Installation manual

PART 2/2

MANUFACTURER	GM / Opel
TYPE	(based on Insignia)
ENGINE DISPLACEMENT	1598cc
NUMBER OF VALVES	16
ENGINE CODE / NUMBER - OUTPUT	A16XHT – 125kW / B16SHL - 125kW / B16SHT - 147kW
FIRING ORDER	1-3-4-2
VEHICLE CATEGORIES	M
TRANSMISSION	AT
VERSION	AFC-2.1 DI-LPG
TYPE VSI INJECTOR	KN9 - 63cc
TYPE INJECTION MODULE	Gen2 Type 2
PETROL ECU MANUFACTURER / CODE	Continental / AC Delco Serv# 12653998 & 12668437
MODEL YEAR:	2011-
SYSTEM APPROVAL NUMBER (R115)	E4-#115R-000028 / VSI-LPG 48
LOCATION R115 SYSTEM STICKER	right side, centre door post
ENGINE SET NUMBER	338/121003/A
MANUAL NUMBER	076/3301900-4
DATE	2020-03-31

Revision: 4

TABLE OF CONTENTS

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

Manual updates / revision

Rev. nr	Rev. Date	Subject update
2	2019-08-28	Start revision management
3	2019-10-15	Added engine code B16SHL & petrol ECM codes
4	2020-03-31	Added engine code B16SHT

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.
- Always download the “general manual 1/2“ from our website for basic instructions and diagrams.
- Always disconnect the battery when installing the LPG system. Make sure the ignition key is outside the car. Be aware of central door locking, radio / telephone memory code and alarm system.
- Do not place the main fuse into the fuse holder before having completed the installation of the VSI system.
- The VSI computer has to be activated by means of the diagnosis software.
- In the unlikely event the VSI computer fails, it will automatically switch over to petrol.
  Never disconnect the VSI computer connector, unless you have removed the main fuse.
- When installing the VSI 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 it may be necessary to adjust the length of the wires.
  Ensure maximum care is taken when connecting the 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 100mm of the exhaust or similar heat source, unless such components are adequately shielded against heat.
- Remove any internal burrs after having shortened the LPG pipe.
  (This guarantees the maximum flow through the pipe without pollution.)
- 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 an exterior filler into the body work).
- After having completed the installation, check the whole system for gas leakage; use a gas leak detection device. Also check for any 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 and filter registration see owner’s 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.

Please fill in the warranty portal completely within 14 days after installation.
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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 no. 099/99928)
- Exhaust gas analyser
- Multimeter
- Oscilloscope
- Prins diagnostic software
- Prins Diagnostic Tool
- Torque wrench (5-50Nm)
- Torque wrench (200-250Nm)
- Portable light
- Assortment drill bits Ø4 to 12 mm
- Assortment cutters (Ø20, 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

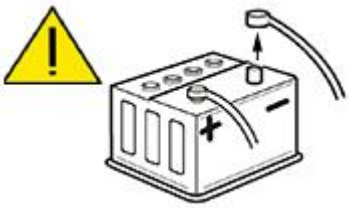
- Check the vehicle drivability on petrol
- Check the fuel system for error codes (scan tool)
- Check if the catalytic converter is in good condition (exhaust gas analyser)
- Check the condition of the ignition system (spark plugs, cables, coil)

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

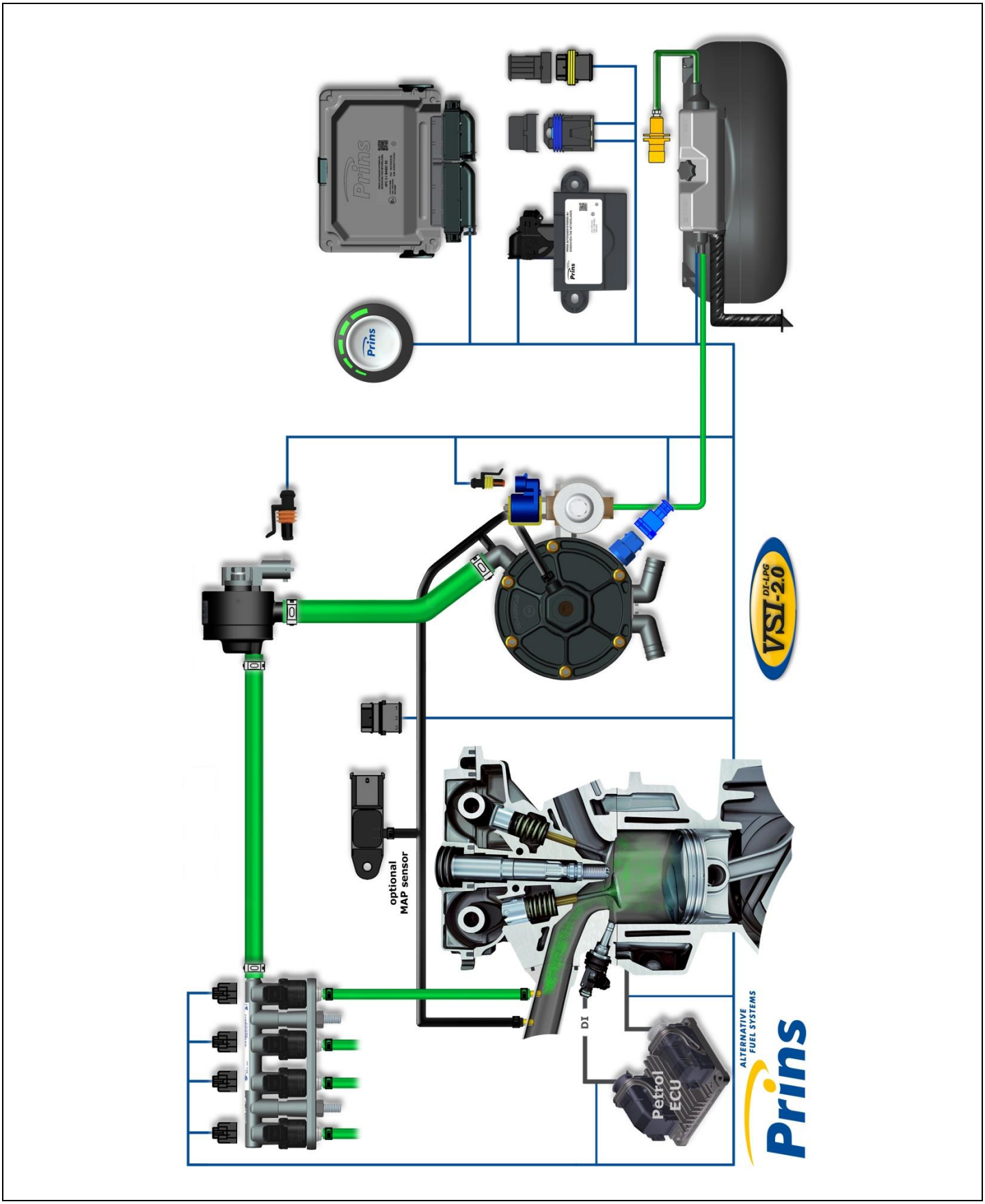
EXPLANATION OF SYMBOLS:

= IMPORTANT, CAUTION



= WEAR SAFETY GOGGLES

Base diagram VSI reducer



VSI approval numbers

Reducer : E4-67R-010054
Lock-off valve OMB : E8-67R-014327
Lock-off valve Valtek : E4-67R-010041

Injector rail Prins : LPG E4-67R-010093
CNG E4-110R-000021

Filter unit T1 / T2 Prins : LPG E4-67R-010096
CNG E4-110R-000028
Filter unit Keihin: LPG E4-67R-010177
CNG E4-110R-000091

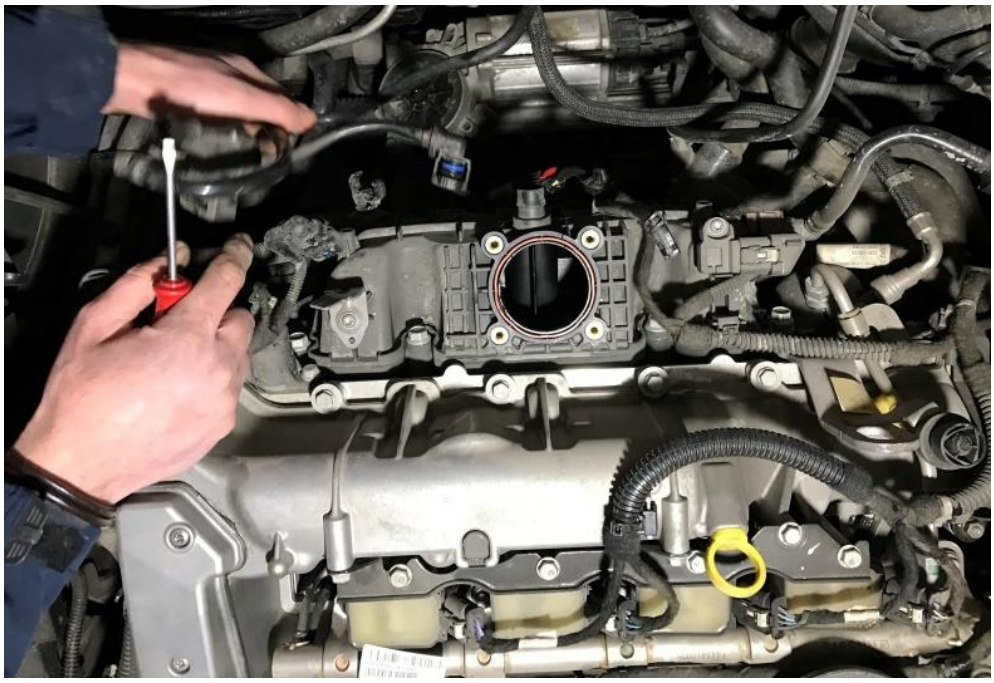
Injector Keihin KN8 : LPG E4-67R-010092
CNG E4-110R-000020
Injector Keihin KN9 : LPG E4-67R-010310
CNG E4-110R-000295

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

Tubithor : LPG E13-67R-010145
CNG E13-110R-000017
Rubia : LPG E4-67R-010068
CNG E4-110R-000003
WinLas : LPG E37-67R-010140
CNG E37-110R-000012

Mounting the inlet manifold couplings

Remove the inlet manifold.
Drill **4** holes of **8,5mm** in the inlet manifold. Cut **M10x1** thread in these holes.
Place the VSI couplings with a lock compound in the inlet manifold.
Watch out that the lock compound doesn't come inside the VSI couplings.
Place the inlet manifold back on the engine.

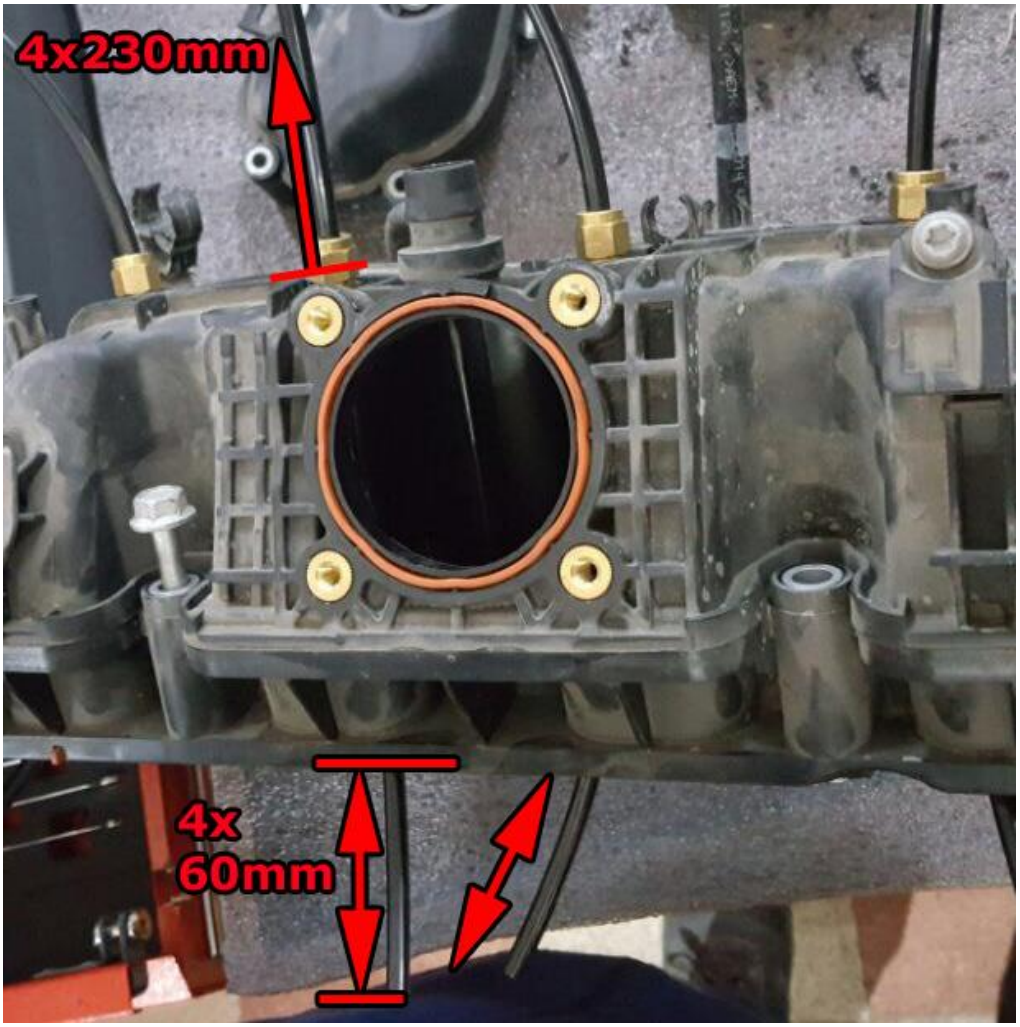


Remove the throttle valve and inlet manifold

Drill **4** holes of **8,5mm** in the inlet manifold.
Cut **M10x1** thread in these holes.

