

AC空调控制系统 AC system

2023年4月
April 2023



AC空调控制系统
AC system

一、架构原理

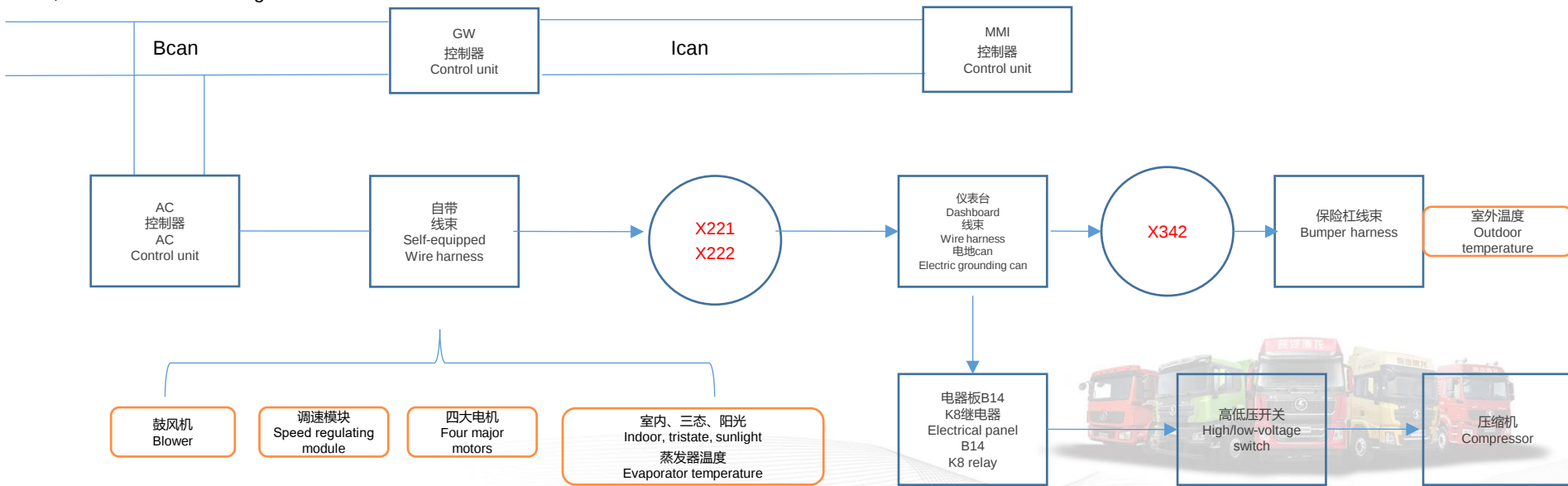
1. Architecture principle

架构：此部分主要介绍主要控制器所在网络，并点出涉及的其他交互控制器或开关。

EBS系统包括 制动踏板、控制器、SAS、ESC、前桥模块、后桥模块、前桥左右ABS电磁阀、轮速、磨损报警、磨损传感器，其中控制器与整车通讯，SAS转角传感器在整车Can，ESC、前桥模块、后桥模块、挂车模块是控制器的子Can，挂车预留can线到EBS的子网。前轴ABS阀是控制器直接控制，各模块集成阀与通信功能。

Architecture: this section mainly introduces the network for the main control unit, and points out other interaction control units or switches that are involved.

The EBS system includes brake pedal, control unit, SAS, ESC, front axle module, rear axle module, front axle LH/RH ABS solenoid valves, wheel speed, wear alarm, and wear sensor; among them, the control unit communicates with the vehicle, and the SAS angle sensor serves as the sub-can of the control unit in the vehicle Can, ESC, front axle module, rear axle module, and trailer module, and the trailer reserves CAN bus for the EBS subnet. The front axle ABS valve is directly controlled by the control unit, and each module integrates valve and communication functions.



