ALTERNATIVE FUEL SYSTEMS

Prins

Quality, innovation and customer care, it's in our nature

DIRECT LIQUI max-2.0 HIGH PRESSURE LIQUID LPG INJECTION

MANUFACTURER	Land Rover
TYPE	Freelander 2 LF
ENGINE DISPLACEMENT	1999
NUMBER OF VALVES	16
ENGINE CODE / NUMBER	204PT
VEHICLE CATEGORIES	M
TRANSMISSION	AT
VERSION	DLM-2.1
PETROL ECU MANUFACTURER / CODE	Bosch MED 17.0
HIGH PRESSURE PETROL POMP	Bosch 0 261 520 - 100/101 / 151/152
HIGH PRESSURE PETROL INJECTOR	Bosch 0 261 500 147
MODEL YEAR:	10-2012
SYSTEM APPROVAL NUMBER (R115)	E4-115R-000009 / DLM-LPG 02
LOCATION R115 SYSTEM STICKER	right side, centre door post
ENGINE SET NUMBER	352/070003/A
MANUAL NUMBER	076/1201600
DATE	2014-05-21

Version 2013-09-28 D

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FOR EXPLANATION AND CIRCUIT DIAGRAMS SEE : INSTALLATION MANUAL GENERAL PART 1 / 2

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 : operating on Windows 98,W2000 or XP.
  Internal memory : 16 Mb or more
  Memory HD space : 5MB
  Screen : 256 colours, advise colours 16 bits or more
  Com port : 1 free COM port 1 or COM port 2 with a 9 or 25 pins connector
- 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)

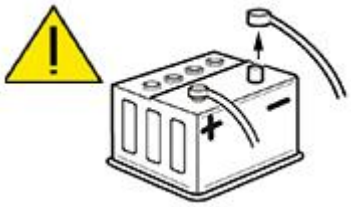
Tightening moments

		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

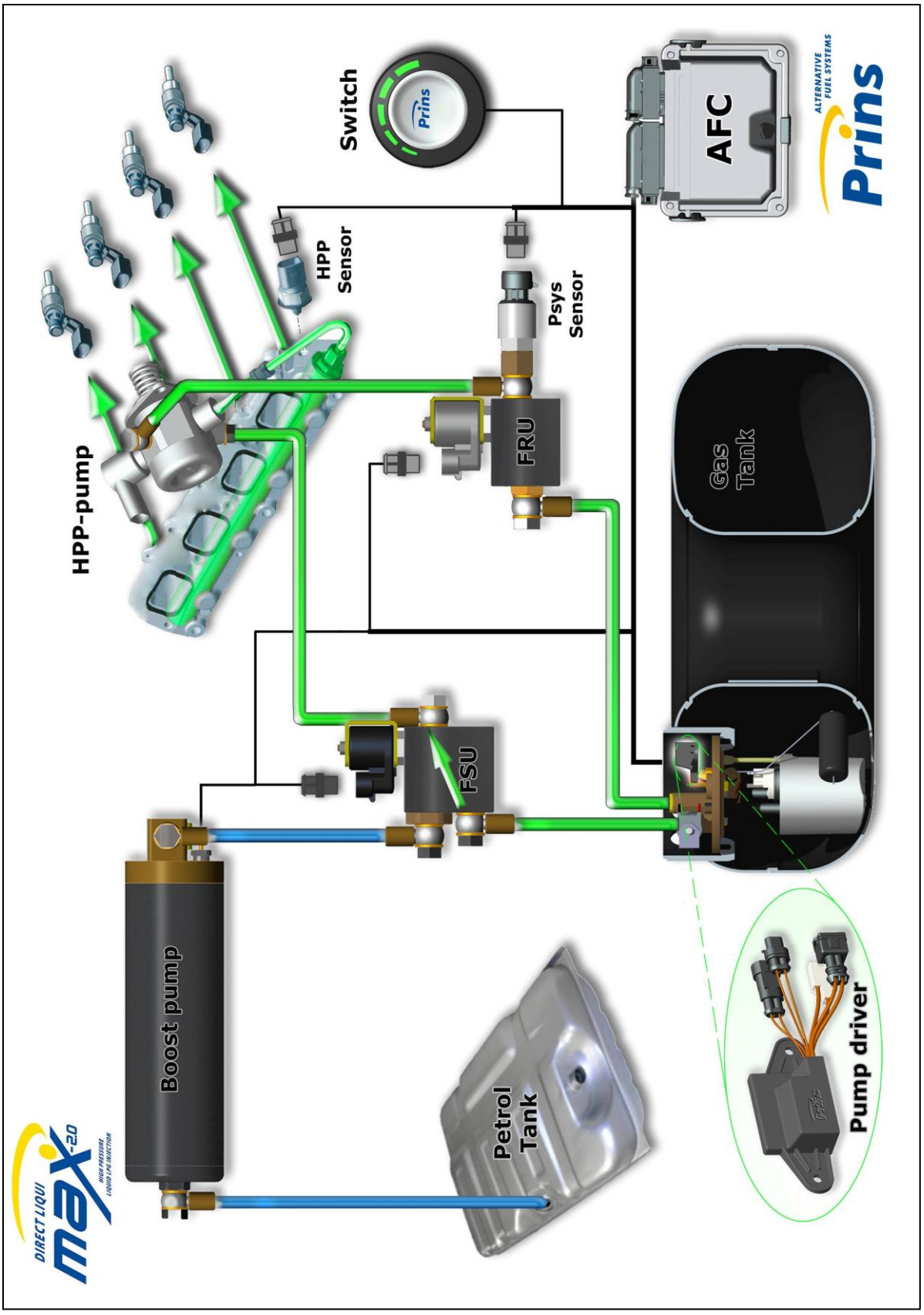
EXPLANATION OF SYMBOLS :

