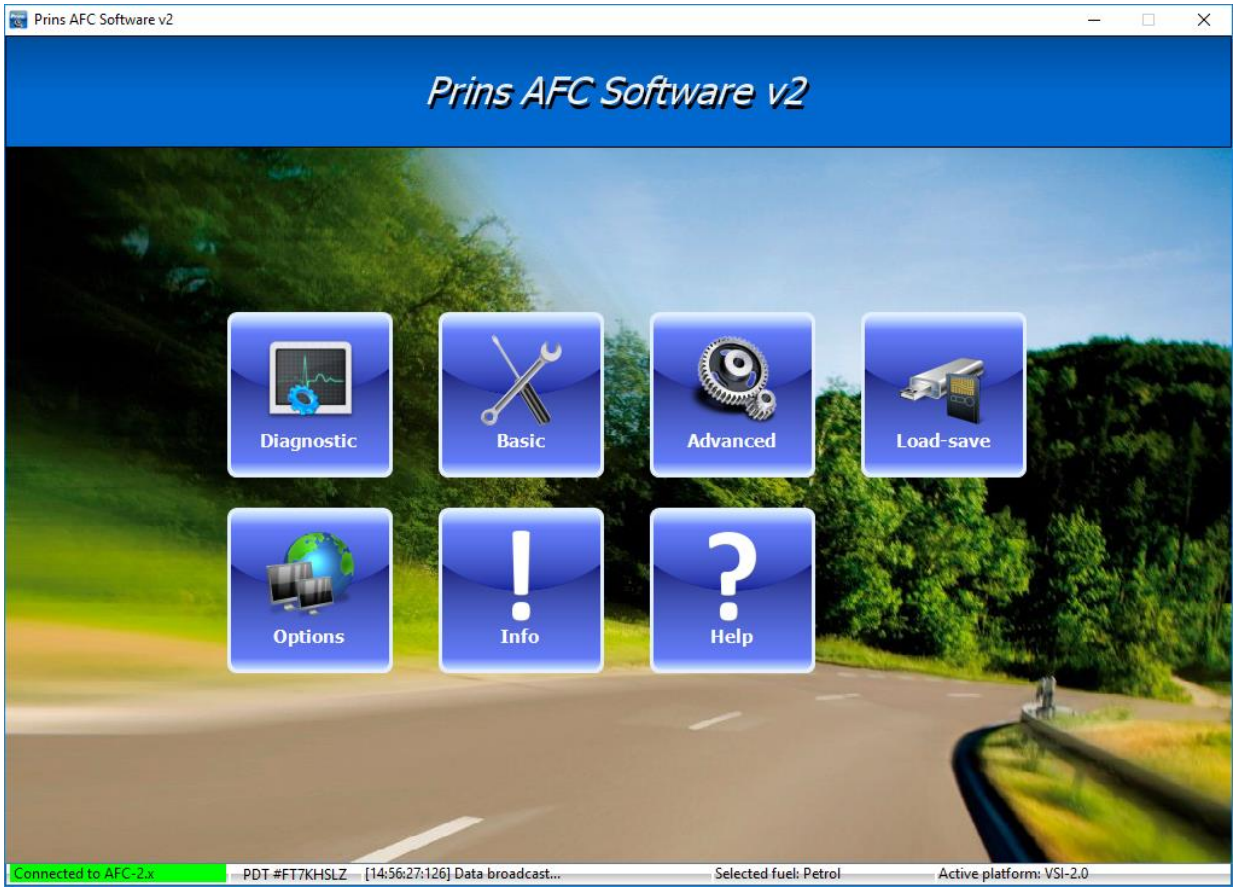
CALIBRATION PARAMETERS

VSI-2.0 LPG UNIVERSAL



This manual is written based on the online firmware shown below:

- [042/000008] VSI-2 Universal Defaulty Calibration
- [042/000009] VSI-2 Universal DACS
- [042/000010] VSI-2 Uni Default Master Slave Cal

1 Contents

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2 General introduction

This manual contains information about:

- Universal VSI-2.0 LPG platform for port fuel petrol engines
- -online firmware:
    - [042/000008] VSI-2 Universal Defaulty Calibration
    - [042/000009] VSI-2 Universal DACS
    - [042/000010] VSI-2 Uni Default Master Slave Cal
- Prins AFC Software V2

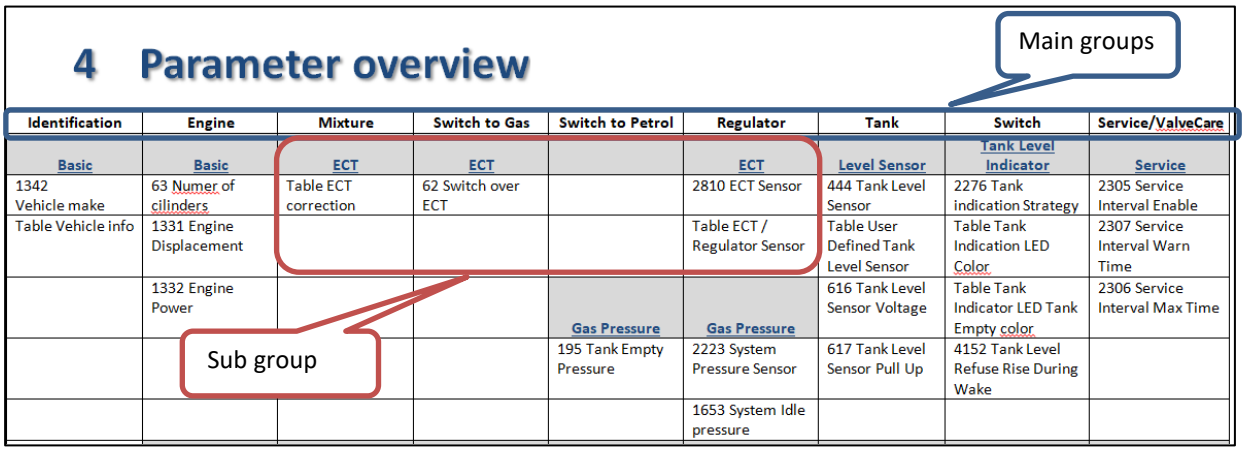
All calibration parameters have been explained, situations are known that parameters are not available for some AFC types.
You will need experience in the installation of VSI-2 and an understanding of engine management systems.
All parameters have been organized into main-groups and sub-groups. This is illustrated in the Parameter Overview chapter.

2.1 Philosophy

The philosophy of structure about the main group is:

- Identification of the vehicle.
- Where can I find the hardware in the vehicle and which parameter has influence?
    - Parts installed on the engine
    - Parts on the gas tank
    - Parts on the reducer
    - Selector switch
- When do I need the parameter?
    - Tune the mixture
    - Switch over to gas
    - Switch back to petrol
    - Service / ValveCare

For Example: the ECT (regulator temperature sensor)
You can find parameters about the ECT in group Regulator Switch over to Gas and Mixture.
The Sensor installed onto the regulator has influence on the Switch over to Gas strategy and the Mixture.



Identification	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
Basic	Basic	ECT	ECT		ECT	Level Sensor	Tank Level Indicator	Service
1342 Vehicle make	63 Numer of cilinders	Table ECT correction	62 Switch over ECT		2810 ECT Sensor	444 Tank Level Sensor	2276 Tank indication Strategy	2305 Service Interval Enable
Table Vehicle info	1331 Engine Displacement				Table ECT / Regulator Sensor	Table User Defined Tank Level Sensor	Table Tank Indication LED Color	2307 Service Interval Warn Time
	1332 Engine Power			Gas Pressure	Gas Pressure	616 Tank Level Sensor Voltage	Table Tank Indicator LED Tank Empty color	2306 Service Interval Max Time
				195 Tank Empty Pressure	2223 System Pressure Sensor	617 Tank Level Sensor Pull Up	4152 Tank Level Refuse Rise During Wake	
					1653 System Idle pressure			

2.2 Tools

To complete the calibration, the following equipment is needed:

- Prins Diagnostic Tool (091/110001/A)
- Universal diagnostics License (contact importer)
- Laptop
- Windows 7 / 8 / 10
- EOBD diagnostics equipment
- Advanced multi meter
- Oscilloscope (recommended)

3 VSI-2 Quick Start Calibration (default Prins parts)

1) Fill the LPG tank with a minimum of 20%

2) Install the main fuse

3) Install the latest firmware in the AFC (Switch stops blinking)

4) Activate the AFC

5) Start vehicle on petrol (system status “SS_Petrol_selected”) and check if all petrol related signals are being received

6) Turn off the air-conditioning, wipers, heaters, blowers lighting and other high powered accessories

7) Set the parameters:

Parameter	Name
63	Number Of Cylinders
1335	Gas Injector Type
444	Tank Level Sensor
924	RPM Signal Source
619	RPM Trigger Level
297	RPM Factor
2407	Output 2 function (eVP-500 or VSI Regulator)
495	Regulator Map Reference (Only if reducer membrane connected to MAP)
533	AD 1 Sensor Selection (for MAP sensor)
2202	MAP Sensor (if Map sensor used)
1174	Lambda 1 Sensor (Only if Lambda sensor used)
1653	System Idle Pressure Default absolute pressure = 2200 mbar (reducer not connected to MAP) Set to default Delta pressure = 1200 mbar (reducer connected to MAP)
195	Tank Empty Pressure XD3= System Idle Pressure minus 400mbar XD4 or XD5= System Idle Pressure minus 600mbar

8) Check if the injectors have been installed correctly. Use the ‘Injector – Actuator test’ available in the diagnostic tool.

9) Set the Gain Factor RC-inj adjustment (during test drive)

226	Gain Factor [RC]

a) Stable petrol injection time between 8-14 ms.
b) Engine speed between 1500 -3000 rpm
c) “closed loop” (λ =1)
d) Tune the fuel trims during gas-mode. These must be similar in value when on petrol-mode.
    a. Increase gain factor => If fuel trims in gas-modes are lower than Fuel trims in Petrol-mode
    b. Decrease gain factor => If fuel trims in gas-modes are higher than Fuel trims in Petrol-mode
e) This situation will be reached with most cars around 120 km/h.

10) Set Offset adjustment (Engine running at increased idle speed)

230	Offset

a) Find the rpm with the lowest petrol injection time and no load
b) Engine speed between 1850 -3000 rpm
c) “closed loop” (λ =1)
d) Tune the injection times during gas-mode. These must be similar in value during petrol-mode.
e) This situation will be reached with most cars at high idle engine speed and low load at 2000 rpm
f) If the gas injector time is lower than 3 ms decrease the system pressure or use a MAP regulator.

11) Adjust the System Gas Pressure by using the adjustment screw in the regulator

12) Use the diagnostic screen of the diagnostic tool

13) Adjust the system gas pressure during engine idle until the gas injector time is ≥3 ms
(Lowest System Gas Pressure is 1600 mbar absolute or 600 mbar Delta Pressure)

14) Set the parameters

1653	System Idle Pressure
195	Tank Empty Pressure

15) Check if maximum gas injector duty cycle during gas mode does not exceed 85-90%.]
Use Process parameter Gas inj DCY [13584]
a) If Duty cycle: < 85% => OK
b) If Duty cycle > 85% => Increase system gas pressure (check smallest gas injection time)
c) If Duty cycle > 85% => fit larger injectors
d) If Duty cycle > 85% => Connect regulator to the inlet manifold
    a. Set parameter 495, 533, 2202
    b. Adjust the system gas pressure
    c. Set parameter 1653, 195
    d. Check duty cycle
e) If Duty cycle is still > 85% => Set parameter ‘15169-Split Fuel Gas DCY Control’ to 85% (above 85% DCY additional petrol will be injected)

16) Check if maximum petrol injector duty cycle during gas mode does not exceed 95%.

17) Judge:
a. Drivability
b. Switch over behaviour Petrol -> LPG -> Petrol
c. Engine behaviour running cold and warm.
d. Shifting / changing gears.
e. The engine behaviour during and after a “fuel cut off”, especially when falling back to idle rpm.
f. Stable idle, when pushing power steering to maximum limit and when shifting from park/neutral to gear and backwards.

18) Final check:
   a. Check system pressure and set to correct value if necessary.
   b. OBD- and AFC fault codes.
   c. All installed components [hoses, wirings components].
   d. Coolant level and the coolant connections, reducer and T-splices.
   e. Gas & petrol leakages.

19) Save the calibration file. Archive the calibration for future use. (Same vehicle, type, engine, etc.)

20) Handover the car and instruction manual to the customer.

4 Parameter overview

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
Vehicle	Engine characteristics			Gas Pressure	Gas Pressure	Level Sensor	Tank Level Indicator	Service
1342 Vehicle make	63 Number of cylinders			195 Tank Empty Pressure	2223 System Pressure Sensor	444 Tank Level Sensor	2276 Tank indication Strategy	2305 Service Interval Enable
23 Table Vehicle info	1331 Engine Displacement				1653 System Idle pressure	76 Table User Defined Tank Level Sensor	155 Table Tank Indication LED Color	2306 Service Interval Max Time
	1332 Engine Power	ECT	ECT		ECT	616 Tank Level Sensor Voltage	157 Table Tank Indicator LED Tank Empty color	2307 Service Interval Warn Time
		6 Table ECT correction	62 Switch over ECT		2810 ECT Sensor	617 Tank Level Sensor Pull Up	4152 Tank Level Refuse Rise During Wake	
	Gas injector	Gas injector		Gas injector	1 Table ECT / Regulator Sensor			
Power	1335 Gas Injector	226 Gain		694 Switch Back to Petrol Above Gas DCY	Shut off Valve	Shut off valve	Fuel Status LED	ValveCare
672 Power Down Mode Enable		230 Offset			17457 Number of regulators	2401 Output 1 Tank Valve	2273 Fuel Status LED Strategy	550 AD2 Analog input 2
		15169 Split fuel Gas DCY			2407 Output 2 Regulator Valve	4335 Tank Valve PWM	158 Table Fuel LED Status	1750 ValveCare Bottle Time Min
OBD		Table 64 Open Loop Table			4336 Regulator valve PWM		159 Table Fuel LED Master Fuel Color	1751 ValveCare Time Max
22 table OBD Tester Emulation Service	RPM		RPM	RPM	6363 Output 3 regulator / Tank	Multiple Tank	Strategy	Critical Trouble Codes
99 table OBD Fix	924 RPM Signal Source		61 Switch over RPM	4309 Switch Back to Petrol Above Maximum RPM		11248 Multiple Tank Valve Strategy	2629 Switch Blink During Gas-Not-Allowed	7 Table Critical Trouble Codes
	619 RPM Trigger Level			3759 Switch Back to Petrol Below Minimum RPM		6363 Output 3 regulator / Tank	3653 Switch Turn Off After Engine Off-Time	
	297 RPM Factor					11613 Tank Volume 1		
	2282 Engine RPM Number Of Samples					11614 Tank Volume 2		
	MAP		MAP		MAP	1039 LSS2 Function	Daylight correction	
	533 AD1 Analog input 1		1741 Switch over to Gas MAP Limit		495 Regulator MAP reference		1562 Daylight Correction Type	
	2202 MAP sensor						57 Table Switch Daylight Correction	
	4 Table MAP Sensor							
	Lambda (λ)	Lambda (λ)	Delay	Delay			Beeper	
	1221 Number of banks	2192 Time open loop (TOL)	139 Switch over to Gas Delay	366 Switch over to Petrol delay			2292 Beeper Volume	
	562 AD3	2193 Error Time Lambda (ETL)	61 Table Switchover time					
	1174 λ sensor 1	29 Table Apply Corrections	Conditions	Conditions				
	563 AD4	46 Table NOx Control Cycles	49 Table Switchover conditions VSI-2	75 Table Switch Back Conditions				
	1175 λ sensor 2	47 Table NOx Control Corr.						

