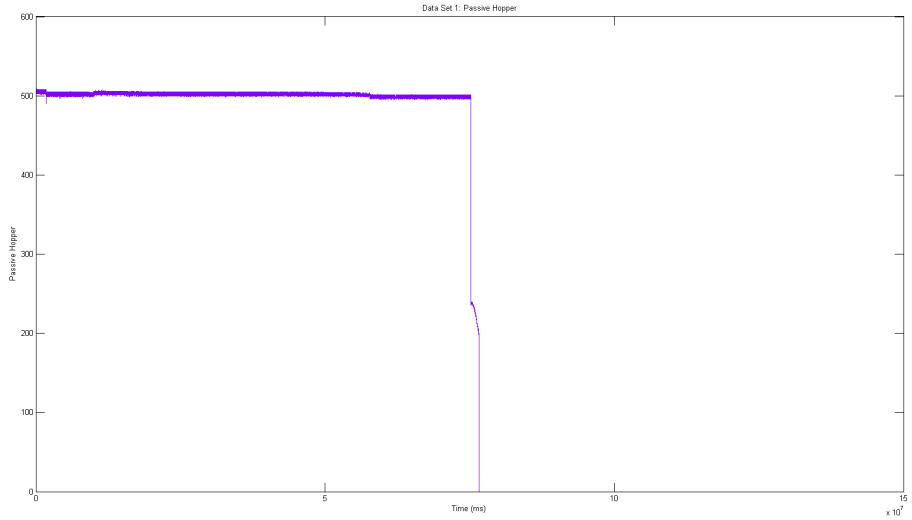
```
close all;
clear all;
clc;
fig = 0;

files = {'data_take2.csv'}; %or {} or {file0.csv, file1.csv... etc.}
files = {};
if length(files) <= 0
    files = uigetfile('*.csv','Select Data Set(s)','MultiSelect','on');
end
if ~iscell(files) %force into iterable, if only 1 input file.
    files = {files};
end

for i = 1:length(files)

    col_data   = csvread(files{i}, 1);
    time_mills = col_data(:,1);
    titles = {'Time (ms)'; ...
        'Active Hopper'; 'Active Tank'; 'Passive Hopper'}; %, 'Passive Tank'};
    clear data;
    for j=2:min(size(col_data))
        bits_threshold = 50;
        data_ind       = find(col_data(:,j) < bits_threshold);
        time_threshold = 100;
        data_ind_ind   = min(find(data_ind > time_threshold));
        time_ms        = time_mills(data_ind(data_ind_ind));
        time_done      = double(time_ms)/1000.0;
        time_done      = time_done / 3600.0;
        fprintf('%s Runtime: %.3f Hours, (msec %d)\n', titles{j}, time_done, time_
    end
    colors = hsv(min(size(col_data)));
    for j = 1:min(size(col_data))

        if j <= length(titles)
            data{j}.title = titles{j};
        else
            data{j}.title = sprintf('Input %.0d', j);
        end
        %data{j}.title = sprintf('Input %.0d', j);
        data{j}.y     = col_data(:,j);
        data{j}.x     = time_mills;
        % don't plot TIME vs TIME.
        if j ~= 0 %usually 1, debug 0
            fig = fig+1;
            figure('units','normalized','outerposition',[0 0 1 1]);
            plot(  data{j}.x, data{j}.y, 'color', colors(j,:));
            ylabel( data{j}.title);
            xlabel(titles(1));
            title(sprintf('Data Set %.0d: %s', i, data{j}.title));
```

```
end
```


Data Set 1: Time (ms)
x 10^7
15
10
5
0
Time (ms)
0
5
10
15
x 10^7
Time (ms)


Data Set 1: Active Hopper
600
500
400
300
200
100
0
Active Hopper
0
5
10
15
x 10^7
Time (ms)



