



PASSENGER CAR SYSTEMS

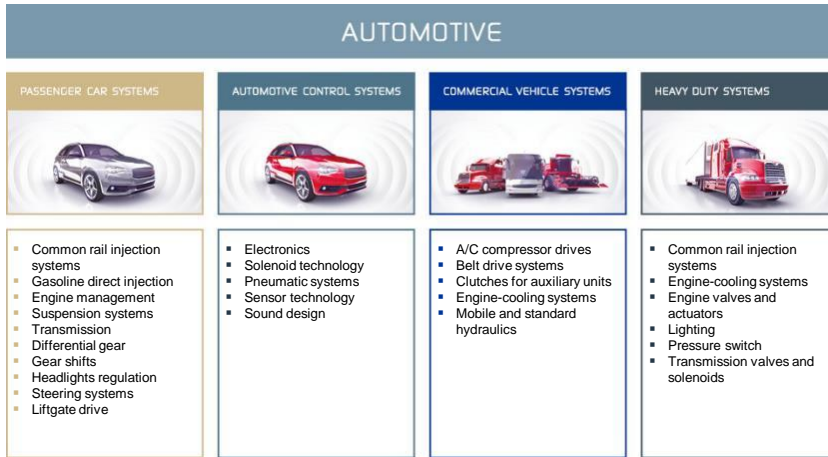


Kendrion open day for investors and analysts  
Kendrion Passenger Car Systems  
Markus Kieninger Thursday, 8 October 2015

## Agenda

- About Kendrion: organisation
- About Passenger Car Systems
- Product range of Passenger Car Systems
- Customer References

**Product overview Division Automotive**



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**New Business Area structure starts 1. Januar 2016**

Merging  
 Passenger Car Systems  
 +  
 Automotive Car Systems



Merging  
 Commercial Vehicle Systems  
 +  
 Heavy Duty Systems



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**Technologies - Automotive**

 Business Area Passenger Car <small>KUHNKE 20124</small>	<p><b>BUSINESS AREA</b> *** <b>Passenger Cars</b></p>	 Business Area Commercial Vehicle <small>LINNIC</small>	<p><b>BUSINESS AREA</b> *** <b>Commercial Vehicles</b></p>
<p><b>TECHNOLOGIES:</b></p> <ul style="list-style-type: none"> <li>- stroke solenoids on/off</li> <li>- stroke solenoids proportional</li> <li>- stroke solenoids bi-stable</li> <li>- electro dynamic actuators</li> <li>- holding magnets</li> <li>- vibrating solenoids</li> <li>- valves on/off</li> <li>- valves proportional</li> <li>- electromagnetic brakes</li> <li>- PE-brakes</li> <li>- electromagnetic clutches</li> <li>- PE-clutches</li> <li>- electronics</li> <li>- solenoid technology</li> <li>- pneumatic systems</li> <li>- sensor technology</li> </ul>		<p><b>TECHNOLOGIES:</b></p> <ul style="list-style-type: none"> <li>- pneumatic clutches</li> <li>- electromagnetic clutches</li> <li>- clutch/brake combinations</li> <li>- vibration damping systems</li> <li>- tensioning systems</li> <li>- hydraulic clutches</li> <li>- visco clutches</li> <li>- angle gear boxes incl. clutch</li> <li>- angle gear boxes incl. clutch</li> <li>- fans</li> <li>- LED</li> <li>- HID</li> <li>- blinkers</li> <li>- pneumatic switches</li> <li>- hydraulic switches</li> <li>- control-units</li> <li>- recuperation modules</li> <li>- linear sensors</li> <li>- angle sensors</li> <li>- locking units</li> <li>- resonance magnets</li> </ul>	

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**Locations of the Kendrion Business Area Passenger Cars**



The map displays global locations of Kendrion Business Area Passenger Cars. Callouts include:

