EBS控制系统
EBS

2023年4月
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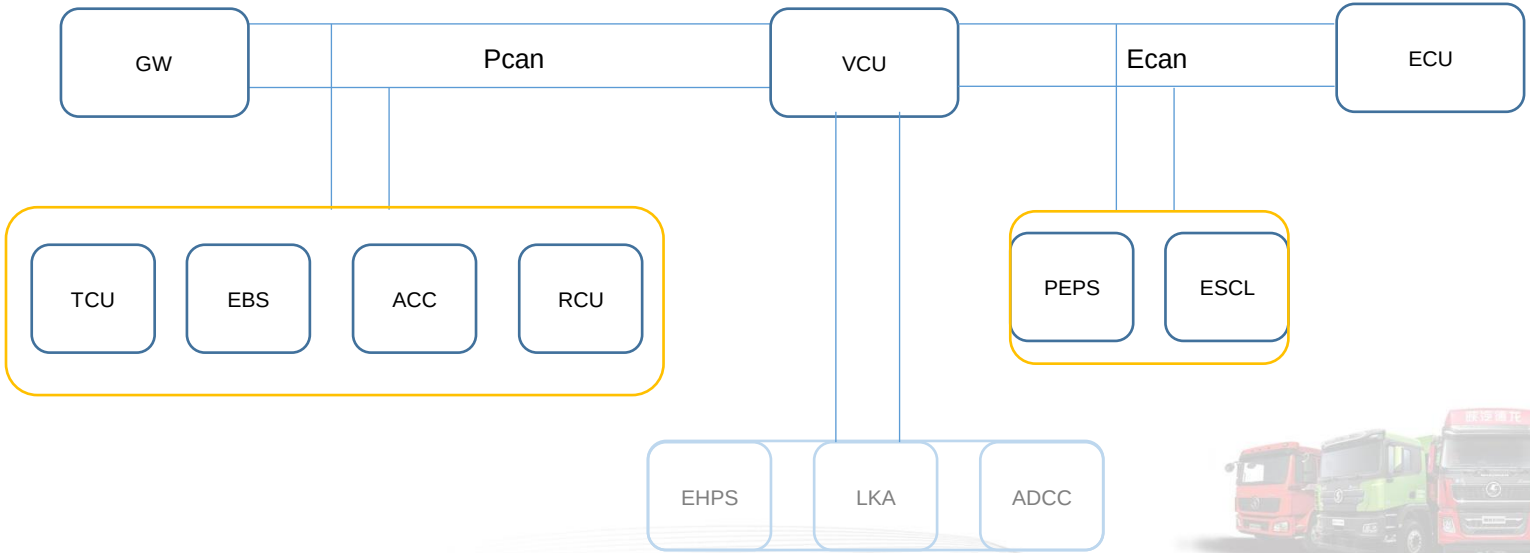
VCU系统
VCU

一、架构原理
I. Architecture principle

VCU整车控制器，主要负责融合整车端的动力需求，统一仲裁判断后将动力需求以唯一接口发送发动机（动力源），实现整车动力的统一处理仲裁。分为三路总线，目前在售车辆主要使用两路总线Pcan(传动系)、Ecan（动力系），具体分布如下。

The VCU is mainly responsible for integrating the power demand of the vehicle end, and sending it to the engine (power source) through a unique interface after unifying the arbitral judgment, so as to realize the unified processing and arbitration of the vehicle power. It is divided into three buses. Currently, vehicles on sale mainly use two buses Pcan (transmission system) and Ecan (power system). The specific distribution is as follows.



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一、架构原理
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VCU输入线束信号
VCU input wire harness signal

输入信号 Input signal	类型分类 Type classification	输入信号 Input signal	类型分类 Type classification
电源1 Power supply 1	B+	离合器开关 Clutch switch	硬线（MT） Hardwire (MT)
电源2 Power supply 2	15电 15 voltage	启动开关 Start switch	硬线 Hardwire
制动开关 Brake switch	硬线或报文 Hardwire or message	制动开度 Brake opening	硬线或报文 Hardwire or message
空挡开关 N position switch	硬线或报文 Hardwire or message	风扇转速 Engine speed of the fan	硬线 Hardwire
PTO开关 PTO switch	行车和驻车 Vehicle driving and parking	辅助制动开关 Secondary brake switch	硬线或报文 Hardwire or message

VCU输出信号
VCU output signal

输入信号 Input signal	类型分类 Type classification
排气制动 Exhaust brake	硬线 Hardwire
启动请求 Start request	硬线或报文 Hardwire or message
PTO开关 PTO switch	行车和驻车 Vehicle driving and parking
风扇控制 Fan control	硬线 Hardwire

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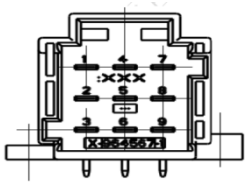
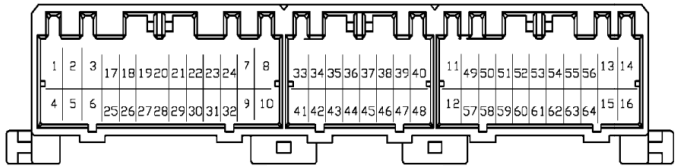
I. Architecture principle



