IPE-GP is "one board" construction that is similar to IPE-GS combined with FFGM. IPE-GS is intended to be placed in a secluded space, while the purpose of IPE-GP is to have it on the dashboard so the driver can access it, like a big RCW-module. The different is that we not have any USB-cable arrangement here. IPE-GP requires only two electrical conductors, one goes from the injector cable and the other to ground (GND). IPE-GP is prepared to be mounted in a suitable box, plastic or metal - I prefer metal.

If you already built IPE-GS have you not any use for this device. GP is a simpler solution than GS but have the same performance. It is not designed to handle sequential injectors system. One can build it to operate in sequential systems but then can we question the purpose with this design? Many cars require higher linear pulse extension which implies that C4 must be bigger. Is C4 then selected to 2200nF shall C5 be cut in half and D9 shall be included too! If one need to compliment with ACFM shall a third cable drawn from the batteries positive pole. In addition is it not necessary to use an NTC-resistor on the engine block. Some older brands of LM393 can cause interferences and shall be avoided. I can recommend this model: LM393N, No. 73-292-04 (ELFA).

IPE-GP intention is simply to convert petrol cars (fuel injection) for low energy fuels.

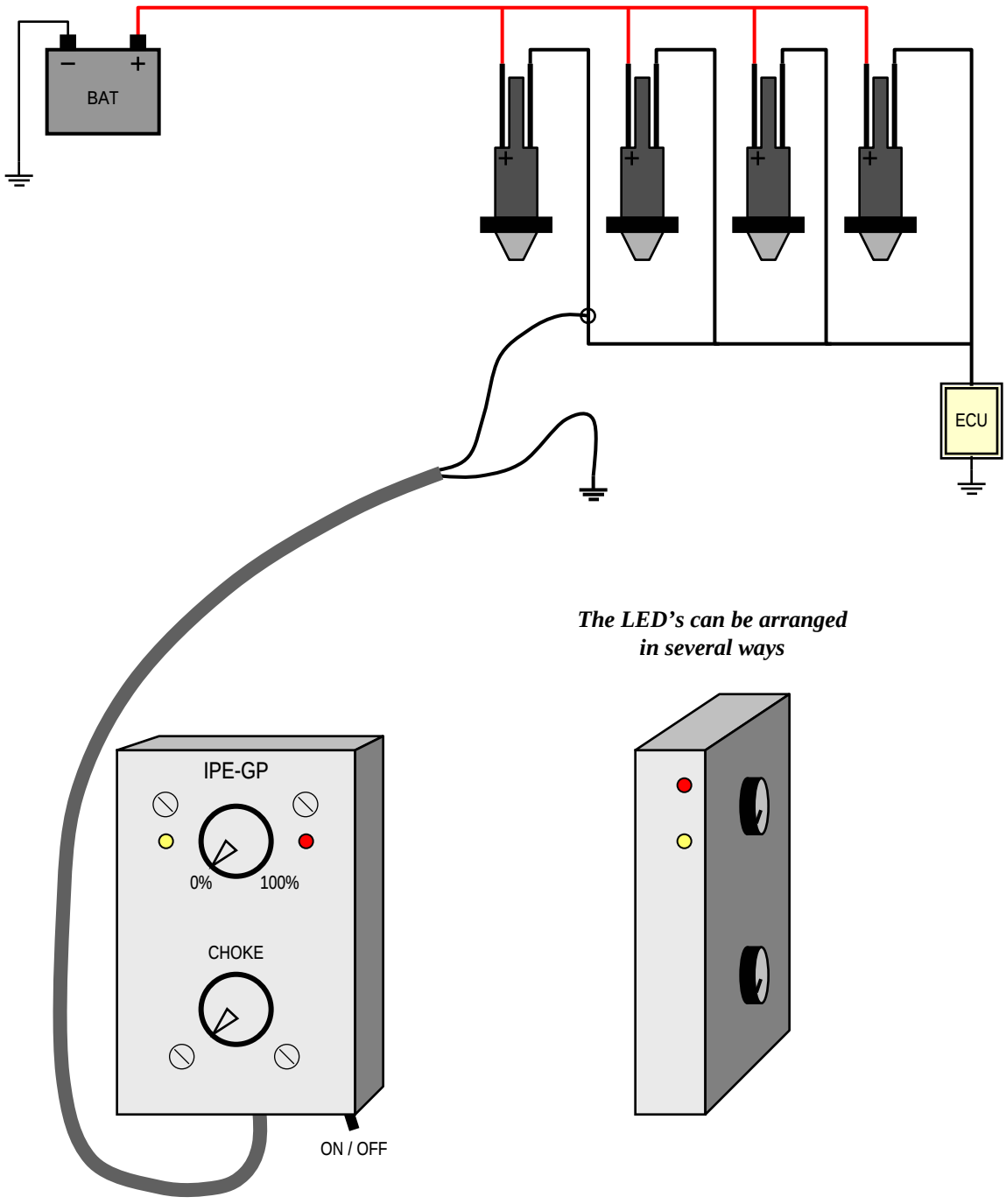
IPE measure the time of every injector pulse before it self creates a pulse that is proportional in width for the pulse width it just had measure. That mean consideration takes by variation of the pulse width. The condition for the concept is that your fuel injections computer or ECU (Electronic Control Unit) doesn't care if some add extra pulse width? Usually that is not a problem for any car.