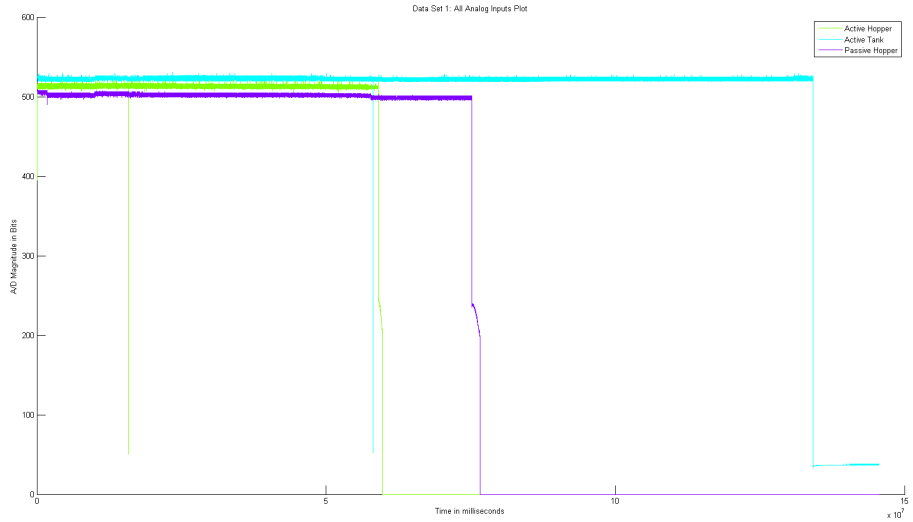



```
end
```

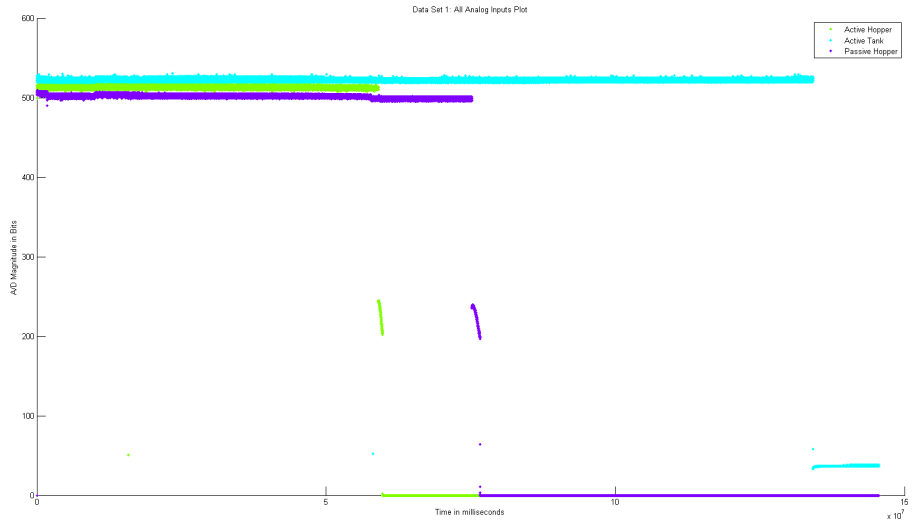
Active Hopper Runtime: 16.604 Hours, (msec 59773315)
Active Tank Runtime: 37.264 Hours, (msec 134151346)
Passive Hopper Runtime: 21.286 Hours, (msec 76630521)

```
fig = fig+1;
figure('units','normalized','outerposition',[0 0 1 1]);
hold on;
for j = 2:length(data)
    plot(data{j}.x, data{j}.y, 'Color', colors(j,:));
end
ylabel('A/D Magnitude in Bits'  );
xlabel('Time in milliseconds'   );
legend(titles(2:length(titles)) );
title(sprintf('Data Set %.0d: %s', i, 'All Analog Inputs Plot') );
```

```
hold off;
```




```
fig = fig+1;
figure('units','normalized','outerposition',[0 0 1 1]);
hold on;
for j = 2:length(data)
    plot(data{j}.x, data{j}.y, '.', 'Color', colors(j,:));
end
ylabel('A/D Magnitude in Bits'  );
xlabel('Time in milliseconds'   );
legend(titles(2:length(titles)) );
title(sprintf('Data Set %.0d: %s', i, 'All Analog Inputs Plot') );
hold off;
```




```
fit = polyfit(transpose(time_mills), 1:length(time_mills),1);
```

```
avg_period = 1/fit(1);
fprintf('\nData Set %s (%.0d) ', files{i}, i);
fprintf('has an Average Sampling Rate of %.3f ', avg_period);
fprintf('milliseconds.\n');
```

```
    Data Set data.csv (1) has an Average Sampling Rate of 1001.143 millisecond
```

```
fs_rate   = 1000/(avg_period); %ms to Hz
N_samples = length(time_mills);
f_axis    = linspace(-fs_rate/2,fs_rate/2,N_samples);
% dft with length N, from frequency [-fs/2:fs/2], divided over N bins.
clear data;
for j = 1:min(size(col_data))

    if j <= length(titles)
        data{j}.title = titles{j};
    else
        data{j}.title = sprintf('Input %.0d', j);
    end
    data{j}.title = sprintf('FFT of %s', data{j}.title);
    data{j}.y = col_data(:,j);
    %fixing bad Arduino conversion factors... from first run.
    if mean(data{j}.y) < 5
        data{j}.y = data{j}.y .* 1023.0 ./ 5.0;%return volts to bits.
    end
    data{j}.y     = fftshift(fft(data{j}.y));
    data{j}.x     = f_axis;
    % don't plot TIME vs TIME.
    if j ~= 0 %usually 1, debug 0
        fig = fig+1;
        figure(fig, 'units','normalized','outerposition',[0 0 1 1]);
        semilogy(  data{j}.x, abs(data{j}.y), 'color', colors(j,:));
        ylabel( data{j}.title);
        xlabel('Frequency in Hz');
        title(sprintf('Data Set %.0d: %s', i, data{j}.title));
    end
```

```
    Error using figure
    Too many input arguments.

    Error in data_analysis_script (line 106)
                figure(fig, 'units','normalized','outerposition',[0 0 1 1]);
```

```
end

fig = fig+1;
figure('units','normalized','outerposition',[0 0 1 1]);
hold on;
for j = 2:length(data)
    semilogy(data{j}.x, abs(data{j}.y), 'Color', colors(j,:));
end
ylabel('A/D Magnitude in Bits'  );
xlabel('Frequency in Hz'        );
legend(titles(2:length(titles)) );
```

```
        title(sprintf('Data Set %.0d: %s', i, 'All Analog Inputs Plot') );
        set(gca, 'yscale','log');
        hold off;

        fig = fig+1;
        figure('units','normalized','outerposition',[0 0 1 1]);
        hold on;
        for j = 2:length(data)
            semilogy(data{j}.x, abs(data{j}.y), '.', 'Color', colors(j,:));
        end
        ylabel('A/D Magnitude in Bits'  );
        xlabel('Frequency in Hz'        );
        legend(titles(2:length(titles)) );
        title(sprintf('Data Set %.0d: %s', i, 'All Analog Inputs Plot') );
        set(gca, 'yscale','log');
        hold off;

    end
```

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