

3SC2208A

三相闭环步进驱动器使用手册

THREE PHASE CLOOSED-LOOP STEP MOTOR DRIVE User's Manual



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前言/Foreword

感谢您使用本公司开环步进驱动器。

Thank you for using our open step drive.

在使用本产品前，请务必仔细阅读本手册，了解必要的安全信息、注意事项以及操作方法等。错误的操作可能引发极其严重的后果。

Before using this product, please read this manual carefully to understand the necessary safety information, precautions, and operation methods. Incorrect operation can have extremely serious consequences.

本产品的设计和制造不具备保护人身安全免受机械系统威胁的能力，请用户在机械系统设计和制造过程中考虑安全防护措施，防止因不当的操作或产品异常造成事故。

This product is designed and manufactured without the ability to protect personal safety from mechanical system threats. Users are advised to consider safety precautions during mechanical system design and manufacturing to prevent accidents caused by improper operation or product abnormalities.

由于产品的改进，手册内容可能变更，恕不另行通知。用户对产品的任何改装我公司将不承担任何责任。

阅读时，请注意手册中的以下标示：

Due to product improvements, the contents of this manual are subject to change without notice. Our company will not be responsible for any modification of the product by the user.

When reading, please pay attention to the following signs in the manual:



注意：提醒您注意文字中的要点。



小心：表示错误的操作可能导致人身伤害和设备损坏。

本产品经过国家强制 3C 认证，CE 认证，ROHS 认证

This product has passed the national mandatory 3C certification, CE certification, ROHS certification



1 概述/Overview

1.1 产品介绍/Product Introduction

3SC2208A是我公司新推出的数字式闭环步进电机驱动器，采用最新32位DSP数字处理技术，驱动器控制算法采用先进的变电流技术和先进的变频技术，驱动器发热小，电机振动小，运行平稳。用户可以设置200-51200内的任意细分以及额定电流内的任意电流值，能够满足大多数场合的应用需要。由于采用内置微细分技术，即使在低细分的条件下，也能够达到高细分的效果，低中高速运行都很平稳，噪音超小。驱动器内部集成了参数上电自动整定功能，能够针对不同电机自动生成最优运行参数，最大限度发挥电机的性能。

3SC2208A is a new digital closed-loop stepper motor driver introduced by our company. It adopts the latest 32-bit DSP digital processing technology. The driver control algorithm adopts advanced variable current technology and advanced frequency conversion technology. The driver generates less heat and the motor vibrates less, smooth operation. USERS can set 200 -51200 within the arbitrary subdivision and rated current within the arbitrary current value, to meet the needs of most applications. Due to the use of built-in micro-subdivision technology, even in the conditions of low subdivision, but also can achieve high subdivision effect, low, medium and high-speed operation is very smooth, ultra-low noise. The auto-tuning function is integrated in the driver, which can automatically generate the optimal operating parameters for different motors and maximize the performance of the motors.

1.2 特性/Characteristics

- 全新 32 位 DSP 技术

New 32 Bit DSP Technology

- 超低振动噪声

Ultra-low vibration noise

- 内置高细分

Built-in high subdivision

- 参数匹配闭环电机基座为 86, 110 全系列闭环电机参数

Parameter matching closed-loop motor base for 86,110 series of closed-loop motor parameters

- 变电流控制使电机发热大为降低

Variable current control greatly reduces the heat generation of the motor.

- 自适应负载变化调整电流输出

Adaptive load change to adjust current output

- 连续输出电流最大值 8.0A

Maximum continuous output current 8.0 A

- 有故障输出指示接口功能

Failure output indicator interface function

- 可接受差分 and 单端式脉冲/方向/脱机指令

Differential and single-ended pulse/direction/offline instructions are acceptable

- 脉冲响应频率最高可达 500KHz（出厂默认 200KHz）

Impulse response frequency up to 500KHz (factory default 200KHz)

- 每圈脉冲数可通过调试软件或拨码设定（细分）

The number of pulses per cycle can be set by debugging software or dialing (subdivision)

- 脉冲，方向和脱机信号输入接口电平为 5-24V 兼容

Pulse, direction and offline signal input interface levels are 5-24V compatible

●工作电压：交流 165V-253Vac

Operating Voltage: AC INPUT VOLTAGE 165V-253Vac

●具有过压、欠压、过流等保护功能

It has the protection functions of overvoltage, undervoltage and overcurrent

●采用 FOC 磁场定位控制技术和空间矢量脉宽调制（SVPWM）闭环控制技术

FOC magnetic field positioning control technology and Svpwm closed-loop control technology are adopted

●具有 RJ45 串口 TTL 电平（RS232 MODEL BUS 协议）调试功能，但需使用本公司专用的串口调试线

With RJ45 serial TTL level (RS232 MODEL BUS protocol) debugging function, but need to use the company's dedicated serial debugging line

●默认接收的编码器线数为 1000 线，可定制为 2500 线，5000 线等任意编码器线数

The default received encoder line number of 1000 lines, can be customized for 2500 lines, 5000 lines and other arbitrary encoder line number

1.3 应用领域/Application areas

适合各种中小型自动化设备和仪器，例如：锂电设备、3C 电子设备、雕刻机、打标机、切割机、激光照排、雕刻机，绘图仪、数控机床、自动装配设备等。在用户期望小噪声、高速度的设备中应用效果特佳。

Suitable for all kinds of small and medium-sized automation equipment and instruments, such as: lithium battery equipment, 3C electronic equipment, engraving machine, marking machine, cutting machine, laser phototypesetting, engraving machine, plotter, CNC machine tool, automatic assembly equipment, etc. It is especially effective in applications where users expect small noise and high speed.

