



DPL-708A Stepper Driver

User Manual

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NO. DLC03 20150909 1.0

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1. Summary

DPL-708A is a new digital two-phase stepping motor driver of our company. The user can set the subdivision within 200 ~ 40000 and any current value within the rated current. The pure sine wave current control technology is adopted to make the motor run smoothly with small noise, which can meet the application needs of most occasions. The automatic parameter setting function is integrated in the driver, which can automatically generate the optimal operation parameters for different motors and maximize the performance of the motor.

1-1. Characteristic

- Parameter auto-tuning function
- Low running noise of motor
- Control signal is 24V, connect to PLC directly
- Power supply 20-80VAC or 30-100VDC
- Effective value of output current 2.0~6.0A
- Dynamic select the subdivision, pulse per rotation can up to 40000
- Can drive any 4, 6, 8 wires two phase stepper motor below 6.0A
- Automatic half the current at standstill
- Photo isolation differential signal input
- Over-voltage and over-current protection

1-2. Application

Suitable for all kinds of small and medium-sized and automatic equipment and instruments, such as: pneumatic marking machine, labeling machine, cutting machine, laser marking machine, plotter, small engraving machine, CNC machine, handling device, etc. It is especially effective in small equipment with low vibration, low noise, high precision and high speed.

1-3. Electric characters

Item		Min. value	Typical value	Max. value
Power supply	(VAC)	20	68	80
	(VDC)	30	68	100
Effective value of current output (A)		2	—	6
Logic current input (mA)		4	7	16
Frequency of stepping pulse (KHz)		0	—	200
Insulation resistance (MΩ)		500	—	—
Environment temperature		0°C~50°C		
Max working temperature		60°C		
Humidity		40%~90% RH (no condensation)		
Vibration		5.9m/s ² Max		

Storage temperature	-20°C~65°C
Dimension	150mm×94mm×57mm

2. Operation Guide

Please read the following suggestions carefully before you install the driver.

2-1. Safety

- The driver is authorized to be installed and operated by the professional staff.
- Don't turn on the power before connecting to the motor.
- Make sure that the input signals meet the technical requirements.
- Don't make the setting or measure operations on the motor and driver during power on.
- Please do the wiring, installation and parameter setting after power is off for more than 3 minutes.
- Ensure the connection operation is absolutely correct and fixable before you turn on the power, including the power wire, motor cable and signal cable.
- Avoid electromagnetic interference.

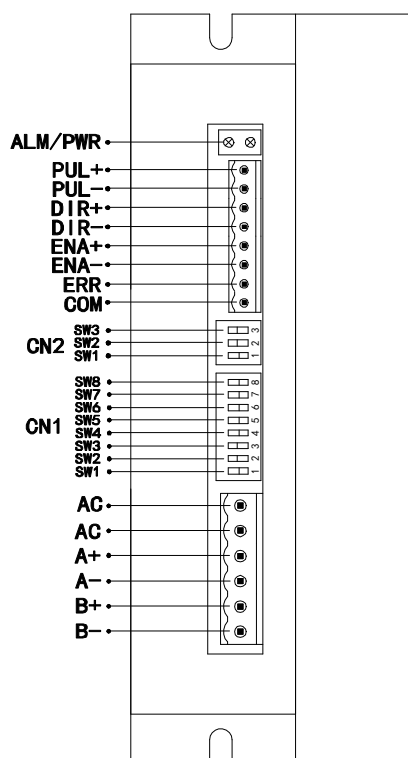
2-2. Attention

- Please use shield cable for signal input, and leave each other for distance. The further the distance, the better the interference is avoided.
- Please connect the motor cover to the GND terminal.
- Don't operate on the output terminal when power on, or else the driver will be damaged.

2-3. Installation

- Don't install the driver next to the heating devices.
- Don't exposure the driver to the dusty, corrosive gas, high humidity, and strong vibration environment.
- For perfect conducting, the ground cable of PC, driver and motor should contact with the ground for large area.