Mounting the inlet manifold couplings

Place the VSI couplings with a lock compound in the inlet manifold.
Watch out that the lock compound doesn't come inside the VSI couplings



Insert Nylon hoses (4x 500mm), sticking out into cylinder head : 60mm

Overpressure / MAP connection

Drill a hole **Ø5mm** into the back of the manifold and cut **M6** thread into the hole for the MAP coupling.
(Image is from a different Insignia model manifold)

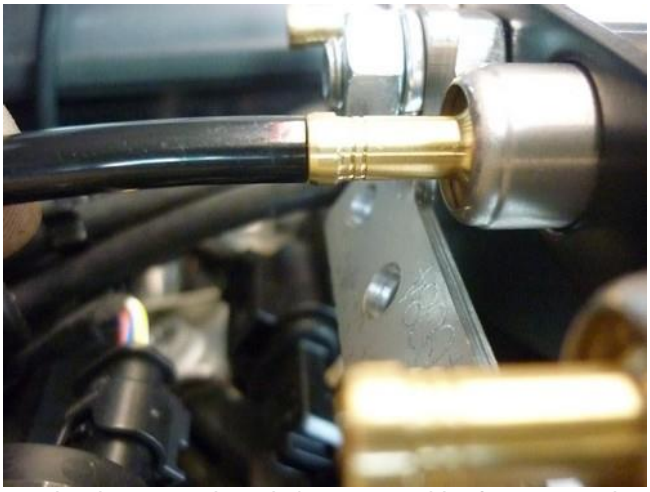
LPG hoses

Hose (Ø in mm)	*From component*	*To component*	*Hose length (cm)*
5	VSI injector 1	Inlet manifold coupling cyl.1	50 *
5	VSI injector 2	Inlet manifold coupling cyl.2	50 *
5	VSI injector 3	Inlet manifold coupling cyl.3	50 *
5	VSI injector 4	Inlet manifold coupling cyl.4	50 *
6	VSI injector 1	Nylon hose cyl.1	± 4
6	VSI injector 2	Nylon hose cyl.2	± 4
6	VSI injector 3	Nylon hose cyl.3	± 4
6	VSI injector 4	Nylon hose cyl.4	± 4

General info.

*Cut the nylon hoses on length, make sure that the inlet of the nylon hose faces the injector outlet.

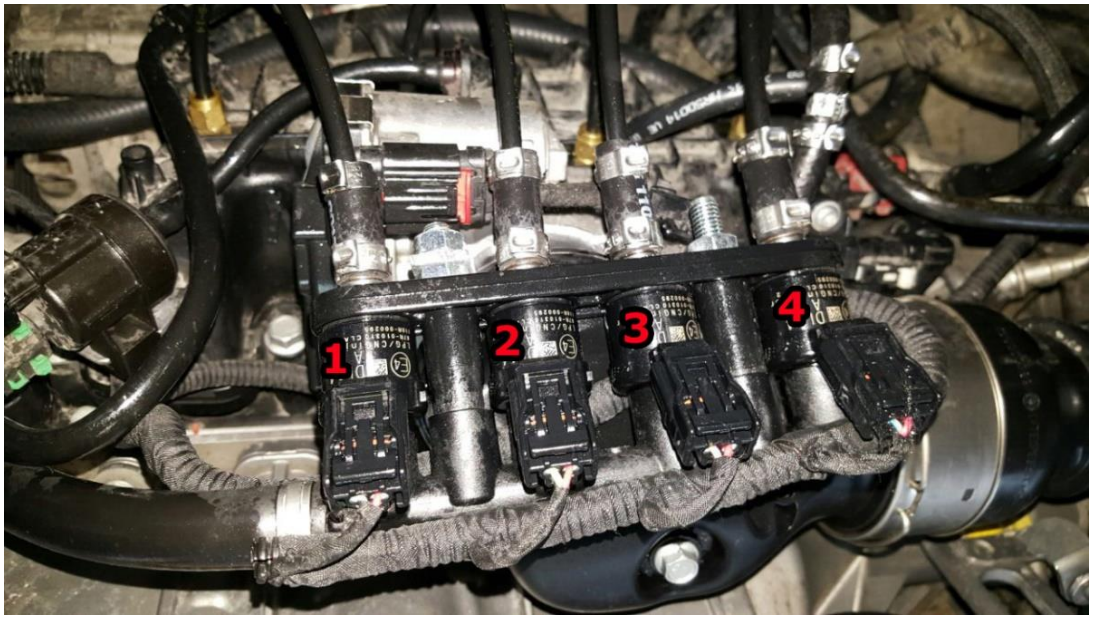
Please observe that there is no damage or fouling to the hoses.



