**Product Information Automotive**

**Gasoline systems**

**Diagnostics and Spare Parts from a single source**

Only Bosch, the leading original equipment supplier, can provide fully comprehensive system expertise for workshops and the aftermarket.

**Motor vehicle components**
- Supply, sales and logistics
- Worldwide logistics network
- More than 130,000 different replacement parts

**Diagnostics**
- Test Equipment
- ESI[tronic] software
- Workshop Equipment
- Technical hotline and knowledge database
- Service Training
- Active assistance for all makes

**For further information click onto:**
www.werkstattportal.bosch.com
At a glance:
PIA gasoline systems

The Product Information Automotive for passenger car gasoline systems, PIA for short, is a supplement to the existing information about Bosch gasoline systems and individual products. It summarizes the most important facts and provides a quick up to date overview of the key points. The PIA also provides information about technical features, customer service and Bosch’s overall expertise in gasoline systems.

A tradition of progress
In the early days of automotive engineering, ignition was one of the major technical issues. It was Robert Bosch who came up with the solution in 1897 – he succeeded in adapting a magneto for a motor vehicle engine. Since then, the name Bosch has been a byword for progressive ideas and pioneering technology, particularly in gasoline systems.

Today, modern vehicles need to meet increasingly tough requirements. They are judged on economic fuel consumption, low emissions and maximum driving pleasure. To simultaneously meet all of these demands, it is no longer sufficient to develop and enhance individual components. Progress can only be achieved by adopting a holistic approach – Bosch uses its system know-how and the complex inter-relationships between the various subsystems to develop pioneering new solutions across systems.

In conjunction with leading motor vehicle manufacturers, Bosch develops and produces everything from individual components to complete gasoline systems. This experience and the high quality demands from the original equipment market are reflected in the aftermarket sector. This is why Bosch can offer a product range that allies impressive quality and reliability with extensive market coverage. Equally, the professional support available to aftermarket and workshops is exemplary.
Vehicle manufacturers worldwide rely on Bosch for original equipment

Comprehensive system know-how
Leading automotive manufacturers rely on the expertise and high quality stands of Bosch injection systems for original equipment. As a pioneer in gasoline injection systems, Bosch can offer a more complete product range than anyone else – from individual components right through to complete injection systems. Meanwhile, you can benefit from Bosch’s decades of experience as a technological leader in manifold injection. Bosch has unique expertise in gasoline direct injection.

Complete range from a single source
Bosch develops and produces gasoline systems for all types of engine. For the aftermarket and workshop sector, more than 10,000 replacement and wear parts are available, as well as the corresponding testing and diagnostic systems.

Worldwide development and production
An international production network develops and produces the complete gasoline injection product range in 19 countries. As a result, components and complete systems are always available close to the market but all to the same uniform production and quality standards. Bosch products guarantee a constantly high quality at all times.

Locations worldwide

- Manufacturing in licence (7)
- Production (38)
Ignition and gasoline injection systems from Bosch: Over a century of system expertise

The Bosch success story in figures – more than 100 years of experience, more than 10,000 items in the full gasoline injection range. A comprehensive replacement parts service supplying replacement and wear parts to the aftermarket and workshop sector.

1902 Delivery of the first high-voltage magneto and the first spark plug
1910 Separation of ignition distributor and high-voltage source
1925 Robert Bosch GmbH introduces battery ignition
1951 Launch of Bosch gasoline injection at the Frankfurt Motor Show
1967 First emission legislation in the USA, Introduction of the first electronic injection system - the intake-manifold pressure controlled D-Jetronic
1973 Energy crisis – reduction in gasoline consumption becomes the number one development objective. Launch of the air-flow metering L-Jetronic and the mechanically/hydraulically controlled K-Jetronic – also an air-flow metering system
1976 Bosch invents the lambda sensor, thus paving the way for regulated catalytic converters
1979 Motronic market launch. The digital processing of numerous engine functions made this system unique. It combines the L-Jetronic principle with electronic map-controlled ignition. The first microprocessor in an automobile
1981 LH-Jetronic market launch. Instead of a flap-type air-flow sensor, the basic L-Jetronic system was fitted with a hot-wire air-mass meter and sold as LH-Jetronic for the first time
1982 KE-Jetronic market launch. The K-Jetronic expanded with an electronic control loop and lambda sensor was used in a series production vehicle for the first time as the KE-Jetronic
1987 Mono-Jetronic market launch. The Mono-Jetronic is an exceptionally economical single-point injection system that enabled even smaller vehicles to be fitted with Jetronic
1989 Mono-Motronic market launch. A development of the Mono-Jetronic the Mono-Monotronic also featured electronic map-controlled ignition and a microprocessor
1989 Electronic throttle control (ETC). In systems with ETC, the driver input is detected by a sensor on the gas pedal. The Motronic control unit evaluates the sensor signal and adjusts the throttle valve, powered by an electric motor, taking account of other vehicle and engine data.
1997 Increasing use of intake modules. Intake modules are pre-assembled units consisting of an intake manifold including injectors, throttle valve unit, pressure regulator etc.
2000 KE-Jetronic market launch. The KE-Jetronic, expands with an electronic control loop and lambda sensor was used in a series production vehicle for the first time as the KE-Jetronic
2003 Launch of throttle device for ETC
2006 Launch of spray-form gasoline direct injection (piezo technology). Extension of product range with transmission control
2008 500 million lambda sensors produced; 25 years of electrohydraulic transmission control; 100 million control units produced
Overview of individual systems

K-Jetronic

The K-Jetronic is a mechanical system in which the fuel is constantly metered on the basis of the volume of air drawn in by the engine. The K-Jetronic was used as original equipment in mass-produced vehicles between 1973 and 1995. Since then, the K-Jetronic has only been of relevance in terms of service and maintenance work.

Further technical information can be found in the “K-Jetronic” booklet. Order number 1 987 722 009. The booklets are available from wholesalers.

L-Jetronic

The L-Jetronic is an electronically controlled injection system with air-flow metering based on the air vane principle and electromagnetically controlled fuel injection into the intake manifold. All engine-related changes are recorded by a variety of sensors and processed in the electronic control unit. This ensures constant good emission quality in combination with low fuel consumption.

Further technical information can be found in the “L-Jetronic” booklet. Order number 1 987 722 010. The booklets are available from wholesalers.

KE-Jetronic

The KE-Jetronic is a mechanical/electronic injection system based on the K-Jetronic. Additional electronics record a variety of measurement variables in the engine, thus permitting optimization of fuel requirements and emission quality.

Further technical information can be found in the “KE-Jetronic” booklet. Order number 1 987 722 021. The books are available from wholesalers.

LH-Jetronic

The LH-Jetronic is closely related to the L-Jetronic. It differs in terms of how it detects the volume of air drawn in by the engine, which in this case is performed by a hot-wire air-mass meter. This measures the air mass drawn in by the engine. The measured result is thus independent of temperature and pressure.

