

## Electropneumatic pressure transducer – EPT

### Product summary

si 0065 **GB**

MSI-PG 09.02

#### Vehicle:

- Vehicles with exhaust gas recirculation (EGR-system)
- Turbochargers with variable geometry (VTG-supercharger)

**Product:** Electropneumatic pressure transducer (EPT)

**Pierburg-Nr.:** various

See respectively valid catalogues, TecDoc-CD or TecDoc data based systems

### 1 Product description

Electropneumatic pressure transducers are used in large numbers for

- exhaust gas recirculation systems (EGR) and
- VTG-superchargers ("Variable Turbo Geometry", turbochargers with variable vanes).

Their function is similar to that of a "Dimmer" in an electrical circuit: From a vacuum and atmospheric pressure a mixed pressure (control pressure) is formed in the EPT that can be infinitely varied via the pneumatic actuator ("vacuum cell").

Via an EPT in conjunction with a pneumatic regulator, far higher forces can be exerted than possible in an electrical system with "dimmer" and actuator – and this with smaller sizes.

The necessary vacuum is present in virtually all vehicles (e.g. from the intake pipe or a vacuum pump).

### 2 Variants

The EPTs are dimensioned according to the particular application.

The following can be varied depending on the requirements (→ Fig. 1):

- Type of position of electrical connection (connector variants, contacting)
- Position of pipe connections
- Method of attachment (bracket)
- Characteristic
- With/without temperature compensation
- Current or pulse controlled
- Dynamic (evacuation/vent time)
- With/without filter at vent connection (ATM)

### 3 Typical characteristics

Rated voltage	[V]	12
Operating voltage	[V]	10 – 16
Resistance	[Ω]	11 – 16
Inductivity	[mH]	40
Pulse duty factor	[%]	20 ... 95
Frequency	[Hz]	250 ... 300
Ambient temperature	[°C]	-30 – 120

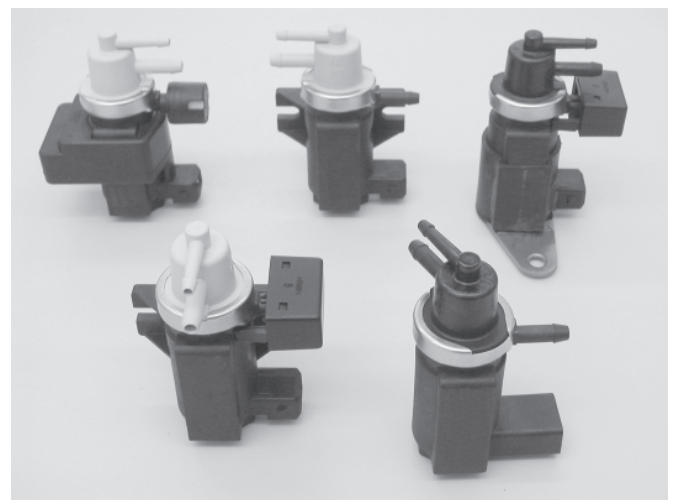


Fig. 1 Product view (type variants)

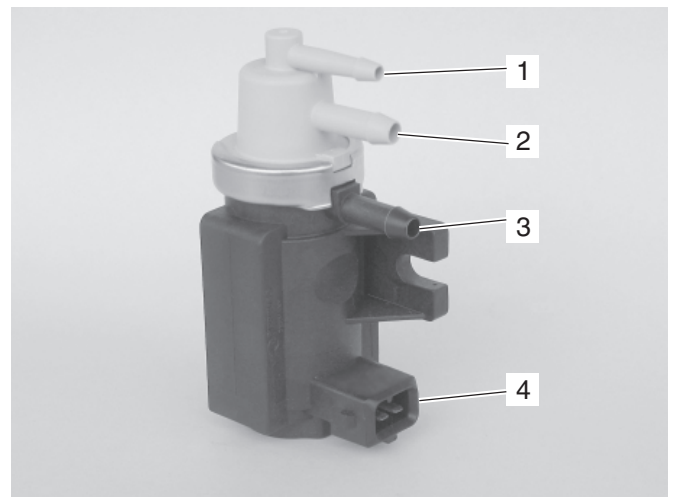



Fig. 2 Connections

- 1 Vacuum supply (VAC)
- 2 Variable control pressure (OUT)
- 3 Vent connection (ATM)
- 4 Electrical connection

 The position of the connections can vary depending on the particular type.

Subject to change of illustrations and text.

