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INSTRUCTION MANUAL

FOR

ASYNCHRONOUS INDUCTION TYPE AC SERVO SYSTEM

ACTUS POWER

NPSA-N
NPSA-NN
NPSA-NF
NPSA-NH
NPSA-PN
NPSA-PNN

VER 1,5

NIKKIDENSO CO., LTD.

PREFACE

Thank you for your purchase of the NIKKI Induction type AC servo system "ACTUS POWER". Before using the system, please read through this operation manual and be familiar with it so that you are able to make optimum use of the system and use it properly.

When connecting each unit of "ACTUS POWER" to NC units of other manufacturers, make sure in advance that there will be no problems in relation to its connection or use.

If each unit of the "ACTUS POWER" that you ordered is a special specifications unit that is different from NIKKI's standard unit, please read the relevant specification sheet for that unit as well as this operation manual, so that you handle theunit properly.

Immediately upon receipt of each "ACTUS POWER" unit, please check the condition of the unit and if any accessory part is missing. When unpacking, if any abnormality is found with the appearance of the unit or any accessory part is not what you expected, or the number of accessories is not correct, then please contact our sales staff before using the unit. For accessory combinations, see 8-5 "Combinations of motor, driver and accessories".

Warranty

The warranty period of our products is one year after shipment from the factory. But the following failures and abnormalities are excluded from the warranty.

1. **Failure or abnormalities ascribable to modification by the client.**
2. **Failure or abnormalities ascribable to use other than that specified.**
3. **Failure or abnormalities ascribable to natural disasters.**
4. **Failure or abnormalities ascribable to connection with products of other manufacturers which have not been approved by NIKKI DENSO.**

If any failure or abnormalities are discovered during the warranty period, please contact the sales staff of our company.

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This operation manual describes the installation, operation, inspection, fault diagnosis, among others on NIKKI induction type AC servo driver (hereinafter referred to as "driver") and NIKKI induction type AC servo motor (hereinafter referred to as"motor").
When installing, operating, inspecting or diagnosing faults, comply with the conditions and procedures described in this manual.

The "ACTUS POWER" series consists of drivers and motors. The drivers include each of series NPSA-N/NN/NF/NH for speed control and each of series NPSA-PN/PNN for position control.

Speed Control Driver

Series Name	Source Voltage	Number of Rotations of Motor	Motor Capacity
NPSA-N	200V/50Hz, 220V/60Hz	1000rpm 2000rpm 4000rpm	3.7kW ~ 37kW 5.5kW ~ 37kW 3.7kW ~ 11kW
NPSA-NN	200V/50Hz, 220V/60Hz	1000rpm 1500rpm 2000rpm 3000rpm 4000rpm	0.2kW ~ 2.8kW 0.2kW ~ 2.8kW 0.8kW ~ 3.7kW 0.05kW ~ 0.6kW 0.1kW ~ 2.2kW
NPSA-NF	200V/50Hz, 220V/60Hz	3000rpm	0.05kW ~ 0.6kW
NPSA-NH	440V/50Hz, 460V/60Hz	1000rpm 2000rpm	3.7kW ~ 55kW 3.7kW ~ 55kW

Position Control Driver

Series Name	Source Voltage	Number of Rotations of Motor	Motor Capacity
NPSA-PN	200V/50Hz, 220V/60Hz	1000rpm	3.7kW
NPSA-PNN	200V/50Hz, 220V/60Hz	1000rpm 1500rpm 2000rpm 3000rpm 4000rpm	0.2kW ~ 2.8kW 0.2kW ~ 2.8kW 0.8kW ~ 3.7kW 0.05kW ~ 0.6kW 0.1kW ~ 2.2kW

CHAPTER 1 OUTLINE

1-1 Purpose

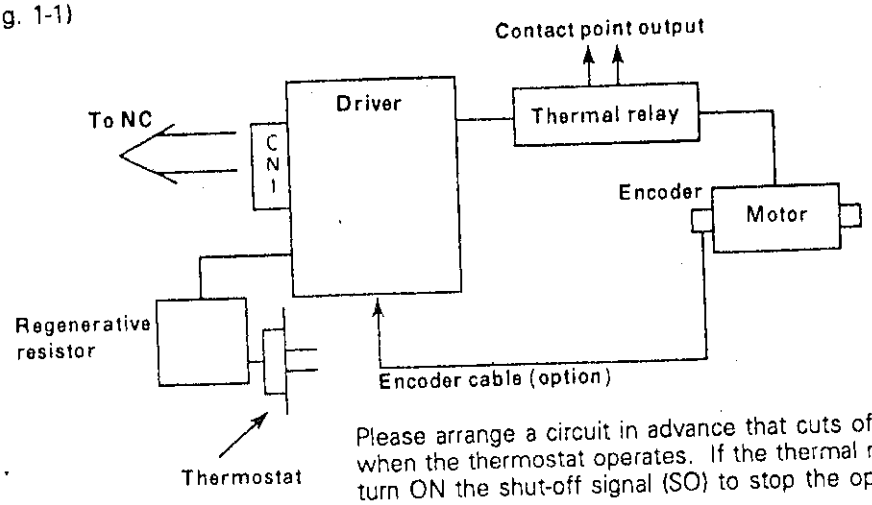
The "ACTUS POWER" (series) can be used as drive sources for various kinds of machine. They are different from ordinary induction type motors, i.e., a constant rotation can be achieved with D.C. voltage as a set speed command value, and the torque control which matches load conditions is automatically performed. The motor is of simple construction resulting in high durability. It enables frequent stopping and starting such as in short tact operations.

Further advanced high accuracy positioning control can be achieved through a combination of "ACTUS POWER" and an NC positioning control which is to be sold separately.

For NC positioning control , see the NIKKI DENSO catalog or consult our sales staff.

1-2 Basic Configuration

"ACTUS POWER" consists of the driver, thermal relay, regenerative resistor, thermostat, and motor. (Fig. 1-1)



Please arrange a circuit in advance that cuts off the power when the thermostat operates. If the thermal relay operates, turn ON the shut-off signal (SO) to stop the operation of the driver.

Fig. 1-1 Basic configuration

Rule of thermal relay: Detects overload status of motor and prevents the motor from burning out. (Example: Motor shaft lock due to overload.)

Rule of regenerative resistance: Converts regenerative energy to heat energy.

Caution: The thermal relay outputs contact point signal when motor is overloaded and thermostat outputs the contact point signal when regenerative energy is excessively large. But each does not protect the unit alone. Using each contact point signal, assemble the protection circuit that cuts off the power. NPSA-2.5NN/2.5PNN are not provided with the regenerative resistor or thermostat. If it is anticipated that load inertia is over 20 times the motor inertia, contact our sales staff.

1-3 Principles of Operation

1-3-1 Kind of Driver

The speed control servo drivers and positioning servo drivers are made available for the NIKKI induction type AC servo system "ACTUS POWER". (Fig. 1-2)

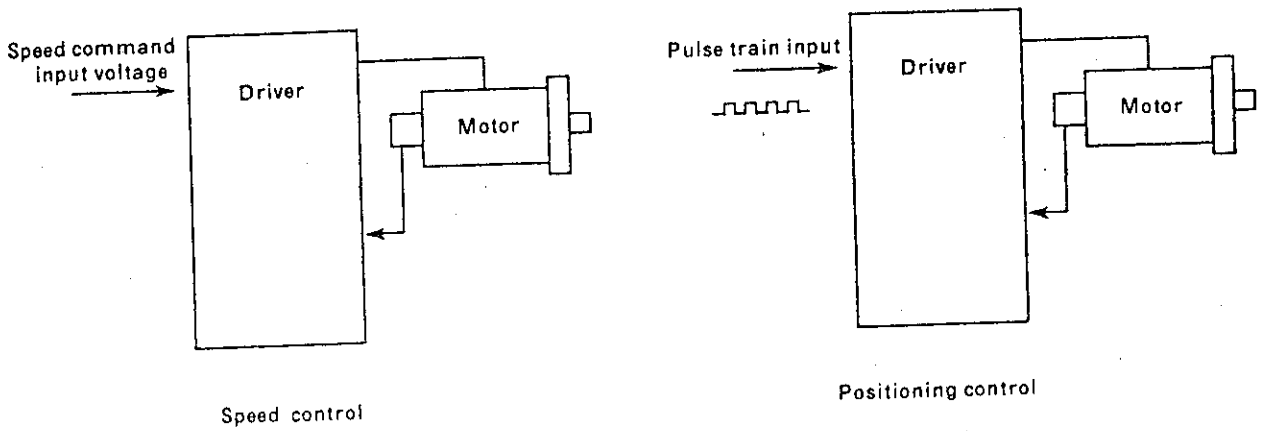


Fig. 1-2 Diagram of principles of operation

1-3-2 Speed Control Drivers NPSA-N/NN/NF/NH

The NPSA-N/NN/NF/NH type drivers input speed command value using D.C. voltage which is amplified in the unit to drive the motor. Speed control is performed as follows: output of the pulse encoder provided on non-load side of motor is taken in by the driver; pulse signal is converted to analog signal in the unit; analog signal is used as speed feedback voltage; speed feedback voltage is compared with speed command input voltage.

If speed feedback voltage is lower than speed command input voltage, driver increases the speed of the motor and if speed feedback voltage is higher than the speed command input voltage driver decreases the speed of the motor.

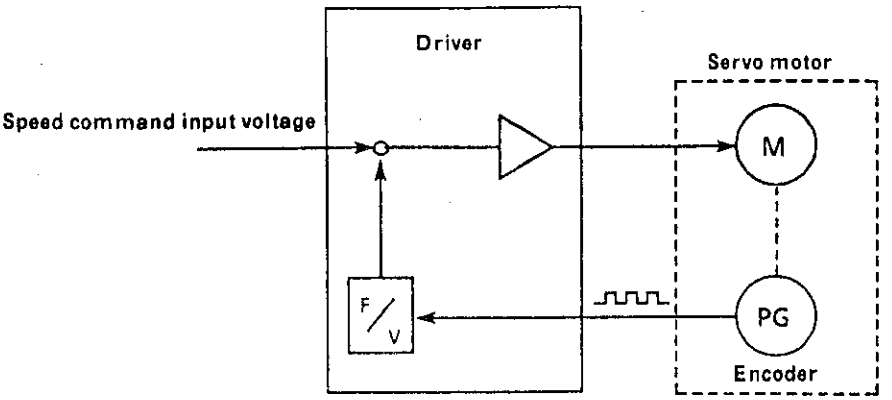


Fig. 1-3 NPSA-N/NN/NF/NH

1-3-3 Position Control Drivers NPSA-PN/PNN

When command pulse is input, the NPSA-PN/PNN type driver controls the shift amount (rotational degree) and speed of motor in accordance with the number of input pulses and frequency.

Command pulse input to driver is added to the deviation counter. This accumulated pulse amount (hereafter referred to as deviation amount) is converted to an analog D.C. voltage by means of a D/A converter.

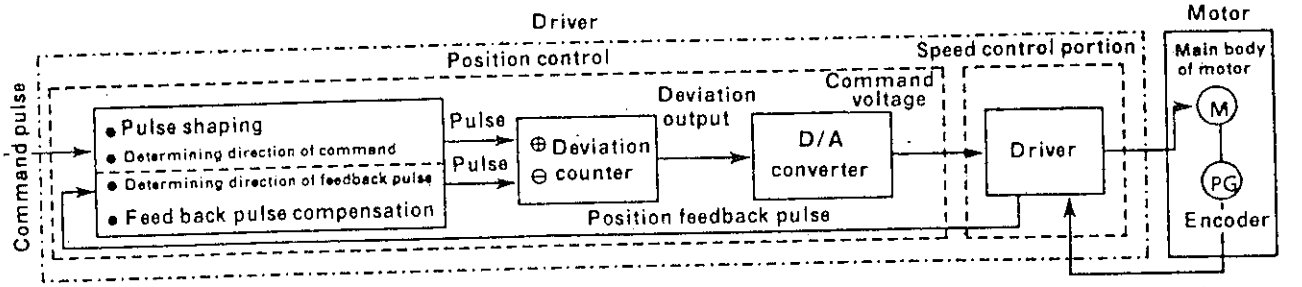
The deviation output of the deviation counter is proportionate to the command voltage and it becomes the speed command of the driver.

Driver drives motor in accordance with this command voltage.

As motor rotates, the encoder on the non-load shaft generates the pulse that is proportionate to the angle of rotation which is input to the deviation counter as the position feedback. This in turn is subtracted from the deviation accumulated in the deviation counter by the command pulse.

When the command pulse is input continuously, the above addition and subtraction are repeated and a constant deviation amount is maintained and the motor continues to rotate. Since the frequency of the command pulse matches the frequency of the feedback pulse, the command pulse frequency is proportionate to the speed of the motor.

When the command pulse stops, only the feedback pulse is input; the deviation amount is subtracted; the command voltage is reduced; the speed of the motor is reduced; the motor rotates until the deviation amount becomes zero (0) completing the positioning.



*If only speed control portion is provided, it is of NPSA-N/NN type. A combination of the speed and position control portion is of NPSA-PN/PNN type.

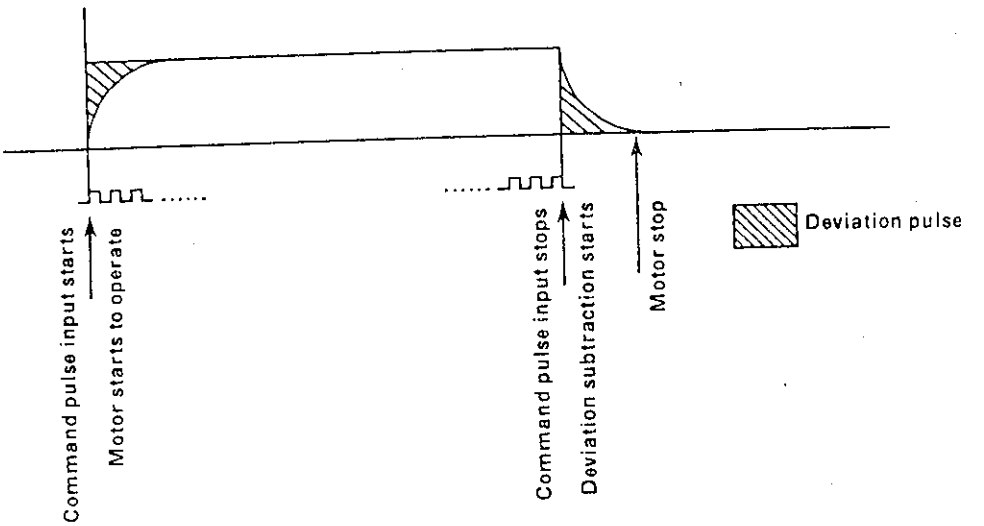
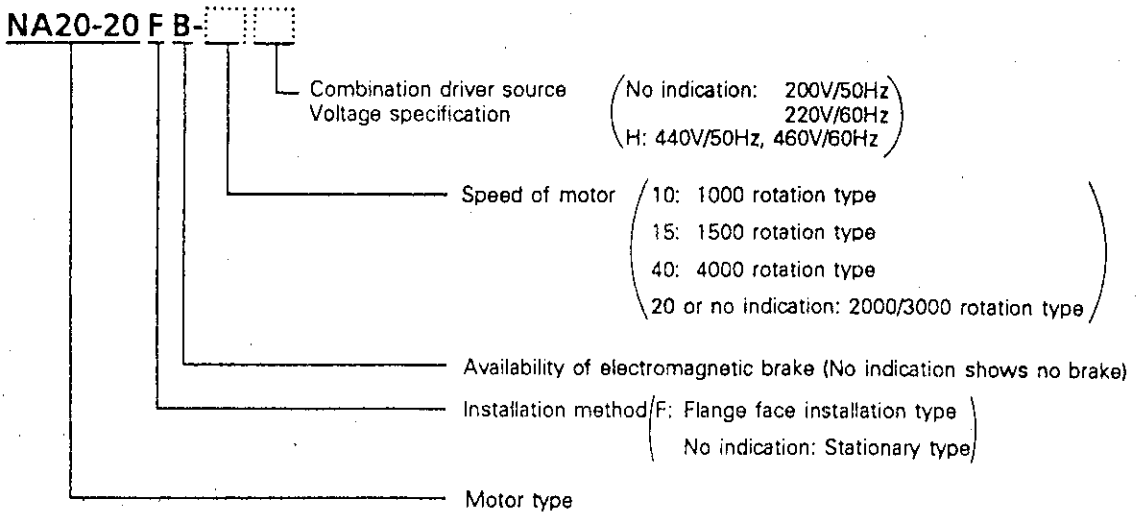


Fig. 1-4 NPSA-PN/PNN

CHAPTER 2 SPECIFICATIONS

2-1 Motor

2-1-1 Motor Type



2-1-2 General Specifications for Motor

Table 2-1 General specifications for motor

	Item		Description
1)	Outside appearance		See dimension drawing in the catalog.
2)	Ambient conditions	Temperature	0 ~ 40°C
		Humidity	85% or less, antisweating
		Location	See Chapter 3.
3)	Installation method		Stationary type or flange type horizontal installation
4)	Installation direction		NA21-1.5F ~ NA20-1100F — Horizontal, under shaft, on shaft* NA20-1500 ~ 5500 — Horizontal
5)	Protection type		NA21-1.5F ~ NA20-1100F — IP44 NA20-1500 ~ 5500 — IP22 NA30 — IP44
6)	Cooling method		Natural air cooling or forced air cooling
7)	Paint color		Black (Munsell N-1.0)
8)	Direction of rotation		Bilateral
9)	Insulation class		F class
10)	Voltage proof		1500V for one minute
11)	Vibration		V10

*If installed on shaft, the load shall be within thrust load.

2-2 Encoder

Thermostast of encoder

An encoder is mounted on servo motor shaft. As the encoder is easily affected by shock or vibration, be careful in installing the motor on a mechanical system. If extreme shock is applied, the encoder may be damaged.

Shock resistance of encoder:

X, Y & Z direction — 50G x 3 times at maximum

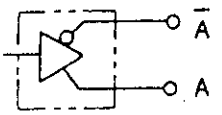
Shaft portion — 10G at maximum

Vibration resistance of encoder:

X, Y & Z direction — 5G x 2 hours at maximum

When there is possibility of shock or vibration being applied which exceeds the above conditions, dismount the encoder from the servo motor following the below mentioned procedure, then mount it again on to the servo motor after servo motor has been installed on a mechanical system.

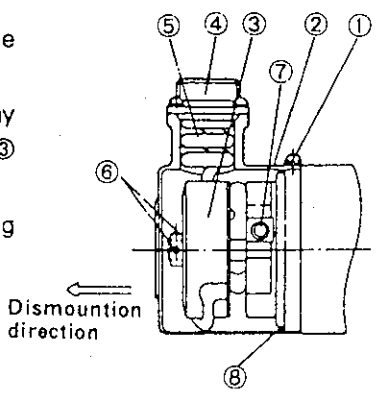
2-2-1 Encoder Specification

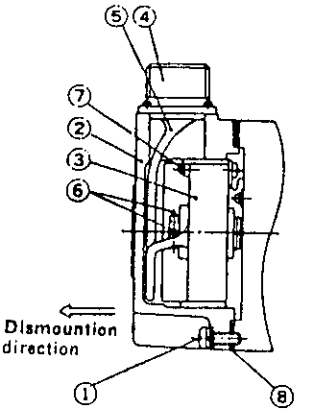
Power voltage	DC +5V ±5%
Current consumption	0.2A max.
Type of output	Line driver  IC: M5A26LS31 or equivalent
Output signal	A phase, B phase 90° phase 2 signals Marker Z phase signal
Number of pulse	1000PPR

2-2-2 Encoder Dismounting Procedure

(1) Encoder dismounting procedure (for motors of 50 to 400W)

1. Remove the three M3 mounting screws ① holding on the encoder cover.
2. Dismount encoder cover ② in the direction of arrow. (Pay particular attention to wiring ⑤ connecting encoder body ③ and receptacle ④. Take care not to lose the packing ⑧.)
3. Loosen the two set screws ⑥ (1.25mm width) tightening the shaft.
4. Remove the three body fixing screws ⑦.
5. Pull out encoder body ③ in the direction of arrow.



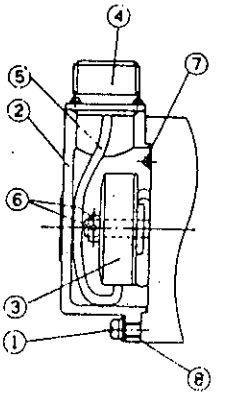


(2) Encoder dismounting procedure (for motors of 600W or above.)

1. Remove the four M5 mounting screws ① holding on the encoder cover.
2. Dismount encoder cover ② in the direction of arrow. (Pay particular attention to wiring ⑤ connecting encoder body ③ and receptacle ④. Take care not to lose the packing ⑧.)
3. Loosen the two M3 set screws ⑥ (1.5mm width) tightening the shaft.
4. Remove the body fixing screws ⑦ (M3 – 1 pce.)
5. Pull out encoder body ③ in the direction of arrow.

(3) Encoder dismounting procedure (for NA30 series)

The same procedure as for NA21-1.5F ~ 10F is applicable except that the positions of the three body fixing screws ⑦ in Procedure 4 are as shown at right.



2-2-3 Encoder Remounting Procedure

(1) Encoder remounting procedure (for motors of 50 to 400W)

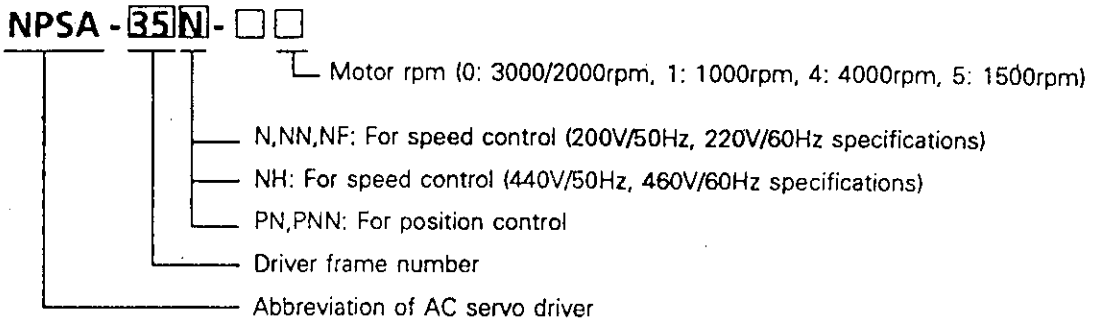
1. Fix O-ring to motor body.
2. Fit encoder body onto motor shaft, and set the encoder to a position where the motor shaft end protrudes by 1mm from the encoder rear end.
3. Aligh positions of motor body mounting holes to those of mounting plate holes, and fix with three body fixing screws ⑦.
4. align the two set screws ⑥ (M3) to the flat faces of motor shaft and tighten (tightening torque: 4kg • cm).
5. While housing the lead wiring in the space between encoder cover and body, tighten the three mounting screws ① (M3).

(2) Encoder remounting procedure (for motors of 600W or above)

1. After fitting two sheets of pacing ⑧ to motor body, fit fiber washer, then encoder body onto motor shaft and push encoder body until it touches the stopper.
2. Align the two set screws ⑥ (M3) to the flat faces of motor shaft and tighten (tightening torque: 6kg • cm).
3. Align positions of motor body mounting holes to those of encoder holes, and fix with mounting screws ⑦.
4. While housing the lead wiring in the space between encoder cover and body, tighten the four mounting screws ① (M5).

2-3 Driver

2-3-1 Driver Type



2-3-2 General Specifications for Driver

Table 2-2 General specifications for driver

	Item		Description	
1)	Outside appearance		See 8-3 Outside drawing	
2)	Ambient conditions	Temperature Humidity Location	0 ~ 50°C (around the unit) 85% or less, antisweating Do not install in any harmful atmosphere that may have corrosive gas, grinding liquid, metal chips, oil and so on.	
3)	Power source		Rated voltage ±10%	
4)	Cooling system		Natural air cooling (NPSA-2.5NN/5NN/2.5NF and 2.5PNN/5PNN) Forced air cooling (NPSA-10NN, 10PNN onward and 5NF, N, LH)	
5)	Installation method		Panel installation type or embedding type common use (NPSA-35N or more, NH is panel installation type)	
6)	Paint color		Black (Munsell N-1.0)	
7)	Vibration proof		0.5G (at 10 ~ 50Hz)	
8)	Impact resistance		5G	
9)	Noise proof		2000V or less 1μ sec width	
10)	Accessories	N, NF NN NH	Control input signal connector CN1	Thermostat Thermal relay Regenerative resistance One set of each (NPSA-2.5NN/2.5PNN do not have regenerative resistance and thermostat as accessories.) Fittings (only NPSA-NN, 20N, NF, PN, PNN)
		PN PNN	Control input connector CNA Pulse train input connector CNB	
11)	Optional parts	N, NH	Volume set for speed command input and torque control input (10kΩ, 1/4W)	
		N, NF NN, NH PN, PNN	Connector CN2 for input from encoder or encoder cable set	
		N, NF NN NH	Connector CN3 for outputting 90° phase difference to outside or encoder cable set	

The specifications for each series are described in the material in Chapter 8.

2-4 Combination of Motor and Driver

Combinations of motor and driver vary depending on peak torque to be output by motor.

Peak torque means the instantaneous maximum torque generated in the combination of any motor to any driver. Note that this is different from the instantaneous maximum torque of a single motor.

NPSA-N/NN/PNN 3000/2000rpm Type (Power input 200V/50Hz, 220V/60Hz)

Motor type	Peak torque/ rated torque	Motor rated rpm	Speed control	Position control	Driver type	Main power source capacity	Blower power source
NA21-1.5F/ NA21-1.5F-B	300%	3000 rpm	O		NPSA-2.5NN-40A	0.18kVA (1φ or 3φ)	———
				O	NPSA-2.5PNN-40A		
NA21-3F/ NA21-3F-B			O		NPSA-2.5NN-50A		
				O	NPSA-2.5PNN-50A		
NA21-6F/ NA21-6F-B			O		NPSA-2.5NN-60A	0.35kVA (1φ or 3φ)	
				O	NPSA-2.5PNN-60A		
NA21-10F/ NA21-10F-B			O		NPSA-2.5NN-70A	0.53kVA (1φ or 3φ)	
				O	NPSA-2.5PNN-70A		
NA20-15F	200%		O		NPSA-5NN-20	1.0kVA	
	300%			O	NPSA-5PNN-20		
	200%		O		NPSA-5NN-30		
	300%			O	NPSA-5PNN-30		
NA20-20F/ NA20-20F-B	200%	2000 rpm	O		NPSA-5NN-40	1.0kVA (1φ or 3φ)	
				O	NPSA-5PNN-40		
	300%		O		NPSA-5NN-50		
				O	NPSA-5PNN-50		
NA20-40F/ NA20-40F-B	200%		O		NPSA-10NN-40	1.9kVA (3φ)	
				O	NPSA-10PNN-40		
	300%		O		NPSA-10NN-50		
				O	NPSA-10PNN-50		
NA20-75F/ NA20-75F-B	200%		O		NPSA-10NN-60	2.9kVA (3φ)	To be supplied From driver
				O	NPSA-10PNN-60		
	300%		O		NPSA-10NN-70		
				O	NPSA-10PNN-70		
NA20-110F/ NA20-110F-BR	200%		O		NPSA-15NN-50	4.7kVA (3φ)	
				O	NPSA-15PNN-50		
	300%		O		NPSA-15NN-60		
				O	NPSA-15-PNN-60		
NA20-180F/	200%		O		NPSA-20NN-50	7.7kVA (3φ)	
				O	NPSA-20PNN-50		
NA20-180F-BR	280%		O		NPSA-20-NN-60		
NA20-270F/ NA20-270F-BR	200%		O		NPSA-35N-50	11kVA (3φ)	
NA20-370F/ NA20-370F-BR			O		NPSA-45N-50	15kVA (3φ)	
NA20-550F/ NA20-550F-BR			O		NPSA-75N-50	22kVA (3φ)	
NA20-750F/ NA20-750F-BR			O		NPSA-100N-50	28kVA (3φ)	
NA20-1100F			O		NPSA-140N-50	40kVA (3φ)	
NA20-1500			O		NPSA-180N-50	65kVA (3φ)	
NA20-1800	180%		O		NPSA-220N-50	78kVA (3φ)	

Blower power source shows the input voltage, input frequency and rated current when the power is input directly from the main power source.

NPSA-N/NN/PN/PNN 1000rpm Type (Power input 200V/50Hz, 220V/60Hz)

Motor type	Peak torque/ rated torque	Motor rated rpm	Speed control	Position control	Driver type	Main power source capacity	Blower power source
NA20-20F-10/ NA20-20F-B-10	300%	1000 rpm	O		NPSA-2.5NN-61	0.53kVA (1φ or 3φ)	———
				O	NPSA-2.5PNN-61		
NA20-40F-10/ NA20-40F-B-10			O		NPSA-5NN-41	1.0kVA (1φ or 3φ)	
				O	NPSA-5PNN-41		
NA20-75F-10/ NA20-75F-B-10	200%		O		NPSA-10NN-41	1.93kVA (3φ)	
				O	NPSA-10PNN-41		
	300%		O		NPSA-10NN-51		
				O	NPSA-10PNN-51		
NA20-110F-10/ NA20-110F-BR-10	200%		O		NPSA-10NN-61	2.9kVA (3φ)	200V/50Hz/0.56A (1φ) 200V/60Hz/0.52A (1φ) 200V/60Hz/0.57A (1φ)
				O	NPSA-10PNN-61		
	300%		O		NPSA-10NN-71		To be supplied From driver
				O	NPSA-10PNN-71		
NA20-180F-10/ NA20-180F-BR-10	200%		O		NPSA-15NN-51	4.7kVA (3φ)	
				O	NPSA-15PNN-51		
	300%		O		NPSA-15NN-61		
				O	NPSA-15-PNN-61		
NA20-270F-10/ NA20-270F-BR-10	200%		O		NPSA-20NN-51	7.7kVA (3φ)	
				O	NPSA-20PNN-51		
	300%		O		NPSA-20NN-61		
NA20-370F-10/ NA20-370F-BR-10	200%		O		NPSA-20NN-71		
				O	NPSA-20PN-51		
NA20-550F-10/ NA20-550F-BR-10			O		NPSA-35N-51	11kVA (3φ)	
NA20-750F-10/ NA20-750F-BR-10			O		NPSA-45N-51	15kVA (3φ)	
NA20-1100F-10			O		NPSA-75N-51	21kVA (3φ)	
NA20-1500-10			O		NPSA-100N-51	29kVA (3φ)	
NA20-2200-10			O		NPSA-140N-51	42kVA (3φ)	
NA20-2700-10			O		NPSA-180N-51	53kVA (3φ)	
NA20-3700-10	180%		O		NPSA-220N-51	68kVA (3φ)	

Blower power source shows the input voltage, input frequency and rated current when the power is input directly from the main power source.