插接器X2 A插件
Connector X2 plug-in A

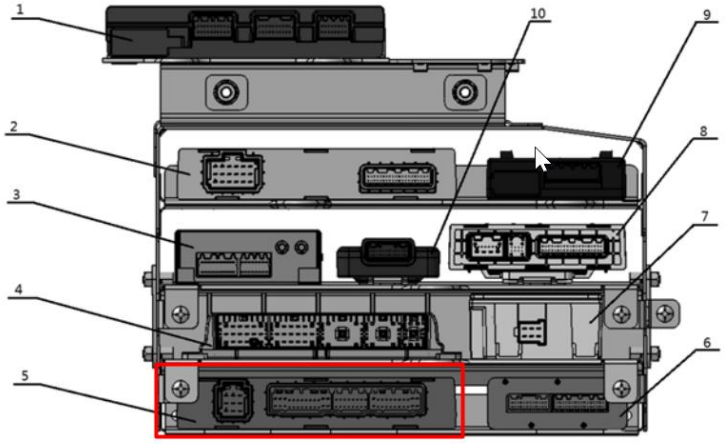


B插件
Plug-in B

D插件
Plug-in D

C插件
Plug-in C

插接器X1
Connector X1



VCU安装位置
VCU installation location

VCU系统
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控制器管脚定义
Definition of control pin

端 Terminal	功能 Function	功能2 Function 2	线号 Wire size	线色 Wire color	线径 Wire diameter	线束端 Wire harness terminal	
1	B+OUT 1		AE	AE	1	1	A113.A
2	B+1		30011	A	2.5	2	
3	B+2		30011	A	2.5	3 3	
4	B+OUT 2					4 4	
5	辅助制动选择 Assisted brake selection		90120	C	0.5	5	
6	GND		L	L	1.5	6 6	
7	辅助制动（+） Assisted brake (+)		90122	C	0.5	7	
8	辅助制动（-） Assisted brake (-)		90121	C	0.5	8	
9	GND		L	L	1.5	9	

A插件
Plug-in A

8	PTO空挡取力器电磁阀 PTO N position PTO solenoid valve		BF	BF	0.5	1	A113.B
7	Motor_fan_control					2	
24	非直驱发动机1档驱动 Gear 1 drive of non-direct drive engine	Engine_retard1 Relay	61667	C	.5	3	
23	非直驱发动机2档驱动 Gear 2 drive of non-direct drive engine	Engine_retard2 Relay	61666	C	0.5	4	
22	PTO空挡取力 PTO N position power takeoff		90124	C	0.5	5	
21	PTO行车取力 PTO driving power take-off		90123	C	0.5	6	
20	车下熄火 Out-off-car flameout		50151	K	0.5	7	
19	车下启动 Out-off-car start		50101	K	0.5	8	
18	T50		BAF	BAF	0.5	9	
17	T15		15002	H	0.5	10	
3	巡航SET- Cruise SET -	Handle_N_SW				11	
2	巡航SET+ Cruise SET +	Handle_D_SW				12	
1	驱发动机反馈缸内制动工作 Drive the engine to feedback VVEB	发动机缸内制动信号 VVEB signal	61670	C	0.75	13	
10	PTO取力器电磁阀 PTO solenoid valve		BFD	BFD	0.5	14	
9	Air_Pump_Fan_HSD	空压机风扇 Air compressor fan				15 15	
32	远程油门切换开关 Remote accelerator toggle switch		90125	C	0.5	16	
31	倒档信号 Reversing gear signal		BCL	BCL	0.5	17	
30	取力就反馈信号 PTO feedback signal		LKD	LKD	0.5	18	
29	手制动信号 Hand brake signal		16109	C	0.5	19	
28	冗余制动信号 Redundant brake signal	Motor_Mode				20	
27	制动信号 Brake signal		BI	BI	0.5	21	
26	空挡信号 N position signal		BAC	BAC	0.5	22	
25	离合器信号 Clutch signal		AI	AI	0.5	23	
6	限速按键切换 Speed limit key switching	Engine_Mode				24	
5	巡航OFF Cruise OFF	Emergency_Stop_SW				25	
4	巡航Resume Cruise Resume	Handle_R_SW				26	

B插件
Plug-in B

14	电磁风扇离合器1 Electromagnetic fan clutch 1		90302	C	0.5	1	A113.C
13	电控硅油电磁阀 Electronic control silicone oil solenoid valve	Fan_PWM	90301	C	0.5	2	
56	排气制动电磁阀 Exhaust brake solenoid valve		LKG	LKG	0.5	3	
55	E_CAN-H	120Ω	D	D	0.75	4	
54	T_CAN-H	120Ω				5	
53	T_CAN-L					6 6	
52	P_CAN-H	120Ω	DB	DB	0.75	7	
51	P_CAN-L		FB	FB	0.75	8	
50	Out_Temp_GND					9	
49	Out_Temp					10	
11	辅助制动开关信号 Secondary brake switch signal	预留AD1 Reserved AD1				11	
16	预留 Reserved	预留LSD4 Reserved LSD4				12	
15	Coolant_Pump_Control	冷却水泵PWM波控制 Cooling water pump PWM wave control				13	
64	电磁风扇离合器2 Electromagnetic fan clutch 2					14	
63	Engine Clutch 1 Fan	预留LSD1 Reserved LSD1 Резервный LSD 1				15	
62	E_CAN-L	120Ω	F	F	0.75	16	
61	AC空调请求信号 A/C request signal					17	
60	排气制动开关 Exhaust brake switch					18	
59	Multi_Power_GND	Multi_Power_GND				19	
58	Inlet_Temp					20	
57	Break Sensor					21	
12	辅助制动开关地 Secondary brake switch grounding	预留AD1_GND Reserved AD1_GND				22	

