XINJE

DP3F1 series closed loop stepping driver

User manual

Basic description

◆ Thank you for purchasing Xinje DP3F1 series stepping driver. Please read this product manual carefully before operating.

◆ The manual mainly provides the user with relevant guidance and instructions for the correct use and maintenance of the step driver. The manual involves the function, use method, installation and maintenance of the step driver.

◆ The contents described in the manual are only applicable to Xinje's DP3F1 series stepping driver products.

Notice to user

This manual is applicable to the following personnel:

◆ The installation personnel of stepper driver

◆ Engineering and technical personnel (electrical engineers, electrical operators, etc.)

◆ The designer

Before operating or debugging the stepper driver, the above personnel should carefully read the safety precautions section of this manual.

Statement of responsibility

◆ Although the contents of the manual have been carefully checked, errors are inevitable and we can not guarantee that they are completely consistent.

◆ We will always check the contents of the manual and make corrections in subsequent versions. We welcome your comments.

◆ The contents described in the manual are subject to change without prior notice.

Contact us

If you have any questions about the use of this product, please contact the agent and office that purchased the product, or contact Xinje company directly.

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Catalog

1. Product introduction

1-1. Model naming rule

Take DP3F1-808A as an example:

$$\underline{\text{DP3F1}} \ - \ \underline{80} \ \underline{8} \ \underline{A}$$

$$① \qquad\qquad ② \ ③ \ ④$$

①	Series name	DP3F1:	DP3F1 closed loop stepper driver
②	Maximum peak current of the driver	80：	8.4A
		70：	7A
		30：	4A
③	Maximum operating voltage of the driver	8：	80V
		5：	50V
④	Power supply type	A：	AC/DC power supply
		None：	DC power supply

1-2. Performance

- The encoder is used as position feedback, which can compensate the position deviation in real time, and solve the problem of losing step of traditional stepping motor
- The current can be adjusted in real time according to the load and speed, so that the operation is more stable and the motor heating is lower
- Compared with the open-loop stepping, the high-speed performance of the motor is significantly improved
- The pulse and direction input voltage supports 5V and 24V
- 4-bit DIP switch, 16 levels subdivision can be set to meet the needs of most customers
- The rotation direction of the motor can be changed by dial switch
- It has power on auto-tuning function, can be set by switch
- It supports single and double pulse mode, can be set by switch
- Support smoothing time, can be set by switch and convenient for debugging and improves the stability of motor operation
- One channel of digital input signal: enable signal input
- Three digital output signals: alarm signal output, in place /Z signal output, brake signal output
- It has over-current, over-voltage, rotation blocking detection, and other protection functions

1-3. Application field

It is suitable for all kinds of small and medium-sized automation equipment and instruments, such as engraving machine, stripping machine, marking machine, cutting machine, laser machine, plotter, medical equipment, CNC machine tool, automatic assembly equipment, electronic processing equipment, etc.

1-4. Electric features

Model		DP3F1-305	DP3F1-705	DP3F1-805A	DP3F1-808A
Input power supply (VDC)		20V~50V/DC	20V~50V/DC	20V~50V/AC 20V~80V/DC	20V~80V/AC 20V~110V/DC
Output peak current (A)		1~4	1~7	1~8.4	1~8.4
Matched motor (base)		42	57/86	86	86
Step pulse frequency (KHz)		24V signal 200K, 5V differential signal 150K			
Control signal input voltage (VDC)		Support 5V and 24V (DC)			
Using environment	Using location	Try to avoid dust, oil mist and corrosive gas			
	Ambient temperature	-10~50℃			
	Storage temperature	-20~65℃			
	Humidity	40%～90% RH (No condensation or water droplets)			
	Vibration	5.9m/s^2 Max			

1-5. Safety precautions

(1) The drive must be installed and operated by professional technicians!

(2) The input voltage of the driver must meet the technical requirements!

(3) It is strictly forbidden to plug the strong current terminal of the driver when the power is on. When the motor stops, there is still a large current flowing through the coil. Plug the strong current terminal will produce a huge instantaneous induced electromotive force, which will burn the driver!

(4) Before power on, please ensure the correctness and firmness of power cable, motor cable and signal cable connection!

(5) Avoid electromagnetic interference!