3. Common Terminals



3-1. Control signal terminals

3-1-1. Description of Control signal terminals

Signal	Function	Description
PUL+	Pulse control signal	The rising edge is effective; motor moves one step at the rising edge of pulse. PUL high voltage is 24V, low voltage is 0~0.5V.
PUL-		
DIR+	Direction control signal	High voltage 24V and low voltage 0~0.5V correspond to two directions of the motor. Exchanging the signal can change the motor direction. The original direction of the motor depends on the wiring. Exchange any phase wiring can change the motor turning direction.
DIR-		
ENA+	Enable signal	To release the motor. When ENA+ connects to 24V, ENA- connects to low voltage, the driver will cut all phase current of the motor, and the stepper pulse will not be responded. Please let the terminal be vacant if out of use.
ENA-		

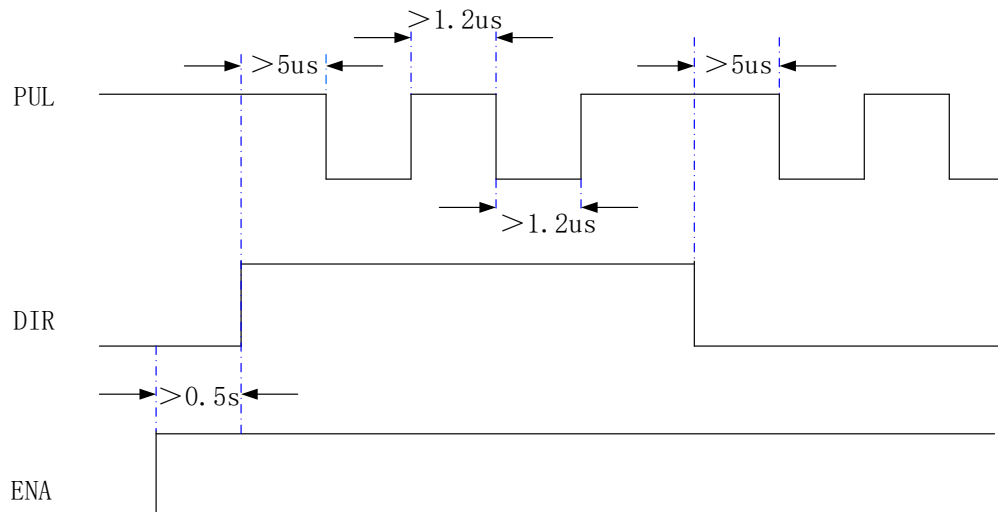
3-1-2. Sequential chart of control signals

In order to ensure the reliability of the system response, please take the following advices.

- The signal high voltage is 24V; low voltage is less than 0.5V.

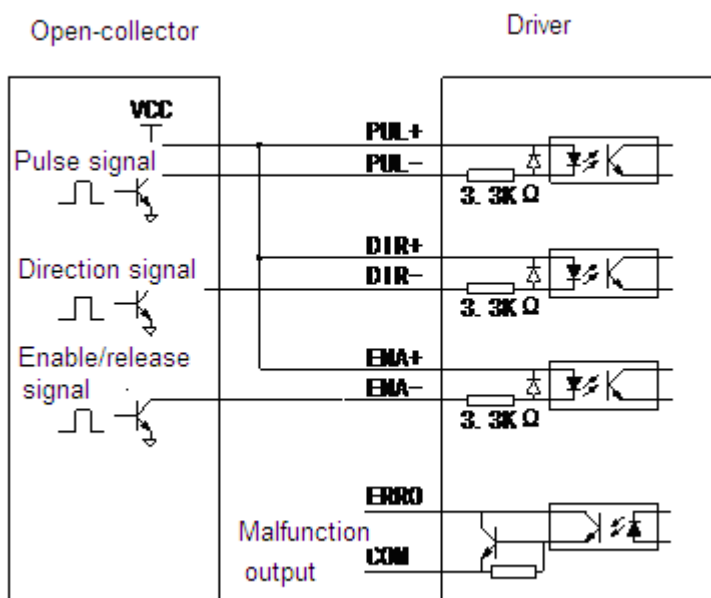
- The ENA (enable) signal should turn to high-level at least 5s before DIR (direction) signal.
- Ensure the DIR (direction) signal is built at least 5 μ s before falling edge of PUL (pulse) signal.
- The width of pulse should be more than 1.2 μ s
- The duration of the pulse low-voltage should be more than 1.2 μ s

The sequential chart is shown as below:



3-1-3. Input circuit

The common positive connection of input circuit is shown as below:



Note:

- All the input signals go through the photoelectric isolation. To ensure the well conducting of inside high-speed optical coupler, keep the control signal current

above 8mA.

- Optical coupler current limiting resistor is built in stepper driver. It is common to supply all the control signals with +24V.

