INJECTION-PERIOD METER
IPM10

If you do not intend to build an IPE-GP or IPE-GS but still want to measure opening time for fuel injectors - this circuit may be useful? With IPM10 one gets accurate information about pulse width whether indoors or on the field. Usually the opening time at idle is what is of interest, therefore this circuit not measure longer than maximum 13 milliseconds. The measurement range is 0.5-10mS with high accuracy. At idle: times over 5 mS are rare - so for extra high accuracy one should calibrate IPM10 for 0.5-7mS because the linearity is then higher.

Luxorparts - Digital Voltage Meter

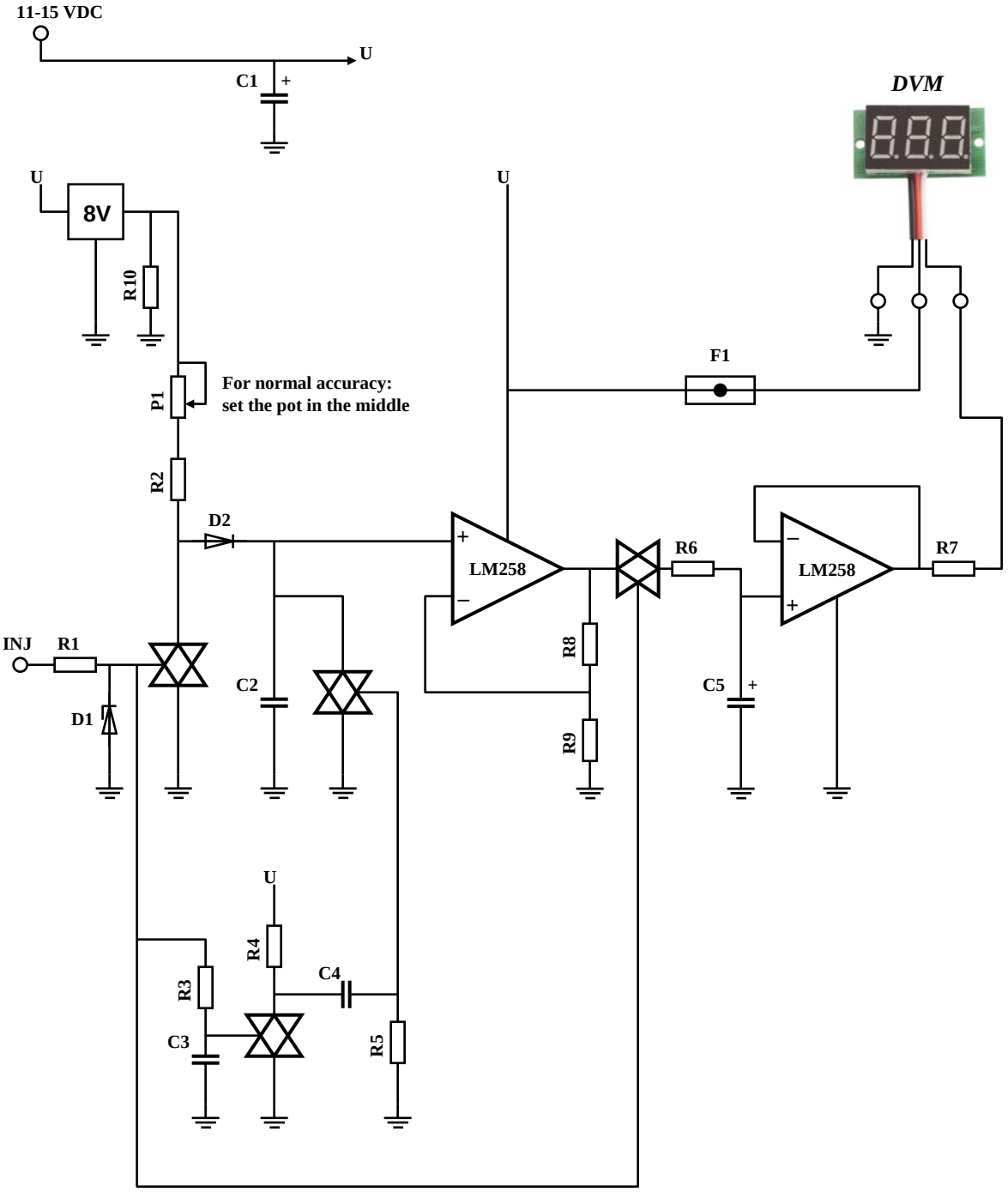
The construction is a bit special when I chose to use a current-saving voltage meter from *Kjell & Company* (powered by 3-30V and measure up to 99V) to digitally deliver the actual pulse time, which is then presented as a volt value (by one decimal) instead - on this way, the design of the electronics for the display circuit has been skipped, which has simplifies the construction considerably. Since the voltage of a car in operation is at least 14 volts, it is theoretical to measure up to 12.5 mS (depends on the selected Op).