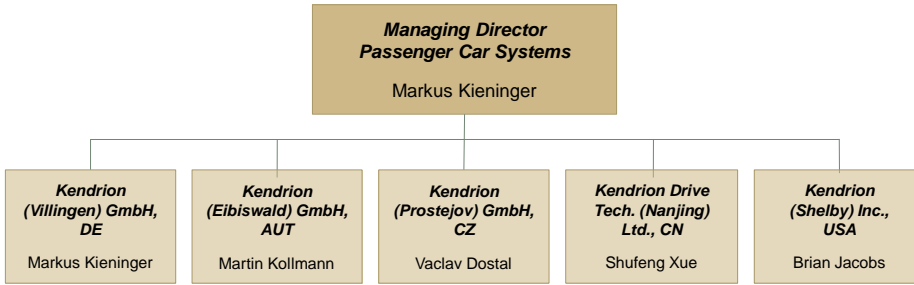
- Kendrion (Villingen), Germany:** PCS
- Kendrion Kuhnke, Germany:** ACS
- Kendrion Kuhnke, Romania:** ACS
- Kendrion (Prostejov), Czech Republic:** CVS, PCS
- Kendrion (Eibiswald), Austria:** PCS
- Kendrion (Shelby), USA:** HDS, PCS, CVS
- Kendrion (Nanjing), China:** PCS, CVS

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Strategic Update Division Automotive

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### Organisation of Passenger Car Systems



### Modular production and processes



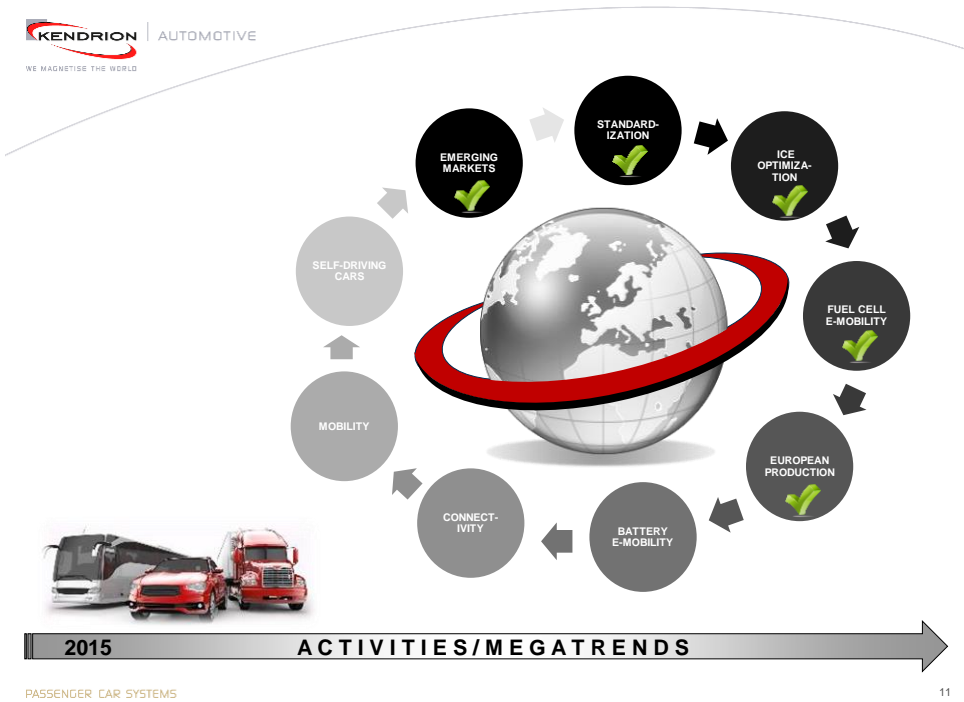
### At Kendrion, Corporate Social Responsibility is not just being responsible; it is about taking responsibility

- Attractive labour standards
- Safe and healthy working environment
- Efficient use of materials; sustainable business processes
- Focus on Energy & CO<sub>2</sub> reduction and environmental protection
- Takes supply chain responsibility within its sphere of influence
- Transparency and fair business conduct
- Sustainable products
- Support local communities

