Prins
A WESTPORT COMPANY

installation manual
Engine Kit
part 2/2

DIRECT LIQUI max-2.0 HIGH PRESSURE LIQUID LPG INJECTION

MANUFACTURER	Alfa Romeo
TYPE	159 Sport Wagon
ENGINE DISPLACEMENT	1750cc TBI – 147kW
NUMBER OF VALVES	16v
ENGINE CODE / NUMBER	939.B.1000
VEHICLE CATEGORIES	M
TRANSMISSION	MT
VERSION	**AFC-2.1**
PETROL ECU MANUFACTURER / CODE	Bosch (FPT) Motronic MED 17.3.1
HIGH PRESSURE PETROL POMP	Bosch 261.520.053 / 261.520.054
HIGH PRESSURE PETROL INJECTOR	Bosch 261.500.067
MODEL YEAR:	2009-2011
SYSTEM APPROVAL NUMBER (R115)	E4-115T-000014 / DLM-LPG 07
LOCATION R115 SYSTEM STICKER	right side, centre door post
ENGINE SET NUMBER	341/070003/A
MANUAL NUMBER	076/0100700
DATE	2016-06-09
	Version 2013-09-28 D

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General instructions

- The installation of the system shall be done in accordance with the installation manual provided by Prins Autogassystemen.
- This manual is based on Dutch regulations, always install the system in accordance to the local regulations.
- For an optimal functioning of the Direct LiquiMax-2.0 system, maintain a clean and organized work environment during installation and maintenance to prevent pollution of the LPG components.
- Always download the “general manual 1/2 “ from our website for basic instructions and diagrams.
- Always **disconnect the battery when installing / servicing** the LPG system. Make sure the ignition key is outside the car.

  Be aware of central door locking, radio / telephone memory code, alarm system.
- Wear safety goggles when working on the petrol filled system / connections (pressurized petrol)
- Do not place the main fuse into the fuse holder before having completed the installation of the system.
- The AFC has to be activated by means of the Prins diagnosis software.
- Never disconnect the AFC connector, unless you have removed the main fuse.
- When installing the wiring harness, ensure that it does not run near any of the ignition components.

  Solder and insulate all electrical connections.
  The wires in the loom are provided with numbers and text. The text on the wire explains the function of the wire.
  The wire harness is not model specific, therefore is it may be necessary to adjust the length of the wires.
  Ensure maximum care is taken when connecting wiring.
  Make professional joints using solder and shrink sleeve. Do not stretch the wiring harness.
- No component of the LPG-system shall be located within 100 mm of the exhaust or similar heat source, unless such components are adequately shielded against heat.
- If holes have to be drilled (wear safety glasses) for installing brackets, etc., the drilled holes must always be treated with an anti-corrosion agent, after the chips have been removed (especially when mounting a exterior filler into body work).
- After having completed the installation, check the whole system for LPG leakage; use a LPG leak detection device. Also check for leak of engine coolant, petrol and air.
- Fitting and maintenance is only allowed by Prins Autogassystemen selected LPG engineers.
- Failure to follow the instructions in this manual can result in a poor or non-working LPG installation or a dangerous situation.
- For maintenance instructions see owner manual.
- Prins Autogassystemen is not responsible for any damages to people or objects as a result of changes to Prins products.
- Check our website regularly for diagrams, certificates, updates, info-bulletins and product information.

Register (warranty card) the system on the Prins warranty portal .

Required equipment / tools / materials for installing a complete system

- Complete workshop toolbox (wrenches, screwdrivers, cutters, pliers, ratchet, sockets)
- Car lift
- Portable computer
- Vehicle fuel system scan tool or OBD scan tool Prins (part nr. 099/99928)
- Exhaust gas analyser
- Multimeter
- Oscilloscope
- Prins diagnostic software
- Prins serial interface
- Torque wrench (5-50Nm)
- Torque wrench (200-250Nm)
- Portable light
- Assortment drill bits 4 to 12 mm
- Assortment cutters (ø 20, 30, 50, 70 mm)
- Portable drill or pneumatic drill
- Thread cutting device (male M6x1, M8x1, M10x1)
- Air gun
- Vacuum cleaner
- Safety goggles
- Hot air gun
- Soldering iron, soldering tin
- Wire-stripping pliers
- Adhesive tape
- Adhesive sealant
- Thread locking compound
- Anti-corrosion agent / black body coating
- Gas leak detection device or foam leak spray
- Shrink sleeves

Vehicle check

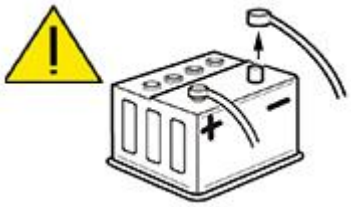
- Check the vehicle drivability on petrol
- Check the fuel system for error codes (scan tool)
- Check if the catalytic converter is in good condition (exhaust gas analyzer)
- Check the condition of the ignition system (spark plugs, cables, coil)

Tightening moments

		Nm	Spanner mm
M 4 x 0,7		3.3	7
M 5 x 0,8		6.5	8
M 6 x 1,0		11.3	10
M 7 x 1,0		14.5	11
M 8 x 1		24.5	13
M 8 x 1,25		27.3	13
M 10 x 1		52	15-16-17
M 10 x 1,5		54	15-16-17
(filtered) Banjo bolt		10	14
Supply line connection		15	13
Fuel module Allen bolts		20	7
Filler hose connection		50	22
Boost pump clamp		7	10
High pressure petrol fuel line		24-35	17

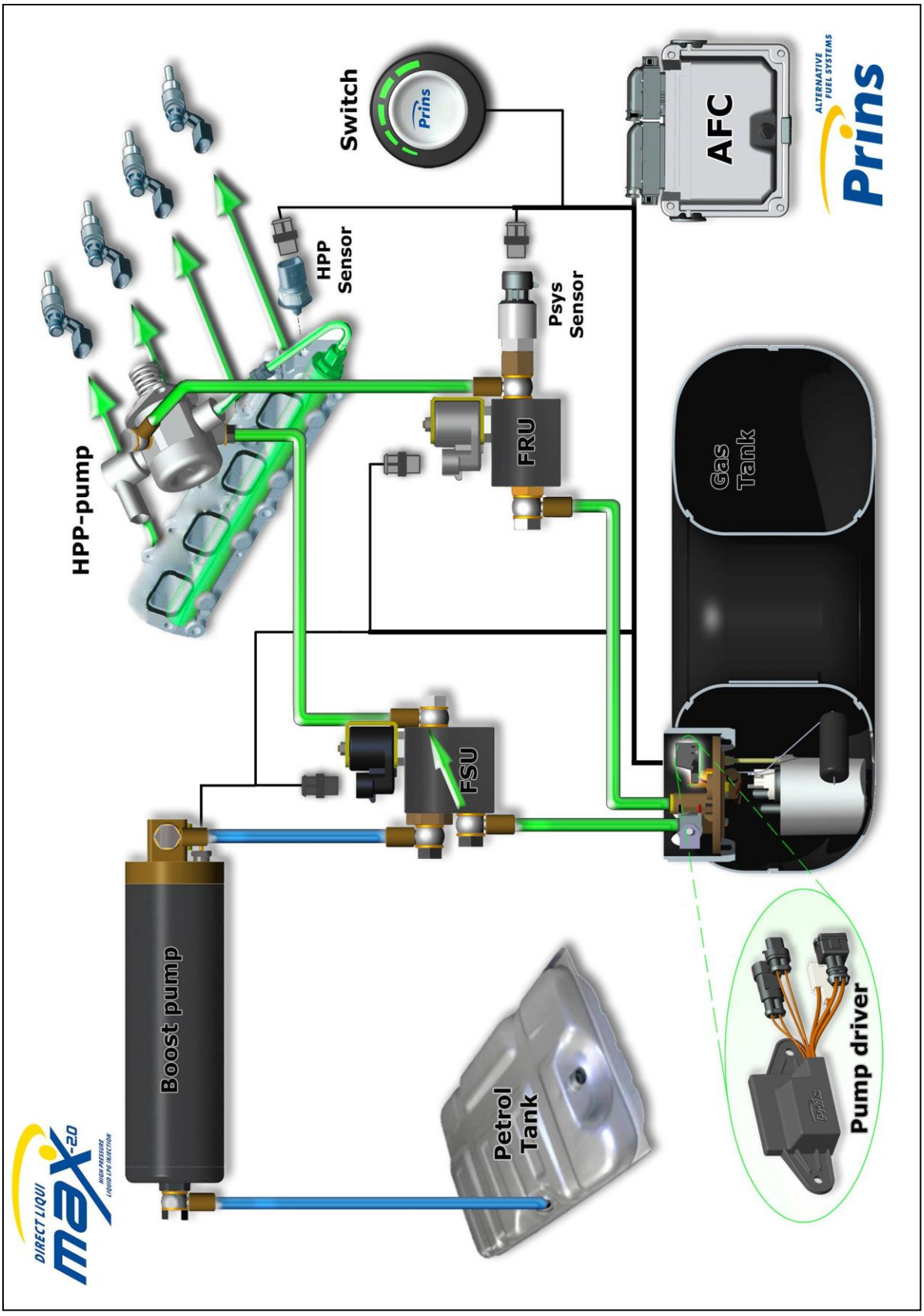
EXPLANATION OF SYMBOLS :

