TS758

闭环步进驱动器使用手册

CLOSED-LOOP STEP MOTOR DRIVE User's Manual

摩川技术(深圳) 有限公司

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目录

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
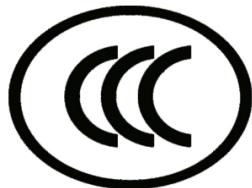
1 概述/Overview

1.1 产品介绍/Product Introduction

　　TS758 是本公司基于十几年步进与闭环步进经验开发的一款混合伺服驱动器，采用最新专用电机控制 DSP 芯片和应用矢量型闭环控制技术，从而彻底克服开环步进电机丢步的问题，同时也能明显提升电机的高速性能、降低电机的发热程度和减小电机的振动，并且提升机器的加工速度和精度以及降低机器的能耗。此外，在电机连续过载时，驱动器会输出报警信号，具有与交流伺服系统同样的可靠性。TS758 适配电机安装尺寸与传统的 86 系列步进电机完全兼容，传统步进驱动方案极易升级。

　　TS758 is a hybrid servo driver developed by our company based on more than ten years' stepping and closed-loop stepping experience. It adopts the latest special motor control DSP chip and applies Vector closed-loop control technology, thus completely overcome the problem of open-loop stepper motor lost step, but also can significantly improve the high-speed performance of the motor, reduce the degree of motor heating and reduce the vibration of the motor, and improve the processing speed and accuracy of the machine and reduce the energy consumption of the machine. In addition, in the motor continuous overload, the driver will output alarm signal, with the same reliability as AC servo system. The installation size of TS758 adaptor motor is fully compatible with the traditional 86 series stepping motor, and the traditional stepping drive scheme is easy to upgrade.

1.2 特性/Characteristics

●工作电压：输入电压交流20V-75V
　Operating voltage: input voltage AC 20V-75V
●连续输出电流最大值8.0A
　Maximum continuous output current 8.0A
●可接受差分和单端式脉冲/方向/脱机指令
　Acceptable differential and single-ended pulse/direction/off-line instructions
●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
　Using FOC field orientation control and space vector pulse width modulation (of SVPWM) loop control technology
●采用了先进的变电流技术和变频技术，有效的降低了电机和驱动器的发热
　The use of advanced technology and frequency-varying current technology, effective to reduce the heat of the motor and drive
●有故障输出指示接口功能
　Fault output indication interface function
●每圈脉冲数可通过调试软件或拨码设定（细分）
　The number of pulses per turn can be set by debugging software or by dialing (subdivision)
●具有过压、欠压、过流等保护功能
　It has the protection functions of overvoltage, undervoltage and overcurrent.
●控制指令最大脉冲频率为500KHz（出厂默认为200KHz）
　Maximum control command pulse frequency is 500KHz (factory default is 200KHz)
●脉冲，方向和脱机信号输入接口电平为5-28V兼容
　Pulse, direction and off-line signal input interface levels are 5-28V compatible
●具有USB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缆
　USB serial TTL level (RS232 MODEL BUS protocol) debugging function, but need to use the company's dedicated serial debugging

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	TS758			
	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	1.0	–	8.0	A
电源电压（交流） Supply Voltage (AC)	20	60	75	VAC
逻辑输入电流 Logic input current	7	10	20	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
位置误差控制精度 Position Error Control Accuracy	–	±1	–	Pulse
速度控制精度 Speed Control Accuracy	–	±2	–	rpm
最高加速度（空载） Maximum acceleration (no load)	–	100	–	rpm /ms
过压保护电压 Overvoltage Protection Voltage	90	92	94	VAC
绝缘电阻 Insulation Resistance	100	–	–	MΩ

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 rvice 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 s trong vibration sites, prohibited combustible gases and cond uctive dust。	
	温度 Temperature	-10℃ ～ +50℃	
	湿度 Humidity	40 ～ 90%RH	
	振动 Vibration	5.9m/s2MAX	
保存温度 Storage temperature		-20℃～60℃	
使用海拔 Use Elevation		1000 米以下 Below 1000 meters	
重量 Weight		0.4KG	