"GP" stands for G-serial Package design.

This construction manipulates the injector timing device, by expanding the pulse width of the existing opening injector pulse or the opening time (or increasing the duty cycle). By other words; it lengthen the ordinary pulses by add a new pulse after the existing pulse to increase the fuel quantity. The new pulse proceeds by a very short spike-equal voltage pulse (shorter than 50μS) and that seems not to have any bad influence of the functionality. This concept is similar and reminds of "piggyback" devices.

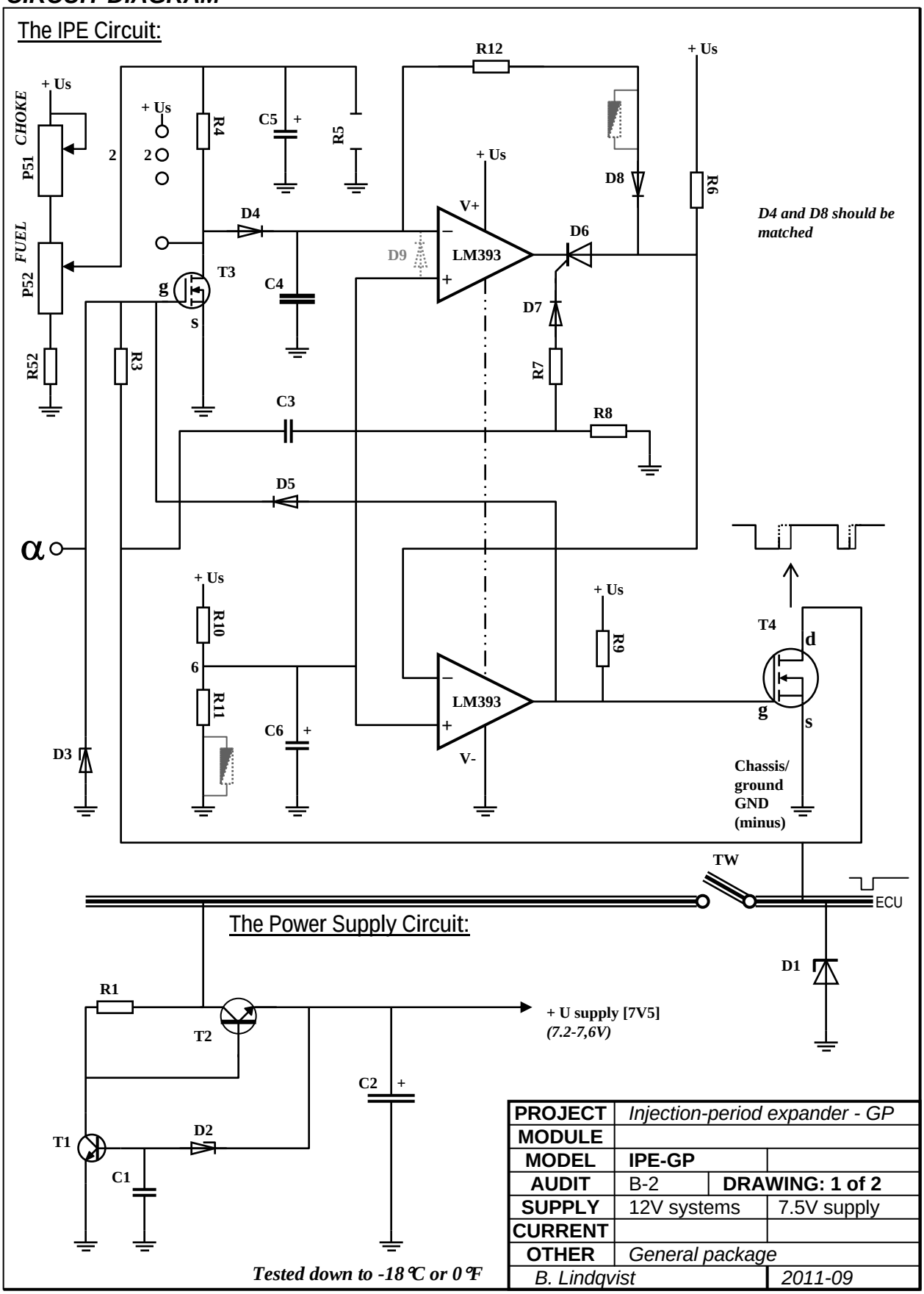
This project make it possible to drive a car (with electronic fuel injector systems) on ethanol or a mixture of petrol/gasoline and ethanol in any possible mixture between them, or for another low energy fuel in the commerce. If you not chosen to change the fuel quantity in some other way? Sometimes the ECU is able to adjust the amount very far from natural difference in the petrol qualities. But if that not is the circumstances with your car/ecu, then you may build this circuit in order to achieve this need of the quantity the engine require to function properly. The device only works for cars with a down pulling opening injection pulse, especially if the injection principle means that the opening of the pulses increase in frequency when the engine speed becomes higher

The principle to connect one IPE-GP unit to a multipoint fuel system (one channel):



