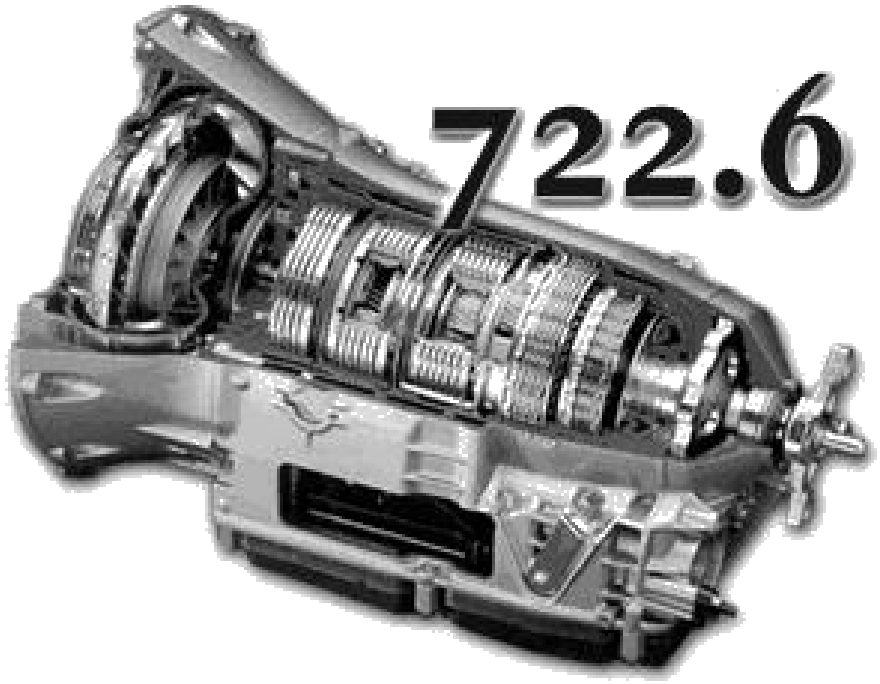
OF Gear ApS

Gearbox & boost control for Mercedes-Benz 722.6

722.6 Gearbox Controller

5-speed + lockup · Installation and User Manual

Controller firmware 200 · Gen 3 controller with OLED display



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1. Product introduction

The OF Gear kit is a stand-alone controller for the Mercedes-Benz 722.6 five-speed automatic gearbox. It can also act as a boost controller for selected VNT and wastegate turbochargers.

Important The system is not intended for on-road use. It will change the drivability of your vehicle. If it is installed, set up or used incorrectly, your engine and transmission can be permanently damaged, or worse. The product comes with no warranty or guarantee of any kind. Installation and use in any vehicle is entirely at the risk of the owner/operator.

This document describes how the system has been used in the past. Installation in your specific vehicle is your full responsibility and may differ from what is described here. All references relate to the latest firmware for the Gen 3 controllers.

The developer of this system cannot be held responsible for any loss, damage or injury caused directly or indirectly by the installation or use of this system.

2. Installation of the system

2.1 Identifying the controller components

The standard kit contains:

- The main control unit
- The 2.4" OLED management display, which works both as gear indicator and for navigating the menus
- A joystick for navigating the menus (it can be broken off the display board and mounted elsewhere)
- Cabling and plugs for the gearbox, gear lever, TPS and paddle shifters (if used)



Main control unit



OLED display and joystick



OLED display in housing

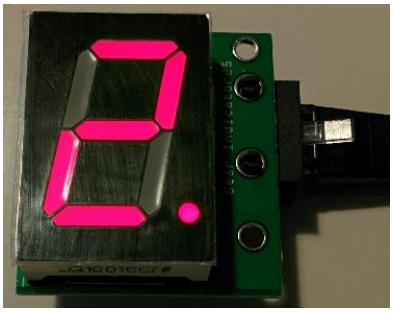


Gen 3 kit with OLED display in housing

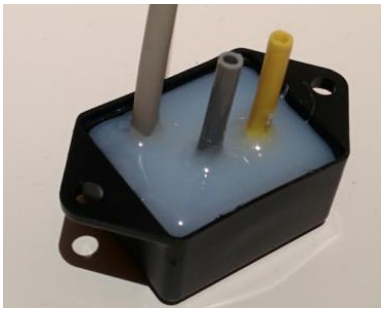


Gen 2 kit (older, 4-line text display)

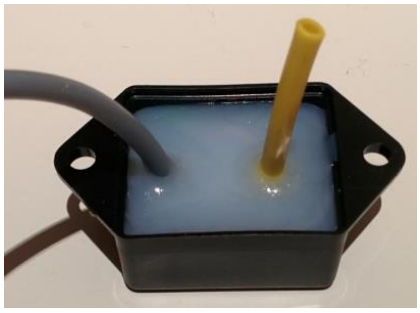
Optional accessories



1" gear indicator (older systems only)



EGP and boost sensor



Boost sensor

The pressure sensors are professional types supplied by Mouser (www.mouser.com). A gel coating protects them from harsh environments. They measure up to 3 bar boost/EGP above ambient pressure.

2.2 External parts needed

TPS sensor

The Mercedes TPS (throttle position sensor) from the W210, 1997–2002, works with this kit. All kits include the matching plug on the wiring harness.

Mercedes part number: **A 012 542 33 17** (German: Gassteller / Pedalwertgeber; English: TPS).



W210 TPS sensor

Alternatively, a TPS sensor that fits the OM603 injection pump can be ordered from OF Gear.



TPS sensor for the OM603 pump

Gear lever and plug

The correct gear lever has a first-gear position, identified by the "1" on the gate (P-R-N-D-4-3-2-1). The plug must be a 10-pin plug with 8 wires.



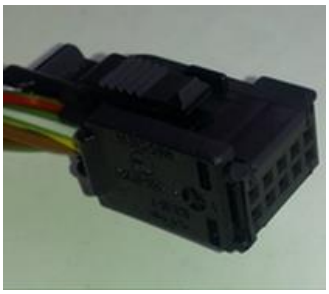
W202 / R129 gear lever



W210 gear lever



Gate with "1" position



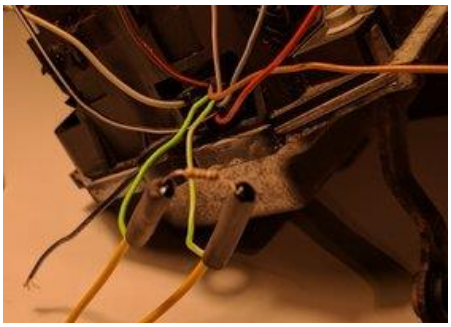
10-pin connector

These levers are typically found in the W202, R129 (2022670637) and W210 (A2022670137). The W210 lever is longer and taller than the W202 and R129 versions; the short versions fit the W124 and the pre-2001 G-Class W463. A gear lever from a right-hand-drive (RHD) car works just as well as a left-hand-drive (LHD) one, but it is mirrored. The part numbers above are for LHD.

Tiptronic shifter (PRND +/−) over CAN bus



Tiptronic shifter



120 Ω resistor between CAN H and CAN L



Shifter connector pin numbers

With the latest firmware, and a controller that has CAN-H and CAN-L marked on the 10-pin plug label, the Tiptronic shifter can be used.

- The standard 10-pin gear lever plug does not fit this shifter; use the 10-pin plug and terminals supplied in the plastic bag.
- Both pin 5 and pin 8 must have power before the lever can be moved out of P.
- Pin 4 must be connected to ground.
- Connect CAN H and CAN L to the gearbox controller.

Important A 120 Ω resistor (supplied in the bag) must be mounted between CAN H and CAN L, as shown in the picture above.

Selecting the Tiptronic shifter: go to Live Data and press the joystick right 9 times to reach the CANBUS page. Press up or down until **TipTronic** is shown, then switch the power off and on. The controller is now set to receive from the Tiptronic shifter.

Tiptronic shifter pin-out

Pin	Function
1	Kickdown switch input (NO, to GND)
2	Instrument lamp input
3	DIAG (not used)
4	GND
5	Shift lock solenoid input +12 V
6	CAN H
7	CAN L
8	+12 V switched
9	GY +12 V from car for reverse lamp
10	GY +12 V to reverse lamp

Connector parts (not verified – buy at your own risk):

Part	Mercedes number
8+2 plug	2035450928
8-pin housing	0345457528
Terminals for 8-pin	0005404505
Terminals for 2-pin plug	0115450726

The shifter used to develop this function came from a CLK (2000–2003), Mercedes number 202267056. Its bolt pattern differs from the PRND4321 type, so it does not bolt directly into the

W463 G-Class or W124 E-Class, but it fits the wood trim, so with a little creativity it can be used in those cars too.

722.6 gearbox – questions and answers

Q: Can I use any 722.6 from the scrapyard?

A: As far as we have seen, any 722.6 works. The usual issue is a small RPM flare on the 3–4 shift.

Q: Which gearbox is best for high-power projects (600 Nm or more)?

A: The W5A580 (AMG) box is one of the strongest.

Q: Which year is best?

A: As new as possible – they only got better over the years.

Q: If I find a W5A580 AMG box, is it just mount and go?

A: Get one that is as new and low-mileage as possible.

Q: What should I do if I want the very best?

A: Have the gearbox overhauled: seals in the valve body and clutches, and clutch clearances tightened beyond Mercedes specification – as tight as possible, but not so tight that the clutches burn from drag.

Q: Can I use an old, worn box if I only want 5th gear and lockup, not racing?

A: Everyone's requirements differ, but if you run it in manual mode and lift off the throttle at every shift, yes. It also works in automatic mode for cruising, not racing.

Q: My box worked perfectly in the donor car, but now it slips between 3rd and 4th.

A: The donor car had torque management, i.e. the engine reduced power during shifts. You therefore never saw the true condition of the gearbox. As the clutches wear, Mercedes compensates by making the shifts take longer, removing momentum from the engine for a longer time.

Q: Can a normal 722.6 from a standard E300 turbodiesel hold 600 Nm?

A: Yes, it can hold it, but shifting under full power is a different matter. In our experience 1→2, 2→3 and 4→5 are fine, but you are at the limit.

Q: The W5A580 does not fit the OM606 – what do I do?

A: Use the torque converter and bell housing from a 722.6 that was originally mounted on an OM606 (24V diesel).

Q: I have an OM606 and don't want to change the bell housing – what should I look for?

A: A gearbox from an E270 CDI, as new as possible; they are built for high torque. Any 722.6 from an inline engine should fit, except the one from the 320 CDI, which has a different bell housing.

Note For a system that works perfectly, have the gearbox checked and adjusted before installation. If you can live with a little slip when shifting under load, try what you have. With a non-overhauled box you may see the engine RPM flare during shifts at 100 % load – in our experience only between 3rd and 4th gear.

Gear ratios

There are two gearing versions of the 722.6. The controller is compatible with both.