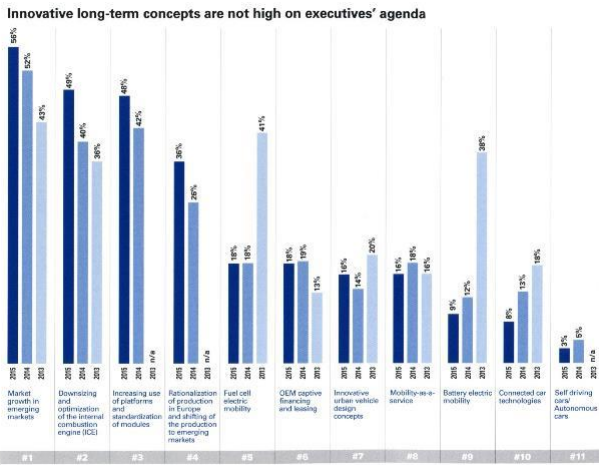


### Quality management ISO 14001:2009 and ISO/TS 16949:2009





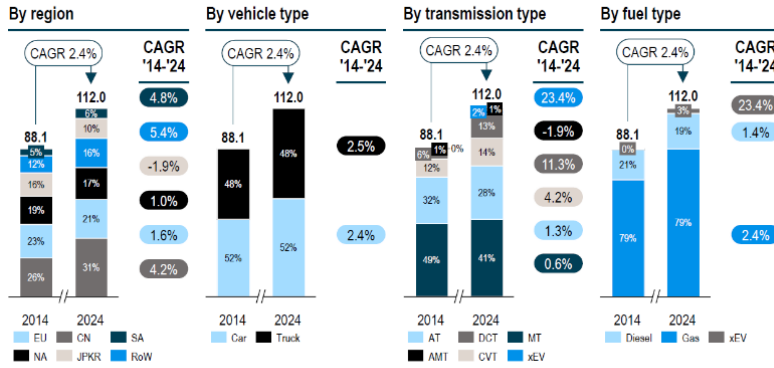
**Market Information: KPMG Study – Key Trends**



### Market Segments – Passenger Cars

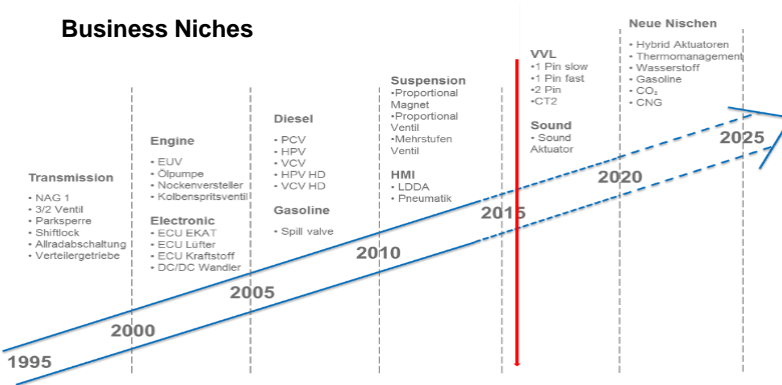
The light vehicle market has recovered to pre-recession volumes and is expected to slowly grow at 2.4% p.a. through 2024

Global light vehicle market volumes [units m]



Source: Roland Berger Component Model

### Business Niches



### Focus on Markets – Categories Passenger Cars MTP



## Applications in the Automotive Industry



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## Focus on Markets: Passenger Cars (PCS) – Fuel Systems

Focus is still on **fuel systems**, because of

- wide product range and higher number of customers and applications (diesel, gasoline)
- market need for high-engineered products (less competitors in technology & less risk of substitution)
- higher environmental restrictions and change to common rail. Therefore the improving and implementing of valve technology will further increase → innovations needed!
- local for local production available

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### Common Rail Injection System



Possible functions :

- ⇒ Regulation of the pump pressure in the rail
- ⇒ Control of diesel volume flow to the high pressure pump

Specific characteristics :

- ⇒ Easy regulation of the pump pressure in the rail without high pressure valve

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### Gasoline Direct Injection



Possible functions :

- ⇒ Operating Area: Gasoline GDI / FSI Systems
- ⇒ Supplies the rail with gasoline

Specific characteristics :

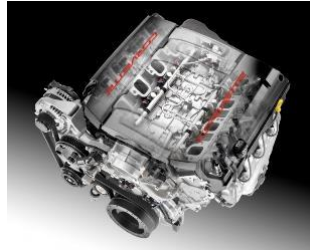
- ⇒ Placed directly in the high pressure gasoline pump
- ⇒ Quick response time
- ⇒ Full flexibility with the connector position