= IMPORTANT, CAUTION

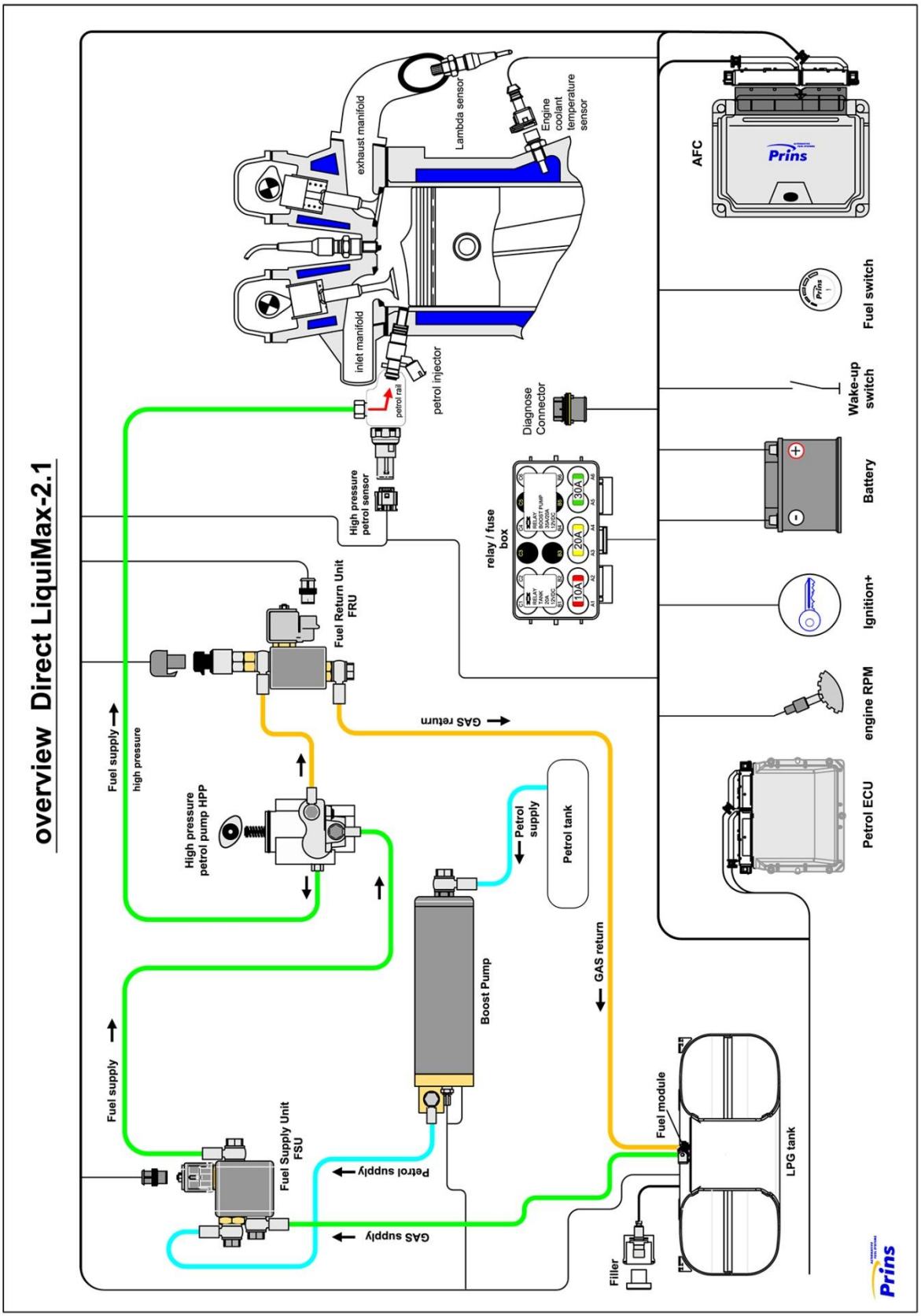
= WEAR SAFETY GOGGLES



Direct LiquiMax-2.1



Direct LiquiMax-2.1diagram



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

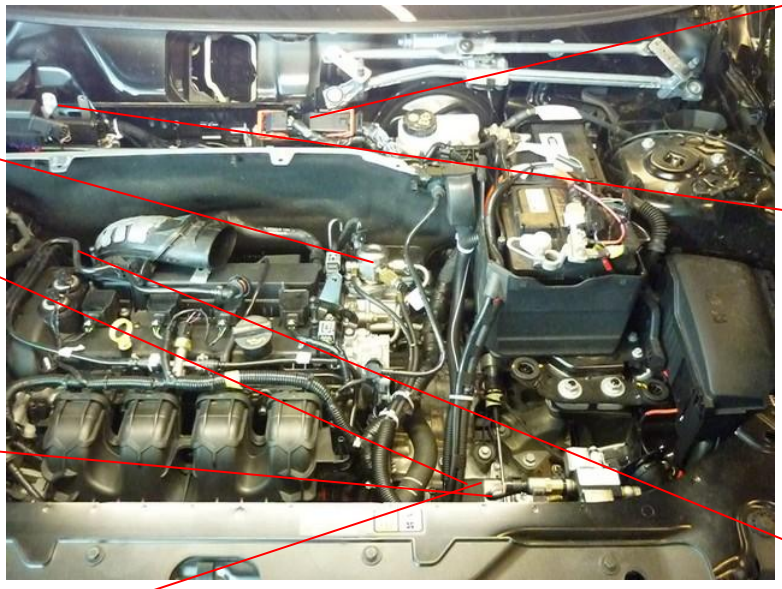
DLM-2.1 component location overview

HPP pump

FSU

FRU

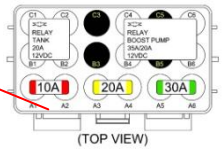
Boost pump



Petrol ECU

AFC

Fuse / relay box



R115 approval sticker :
Right side centre door post

Removal of the Bosch High Pressure Petrol Pump

-REMOVAL-

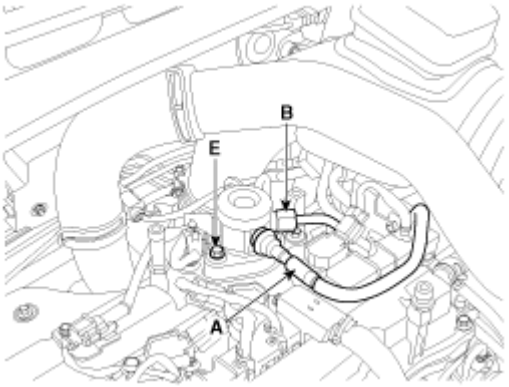
-WARNING-

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.



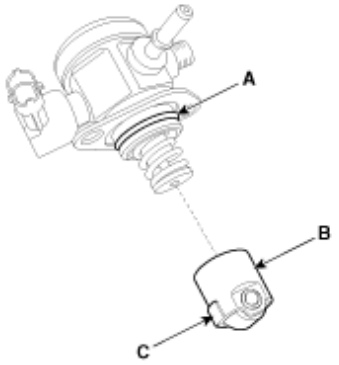
CAREFULLY store the removed petrol pump. Make sure no pollution can come into the pump.

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.



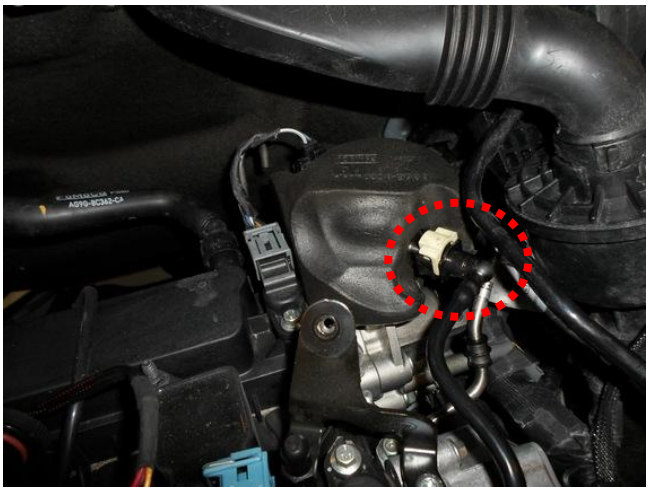
Installation bolts:
When tightening the installation bolts of the high pressure fuel pump, tighten and turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.
High pressure petrol pump installation bolt: 12.8 ~ 14.7 N.m

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

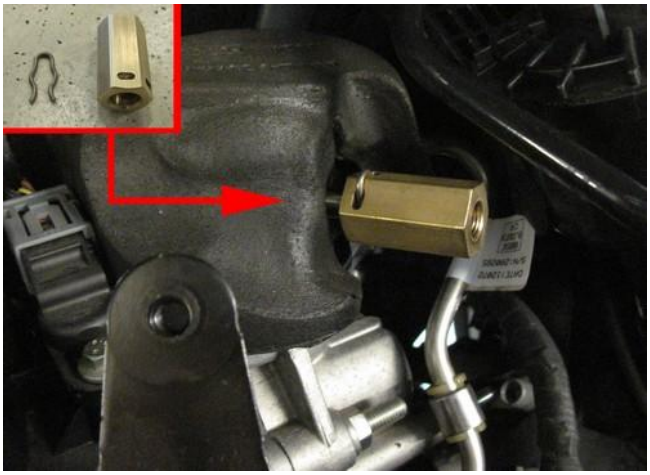
Replace the original high pressure petrol pump for the adapted high pressure petrol pump.
(Follow the workshop manual of the car)



Remove the quick release of the fuel supply line to the high pressure pump and turn the fuel supply line 180 degrees with the quick release to the front. See next page.

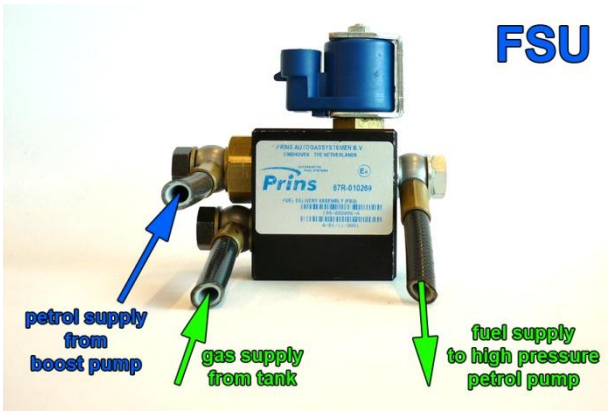
"Old" high pressure pump.

