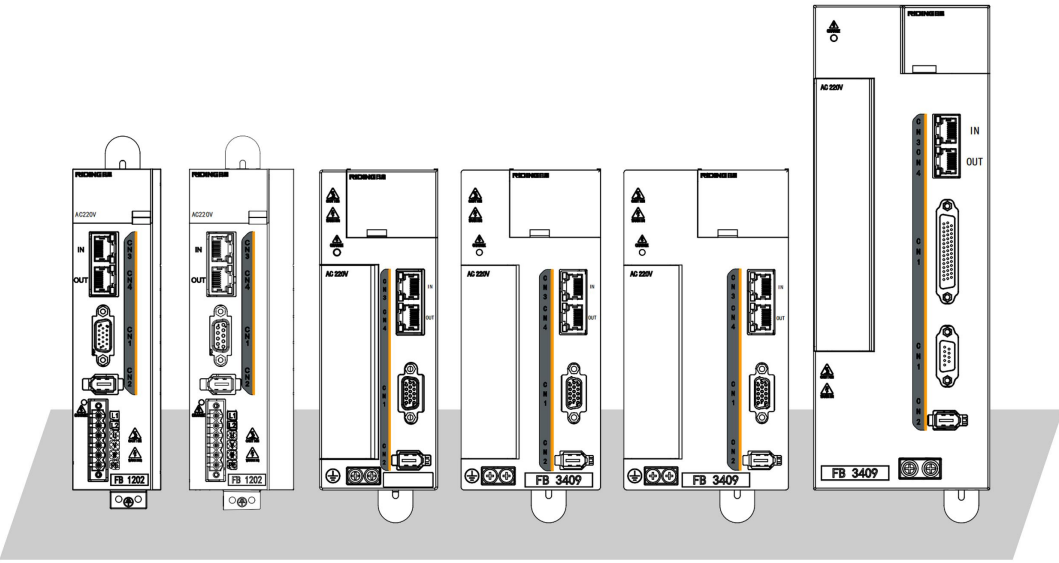
FB-E

Series Servo

Operation Manual



Safety Warnings

Security Matters

1. Safety Precautions	
DANGER	
	1. Do not touch inside of the servo drive. Otherwise, you may be electric shocked.
	2. Servo drive and GND terminal of servo motor must be connected to the ground or it may cause electric shock.
	3. Please check wiring at least 5mins later after powered off or it may cause electric shock.
	4. Please do not damage the cable line, or impose unnecessary stress, pressure load objects on it. Otherwise, may result in malfunction, damage and electric shock.
	5. During operation, do not touch the rotating part of the servo motor. Otherwise, you may be injured.
CAUTION	
	1. Operate servo motor and servo drive under specific order. Otherwise, fire and malfunction may occur.
	2. Do not place the facility in environment which has easy access to splashed water, corrosive gas, flammable gas or flammable materials. Otherwise, fire and fault may occur.
	3. Servo drives, servo motors and peripheral equipment are in high temperature when operated, keep distance or you may be burned.
	4. During the power-on process and within a period of time after cutting off the power supply, the servo drive heat radiator, regenerative resistor, servo motor is in a high temperature state. Do not touch it or you may be burned.
	5. During the running of servo motor in final product, if the surface temperature exceeds 70°C, please tag a label to inform high temperature.

2. Wiring Precautions	
CAUTION	
	·The wiring should be correct and connected firmly. Otherwise, fires, malfunctions, injuries, etc. may occur.

	PROHIBITION
	1. Do not connect servo motor U, V, W terminals with commercial power supply (220V). Otherwise, fire and malfunction may occur.
	2. Please connect the protecting earthing (PE) to the U, V, W terminals of the servo motor side. When wiring, please do not mistake the order of the U, V, W terminals
	3. Please never carry out voltage resistance and resistance test on the encoder terminal to prevent the encoder from being damaged. When testing the withstand voltage and resistance of the U, V, W terminals on the servo motor side, please cut off the connection with the servo driver
	4. Do not take the wrong terminal sequence of the encoder. Otherwise, the encoder and the servo drive may be damaged.
	INSTRUCTION
	·Ground is used to prevent electric shock in case of accidents. For safety reasons, be sure to install the protecting earthing.

3．Operation & Running Precautions	
	CAUTION
	1. Excessive adjustments and changes will lead to instability, so do not operate it casually. Otherwise, may get injured.
	2. During the trial operation, the servo motor is fixed, and the machine is cut off from the mechanical equipment. After the operation is confirmed, it is installed in the equipment. Otherwise, may get injured.
	3. Self-protection arrester brake is not a stop equipment to protect facility. Please install safe stop equipment on side of facility. Otherwise, failure, injury and other accidents may occur.
	4. When servo drive alarms, try to find reasons. Reset alarm and run again only after confirming the security. Otherwise, it may be injured.
	5. The motor may restart suddenly when the power is turned off after an instantaneous power failure, so please do not approach the device. (Please consider in the mechanical design, how to ensure personal safety when restarting) Otherwise, it may be injured.
	6. Verify the specifications of power. Otherwise, it may cause fire, failures and injuries.

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1 OVERVIEW

1.1 Product Introduction

A servo system is an automatic control system that takes mechanical parameters as the control object. It is a follow-up system whose output can automatically, rapidly and accurately follow the changes of the input. Up to now, AC servo technology has become mature with continuously improved performance, and is widely applied in fields such as textile machinery, printing and packaging machinery, numerical control machine tools and automated production lines.

The excellent performance of EtherCAT technology enables control methods that cannot be realized by traditional fieldbus systems. In this way, ultra-high-speed control loops can also be built via the bus. Functions that previously required support from dedicated local hardware can now be mapped in software. The abundant bandwidth resources allow state data and all other types of data to be transmitted in parallel. EtherCAT technology aligns communication technology with modern high-performance industrial PCs. Bus systems are no longer a bottleneck for control concepts. The data transmission performance of distributed I/O surpasses that which was previously only achievable with local I/O interfaces.

1.2 Data Specification

1.2.1 Basic Specifications

<table>
<tr><td colspan="2" rowspan="2">Main power</td><td>AC 220V Series</td><td>Single-phase, voltage range: -10% +10%、 50/60HZ</td></tr>
<tr><td>AC 220V Series</td><td>Three-phase, voltage range: -15% +10%、 50/60HZ</td></tr>
<tr><td colspan="3">Control mode</td><td>SVPWM sine wave drive</td></tr>
<tr><td colspan="3">Feedback</td><td>Standard configuration: absolute 17/23-bit encoder</td></tr>
<tr><td rowspan="7">Functions · Input and Output Signals</td><td colspan="2">Instruction sequence input (CONT1～4)</td><td>Enable, alarm reset, gain switching, pulse clearing, forward/reverse rotation control, speed command selection, control mode selection and switching, emergency stop, forward/reverse limit, electronic gear ratio switching, etc.</td></tr>
<tr><td colspan="2">Instruction sequence output (OUT1～2)</td><td>Ready, zero speed, positioning completed, torque limit output, servo alarm, etc.</td></tr>
<tr><td rowspan="2">Regenerative Braking</td><td>1201, 1202, 1204</td><td>The standard version cannot be connected with external braking resistors, which need to be selected additionally if required.</td></tr>
<tr><td>1205, 1206</td><td>A braking resistor (50Ω, 50W) is built inside.</td></tr>
<tr><td colspan="2">Control mode</td><td>EtherCAT Mode</td></tr>
<tr><td colspan="2">Monitoring function</td><td>Feedback speed, command speed, average torque, feedback current position, command current position, position deviation, DC bus voltage, electrical angle, internal temperature of the driver, input analog voltage value, input signal, output signal, cumulative command pulse, peak torque, input pulse train frequency, motor code, software version, multi - turn encoder status, current alarm, alarm record, communication connection status, etc.</td></tr>
<tr><td colspan="2">Keyboard, display</td><td>Four function buttons and 5-digit LED digital tube display</td></tr>
<tr><td colspan="2">Auxiliary functions</td><td>zero speed clamping function</td></tr>
</table>

Protection		Overcurrent, overspeed, overvoltage, encoder failure, memory failure, regenerative resistor overheating, overload, undervoltage, overvoltage, deviation excess, driver overheating, homing failure, communication status fault
Usage environment	Placement location	Indoor environment, altitude below 1000 meters, dust-free, free of corrosive gases and direct sunlight
	Temperature \ Humidity	-10～55[℃] \ 10～90[%RH] non-condensing
	Vibration resistance \ Shock resistance	4.9 m/s^2 \ 19.6 m/s^2

1.2.2 EtherCAT specifications

Physical Layer	100BASE-TX(IEEE802.3)
Baud rate	100 Mbps / Full Duplex
Number of EtherCAT ports	2(RJ45)
Max Cable Length	100m
Network cable specifications	Cat5e or higher
Application Layer Protocol	EtherCAT
Synchronization Mode	DC Distributed Clock Synchronization
Synchronization Performance	Jitter <1us
SYN0 Synchronization Period	Support 250us, 500us, 1ms, 2ms, 4ms, 8ms
Topology	Line
Refresh time	~100μs for 100 axes
CoE Service	SDO,PDO,Emergency,SDO information.
PDO Configuration	TPDO1/RPDO1: User-definable (max 8 objects/32Byte) TPDO2-5/RPDO2-5: Fixed mapping (non-configurable)
Support operating modes	CSP (Sync Position), CSV (Sync Speed), CST (Sync Torque), HM (Homing), PP (Profile Position), PV (Profile Speed), TQ (Profile Torque)
Instruction information	5-digit LED, RUN/ERR/L/A LEDs (RJ45-integrated)

1.3 Servo Drive Model Description

FB	12	05	-	A	T	E	(***)
1	2	3		4	5	6	7

1: Indicates the type of controller: FB series single axis drive;

2: Indicates the power supply voltage level: 12 stands for single-phase AC 220V; 32 stands for three-phase AC 220V; 34 stands for three-phase AC 380V;

3: Indicates the rated output current grade of this drive, measured in amperes (A);

4: Indicates the corresponding motor encoder type. A stands for 17-bit or 23-bit bus encoder;

5: T stands for standard version;

6: Communication function. E refers to EtherCAT communication;

7: The information in parentheses denotes special features of the drive in terms of software and hardware, while the default means no special features are equipped.

1.4 Servo Motor Model Description

1.4.1 4-Pole Motor Model Description

130	ST	-	Z	AD	050	C	2	A	-	I	/	**
1	2		3	4	5	6	7	8		9		10

1: indicates the base number, including: 40, 60, 80, 90, 110, 130, 150, 180 (unit: mm)

2: Indicates the code of performance parameters, ST means sine wave-driven permanent magnet synchronous AC motors.

3: ‘Z’ stands for an electromagnetic brake; the default means no brake is equipped.

4: indicates the feedback type of the motor

"AB" and "AD" represent 23-bit multi-turn integral absolute encoders; "AC" represents 23-bit multi-turn split absolute encoders; "CJ" and "CE" represent 17-bit single-turn incremental magnetic encoders; "CL" represents 17-bit multi-turn absolute magnetic encoders.

5: Indicates the rated output torque, unit: ×0.1N.m;

6: Indicates the rated speed of the motor:

A for 1500r/min	D for 3000r/min
B for 2000 r/min	E for 1000r/min
C for 2500r/min	

7: indicates the working voltage of the motor, "2" represents 3-phase AC 220V

8: Output shaft form:

A for straight shaft with key, key width 6mm.	E for straight shaft with key, key width 10mm.
B for no keys on straight shaft.	F for straight shaft with key, key width 4mm.
C for straight shaft with key, key width 8mm.	G for straight shaft with key, key width 12mm.
D for straight shaft with key, key width 5mm.	H for straight shaft with key, key width 3mm.

9: Indicates the specification of the motor encoder. "I" stands for optical encoder, and "C" stands for magnetic encoder.

10: Derivative number, used to distinguish detailed differences and applied for non-standard motors.

1.4.2 Description of 5-pole Motor Model

80	SG	-	Z	CL	024	D	2	A	-	A	/	**
1	2		3	4	5	6	7	8		9		10

1: Indicates the motor frame size, commonly including 40, 60, 80 and 130 (unit: mm).

2: Indicates the characteristic classification of permanent magnet synchronous AC servo motors: "SG" and "SE" stand for conventional 5-pole-pair motors.

3: "Z" stands for motors equipped with electromagnetic brakes, while the default means no brakes are fitted.

4: Indicates the type of encoder equipped with the motor:

Code	Explanation	Code	Explanation
AC	23-bit photoelectric multi-turn absolute value, split type	**AD**	23-bit photoelectric multi-turn absolute type, integrated structure
CJ	17-bit magnetic encoding, single-turn, split type	**CL**	17-bit magnetic encoder, multi-turn absolute value, split type
AE	23-bit photoelectric, single-turn, split type	**AF**	23-bit photoelectric, single-turn, integral type
AB	23-bit optical encoder, multi-turn absolute, Tamagawa	**CE**	17-bit magnetic encoding, single-turn, split type, compatible with 40-series motors

5: Indicates the rated output torque of the motor with three or four digits, unit: ×0.1N.m.

6: Indicates the rated speed of the motor, as follows:

A	1500 RPM	**D**	3000 RPM
B	2000 RPM	**E**	1000 RPM
C	2500 RPM		

7: indicates the rated voltage of the motor, '2' indicates that the rated voltage is 220V.