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### Example Engine and Vehicles



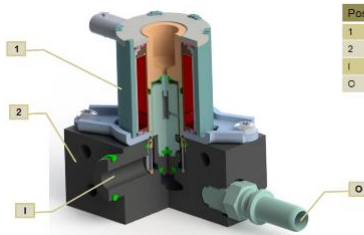
**3.5l V6/V8 engine for GM**

Specific characteristics :

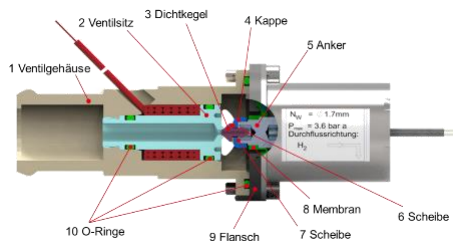
- ⇒ Placed directly in the high pressure gasoline pump
- ⇒ Quick response time
- ⇒ Full flexibility with the connector position



### Hydrogen Regulation for Fuel Cell Cars Shut-Off valve and Purge Valve



Pos.	Benennung
1	Erregersystem kpl.
2	Ventilblock kpl.
I	Anschluss Einlass
O	Anschluss Auslass

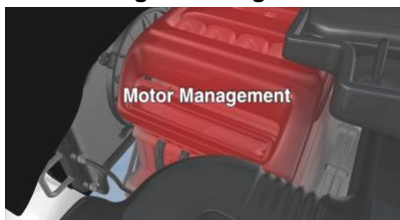


## Focus on Markets: Passenger Cars (PCS) – Engine Management

Focus will also remain on **engine management**, because of

- ICE will remain the major propulsion technology until 2030 with the mega trend: consumption and emission reduction
- wide product range and application possibilities (pneumatic valves, hydraulic valves, etc.)
- many valves and actuators per engine needed
- technology know-how within Kendrión
- potential niche markets and applications for new technologies such as variable valve lifting (VVL) and thermal management
- Local for local production available

## Engine Management



Possible functions :

- ⇒ Camshaft / Inlet manifold adjustment
- ⇒ Actuation of hydraulic slide-valves
- ⇒ Oil- and water-pump control
- ⇒ Diverse motor functions
- ⇒ Variable Valve Lift

Specific characteristics :

- ⇒ Short reaction time
- ⇒ Available with integrated sensor
- ⇒ Light
- ⇒ High flow rates possible



## Engine management I:

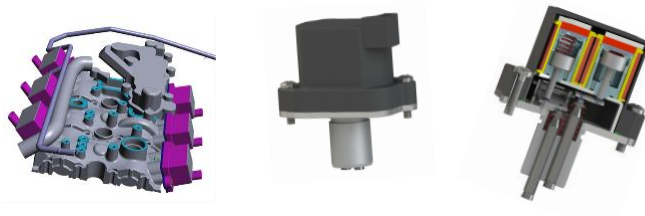
Focus on **VVL** market, because

- Reducing consumption and emissions is one of the megatrends
- Strongly growing demand of VVL systems (+25%/year)
- Only very few competitors (one single source for 2-pin)
- Kendrion design (spring forced) is the only one, which could operate at very low temperatures fast enough  $< -35^{\circ}\text{C}$  - needed for diagnostic purposes
- We generated a lot of know-how in the last 12 month, high level of engineering necessary and mostly underestimated requirements

Focus on Europe and NA as there is market demand. On long term it will be China as well.

## Engine Management I: VariableValveLift System

- 2 main projects - world engines with high production volumes
  - Daimler (gasoline)
  - Audi (gasoline)
  - timing (advanced engineering) and design fit to customer demands
- Design status ready to start series development

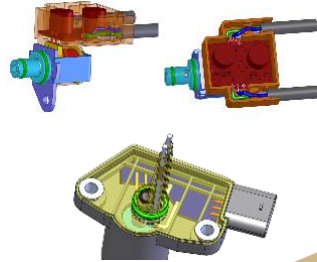


## Engine Management II

Focus on **Thermal/Water Management** market, because

- Reducing consumption and emissions is one of the megatrends
- Mahle, GPM and Greatwall with mechatronic modules
- Used in Hybrid- and e-cars as well as ICE