The LED's can be arranged in several ways

CIRCUIT DIAGRAM

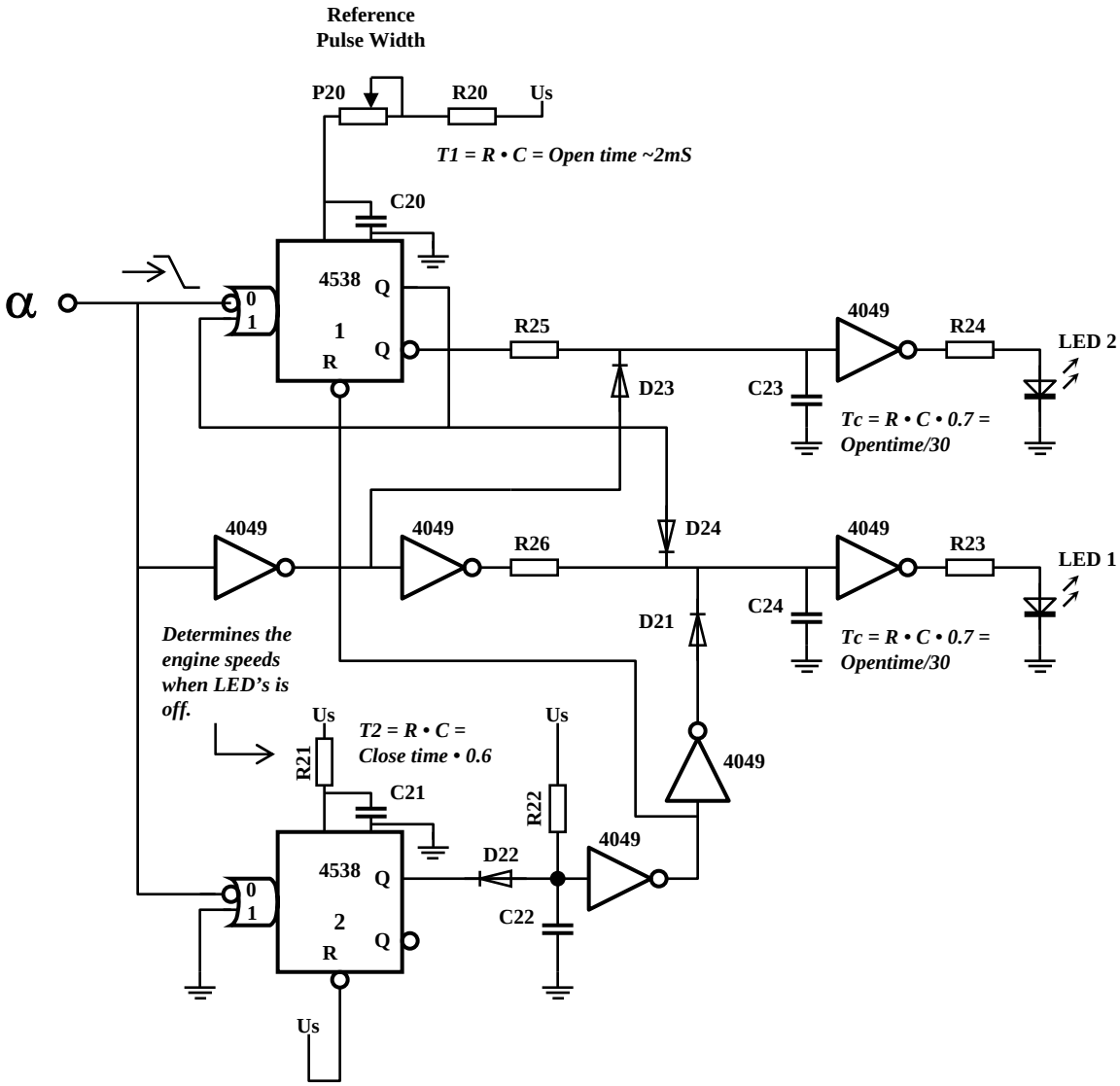


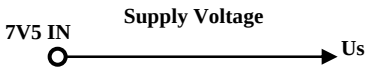
PROJECT	*Injection-period expander - GP*		
MODULE			
MODEL	**IPE-GP**		
AUDIT	B-2	**DRAWING: 1 of 2**	
SUPPLY	12V systems	7.5V supply	
CURRENT			
OTHER	*General package*		
B. Lindqvist		*2011-09*	

CIRCUIT DIAGRAM

The FFG Circuit:

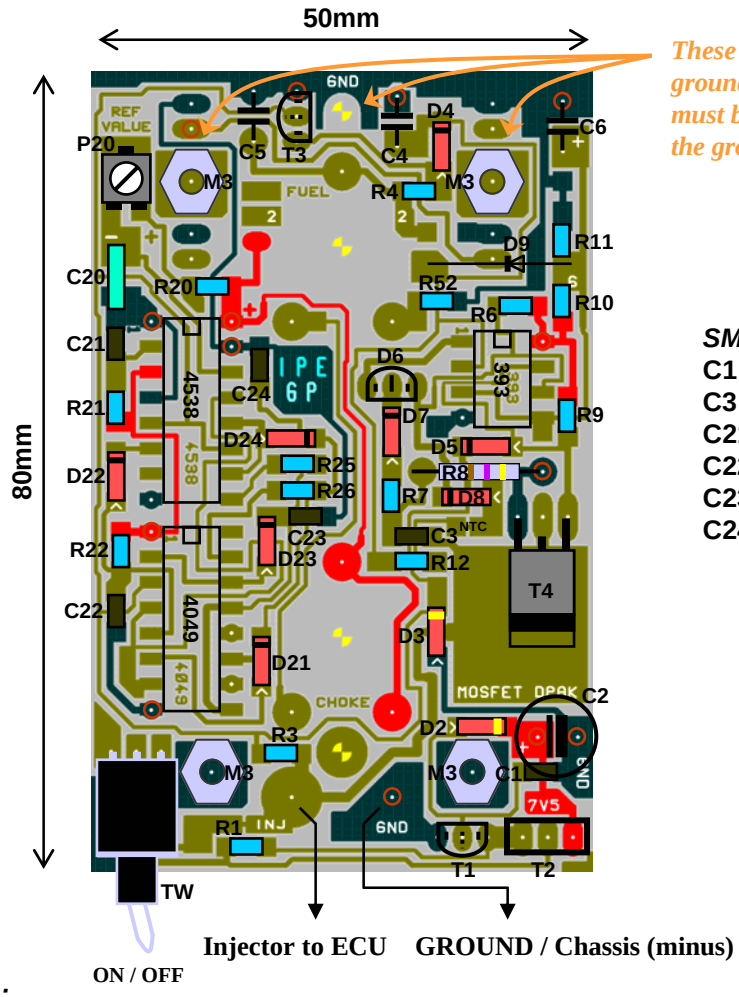
Circuit to measure and indicate if the engine need more or less fuel through two LED's.





PROJECT	*Injection-period expander - GP*		
MODULE			
MODEL	**IPE-GP**		
AUDIT	B-2	**DRAWING: 2 of 2**	
SUPPLY	12V systems	7.5V supply	
CURRENT			
OTHER	*General package*		
B. Lindqvist		*2011-09*	

PLACING OF COMPONENTS



SMR1206:
R1 = 2k2
R3 = 150k
R4 = 33k
R5 = 2M2
R6 = 1k
R7 = 4k7
R9 = 4k7
R10 = 47k
R11 = 22k
R12 = 22k
R20 = 33k
R21 = 470k
R22 ≥ 2M2
R25 = 10k
R26 = 10k
R52 = 35-50k

SMC1206:
C1 = 100n
C3 = 10n
C21 = 100n
C22 = 100n
C23 = 10n
C24 = 10n

Other Components:
R8 = 470Ω , hole mount
C2 = 1000µ , 16V , E-lytic , hole mount
C4 = 1000n , plastic (determine the linearity)
C5 = 22µ , 16V , E-lytic , hole mount
C6 = 22µ , 16V , E-lytic , hole mount
C20 = 47n , plastic type , hole mount
P20 = 50k , chiptrimpot 23B , SMD

Semiconductors:
D2 & D3 = BZV55-B6V8 , zener 6.8V , SMD
D4, D5, D7, D8, D21-24 = BAS32 , SMD
D6 = 2N5064 , thyristor , hole mount (or similar)
T1 = BC546B , hole mount
T2 = BD139 , hole mount
T3 = BS170 , N-MOS , hole mount
T4 = IRLR3410 , 17A , 100V , logic DPAK (or better)
TW = Toggle Switch , 2-way , TL36W015

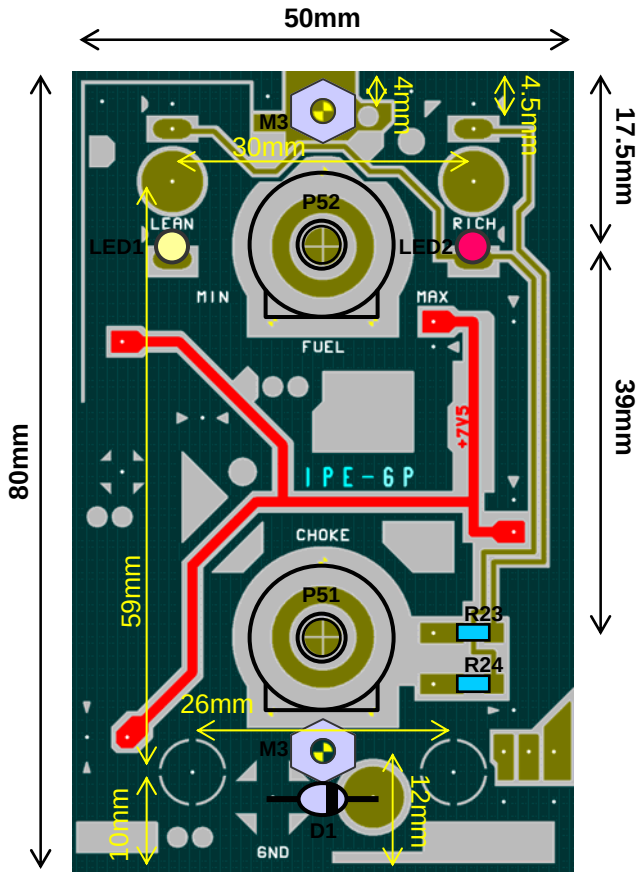
Integrated Circuits (hole mount):
LM393N = Low power dual voltage comp (see text)
4538 = Dual monostable flip-flop
4049B = Hex inverting buffer

T3 is extremely ESD sensitive! Get broken if not the legs is shorted when you mount it.
To speed up the start of the system; utilize D9 and change C5 from 22µF to 10µF.
A small C5 can make the car a little more difficult to start if the engine is warm.

