YASKAWA

AC SERVO DRIVES
JUNMA SERIES

SERVOMOTOR TYPE SJME
SERVOPACK TYPE SJDE

Industry's First — A new concept in servo drives - JUNMA

In the blink of an eye, a top-level Olympic relay runner passes his baton to his teammate. Not even the smallest motion is wasted. This almost imperceptible speed and accuracy brings their team to victory.
JUNMA similarly uses the world's top-level servo technology to provide a quick and efficient setup. Simply connect the servomotor to JUNMA. That's all you have to do to obtain stellar servo performance.

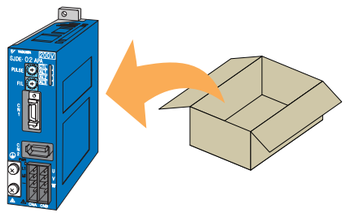
JUNMA is a totally new concept in digital servo drives that requires no parameter settings and gain adjustments to achieve high-precision positioning.

There's no reason to wait. JUNMA's ready-to-use features for high-speed, high-torque, and high-precision operation are ready to work for you.

Connect it and, zip! It's ready to go.

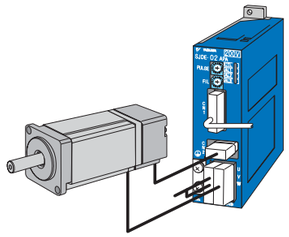
1 Unpacking

Remove the SERVOPACK from the box.



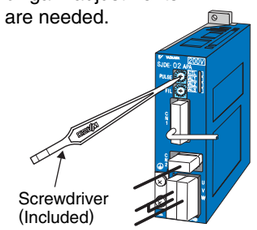
2 Installation and Wiring

Connect the cables for the power supply, signals, and the motor.



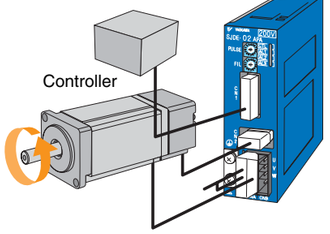
3 Setting Reference Pulse

Select the reference pulse switch for your controller. No parameter settings or gain adjustments are needed.



4 Setup Completion

The motor is ready to run with the reference from the controller. The required torque is possible even at a high-speed rotation of 4500 min^{-1}.



Features of JUNMA Drives

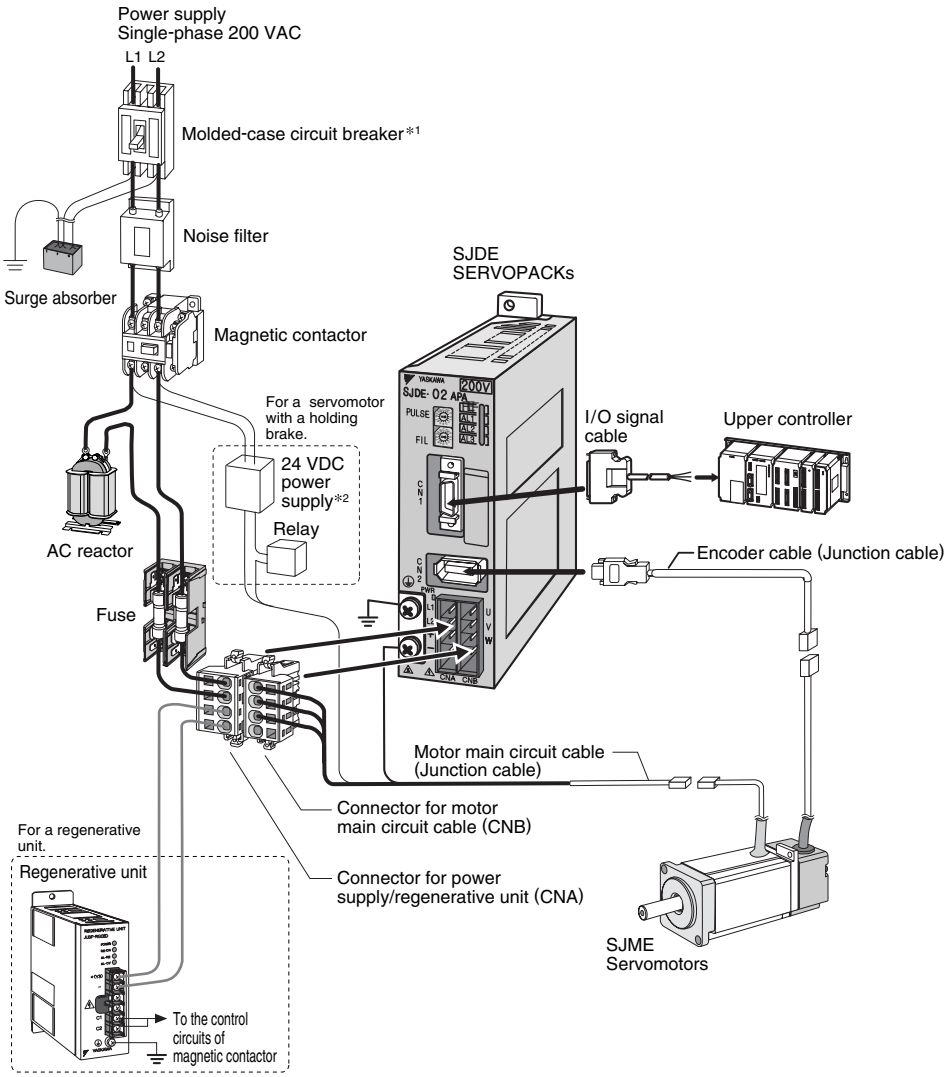
1. Attain optimum servo performance without setting parameters or adjusting gains.
   - Resolution: 10,000 pulses/rev
   - High torque output at a high speeds of 4,500 min^{-1}
2. Easily suppress mechanical vibrations with the turn of the rotary switch.
3. Conforms to international standards.

Note: Scheduled to conform to the RoHS directive.
(RoHS directive: Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment)

CONTENTS

System Configuration/ Model Designation

■Connection to Peripheral Devices



*1 : Install a ground fault interrupter to protect against both overloads and shortcircuits, or install a ground fault interrupter for ground fault protection and a molded-case circuit breaker.
*2 : Prepare 24 VDC power supplies for a holding brake and I/O signals.

■Model Designation

●SERVOPACKs

SJDE − 02 A P A

- JUNMA-series SJDE SERVOPACKs
- Applicable Servomotor Capacity
  - 01 : 100 W
  - 02 : 200 W
  - 04 : 400 W
  - 08 : 750 W
- Power Supply Voltage
  - A: 200 VAC
- Interface Specifications
  - P : Pulse-train reference input
- Design Revision Order
  - A

●Servomotors

SJME − 02 A M B 4 1

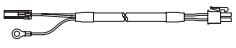
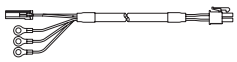
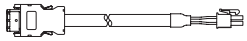
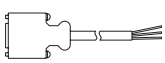
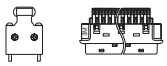
- JUNMA-series SJME Servomotors
- Rated Output
  - 01 : 100 W
  - 02 : 200 W
  - 04 : 400 W
  - 08 : 750 W
- Power Supply Voltage
  - A : 200 VAC
- Encoder Specifications
  - M: Incremental encoder
- Design Revision Order
  - B
- Shaft End Specifications
  - 4: Straight, key
- Options
  - 1 : No option
  - C : 24 VDC holding brake

■SERVOPACKs and Applicable Peripheral Devices

Rated Output	Servomotor		SERVOPACK	Power Supply Capacity per SERVOPACK kVA	Current Capacity for Molded-case Circuit Breakers* Arms	Current Capacity and Model of External Fuse	Inrush Current A0-P	Magnetic Contactor	Noise Filter	
	Without holding brake	With holding brake								
100 W	SJME-01AMB41	SJME-01AMB4C	SJDE-01APA	0.40	4	0KLK015.T (15 Arms)	30	HI-11J	FN2070-6/07	
200 W	SJME-02AMB41	SJME-02AMB4C	SJDE-02APA	0.75						
400 W	SJME-04AMB41	SJME-04AMB4C	SJDE-04APA	1.2	8				FN2070-10/07	
750 W	SJME-08AMB41	SJME-08AMB4C	SJDE-08APA	2.2	16	0KLK030.T (30 Arms)	60	HI-15J	FN2070-16/07	
Manufacturer	Yaskawa Electric Corporation			–	–	Littelfuse Inc.	–	Yaskawa Controls Co., Ltd.	Schaffner Electronic	
Contact	Yaskawa Local Office			–	–	Yaskawa Local Office	–	Yaskawa Local Office		

* : Typical value at the rated load. The specified derating is required to select the appropriate capacity of molded-case circuit breaker.
Braking characteristics (25˚C): Two seconds min at 200% and 0.01 seconds min at 700%.

■Cables and Connectors

Name	Type		Model	Length	Appearance	Ref. Page	Contact
Servomotor Main Circuit Cables with Connectors at Both Ends (Junction Cables)	Without holding brake		JZSP-CHM000-03	3 m		P.25	Yaskawa Local Office
			JZSP-CHM000-05	5 m			
			JZSP-CHM000-10	10 m			
			JZSP-CHM000-15	15 m			
			JZSP-CHM000-20	20 m			
	With holding brake		JZSP-CHM030-03	3 m			
			JZSP-CHM030-05	5 m			
			JZSP-CHM030-10	10 m			
			JZSP-CHM030-15	15 m			
			JZSP-CHM030-20	20 m			
Connector Kits for Servomotor Main Circuit Cable*1	To Servomotor Plug (For servomotors w/wo holding brake)	Crimp Type	JZSP-CHM9-1*2	—		P.26	Yaskawa Local Office
	To SERVOPACK CNB (For servomotors w/wo holding brake)	Spring Type	JZSP-CHM9-2*3	—		P.26	Yaskawa Local Office
		Crimp Type	See page 26.	—		P.26	Yaskawa Local Office
Power Supply and Regenerative Unit Connector Kits*1	To SERVOPACK CNA	Spring Type	JZSP-CHG9-1*3	—		P.26	Yaskawa Local Office
Encoder Cables with Connectors at Both Ends (Junction Cables)			JZSP-CHP800-03	3 m		P.27	Yaskawa Local Office
			JZSP-CHP800-05	5 m			
			JZSP-CHP800-10	10 m			
			JZSP-CHP800-15	15 m			
			JZSP-CHP800-20	20 m			
Encoder Cable Connector Kits	To Servomotor	Crimp Type	JZSP-CHP9-1*2	—		P.28	Yaskawa Local Office
	To SERVOPACK CN2	Soldered Type (Black)	JZSP-CHP9-2	—			
		Soldered Type (Gray)	JZSP-CHP9-3	—			
I/O Signal Cables			JZSP-CHI003-01	1 m		P.29	Yaskawa Local Office
			JZSP-CHI003-02	2 m			
			JZSP-CHI003-03	3 m			
I/O Signal Connector Kits*1	For SERVOPACK CN1	Soldered Type	JZSP-CHI9-1	—			

*1 : Sold separately. If making cable assemblies, these connectors are necessary.
*2 : Refer to the reference pages for models of crimping tool. Crimping tools are ordered separately.
*3 : With tool (lever for wiring).

	Surge Absorber	AC Reactor	Regenerative Unit
	R・C・M-601BQZ-4	X5052	JUSP-RG08D
		X5053	
		X5054	
		X5056	
	Okaya Electric Industries Co., Ltd.	Yaskawa Controls Co., Ltd.	Yaskawa Electric Corporation
	Yaskawa Local Office		Yaskawa Local Office

■Precautions When Selecting Peripheral Devices

●Regenerative Units

The rotational energy of driven machines, including servomotor, is returned to the SERVOPACK as electric power. This is called regenerative power. The power is absorbed by the main capacitor inside the SERVOPACK. When the capacitor has reached its limit in power absorption, the regenerative unit is required to dissipate the excess.

The servomotor will be driven in the regeneration state in the following circumstances:

- Deceleration period to a stop during deceleration operations.
- During continuous descending operations along the vertical axis.
- During continuous operations with the servomotor rotated from the load side (negative load).

< Allowable Regenerative Frequency >

The following graphs show the allowable regenerative frequency determined by load moment of inertia and motor speed. The graphs show values for the horizontal axis. For the vertical axis, refer to the results obtained with the SigmaJunmaSize+: AC Servomotor Selection Software.

Power Supply Voltage: 200 V	Power Supply Voltage: 230 V
SJDE-01 (100 W) Allowable Regenerative Frequency No limit (Regenerative unit not required.) Load moment of inertia ($\times 10^{-4}$ kg·m^2) 0.6 0.5 0.4 0.3 0.2 0.1 0 0 3000 4500 Speed (min^{-1})	SJDE-01 (100 W) Allowable Regenerative Frequency No limit (Regenerative unit not required.) Load moment of inertia ($\times 10^{-4}$ kg·m^2) 0.6 0.5 0.4 0.3 0.2 0.1 0 0 3000 4500 Speed (min^{-1})
SJDE-02 (200 W) Allowable Regenerative Frequency 30 times/min. (Regenerative unit required.) 60 times/min. (Regenerative unit required.) No limit (Regenerative unit not required.) Load moment of inertia ($\times 10^{-4}$ kg·m^2) 3 2.5 2 1.5 1 0.5 0 2.4 1.3 0 3000 4500 Speed (min^{-1})	SJDE-02 (200 W) Allowable Regenerative Frequency 30 times/min. (Regenerative unit required.) 60 times/min. (Regenerative unit required.) No limit (Regenerative unit not required.) Load moment of inertia ($\times 10^{-4}$ kg·m^2) 3 2.5 2 1.5 1 0.5 0 1.8 0.8 0 3000 4500 Speed (min^{-1})
SJDE-04 (400 W) Allowable Regenerative Frequency 12 times/min. (Regenerative unit required.) 30 times/min. (Regenerative unit required.) 60 times/min. (Regenerative unit required.) No limit (Regenerative unit not required.) Load moment of inertia ($\times 10^{-4}$ kg·m^2) 5 4 3 2 1 0 3.9 2.8 1.8 0 3000 4500 Speed (min^{-1})	SJDE-04 (400 W) Allowable Regenerative Frequency 12 times/min. (Regenerative unit required.) 30 times/min. (Regenerative unit required.) 60 times/min. (Regenerative unit required.) No limit (Regenerative unit not required.) Load moment of inertia ($\times 10^{-4}$ kg·m^2) 5 4 3 2 1 0 3.0 1.9 1.1 0 3000 4500 Speed (min^{-1})
SJDE-08 (750 W) Allowable Regenerative Frequency 6 times/min. (Regenerative unit required.) 12 times/min. (Regenerative unit required.) 30 times/min. (Regenerative unit required.) No limit (Regenerative unit not required.) Load moment of inertia ($\times 10^{-4}$ kg·m^2) 10 8 6 4 2 0 8.5 5.3 3.7 0 3000 4500 Speed (min^{-1})	SJDE-08 (750 W) Allowable Regenerative Frequency 6 times/min. (Regenerative unit required.) 12 times/min. (Regenerative unit required.) 30 times/min. (Regenerative unit required.) No limit (Regenerative unit not required.) Load moment of inertia ($\times 10^{-4}$ kg·m^2) 10 8 6 4 2 0 6.9 3.6 2.1 0 3000 4500 Speed (min^{-1})

Note: An overvoltage alarm will occur if the regenerative frequency exceeds its allowable limit. This may cause a failure of the regenerative unit.

< Caution >

- The regenerative unit heats up and reaches a high temperature. Use heat-resistant, non-flammable cables and make sure that the cables do not touch the unit. Refer to P16 for the applicable size of cables to connect the unit.
- The regenerative unit has three error detection functions: regenerative resistor disconnection, regenerative transistor fault, and overvoltage detection. When these functions are tripped, the built-in alarm relay will operate and the C1 and C2 output terminals of the regenerative unit will be opened.
- The power supply (through L1 and L2) to the SERVOPACK must be turned off when the alarm relay turns on. Two to three seconds are required to reset the alarm relay once the alarm relay operates. The alarm state will return to normal after the main capacitor in the SERVOPACK finishes discharging.

●Molded-case Circuit Breaker (MCCB)

Observe the following precautions when selecting a molded-case circuit breaker.

< Maximum Input Current >

- The instantaneous maximum output of SERVOPACK is approximately 3 times the rated output and the output can last up to 3 seconds. Select a molded-case circuit breaker whose operating time is 5 seconds or more at 300% of SERVOPACK rated current. The general-purpose low-speed acting molded-case circuit breakers are applicable.
- Rated torque for a molded-case circuit breaker must be equal to or greater than the total power consumption of all devices including the controllers. If using more than one SERVOPACK, calculate an effective load current from the total power supply capacity. The power capacity per SERVOPACK is shown in the table on page 4, SERVOPACKs and Applicable Peripheral Devices.

< Inrush Current >

- Select a molded-case circuit breaker with an allowable current larger than the total inrush current of the SERVOPACKs if multiple SERVOPACKs are turned on at the same time.
- SERVOPACK's inrush current is shown in the table on page 4, SERVOPACKs and Applicable Peripheral Devices.

●Ground Fault Interrupter

- Use a ground fault interrupter for high-frequency compliant inverters . If a general-purpose ground fault interrupter is used, select a rated current of 200 mA or more.
- High-frequency current may leak through the armature of a servomotor due to high-speed switching in the SERVOPACKs.

●Magnetic Contactor

A magnetic contactor is required to make the AC power to SERVOPACK on/off sequence externally. Be sure to attach a spark killer to the exciting coil of the magnetic contactor.