3 安装/Installation

3.1 安装尺寸/Mounting dimensions
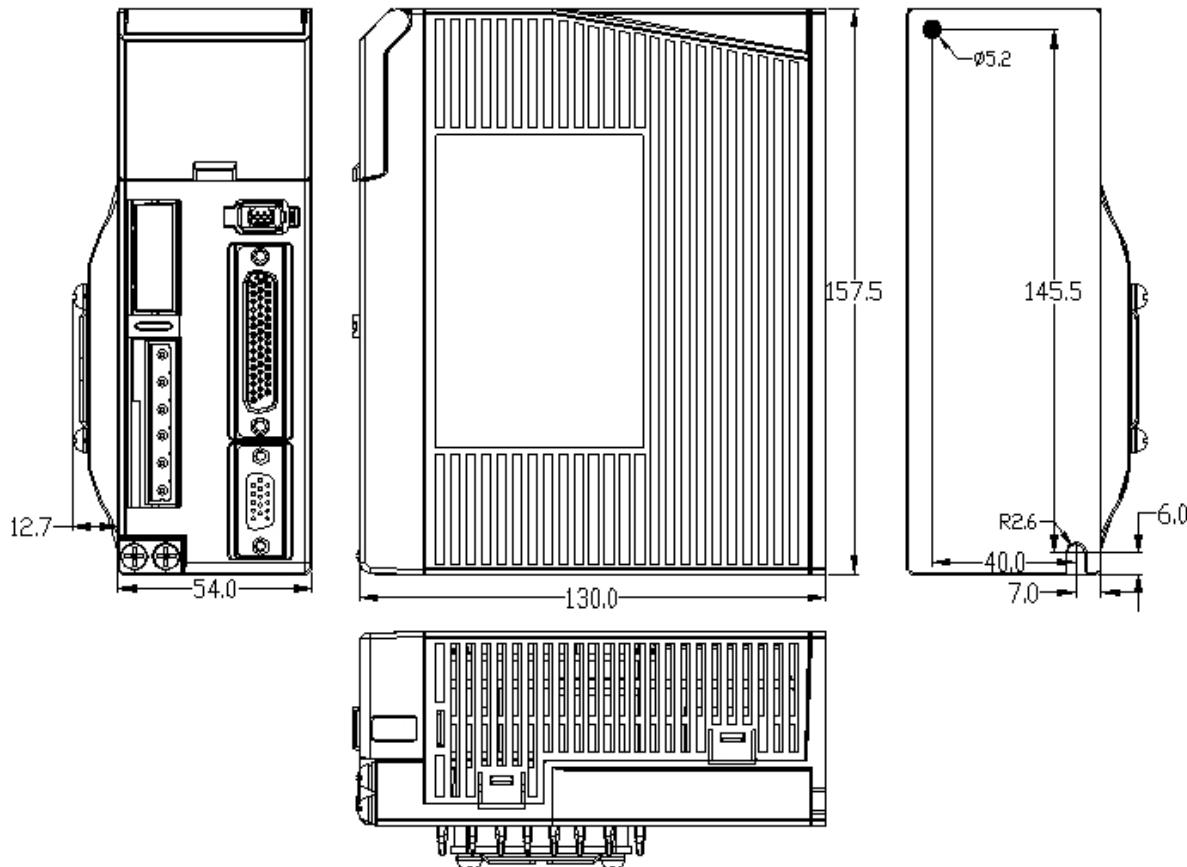
3.2 安装方法/Installation method