2. Installation and wiring

2-1. Installation

2-1-1. Outline dimension

- DP3F1-305, DP3F1-705   Unit: mm
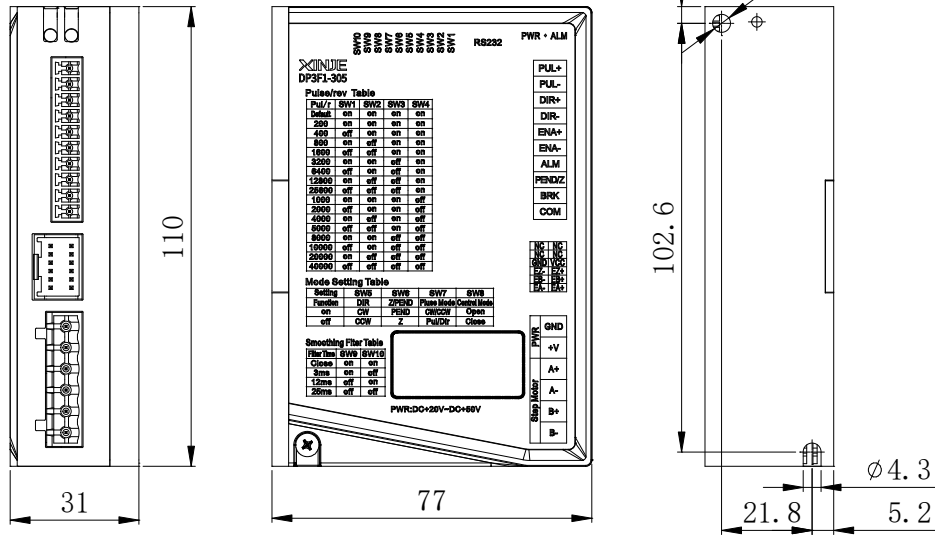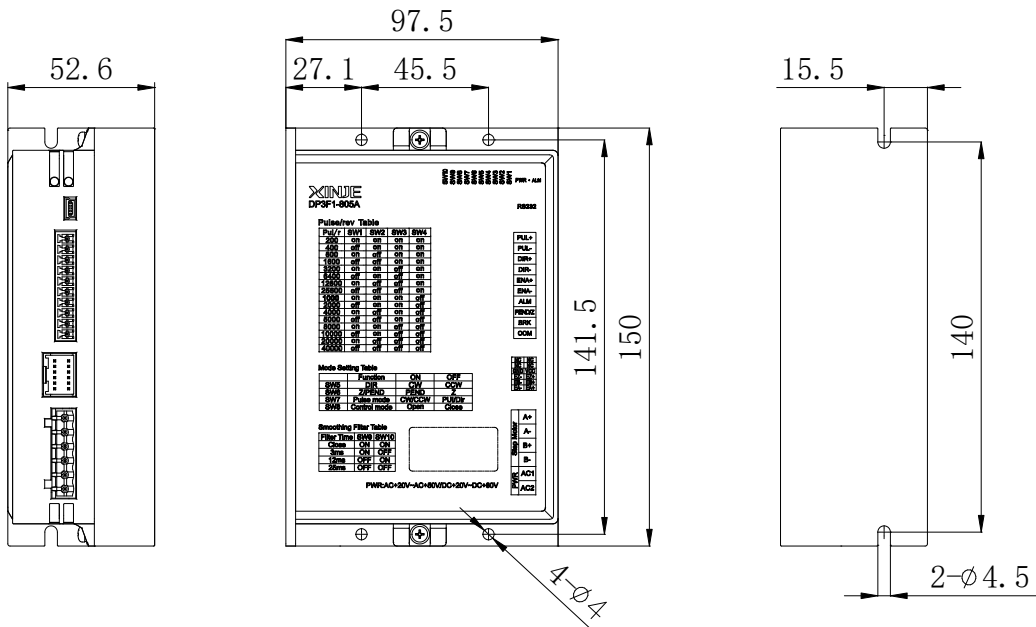
- DP3F1-805A   Unit: mm
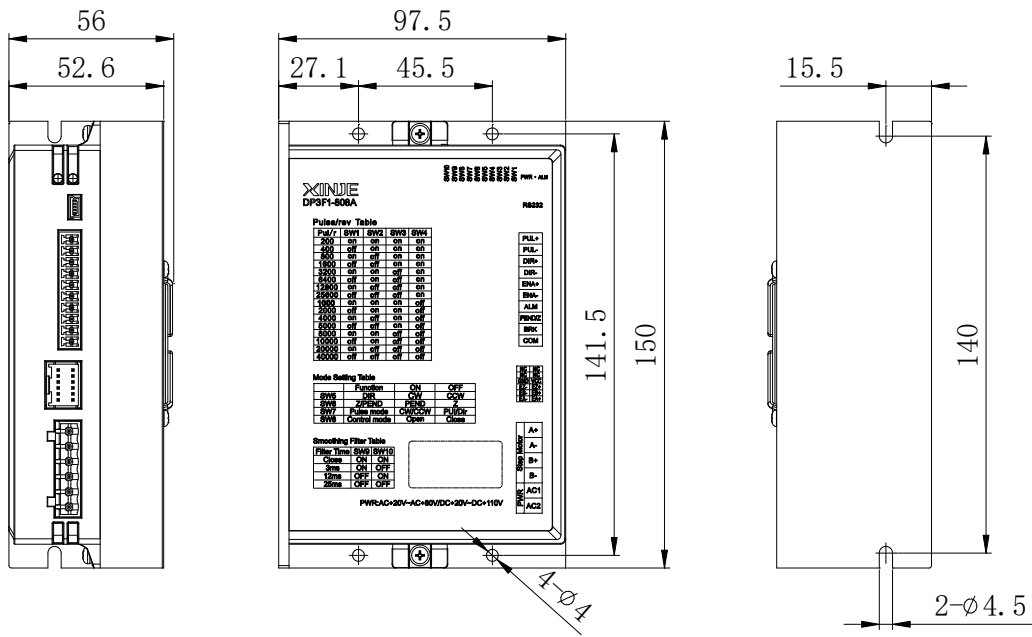
2-1-2. Installation environment

The reliable working temperature of the driver is usually within 60℃ and that of the motor is within 80℃. To ensure that the driver works within the reliable working temperature range, the driver should be installed in the electric cabinet with good ventilation and proper protection. If necessary, a fan should be installed near the driver for forced heat dissipation. Avoid being used in dust, oil mist, corrosive gas, high humidity and strong vibration.