Cut nylon hoses on length / connect with Ø6mm LPG hose

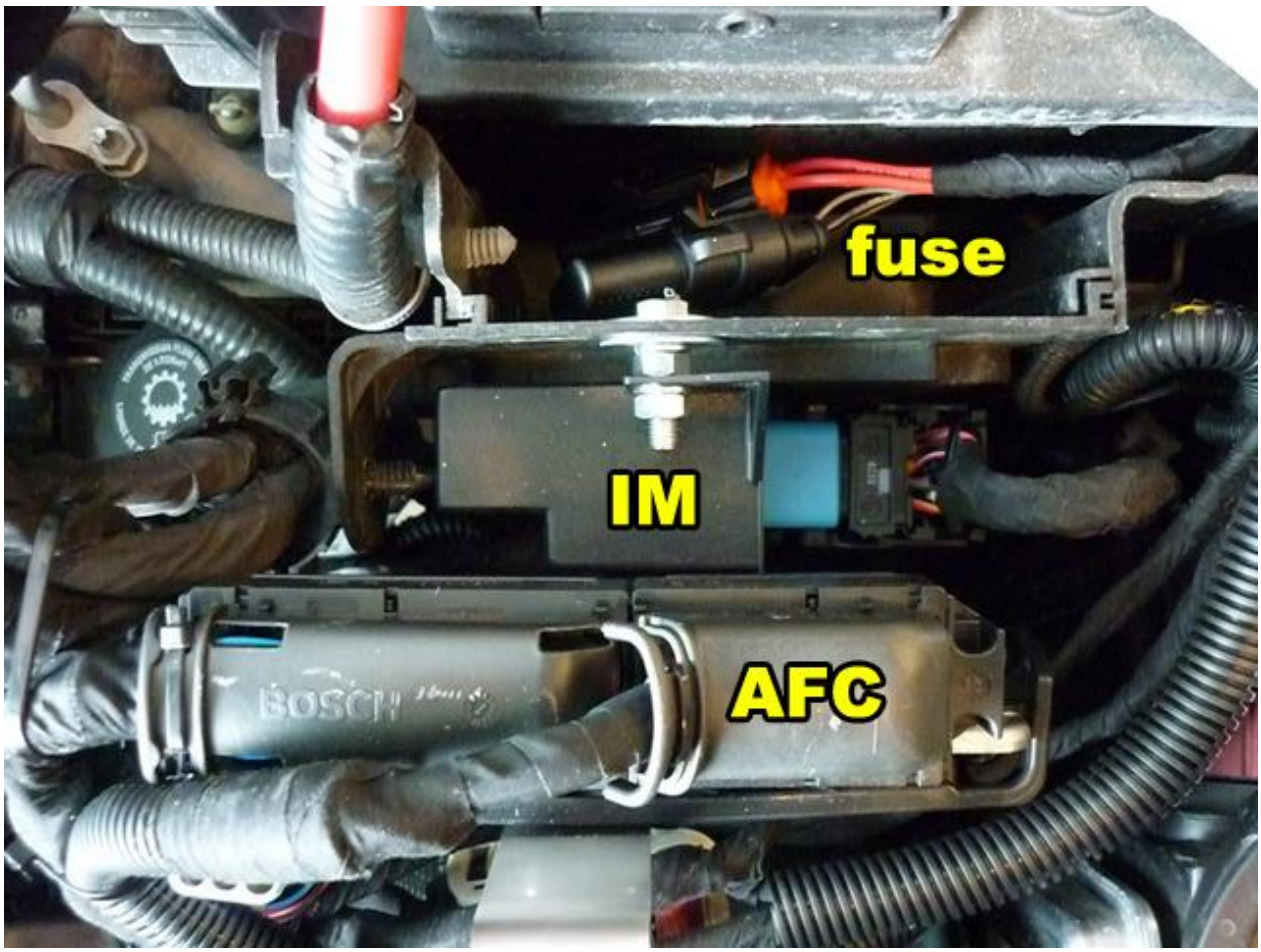
Mounting the VSI injector rail

Mount the injector rail with a metal strip on top of the inlet manifold.



Mounting the AFC / Injection Module

Example Opel Insignia: position the AFC and Injection Module in front of the battery.



Mounting the fuel selection switch 10th VIN CODE F-H

When mounting the switch, only push on its sides.
Pushing the switch hard in the centre may result in damage to the switch.

INSIDE: Switch / CAN & *56 DI2*

See next page !!

Extend wires from AFC to module in trunk.

Remove coolant reservoir to reach grommet.

(Opel Insignia)

Mounting the fuel selection switch 10th VIN CODE B-E

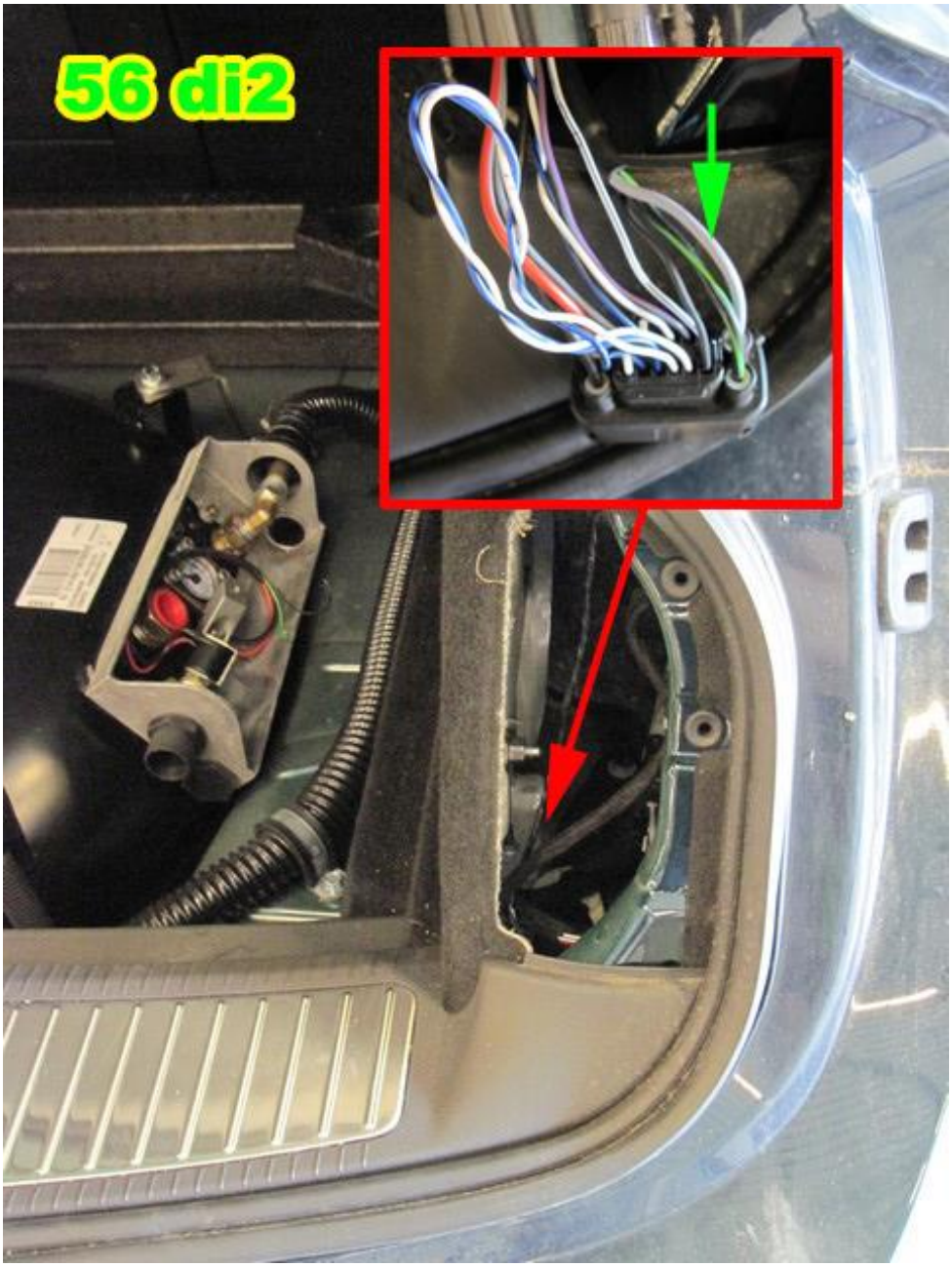
When mounting the switch, only push on its sides.
Pushing the switch hard in the centre may result in damage to the switch.