8: Use a single letter to indicate the shaft key width of the motor in mm, as follows:

A	6	**E**	10
B	Optical axis	**F**	4
C	8	**H**	3
D	5	**G**	12

9: Use a single letter to indicate the outlet form of the motor:

Letter	Definition	Letter	Definition
A	Lead wire + AMP plug	**D**	Plug-in plug

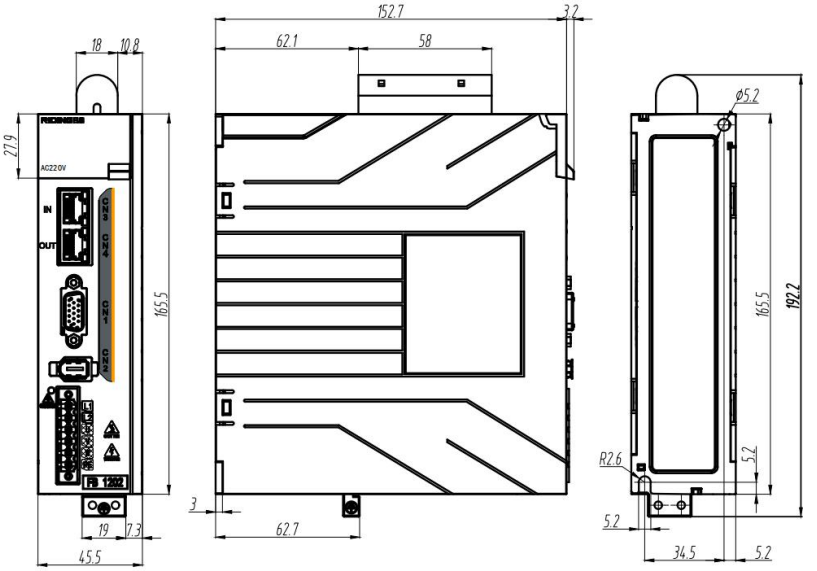
B	Wire lead + plastic waterproof plug	**E**	Straight lead wire
C	Aviation plug	**Q**	Others

10: Use two letters to indicate special requirements for the motor; default means no special requirements.

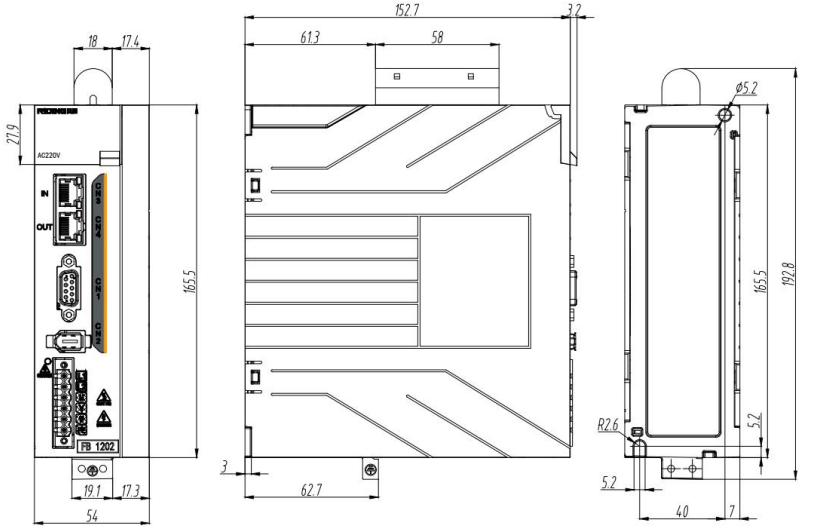
2 SERVO DRIVE AND MOTOR INSTALLATION

2.1 Servo Drive Installation size

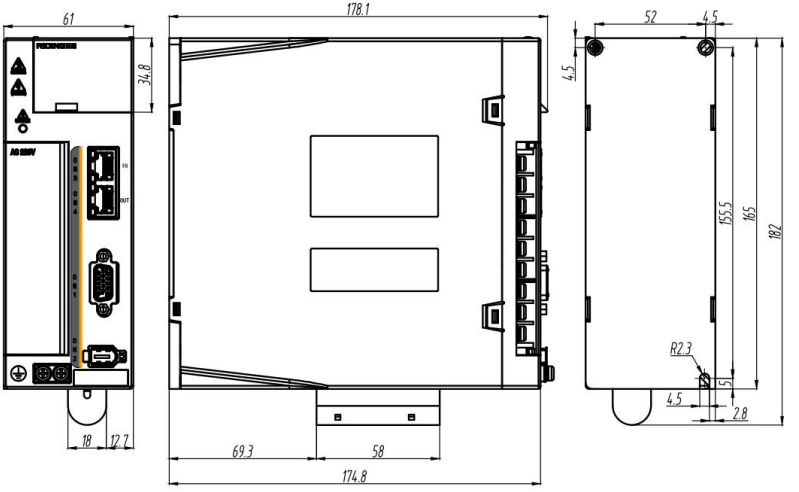
Units: mm



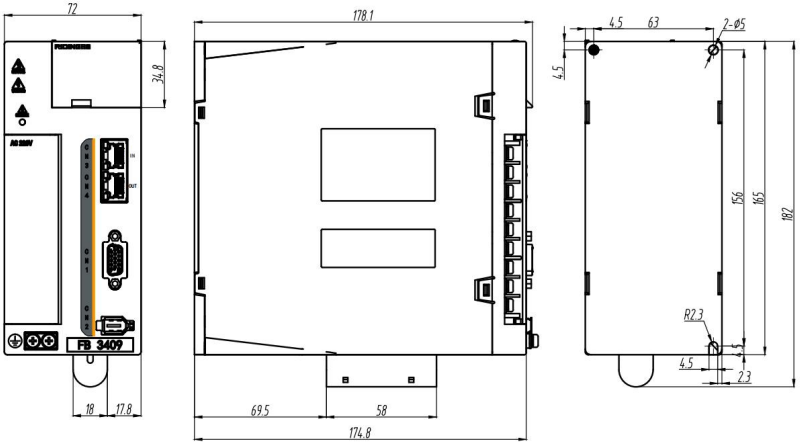
FB1201/FB1202/FB1204-ATE Installation dimensions



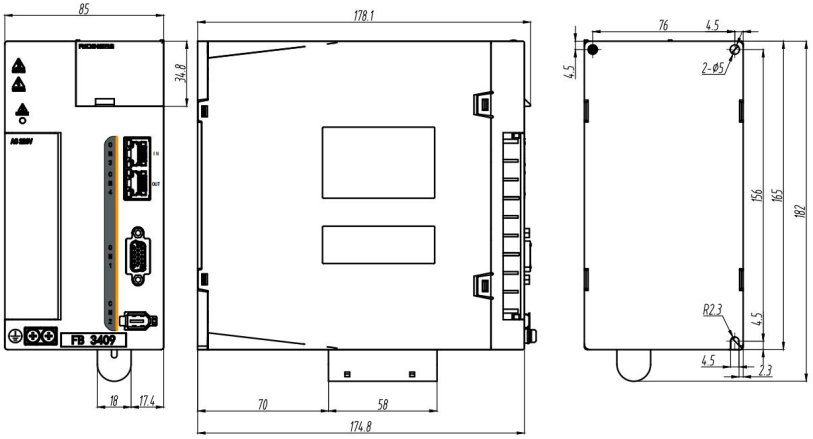
FB1205/FB1206-ATE Installation dimensions



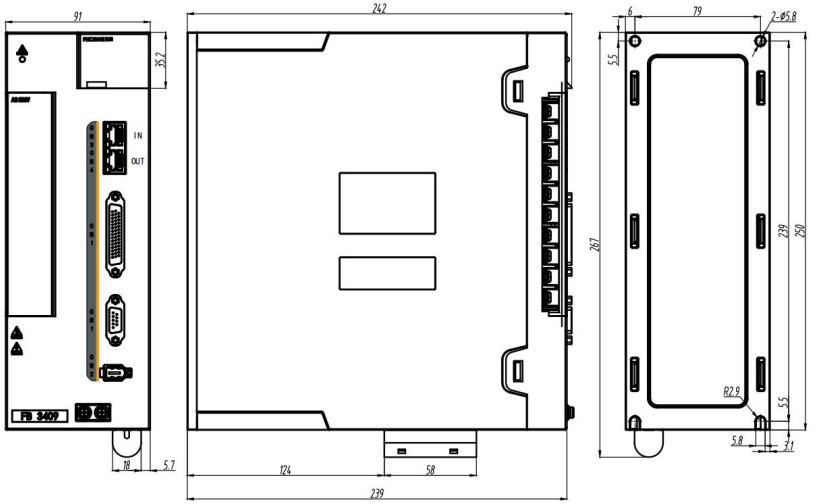
FB3404-ATE Installation dimensions



FB3409/FB3210/FB3215-ATE Installation dimensions



FB3413/FB3220-ATE Installation dimensions



FB3417/FB3425-ATE Installation dimensions

2.2 Power Supply

Supply the corresponding AC power to the servo drive in accordance with the wiring diagram and drive model.

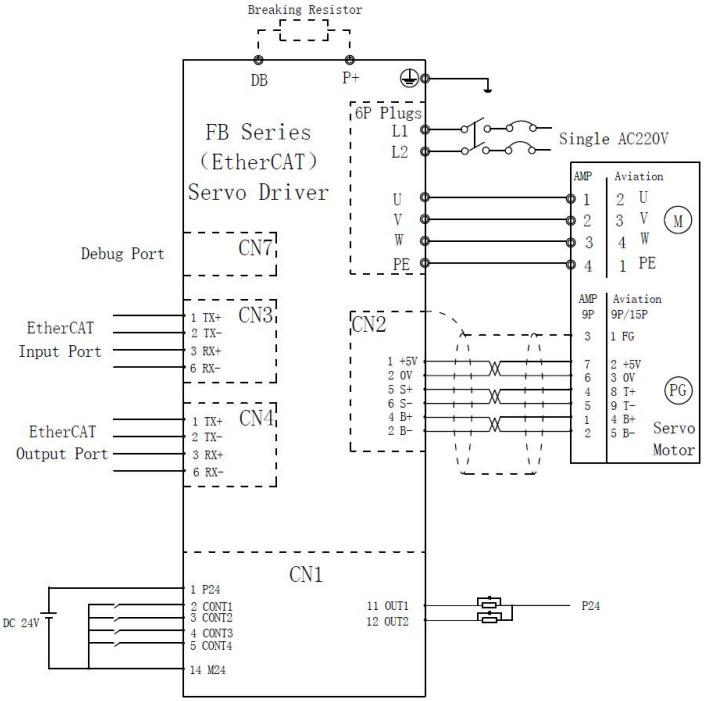
Range: Single/Three-phase 200~230V, -10%~+10%, 50/60Hz.

Three-phase 350~410V, -15%~+10%, 50/60Hz.

※ **If the supply voltage exceeds a given limit value, it will damage the servo drives.**

2.3 Wiring Diagram

Low-Power (Single-Board) FB-E Series for 220 V

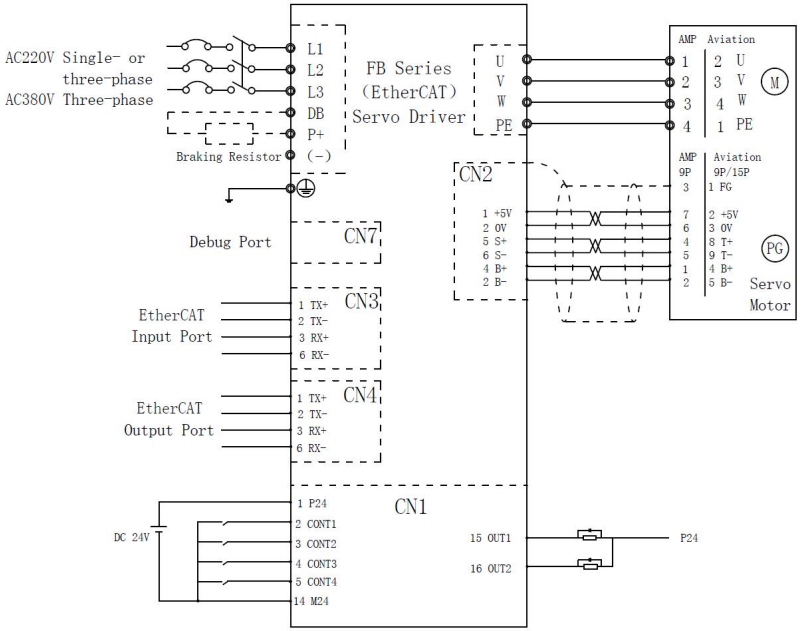


Notes: 1. 220V Related Models: FB1201-ATE、FB1202-ATE、FB1204-ATE、FB1205-ATE、FB1206-ATE;

2. FB1205-ATE、FB1206-ATE is equipped with a built-in braking resistor, while braking resistors for other models are externally optional.

3. CN1 is a 3-row DB15 female connector, CN2 is an SC06 plug, CN3 and CN4 are Ethernet ports, and CN7 is a Type-C interface.

High-Power FB-E Series for 220 V and 380 V



Notes: 1. 220V Related Models: FB3210-ATE、FB3215-ATE、FB3220-ATE;

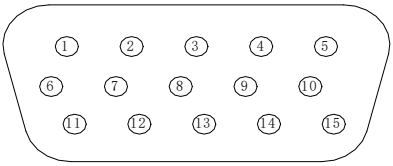
2. 380V Related Models: FB3404-ATE、FB3409-ATE、FB3413-ATE、FB3417-ATE、FB3425-ATE;

3. CN1 is a 3-row DB15 female socket, CN2 is an SC06 plug, CN3 and CN4 are Ethernet ports, and CN7 is a Type C interface.

3 WIRING AND DETAILED INSTRUCTIONS

3.1 The Input And Output Command Control Sequence (CN1)

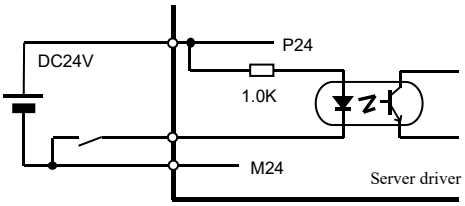
Pins of servo drive control line plug (three-row DB15 male)



Connect the control signals to the host controller to connector 1 (CN1) of the servo driver. The definitions of each signal are shown in the table below.

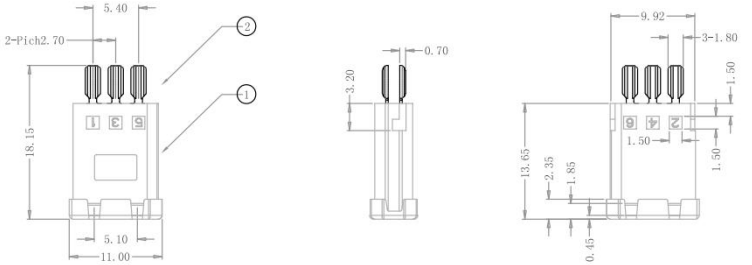
Code	CN1 pin number	Signal name	Function and definition
P24 M24	1 14	Power supply for control signal input and output	Control signals and input/output signals adopt input power supply (DC24V/0.3A). P24: 24V input M24: Standard potential 0V input
CONT1 CONT2 CONT3 CONT4	2 3 4 5	Input command control sequence	Input commands to control sequence signals.(DC24V/10mA) CONT1:(Not specified at factory) CONT2:(Not specified at factory) CONT3:(Not specified at factory) CONT4:(Not specified at factory)
OUT1 OUT2	11 12	Output command control sequence	Output command control sequence signals. (Max DC 30V/50mA) OUT1: (Factory default value: 16) OUT2: (No factory default setting)

Interface circuit diagram

Signal name	Circuit
Input Command Control Sequence Interface Specification DC24V/10mA (Per Point)	

3.2 Encoder (CN2)

Encoder wire pin terminals on the servo drive side:



An encoder is installed inside the rear end of the servo motor; the wiring of the encoder is connected to connector 2 (CN2) of the servo driver.