2-2. Wiring

2-2-1. Typical wiring diagram
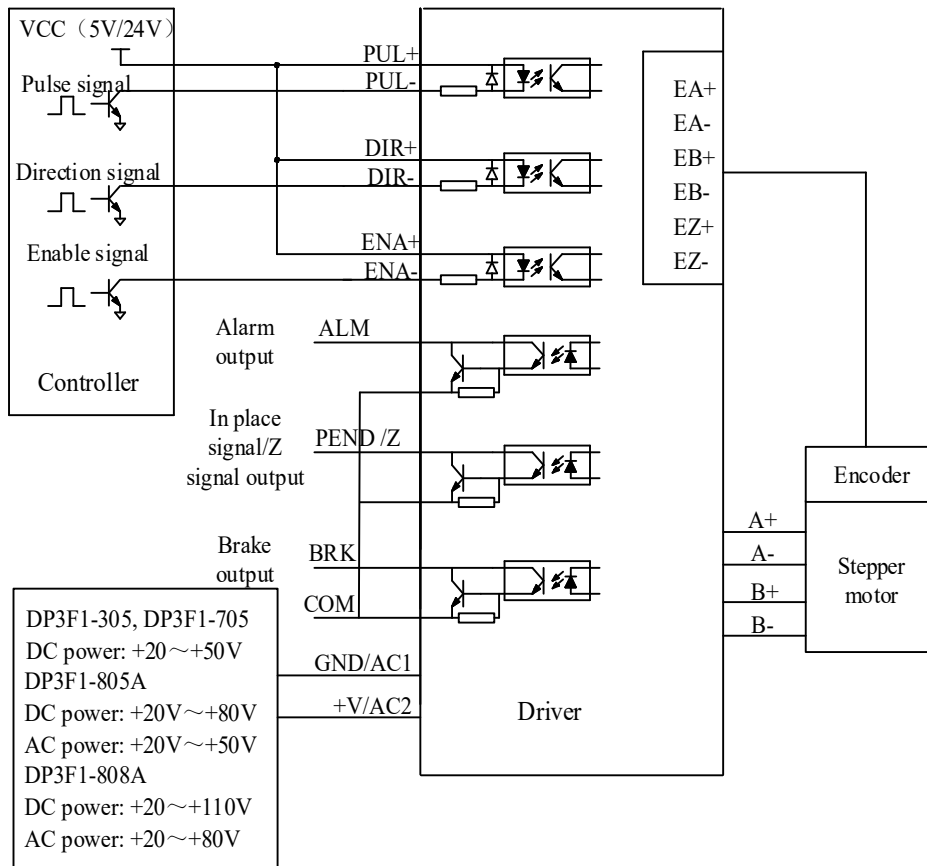
2-2-2. Brake wiring

DP3F1 series stepping driver contain brake control terminal. When driving the brake type stepping motor, the brake can be opened or closed by the driver.

BRK+ terminal can withstand up to 50mA current, it cannot control the brake directly, please choose intermediate relay to control the brake. As shown in below diagram:
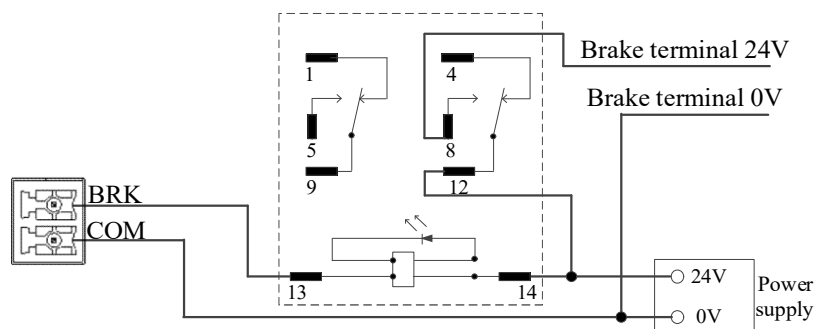
Note: Brake 24V corresponds to the red line; Brake 0V corresponds to the black line.

2-2-3. Wiring notice

(1) The pulse and direction signal cables and motor cables are not allowed to be bound side by side, and it is better to separate them at least 10cm, otherwise it is easy to interfere with the pulse direction signal, resulting in inaccurate motor positioning, system instability and other problems.

(2) If a power supply supplies multiple drives, parallel connection should be adopted at the power supply, and chain connection from one to another is not allowed.

(3) It is strictly forbidden to connect the wire head to the terminal after adding tin, otherwise the terminal may be damaged due to overheating due to increased contact resistance.

(4) The wiring head should not be exposed outside the terminal to prevent accidental short circuit from damaging the driver.

