
WINDCNC

All-Digital Spindle Servo Unit

Quick Start Guide

NanJing WindCNC Technology Co., Ltd.

Version: V2.04

Perfect every single detail of products scrupulously

Follow the advanced technologies actively and keenly

Serve every customer sincerely and effectively

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Version History

Version: 2.04

Updated on: August 27, 2020

Updates:

1. Added the torque limit control mode F5-17

Version: 2.03

Updated on: August 27, 2020

Updates:

2. Optimized the overload protection function
3. Added the oriented spindle stop function
4. Added the external locking signal
5. Combined single encoder and second encoder functions

Introduction

■ Thank you for purchasing DF-SAXXX series spindle servo drive from NanJing WindCNC Technology Co., Ltd. The drive is designed for machining and other automation fields, and its response characteristics, overload capacity, speed smoothness and other indicators are better than traditional variable-frequency drives in all aspects, and more suitable for spindle applications such as lathes, milling machines and machining centers, grinding machines, planers, hobbing machines, etc. It can participate in the position interpolation control of coordinate axes and has the same speed control performance of synchronous servo. It is a high performance asynchronous motor servo drive.

Please read this manual carefully before use to ensure proper installation, commissioning and use of the drive, so as to make it perform perfectly for control use.

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Cautions and Notes

- **When performing wiring or maintenance work, be sure to disconnect the power supply first.**
Because there is a large capacity electrolytic capacitor inside the drive, the internal circuit is still high-voltage. To prevent electric shock, do not touch the power terminal within 5 minutes.

The CHARGE indicator will turn off when the power is discharged. Make sure that the CHARGE indicator is off before connecting and checking.
- **Do not run the power and signal cables through the same tube, and do not tie them together.**
When wiring, make sure that the power and signal cables are 30cm or more.
- **Use double-stranded cable and multi-core double-stranded shielded cable for encoder cable.**
- **The maximum wiring length of input and output signal cables is 5m, and that of encoder cables is 20m.**
- **Select the R, S, T, U, V, and W power cables with the appropriate current density according to the motor power.**

Model Selection Guide

Model definition rule: DF – SXXXX AC380V

DF	SA	XXX		M	AC380V
Da Feng	Asynchronous servo	Code	Rated power	Blank: pulse analog quantity M: MII bus	Input voltage
		022	2.2KW		
		037	3.7KW		
		055	5.5KW		
		075	7.5KW		
		110	11KW		
		150	15KW		
		185	18.5KW		
		220	22KW		

Example: Model DF-SA037 i.e., Da Feng asynchronous spindle servo with rated power of 3.7KW, and input voltage of 380V AC

Model selection according to external braking resistor:

Servo drive model	Minimum power of braking resistor	Minimum resistance of braking resistor	Qty
DF-SA022 (2.2KW)	600W	55 ohms	1
DF-SA037 (3.7KW)	1000W	45 ohms	1
DF-SA055 (5.5KW)	1200W	32 ohms	1
DF-SA075 (7.5KW)	1500W	30 ohms	1
DF-SA110 (11KW)	1000W	45 ohms	2
DF-SA150 (15KW)	1200W	32 ohms	2
DF-SA185 (18.5KW)	1200W	32 ohms	2
DF-SA220 (22KW)	1200W	32 ohms	2

Model selection according to circuit breaker, contactor, and cable:

Servo drive model	Circuit breaker (air switch A)	Main circuit cable (copper core area mm ²)	Contactor (current A)
DF-SA022 (2.2KW)	10A	2.5	9
DF-SA037 (3.7KW)	16A	4	16
DF-SA055 (5.5KW)	32A	4	18
DF-SA075 (7.5KW)	40A	6	25
DF-SA110 (11KW)	63A	6	32
DF-SA150 (15KW)	63A	10	50
DF-SA185 (18.5KW)	100A	16	63
DF-SA220 (22KW)	100A	16	80

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Chapter One Installation and Dimension

1.1 Environmental requirements for servo drive installation

- Temperature: 0~55°C;
- Ambient humidity: not more than 90% RH (non-condensing);
- Altitude: not exceeding 1000m;
- Vibration limit: 4.9m/s²;
- Impact limit: 19.6m/s²;
- Other notes and cautions on installation:

- Installed in a control cabinet

It is necessary to take into account the size of the control cabinet, the placement of the servo drive and the cooling method to ensure that the ambient temperature of the servo drive is below 55°C. For details of the operation, please refer to the relevant description under paragraph 1.2.2.

- Installed near a heat source

It is necessary to control heat source radiation and temperature rise due to convection to ensure that the ambient temperature of the servo drive is below 55°C.

- Installed near a vibration source

It is necessary to install vibration isolation devices to avoid transmission of vibration to the servo drive.

- Exposed to corrosive gases

Take necessary measures to prevent exposure to corrosive gases. Corrosive gases may not immediately affect the servo drive, but can obviously cause failure of electronic components and contactor-related devices.

- Other environments

Do not make the drive exposed to high temperature, high humidity, dewdrops, oil spills, dust, iron filings or radiation.

Note: When storing the servo drive with the power off, place the drive in the following environment: -20 to 85°C, not more than 90% RH (non-condensing)

1.2 Installation of Servo Drive

1.2.1 Direction

The servo drive can be installed in a variety of ways, but in any case, the servo drive must be installed in the vertical direction.