The maximum wiring length of the encoder is 20 meters, which is restricted by the cables used for wiring.

Wiring Definition of Encoder Cable:

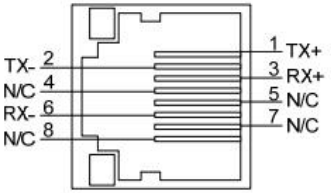
17-bit or 23-bit bus-type encoder				
Driver side CN2	**Definition**	**Corresponding pins on the motor side**		
Encoder socket		**9Pin AMP plug**	**15-pin aviation plug**	**9-pin aviation small plug**
1	5V	7	2	2
2	0V	6	3	3
5	S+	4	8	8
6	S-	5	9	9
4	BAT+	1	4	4
2	BAT-	2	5	5
Shell	Shielding layer	3	1	1

Note: 110 flange and above is 15-pin aviation plug, 90 flange and below have two plugs: 9Pin AMP plug and 9-pin aviation small plug, the specific subject to the actual situation.

3.3 Communication Interface, (CN3, CN4) EtherCAT Port Description

CN3 is for input (IN), and CN4 is for output (OUT)

The pin definitions of CN3/CN4 ports are as follows:



Interfaces CN3 and CN4 are EtherCAT communication interfaces:

CN3, CN4 pins	Pin Definition	Function Description
1	TX+	Drive data transmission differential + terminal
2	TX-	Drive data transmission differential - terminal
3	RX+	Drive data transmission differential + terminal
6	RX-	Drive data transmission differential - terminal
4、5、7、	N/C	

Ports CN3 and CN4 are standard RJ45 sockets. It is recommended to use Cat5e or higher-grade shielded twisted-pair cables for direct connection.

3.4 Program Upgrade and Upper Computer Debugging Interface（CN7）

The driver can be connected to a computer via the CN7 interface (Type-C) for program upgrading, upper computer debugging and other operations.

4 SERVO PARAMETER DESCRIPTION

4.1 Parameter Settings

Setting method:

Use MODE ESC key to select the parameters edit mode, switch to the PN-01,using ∨ ∧ key to select the parameter number, or using SHIFT ENT key to shift, so as to quickly find the parameters to be set.Press SHIFT ENT key for more than 1 second into the parameter setting.

4.2 Parameter List

No.	Definition	Setting range	Default value	Change
P0				
P0-00	Electronic gear numerator 0	1-100000000	131072	Outage
P0-01				
P0-02	Electronic gear denominator 0	1-100000000	10000	Outage
P0-03				
P0-04	Command pulse shape	0: Pulse + direction 1：AB Pulse 2：Positive and negative pulse	0	Outage
P0-05	Rotation direction switch	0: Same as the default direction 1: Opposite to the default direction	0	Outage
P0-06	Output pulse phase switching when rotating	0. Phase B starts when CCW rotates 1: Phase A starts when CCW rotates	0	Outage
P0-07	Forward torque limit	0-300%	250%	Always
P0-08	Reverse torque limit	0-300%	250%	Always
P0-09	Control mode selection	0：position 1：speed 2：Torque 3：position ⇔speed 4：position ⇔Torque 5：speed ⇔Torque 6：Can communication 7：Internal position 8：Internal position ⇔speed 9：Internal position ⇔Torque 10：Pulse speed mode 11：CANOPEN mode 12: EtherCAT Mode	12	Outage

P0-10	CONT1 Input signal distribution	0：not specified 2：Manually rotate forward [FWD] 4：Point-to-point start signal 6：Origin signal 9：emergency stop 14：Choice of acceleration and deceleration 20：Torque limit selection 2 25：Gear ratio switching 2 26：Pulse input prohibited 28：Command pulse ratio 2 32：Position cancel 36：Mode switch 37：Position control mode 38：Torque control mode 43：Effective schedule 44：Schedule 1 46：Schedule 4 50：Clear position deviation 52：Multi-speed selection 2 54：Multi-speed selection 4 66：Point-to-point location selection 2 68：Point-to-point location selection 4 71：Tp2	1: Servo start [RUN] 3：Manually rotate reverse [REV] 5：Origin trigger 7：Left limit 8：Right limit 10：Alarm clear 17：Gain switching 19：Torque limit selection 1 24：Gear ratio switching 1 27：Command pulse ratio 1 31：Run pause 34：Overheating of external braking resistor 39：Speed control mode 45：Schedule 2 47：Schedule 8 51：Multi-speed selection 1 53：Multi-speed selection 3 55：Forced slide stop 65：Point-to-point location selection 1 67：Point-to-point location selection 3 70：Tp1	1	Outage
P0-11	CONT2 Input signal distribution			0	Outage
P0-12	CONT3 Input signal distribution			0	Outage
P0-13	CONT4 Input signal distribution			0	Outage
P0-14	CONT5 Input signal distribution			0	Outage

P0-15	OUT1 Signal distribution	0：not specified 1：Ready 2：Locate finishing 11：Speed limit determination 12：Brake action 14：Brake timing 15：Alarm a contact output 16：Alarm b contact output 20：OT detection 22：Return to origin completed 23：Zero position deviation 24：Zero speed 25：Speed reached 26：Current limit detection 30：Multi-segment location 0 31：Multi-segment location 1 32：Multi-segment location 2 33：Multi-segment location 3 34：Multi-segment location 4 35：Multi-segment location 5 38：+OT detection 39：- OTdetection 41：Force stop detection 50：Internal position completion signal	16	Outage
P0-16	OUT2 Signal distribution		0	Outage
P0-17	OUT3 Signal distribution		0	Outage
P0-18	OUT4 Signal distribution		0	Outage
P0-19	Zero speed range	0.1~P0-34（rpm）	50.0	Always
P0-20	Z phase compensation	0~60000（puls）	0	Always
P0-21	Deviation zero range/positioning ending range	0~100000000（puls）	100	Always
P0-22				Always
P0-23	Deviation exceeds detection value	0.1~100.0(Circles)	15.0	Always
P0-24	Judge time of positioning ending	0.000~1.000 seconds (0.001 seconds)	0	Always
P0-25	Positioning ending output form	0: output form 1 1: output form 2	0	Outage
P0-26	Minimum OFF time when positioning is ended	1~1000（msec）	20	Always
P0-27	Related parameters of insufficient voltage	0x0111 bit0-3 Whether to detect LU alarm 1 detect 0 not detect bit4-7 Motor action when undervoltage 0 Emergency stop 1 Slide stop bit8-bit11 Whether LU alarm needs self-recovery	0x0001	Valid upon power-on
P0-28	No definition available	0-1	0	Always
P0-29	Prohibit overwriting of parameters	0: rewriteable 1: rewrite prohibited	0	Always
P0-30	Power on display interface	0~50	0	Outage

P0-31	Consistent speed range	0.1~6000.0（rpm）	10.0	Always
P0-32	Speed limit selection during torque control	0: Use analog quantity as speed reference 1: Use P0-33 as the speed reference	0	Always
P0-33	Maximum speed (for torque control)	0.1~6000.0 (rpm) (for torque control)	3000.0	Always
P0-34	Maximum speed (for position and speed control)	0.1~6000.0 (rpm) (for control position and speed)	3000.0	Always
P0-35	Acceleration time 1 (combination test	1~10000（msec）	100	Always
P0-36	Deceleration time 1 (combination test	1~10000（msec）	100	Always
P0-37	Acceleration time 2	1~10000（msec）	500	Always
P0-38	Deceleration time 2	1~10000（msec）	500	Always
P0-39	Torque arrival judgment time	0~1000（msec）	3	Outage
P0-40	Position regulator gain 1	1~2000[rad/sec] (1 scale)	50	Always
P0-41	Speed regulator gain 1	1~30000[Hz] (1 scale)	100	Always
P0-42	Speed regulator integral coefficient 1	0.20~500.00[ms]	20.00	Always
P0-43	S-shaped time constant	0~1000（msec）	100	Always
P0-44	Position loop feed-forward gain 1	0.000~1.200 (0.001 scale)	0	Always
P0-45	Feed-forward filter time constant	0.0~250.0[msec]	0	Always
P0-46	Torque filter time constant	0.00~20.00[msec]	0.5	Always
P0-47	Speed setting filter	0.00~20.00[msec] (0.01 scale)	0	Always
P0-48	Main reason for the gain switch	0: Position deviation (x10) 1: Feedback speed, 2: Command speed 3: Switched by input port	1	Always
P0-49	Gain switching level	1~1000（1scale or %）	50	Always
P0-50	Gain switching time constant	1~100[msec] (1Scale)	10	Always
P0-51	Position regulator gain 2	30~200%（1%）	100	Always
P0-52	Speed regulator gain 2	1~1500（%）	100	Always
P0-53	Speed regulator integral coefficient 2	1~1500（1%）	100	Always
P0-54	Position loop feedforward gain 2	0~1200（%）(1%)	100	Always
P0-55	Analog filtering ms	0.00~300.00（msec）	1	Always
P0-56	Deceleration time after losing enable	0~10000（msec）	100	Always
P0-57	Action sequence when losing enable	0: Emergency Stop 1: Free Stop	0	Outage
P0-58	OL type Judgment type	To be added	0	Outage
P0-59	OL ratio	0.0000~1.5000	0.5	Always

P0-60	One-time delayed S-shaped time constant	0.0~1000.0（msec）	0	Always
P0-61	Low voltage point setting	150~210V	160	Outage
P0-62	OH alarm temperature selection	40～110 °C	80	Outage
P0-63	Fan opening temperature	20～70 °C	40	Always
P0-64	Motor code	0~500	0	Outage
P0-65	Analog input 1 offset	0~4096	2048	Outage
P0-66	Analog input 1 corresponds to the maximum speed	0.0~P0-34	1000	Always
P0-67	Analog usage configuration	0x0~0x1111 bit0，Analog 1 and 2 modes bit1, 1: Unipolar 0~10V0: Bipolar -10~10V bit2, the number of hardware analogs 0: Single analog 1: Double analog bit3. Torque given source 0. Analog given 1. Parameter given （P2-08 and P2-09）	0x0000	Outage
P0-68	Analog 1 ratio	0.00~3.00	1	Always
P0-69	Analog input 2 offset	0~4096	2048	Outage
P0-70	Analog input corresponds to the	0~300%	100	Always
P0-71	Reserved	0~1	0	Always
P0-72	Analog 2 ratio	0.00~3.00	1	Always
P0-73	Analog speed zero limit	0.0~P0-34（rpm）	10	Always
P0-74	Analog torque zero limit	0~300%	5%	Always
P0-75	CONT has always been effective internally1	0~78	0	Outage
P0-76	CONT has always been effective internally2		0	Outage
P0-77	CONT has always been effective internally3		0	Outage
P0-78	CONT has always been effective internally4		0	Outage
P0-79	Parity/stop bit selection (for Modbus)	RTU: 1: 8N2(no) 3:8O1(odd) 5:8E1(even)	1	Outage

P0-80	Communication application configuration	0x0~0x111 bit0，Communication whether to save EEPROM: 0,storage, 1no bit1, Action after the communication times out: 0, no matter, only the status is displayed.;1, Slow down and stop (parameter not realized) bit2, Communication access 32bit parameter sequence: 0, first low then high ;1,first high then low	0x000	Outage
P0-81	Unrealized	0-1	0	Always
P0-82	485 CAN station number	1-127	1	Outage
P0-83	485 baud rate	0=4800，1=9600，2=19200， 3=38400，4=57600，5=115200	1	Outage
P0-84	CAN baud rate	0=125k， 1=250k ，2=500k， 3=1M	3	Outage
P0-85	Compatible with 402 version Speed unit problem	0: Use rpm according to the old version 1: Use PUU/S	1	Outage
P0-86	0S alarm ratio	1.10~5.00	1.1	Always
P0-87	Related actions after OT	0：Maximum torque stop； 1: Stop according to the set curve； 2：Inertia runs to 0 speed before locking	0	Always
P0-88	Type of deviation detection	0: Exceeding deviation alarm detection 1: Exceeding deviation is not alarmed, and pulse is actively lost	0	Outage
P0-89	Power section selection	0~20	6	Outage
P0-90	EC alarm detection time	3~3000(msec)	12	Outage
P0-91	Overcurrent forecast value	10~500%	350	Always
P0-92	Test speed given Fn-01	0.0~P0-34(rpm)	50	Always
P0-93	Test operation mode	0: location (unrealized) 1：speed 2：Torque (unrealized)	1	Always
P0-94	Test speed given Fn-10	0.0~P0-34(rpm)	200	Always
P0-95	Current loop feedforward ratio	0~500%	0	Always
P0-96	Differential time of current regulator	0~1.00（msec）	0	Always
P0-97	Current regulator cutoff frequency	100~3000(Hz)	600	Always
P0-98	Current regulator time constant scaling factor	0.00~10.00	1.00	Always

