



ALL MADE BY ESTUN

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Home

Complete Solution of Second Generation
Electro-hydraulic Hybrid Servo Pump System



ALL DIGITAL AC SERVO SYSTEMS

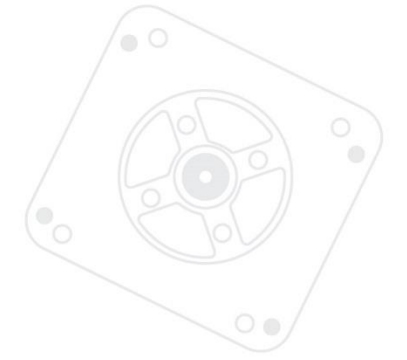
Nanjing ESTUN Automation Co., Ltd. is a leading product & service provider of core components of high-end intelligent equipment, industrial robots and intelligent manufacturing systems.

As one of the influential companies in China's motion control field, ESTUN Automation has completed the strategic transformation of its core automation component product line from AC servo system to motion control system solution, and its business model is undergoing an upgrade from Single Axis to Single Machine and to Unit.

ESTUN Automation has been exploring the development strategy of "internationalization". It has acquired Trio (UK), taken a controlling stake in M.A.i. (Germany), acquired shares in Barrett (USA) and Euclid (Italy), and established a European R&D Center in Milan, thereby completing the initial international layout in terms of brand and technology, and laying a solid foundation for the implementation of its development strategies in motion control solutions, intelligent collaborative robots, rehabilitation robots and Industry 4.0. At present, ESTUN Automation has seven overseas branches globally with businesses in over 60 countries and regions.

In the future, ESTUN will follow the development trend of the industry and embark on a road of development with ESTUN characteristics. With the goal of creating the world's first brand of Chinese robots, ESTUN will build itself into a mission of creating the world's brand of Chinese robot, and build ESTUN Automation into an international enterprise recognized and respected by its peers.

A brighter world deserves our full attention.



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Product Introduction

Advantages of Electro-hydraulic Hybrid Servo Drives

Hydraulic driving system

High power density
High power output
High energy consumption
High noise level
.....

Electric-only Drive System

High dynamic response
High accuracy
Energy efficient and easy to control
High installation requirements
.....

Electro-hydraulic Servo Drive System

Reduced energy consumption

- ▶ Oil supply on demand to avoid energy saving and overflow waste
- ▶ No motor rotation during standby, so there's almost no consumption of electrical energy.

Reduced noise

- ▶ Use of low-noise internal gear pumps and four-quadrant piston pumps to reduce noise during system operation.
- ▶ No motor rotation during standby, so there's almost no noise.

Improved control performance

- ▶ Precise control of servo motor torque and speed for high-precision pressure and flow control.
- ▶ Low oil temperature variation to improve system reproducibility



Electro-hydraulic Servo Drive System

Closed-loop control of the position, speed and pressure of the load is achieved by controlling a permanent magnet synchronous servo motor to drive a hydraulic pump. It is a system that combines the advantages of both hydraulic control and servo control

Reduced costs

- ▶ Eliminate the need for expensive mechanical devices compared to electric-only drive system.
- ▶ 75% reduction in hydraulic oil use compared to valve systems

Reduced noise

- ▶ 75% of the tank volume is saved compared to open hydraulic circuits.
- ▶ The configuration is more flexible than other drive modes, making it possible to miniaturize all components

Improved control performance

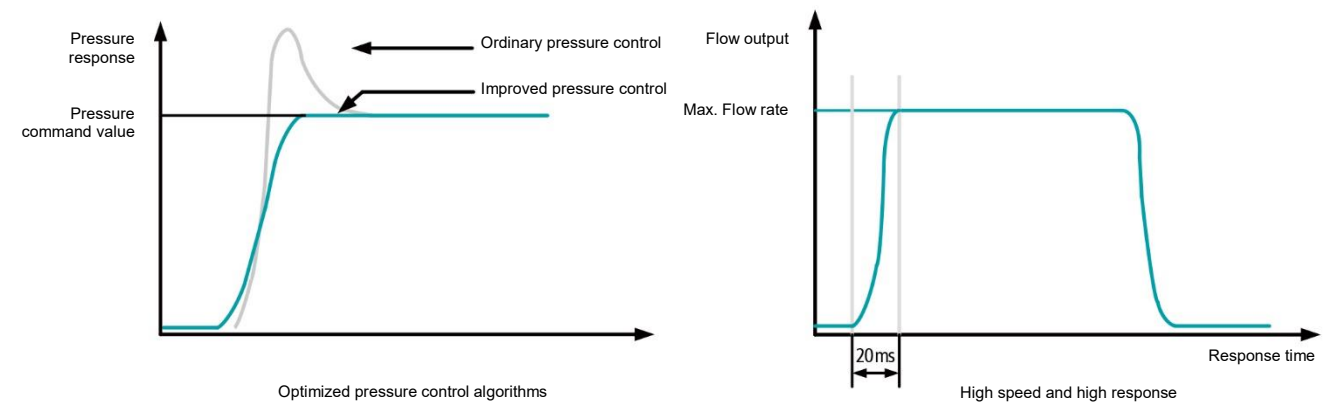
- ▶ There is no need for regular lubrication of the ball screws compared to electric-only drive system.
- ▶ Reduced hydraulic oil requirements and longer life of hydraulic components, compared to servo valve systems

High Energy Efficiency

ESTUN's servo pump system achieves the closed loop control of both speed and pressure under the driving of internal gear pump by using the AC servo drive and permanent magnet synchronous servo motor. The output flow is determined by the speed of the servo motor and the displacement of the quantitative internal gear pump, while the system pressure is measured in real time by a pressure sensor. This enables energy to be supplied on demand, which significantly reduced the electricity costs compared to a dosing or variable pump, saved cooling water and reduced the heat generated without power consumption.

High Response Control

- ▶ [High Efficiency] The internal gear pump of imported brand is used, which is optimized for injection molding machines, die-casting machines, hydraulic presses, bending machines and other electro-hydraulic hybrid applications, and the high-speed permanent magnet synchronous motor is used to increase the output of the oil pump and improve the running speed of the machine, as well as to ensure low leakage and low noise.
- ▶ [High Dynamic] Use of high performance ProNet series AC servo system, featuring high overload capability and no-load system response time of 20ms, to ensure fast system response.
- ▶ [High Precision] High-precision pressure sensors are used to monitor the system pressure, while the servo motor uses an imported resolver as a feedback element. The servo pump system can monitor pressure commands and feedback with a resolution of 12bits, pressure fluctuations of less than ± 0.5 bar at low speeds, detection resolution of 65536 pulses/revolution for the resolver and a system control cycle of 0.1 milliseconds, in this way the demands for producing high-precision products are met.



Specialization

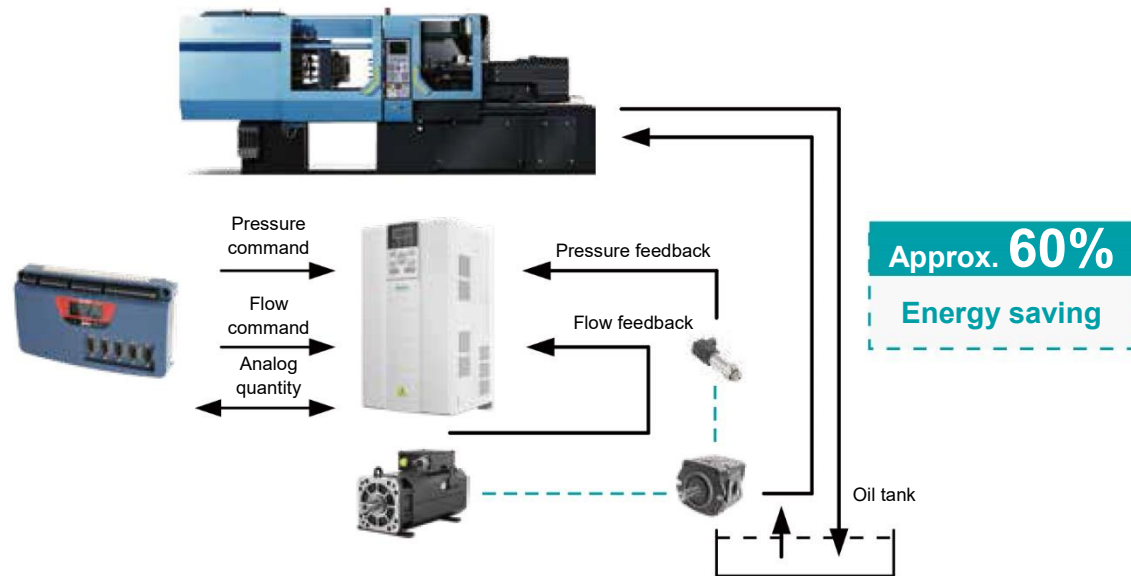
ESTUN has focused on the R&D of AC servo systems for many years and has now mastered a number of core technologies of AC servo systems. It has developed servo systems for electro-hydraulic hybrid applications such as injection molding machines, die-casting machines, hydraulic presses and bending machines, with power ranging from 8.7KW to 120KW, to meet most of the needs. ESTUN can also develop customized solutions to meet the special needs of different customers.

The Motion Control & Servo Products Division of ESTUN has many years of experience in the hydraulic products R&D, and employed a number of senior hydraulic engineers and senior consultants who can provide complete hydraulic solutions based on the needs of customers.

02

Application Solutions

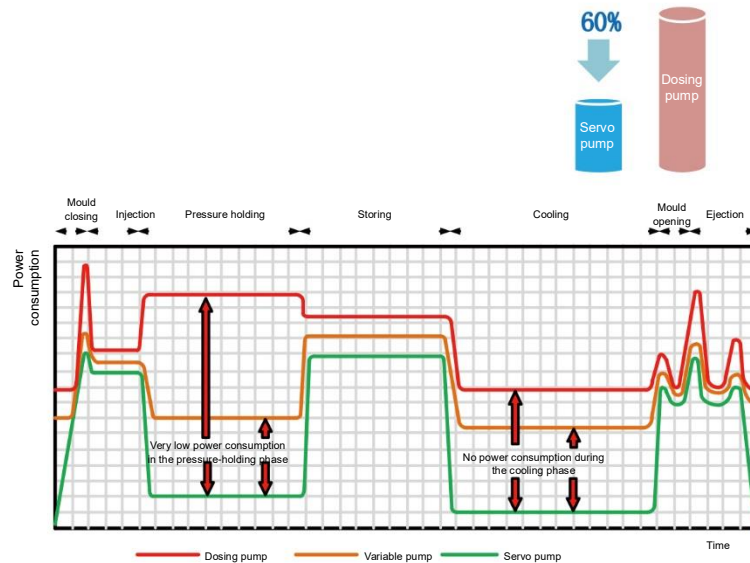
Solutions for Injection Molding Machine



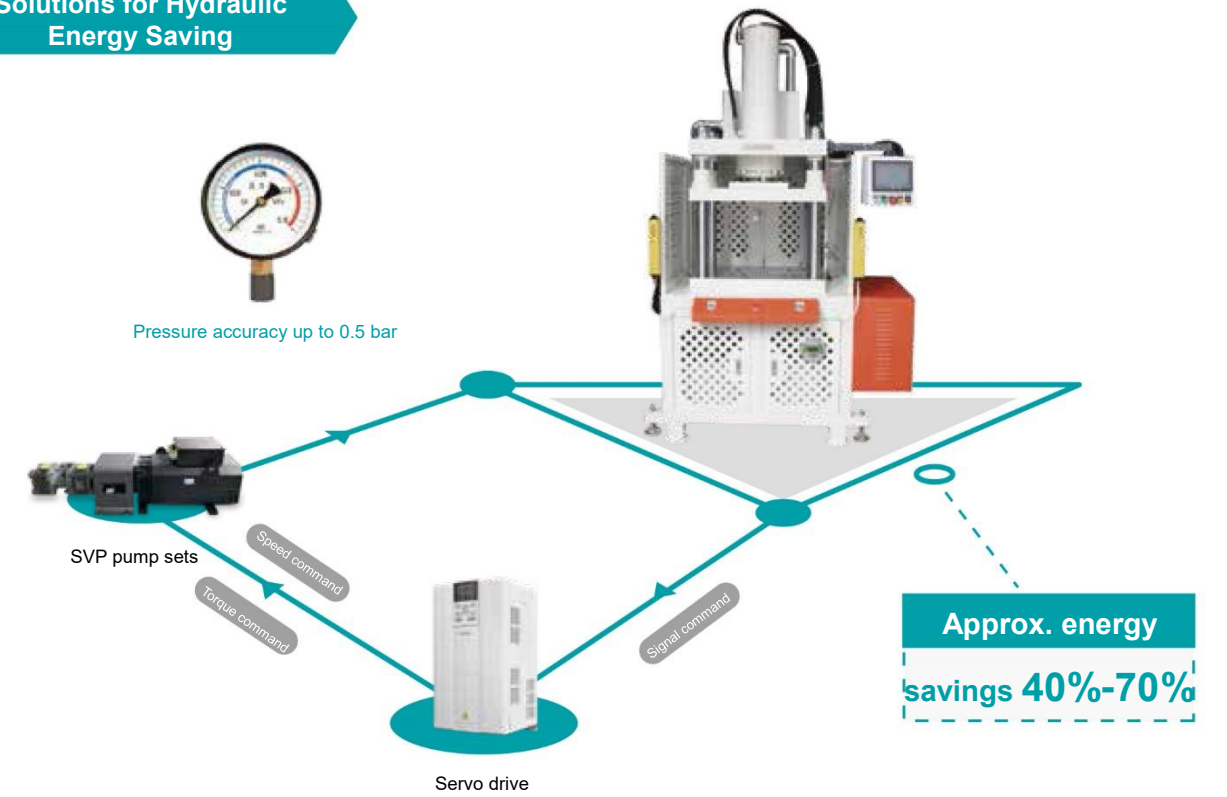
Approx. 60%
Energy saving

Advantages

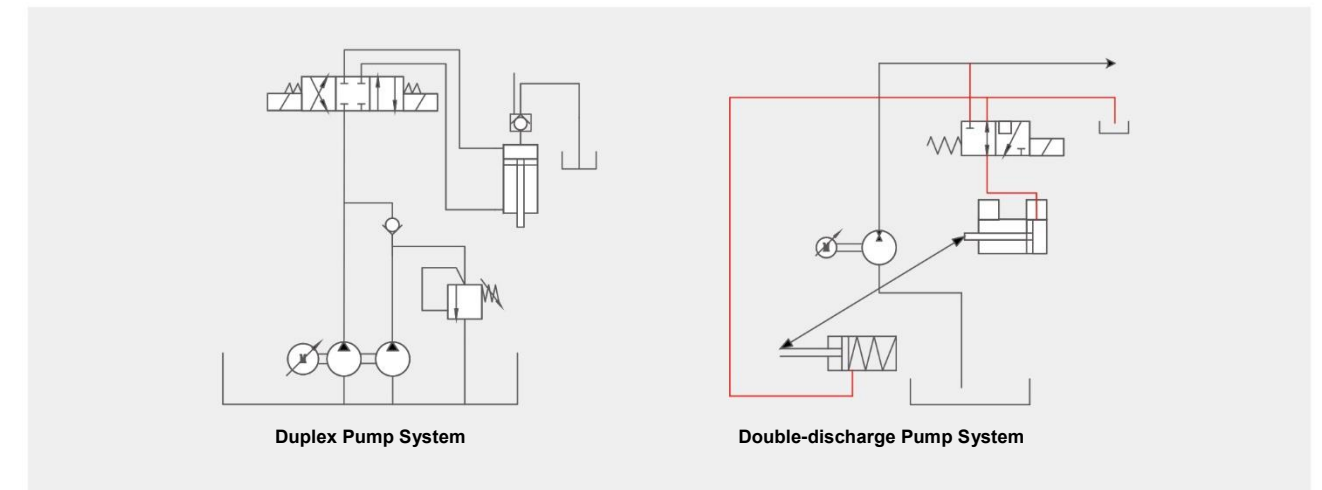
- ▶ **High Energy Savings:** Full use of the servo motor's speed control performance, as well as the combination with optimized pressure and flow control algorithms to supply oil on demand, resulting in energy savings of up to 80% or more compared to the original dosing system.
- ▶ **High Precision:** The servo's fast following of pressure and flow ensures the accuracy of mould opening/closing, and the accuracy of injection is also controlled within 0.1mm; the use of high-precision pressure sensors as well as the high response PID algorithms would make sure that the system pressure fluctuation is controlled within $\pm 0.5\text{bar}$.
- ▶ **High Efficiency:** High-efficiency weak magnetic algorithms are used to give full play to the high speed of the servo motor, allowing the system to obtain a greater flow output and improving the overall efficiency of the injection molding machine; the fastest servo response can be up to 13ms, so that the system builds up pressure



Solutions for Hydraulic Energy Saving



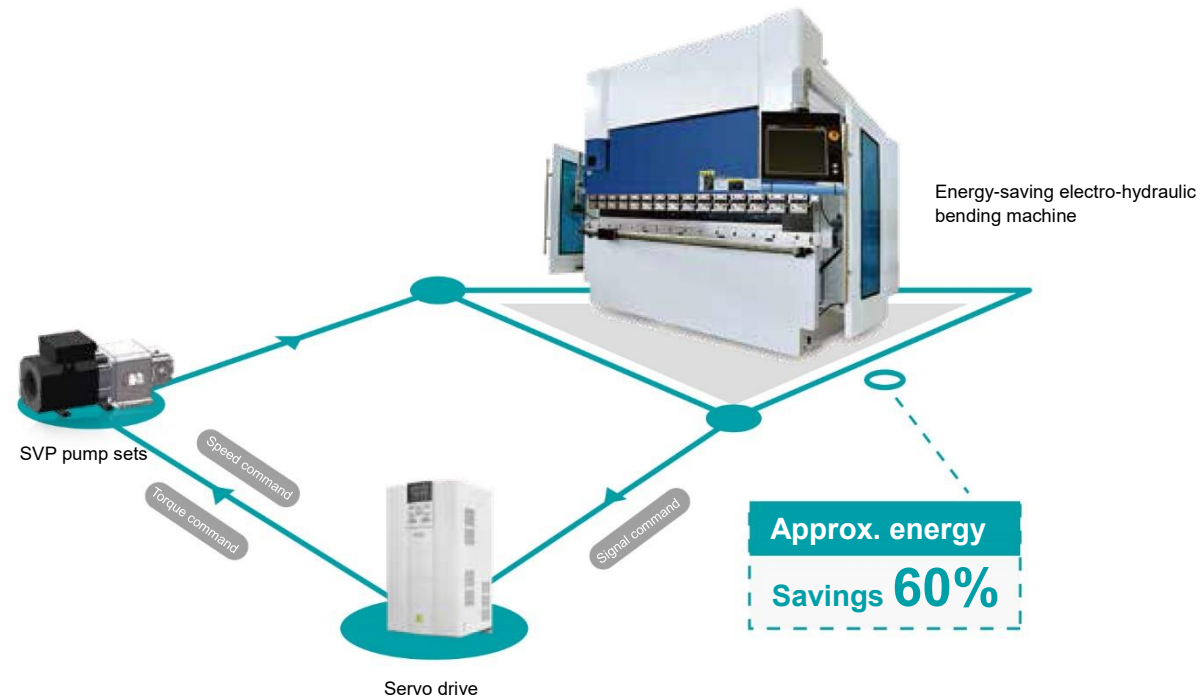
Schematic Diagram



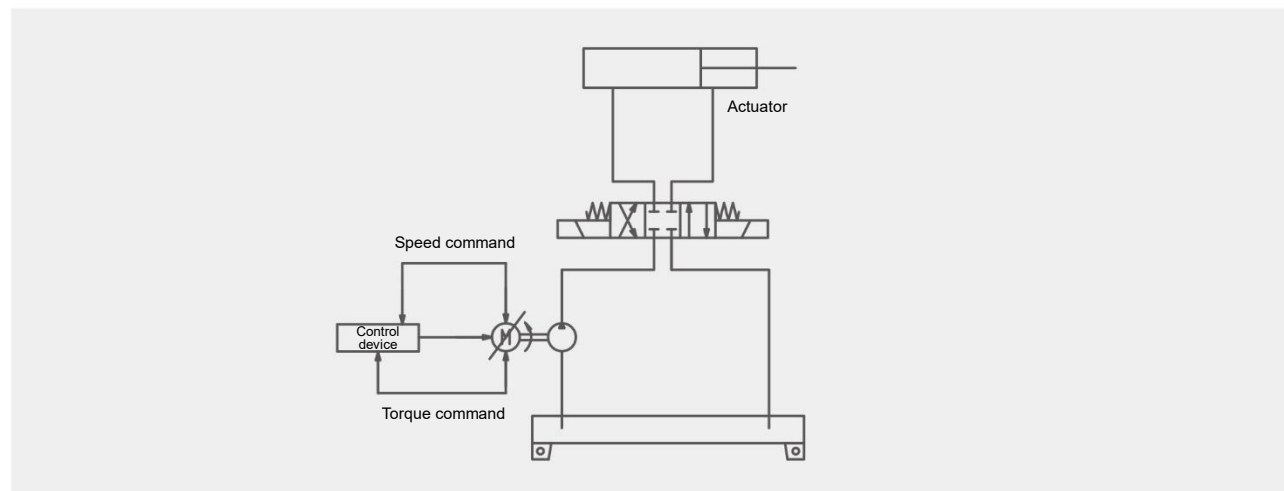
Advantages

- ▶ **Energy saving:** the servo pump system is supplied with oil on demand, which greatly improves energy efficiency.
- ▶ **Noise reduction:** the servo pump system rotates only when needed, resulting in a noise reduction of 30%.
- ▶ **Higher efficiency:** the duplex pump and double-discharge pump systems reduce the need for motor power and are more efficient compared to single pump systems.

Solutions for SVP Systems of Bending Machines



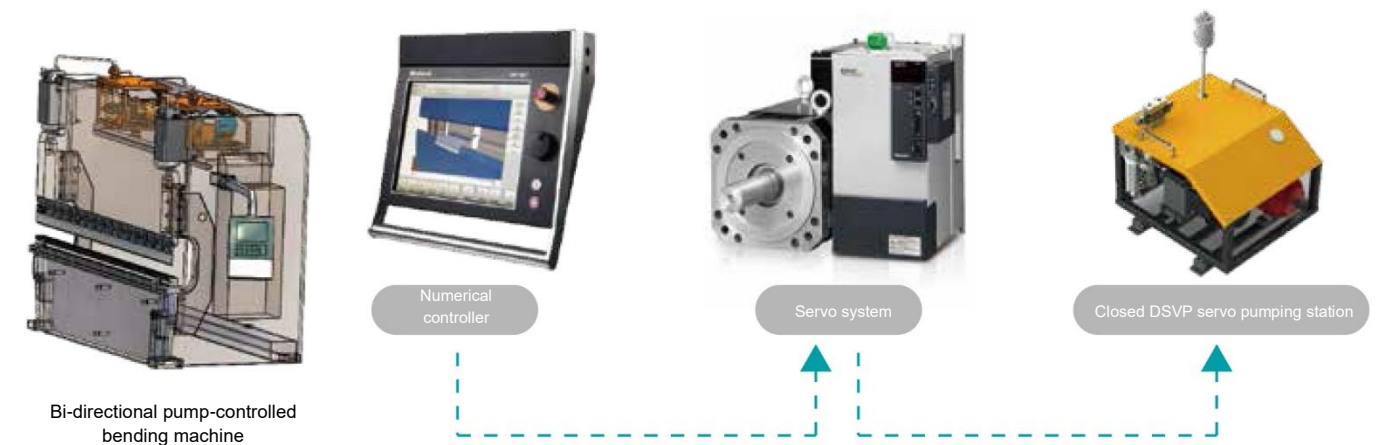
Schematic Diagram



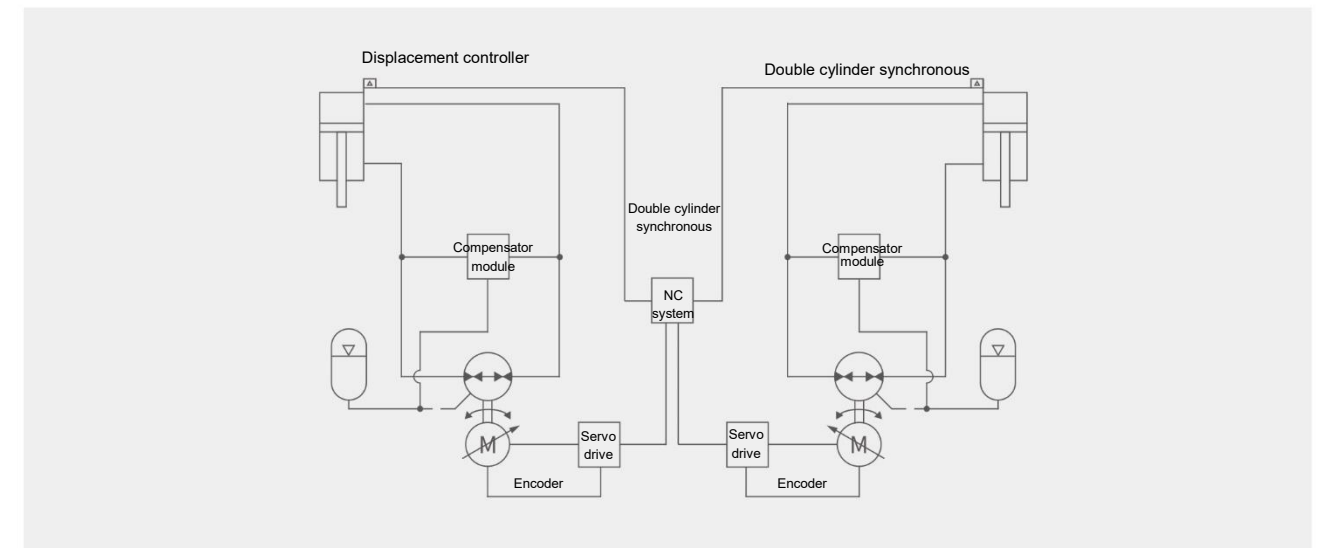
Advantages

- ▶ Energy saving: the servo pump system is supplied with oil on demand, which greatly improves energy efficiency.
- ▶ Noise reduction: the servo pump system rotates only when needed, resulting in a noise reduction of 30%.
- ▶ Reduced oil temperature: use of torque limiting and analog speed control, which would eliminate the valve shut-off and overflow, and thereby significantly reducing oil temperature.

Solutions for DSVP Systems of Bending Machines



Schematic Diagram



Advantages

- ▶ Closed DSVP electro-hydraulic hybrid hydraulic system allows high-precision control of pressure, position and synchronization. The system has a repeatability of $\pm 0.005\text{mm}$ and synchronization accuracy within $\pm 0.020\text{mm}$.
- ▶ Compared to valve systems, the elimination of throttling losses results in significant energy savings; the tank volume is reduced by 75%; the low heat balance temperature eliminates the need for cooling devices and extends the life of hydraulic components; and the sensitivity to hydraulic oil particles is reduced from NS7 to NS9.
- ▶ Compared to electric drives, there is no need for ball screw replacement and grease filling maintenance.

Electro-hydraulic Servo Motion Controller

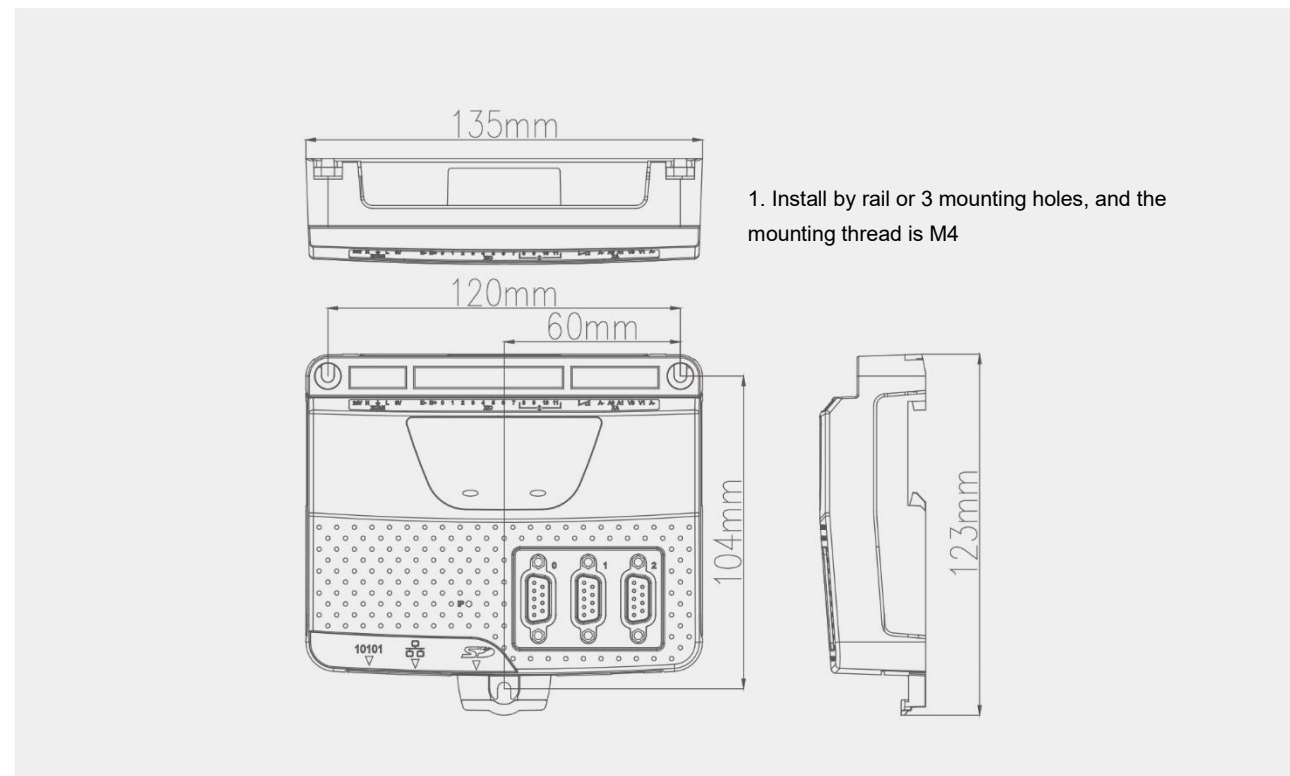
MC403



MC403 Electro-hydraulic Servo Motion Controller

- ▶ Supports 2-cylinder position closed-loop control as well as synchronous control of both cylinders; receives the displacement signal from the encoder, and compares it with the target value; obtains the new flow and pressure commands, which are then sent to the drive in analog form to form a closed loop and ensure the control effect.
- ▶ 533MHz ARM11 processor, 64-bit high-precision motion computation, and servo refresh cycle of 125us.
- ▶ Supports EnDAT, SSI and Tamagawa absolute encoders.
- ▶ Encoder differential input max. frequency 6MHz, pulse output max. frequency 2MHz, built-in 2 x 12bit analog inputs, and 2 x 12bit analog outputs.
- ▶ Built-in 8-way inputs, 4-way bi-directional inputs and outputs, with CANopen expansion up to 512 I/Os.
- ▶ Ethernet-IP / Modbus TCP / Trio ActiveX / UDP / RS232 / RS485.
- ▶ IEC 61131-3 programming language (LD, ST, SFC, FBD), and multi-tasking programming language TrioBASIC.

Installation Dimension



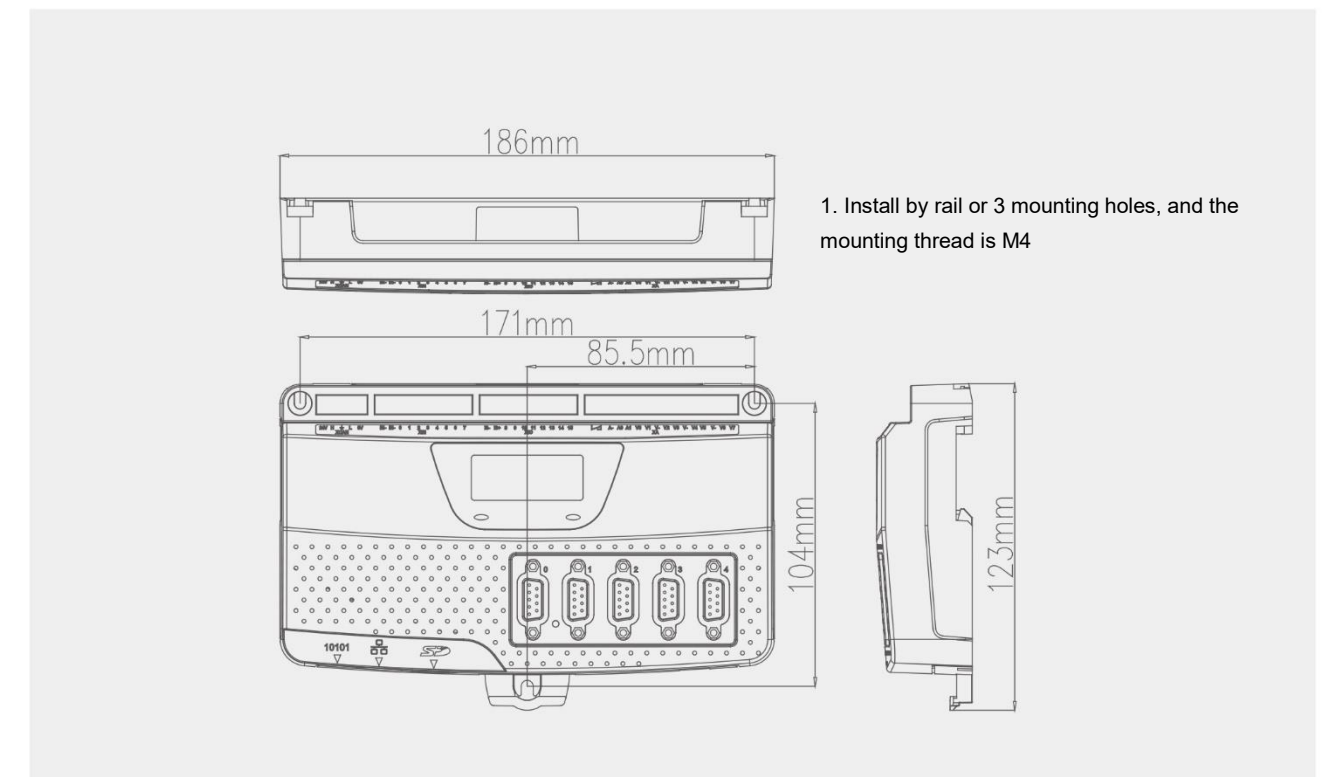
MC405



MC405 Electro-hydraulic Servo Motion Controller

- ▶ Supports 4-cylinder position closed-loop control as well as synchronous control of four cylinders; receives the displacement signal from the encoder, and compares it with the target value; obtains the new flow and pressure commands, which are then sent to the drive in analog form to form a closed loop and ensure the control effect.
- ▶ 533MHz ARM11 processor, 64-bit high-precision motion computation, and servo refresh cycle of 125us-2,000 us.
- ▶ Supports EnDAT, SSI and Tamagawa absolute encoders.
- ▶ Encoder differential input max. frequency 6MHz, pulse output max. frequency 2MHz, built-in 2 x 12bit analog inputs, and 4 x 12bit analog outputs.
- ▶ Built-in 8-way inputs, 4-way bi-directional inputs and outputs, with CANopen expansion up to 512 I/Os.
- ▶ Ethernet-IP / Modbus TCP / Trio ActiveX / UDP / RS232 / RS485.
- ▶ IEC 61131-3 programming language (LD, ST, SFC, FBD), and multi-tasking programming language TrioBASIC.

Installation Dimension



03

Servo Drives



Model Coding

ProNet	-	87	D	F	B
Servo drive		Rated output power	Voltage class	Drive type	Design order
		Mark Spec.	Mark Spec.	Mark Spec.	Mark Spec.
		87: 8.7KW 1A: 11KW 1E: 15KW 1H: 18KW 2B: 22KW 3Z: 30KW 3E: 35KW 4E: 45KW 5E: 55KW 7E: 75KW 1AZ: 110KW 1CB: 132KW 1FZ: 160KW	D: 400VAC	I: For the electrohydraulic industry F: For the electrohydraulic industry (second generation products)	B: Resolver

Servo Drive Characteristics

- ▶ Superior servo control algorithms, higher dynamic response and positioning accuracy
- ▶ Easy parameter setting and adjustment
- ▶ Pressure loop adjustment of multiple PID control
- ▶ Highly reliable and large allowance design
- ▶ All boards are treated using conformal coatings for high adaptability to harsh environments
- ▶ Excellent weak magnetic control

Product Matching

Servo drives	Adaptable motor	Resolver	External regenerative resistor
ProNet-87DFB	EMB-87DRC22	PRPD-BA24-XX	1500W 25Ω
ProNet-1ADFB	EMB-1ZDRC22		1500W 25Ω
ProNet-1EDFB	EMB-1CDRC22		2000W 16Ω
ProNet-1HDFB	EMB-1FDRC22		2000W 16Ω
ProNet-2BDFB	EMB-2ADRC22		2000W 16Ω
ProNet-3ZDFB	EMB-2FDRC22		3000W 15Ω
ProNet-3EDFB	EMB-3CDRC22		4000W 10Ω
ProNet-4EDFB	EMB-4EDRC22		5000W 10Ω
ProNet-5EDFB	EMB-5EDRC22		5000W 5Ω
ProNet-7EDFB*	EMB-7EDRC22		7400W 6.8Ω
ProNet-1AZDFB*	EMB-9ZDRC22		10KW 6.8Ω
ProNet-1CBDFB*	EMB-1ZDDRC22		10KW 3.4Ω
ProNet-1FZDFB*	EMB-1AEDRC22		15KW 3.4Ω

Notes:

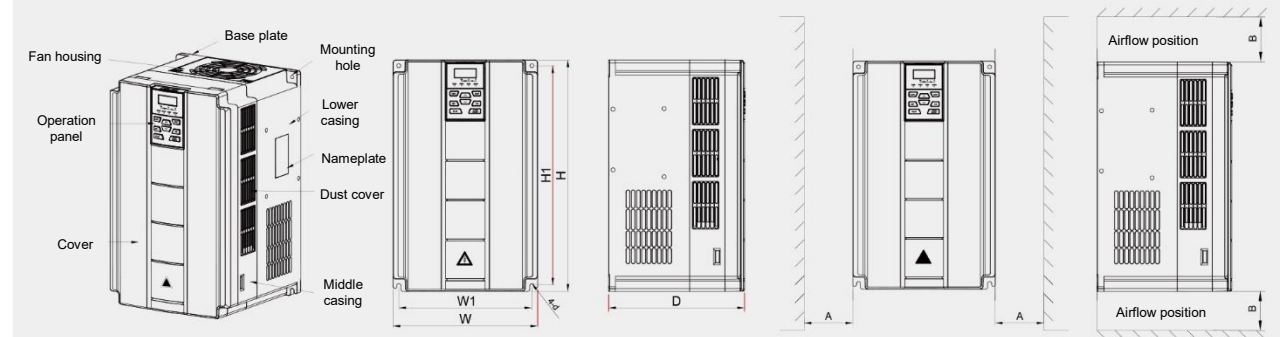
- ① The external regenerative resistor in the table is the recommended model (calculated according to 10% braking power); in practice, if the power is insufficient (e.g. over-voltage alarm, severe heating of the resistor), the resistance and power of the resistor will need to be adjusted. Please contact ESTUN technical sales staff for details.
- ② When a single resistor cannot meet the power resistance requirement, more than one can be connected in parallel, but the total power after the parallel connection cannot be lower than the power in the table, and the resistance value after the parallel connection cannot be lower than the resistance value.
- ③ A separate braking unit (7E-9Z: DBM-4110; 1ZD-1AE: DBM-4160) is required.
- ④ A reactor (directly supplied by manufacturer) of 200*159*255mm is required.

Specifications of Servo Drives

Item	Spec.	Description
Control characteristic	Output frequency (Hz)	50Hz/60Hz
	Speed control accuracy	±0.5%
	Injection repeatability	2‰
	Pressure control accuracy	±0.5bar
I/O signals	External input signal	Seven switching inputs, one of which can be used as a high-speed pulse input. Active open collector NPN, PNP and dry contact input are supported. Three analog input terminals, one of which can only be used as a voltage input, and the other two voltage and current are selectable.
	External output signal	One high-speed pulse output terminal, and square wave signal output from 0 to 50kHz, to allow the physical quantities such as set frequency and output frequency; one switching output terminal; two sets of relay output terminals.
Communication function	Communication control	RS485 communication port of MODBUS protocol, and CAN communication port of CANopen protocol
Encoder interface	PRPD-BA24	Resolver input, and motor KTY84 temperature sensor input

Item	Spec.	Description
Protection characteristics	Overload capacity	150% 1min; 180% 10s; 200% 0.5s 7E~1FZ:150% 1min,170% 15s
	Motor over-temperature protection	Alarm if internal motor temperature exceeds 120°C
	Over-current protection	Alarm if IGBT module current exceeds 400% of rated current
	Over-voltage protection	Vdc>800V overvoltage protection
	Low-voltage protection	Vdc<390V low-voltage protection
	Encoder exception protection	Alarm for broken encoder or abnormal communication
	Open-phase protection	Three-phase power input open-phase protection
	Regenerative brake circuit protection	Alarms for damaged bleeder resistor, abnormal regeneration circuit, bleeder circuit overcurrent and short circuit
	Other protection	Alarms for parameter destruction, over speed, overload, abnormal current detection circuit and momentary power failure
	Protective treatment	For different protections, the reset method can be divided into manual reset and power-down reset
	Error recording	Last 10 fault alarms can be recorded
Environment	Operating temperature	-20°C~+55°C
	Storage temperature	-25°C~+55°C
	Operating humidity	5%~95%RH or less (no condensation)
	Storage humidity	5%~95%RH or less (no condensation)
	Altitude	Altitude below 1,000m
	Vibration/shock resistance	4.9m/s ² /19.6m/s ²
	Installation site	No corrosive or flammable or explosive gases, good ventilation, little dust, and dry environment

ProNet-3ZDFB ~ ProNet-3EDFB



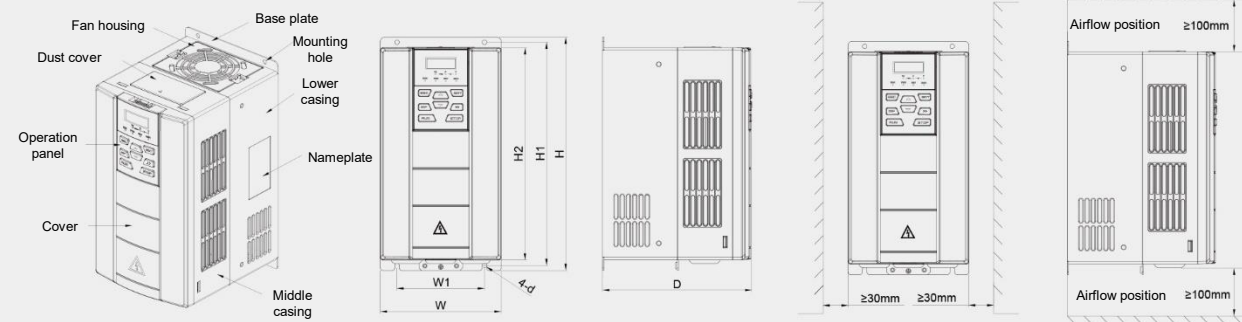
Component Diagram

Outline Dimensional Drawing

Installation Orientation and Space Requirements

Dimensions and Installation of Servo Drives

ProNet-87DFB ~ ProNet-2BDFB

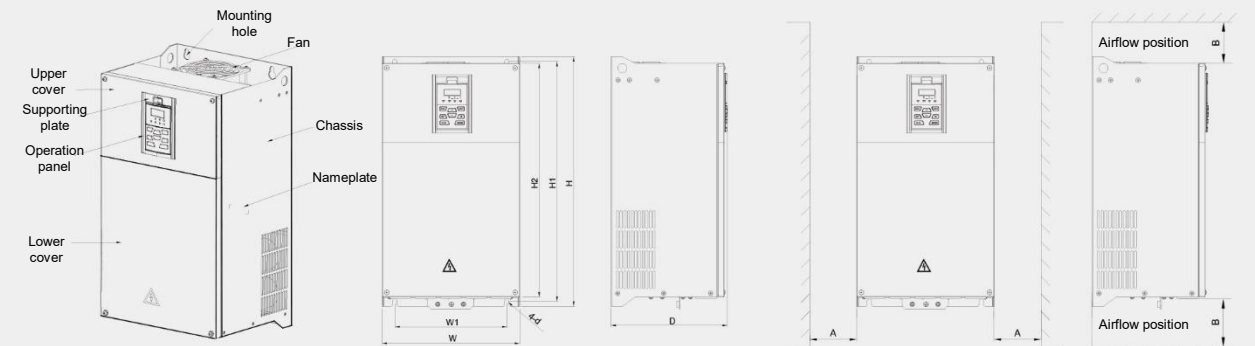


Component Diagram

Outline Dimensional Drawing

Installation Orientation and Space Requirements

ProNet-4EDFB ~ ProNet-5EDFB

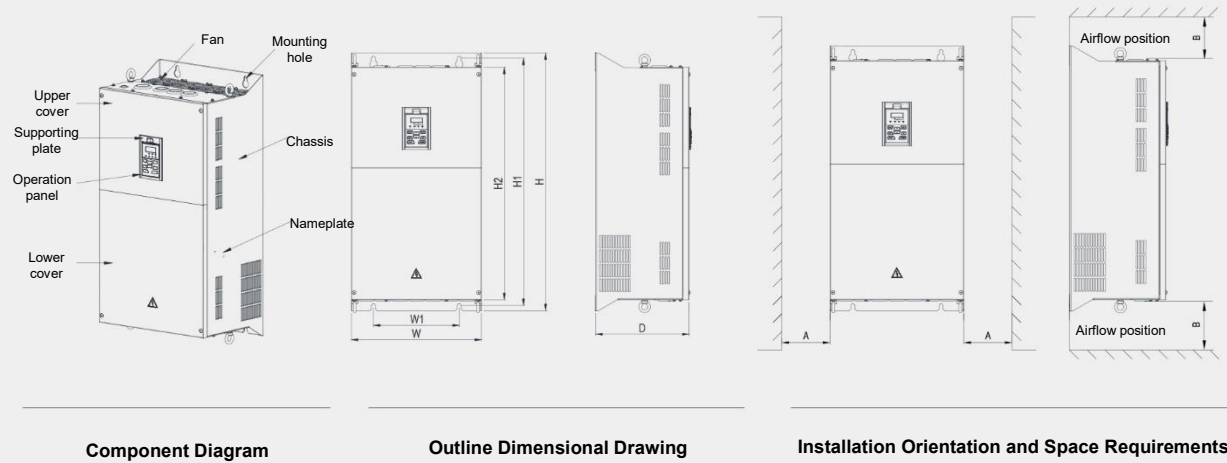


Component Diagram

Outline Dimensional Drawing

Installation Orientation and Space Requirements

ProNet-7EDFB~ProNet-1FZDFB



Component Diagram

Outline Dimensional Drawing

Installation Orientation and Space Requirements

Product Outline and Mounting Dimensions and Weight

Drive model	Outline and mounting dimensions (mm)							Weight (kg)
	W	H	D	W1	H1	H2	Mounting hole d	
ProNet-87DFB	145	280	179	105	268	255	5.5	3.9
ProNet-1ADFB	190	365	187	120	353	335	6	6.2
ProNet-1EDFB								
ProNet-1HDFB								
ProNet-2BDFB								
ProNet-3ZDFB	250	400	235	230	380	/	6.8	12
ProNet-3EDFB								
ProNet-4EDFB	300	545	255	245	523	510	10	35.6
ProNet-5EDFB	385	670	261	260	640	600	12	37
ProNet-7EDFB	395	785	291	260	750	705	12	50
ProNet-1AZDFB								
ProNet-1CBDFB								
ProNet-1FZDFB								
ProNet-1FZDFB	440	900	356	300	865	820	14	66

04

Servo Motors



Model Coding

EMB - 1Z D R C 2 2

EMB motor series		Rated output power		Supply voltage		Encoder		Design order		Shaft end		Option	
Mark	Spec.	Mark	Spec.	Mark	Spec.	Mark	Spec.	Mark	Spec.	Mark	Spec.	Mark	Spec.
	87: 8.7KW 1Z: 10.8KW 1C: 13.2KW 1F: 16.7KW 2A: 21.4KW 2F: 26.9KW 3C: 33KW 4E: 45KW 5E: 55KW 7E: 75KW 9Z: 90KW 1ZD: 104KW 1AE: 115KW		D: 400VAC		R: Resolver		A, B, C: Design order		1: flat without keys 2: flat and straight with key and thread (standard)		1: without optional accessories 2: with oil seal 3: with brake (DC24V) 4: with oil seal and brake		

Servo Motor Characteristics

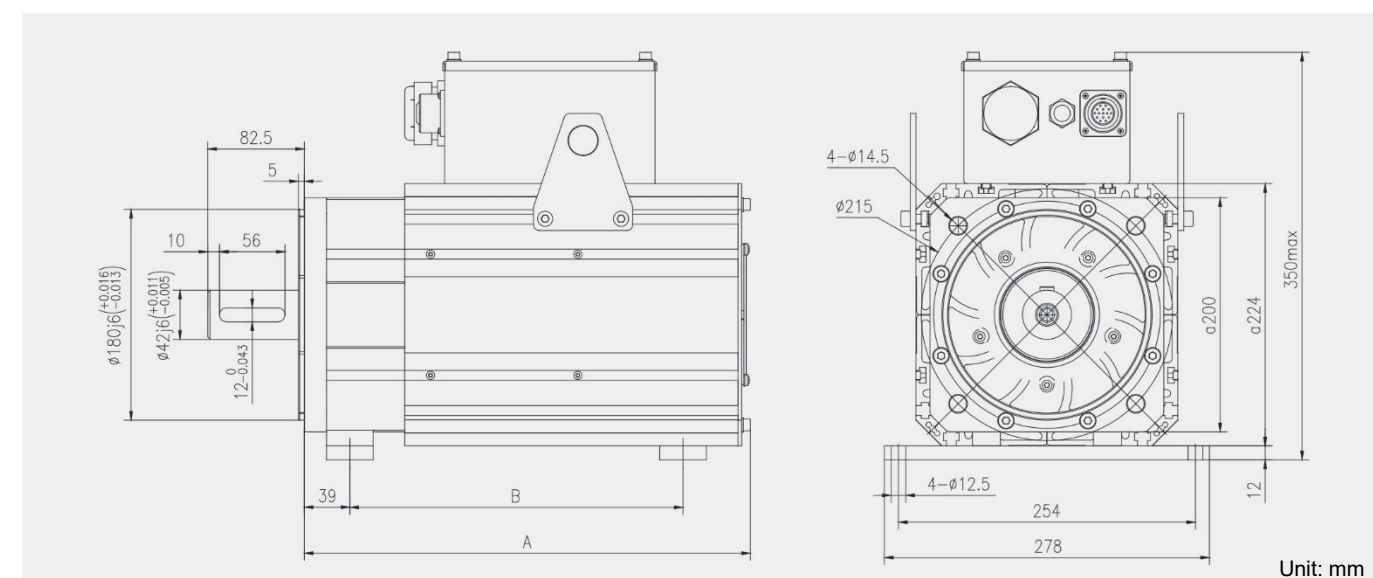
- ▶ Wider range of weak magnetic speed regulation and stronger overload capacity
- ▶ Higher motor efficiency due to the use of high specification permanent magnet materials
- ▶ Rich R&D and manufacturing experience, and can be customized according to customer needs
- ▶ Imported high-performance resolver of higher reliability
- ▶ Built-in multiple sets of high-precision temperature sensors to improve system protection level

Servo Motor Specifications

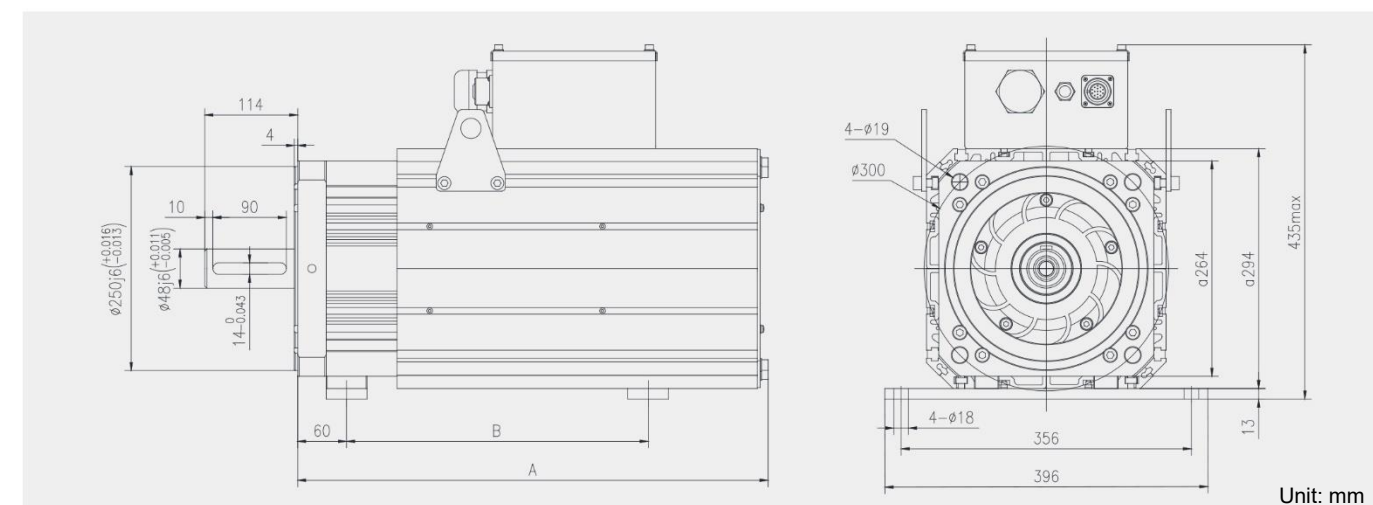
Model of servo motor		EMB-87DRC22	EMB-1ZDRC22	EMB-1CDRC22	EMB-1FDRC22	EMB-2ADRC22	EMB-2FDRC22	EMB-3CDRC22
Voltage	V	400AVC						
Rated output power	kW	8.7	10.8	13.2	16.7	21.4	26.9	33
Rated torque	N · m	46	57.2	70.2	88.8	113.3	142.5	175
Rated current	Arms	15.5	19.3	23.5	29.8	38.2	34.5	34.5
Max. Instantaneous torque	N · m	89	116	147	177.2	238	285.4	375
Max. Instantaneous current	Arms	32.5	42	54	60	74	89	138
Kt value	Nm/A	2.97	2.97	2.97	2.97	2.97	2.88	2.86
Rated speed	r/min	1800						
Max speed	r/min	2500						
Order		8						
Rotor moment of inertia	$\times 10^{-4} \text{kg} \cdot \text{m}^2$	62	73	87	98	112	137	187
Weight (Kg)		39.5	43	46	46	53	59.5	74
Encoder		Resolver						
Heat resistance class		F						
Ambient temperature		0 ~ +40°C (no freezing)						
Ambient humidity		20%~80% (no condensation)						
Vibration resistance		24.5m/s ²						
Protection mode		Fully enclosed, self-cooling, IP54 (excluding shaft extensions if not equipped with oil seal), fan area protection IP20						

Model of servo motor		EMB-4EDRC22	EMB-5EDRC22	EMB-7EDRC22	EMB-9ZDRC22	EMB-1ZDDRC22	EMB-1AEDRC22
Voltage	V	400AVC					
Rated output power	kW	45	55	75	90	104	115
Rated torque	N · m	239	292	398	430	498	550
Rated current	Arms	81.2	98	127	170	187	206
Max. Instantaneous torque	N · m	440	584	600	670	755	810
Max. Instantaneous current	Arms	162	180	225	308	330	345
Kt value	Nm/A	2.94	2.98	2.9	2.53	2.66	2.67
Rated speed	r/min	1800			2000		
Max speed	r/min	2500			2600		
Order		8			8		
Rotor moment of inertia	$\times 10^{-4} \text{kg} \cdot \text{m}^2$	380	500	630	720	815	905
Weight (Kg)		115	134	153	176	199	222
Encoder		Resolver					
Heat resistance class		F					
Ambient temperature		0 ~ +40°C (no freezing)					
Ambient humidity		20%~80% (no condensation)					
Vibration resistance		24.5m/s ²					
Protection mode		Fully enclosed, self-cooling, IP54 (excluding shaft extensions if not equipped with oil seal), fan area protection IP20					

Outline Dimensions of EMB Series Motors



Motor model	EMB-87DRC22	EMB-1ZDRC22	EMB-1CDRC22	EMB-1FDRC22	EMB-2ADRC22	EMB-2FDRC22	EMB-3CDRC22
A [mm]	345	362	381	417	417	453	525
B [mm]	265	265	285	310	310	350	430

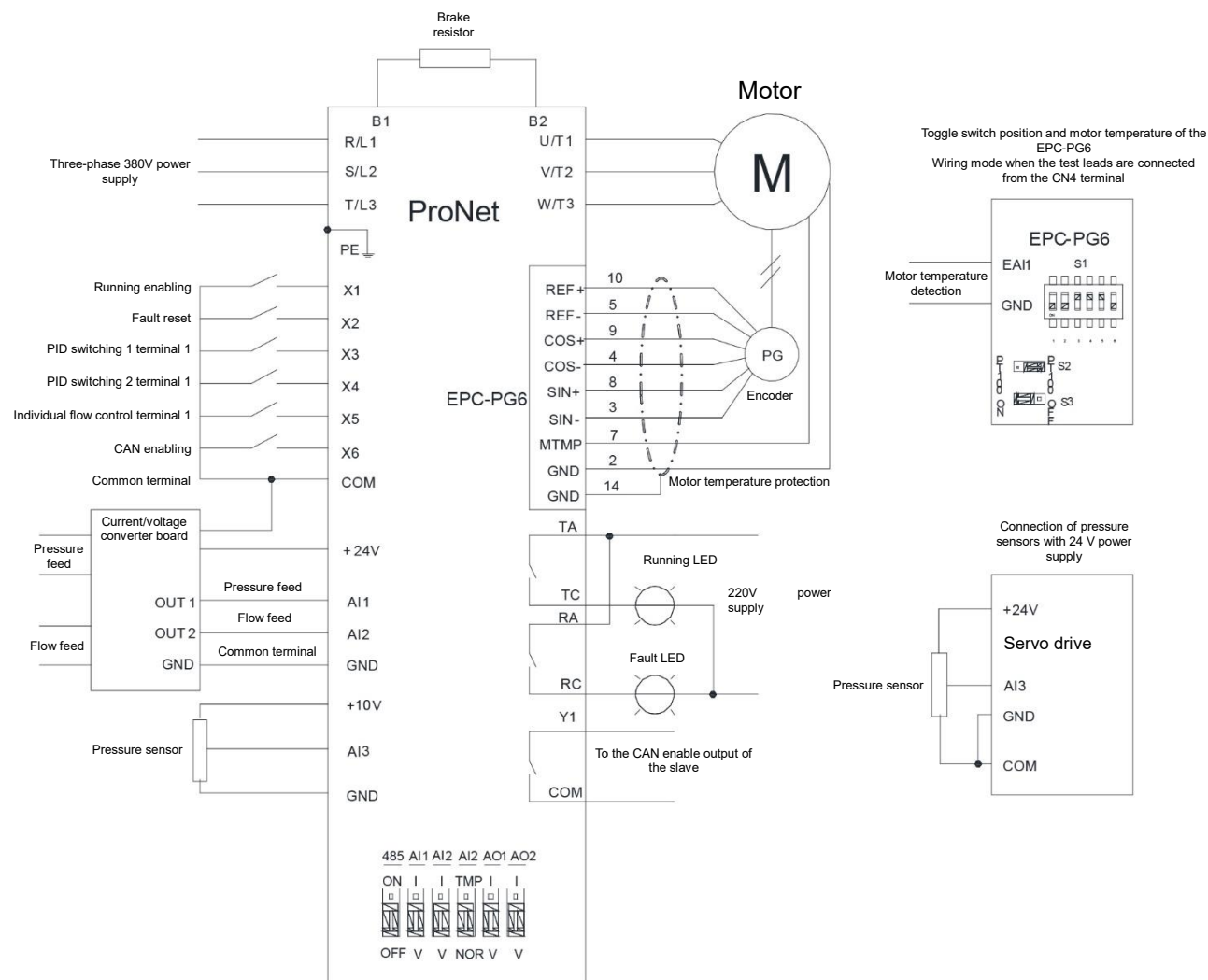


Motor model	EMB-4EDRC22	EMB-5EDRC22	EMB-7EDRC22	EMB-9ZDRC22	EMB-1ZDDRC22	EMB-1AEDRC22
A [mm]	524	577	631	684	758	811
B [mm]	365.5	419	473	526	600	653
C [mm]	14	14	14	14	18	18
D [mm]	48	48	48	48	60	60
E [mm]	51.5	51.5	51.5	51.5	64	64

05

Connections between Drive and Peripherals

Example of Connections to Peripherals



06

Accessories

Cables

PRPD-BA24-XX