3. Driver interface
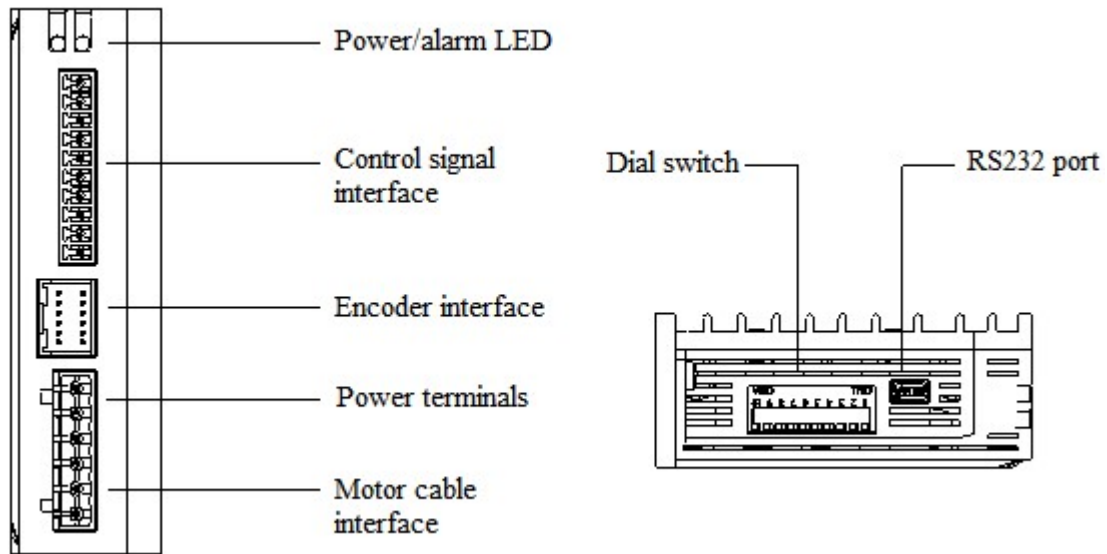
3-1. Status indicator and troubleshooting

The green LED is the power indicator. When the driver is powered on, the LED is always on; When the drive is powered off, the LED goes out.

The red LED is the fault indicator. When there is a fault, the indicator will flash continuously, then stop for one second, and then flash continuously. When the fault is cleared by the user, the red LED is always off.

The continuous flashing times of red LED represent different fault information, and the specific relationship is shown in the table below. The alarm output terminal outputs high level.

Flashing times	Fault	Solution
1	Over current or short circuit	Check the power cable for short circuit
2	Over voltage	Check whether the power supply voltage is too high
3	Under voltage	Check whether the power supply voltage is too low
4	Motor open circuit or poor contact	Check whether the power cable is well installed or broken
5	Position over limit	Check whether the encoder cable is broken, check whether the motor is blocked, and increase the acceleration time appropriately
12	Power on motor stall detection	Check whether the motor stall exsited, clear the alarm through the upper computer

Note: Due to the DP3F1-305 and DP3F1-705 drivers not having the function of reverse polarity protection for the power supply, please confirm again that the positive and negative polarity connections of the power supply are correct before powering on. Reverse polarity will burn out the fuse in the driver. The overvoltage values of DP3F1-305 and DP3F1-705 are both DC60V; The overvoltage values of DP3F1-805A are AC60V and DC85V; The overvoltage values of DP3F1-808A are AC106V and DC150V.

3-2. Upper computer communication interface

The definition of RS232 interface pin arrangement is as follows:

Pin	Function	Note
1	VCC	Power supply +
2	WT	Data write
3	WR	Data read
4	ID	Vacant
5	GND	Power supply ground

Note: the upper computer can set the subdivision and other functions. When SW1-SW4 are all ON, the upper computer can set the subdivision, please power on again after setting. Other switch status is subject to dialing setting.

3-3. Control signal interface

3-3-1. Function
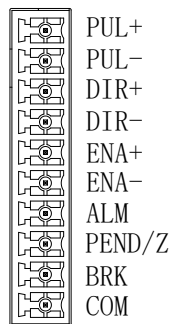
Signal	Function	Explanation
PUL＋	Pulse control signal	Select a 5/24VDC pulse input signal, and the pulse edge can be changed through the upper computer as needed. The default rising edge is valid. (Note: 5/24VDC compatible)
PUL－		
DIR＋	Direction control signal	High/low level signals correspond to the two directions of motor operation. (Note: 5/24VDC compatible)
DIR－		
ENA－	Enable input signal	Used to release the motor, when the enable signal is turned on, the driver will cut off the current of each phase of the motor and be in a free state, and the stepper pulse will not be responded to. At this point, the heating and temperature rise of the driver and motor will decrease. When it is necessary to enable, hang the signal end of the motor release in the air. The signal supports 24VDC. (Note: 5/24VDC compatible)
ENA＋		
ALM	Alarm output signal	Three output signals, maximum saturation output 50 mA, maximum 24 VDC. Pend+/Z terminal default is Z signal, the customer can modify the Z signal to in place signal through the upper computer according to the demand.
Pend/Z	In place/Z signal output	
BRK	Brake output signal	
COM	Output signal common terminal	

3-3-2. Control signal timing diagram

To ensure the reliability of system response, we have the following requirements for each control signal:

- Signal high voltage level requires 24V to be effective, and low voltage level requires less than 0.5V to be effective.
- ENA (enable signal) should turn to high level at least 3 seconds in advance of DIR (direction signal).
- Ensure that the DIR (direction signal) leads the PUL (pulse signal) falling edge by at least 5 μs.
- The pulse width cannot be less than 1.2 μs.
- The duration of pulse low-level cannot be less than 1.2 μs.

The specific sequence diagram is as follows:
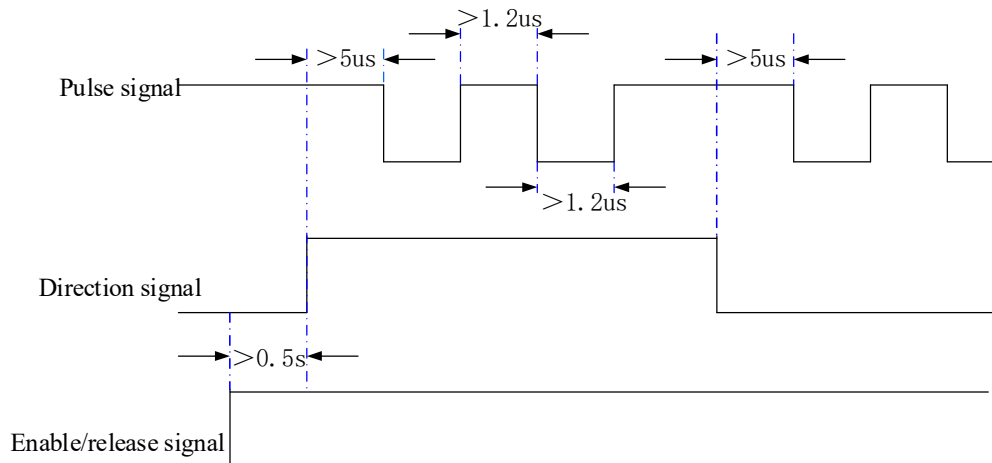
3-3-3. Control signal circuit