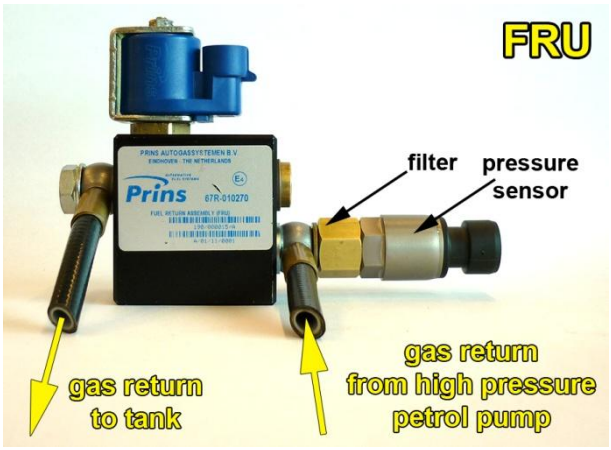
"New" high pressure pump with return.

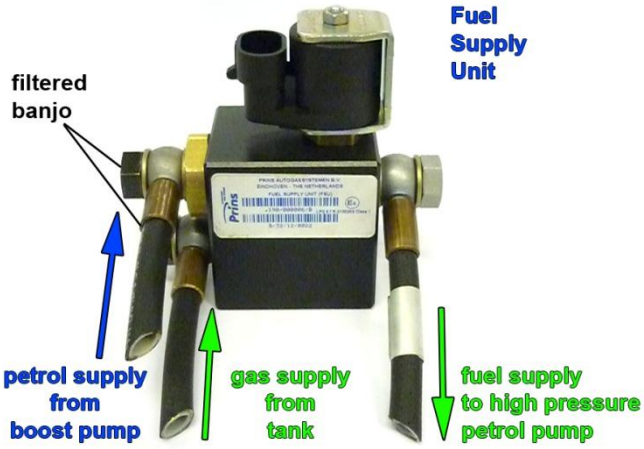


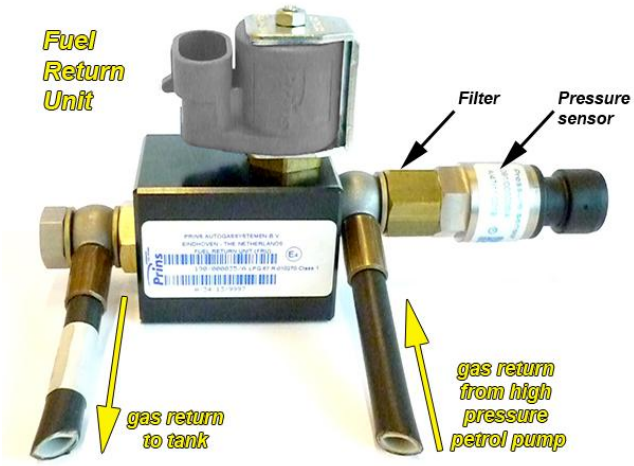
Mount "new" high pressure pump. Mount quick release to high pressure pump inlet.

Fuel Supply Unit / Fuel Return Unit





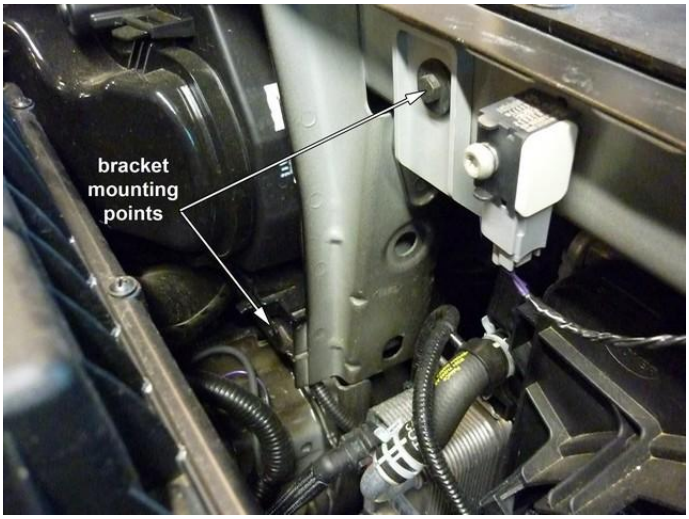




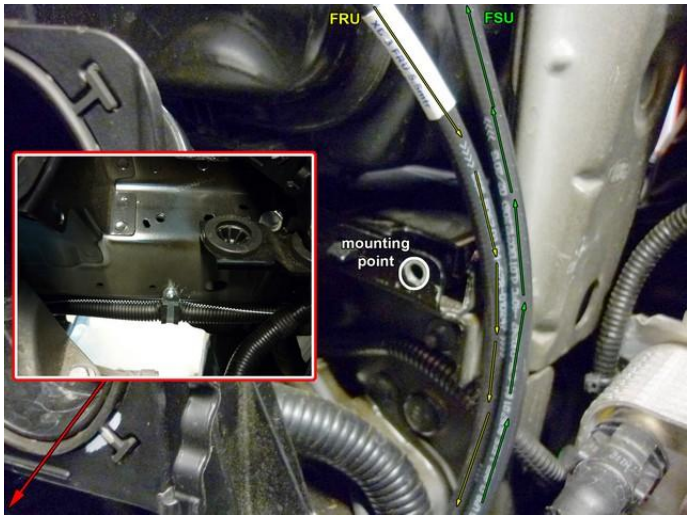
Black filtered banjo will only be used on inlet connections !

Filter inside sensor banjo

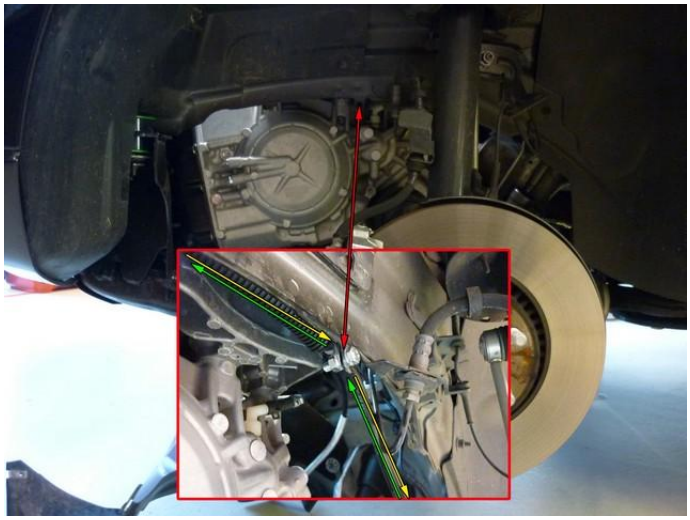
Mounting the system bracket, preparation



