HNC Electric

Installation and Wiring for SV-E3 Series Servo Drive

User's Manual

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Thank you for purchasing this product.

This manual mainly describes the safety use, installation and wiring for SV-E3 series servo drive.

For more details, please refer to <SV-E3 Series Servo Drive Instruction Manual>.

Confirm the following items when unpacking:

Number	Name		Quantity
1	Servo drive		1
2	Accessories	Connecting terminal	3
		Cold-pressed	7
		Crowbar	1
3	Installation and Wiring for SV-E3 Series Servo Drive User's Manual		1
4	Certificate of Approval		1

◎ Check if there are some damage to the products during transportation.

◎ Any questions, please contact the HNC Corporation.

Safety precautions

Please pay attention to the flowing safety precautions anywhere and anytime during acceptance inspection, installation, wiring, operation and maintenance.

■ terminal

DANGER — Indicates that incorrect handling may result in death or severe injury.

CAUTION — Indicates that incorrect handling may result in medium or slight personal injury or physical damage.

Indicates "Prohibitions"(Indicates what must not be done.)

Indicates "Forced".(Indicates what must be done.)

⚠ DANGER

Installing and wiring		
⊘	Do not connect the motor to the commercial power.	To prevent fire or malfunction.
	Do not place the combustibles around the servo motor and drive.	To prevent fire
!	Be sure to protect the drives through the case, and leave specified clearances between the case or other equipment and the drive.	To prevent electric shock, fire or malfunction.
	Install it at the place free from excessive dust and dirt, water and oil mist	To prevent electric shock, fire , malfunction or damage.
	Install the equipment to incombustibles, such as metal.	To prevent fire.
	Any person who is involved in wiring and inspection should be fully competent to do the work.	To prevent electric shock.
	FG terminal of motor and drive must be grounded.	To prevent electric shock.
	Perform the wiring correctly after cut off the breaker.	To prevent electric shock, injury, malfunction or damage
	Have the insulation processing when connecting cables.	To prevent electric shock, fire or malfunction.
Operation and running		
⊘	During operation, never touch the internal parts of the drive.	To prevent burns or electric shock.
	The cables should not be damaged, stressed loaded, or pinched.	To prevent electric shock malfunction or damage.
	During operation, never touch the rotating parts of the servo motor.	To prevent injury.
	Do not install the equipment under the conditions with water, corrosive and flammable gas.	To prevent fire.
	Do not use it at the location with great vibration and shock.	To prevent electric shock, injury or fire.
	Do not use the servo motor with its cable soaked in oil or water.	To prevent electric shock, malfunction or damage
	Operate the switches and wiring with dry hand.	To prevent electric shock, injury or fire.
	Do not touch the keyway directly when using the motor with shaft-end keyway.	To prevent injury.
	Do not touch the motor and drive heat sink, as they are very hot.	To prevent burns or parts damaged.
	Do not drive the motor by external drive.	To prevent fire.

Other safety instructions		
!	Confirm the equipment's safety after the earthquake happens.	To prevent electric shock, injury or fire.
	Installing and setting correctly to prevent the fire and personal injury when earthquake happens.	To prevent injury, electric shock, fire, malfunction or damage.
	Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.	To prevent injury, electric shock, fire, malfunction or damage.
!	Before wiring or inspection, turn off the power and wait for 5 minutes or more.	To prevent electric shock.