Gear	Small NAG (W5A330)	Large NAG (W5A580)
1	3.932	3.59
2	2.408	2.19
3	1.486	1.41
4	1.00	1.00
5	0.83	0.83
R1	−3.10	−3.16
R2	−1.90	−1.93

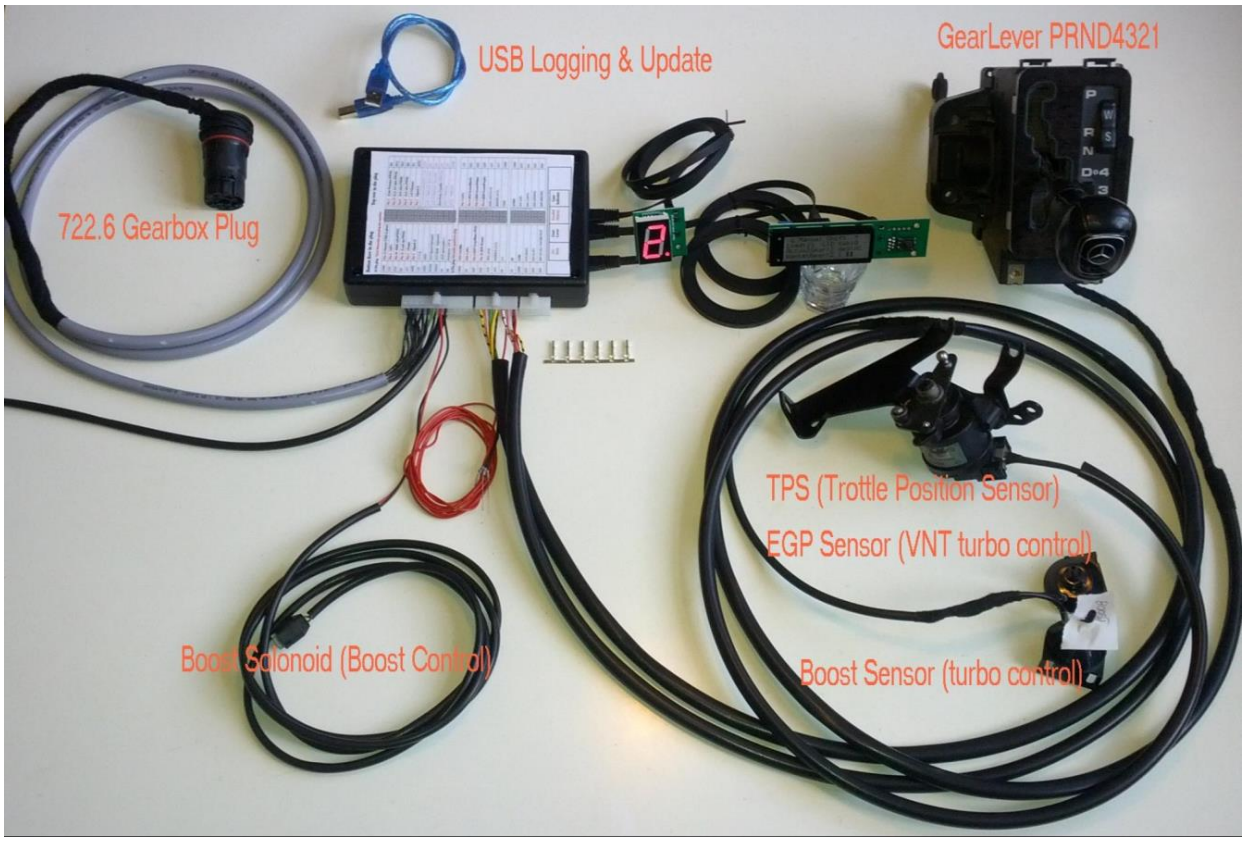
Clutch packs – the more friction discs the better

Number of friction discs / steel discs per clutch for the different 722.6 variants:

Variant (722.xxx)	K1	K2	K3	B1	B2	B3	Lockup
600 / 660	3/4	4/5	3/4	2/3	4/5	3/4	1/2
601 / 602 / 603 / 610	3/4	3/4	3/4	2/3	4/5	3/4	1/2
604 / 606 / 609 / 617	4/5	4/5	4/5	3/4	4/5	4/5	2/3
605 / 607 / 608 / 611 / 614 / 618 / 662 / 664 / 699	4/4	4/5	4/5	3/4	5/6	4/5	1/2
665	3/4	4/5	4/5	3/4	4/5	4/5	1/2
620 / 621 / 624 / 626 / 627 / 628 / 630 / 633 / 636 / 666	4/5	6/7	5/6	4/5	5/6	5/6	2/3
622 / 623 / 625 / 631 / 632 / 663 / 669	5/6	5/6	4/5	3/4	5/6	5/6	2/3
629 / 634 / 661	5/6	5/6	4/5	4/5	5/6	5/6	2/3

2.3 Installing the controller

1. **Gearbox:** connect the large, round multi-pin plug directly to the gearbox.
2. **Gear lever:** connect the rectangular gear lever plug to the gear lever.
3. **TPS:** connect the TPS plug to the TPS sensor.
4. **Power:** connect **black** to ground (make sure it is a good connection) and **red** to a 12 V supply that is live when the ignition is on. Use an 8 A fuse on this wire.



Example of a connected Gen 2 kit. The boost solenoid, EGP sensor and boost sensor are only needed when the unit is used as a boost controller.

Controller pin-out

All controllers are delivered with a complete wiring harness; the tables below are for reference.

24-pin connector – gearbox

Controller	Gearbox plug	Description
1	2	Line pressure
2	13	1-2 / 4-5 PWM
3	8	2-3 PWM
4	9	3-4 PWM
5	7	+5 V sensor
6	1	Speed 1
13	12	Sensor GND
14	6	12 V
15	10	Shift PWM
16	11	Lockup PWM
17	4	Temperature
18	3	Speed 2

24-pin connector – AUX and power

Controller	Description
7	12 V out AUX
8	AUX-1 Boost (PWM GND)
9	AUX-3 (PWM GND)
10	Horn / paddle (PWM GND)
11	AUX-4 (PWM GND)
12	AUX-2 (PWM GND)
19	12 V in (8 A fuse)
20	GND
21	EXT speed
22	EXT RPM
23	AUX opto
24	Kickdown opto

14-pin connector – gear lever

Controller	Lever plug	Description
1	7	12 V
2	5	D23 green/black
3	4	D25 green/white
4	9	D29 green/purple
8	3	GND
9	1	5 V
10	2	D27 grey/blue
11	10	D31 brown

RJ45 – joystick and display

Pin	Description
1	Joystick GND
2	Joystick UP (D37)
3	Joystick LEFT (D41)
4	Joystick DOWN (D45)
5	Joystick RIGHT (D49)
6	Display 5 V
7	Display GND
8	Display D39 (DAT)
9	Display D43 (LAT)
10	Display D47 (CLK) / tacho out

Controller label – complete pin assignment

The label on the controller shows the full assignment. Red pin numbers refer to the Mercedes gearbox plug and the Mercedes gear lever plug.

Signal	Bottom row	Top row	Signal
GND	Pin 12 – sensor GND to gearbox	Pin 2 – line pressure PWM	D13
12 V	Pin 6 – 12 V	Pin 13 – 1-2 / 4-5 valve PWM	D12
D10	Pin 10 – shift valve PWM	Pin 8 – 2-3 valve PWM	D11
D8	Pin 11 – lockup PWM	Pin 9 – 3-4 valve PWM	D9
A11	Pin 4 – temperature	Pin 7 – +5 V sensor	5 V
INT0	Pin 3 – speed 2	Pin 1 – speed 1	INT1
12 V	12 V in (8 A fuse)	12 V out boost / idle / AUX 1–4	12 V
GND	GND	AUX-1 PWM GND – boost valve	D7
D19/i4	EXT speed (optional)	AUX-3 PWM GND / idle GND	D6
D18/i5	EXT RPM (optional)	Horn relay if paddle, PWM GND	D5
D1	AUX optocoupler 1	AUX-4 PWM GND	D4
D0	Kickdown 12 V in (opto)	AUX-2 PWM GND	D44
GND	Lever pin 3 (GND)	Lever pin 7 (12 V)	12 V
5 V	Lever pin 1 (5 V)	Lever pin 5	D23
D27	Lever pin 2 (W/S)	Lever pin 4	D25
D31	Lever pin 10	Lever pin 9	D29
A14	TPS (0–5 V)	EGP (0–5 V)	A15
A12	Paddle (0–5 V)	Boost (0–5 V)	A13
5 V	5 V	GND	GND
5 V	5 V	GND	GND
GND	GND	D37 (UP)	D37
D39	D39 (tacho out)	D41 (LEFT)	D41
CAN H	CAN H	D45 (DOWN)	D45
CAN L	CAN L	D49 (RIGHT)	D49

Sections: rows 1–12 gearbox and AUX (24-pin) · rows 13–19 gear lever and sensors (14-pin) · rows 20–25 joystick, display and CAN (10-pin).

Connecting the TPS sensor

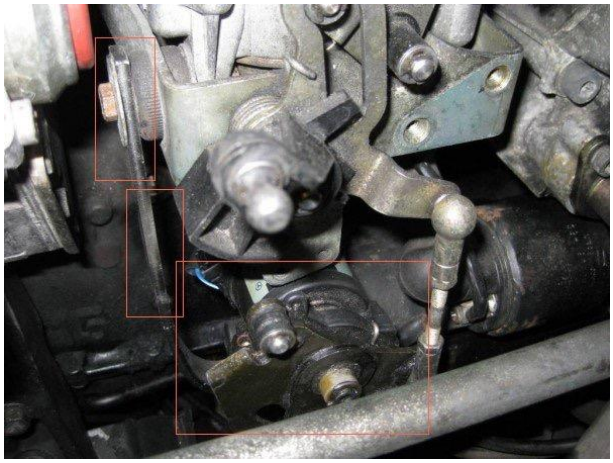
The W210 TPS sensor has a 6-pin plug; the pin numbers 1–6 are marked on the plug.



Mercedes TPS sensor plug

- Pin 1 → 5 V
- Pin 6 → 0 V (GND)
- Pin 5 → TPS input
- Other pins are not connected.

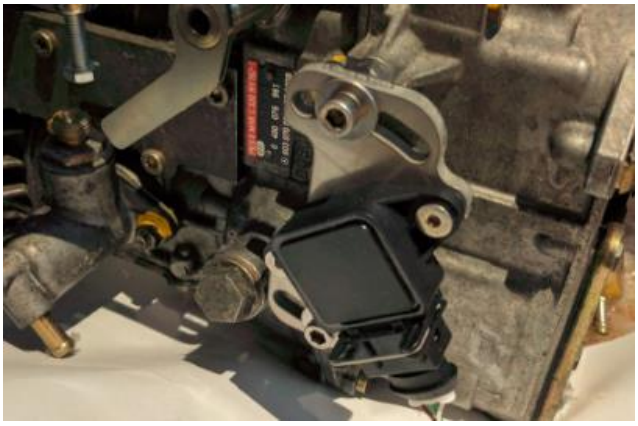
The TPS sensor can be mounted anywhere, as long as it moves together with the throttle. The example below shows it mounted under the injection pump.



TPS sensor mounted on an OM606 in a G-Class (mechanical pump)



OF Gear TPS kit



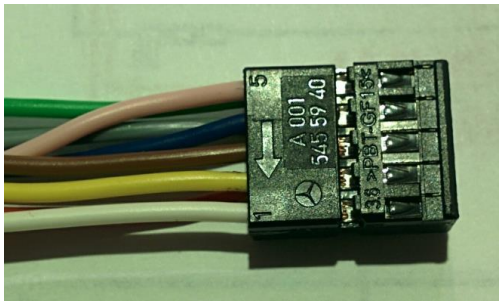
TPS kit mounted on the pump

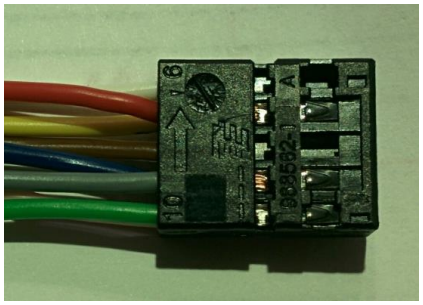
TPS kit wiring: pin 1 ground (brown), pin 2 +5 V (white), pin 3 TPS 0–5 V (green).

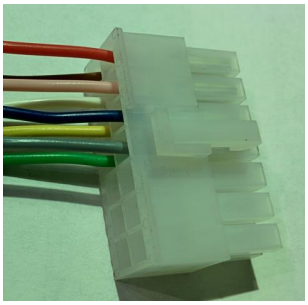
Connecting the controller for gearbox control

Gear lever: 10-pin Mercedes plug to 14-pin controller plug

All controllers are delivered with a wiring harness, so this is for reference only.

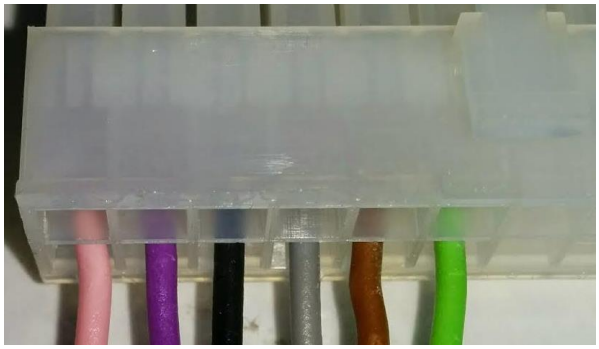






24-pin gearbox plug to controller plug

The latest controllers use white wires with printed numbers; the colour photos below are for reference.







