XINJE

DPL685 Stepper Drive

User Manual

Catalog

1. Summary

DPL-685 is two phase digital stepper drive. It can set the subdivision from 200 to 40000 and any current inside the rated current. Based on the pure sine wave current control technology, this series product have a good performance in smoothly running with low noise, meets the high resolution requirement of the numerical control equipments, such as laser marking machine, CNC machine etc. The drive can auto-study the parameters depend on different motors, to maximize the motor performance.

1-1. Characteristic

- Low noise on motor running.
- Parameter auto-study function.
- Control signal is 24V, connect to PLC directly.
- Power supply 20~50VDC.
- Effective value of output current is 1.9~5.0A.
- Dynamic selection on subdivision with maximal value of 40000.
- Fit for 4, 6, 8 lines two phases stepper motor whose current is below 5.0 A.
- Half the current when drive is static
- Photo isolator input signal.
- Easy-operation on current setting and selection by user.
- Over-voltage and over-current protection.

1-2. Application

This series product can well meet the requirement of the small and medium automation devices and instruments, such as aerodynamic marking machine, labeling machine, cutting machine, laser marking machine, plotter, small carving machine, CNC machine etc., especially having a perfect performance on the devices which require low noise and vibration, high precision and speed.

1-3. Electric characters

Item	Min. value	Typical value	Max. value
Effective value of output current	1.9	-	5
Power supply voltage (VDC)	20	36	50
Logic input current (mA)	4	7	16
Stepper pulse frequency (KHz)	0	-	200
Insulation resistance(MΩ)	500	-	-

Ambient temperature	0℃~50℃
Max working temperature	60℃
Humidity	40%~90% RH (no condensation)
Vibration	5.9m/s^2 Max
Storage temperature	-20℃~65℃
Dimension	150mm×94mm×57mm

2. Operation Guidance

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

2-1. Safety

■ The driver is authorized to be installed and operated by the professionals and technicians.
■ Don't turn on the power before you connect the motor.
■ Make sure that the driver input meets 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 heat producing appliance.
■ Don't exposure the driver to the dusty, corrosive gas, elevated humidity, and advised to use with small vibration.
■ For perfect conducting, please ensure the fixation between earth wire of host

computer, driver, motor and ground.

3. Common Terminals
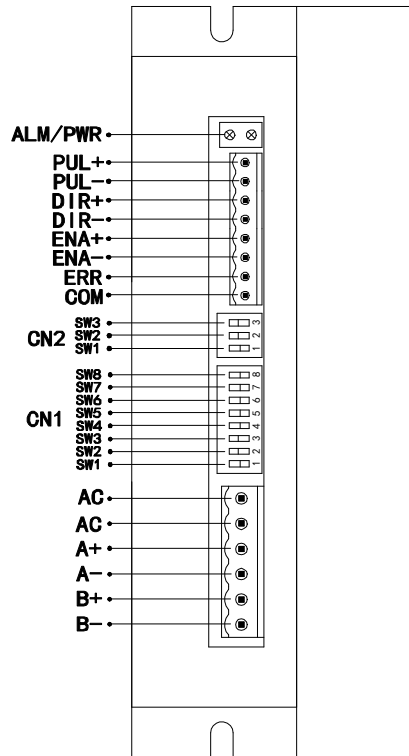
Note: no need to set CN2.

3-1. Control signal terminals

3-1-1. Description of Control signals terminals

| Signal	Function	Description
PUL+ PUL-	Pulse control signals	Be available on the rising edge, motor moves a step at the rising edge of pulse turning from low-level to high-level. PUL high voltage is 24V, low voltage is 0~0.5V.
DIR+ DIR-	Direction control signals	The direction of motor rotating changed by the switching of pulse between low-level and high-level .Once the pulse status is changed, the direction correspondingly turns. The original direction depends on the wiring of motor, which means the phase connection. High voltage is 24V, low voltage is 0~0.5V.

ENA+	Enable/release signal	Used for motor release. The stepper will not be active when ENA+ terminal connects to 24V and ENA- connects to low-level, in this case, the driver cuts off current of all phases and in free status, and also the temperature decrease. Please hang these terminals in the air if do not use them.
ENA-		

3-1-2. Sequential chart of control signal

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

■ The high-level signal is effective when voltage is 24V, the low-level signal is effective when in the range of 0V to 0.5V.

■ The ENA (enable) signal should be turned to high-level 0.5s before DIR (direction) signal or more.

■ Ensure the falling edge of the DIR (direction) signal built 5μs before PUL (pulse) signal or more.

■ The width of pulse should be more than 1.2μs

■ The duration of the low-level pulse should be more than 1.2μs

The sequential chart shows as below:
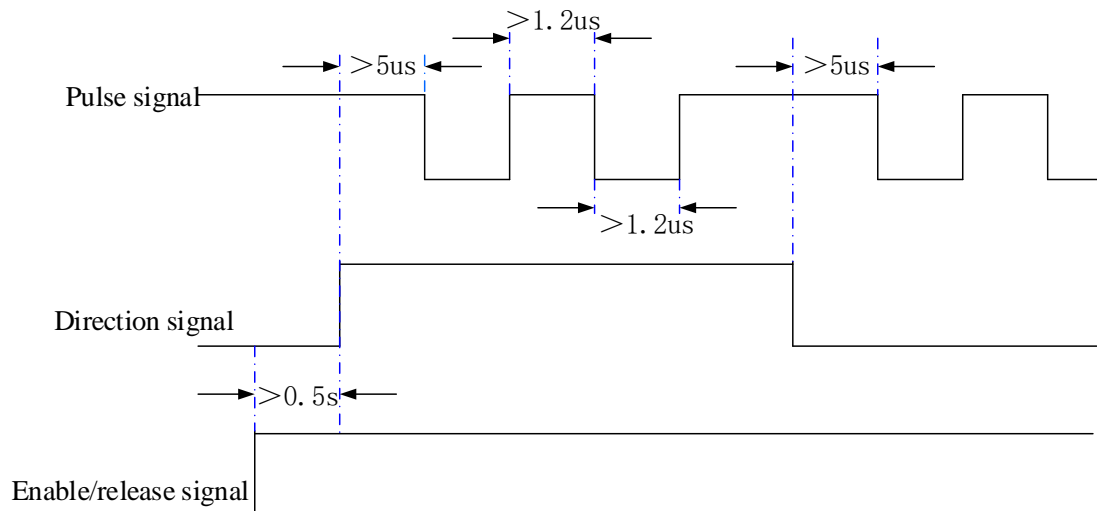
3-1-3. Input circuit

The connection on common anode way of the drive input circuit is shown as below:
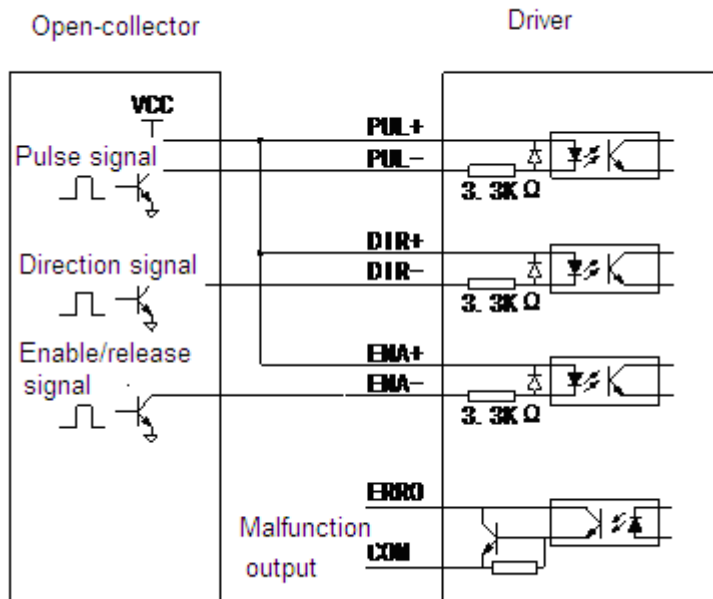
Note:

- The input signal is photoelectric isolation. Make sure the control signal driven current is more than 8mA to keep the good conducting of the internal high-speed opticalcoupler.
- 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 the terminal

| Terminal	Function	Description
GND	DC power supply ground terminal	DC power supply ground terminal
+V	Positive terminal of DC power supply	the value is between min voltage and max voltage, it is better to use recommended value
A+，A-	A-phase of motor	Switching the A+ and A- can chagne the motor direction
B+，B-	B-phase of motor	Switching the B+ and B- can chagne the motor direction

3-2-2. Requirement of power supply

- Don't connect the power supply terminal in reverse way.
- To keep the normal working of drive, please ensure the power supply in this range: 20~50VDC.
- It is better to use non-regulated DC power supply, and make sure the current

output of power is 60% higher than setting current of driver.

■ Please ensure the current of power supply is higher than motor working current.

3-2-3. Wiring
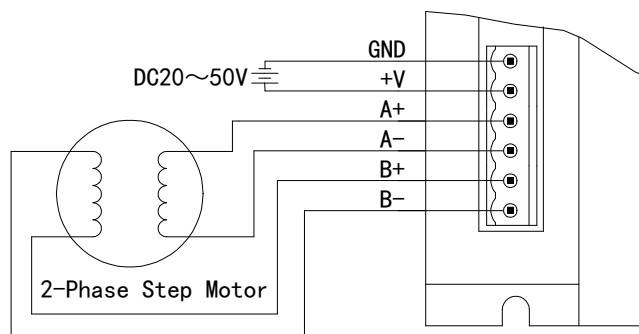
1. Select drvie input voltage

Generally, the higher the power supply voltage, the larger the torque of motor high-speed, and avoid lost steps with high-speed. But the high voltage will cause over-voltage protection and motor over-heat, drive damaged. When motor is working under high voltage, the motor will have vibration with low-speed. Please choose a little small for the input voltage.

2. Select the drive output current

For the same motor, the larger the drive current, the larger the motor output torque. But motor and drive will be over-heat for large current. The motor heating is related to output current and motor motion type, motor stay time. Please choose the current based on the rated motor current and adjust it as need.

If the temperature is low ($< 40℃$), it can increase the current to enlarge the motor output power (torque and high-speed response). After setting the current, test-run the motor for 15 to 30 minutes, if the motor tempearture is larger than $70℃$, decrease the current. Generally, the current setting must keep the motor not over-heat for long time running(stepper motor temperature must lower than $80℃$).

Users can choose suitable connection methods as actual conditions.

There are some typical connections for your reference as below:

■ 4 lines motor: output current equal to or less than motor rated current

■ 6 lines motor high torque mode: output current set to 50% of motor unipolarity connection rated current

■ 6 lines motor high speed mode: output current set to 100% of motor unipolarity connection rated current

■ 8 lines motor serial connection mode: output current set to 70% of motor unipolarity connection rated current

■ 8 lines motor parallel connection mode: output current set to 140% of motor unipolarity connection rated current
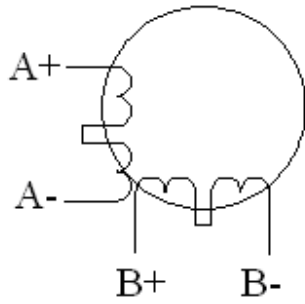
Serial-connection with 8-leads
large torque at a low speed
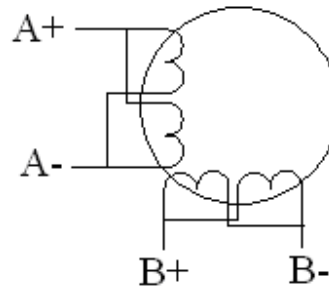
Parallel connection with 8-leads
good performance at a high speed
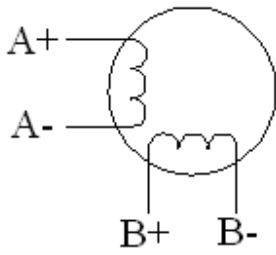
Motor with 4 leads
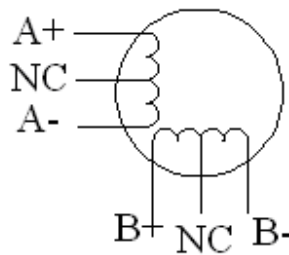
6-leads motor with large torque
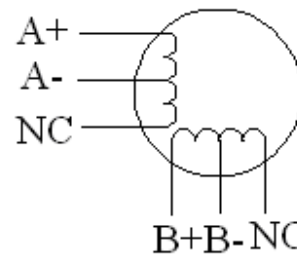
6-leads motor with high speed

3-3. Function Setting

The drive has 8-bit switch to set the current, half-current/full-current, self-study, pulse number per circle.

CN1 (SW1~SW3): set current output

CN1 (SW4): set half current and full current (SW4=OFF is half current, SW4=ON is full current)

CN1(SW4): SW4 going round trip between ON and OFF once in 1 second is self-study function.

CN1 (SW5~SW8): pulse numbers per circle

3-3-1. Current Setting

1. The dynamic current is set by CN1 (SW1~SW3):

Peak	RMS	SW1	SW2	SW3
2.7	1.9	OFF	OFF	OFF
3.4	2.4	OFF	OFF	ON
4.0	2.8	OFF	ON	OFF
4.2	3.0	OFF	ON	ON
5.1	3.6	ON	OFF	OFF
6.0	4.2	ON	OFF	ON
6.5	4.6	ON	ON	OFF
7.0	5.0	ON	ON	ON

2. Static current setting

The static current can be set by CN1 (SW4). SW4 OFF means the static current is half of the dynamic current, SW4 ON means the static current is same to dynamic current. Please set SW4 to OFF for general using, this can decrease the drive and motor heating, improve the reliability. About 0.4 second after pulse outputting stop, the current auto-decrease to 60% of actual value. The heating value decreases to 25%.

Half-current means the force of stator locked rotor will decrease 50%, it can decrease the motor heating and save energy.

For the machine that object gives small reaction force to motor, please use half-current or even enable motor.

For the machine that the reaction needs the motor self-lock to positioning, please use full current, such as up-down transmission structure.

3-3-2. Pulse numbers per circle

The pulse numbers of per circle is set through CN1(SW5~SW8):

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 self-study

The parameter self-study function can learn the best running parameter according to different motors and make the motor in best performance.

SW4 goes round trip between ON and OFF once in 1 second can enter self-study function. It can self-study the motor parameters and auto-tune the control parameters. Please do the self-study function when the power supply voltage, motor and other condition changed. Otherwise, the motor running will be abnormal. Please do not input pulse when self-study is working, the direction signal cannot change. The time interval between self-study cannot less than 3 seconds.

The method to enter self-study mode:

1. SW4 from ON to OFF, then from OFF to ON in 1 second
2. SW4 from OFF to ON, then from ON to OFF in 1 second

3-4. Protection function

- **Indicator LED**

  Power indicator light PWR: Green-light turning on means normal working.
  Alarm indicator light ALM: It will alarm when red-light turns on which means over-voltage or over-current; the red-light flashing means over-voltage alarm, the red-light turning on constantly means over-current.

- **Error output**

  The error signal output from the ERRO and COM terminal when there is over-voltage, over-current.

- **Over-current/over-voltage protection**
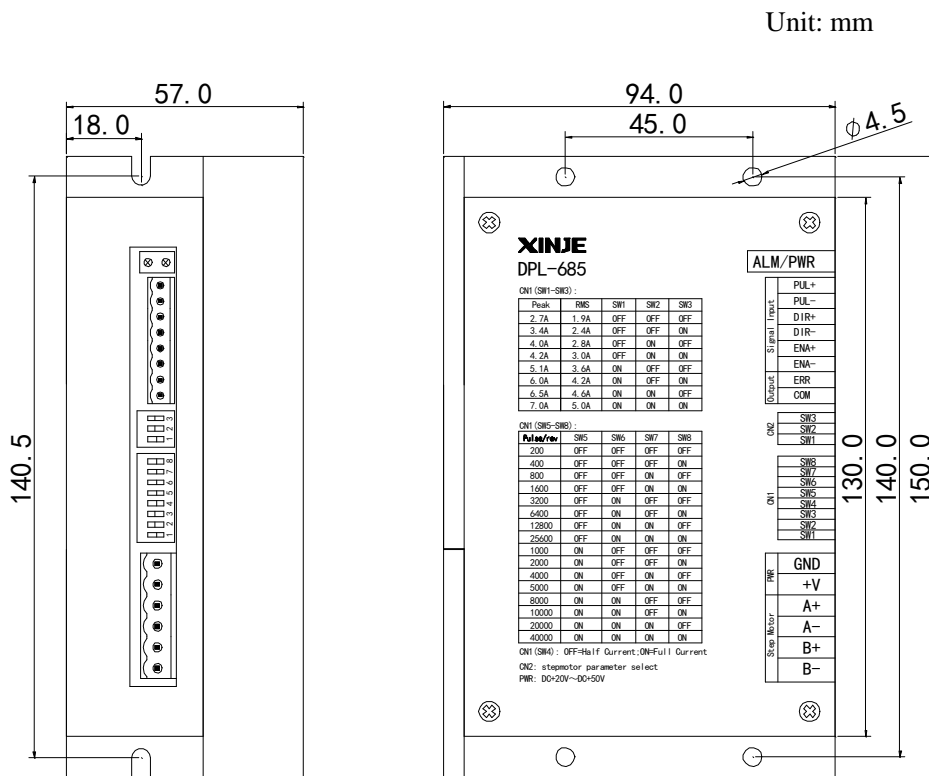
  If the power voltage is more than 50VDC of the upper-limit value or the current of motor is 20% higher than the setting value, the protection circuit will cut off the PWM output and the alarm indicator light turns on.

Note: the drive stops working when the protection circuit is active. After you remove the malfunction and restart the driver, the driver working normally again.

4. Dimension installation and wiring

4-1. Dimension

Unit: mm

CN1 (SW1-SW3):

Peak	RMS	SW1	SW2	SW3
2.7A	1.9A	OFF	OFF	OFF
3.4A	2.4A	OFF	OFF	ON
4.0A	2.8A	OFF	ON	OFF
4.2A	3.0A	OFF	ON	ON
5.1A	3.6A	ON	OFF	OFF
6.0A	4.2A	ON	OFF	ON
6.5A	4.6A	ON	ON	OFF
7.0A	5.0A	ON	ON	ON

CN1 (SW5-SW8):

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

CN1 (SW4): OFF=Half Current;ON=Full Current

CN2: stepmotor parameter select

PWR: DC+20V~DC+50V

4-2. Installation

Install the driver in the well-ventilated cubicle under well protection and check the cooling fans periodically. Please leave at least 10cm around driver for cooling purpose. Avoid dust and moisture.

4-3. Typical Wiring
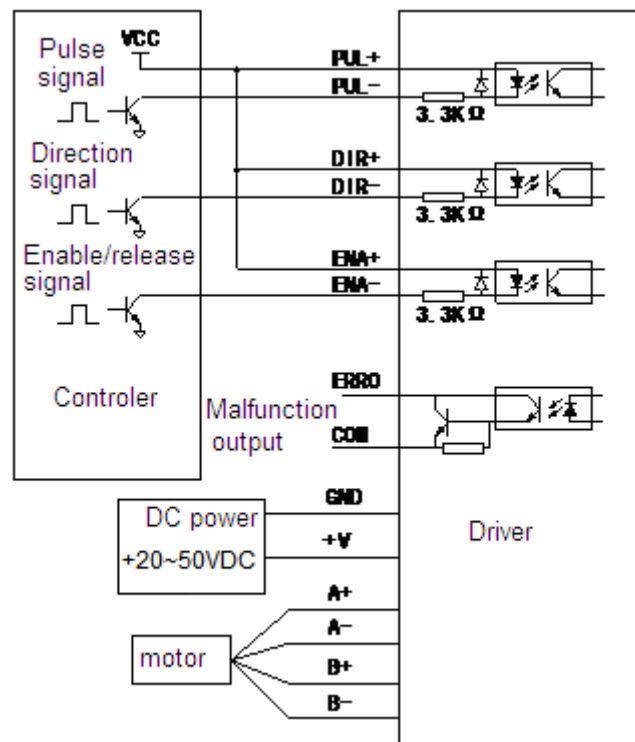
Note: please separate the power cables (power supply cable, phase cable) and the weak electricity cable in order to avoid interfering.

5. Malfunction Diagnoses and Solution

Malfunction	Causation	Solution
The power light doesn't work	Something wrong with the power supply	Check the power supply
	The voltage of power is not enough	Increase the voltage of power
The motor doesn't work	Current is too low	Reset the current
	Subdivision is too low	Reset the subdivision
	Protection circuit is active	Restart the driver
	The release signal is low	Remove this signal
	Power off	Restart the driver
	Connection on motor is incorrect	Check connection
	No pulse input	Adjust the pulse width and voltage
The direction of motor is incorrect	Inverse of phase-sequence	Exchange for phase-sequence
	Disconnection	Check connection
Alarm indicator turn on	Incorrect connection on motor	Rewire
	Over-voltage or too slow	Adjust the power voltage
	Motor or drive is damaged	Check the driver and motor
The torque of motor is too small	Acceleration is too high	Reduce the pulse acceleration
	Driver doesn't match with motor	Change a suitable driver

6. Motor Selection

The DPL-685 is fit for 4, 6, 8 lines 2 phases, 4 phases mixed type stepper motor, the step angle is 1.8 or 0.9 degree. Please choose suitable motor to match the drive to get the best running performance.

Please choose the motor according to motor torque and rated current. The torque is related to motor dimension, the larger the motor, the larger the torque. The current is related to the inductance, small inductance has large current and has better performance for high-speed running.

1. Make sure the load torque, transmission ratio, working speed range

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

J: load moment of inertia

ε: max load angular acceleration

C: safety factor, recommended value 1.2~1.4

T_{load}: max load torque, including effective load, friction, transmission efficiency, etc

2. The factors affect the motor output torque

For fixed stepper motor and connection method, the output torque has the following features:

■ The larger the motor actual current, the larger the output torque, but the motor coper loss ($P = I^2R$) is larger, the motor heating is serious.

■ The higher the drive power supply voltage, the larger the motor high-speed torque.

■ According to the torque-frequency curve of motor, the torque is smaller for high-speed.
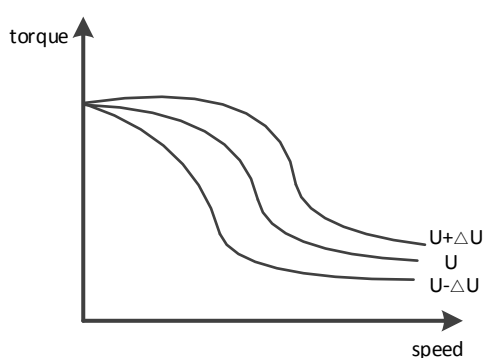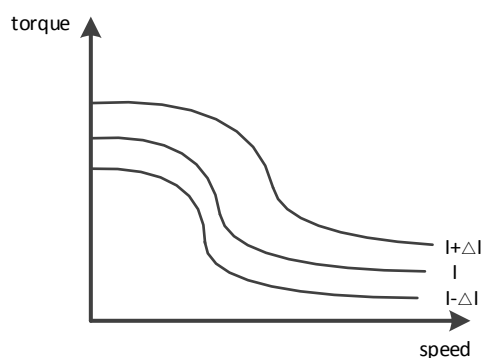
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