C插件
Plug-in C

40	多功率输入信号 Multiple power input signals	Multi_Power_Signal				1	A113.D
39	（远程）油门踏板1电源5V (Remote) accelerator pedal 1 power supply 5V		90001	C	0.5	2	
38	油门踏板1信号 Accelerator pedal 1 signal		90101	N	0.5	3	
37	（远程）油门踏板2电源5V (Remote) accelerator pedal 2 power supply 5V		90002	C	0.5	4	
36	油门踏板2信号 Accelerator pedal 2 signal		90102	N	0.5	6	
35	风扇转速传感器电源5V Power supply 5 V of the fan engine speed sensor		90010	C	0.5	6	
34	风扇转速传感器信号 Fan engine speed sensor signal		90110	N	0.5	7	
33	预留HSD2 Reserved HSD2					8	
48	Break Sensor GND					9	
47	Inlet_Temp_GND					10	
46	远程油门踏板1信号 Remote accelerator pedal 1 signal		90103	N	0.5	11	
45	（远程）油门踏板1底线 (Remote) accelerator pedal 1 bottom line		31010	C	0.5	12	
44	远程油门踏板2信号 Remote accelerator pedal 2 signal		90104	N	0.5	13	
43	(远程)油门踏板2地线 (Remote) accelerator pedal 2 ground wire		31011	C	0.5	14	
42	风扇转速传感器地线 Fan engine speed sensor ground wire		LN	LN	0.5	15	
41	Start Relay 启动继电器 Start Relay Start relay		BAD	BAD	0.5	16	

D插件
Plug-in D

VCU系统
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二、功能逻辑
II. Functional logic

1、启动功能
1. Start function

- VCU接收启动开关（来自PEPS控制器）的硬线请求，判断整车条件是否满足，满足后再向发动机发送启动请求（报文），发动机控制启动继电器及启动机运转，同时喷油启动。
  The VCU receives the hardwire request from the start switch (from the PEPS control unit), determines whether the vehicle conditions are met, based on which a start request (message) is sent to the engine. The engine controls start of the relay and operation of the starter, and at the same time spray oil for start.
- 常见启动条件判断：
  Judging on common startup conditions:
  1）空挡有效，AMT时接收ETC2报文，MT车型接收变速箱的硬线开关，最终在VCU的报文VCU1中反应状态
  1) With valid N position and AMT, ETC2 messages are received. MT models receive the hardwire switch of the transmission, and finally reflect the state in the VCU message VCU1.
  空挡无效时，也允许强制启动，强制启动需要持续按启动按钮3s以上。
  With invalid N position, forced start is also permitted, in which the start button must be constantly pressed for more than 3 seconds.
  2）要求制动信号有效（PEPS的要求），VCU接收制动信号并发送给PEPS，该信号有效时PEPS才会发送启动开关
  2) The brake signal is required to be valid (required by PEPS), which is received by the VCU and sent to PEPS. Only when the signal is valid will PEPS send it to the start switch
  硬线给VCU，无制动信号的情况下，按下启动按钮PEPS会直接执行下电动作，表现是仪表直接下电黑屏。
  When the hardwire connects to VCU without a brake signal, press the start button so that PEPS will directly execute the power-off action, which is displayed as direct power-off of IC and blank screen.
  VCU的制动信号来源，EBS车型直接采集其报文信号，ABS车型直接采集脚阀的制动开关硬线。
  As for the brake signal source of the VCU, EBS model directly collects its message signal, and ABS model directly collects the brake switch hardwire of the foot valve.
  3）变速箱条件：VCU接收TCU的启动判断状态，当变速箱不允许启动时，VCU不执行任何启动动作
  3) Transmission condition: VCU receives the start judgment state of TCU. When the transmission is not allowed to start, VCU does not perform any start action
  变速箱常见不允许启动情况：机械不在空挡、手柄命令与实际不符、超低温环境等。
  Common impermissible start conditions for the transmission: the machine is not in N position, inconsistent handle command with reality, ultra-low temperature environment, etc.
  4）防盗认证激活：更换非法控制器后，车辆将启动防盗机制，不允许启动。
  4) Activation of anti-theft certification: after replacing the illegal control unit, the vehicle will start the anti-theft mechanism and reject start.

