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PILOT DBS

(Dynamic Brake System)

Drive-by-wire electronic hydraulic brake systemA close-up of a car brake system

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1. **General description**

The DBS Brake-by-Wire system represents an intelligently managed hydraulic brake system specifically tailored and designed for L4 level autonomous vehicles. This system is characterized by its compact size, lightweight design, ease of installation, and rapid pressure build-up capabilities.

Employing a highly integrated approach, the DBS system incorporates a brushless motor, transmission mechanism, master cylinder assembly, oil pressure sensor, and an Electronic Control Unit (ECU). The ECU, utilizing signals from the host computer, interprets braking intentions and orchestrates the motor's operation. This, in turn, actuates the master cylinder through the transmission mechanism, facilitating the generation of braking pressure for active braking.

The versatility of the DBS system extends its applicability to a diverse range of autonomous driving scenarios, including unmanned distribution, logistics, inspection, and specialized vehicles.

1. **Description of working principles**

The layout of brake-by-wire system DBS is shown in the figure below:

A diagram of a car engine

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1. **Product components**

DBS consists from electronic hydraulic brake actuator assembly, motor, controller, brake master cylinder and pressure sensor.

Diagram of a mechanical part with text

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1. **Product parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Description** | **Unit** | **Value** |
|  |  |  |  |
| 1. | Product Assembly Dimensions | mm | 297x219x142 |
| 2. | Assembly weight | kg | 4.6 |
| 3. | Motor rated power | W | 460 |
| 4. | Motor rated current | A | 50 |
| 5. | Brake main cylinder diameter | mm | 20.64 |
| 6. | Master cylinder maximum pressure | MPa | 10 |
| 7. | Brake pressure control accuracy | MPa | +/- 0.2 |
| 8. | Brake response delay time | ms | < 100 |
| 9. | Maximum brake pressure time | ms | < 200 |
| 10. | Vehicle weight | kg | < 1500 |
| 11. | Operating temperature | C | -40 +120 |

1. **Size parameters (unit: mm)**

**A drawing of a mechanical device

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1. **Mounting and connection parameters (unit: mm)**

A drawing of a mechanical device

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The master cylinder within the brake system is designed to provide dual brake circuit outputs, individually routed to the two brake pipes and subsequently distributed to each brake line.

A three-way valve facilitates the connection of the brake lines to two brake caliper cylinders, allowing for flexible arrangement in either X-type or H-type configurations.

The brake pipeline interface is standardized with a thread size of M10X1.0.

For assembly, the brake system is securely fastened through the use of two M8 bolts in the designated mounting holes.

1. **Electrical interface**

**A diagram of a computer port

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**A diagram of a room

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|  |  |  |  |
| --- | --- | --- | --- |
| **Terminal** | **Function description** | **Signal Type** | **Signal** |
|  |  |  |  |
| PIN 1 | PW+ | Power positive | Battery positive |
| PIN 2 | PRS\_VS | Pressure sensor power supply | Power output positive |
| PIN 4 | PRS | Pressure sensor signal | Signal input |
| PIN 8 | PRS-GND | Pressure sensor ground | Power output ground |
| PIN 9 | PGND | Power negative | Ground |
| PIN 10 | CANL-1 | CAN bus 1 Low | CAN Low |
| PIN 12 | DTS\_GND | (0-5V) pedal ground power output ground |  |
| PIN 13 | DTS-VS | (0-5V) pedal power supply | Power output positive |
| PIN 15 | / | Emergency stop switch (high level) | active high |
| PIN 16 | CANL-2 | CAN bus 2 low | level signal |
| PIN 18 | CANH-1 | CAN bus 1 high | level signal |
| PIN 20 | IG | Ignition signal | active high |
| PIN 22 | DTS-1 | (0-5V) pedal signal line | level signal |
| PIN 25 | CANH-2 | CAN bus 2 high | level signal |

1. **Controller communication protocol**

Communication protocol : CAN 2.0B standard;

Communication baud rate : 500kbs;

Data feedback/sending frequency : 20ms.

Message format: Intel format.

Electronic hydraulic brake assembly can be controlled to output the target brake oil pressure through the external CAN bus interface.

And feedback the current working status information (real-time oil pressure, fault information, etc.) in real time.

The controller does not have a 120 ohm resistor.

1. **Communication modes**
2. **Pedal mode** (0-5V electrical signal pedal)

00 02 00 00 00 00 00 00

With pedal sign signal, with opening and closing degree display

1. **Wire control mode**

**00 00 00 00 00 00 00 00**

Control via CAN line communication

1. **Software manual mode**

00 03 00 00 00 00 00 00

Control by sending 0Mpa and non-0Mpa pressure. When sending 0Mpa, a reverse current will be sent, and the master cylinder The piston returns. When sending non-0Mpa, it will send positive current to push the master cylinder piston. The rest of the operations are the same as the eighth mode

1. **Software auto mode**

00 01 00 00 00 00 00 00

It will automatically send reverse current and forward current at intervals of 5 seconds to squeeze the master cylinder repeatedly. The rest of the operations are the same as the eighth module.

**CAN Redundancy**

There are two CAN lines, which are divided into CAN1 and CAN2. Both lines can be used individually. When the ignition wire is first connected, Both CAN1 and CAN2 are in the state of being activated. After receiving a signal other than 0Mpa, the CAN line will be activated

When only one of CAN1 and CAN2 is activated, when the signal is interrupted, a fault code will be reported, and the pressure will be

It rises to 8Mpa in one second, and then slowly drops to 6Mpa in thirty seconds.

When both are activated at the same time, the commands received by CAN1 will be processed first. When an accident occurs in CAN1 and the signal is interrupted

When it is off, the channel will be switched immediately to process the CAN2 signal, the motor will not perform emergency processing, and the feedback signal.

A warning code in will send a communication failure.

When the signal is interrupted due to an accident in CAN1, it still keeps processing the commands received by CAN2 and sends Send a warning code. When both of them are interrupted, the warning code will not be sent, but the fault code will be sent instead, and the pressure

It will rise to 8Mpa in one second, and then slowly drop to 6Mpa in thirty seconds.

1. **Technical notes**

Brake fluid grade: DOT4

2. Before using the product, the brake fluid must be bleeded to ensure that there is no air in the brake pipeline.

During the installation and debugging process, during the installation and wiring of the controller, it is necessary to perform 12V power-off operation, and wait for the controller to

Power on after the installation is complete

4. When arranging the brake pipeline, the layout of the brake pipeline should be organized as much as possible, and there should be no fluctuations in height and height, and large-angle bending.

The controller does not have a waterproof function, please try to arrange it in a high place and inside the cabin.

DBS is a service brake system and cannot be used as a parking brake for long-term pressure maintenance.

When the pressure sensor fails, the pressure sensor fault code will be sent, and the pressure feedback signal is 23Mpa at this time.