



GLORY 600 training courseware

--Chassis Control System



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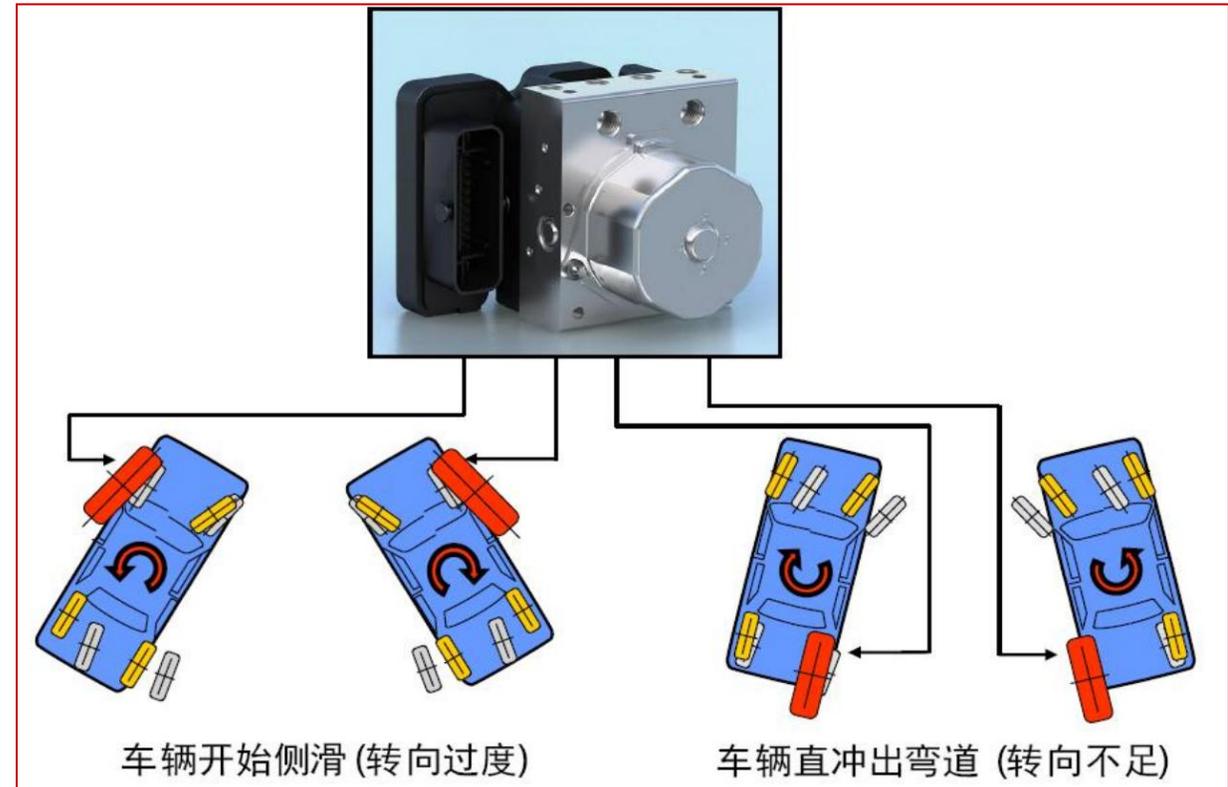


Course targets

- Understand the component and structure principle of ESP of GLORY
- Understand the calibration and exhaust steps of GLORY ESP system sensors
- Can use the diagnostic instrument to detect the ESP system faults

1、ESP/ESC Function

The Electronic Stability Program (ESP) can provide optimum vehicle stability and directional control when cornering at high speed or driving on slippery surfaces. ESP includes ABS, TCS, VDC and other functions.



The vehicle starts to sideslip (oversteer)

Vehicle rush straight out of a corner (understeer)

ESP integrates three functional modules: ABS, TCS and VDC, and also integrates value-added sub-functions: HHC, HDC, HBA.

●ABS (Anti-lock Brake System)

●TCS (Traction control system)

TCS prevents the vehicle's drive wheels from slipping when accelerating by reducing engine power, and applies brake force control if necessary to prevent the drive wheels from idling. TCS makes it easy to start, accelerate and climb hills in adverse driving conditions.

●VDC (Vehicle Dynamics Control)

When the vehicle turns suddenly during driving, the VDC system determines the driver's driving intention according to the steering wheel angle and vehicle speed and other information, and continuously compares it with the actual situation of the vehicle. If the vehicle deviates from the normal driving route, the VDC will correct it by applying the brakes to the corresponding wheels to help the driver control the sideslip and maintain the directional stability of the vehicle.

●HHC(Hill start-assist control)

After the brake pedal is released, the HHC maintains the brake pressure applied by the driver, and allows the driver up to two seconds to move the foot from the brake pedal to the accelerator pedal, preventing the vehicle from rolling back on a hill.

●HBA(Hydraulic Brake Assist)

When the driver quickly steps the brake pedal, the HBA can recognize that the vehicle is in an emergency state and quickly increase the braking pressure to the maximum value, so that the ABS intervenes more quickly and effectively shortens the braking distance.

HDC (Hill descent control)

HDC, also known as the slope control system, when driving downhill the vehicle can be braked automatically without stepping on the brake pedal, and the vehicle passes the steep downhill section smoothly. For this moment the driver can free his feet and concentrate entirely on the steering wheel.

➤ II. ESP system function

ESP系统



1、HDC (Hill descent control)

- Start condition

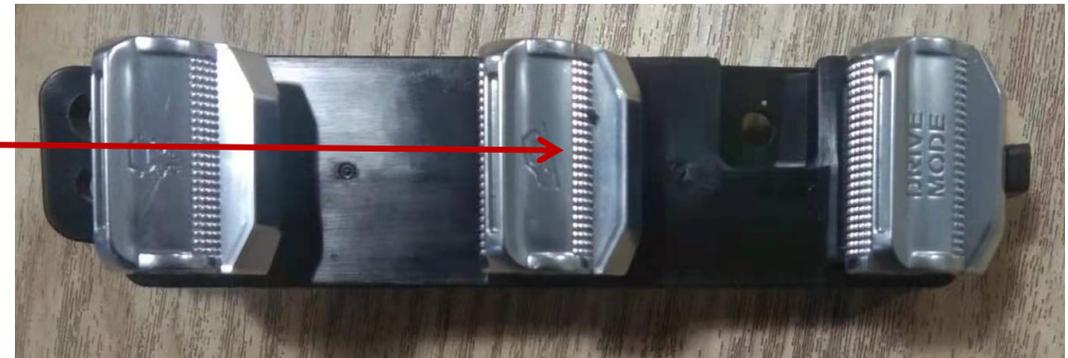
Press the HDC button, and the yellow indicator light of HDC sign on the dashboard will light up. If the vehicle speed is between 35km/h and 60km/h or the gradient is insufficient, the HDC will be in a preparation state, and the indicator light will be always on. But the HDC does not start working at this time.

Three conditions must be met for the start of HDC:

- a、 vehicle speed 10km/h~35km/h;
- b、 Steep slopes are continuously bigger than about 0 degrees;
- c、 The steep slope section is continuous and has a certain length.



HDC Switch



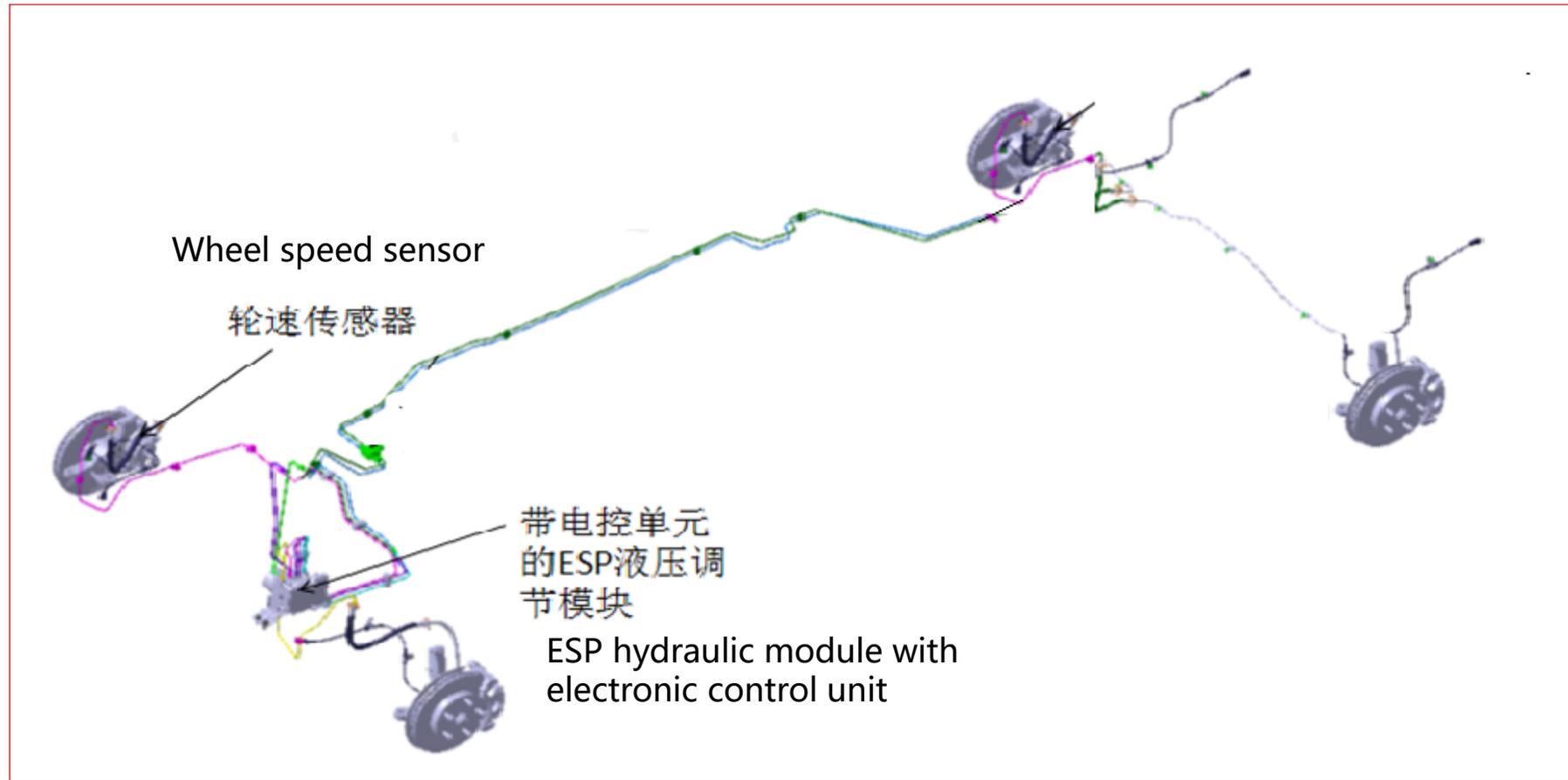
2、Precautions for HDC

2.1. When HDC intervenes in the work, the indicator light on the dashboard will flash, and at the same time, you can hear the obvious friction sound of the brake disc or feel a sense of irregularity during the driving process of the vehicle, which is a normal phenomenon.

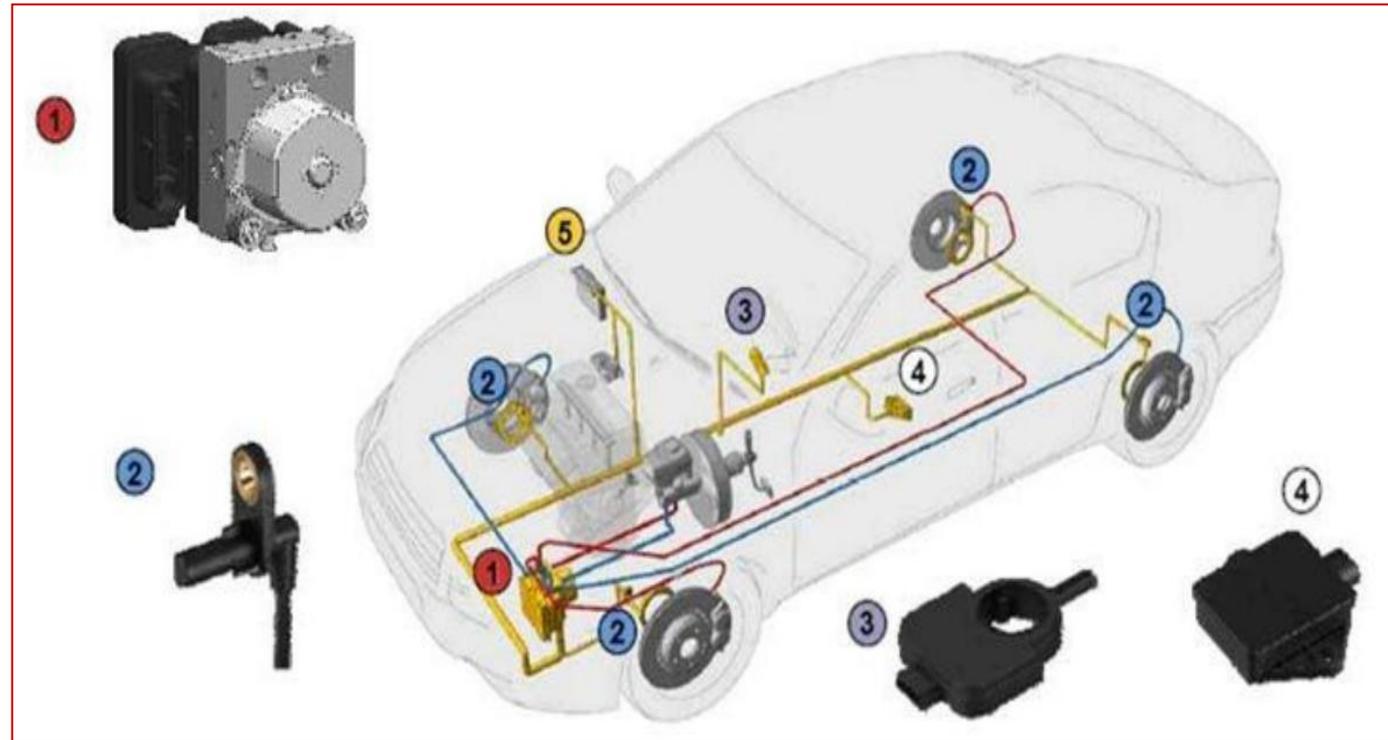
2.2. Since the friction pads will heat up during continuous braking on steep slopes, continuous long steep slopes may cause thermal recession of the brake pads (under normal circumstances, it will hardly occur unless the steep slopes are very, very long). When it is detected that the temperature of the brake disc exceeds 650°C, the HDC will stop working, and the ESP indicator light will be on. When the brake disc temperature cools down, the HDC will resume normal operation and the ESP indicator light will be off.

3、ESP system component

ESP consists of hydraulic module with electronic control unit, wheel speed sensor, yaw velocity and lateral acceleration sensor.



- 1、 ESP hydraulic module with electronic control unit
- 2、 Wheel speed sensor
- 3、 Steering wheel angle sensor (integrated in steering upper axle)
- 4、 Yaw rate sensor (integrated in ESP hydraulic control unit)
- 5、 Communication with the engine management system



ESP executive body assembly

The ESP executive body assembly is the control center of ESP system. Its main task is to continuously monitor, receive the speed signal from the wheel speed sensor, the steering wheel angle signal, the yaw rate and the lateral acceleration signal of the yaw rate sensor, and measure, compare, analyze and discriminate, and analyze the four wheels braking situation. Once it is judged that the wheels are about to lock or encounter a sudden obstacle, it immediately enters the body stability control state, and sends commands to the hydraulic unit through the internal electronic control unit to control the working pressure of the brake cylinders corresponding to the four wheels to prevent the wheels from locking, or to avoid obstacles in an emergency..

Wheel speed sensor

Wheel speed sensor assembly is a very important part of ESP system. It measures the number of turns the wheels and then generates an AC signal that is sent to the ESP actuator assembly.

EPS angle signal (integrated in steering upper axle)

The steering wheel angle sensor mainly monitors the steering angle of the steering wheel.

Yaw rate sensor

The yaw rate sensor integrates a side slip sensor (mainly monitoring the state of the car body rotating around the vertical axis) and a lateral acceleration sensor (mainly monitoring the centrifugal force when the car turns).

ESP system warning light

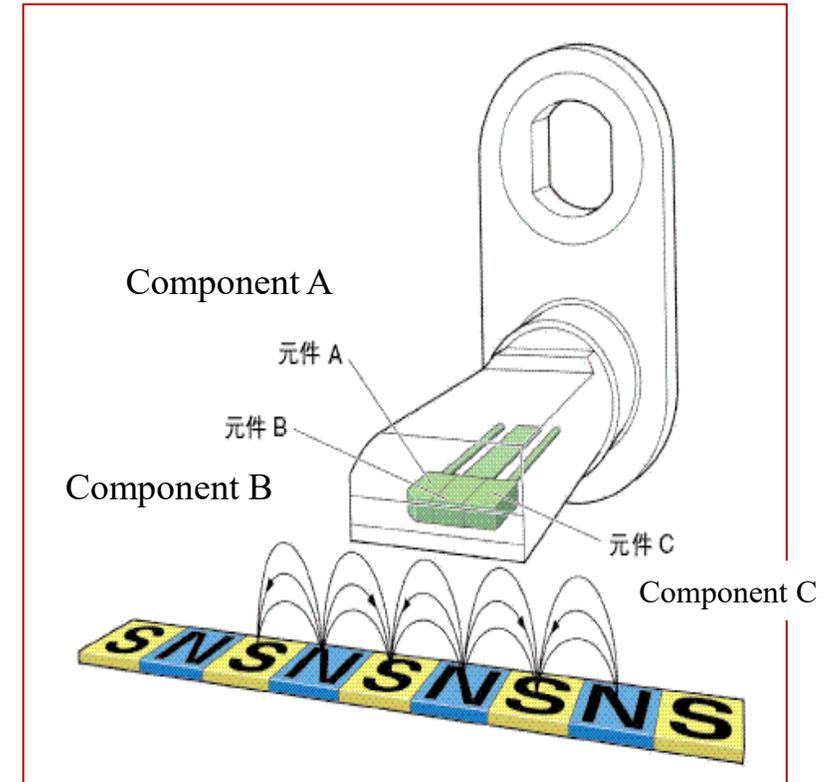
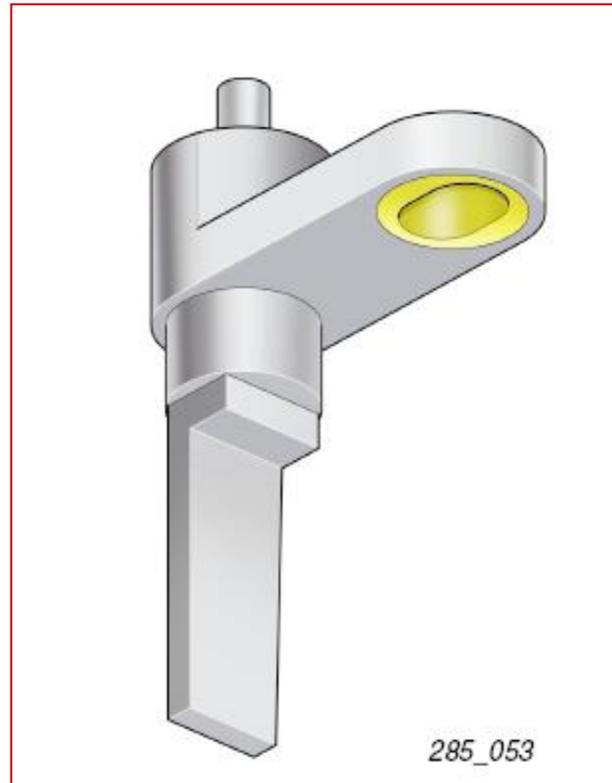
The body stability control warning light will illuminate in the following situations:

The moment the ignition switch is turned on, the body stability control system warning light comes on to check whether the light is working properly, and then goes out.

When the ESP system is faulty, the electronic control module detects that the ESP braking system is faulty, it will light the ESP system warning light to remind the driver that there is a fault.

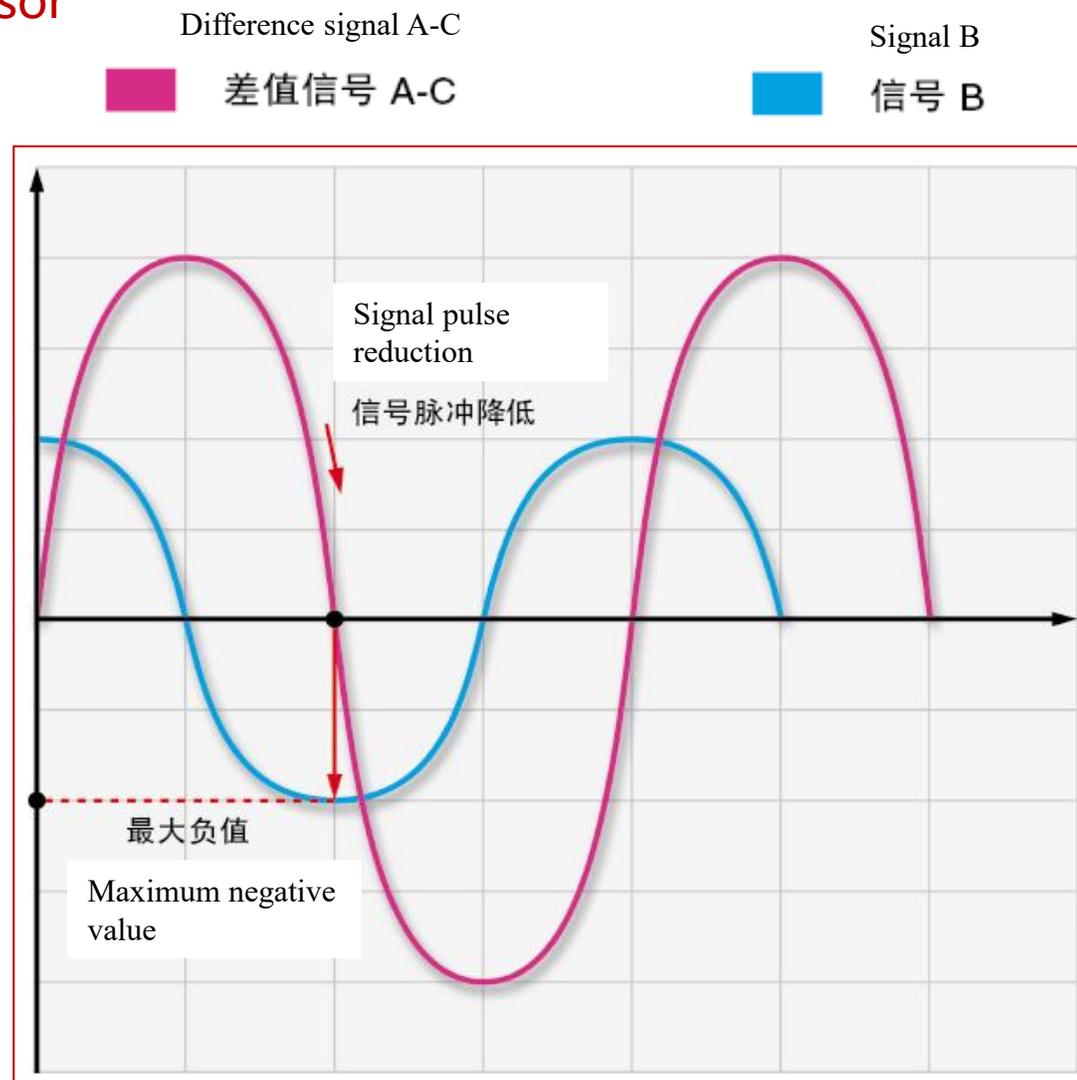
4. Wheel speed sensor

The ECU calculates the rotational speed of the wheels based on the signals from the wheel speed sensors. Active (Hall) sensors are becoming more and more popular. They use magnetic fields for non-contact detection of wheel speed, also has the ability to identify wheel rotation direction and the stop.



Orientation recognition of the speed sensor

Hall element B is located in the center of A and C. When the signals A, C and their difference signal zero flow, the element B recognizes the magnetic current maximum. The twist direction is identified when signal B is at its maximum value (positive or negative). For example, when the difference signal A-C reaches zero circulation due to signal pulse reduction, the signal B maximum value is negative and a twist to the left is recognized.



5. Yaw rate sensor module

The longitudinal acceleration, lateral acceleration and yaw rate sensors are collectively called the yaw rate sensor module, and these three sensors are integrated in the ESP hydraulic control unit.

5.1. Installation position of yaw rate sensor:

The sensors are integrated in the ESP hydraulic control unit.

5.2. Yaw rate sensor function :

It is determined whether the state of the vehicle matches the driver's intention.

5.3. Impact after the yaw rate sensor fails:

If the information from the yaw rate sensor is missing, the ESP cannot know the required vehicle state and the ESP function will fail.

The information is transmitted to the sensors of the control unit via the CAN bus.



6. ESP OFF switch

Function:

By pressing the ESP pushbutton switch, the ESP function is deactivated, by pressing the button again, the ESP function is reactivated.

ESP should be turned off when:

- When the car is driving hard in deep snow or loose ground,
- When driving with snow chains,
- When the vehicle is detected on the power testing test bench

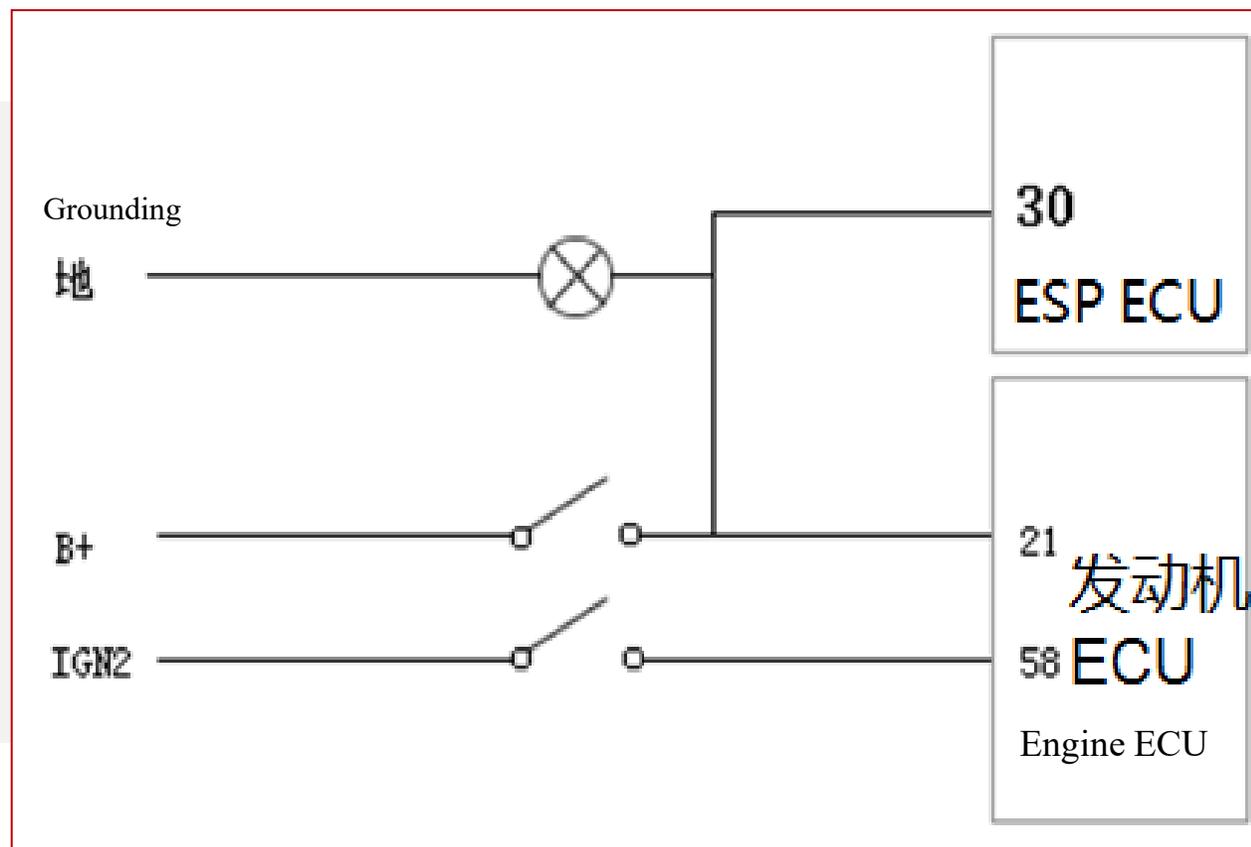
When the ESP is working, the ESP cannot be turned off after the vehicle speed exceeds 80km/h. When a fault occurs, the ESP cannot be turned off, and the ESP indicator on the dashboard will give an alarm, and the switch has no self-diagnosis function.



7. Brake light switch

The ESP ECU detects the brake light switch signal voltage in order to determine when the brake pedal is engaged and to test the brake light switch circuit.

The brake light switch is a constant open switch. When the brake pedal is stepped, the switch closes and the brake light switch provides a +12V signal voltage to the stop light signal circuit (+BLS).

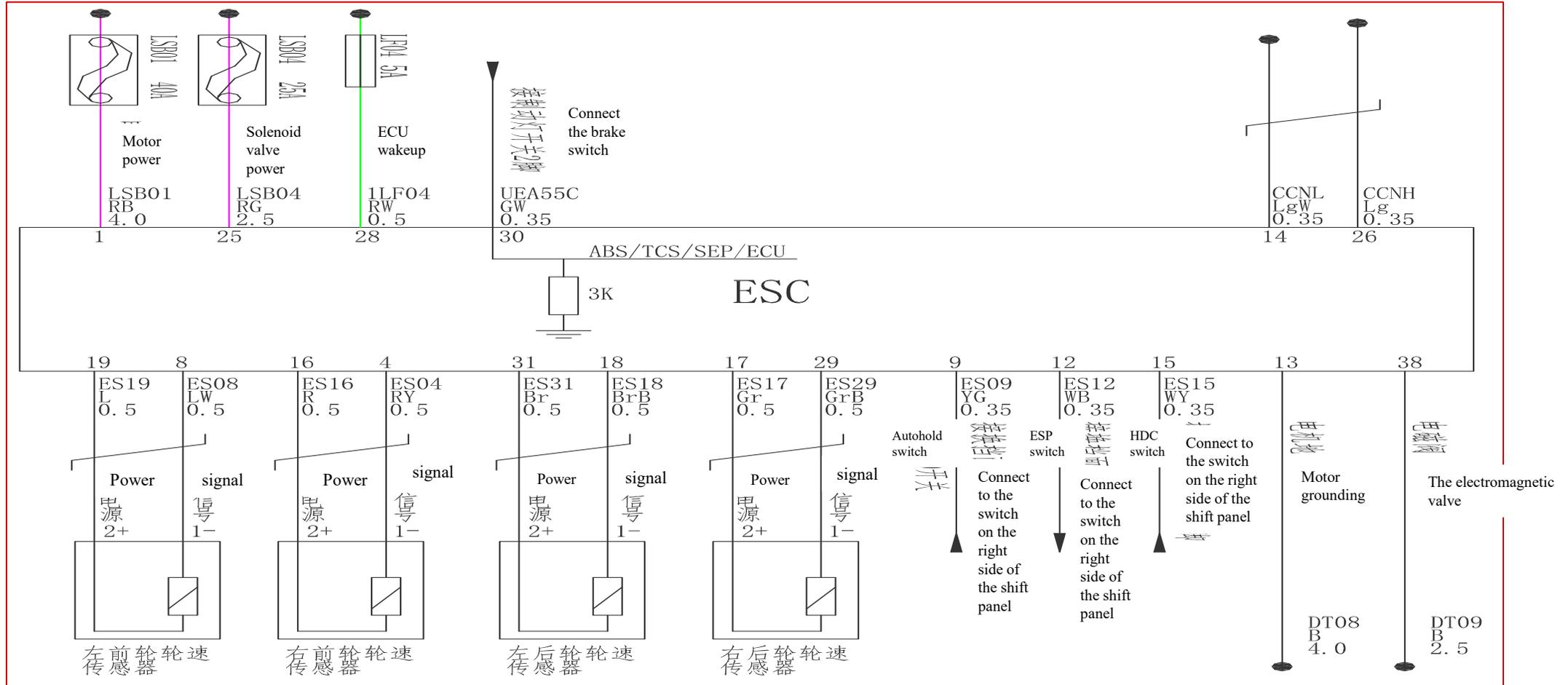


IV. ESP electrical system circuit diagram

ESP系统



ESP ECU circuit schematic



Left front wheel speed sensor

Right front wheel speed sensor

Left rear wheel speed sensor

Right rear wheel speed sensor

1、ESP Diagnostic precautions

Before diagnosing the ESP system, if there is a fault in the basic braking system, it must be eliminated first, such as:

Brake system noise; Brake pedal too hard; The brake pedal or vehicle vibrates during normal brake; Vehicle brake deviation; Parking brake system fault

The following two situations indicate that the ESP system has detected a failure:

- (1) Turn on the ignition switch, the system self-test is completed, and the warning light remains on;
- (2) The warning light stays on while driving;

At this point, the driver can realize normal brake, but the applied braking force should be minimized to prevent the wheels from locking. After the warning light is on, you should drive carefully and go to the special service station for inspection and repair immediately to prevent more failures and cause traffic accidents.