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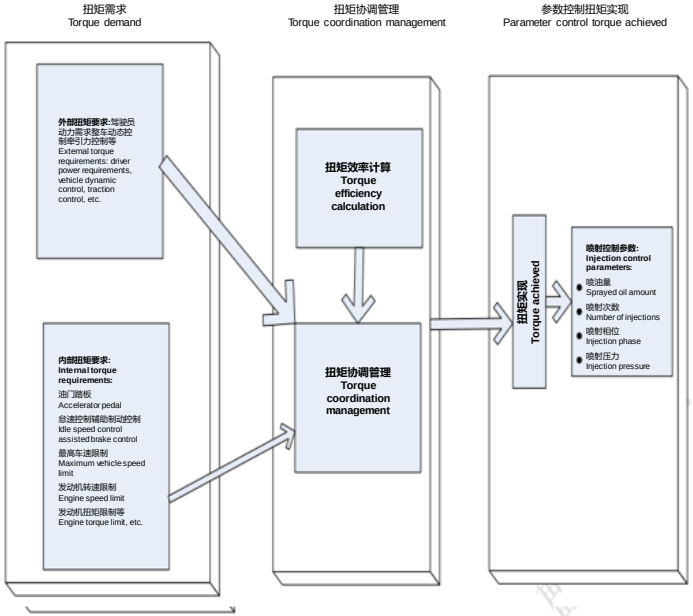
二、功能逻辑
II. Functional logic
2、正扭矩控制
2. Positive torque control

- VCU接收整车扭矩需求，综合仲裁判断，满足J1939协议要求，以唯一接口向发动机请求扭矩，发动机也只接受整车唯一接口控制动力。
  On receiving the vehicle's torque demand, VCU makes comprehensive arbitral judgment, and sends request for torque to the engine through the unique interface, when the J1939 protocol requirements are met. The engine only accepts the braking force from the vehicle's unique interface.
- 整车端向VCU发起扭矩需求的节点包括不限于：油门踏板、巡航、TCU、EBS（ASR/ESC）、ACC、AEBS、PTO固定转速、怠速控制、空调AC怠速提升控制、故障模式、最高车速限制等因素。
  The nodes at the vehicle end that initiate torque requirements to the VCU include but not limited to: accelerator pedal, cruise, TCU, EBS (ASR/ESC), ACC, AEBS, PTO fixed engine speed, idle speed control, A/C idle speed boost control, fault mode, maximum vehicle speed restrictions and other factors.
- 发动机接收整车唯一接口控制扭矩，但自身还需要考虑排放、安全因素执行喷油控制，主要包括但不限于低怠速控制、高转速保护、后处理排放等因素。
  The engine receives the unique interface control torque of the vehicle, but it also needs to consider emission and safety factors to implement fuel injection control, which mainly include but not limited to low idle speed control, high engine speed protection, after-treatment system emission and other factors.



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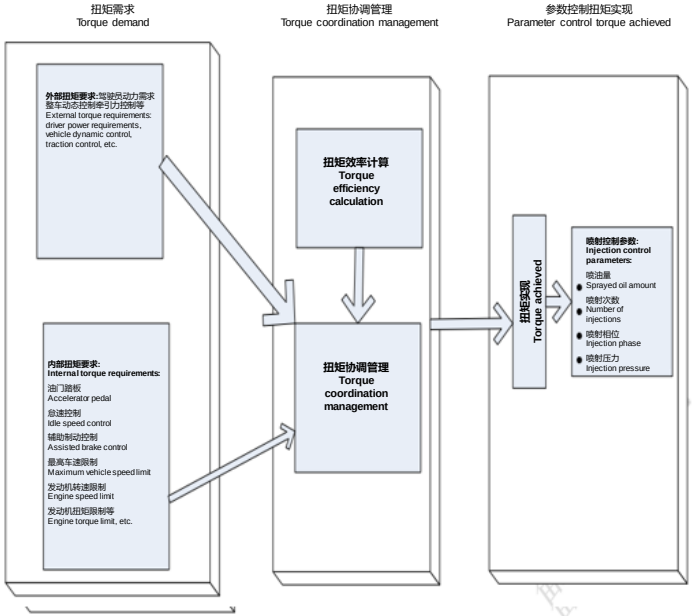
二、功能逻辑
II. Functional logic

3、负扭矩控制
3. Negative torque control

- VCU控制负扭矩包括排气制动、缸内制动、缓速器制动。
  The negative torque controlled by VCU includes exhaust brake, VVEB and retarder brake.
- 排气制动：VCU直接控制电磁阀硬线，请求源主要是辅助制动开关、制动脚阀，ACC、AEB等功能。
  Exhaust brake: VCU directly controls the solenoid valve hardwire, with the request source being mainly the secondary brake switch, brake foot valve, ACC, AEB and other functions.
- 缸内制动：VCU接收整车扭矩需求，综合仲裁判断，满足J1939协议要求，以唯一接口向发动机请求刚内负扭矩，发动机也只接受整车唯一接口控制动力；包括不限于辅助制动开关、制动脚阀，ACC、AEB请求，TCU控制，EBI控制等功能。
  VVEB: VCU receives the torque demand of the vehicle and makes comprehensive arbitral judgments that meet the requirements of the J1939 protocol; it requests in-cylinder negative torque from the engine through a unique interface, which only accepts the braking force of the vehicle's unique interface; including but not limited to the secondary brake switch, brake foot valve, ACC, AEB request, TCU control, EBI control and other functions.
- 缓速器制动：整车端向RCU发起扭矩需求，但RCU不仅接收VCU请求，还自行接收外接控制器的请求。VCU对缓速器的请求源节点包括不限于：辅助制动开关、制动脚阀等。
  Retarder braking: The vehicle end will initiate a torque request to the RCU. However, the RCU not only receives VCU requests, but also those from the external control units by itself. The VCU's request source nodes for the retarder include but not limited to: secondary brake switch, brake foot valve, and so on.