P0-99	Current loop output filter	0.000~1.000（msec）	0	Always
P1				
P1-00	Indexing function speed/internal position speed 1	0.1~P0-34	500	Always
P1-01	Multi stage speed 1/internal position speed 2	0.1~P0-34	500	Always
P1-02	Multi stage speed 2/internal position speed 3	0.1~P0-34	1000	Always
P1-03	Multi stage speed 3/internal position speed 4	0.1~P0-34	1000	Always
P1-04	Multi stage speed 4/internal position speed 5	0.1~P0-34	1000	Always
P1-05	Multi stage speed 5/internal position speed 6	0.1~P0-34	1000	Always
P1-06	Multi stage speed 6/internal position speed 7	0.1~P0-34	1000	Always
P1-07	Multi stage speed 7/Internal position speed 8	0.1~P0-34	1000	Always
P1-08	Multi stage speed 8/internal position speed 9	0.1~P0-34	1000	Always
P1-09	Multi stage speed 9/internal position speed 10	0.1~P0-34	1000	Always
P1-10	Multi stage speed 10/internal position speed 11	0.1~P0-34	1000	Always
P1-11	Multi stage speed 11/internal position speed 12	0.1~P0-34	1000	Always
P1-12	Multi stage speed 12/internal position speed 13	0.1~P0-34	1000	Always
P1-13	Multi stage speed 13/Internal position speed 14	0.1~P0-34	1000	Always
P1-14	Multi stage speed 14/internal position speed 15	0.1~P0-34	1000	Always
P1-15	Multi stage speed 15/internal position speed 16	0.1~P0-34	1000	Always
P1-16	Output pulse frequency divider (unrealized)	0~100000000	1	Outage
P1-17				Outage
P1-18	Output pulse frequency division denominator(unrealized)	0~100000000	16	Outage
P1-19				Outage
P1-20	CONT1~5 signal polarity	0~0xffff bitn is 1 means the polarity is reversed	0	Outage
P1-21	CONT1 filter time. The highest bit is the filter form	0-22000 10000 digits 0. Double edge dly 1. Rising edge dly	0	Outage
P1-22	CONT2 filter time. The highest bit is the filtering form	0-22000 10000 digits 0. Double edge dly 1. Rising edge dly 2. Falling edge dly	0	Outage

P1-23	CONT3 filter time. The highest bit is the filtering form	0-22000 10000 digits 0. Double edge dly 1. Rising edge dly 2. Falling edge dly	0	Outage
P1-24	CONT4 filter time. The highest bit is the filtering form	0-22000 10000 digits 0. Double edge dly 1. Rising edge dly 2. Falling edge dly	0	Outage
P1-25	CONT5 filter time. The highest bit is the filtering form	0-22000 10000 digits 0. Double edge dly 1. Rising edge dly 2. Falling edge dly	0	Outage
P1-26	OUT1~3 Signal polarity	0~0x3ff, Bitn of 1 indicates opposite polarity	0	Outage
P1-27	Electronic gear molecule 1	0~100000000	1	Always
P1-28				Always
P1-29	Electronic gear molecule 2	0~100000000	1	Always
P1-30				Always
P1-31	Electronic gear molecule 3	0~100000000	1	Always
P1-32				Always
P1-33	Command pulse ratio 1	0.01~100.00	1	Always
P1-34	Command pulse ratio 2	0.01~100.00	10	Always
P1-35	Select torque limit	0：Setting of torque limits 0 and 1 for the CONT input 1：TREF terminal voltage	0	Always
P1-36	Second torque limit	0~300%	300	Always
P1-37	Third torque limit	0~300%	300	Always
P1-38	Brake action time, tens of thousands indicate action	0-10000 ms	0	Always
P1-39	High-speed pulse low-pass filter	0~500（kHz）	0	Outage
P1-40	Brake working incapacitation time	0~10000 ms	0	Always
P1-41	Curve type	0: T-shaped curve 1. S-shaped curve (not considering 0 speed overturn) 2: S-shaped curve (considering 0 speed overturn)	0	Outage
P1-42	Scheduling function switch (Temporarily unrealized)	0~1	0	Always
P1-43	Schedule ratio 1	0.00~1.50	0.1	Always
P1-44	Schedule ratio 2	0.00~1.50	0.2	Always
P1-45	Schedule ratio 4	0.00~1.50	0.4	Always
P1-46	Schedule ratio 8	0.00~1.50	0.8	Always
P1-47	Number of output pulses per revolution	16~4095	2500	Outage
P1-48				Outage

P1-49	Reserved	0.50~300.00	3.19	Outage
P1-50	Carrier frequency	8/12	12	Outage
P1-51	Dead time（unrealized）	2.0~5.0（usec）	2.8	Outage
P1-52	Encoder type configuration	0-0x6226 bit0-3 INC/ABS selection 0: incremental, incremental system 1: Single-turn, incremental system 2: Multi-turn, absolute system 3: Multi-turn, incremental system 4: Multi-turn , ignoring multi turn alarms; 5: Multi-turn, treated as single laps (temporarily invalid) bit4-7 Whether it is a line-saving encoder 1: ABZ-UVW provincial line type; 2: PWM type provincial line type (Leise model) bit8-11 Special processing for Z signal 1：Z in the form of a half circle 2 One z for each electrical angle bit12-bit15 Set angle compensation method: 0, no compensation	1	Outage
P1-53	Absolute encoder configuration	0: 17 digits, 1: 20 digits, 2: 23 digits	0	Outage
P1-54	Line number of incremental encoder	180~10000 lines	2500	Outage
P1-55	Encoder error protection time	0~3000(msec)	1500	Outage
P1-56	Motor rated speed	50~6000rpm	2500	Outage
P1-57	Motor rated current	0.01~120.00A	5	Outage
P1-58	Motor rated voltage	110~230V	220	Outage
P1-59	Motor torque coefficient	0.01~15.00	1	Outage
P1-60	Motor pole pairs	1~16	4	Outage
P1-61	Motor stator resistance	0.01~100.00(Ω)	1.84	Outage
P1-62	Motor cross-axis inductance	0.05~320.00mH	3.2	Outage
P1-63	Motor straight shaft inductance	0.05~320.00mH	3.2	Outage
P1-64	Motor Back EMF	10~1000(v/kRPM)	68	Outage
P1-65	Motor rotor inertia	0.001~30.000(gm^2)	1.06	Outage
P1-66	Motor electrical time constant	0.5~300.00(ms)	3.19	Outage
P1-67	Reserved	0.0~25.5	0	Outage
P1-68	Reserved	0.50~300.00	3.19	Outage
P1-69	Reserved	0.50~300.00	3.19	Outage
P1-70	Reserved	0~3000.0	0	Always

P1-76	Notch Filter 1/2 Switch	0x0000-0x0011	0	Always
P1-77	Notch Filter 1 Frequency	50-4000[Hz]	1000	Always
P1-78	Notch Filter 1 Depth	0-40	40	Always
P1-79	Notch Filter 1 Width	0-1.00	0.3	Always
P1-80	Notch Filter 2 Frequency	50-4000[Hz]	1000	Always
P1-81	Notch Filter 2 Depth	0-40	40	Always
P1-82	Notch Filter 2 Width	0-1.00	0.3	Always
P1-85	Locked-rotor alarm judgment speed	1.0-200．0rpm	10.0	Always
P1-86	Locked-rotor alarm judgment time	10-5000(ms)	500	Always
P1-87	Over-speed alarm judgment speed	5.0-100.0	50.0	Always
P1-88	Over-speed alarm judgment time	10-5000(ms)	1000	Always
P1-89	Alarm shielding function	0x0000-0x0011 bit0-3 Stall alarm shielding = 1 indicates shielding bit4-7 Over-speed alarm shielding = 1 indicates shielding	0x0001	Always
P1-90	Load disturbance compensation cutoff frequency	0-500[Hz]	100	Always
P1-91	Load disturbance compensation ratio	0-100[%]	0	Always
P1-92	Notch filter 3 frequency	50-4000[Hz]	1000	Always
P1-93	Notch filter 3 depth	0-40	40	Always
P1-94	Notch filter 3 width	0-1.00	0.3	Always
P1-95	Notch filter 4 frequency	50-4000[Hz]	1000	Always
P1-96	Notch filter 4 depth	0-40	40	Always
P1-97	Notch filter 4 width	0-1.00	0.3	Always
P1-98	Parameter self-adjusting mode	0: Off 1: On standard rigid table function	0	Always
P1-99	Rigidity level	0-30	16	Always
P2				
P2-00	Moving average S shape time	0~500（msec）	0	Always
P2-01	Convergent integral filtering	0.00~20.00（msec）	0.5	Always
P2-02	Position loop convergence integration time	1.0~1000.0（msec）	1000	Always
P2-03	Position loop differential	0.00~1.00（msec）	0.05	Always
P2-04	End convergence position deviation	0~10000（puls）	20	Always
P2-05	Reserved	0.0~25.5	0	Outage
P2-06	Reserved	0.0~25.5	0	Outage

P2-07	Reserved	0.0~25.5	0	Outage
P2-08	Forward torque given by panel	0~300%	100	Always
P2-09	Reverse torque given by panel	0~300%	100	Always
P2-10	Load inertia ratio	0.0~100.0	0	Always
P2-11	Speed loop feedforward coefficient	0.000~1.500	0	Always
P2-12	Speed feedback method	0~0x31 bit0-3 0. Encoder feedback; 1. Speed observer Bit4-7 Observer gear	0x10	Outage
P2-13	Speed feedback filter time constant	0.00~10.00（msec）	0.2	Always
P2-14	Speed loop PI regulator	0: normal；1:PDFF； 2: high beat	0	Outage
P2-15	PDFF-Kf	0.00~2.00	1	Always
P2-16	Feedback speed sliding window filtering	0x0010~0x0810 Bit8-11 Number of speed sliding window filters	0x0410	Outage
P2-17	Static torque limit value	0~150(%)	95	Always
P2-18	Static torque limit judgment time	0~10000（msec）	0	Always
P2-19	Reserved	0~200	0	Always
P2-20	Reserved	0~200	0	Always
P2-21	Reserved	0~200	0	Always
P2-22	Virtual In1 (Unrealized)	Reserved	0	Outage
P2-23	Virtual In2 (Unrealized)	Reserved	0	Outage
P2-24	Virtual In3 (Unrealized)	Reserved	0	Outage
P2-25	Virtual In4(Unrealized)	Reserved	0	Outage
P2-26	Virtual In5 (Unrealized)	Reserved	0	Outage
P2-27	Virtual In6 (Unrealized)	Reserved	0	Outage
P2-28	Virtual In7 (Unrealized)	Reserved	0	Outage
P2-29	Virtual In8 (Unrealized)	Reserved	0	Outage
P2-30	Virtual OUT1 (Unrealized)	Reserved	0	Outage
P2-31	Virtual OUT2 (Unrealized)	Reserved	0	Outage
P2-32	Virtual OUT3 (Unrealized)	Reserved	0	Outage
P2-33	Virtual OUT4 (Unrealized)	Reserved	0	Outage
P2-34	Virtual OUT5 (Unrealized)	Reserved	0	Outage
P2-35	Virtual OUT6 (Unrealized)	Reserved	0	Outage
P2-36	Virtual OUT7 (Unrealized)	Reserved	0	Outage
P2-37	Virtual OUT8 (Unrealized)	Reserved	0	Outage
P2-38	Decimal point position of position data(Unrealized)	Reserved	0	Always

P2-39	origin position return speed	0.1~1000.0（rpm）	500	Always
P2-40	origin position return crawl speed	0.1~1000.0（rpm）	50	Always
P2-41	Origin regression configuration bit	0x1445 bit0~3. Return to origin mode. 0: Positive direction return (external reference point). 1: Reverse direction return (external reference point). 2: Positive and Positive (mixed reference). 3: Positive and negative (mixed reference). 4: negative and positive. 5: Negative and negative. bit4~7. Origin return trigger mode. 0: Off. 1: Level trigger. 2: Rising edge trigger. 3: Automatically trigger once when power on and level-triggered. 4: Trigger once at power-on and trigger on rising edge. bit8~11. Reference point setting, origin reference signal. 0: External reference. 1: Z signal reference. 2: Hybrid reference. 3: Obtain the reference point from the recorded position, and then go to the origin. 4: Direct position to origin. bit12~15. Whether to allow skipping. 0: Allow to skip the high-speed segment when the external signal is valid. 1: Not allowed.	0	Outage
P2-42	Reserved	0-255	0	Outage
P2-43	Reserved	0-255	0	Outage
P2-44	Origin signal in-position delay	0-5000(ms)	50	Always
P2-45	Origin signal output delay	0-5000(ms)	100	Always
P2-46	Preset position	-2147483647~2147483647	0	Always
P2-47				Always
P2-48	Z phase offset	-2147483647~2147483647	0	Always
P2-49				
P2-50	Origin LS timing selection	0-1 （Unrealized）	0	Outage
P2-51	Select origin return to OT operation	0-1 （Unrealized）	0	Outage
P2-52	Positive software OT detection	-2147483647~2147483647	2000000000	Always

P2-53				
P2-54 P2-55	Negative software OT detection position	-2147483647~2147483647	-2000000000	Always
P2-56	Software OT is valid/invalid	0-0x22 bit0-3 How to handle OT: 0: Do not detect software OT; 1: Improper OT making mistakes; 2: OT reported software error bit4-7 PN001=1~6 Whether to process: 0: No processing; 1: Only absolute position is established after restriction; 2: Relative position and absolute position are limited	0	Outage
P2-57	Position command i form	(If P0-09=7) 0-1 (Unrealized)	0	Outage
P2-58	positioning data is valid/invalid	0-1 (Unrealized)	0	Always
P2-59	Sequential start is valid/invalid	0~2 (Unrealized)	0	Always
P2-60	Stop timing decimal point position	0~10 (Unrealized)	10	Always
P2-61	Return to origin acceleration time	1~10000 (msec)	100	Always
P2-62	Return to origin deceleration time	1~10000 (msec)	100	Always
P2-63 P2-64	High byte of forward travel Must be positive	0~2147483647	2000000000	Always Always
P2-65 P2-66	High byte of reverse travel Must be positive	0~2147483647	2000000000	Always
P2-67	EtherCAT communication configuration parameters	0x0111 Bit0-3: Position loop smoothing function, 0=Off, 1=On Bit4-7: Position loop command compensation command, 0=Off, 1=On	0x0110	Outage
P2-68	EtherCAT slave alias	0~65535	0	Outage
P2-69	EtherCAT position loop smooth speed threshold	0~500rpm	60	Always
P2-70	EtherCAT data frame loss alarm threshold	2~100	36	Always
P2-71	Reserved	0~0xFFFF	0	Always
P2-72	Reserved	0~0xFFFF	0	Always
P2-73	Reserved	0~0xFFFF	0	Always
P2-82	Filtering time of probe 1	0-50	2	Always
P2-83	Filtering time of probe 2	0-50	2	Always