⚠ CAUTION

Installing and wiring		
!	Please follow the specified combination of the motor and drive.	To prevent fire or malfunction.
	Do not touch the terminals of connector directly.	To prevent electric shock or malfunction.
!	Do not block intake and prevent the foreign matters from entering into the motor and drive.	To prevent electric shock or fire.
	Fix the motor and have the test run away from the mechanical system. After confirming the operation,the motor can be securely mounted to mechanical system.	To prevent injury.
	The servo motor must be installed in the specified direction.	To prevent injury or malfunction.
	Install the equipment correctly in accordance with its weight and rated output.	To prevent injury or malfunction.
Operation and running		
⊘	Do not climb or stand on servo equipment. Do not put heavy objects on equipment.	To prevent fire or malfunction.
	The parameter settings must not be changed excessively. Operation will be instable.	To prevent injury.
	When power is restored after an instantaneous power failure, keep away from the machine because the machine may be restarted suddenly(design the machine so that it is secured against hazard if restarted).	To prevent injury.
	Keep it away from the direct sunlight.	To prevent malfunction.
	Do not put strong impact on the motor, drive and motor shaft.	To prevent malfunction.
	The electromagnetic brake on the servo motor is designed to hold the servo motor shaft and should not be used for ordinary braking.	To prevent injury or malfunction.
!	Do not install or operate a faulty servo motor or drive.	To prevent injury, electric shock or fire.
	Check the power specification.	To prevent fault.
	The electromagnetic brake may not hold the servo motor shaft. To ensure safety, install a stopper on the machine side.	To prevent injury.
	A sudden restart is made if an alarm is reset with the run signal on.	To prevent injury.
	Connect the relay for emergency stop and for brake in series.	To prevent injury or malfunction.
Transportation and storage		
⊘	Do not subject the equipment to the place with rain, waterdrop, poisonous gases or liquids.	To prevent malfunction.
	Do not carry the servo motor by the cables, shaft or encoder during transportation.	To prevent injury or malfunction.
	Do not drop or dump the motor during transportation and installation.	To prevent injury or malfunction.
!	Store the unit in a place in accordance with the instruction manual.	To prevent malfunction.
	If store it for a long time, Consult HNC.	To prevent malfunction.
Other safety instructions		
!	Please dispose the battery according to your local laws and regulations.	
	When disposing of the product, handle it as industrial waste.	
Maintenance and inspection		
⊘	Do not disassemble and/or repair the equipment on customer side.	To prevent malfunction.
	Do not turn on or switch off the main power frequently.	To prevent malfunction.
	Do not touch the servo drive heat sink, regenerative resistor, servo motor etc. Their temperatures may be high while power is on or for some time after power-off.	To prevent burns or electric shock.
!	When the drive become faulty, switch off the control circuit and main power.	To prevent fire.
	If the servo motor is to be stored for a long time, switch off the power.	To prevent misoperation

About maintenance and inspection

< Warranty period>

●The term of warranty for the product is 18 months from the date of manufacture. It's exceptional to brake motors as they are warranted when acceleration/deceleration times is not beyond the specified service life.

< Warranty coverage >

●This warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are stated in the instruction manual and user manual for the Product.

However, even during warranty period, the repair cost will be charged on customer in the following cases.

1)A failure caused by improper storing or handling, repair and modification.

2)A failure caused by the parts which have dropped down or damaged during transportation

3)A failure caused when the products have been used beyond the product specification

4)A failure caused by external factors such as inevitable accidents, including but not limited to fire, earthquake, lightning stroke, windstorm disaster, flood, salt damage, abnormal fluctuation of voltage and other natural disaster.

5)A failure caused by the intrusion of water, oil, metal and other foreign matters.

The warranty coverage is only for the product itself. We assume no responsibilities for any losses of opportunity and/or profit incurred by you due to a failure of the Product.

1. Product introduction and model selection

Model name identification

SV-E3 (Series name) | P (Pulse/Bus) | 005 (Rated power) | A (Voltage type) | 2 (Voltage) | -B (Version)