INSIDE: Switch / CAN & *56 DI2 – 10 DAC2 – 17 AD2*
See next page !!
Extend wires from AFC to module in trunk.

Remove coolant reservoir to reach grommet.

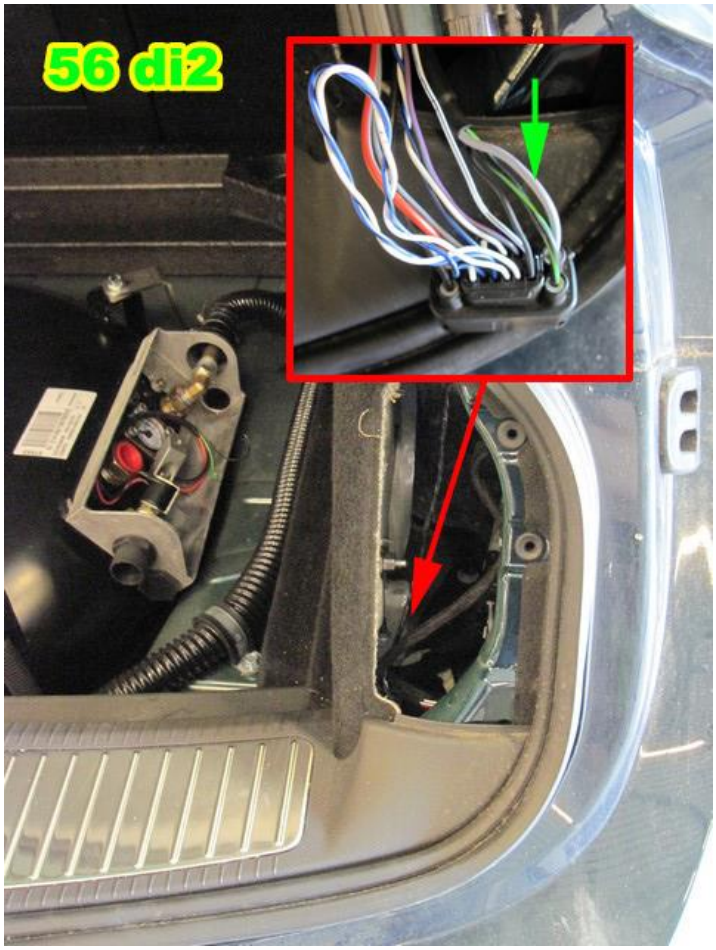
(Opel Insignia)

PWM wiring fuel pump module 10th VIN CODE F-H



56	DI2 EXTEND		Yellow-green	**grey** (thick), Wire location : trunk, **Fuel Control Module**, pin **8**

PWM wiring fuel pump module 10th VIN CODE B-E



For the DI2 there are 2 possible options

It is always the thick grey wire!

56	DI2 EXTEND		Yellow-green	**grey** (thick), Wire location : trunk, **Fuel Control Module**, pin **13**

or

56	DI2 EXTEND		Yellow-green	**grey** (thick), Wire location : trunk, **Fuel Control Module**, pin **8**

For the Low Pressure Sensor Signal Interruption there are 2 options

Connect one of those 2 options. First check for option 1.
If option 1 is ***not available***, you have to use option 2.

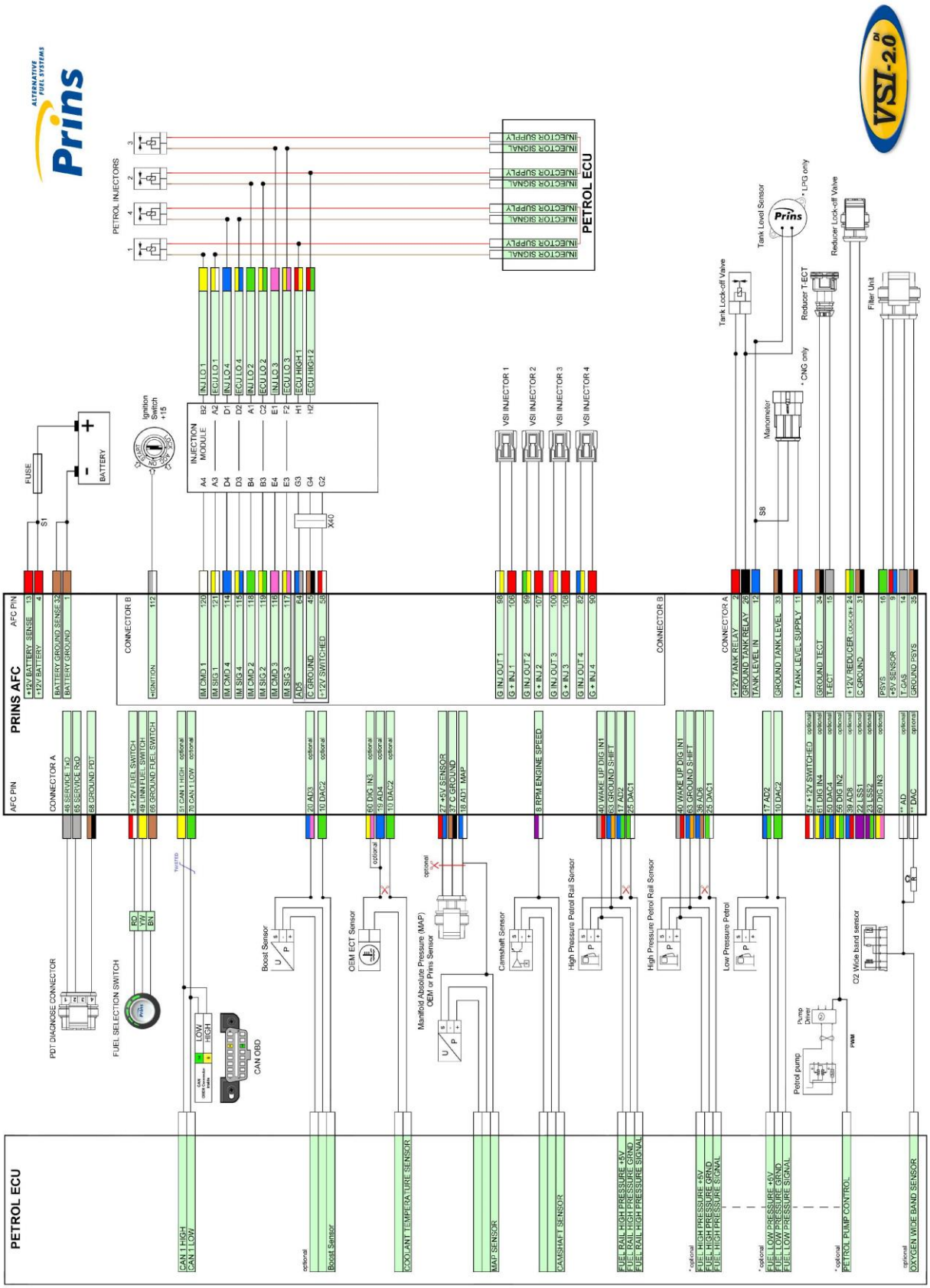
Option 1:

17 & 10 EXTEND				*Low pressure petrol sensor signal interruption.* Wire location : trunk, **Fuel Control Module**, pin **10**
17	AD 2		Blue-brown	Sensor side
10	DAC 2		Green	Petrol ecu side

Option 2:

17 & 10				*Low pressure sensor interruption.* Wire colour : **blue-white** Wire location : petrol ECU **X1**, blue connector, pin **2**
17	AD 2		Blue-green	Sensor side.
10	DAC 2		Green	ECU side.

