



东风乘用车

# 电机及控制系统



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# Motor and Control System



- 1、熟悉E70电机及控制系统各部件的功用
- 2、熟悉E70电机及控制系统的工作原理
- 3、能对E70电机及控制系统进行故障诊断与排除
- 4、掌握E70电机及控制系统相关部件的拆装更换方法及维修注意事项





1. Familiar with the composition of E70 motor and control system and functions of its components
2. Familiar with the working principle of the E70 motor and control system
3. Troubleshoot the E70 motor and control system
4. Master the removal and refitting and replacement methods and service precautions of the E70 motor and control system

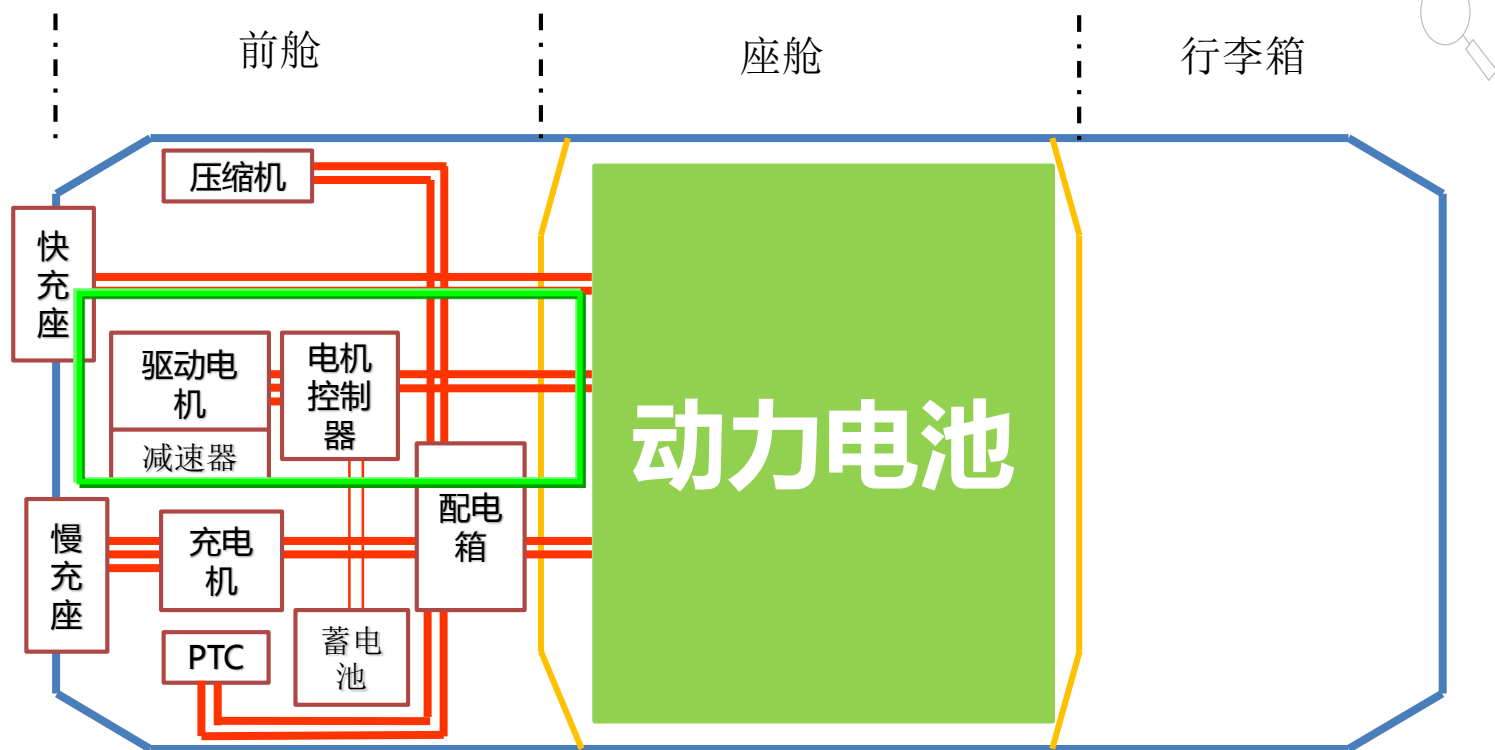




# 一、E70电机及控制系统概述

E70电机及控制系统作为车辆的动力系统，作用有：

- 1、将动力电池的电能转换为机械能，为驱动轮提供动力。
- 2、此系统中的电机控制器包含DC-DC，起到直流降压的作用，能够将高压转为14V左右的低压，对蓄电池进行充电。
- 3、电机控制器同时集成了整车控制器VCU的功能。



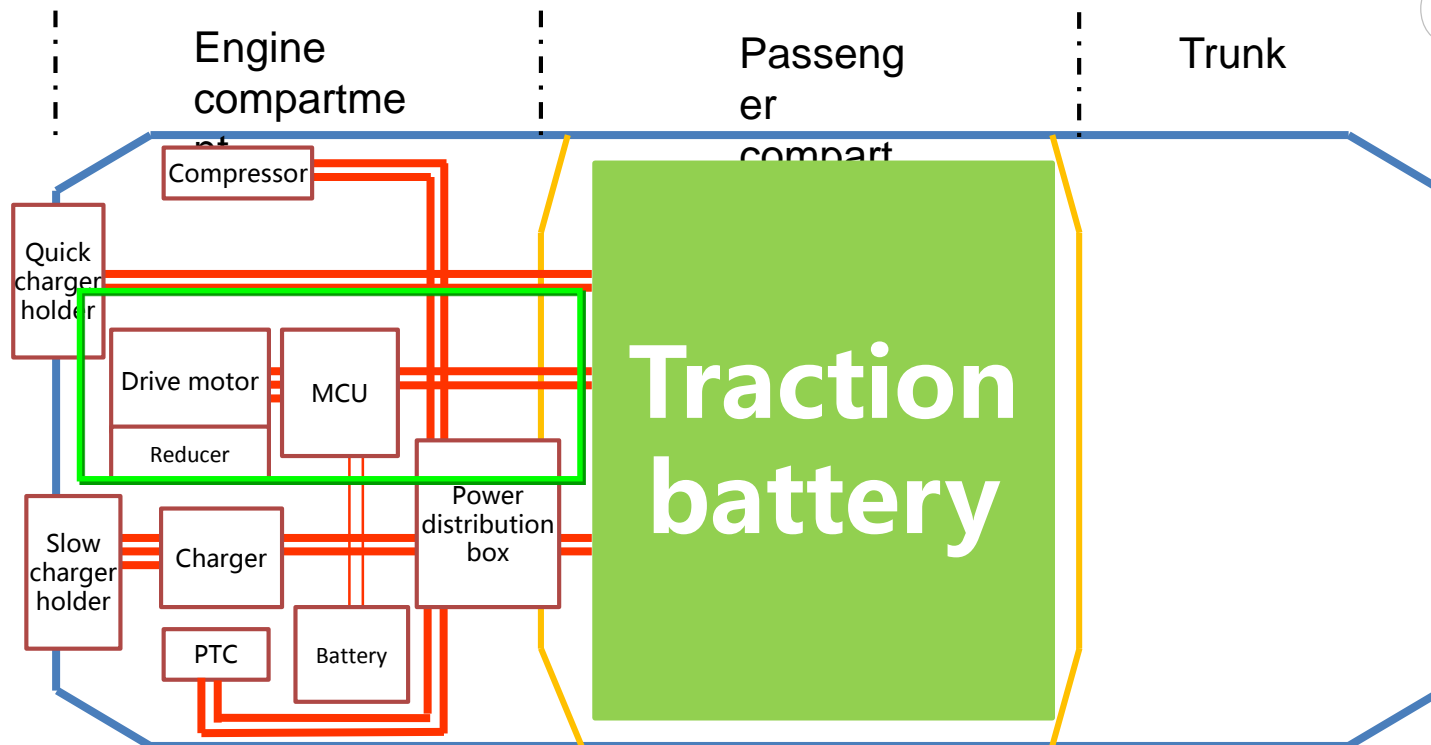
# I. Overview of E70 motor and control system



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E70 motor and control system, as the power system of the vehicle, has the functions:

1. Converting electrical energy to mechanical energy power the drive wheels.
2. The MCU in this system includes DC-DC MCU, which acts for DC voltage reduction and can convert the high voltage to a low voltage of about 14V to charge the battery.
3. The MCU integrates the functions of the VCU.





# 一、E70电机及控制系统概述

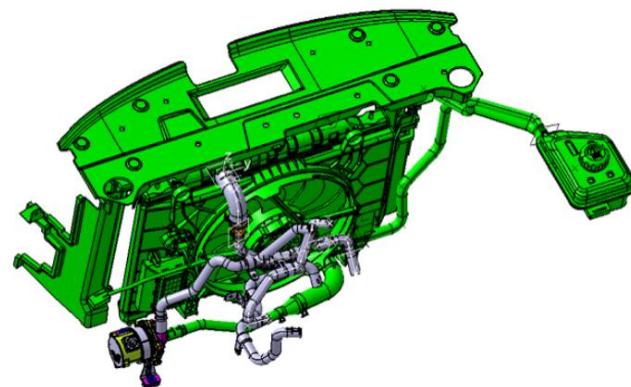
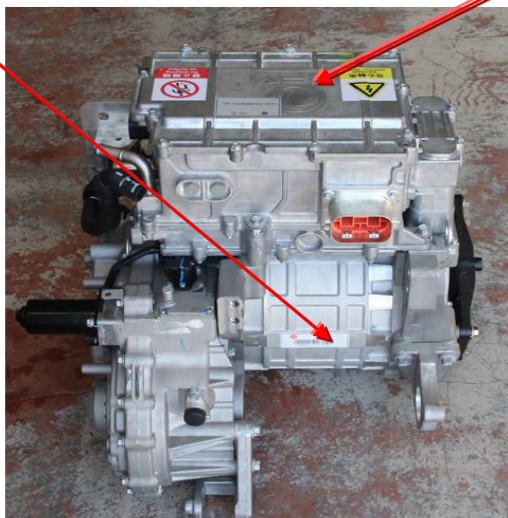
## 电机及控制系统的组成

