

Confidentiality level: Level 1

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EHB Product Manual

Version 1.0

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Change history

Table 1. Revised History Record Form

version	Description of Change	Change date	Prepared by	proofreader
V1.0	create	2020/5/16	PanGuangliang	JiangChenyu

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1 Overview

1.1 Product description

The Electro-Hydraulic Braking System uses the motor as the power source, and transmits the motor power to the hydraulic master cylinder through the transmission mechanism, pushing the hydraulic master cylinder to build pressure. The EHB system is small in size, light in weight, easy to install, and has a fast pressure response speed. It can achieve assisted braking, wire controlled braking, and brake energy recovery functions, providing brake assistance to drivers while meeting the needs of advanced driving assistance systems and intelligent driving.

The Jiyu EHB system adopts a highly integrated solution, integrating the pedal feel simulator assembly, pedal displacement sensor assembly, motor assembly, transmission mechanism assembly, master cylinder assembly, and electronic control unit assembly. When the EHB system is in operation, the ECU assembly analyzes the braking intention of the entire vehicle based on the pedal displacement sensor assembly signal and other signals of the vehicle. By controlling the motor assembly to generate corresponding torque and pushing the master cylinder assembly to establish hydraulic pressure through the transmission assembly, the braking function is achieved; At the same time, the pedal feel simulator provides the driver with a good brake pedal feel.

The Jiyu EHB system can be easily and conveniently matched with traditional chassis braking systems, completely replacing vacuum boosters and their ancillary components, providing active assistance function. Compared to vacuum boosters, the Jiyu EHB system can achieve line controlled braking function, and upper level controllers such as the vehicle controller can send line controlled braking commands through CAN communication to execute braking; The Jiyu EHB system has decoupling characteristics between brake pedal input and brake fluid pressure output to achieve more efficient regenerative braking. Jiyu can match the optimal energy recovery algorithm based on the characteristics of EHB, and adopt a coordinated energy recovery strategy to maximize energy recovery without changing the driver's braking needs and meeting the safety requirements of the entire vehicle.

1.2 List of product technical standards

Jiyu EHB meets the requirements of relevant national laws and regulations.

Table 2. List of technical standards

order numbe	Standard number	Standard name	standard type
1	ISO 16750 1-5	Environmental test methods and requirements for electrical and electronic equipment of road vehicles	international standard
2	ISO 11452	Test of electrical interference parts caused by narrow band radiation electromagnetic energy of road vehicles	international standard
3	ISO 10605-2008	Test method for electrical interference caused by static discharge of road vehicles	international standard
4	GB 7258-2017	Safety and technical conditions for motor vehicle operation	national standards
5	GB 21670-2008	Technical requirements and experimental methods of passenger car braking system	national standards
6	GB/T 30512-2014	Requirements for prohibited substances in automobiles	national standards
7	QC/T 564-2008	Performance requirements and bench test method for passenger vehicles	occupation standard
8	QC/T 307-2016	Performance requirements and test bench method	occupation standard
9	QC/T 311-2008	Performance requirements of automobile hydraulic brake master cylinder and bench test method	occupation standard
10	QC/T 1067-2017	Connectors for automotive wire harness and electrical equipment	occupation standard

1.3 Product functions

1.3.1 Power braking

When the driver steps on the pedal, the pedal displacement is detected through the pedal displacement sensor. The pedal displacement corresponds to the target brake

fluid pressure, and the EHB motor outputs an appropriate torque to achieve this target fluid pressure.

1.3.2 Line control movement

The vehicle controller sends a braking command to the EHB controller, which includes the target braking deceleration/brake fluid pressure. EHB will automatically calculate the required EHB motor output torque and execute brake commands to achieve by-wire braking.

1.3.3 Brake energy recovery

The braking energy recovery system implemented by Jiyu based on EHB has a high braking energy recovery rate, which can maximize the utilization of the driving motor for energy recovery. Based on the NEDC working cycle, the braking energy recovery rate can reach 20%. The braking sensation during the energy recovery process is good, meeting the safety requirements of the entire vehicle.