Control signal input and output circuit diagram, as shown in the figure below:
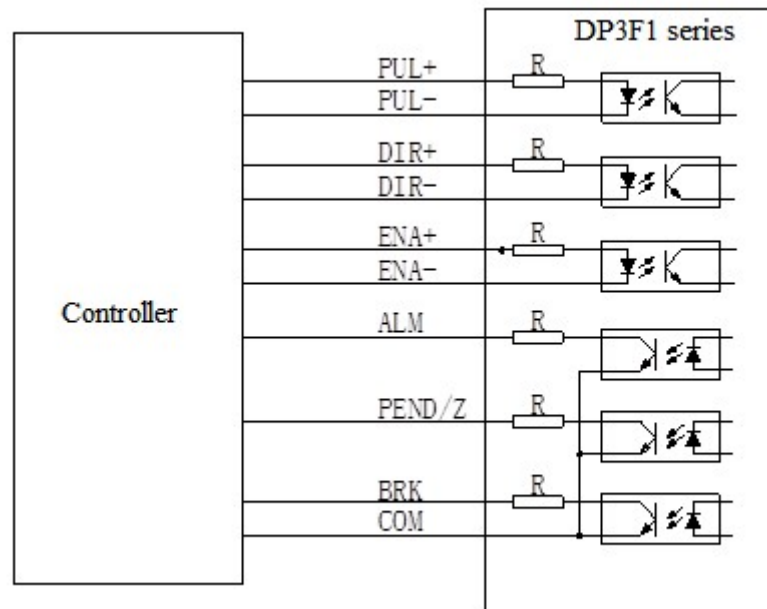
Differential mode input
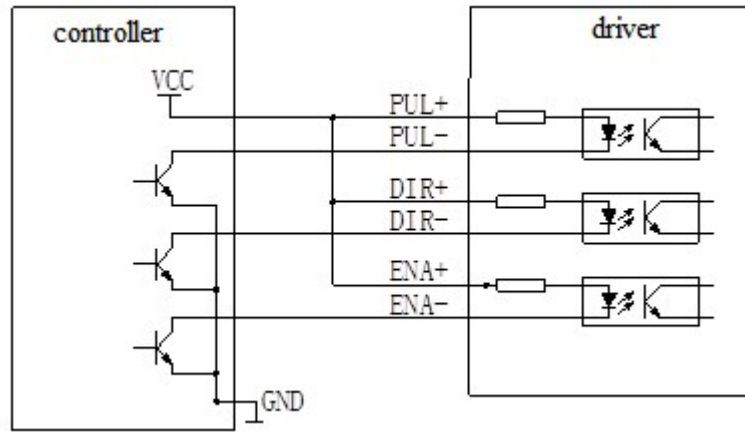
Input single ended common anode connection method
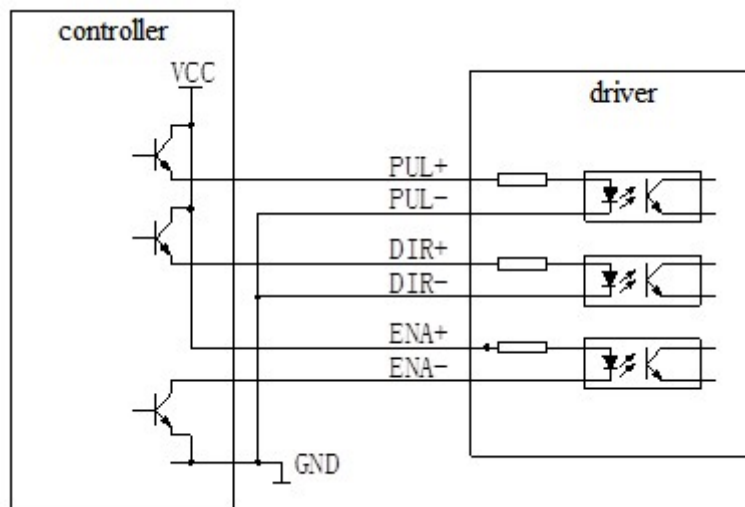
Input single ended common cathode connection

3-4. Encoder signal input terminal
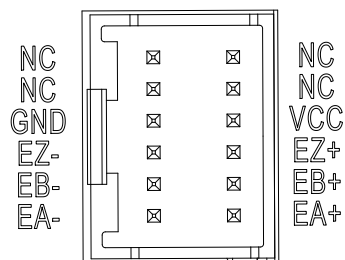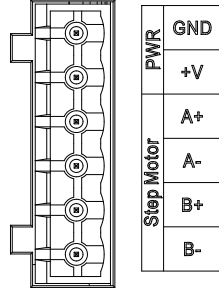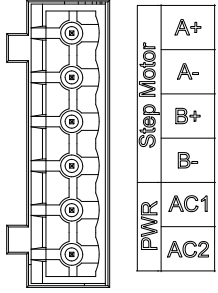
Pin	Name
NC	Reserved
NC	Reserved
NC	Reserved
NC	Reserved
VCC	5V power output, provided by driver, only used for encoder power
GND	supply
EZ+	Encoder Z phase signal +
EZ-	Encoder Z phase signal -