VCU系统
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二、功能逻辑
II. Functional logic

4、PTO控制
4. PTO control

- PTO 转速控制是一种发动机恒定速度运行的功能，且转速不随负荷变化而 变化。
  PTO engine speed control is a function that allows the engine to run at a constant speed, which does not vary with load changes.
- 激活条件：停车状态，未踩下油门，无油门扭矩类故障，未踩下制动，配置字开启。
  Activation conditions: parking state, the accelerator not depressed, faults without accelerator torque, the brake not depressed, and the open configuration bits.
- 执行开关：保证巡航使能开关有效的同时，按下巡航Resume按键。
  Execution switch: at the moment when the cruise enabling switch is valid, press the cruise Resume key.
- 执行动作：VCU控制器发动机进入预先设定的转速值运行，再通过巡航+或巡航-可以以一定步长调整相关转速。
  Execution action: the engine of VCU control unit operates by entering the preset engine speed value, and then adjusts the relevant engine speed with a certain step width through cruise + or cruise -.
  预先设定值约1300rpm，具体数值可以通过VDI进入VCU控制器的控制器标识读取，且可以通过VCU的“写参数”界面更改设定值。
  The preset value is about 1300 rpm. Read the specific value of signs by VDI entering the VCU control unit, which can be changed with the "write in parameter" interface of the VCU.

- 退出条件：按下巡航off按键，即将巡航使能开关置0。（配开关图）
  制动踏板开关踩下。

  Exit condition: press the cruise off key and set the cruise enabling switch to 0. (with a switch diagram)
  Depress the brake pedal switch.

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二、功能逻辑
II. Functional logic
4、PTO控制
4. PTO control

- 常规用途：
  General use:

  1）PTO取力，要求发动机提供恒定转速值。
  1) PTO torque extraction requires the engine to provide a constant engine speed value.

  2）蓄电池充电：电池亏电或电量不足时，启动车辆视听该功能提升转速可更快对电池充电。
  2) Battery charging: when the battery is depleted or insufficient, start the vehicle audio and video function to increase the engine speed and charge the battery faster.

  3）风扇故障判断：不清楚硅油冷却风扇是否可以脱离时，可以使用该功能提升转速1300rpm，等待1min左右，通过观测噪音是否明显降低，或读取VDI中VCU上报的风扇转速来判断风扇与发动机差值，判断风扇是否脱能够开。
  3) Fan failure judgment: it can be used to raise the engine speed to 1300 rpm for waiting about 1 minute, when it is not clear whether the silicone oil cooling fan can be disengaged. By observing whether the noise is obviously degraded, or reading the fan speed reported by VCU in VDI, the difference between the fan and engine is judged for whether the fan is disconnected.

注意事项：PTO模式下脚油门不起作用。
Note: the foot accelerator does not work in the PTO mode.

该模式与巡航的条件较近，尤其是开关复用，车速、配置字相异，可以用于巡航功能异常的校验判断。
This mode is close to the conditions of cruise, especially reuse of the switch. As the vehicle speed is different from configuration bits, it can be used to verify and judge abnormal cruise control functions.

该转速值仅当次激活有效，下电后再次启动车辆不会保持。
The engine speed value is only valid for the current activation, and will not be maintained for next startup of the vehicle after power-off.

开关不能粘连。
Switches cannot be glued.

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二、功能逻辑
II. Functional logic
5、巡航控制
5. Cruise control

- 通过多功能开关操作取代油门踏板控制整车以恒定车速行驶，减轻了驾驶员 疲劳，降低油耗。
  With the operation of multi-function switch, the vehicle is controlled by replacing the accelerator pedal and drives at a constant vehicle speed, which reduces the driver fatigue and fuel consumption.
- 激活条件：
  Activation conditions:
  1）车速＞40kph。
  1) Vehicle speed > 40 kph.
  2）制动开关、离合开关、手刹开关、ABS等未激活。
  2) The brake switch, clutch switch, handbrake switch, ABS, etc. are inactive.
  3）手刹、离合、转速、车速、制动等重点信号无故障。
  3) No fault for key signals such as hand brake, clutch, engine speed, vehicle speed and brake.
  4）制动信号可以正常激活。
  4) The brake signal can work with normal activation.
  5）配置字开启。
  5) Turn on the configuration bits.
- 执行开关：保证巡航使能开关有效的同时，按下巡航set+按键。
  Execution switch: press the cruise set + key while ensuring the cruise enabling switch is valid,
- 执行动作：VCU控制器发动机进入实时车速值巡航。可以通过巡航+或巡航-更改当前设定车速值。
  Execution action: the VCU control unit engine enters the real-time vehicle speed cruise. The current set speed value can be changed through cruise + or cruise -.