Before this creation began to take shape I tested an automotive multimeter from Biltema, with the ability to measure injector time but it did not work well. The K&C Display Meter powered by IPM10 can be placed in the passenger compartment fed with a USB cable, which could actually intend to be used for an RCW module to IPE-GS? Two poles/wires and one ground (the screening on the USB cable) are what it takes to communicate with an IPM10. For example, the two remaining poles can be used by two LEDs belonging to a LFFGM or other modules? Or, IPM10 is a complement to any pulse extender of any kind.

The device is based on the logic IC: 4066, which is equipped with four analogue gates. Such a gate is necessary for the *"sample and hold"* function but it is also possible to connect them as inverting gate elements which means that one do not need to use more than one logic integrated circuit here. A voltage reference (here 8 volts) is necessary so that the measured values do not assume different values depending on the power supply voltage.

IPM10 measures all pulses but ignores interference and/or spikes. It is necessary because an IPE-Gx generates a spike, which then not affects the measurement.

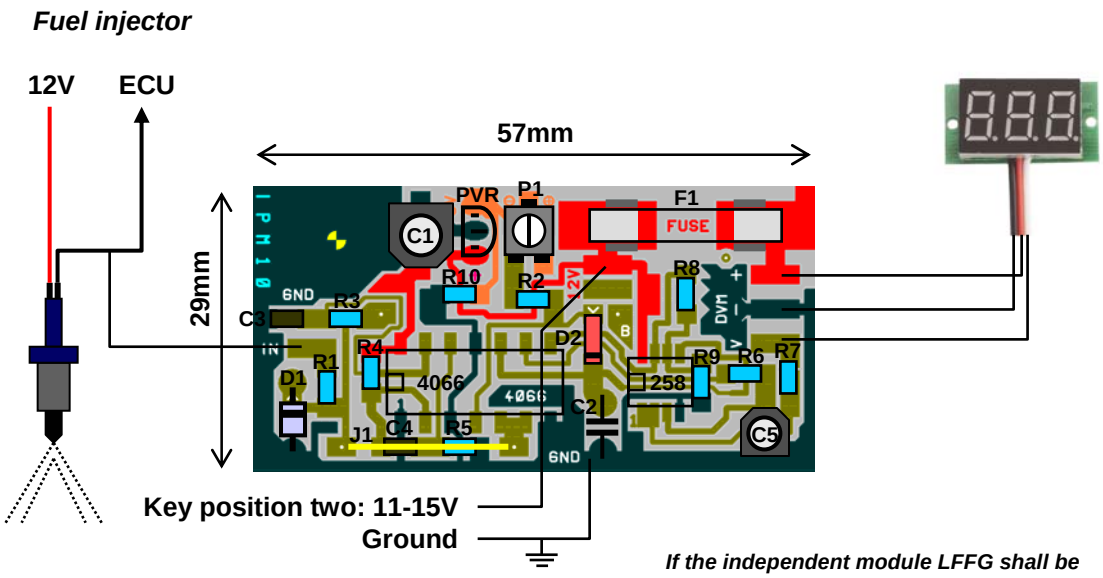
CIRCUIT DIAGRAM



PROJECT	*Injection-period Meter*	
MODULE		
MODEL	**IPM10**	
AUDIT	A-1	**DRAWING: 1 of 1**
SUPPLY	11-15 VDC	
CURRENT	Max 22mA	
OTHER		
B. Lindqvist		

IPM10 resists both cold and heat without measurement errors occur. The display unit starts to show error round about -10 C. It can however resist heat well.

PLACING OF COMPONENTS



If the independent module LFFG shall be combining with this circuit so can it be powered by 8V from IPM10. The aforementioned can use a double sided board if they will coexist, because they have same dimensions.