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
Master / Slave					Master / Slave	Master / Slave		
990 CAN 1 protocol Selection					2589 Slave Regulator SO Valve	2588 Slave Tank SO Valve		
996 CAN 2 protocol Selection	Petrol Low Fuel Pressure	FCO	Corrections			21412 Tank Volume Slave		
1002 Master Slave Selection	493 Variable Petrol Fuel Rail Pressure	675 Petrol Pulse width min	1242 Switch Over correction					
	2517 Channel 5 Own Sensor	1236 FCO Correction	1240 Switch Over Correction Hold Inj					
	2522 Channel 5 Sensor Select	1235 FCO corr. decay	1241 Switch Over Correction decay					
	44 Table Petrol Low pressure Sensor	1234 FCO corr. Hold inj.						
	7055 OEM Sensor Ground Offset*1							
	4828 Simulation Channel 1 Allowed							

5 AFC Management

5.1 Vehicle

Description

Enter the vehicle data in the AFC. This information is added into the log file and snapshot data. This makes it clear as to which vehicle the data and adjustments are from.

Conditions

- This identification name will be used as file name, when saving the calibration.

Parameters

ID	Name	Value	Unit	Default (min/max)	Explanation
1342	Vehicle Make	Value	-	N/A	The vehicle name will also be stored in the log file.
23 Table	Vehicle identification	Table		VSI-2 Universal Default Calibration	This identification name will used as file name, when saving the calibration.

Linked parameters

- None

5.2 Power

Conditions

- Use this parameter if sensor fault occurs during startup of the system.

Parameters

ID	Name	Value	Unit	Default (min/max)	Explanation
672	Power Down Mode Enable	Yes/No	-	Yes	Yes: The AFC will shut down completely; - Startup will take 1 sec - Very low current ~20 mA during sleep No: AFC will shut down completely; - Startup will take 20 msec - Current ~55 mA

Linked parameters

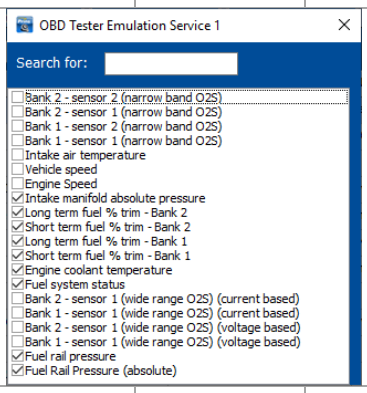
- None

5.3 OBD

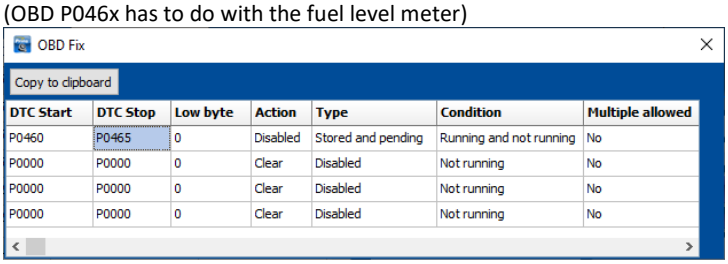
Conditions

- Use this parameter if sensor fault occurs during startup of the system.

Parameters

ID	Name	Value	Unit	Default (min/max)	Explanation
22 table	OBD Tester Emulation Service	List of options	-	-	Select what should be requested via the CAN-bus. These selected messages can be logged in menu Monitoring. Only select the messages needed for diagnostics. The more messages selected, the more load on the CAN bus.
					An example of default selected messages.
99 table	OBD Fix	Table			With the use of this table OBD fault codes will de erased.

In this example the stored and pending OBD fault code P0460 until P0465will be cleared during a running and not running engine. (OBD P046x has to do with the fuel level meter)



DTC Start	DTC Stop	Low byte	Action	Type	Condition	Multiple allowed
P0460	P0465	0	Disabled	Stored and pending	Running and not running	No
P0000	P0000	0	Clear	Disabled	Not running	No
P0000	P0000	0	Clear	Disabled	Not running	No
P0000	P0000	0	Clear	Disabled	Not running	No

DTC Start: DTC trigger to clear fault code.
DTC Stop: Last DTC trigger in the sequence to clear fault code. (start P0460 Stop P0465)
Low byte: Do not modify this.
Action:
- Clear: Clear the trouble code
- Disable: function the test if the fault code will appear again

Type:
- Pending: ECM detects a fault.
- Stored: ECM detects the error for a certain number of times and the engine light up.

Condition:
- Running: OBD code will be cleared during running engine (Risk of irregular running engine during erasing fault codes)
- Not running: OBD code will be cleared during active ignition

Multiple allowed:
- Yes: All OBD fault codes will be erased.
- No: Only entered fault codes at 'DTC Start – DTC Stop' will be cleared.

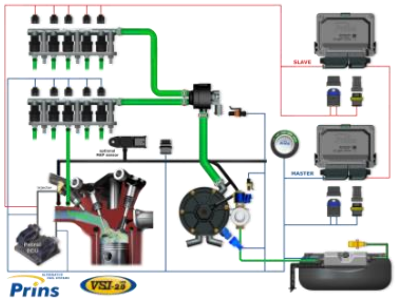
Linked parameters

- None

5.4 AFC Master / Slave

Description

Two AFC V2.1 8D can be combined to a Master – Slave system to handle 10 or more cylinder engines. (AFC partno. 180/700024)
The Master and Slave AFC's exchange information with each other by CAN-bus. Some input signals need to be connected to both AFC's, like +12V petrol injectors, RPM, AD inputs and if one reducer is used the gas pressure. The CAN bus is not fast enough to process signals as live signals. Refer to the electrical diagram on the members area or at the end of this document.



Load firmware
Special online firmware needs to be programmed into both Master and Slave AFC separately.

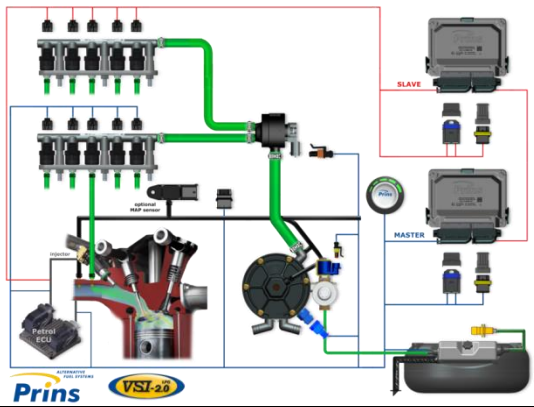
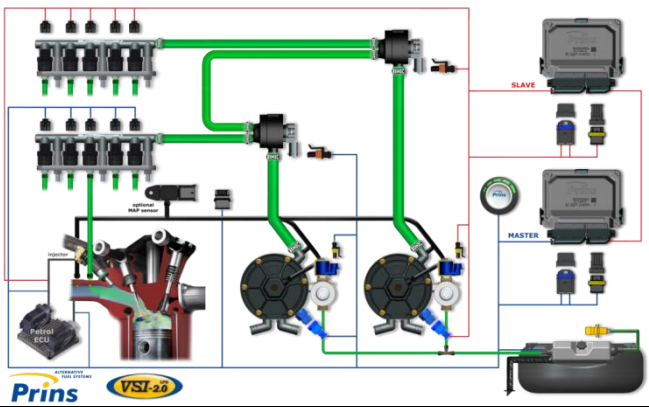
Master – Slave Calibration
Connect the diagnostic tool to the Master AFC for calibration. The Master AFC will synchronize all calibration parameter changes with the slave AFC.
For a 10 cylinder engine, enter 5 cylinders into the Master AFC. The Slave AFC will also be calibrated as a 5 cylinder engine. For 12 cylinders, use 6. Etc.

Synchronized Master – Slave
If the Master AFC is connected, various settings will be synchronized between the Master and Slave AFC, such as:
Reset Service Hours

- Set the calibration parameters for both Master and Slave AFC
- Import or export partial calibrations

Non- Synchronized information
The information in the list below can only be read out directly from the AFC. Connect the diagnostic tool directly to the Master or Slave AFC to:

- Monitor and log process parameters
- Read out fault codes (The Master will inform that fault codes are present in the Slave AFC)
- Reset Max. temperatures and adaptive values
- Load / save Calibration
- Program firmware
- Read out AFC information

	
Master – Slave 1 reducer	Master – Slave 2 reducer2

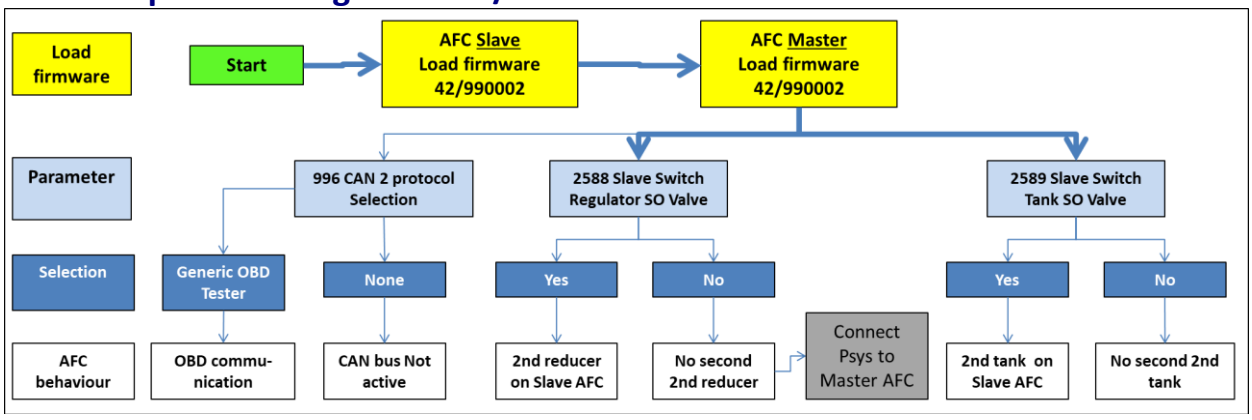
Conditions

- Master – Slave functionality is available in AFC V2.1 Full and all AFC versions that follow.
- Connect signals to both AFC's:
  - Engine speed
  - CAN-bus to the same pins
  - + Petrol injector
  - MAP-sensor AD1 (if used)
  - AD2 (if used)
- Connect +12 battery to slave AFC to activate the slave-mode. (191/140018)

Calibration parameters – AFC management – Master / Slave

ID	Name	Value	Default (min/max)	Explanation
990	CAN 1 protocol Selection	Generic OBD Tester Emulation / PSA Fuel Gauge Reset/ Master-Slave *	Generic OBD Tester	**Generic OBD Tester Emulation**: OBD communication protocol **Generic OBD Tester Gateway:** Activate OBD Gateway function **PSA Fuel Gauge Reset**: To reset the fuel gauges of PSA related vehicles via CAN-bus without a special relay. **Master Slave**: Communication between master & slave (only available with Master/Slave firmware) **None**: No CAN communication active
996	CAN 2 protocol Selection	Generic OBD Tester Emulation / Generic OBD Tester Gateway / PSA Fuel Gauge Reset/ None	None	
1002	Master Slave Selection	Automatically on CONA 67 / Disabled / Master / Slave	Automatically on CONA 67	**Automatically on CONA 67:** Slave AFC when +12V connected on pin A67 **Disabled:** Master Slave diasbled **Master:** Set if AFC is the master **Slave:** Set if AFC is the slave

Roadmap AFC settings Master / Slave



Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
Master / Slave					Master / Slave	Master / Slave		
990 CAN 1 protocol Selection					2589 Slave Regu-lator SO Valve	2588 Slave Tank SO Valve		
996 CAN 2 protocol Selection								

6 Engine

6.1 Engine characteristics

Description

Set the parameters to create a working calibration.

Conditions

- The number of cylinders is crucial for correct functioning of the gas system.

Parameters - basic

ID	Name	Value	Unit	Default (min/max)	Explanation
63	Number Of Cylinders	Value	-	4	The gas injector outputs will be activated. Only the activated injector outputs will be activated and monitored for diagnostic.
1331	Engine Displacement	Value	cm^3	0	Enter the engine displacement for correct identification of the calibration. Often the information may be found in the registration documents of the vehicle.
1332	Engine Power	Value	kW	0	Enter the engine power for correct identification of the calibration. Often the information may be found in the registration documents of the vehicle.

Linked parameters

- None

6.2 Gas injector

Description

Different types and sizes of gas injectors may be selected.

Conditions

- Wrong selection may influence the drivability such as stalling at round abounds, rough idle, etc.

Parameters – Gas injector

ID	Name	Value	Unit	Default (min/max)	Explanation
1335	Gas Injector	Pre-defined Prins injector types	-	N/A	Select the installed injector type. Different injectors may have different specifications and current strategies. Wrong selection of the injectors may influence the drivability.

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
	Gas injector	Gas injector		Gas injector				
	1335 Gas Injector	226 Gain		694 Switch Back to Petrol Above Gas DCY				
		230 Offset						
		15169 Split fuel Gas DCY						
		Table 64 Open Loop Table						

6.3 RPM

Description

The RPM signal is needed for safety and various calculations. The lock-off solenoid valves and gas injectors will not be enabled without an RPM signal.
Check if the rpm displayed in the Prins AFC software is equal to the actual engine RPM.

Conditions

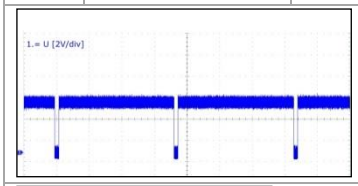
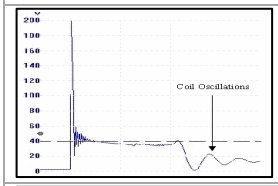
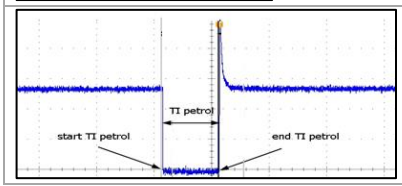
It is not possible to switch over to gas without an rpm signal.
An incorrect RPM signal has a negative influence on the following parameters:
Process parameters:

- Gas Inj DCY Cyl 1-8
- Petrol Inj DCY Cyl 1-8
- RPM

Calibration Parameters:

- Switch Over RPM [61]
- Open loop table (Only visible with license module “Open loop control VSI” (Timax.))