= IMPORTANT, CAUTION

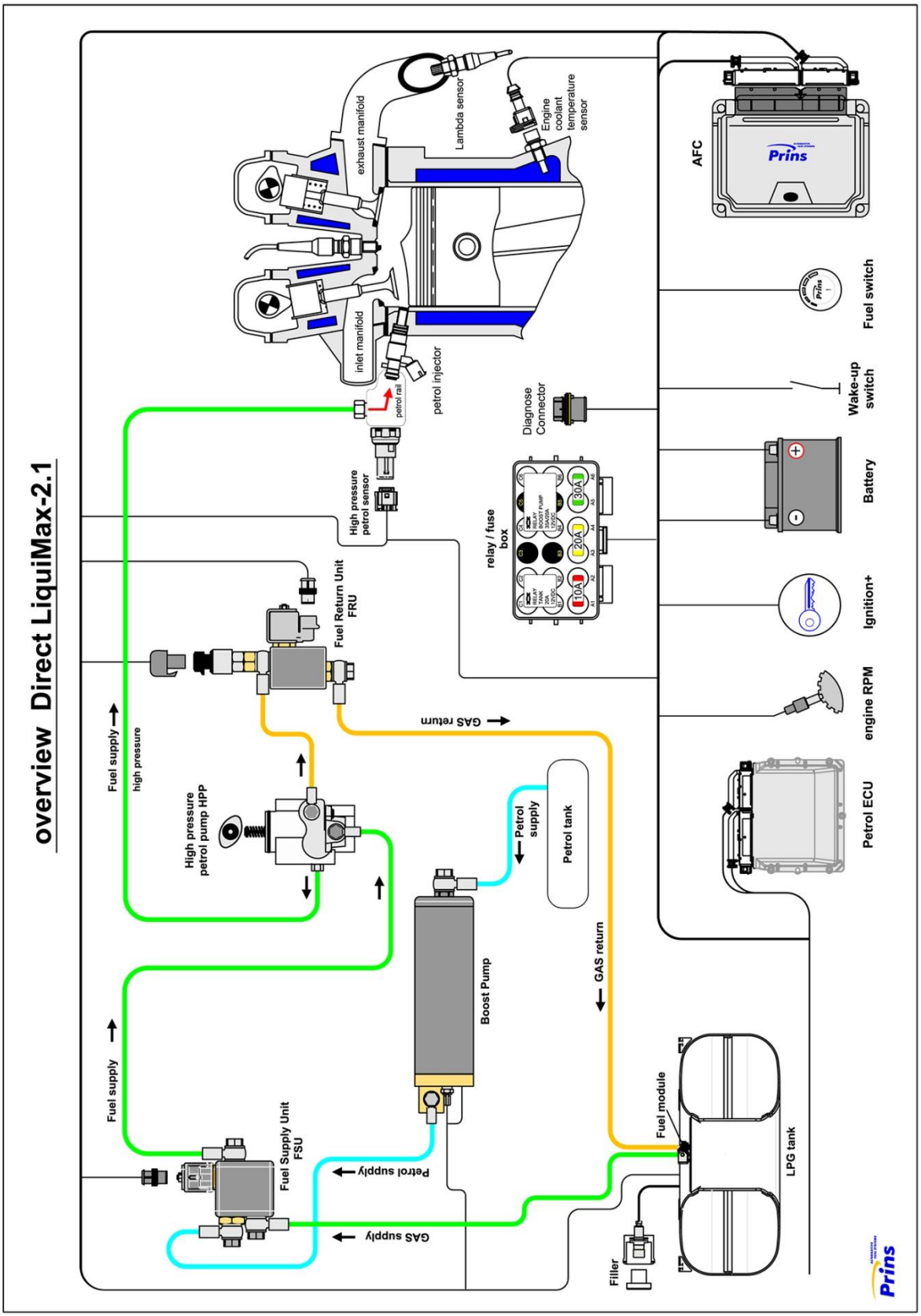


= WEAR SAFETY GOGGLES

Direct LiquiMax-2.0, AFC-2.1



Direct LiquiMax-2.0 diagram, AFC-2.1



Direct LiquiMax parts / approval numbers

1st generation

2nd generation

Fuel Supply Unit : E4-67R-010269

1st generation

2nd generation

Fuel Return Unit : E4-67R-010270
Pressure Sensor : E4-67R-010051

Boost pump

High Pressure Pump : E4-67R-010266
High Pressure Rail : E4-67R-010267
High Pressure Injectors : E4-67R-010309

Prins AFC: E4-67R-010098
E4-10R-030507

Fuel lines series XD : E4-67R-010247 XD3
E4-67R-010247 XD4

DLM component location overview

HPP pump

FSU

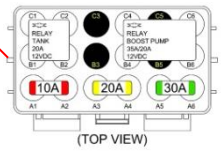
FRU

Boost pump

Petrol ECU

AFC

Fuse / relay box



R115 approval sticker :
Right side centre door post

Removal of the Bosch High Pressure Petrol Pump

-REMOVAL-

-WARNING-

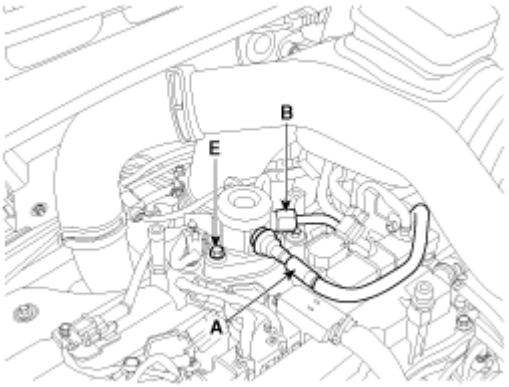
In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, there may be injury caused by leakage of the high pressure fuel.

Don't do any repair work right after engine stops (HOT engine).

- Turn the ignition switch OFF and disconnect the battery negative (-) cable.
- Ware safety goggles.
- Disconnect the fuel pressure regulator valve connector
- Disconnect the High Pressure fuel feed pipe (B)
- Remove the Low Pressure fuel pipe / hose (A).
- Remove the installation bolts (E), and then remove the high pressure fuel pump from the cylinder head assembly.

  CAUTION:

  Unscrew in turn the two bolts in small steps (0.5 turns). In case of fully unscrewing one of the two bolts with the other bolt installed, the housing surface of the cylinder head may break because of tension of the pump spring.



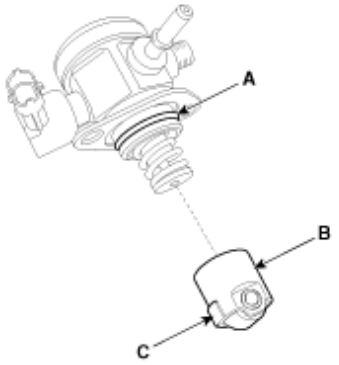
CAREFULLY store the removed petrol pump. Make sure no pollution can come into the pump.

Installation of the Bosch High Pressure Petrol Pump

-INSTALLATION-

Before installing the high pressure fuel pump, position the roller tappet (**B**&**C**) in the lowest position by rotating the crankshaft. Otherwise the installation bolts may be broken because of tension of the pump spring.

Apply engine oil to the O-ring (**A**) of the high pressure fuel pump, the roller tappet (**B**), and the protrusion (**C**). (roller tappet, only if removed from cylinder head)
Also apply engine oil to the groove on the location where the protrusion (**C**) is installed.



Installation bolts:
When tightening the installation bolts of the high pressure fuel pump, tighten and turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.
High pressure petrol pump installation bolt: 12.8 ~ 14.7 N.m

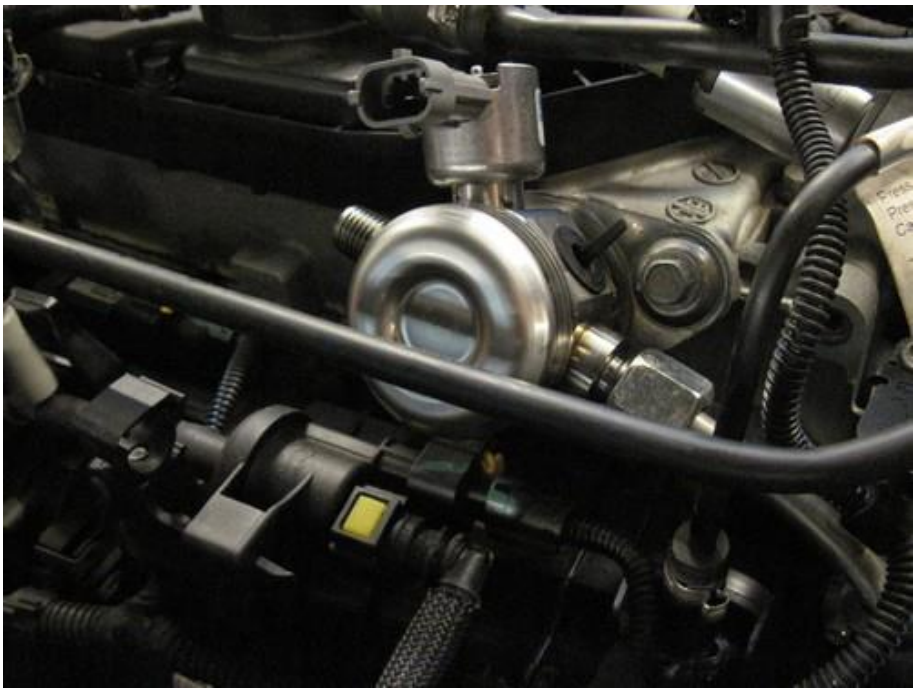
Petrol pipe:
First hand-tighten the nut(s) fully until they are not fastened any more in order to have them inserted in place and then completely tighten to the specified torque using a torque wrench.
If not tightening the bolts or nuts in a straight line with the mating bolt holes or fittings, it may cause a fuel leak due to broken threads.
High pressure petrol pipe installation nut: 26.5 ~ 32.4 N.m

Installation is reverse of removal.