Further technical information can be found in the “L-Jetronic” booklet. Order number 1 987 722 010. The booklets are available from wholesalers.
Overview of individual systems

Mono-Jetronic

Mono-Jetronic is an electronically controlled single-point injection system, in which a solenoid injector injects the fuel for all cylinders at a central location above the throttle valve. The operating data is recorded using sensors and converted into injection pulses in an electronic control unit.

Further technical information can be found in the "Mono-Jetronic" booklet. Order number 1 987 722 033. The booklets are available from wholesalers.

Motronic ME with ETC

The principal function of the engine-management system is to set the driver’s torque input whilst at the same time achieving optimum fuel consumption and the lowest possible emission level. The ME-Motronic engine-management system combines all the sub-systems required for this: The electronic throttle control (ETC) sets the amount of air needed to generate this torque. The corresponding fuel mass is controlled in the gasoline injection sub-system and the ignition sub-system sets the appropriate ignition point as well as the necessary ignition energy.

Motronic manifold injection

Motronic combines an injection system and an ignition system for engine management. Fuel metering and ignition are optimally co-ordinated with one another. Other optimized electronic functions can also be included. Digital data processing and the use of microprocessors make it possible to convert a wide range of operating data into map-controlled injection and ignition data.

Further technical information can be found in the "Motronic" booklet. Order number 1 987 722 029. The booklets are available from wholesalers.

Motronic - gasoline direct injection

Engines with gasoline direct injection form the air/fuel mixture directly in the combustion chamber. Only fresh air flows through the open inlet valve on the induction stroke. Special injectors inject the fuel directly into the combustion chamber at high pressure. Exact metering, conditioning and distribution of the air and fuel for each individual combustion stroke permit economical operation and a low level of emissions. Thanks to its torque-based electronic control, the Motronic engine management system opens up new dimensions in gasoline direct injection.

Further technical information can be found in the "Motronic" booklet. Order number 1 987 722 029. The booklets are available from wholesalers.
Electric fuel pumps: The complete range from the *system specialists*

### Customer satisfaction thanks to OEM quality

Whether it is complete delivery module solutions, fuel pumps or our special kits for repairs based on current value – With Bosch you can offer your customers reliable OEM quality. Bosch is constantly developing its technology to meet the aftermarket, workshop and OEM requirements of the future. That is why leading vehicle manufacturers rely on state of the art Bosch technology and on 40 years of experience.

### Electric fuel pumps from Bosch – reliable performance

The electric fuel pump has to supply the engine with sufficient fuel at the required pressure under all operating conditions. It is also increasingly assuming the function of a pre-supply pump for modern direct injection systems in both gasoline and diesel engines. 

The principal requirements:

- Delivery between 60 and 200 l/h at rated voltage
- Pressure in fuel system between 300 and 450 kPa (3…4.5 bar)
- Reliable build up of system pressure even for cold starts or with adverse battery voltage

### Impressive Bosch quality

Bosch electric fuel pumps are optimized for the specific engine type and are produced to stringent quality standards. These are the key features of Bosch electric fuel pumps:

- Maximum operational reliability
- Compliance with all original equipment demands
- Long service life
- Low noise
- Optimum fuel delivery
- Maximum reliability for hot gasoline delivery
- High level of interference suppression

In 1967 Bosch supplied the first gasoline injection system with electric fuel pump. And Bosch has been setting standards ever since with its high performance and durable systems. This is why a whole range of leading vehicle manufacturers put their trust in electric fuel pumps from Bosch.
The Bosch universal range: 7 instead of 72

Compact and powerful: The new generation of fuel delivery modules

One type for a variety of applications: The universal electric fuel pump range from Bosch. The 72 pumps used in the past can now be replaced by just 7 universal electric fuel pumps from Bosch. Parts set is the key - Each of the 7 electric fuel pumps is supplied with a parts set and easy to follow installation instructions. These pumps form the Bosch universal range.

Bosch is constantly working on improving and optimizing its motor vehicle components. This results in innovative technology and products that play a pioneering role in the whole automotive sector. The new XML fuel delivery modules are just one example of this.

Clear benefits:
Compared to conventional fuel pumps, the new generation offer an impressive 30% higher efficiency and provide the precise fuel supply required for partial or full load. This saves fuel and reduces CO₂ emissions. They also feature:
- Improved cold start performance
- Improved interference suppression
- Improved compatibility with different fuel types

Table:

<table>
<thead>
<tr>
<th>Order number</th>
<th>Applications</th>
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<tr>
<td>0 580 254 053</td>
<td>Audi, Porsche</td>
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<tr>
<td>0 580 464 085</td>
<td>Fiat, Holden, Opel, Renault, Seat, VW</td>
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</tbody>
</table>

In the original equipment market, numerous manufacturers already use the new fuel pumps from Bosch, including Audi, Fiat, Ford, GM, Mercedes-Benz, Renault, and VW.

Beware of imitations! Certain rival companies make use of inferior imitation products instead of Bosch pumps. This can lead to a loss of power due to insufficient fuel.

It couldn't be simpler
The special parts set turns a universal electric fuel pump into a specialist for a particular engine type. Needless to say, it meets all the requirements for original equipment.
The Bosch kit concept:
The clever way to repair fuel delivery modules

A clever idea from Bosch
The kit concept is an additional alternative for repairing fuel delivery modules. Instead of completely replacing them every time, the kit solution from Bosch enables many delivery modules to be repaired.

The kit provides the workshop with a complete package of all wear parts, allowing them to offer an economical solution that will impress even the most cost-conscious drivers. The replacement service, including removal and installation requires minimal time and work.

Calculation example: Catalog price excluding sales tax

VW fuel delivery module

| Model price | 189 EUR |

Bosch kit solution

| Kit solution | 121 EUR |
| + Installation costs | 22 EUR |
| **Total** | **244 EUR** |

Purchase costs: -36 %
Total costs: -26 %

Impressing the aftermarket and workshop sector:
- Repair concept for 750 additional vehicles
- Maximum market coverage also including modern diesel injection systems
- Quick and easy to replace
- Detailed fitting instructions provided with ever kit
- Less storage space required
- Lower storage and handling costs
- High Bosch original-equipment quality throughout
- Long-term availability of all products – at competitive prices

Uncomplicated, fast and reliable: Fuel delivery module repair with the kit concept. Bosch provides you with all the necessary parts and easy to follow fitting instructions. You can rely on us – and so can your customers.
Injectors: Excellent **vehicle coverage**, optimum availability

Top technology from the top supplier
Every injector reflects the excellence of the inventors and world leader in injection technology – Bosch. Bosch partners can therefore rely on the extensive system know-how of the number one name in original equipment. We have many years’ experience and have produced more than a billion injectors.

Good ideas for better engine performance
Bosch’s ground-breaking developments have made it one of the pioneers in gasoline injection systems. Example: The exceptionally fast operating high pressure injection valves with piezo technology, the development of which won the German Future Prize.