## 4 Applications

### 4.1 Exhaust gas recirculation (EGR)

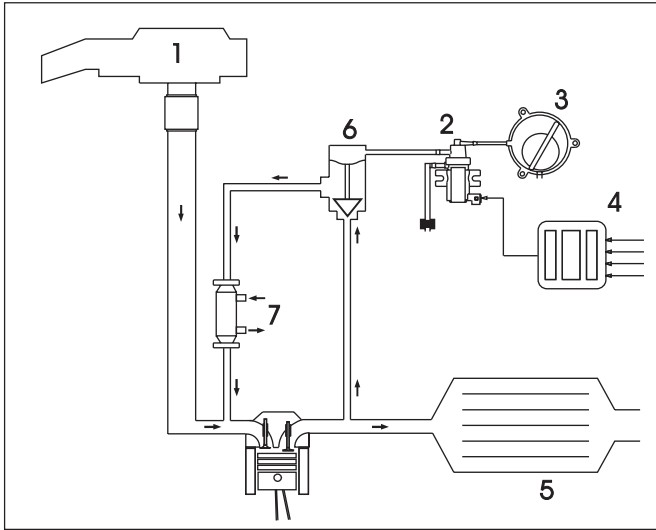


Fig. 3 EPT in exhaust gas recirculation system

- 1 Air filter
- 2 EPT
- 3 Vacuum pump
- 4 Engine control unit
- 5 Catalyst
- 6 EGR-valve
- 7 EGR-cooler

Exhaust gas recirculation serves for the reduction of pollutants in the exhaust gas. The fresh air supplied to the engine is added to the exhaust gas.

This reduces the oxygen content in the combustion chamber and in turn the combustion temperature. The lower combustion temperature reduces the emission of nitrogen oxides ( $\text{NO}_x$ ).

An exhaust gas recirculation system only operates effectively when it is precisely controlled. EGR-valves can be controlled either pneumatically or electrically, depending on the particular type. With pneumatic control, the necessary vacuum ("control pressure") modulation takes place via an EPT. The EPT is controlled via a specific family of characteristics. The control pressure with which the EGR-valve is operated is set depending on the signal mark-space ratio.

### 4.2 VTG-supercharger

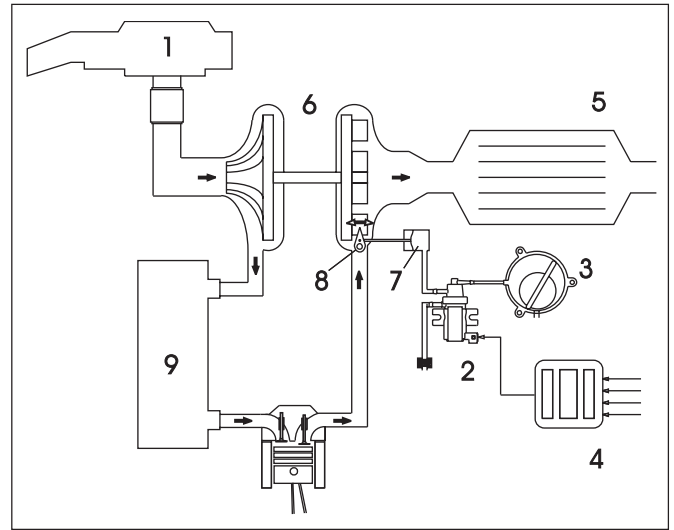


Abb. 4 EPT in VTG-supercharger

- 1 Air filter
- 2 EPT
- 3 Vacuum pump
- 4 Engine control unit
- 5 Catalyst
- 6 VTG-supercharger
- 7 Vacuum cell
- 8 Variable vanes
- 9 Charge air cooler

The achievable engine torque of a vehicle with internal-combustion engine depends on the proportion of fresh gas in the cylinder charge.

Exhaust gas turbochargers utilise the energy in a turbine in order to increase the cylinder charge via a connected compressor.

VTG-superchargers vary the required boost pressure by varying the turbine vanes. This variation must take place with precision.

The EPT is controlled by the engine control unit via a specific family of characteristics. The control pressure with which the turbine vanes are varied via a vacuum cell is set depending on the signal mark-space ratio. This variable turbine geometry enables a particularly rapid response at low speeds and high efficiency in the upper speed range.