Before unplugging the ESP and sensor wiring harnesses, the ignition switch must be disconnected; ensure that the connectors are dry and clean to avoid any foreign matter entering; the ESP wiring harness must be well installed in the horizontal and vertical directions to avoid damage to the connector.

When connecting the ESP brake line, it must be ensured that it is connected correctly. The ESP ECU cannot judge whether the brake lines are properly connected. Incorrect connections may lead to serious accidents. When connecting the brake lines, the marks on the ESP assembly must be followed:

- MC1: Brake line 1 connected to brake master cylinder; MC2 : Brake line 2 connected to brake master cylinder;
- FL: Brake line connected to the left front wheel brake cylinder; FR: Brake line connected to the right front wheel brake cylinder;
- RL: Brake line connected to the left rear wheel brake cylinder; RR: Brake line connected to the right rear wheel brake cylinder.

2. ESP may produce noise when:

After starting the engine, when the speed reaches about 40km/h, there will be a short "hum" sound, which is the sound of the ESP self-check, and it is a normal phenomenon. There will be sound when ESP is working normally, mainly reflected in the following aspects:

The sound of the motor, solenoid valve and return pump in the ESP hydraulic unit;

The sound caused by the rebound of the brake pedal;

The impact sound between the suspension and the body caused by emergency brake;

3. Preliminary inspection

Before diagnosing the ESP system, the easily accessible components that may cause the ESP system faults should be checked first. Visual inspection and appearance inspection procedures can quickly identify the failure, eliminating the need for further diagnosis.

- (1) Make sure that only tires and wheels of the recommended size are installed on the vehicle. The tread pattern and depth of the coaxial tires must be the same. Please refer to the user manual for specific tire models.
- (2) Check ESP hydraulic regulator, brake lines and connections for leakage.
- (3) Check the fuses of the ESP system to make sure the fuses are not burned and are the correct model. The ESP system has three fuses, namely: pump motor fuse (40A); solenoid valve fuse (25A); electronic control unit fuse (5A) according to the actual circuit diagram.
- (4) Check the battery voltage and whether the battery terminals are corroded or loose. The normal operating voltage range for an ESP system is 9–16V.
- (5) Check whether the ground point of the ESP ground wire is loose and whether the ground position has been changed.
- (6) Penetrate into the connector of the ESP ECU, resulting in functional failure.

(7) Do the visual inspection and appearance inspection for the following electrical components:

- Whether the wiring harnesses and connectors of the related parts of the ESP system are properly connected, pinched or cut.
- Whether the wiring harness is routed too close to high-voltage or high-current devices such as high-voltage electrical components, alternators/starters, aftermarket stereo amplifiers, etc.

CAUTION: High voltage or high current devices may induce inductive noise in the circuit, which can interfere with the normal operation of the circuit.

ESP components are sensitive to electromagnetic interference (EMI). If intermittent failure is suspected, check that aftermarket anti-theft devices, lights or mobile phones are installed correctly.

(8) ESP is an active safety system. Its main function is to maximize the use of ground attachment and maintain the steerability and driving stability of the car. However, ESP cannot completely prevent the car from slipping when exceeding physical limits or driving at high speed on slippery surfaces.

(9) If the ESP is too noisy, it may be caused by the following reasons:

- The fixing of the ESP assembly and the ESP bracket is loose.
- The fixing of the ESP bracket to the body is loose.
- The plastic gasket on the ESP bracket is missing or damaged.
- Deformation, bumping and interference of brake lines
- Brake line bracket broken.



4、 Diagnostic process

(1) Vehicle enters repair shop

(2) Problem analysis

(3) Read fault codes

(If there is a fault code, go to step 4)

(If there is no fault code, go to step 6)

(4) Record the fault code, then clear the fault code.

(5) Confirm and reproduce the fault: accelerate the vehicle to 40km/h, simulate the fault occurrence state, and re-read the fault

There is a fault code (current fault code. Go to step 7)

No fault code (Historical fault code. Go to Step 8)

(6) No fault code breakdown maintenance, then go to Step 9.

(7) Eliminate the faults according to the fault code list, then go to step 9.

(8) Troubleshoot according to the symptom table, then go to step 9.

(9) Confirm and troubleshoot, carry out maintenance completion inspection

(10) Prevent failures from recurring

End

5. No fault code fault maintenance

If there is a fault in the braking system, but the ESP does not store the fault code, this type of fault is called a no fault code fault. No fault code faults are generally caused by a fault in the base braking system. For example:

- Leakage of brake fluid (may cause the brake to be soft, the brake distance is too long, and it may cause brake failure in severe cases)
- Use inferior quality brake fluid (inferior brake fluid will corrode the brake line and the internal components of the ESP hydraulic adjustment module, and even lead to brake failure in serious cases)
- There is air in the brake line (may cause the brake to be soft, or even to fail)
- The brake line is blocked (may cause the brake to be hard, the brake to run off, or even the brake to fail)
- Brake disc excessive wear (may cause soft brakes and long brake distance)
- Booster failure (may cause the brake to be hard or soft, the brake pedal travel is too long, and it will cause the brake failure in serious cases).
- Wrong connection of brake lines (may cause ABS/ESP performance to drop, tail swing, long braking distance, etc. For the correct installation method, please refer to the signs near the oil hole on the ESP hydraulic adjustment module: MC1 means No. 1 master cylinder oil pipe; MC2 means No. 2 master cylinder oil pipe; FL means left front wheel cylinder oil pipe; FR means right front wheel cylinder oil pipe; RL means left Rear wheel cylinder oil pipe; RR stands for right rear wheel cylinder oil pipe).
- Note:** No power supply to ESP or abnormal interruption of power supply will cause the brake warning light, ABS warning light and ESP warning light to stay on, but there is no fault code.

Troubleshooting suggestion: Check the corresponding parts for the fault phenomenon, and troubleshoot according to the vehicle maintenance manual.

6. Occasional fault maintenance

In electronic systems, transient poor contact problems may occur in electrical circuits and input and output signals, resulting in occasional failures. Sometimes the cause of the failure will disappear on its own, so it is not easy to find out the problem. When encountering an accidental failure, you can simulate the failure in the following ways to check whether the failure recurs. If the fault does not recur at this time, it is necessary to wait until the next fault occurs to diagnose and repair. Typically, occasional failures evolve into reproducible failures and do not go away on their own.

7. Exhaust description

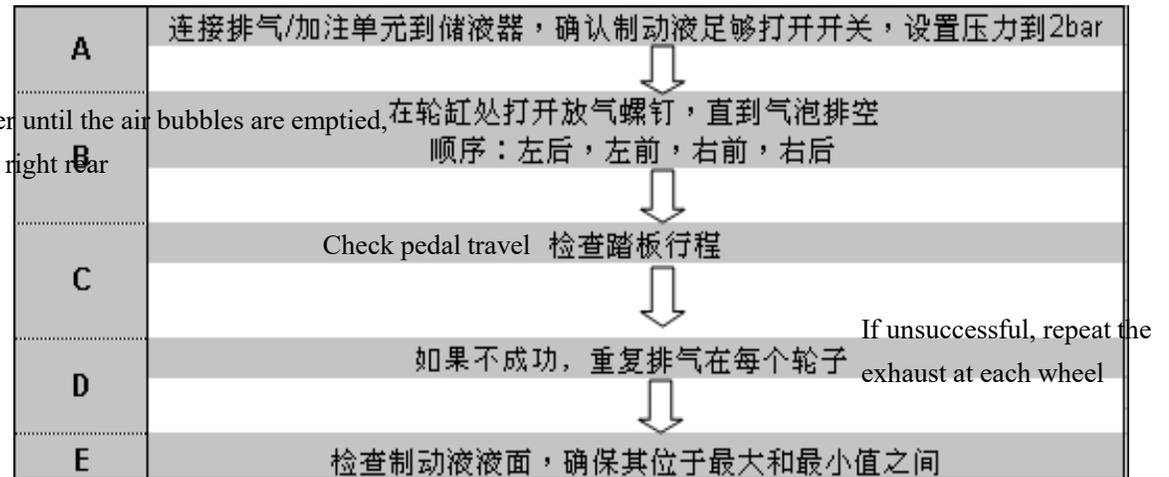
The hydraulic unit can be manually vented, and one of the following three venting procedures can be selected for maintenance:

- Exhaust with filling unit (exhaust pressure 2 bar);
- Exhaust with manual pedal;
- Manual pedal and filling unit combined exhaust.
- After the customer replaces the brake system components (such as replacing the brake fluid, brake line, hydraulic unit), or when the brake pedal is soft, the exhaust must be carried out.
- Customer-replaced hydraulic units must be oil-filled ESP hydraulic regulators with ECU (unoiled hydraulic units require special filling equipment and procedures and are not recommended for aftermarket use) .
- When exhausting, it is necessary to ensure that the structure of the braking system is complete, and all high-pressure hydraulic units have been connected.
- Apply the parking brake before venting.
- Brake fluid is corrosive, if it accidentally gets on the skin, it must be cleaned.

7.1. Exhaust with exhaust/filling unit (exhaust pressure 2 bar)

Open the vent screw at the wheel cylinder until the air bubbles are emptied, sequence: left rear, left front, right front, right rear

Connect the exhaust/fill unit to the reservoir, make sure there is enough brake fluid to open the switch, set the pressure to 2bar.

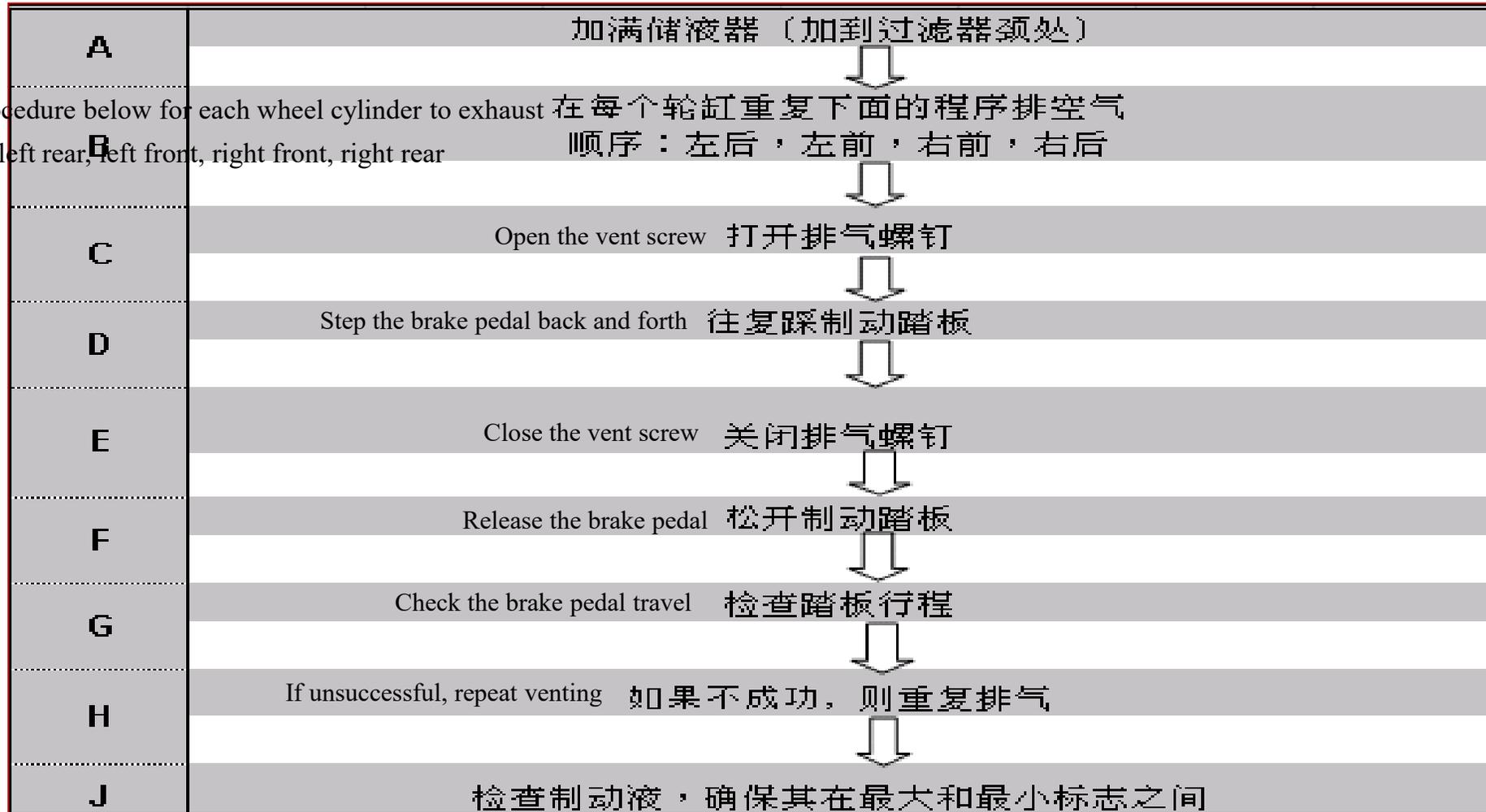


Check brake fluid level to make sure it is between maximum and minimum

7.2. Manual pedal exhaust

Fill up the reservoir (add to the filter neck)

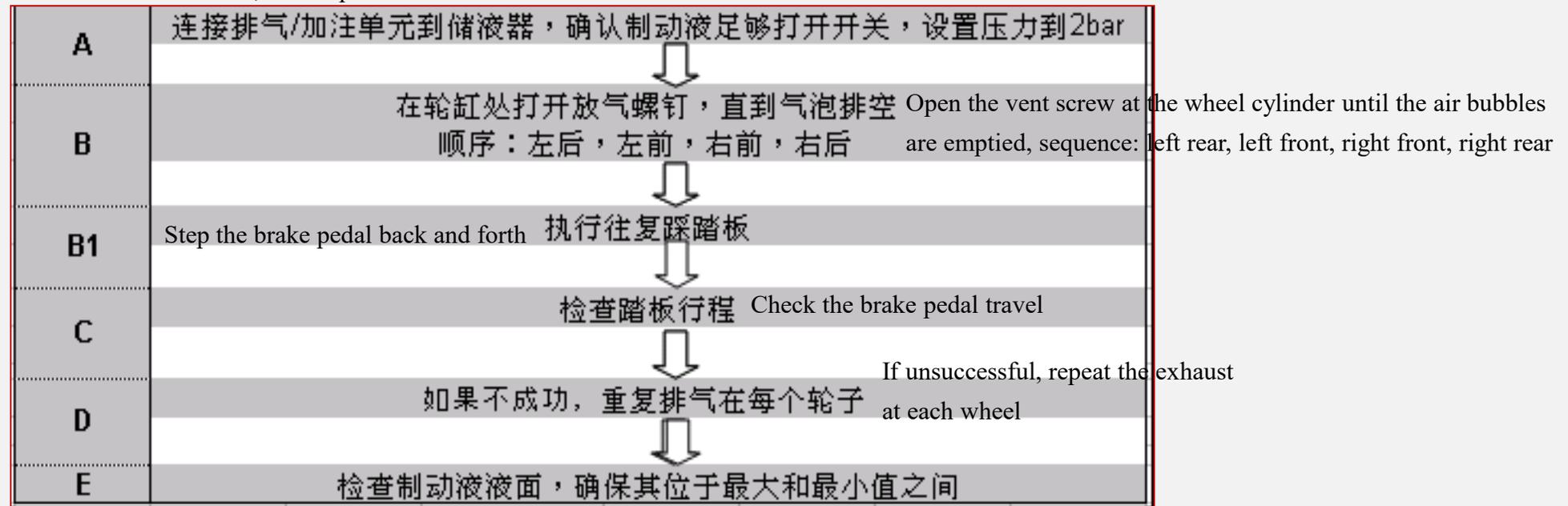
Repeat the procedure below for each wheel cylinder to exhaust air, sequence: left rear, left front, right front, right rear



Check brake fluid level to make sure it is between maximum and minimum

7.3. Combination of manual pedal exhaust and 2 bar exhaust

Connect the exhaust/fill unit to the reservoir, make sure there is enough brake fluid to open the switch, set the pressure to 2bar.



Check brake fluid level to make sure it is between maximum and minimum

Remark:

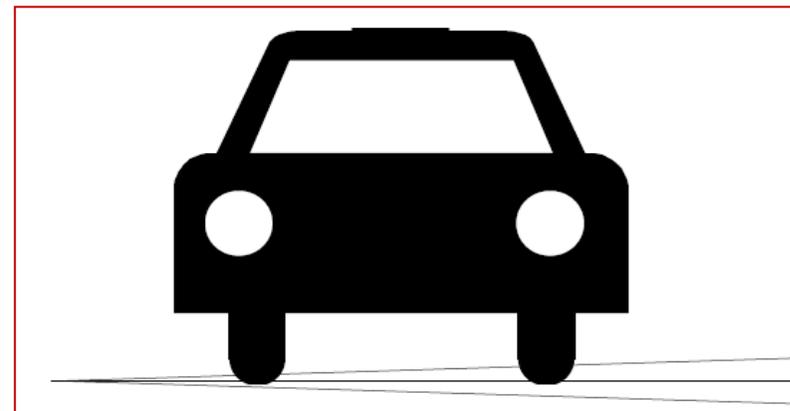
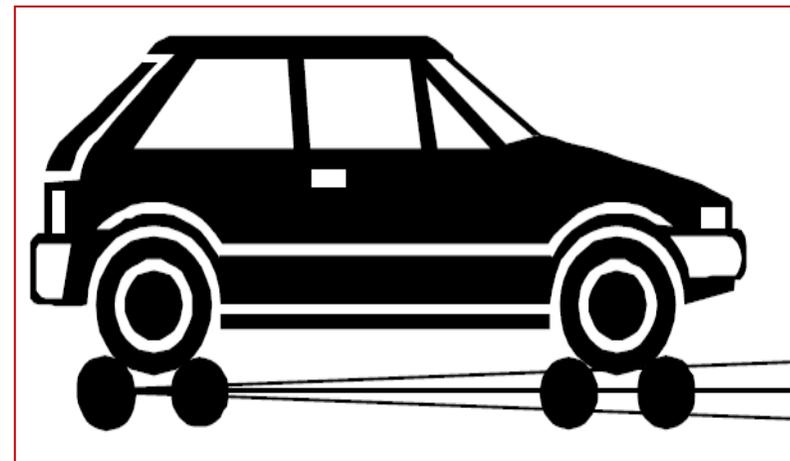
- During the entire exhaust process, the brake fluid in the accumulator cannot be lower than the minimum mark.
- If you want to repeat a certain stage or the entire exhaust process, you must wait 5 minutes to allow the solenoid valve to cool down, otherwise the solenoid valve may be damaged due to overheating.

8. Yaw rate sensor calibration

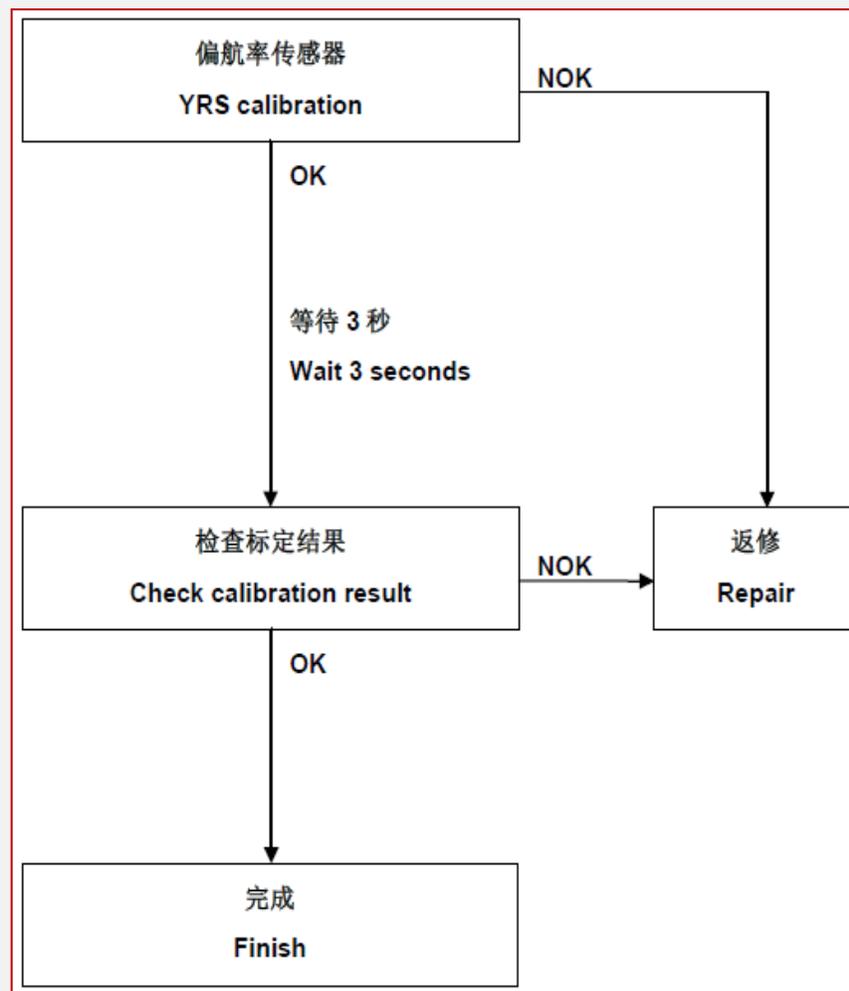
The yaw rate sensor includes an integrated sensor (IIS) and an external sensor. The integrated sensor requires that the horizontality of the ESP installation should not exceed $\pm 5^\circ$.

Prerequisites for Sensor Offset Calibration

- The maximum tilt angle of the test bench must be within the allowable range of $\pm 0.57^\circ$ ($\pm 1\%$)
- The test bench must be stationary
- Turn the steering wheel to the forward position
- Tire pressure is correct
- Normal load condition
- The vehicle is supported by its own wheels
- No allow the additional disturbances such as closing the doors or closing the hood, etc.



9. Calibration process of yaw rate sensor:



➤ V. Diagnosis, maintenance and fault codes of ESP system

ESP系统



DTC code	DTC meaning	DTC code	DTC meaning
B111717	ECU supply voltage is high	C11AB00	General wiring fault of left rear wheel speed sensor
B111716	ECU supply voltage is low	C113A08	Right rear wheel speed sensor signal failure
C110004	ECU hardware failure	C113B00	Right rear wheel speed sensor wiring fault
C110008	ECU software failure	C11A600	Right rear wheel speed sensor power cable shorted to ground
C116B06	Abnormal control of ABS/ESP (for example, the trigger time is too long)	C11A700	Right rear wheel speed sensor signal wire shorted to power
C113108	Left front wheel speed sensor signal failure	C11AC00	General wiring fault of right rear wheel speed sensor
C113200	Left front wheel speed sensor wiring fault	C119904	Wheel speed sensor general failure (multiple sensor failures)
C11A000	Left front wheel speed sensor power cable shorted to ground	C114460	Pressure sensor signal failure
C11A100	Left front wheel speed sensor signal wire shorted to power	C114510	Pressure sensor wiring fault
C11A900	Left front wheel speed sensor general wiring fault	C114008	Brake light switch fault
C113408	Right front wheel speed sensor signal failure	C116108	Lateral acceleration sensor signal failure
C113500	Right front wheel speed sensor wiring fault	C116208	Longitudinal acceleration sensor signal failure
C11A200	Right front wheel speed sensor power cable shorted to ground	C116308	Yaw angle sensor signal failure
C11A300	Right front wheel speed sensor signal wire shorted to power	C119604	Internal failure of yaw angle sensor
C11AA00	Right front wheel speed sensor general wiring fault	C11A800	Lateral yaw sensor not calibrated/calibration failed
C113708	Left rear wheel speed sensor signal failure	U100500	High network voltage
C113800	Left rear wheel speed sensor wiring fault	U100700	Low network voltage
C11A400	Left rear wheel speed sensor power cable shorted to ground	U110104	Hardware fault
C11A500	Left rear wheel speed sensor signal wire shorted to power	U007488	Network shut down

DTC code	DTC meaning	DTC code	DTC meaning
U010087	EMS signal not received	U244083	BCM check code error
U140008	EMS data length error	U012887	EPB signal not received
U250082	EMS counter error	U142808	EPB data length error
U240083	EMS check code error	U252882	EPB counter error
C136600	SAS calibration failure	U242883	EPB check code error
C136008	SAS signal failure	U015587	IC signal not received
C112004	Return pump failure	U145508	IC data length error
C117208	Valve general failure	U255582	IC counter error
C114C04	PATA switch failure	U245583	IC check code error
C121208	Variable write error	U016487	AC signal not received
C118C08	The reverse switch signal is continuously high/low	U146408	AC data length error
U010187	TCU signal not received	U256482	AC counter error
U140108	TCU data length error	U246483	AC check code error
U250182	TCU counter error	U011D87	AWD signal not received
U240183	TCU check code error	U141D08	AWD data length error
U014087	BCM signal not received	U251D82	AWD counter error
U014087	BCM signal not received	U241D83	AWD check code error
U144008	BCM data length error	U1A4087	CCP signal not received
U254082	BCM counter error	U144108	CCP data length error

➤ V. Diagnosis, maintenance and fault codes of ESP system

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DTC code	DTC meaning	DTC code	DTC meaning
U254182	CCP counter error	C113208	Left front wheel speed sensor fault
U244183	CCP check code error	C113508	Right front wheel speed sensor fault
U013187	EPS/SAS signal not received	C113808	Left rear wheel speed sensor fault
U143108	EPS/SAS data length error	C113b08	Right rear wheel speed sensor fault
U253182	EPS/SAS counter error	C119908	Overall steering wheel speed sensor fault
U243183	EPS/SAS check code error	C117204	Brake disc overheating
U015187	ABM signal not received	C11AD08	General failure of vacuum sensor
U145108	ABM data length error	U140208	HAS invalid value
U255182	ABM counter error	U140508	MRR (frame) ABA signal failure
U245183	ABM check code error	U140608	MRR (frame) ABP signal failure
U023587	MRR signal not received	U140708	MRR (frame) ABE signal failure
U143508	MRR data length error	U140808	MRR (frame) AWB signal failure
U253582	MRR counter error	U140908	MRR (frame) signal failure (ACC target, ACC brake preferred, VLC) or EMS (frame) signal failure (ECG overload)
U243583	MRR check code error	U141008	MRR (frame) signal failure (ACC state of ESC)
U013987	Lost communication with EMS(303,304,360)	U141108	CCP (frame) signal failure (PATA switch)
U143908	CAN data length code error(EMS 303,304,360)	U141208	MRR (frame) signal failure (ACC driver is off and ACC is always on standby)
U253982	CAN valid counter error(EMS 304)	U141308	TCU (frame) signal failure (actual gear and target gear)

➤ V. Diagnosis, maintenance and fault codes of ESP system

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DTC code	DTC meaning	DTC code	DTC meaning
U243983	CAN checksum error (EMS 304)	U141408	AC (frame) signal failure (ambient temperature) or IC frame (engine off time)
C112001	ECU internal failure	U141508	EMS (frame) signal failure (ACC pedal)
U141608	EPB (frame) signal failure (deceleration request)	U142608	EPS/SAS (frame) signal failure (steering angle valid)
U141708	CCP (frame) signal failure (CCP HDC)	U014287	Lost communication with BCM
U141808	ABM/IC (frame) signal failure (driver's seat belt)	U144208	BCM_365 CAN data length code error
U141908	EMS (frame) signal failure (engine speed or torque)	U144308	BCM_365 (frame) signal failure
U142008	EMS (frame) signal failure (clutch pedal low)	U1B0087	Lost message EMS_1A1
U142108	EPB (frame) signal failure (manual parking key or switch position valid or transitional state)	U1B0187	Lost message EMS_1D0
U142208	AWD (frame) signal failure (estimated torque)	C18B287	PM2.5 sensor failure
U142308	EPS/SAS (frame) signal failure (estimated torque)	U1A4287	Lost communication with negative ion generator
U142408	EPB (frame) signal failure (parking brake)	U1A4187	Lost communication with PM2.5 sensor
U142508	EPB (frame) signal failure (neutral)	U1A4487	Missing RAC (LIN)

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- 02** The structure and working principle of EPS
- 03** The function of EPS system
- 04** EPS power-assisted assembly electrical introduction
- 05** EPS maintenance precautions and fault codes



Course targets

- **Be able to understand the EPS functions**
- **Be able to master EPS maintenance methods and fault diagnosis**
- **Be able to master the median calibration method of EPS system**

➤ I. EPS System Overview

EPS系统



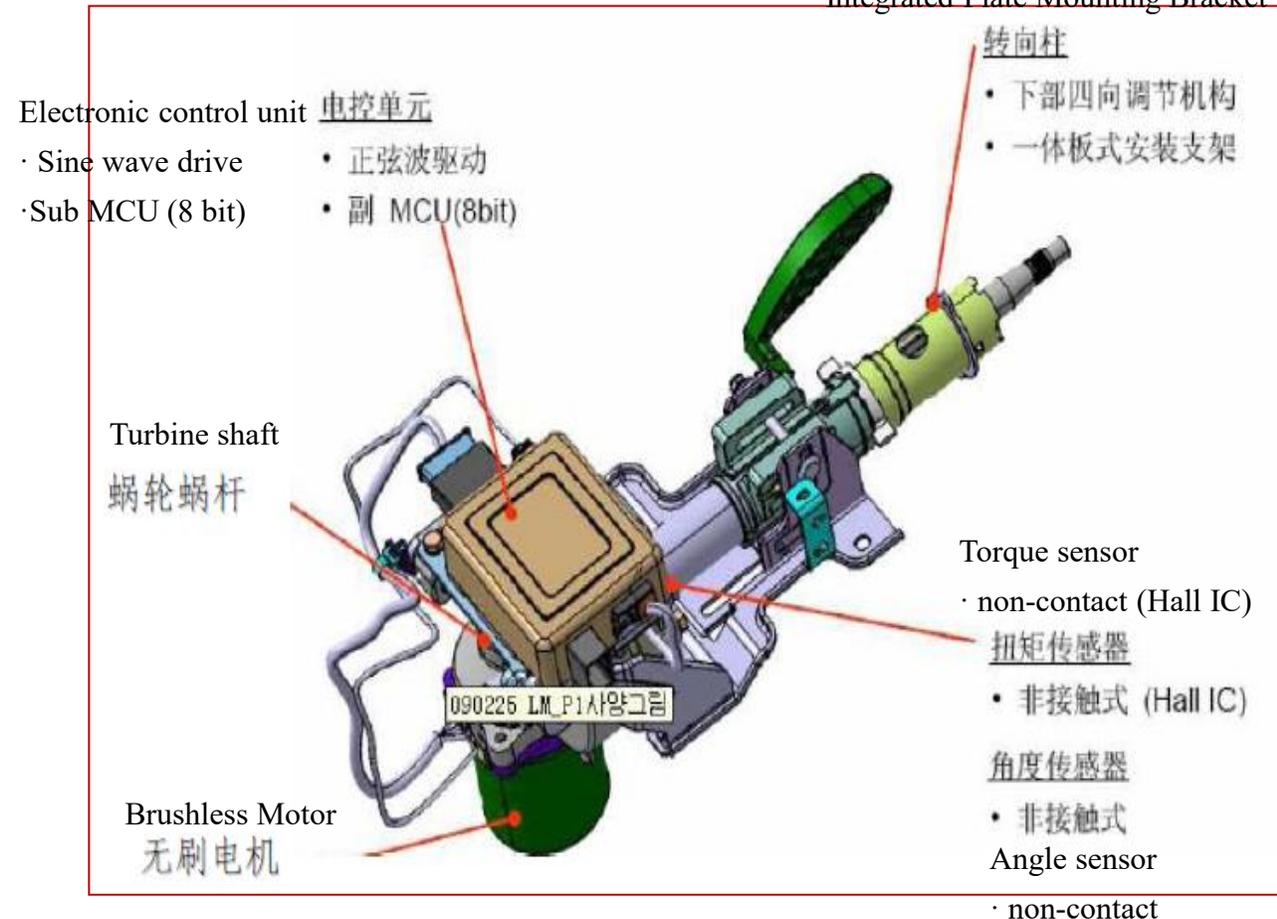
1. What is Electric Power Steering (EPS)?