P (Pulse/Bus) Type	Pulse/Bus
P	Pulse
B	Bus

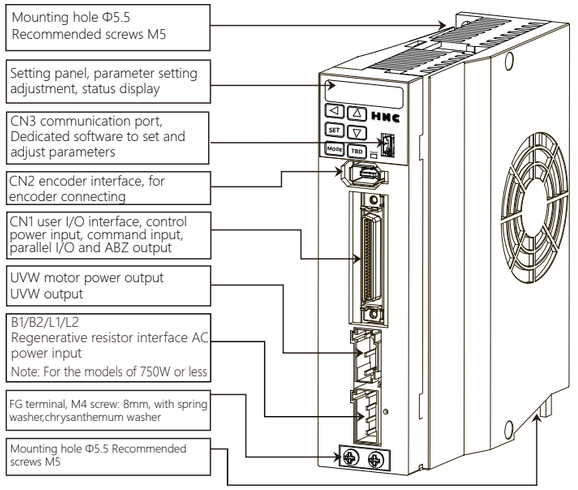
Rated power Type	Output
005	50W
010	100W
020	200W
040	400W
075	750W
100	1000W
150	1500W
200	2000W

Voltage type Type	voltage tyge
A	Alternat current
D	Direct current

Voltage Type	voltage
2	220V
3	380V
4	24V
8	80V

Version Type	Version
A	Standard
B	Classic

Drive parts name



Model selection of peripheral braking resistor

Rated output	50W	100W	200W	400W	750W	1kW	1.5kW	2kW
Resistance	40～50Ω	40～50Ω	40～50Ω	40～50Ω	40～50Ω	30Ω	30Ω	20Ω
Allowable power	20W	20W	20W	20W	20W	40W	40W	60W

2. Drive specification

Specification

Item			Specification							
Model Name SV-E3P□□□A			005	010	020	040	075	100	150	200
Common specification	Applicable motor		50W	100W	200W	400W	750W	1kW	1.5kW	2kW
	Overall dimensions	W(mm)	40			48		61		
		H(mm)	160			160		160		
		D(mm)	135			135		175		
	Weight (kg)		0.6			0.7		1.5		
	Input power	Main circuit power	Single-phase 200～240V±10% 50/60Hz					Three-phase 200～240V ±10% 50/60Hz		
		Control power	DC24V±10% 260mA(Typ.)/ Excluding inrush current					I/O power: DC24V±10% 100mA, The control power is supplied from drive		
	Control type		Three-phase PWM inverters sine-wave driven							
	Output specification	Rated current(Arms)	0.6	0.9	1.7	2.7	4.3	5.6	9.9	12.2
		Output frequency(Hz)	0～400			0～333		0～300	0～250	
	Encoder feedback		1 turn absolute type 17BIT (function for multi-turn absolute encoder after battery is added)							
	Control signal	Input	8 points (DC24V optocoupler isolation) are switched according to the control mode function							
		Output	8 points (DC24V optocoupler isolation, collector open output) are switched according to the control mode function							
	Analog signal	Input	1 point (±10V) is switched according to the control mode function							
	pulse signal	Input	Rs-422 differential, two sets of open collector							
		Output	A/B/Z phase RS-422 differential only z-phase collector open-circuit output							
	Communication		USB:PC Communication RS-485: Upper remote Control Communication (corresponding to multiple stations)							
	Regeneration		Externally regenerated resistance							
	Dynamic brake		Nothing							
	Control mode		Position control, internal position mode, speed control, internal speed mode, torque control							
Environmental specification	Temperature	Ambient temperature for use	0～55℃							
		Ambient temperature for storage	-20～65℃							
	Humidity	Ambient humidity for use	20～85%RH or less(Without condensation)							
		Ambient humidity for storage	20～85%RH or less(Without condensation)							
	Atmosphere for use& storage		Indoors(Not subject to direct sunlight); free from corrosive gas, flammable gas, oil mist, or dust							
	Altitude		1000m or less above sea							
	Vibration		5.8m/s2(0.6G) or less, 10～60Hz(No continuous operation allowed at frequency of resonance)							
Dielectric strength			1 minute at 1500 VAC across the primary and FG							
Points to note			・Grounding is mandatory. Class I relevant products							
			・"Over voltage category II" relevant products							
			・"Pollution degree2" relevant products							

3. Installation and size of servo motor and drive

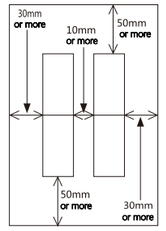
Installation environment conditions

About the environmental conditions, make sure to follow the company's instructions. If you need to use the product outside the scope of the environmental conditions, please consult HNC Corporation in advance.