High pressure petrol pump installation

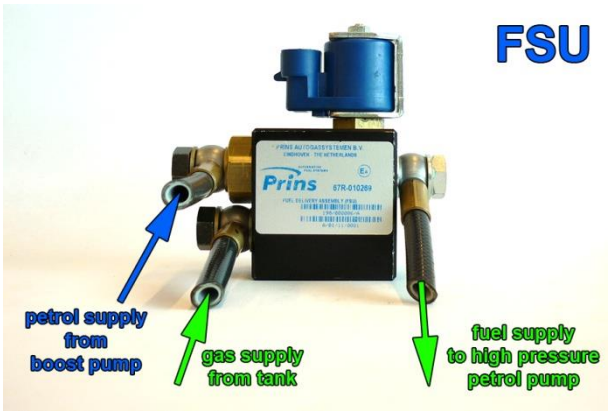
Replace the original high pressure petrol pump for the adapted high pressure petrol pump.
(Follow the workshop manual of the car)

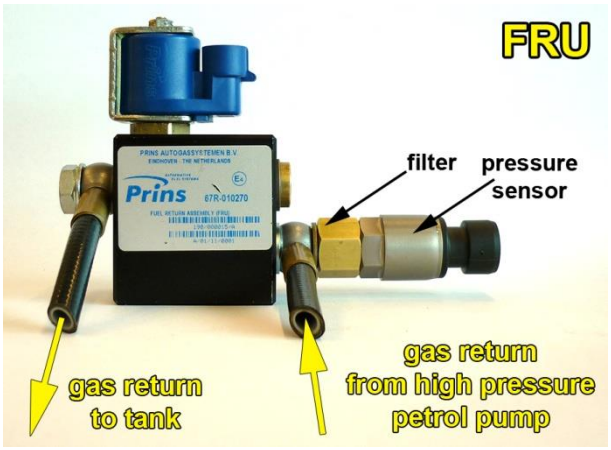
Original high pressure pump.

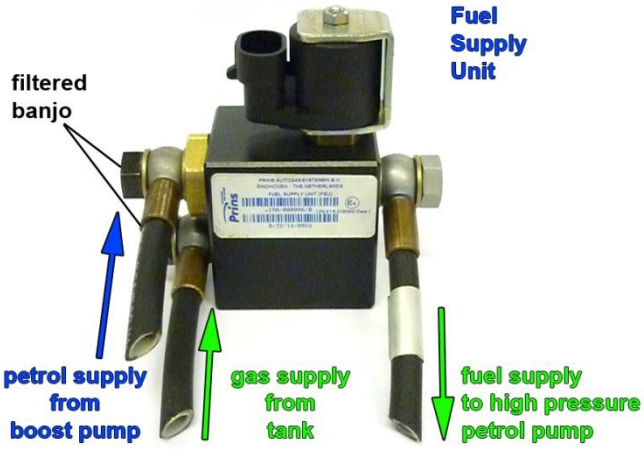


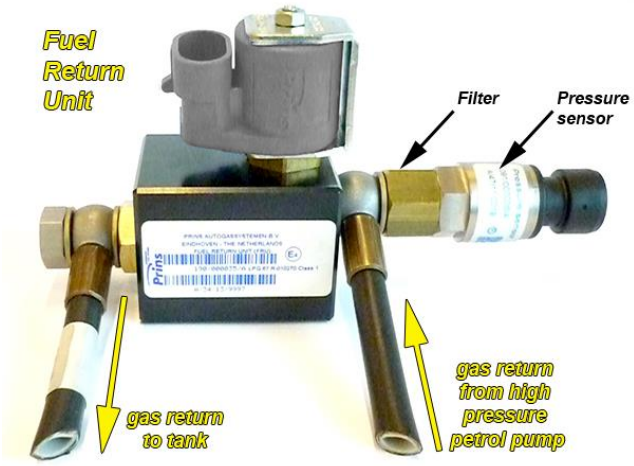
Adapted high pressure pump (Bosch type 6).

Fuel Supply Unit / Fuel Return Unit





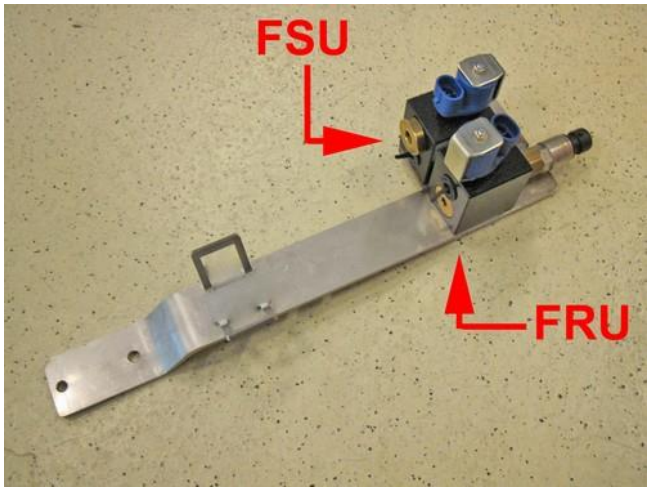




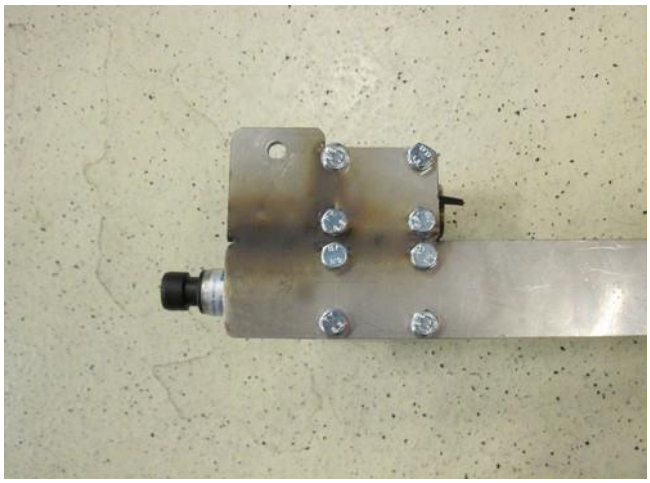
Black filtered banjo will only be used on inlet connections !

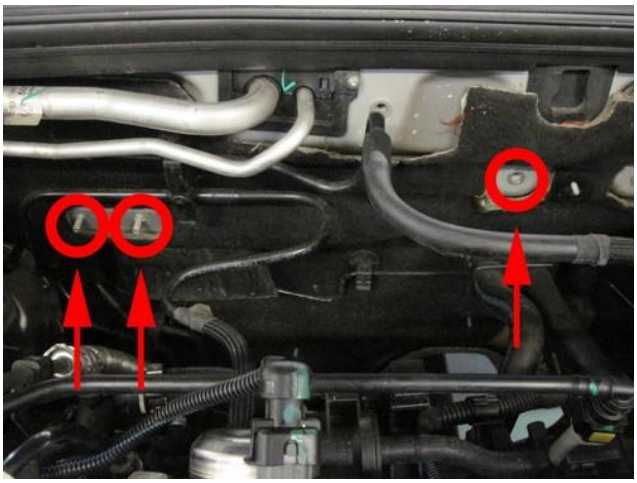
Filter inside sensor banjo

Mounting the Fuel Units

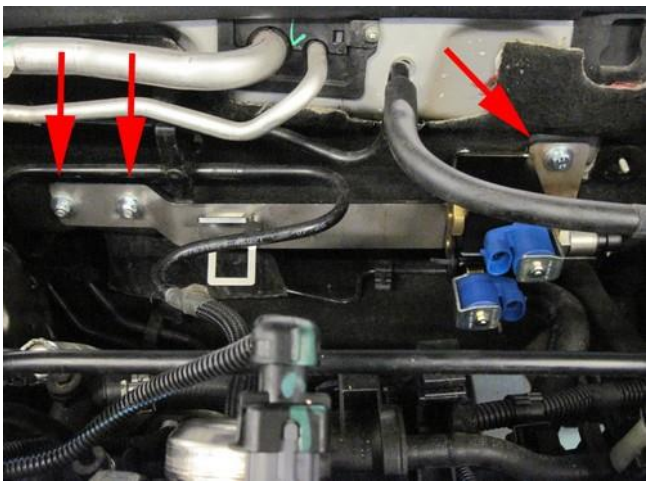


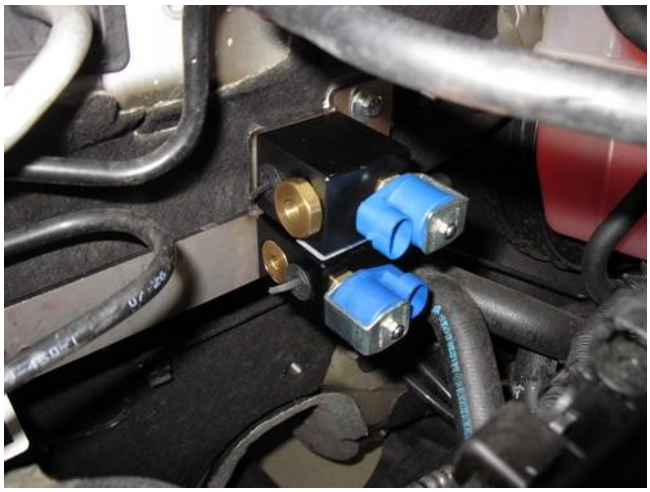
Mount the FSU & FRU (1st gen on picture)on the fuel bracket