This project needs a double side board. Use a heat sink for T4 if it get to hot - low impedance injectors. To fix T4 us solder. You need to drill 4 holes for supply voltage. Some holes can be drilled without more purpose than facilitate the mounting. Most components is SMD but some is hole mounted. Some GND-connections (minus) can be excluded and some of them can't. Holes with a red circle must be soldered on both sides.

PROJECT	*Injection-period expander - GP*	
MODULE		
MODEL	**IPE-GP**	
AUDIT	B-2	**DRAWING: 1 of 1**
OTHER	*Component side*	
B. Lindqvist		*2011-09*

PLACING OF COMPONENTS



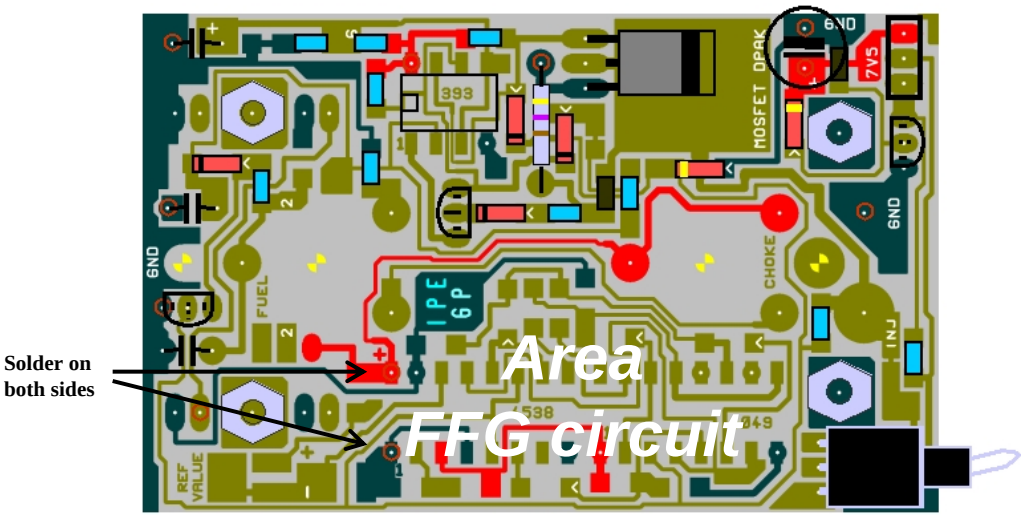
SMR1206:
R23 = 470Ω
R24 = 470Ω

Semiconductors:
D1 = BZT03C47 , zener 47V , hole mount
P51 = 20k , PT-15NV , hole mount
P52 = 10k , PT-15NV , hole mount
Also other types of rheostats...
LED1 = Yellow , EL1224UYC (or similar)
LED2 = Red , EL1224SURC (or similar)
LED's shall illuminate about 500 mcd.

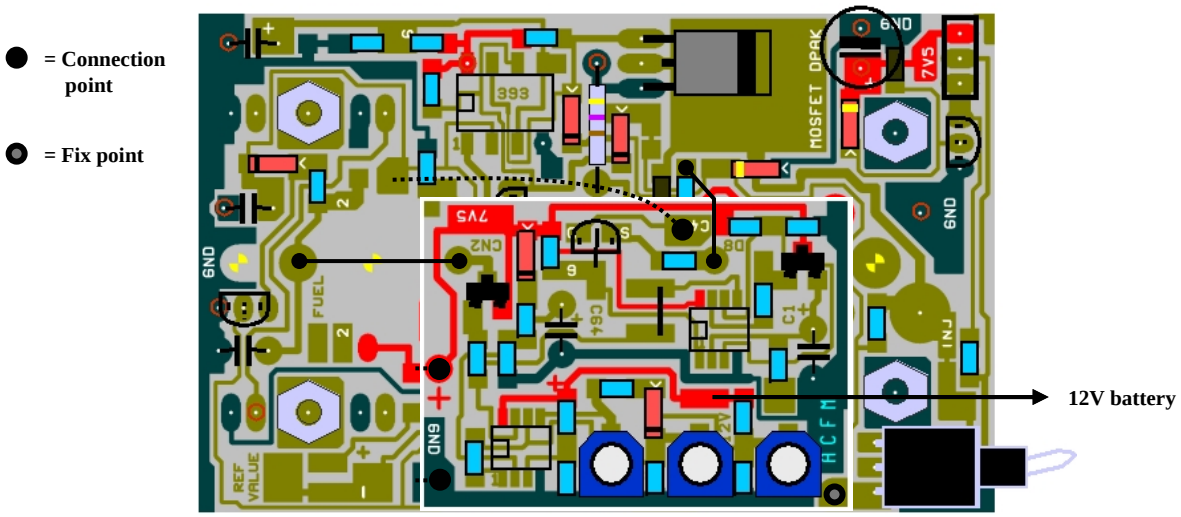
The ground side (upper side) contains only two resistors (for the LED's), the LED's, one zenerdiode and potentiometers/rheostats for fuel and choke. You can also mount the on/off switch on this side.