NPSA-N/NN/PNN 1500rpm Type (Power input 200V/50Hz, 220V/60Hz)

Motor type	Peak torque/ rated torque	Motor rated rpm	Speed control	Position control	Driver type	Main power source capacity	Blower power source
NA30-13F-15/ NA30-13F-B-15	300%	1500 rpm	O		NPSA-2.5NN-75	1.0kVA (1φ or 3φ)	———
				O	NPSA-2.5PNN-75		
			O		NPSA-5NN-45		
				O	NPSA-5PNN-45		
NA30-25F-15/ NA30-25F-B-15			O		NPSA-5NN-55		
				O	NPSA-5PNN-55		
NA30-50F-15/ NA30-50F-B-15	200%		O		NPSA-10NN-45	1.9kVA (3φ)	
				O	NPSA-10PNN-45		
	300%		O		NPSA-10NN-55		
				O	NPSA-10PNN-55		
NA30-110F-15 NA30-110F-B-15	200%		O		NPSA-15NN-55	4.7kVA (3φ)	
				O	NPSA-15PNN-55		
	300%		O		NPSA-15NN-65		
				O	NPSA-15PNN-65		
NA30-180F-15 NA30-180F-B-15	200%		O		NPSA-20NN-55	7.7kVA (3φ)	
				O	NPSA-20-PNN-55		

Blower power source shows the input voltage, input frequency and rated current when the power is input directly from the main power source.

NPSA-N/NN 4000rpm Type (Power input 200V/50Hz, 220V/60Hz)

Motor type	Peak torque/ rated torque	Motor rated rpm	Speed control	Position control	Driver type	Main power source capacity	Blower power source
NA20-3AF-40	300%	4000 rpm	O		NPSA-2 5NN-54	0 18kVA (1φ or 3φ)	———
NA20-6BF-40			O		NPSA-2 5NN-64	0.35kVA (1φ or 3φ)	
NA20-10BF-40			O		NPSA-5NN-44	1 0kVA (1φ or 3φ)	
NA20-20F-40	200%		O		NPSA-10NN-44	1.93kVA (3φ)	
	300%		O		NPSA-10NN-54		
NA20-40F-40	200%		O		NPSA-10NN-64	2.9kVA (3φ)	
	300%		O		NPSA-10NN-74		
NA20-75F-40	200%		O		NPSA-15NN-54	4.7kVA (3φ)	
	300%		O		NPSA-15NN-64		
NA20-110F-40	200%		O		NPSA-20NN-54	7.7kVA (3φ)	To be supplied rom driver
NA20-180F-40	180%		O		NPSA-35N-54	11kVA (3φ)	
NA20-270F-40			O		NPSA-45N-54	15kVA (3φ)	
NA20-370F-40			O		NPSA-75N-54	22kVA (3φ)	

Blower power source shows the input voltage, input frequency and rated current when the power is input directly from the main power source.

NPSA-NF 3000rpm Type (Power input 200V/50Hz, 220V/60Hz)

Motor type	Peak torque/ rated torque	Motor rated rpm	Speed control	Position control	Driver type	Main power source capacity	Blower power source
NA21-1.5F/ NA21-1.5F-B	300%	3000 rpm	O		NPSA-2.5NF-40A	0.18kVA (1φ)	———
NA21-3F/ NA21-3F-B			O		NPSA-2.5NF-50A		
NA21-6F/ NA21-6F-B			O		NPSA-2.5NF-60A	0.35kVA (1φ)	
NA21-10F/ NA21-10F-B			O		NPSA-2.5NF-70A	0.53kVA (1φ)	
NA21-20F/ NA21-20F-B			O		NPSA-5NF-50	1.0kVA (1φ)	

Blower power source shows the input voltage, input frequency and rated current when the power is input directly from the main power source.

NPSA-NH 2000rpm Type (Power input 440V/50Hz, 460V/60Hz)

Motor type	Peak torque/ rated torque	Motor rated rpm	Speed control	Position control	Driver type	Main power source capacity	Blower power source
NA20-180F-20H/ NA20-180F-BR-20H	200%	2000 rpm	O		NPSA-20NH-50	7kVA (3φ)	100V/50Hz/1.12A Single phase 100V/60Hz/1.04A Single phase 110V/60Hz/1.14A Single phase
NA20-270F-20H/ NA20-270F-BR-20H			O		NPSA-35NH-50	10kVA (3φ)	100V/50Hz/1.44A Single phase 100V/60Hz/1.32A Single phase 110V/60Hz/1.44A Single pahse
NA20-370F-20H/ NA20-370F-BR-20H			O		NPSA-45NH-50	14kVA (3φ)	
NA20-550F-20H/ NA20-550F-BR-20H			O		NPSA-75NH-50	20kVA (3φ)	100V/50Hz/0.96A Single phase 100V/60Hz/0.86A Single phase 110V/60Hz/0.98A Single phase
NA20-750F-20H/ NA20-750F-BR-20H			O		NPSA-100NH-50	27kVA (3φ)	400V/50Hz/0.6A 3-phase 400V/60Hz/0.41A 3-phase 440V/60Hz/0.45A 3-pahse
NA20-1100F-20H			O		NPSA-140NH-50	38kVA (3φ)	
NA20-1500-20H			O		NPSA-180NH-50	52kVA (3φ)	400V/50Hz/1.0A 3-phase 400V/60Hz/1.0A 3-phase 440V/60Hz/1.0A 3-pahse
NA20-1800-20H			O		NPSA-300NH-30A PUB-300NH-50	63kVA (3φ)	
NA20-2700-20H			O		NPSA-300NH-50A (Driver main body) PUB-300NH-50 (Special power source	95kVA (3φ)	

Blower power source shows the input voltage, input frequency and rated current when the power is input directly from the main power source.

NPSA-NH 1000rpm Type (Power input 440V/50Hz, 460V/60Hz)

Motor type	Peak torque/ rated torque	Motor rated rpm	Speed control	Position control	Driver type	Main power source capacity	Blower power source
NA20-370F-10H	200%	1000 rpm	O		NPSA-20NH-51	7.0kVA (3φ)	100V/50Hz/1.12A Single phase 100V/60Hz/1.04A Single phase 110V/60Hz/1.14A Single phase
NA20-550F-10H			O		NPSA-35NH-51	10.0kVA (3φ)	100V/50Hz/1.44A Single phase 100V/60Hz/1.32A Single phase 110V/60Hz/1.44A Single pahse
NA20-750F-10H			O		NPSA-45NH-51	13.4kVA (3φ)	
NA20-1100F-10H			O		NPSA-75NH-51	19.3kVA (3φ)	100V/50Hz/0.96A Single phase 100V/60Hz/0.86A Single phase 110V/60Hz/0.98A Single phase
NA20-1500-10H			O		NPSA-100NH-51	26.3kVA (3φ)	400V/50Hz/1.0A 3-phase 400V/60Hz/1.0A 3-phase 440V/60Hz/1.0A 3-pahse
NA20-2200-10H			O		NPSA-140NH-51	38.0kVA (3φ)	
NA20-2700-10H			O		NPSA-180NH-51	48.0kVA (3φ)	
NA20-3700-10H			O		NPSA-300NH-31A PUB-300NH-50	67.0kVA (3φ)	400V/50Hz/3.2A 3-phase 400V/60Hz/2.9A 3-phase 440V/60Hz/2.8A 3-pahse
NA20-5500-10H			O		NPSA-300NH-51-A (Driver main body) PUB-300NH-50 (Special power source	99.0kVA (3φ)	

Blower power source shows the input voltage, input frequency and rated current when the power is input directly from the main power source.

CHAPTER 3 INSTALLATION

3-1 Acceptance Inspection

Upon accepting our products, check the following.

(1) Check if product is the ordered product. (type, output rating, etc.)

(2) Check if carton is broken.

(3) Check if accessories are delivered with the product. For a combination of accessories, see 8-5 Combination of motor, driver and accessories.

Caution: If the carton is broken, do not unpack but contact our sales staff.

3-2 Precautions for Installation (handling)

Handle with care so as not to drop the driver, etc.

Do not apply any strong force to the cover of the driver when handling.

3-3 Caution on Storage and Transportation of Motor

(1) Caution on storage

If your NIKKI DENSO producs are not to be used, but stored immediately upon receipt, please store them according to the conditons shown below to prevent rusting or undue deterioration of the insulation. However, it is advised to open the proudct packages as soon as they arrive to check that the product has not been damaged or mistreated in any way during transportation before actually putting the product into storage.

Please note that any defects caused by not observing the following storage conditions will not be covered by the NIKKI DENSO WARRANTY.

Item		Description
Ambient conditions	Temperature	−10°C ~ +60°C
	Humidity	85% or less, no condensation allowed.
	Storage location	Store in a location which is clean and free from any dust or dirt. Do not store in any potentially hazardous area including ones containing corrosive gas, grinding fluid, metal particles, oil, among others.
Vibration		Store in places free of vibration.
Others		The effective period for the rust preventive treatment of the product is a maximum of three months from the time of shipment from the NIKKI DENSO plant. If the product is to be stored for a time exceeding the above period, the customer is required to apply his own rust-proofing treatment to machine surfaces and to periodically check on their condition.

(2) Caution on transportation

If your NIKKI DENSO producs are not to be re-transported after initial receipt, transport them under the following conditions. If the product is transported without observing the following conditions, the NIKKI DENSO PRODUCT WARRANTY will be null and void.

Item		Description
Ambient conditions	Temperature	−10°C ~ +60°C
	Humidity	85% or less, no condensation allowed.
	Transportation condition	Do not transport in potentially hazardous surroundings affected by corrosive gas, grinding fluid, metal particles, oil, among others.
Vibration resistance		0.5G

3-4 Caution in Storage and Transportation of Driver

(1) Caution on storage

If your NIKKI DENSO producs are not to be used, but stored immediately upon receipt, please store them according to the conditons shown below to prevent rusting or undue deterioration of the insulation. However, it is advised to open the proudct packages as soon as they arrive to check that the product has not been damaged or mistreated in any way during transportation before actually putting the product into storage.

Please note that any defects caused by not observing the following storage conditions will not be covered by the NIKKI DENSO WARRANTY.

Item		Description
Ambient conditions	Temperature	-10°C ~ +60°C
	Humidity	85% or less, no condensation allowed.
	Storage location	Store in a location which is clean and free from any dust or dirt. Do not store in any potentially hazardous area including ones containing corrosive gas, grinding fluid, metal particles, oil, among others.
Vibration		Store in places free of vibration.
Others		If the product is to be stored over a long period, the customer is required to apply his own rust-proofing treatment to machine surfaces and periodically check on its condition.

(2) Caution on transportation

If your NIKKI DENSO producs are to be re-transported after initial receipt, transport them under the following conditions. If the product is transported without observing the following conditions, the NIKKI DENSO PRODUCT WARRANTY will be null and void.

Item		Description
Ambient conditions	Temperature	-10°C ~ +60°C
	Humidity	85% or less, no condensation allowed.
	Transportation condition	Do not transport in potentially hazardous surroundings affected by corrosive gas, grinding fluid, metal particles, oil, among others.
Vibration resistance		0.5G

Do not apply any strong force to the cover of the driver when handling.

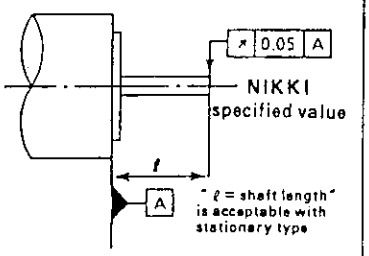
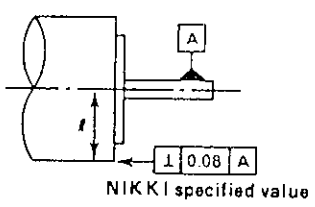
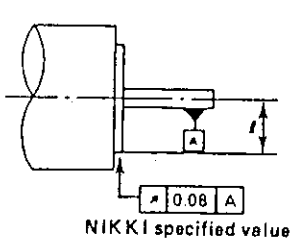
3-5 Installation Conditions of Motor

3-5-1 Centering of Motor Shaft

(1) To prevent any center deflection in the installation of the motor, see Table 3-1 "Machining Accuracy".
(2) It is recommended that the flexible joint, that can absorb any center deflection of the shaft, be used when connecting motor shaft to load shaft.
(3) When transmitting power by means of pulley or belt, see Table 3-2 (Allowable Load for Output Shaft) so that load to be applied to the shaft end does not surpass allowable value.

Caution: The center deflection, when load is connected, may increase load to motor causing

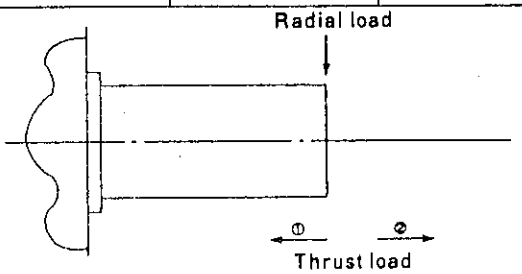
Table 3-1 Machining accuracy of motor shaft portion

		
Deflection of output shaft against the flange face	Squareness of flange face against output shaft	Degree of center deflection of faucet joint against output shaft

Supplement: The value in figure is applicable when $\ell \leqq 100$. When $\ell > 100$,
Specified Value $\times \sqrt{\ell/100}$ to be applied.

Table 3-2 List of allowable loads for motor output shaft

Motor type	Output (W)	Thrust load (Kg)	Thrust load direction	Thrust load (Kg)
NA21-1.5F	50	8	Both direct.	11
NA21-3F	100	8	Both direct.	11
NA21-6F	200	8	Both direct.	19
NA21-10F	300	8	Both direct.	19
NA20-15F	400	20	Both direct.	25
NA20-20F	600	20	Both direct.	50
NA20-40F	800	25	Both direct.	60
NA20-75F	1.5K	25	Both direct.	65
NA20-110F	2.2K	65	One direct②	125
NA20-180F	3.7K	65	One direct②	125
NA20-270F	5.5K	85	One direct②	180
NA20-370F	7.5K	85	One direct②	180
NA20-550F	11K	100	One direct②	220
NA20-750F	15K	140	One direct②	220
NA20-1100F	22K	140	One direct②	220
NA20-1500	30K			280
NA20-1800	37K			280
NA20-2700	55K			390
NA20-2200-10	22K			280
NA20-3700-10	37K			375
NA20-5500-10	55K			350
NA30-13F-15	200	25	Both direct.	30
NA30-25F-15	400	45	Both direct.	55
NA30-50F-15	800	55	Both direct.	65
NA30-110F-15	1.6K	75	Both direct.	90
NA30-180F-15	2.8K	75	Both direct.	110



Caution:

1: NA20-1500 or above do not have a structure to which a thrust load can be applied. Be aware of this.
2: Allowable thrust loads for NA20-110F-1100F are unilateral.
3: When thrust load and radial load are applied simultaneously, the values are different from the values in the list. Keep this in mind.

3-5-2 Considerations about Cooling

The allowable ambient temperature range of the motor is 0 ~ 40°C.

About 10% of motor capacity is radiated in the form of heat, so arrange cooling system so that this heat can be dissipated efficiently.

3-6 Driver Installation Conditions

3-6-1 Location

(1) Temperature in the enclosed control board
The temperature in the control board for housing the driver should be between 0 ~ 50°C.

(2) If there are any radiating bodies and vibration sources, be sure that the driver cannot be affected by these.

(3) Avoid any surroundings that have high temperature or humidity, dust, iron chips, soot or any environment that has corrosive gas.

(4) If there is a noise source such as an electric welding machine operating near the location of the driver, induction noise may mix, so strengthen the grounding treatment. Depending on the operating environment, a noise filter may be required.

(5) The inside of the board should be well air ventilated.

3-6-2 Installation Method

(1) It is normal to install the driver vertically.
Install the driver vertically so that the unit has effective radiation.

(2) Secure a space of 10cm or more above and below the driver. (Fig. 3-1)

(3) The NPSA-NN/NF/20N/PN/PNN can be installed on a panel or embedded using the attached metal fittings. (Fig. 3-2) The NPSA-35N onward and NH type are to be installed on the panel. (Fig. 3-3)

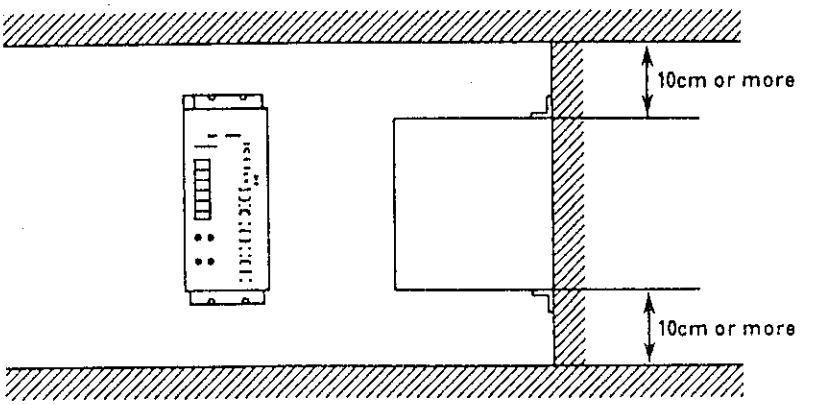


Fig. 3-1 Driver istallation and air ventilation

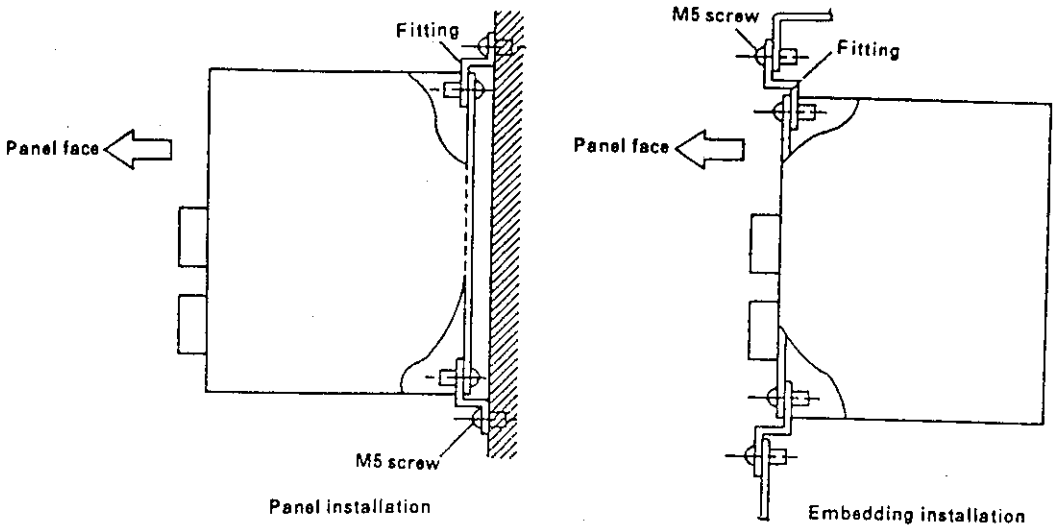


Fig. 3-2 Installation of NPSA-NN/NF/20N/PN/PNN

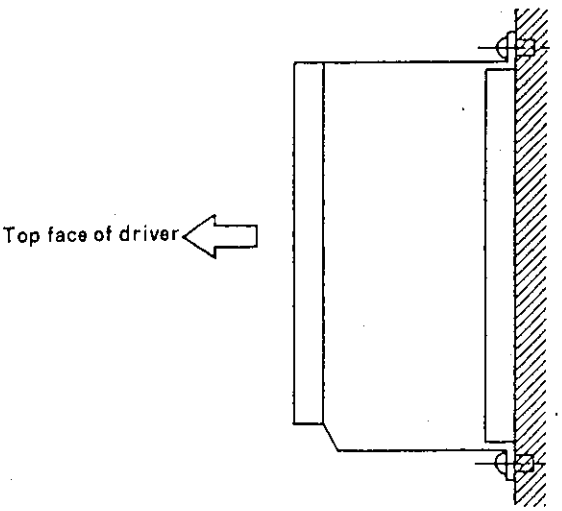


Fig. 3-3 Installation of NPSA-N, NH

3-6-3 Cooling

(1) The allowable ambient temperature of the driver is within the range of 0 ~ 50°C.
The calorific power of the driver is about 10% of the approx. motor capacity + some 60W.

(2) Select the cooling blower or heat exchanger that has a capacity calculated by the above equation or a larger capacity.

(3) When using a multi-shaft structure and installing multiple drivers in the one housing board, give special consideration to cooling.

(4) The cooling blower is used in NPSA-10NN onward, 5NF, 10PNN/20PNN and N, NH type drivers. Allow sufficient space so that sufficient air ventilation can be provided.

Caution: **If ambient temperature is over allowable ambient temperature (0 ~ 50°C) of the driver, overheating may cause failure or damage of unit parts resulting in malfunction or inoperability of the driver. Therefore, keep ambient temperature within the specified range.**

(5) When installing multiple drivers or a ventilating fan on the board, if the ventilating fan installation location is inappropriate, ambient temperature of the driver may rise or ineffective ventilation may be caused. So sufficient care should be exercised in this matter. (Fig. 3-4)

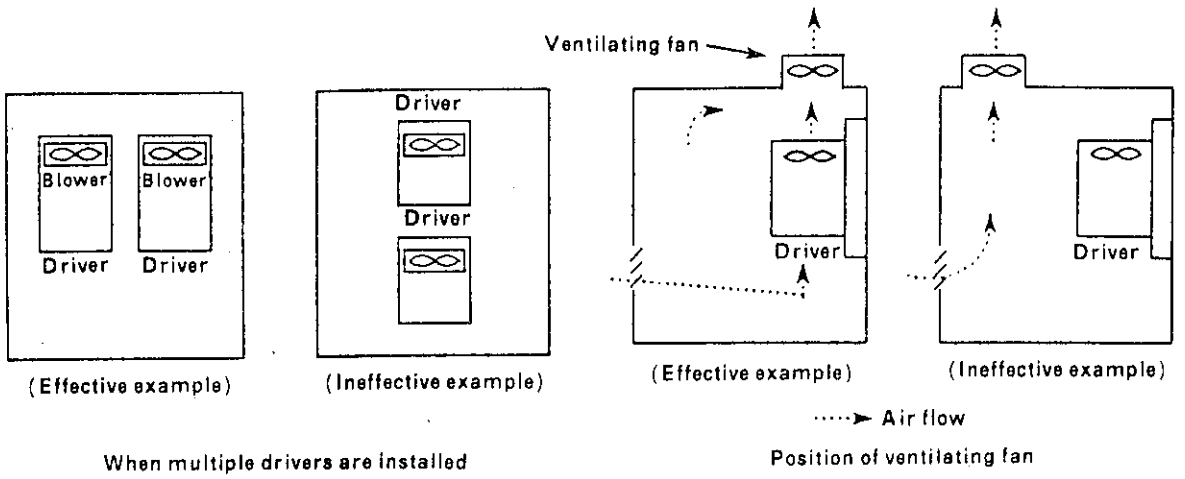


Fig. 3-4 Considerations about cooling

3-7 Installation Instructions

To install each unit, properly observe the descriptions and cautions indicated of each item in this manual, observing precautions.

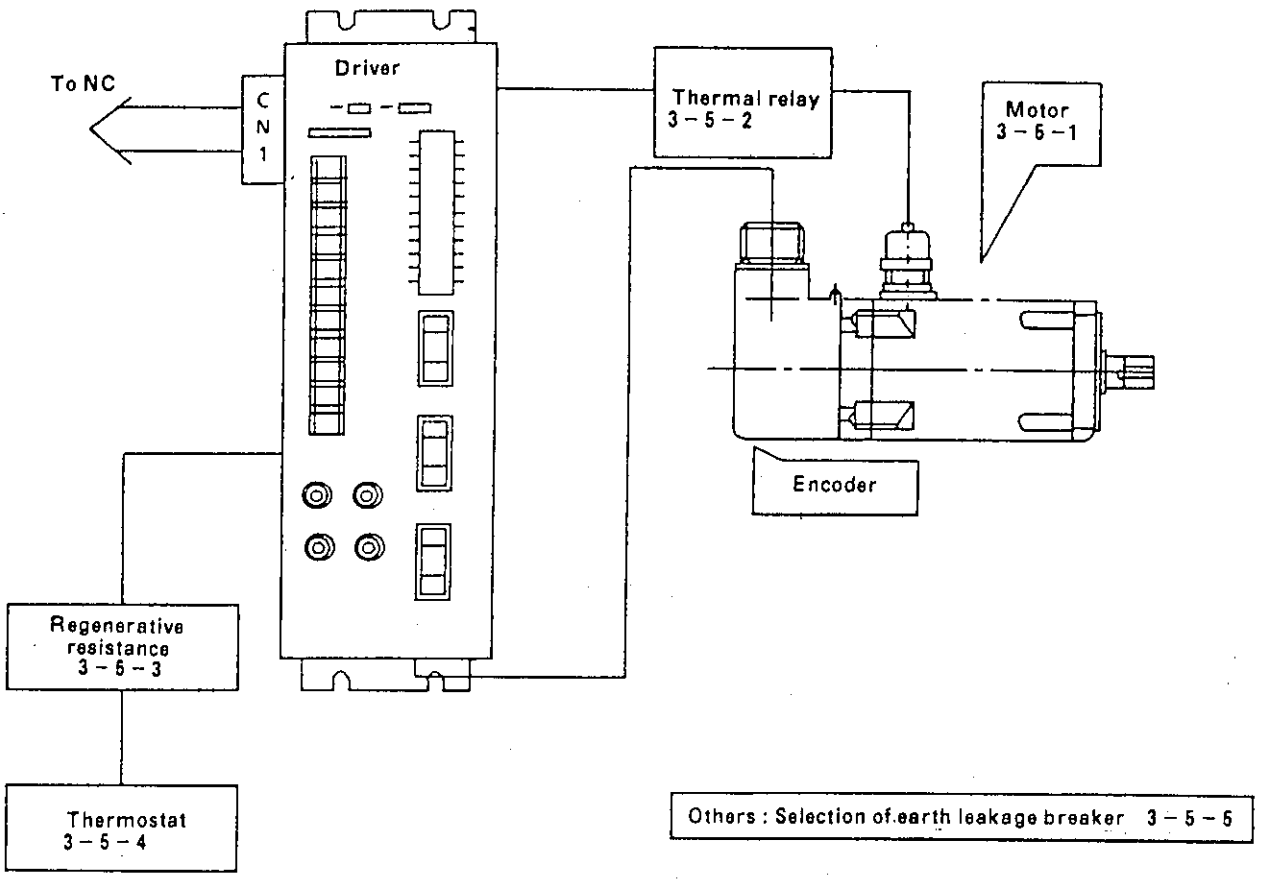


Fig. 3-5 Item to be referred to for the installation of each unit

3-7-1 Motor

(1) When assembling a coupling onto shaft, be careful not to give a shock of 10 G or more. Do not strike shaft end with a hammer. (Fig. 3-6)

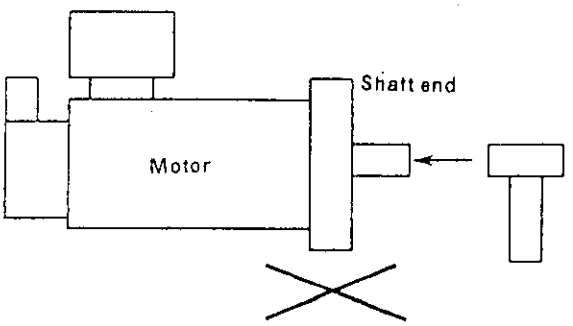


Fig. 3-6 Do not strike motor shaft

(2) Check if shaft key has play and if screw is loose.
(3) Do not change direction of encoder on the motor.
(4) If the location is exposed to oil or water, arrange so that oil or water cannot enter motor by flowing along lead wire.
If the lead wire allows entry of water or oil, it may affect motor or encoder. Therefore, be sure that lead wire cannot be accidentally dipped in oil or water.
(5) In self mobilizing applications in which motor itself shifts, care should be taken so that the cable cannot be cut or stepped over during operation.
(6) Use the oil seal specified by NIKKI DENSO. This is available as an option. Consult our sales staff.

3-7-2 Thermal Relay

(1) Thermal relay type
Use the TR-ISN~TR-10N thermal relays manufactured by Fuji Electric Co., Ltd.

(2) Installation of thermal relay
When thermal relay senses over current from driver to motor, it outputs the contact point signal. Therefore, install it carefully. Error in installation may cause malfunction.

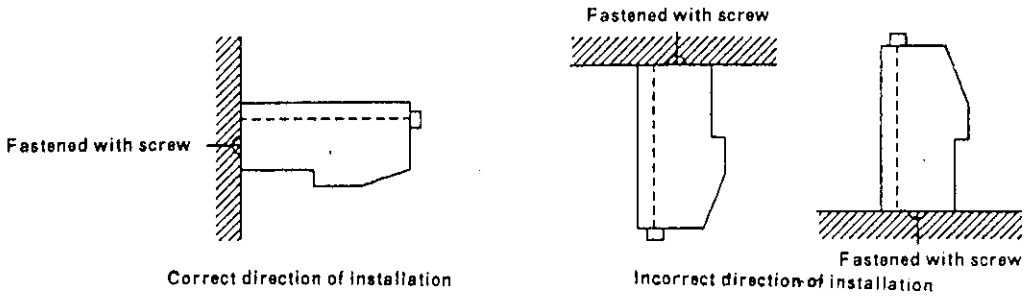


Fig. 3-7 Direction of installation of thermal relay

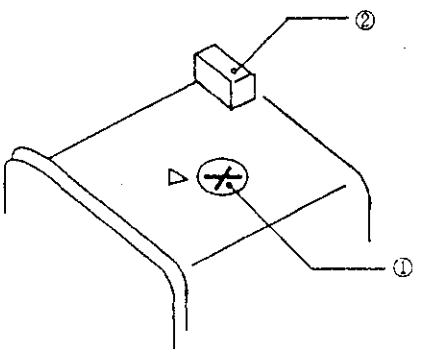


Fig. 3-8 Adjustment dial, full reset button

(3) Operating the thermal relay

① Adjustment dial

Turn adjustment dial using a Phillips screwdriver to set value on dial to the rated current of the motor.