1.4 Product characteristics

- 1) Match with the traditional chassis brake system, completely replace the vacuum booster and its auxiliary parts;
- 2) decoupling of brake pedal from brake fluid pressure to achieve efficient regenerative braking;
- 3) Support line control movement, which can realize automatic emergency braking, advanced driver assistance system, and intelligent driving;
- 4) Using permanent magnet synchronous motor, long life, high reliability;
- 5) High accuracy of liquid pressure control and fast response;
- 6) High integration degree, small volume, light weight, convenient installation;

1.5 Product parameters

Table 3. Product parameters

12V The operating voltage range of the V system	9V~16V
24V The operating voltage range of the system	18V~32V
Operating temperature	-40°C~120°C
Maximum Pressure Capacity	> 14MPa (T185) > 17MPa (T1120)
10MPa active build pressure time	≤200ms

Deadlock time TTL (Time To Lock)	$\leq 250\text{ms}$
size	357mm*222mm*185mm
weight (kg)	~5.9kg
levels of protection	IP67

2 System composition

2.1 Appearance

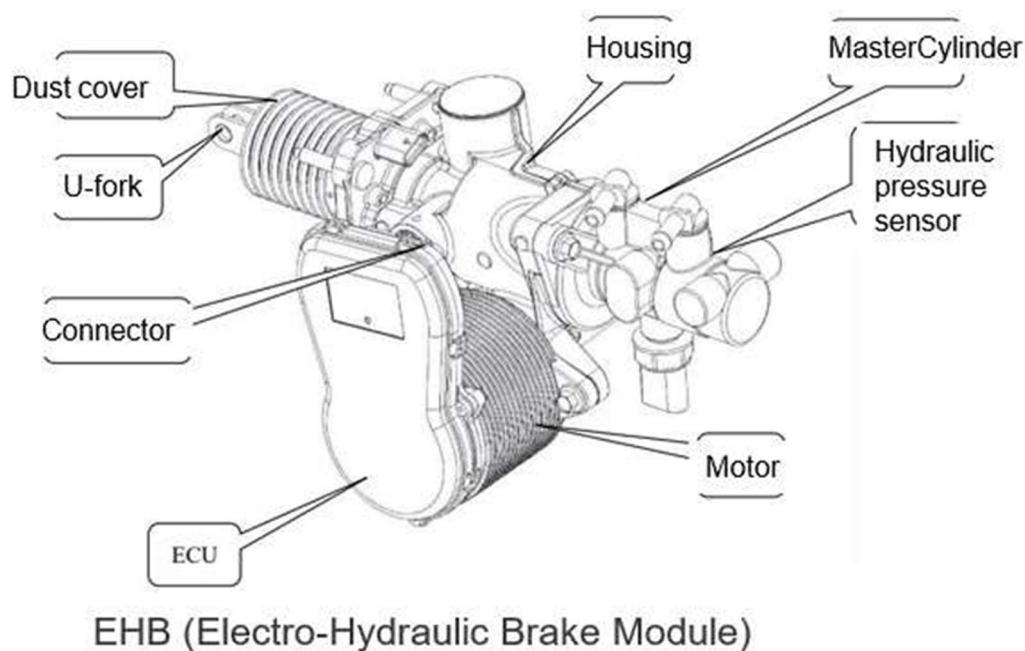


Figure 1. EHB component composition

2.2 Installation dimensions

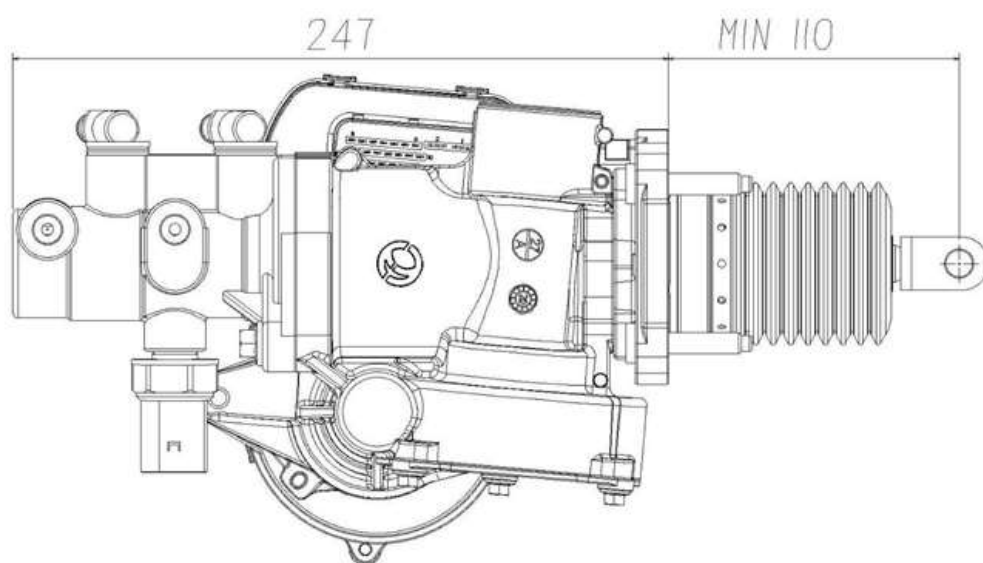


Figure 2. Main view (T185)

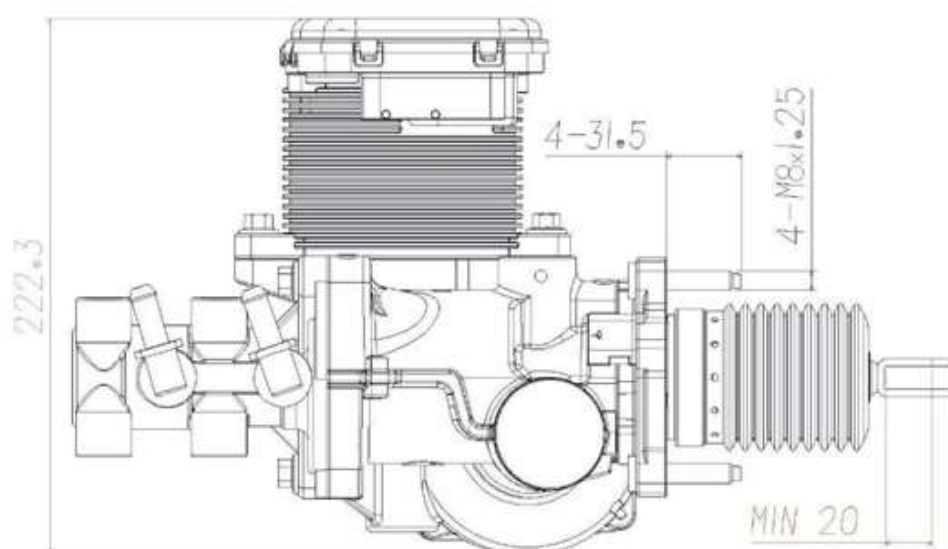


Figure 3. Top view (T185)

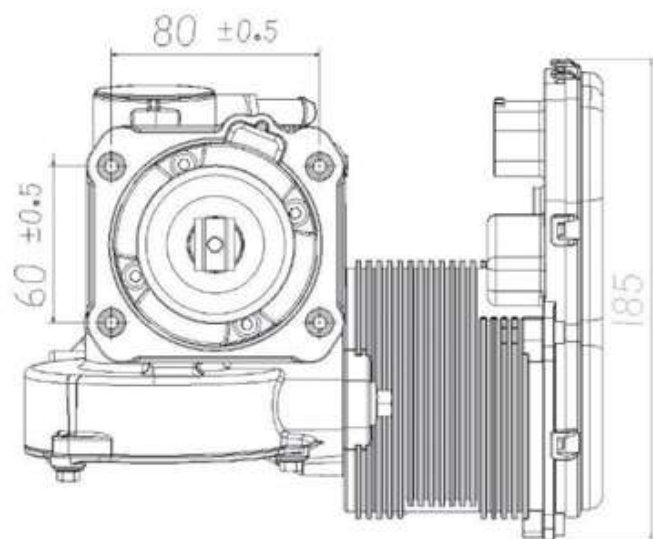


Figure 4. Right view (T185)