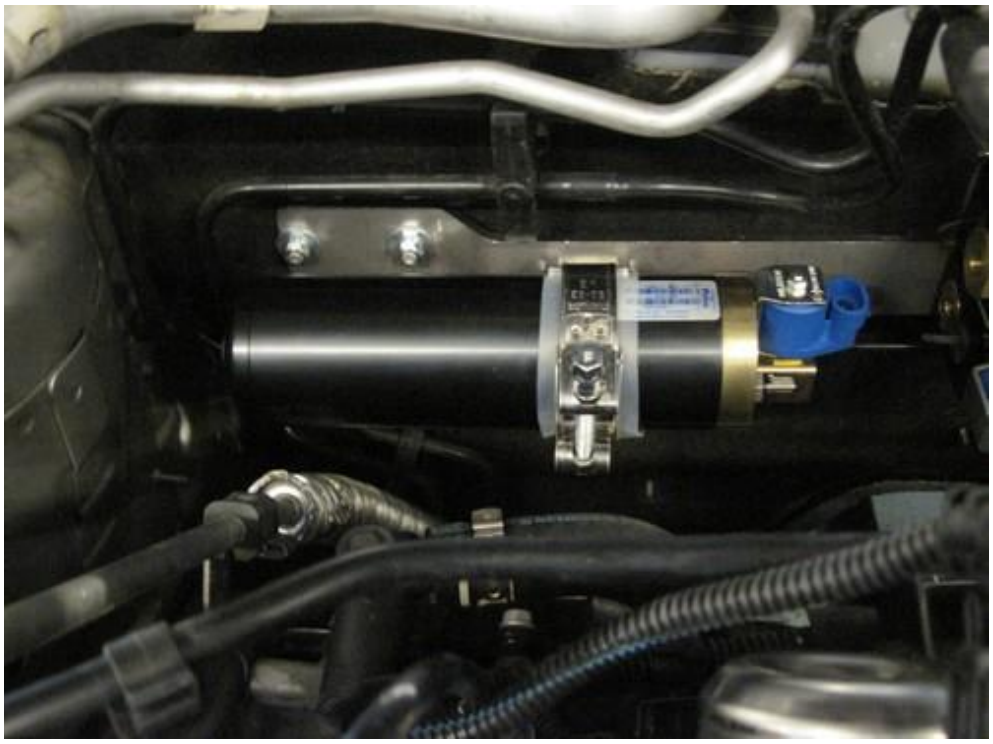
Mount the FSU & FRU on the fuel bracket. Mount bracket with FSU / FRU on original mounting points.

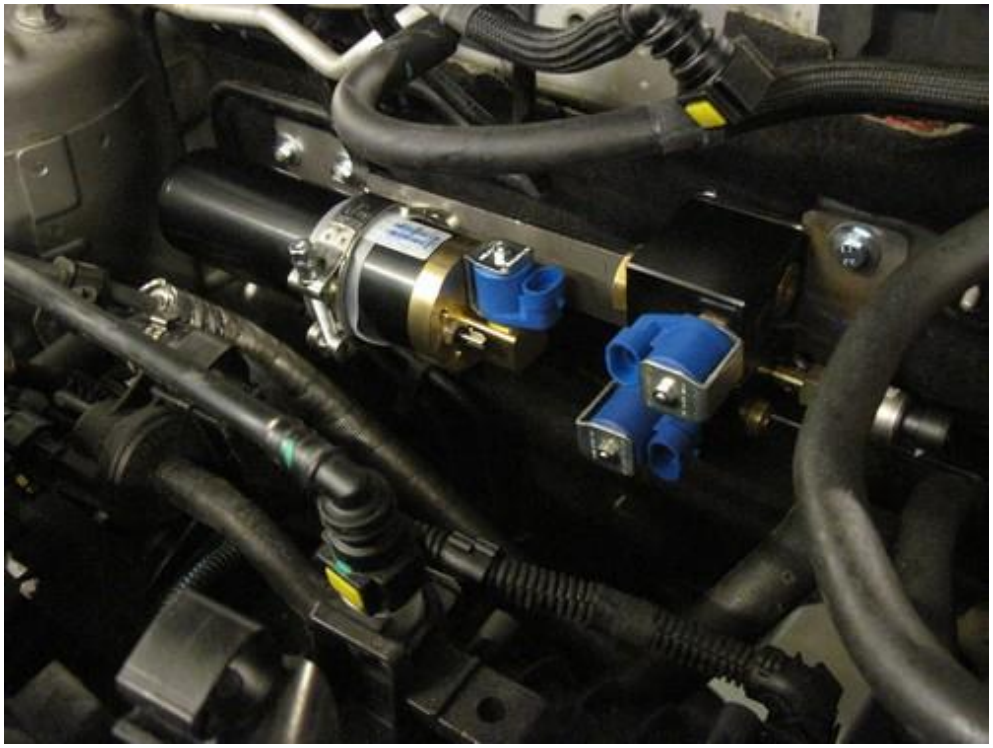




Mount bracket with FSU / FRU on original mounting points.

Boost pump

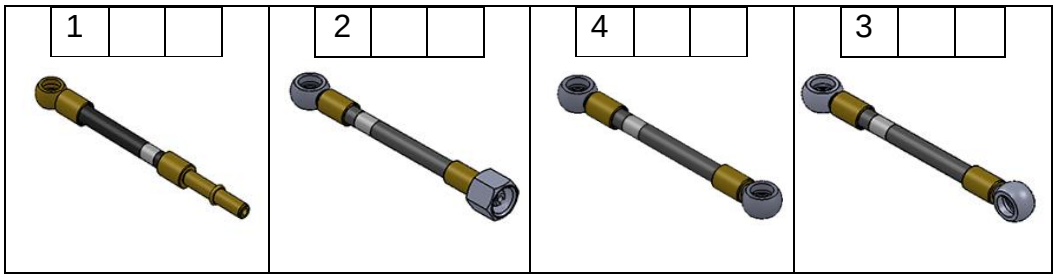




Mount boost pump with clamp and rubber ring to fuel bracket.

LPG / petrol fuel lines

Hose		from	to	Length (cm)
1	XD	Adapter original petrol hose	Petrol boost pump	40
2	XD	Fuel supply unit	High pressure petrol pump	40
3	XD	Petrol boost pump	Fuel supply unit	20
4	XD	Fuel return unit	High pressure petrol pump	65
				n.a.

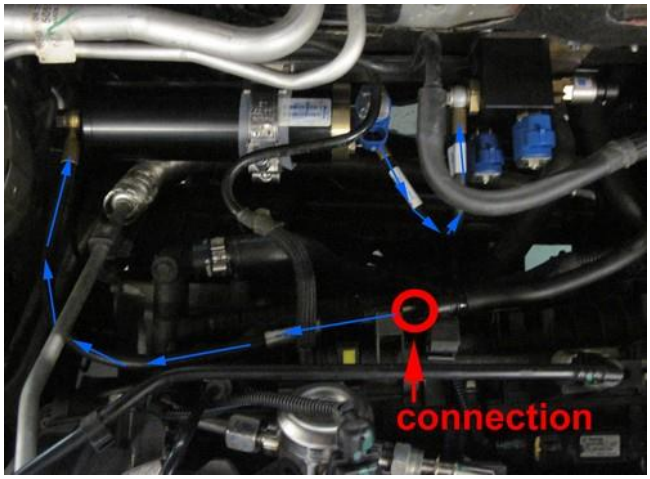


Install the fuel line using two bonded seal washers and banjo bolt :

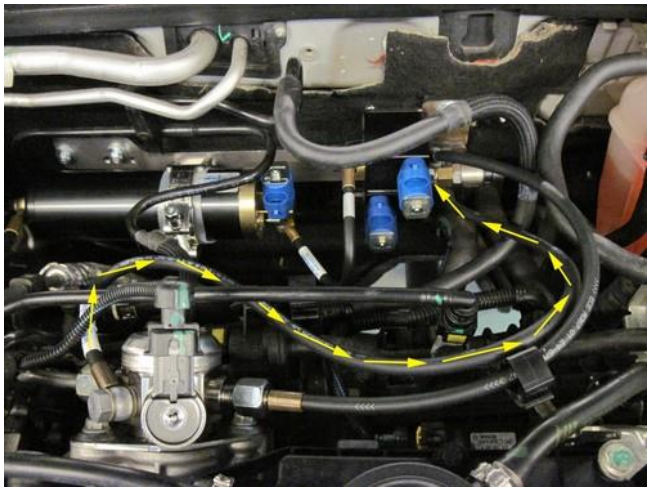
<u>Filtered banjo:</u> (FSU supply inlets / boost pump inlet / HPP pump inlet : black filtered banjo) :

