

Developing innovative  
technology to improve  
automotive components



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**Let more people benefit from the  
development of automotive technology.**

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While lots of other industries have already been disrupted, the automotive industry has seen very little change and consolidation in the past several years. But now the change is coming. A whole new shared mobility system enabled by automation, connectivity, and electrification will change society in the 21<sup>st</sup> century.

That's why Baolong implemented the Intelligent & Lightweight strategy to illustrate Baolong's passion to continue innovating in automotive products and solutions. Baolongers take on challenges without fearing change to let more people benefit from the development of automotive technology. Baolong did it in the first 20 years, and is ready for the next 20 years.

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# Milestones

Baolong began as a trading company focusing on tire valves, a business founded on May 20, 1997 by Holley Chen and Charles Zhang to provide overseas customer with cost-effective automotive components. Manufacturing first took place in the plant in Songjiang, Shanghai. Constrained by space, Holley and Charles decided to set up another plant in Ningguo, Anhui. Baolong invested in Dill Air Controls (Dill) based in the U.S.A., which has grown up into the regional leader supplier in tire valves and TPMS. Baolong stands apart from crowd worldwide in the field related to wheels, e.g., tire valves, wheel weights, and TPMS.

Baolong produces performance exhaust tips, hydroforming chassis & body parts, pressure sensors, cameras and millimeter-wave radars, and has become one of the world's leading suppliers in the field of performance exhaust tips. In 2017, Baolong held its initial public offering (IPO) and began trading on the Shanghai Stock Exchange. The same year, Baolong celebrated its anniversary, marking 20 years of developing innovative technology to improve automotive components.

<p><b>1997</b> <b>Establishment of Baolong Automotive</b> Baolong started from selling tire valves for cars to overseas customers.</p> 	<p><b>2000</b> <b>R&amp;D of wheel weights for cars</b> Baolong started the R&amp;D of wheel weights.</p> 	<p><b>2002</b> <b>R&amp;D of TPMS for cars</b> TPMS was developed.</p> 	<p><b>2006</b> <b>Establishment of Anhui Plant</b> The new plant in Ningguo, Anhui, China was established to expand the capacity of tire valves and performance exhaust tips.</p> 	<p><b>2012</b> <b>R&amp;D of hydroforming chassis &amp; body parts</b> Baolong started the R&amp;D of hydroforming chassis &amp; body parts.</p> 	<p><b>2016</b> <b>Enterprise Technology Center</b> Baolong was awarded as a National-recognized Enterprise Technology Center.</p> 	<p><b>2018</b> <b>Acquirement of PEX</b> Baolong acquired automotive sensor manufacturer, PEX.</p> 
<p><b>1999</b> <b>Start of production for tire valves</b> Baolong built the production line of tire valves in Songjiang, Shanghai, China.</p> 	<p><b>2001</b> <b>R&amp;D of performance exhaust tips for cars</b> Baolong started the R&amp;D of metal tubing in forming performance exhaust tips.</p> 	<p><b>2005</b> <b>Establishment of Dill</b> Dill headquartered in North Carolina and focused on tire valves for cars and aircraft, in addition to TPMS, tools, gauges, industrial tanks.</p> 	<p><b>2009</b> <b>R&amp;D of automotive pressure sensors</b> Baolong started the R&amp;D of automotive pressure sensors.</p> 	<p><b>2014</b> <b>Establishment of intelligent driving R&amp;D Center</b> Baolong set up new R&amp;D center for intelligent driving in Wuhan, Hubei, China.</p> 	<p><b>2017</b> <b>IPO on Shanghai Stock Exchange</b> Baolong was taken public 20 years after its establishment.</p> 	<p><b>2019</b> <b>Establishment of BH SENS</b> Baolong and Huf H&amp;S GmbH &amp; Co. KG (Huf) set up a joint venture named BH SENS in the field of TPMS.</p> 