P3				
P3-00	Point-to-point control parameters 1	bit0~3 Point to point trigger mode 0：high level， 1 rising edge bit4~7 running mode 0:1/0 mode，Multiple positions； 1：Discontinuous programming mode； 2：Continuous programming mode； 3: Infinite loop bit8~11 Addressing mode 0: normal, 1: sequential addressing, 2: reverse addressing, 3: optimal addressing bit12~15 Coordinate system mode 0: relative position, 1: absolute position	0x1001	Outage
P3-01	Point-to-point control parameters 2	bit0~3 M Code output mode 0：Output on startup 1：Output when positioning is completed bit4~7 Combinatorial code logic： 0 Delta-like combinational logic 1 Delta-like combinational logic	0x0011	Outage
P3-02	Reserved	0~3	0	Outage
P3-03	Reserved	0~1	1	Outage
P3-04	Cycle times with mode 2	1~30000	1	Always
P3-05	spare	1~30000	1	Outage
P3-06 P3-07	Single-turn setting of indexing function	-2147483647~2147483647	10000	Outage
P3-08	Programming mode enables segment/index function single-turn	1~32	16	Always
P3-09	Reserved	0.0~25.5	0	Outage
P3-10 P3-11	Multi - terminal position given 0	-2147483647~2147483647	0	Always Always
P3-12 P3-13	Multi - terminal position given 1	-2147483647~2147483647	0	Always
P3-14 P3-15	Multi - terminal position given 2	-2147483647~2147483647	0	Always Always
P3-16 P3-17	Multi - terminal position given 3	-2147483647~2147483647	0	Always Always

P3-18 P3-19	Multi - terminal position given 4	-2147483647~2147483647	0	Always Always
P3-20 P3-21	Multi - terminal position given 5	-2147483647~2147483647	0	Always Always
P3-22 P3-23	Multi - terminal position given 6	-2147483647~2147483647	0	Always Always
P3-24 P3-25	Multi - terminal position given 7	-2147483647~2147483647	0	Always Always
P3-26 P3-27	Multi - terminal position given 8	-2147483647~2147483647	0	Always Always
P3-28 P3-29	Multi - terminal position given 9	-2147483647~2147483647	0	Always Always
P3-30 P3-31	Multi - terminal position given 10	-2147483647~2147483647	0	Always
P3-32 P3-33	Multi - terminal position given 11	-2147483647~2147483647	0	Always Always
P3-34 P3-35	Multi - terminal position given 12	-2147483647~2147483647	0	Always Always
P3-36 P3-37	Multi - terminal position given 13	-2147483647~2147483647	0	Always Always
P3-38 P3-39	Multi - terminal position given 14	-2147483647~2147483647	0	Always
P3-40 P3-41	Multi - terminal position given 15	-2147483647~2147483647	0	Always Always
P3-42	Delay 1 unit	0~5000(ms)	100	Always
P3-43	Delay 2 unit	0~5000(ms)	100	Always
P3-44	Delay 3 unit	0~5000(ms)	100	Always
P3-45	Delay 4 unit	0~5000(ms)	100	Always
P3-46	Delay 5 unit	0~5000(ms)	100	Always
P3-47	Delay 6 unit	0~5000(ms)	100	Always
P3-48	Delay 7 unit	0~5000(ms)	100	Always
P3-49	Delay 8 unit	0~5000(ms)	100	Always
P3-50	Delay 9 unit	0~5000(ms)	100	Always
P3-51	Delay 10 unit	0~5000(ms)	100	Always
P3-52	Delay 11 unit	0~5000(ms)	100	Always

P3-53	Delay 12 unit	0~5000(ms)	100	Always
P3-54	Delay 13 unit	0~5000(ms)	100	Always
P3-55	Delay 14 unit	0~5000(ms)	100	Always
P3-56	Delay 15 unit	0~5000(ms)	100	Always
P3-57	Delay 16 unit	0~5000(ms)	100	Always
P3-58	Reserved	0.0~25.5	0	Outage
P3-59	Reserved	0-0x01	0	Outage
P3-60	Bleed resistance value	1-1000(Ω)	16	Always
P3-61	Bleed resistance power	0-10000(W)	0	Always
P3-62	Voltage linear correction coefficient	0.0001-3.0000	1.0000	Always
P3-63	Voltage linear correction bias	0．0-1000.0(V)	500.0	Always
P3-64	Reserved	0-0x1111	0x1100	Outage
P3-71	HU hardware alarm filtering time	0-10000(ms)	1000	Always
P3-72	HU software alarm filtering time	0-10000(ms)	500	Always
P3-80	Inertia identification operation initial motion direction	0-1	0	Always
P3-81	Inertia identification operation compensation distance	0-20.00 [circle]	2.00	Always
P3-82	Inertia identification operation speed	100.0-1000.0[rpm]	500.0	Always
P3-83	Inertia identification operation acceleration and deceleration time	10-1000[ms]	100	Always
P3-86	Model control enable	0-1	0	Always
P3-87	Model control gain	0-1000.0[Hz]	40.0	Always
P3-88	Feedforward compensation ratio of the model	0-200.0[%]	90.0	Always

All the time: Effect immediately after modification

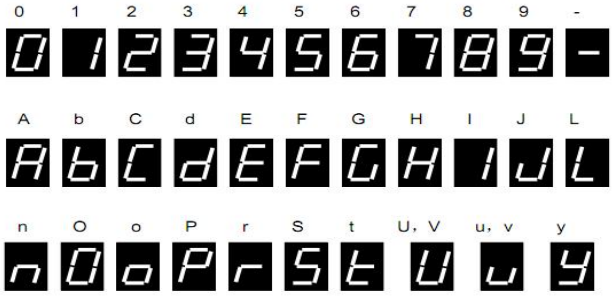
Outage：Restart power to take effect after the modification；

Conditions are valid: can only be modified when the servo lose enabled.

5 THE MAIN OPERATION FUNCTIONS OF SERVO

5.1 Panel Introduction

Seven-Segment Display:



Key:

MODE ESC Changing mode(MODE)
Delete (ESC)

SHIFT ENT Shift the positioning to the right(SHIFT).
Confirm the model and numerical (ENT)
Push this button for 1 more than second when confirming

Choose servo model
decrement of value (-1)

Choose Servo mode
Increment of value (+1).

5.2 Parameter Settings

Power on after the wiring properly connected and set parameters if no alarm occurs.

1. .First Press MODE ESC key repeatedly until the panel display: P0; then Press SHIFT ENT key for 1 second or more, panel displays Pn-01；
2. Press SHIFT ENT key for 1 second or more, panel displays the parameter value of Pn-01；
3. Press ∨ , ∧ key to change the value, press SHIFT ENT key to shift position. Press SHIFT ENT more than 1 second after changing value，Value is written successfully when Pn-01 is displayed；
4. Press ∧ key，panel display:P0-02, Repeat step 2 to set the second parameter.
5. can use the shift function of SHIFT ENT key to quickly switch to the parameter number to be set, or quickly set the value to need to be set;
6. Set other parameters in the same way.

Note：The motor code must be set for the first commissioning；
Be sure to turn off the power after setting all the parameters and then on again

5.3 Function List

Mode	Subschema	Select subschema	Expressions and setting
Sequence monitoring mode	Sequence mode	Sn-01	P-SOF
	The current alarm	Sn-02	EC
	Alarm record	Sn-03	1-EC
	Display station number	Sn-04	Ad01
	CANopen/EtherCAT Status	Sn-05	` 88on
Monitoring mode	Feedback speed/rpm	On-01	1000
	Command speed/rpm	On-02	1000
	Average torque/p.u.	On-03	1
	Feedback current position accumulation/Internal unit	On-04	H0001/L5330
	Command current position accumulation/User unit	On-05	H0001/L5330
	Position deviation amount/Internal unit	On-06	10000
	DC bus voltage/V	On-07	100
	Electrical angle/Pulse	On-08	10
	Drive internal temperature/℃	On-09	25
	Servo power-on time/second	On-10	3600
	Input signal	On-11	H0001/L0000
	Output signal	On-12	H000E
		On-13	Spare
	Peak torque/p.u.	On-14	3
	Pulse sequence input frequency	On-15	10
	Motor code	On-16	6
	Software version number	On-17	
	Unfiltered feedback speed/rpm	On-19	
	Number of absolute encoder	On-20	50
	Manufacturer reserved	On-21～27	Manufacturer reserved

	DE error number	On-28	P 82
	Absolute coordinate system feedback	On-29	H0001/L0000
	Communication coordinate system feedback position (6041h)/User unit	On-30	H0001/L0000
	Digital Tube Test	On-31	
	Multi-turn encoder value	On-32	1
	Capture time during failure / second	On-36	1200
	EtherCAT invalid frame count	On-38	H0001/L0000
	EtherCAT forward error count	On-39	H0001/L0000
	EtherCAT lost connection count	On-40	H0001/L0000
	EtherCAT smoothing function startup	On-41	0
	EtherCAT OP mode frame loss count	On-42	0
	EtherCAT communication cycle (us)	On-43	2000
	EtherCAT Communication Status	On-44	H0001/L0000
	Encoder error display bit	On-58	H0000
	Encoder reports effective bit count	On-59	17
	Probe function configuration bit	On-61	H0000
	Probe function status bit (60B9h)	On-62	H0000
	Probe 1 positive edge capture position value (60BAh)	On-63	H00/C0000/L5330
	Probe 1 positive edge capture position value (60BBh)	On-65	H00/C0000/L5330
	Probe 2 positive edge capture	On-67	H00/C0000/L5330
	Probe 3 positive edge capture	On-69	H00/C0000/L5330
	EtherCAT station alias	On-75	3
	Load inertia ratio identification	On-78	2.00
	Total moment of inertia/*10gcm^2	On-79	150
Parameters edit mode	Parameters editor	P0-01～P3-64	

Trial Operation Mode	Manual operation	Fn-01	JOG
	Clear the current command and	Fn-02	PRT
	Clear integrating pulse	Fn-03	CPCR
	Alarm reset	Fn-04	RT
	Clear alarm record	Fn-05	ALRT
	Parameters initialization	Fn-06	PART
	Automatic adjustment compensation	Fn-07	OFFB
	Manufacturers reserved	Fn-08、Fn-09	
	Test operation	Fn-10	ESY.1
	Manufacturers reserved	Fn-11，Fn12	
	Zero calibration of absolute encoder	Fn13	
	Absolute encoder clears multiple	Fn14	
	Manufacturers reserved	Fn15，Fn16	
	Absolute value encoder coordinate	Fn17	Clr0
	Inertia Identification	Fn19	

5.4 Sequence Monitoring Mode

The sequence monitoring mode can display the current status and alarm detection records of the servo driver.

Press the MODE key to display [Sn]. Press the ENT key to show [Sn-01], then adjust the sub-mode using the ∧ or ∨ keys. Press and hold the ENT key for more than one second to display the input content.

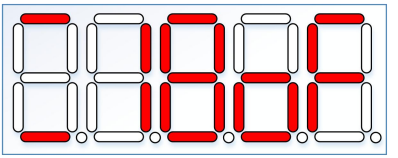
SN-01: Sequence Mode SN-02: Current Alarm

SN-03: Alarm Record SN-04: Station Number Display

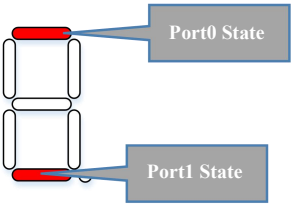
SN-05: CANopen/EtherCAT Status

When using the EtherCAT bus, the link status of EtherCAT physical layer Port0 and Port1, ESM status, working mode, and servo operation status can be obtained through the panel digital tube.

Use the four buttons to switch the display page to the Sn-05 status page, and you will see a screen similar to the following:



1. The leftmost digital tube indicates the connection status of Port0 (CN3) and Port1 (CN4),



The constant illumination of this segment indicates that the Port has a communication connection, while constant extinguishment indicates no communication connection.

2. The second digital tube from the left indicates the ESM status.

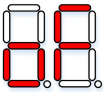
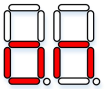
Display	Meaning
	1: Indicates that the current ESM state machine is in the Init state.
	2: Indicates that the current ESM state machine is in the Pre-Op state.
	4: Indicates that the current ESM state machine is in the Safe-Op state.
	8: Indicates that the current ESM state machine is in the Op state.
	b: Indicates that the current ESM status is in error, such as a state transition error or system disconnection.

3) The third digital tube from the left indicates the current operating mode of the servo, namely the value of object dictionary 6061h.

Possible displays are numbers ranging from 0 to 10, which stand for different working modes. For

instance, if the working mode is set to the Concurrent Synchronous Position mode (CSP), this digit will show "8". The number "0" means no working mode has been configured.

4) The fourth and fifth digital tubes from the left indicate the current operating status of the servo.

Display	Meaning
	OF: Indicates that the servo is currently in a non-enabled state.
	On: Indicates that the servo is currently in the enabled state.

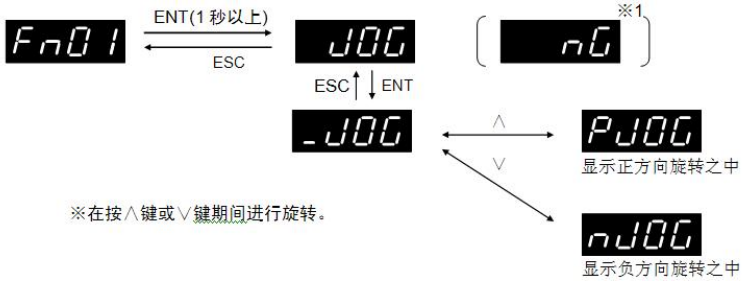
Parameter Number	Parameter Name	Remarks
On-38	Initial detection of invalid frame counter	H: Port1 interface counter L: Port0 interface counter Maximum count up to 0xFF. Count the number of error frames received by EtherCAT.
On-39	Front-end error frame counter	H: Port1 interface counter L: Port0 interface counter Maximum count up to 0xFF. Count the number of front-end error frames received by EtherCAT
On-40	Link Loss Counter	H: Port1 interface counter L: Port0 interface counter Maximum count up to 0xFF. Count only when the port is in Auto or Auto close mode.
On-41	EtherCAT position correction times	This parameter takes effect when the bit0-3 parameter in P2-67 is set to 1, which enables the EtherCAT position smoothing function.
On-42	Number of packet losses of EtherCAT in OP mode	This parameter counts the number of packet losses when EtherCAT is running in the OP state. This parameter is only valid when the slave station operates in the OP state.
On-43	Master Station Sync Cycle	Unit: us
On-44	EtherCAT Communication Status Register	In the EtherCAT state machine, regarding the value of register 0x110, checking SN05 is mostly sufficient to determine connection issues.
On-75	EtherCAT station alias	This displays the currently valid station number of the ESC for this

		drive.