Parameters – RPM source

ID	Name	Value	Unit	Default (min/max)	Explanation
924	RPM Signal Source	Camshaft / Ignition coil / Petrol injector/ Petrol injector + MAP	-	Camshaft	**Camshaft**: Block wave signal (signal wire from active ignition coil could also be used) **Ignition coil:** Switched wire to ground on the ignition coil. **Petrol injector**: RPM will be calculated from the injector pulse. Lock off valves will be closed after 2 s Fuel Cut Off and activated with a petrol injector signal. Petrol pre and post injections will influence the RPM. This can cause unwanted behavior. **MAP + Petrol injector:** RPM will be calculated from the injector pulse. If the MAP value is lower that 600mbar during Fuel Cut Off, the lock off valves will stay open.
619	RPM Trigger Level	0,8 / 3,0 / 5,6 / 19,7	V	3,0	Only change the default trigger level if the RPM signal is not displayed properly.
2282	Engine RPM Number Of Samples	1-20	-	4	
297	RPM Factor	-	-	1 (0-255)	If the engine speed of the vehicle is not equal to engine speed read by the AFC, then it can be corrected by filling in the correct RPM factor.
					Example of a Camshaft Hall signal
					Example of an Ignition coil signal 1 puls per 2 revolutions
					Example of an Injector signal

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
	RPM		RPM	RPM				
	924 RPM Signal Source		61 Switch over RPM	4309 Switch Back to Petrol Above Maximum RPM				
	619 RPM Trigger Level			3759 Switch Back to Petrol Below Minimum RPM				
	297 RPM Factor							

6.4 MAP

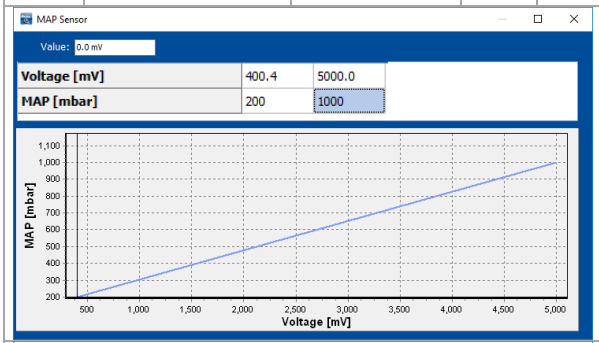
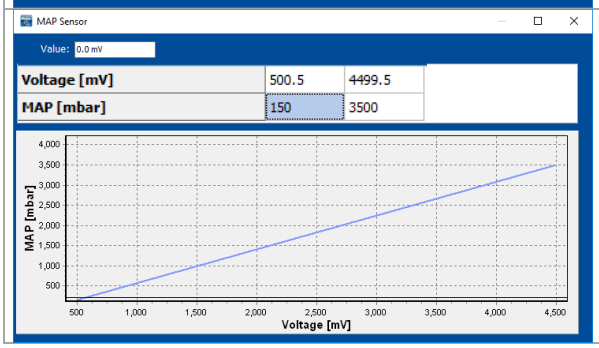
Description

If the operating range of the reducer is not sufficient, then the reducer may be connected to the inlet manifold pressure with a vacuum hose. The gas pressure will lower during idle and the injection time will increase. The gas pressure will increase during high engine loads and the duty cycle of the gas injector will lower. Always use a regulator connected to the inlet manifold pressure with a forced induction engine.
Different MAP sensors have been used. Select the installed sensor.

Conditions

- Set Parameter [495] Regulator MAP reference to yes in order to activate this function.
- Use with low gas injection time <2,4ms at idle and a high duty cycle at high revs with high load.
- Different MAP sensors have been used. Select the installed sensor.

Parameters – MAP sensor

ID	Name	Value	Unit	Default (min/max)	Explanation
533	AD1 Analog input 1	Disable / Low pressure petrol / MAP / ValveCare	-	Disabled	Connect the MAP sensor to this AD input 1 and select MAP
2202	MAP sensor	1, 15 bar Bosch / 2,5 bar Bosch/ Disabled / Table lookup	-	Disabled	Different sensors have been used. Also the OEM MAP sensor can be connected to the AFC. Use the Table lookup to configure the OEM MAP sensor.
4 Table	MAP Sensor	Table	mV / mbar		Only linear MAP sensors can be configured. Read out the voltage and pressure during idle and at engine off. Use an OBD reader to measure these values. Extrapolate the values in case of and forced induction engine. Or use the Wizard.
					An example of an MAP sensor used on an atmospheric engine. The highest MAP pressure will not be higher than the ambient pressure. Voltage (mV): Lowest values 400,4 / Highest values 5000 MAP (mbar): Lowest values 200 / Highest values 1000
					An example of an MAP sensor used on a forced induction engine. The highest MAP pressure will be higher than the ambient pressure. In this example 3500 mbar absolute. Voltage (mV): Lowest values 500,5 / Highest values 5000 MAP (mbar): Lowest values 150 / Highest values 3500

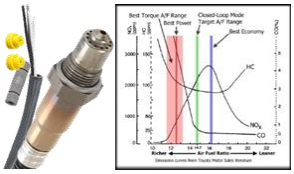
Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
	MAP		MAP		MAP			
	533 AD1 Analog input 1		1741 Switch over to Gas MAP Limit		495 Regulator MAP reference			
	2202 MAP sensor							
	4 Table MAP Sensor							

6.5 Lambda (λ)

Description

The oxygen sensor monitors the mixture. The signal can be used for preventing OBD fault codes and engine failure. Oxygen sensor signals may also be used for extra fine tuning during calibration and can be helpful during diagnostics.
A variety of sensors can be selected. The mixture will be lean during fuel cut off and rich at WOT. Read out the values and select the correct sensor.

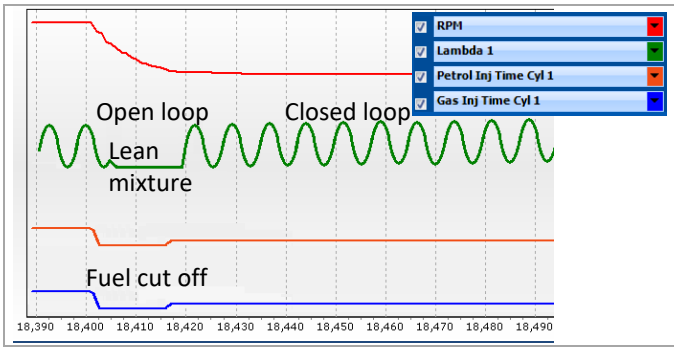


Conditions

- Only AD input 3 & 4 are designed for oxygen sensor signals
- Only narrow band oxygen sensors are supported by the AFC.

Parameters – Lambda (λ)

ID	Name	Value	Unit	Default (min/max)	Explanation
1221	Number of banks	1 /2		1 (1/2)	Number of cylinder banks with their own upstream oxygen-sensor. Upstream: before catalyst.
562	AD3	Disabled / Lambda sensor 1 / Lambda sensor 2 / Low pressure petrol / MAP / ValveCare		Disabled	AD input 3 has been designed for oxygen sensor signals
1174	λ sensor 1	0,5-1,5 / 0-0,5 / 0-1 / 0-5 / 1-0 / 1-2 / 2,5-3,5 / 5-0 / Disabled	V	Disabled	Type of upstream oxygen 1 sensor (lean/rich) Upstream: before catalyst.
563	AD4	Disabled / Lambda sensor 1 / Lambda sensor 2 / Low pressure petrol / MAP / ValveCare		Disabled	AD input 4 has been designed for oxygen sensor signals
1175	λ sensor 2	0,5-1,5 / 0-0,5 / 0-1 / 0-5 / 1-0 / 1-2 / 2,5-3,5 / 5-0 / Disabled	V	Disabled	Type of upstream oxygen 2 sensor (lean/rich) Upstream: before catalyst.



During closed loop the oxygen sensor signals will fluctuate between a minimum and maximum value. Notice these values.
The mixture is lean during fuel cut off.

Select the correct sensor. (lean-rich)

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
	Lambda (λ)	Lambda (λ)						
	1221 Number of banks	2192 Time open loop (TOL)						
	562 AD3	2193 Error Time Lambda (ETL)						
	1174 λ sensor 1	29 Table Apply Corrections						
	563 AD4	46 Table NOx Control Cycles						
	1175 λ sensor 2	47 Table NOx Control Corr.						

6.6 Petrol Low Fuel pressure

Description

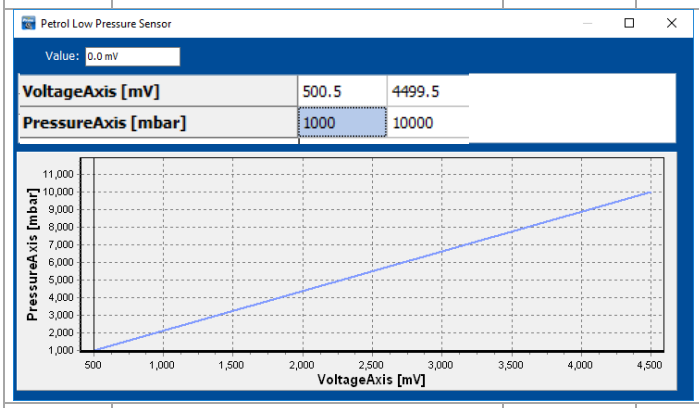
When a vehicle is equipped with a low pressure petrol fuel sensor then this signal may be read out by the AFC. The calculated gas injection times will be corrected based on the actual petrol fuel rail pressure.

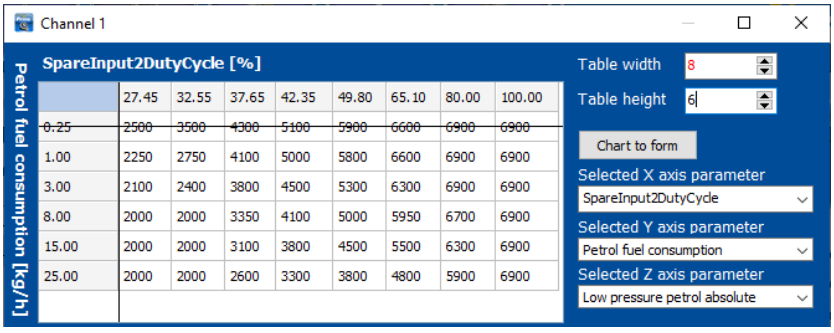
Conditions

- First set this parameter and the table before calibrating the base mixture (Gain/offset).

Parameters - Petrol Low Fuel pressure

ID	Name	Value	Unit	Default (min/max)	Explanation
493	Variable Petrol Fuel Rail Pressure	Yes/No	-	No	The calculated gas injection times will be corrected based on the actual petrol fuel rail pressure. Set this parameter before calibrating the base mixture (Gain/offset). Connect the signal of the fuel pressure sensor to AD input 2 or 4.
2517	Analog Channel 5 Is Own Sensor *1	Yes/ No/ Yes for master, No for slave	-	No	**Yes**: Prins dedicated low pressure petrol sensor **No**: OEM sensor or NOT Prins sensor Yes for Master, No for slave: OEM sensor connected to Master; no connection to Slave.
2522	Analog Channel 5 Sensor Select *1	Disabled/ Low pressure petrol		Low pressure petrol	Connect the low pressure petrol sensor to this AD input 5 and select low pressure petrol.
7055	Analog Dedicated OEM Sensor Ground Offset Enable *1	Yes/No	-	No	Connect the OEM sensor ground offset wire to eliminate potential voltage differences.
4828	Simulation Channel 1 Allowed Specifier *1	Always/ Condition 1/ Never		Condition 1	**Always**: Simulate always when running on gas. **Condition 1**: Simulate when petrol low pressure > 4 bar (4000 kpa) **Never**: Never simulate

<table>
<tr><td>44
Table</td><td>Petrol Low pressure Sensor</td><td>Table</td><td>-</td><td>Default Prins values</td><td>Only linear sensors can be configured.
Read out the voltage and pressure during idle and at rpm with high load. An OBD scanner may be useful to measure the sensor characteristic!
This table can also be used for Petrol Low Fuel Pressure simulation. Please contact Prins when simulation is needed.</td></tr>
<tr><td colspan="4"> 
</td><td></td><td>An example of a petrol low fuel sensor.
<table><tr><th></th><th>Lowest values</th><th>Highest values</th></tr><tr><td>Voltage (mV)</td><td>500,5</td><td>4499.5</td></tr><tr><td>MAP (mbar)</td><td>1000</td><td>10000</td></tr></table></td></tr>
<tr><td>48
Table</td><td>Channel 1 *1</td><td>Petrol low pressure</td><td></td><td></td><td>Simulation table of low petrol pressure during gas modes.

OBD communication must be present to read the fuel consumption.</td></tr>
<tr><td colspan="4"> 
</td><td></td><td>Petrol low pressure Pump duty cycle (%): PWM signal from petrol pump inside petrol tank or signal from petrol pump driver.

Petrol fuel consumption (kg/h): Current petrol fuel consumption read from the CAN-bus

Low pressure petrol absolute (kPa): Fuel pressure derived from duty cycle and consumption.</td></tr>
<tr><td colspan="6">*1: Only available in VSI-2 Universal DACS Firmware 043/000009</td></tr>
</table>

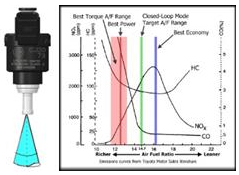
Linked parameters

- None

7 Mixture

7.1 Gas injector - Mixture

Description



The Gain Factor [RC] is one of the most important mixture adjustment and is displayed in percent. It is the relation between the petrol injection times and gas injection times. The petrol injection times will be multiplied by the gain factor to calculate the GAS injection times.
Mixture adjustment can be made with the offset during low load or increased idling.
If the fuel trims during petrol mode are more than 10%, be aware of deviations within the petrol system.
Normally the fuel trims will not exceed 8%.

Conditions

Methods to tune the Gain Factor

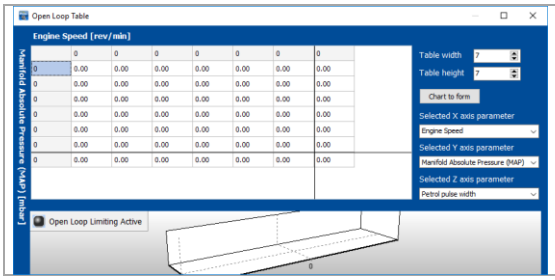
- OBD scanner: (The most accurate and recommended method)
  - Read out the fuel trims during driving in gas mode with an EOBD scanner.
  - Tune the fuel trims on gas mode to the same value as during petrol mode.
- Without OBD scanner: (This method is less accurate)
  - Compare the petrol fuel injection times during petrol & gas mode. These must remain identical.

Procedure

- Inform chapter: 3 VSI-2 Quick Start Calibration

Parameters - Gas injector - Mixture

ID	Name	Value	Unit	Default (min/max)	Explanation
226	Gain [RC]	Value	%	150,00 (60-270)	Basic gas injection time = petrol injection time x GAIN factor
230	Offset	Value	ms	0 (-2,0-2,0)	The offset adjusts the fuel trims during low engine load at during increased idling. Minimal gas injector time: 2,5ms
15169	Split fuel Gas DCY control	Value	%	Disabled = 0 (0/199.2)	Above this value, the AFC will start blending petrol. **0**: disabled **DCY Gas injection < value**: only gas injection **DCY Gas injection > value**: gas and petrol injection
64 Table	Open Loop Table	RPM / MAP/ Petrol injection time	ms	Disabled = 0 0-65	Use the “open loop table” if limitation of enrichment is needed. Fill in the maximum petrol injection time which is used to calculate the gas injector time. An indication is shown in the table when the limitation is active.



An example of unfilled table.

Notice the indication 'Open Loop Limiting Active', this will be green during active limitation.

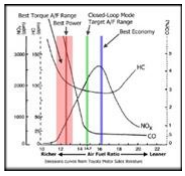
Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
	Gas injector	Gas injector		Gas injector				
	1335 Gas Injector	226 Gain		694 Switch Back to Petrol Above Gas DCY				
		230 Offset						
		15169 Split fuel Gas DCY						
		Table 64 Open Loop Table						

7.2 ECT correction - Mixture

Description

The amount of injected gas may be modified during low engine temperatures. With this table the petrol fuel enrichment may be corrected during gas mode.

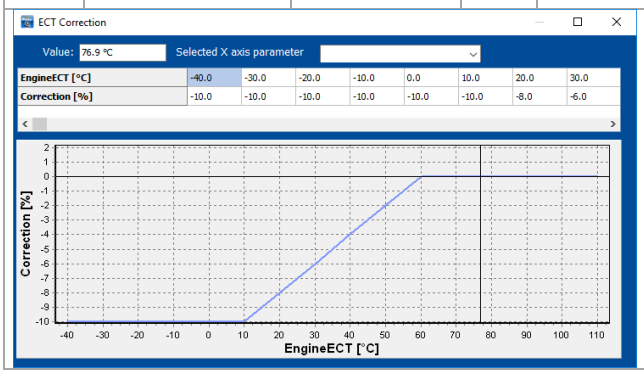


Conditions

- Switch over to gas temperature at low engine temperatures.