① Keep it away from the direct sunlight.
② Drive must be installed in the cabinet.
③ Keep it away from the water, oil (cutting oil, oil mist) and moisture.
④ Do not install the equipment under the conditions with water, corrosive and flammable gas.
⑤ Free from the dust, iron powder, cutting powder and so on.
⑥ Keep it away from the area with high temperature, excessive vibration and shock.

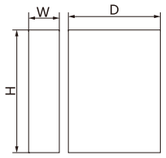
Installation direction and space

Leave sufficient space around the drive to ensure the heat dissipation and convection in the cabinet when installing the drive.



- Install the drives in the vertical direction. Please use two M5 screws to fix the drive of 750W or less respectively. Use three M5 screws to fix the drive and master drive of 1kW or more respectively.
- In order to ensure that surrounding temperature between internal boards is not more than 55℃, cooling fan or cooler is needed to reduce the temperature, when the drives are installed in the sealed cabinet.
- The temperature on the surface of cooling plate would be 30℃ higher than the surrounding temperature.
- Use heat-resistant material for the wiring and isolate wiring from the machine and other cables which are easily affected by the temperature.
- The service life of servo drive depends on the temperature around the electrolytic capacitor. When the electrolytic capacitor is close to the service life, the static capacity will decrease and internal resistance will increase. Consequently, it will lead to overvoltage alarm, malfunction caused by noise and components damage. The service life of electrolytic capacitor is approx. 5 to 6 years under the condition
  [average annual temperature 30℃, load rate 80% and operation of less than 20 hours a day on average]

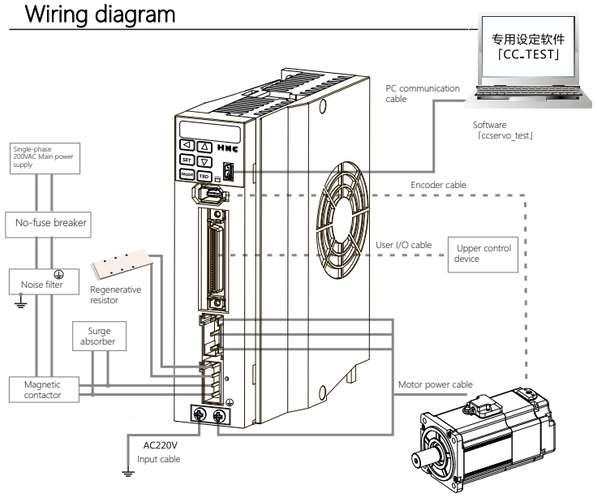
Drive dimension



Model SV-E3P□□□A	Dimension W(mm)	H(mm)	D(mm)	Weight (kg)
005 010 020	40	160	135	0.6
040 075	48	160	135	0.7
100 150 200	61	160	175	1.5

4. Wiring explanation for servo motor and drive

Wiring diagram



【 Points for correct wiring 】

※ 24VDC and 200VAC input (main circuit) power supply should be wired from the same 200VAC main power supply.

※ A twisted-pair shielded cable should be used when I/O cable length is over 50cm.

※ The encoder cable should be less than 20m.

CAUTION

① Please note that there is high voltage in the solid line of wiring diagram when wiring and using.
② The broken lines in the wiring diagram indicates the non-dangerous voltage circuit.