SMR1206:
R1 = 2k2
R2 = 510k
R3 = 100k
R4 = 6k8
R5 = 68k
R6 = 10k
R7 = 220Ω
R8 = 100k
R9 = 6k8
R10 = 1k5

SMC1206:
C3 = 220p
C4 = 1n

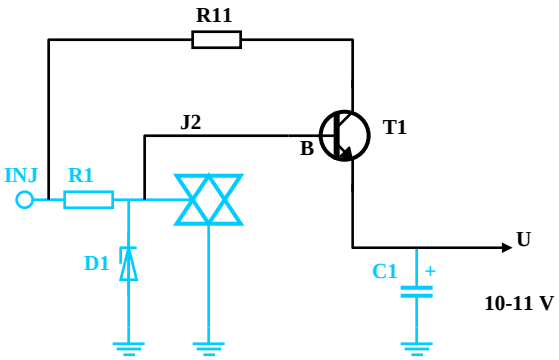
Other components:
C1 = 47uF , 16V , E-lytic , SMD / hole mount
C5 = 10uF , 16V , E-lytic , SMD / hole mount
C2 = 220n , plastic , hole mount
P1 = 100k , chiptrimpot , 23B , SMD
F1 = 500mA , melting fuse
J1 = Jumper

Semiconductors:
D1 = 12V , zener diode , ≥ 0.5W , hole mount
D2 = BAS32 , SMD
PVR = 8V , positive voltage regulator , hole mount
4066 = Quad bilateral switches , hole mount
LM258 = Low power dual operational amplifiers , SMD
LM2904 is a better chose then LM258!

The circuit requires only a single side board. All components should be handled as SMD, thus made, all soldering take place on the same side. Holes can be drilled for the M3-screw and J1.

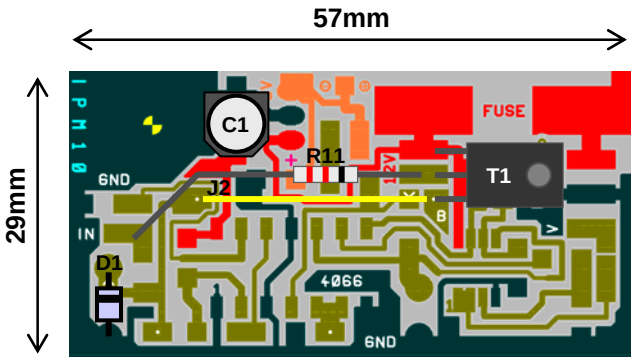
PROJECT	*Injection-period Meter*	
MODULE		
MODEL	**IPM10**	
AUDIT	A-1	**DRAWING: 1 of 1**
OTHER		
B. Lindqvist		*2017-06*

CIRCUIT DIAGRAM AND PLACING OF COMPONENTS



There is a possibility that IPM10 will provide itself through the fuel injector it currently measures. Then one not need any supply voltage from the outside.

If one choose this method, one can expect a slightly lower voltage and thus a smaller measuring range (0-10 mS).



Only components required for self-providing are deployed.

Components:
T1 = BD439 or similar NPN , hole mount
R11 = 22Ω , hole mount
J2 = Jumper (to base on T1)

Components that shall be changes:
C1 ≥ 220uF , 16V , E-lytic , SMD / hole mount
D1 = 13V , zener diode , ≥ 0.5W , hole mount

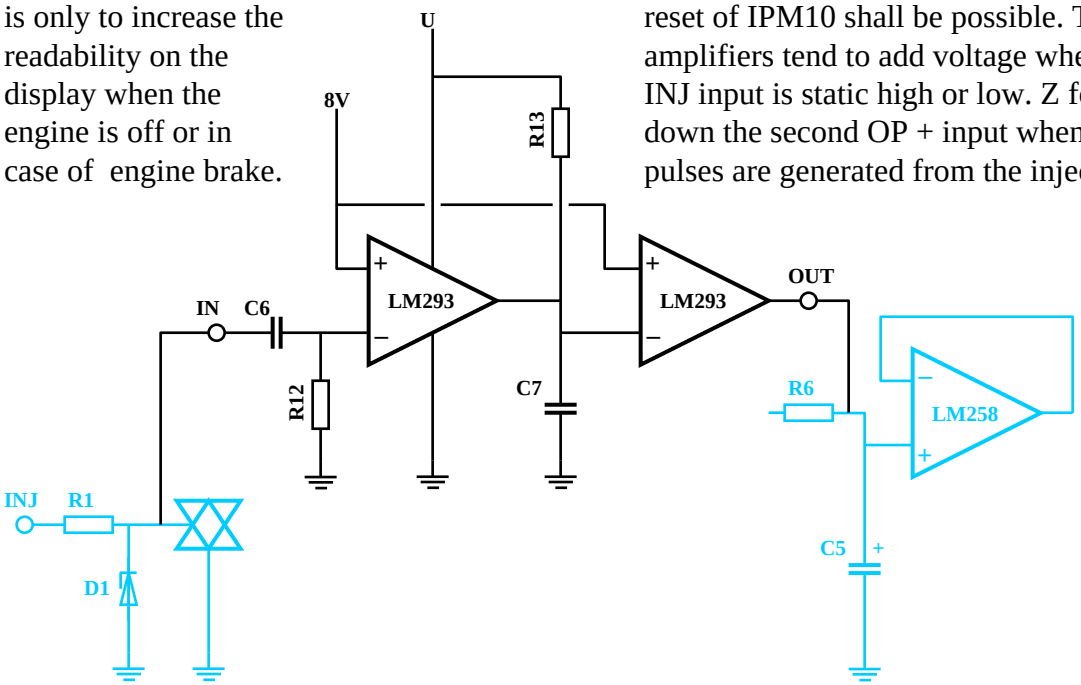
The circuit requires only a single side board. All components should be handled as SMD, thus made, all soldering take place on the same side. Holes can be drilled for the M3-screw, J1 and J2.