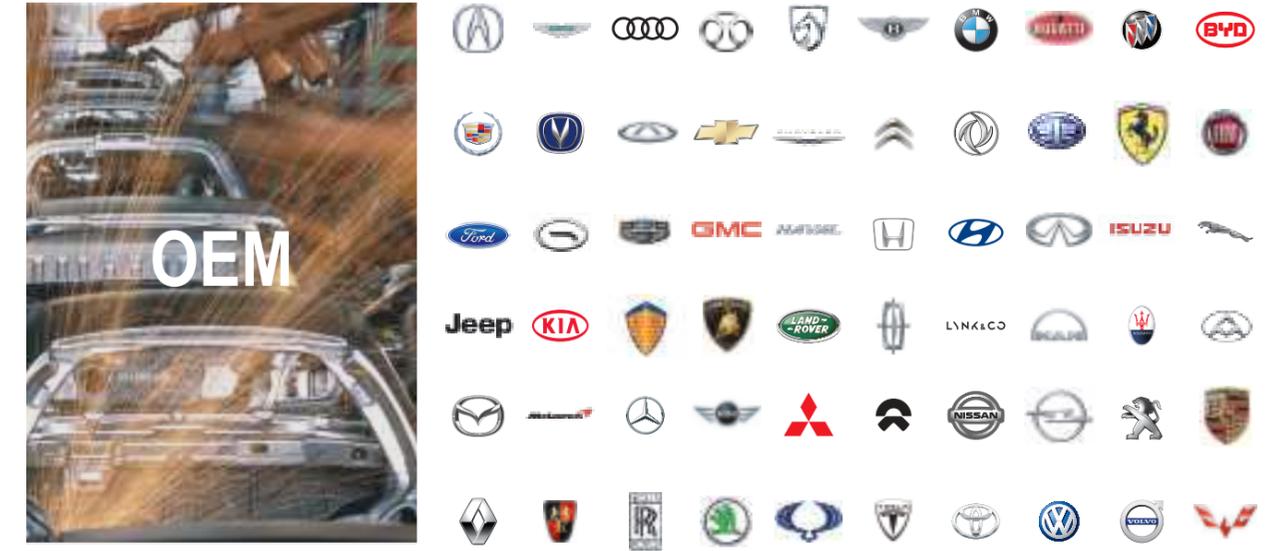
# Global Footprint

When customers choose Baolong as a supplier of automotive products and solutions, they can be assured of a broad spectrum of services from Baolong's global network. Globally present, the access to Baolong's dedicated employees is never far away. Baolong's talents who all know the automotive industry and understand customers' specific demands and needs are always ready to support customers.



# Customer Base

Baolong cooperates with many world-renowned OEMs and Tier 1 companies that trust us to implement the most innovative and game-changing products and solutions to improve safety, efficiency and comfort.



# Certifications

Baolong takes pride in the many certifications and honors that recognize our talent, technology and hard work.



Integration of Informatization and Industrialization Management System Certificate