Parameters - ECT - Mixture

ID	Name	Value	Unit	Default (min/max)	Explanation
6 Table	ECT correction	Gas amount / engine temperature	-	-	The amount of injected gas may be modified during low engine temperatures. With this table the petrol fuel enrichment may be corrected during gas mode.



An example of a correction of the injected gas amount.

	Lowest values	Highest values
Voltage (mV)	500,5	4499.5
MAP (mbar)	1000	10000

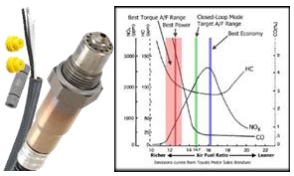
Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
		ECT	ECT		ECT			
		6 Table ECT correction	62 Switch over ECT		2810 ECT Sensor			
					1 Table ECT / Regulator Sensor			

7.3 Lambda (λ) – Mixture

Description

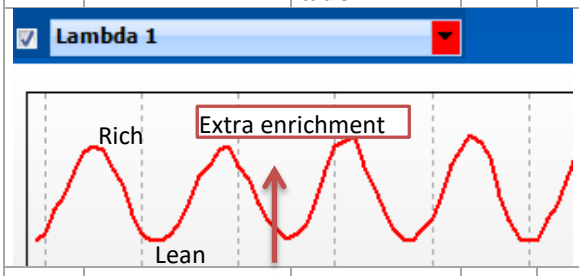
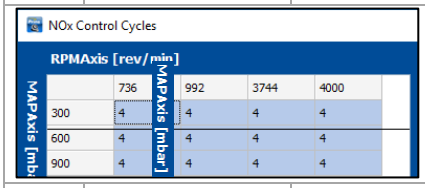
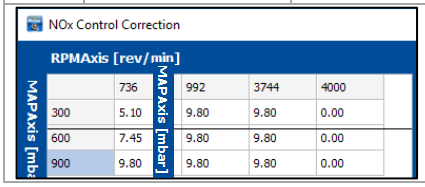
The oxygen sensor monitors the mixture. The signal can be used for preventing OBD fault codes and engine failure. Oxygen signals may also be used for extra fine tuning during calibration and will be helpful during diagnostics.



Conditions

- NOx emission corrections may be used to fine-tune the gas mixture to prevent downstream oxygen sensor related errors.

Parameters – Lambda (λ) - Mixture

ID	Name	Value	Unit	Default (min/max)	Explanation
2192	Time Open Loop (TOL)	Value	s	90,0	Time counter before oxygen guard (ETL 2193) is active after each engine start
2193	Error Time Lambda (ETL)	Value	s	45,0	Time counter for lean mixture error, only active when oxygen sensor is enabled (no counts during FCO-status)
29 Table	Apply corrections	Apply Nox correction &/OR Apply open loop table	-	Apply open loop table	Set this table to activate table 46 NOx Control Cycles and/or table 47 NOx Control Correction
					To enrich the mixture if the exhaust mixture goes from lean to rich during open loop.
46 Table	NOx Control Cycles	Table	-	0	The amount of injections to enrich the mixture if the exhaust mixture goes from lean to rich during open loop. The mixture will only be enriched during gas modes. 1 cycle is only 1 injection.
					Set the amount of cycles in relation of the engine speed and MAP. 4 cycles: - 4 injections to extra enrich the mixture, when the exhaust mixtures goes from lean to rich
47 Table	NOx Control Correction	Table	-	0	To enrich the mixture in percentage when the exhaust mixture goes from lean to rich during open loop. The mixture will only be enriched during gas modes.
					Set the amount of extra gas (%) in relation to the engine speed and MAP.

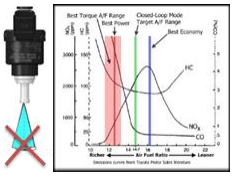
Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
	Lambda (λ)	Lambda (λ)						
	1221 Number of banks	2192 Time open loop (TOL)						
	562 AD3	2193 Error Time Lambda (ETL)						
	1174 λ sensor 1	29 Table Apply Corrections						
	563 AD4	46 Table NOx Control Cycles						
	1175 λ sensor 2	47 Table NOx Control Corr.						

7.4 Fuel Cut Off (FCO) – Mixture

Description

Use the Fuel cut off parameters if the engine does not pick up smoothly after the fuel cut off. This ensures a mixture which can be richer or leaner for a short while after fuel cut-off.

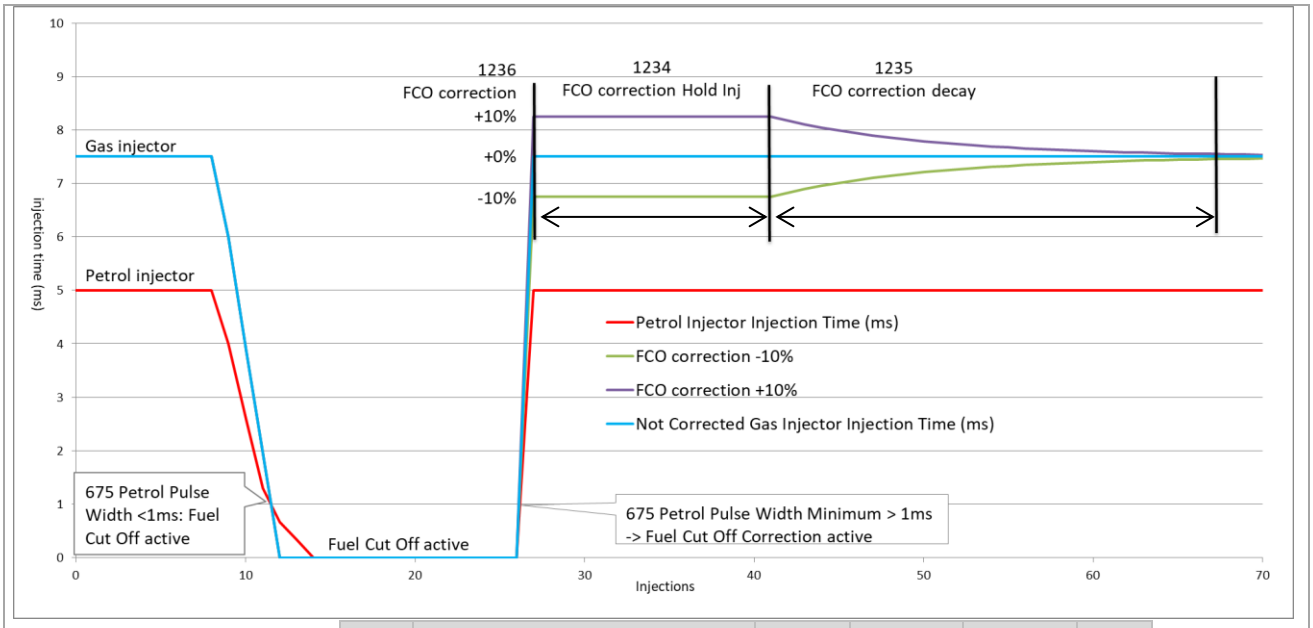


Conditions

- Engines that start to inject extremely late after fuel cut-off (< 1200 RPM).

Parameters - Fuel Cut Off - Mixture

ID	Name	Value	Unit	Default (min/max)	Explanation
675	Petrol Pulse Width Minimum	Value	ms	1,0 (0-1)	If the petrol injector time becomes below this value then the gas injector will not inject anymore. The status Fuel Cut Off (FCO) will become active.
1236	FCO correction	Value	%	0 (-25/25)	The Gas injection time will be modified for a certain number of injections after a Fuel Cut-Off. Gas inj time = Normal Gas inj +/- percentage.
1234	FCO correction Hold Inj	Value	-	0 (0/100)	Number of petrol injections to hold Fuel Cut Off correction value before decay [1235]
1235	FCO correction decay	Value	%	10,16 (0/100)	Percentage by which the Fuel Cut Off correction reduces to normal injection time.



ID	Name	Green	Blue	Purple	Unit
675	Petrol Pulse Width Minimum	1	1	1	ms
1236	FCO correction	-10	0	10	%
1234	FCO correction Hold Inj	15	15	15	-
1235	FCO correction decay	10	10	10	%

Linked parameters

- None

8 Switch over to Gas

8.1 Switch over to gas

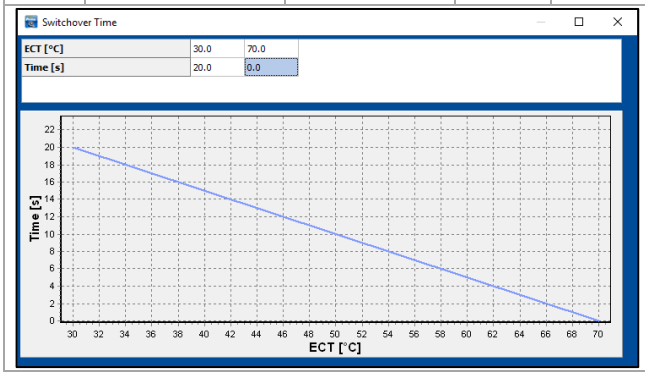
Description

Seamless switch over to gas may depend on the structure of the engine and the position of the gas nipples.

Conditions

- The switch-over-to-gas parameters can be adjusted if the switch over does not go smoothly.

Parameters - Switch over to Gas

ID	Name	Value	Unit	Default (min/max)	Explanation
62	Switch over ECT	Value	°C	30-50 (30-120)	The minimum engine temperature to switch over to gas mode. The default temperature depends on amount of cylinders
61	Switch over RPM	Value	rpm	0 (0-65535)	Use when engine does not switch over to gas smoothly at low rpm and low engine temperature.
1741	Switch over to Gas MAP Limit	Value	Mbar	0 (0-65535)	Use this parameter if the switch over to gas during high load is not smooth. Above the value the system will not switch over to gas mode.
49 Table	Switchover conditions VSI-2.0	Active / inactive	-	-	Set this parameter to activate parameter 1741 Switch over to Gas MAP Limit
139	Switch over to Gas Delay	value	cycles	2 (0-8)	The amount of cycles to switch over from petrol to gas per cylinder.
61 Table	Switchover time	ECT vs. time	-	-	The delay time to switch over to gas depends on the coolant temperature during engine start. This timer counts down after detecting an RPM. This remains at zero, during engine running.
					Example: If the coolant temperature is 40°C during start, then the system switches over to gas after 15 seconds. Lowest values: ECT (°C) 30, Time (s) 20 Highest values: ECT (°C) 70, Time (s) 0

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
		ECT	ECT		ECT			
		6 Table ECT correction	62 Switch over ECT		2810 ECT Sensor			
					1 Table ECT / Regulator Sensor			
	RPM		RPM	RPM				
	924 RPM Signal Source		61 Switch over RPM	4309 Switch Back to Petrol Above Maximum RPM				
	619 RPM Trigger Level			3759 Switch Back to Petrol Below Minimum RPM				
	297 RPM Factor							
	MAP		MAP		MAP			
	533 AD1 Analog input 1		1741 Switch over to Gas MAP Limit		495 Regulator MAP reference			
	2202 MAP sensor							
	4 Table MAP Sensor							

8.2 Switch over to gas correction

Description

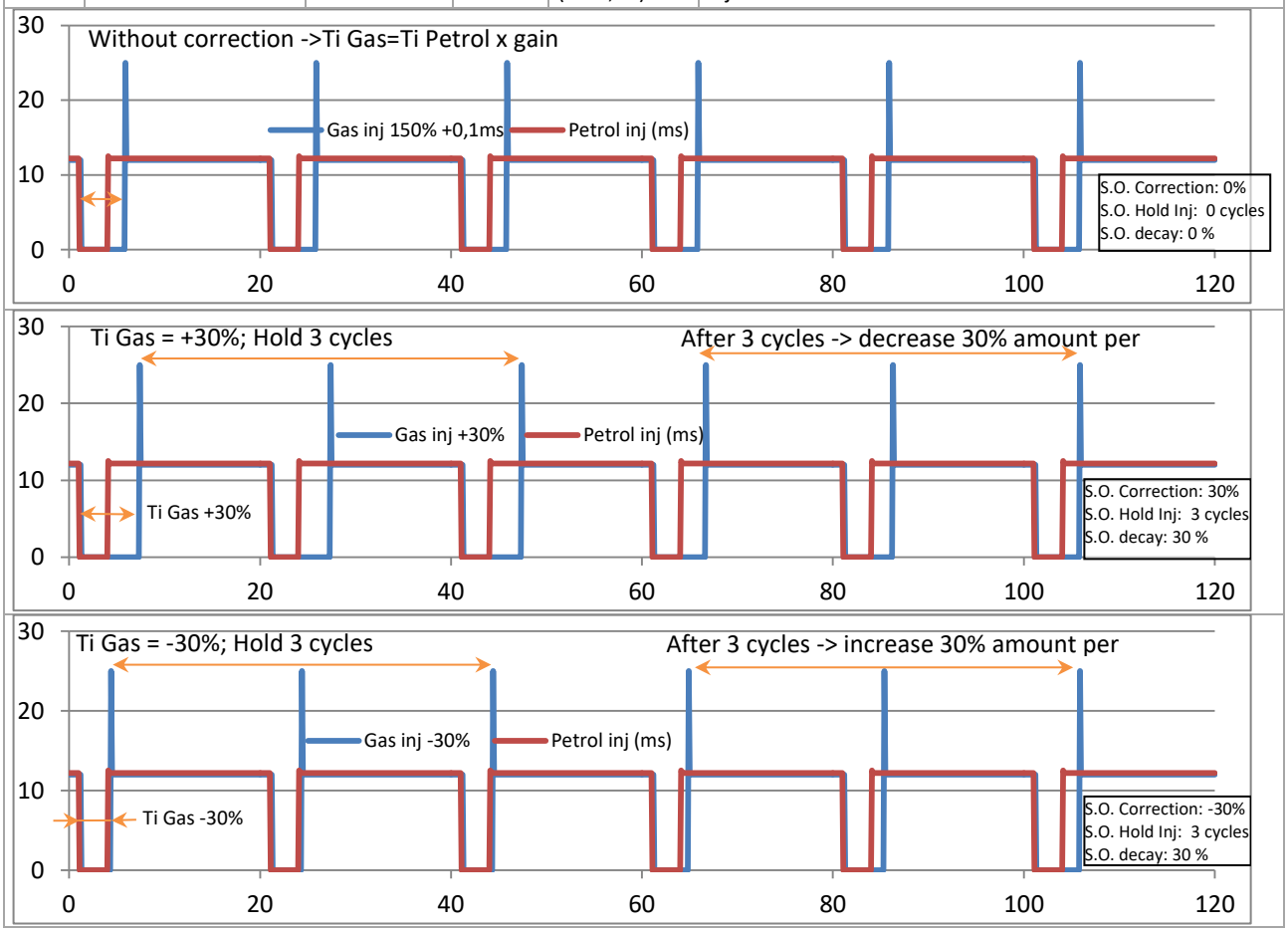
The mixture can be adjusted during switch over from petrol to gas. Less or more gas can be injected during the switch over. This correction can be set between -30% and +30%. Use the “switch over correction” if the switch over behaviour is not optimal. Check behaviour with different engine loads. In case the switch over is still not smooth during driving conditions -> check the electrical petrol injector interruption wiring connection! Use the ‘Injector – Actuator test’ available in the diagnostic tool.

Conditions

- Corrections often used when long hoses have been used between injector and inlet manifold.
- Corrections also used for CNG.

Parameters - Switch over to Gas correction

1242	Switch Over correction	Value	%	0 (-30-30)	The Gas injection time will be modified for a certain amount of injections after switch over to gas. Gas inj time = Normal Gas inj +/- percentage.
1240	Switch Over Correction Hold Inj	Value	Cycles	0 (0-100)	Number of petrol injections to hold the correction value before decay [1242]
1241	Switch Over Correction decay	Value	%	10,15 (0-99,61)	Percentage by which the correction reduces to normal injection time.