EPS (Electric Power-assistant Steering, hereinafter referred to as EPS) system, is a steering system that uses an EPS motor to provide steering power to assist the driver in steering operations.

The EPS system is based on the mechanical steering system, and applies the latest electronic technology and high-performance motor control technology to the automotive steering system. On the basis of the original automobile steering system, the EPS system transforms and adds the following parts: EPS electronic control unit, torque and rotation angle sensor, EPS motor, etc. The transmission mechanism of the system is driven by an electric motor, which replaces the traditional mechanical hydraulic mechanism. It provides real-time steering wheel assist to the driver in a variety of environments.

Steering column

- Lower four-way adjustment mechanism
- Integrated Plate Mounting Bracket



2. EPS technical advantages

Energy conservation and environment protection, reducing fuel consumption by 3% to 5%

Since the hydraulic pump is always working when the engine is running, the hydraulic steering system increases the fuel consumption of the entire engine by 3% to 5%, while the EPS uses the battery as the energy source and the motor as the power element, which can work independently of the engine. EPS does not directly consume engine fuel. EPS does not have the problem of fuel leakage of hydraulic power steering system. EPS is electronically controlled, which has almost no pollution to the environment and reduces fuel consumption.

Easy installation, the main components of EPS are integrated into one

The main components of EPS can be integrated together, which is easy to arrange. Compared with the hydraulic power steering system, many components are reduced. There are no oil pumps, oil pipes, pressure flow control valves, oil storage tanks, etc. required by the hydraulic system. The number of components is small and easy to assemble and time saving.

High efficiency, can reach more than 90%

The efficiency of hydraulic power steering system is generally 60% to 70%, while the efficiency of EPS is higher, which can be as high as 90% or more.

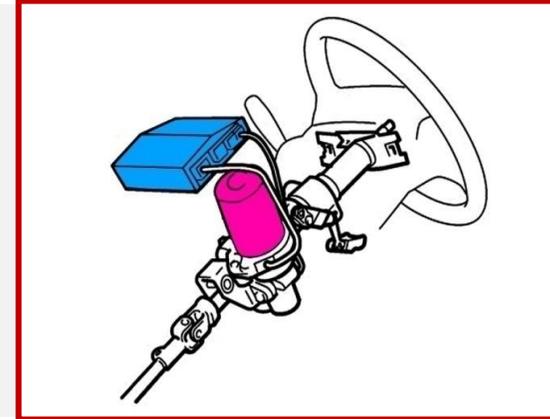
Good driving experience, satisfactory steering assist at all speeds.

Most of the traditional pure hydraulic power steering systems use a fixed magnification, and the working driving force is large, but it cannot achieve the lightness and road feel of the car when driving at various speeds. The hysteresis characteristic of the EPS system can be compensated by the software of the EPS controller, so that the car can get a good road feeling at various speeds.

3. Compared with the traditional power steering system

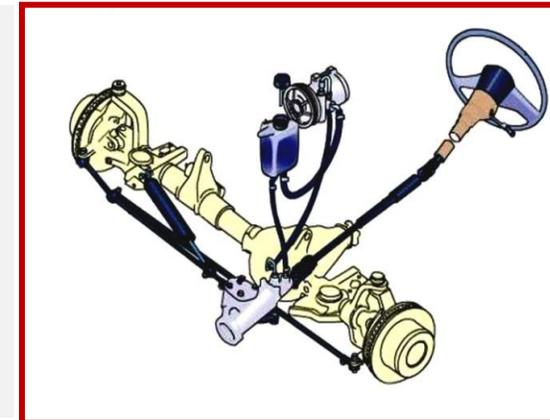
EPS

- Low fuel consumption
- Convenient layout
- High efficiency
- Good driving sense



Hydraulic power-assisted

- Low fuel consumption
- Complicated layout
- Low efficiency
- Bad driving sense





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➤ II. The structure and working principle of EPS

EPS系统



1. The components of EPS system

Like other control systems, the system consists of sensors (torque angle sensor, engine speed, vehicle speed sensor), controller (EPS electronic control unit), actuator (EPS motor) and related mechanical components.



➤ II. The structure and working principle of EPS

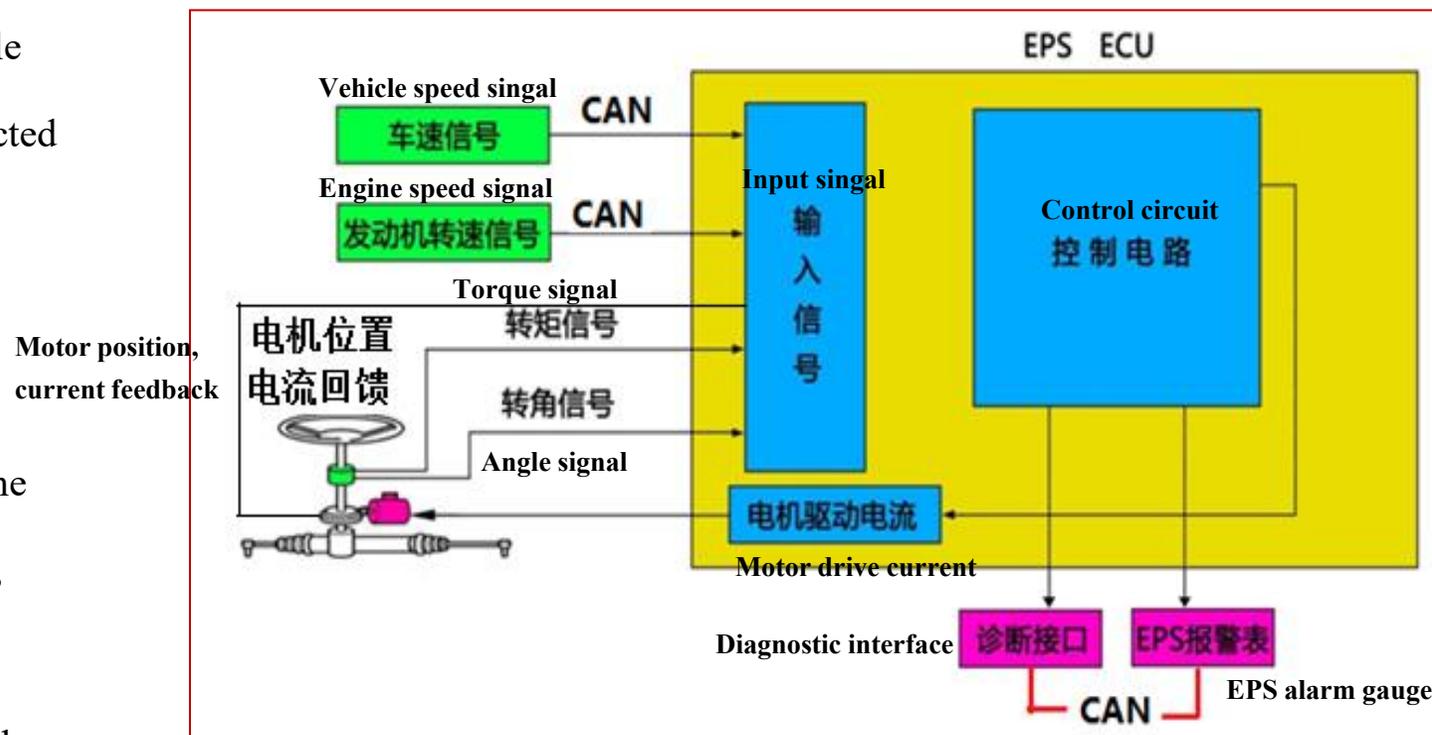
EPS系统



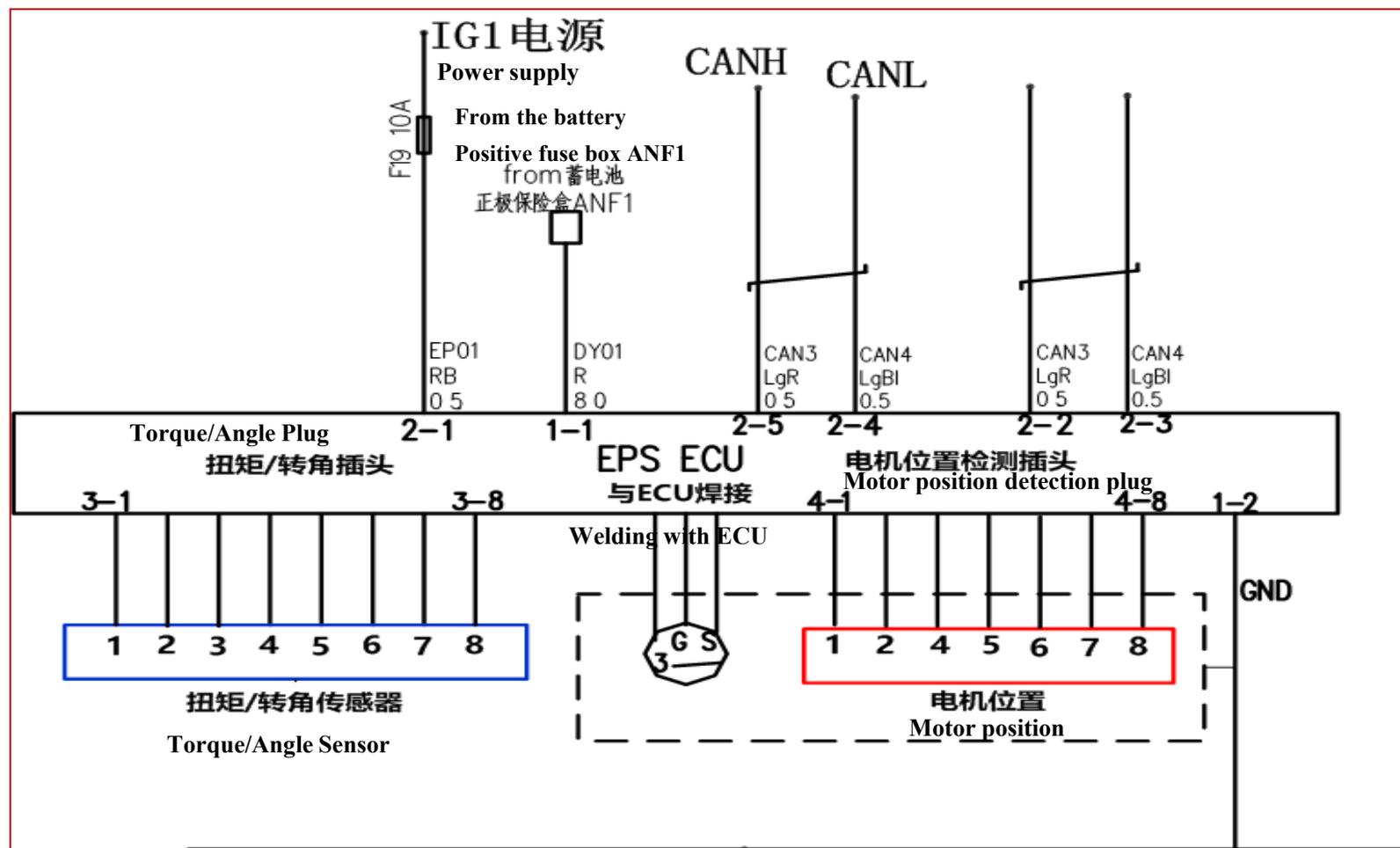
2. EPS system working principle

2.1 EPS working principle

- When the steering shaft rotates, the angle sensor and torque sensor convert the detected angle and torque signals into electrical signals and send them to the electronic control unit ECU,
- The ECU then calculates according to the corner torque signal, vehicle speed signal, engine speed signal, etc., to obtain the steering of the power-assisted motor and the magnitude of the power-assist current, and completes the steering power-assist control.



2.2. Principle of EPS external circuit





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III. The function of EPS system

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1. EPS control strategy

The EPS system changes its control method according to the different speed of the vehicle. Details are as follows:

- **When parking or at low speed**

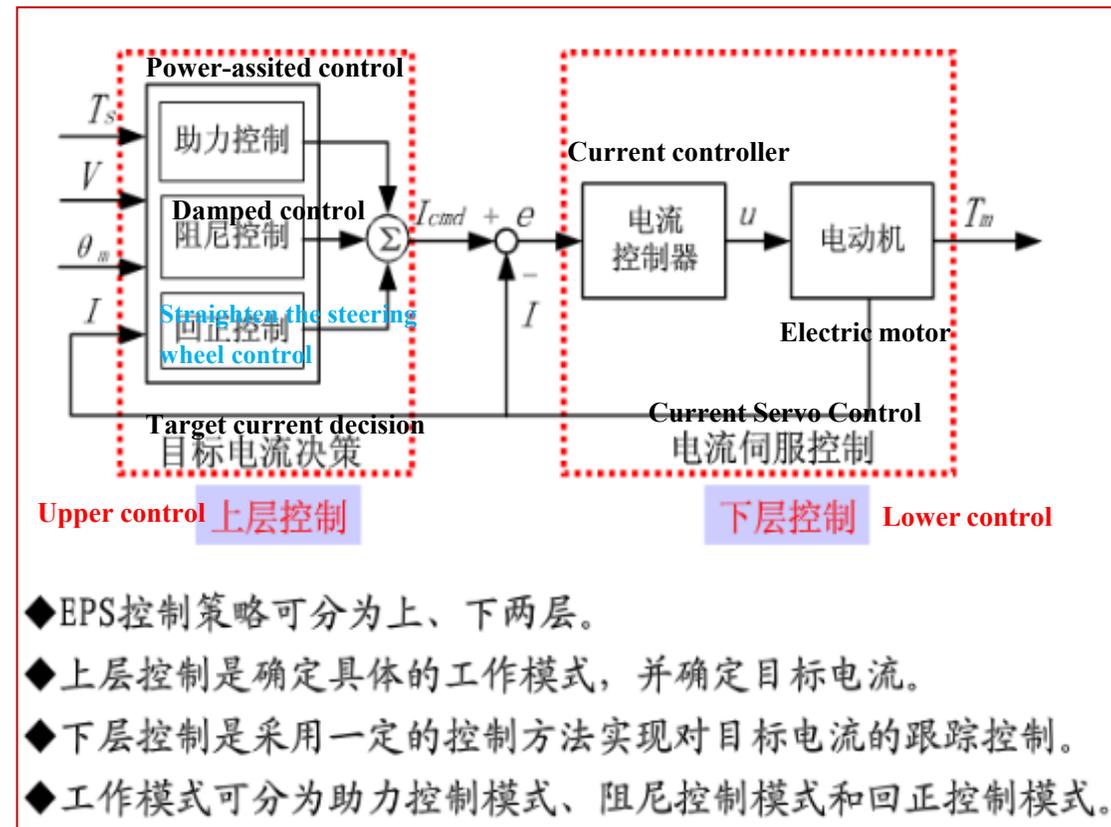
High current → light steering force

Ensure the steering performance of low-speed driving

- **At high speed**

Small current → heavy steering force

Ensure high-speed driving stability



EPS control strategy can be divided into upper and lower layers;

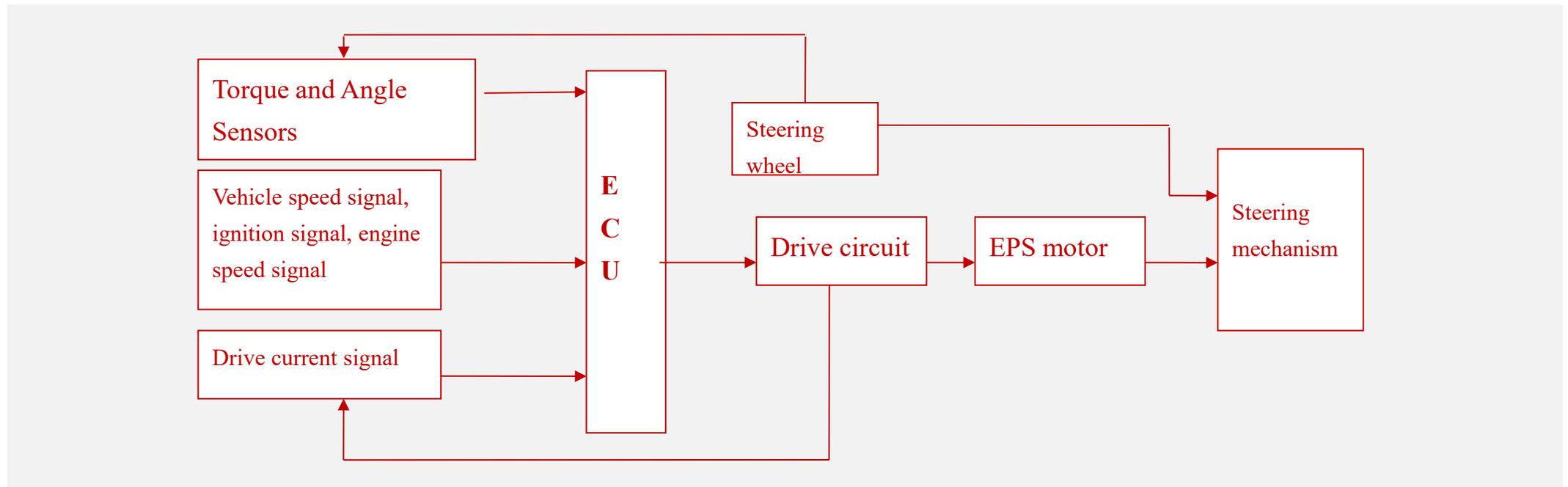
The upper control determines the specific working mode and determines the target current;

The lower control adopts a certain control method to realize the tracking control of the target current;

The working mode can be divided into power-assisted control mode, damped control mode and return control mode

2. EPS assist control function

The power assist characteristics of EPS belong to the vehicle speed-sensitive type, that is, under the same steering wheel torque input, the target current of the motor changes with the change of vehicle speed, which can better take into account the requirements of portability and road feel.



The assist characteristic of EPS adopts segmented assist characteristic. The EPS motor applies assist torque according to the steering wheel deviation direction. In order to ensure light steering at low speed, stable operation at high speed and better road feel.

3. Straighten the steering wheel control

When steering, due to the existence of the caster angle of the steering wheel and the inclination angle, the steering wheel has the function of automatic return. EPS system adds EPS motor and deceleration mechanism on the basis of mechanical steering mechanism. The EPS system controls the EPS motor through the EPS electronic control unit, and performs the steering return action of the vehicle together with the return torque generated by the front wheel alignment, so that the steering wheel can quickly return to the right, suppress the steering wheel oscillation, and maintain the road feel, improve steering sensitivity and stability, optimize steering return characteristics, and shorten convergence time. The return-to-positive control generates a return-to-positive torque by adjusting the return-to-positive compensation current, which makes the steering wheel return to the neutral position in a certain direction.

4. Damping control function

When the vehicle is driving at high speed, the damping control is performed by controlling the damping compensation current, which enhances the driver's road feeling and improves the steering stability of the vehicle when the vehicle is driving at high speed.

5. EPS working mode



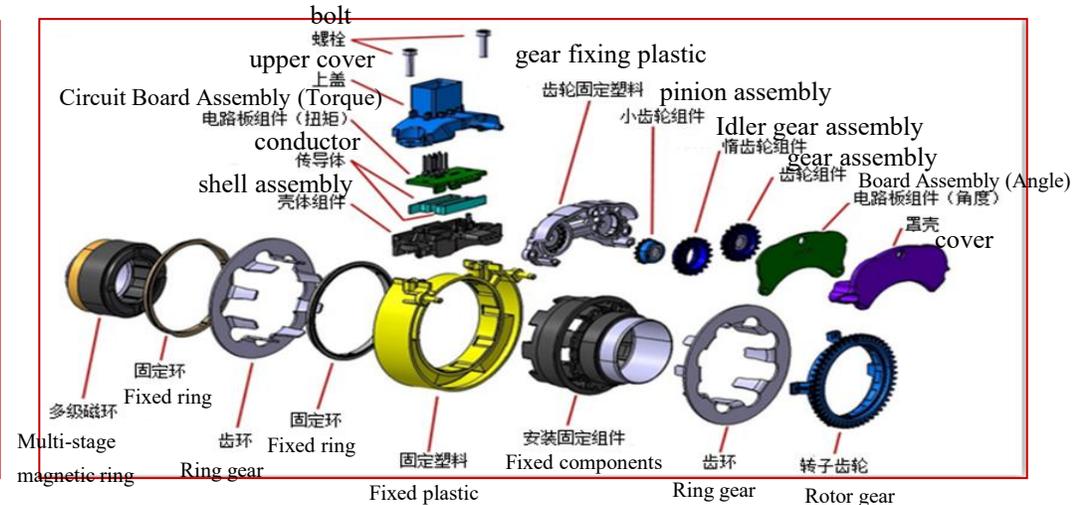
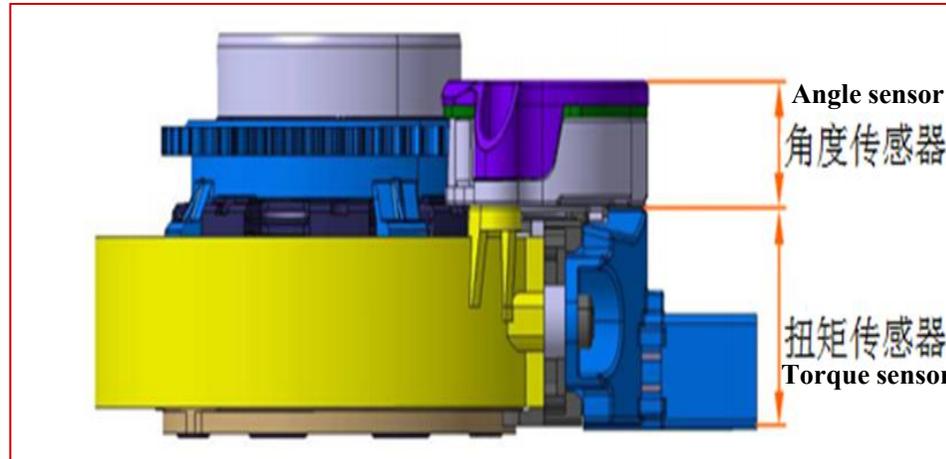


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1. Torque and angle sensor

The electrical components on the power steering assembly mainly include: torque/rotation angle sensor, power assist motor, and EPS computer.



1.1 the role of torque, angle sensor

The torque/rotation angle sensor is used to detect the torque applied by the driver on the steering wheel and the direction in which the driver turns the steering wheel. The signal is the main control signal of the EPS ECU. The ECU determines whether the driver's intention is to perform a steering operation through these two signals, and the steering wheel is in which direction, so that the ECU can control the magnitude and direction of the electric current of the motor.

1.2. Calibration of torque and angle sensors

Calibration of torque and angle sensor signals:

When replacing parts such as the pipe column, steering gear, etc., the center calibration of the signal of the angle sensor must be performed (through the diagnostic instrument), otherwise the EPS may perform dangerous operations such as automatic steering or low-speed deviation. If the torque sensor reports an error or the left and right steering forces are obviously different, the torque sensor signal can be calibrated at the same time.

The calibration method can be operated according to the prompts of the diagnostic instrument.

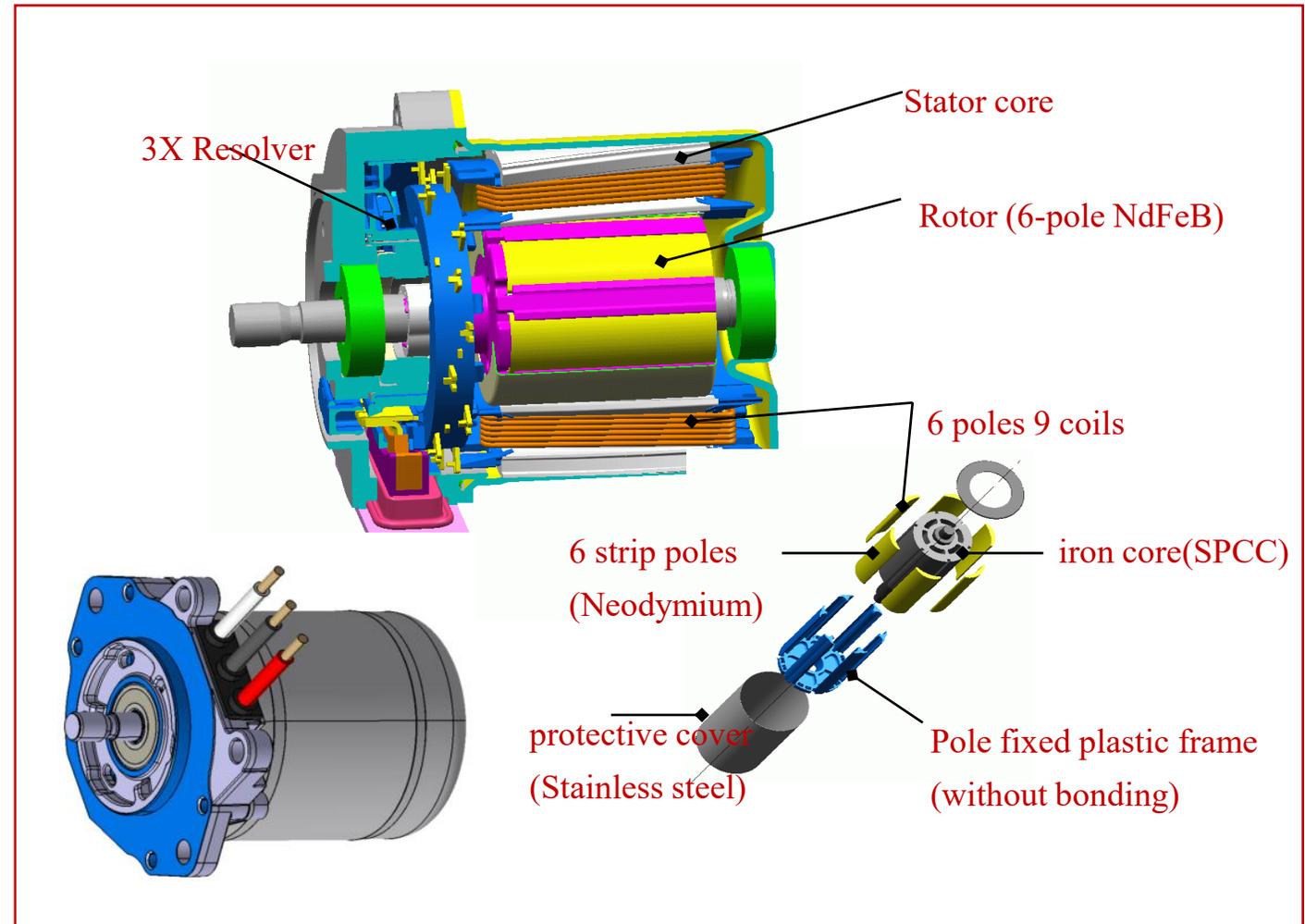
Calibration steps:

- 1) The four-wheel alignment parameters must be normal, and the wheels must be kept in a straight driving position.
- 2) Refill tire pressure as required.
- 3) The engine is running at idle speed.
- 4) Accessing the EPS System by the diagnostic tool 。
- 5) First clear the steering wheel center information.
- 6) Perform angle/torque sensor calibration.