2 性能指标/Performance Index

2.1 电气特性/Electrical characteristics

说明 Explanation	3SC2208A			
	最小值 Minimum Value	典型值 Typical Value	最大值 Maximal Value	单位 Unit
连续输出电流 Continuous output current	1	—	8	A
电源电压（交流） Power Supply Voltage (DC/AC)	165	220	253	VAC
逻辑输入电流 Logic input current	6	10	16	MA
逻辑输入电压 Logical input voltage	5	5	24	VDC
脉冲频率 Pulse Frequency	0	200	500	KHz

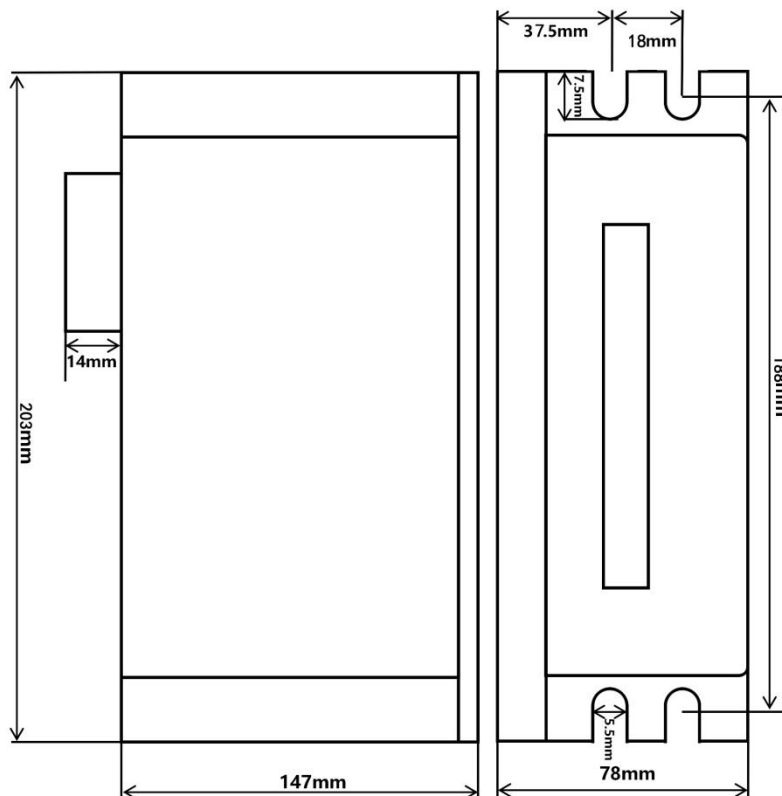
脉冲高电平宽度 Pulse high width	1.5	—	—	US
绝缘电阻 Insulation Resistance	100	—	—	MΩ
位置误差控制精度 Accuracy of position error control	—	±1	—	PULSE
最高加速度（空载） Maximum acceleration (no load)	—	100	—	RPM/MS
过压保护电压 Overvoltage protection voltage	255	—	—	VAC
速度控制精度 Speed control accuracy	—	±2	—	RPM

2.2 使用环境/Use environment

冷却方式 Cooling Mode		自然冷却或强制风冷 Natural Cooling or forced air cooling
使用环境 Service Environment	场合 Occasion	不能放在其它发热的设备旁，要避免粉尘、油雾、腐蚀性气体，湿度太大及强振动场所，禁止有可燃气体和导电灰尘。 Can not be placed next to other heating equipment, to avoid dust, oil mist, corrosive gases, humidity is too large and strong vibration sites, prohibited combustible gases and conductive dust.
	温度 Temperature	-10℃ ~ +50℃
	湿度 Humidity	40 ~ 90%RH
	振动 Vibration	5.9m/s ² MAX
保存温度 Storage temperature		-20℃~60℃
使用海拔 Use Elevation		1000 米以下 Below 1000 meters
重量 Weight		2KG

3 安装/Installation

3.1 安装尺寸/Mounting dimensions



3.2 安装方法/Installation method

驱动器的可靠工作温度通常在 60℃ 以内，电机工作温度为 80℃ 以内。

The reliable operating temperature of the driver is usually within 60℃, and the motor operating temperature is within 80℃.

建议使用时选择自动半流方式，马达停止时电流自动减一半，以减少电机和驱动器的发热。

It is recommended to use the automatic semi-flow mode when using the motor. When the motor stops, the current is automatically reduced by half to reduce the heat of the motor and the drive.