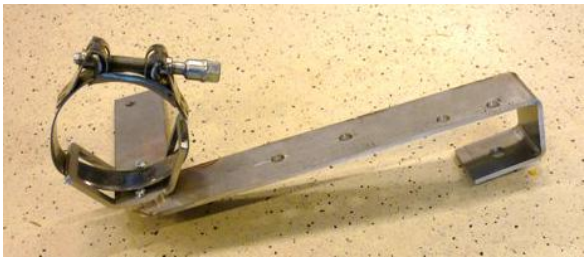
Remove air box



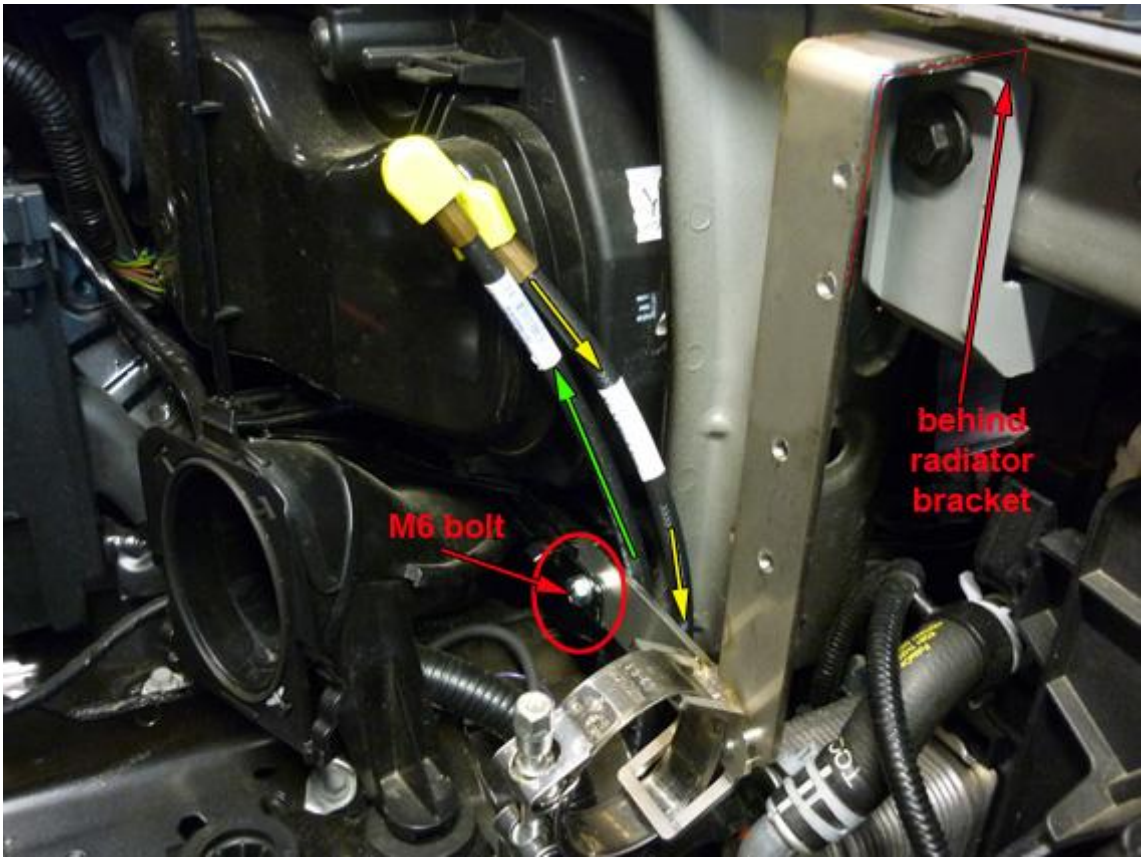
Install fuel lines for FSU and FRU



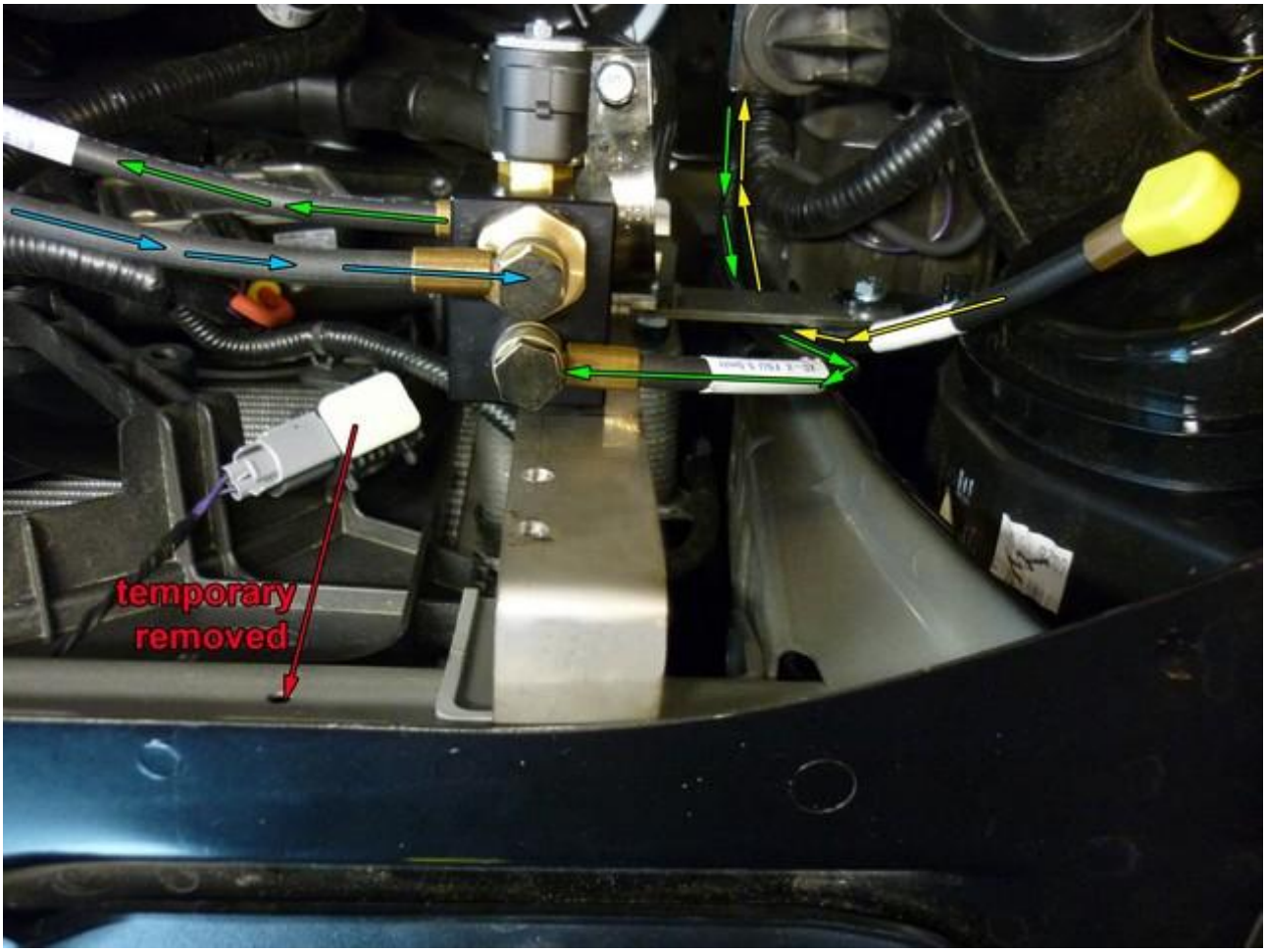
Mounting the system bracket



Install boost pump bracket with M6x10 bolts.

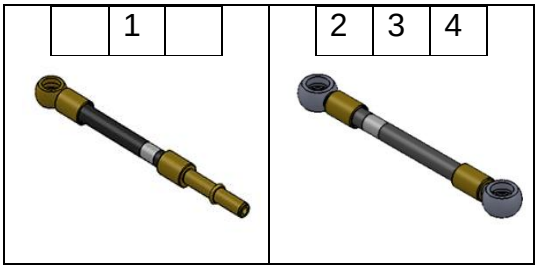


Mounting the Fuel SUPPLY Unit



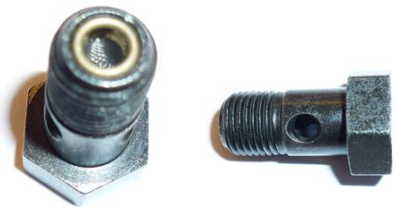
LPG / petrol fuel lines

Hose		from	to	Length (cm)
1	XD4	Adapter original petrol hose	Petrol boost pump	45
2	XD	Fuel supply unit	High pressure petrol pump	55
3	XD	Petrol boost pump	Fuel supply unit	20
4	XD	Fuel return unit	High pressure petrol pump	75