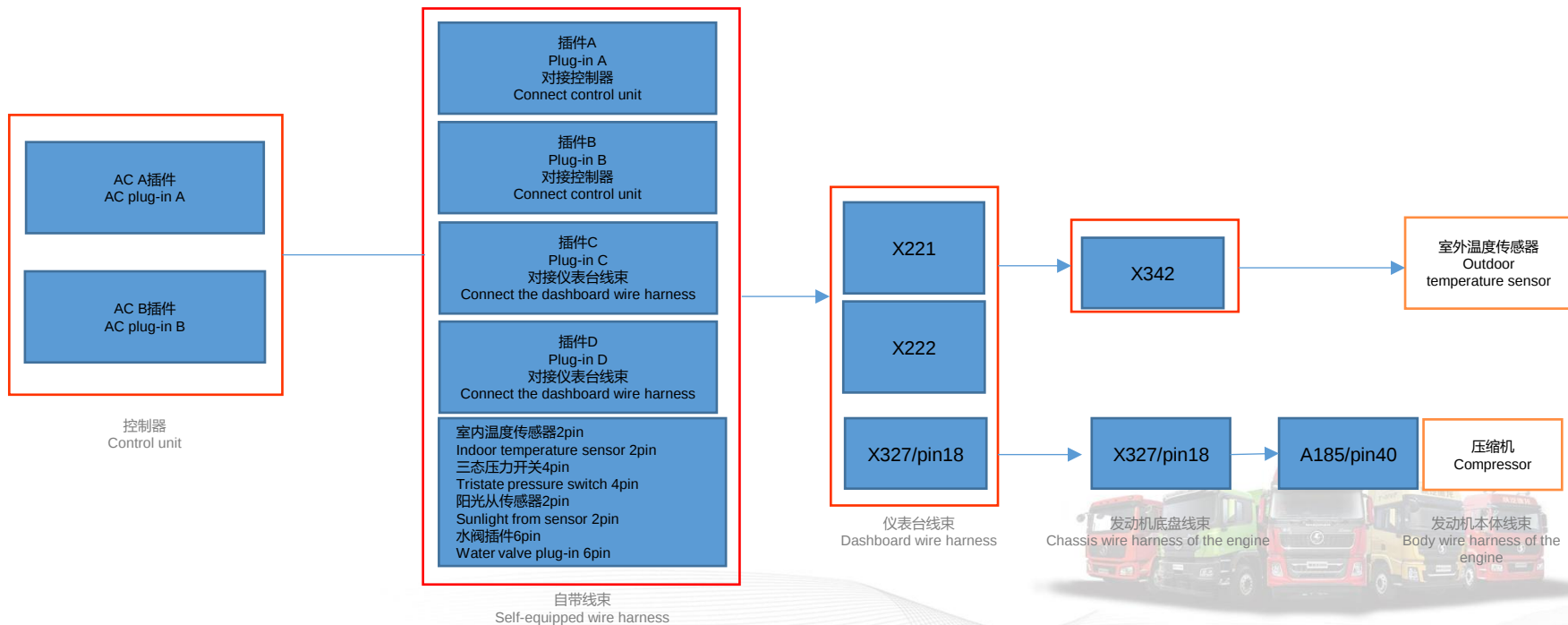
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一、架构原理

I. Architecture principle

线束结构：线束拓扑、接插件对接、各线束重点或特殊功能，例如继电器、保险、卡接等。

Wire harness structure: wire harness topology, connector docking, key points or special functions of each wire harness, such as relay, fuse, clip, etc.



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压缩机控制信号流:

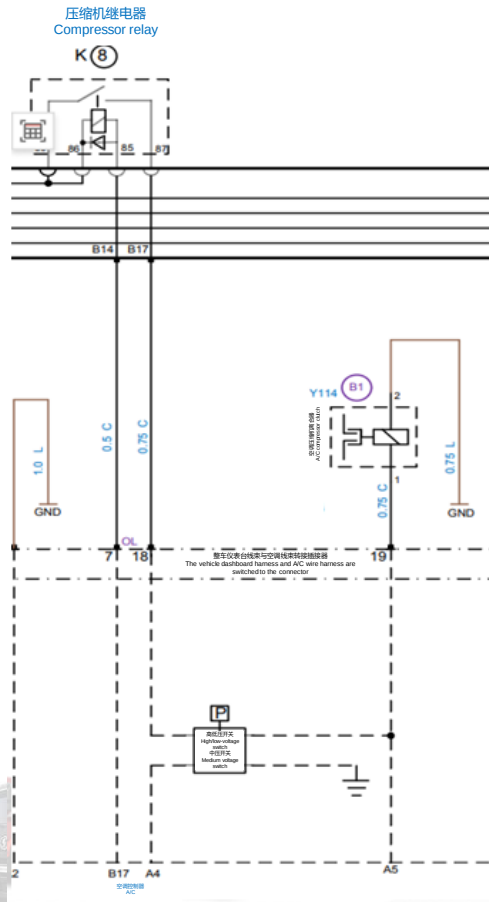
Compressor control signal flow:

AC控制器B17输出低控信号，经X222的pin7至电器板K8继电器（B14），继电器输出B17，经X222的pin18进入空调自带线束，在线束内部串入高低压开关（pin1进入pin4出来），高低压信号出来一分为二，一进入控制器A5，二经X222的pin19，到仪表盘、底盘、发动机线束控制压缩机。

The AC control unit B17 outputs a low-control signal, which travels to the K8 relay (B14) of the electrical panel through X222 pin7; the relay outputs B17, which enters the A/C self-contained wire harness through X222 pin18, and is strung to the high / low-voltage switch inside the wire harness (pin1 in and pin4 out). The high / low voltage signals come out by one division in two; one enters the control unit A5, and the other passes through X222 pin19 and arrives at the dashboard, chassis, and engine wire harness, which controls the compressor.

如果高低压确实异常，控制输出后无法驱动压缩机，但AC状态却可以主动点亮，可以根据AC状态点亮时间变化，判断是否高低压异常。

If the high and low voltages are indeed abnormal, and the drive compressor cannot be installed after controlling the output, even though the AC state will actively come on, you may determine whether the high and low pressures are abnormal according to changes in lighting time of the AC state.



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空调自带线束管脚定义
Pin definition of A/C self-contained harness

插接件 Connector	针脚编号 Pin number	信号定义 Signal meaning	针脚编号 Pin number	信号定义 Signal definition	插接件 Connector	针脚编号 Pin number	信号定义 Signal definition	针脚编号 Pin number	信号定义 Signal definition
插接件A (与 泡 壶对接) Connector A (connected to the bubble control device)	1	附件供电+ Accessory power supply+	17		C (与整车线束对 接) (Connect with the vehicle harness)	1	室外温度传感器+ Outdoor temperature sensor +	11	/
	2	功率地 Power grounding	18	调速模块控制信号 Speed regulating module control signal		2	附件供电+ Accessory power supply+	12	/
	3	点火信号 Ignition signal	19			3	功率地 Power grounding	13	/
	4	中Y (-) Medium Y (-)	20			4	信号地 Signal ground	14	/
	5	高压/低压(-) High pressure / low pressure (-)	21			5	CAN_H	15	/
	6	信号地 Signal ground	22			6	CAN_L	16	/
	7	阳光传感器+ RLS +	23			7	压缩机控制信号(-) Compressor control signal (-)	17	/
	8	室内温度传感器+ Indoor temperature sensor +	24	步进机电源 Stepping motor power supply		8		18	N1到压结机离合器 继电器 N1 to the pressing machine clutch and relay
	9	室外温度传感器+ Outdoor temperature sensor +	25			9		19	高压/低压(-) High pressure / low pressure (-)
	10	风脚传感器+ Lower airflow sensor +	26	风机反馈 Fan feedback		10		20	/
	11	蒸发器温度传感器+ Evaporator temperature sensor +	27		D (与整车线束对 接) (with the vehicle harness)	1	电池电压 Battery voltage	3	点火信号 Ignition signal
	12		28			2	功率地 Power grounding	/	/
	13		29	室内温度传感器 Indoor temperature sensor		1	室内温度传感器+ Indoor temperature sensor +	2	信号地 Signal ground
	14		30	三态压力开关接插件 Tristate pressure switch connector and plug-in		1	N1到压结机离合器继电器 N1 to the compressor clutch and relay	3	中压(-) Medium voltage (-)
	15	CAN_H	31			2	信号地 Signal ground	4	高压/低压(-) High pressure / low pressure (-)
	16	CAH_L	32	阳光传感器接插件 RLS connector and plug- in		1	信号地 Signal ground	2	阳光传感器(+) RLS (+)
插接件B (与控 制 器对接) Connector B (connected to the control unit)	1	循环风门驱动信号4 Recirculation damper drive signal 4	11	模式风门驱动信号2 Mode damper drive signal 2	水阀接插件 Water valve connector and plug-in	1	水阀电机驱动信号1 Water valve motor drive signal 1	4	水阀电机驱动信号3 Water valve motor drive signal 3
	2	循环风门驱动信号3 Recirculation damper drive signal 3	12	模式风门驱动信号1 Mode damper drive signal 1		2	水阀电机信号+ Water valve motor signal +	5	/
	3	循环风门驱动信号2 Recirculation damper drive signal 2	13	水阀电机驱动信号4 Water valve motor drive signal 4		3	水阀电机驱动信号2 Water valve motor drive signal 2	6	水阀电机驱动信号4 Water valve motor drive signal 4
	4	循环风门驱动信号1 Recirculation damper drive signal 1	14	水阀电机驱动信号3 Water valve motor drive signal 3	/	/	/	/	/
	5	混合风门驱动信号4 Mixing damper drive signal 4	15	水阀电机驱动信号2 Water valve motor drive signal 2	/	/	/	/	/
	6	混合风门驱动信号3 Mixing damper drive signal 3	16	水阀电机驱动信号1 Water valve motor drive signal 1	/	/	/	/	/
	7	混合风门驱动信号2 Mixing damper drive signal 2	17	压缩机控制信号 (-) Compressor control signal (-)	/	/	/	/	/
	8	混合风门驱动信号1 Mixing damper drive signal 1	18	/	/	/	/	/	/
	9	模式风门驱动信号4 Mode damper drive signal 4	19	/	/	/	/	/	/
	10	模式风门驱动信号3 Mode damper drive signal 3	20	/	/	/	/	/	/