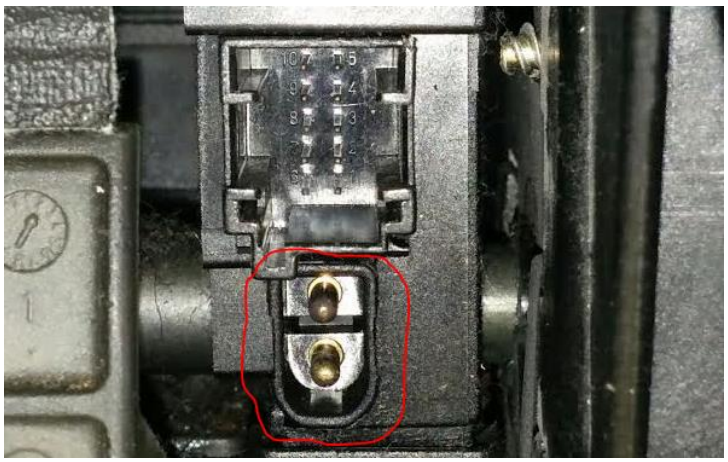
Connecting a Tiptronic shifter (optional) or paddle shifters

Without the CAN bus option, the controller cannot communicate with the Tiptronic shifter. You can still use it, but there is then no W/S switch (any switch can be used for that). Only P/N and R/D can be detected from the gearbox, so the hold functions for 4, 3, 2 and 1 do not work.

To use +/−, add micro switches that switch to ground when + or − is pressed and connect them to the PADDLE input.

Connecting the reverse light

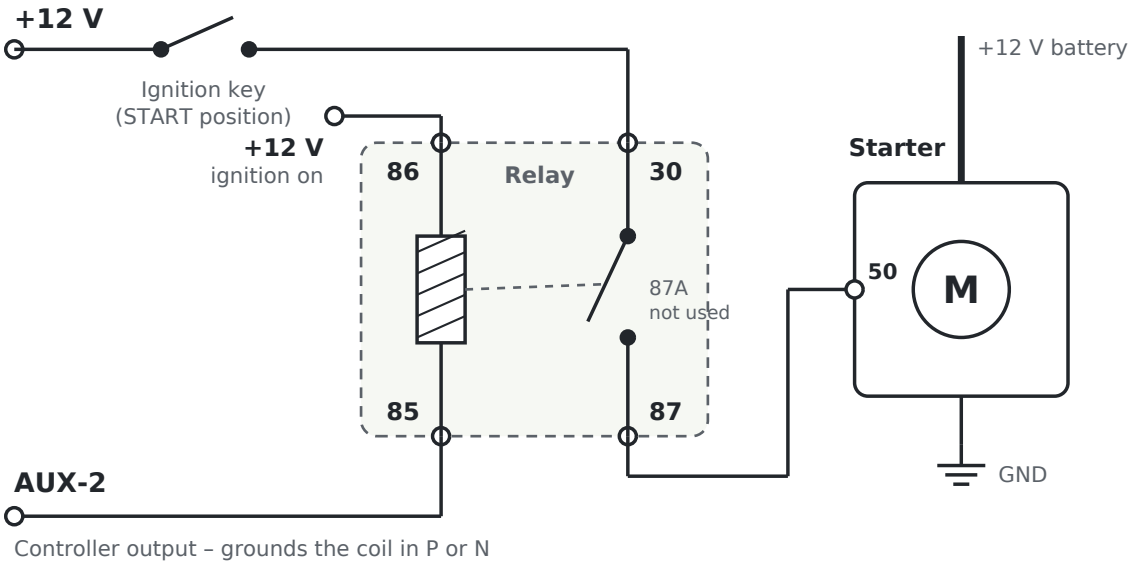
The two pins marked below are shorted when the lever is in R and can be used for the reverse light.



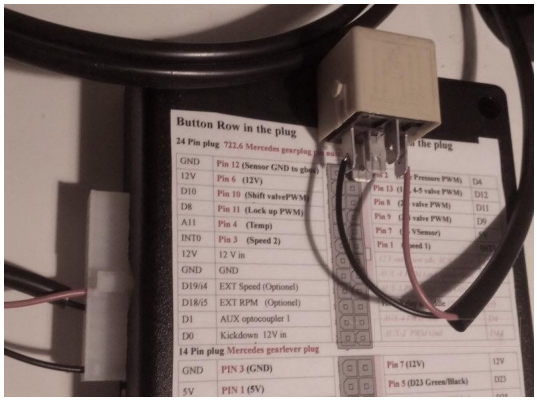
Connecting a starter lockout (optional)

```
Boost Control → General Boost → USE PWM - AUX-2
```

When set to **2**, AUX-2 works as a starter lockout: the output is pulled to ground in P or N. It can drive a relay that has 12 V on the other side of the coil (from version 113). The function sits in the boost menu because it uses one of the boost AUX outputs. It works with or without the Mercedes gear lever. AUX-2 cannot be used for anything else at the same time.



Starter lockout wiring: the starter only gets its signal from the key when AUX-2 grounds the relay coil (lever in P or N)



Relay mounted

Cut the thin wire from the ignition key to the starter solenoid. Connect one end to terminal 30 of the relay and the other to terminal 87. The engine can then only be started when the controller grounds the relay coil.

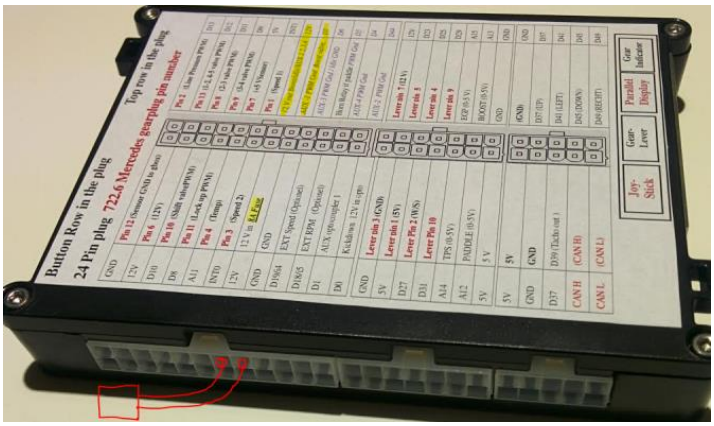
Connecting the controller for boost control

Vacuum actuator for vacuum-actuated turbos

To use the built-in boost controller with a vacuum-actuated turbo you need a vacuum valve as shown. 100 % PWM gives maximum vacuum (wastegate closed); 0 % PWM gives no vacuum (wastegate open). The part was used in many Mercedes cars from 1997 to 2000 for both boost control and EGR. Connect it to the two pins marked in red; polarity does not matter, as it is a solenoid.



Vacuum valve



Connection pins (red)

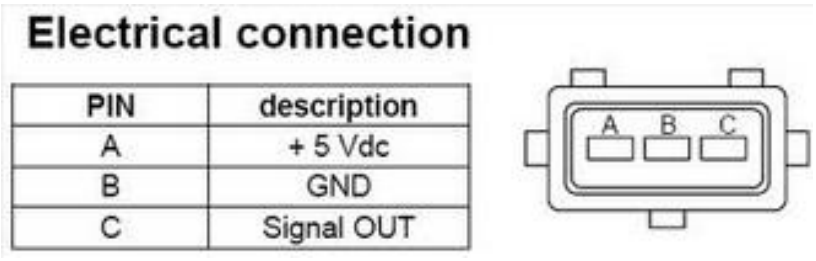
Connecting the boost and EGP sensor

Mercedes W210 E300 turbodiesel boost sensor (max. 1.65 bar / 25 psi): if you need no more than 1.65 bar, the original sensor from a W210 E300 turbodiesel can be used, as it has a standard 0–5 V output. Only this exact type has been tested. Set:

Menu	Value
Boost Control → General Boost → 0 point boost	305
Boost Control → General Boost → Max boost at 5V	170

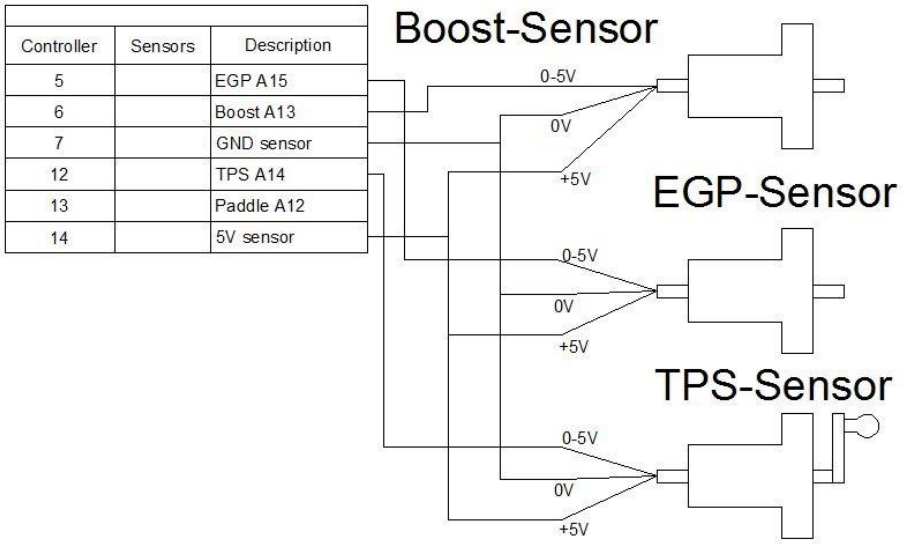


W210 E300 boost sensor



Electrical connection

Connect the boost sensor to the intake manifold.



Sensor wiring: boost, EGP and TPS sensors share 5 V and sensor GND

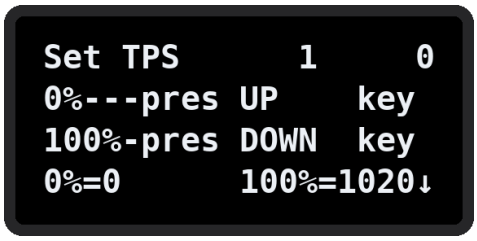
2.4 Initial quick setup

> **Important** The steps below let you control the gearbox, but they are not enough to make it shift properly. For correct operation, a detailed setup for your car (weight, power, gear ratios) and your driving style is needed by adjusting and fine-tuning the options provided.

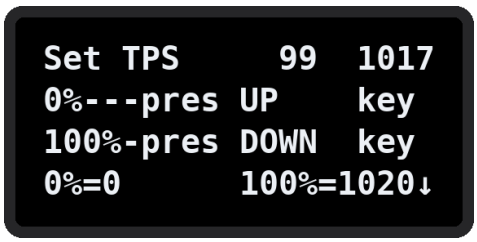
Calibrate the TPS

Before starting the engine, calibrate the TPS. This teaches the controller the signal it receives with the throttle pedal fully released and fully pressed. Put the W/S switch in **W** (if you have the Mercedes gear lever).

1. Switch on the ignition so the controller is powered, but do **not** start the engine.
2. Press the joystick down until **Setup** is shown.
3. Press the joystick right to enter the menu.
4. Press the joystick down until **Setup TPS** is shown.
5. Press the joystick right to enter.
6. With 0 % throttle (pedal released), press the joystick **UP**.



7. Press the pedal fully (100 %) and press the joystick **DOWN**.



8. Put the W/S switch in **S** and repeat steps 1–7 (only if you have a W/S switch).

Set up the gear lever

Put the W/S switch in **W** (if you have the Mercedes gear lever).

1. Switch on the ignition, but do **not** start the engine.
2. Press the joystick down until **Setup** is shown.
3. Press the joystick right to enter the menu.
4. Press the joystick down until **Lever Setup** is shown.
5. Press the joystick right to enter.
6. With the 10-pin plug on a PRND4321 gear lever, set the value to **0** with up/down. Without a gear lever plug, set it to **1**.
7. Press the joystick right to save.
8. Put the W/S switch in **S** and repeat steps 1–7 (only if you have a W/S switch).

Define the load

For turbocharged diesel engines with a boost sensor, engine torque is calculated from a combination of TPS and boost. Example: a diesel with 750 Nm peak torque produces 250 Nm at 100 % TPS without boost – about 33 % torque. When the turbo delivers 2 bar, the remaining ~66 % is added, giving 750 Nm. For a petrol engine only TPS is used: 100 % TPS = 100 % torque.

Engine	Load – TPS Boost	Boost Part Load
Diesel with boost sensor	2.5	33
Petrol 3 L (6-cyl)	1.5	1
Petrol 5 L (V8) or larger	1	1

Load – TPS Boost is saved automatically when changed. Boost Part Load must be saved by pressing right.