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

LOW pressure petrol hose re-route

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

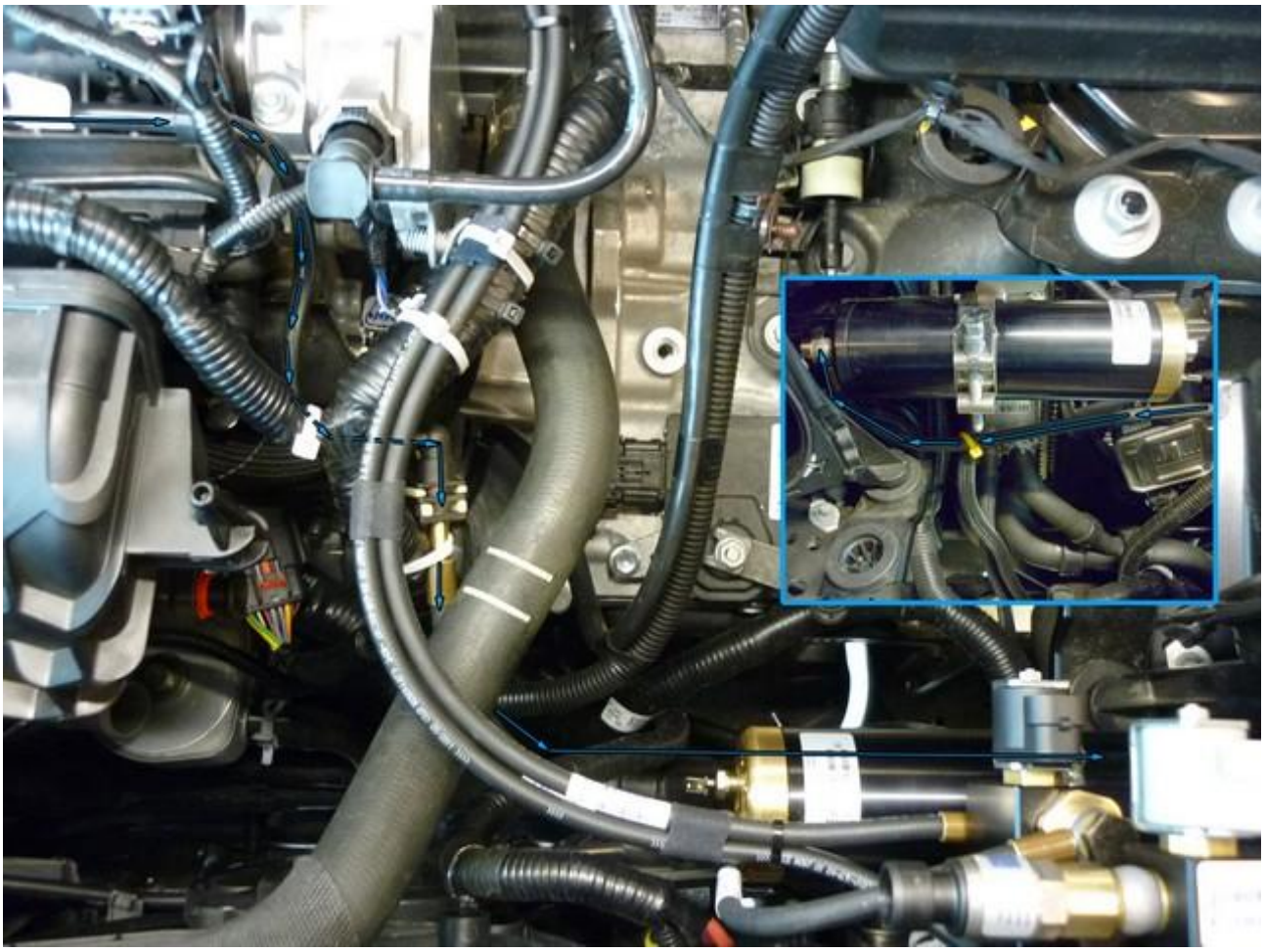
Re-route the original petrol pipe (underneath wiring loom)

High pressure petrol pump LPG return and supply

Boost pump / FRU

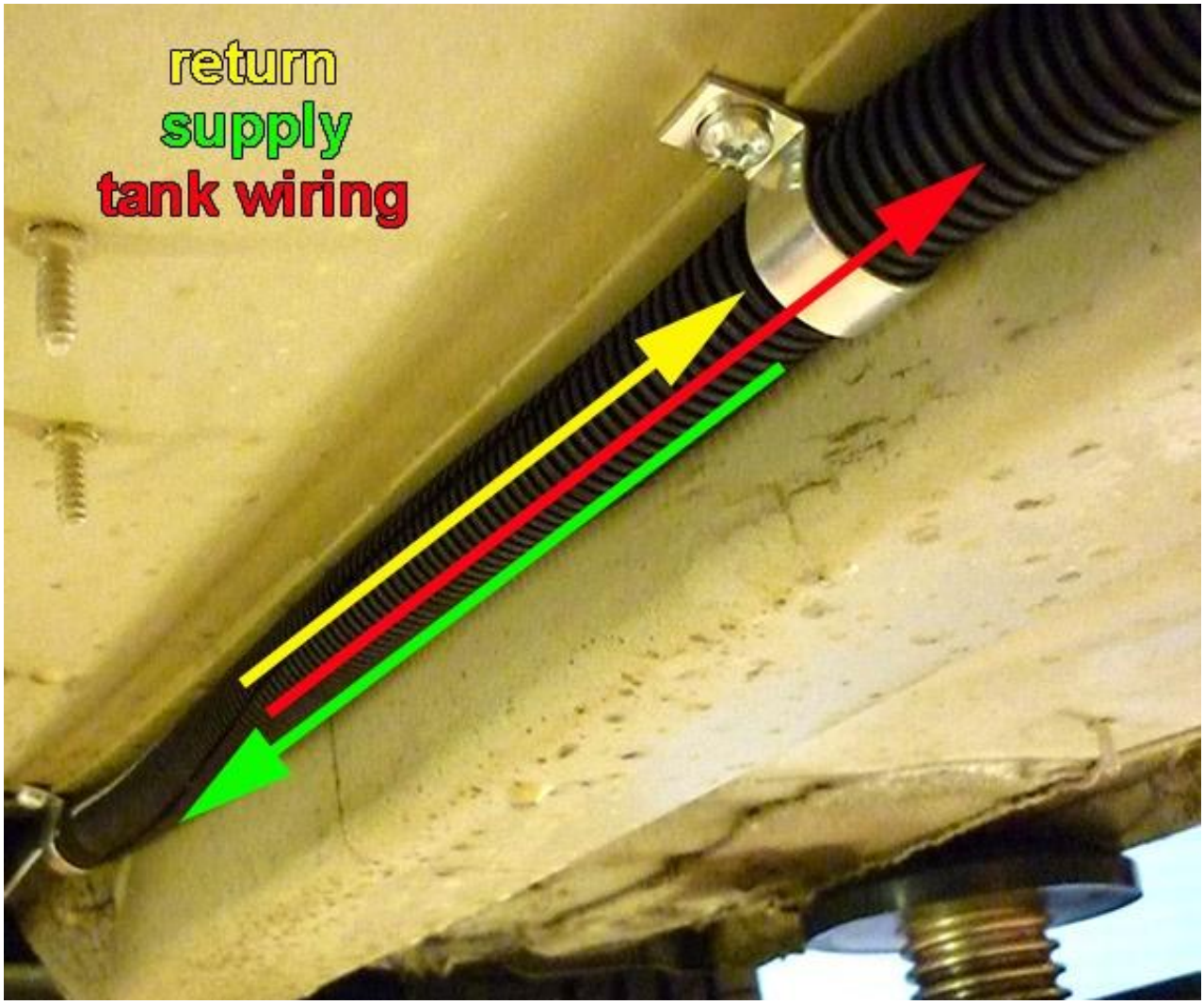
Connection of the fuel hose to the boost pump.

Connect the fuel hoses to the boost pump.



Supply hose – Return hose – Tank wiring

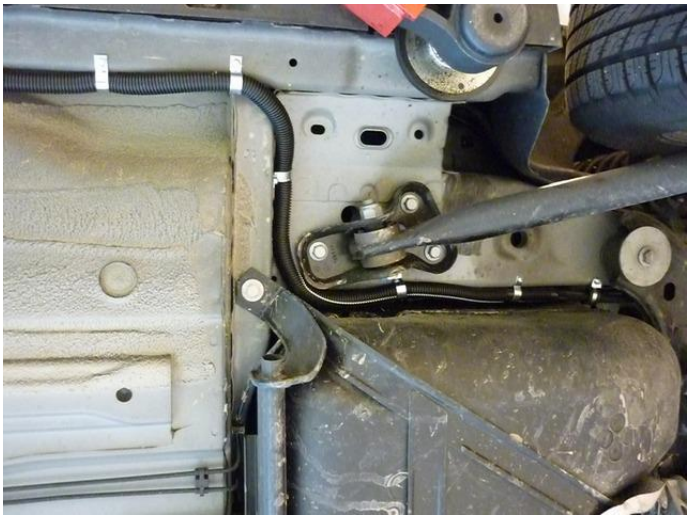
Protect the supply- and return hose together with tank-wiring using the Ø16 split tube.
Mount the “hose assembly “ with clamps, with a maximum distance of 40cm.