电机及控制系统

电机及减速器

电机控制器

冷却系统

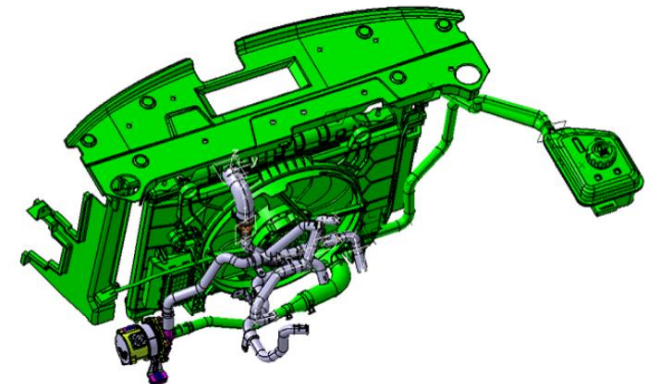
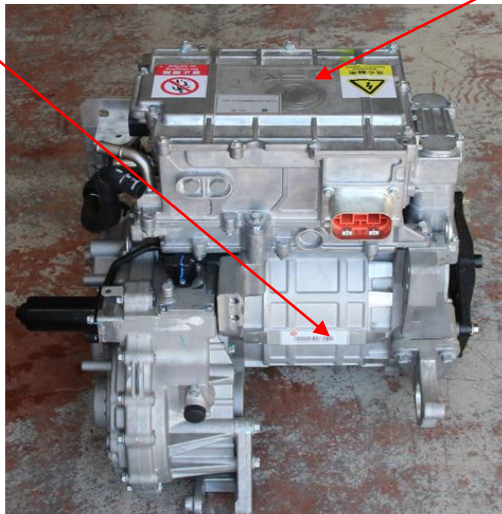
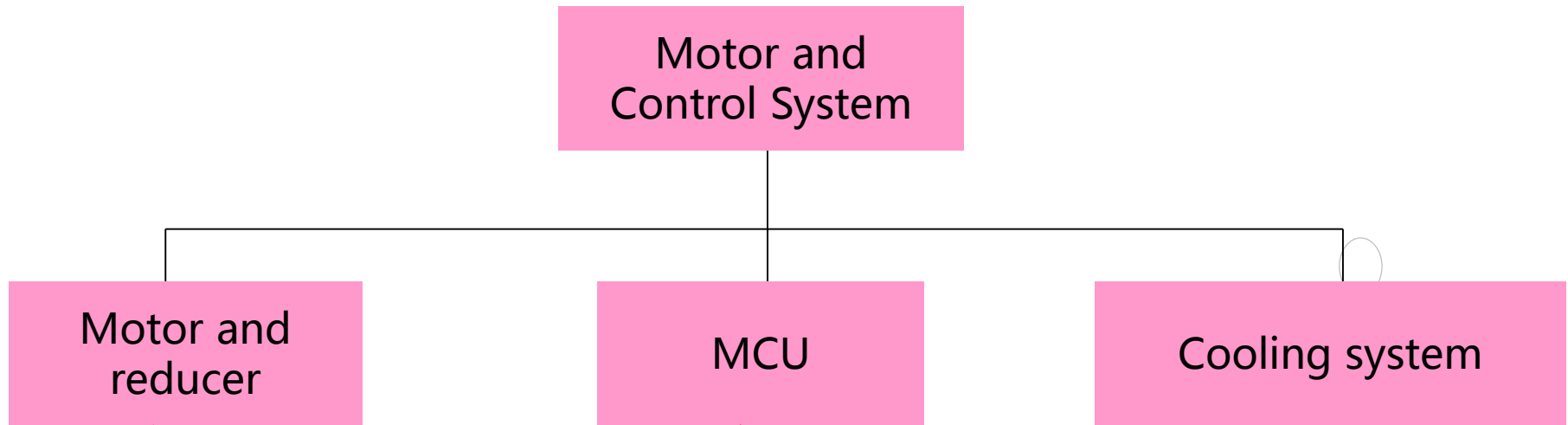


# I. Overview of E70 motor and control system



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## Composition of motor and control system





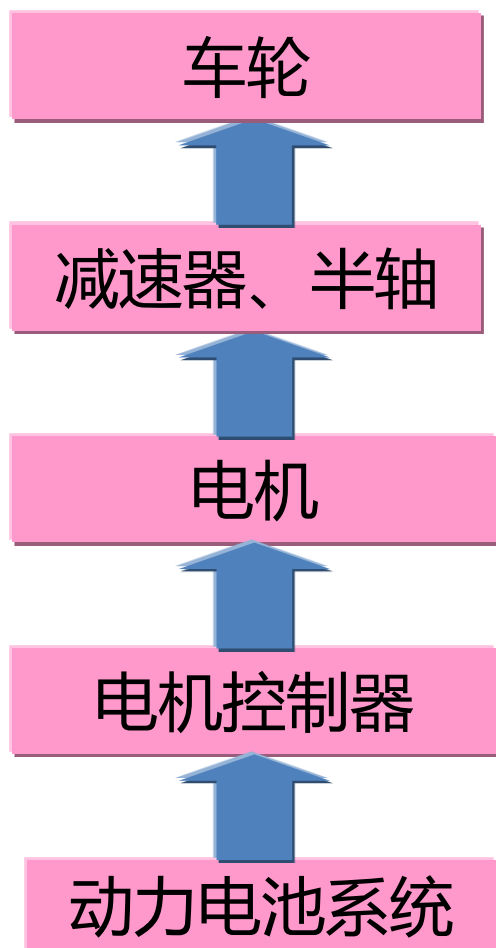
# 一、E70电机及控制系统概述



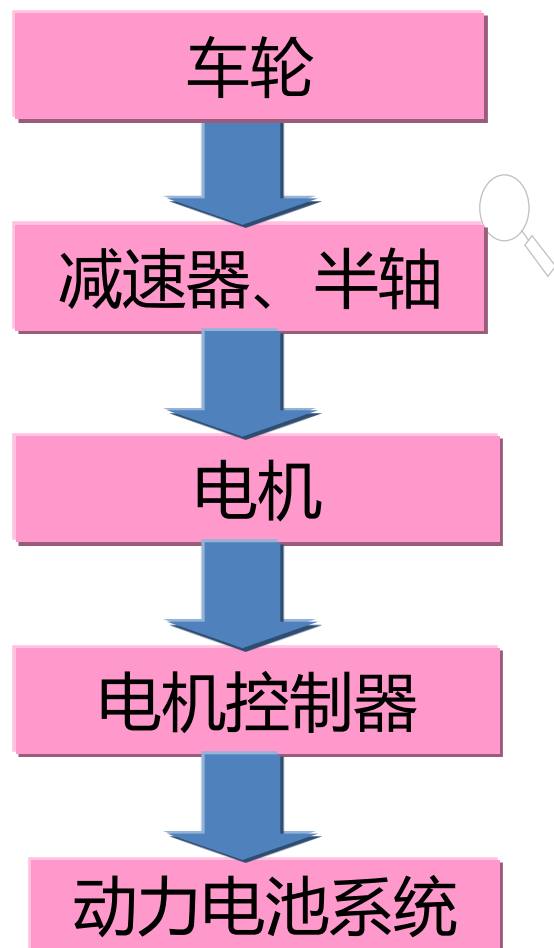
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## 电机及控制系统的工作模式

### 1. 电动模式(驱动模式)



### 2. 发电模式(能量回收模式)



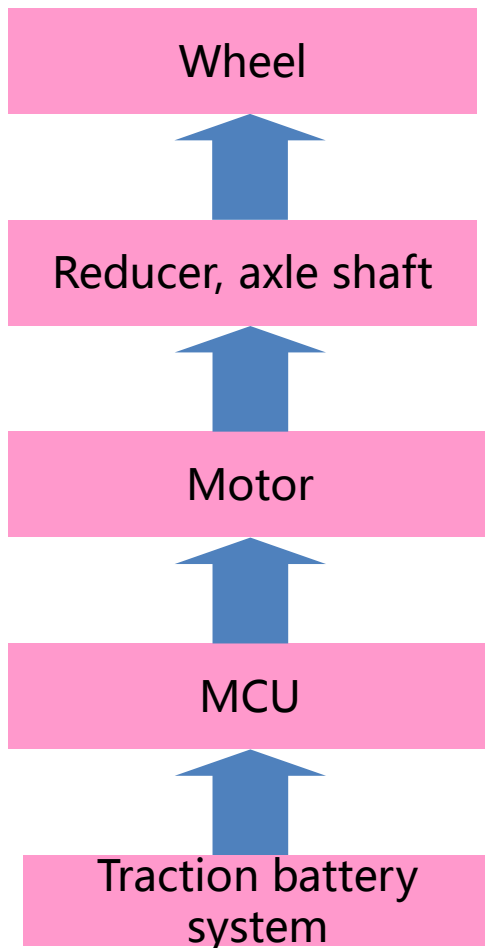
# I. Overview of E70 motor and control system



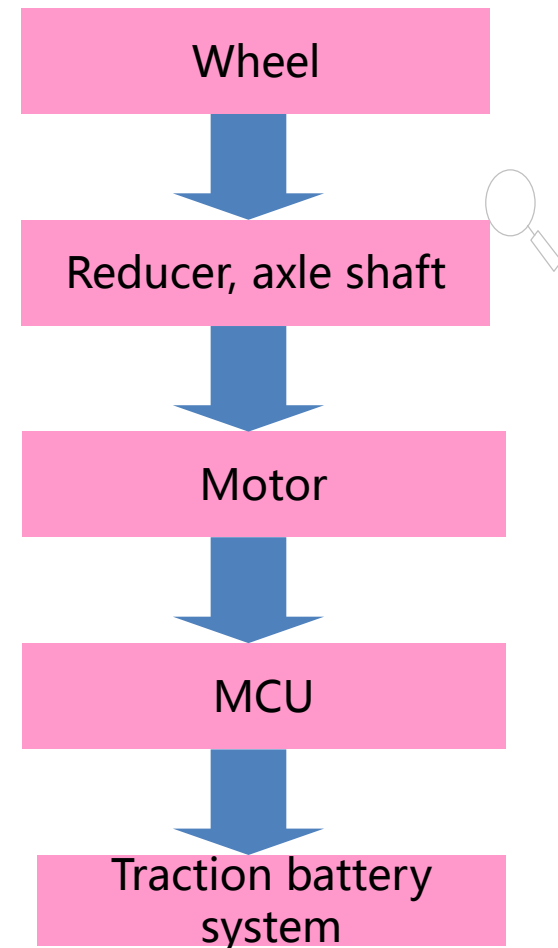
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## Operating mode of motor and control system

### 1. Electric mode (drive mode)



### 2. Power generation mode (energy recovery mode)



# 一、E70电机及控制系统概述



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## 电机的ECO/SPORT模式以及能量回收强度调节功能

- 1.切换到ECO模式，车辆进入经济模式，与正常驱动模式相比，可降低能量消耗，同时加速性能稍差.
- 2.切换到SPORT模式，车辆进入动力模式，与正常驱动模式相比，加速性能更好，经济性稍差.
- 3.通过能量回收强度调节功能，可实现“弱”、“中”、“强”三种能量回收强度选择，强度越高，能量回收越明显，同时感觉到车辆的滑行减速度有所增加。

这些功能均具备记忆功能，下次启动车辆依然保持原有状态，同时在仪表上有对应的指示。



SPORT模式按键

模式指示灯



能量回收指示

# I. Overview of E70 motor and control system



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## ECO/SPORT mode and energy recovery intensity adjustment of motor

1. After being switched to the ECO mode, the vehicle enters the ECO mode, and in this mode, energy consumption will be reduced and acceleration will be declined compared with traveling in the normal drive mode.
2. After being switched to the SPORT mode, the vehicle enters the SPORT mode, and in this mode, acceleration will be improved and economical efficiency will be declined compared with traveling in the normal drive mode.
3. Three energy recovery intensity of "weak", "medium" and "strong" can be achieved based on the energy recovery intensity adjustment function. The higher the energy recovery intensity, the more obvious the energy recovery, and the vehicle's coasting deceleration is increased. These functions all have a memory, and the vehicle will remain in its original state the next time it is started, and corresponding indications will be displayed on the instrument panel.