### 3/2 Valve for Water Pump Regulation

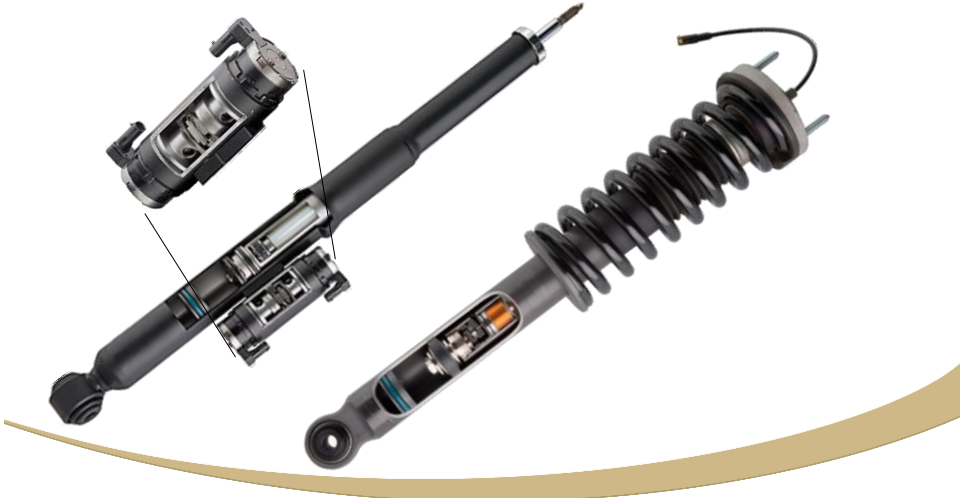


## Focus on Markets: Passenger Cars (PCS) – Suspension Systems

**Suspension systems** market is very attractive, because of

- increasing market of semi and fully variable suspension systems – therefore high-engineered valves are needed (less competitors in technology & less risk of substitution)
- high demands per vehicle (4 to 8 valves per car!)
- Stable business with very long life cycle > 10 years
- technology **will not be substituted** by electrification / hybridization of the combustion engine
- Local for local production available

### Semi Active Damping – Suspension



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### Chassis



Possible functions :

- ⇒ Swift regulation of the shock absorber
- ⇒ Realization of chassis set-up

Specific characteristics :

- ⇒ Integrated in the shock absorber tube

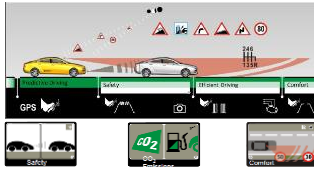


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**„Linear Direct Drive Actuator“ for „Accelerator Force Feedback Pedal“**

Pedalsteller = LDDA = „Linear Direct Drive Aktuator“  
used as passive safety device in the accelerator pedal

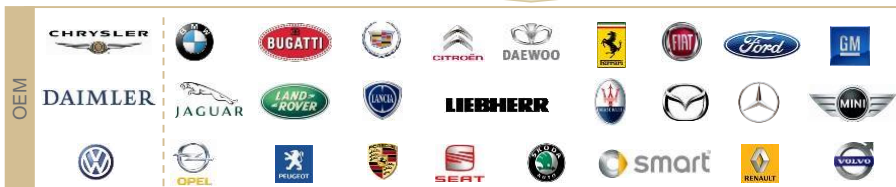
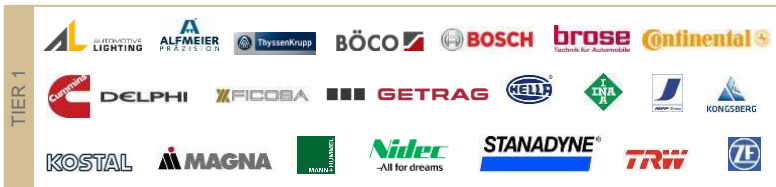


Benefits of Human-Maschine Interface:

- Reduced back side crashes
- Save and comfortable drive
- Economic driving
- Higher driving attention through haptical feedback (instead of optical)

**Customer references**

Kendrion Passenger Car Systems





# WE MAGNETISE THE WORLD

[www.kendrion.com](http://www.kendrion.com)

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