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二、功能逻辑
II. Functional logic
6、巡航控制
6. Cruise control

- 退出条件：进入要求 的任意条件不满足，均会退出巡航。.
  Exit conditions: if any condition of the entry requirement is not met, the cruise will exit.
  巡航使能开关置0，退出巡航。
  Set the cruise enabling switch to 0 and exit cruise.
- 执行开关：当次非使用巡航使能开关退出巡航，均会记忆内部状态；
  Execution switch: if the cruise enabling switch is not used to exit the cruise, the internal state will be preserved in memory;
  再次满足条件后，按下巡航Resume可以恢复巡航状态。
  When the conditions are met again, press Cruise Resume to restore the cruise state.
- 执行动作：VCU控制器发动机进入上次巡航设定值进行巡航。
  Execution action: the VCU control unit engine will cruise by entering the last cruise setup value.
- ACC匹配控制：当车辆具备ACC自适应巡航功能时，VCU接收ACC的外部扭矩控制，但进入条件需要满足ACC条件。
  ACC matching control: when the vehicle is provided with the ACC self-adaptive cruise function, the VCU will receive external torque control of the ACC, but with the entry satisfying ACC conditions.
- 注意事项：CC巡航功能车速在60kphl以上舒适性效果更佳。
  Note: the vehicle speed of above 60 kph for the CC cruise control function has better effect in comfort.
  开关是自复位式开关，不能粘连。
  The switch is self-resetting and cannot be glued.

VCU系统
VCU

二、功能逻辑
II. Functional logic

7、怠速调整
7. Idle speed adjustment

- 怠速控制是一种发动机在怠速情况下进行转速调整的功能，以满足特殊需求工况。
  Idle speed control is a function of adjusting the engine speed in idling, so as to meet special work demands.
- 激活条件：
  Activation conditions:
  1）油门开度为0。
  1) The accelerator opening is 0.
  2）制动信号无故障。
  2) The brake signal is fault free.
  3）配置字开启。
  3) Start configuration bits.
  4）开关是自复位式开关，不能粘连。
  4) The switch is a self-resetting switch without adhesion.
- 执行开关：
  Execution switch:
  1）踩下制动踏板，确保巡航使能开关开启有效，同时按下续航Resume按键；
  1) Depress the brake pedal, ensure the cruise enabling switch is on and valid, and press the enduring Resume key at the same time;
  以上条件同时有效 3 秒以上时，VCU进入怠速调整状态。
  When the above conditions are valid for more than 3 seconds simultaneously, the VCU enters the idle speed adjustment state.
  2）通过巡航+或巡航-可调整当前怠速值。
  2) The current idle speed value can be adjusted by cruise + or cruise -.
  3）该调整一般不会主动保存，仅档次有效，下电再上电启动后，仍恢复原怠速值。
  3) Generally, the adjustment is only valid for the current time and will not be saved in active forms. After being started by power-off and power-on again, it will restore to the original idle speed value.
- 执行动作：VCU控制器发动机进入怠速调整值，退出后不再保存。
  Execution action: the VCU control unit engine enters the idle speed adjustment value, and exits without being saved.

VCU系统
VCU

二、功能逻辑
II. Functional logic
7、怠速控制
7. Idle speed control

- 退出方法：
  Exit method:

  1）正常按下巡航off即可退出怠速调整，但不保存怠速值。
  1) Press the cruise off normally to exit the idle speed adjustment, without saving the idle speed value.

  2) 踩下制动踏板，同时按下巡航“OFF”按键，同时有效 3 秒以上时，将会保存设定值并退出怠速调整状态，再按巡航+或巡航-不会再调整怠速值；并再次上电后怠速值为上次设定值。
  2) Depress the brake pedal and press the cruise "OFF" key simultaneously. If both are valid for more than 3 seconds, the set value will be saved and the idle speed adjustment state will exit. By pressing cruise + or cruise - again the idle speed value will not be adjusted; and after power-on again, the idle speed value equals to the last set value.

- AC怠速提升：
  AC idle speed increase:

  当停车状态开启AC后，需要提升发动机转速，即发动机怠速值，但此种提升随空调的开启关闭进行，行车后正常响应行驶扭矩。
  When AC is turned on in the parking state, the engine speed shall be increased, that is, the engine idle speed value. However, such an increase occurs along with on / off of the A/C, and normal response to the driving torque after vehicle driving.

VCU系统
VCU

二、功能逻辑
II. Functional logic

8、车速限制
8. Vehicle speed limit

- 在各种路况下，对车辆进行最高车速限制，提高驾驶安全系数。
  Under various road conditions, restrict the maximum vehicle speed limit, so as to improve the safety factor for driving.
- X6000车型最高车速值由VCU控制，当接近最好车速限制值时，VCU请求扭矩变化，以适应车速限制法规或需求。
  The maximum vehicle speed value of the X6000 model is controlled by the VCU. When it gets close to the best speed limit value, the VCU requests a torque change, so as to adapt to the speed limit regulations or requirements.
- 车速限制值在VDI诊断仪的VCU的控制器标识界面中可读。
  The vehicle speed limit value must be readable in the VCU sign interface of the VDI diagnostic unit.
- 车速限制值为满足特殊工况的特殊需求，可在标定界面临时调整，VDI的VCU写参数界面进行调整。
  In order to meet the special needs of special working conditions, the vehicle speed limit value can be temporarily adjusted in the calibration interface, and the VCU writing parameter interface of VDI.

