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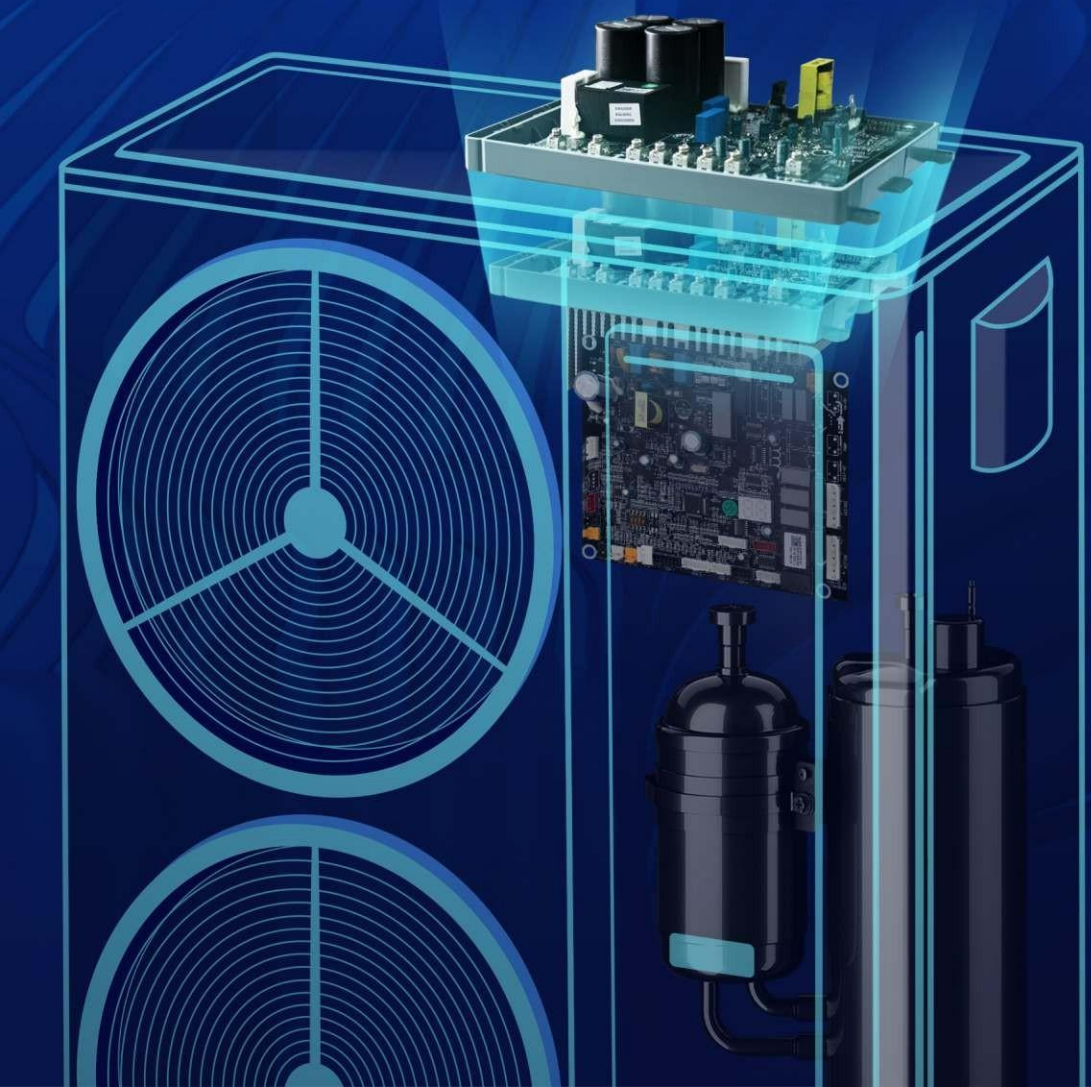
DC Inverter Driver Specification

变频驱动规格书

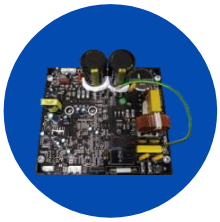
单相 1HP 变频驱动

DC Inverter Driver Single Phase 1HP

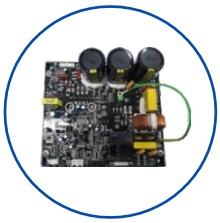


DC INVERTER DRIVER SPECIFICATION

变频驱动规格书



单相 1HP&2HP 变频驱动
DC Inverter Driver Single Phase 1HP&2HP



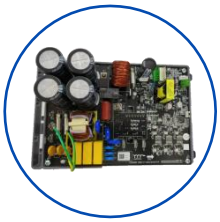
单相 3HP 变频驱动
DC Inverter Driver Single Phase 3HP



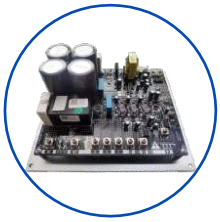
单相 4HP 变频驱动
DC Inverter Driver Single Phase 4HP



单相 6HP 变频驱动
DC Inverter Driver Single Phase 6HP



三相 7HP 变频驱动
DC Inverter Driver Three Phase 7HP



三相 10HP 变频驱动
DC Inverter Driver Three Phase 10HP



三相 12HP 变频驱动
DC Inverter Driver Three Phase 12HP



三相 16HP 变频驱动
DC Inverter Driver Three Phase 16HP



三相 20HP 变频驱动
DC Inverter Driver Three Phase 20HP

变频驱动规格书

DC Inverter Driver Specification

产品名称 Product name	**单相1HP变频驱动 DC Inverter Driver Single Phase 1HP**
产品型号 Product model	**BDQ35A2F1/BDQ35A2F2**
版本号 Version number	**V 1.3**

需方审批 Approved by Customer		
客户名称 Customer's Name		
确认意见和审核 Comments and checked by	批准 Approved by	盖章 Company's seal

供方审批 Approved by Supplier		
编制 Prepared by	审核 Checked by	批准 Approved by

珠海亚丁科技有限公司
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更改记录Revision record

版本号 Version No.	**更新日期** Date	**更改点** Revision Item	**更改目的** Change purpose	**确认人** Confirmed by
V1.0	2023-06-10	完成初版的编写。 First version.		
V1.1	2023-08-29	完善STO功能说明，补充该功率段主流驱动型号 Improve the STO function description and supplement the mainstream drive models in this power range		
V1.2	2024-03-13	优化产品部件编码、型号排版 Optimize product component coding and model layout		
V1.3	2025-04-11	优化产品部件编码、型号排版 Optimize product component coding and model layout		

安全注意事项Safety Information

安全声明 Safety Precautions

1） 在安装、操作、维护产品时，请先阅读并遵守本安全注意事项。
Please read and follow the safety precautions when installing, operating and maintaining the product.

2） 为保障人身和设备安全，在安装、操作和维护产品时，请遵循产品上标识及手册中说明的所有安全注意事项。
To ensure your safety and prevent damage to equipment, please follow the marks on the product and safety precautions in this manual when installing, operating and maintaining the product.

3） 手册中的“注意”、“警告”和“危险”事项，并不代表所应遵守的所有安全事项，只作为所有安全注意事项的补充。
"CAUTION", "WARNING", and "DANGER" items in the manual do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.

4） 本产品应在符合设计规格要求的环境下使用，否则可能造成故障，因未遵守相关规定引发的功能异常或部件损坏等不在产品质量保证范围之内。
Use this product in environment meeting the design and specification requirements; otherwise, a fault may occur. Noncompliance-caused malfunction or damage to parts are not covered in product quality warranty.

5） 因违规操作产品引发的人身安全事故、财产损失等，我司将不承担任何法律责任。
It is not legally responsible for any personal safety accident or property losses caused by improper operation of this product.

安全等级定义 Safety Grade and Definition

⚠ 危险 DANGER

“危险”表示如果不按规定操作，则导致死亡或严重身体伤害。
The "DANGER" indicates the improper operation, which, if not avoided, causes death or serious injury.

⚠ 警告 WARNING

“警告”表示如果不按规定操作，则可能导致死亡或严重身体伤害。
The "WARNING" indicates the improper operation, which, if not avoided, may cause death or serious injury.

⚠ 注意 CAUTION

“注意”表示如果不按规定操作，则可能导致轻微身体伤害或设备损坏。
The "CAUTION" indicates the improper operation, which, if not avoided, may cause minor injury or equipment damage.

安全注意事项 Safety Information

开箱验收 Unpacking and Checking

注意 CAUTION

- 开箱时发现产品及产品附件有损伤、锈蚀、使用过的迹象等问题，请勿安装！
  Do not install the product and its accessories when you find that the product and its accessories have any damage or corrosion or they have been used.
- 开箱时发现产品内部进水、部件缺少或有部件损坏时，请勿安装！
  Do not install the product when there is water inside the product or any of its parts is missing or damaged.
- 请仔细对照装箱单，发现装箱单与产品名称不符时，请勿安装！
  Do not install the product when the product name is inconsistent with that in the packing list.

储存与运输时 During Storage and Transportation

注意 CAUTION

- 请按照产品的储存与运输条件进行储存与运输，储存温度、湿度满足要求。
  Store and transport the product according to its storage and transportation conditions. The storage temperature and humidity shall meet relevant requirements
- 避免在水溅雨淋、阳光直射、强电场、强磁场、强烈振动等场所储存与运输。
  Do not store or transport the product in places with direct sunlight, strong electric field, strong magnetic field or strong vibration or places that are wet by rain or splashing water.
- 避免产品储存时间超过3个月，储存时间过长时，请进行更严密的防护和必要的检验。
  Do not store the product for over three months. Take stricter prevention measures and perform necessary inspection when the storage time is too long.