PROJECT	*Injection-period expander - GP*	
MODULE		
MODEL	**IPE-GP**	
AUDIT	B-2	**DRAWING: 1 of 1**
OTHER	*Ground (plane) side*	
B. Lindqvist		*2012-10*

If the FFG-circuit is excluded is the whole thing about half as complicated to build. You lose the ability to set the fuel exactly to the LEDs. Usually is it possible to adjust the amount of fuel by simply pay attention to engine condition. Too little fuel makes the engine/car weak and unwilling to respond quickly to the throttle. If you want that, just skip the FFG-circuit components. One not needs to plan/buy/install any LEDs. The PWB appearance can of course be intact, in the case you later want to add a FFG-circuit?

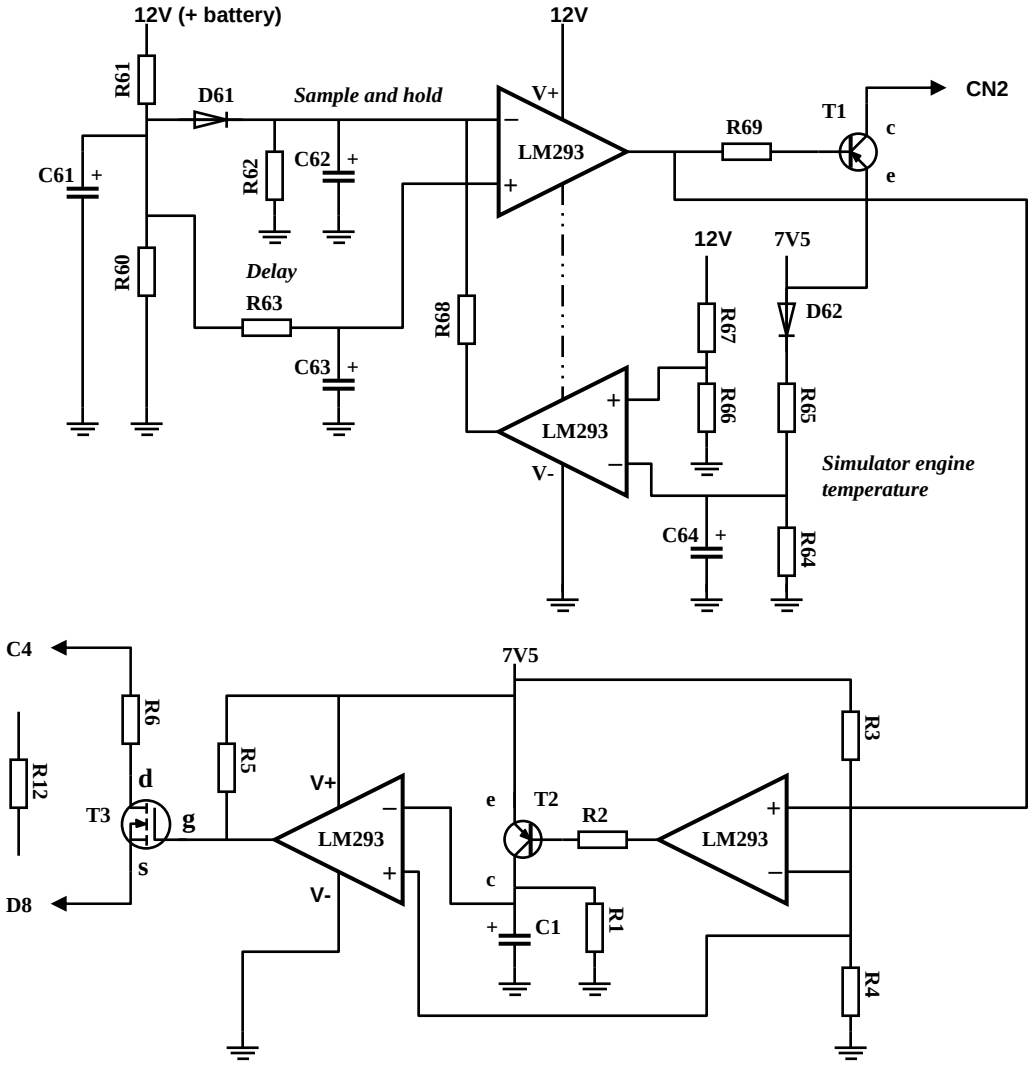


An ACF module can be installed with or without a FFG circuit. ACFM could replace the space FFG addresses, and if so did one not have to build/etching a standalone module. But if the possibility in the future is to expansion with an FFG-circuit should one have a separate ACF-module. The single-sided ACFM is placed on the IPE-GP (double board) above the area where the FFG-circuit is located. Then - solder the solid linkages/struts (which may comprise for example copper wire) on the items that are shown below.