CNAS L12065 Baolong Automotive



IATF 16949 Ningguo Branch



ISO 14001 Ningguo Branch



OHSAS Anhui Plant



ISO 14001 Anhui Plant



ISO 14001 Baolong Automotive



IATF 16949 Baolong Automotive

# Enterprise Honors

Customer Awards



Ford Q1 Preferred Quality Status



GM Supplier Quality Excellence Award



Wurth Grade "A" Supplier



Tenneco Grade "A" Supplier



Faurecia Global Supplier

Government Awards



National-recognized Enterprise Technology Center



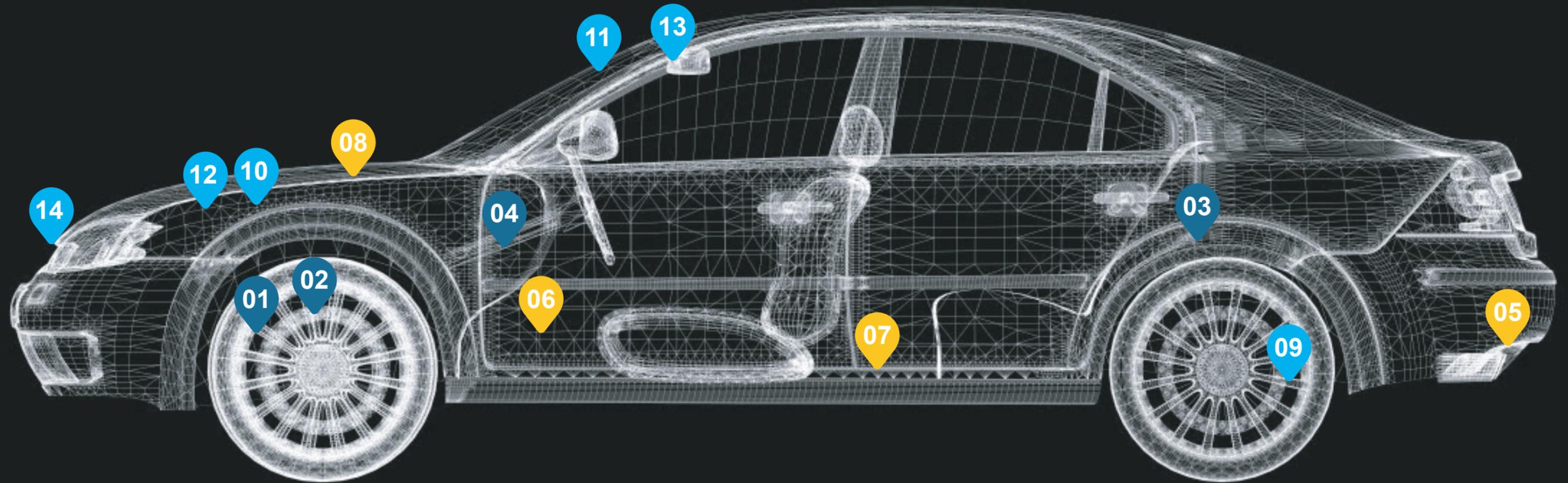
Academician Expert Workstation



National Intellectual Property Advantage Enterprise



# Business Overview



MADE BY BAOLONG

Automotive Rubber & Metal Parts



Tire Valves



Wheel Weights



Air Springs



Aluminum Parts

Automotive Metal Tubing



Performance Exhaust Tips



Hydroforming Exhaust Piping



Hydroforming Chassis & Body Parts



EGR Housings

Automotive Electronics



TPMS



Pressure Sensors



Rain-Light-Humidity Sensors



Current Monitoring Systems



Cameras



Millimeter-wave Radars

# Tire Valves

Tire valves are critical to vehicles in preventing air from escaping. There are two main types of tire valves: snap-in and clamp-in, and it's the vehicle, required tire inflation pressures, driving conditions, and wheel design that dictate which type of valve is appropriate for the application.

The tire valves from Baolong are designed to meet international standards such as ISO, TRA<sup>1)</sup>, ETRTO<sup>2)</sup>, and JATMA<sup>3)</sup>.

Over the past years, Baolong has become and remains one of the largest tire valve manufacturers in the world. Baolong takes this growth and its continued expansion in the field of traditional tire valve, TPMS valves and service kits very seriously, all while keeping a keen eye on improving the products.

1) TRA: The Tire and Rim Association (the U.S.A.)

2) ETRTO: The European Tire and Rim Technical Organization

3) JATMA: The Japan Automobile Tire Manufacturers Association

## Baolong's Features and Benefits

- + 100% EPDM: Ozone resistance test over 500 hours without anti-aging agents.
- + Safety and reliability: Fully automatic assembly and inspection machine, automatic air leakage test by sensors.
- + Traceability: Easy identification with production date marked on each individual valve.

# Wheel Weights

When wheels are machined they're not perfectly balanced. One part of it might be heavier, causing a rough ride or unevenly worn tires. Wheel weights paired with a wheel balancing machine can ensure that the wheel is balanced.

The global ongoing movement and legislation to ban the use of lead wheel weights is a widening trend, based on increasing studies illustrating the impact that lead wheel weights have on our environment. As one of the largest manufacturers of wheel weights in the world, Baolong has already phased out lead wheel weights entirely, and provides car makers and IAM with non lead weights for a better environment.

## Baolong's Features and Benefits

- + Complete tests: Inspections on materials, tests on clip-on wheel weights, tests on stick-on wheel weights.
- + Environmentally friendly materials: High purity zinc is used in accordance with EU End of life vehicle Directive 2000/53/EC and amendment 2002/525/EC.
- + High performance "TOSTIK" tape: Baolong's "TOSTIK" tape has superior films and higher performance adhesives, making Baolong's stick-on weights one of the easiest to install on the market.



# Air Springs

Air springs are used in place of conventional steel springs in heavy vehicle applications such as buses and trucks, and in some passenger vehicles. The purpose of air springs is to provide a constant, smooth ride quality. Modern electronically controlled systems using air springs in automobiles and light trucks almost always feature self-leveling along with raising and lowering functions.