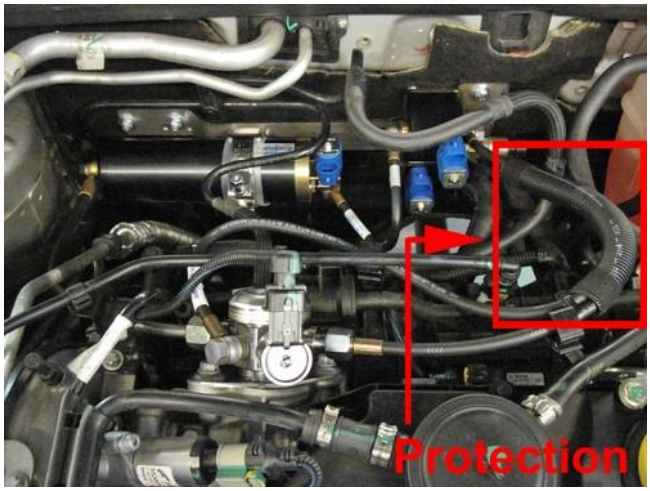
181/300009/A

Fuel hose connections

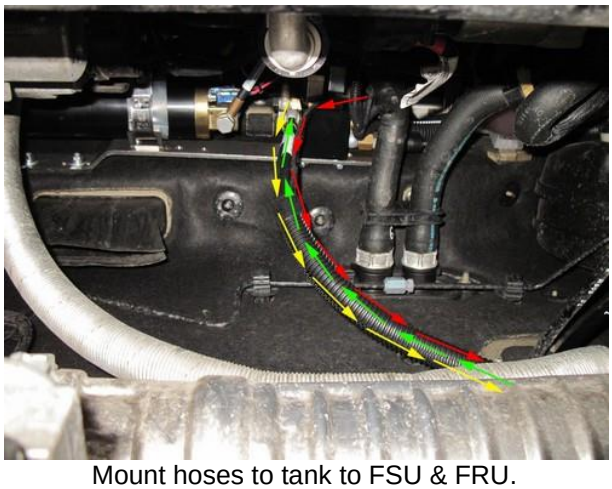


Connect hose from original fuel hose to boost pump. Connect hose from boost pump to FSU. Connect fuel hose from FSU to High Pressure Pump.





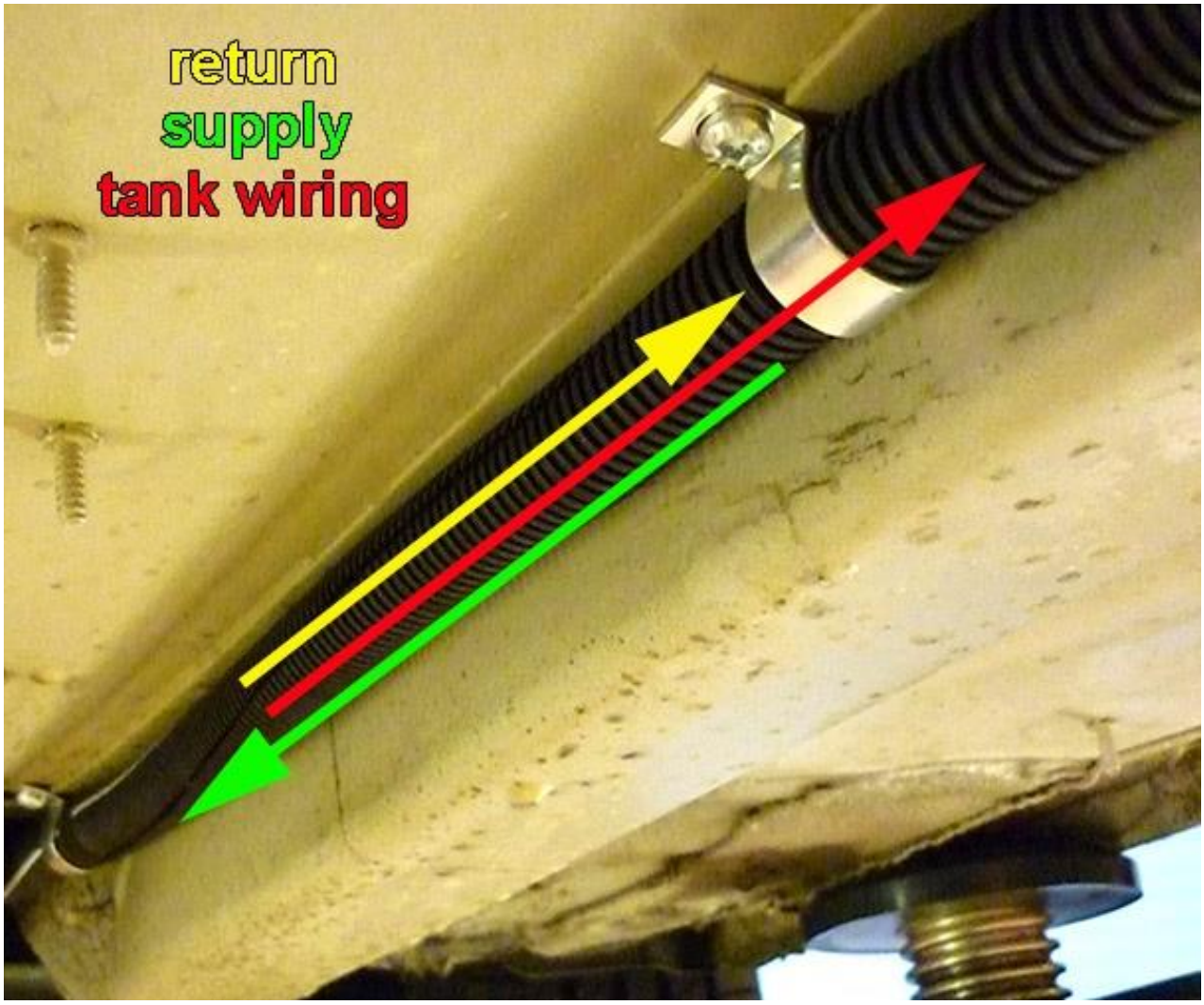
Connect fuel hose from High Pressure Pump to FRU. Mount protection around hoses to & from High Pressure pump.



Mount hoses to tank to FSU & FRU.

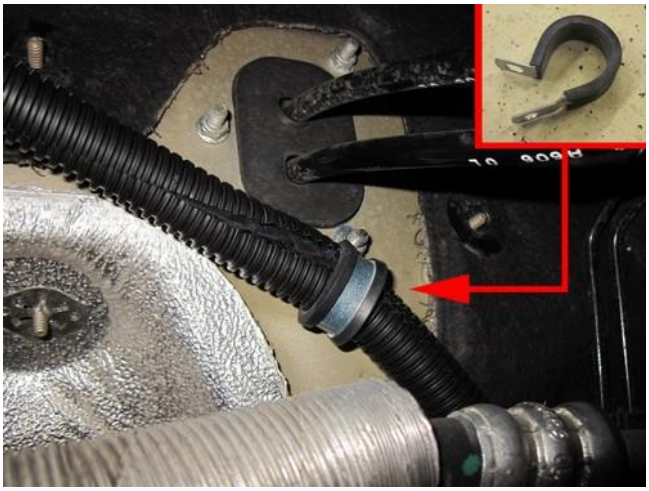
Supply hose – Return hose – Tank wiring

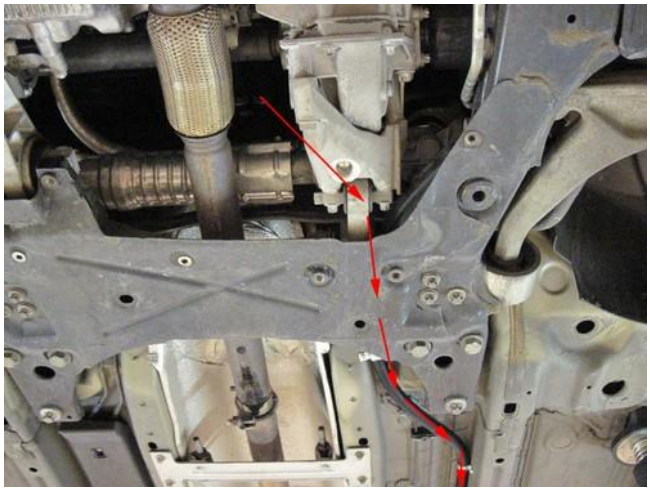
Protect the supply- and return hose together with tank-wiring using the Ø16 split tube.
Mount the “hose assembly “ with clamps, with a maximum distance of 40cm.