Basic Wiring Diagram



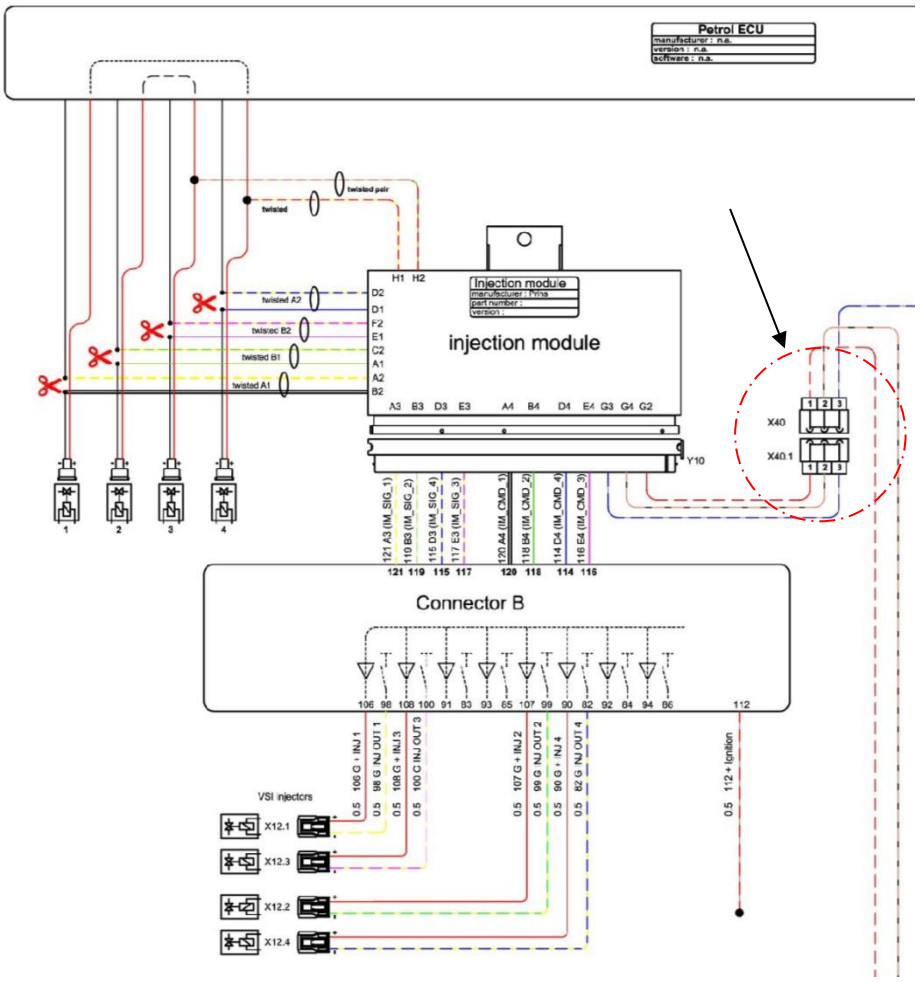
Electrical connections – Insulate

19	AD4	Blue	***Insulate***
22	LSS1	Purple	***Insulate***
23	LSS2	Purple-green	***Insulate***
36	AD6	Blue-brown	***Insulate***
38	AD7	Blue-light Blue	***Insulate***
39	AD8	Blue-red	***Insulate***
43	+12 Valve 2	Red-white	***Insulate***
50	DAC4	Green-blue	***Insulate***
60	DIG IN3	Yellow-pink	***Insulate***
61	DIG IN4	Yellow-blue	***Insulate***
62	C Ground	Brown-black	***Insulate***
74	DAC3	Green-pink	***Insulate***
Insulate additional loose wires			

Electrical connections

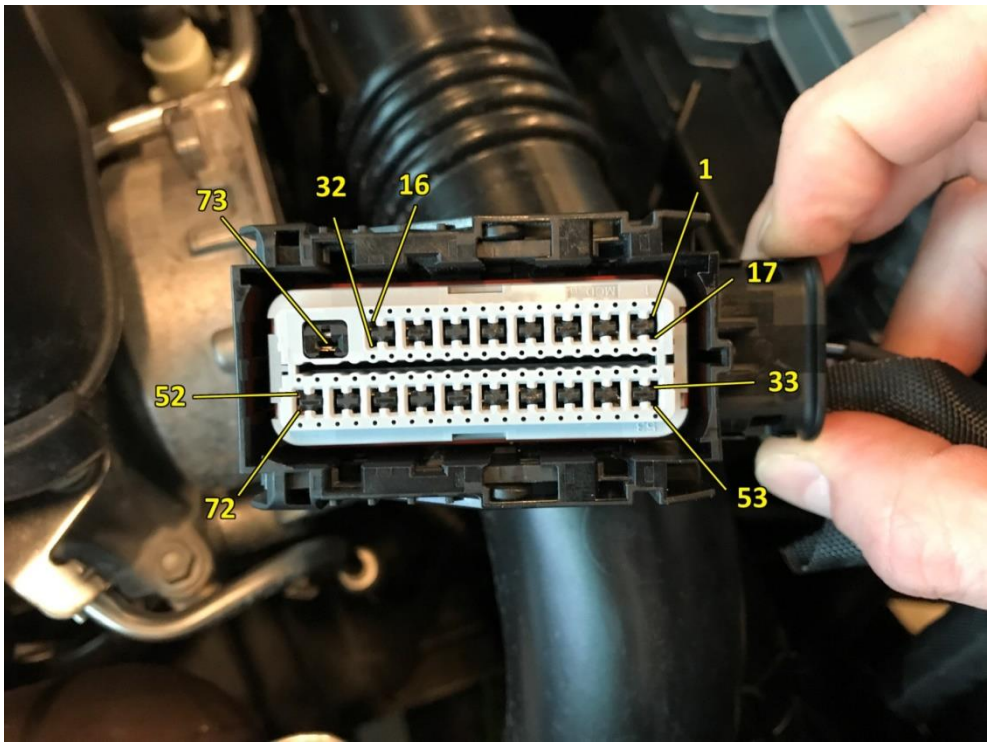
Check and measure the wiring in case of changes in the cars wiring colours.