5.5 Manual Trial Operation

5.5.1 Manual Operation

The servo motor can be rotated while pressing the keys on the touch panel. The rotation speed of the servo motor is set according to P0-92.



When the servo motor is driven to rotate by sequential signals controlled by input and output commands, it is displayed as [NG].

※1) Reasons for NG display

- The RUN signal and FWD/REV signal are connected
- The motor is in operation

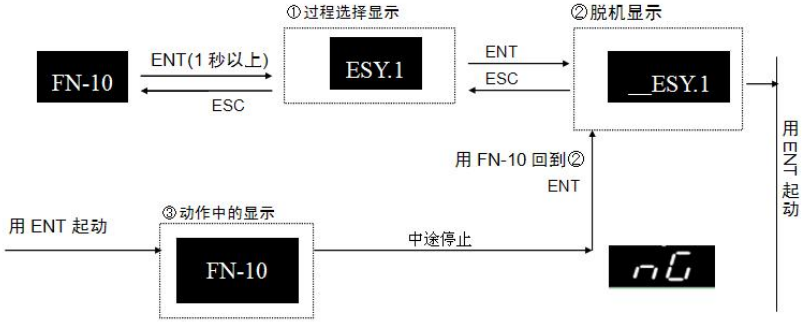
注意 Forced stop, external regenerative resistor overheating, and ±OT idle signals remain valid even during trial operation. If the equipment fails to rotate in trial operation, please check the above signals.

5.5.2 Test Operation

Users can perform test runs via the FN10 function. When operating in speed mode, the running speed is set through P0-94.

Press ENT in FN10 mode, and essy.x will be displayed (x=0: position mode; x=1: speed mode; x=2: torque mode). Press ENT again to show -essy.x, then press the UP or DWN key to select forward or reverse rotation of the motor. After operation, the display in speed mode will switch to show the current speed; no switching occurs in position mode, while torque mode will switch to display the current output torque.

Use the keyboard to switch back to FN10 mode again. Press the ent key to disable the motor enable function, and the motor will stop by coasting freely.



5.6 Inertia Identification

The purpose of inertia identification is to simplify the PI parameter tuning process of the speed loop. Combined with the rigidity level function, it enables adjusting the rigidity of the servo system with a single parameter. Accurate inertia parameters, together with theoretically calculated speed loop PI parameters, can achieve the optimal performance of the speed loop.

FN-19 enables inertia identification. The motor automatically gets enabled and rotates forward and reversely. Upon successful identification, it automatically switches to ON-78 to display the load inertia ratio. For instance, a reading of 5.00 means the inertia of the external mechanical load is 5.00 times the rated inertia of the motor. ON-79 shows the identified total system inertia (including the motor itself), and the unit of the value obtained by multiplying the displayed number by 10 is gcm^2. After successful identification, P2-10 can be set according to the value shown on ON-78. Parameters such as the initial rotation direction, rotation turns and acceleration can be configured for the inertia identification process, and the relevant parameters are listed as follows:

Parameter	Name	Range	Default Value	Unit	Effective method
P3-80	Inertia identification of initial movement direction	0: Positive direction 1: Reverse direction	0	-	Effective immediately
P3-81	Inertia Identification Compensation Operating Distance	0-20.00	2.00	circle	Effective immediately
P3-82	Inertia identification operating speed	100.0-1000.0	500.0	rpm	Effective immediately
P3-83	Inertia identification acceleration and deceleration time	10-1000	100	ms	Effective immediately
P2-10	Set the load inertia ratio	0-100.00	0	-	Effective immediately

*If the motor vibrates violently during inertia identification, reduce the gains of the position loop and speed loop first.

*When the inertia is small, appropriately reduce P3-83 to improve recognition accuracy; when the inertia is large, increase P3-83.

5.7 Rigidity Grade Selection

To simplify the parameter adjustment process for users, you can enable the standard rigidity table function:

Parameter	Name	Range	Default Value	Unit	Effective method
P1-98	Parameter self-adjusting mode	0-1	0	-	Effective immediately
P1-99	Rigidity Grade	0-30	16	-	Effective immediately

Set P1-98 to 1 to enable the standard rigidity table function.

P1-99 is used to adjust the rigidity level; the higher the value, the stronger the rigidity. After enabling this function, the position loop gain P0-40, speed loop gain P0-41 and speed loop time constant P0-42 and torque command filter time constant P0-46 are automatically modified according to the rigidity level. An excessively high rigidity level will cause vibration, so it is recommended to set it reasonably.

Set P1-98 to 0 to enter the manual gain adjustment mode, where users can customize the gain and filter parameters of the three control loops:

Position loop parameters

The performance of the position loop is mainly determined by gain and feedforward parameters:

Parameter	Name	Range	Default Value	Unit	Effective method
P0-40	Position loop gain	1-2000	50	Hz	Effective immediately
P0-44	Position loop feedforward gain	0-1.200	0	-	Effective immediately
P0-45	Feedforward filtering time constant	0.0-250.0	0	ms	Effective immediately

Speed loop parameters

The rigidity of the speed loop is mainly set by two parameters: speed loop gain and speed loop time constant.

Parameter	Name	Range	Default Value	Unit	Effective method
P0-41	Speed loop gain	1-30000	100	Hz	Effective immediately
P0-42	Speed loop integral time constant	0.20-500.00	20.00	ms	Effective immediately

P0-46	Torque command filter time constant	0.00-20.00	0.25	ms	Effective immediately

When the load inertia ratio set in P2-10 is accurate, the speed loop gain can be equivalent to the speed loop bandwidth. A higher setting value delivers faster response, while excessively high gain may cause servo vibration. The smaller the speed loop integral time constant, the stronger the integral effect. When PDFF or IP control is required, adjust the P2-15 parameter to achieve it:

Parameter	Name	Range	Default Value	Unit	Effective method
P2-15	Speed Loop PDFF Coefficients	0-2.00	1.00	-	Effective immediately

P2-15 defaults to 1.0, which means PI control; when changed to 0, the speed loop control becomes IP control.

Current loop parameters

The PI parameters of the current loop are calculated based on motor resistance, inductance and other parameters. These parameters can set the bandwidth of the current loop and fine-tune the time constant. The relevant parameters are as follows:

Parameter	Name	Range	Default Value	Unit	Effective method
P0-97	Current loop gain	100-3000	600	Hz	Effective immediately
P0-98	Current loop time constant scaling ratio	0-10.00	1.00	-	Effective immediately

Multiply the parameter value of current loop gain P0-97 by 2 to get the actual current loop bandwidth, since line inductance and line resistance are entered when setting motor parameters. The current loop time constant is automatically calculated based on motor inductance and resistance. It can be adjusted via P0-98 under special circumstances, yet modification is generally not recommended.

5.8 Model Tracking Control

In trajectory tracking or fast positioning applications, feedforward control is often adopted to reduce following errors or shorten positioning time. Nevertheless, conventional feedforward methods tend to cause severe overshoot and vibration, and it is difficult to tune feedforward gains and filter coefficients. Model following control calculates velocity and torque feedforward values directly from position commands via mathematical models, which simplifies parameter tuning and delivers favorable position tracking performance. The relevant parameters are listed as follows:

Parameter	Name	Range	Default Value	Unit	Effective method
P3-86	Model control enable	0-1	0	-	Effective immediately

P3-87	Model control gain	0-1000.0[Hz]	40.0	Hz	Effective immediately
P3-88	Feedforward compensation ratio of the model	0-200.0[%]	90.0	%	Effective immediately

P3-86: Set to 1 to enable this function. After activation, the regular feedforward will be replaced by the feedforward output of model tracking control, and parameters P0-44/P0-45 will become invalid.

P3-87: The higher the model control gain, the faster the dynamic response; an excessively high value will cause vibration.

P3-88: The larger the feedforward compensation ratio, the smaller the position following error, yet an overly large value may result in overshoot. It shall be set reasonably according to application requirements.

5.9 Mechanical Resonance Suppression

Mechanical resonance is highly likely to occur when mechanical rigidity is insufficient or the load inertia is relatively large. When resonance happens, the most effective solutions are to reduce the gains of the position loop and speed loop or increase the torque command filter time constant, yet these methods will lower the servo rigidity. If high dynamic response is required meanwhile, the notch filter function can be adopted. The new FC-E is equipped with 4 sets of torque command notch filters, which can suppress resonance points at four different frequencies simultaneously. The relevant parameters are as follows:

Parameter	Name	Range	Default Value	Unit	Effective method
P1-76	Notch Filter 1/2 Switch	H0000h-H0011	0	-	Effective immediately
P1-77	Notch Filter 1 Frequency	50-4000	1000	Hz	Effective immediately
P1-78	Notch Filter 1 Depth	0-40	40	-	Effective immediately
P1-79	Notch Filter 1 Width	0-1.00	0.3	-	Effective immediately
P1-80	Notch Filter 2 Frequency	50-4000	1000	Hz	Effective immediately
P1-81	Notch Filter 2 Depth	0-40	40	-	Effective immediately
P1-82	Notch Filter 2 Width	0-1.00	0.3	-	Effective immediately
P1-92	Notch Filter 3 Frequency	50-4000	4000	Hz	Effective immediately
P1-93	Notch Filter 3 Depth	0-40	40	-	Effective immediately

P1-94	Notch Filter 3 Width	0-1.00	0.3	-	Effective immediately
P1-95	Notch Filter 4 Frequency	50-4000	4000	Hz	Effective immediately
P1-96	Notch Filter 4 Depth	0-40	40	-	Effective immediately
P1-97	Notch Filter 4 Width	0-1.00	0.3	-	Effective immediately

The lower two bits of P1-76 control the enable of notch filter 1 and notch filter 2 respectively, and setting them to 1 enables the corresponding notch filters.

Notch filters 3 and 4 are ineffective when the frequency is set to 4000Hz, but take effect when set to other values.

The frequency of the notch filter is generally obtained by performing FFT analysis on frequency sweep data. The larger the depth parameter of the notch filter, the greater the notch depth; the larger the width parameter of the notch filter, the wider the notch frequency range.

5.10 Position Latching Function

Position latching function, also known as Touch Probe Function, is a function specified in the CiA402 sub-protocol for latching positions at the edge of a certain signal.

This series of servos is equipped with two sets of independent probes that can latch position information simultaneously. The trigger sources include general digital inputs (DI3 and DI4) and Z-phase signals (simulated zero-crossing points of absolute encoders). Touch probe 1 is hereinafter referred to as Tp1, and Touch probe 2 as Tp2.

When using digital inputs DI3 and DI4 of the servo driver as probe trigger sources, it is necessary to set the corresponding IO function parameters P0-12 and P0-13. Tp1 and Tp2 correspond to input function codes 70 and 71 respectively. For example, when P0-12=70 and P0-13=71, DI3 can serve as the trigger source for Tp1 and DI4 as the trigger source for Tp2. Meanwhile, digital inputs can also be filtered via software. The larger the values of P2-82 and P2-83, the longer the filtering time. It should be noted that excessively long filtering may prevent short pulse signals from triggering probe movements. The relevant parameters are as follows:

Parameter	Name	Range	Default Value	Unit	Effective method
P0-12	CONT3 signal allocation	0-78 (70: Tp1 71: Tp2)	0	-	Power outage in effect
P0-13	CONT4 signal allocation	0-78 (70: Tp1 71: Tp2)	0	-	Power outage in effect
P2-82	Number of filters for Probe 1	0-50	2	-	Effective immediately
P2-83	Number of filters for Probe 2	0-50	2	-	Effective immediately

The object dictionary 60B8h controls the movement of the probe, 60B9h feeds back the probe status, 60BAh and 60BBh are respectively the rising edge and falling edge latch positions of Tp1, and 60BCh and 60BDh are respectively the rising edge and falling edge latch positions of Tp2.

The meanings of object dictionaries 60B8h and 60B9h are as follows:

Index	Sub-index	Name	Range	Data type	Access properties	PDO mapping	Unit	Default value
60B8h	00h	Probe Mode	0-65535	UINT16	RW	ALL	-	0

The object performs bitwise operations to execute probing functions, with the meaning of each bit as shown in the following table:

Bit	Value	Meaning	
0	0	Close Tp1	Start and stop of Tp1 (Start triggered by rising edge)
	1	Open Tp1	
1	0	Single Mode	Tp1 trigger mode selection
	1	Continuous Mode	
2	0	Trigger source selection digital input DI3/DI4	Tp1 trigger source selection
	1	Trigger source selects Z-phase signal	
3	-	Reserved	Unused
4	0	Disable Tp1 rising edge trigger	Tp1 rising edge selection
	1	Enable Tp1 rising edge trigger	
5	0	Disable Tp1 falling edge trigger	Tp1 falling edge selection
	1	Enable Tp1 falling edge trigger	
6-7		Reserved	Unused
8	0	Close Tp2	Start and stop of Tp2 (Start triggered by rising edge)
	1	Open Tp2	
9	0	Single Mode	Tp2 trigger mode selection
	1	Continuous Mode	
10	0	Trigger source selection digital input DI3/DI4	Tp2 trigger source selection
	1	Trigger source selects Z-phase signal	
11	-	Reserved	Unused
12	0	Disable Tp2 rising edge trigger	Tp2 rising edge selection
	1	Enable Tp2 rising edge trigger	
13	0	Disable Tp2 falling edge trigger	Tp2 falling edge selection
	1	Enable Tp2 falling edge trigger	

14-15		Reserved	Unused

Index	Sub-index	Name	Range	Data type	Access properties	PDO mapping	Unit	Default value
60B9h	00h	Probe Mode	0-65535	UINT16	RO	TPDO	-	0

This object indicates the probe status, and the meaning of each bit is shown in the table below:

Bit	Value	Meaning	
0	0	Tp1 is stopping	Startup and shutdown status of Tp1
	1	Tp1 is acting	
1	0	Tp1 Rising edge not completed	Tp1 rising edge trigger state
	1	Tp1 Rising edge has been captured	
2	0	Tp1 falling edge not completed	Tp1 falling edge trigger state
	1	Tp1 falling edge has been captured.	
3-5	-	Reserved	Unused
6-7	-	Not supported	Unused
8	0	Tp2 is stopping	Startup and shutdown status of Tp2
	1	Tp2 is acting	
9	0	Tp2 Rising edge not completed	Tp2 rising edge trigger state
	1	Tp2 Rising edge has been captured	
10	0	Tp2 falling edge not completed	Tp2 falling edge trigger state
	1	Tp2falling edge has been captured.	
11-13	-	Reserved	Unused
14-15	-	Not supported	Unused

6 SERVO ALARM

6.1 Alarm Content

Alarm detection content:

After detection of alarm, the servo drive alarm codes flash automatically on the touch panel.