Pin	Name
EB+	Encoder B phase signal +
EB-	Encoder B phase signal -
EA+	Encoder A phase signal +
EA-	Encoder A phase signal -

3-5. Motor and power supply interface

3-5-1. Strong current interface function

DP3F1-305, DP3F1-705	DP3F1-805A, DP3F1-808A

Interface	Function	Explanation
A+, A-	Motor phase A coil	Cannot change direction by exchanging A+, A-
B+, B-	Motor phase B coil	Cannot change direction by exchanging B+, B-
GND	DC power supply ground	DC power supply ground
+V	DC power supply positive pole	Select the voltage according to the demand
AC1, AC2	AC power supply	

Note:

DP3F1-305 range is 20~50VDC: recommended value is 24~36VDC.

DP3F1-705 range is 20~50VDC: recommended value of 57 motor is 24 ~ 36VDC, recommended value of 86 motor and high-speed application is 48V.

DP3F1-805A range: 20-50VAC: recommended above 34V, DC range: DC+20-80VDC, recommended above 48V, AC1/AC2 power supply wiring has no positive or negative polarity distinction;

DP3F1-808A range of 20~80VAC: recommended above 48V, DC range of DC+20~110VDC, recommended above 48V, AC1/AC2 power supply wiring has no positive or negative polarity distinction.

3-5-2. Power supply requirements

The power supply voltage can work normally within the calibration range. The driver should preferably use non-regulated DC power supply, or use transformer + bridge rectifier + capacitor filter. It is recommended that users use 24V-48VDC power supply (except DP3F1-805A, DP3F1-808A) to avoid grid fluctuation exceeding the working range of driver voltage. If the regulated switching power supply is used, the switching power supply output current range should be set to the maximum.

Note:

(1) Do not reverse the power supply voltage!

(2) Do not exceed the working range of the power supply to ensure the normal operation of the driver.

(3) The power supply should be non-regulated DC power supply, and the output capacity of the power supply should be greater than 60% of the set current of the driver.

(4) If the stabilized voltage switching power supply is used for power supply, the output current range of the power supply should be greater than the working current of the motor.

(5) In order to save space, two or three drives can share one power supply, but the power supply should be large enough.

4. DIP switch

DP3F1 series drivers adopt 10 digit DIP switch to set subdivision precision and driver related function settings. Detailed description is as follows:
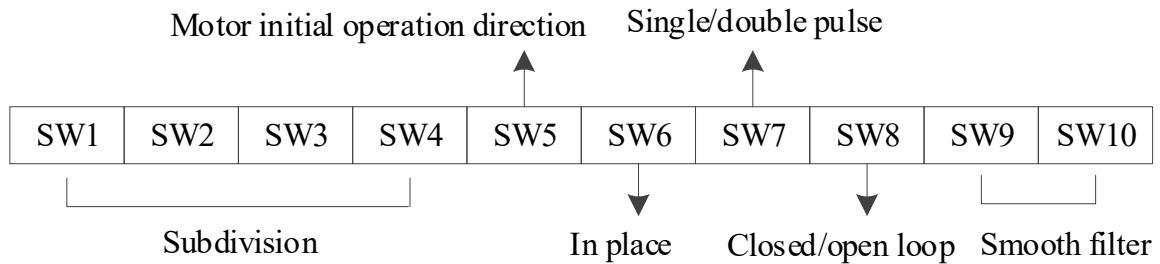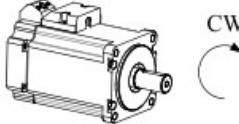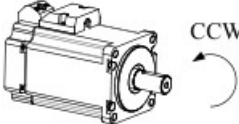
4-1. DIP switch functions

SW1-SW4 is used for subdivision setting, as shown in the following table:

Step	SW1	SW2	SW3	SW4
Default, set by upper computer (4000)	On	On	On	On
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

The specific functions of SW5-SW10 are as follows:

Switch	Function	ON	OFF
SW5	Initial direction selection of motor	CW (face the shaft end)	CCW (face the shaft end)
SW6	Output in place signal	YES	NO
SW7	Control signal pulse mode	Double pulse (CW/CCW)	Pulse+ direction
SW8	Open/closed loop	Open loop	Closed loop

Switch	Function	ON			OFF
SW9 SW10	Smooth filter	3ms, 12ms, 25ms instruction filtering time can be set in combination			
		Smooth time	SW9	SW10	
		Shut down the filter	ON	ON	
		3ms	ON	OFF	
		12ms	OFF	ON	
		25ms	OFF	OFF	

5. Driver parameters

DP3F1 series driver parameters can be set by PC. The driver has a set of best default configuration parameters corresponding to the motor, which does not need to be adjusted normally. Refer to the table below for specific parameters and functions.