Geared to excellent engine performance
Injectors supply the engine with the required quantity of fuel for the relevant operating conditions. A defective injector can lead to a higher injected fuel quantity and thus to excessive fuel consumption.

Engines benefit from timely replacement
Only properly functioning injectors can provide motorists with an assurance of:
- Minimized fuel consumption
- Significantly improved starting performance
- Immediate acceleration
- Longer service life for exhaust components

The milestones for injectors
Since 1967: Intake manifold injector EV1
Since 1992: Intake manifold injector EV6
Since 1999: Intake manifold injector EV14
Since mid 2005: High pressure injector HDEV5 for gasoline direct injection
Since late 2005: High pressure injector (piezo injector) HDEV4 for gasoline direct injection

Geared to optimum performance:
- Help in choosing the right injectors
- A comprehensive range for the workshop and aftermarket sector
- All injectors come in original-equipment quality
- Rapid availability
- Simple, reliable installation

Despite correct signal patterns and a positive function test, a mechanical malfunction such as a defective spray pattern may exist.

Top quality products keep customers happy
- Optimum spray pattern for perfect mixture generation and efficient combustion, even for dynamic driving
- Low consumption and emissions, particularly in the starting and warm-up phase
- Outstanding warm start performance thanks to improved cross-sections inside the valves
- Optimum corrosion resistance thanks to use of high-alloy steels and almost complete plastic covering

Bosch offers the aftermarket and workshop sector
- The broadest range and the greatest market coverage
- Easy and secure ordering thanks to high data quality and reliability of application data
- Rapid availability thanks to worldwide network for production, sales and logistics
- Simple, reliable installation
- Original-equipment quality with excellent and leak-free fitting and minimal function tolerances

Engines benefit from timely replacement
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Outstanding warm start performance thanks to improved cross-sections inside the valves
Bosch – the number one name worldwide for lambda sensors

Bosch invented lambda sensors more than 30 years ago. Today...

- ...Bosch is the world’s largest manufacturer, with a total of more than 500 million sensors produced.
- ... Bosch has the most production experience with 45 million sensors produced each year.
- ... Bosch’s innovations are continuously advancing development.
- ... Bosch leads the way in the original equipment and aftermarket sectors.

- ... Bosch supplies all lambda sensors for the aftermarket sector in original-equipment quality.
- ... Bosch has a uniquely broad product range.
- ... Bosch provides the highest data quality with reliable and complete application data.
- ... Bosch guarantees rapid availability anywhere, thanks to its international sales network.

All European vehicle manufacturers, and most leading producers worldwide, rely on lambda sensors from Bosch. Bosch lambda sensors give you a decisive advantage over the competition and enable you to offer your customers what they want – replacement parts that are environmentally friendly, save fuel and have a long service life.

Bosch lambda sensors:
- The world’s leading original equipment and aftermarket products
- An unsurpassed manufacturing record
- Dependable thanks to high data quality with reliable application data
- Genuine connector and matching cable length

The lambda sensor
- measures the residual oxygen content in the exhaust gas
- when warm (350 °C) generates a voltage of between approx. 25 and 900 mV depending on the oxygen content in the exhaust gas
- compares the residual oxygen content in the exhaust gas with the oxygen content of the ambient air
- detects the transition from a rich mixture (lack of air $\lambda < 1$) to a lean mixture (excess air $\lambda > 1$) and vice versa

Layout and functioning of the lambda sensor

Design

- Function

- Layout

Lambda control loop
1. Intake air
2. Fuel supply
3. Injector
4. Electronic control unit
5. Control sensor (upstream of catalytic converter)
6. Catalytic converter
7. Exhaust gas
8. Diagnostic sensor (downstream of catalytic converter)

Mode of operation

The control unit uses the lambda sensor voltage signal to regulate the mixture composition and control the injection quantity accordingly. The fuel quantity has to be reduced if the mixture is too rich ($\lambda < 1$) and increased if it is too lean ($\lambda > 1$). An optional diagnostic sensor after the catalytic converter detects whether the control sensor is still working properly.
The broad Bosch lambda sensor range:
Variety provides reliability

Unheated lambda sensors
Unheated lambda sensors paved the way for future exhaust control. They require a minimum operating temperature of 350 °C and therefore need to be fitted close to the engine.
Replacement interval:
Every 50,000 – 80,000 km

Heated lambda sensors, 3-pole
To allow lambda sensors to be fitted away from the engine, the next stage in their development was to incorporate a heater. This ensured that the sensor element was continuously at its functioning temperature of 350 °C for the first time.
Replacement interval:
Every 100,000 – 160,000 km

Heated lambda sensors, 4-pole
The 4-pole sensors transmit their signal via an additional fourth connection rather than via the housing. This enables to recognize a cable break that would make lambda control ineffective to be detected.
Replacement interval:
Every 160,000 km

Planar lambda sensors
Planar lambda sensors consist of several ceramic sheets with an integrated heater. They reach their operating temperature twice as quickly as previous lambda sensors, thus halving emissions in the critical cold starting phase.
Replacement interval:
Every 160,000 km

Planar broadband sensors
Planar broadband sensors have two measuring cells and a 6-pole connector. They provide extremely accurate measurements in both the rich and the lean range. They can also be used to control gas and diesel engines.
Replacement interval:
Every 160,000 km

Universal lambda sensors
Thanks to their universal connector, a small number of universal lambda sensors can be used to replace a wide range of original sensors. This involves cutting the cable for the fitted sensor at an appropriate point. The universal connector then connects the universal sensor to the end of the cable in the vehicle.

Reasons for Bosch’s variety
Bosch believes it is vital for every lambda sensor to exactly meet the vehicle manufacturer’s specifications. Because of the numerous technical features of lambda sensors, this necessarily results in a very wide variety of types. Different lambda sensor types cannot therefore simply be combined or interchanged. Liberal combinations bring a deterioration in optimum functioning and lead to fitting problems.

This is why Bosch offers around 1000 different lambda sensors. This variety of types results from the following features:

- Sensor type
- Heat output
- Cable length
- Number of wires
- Connector
- Protective tube
Lambda sensors:
Always right with Bosch

Lambda sensors are subject to extreme loads
A properly functioning lambda sensor forms the basis for reliable engine operation and thus fuel economy, low pollutant emissions and good emission values. Bosch lambda sensors are unbeatable thanks to their long service life, excellent operation and optimum engine compatibility.