SPORT mode button

Mode indicator lamp



Energy recovery indication

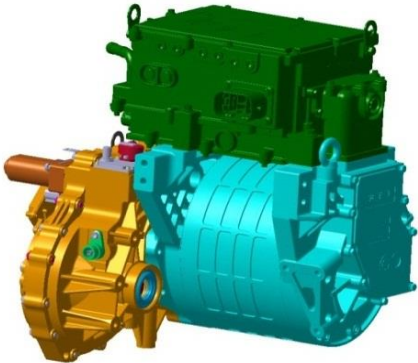
# 一、E70电机及控制系统概述



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## 电机技术参数

电机类型	永磁同步电机
工作电压范围	240 ~ 420V
额定/峰值功率	42/90kW
额定/峰值扭矩	100/260Nm
最高转速	10500rpm/min
冷却方式	水冷



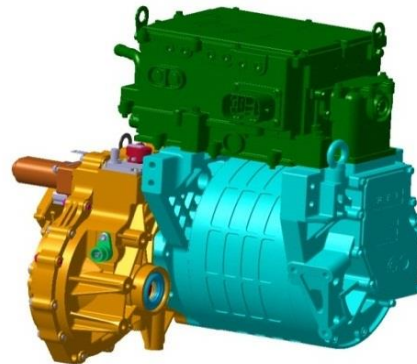
# I. Overview of E70 motor and control system



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## Technical parameters of motor

Type of motor	Permanent magnet synchronous motor
Operating voltage range	240 ~ 420V
Rated/peak power	42/90kW
Rated/peak torque	100/260Nm
Max. speed	10,500rpm/min
Cooling method	Water cooling



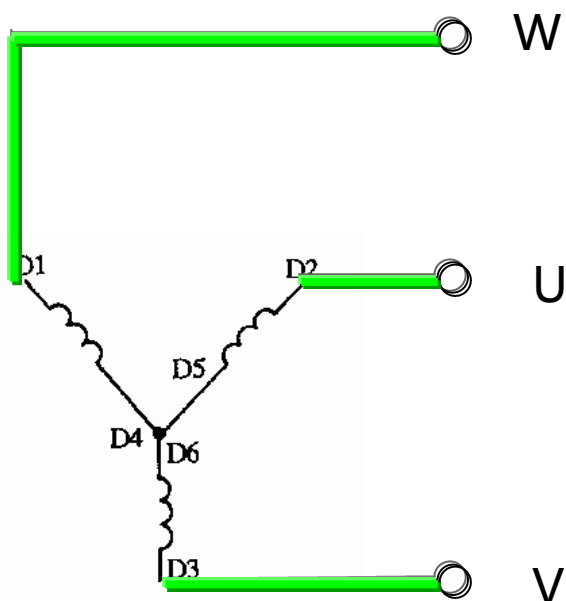


# 一、E70电机及控制系统概述

**电机类型：**三相永磁同步电机

**内置传感器：**电机转速传感器（相位传感器）和定子温度传感器

**电机内部结构：**定子为三相Y形连接的线圈，电机的转子为永久磁铁





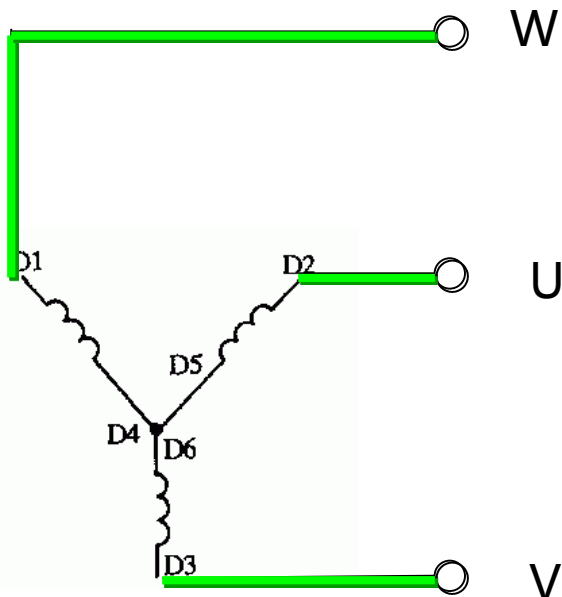
# I. Overview of E70 motor and control system



**Motor type:** three-phase permanent magnet synchronous motor

**Built-in sensor:** motor speed sensor (phase sensor) and stator temperature sensor

**Internal structure of motor:** the stator is a three-phase Y-connected coil, and the rotor is a permanent magnet.





# 一、E70电机及控制系统概述



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功率提升 ( 90kw→110kw )

百公里加速提升 ( 10.8s→9.9s )

	功率	扭矩	0-50公里加速	百公里加速
E70现生产	90	260	4.3	10.8
E70周年版	110	260	-	9.9
帝豪EV450	120	250	4.1	9.3
比亚迪e5 450	160	310	-	-
北汽EU5	160	300	3.4	7.8

驱动电机的定转子设计优化，使电机效率提升，NEDC综合效率提升从86%到89%，使能耗降低，续航加强

电驱动总成优化设计，使最大功率得到22%的提升

电机与电控策略优化，系统匹配性开发，实现定速巡航功能

充电功率由60kw增加到90kw，明显提高充电速率

# I. Overview of E70 motor and control system



**Power increase (90 kwh →  
110 kwh)**

**Increase of acceleration per  
100 km (10.8s → 9.9s)**

	Power	Torque	0-50 km acceleration	Acceleration per 100 km
Currently produced E70	90	260	4.3	10.8
E70 anniversary version	110	260	-	9.9
Emgrand EV450	120	250	4.1	9.3
BYD e5 450	160	310	-	-
BAIC EU5	160	300	3.4	7.8

The design of the stator and rotor of the drive motor is optimized to improve the efficiency of the motor. The overall efficiency of NEDC is increased from 86% to 89%, which reduces energy consumption and enhances the range.

Optimized design of the electric drive assembly increases the maximum power by 22%.

Motor and electronic control strategy optimization, system matching development, to achieve cruise control function

Charging power is improved from 60 kw to 90 kw, significantly increasing the charging rate.

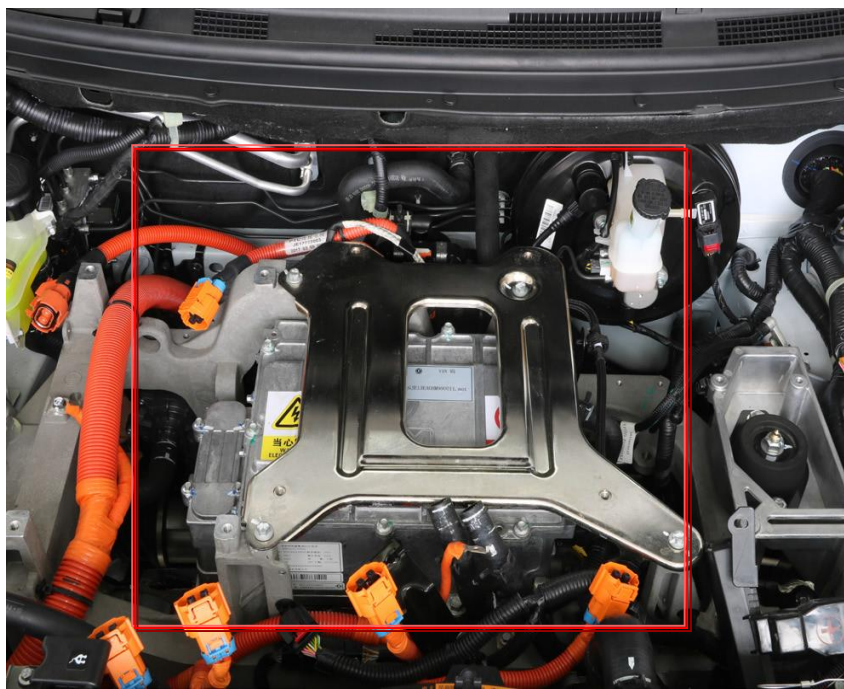
# 一、E70电机及控制系统概述



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**电机控制器**：接收加速、制动、档位等行驶工况信号，为电机三相端子提供配电

**内置传感器**：电流传感器、温度传感器



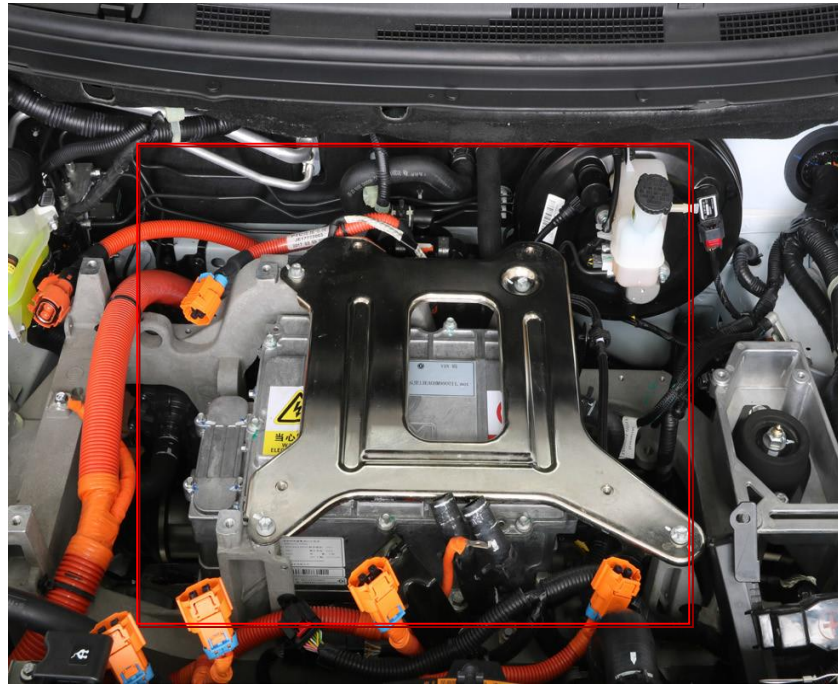
电机控制器

# I. Overview of E70 motor and control system



**MCU:** Receiving driving condition signals such as acceleration, braking, gear position, etc. to provide power distribution for the three-phase terminal.