Define how RPM and speed are measured

An **external speed sensor** is strongly preferred. Many older cars do not have one, so the controller can also use the speed sensors inside the gearbox. In firmware later than 157 there are separate menus for **Speed EXT/INT** and **RPM EXT/INT**.

Value	Meaning
0	External speed and RPM sensors are connected
1	External RPM sensor connected; internal speed sensor is used
2	No external sensors; km/h and engine RPM are read from the internal gearbox sensors

Select the value in **Setup → Use int speed/Rpm** (W position, ignition on, engine off), press right to save, then repeat with the switch in S. The internal speed cannot be read during a shift, which is why an external sensor is preferable. After connecting an external speed sensor, drive slowly (10 km/h) and check the speed in Live Data; if it is wrong, adjust **Adjust Ext Speed %**.

Set the shift firmness

On the first drive, pay close attention to how firm the shifts are. If all shifts are too soft or too hard, adjust:

```
Shift Firmness → General Firmness
```

- Shifts too soft → **lower** the number.
- Shifts too hard → **raise** the number.

> **Important** A shift that is too soft can fail to complete, leaving the gearbox in the gear it was in. A shift that is slightly too hard is always better than one that is too soft.

3. User manual for gearbox control

3.1 Controller menu

View Live Data
Live data dashboards 1–4

Manual Shift

Setup Parameters
Setup TPS · Load – TPS Boost · Boost part load · Converter Lockup · Converter Unlock · Lockup 2-4 gear · TPS Speed 25/50/75% · Volt reg 100% · Temp reg +/− · Kickdown at %TPS · Fail Handling · Max speed fail · Slow upshift · PWM N→D P→R · PWM 3-4 N-D/P · RPM INT/EXT · Adjust ext RPM · Speed INT/EXT · EXT Speed % · INT Speed % · Delay 3-4 · Reset km · Lockup Soft/Hard · Use Paddle · Start up display · Lever setup · Idle RPM <500 no · Time bet M shift · LineRegTime · PresRegTime · ShiftValve Time · 1-2 Soft high RPM · Tacho out

Userdata/Factory
Lever S data · Default W / Reset

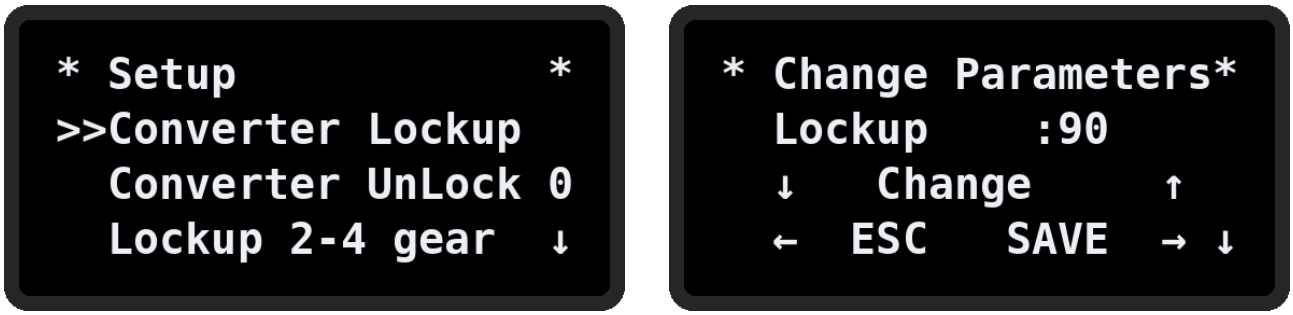
Shift Speeds
MinSpeed 1→2 … 4→5 · MaxSpeed 1→2 … 4→5 · MinSpeed 2→1 … 5→4 · MaxSpeed 2→1 … 5→4 · Kickdown ok 2→1 … 5→4 · RPM Kickdown 1-2 … 4-5 · Kickdown ok RPM

View Shift Speed

Boost Control
General boost · TPS → Boost · TPS → deltaP · RPM → Boost · Speed → Boost · TPS / EGP / RPM → PWM AUX-2 · AUX-1 / RPM / Boost → PWM AUX-3 · AUX-2 / Boost / RPM → PWM AUX-4

Shift Firmness
General Firmness · Firm/Load 1↔2, 2↔3, 3↔4, 4↔5, 2↔1, 3↔2, 4↔3, 5↔4 · Line/Pres MAX/MIN

Rate Last Shift

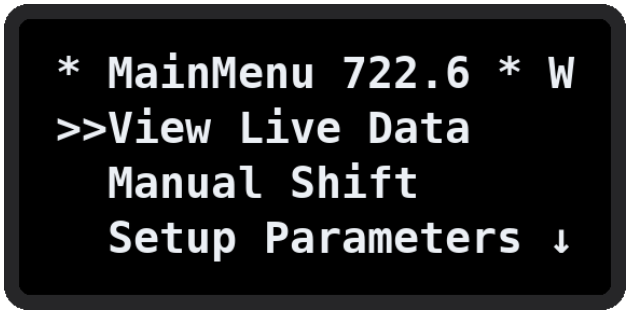


Menu navigation (left) and changing a value (right)

Change a value with the joystick up/down and press right to use it. To keep the change after the controller is switched off, save it under **Userdata/Factory → Default W**.

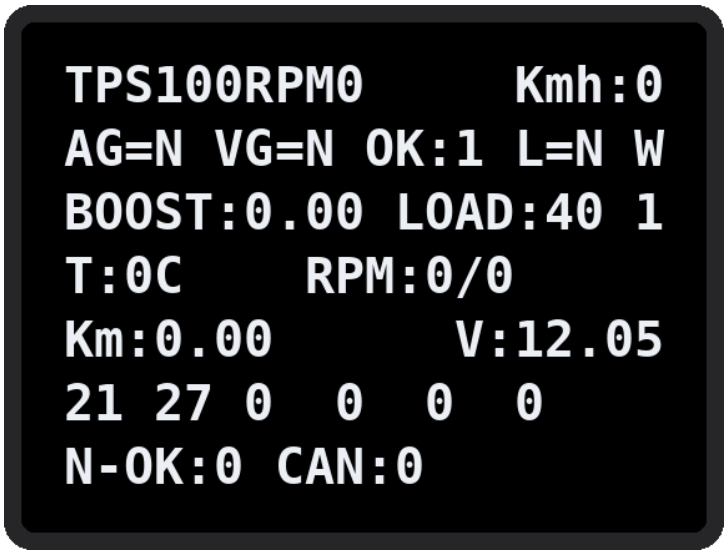
3.2 Live data dashboards

In the main menu, go to **View Live Data** and press right to show the dashboards.



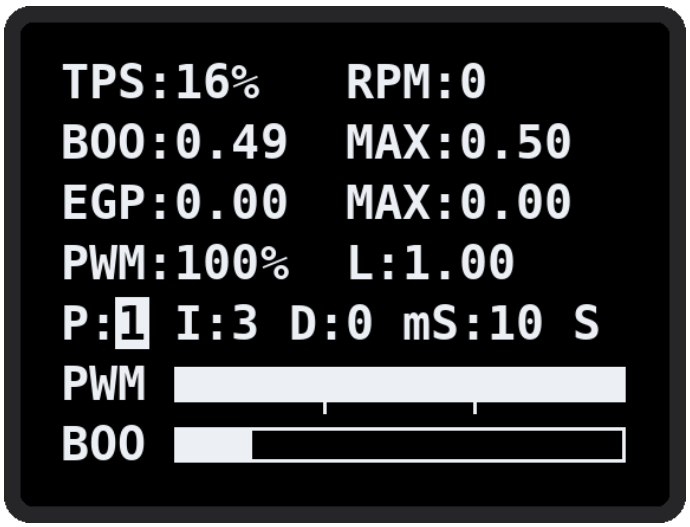
Main menu

Live data dashboard 1



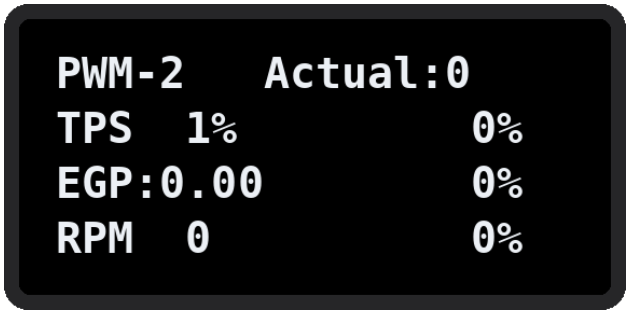
Field	Description
TPS	Throttle pedal position from the TPS, 0–100 %
RPM	Engine RPM. If taken from inside the gearbox, it is only valid while driving.
Kmh	Speed from the gearbox or from an external sensor
AG	Actual gear currently engaged (N = neutral)
VG	Gear the controller wants to shift to
OK	Shift delay status (only one shift per 2 s is allowed): 0 = waiting, 1 = OK to shift
L	Gear lever position P, R, N, D, 4, 3, 2, 1
W/S	Selected program, Winter / Sport (as OEM)
BOOST	Current boost pressure in bar (if a boost sensor is connected)
LOAD	Calculated engine load in % from TPS and boost (see Load – TPS Boost in section 3.4)
T	Oil temperature inside the gearbox; only valid in gear (cannot be read in P and N)
RPM x/y	Speed of the two internal gearbox drums (internal sensors 1/2) – not engine or driveshaft RPM
Km	Kilometres driven
V	Supply voltage to the controller
Valve values	Line pressure, shift pressure, lockup, 1-2/4-5 valve, 2-3 valve, 3-4 valve
N-OK	Neutral check status
CAN	CAN bus status (0 = no CAN data received)

Live data dashboard 2



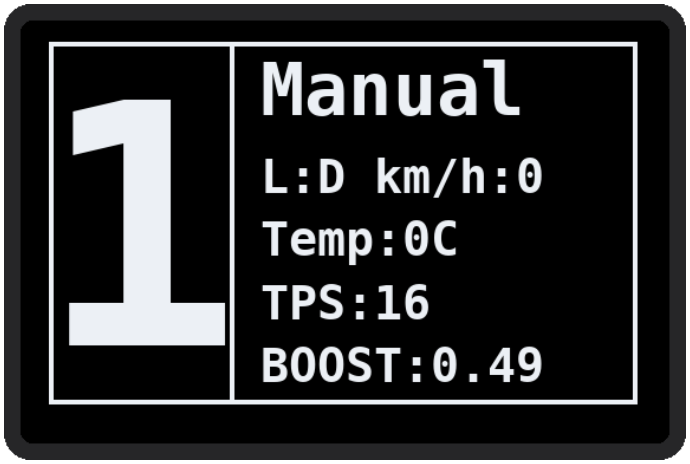
Field	Description
TPS	Throttle pedal position, 0–100 %
RPM	Engine RPM (internal value only valid while driving)
BOO	Current boost pressure (if a boost sensor is connected)
MAX	Maximum boost since the ignition was switched on
EGP	Current exhaust gas pressure (if an EGP sensor is connected)
MAX	Maximum EGP since the ignition was switched on
PWM	Actual value sent to the boost valve, 0–100 %
L	Target value based on all inputs

Live data dashboard 3



Field	Description
PWM	Actual value sent to the boost valve, 0–100 % (the lowest of the three below)
Actual	Current PWM sent to the AUX-2 output
TPS / %	Throttle position and the PWM wanted from the TPS table
EGP / %	Exhaust gas pressure and the PWM wanted from the EGP table
RPM / %	Engine RPM and the PWM wanted from the RPM table

3.3 Manual shift

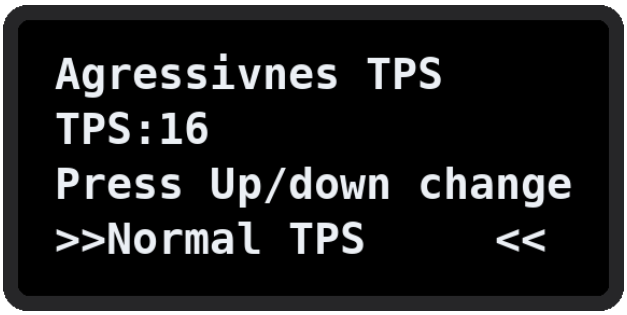


Use the joystick up/down to change gear – 100 % manual – or use paddle shifters or switches on a rally-type shifter. Only one shift every 2 s is possible (adjustable in the setup menu). Downshifts are only allowed where a kickdown would allow them, so the engine cannot be over-revved.