1.2.2 Installation standards

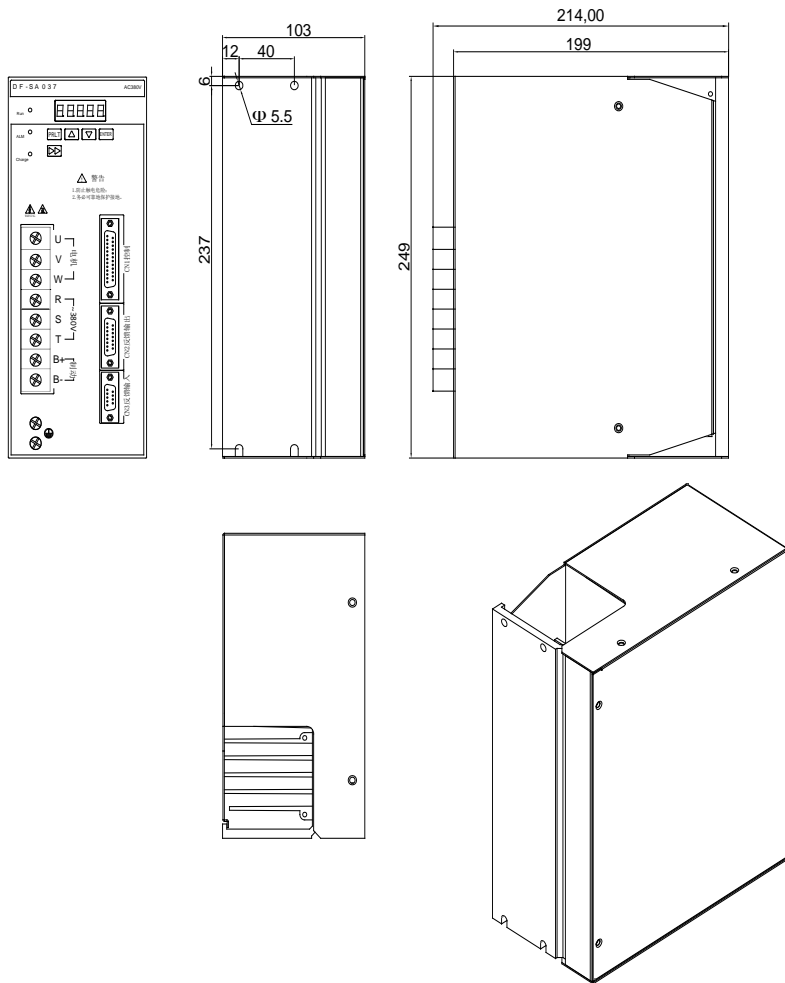
· Servo installation direction

Install the servo vertically on the wall with the operation panel facing outwards;

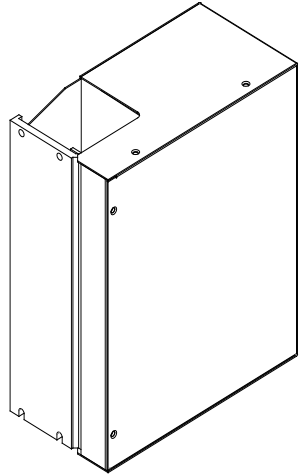
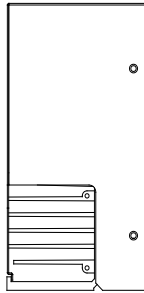
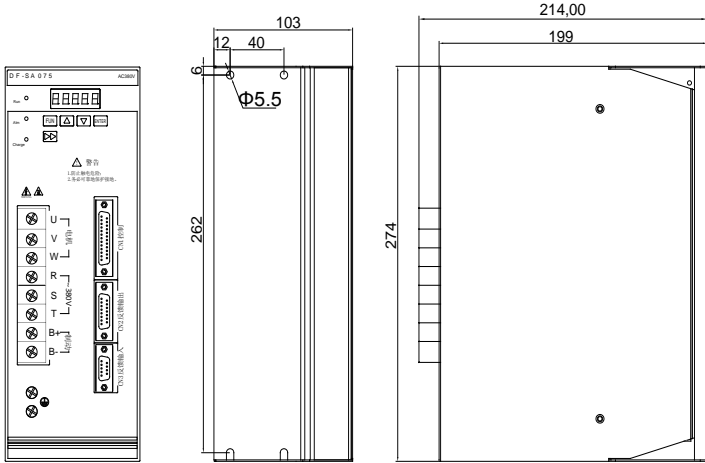
· Heat dissipation