5.Drive parameters and wiring

A brief list of parameters for D3 series drives

Basic general parameter		
Number	Parameter	Instructions
2.0	Control mode	Parameters related to control mode and instruction mode
3.0	Command mode selection	
4.0	Communication address	Related parameters of rS-485 and Absolute encoder
8.0	Selection of host communication mode	
11.0	RS485 communication minimum response time	
257.0	Selection of an encoder system	
67.0	Selection of drive restriction options	The driver inputs the relevant prohibited parameters
67.1	Selection of deceleration method at drive restriction input	
67.2	Selection of stop status at drive restriction	
67.3	Selection of position difference counter status at drive restrictio	
144.0	With or without the use of torque command limit override	Relevant parameters of torque limit
144.1	Torque limit state output mode	
147.0	Torque command limit override 1	
148.0	Torque command limit override 2	
151.0	Torque command limit override at prompt stop	Parameters associated with a safe stop
224.0	Type selection deceleration stop at servo OFF	
224.1	Deceleration stop at Servo off: cancelation reasons	
224.2	Use of a deceleration stop in case of control power supply voltage drop	
226.0	Deceleration stop : operating time at servo off	
227.0	Cancellation speed of deceleration stop and brake cancellation OFFat servo OFF	
228.0	Operating time of deceleration stop at control power supply voltage drop	
237.0	Delay time at servo OFF	
272.1	Encoder output rotation direction	
276.0	Division and multiplication of encoder pulse output Numerator	Related parameters of the encoder pulse output
278.0	Division and multiplication of encoder pulse output Denominator	

Parameters related to pulse position control		
Number	Parameter	Instructions
Related parameters of control mode		
2.0	Control mode	Set to " 0"
3.0	Command mode selection	Set to " 1"
32.0	Pulse train command input mode	Select pulse signal type of pulse command input. 0= Pulse and direction 1= Orthogonal phase difference 2= CCW/CW
34.0	Division/ multiplication (Numerator)	Setting range (Numerator) 1 to 65535
36.0	Division/ multiplication (Denominator)	Set to (number of output pulses of the host control device)/4
Run related parameters		
32.1	Pulse train command Rotation direction	Select rotation direction of pulse command input 0: CCW addition counting 1: CCW subtraction counting
32.3	Selection of Pulse train input logic	Select the logic for pulse train input.
33.0	Pulse command input filter selection	The function of input filter is to reduce the fault caused by noise
64.0	Judgment of positioning completion	Specify the conditions for the end of the positioning
68.0	Positioning completion range	
69.0	Positioning completion speed	
70.0	Positioning completion pulse command input (speed)	
71.0	Delay time of positioning completion detection	
66.0	With(out) use of position command smoothing filter 1	Setting of vibration reduction filter, Used to suppress the resonance of the device whenthe acceleration/ deceleration command is too high or during positioning
66.1	With(out) use of position command smoothing filter 2	
80.0	Average movement number of position command smoothing filter 1	
81.0	Average movement number of position command smoothing filter 2	

Related parameters of analog speed control		
Number	Parameter	Instructions
Related parameters of control mode		
2.0	Control mode	Set to " 1"
3.0	Command mode selection	Set to " 2"
Run related parameters		
48.0	Analog command input Filter parameter (Numerator)	Low-pass filter parameter for smoothing analog speed command input.It is valid when input filter selection (No.062.1) is set "1".
49.0	Analog command input Filter parameter (Denominator)	
50.0	Analog command input Gain (Numerator)	Gain of analog speed command input. When (Numerator) / (Denominator)=1 and ±10V analog command voltage is input, the highest rotation speed of motor can be reached.
51.0	Analog command input Gain (Denominator)	
52.0	Analog speed command CCW speed limit threshold value (Numerator)	Analog speed command CCW speed limit threshold value.
53.0	Analog speed command CCW speed limit threshold value (Denominator)	
54.0	Analog speed command CW speed limit threshold value (Numerator)	Analog speed command CW speed limit threshold value.
55.0	Analog speed command CW speed limit threshold value (Denominator)	
60.0	Analog speed command fixed offset value	When using manual adjustment to adjust offset value of analog speed command, set the adjustment value.
62.0	Analog speed command rotation direction	Select rotation direction of analog speed command. 0=Inputting negative voltage, the motor has CCW rotation; 1= Inputting negative voltage, the motor has CW rotation.
62.1	Select analog speed command input filter	Select analog speed command input filter.Input filter constant can be set in No.048.0, No.049.0.
62.2	Select offset adjustment type of analog speed command	Select offset adjustment of analog speed command.
77.0	With(out) the use of speed command smoothing filter	Choose whether to use speed command smoothing filter.The average movement time can be set in No.78.0
78.0	Average movement time of speed command smoothing filter	Set the average movement time of speed command smoothing filter. It can be used when No.77.0 is effective