Group P0: Basic function

Parameter	Address	Function	Range	Default	Note
P0-01	0x0001	Subdivision	200~51200	4000	Subdivision switch takes effect when all on, otherwise can set subdivision by switch
P0-02	0x0002	Pulse filter	0~48	1	Filter switch takes effect when all on, otherwise can set subdivision by switch setting
P0-03	0x0003	Closed loop current percentage	1~100	100	Maximum current percentage in closed loop mode Maximum current in closed loop mode= Percentage of closed loop current % × peak current
P0-04	0x0004	Control mode	0~1	0	0: External pulse 1: Internal speed
P0-05	0x0005	Open loop current percentage	1~100	50	Operating current in open loop mode = Percentage of open loop current % × peak current
P0-06	0x0006	Open/closed loop mode	0~1	1	0: Open loop mode; 1: Closed loop mode
P0-07	0x0007	Pulse edge	0~1	0	0: Rising edge 1: Falling edge
P0-08	0x0008	Pulse mode	0~1	1	0: CW/CCW 1: Pulse + Direction
P0-09	0x0009	Closed loop holding current percentage	1~100	50	Closed loop holding current = Percentage of closed loop holding current % × Maximum current in closed loop mode
P0-15	0x000F	Rigidity level	0~7	3	The larger the value, the stronger the rigidity
P0-16	0x0010	Motor stall detection	0~1	0	0: enable the stall detection 1: disable the stall detection

Group P1: Gain control parameters

Parameter	Address	Function	Range	Default	Note
P1-00	0x0100	Current Auto-tuning	0~1	1	0: Set parameters; 1: Self-tuning parameters
P1-01	0x0101	Current Kp	1~65535	1500	
P1-02	0x0102	Current Ki	1~65535	400	
P1-03	0x0103	Current kd	0~65535	0	
P1-04	0x0104	Current Kc	0~65535	0	

P1-05	0x0105	Speed Kp	1~65535	60	
P1-06	0x0106	Speed Ki	0~65535	0	
P1-07	0x0107	Position Kp	1~65535	2200	
P1-08	0x0108	Position Ki	0~65535	500	
P1-09	0x0109	Back EMF	1~300	50	
P1-10	0x010A	Weak magnetic coefficient	1~100	20	
P1-11	0x010B	Inductance	1~10000	1000	
P1-12	0x010C	Startup delay	1~10	1	
P1-13	0x010D	In place delay	0~100	3	
P1-14	0x010E	In place error	0~100	4	

Group P2: IO configuration parameters

Parameter	Address	Function	Range	Default	Note
P2-00	0x0200	Motor enable	0~1	0	0: Not enable 1: Enable
P2-01	0x0201	Z phase /in-place output	0~1	0	0: Z phase 1: In-place
P2-02	0x0202	Alarm output	0~1	0	0: High level 1: Low level
P2-03	0x0203	Brake output	0~1	0	0: High level 1: Low level
P2-04	0x0204	Z phase /in-place level	0~1	0	0: High level 1: Low level
P2-05	0x0205	Alarm clear	0~1	0	0: High level 1: Low level

Group P3: Protection function parameters

Parameter	Address	Function	Range	Default	Note
P3-00	0x0300	Tracking error limit	1~32000	4000 (1 turn)	
P3-02	0x0302	Under voltage alarm threshold	0~20	0	When the default value is 0, the alarm is shielded

Group P4: Motor parameters

Parameter	Address	Function	Range	Default	Note
P4-00	0x0400	Peak current	305: 1~40 705: 1~70	305: 30 705: 70	Unit: 0.1A
P4-02	0x0402	Operation direction	0~1	0	0: Counter clockwise 1: Clockwise
P4-03	0x0403	Rotation detection threshold	0~65535	1	Threshold for detecting rotation, Unit: rpm
P4-04	0x0404	Z signal output holding time	1~65535	2	Unit: ms

Group P5: Internal speed parameters

Parameter	Address	Function	Range	Default	Note
P5-04	0x0504	Acceleration	1~2000	200	Unit: rpm/s
P5-05	0x0505	Direction	0~1	0	0: Counter clockwise; 1: Clockwise
P5-10	0x050A	Startup speed	0~2000	200	Unit: rpm
P5-11	0x050B	Stop speed	0~2000	200	Unit: rpm
P5-13	0x050D	Preset speed 1	0~2000	200	Unit: rpm

Group P7: Communication parameters

Parameter	Address	Function	Range	Default	Note
P7-00	0x0700	Driver station no.	1~100	1	
P7-01.0~1	0x0701.0~1	Baud rate	04：4800 05：9600 06：19200 07：38400 08：57600 09：115200 0A：192000 0B：256000 0C：288000	06	Default: 19200bps, 1 stop bit, even parity
P7-01.2	0x0701.2	Stop bit	0: 2 bits 2: 1 bit	2	
P7-01.3	0x0701.3	Parity bit	0: no parity 1: odd parity 2: even parity	2	

Group P8: Curve acquisition

Parameter	Address	Function	Range	Default	Note
P8-00	0x0800	Sampling channel 1	0~FFFF	8001	
P8-01	0x0801	Sampling channel 2	0~FFFF	8003	
P8-02	0x0802	Sampling channel 3	0~FFFF	0	
P8-03	0x0803	Sampling channel 4	0~FFFF	0	
P8-04	0x0804	Sampling channel 5	0~FFFF	8002	
P8-05	0x0805	Sampling channel 6	0~FFFF	8004	
P8-06	0x0806	Sampling channel 7	0~FFFF	0	

