

# **T60 Closed Loop Stepper Driver**

## **User Manual**

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## 1. Product Overview

Thank you for choosing Rtelligent T series digital stepper servo driver.

Stepper servo is a stepper motor scheme formed based on the common open loop stepper motor in combination with position feedback and servo algorithm, which features high speed, high torque, high precision, low vibration, low heating and no loss of step.

Based on the new 32-bit DSP platform, and adopting the field oriented control (FOC) and field-weakening control algorithm design, Rtelligent T series stepper servo driver surpasses the performance of common steppers comprehensively.

- The built-in PID parameter adjustment function makes the motor better meet the application of different kinds of loads.
- The built-in field-weakening control algorithm makes the motor to reduce the magnetic field characteristics and keep the power at high speed.
- The built-in current vector control function makes the motor have the current characteristic of servo and low heating.
- The built-in micro-stepping command algorithm makes the motor can run while maintaining a stable and low vibration at various speeds.
- The encoder feedback with the built-in 4000 pulse resolution makes the positioning precision increase and never loses the step.

In conclusion, combined with the servo control scheme with stepper motor characteristics, T series stepper servo driver can enable the stepper motor to perform a better performance and replace servo applications of the same power so it's the most cost-effective option for automatic equipment.

T60 driver can set up micro-stepping and other parameters with DIP switch and testing software. It has protection functions of voltage, current and position, and adds alarm output interface. Its input and output signals are all optoelectronic isolation.

Power supply	24 –50 VDC
Control precision	4000 Pulse/r
Pulse mode	Direction & pulse, CW/CCW double pulse
Current control	Servo vector control algorithm
Micro-stepping settings	DIP switch settings, 15 options (or testing software settings)
Speed range	Conventional 1200 ~ 1500rpm, up to 4000rpm
Resonance suppression	Automatically calculate the resonance point and inhibit the IF vibration
PID parameter adjustment	Test software to adjust motor PID characteristics
Pulse filtering	250KHz digital signal processing filter
Alarm output	Over current, over voltage and position error

We hope that our products with excellent performance can help you to complete the sports control program successfully.

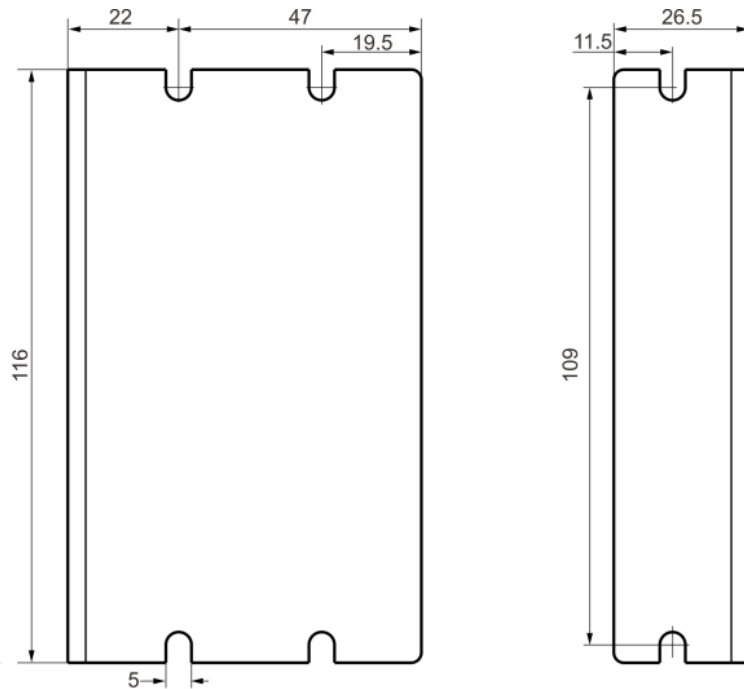
Please read this technical manual before using the products.