Refer to the diagram and leave enough space for fan and air convection

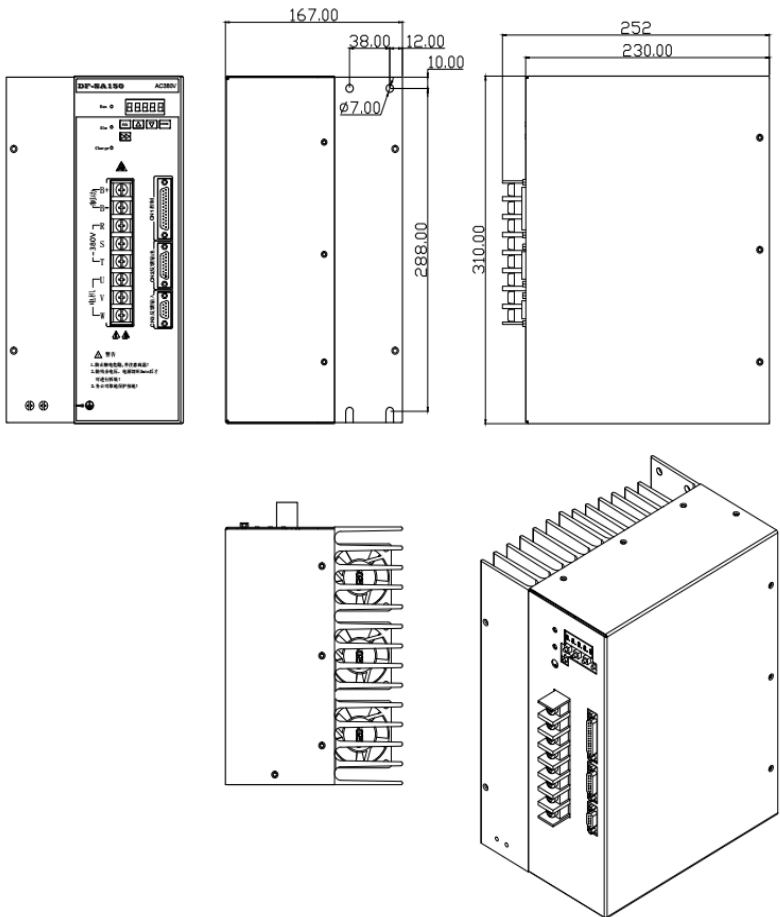
1.2.3 Installation dimensions



(a) 2.2KW-5.5KW



(b) 7.5KW-11KW



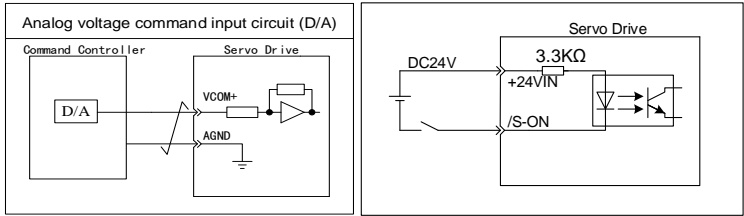
(c) 15KW-22KW

Chapter Two Interface and Wiring

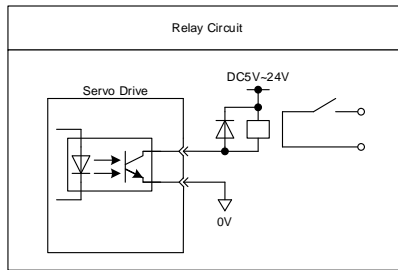
2.1 Technical Specifications

Spindle servo	DF-SA037	DF-SA055	DF-SA075	DF-SA110	DF-SA150	DF-SA185	DF-SA220
Adaptable	≤4KW	≤5.5KW	≤7.5KW	≤11KW	≤15KW	≤18.5KW	≤22KW
Rated current	≤10A	≤13.5A	≤19A	≤24A	≤30A	≤38A	≤43A
Control mode			Position control, test run, speed control, etc.				
Encoder feedback			Two-way 100-10000-line incremental encoder				
Operating conditions	Ambient temperature / Storage temperature		Operating ambient temperature: 0~+50°C, storage temperature: -20~+85°C				
	Ambient humidity /		90% RH or less (no freezing or condensation)				
	Vibration / Impact		4.9m/s ² / 19.6m/s ²				
Input voltage			Three-phase 380/400/415/440V (+10% - 15% error allowed)				
Maximum spindle speed			Maximum 15000rpm for 2-pole motor				
Performance	Speed control range		1:10000 (The lower limit of speed control range requires smooth running without creep at rated load)				
	Speed control accuracy		1mm				
	Position control		1pulse				
	Braking mode		External energy consumption resistance braking				
Spindle function			Oriented spindle stop, rigid tapping, C-axis control, thread cutting, electronic gearing, swing control				
Simulated speed Command	Command voltage		DC±10V or MII bus command				
	Input impedance		About 20KΩ				
	Circuit time parameter		50μs				
Position Command input	Position command		Direction+pulse, A, B quadrature pulse or MII bus command				
	Position command		≤500kHz				
Input signal	Digital input		7 points (NPN type)				
Output signal	Digital output		6 points (NPN type) +24V DC 70mA				
Encoder pulse output			A-phase, B-phase and C-phase RS422 differential pair drive				
Protection functions			Overcurrent, overvoltage, undervoltage, overload, overspeed, encoder feedback error, etc.				
Monitoring functions			Spindle speed, current position, position deviation, motor current, input and output signals, etc.				
Intelligent function			Self-learning of motor parameters				
Overload capacity			2-3 times				

2.1.1 Input signal schematic



2.1.2 Output signal schematic



2.2 Terminal Definition

2.2.1 Description of drive terminals:

1) First encoder input (CN3):

This interface on the drive side is a DB9 hole type socket;

Port	Pin	Name	Function	Remarks
CN3	1	IENA+	Differential input positive terminals of the first encoder	
	2	IENB+		
	3	IENC+		
	4	+5V	Digital +5V power supply	
	5	GND	Digital +5V power supply grounding	
	6	IENA-	Differential input negative terminals of the first encoder	
	7	IENB-		
	8	IENC-		
	9	GND	Digital +5V power supply grounding	

2) Second encoder input (optional) and first encoder output (CN2):

This interface on the drive side is a DB15 hole type socket;

Port	Pin	Name	Function	Remarks
CN2	1	GND	Digital +5V power supply grounding	
	2	ENAOUT-	Differential output negative terminals of the first encoder	
	3	ENBOUT-		
	4	ENCOUT-		
	9	ENAOUT+	Differential output positive terminals of the first encoder	
	10	ENBOUT+		
	11	ENCOUT+		
	8	GND	Digital +5V power supply grounding	
	7	2ENC-	Differential input positive terminals of the second encoder	
	6	2ENB-		
	5	2ENA-		
	14	2ENC+	Differential input negative terminals of the second encoder	
	13	2ENB+		
	12	2ENA+		
	15	+5V	Digital +5V power supply	

3) Control signal input (CN1):

This interface on the drive side is a DB25 hole type socket;

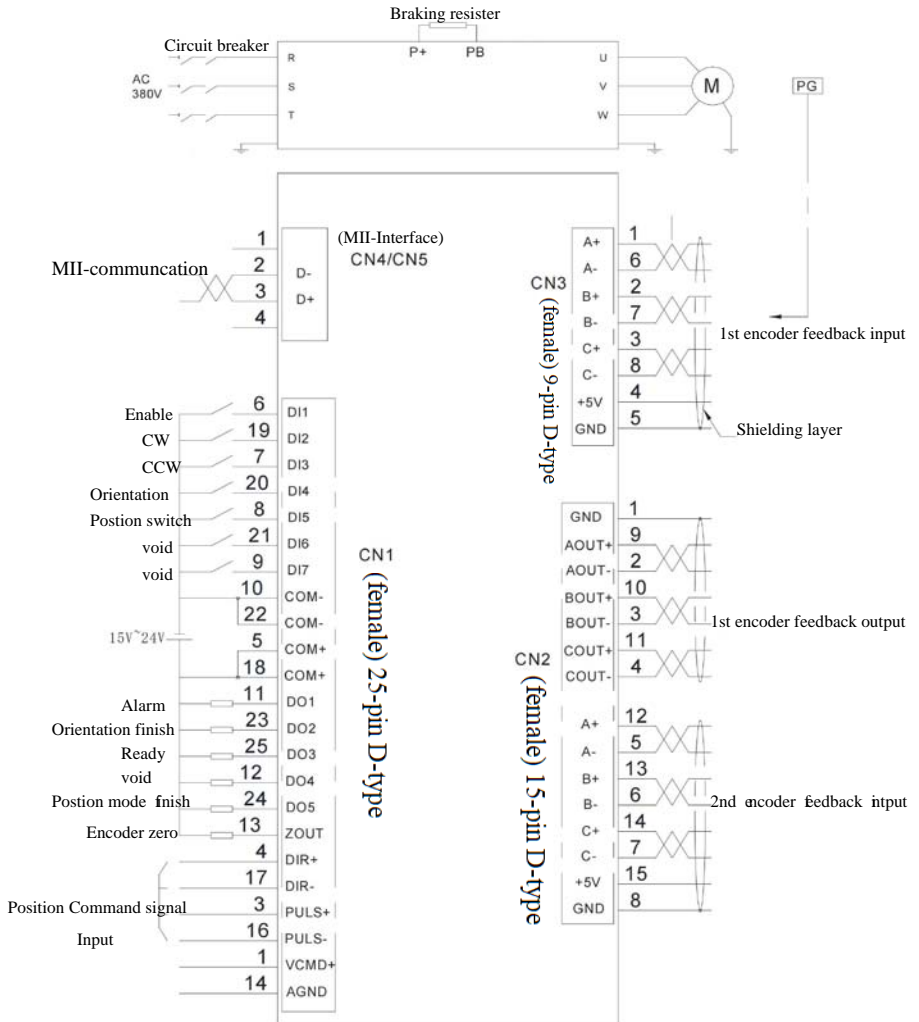
Port	Pin	Name	Function	Remarks
CN1	6	DI1	Enable input	NPN type
	19	DI2	CW forward rotation input	NPN type
	7	DI3	CCW reverse rotation input	NPN type
	20	DI4	Positioning input	NPN type
	8	DI5	Speed/Position mode switching	NPN type
	21	DI6	Standby	NPN type
	9	DI7	Standby	NPN type
	5	COM+	Common terminals of input points (connected with an external DC power supply of 15 V~24 V)	
	18	COM+		
	11	DO1	Alarm output	NPN & NO
	23	DO2	Positioning completion output	NPN & NO
	25	DO3	Servo ready for output	NPN & NO
	12	DO4	Control mode switching completed	NPN & NO
	24	DO5	Zero speed output	NPN & NO
	13	ZOUT	Encoder zero position signal output	NPN & NO
	10	COM-	Common terminals of output points (connected with grounding point of an external DC power supply of 15 V ~ 24 V)	
	22	COM-		
	4	DIR+	Position direction input	
	17	DIR-		
	3	PULS+	Position command pulse input: Pulse + direction	
	16	PULS-		
	1	VCMD+	Analog input (0-10V)	
	14	AGND	Analog grounding	
2	Reserve	Do not use		
15	Reserve	Do not use		