3-2. Power Terminals

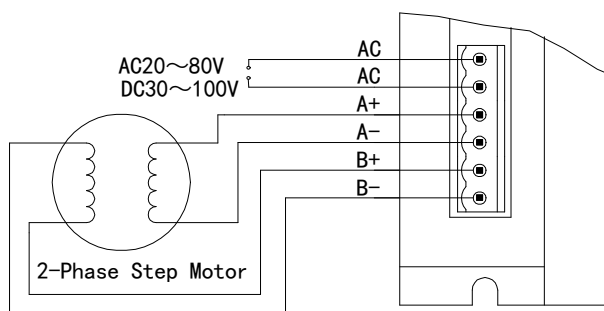
3-2-1. Description of Heavy-current terminal

Terminal	Function	Description
AC, DC	AC or DC	Between the minimum and maximum supply voltage, the recommended value should be used
A+, A-	Phase A of motor	Exchanging A+ and A- can change the motor running direction
B+, B-	Phase B of motor	Exchanging B+ and B- can change the motor running direction

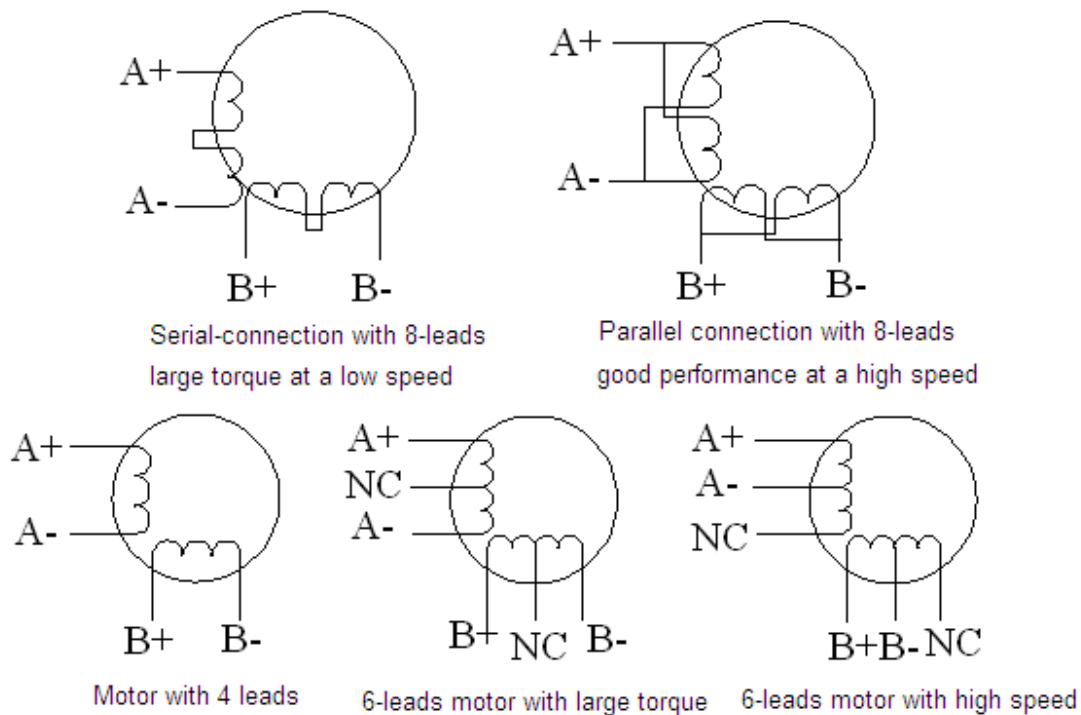
3-2-2. Requirement of power supply

- Do not reverse the power supply voltage!
- To keep the normal working of drive, please ensure the power supply in this range: 20-80VAC/30-100VDC.
- It is advised to use non-regulated DC power supply, and make sure the current output of power is 60% higher than setting current of driver.
- If using regulated DC power supply, the current of power supply is higher than motor working current.

3-2-3. Wiring



For 4-wire, 6-wire and 8-wire stepper motors, the performance of motors connected with different coils is quite different, as shown in the following figure:



3-2-4. Selection of input voltage and output current

1. Selection of driver input voltage

Generally speaking, the higher the power supply voltage is, the greater the torque is when the motor is at high speed, and the step lost can be avoided when the motor is at high speed. However, too high voltage will lead to over-voltage protection of the driver, serious heating of the motor, and even damage the driver; and the vibration of the motor at low speed will be greater when the high voltage is working. Therefore, when the performance requirements can be met, the input voltage can be smaller.