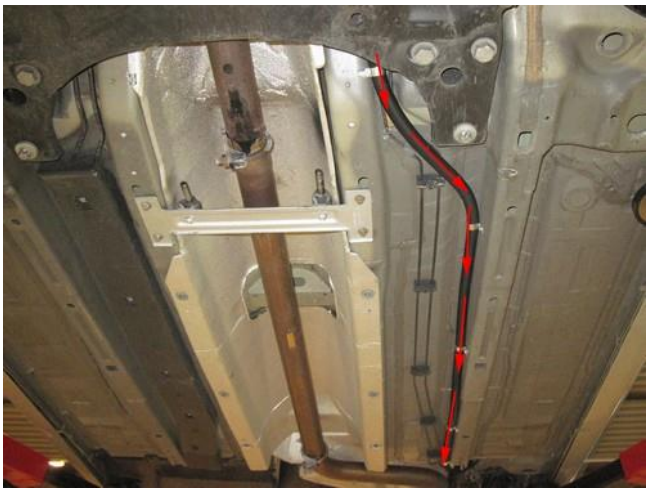
Demo photo

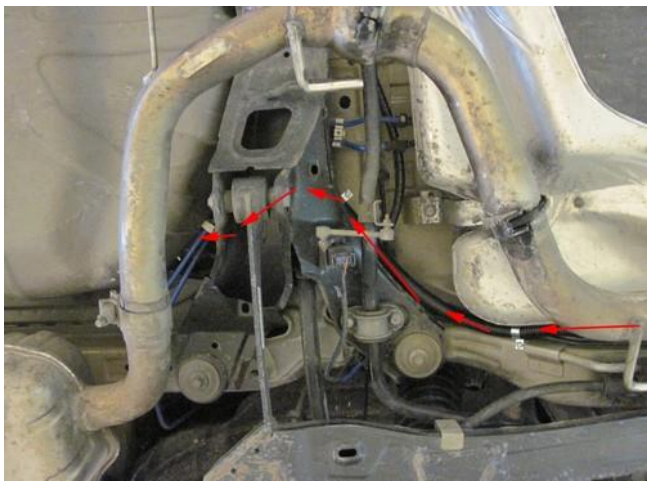
Hose / Tank wiring routing



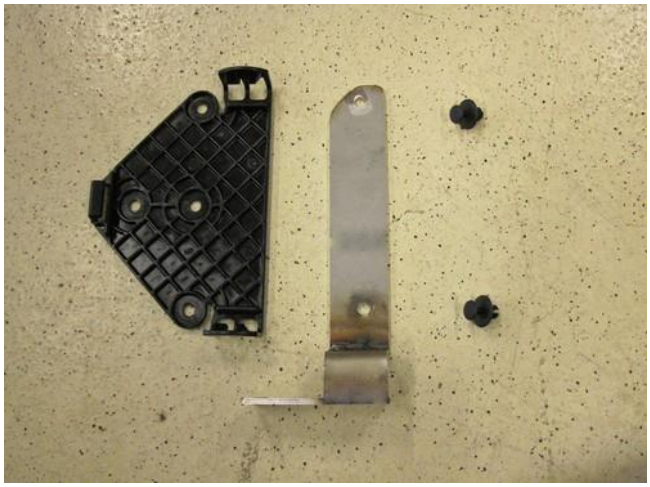


Mount hoses to tank to FSU & FRU. Hose routing.

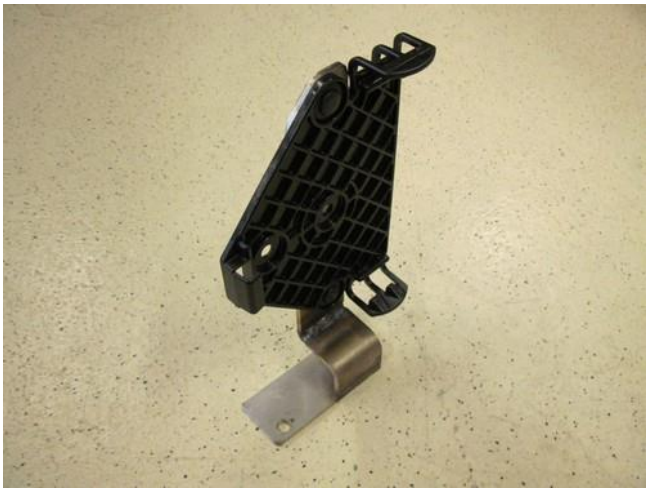




Mounting the AFC-2.1



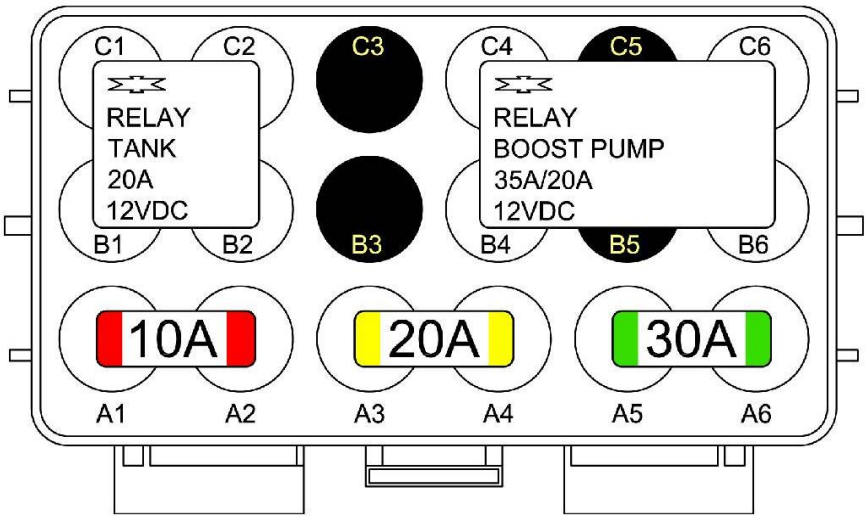
Remove battery and replace support to the front. Mount plastic AFC clip to bracket with quick clips.



Mount plastic AFC clip to bracket with quick clips. Mount AFC bracket to original bolt from battery support.

Mount AFC. If necessary, bend support from battery cable to the front to “extend” cable routing.

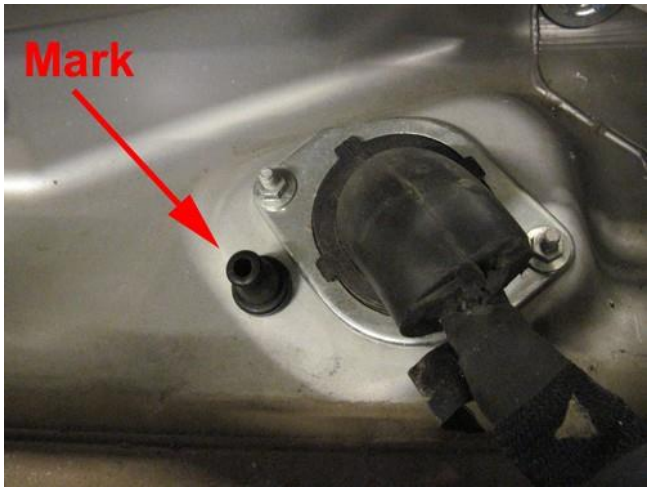
Mounting the fuse / relay box



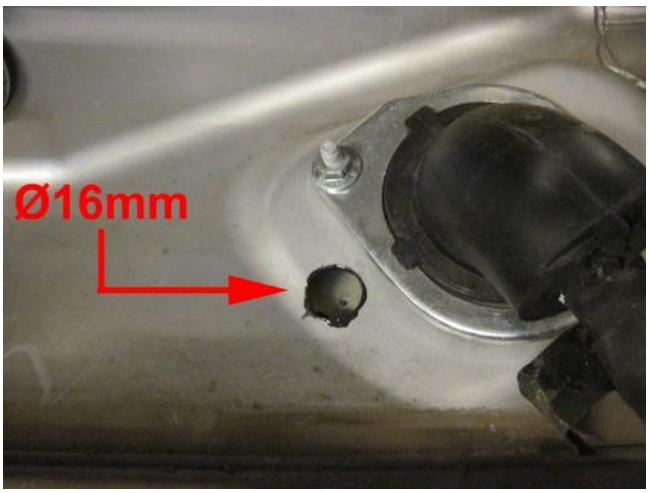
(TOP VIEW)

Use both brackets to mount the fuse / raley box to the vehicle

Wiring AFC / grommet



For wiring transit, remove wipers, wiper box and wiper engine. Mark hole for drilling with grommet.



Drill hole Ø16mm for grommet mounting, treat anti-rust. Mount grommet and stab wiring through grommet. Seal grommet/wiring with a sealant. Remount wiper engine, wiper box and wipers.

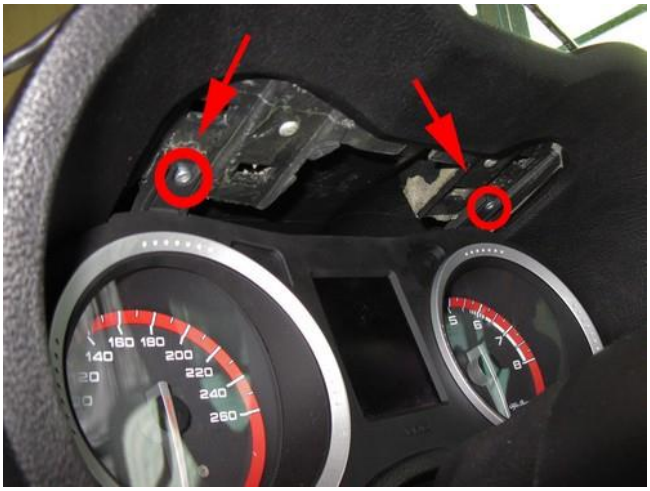
Switch / Can & Wake Up wire 40 inside!!

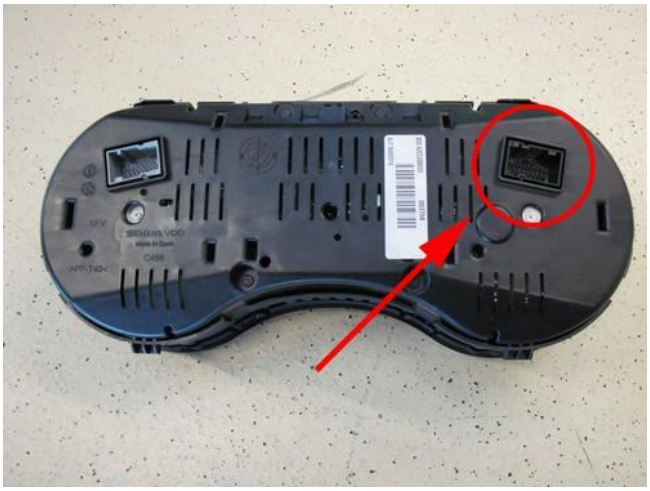
Mounting the fuel selection switch

Mount the switch, drill Ø8,2mm.