## 5 Faults

A faulty EPT is noticeable by:

EGR-system	VTG-supercharger
<ul style="list-style-type: none"> <li>– Change to an emergency condition</li> <li>– Reduction in engine output</li> <li>– EGR no longer ensured</li> <li>– Vehicle shakes</li> <li>– Black smoke</li> </ul>	<ul style="list-style-type: none"> <li>– Reduction in engine output</li> <li>– Low torque when accelerating from low speeds ("turbohole")</li> </ul>

## 6 Basic design

The heart of an EPT is a double seat valve. It is operated on the one hand by a diaphragm through the supply vacuum (VAC connection), whilst a controlling magnetic force acts on the double seat valve via an armature on the other hand.

The EPT accordingly forms from the vacuum (e.g. produced by a vacuum pump) and the ambient pressure a mixed pressure ("control pressure"). The vent connection (ATM connection) should be provided with a filter against fouling.

With this control pressure

- the pneumatic EGR-valve of the exhaust gas recirculation can be controlled or
- the vanes in the VTG-supercharger can be varied via a vacuum cell

For controlling the ETP via the engine control unit, a control current is necessary. This is not a direct current however, but a current pulsed at a constant frequency ("pulse width modulation"). The pulse duration is termed "pulse duty factor".

Depending on whether the current or the pulse duty factor acts as a reference variable for the control circuit, an EPT is referred to as "current controlled or "pulse duty factor controlled".

As an alternative to current control in the control unit, Pierburg have developed the temperature-compensated EPT:

The magnetic force that operates the regulator reduces at high temperatures, as they occur in an operational vehicle.

With the temperature-compensated EPT, the magnetic force is maintained over a wide range independent of temperature. This makes sophisticated current control circuitry in the control unit unnecessary. Control then only takes place via an appropriate pulse duty factor. The majority of employed EPTs are pulse duty factor controlled.

## 7 Testing

### 7.1 EPT and EOBD

EPTs are electrically monitored on vehicles with OBD systems.

Possible EOBD fault codes can be:

P0033	Boost pressure control valve - circuit malfunction
P0034	Boost pressure control valve - Signal too low
P0035	Boost pressure control valve - Signal too high
P0234	Engine supercharging - Limit exceeded
P0235	Engine supercharging - Limit not reached
P0243	Boost pressure control valve A - Circuit malfunction
P0244	Boost pressure control valve A - Range/malfunction
P0245	Boost pressure control valve A - Signal too low
P0246	Boost pressure control valve A - Signal too high
P0247	Boost pressure control valve B - Circuit malfunction
P0248	Boost pressure control valve B - Range/malfunction
P0249	Boost pressure control valve B - Signal too low
P0250	Boost pressure control valve B - Signal too high

Indirect monitoring of the EPT takes place by monitoring the function of the EGR-valve:

P0400	Exhaust gas recirculation - Flow rate malfunction
P0401	Exhaust gas recirculation - Insufficient flow rate detected
P0402	Exhaust gas recirculation - Excessive flow rate detected
P0403	Exhaust gas recirculation - Circuit malfunction
P0404	Exhaust gas recirculation - Range/malfunction
P0405	EGR-valve - Sensor A - Input signal too low
P0406	EGR-valve - Sensor A - Input signal too high
P0407	EGR-valve - Sensor B - Input signal too low
P0408	EGR-valve - Sensor B - Input signal too high

A faulty air flow sensor can supply the engine control unit with incorrect inputs signals, which then control the EPT incorrectly:

P0100	Air flow sensor - Circuit malfunction
P0101	Air flow sensor - Range/malfunction
P0102	Air flow sensor - Input signal too low
P0103	Air flow sensor - Input signal too high
P0104	Air flow sensor - Intermittent circuit interruptions

## 7.2 General



### Safety information:

- When the ignition is switched on, no connectors must be disconnected or connected. The voltage surges occurring as a result can damage the electronic components.
- Resistance measurements on the EPT must only be carried out with the connector disconnected as internal control unit circuitry can be damaged.

### Notes:

- Depending on the vehicle manufacturer and scan tool, the EPTs can be activated as part of actuator diagnostics. It is recommended to initially read out the fault memory according to the instructions of the diagnostic unit manufacturer.
- An EPT activated through actuator diagnostics is controlled at intervals, so that it switches audibly or noticeably. When it switches audibly or noticeably, the voltage supply and the EPT are electrically okay. Leaks or internal fouling is not detected (See → Chapter 5.5).
- On completion of the test and possible replacement, the fault memory must be deleted.



Electrical faults in the cable harness or in the EPT itself are stored as faults in the majority of applications and must be located, in the same way as for mechanical faults, such as leaks, sticking of the valve, etc., using conventional test equipment.

When searching for the fault, attention should be paid to


- Leaks in the hoses
- Poor contact at connectors
- Smooth operation of the actuators (pressure cell or EGR-valve).
- Faultless function of the air flow sensors.