If there are detections of multiple alarms, the touch panel displays the alarms in the following order of priority

Priority order	Display	Name	EMCY message code (603Fh)
1	OC1	Overcurrent 1	0x2311
2	DE	Storage error	0x5530
3	EC	Encoder communication error	0x7305
4	EH	Current sampling loop damaged	0x5210
5	PLD	CPLD error	0x7500
6	CE	Motor code error	0x7122
7	ND	No motor code	0xFF01
8	EC1	Absolute value encoder selection	0x7380
9	EC2	Absolute encoder single turn	0x7381
10	nd1	Read new motor	0x7383
11	nd2	Error reading motor information	0x7384
12	OS1	Electric scooter	0x8400
13	OC2	Overcurrent 2	0x2312
14	OS	Overspeed	0x8400
15	OL	motor overload	0x3230
16	OL1	Drive overload	0x2350
17	Loc	Motor stall	0x7121
18	Lu	low voltage	0x3120
19	HU	Overvoltage	0x3110
20	OF	Deviation exceeded	0x8611
21	AH	Drive overheating	0x4210
22	EP	Bleed circuit fault	0x5420
23	RH1	Regenerative resistor overheating	0x7112
24	BAT1	Battery alarm 1	0xFF03
25	BAT2	Battery error 2	0xFF04
26	LOT	Absolute encoder multi turn	0x7320

27	EC3	Absolute value encoder multi turn	0x7382
28	nd3	Encoder EEPROM write error	0x7385
29	GOH	Zero return error	0x8613
30	CO01	402 State machine does not switch	0xFF05
31	CO02	EtherCAT state machine does not switch normally	0xFF06
32	PPOT	Positive soft limit alarm	0x5442
33	PNOT	Negative soft limit alarm	0x5443
34	PAr1	Mechanical single-loop PUU count over-limit alarm	0xFF08
35	PAr2	Origin offset over-limit alarm	0xFF09

6.2 Alarm Explanation And Handling

Alarm code	Alarm name	running status	Probable cause	Handling(for reference only)
OS	Over Speed	Appears when the drive is powered on	Drive circuit fault	Replace the drive
			Encoder fault	Replace the servo motor
		Appears when the motor has just started	Excessive load inertia	1.Reduce the load inertia
				2.Replace more powerful drive and servo motor
			Encoder zero error	1.Replace servo motor
				2.Send back to the manufacturers to readjust the encoder zero
			Motor U, V, W phase sequence error	Check the wiring and connect the wiring correctly
			Encoder wiring error	
		Appears during motor operation	The entered command pulse frequency is too high	Upper computer sets inputted command pulse frequency correctly
			Electronic gear ratio is too large	Set the appropriate electronic gear ratio correctly
			Acceleration and deceleration time constant is too small, so that exceed constant speed is overshoot (speed controlling)	1.Increase the acceleration and deceleration time constant
				2. S-shaped time constant (parameter P0-43) is set larger
				3. Speed response during operation (parameter P0-41) is set a little higher

			Encoder fault	Replace servo motor
			Servo system parameters are not adjusted well, causing overshoot	1. Reset the gain related to the regulator
				2.If gain is difficult to set a suitable value, replace the suitable motor
HU	Main circuit overvoltage	Appears when the power is turned on	Drive internal circuit board fault	Replace servo drive
			Power supply voltage is too high	View the drive value of ON-07 is greater than the 380V or not, Check whether the power supply is too large.
		Appears during motor operation	Disconnect the brake resistor wiring	Connection again
			Braking resistor damaged	Under the condition of power off, measure whether the resistance of the braking resistor is consistent with the label. If it is judged to be damaged, replace the braking resistor
			The internal braking transistor of the driver is	Replace servo drive
			The internal brake circuit of the drive is damaged	
			Braking resistor capacity is not enough	1.Reduce the frequency of start and stop
				2.Increase the acceleration / deceleration time constant
				3.Reduce the current limit amplitude
				4.Reduce the load inertia
				5.Reduce speed
				6.External braking resistor with sufficient capacity
			Servo motor inertia is not enough	Replace servo motor with greater inertia
LU	Main circuit under-voltage	Appears when the power is turned on	The main power wire contact badly	Whether the main power indicator light between the drive power terminal block is on, if it is not on, check whether the connection is good.
			Unstable power supply, power supply voltage is low	Check whether the drive On-07 value is less than the set value of P0-61
				determine whether the stability of power supply or not
			Temporary power outage for more than 20ms	Check the power supply
			Drive internal components fault	Replace servo drive

		Appears during motor operation	Power capacity is not enough	Check the power supply
			Power break down instantaneously	
OF	Position deviation exceeds	Appears when the power is turned on	Drive circuit board fault	Replace servo drive
		Appears when the motor starts	Motor U, V, W wiring error	Correct wiring
			Encoder wiring error	
			Position percentage gain is too small	Increase the position percentage gain
			Less output torque	1. Check the torque limit value
				2. Reduce the load capacity
				3. Replace high-power servo drive and servo motor
			Pulse command frequency is too high	Check if On-15 is below 500 during differential input, and check if On-15 is below 200 during open collector input. If not, reduce the pulse frequency
		During motor operating	Drive power circuitry failure	Replace servo drive
			Drive parameters are not adjusted well	Increase the position gain
			Pulse command frequency is too high	Check if On-15 is below 500 during differential input, and check if On-15 is below 200 during open collector input. If not, reduce the pulse frequency
			Input supply voltage is lower	When loading, the voltage drops below the working voltage, choose the correct transformer and install the regulator
AH	Drive overheat	Alarm when the power is turned on, when the ambient temperature is normal	Driver internal circuit failure	Replace servo drive
		Appears during motor operation	Cooling fan does not work	Check the temperature value displayed on On-09. If the fan is not turned on when it exceeds 40℃, replace the servo drive

			High ambient temperature, poor heat dissipation in the working environment	To maximize the ventilated effect in the environment
			Can't consume renewable electricity	Extend the deceleration time
EC	Encoder communication error	Appears when the power is turned on	Encoder cables error	Check whether the wiring of the encoder cable is correct and whether there is a disconnection
		Appears during operation	The power-on sequence of the servo does not match the encoder	Check the information of the encoder, set P1-55 to the encoder starts to produce valid output
			Encoder cable bad contact	Check the encoder cable is contact well or not
			Encoder damaged	Replace servo drive
EH	Current sampling loop damage	Appears when the power is turned on	The drive internal current sampling circuit damaged	Replace servo drive
DE	Storage error	Appears when the power is turned on	The speed parameter exceeds the maximum speed P0-34	Check the parameters P0-19, P0-66, P0-73, P0-92, P0-94, P1-00~P0-15 and confirm that they are smaller than P0-34, and then restart
			Incorrect motor code settings	Confirm whether the P0-64 parameters match the motor nameplate, and restart after confirmation.
			The data exceeds the normal size limit	Check ON28, confirm the parameter causing DE, and then modify this parameter to the normal range
			Storage is damaged or communication changes storage parameters too frequently	Replace the servo driver. If the storage parameters are modified too frequently during communication, please set P0-80=HXXX1 parameters, and do not write the communication parameters to the storage
			Abnormal communication between storage and main chip	
OL	Overload	Appears when the power is turned on	Drive internal circuit board fault	Replace servo drive
		Appears during motor operation	Run over rated torque	1. Check the load

				2. Reduce the start-stop frequency
				3. Replaced by more powerful drive and servo motor
			Driver power line U, V, W wiring is wrong	Check the wiring and confirm U, V, W correct wiring
			Motor operates with oscillation and unstable	1．Increase the gain
				2．Increase the acceleration and deceleration time
				3．Reduce the load inertia
			Servo motor abnormalities	Replace servo motor
OC1	Over-current 1	Appears when the power is turned on	Internal circuit of drive fault	Replace servo drive
		Appears during motor operation	Drive power lines U, V, W short-circuit	Check power line
			Acceleration and increase time too short	Increase the acceleration and deceleration time
			Excessive rigidity of the control loop parameters	Reduce the rigidity, which reduces the position gain, speed gain
			Output current is too large	Reduce the maximum current limit value parameter P0-07/08
			Poorly grounded, external interference	Correctly grounding
			Drive internal circuit damage, lack phase, and so on	Replace servo drive
OC2	OC2	Over-current 2	Appears during motor operation	Drive fault
ND	No motor code	Appears on power up	Set corresponding motor code before using drive	Motor code setting method：
				Set P0-64: motor code, please check the code item on the instruction manual or motor nameplate.
CE	Motor code error	Appears after modifying the motor code	The setting motor code not match drive	Reconfirm motor code
PLD	CPLD communication error	Appears on power up	CPLD and DSP communication error	Replace servo drive

RH1	Overheating of bleed resistor	Running	Mismatch between bleed resistance and operating conditions	1 Check whether the parameters P3-60 and P3-61 are consistent with the actual discharge resistance 2. Replace the bleed resistor with higher power
BAT1	Battery alarm 1	Running	The battery voltage starts to drop	Replace the battery when the drive is powered on
BAT2	Battery alarm 2	Running	The battery voltage has dropped to a low level and the recording position has been lost	1. Replace the battery when the drive is powered on 2. Since the position data has been lost, it must be reset to zero
LOT	Absolute encoder multi-turn alarm	The motor runs in one direction for a period of time	In the absolute value system, it turned more than 32767 times in one direction, and the position record was sent incorrectly	1 Check the application type Set the appropriate P1-52 2 After doing FN14 near the working range, find the origin again
GOH	Back to zero error	After a period of time back to zero	Can't find the origin after hitting the left and right limit switches	1. Check whether the origin switch signal is normal 2. Check whether the correct homing setting is correct
PPOT	Positive software limit alarm	Run for a period of time in the forward direction of the motor	Run to the software's positive OT limit point	Confirm the direction and size of the given command
P0OT	Negative software limit alarm	Run in the reverse direction of the motor for a period of time	Run to the software negative OT limit point	Confirm the direction and size of the given command
CO01	402 State machine does not switch normally	The server is running in canopen mode	When the 402 state machine switches to the OP state, the enable operation is executed but the working mode 6060h is not set.	Check whether there is a running mode set on the host computer sending

CO02	Abnormal transition of EtherCAT state machine	When the CiA402 state machine is in the Operation Enable state, the ESM state machine switches from the OP state to other states.	Disconnection at the physical layer or misoperation of the host computer	Check the network cable connection
OL1	Drive overload	Servo running	Power range mismatch	1. Check for unreasonable matching such as large motors paired with small drives or small motors paired with large drives. 2. Verify whether the power range parameters match the drives.
LOC	Motor stall	Servo running	Mechanical jamming, motor damage and seizure or wrong phase sequence connection	Check the machinery, motors and phase sequence; Parameters P1-85, P1-86 and P1-89 can adjust alarm sensitivity or disable the corresponding alarm.
OS1	Motor Overspeed	Servo running	Parameter error, wrong phase sequence connection, incorrect encoder zero position	Check the servo parameters, phase sequence and encoder zero position. Parameters P1-87, P1-88 and P1-89 can be used to adjust the alarm sensitivity or disable this alarm.
EC1	Wrong selection of absolute encoder	Power-on occurs	The number of feedback bits reported by the encoder during power-on self-test is inconsistent with the setting value of parameter P1-53.	Please confirm with the supplier the actual encoder bits of the installed motor, modify the corresponding bits of parameter P1-53, and restart the servo drive.
EC2	Single-turn position error of absolute encoder	Power-on occurs	The encoder fails to obtain accurate single-turn position information during power-on self-test.	1. Try powering off and restarting the servo. 2. Check if the rear end cover of the motor is loose or contaminated. 3. Replace the motor if the above methods fail.
EC3	Multi-turn position error of absolute encoder	Power-on occurs	The encoder reports that it cannot obtain accurate multi-turn position information during power-on self-test.	1. Try powering off and restarting the servo. 2. Check if the rear end cover of the motor is loose or contaminated. 3. Replace the motor if the above methods fail.

nd1	Detected a new motor	Power-on occurs	The motor information recorded in the encoder is inconsistent with the current servo settings.	1. If the motor information reading function is required, simply power off and restart the servo, and the servo will load the read motor. 2. If the motor information reading function is not used, set the corresponding bit of P1-53 to 0, and confirm P0-64 to ensure it is set to the corresponding motor, then restart the servo.
nd2	Error reading motor information	Power-on occurs	It is confirmed that the motor information recorded in the encoder is incomplete	1. Set the P1-53 parameter to disable the function of obtaining motor information from the encoder, and manually configure P0-64 to the corresponding motor, then restart the servo.
nd3	Encoder EEPROM write error	Power-on occurs	Failed to modify the motor parameter information recorded by the encoder	1. Set parameter P1-53 to disable the function of obtaining motor information from the encoder, then restart the servo drive.

6.3 View Current Alarm Status

First, check the historical alarm records through Sn-03, retrieve the required alarm code, long press the "ENT" key, then use the up and down keys to browse the related status when this alarm occurred, totaling five items, as detailed below.