Baolong has been devoted to developing and manufacturing high performance air springs for commercial vehicles and passenger vehicles. Baolong's engineered products satisfy original equipment standard, and make vehicles safer, more cost-effective and more comfortable.

## Baolong's Features and Benefits

- + Complete tests on raw materials, compound rubbers and air springs: Performance tests for salt spray, durability, burst, leakage, etc.
- + Strong R&D and manufacturing competence: Baolong has complete advanced manufacturing facilities and R&D teams, making full use of technological superiority and advanced testing facilities to achieve optimum structural design of air springs.



# Aluminum Parts

Aluminum is essential for boosting the fuel economy of modern vehicles while maintaining safety and performance. Because it takes less energy to accelerate a lighter object, aluminum parts offer great potential for increasing vehicle efficiency.



## Baolong's Features and Benefits

Global trends toward CO<sub>2</sub> reduction and resource efficiency have significantly increased the importance of light weight cars in recent years. Accordingly, Baolong has been devoted to developing and manufacturing aluminum parts since 2008.

- + Baolong has the professional technical advantages and experimental equipment for the R&D of aluminum parts.
- + Baolong's complete production equipment and production lines of aluminum parts ensure the mass production for customizable products.



# Performance Exhaust Tips

Performance exhaust tips give the back-end of the vehicle a serious stylistic boost. There are two types of exhaust tips: exhaust tips fitted directly to exhaust systems, either by means of springs, welding, clamping or simply a screw; the other type is assembled on rear plastic bumpers, integrated into the design using free form shapes.



## Baolong's Features and Benefits

- + Design: Baolong's R&D team works closely with its customers to perfect and innovate the design of exhaust tips.
- + Metal Production: A combination of standard press manufacturing and automated manufacturing is used to give the flexibility of producing complex, tailor-made parts.
- + Manufacturing Process: Baolong uses proprietary technologies, depending on design, complexity, volume and requirements for the final look. Together with its customers, Baolong manufactures the products in the most cost-effective way.

Baolong manufactures performance exhaust tips for the global automotive industry and is one of the market leaders in this field. Competitive costs, thousands of available specifications, satisfying delivery and accurate claim solutions are all ensured with Baolong's decades of experience in the exhaust systems business.



# Hydroforming Chassis & Body Parts

Underneath the exterior panels of every vehicle resides its structural backbone, including complex assemblies such as frame rails, floor pans, upper body pillars and body side structures.

## Baolong's Features and Benefits

Started since 2012, Baolong supplies car makers and their suppliers with hydroforming chassis & body structural parts. Through innovative hydroforming, the chassis & body parts will meet or exceed customer specifications for lightweight and crash performance. With Baolong's long-term production experience and its advanced technology on hydroforming machines and high power laser cutting machines, Baolong is at the forefront of hydroforming technology critical to automotive lightweight.

- + Metal forming: Baolong's decades of technology accumulation provides it full capabilities in metal forming, such as material performance testing equipment, forming process R&D, tooling machine development and design, whole process capabilities of trial production, in-house PLM & BPS application.
- + Overall solutions: Baolong has the ability to provide customers with overall solutions in forming and lightweight aspects, and provide the process capabilities of mass production.



# Hydroforming Exhaust Piping

The purpose of an exhaust system is to safely route exhaust gases from the engine, while also providing attenuation of combustion noise. The exhaust system includes aftertreatment devices, mufflers, hangers, and piping which connects all the other exhaust elements.

## Baolong's Features and Benefits

- + **Metal forming:** Baolong's decades of technology accumulation provides it full capabilities in metal forming, such as material performance testing equipment, forming process R&D, tooling machine development and design, whole process capabilities of trial production, in-house PLM & BPS application.
- + **Overall solutions:** Baolong has the ability to provide customers with overall solutions in forming and lightweight aspects, and provide the process capabilities of mass production.

More and more demanding requirements are being placed on the automotive exhaust system in the areas of thermodynamics, durability, diversification, shorter development time and cost savings. Therefore Baolong is constantly working on new, innovative and highly effective development and manufacturing methods for exhaust piping based on requirements shared by customers. Thanks to its hydroforming technology, Baolong creates exhaust piping of complex shapes with unparalleled precision and weight reduction that meets customer specifications for durability and thermal performance.