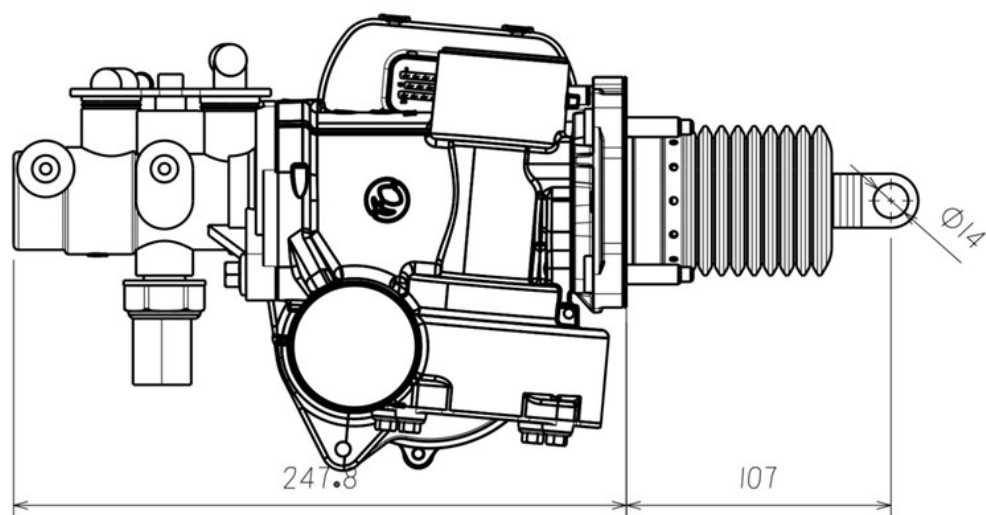


Figure 5. Main view (T1120)

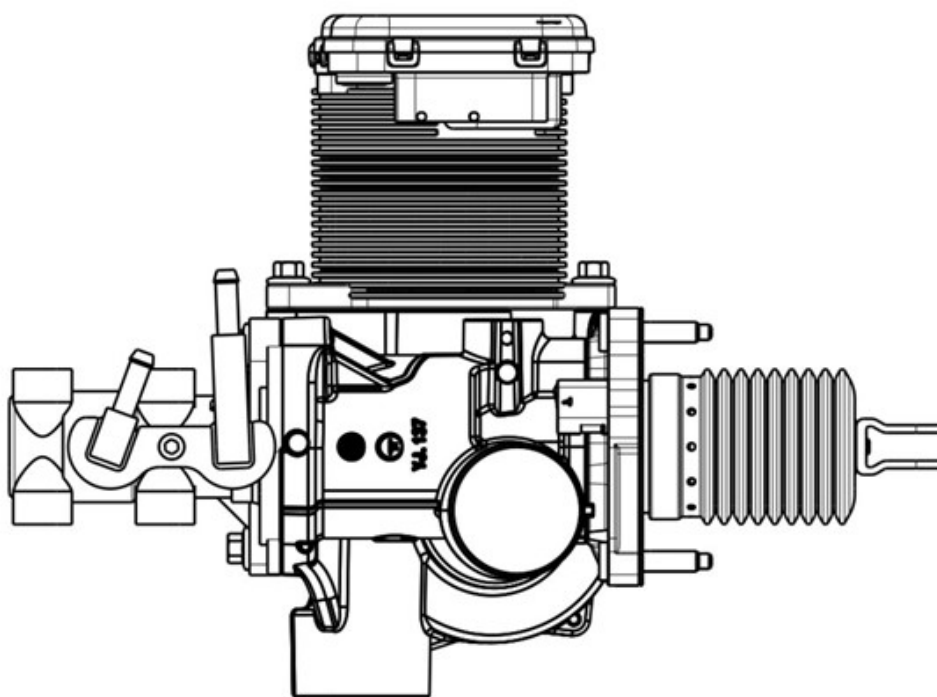


Figure 6. Top view (T1120)

