SERVICE INFORMATION

ELECTROPNEUMATIC VALVES

TECHNICAL INFORMATION

These are small, unobtrusive and frequently fitted within areas of the engine compartment which are difficult to see or access. The function of the electropneumatic valves within the pneumatic system of the vehicle is equivalent to the function of switches and dimmers in electric circuits.

In connection with a pneumatic actuator it is thus possible to operate valves or to control turbochargers, for example.

They offer the following advantages:

- high actuating forces from within a small space
- the necessary low pressure as auxiliary energy is available in almost all vehicles (due to the low-pressure in the intake manifold or generated by a vacuumpump)
- only a small amount of electric power is necessary for the actuating processes

In all newer vehicles often several electropneumatic valves have been built in.

Application example: Intake manifold with electropneumatic valves (highlighted in red) as used in Mercedes-Benz C Class vehicles

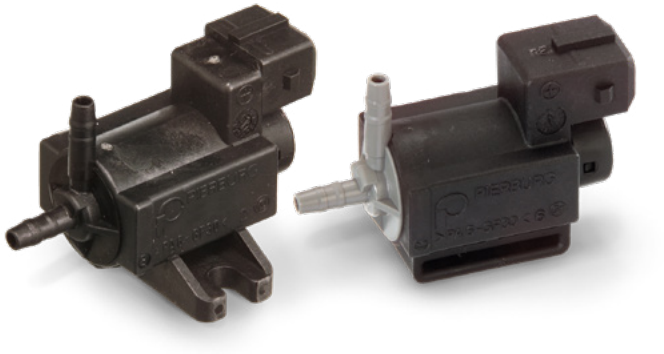
SWITCHOVER VALVES

Operation of an switch over valve is comparable to a switch in an electric circuit: Pressure / low pressure is “switched over” between two connections.

Switchover valves are mainly used where a simple open-close function of the pneumatic actuators is needed:

- Bypass valves on EGR coolers
- Exhaust valves
- Secondary air valves
- Intake manifold valves]
- Boost pressure control valves (wastegate)

Newer switchover valves may also be driven by means of pulse width modulation.



PULSE WIDTH MODULATION (PWM)

In order to drive the newer types of electropneumatic valves by the engine controller, a control current is necessary. However, this control current is not DC but is instead a current which is clocked at a constant frequency (“pulse width modulation”).
The switch on duration of a pulse is here termed “duty cycle”. Depending on whether the current or the duty cycle is used as the command variable, such an electropneumatic valve is designated as being “current controlled” or “duty cycle controlled” (respectively “clock controlled”).

At the controlled intake manifold in the Opel Astra already two switchover valves have been fitted (highlighted in red).
One controls through the actuator above it (highlighted in red) the intake manifold throttles; the other switches the secondary air shut-off valve (not shown).