4) MII bus interface (CN4/CN5):

The interface on the drive side is an MII bus socket;

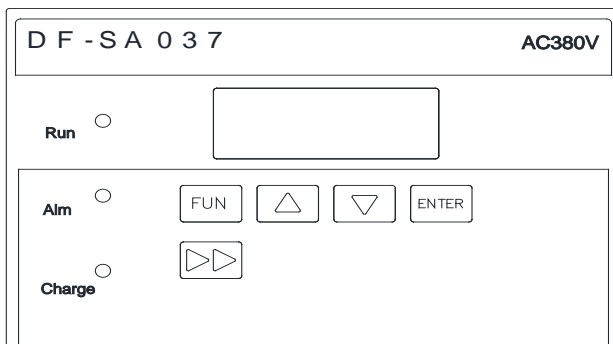
Port	Pin	Name	Function	Remarks
CN4/CN5	1	Reserve		
	2	D-	MII bus communication data is negative	
	3	D+	MII bus communication data is positive	
	4	Reserve		

2.2.2 Drive terminal connection schematic:



Chapter Three Operating Instructions






3.1 Functions of Panel Operator







Run ○ : Operation indicator

Charge ○ : internal main power indicator

Alm ○ : fault indicator

Symbol	Name	Functions
	Function key	Main function switching: status display, parameter setting and monitoring
	DOWN key	Press the DOWN key to reduce the set value
	UP key	Press the UP key to increase the setting value
	Setting key	Press this key to display the settings and values of parameters and enter the parameter setting status
	Shift key	Press this key to select the parameter bit to be set

Note: Refer to the function applications under Chapter Five to set corresponding parameters.

1. Press  and  at the same time to start test run or parameter self-learning
2. Press  and  at the same time to stop test run or parameter self-learning

Chapter Four Parameter Definitions

Descriptions of symbols in the table: @ - indicates that the parameter function is a non-standard option function

X - indicates that the parameter will be valid after power-on and restart

√ - indicates that this parameter will be valid immediately after modification

4.1 Function Parameter Table

System parameter					
Function code	Name	Setting range	Minimum unit	Factory setting	Be valid immediately
F0-00	Motor control mode	0: frequency conversion mode 1: V/F 2: servo mode	1	2	√
F0-01	Speed command source	0: analog port 1 1: standby 2: pulse command 3: speed for test run	1	0	√
F0-02	Speed for test run	0~10000 RPM	1 RPM	300 RPM	√
F0-03	Parameter initialization	0: no operation 1: restore the factory settings 2: save the parameters to EEROM	1	0	×

F0-04	Motor tuning selection (only valid when F0-09 is 0)	0: no action 1: motor static self-learning 2: motor dynamic self-learning 3: encoder phase sequence self-learning 4: encoder phase sequence + transmission ratio self-learning 5: motor dynamic + encoder phase sequence self-learning 6: motor dynamic + encoder phase sequence + transmission ratio self-learning	1	0	√
F0-05	Run command channel selection	0: Operating keyboard run command channel 1: Control port run command channel	1	1	√
F0-06	Upper limit of torque	0.0~300.0%	0.1	200.0%	×
F0-07	Maximum spindle speed	100~15000 RPM	1 RPM	3000 RPM	√
F0-08	Shutdown status monitoring parameter selection	0~3 0: motor speed 1: set speed 2: output current 3: bus voltage	1	0	√
F0-09	Shutdown mode	0: deceleration shutdown 1: free shutdown	1	0	√

F0-10	Manufacturer password	0~65535	1	0	×
F0-11	Shieldable fail-safe start control	The units place: Input phase loss protection (1 valid) The tens place: Motor overheat protection (1 valid) The hundreds place: Shield #17 alarm (1 valid)	1	0000H	×
F0-13	Overload current percentage	0-90%	1	70	×
F0-14	Alarm delay time	0-65536S	1	0.2	√
F0-15	Allowable difference of target speed	0-100%	1	80	√
Motor parameters:					
F1-00	Rated power of motor	1.5~22.0KW	0.1KW	Model settings	√
F1-01	Rated frequency of motor	0.01Hz~1000.00HZ	0.01Hz	50Hz	√
F1-02	Rated voltage of motor	0~460V	1V	Model settings	√
F1-03	Rated current of motor	0.1~2000.0A	0.1A	Model settings	√
F1-04	Rated speed of motor	0~15000RPM	1RPM	Model settings	√
F1-05	Number of motor pole pairs	0~50	1	2	√