## 2. Application Environment and Installation

### 2.1 Environmental requirement

Item	Rtelligent T60
Installation environment	Avoid dust, oil and corrosive environment
Vibration	0.5G (4.9m/s <sup>2</sup> ) Max
Operating temperature/humidity	0°C ~ 45°C / 90% RH or less (no condensation)
Storage and transportation temperature:	-10°C ~ 70°C
Cooling	Natural cooling / away from the heat source
Waterproof grade	IP54

## 2.2 Driver installation dimensions



## 2.3 Driver installation requirements

Please install the drive vertically or horizontally, with its front facing forward, top facing upward to facilitate cooling.

During assembly, avoid drillings and other foreign matters falling inside the drive.

During assembly, please use M3 screw to fix.

When there is vibration source (such as a driller) close to the installation position, please use a vibrating absorber or a vibration resistant rubber gasket.

When multiple drives are installed in the control cabinet, please pay attention to reserve enough space for sufficient heat dissipation. If necessary, you can configure cooling fans to ensure good heat dissipation conditions in the control cabinet.

### 3. Driver Port and Connection

#### 3.1 Port function description

Function	Grade	Definition	Remarks
Power supply input	V+	Input to the positive pole of the DC power supply	DC 24~50V
	V-	Input to the negative pole of the DC power supply	
	NC	Not connected/undefined	
Motor connection	A+	Positive terminal of phase-A winding	Red (42 red)
	A-	Negative terminal of phase-A winding	Blue (42 green)
	B+	Positive terminal of phase-B winding	Green (42 blue)
	B-	Negative terminal of phase-B winding	Black (42 yellow)
Encoder connection	EB+	Positive terminal of Encoder phase B	Green
	EB-	Negative terminal of Encoder phase B	Yellow
	EA+	Positive terminal of Encoder phase A	Brown
	EA-	Negative terminal of Encoder phase A	White
	VCC	Encoder working power 5V positive	Red
	GND	Encoder working power 5V ground terminal	Blue
Pulse connection	PUL+	Pulse input interface	3.3 ~ 24V level compatible
	PUL-		
	DIR+	Direction input interface	
	DIR-		
Enable terminal	ENA+	Enable control interface	
	ENA-		
Alarm output	ALM+	Alarm output interface	Less than 24V, 40mA
	ALM-		

### 3.2 Power supply input

The power supply of the driver is DC power, and the input voltage range is between 24V~ 50V.

**Do not mistakenly connect the power supply to the NC pin, and do not reversely connect the polarity of the input power! !**

#### Power selection reference:

##### Voltage:

The stepper motor has the characteristic of torque decreasing as the motor speed increases, and the voltage of the input power supply will affect the declining amplitude of the motor torque at high speed. Increasing the voltage of the input power supply appropriately can increase the output torque of the motor at high speed.

Stepper servos have higher revolution speed and torque output than ordinary steppers. Therefore, if the better high-speed performance is wanted, the power supply voltage of the drive is required to increase.

##### Current:

The work of the drive is to convert the input power supply with high voltage and low current to the low voltage and high current at both terminals of the motor winding. In actual application, the appropriate power supply is selected according to the motor mode and the torque of the load.

#### The effects of regeneration voltage:

When the stepper motor is working, it also keeps the characteristics of the generator. At deceleration, the kinetic energy accumulated by the load is converted into electric energy, which will be superimposed on the drive circuit and the input power. In application, attention should be paid to the setting of acceleration and deceleration time to prevent the protection of the drive or power supply.

When the drive is powered off, similarly, the drive LED indicator will be on if the load is increased to allow the motor to move