You can’t go wrong with Bosch
When it comes to replacing lambda sensors you can rely on Bosch:
- No risk thanks to guaranteed original-equipment quality
- Help in choosing the right sensor

Bosch: Always the best lambda sensor for the job
All Bosch lambda sensors are made to measure for each vehicle model. For guaranteed reliability and ease of installation:
- The right cable length
- Correct connectors
- Pre-greased thread

Drivers save money every mile
Average driving performance per year
Average fuel consumption per 100 km
Annual fuel consumption
Fuel price per liter
Annual costs of fuel

<table>
<thead>
<tr>
<th></th>
<th>With used lambda sensor</th>
<th>With new Bosch lambda sensor</th>
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<tbody>
<tr>
<td>14,000 km</td>
<td>10.4 l</td>
<td>9.0 l</td>
</tr>
<tr>
<td></td>
<td>1.456 l</td>
<td>1.260 l</td>
</tr>
<tr>
<td></td>
<td>1.50 €</td>
<td>1.50 €</td>
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<tr>
<td></td>
<td>2,184.00 €/year</td>
<td>1,890.00 €/year</td>
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</table>

Regular checking and replacement are therefore vital
There are any number of good reasons why motorists should make sure their Bosch lambda sensors are always in top condition:
- Up to 15% fuel savings compared to a used lambda sensor
- Avoiding expensive catalytic converter damage
- Compliance with stringent emission standards
- Improved performance
For added comfort, safety and environmental protection: Sensors are becoming increasingly important

Increasing original-equipment figures ensure a growing demand for replacements
Modern vehicles are being equipped with more and more electronic components. This increases the number of sensors, used to record a wide range of parameters in the vehicle. Applications of sensors are almost limitless and are constantly being expanded. Today’s drivers no longer want to do without the benefits that these systems provide, which include improvements in cost-efficiency, safety, convenience and performance. In fact, there are hardly any vehicles without sensors on the road today.

Comprehensive range, impressive quality
Count on the OEM quality of the comprehensive sensor range from Bosch – the world’s leading sensor manufacturer. All Bosch sensors are fine-tuned to the particular vehicle model and are easy to replace.

With over 2000 different products, Bosch supplies all important types of sensor – for applications ranging from engine management right through to passive safety. Sensors supplied by Bosch include lambda sensors, air-mass meters, pressure sensors, temperature sensors, knock sensors, engine speed sensors and much more…

Hot-film air-mass meters: Optimum performance and low levels of harmful emissions
Hot-film air-mass meters measure the actual air flow in the engine very quickly and precisely to allow the specified air/fuel ratio to be maintained. This ensures optimum engine combustion, which has the twin benefits of low levels of harmful emissions combined with improved performance.

Itemized benefits for you and your customers:
• Bosch hot-film air-mass meters are genuine replacement parts, exactly tailored to the specific engine type
• All replacement parts offer original-equipment quality
• For repairs in line with current value, Bosch also supplies hot-film air-mass meters as exchange products

Genuine or imitation?
Only genuine parts are exactly tailored to the specific engine type and guarantee optimum performance and compliance with the statutory emission values. The vehicle homologation will be invalidated if non-genuine air-mass meters are used. In addition, this can result in a considerable loss of engine power and thus higher fuel consumption.
Bosch sensors: The comprehensive range from the sensor specialist

Sensors

Bosch sensors

Low-pressure sensors
These are used to monitor oil, fuel, intake manifold and ambient pressure. This ensures excellent accuracy and fast response times.

High-pressure sensors
These record the fuel pressure in the fuel rail of the Common Rail System and in the high-pressure rail of the direct gasoline injection system. The sensors are vibration resistant and have an impressively compact and robust construction – offering exceptional measuring accuracy over their entire service life.

Knock sensors
“Knocking” can permanently damage an engine. Knock sensors fitted directly to the engine block record structure-borne sound (knocking) in the engine and transfer this data to the engine-management system. These values can then be used to counteract the problem and ensure smoother combustion. The “ear” of the engine ensures a long service life and optimum operation.

Crankshaft sensors
These sensors are fitted directly opposite a pulse wheel, separated by an air gap. They provide non-contact measurement of crankshaft rotation angle and speed.

Camshaft sensors (phase sensors)
For non-contact measurement of camshaft rotation angle. They are fitted directly to the camshaft.

Temperature sensors
Temperature sensors monitor the temperature of coolant, oil and air and transfer the data to the engine-management system. Depending on the application, the sensors may be installed in the engine block, cooling circuit or intake tract.

Renowned vehicle manufacturers rely on Bosch sensors:

- Alfa Romeo
- Audi
- Bentley
- BMW
- Citroën
- Ferrari
- Fiat
- Ford
- Lancia
- Maybach
- Mazda
- Mercedes-Benz
- Nissan
- Opel
- Peugeot
- Porsche
- Renault
- Saab
- Seat
- Skoda
- Toyota
- Volvo
- VW

Sensor systems: A rapidly expanding market with excellent prospects for the aftermarket and workshop sectors

Comprehensive range, impressive quality:
- A rapidly expanding market with excellent prospects
- Comprehensive range in original-equipment quality
- Over 2000 products in all the key sensor groups
Bosch ignition systems
The first choice right from the start

In the early days, ignition in gasoline engines was “the problem of problems”, as automotive pioneer Carl Benz once put it. A number of leading brains set about solving this problem – including Robert Bosch. Finally, Bosch managed to develop a high voltage magneto, patented in 1902.

Benefit from over a century of experience
Bosch developed the spark plug over a century ago. Since then, the company has worked on all the components that play a role in ignition in combustion engines.

No other manufacturer can call on this kind of experience.

Complete range? Only from Bosch
Bosch is the only supplier in the world that can offer its partners a complete range of all ignition components. There is a good reason why Bosch stands for quality and expertise, state of the art technology and pioneering developments.

1. Spark plugs
   By constantly developing innovative spark plug technologies, Bosch ensures high quality state of the art products – for original equipment and the aftermarket sector.

2. Silicone power and silicone copper
   The tailored ignition cable range – the right connection every time.

3. Ignition distributors
   ▶ Ignition distributors covered by exchange programm
   ▶ Excellent market coverage for ignition-distributor caps and rotors

4. Bosch ignition coils
   Proven successful models in original-equipment quality

5. Ignition modules
   Compact range (7 part numbers) to spark off success

Expertise from a system supplier:
▶ The only supplier of all ignition components
▶ Comprehensive range in original-equipment quality
▶ Excellent market coverage
▶ A leading innovator: Continuous development
Bosch ignition coils:
Innovative technology in original-equipment quality

Ignition coil technology – Progress made by Bosch
Modern plastic ignition coils minimize the weight and size of the component, while still offering excellent electrical voltage, temperature and vibration resistance. Bosch will continue to set the tone for ignition systems in the future. For example, with its innovative compact coils with primary current control and diagnostic function.

Bosch ignition modules:
The compact range for modern ignition systems

System partner to the automotive industry for plastic ignition coils
Bosch plastic ignition coils are used as original-equipment worldwide. As a replacement part, this innovative ignition coil technology provides all the benefits of original equipment quality.
- Reduced fuel consumption
- Reduced harmful emissions

Excellent market coverage thanks to continuous expansion of range
Technical innovations are incorporated into engine production in close cooperation with the automotive industry. This constant expansion and updating of the range results in ever-increasing market coverage for ignition coils.