The set value varies depending on combination of driver and motor. When setting, see 8-2 (Electrical Specifications).

② Full reset button

When the reset button is pushed in to full depth, it may trip mechanically. If it trips, press down the button manually to reset.

Caution: **At time of shipment from factory, value not set, so set value to rated current of motor.**

3-7-3 Regenerative Resistance

The role of regenerative resistance is to radiate energy that cannot be absorbed through a regenerative condenser because of too large a load inertia, out of the regenerative energy to be generated when motor brake is applied. (Fig. 3-9, 3-10)

Since regenerative resistance radiates heat, do not install anything around that may be affected by heat when installingregenerative resistor.

Regenerative energy can be expressed by the following formulae.

$$E = \frac{GD^2 \times N^2}{730 \times 10^3} \text{ (Kw·S)}$$

$$Wr = E/t \text{ (Kw)}$$

E: Total regenerative power (kw · S)
GD^2: Total GD^2 (kg · m²)
N: motor (rpm)
Wr: Average regenerative power (kw)
t: Time (sec) Figure shown below.

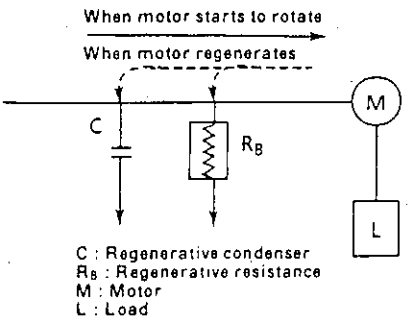


Fig. 3-9 Direction of current

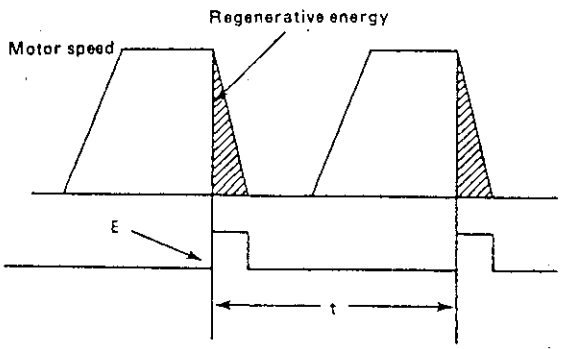


Fig. 3-10 Motor speed and regenerative energy

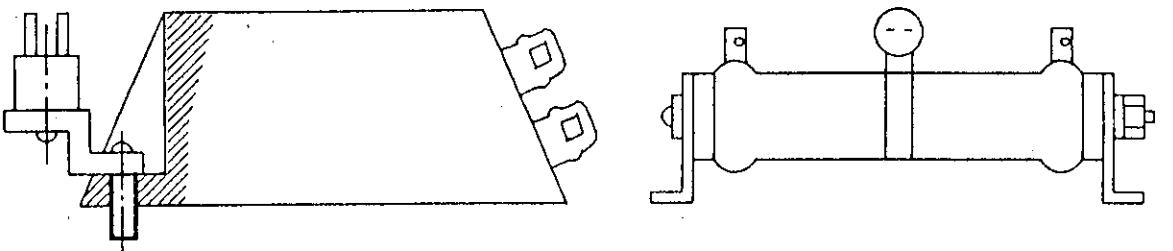
For applicable regenerative resistance classified by driver type, see 8-4-2 (Regenerative Resistance).

Caution: **If load inertia is large or forward/reverse and start/stop occurs frequently (duty cycle is extreme), capacity of resistance to be supplied with accessories may be insufficient, so when placing an order consult our sales stuff.**

3-7-4 Thermostat

When regenerative resistance radiates heat excessively, thermostat operates and outputs contact point signal. Connect the thermostat to the circuit that is capable of cutting off the power to protect the driver. The contact point capacity of the thermostat is 200V AC 1A.

Caution: **If excessive current flows when the regenerative resistor is used, parts in the thermostat may melt. Therefore, when a contact point signal is output, connect to the circuit that is capable of cutting off the power.**



Location of thermostat in case of cement resistance

Location of thermostat in case of porcelain enamel resistance (Install at center).

Fig. 3-11 Location of thermostat

3-7-5 Selecting Earth Leakage Breaker

Since the NIKKI driver drives a motor using the inverter system, its output voltage contains harmonic components, so current leakage to the ground may be generated simultaneously depending on ground static capacity on wire route from driver to motor and floating capacity between motor coil and iron core.

Therefore, when an earth leakage breaker is to be installed on the power source side of the driver, select the 50/60 Hz inverter type breaker out of products sold on the market. (Because current leakages of harmonic component may cause malfunctions.)

When selecting sensitivity current, see extension provision 135-2-4.

Caution: 1. If wire route is long, the current leakage from electric wire cannot be ignored.
2. To reduce current leakage, use as short an electric wire as possible and wire as far from the ground as possible (about 30 cm).

CHAPTER 4 WIRING

4-1 Cautions on Wiring

4-1-1 Cautions on Wiring Main Circuit

Observe the following cautions when wiring the main circuit.

(1) Connection

① Care must be taken for the phase sequence of motor and driver connection terminals (U, V, W), or the motor will not operate normally.
For reversing motor revolution, see 4-5-2 "Setting Direction of Motor Revolution".

② Don't connect a magnet relay or non-fuse breaker to wiring between motor and driver. Connect only thermal relay supplied with accessories to wiring.

③ When using motor with cooling blower, always connect cooling blower to motor and check operation of the blower.

(2) Grounding

① Always ground wiring to prevent potential hazards and noise.

② Apply Class 3 grounding and over. Ground wiring to the grounding terminal (E) of driver. Use a cable having a diameter equivalent to that of power cable or over.

③ Ground motor by the ground terminal (E) of the motor terminal box or main motor unit and the ground terminal (E) of driver.

(3) Cable

Diameters of cables differ according to types of motor. Select appropriate cable diameter according to 4-2 "Service Cable".

(4) Thermal relay

① Use attached thermal relay.

② Set adjustment dial of thermal relay to rated current value of motor in use. For rated current value of respective motors, see tables of 8-2 "Electric Specifications".

③ When the thermal relay is actuated and a contact signal is output, always turn shut-off signal (SO) to ON and assemble a circuit for stopping the motor.

(5) Regenerative resistor

① Use the regenerative resistor supplied with accessories (NPSA-2.5NN/2.5PNN is not accompanied with regenerative resistor).

② Since heat is generated by regenerative energy, locate the resistor so that other equipment will not be affected by heat.

③ When making multiple connections, connect cables in parallel.

4-1-2 Cautions on Grounding

Ground with a dedicated terminal according to the Class 3 grounding mode (100 ohms or under). This reduces noise and eliminates device malfunction.

Caution: 1. To reduce noise and prevent device malfunction, install dedicated Class 3 grounding (100 ohms or under).
2. If no dedicated grounding is available, split a shared grounding with some other device at the grounding point. Avoid sharing groundings with any high-power equipment.
3. Don't ground to the steel structure of any building.

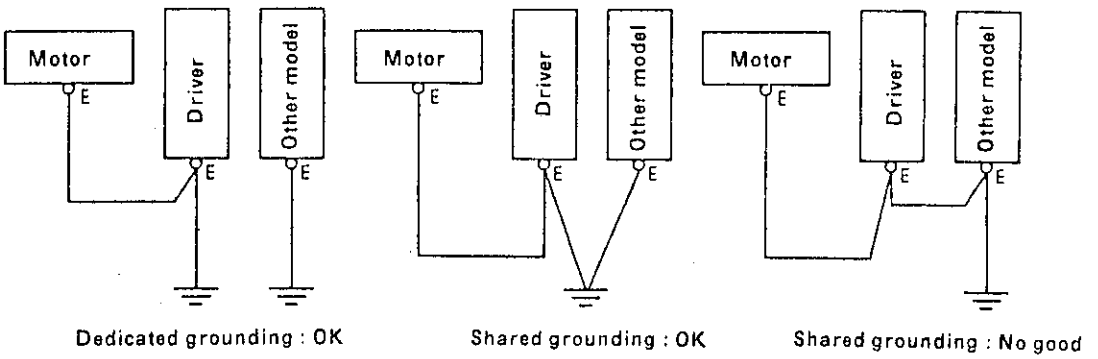


Fig. 4-1 Grounding

4-2 Service Cable

For service cable, use cables as listed in Tables 4-1 & 4-2.

Table 4-1 Service cable

Unit: mm²

Name \ Type		Terminal	NPSA-2.5 NPSA-5	NPSA-10	NPSA-15	NPSA-20
Main circuit	AC power supply	R, S	2	—	—	—
	AC power supply	R,S,T	—	2	2	3.5
	Grounding	E	2	2	2	3.5
	Motor	U,V,W	0.75~ 2	2	2	3.5
	Motor cooling blower	U,V	—	—	0.75	0.75
	Regenerative resistor	B_1,B_2	0.75	0.75	2	3.5
Control circuit	Speed setting Torque setting	INL,INH LM1,LM2	0.5 2-core shielded cable			
	Control circuit	DR SO TL RST	0.5 shielded			
	Encoder		8-core twisted and shielded cable (optional)			
	Servo-ready	TS1,TS2	0.5			
Position control circuit	Control I/O	CNA	0.5			
	Pulse-train input	CNB	Twisted and shield cable			
	Indicator (optional)	CNC	Dedicated cable			

Table 4-2 Service cable (NPSA-35N~NPSA-220N, NPSA-20NH~NPSA-300NH)

Unit: mm²

Name	Type / Terminal	NPSA-20NH	NPSA-35N	NPSA-35NH	NPSA-45N	NPSA-45NH	NPSA-75N	NPSA-75NH	NPSA-100N
Main circuit	AC power supply — R, S,T	2	5.5	2	5.5	2	14	3.5	22
	Grounding — E	2	5.5	2	5.5	2	14	3.5	22
	Motor cable — U,V,W	2	5.5	2	8	3.5	14	5.5	22
	Motor cooling blower — U, V	0.75							
	Regenerative resistance — B1, B2	2	3.5	2	3.5	2	5.5	3.5	8
Control circuit	Speed setting Torque setting — INL, INH LM1, LM2	0.5 2-core shielded cable							
	Control signal — DR SO TL RST	0.5 shielded cable							
	Encoder	8-core twisted and shielded cable							
	Servo-ready — TS1, TS2, TS3	0.75							

Name	Type / Terminal	NPSA-100NH	NPSA-140N	NPSA-140NH	NPSA-180N	NPSA-180NH	NPSA-220N	NPSA-300NH-30-A31-A	NPSA-300NH-50-A51-A
Main circuit	AC power supply — R, S,T	5.5	30	8	50	14	80	22	38
	Grounding — E	5.5	30	8	50	14	80	22	38
	Motor cable — U,V,W	8	38	14	50	22	80	30	60
	Motor cooling blower — U, V	0.75	1.25						
	Regenerative resistance — B1, B2	3.5	14	5.5	14	8	38	8	22
	Power unit — DP, DN	—	—	—	—	—	—	—	50
Control circuit	Speed setting Torque setting — INL, INH LM1, LM2	0.5 2-core shielded cable							
	Control signal — DR SO TL RST	0.5 shielded cable							
	Encoder	8-core twisted and shielded cable							
	Servo-ready — TS1, TS2, TS3	0.75							

4-3 Anti-noise Measures

4-3-1 Anti-noise Measures

External noise enters the wiring from the power supply and signal cable. Noise from signal cable is preventable by the arrangement of wiring.

(1) Signal cable

Keep the signal wiring (DR, S0, TL, and RST) as short as possible within a maximum 2 meters. When extending the wiring to longer than 2 meters, use a microcurrent type relay (Fig. 4-2).

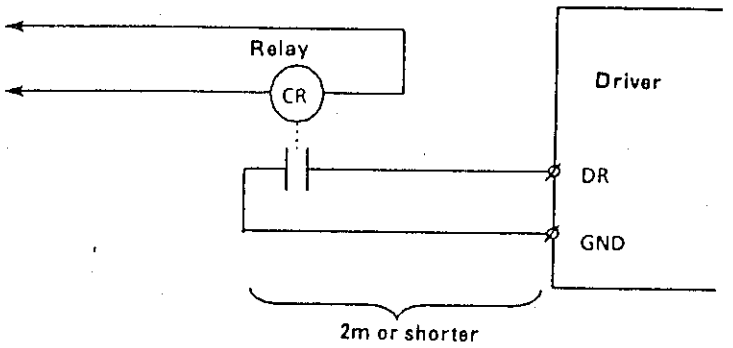


Fig. 4-2 Anti-noise measures for signal cable

(2) Analog input signal cable

Use a shielded cable for speed command input, torque control input and other micro-analog input signals. Separate wiring from cables for high-power wiring. Connect shielded cable to grounding terminal (E) on driver side. Don't connect it to grounding terminal on the side of any other device. (Fig. 4-3)

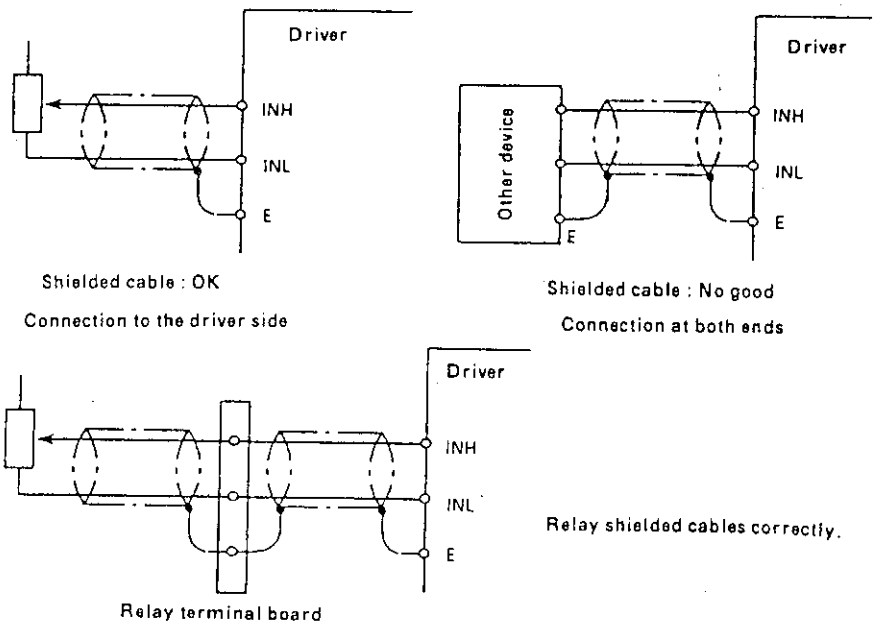


Fig. 4-3 Anti-noise measures for analog input signal cable

If speed input and torque control input signal cables are extended, they will be more easily affected by noise. Connect an isolation amplifier, etc. to the cables.

(3) Wiring

Separate power cable (motor, solenoid, relay) from signal cable. Don't place them in the same duct. If separation is impractical, wire them so that two cables will not run in parallel, or, place the signal cable inside a metal tube to shut off noise.

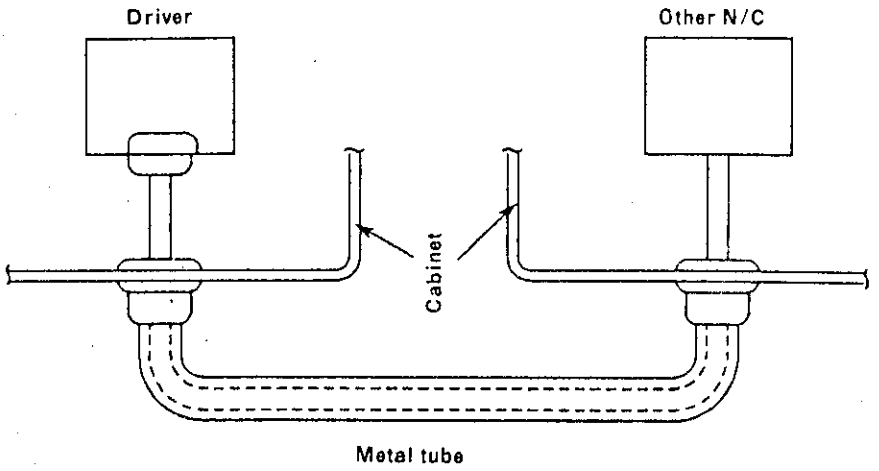


Fig. 4-4 Anti-noise measures for power and signal cables

(4) Installation of noise killer

Suppress noise generation by installing a noise killer (for AC power supply) or a diode (for DC power supply) to a relay, electromagnetic brake, solenoid, etc. when they are used near the driver. Install the noise killer or diode as close to any noise-generating device as possible (Fig. 4-5).

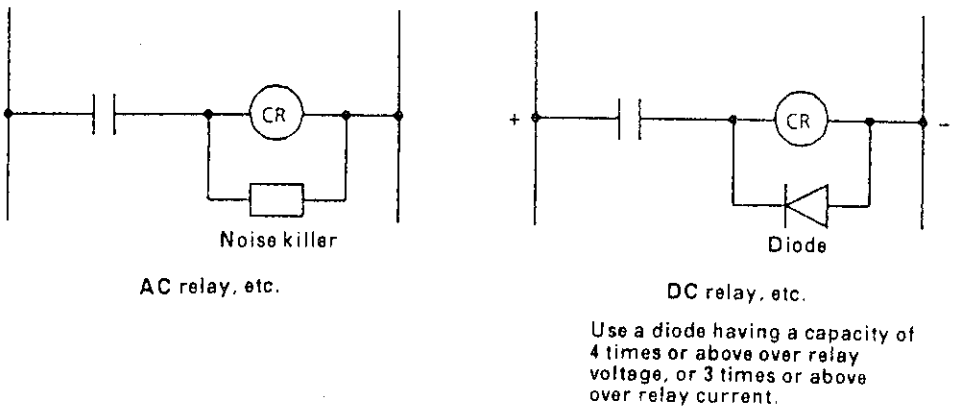


Fig. 4-5 Anti-noise measures for relay, etc.

4-3-2 Anti-noise Measures when Sharing Power Supply with Induction Motor

With a main power supply connection as shown in Figure 4-6, spike voltage generated during forward or reverse revolution of an induction motor (IM1) may cause damage to diode stack inside the driver. Since the withstand voltage of diode stack is 800 V, insert spike killers, etc. to main power supply (between R-S-T) to suppress spike voltage under 800 V if IM1 is a high-capacity induction motor.

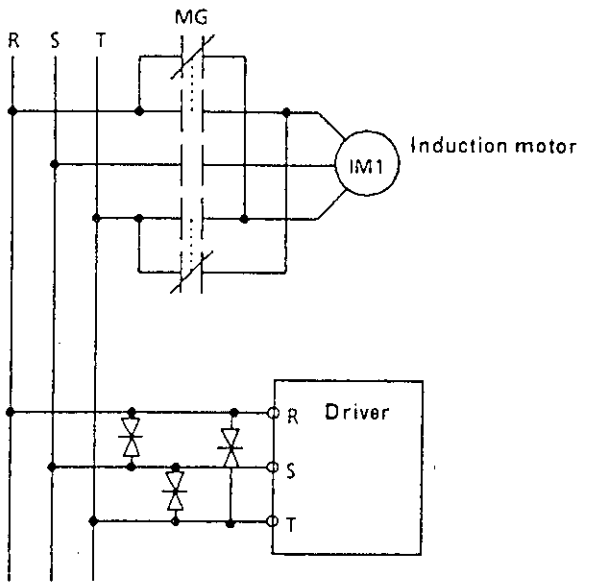


Fig. 4-6 Sharing power supply with induction motor

4-3-3 Cautions on Encoder Cable Wiring

If an encoder cable is wired through a relay terminal installed between a motor and a driver as shown in Figure 4-7, noises may enter the encoder cable from unshielded relay terminal to prevent it from performing normally. Provide relay terminal with complete shielding or don't relay the encoder cable.

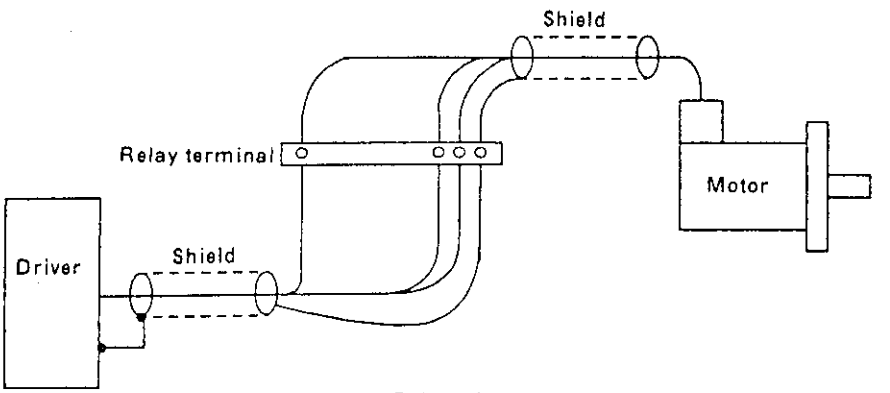


Fig. 4-7 Relay of encoder cable

4-3-4 Caution on Regenerative Resistor Wiring

Connect a regenerative resistor to the driver with as short a wiring as possible within a maximum of 1 meter. If wiring between them becomes longer, transistors inside driver may be damaged by noise causing malfunction.

Caution: Limit length of wiring between regenerative resistor and driver to within a maximum of 1 meter.

4-4 Input Power Circuit

4-4-1 Input Power Circuits by Model Type

The following diagrams explain circuits recommended by NIKKI DENSO.

When the "Operation ON" switch is closed, the electromagnetic switch "CR" makes the relay contact "CR" close and electric power is supplied to the driver.

During supplying the power to the driver, if the "Operation OFF" switch is opened, the power to the electromagnetic switch "CR" is cut, relay contact "CR" is opened and the power to the driver is cut

And driving supplying the power to the driver, if the contact of "Thermostat" to the regenerative resistor is opened, the power to the electromagnetic switch is cut , relay contact "CR" is opened and the power to the driver is cut.

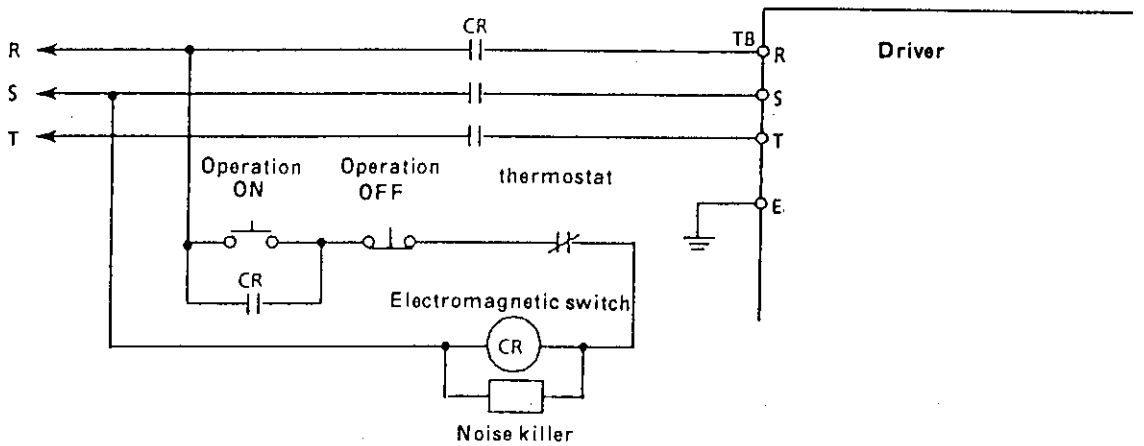


Fig. 4-8 Input power supply

Cautions: (1) When using an electromagnetic switch, always use a noise killer.
(2) Avoid sharing the power supply with a large capacity driver and any other high-power device.

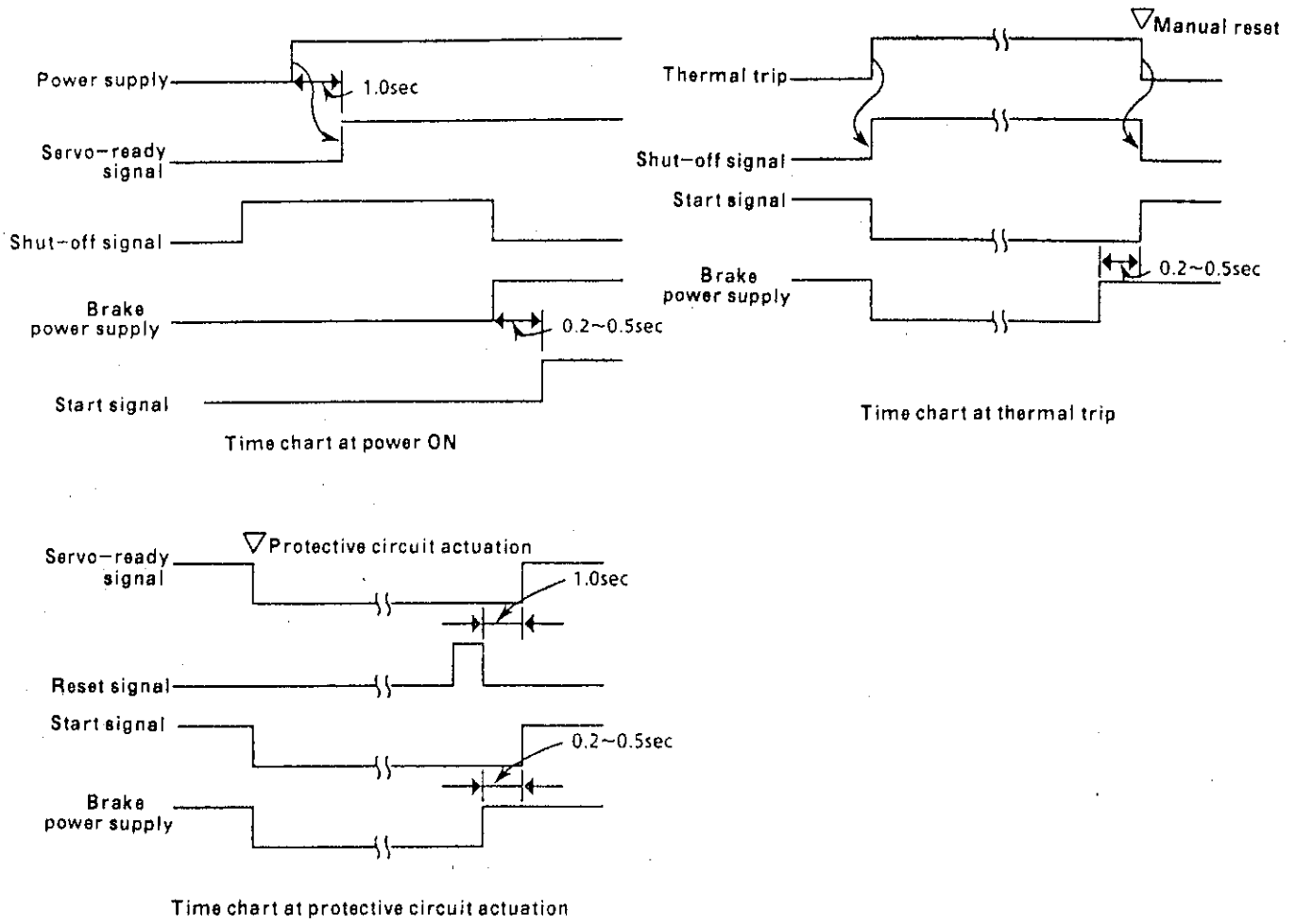


Fig. 4-9 Time charts of various signals

4-5 Motor Input/Output Circuit

4-5-1 Motor Output Circuit Connection

Make connections according to the following procedures:

(1) Connect motor connection terminals (U, V, W) with servo driver connection terminal board (U, V, W). If motor connecting cables are colored, match U, V, and W with red, white, and black respectively.

(2) Always connect motor grounding terminal (E).

(3) Connect an attached thermal relay and set current value to the rated motor current. When thermal relay is actuated, stop motor operation. (Turn shut-off (S0) signal ON to stop the motor.)

(4) When using motor with brake, always release the brake before turning start signal (DR) ON (or the motor may burn out).

Caution: Always ground motor.

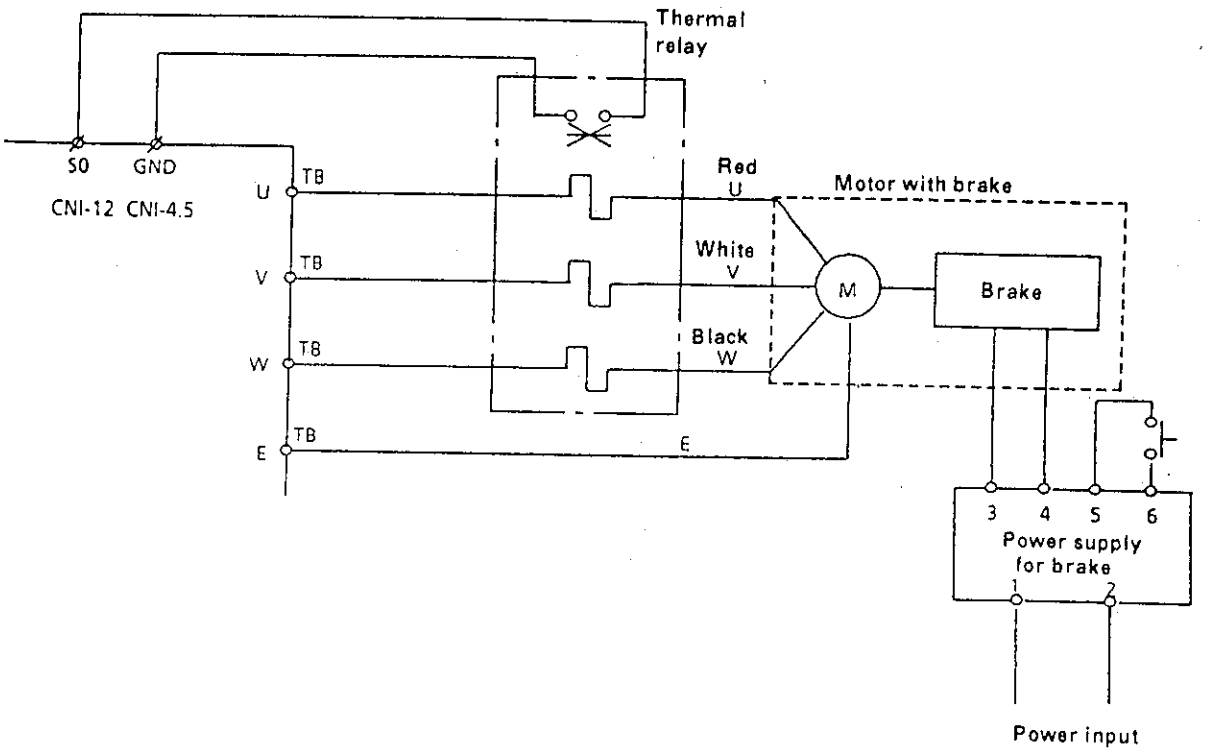


Fig. 4-10 Motor Input / Output circuit

4-5-2 Motor Rotation Direction Setting

Set the direction of motor rotation by wiring as follows:

(1) When a motor is standard-connected and a positive voltage or normal command pulse is input as speed command, the rotation will be counterclockwise when viewed from the side of load axis (normal rotation).