Demo photo

Hose / tank wiring routing





Mounting the AFC bracket



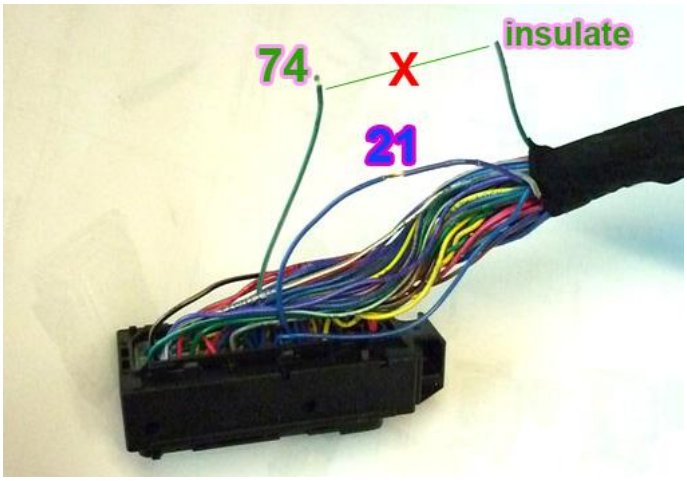


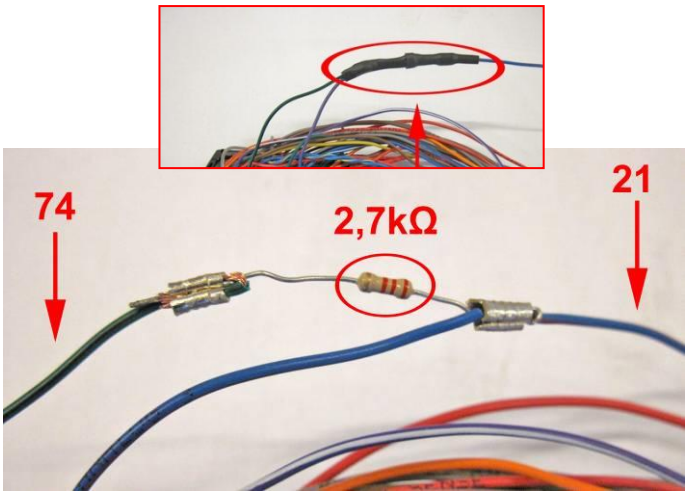
Mount AFC to bracket. Hold in place and mark hole for drilling.

Drill a hole of Ø7mm and treat with anti-rust.

See page next page before installing wiring loom !!!

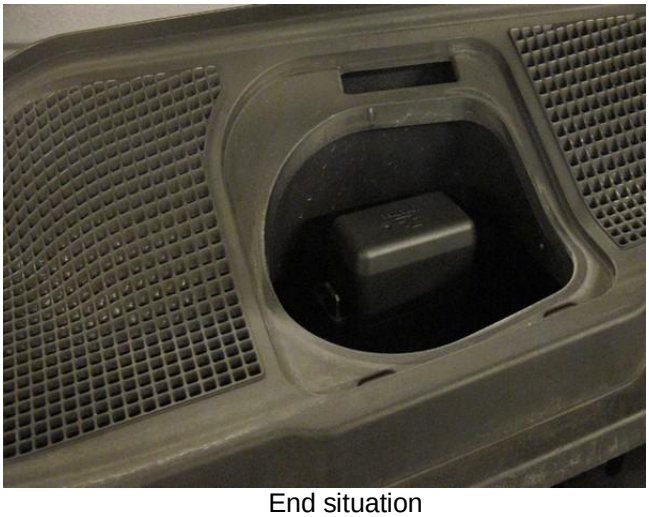
Adapt wiring loom



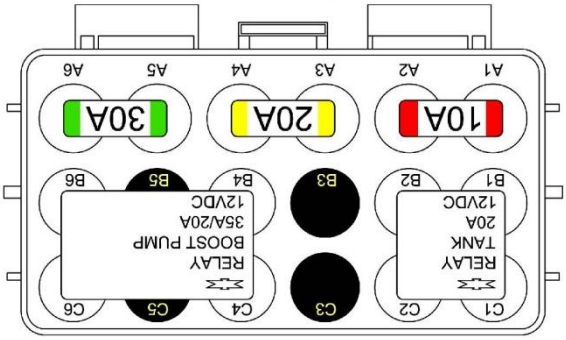


				Wideband lambda probe connection
21	AD9	Blue-purple	Blue-purple	Wire colour : **Brown-yellow** Wire location : Petrol ECU *pin A64*
74	DAC3	Green-pink		Connect wire 74 (DAC3) with the 2,7 kOhm resistor to wire 21 (AD9). Use heat shrink for protection. When connected like pictures, connect wire 21 to petrol ECU.

Mounting the fuse / relay box

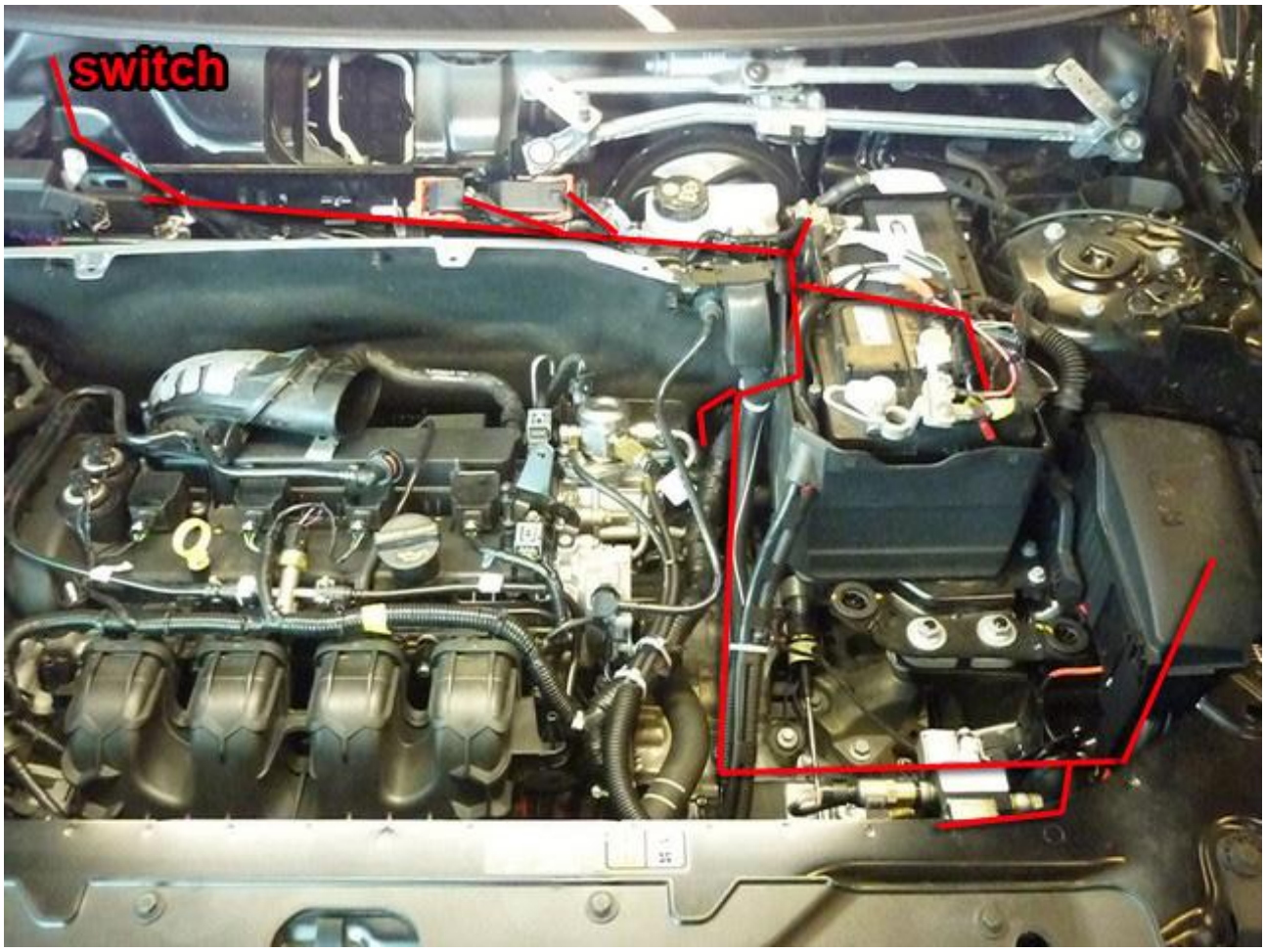


End situation



Fuse & relay location. (front side car view)

Wiring AFC



Mounting the fuel selection switch option 1

Mount the switch, drill Ø8,2mm.