2. Steering assist motor

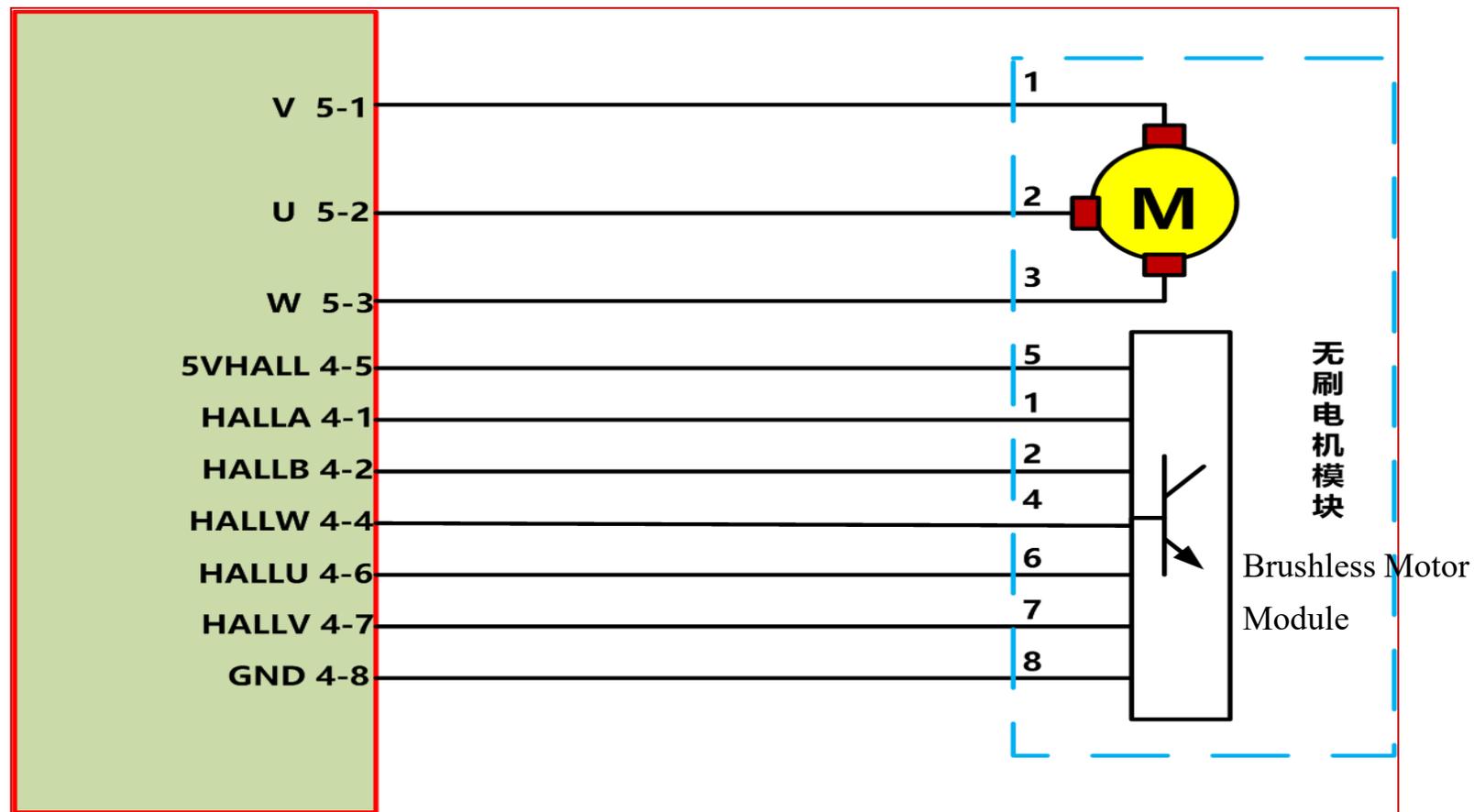
2.1. Motor parameters

Motor form: permanent magnet brushless motor
Rated voltage: 9-16V
Rated power: 400W
Rated current: 80A
Rated speed: 980r/min



2.2 EPS brushless motor circuit diagram

Idea Motor Circuit



Controller plug definition:

Electrical appliances	PIN definition	Signal definition	Type	Input/output	Signal source	Notes
Power supply	CN1-1	BAT+	hard wire	input	battery	Vehicle access plug
	CN1-2	GND	hard wire	input	body ground	
Vehicle signal input and output plug	CN2-1	IGN	hard wire	input	Vehicle information	If the voltage is greater than 4.6V, there is an ignition signal; if the voltage is less than 2V, there is no ignition signal.
	CN2-2	CANH	bus	input/output	Vehicle information	CAN bus
	CN2-3	CANL	bus	input/output	Vehicle information	CAN bus
	CN2-4	CANL	bus	input/output	Vehicle information	CAN bus
	CN2-5	CANH	bus	input/output	Vehicle information	CAN bus
	CN2-6					
	CN2-7					
	CN2-8					



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The electric power steering system of this vehicle has an active return control function. After the steering system (rack and pinion electric power steering assembly, etc.) is dismantled and replaced, the four-wheel alignment of the vehicle needs to be re-calibrated, and calibrate the torque angle signals and ESP angle signal, and clear the fault code.

1. Pay attention when removing or reinstalling the power steering assembly

- ① Avoid impacting the electric power steering assembly, especially the sensor, EPS ECU, EPS motor and reduction mechanism. If the electric power steering assembly is dropped or severely impacted, it will need to be replaced with a new one.
- ② When moving the power steering assembly, do not pull on the wire harness.
- ③ Before disconnecting the steering column or intermediate shaft from the steering gear, the wheels should be kept in the forward direction and the vehicle is powered off, otherwise, the clock spring on the steering column will be off-center and the clock spring will be damaged.
- ④ The vehicle is powered off until the steering column or intermediate shaft is disconnected. Do not move the wheel after disconnecting the above parts. Failure to follow these procedures can cause some parts to be misaligned during installation.
- ⑤ The duration of the steering wheel hitting the limit position should not exceed 5 seconds, otherwise the booster motor may be damaged.
- ⑥ The EPS system can only be repaired by external circuits, such as EPS computer, torque sensor, angle sensor, motor problems, and only the EPS assembly can be replaced.

2. Fault Diagnosis List

Faults	Possible reason	Solution
Steering heavy	Tires (improper inflation)	Inflate the four-wheel tires as required
	Front wheel alignment (incorrect)	Adjust the front wheel alignment according to the specified parameters
	Lower swing arm ball joint, steering rod ball joint (worn)	Replace the lower swing arm, replace the steering rod
	Suspension swing arm ball joint (worn)	Replacing the Swing Arm Ball
	Steering column assembly (faulty)	Replace steering column assembly
	Steering gear (faulty)	Replace the steering gear assembly
	EPS ECU (faulty)	Replace EPS ECU
Insufficient return	Tires (improper inflation)	Inflate the four-wheel tires as required
	Front wheel alignment (incorrect)	Adjust the front wheel alignment according to the specified parameters
	Steering column (curved)	Correct or replace the steering column
	Steering gear (faulty)	Replace steering column assembly
	EPS ECU (faulty)	Replace EPS ECU

5. EPS maintenance precautions



and fault codes

EPS系统



fault phenomenon	possible reason	solution
Great volatility, Turn to card issuance	The torque sensor signal fluctuates greatly, resulting in large power assist fluctuations	Check torque sensor signal Replace upper steering column assembly if necessary
	The mechanical part of the steering system fluctuates greatly, that is, the rotational torque fluctuates greatly at no load.	Calibrate the torque sensor, replace the steering upper column assembly if it fails
	The motor itself fluctuates greatly	Replace the upper steering column assembly
Uneven steering force left and right	The torque sensor signal is not centered, resulting in a large boost on one side and a small boost on the other	Re-calibrate the neutral position, check the torque sensor signal, and replace the steering column assembly as required
	The clockwise and counterclockwise rotational torques of the mechanical parts of the steering system are quite different	Align the front wheel, check the mechanical parts, and replace the corresponding parts
	The corresponding characteristic curves of the motor clockwise and counterclockwise are quite different	Calibrate the angle sensor, torque sensor, replace the upper steering column assembly if it fails
Excessive clearance	The ball joint of the lower swing arm and the ball joint of the steering rod are worn	Replace the lower swing arm, replace the steering rod
	Suspension swing arm ball joint (worn)	Replacing the Swing Arm Ball
	Intermediate shaft, sliding yoke (wear)	Replace the intermediate shaft assembly
	Front wheel bearing (wear)	Replace front wheel hub bearing
	Steering gear (worn)	Replace the steering gear

5. EPS maintenance precautions and fault codes

EPS系统



fault phenomenon	possible reason	solution
Steering noise	Abnormal noise caused by excessive internal clearance of steering gear or excessive clearance of inner and outer ball joints	Replacing the Mechanical Steering Gear
	Abnormal noise at the oil seal of the steering gear input shaft	
	Abnormal noise at the extension shaft	Replace the extension shaft
	Steering Column Bearing/Universal Joint	Replace Electric Power Steering Pipe string and universal joint assembly
	Wear at the EPS motor worm gear/excessive fit clearance	

5. EPS maintenance precautions and fault codes

3. EPS median calibration actively returns to positive

◆Use the diagnostic instrument to enter the EPS electric power steering system, and select to clear the neutral data. The EPS indicator flashes during the clearing process.

◆Median data calibration

Vehicle speed ≥ 55 km/h

Hold the steering wheel lightly (torque < 0.9 N·m)

Keep driving straight for more than 3s

After the neutral calibration, the EPS indicator light goes out, the ignition switch is ON, and the EPS light turns off after 1s;

After completing the four-wheel alignment, use the diagnostic instrument to reset the hardware and software of the ECU.

4. EPS failure

When the EPS system fails, the EPS controller will select a reasonable safety protection according to the severity of the current failure: when a serious failure occurs, the EPS system power will be cut off, automatically converted to an unassisted mechanical steering system and the EPS indicator light will always be on ;

When there is a general fault, it will enter the small power assist mode and the EPS indicator light will always be on.

5. EPS maintenance precautions and fault codes

EPS系统



DTC display code	DTC meaning	DTC display code	DTC meaning
B111717	Battery voltage is too high	C130541	ECU ROM and verification failed
B111716	Battery voltage is too low	C130242	ECU RAM failure
C132416	The output voltage of the temperature detection circuit is too low	C136061	ECU operation error
C132417	The output voltage of the temperature detection circuit is too high	C138000	ECU overtemperature fault
C136000	Torque sensor power supply voltage is abnormal	C136641	ECU does not execute torque signal calibration command
C135000	Motor position sensor failure	C130000	ECU operation error
C139000	relay failure	C130001	Calibration data read error
C136654	ECU does not perform angle calibration	U007388	CAN bus offline
C134071	Motor drive circuit failure	C131581	CAN bus offline
C133023	The main/auxiliary torque signal is always low level	C130185	The speed exceeds the upper limit
C133024	The main/auxiliary torque signal is always high level	U012287	Lost communication with ABS
C133049	Main/Auxiliary/Main+Auxiliary Torque Signal Duty Cycle Abnormal	U010087	Lost communication with EMS
C133038	Abnormal main/auxiliary torque signal cycle	U007488	BUS-OFF of CHA CAN bus detected
C133123	Signal level remains low at any angle	U010187	Lost communication with TCU
C133124	Signal level remains high at any angle	U015987	Lost communication with APA
C133149	Abnormal duty cycle of main angle/secondary angle signal	U026487	Lost communication with MPC
C133138	The main angle/sub angle signal cycle is abnormal	U010187	Loss of communication with TCU
C133129	Angle signal not available	U018687	Loss of communication with RRM
C134072	Power assist motor failure		

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ESP system

02

EPS system

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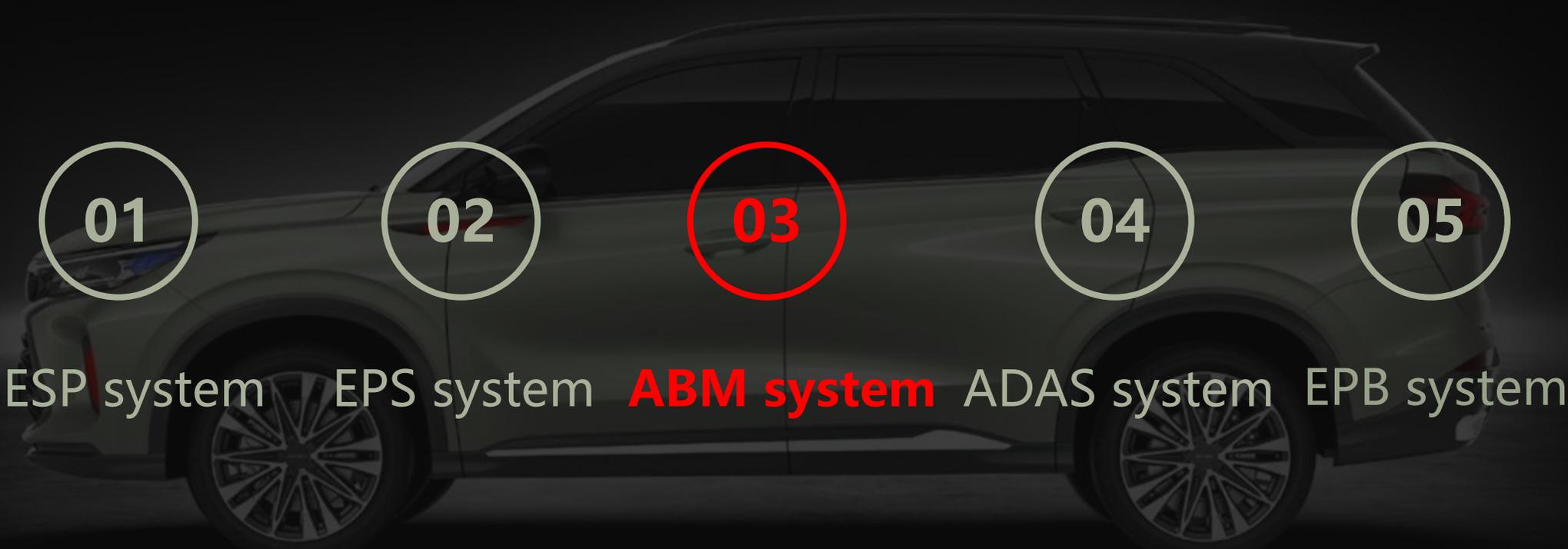
ABM system

04

ADAS system

05

EPB system





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- 04** The electrical system of the airbag
- 05** Airbag maintenance precautions and fault codes



Course targets

- **Be able to understand the composition and structure principle of Glory 600 SRS**
- **Be able to understand the operation steps of replacing parts of Glory 600 SRS system**
- **Able to use the diagnostic instrument to detect the SRS system for fault diagnosis**

➤ 1. Airbag Overview

ABM系统



The Supplemental Restraint System (SRS) is an auxiliary protection system on the car. It is used in conjunction with the seat belt to provide occupants with very effective crash protection.





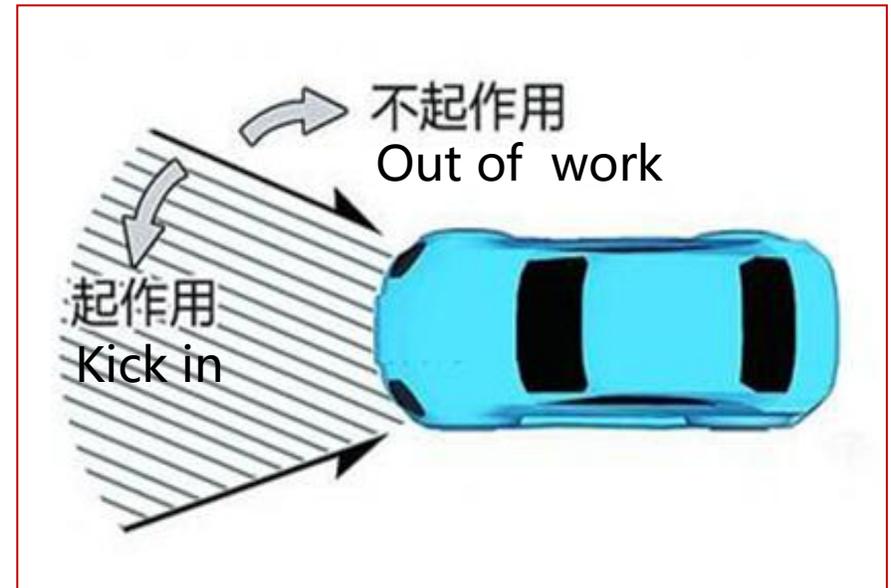
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➤ 2. Types of airbags

Airbag systems come in the following forms: driver's airbag installed in the steering wheel; passenger's airbag installed in the dashboard; side airbag installed in the door; rear seat installed in the front seatback. They are used to protect the driver, co-driver and passengers respectively in the event of a car crash.

Airbags are divided into forward and lateral directions according to the effective range in which they are detonated. A forward-deployed airbag is in a 30-degree angle or obliquely forward collision on the effective range, and the airbag is detonated only when the longitudinal acceleration (negative value) reaches a certain value, while the lateral acceleration (including the collision from the side and the system) Rollover of the longitudinal axis) cannot be detonated, and side airbags can be used to prevent side impacts.





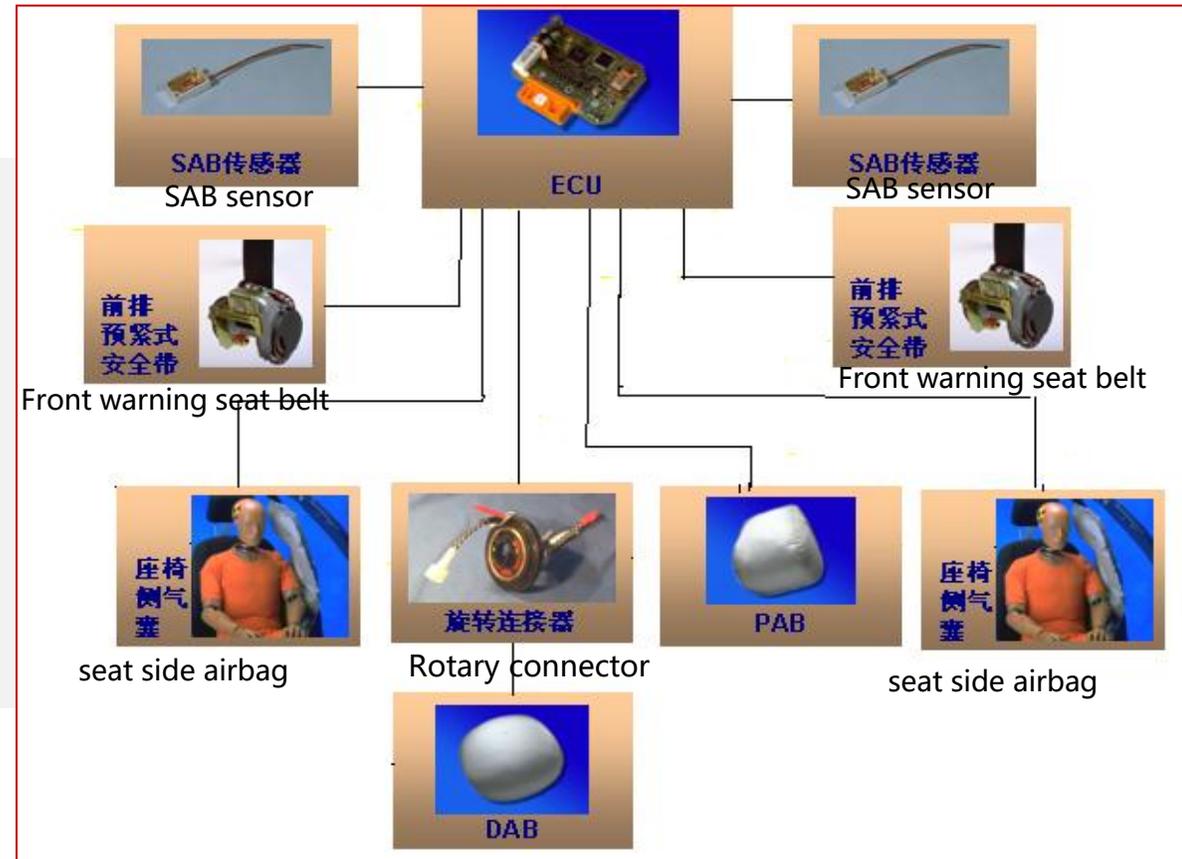
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3. The composition and working principle of the airbag

1. The composition of the airbag

The airbag system is mainly composed of collision sensor, electronic control unit, warning light, gas generator and airbag, seat belt tensioner and so on.



3. The composition and working principle of the airbag

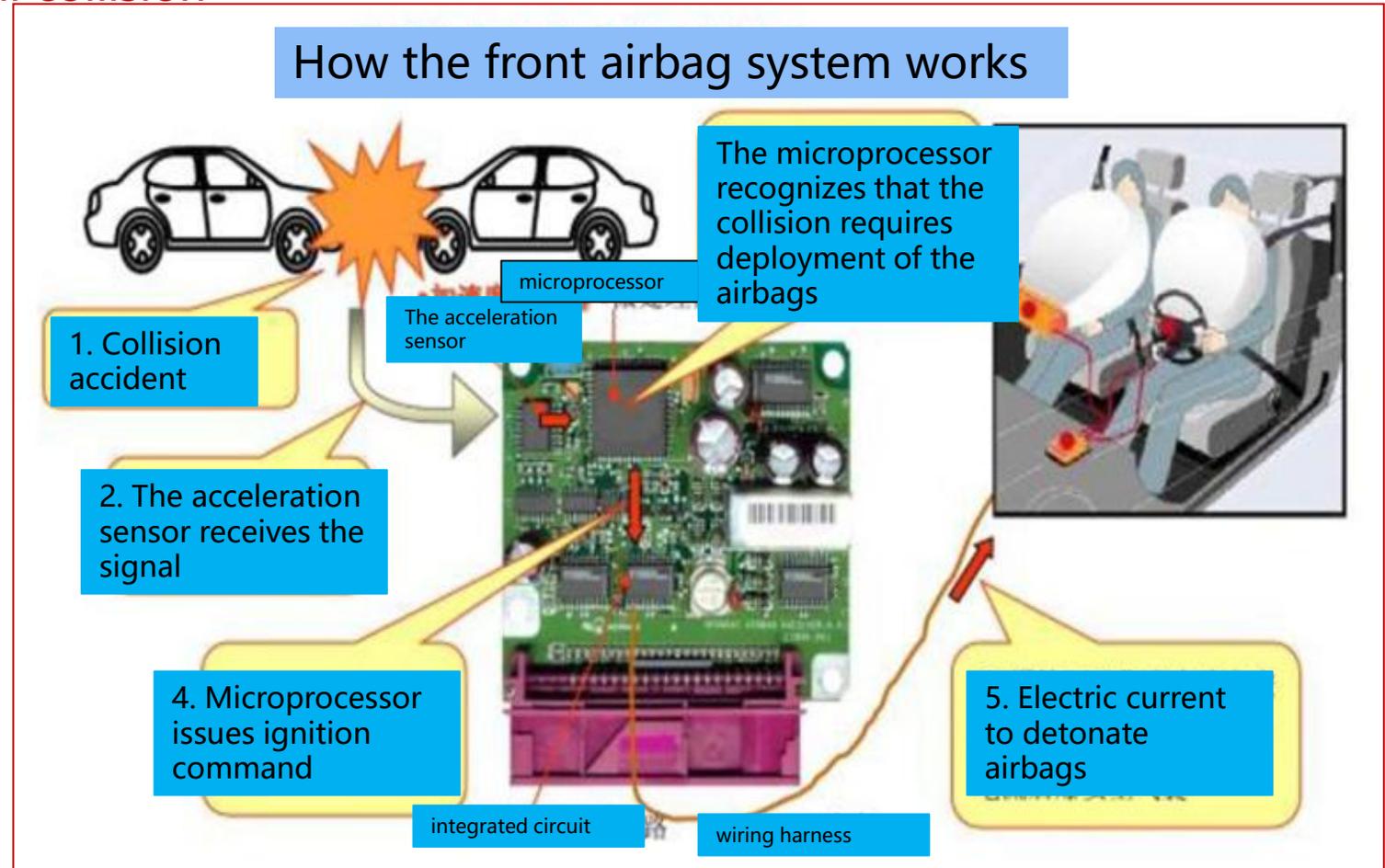
2. The working principle of the airbag

When the car speed exceeds 30 km/h and a front collision accident occurs, the collision sensor installed in the front end of the car and the safety sensor installed in the middle of the car can detect the sudden deceleration of the vehicle speed, and the collision sensor will transmit the collision information to the electronic control unit computer ECU. Called the microprocessor CPU, the microprocessor judges the severity of the impact and decides whether to activate the airbag within a few ms. If necessary, an ignition signal will be sent to make the gas generator inflate the airbag in a very short time (the quantity of gas is strictly calculated). Buffer protection for driver and passengers.

Since it only takes 50 ms from the time the sensor receives the signal to the deployment of the airbag, and the time for the driver to hit the steering wheel is about 60 ms, it can effectively protect the driver in the event of a collision and avoid the driver directly hitting the steering wheel. Danger.

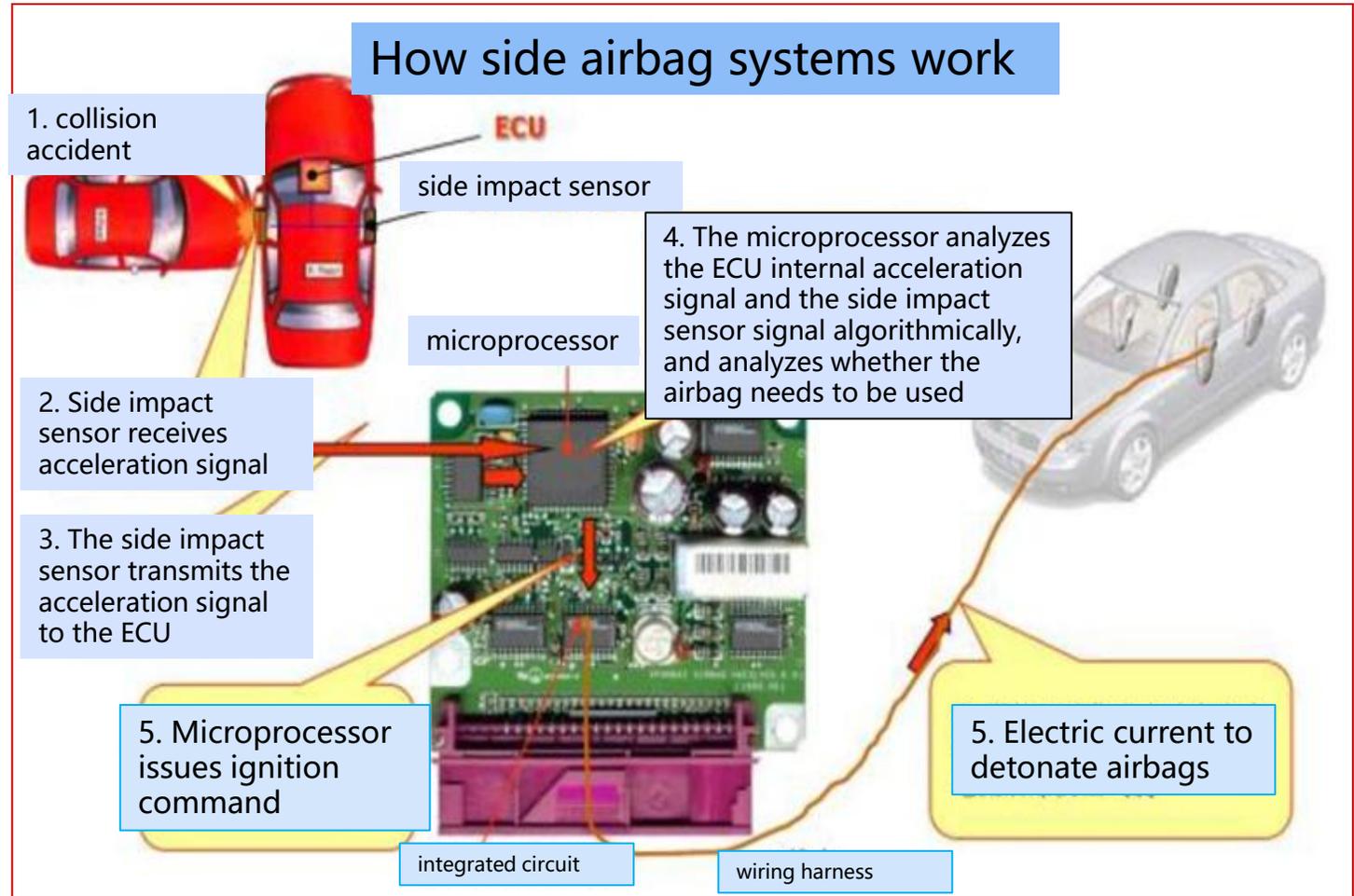
3. The composition and working principle of the airbag

(1) Working principle of frontal collision



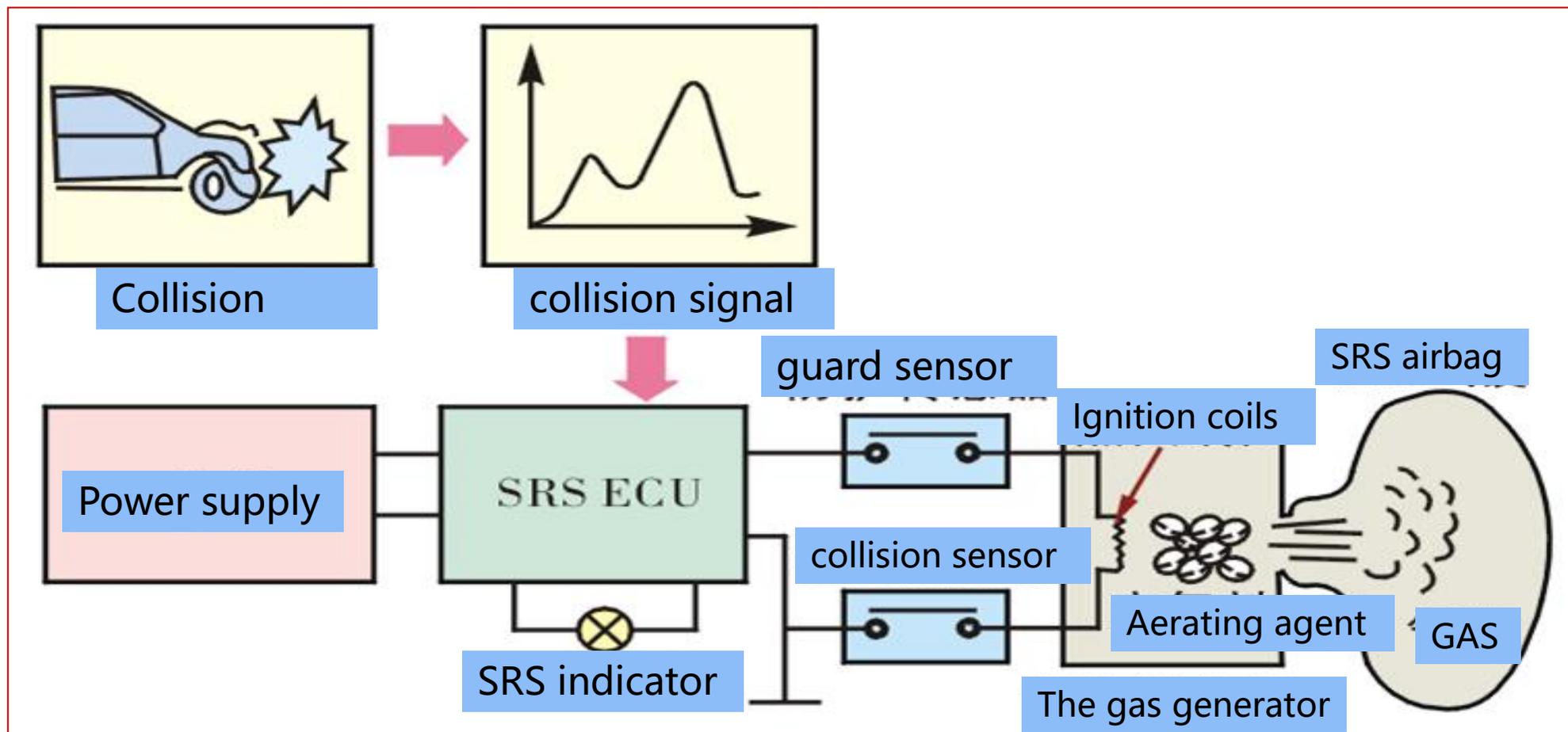
3. The composition and working principle of the airbag