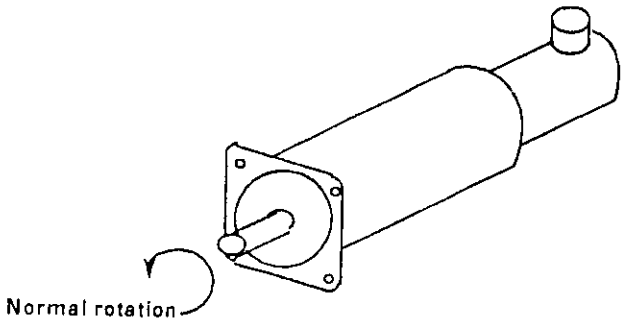


Fig. 4-11 Motor rotation (normal)

(2) To reverse rotation, input either negative command voltage, or reverse command pulse.

(3) To reverse motor through positive voltage command cr normal rotation command pulse, change phase sequence of motor main circuit and shift phase A and phase B signals of encoder feedback. To shift phases A and B of the encoder, cut jumper wire (J10) of the printed circuit board (Fig. 4-13).

(4) When encoder feedback phase sequence is shifted by dip switch SWEN3 of NPSA-PN/PNN,always shift phases U and V of motor and cut the jumper wire (J10).

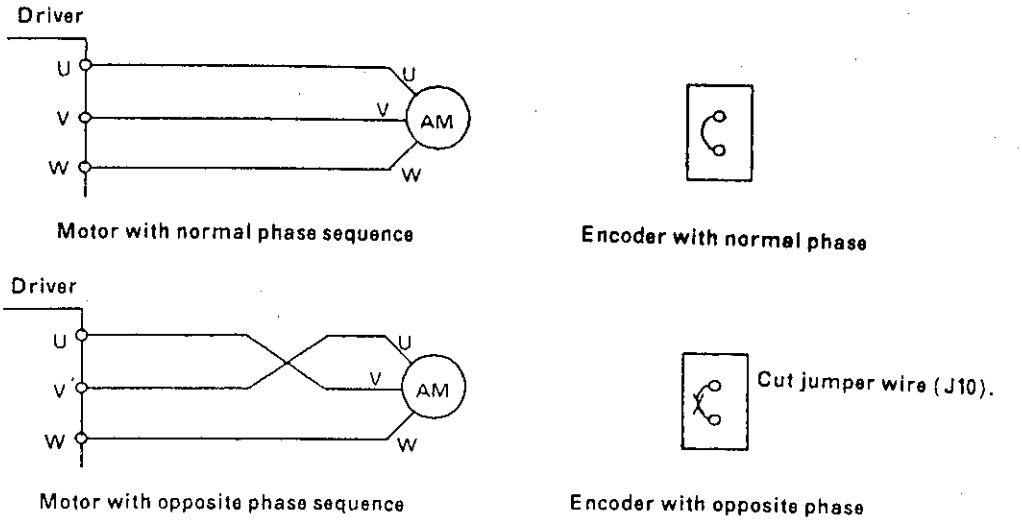


Fig. 4-12 Setting of motor rocation direction

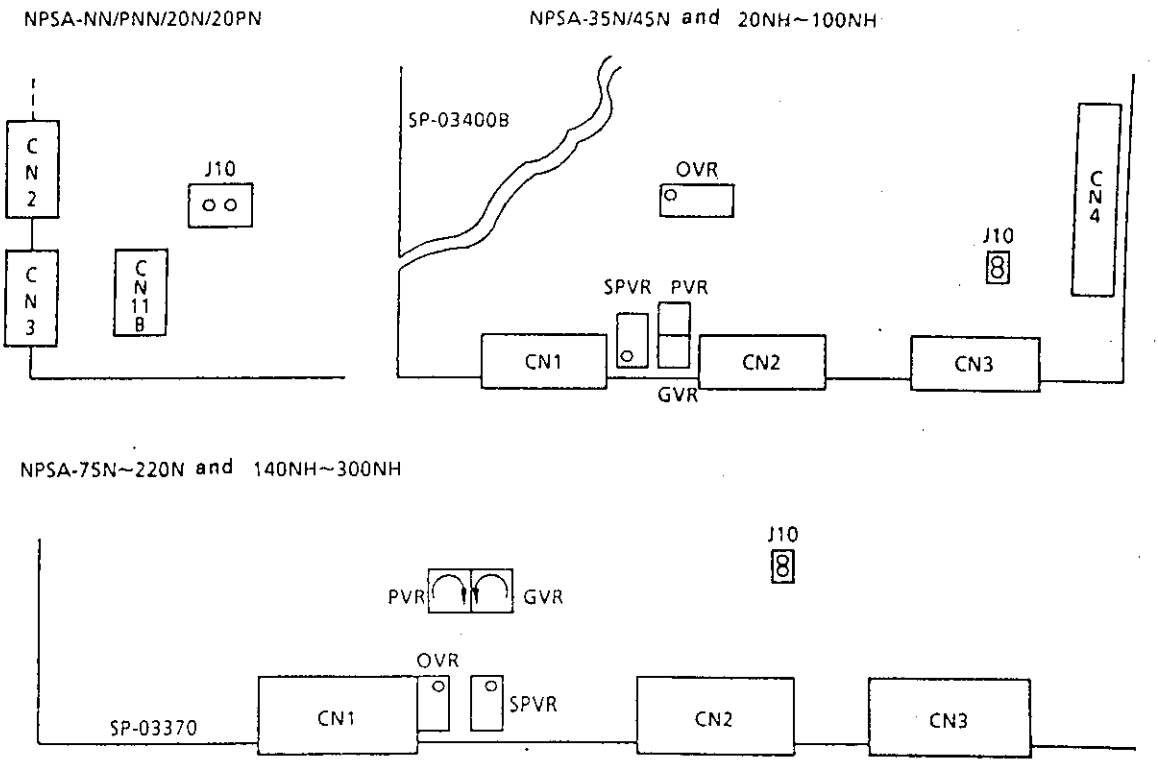


Fig. 4-13 Jumper wire position

4-5-3 Motor Cooling Blower Wiring

Motors having a capacity of NA20-110F and upward are equipped with a cooling blower. The following are the specifications of the equipped cooling blower. For rated current values of motors with cooling blowers, see 8-6 "Cooling Blower".

Caution: **Thermal relay of cooling blower not sold by NIKKI DENSO, so please obtain a suitable unit separately.**

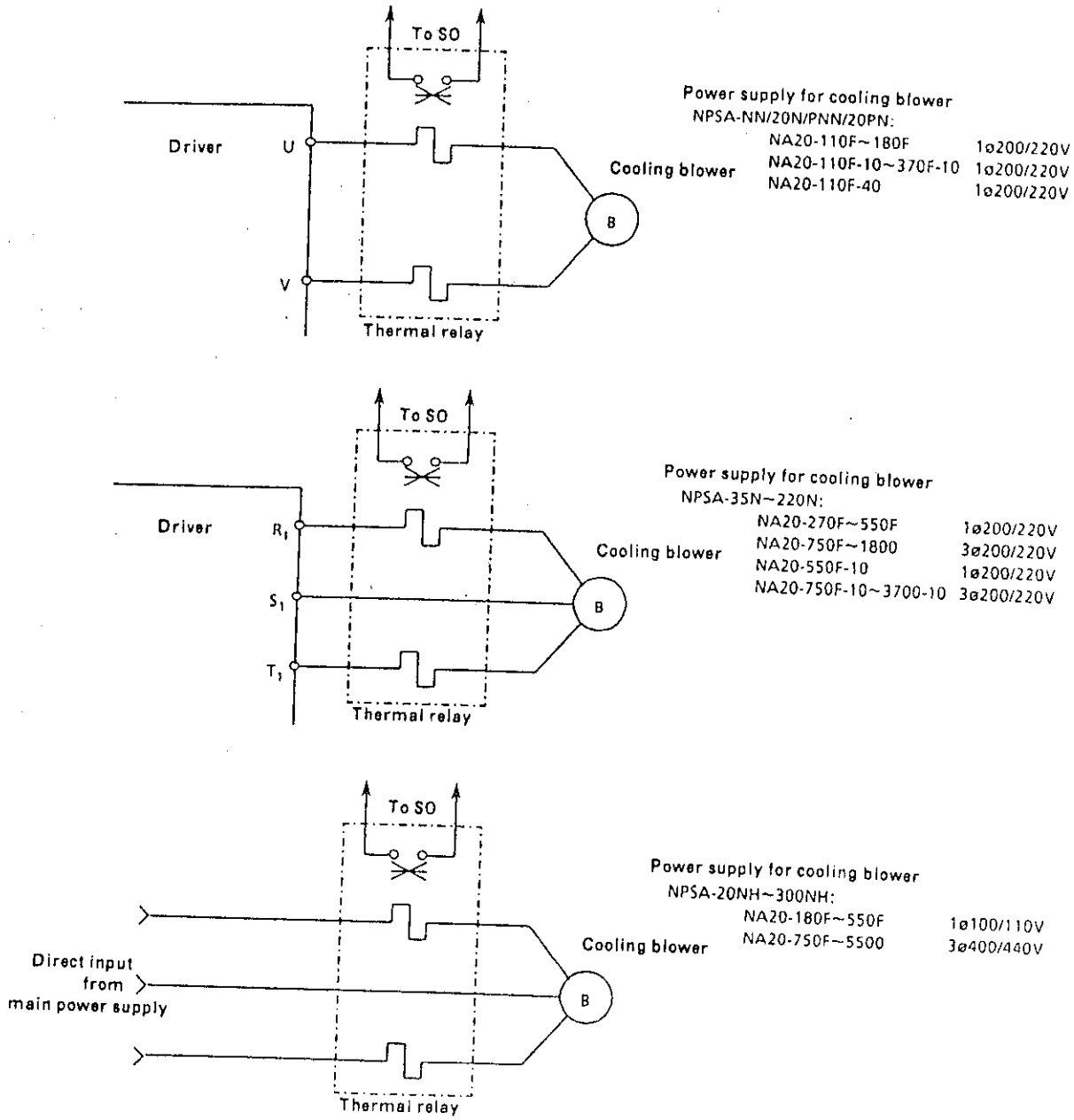


Fig. 4-15 Wiring of cooling blower and thermal relay to power supply

Caution: **Set thermal relay to rated current value of cooling blower motor.**

4-5-4 Electromagnetic Brake

Our motors are provided with a brake for holding.
Brakes are of a non-excitation actuation type. They release when a voltage is applied and close when there is no voltage. Figure 4-16 shows the structure of this brake. Our brakes are manufactured by Ogura Clutch, Tokushu Seiko, and Shinko Denki.

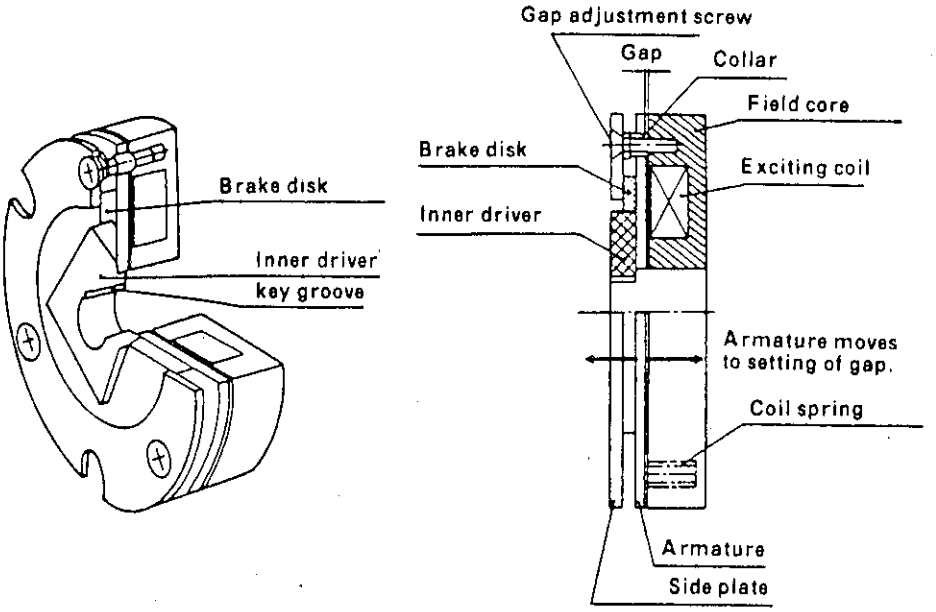


Fig. 4-16 Brake structure diagrams

As shown in the above diagram, the armature moves according to the portion of gap set, pushing in brake disk mounted to side plate to stop the motor. Time required for stopping the motor is 0.2 to 0.5 sec. Figure 4-17 shows wiring connection of brake.
Moreover, brake terminals are not polarized. If brake terminal P is connected to terminal 3 of brake power supply, connect N to 4.

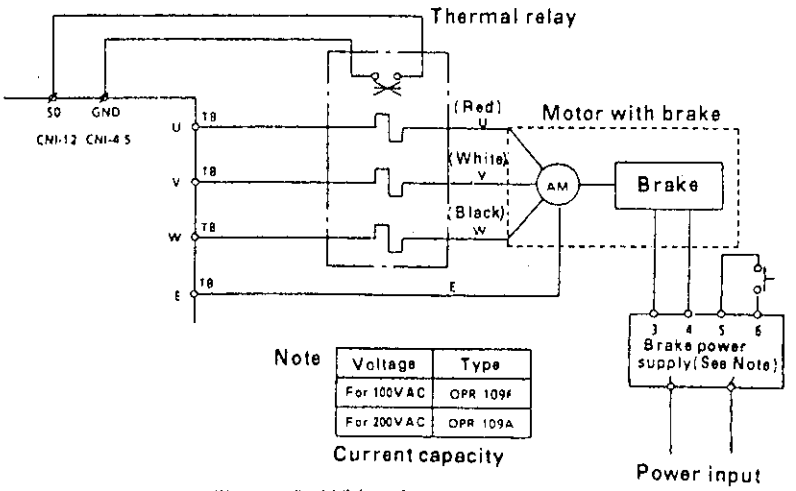


Fig. 4-17 Wiring for brake motor

Caution: Since brake requires 0.2-0.5 second to stop motor, set start signal (DR) timing with this in consideration (Fig. 4-18).
As brake is for holding, don't actuate it during motor operation.
Always turn start signal (DR) OFF before actuating brake.

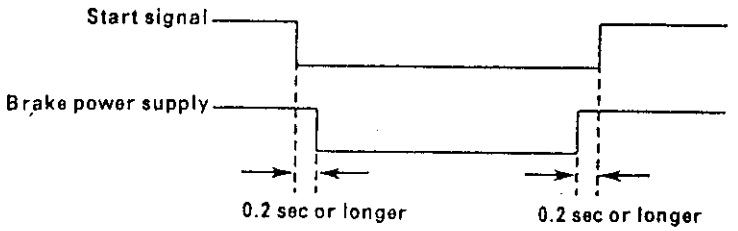


Fig. 4-18 Brake and start signal (DR) timing

Brake has backlash due to its structure.
See Table 4-4 for backlash angles.

Table 4-4

Motor type	Maximum backlash angle
NA20-6FB/10FB	1.15°
NA20-20FB	0.71°
NA20-40FB	0.63°
NA20-75FB	0.357°
NA20-110FB/180FB	0.297°
NA20-270FB/370FB	0.297°
NA20-550FB/750FB	0.318°
NA30-13FB-15	0.7°
NA30-25FB-15	0.6°
NA30-50FB-15	0.6°
NA30-110FB-15	0.6°
NA30-180FB-15	0.6°

4-5-5 Encoder Pulse Input (CN2) Wiring

Driver is adjusted in combination with pulse number of encoder incorporated into motor. When changing motor and/or driver, be sure in advance that encoder pulse numbers are the same. For wiring, follow the procedures below.

(1) Use 8-core shielded, twisted pair cable for wiring from motor. Keep wiring length to within 50 meters. (Cable is available optionally. Refer to 8-7 "Option".)
(2) Connect encoder output pulse to connector CN2 on driver side.
(3) For motor side connector, MS connector is used for the NA20-20F & upward and the NA30 series. SRC connector is used for the NA20-10F & downward (Table 4-5).

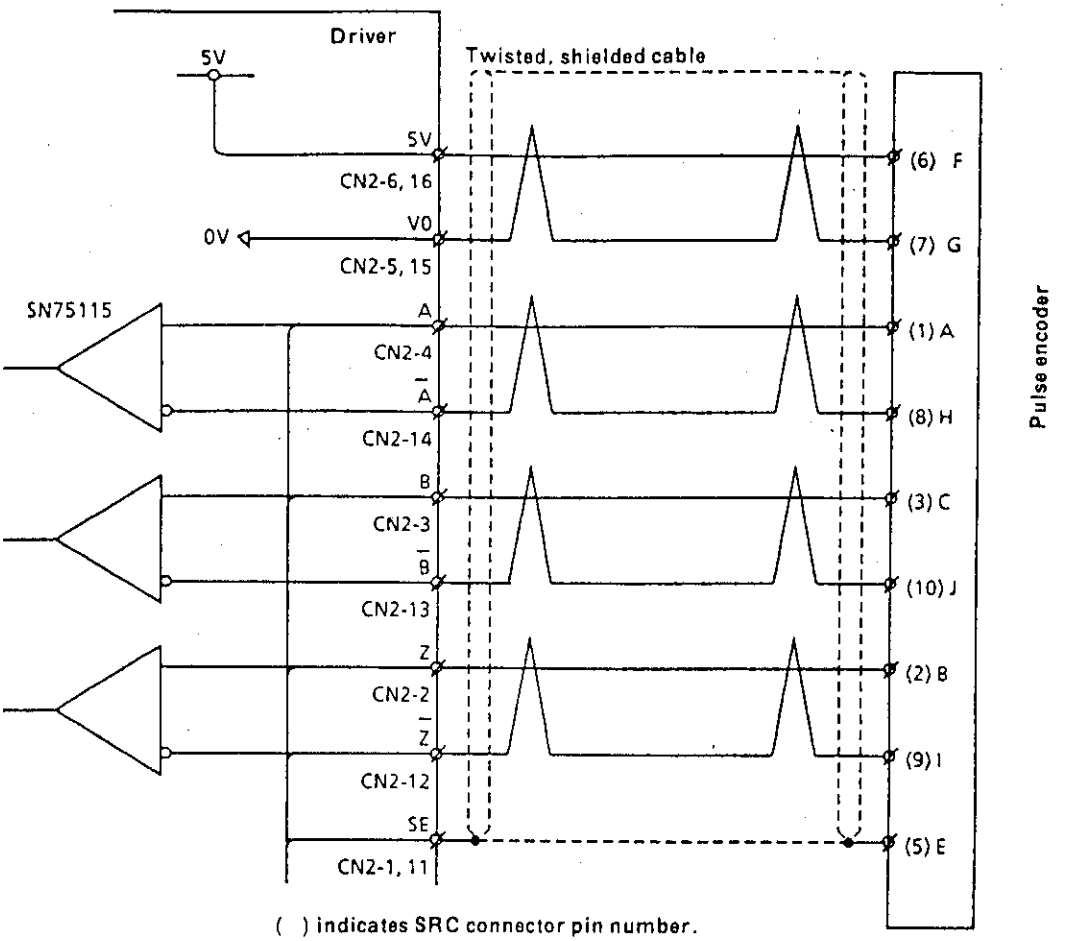


Fig. 4-19 Encoder and driver connection

Table 4-5 Encoder pulse input connector CN2

Pin number	Cable color	Name	Motor side connector pin number
1, 11	—	Shielded	E (5)
6, 16	White	Power supply +5V	F (6)
5, 15	Black	Power supply GND	G (7)
4	Red	Pulse signal A	A (1)
14	Black	Pulse signal $\overline{A}$	H (8)
3	Green	Pulse signal B	C (3)
13	Black	Pulse signal $\overline{B}$	J (10)
2	Yellow	Marker signal Z	B (2)
12	Black	Marker signal $\overline{Z}$	I (9)

Honda Communications Industry

*( ) indicates SRC connector pin number.

4-6 Regenerative Resistor

4-6-1 Regenerative Resistor Wiring

Connect a regenerative resistor to the driver (except for NPSA-2.5NN/2.5PNN). Keep wiring length to a maximum of 1 meter. Mount the regenerative resistor to terminals B1 and B2. For resistance value and capacitance, see 8-5 "Combination of Driver, Motor, and Accessories".

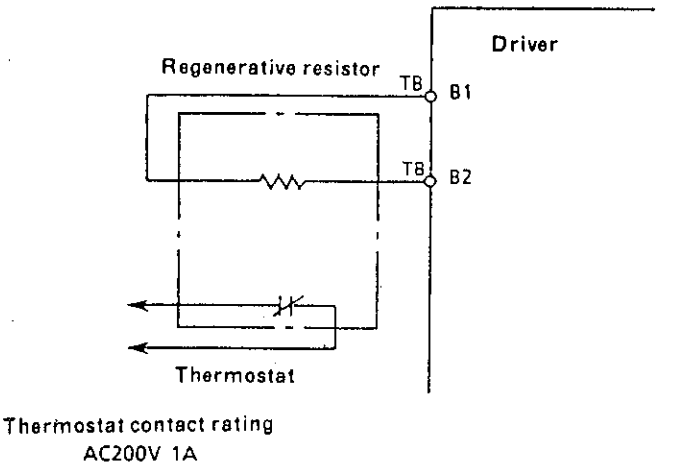


Fig. 4-20 Regenerative resistor wiring

Regenerative resistor is provided with a temperature detection thermostat. When mounting regenerative resistor, mount the thermostat using the fitting supplied with accessories.

Caution: 1. When more than one regenerative resistors are provided, always connect them in parallel.
2. If the regenerative resistor temperature rises because of excessive regenerative energy caused by high load GD^2 or some other reason, the thermostat detects it and outputs contact. Construct circuit for shutting power off using this contact signal.

4-7 Control Input/Output Signal

4-7-1 Control Input/Output Signal Table

Table 4-6 Control I/O signal table

	I/O	Driver type	Signal specifications		
Servo-ready signal	Output	NN/20N/PN/PNN	Open collector	DC24V	50mA
		35N upward & NH	Contact output	AC200V	1A
Speed command input	Input	N/NN/NF/NH	Analog signal	±10V	
Shut-off signal	Input	All types	Current loop	DC24V	10mA
Reset signal	Input	All types	Current loop	DC24V	10mA
Start signal	Input	All types	Current loop	DC24V	10mA
Torque control signal	Input	All types	Current loop	DC24V	10mA
Torque limit input	Input	All types	Analog signal	+10V	
Speed feedback output	Output	NN	Analog signal	±9V	5mA
Speed feedback output	Output	NF	Analog signal	±9V	5mA
Encoder pulse output	Output	N/NN/NF/NH	Line driver	5V 90° phase difference signal	
Deviation clear signal	Input	PN/PNN	Current loop	DC24V	10mA
Display clear signal	Input	PN/PNN	Current loop	DC24V	10mA
Command pulse input inhibit signal	Input	PN/PNN	Current loop	DC24V	10mA
Positioning ready signal	Output	PN/PNN	Open collector	DC24V	100mA
Overflow signal	Output	PN/PNN	Open collector	DC24V	100mA
Encoder marker signal	Output	PN/PNN	Open collector	DC24V	100mA
Command pulse input	Input	PN/PNN	Line driver	5V 90° phase difference signal	
			Open collector		
Display output	Output	PN/PNN	Line driver	5V 90° phase difference signal	

With current loop, the signal is effective (ON state) when current is flowing, and the signal is ineffective (OFF state) when current is not flowing.

4-7-2 Servo-ready Signal (TS1, TS2) Output Wiring

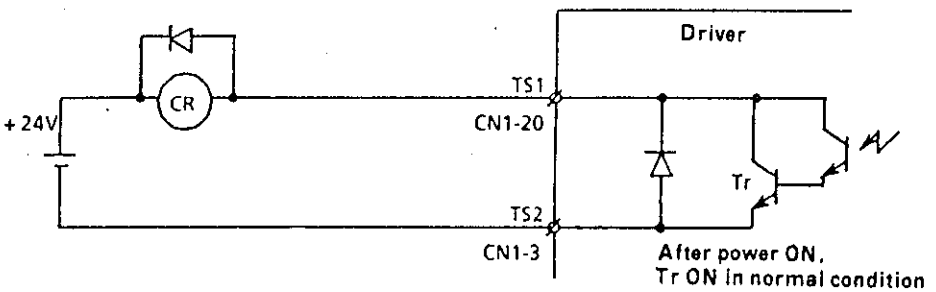
The following outlines function of this signal output.

(1) Servo-ready signal output will be turned ON when internal circuitry of driver is ready for operation. It will be turned OFF when protective circuit is actuated or when power is not turned ON.

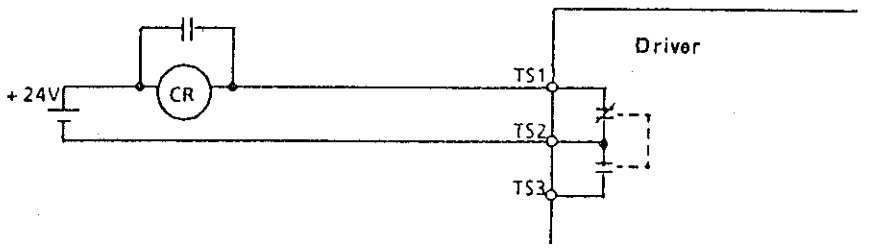
(2) For NPSA-2.5NN~20NN/20N and 2.5PNN~20PNN/20PN, output circuit is isolated with open collector output (24 VDC, 50mA). For the 35N & upward and the NH type driver, output circuit is contact output (200 VAC, 1A).

(3) If protective circuit is actuated, reset circuit by connecting CN1-11 and CN1-4 with reset signal(RST) or turn power ON again.

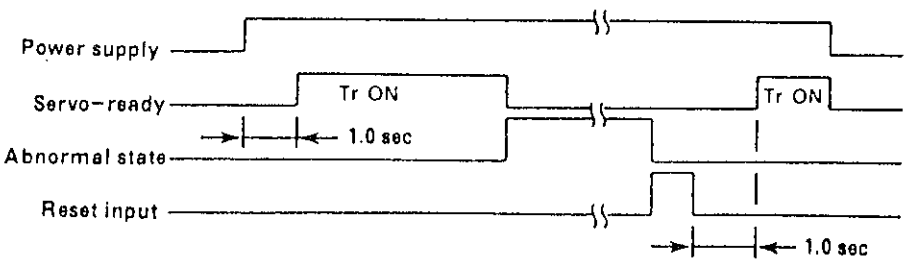
(4) When power is switched ON, it takes 1.0 second before servo-ready signal is output due to power resetting of the device. Therefore, when incorporating into an external circuit, care should be taken in timing. Always connect a surge absorber diode to the external relay.



Open collector output



Contact output



Servo-ready signal time chart

Fig. 4-21 Servo-ready signal (TS1, TS2)

4-7-3 Speed Command Input (INH, INL) Wiring (excepting NPSA-PN/PNN)

Function outline and connection are as follows:

(1) Driver is adjusted so as to reach rated speed at ±10 VDC of input voltage. Motor stops at 0 V.

(2) Maximum input voltage should be ±10 V.

(3) With a standard connection, motor makes a normal rotation (counterclockwise when viewed from side of load axis) if input voltage is positive to terminal INL. Motor reverses (clockwise when viewed from the side of load axis) when negative voltage is input.

(4) For reversing motor with positive voltage command input, see 4-5-2, "Motor Rotation Direction Setting".

(5) When using ±10 V from an auxiliary power supply, fluctuation to rated speed may appear due to reliance on Zener voltage. To eliminate fluctuations in speed, adjust speed adjustment SPVR.

(6) When supplying voltage for speed command input from external control device, connect common line (GND) of external control device to terminal INL (CN1-6).

(7) Use two-core shielded cable for wiring. Connect metal shield to grounding terminal (E).

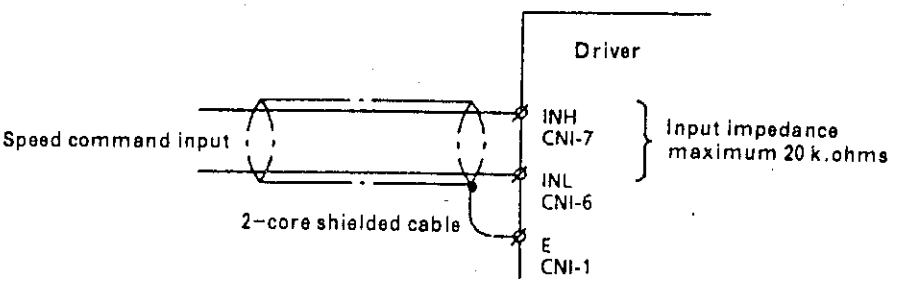


Fig. 4-22 Speed command input

(8) When using auxiliary power supply for speed command input, variable resistor for speed setting is to be connected as shown in Fig. 4-23.
Connector CN1-15(+10 V) and CN1-14(-10 V) can be used for auxiliary power supply.
Auxiliary power supply is designed for Zener output.