Mounting the fuel selection switch option 2

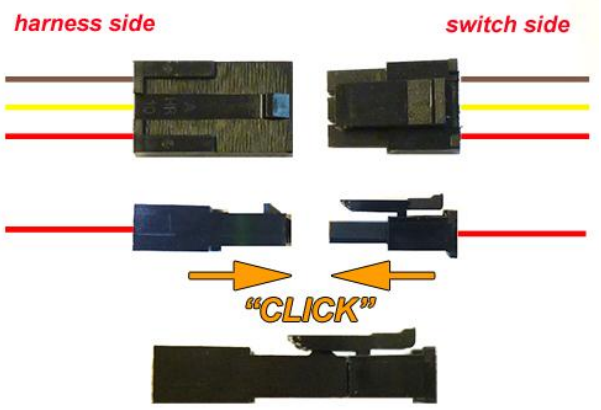
Mount the switch, drill up to Ø28mm with a conical drill.

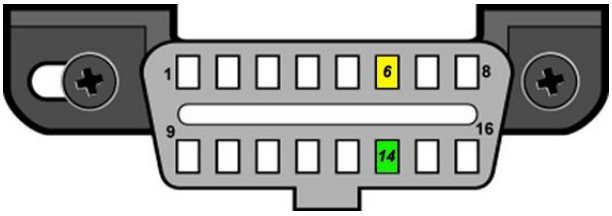
Hot plastic glue to hold button top cover in place

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	EOBD connector pin 6
70	CAN-Low	Green	EOBD connector pin 14
			 

Electrical connections

Insulate not used wires.

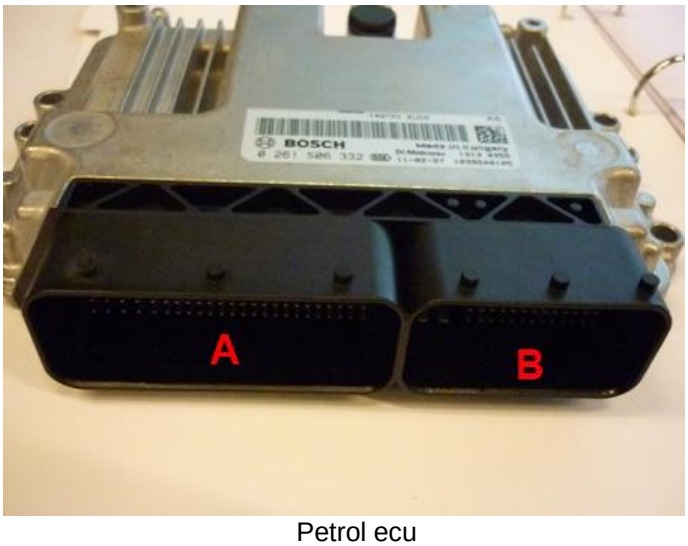
Wire number / code	Wire colour	Connection
19 AD 4	Blue	Insulate
20 AD 3	Blue-pink	Insulate
21 AD 9	Blue-purple	Insulate
22 LSS 1	Purple-white	Insulate
23 LSS 2	Purple-green	Insulate
42 Digital out pull up 2	Red-purple	Insulate
58 +12V switched	Red-white	Insulate
61 DI 4	Yellow-blue	Insulate
74 DAC 3	Green-pink	Insulate

Electrical connections

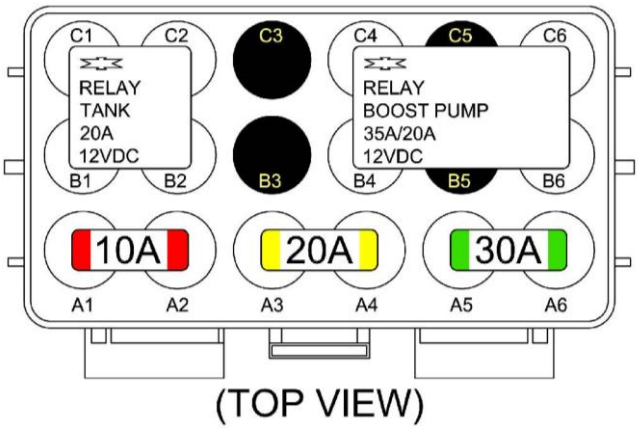
Check and measure the wiring in case of changes in the cars wiring colours.

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

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. Wire location : **+ Battery** 



Petrol ecu

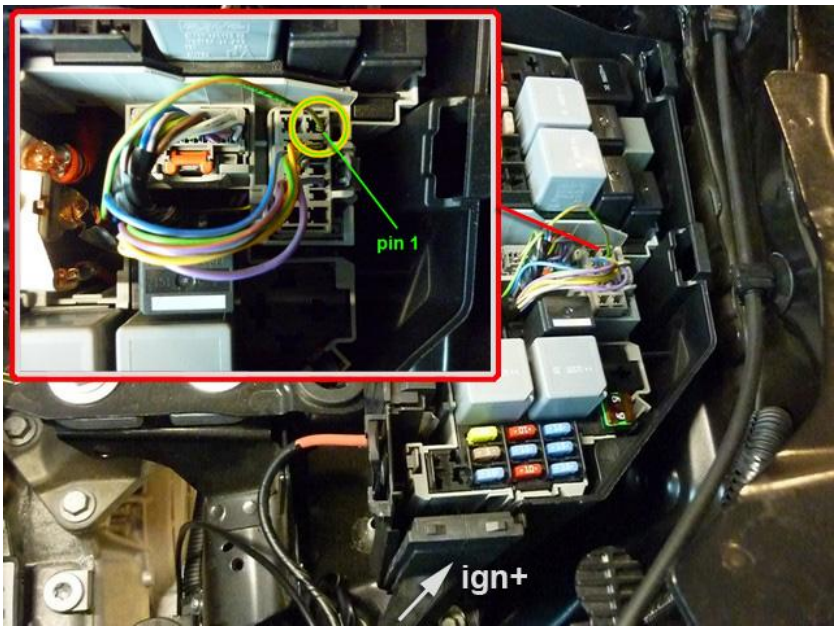


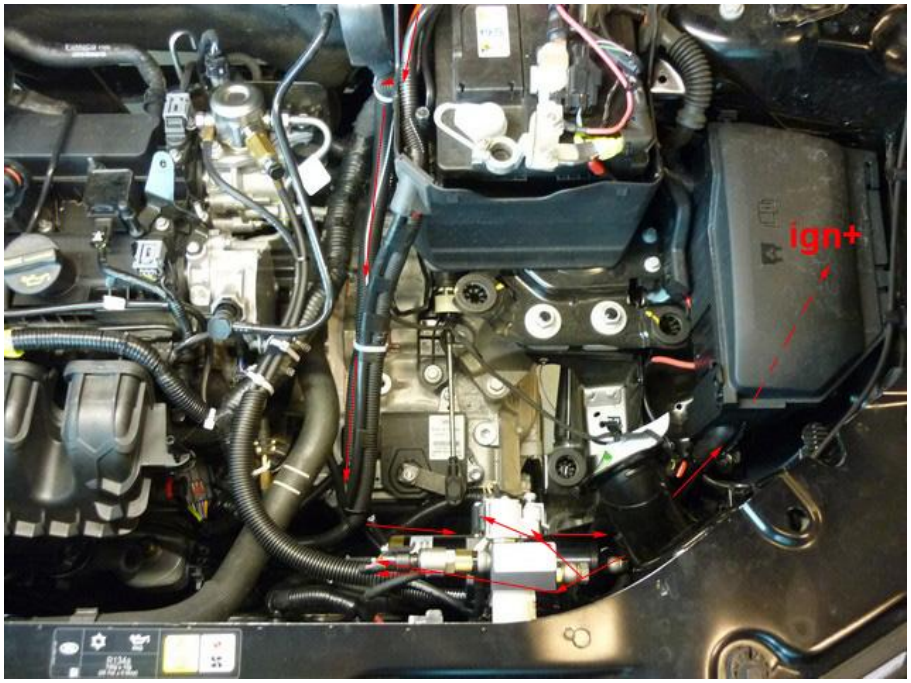
Wiring Transit

Carefully drill a hole Ø30mm for wiring transit.