**Built-in sensor:** current sensor and temperature sensor



MCU

# 一、E70电机及控制系统概述



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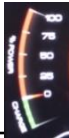






## 电机及控制系统相关的指示和警报灯

序号	图样	说明
1		电机功率/能量回收表
2	 绿色	Ready指示灯 
3	 红色	DC-DC充电系统故障警报灯
4	 黄色	车辆功能受限警报灯
5	 红色	整车高压系统故障警报灯
6	 红色	驱动电机故障警报灯

# I. Overview of E70 motor and control system



## Relevant indicator lamps and alarm lamps of motor and control system

Sequence number	Drawing	Notes
1		Motor power/energy recovery table
2	 Green	Ready indicator lamp 
3	 Red	DC/DC charging system malfunction alarm lamp
4	 Yellow	Vehicle function limited alarm lamp
5	 Red	High voltage system alarm lamp
6	 Red	Drive motor malfunction alarm lamp

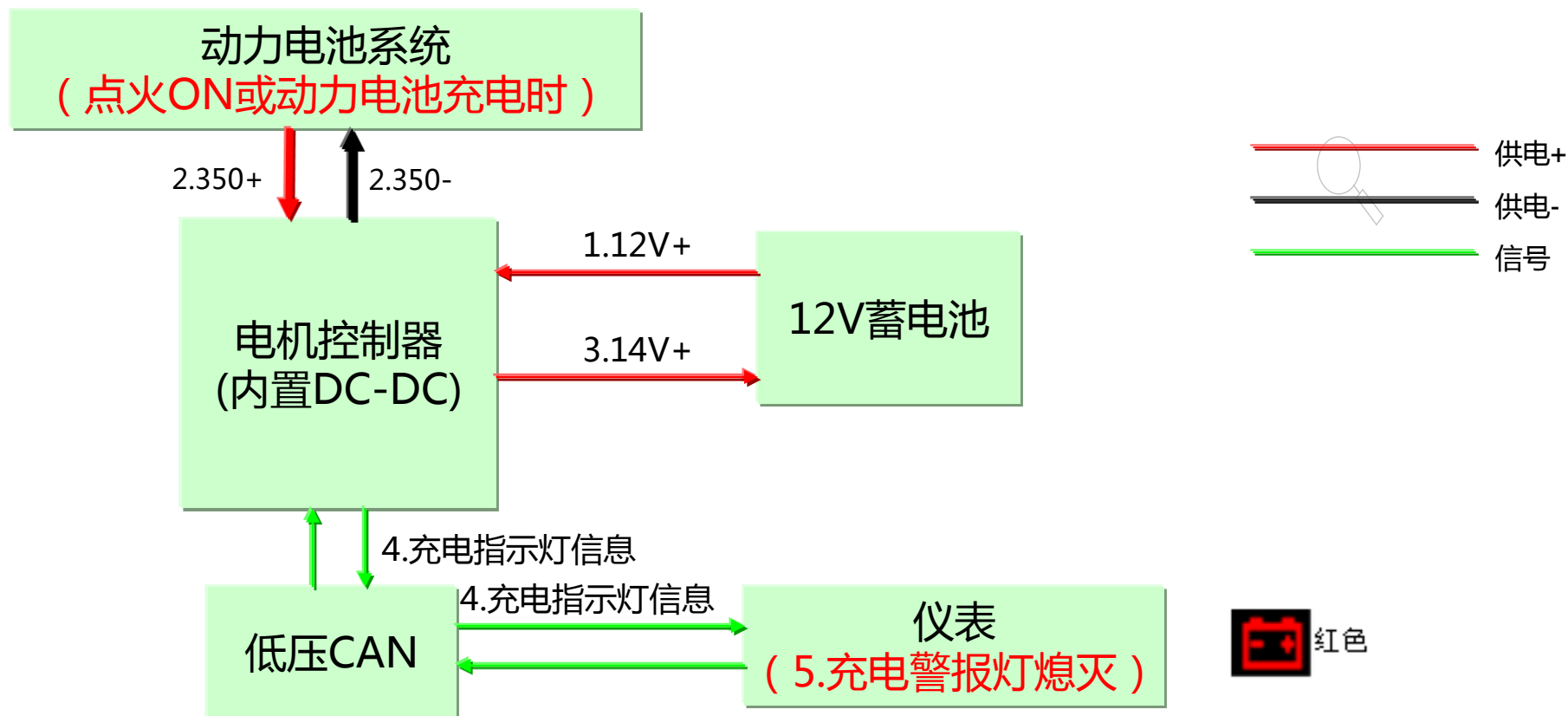
## 二、E70电机及控制系统工作原理及电路图



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### 电机及控制器系统的基本原理及电路图分析

#### 1.DC-DC充电



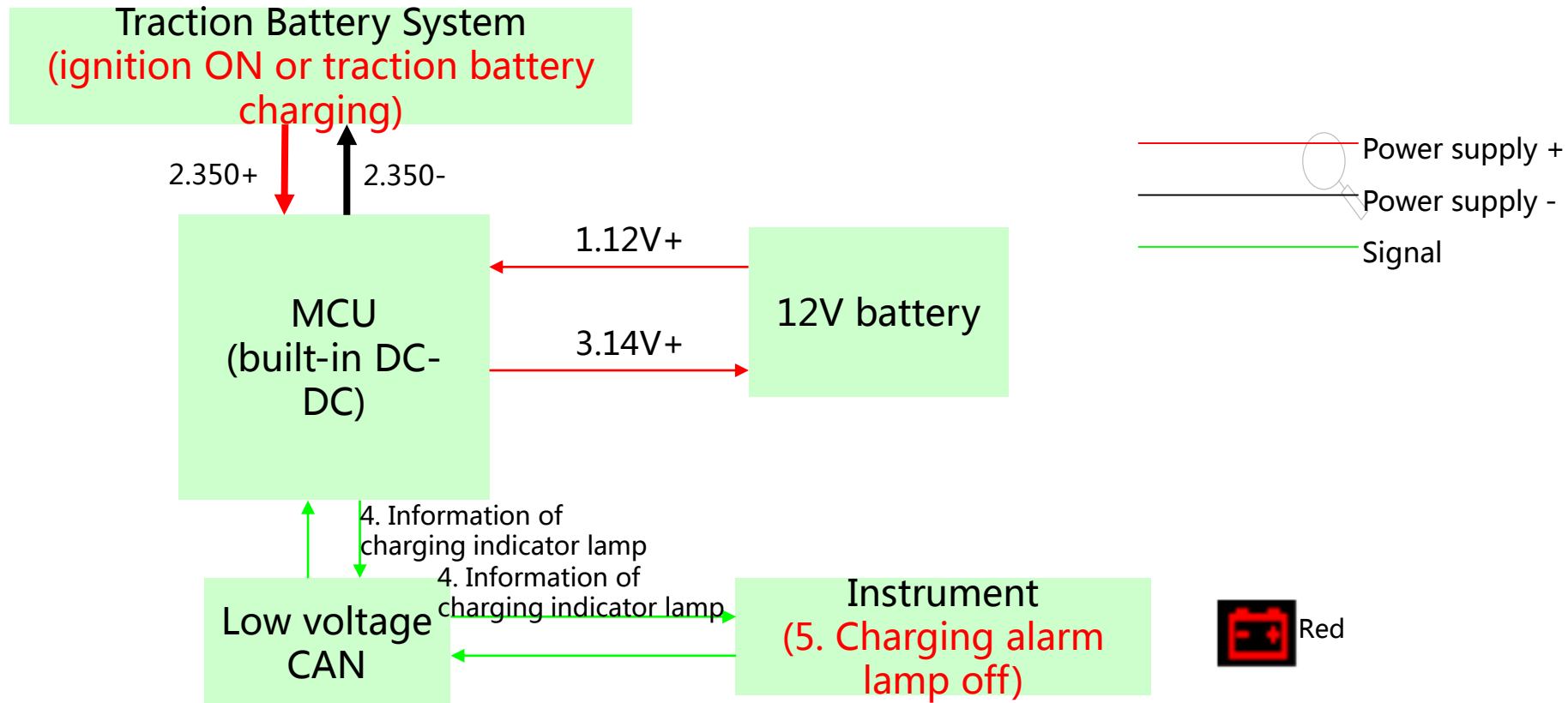
## II. Working principle and circuit diagram of E70 motor and control system



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### Analysis of working principle and circuit diagram of motor and control system