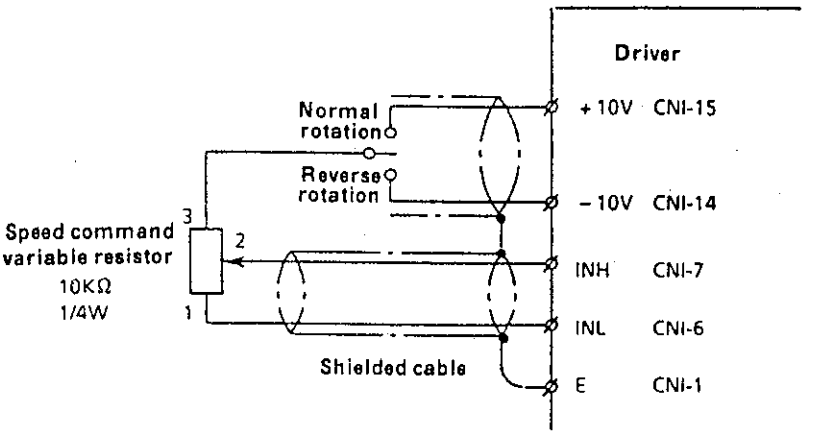


Fig. 4-23 When using auxiliary power supply for speed command input

(9) When using a relay for speed command input, use DC micro current switch relay. When the motor is not in operation, short-circuit terminals INH and INL or make them have the same potential.

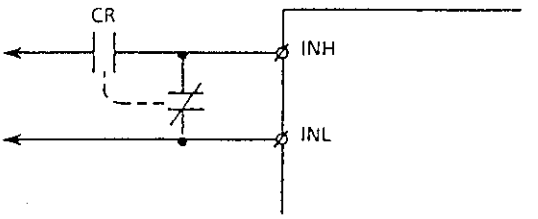


Fig. 4-24 When using relay for speed command input line

4-7-4 Shut-off Signal (S0) Wiring

Function outline is as follows:

(1) Motor is freed when shut-off signal is turned ON. When shut-off signal is input during operation of motor, motor stops naturally.
(2) When shut-off signal is ON, "S0" lights up.
(3) When thermal relay is actuated, input contact output.
(4) If shut-off signal is ON when power is turned ON, driver does not perform error detection. If any error exists, driver will detect it after shut-off signal is cleared.
(5) Servo-ready signal (TS1, TS2) is not turned OFF if shut-off signal is input.

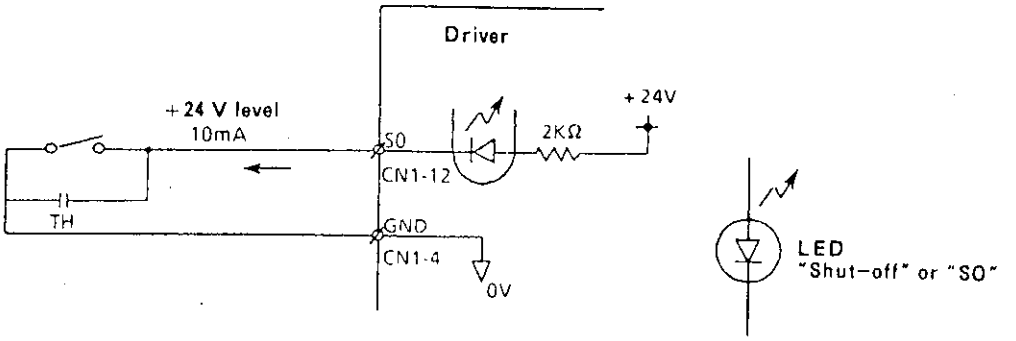


Fig. 4-25 Shut-off signal

4-7-5 Reset Signal (RST) Wiring

Function outline is as follows:

(1) Reset signal refers to a signal that releases driver protective circuit from actuation (This is possible through instantaneous input).

(2) Protective circuit may also be released from actuation by turning power OFF and then ON again.

(3) When reset signal is ON, error display lit by protective actuation is simultaneously cleared. When reset signal is turned OFF again, driver is in operating condition.

(4) Always reset protective circuit after removing the cause of actuation.

(5) Enter reset signal when emergency stop is actuated. Input continually reset signal for emergency stop. Then motor is freed and servo-ready signal (TS1, TS2) is turned OFF.

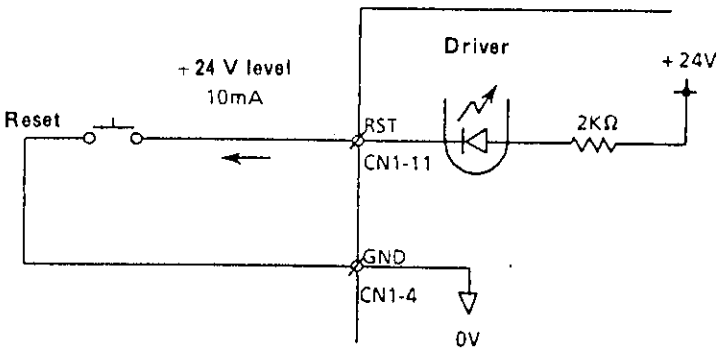


Fig. 4-26 Reset signal

4-7-6 Start Signal (DR) Wiring

Function outline is as follows:

(1) When start signal is turned ON, external speed command input becomes effective.

(2) If start signal is turned OFF while motor is in operation, the motor makes a sudden stop through regenerative braking.

(3) When start signal is ON, LED "DR" lights up.

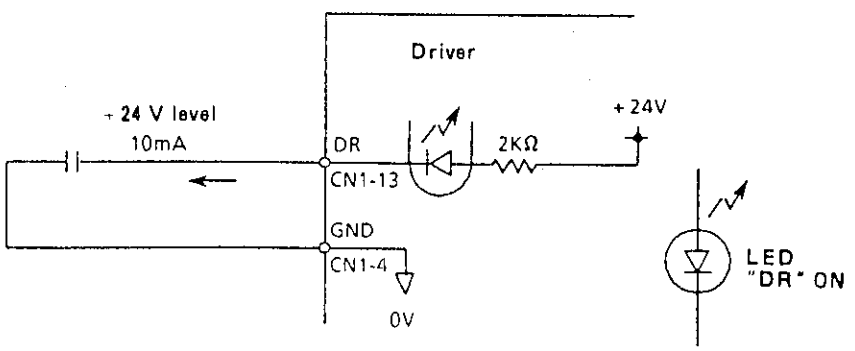


Fig. 4-27 Start signal

4-7-7 Torque Limit Signal (TL) and Torque Limit Input Wiring

(1) When torque limit signal is OFF, peak torque ratio to rated motor torque reaches 200-300%. Since peak torque ratio to rated motor torque differs according to combination of driver and motor used, see "Peak Torque/Rated Torque" column in the respective tables described in 2-3, "Motor and Driver Combination".

(2) When torque limit signal is ON, peak torque of motor is proportionate with a torque limit input voltage. A peak torque is output by the combination of driver and motor when input voltage is +10 V. Fig. 4-28 shows approximate relations of input voltage from 0 to +10 V and the motor output torque.

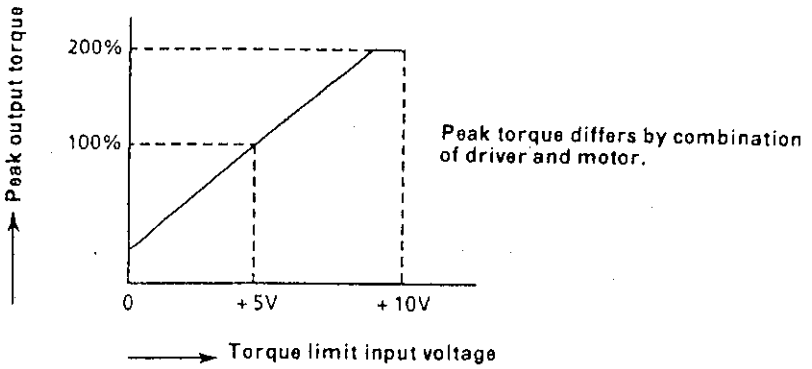


Fig. 4-28 Relation of peak torque and torque limit input voltage

(3) Torque limit signal is effective for both normal and reverse rotation directions.
When a peak torque is set by torque limit input, the rate of peak torque will be the same for both normal and reverse rotation directions.

(4) When torque limit signal is turned ON, the LED "TL" lights up.

(5) Always use shielded cable for wiring.

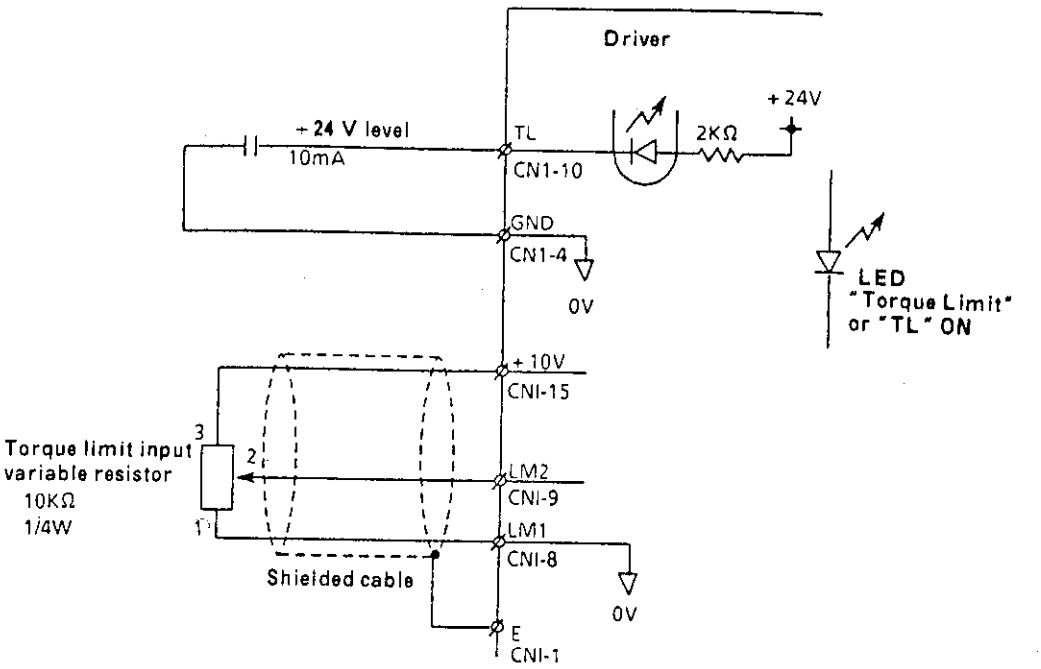


Fig. 4-29 Torque limit

4-7-8 Speed Feedback Output Signal (NPSA-NN/PNN only)

Function outline is as follows:

(1) Outputs a voltage after making F/V conversion of encoder feedback signal.

(2) Output voltage will be ±9 VDC during rated speed of motor.
Output voltage of motor connected in normal phase sequence is output as negative voltage to common line during normal rotation, or as positive voltage to common line during reverse rotation.

(3) Use shielded cable for wiring.
Use output current under 5 mA.

Caution: When connected in opposite phase sequence, output voltage polarity will be in reverse.

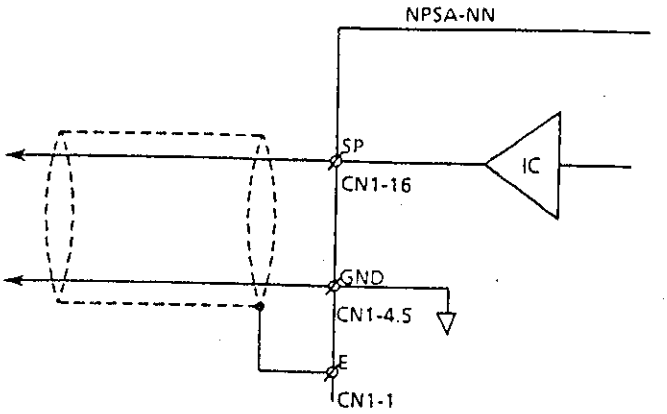


Fig. 4-30 Speed feedback output signal

(4) Care should be taken for analog IC output. When wiring near power supplies for other devices or through a section charged by a voltage of 30 V or more, put the cable through a protective metal tube.

(5) Keep the wiring length to a 1.5 meter maximum.

4-7-9 Speed Feedback Output Signal Circuit Wiring (for the NPSA-NF only)

Outline of operation is as follows:

(1) Outputs speed signal after making F/V conversion of encoder feedback signal.

(2) Output at rated speed of motor is ±9 VDC. (Minimum load resistance is 2 kΩ)
At normal rotation → Output in negative voltage
At reverse rotation → Output in positive voltage

Caution: If connected in opposite phase sequence, voltage will be polarized in reverse.

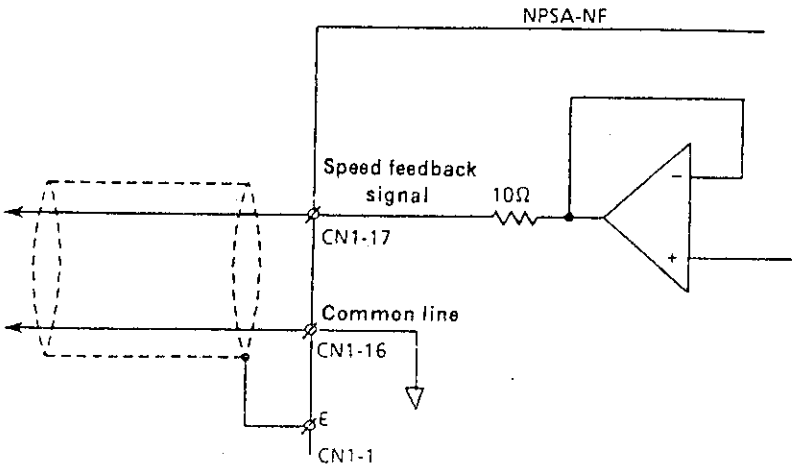


Fig. 4-31 Speed feedback output signal

4-7-10 Encoder Pulse Output (CN3) Wiring (except the NPSA-PN/PNN)

When using a motor-incorporated encoder as position detector, encoder pulse is output from connector CN3.

Arrange wiring as follows:

(1) Use 8-core shielded, twisted pair cable for wiring.
(This cable is optionally available.)

(2) Keep the wiring length to within a 50 m maximum.

(3) Receive pulse encoder signal through line receiver AM26LS32 (or equivalent).

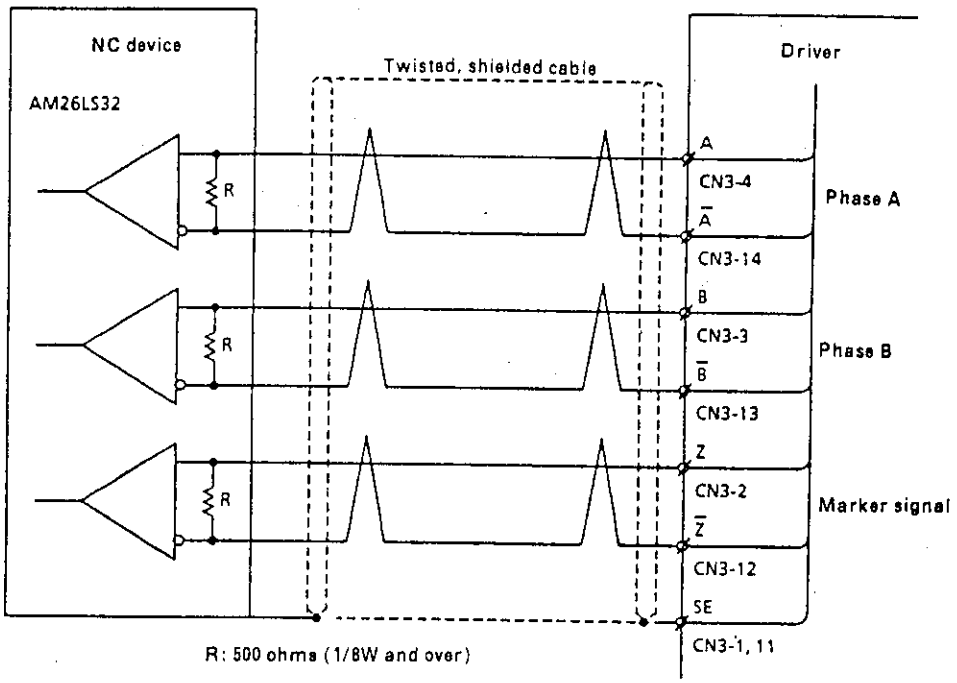


Fig. 4-32 Encoder pulse output wiring

Table 4-7 Encoder pulse output connector CN3

Pin number	Cable color	Name
1, 11	—	Shielded
6, 16	White	—
5, 15	Black	—
4	Red	Pulse signal A
14	Black	Pulse signal $\overline{A}$
3	Green	Pulse signal B
13	Black	Pulse signal $\overline{B}$
2	Yellow	Marker signal Z
12	Black	Marker signal $\overline{Z}$

4-7-11 Deviation Clear Signal (CLR), Display Clear Signal (CLD), and Command Pulse Input Inhibit Signal (IH) Wiring (for the NPSA-PN/PNN only)

Since control input signal is isolated from internal power supply of the NPSA-PN/PNN, please arrange for an input power supply (+24 V).

For signal input, either a contact or non-contact may be used. When using a contact, select one for a micro current having a contact rating that can switch 30 VDC, 10 mA correctly and with a chattering time of 5 msec or under.

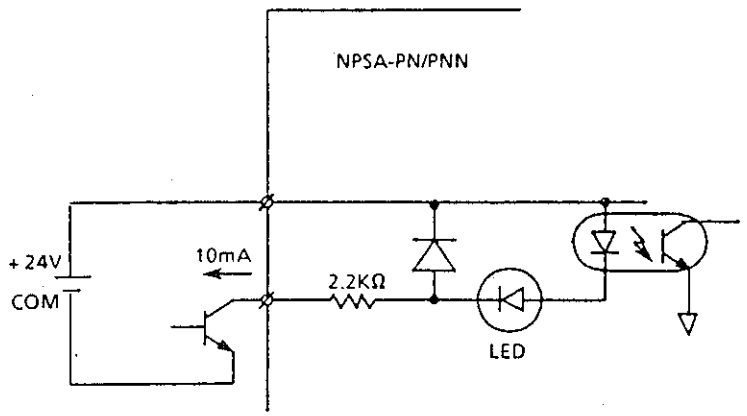


Fig. 4-33 Control input signal

(1) Clears deviation counter and decreases speed command voltage to 0 V when deviation clear signal is input. This causes motor to make a sudden stop.

(2) When display clear signal is input, current position display (optional) is reset.

(3) When normal rotation pulse or reverse rotation pulse is input, the NPSA-PN/PNN starts operation. However, if command pulse input inhibit signal is ON, pulse input will be invalidated.

(4) Provide individual clear signals (CLR and CLD) with pulse widths of 5 ms and over. Moreover, respective input signals have negative logic. When switched ON, they become signal inputs.

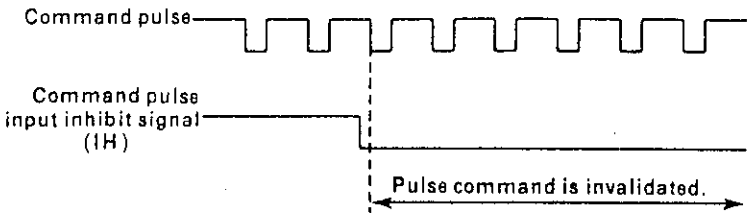


Fig. 4-34 Command pulse input inhibit signal

Caution: Separate signal cable from any other power cable (motor, power supply, etc.) system. Or noise may cause malfunction.

4-7-12 Positioning Ready Signal (PN), Overflow Signal (OF), and Encoder Marker Signal (MK) Wiring (for the NPSA-PN/PNN only)

Since the control output signal is an open collector output by the Darlington connection transistor isolated from the internal power supply of the NPSA-PN/PNN, customers are requested to arrange for an output power supply (+24 VDC).

Output capacity is 24 VDC, 100 mA,

A clamper diode is provided internally. When a relay or other inductive load exists, always insert the diode in parallel with the load to prevent noise from inverse electromotive force. Moreover, when lamp load is present, insert a pre-heating resistor to use the output signal under the rated current including the rush current.

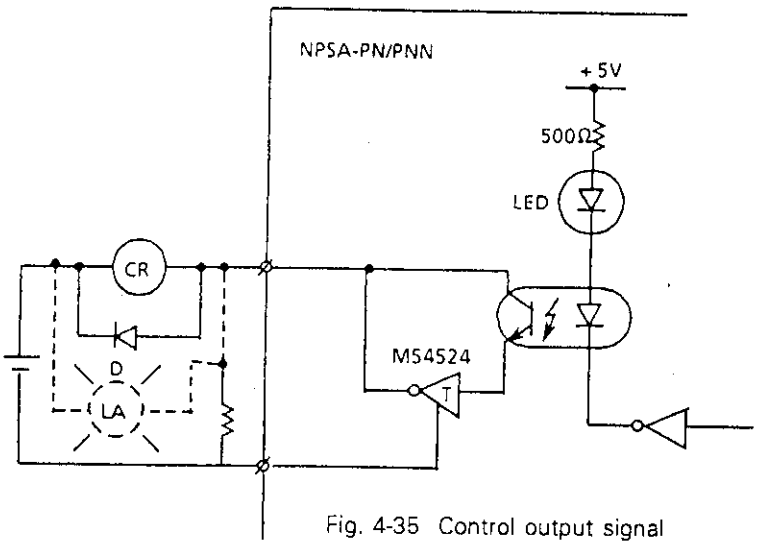


Fig. 4-35 Control output signal

(1) When deviation enters positioning ready range (1–255 pulse setting by SWPN), positioning ready signal is output.

(2) If motor fails to balance itself against input frequency, excessive command pulse is deposited inside deviation counter beyond its capacity leading to an overflow.

In such a case, input pulse number and feedback pulse number will not coincide causing a positioning error.

If deviation reaches a certain value and over, the overflow signal is output to the outside. Cut off the input pulse using this signal to stop the inflow of deviation.

Deviation > 4032: overflow

(3) When encoder marker signal is detected, it is input to CN2 and the encoder marker signal is output by negative logic (open collector output).

This output is not isolated from the internal power supply of the NPSA-PN/PNN.

Caution: Separate signal cable from any other power cable (motor, power supply, etc.) system. Or noise may cause malfunction.

4-7-13 Command Pulse Input Wiring (for the NPSA-PN/PNN only)

As illustrated, there are two types of command pulse input circuits. Input selection is made by using the dip switch SWEN No. 7. Select input circuit as follows:

SWEN No. 7	ON	Line driver input
	OFF	Open collector input

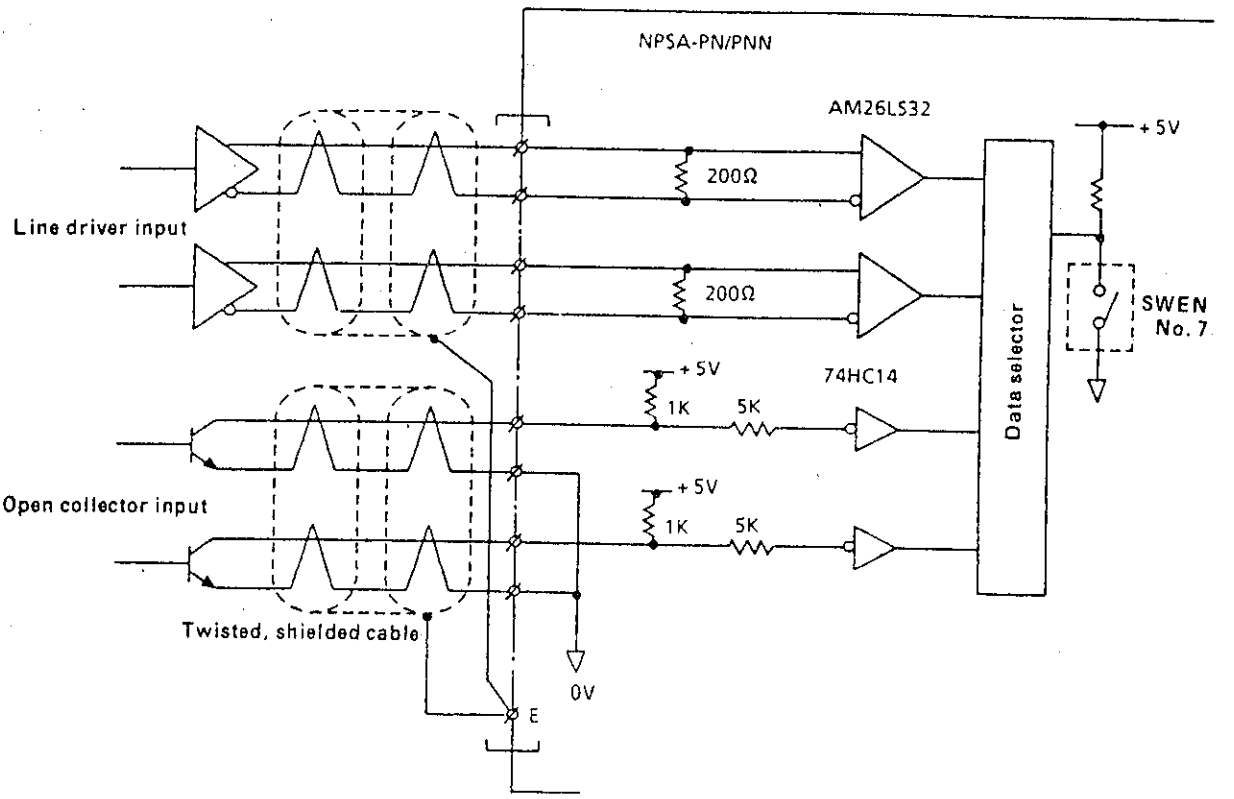


Fig. 4-36 Command pulse input

Caution: Always use twisted, shielded cable for external wiring as shown in the figure.

(1) When selecting line driver input, use line driver for the output circuit of external device. Use a shielded cable for wiring to prevent noise.
- Recommended element on output side: AM26LS31(AMD) and SN75113, SN75172(Texas)
- Maximum cable length: 20 meters

(2) When selecting an open collector input, use an open collector type for the output circuit of the external device. Use a twisted, shielded cable for wiring to prevent noise.
- Maximum cable length: 1.5 meters

(3) When operating the NPSA-PN/PNN, short-circuit a start signal (DR) to GND before turning power ON or entering command pulse.

Caution: **Separate signal cable from any other power cable system (motor, power supply, etc.). Or noise may cause malfunction.**

4-7-14 Display Output Wiring (for the NPSA-PN/PNN only)

Encoder feedback pulse is output from CNC of NPSA-PN/PNN. By connecting optional current position display unit DPU-500 to it, the current position can be displayed.
For connection to the NPSA-PN/PNN type driver, use the special cable attached to the DPU-500. As for signal specification, feedback pulse from encoder is output on the line driver level (see next page).