### 3.3 Encoder connection

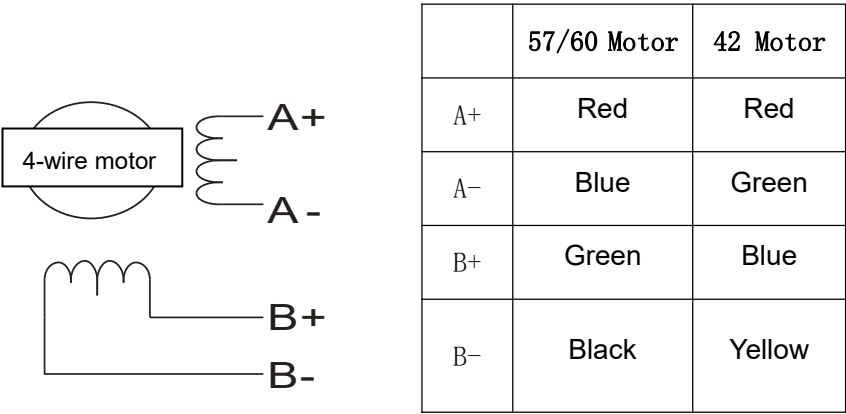
The T60 encoder is A/B differential output and is connected in the corresponding order when used.

EB+	EB-	EA+	EA-	VCC	GND
Green	Yellow	Brown	White	Red	Blue

**Rtelligent also provides a certain length of special cables for encoders. Please purchase the extension cables of different lengths according to the installation needs.**

### 3.4 Motor connection

The matching motor of the T60 driver is the corresponding T series stepper servo motor, and its corresponding motor connection order is fixed and unique.

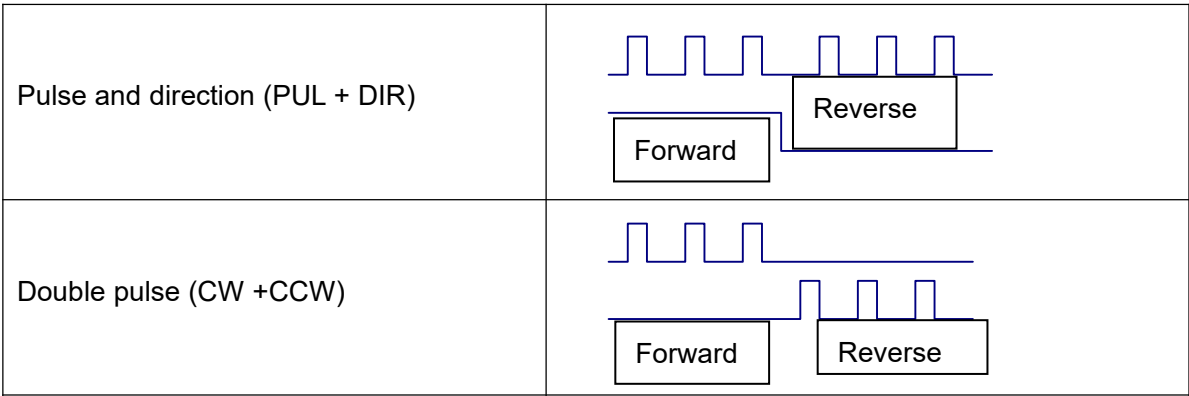


### 3.5 Control signal connection

#### 3.5.1 PUL, DIR Port: connection for pulse command

The signal interface of standard T series drive is pulse-shaped, and the T60 can receive three types of pulse command signals.

The upper controller can be the pulse signal generating device, such as PLC, MCU, control card and controller.



#### 3.5.2 ENA port: enable/disable

When the default optocoupler is off, the drive outputs the current to the motor. When the internal optocoupler is on, the drive will cut off the current of each phase of the motor so that the motor is in a

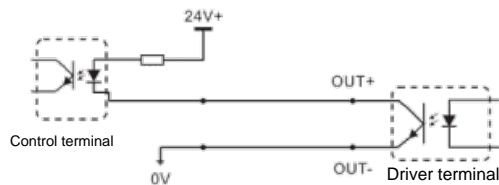


free state, and the stepper pulse can not be responded.

When the motor is in the wrong state, the port enables automatic disconnection. The level logic of the enable signal can be set to the opposite.

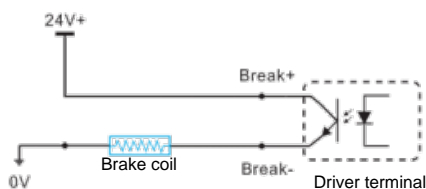
### 3.5.3 ALM port: alarm output

The ALM port is used to output the operating status of the driver to an external control circuit. When the driver is in the error state and the normal working state, ALM outputs different optocoupler levels.