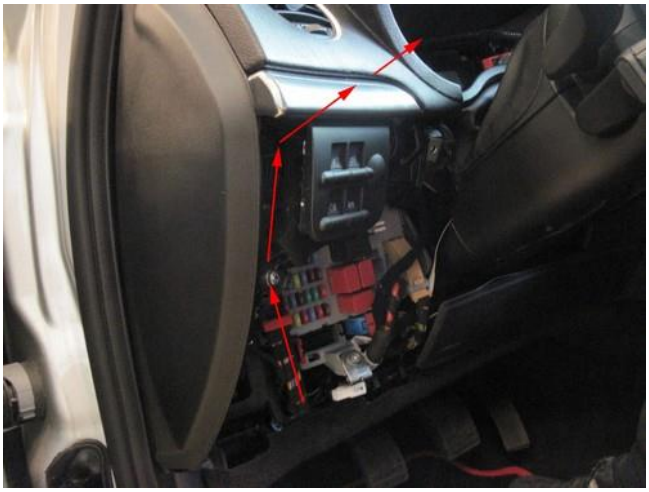
Option 1.

Option 2 (12V connection).





Remove instrument cluster. Connect Wake-up to black connector (see electrical connections)

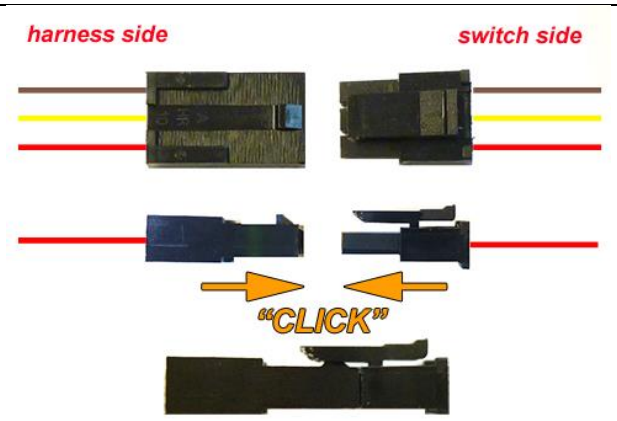


Wiring routing Wake-up.

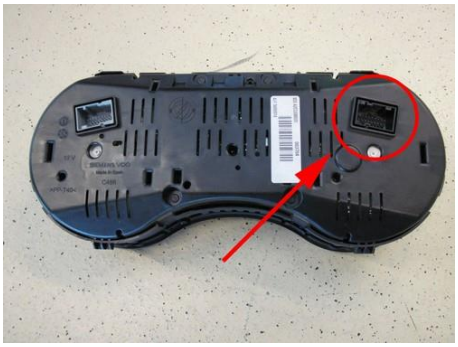
Electrical connections

Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

Driver room

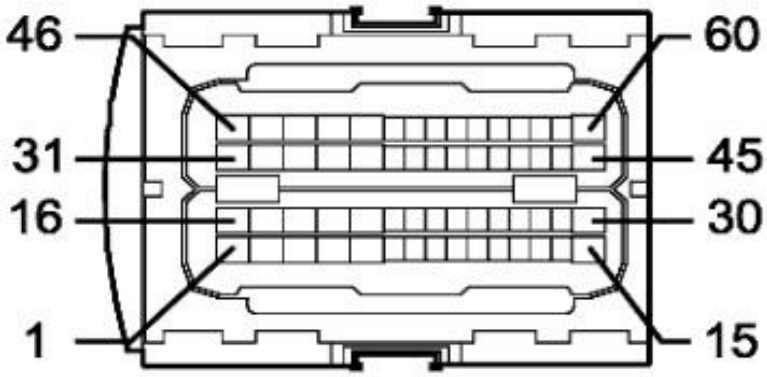
Wire number / code	**Wire colour**	**Connection**
3-pole micro connector 66 Ground fuel switch 3 +12V fuel switch 49 LIN fuel switch	Brown-black Red-white Yellow	Connect the 3-pole connector to the Prins fuel selection switch.
		

51	CAN-High	Yellow	***Not connected, insulate***
70	CAN-Low	Green	***Not connected, insulate***

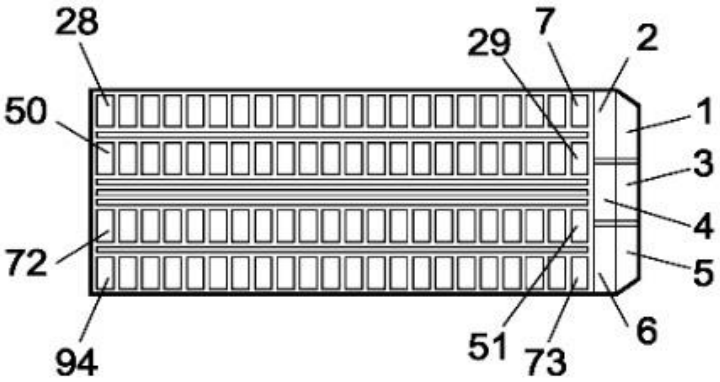
40 Wake-up	Grey-red	wake-up Wire colour : **grey** Wire location : **pos 6 from black connector behind instrument cluster** (see picture) 

Electrical connections Petrol ECU

Check and measure the wiring in case of changes in the cars wiring colours.



Connector A



Connector K

Electrical connections

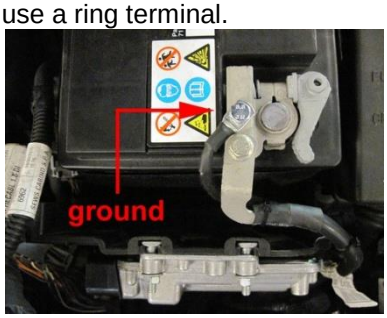
Check and measure the wiring in case of changes in the cars wiring colours.

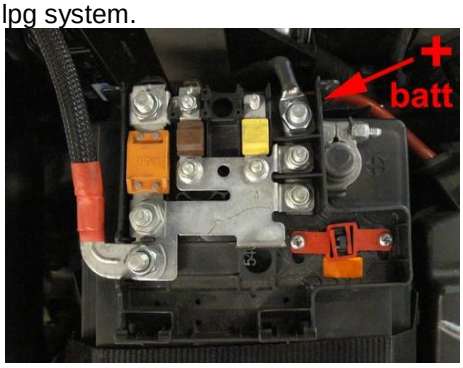
Insulate not used wires:

Wire number / code		Wire colour	Connection
10	DAC 2	Green	***Insulate***
17	AD 2	Blue-green	***Insulate***
19	AD 4	Blue	***Insulate***
20	AD 3	Blue-pink	***Insulate***
22	LSS 1	Purple-white	***Insulate***
23	LSS 2	Purple-green	***Insulate***
42	Digital out pull up 2	Red-purple	***Insulate***
56	DI 2	Yellow-green	***Insulate***
58	+12V switched	Red-white	***Insulate***
51	**CAN-High**	Yellow	***Not connected, insulate***
70	**CAN-Low**	Green	***Not connected, insulate***
Insulate not used additional wires			

Electrical connections

Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

1-32 MAIN GND ecu MAIN GROUND SENSE	Brown	Connect to the '–' of the battery (-31) ; use a ring terminal. 

4 – 13 +12V BATT sense +12V BATT fused +12V BATT boost pump +12V BATT pump driver	Red	Connect to the '+' of the battery (+30); use a ring terminal. **Do not place the fuses** before having completed the installation of the lpg system. 

Electrical connections Petrol connector A

Check and measure the wiring in case of changes in the cars wiring colours.

Wire number / code	***Wire colour***	***Connection***
36&25		*High pressure petrol sensor signal interruption* Wire colour : **pink or grey** Wire location : **pos A40 petrol ECU**
36 AD 6	Blue-brown	Sensor side
25 DAC 1	Green-white	Petrol ecu side

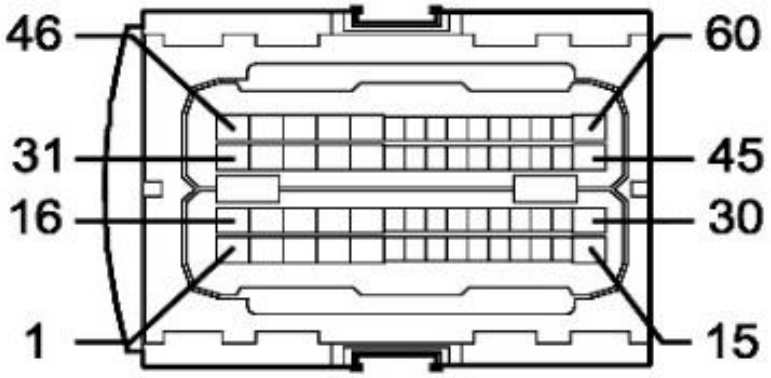
63 Ground Shift	Blue-orange	*High pressure petrol sensor ground* Wire colour : **red–purple or brown-purple** Wire location : **pos A13 petrol ECU**