Caution: **Separate signal cable from any other power cable system (motor, power supply, etc.). Or noise may cause malfunction.**

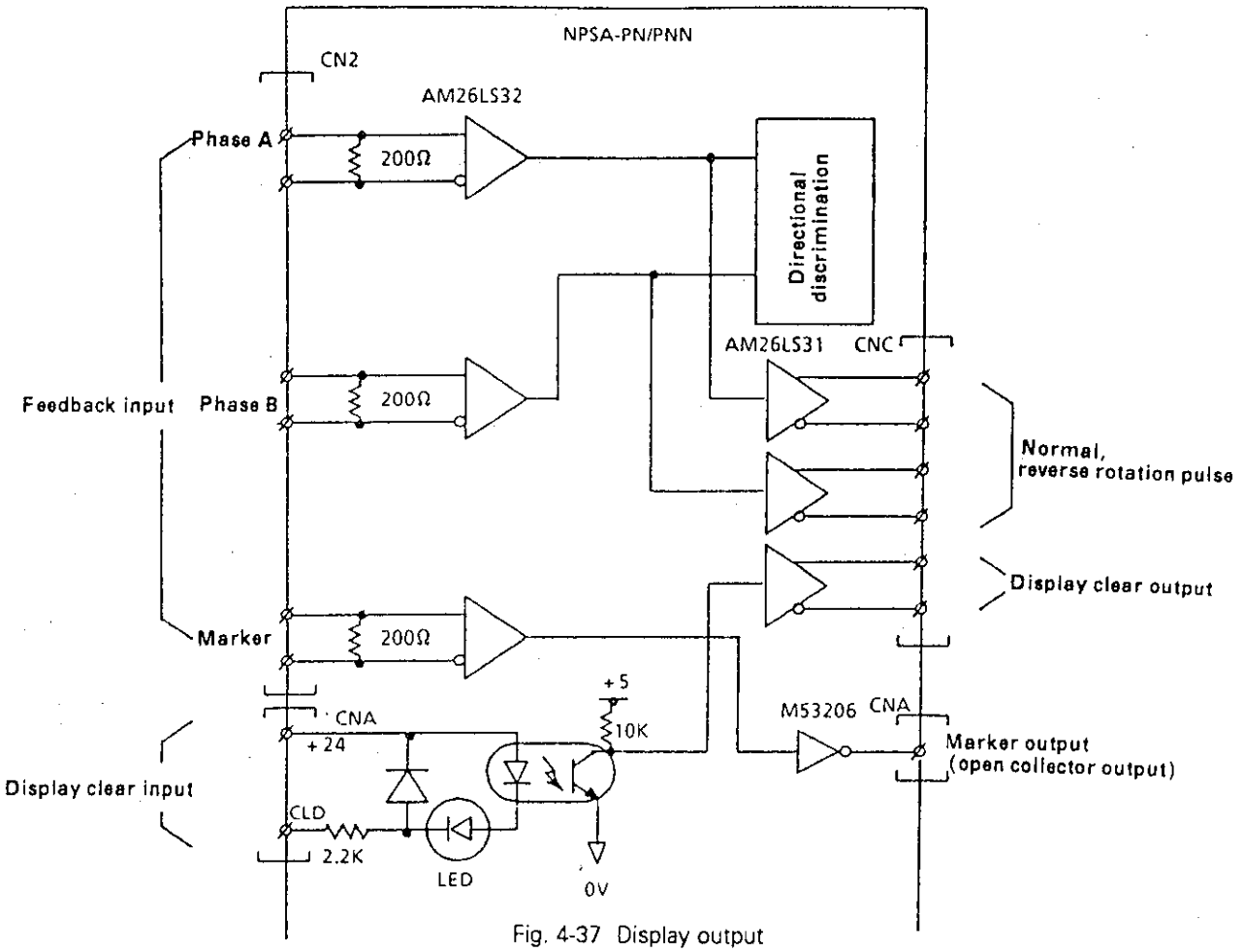


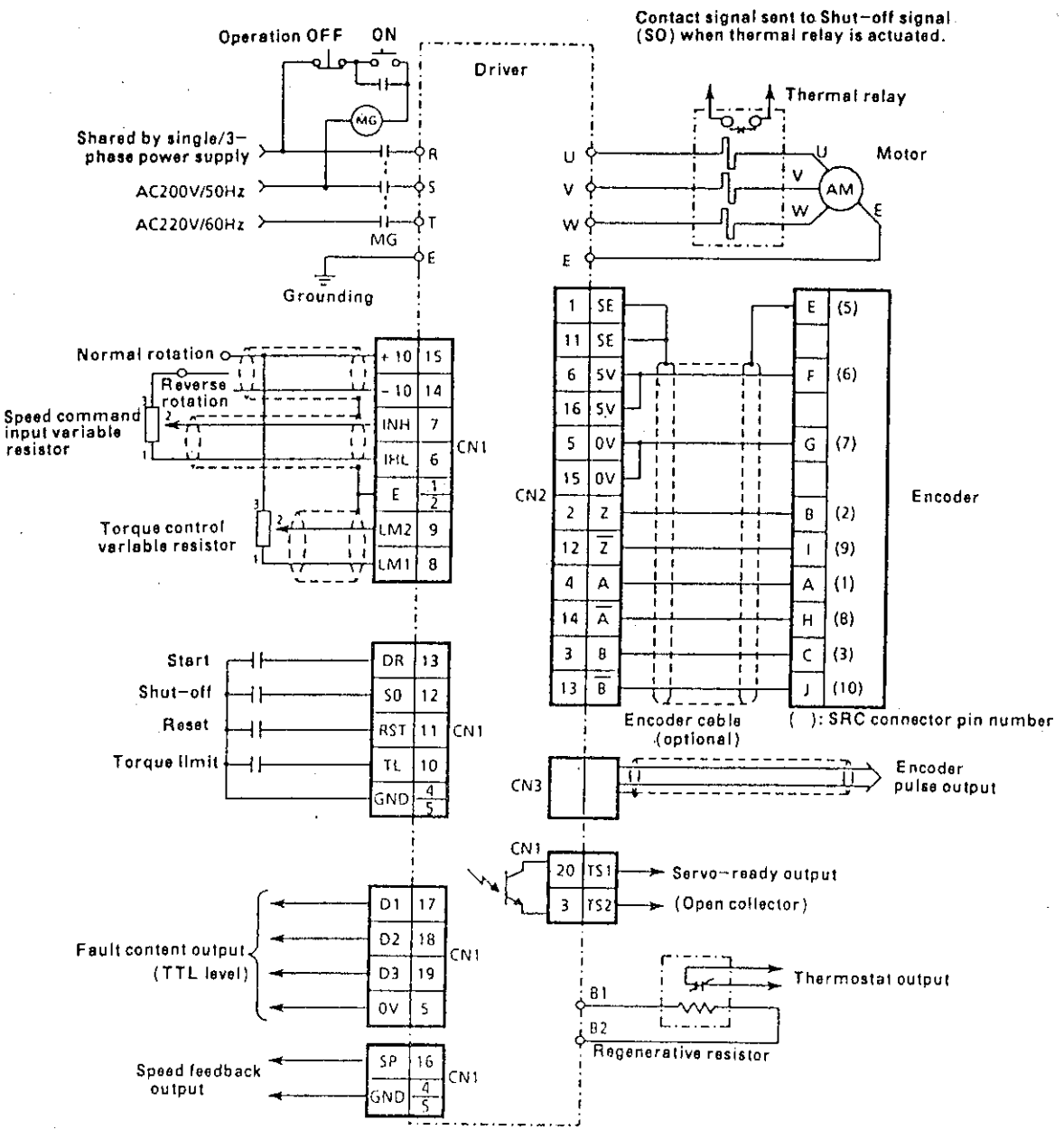
Fig. 4-37 Display output

4-8 Standard Wiring Diagram

4-8-1 Standard Wiring Diagram for the NPSA-/N/NN/NF/NH Series

The following pages show standard wiring diagrams of the NPSA-N/NN/NF/NH series with cautions to be observed.

1 NPSA-2.5NN/5NN



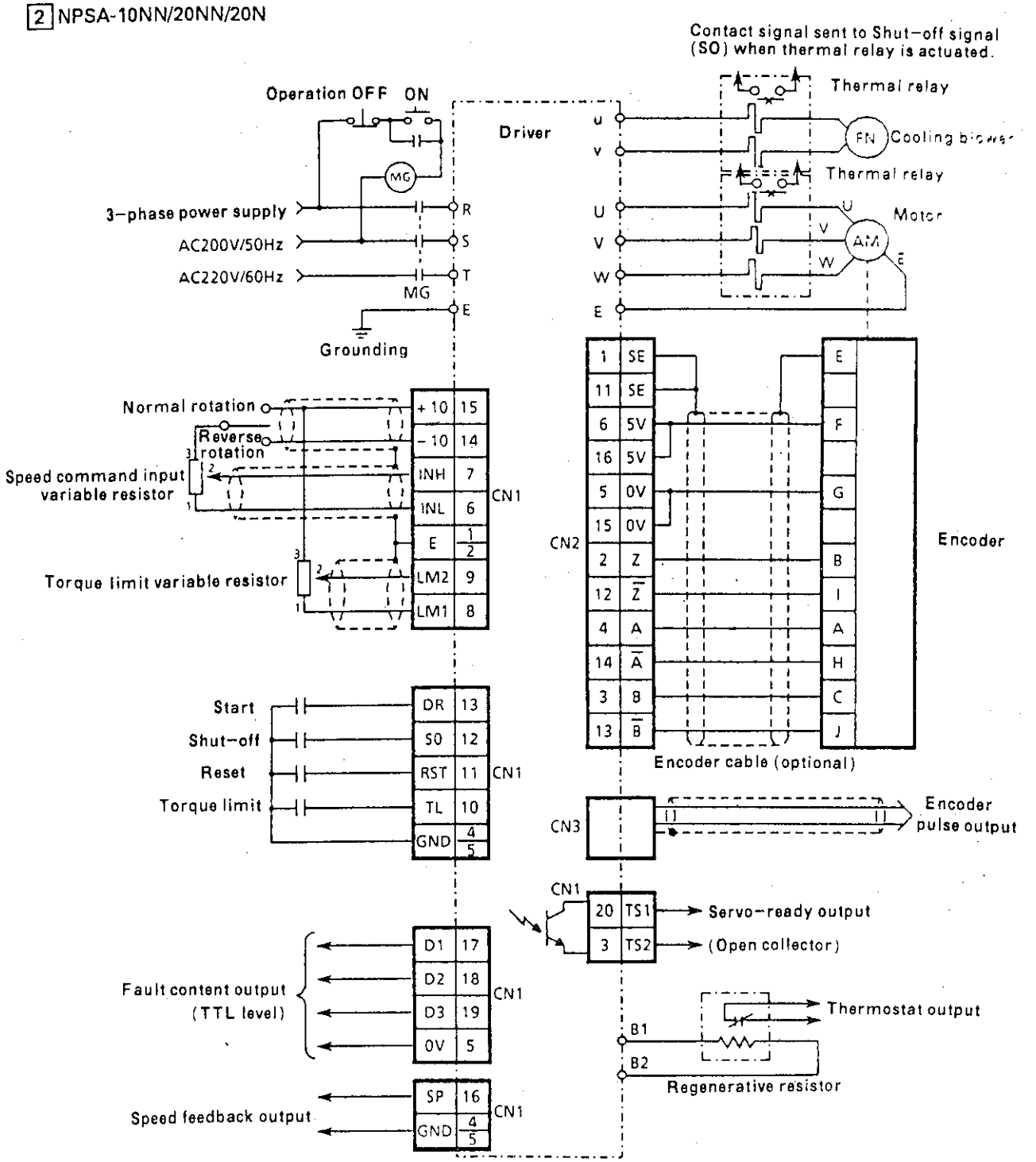
*Regenerative resistor and thermostat are not attached to the NPSA-2.5NN.

*When using a single phase power supply, connect to terminals R and S.

Caution: When thermostat is actuated by the temperature rise of regenerative resistor, turn AC power OFF.

Fig. 4-38

2 NPSA-10NN/20NN/20N



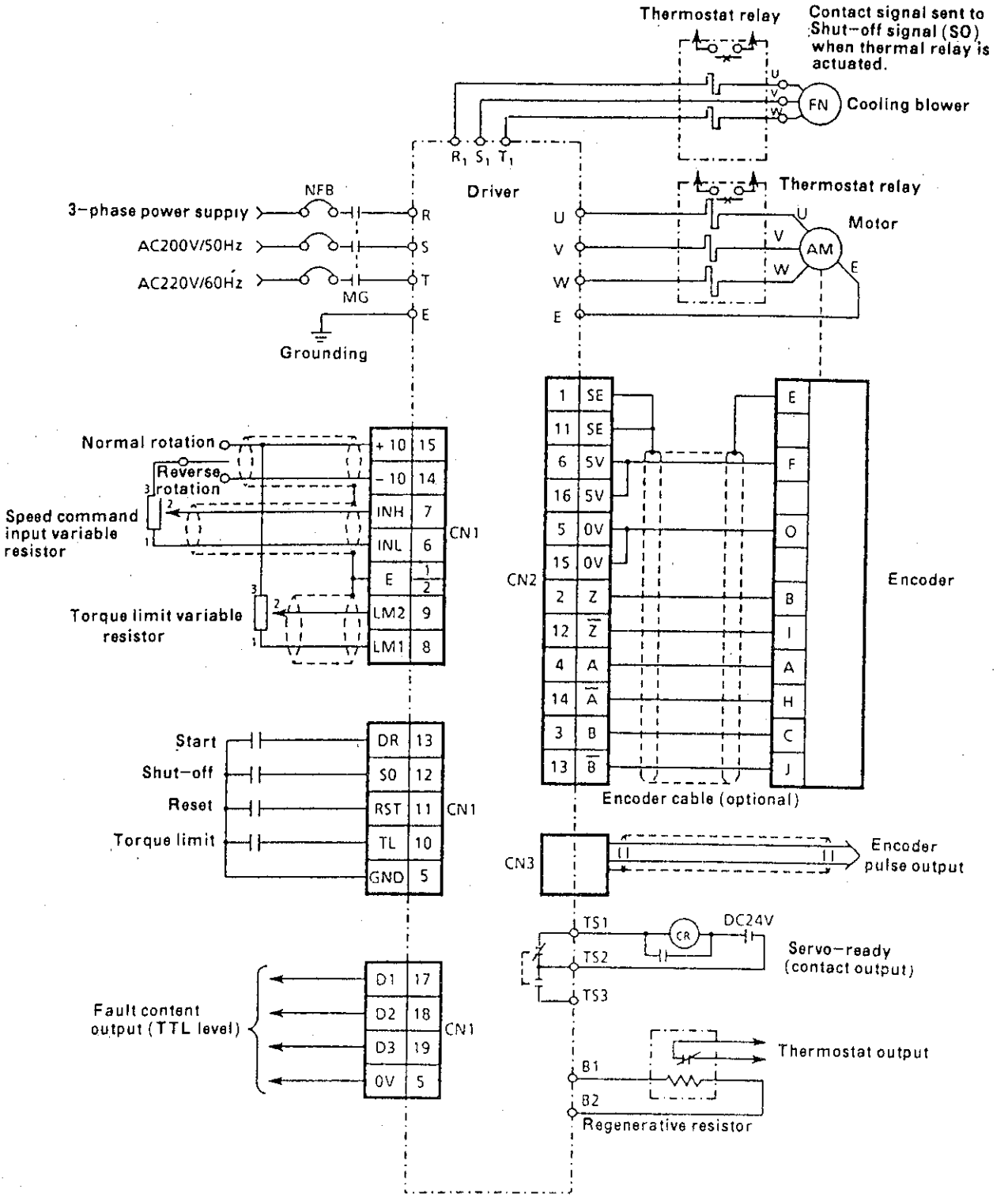
*Connect cooling blower power terminal to dedicated driver terminal. When combining motor NA21-110F-10 (1000 rpm) and NPSA-10NN-61, connect blower terminal to terminals R and S since no dedicated blower terminal is provided (cooling blower has no polarity).

*No speed feedback output is provided with the NPSA-20N.

Caution: When thermostat is actuated by the temperature rise of regenerative resistor, turn AC power OFF.

Fig. 4-39

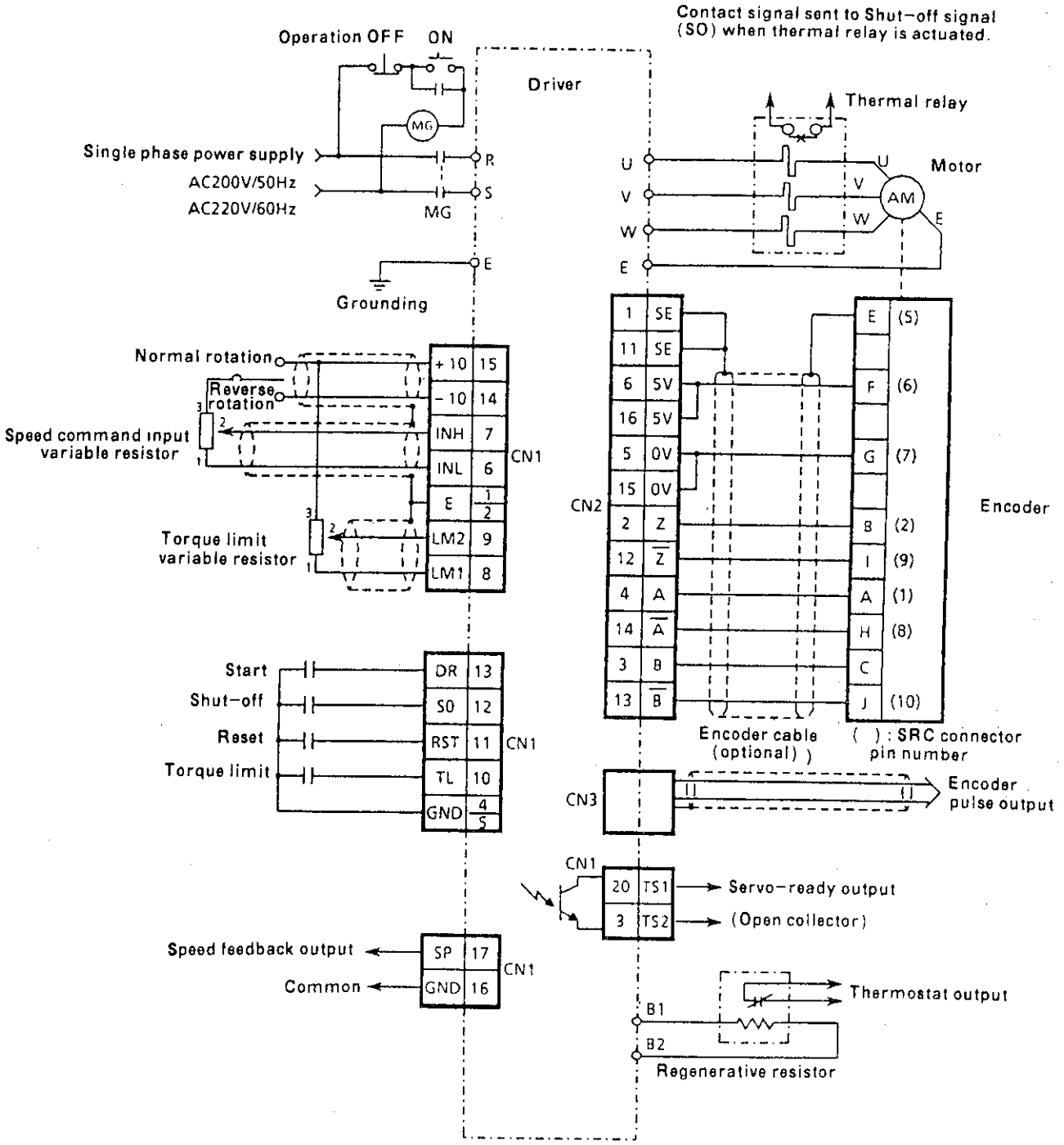
3 NPSA-35N~220N



Caution: When thermostat is actuated by the temperature rise of regenerative resistor, turn AC power OFF.

Fig. 4-40

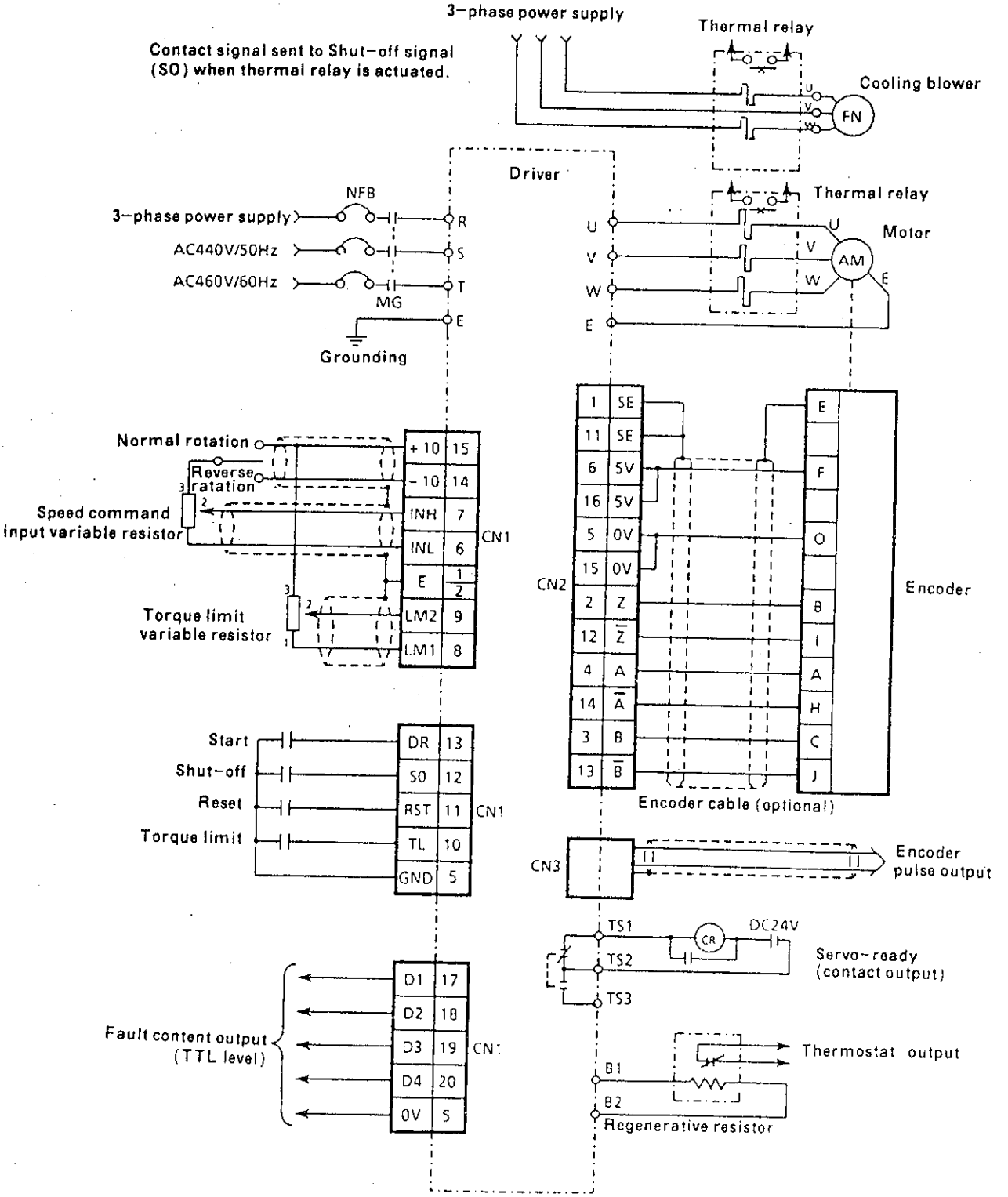
4 NPSA-2.5NF/5NF



Caution: When thermostat is actuated by the temperature rise of regenerative resistor, turn AC power OFF.

Fig. 4-41

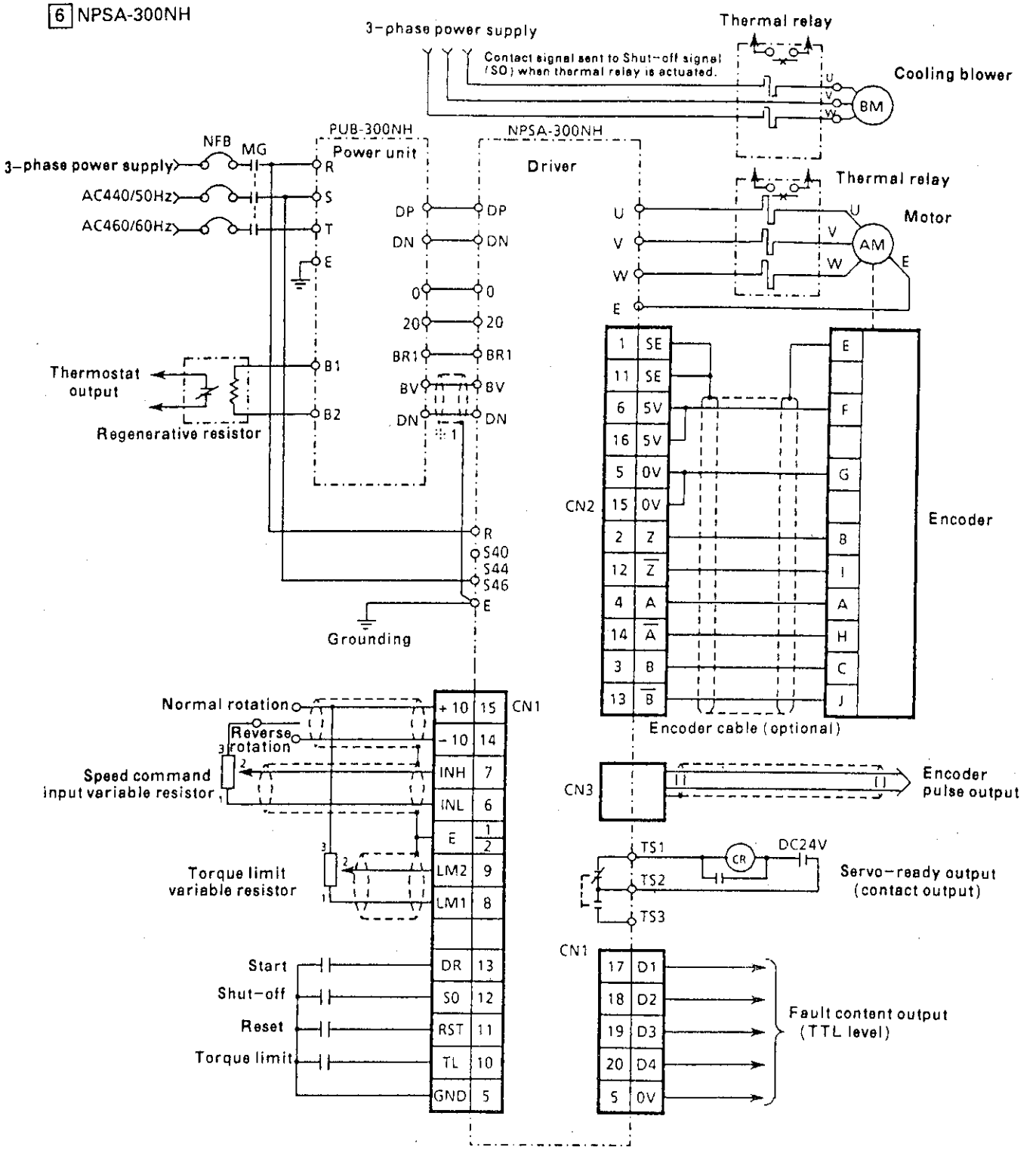
5 NPSA-20NH-180NH



Caution: When thermostat is actuated by the temperature rise of regenerative resistor, turn AC power OFF.

Fig. 4-42

6 NPSA-300NH



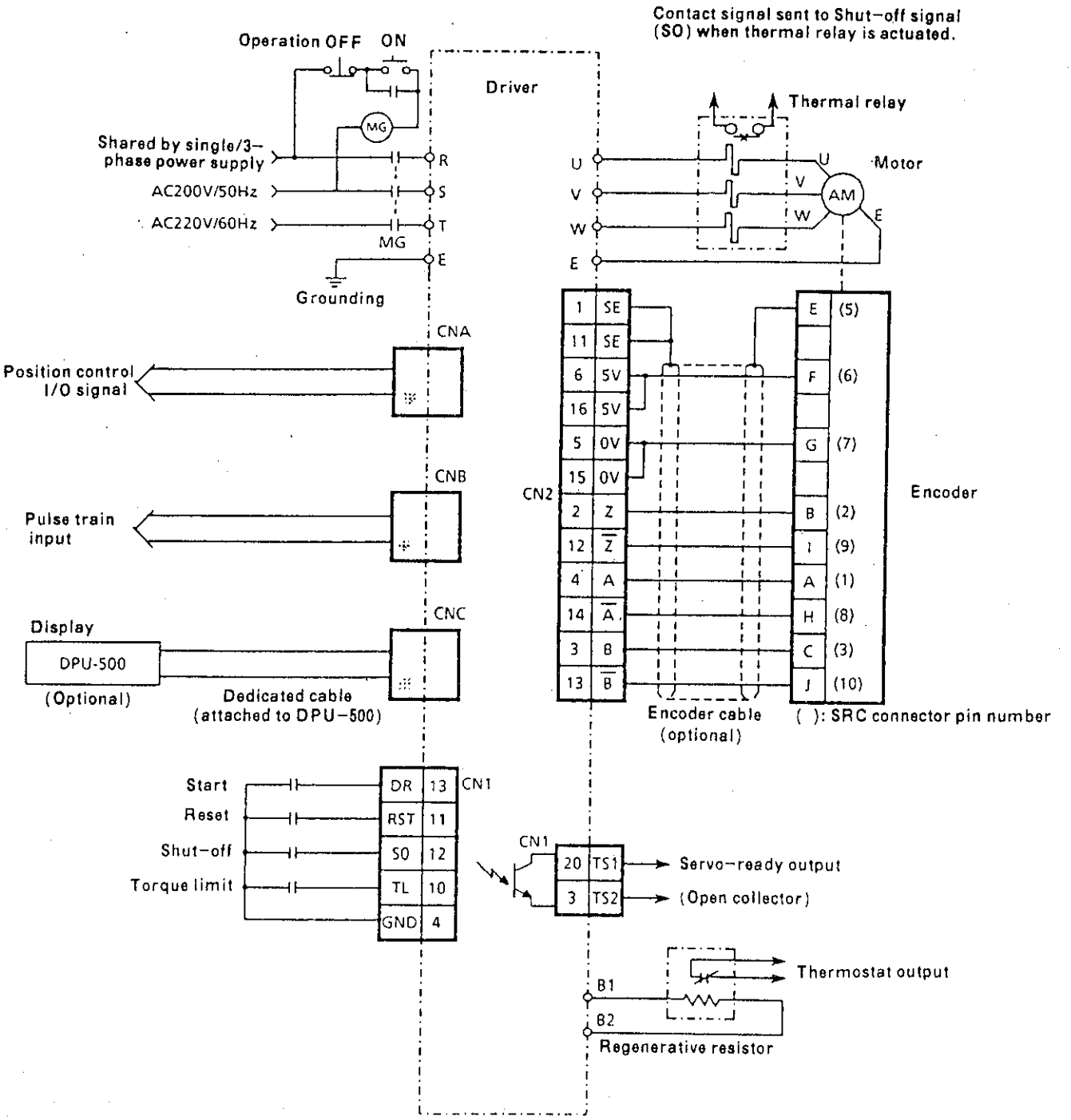
*1. Use 2-core twisted, shielded cable for wiring BV and DN.

Caution: When thermostat is actuated by the temperature rise of regenerative resistor, turn AC power OFF.

Fig. 4-43

4-8-2 Standard Wiring Diagram for the NPSA-PNN Series

[1] NPSA-2.5PNN/5PNN

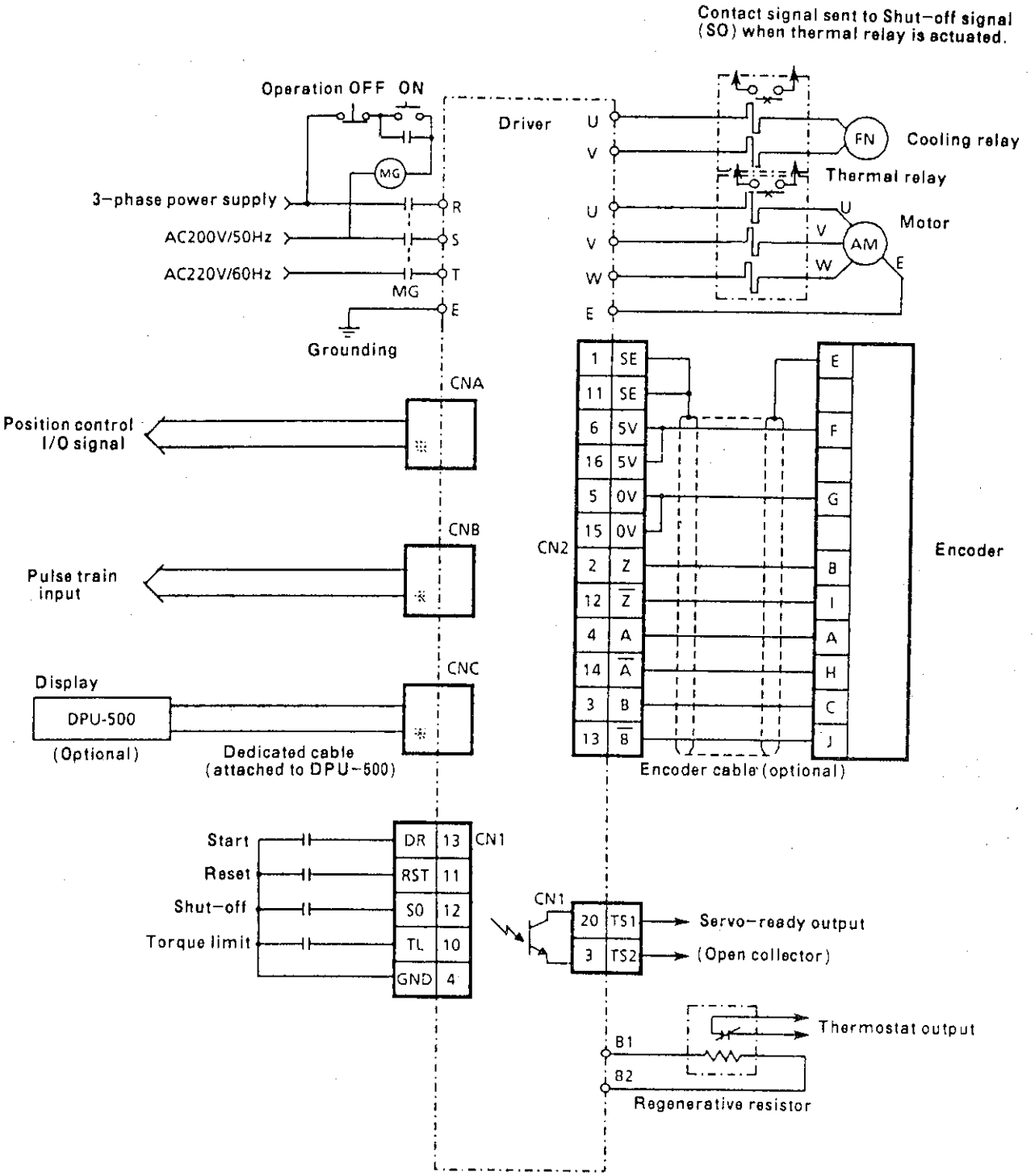


* See 4-8-3. CN1 is same as NPSA-N/NN.