3.4 Setup parameters

Setup TPS





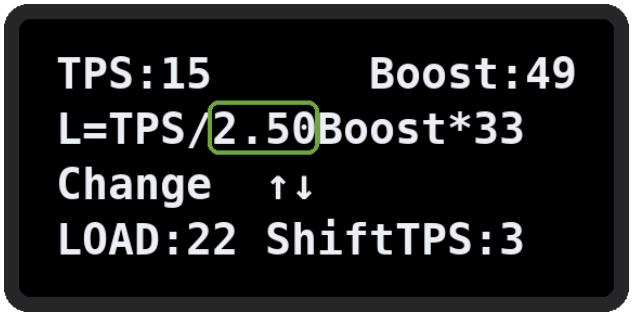
Calibrates the TPS – see *Calibrate the TPS* in section 2.4 for the procedure.

Pressing right once more in Setup TPS opens the screen on the right, where you choose how aggressively TPS is shown. Drive at 80 km/h: around 30 % TPS is correct. If it shows about 10 %, choose **Aggressive TPS**; if it shows about 60 %, choose **Slow TPS**.

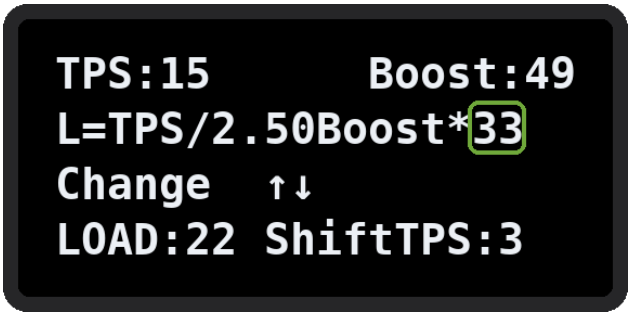
Load – TPS Boost; Boost Part Load

See *Define the load* in section 2.4. Load is the engine torque approximated from TPS and boost:

```
LOAD = TPS / [Load - TPS Boost] + Boost × [Boost Part Load]
```



Load – TPS Boost



Boost Part Load

If **Load – TPS Boost** is set to 2, 100 % throttle gives 50 % load and boost gives the rest.

Example: an engine has 700 Nm at 100 % TPS and 2 bar boost. At 1 bar and 100 % TPS: Load = 100 / 2.5 + 1 × 33 = 73 % → 700 × 0.73 = 511 Nm. At 50 % TPS with a setting of 2: 50 / 2 + 1 × 33 = 58 %.

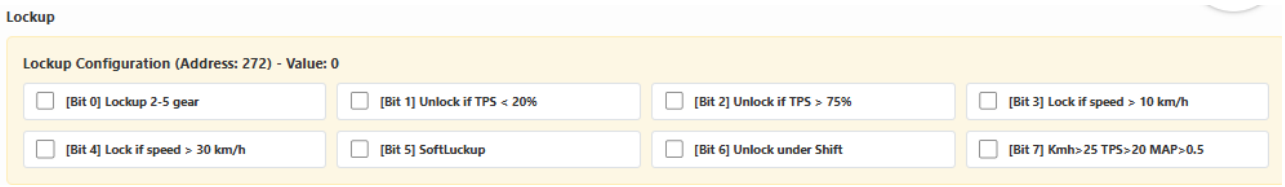
CANBUS BALDUR (from version 201): Boost Part Load also scales the rack position at which 100 % load is reached. CAN_rackpos is 0–100 %.

```
LOAD = (CAN_rackpos × 40) / [Boost Part Load]
```

- 33 → 100 % load at 82 % rack (100 = 82 × 40 / 33)
- 20 → 100 % load at 50 % rack (100 = 50 × 40 / 20)
- Electronic OM606 pump with standard 6 mm elements: leave at 33
- 7.5 or 8 mm elements from DieselMekkan: use 20

Converter lockup

The lockup can be set in **Setup Parameters → Lockup New**. These are the following possibilities:



Lockup configuration in the Parameter Tool

Other setup parameters

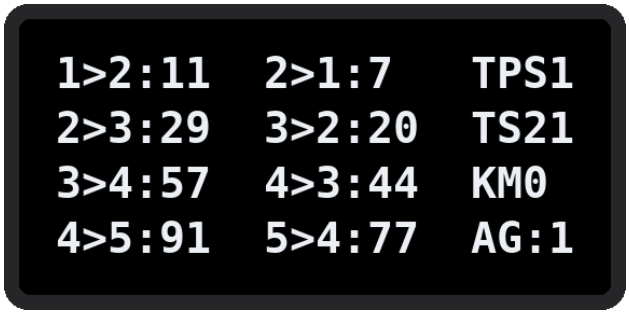
Parameter	Description
Volt reg 100%	Adjusts the voltmeter if it does not show the correct value.
Temp reg +/−	Adjusts the displayed temperature by ±20 °C. Only use it if you know the reading is wrong.
Kickdown at %TPS	At 97, kickdown is triggered above 97 % TPS. At 101 there is never kickdown. At 105, kickdown is triggered by an external 12 V signal.
Fail Handling	Default is 1. See chapter 6, Troubleshooting.
Max speed fail	Safety function that prevents the speed reading from dropping too fast. Set to a maximum of 20.
Slow upshift	The higher the number, the slower the upshift when the throttle is released quickly. Suppresses unwanted upshifts when driving slowly in town.
PWM N→D P→R	Called "garage shift" by Mercedes. Default 25. If engagement of D and R is harsh, raise the value (try 35); if it does not engage, lower it (e.g. 15). The value is not used the first two times R or D is engaged, to ensure engagement.
PWM 3-4 N-D/P	The 3-4 valve is driven with a PWM signal when shifting N→D or P→R for smoother engagement. Default 50. If it sometimes does not engage, set it to 0.
RPM INT/EXT; Adjust ext RPM	Selects internal (gearbox) or external engine RPM. The internal RPM always shows 0 when the car is stationary with the engine running, because the converter slips – this is normal. Adjust ext RPM (default 36) calibrates an external RPM signal; if the RPM reads too high, lower the number.
Speed INT/EXT; EXT Speed %; INT Speed %	Selects internal or external speed – see section 2.4. With internal speed there is a short period during each shift where speed cannot be calculated. With a large speed change (powerful engine or emergency braking during a shift) the signal can fluctuate so much that the controller stops shifting to prevent damage. Check the speed at 10 km/h in Live Data and correct it with EXT Speed % or INT Speed %.
Delay 3-4	The 722.6 has a delay on the 3→4 shift that can cause problems with high power or towing. Only use it if the 3-4 shift slips: start at 5 and increase by 1 until the slip is gone. Above 15 the gearbox is worn. Values −1 to −9 only allow the 3→4 shift when TPS is below 10–90 % – lift off to get a smooth shift.
Reset km	Right: reset total km to 0. Up: add 1000 km per press. Down: subtract 100 km per press (100 km precision).
Lockup Soft/Hard	Selects soft or hard converter lockup.
Use Paddle	Paddles on analog input 9: 0 = disabled; 1 = read value for testing; 2 = read value and activate horn output; 3 = paddle shift active; 4 = paddle shift active – pressing a paddle in the main menu switches instantly to manual, and it returns to automatic when driving very slowly in a high gear (firmware 95+).
Start up display	0 = main menu; 1 = boost live data (when used only as boost controller); 2 = start in manual mode (race mode); 3 = live data.
Lever setup	0 = Mercedes standard lever; 1 = no lever (N, P, R and D detected, but not 4-3-2-1); 2 = special gearbox with a 120 Ω output in R (gives reverse light output on AUX-3). See section 2.4 for the procedure.
Idle RPM <500 no	Only used with extra components fitted and an external RPM signal (the calculated RPM is always 0 when stationary). Must be above 500 RPM to give an output. From version 123: exactly 510 sets idle to 800 RPM below 45 °C oil temperature and 650 RPM when warmer.
Time bet M shift	Minimum time between shifts. At 1000 ms you must wait 1 s between 1→2 and 2→3. In automatic mode 500 ms is added, so the standard 1500 ms becomes 2000 ms.
Temp Line −20deg / 120deg	Line pressure correction when cold (default −3) and hot (default +5). Higher number = softer shift.

Parameter	Description
Temp Pres −20deg / 120deg	Shift pressure correction when cold and hot. Higher number = softer shift.
LineRegTime · PresRegTime · ShiftValve Time · 1-2 Soft high RPM · Tacho out	Advanced timing and output settings – leave at default unless advised by OF Gear.

Limit engine power during shifts

This is not in the setup menu but under **Boost Control → General Boost → Use PWM - AUX-4**. See *AUX-4* in chapter 4. Engine limiting only works above 20 % TPS, to avoid stalling at low RPM.

3.5 Shift speeds

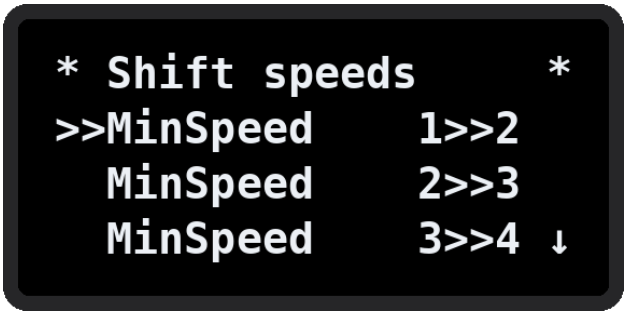


View Shift Speed – all up- and downshift speeds at the current TPS

This screen shows all up- and downshift speeds at the current TPS. Test it with the engine off: open the screen and press the throttle to see where the shifts would happen at that TPS.

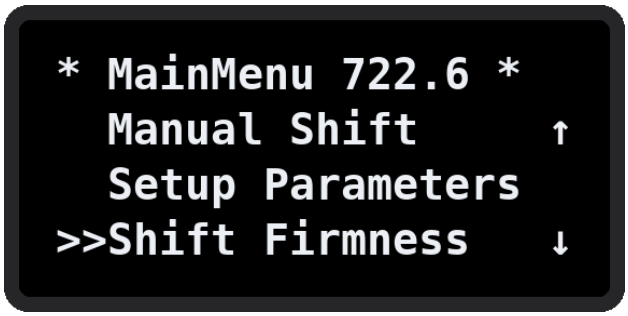
For each shift you set the speed at 0 % throttle (**Min**) and at 100 % throttle (**Max**), for both upshifts (e.g. MinSpeed 1→2, MaxSpeed 1→2) and downshifts (e.g. MinSpeed 2→1, MaxSpeed 2→1).





Parameter	Description
Kickdown ok 2→1 (etc.)	Below this speed a kickdown downshift to the lower gear is allowed
RPM Kickdown 1-2 (etc.)	At kickdown, the upshift happens at this RPM
Kickdown ok RPM	A kickdown downshift only happens if RPM is below this value

3.6 Shift firmness





Parameter	Default 1→2	Default 2→1	Effect
LineLowLoad	20	20	Higher = softer shift at low load
PresLowLoad	30	30	Higher = softer shift at low load
LineHiLoad	−6	−6	Higher = softer shift at high load
PresHiLoad	12	12	Higher = softer shift at high load

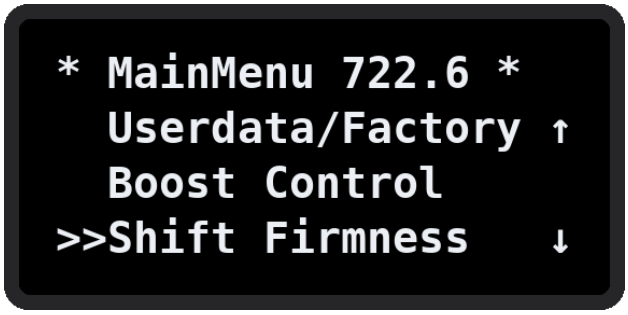
If the 1→2 shift is too hard at very low load, try LineLowLoad 1→2 = 22 and PresLowLoad 1→2 = 32. Press » to save. With firmware version 2 and later, values are saved automatically; on

older versions save permanently under Userdata/Factory before switching off. Do the same for high load if the shift is too hard or too soft.

When soft and hard shifts are set up, fine-tune the middle range with **Load at 25 % / 50 % / 75 % load**: if the shift is too hard at that load, lower the number.