(2) Working principle of side collision

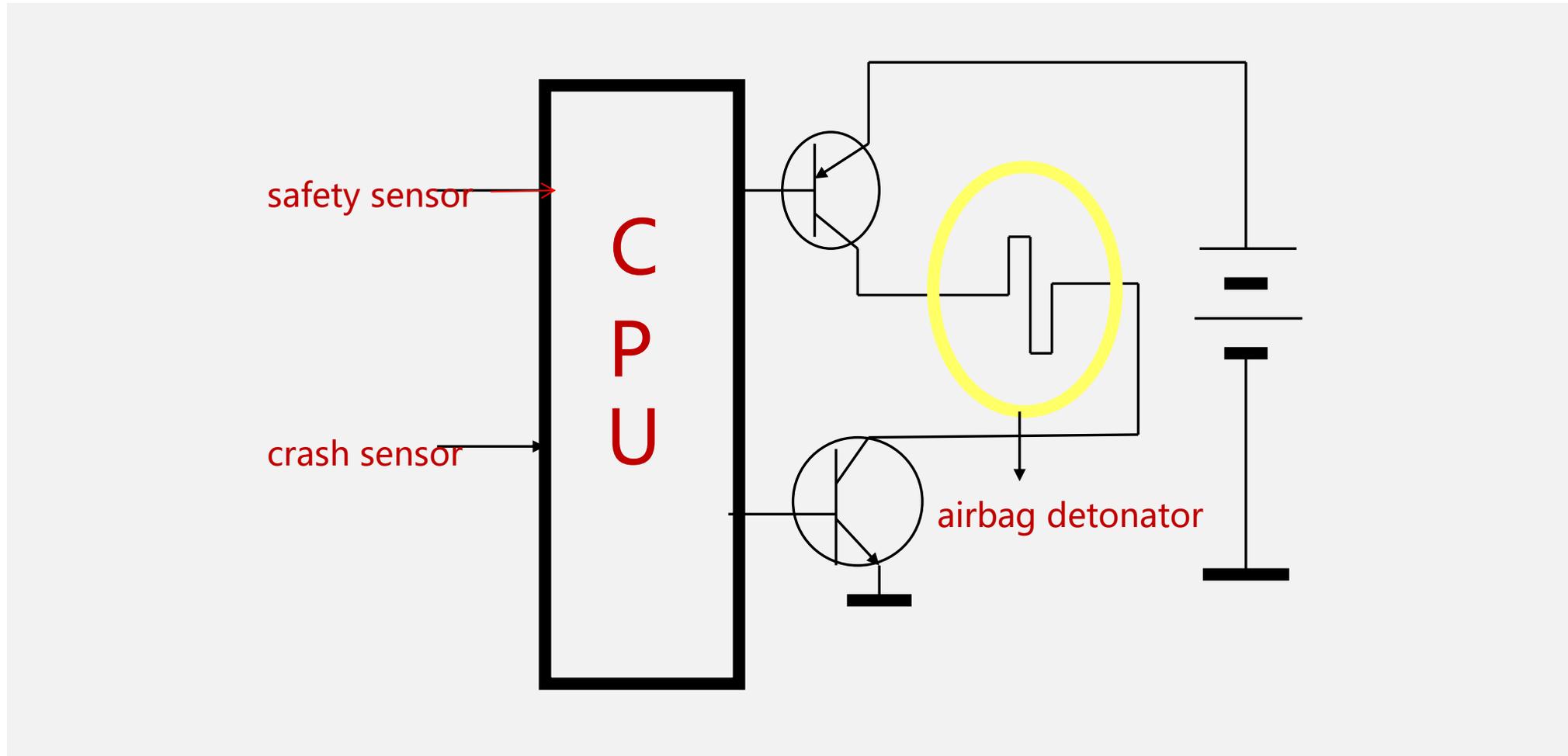


3. The composition and working principle of the airbag

(3) The ignition principle of the airbag



3. The composition and working principle of the airbag





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➤ 4. the electrical system of the airbag

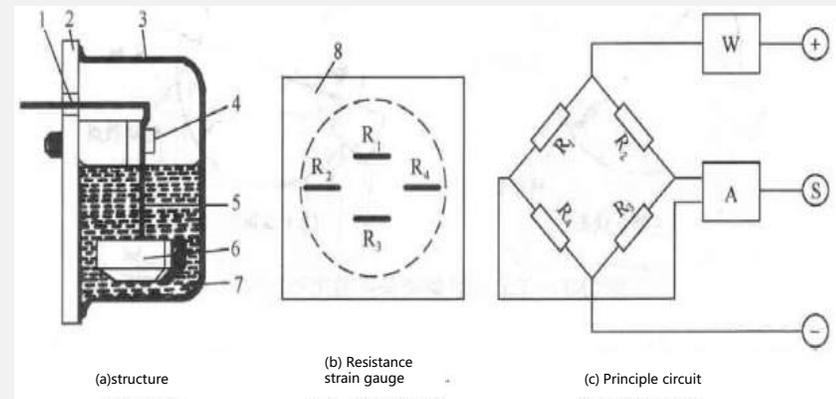
ABM系统



crash sensor : Detect the signal of the collision intensity of the car, and input the signal to the airbag ECU. The collision sensor installed in the front of the car is called the front collision sensor; the collision sensor installed inside the airbag ECU is called the central sensor.

safety sensor : Safety sensors, also called safety sensors, prevent accidental deployment of the airbag system in the event of a non-collision. The safety sensor is installed inside the airbag ECU, usually there are two safety sensors

1. Windlight new 580 resistance strain gauge safety sensor



1. Sealing resin
2. Sensor base plate
3. Housing
4. Electronic circuit
5. Resistance strain gauge
6. Vibration block
7. Buffer medium
8. Silicon diaphragm

When the car is collided, the vibration block vibrates, the buffer medium vibrates, the strain resistance of the strain gauge is deformed, and the resistance value changes accordingly. After signal processing and amplification, the signal voltage output by the sensor S terminal will change. The SRS computer can judge the severity (intensity) of the collision according to the strength of the voltage signal. If the voltage exceeds the set value, the SRS computer will immediately send an ignition command to the igniter to detonate the igniter, so that the inflator is thermally decomposed to generate gas to inflate the airbag.

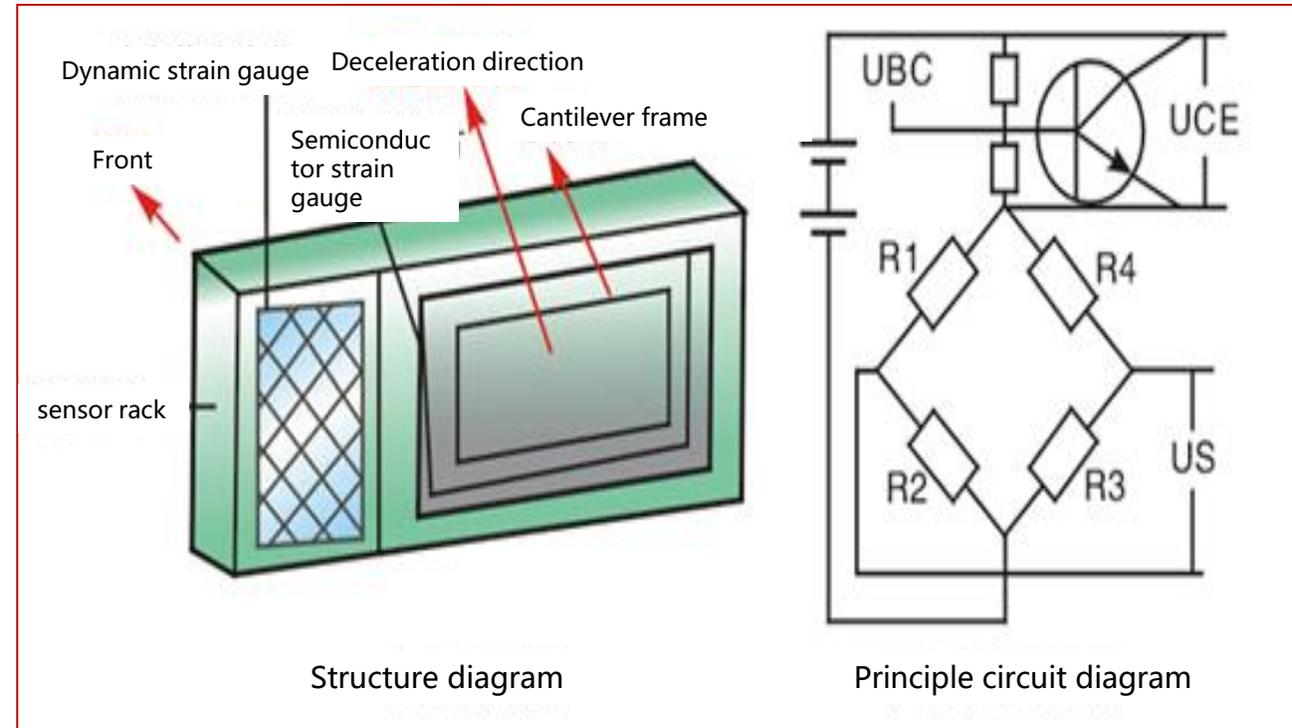
➤ 4. the electrical system of the airbag

ABM系统



2. Windlight new 580 piezoelectric effect central collision sensor

Piezoelectric impact sensor is a sensor made of piezoelectric effect. The piezoelectric effect refers to the effect that the output voltage of the piezoelectric crystal changes due to the change of the shape of the crystal under the action of pressure. Piezoelectric crystals are usually made of quartz or ceramics. Under pressure, the shape and output voltage of the piezoelectric crystal will change. When the car is hit by a collision, the piezoelectric crystal in the sensor will change the output voltage under the pressure generated by the collision. The SRS computer can judge the intensity of the collision according to the strength of the voltage signal. If the voltage signal exceeds the set value, the SRS computer will immediately send an ignition command to the igniter, detonating the ignition agent to make the gas generator inflate the airbag, and the SRS airbag will expand to protect the driver and passengers.



➤ 4. the electrical system of the airbag

ABM系统



3. Fengguang new 580 side impact sensor (1 each on the left and right)

The sensor adopts piezoelectric effect structure to detect side impact acceleration. Installed at the lower ends of the B-pillars on both sides, the piezoelectric effect acceleration sensor can sense the collision signal and send the signal to the airbag controller in the event of a side collision. In the event of a side impact, the ECU controls the side airbags by communicating with the side impact sensor.

When a side collision occurs, the vehicle lateral (Y-axis) deceleration signal is determined by the acceleration sensor at the lower end of the B-pillar on the side of the vehicle.

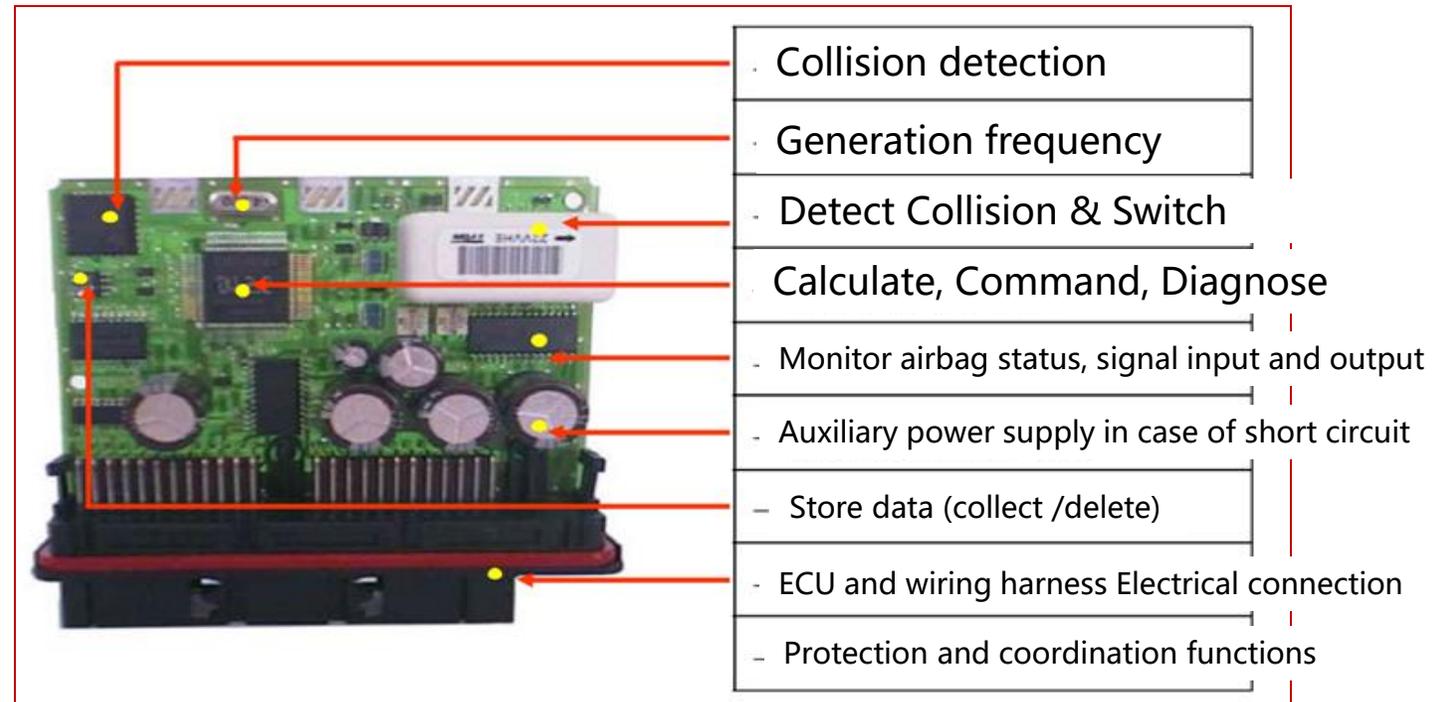
Frontal and side airbags can be deployed at the same time when frontal and side airbag deployment conditions are met simultaneously (special collision conditions).



➤ 4. the electrical system of the airbag

4. Airbag ECU:

The diagnostic circuit in the ECU continuously checks the faults that may cause the airbag to fail to be detonated or accidentally detonated. If a fault is found, the fault content will be stored in the memory circuit according to the code for reading during maintenance, and the SRS system warning light will be turned on at the same time. to notify the driver. Backup power consists of capacitors and DC converters. When the vehicle power supply is damaged due to a collision, the capacitor will continue to supply power

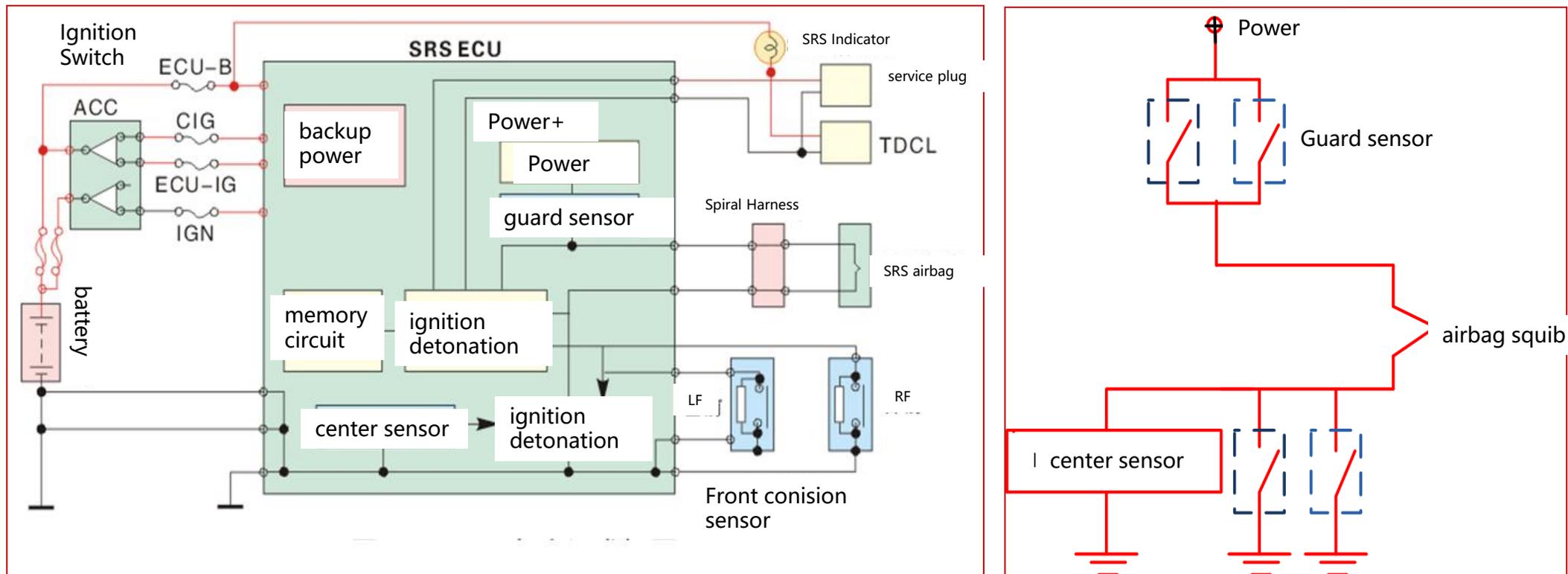


➤ 4. the electrical system of the airbag

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In order to ensure the reliable operation of the SRS system and prevent false detonation, the system needs to detect the collision sensor, the central airbag sensor and the safety sensor at any time. Among the three, the deceleration value set by the safety sensor closed is the smallest, and the connection relationship between them is the smallest. The triggering condition of the airbag is: when the vehicle is in a frontal collision, if a safety sensor and a collision sensor are closed at the same time; or a safety sensor and a central airbag sensor are closed at the same time; or three sensors are closed at the same time, the airbag is detonated. .



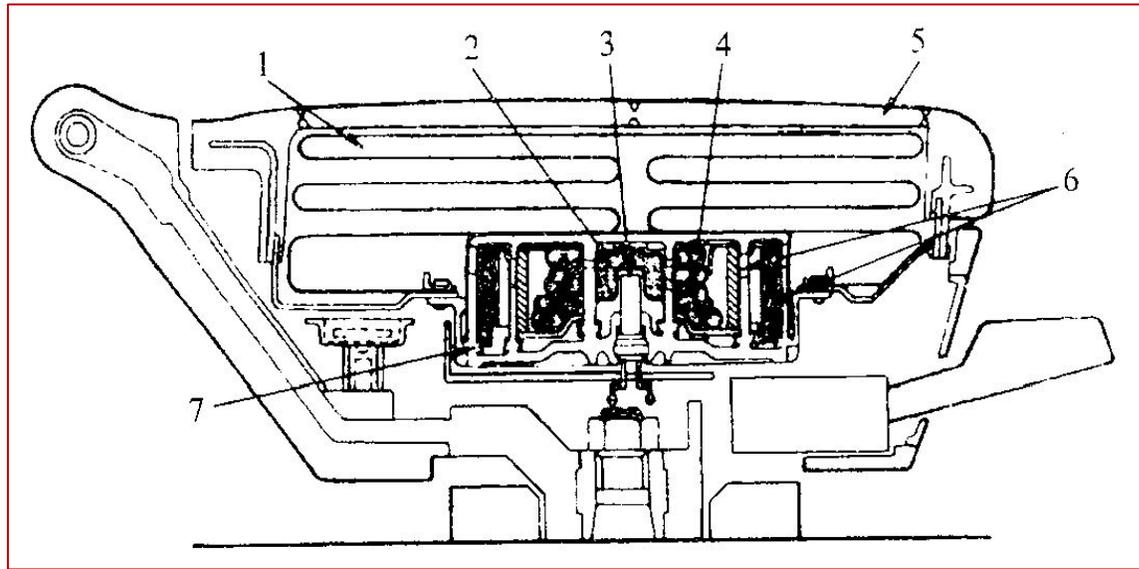
➤ 4. the electrical system of the airbag

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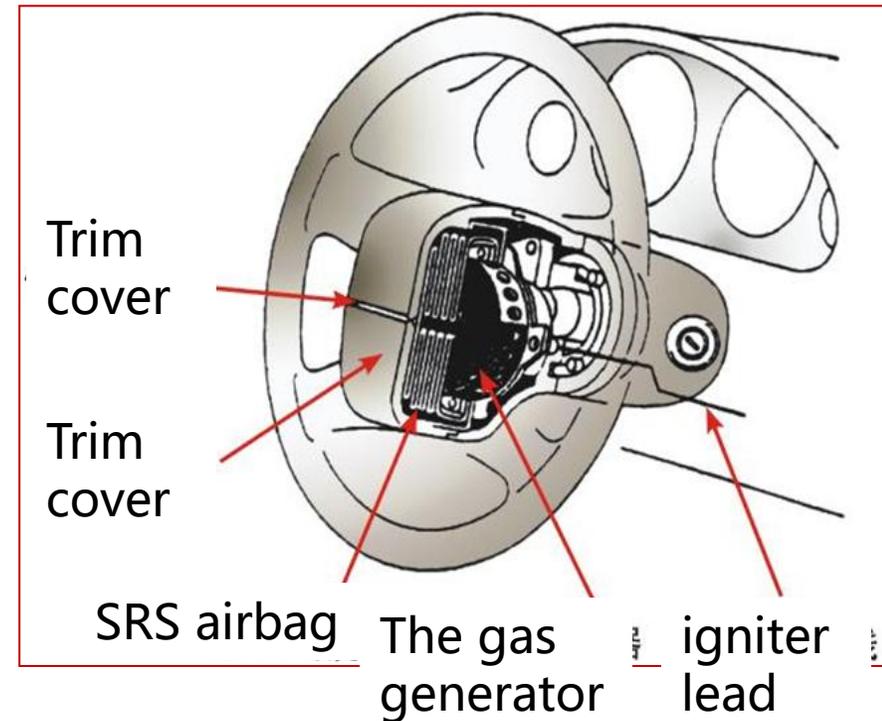


4. Driver Airbag

As an air bag assembly, the inflation element and air bag cannot be disassembled. For the single airbag SRS system, the airbag assembly is installed in the steering wheel at the driver's end; for the dual airbag SRS system, the airbag assembly is installed in the steering wheel at the front of the driver and the upper end of the toolbox in front of the co-driver is equipped with an airbag assembly.



1- Airbag 2- Gunpowder 3- Electric Detonator 4- Nitrogen Generator
5- Steering Wheel Box 6- Filter



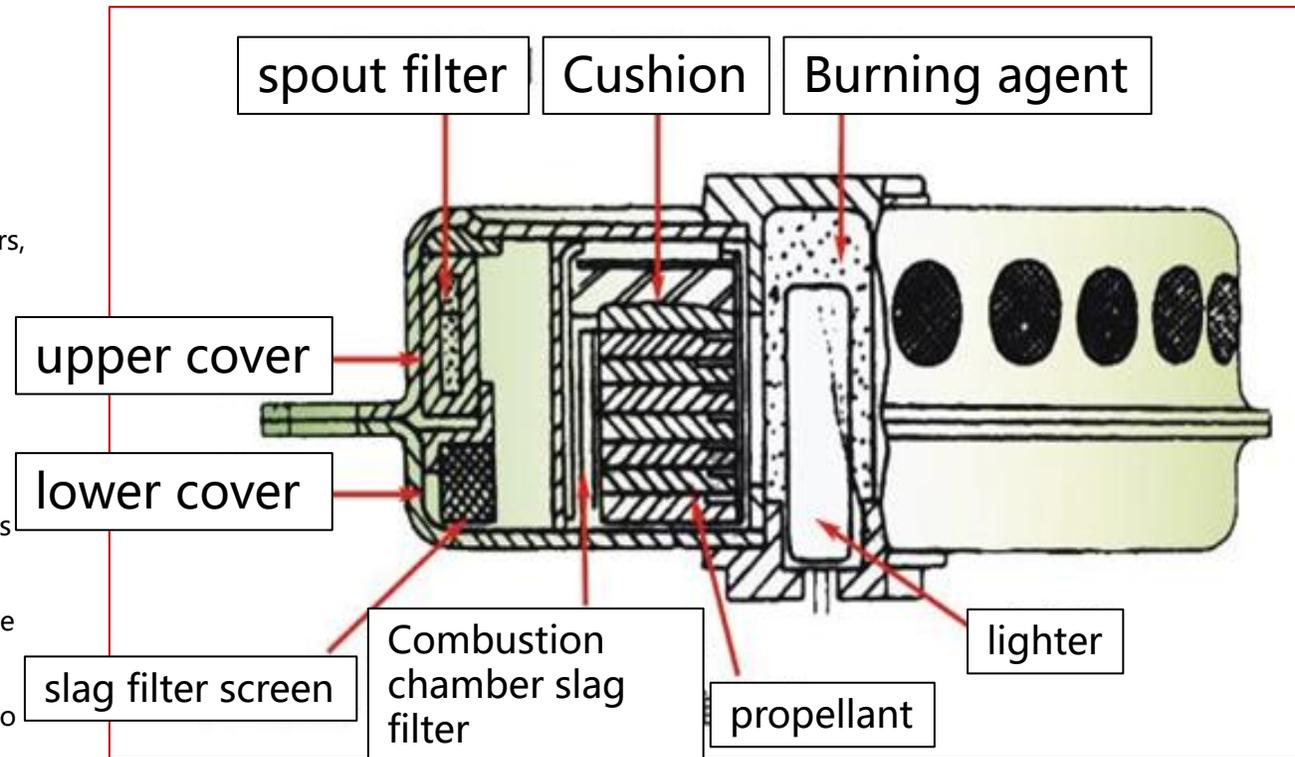
➤ 4. the electrical system of the airbag

ABM系统



5. Secondary airbag assembly

The inflatable element located in the lower part of the airbag is composed of electric detonator, gunpowder, gas generating agent, buffer pad, filter screen, filter screen and shell. When the collision occurs, the electric detonator detonates the gunpowder, producing a large amount of high-temperature gas, which collides or smashes the gas generating agent, and at the same time cools the high-temperature gas and continues to generate gas. After many times of filtration, the smoke and dust are removed, and the airbag is sprayed from the gas nozzle, so that the airbag is filled with gas at the moment of vehicle collision.



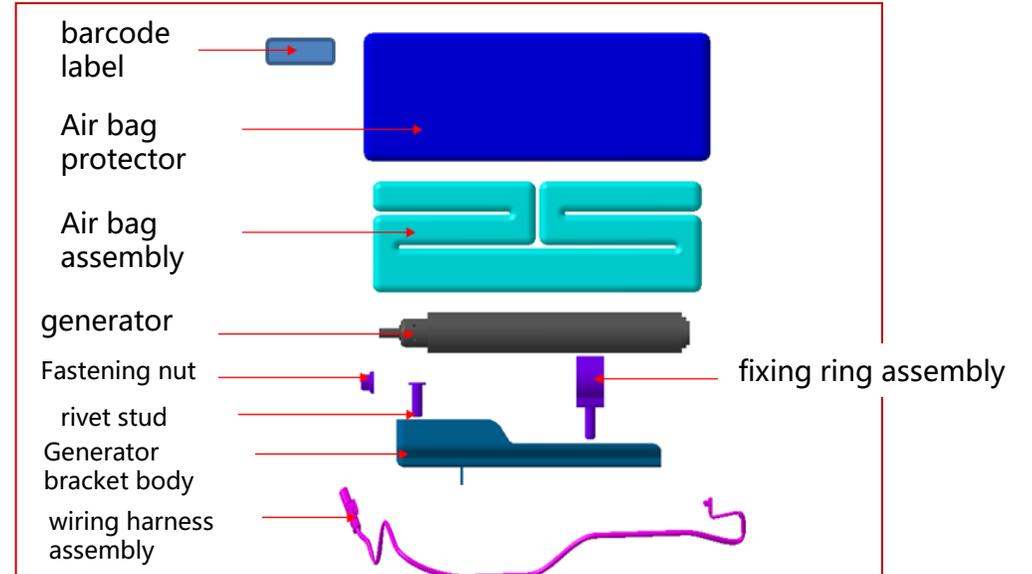
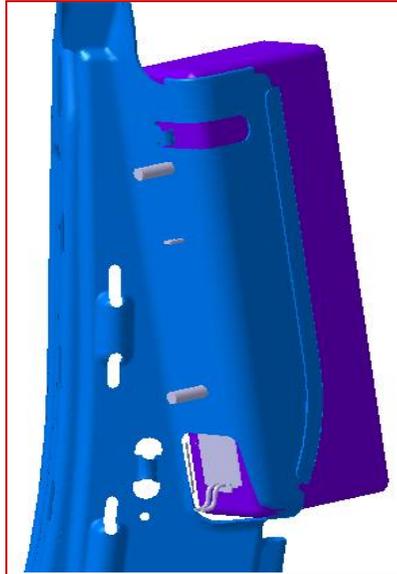
➤ 4. the electrical system of the airbag

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6. Side airbags (driver side and passenger side rear side airbags)

It is installed on the side of the driver's seat and the passenger's seat. When the car is subjected to a strong impact from the side of the vehicle, the airbag controller (ECU) issues an ignition command to detonate the side airbags. The side airbags disperse and reduce the side impact force on the torso of the front passenger. The structure is the same as the auxiliary airbag module. .



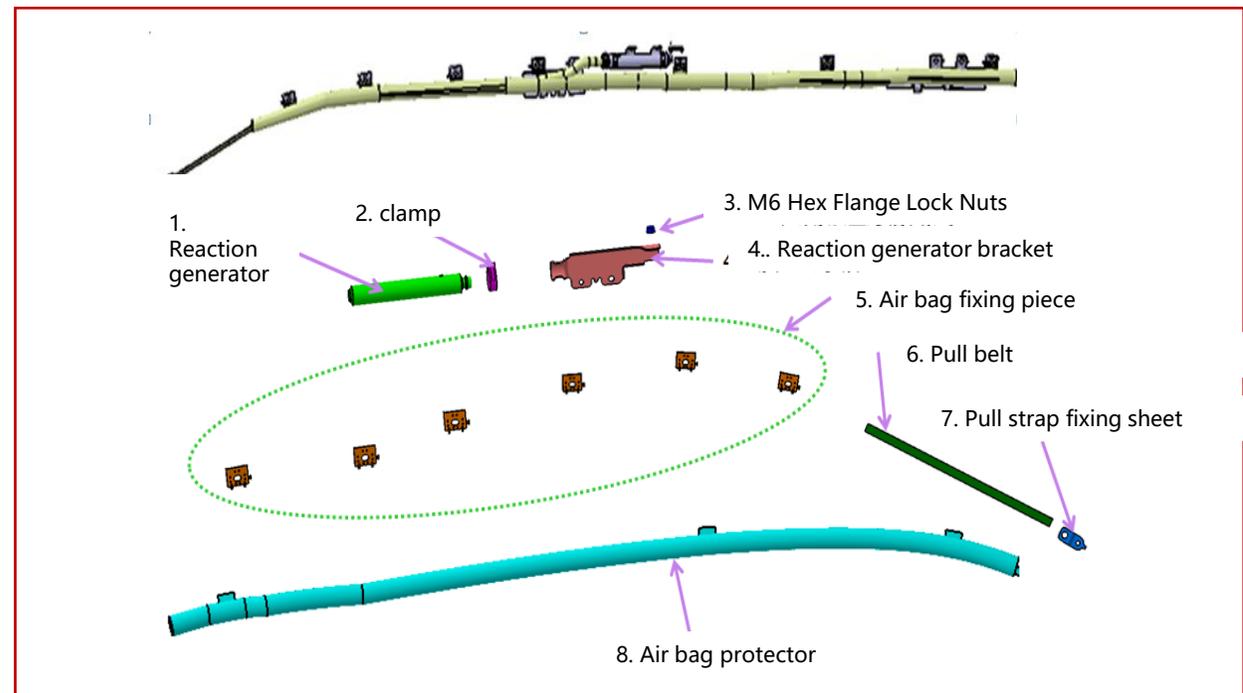
➤ 4. the electrical system of the airbag

ABM系统



7. Side Air Curtain (CAB)

The side air curtain is installed between the upper longitudinal beam and the roof from the A-pillar to the C-pillar, and its main function is to protect the occupant's head in the event of a side collision and side rollover.