●Noise Filter

- Install a noise filter on the power supply lines for peripheral devices as necessary.
- Because the SJDE SERVOPACK is designed as an industrial device, it provides no mechanism to prevent noise interference. Use a noise filter to prevent noise interference. If the equipment is to be used near private houses or may receive noise interference, install a noise filter on the input side of the power supply line.
- Place the reference input device and noise filter as close to the SERVOPACK as possible.

■Ratings and Specifications

Voltage		200 VAC				Description
Servomotor Model: SJME-□□A		01	02	04	08	
Applicable SERVOPACK	SJDE-□□A	01	02	04	08	–
Rated Output*1	W	100	200	400	750	Motor output at the rated operating point
Rated Torque*1,*2	N·m	0.318	0.637	1.27	2.39	Torque at the rated operating point
Instantaneous Peak Torque*1	N·m	0.955	1.91	3.82	7.16	Maximum instantaneous torque of the motor
Rated Current*1	Arms	0.84	1.1	2.0	3.7	Current flowing to the motor at the rated operating point
Instantaneous Max. Current*1	Arms	2.5	3.3	6.0	11.1	Maximum current allowed to flow instantaneously to the motor
Rated Speed*1	min^{-1}	3000				Speed at the rated operating point
Max. Speed*1	min^{-1}	4500				Highest possible speed
Torque Constant	N·m/Arms	0.413	0.645	0.682	0.699	Generated torque ratio for current flowing to the motor
Rotor Moment of Inertia	$kg·m^2 \times 10^{-4}$	0.0634	0.330	0.603	1.50	Inertia moment at the rotor shaft
Rated Power Rate*1	kw/s	16.0	12.3	26.7	38.1	Motor output per unit time
Rated Angular Acceleration*1	rad/s2	50200	19300	21100	15900	The theoretical angular acceleration (also called torque-to-inertia ratio) at the rated torque
Time Rating		Continuous				"Continuous rating" means that the temperature of the servomotor in continuous operation under specified conditions will not exceed a specified temperature or other limitation.
Thermal Class		B				Highest allowable temperature for armature winding: 130˚C
Vibration Class		15μm or below				The maximum vibration amplitude of the motor expressed in units of micrometers on the condition that the vibration is measured with a vibrometer parallel to the shaft and in two directions perpendicular to the shaft.
Withstand Voltage		1500 VAC for one minute				–
Insulation Resistance		500 VDC, 10 MΩ min.				–
Enclosure		Totally enclosed, self-cooled, IP55 (excluding shaft opening and connectors)				Level of protection from dust and water drops
Impact Resistance		Impact acceleration: 490 m/s^2 in three directions — vertical, side to side, and front to back. Impact occurrences: 2				Impact resistance of the motor in three directions (up and down, left and right, and back and forth) with the motor shaft mounted horizontally
Vibration Resistance		Vibration acceleration: 49 m/s^2 in three directions - vertical, side to side, and front to back.				Vibration resistance of the motor in three directions (up and down, left and right, and back and forth) with the motor shaft mounted horizontally

*1 : Values marked with *1 and the speed/torque characteristics are obtained when the servomotor is combined with an SJDE SERVOPACK at an armature winding temperature of 100˚C. Other values are obtained at 20˚C.
*2 : The rated torques listed here are the values for the continuous allowable torque at 40˚C with an aluminum heatsink (250 mm × 250 mm × 6 mm) attached.

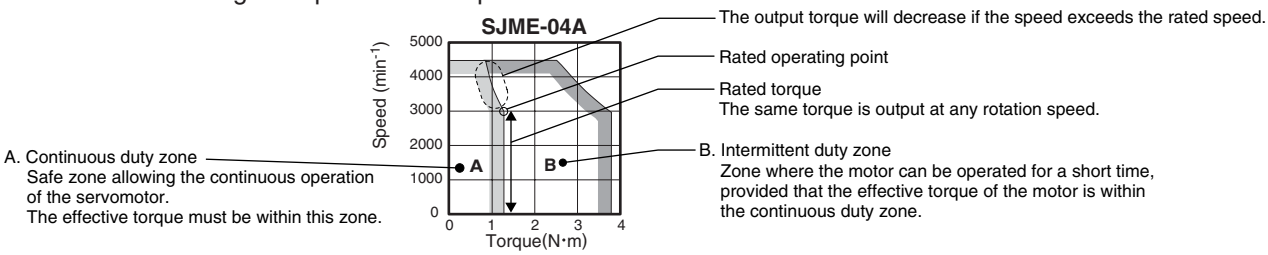
■Holding Brake Specifications

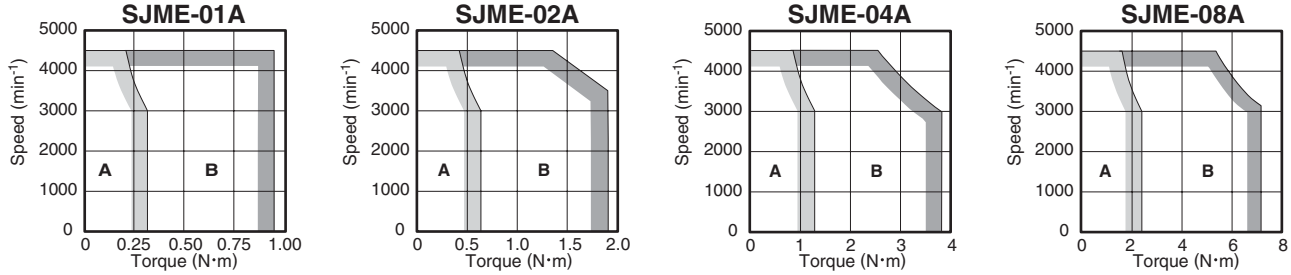
Servomotor Model:SJME-□□ A		01	02	04	08	Description
Rated Voltage		24 VDC ±10%				–
Holding Brake Moment of Inertia*	$kg·m2 \times 10^{-4}$	0.0075	0.064		0.171	–
Capacity	W	6	6.9		7.7	–
Min. Holding Torque (Static Friction Torque)	N·m	0.318	1.27		2.39	Torque against an external force to hold the shaft
Coil Resistance	Ω (at 20˚C)	96	83		75	Resistance of the built-in coil in the holding brake
Rated Current	A (at 20˚C)	0.25	0.29		0.32	Current that flows when the holding brake is released
Holding Brake Release Time	ms	80 max.				
Rise Time for Holding Torque	ms	100 max.				

*: To obtain the moment of inertia of a motor with a holding brake, add the holding brake moment of inertia to the rotor moment of inertia. The rated power rate and rated angular acceleration of the motor will change according to the motor moment of inertia.
Notes: 1 The holding brake is only used to hold the load and cannot be used to stop the servomotor.
2 Do not apply the holding brake when the servo is on. Failure to observe this caution may cause an overload in the SERVOPACK or a decrease in the holding brake life.

■Speed / Torque Characteristics

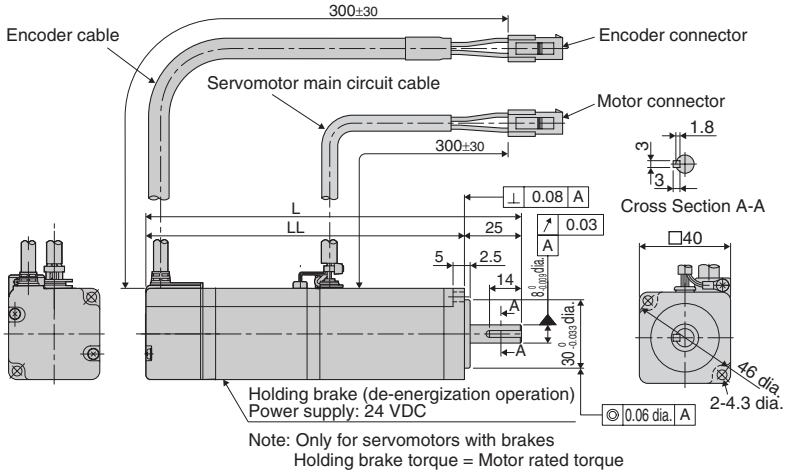
How to Read a Gragh of Speed and Torque Characteristics



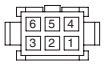


■Dimensions Units: mm

●100 W



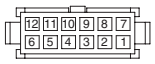
Motor Connector Specifications



Plug:
5559-06P-210
Terminal (No.1 to 3, 5, 6):
5558T(chained) or 5558TL(detached)
Grounding Pin (No.4):
30490-2002(chained) or
30490-2012 (detached)
(Manufacture: Molex Japan Co., Ltd)

	Without holding brake		With holding brake	
1	Phase U	Red	Phase U	Red
2	Phase V	White	Phase V	White
3	Phase W	Blue	Phase W	Blue
4	F G	Green/Yellow	F G	Green/Yellow
5	–	–	Brake	Red
6	–	–	Brake	Black

Encoder Connector Specifications

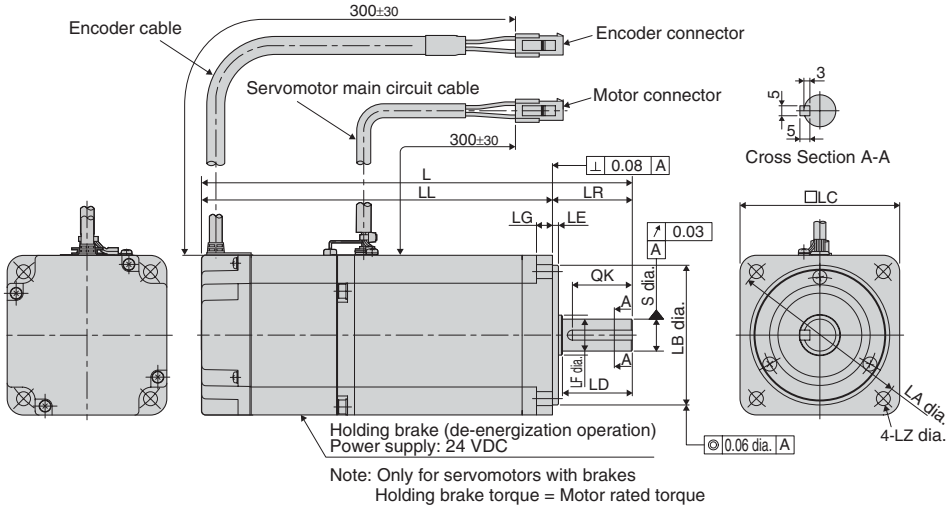


Plug:
5559-12P-210
Terminal:
5558T2(chained) or
5558T2L(detached)
(Manufacture: Molex Japan Co., Ltd)

1	PG5V	Red
2	PG0V(GND)	Black
3	Phase A+	Blue
4	Phase A–	Blue/White
5	Phase B+	Yellow
6	Phase B–	Yellow/White
7	Phase /Z	Purple
8	Phase U	Gray
9	Phase V	Green
10	Phase W	Orange
11	–	–
12	FG	Shield

Type SJME-	L	LL	Approx. Mass kg
01AMB41	119	94	0.5
01AMB4C	164	139	0.7

●200 W to 750 W



Type SJME-	L	LL	LR	LG	LE	S	LB	LC	LD	LF	LA	LZ	QK	Approx. Mass kg
02AMB41	125.5	95.5	30	6	3	$14^{0}_{-0.011}$	$50^{0}_{-0.039}$	60	–	–	70	5.5	20	0.9
02AMB4C	165.5	135.5												1.5
04AMB41	148.5	118.5							–	–				1.3
04AMB4C	188.5	158.5												1.9
08AMB41	173	133	40	8	3	$16^{0}_{-0.011}$	$70^{0}_{-0.046}$	80	35	20	90	7	30	2.6
08AMB4C	216	176												3.5

■Ratings and Specifications

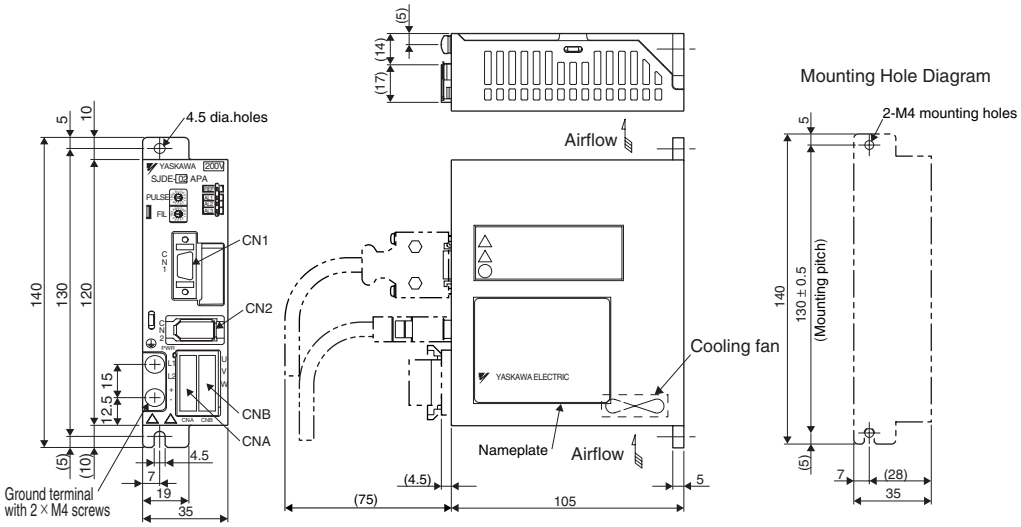
SERVOPACK model SJDE-			01APA	02APA	04APA	08APA	Description
Applicable servomotor capacity [kW]			0.1	0.2	0.4	0.75	Motor capacity that the SERVOPACK can drive.
Continuous output current [Arms]			0.84	1.1	2.0	3.7	Current that the SERVOPACK can output continuously.
Instantaneous max. output current [Arms]			2.5	3.3	6.0	11.1	Maximum current that the SERVOPACK can output instantaneously.
Input power supply (for main circuit and control circuit)	Voltage		Single-phase 200 V to 230 VAC, +10% to -15%				–
	Frequency		50/60Hz ±5%				–
	Capacity at rated output [kVA]		0.40	0.75	1.2	2.2	Power supply capacity required to operate a motor at the rated output.
Power loss at rated output [W]			14	16	24	35	Electric power emitted as heat from the SERVOPACK while operating the motor at the rated torque and rated speed.
Input control method			Capacitor-input type, single-phase full-wave rectification with resistance to prevent inrush currents.				–
Output control method			PWM control, sine wave power driven system				–
Feedback			Incremental encoder				Speed or position detector fixed on the motor shaft opposite the load side.
Allowable load moment of inertia [kgm²]*1			0.6×10^{-4}	3×10^{-4}	5×10^{-4}	10×10^{-4}	Allowable moment of inertia of the machine converted at the motor shaft.
Reference input Pulse type or pulse resolution can be selected with the PULSE switch.		Pulse type	Select one of the following settings: 1. CCW + CW pulse train 2. Sign + pulse train 3. CCW + CW pulse train (negative logic) 4. Sign + pulse train (negative logic)				Types of pulse train signals to drive motor, input into the SERVOPACK. "CCW+CW" means input both counter-clockwise and clockwise rotation pulse trains.
		Pulse resolution	Select one of the following settings: 1. 1000 pulses/rev (Open collector/line driver) 75 kpps max. 2. 2500 pulses/rev (Open collector/line driver) 187.5 kpps max. 3. 5000 pulses/rev (Line driver) 375 kpps max. 4. 10000 pulses/rev (Line driver) 750 kpps max.				Required reference pulse per turn of the motor.
I/O Signals	Input	Clear	Clears the positioning error at the rising edge of the pulse.				–
		Servo ON	Turns the servomotor on or off.				–
	Output	Alarm	OFF if an alarm occurs. Note: OFF for 2s when power is turned on.				–
		Brake	External signal to control brakes. Turn ON to release the brake.				–
		Positioning completed	ON if the position error is within ± 10% of the position reference.				–
		Origin	ON at the motor origin. (Width: 1/500 rev) Note: Use the rising edge of the pulse.				The motor origin is only one per motor rotation.
Built-in functions	Dynamic brake (DB)		Operated at main power off, servo alarm, or servo OFF. (OFF after motor stops.)				Method that stops the motor by short-circuiting the internal circuit of the SERVOPACK.
	Protection		Speed errors, overload, encoder errors, voltage errors, overcurrents, disablement of the built-in cooling fan, system errors. Note: Ground fault protection circuit is not built in.*2				–
	LED display		5 (PWR, REF, AL1, AL2, AL3)				–
	Reference filter		Select one of eight levels with FIL switch.				–
Regenerative processing			If the regenerative energy is too large, install a regenerative unit.				Function to dissipate regenerative electric power when the motor is rotated by external force. This function is required for a high load moment of inertia.
Cooling method			Forced cooling (built-in fan)				–
Operating temperature			0℃ to +55℃				–
Operating humidity			90% RH or less (no condensation)				–
Storage temperature			-20℃ to +70℃				–
Storage humidity			90% RH or less (no condensation)				–
Ambient Conditions			• Free from corrosive gases • Free from dust and iron particles • Free from water droplets or machine oil.				–
Altitude			1000 m or below				–
Vibration resistance			4.9 m/s²				–
Shock resistance			19.6 m/s²				–
Operating conditions			Installation category (overvoltage category): Ⅱ Pollution degree: 2 Protection class: IP1X (EN50178)				–

*1 : Be sure to use the motor within the allowable load moment of inertia.
The motor will become unstable if the load moment of inertia exceeds the allowable value.