VCU系统
VCU

二、功能逻辑
II. Functional logic
9、风扇控制
9. Fan control

主要根据发动机水温、进气温度、发动机转速等来控制冷却风扇的转速。风扇类型为电磁离合器风扇及电控硅油风扇。
The cooling fan speed is mainly controlled based on engine water temperature, air inlet temperature, engine speed, etc. Fan types are electromagnetic clutch fans and electronically controlled silicone oil fans.

电控风扇是根据发动机的外部条件（水温、进气温、空调等）来自动调整风扇的转速，使发动机工作在最佳温度下，在满足整车散热需求的前提下有效降低 风扇功率消耗，最终达到降低油耗，给发动机快速降温的目的。
The electronically controlled fan automatically adjusts the engine speed according to the external conditions of the engine (water temperature, intake air temperature, A/C, etc.), so that the engine works at the optimal temperature and effectively reduces the fan power consumption on the premise of meeting the cooling needs of the vehicle. Ultimately, it achieves the purpose of reducing fuel consumption and quickly cooling the engine.

- 风扇的最常见控制源是水温信号，具体水温开启风扇值时出厂统一标定，市场不可更改。
  The most common control source of the fan is the water temperature signal. The specific fan start water temperature value passes the uniform calibration at the factory, which cannot be changed by the market.
- 风扇的控制采用PWM信号控制风扇离合器占空比，接收PWM的转速传感器信号计算风扇转速进行闭环控制。
  The fan control adopts the duty cycle of PWM signal control to the fan clutch, and accepts the PWM engine speed sensor signal for calculation of the fan speed in the closed-loop control.
- VCU控制风扇的电磁阀，其电源端来源VCUDE 24V输出，控制端来自VCU的C2，是一个PWM信号。
  VCU controls the solenoid valve of the fan, the power supply of which is output from VCUDE 24 V, and the control terminal from C2 of VCU, which is a PWM signal.
  当该针脚为24V时硅油风扇直连，当该针脚为0V时风扇不驱动。
  When the pin is 24 V, the silicon oil fan is directly connected, and when it is 0 V, the fan does not drive.
- VCU 会将采集的风扇转速、输出的控制占空比、驱动状态和驱动源进行报文发送。
  VCU will send the collected engine speed of fan, output control duty cycle, drive state and drive source in messages.

VCU系统
VCU

二、功能逻辑
II. Functional logic
10、辅助制动控制
10. Assisted brake control

X6000平台主要辅助制动包括排气制动、发动机缸内制动、液力缓速器制动，以实现车辆制动，减少主制动使用，保证安全节省成本。
The main assisted brake of the X6000 platform includes exhaust brake, VVEB, and hydraulic retarder brakE, so as to achieve vehicle braking, reduce the use of main braking, and ensure safety and cost savings.

- 辅助制动的驱动：
  Assisted brake drive:
  1)排气制动：由VCU直接驱动硬线，使能电磁阀，高有效控制。
  1) Exhaust brake: the VCU directly drives the hardwire, enabling solenoid valve, and active-high control.
  2)发动机缸内制动：由VCU接收仲裁整车需求，发送报文控制发动机执行，发动机仅接收VCU需求。
  2) VVEB: the VCU receives and arbitrates the vehicle requirements, sends messages and controls the engine execution. The engine only receives VCU requirements.
  3）液力缓速器制动：由VCU根据开关判断，进行报文请求，但缓速器可自行接收整车其他控制器请求。
  3) Hydraulic retarder brake: the VCU judges from the switch, and requests with messages; but the retarder can receive requests from other control units of the vehicle by itself.
- 辅助制动激活条件：
  Conditions for assisted brake activation:
  1）非空挡条件；
  1) Situation in the positions other than N position;
  2）未踩下油门；
  2) The accelerator not depressed;
  3）发动机转速较高，约900rpm以上；
  3) The engine speed is relatively high for more than around 900 rpm;
  4）ABS等不能激活；
  4) ABS, etc. without activation;
  5）无外界控制要求禁用。
  5) Non external control requirements are disabled.