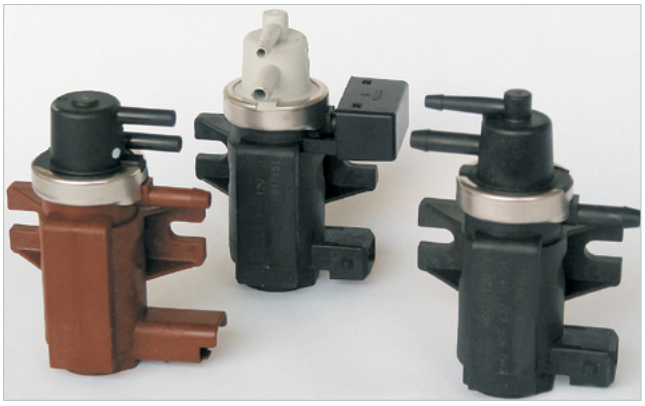
PRESSURE TRANSDUCER

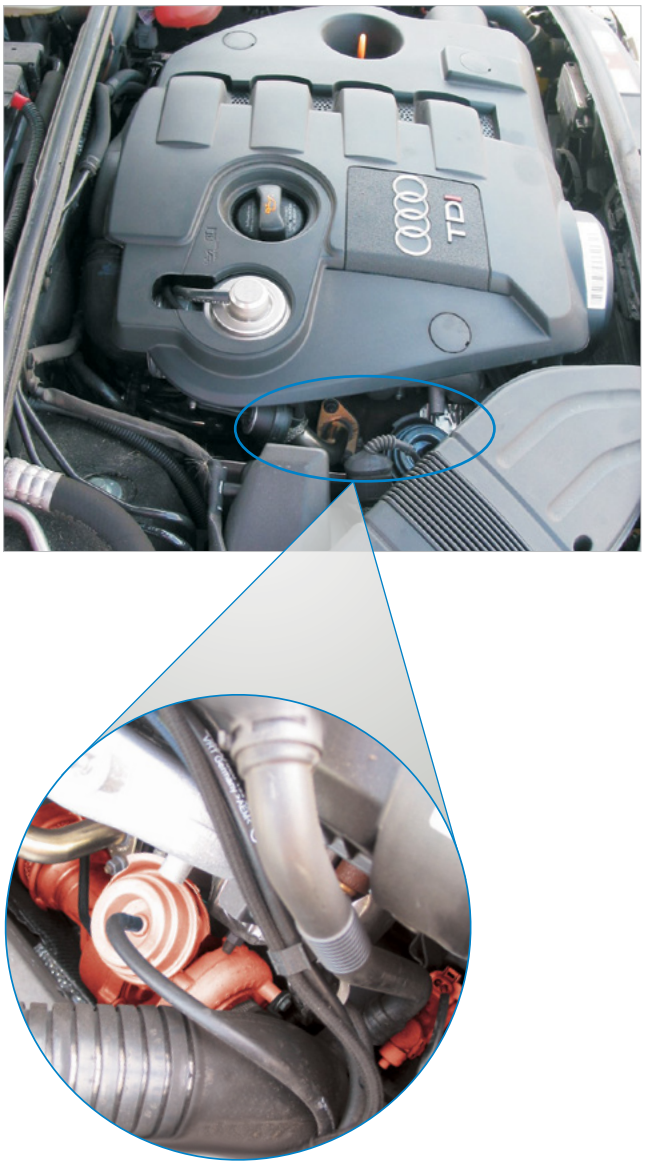
Pressure transducer are used in large numbers in exhaust gas return systems (AGR) and VTG chargers (“Variable Turbo Geometry”, turbochargers with adjustable guide vanes).

Their operation resembles that of a “dimmer” in an electric circuit. From the low pressure and the atmospheric pressure, a mixed pressure (control pressure) is generated within the pressure transducer through which the pneumatic actuators can be adjusted in a continuously variable manner.

Pressure transducers are driven by means of pulse width modulation. Frequently several pressure transducers have been built into a vehicle.

For identification purposes at the work-shops, the vehicle manufacturers frequently use different colours for head section and body of an pressure transducer.





Pressure transducer and VTG charger (highlighted in red) in the Audi A4 TDI

COMPLAINTS

Since electropneumatic valves are used in many systems of a vehicle, the symptoms which indicate a malfunctioning or failed valve can be highly varied:

- Insufficient power
- Turbo lag in the case of turbochargers
- Black smoke
- Jerkiness
- Emergency operation (in case of a malfunctioning valve in the EGR system)

Electropneumatic valves are monitored by the ODB (on board diagnosis system) not as to their operation but instead as to continuity, short-circuit and short-circuit to ground. For this reason failures are not reliably detected and malfunctions are frequently attributed to other components.

POSSIBLE CAUSES

- The most frequent causes why a valve is malfunctioning or has failed are water and dirt which have entered into the system of the controlling low-pressure. This may happen through leaky hose joints or broken hose connections.
- High ambient temperatures can cause intermittent malfunctions.
- In rare cases malfunctions are caused by confused connection hoses.
- A defective vacuum pump may deliver an insufficient low pressure for properly driving the valves.

For this reason an expert with system know-how is required in such cases who will not only rely on an error message and simply only replace a (possibly) wrong component but who will instead scrutinise the indicated error and determine the causes.

Checking a pressure transducer using a manually operated vacuum pump (VW Golf IV) (Pierburg Art. Nr. 12 00001 11 900)

TESTING

The leak tightness of an electropneumatic valve can easily be checked with a manually operated low-pressure generating pump.

A simple electric test of an electropneumatic valve will in many cases be possible with a commercially available multirange meter.

MANY DESIGNATIONS

Vehicle and valve manufacturers sometimes use different designations for these components. Here is a selection of alternative designations for the respective names:

PRESSURE TRANSDUCER:
Electropneumatic pressure transducers (EPW), electric pressure transducer

SWITCHOVER VALVE:
Electric switchover valve (EUV), solenoid valve boost pressure limitation N75 (VW), solenoid switchover valve (VW), electric valve (BMW)