Innovative plastic ignition coil in original-equipment quality

<table>
<thead>
<tr>
<th>Spark plug connectors (silicon rubber)</th>
<th>Spark plug contact (spring)</th>
<th>Interference suppression resistor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary winding</td>
<td>Secondary winding</td>
<td>Connector</td>
</tr>
</tbody>
</table>

Bosch ignition modules set standards
Numerous vehicle manufacturers put their trust in Bosch. With good reason. As well as excellent reliability, they know that Bosch ignition systems are 100% tailored to the engine.

Additional plus points
- Constantly high ignition voltage
- Absolute freedom from leaks and maximum corrosion protection

Bosch ignition modules are used by many leading vehicle manufacturers:
Alfa Romeo, Audi, BMW, Citroën, Fiat, Ford, Lancia, Mercedes-Benz, Opel, Peugeot, Porsche, Renault, Saab, Seat, Skoda, Volvo, VW

<table>
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<th>Order number</th>
<th>Applications</th>
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<td>0 227 100 123</td>
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<tr>
<td>0 227 100 140</td>
<td>Citroën, Peugeot</td>
</tr>
<tr>
<td>0 227 100 200</td>
<td>BMW, Chevrolet, Porsche, Opel</td>
</tr>
<tr>
<td>0 227 100 203</td>
<td>Alfa Romeo, Fiat, Lancia, Opel, Volvo</td>
</tr>
<tr>
<td>0 227 100 211</td>
<td>Audi, Seat, Skoda, VW</td>
</tr>
</tbody>
</table>
Ignition systems

Bosch ignition cables: The high performance connection

- Bosch ignition cables
- Spark plugs from Bosch: The right solution for everyone

Reliability in original-equipment quality
Vehicle manufacturers trust Bosch ignition cables as original equipment. There are many reasons for this:
- Outstanding interference suppression and insulation
- Corrosion resistant and safe contact plug-in connections
- Extreme heat and cold resistance from -60 °C to over +200 °C
- Resistance to chemical and mechanical influences
- Protects engine and catalytic converter

Over 92% market coverage
- More than 220 resistance ignition-cable sets
- Over 410 pre-assembled resistance individual cables
- Around 130 pre-assembled copper-core individual cables
- Over 110 copper-core ignition cable sets

Two product series guarantee success
Silicon-Power: The high performance ignition cable specially for vehicles with resistance ignition cables as original equipment.
- With carbon-impregnated fiberglass internal conductors – durable and break resistant.
Silicon-Copper: The high performance ignition cable for all vehicles with copper-core ignition cables as original equipment.
- Highly conductive copper inner conductor refined with tin

Spark plugs from Bosch: The right solution for everyone

- All well-known vehicle manufacturers fit Bosch spark plugs as standard. The Bosch range currently includes 1250 variations with 31 different electrode configurations – the right spark plug for every engine and 98% market coverage.

Quality in original-equipment technology
Bosch spark plugs impress with their outstanding technology, excellent reliability and exemplary quality.

Bosch Super / Super plus
- For long-term performance under different operating conditions
- Factory-set electrode gap
- Bosch Super plus – the 55 top products for almost any vehicle

Bosch Super 4
- Improved engine power with up to 60% higher efficiency
- Considerably improved acceleration
- Greater ride comfort thanks to smoother operation and superior engine power

Bosch Super special
- Special spark plugs for two-wheeled vehicles, snowmobiles, garden equipment, motor boats etc.
- Outstanding starting performance over the entire service life
- Effective protection against corrosion and thread seizing
Bosch idle actuators: Compact range with high market coverage

Around 32 million vehicles have been fitted with Bosch idle actuators. Around 80% of them are more than 7 years old.

An attractive market
Idle actuators have primarily been fitted in the KE-Jetronic/Motronic, L-Jetronic and Motronic systems. Most vehicles fitted with an idle actuator therefore have already had several years of service and have clocked up high mileage.

That means: An increased demand for repairs can be expected. Bosch idle actuators thus represent an attractive and lucrative market.

Reach your market with just 15 order numbers
With just 15 order numbers, the Bosch compact range covers around 88% of all vehicles fitted with Bosch idle actuators. The complete range includes a total of 60 different types.

Benefits for aftermarket and workshops:
- Low ordering and storage costs
- Excellent market coverage
- Customer satisfaction thanks to rapid availability

Order number Application
0 280 140 516 Alfa, Chevrolet, Citroën, Fiat, Opel, Peugeot, Renault, Saab, Vauxhall, Volvo
0 280 140 505 Alfa, Audi, Ferrari, Fiat, Hyundai, Kia, Lancia, Nissan, Saab, Seat, VW
0 280 140 501 Alfa, AMC, Citroën, Lancia, Peugeot, Porsche, Renault, Volvo
0 280 140 510 MB
0 280 140 546 BMW
0 280 140 509 BMW, Citroën, Peugeot, Porsche
0 280 140 574 BMW
0 280 140 512 Audi, VW
0 280 140 542 Volvo
0 280 140 537 Citroën, Fiat, Lancia, Peugeot
0 280 140 529 BMW, Bertone
0 280 140 549 BMW
0 280 140 551 VW
0 280 140 520 Volvo
0 280 140 532 BMW, MAN, Rover

eXchange – Back in Box
Outstanding quality, comprehensive range, top class service

1. Purchase of a genuine Bosch exchange product
2. Exchange for the corresponding used part
3. The used part comes in the packaging of the exchange product
4. Return of used part to Bosch

The comprehensive, intelligent exchange range
Currently a total of 21 product groups from the starter/alternator, diesel/gasoline injection and brake caliper sectors.
- Excellent market coverage for all major vehicle manufacturers
- Constant updating of range
- First-class service
- Quick and easy processing of used products
- Quality standards comparable to original equipment
- 100% replacement of all critical components
- Consistent use of genuine Bosch replacement parts
- Same warranty as for new products

Gasoline injection products in exchange program
- Hot-film air-mass meter
- Hot-wire air-mass meter
- Air-flow sensor
- Fuel distributor
- Electronic control units
- Central injection unit (ZEE) bottom section
- Central injection unit (ZEE) Top section
- Ignition distributor
Gasoline injection components:
A to Z guide

Accelerator-pedal module
- **Systems:** Motronic with ETC
  - **Function:** In contrast to conventional engine-management systems, with the Motronic with ETC the driver’s acceleration input is no longer relayed to the throttle valve by cable. Instead, the input is detected using a pedal-travel sensor (also referred to as “electronic throttle control”) and transmitted to the electronic control unit. The accelerator-pedal module is a pre-assembled unit containing a vehicle-specific foot plate alongside the pedal-travel sensor (potentiometer / hall sensor).
  - The Motronic control unit evaluates the sensor signal and adjusts the electric motor-driven throttle valve (throttle device), taking into account other vehicle and engine data.
  - **Order number:** 0 280 755 ...