Wire number / code	Wire colour	Connection
32 Ground sense 1 Ground battery	Brown Brown	*Connect to the '–' of the battery; use a ring terminal or solder:* Wire colour : Wire location :
4 +12V Battery	Red	*Do not place the fuse in the holder before having completed the installation of the LPG system.* Wire colour : Wire location :
98 98 G INJ OUT **1** 106 106 G + INJ 1	**White-yellow** red	Connector VSI-injector to cylinder **1**. Timing belt side
99 99 G INJ OUT **2** 107 107 G + INJ 2	**Green-yellow** red	Connector VSI-injector to cylinder **2**.
100 100 G INJ OUT **3** 108 108 G + INJ 3	**Pink-yellow** red	Connector VSI-injector to cylinder **3**.
82 82 G INJ OUT **4** 90 90 G + INJ 4	**Blue-yellow** red	Connector VSI-injector to cylinder **4**.



Petrol ECU

Petrol ECU location



Petrol ECU pin numbering

All pins on the three ECU connectors are numbered in the same way.

Electrical connections 10th VIN CODE F-H

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

⚠ For measuring the petrol injectors :

Interrupt each petrol injector control wire (injector min)
Each VSI wire has a petrol injector / cylinder number printed on the wire, connect this wire to the corresponding petrol injector / cylinder.
Connect the **bicoloured** VSI measuring wire to the **ecu side** (wire code: ecu-lo).
Connect the **corresponding full coloured** VSI wire to the **petrol injector side** (wire code: inj-lo).
See diagrams: Installation manual general part 1 / 2.

Attention:
Each bicoloured measuring wire corresponds to a specific LPG injector and petrol injector / cylinder number.
Do not interchange the wires.

X2 (Black connector):

VSI measure wire nr. :	Full coloured / Bicoloured Module position	Interrupt petrol injector wire
INJ LO 1 ECU LO 1 Petrol injector cyl. 1	White White-yellow B2 / A2	Injector side. ECU side. Colour : **brown** Location : **X2**, black connector, pin **51**
INJ LO 4 ECU LO 4 Petrol injector cyl. 4	Blue Blue-yellow D1 / D2	Injector side. ECU side. Colour : **grey-blue** Location : **X2**, black connector, pin **49**
Module wire pos. H1 ECU HIGH A (cyl. 1-4)	Red-yellow H1	Colour : **blue-white & brown-white** **Twist** and solder wires together with H. Location : **X2**, black conn, pin **69 & 71** 
INJ LO 2 ECU LO 2 Petrol injector cyl. 2	Green Green-yellow A1 / C2	Injector side. ECU side. Colour : **blue** Location : **X2**, black connector, pin **48**
INJ LO 3 ECU LO 3 Petrol injector cyl. 3	Pink Pink-yellow E1 / F2	Injector side. ECU side. Colour : **green** Location : **X2**, black connector, pin **50**
Module wire pos. H2 ECU HIGH B (cyl. 2-3)	Red-green H2	Colour : **blue-grey & green-grey** Twist and solder wires together with H. Location : **X2**, black conn, pin **68 & 70** 

Electrical connections 10th VIN CODE F-H

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

X1 (Blue connector):

112			*Connect to +ignition / contact+ (+15).* **Do not place the fuses in the holder before having completed the installation of the LPG system**. Wire colour : **Purple-blue** (thick) / **Violet-grey** Wire location : **X1**, blue connector, pin **73** → **A16XHT** **X1**, blue connector, pin **14** → **B16SHL**
112 + Ignition		Red-grey	

X2 (Black connector):

			High pressure petrol sensor supply 5V Wire colour : **brown-red** Wire location : **X2**, black connector, pin **9**
40 Wake-up		Grey-red	

17 & 10			*Low pressure petrol sensor signal interruption.* Wire colour : **blue-white** Wire location : **X2**, black connector, pin **20**
17 AD 2		Blue-brown	Sensor side
10 DAC 2		Green	Petrol ecu side

			High pressure petrol sensor ground. Wire colour : **black-green** Wire location : **X2**, black connector, pin **25**
63 Ground Shift		Blue-orange	

36 & 25			*High pressure petrol sensor signal interruption.* Wire colour : **blue-green** Wire location : **X2**, black connector, pin **26**
36 AD 6		Blue-brown	Sensor side
25 DAC 1		Green-white	Petrol ecu side

			For measuring the engine speed signal. Wire colour : **yellow-purple** Wire location : **X2**, black connector, pin **39**
8 RPM		Purple-white	

			Oxygen sensor Wire colour :**Purple-grey** Wire location : **X2**, black connector, pin **53**
20 AD 3		Blue-pink	

X3 (Grey connector):

		Red-blue Brown-black	*MAP sensor in. (cut off Prins connector)* insulate insulate Wire colour : **green-white** Wire location : **X3**, grey connector, pin **40**
18 AD 1		Blue-white	

Inside trunk pwm, see page 16

56 DI2		Yellow-green	**grey** (thick), Wire location : trunk, **Fuel Control Module**, pin **8**

Electrical connections 10th VIN CODE B-E

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

⚠ For measuring the petrol injectors :
Interrupt each petrol injector control wire (injector min)
Each VSI wire has a petrol injector / cylinder number printed on the wire, connect this wire to the corresponding petrol injector / cylinder.
Connect the **bicoloured** VSI measuring wire to the **ecu side** (wire code: ecu-lo).
Connect the **corresponding full coloured** VSI wire to the **petrol injector side** (wire code: inj-lo).
See diagrams: Installation manual general part 1 / 2.

Attention:
Each bicoloured measuring wire corresponds to a specific LPG injector and petrol injector / cylinder number.
Do not interchange the wires.

