For a petrol car converted to run on E85 through a mechanical method such as higher fuel pressure or bigger injectors exist a need for an efficient cold-start circuit. If any solution already is used like; an extra gas tank with associated spreader (for an example), one could use an electronic circuitry that affect temperature sensor.

Unlike CSD, which also makes what CSC does so is this project based on the module IPE-GS and GP is using (ACM). When a new cold start device saw the day of the light got this circuit step aside and its name was changed to CSC. It is a further development of SSC which was the first circuit that utilized voltage injection. SSC worked not entirely satis-factory so there was a need for a better circuit. Both CSD and CSC synthesis work fine without any known faults, so far.

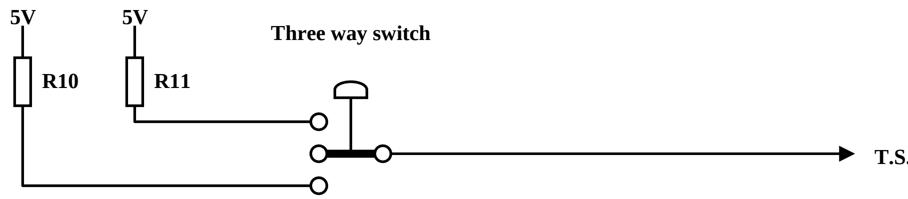
CSC is based on the proven AC module thereto is it here adapted to affect the temperature sensor. The strength of the choke and enrichment is determined by two selectable fixed resistors - R10 respectively. R11 and do not vary over time. The choke is activated by the drop of the accumulator/battery, because when the engine is starting will the voltage sink due to the starter's high power consumption. Will it sink more than normal (about 1V) jumps the choke in, which means that the temperature sensor get a high voltage across it. The choke only last a few seconds and does not participate as a start-aid when the car engine is warm. When the engine is warm (about 150°F) will also the enrichment expires. The enrichment time thus determined by a temperature value that one can decide via R12 and R13. Enrichment is achieved by a slightly higher voltage than the actual voltage that is applied to the temperature sensor. Both choke and enrichment seems after a resistance that reduces the regular control unit "pull up" resistor via parallel connection. These is activated distinctive - either they are on or they are off.

CSC is automatic and more complicated to build than SSC, but if you choose to use many modules to SSC is the difference reduced however. Regardless of the outside temperature, will the percentage change in both the choke and the enrichment always be equal.

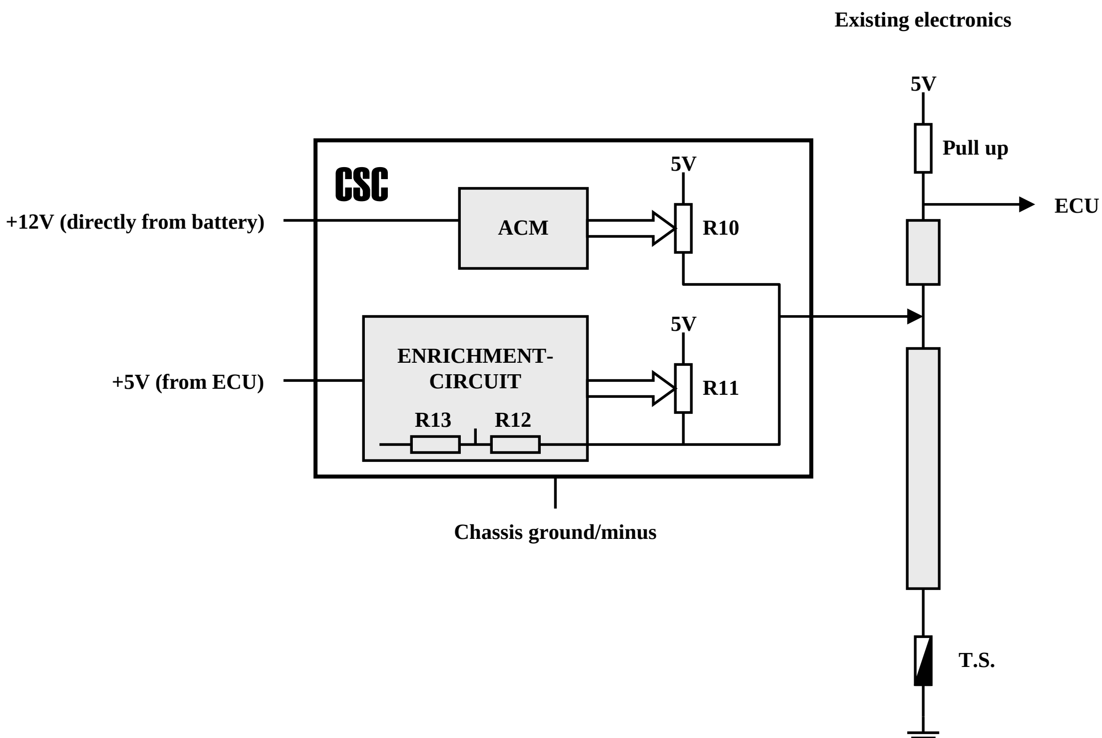
CSC is thus designed to be connected to a temperature sensor that is located on the engine block. If one manipulates this sensor will it result in varying fuel supply. There are also other temperature sensors on that type of vehicles, such as in the air duct. This sensor is mainly used to calculate proper amount of air and contributes current the fuel quantity less than an engine sensor.