安装驱动器时请采用竖着侧面安装，使散热齿形成较强的空气对流。

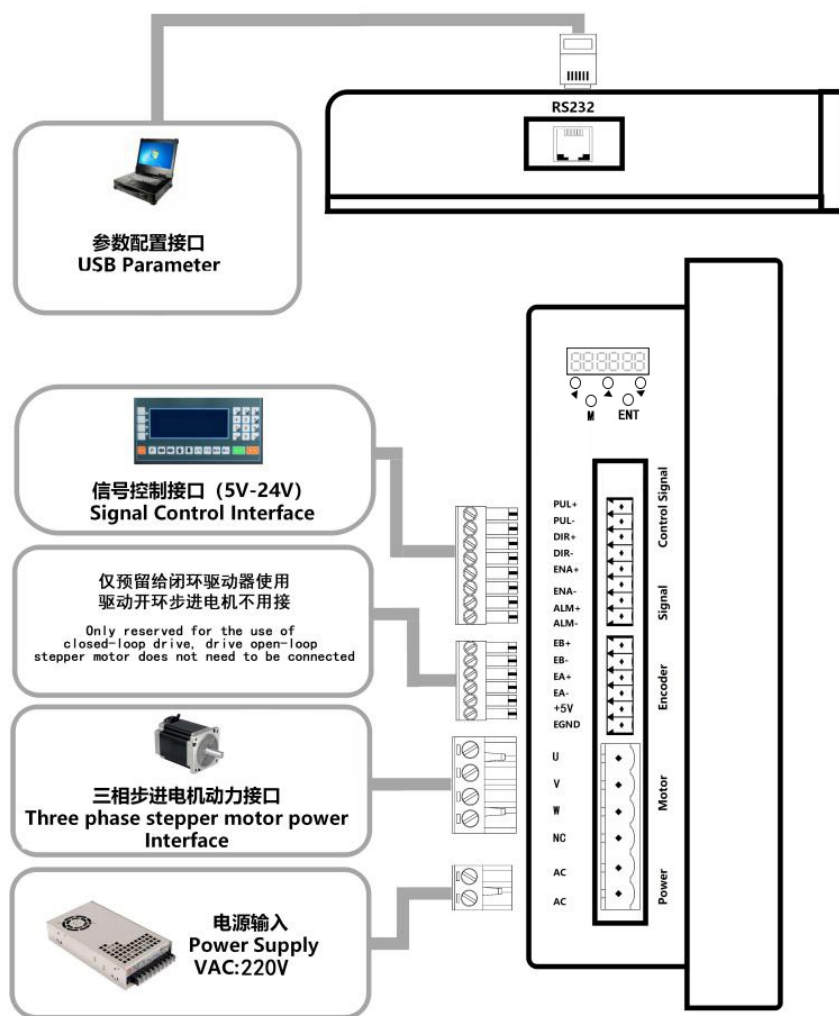
Install the drive with vertical side mounting so that the heat dissipating teeth form a strong air convection.

必要时机内靠近驱动器处安装风扇，强制散热，保证驱动器在可靠工作温度范围内工作。

Install a fan near the drive when necessary to force heat dissipation to ensure that the drive works within a reliable operating temperature range.

