

Title: WHAT CURRENTS AND VOLTAGES ARE PRESENT IN THE CAR

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Intro

In this report we did various measurements on the RC car we ordered. We did these so we can regenerate the same values using a NodeMCU.

Materials and Methods

Oscilloscope (Tektronix TDS 2002C)
Multimeter (HAMEG HM8012°
Excel
Laptop
RC-car
Matlab

We used the multimeter as an amperemeter to get the current flowing threw the circuit of the DC-motor and as a voltmeter to get the potential difference over the circuit of the DC-motor. We made measurements and put them into an excel sheet to finally calculate the statistics with matlab.

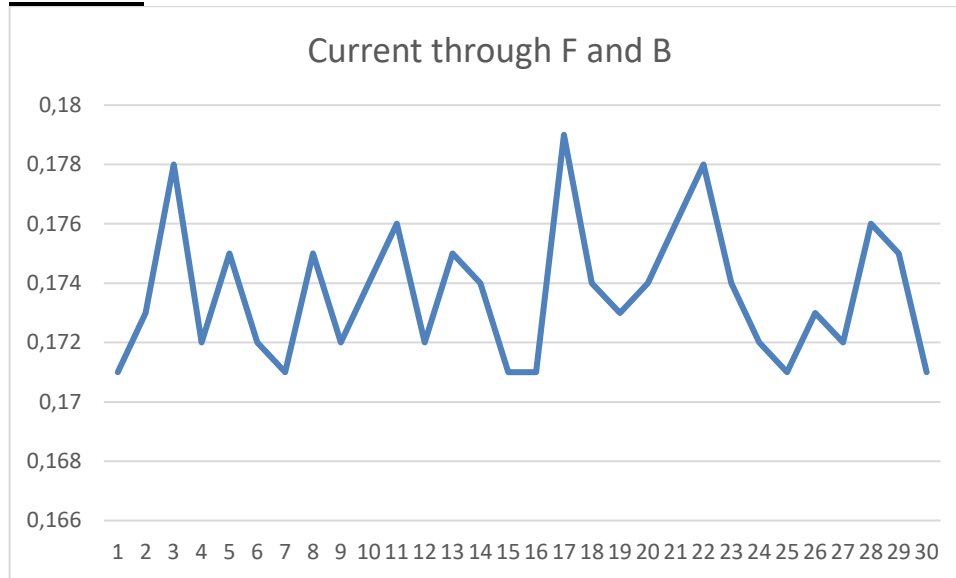
Results

We made following measurements:

| Current door F en B | Volt over F en B |
|---------------------|------------------|
| 0.171 | 4.17 |
| 0.173 | 4.18 |
| 0.178 | 4.176 |
| 0.172 | 4.171 |
| 0.175 | 4.181 |
| 0.172 | 4.174 |
| 0.171 | 4.185 |
| 0.175 | 4.182 |
| 0.172 | 4.19 |
| 0.174 | 4.118 |
| 0.176 | 4.172 |
| 0.172 | 4.171 |
| 0.175 | 4.159 |
| 0.174 | 4.165 |
| 0.171 | 4.169 |
| 0.171 | 4.16 |
| 0.179 | 4.161 |
| 0.174 | 4.173 |
| 0.173 | 4.169 |
| 0.174 | 4.16 |
| 0.176 | 4.162 |
| 0.178 | 4.171 |
| 0.174 | 4.16 |
| 0.172 | 4.155 |
| 0.171 | 4.153 |
| 0.173 | 4.162 |
| 0.172 | 4.161 |
| 0.176 | 4.157 |
| 0.175 | 4.159 |
| 0.171 | 4.156 |
| AMPERE | VOLT |

Lets discuss each part.

Current



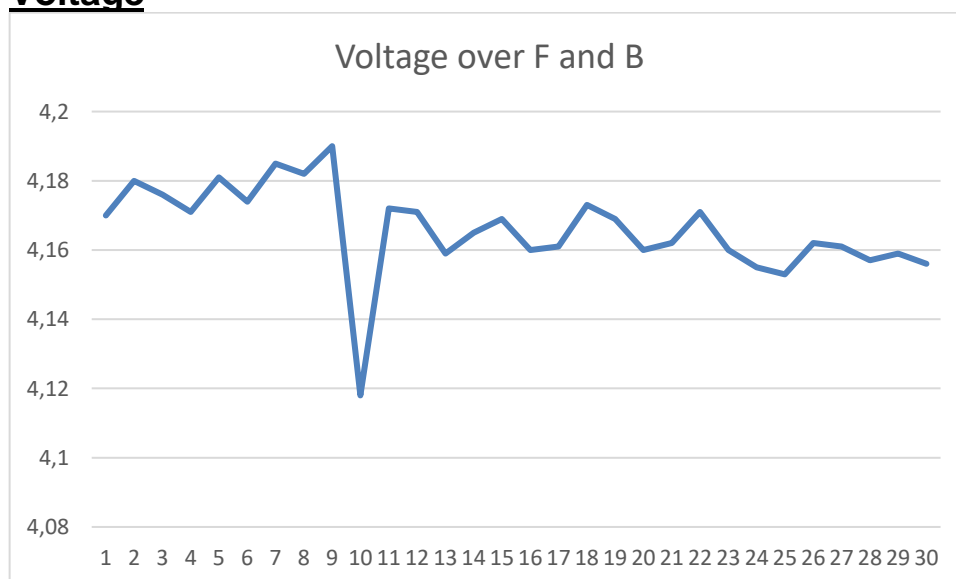
| | |
|----------------------------------|--------------|
| Standard deviation of the sample | 0.0023 |
| Mean of the sample | 0.1737 |
| Variation of the sample | 0.0000051954 |