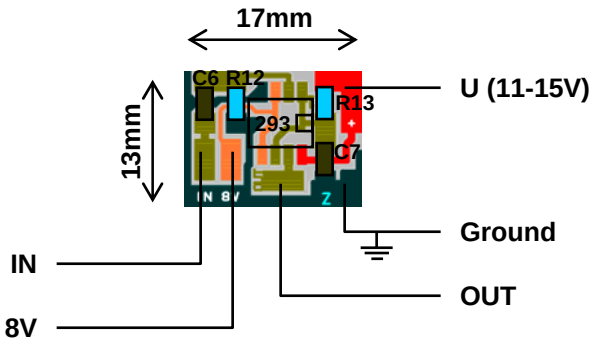
PROJECT	*Injection-period Meter*	
MODULE		
MODEL	**IPM10**	
AUDIT	A-1	**DRAWING: 1 of 1**
OTHER	No supply	
B. Lindqvist		*2017-06*

MODULE PLACING OF COMPONENTS AND CIRCUIT DIAGRAM

The function of this module is only to increase the readability on the display when the engine is off or in case of engine brake.

Additional electronics is demanded if a reset of IPM10 shall be possible. The OP amplifiers tend to add voltage when the INJ input is static high or low. Z forces down the second OP + input when no pulses are generated from the injector.





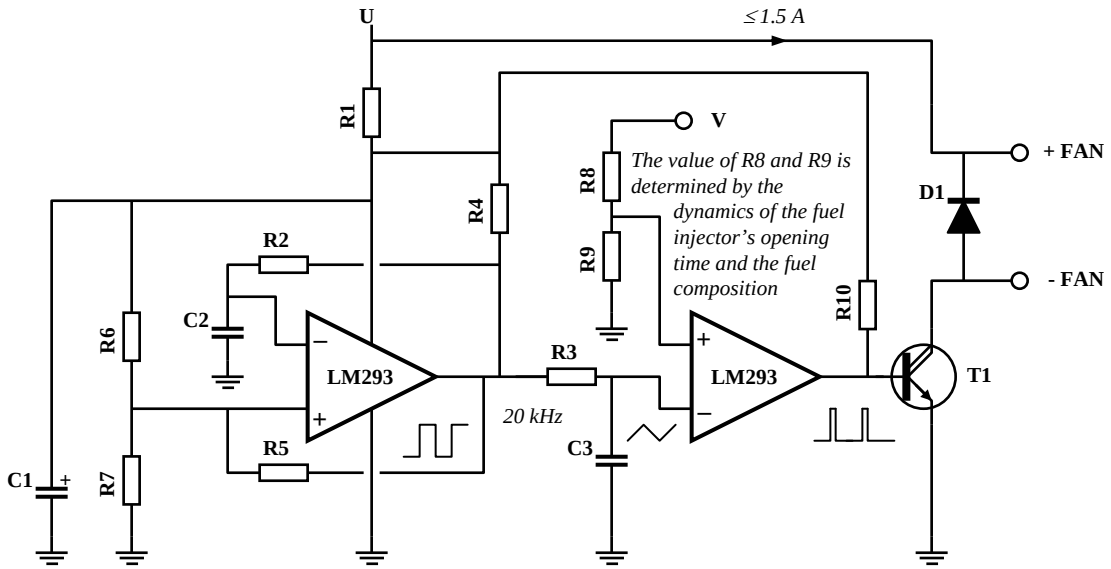
SMR1206:	*SMC1206:*	*IC:*
R12 = 1M	**C6 = 220p**	**LM293 = Low power dual voltage comp , SMD**
R13 = 4M7	**C7 = 100n**	***LM2903 is a better chose then LM293!***