Parameter	Address	Function	Range	Default	Note
P8-07	0x0807	Sampling channel 8	0~FFFF	0	
P8-08	0x0808	Sampling channel 9	0~FFFF	1008	
P8-09	0x0809	Sampling channel 10	0~FFFF	1009	
P8-10	0x080A	Sampling channel 11	0~FFFF	0	
P8-11	0x080B	Sampling channel 12	0~FFFF	0	
P8-12	0x080C	Sampling channel 13	0~FFFF	0	
P8-13	0x080D	Sampling channel 14	0~FFFF	0	
P8-14	0x080E	Sampling channel 15	0~FFFF	0	
P8-15	0x080F	Sampling channel 16	0~FFFF	0	
P8-16	0x0810	Sampling mode	0~5	1	0: None; 1: Manual; 2: Automatic; 3: Conditional trigger; 4: Enable trigger; 5: Error trigger
P8-17	0x0811	Sampling interval	1~65535	20	
P8-18	0x0812	Sampling time	0~65535	1024	
P8-19	0x0813	Trigger channel	0~FFFF	0	
P8-20	0x0814	Trigger threshold low bit	0~65535	0	
P8-21	0x0815	Trigger threshold high bit	0~65535	0	
P8-22	0x0816	Trigger slope	0~65535	0	
P8-23	0x0817	Sampling percentage	0~100	100	

Group U0: Monitor parameters

Parameter	Address	Content		Note
U0-00	0x1000	Set speed		rpm
U0-01	0x1001	Feedback speed		rpm
U0-02	0x1002	Encoder feedback	0~15 bits	Encoder pulse
U0-03	0x1003		16~31 bits	
U0-04	0x1004		32~47 bits	
U0-05	0x1005		48~62 bits, 63: direction bit	
U0-06	0x1006	Feedback pulse numbers	0~15 bits	Command pulse
U0-07	0x1007		16~31 bits	
U0-08	0x1008		32~47 bits	

Parameter	Address	Content		Note
U0-09	0x1009		48~62 bits, 63: direction bit	
U0-10	0x100A	Pulse numbers	0~15 bits	Command pulse
U0-11	0x100B		16~31 bits	
U0-12	0x100C		32~47 bits	
U0-13	0x100D		48~62 bits, 63: direction bit	
U0-14	0x100E	Position offset	0~15 bits	Command pulse
U0-15	0x100F		16~31 bits	
U0-16	0x1010	Single turn encoder counting value	0~15 bits	Encoder pulse
U0-17	0x1011		16~31 bits	
U0-18	0x1012	Single turn pulse counting value	0~15 bits	Command pulse
U0-19	0x1013		16~31 bits	
U0-20	0x1014	Pulse turns	0~15 bits	
U0-21	0x1015		16~31 bits	
U0-22	0x1016	Encoder turns	0~15 bits	
U0-23	0x1017		16~31 bits	
U0-24	0x1018	Feedback electric angle		
U0-25	0x1019	Given electrical angle		
U0-26	0x101A	A phase feedback current		mA
U0-27	0x101B	B phase feedback current		mA
U0-28	0x101C	Reference feedback current		mA
U0-29	0x101D	A phase given current		mA
U0-30	0x101E	B phase given current		mA
U0-31	0x101F	Reference given current		mA
U0-32	0x1020	Bus voltage		V

Group U1: Monitor parameters

Parameter	Address	Content	Note
U1-00	0x1100	Present alarm code	
U1-01	0x1101	Phase A current when alarm occurs	
U1-02	0x1102	Phase B current when alarm occurs	
U1-03	0x1103	Reference current when alarm occurs	
U1-04	0x1104	Bus voltage when alarm occurs	
U1-05	0x1105	Position offset when alarm occurs	
U1-06	0x1106	Speed when alarm occurs	
U1-07	0x1107	The time when alarm occurs	0~15 bits
U1-08	0x1108	The time when alarm occurs	16~31 bits
U1-09	0x1109	Error numbers for this time operation	
U1-10	0x110A	Latest 2nd alarm code	
U1-11	0x110B	Latest 3rd alarm code	
U1-12	0x110C	Latest 4th alarm code	
U1-13	0x110D	Latest 5th alarm code	
U1-14	0x110E	Latest 6th alarm code	

Group U2: Monitor parameters

Parameter	Address	Content	Note
U2-00	0x1200	Power on times	
U2-01	0x1201	Machine type	
U2-02	0x1202	Series	
U2-03	0x1203	Model	
U2-04	0x1204	Firmware generation date	Year
U2-05	0x1205	Firmware generation date	Month
U2-06	0x1206	Firmware generation date	Day
U2-07	0x1207	Software version	
U2-08	0x1208	Hardware version	
U2-09	0x1209	Power on operation time	Hour
U2-10	0x120A	Power on operation time	Minute
U2-11	0x120B	Power on operation time	Second
U2-12	0x120C	Device serial number	0~15 bits
U2-13	0x120D	Device serial number	16~31 bits
U2-14	0x120E	Firmware generation date	Year
U2-15	0x120F	Firmware generation date	Month /day
U2-16	0x1210	Firmware generation date	Hour /minute

6. Common troubleshooting

Fault	Reason	Solution
The power light doesn't work	Power supply system error	Check the power supply circuit
	Low supply voltage	Increase the power supply voltage
The motor doesn't work	The current setting is too small	Set suitable current
	The subdivision is too large	Set suitable subdivision
	Protection circuit action	Power on again
	Release signal is low	Do not connect this signal
	Not power on	Power on again
	Motor wiring error	Check the wiring
	No pulse signal input	Check the pulse cable and signal voltage
Motor direction is error	Line failure	Check the circuit
Alarm light is on	Motor cable connection error	Wiring again
	Voltage too high or too low	Adjust the power supply voltage
	Motor or driver damaged	Check the motor and driver
Motor torque is small	Acceleration is too fast	Decrease the acceleration value
	The model selection is not suitable	Select the model again

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