



The measurement of injector current

1. Basic phenomenon of current

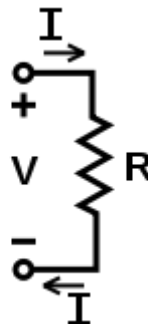
1.1. Basics' laws

Electric current is a flow of electric charge through a medium. This charge is typically carried by moving electrons in a conductor such as wire.

Ohm's law. The current through a conductor between two points is directly proportional to the potential difference across the two points, and inversely proportional to the resistance between them.

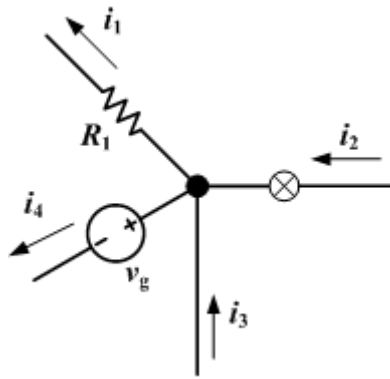
$$I=U/R$$

$$[I] = V/\Omega = A$$



First Kirchhoff's law (nodal rule). At any node (junction) in an electrical circuit, the sum of currents flowing into that node is equal to the sum of currents flowing out of that node.

$$\sum I_k=0$$



In this case (figure): $i_2+i_3=i_1+i_4$

1.2. Common Rail

Common rail direct fuel injection is a modern variant of direct fuel injection system for petrol and diesel engines. On diesel engines, it features a high-pressure (over 1,000 bar/15,000 psi) fuel rail feeding individual solenoid valves, as opposed to low-pressure fuel pump feeding unit injectors (Pumpe/Düse or pump nozzles). Third-generation common rail diesels now feature piezoelectric injectors for increased precision, with fuel pressures up to 1,800 bar/26,000 psi.

1.3. Experiment description

On the figure (fig. 1) showed supply wires for injectors. Currents are measured with current clamp (fig. 2) and oscilloscope (fig. 3). Experiment relies on measure currents for all (four) injectors.



Fig. 1. Fiat 1,3 tdi common rail engine and voltage supply wires for injectors



Fig. 2. Current clamp

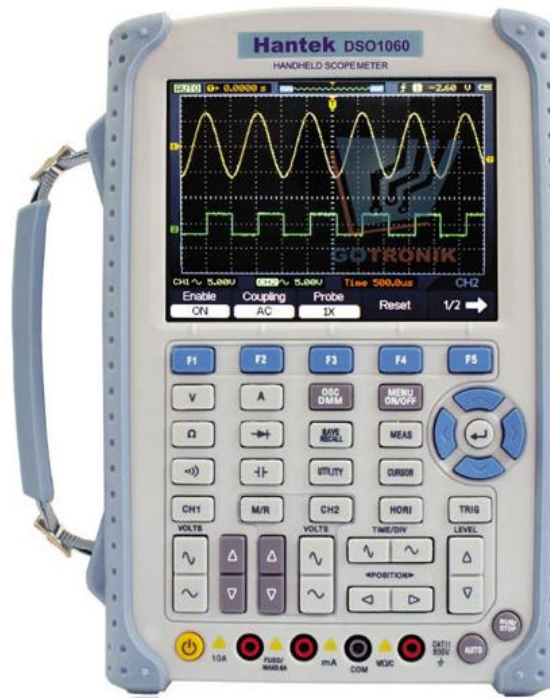


Fig. 3. Oscilloscope

1.4. Elaboration of results

1.4.1. Find a relation (function) between crankshaft speed and current frequency (draw chart).

No.	Crankshaft speed	f [Hz]
1.	500	
2.	800	
3.	1200	
4.	1500	
5.	1800	
6.	2000	
7.	2200	

1.4.2. Find current amplitude for all injectors, count effective and average values.

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$\omega = 800 \text{ rpm}$					
No.	Injector no.	Amp. [A]	I_{p-p} [A]	I_{AV} [A]	I_{eff} [A]
1.	I				
2.	II				
3.	III				
4.	IV				
$\omega = 1500 \text{ rpm}$					
5.	I				
6.	II				
7.	III				
8.	IV				
$\omega = 2000 \text{ rpm}$					
9.	I				
10.	II				
11.	III				
12.	IV				