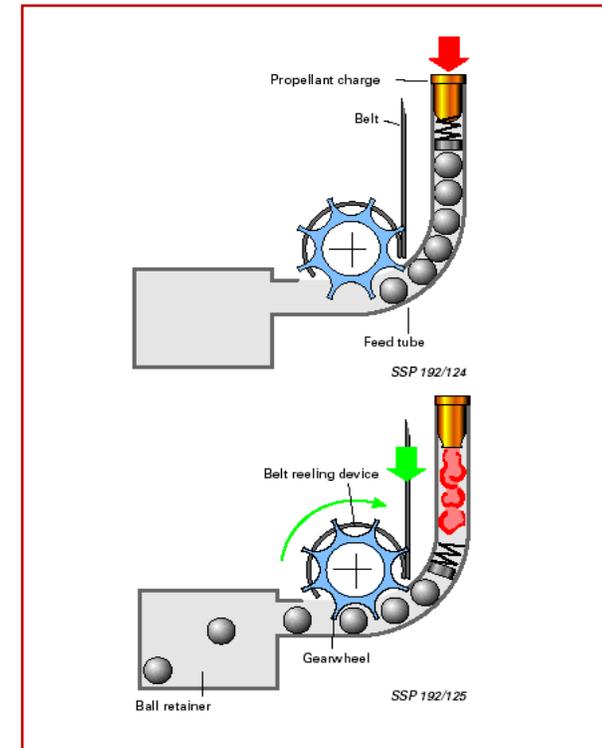
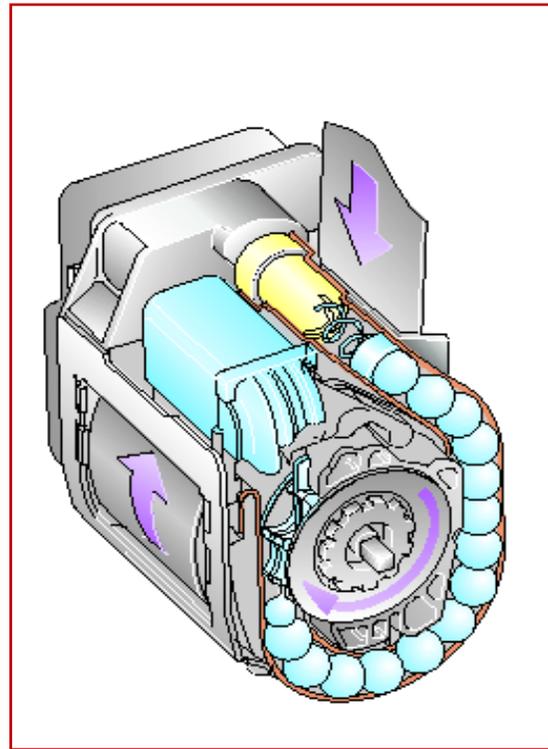
➤ 4. the electrical system of the airbag

ABM系统



8. Seat belt tensioner (driver side and passenger side)

Under the working conditions of the retractor, the airbag ECU provides the ignition current to the explosive device of the retractor. At this time, the safety sensor is not connected as a component to the ignition circuit of the tensioner. However, the microprocessor only activates the tensioner when the inductive safety sensor is turned off.



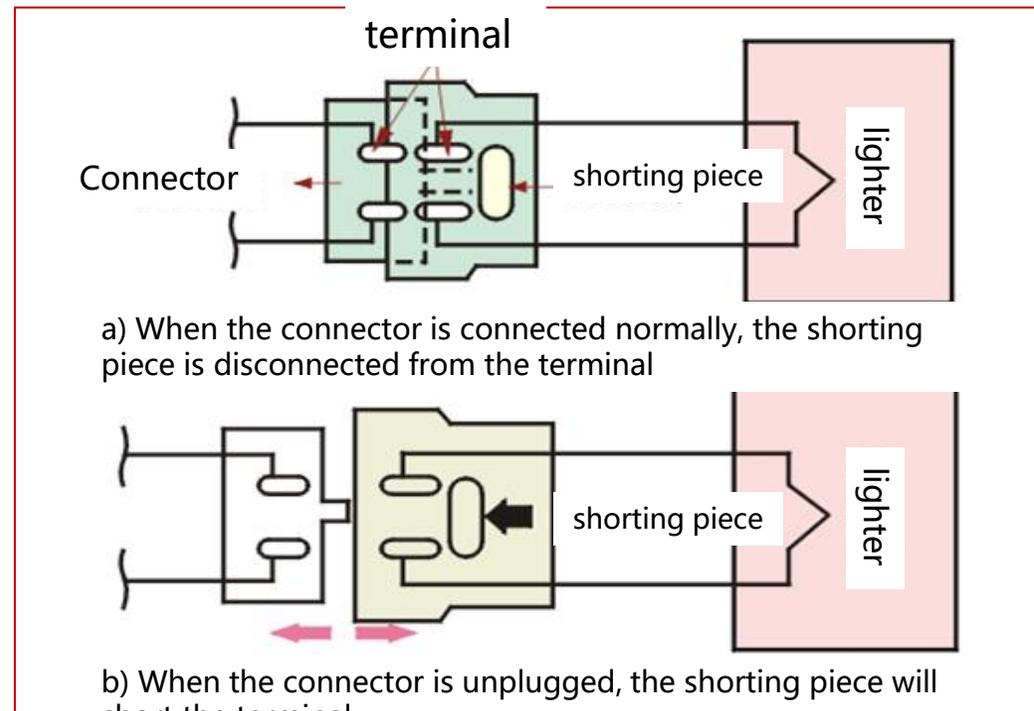
➤ 4. the electrical system of the airbag

ABM系统



9. Screw connectors

The inflatable element and the airbag are installed on the steering wheel and rotate with the steering wheel at any time. The screw connector is used to connect the electric detonator lead wire that rotates with the steering wheel to the fixed ECU wire, as shown in Figure 7.16. The screw connector consists of a rotor, a housing, a wire and a release cam. There are connecting flanges and grooves between the rotor and the release cam. When the steering wheel is turned, the two are in contact with each other to form an integral rotation. The spiral wire about 5m long is installed in the screw connector, which can be rotated 2.5 turns with the steering wheel in any direction without dragging foreign objects. In addition, a horn switch contact is connected to the screw connector; on a vehicle equipped with a cruise control system, the screw connector is also connected to the CCS main switch.



➤ 4. the electrical system of the airbag

ABM系统



10. Airbag warning light

The airbag warning light is located on the instrument cluster. When the center airbag sensor assembly self-diagnostic mechanism detects a malfunction, the warning light will warn the driver of the malfunction. Under normal conditions, when the ignition switch is turned to the ACC or ON position, the warning light will come on for about 6 seconds and then go off.



➤ 4. the electrical system of the airbag

ABM系统



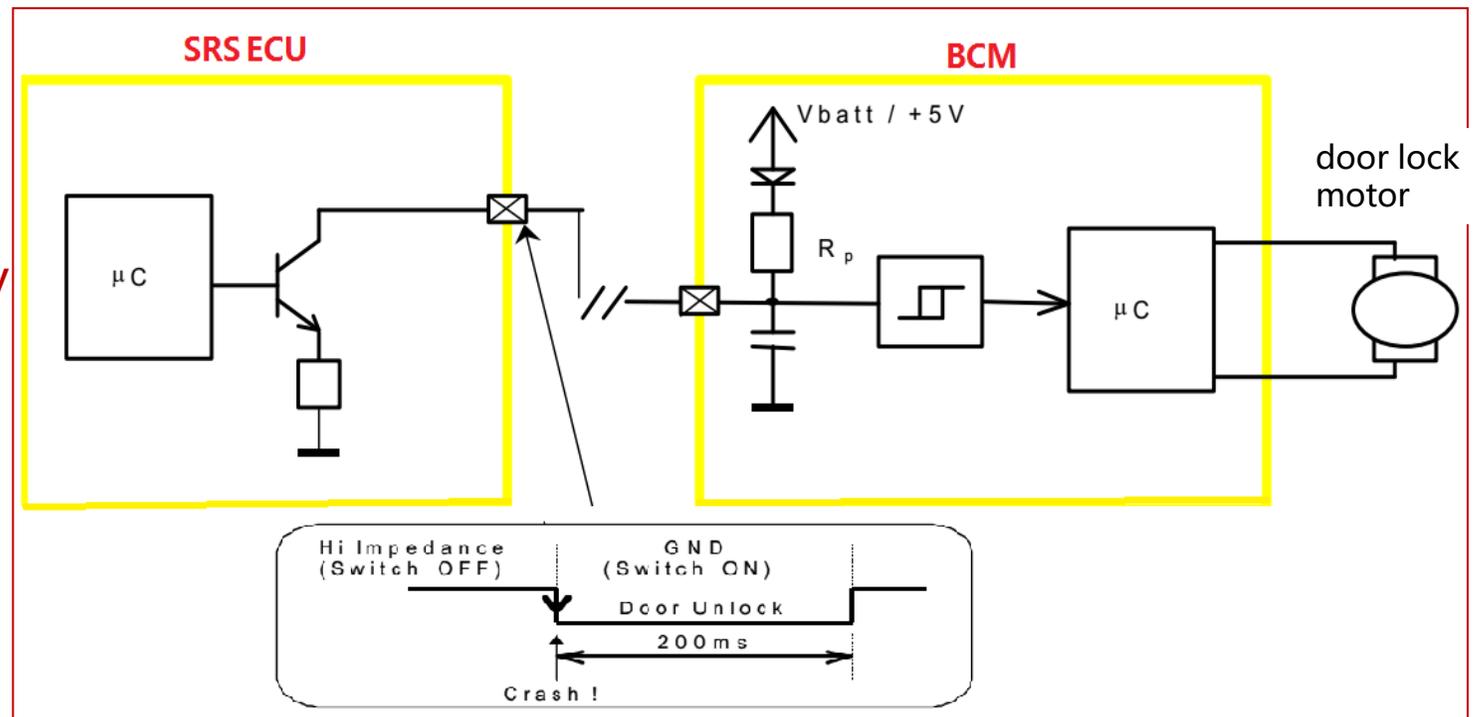
11. Airbag crash output

Collision output function

When the degree of collision exceeds the specified range, the ECU sends a door lock release signal to the time module.

Collision Output Job Summary

Once a vehicle collision (front or side airbag and retractor deployment condition) is sensed, the airbag ECU sends a collision output signal. After this signal is sent to the BCM, the door unlock function is performed.





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- 01** Airbag Overview
- 02** Types of Airbags
- 03** The composition and working principle of airbag
- 04** The electrical system of the airbag
- 05** Airbag maintenance precautions and fault codes

➤ 5. Airbag maintenance precautions and fault codes

There are explosives such as gunpowder and electric detonator in the airbag, so the maintenance operation must be carried out in the correct order. Failure to do so could result in an accident in the airbag system during service, resulting in a serious accident, or ineffectiveness when airbag inflation is required for protection. Therefore, the maintenance should pay attention to the following points:

1. The airbag system can only work once. The airbag that is detonated after an accident must be replaced. For safety reasons, all components of the airbag system also need to be replaced. After 10 years, the air bag system must be sent to the repair shop for replacement. The replacement date is usually attached to the label of the tool box or under the sunshade mirror.
2. The fault code is an important information source for the fault diagnosis of the airbag system. When diagnosing the system fault, the fault code should be read first, and then the battery should be disconnected. Before the maintenance operation, be sure to turn the ignition switch to the LOCK position, and start working 90s after the cable is disconnected from the negative terminal of the battery. Because the airbag system has a backup power supply. If maintenance work is started less than 90 seconds after the negative battery terminal is removed, it may detonate. If the ignition switch is in the ON or ACC position for inspection, a fault code will appear.

➤ 5. Airbag maintenance precautions and fault codes

3. Since the storage contents of the clock and audio system in the car are eliminated with the detachment of the battery, the contents of each storage system should be recorded before starting the maintenance. After the maintenance, the audio system and clock should be reset. or adjust. Similarly, for those with steering wheel electric tilt and telescopic steering system, electric seats, electric exterior mirrors and electric safety shoulder belt tie-downs, since they all have a memory function to store parameters, they must be reset after maintenance. Therefore, after the overhaul, the user must be informed to adjust and reset the memory content according to their personal needs and habits.
4. If the vehicle has a minor collision and the SRS is not triggered, also check the steering wheel pad, front passenger airbag assembly, seat belt tensioner and airbag sensor.
5. If the SRS system of the collided vehicle has been activated, in addition to replacing the detonated airbags and seat belt pretensioners, all impact sensors and central airbag sensor assemblies must be replaced at the same time, and the wiring harness and connector conditions must be checked. Removal and repair of a replaced crash sensor, center air bag sensor assembly, steering wheel pad, front passenger air bag assembly or seat belt tensioner for reuse is not permitted.

➤ 5. Airbag maintenance precautions and fault codes

SRS parts from other vehicles cannot be used, only factory designed parts, including wiring, can be used. It is not allowed to pull the wire randomly or change the wire at will, so as not to affect the reliability of the airbag. Whenever parts need to be replaced, new parts should be installed.

6. If any system components such as crash sensor, SRS computer or steering wheel pad, front passenger airbag assembly or seat belt tensioner are found to have cracks, dents or other defects in the shell, bracket or connector, they should be replaced with new ones. . During the repair process, if there is impact on the sensor, the airbag sensor should be removed before repairing, and it is strictly forbidden to mechanically impact the sensor and the airbag.

7. Do not expose the crash sensor, SRS computer, steering wheel pad, front passenger airbag assembly or seat belt retractor to direct exposure to hot air or near sources of ignition. When using a blowtorch or welding equipment, do not get close to the inflator to prevent the airbag from automatically inflating. It is advisable to use a high impedance (at least 10kD/V) multimeter to detect the circuit. After the repair work is completed, the SRS warning light should be checked.

➤ 5. Airbag maintenance precautions and fault codes

8. Crash sensors that have been crashed and the SRS system has been triggered cannot be reused. Either left or right, and even the middle crash sensor should be replaced at the same time. When a crash sensor is installed, the arrow on the sensor should point towards the front of the vehicle. The locating bolts of the crash sensor are rust-proof. When the sensor is removed, it must be replaced with a new set screw. When connecting the connector, the electrical detection mechanism must be securely locked, otherwise the fault code will be detected on the diagnostic system.

9. When removing the steering wheel airbag assembly, the top side of the steering wheel pad should be upright, and it should not be turned upside down. Also be sure to keep the top side up when moving the new steering wheel pad. The steering wheel pads must not be greased or cleaned with any type of detergent. The steering wheel pad assembly should be placed in a place where the ambient temperature is lower than 93°C, the humidity is not high, and it is far away from electric field interference. When the vehicle is scrapped or only the steering wheel pad mechanism is scrapped, use a special tool to trigger and deploy the airbag before scrapping, and the operation should be performed in a place far away from the interference of electric fields.

10. Never use a multimeter to measure the resistance of the airbag electric detonator, because a small current can detonate the electric detonator and inflate the airbag. When installing the screw connector, it must be preset in the middle position, so that when the steering wheel is turned from the middle position to the left and right directions for 2.5 turns, the spiral wire will not be broken or other faults will be caused.

➤ 5. Airbag maintenance precautions and fault codes

11. When disassembling and installing the front passenger airbag assembly, place the airbag door upwards. If the airbag door is facing down, it could cause a serious accident if the airbag inflates and deploys. The airbag assembly must not be greased, and the airbag door must not be cleaned with any type of detergent. The airbag assembly should be stored in a place where the ambient temperature is lower than 93°C, the humidity is not high and away from the interference of electric fields. When using arc welding, the airbag connector must be disconnected before starting work. When the vehicle is scrapped or the front passenger airbag assembly is scrapped, the airbag should be triggered and deployed before it is scrapped to avoid accidental detonation and injury to people. When detonating the operation, it should be carried out in a place far away from the interference of the electric field.

12. When storing the removed or new seat belt, the handle of the double lock connector should be in the pinned position, taking care not to damage the connector. Never use a multimeter to measure the electrical resistance of the seat belt retractor to prevent the retractor from being triggered. Seat belts must not be stained with oil or water, and must not be cleaned with any type of detergent. The connector must be disconnected before arc welding. The connector is installed under the front door frame panels and under the carpet. When the vehicle is scrapped or only the seat belt is scrapped, the seat belt tensioner should be activated before scrapping, and this operation should be carried out in a place far away from the interference of the electric field. The electronic control unit of the SRS system that has been in a collision and the SRS has been triggered cannot be reused. Before disassembling the SRS computer, be sure to turn the ignition switch to the LOCK position, and start the operation 90s after disconnecting the battery ground wire.

5. Airbag maintenance precautions and fault codes

ABM系统



DTC display code	DTC meaning	DTC display code	DTC meaning
U007488	CHA CAN Controller Bus Off	C140611	Driver's side airbag circuit shorted to ground
B111717	Battery voltage is too high	C140711	Passenger side airbag circuit shorted to ground
B111716	Battery voltage is too low	C140811	Driver's knee airbag circuit shorted to ground
U010087	Lost communication with EMS	C140911	The driver's air curtain circuit is shorted to ground
U010187	Lost communication with TCU	C140A11	Passenger air curtain circuit short circuit to ground
U012287	Lost communication with ESP	C140B11	Short to ground in the rear driver's side airbag circuit
U013187	Lost communication with EPS	C140C11	Short circuit to ground in the side airbag circuit on the rear passenger side
U023587	Lost communication with MRR	C140D11	Rear driver's side seat belt pretensioner short to ground (shoulder belt)
U014087	Lost communication with BCM	C140E11	Rear passenger side seat belt pretensioner short circuit to ground (shoulder belt)
U018687	Lost communication with IVI	C140012	Driver airbag circuit shorted to power
U012887	Lost communication with EPB	C140112	Passenger airbag circuit shorted to power
U029387	Lost communication with VCU	C140212	Driver's seat belt pretensioner shorted to power (shoulder belt)
U015587	Lost communication with IC	C140312	Driver's seat belt pretensioner shorted to power supply (end piece)
C140011	Driver airbag circuit shorted to ground	C140412	Passenger seat belt pretensioner shorted to power supply (shoulder belt)
C140111	Passenger airbag circuit shorted to ground	C140512	Passenger seat belt pretensioner shorted to power supply (end piece)
C140211	Driver's seat belt pretensioner shorted to ground (shoulder belt)	C140612	Driver's side airbag circuit shorted to power
C140311	The driver's seat belt pretensioner is shorted to ground (end piece)	C140712	Passenger side airbag shorted to power
C140411	Passenger seat belt pretensioner short to ground (shoulder belt)	C140812	Driver's knee airbag circuit shorted to power
C140511	Passenger seat belt pretensioner short circuit to ground (end piece)	C140912	The driver's air curtain circuit is shorted to the power supply

5. Airbag maintenance precautions and fault codes

ABM系统



DTC display code	DTC meaning	DTC display code	DTC meaning
C140A12	The occupant air curtain circuit is shorted to the power supply	C140E13	The resistance value of the seat belt pretensioner on the rear passenger side is too high (shoulder belt)
C140B12	Rear driver's side airbag circuit shorted to power	C14001A	Driver airbag circuit resistance too low
C140C12	Rear passenger side side airbag circuit shorted to power	C14011A	Passenger airbag circuit resistance is too low
C140D12	Rear driver's side seat belt pretensioner shorted to power supply (shoulder belt)	C14021A	Driver's seat belt pretensioner resistance is too low (shoulder belt)
C140E12	Rear passenger side seat belt pretensioner shorted to power supply (shoulder belt)	C14031A	The resistance of the driver's seat belt pretensioner is too low (end piece)
C14001B	Driver airbag circuit resistance is too high	C14041A	Occupant seat belt pretensioner resistance is too low (shoulder belt)
C14011B	Passenger airbag circuit resistance is too high	C14051A	Passenger seat belt pretensioner resistance is too low (end piece)
C14021B	Driver's seat belt pretensioner resistance is too high (shoulder belt)	C14061A	Driver's side airbag circuit resistance is too low
C140313	The resistance of the driver's seat belt pretensioner is too high (end piece)	C14071A	Passenger side airbag resistance is too low
C14041B	Passenger seat belt pretensioner resistance is too high (shoulder belt)	C14081A	Driver's knee airbag circuit resistance is too low
C140513	The resistance value of the passenger seat belt pretensioner is too high (end piece)	C14091A	The resistance of the driver's air curtain circuit is too low
C14061B	Driver's side airbag circuit resistance is too high	C140A1A	The resistance value of the occupant air curtain circuit is too low
C14071B	Passenger side airbag resistance is too high	C140B1A	The resistance of the rear driver's side airbag circuit is too low
C140813	Driver's knee airbag circuit resistance is too high	C140C1A	The resistance value of the side airbag circuit on the rear passenger side is too low
C140913	The resistance of the driver's air curtain circuit is too high	C140D1A	Rear driver's side seat belt pretensioner resistance is too low (shoulder belt)
C140A13	The resistance value of the occupant air curtain circuit is too high	C140E1A	The resistance value of the seat belt pretensioner on the rear passenger side is too low (shoulder belt)
C140B13	The resistance of the rear driver's side airbag circuit is too high	C14001C	Driver airbag circuit wiring
C140C13	The resistance value of the side airbag circuit on the rear passenger side is too high	C14011C	Passenger airbag circuit wiring
C140D13	Rear driver's side seat belt pretensioner resistance is too high (shoulder belt)	C14021C	Driver's seat belt pretensioner wire (shoulder belt)

5. Airbag maintenance precautions and fault codes

ABM系统



DTC display code	DTC meaning	DTC display code	DTC meaning
C14032B	Driver's seat belt pretensioner wire (end piece)	C140755	Passenger side airbag connection misconfigured
C14041C	Passenger seat belt pretensioner wire (shoulder belt)	C140855	Driver's knee airbag circuit connection configuration error
C14052B	Passenger seat belt pretensioner wire (end piece)	C140955	Driver's curtain air circuit connection configuration error
C14061C	Driver's side airbag circuit wiring	C140A55	Occupant air curtain circuit connection configuration error
C14071C	Passenger side airbag wiring	C140B55	Rear driver's side side airbag circuit connection configuration error
C14082B	Driver's side knee airbag circuit wiring	C140C55	Incorrect connection configuration of the side airbag circuit on the rear passenger side
C14092B	Driver's curtain air loop wiring	C140D55	Rear driver's side seat belt pretensioner connection configuration error (shoulder belt)
C140A2B	Passenger air curtain loop wiring	C140E55	Rear passenger side seat belt pretensioner connection configuration error (shoulder belt)
C140B2B	Rear driver's side airbag circuit wiring	C143811	The driver's side peripheral sensor is shorted to ground
C140C2B	Rear passenger side side airbag circuit wiring	C143911	Passenger side peripheral acceleration sensor is shorted to ground
C140D2B	Rear driver's side seat belt pretensioner cable (shoulder belt)	C143812	The positive side of the driver's side acceleration sensor is connected to the power supply
C140E2B	Rear passenger side seat belt pretensioner cable (shoulder belt)	C143912	The positive side of the passenger side acceleration sensor is connected to the power supply
C140055	Driver airbag circuit connection misconfigured	C143813	Driver's side accelerometer sensor is open
C140155	Passenger airbag circuit connection configuration error	C143913	Passenger side acceleration sensor resistance is too high
C140255	Driver seat belt pretensioner connection configuration error (shoulder belt)	C14381C	Driver's side peripheral sensor wiring
C140355	Driver seat belt pretensioner connection configuration error (end piece)	C14391C	Passenger side peripheral acceleration sensor wiring
C140455	Occupant seat belt pretensioner connection configuration error (shoulder belt)	C143255	Driver side peripheral sensor configuration error
C140555	Passenger seat belt pretensioner connection configuration error (end piece)	C143355	Passenger side peripheral acceleration sensor configuration error
C140655	Driver's side airbag circuit connection configuration error	C143281	Driver's side peripheral sensor received invalid data

5. Airbag maintenance precautions and fault codes

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DTC display code	DTC meaning	DTC display code	DTC meaning
C143381	Passenger side peripheral acceleration sensor received invalid data	C145300	Driver side collision detected
C143296	Driver side peripheral sensor internal error	C145400	Co-pilot side collision detected
C143396	Passenger side peripheral sensor internal error	C145500	rear collision
C143229	Driver side accelerometer error due to signal boost or algorithm sensor watchdog error	C144001	System configuration mismatch
C143329	Occupant side accelerometer error due to signal boost or algorithm sensor watchdog error	C144101	The identification code of the sensor is inconsistent with the identification code predetermined by the algorithm
C14324A	Driver's side acceleration sensor initialization error	C144201	The parameter output identification code is inconsistent with the algorithm predetermined identification code
C14334A	Passenger side acceleration sensor initialization error	C144401	The transmission parameter value code is inconsistent with the algorithm predetermined identification code
C142011	Driver's seat belt buckle shorted to ground	C144501	The verification code was updated incorrectly
C142012	Driver's seat belt buckle shorted to power	C144048	software mismatch error
C142112	The passenger seat belt buckle is shorted to the power supply	C144652	Bootlader flash failed
C142013	The resistance of the driver's seat belt buckle sensor is too high	C146201	Sensor redundancy check
C14201E	Driver's seat belt buckle sensor out of range	C146301	Bus communication timeout
C14202B	Driver's seat belt buckle	U012101	Invalid speed information
C142055	Driver seat belt buckle misconfigured	U110187	Sending a message not being responded to
C142155	Incorrect configuration of passenger seat belt buckle	C142555	Collision output misconfigured
C142512	Collision output short-circuit power	C145000	Front collision detected
C142514	Collision output short to ground or disconnected		

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System**

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Course targets

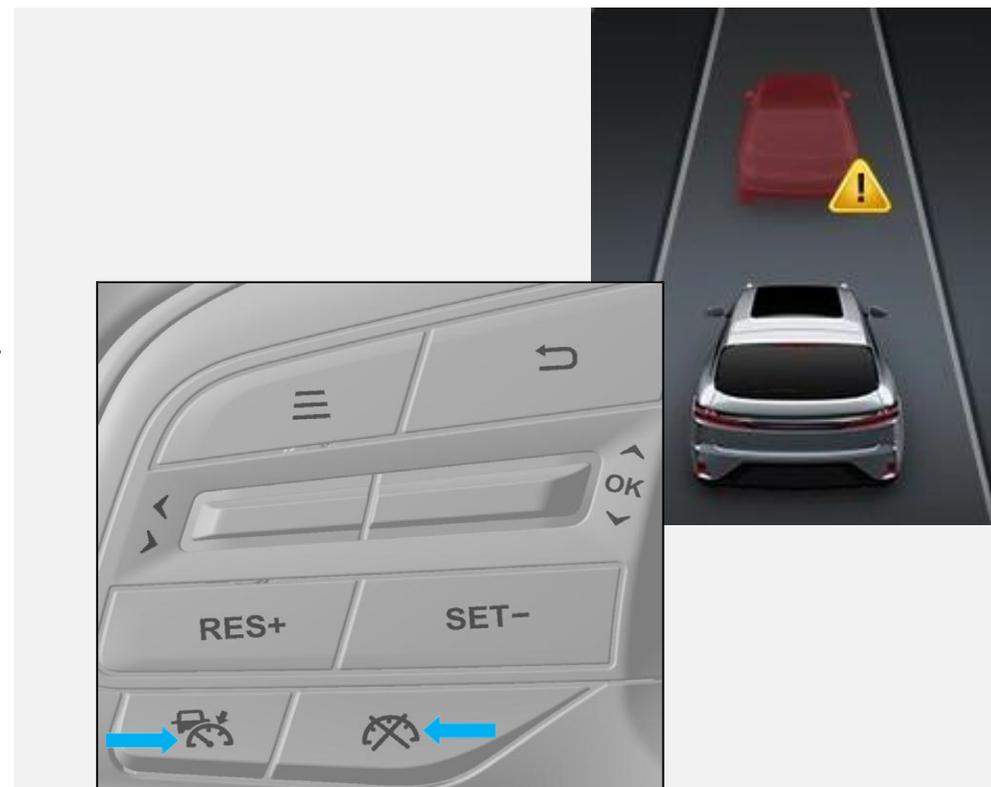
- Can tell the ADAS operation method of the new 580
- Can tell the functions of the new 580ADAS of the scenery
- Ability to test ADAS systems using diagnostics

➤ 1. ADAS system introduction

What is an ADAS system

When the driver drives on the highway for a long time at high speed, he needs to be highly focused, but it will cause the driver's mental fatigue after a long time. A little carelessness at this time may lead to a dangerous situation where the vehicle deviates from the normal driving lane. In order to avoid such accidents, Fengguang F508 vehicles are equipped with ADAS system (that is, assisted driving system). Now make a brief introduction to the structure and function of this system.

The assisted driving system can realize functions such as adaptive cruise ACC, blind spot monitoring BSD/merging assist LCA system, door opening warning (DOW), rear vehicle crossing warning (RCTA), forward collision warning (FCW), automatic emergency braking AEB and other functions.





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➤ 2. Components and components of the system

ADAS系统



1. The composition of the ADAS system mainly includes millimeter-wave radar, instrumentation, and MP5.



Millimeter wave radar



meter



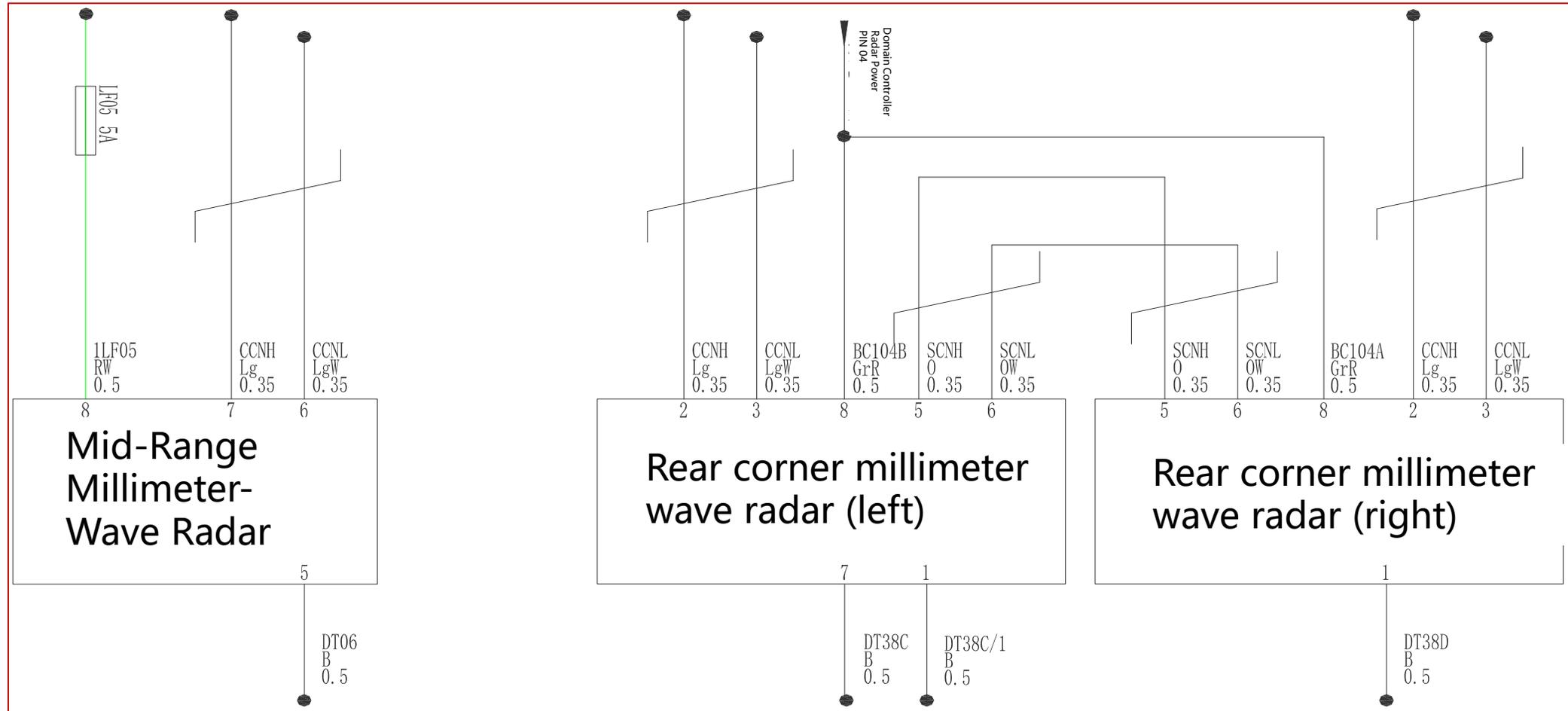
MP5

2. Components and components of the system

ADAS系统



2. Circuit diagram of millimeter wave radar in ADAS system.





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1、 Introduction of ADAS system functions

ACC is capable of driving at the speed set by the driver, and can also drive at the selected distance from the slower vehicle ahead. The ACC vehicle can follow a vehicle to a stop position when it detects a vehicle in front of it moving to a stop. When following a stopped vehicle, if the vehicle ahead is stopped for less than 3s, ACC can actively resume the system and drive the vehicle again; if the vehicle is stopped for more than 3s, the driver can press the accelerator pedal or press the RES/+ button to get the vehicle moving again.