#### 1.DC-DC charging





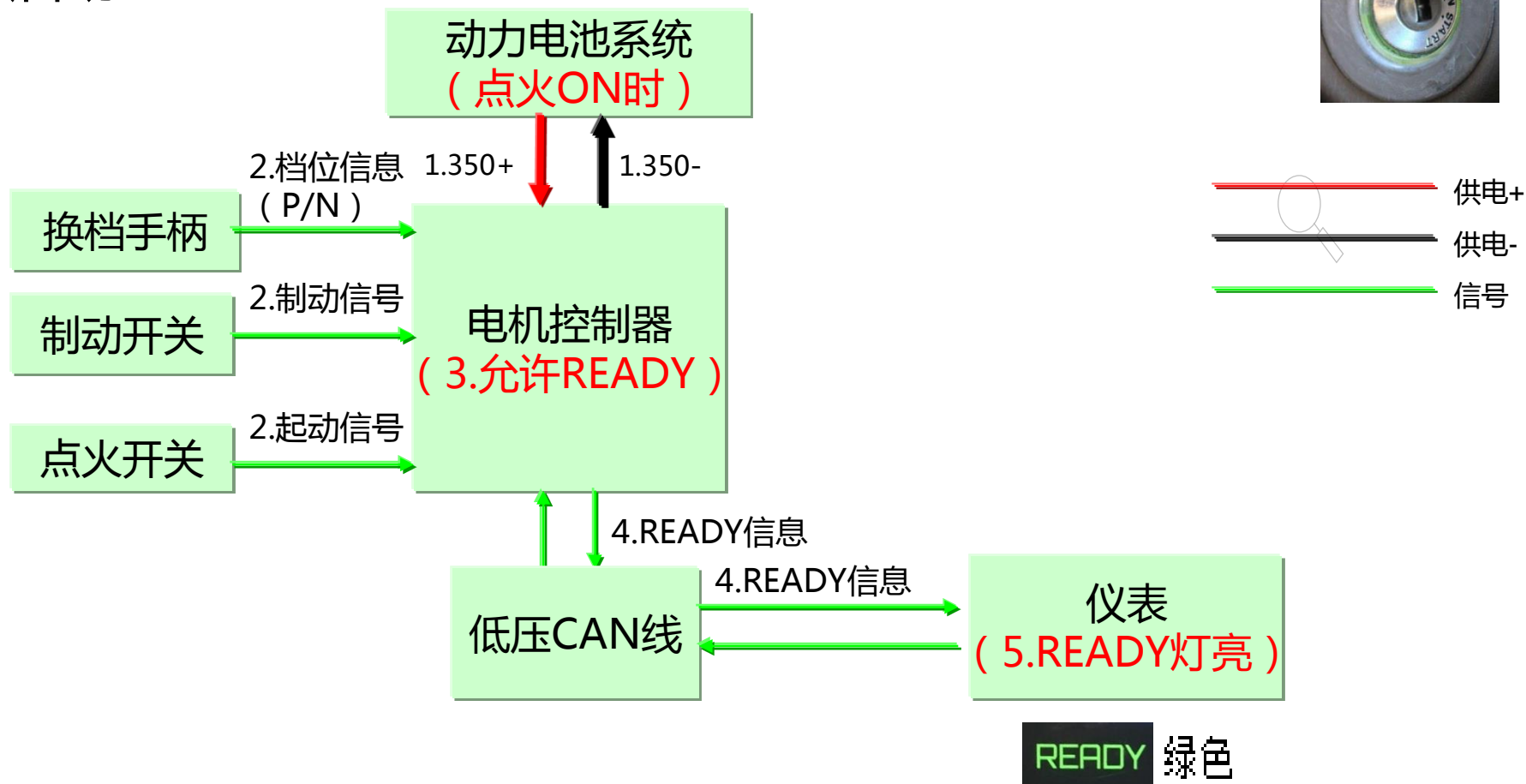
## 二、E70电机及控制系统工作原理及电路图



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### 电机及控制器系统的基本原理及电路图分析（E0级出租车）

#### 2.启动READY



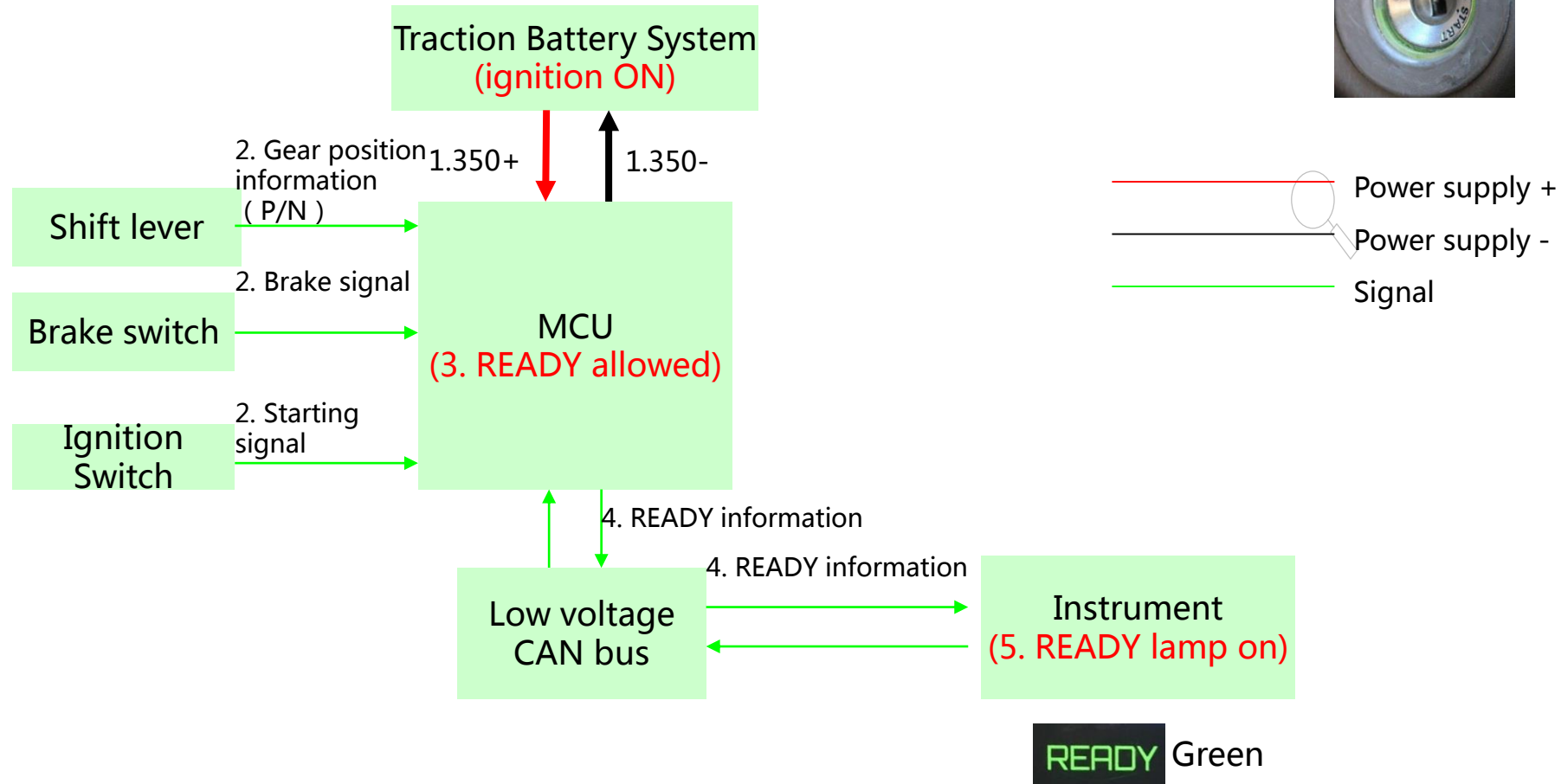
## II. Working principle and circuit diagram of E70 motor and control system



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### Analysis of working principle and circuit diagram of motor and control system (E0 class taxis)

#### 2. Start READY



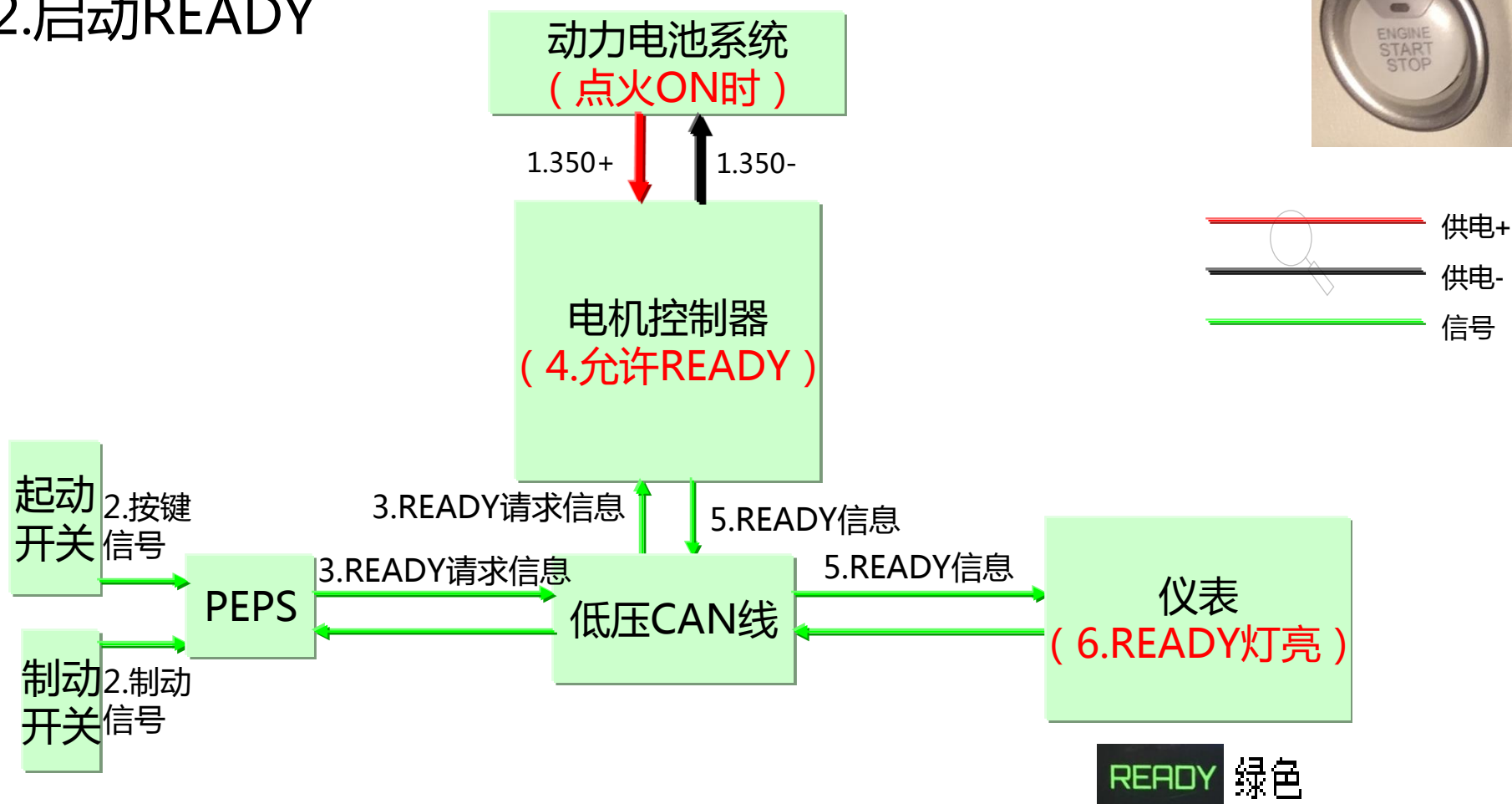
## 二、E70电机及控制系统工作原理及电路图



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### 电机及控制器系统的基本原理及电路图分析（E0级私家车及E1级）