Air-flow sensor
- **Systems:** L-Jetronic, Motronic
  - **Function:** The air flowing into the engine deflects a sensor plate in opposition to the restoring force of a spring. A potentiometer converts the deflection of the sensor plate into a voltage. The electronic control unit uses this signal to calculate the quantity of fuel required.
  - **Order number:** 0 280 200 ..., 0 280 201 ..., 0 280 202 ..., 0 280 203 ..., BX: 0 986 260 0 ...

Air-flow sensor (mechanical)
- **Systems:** K-, KE-Jetronic, KE-Motronic
  - **Function:** The air-flow sensor and the fuel distributor combine to form the mixture control unit. The two components must be replaced individually. The air flowing through the air funnel moves the sensor plate by a certain distance. The deflection of the sensor plate is transmitted by way of a lever system to the fuel distributor.
  - **Order number:** 0 438 120 ..., 0 438 121 ..., F 026 TX2 ..., BX: 0 986 439 ...

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Gasoline injection components:
A to Z guide

**Air-mass meter**
*System:* LH-Jetronic, Motronic
*Function:* The air-mass meter is installed between the air filter and throttle valve and measures the intake-air mass. Use is made in practice of hot-wire and hot-film air-mass meters. Both sensors operate on the same principle: An electrically heated thin platinum wire or platinum film resistor is positioned in the intake-air flow together with a temperature sensor as a temperature-sensitive resistor. The electronic control unit is supplied with a voltage signal proportional to the air-mass flow and uses this signal to calculate the quantity of fuel required.
*Part number:* 0 232 10 ...

**Camshaft sensor**
*System:* Motronic
*Function:* The camshaft position indicates whether an engine piston moving towards top dead center is in the compression or exhaust stroke. The speed sensor at the camshaft (also referred to as phase sensor) passes this information to the electronic control unit.
*Part number:* 0 261 210 ...

**Canister-purge valve**
*System:* Motronic
*Function:* Vapors are produced in the fuel tank by external heat radiation or surplus fuel having been warmed in the engine compartment flowing back from the fuel circuit. These vapors are purged by way of an activated charcoal filter. This filter retains the fuel vapor and only allows the air to escape into the open. This also ensures pressure equalization. For regular regeneration of the activated charcoal, a further pipe containing the canister-purge valve is routed from the activated charcoal canister to the intake manifold. The method of actuation of the canister-purge valve (regeneration valve) is such that the activated charcoal canister is adequately purged with minimal lambda deviations.
*Order number:* 0 280 170 ...

**Central injection unit (Mono-Jetronic)**
*System:* Mono-Jetronic, Mono-Motronic
*Function:* The main component of Mono systems is the central injection unit. This contains the injector, the pressure regulator, the throttle-valve, the throttle-valve actuator and sensors for intake-air temperature and throttle-valve position. Bosch supplies the appropriate workshop parts sets for repair work.
*Order number:* BX: 0 986 438 5.., 0 986 438 6.. 0 438 201 ...

**Crankshaft sensor**
*System:* Motronic
*Function:* A ferromagnetic gear wheel with reference mark (tooth gap) is attached to the crankshaft. The speed sensor scans the tooth sequence. The electronic control unit uses the signal to calculate the crankshaft position and speed. Some systems are fitted with two sensors. The crankshaft position and speed are then measured separately.
*Order number:* 0 261 210 ...

**Cold-start valve**
*Systems:* D-, L-, LH-, K-, KE-Jetronic, Motronic (some)
*Function:* The cold-start valve injects additional fuel into the intake manifold during the starting phase. In this process, the fuel is highly atomized by a swirl nozzle. The cold-start valve is attached to the intake manifold so as to provide a uniform supply for all cylinders. The injection time of the cold-start valve is limited by the thermostatic or the electronic control unit.
*Order number:* 0 280 170 ...
Gasoline injection components: A to Z guide

Electric fuel pump / in-tank unit

Systems: All systems
Function: The electric fuel pump has to supply the engine with sufficient fuel at the required pressure under all operating conditions. The electric fuel pump is also increasingly assuming the function of a pre-supply pump for modern direct injection systems in both gasoline and diesel engines. Principal requirements: Delivery rate between 60 and 200 l/h at rated voltage, pressure in fuel system between 300 and 450 kPa (3...4.5 bar), build-up of system pressure from 50% to 60% of rated voltage; cold starting operation is definitive for this.
Order number: 0 580 254 ..., 0 580 303 ..., 0 580 305 ..., 0 580 309 ..., 0 580 310 ..., 0 580 313 ..., 0 580 314 ..., 0 580 453 ..., 0 582 980 ..., 0 986 580 ...

Electronic control unit

Systems: Jetronic and Motronic
Function: The electronic control unit determines the quantity of fuel required in each case and regulates all the connected actuators and injectors. This is implemented on the basis of the signals from the temperature, pressure and load-detection sensors. Electronic control units for Motronic systems also regulate the ignition point. In modern systems, the electronic control unit additionally assumes diagnosis functions. Faults occurring are stored in the fault memory and can be read out using self-diagnosis testers.
Note: Electronic control units in vehicles with immobilizer sometimes have to be "matched". This work can only be performed in specially equipped workshops.
Order number: 0 438 170 ...

Fuel accumulator

Systems: K, KE-Jetronic
Function: The fuel accumulator keeps the fuel-supply system pressurized after shutting off the engine. This considerably enhances starting performance, particularly with a hot engine. The accumulator also has a sound-absorbing effect.
Order number: 0 438 170 ...

Fuel distributor

Systems: K, KE-Jetronic, KE-Motronic
Function: The fuel distributor and the air-flow sensor combine to form the mixture control unit. The two components must be replaced individually. The control plunger on the fuel distributor is deflected by way of a lever system on the air-flow sensor. This meters the quantity of fuel to be injected to each cylinder.
Note: The fuel distributor can only be replaced as a complete unit. It cannot be assembled using workshop equipment after removing individual components.
Order number: 0 438 100 ..., 0 438 101 ..., T 026 TX2 ..., BX: 0 986 438 ...

Fuel rail

Systems: L, LH-Jetronic, Motronic
Function: Along with the electric fuel pump, fuel filter, injectors and pressure regulator, the fuel rail forms part of the fuel-supply system which always supplies the engine with the necessary amount of fuel under all operating conditions. The pressure generated by the fuel pump is applied to all injectors by way of the fuel rail. The unused fuel flows back to the fuel tank via a pressure regulator. In most cases, the pressure regulator (fuel rail – conventional design with pressure regulator) uses the intake-manifold pressure as a reference. The use of this typical pressure and the flow through the fuel rail (fuel cooling) prevent the formation of any unwanted vapor bubbles in the fuel.
Order number: 0 280 151 ..., 0 280 152 ...