1.1、On and off of ACC function

Cruise mode is selected as ACC, ACC on/off toggle switch is used to control ACC function. When the ACC function is on, the instrument will light up the corresponding status indicator and the text status will switch; when ACC is off, the instrument indicator goes off.

1) Enabling conditions

a Power mode is ON.

b ACC function is off.

2) Trigger condition

Press the ACC function switch.

3) Turn off condition

a Press the OFF button when the ACC function is ON.

b Power mode is not ON.

4) Execution output

a when the ACC function is off, the driver controls the start button, the ACC function is on, and the system state enters the stop state when there is no inhibition condition; After receiving the ACC system status, the instrument will turn on the ACC gray indicator.

If there are inhibition conditions, the system enters active mode.

b when the ACC function is on, the driver controls the off button, the ACC function is off, and the system state enters the off state; The instrument will turn off the ACC status indicator after receiving the ACC system status.



1.2、 Activation System

In the same ignition cycle, the system status is in active mode, if the driver has not used ACC function before, the driver controls the ON button, the cruise function works and the system status enters driving mode; if the driver has used ACC function before, the driver controls the SET/- button or RES/+ button, which can make the cruise function work and then the system status enters driving mode.

1) Enabling conditions

A. The system state is in standby.

B. The vehicle speed is greater than 5km/h (ACC state enters the active state from the stop state).

2) Trigger conditions

The driver controls the SET/-button or RES/+button

3) Execution output

When the driver controls the start button, the ACC cruise function works. And when the actual vehicle speed is greater than 30km/h, the current vehicle speed is taken as the target vehicle speed. When the actual vehicle speed is less than 30km/h, the system sets 30km/h as the cruise speed. When the driver controls the RES/+ button, the system returns to the last setting state and the system enters the driving mode; The instrument will turn on the green ACC status indicator after receiving the ACC system status.

1.3、 Change the target vehicle speed

The driver can adjust the target speed by using SET/- and RES/+ buttons.

1) Enabling conditions

The system state is in driving mode.

2) Trigger condition

The driver presses the SET/- or RES/+ button.

a The driver presses the SET/- button.

b The driver presses the RES/+ button.

3) Execution output

a When the driver presses the SET/- button once, the target speed displayed on the instrument decreases by 1km/h; when the SET/- button is pressed and held, the MRR determines the target speed and adjusts it every 750ms, and the target speed displayed on the instrument decreases by 5km/h.

b When the driver presses the RES/+ button once, the target speed displayed by the instrument increases by 1km/h; press and hold the RES/+ button, the MRR judges the target speed and adjusts it every 750ms, and the target speed displayed by the instrument increases by 5km/h.

Notes.

a For walk-stop ACC, the target speed range that the driver can set is 30-150km/h (calibratable).

b When the driver presses the button for $\leq 750\text{ms}$ (calibratable), it is a short press; when the driver presses the button for $> 750\text{ms}$, it is a long press. The logic judgment of long and short press is made by MRR.

c Adjustment to the long time press (for example, the current target speed is 66km/h, the long press should be changed by 70, 75, 80, 85km/h in sequence).

d If the target speed has reached the set max. (min.) value, continue to press the RES/+ button or SET/- button, the target speed will keep the current speed unchanged.

1.4、 Resume cruising

Function Description

The driver can resume the cruise by operating the RES/+ button.

1) Enabling conditions

a The ACC function is in stop mode.

b The cruise function has been used during this ignition cycle, and the previously set target speed and set headway have been stored.

2) Trigger condition

Driver operates res/+ key

3) Execute output

When the cruise function resumes, the previously stored target vehicle speed and the set headway are taken as the current vehicle speed and headway. The system state is switched to the active control mode or stopped. The instrument illuminates the green ACC status indicator and displays "ACC function activated" for 3S before disappearing.

1.5、 Cruise control

When the speed of the vehicle in the front driving track is greater than the target speed set by ACC vehicle or there is no vehicle, drive at the target speed set by the driver at a uniform speed.

1) Enabling conditions

The system state is in active control mode.

2) Trigger conditions

a Failure to recognize the vehicle in front.

b The distance with the vehicle in front is greater than the set target distance.

3) Execution output

a ACC controls the vehicle to drive according to the target speed set by the driver, and the instrument always shows the target speed.

b If the current speed is lower than the target speed, ACC control achieves vehicle acceleration.

c If the current speed is higher than the target speed, ACC controls the vehicle to slow down in a smooth manner.

1.6、 Follow Control

When the status of the vehicle ahead has a large impact on the ACC vehicle speed control (such as the vehicle ahead slowing down), it can automatically maintain the distance between the vehicle ahead and the ACC vehicle according to the set headway. If the vehicle ahead moves to a complete stop, this vehicle will also follow to the stop.

1) Enabling conditions

The system state is in active control mode.

2) Trigger conditions

Detailed reference to the Bosch platform program.

3) Execution output

a If the distance between two vehicles is less than the set time spacing of vehicle, the ACC vehicle will automatically perform deceleration control to ensure the distance between the two vehicles.

b If the distance between two vehicles is equal to the set time spacing of vehicle and the set target speed is higher than the speed of the vehicle in front, ACC controls the vehicle to drive with the vehicle in front to keep the set time spacing.

c If the vehicle in front slows down to stop, the ACC vehicle will also follow to stop, sending a request signal to ESC to stop.

1.7、 Start control after follow stop

After the ACC system decelerates the vehicle to a stop, the ACC can actively restore the system and re-drive the vehicle when the car in front of it leaves within 3s; within 3s-3min of a complete stop, the driver can start the vehicle by pressing the accelerator pedal or operating the RES/+ button. After 3min, the ACC activation process must be followed again.

2、Front Collision Warning(FCW)

2.1、FCW

The FCW on/off switch is used to control the enable and disable of the FCW function. Operate the multimedia system to set the FCW function on/off, and the instrument will prompt when it is on or off. When the vehicle is powered on for the first time, the FCW function is turned on by default, and then powered on again, the state of the last power down is remembered.

1) Enabling conditions

a Power mode is ON; b FCW function is off.

2) Trigger conditions

Operation MP5 to open FCW function, the whole vehicle MP5 set the signal sending logic : MP5 sets the signal as periodic message. The default value of MP5 _ FcwaNOffset is No Request. The driver operates MP5 to turn on the FCW function. The set signal is on, and three frames are sent continuously. Then the signal value is restored to No Request, and the MRR receives MP5_ FcwOnOffset =on to enable FCW function.

3) Turn off conditions

a Operate MP5 to turn off the FCW function when the FCW function is on; b Power mode is non-ON.

4) Execution output

a When the FCW function is off, operate MP5 to start the FCW function, the FCW function is on, and the system status is on; B when the FCW function is on, operate MP5 to close the FCW function, the FCW function is closed, and the system status is off; C instrument indicates the signal status according to MRR_ Pcwanoftstatus .

➤ 三、Introduction of ADAS system functions

ADAS系统



2.2、Instrument and alarm display

Illustration	Logical Description	Text Message	Sound Alarm
NA	No FCW function for this model		
 橘色常亮	Instrument display "Forward collision warning system is off" text for 3s, the FCW icon on the constant display interface is always orange		
 白色常亮	FCW system is on, but the working conditions are not met, it is in standby state, and the interface icon is always white.		
 绿色常亮	FCW system is on, this is the working state but no alarm, the interface is always green		
 红色闪烁	FCW system is on, it is working and generating alarm, the interface icon flashes red and triggers Level1 or Level2 alarm.	Danger ahead, please pay attention	Level1 alarm, fixed frequency beeping alarm (slightly slow)
		Danger ahead, please pay attention	Level2 alarm fixed frequency beeping alarm (sharp)

3、 Automatic emergency braking (AEB)

3.1、 AEB function on/off

Function Description

The AEB on/off switch is used to control the enable and disable of the AEB function. The MP5 system is operated to set the AEB function on/off, and the instrumentation prompts when it is on or off. Whenever the vehicle is powered on, the AEB function is turned on by default.

1) Enabling conditions

- A、 Power mode is ON.
- b、 AEB function is off.

2) Trigger conditions

Operate MP5 to turn on the AEB function.

3) Closing conditions

- a. Operate the MP5 to turn off the AEB function when the AEB function is on.
- b、 Power mode is non-ON.

4) Execute output

a、 When the AEB function is off, operate MP5 to turn on the AEB function, the AEB function is on, and the system state enters ON

b. When the AEB function is on, operate MP5 to turn off the AEB function, MP5 pops up the confirmation window, and the AEB function turns off after the driver confirms again, and the system status enters OFF.

3.2、 Alarm solutions

The driver will receive an alarm when there is a risk of collision between the self-car and the front, reaching a defined danger level.

Alarm program is as follows.

- 1、 The system detects the obstacle ahead and triggers the safety distance alarm (level 0 alarm), the alarm prompt given, the instrument displays the alarm picture, no sound prompt.
- 2、 The system detects the obstacle in front and triggers the pre-collision alarm (level 1 alarm), the alarm prompt is given, the meter displays the alarm picture, and MP5 carries out sound warning (When the user selects "Off", the MP5 does not give an audible warning; when the user selects "On", the MP5 gives an audible warning).
- 3, the system detects an obstacle in front of it, triggers an emergency alarm (for the car, secondary alarm), gives the alarm prompt, the meter displays the alarm picture, MP5 carries on the speaker sound alarm prompt, frequency 2Hz.
- 4, the system detects an obstacle in front of it, triggers an emergency alarm (for pedestrians, secondary alarm), gives an alarm prompt, the meter displays the alarm picture, MP5 carries out a speaker sound alarm prompt, frequency 2Hz.
- 5, the system detects the obstacle in front of it , triggering the AEB (for the car), the alarm prompt given, the instrument to display the alarm picture, MP5 for the speaker sound alarm prompt, frequency 2Hz.

➤ 三、 Introduction of ADAS system functions

ADAS系统



4、 Blind Zone Monitor_Lane Change Assist (BSD_LCA) System Introduction

The Blind Zone Monitoring/Lane Change Assist System monitors the driver's blind spot within the radar coverage area. When another vehicle is in the blind spot or approaching the car from behind at a very fast speed, the warning light on the outside mirror will come on to alert the driver; if the driver turns on the turn signal on the corresponding side at this time, the warning light on the outside mirror on the corresponding side will flash and the buzzer will sound an audible alarm to alert the driver of the danger of collision.

4.1、 BSD_LCA subsystem function

Subfunction	Function point	Functional Overview
setting	Turn on/off	The function is turned on and off by pressing the BSD-LCA switch.
Environmental Perception	Blind spot detection	After the BSD function is enabled, the BSD working conditions must be met at the same time before the BSD function can be activated.
	Lane Change Assist	After the LCA function is enabled, the LCA function needs to be met at the same time before the LCA function can be activated.
Alarm	Level 1 Alarm	When BSD_LCA is working, it is detected that there is a target vehicle behind the vehicle side, which is a first-level alarm. The LED warning light on the outside rearview mirror on the side of the target vehicle will be on for a long time.
	Level 2 Alarm	When BSD_LCA is working, it is detected that there is a target vehicle behind the vehicle side and the driver turns on the turn signal on the corresponding side, which is a secondary alarm. The LED warning light in the exterior mirror on the side where the target vehicle is detected will flash and the warning tone will sound.
Status Monitoring	System self-test	Every time the whole vehicle is powered on, the system will detect whether the state is normal, prompt the operating state of the system, and give different alarm prompts according to the results.
System failure	Alarm	When the BSD_LCA fails, the driver will be reminded through the IC.

4.2、BSD_LCA function on and off

The BSD_LCA switch is used to control the enabling and disabling of the BSD_LCA function. When the BSD_LCA switch is pressed by the operating MP5 system, the function is enabled/disabled and the corresponding status indicator on the instrument is illuminated. The BSD_LCA function is enabled by default when the vehicle is powered on for the first time; when the vehicle is powered on for the second and subsequent times, the BSD_LCA function remains the same as the previous ignition cycle.

1) Enabling conditions

- a. Power mode is ON.
- b. BSD_LCA function is off.

2) Trigger condition

Operate MP5 system to press BSD_LCA function switch.

MP5 signal sending logic.

3) Shutdown conditions

- a. Operating the MP5 system with the BSD_LCA function on, pressing the BSD function switch.
- b. The power mode is non-ON.

4) Execution Output

The display messages related to the BSD_LCA system status are as follows.

1. When the instrument receives the mrr_ signal, the instrument graphic indicates "BSD/LCA function is off", which disappears after 3s, and the BSD function indicator in the instrument lights up in yellow.
2. When the instrument receives the mrr_ signal, the instrument graphic indicates "BSD/LCA function is on" and disappears after 3s, and the BSD function indicator in the instrument is off.

5、 Door Opening Warning (DOW) System Introduction

DOW subsystem is similar to BSD_LCA function and is an extension of DOW function. When the car is at low speed (0 to 5km/h) and a vehicle approaches the car from behind and enters the alarm area (lateral:1.7m,longitudinal:2m,TTE:1.8s), and all four doors are closed, the alarm light on the exterior mirror will light up to remind the driver; if the driver or occupant opens the door at this time, the alarm light on the exterior mirror on the corresponding side will flash and the buzzer will sound alarm to remind the driver or occupant of the danger of collision.

5.1、 DOW Function

Sub-function	Function Point	Function Overview
Set	Turn on/off	The function is turned on and off by pressing the DOW switch.
Environmental Perception	Blind Zone Detection	After the DOW function is enabled, the DOW working conditions must be met at the same time before the DOW function can be activated.
Alarm	Level 1 Alarm	When DOW is working, it is detected that there is a target vehicle approaching behind the vehicle side and entering the alarm area, which is a first-level alarm. The LED warning light on the outside rearview mirror on the side of the target vehicle will be on for a long time.
	Level 2 Alarm	When DOW is working, it is detected that there is a target vehicle behind the vehicle side and the door on the corresponding side of the driver or co-driver is open, which is a secondary alarm. When the target vehicle is detected, the LED warning light of the exterior mirror on the side of the vehicle will light up and the buzzer will sound.
Status Monitoring	System self-test	Every time the whole vehicle is powered on, the system will detect whether the state is normal, prompt the operating state of the system, and give different alarm prompts according to the results.
	System failure alarm	If a malfunction occurs during work, the driver will be reminded via the instrumentation.

5.2、 DOW function on and off

The DOW switch is used to control the enabling and disabling of the DOW function. When the MP5 system is operated and the DOW switch is pressed, the function is enabled/disabled, and the corresponding DOW status indicator on the instrument is lit in the corresponding color. The DOW function is enabled by default when the vehicle is powered on for the first time; when the vehicle is powered on for the second time and thereafter, the DOW function remains the same as the last ignition cycle.

1) Enabling conditions

- a. Power mode is ON.
- b. DOW function is off.

2) Trigger conditions

Operate the MP5 system to press the DOW function switch.

The setting signal sending logic of MP5 of the whole vehicle.

3) Shutdown conditions

- a. Pressing the BSD function switch while the DOW function is on and operating the MP5 system.
- b. The power mode is non-ON.

4) Execution Output

The display information related to the DOW system status is as follows.

1. When the instrument receives mrr off, the instrument graphic will prompt "DOW function off", which will disappear after 3s, and the BSD function indicator in the instrument will light up in yellow.
2. When the instrument receives mrr open, the instrument graphic will prompt "DOW function on", which will disappear after 3s, and the DOW function indicator in the instrument will be off.

5.3、 Alarm

Level 1 Alarm

When DOW is working, a target vehicle is detected in the blind zone and the alarm conditions are met, which is a level 1 alarm. The LED alarm light on the side of the outside mirror of the detected target vehicle will light up amber and stay on for a long time. Details are as follows.

- 1、 When the DOW level 1 alarm (left) is triggered, BCM lights up the indicator light on the left exterior mirror to give the driver an alarm indication.
- 2、 When the DOW level 1 alarm (right) is triggered, BCM lights up the indicator light on the right exterior mirror to give the driver an alarm indication.

Level 2 Alarm

Function Description

When the DOW works, there is an alarm message generated and the door on the corresponding side (left/right) is opened, it is a secondary alarm. The LED alarm light on the outside mirror of the side of the target vehicle is detected will light up amber, stay on for a long time, and trigger the alarm sound of the instrument buzzer at the same time. Details are as follows.

- 1、 When the DOW secondary alarm (left) is triggered, BCM lights up the indicator on the left exterior mirror to give the driver an alarm indication. When MP5 receives the signal, the speaker (left) emits an alarm sound with a frequency of 2Hz.
- 2、 When triggering DOW secondary alarm (right), BCM lights up the indicator light on the right exterior mirror to give the driver an alarm indication. When MP5 receives the signal, the speaker (right side) emits an alarm sound with a frequency of 2Hz.

6、 RCTA System Introduction

The RCTA subsystem monitors the side and rear within the radar coverage. If a vehicle approaches the vehicle from the side and rear, the driver is alerted by sound as well as MP5 images to avoid a collision.

6.1、 RCTA function

Sub-function	Function Point	Function Overview
Set	Turn on/off	After POWER ON, the RCTA function is always on and cannot be turned off by the user
Environmental Perception	RCTA	After starting the RCTA function, it is necessary to meet the working conditions of the RCTA at the same time before activating the RCTA function.
Alarm	Alarm	When the RCTA works, if it detects that there is a target vehicle behind the vehicle side and the alarm conditions are met, the graphic information alarm is superimposed in the reverse image interface. (only when the reverse image interface is displayed on MP5 can there be graphic and directional voice alarm, and MP5 only carries out directional voice alarm on other interfaces)
Status Monitoring	System self-test	Each time the whole vehicle is powered on, the system will detect whether the status is normal, prompt the operating status of the system, and give different alarm prompts according to the results.
	System failure alarm	A malfunction occurs while the RCTA is operating and alerts the driver via the instrumentation.

6.2、 RCTA function on and off

After the power supply POWER ON, the RCTA function is on; after the power supply POWER OFF, the RCTA function is off.

Alarm

RCTA can be activated when the gear is R and RTCA is on . The alarm prompt function of RCTA is triggered when the conditions are met.

When the RCTA is working, the target vehicle is detected in the blind spot and the alarm conditions are met. Then there is a graphic prompt in the MP5 system in the reversing image interface (detecting the side of the target vehicle) and a voice alarm with orientation, which will disappear until the alarm condition is not met. MP5 only carries out the voice alarm with orientation in other interfaces. Details are as follows.

- 1、 When the RCTA alarm (left) is triggered, MP5 will receive the signal, and if the panoramic interface shows the reverse rear view image, the alarm icon on the left will be displayed in the reverse rear view image interface, and the speaker voice will prompt "please pay attention to the left rear".
- 2、 When the RCTA alarm (right) is triggered, MP5 will receive the signal, and if the panoramic interface shows the reverse rear view image, the alarm icon on the left will be displayed in the reverse rear view image interface, and the speaker voice will prompt "please pay attention to the right rear".



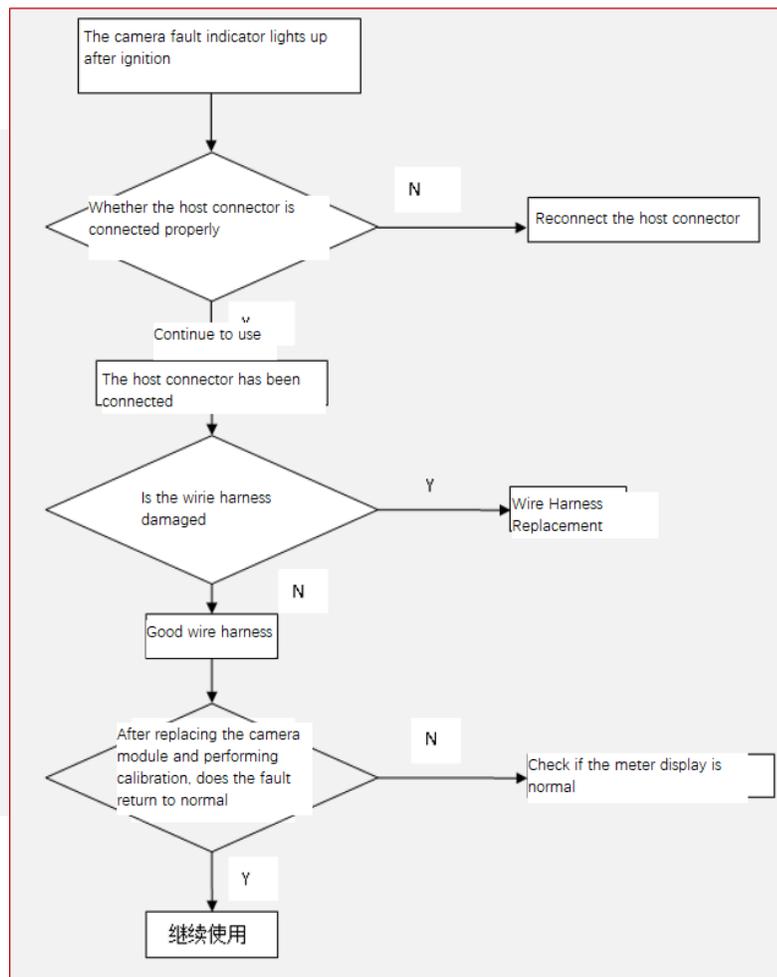


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- 02 Introduction to ADAS system
- 03 Introduction to ADAS system
- 04 Common fault diagnosis and fault codes**

四、Common fault diagnosis and fault code

ADAS系统



1. System failed to work

Specific performance : The function cannot be opened and triggered normally when the function opening conditions are met
Cause of failure: The Advanced Assisted Driving System is not working.

Maintenance method: Check whether the DC+12V power between pin 3 and pin 12 of the driver assistance multi-function camera is sent to the controller, and detect whether the wake-up signal on pin 6 is normal 12V; if the power is normal, please replace the controller.

2. Function temporarily unavailable

Specific performance: When the function is running, the combination meter reminds the driver that the function is temporarily unavailable.

Cause of failure: The sensor is temporarily incapable of functioning due to a temporary reduction in capability (affected by bright light, rain, snow, shading, etc.).

Maintenance method: No maintenance is required and the system recovers itself.

3. Camera blocked

Specific performance: The combination instrument reminds the driver that the camera is blocked.

Cause of failure: The camera is seriously blocked.

Maintenance method: Clean the transmission area of the lens on the outer surface of the windscreen.

4. Camera is not calibrated

Specific performance: Prompt that the camera is not calibrated after replacing a new camera

Cause of failure: Camera is not calibrated

Maintenance method: Perform camera calibration again

➤ 四、Common fault diagnosis and fault code

ADAS系统



DTC display code	DTC meaning	DTC display code	DTC meaning
B111716	Low battery voltage	U010383	ESP communication speed message 0x1f8 checksum Error
B111717	High battery voltage	U013187	Lost communication with ESP
U007488	CAN BUS off	U014087	Lost communication with BCM
U010187	Lost communication with TCU	U018687	Lost communication with IVI
U010186	Invalid communication with TCU	U01068A	Communication failure among radars
U010189	TCU communication gear message 0x132/0x126 Rolling counter Error	C040144	Internal Flash error
U010183	TCU communication gear message 0x132/0x126 checksum Error	C040297	Bumper covered by foreign matters
U012287	Lost communication with ESP	C040396	The angle calibration of the electrical function test of the vehicle off-line failed-internal fault
U012286	Lost communication with ESP	C040378	The angle calibration of the electrical function test of the vehicle off-line failed-Environmental interference
U012289	ESP communication yaw rate message 0x1fb Rolling counter Error	C04037C	The angle calibration of the electrical function test of the vehicle off-line failed-Triangular cone out of range
U012283	ESP communication yaw rate message 0x1fb checksum Error	C040395	Large deviation of radar installation angle
U010389	ESP communication speed message 0x1f8 Rolling counter Error		

➤ 四、Common fault diagnosis and fault code

ADAS系统



DTC display code	DTC meaning	DTC display code	DTC meaning
B111716	Low battery voltage	U010383	ESP communication speed message 0x1f8 checksum Error
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EPB System



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- 04** Fault repair and fault code of EPB system



Course Objectives

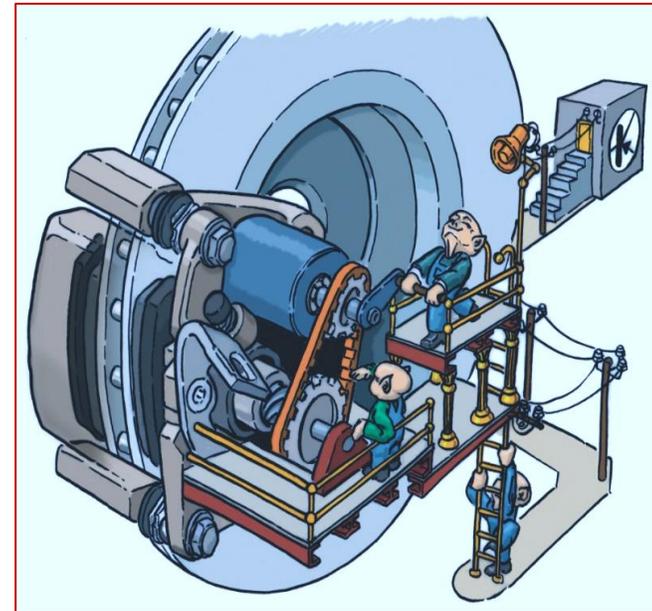
- Understand the composition and structure principle of EPB
- Understand the brake pad replacement procedure
- Use diagnostic instrument to test EPB system

1、 What is EPB

EPB, also known as Electrical Park Brake system, refers to the integration of the temporary braking during driving and the long-time braking function after parking. And by the electronic control method to achieve parking brake technology, from the technical upgrade, EPB compared to the traditional type of hand parking brake mode has advanced a big step.

The EPB system is manually operated by electronic pushbuttons and also has AUTOHOLD automatic control.

When the parking brake is required, the EPB button is pulled up, and the button operation signal is fed back to the electronic control unit, which controls the motor and the planetary reduction gear mechanism to work, and brakes the left and right rear brake calipers.





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➤ 二、Composition and working principle of

EPB系统



1、Composition of EPB

The EPB control system, like other electronic control systems, also consists of three parts: sensors (switches), electronic controllers, and actuators.

◆ The EPB system consists of a parking brake switch, left and right rear calipers equipped with planetary reduction mechanisms and motors, and an electronic control unit. The electronic control unit of this system communicates with the whole vehicle controller local area network (CAN) to control the motors on the left and right rear calipers.



➤ 二、Composition and working principle of

EPB系统



2.1、Parking switch

The parking switch is installed at the rear end of the transmission gear lever. The parking switch provides a digital signal to EPNECU. Its signal has two modes: parking brake and parking release.

NO.	Terminal name
1	Potential signal of button switch
2	Power Supply
4	Backlight
5	Grounding
6	Potential signal of button switch
8	Potential signal of button switch
9	Potential signal of button switch
11	ESC control signal

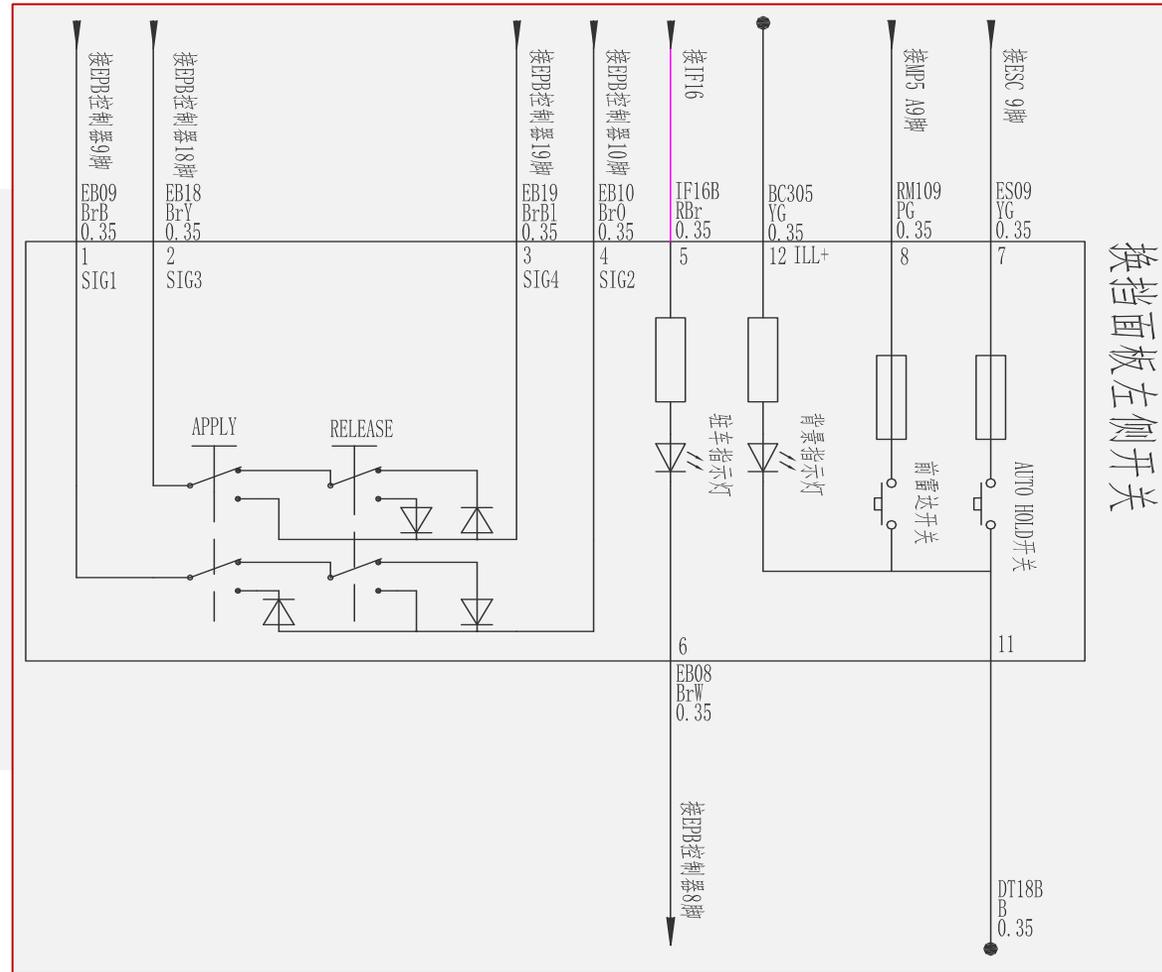


二、Composition and working principle of

EPS系统



2.2、Circuit diagram of parking switch



➤ 二、Composition and working principle of

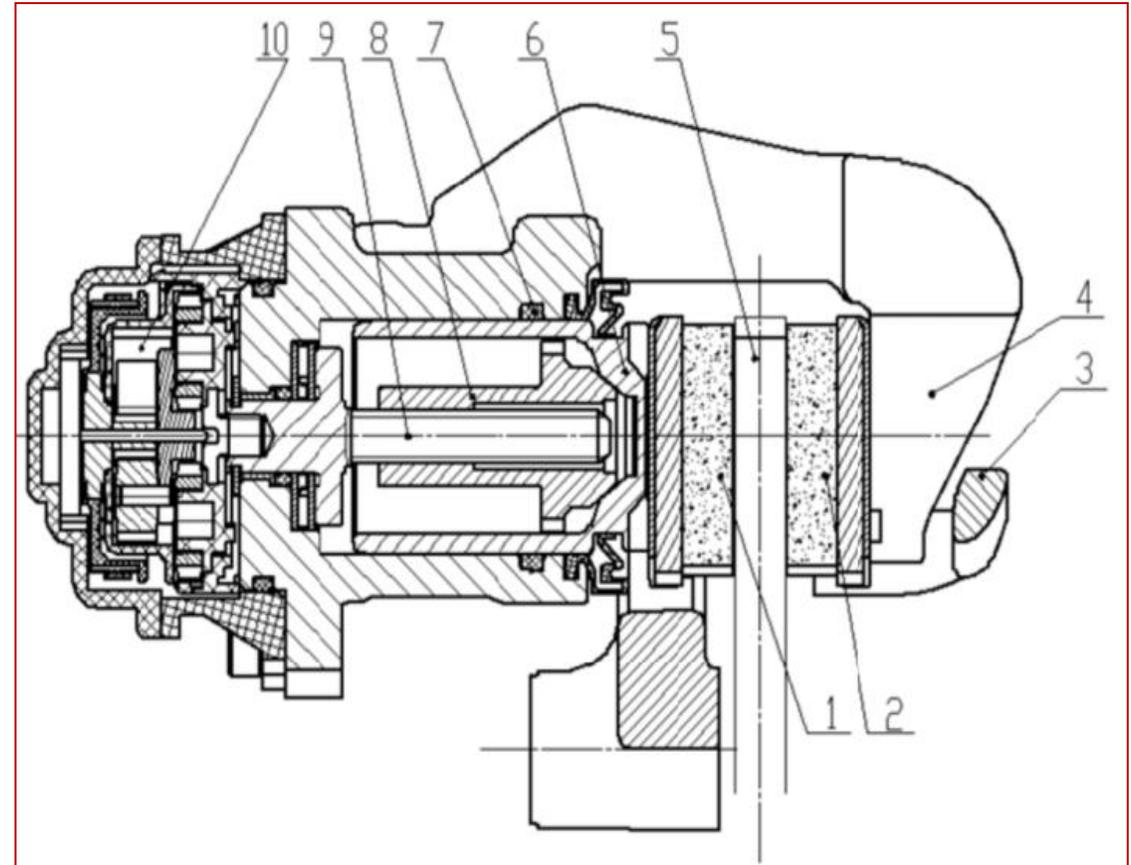
EPS系统



3、Parking Brake

Parking brake: pull up the parking button, the drive motor assembly rotates, driving the screw (9) to rotate, the rotation of the screw pushes the nut (8) forward, the piston (6) advances under the action of the nut (8), the piston clamps, completing the parking.