Linked parameters

- None

9 Switch back to Petrol

9.1 Switch back to petrol strategy

Description

The system may switched back automatically to petrol during various situations.

Conditions

- Normally only parameter 195 Tank Empty Pressure needs to be modified.

Parameters - Switch back to Petrol

ID	Name	Value	Unit	Default (min/max)	Explanation
195	Tank Empty Pressure	Value	mbar	1500	Minimum system pressure. (below this value the system switches back to petrol) XD3 = System Idle Pressure minus 400mbar XD4 or XD5 = System Idle Pressure minus 600mbar
694	Switch Back to Petrol Above Gas DCY	Value	%	120 (0-120)	If the duty cycle exceeds the value, the system switches back to petrol mode. Activate this parameter in table 75 Switch Back Conditions
3759	Switch Back to Petrol Below Minimum RPM	Value	Rpm	0 (0-65535)	If the engine speed is below this value, the system switches back to petrol mode. Activate this parameter in table 75 Switch Back Conditions
4309	Switch Back to Petrol Above Maximum RPM	Value	Rpm	0 (0-8160)	If the engine speed exceeds the value, the system switches back to petrol mode. Activate this parameter in table 75 Switch Back Conditions
366	Switch over to Petrol delay		Cycles	2 (0-8)	The amount of cycles to switch over from gas to petrol per cylinder.
75 Table	Switch Back Conditions	-	-	-	Enable/disable parameter [694] Gas injector duty cycle, [3759] Minimum RPM, [4309] Maximum RPM

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
	Gas injector	Gas injector		Gas injector				
	1335 Gas Injector	226 Gain		694 Switch Back to Petrol Above Gas DCY				
		230 Offset						
		15169 Split fuel Gas DCY						
		Table 64 Open Loop Table						
	RPM		RPM	RPM				
	924 RPM Signal Source		61 Switch over RPM	4309 Switch Back to Petrol Above Maximum RPM				
	619 RPM Trigger Level			3759 Switch Back to Petrol Below Minimum RPM				
	297 RPM Factor							
				Gas Pressure	Gas Pressure			
				195 Tank Empty Pressure	2223 System Pressure Sensor			

10 Regulator

10.1 Solenoid valve(s)

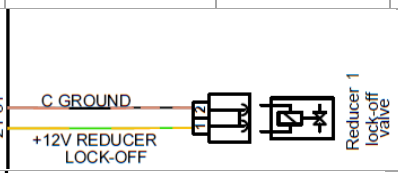
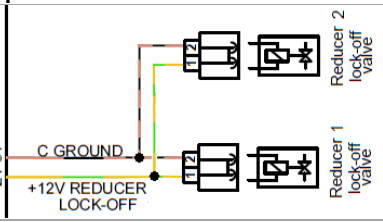
Description

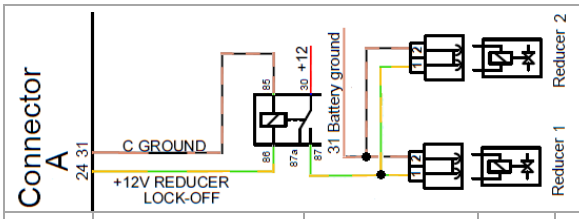
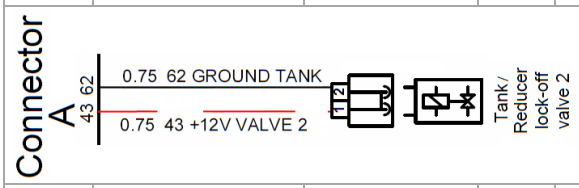
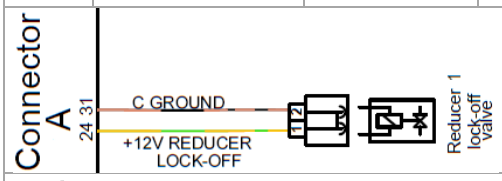
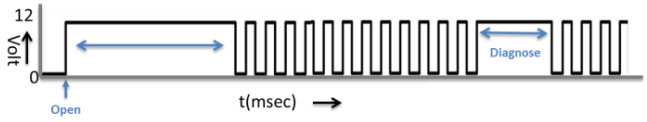
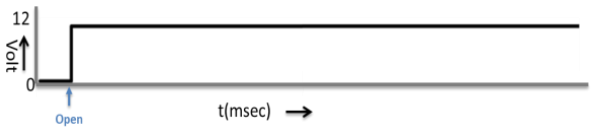
The AFC actuates the solenoid of the regulator lock off valve, connected to power output 2. The output provides a Pulse Width Modulation voltage (PWM) as default. This can be changed with the diagnostic tool. Note: The duty cycle differs between the tank solenoid valve and the regulator solenoid valve.
Most of the gas systems use only one regulator. If more regulators have been used, different strategies can be used to actuate the solenoid valves.

Conditions

- PWM function available as from AFC V2.1

Parameters – Solenoid Valve(s) Reducer

ID	Name	Value	Unit	Default (min/max)	Explanation
17457	Number of regulator SO valves	1 - 2	-	1	Number of solenoid valves connected to a single high side output. This parameter corrects the I_{min} and I_{max} for diagnostics. Note: Only 1 eVP-500 can be installed
2407	Output 2 function	Disabled/ eVP-500/ Regulator valve/ Regulator valve relay/ Tank valve relay	-	Disabled	**Disabled**: No solenoid valve connected **eVP-500**: eVP-500 reducer **Regulator valve**: 1 regulator valve supplied **Regulator valve relay**: regulator valves supplied by a relay. Diagnostic function disabled
Connector A 24 31					[17457] Number of regulators: 1 [2407] Output 2 function: Regulator valve
Connector A 24 31					[17457] Number of regulators: 2 [2407] Output 2 function: Regulator valve

					[17457] Number of regulators: 1 [2407] Output 2 function: Regulator valve relay
6363	Output 3 function	Disabled / Regulator valve 2 / Tank valve 2			**Disabled**: Output 3 not active (no diagnosis) **Regulator valve 2**: Will be active if [17457] Number of regulator SO valves is set to 2. **Tank valve 2**: Will be active if [11248] Multiple Tank Valve Strategy is active (Separate / Simultaneously)
					
4336	Power Regulator SO PWM Enable	Yes/No	-	Yes	**Yes**: To reduce the voltage and power through the solenoids [1 and 2]. The temperature of the solenoid will increase less. The first few seconds switched with 12V, then PWM switched. After each 60 seconds the sequence will repeated. **No**: Some valves can't handle PWM. They remain in a closed position or the valve produces a whistling sound.
					
					Yes: Average supply voltage < 12V
					No: Supply voltage > 12V

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
Master / Slave					Master / Slave	Master / Slave		
990 CAN 1 protocol Selection					2589 Slave Regulator SO Valve	2588 Slave Tank SO Valve		
996 CAN 2 protocol Selection								

10.2 Evaporator Coolant Temperature (ECT)

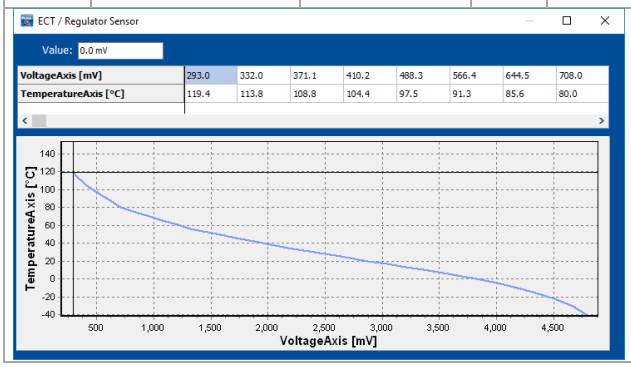
Description

Different temperature sensors can be selected. If a different sensor has been installed use the table lookup function.

Conditions

- Be aware of the used sensor.

Parameters – Evaporator Coolant Temperature

ID	Name	Value	Unit	Default (min/max)	Explanation
2810	ECT Sensor	Disabled / OMVL / Prins / Table lookup / Type 2	-	Prins	Regulator Temperature Sensor
1 Table	ECT / Regulator Sensor	Voltage vs. temperature	-	-	If a different sensor has been installed, set the values with this table.
					Example of the table of a temperature sensor.

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
		ECT	ECT		ECT			
		6 Table ECT correction	62 Switch over ECT		2810 ECT Sensor			
					1 Table ECT / Regulator Sensor			

10.3 Gas Pressure / temperature sensor

Description

Different gas pressure sensors can be selected. Prins has supplied various MAP sensors in the past.

Conditions

- Be aware of the applied sensor.

Parameters – Gas Pressure / temperature sensor

ID	Name	Value	Unit	Default (min/max)	Explanation
2223	System Pressure Sensor	4,0/5,5/ Disabled/ Sensata 4,5	bar	4,0	Used sensor to measure the gas pressure and temperature in the gas filter after the reducer.
1653	System Idle Pressure	Value	mbar	2200	Required gas pressure during idling running of the engine. Default absolute pressure = 2200 mbar (reducer not connected to MAP) Set to default Delta pressure = 1200 mbar (reducer connected to MAP)

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
				Gas Pressure	Gas Pressure			
				195 Tank Empty Pressure	2223 System Pressure Sensor			
					1653 System Idle pressure			

10.4 MAP Regulator

Description

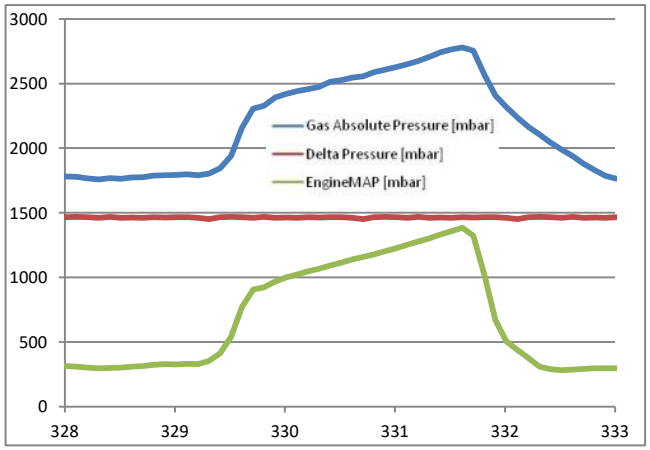
If the operating range of the reducer is not sufficient, then the reducer may be connected to the inlet manifold pressure by a hose. The gas pressure will lower during idle and the injection time will increase. The gas pressure will increase during high engine loads and the duty cycle will lower. Always use a regulator connected to the inlet manifold pressure with a turbo engine.

Conditions

- Only set this parameter to Yes if the regulator has been connected to the inlet manifold.
- Other parameters need to be set. Inform the parameter overview.

Parameters – Regulator MAP reference

ID	Name	Value	Unit	Default (min/max)	Explanation
495	Regulator MAP reference	Yes/No	-	No (Yes/No)	Regulator connected to inlet manifold



Gas Absolute Pressure=
Adjustable reducer pressure (1,7-2,6 bar)+MAP

Manifold Absolute Pressure=
depends on throttle position and turbo boost
(0,2- +/-1,9bar Abs)

Delta Pressure =
Gas Absolute Pressure - Manifold Pressure
= constant

Example:
Gas Absolute Pressure = 1800 mbar (Abs)
Manifold Absolute Pressure = 300 mbar (Abs)
Delta Pressure = 1800-300 =1500 mbar = constant

Conclusion:
System Idle Pressure = Delta Pressure
Tank empty detection based on calculated Delta Pressure.

ID	Name	Value	Unit	?
495	Regulator Map Referenced	Yes	-	✓
1653	System Idle Pressure	1500	mbar	✓
195	Tank Empty Pressure	1000	mbar	✓

Example of parameters which belong to the graph above.

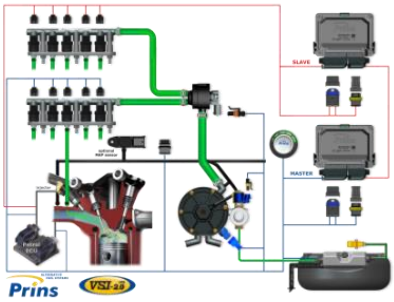
Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
	MAP		MAP		MAP			
	533 AD1 Analog input 1		1741 Switch over to Gas MAP Limit		495 Regulator MAP reference			
	2202 MAP sensor							
	4 Table MAP Sensor							

10.5 Master / Slave

Description

Two AFC's can be combined to a Master – Slave system to handle 10 or more cylinder engines.
Often a second reducer must be installed to obtain sufficient LPG quantity. Connect the second reducer, ECT and gas pressure sensor to the slave AFC. Set the parameters in the Master AFC using the diagnosis tool.



More information
Refer to the chapter Supplement Master / Slave for electrical diagram and more information.

Conditions

- Connect the PDT to the Master AFC to program the parameters of both master and slave.

Parameters –Master / Slave Regulator SO Valve

ID	Name	Value	Unit	Default (min/max)	Explanation
2589	Slave Switch Regulator SO Valve	Yes / No	-	Yes	**Yes**: Slave AFC controls the 2nd Regulator SO valve **No**: No 2nd Regulator SO valve connected

Linked parameters

AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
Master / Slave					Master / Slave	Master / Slave		
990 CAN 1 protocol Selection					2589 Slave Regulator SO Valve	2588 Slave Tank SO Valve		
996 CAN 2 protocol Selection								

11 Tank

11.1 Solenoid Valve(s)

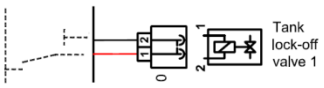
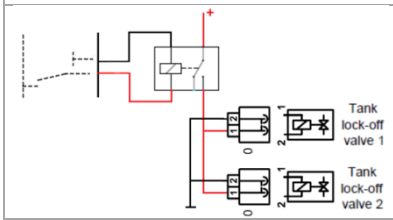
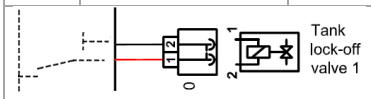
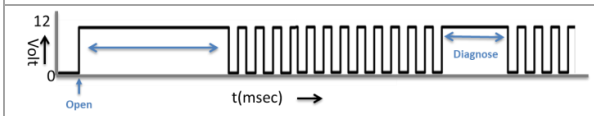
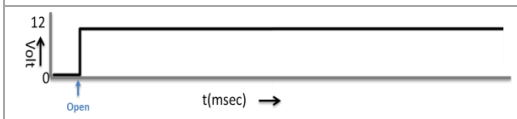
Description

The AFC supplies the solenoid of the tank lock off valve, connected to power output 1. The output provides a Pulse Width Modulation voltage (PWM) as default. This can be changed with the diagnostic tool. Note: The duty cycle differs between the tank solenoid valve and the regulator solenoid valve. Most of the gas systems use only one tank. If more tanks are used, different strategies can be used to supply the solenoid valves.

Conditions

- PWM function available as from AFC V2.1

Parameters - Solenoid Valve(s) Tank

ID	Name	Value	Unit	Default (min/max)	Explanation
2403	Output 1 function	Disabled / Tank valve / Tank valve relay	-	Tank valve	**Disabled**: No Valve connected / manual valve **Tank valve**: 1 tank valve supplied **Tank valve relay**: tank valves actuated by a relay. Diagnostic function is disabled.
					**Tank valve**: only one Solenoid
					Tank valve relay: tank valves actuated by a relay.
4335	Power Tank SO PWM Enable	Yes/No	-	Yes	**Yes**: To reduce the voltage and power through the solenoids [1 and 2]. The temperature of the solenoid will increase less. The first few seconds switched with 12V, then PWM switched. After each 60 second the sequence will be repeated. **No**: Some valves can't handle PWM. They remain in a closed position or the valve produces a whistling sound.
					