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
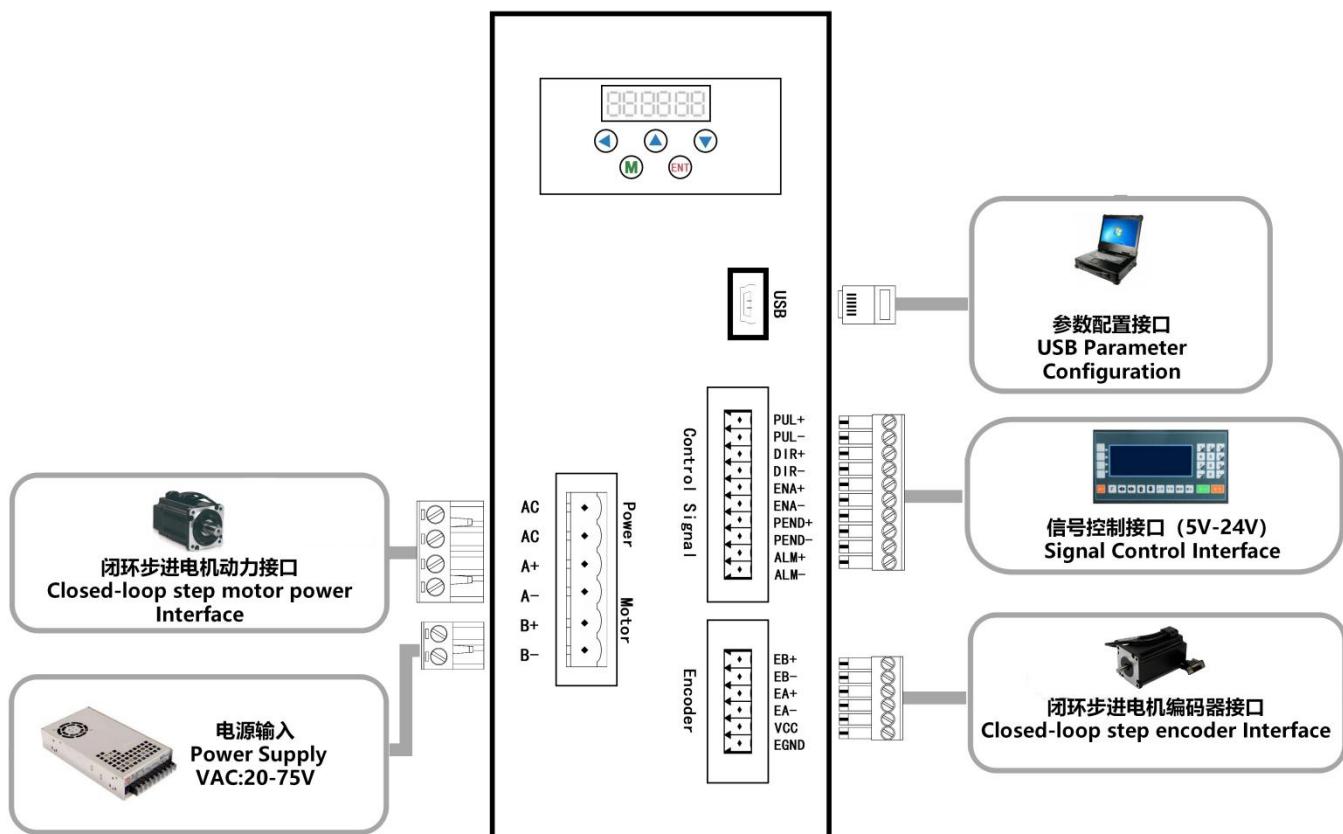
4.2 端口定义/Port Definition