# EGR Housings

EGR works by recirculating a portion of an engine's exhaust gas back to the engine cylinders to reduce NOx emissions. The EGR includes control valves, coolers, piping, flanges, gaskets, and housings which house the other EGR elements. The size, shape, durability and thermal characteristics of the housings contribute to the performance of EGR.



## Baolong's Features and Benefits

The increasingly stringent emission standards require the deployment of increasingly effective and sophisticated technologies for emission reduction in both gasoline and diesel vehicles. A lower NOx limit requires car makers to utilize advanced engine technologies like EGR. As a globally renowned specialist in the field of metal tubing, Baolong is devoted to developing and manufacturing EGR housings with hydroforming technology. Rigorous durability and thermal fatigue tests ensure the superior properties of Baolong's EGR housings.

- + **Design:** Baolong's R&D team works closely with its customers to perfect and innovate the design of EGR housings.
- + **Metal Production:** A combination of standard press manufacturing and automated manufacturing is used to give the flexibility of producing complex, tailor-made parts.
- + **Manufacturing Process:** Baolong uses proprietary technologies, depending on design, complexity, volume and requirements. Together with its customers, Baolong manufactures its EGR housings in the most cost-effective way.

# TPMS

TPMS reports real-time tire pressure on the vehicle's dashboard graphic display, helping drivers avoid traffic accidents, poor fuel economy, and increased tire wear due to under-inflated tires.

## BH SENS's Features and Benefits

- + BH SENS has decades of OE experience for passenger vehicles, trucks, buses and off-road vehicles.
- + Easy to mount with aluminum clamp-in and rubber snap-in stem options, and support automatic location of the tire.
- + Aftermarket TPMS performs identically to the original OEM-equivalent.

The joint venture BH SENS by Baolong and Huf has been officially launched and put into operation in China, Europe and the U.S.A. as of January, 2019. Integrating the experience and capabilities of Baolong and Huf in the field of TPMS, BH SENS is one of the world's largest suppliers of both OEM and IAM TPMS solutions, meeting the diverse demands of customers in passenger vehicle, commercial vehicle and off-road markets.



# Pressure Sensors

A great amount of measurement data must be collected and forwarded by pressure sensors to allow control systems to work safely and reliably, ensuring trouble-free and efficient operation of a vehicle.



Baolong's pressure sensors fulfil this task reliably and accurately, even in the toughest conditions. Baolong's pressure sensors are available in different designs with versatile functions and are individually adapted to customer requirements. Baolong's product line includes: T-map, fuel tank pressure sensor, SCR pressure sensor, engine oil pressure sensor, air-conditioning pressure sensor, GPF/DPF differential pressure sensor, carbon canister desorption pressure sensor, air brake pressure sensor, brake booster pressure sensor, etc.

## Baolong's Features and Benefits

- + Baolong's MEMS sensing technique leads to small volume, easy for installation and low-cost OEM application design.
- + Additional features and benefits:
  - Excellent long-term stability
  - Intelligent zero compensation and temperature compensation
  - Excellent EMC/ESD performance
  - Proof pressure and reversepolarity protection and short-circuit protection
  - Improved accuracy in a wide range of operations, including industry leading temperature range accuracy
  - Wild range of operating temperature
  - Pressure range, output curve, and dimension customization design
  - Distinguished vibration proof
  - Highly modular product configurations
  - Well sealing design and protective design

# Rain-Light-Humidity Sensors

Rain-light-humidity sensors measure the volume of rain, the ambient light levels, the temperature and relative humidity, to automatically control the wipers, lamps and air-conditioning.



## Baolong's Features and Benefits

- + Makes driving safer and more comfortable.
- + Reduces fuel consumption and emissions by ensuring the intelligent use of the wipers, lamps and air-conditioning.

Baolong has been devoted to developing and manufacturing rain sensors for several years. Now Baolong has developed this technology further to create a truly multi-functional sensor which measures not only the volume of rain, but also the ambient light levels, the temperature, and relative humidity at the windshield. All these functions are combined into a single sensor, which is small enough to be integrated almost invisibly into the mirror arm.