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二、功能逻辑

II. Functional logic

1、空调通用功能描述:

1. Generic function description of A/C:

上电默认空调系统处于关机状态。

Power-on of the A/C system acquiesces in the A/C off status.

初始化:

Initialization:

30+电下不发送报文; ACC 电, 400ms 完成初始化, 接受 CAN 总线报文。

No message is sent when it is below 30+ voltage; as for ACC voltage, the initialization is completed in 400 ms and CAN bus messages are accepted.

激活条件:

Activation conditions:

- 1) 电源为 30+; 。
- 1) The power supply is 30+;.

默认执行动作:

Default actions:

- 1) 空调关机;
- 1) Turn off the A/C;
- 2) 内循环;
- 2) Internal circulation;
- 3) A/C 关闭、水阀/PTC 关闭;
- 3) Close A/C and water valve / PTC;
- 4) 出风模式、风量、设置温度为关机前状态。
- 4) The air supply mode, air volume, and temperature setup are in the status before shutdown.

退出条件:

Exit conditions:

- 1) 30+电源断开。
- 1) 30+ power supply disconnected.



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空调系统具有制冷、制热、出风模式转换、风量调节、内外循环、除霜除雾功能。

The A/C system is provided with the functions of cooling, heating, air supply mode conversion, air volume adjustment, fresh and recirculation, defrosting and defogging, etc.

2、制冷功能:

功能包括空调压缩机启动, 发动机转速提升、蓄电池电压监控、压缩机保护、冬季低温时, 冷媒 加注、高压断开保护、低压断开保护、中压风扇加速、冬季低温保护。

2. Cooling function:

The function includes start of A/C compressor, engine speed increase, battery voltage monitoring, compressor protection, refrigerant filling at low temperature in winter, high voltage disconnecting protection, low voltage disconnecting protection, medium voltage fan acceleration, and low temperature protection in winter.

压缩机启动、提升发动机转速; 将冷媒送到膨胀阀, 进入散热器, 增加散发面积, 再由鼓风机带走热量。

The compressor starts and increases the engine speed; transfers the refrigerant to the expansion valve and into the radiator for increasing the dissipation area, and then the blower takes away the heat.

制冷开启就是压缩机打开, 且压缩机不可调转速, 自动模式下根据温差实现开启关闭压缩机调节温度。

Start cooling means turning on the compressor, and the engine speed of the compressor cannot be adjusted. In the auto mode, turn on / off the compressor and adjust temperature according to the temperature difference.

压缩机启动受蒸发器温度 (6°C), 发动机转速, 冷媒压力 (高低压异常) 影响。

Compressor start is affected by evaporator temperature (6°C), engine speed, and refrigerant pressure (abnormal high and low pressure).

压缩机启动时不判断冷媒压力状态, 压缩机启动后若冷媒压力异常 (压力高 或者低, 高低压开关断开), 则关闭压缩机;

When the compressor is turned on, do not judge the refrigerant pressure status. If it is abnormal after the compressor is started (high or low pressure and the high / low-voltage switch is disconnected), turn off the compressor;

从现象上看, AC按钮显示状态会快速变化。

Seen from the phenomenon, the display status of AC button changes rapidly.