4 驱动器端口与接线/Driver ports and wiring

4.1 接线示意图/Schematic diagram of wiring

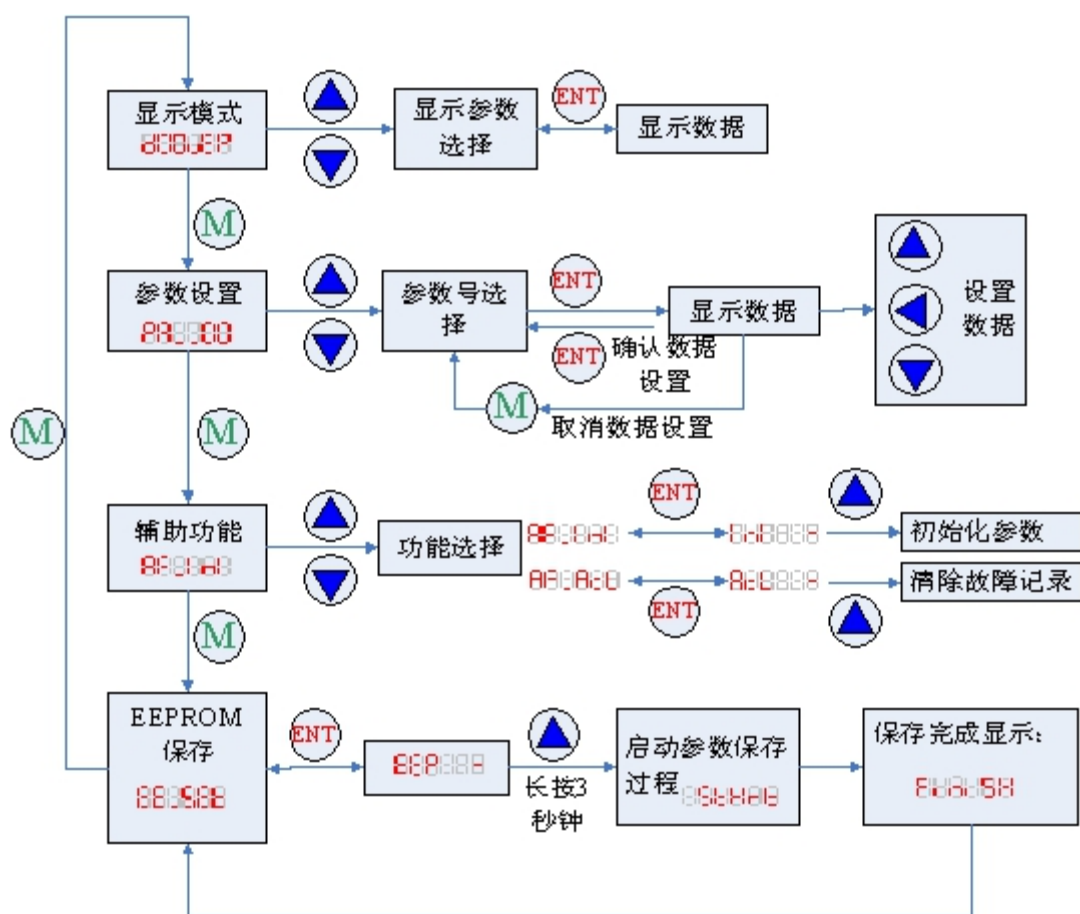


4.2 端口定义/Port Definition

4.2.1 LED 数码管状态指示/Status indication LED digital

3SC2208A 有一个 LED 指示电源和六位数码管显示状态，数码管面板操作请参考说明。显示参数定义如下表：

3SC2208A an LED to indicate power status and six digital display, LED panel operation Please refer. Display parameters defined as follows:



显示模式：

显示参数的含义如下：

LED 显示 LED display	含义 Meaning	备注 Remark
888888	数据低位 Low Level Data	数据地位与高位之间用 ata between
888888	数据高位 High Level Data	
888888	位置误差 Position Error	为驱动器接收脉冲与编码器反馈的误差。范围为 32 位。查看此项时，分为 L 和 H 两个查看项，分别表示低位和高位。 Receives the error pulse and encoder feedback to the driver. 32-bit range. When viewing this, L and H are divided into two viewing entries represent the low and high.

888888	电机速度: RPM Motor speed: RPM	
888888	给定速度: RPM Given speed: RPM	
888888	脉冲反馈脉冲数: Number of pulse feedback pulses:	
888888	脉冲给定脉冲数: Pulse given number of pulses:	
888888	峰值电流给定: (毫安) Peak current given: (mA)	
888888	驱动器故障代码: Drive Fault Code: 0001——过流保护 0001 -- Overcurrent Protection 0002——过压保护 0002 -- Overvoltage Protection 0008——刹车故障 0008 -- Brake Fault 0020——超差保护 0020 -- Override Protection	
888888	经过整流后的母线电压: Bus voltage after rectification: 电压=显示的数据/10; voltage = displayed data/10;	
888888	驱动器的版本号: Version number of the drive:	