X3 (gey connector):

VSI measure wire nr. :	Full coloured / Bicoloured Module position	Interrupt petrol injector wire
INJ LO 1 ECU LO 1 Petrol injector cyl. 1	White White-yellow B2 / A2	Injector side. ECU side. Colour : **brown** Location : **X3**, grey connector, pin **52**
INJ LO 4 ECU LO 4 Petrol injector cyl. 4	Blue Blue-yellow D1 / D2	Injector side. ECU side. Colour : **grey-blue** Location : **X3**, grey connector, pin **50**
Module wire pos. H1 ECU HIGH A (cyl. 1-4)	Red-yellow H1	Colour : **blue-white & brown-white** **Twist** and solder wires together with H. Location : **X3**, grey conn, pin **70 & 72** 
INJ LO 2 ECU LO 2 Petrol injector cyl. 2	Green Green-yellow A1 / C2	Injector side. ECU side. Colour : **blue** Location : **X3**, grey connector, pin, pin **46**
INJ LO 3 ECU LO 3 Petrol injector cyl. 3	Pink Pink-yellow E1 / F2	Injector side. ECU side. Colour : **green** Location : **X3**, grey connector, pin **48**
Module wire pos. H2 ECU HIGH B (cyl. 2-3)	Red-green H2	Colour : **blue-grey & green-grey** Twist and solder wires together with H. Location : **X3**, grey conn, pin **66 & 68** 

			For measuring the engine speed signal. Wire colour : **yellow-purple** Wire location : **X3**, grey connector, pin **33**
8 RPM		Purple-white	

Electrical connections 10th VIN CODE B-E

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

X1 (Blue connector):

112			*Connect to +ignition / contact+ (+15).* **Do not place the fuses in the holder before having completed the installation of the LPG system**. Wire colour : **purple-blue** (thick) Wire location : **X1**, blue connector, pin **73**
112 + Ignition		Red-grey	

X2 (Black connector):

			High pressure petrol sensor supply 5V Wire colour : **brown-red** Wire location : **X2**, black connector, pin **18**
40 Wake-up		Grey-red	

			High pressure petrol sensor ground. Wire colour : **black-green** Wire location : **X2**, black connector, pin **3**
63 Ground Shift		Blue-orange	

36 & 25			*High pressure petrol sensor signal interruption.* Wire colour : **blue-white** Wire location : **X2**, black connector, pin **19**
36 AD 6		Blue-brown	Sensor side
25 DAC 1		Green-white	Petrol ecu side

			Oxygen sensor Wire colour :**Purple-grey** Wire location : **X2**, black connector, pin **10**
20 AD 3		Blue-pink	

		Red-blue Brown-black	*MAP sensor in. (cut off Prins connector)* insulate insulate Wire colour : **green-white** Wire location : **X2**, black connector, pin **43**
18 AD 1		Blue-white	

Inside trunk pwm, see page 17

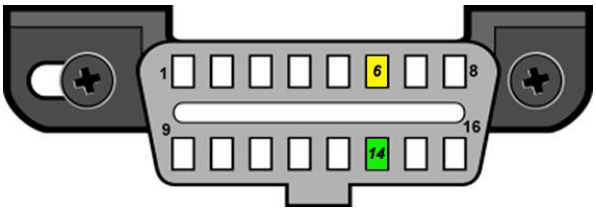
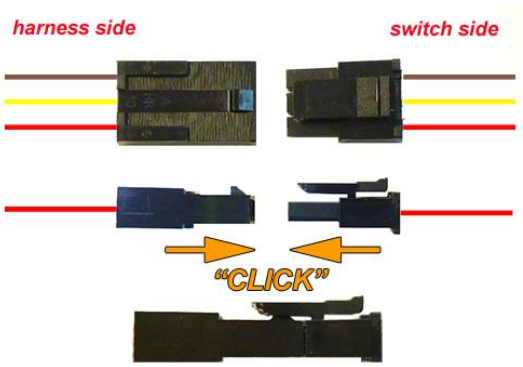
56 DI2 EXTEND		Yellow-green	**grey** (thick), Wire location : trunk, **Fuel Control Module**, pin **13**

Option 1 (if not available, see page 17 for option 2)

17 & 10 EXTEND			*Low pressure petrol sensor signal interruption.* Wire location : trunk, **Fuel Control Module**, pin **10**
17 AD 2		Blue-brown	Sensor side
10 DAC 2		Green	Petrol ecu side

Electrical connections

Driver room

51 CAN1 High 70 CAN1 Low	Yellow Green	*Connect to EOBD diagnose connector.* Pin : 6 Pin : 14
		
3-pole micro connector 66 Ground fuel switch 3 +12V fuel switch 49 LIN fuel switch	Brown-black Red-white Yellow	*Connect to switch.* Connect the 3-pole connector to the Prins fuel selection switch
		

Electrical connections

Connectors in wiring loom

2-pole blue connector 15 T-ECT 34 Ground T-ECT	 Grey Brown-black	*For measuring the engine coolant temperature (Tect).* Connect the connector to the reducer temperature sensor.
4-pole connector 35 Ground Psys 14 T-Gas 9 +5 Volt sensor 16 Psys	 Brown-black Grey Red-blue Green	*For measuring gas pressure and temperature.* Connect the connector to the filter unit sensor.
2-pole connector 24 +12V reducer 31 C Ground	 Yellow-green Brown-black	Connect the connector to the reducer
4-pole connector 46 Service TxD 65 Service RxD 68 Ground PDT	 Grey Grey Brown-black	Diagnose connector.
Tank wiring loom 2 +12V Tank relay 12 Tank level IN 26 Ground tank relay	 red blue black	 Connect to the tank lock-off. Connect the tank level gauge. Connect to the tank lock-off.
Wiring loom link 45 C ground 58 +12V switched 64 AD5	 Brown–black Red–white Blue-grey	Connection from AFC connector A to connector B.

Optional:

3-pole connector 11 + manometer 12 tank level in 33 ground manometer	 red blue brown	***Cut off connector and insulate wires***

Checklist after installation

1. Connect the Prins Diagnostic Tool and run the VSI diagnostic program.
   Install the VSI fuse, turn the ignition key in the accessory position.
   When working on the car, beware of moving and rotating parts in the engine compartment.

2. When commissioning the LPG system, you must activate the VSI computer with the diagnostic software. When the VSI computer has not been activated, the switch will keep blinking.
   To activate the VSI computer, select function *activate ECM* in the diagnostic software.

3. Check whether the program in the VSI computer matches with the car (dedicated engine set):
   Refer the car description in the diagnostic software (Basic → Identification) and compare these with the set number.

4. The system will switch over to LPG as soon as the temperature of the coolant becomes higher than parameter 70 - Switch over ECT.

5. Check all components and connections for any gas leakage (use a LPG leak detector device or a fluid detection like soap). Caution for moving and rotating parts in the engine compartment!

6. Let the engine run warm on petrol >80°C.
   Check if the evaporator heats up.
   Check the engine signals, petrol injection time, RPM, ECT, lambda, MAP signal and petrol pressure signal.
   Let the engine run idle on LPG.
   Adjust the evaporator pressure.
   Refer to *Basic → System* in the diagnostic software for the idle level value set.
   Adjust the evaporator pressure in such a way that the pressure measured (P-sys) equals the idle level value.
   Turn the socket-head screw at the front of the evaporator to adjust the pressure.
   An error code will be generated whenever the pressure variation is too high.

7. Use the diagnostic software to check again all input and output signals.

8. Check the system for error codes and solve these, if required.
   Check the petrol ECM for EOBD error codes.
   Place the protection connector on the VSI communication connector.

9. Take a test drive and check the drivability on LPG and petrol.

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