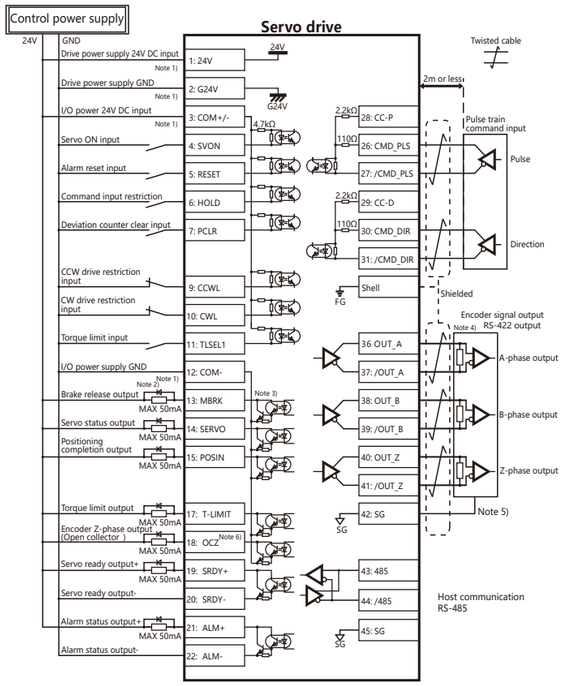
Related parameters of internal speed control		
Number	Parameter	Instructions
Related parameters of control mode		
2.0	Control mode	Set to " 1"
3.0	Command mode selection	Set to " 3"
388.0	Selection of Internal speed command type	Set to " 1"
Run related parameters		
390.0	Internal speed command Acceleration time	[Initial value] 1000 [ms]
391.0	Internal speed command Deceleration time	[Initial value] 1000 [ms]
392.0~399.0	Target speed 1~8	Target speed 1~8: 500/1000/1500/ 2000/2500/3000/ 4000/5000 [r/min]

Related parameters of analog torque control		
Number	Parameter	Instructions
Related parameters of control mode		
2.0	Control mode	Set to " 2"
3.0	Command mode selection	Set to " 2"
Run related parameters		
152.0	Analog torque command speed limit value	Set Speed limit value of analog torque control mode.
288.0	Analog torque command input filter (Denominator)	This parameter is for the low-pass filter that smooths analog torque command input.It's valid when No.302.1 =1(enable).
289.0	Analog torque command input filter (Numerator)	
290.0	Analog torque command input gain (Denominator)	Set Analog torque command input gain.Input of Analog command voltage =-10V or +10V with (Numerator)/(Denominator)=1 attains motor peaks torque.
291.0	Analog torque command input gain (Numerator)	
292.0	Analog torque command CCW torque limit Override (Denominator)	Set Analog torque command CCW torque limit Override
293.0	Analog torque command CCW torque limit Override (Numerator)	
294.0	Analog torque command CW torque limit Override (Denominator)	Set Analog torque command CW torque limit Override
295.0	Analog torque command CW torque limit Override (Numerator)	