Park release: After pressing the button, the drive motor assembly rotates, driving the screw (9) to rotate, the rotation of the screw drives the nut (8) to retreat, the piston retreats under the action of the rectangular ring (7), and the piston (6) retreats to complete the release.



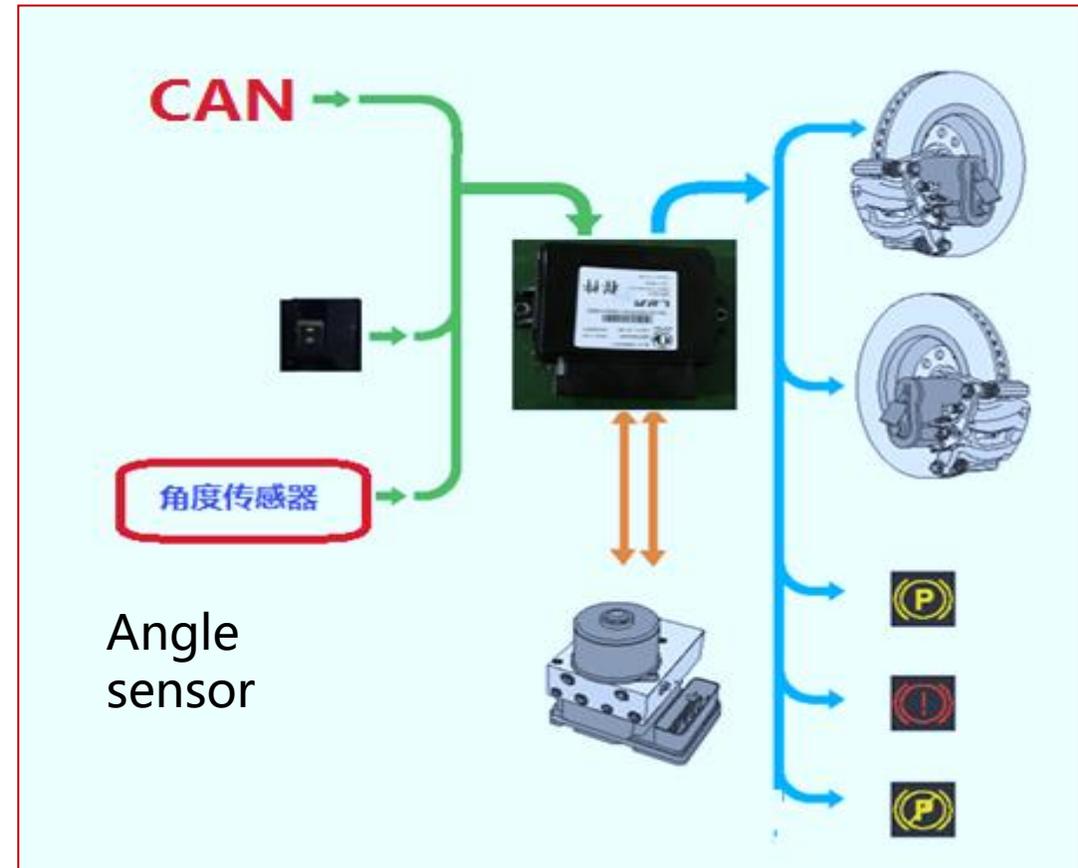
➤ 二、Composition and working principle of

EPB系统



4、How the EPB system works

The controller collects digital signals such as vehicle speed, engine speed, motor speed, parking brake switch and analog signals such as clutch position, brake pedal, accelerator pedal, gear switch, seat belt switch and slope, and the drive signals of the left and right DC motors output by the control system..

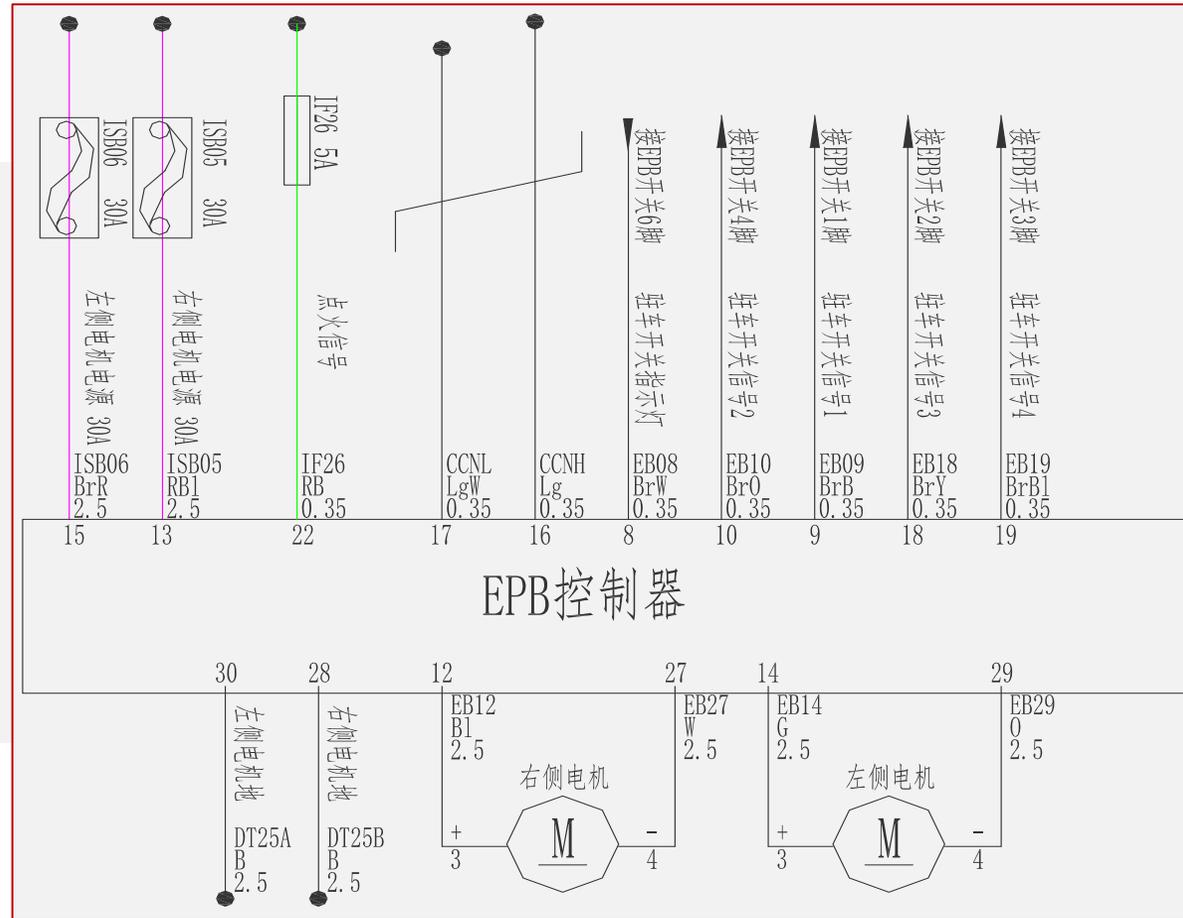


二、Composition and working principle of

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5、Circuit principle of EPB system





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➤ 三、EPB system function

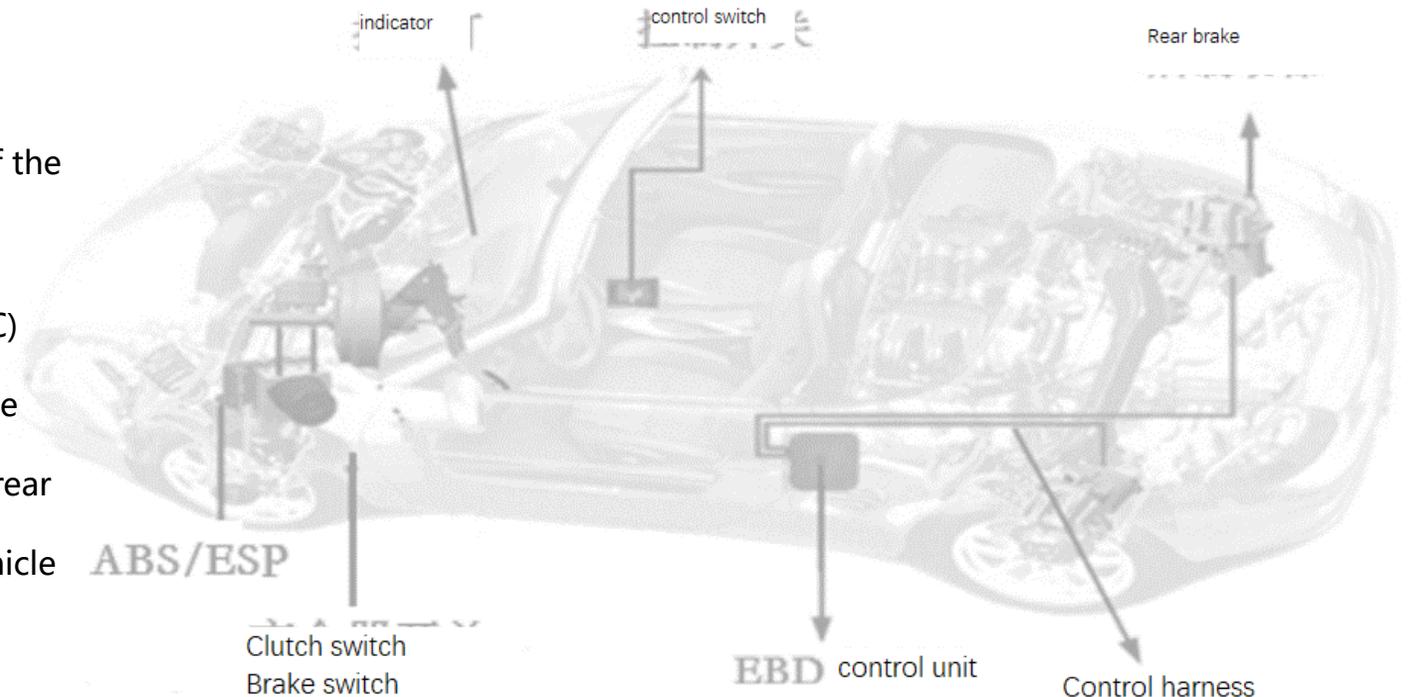
EPB系统



1、EPB functional form

There are three types of automatic control functions that are commonly used.

- One is that after the engine shuts down, the motor is jointly controlled by the vehicle CAN and the electronic control unit of the system to brake the left and right rear brake calipers.
- Another EPB system and electronic stability control system (ESC) jointly work to drive off the slope, when the vehicle starts on the slope, the EPB electronic control unit control the left and right rear wheel brake calipers, so that they automatically release, the vehicle can automatically drive off.
- The third AUTO HOLD refers to a function that automatically brakes the vehicle through the action of the ABS/ESP control unit.



➤ 三、EPB system function

EPB系统



2、EPB function introduction

function	operation	Action response	remarks
Auto park with the engine off	When the vehicle speed is <3.5km/h, from IGN ON→IGN OFF	The vehicle is parked and the park light is illuminated.	
Auto park with main door open	When the vehicle speed is less than 3.5km/h and IGN ON is in gear, open the main driving door.	The vehicle is parked and the park light is illuminated.	
Slope reclamping function		EPB in the clamping state, IGN OFF within 10 minutes of detection of the parking wheel speed signal, EPB automatically clamping again to the maximum clamping force	EPB cannot be triggered in its normal state.
Slope reclamping failure alarm function		Within 10 min of IGN OFF, if the EPB still detects the parking wheel speed signal after executing the slope re-clamping function, the alarm light will illuminate.	EPB cannot be triggered in its normal state.
Clamp after high temperature cooling		If the time calculated by the temperature model is <10min, the clamping is judged according to the wheel speed signal, and if >10min the clamping is done again according to the temperature model time.	EPB cannot be triggered in its normal state.
automatic release	Drive the car to a high place (slope > 5%), the gear is in forward or reverse gear, fasten the seat belt, close the door, lift the brake pedal, and then step on the accelerator pedal steadily.	EPB automatically disengages the parking brake and the parking lights go out.	
	Drive the car to a low place (slope > 5%), the gear is in forward or reverse gear, the seat belt is fastened, the door is closed, lift the clutch pedal, and step on the accelerator pedal.	EPB automatically disengages the parking brake and the parking lights go out.	
	The vehicle is on a road with a gradient of <5%, the gear is in forward or reverse gear, the seat belt is fastened, the door is closed, the clutch pedal is lifted,	EPB automatically disengages the parking brake and the parking lights go out.	

➤ 三、EPB system function

EPB系统



function	operation	Action response	remarks
Child lock	In the IGN OFF position, touch the EPB button	The park light is on and the EPB cannot release the parking brake.	
Dynamic parking	Vehicle speed > 3.5km/h, continuously pull up the EPB switch.	EPB performs dynamic braking function (anti-lock function), brake tail light illuminates, release EPB switch, EPB releases; park indicator light flashes. (Park stop at speed <3.5km/h.)	
Fault Alarm		When the EPB is malfunctioning, the alarm indicator lights up and goes off when the fault is cleared.	
Background light for button	Turn on the small light.	When the night light is on, the background light (red) of the EPB switch button lights up, and when the night light is off, the background light of the EPB switch goes out.	
Faulty parking	When the speed signal fails (ABS or CAN bus failure), pull up the park button > 30s	EPB按小驻车力制动，30s后逐步加大驻车力直至驻车成功。若驻车成功前释放驻车按键，将释放制动。	

3、Static mode (park and release function)

When the electronic parking control module receives the parking button signal and the electronic parking system is informed through CAN bus that the vehicle speed is lower than 3.5km/h at this time, the vehicle enters the static mode state and the electronic parking module controls the rear left and right wheel brake motors to realize normal parking brake. At the same time, the system lights up the electronic parking indicator on the combination instrument through CAN network; according to the different slope to achieve different parking force, to avoid the pulling force is not enough to produce skidding accidents;

4、Dynamic mode (emergency braking)

If the brake pedal gets stuck or fails during the vehicle's driving, the driver can continuously pull up the parking brake button, and the electronic parking module will exchange information with the brake control module through the CAN network after receiving the brake request signal, so that the EPB can apply the brake and realize the "dynamic emergency braking function".

5、AUTOHOLD

The AUTO HOLD system is a technology application that enables automatic braking while the vehicle is in operation. With the automatic parking brake activated, this technology allows the driver to stop the vehicle without having to apply the brakes for a long time and can avoid unnecessary skidding of the vehicle.



The AUTOHOLD mode enables the driver to avoid unnecessary sliding of the vehicle without braking for a long time and starting the electronic parking brake. In addition, this function also prevents the vehicle from sliding when starting on a slope.

5.1、Method of use:

1. Turn on/off the auto park hold function: With the engine running, the left front door closed and the driver's seat belt fastened, press the "AUTO HOLD" switch to turn on the auto park hold function (the AUTO HOLD green light on the combination meter is on); with the auto park hold function on, press the "AUTO HOLD" switch again to turn off the auto park hold function (the AUTO HOLD green light on the combination meter is off). Press the "AUTO HOLD" switch again to turn off the automatic park and hold function (the AUTO HOLD green light on the combination meter goes off).
2. Automatic park and hold function activation: After the automatic park and hold function is turned on, when the vehicle speed is zero, press the brake, to activate the automatic park and hold function , and the red P indicator on the meter lights up. At this time, release the brake pedal, the wheels keep the brake state, and the vehicle remains stationary; this state is maintained for more than 10min, then it automatically switches to EPB static park mode, the rear wheel EPB caliper motor works, holding The rear wheel brakes work and the red P indicator lights up on the instrument.
3. Automatic park and hold status release: lightly press the accelerator pedal to release the park and hold status, and the red P indicator of the instrument goes off.

5.2、AUTOHOLD Precautions :

1. To start AUTO HOLD, all the doors must be closed and the seat belt buckled. It is recommended to turn on AUTO HOLD when waiting for traffic lights, traffic jams, or following the car slowly uphill to ensure that you will not slip back.
2. It is recommended to turn off AUTO HOLD when reversing. The system will be locked and opened repeatedly, which will cause insecurity in a narrow space. Some models may automatically turn off when reversing, please refer to your own manual for details.
3. When starting with AUTO HOLD, the accelerator should be gentle and give AUTO HOLD a little time to unlock.

5.3、 What is the difference between AUTO HOLD and hill assist?

The automatic parking system (AUTO HOLD) is based on the electronic handbrake system, while the hill assist system (HAC, HHC, etc., named differently by manufacturers) is based on the ESP system. As long as the automatic parking is activated regardless of whether it is flat or hill the system will continue to hold the brake until the sensor senses that the gas pedal has been depressed. The hill assist, on the other hand, works when the system detects that the vehicle is on a hill, and only holds the brakes for a short time (2-3 seconds), with no connection to the gas pedal.

For AUTO HOLD function, it is more suitable for "lazy people". Simplify the operation, to win the convenience of the same time, but also to reduce the "skid" brought about by the accident. However, in order to protect the environment and reduce the wear and tear of the transmission system, automatic models are better to park in N gear at the right time.



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- 01** EPB system overview
- 02** Composition and working principle of EPB system
- 03** EPB system functions
- 04** Fault repair and fault code of EPB system

1、EPB troubleshooting steps

Step 1: Confirm whether the controller ignition switch (PIN11) and controller power supply (PIN26) are normal

1) Turn on the ignition switch 2) Light up the parking indicator on the parking button 3) Turn off the ignition switch 4) Observe whether the parking indicator is delayed off, if it is delayed off, the ignition switch and the controller power supply are normal.

Note:For models without AUTO indicator, it is not necessary to observe this indicator.

Step 2: Use diagnostic instrument to read the fault code and troubleshoot according to the code instructions. When the fault code indicates "self-test fault" or motor related fault, the possible causes should also include the motor power cable (controller PIN13 PIN15) fault.

Step 3:Make sure the manual park, auto park, manual release and auto release functions (uphill forward, uphill reverse, downhill forward, downhill reverse) are all normal.

Step 4:Clear the history and current fault codes using the diagnostic instrument.

Step 5:Turn off the ignition switch. 5 seconds later, turn on the ignition switch and use the diagnostic instrument to read the fault code to ensure that no fault repair is completed.

2、 Troubleshooting when there is no fault code

Verify that the ignition switch (controller PIN22) and controller power supply (controller PIN26) are normal. Depending on the failed function, confirm that the necessary conditions for the function and the trigger conditions are met.

3、 Controller replacement

Step 1: Turn off the ignition switch.

Step 2: Remove the fixing bolt of the original controller and unplug the wiring harness connected to the controller.

Step 3: Replace the controller with a new one, tighten the fixing bolt, and plug in the wire harness connected to the controller.

Note that the connector of the controller is facing the front of the car.

Step 4: Turn on the ignition and read the fault code. If there is a fault, troubleshoot it as described in "Product Troubleshooting".

Step 5: Stop the vehicle on a level road and use the diagnostic instrument to calibrate the zero point of the angle sensor.

Step 6: Turn off the ignition key and turn on the ignition key after 5 seconds. Must operate and do not allow the battery to lose power.

Step 7: Use diagnostic to read the angle zero point and confirm the angle sensor zero point is calibrated correctly.

Step 8: Test the manual park function, manual release function, automatic park function, flat road automatic release function, uphill forward gear automatic release function, uphill reverse gear automatic release function, downhill forward gear automatic release function, downhill reverse gear automatic release function and dynamic park function.

All functions are normal, the replacement of the controller is completed.

Note: The same type of controller must be used for replacement.

4、Procedure for replacing brake pads

Step 1: Keep the ignition switch is ON.

Step 2: Cancel the auto park function. Confirm whether the auto mode indicator is off or not. If the auto mode indicator is lit, press the mode button and the auto mode indicator goes off to prove that the auto mode is cancelled successfully.

Step 3: Perform maintenance release operation. Ignition switch to ON, depress the brake pedal (can), then operate as follows:

1) press the parking button and hold it for 10[^]15 seconds, 2) release the parking button and immediately press the parking button again, the time to release the parking button in this operation should be less than 1 second. After the above two steps are completed, the electronic parking ECU assembly will execute the maintenance release action, and the sound of mechanical rotation at the rear brake caliper assembly will be heard when the action is executed.

Step 4: Turn the ignition switch to OFF, the electronic parking ECU assembly should not operate, and the sound of mechanical rotation at the rear brake caliper assembly should not be heard.

Step 5: Use torque wrench to loosen the 'sliding shaft bolt'

Step 6: Rotate the caliper parts in the counterclockwise direction by a certain angle, the angle is appropriate.

Step 7: Remove the old brake pads.

Step 8: Press the piston to the bottom.

Step 9: Replace the brake pads with new ones.

Step 10: Adjust the torque to 30-35N.m and use a torque wrench to lock the 'sliding bolt' to complete the replacement (as shown in Figure III).

Step 11: Perform manual parking and manual release operation, if the electronic parking ECU assembly works normally, the brake pad replacement is finished.

Note: Step 3 can also use diagnostic instrument for maintenance release operation

➤ 四、EPB system fault repair and fault codes

EPB系统



5、EPB emergency response

When the car is locked, it cannot be released by button operation, use the following method to release the parked car.

If the brake cannot be released

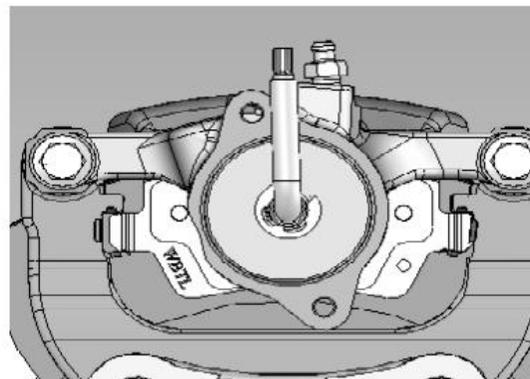
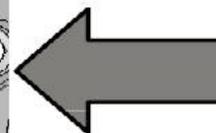
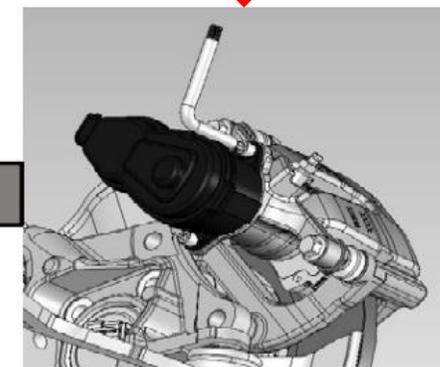
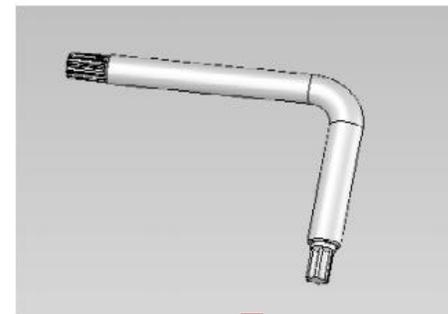
remove the wheel;

Remove the motor fixing bolts;

Rotate the parking screw 2 to

3 turns clockwise

Reinstall the motor.



6、 EPB brake motor installation

Pay attention to the pressure into the right strength, not to squeeze, cut O-ring;

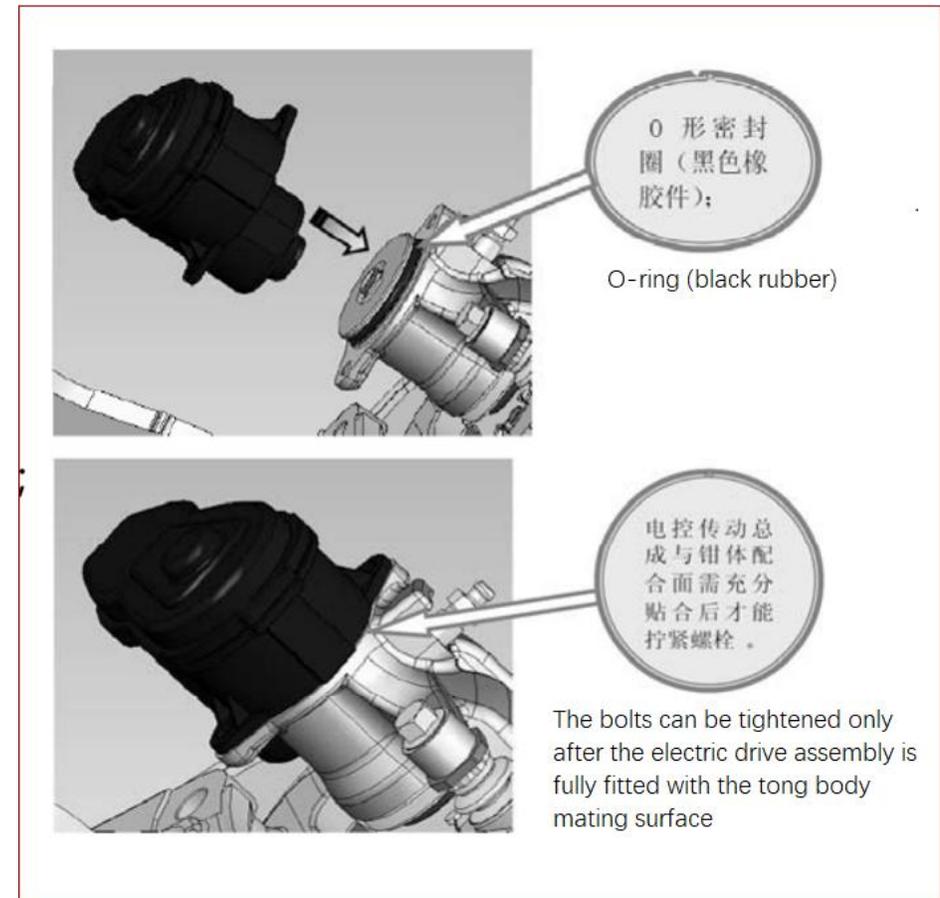
The motor and the clamp body should be fully fitted when assembled

Fixing bolt can not be used twice;
tightening torque 9-11N.M;

Do not use the EPB function again when EPB fails.

7、 Product initialization

The controller performs the angle sensor zero initialization when the ignition switch is turned on for the first time after leaving the factory. The OEM needs to ensure that the vehicle is in a horizontal position when the controller turns on the ignition switch for the first time. If the angle sensor zero point is initialized incorrectly, the angle sensor zero point needs to be recalibrated using a diagnostic instrument



四、EPB system fault repair and fault codes

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8、Common brake faults and troubleshooting

Common faults and troubleshooting of integrated electronic parking brake		
Fault	Cause of fault	Exclusion method
Poor braking	1. Air in the brake line	Exhaust air
	2. Brake disc or drum deformation, poor contact	Repair or replacement
	3. Poor sliding of wheel cylinder piston	Repair or replacement
Brake stuck	1. The wheel cylinder cup is swelled and the piston is stuck	Replacement, cleaning or repair
	2. Automatic adjustment device of brake gap is bad	Disassemble and overhaul
	3. Poor return of the parking brake	Timely correction
	4. Severe deformation of the brake disc	Repair or replacement
Braking deviation	1. The gap between the left and right friction plate and the disk is not equal	Adjust to Consistency
	2. Single-sided friction plate with oil	Repair or replacement
	3. Brake caliper return spring is damaged or poorly assembled	Repair or replacement
	4. different friction plate models, manufacturers	Replace with same manufacturer, same model
	5. There is air in the wheel cylinder, oil pipe blockage or jamming	Repair
	6. The air pressure and wear of the left and right tires are different	Repair or replacement
	7. Suspension spring damage or bad shock absorber	Replacement
Braking failure	1. Brake pipe rupture or joint oil leakage	Replace or fasten
Brake fluid leakage	2. Leakage at the brake pipe joint	Disassembly and replacement
	3. Leakage of brake wheel cylinder	Replacement of seal
Parking cannot be released	1. Parking device failure	Repare or replace with same manufacturer, same model
	2. ECU failure	Replace with same manufacturer, same model

➤ 四、EPB system fault repair and fault codes

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8、Common brake faults and troubleshooting

DTC display code	DTC meaning	DTC display code	DTC meaning
C100196	EPB actuator or motor rear left	U007488	High-speed CAN communication bus failure
C100296	EPB actuator or motor rear right	U010087	Lost communication with EMS
C100377	EPB actuator error or irrelevance (left, right or both)	U010187	Lost communication with TCU
C100549	Demand light error	U012287	Lost communication with ESP
C100509	EPB switch is damaged	U014087	Lost communication with BCM
U300A29	Ignition switch error	U015587	Lost communication with IC
U300049	Control module error	U015187	Lost communication with ABM
U300053	EOL error	U040181	Invalid data received from EMS
U300054	EOL error	U040281	Invalid data received from TCU
U300368	Activity information error	U040381	Invalid data received from ABM
B111717	The circuit voltage is above the threshold	U041681	Invalid data received from ESP
B111716	The circuit voltage is below the threshold	U041181	Invalid data received from IC
U000187	High-speed CAN communication bus failure	U041281	Invalid data received from BCM



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