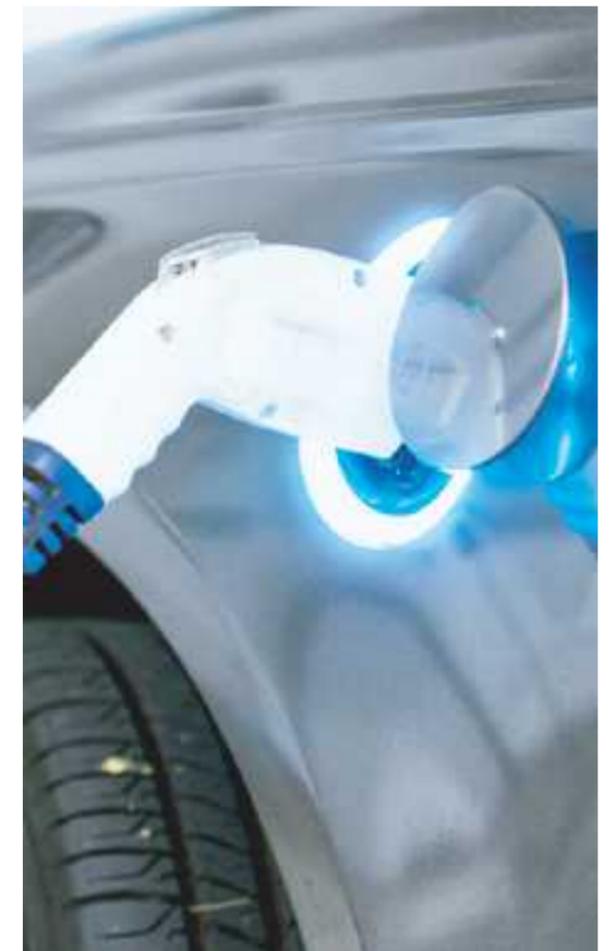
# Current Monitoring Systems

Current monitoring systems used for controlling motor drive, direct current conversion control of motor regenerative current and detecting charged and discharged current of batteries of electric vehicles and hybrid vehicles, which play a very important role as core parts of control.

## Baolong's Features and Benefits

- + Uses the leading fluxgate technology to realize the frequency difference detection scheme.
- + High reliability and safety.

Adoption of electric vehicles is picking up, mostly thanks to supportive policy and technological advancements. Baolong has thought seriously about that and decided to do things we are specialized in. There is a huge volume of various systems in electric vehicles that require current sensing. Baolong has developed current monitoring systems that measure electrical parameters in BMS, motor control applications, on-board chargers and DC/DC converters. Baolong's innovative and high quality solutions for current sensing ensure customer systems are optimized, reliable and safe.



# Cameras

ADAS systems rely on cameras to quickly and accurately detect and recognize other vehicles, pedestrians, obstacles, traffic signs, lane lines, etc. The information captured by ADAS cameras is quickly analyzed by supporting software and used to trigger a response by the vehicle to improve safety.

## Baolong's Features and Benefits

ADAS makes driving safer. ADAS relies on several main sensor systems and sub-systems, for instance, cameras. Baolong is committed to developing the "eyes and ears" of the vehicle, focusing on automotive sensors like cameras for the purpose of ADAS. Already, Baolong's ADAS technologies are providing drivers active guidance during parking and driving. The camera systems from Baolong include rear parking camera, thermal imaging and night vision systems, dynamic vision sensors, driving monitoring systems, Face ID, 360° vision systems, BSD cameras, stereo cameras, and more.

- + Excellent Image Quality: Baolong's cameras feature high resolution, excellent image quality and high dynamic range, which enable software to quickly and accurately interpret information to keep the vehicle and occupants safe.
- + Customizable Solutions: Modular solutions that enable customers to choose from a portfolio of image sensors and image sensor processors.