High-pressure injector HDEV-1 + HDEV-5

System: Motronic gasoline direct injection
Function: The high-pressure injector (HDEV), one of the key components in gasoline direction injection, is linked to the fuel rail by hydraulic connections and is actuated by a current regulated output stage. The solenoid swirl valve injects a precisely metered quantity of fuel with a defined spray pattern directly into the combustion chamber in finely atomized form. The injected fuel quantity is determined by pressure, flow rate and the actuation time of the injector. The injection spray geometry is tailored to the requirements of the corresponding engine and the combustion process.
Order number: 0 261 500 ...

Order number: 0 261 500 ...
Gasoline injection components: A to Z guide

**High-pressure injector HDEV-4** (Piezo injector)

**System:** Motronic gasoline direct injection
**Function:** The HDEV-4 is a high-speed piezo injector for gasoline with variable needle lift. The nozzle opens outwards and ensures outstanding spray stability whilst at the same time being extremely resistant to coking. The injector covers a wide metering range in which the quantity characteristic curve exhibits a high degree of linearity. Its rapid and accurate multiple injections open up new options for the design of the injection process.

**Order number:** 0 261 500 ...

**High-pressure pump HDP-1**

**System:** Motronic gasoline direct injection
**Function:** The 3-barrel radial piston high-pressure pump is driven by the camshaft via a coupling. It compresses the fuel provided by the fuel pump to up to 12 MPa and conveys it into the high-pressure fuel rail (KVS-HD). The fuel provides cooling and lubrication for the high-pressure pump.

**Order number:** 0 261 520 ...

**High-pressure pump HDP-2**

**System:** Motronic gasoline direct injection
**Function:** In contrast to the HDP-1, the HDP-2 high-pressure pump is a unit pump. It is also a demand-regulated, intermittent delivery 1-barrel piston pump with a maximum pressure range up to 120 bar. It features an integral pressure damper and the integrated fuel quantity control valve. In addition, the pump is of modular design for flexible adaptation to different customer requirements. It is attached directly to the cylinder head or to an adapter housing.

**Order number:** 0 261 520 ...

**High-pressure pump HDP-5**

**System:** Motronic gasoline direct injection
**Function:** The HDP-5 is a quantity-controlled single-barrel high-pressure pump for 4 to 8-cylinder engines. In new engine projects it supersedes all the previous 1st generation Bosch high-pressure pumps (HDP-1 and HDP-2).

**Order number:** 0 261 520 ...

**High-pressure sensor**

**System:** Motronic gasoline direct injection
**Function:** The sensor installed in the high-pressure fuel rail is designed to detect the fuel-pressure level in the rail. The pressure measured is used as the actual quantity for rail-pressure regulation.

**Order number:** 0 261 545 ...

**Idle actuator**

**Systems:** LH, KE-Jetronic, KE-Motronic, Motronic
**Function:** The idle actuator is installed in a bypass around the throttle valve and keeps the idling speed steady under all conditions. Electrical actuation is effected by way of the engine control unit or the idle controller on vehicles with idle-speed control. Extensive use is made of idle actuators with hose connection. Add-on idle actuators are also employed in Motronic systems.

**Order number:** 0 280 140 5..
Gasoline injection components:
A to Z guide

### Idle controller (electronic control unit)

**Systems:** All systems with idle-speed control

**Function:** The idle controller regulates the idle rotary actuator and keeps the engine idling speed absolutely steady. This avoids speed fluctuations on activating loads such as power steering, air conditioner or automatic transmission gearshift.

**Order number:** 0 280 220 ...

### Ignition cable

**Function:** The air/fuel mixture in a gasoline engine is ignited by an electrically generated spark. The required energy for this must be transferred from the ignition coil via the ignition distributor to the spark plug by the ignition cables with no losses or interference.

**Order numbers:**
- 0 356 912 ...
- 0 356 913 ...
- 0 986 356 ...
- 0 986 357 ...

### Ignition coil

**Function:** The operating principle of an ignition coil is based on Faraday’s law of Induction. Modern ignition coils consist of iron cores made up of individual laminations and a plastic casing. To provide better insulation of the windings, the casing is cast in epoxy resin. The compact coil shown is one of the plastic ignition coils. It provides a high spark energy (> 60 mJ) and a long spark duration (≥ 1.8 ms) and thus ensures reliable, optimum combustion of the air/fuel mixture under all engine operating conditions.

**Order numbers:**
- 0 221 ...
- F 000 ZS0 ...
- 1 227 030 ...
- 0 986 221 ...

### Ignition distributor

**Type 1:**
- Ignition distributor with contact. Used for conventional coil ignition and contact controlled transistorized ignition. The ignition point is modified by way of speed-dependent centrifugal or vacuum advance.

**Order number:** 0 231 ...

**Type 2:**
- Ignition distributor with non-contacting sensor. This is used for transistorized ignition with inductive or Hall sensor. The ignition point is modified by way of speed-dependent centrifugal or vacuum advance. Also double-acting. Also with add-on trigger box.

**Order number:** 0 237 ...

**Type 3:**
- Ignition distributor for electronic ignition. The ignition distributor only has the high voltage section (cap, rotor).

**Order number:** 0 237 5 ..., BX: 0 986 237 ...

### Ignition module

**Function:** The ignition module controls the ignition point depending on the current load and the engine speed.

**Order number:** 0 227 100 ...

### Injector (electromagnetic)

**Systems:** D-, L-, LH-Jetronic, Motronic

**Function:** Each cylinder is assigned an injector. This is actuated electronically and injects the fuel upstream of the engine inlet valves. In this process, the nozzle needle is lifted off its seat, allowing the fuel to emerge through a precision annular orifice. Even the slightest contamination of the fuel or deposits can impair operation. The injectors are installed by way of special holders in rubber moldings. The thermal insulation thus achieved prevents the formation of vapor bubbles and thus ensures good hot starting performance. To avoid unmetered air and leakage, the O-rings are always to be replaced prior to renewed installation.

**Order numbers:**
- 0 280 150 ...
- 0 280 155 ...
- 0 280 156 ...
- 0 280 157 ...
- 0 280 158 ...
Gasoline injection components:  
A to Z guide

Injector (electromagnetic, single point injection)

**Systems:** Mono-Jetronic, Mono-Motronic  
**Function:** The injector is installed in the top section of the central injection unit. In this case one injector supplies all the cylinders with fuel. The fuel is injected into the intake manifold upstream of the throttle valve. As each ignition pulse also triggers an injection pulse, the injector is designed for very short switching times. During injection, the valve needle is lifted off its seat. Even the slightest fuel contamination can impair operation.  
**Order number:** 0 280 150 051 – 0 280 150 099, 0 280 150 651 – 0 280 150 699

Injector (mechanical)

**Systems:** K-, KE-Jetronic  
**Function:** K-Jetronic valves open at a precisely defined fuel pressure (usually between 3.5 and 4.1 bar). In this process the valve needle oscillates at a high frequency and the fuel is thoroughly atomized even in the case of very small injected quantities. Each cylinder is assigned an injector, which injects the fuel directly upstream of the engine inlet valves. Atomization, opening pressure and freedom from leaks have a major influence on emission characteristics, fuel consumption and starting performance. To avoid unmetered air and leakage, the O-rings are always to be replaced prior to installation.  
**Order number:** 0 437 502 ...