CSC does not require that one must expose or breaking up existing electronics/cables, it only should be connected to the temperature sensor warm side. Furthermore, the sensor must be grounded on the chassis!

PRINCIPLE

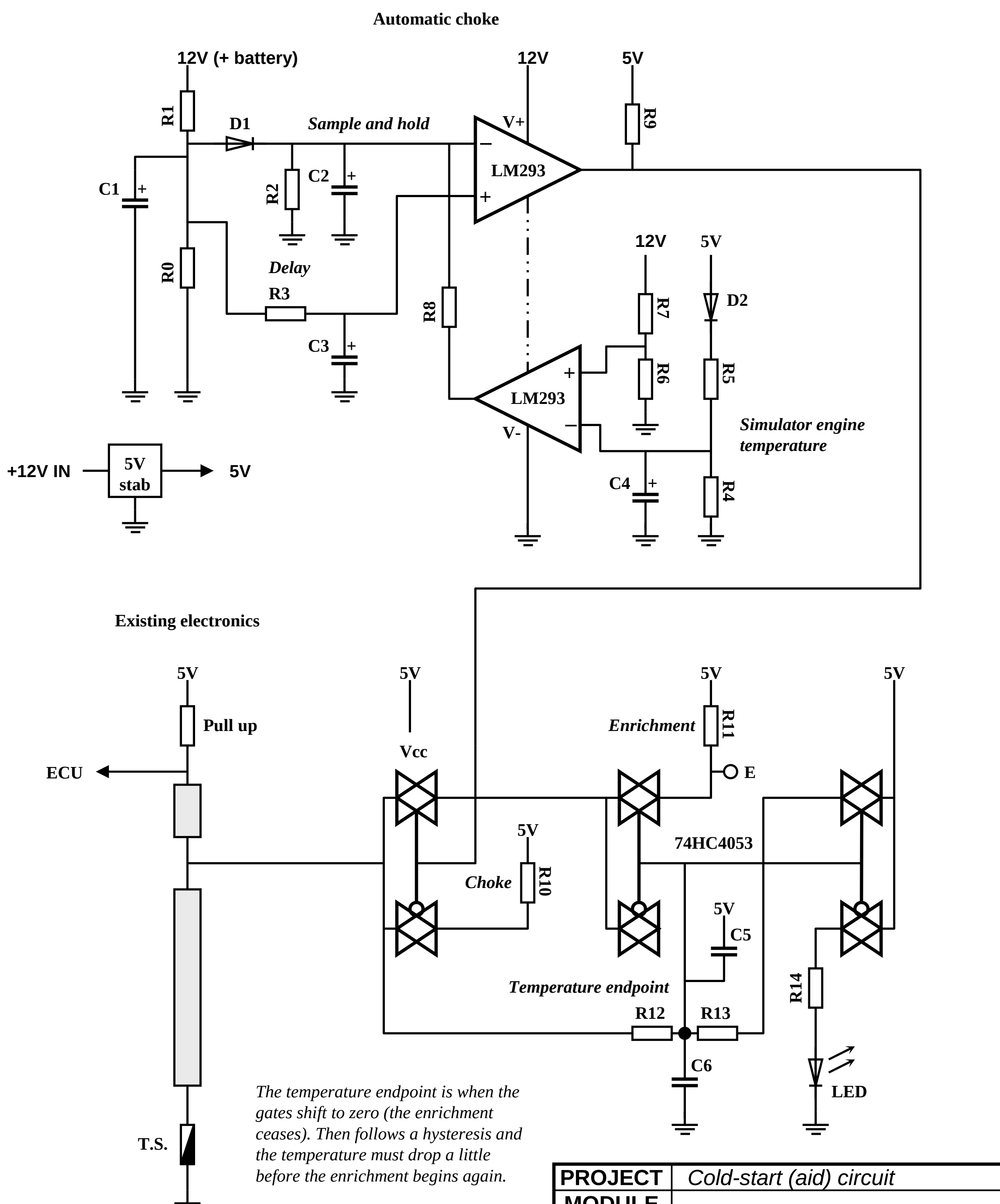


The simplest engagement to provide a cold start resistance should be the arrangement above. This is the principle in which CSC is working after if one choose to construct just this particular circuit.



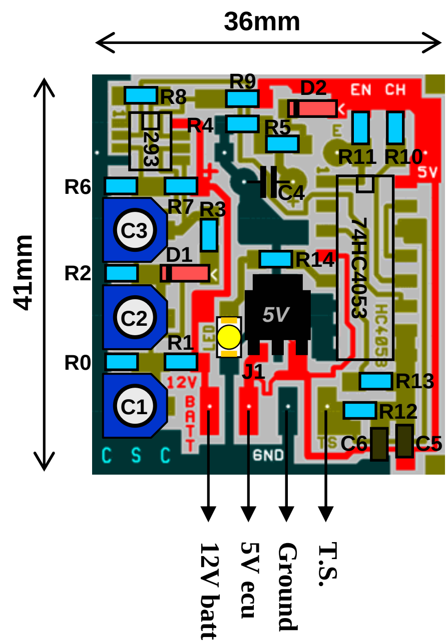
One way to achieve an elevated value of the voltage across the temperature sensor is with a digital switch in a CMOS circuit making a parallel connection with an external resistor over the pull up resistance in the existing electronics in an equivalent ECU. The size of R10 that determines the choke strength should be between 1000 to 1500 ohms, while R11 which determines the strength of the enrichment should be between 2100-2300 ohms. These values depend on the way the current temperature sensor is designed. The recommended values (R10, R11 and R21) in this document are optimal when it comes to my car, a Citroen Xantia. For this car model is the pull up = 2000 ohms at 150°F, the voltage is then 0.8 V. The LED is connected to the enrichment