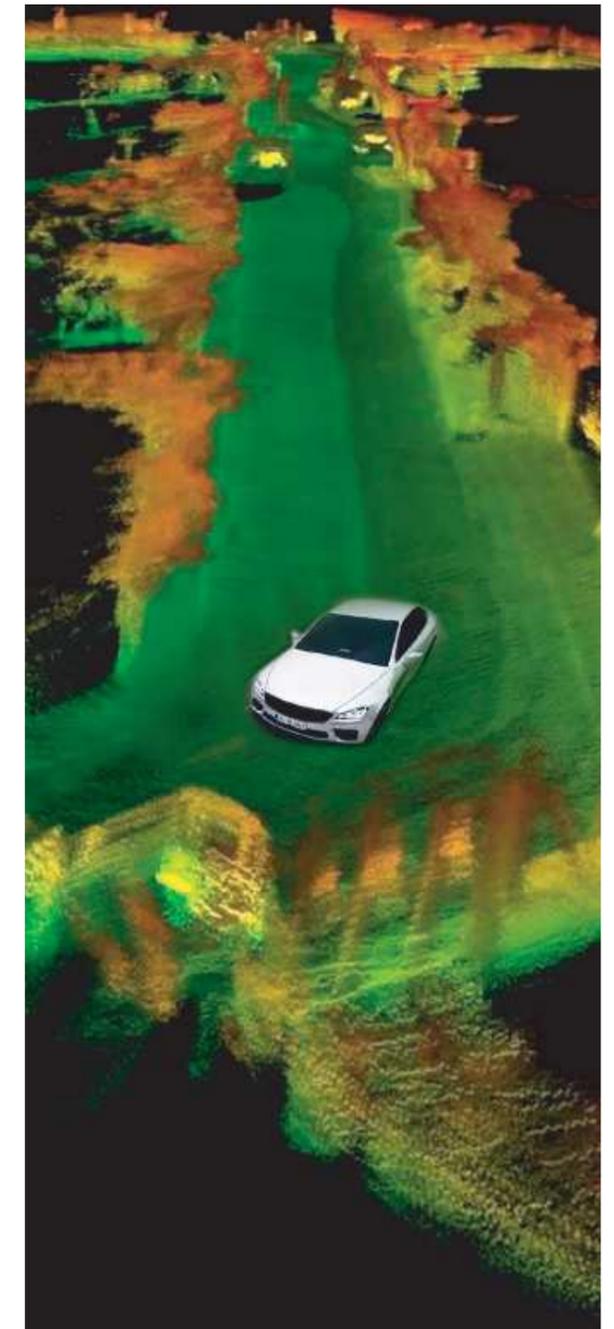
# Millimeter-wave Radars

On the road, millimeter-wave radars are playing a key role of ADAS, which constitutes an intermediate stage in the development of autonomous vehicles. ADAS often incorporate short- and long-range radar using electromagnetic waves for determining the distance, speed, and direction of objects.

Radars represent the better option for detection in rough weather and obscure road conditions compared with other sensors. The short- and long-range radars from Baolong are particularly useful in several ADAS technologies: BSD, LCA, RCTA, FCW, ACC, AEB, IACC. Moreover, using Baolong's sophisticated software algorithms, its fusion of radars and multi-purpose cameras generates an extremely detailed "image" which forms the basis for a highly accurate interpretation of the vehicle's surroundings. This enables the implementation of additional assistance and safety functions for ADAS.

## Baolong's Features and Benefits

- + Baolong has been devoted to developing radars for several years and is skilled in antenna design and algorithm.
- + With decades of manufacturing experience in automotive electronics, Baolong has the ability for mass production of radars.
- + Baolong has complete radar production lines including 24GHz radar, 77GHz radar, 77GHz cascade radar and image radar.
- + Modular solution that enables the customers to choose from a portfolio of radar chips.



# Baolong Automotive

Baolong Automotive was founded in 1997 and is headquartered in Shanghai, China. Baolong is an automotive supplier with production facilities in China, the U.S.A., Hungary, Germany, Austria and distribution centers in China, the U.S.A., Germany, Poland, Austria, Japan, etc. Baolong uses its expertise in automotive technology to offer high-quality and creative products for its customers. The products include tire valves, wheel weights, air springs, aluminum parts, performance exhaust tips, hydroforming chassis & body parts, hydroforming exhaust piping, EGR housings, TPMS, pressure sensors, rain-light-humidity sensors, current monitoring systems, cameras, millimeter-wave radars, etc. With more than 3,900 employees, the company generated a turnover of around 2.3 billion RMB in 2018. Baolong is regarded as one of the world market leaders for tire valves, wheel weights and performance exhaust tips. In the field of TPMS, the joint venture BH SENS by Baolong and Huf is one of the world's largest suppliers of both OEM and IAM TPMS solutions.