Knock sensor

**System:** Motronic  
**Function:** The knock sensor converts vibration into electric signals. This enables the electronic control unit to detect knocking combustion and to retard the ignition point to prevent engine damage. In some cases several sensors are attached to the engine block for knock control purposes.  
**Order number:** 0 261 231 ...

Lambda sensor

**Systems:** All  
**Function:** With older systems, the lambda sensor is installed upstream of the catalytic converter. The sensor measures the oxygen content of the exhaust gas and supplies the electronic control unit with a voltage of approx. 800 mV for a rich mixture (λ < 1) and approx. 100 mV for a lean mixture (λ > 1). Modern systems require two lambda sensors - one upstream of the catalytic converter (= lambda control sensor) and one downstream (= lambda diagnosis sensor). Increasing use is being made of planar sensors. These attain the necessary operating temperature after just a few seconds. To permit lean operation of the engine, the sensor upstream of the catalytic converter must be capable of detecting a lean mixture composition. The latest broadband sensors are used for this purpose.  
**Order number:** Unheated: 0 258 001 ..., 0 258 002 ...  
Heated: 0 258 003 ..., 0 258 005  
Planar: 0 258 006 ..., 0 258 007 0 258 010 ... und 0 258 017 ...

Pressure-control valve

**System:** Motronic gasoline direct injection  
**Function:** The pressure-control valve is positioned between the rail and the low-pressure end of the high-pressure pump. The pressure in the rail is set by varying the flow cross-section. The surplus fuel conveyed is returned to the tank.  
**Order number:** 0 261 540 ...

Pressure damper

**Systems:** D-, L-, LH-, K-, KE-Jetronic, Motronic  
**Function:** The pulsation of the injectors and the cyclic delivery action of fuel pumps cause fluctuations in fuel pressure. These may be transmitted to other components and the body and result in noise. The pressure damper smoothes the pressure peaks and is primarily designed to reduce noise.  
**Order number:** 0 280 161 ...
Gasoline injection components:  
A to Z guide

**Pressure sensor (Motronic)**

*Systems:* Motronic  
*Function:* Pressure sensors can be used for a variety of applications. Intake-manifold pressure sensors measure the absolute pressure in the intake manifold. These sensors are either integrated into the electronic control unit or fitted in the vicinity of the intake manifold in the form of externally mounted sensors. Modern systems featuring on-board diagnosis are additionally fitted with tank-pressure sensors. Modern DUO sensors combine pressure and temperature measurement.  
*Order number:* 0 261 230 ...

**Pulse valve**

*System:* K-Jetronic (with lambda control)  
*Function:* The pulse valve is installed in the connecting line between the sub-chambers of the fuel distributor and the fuel return. It is actuated by the lambda controller and opened and closed in a defined cycle. This enables the pressure in the sub-chambers to be varied and the air/fuel mixture to be regulated to $\lambda = 1$.  
*Order number:* 0 280 150 300 – 0 280 150 349

**Secondary-air pump (electric)**

*System:* Motronic  
*Function:* The electric secondary-air pump is used to ensure compliance with the stringent emission legislation in the post-start phase. Fresh air injected directly downstream of the combustion chamber causes afterburning of the hot exhaust gases and ensures more rapid warm-up of the catalytic converter.  
*Order number:* 0 580 000 ...

**Shutoff valve**

*System:* Motronic  
*Function:* The shutoff valve is used in turbo engines to protect the turbocharger. The turbocharger remains in operation on switching from turbo to overrun mode. Without a shutoff valve, the air would impact against the closed throttle valve and flow back into the turbocharger. This return flow of air could damage the turbocharger. To guard against this, the seat of the shutoff valve is opened by the vacuum applied in the intake manifold in overrun mode with the throttle valve closed. This enables the air conveyed by the continued operation of the turbocharger to be routed via a bypass around the turbocharger and back into the intake manifold.  
*Order number:* 0 280 142 100 – 0 280 142 117

**Temperature sensor**

*Systems:* D-, L-, LH-Jetronic, Mono-Jetronic, Motronic, Mono-Motronic  
*Function:* The temperature sensor measures the temperature in the coolant circuit and provides the electronic control unit with an electric signal. The sensor consists of an NTC thermistor embedded in a threaded sleeve or a plastic casing. The “coolant temperature” signal is particularly important for the starting and warm-up phase.  
*Order number:* 0 280 130 ...
Gasoline injection components
A to Z guide

**Throttle-valve assembly**

*Systems:* Matronic with ETC
*Function:* In engine-management systems with ETC, the throttle-valve is no longer adjusted directly using a cable. The acceleration input is detected by a pedal-travel sensor (also referred to as “electronic throttle control”) and the sensor signal is relayed to the electronic control unit. The signal received by the electronic control unit is converted into a control signal incorporating other vehicle and engine data. This control signal opens or closes the throttle-valve (driven by an electric motor) in line with the driver input and driving situation.

*Order number:* 0 280 750 ...

**Throttle-valve potentiometer, throttle-valve sensor**

*Systems:* Mono-Jetronic, Motronic, Mono-Motronic
*Function:* Throttle-valve sensors are attached to the throttle-valve assembly or the central injection unit. These sensors detect the position of the throttle valve and the angular velocity on opening and closing. The angular velocity is an important signal for the electronic control unit to provide compensation for load change jolts and to prevent part load bucking.

*Order number:* 0 280 122 ...

**Throttle-valve switch**

*Systems:* D-, L-, LH-, KE-Jetronic, Motronic
*Function:* The throttle-valve switch is attached to the throttle-valve assembly. The switch is actuated by the throttle-valve shaft. One contact is made in each case in the “idle” and “full load” positions. These signals enable the electronic control unit to activate the idle increase function with a cold engine and enrichment at full load.

*Order number:* 0 280 120 000 – 0 280 120 499

**Vacuum limiter**

*Systems:* L-, LH-, K-, KE-Jetronic, Motronic
*Function:* The vacuum limiter restricts the difference in pressures upstream and downstream of the throttle valve. Additional air flows into the intake manifold if the set pressure difference is exceeded.

*Order number:* 0 280 160 1.., 0 280 160 3..

**Warm-up regulator**

*System:* K-Jetronic
*Function:* Warm-up regulators consist of a spring-controlled diaphragm valve and an electrically heated bimetallic spring. As a function of engine temperature and time, the control pressure in the fuel distributor is reduced and more fuel is injected into the engine.

*Order number:* 0 438 140 ...

**Components**