2. Selection of driver output current

For the same motor, the larger the current setting value is, the greater the output torque of the motor will be. However, if the current is too large, the heating of the motor and the driver will be serious. The amount of heat generated by the motor is not only related to the selection of the output current of the driver, but also related to the type of motor motion and the dwell time of the motor. The setting mode should be based on the rated current value of the motor, but the best value in practical application should be adjusted on this basis.

In principle, if the temperature is very low ($< 40^{\circ}\text{C}$), increase the current setting value as necessary to increase the motor output power (torque and high-speed response). When the current is set and the test run lasts for 15-30 minutes, if the temperature rise of the motor is greater than 70 degrees, the current value shall be properly reduced. In general, the output current of the driver is set to the value that the motor is warm but not overheated when it works for a long time (it is normal if the temperature of the step motor is not more than 80°C).

Therefore, in actual use, users should take appropriate connection mode according to

their own needs to achieve satisfactory results.

- 4-wire motor: the output current is set equal to or slightly less than the rated current of the motor;
- High torque mode of 6-wire motor: the output current is set to 50% of the rated current of motor single polarity connection method;
- High speed mode of 6-wire motor: the output current is set to 100% of the rated current of motor single polarity connection method;
- 8-wire motor series connection: the output current can be set to 70% of the rated current of motor single polarity connection;
- 8-wire motor parallel connection: the output current can be set to 140% of the rated current of motor single polarity connection.

3-3. Function Setting

The driver adopts three digits DIP switch to set the output current value, one digit DIP switch to set half current / full current, auto-tuning, and four digits DIP switch to set the number of pulses per revolution. The specific function settings are as follows:

CN1 (SW1 ~ SW3): set current output value;

CN1 (SW4): set half current / full current (SW4 = off: half current state; SW4 = on: full current state);

CN1 (SW4): one round trip within one second, auto-tuning function;

CN1 (SW5 ~ SW8): set the number of pulses per revolution.

3-3-1. Current Setting

(1) working (dynamic) current is set through CN1 (SW1~SW3), please see below details:

REF Current	PK Current	SW1	SW2	SW3
2.40	2.00	OFF	OFF	OFF
3.08	2.57	OFF	OFF	ON
3.77	3.14	OFF	ON	OFF
4.45	3.71	OFF	ON	ON
5.14	4.28	ON	OFF	OFF
5.83	4.86	ON	OFF	ON
6.52	5.43	ON	ON	OFF
7.20	6.00	ON	ON	ON

(2) Static current setting

The static current can be set by CN1 (SW4) dial switch. OFF indicates that the static current is set to half of the dynamic current, and ON indicates that the static current is the same as the dynamic current. In general use, CN1 (SW4) should be set to off to reduce the heat of motor and driver and improve the reliability. About 0.4 seconds after the pulse train stops, the current automatically reduces to about half (60% of the actual value), and the calorific value theoretically reduces to 25%.

Half current means that when the motor stops, the force of the stator locking the rotor will be reduced to half, which can reduce the heat output and energy saving of the motor.

1: For the equipment with small reaction force (most of which are of this structure), please use half current or even enable motor.

2: Reaction force requires self-locking of stepping motor to locate the structure, please select full current. (example: upper and lower transmission structure)

3-3-2. Pulse per revolution setting

The number of pulses per revolution is controlled by CN1 (SW5-SW8) four digit dial switch, and the detailed settings are shown in the table below:

Pulse/rev	SW5	SW6	SW7	SW8
200	OFF	OFF	OFF	OFF
400	OFF	OFF	OFF	ON
800	OFF	OFF	ON	OFF
1600	OFF	OFF	ON	ON
3200	OFF	ON	OFF	OFF
6400	OFF	ON	OFF	ON
12800	OFF	ON	ON	OFF
25600	OFF	ON	ON	ON
1000	ON	OFF	OFF	OFF
2000	ON	OFF	OFF	ON
4000	ON	OFF	ON	OFF
5000	ON	OFF	ON	ON
8000	ON	ON	OFF	OFF
10000	ON	ON	OFF	ON
20000	ON	ON	ON	OFF
40000	ON	ON	ON	ON

3-3-3. Parameter auto-tuning

Parameter auto-tuning function can automatically generate optimal operation parameters for different motors, and maximize the performance of the motor.