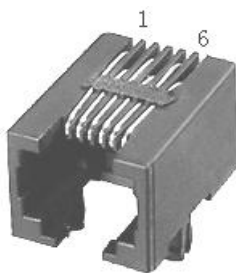
OUT is ALM or Pend, pay attention to the series current limiting resistor.

**RTelligent** provides solutions for dedicated brake controllers, examples are as follows:



Break is the brake control signal, which is set by software.  
Do not connect the brake coil reversely (red+, black-).

## 3.6 RS232 serial port

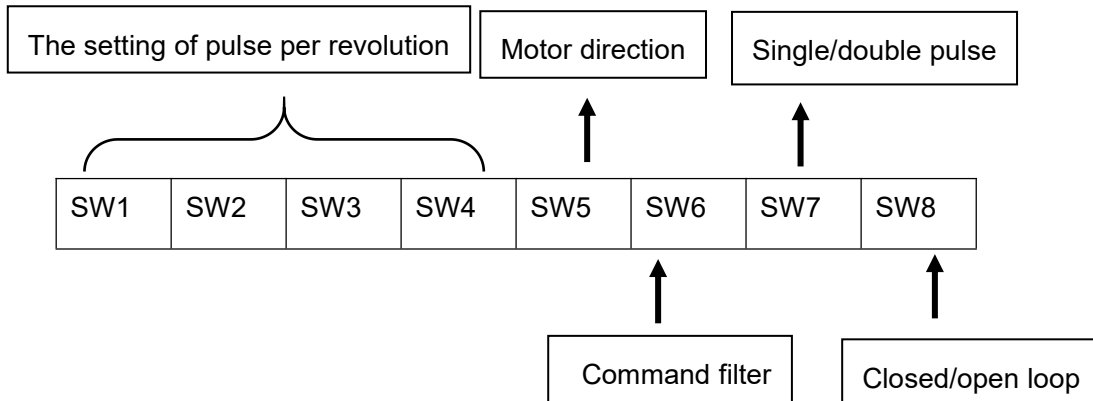


S/N	Symbol	Description
1	NC	
2	+5V	Positive terminal of power supply
3	TxD	RS232 transmitting terminal
4	GND	Ground terminal of power supply
5	RxD	RS232 receiving terminal
6	NC	

RS232 serial port is used to connect T60 testing software and change other related operating parameters of driver.

**Do not pull/insert 232 serial port when the power supply is connected! !**

## 4. The setting of DIP switches and operating parameters



### 4.1 The setting of pulse per revolution

Stepping count/revolution	SW1	SW2	SW3	SW4	Remarks
3600	on	on	on	on	The DIP switch is turned to the "Default" state and the testing software can freely change other micro-stepping level number
800	off	on	on	on	
1600	on	off	on	on	
3200	off	off	on	on	
6400	on	on	off	on	
12800	off	on	off	on	
25600	on	off	off	on	
51200	off	off	off	on	
1000	on	on	on	off	
2000	off	on	on	off	
4000	on	off	on	off	
5000	off	off	on	off	
8000	on	on	off	off	
10000	off	on	off	off	
20000	on	off	off	off	
40000	off	off	off	off	

DIP SW1, SW2, SW3, SW4 are used to set the number of pulse needed for per motor revolution

Motor speed = command pulse frequency ÷ pulse per revolution

Motor stroke = number of command pulses ÷ pulse per revolution

## 4.2 Motor direction selection

DIP SW5 is used to set the running direction of the motor under the initial pulse.

The “off” means that the motor direction is counterclockwise when inputting the initial pulse;

The “on” means that the motor direction is clockwise when inputting the initial pulse.

※ The initial pulse is the testing pulse used when developing the drive software; Please refer to the actual running direction of the motor.

## 4.3 Pulse filtering function selection

DIP SW6 is used to set the pulse filtering function of drive.