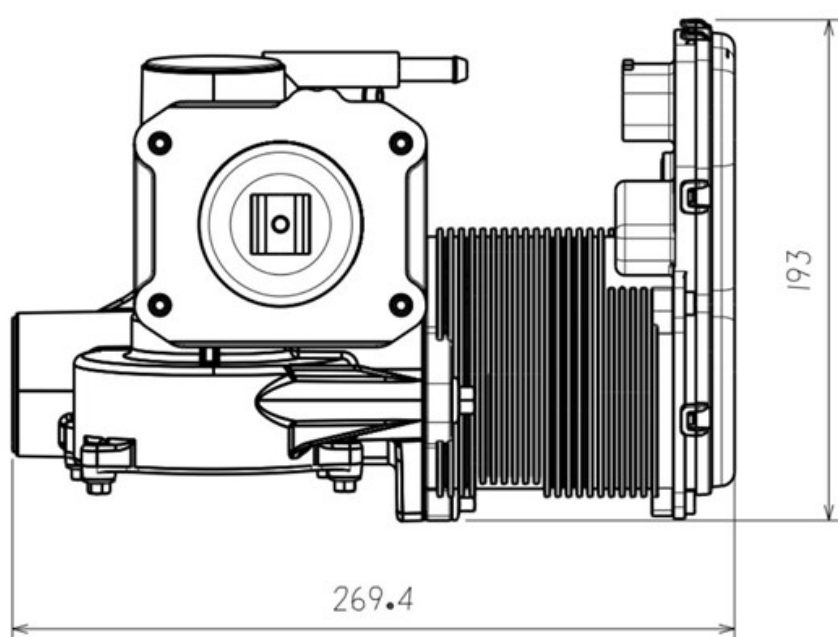


Figure 7. Right view (T1120)

EHB mounting holes can be selected from 60x80, 60x70 and 72x72 according to customer requirements.

2.3 Permanent magnet synchronous motor

The permanent magnet synchronous motor can drive the electronic hydraulic braking system (EHB) of the vehicle with high efficiency, and the overall design meets the IP67 level.