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

TS758 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：

TS758 an LED to indicate power status and six digital display, LED panel operation Please refer. Display parameters defined as follows:
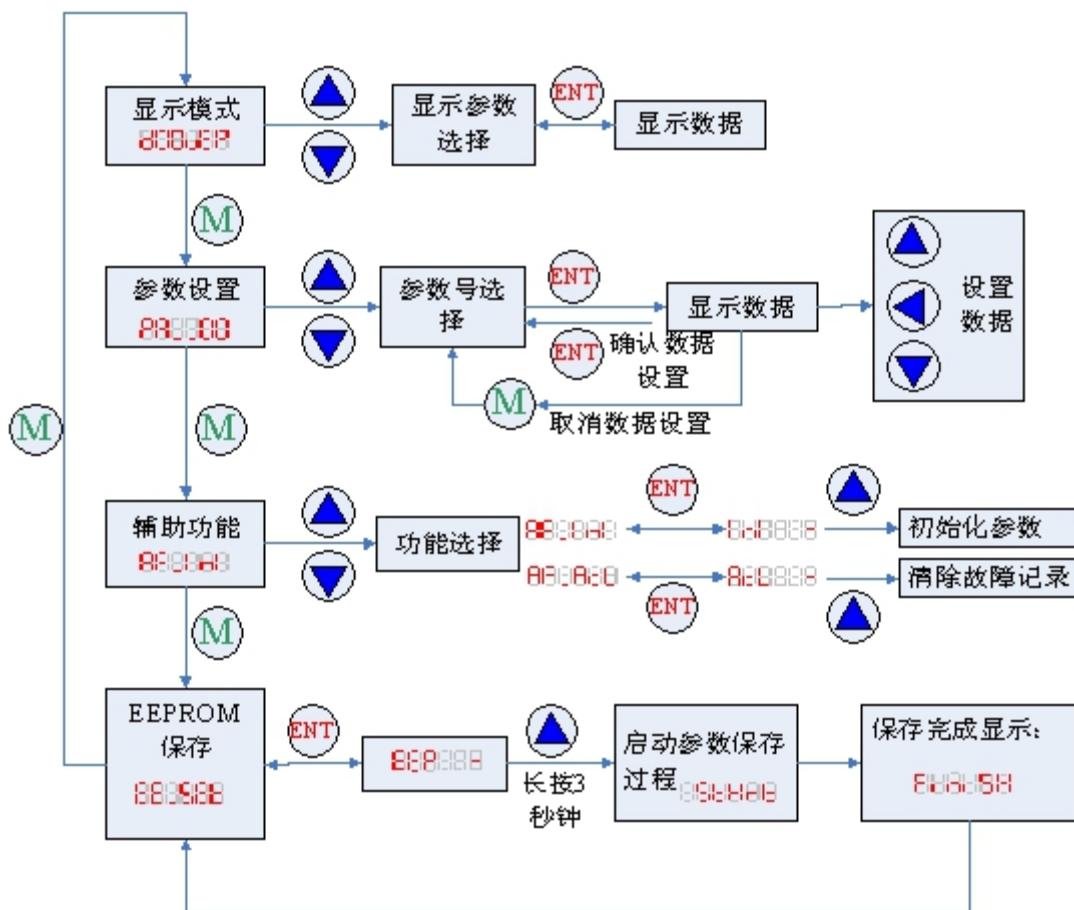
显示模式：

显示参数的含义如下：

LED 显示 LED display	含义 Meaning	备注 Remark
数据低位	数据低位 Low Level Data	数据地位与高位之间用 With high status and data between
数据高位	数据高位 High Level Data	

000069	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.
003608	电机速度：RPM Motor speed: RPM	
002508	给定速度：RPM Given speed: RPM	
003808	脉冲反馈脉冲数： Number of pulse feedback pulses:	
004008	脉冲给定脉冲数： Pulse given number of pulses:	
005093	峰值电流给定：（毫安） Peak current given: (mA)	
006808	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	
007306	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;	
008000	驱动器的版本号： Version number of the drive:	

4.2.2 接口定义/Interface definition

功率端子接口 1/Power Terminal Interface 1

端子号 Terminal number	符 号 Symbols	名 称 Name	说 明 Explanation
1	AC	交流电源输入端 AC power input	供电 20-75Vac Power 20-75Vac
2	AC		

功率端子接口 2/Power Terminal Interface 2

端子号 Terminal number	符 号 Symbols	名 称 Name	说 明 Explanation
1	A+	混合伺服电机接线端（注意接线颜色不能弄错） Mixed Servo Motor Terminal (make sure the color of the terminal is correct)	步进电机 A+相绕组接口 Stepping motor A + phase winding interface
2	A-		步进电机 A-相绕组接口 Stepping motor A-phase winding interface
3	B+		步进电机 B+相绕组接口 Stepping motor B + phase winding interface
4	B-		步进电机 B-相绕组接口 Stepping motor B-phase winding interface

控制信号端口（44针DB头）/Control Signal Port (44 DB NEEDLE HEAD)

端子号 Terminal number	符 号 Symbols	名 称 Name	说 明 Explanation
3	PUL+	脉冲正输入端 Pulse Positive Input	兼容 5V-24V 电平信号 Compatible 5V- 24V level signal
4	PUL-	脉冲负输入端 Pulse negative input	
5	DIR+	方向正输入端 Directional Positive Input	
6	DIR-	方向负输入端 Directional negative input	