4.2.2 控制信号输入端口/Control Signal Input Port

控制信号接口

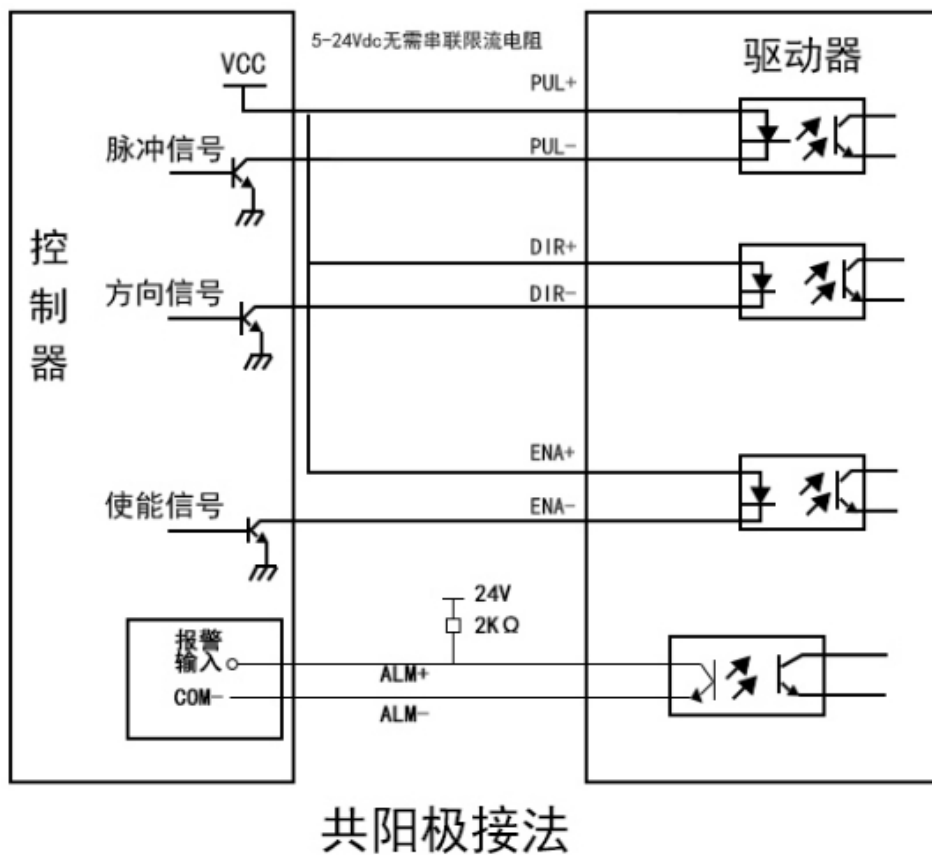
Control Signal interface

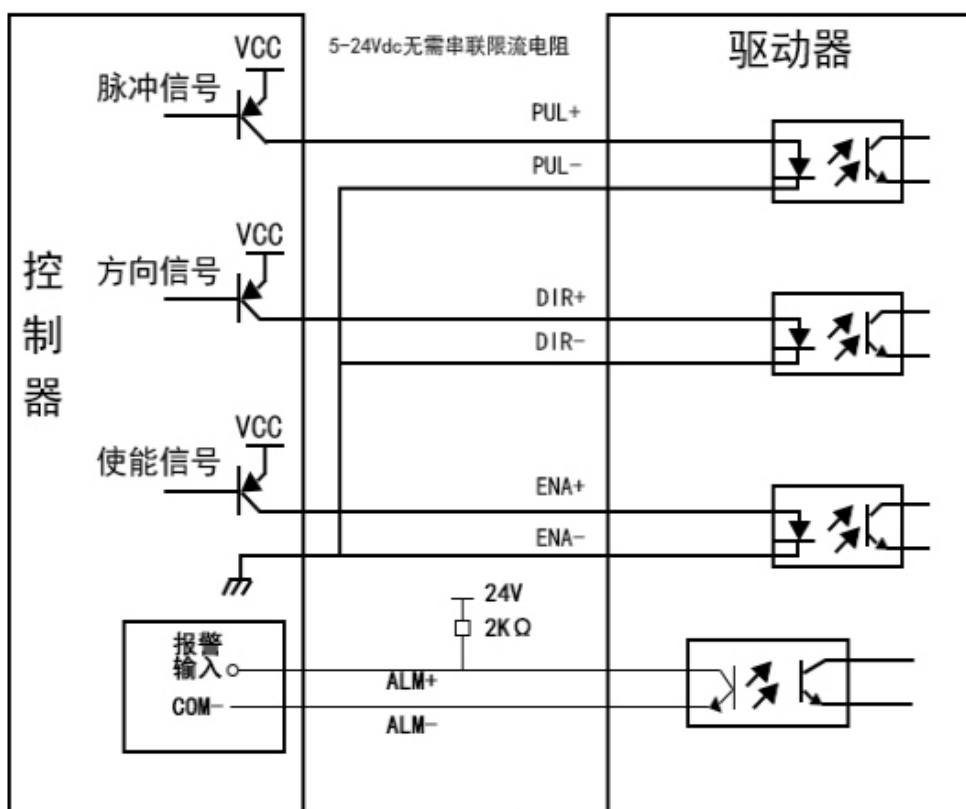
接口名称 Interface name	功能 Features	说明 Explanation
PUL+	脉冲正输入端 Pulse Positive Input	

PUL-	脉冲负输入端 Pulse negative input	兼容 5V-24V 电平信号 Compatible 5V - 24V level signal
DIR+	方向正输入端 Directional Positive Input	
DIR-	方向负输入端 Directional negative input	
ENA+	使能正输入端 Enable Positive Input	
ENA-	使能负输入端 Enable negative input	
ALM+	报警信号正输出端 Positive output of alarm signal	集电极开路 OC 输出，最大上拉电平 24V，最大输出电流 100mA Open collector output, maximum pull up level 24V, maximum output current 100mA
ALM-	报警信号负输出端 Negative output of alarm signal	