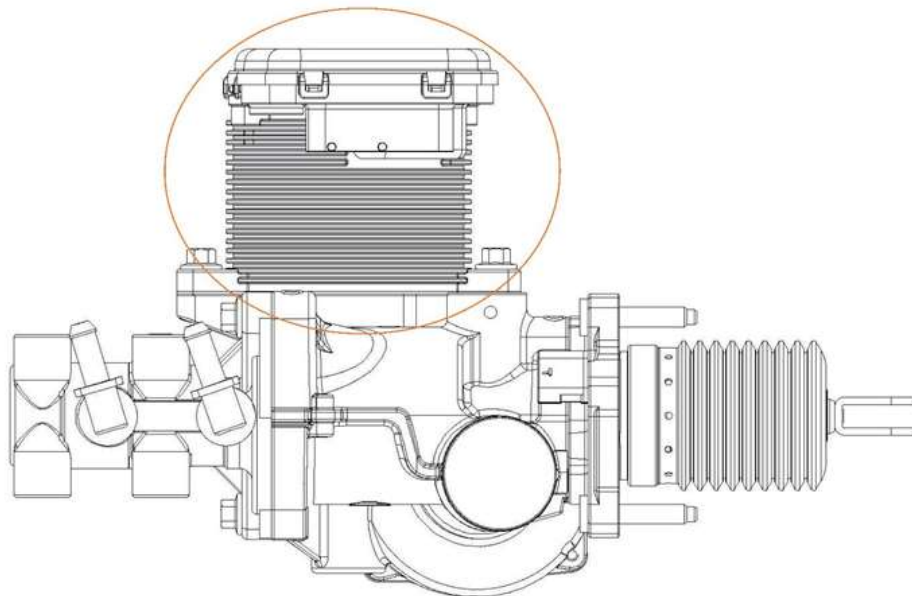


Figure 8. Motor position

2.3.1 Motor characteristics

Fast, dynamic response

Small and lightweight module

Long service life, without any maintenance and maintenance

High efficient torque output and lower power consumption

The operation is quiet and stable

2.4 EHB electronic controller (ECU)

The ECU completes functions such as exchanging information with the entire vehicle, collecting sensor information, and controlling the motor. The ECU meets the following electrical conditions and safety requirements.

Table 4. EMC Test

project	Test items
---------	------------

EMC (Reference to SAIC standard)	BCI (high-current injection interference)
	RI (spatial electromagnetic wave interference)
	CE (transduced radiation)
	RE (space electromagnetic wave radiation)
	ESD (electrostatic discharge)
	CI (transient conduction anti-interference)
	MFI (magnetic field anti-interference)

Table 5. Electrical performance test requirements

project	Test items
behaviour of electricity	Long time over voltage
	transient overvoltage
	Instantaneous undervoltage
	The transition starts the voltage
	Throw load voltage
	The ripple voltage is superimposed
	The power supply voltage drops slowly and rises slowly
	The power supply voltage drops slowly and increases rapidly
	Reset performance
	Short-term interruption
	The pin interrupt
	Connection plug-in interrupt
	start pulse
	reversed polarity
	Ground offset
	Short-circuit to the signal line and the load
	Insulation impedance
	Static current test
	dielectric strength

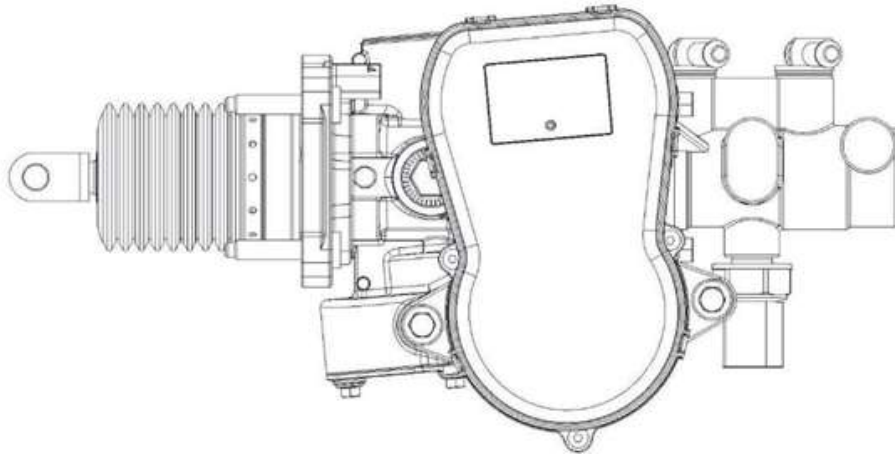


Figure 9. Schematic diagram of the motor controller position

2.4.1 Requirements of the working environment

Operating voltage of 12V system: 9V~16V, typical value 13.5V

Operating voltage of 24V system: 18V~32V, typical value: 27V

Working environment temperature: -40°C ~105°C

Storage temperature: -40°C ~105°C

Storage humidity: 0-100%

Static current (KL 15 down): <1 mA

Static current (KL 15 power on @ no): <500 mA

Maximum power-driving steady-state current: 40A

Maximum instantaneous current: 60A, duration <200ms

2.5 shift sensor

The EHB dedicated non-contact displacement sensor independently developed by Jiyu utilizes the detection of changes in the magnetic field angle of the permanent magnet placed in the push rod, which is then converted into a signal output by the induction IC Hall chip. It has high stability and compatibility, and has passed vehicle environmental durability testing and various electronic characteristic tests.