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3、制热功能:

将发动机热冷却液通过水阀电机控制进入制热芯体, 气体流通还需要混合电机控制; 水阀电机和混合电机均是可无极调节的电机, 功能主要是水阀控制、混合风门控制。

3. Heating function:

The hot engine coolant enters the heating core with the control of the water valve motor, and the gas circulation is also controlled by the hybrid motor; both the water valve motor and the hybrid motor are infinitely adjusted motors, with the functions being mainly controlled by water valve and mixing damper.

AC开启时水阀自动关闭, AC关闭时水阀受设定温度和实际温度影响。

The water valve automatically closes when AC is turned on. When AC is turned off, the water valve is affected by the set temperature and actual temperature.

1) 设定温度为 31°C时全开水阀 (通水)

1) When the set temperature is 31°C, the water valve is fully opened (with water supply)

2) 室外温度 $\geq 20^{\circ}\text{C}$ 且设定温度 $< 31^{\circ}\text{C}$ 时, 禁止开水阀。

2) When the outdoor temperature is $\geq 20^{\circ}\text{C}$ and the set temperature is $< 31^{\circ}\text{C}$, do not open the water valve.

3) 室外温度 $< 20^{\circ}\text{C}$ 且设定温度 $< 31^{\circ}\text{C}$ 时, 按以下执行:

设定温度与实际温度差值较大 (约 2°C) 时, 关闭或开水阀。

设定温度与实际温度差值较小时, 维持商议状态。

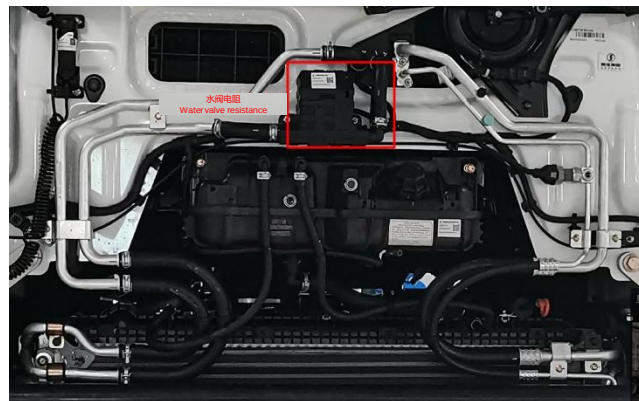
混合风门的控制, 在 31°C 时全关 (全热), 在 $15\sim 30^{\circ}\text{C}$ 之间渐变开度。

3) When the outdoor temperature is $< 20^{\circ}\text{C}$ and the set temperature is $< 31^{\circ}\text{C}$, proceed as follows:

When the difference is large between the set temperature and the actual temperature (for about 2°C), close or open the water valve.

When the difference between the set temperature and the actual temperature is small, keep on with the negotiation status.

Control of the mixing damper is fully closed (full heat) at 31°C and gradually opens between 15 and 30°C .



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4、混合风门:

4. Mixing damper:

决定进入出风口的气体是否经过制热芯体, 如果有制热需求或除霜需求就必须经过, 但可以无极调节实现分气混合比例。

It determines whether the gas into the outlet will pass through the heating core, and it must do if there is requirement for heating or defrosting, but the gas mixing proportion may be achieved with infinite adjustment.

5、除霜模式:

5. Defrost mode:

除霜模式下需要制冷又制热, 制冷主要是干燥空气, 制热主要是除已经产生的雾气。此时混合风门需要开启。

In the defrosting mode, both cooling and heating are required. Dry air is mainly for cooling and heating is mainly used to remove the fog that has already been generated. At this time, open the mixing damper.

6、风量控制:

6. Air volume control:

接收报文, 控制鼓风机, 实现风量大小。包括手动调节和自动调节。

Receive messages, control the blower, and adjust the air volume size, including manual adjustment and automatic adjustment.

空调接收风量信号, 顺时针旋钮旋转或按下风量+, 逆时针旋钮旋转或按下风量-, 风量递增递减均为1;

The A/C receives the air volume signal; by rotating the knob clockwise or pressing air volume +, and rotating the knob counterclockwise or pressing air volume -, the air volume increases and decreases progressively by 1;

风量最小档位为1, 风量最大档位为8, 再接收风量递减或递增信号, 保持最小或最大档位风量。

When the minimum air volume position is 1 and the maximum air volume position is 8, receive the air volume decreasing or increasing signal and maintain the minimum or maximum air volume.