					Yes: Average supply voltage < 12V
					No: Supply voltage > 12V

Linked parameters

- None

11.2 Tank Level Sensor

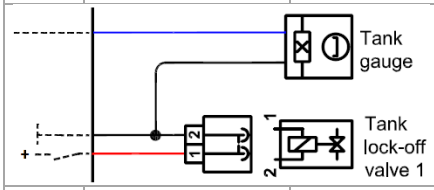
Description

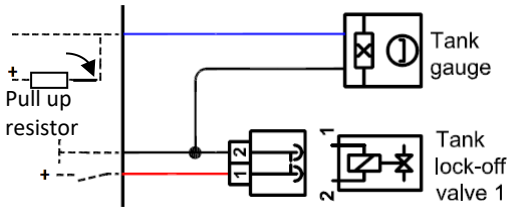
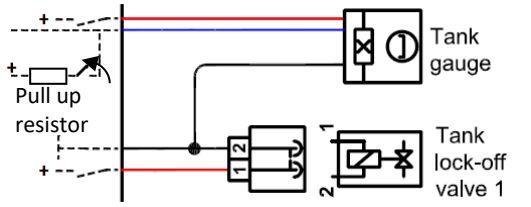
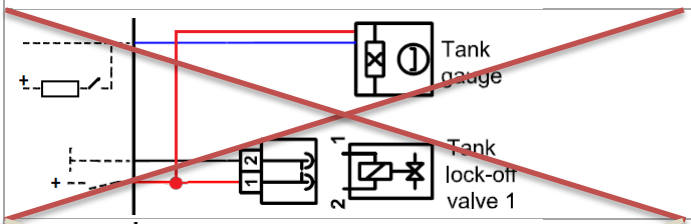
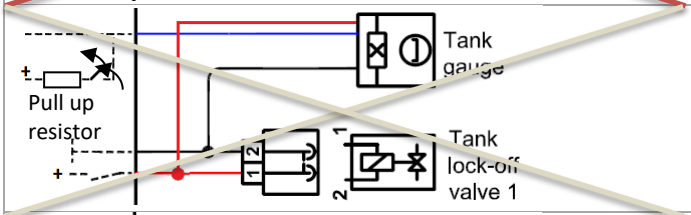
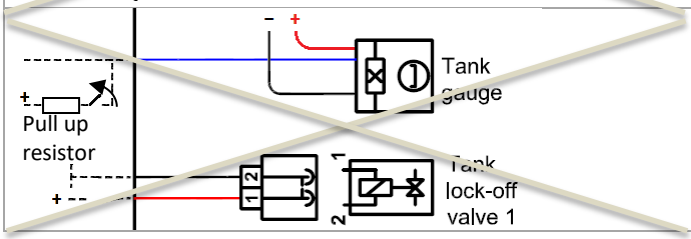
The AFC has a few pre-defined tank level sensors to choose from. It is possible to calibrate a different sensor if it is not listed or if the pre- defined sensor is not accurate enough. Use the <user defined> option and set the correct parameters. The AFC supplies the sensor with 5 or 10 Volt.
When 2 tanks are installed, use the Multiple Tank Function for more advanced functions.

Conditions

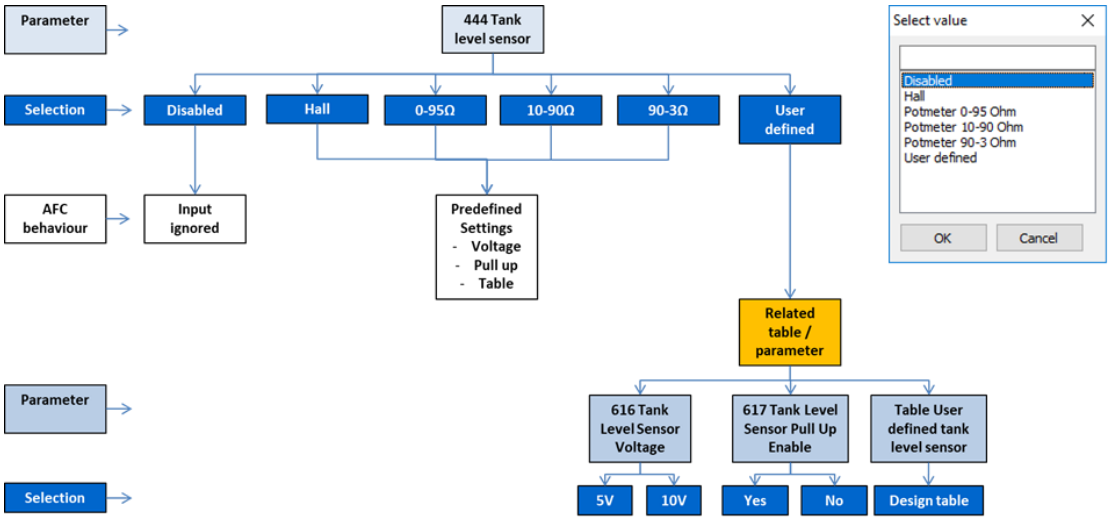
- Do not supply a two wire sensor with a positive voltage. (5V/10V/12V)

Parameters – Tank Level Sensor

ID	Name	Value	Unit	Default (min/max)	Explanation
444	Tank Level Sensor	Disabled / Hall / 0-95Ω / 10-90Ω / 90-3Ω / User defined	-	0-95 Ohm	Select <User defined> if the correct value is not available. If <User defined> then also parameter <616>, <617> and Table <User defined tank level sensor> may set.
					Connect the tank level sensor to the AFC as shown, when the value <Hall / 0-95Ω / 10-90Ω / 90-3Ω> has been selected.
616	Tank Level Sensor Voltage	10V / 5V	-	5V	Select the supply voltage according the specifications of the sensor. *Only change this parameter if parameter <444 Tank Level Sensor> has been set to <User defined>
76 Table	User defined tank level sensor	Table	-	Default Prins values (0-95Ω)	Tank Level Status versus Sensor Signal Voltage.

ID	Name	Value	Unit	Default (min/max)	Explanation
617	Tank Level Sensor Pull Up Enable	Yes/No	-	Yes	Set to <No> when the tank level sensor has an external power supply. The Pull up resistor will be disabled. *Only change this parameter if parameter <444 Tank Level Sensor> has been set to <User defined>
					Yes; Switch close -> Resistor enabled Sensor type: 2 wire sensor, Connected: Ground – Signal
					NO, Switch Open -> Resistor disabled Sensor type: 3 wire sensor, Connected: AFC internal power supply – Signal, Ground
					Does not function, AFC and gauge could be damaged Sensor type: 2 wire sensor, Connected: 5V/10V/12V Supply – Signal
					Avoid this situation NO, Switch Open -> Resistor disabled Sensor type: 3 wire sensor, Connected: 12V Supply, 12V(PWM) – Signal, Ground
					Avoid this situation NO, Switch Open -> Resistor disabled Sensor type: 3 wire sensor Connected: 5V/10V/12V Supply – Signal, Ground

Roadmap AFC settings tank level sensor

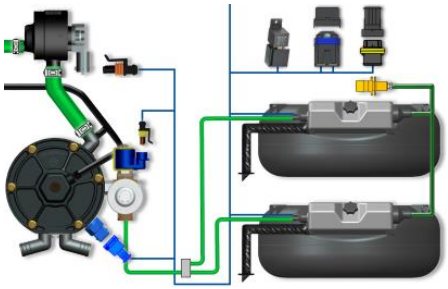


Linked parameters

- None

11.3 Multiple Tank Function

Description



This function allows switching two tank lock off valves separately or simultaneously. Also the actual tank levels will be added from both tanks by the AFC and the average level will be displayed on the fuel switch. The tank level signals measured in both tanks will be switched (multiplexed) by a relay and processed by the AFC.

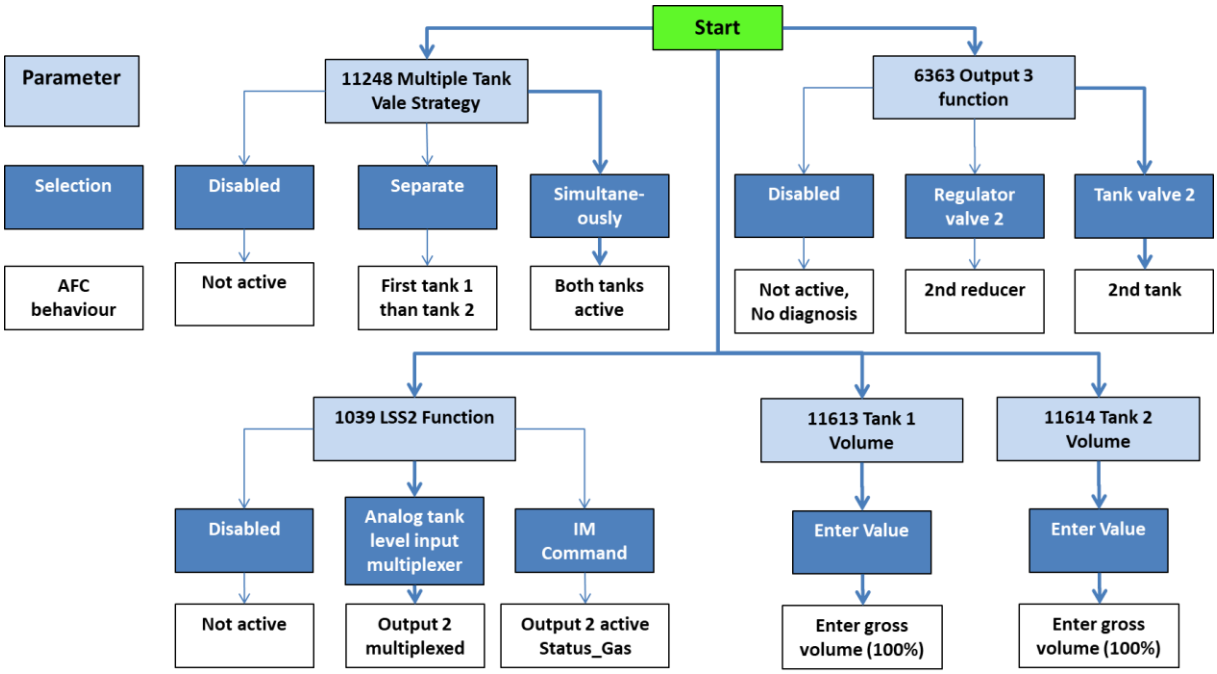
Conditions

- Multiple tank level supported as from AFC-2.0 V2 and AFC-2.1; see label on AFC B2B site.
- Additional wiring loom set 2nd tank module
- Identical tank level sensor types (0-95Ω or both Hall)
- Correct parameter settings
- Always use a tank connection block to connect both tanks to one reducer.

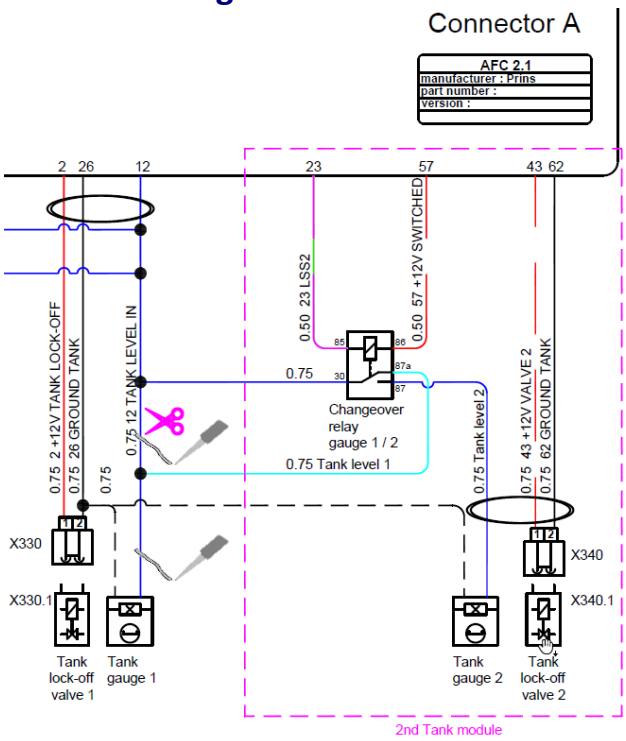
Parameters - Multiple Tank Function

ID	Name	Value	Unit	Default (min/max)	Explanation
11248	Multiple Tank Valve Strategy	Disabled / Separate / Simultaneously	-	Disabled	**Disabled**: multiple tank strategy not active (default) **Separate**: Tank valve 1 opened until empty -> Tank valve 2 opened. **Simultaneous**: Both valves opened (Not allowed in some countries. Check this before activating this function)
6363	Output 3 function	Disabled / Regulator valve 2 / Tank valve 2			**Disabled**: Output 3 not active (no diagnosis) **Regulator valve** 2: Will be active if [17457] Number of regulator SO valves is set to 2. **Tank valve 2**: Will be active if [11248] Multiple Tank Valve Strategy is active (Separate / Simultaneously)
1039	LSS2 Function	Analog tank level input multiplexer / Disabled / IM Command	-	IM Command	**Disabled**: Output low switched 2 not active. **Analog tank level input multiplexer**: Output 2 switched on/off for a certain time. **IM Command**: Output 2 active during System_Status_Gas.
11613	Tank 1 Volume	Value	l	0	Enter the gross tank volume (100%)
11614	Tank 2 Volume	Value	l	0	Enter the gross tank volume (100%)

Roadmap AFC settings Multiple Tank function



Electrical diagram

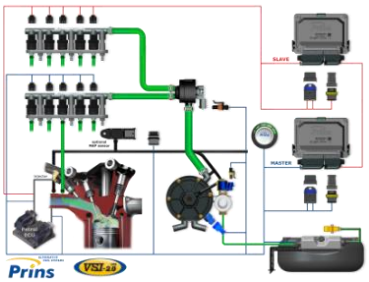


Linked parameters

- None

11.4 Master / Slave

Description



Two AFC's can be combined to a AFC Master / Slave system to handle 10 or more cylinder engines.
Often a second tank must be installed to obtain sufficient LPG quantity.
Connect the second SO valve and tank level sensor to the slave AFC. Set the parameters in the Master AFC using the diagnosis tool.

More information
Inform the chapter Supplement Master / Slave for electrical diagram and more information.

Conditions

- Connect the PDT to the Master AFC to program the parameters for both master and slave AFC.

Parameters –Master / Slave Tank

ID	Name	Value	Unit	Default (min/max)	Explanation
2588	Slave Switch Tank SO Valve	Yes / No	-	No	**Yes**: Slave AFC controls the 2nd tank SO valve **No**: No 2nd tank SO valve connected
21412	Tank Volume Slave	Value	l	0	Enter the gross tank volume onnected to the slave AFC (100%)

Linked parameters

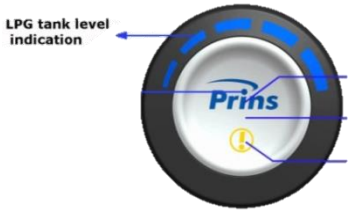
AFC Management	Engine	Mixture	Switch to Gas	Switch to Petrol	Regulator	Tank	Switch	Service/ValveCare
Master / Slave					Master / Slave	Master / Slave		
990 CAN 1 protocol Selection					2589 Slave Regulator SO Valve	2588 Slave Tank SO Valve		
996 CAN 2 protocol Selection								

12 Switch

12.1 Tank level indicator

Description

Only change the LED color if the driver explicitly requests it. Different LED color may influence your diagnostic sequence.



Conditions

- Parameters are available for all systems.