Caution: When thermostat is actuated by the temperature rise of regenerative resistor, turn AC power OFF.

Fig. 4-44

2 NPSA-10PNN/20PNN/20PN



* See 4-8-3. CN1 is same as NPSA-N/NN.

Caution: When thermostat is actuated by the temperature rise of regenerative resistor, turn AC power OFF.

Fig. 4-45

4-8-3 NPSA-PN/PNN Series Signal Connection (CNA, CNB, CNC)

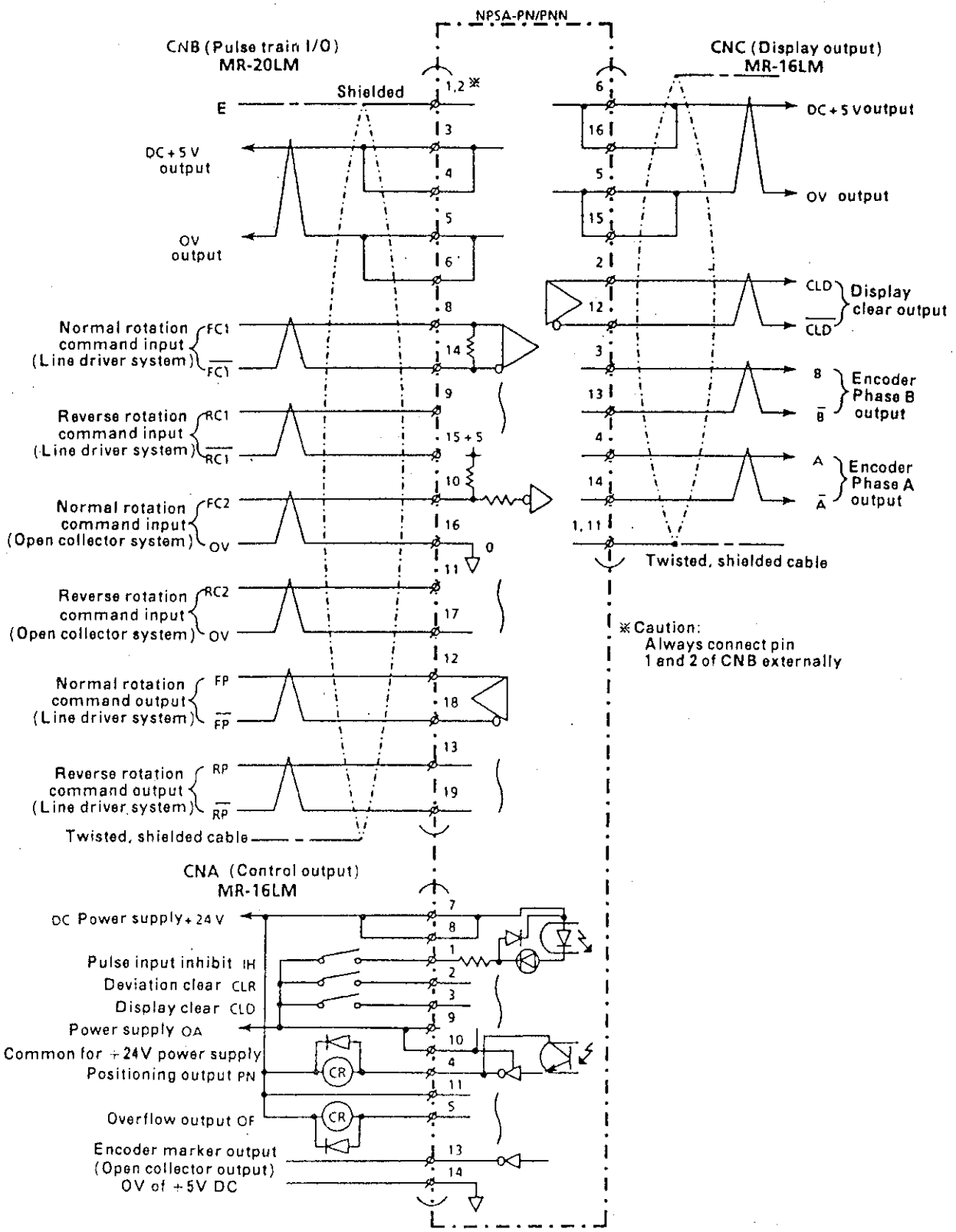


Fig. 4-46 NPSA-PN/PNN signal connection

4-9 Connector Table

4-9-1 Control Signal Input/Output Connector (CN1)

This table outlines pin numbers, codes, input/output of control signal input/output connector CN1 used in all series.

[1] NPSA-2.5-20NN/20N/2.5PNN-20PNN/20PN

Table 4-8 Connector pin connection

Pin number	Code	Description	Remarks
CN1-1,2	E	Shielded ground	
CN1-3	TS2	Servo-ready output 0V	Output with TS1 (CN1-20)
CN1-4,5	GND	Control line common 0V	
CN1-6	INL	Speed command input 0V	Common
CN1-7	INH	Speed command input 0 ~ ±10V	Input impedance maximum 20k ohms, analog control input
CN1-8	LM1	Torque limit input 0V	
CN1-9	LM2	Torque limit input 0 ~ ±10V	Input impedance maximum 10k ohms, analog control input
CN1-10	TL	Torque limit signal input terminal	+24V level 10mA
CN1-11	RST	Note: Reset signal input terminal	Same as above
CN1-12	SO	All stop signal input terminal	Same as above
CN1-13	DR	Start signal input terminal	Same as above
CN1-14	−10V	Speed command input auxiliary power supply −10V output (Zener output power supply)	Maximum 8mA
CN1-15	+10V	Speed command input auxiliary power supply +10V output (Zener output power supply)	Maximum 8mA
CN1-16	SP*	Speed feedback output signal	±9V rated revolution
CN1-17	D_1	Error output 2^0 (see Table 4-9)	+5V level 6mA LS05 TTL level outpout
CN1-18	D_2	Error output 2^1 (see Table 4-9)	Same as above
CN1-19	D_3	Error output 2^2 (see Table 4-9)	Same as above
CN1-20	TS1	Servo-ready output	Open collector output with TS2 (CN1-3)

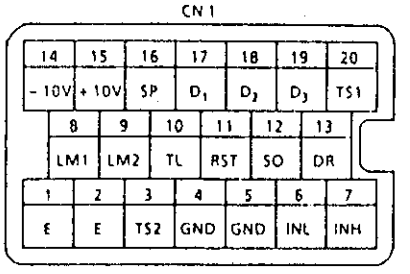


Diagram as seen from the joint section of connector.

Table 4-9 Error output state

Output	D1	D2	D3	State	Output	D1	D2	D3	State
0	1	1	1	Shut-off signal input	4	1	1	0	Excess current detection
1	0	1	1	Excess current detection	5	0	1	0	Encoder error detection
2	1	0	1	Under-voltage detection	7	0	0	0	Normal operation
3	0	0	1	Overvoltage detection					

Note: Error reset may be effected by reclosing the power apply.

[2] NPSA-2.5NF/5NF

Table 4-10 Connector pin connection

Pin number	Code	Description	Remarks
CN1-1,2	E	Shielded ground	
CN1-3	TS2	Servo-ready output 0V	Output with TS1 (CN1-20)
CN1-4,5	GND	Control line common 0V	
CN1-6	INL	Speed command input 0V	Common
CN1-7	INH	Speed command input 0 ~ ±10V	Input impedance maximum 20k ohms, analog control input
CN1-8	LM1	Torque limit input 0V	
CN1-9	LM2	Torque limit input 0 ~ ±10V	Input impedance maximum 10k ohms, analog control input
CN1-10	TL	Torque limit signal input terminal	+24V level 10mA
CN1-11	RST	Note: Reset signal input terminal	Same as above
CN1-12	SO	All stop signal input terminal	Same as above
CN1-13	DR	Start signal input terminal	Same as above
CN1-14	-10V	Speed command input auxiliary power supply -10V output (Zener output power supply)	Maximum 8mA
CN1-15	+10V	Speed command input auxiliary power supply +10V output (Zener output power supply)	Maximum 8mA
CN1-16	GND	Signal line common 0V	Common
CN1-17	SP	Speed feedback signal output	±9V rated revolution Load resistance 2k ohms min.
CN1-20	TS1	Servo-ready output	Open collector output with TS2 (CN1-3)

Note: Error reset may be effected by reclosing power supply.

CN 1

14	15	16	17	18	19	20
-10V	+10V	GND	SP			TS1

8	9	10	11	12	13
LM1	LM2	TL	RST	SO	DR

1	2	3	4	5	6	7
E	E	TS2	GND	GND	INL	INH

Diagram as seen from the joint section of connector.

3 NPSA-35N-220N/20NH-300NH

Table 4-11 Connector pin connection

Pin number	Code	Description	Remarks
CN1-1,2	E	Shielded ground	
CN1-3			Output with TS1 (CN1-20)
CN1-4,5	GND	Control line common 0V	
CN1-6	INL	Speed command input 0V	Common
CN1-7	INH	Speed command input 0 ~ ±10V	Input impedance maximum 20k ohms, analog control input
CN1-8	LM1	Torque limit input 0V	
CN1-9	LM2	Torque limit input 0 ~ ±10V	Input impedance maximum 10k ohms, analog control input
CN1-10	TL	Torque limit signal input terminal	+24V level 10mA
CN1-11	RST	Note: Reset signal input terminal	Same as above
CN1-12	SO	All stop signal input terminal	Same as above
CN1-13	DR	Start signal input terminal	Same as above
CN1-14	-10V	Speed command input auxiliary power supply -10V output (Zener output power supply)	Maximum 8mA
CN1-15	+10V	Speed command input auxiliary power supply +10V output (Zener output power supply)	Maximum 8mA
CN1-16			
CN1-17	D_1	Error output 2^0 (see Table 4-12)	+5V level 6mA LS05 TTL level outpout
CN1-18	D_2	Error output 2^1 (see Table 4-12)	Same as above
CN1-19	D_3	Error output 2^2 (see Table 4-12)	Same as above
CN1-20	D_4	Servo-ready output	Open collector output with TS2 (CN1-3)

*D_4 is level "1"

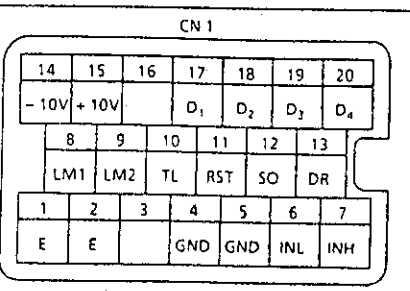


Diagram as seen from the joint section of connector.

Table 4-12 Error output state

Output	D1	D2	D3	State	Output	D1	D2	D3	State
0	1	1	1	All stop signal input	4	1	1	0	Excess speed detection
1	0	1	1	Excess current detection	5	0	1	0	Encoder error detection
2	1	0	1	Under-voltage detection	7	0	0	0	Normal operation
3	0	0	1	Over-voltage detection					

Note: Error reset may be effected by reclosing the power apply.

4-9-2 Encoder Pulse Input Connector (CN2)

This table outlines pin numbers, cable colors, and names of encoder pulse input connector CN2 used in all series, and connector pin numbers on the motor side.

Table 4-13 Connector pin connection

Pin number	Cable color	Name	Motor side connector pin number
1, 11	—	Shielded	E (5)
6, 16	White	Power supply +5V	F (6)
5, 15	Black	Power supply GND	G (7)
4	Red	Pulse signal A	A (1)
14	Black	Pulse signal $\overline{A}$	H (8)
3	Green	Pulse signal B	C (3)
13	Black	Pulse signal $\overline{B}$	J (10)
2	Yellow	Marker signal Z	B (2)
12	Black	Marker signal $\overline{Z}$	I (9)

*( ) indicates SRC connector pin number.

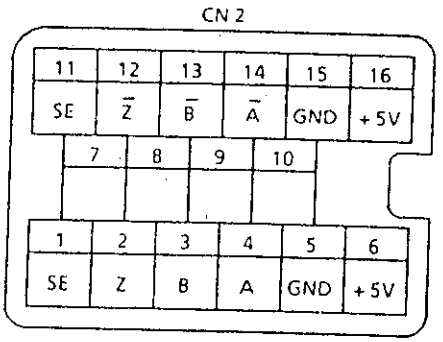


Diagram as seen from the connector wire section.
Note: Since CN2 and CN3 are of identical type, care must be taken for misinstallation when making connections.

Caution: Since CN2 and CN3 are identical (MR-16RM by Honda), exercise care in avoiding misinstallation when making connections.

4-9-3 Encoder Pulse Output Connector (CN3)(except NPSA-PN/PNN)

This table outlines pin numbers, cable colors and names of encoder pulse output connector CN3 used in NPSA-N/NN/NF/NH.

Table 4-14 Connector pin connection

Pin number	Cable color	Name
1, 11	—	Shielded
6, 16	White	—
5, 15	Black	—
4	Red	Pulse signal A
14	Black	Pulse signal $\overline{A}$
3	Green	Pulse signal B
13	Black	Pulse signal $\overline{B}$
2	Yellow	Marker signal Z
12	Black	Marker signal $\overline{Z}$

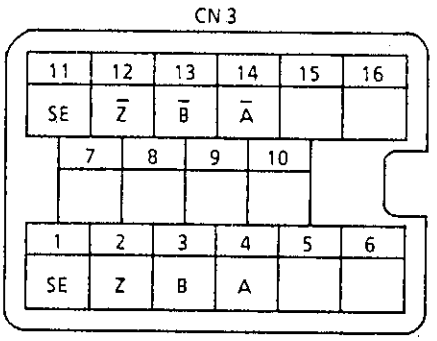


Diagram as seen from the connector wire section.
Note: Since CN3 is of identical type with CN2, care must be taken for misinstallation when making connections.

Caution: Since CN3 is identical with CN2 (MR-16RM by Honda), exercise care in avoiding misinstallation when making connections.

4-9-4 NPSA-PN/PNN Series Connector (CNA, CNB and CNC)

The table below indicates signal names corresponding with pin numbers of connectors CNA, CNB and CNC. These connectors are not installed on the NPSA-N, NN, NF and NH types, however.

Table 4-15 Connector pin connection

Position control I/O (CNA)

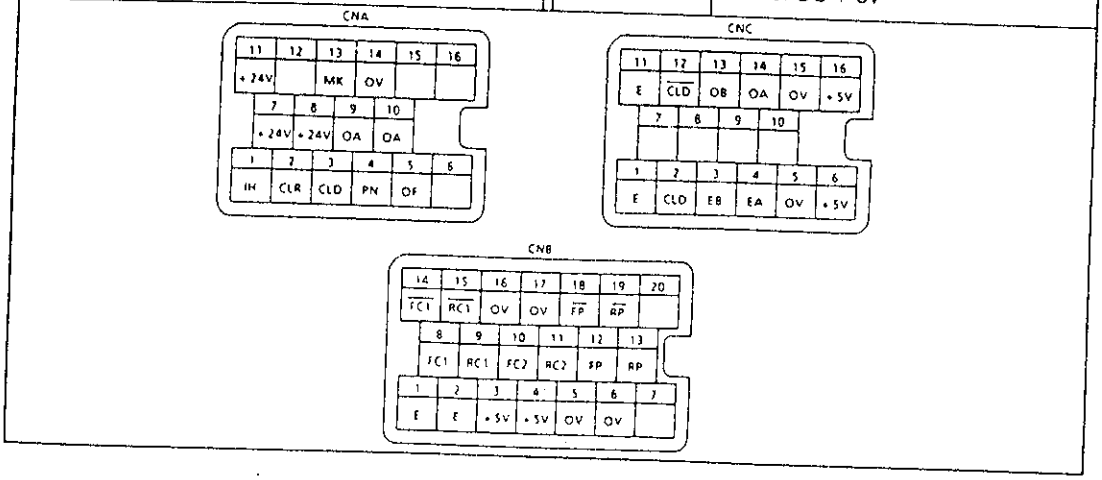
Pin number	Signal name	Pin number	Signal name
1	IH (Command pulse input inhibit)	7	DC + 24V input
2	CLR (Deviation clear)	8	DC + 24V input
3	CLD (Display clear)	9	DC + 24V input
4	PN (Positioning ready output)	10	DC + 24V input
5	OF (Overflow output)	11	DC + 24V input
13	MK (Encoder market output)	14	0V of DC +5V

Pulse train input (CNB)

Pin number	Signal name	Pin number	Signal name
1	E (Grounding)	11	RC2 (Reverse rotation command input)
2	E (Grounding)	12	FP (Normal rotation command output)
3	DC + 5V output	13	RP (Reverse rotation command outpout)
4	DC + 5V output	14	$\overline{FC1}$ (Normal rotation command input)
5	0V	15	$\overline{RC1}$ (Reverse rotation command inpout)
6	0V	16	0V
8	FC1 (Normal rotation command input)	17	0V
9	RC1 (Reverse rotation command input)	18	$\overline{FP}$ (Normal rotation command output)
10	FC2 (Normal rotation command input)	19	$\overline{RP}$ (Reverse rotation command input)

Display output (CNC)

Pin number	Signal name	Pin number	Signal name
1	E (Grounding)	11	E (Grounding)
2	CLD (Display clear)	12	$\overline{CLD}$ (Display clear)
3	B (Encoder phase B)	13	$\overline{B}$ (Encoder phase B)
4	A (Encoder phase A)	14	$\overline{A}$ (Encoder phase A)
5	0V	15	0V
6	0V of DC + 5V	16	0V of DC + 5V



CHAPTER 5 OPERATING METHOD

5-1 Outline

This chapter describes the procedure from power ON to operation after installation including precautions.

5-2 Checks before Operation

After installation and wiring are complete, perform following checks before operation.

(1) Check if wiring is properly connected. Especially, check if the power is connected to U, V and W.

(2) Check if any section is short-circuiting through the electric wiring with electric wire pieces.

(3) Check if any section of wiring has been applied with excessive forces.

(4) Check if any screws or terminals are loose.

(5) Check if there is any short circuiting or faulty grounding of the sequence on output and load side.

Caution: 1. Do not perform an insulation test between driver terminals using a megger tester.
2. Do not perform an insulation test of control circuit terminals using a megger tester.

5-3 Display

5-3-1 Status Display LED

Status is displayed on the LED display on the face of the driver. Deviation amount of the NPSA-PN/PNN is displayed on the PCB's LED. When operating, always check status on display. Also, perform fault diagnosis during failure and check external sequence through display. Display portion of the NPSA-35N & onward and NH type drivers consist of a single and a 7 segment LED.

5-3-2 Operation Status Display

LEDs shown in Fig. 5-1 display status of the driver during operation. This is also used to confirm the external sequence. Table 5-1 is a list of status displays according to machine type.

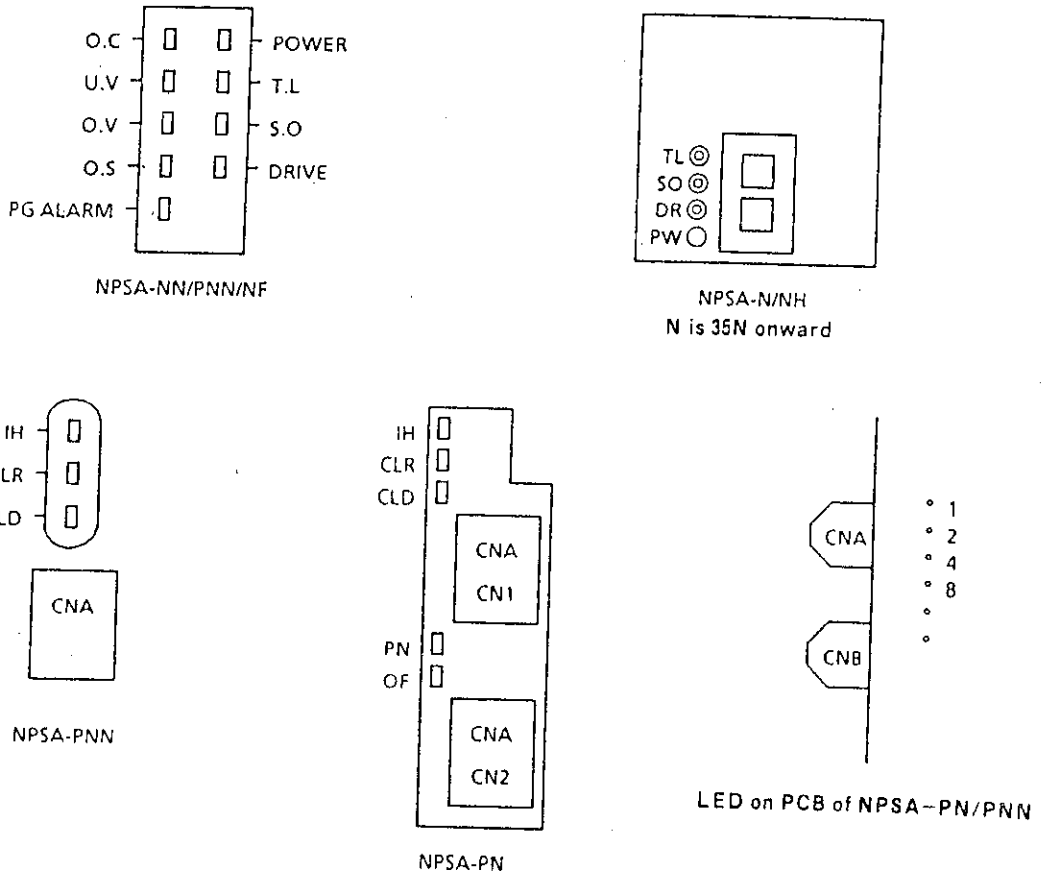


Fig. 5-1 LED positions

Table 5-1 List of status displays

Machine type / Name	NPSA-NN/NF	NPSA-PNN	NPSA-20N	NPSA-PN	NPSA-N/NH
	Display				
Power source	POWER	POWER	Power source	Power source	PW
Start	DRIVE	DRIVE	Start	Start	DR
Shut-off	S.O	S.O	Master stop	Master stop	SO
Torque limit	T.L	T.L	Torque limit	Torque limit	TL
Pulse train input inhibit	—	IH	—	IH	—
Deviation clear	—	CLR	—	CLR	—
Display clear	—	CLD	—	CLD	—
Positioning complete	—	PN	—	PN	—
Overflow	—	OF	—	OF	—

5-3-3 Description of Display

Table 5-2 shows the LED ON conditions and status of the unit when the display is ON.

Table 5-2 LED lighting and the unit status

Name	Conditions	Status of unit
Power source	When power for the driver is turned ON, LED lights.	
Start	When the driver is given the start signal, this comes ON.	The driver is operating.
Shut-off	When shut-off signal is input to the driver, LED lights.	The motor is free.
Torque limit	When torque limit signal is output to driver, LED lights.	The torque limit is possible.
Pulse train input inhibit	When pulse train input inhibit is input to the driver, LED lights.	Pulse train input is suspended.
Deviation clear	When deviation clear signal is input to driver, LED lights.	The motor stops suddenly and the motor is in the servo lock status.
Display clear	When display clear signal is input to driver, LED lights.	The display of the display unit (option) is made zero.
Positioning complete	When positioning signal is being output, LED lights.	The motor is in servo lock status.
Overflow	During overflow, LED lights.	The motor stops suddenly and the motor is in the servo lock status.

5-3-4 LED Display on PCB (NPSA-PN/PNN only)

When each LED lights, following operation status of motor is displayed.

(1) Display of motor operation status

F: When motor is in forward operation, this comes ON.

R: When motor is in reverse operation, this comes ON.

Also, amount of deviation is displayed on the LED (1, 2, 4, 8). LED display of the deviation is performed up to 15 pulse (lower 4 bit).

(2) Checking the operation status of motor

When motor is stopping or shifting in the positive direction away from the home position, R comes ON.

When motor shifts in reverse direction, F comes ON.

When motor is stopping, deviation displays ±0 ~ 2 and keeps servo lock status.

5-3-5 Error Display

When driver detects abnormalities in unit, error displays shown in Table 5-3 are given. When driver detects an error it does not control the motor, so the motor is free.

Table 5-3 List of errors displayed

Machine type / Name	NPSA-NN/PNN/NF	NPSA-20N/PN	NPSA-NH/N
	Display		
Over current	O.C.	Over current	1
Under current	U.V.	Under current	2
Over voltage	O.V.	Over voltage	3
Over speed	O.S.	Over speed	4
PG cut	PG ALARM	PG cut	5
Overload	—	—	6

When shut-off signal (SO) is being input to the NPSA-35N & onward and NH, the LED display shows zero. If motor is freed because of error display, identify cause and take countermeasures in accordance with the procedure in Chapter 7. "Fault and Remedies", then restart the operation.

5-4 Setting of NPSA-N/NN/NF/NH

For NPSA-N/NN/NF/NH, rotation control and peak torque limit of motor can be performed by setting speed command input and torque limit input.

5-4-1 Speed Command Input Voltage

Outline of operation

As for motor and driver relation, when power is turned ON and start signal (DR) is turned ON, the motor starts rotating in proportion to the voltage set in the speed command input (INH, INL). When the start signal (DR) is turned OFF, motor stops.

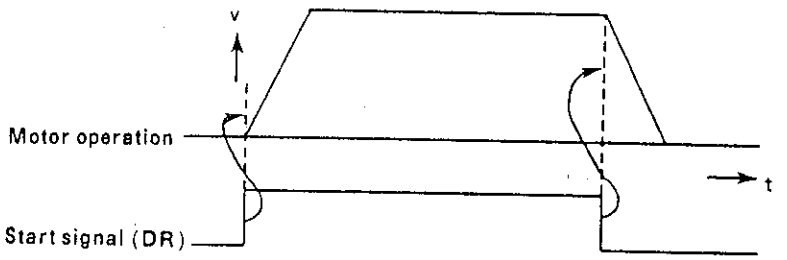


Fig. 5-2 Motor operation

(1) Adjustment has been made so that the motor rotates at the rated rpm when the input voltage is DC ±10V. The motor stops at 0 V. (Fig. 5-3)

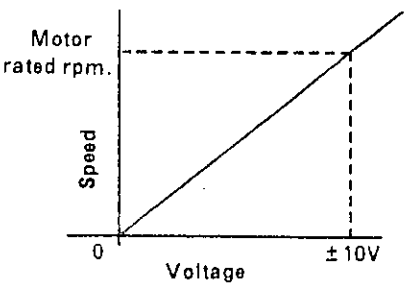


Fig. 5-3 Speed command input voltage and motor rotation

(2) Input voltage should be max. ±10 V.

(3) When input voltage is positive against terminal INL, the standard connection makes the motor start a forward rotation (counterclockwise when viewing from the load shaft side). When voltage is negative motor starts a reverse rotation.

(4) When making the motor start a reverse rotation through the command input of a positive voltage, see 4-5-2 "Setting the Direction of Motor Rotation".

5-4-2 Torque Limit Signal (TL)

(1) When the torque limit signal (TL) is OFF, peak torque of motor is the torque set. Peak torque varies depending on the combination of driver and motor.
(2) When the torque limit signal (TL) is ON, peak torque of motor is proportionate to torque limit input voltage value.

5-4-3 Torque limit input

(1) When the torque limit signal (TL) is ON, this is valid.
(2) When the input voltage is 0 - +10 V, the relationship between input voltage and output torque of motor is as shown in the following diagram.

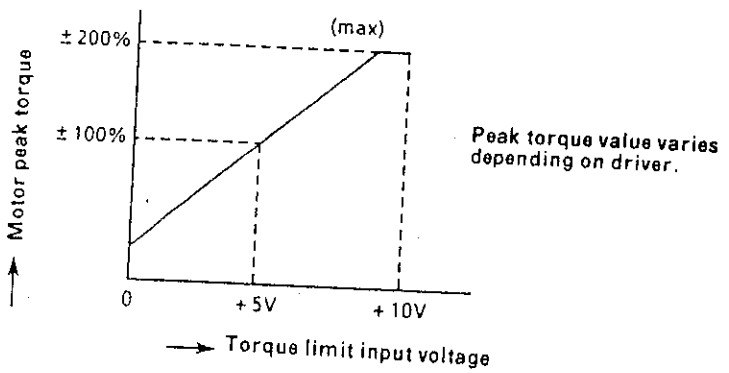


Fig. 5-4 Torque limit input voltage and motor peak torque

(3) Torque limit is controlled by same input voltage value both in forward and reverse rotation.

Caution: Torque limit signal and torque limit input signal are also the same (functions) in NPSA-PN/PNN.