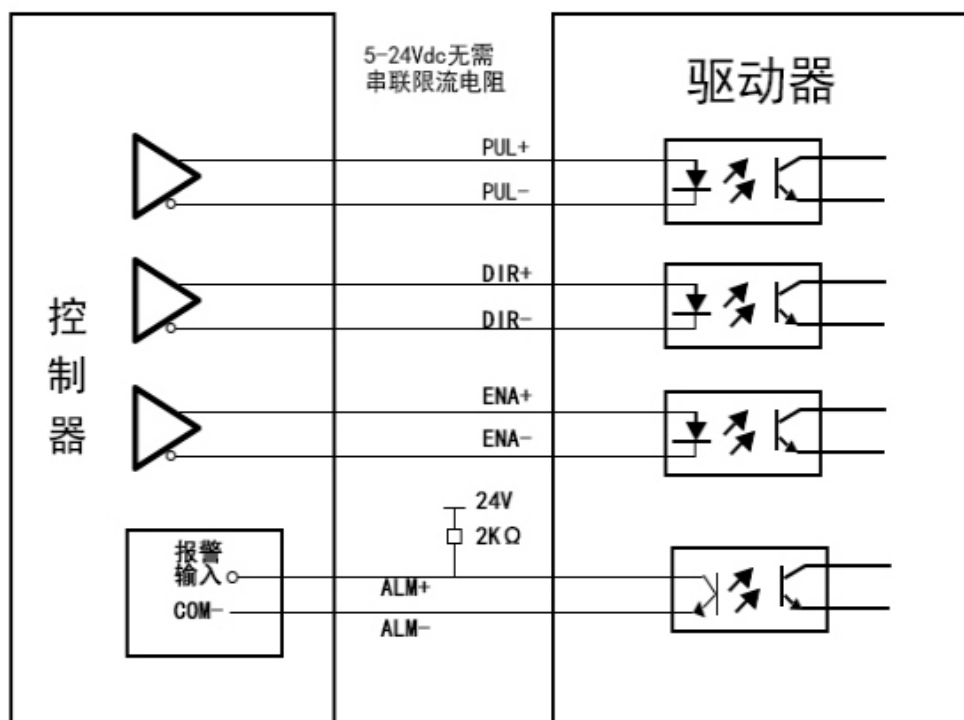
控制信号接口电路

A control signal interface circuit





共阴极接法



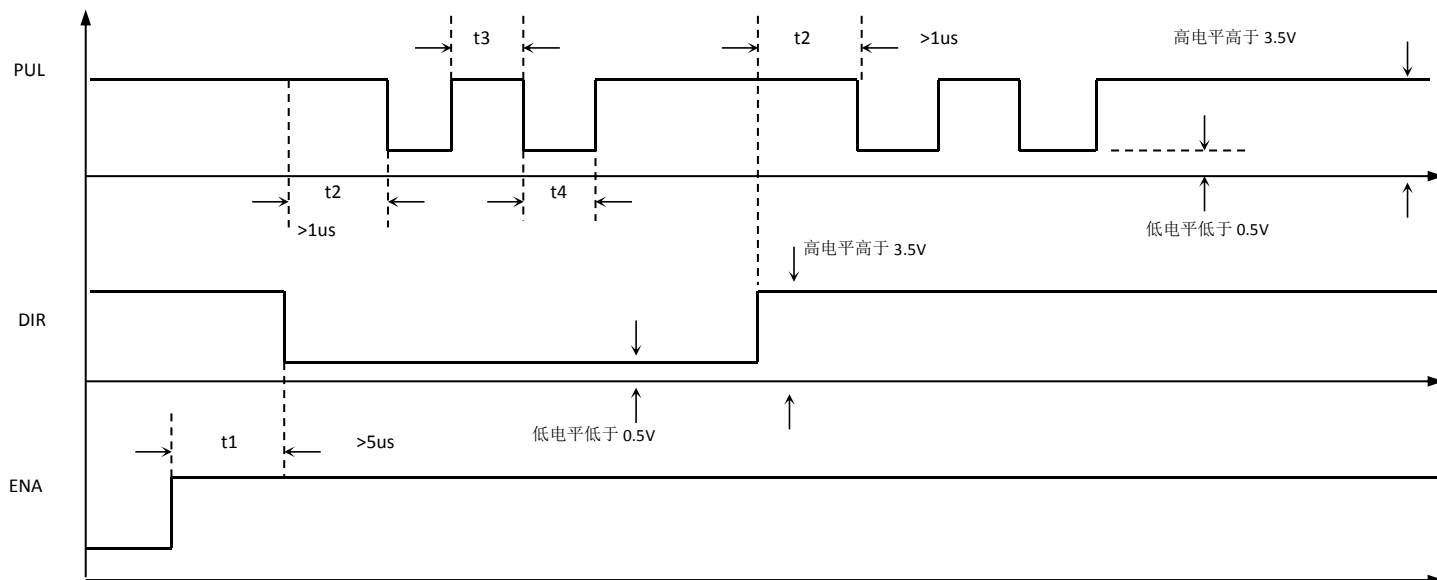
差分方式控制信号接口接线图

控制信号时序图

A control signal timing in FIG.

为了避免一些误动作和偏差，PUL-、DIR-和 ENA-应满足一定要求，如下图所示：

In order to avoid malfunctions and deviations, PUL-, DIR- ENA- should meet certain requirements, and, as shown below:



注释/Comment:

t1: ENA（使能信号）应提前 DIR 至少 $5\mu s$ ，确定为高。一般情况下建议悬空即可；

t1: ENA (enable signal) DIR should advance at least $5\mu s$, determined to be high. In general recommendations can be suspended;

t2: DIR 至少提前 PUL 下降沿 $1\mu s$ 确定其状态高或低；

t2: DIR PUL falling $1\mu s$ determined in advance of at least a high or low state;

t3: 脉冲宽度至少不小于 $1.5\mu s$ ；

t3: at least a pulse width of not less than $1.5\mu s$;

t4: 低电平宽度不小于 $1.5\mu s$ 。

t4: low level width not less than $1.5\mu s$.

4.2.3 编码器输入端口/Encoder input port

接口名称 Interface name	功能 Features
EA+	编码器 A 信号差分输入接口 Encoder a signal differential input interface
EA-	
EB+	编码器 B 信号差分输入接口 Encoder b signal differential input interface
EB-	
+5V	给电机的编码器提供直流电压 5V，电流 100mA Provide DC voltage of 5V, current of 100mA to encoder of motor
EGND	5V 参考端负极 5V Reference Terminal Negative

4.2.4 电源及电机输出端口/Output ports of power supply and motor

供电与电机动力接口

Power supply and motor power interface

接口名称 Interface name	功能 Features
AC	供电电压范围：交流 165-253Vac Voltage range: AC 165-253Vac
AC	
NC	不接 NO
U	电机 U 相线圈接口 Motor U phase coil interface
V	电机 V 相线圈接口 Motor V phase coil interface
W	电机 W 相线圈接口 Motor W phase coil interface

RJ45 串口 RS232-TTL (3.3V) 电平通讯接口

RJ45 serial port RS232-TTL (3.3V) level communication interface

接口名称 Interface name	功能 Function	说明 Account for
+5V	5V 电源正极 5V power supply positive pole	靠近拨码测引脚 Near Dial Pin
TXD	RS232-TTL (3.3V) 发送端 Rs232-ttl (3.3 v) 发送器	
RXD	RS232-TTL (3.3V) 接收端 Rs232-ttl (3.3 v) 接收器	
GND	5V 电源地 5V ground	0V