7	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 OC open collector output, a pull-level maximum 24V, 100mA maximum output current
8	ALM-	报警信号负输出端 Negative output of alarm signal	
9	PEND+	到位信号正输出端 position signal Positive output terminal	
10	PEND-	到位信号负输出端 Position signal negative output terminal	
11	ENA+	使能正输入端 Enable Positive Input	兼容 5V-24V 电平信号 Compatible 5V- 24V level signal
12	ENA-	使能负输入端 Enable negative input	

编码器信号端口（15 针 DB 头）/Encoder Signal Port（15 DB NEEDLE HEAD）

端子号 Terminal number	符 号 Symbols	名 称 Name
1	EA＋	编码器 A 通道正输入
2	EB＋	编码器 B 通道正输入
3	GND	编码器 GND
11	EA－	编码器 A 通道负输入
12	EB－	编码器 B 通道负输入
13	VCC	编码器+5V 电源输出

电源电压在规定范围之间都可以正常工作，驱动器最好采用非稳压型直流电源供电，也可以采用变压器降压＋桥式整流＋电容滤波。但注意应使整流后电压纹波峰值不超过其规定的最大电压。建议用户使用低于最大电压的直流电压供电，避免电网波动超过驱动器电压工作范围。

The power supply voltage can work normally between the specified ranges. The driver is preferably powered by an unregulated DC power supply, or a transformer buck + bridge rectifier + capacitor filter. Note, however, that the peak voltage ripple after rectification should not exceed its specified maximum voltage. It is recommended that the user supply power with a DC voltage lower than the maximum voltage to prevent the grid from fluctuating beyond the operating range of the driver voltage.

如果使用稳压型开关电源供电，应注意开关电源的输出电流范围需设成最大。

If using a regulated switching power supply, be aware that the output current range of the switching power supply must be set to maximum.

请注意：

Please note:

接线时要注意电源正负极切勿反接；

When wiring, pay attention to the positive and negative poles of the power supply, do not reverse connection;

最好用非稳压型电源；

It is better to use an unstable power supply;

采用非稳压电源时，电源电流输出能力应大于驱动器设定电流的60%即可；

The output capacity of the power supply current should be greater than 60% of the set current of the driver when an unstable power supply is used;

采用稳压开关电源时，电源的输出电流应大于或等于驱动器的工作电流；

When a regulated switching power supply is adopted, the output current of the power supply shall be greater than or equal to the working current of the driver;

为降低成本， 两三个驱动器可共用一个电源，但应保证电源功率足够大。

To reduce costs, two or three drives can share a power supply, but the power supply should be large enough.