F1-06	Number of encoder lines	100~20000	1	2500	√
F1-07	Encoder phase sequence	0: A ahead of B 1: B ahead of A	1	0	√
F1-08	Motor no-load current	0.1~6553.5A	0.1A	Model settings	×
F1-09	Motor stator resistance	0.001~65.535Ω	0.001Ω	Model settings	×
F1-10	Motor rotor resistance	0.001~65.535Ω	0.001Ω	Model settings	×
F1-11	Stator and rotor inductance of motor	0.1~6553.5mH	0.1mH	Model settings	×
F1-12	Stator-rotor mutual inductance of motor	0.1~6553.5mH	0.1mH	Model settings	×
F1-13	Rotor inertia of motor	1~1000 F1.13= F1.13* D-00/ D-09	10	Model settings	×

Terminal parameters:					
F2-00	Spindle operation control mode	0: Enable + direction; 1: CCW + CW; 2: Enable + CCW + CW;	1	1	√
F2-01	Input terminal DI1 function	0: The console is idle 1: Enabled by spindle	1	1	√
F2-02	Input terminal DI2 function	2: Enabled by spindle forward rotation	1	2	√
F2-03	Input terminal DI3 function	3: Enabled by spindle reverse rotation	1	3	√
F2-04	Input terminal DI4 function	4: Spindle positioning 5: Switching between spindle	1	4	√
F2-05	Input terminal DI5 function	position ring and speed ring 6: External reset signal input	1	5	√
F2-06	Input terminal DI6 function	(RST) 7: Spindle zero servo 8: Spindle emergency stop	1	6	√
F2-07	Input terminal DI7 function	9: Spindle forward and backward 10: Spindle analog gain switching 11: Spindle swing mode 12: Orientation position option 1 13: Orientation position option 2 14: Orientation position option 3 15: Positioning point acquisition terminal 16: External zero point input 17: Torque limit control input	1	7	√

		18: External fault input			
F2-8	Open collector output terminal DO1 setting	0: No output	1	1	√
F2-9	Open collector output terminal DO2 setting	01: fault output (valid at low level) 11: fault output (valid at high level)	1	2	√
F2-10	Open collector output terminal DO3 setting	2: Positioning completed 3: ready 4: Control mode switching completed	1	3	√
F2-11	Open collector output terminal DO4 setting	5: Zero speed output 6: Preset speed reached	1	4	√
F2-12	Open collector output terminal DO5 setting	7: in service 8: Positioning completion output	1	5	√
Speed loop parameters:					
F3-00	Speed loop (ASR) Proportional gain 1	0~500HZ	1HZ	200HZ	√
F3-01	Speed loop (ASR) Integration time 1	0.0~1000.0mS	0.1mS	40.0mS	√
F3-02	Speed feedback filtering	0.0~10.0ms	0.1	3.0	√
F3-03	Acceleration time 1	0.1~3600.0S	0.1	1	√
F3-04	Deceleration time 1	0.1~3600.0S	0.1	1	√

Position loop parameters					
F4-00	Position servo proportional gain	1~200	1	25	√
F4-01	Positioning proportional gain	1~120	1	20	√
F4-02	Position command mode (pulse input mode)	0: A and B are orthogonal 1: PLUS + SIGN 2: MII bus command	1	1	√
F4-03	Pulse direction	0: unchanged 1: opposite	0	0	√
F4-04	Position command Gear ratio molecule	0~65535	1	1	√
F4-05	Position command Gear ratio denominator	1~65535	1	1	√
F4-06	Speed pulse Filtering time	0~25ms	1ms	3	√
F4-07	Second encoder phase sequence	0: A ahead of B 1: B ahead of A	1	0	×
F4-08	Number of second encoder lines	1~20000	1	1024	×
F4-09	Second encoder selection	0: invalid 1: valid (Motor parameters are set to '0' during self-learning)	1	0	×

Spindle positioning parameters:					
F5-00	Spindle positioning Acceleration and deceleration time	0.001~65.535S	0.001S	5.000S	√
F5-01	Orientation position 1	0~4*(F1-06)	1 PLUS	0 PLUS	√
F5-02	Positioning speed judgment criteria	0~1500RPM	1RPM	300RPM	√
F5-03	Positioning search speed	0~1500RPM	1RPM	200RPM	√
F5-04	The position reaches the detection level	0~65535 PLUS	1 PLUS	5 PLUS	√
F5-05	Positioning direction	0: speed direction before positioning 1: forward 2: backward	1	1	√
F5-06	Reserve				
F5-07	Reserve				
F5-08	Orientation position 2	0~4*(F1-06)	1 PLUS	0 PLUS	√
F5-09	Orientation position 3	0~4*(F1-06)	1 PLUS	0 PLUS	√
F5-10	Orientation position 4	0~4*(F1-06)	1 PLUS	0 PLUS	√
F5-11	Orientation position 5	0~4*(F1-06)	1 PLUS	0 PLUS	√
F5-12	Orientation position 6	0~4*(F1-06)	1 PLUS	0 PLUS	√
F5-13	Orientation position 7	0~4*(F1-06)	1 PLUS	0 PLUS	√
F5-14	Orientation position 8	0~4*(F1-06)	1 PLUS	0 PLUS	√
F5-15	Position arrival signal Output delay	0~5000ms	1	500ms	√

F5-16	Positioning reference point	0: encoder z signal 1: external input signal	1	0	√
F5-17	Torque limit value	0.00~1.00	0.01	0.50	√
Analog input:					
F6-00	All null bias	-500~500	1	0	√
F6-01	All input filtering time	0.00S~10.00S	0.01S	0.10S	√
F6-02	All input gain	0.01%~600.00%	1	100.00%	√
F6-03	All input polarity	0: unipolar (0~10V) 1: Bipolar (-10~10V)	1	0	×
Communication parameters:					
F7-05	MII bus local address	1 ~ 30: slave station address	1	4	√
F7-06	MII bus communication rate	0: 4M; 1:10M	1	1	√
F7-07	MII communication byte length	0: 17bit; 1:32bit	1	0	√