#### 2.启动READY



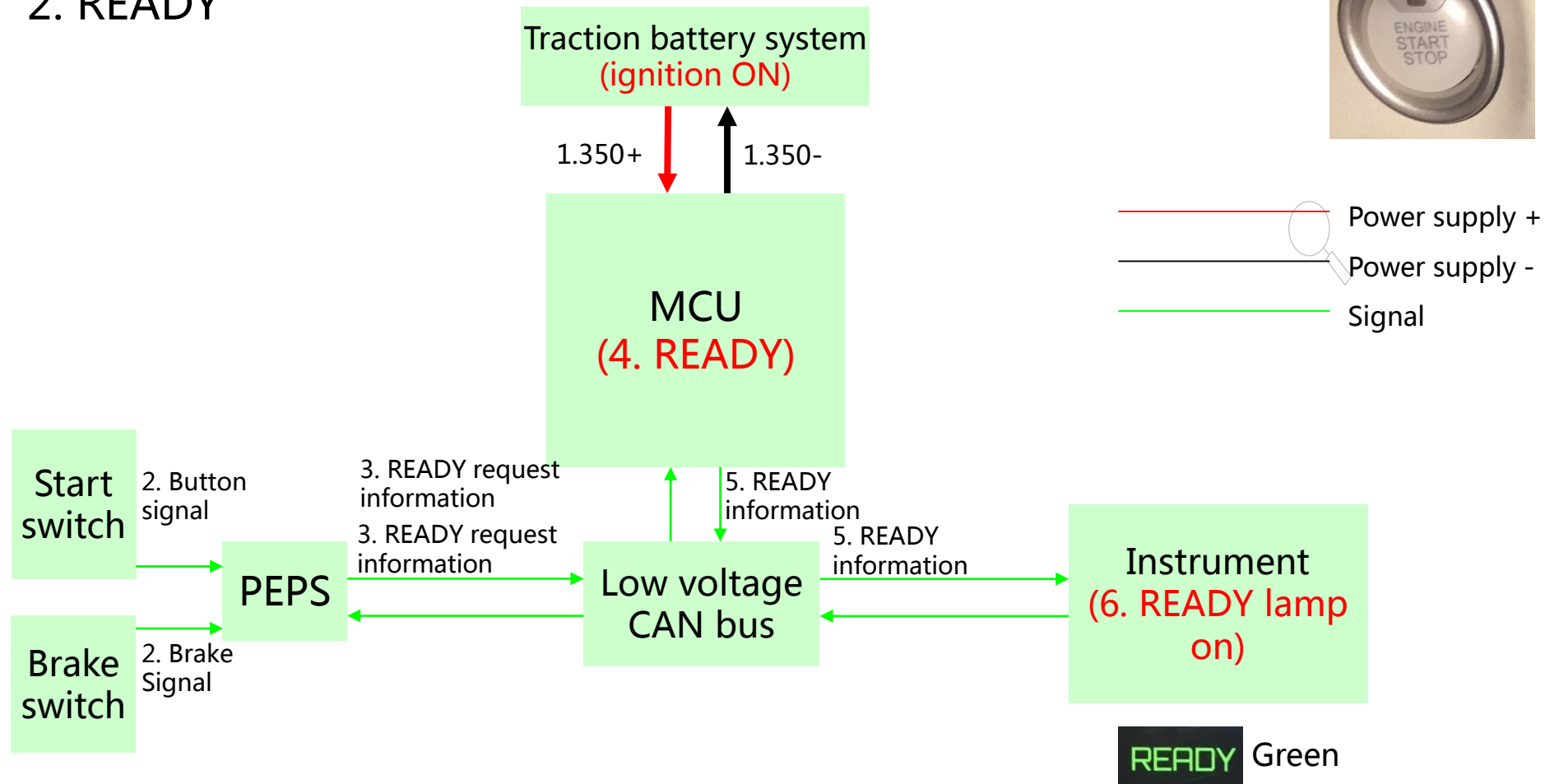
## II. Working principle and circuit diagram of E70 motor and control system



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### Analysis of working principle and circuit diagram of motor and control system (E0 and E1 class taxis)

#### 2. READY



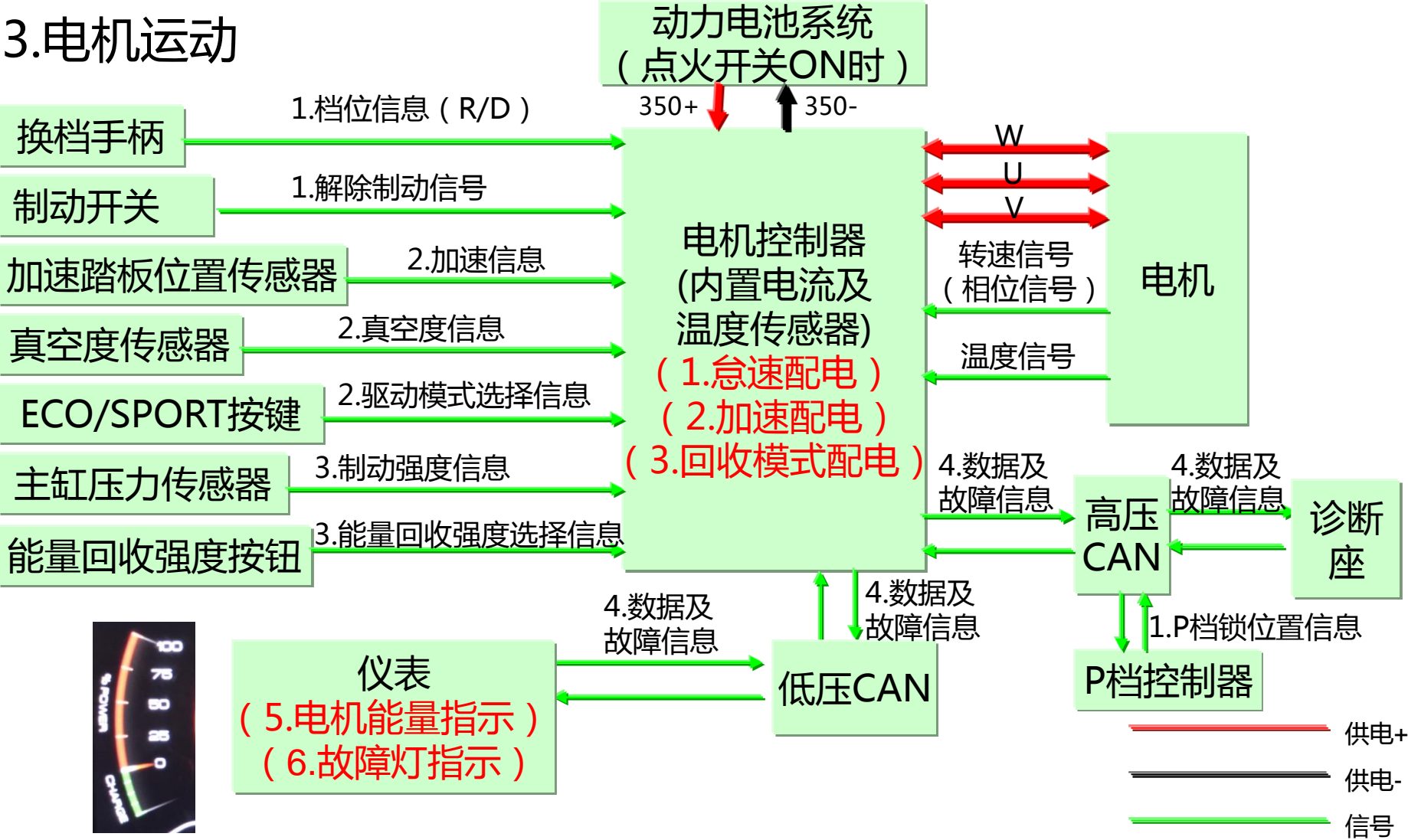
# 二、E70电机及控制系统工作原理及电路图



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## 电机及控制器系统的基本原理及电路图分析

### 3.电机运动



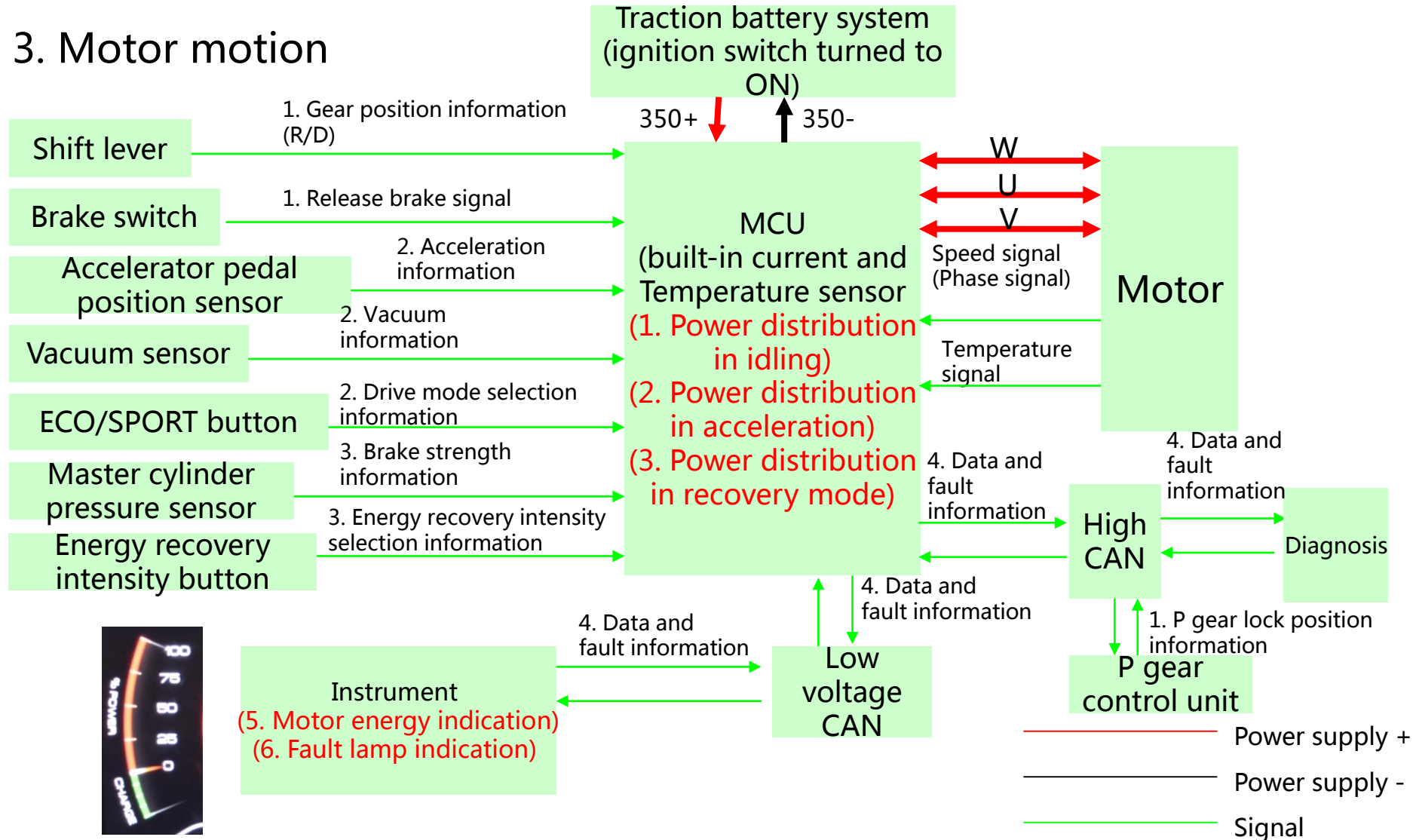
# II. Working principle and circuit diagram of E70 motor and control system