控制信号接口电路
A control signal interface circuit

共阳极接法

共阴极接法

差分
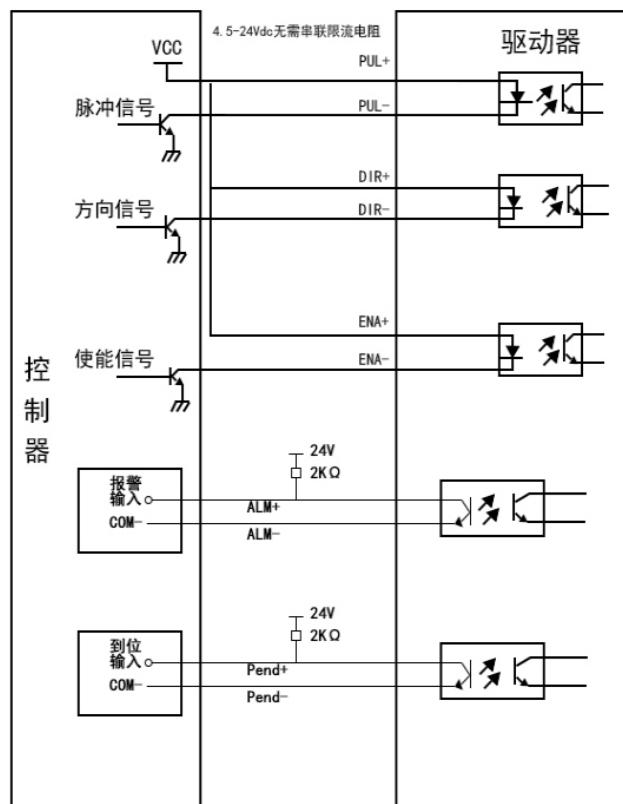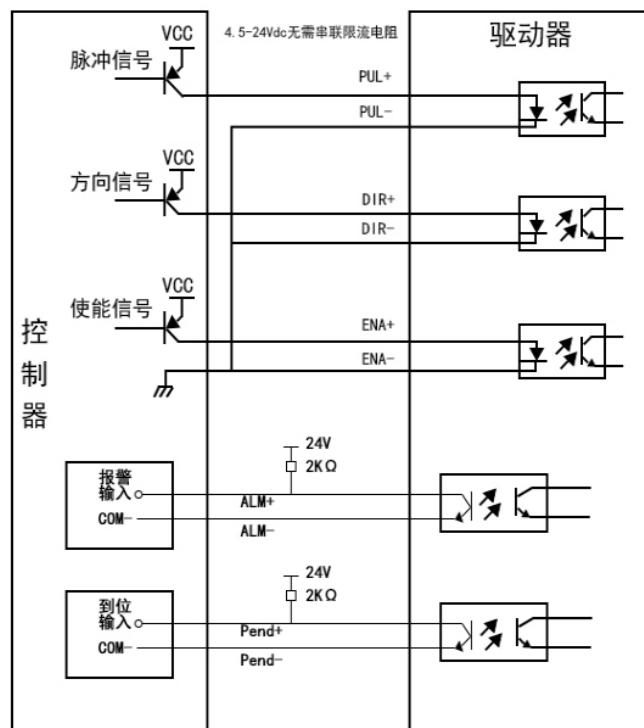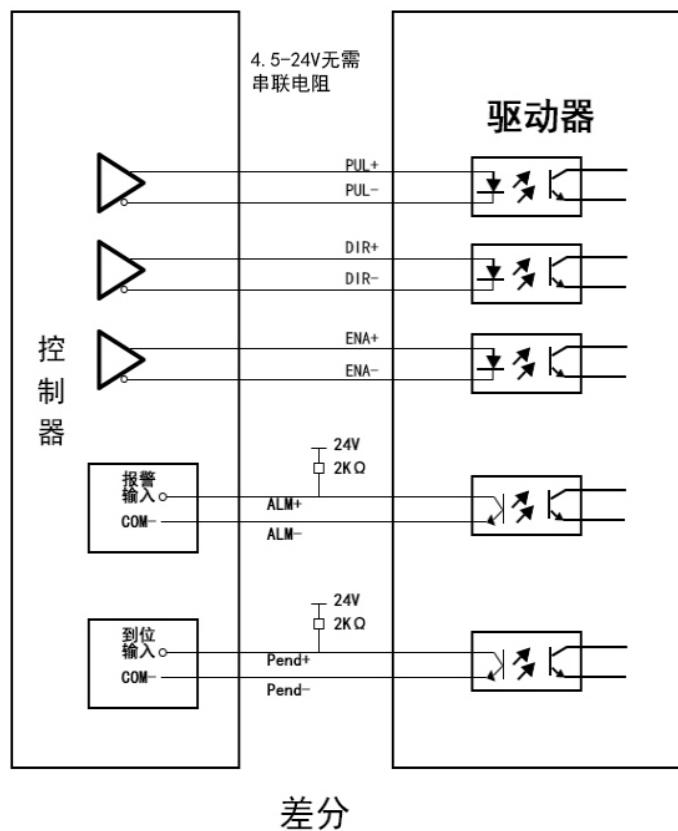
控制信号时序图
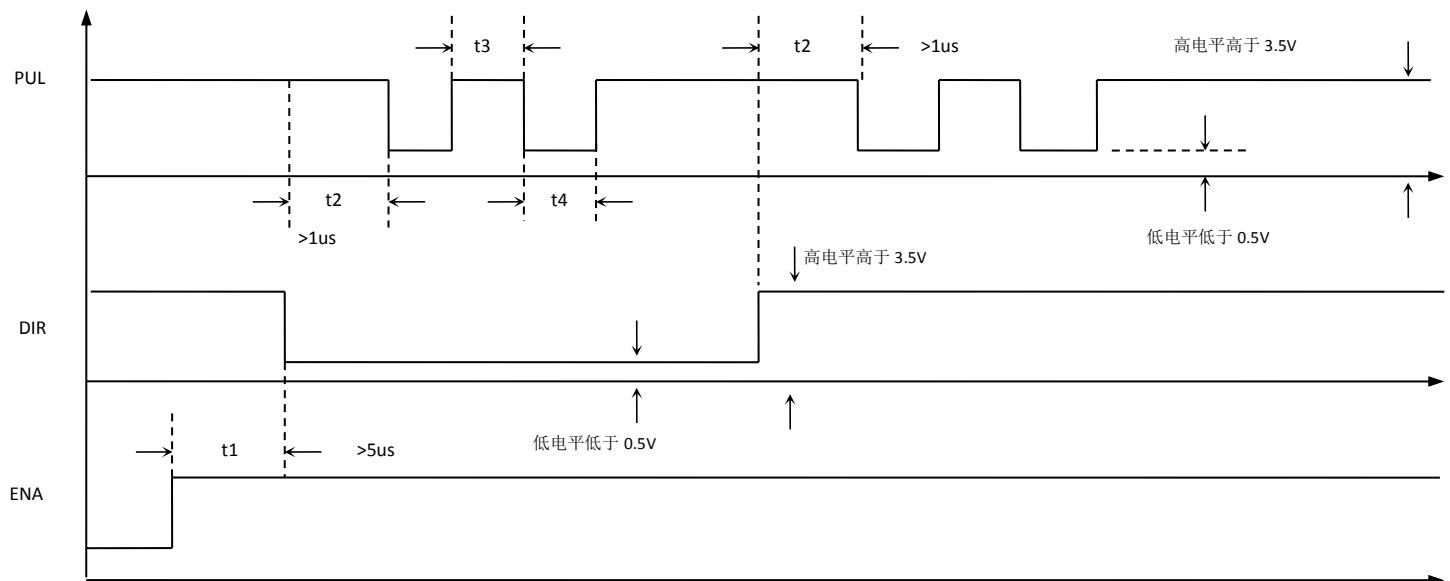
A control signal timing in FIG.