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7、出风模式控制:

7. Air supply mode control:

通过控制模式电机，将来自制冷芯体或制暖芯体的空气，从除霜、吹脚、吹脸的风道吹出来，因此一共5个模式：除霜、除霜吹脚、吹脚、吹脚吹脸、吹脸模式。

By controlling the mode motor, the air from the cooling core or heating core is blown out of the air ducts for defrosting, blowing feet and blowing face, and is therefore divided into 5 modes in total: defrosting, defrosting and lower airflow, lower airflow, lower airflow and upper airflow, and upper airflow mode.

自动模式时受实际温度自动变换模式。

In auto mode, the mode automatically changes depending on the actual temperature.

8、内外循环:

8. Internal and external circulation:

主要是进入鼓风机的空气来源，X6000是内外循环二选一，部分本体可以实现内外同时进气。

It is mainly the air source entering the blower. X6000 is alternative for the internal and external circulation. Some bodies perform simultaneously both internal and external gas intake.

包括手动控制和自动控制。

Including manual control and automatic control.

手动模式下，按下一次按键，切换一次风门。

In the manual mode, press the key once to switch the damper.

自动模式下，受实际温度范围影响，自动更换循环模式。

In auto mode, the cycle mode is automatically changed due to the impact of actual temperature range.



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9、蒸发器保护:

9. Evaporator protection:

蒸发器就是制冷芯体, 为防止其结冰, 需要阻止进一步制冷, 需要端来压缩机。

The evaporator is the cooling core, which must be prevented from further cooling in case of freezing, and a compressor is required.

压缩机运行过程中, 检测蒸发器温度, 蒸发器温度降低、回升的过程中, 压缩机自动关闭、恢复运行, 整个过程中多媒体显示屏上 A/C 开关状态依然为启动状态。

When the compressor is operating, detect temperature of the evaporator. In the process of decrease and recovery of the evaporator temperature, the compressor automatically shuts down and resumes operation. During the entire process, the A/C switch status on the multimedia display remains started.

- 1) 当蒸发器温度 $\leq 3^{\circ}\text{C}$ 时; 压缩机关闭。

When the evaporator temperature is $\leq 3^{\circ}\text{C}$; the compressor is turned off.

- 2) 当蒸发器温度回升 $\geq 6^{\circ}\text{C}$ 后; 压缩机开启。

When the evaporator temperature rises to $\geq 6^{\circ}\text{C}$, the compressor will start.

- 3) 当 $3^{\circ}\text{C} < \text{蒸发器温度} < 6^{\circ}\text{C}$ 时; 保持上一状态。

When $3^{\circ}\text{C} < \text{evaporator temperature} < 6^{\circ}\text{C}$; remain in the previous status.

10、驻车空调 (预留) :

10. Parking A/C (reserved):

为保护压缩机, 需要高低压开关, 该开关不影响管路通断, 但影响输出开关状态影响电源, 实现保护。

预留配置字, 主要影响驻车空调功能, 当没有驻车空调功能时, 其AC1报文中“驻车空调运行模式”为无效7。

In order to protect the compressor, the high / low-voltage switch is required, which affects not the connection and disconnection of the pipeline, but the output switch status and the power supply for protection.

The reserved configuration bits mainly affect the parking A/C function, without which the "parking A/C operation mode" in the AC1 message is shown as invalid 7.



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11、空调散热需求：

11. Radiating requirements for A/C:

空调在运行过程中，冷媒制冷产生热量，在达到中压时需要进行散热，否则压力进一步升高会损坏压缩机。

When the A/C is operating, the refrigerant will generate heat in cooling, which requires to be dissipated when reaching the medium pressure, otherwise the compressor might be damaged with further increased pressure.

故障表现是空调频繁启停，不制冷，压缩机频繁损坏。

Manifestations of faults are frequent starts and stops of A/C, cooling failure, and frequent damages of the compressor.

12、请求风扇散热功能

12. Request for radiating function of the fan

空调压缩机运行过程中，若冷媒压力达到中压（控制器 A4 针脚检测到低电平输入），中压开关断开，控制器 A4 针脚由接收到低电平信号变为悬空，控制器发送 AC1 报文“请求风扇信号”。

When the A/C compressor is operating, if the refrigerant pressure reaches the medium range (low level input is detected for the control unit A4 pin), the medium pressure switch will turn off, the control unit A4 pin will change from receiving a low level signal to floating, and the control unit will send the AC1 message "Request fan signal".

说明：此风扇由其他控制器负责驱动，空调控制器仅负责发出风扇请求信号。

Note: this fan is driven by other control units, and the A/C control unit is only responsible for sending fan request signals.