circuit and is off while it's going on; it lights up when the enrichment ends and is then lit as long as the car is used. With the help of the light one can determine the temperature at which the enrichment ceases.

CIRCUIT DIAGRAM



PROJECT	*Cold-start (aid) circuit*	
MODULE		
MODEL	**CSC**	
AUDIT	A-1	**DRAWING: 1 of 1**
SUPPLY	12 & 5V	
CURRENT	off state~0.6mA	
OTHER	*For mechanical conversions*	
B. Lindqvist		*2012-12*

PLACING OF COMPONENTS



For CSC2 where USEM is implemented, the measures is 50x36 mm.

Onto a Molex?

SMR1206:
R0 = 330k
R1 = 100k
R2 = 10M
R3 = 220k
R4 = 10M
R5 = 100k
R6 = 47k
R7 = 330k
R8 = 2k2
R9 = 10k
R10 = 1k2
R11 = 4k7 ⟸ *actually too high*
R12 = 1M
R13 = 2M2
R14 = 220Ω

SMC1206:
C5 = 100n
C6 = 47n

Other components:
C1-C3 = 22µ , 16V , E-lytic , SMD/hole mount
C4 = 470µ , 16V , E-lytic , hole mount
D1 & D2 = BAS32 , SMD
LED = SMD , Chip-type 1206
LM293 = Low power dual voltage comparators , SMD
74HC4053 = 2-channel multiplexer , hole mount
5V stab = LM340MP , 5V , SMD (only for 12V supply)

If one is selecting a 12V source instead of a 5V source must one use an LM340MP. In that case shall the printed jumper at J1 sanded off.

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 C4 and the cable attachment.