61 DI 4	Yellow-blue	*Digital Input 4, 5Volt* Wire colour : **blue - red** Wire location : **pos A29 petrol ECU**

18 AD 1	Blue-white	*Analog in (sensor side) MAP sensor in* Wire colour : **yellow** Wire location : **pos A55 petrol ECU**

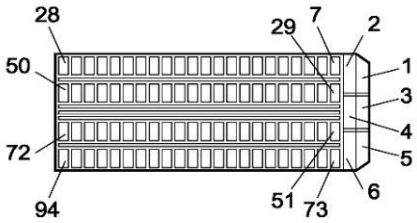
8 RPM engine speed	Purple-white	*For measuring the engine speed signal.* Wire colour : ***purple-white or grey-white*** Wire location : ***pos A53 petrol ECU***

15 T-ect	Grey	*For measuring the engine coolant temperature*. Wire colour : ***green - white*** Wire location : ***pos A57 petrol ECU***



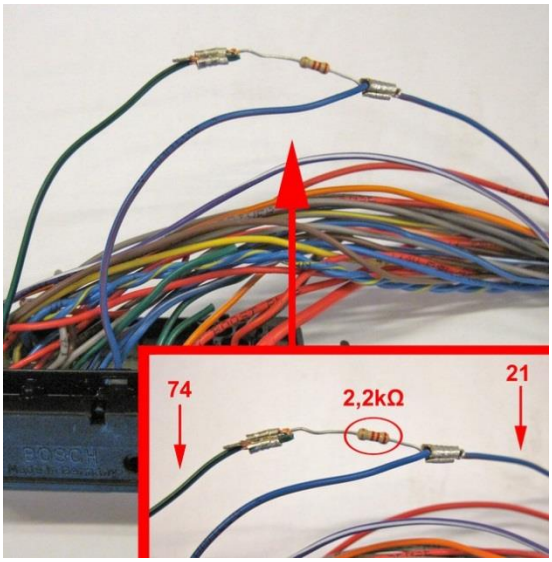
Electrical connections Petrol connector K

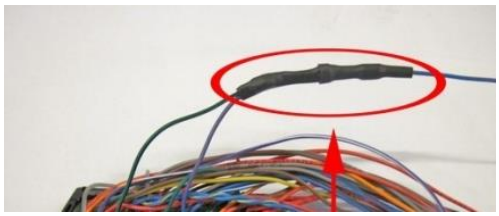
Check and measure the wiring in case of changes in the cars wiring colours.

7 +12V IGNITION	Grey - white	Make a connection to +ignition / contact+ (+15). **Do not place the fuses** in the holder before having completed the installation of the lpg system. Wire colour : ***green-orange*** Wire location : ***pos K3 petrol ECU*** 

60 DI 3	Yellow-pink	*Digital Input 3, MAF in* Wire colour : ***green-black*** Wire location : ***pos K18 petrol ECU***

21 AD9 74 DAC3	Blue-purple Green-pink	*Wideband lambda probe connection* Wire colour : ***red - green*** Wire location : ***pos K79 petrol ECU*** Connect wire 74 (DAC3) with the 2,2 kOhm resistor to wire 21 (AD9). Use heat shrink for protection. When connected like pictures, **connect wire 21** to petrol **ECU K79**





Connect wire 74 (DAC3) with the 2,2 kOhm resistor to wire 21 (AD9). Use heat shrink for protection.

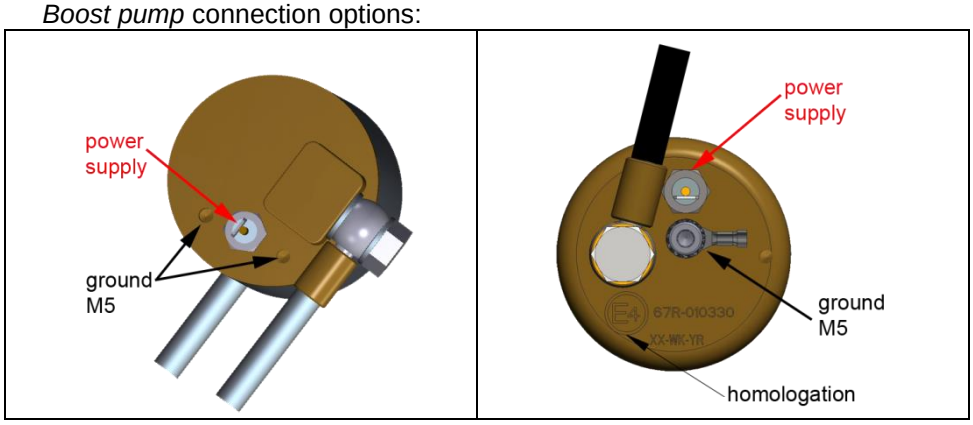
Electrical connections

Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

Engine room

Wire number / code	Wire colour	Connection
3-pole connector		*Connect the 3-pole connector to the Psys sensor positioned* into the Fuel Return Unit.
35 Ground Psys pin A	Brown	Sensor wire pin A
9 +5V sensor pin B	Red-blue	Sensor wire pin B
16 Psys pin C	Green	Sensor wire pin C
2-pole connector FSU, black		
24 + Lock-off FSU	Yellow-green	Connect the 2-pole connector to the lock-off valve
31 C Ground	Brown-black	of the Fuel Supply Unit
2-pole connector FRU, grey		
43 + Lock-off FRU	Red-white	Connect the 2-pole connector to the lock-off valve
34 C Ground	Brown-black	of the Fuel Return Unit
4-pole diagnose connector		*Diagnose connector for service / diagnosis*
46 Service TxD	Grey	Connector pin 1
65 Service RxD	Grey	Connector pin 2
68 C Ground	Brown-black	Connector pin 4
Boost pump relay		
2 + relay boost pump	Red-white	Pin 86 of the boost pump relay C4
26 Ground BP relay	Purple-blue	Pin 85 of the boost pump relay B6
+12V fused BATT	Red 2.5mm2	Pin 30 of the boost pump relay C6-A5
+12V Boost pump	Red 2.5mm2	Pin 87 of the boost pump relay B4
Wiring tank pump driver relay		
57 + driver relay	Red-white	Pin 86 of the driver relay C1
73 LSS 4 tank relay	Purple-blue	Pin 85 of the driver relay B2
+12V BATT fused	Red 2.5mm2	Pin 30 of the driver relay C2-A4
+12V driver	Red 2.5mm2	Pin 87 of the driver relay B1

Boost pump connection options:

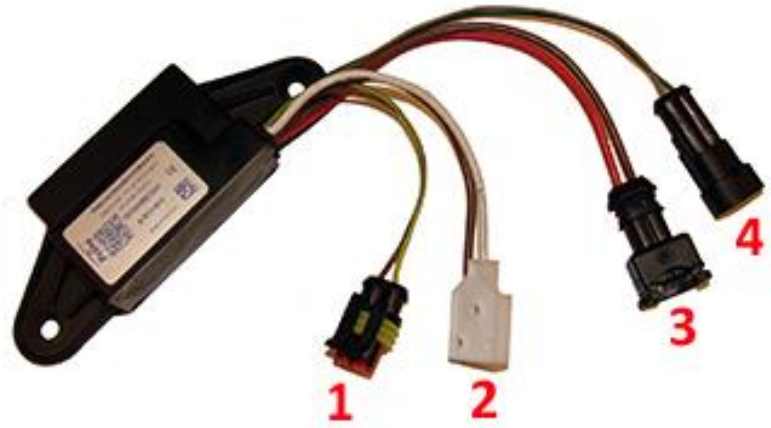


Electrical connections

Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

Lpg tank housing

Wire number / code	*Wire colour*	*Connection*
3-pole tank level connector 33 Ground tank gauge 12 Tank level in 11 + tank level supply	 Brown-black Blue Red-blue	Connect the 3-pole connector to the tank level sensor.
2-pole driver connector 71 LSS 3 PWM driver 64 AD 5 driver diagnose	 Purple-pink Blue-grey	Connect the 2-pole connector to the pump driver (4).
1. *2-pole connector tank lock-off*	Green-yellow Brown	From tank pump driver From tank pump driver
2. *3-pole connector tank pump*	Red 2.5mm^2 Brown 2.5mm^2	From tank pump driver From tank pump driver
3. *2-pole connector power driver*	Red 2.5mm^2 Brown 2.5mm^2	From tank pump relay 87 From main ground
4. *2-pole connector driver*	Green Grey	From AFC pin 71 pwm From AFC pin 64 diagnose



Checklist after installation

1. Install the system fuses.
   Turn on ignition.
   Connect the Prins interface wire and run the Prins diagnosis program.
   When working on the car, beware of moving and rotating parts in the engine compartment
   (even when the engine is not running !!).

2. When commissioning the LPG system, you must activate the AFC with the diagnosis software.

3. Check whether the program in the AFC matches with the car (dedicated engine set):
   See “Identification” in the diagnosis program.

4. Check all components and connections for any LPG leakage, use a LPG leak detector device or
   a fluid detection like soap. Also check for petrol leakage. Make sure the solenoid valves are in open position.
   No evidence of leakage is permitted.
   Caution for moving and rotating parts in the engine compartment !

5. Use the diagnosis software to check again all input and output signals.

6. Check the system for error codes and solve these, if required.
   Check the petrol MMS for EOBD error codes.
   Place the protection connector back on the diagnose connector.

7. Make a test drive and check the cars drivability on LPG and petrol.