4.2 Table of codes displayed on monitor

Monitoring code	Name	Range
D-00	Motor speed (RPM/min)	0-36000
D-01	Target speed	0~65535
D-02	Output current (A)	0.1-2000.0
D-03	Bus voltage (v)	0.0-1000.0V
D-04	Input terminal status	0~FFH
D-05	Output terminal status	0~3H
D-06	Analog input AII(V/mA)	0.0-10.0V
D-07	Radiator temperature	-40.0~150.0
D-08	Actual position of motor	0~65535
D-09	Second encoder speed	0~65535
D-10	Position pulse input count is lower by four bits	0~65535
D-11	Position pulse input count is higher by four bits	0~65535
D-12	Actual deviation of position closed loop (following error)	0~65535
D-13	Z-signal real-time sampling value	0~65535
D-14	Pulse input frequency	0~65535
D-15	Reserve	
D-16	Cumulative running time of this machine	0~65535H
D-17	Accumulative power-on time	0~65535H
D-18	Type of previous fault	0~23
D-19	Types of previous two faults	0~23
D-20	Current fault type	0~23
D-21	Running speed at current fault	0~ maximum speed
D-22	Output current at current fault	0. 0~1000.0A
D-23	Bus voltage at current fault	0.0-1000.0V
D-24	Software version number	0.00~99.99

4.3 Fault Code Table

Fault code	Name	Faults and solutions
E-01	Overcurrent	<ol style="list-style-type: none"> 1. UVW wiring error; 2. Encoder signal line wiring error; 3. The motor related parameters are set incorrectly (parameters F1-00 to F1-07); 4. If the wiring is normal, F0-13 to 90 can be increased to increase the overload current threshold; 5. Bad connection and burning of motor side terminals; 6. There is water and oil in the motor. Replace the motor to troubleshoot.
E-02	Bus overvoltage	<ol style="list-style-type: none"> 1. The bus voltage (usually operating) is about 580V, the brake resistor discharge point is about 680V. When the voltage rises too fast to discharge, it can be judged as over-voltage by monitoring the d-03 value. 2. Check whether the external braking resistor is connected or damaged. 3. The deceleration time is too small, increase the setting value of F3-04 appropriately. 4. The resistance value of braking resistor does not match;
E-03	Bus undervoltage	<ol style="list-style-type: none"> 1. The bus voltage (normally operating) is about 580 V. When the voltage is reduced to 400 V, it can be judged as undervoltage by monitoring the d-03 value. 2. Measure the external 380V RST power line to verify whether it is out of phase, or whether the voltage is incorrect. 3. The acceleration time is too small, increase the value of F3-03 appropriately. 4. Re-power after a power failure of a too short duration.

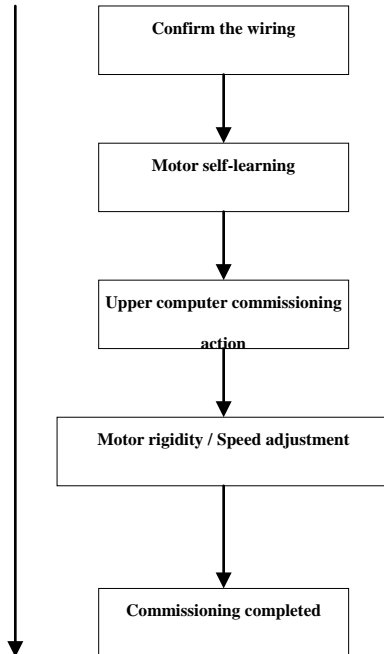
E-04	Motor overload	<ol style="list-style-type: none"> 1. UVW wiring error; 2. Incorrect wiring of the encoder signal line: When the motor is rotating, check whether there is a change in the value of d-08. 3. The motor related parameters are set incorrectly (parameters F1-00 to F1-07); 4. Excessive motor load: check mechanical tightness.
E-05	Drive overload	<ol style="list-style-type: none"> 1. UVW wiring error; 2. Encoder signal error: When the motor is rotating, check whether there is a change in the value of d-08. 3. The motor related parameters are set incorrectly (parameters F1-00 to F1-07); 4. Excessive motor load: check mechanical tightness. 5. Bad connection and burning of motor side terminals;
E-06	IGBT radiator overheating	<ol style="list-style-type: none"> 1. The drive fan is damaged;
E-07	Current detection error	<ol style="list-style-type: none"> 1. Drive failure: replace the drive.
E-08	Motor self-learning fault / Motor overspeed	<ol style="list-style-type: none"> 1. Modify the F1-07 parameter settings and turn power on again to troubleshoot. 2. Encoder signal error: When the motor is rotating, check whether there is a change in the value of d-08. 3. The motor related parameters are set incorrectly (parameters F1-00 to F1-07);
E-09	EEPROM read-write failure	<ol style="list-style-type: none"> 1. Drive failure: replace the drive.
E-10	Power module failure	<ol style="list-style-type: none"> 1. UVW wiring error; 2. Encoder signal error: When the motor is rotating, check whether there is a

		<p>change in the value of d-08.</p> <p>3. The motor related parameters are set incorrectly (parameters F1-00 to F1-07);</p> <p>4. There is no reliable grounding;</p> <p>5. Motor failure, replace the motor to troubleshoot;</p> <p>6. Drive failure: replace the drive to troubleshoot.</p> <p>7. Increase F0-13 to 90;</p> <p>8. Bad connection and burning of motor side terminals;</p> <p>6. There is water and oil in the motor. Replace the motor to troubleshoot.</p>
E-11	Input side out of phase	1. RST out of phase
E-13	Motor overheating	1. The motor fan is damaged or heavily loaded for a long time
E-14	Encoder fault	1. Encoder failure or wiring error
E-15	External equipment failure	
E-16	Abnormal discharge	1. The braking resistance is too large or damaged
E-17	Second encoder speed detection exception	<p>1. F4-07 parameter error;</p> <p>2. Second encoder signal line wiring error;</p>
E-18	Target speed deviation is too large	<p>1. 1. Too much difference between the target speed and actual speed of the motor: check whether the machinery is stuck, or you can increase the value of F0-15 appropriately to reduce the chance of alarm.</p> <p>2. 2. Encoder phase sequence error: modify F1-07.</p> <p>3. Encoder signal error: When the motor is rotating, check whether there is a change in the value of d-08.</p>

		4. Spindle load inertia is too large: increase the setting time of F0-14 appropriately
E-23	The direction of the second encoder is reversed	1. F4-07 parameter error 2. Second encoder signal line wiring error;
E-63	MII bus communication time-out due to disconnection	1. No terminal resistance 2. Wrong socket or cable or poor contact
E-64	MII bus communication synchronization error	1. No terminal resistance 2. Wrong socket or cable or poor contact 3. There is strong interference on site, so it is necessary to add magnetic rings

Chapter Five Commissioning

Steps:



5.1 Motor self-learning operation

5.1.1 Preparation before power-on

Confirm that the main cable wires R/S/T/U/V/W/PE are correctly positioned;

Confirm that the drain resistors are connected to B+ and B-;

Confirm that the control board terminals are wired correctly.