MODULE CIRCUIT DIAGRAM

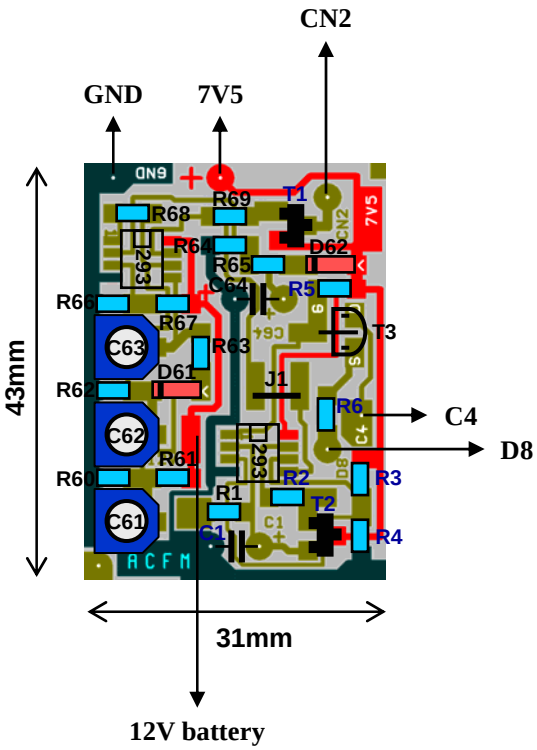
An automatic choke and an automatic up-regulation of the fuel amount before the engine is warm enough means that the car works almost flawlessly when running on E85. In principle required any additional measures to be taken despite that the fuel has other properties. In addition, not needed an NTC resistor on the engine block. The module is soldered on top of the IPS-GP's component-side, but no adjustments or modifications to the original layout of the IPE-GP is required (D6 can be folded down). The circuit is almost identical to the modules ACM (autogm) and AFEa (ipe-s) but is here combined into one module. A modification has been made around R12. A mosfet (T3) open and close and thus controls the fuel-up regulation - instead of a bipolar PNP transistor.



ACFM works equally well for IPE-GS and can be the first choice instead of ACM and AFE. ACFM is controlled by time (not the engine temperature) and therefore require an extra cable from the battery positive terminal

PROJECT	*Injection-period expander - GP*	
MODULE	*Automatic choke & fuel*	
MODEL	**ACF**	
AUDIT	B-2	**DRAWING: 1 of 1**
SUPPLY	12 & 7.5V	
CURRENT	off state~0.6mA	
OTHER	*ACM and AFEa implemented*	
B. Lindqvist		*2011-09*

MODULE PLACING OF COMPONENTS



SMR1206:

R60 = 330k
R61 = 100k
R62 = 10M
R63 = 220k
R64 = 10M
R65 = 100k
R66 = 100k
R67 = 470k
R68 = 2k2
R69 = 4k7

R12 = 27k (not 22k)

R1 = 1M*
R2 = 22k
R3 = 22k
R4 = 2k2
R5 = 100k
R6 = 150k
Enrichment ~10%

**** R1 can be an NTC-100k in serial with 680k***

Other Components:

C61-C63 = 22µ , 16V , E-lytic , SMD/hole mount
C1 & C64 = 470µ , 16V , E-lyt , hole mount
D61 & D62 = BAS32 , SMD
T1 & T2 = BC857B , SMD
T3 = BS170 or 2N7000 , N-MOS , hole mount
LM293/2903 x 2 = Low power dual voltage comparators , SMD
J1 = Jumper

T3 is extremely ESD sensitive! Get broken if not the legs is shorted when you mount it.

The module requires only a single side board.
No hole need to be drilled for any component.

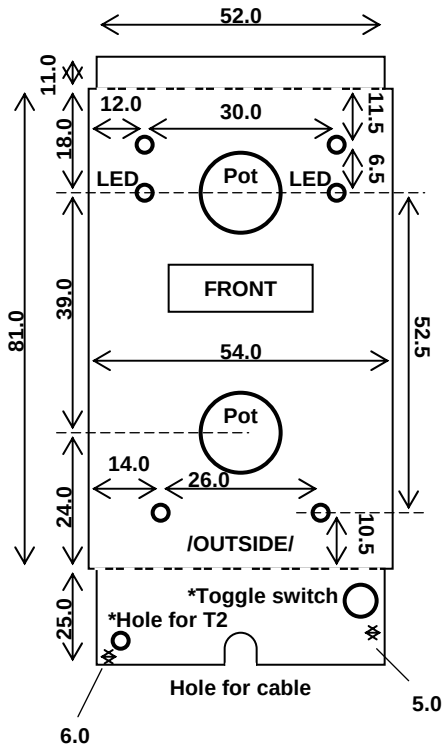
PROJECT	*Injection-period expander - GP*	
MODULE	*Automatic choke & fuel*	
MODEL	**ACF**	
AUDIT	B-2	**DRAWING: 1 of 1**
OTHER		
B. Lindqvist		*2011-09*

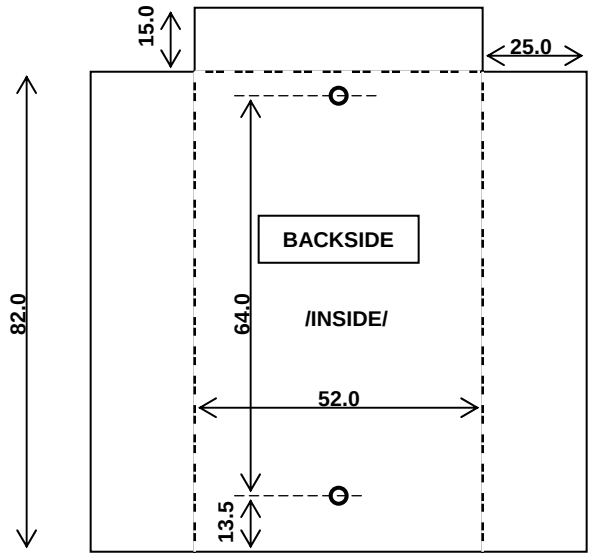
DRAWING

THE DRAWINGS IS NOT ACCORDING TO SCALE

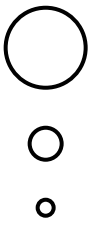
[mm]