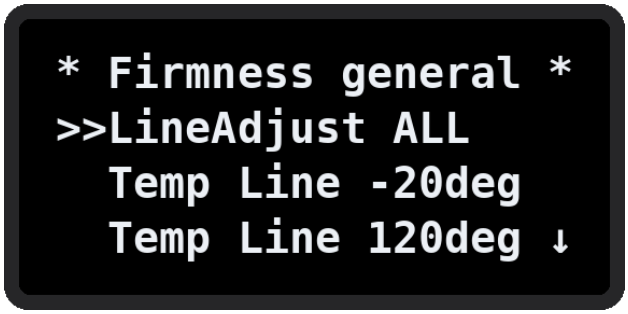
If all shifts are too soft or too hard, use **Shift Firmness → General Firmness**: lower number = firmer shifts, higher number = softer shifts.

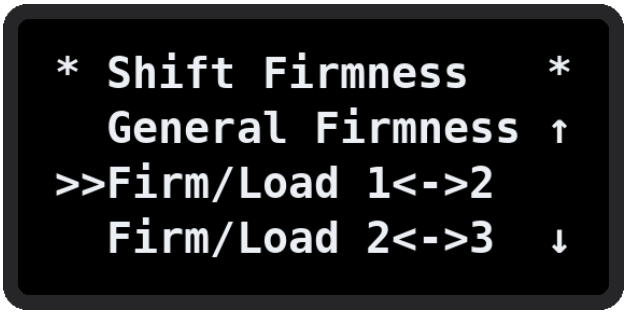
> **Important** A shift that is too soft can fail to complete, leaving the gearbox in the gear it was in. A slightly too hard shift is always better than one that is too soft.



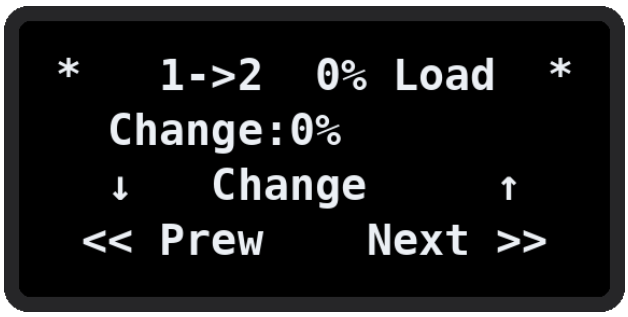


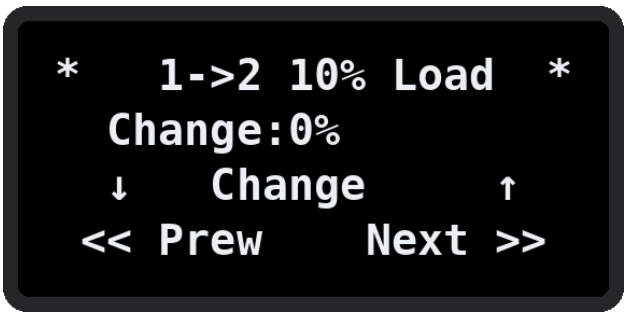
In **General Firmness** you can adjust the temperature correction and the general line pressure. From version 139, **LineAdjust ALL** is renamed **Firmness All L=H** and adjusts both line pressure and shift pressure: lower number = harder shift, higher number = softer shift.

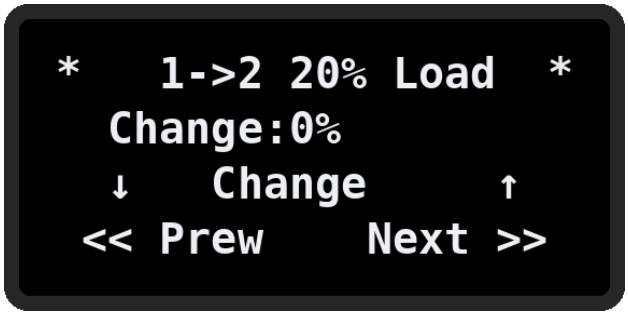


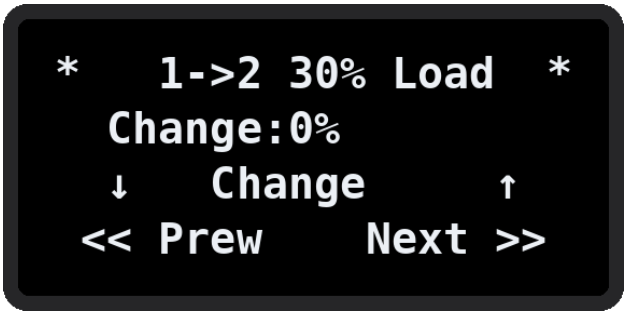


To adjust firmness for individual load points, enter **Firm/Load** for the shift you want:

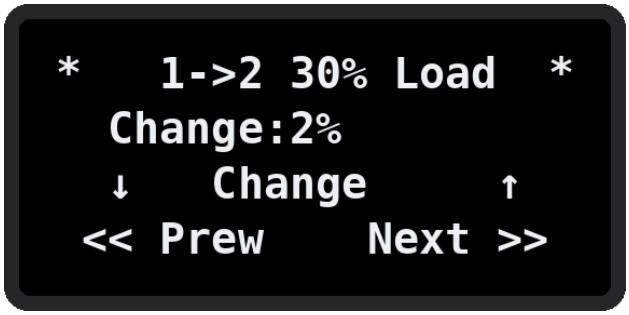








To make a shift slightly firmer at, for example, 30 % load only, raise the value at that point (higher number = firmer shift, only at that load):



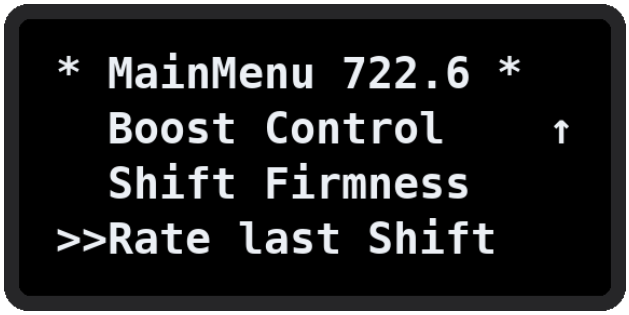
Before you leave the menu you are offered to save the changes. They are saved automatically for W or S depending on the switch position.





The last menu in Shift Firmness, **Line/Pres MAX/MIN**, sets the minimum and maximum for every gear. Leave it at the default values.

3.7 Rate last shift



After each shift, this screen shows the last shift and the load at which it happened. In the example below the gearbox has shifted 2→1 at 1 % load (no load).





Press the joystick **down** if the shift was too hard (the controller replies *Notet to Hard* and makes the next shift softer), or **up** if it was too soft. Each shift has 10 load points, and upshifts and downshifts are stored separately.

4. User manual for boost control

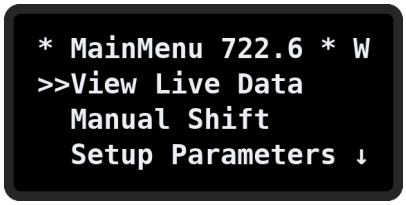


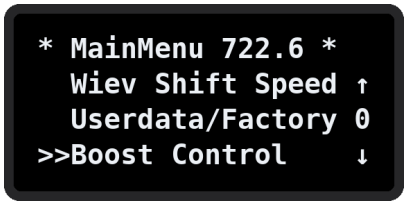
Boost target 0.6 bar, actual 0.63 bar – PWM is below 100 %, so the wastegate is opening

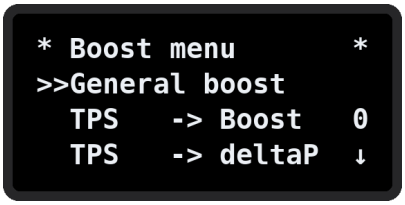
The boost controller can be used in several ways. Select the mode in:

```
Boost Control → General boost → VNT Boost/EGP
```

Value	Mode
0	PWM mode – specify the PWM directly as a function of boost etc. (see below)
1, 2, 3, 4	VNT turbos – four different control algorithms
5	Normal (wastegate) turbo
6	Normal turbo, more aggressive limit
7	Normal turbo, even more aggressive limit
8 … 20	Increasingly aggressive limit; 20 = extreme



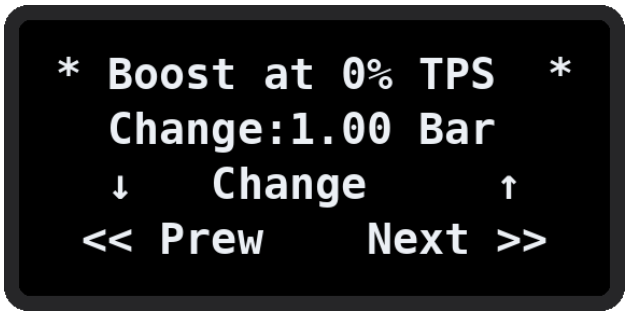




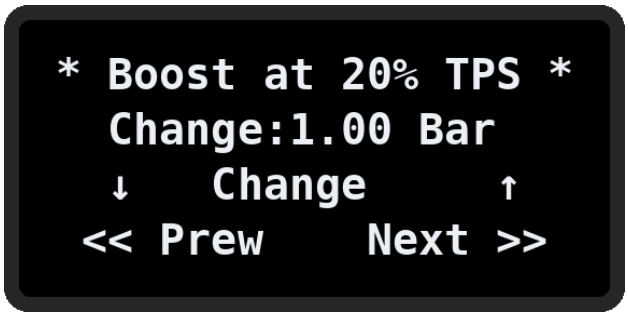
Boost Control is at the bottom of the main menu; it contains General boost and all data points

Example: wastegate turbo, open at 1 bar

Go to **Boost Control → TPS → Boost** and press right. There are 11 data points, one for each throttle position 0, 10, 20 … 100 %. Right = next point, left = previous, up = higher value, down = lower value. Video: youtube.com/watch?v=ULEGavGRavs









Check the result in Live Data. Here TPS is 41 % and the limit is 0.6 bar (9 psi) at that throttle position. Boost is slightly higher, so the PWM output is below 100 % – the wastegate has started to open.

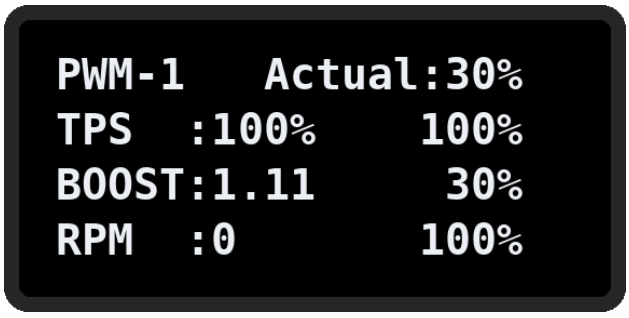


PWM mode – full control of the boost valve

PWM (pulse width modulation) at 10 % means the solenoid is powered 10 % of the time and the wastegate is almost fully open. At 100 % the solenoid gives full vacuum and the wastegate closes.

```
Boost Control → General boost → VNT Boost/EGP = 0
Boost Control → General boost → Use PWM-1 Boost = 1
```

The menu now changes for PWM control. Set the tables you want in **EGP-Boost → % PWM**, **Boost → % PWM**, **RPM → % PWM** and **Speed → % PWM**. The lowest PWM value from these tables is sent to the valve. Below, boost limits the PWM to 30 %:

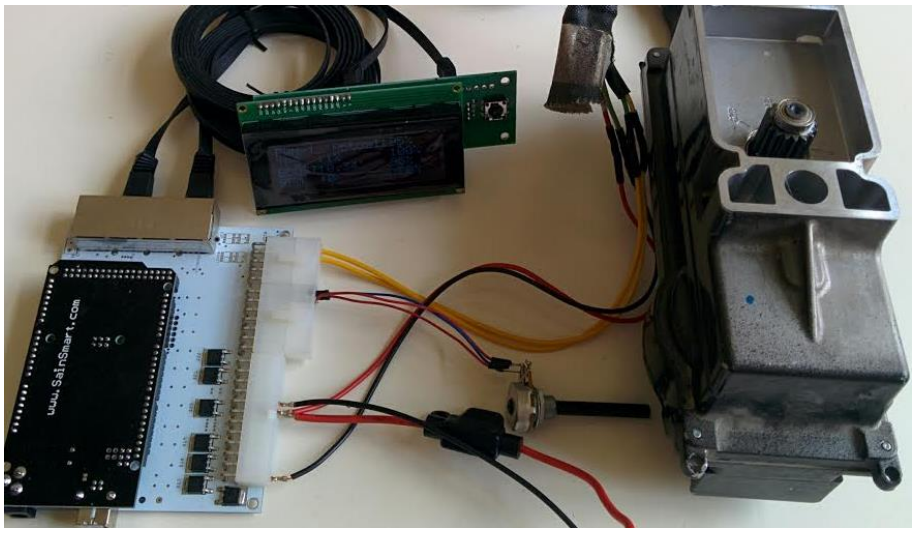


Holset CAN bus control (from firmware 144, hardware version 4)

The Holset HE351VE is a popular VNT turbo and can be controlled over the CAN bus output.