5 参数设置/Parameter settings

3SC2208A 驱动器的参数设置有两种方法：一种是通过 PC 机的 RS232 串行通讯口，采用专用调试软件完成参数设置，另外一种是通过直接驱动器的安检面板设置参数，驱动器内部存有一套对应电机最佳的默认出厂配置参数，用户只须按照具体使用情况调整驱动器内部细分数即可，详细使用情况请参看调试软件的使用说明。具体可调整参数及功能见下表：

TS758 drive parameters there are two methods: one is through the RS232 serial communication port of a PC, using a dedicated debugging software parameter setting is completed, another panel is set security parameters direct drive, there is an internal drive motor corresponding to the optimal default factory configuration parameters, the user need only adjust the drive to the internal breakdown of the number in accordance with the specific use, see the detailed use of the software debugging using Pro Tuner explained. DETAILED adjustable parameters and functions as follows:

参数符号	参数名称	参数范围	备注
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Parameter symbol	parameter name	Parameters	Remark
KcP	电流环比例数 Current Ring Proportion Coefficient	0~65535	仅用于出厂设置，禁止修改 Only for factory setting, modification
KcI	电流环积分数 Current Ring Integral Coefficient	0~65535	仅用于出厂设置，禁止修改 Only for factory setting, modification
KpP	位置环比例数 Position Ring Proportional Coefficient	0~65535	仅用于出厂设置，禁止修改 Only for factory setting, modification
KpI	位置环积分数 Position Ring Integral Coefficient	0~65535	仅用于出厂设置，禁止修改 Only for factory setting, modification
Kd	速度环阻尼数 Velocity Ring Friction Coefficient	0~100	仅用于出厂设置，禁止修改 Only for factory setting, modification
Kvff	速度环前馈数 Feed forward coefficient of velocity loop	0~100	仅用于出厂设置，禁止修改 Only for factory setting, modification
	保持电流百分比 Holding current percentage	0~100%	出厂默认设置 40 Factory default setting 40
	闭环电流百分比 Closed loop current percentage	0~100%	出厂默认设置 100 Factory default setting 100
	编码器线数 Number of encoder lines	4000	4000
	跟踪误差限 Tracking Error Limit	0~65535	出厂默认设置 1000 Factory default setting 1000
	细分数 Fine Fraction	200~65535	出厂默认设置 4000 Factory default setting 4000

参数模式数码管显示为:

Digital display mode parameters as:



其中的“00”表示参数序号，具体含义如下表

Wherein "00" represents a parameter number, the specific meaning of the following table

序号 Serial number	名称 Name	默认值 Default value	范围 Range	说明 Account for
00	电流环 Kp Current ring KP	根据电机上电默认自整定参数 According to the motor on the electrical default self-tuning parameters	0~65535	越大电流上升越快,但过大将导致电机震荡,声音大 The higher the current, the faster it rises, but too much will cause the motor to vibrate and make a loud noise
01	电流环 Ki Current ring KI		0~65535	电流积分 Current integration
02	电流环 Kc Current ring KC	256	0~1024	减小中速振动,越大振动越小,但电流下降也越快。 The bigger the vibration is, the smaller the vibration is, but the lower the current is.
03	位置环 Kp Position Ring KP	2500	0~65535	
04	位置环 Ki Position Ring KI	500	0~65535	消除电机停止时的静态误差 Eliminate the static error when the motor stops
05	位置环 Kd Position Ring KD	200	0~1000	减小电机的超调 Reduce Motor overshoot
06	位置环 Kvff Position Ring KVFF	30	0~100	补偿电机及控制回路的滞后 Lag of compensation motor and Control Circuit
07	驱动器位置给定分辨率 Given	4000	200~65535	设置电机运行一转需要的脉冲数 Set the number of pulses required for one revolution of

	resolution of drive position			the motor
08	编码器分辨率 ENCODER resolution	1000	200~65535	默认 1000 线编码器，4 倍频 Default 1000 wire encoder, 4 x frequency
09	跟踪误差报警 阈值 Tracking error alarm threshold	2000	1~65535	单位为脉冲数，此处的脉冲数以编码器分辨率为基准。 The unit is the number of pulses, where the number of pulses is based on the encoder resolution.
10	保持电流百分比 Percent Holding Current	60	0~100	设定电机在静态时的保持力矩，同时也为电机起动时的电流。 驱动器的最大电流为 8A Set the motor in static Torque, but also for the motor starting current. The maximum current of the driver is 8A
11	闭环电流百分比 Percentage of closed loop current	100	1~100	设定电机的电流环参数衰减比。 可减少启动噪声 Set the current loop parameter attenuation ratio of the motor. Reduces startup noise
12	保持时间 Hold time	40	1~65535	设定停止接收脉冲后，多少时间进入位置保持模式。进入位置保持后，驱动器忽略小的误差变动。 。单位为 50us 的周期数 Set How long to enter position hold mode after stop receiving pulse. After the entry position is held, the driver ignores small error changes. The number of cycles in 50 us
13	脉冲滤波使能 Pulse filtering enable	1	0 或者 1	0——不使用内部脉冲滤波器 1——使用内部脉冲滤波器 滤波时间单位为 us。时间越大，滤波效果越强，但是滞后越大。 0 -- do not use an internal pulse filter 1 -- use an internal pulse filter to filter in us. The larger the time, the stronger the filtering effect, but the greater the lag.
14	滤波时间 Filtering time	10000	50~25600	