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 5μs，确定为高。一般情况下建议悬空即可；

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

t2：DIR 至少提前 PUL 下降沿 1μs 确定其状态高或低；

t2: DIR PUL falling 1μs determined in advance of at least a high or low state;

t3：脉冲宽度至少不小于 1.5μs；
　　t3: at least a pulse width of not less than 1.5 us;
t4：低电平宽度不小于 1.5μs。
　　t4: low level width not less than 1.5μs.

4.2.3 编码器输入端口/Encoder input port

低压伺服电机/直流无刷伺服电机/空心杯伺服和外转子伺服电机/编码器接口
Low voltage servo motor/Brushless dc servo motor/Hollow glass servo motor/Outer rotor servo moto/Encoder Interface

接口名称 Interface name	功能 Features
EA+ EA-	编码器 A 信号差分输入接口。 Encoder A signal differential input interface.
EB+ EB-	编码器 B 信号差分输入接口。 Encoder B signal differential input interface.
VCC	给电机的编码器和霍尔元件提供直流电压 5V，电流 100mA。 Provide a DC voltage of 5V and a current of 100mA to the encoder and Hall element of the motor.
EGND	5V 参考端负极 5V reference terminal negative electrode

4.2.4 USB 串口 RS232-TTL（3.3V）电平通讯接口/USB serial RS232-TTL（3.3V）level communication interface

可以通过 USB 串口转接装置（串口转接装置另配）和专用 USB 串口电缆线连接 PC 机（禁止带电插拔）。通过 PC 机软件可以对驱动器进行功能和参数设置,如客户可以通过本公司上位机软件设置所需要的任意细分值，任意电流值、脉冲有效沿、单双脉冲控制、脉冲信号带宽，开闭环电机切换，滤波响应时间等等，还可以进行共振点和振动的消弱调节。

Can be connected to a PC (hot plug is prohibited) by the USB serial switching means (switching means reprovision serial) port and a dedicated USB cable. Function parameters can be the drive and the PC software, as required by the customers PC software company set to any value segment, any current value, the effective pulse edge, single and double pulse control, the pulse signal bandwidth, open loop motor switching, the response time of the filter, etc., can also weaken the resonance point adjustment and vibration.