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## Analysis of working principle and circuit diagram of motor and control system

### 3. Motor motion



## 二、E70电机及控制系统工作原理及电路图

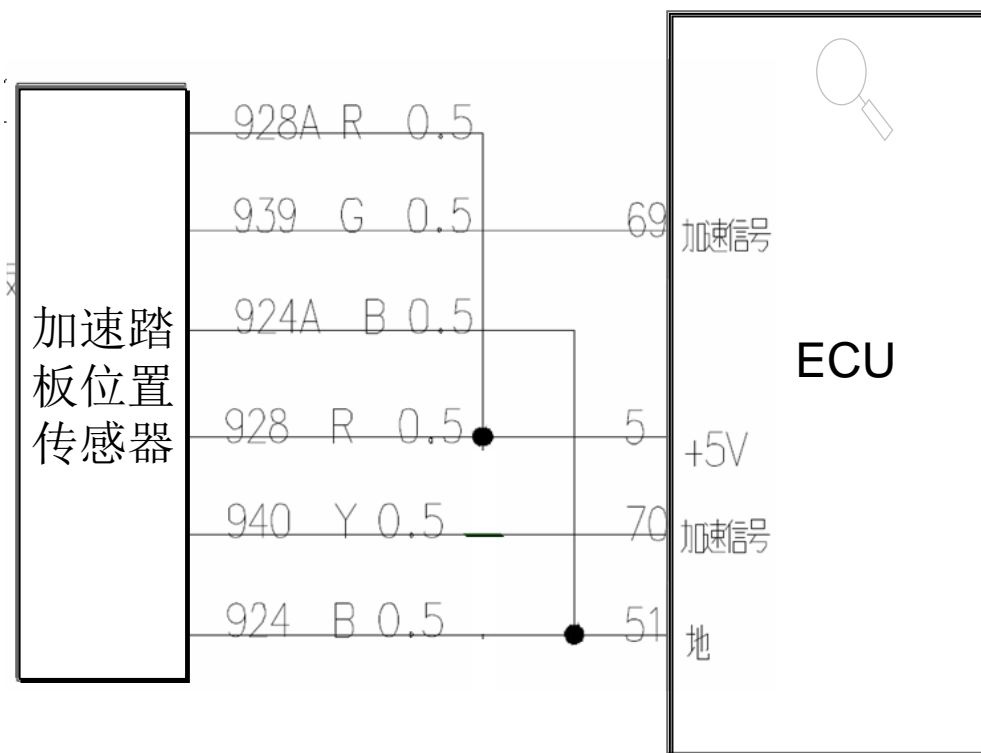
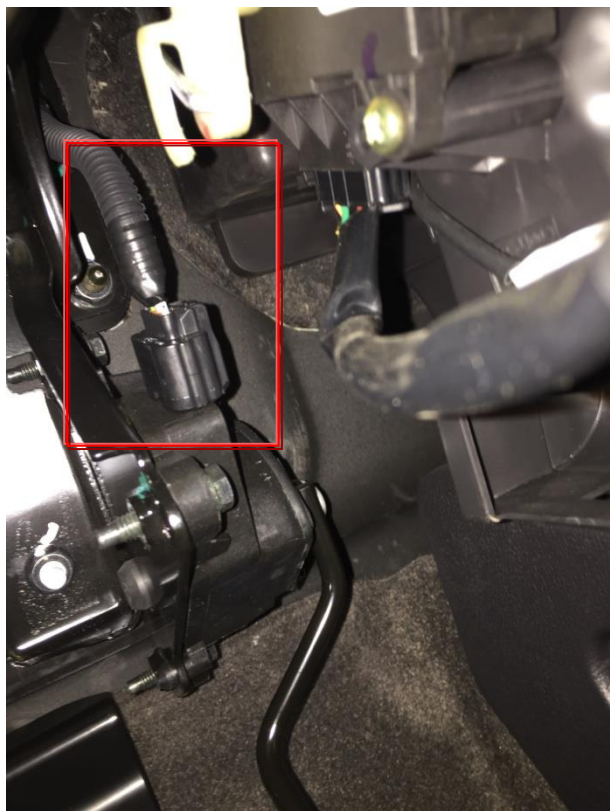


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### 加速踏板位置传感器的工作原理及检测方法：

原理：两个霍尔式位置传感器,5V供电及接地共用，两根信号线信号成反向变化

检测：万用表测量传感器5V供电及接地，工作时使用诊断仪读取数据流





## II. Working principle and circuit diagram of E70 motor and control system

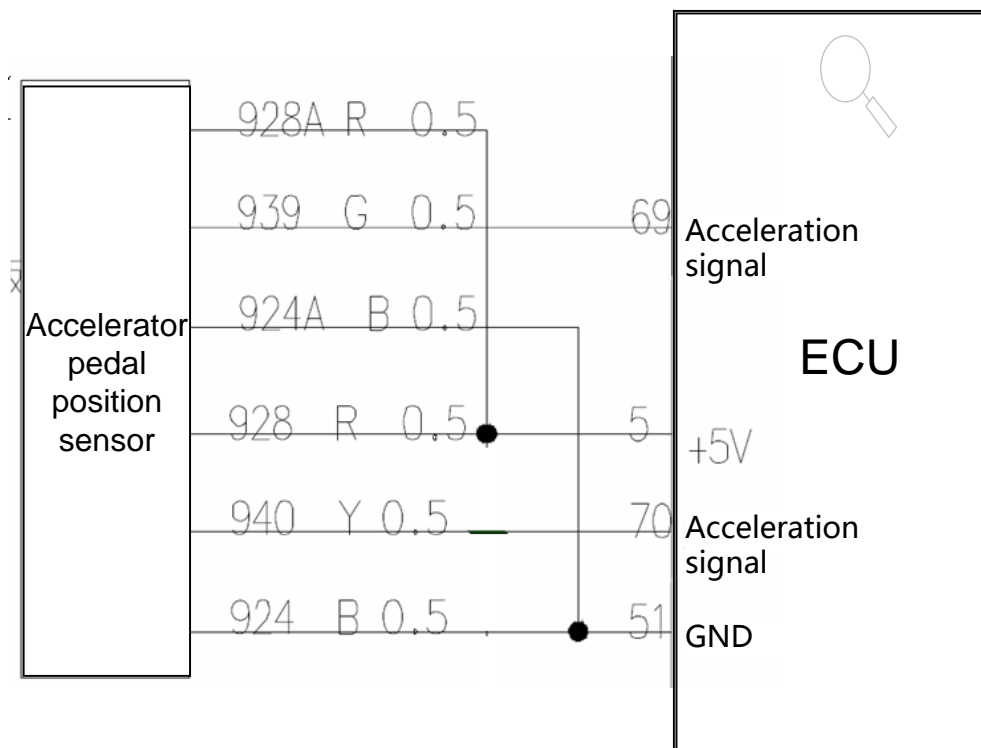
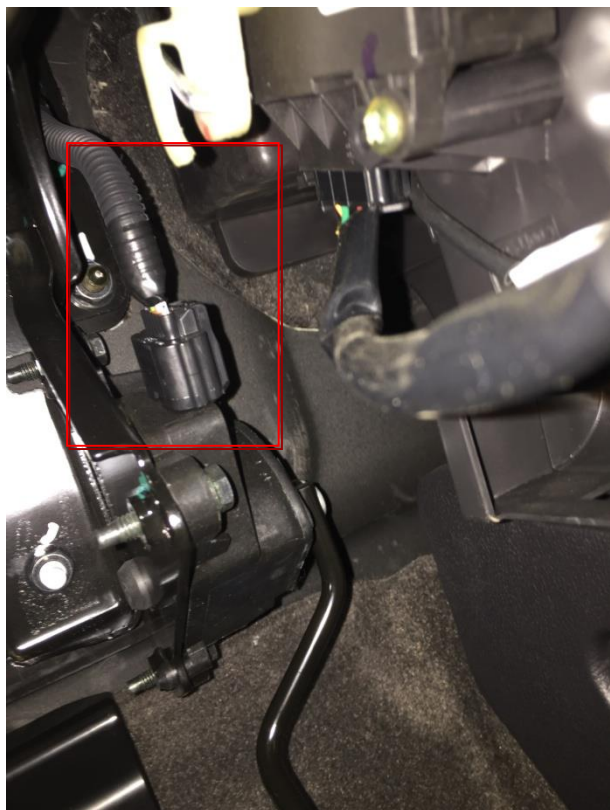


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### Working principle and detection method of accelerator pedal position sensor:

Principle: Two Hall position sensors, 5V power supply and grounding are shared, and the signals of two signal lines are reversely changed.

Detection: The multimeter measures the 5V power supply and grounding of the sensor, and the data stream can be read by the scan tool during operation.