15	使能电平 Enabling level	1	0 或者 1	0——使能时(电机可以响应脉冲), 光耦导通, EN 端口需要输入 5V 信号 1——使能时(电机可以响应脉冲), 光耦截止, EN 端口可以不输入信号 0 As enabling time (the motor can respond to pulses) , optically coupled on, EN port requires Input 5V signal 1 as enabling time (the motor can respond to pulses) , optically coupled off, EN port can not input signals
16	故障输出电平 Fault output level	1	0 或者 1	0——故障时光耦不导通 1——故障时光耦导通 0 -- Foshan -- trouble time optical coupler not on 1 -- Trouble time optical coupler on
17	单双脉冲选择 Single and double pulse selection	0	0 或者 1	0——脉冲+方向 1——双脉冲模式(待添加) 0 -- Pulse direction 1 -- Dual pulse mode (to be added)
18	脉冲有效沿 Effective edge of pulse	0	0 或者 1	0——上升沿 1——下降沿 Harvard University Press, Harvard University
19	电机运行方向 Motor Direction	1	0 或者 1	0 与 1 表示两个不同的运行方向 0 And 1 indicate two different running directions
20	脉冲带宽选择 Pulse bandwidth selection	0	0~300	限制最大脉冲频率 Limiting maximum pulse frequency
21	内部加速度 Internal acceleration	200	1~2000	内部测试时的加速度, R/S^2 Acceleration for internal testing, r/s^2

22	内部速度 Internal Velocity	60	1~3000	内部测试时的速度, RPM Speed for internal testing, RPM
23	内部行程 Internal Travel	100	1~65535	内部测试时的行程 电机运行的行程=设定值/100(转) Run stroke of motor in internal test = set value/100 (RPM)
24	内部运行次数 Number of internal runs	1	1~65535	内部电机重复运行的次数 The number of repetitions of the internal motor
25	内部启动方向 Internal Start Direction	1	0 或者 1	0 和 1 分别表示两个启动方向 0 And 1 represent the two startup directions, respectively
26	内部运行间隔 Internal running interval	100	1~65535	电机运行完一个梯形后等待设定的时间, 然后再次运行下一个梯形 After the motor runs a trapezoid, it waits a set time, and then runs the next trapezoid again
27	内部是否往复运行 Whether or not the interior runs back and forth	1	0 或者 1	设定在测试时, 是否往复运行一个来回表示一次 0——不往复运行 1——往复运行 Sets whether to run a round trip while being tested, meaning a 0-foshan non-reciprocating operation -- a Florida reciprocating operation
28	起动/停止测试 START/STOP test	0	0 或者 1	1——启动运行, 0——停止运行 写入 1 后, 电机运行, 如果运行次数完成, 此参数自动变为 0 1 -- Start Up, 0 Foshan -- stop writing to 1, the motor runs, and if the number of runs completes, this parameter automatically becomes 0
29	闭环模式选择 Closed-loop mode selection	1	0 或者 1	0——FOC 模式 1——PM 模式 0 -- Foshan FOC Mode 1 -- Harvard mode

30	开闭环模式选择 Open and close loop mode selection	1	0 或者 1	0——开环模式 1——闭环模式 0 -- Open Mode 1 -- lock mode
31	电机法兰选择 Motor flange selection	1	0 或者 1	0——110 电机 1——86 电机 0-110 motor, 1-86 motor
32 (暂无)	电流环上电自动整定功能 Automatic setting function on current ring	1	0 或者 1	0——上电自动整定无效 1——上电自动整定有效(默认) Automatic setting on 0 Foshan -- Invalid 1 -- Automatic Setting on Foshan (default)

注意：驱动器出厂默认的电环、位置环和速度环参数为配套电机的最佳参数，客户一般无需修改，只需要根据系统控制的需要选择好电机细分数及开闭环电流的百分比即可。

Note: The factory default drive current loop, velocity loop and position loop parameters for the optimal parameters of the motor being, customers generally do not need to modify the system only need to control the need to choose a good percentage of the number of subdivisions and open and closed loop motor current in accordance with.

6 保修及售后服务 /Warranty and after-sales service

请保留好包装箱以便运输、储存或需要退回本公司维修时使用。一年保修期：

Please keep the packing box for transportation, storage or need to return to the company for maintenance. One year warranty period:

来自本驱动器使用一年内因为产品自身的原因造成的损坏，负责保修。

From the use of this drive within one year because of the product itself caused by the damage, responsible for the warranty.

不在保修之列：/Not covered by warranty:

不恰当的接线、电源电压和用户外围配置造成的损坏。/Damage caused by improper wiring, power supply voltage and user peripheral configuration.

无本公司书面授权条件下，用户擅自对产品进行更改。/Without the written authorization of the company, users make changes to the products without authorization.

超出电气和环境的要求使用。/Use beyond electrical and environmental requirements.

驱动器序列编号被撕下或无法辨认。/The drive serial number has been torn off or is unreadable.

外壳被明显破坏。/The outer shell was visibly damaged.

不可抗拒的灾害。/An irresistible disaster. 6.2 售后服务 /Aftersales Service

添加微信或者拨打电话



(+86) 18926788846

Email: Tech@TQKTEC.COM

您拨打电话之前，请先记录以下信息：

Before you call, please record the following information:

故障现象/Fault phenomenon

产品型号和序列号/Product model and serial number

安装日期或者生产日期/Installation date or production date