1. Set **Boost Control → General boost → CANBUS** to **HOLSET 1**, or **HOLSET 2** to move the vanes the other way.
2. Set **Boost Control → General boost → VNT Boost/EGP** to **0**.
3. Restart the controller twice.
4. Set the EGP-Boost, Boost, RPM and Speed → % PWM tables. In this mode, % PWM is the VNT vane position in %.

Holset wire	Connection
Red/green	12 V
Green/yellow	0 V (GND)
Yellow	CAN H
Green	CAN L



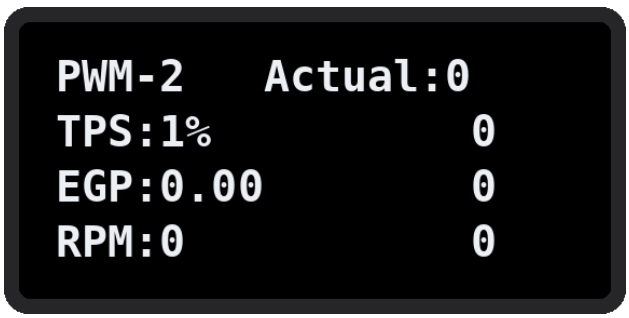
Test setup with Holset actuator

Extra AUX outputs

There are three more PWM AUX outputs.

AUX-2

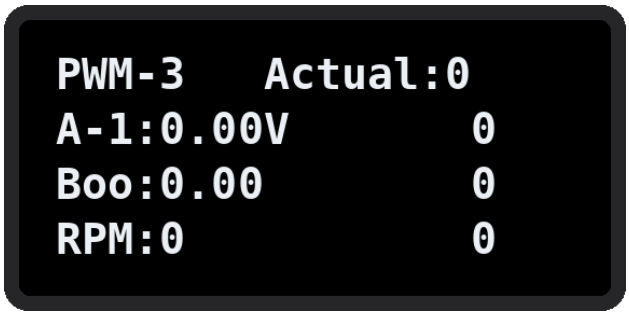
```
General Boost → USE AUX-2
```



Value	Function
1	PWM output from TPS, EGP and RPM tables – the lowest of the three is used
2	Starter lockout (see section 2.3)

Value	Function
3	Gear oil cooler fan (from version 159): pulls AUX-2 to ground above 90 °C, releases at 85 °C. On some firmware versions value 3 instead drives the gear lever lock solenoid (see AUX-3, value 3).

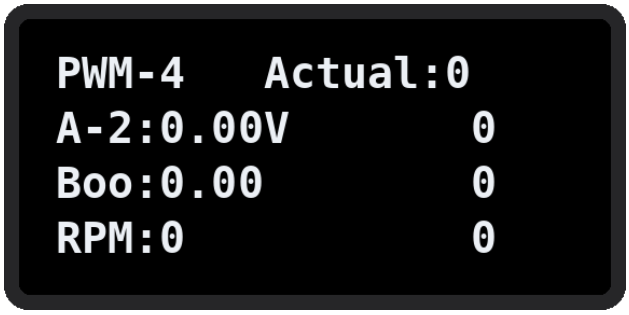
AUX-3



Value	Function
1	PWM output from analog input 1, boost and RPM tables – lowest of the three
3	Drives the gear lever lock solenoid so the lever cannot be moved to R or P above 10 km/h (gives a ground signal; supply 12 V to the other side of the solenoid)
4	Gear oil cooler fan: pulls AUX-3 to ground above 90 °C, releases at 85 °C

Note AUX-3 is also used for the reverse light when Lever setup is 2, and cannot then be used as AUX-3.

AUX-4 – AUX output or engine power limit




```
General Boost → Use PWM - AUX-4
```

Value	Function
1	PWM output from analog input 2, boost and RPM tables – lowest of the three (no power limit)
2	Instant 200 ms pulse at 100 % PWM
3	Instant 300 ms pulse at 100 % PWM
12	100 ms delay, then 100 ms pulse (ends at 200 ms) at 100 % PWM
25	200 ms delay, then 300 ms pulse (ends at 500 ms) at 100 % PWM

Engine limiting only works above 20 % TPS, to avoid stalling at low RPM.

Example – how the lowest value is chosen

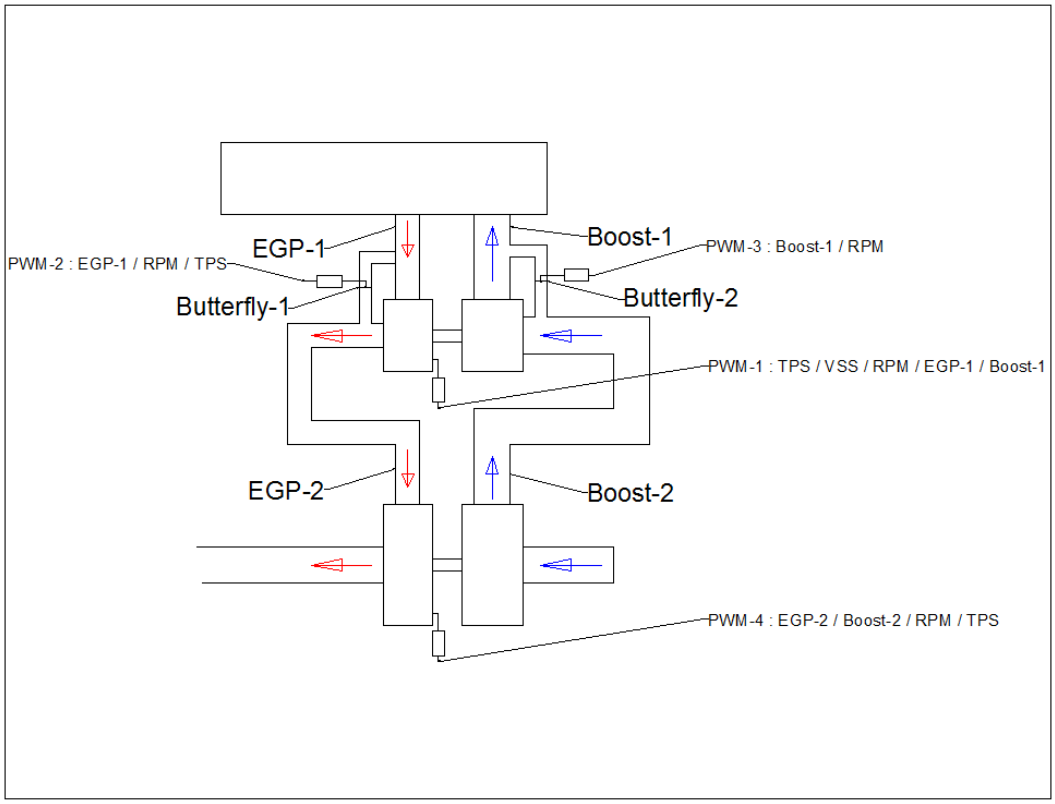
A-2 (V)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
PWM %	100	100	100	100	100	100	100	100	90	75	30

Boost (bar)	0	0.15	0.3	0.45	0.6	0.75	0.9	1.05	1.2	1.35
PWM %	100	100	100	100	100	100	60	30	0	0

RPM	0	500	1000	1500	2000	2500	3000	3500	4000	4500
PWM %	100	100	100	100	100	100	100	80	60	40

With A-2 = 4.5 V (→ 75 %), boost = 0.9 bar (→ 60 %) and RPM = 3500 (→ 80 %), the lowest value, **60 %**, is sent to the valve.

Advanced: two VNT turbos in compound



5. Using a computer with the controller

The controller is set up and updated with the **OF Gear Parameter Tool**, which runs directly in your web browser. There is nothing to download or install: no Arduino IDE, no upload program and, on most computers, no extra driver. The Parameter Tool talks to the controller over the USB cable using the browser's built-in serial connection (Web Serial).

```
https://ofgear.dk/download/ParameterTool.html
```

The Parameter Tool can also be found on www.ofgear.dk under **Download → Parameter Tool**.

What you need

Item	Requirement
Computer	Windows 10/11, macOS or Linux, with internet access
Browser	Google Chrome or Microsoft Edge (desktop version). Firefox and Safari do not support Web Serial and cannot be used.
Cable	The USB cable supplied with the kit – it must be a data cable, not a charge-only cable

Important Only connect or disconnect the USB cable while the vehicle is stationary. The controller restarts when a computer connects to it.

Connecting to the controller

1. Open **ofgear.dk/download/ParameterTool.html** in Chrome or Edge.
2. With the vehicle stationary, connect the USB cable between the computer and the controller.
3. Click **1. Connect (Serial)**. The browser shows a list of serial ports.
4. Select **Arduino Mega 2560** (on Windows shown with its COM port) and click **Connect**.
5. Select **Winter Mode (W)** or **Sport Mode (S)** – the two programs have separate settings.
6. Click **2. Read Data from TCU (Fast)** to fetch the current settings.

Note The first time, the browser asks for permission to access the serial port. This is normal – the Parameter Tool can only see the port you select yourself.

Updating the firmware

1. Connect to the controller and read the data as described above.
2. Click **Save to PC** to keep a backup of your current settings (repeat for W and S).
3. Open the **Firmware** tab and click **Update to latest firmware**. To install a specific version received from OF Gear instead, click **Open Firmware (.hex)**, select the file and click **Upload to Mega**. Tick **Verify after upload** to have the upload checked.
4. Wait until the Parameter Tool reports that the upload is complete (about 60 seconds). Do **not** disconnect the cable, close the browser or switch off the power during the update.
5. The controller restarts. Connect again, read the data and check your settings. If anything was reset, load the backup with **Import (.txt)** and click **4. Transfer to TCU (Smart Flash)**.

Note If an update is interrupted, connect again and repeat the update. The controller's boot loader is not affected, so the controller can always be updated again.

Setting up the controller

All the parameters described in chapters 3 and 4 can be changed in the Parameter Tool, which is much quicker than using the joystick. Change the values in the tabs and click **4. Transfer to TCU (Smart Flash)** to store them in the controller.

Button / tab	What it does
1. Connect (Serial)	Opens the USB connection to the controller
2. Read Data from TCU (Fast)	Fetches all current settings from the controller
4. Transfer to TCU (Smart Flash)	Writes the changed settings to the controller (stored permanently)
Winter Mode (W) / Sport Mode (S)	Selects which program's settings are read and written
Save to PC / Import (.txt)	Saves all settings to a file, or loads them from a file – keep a backup
Shiftfirmness, Shift Speed	Shift firmness per shift and load, and shift speeds (chapter 3)
Boost Curves, PWM AUX Outputs	Boost control tables and AUX outputs (chapter 4)
Sensor System Setting	Sensors, lockup, CAN bus, gear lever, 3-4 shift and paddle input
Live Data	Live stream at 100 ms or 20 ms with charts; Download Log (.txt) saves the recording
Analysis / Shift Analyse	Plays back log files and records each shift for detailed analysis
Clear Speed Fail	Clears a speed fail (see chapter 6)
TOTAL RESET (14001)	Resets the controller to factory settings – save a backup first

Important Do not change settings from the computer while driving. Use a passenger, or stop the vehicle before changing and transferring parameters.

If the connection does not work

Problem	Solution
Nothing happens when clicking Connect	The browser does not support Web Serial. Open the page in Chrome or Edge.
The controller is not in the list of ports	Try another USB cable (it may be charge-only) or another USB port. On Windows, check that the controller appears under Ports (COM & LPT) in Device Manager.
"Failed to open serial port"	Another program is using the port – close any other tab with the Parameter Tool, the old setup program or the Arduino IDE, and try again.
The update stops halfway	Click Abort if needed, reconnect the cable, connect again and repeat the update.

6. Troubleshooting

Fail messages

#	Message	km/h shown
1	RPM_1 Start Fail	200
2	RPM_1 Start Fail	175
3	Speed Fail	150
4	GearLever N at speed	125
5	Shut down under speed	–

How the controller reacts is set in **Setup → Fail Handling**. The standard setting is **1** (2 on older controllers). Please do not change it without contacting OF Gear first.