The “off” means the pulse filtering function is off;

The “on” means the pulse filtering function is on.

※ The pulse filtering function is the filtering action by the drive upon the input commands. When the filtering function is on, the drive will smoothen the input pulse command to make the acceleration and deceleration of motor softer, but this will also cause certain delay of the pulse command.

Filtering time setting: The default time of filtering function is 6.4ms, and the software can change the time below the 25.6ms.

## 4.4 Pulse mode selection

DIP SW7 is used to set the pulse command mode of drives.

The “off” means pulse + direction (single pulse) mode; the “on” means double pulse mode.

※ When you need to set the drive pulse mode to A/B orthogonal pulse mode, set the pulse mode check function to A/B orthogonal pulse mode in the testing software and turn on SW7.

## 4.5 Open/closed loop selection








DIP SW8 is used to set the drive control mode.

The “off” means the closed loop control mode;

The “on” means the open loop control mode.

※ **The above parameters are set for the DIP switches; For other parameters, please refer to Appendix A: Application Instructions for Testing Software**

## 5. Driver working status LED indication

LED status		Driver status
	Green indicator is on for long time	Drive not enabled
	Green indicator is flickering	Drive working normally
	One green indicator and one red indicator	Drive overcurrent
	One green indicator and two red indicators	Drive input power overvoltage
	One green indicator and three red indicators	The internal voltage of the drive is wrong
	One green and four red indicators	Tracking error exceeds limits
	One green and five red indicators	Encoder phase error

## 6. Common Faults and Troubleshooting

Phenomenon	Possible situations	Solutions
<b>Motor does not work</b>	Power indicator is off	Check the power supply circuit for normal power supply
	The motor rotor is locked but the motor does not work	Pulse signal is weak; increase the signal current to 7-16mA
	The speed is too slow	Select the right micro-stepping
	Drive is protected	Solve the alarm and re-power
	Enable signal problem	Pull up or disconnect the enable signal
	Command pulse is incorrect	Check whether the upper computer has pulse output
<b>The steering of motor is wrong</b>	The rotary direction of motor is reverse	Adjust the DIP SW5
	The motor cable is disconnected	Check the connection
	The motor has only one direction	Pulse mode error or DIR port damaged

<b>Alarm indicator is on</b>	The motor connection is wrong	Check the motor connection
	The motor connection and encoder connection are wrong	Check the sequence of encoder connection
	The voltage is too high or too low	Check the power supply
<b>The position or speed is wrong</b>	The signal is disturbed	Eliminate interference for reliable grounding
	The command input is incorrect	Check the upper computer instructions to ensure the output is correct
	The setting of Pulse per revolution is wrong	Check the DIP switch status and correctly connect the switches
	Encoder signal is abnormal	Replace the motor and contact the manufacturer
<b>The driver terminal burned up</b>	Short circuit between terminals	Check power polarity or external short circuit
	Internal resistance between terminals is too large	Check whether there is any solder ball due to excessive addition of solder on the wire connections
<b>The motor is out of tolerance</b>	Acceleration and deceleration time is too short	Reduce command acceleration or increase drive filtering parameters
	Motor torque is too low	Select the motor with high torque
	The load is too heavy	Check the load weight and quality and adjust the mechanical structure
	The current of power supply is too low	Replace the appropriate power supply

## Appendix A. Guarantee Clause

### A.1 Warranty period: 18 months

We provide quality assurance for one year from the date of delivery and free maintenance service for our products during the warranty period.

### A.2 Exclude the following:

- Improper connection, such as the polarity of the power supply is reversed and insert/pull the motor connection when the power supply is connected.
- Beyond electrical and environmental requirements.
- Change the internal device without permission.

### A.3 Maintenance process

For maintenance of products, please follow the procedures shown below:

- (1) Contact our customer service staff to get the rework permission.
- (2) The written document of the drive failure phenomenon is attached to the goods, as well as the contact information and mailing methods of the sender.

Mailing address:

Post code:

Tel.: