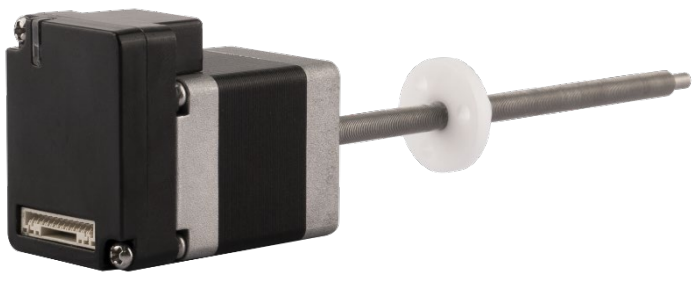DINGS'
Precision Motion Specialist

VER 1.2 **Technical Manual**

DS-CL28-IRS4 (IPD)

Product Guarantee

- Within one year of purchasing this product, if a malfunction occurs due to non error/improper operation reasons, the faulty product can be transported back to our company by express delivery or logistics, and then you can enjoy free repair services. Maintenance usually takes several working days, and we hope you can understand.

- If the malfunction occurs due to improper operation or error, or if any degree of malfunction occurs one year after purchase, the repair fee will be charged. As mentioned in the previous article, faulty products can be transported back to our company by express delivery or logistics. Due to the fact that maintenance usually takes several working days, if this product is used in an extremely important operating system, we kindly consider purchasing spare parts to ensure the stability of the system.

- If this product is sent to our company for repair by mail, and it is damaged during transportation, our company cannot be held responsible for such faults. We kindly request the user to confirm that the packaging of this product is filled with sufficient cushioning materials before shipment, and to try to prevent the product from being affected by excessive external vibration (below 0.5G).

- The following service items are not included in the selling price of this product, so we hope everyone understands.

- Review and judgment of system suitability (during design)

- Trial operation and adjustment (if the motor needs to be adjusted, the original plan motor will not be able to be returned)

- Fault diagnosis and maintenance on the site where this product is located

- Precautions For Use

- Please comply with the rated values and use this product in the environment stated in this book.

- The design and manufacturing purpose of our company's products is not to enable them to be used in life-threatening situations or environments. Therefore, if you need to purchase this product for special purposes, please inform our business personnel and discuss and confirm.

- Our company continues to strive for higher quality and better customer trust, but when using our products, please be sure to consider safety designs such as multiple backup designs, fire response designs, and malfunction prevention designs to avoid personal accidents, fire accidents, and other social damages caused by system design failures.

- In order to continuously improve its features, this product may undergo specifications changes without prior notice in the future.

Safety Precautions

To ensure that all users can safely use this drive, the safety precautions are listed in the following table in this book. Precautions are recorded here

⬦ Danger	Indicates the possibility of a dangerous situation leading to death or serious injury or illness if an error occurs.
⚠ Attention	Indicates that if a mistake occurs, there is a possibility of a hazardous situation leading to moderate or minor personal injury. It is also possible to cause material losses.
🚫 prohibition	Indicates that it cannot be violated
❗ Enforcement	Indicates that it must be completed

⬦ Danger
- Do not touch the terminal or its interior with your hands when powered on. **Otherwise, there is a risk of electric shock.**   - Do not forcefully pull or twist the cable, or place heavy objects on the cable. **Otherwise, there is a risk of electric shock and fire.**   - Do not touch the movable parts of the module with your hands. **Otherwise, there is a risk of injury caused by being caught in the rotating shaft.**   - Do not touch the inside of the drive with your hands. **Otherwise, there is a risk of electric shock.**   - Please make sure to ground the grounding terminals of the driver and motor. **Otherwise, there is a risk of electric shock.**

- Please confirm the power outage before proceeding with actions such as movement, wiring, maintenance, and inspection. The displayed LED lights on the panel should be completely extinguished before proceeding. **Otherwise, there is a risk of electric shock.**
- Do not touch the rotating part of the motor during operation. **Otherwise, there is a risk of injury.**

⚠ Attention

- Do not use this product in places that may be contaminated with water, oil, drug droplets, or in places with corrosive or combustible gases.
- Please use the specified power supply voltage. Otherwise, there is a risk of fire.
- The temperature of the driver, motor, and surrounding machines may rise, so please do not touch them. Otherwise, there is a risk of burning and scalding.
- Please connect the wiring correctly.
- Please use the motor and driver in combination according to the specified combination. Otherwise, there is a risk of fire.
- When powered on or shortly after power outage, the heat dissipation fins and motors of the drive may still be in a high temperature state, so do not touch them. Otherwise, there is a risk of burning and scalding.
- Do not apply excessive pressure to the edge of the casing. Otherwise, there is a risk of injury.

🚫 Prohibition

- Do not use this product in a place that is exposed to direct sunlight, or store it here.
- Do not use this product in places with ambient temperature and humidity exceeding the specified range, or store it here.
- Do not use this product in places with a lot of dust, dust, etc., or store it here.
- Please do not use this product in a place that may be subjected to direct vibration or impact, or store it here.
- Do not repair or modify the internal and external structures of this product on your own.

❗ Enforcement

- Please set an emergency stop circuit that can stop the action in real time externally.

Table of Contents

1. Product Introduction

1.1 Features

- Power supply : DC 24V
- Max. rated current output (peak) : 1.5A / phase
- Max. frequency response : 500KHz (duty cycle 50%)
- Support pulse mode, internal pulse mode, I/O Control, position pressing mode, torque mode
- 3 input signals : pulse, direction, offline

  (optocoupler isolation, 5V signal drive, current limiting resistor required for exceeding 5V)
- 1 output signal : alarm (optocoupler isolation, output when there is no alarm)
- Protection function : overcurrent, overvoltage, undervoltage, motor not connected

1.2 Technical Parameter

Drive model		DS-CL28-IRS4 (IPD)
Power supply		24 VDC
Output current		Max. rated current 1.5A/phase (peak)
Drive mode		Full-bridge bipolar PWM driver
Input signal	Pulse signal	Optocoupler input voltage H=3.5-5V, L=0-0.8V Conduction current 6-15mA
	Direction signal	Signal power supply 12VDC series resistance R=1K Ω Signal power supply 24VDC series resistance R=2.2K Ω
	Enable signal	It can also be selected based on the input signal voltage, such as fixed 12V or 24V.
Output signal	Alarm signal	Photoelectric isolated output function, maximum withstand voltage 30VDC, maximum Saturation current 10mA
Environmental Specifications	Surrounding air conditions	Avoid dust, oil mist and corrosive gases
	Humidity	< 85 % RH, No condensation
	Temperature	0°C - +40°C
	Heat dissipation	Installed in a ventilated environment

1.3 Dimension Drawings (mm)
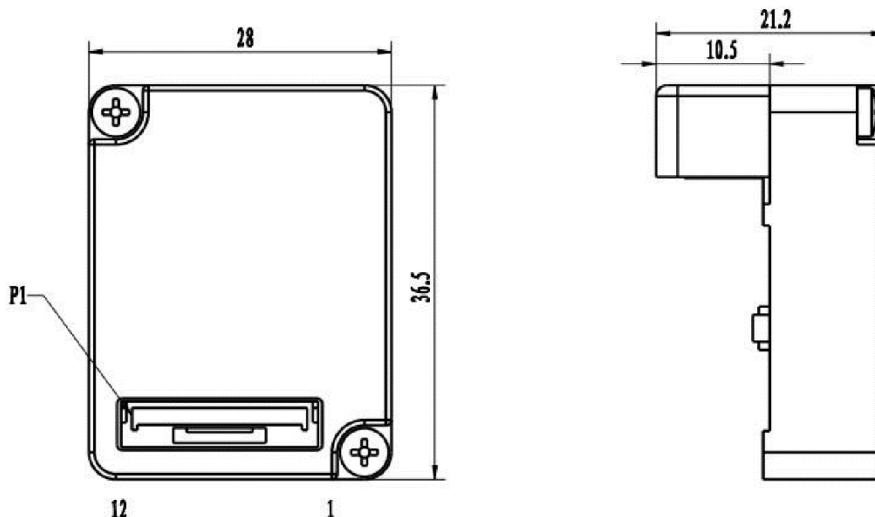
2. Schematic and Interface Definition

Pilot lamp

Power and signal input

Work indicator light

Alarm indicator light

Sketch Map

12   1

Power and signal input
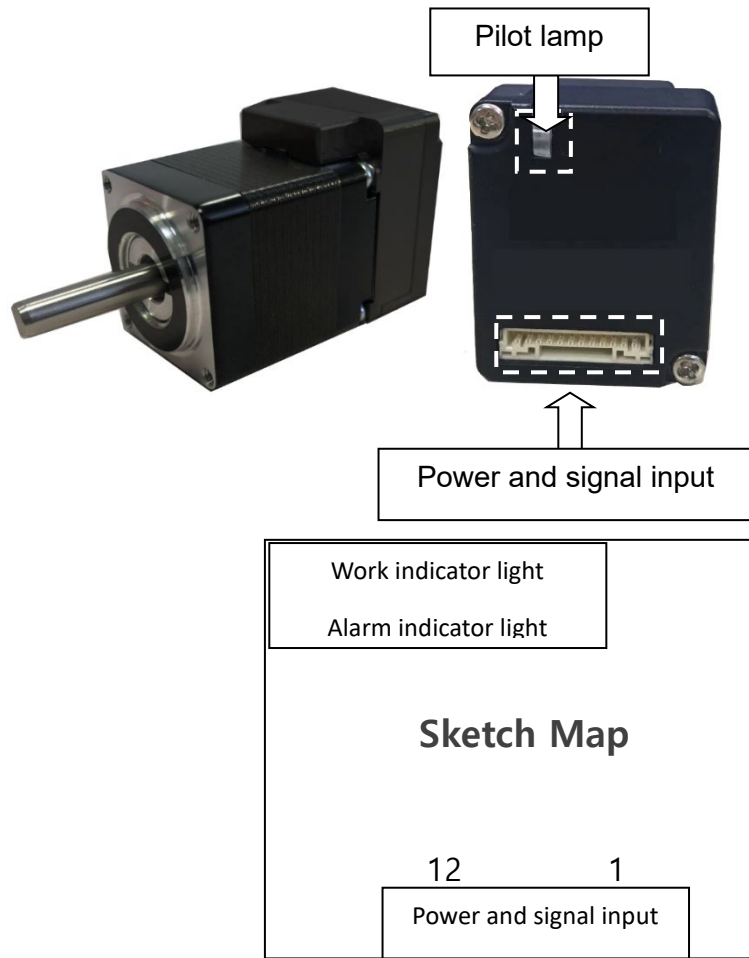
2.1 Power Input and Signal Input (arranged from right to left as shown in the diagram)

pin	DS-CL28-IRS4	DS-CL28-IRS4 describe	DS-CL28-IPD	DS-CL28-IPD describe
1	GND	GND	GND	GND
2	V+	24VDC	V+	24VDC
3	485-A	485 communicate	485-A	485 communicate
4	485-B		485-B	
5	OUT-	Alarm Output	OUT-	Alarm Output
6	OUT+		OUT+	
7	IN3-	Input 3	FREE-	Offline
8	IN3+		FREE+	
9	IN2-	Input 2	DIR-	Direction
10	IN2+		DIR+	
11	IN1-	Input 1	STEP-	Pulse
12	IN1+		STEP+	

2.2 Indicator Light Function

This product has two LED indicators in red and green to display the status:

(1) Status Indicator

Status function	Green light	Explanation
Stopping	Blinking	Enable, motor phase locked but motor not running
Running	Always on	Drive is running
Enable disconnection	Blinking	Enable disconnection, motor can be free

(2) Fault Indicator

Alarm function	Light flashing	Explanation
Motor overcurrent	1 green + 1 red	Motor phase current overcurrent or driver failure
Motor phase loss	1 green + 2 red	Abnormal motor wiring
Over voltage	1 green + 3 red	Power input greater than 30V
Under voltage	1 green + 4 red	Power input less than 18V
Other alarms	1 green + 5 red	

3. Signal Input

3.1 Pulse Signal : STEP

It can accept 3.5-5VDC single ended or differential signals, with a maximum voltage of 5V. The change from off to on is understood as receiving an effective pulse along the instruction. For the common anode, the low level is effective (for the common cathode, the high level is effective), and at this time, the driver will drive the motor to run one step according to the corresponding timing. For the normal operation of the driver, the duty cycle of the effective level signal should be below 50%. To ensure the reliable response of the pulse signal, the duration of the pulse effective level of the subdivided driver should not be less than 1us. The signal response frequency of the subdivision driver is 500KHz, and an excessively high input frequency may result in incorrect response.

3.2 Direction Signal : DIR

It can accept 3.5-5VDC single ended or differential signals, with a maximum voltage of 5V. The on and off of the internal optocoupler at this end are interpreted as two directions of motor operation, and a change in the direction signal will cause a change in the direction of motor operation. The suspension at this end is equivalent to an input high level. It should be noted that the subdivision driver should ensure that the direction signal is established at least 10us ahead of the pulse signal input to avoid incorrect response of the driver to the pulse signal. When reversing the motor, it is necessary to slow down the motor to the starting frequency before reversing. The commutation signal must change after the end of the last STEP pulse of the previous direction signal and before the first STEP pulse of the next direction signal. When there is no need to change direction, the direction signal end can be suspended in the air.

3.3 Enable Signal : FREE

It can accept 3.5-5VDC single ended or differential signals, with a maximum voltage of 5V. When the built-in optocoupler is turned on, the motor phase current is cut off and the rotor is in a free state (offline state). When this function is not needed, the offline signal end can be suspended.

3.4 Pulse / Direction Input Timing Diagram

Input signal waveform and timing (single pulse mode)

STEP Input port

≥0.9uS

<0.1uS   <0.1uS   ≥10uS   ≥0.9uS

DIR Input port

≥10uS

<0.1uS   <0.1uS

(Low level forward, high level reverse)

Input signal waveform and timing (double pulse mode)

STEP Input port (CW)

≥0.9uS

<0.1uS   <0.1uS   >10uS >10uS

T

DIR Input port (CCW)

≥0.9uS
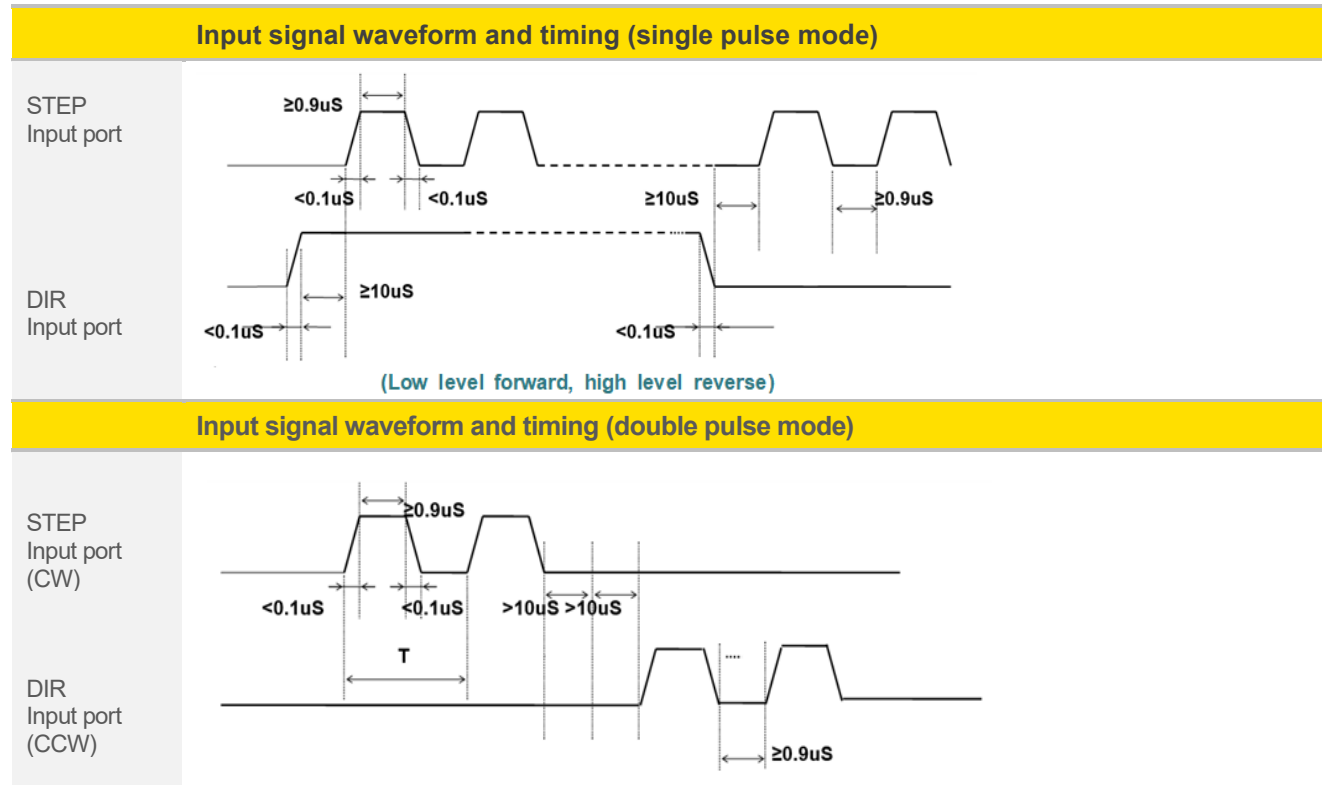
4. Typical Signal Connection Method

4.1 Differential Connection Method

Controller

STEP+ —— PUL+
STEP- —— PUL-

DIR+ —— DIR+
DIR- —— DIR-

FREE+ —— ENA+
FREE- —— ENA-

Drive
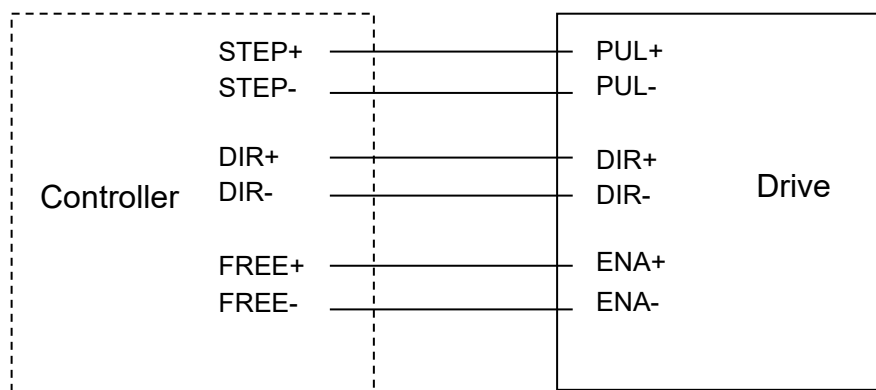
4.2 Common Anode Connection Method
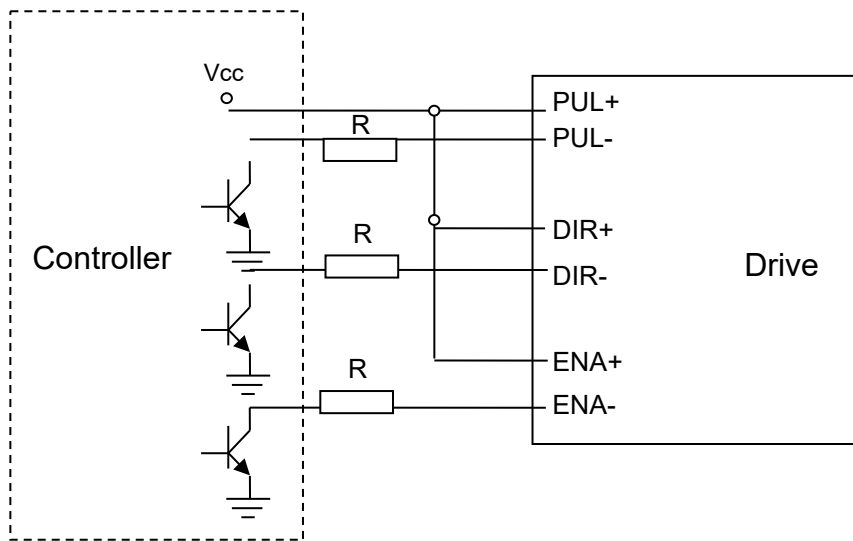
4.3 Common Cathode Connection Method
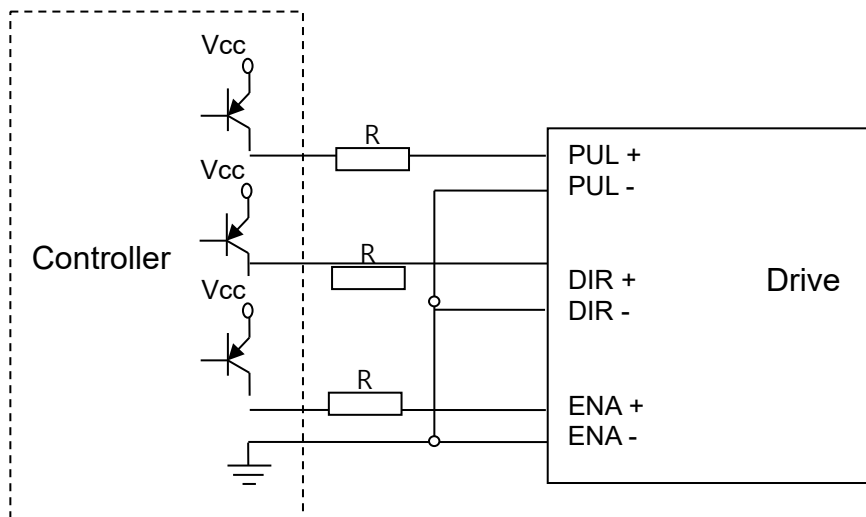
	VCC 3.5-5 VDC	R=0 Ω
Notes	VCC 12VDC	R=1K Ω
	VCC 24VDC	R=2.2K Ω

5. Control Parameter

5.1 Controller Basic Status (Class 01)

adr	word	content	Elaborate	Range / unit
0100	1	Motor current	Motor real-time current value	0.1%A
0101	1	Input voltage	Current input voltage	1%V
0104	2	Set up segmentation	Set segmentation value	ppr
0106	1	Pulse mode	1 is pulse + direction mode, 2 is double pulse mode	1-2
0108	1	Error code	Code at the time of alarm, see 1-2 for content, and display "0" for no fault	-
0109	1	Operating status	Drive running status, see 1-1	-
0110	1	hardware version	Drive hardware version	-
0111	1	Software version	Drive software version	-
0117	2	current position	target location	pulse
0119	1	Actual speed display	Display the actual speed after reducing the data by 100 times	0.01rps
0126	1	Actual location	Run real-time location	pulse
0174	1	IO select multiple run paragraphs	-	-
0176	1	Multi-segment writing error No	-	-
0178	1	Multi-stage operation	-	-
0135	1	Input port status	<table><tr><td>Data bit</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>Input port</td><td>IN3</td><td>IN2</td><td>IN1</td></tr></table>	

5.2 Basic Parameter Setting (Class 02)

adr	word	content	Elaborate	Range / unit
0201	1	Motor direction switching	Select the motor running direction and set the encoder direction Default: 0	0 ~ 3
0213	1	Half-flow ratio	Half flow percentage. Open loop effective. Default: 50	10%~100%
0217	1	Motor control mode	0 : Open loop 1 : Closed loop Default : 1	0~1
0224	1	Angular filtering	The smaller the value, the smoother the motor runs, but the higher the delay	1~700
0234	1	Digital filtering	Filter coefficient of input pulse. The larger the value, the lower the input frequency response.	1~15
0241	1	Input Current	Set current Default: 1000	100~4500 0.1%A
0242	2	Set up segmentation	Pulses per revolution	200~102400 ppr
0244	1	Pulse mode	1: Pulse + direction mode 2: Double pulse mode	1~2
0245	1	Half-flow time	Delay time for the motor to enter the half current state after stopping operation Default: 200ms	1~30000ms

0283	1	Percentage of positive torque setting value	In torque mode Torque=input current (0241) * percentage (0283) During forward operation, output with set torque Default value: 50	0~120%
0284	1	Reverse torque setting percentage	In torque mode Torque=input current (0241) * percentage (0284) When running in reverse, output with set torque Default value: 50	0~120%
0285	1	Percentage of setting value of return to zero point torque	Torque=input current (0241) * percentage (0285) When the return to the origin method is torque return to the origin, output the set torque Default value: 80	10~120%
0286	1	Torque detection time	Torque reaches detection time Default value: 10	1~10000ms
0287	1	Torque mode operating speed	In torque mode Run forward at the set speed, with torque reaching a stop	-5000~5000 0.01rps
0296	1	Selection of operating mode	0: External pulse 1: Internal pulse 5: Torsion mode 6: Position pressing mode Default: 0 Note: After modifying the function, it needs to be powered off and restarted	0~6
0298	1	mailing address	Default: 1	1~250
0299	2	Communication baud rate	Default: 19200	4800~115200

5.3 Closed Loop Parameter Setting (Class 04)

adr	word	content	Elaborate	Range / unit
0246	1	Encoder resolution	Resolution=Number of encoder lines x 4	200~65535
0247	2	In place scope	The value is the encoder resolution. Closed loop is effective. Default: 10	1~1000 encoder resolution
0251	1	Speed loop Kp	Speed loop Kp	0~30000
0252	1	Speed loop Ki	Speed loop Ki	0~30000
0255	1	Position ring Kp	Position ring Kp	0~30000
0258	1	Position deviation threshold	The value is the encoder resolution. Closed loop is effective.	1~30000 encoder resolution

5.4 Control Parameters (Class 05)

adr	word	content	Elaborate	Range / unit
0301	1	Starting speed	Default : 100	1~1000 0.01rps
0302	1	Stop speed	Default : 100	1~1000 0.01rps
0303	1	Acceleration	Default : 50	5~10000 rps^2
0304	1	deceleration	Default : 50	5~10000 rps^2

0305	1	Home mode	0: Clockwise return to origin 1: Counterclockwise return to origin 2: Positive limit return to origin 3: Reverse limit return to origin 6: Forward torque return to origin 7: Reverse torque return to origin 8: Clockwise Z-pulse return to origin 9: Counterclockwise Z-pulse return to origin Default value : 0	0~10
0306	1	Position mode speed	Default : 1000	1~5000 0.01rps
0307	1	Speed mode speed	In speed mode, the running direction is consistent with the speed direction Default : 1000	-5000~5000 0.01rps
0308	1	Jog mode speed	Default : 100	1~5000 0.01rps
0309	1	Home Mode Speed	Default : 200	1~5000 0.01rps
0310	1	Return to origin approach speed	Running speed after hitting the origin Default : 100	1~5000 0.01rps
0311	2	Home offset pulse	Default: 0	-2000000000~ 2000000000 pulse
0313	2	Output pulse	Running stroke Absolute position mode : run to the specified position Relative position mode : run the set offset stroke Default : 0	-2000000000~ 2000000000 pulse
0315	2	In place pulse width	Reaching the target position and approaching the distance, outputting the arrival signal Default : 0	-2000000000~ 2000000000 pulse
0317	2	Forward soft limit	Default : 2000000000 Note: It is invalid during return to origin	-2000000000~ 2000000000 pulse
0319	2	Negative soft limit	Default: -2000000000 Note : Invalid during homing process	-2000000000~ 2000000000 pulse
0321	2	Set current position	Default: 0	-2000000000~ 2000000000 pulse
0323	1	Control commands	0. empty 1. Absolute running, running to the set distance, running direction is determined by distance plus or minus, speed plus or minus value is invalid, it is effective to modify target position during running 2. Relative running, running at a set distance and running speed. The running direction is determined by the distance plus or minus. The speed plus or minus value is invalid. Modifying the movement distance during running is invalid 3. Speed mode 4. Jog forward 5. Reverse jog 6. deceleration and stop	0~29

adr	word	content	Elaborate	Range/unit
			7. Emergency stop 8. Set the current position, which can only be set when the motor is stopped 12. Back to origin 13. Alarm clear 14. Multi-segment data verification 15. Multi-segment data storage 16. Multi-segment data starts 17. Multiple data pauses 18. End of multiple segments of data 20. Enable Default : 0	
0324	1	Internal control switch	<table><tr><td>Data bit</td><td>Bit1</td><td>Bit0</td></tr><tr><td>Features</td><td>Negative soft limit</td><td>Positive soft limit</td></tr></table>1: open function, 0: close function Default : 0	0-32
0327	1	Number of paragraphs	Default: 1	1~32
0328	1	Multiple selection	Default: 0 Note: If IO port is configured with multi-segment selection function, IO configuration multi-segment selection is preferred	0~31

	Notes	1. There is a limit on the number of EEPROM writes (up to 1 million) 2. Except for parameters marked in yellow that do not automatically save EEPROM, all other parameters are automatically saved in EEPROM

5.5 Input Block Designation (Class 06)

adr	word	content	Elaborate	Range/unit
0400	1	IN1 function selection	0. empty 1. Absolute running, running to the set distance, running direction is determined by distance plus or minus, speed plus or minus value is invalid, it is effective to modify target position during running 2. Relative running, running at a set distance and running speed. The running direction is determined by the distance plus or minus. The speed plus or minus value is invalid. Modifying the movement distance during running is invalid 3. Speed mode 4. Jog forward 5. Reverse jog 6. deceleration and stop 7. Emergency stop 8. Set the current position, which can only be set when the motor is stopped 9. positive limit 10. Negative limit 11. Origin signal 12. Back to origin 13. Alarm clear 14. Multi-segment data verification 15. Multi-segment data storage	0~30

			16. Multi-segment data starts 17. Multiple data pauses 18. End of multiple segments of data 20. Enable 25. IO port configuration multi-stage selection Bit0 26. IO port configuration multi-stage selection Bit1 27. IO port configuration multi-stage selection Bit2 28. IO port configuration multi-stage selection Bit3 29. IO port configuration multi-stage selection Bit4 Default: 0	
0401	1	IN2 function selection	The setting content is the same as IN1 (default value: 0)	0~30
0402	1	IN3 function selection	The setting content is the same as IN1 (default value: 0)	0~30
0429	1	Universal digital input logic	Default value: 0	1~32767
0410	1	Pseudo communication settingIN1	0: OFF (initial value 0) 1: ON (trigger the action of IN1 configuration)	0~1
0411	1	Pseudo communication settingIN2	0: OFF (initial value 0) 1: ON (trigger the action of IN2 configuration)	0~1
0412	1	Pseudo communication settingIN3	0: OFF (initial value 0) 1: ON (trigger the action of IN3 configuration)	0~1

## 5.6 Multi-segment Position Mode (Class 08)

Multiple address ranges from 1024 to 1536, with a maximum of 256 data settings

(1) Multi-segment command format

Common code	word	content	Elaborate	Range / unit
1	2	Absolute operation	Parameter 1: Running position Default : 0	-2147483647 ~ 2147483647pulse
2	2	Relative operation	Parameter 1: Running distance Default : 0	-2147483647 ~ 2147483647pulse
51	1	Starting speed	Default : 100	1~2000 0.01rps
53	1	Stop speed	Default : 100	1~2000 0.01rps
54	1	Fixed length speed	Default : 1000	1~5000 0.01rps
61	1	Acceleration	Default : 100	5~1000 rps^2
62	1	Deceleration	Default : 100	5~1000 rps^2
65	2	Waiting for jump	A (high 8 bits) / B (low 8 bits) / C (low 16 bits) A: fixed to 0 / B: jump address / C: Waiting time	-
66	2	Jump sequence	A (high 16 bits) / B (low 16 bits) A: number of cycles / B: jump address	-
100	1	Multi Segment End	Each paragraph must end with a closing code as the closing symbol	-

The multi segment position mode function is a working method that combines multiple position segments in a certain order, triggers motion through external IO signals, and completes a series of position segment actions. This function can be seen as a multi segment combination of position modes. Users can store the description parameters of several position segments, such as acceleration/deceleration, pulse

number, etc., in EEPROM in advance. To enable these position segments, only a trigger signal needs to be provided to complete the work. The working process is described in the following figure.

Multi segment position working mode
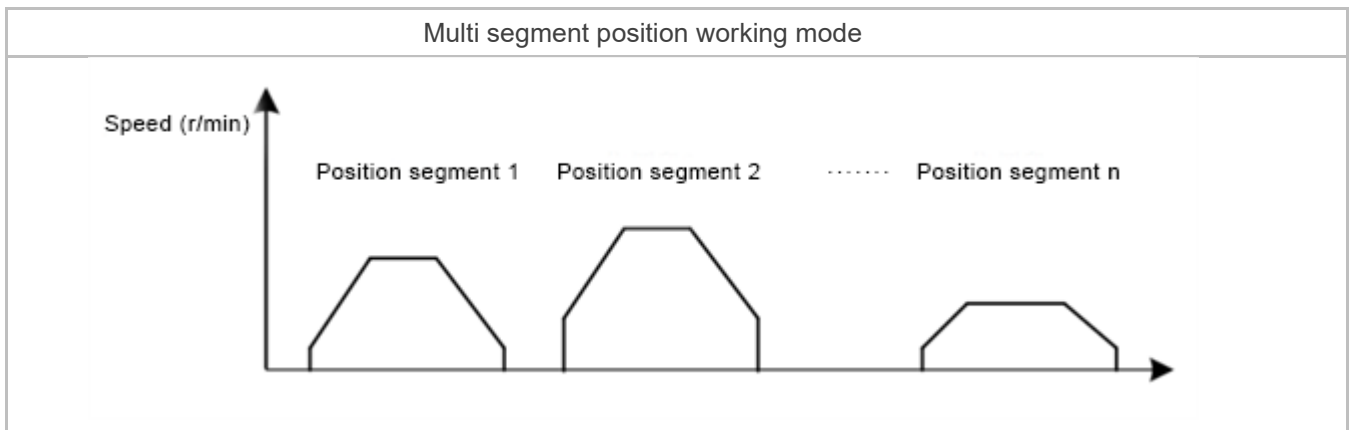
(2) Port selection corresponds to multiple segments

Bit4	Bit3	Bit2	Bit1	Bit0	Position segment
0	0	0	0	0	1
0	0	0	0	1	2
0	0	0	1	0	3
0	0	0	1	1	4
…	…	…	…	…	…
1	1	1	0	1	30
1	1	1	1	0	31
1	1	1	1	1	32

(3) IO Select port

Input port configuration multi segment selection function 25-29: IO port configuration multi segment selection Bit0~Bit4

Input Port Configuration Multi Segment Start Function 15: Multi Segment Data Start

Port selection corresponds to multiple segments

Example : IN1 Port Function Configuration 25, Bit0

IN3 Port Function Configuration 26, Bit1

Can configure IN1~IN7 functions according to requirements

IN3 / Bit1	IN1 / Bit0	Position segment
0	0	1
0	1	2
1	0	3
1	1	4

Note: "1" in the table represents an effective holding signal

Paragraph selection signal needs to be completed at least 20ms before the signal starts

The multi segment position mode function is a working method that combines multiple position segments in a certain order, triggers motion through external IO signals, and completes a series of position segment actions. This function can be seen as a multi segment combination of position modes. Users can store the description parameters of several position segments, such as acceleration/deceleration, pulse number, etc., in EEPROM in advance. To enable these position segments, only a trigger signal needs to be provided to complete the work. The working process is described in the following figure.

![DINGS' Precision Motion Specialist]