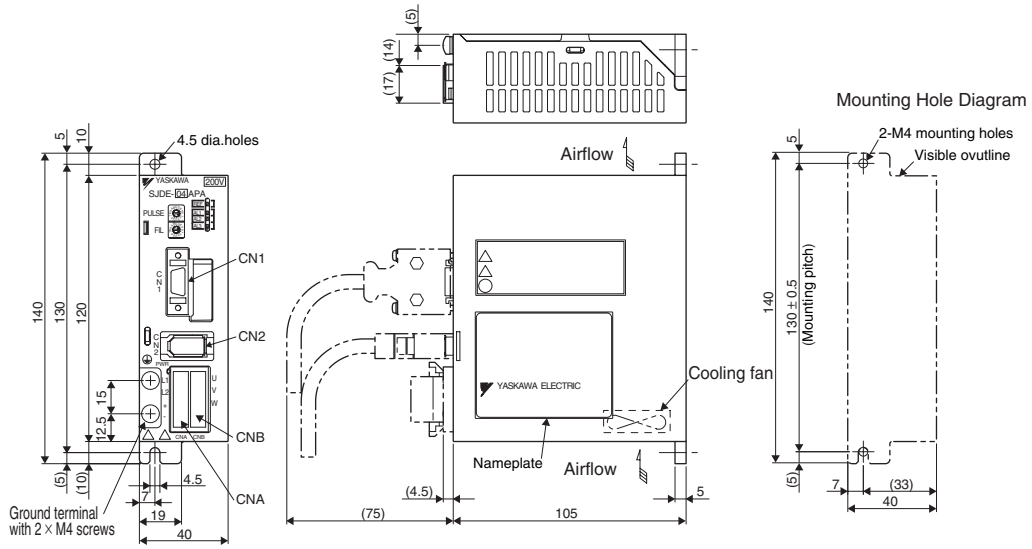
*2 : The ground fault protection circuit is designed for ground fault inside the motor windings while the motor is running.
Therefore, it may not protect the system under the following cases.
• A low-resistance ground fault occurs in the main circuit cable or in the connector of the cable for the servomotor.
• The power supply is turned on during a ground fault.
To make your system even safer, install a ground fault interrupter for overloads and shortcircuits, or install a molded-case circuit breaker combined with a ground fault interrupter for ground faults.

■Dimensions Units: mm

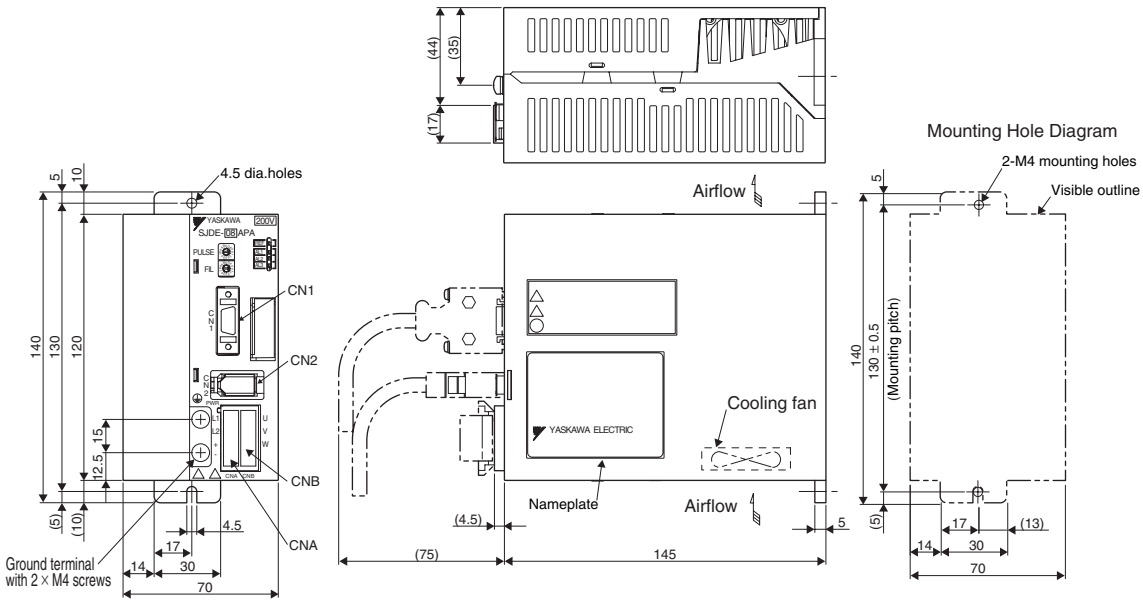
●SJDE-01, 02 (100 W, 200 W)



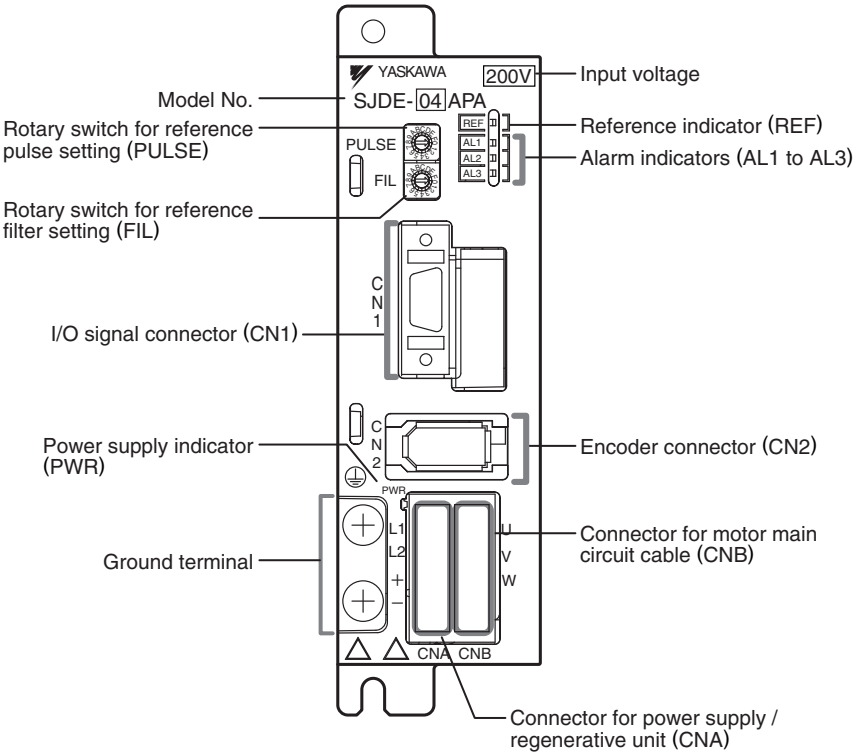
●SJDE-04 (400 W)



●SJDE-08 (750 W)



■Part Names and Functions



●Reference Pulse Setting (PULSE)

PULSE 

Setting	Reference Pulse Resolution (P/REV)	Pulse Output Circuit Form	Reference Pulse Type
0	1000	Open collector or line driver	CW + CCW Positive logic
1	2500		
2	5000	Line driver	CW
3	10000		CCW
4	1000	Open collector or line driver	CW + CCW Negative logic
5	2500		
6	5000	Line driver	CW
7	10000		CCW
8	1000	Open collector or line driver	Sign + pulse train, Positive logic
9	2500		
A	5000	Line driver	PULS
B	10000		SIGN
C	1000	Open collector or line driver	Sign + pulse train, Negative logic
D	2500		
E	5000	Line driver	PULS
F	10000		SIGN

Notes : 1 Settings should be done after the power is turned off.
2 The factory setting is 0.

●Reference Filter Setting (FIL)

FIL 

Setting	Acceleration/ Deceleration Time for Step Reference*4	Positioning Settling Time *3	Description
0*2	45 ms	100 to 200 ms	▲ Small filter time constant (short positioning time)
1	50 ms	110 to 220 ms	
2	60 ms	130 to 260 ms	
3	65 ms	150 to 300 ms	
4	70 ms	170 to 340 ms	Large filter time constant (little vibration with a long positioning time) ▼
5	80 ms	200 to 400 ms	
6	85 ms	250 to 500 ms	
7	170 ms	500 to 1000 ms	
8 to F	Do not set 8 through F.		

*1 : If the machine vibrates when starting or stopping, set a larger value.
*2 : The factory setting is 0. Not necessary to change this value unless machine vibrates.
*3 : The value depends on conditions such as the amplitude of accel/decel reference, the rigidity of the machine, and the reference resolution.
*4 : Select the appropriate servomotor capacity on the basis of values at a step reference.

●Reference (REF)

Indicators*	Motor Power	Reference Pulses
Lit orange	OFF	–
Blinks orange	OFF	Input
Lit green	ON	–
Blinks green	ON	Input

*: Lit yellow for 1 s when the clear signal is input.

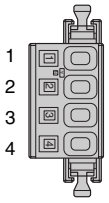
●Alarm (AL1, AL2, and AL3)

■: Lit □: OFF

Indicators	Meaning of Alarm	Indicators	Meaning of Alarm
AL1 □ AL2 □ AL3 □	Normal	AL1 ■ AL2 □ AL3 ■	Overcurrent
AL1 ■ AL2 □ AL3 □	Speed error	AL1 □ AL2 ■ AL3 ■	Cooling fan in SERVOPACK stopped
AL1 □ AL2 ■ AL3 □	Overload	AL1 ■ AL2 ■ AL3 ■	System error
AL1 ■ AL2 ■ AL3 □	Encoder error	AL1 ■ ↔ □ AL2 ■ ↔ □ AL3 ■ ↔ □ Blinks at regular intervals.	Reference pulse setting (PULSE) changed.
AL1 □ AL2 □ AL3 ■	Voltage error		

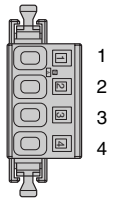
●Connector for Power Supply/ Regenerative Unit (CNA)

Pin No.	Symbol	Signal Name
1	L1	Power supply input terminals
2	L2	
3	+	Regenerative unit connection terminals
4	–	



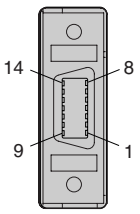
●Connector for Motor Main Circuit Cable (CNB)

Pin No.	Symbol	Signal Name
1	U	Phase U
2	V	Phase V
3	W	Phase W
4	–	Not used



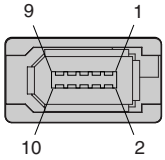
●I/O Signal Connector (CN1)

Pin No.	I/O	Symbol	Signal Name	Pin No.	I/O	Symbol	Signal Name
1	Input	CW, PULS	Reverse rotation pulse, reference pulse	8	Input	CLR	Position error pulse clear
2	Input	/CW, /PULS		9	Input	/CLR	
3	Input	CCW, SIGN	Forward rotation pulse, reference sign	10	Output	PCO	Phase-C signal
4	Input	/CCW, /SIGN		11	Output	SG-PCO	Phase-C signal ground
5	Input	+24VIN	External input power supply	12	Output	ALM	Servo alarm
6	Input	/S-ON	Servo ON	13	Output	/BK	Brake
7	Output	SG-COM	Output signal ground	14	Output	/COIN	Positioning completed
				Shell	–	–	FG



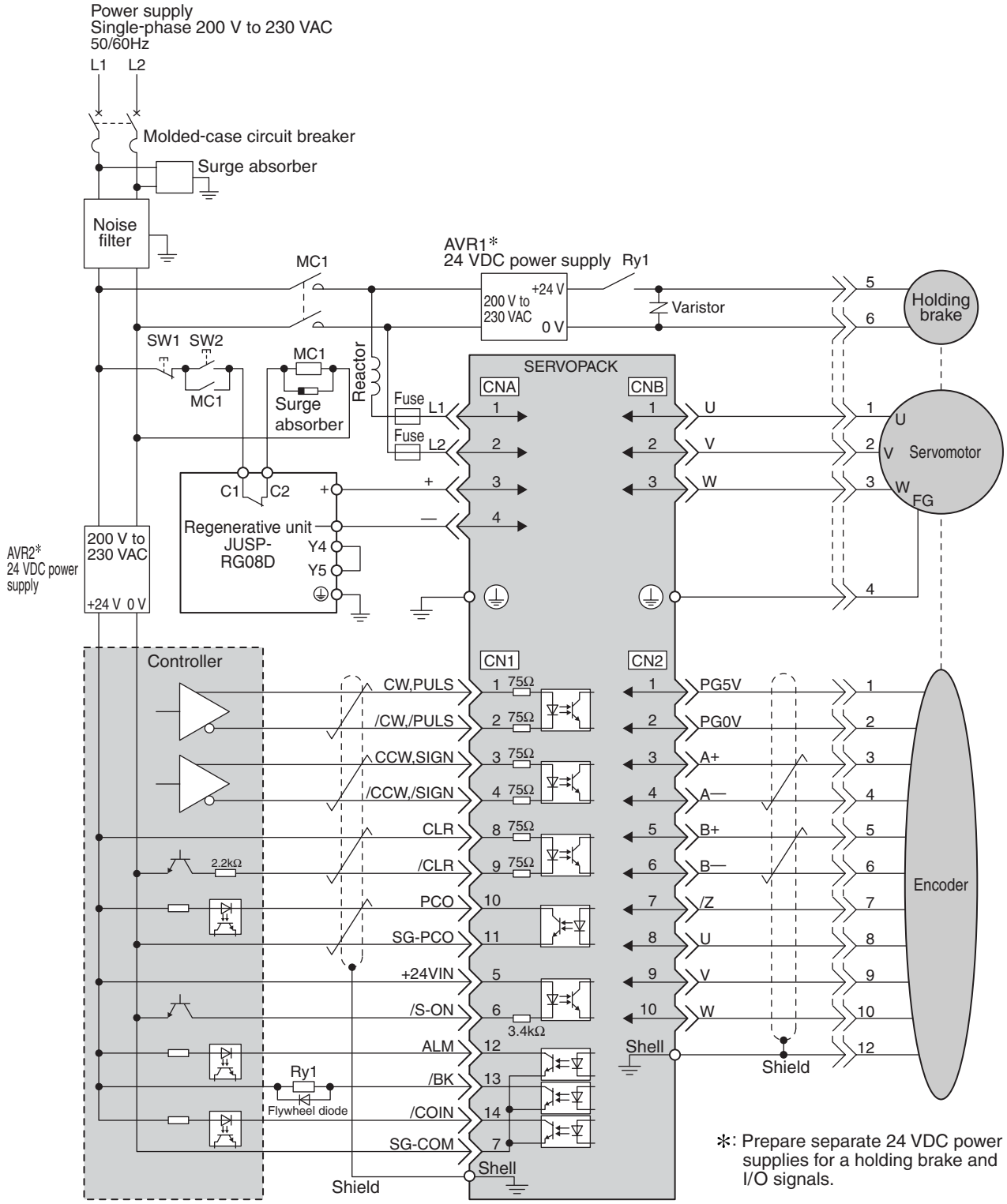
●Encoder Connector (CN2)

Pin No.	Symbol	Signal Name	Pin No.	Symbol	Signal Name
1	PG5V	PG power supply +5 V	6	B–	Phase B–
2	PG0V	PG power supply 0 V	7	/Z	Phase /Z
3	A+	Phase A+	8	U	Phase U
4	A–	Phase A–	9	V	Phase V
5	B+	Phase B+	10	W	Phase W



Connection Diagram

■Example



Notes: 1 AVR1 : 24 VDC power supply for holding brake
AVR2 : 24 VDC power supply for I/O signals
SW1 : Power off switch
SW2 : Power on switch
MC1 : Magnetic contactor
Ry1 : Relay for holding brake

・Manufacturers of Components

Surge absorber	Okaya Electric Industries Co., Ltd.(Spark killer):	CRE-50500
Flywheel diode	Toshiba Corp.:	1NH42
Relay for holding brake	Omron Corp.:	MY series
Varistor	Nippon Chemi-Con Corp.:	TNR7V121K

2 The ground fault protection circuit is designed for ground fault inside the motor windings while the motor is running. Therefore, it may not protect the system under the following cases.
- A low-resistance ground fault occurs in the main circuit cable or in the connector of the cable for the servomotor.
- The power supply is turned on during a ground fault.

To make your system even safer, install a ground fault interrupter for overloads and shortcircuits, or install a molded-case circuit breaker combined with a ground fault interrupter for ground faults.

■Main Circuit Wiring

- For SJDE SERVOPACKs, use a power supply capacity of 5,000 Arms or less (230 Vrms max.).
- Use UL-approved fuses or circuit breakers. Wiring should meet the National Electrical Code (NEC) or an equivalent.
- Use 75 ˚C heat-resistant copper cables or an equivalent.

●Cable Types

Cable Types		Allowable Conductor Temperature
Symbol	Name	
PVC	Standard vinyl cable	–
IV	600 V vinyl cable	60℃
HIV	Heat-resistant vinyl cable	75℃

- Cable sizes are selected for three cables per bundle at 40℃ ambient temperature with the rated current.
- Use cables with a minimum withstand voltage of 600 V for main circuits.
- If cables are bundled in hard vinyl conduits or metal conduits, consider the derating of the allowable current.
- Use heat-resistant cables under high ambient temperatures in a panel where standard vinyl cables will rapidly deteriorate.
- Do not use cables under continuous regenerative state.

The following table shows the cable size and the allowable current for three cables per bundle. Do not use cables at a current higher than the recommended allowable current shown in the following table.

●600-V Heat-resistant Vinyl Cables (HIV)

AWG Size	Nominal Cross Section mm²	Configuration wires/mm	Conductive Resistance Ω /mm	Allowable Current at Ambient Temperature A		
				30℃	40℃	50℃
20	0.5	19/0.18	39.5	6.6	5.6	4.5
–	0.75	30/0.18	26.0	8.8	7.0	5.5
18	0.9	37/0.18	24.4	9.0	7.7	6.0
16	1.25	50/0.18	15.6	12.0	11.0	8.5
14	2.0	7/0.6	9.53	23	20	16

Note : The values in the table are only for reference.

●Power Supply Input Terminals (L1, L2), Motor Connection Terminals (U, V, W), and Regenerative Unit Connection Terminals (+, –)

Capacity W	SERVOPACK Type	Terminal Symbol		
		L1, L2	U, V, W	+,–
100	SJDE-01A	HIV1.25 mm²	HIV1.25 mm² Wiring length: 20 m max.	HIV1.25 mm² Wiring length: 0.5 m max.
200	SJDE-02A			
400	SJDE-04A	HIV2.0 mm²		
750	SJDE-08A			

Note : Connectors are used for all wiring.

●Ground Terminal (⏚)

Cable Size	Terminal Screw Size	Tightening Torque
HIV 2.0 mm² min.	M4	1.2 to 1.4 N·m

<Signal Line Cable Sizes>

The following table specifies the appropriate cables for the CN1 and CN2 connectors on the SERVOPACK.

Connector Name and Symbol		Item	Specification
I/O Signal Connector	CN1	Cable	Use twisted-pair cables or shielded twisted-pair cables.
		Maximum cable length	3 m
		Applicable cable	AWG24 (0.2 mm²), AWG26 (0.12 mm²), AWG28 (0.08 mm²)
		Finished cable dimension	8 mm dia. max.
Encoder Signal Connector	CN2	Cable	Use the cables specified by Yaskawa or use shielded twisted-pair cables.
		Maximum cable length	20 m
		Applicable cable	AWG22 (0.33 mm²) and AWG26 (0.12 mm²) Use AWG22 for the encoder power supply and AWG26 for signal lines.
		Finished cable dimension	9 mm dia. max.

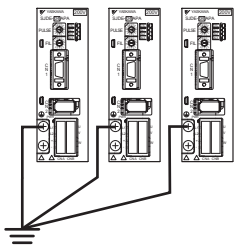
■Wiring Precautions

- Wiring must be performed by experts in electrical work.
- Design the circuit so that both the /S-ON signal and the power supply turn off at the same time in case of an emergency stop.
- The SERVOPACK does not include an overtravel function. To make your system even safer, include a function so that the /S-ON signal will turn off when the overtravel limit switch is activated.
- If the servomotor is used to drive a vertical axis, take safety measures to prevent the workpiece from falling down when an alarm occurs. Failure to observe this precaution may result in injury or damage to the equipment caused by fallen workpieces.
- Use a molded-case circuit breaker and fuse to protect the power supply line. The SJDE SERVOPACK is connected directly to a commercial power supply without a transformer, so always use a circuit breaker and fuse to protect the SERVOPACK from accidents.
- The ground protection circuit is designed for ground fault inside the motor windings while the motor is running.
  Therefore, it may not protect the system under the following cases.
  - A low-resistance ground fault occurs in the main circuit cable or in the connector of the cable for the servomotor.
  - The power supply is turned on during a ground fault.

  To make your system even safer, install a ground fault interrupter for overloads and shortcircuits, or install a molded-case circuit breaker combined with a ground fault interrupter for ground faults.
- Do not run the power and signal lines together in the same duct, or do not bundle them together. The distance between a power line (such as power supply lines or servomotor cables) and signal lines must be at least 30 cm.
- Note that longer cables for pulses result in a lower transmission rate.
- Customers must provide a 24 VDC power supply with double insulation.
- Install an interlock system in the circuit to avoid accidents when opening or closing the machine's protective cover.

●Grounding

- To ground a SERVOPACK, follow these conditions.
  - Use as thick a cable as possible (HIV 2.0 mm^2 min.) for grounding.
  - A ground resistance of 100Ω or less is recommended.
  - Use a single point ground as shown in the figure.



●Cables

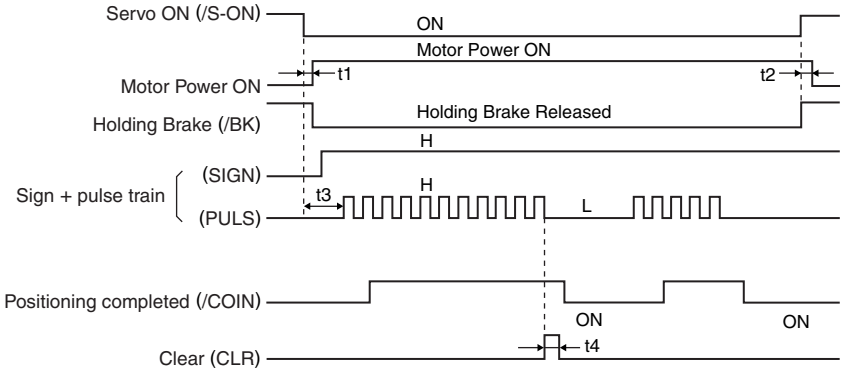
- For wiring, use the specified cables. The wiring distance should be as short as possible.
- Do not bend exessively or apply tension to cables. The conductor of a signal cable is very thin (0.08 to 0.12 mm^2), so handle the cables carefully.

■Explanation of I/O Signals

Pulse train references are given to control the position of the servomotor. The SJDE SERVOPACKs support the following outputs for pulse trains from the upper controller.

- Line driver output
- +24 V open-collector output
- +12 V open-collector output
- +5 V open-collector output

●I/O Signal Timing Examples

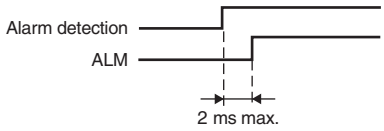


t1: Approx. 40 ms
t2: Approx. 130 ms*3
t3 ≧ 40 ms*1
(Motor with holding brake: 100 ms)

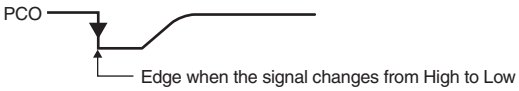
t4 ≥ 20 µs*2

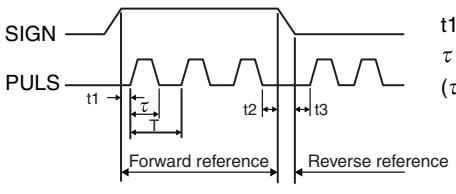
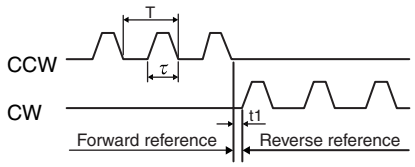
*1: The interval from when the servo ON signal is turned ON until the reference pulse is input must be at least 40 ms, or the reference pulse may not be received by the SERVOPACK. If a motor with a holding brake is used, provide an interval of at least 100 ms because more time will be required to release the brake.
*2: The error counter clear signal must be ON for at least 20 μs. If the reference pulse is stopped and the clear signal is turned ON, the motor will be able to stop at that position.
*3: The delay time of the holding brake is 100 ms. Use a relay for holding brake with an operating time of 30 ms or less.

Notes: 1 The alarm signal turns ON within 2 ms after an alarm is detected.



2 Use the falling edge as the phase-C output signal (High to Low), because the waveform of the rising edge (Low to High) is distorted.

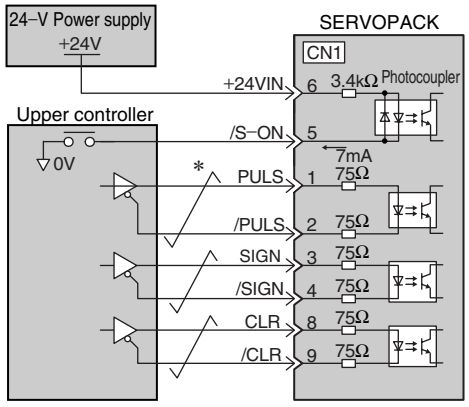


Reference Pulse Signal Form	Electrical Specifications	Remarks
Sign + pulse train input (SIGN + PULS signal) Maximum reference frequency: 750 kpps (187.5 kpps for an open-collector output)	 t1, t2, t3 > 3 μs $\tau \geq 0.65\,\mu$s $(\tau/T)\times 100 \leq 50\%$	Sign (SIGN): High = Forward reference Low = Reverse reference
CW pulse + CCW pulse Maximum reference frequency: 750 kpps (187.5 kpps for an open-collector output)	 t1 > 3 μs $\tau \geq 0.65\,\mu$s $(\tau/T)\times 100 \leq 50\%$	–

■Connection Examples of Input Signals

●Line Driver Output

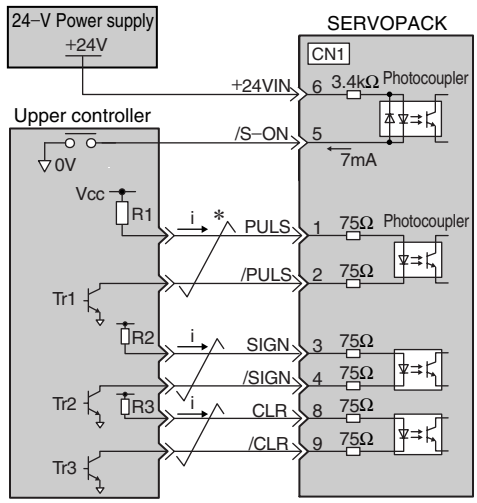
Applicable line driver: SN75174 or MC3487 (Manufactured by Texas Instruments Inc.) or equivalent



*: Twisted-pair wires

●Open-collector Output

Set the R1 through R3 current limit resistors so that input current (i) will fall within the following range.
Input current (i) = 7 mA to 15 mA



*: Twisted-pair wires

Examples:

- When Vcc is +24 V: R1 through R3 = 2.2 kΩ
- When Vcc is +12 V: R1 through R3 = 1 kΩ
- When Vcc is +5 V: R1 through R3 = 180 Ω

Note: The following signal logic applies for an open-collector output.

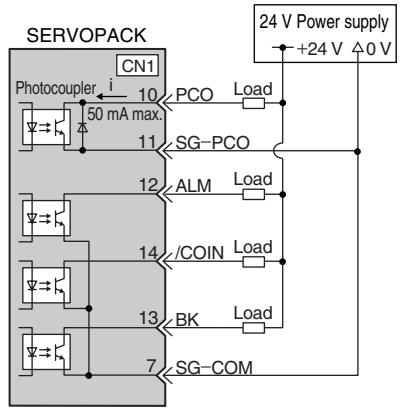
Tr1 to Tr3 ON	Equivalent to high level input
Tr1 to Tr3 OFF	Equivalent to low level input

■Connection Example of Output Signals

Set the load so that the output current (i) will fall within 50 mA or less.

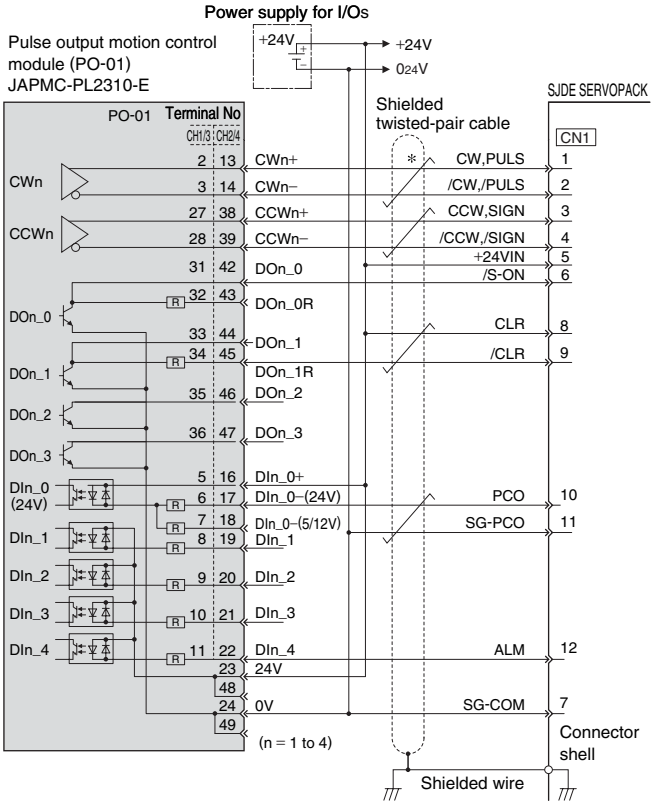
Photocoupler output (per output signal)

- Max. voltage: 30 VDC
- Max. current: 50 mADC



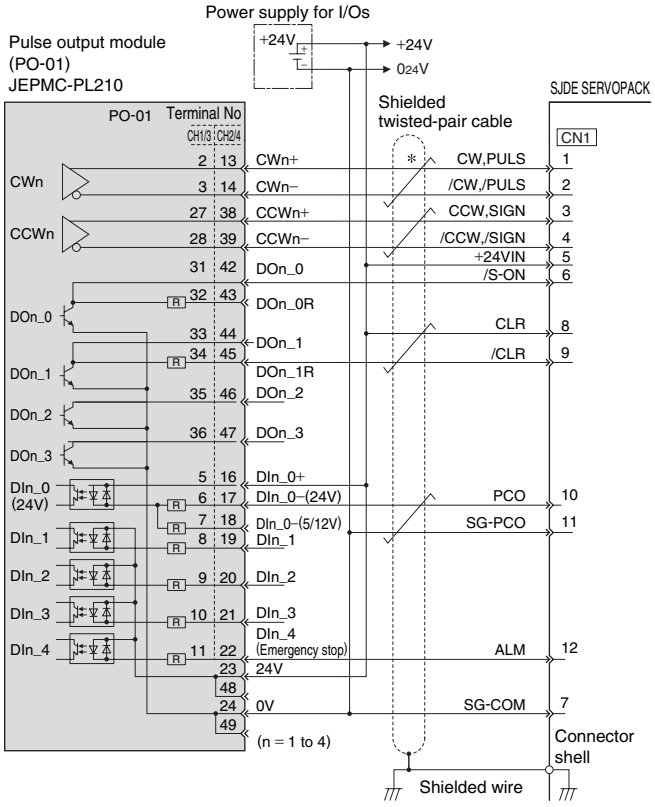
Connection to Controller

●Wiring to Yaskawa MP2000-series Machine Controllers



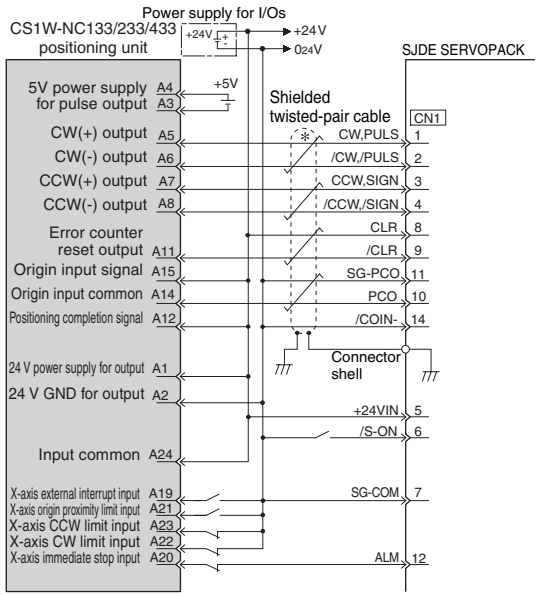
Note: Only the signals between the SJDE SERVOPACK and the pulse output motion control module (PO-01, JAPMC-PL2310-E) are shown in the diagram.

●Wiring to Yaskawa MP900-series Machine Controllers



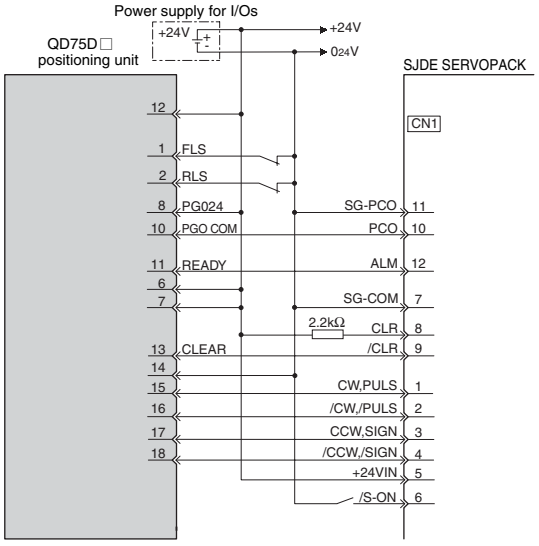
Note: Only the signals between the SJDE SERVOPACK and the pulse output module (PO-01, JEPMC-PL210) are shown in the diagram.

●Wiring to Omron's CS1W-NC133/233/433 Positioning Units



Notes : 1 Omron = Omron Corporation
2 Only signals between Yaskawa's SJDE SERVOPACK and Omron's CS1W-NC133/233/433 positioning unit are shown in the diagram.

●Wiring to Mitsubishi's QD75D□ Positioning Units



Notes : 1 Mitsubishi = Mitsubishi Electric Corporation
2 Only signals between Yaskawa's SJDE SERVOPACK and Mitsubishi's QD75D□ positioning unit are shown in the diagram.

*: represents twisted-pair shielded wire.

■Servomotor

●Precautions

The service life of the servomotor will be shortened or unexpected problems will occur if the servomotor is installed incorrectly or in an inappropriate location. Always observe the precautions in this section when installing a servomotor.

- If the junction cables are connected to the motor, be sure to connect the servomotor's main circuit cable before connecting the encoder cable. If the encoder cable is connected first, the encoder may become damaged because of the voltage differences between the ground and the frame.
- If using cables that are not made by Yaskawa, ensure that connector pins and cables are correctly configured.
- Make sure there is no foreign matter (such as dust and metal chips) in the connector before connecting.
- When handling a servomotor with its cables connected, hold the servomotor body. Otherwise the connectors and cables will be damaged.

●Installation Conditions

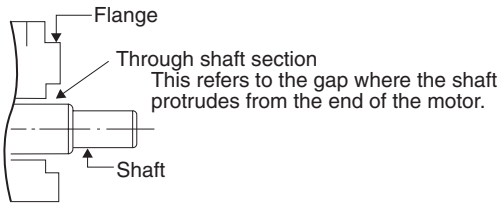
Item Conditions	Description
Operating temperature	0℃ to +40℃ without freezing
Operating humidity	20% to 80%RH with no condensation
Installation sites	• Indoors • Free from corrosive or explosive gases • Well-ventilated and free from dust and moisture • Facilitates inspection and cleaning
Storage conditions	If the power cable is disconnected, store the motor under these conditions. Temperature: −20℃ to +60℃ without freezing Humidity: 20% to 80%RH with no condensation
Altitude	1000 m or below above sea level

Note : Do not directly connect the servomotor to a commercial power line. This will damage the servomotor.

●Waterproof Specifications

The protective structure of the servomotors is designed with an IP55 rating.

- The servomotor can be used in a location that is subject to water drops, except for the connector and the section where the shaft passes through.
- Do not use the servomotor in a location that is subject to oil mist.

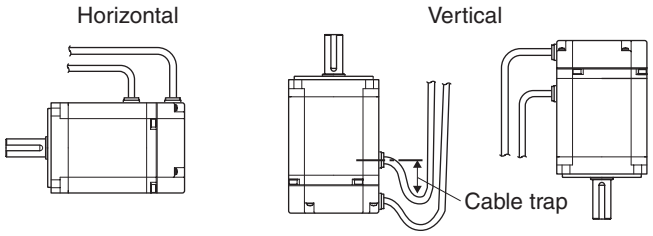


●Direction of Servomotor Rotation

The forward rotation of the servomotor is counterclockwise when viewed from the load.

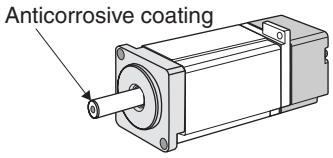
●Installation Direction

- The motor can be installed horizontally or vertically. If the motor is mounted vertically, provide a cable trap so that water drops do not enter the motor.
  If the motor is installed with the axis pointing up, take preventive measures so that oil does not splash on the motor from other parts of the machine such as the gearbox.
- Do not bend or pull excessively any cables, the lead openings, and the junctions of the cables.
  The cores in the encoder cable and the brake signal line in the main circuit cable are only 0.2 mm^2 or 0.3 mm^2. Be sure to protect them from stress.

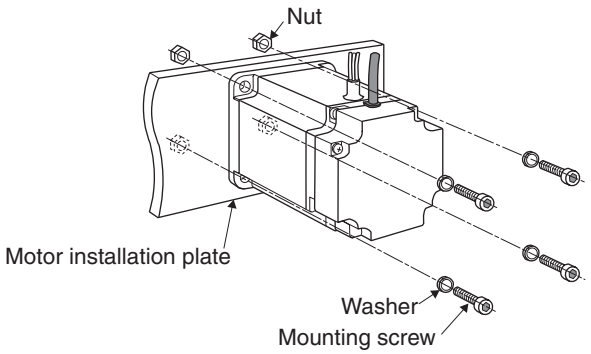


●Installation Method

- The end of the motor shaft is coated with an anticorrosive coating. Thoroughly remove the coating prior to installation, or it will not be possible to couple the motor to the mechanical system.



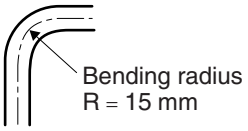
- Use the mounting holes (two for 100-W models and four for 200- to 750-W models) on the motor installation surface to secure the motor.



- Do not apply shock directly to the output shaft or encoder when mounting the motor, because the servomotor shaft is directly coupled to the encoder. The encoder may be damaged by the shock.

<Precautions>

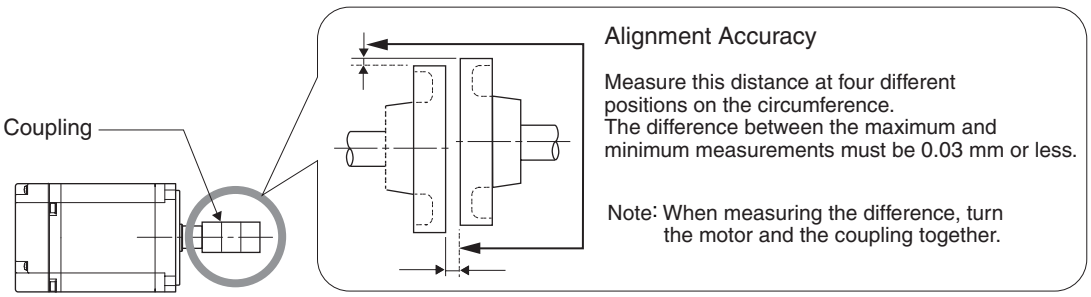
The motor main circuit cable, encoder cable, and junction cable cannot be used for applications in which the cables are moved, twisted, or rotated to a small bending radius. The cable bending radius in the center of the cable must be of 15 mm or larger. If the cables need to be bent, contact your Yaskawa representative.



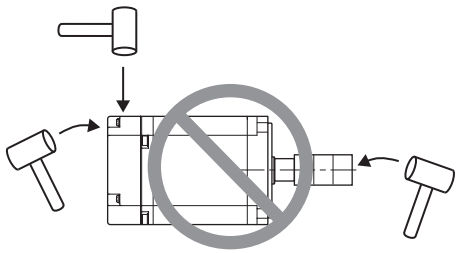
●Coupling to the Machine

Observe the following precautions when coupling the servomotor with the drive axis of the machine.

- Align the shaft of the servomotor with the shaft of the equipment, and then couple the shafts.
- Make sure that the motor and the machine are accurately aligned.
  Failure to observe this caution may result in damage to the motor axis or deterioration of the service life of the servomotor by an eccentric load. Keep the eccentric load as small as possible.



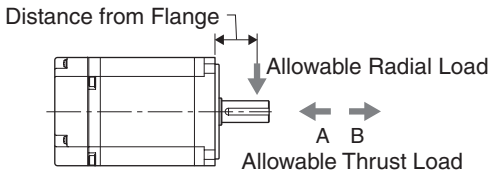
- A metal plate-spring coupling with high torsion rigidity designed for servomotors is recommended to maintain the response characteristics and durability of the servomotor.
- When attaching the coupling to the shaft of the servomotor, do not hammer the axis or near the encoder. Such shocks and vibrations may cause the encoder to malfunction.



●Allowable Loads

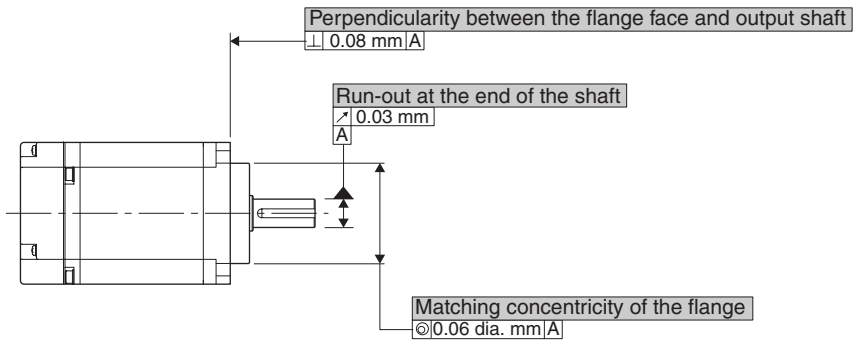
Design the mechanical system so that, during operation, the thrust and radial loads applied to the servomotor shaft do not exceed the range shown in the table below.

Servomotor Model SJME-	Allowable Radial Load N	Allowable Thrust Load N	Distance from Flange mm
		Direction A or B	
01A	78	54	20
02A	245	74	25
04A	245	74	25
08A	392	147	35



●Mechanical Tolerance TIR (Total Indicator Reading)

The following diagram shows tolerances for the servomotor's output shaft and installation area.



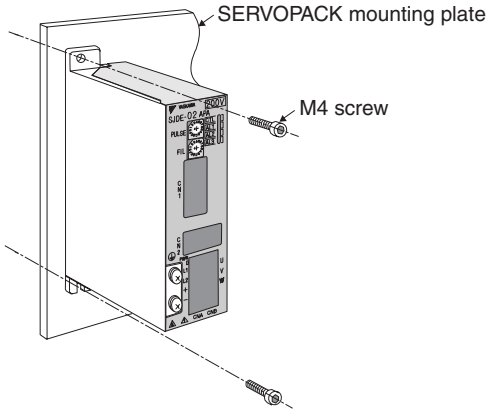
■SERVOPACK

●Mounting Conditions

Installation Site	Precautions
In a control panel	The ambient temperature around the SERVOPACK must be 55˚C or less. Design the control panel size, unit layout, and cooling method accordingly. Note: The maximum ambient temperature for long-term reliability is 45˚C.
Near a heating unit	The ambient temperature around the SERVOPACK must be 55˚C or less. Minimize the heat radiating from the heating unit as well as any temperature rise caused by natural convection.
Near a source of vibration	Install a vibration isolator beneath the SERVOPACK to eliminate vibrations from the machine.
At a site where corrosive gasses might enter the control panel	Take appropriate action to avoid corrosive gases. Corrosive gases do not have an immediate effect on the SERVOPACK but will eventually cause the electronic components, relays, and magnetic contactors to malfunction.
At a contaminated site	Take appropriate action to avoid any contaminants such as dust, iron particles, water drops, or oil mist. Contamination will cause the electronic components to immediate malfunction.

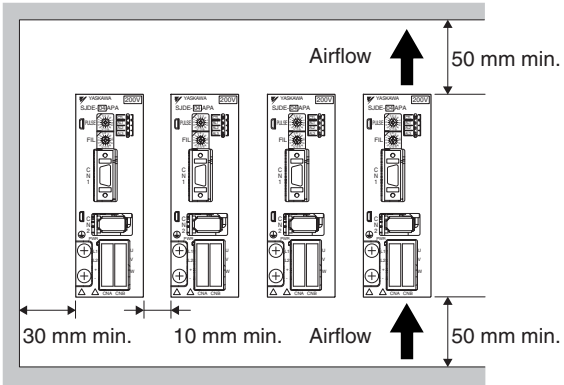
●Mounting Method

- Mount the SERVOPACK vertically, so the bottom is perpendicular to the wall. The SERVOPACK must be mounted in the specified direction because it contains a built-in fan for cooling.
- Fix the mounting plate securely with the two M4 screws in the mounting holes.



●Spacing

To ensure effective cooling, sufficient space must be kept between the individual SERVOPACK units and also between the SERVOPACK units and the panel wall as shown in the figure.



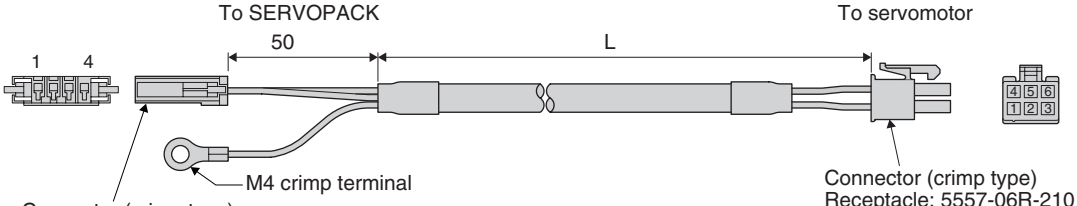
Cable and Connector Dimensions

Units: mm

■Servomotor Main Circuit Cables with Connectors (Junction Cables)

Motor Type	Model	Cable Length (L)	Contact
Without holding brakes	JZSP-CHM000-03	3 m	Yaskawa Local Office
	JZSP-CHM000-05	5 m	
	JZSP-CHM000-10	10 m	
	JZSP-CHM000-15	15 m	
	JZSP-CHM000-20	20 m	
With holding brakes	JZSP-CHM030-03	3 m	
	JZSP-CHM030-05	5 m	
	JZSP-CHM030-10	10 m	
	JZSP-CHM030-15	15 m	
	JZSP-CHM030-20	20 m	

●JZSP-CHM000-□□ (For Motors without Holding Brakes)



Connector (crimp type)
Receptacle: F32FSS-04V-KY
Receptacle contact: SF3F-01GF-P2.0 or SF3F-41GF-P2.0
(J.S.T. Mfg. Co., Ltd.)

Connector (crimp type)
Receptacle: 5557-06R-210
Terminal: 5556T(chained) or
5556TL(detached)
(Molex Japan Co., Ltd.)

<Wiring Specifications>

Connector for SERVOPACK

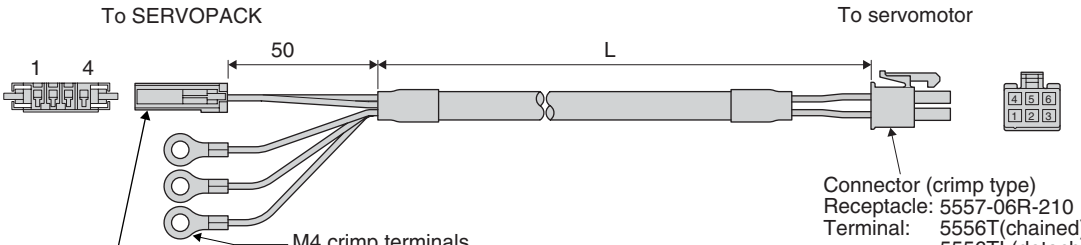
Pin No.	Signal	Cable Color
1	Phase U	Red
2	Phase V	White
3	Phase W	Blue
4	—	—
Crimp terminal	F G*	Green/Yellow

Connector for Servomotor

Pin No.	Signal	Cable Color
1	Phase U	Red
2	Phase V	White
3	Phase W	Blue
4	F G	Green/Yellow
5	—	—
6	—	—

*: Connect the FG pin to the grounding terminal of the SERVOPACK.

●JZSP-CHM030-□□ (For Motors with Holding Brakes)



Connector (crimp type)
Receptacle: F32FSS-04V-KY
Receptacle contact: SF3F-01GF-P2.0 or SF3F-41GF-P2.0
(J.S.T. Mfg. Co., Ltd.)

Connector (crimp type)
Receptacle: 5557-06R-210
Terminal: 5556T(chained) or
5556TL(detached)
(Molex Japan Co., Ltd.)

<Wiring Specifications>

Connector for SERVOPACK

Pin No.	Signal	Cable Color
1	Phase U	Red
2	Phase V	White
3	Phase W	Blue
4	—	—
Crimp terminal	F G*1	Green/Yellow
Crimp terminal	Brake*2	Black
Crimp terminal	Brake*2	Black

Connector for Servomotor

Pin No.	Signal	Cable Color
1	Phase U	Red
2	Phase V	White
3	Phase W	Blue
4	F G	Green/Yellow
5	Brake	Black
6	Brake	Black

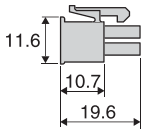
*1: Connect the FG terminal to the grounding terminal of the SERVOPACK.
*2: No polarity for brake.

■Servomotor Main Circuit Cable Connector Kits for Servomotor

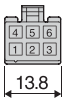
Type	Model	Part No.	Qty	Manufacturer	Contact
Crimp Type (For servomotor w/wo holding brake)	JZSP-CHM9-1	Receptacle: 5557-06R-210	1	Molex Japan Co.,Ltd.	Yaskawa Local Office
		Terminal: 5556T (chained) or 5556TL (detached)	7		
	57027-5000	Crimping tool: 57027-5000	–	Molex Japan Co.,Ltd.	Yaskawa Local Office

Note: A crimping tool is ordered separately.

・Receptacle



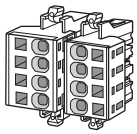
・Terminals



■Servomotor Main Circuit Cable Connector Kits for SERVOPACK CNB

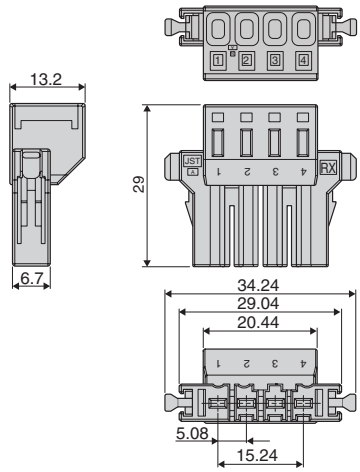
Power Supply/Regenerative Unit Connector Kits for SERVOPACK CNA

Type		Model	Part No.	Qty	Manufacturer	Contact
Servomotor Main Circuit Cable Connector Kits for CNB (For servomotor w/wo holding brake)	Spring Type	JZSP-CHM9-2	Connector: 04JFAT-SAYGF-N Tool (lever for wiring): J-FAT-OT		J.S.T.Mfg. Co.,Ltd.	Yaskawa Local Office
	Crimp Type	F32FSS-04V-KY	Receptacle: F32FSS-04V-KY	1	J.S.T.Mfg. Co.,Ltd.	Yaskawa Local Office
		SF3F-41GF-P2.0	Receptacle contact: SF3F-41GF-P2.0	4		
		YRF-880	Crimping tool: SF3F-41GF-P2.0	–		
Power Supply/ Regenerative Unit Connector Kits for CNA	Spring Type	JZSP-CHG9-1	Connector: 04JFAT-SBXGF-N Tool (lever for wiring): J-FAT-OT		J.S.T.Mfg. Co.,Ltd.	Yaskawa Local Office

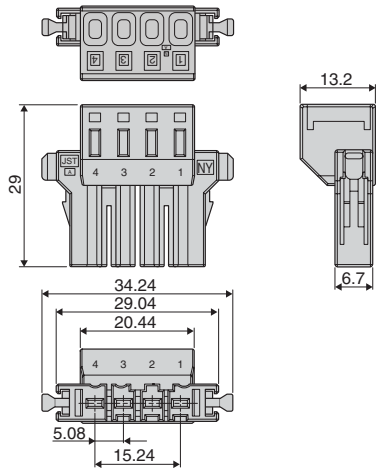


Note: A crimping tool is ordered separately.

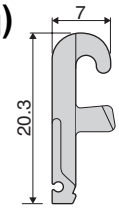
●CNA Connector Model: 04JFAT-SBXGF-N



●CNB Connector Model: 04JFAT-SAYGF-N

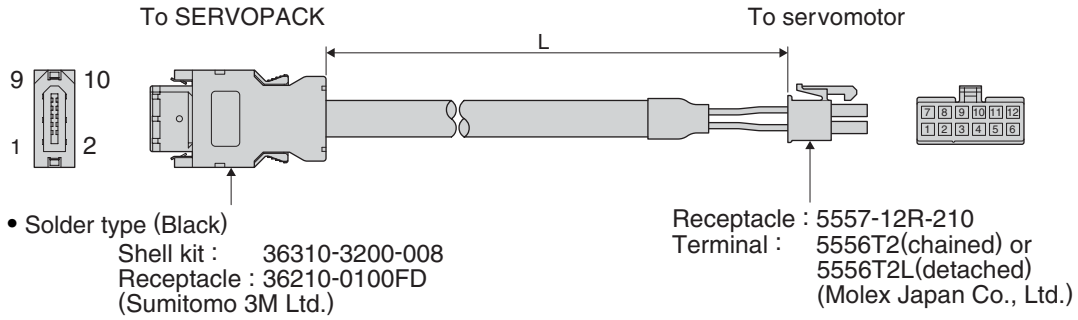


●Wiring Tool (Lever for Wiring) Model: J-FAT-OT



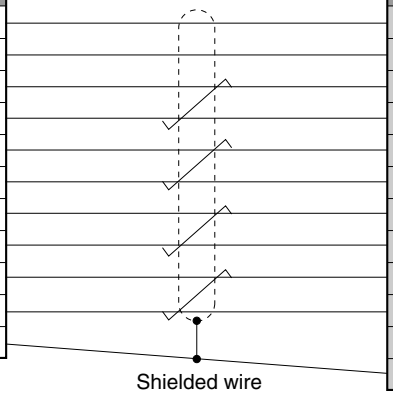
■Encoder Cables with Connectors (Junction Cable)

Model	Length (L)	Contact
JZSP-CHP800-03	3 m	Yaskawa Local Office
JZSP-CHP800-05	5 m	
JZSP-CHP800-10	10 m	
JZSP-CHP800-15	15 m	
JZSP-CHP800-20	20 m	



<Wiring Specifications>

Pin No.	Signal	Wire Color
1	PG5V	Red
2	PG0V(GND)	Black
3	Phase A+	Blue
4	Phase A−	Blue/White
5	Phase B+	Yellow
6	Phase B−	Yellow/White
7	Phase /Z	Purple
8	Phase U	Gray
9	Phase V	Green
10	Phase W	Orange
Shell	−	Shield wire



Pin No.	Signal	Wire Color
1	PG5V	Red
2	PG0V(GND)	Black
3	Phase A+	Blue
4	Phase A−	Blue/White
5	Phase B+	Yellow
6	Phase B−	Yellow/White
7	Phase /Z	Purple
8	Phase U	Gray
9	Phase V	Green
10	Phase W	Orange
11	−	−
12	FG	Shield

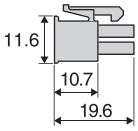
■Encoder Cable Connector Kits

●For Servomotor Encoder Plug

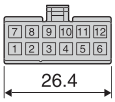
Type	Model	Part No.	Qty	Manufacturer	Contact
Crimp Type	JZSP-CHP9-1	Receptacle: 5557-12R-210	1	Molex Japan Co., Ltd.	Yaskawa Local Office
		Terminal: 5556T2 (chained) or 5556T2L (detached)	12		
	57026-5000	Crimping tool: 57026-5000	–	Molex Japan Co., Ltd.	Yaskawa Local Office

Note: A crimping tool is ordered separately.

・Receptacle

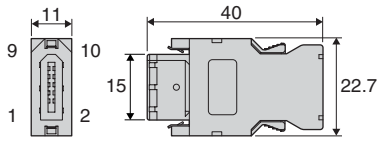


・Terminals



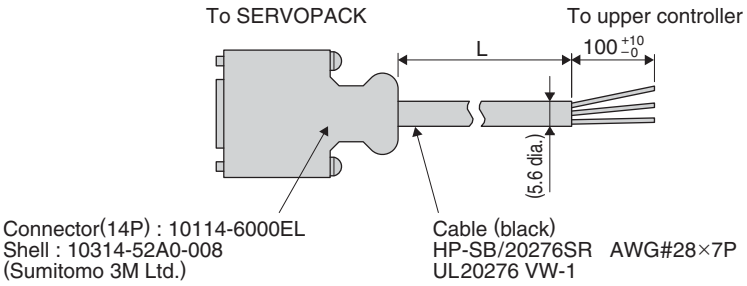
●For SERVOPACK CN2

Type	Model	Part No.	Manufacturer	Contact
Soldered Type (black)	JZSP-CHP9-2	Shell kit: 36310-3200-008 Receptacle: 36210-0100FD	Sumitomo 3M Ltd.	Yaskawa Local Office
Soldered Type (gray)	JZSP-CHP9-3	Plug and cable cover: 54599-1019 Plug connector: 54593-1019	Molex Japan Co.,Ltd.	Yaskawa Local Office



■I/O Signal Cables

Cable Mode	Length (L)	Contact
JZSP-CHI003-01	1 m	Yaskawa Local Office
JZSP-CHI003-02	2 m	
JZSP-CHI003-03	3 m	



＜Wiring Specifications＞

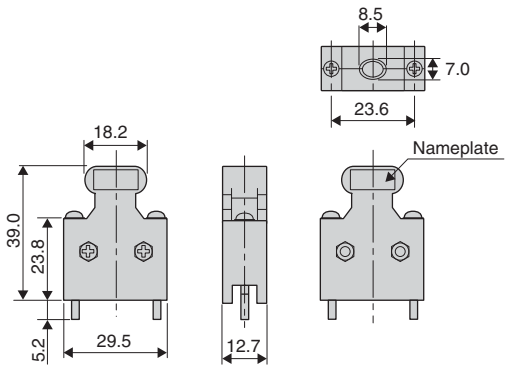
Pin No.	Signal Code	Signal Name	Lead Color	Marking Dots	Marking Color	Pin No.	Signal Code	Signal Name	Lead Color	Marking Dots	Marking Color
1	CW, PULS	Reverse rotation pulse, reference pulse	Orange	1	Black	8	CLR	Position error pulse clear	Yellow	1	Red
2	/CW, /PULS				Red	9	/CLR		Pink		Black
3	CCW, SIGN	Forward rotation pulse, reference sign	Light gray		Black	10	PCO	Phase-C signal			Red
4	/CCW, /SIGN				Red	11	SG-PCO	Phase-C signal ground	Orange	2	Black
5	+24VIN	External input power supply	White		Black	12	ALM	Servo alarm			Red
6	/S-ON	Servo ON			Red	13	/BK	Brake	Light gray		Black
7	SG-COM	Output signal ground	Yellow		Black	14	/COIN	Positioning completed			Red
						Shell	–	FG	–	–	

■I/O Signal Connector Kits

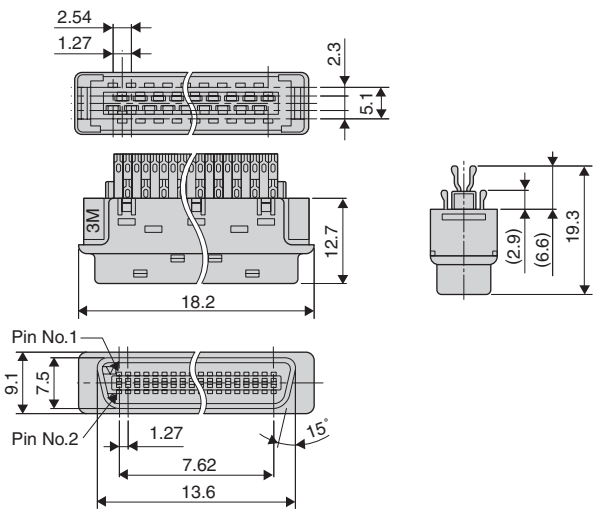
●For SERVOPACK CN1

Type	Model	Part No.	Manufacturer	Contact
Soldered type	JZSP-CHI9-1	Shell kit: 10314-52A0-008	Sumitomo 3M Ltd.	Yaskawa Local Office
		Plug: 10114-3000PE		

• Shell Kit



• Plug

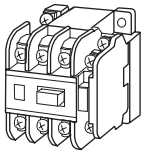


Peripheral Device Dimensions

Units: mm

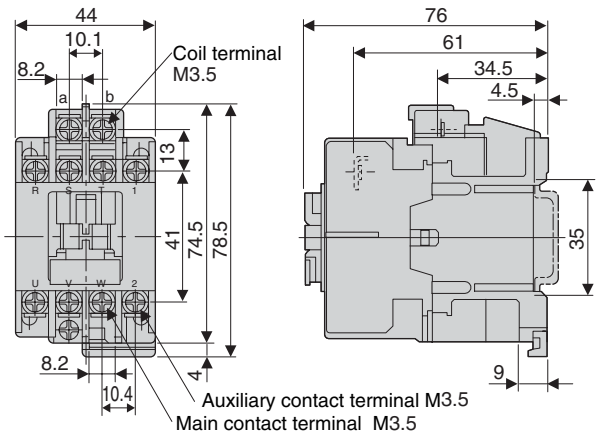
■Magnetic Contactor

Model	Specifications	Manufacturer	Contact
HI-11J	20 A	Yaskawa Controls Co., Ltd.	Yaskawa Local Office
HI-15J	35 A		

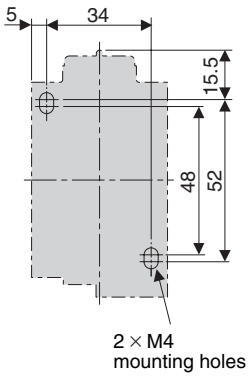


●HI-11J

Dimensions



Mounting Hole Dimensions

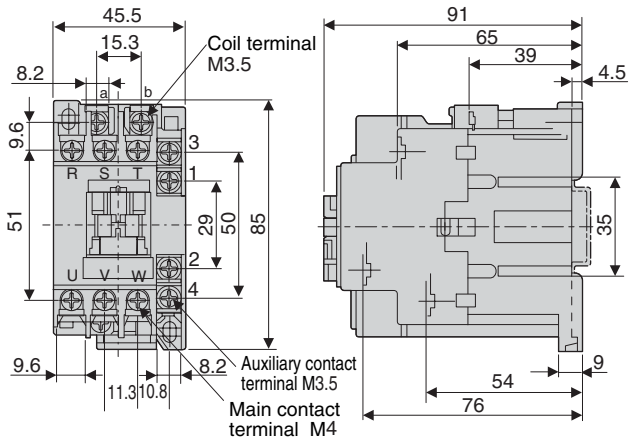


Terminal Symbols

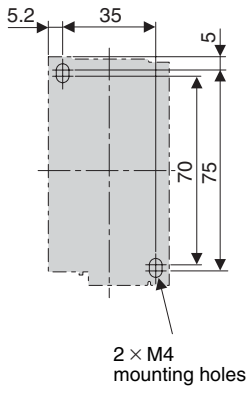
Auxiliary Contact	Structure
NO	NO A1 — A2 NC R 1 S 3 T 5 1 13 U 2 V 4 W 6 2 14
NC	NO A1 — A2 NC R 1 S 3 T 5 1 11 U 2 V 4 W 6 2 12

●HI-15J

Dimensions



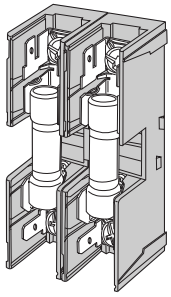
Mounting Hole Dimensions



Terminal Symbols

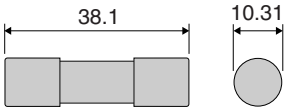
Auxiliary Contact	Structure
NONC	NO A1 — A2 NC R 1 S 3 T 5 1 21 3 13 U 2 V 4 W 6 2 22 4 14

■External Fuse



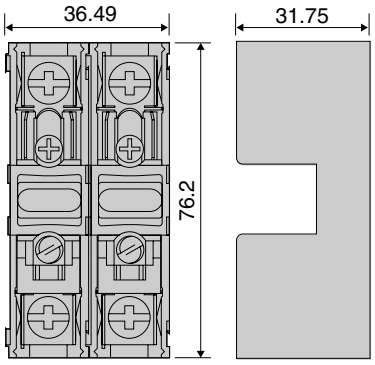
●Fuse

Model	Rated Current	Rated Voltage	Fusing Time	Applicable SERVOPACKs	Manufacturer	Contact
0KLK015.T	15 Arms	600 V	Within 2 s at 200%	SJDE-01 to 04	Littelfuse Inc.	Yaskawa Local Office
0KLK030.T	30 Arms			SJDE-08		



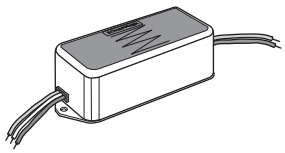
●Fuse Block

Model	Type	Manufacturer	Contact
L60030M2SQ	Screw terminal, 2 poles	Littelfuse Inc.	Yaskawa Local Office
L60030M2C	Copper box lug, 2 poles		



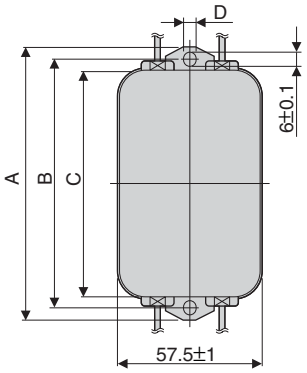
■Noise Filter

Model	Specifications	Manufacturer	Contact
FN2070-6/07	Single-phase 250 VAC, 6 A	Shaffner EMC, Inc.	Yaskawa Local Office
FN2070-10/07	Single-phase 250 VAC, 10 A		
FN2070-16/07	Single-phase 250 VAC, 16 A		

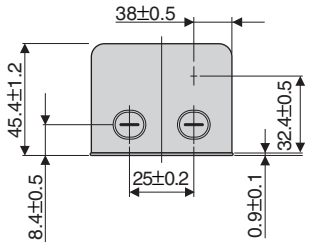


●FN2070-6/07, FN2070-10/07

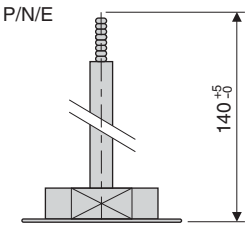
Top view



Side view



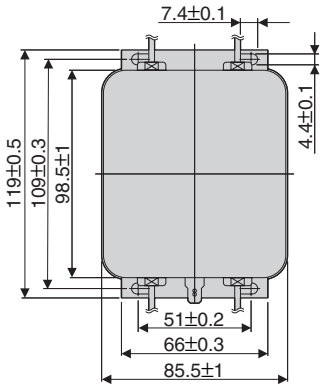
Contact terminal



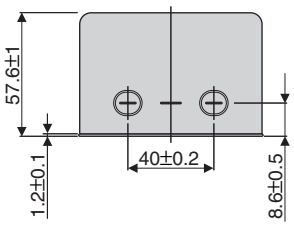
Model	A	B	C	D
FN2070-6/07	113.5±1	103±0.3	94±1	4.4±0.1
FN2070-10/07	156±1	143±0.3	130.5±1	5.3±0.1

●FN2070-16/07

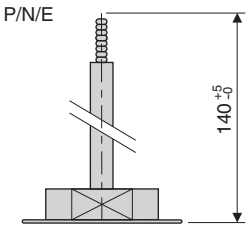
Top view



Side view

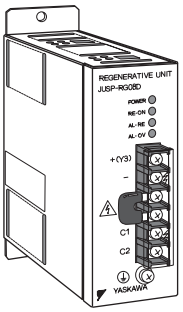


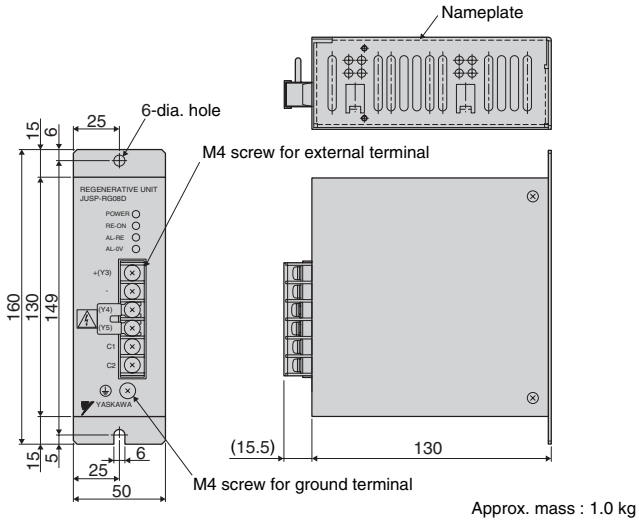
Contact terminal



■Regenerative Unit

Model	JUSP-RG08D	Manufacturer	Contact
Resistance	50 Ω	Yaskawa Electric Corporation	Yaskawa Local Office
Allowable regenerative energy	12 W		
Regenerative voltage	380 VDC		
Regenerative current	8 ADC		
Error detection	Disconnection of regenerative resistance, failure of regenerative transistor, or overvoltage		
Alarm output	NC contact (Opens when an error is detected.) Contact specifications: 250 VAC, 1.5 A (inductive load)		

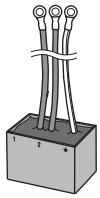




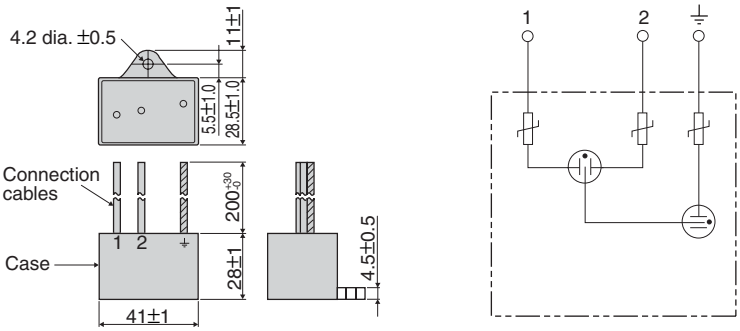
Approx. mass : 1.0 kg

■Surge Absorber (For lightning surge protection)

Model	Specifications	Manufacturer	Contact
R·C·M-601BQZ-4	Single-phase 250 VAC	Okaya Electric Industries Co., Ltd.	Yaskawa Local Office



<Internal Connection Diagram>

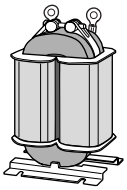


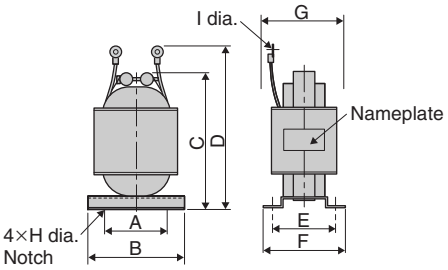
Peripheral Device Dimensions

Units: mm

■AC Reactor

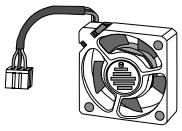
Model	Inductance (mH)	Rated Current (A)	Contact
X5052	45.0	1.0	Yaskawa Local Office
X5053	20.0	2.0	
X5054	5.0	3.0	
X5056	2.0	5.0	





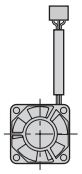
Model	Dimensions mm									Approx. Mass
	A	B	C	D	E	F	G	H	I	kg
X5052	35	52	80	95	30	40	45	4	4.3	0.4
X5053	35	52	90	105	35	45	50	4	4.3	0.6
X5054	35	52	80	95	30	40	45	4	4.5	0.4
X5056	35	52	80	95	30	40	45	4	4.3	0.4

■Replacement Cooling Fan

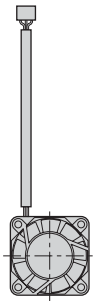


Model	Applicable SERVOPACKs	Contact
JZSP-CHF08-1	SJDE-01 to 04	Yaskawa Local Office
JZSP-CHF08-2	SJDE-08	

●JZSP-CHF08-1



●JZSP-CHF08-2



Service Life

Servodrive parts are subject to deterioration caused by mechanical wear and aging.

- The following values for the service life are only for reference. The service life varies with environmental conditions and applications. Refer to the values for the service life in the tables and contact your Yaskawa representative to determine whether part replacement is required. If a problem occurs before the estimated service life expires, an inspection is necessary.

●SERVOPACKs

Part	Service Life	Remarks
Cooling fan	30,000 hours	The service life varies with the operating conditions. Check for abnormal sounds or vibration with daily inspection.

Note : The following cooling fans are available for replacement. Contact your Yaskawa representative when ordering.
- SJDE-01 to 04 : JZSP-CHF08-1
- SJDE-08 : JZSP-CHF08-2

●Servomotors

Part	Service Life	Remarks
Bearings	20,000 hours	The service life varies with the operating conditions. Check for abnormal sounds or vibration with daily inspection.

Selection of Servomotor Size

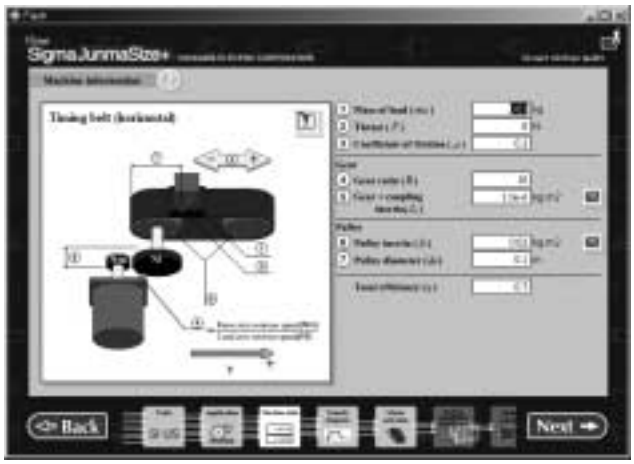
■AC Servomotor Selection Program: SigmaJunmaSize+

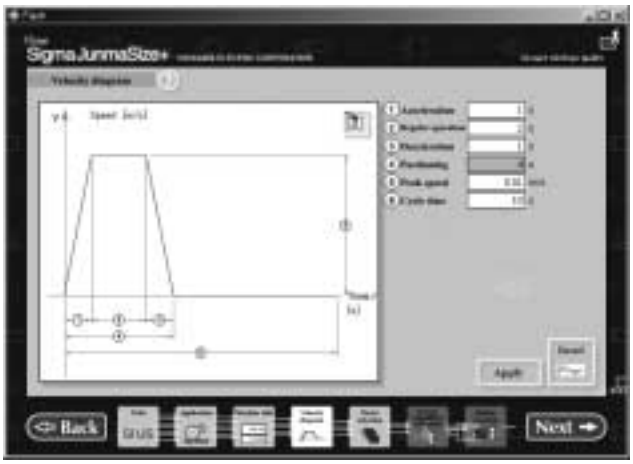
SigmaJunmaSize+ is the software that can help you select the optimal servo drive for your system.

●Features

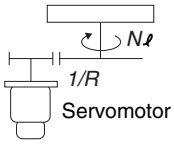
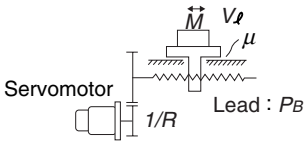
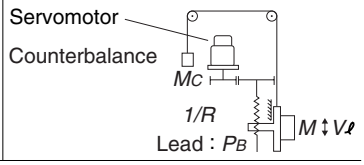
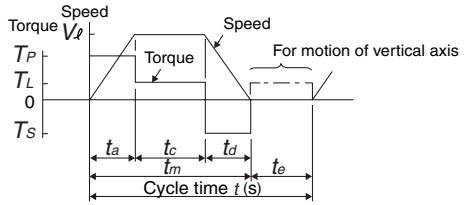
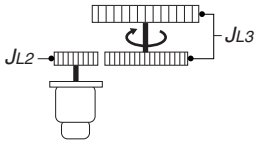
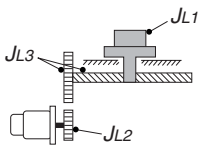
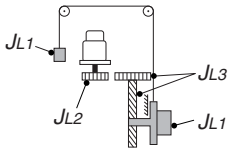
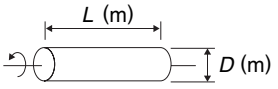
- Obtain product updates.
- Select the optimal servomotor with the help of an interactive wizard.
- Refer to and reuse stored data.

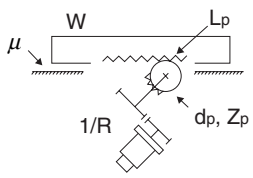
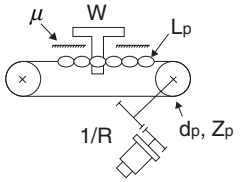
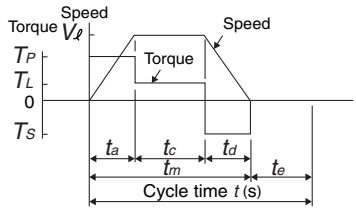
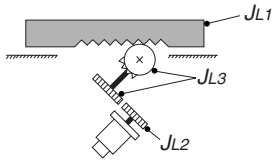
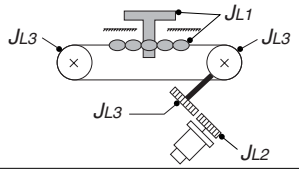
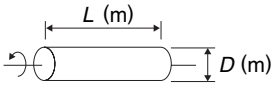
●Servomotor Selection Screen





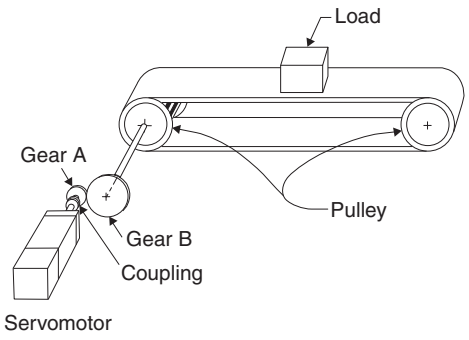
■Formulas for Selecting Servomotor Capacity

Motions	Rotational Motion	Linear Motion	
		Horizontal Axis	Vertical Axis
Mechanical Configuration			
	N_ℓ : Load axis speed (min^{-1}) V_ℓ : Load speed (m/min) T_ℓ : Load torque (N·m) μ : Friction coefficient	P_B : Ball screw lead (m) M : Mass of linear-motion section (kg) M_C : Mass of counterbalance (kg)	$1/R$: Gear ratio η : Mechanical efficiency T_{PM} : Servomotor maximum torque (N·m)
Speed Diagram			
Travel Distance (m)	$S=\frac{V_\ell}{60}\cdot\frac{t_a+2t_c+t_d}{2}$ $\left(\text{Where } t_a=t_d,\ S=\frac{V_\ell}{60}(t_m-t_a)\right)$		
Load axis speed (min^{-1})	N_ℓ	$N_\ell=\frac{V_\ell}{P_B}$	$N_\ell=\frac{V_\ell}{P_B}$
Motor Speed (min^{-1})	$N_M=N_\ell\cdot R$		
Load Torque at Motor Shaft (N·m)	$T_L=\frac{T_\ell}{R\cdot\eta}$	$T_L=\frac{9.8\times\mu\cdot M\cdot P_B}{2\pi\cdot R\cdot\eta}$	$T_L=\frac{9.8\times(M-M_C)P_B}{2\pi\cdot R\cdot\eta}$
Load Moment of Inertia at Motor Shaft (kg·m^2)	$J_L=J_{L1}+J_{L2}+J_{L3}$		
			
Linear Motion	—	$J_{L1}=M\cdot\left(\frac{P_B}{2\pi R}\right)^2$	$J_{L1}=(M+M_C)\cdot\left(\frac{P_B}{2\pi R}\right)^2$
Rotational Motion	·Solid cylinder  <Moment of inertia for motor shaft> At gear input side $J_{L2}=J_K$ At gear output side $J_{L3}=\frac{J_K}{R^2}$	$J_K=\frac{1}{8}M_K\cdot D^2$ or $J_K=\frac{\pi}{32}\rho\cdot L\cdot D^4$ M_K : Mass (kg) ρ : Density (kg/m^3)…Iron $\rho=7.87\times10^3$ (kg/m^3) …Aluminum $\rho=2.70\times10^3$ (kg/m^3)	
Running Power (W)	$P_0=\frac{2\pi\cdot N_M\cdot T_L}{60}$		
Acceleration Power (W)	$P_a=\left(\frac{2\pi}{60}\cdot N_M\right)^2\frac{J_L}{t_a}$		
Required Starting Torque (N·m)	$T_P=\frac{2\pi\cdot N_M(J_M+J_L)}{60\times t_a}+T_L$		
Required Braking Torque (N·m)	$T_S=\frac{2\pi\cdot N_M(J_M+J_L)}{60\times t_d}-T_L$		
Effective Torque (N·m)	$T_{rms}=\sqrt{\frac{T_P^2\cdot t_a+T_L^2\cdot t_c+T_S^2\cdot t_d}{t}}$		$T_{rms}=\sqrt{\frac{T_P^2\cdot t_a+T_L^2(t_c+t_e)+T_S^2\cdot t_d}{t}}$
Min. Starting Time (s)	$t_{am}=\frac{2\pi\cdot N_M(J_M+J_L)}{60(T_{PM}-T_L)}$		
Min. Braking Time (s)	$t_{dm}=\frac{2\pi\cdot N_M(J_M+J_L)}{60(T_{PM}+T_L)}$		

Motions	Linear Motion	
	Rack & Pinion	Chain and Timing Belt
Mechanical Configuration		
	N_ℓ: Load axis speed (min^{-1}) V_ℓ: Load speed (m/min) T_ℓ: Load torque (N·m) μ : Friction coefficient	M : Mass of linear-motion section (kg) $1/R$: Gear ratio η : Mechanical efficiency T_{PM}: Servomotor maximum torque (N·m)	d_p : Pitch diameter (m) Z_p : Number of gear L_p : Pitch (m) $P_B = Z_p \cdot L_p$ or $\pi \cdot d_p$
Speed Diagram		
Travel Distance (m)	$S = \frac{V_\ell}{60} \cdot \frac{t_a + 2t_c + t_d}{2}$ $\left(\text{Where } t_a = t_d, \quad S = \frac{V_\ell}{60}(t_m - t_a) \right)$	
Load axis speed (min^{-1})	$N_\ell = \frac{V_\ell}{P_B}$	
Motor Speed (min^{-1})	$N_M = N_\ell \cdot R$	
Load Moment of Torque at Motor Shaft (N·m)	$T_L = \frac{9.8 \times \mu \cdot M \cdot P_B + 2\pi \cdot T_\ell}{2\pi \cdot R \cdot \eta}$	
Load Moment of Inertia at Motor Shaft (kg·m^2)	$J_L = J_{L1} + J_{L2} + J_{L3}$	
		
Linear Motion	$J_{L1} = M \cdot \left(\frac{P_B}{2\pi R} \right)^2$	
Rotational Motion	·Solid cylinder  <Moment of inertia for motor shaft> At gear input side $J_{L2} = J_K$ At gear output side $J_{L3} = \frac{J_K}{R^2}$	$J_K = \frac{1}{8} M_K \cdot D^2$ or $J_K = \frac{\pi}{32} \rho \cdot L \cdot D^4$ M_K: Mass (kg) ρ : Density (kg/m^3)…Iron $\rho = 7.87 \times 10^3$ (kg/m^3) …Aluminum $\rho = 2.70 \times 10^3$ (kg/m^3)	
Running Power (W)	$P_0 = \frac{2\pi \cdot N_M \cdot T_L}{60}$	
Acceleration Power (W)	$P_a = \left(\frac{2\pi}{60} \cdot N_M \right)^2 \frac{J_L}{t_a}$	
Required Starting Torque (N·m)	$T_P = \frac{2\pi \cdot N_M (J_M + J_L)}{60 \times t_a} + T_L$	
Required Braking Torque (N·m)	$T_S = \frac{2\pi \cdot N_M (J_M + J_L)}{60 \times t_d} - T_L$	
Effective Torque(N·m)	$T_{rms} = \sqrt{\frac{T_P^2 \cdot t_a + T_L^2 \cdot t_c + T_S^2 \cdot t_d}{t}}$	
Min. Starting Time (s)	$t_{am} = \frac{2\pi \cdot N_M (J_M + J_L)}{60(T_{PM} - T_L)}$	
Min. Braking Time (s)	$t_{dm} = \frac{2\pi \cdot N_M (J_M + J_L)}{60(T_{PM} + T_L)}$	

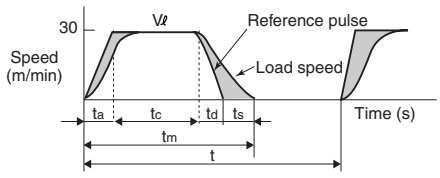
■Servomotor Selection Example 1

Mechanical Specifications



- Load speed: $V\ell$ = 30 m/min
- Mass of linear-motion section: M = 4 kg
- Pulley diameter: D_P = 0.064 m
- Pulley thickness: L_P = 0.02 m
- Pulley density: ρ_P = 2690 kg/m^3
- Coupling mass: M_C = 0.3 kg
- Coupling outer diameter: D_C = 0.03 m
- Gear A outer diameter: D_A = 0.02 m
- Gear A thickness: L_A = 0.02 m
- Gear B outer diameter: D_B = 0.1 m
- Gear B thickness: L_B = 0.02 m
- Gear density: ρ_A, ρ_B = 7870 kg/m^3
- Gear ratio: R = 5
- Positioning frequency: n = 40 times/min
- Traveling distance: ℓ = 0.5 m
- Positioning time: t_m = 1.2 s max.
- Friction coefficient: μ = 0.2
- Load torque: $T\ell$ = 0.05 N·m
- Mechanical efficiency: η = 0.9 (90%)

●Speed Diagram



Cycle time $t = \frac{60}{n} = \frac{60}{40} = 1.5$ (s)

Where acceleration time (t_a) = deceleration time (t_d) and settling time (t_s) = 0.1 s when the filter setting of the FIL rotary switch is 0.

Acceleration time : $t_a = t_d = t_m - t_s - \frac{60\times\ell}{V\ell} = 1.2 - 0.1 - \frac{60\times0.5}{30} = 0.1$ (s)

Constant-speed time : $t_c = t_m - t_s - t_a - t_d = 1.2 - 0.1 - 0.1 - 0.1 = 0.9$ (s)

●Speed

$P_B = \pi d = \pi \times 0.064 = 0.201$

- Load axis speed $N\ell = \frac{V\ell}{P_B} = \frac{30}{0.201} = 149$ (min^{-1})
- Motor speed $N_M = N\ell \cdot R = 149\times5 = 745$ (min^{-1})

●Load Torque at Motor Shaft

$$T_L = \frac{\mu \cdot 9.8 \cdot M \cdot P_B + 2\pi \cdot T\ell}{2\pi R \cdot \eta} = \frac{0.2\times9.8\times4\times0.201 + 2\pi\times0.05}{2\pi\times5\times0.9} = 0.0669 \text{ (N·m)}$$

●Load Moment of Inertia

- Linear-motion section

$$J_{L1} = M\left(\frac{P_B}{2\pi R}\right)^2 = 4\times\left(\frac{0.201}{2\pi\times5}\right)^2 = 1.639\times10^{-4} \text{ (kg·m}^2\text{)}$$

- Load-shaft motion section : Pulley×2 + Gear B

$$J_{L2} = \frac{\Sigma J_i}{R^2} = \frac{1}{5^2}\times\frac{\pi}{32}\times(2690\times0.02\times(0.064)^4\times2 + 7870\times0.02\times(0.1)^4) = 0.687\times10^{-4} \text{ (kg·m}^2\text{)}$$

- Motor-shaft motion section : Gear A + Coupling

$$J_{L3} = \frac{\pi}{32}\times7870\times0.02\times(0.02)^4 + \frac{1}{8}\times0.3\times(0.03)^2 = 0.362\times10^{-4} \text{ (kg·m}^2\text{)}$$

- Load moment of inertia at motor shaft

$$J_L = J_{L1} + J_{L2} + J_{L3} = (1.639 + 0.687 + 0.362)\times10^{-4} = 2.69\times10^{-4} \text{ (kg·m}^2\text{)}$$

●Load Running Power

$$P_o = \frac{2\pi N_M \cdot T_L}{60} = \frac{2\pi \times 745 \times 0.0669}{60} = 5.2(\text{W})$$

●Load Acceleration Power

$$P_a = \left(\frac{2\pi}{60} N_M\right)^2 \frac{J_L}{t_a} = \left(\frac{2\pi}{60} \times 745\right)^2 \times \frac{2.69 \times 10^{-4}}{0.1} = 16.4(\text{W})$$

●Provisional Selection

Selection criteria
- $T_L \leqq$ Motor rated torque
- $P_a + P_o$ =(1 to 2)×Motor rated output
- $N_M \leqq$ Motor rated speed or maximum speed
- $J_L \leqq$ Allowable load moment of inertia of SERVOPACK

The following combination of SERVOPACK and servomotor satisfies the selection criteria.
- Servomotor : SJME-02AMB41
- SERVOPACK : SJDE-02APA

<Ratings>

• Rated output:	200 (W)
• Rated speed:	3000 (min^{-1})
• Maximum speed:	4500 (min^{-1})
• Rated torque:	0.637 (N·m)
• Instantaneous peak torque:	1.91 (N·m)
• Rotor moment of inertia:	0.330×10^{-4} ($\text{kg} \cdot \text{m}^2$)
• Allowable load moment of inertia of SERVOPACK:	3×10^{-4} ($\text{kg} \cdot \text{m}^2$)

●Final Selection

Required Starting Torque

$$T_P = \frac{2\pi N_M (J_M + J_L)}{60 t_a} + T_L = \frac{2\pi \times 745 \times (0.330 + 2.69) \times 10^{-4}}{60 \times 0.1} + 0.0669 = 0.303 \text{ (N·m)}$$

< 1.91(N·m) = Instantaneous peak torque
Therefore, the provisionally selected servomotor can be used.

Required Braking Torque

$$T_S = \frac{2\pi N_M (J_M + J_L)}{60 t_a} - T_L = \frac{2\pi \times 745 \times (0.330 + 2.69) \times 10^{-4}}{60 \times 0.1} - 0.0669 = 0.169 \text{ (N·m)}$$

< 1.91(N·m) = Instantaneous peak torque
Therefore, the provisionally selected servomotor can be used.

Effective Torque

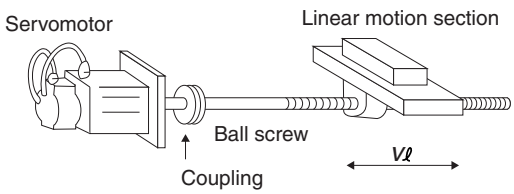
$$T_{rms} = \sqrt{\frac{T_P^2 \cdot t_a + T_L^2 \cdot t_c + T_S^2 \cdot t_d}{t}} = \sqrt{\frac{(0.303)^2 \times 0.1 + (0.0669)^2 \times 0.9 + (0.169)^2 \times 0.1}{1.5}}$$

= 0.103 (N·m)
< 0.637 (N·m) = Rated torque
Therefore, the provisionally selected servomotor can be used.

The provisional selection of SERVOPACK and servomotor has been confirmed to have sufficient capacity to satisfy the selection criteria.

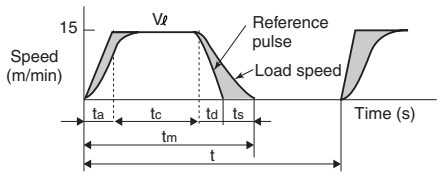
■Servomotor Selection Example 2

Mechanical Specifications



- Load speed: $V\ell$ = 15 m/min
- Mass of linear-motion section: M = 80 kg
- Ball screw length: L_B = 0.8 m
- Ball screw diameter: D_B = 0.016 m
- Ball screw lead: P_B = 0.005 m
- Ball screw density: ρ = 7.87×10³ kg/m³
- Coupling mass: M_C = 0.3 kg
- Coupling outer diameter: D_C = 0.03 m
- Positioning frequency: n = 40 times/min
- Traveling distance: ℓ = 0.25 m
- Positioning time: t_m = 1.2 s max.
- Electrical stopping accuracy: η = ±0.01 mm
- Friction coefficient: δ = 0.2
- Mechanical efficiency: μ = 0.9 (90%)

●Speed Diagram



Cycle time $t = \frac{60}{n} = \frac{60}{40} = 1.5$ (s)

Where acceleration time (t_a) = deceleration time (t_d) and settling time (t_s) = 0.1 s when the filter setting of the FIL rotary switch is 0.

Acceleration time : $t_a = t_d = t_m - t_s - \frac{60\times\ell}{V\ell} = 1.2 - 0.1 - \frac{60\times0.5}{30} = 0.1$ (s)

Constant-speed time : $t_c = t_m - t_s - t_a - t_d = 1.2 - 0.1 - 0.1 - 0.1 = 0.9$ (s)

●Speed

- Load axis speed $N\ell = \frac{V\ell}{P_B} = \frac{15}{0.005} = 3000$ (min^{-1})
- Motor speed The gear ratio is 1/R = 1/1 because of direct coupling.
  Then, $N_M = N\ell \cdot R = 3000\times1 = 3000$ (min^{-1})

●Load Torque at Motor Shaft

$$T_L = \frac{\mu\cdot 9.8\cdot M\cdot P_B}{2\pi R\cdot\eta} = \frac{0.2\times9.8\times80\times0.005}{2\pi\times1\times0.9} = 0.139\ (N\cdot m)$$

●Load Moment of Inertia

- Linear-motion section $J_{L1} = M\left(\frac{P_B}{2\pi R}\right)^2 = 80\times\left(\frac{0.005}{2\pi\times1}\right)^2 = 0.507\times10^{-4}$ (kg·m²)
- Ball screw $J_B = \frac{\pi}{32}\rho\cdot L_B\cdot D_B{}^4 = \frac{\pi}{32}\times7.87\times10^3\times0.8\times(0.016)^4 = 0.405\times10^{-4}$ (kg·m²)
- Coupling $J_C = \frac{1}{8}M_C\cdot D_C{}^2 = \frac{1}{8}\times0.3\times(0.03)^2 = 0.338\times10^{-4}$ (kg·m²)
- Load moment of inertia at motor shaft

$$J_L = J_{L1} + J_B + J_C = 1.25\times10^{-4}\ (kg\cdot m^2)$$

●Load Running Power

$$P_o = \frac{2\pi N_M\cdot T_L}{60} = \frac{2\pi\times3000\times0.139}{60} = 43.7(W)$$

●Load Acceleration Power

$$P_a = \left(\frac{2\pi}{60} N_M\right)^2 \frac{J_L}{t_a} = \left(\frac{2\pi}{60} \times 3000\right)^2 \times \frac{1.25 \times 10^{-4}}{0.1} = 123.4 \text{ (W)}$$

●Provisional Selection

Selection criteria
- $T_L \leqq$ Motor rated torque
- $P_a + P_o$ =(1 to 2)×Motor rated output
- $N_M \leqq$ Motor rated speed or maximum speed
- $J_L \leqq$ Allowable load moment of inertia of SERVOPACK

The following combination of SERVOPACK and servomotor satisfies the selection criteria.
- Servomotor : SJME-02AMB41
- SERVOPACK : SJDE-02APA

<Ratings>

- Rated output: 200 (W)
- Rated speed: 3000 (min^{-1})
- Maximum speed: 4500 (min^{-1})
- Rated torque: 0.637 (N·m)
- Instantaneous peak torque: 1.91 (N·m)
- Rotor moment of inertia: 0.330×10^{-4} ($kg \cdot m^2$)
- Allowable load moment of inertia of SERVOPACK: 3×10^{-4} ($kg \cdot m^2$)

●Final Selection

Required Starting Torque

$$T_P = \frac{2\pi N_M (J_M + J_L)}{60 t_a} + T_L = \frac{2\pi \times 3000 \times (0.330 + 1.25) \times 10^{-4}}{60 \times 0.1} + 0.139 \fallingdotseq 0.635 \text{ (N·m)}$$

< 1.91 (N·m)=Instantaneous peak torque
Therefore, the provisionally selected servomotor can be used.

Required Braking Torque

$$T_S = \frac{2\pi N_M (J_M + J_L)}{60 t_a} - T_L = \frac{2\pi \times 3000 \times (0.330 + 1.25) \times 10^{-4}}{60 \times 0.1} - 0.139 \fallingdotseq 0.357 \text{ (N·m)}$$

< 1.91 (N·m)= Instantaneous peak torque
Therefore, the provisionally selected servomotor can be used.

Effective Torque

$$T_{rms} = \sqrt{\frac{T_P{}^2 \cdot t_a + T_L{}^2 \cdot t_c + T_S{}^2 \cdot t_d}{t}} = \sqrt{\frac{(0.635)^2 \times 0.1 + (0.139)^2 \times 0.9 + (0.357)^2 \times 0.1}{1.5}}$$

$\fallingdotseq$ 0.217 (N·m)
< 0.637 (N·m)= Rated torque
Therefore, the provisionally selected servomotor can be used.

The provisional selection of SERVOPACK and servomotor has been confirmed to have sufficient capacity to satisfy the selection criteria.

Terminology

■SERVOPACKs

●Servo OFF

The state in which power is not supplied to the motor.

●Servo ON

The state in which power is supplied to the motor.

●H level

The digital signal is at high level (5 V for TTL levels).

●L level

The digital signal is at low level (0 V for TTL levels).

●Rising edge

The portion in a waveform where an electric signal shifts from a low level to a high level.

●Positioning settling time

The SERVOPACK drives the motor by inputting a pulse train for position reference. The positioning settling time is the time from the completion of the pulse train input to the completion of positioning.

●Overload

The state in which the torque integrated for a certain period exceeds a preset allowable value.

●Momentary power interruption

The state where the supply of voltage to the SERVOPACK turns off momentarily.

●Open collector

A transistor output whose collector is not connected to a specific voltage line. The output signal is applied to connect a specific voltage line through a load or a pull-up resistor.

●Line driver

An IC with a relatively long-distance signal transmission, or the circuit using such an IC.

●Power hold time

The maximum time that the voltage of the power supply can be maintained without generating any alarms during a momentary interruption of power.

●Noise countermeasures

A method to prevent or suppress noise that may disturb the signal lines resulting in malfunctions. Countermeasures should be taken so that noise is not radiated from the SERVOPACK and so that the SERVOPACK is not adversely influenced by external noise.

●Frame ground

A ground to the chassis of the equipment (abbreviation: FG). A frame ground is also called the “earth.” The frame ground is connected to a ground wire or the cable shield wire.

●Signal ground

The electrical potential reference for operating an electrical circuit (abbreviation: SG).

■Servomotors

●Forward rotation and reverse rotation

With Yaskawa's AC servomotors, forward rotation is the CCW direction and reverse rotation is the CW direction as seen from the load side of the motor.

●Motor with holding brake

The holding brake is used while the motor is not rotating. Do not use the brake to stop the motor during operation. The servo must be in the Servo OFF state while the brake is being applied.

●Alignment accuracy

The mechanical precision between the two shafts of the rotating machines coupled together. Centering precision usually refers to the difference in position between the axes of the motor shaft and the load shaft.

●Allowable thrust load

The maximum allowable load applied parallel to the axis of the motor shaft.

●Allowable radial load

The maximum allowable load applied vertically to the axis of the motor shaft.

■Peripheral Devices

●Ground fault interrupter

A device that automatically shuts off the circuit when the low-voltage line has a ground fault.

●Magnetic contactor

A magnetic switch that turns power on and off.

●Surge protector

A device that absorbs external voltages, such as lightning surges, to prevent the malfunctioning and destruction of peripheral electronic circuits.

●Noise filter

A device installed to block noise from power lines.

●Servomotor size selection software

Software used to select servomotors and SERVOPACKs.

Product name: SigmaJunmaSize+

●Coupling

A joint that connects the motor shaft and load shaft. The coupling can absorb a certain level of deviation in alignment between the motor shaft and the load shaft. Couplings are available in metal plate-spring types, Oldham types, and bellows types. Metal plate-spring couplings are recommended for the optimum performance of the servomotor and have good durability.

FAQs

Q. What are the features of a servomotor?

A. Compared with a stepping motor, a servomotor can output constant torque in low- to high-speed ranges. Unlike a stepping motor, which causes problems with vibration, noise, heat generation, and loss of control (out of synchronization), a servomotor ensures smooth rotation.

Q. What features does the JUNMA servodrive have compared with other servodrives?

A. Conventional servodrives require settings for a variety of functions, including servo gain settings. The JUNMA servodrive works with minimal adjustments of two rotary switches instead of parameters. Therefore, high-performance control is ensured with the same ease as a stepping motor.

Q. What machines can the JUNMA be used for?

A. The JUNMA can be used for almost all machines, including with timing belts and ball screws. The JUNMA cannot be used if the alignment accuracy exceeds the recommended accuracy specified *in Coupling to the Machine* (page 23).

Q. What is "Servo ON"?

A. The power is applied to the servomotor by turning ON the /S-ON I/O signal. When power is applied to the motor, the position of the motor shaft will be locked unless a reference is input. In the servo ON state, the servomotor is in a servo-locked state and will not move even if external force is applied.

Q. The red indicator on the front panel of the SERVOPACK was lit and the servomotor stopped operating. What should be done?

A. The alarm has been turned on. The meaning of alarms and corrections vary in accordance with the LED display and the number of lights that are on. For details, refer to *Alarm* (page 13).

Q. Why does the REF (green indicator) blink while the motor is in operation?

A. The REF blinks to indicate that a reference pulse is being input (i.e., the motor is rotating).Do not touch the machine or motor shaft while the REF is blinking, no matter how slowly the motor is turning. For details, refer to *Part Names and Functions* (page 12).

Q. When is the FIL rotary switch for the reference filter setting used?

A. The FIL switch is used to smooth the reference input to the SERVOPACK. The initial value (0) may be used in most cases. If the machine vibrates, increase the value. The higher the value is, the smoother the motion becomes but the longer the position settling time will be. Settings up to 7 are available.

Q. The servomotor generates noise after the servomotor is turned on or after the value of the FIL rotary switch for reference filter setting is changed. What should be done?

A. The JUNMA starts vibration detection when the servo is turned on, and tuning is done automatically if needed. When first the SERVOPACK is turned on and vibration is detected, tuning is done only once by the JUNMA. Some noise may be generated at that time. Once the tuning is made, the adjusted value will be used until the setting of the FIL rotary switch for reference filter is changed. Therefore, no further noise will be generated.

Q. The machine vibrates. What should be done?

A. Users are not required to do any special tuning for machine vibration, because the JUNMA detects the vibration and performs automatic tuning. If any unusual noise occurs while the machine is running, the detected vibration may be different from the actual vibration. Increase the Reference Filter Setting (FIL) by one, and then return to the previous setting. JUNMA will now be able to do automatic tuning again.

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YASKAWA ELECTRIC CORPORATION

YASKAWA

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Specifications are subject to change without notice
for ongoing product modifications and improvements.

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