0: Intermediate DC voltage during alarm (V);
1: Motor speed during alarm (%);
2: Motor output current during alarm (%);
3: Terminal input signal during alarm;
4: Terminal output signal during alarm;

Appendix 1: Selection Table for 220V Servo Drives and 4-Pole Motors

Servo motor					Corresponding driver	
Type	Rated power (KW)	Rated current (A)	Rated torque (N.m)	Rated speed (r/min)	Model	Motor code
40ST-CJ001D2H	0.05	0.4	0.16	3000	FB1201-ATE	83
40ST-CJ003D2H	0.1	0.6	0.32	3000	FB1201-ATE	81
60ST-CJ006D2D	0.2	1.2	0.637	3000	FB1201-ATE	4
60ST-CJ013D2D	0.4	2.8	1.27	3000	FB1202-ATE	5
60ST-CJ019D2D	0.6	3.5	1.91	3000	FB1204-ATE	6
80ST-CJ013D2A	0.4	2	1.27	3000	FB1202-ATE	11
80ST-CJ024D2A	0.75	3	2.39	3000	FB1204-ATE	12
80ST-CJ035B2A	0.73	3	3.5	2000	FB1204-ATE	13
80ST-CJ035D2A	1.05	4.5	3.5	3000	FB1205-ATE	17
80ST-CJ040C2A	1	4.4	4	2500	FB1205-ATE	14
90ST-CJ024B2D	0.5	3	2.4	2000	FB1204-ATE	21
90ST-CJ024D2D	0.75	3	2.4	3000	FB1204-ATE	22
90ST-CJ035B2D	0.73	3	3.5	2000	FB1204-ATE	23
90ST-CJ040C2D	1	4	4	2500	FB1205-ATE	24
110ST-CJ020D2A	0.6	2.5	2	3000	FB1202-ATE	31
110ST-CJ040B2A	0.8	3.5	4	2000	FB1205-ATE	32
110ST-CJ040D2A	1.2	5	4	3000	FB1205-ATE	33
110ST-CJ050D2A	1.5	6	5	3000	FB1206-ATE	34
110ST-CJ060K2A	0.5	2.2	6	800	FB1202-ATE	165
110ST-CJ060B2A	1.2	4.5	6	2000	FB1205-ATE	35
110ST-CJ060D2A	1.8	6	6	3000	FB1206-ATE	36
110ST-CJ065E2A	0.65	3	6.5	1000	FB1204-ATE	166
110ST-CJ080B2A	1.6	6.7	8	2000	FB1206-ATE	151
110ST-CJ100B2A	2.0	8.5	10	2000	FB3210-ATE	98
130ST-CJ040C2A	1	4	4	2500	FB1205-ATE	41
130ST-CJ050C2A	1.3	5	5	2500	FB1205-ATE	42
130ST-CJ050D2A	1.5	5.8	5	3000	FB1206-ATE	170

130ST-CJ060A2A	0.9	4.3	6	1500	FB1205-ATE	43
130ST-CJ060C2A	1.5	6	6	2500	FB1206-ATE	44
130ST-CJ060D2A	1.9	7.5	6	3000	FB1206-ATE	101
130ST-CJ077A2A	1.2	5	7.7	1500	FB1205-ATE	187
130ST-CJ077C2A	2	7.5	7.7	2500	FB1206-ATE	45
130ST-CJ100E2A	1	4.5	10	1000	FB1205-ATE	46
130ST-CJ100A2A	1.5	6	10	1500	FB1206-ATE	47
130ST-CJ100C2A	2.6	10	10	2500	FB3210-ATE	48
130ST-CJ100D2A	3	14	10	3000	FB3220-ATE	142
130ST-CJ120E2A	1.2	6.5	12	1000	FB1206-ATE	152
130ST-CJ120A2A	1.9	7	12	1500	FB3210-ATE	37
130ST-CJ120C2A	3.1	12	12	2500	FB3210-ATE	79
130ST-CJ150E2A	1.5	7.3	15	1000	FB1206-ATE	53
130ST-CJ150A2A	2.3	9.5	15	1500	FB3210-ATE	49
130ST-CJ150C2A	3.8	13.5	15	2500	FB3220-ATE	50
130ST-CJ170E2A	1.7	7.5	17	1000	FB3210-ATE	73
130ST-CJ170B2A	3.5	14	17	2000	FB3220-ATE	51
130ST-CJ190E2A	2	8.4	19	1000	FB3210-ATE	167
130ST-CJ230B2A	4.8	16.5	23	2000	FB3220-ATE	52
150ST-CJ150B2C	3	14	15	2000	FB3210-ATE	96
150ST-CJ180B2C	3.6	17	18	2000	FB3220-ATE	95
150ST-CJ230B2C	4.7	21	23	2000	FB3220-ATE	90
150ST-CJ270E2C	2.8	14.5	27	1000	FB3220-ATE	109
150ST-CJ270B2C	5.5	24	27	2000	FB3220-ATE	72
180ST-AD172A2E	2.7	10.5	17.2	1500	FB3210-ATE	61
180ST-AD190A2E	3	12	19	1500	FB3210-ATE	62
180ST-AD190B2E	4	16	19	2000	FB3220-ATE	176
180ST-AD215B2E	4.5	16	21.5	2000	FB3220-ATE	63
180ST-AD270E2E	2.9	12	27	1000	FB3210-ATE	64
180ST-AD270A2E	4.3	16	27	1500	FB3220-ATE	65
180ST-AD350E2E	3.7	16	35	1000	FB3220-ATE	66
180ST-AD350A2E	5.5	24	35	1500	FB3220-ATE	67

Appendix 2: Selection Table for 380V Servo Drives and 4-Pole Motors

Motor model	Rated power (KW)	Rated current (A)	Rated torque (N.m)	Rated Speed (r/min)	Corresponding Drive Model	Motor Code
80ST-CJ024D4A-I	0.75	1.6	2.39	3000	FB3404-ATE	35
80ST-CJ035D4A-I	1	2.5	3.5	3000	FB3404-ATE	50
80ST-CJ040C4A-I	1	3	4	2500	FB3404-ATE	103
110ST-CJ040D4A-I	1.2	3	4	3000	FB3404-ATE	102
110ST-CJ060D4A-I	1.8	4.5	6	3000	FB3409-ATE	31
130ST-CJ040C4A-I	1	2.6	4	2500	FB3404-ATE	48
130ST-CJ050C4A-I	1.3	3	5	2500	FB3404-ATE	45
130ST-CJ060E4A-I	0.6	2	6	1000	FB3404-ATE	54
130ST-CJ060A4A-I	0.9	2.5	6	1500	FB3404-ATE	37
130ST-CJ060C4A-I	1.5	4.0	6	2500	FB3404-ATE	51
130ST-CJ060D4A-I	1.8		6	3000	FB3409-ATE	38
130ST-CJ077E4A-I	0.8	2.5	7.7	1000	FB3404-ATE	55
130ST-CJ077C4A-I	2	4.5	7.7	2500	FB3409-ATE	49
130ST-CJ077D4A-I	2.4	5.6	7.7	3000	FB3409-ATE	112
130ST-CJ085E4A-I	1.3	2.75	8.5	1000	FB3404-ATE	56
130ST-CJ085A4A-I	1.3	3.5	8.5	1500	FB3404-ATE	110
130ST-CJ100E4A-I	1	2.5	10	1000	FB3404-ATE	40
130ST-CJ100A4A-I	1.5	3.5	10	1500	FB3404-ATE	39
130ST-CJ100C4A-I	2.6	6	10	2500	FB3409-ATE	22
130ST-CJ100D4A-I	3	7.7	10	3000	FB3409-ATE	83
130ST-CJ120C4A-I	3.15	6.7	12	2500	FB3409-ATE	96
130ST-CJ150E4A-I	1.5	3.5	15	1000	FB3404-ATE	46
130ST-CJ150A4A-I	2.4	5.7	15	1500	FB3409-ATE	2
130ST-CJ150B4A-I	3	6.6	15	2000	FB3409-ATE	84
130ST-CJ150C4A-I	3.8	7.4	15	2500	FB34013-ATE	52
130ST-CJ170A4A-I	2.7	5.5	17	1500	FB3409-ATE	57

130ST-CJ170B4A-I	3.5	7.7	17	2000	FB3409-ATE	3
130ST-CJ180A4A-I	2.8	6.5	18	1500	FB3409-ATE	18
130ST-CJ180C4A-I	4.5	11.2	18	2500	FB34013-ATE	91
130ST-CJ230A4A-I	3.6	7.5	23	1500	FB34013-ATE	43
140ST-CJ050C4A-I	1.3	3	5	2500	FB3404-ATE	53
150ST-CJ150B4C-I	3	6.8	15	2000	FB3409-ATE	26
150ST-CJ150C4C-I	3.8	9.5	15	2500	FB34013-ATE	27
150ST-CJ180B4C-I	3.6	8.5	18	2000	FB34013-ATE	28
150ST-CJ230B4C-I	4.7	12	23	2000	FB34013-ATE	29
150ST-CJ270A4C-I	4.2	11	27	1500	FB34013-ATE	47
180ST-AD190A4E-I	3	7.5	19	1500	FB3409-ATE	62
180ST-AD215B4E-I	4.5	9.5	21.5	2000	FB34013-ATE	32
180ST-AD270A4E-I	4.3	10	27	1500	FB34013-ATE	65
180ST-AD270B4E-I	5.6	12.8	27	2000	FB34013-ATE	24
180ST-AD350A4E-I	5.5	12	35	1500	FB34013-ATE	67
180ST-AD350B4E-I	7.3	16	35	2000	FB34017-ATE	25
180ST-AD480E4E-I	5	12	48	1000	FB34013-ATE	30
180ST-AD480A4E-I	7.5	20	48	1500	FB34025-ATE	68

Appendix 3: Selection Table for 220V Servo Drives and 5-Pole Pair Motors

Motor model	Rated power (KW)	Rated torque (N.m)	Rated Speed (r/min)	Rated current (A)	Corresponding Drive Model	Motor Code
40SE-AC003D2H-A	0.1	0.32	3000	1.1	FB1201-ATE	175
60SE-AC006D2D-A	0.2	0.64		1.4	FB1202-ATE	171
60SE-AC013D2D-A	0.4	1.27		2.1	FB1202-ATE	172
60SE-AC019D2D-A	0.6	1.91		4.2	FB1204-ATE	209
80SE-AC024D2A-A	0.75	2.39		3.8	FB1204-ATE	173
80SE-AC032D2A-A	1.00	3.2		5.7	FB1206-ATE	174
60SG-CJ013D2D-A	0.4	1.3	3000	2.5	FB1204-ATE	212
80SG-CJ024D2A-A	0.75	2.4		4.6	FB1205-ATE	211
80SG-CJ032D2A-A	1.0	3.2		5.8	FB1206-ATE	210
110SG-CJ042B2A-C	0.9	4.2	2000		FB1205-ATE	
110SG-CJ064B2A-C	1.3	6.4	2000	6.7	FB1206-ATE	
130SG-CJ083D2A-C	2.6	8.3	3000	12.0	FB3215-ATE	124
130SG-CJ048B2C-C	1.0	4.8	2000	5.2	FB1205-ATE	177
130SG-CJ062B2C-C	1.3	6.2		6.6	FB1206-ATE	183
130SG-CJ072B2C-C	1.5	7.2		8.0	FB3210-ATE	184
130SG-CJ096B2C-C	2.0	9.6		10	FB3210-ATE	178
130SG-CJ115B2C-C	2.5	11.5		12.8	FB3215-ATE	179
130SG-CJ148B2C-C	3.0	14.8		14.5	FB3215-ATE	180
130SG-CJ054A2C-C	0.85	5.4	1500	6.2	FB1206-ATE	181
130SG-CJ083A2C-C	1.3	8.3		9.3	FB3210-ATE	182
130SG-CJ115A2C-C	1.8	11.5		12.5	FB3215-ATE	186
180SG-AD186A2E-C	2.9	18.6		18.0	FB3220-ATE	

Appendix 4: Selection Table for 380V Servo Drives and 5-Pole-Pair Motors

Motor model	Rated power (KW)	Rated torque (N.m)	Rated Speed (r/min)	Rated current (A)	Corresponding Drive Model	Motor Code
80SG-CJ024D4A-A	0.75	2.4	3000	3.6	FB3404-ATE	127
80SG-CJ032D4A-A	1.0	3.2		4.1	FB3404-ATE	128
130SG-CJ083D4C-C	2.6	8.3	3000	8.7	FB3409-ATE	121
130SG-CJ115D4C-C	3.6	11.5		11.2	FB3413-ATE	123
130SG-CJ148D4C-C	4.6	14.8		15.0	FB3417-ATE	122
130SG-CJ048B4A-C	1.0	4.8	2000	4.4	FB3404-ATE	129
130SG-CJ072B4A-C	1.5	7.2		4.6	FB3404-ATE	116
130SG-CJ096B4A-C	2.0	9.6		5.5	FB3409-ATE	117
130SG-CJ115B4A-C	2.4	11.5		6.5	FB3409-ATE	126
130SG-CJ148B4A-C	3.0	14.8		8.0	FB3409-ATE	118
130SG-CJ054A4C-C	0.85	5.4	1500	3.3	FB3404-ATE	113
130SG-CJ083A4C-C	1.3	8.3		6.0	FB3409-ATE	
130SG-CJ115A4C-C	1.8	11.5		6.6	FB3409-ATE	114
180SG-AD186A4E-C	2.9	18.6	1500	11.9	FB3413-ATE	104
180SG-AD284A4E-C	4.4	28.4		14.0	FB3417-ATE	119
180SG-AD350A4E-C	5.5	35		17.0	FB3417-ATE	115
180SG-AD480A4E-C	7.5	48		26.0	FB3425-ATE	125

Appendix 5: Motor Code Setting Method

If the motor code is not set, the drive will display an "Nd" alarm after power-on, and the motor code needs to be configured at this point:

Set P0-64: motor code. For the specific motor code, refer to the manual or the code field on the motor nameplate.

Note: Power off and restart after configuration. Improper settings will trigger a "CE" alarm on the drive.

Appendix 6: Main Models and Descriptions of FB (EtherCAT Series) Servos

NO.	Model	Power (KW)	Brake Resistor	Fan
1	FB1201-ATE	0.2	Optional	No
2	FB1202-ATE	0.4	Optional	No
3	FB1204-ATE	0.75	Optional	Yes
4	FB1205-ATE	1.0	Internal 50Ω, 50W	Yes
5	FB1206-ATE	1.5	Internal 50Ω, 50W	Yes
6	FB3210-ATE	2	Optional	Yes
7	FB3215-ATE	3	Optional	Yes
8	FB3220-ATE	4	Optional	Yes
9	FB3404-ATE	1.5	Optional	Yes
10	FB3409-ATE	3	Optional	Yes
11	FB3413-ATE	5.5	Optional	Yes
12	FB3417-ATE	7.5	Optional	Yes
13	FB3425-ATE	11	Optional	Yes