5.1.2 Confirmation of voltage level

Confirm that the input voltage connected to R/S/T is three-phase 380V.

5.1.3 Self-learning of motor parameters

1. Before self-learning, the following parameters should be determined:

Function code	Name	Setting value	Factory settings	Be valid immediately
F0-05	Run command channel selection	0: Operating keyboard run command channel	1	√
F4-09	Second encoder selection	0: invalid	50.00Hz	×

2. Determine motor parameters

F1-00	Rated power of motor	0.4~900.0KW	Model settings	√
F1-01	Rated frequency of motor	0.01Hz~1000.00HZ	Model settings	√
F1-02	Rated voltage of motor	0~460V	Model settings	√
F1-03	Rated current of motor	0.1~2000.0A	Model settings	√
F1-04	Rated speed of motor	0~36000RPM	Model settings	√
F1-05	Number of motor pole pairs	0~50	2	√

F1-06	Number of encoder lines	100~20000	2500	√
F1-07	Encoder phase sequence	0: A ahead of B 1: B ahead of A	1	√

3. Self-learning mode setting

F0-04	Motor tuning selection (only valid when F0-05 is 0)	1: motor static self-learning 5: motor dynamic + encoder phase sequence self-learning	0	√
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Generally F0-04 is set to 1 or 5. It is recommended to set it to 5. If Er-08 (encoder failure) occurs after learning, it is generally the encoder phase sequence error. You can change the phase sequence by modifying the parameter F1-07. Restart the drive F0-04 to reset it to 0, and then resetting is required.

Note:


Apart from the motor static self-learning mode F0-04, other self-learning modes will make the motor rotate. Therefore, before the motor enters the self-learning state, please make sure that it will not cause mechanical failure when rotating.

The self-learning process may be long, please wait patiently, and be careful not to let people close to the spindle in self-learning state

4. Enter the self-learning mode operation

1. Set the motor parameters and select the contents to be learned in F0-04.
2. After confirming F0-05=0 (keyboard enabled), press  to find the interface where LED displays F0.
3. Then press the  key and the  key at the same time, and the keyboard displays "STUDY",

indicating that the system starts self-learning.

4. If the learning process is normal, the LED will display "GOOD" after learning is finished. Then press  to return to the normal display interface.

5. Change F0-05 back to 1, restart the drive, and complete self-learning.

5.2 Upper Computer Commissioning - Speed Control

Basic settings:

Function code	Name	Setting value	Default	Immediately
F0-05	Control mode	1: terminal control	1	√
F0-07	Maximum speed limit	Set according to the motor model	3000	√
F2-02	Forward command input	2	2	√
F2-03	Backward command input	3	3	√

Analog speed control:

F0-01	Speed command source	0: analog port	0	√
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Pulse frequency and speed control:

F0-01	Speed command source	2: pulse frequency	0	√
F4-02	Position command mode	0: A and B are orthogonal 1: PLUS + SIGN	1	√

Commissioning process:

- ① Make sure the parameters of basic settings are set correctly first, and the analog detail settings can be defaulted
- ② Make the upper computer output the forward/backward signal and the analog value
If the upper computer is a numerical control system, use code M03 S300 to test the motor performance
- ③ Adjust the detail settings as required

Detail settings:

F3-03	Acceleration time	1		1	√
F3-04	Deceleration time	1		1	√
F6-00	All null bias	-500~500		0	√

5.3 Upper Computer Commissioning - Servo Spindle

The analog control of servo spindle is debugged according to the method in paragraph 5.2.

Basic settings of position/positioning control:

Function code	Name	Setting value	Factory settings	immediately
F0-00	Motor control mode	2. Inductive vector	2	√
F1-06	Number of encoder lines	To be filled in according to the actual conditions	2500	√
F4-02	Pulse mode	0: A and B are orthogonal or 1: pulse + direction	1	√

Commissioning process:

- ① Make sure the parameters of basic settings are set correctly first, and the detail settings can be defaulted;
- ② Set the gear ratio of the upper computer;
- ③ Make the upper computer output position mode command and send out pulse command to run the spindle;
- ④ Adjust the detailed parameters according to the actual situation;

Detail settings:

F3-00	Proportional gain of speed loop (ASR)	0~500HZ	150	√
F4-00	Position servo proportional gain	1~2000	30	√
F4-01	Positioning/Feeding proportional gain	1~2000	20	√
F4-04	Position command gear ratio molecule	0~65535	1	√
F4-05	Position command gear ratio denominator	1~65535	1	√

Note: The default number of motor encoder lines configured by our company is 2500, and the ratio between F4-04 and F4-05 is 1: 1. If the number of encoder lines is not 2500, it is necessary to set F4-05 to 2500 and F4-04 to the actual number of encoder lines.

5.4 Commissioning of spindle orientation positioning:

Function code	Name	Setting value	Factory settings	Be valid immediately
F5-00	Spindle positioning deceleration time	1	1.000	√
F5-01	Orientation position 1 Spindle orientation	0	0 PLUS	√
F5-02	Positioning speed limit	1000	1000 RPM	√
F5-03	Positioning search speed	800	800 RPM	√
F5-04	The position reaches the detection level	1	1 PLUS	√
F5-05	Positioning direction	0: speed direction before positioning 1: forward 2: backward	0	×

Commissioning process:

- ① Manually toggle the spindle to the expected position
- ② Check the encoder position value of D-08
- ③ Fill the value in D-08 into F5-01
- ④ After exiting F5-01 interface, restart the drive
- ⑤ For the orientation debugging of the upper computer, it is the same as the orientation command M19 of the numerical control system

5.4.1 Multi-position orientation

In some special occasions (for example, the upper computer has no pulse command and the machine tool needs to be positioned from multiple angles), the orientation positions of the spindle can be selected by binary combination of external input signals.