VCU系统
VCU

二、功能逻辑
II. Functional logic
11、辅助制动控制
11. Assisted brake control

- 辅助制动开关：
  Secondary brake switch:
  1）无缓速器车型，开关最高到2挡，仅有排气制动和缸内制动，可实现联合制动。
  1) For models without retarder, the highest gear of switch is Gear 2, with only exhaust brake and VVEB, which can realize combined brake.
  2）有缓速器车型，开关最高到5挡，可实现排气制动、缸内制动、缓速器制动；
  2) For models with retarder, the highest gear of switch is Gear 5, which can realize exhaust brake, VVEB and retarder brake;
  采用陕汽自主开发的联合制动控制，最大化发挥辅助制动的性能，提升制动能力、提升经济性和舒适性。
  It adopts the joint braking control that is independently developed by Shaanxi Automobile, so as to maximize the performance of assisted brake, improve braking capacity, economy and comfort.
  3）有缓速器时，1挡为恒速挡，可动态调用相关辅助制动，实现车辆下坡恒速控制。
  3) When there is a retarder, Gear 1 is the constant speed position, which can dynamically mobilize the relevant assisted brake, so as to achieve constant speed control of the vehicle downhill.
  5挡时，各项辅助制动均能发挥最大制动能力，保证制动效果。
  In Gear 5, each assisted brake can exert its maximum braking capacity and ensure the braking effect.
  其他档位按照自主联合制动策略进行制动，保证舒适性、经济性和制动能力。
  Other positions shall be used for brake according to the autonomous joint braking strategy, so as to ensure comfort, economy and braking capacity.
- 制动信号源：
  Brake signal source:
  1）怀挡开关时，辅助制动开关信号，来源Lin线，给到BCM，再发送Can信号给VCU。
  1) With the column shifter switch, the signal of the secondary brake switch and the source Lin bus will be sent to the BCM, and then sends the Can signal to the VCU.
  2）非怀挡开关时，辅助制动开关是硬线直接给到VCU，且是自复位信号。
  2) Without the column shifter switch, the secondary brake switch is directly sent through hardwire to the VCU, in self-resetting signals.
- 注意事项：发动机转速和散热能力影响辅助制动能力，后市场不能随意改装冷却系统。
  Note: as the engine speed and heat dissipation capacity affect the assisted brake ability, the aftermarket shall not change the cooling system at will.

VCU系统
VCU

二、功能逻辑
II. Functional logic
12、主副刹联动功能控制
12. Main and accessory brake linkage function control

- X6000车型独有的主副刹联动，需要采集制动踏板开度信号，根据特定条件，在主制动工作的同时，调研辅助制动工作，以减少主制动力矩输出，达到减少制动摩擦片磨损的目的。
  The unique main and assisted brake linkage of the X6000 model needs to collect the brake pedal opening signal. According to specific conditions, the assisted brake work is investigated while the main brake is working, so as to reduce output of the main braking force torque and wearing of the brake friction plate.

- 辅助制动激活条件：
  Conditions for assisted brake activation:
  1）非空挡条件；
  1) Situation in the positions other than N position;
  2）未踩下油门；
  2) The accelerator not depressed;
  3）发动机转速较高，约900rpm以上；
  3) The engine speed is relatively high for more than around 900 rpm;
  4）ABS等不能激活；
  4) ABS, etc. without activation;
  5）无外界控制要求禁用。
  5) Non external control requirements are disabled.

VCU系统
VCU

二、功能逻辑
II. Functional logic
13、取力器控制
13. PTO control

- 接收取力器翘板开关信号，对取力器电磁阀控制，实现气路的控制，并将电磁阀的控制信号发送在总线，此功能不影响油门使用。
  It receives the rocker switch signal of the PTO, controls the PTO solenoid valve and the air path, and sends the control signal of the solenoid valve to the bus. This function does not affect the use of accelerator.
- 分为手动变速箱MT和自动变速箱AMT两种配置。
  It is divided into two configurations: manual transmission MT and automatic transmission AMT.

输入输出线号：
Input and output wire size:

行车取力器开关：X1-21
Vehicle PTO switch: X1-21
空挡取力器开关：X1-22
N position PTO switch: X1-22
取力器反馈信号：X1-30
PTO feedback signal: X1-30

输出信号：
Output signal:

行车取力器电磁阀：X-10
Driving PTO solenoid valve: X-10
空挡取力器电磁阀：X-8
N position PTO solenoid valve: X-8

VCU系统
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二、功能逻辑
II. Functional logic
14、取力器控制
14. PTO control

- MT功能控制：
  MT function control:
  1、空档取力开关（X1-22）信号有效时，取力器电磁阀(X1-10) 、空档取力器电磁阀(X1-8)都输出控制。
  1. When the N position PTO switch (X1-22) signal is valid, both the PTO solenoid valve (X1-10) and the N position PTO solenoid valve (X1-8) will output control.
  2、空档取力开关信号（X1-22）和行车取力开关信号(X1-22)都有效时，只有取力器电磁阀(X1-10)输出控制。
  2. When the N position PTO switch signal (X1-22) and vehicle driving PTO switch signal (X1-22) are both valid, only the PTO solenoid valve (X1-10) outputs control.
  3、当取力器反馈信号有效时，VCU 通过报文形式将举升状态发送到总线上进行显示。
  3. When the PTO feedback signal is valid, the VCU will send the lifting state in messages to the bus for display.

- AMT功能控制：
  AMT function control:
  1、空挡取力开关（X1-22）信号有效时，VCU发送请求报文。
  1. When the N position PTO switch (X1-22) signal is valid, the VCU will send a request for messages.
  2、变速箱TCU接收VCU的请求，综合自身条件判断，发出允许使用取力器；VCU驱动取力器电磁阀（X1-10）。
  2. The transmission TCU receives the request from the VCU, makes judgement based on its own conditions, and sends a permission to use the PTO; the VCU drives the PTO solenoid valve (X1-10).
  3、当取力器反馈信号有效时，VCU 通过报文形式将举升状态发送到总线上进行显示。
  3. When the PTO feedback signal is valid, the VCU will send the lifting state in messages to the bus for display.