PROJECT	*Cold-start (aid) circuit*	
MODULE		
MODEL	**CSC**	
AUDIT	A-1	**DRAWING: 1 of 1**
OTHER		
B. Lindqvist		*2012-12*

MODULE PLACING OF COMPONENTS AND CIRCUIT DIAGRAM

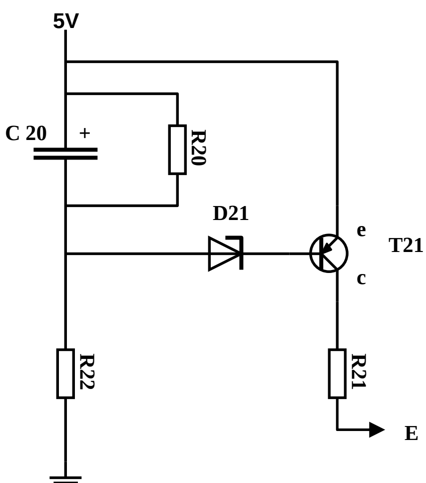
To avoid that idle begin to rush at a cold start must R11 only in a small extent affect the temperature sensor. This means that the effect of the resistance become small, i.e. the fuel addition at E85-operation will be too low while the engine not is warm. To increase the fuel quantity must the enrichment be larger but if a delay is added before the temperature change will the engine get enough time to adjust itself.

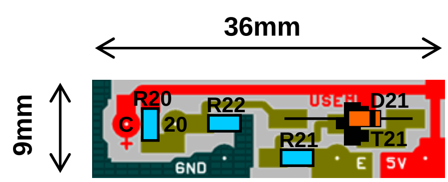
The temperature reduction which follows is not sudden but gradually, during about 40 seconds, so at the beginning of a cold start is USEM inactive but soon it begins to add additional voltage on T.S. R21 thus lowering the overall resistance together with R11 (parallel connection), so that the voltage increases and the enrichment then takes off.

Calculation support for sizing:

R10 = Pull up x 0.6
R11 = Pull up x 5.0
R21 = Pull up x 1.3

RE (resulting) = Pull up (R11//R21)





The module is placed and fixed above CSC1 on its upper part.

SMR1206:
R20 = 1M
R21 = 2k7
R22 = 220k
R11 = 10k

Other components:
C20 = 470µ , E-lytic , hole mount
D21 = Zener 2V7 , hole mount
T21 = BC857B-PNP, SMD

R11 makes little effort when using USEM and may be increased (high idle avoided then).

For CSC2 where USEM is implemented shall R21 be a hole mount resistance.

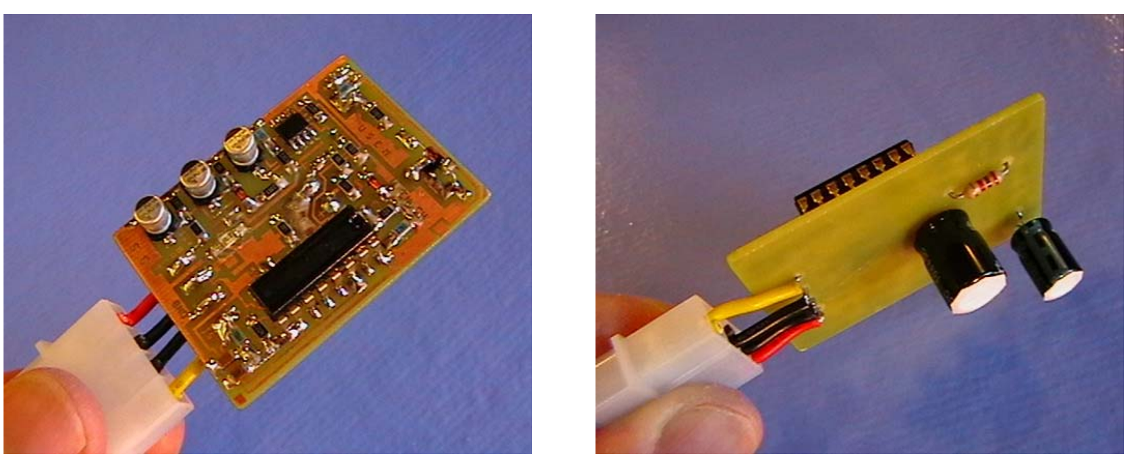
When USE is introduces at CSC shall R12 and R13 be re-weighted, so that the temperature change not is moving. The deviation will tend to be so small that one can ignore it.

The module requires only a single side board. All components should be handled as SMD, thus made, all soldering take place on the same side. Holes should be drilled for 5V, GND and E.

PROJECT	*Cold-start (aid) circuit*	
MODULE	*Up-step enrichment*	
MODEL	**USE**	
AUDIT	A-1	**DRAWING: 1 of 1**
SUPPLY	5V	
CURRENT		
OTHER	*Tested*	
B. Lindqvist		*2012-12*

PHOTOS

CSC2 (USEM is implemented)



Ready to plug