### 7.3 Required equipment:

- Multimeter
- Pressure gauge or Pierburg pressure/vacuum hand pump 4.07370.02.0
- Oscilloscope if required

### 7.4 Testing voltage supply

- Disconnect connector from EPT.
- Switch on vehicle ignition.
- Measure the voltage between the contacts and engine ground (see → Fig. 5).  
One of the contacts must give a battery voltage reading.

 The connector polarity varies from vehicle to vehicle.  
The supply voltage is present on contact 1 or 2.

- Switch off the ignition again.

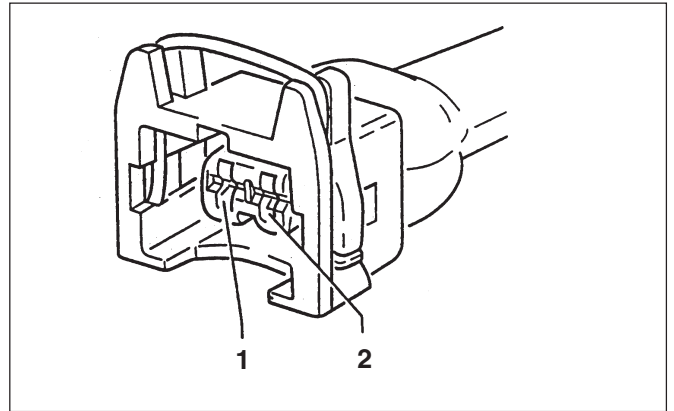


Fig. 5

### 7.5 Electrical resistance measurement on EPT

- Measure the resistance between the contacts of the EPT (see → Fig. 6)  
Required value: 11 – 18  $\Omega$
- Reconnect the connector.

### 7.6 Functional test

- Connect pressure gauge/vacuum hand pump to connection (2) as shown in Fig. 2.  
The other hose connections can remain as they are.
- Allow the engine to idle and measure the pressure.  
Required value: Minimum 480 mbar
- Disconnect supply voltage connector from the EPT and measure the pressure.  
Required value: 0 – max. 60 mbar

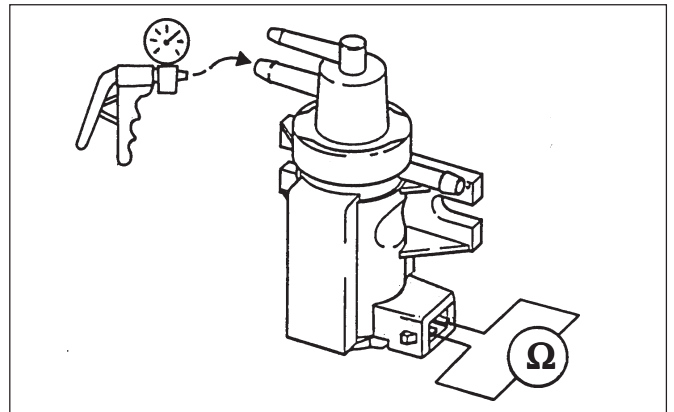


Fig. 6

### 7.7 Testing control signal

If necessary, the signal from the engine control unit to the EPT can additionally be tested with an oscilloscope. This is a mass-controlled square-wave signal.

- As the pin assignments of the connector on the EPT vary, it must first be determined on which contact the supply voltage is present (see → Fig. 5).
- The ground signal for the oscilloscope input can be tapped off from the other contact.
- Allow the engine to idle at operating temperature.
- On acting on the accelerator, the square-wave signal must change in width.

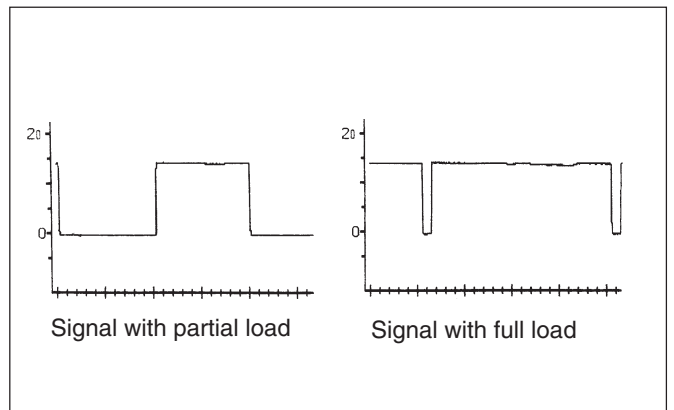


Fig. 7