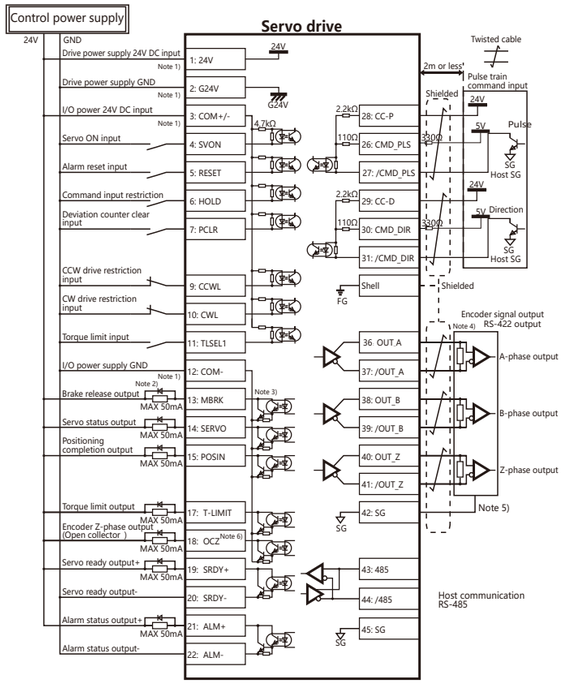
6. Operation

Position control mode (Pulse position command input)

Wiring for user I/O connector (CN1) (Differential input)

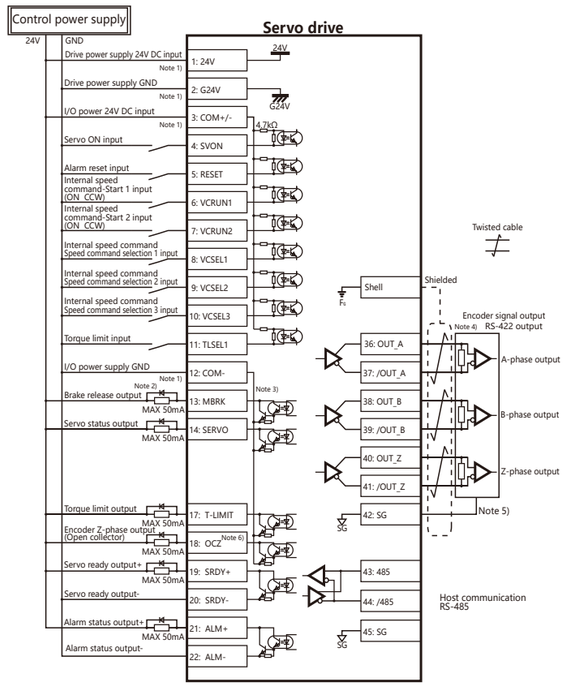


Pulse position command input (24V / 5V open collector input)



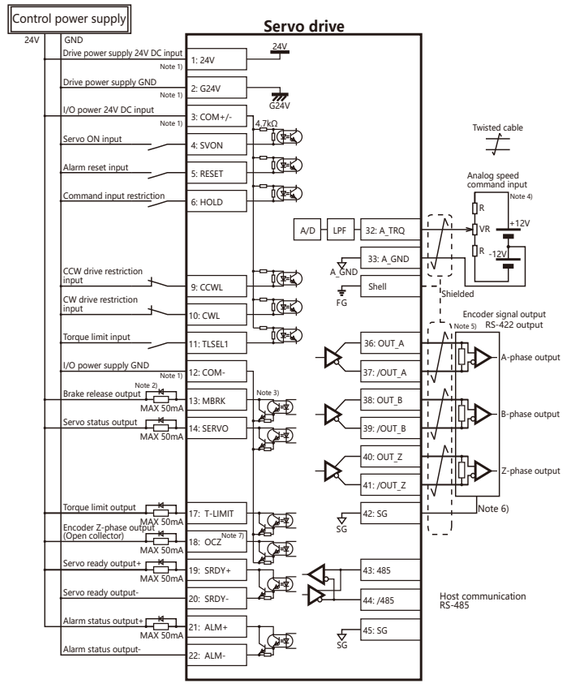
Speed control mode (Internal speed command)