If CN1 (SW4) is turned back and forth once within one second, the driver can automatically complete the motor parameter identification and control parameter auto-tuning; when the motor, power supply voltage and other conditions change, please carry out auto-tuning, otherwise, the motor may run abnormally. Note that the pulse cannot be input at this time, the direction signal shall not change, and the two times of auto-tuning time shall not be less than 3 seconds.

Implementation method (1): SW4 is turned from on to off, and then from off to on within 1 second;

Implementation method (2): SW4 is turned from off to on, and then turned from on to off within 1 second.

3-4. Protection function

■ status indicator

Power indicator PWR: when the green light is on, it is in normal working condition;

Alarm indicator light ALM: when the red light is on, it enters the alarm state, indicating that there is overvoltage, overcurrent or short circuit at this time; If the red light flashes, it means over-voltage alarm; if the red light is always on, it means over-current or short-circuit alarm.

■ Fault output

When the driver has overvoltage or undervoltage, the err and com terminals output fault signals.

■ Over current and over-voltage protection

When the power supply voltage is greater than the upper limit voltage AC85V / DC120V, or the motor current is greater than 20% of the set value, the protection circuit takes protective measures, turns off the PWM output, and the alarm indicator gives the corresponding alarm information.

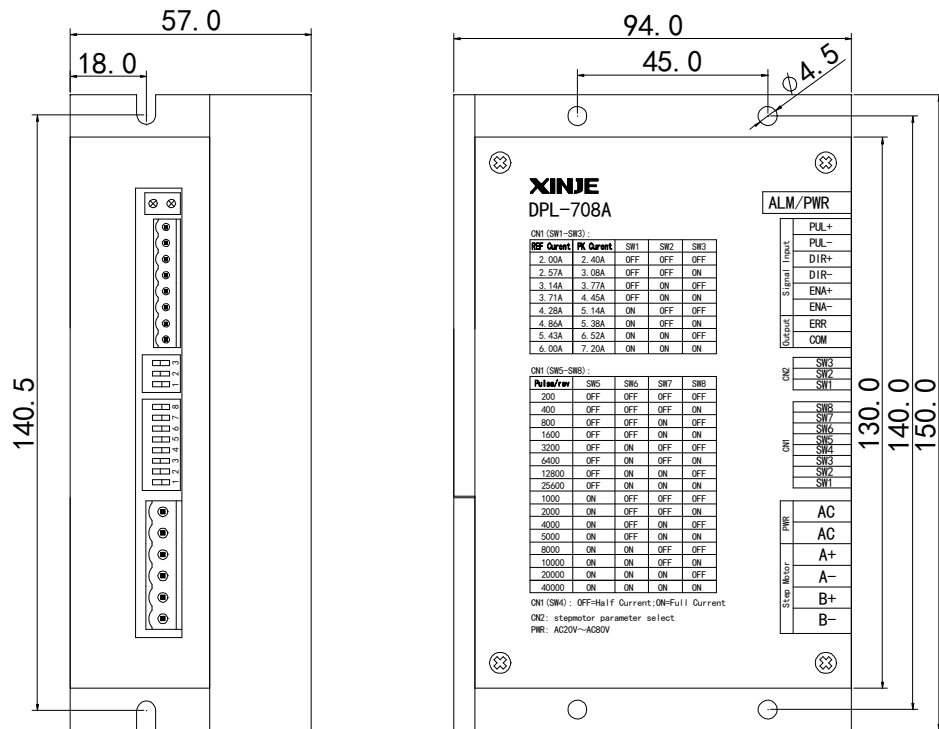
Note: after the above protection circuit acts, the driver cannot work normally. Only after the fault is eliminated, power on again and the power indicator turns green, the driver can be recovered.

4. Dimension and wiring

4-1. Dimension

The dimension of DPL-708A is shown as below:

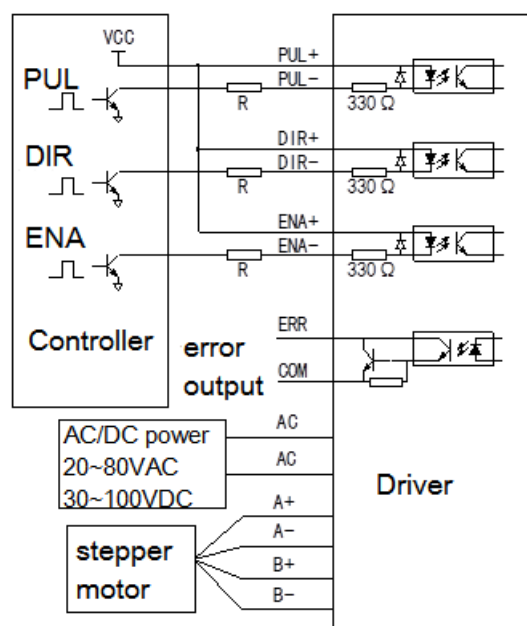
Unit: mm



4-2. Installation

The driver shall be installed in a well ventilated and well protected electric cabinet, and the operation of the cooling fan shall be checked regularly. In order to ensure the heat dissipation condition of the driver, please install it according to the space of at least 10cm. Avoid dust and sundries falling into the driver during installation.

4-3. Typical wiring



Note: when wiring, the user shall follow the principle of separating power cable (motor phase cable, power cable) and weak current signal cable to avoid interference of control signal.

5. Fault and solution

Malfunction	Causation	Solution
The power light doesn't work	Something wrong with the power supply	Check the power supply
	The power voltage is too low	Increase the power voltage
The motor doesn't work	Setting current is too low	Reset the current
	Subdivision is too small	Reset the Subdivision
	Protection circuit is working	Re-power the driver
	The release signal is low	Do not connect the signal
	Power off	Re-power
	Motor wiring is error	Check the wiring
	No pulse input	Adjust the pulse width and signal voltage
The direction of motor is incorrect	Inverse of phase-sequence	Exchange the phase-sequence
	Disconnection	Check the wiring
Alarm indicator lights	Motor wiring is wrong	Re-wiring
	The voltage is too low or high	Adjust the power voltage
	Motor or drive is damaged	Check the driver and motor
Motor torque is too small	Acceleration is too high	Reduce the acceleration value
	Driver doesn't match with the motor	Change the driver

6. Motor Selection

DPL-708A is suitable for 4,6,8-wire two-phase and four phase hybrid stepping motor, and the step angle of 1.8 degree and 0.9 degree can be applied. But in order to make the motor run best, it is usually necessary to choose a suitable motor and driver.

Generally speaking, the choice of motor mainly depends on motor torque and rated current. The torque depends on the size of the motor, and the torque of the motor with large size is also large; the current mainly depends on the inductance, the current of the small inductance is large, and the performance of the motor at high speed is good.

(1) Determine the load torque and transmission ratio working speed range

$$T_{\text{motor}} = C (J\varepsilon + T_{\text{load}})$$

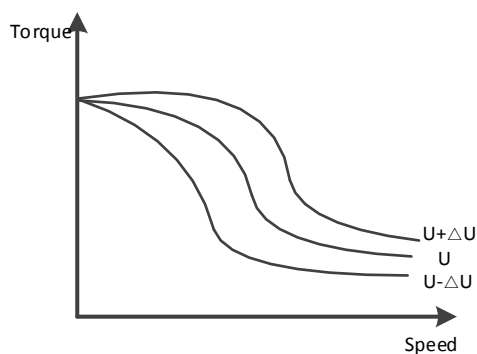
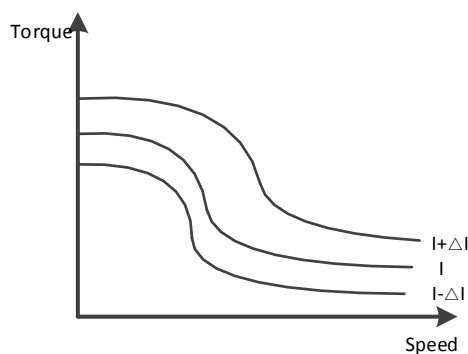
J: Moment of inertia of load; ε : maximum angular acceleration of load; C: safety factor, recommended value 1.2-1.4;

T_{load} : the maximum load torque, including the effective load, friction, transmission efficiency and other resistance torque.

(2) The factors determine the motor output torque

For a given stepping motor and coil connection, the output torque has the following characteristics:

- The larger the actual current of the motor is, the greater the output torque is, but the more the copper loss ($P = I^2R$) of the motor is, the more the motor heats up;
- The higher the power supply voltage of the driver, the greater the high-speed torque of the motor;
- It can be seen from the torque frequency characteristic diagram of stepping motor that the torque of high speed is smaller than that of medium and low speed.



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