安装时 During Installation

注意 CAUTION

- 驱动器工作时会产生高温，周围要留有足够的空间，确保驱动器散热。
  The driver will generate high temperature when it is working. Leave enough space around the driver to ensure the heat dissipation of the driver.
- 安装使用的环境温度要求禁止超出规格书所允许的范围；避免太阳直射。
  The ambient temperature requirements for installation and use must not exceed the range allowed in the specification; avoid direct sunlight.
- 请勿安装在潮湿、凝露的场所。
  Do not install in the places where is humid or easy condensation.
- 请勿安装在有粉尘、腐蚀性气体、爆炸性气体、易燃性气体、液体、油雾及盐腐蚀等场所。
  Do not install in the places where is dusty, corrosive gas, explosive gas, flammable gas, liquid, oil mist and salt corrosion.
- 本驱动器无外壳，安装时，请谨防掉入铁丝、铁屑、铜丝等异物，否则会因短路造成驱动器烧坏。
  This driver has no casing. Please be careful that keep the driver installed place where is not easy to drop foreign objects such as iron wire, iron filings, copper wire, etc. Otherwise, the driver will be burned due to short circuit.
- 安装时请注意参考套件清单中的驱动组件、滤波板、电抗器型号，谨防不按功率等级错误搭配使用。
  Please pay attention to the correct model of drive module, filter board and reactor in the component list during installation. Be careful not to use them incorrectly according to the power level.
- 本驱动器无散热风扇，请做好充分的冷却。驱动器的冷却需要考虑散热器和元器件散热。因此在设计控制柜时，可把散热器置于控制柜外，需设计相应的风道使得有冷风对散热器和元器件进行散热。对元器件进行散热时，需谨防空气流动带来的粉尘、油雾、水滴等异物落到驱动器上，造成器件短路，必要时在空气进气口增加过滤装置。
  This drive is not equipped a cooling fan. Please provide adequate cooling for the driver heat sink and component ensure heat dissipation. Therefore, on the control cabinet design, the heat sink can be placed outside the control cabinet with corresponding air flow needs to be go through the heat sink for heat dissipation. Air flow for heat dissipation must be careful to prevent dust, oil mist, water droplets and other foreign objects from falling on the driver, it will cause short circuit of the device. If necessary, add a filter at air inlet.

接线时 During Wiring

危险 DANGER

- 严禁非专业人员进行设备安装、接线、保养维护、检查或部件更换！
  Non-professionals are strictly prohibited from equipment installation, wiring, maintenance, inspection or parts replacement!

- 请勿在电源接通的状态下进行接线作业，否则会有触电的危险。
  Do not perform wiring when the power is turned on. Failure to comply may result in electric shock.
- 请遵守静电防止措施（ESD）规定的步骤，并佩戴静电手环进行接线等操作，避免损坏产品内部的电路。
  Follow the ESD precautions and wear EDS wrist strap to avoid damage to the circuit inside the product.

警告 WARNING

- 严禁将输入电源连接到设备或产品的输出端，否则会引起设备损坏，甚至引发火灾。
  It is prohibited to connect the input power to the output terminal of the equipment or product; otherwise, the equipment may be damaged or fire may occur.
- 驱动设备与电机连接时，请务必保证驱动器与电机端子相序准确一致，避免造成电机反向旋转。
  When connecting a driving equipment to the motor, be sure that the phase sequence of the driver and the motor terminal are consistent, so as to avoid reverse rotation of the motor.

上电时 During Power-on

危险 DANGER

- 上电前，请确认设备安装完好，接线牢固。
  Before power-on, be sure the equipment and product are installed properly, the wiring is firm.
- 上电前，请确认电源符合设备要求，避免造成设备损坏或引发火灾！
  Before power-on, be sure the power supply meets the equipment requirements to avoid damage to the equipment or causing fire!
- 严禁在通电状态下触摸设备的任何部位，否则有触电危险！
  It is prohibited to touch any part of the equipment when power is on; otherwise, there is the danger of electric shock!

运行时 During Running

危险 DANGER

- 严禁在运行状态下触摸设备的任何部位，否则有触电危险！
  It is prohibited to touch any part of the equipment when it is running; otherwise, there is the danger of electric shock!
- 严禁非专业技术人员在运行中检测信号，否则可能引起人身伤害或设备损坏！
  Non-professional technicians are prohibited to detect the signal when the equipment is running; otherwise, there is the danger of personal injury or damage to the equipment!

维修时During Repair

危险 DANGER

- 严禁非专业人员进行设备安装、接线、保养维护、检查或部件更换！
  Non-professionals are strictly prohibited from equipment installation, wiring, maintenance, inspection or parts replacement!
- 严禁在通电状态下进行设备维修，否则有触电危险！
  It is prohibited to maintain the equipment when power is on; otherwise, there is the danger of electric shock!
- 切断所有设备的电源后，请至少等待10 分钟再进行设备检查、维修等操作。
  After the equipment power is cut off, wait for at least 10 minutes before maintaining the equipment or performing other operations.

报废时During Scrapping

警告 WARNING

- 请按照国家有关规定与标准进行设备、产品的报废，以免造成财产损失或人员伤亡！
  Scrap the equipment and product according to national regulations and standards to avoid property loss or personal injury!
- 报废的设备与产品请按照工业废弃物处理标准进行处理回收，避免污染环境。
  Recycle scrapped equipment and product according to industrial waste processing standards to avoid pollution to the environment.

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1 产品主要参数 Product main parameters

型号 Model		**BDQ35A2F1/BDQ35A2F2**
输 入 Input	输入电压 Input voltage	单相：220VAC ±20% Single Phase：220VAC ± 20%
	输入频率 Input frequency	50Hz or 60Hz
	输入电流 Input Current	Max. 9A @ 220VAC
	输入功率 input power	Max. 1.97KW
输 出 Output	输出频率 Output frequency	(10～120) Hz（参考压缩机规格书） (10～120) Hz（Refer to compressor specification ）
	载波频率 Carrier frequency	5 KHz
	输出电流 Output current	7A Max
	效率（满载） Efficiency (full load)	≥ 0.96
控 制 特 性 Control characteristics	控制方式 Control method	无传感器 SVPWM 正弦波控制、磁场定向控制（FOC） 有效减小高次谐波成分、电机振动、转矩波动及噪音 Sensorless SVPWM sine wave control, field oriented control (FOC) Effectively reduce higher harmonic components, motor vibration, torque ripple and noise
	控制策略 Control Strategy	速度环+电流环双闭环电机控制模型 速度环确保输出频率稳定，电流环确保转矩精度 Speed loop + current loop dual closed-loop motor control model Speed loop ensures stable output frequency and current loop ensures torque accuracy
	启动方式 Start way	0Hz闭环启动，根据负载自动调整启动转矩 0压差启动时，启动电流小，无冲击电流，有效保护压缩机 0Hz closed-loop start up, automatically adjust the starting torque according to the load 0 Start-up current is small, no starting current, effective protection for compressor
	最小电流 Minimum current 最大转矩控制 Maximum torque control	有效利用压缩机凸极特性产生的磁阻转矩，减小压缩机和IPM功率器件损耗，提升系统效率 Effectively utilize the reluctance torque generated by the salient pole characteristics of the compressor, reduce the losses of the compressor and IPM power devices, and improve system efficiency

	弱磁控制 Field weakening control	有效提高压缩机的频率运行范围 Effectively increase the frequency operating range of the compressor
通讯 Communication	接口 Interface	异步半双工（RS-485） Asynchronous Half Duplex (RS-485)
	协议 Protocol	MODBUS RTU
结构 Structure	尺寸 Dimension	L* W *H= 187*165*88.4mm
	冷却方式 Cooling method	风冷 Air cooling
环境特性 Environmental characteristics	储温度范围 Storage temperature range	-40℃ ~ 85℃
	工作温度范围 Range of working temperature	-30℃ ~ 60℃
	工作湿度范围 Operating humidity range	10% ~ 95%（无结霜和凝露） 10% ~ 95%（No frost and condensation）
	使用海拔高度 Use altitude	1000m以下使用不降额，1000m以上每升高100m降额1%，最高使用海拔为4000m。 No derating is required below 1000m. For every 100m increase above 1000m, derate by 1%. The maximum usable altitude is 4000m.

2 产品部件 Product Assembly

本变频驱动是以套件出货，套件清单如下，包括驱动板组件、电抗器，其中驱动板组件包括驱动板、散热器和安装固定板等。

The driver product is one set of assembly components including driver board and reactor., and driver board is a package with heat sink.

表1 驱动套件清单

Table 1 Driver assembly components list

功能描述 Description	**组件编码 Component code**	**组件型号 Component model**	**数量 Quantity**
基础型号 Base model	S30020090	驱动板组件BDQ35A2F2 Driver board assembly BDQ35A2F2	1
STO型号 STO model	S30020091	驱动板组件BDQ35A2F1 Driver board assembly BDQ35A2F1	1
	S34020001	电抗器 5mH/10A Reactor 5mH/10A	1

表2驱动板差异说明

Table 2 Explanation of differences in drive board

驱动型号 Driver model	尺寸 Dimension	输入电流 Input Current	是否有STO功能 Is there a STO function	反馈电流有效值 Feedback RMS Current
BDQ35A2F2	H * W *D = 187*165*88.4mm	Max. 9A @ 220VAC	否 No	实际值*10 Actual Value*10
BDQ35A2F1	H * W *D = 187*165*88.4mm	Max. 9A @ 220VAC	是 Yes	实际值*10 Actual Value*10

本变频驱动采用磁场定向控制技术（FOC）、电压空间矢量控制技术（SVPWM）、最小电流最大转矩控制技术（MTPA）、弱磁控制技术（Flux Weakening）等先进控制技术，可驱动直流变频压缩机；谐波抑制采用无源直流母线电抗器抑制方式。

The driver is available for DC inverter compressor via Field Oriented Control (abbreviated to FOC), Space Voltage Vector Pulse Width Modulation (abbreviated to SVPWM), Maximum Thrust Per Ampere (abbreviated to MTPA), Flux Weakening Magnetic Control and other advanced control technology. Harmonic suppression is applied via passive DC bus reactor.