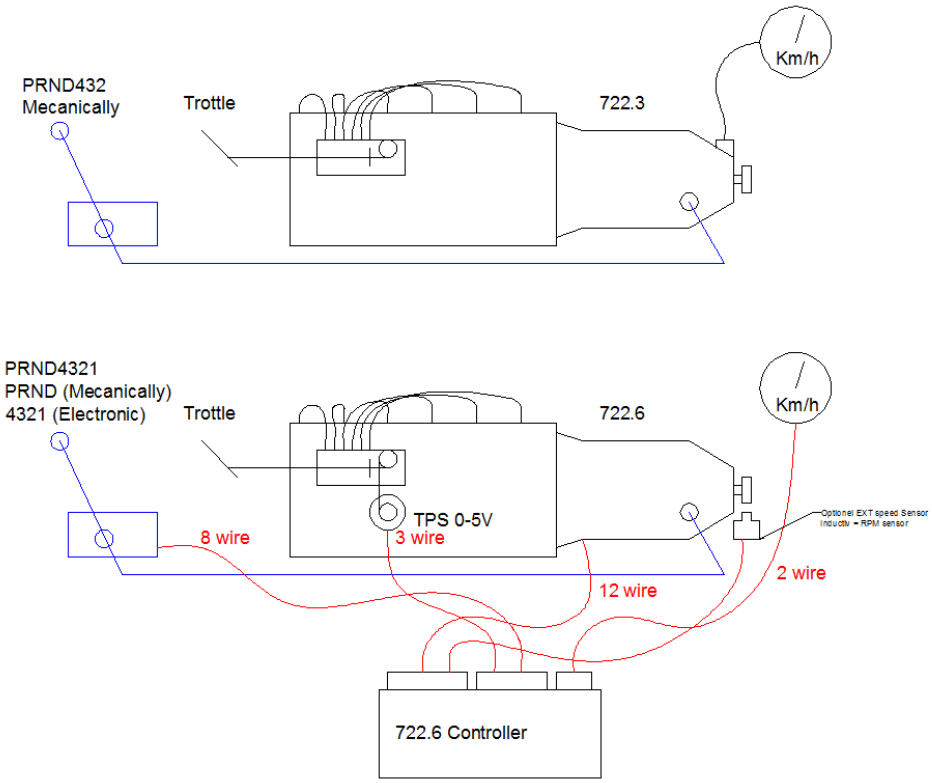
Setting	Behaviour
0	No fail messages and no shift lock. **Do not use.**
1	Fails 1, 2, 3: message only, no shift lock. Internal speed sensor: fails 4 and 5 lock shifting and show a message. External speed sensor: fail 4 does not lock shifting; fail 5 locks shifting and shows a message.
2	Fail 3: message only. Fails 1, 2, 4, 5: lock shifting and show a message.
3	All fails (1–5) lock shifting and show a message.

Important If the message **Shut down under speed – press Left to reset** appears, press the joystick left to reset. Only do this when the vehicle is stationary (0 km/h).

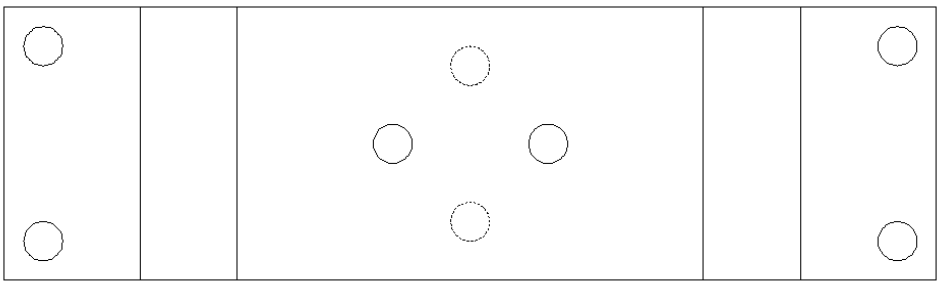
Appendix

A. Conversion example – W124 (OM603 → OM606, 722.3 → 722.6)

- The propeller shaft does not need to be changed – just make sure the flange fits.
- If the car has a mechanical speedometer, use an electronic one from a W124 (420 or 500) – make sure it is electronic.
- The crossmember from any W210 can be used; two holes must be drilled.



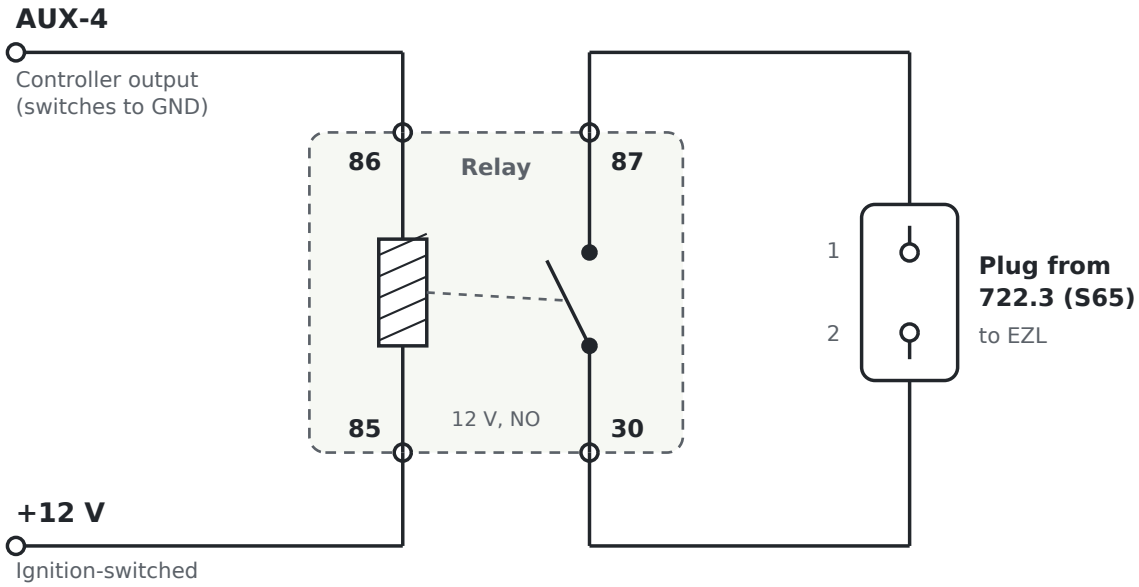
Wiring before (722.3) and after (722.6 with controller)



W210 crossmember – the two dashed holes must be drilled

B. Transmission overload protection on W124 petrol cars (optional, untested)

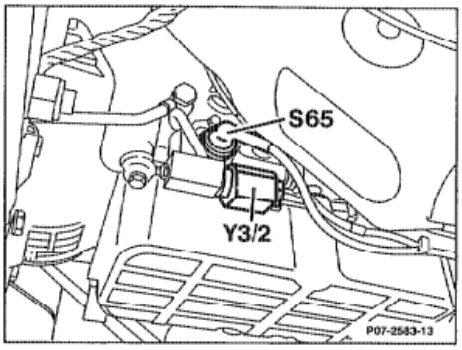
The controller can also send a signal to the engine's ignition control unit. This has not yet been tested. On the original 722.3 the S65 switch most likely just shorts two wires; if so, a relay driven by the AUX-4 output can do the same. If you know exactly how the S65 switch works, please contact OF Gear.



Proposed relay wiring: when AUX-4 pulls terminal 86 to ground, the relay closes and shorts the two S65 wires

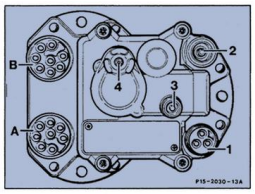
Background (Mercedes documentation): to protect the shift elements from excessive heat during power shifts at high engine speed, the EZL ignition control unit retards ignition to 5° before TDC for about 400 ms during 1→2 and 2→3 upshifts (also used on full-load 3→2 downshifts for smoother shifts). This happens when engine speed is above approx. 4000 rpm, intake vacuum is below approx. 300 mbar, and the S65 switch on brake band B1 signals a shift. S65 is a hydraulic switch: open below 1.8 bar working pressure, closed above 1.8 bar. On the EZL, plug B pin 3 is the transmission overload protection input.

The transmission overload protection switch, brake band B1 (S65) (engine 120: brake band B1 (S65) and B2 (S65/1)) is designed as a hydraulic switch and linked to the operating pressure circuit of brake band "B1" and "B2", respectively, of the automatic transmission.
The opening and closing of the transmission overload protection switch, brake band B1 (S65) (engine 120: brake band B1 (S65) and B2 (S65/1)) is detected as a shift signal by the appropriate EZL ignition control unit.
The shift function of the transmission overload protection switch, brake band B1 (S65) is dependent on the working pressure which exists at "B1".
Working pressure <1.8 bar: S65 opened.
Working pressure >1.8 bar: S65 closed.



S65 Transmission overload protection switch, brake band B1
Y3/2 Shift point retard solenoid valve

S65 switch and Y3/2 valve



1 3-pole connector, knock sensors
1 = shared ground
2 = Knock sensor 2
3 = Knock sensor 1
2 Coaxial connector for the control wire from the crankshaft position sensor
3 Reference resistor connector (EZL/AKR)
4 Vacuum connection
A 8-pole connector
1 = Ignition coil circuit 1
2 = Ground circuit 31
3 = circuit 15Z
4 = TN signal
5 = Data line negative
6 = 5-speed automatic transmission control unit (N15/1)
7 = Data line to the CIS-E control unit (N3)
8 = Blink signal output
B 8-pole connector
1 = Camshaft position sensor positive
2 = unused
3 = Transmission overload protection
4 = Coolant temperature sensor
5 = Coolant temperature sensor ground

EZL connector pin-out

C. Gear oil level

The correct oil level is very important on the 722.6. The gearbox was never delivered with a dipstick, but a dipstick tool can be bought (Mercedes part number **140 589 15 21 00**) or made yourself; see the BenzWorld forum thread "W210 homemade dipstick 722.6 transmission".

D. Speedometer on older cars

A method for moving the internal VR trigger wheel to the driveshaft and keeping a mechanical speedometer is described on PeachParts ("380SL diesel conversion project" and "Mechanical to Electronic Speedometer Conversion").

E. Torque capacity

- W5A580 (large NAG): approx. 800 Nm (578 lb·ft)
- 722.649 (E65 AMG): believed to be the strongest 722.6 – handles approx. 1000 Nm
- 722.608: 300 TD diesel · 722.623: some V8 petrol engines

F. Where to find the 722.6 gearbox

- Mercedes-Benz W140 (1996–1999)
- W220 (2000–2005)
- W221 (V12 models only)
- W210 (1997–2002)
- W211 (2002–2004)
- W202 (1997–2000)
- W203 (2000–2004)
- W163 (1998–2005)
- W168 (1997–2004)
- W169 (2004–)
- B-Class (2005–)
- R170 (1998–2005)
- R129 (1990–2001)
- R230 (V12 and earlier, up to 2005)
- W208 (1998–2002)
- W209 (2003–2005)
- C215 (2000–2006, V12 only)
- C216 (2007–, V12 only)
- W463 (1996–, AMG models only)
- SLR (2005–2009)
- Maybach 57 and 62 (2002–)
- Jaguar X308 (1998–2002, supercharged only)
- Jaguar XK X100 (1998–2002, supercharged only)
- SsangYong Rexton (2004–)
- SsangYong Kyron (2006–)
- SsangYong Rodius (2005–)
- Dodge Magnum (2005–2008): all HEMI, all AWD and some 3.5 L RWD V6
- Chrysler 300 (2005–): all HEMI, all AWD, some 3.5 L RWD V6, all Pentastar V6
- Dodge Charger (2006–): all HEMI, all AWD, some 3.5 L RWD V6, all Pentastar V6
- Dodge Challenger (2008–): all HEMI, all Pentastar V6
- Dodge Nitro (2007–2011): 4.0 L V6
- Jeep Commander (2006–2010): 3.7 L V6, 3.0 L CRD V6
- Jeep Grand Cherokee (2005–): 3.7 L V6, 3.0 L diesel, SRT8, all Pentastar V6
- Dodge Durango (2011–): 3.6 L V6
- Jeep Wrangler (2011–): 2.8 L diesel; (2012–): 3.6 L V6