The standard deviation of this sample is 0.0023 ampere which means the values differ from each other approximately 2,3 mA. The variation also measures the spreading of the values, in this case the amperes. The value is small because the amperes are very close to each other, they only differ in a factor 10^{-3} or few mA.

| | |
|---|--|
| 99% Confidence interval of the mean | $0,1725A < I < 0.1748A$ |
| 99% Confidence interval of the variation | $5,50 * 10^{-8} A^2 \leq \sigma^2 \leq 8,75 * 10^{-7} A^2$ |
| 99% Confidence interval of the standard deviation | $2,35 * 10^{-4} A \leq \sigma \leq 9,35 * 10^{-4} A$ |

These Confidence intervals show that 99% of the values of our measurements have a mean, variation, standard deviation that is between these intervals.

Voltage



In this graph we can see there is an outlier voltage at the 10th measurement, that might have been caused by a fault during the measurement.

| | |
|----------------------------------|--------------------|
| Standard deviation of the sample | 0.0132 |
| Mean of the sample | 4,1661 |
| Variation of the sample | $1,7365 * 10^{-4}$ |

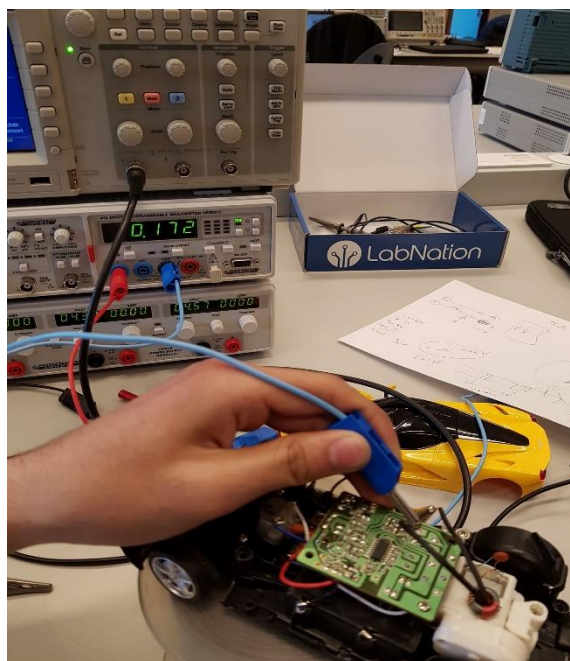
The standard deviation is 0.0132V, so the values measured are spread with approximately 0.0132V. The variation again measures as well the spreading of the measurements.

| | |
|---|--|
| 99% Confidence interval of the mean | $4,1594 V < U < 4,1727 V$ |
| 99% Confidence interval of the variation | $1,84 * 10^{-6} V^2 \leq \sigma^2 \leq 2,93 * 10^{-5} V^2$ |
| 99% Confidence interval of the standard deviation | $0.0014 \leq \sigma \leq 0.0054 V$ |

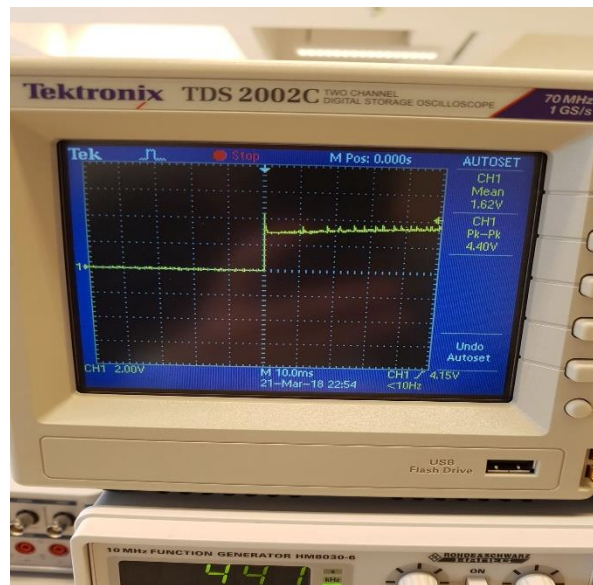
These confidence intervals tell us that 99% of the measurements have a mean, variation, standard deviation shown by these intervals.

Information & conclusion

Using the multimeter we figured out what the currents and the voltages were on the F and B pins of the car. These pins are for forward and backwards driving of the car.



For the voltage we used the oscilloscope and also the multimeter. We did this so we could see if the generated signal of the car is modulated or not. In our case it is not modulated so we don't have the PSW unit in the car.



To conclude everything together. After measuring on the different parts we can be certain of the voltages and currents we will have to provide via a H-bridge between the pins and the car.

Referencelist

Statistics course of 2017-2018