接口名称 Interface name	功能 Features	说明 Explanation
+5V	5V 电源正端 5V power supply	靠近拨码测引脚 Close sense pin DIP
TXD	RS232-TTL(3.3V)发送端 RS232-TTL (3.3V) transmitting side	
RXD	RS232-TTL(3.3V)接收端 RS232-TTL (3.3V) receiving side	

GND	5V 电源地 5V power supply ground	0V

注意：串口电缆线必须为专用电缆，视用户情况附送，使用前请确认，以免发生损坏。
Note: Serial cable must be dedicated cable, depending on the user situation comes, confirm before use to prevent damage.

4.2.5 参数设置/Parameter settings

　　TS758 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 Parameter Symbol	参数名称 parameter name	参数范围 Parameters	备注 Remark
KcP	电流环比例系数 Current Ring Proportion Coefficient	0～65535	仅用于出厂设置，禁止修改 Only for factory setting, modification
KcI	电流环积分系数 Current Ring Integral Coefficient	0～65535	仅用于出厂设置，禁止修改 Only for factory setting, modification
KpP	位置环比例系数 Position Ring Proportional Coefficient	0～65535	仅用于出厂设置，禁止修改 Only for factory setting, modification
KpI	位置环积分系数 Position Ring Integral Coefficient	0～65535	仅用于出厂设置，禁止修改 Only for factory setting, modification
Kd	速度环阻尼系数 Velocity Ring Friction Coeffic	0～100	仅用于出厂设置，禁止修改 Only for factory setting, modification

	ient		
Kvff	速度环前馈系数 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

参数序号 Parameter Number	定义 definition	默认值 Default Value	范围 Range	说明 Explanation
00	电流环 Kp Current loop Kp	1000	0~65535	
01	电流环 Ki Current loop Ki	200	0~65535	
02	电流环 Kc Current loop Kc	256	0~1024	
03	位置环 Kp Position loop Kp	2500	0~65535	
04	位置环 Ki Position loop Ki	500	0~65535	
05	位置环 Kd Position loop Kd	200	0~1000	
06	位置环 Kvff Position loop Kvff	30	0~100	
07	每转脉冲	4000	200~65535	

	PULSE PER ROTATION			
08	编码器分辨率 Encoder resolution	4000	200~65535	
09	跟踪误差报警阀值 Tracking Error Warning Threshold	1000	1~65535	
10	保持电流百分比 Holding current percentage	40	0~100	
11	闭环电流百分比 Closed loop current percentage	100	1~100	
12	保持时间 Retention Time	1000	1~65535	
13	脉冲滤波使能 Pulse filtering enable	0	0/1	
14	滤波时间 Filtering Time	25600	0~25600	
15	使能电平 Enable Level	1	0/1	
16	故障输出电平 Fault output level	1	0/1	
17	单双脉冲选择 Single and double pulse selection	0	0/1	
18	脉冲有效沿 Effective edge of pulse	0	0/1	
19	电机旋转方向 Rotating Direction of Motor	1	0/1	
20	可接受脉冲频率范围旋转 Acceptable Pulse Frequency Range Rotation	0	0/1	
21	加速度 Acceleration	200	1~2000	这些参数是通过按键面板控制电机旋转时用到 These parameters are used by the key panel to control the motor rotation.
22	速度 speed	60	1~3000	
23	行程 Travel	100	1~65535	
24	运行次数 Number of runs	1	1~65535	
25	启动方向 Starting Direction	1	0/1	
26	运行间隔时间 Running Interval Time	100	1~65535	
27	是否往复运行 Whether to run back and forth	1	0/1	

28	启动/停止测试 Start/Stop Test	1	0/1	
29	预留 Reserve			

注意：驱动器出厂默认的电流环、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.

5 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