## 二、E70电机及控制系统工作原理及电路图

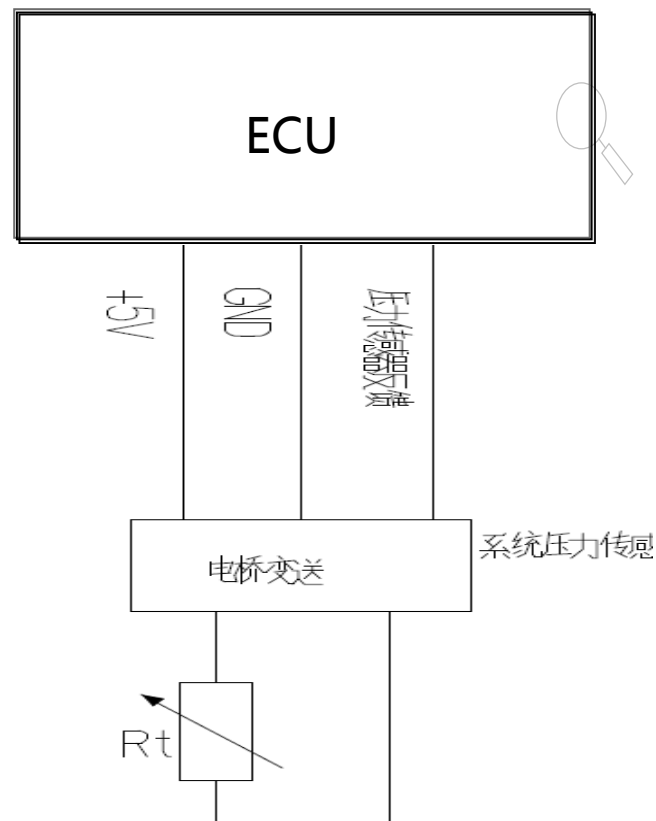


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### 主缸压力传感器的工作原理及检测方法：

原理：压力可变电阻式传感器

检测：测量传感器5V供电及接地，工作时可通过诊断仪读取数据流



## II. Working principle and circuit diagram of E70 motor and control system

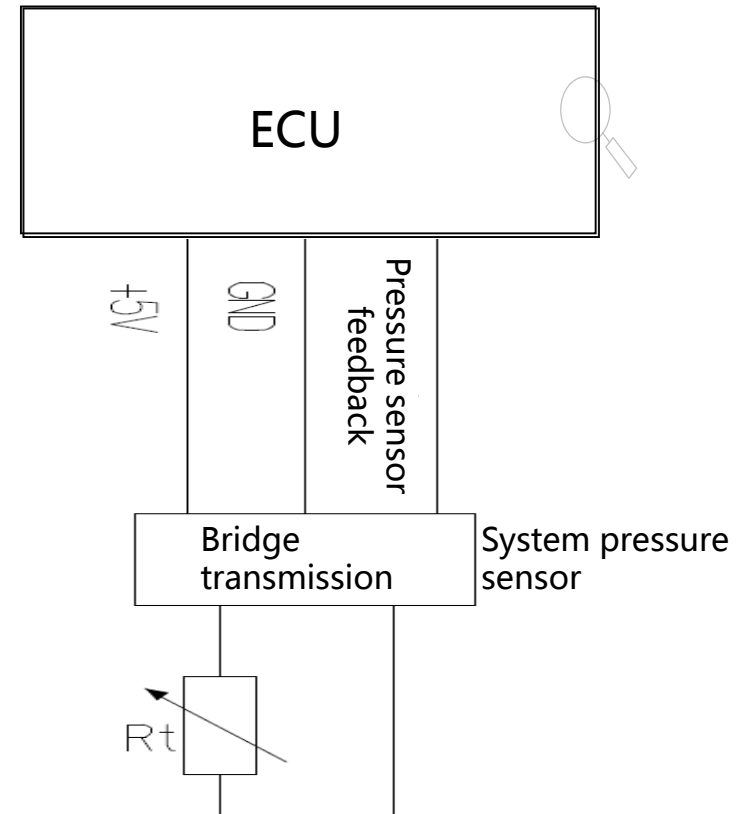


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### Working principle and detection method of master cylinder pressure sensor:

Principle: Variable resistance pressure sensor

Detection: The multimeter measures the 5 V power supply and grounding of the sensor, and the data stream can be read by the scan tool during operation.



# 三、E70电机及控制系统故障诊断



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电机控制系统有故障自诊断的功能，且有独立的诊断地址，利用专用故障诊断仪可对系统进行诊断，结合电路图的原理对故障进行排查。

常见故障现象及原因如下

常见故障现象（电池可上强电为前提）	维修建议
无法实现DC-DC充电功能	检查电机控制器及高低压连接
无法READY	检查相关信号元件、PEPS控制器、整车控制器、电机控制器
可READY，无法行驶	检查相关信号元件、电机及减速器
电机限速	检查电机控制器、电机、真空度、温度
电机超速	检查电机负载是否出现断路（减速器、半轴、车轮）

### III. Troubleshooting of E70 motor and control system



The motor and control system has the function of fault self-diagnosis, and has an independent diagnosis address. The special scan tool can be used to diagnose the system to troubleshoot according to the principle of the circuit diagram.

Common fault phenomena and causes are as follows:

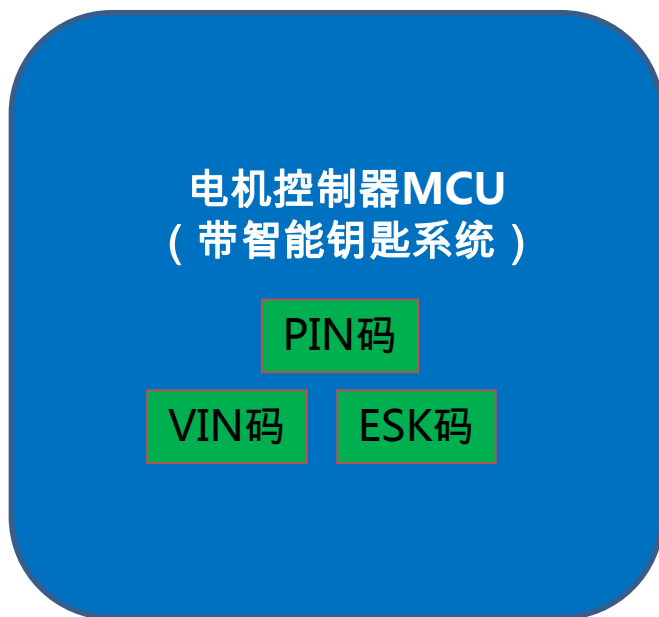
Common fault phenomenon (provided the battery can be powered with heavy current)	Recommended countermeasures
Failure to realize DC-DC charging function	Check the MCU and high and low voltage connections.
READY unavailable	Check the related signal components, PEPS control unit, VCU, and MCU.
READY allowed, but unable to drive	Check the related signal components, the motor and reducer.
Motor speed limit	Check the MCU, motor, vacuum, and temperature.
Motor overspeed	Check the motor load for open circuit (reducer, axle shaft, wheel).

## 四、E70电机及控制系统维修注意事项



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电机控制器MCU有两种不同的备件（软件程序差异，一种不带ESK码等防盗信息，一种带ESK码等防盗信息），在更换电机控制器MCU时，要根据车型配置进行选择备件。带智能钥匙系统车型的MCU在更换时，要进行防盗相关信息的写入（具体可参考防盗系统课件）。



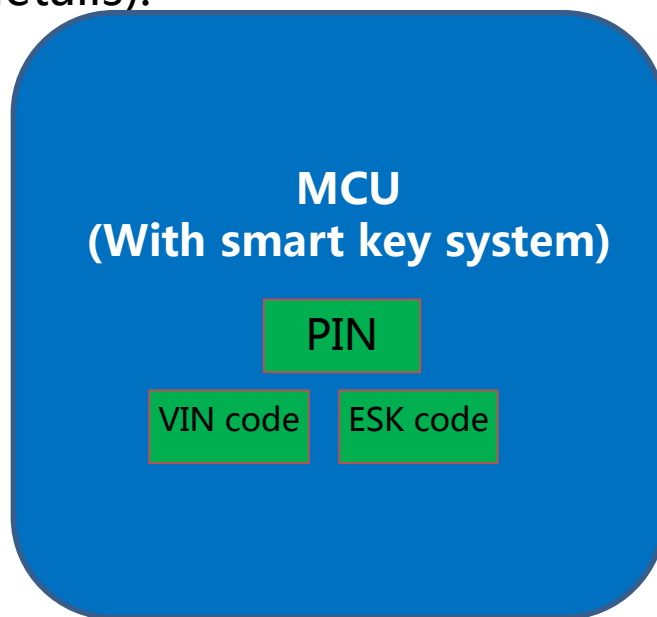
## IV. Precautions for service of E70 motor and control system



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The MCU has two different types of spare parts (due to software program differences, one type without anti-theft information such as ESK code, one type with anti-theft information such as ESK code). When replacing the MCU, it is necessary to select spare parts according to the vehicle configuration.

When replacing the MCU of the vehicle with the smart key system, it is necessary to write the anti-theft related information (refer to the anti-theft system courseware for details).



## 四、E70电机及控制系统维修注意事项



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- 严禁未经培训的人员进行高压部分检修，避免发生安全事故；
- 在开始换件维修工作之前，**请先拔出开启钥匙，再断开蓄电池，断开维修开关，装好相应的专用堵盖**
- 维修人员必须佩戴必要可靠的安全防护用品（绝缘手套，绝缘鞋）
- **在维修作业前请采用安全隔离措施（使用警戒栏隔离），并树立高压警示牌，以警示相关人员，避免发生安全事故；**
- 工作环境要求保持干燥，照明充足，透风；
- 工作环境中要求没有杂物，散乱的工具和部件，燃烧源和危险物品；
- 如果需要对电动机水道或相关部件进行维护，且电动机控制系统已经工作了一段时间。**应该在松开水箱水盖或打开水道之前，让电动机控制系统进行一段时间的冷却，以便冷却系统释放压力；**
- **不要让电动机过速，让电动机过速会对电动机的工作寿命产生很大的影响，正确操作车辆来防止电动机超速。**

## IV. Precautions for service of E70 motor and control system



东风乘用车

- It is strictly forbidden for untrained personnel to carry out high voltage maintenance to avoid safety accidents;
- Before starting the replacement, please pull out the opening key, disconnect the battery, disconnect the service switch, and install the corresponding special plug;
- Service personnel must wear necessary and reliable PPE (insulated gloves, insulated shoes);
- Take safety isolation measures (isolating by the warning bar) before service, and set up high voltage warning signs to alert relevant personnel to avoid safety accidents;
- The working environment is required to remain dry, with sufficient lighting and ventilation;
- No debris, scattered tools and components, sources of ignition and dangerous goods exist in the working environment;
- If it is necessary to maintain the motor water channel or related components, and the motor control system has been in operation for some time. The motor control system should be allowed to cool for a period of time before the radiator cover is opened or the water channel is opened, so that the pressure of the cooling system can be released;
- Do not over-speed the motor. Motor overspeed will have a large impact on the service life of the motor. Operate the vehicle correctly to prevent the motor from overspeeding.





1.对E70的电机及控制系统进行认知和拆装

2.完成E70高压实践任务单





1. Cognize and remove and refit the E70 motor and control system.
2. Complete the tasks list of the E70 high voltage systems.