Wiring for user I/O connector(CN1) (Internal speed command)



Speed/Torque control mode (Analog speed/Analog torque command input)

Wiring for user I/O connector (CN1) (Analog speed/Analog torque command input)



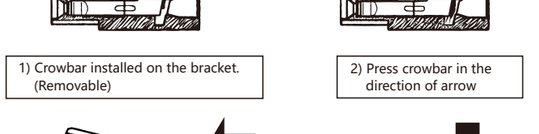
Note 1) Control power supply(24V, G24V) and I/O power (COM+, COM-) share the same power supply(For the models of 750W or less).
Note 2) If there is drive inductive load(relay), please use protective circuits(diode).
Note 3) Transistor output is an open collector output circuit of the Darlington-connected. It should be connected with relay or optocoupler. Please don't connect transistor directly because the voltage VCE(SAT) between collector and emitter is about 1V which cannot meet the required voltage VIL of TTL IC when transistor is ON.
Note 4) Terminal resistance must be connected as shown in the wiring diagram.
Note 5) Connect the signal ground on the host control device of output signal of the encoder. The connection of signal ground and power supply GND may cause malfunction.
Note 6) If the pulse width of Z-phase is too narrow to identify the host control device, please reduce the encoder pulse output division and multiplication No.276.0, 278.0 or reduce the speed to increase the pulse width.[Pulse width]=1/speed/(division and multiplication×2^{17})

Description of User I/O connector (CN1) terminal arrangements

Terminal arrangements

26 CMD_PLS	28 CC-P	30 CMD_DIR	32 A_SPEED	34 A_TRQ	36 OUT_A	38 OUT_B	40 OUT_Z	42 SG	44 /485	46 G24	48 SP4	50 EDM-
27 /CMD_PLS	29 CC-D	31 /CMD_DIR	33 A_GND	35 A_GND	37 /OUT_A	39 /OUT_B	41 /OUT_Z	43 485	45 SG	47 SP3	49 EDM+	
1 VCC	3 COM1	5 I2(RESET)	7 I4(PCLR)	9 I6(CCWL)	11 I8(TLSEL1)	13 O1(MBRK)	15 O3(POSIN)	17 O5	19 O7+(SRDY+)	21 O8+(ALM+)	23 VCC	25 SP2		
2 G24	4 I1(SVON)	6 I3(HOLD)	8 I5	10 I7(CWL)	12 COM2	14 O2(SERVO)	16 O4	18 O6(OCZ)	20 O7-(SRDY-)	22 O8-(ALM-)	24 Sp1			

Connector



7. Appendix

Recommended wire/cable

Cable name	AWG	UL	Heat-resistance	Remarks
Motor power cable (750W or less)	18	2517	105℃	
Motor power cable (1KW or more)	14 Note 1)	2501	105℃	
200VAC input (750W or less) ※Including FG cable	18	1015	105℃	
200VAC input (1KW or more) ※Including FG cable	14 Note 1)	1015	105℃	
Encoder	Power: 22 Signal: 24	20276	80℃	5P shielded cable: max. 20m (when using twisted shielded cable)
User I/O	26	1007	80℃	Twisted shielded cable Recommend cable: 50m or less
Regenerative resistor connection	18	1015	105℃	
Brake	18	2517	105℃	1P(2-core)
Main circuit DC power distribution (750W or less) Note 2)	18	1015	105℃	
Main circuit DC power distribution (1kW or more) Note 2)	14 Note 1)	1015	105℃	
Communication among drives Note 2)	28	20539	80℃	

The length of cable depends on the actual situation.

Note 1) AWG16 cable can be used for 1kW motor.
Note 2) For multi-axial drive.

Wiring for power connector (B1/B2/L1/L2,U/V/W) of servo drive

The crowbar bundled in the package is needed when wiring.
1) Steps of cable connection