Operational process:

- ① The upper computer sends a combined coding signal to the spindle servo drive to select the expected orientation position
- ② Delay 0.5 seconds
- ③ The upper computer sends an orientation signal to the servo drive to execute the orientation action
- ④ The upper computer detects the proper-orientation signal fed back by the spindle servo
- ⑤ Complete

External code input correspondence

The terminal status corresponds to the selected position	I/O status of corresponding terminal (1: closed 0: open)			
	position option 1	position option 2	position option 3	parameters
Orientation position 1	0	0	0	F5-01
Orientation position 2	1	0	0	F5-08
Orientation position 3	0	1	0	F5-09
Orientation position 4	1	1	0	F5-10
Orientation position 5	0	0	1	F5-11
Orientation position 6	1	0	1	F5-12
Orientation position 7	0	1	1	F5-13
Orientation position 8	1	1	1	F5-14

Wiring reference:

Port	Pin	Name	Function	Remarks
CNI Port	19	DI2	CW forward rotation input	NPN type
	7	DI3	CCW reverse rotation input	NPN type
	20	DI4	Positioning input	NPN type
	8	DI5	Positioning selection input 1	NPN type
	21	DI6	Positioning selection input 2	NPN type
	9	DI7	Positioning selection input 3	NPN type
	11	DO1	Alarm output	NPN type open collector
	23	DO2	Positioning completion output	NPN type open collector

Parameter setting reference:

Function code	Name	Setting value	Factory settings	immediately
F2-02	Input terminal DI2 function	2	2	√
F2-03	Input terminal DI3 function	3	3	√
F2-04	Input terminal DI4 function	4	4	√
F2-05	Input terminal DI5 function	12	5	√
F2-06	Input terminal DI6 function	13	6	√
F2-07	Input terminal DI7 function	14	7	√

5.4.2 Orientation based on external signals

In some special occasions, for example, when the ratio of spindle motor to spindle unit is not 1: 1, the orientation position of spindle unit cannot be determined. If there is no second encoder and the positioning requirements for spindle are not high, the external signal orientation mode can be adopted.

Wiring reference:

Port	Pin	Name	Function	Remarks
CN1	21	DI6	External zero point input	NPN type

Parameter setting reference:

Function code	Name	Setting value	Factory settings	immediately
F2-06	Input terminal DI6 function	16	6	√
F5-16	Positioning reference point	1: external input signal	0	√

5.5 Commissioning of MII Bus Control Mode

1. Motor self-learning related settings

Relevant parameters:

Function code	Name	Setting value	Factory setting	immediately
F0-01	Speed command source	0	0	×
F4-02	Position command mode	0	2	×
F7-05	MII communication address	4	4	×
F7-06	MII bus communication rate	1	1	×
F7-07	MII communication byte length	0	0	×

• Make sure the above parameters are correct, and in addition, do not plug in the USB bus when performing self-learning.

- The others are the same as the way of pulse servo spindle self-learning. See paragraph 5.1.

2. After completing self-learning, make sure that some parameters of the drive are the same as shown in the following table:

F0-05	Control mode	1: terminal control		√
F4-02	Position command mode	2: bus communication		√
F0-01	Speed command source	0		√

3. Power off. Connect the USB bus plug to the system, then power on to debug the spindle action. Adjust the detail parameters. See paragraph 5.4 for orientation action debugging.

Detail settings of speed mode:

F3-03	Acceleration time	1 (second)	1	√
F3-04	Deceleration time	1 (second)	1	√

Detail settings of position mode:

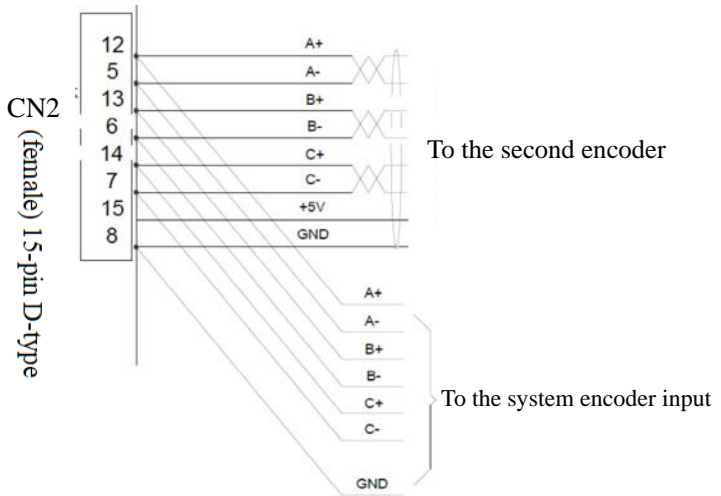
F3-00	Proportional gain of speed loop (ASR)	0~500HZ	150	√
F4-00	Position servo proportional gain	1~2000	30	√
F4-01	Positioning/Feeding proportional gain	1~2000	20	√

Note: To restart the drive after power failure, you must wait until the driver LED display is completely off before reapplying power.

5.6 Double Encoder Debugging - Pulse Spindle Servo Drive

1. Wiring

Wiring diagram of spindle servo second encoder



2. The motor self-learning operation is the same as that described in paragraph 5.1, and self-learning parameters are also the same as the settings described in paragraph 5.1.

3. After motor learning is completed, the following debugging related parameters can be set:

Code	Name	Setting value ()	Factory setting	immediately
F4-04	Position command gear ratio molecule	Number of second encoder lines (such as 1024/5000)	1	√
F4-05	Position command gear ratio denominator	2500	1	√
F4-07	Second encoder phase sequence	0 or 1	1	×
F4-08	Number of second encoder lines	Number of second encoder lines (such as 1024/5000)	0	×
F4-09	Second encoder selection	1: valid	0	×

3. Debugging operations are the same as that described in paragraphs 5.2, 5.3 and 5.4

4. Double encoder debugging, D parameter related changes

Number	Contents	Attributes of display values
D-00	Motor speed (RPM/min)	First encoder (motor side) display
D-01	Target speed	First encoder (motor side) display
D-08	Actual position of motor	Second encoder (spindle unit side) display
D-09	Second encoder speed	Second encoder (spindle unit side) display
D-10	Position pulse input count is lower by four bits	Second encoder (spindle unit side) display
D-11	Position pulse input count is higher by four bits	Second encoder (spindle unit side) display
D-12	Actual deviation of position closed loop (following error)	Second encoder (spindle unit side) display
D-13	Z-signal real-time sampling value	Second encoder (spindle unit side) display