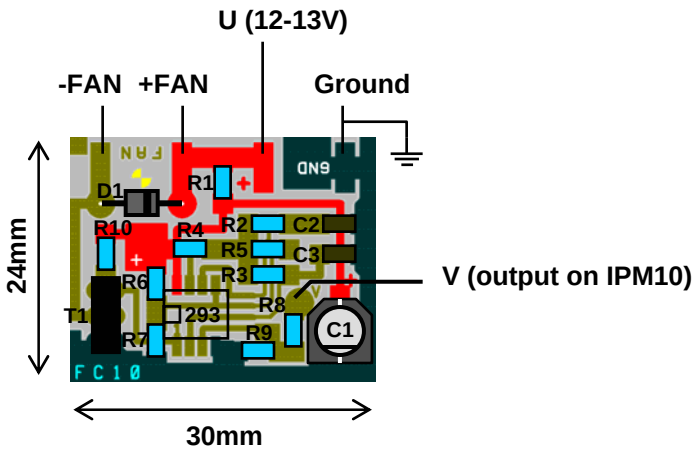
The circuit requires only a single side board. All components is of the type SMD.

PROJECT	*Injection-period Meter*	
MODULE	*Zero*	
MODEL	**Z**	
AUDIT	A-1	**DRAWING: 1 of 1**
OTHER	For resetting DVM	
B. Lindqvist		*2017-06*

MODULE PLACING OF COMPONENTS AND CIRCUIT DIAGRAM

The step is not far letting IPM10 controls the speed of a 12V PC fan. This fan should be placed at the engine's intake to provide more efficient air supply. This may be similar to a primitive air compressor (that lack the inertia a turbocharger has). What is missing is a PWM circuit that effectively minimizes heat loss.





SMR1206:
R1 = 47Ω
R2 = 33k
R3 = 100k
R4 = 4k7
R5 = 100k
R6 = 100k
R7 = 100k
R8 = ?
R9 ≥ 100k
R10 = 4k7

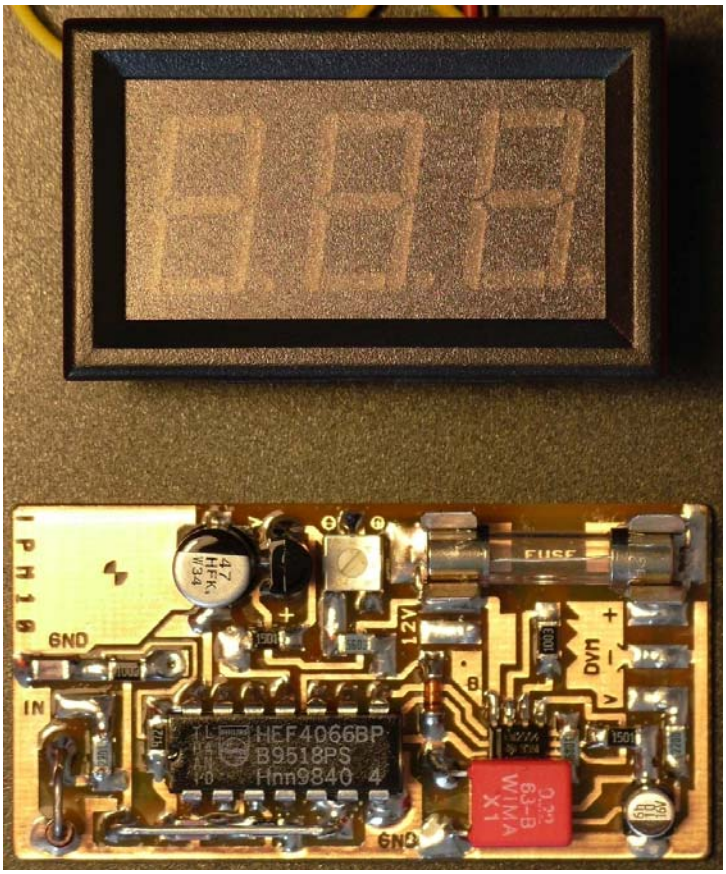
SMC1206:
C2 = 1n
C3 = 150p

Other components:
C1 = 22uF , 16V , E-lytic , SMD / hole mount
D1 = 1N4937 , ultrafast diode , hole mount
T1 = BD677 , Darlington transistor , hole mount
LM293 = Low power dual voltage comp , SMD
LM2903 is a better chose then LM293!

The circuit requires only a single side board. All components should be handled as SMD, thus made, all soldering take place on the same side.

PROJECT	*Injection-period Meter*	
MODULE	*Fan Control*	
MODEL	**FC10**	
AUDIT	A-2	**DRAWING: 1 of 1**
OTHER	Controlling fan speed	
B. Lindqvist		*2017-08*

PHOTOS



IPM10 under a DVM