变频器采用集成设计，有利于提高可靠性及减少安装尺寸。整套产品包括：驱动板组件、滤波板和电抗器。如图1所示：

High reliability and space saving, thanks to compact and integration design. The DC inverter driver product we supplied including driver board, filter board, reactor. In picture 1

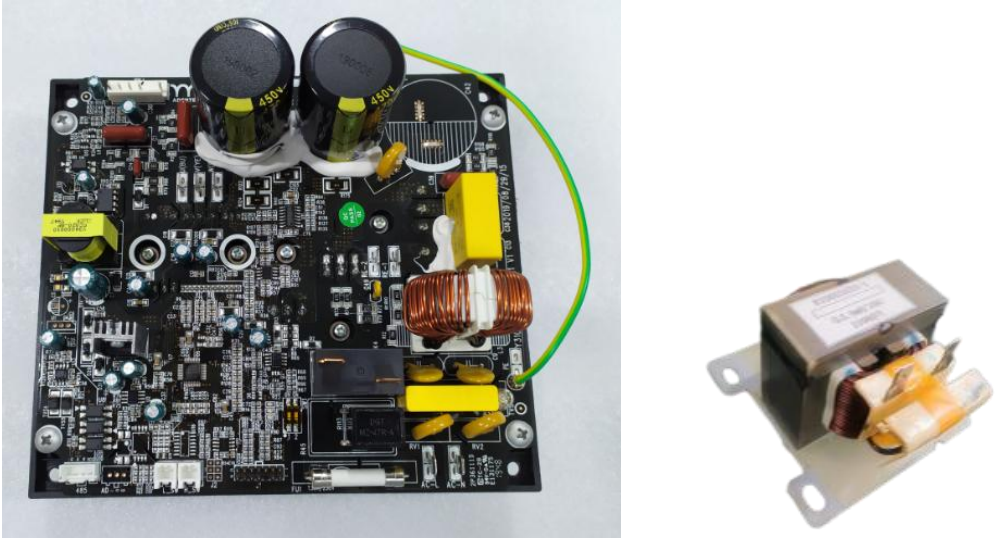


图1 变频器外形图

Picture 1 Driver appearance

3 系统图框 System Diagram (Wiring Diagram)

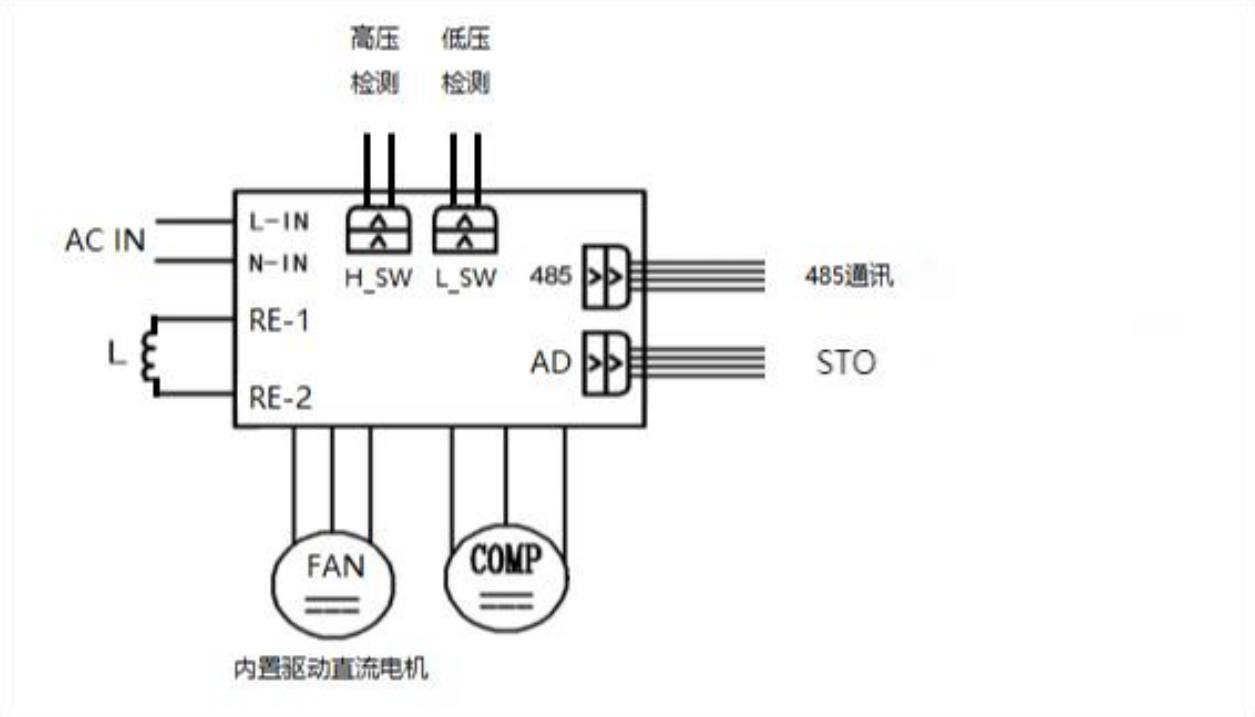


图2系统框图(接线图)

Diagram 2 System Diagram (Wiring Diagram)

4 接口定义 Interface Definition

表3 变频驱动接口定义

Table 2 Driver Board Interface Definition

丝印名称 Silk-screen Icon	端子 Interface	功能描述 Description
AC - L	驱动板火线输入 Live wire input on driver board	连接电源火线 Connected to power supply live wire
AC - N	驱动板零线输入 Neutral wire input on driver board	连接电源零线 Connected to power supply neutral wire
PE	地线 Ground wire	连接电源地线 Connected to power supply ground wire
RE-1	电抗器接口 Reactor interface	接电抗器，无极性 Connected to reactor, non-polarity.
RE-2	电抗器接口 Reactor interface	接电抗器，无极性 Connected to reactor, non-polarity.
U、V、W	压缩机输入接口 Compressor input interface	接压缩机，注意不允许接错线，否则会损坏压缩机 Connected to compressor U、V、W one by one, attention to the right connection, compressor would be damaged if wrong connection or reversed phase sequence.
485	４８５通信接口 （1~4脚：VCC, B, A , GND） RS485 communication interface （1~4 Pin：VCC, B, A , GND）	隔离通讯方式，可无需上位机提供电源，上位机只需提供485接口A、B，注意上位机不需要做隔离。 Isolated communication mode, no need external power input, connected to A, B interface for host device (main controller). Note that the host device does not need to be isolated.
FAN	风机输入接口 （1~6脚：+310V，/，GND，+15V，VSP，FG） DC Fan motor input interface （1~6Pin：+310V，/，GND，+15V，VSP，FG）	接内置驱动直流风机 Connect to built-in driver DC fan motor
H_SW	系统高压检测接口 High pressure switch	开关量信号输入 Switch signal input
L_SW	系统低压检测接口 Low pressure switch	开关量信号输入 Switch signal input

AD	0-10V控制接口/STO接口 （1~3脚：GND、ADO、ADI） 0-10V control/STO interface （1~3 Pin:GND、ADO、ADI）	**0-10V控制 0-10V control** O：5V TTL电平输出，用于反馈压缩机开停状态（压缩机开：高电平，压缩机关：低电平）， I：AD信号输入，用于频率控制输入，2~10V对应压机频率为10~120Hz。 （计算公式：运行频率=Vin*10/53/3.3/256-19（计算值小于10为0，大于120等于120））驱动板该端口与相对参考地的阻抗为53k。 G：AD信号的参考地 O：5V TTL level output for of compressor ON/OFF state feedback（ON-High level，OFF-Low level） I：AD signal input for compressor frequency command，2~10V corresponds to compressor frequency 10~120Hz. （Formula：Operating frequency = Vin*10/53/3.3/256-19，if calculated value < 10 equals 0，>120 equals 120） The impedance of the port and relative reference ground is 53k. G：AD signal reference ground **STO功能 STO Function** AD-G与AD-O连通,驱动正常工作;断开时触发STO停机保护。 AD-G and AD-O are connected, driven normally;STO shutdown protection is triggered when disconnected.

5 保护功能 Protection Function

表4 保护功能
Table 3 Protection Function

保护功能 Protection Function	**功能介绍 Function Introduction**	**保护方法 Protection Method**
压缩机过流保护 Compressor over current protection	Ⅰ.当因系统堵、压力过高、电压瞬间跌落等因素造成压缩机绕组瞬间电流过大时，会导致压缩机转子磁钢退磁，造成压缩机损坏，需停机保护 I. If instantaneous winding current of compressor rotor is over large due to system block, excessive pressure, instantaneous voltage drop etc., it will cause degaussing of compressor rotor and compressor damage, shutdown protection and warning are necessary. Ⅱ.当因压缩机磨损、缺油、退磁、回液等因素造成压缩机电流过大时，有可能造成烧坏驱动板，需保护预警 II. If compressor current is over large due to compressor abrasion, oil-absent, demagnetization, liquid return and other factors, it may cause driver board burnout, shutdown protection and warning are necessary.	驱动板检测到压缩机相电流超过设定的保护值（瞬时值），停机保护 Compressor phase instantaneous current is detected exceed preset Protection Value (instantaneous value), shutdown protection will happen.
IPM模块保护 IPM module protection	Ⅰ.当因系统堵、压力过高、电压瞬间跌落等因素造成压缩机绕组瞬间电流过大或者IPM模块出现短路时，会导致压缩机转子磁钢退磁或者烧坏IPM模块，需停机保护 I. If instantaneous winding current of compressor is over large or IPM module is short circuit due to system block, excessive pressure, and instantaneous voltage drop etc., it will cause the compressor rotor demagnetization or IPM module burnout, shutdown protection and warning are necessary. Ⅱ.当因压缩机磨损、缺油、退磁、回液等因素造成压缩机电流过大时，有可能造成烧坏驱动板，需保护预警 II. If compressor current of compressor is over large due to compressor abrasion, system block, oil-absent, demagnetization, liquid return etc., it may causes drive board burnout, shutdown protection and warning are necessary.	驱动板检测到IPM模块瞬间电流超过设定的保护值（瞬时值），停机保护 If IPM instantaneous current of driver is exceed preset Protection Value (instantaneous value), shutdown protection will happen.

主控与驱动通讯故障 Communication malfunction between host device (main controller) and driver board	当主控与驱动之间的通信电路发生异常时会导致驱动板收不到数据或者收到的数据不正确；或者当主控发送的数据错误时，驱动板报相应通信故障 If an abnormality occurs in the communication circuit between the main control and the driver, the driver board cannot receive data or receive incorrect data, or main controller sends wrong data, driver board reports a corresponding communication malfunction.	驱动板连续30s没有收到上位机的点名数据或收到不符合通讯协议规定的数据，保护提示 Driver board continuously 30s receives nothing of roll call data from host device (main controller) or inconsistent data according to protocol, protection will happen and warning.
直流母线过电压保护 DC bus voltage over high protection	当因电源异常，雷击，浪涌等因素引起直流母线电压过高时，会造成驱动板上的功率器件过电压而烧坏，需停机保护 If the DC bus voltage is over high due to power supply abnormality, lightning strike, surge and other factors, it will cause the power component on the driver board overvoltage burnout, shutdown protection and warning are necessary.	任何时候，驱动板检测到直流母线电压超过420V时，保护提示 Whenever the driver board detects DC bus voltage over high (420V), protection will happen and warning.
直流母线欠电压保护 DC bus voltage over low protection	当电源电压瞬间跌落，而压缩机负载不能瞬间突变时，驱动板输入/输出电流会瞬间冲高，可能会烧坏功率器件或者造成压缩机退磁，需停机保护 If power supply voltage drop instantaneously but the load of the compressor cannot be changed so fast, the input / output current of the driver board will be go high instantly, it may cause power component burnout or compressor demagnetization, shutdown protection and warning are necessary.	在压缩机运行时，驱动板检测到直流母线电压低于200V时，停机保护 Under compressor running, the driver board detects DC bus voltage over low (200V), protection will happen and warning.
压缩机失步保护 Compressor non-synchronism protection	当出现系统堵、压力过高或者压缩机磨损、缺油、退磁、回液等因素时，会造成压缩机运行转速与驱动板目标转速出现不同步（失速），以及进一步出现压缩机过流和IPM模块保护，需停机保护 If system block, over high pressure, compressor abrasion, oil-absent, demagnetization, liquid return and other factors occur, it will cause the compressor running speed out of sync with drive board target speed (stall), and further cause compressor overcurrent and IPM module protection, shutdown protection and warning are necessary.	驱动板连续两秒检测到实际运行频率与目标设定频率相差设定值（电频率）时，停机保护 Driver board detect continuously 2s running frequency deviates from setting frequency by preset value (electric frequency), protection will happen and warning.

压缩机启动失败 Compressor startup failure	当出现系统堵、压力过高或者压缩机磨损、缺油、退磁、回液等因素时，会造成压缩机不能正常启动，需停机保护 If system block, over high pressure, compressor abrasion, oil-absent, demagnetization, liquid return and other factors occur, it will cause the compressor startup failure, shutdown protection and warning are necessary.	驱动板收到开机指令进入启动阶段后，转速连续10s未达到目标设定转速时，停机保护 After driver board receive startup command and enter into start-up state, continuously 10s compressor running speed unable reach setting speed, protection will happen and warning.
电流检测电路故障 Current sensing circuit protection	当检测压缩机电流的电路出现异常时，会出现压缩机转速波动、噪音大、振动大、压缩机过流等，需保护预警 When an abnormality occurs in the circuit for detecting the compressor current, compressor speed fluctuations, high noise, large vibration, and compressor overcurrent will occur, which requires protection and early warning.	驱动板收到开机指令后检测到压缩机电流检测电路异常时，保护提示 Compressor current sensing circuit is detected abnormal after driver board receives startup command, protection will happen and warning.
充电回路故障 Charging circuit malfunction	驱动板直流母线充电时，需要增加缓冲电路，以防止充电冲击电流过大而烧坏器件。当充电缓冲电路故障时，会导致直流母线无法正常充电，需保护预警 In the process of driver board DC bus charging, it is need to add a buffer circuit to prevent components burnout due to over high charging impulse current. If the charging buffer circuit is malfunction, it will causes the DC bus charging failure, shutdown protection and warning are necessary.	驱动板收到开机指令后，执行直流母线电路充电步骤，当连续充电两次后检测母线电压都没达到100V，则认为充电回路异常，保护提示。 Driver board enter into the DC bus circuit charging process after receiving startup command, and continuously twice detect bus voltage low than 100V, charging circuit abnormal, protection will happen and warning.
IPM温度传感器故障 IPM temperature sensor malfunction	当检测IPM模块温度的电路异常时，无法检测到准确的IPM模块温度，无法通过温度对压缩机进行限频、降频和保护等动作，需保护预警。 If IPM temperature sensor abnormal is detected, the accurate temperature of IPM module cannot be detected, it is fail to control compressor frequency limit, frequency reducing and protection by temperature, shutdown protection and warning are necessary.	驱动板收到开机指令后，检测到压缩机IPM模块温度检测电路出现短路或者断路等，保护提示。 Compressor IPM temperature sensor circuit is detected short or open circuit, after driver board receives startup command, protection happen will and warning.

IPM过温保护 IPM overheat protection	当IPM模块温度过高时，会导致驱动板IPM模块烧坏，需停机保护。 If temperature of IPM module is over high, it will cause driver board IPM module burnout, shutdown protection and warning are necessary.	任何时候，驱动板检测到压缩机模块温度大于100℃时，保护提示。 Whenever driver board detect compressor IPM module temperature higher than 100℃, protection will happen and warning.
压缩机型号错误 Compressor model code error	开机前，主控需把所选用的压缩机代号发给驱动板，驱动板根据代号读取相应压缩机的参数。当发过来的压缩机代号与所选用功率等级的驱动板所储存的压缩机代号不一致时，说明驱动板与压缩机不匹配或者驱动板暂未支持此型号压缩机 Before startup, main control (host device) needs to send the selected compressor code to driver board, and drive board reads the corresponding compressor parameters. If the compressor code is sent by main control (host device) is not match the one of compressor code stored in the driver board, it means that the driver board and compressor are unmatched, or driver board cannot support the compressor yet.	开机前，驱动板接收到与本身储存的压缩机代号不一致时，保护提示 Before startup, if the driver board receives the inconsistent of the compressor code in store, protection will happen and warning.

6 功能描述 Function

6.1 待机Standby

驱动板得电后，芯片电源指示灯D19（红色）亮，此时严禁用手接触驱动板上的任何部件。随后芯片进入得电复位状态，工作及故障指示灯D25（黄色）亮，随后在无故障前提下，驱动板进入待机状态，工作及故障指示灯D26（红色））慢速闪烁。

After driver board is powered on, the chip power indicator light D19 (Red) is bright, DO NOT touch any component on board.

Then the chip go into reset state, status digital display D25 (Yellow) is bright, if no error happen, the driver board go into standby mode，and operating and error indicator light D26（red）slow blinking.

6.2 PFC的控制 PFC control

驱动板整流部分采用的是全控型数字式PFC，因此在控制方式上比较灵活，可以充分的依据各个输入输出量来进行实时的控制。

Thinks to full control digital PFC for rectifier on driver board, control mode is flexible and available for real-time controlling according to all type input and output parameter.

- 6.2.1PFC的开关控制 PFC ON/OFF control

PFC开关动作时会产生电流冲击，因此为防止这种情况，在母线电压低于（目标值 - 10V）之前，按照1V/ms的加速度进行上升，最终的目标电压为：370VDC。

正常运行模式，PFC的开关条件如下：

1) 开机后，压缩机功率大于200W且目标频率大于30rps时，开PFC。
2) 压缩机运行时，当目标频率小于26rps时，关闭PFC。
3) 当压缩机或者PFC部分出现故障时，立即停机并关闭PFC。

Bus voltage rise at an acceleration of 1 V/ms, before bus voltage low than target voltage -10V, target voltage is 370VDC, to prevent current impact happens when PFC switch.

Normal running modes, PFC switch condition:

1) After startup, compressor power > 200W and target frequency > 30rps, PFC switch on.
2) When compressor is running, if target frequency < 26rps, PFC is switched off.
3) If malfunction happen in compressor or PFC, unit is forced to be stop and PFC is switch off.

- 6.2.2 PFC电流控制 PFC current control

当压缩机高频重载运行，驱动板输入电流比较大，输入纹波电流也比较大，长时间运行该工况下，功率器件的发热比较严重。为保护功率器件，延长驱动的使用寿命，因此对输入电流进行控制。

1) 当输入电流有效值大于16A时，限制频率升高；当输入电流有效值大于17A时，进行降频处理。

2) 当输入电流瞬时值大于18A时，立即停机，并显示PFC过流保护。

When compressor run at high frequency and heavy load, driver board input current would be large, ripple will be large too. Under long term running in this condition, heating of power component would be over high. In order to protect the power component, prolong the life of driver board, input current should be controlled.

1) If input current effective value is higher than16A, the frequency is limited in increase; If the input current effective value is higher than 17A, frequency is forced to reduce.
2) If input current instantaneous value is higher than 18A, unit is stop immediately and display PFC over-current protection.

6.3 压缩机的控制 Compressor Control

基本思想：接收上位机的开机指令和设定频率后，使压缩机运行在设定频率内。接收到上位机关机指令后，停止压缩机。当检测到故障后，无论之前压缩机处于何种状态均停止压缩机运行，故障指示灯显示相应故障代码，直到故障消除。

Basic logic: Compressor runs at setting frequency, if driver board receives start and setting frequency command from host device (main controller). Compressor shut down, if driver board receives shut down command from host device (main controller). If the driver board detect malfunction happen, compressor would shut down at any state, status digital display LED1 displays corresponding error codes until the error is cleared.

- 6.3.1待机及开机启动 Standby and startup

在待机状态时，工作及故障指示灯显示D26慢速闪烁(红色)。收到上位机开机指令和设定频率后，开机启动，工作及故障指示灯显示D26快速闪烁(红色)。

Under standby mode, running and error indicator light D26（red） slow blink. If the driver board receives startup command and setting frequency command from host device (main controller), compressor is start and run, error indicator light D26（red）fast blink.

- 6.3.2开机正常运行 Normal running

1）升频速度设置Frequency increasing speed setting

运行状态：上位机可控，范围值：0.1rps - 3rps (机械频率)，超出范围默认1rps (机械频率)。

限频状态： 0.5rps(机械频率)。

Running status: control by host device (main controller)
Control range: 0.1rps/s - 3rps/s (Mechanical frequency), default speed 1rps/s (Mechanical frequency) if command is out of range
Frequency limiting state: 0.5rps/s

2）降频速度设置 Frequency reducing speed setting

运行状态：上位机可控，范围值：0.5rps -3rps (机械频率)，超出范围默认2rps (机械频率)。

限频但未进降频状态：同正常运行状态。

限频并进降频状态：2rps (机械频率)。

Running status: control by host device (main controller).
Control range: 0.5rps/s - 3rps/s (Mechanical frequency), default speed 2rps/s (Mechanical frequency) if command is out of range.
Frequency limiting and NO go into forced frequency reducing status: Equivalent to normal operation
Frequency limiting and forced reducing state: 2rps/s (Mechanical frequency).

3）限降频条件Frequency limit and forced reducing condition

① 频率慢升条件

a．检测到压缩机运行电流 ≥ I频率缓升压缩机电流

b．检测到驱动板输入电流 ≥ I频率缓升电流

c．检测到模块温度 ≥ 82℃

① Frequency forced slow increase condition

a．Compressor running current ≥ I frequency slow increase compressor current

b．Driver input current ≥ I frequency slow increase current

c．IPM temperature ≥ 82℃

② 限频控制：当运行状态达到以下任一条件时，限制压缩机频率上升。

a. 检测到压缩机运行电流 ≥ I禁止升频压缩机电流

b. 检测到驱动板输入电流 ≥ I禁止升频电流

c. 检测到模块温度 ≥ 88℃

② Frequency limiting control: If the running parameter meets one of the following conditions, compressor frequency is limited against increasing.

a．Compressor running current ≥ I frequency limit compressor current

d．Driver input current ≥ I frequency limit current

c． IPM temperature ≥ 88℃

③ 降频控制：当运行状态达到以下任一条件时，降低压缩机频率。

a. 检测到压缩机运行电流 ≥ I降频压缩机电流

b. 检测到驱动板输入电流 ≥ I降频电流

c. 检测到模块温度 ≥ 91℃，慢速降频

d. 检测到模块温度 ≥ 93℃，快速降频

③ Frequency limiting control: If the running parameter meets one of the following conditions, compressor frequency is limited to reduce.

a．Compressor running current ≥ I frequency forced reducing compressor current

b．Driver input current ≥ I frequency forced reducing current

c．IPM temperature ≥ 91℃，frequency slow reduce

d．IPM temperature ≥ 93℃，frequency fast reduce

备注：不同的压缩机，限、降频电流会根据压缩机特性不同而有所区别。

Note: Frequency limit and reducing condition will be different according to compressor characteristic.

6.4 直流风机的控制DC FAN control

当接收到主控发过来的直流风机转速大于99rpm，驱动板开始进行直流风机输出控制；驱动

板输出控制电压，并检测直流风机的转速反馈信号；当没有检测到反馈信号或转速信号异常低，则会报直流风机1故障。

备注：

1) 如果检测到直流风机故障，则压缩机也会停止运行；

2) 除非直流风机本身或者驱动板硬件问题，其它故障不影响主控对直流风机运行的控制

Driver board startup DC fan motor controlling if it receives command of fan speed larger than 99 rpm from host device (main controller) for DC fan motor, driver board output controlling voltage, and detect DC fan motor running speed feedback. If driver board cannot detect the feedback signal and rotation speed signal ultra-low, DC fan motor malfunction happen.

Note:

1) If DC fan motor malfunction happen, compressor would be shutoff immediately;

2) Except DC fan motor failure and driver board hardware failure, it is no any effect for the DC fan motor controlling cause by any other malfunction.

6.5 关机 Turning OFF

收到上位机的停机命令后，驱动关闭压缩机。

详细的停机时序请参见《亚丁主控与变频驱动通信协议》。

Driver board shut down the compressor, if it receives OFF command from host device (main controller).

Detail about shutdown time sequence refers to communication protocol.

6.6 故障停机 Malfunction Shutdown

运行过程出现任何驱动故障时，都会立即停压缩机，关闭PWM输出，显示当前故障指示灯。不管此时主控发何指令都进入故障待机状态。

“压缩机电流检测电路故障”和“整机电流检测电路故障”这两个故障定义为硬件故障，出现后驱动板不可自动恢复运行。其它故障均属于可恢复故障，出现后最短恢复时间为1分钟。

Driver board will shut down compressor immediately, shut down PWM output at the same time, if any malfunction happen in running state, display error code. Unit will go into malfunction standby state, whatever command is sent from host device (main controller).

Compressor current detection circuit failure and Unit current detection circuit failure are failure happen in hardware, if the failure happens, the malfunctions are not available to recovery. Other malfunctions are recovery available, Driver board recover from malfunction after as least 1 minute.

7 故障代码和故障排查 Error code and trouble shooting

运行过程出现任何驱动故障时，都会立即停压缩机，故障指示灯显示相应故障代码。具体内容参考下表4。

If any malfunctions happen in running status, driver board will shut down compressor immediately. Error indicator light will display corresponding error codes. Malfunction information show in following.

7.1 故障代码 Error code

表5 故障类型及指示

Table 4 Error code and definition

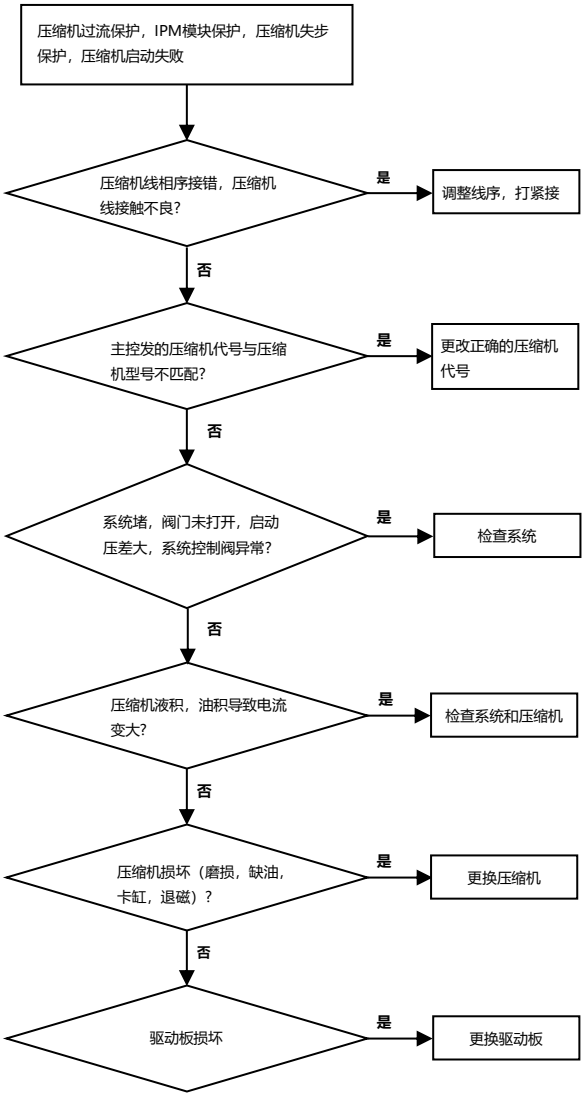
正常模式 Normal running status	**LED1** **红 Red**	**LED2** **黄 Yellow**	**LED3** **绿 Green**	备注
复位模式	灭 Dark	亮 Light	灭 Dark	黄灯亮约6s Yellow light on for about 6 seconds
待机模式	闪 Blink	灭 Dark	灭 Dark	约1s闪烁一次 Flashing once for approximately 1 second
运行模式	闪 Blink	灭 Dark	灭 Dark	约250ms闪烁一次 About 250ms flashing once
故障类型 Error type	**LED1** **红 Red**	**LED2** **黄 Yellow**	**LED3** **绿 Green**	备注 Notes
直流母线电压保护 DC bus voltage protection	闪 Blink	闪 Blink	灭 Dark	直流母线电压过低（200Vdc）或过高（420V） DC bus voltage over low (200Vdc) or voltageover high (420V)
主控与驱动通讯故障 Communication malfunctionbetween main control and driver	灭 Dark	闪 Blink	闪 Blink	连续30s没有收到上位机的点名数据或收到不符合通讯协议规定的数据 Continuous 30s receive nothing for naming datafrom host device (ain controller)or inconsistent data according to protocol
充电回路故障 Charging circuit malfunction	闪 Blink	闪 Blink	亮 Light	开机后，连续两次检测母线电压都没达到100V Continuous twice detection of bus voltage <100V after start-up
驱动输入过流保护 PFC input over current protection	亮 Light	亮 Light	闪 Blink	驱动输入电流超过设定保护值 Driver input current > Setting protection value
PFC模块保护 PFC module protection	亮 Light	闪 Blink	闪 Blink	IGBT瞬间峰值电流超过设定保护值 If IGBT instantaneous peak current > Settingprotection value
PFC电流检测电路故障 PFC current sensing malfunction	亮 Light	灭 Dark	闪 Blink	开机后检测到PFC电流检测电路异常 PFC current sensing circuit is detectedabnormal after start-up
压缩机IPM模块保护 Compressor IPM moduleprotection	闪 Blink	灭 Dark	闪 Blink	驱动电源电压过低，压缩机IPM模块瞬间电流过大超过设定保护值 If driver power voltage is over low, IPMinstantaneous current is over high, exceedsetting protection value
压缩机过流保护 Compressor over currentprotection	闪 Blink	闪 Blink	闪 Blink	检测到压缩机相电流超过设定保护值 Compressor phase instantaneous current isdetected exceed setting protection value
压缩机启动失败 Compressor start failure	亮 Light	闪 Blink	灭 Dark	转速连续未达到同步频率 Continuous 10s non synchronous frequencyrunning

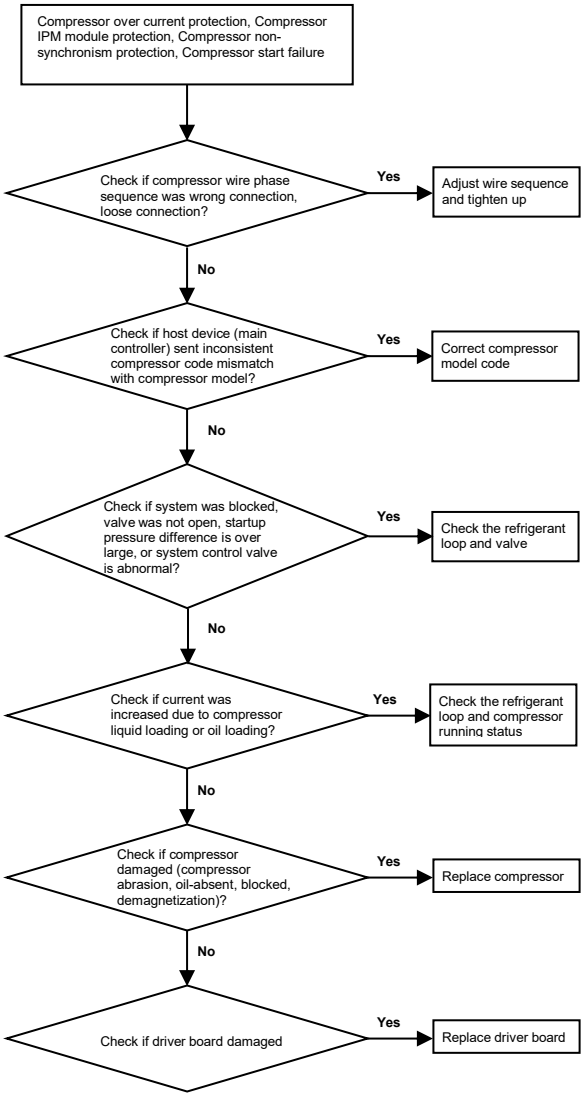
压缩机失步保护 Compressornon-synchronism protection	闪 Blink	灭 Dark	亮 Light	连续两秒运行频率偏离设定频率 Continuous 2s running frequency deviates fromsetting frequency
压缩机电流检测电路故障 Compressor current sensing malfunction	灭 Dark	灭 Dark	闪 Blink	开机后检测到压缩机电流检测电路异常 Compressor current sensing circuit is detectedabnormal after start-up
压缩机IPM温度传感器故障 Compressor IPM temp. sensor malfunction	灭 Dark	闪 Blink	亮 Light	开机后检测到压缩机IPM模块温度检测电路异常 Compressor IPM temp. sensor circuit isdetected abnormal after start-up
压缩机IPM过温保护 Compressor IPM overheat protection	亮 Light	闪 Blink	亮 Light	检测到压缩机模块温度大于100℃ If compressor IPM temperature higher than100℃
拨码开关电平异常 Dip-switch electrical leve abnormity malfunction	亮 Light	灭 Dark	灭 Dark	拨码开关状态通过AD采样判定，正常只有高电平（2-3.3V）和低电平（0-0.7V）两种状态；如果电平不在高、低电平区间则报异常 Dip switch state is determined by AD samplingand only two states are normal high leve(2-3.3V) and low level (0-0.7V): if the level is notin these two ranges, error happen
读EEPROM错误 Read EEPROM error	亮 Light	灭 Dark	亮 Light	EEPROM数据读取错误 EEPROM malfunction
压缩机型号匹配错误 Compressor model invalid error	亮 Light	亮 Light	亮 Light	主控发送压缩机型号不在存储区内 Compressor model code in host device (maincontroller) command is not match the code inEEPROM
高压保护 High pressure protection	灭 Dark	灭 Dark	亮 Light	高压开关跳开 High pressure switch is open
低压保护 Low pressure protection	灭 Dark	闪 Blink	灭 Dark	低压开关跳开 Low pressure switch is open
内置驱动直流风机故障 Built-in drive DC fan failure	闪 Dark	亮 Light	亮 Light	连续 5 秒检测到风机反馈转速 低于 60rpm 时 When the feedback speed of the fan is detected to be below 60rpm for 5 consecutive seconds
STO接口断开 STO interface disconnected	闪 Blink	亮 Light	灭 Dark	开机后检测到STO接口断开 The STO interface is disconnected after start-up

7.2 故障排查 trouble shooting

- 7.2.1 压缩机过流保护，IPM模块保护，压缩机失步保护，压缩机启动失败

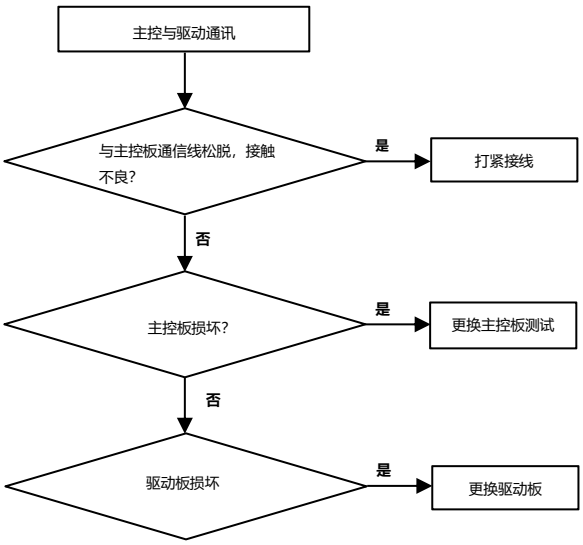
Compressor over current protection, Compressor IPM module protection, Compressor non-synchronism protection, Compressor start failure

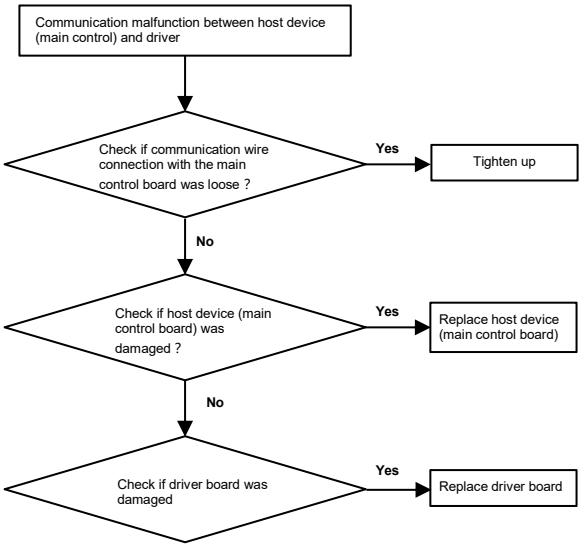




- 7.2.2 主控与驱动通讯故障

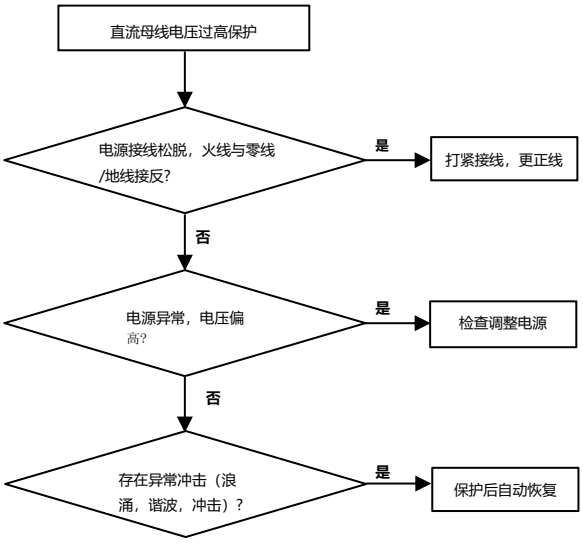
Communication malfunction between host device (main control) and driver

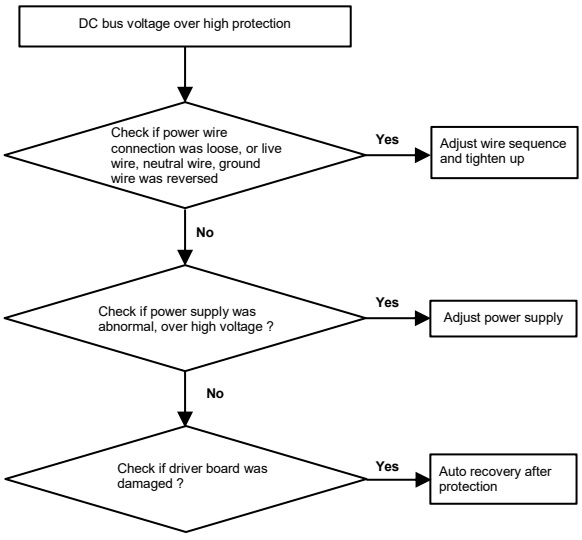




- 7.2.3 直流母线过电压保护

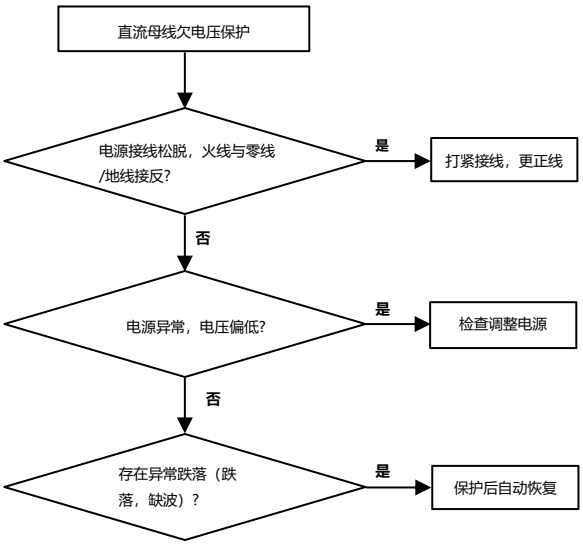
DC bus voltage over high protection

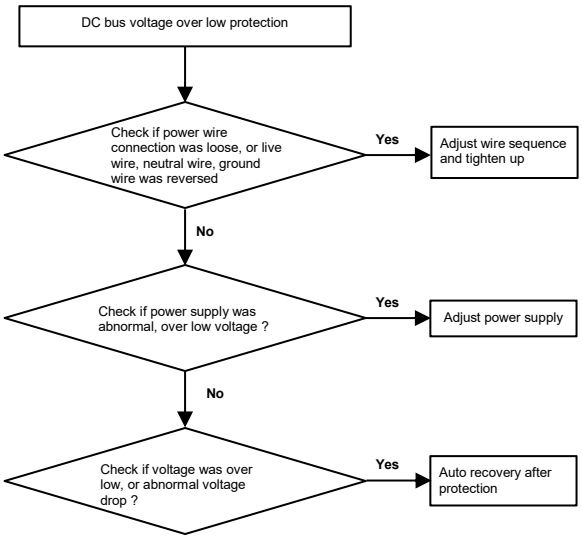




- 7.2.4直流母线欠电压保护

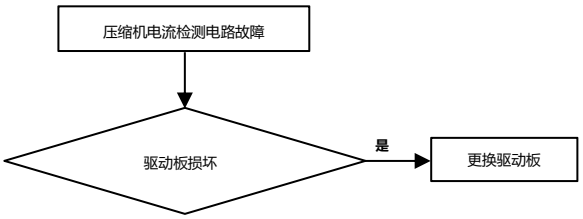
DC bus voltage over low protection

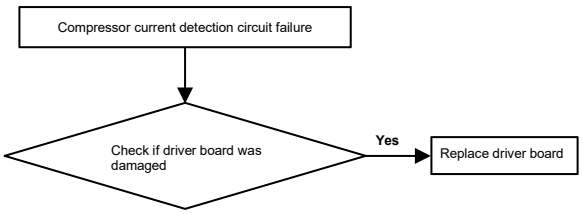




- 7.2.5 压缩机电流检测电路故障

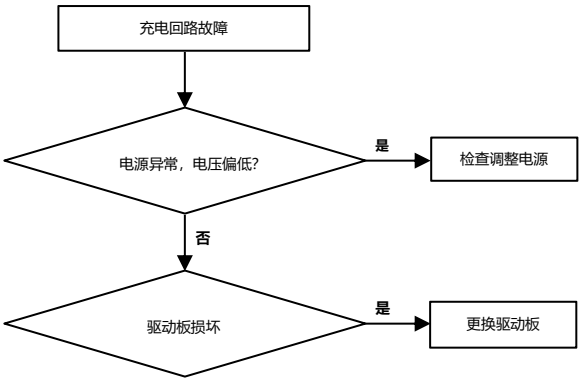
Compressor current detection circuit failure

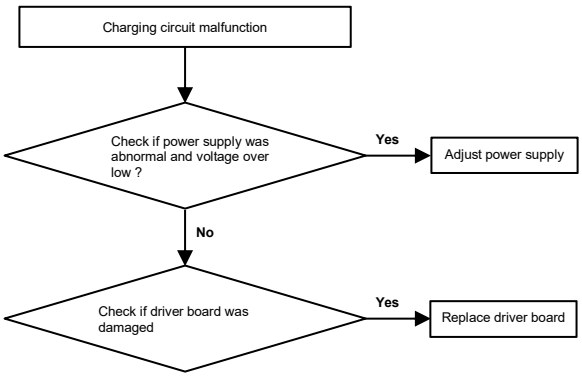




- 7.2.6充电回路故障

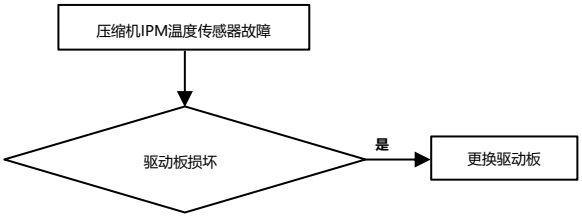
Charging circuit malfunction

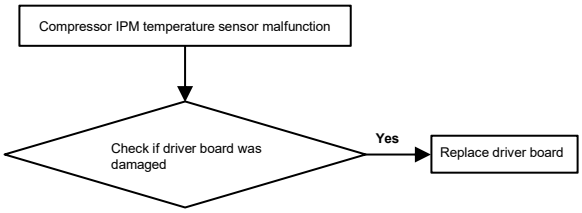




- 7.2.7 压缩机IPM温度传感器故障

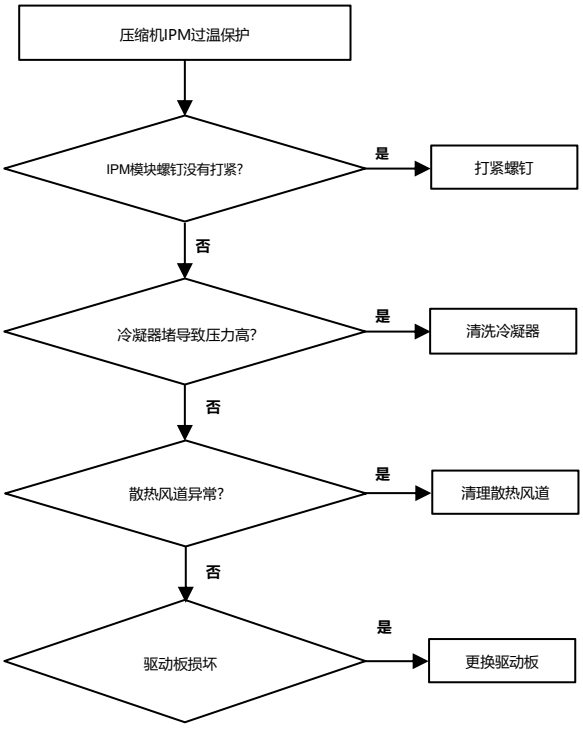
Compressor IPM temperature sensor malfunction

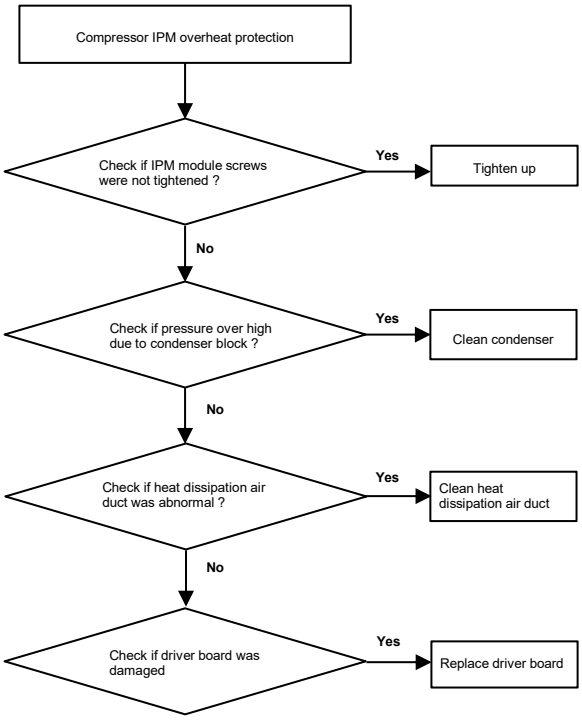




- 7.2.8压缩机IPM过温保护

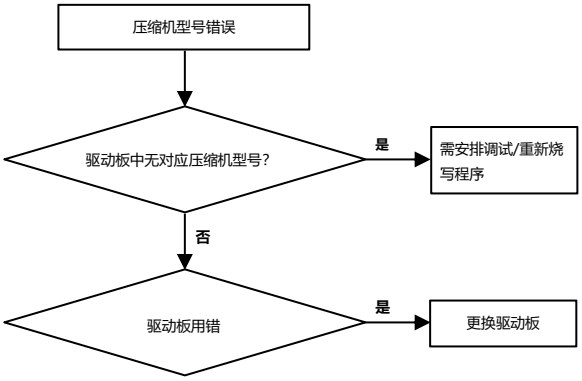
Compressor IPM overheat protection

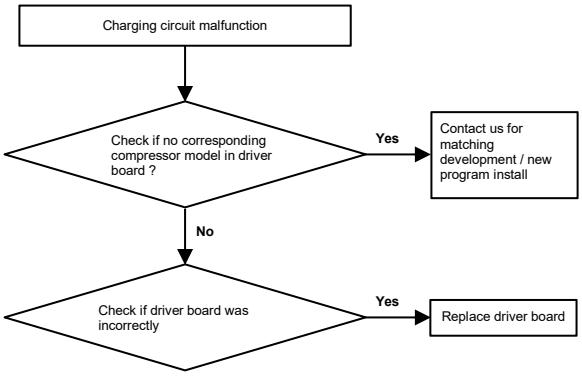




- 7.2.9压缩机型号错误

Compressor model code error





8 拨码Dial Switch

可实现0-10V控制、485通讯（自定义485协议）和MODBUS通讯三种控制方式，三种控制方式通过拨码开关选择，如下所示：

The Driver is available for 3 control modes, which can be selected and set on dial switch, in following table:

工作模式 Operation mode	BIT1	BIT2	备注
MODBUS	OFF	OFF	带高、低压开关状态信息，具体参考协议 注1 With high and low pressure switch status information note1
MODBUS	OFF	ON	带高、低压开关信号触发停机 注2 High and low pressure switch signal trigger shutdown note2
0-10V控制方式 0-10V analog signal	ON	OFF	
MODBUS	ON	ON	带温度输出（H_SW & L&SW） With temperature output（H_SW & L_SW）

备注：

1，驱动板输出连接到H_SW和L_SW位置的开关的开/关的状态，具体参考协议；
2，驱动板检测到连接到H_SW和L_SW位置的开关断开则报故障同时停压缩机；
3，标准版本硬件不带0-10V控制方式接口电路，如需此控制方式请提前告知。

Note:

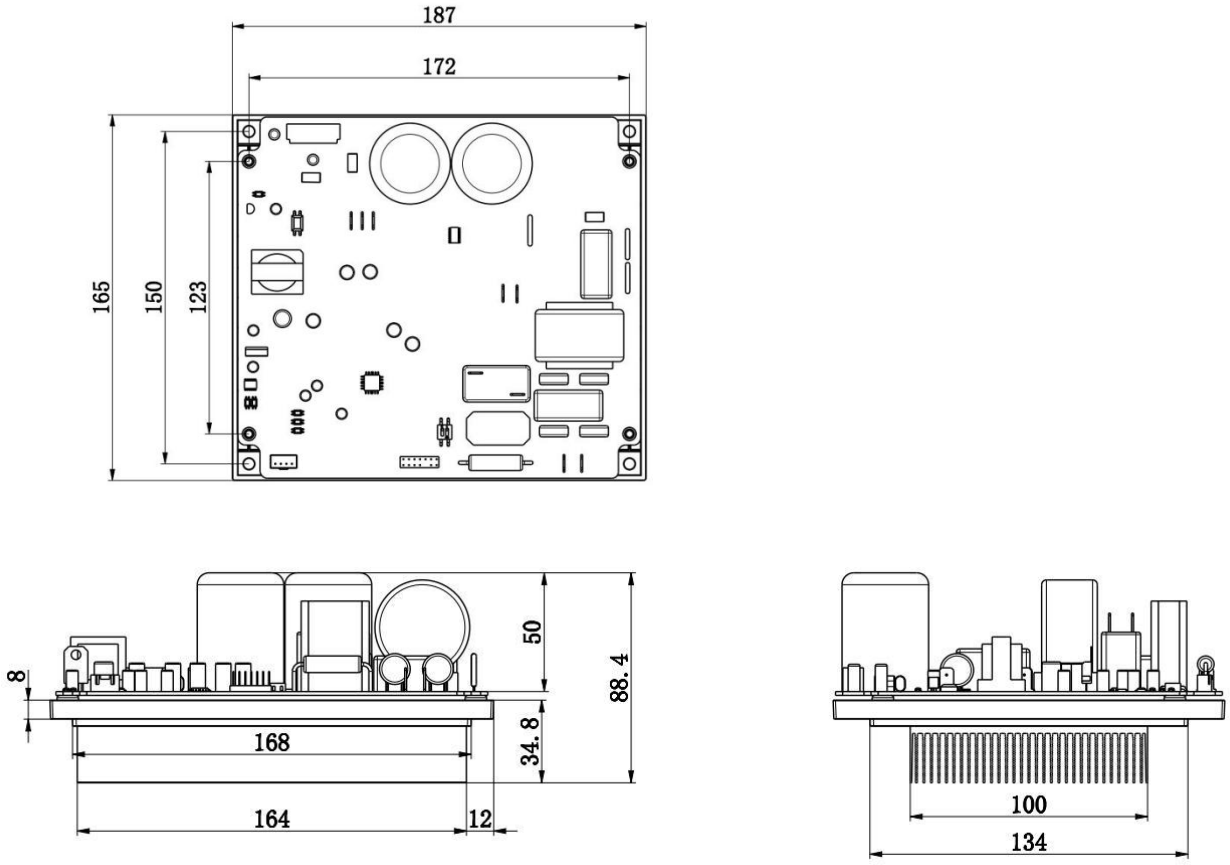
1，Drive board output on/off status of H_ SW and l_ SW, refer to the protocol for details；
2，If the switch of H_SW and L_SW position is detected to be off, it will report a fault and stop the compressor at the same time；
3，Standard version is no available for 0-10V analog signal interface, if it is requested, please inform us in advance.

9 安装尺寸Installation Dimension

9.1驱动组件尺寸Driver board heat sink installation dimension

驱动组件四角有4个安装定位孔，直接安装在电控盒上：

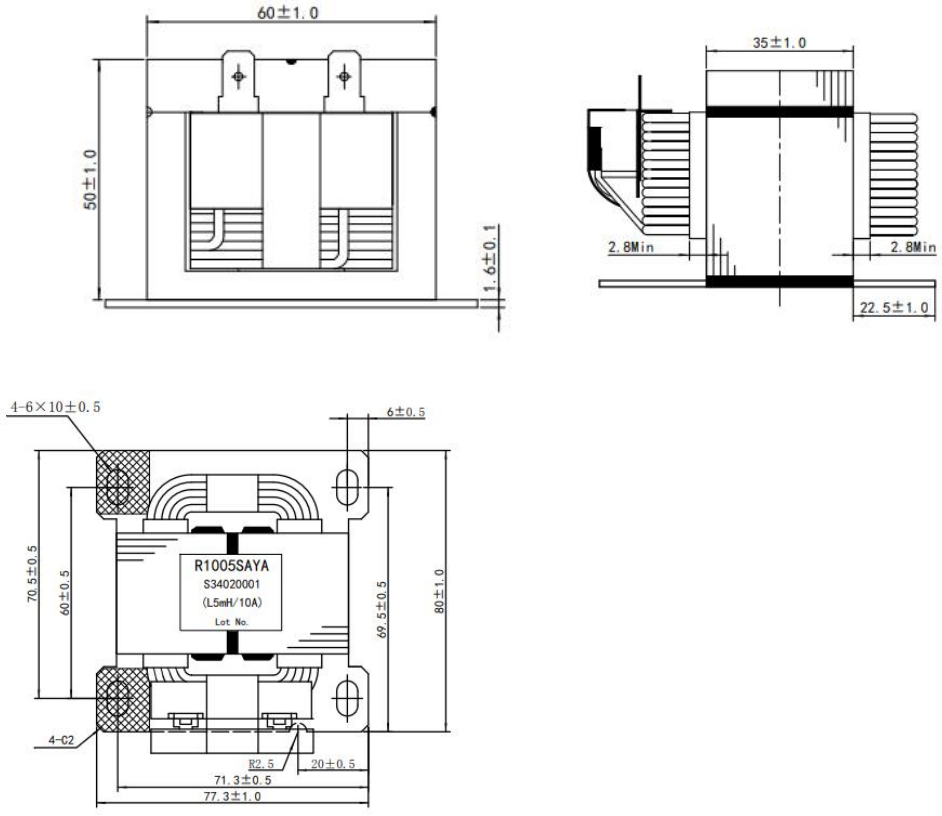
There are 4 positioning holes on the radiator, which can be directly installed on the electric control box：



备注：若需驱动组件3D图纸，请联系我司。

Note: If you need 3D drawings of drive components, please contact us.

9.2电抗器尺寸Reactor installation dimension



备注：

1. 所有尺寸都不包括绝缘漆。
2. 去除底板孔内的过量绝缘漆。
3. 未注公差：±1.0mm。

Remark:

1. All sizes do not include insulating paint
2. Remove excess insulating paint from the bottom plate holes
3. Unmarked tolerance：±1.0mm

9.3安装注意事项 Installation Precautions

安装驱动板时驱动板的散热器不能接触机器导电外壳，散热器距离机组钣金件至少要有4mm以上电气间隙,以保证其具有良好的绝缘能力。

When installing the drive board, the heat sink of the drive board should not come into contact with the conductive shell of the machine. There must be at least 4mm electrical gap between the heat sink and the sheet metal of the unit to ensure good insulation.

10 线径选择Connection Wire Selection

10.1板间连线及线径选择Connection wire requirement

导线的阻抗与其长度成正比，与其线径成反比，在使用时，需注意线材与线径的选择。

板间连线推荐使用铜芯线，其线径的选择需要考虑电流值、环境温度等因素，以防止电流过大使导线过热而造成事故。

The impedance of the connection wire is directly proportional to its length and inversely proportional to its diameter. In use, should be attention to the selection of wire material and diameter.

Copper core wires are recommended for connection wire. Current value and ambient temperature should be taken into account in the selection of wire diameter in order to prevent accidents caused by overheating of over current.

表6 板间连线及线径选择

Table 6 Connection Wire Diameter

丝印名称 Silk-screen Icon	**端子Interface**	**线径选择（推荐值） Wire Diameter Recommendation**	**备注Note**
AC - L	滤波板火线R相输入 Live wire R phase input on filter board	(1.0 ~ 1.5)mm^2	电流Current 9A Max @ 220VAC
AC -N	滤波板火线S相输入 Live wire S phase input on filter board		
PE	地线 Ground wire	(1.0 ~ 1.5)mm^2	驱动板自带地线 Driver board comes with ground
RE-1	电抗器接口 Reactor interface	(1.0~ 1.5)mm2	最大电流 Maximum current 9A
RE-2	电抗器接口 Reactor interface		
U、V、W	压缩机输入接口 Compressor input interface	(1.0 ~ 1.5)mm2	输出电流 Output current 7A Max
485	４８５通信接口 （GND、A、B、VCC） RS485 communication interface （GND、A、B、VCC）	端子型号：XH-4P-K3。推荐使用26AWG(截面积0.1281mm2)电缆，带2根导线和一根屏蔽线的绞合铜线。 Terminal model: XH-4P-K3. It is recommended to use 26AWG (cross-sectional area 0.1281mm2) cable with twisted copper wire with 2 wires and a shielded wire.	

附表：（仅供参考）Schedule:（For reference only)

表7 铜线在不同的温度下能承受的最大电流

Table 7 Maximum current that copper wires withstand at different temperatures

线径（大约值）（平方毫米） **Wire diameter(approximate) (mm^2)**	**铜线温度（摄氏度）** **Cooper wire temperature (℃)**			
	60℃	75℃	85℃	90℃
	电流Current (A)			
2.5	20	20	25	25
4.0	25	25	30	30
6.0	30	35	40	40
8.0	40	50	55	55
14.0	55	65	70	75

11 产品命名规则 Nomenclature

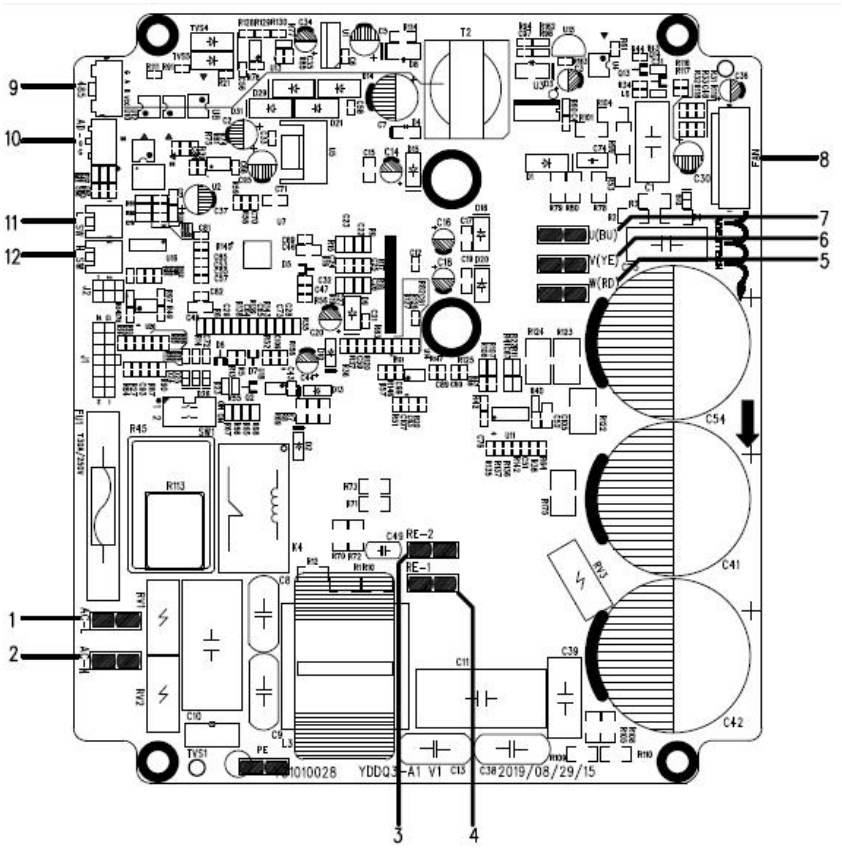
B	x	x	x	xx	x	x	
							一位数字或字母（1...9.A.....Z），散热器尺寸差异或者其他细小功能差异，缺省则为风冷基型产品One digit or letter (1... 9. A... Z), difference in radiator size or other minor functional differences, defaults to air-cooled base products
							一位字母，表示散热类型；F：风冷 ，Y：液冷，缺省则为风冷基型产品A letter indicating the type of heat dissipation; F: Air-cooled, Y: liquid cooled, default to air-cooled base products
							一位字母+一位数字,表示PCB板平台系列One letter+one digit represents the PCB board platform series,
							两位或三位数字,表示能力，如175：17.5kw冷量Two or three digits representing capacity, such as 175:17.5kw cooling capacity
							一位或两位字母,表示驱动板功能，其中Q表示驱动板，L表示滤波板，FQ表示风机驱动板One or two letters representing the function of the drive board, where Q represents the drive board, L represents the filter board, and FQ represents the fan drive board
							一位字母,表示电源规格，其中D表示单相，S表示三相A letter representing the power supply specification, where D represents single-phase and S represents three-phase
							B表示公司名称（亚丁）B represents the company name (Aden)

备注：不同客户因需求不同，套件型号不一样，以实际出货为准。

Remarks: Due to different requirement from different customers, the final model depends on the actual cargo.

附录A PCB丝印图 Appendix A PCB silk screen drawing

驱动板 Driver board:



序号 No.	名称 Name
1	驱动板L相输入 Driver board L-phase input
2	驱动板N相输入 Driver board N-phase input
3	电抗器接线端1 Reactor terminal 1
4	电抗器接线端2 Reactor terminal 2
5	压缩机W相输出 Compressor W-phase output
6	压缩机V相输出 Compressor V-phase output
7	压缩机U相输出 Compressor U-phase output

8	直流风机接口 DC Fan terminal
9	驱动板与主控板485通讯端 Driver board and main control board 485 communication terminal
10	0~10V控制接口/STO接口（可选） 0~10V control terminal/STO terminal（optional）
11	低压开关接口（可选） Low pressure switch terminal
12	高压开关接口（可选） High pressure switch terminal（optional）