Parameters – Tank level indicator

ID	Name	Value	Unit	Default (min/max)	Explanation
2276	Tank Indicator LED Strategy	Always on / Only when actual fuel gas / Only when gas selected	-	Always on	**Always on**: LED's active during Petrol and Gas mode **Only when active fuel is gas**: LED's active during gas mode. **Only when gas is selected**: LED's active during gas mode, switch over and petrol start.
155 Table	Tank Indication LED Color	Table	-	Blue 0-0-25 (0-225)	The LED color can be modified for the tank level indication. The diagnostic tool will display the chosen color as an indication.
157 Table	Tank Indication LED Tank Empty Color	Table	-	Red 25-0-0	The LED color can be modified for the tank empty situation. The diagnostic tool will display the chosen color as an indication.
4152	Tank Level Refuse Rise During Wake	Yes/No	-	No	Tank level may rise during dynamic driving conditions. **Yes**: The tank level indicator may not rise during engine on. It only rises during ignition on. **No**: The tank level indicator may rise during engine on.

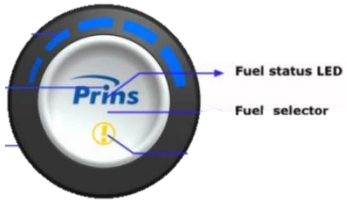
Linked parameters

- None

12.2 Fuel Status LED

Description

Only change the LED color if the driver explicitly requests it. Different LED color may influence diagnostics.



Conditions

- Parameters are available for all systems.

Parameters – Fuel Status LED

ID	Name	Value	Unit	Default (min/max)	Explanation
2273	Fuel Status LED Strategy	Active during gas operation / Based on selected fuel	-	Active during gas operation	**Active During Gas**: LED only active when driving in gas mode. **Based on selected fuel**: Gas or Petrol status will be shown by the Fuel Status LED. The petrol color LED may be changed by using Table "Fuel Status LED Master Fuel Color.
158 Table	Fuel Status LED Color (Gas)	Table	-	25-25-25 (0-225)	The LED color can be modified for gas mode. The diagnostic tool will display the chosen color as an indication.
159 Table	Fuel Status LED Master Fuel Color	Table	-	0-0-0 (0-225)	The LED color can be modified for petrol mode. The diagnostic tool will display the chosen color as an indication.

Linked parameters

- None

12.3 Switch Strategy

Description

Only change the LED color if the driver explicitly requests it. Different LED color may influence diagnostics.

Conditions

- Parameters are available for all systems.

Parameters – Switch Strategy

ID	Name	Value	Unit	Default (min/max)	Explanation
2629	Switch Blink During Gas Not Allowed	Yes/No		No	The Switch can display a gas not allowed situation.
3653	Switch Turn Off After Engine Off-Time	Value / 0 = disabled	s	0 (0-522,2)	The delay time that the switch stays illuminated after an engine stop.

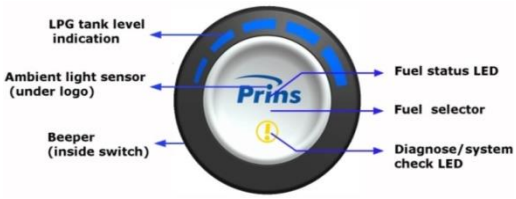
Linked parameters

- None

12.4 Daylight Correction

Description

Only change the correction if the driver explicitly requests it. Different LED color may influence your diagnostics sequence.



Conditions

- Parameters are available for all systems.

Parameters – Daylight correction

ID	Name	Value	Unit	Default (min/max)	Explanation
1562	Daylight Correction Type	Linear / None / Table lookup	-	Table lookup	The LED intensity may be corrected based on daylight intensity (daylight sensor located in the switch)
57 Table	Switch Daylight Correction	Table	-	Default Prins values	To adjust the day light correction.

Linked parameters

- None

12.5 Beeper

Description

Only change the volume if the driver has a special request. Different volume may influence your diagnostics sequence. No beeper signal is not desired.

Conditions

- Parameters are available for all systems.

Parameters – Beeper

ID	Name	Value	Unit	Default (min/max)	Explanation
2292	Beeper Volume	Loud / Normal / Quiet	-	Loud	Beeper volume can be set.

Linked parameters

- None

13 Service / ValveCare

13.1 Service

Description

The gas filters inside the regulator solenoid valve and the dry gas filter need to be replaced after a certain time. The interval depends of the cleanliness of the gas and the pollution in various parts of the GAS system that occur during and directly after the installation. The counter may be set in hours and will only decrease during gas mode.

Conditions

- County depended
- Gas quality

Parameters – Service

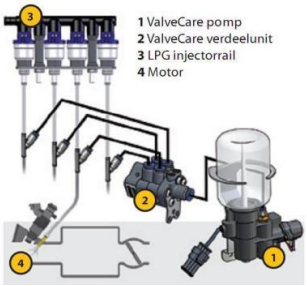
ID	Name	Value	Unit	Default (min/max)	Explanation
2305	Service Interval Enable	Yes/No	-	Yes	If enabled then set the service times with parameter 2306 and 2307.
2306	Service Interval Maximum Time	Value	hr	1008,0	If the time expires then the system switches back to petrol. Default = 1000 hours (1000hours x 50km/h (average) = 50.000 km)
2307	Service Interval Warn Time	Value	hr	896	If the time expires then the driver will be warned by a non-critical trouble code and the system should be serviced. Default = 900 hours (900hours x 50km/h (average) = 45.000 km)

Linked parameters

- None

13.2 ValveCare

Description



The ValveCare unit communicates directly with the Prins VSI system. Set the AD input, once the ValveCare system is installed. Recommended AD input 2.
Also set the service time waring and maximum time.

Conditions

- Bleed the ValveCare system after installation or when a hose / distribution unit has been replaced.

Parameters – ValveCare

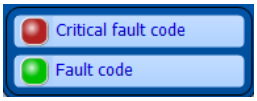
ID	Name	Value	Unit	Default (min/max)	Explanation
550	AD 2 Sensor Selection	Disable / Low pressure petrol / MAP / ValveCare	-	Disabled	Connect the Valve Care or fuel rail pressure sensor to this AD input
1750	ValveCare Bottle Time Min	Value	hr	5	If the time expires then Trouble code 92 (VC pump debit too high) will be set.
1751	ValveCare Bottle Time Max	Value	hr	200	If the time expires then critical trouble code 9 (VC pump debit too low) will be set. System switches back to petrol. Gas_Not_Allowed

Linked parameters

- None

13.3 Critical Trouble codes

Description



It is possible to select if ValveCare and Service related trouble codes are critical or not.
If the checkbox is not checked, the trouble code will be non-critical which means:

- A non-critical trouble code will be set
- Diagnostic LED on the fuel switch will be active
- Driving on LPG/CNG is still possible, the system will not switch back to petrol mode

If the checkbox is checked, the trouble code will be critical which means:

- A critical trouble code will be set
- Diagnostic LED on the fuel switch will blink
- Driving on gas is not possible, the system will switch back to petrol mode

Conditions

- Parameters are available for all systems.

Parameters – Critical Trouble codes

ID	Name	Value	Unit	Default (min/max)	Explanation
7 Table	Critical Trouble Codes	ValveCare pump debit too high / ValveCare pump debit too low / Service interval exceeded	-	ValveCare pump debit too high / ValveCare pump debit too low	A critical error code ensures that: the system switches to petrol mode the diagnostic LED on the fuel switch will blink. A non-critical error code ensures that: gas mode continues the fuel switch will be lit continuously. Unchecked means a non-critical trouble code.

Linked parameters

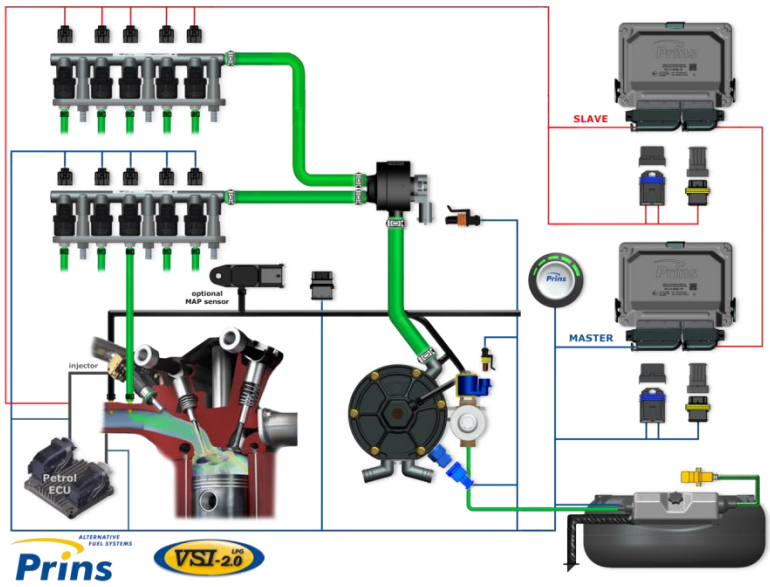
- None

14 Supplement

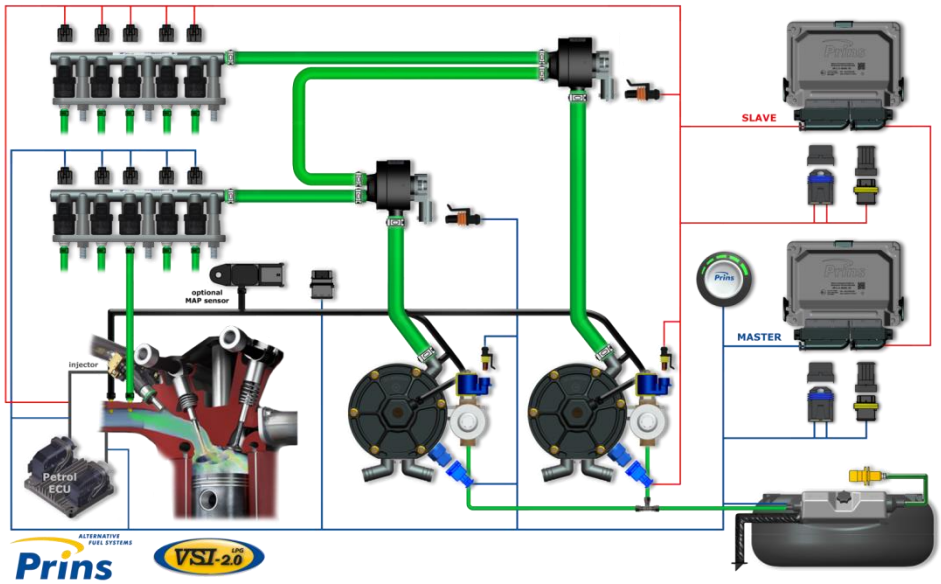
14.1 Supplement Master / Slave

System overview

One reducer

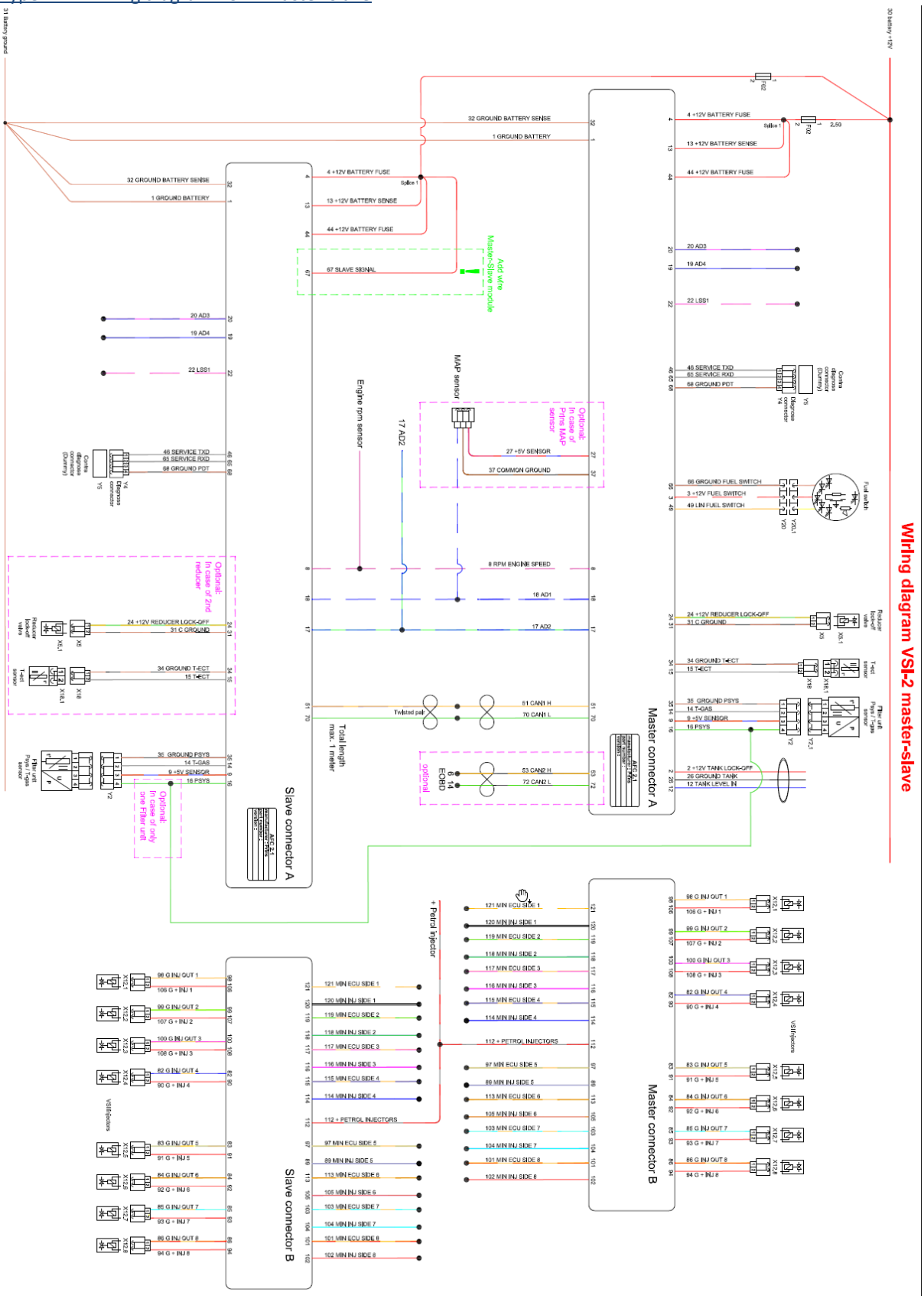


Two reducers



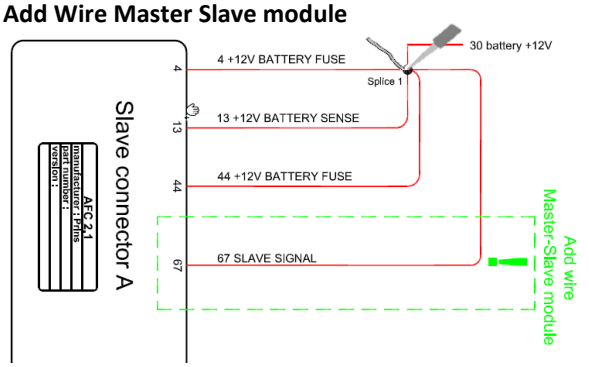
Electrical diagram complete overview

Hyperlink: Wiring diagram VSI-2 master-slave



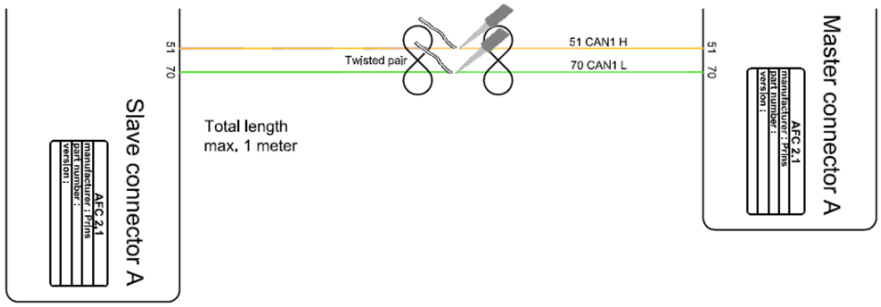
Electrical diagram detail

Add Wire Master Slave module

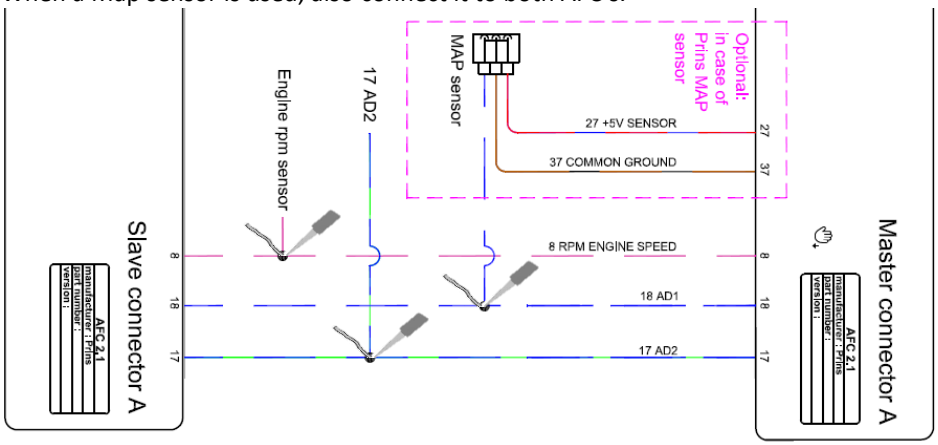


Pin 67 -> 30 battery +12V -> AFC = Slave
WIRE MASTER SLAVE MODULE **BOSCH** 191/140018/A
WIRE MASTER SLAVE MODULE **Tyco** 191/140044/A