ALUMINUM SHEET 1mm





HOLE DIM. DIAMETER



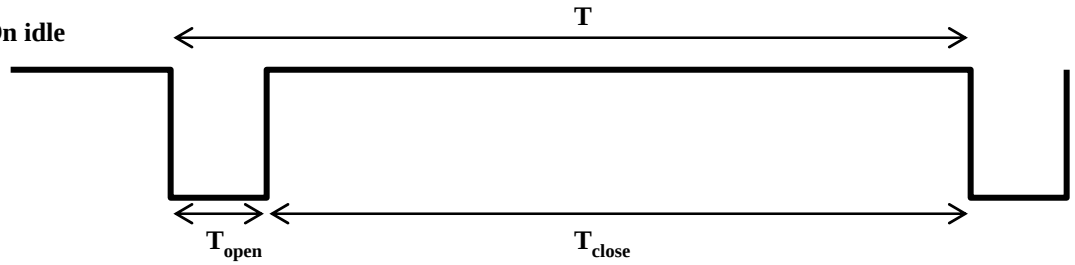
**** = optional***
The cooling of T2 can be excluded. No heat of T2 has so far been detected.

PROJECT	*Injection-period expander - GP*	
MODULE		
MODEL	**IPE-GP**	
AUDIT	B-2	**DRAWING: 1 of 1**
OTHER	*Unit housing, such as aluminum*	
B. Lindqvist		*2011-09*

Preliminary investigation:

For your car (on pure petrol)

On idle



T_{open} = _____ (~2mS)

T_{close} = _____ (T_{open}•30±5)

$T = T_{open} + T_{close}$ = _____

Duty Cycle = T_{open} / T = _____

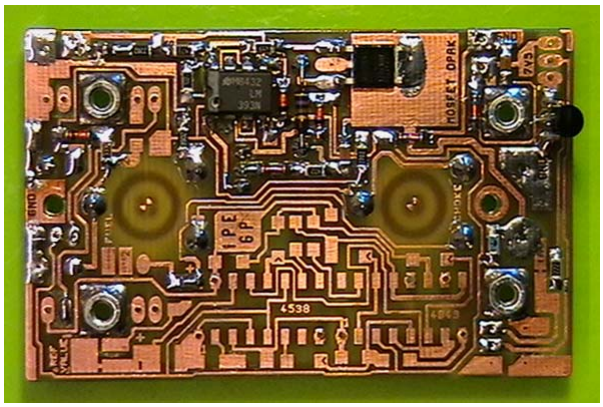
It is possible to use IPE-GP (FFG-circuit) as a measure instrument to measure the opening time if you don't have an oscilloscope.
First: Adjust rheostats P52 (fuel) and P51 (choke) full to left (zero).
Then: Adjust P20 (reference value) until the both LED's are down.
Finally: Measure the resistant on P20, add it with R20 and multiplicity the sum with C20.
The result is the opening time [seconds].

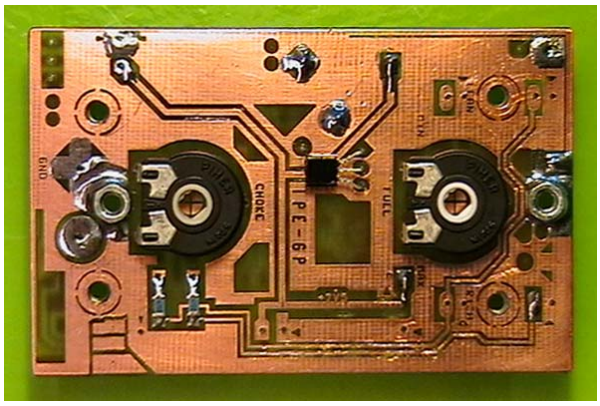
T1 = T_{open} = _____

T2 = T_{close} · 0.6 = _____

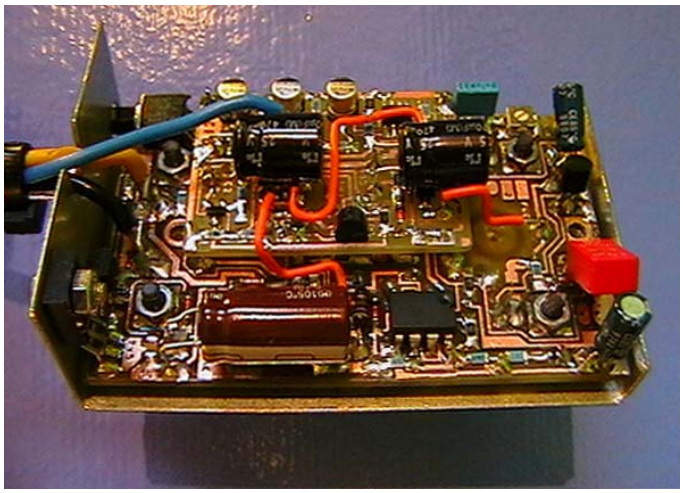
Tc = T_{open} / 30 = _____

PHOTOS





The circuit-board without FFG and with all SMD components mounted



Fully equipped and with ACFM

Front with panel