Electrical connections

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 : fuse box, 14-pole grey connector, **pin 1** 



Electrical connections

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

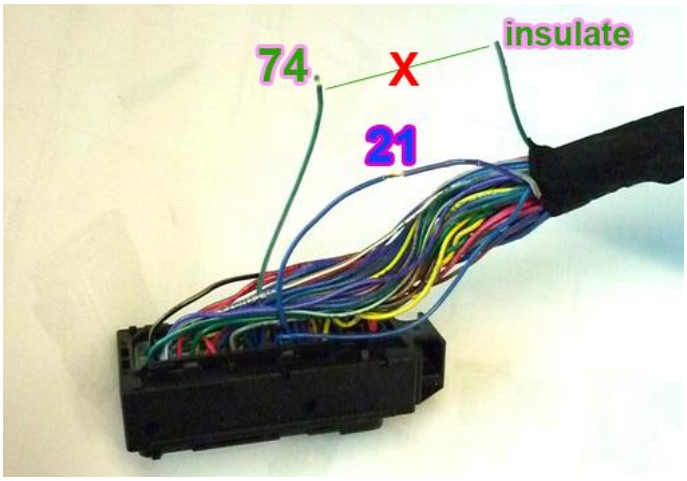
Wire number / code	*Wire colour*	*Connection*
17&10		*Low pressure petrol sensor signal interruption* *Wire colour :* **Purple-brown** *Wire location :* Petrol ecu Pin **A7**
17 AD 2	Blue-green	Sensor side
10 DAC 2	Green	ECU side
36&25		*High pressure petrol sensor signal interruption* *Wire colour :* **Blue-brown** *Wire location :* Petrol ecu Pin **A9**
36 AD 6	Blue-brown	Sensor side
25 DAC 1	Green-white	Petrol ecu side
15 T-ect	Grey	For measuring the engine coolant temperature. *Wire colour :* **Yellow** *Wire location :* Petrol ecu pin **A12**
40 Wake-up	Grey-red	*High pressure petrol sensor 5Volt supply / car wake-up* *Wire colour :* **Grey** *Wire location :* Petrol ecu Pin **A23**
63 Ground Shift	Blue-orange	*High pressure petrol sensor ground* *Wire colour:* **Blue-grey** *Wire location :* Petrol ecu Pin **A31**
60 DI 3	Yellow-grey	*Airflow* *Wire colour :* **Yellow-purple** *Wire location :* Petrol ecu Pin **A55**
8 RPM engine speed	Purple-white	For measuring the engine speed signal. *Wire colour :* **Blue-green** *Wire location :* Petrol ecu pin **A80**

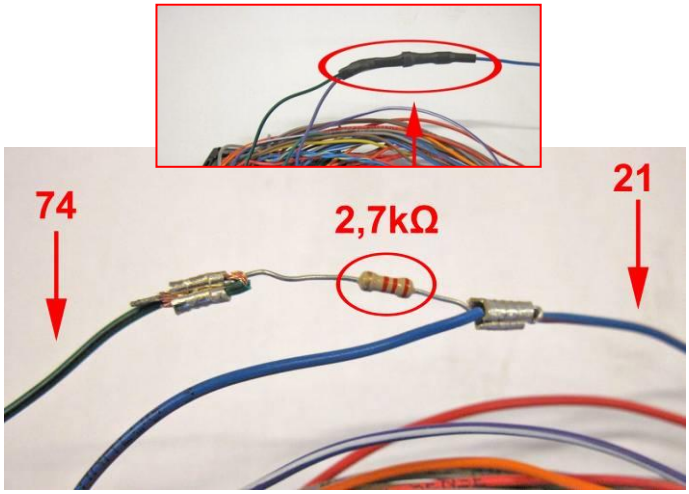
Electrical connections

18 AD 1	Blue-white	*Analog in (sensor side) MAP sensor in* *Wire colour :* **Green-brown** *Wire location :*Petrol ecu pin **A83**

56 DI 2	Yellow-green	*OEM petrol pump driver, PWM IN* *Wire colour :* **Yellow-orange** *Wire location :* Petrol ecu Pin **B45 (!! small-connector !!)**

21 AD9 Blue-purple 74 DAC3 Green-pink	Blue-purple	*Wideband lambda probe connection* Wire colour : **Brown-yellow** Wire location : Petrol ECU *pin A64* Connect wire 74 (DAC3) with the 2,7 kOhm resistor to wire 21 (AD9). Use heat shrink for protection. When connected like pictures, connect wire 21 to petrol ECU.





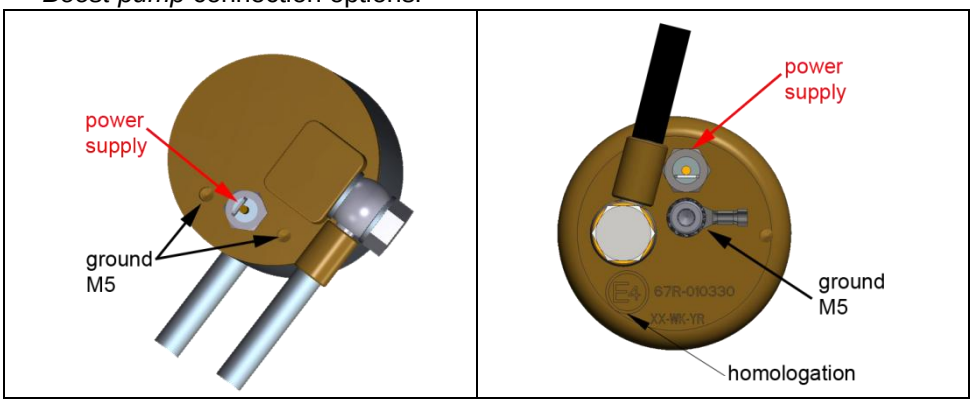
Electrical connections

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

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:

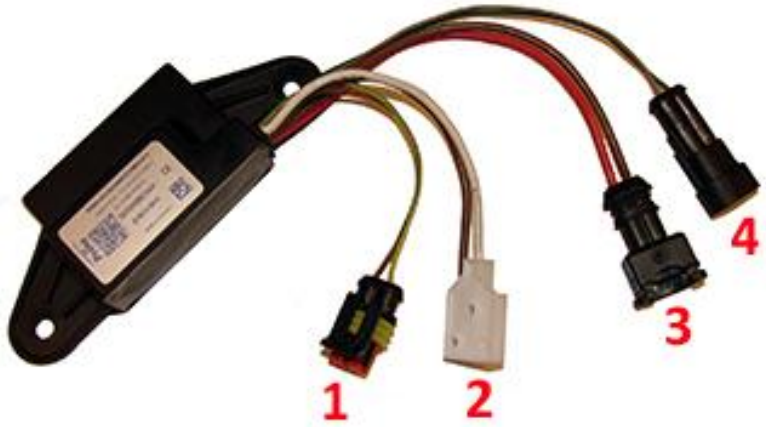


Electrical connections

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.