Connect Master Slave CAN bus

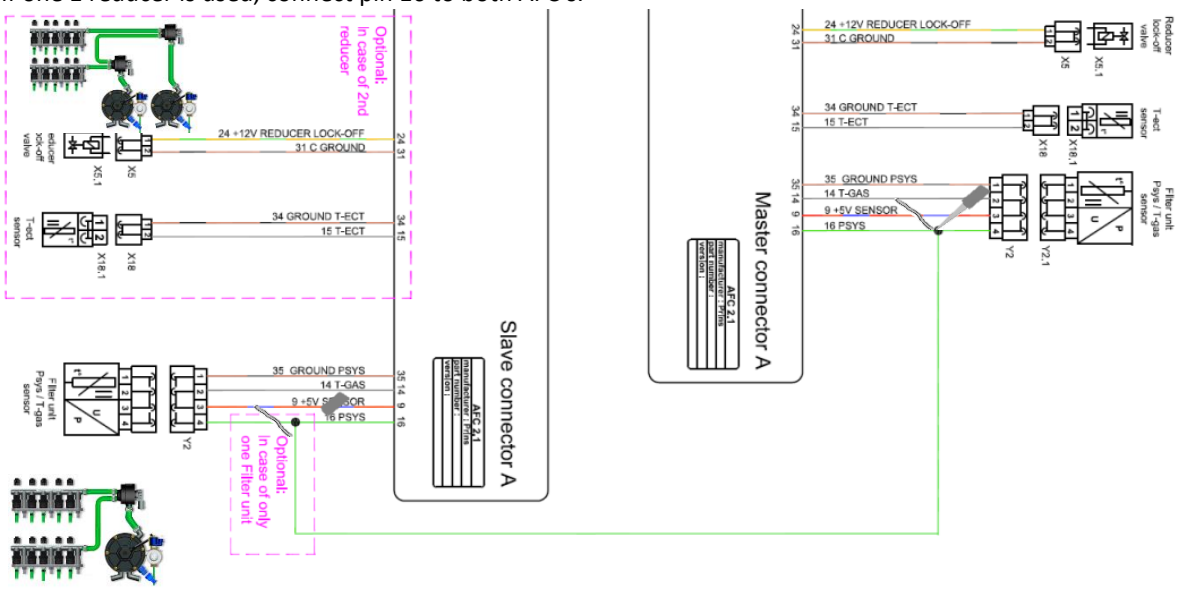


Connect RPM signal, AD1 and AD2 (if used)
The RPM needs to be connected to pin 8 of both AFC's.
When a Map sensor is used, also connect it to both AFC's.



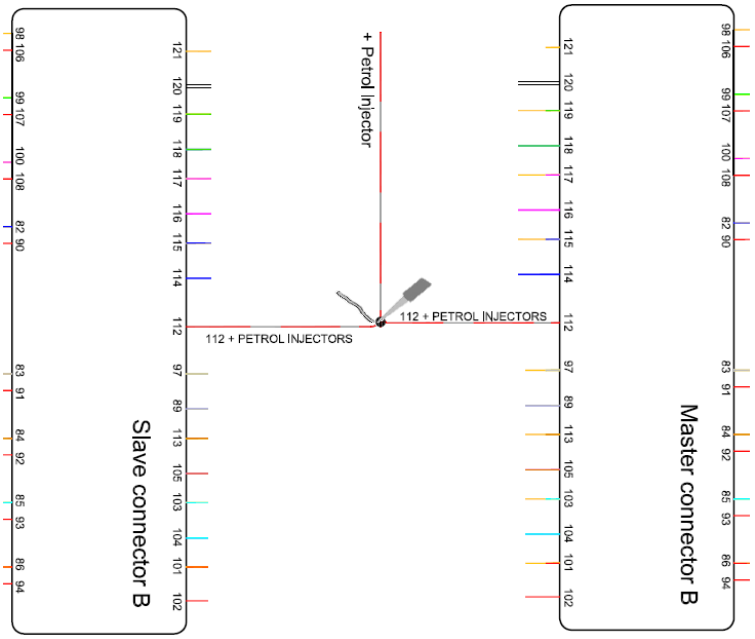
Reducer and filter unit option

If one 1 reducer is used, connect pin 16 to both AFC's.

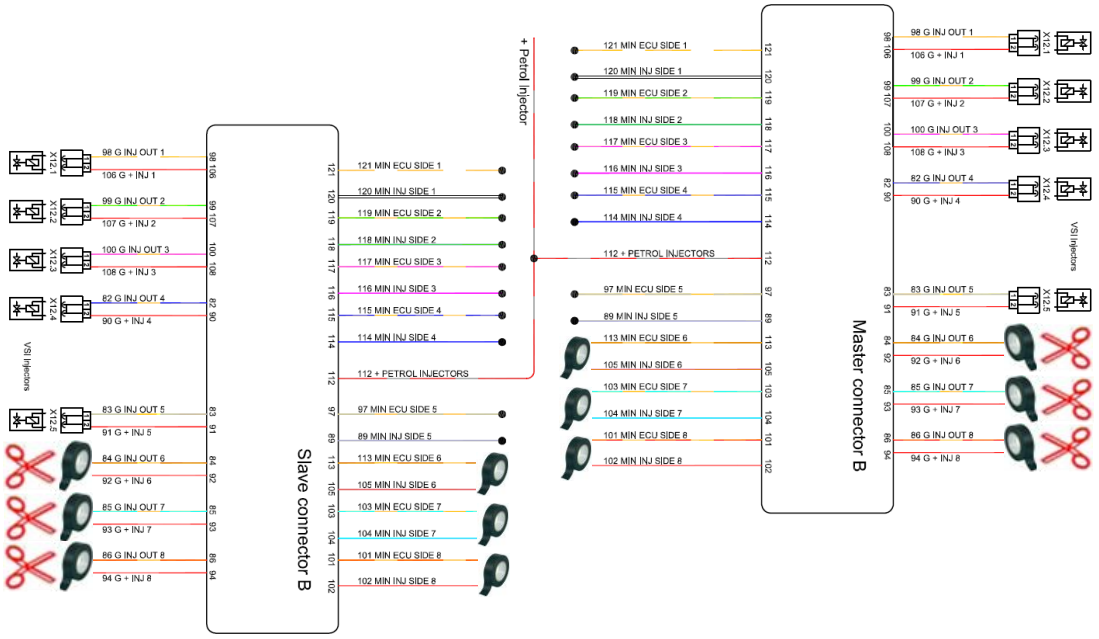


+12V Petrol injectors

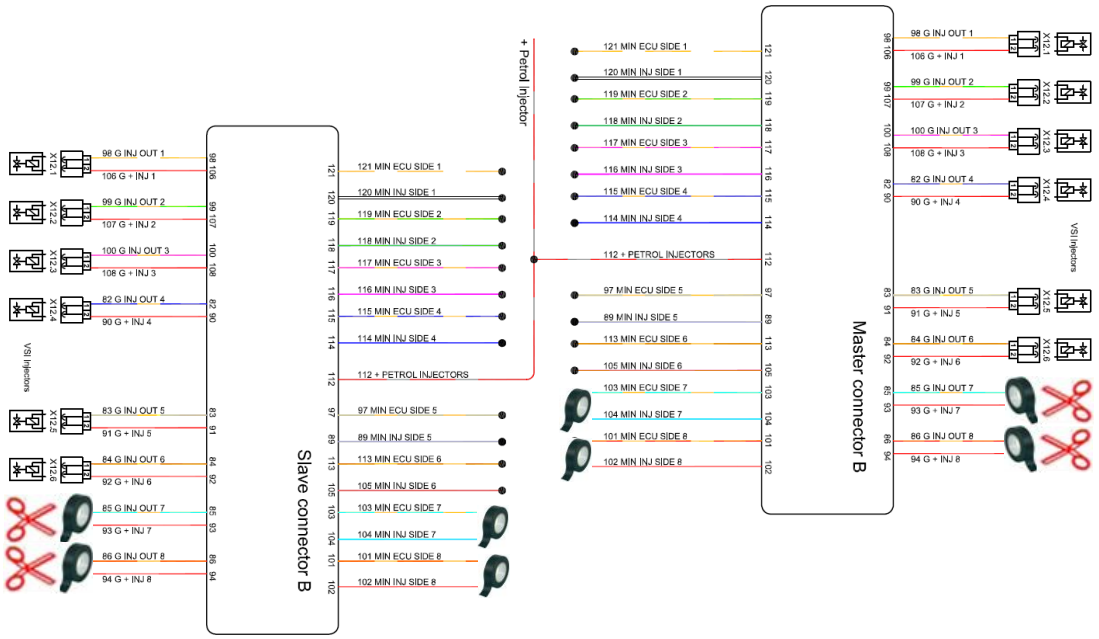
Connect + petrol injectors to pin 112 of both AFC's



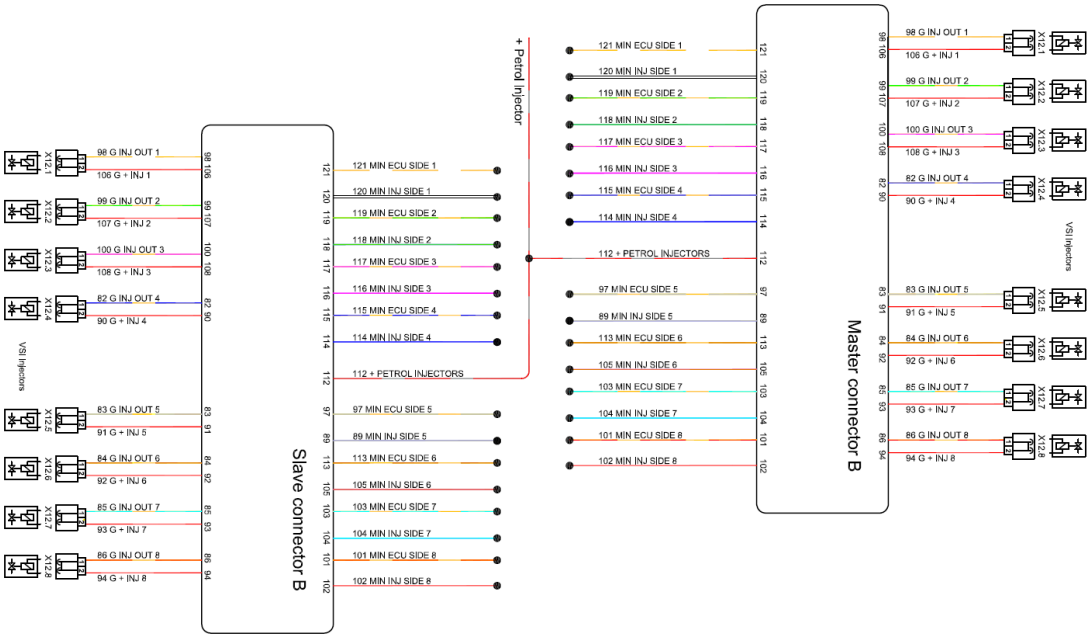
10 cylinder (2x5)



12 cylinder (2x6)

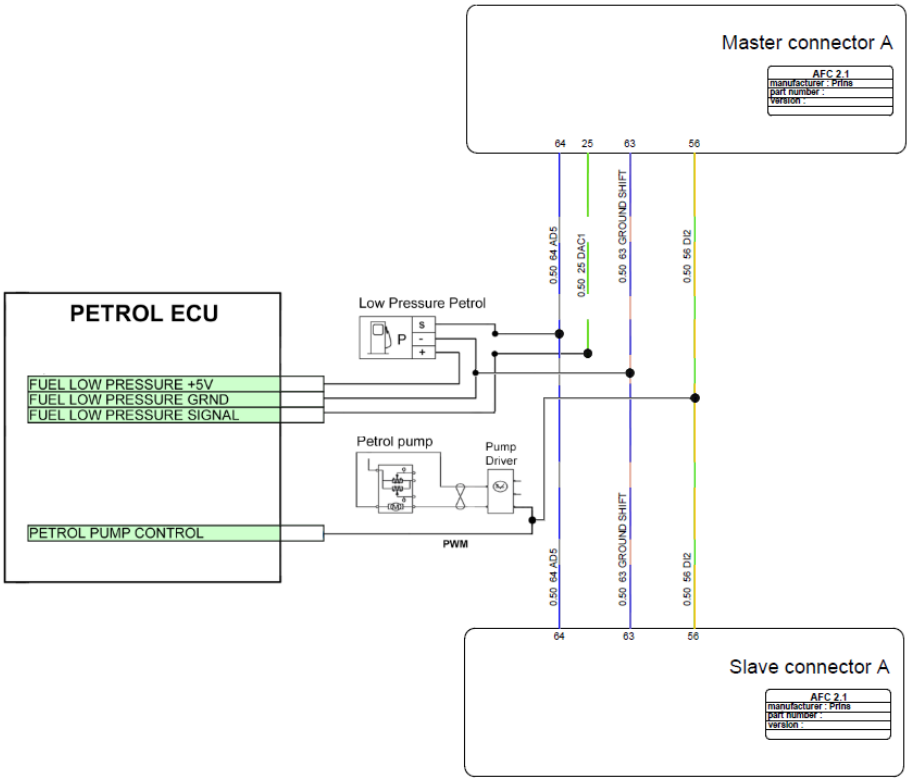


16 cylinder (2x8)



Petrol low pressure simulation

Pin no.	Wire text	Connect to:	Connect to AFC:
64	AD5	Petrol low pressure sensor side	Master & Slave
25	DAC1	Petrol low pressure ECU side	Master
63	Ground shift	Sensor ground	Master & Slave
56	DI2	Pulse signal to pump driver	Master & Slave



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