2.5.1 Displacement sensor characteristics

A contactless design using the Hall effect

Double signal complementary output

Provide diagnostic function

2.6 Liquid pressure sensor

hydraulic pressure through the sensing surface, which is then converted into an analog signal output by the IC. It has the characteristics of high accuracy and good stability, and has passed vehicle environmental durability testing and various electronic characteristic tests.

2.6.1 Parameters of the liquid pressure sensor

Table 6. Specifications of the liquid pressure sensor

service voltage	4.75~5.25V
operating temperature range	-40°C~140°C
working pressure	0~300bar
safe pressure	450bar
bursting pressure of tank shell	600bar

3. Definition of the connector device

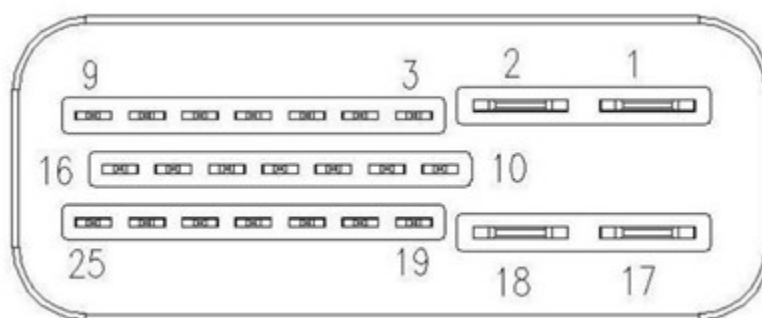


Figure 7. Connection line pin diagram

Table 7. Definition of the connector

order number	components and parts Pin	Pin, and the foot function
1	PIN 1	Power supply ^{+(KL30)}
2	PIN 2	Power supply ^{+(KL30)}
3	PIN 3	Fluid pressure sensor _GND
4	PIN 4	Fluid pressure sensor signal
5	PIN 5	Fluid pressure sensor power supply
6	PIN 6	Displacement sensor signal 2
7	PIN 7	displacement sensor _GND1
8	PIN 8	Displacement sensor power supply 1
9	PIN 9	The liquid level detection positive
10	PIN 10	displacement sensor _GND2
11	PIN 11	Void
12	PIN 12	Displacement sensor power supply 2
13	PIN 13	The fluid level detection negative
14	PIN 14	Displacement sensor signal 1
15	PIN 15	Void
16	PIN 16	Void
17	PIN 17	Power Supply - (KL 31)
18	PIN 18	Power Supply - (KL 31)
19	PIN 19	IGN(KL15)
20	PIN 20	Void
21	PIN 21	Void
22	PIN 22	CAN-CAN-L
23	PIN 23	CAN1-CAN-H
24	PIN 24	Void
25	PIN 25	Void or pedal travel switch (effective for high level of voltage)

4 Packaging

Packaging specifications and requirements for mass production products are separately provided by the customer.

5. Transportation and storage

In the process of transportation and storage, products should avoid collision and rain and snow, prohibit contact with corrosive substances, away from heat source.

6 Notes for product use

1) The EHB system, as a service brake system, is prohibited from being used as a parking brake. If EHB needs to be used for temporary parking, it should be executed according to the following function definition: when the parking time of EHB reaches a certain value, it will automatically reduce the output and issue an EPB pull command. At this point, EPB should be able to respond immediately and provide feedback on the current status to EHB.

2) Prohibit power on and exhaust operations on the EHB system. Before exhaust, the EHB connector must be disconnected.

3) The design of each EHB system is aimed at a specific vehicle model that has been matched in the early stage of the project, and the use of the EHB system on unmatched vehicle models is prohibited.

4) When installing EHB, the tightening torque of its mounting surface bolts and brake pipeline oil pipes must meet the requirements specified in the after-sales manual.

5) For the split EHB system, the layout position of the liquid reservoir must be higher than the brake main cylinder and brake pipeline.

6) For the EHB power supply system scheme, it is prohibited to use DCDC for power supply alone. A battery or battery & DC/DC power supply must be used.