5-5 Setting of NPSA-PN/PNN

5-5-1 Outline of Operation

Positioning operation of NPSA-PN/PNN shows an exponential function curve. Stability and positioning time can be changed by adjusting position loop gain. Be familiar with this description in order to the setting on the NPSA-PN/PNN. For setting the dip switch, see 5-5-8 "Dip switch setting".

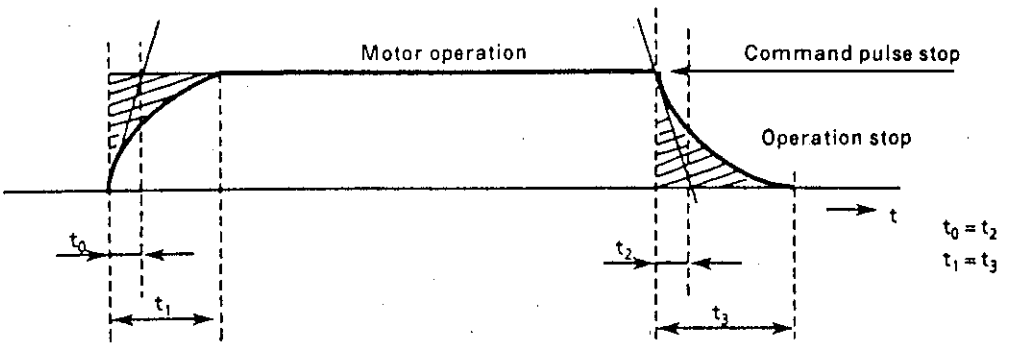


Fig. 5-5 NPSA-PN/PNN motor operation

Further, motor rotation after command pulse stops is the same as the delay amount when starting up. (Hatched section in Fig. 5-5.)

5-5-2 Forward and Reverse Rotation

When command pulse is given to input terminal (FC1 or FC2), motor starts a forward rotation. When command pulse is given to input terminal(RCl or RC2), motor starts a reverse rotation. The input pulse operates an internal binary deviation counter and adds the pulse. The counter output is input to the D/A converter which is output as the analog command voltage. As the motor rotates, the pulse feed back from the position detection encoder subtracts the deviation counter numeric value.

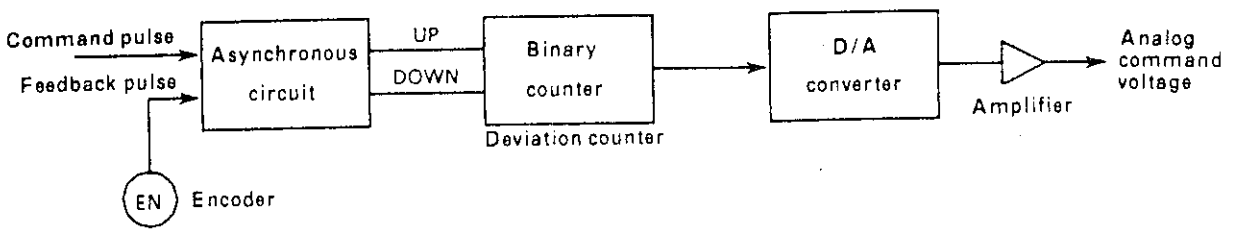


Fig. 5-6 Block diagram of position control portion

Relationship between deviation and input frequency is as shown in the following figure.

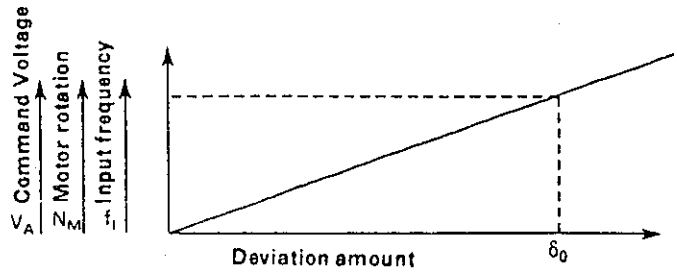


Fig. 5-7 Deviation and input frequency

Since the deviation counter uses a binary 12 bit, it is capable of having a deviation up to 4095 pulses. At 4032 pulses the overflow signal is output.
Against a fixed deviation the analog command voltage is ±10 V and the speed of motor is to be set to the rated rpm.

5-5-3 Speed of Motor and Input Frequency

When the motor is rotating at a constant rpm, input frequency and encoder feedback frequency can match. So the speed of motor can be set using input frequency.

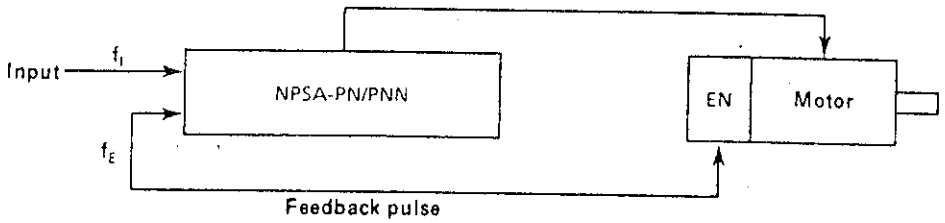


Fig. 5-8 Speed of motor and Input Frequency

With the above configuration, $f_I = f_E$, so if the encoder pulse is 1200 ppr, using the speed of motor, N_M rpm,

$$f_I = f_E = 1200 \text{ ppr} \times N_M \text{ rpm}/60 \text{ (pps)}$$

Example: If f_I = 12 kpps is input (let encoder pulse be 1200 ppr),

$$N_M = 12 \times 10^3 \times 60/1200 = 600 \text{ rpm}$$

5-5-4 Command Pulse

There are two kinds of input method for command pulse: input for line driver and input for open collector. With both methods, pulse per direction and a 90° out of phase pulse can be input.

[1] Pulse input per direction

When performing input of pulse per direction using input method for line driver, input to FC1 and $\overline{FC1}$ for forward rotation and input to RC1 and $\overline{RC1}$ for reverse rotation.

When performing input of pulse per direction using input method for open collector, input to FC2 and 0V for forward rotation, and input to RC2 and 0 V for the reverse rotation.

When performing the input of pulse per direction, input by pulse width shown in following figure using line driver or open collector.

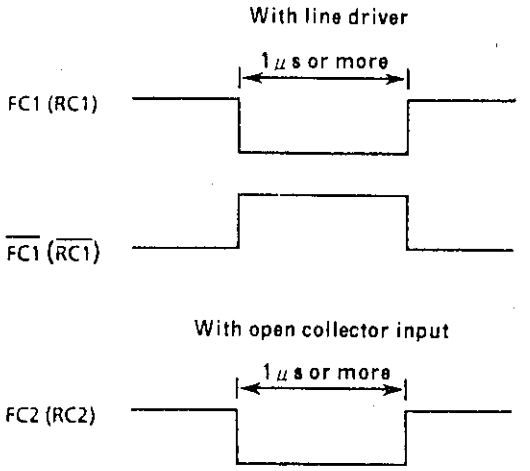
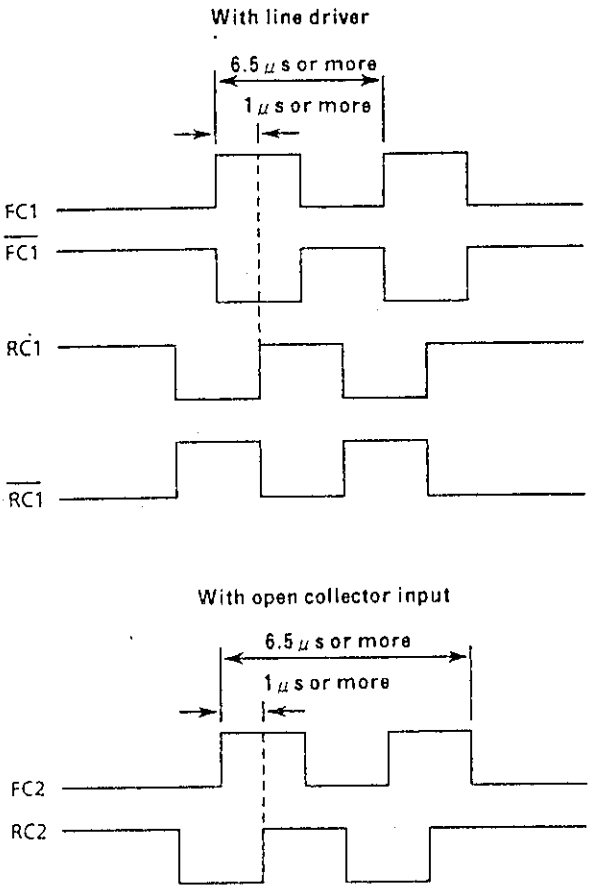


Fig. 5-9 Width of command pulse

2 90° phase difference pulse input

When 90° phase difference pulse is input, discrimination between forward and reverse rotation is performed in the NPSA-PN/PNN. When an A phase is input to the $\overline{FC1}$ and FC1 and a B phase is input to the $\overline{RC1}$ and RC1, if the pulse phase to be input first is an A phase the rotation is a reverse rotation, and if it is a B phase the rotation is a forward rotation. When performing an input of 90° out of phase pulse, input by pulse width shown in the following figure using line driver or open collector.



Note: The L level with open collector input should be 0.8V or less.

Fig. 5-10 Width of command pulse

5-5-5 Positioning

When motor is rotating, the difference between the command pulse and feedback pulse always remains on deviation counter. So even if command pulse is stopped, the motor rotates until the deviation is zero. That is, the command pulse number and the shift pulse number (feedback pulse number) match.

Example: Speed of motor: 1800rpm (30rps)
Encoder: 1200ppr
Feedback frequency: 1200ppr x 30rps=36kHz
∴Command pulse frequency 36kHz

If a pulse of 6000 is given at command pulse frequency 36 kHz, the motor rotates 6000p/1200ppr=5 times and stops.
When deviation in the deviation counter is in the positioning complete range, the positioning complete signal (PN) is output and positioning is completed when the degree of deviation is zero.

5-5-6 Positioning Time

As the position loop gain is increased, the positioning time becomes shorter and the gain setting range varies depending on the motor, driver and load conditions.

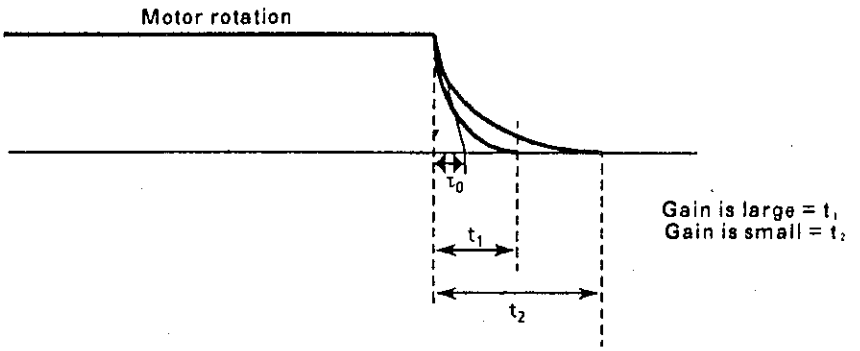


Fig. 5-11 Positioning time

The relational expression between the positioning time and position loop gain is as shown below.
Rated motor speed: V_0, Speed at positioning time: V_P
Assuming the time from when the motor starts reducing speed until the positioning speed becomes V_P as "t",

$$V_P = V_0 \varepsilon^{-\frac{t}{t_0}}$$

Where, t_0 is time constant when accelerating or decelerating, the position loop gain PA = $1/t_0$.
To obtain the time required, supposing speed V_P is 5% of V_0,

$$V_P/V_0 = 0.05 = \varepsilon^{-\frac{t}{t_0}}$$

$$\therefore \log_n 0.05 - t/t_0 = -2.9957$$

Therefore, $t = 3t_0$, that is, the time required for reaching 5% of the rated speed during decelerating is about 3 times the time constant to.

For example, suppose PA = 15, then $t_0 = 0.0667$ is obtained.

From the above equation t = 0.02 sec.

If V_p is assumed as 2% and when $t_0 = 0.0667$

logtn0.02 = −3.912 = −t0.067

∴t = 0.26 sec.

5-5-7 Servo Lock

If an external force is applied to motor when positioning is complete and the motor keeps stopping, torque is generated for correcting shift of the position, for returning shifted position to the zero position and a servo lock pulse of ±1 ~ 2 is set. Direction of the shift can be judged by the status display LED (F, R) on the driver.

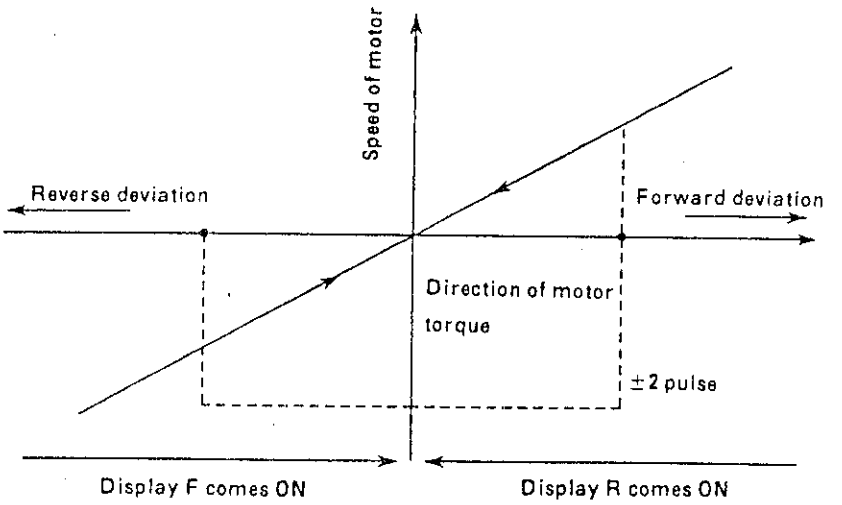


Fig. 5-12 Servo lock

5-5-8 Setting the Dip Switch

There are several dip switches on the PCB of the unit. Set these switches before turning ON or turning OFF the power. The position of each dip switch is shown in the following figure and a description for setting each dip switch is shown in Table 5-4.

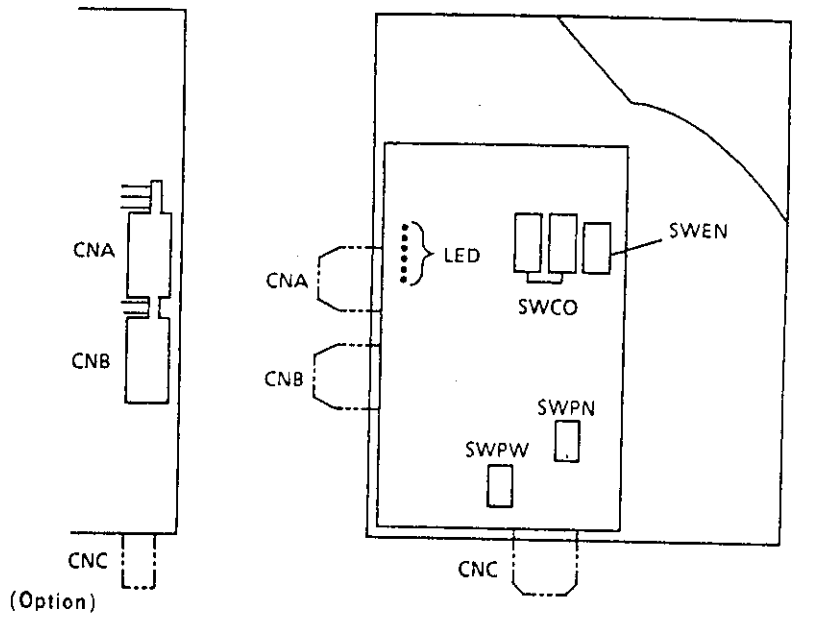


Fig. 5-13 Position of dip switches

Table 5-4 List of dip switches

Dip switch name	Switch No.	Description
SWPG		Set value of the position loop gain. Set range: 1 ~ 255 Negative logic, see 5-5-9 Setting of Position Loop Gain (SWPG).
SWPN		Set output range of positioning complete signal (PN). Set range: 1~ 255 pulse See 5-5-10 Setting of Output Range of Positioning Complete Signal (SWPN).
SWEN	1 2	Set magnification of encoder pulse. Set range: 1 time, double, quadruple See 5-5-11 Setting the Encoder Pulse Magnification (SWEN 1, 2)
	3	Set the forward/reverse rotation of encoder pulse input. When setting to the reverse rotation simply by using forward rotation command pulse, set in accordance with 5-5-14 Selecting of Normal/Reverse Selector Switch for Command Pulse Input. Turn This switch to OFF.
	4 5	Set command pulse magnification. Set range: single, double, quadruple See 5-5-13 Setting the Instruction Pulse Magnification (SWEN 4, 5)
	6	To input normal command pulse, set normal/reverse rotation. See 5-5-14 Setting of Normal/Reverse Rotation of the Instruction Pulse Input (SWEN 16)
	7	Set pulse train input circuit to the line receiver or open collector system. See 5-5-15 Setting of Command Pulse Input Selector Switch (SWEN7).
SWCO		Set the correction value of feedback pulse number. Set range: 1 ~ 262144 See 5-5-16 Setting of Feedback Pulse Number Correction (SWCO).

5-5-9 Setting of Position Loop Gain (SWPG)

Adjust the position loop gain using the D/A conversion portion; it is expressed as the degree of deviation. The position loop gain can be expressed as follows at rated speed.

$$PA = \frac{\text{Operation frequency/sec}}{\text{Deviation degree}} \text{ (1/sec)}$$

Therefore, changing the degree of deviation at the same speed is equal to changing the position loop gain.

When the gain is increased as in the figure shown below, the inclination is changed b → a and the deviation against the same speed decreases $\delta_2 \rightarrow \delta_1$.

The maximum value of the position gain varies depending on the motor, driver and load inertia, so set at a sufficient value to take these into consideration.

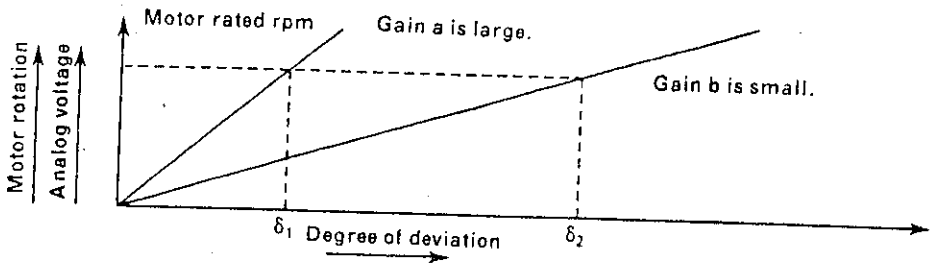


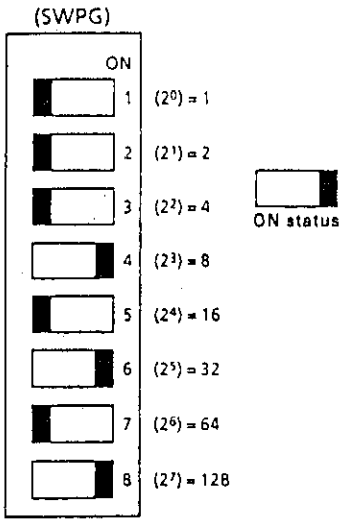
Fig. 5-14 Position Loop Gain

If gain is too large, the rotation of motor becomes unstable and especially when it stops or operates vibration may occur and the forward/reverse (F, R) of the LED will blink rapidly. If this happens, reduce gain to prevent vibration.

Yet if the lamp comes ON within range of a ±1 ~ 2 pulse when positioning is complete and the motor operates within the range of a ±1 ~ 2 pulse, this status is normal. (Servo lock status)

Loop gain PA can be obtained from operation frequency and deviation.
The degree of deviation can be obtained using the SWPG set value by the following equations:

δ = K x G (pulse)
PA = Maximum frequency/δ (1/S)
K is constant (13 ~ 16).



Because of negative logic, signal is valid when switch is OFF.
Example:
In case of the setting shown at left, if the frequency is 50KPPS, gain PA is:
Set value G = 1 + 2 + 4 + 16 + 64 = 87
Deviation amount δ = K x G = 13 x 87 = 1131 pulse

Loop gain PA $\frac{50\text{KPPS}}{1131}$ = 44 (1/S)

But if the maximum frequency is 24kHz or more, set the gain value to 188.

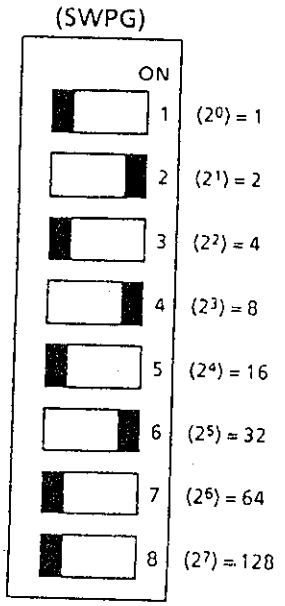
Caution: When the maximum frequency is 24KHz or more, set value to 188.

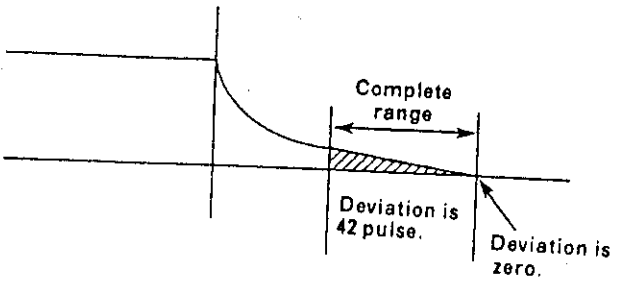
5-5-10 Setting of Output Range of Positioning Complete Signal (SWPN)

When deviation is zero, the positioning complete signal(PN) is output. If the signal is required for the early control of the external unit, it is possible to output the signal before the degree of deviation is zero. Set the switch using the SWPN through the binary 8 bit. The set range is 1 ~ 255 pulse. When the degree of deviation is within the set value in the forward or reverse direction, the positioning complete signal is output. For example, when the dip switch (SWPN) is set as shown in the following figure on the left.

PN = 2 x 1 + 8 x 1 + 32 x 1 = 42

and when the degree of deviation is within ±42 pulse, the positioning complete signal is output.





When deviation is 42 pulse or less (complete range in the above figure: hatched section), the complete signal is output.

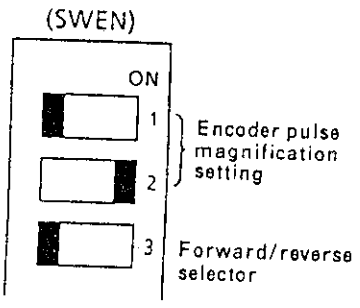
Fig. 5-15 Positioning Complete Range

Further, positioning complete output is not memory signal, so if motor is operated by an external force, complete output may drop instantaneously. Therefore, if considered necessary, add an external memory circuit.

5-5-11 Setting of Encoder Pulse Magnification (SWEN 1, 2)

To increase the resolution per rotation of the motor, increase the magnification of encoder pulse. Using internal switch, it is possible to set encoder pulse number to a single, double and quadruple magnification.

Status	Switch No.		Description	Kind of feedback pulse
	1	2		
①	OFF	OFF	Setting is impossible	
②	ON	OFF	(Encoder pulse) 1 time	90° phase pulse
③	OFF	ON	(Encoder pulse) double	
④	ON	ON	(Encoder pulse) quadruple	



Caution: If switches I and 2 are both set to OFF, the motor may run erratically, so do not set them in this way.

The above figure shows status (3) with the encoder pulse set to double. Note that encoder pulse input is in normal operation.

5-5-12 Setting of the Forward/Reverse Selector Switch (SWEN 3) for Encoder Pulse Input

Change over the forward/reverse direction of feedback pulse input against motor forward rotation.
Using this selector switch, motor rotation can be reversed but to reverse motor rotation only change it over by turning OFF SWEN 6.

SWEN 3	ON → Reverse direction
	OFF → Normal operation

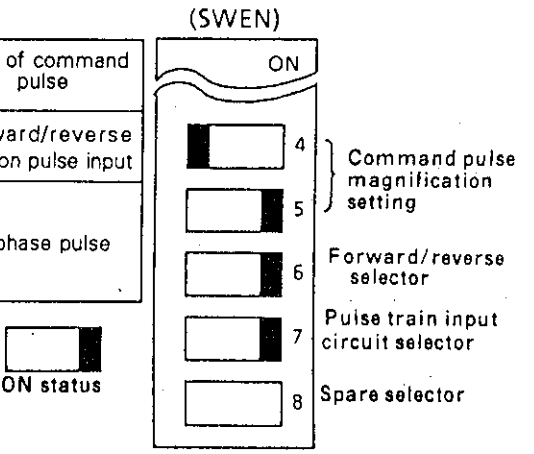
Normally, set SWEN to OFF (reverse).

Caution: After changing over encoder feedback pulse, change over phase connection of the U.V of the motor. Also, cut jumper wire JI0 without fail.

5-5-13 Setting of Command Pulse Magnification (SWEN 4, 5)

With a 90 phase difference pulse input by using the internal switch, the command pulse number can be set to a single, double and quadruple.

Status	Switch No.		Description	Kind of command pulse
	1	2		
①	OFF	OFF	Pulse through	Forward/reverse rotation pulse input
②	ON	OFF	(Command pulse) 1 time	90° phase pulse
③	OFF	ON	(Command pulse) double	
④	ON	ON	(Command pulse) quadruple	



The above figure shows status (3) when the command pulse is set to double. Also, against forward command, the motor performs a forward rotation.
Pulse train input speed is the input selection status for the line driver.

5-5-14 Setting of Forward/Reverse Selector Switch (SWEN 6) for Command Pulse Input

When reversing the rotation of the motor against forward command pulse input, or performing forward rotation against reverse command pulse input, use the SWEN 6 selector.

SWEN 6	ON → When forward pulse is input, forward rotation.
	OFF → When forward pulse is input, reverse rotation.

5-5-15 Setting of Command Pulse Input Selector (SWEN 7)

Set command pulse input circuit to line driver/open collector.

SWEN 7	ON → Input for line driver
	OFF → Input for open collector

5-5-16 Setting of Feedback Pulse Number Compensation (SWCO)

[1] Compensation rate

When the degree of machine movement per single pulse of feedback does not match the input command pulse, set the SWCO for compensation.
The compensation rate (NC) is expressed by the following equation.

$$NC = \frac{\Delta F}{\Delta S} = \frac{\text{Feedback pulse feed/1 pulse}}{\text{Command pulse feed/1 pulse}}$$

Also, NC can be expressed by setting (M) of dip switch (SWCO).
Since set value (M) of compensation rate performs an 18 bit compensation, the compensation rate NC can be expressed by the following equation.

$$NC = \frac{M}{2^{18}} = \frac{M}{262144} = \frac{\Delta F}{\Delta S}$$

Using the switch set M = 1 ~ 262144.
For example, with feed per

Specified one pulse $\Delta S = 0.01$mm/pulse
and feedback pulse feed $\Delta F = 0.008$mm/pulse.

Correction factor set value $M = \frac{\Delta F}{\Delta S} \times 262144 = \frac{0.008}{0.01} \times 262144 = 209715.2$

To set, count decimals of .5 and over as a whole number and round off anything less.
As an example, in the above case, M = 209715 is to be set.

[2] Relationship in size between ΔS and ΔF

Since the compensation rate range is $0 < NC \leq 1$, feedback pulse of feed per one pulse should be small against command value.

$\Delta S \quad \Delta F$

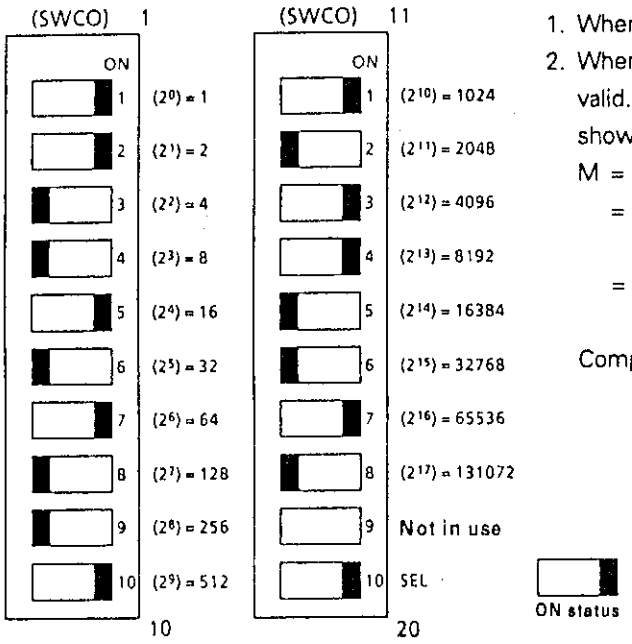
However, when $\Delta S < \Delta F$, perform as follows.
Since feedback pulse can be doubled against the command pulse through the encoder pulse magnification setting (SWEN 1,2) to obtain a feed of about 1/2 against the command pulse, a compensation setting is possible even when $\Delta S < \Delta F$.

Example: Command feed ΔS = 0.01mm/pulse
Feedback pulse ΔF = 0.012mm/pulse
If encoder setting is double, ΔF = 0.012/2 = 0.006/pulse

$$NC = \frac{\Delta F}{\Delta S} = \frac{0.012/2}{0.01} = \frac{M}{262144}$$

$\therefore M = 157286.4$

To set, count decimals of .5 and over as a whole number and round off anything less. In this case, M = 157286 is to be set.



1. When switch is turned ON, signal is input.
2. When SEL is turned ON, feedback pulse correction is valid. For example, when dip switch (SWCO) is set as shown in the left figure,

$$M = 2^0 + 2^1 + 2^4 + 2^6 + 2^9 + 2^{10} + 2^{12} + 2^{13} + 2^{16}$$
$$= 1 + 2 + 16 + 64 + 512 + 1024 + 4096 + 8192 + 65536$$
$$= 79443$$

Compensation factor $NC = \frac{79443}{262144} = 0.3031$

When feedback compensation is performed, motor speed rises as an inverse ratio of the factor, so reduce frequency of the command pulse.

5-6 Operation

The unit should be operated in accordance with the following procedure.

5-6-1 Confirmation of Source Voltage

Check the source voltage according to the following:

NPSA-N/NN/PN/PNN/NF:	200V/50Hz, 220V/60Hz	±10%
NPSA-NH:	440V/50Hz, 460V/60Hz	±10%

5-6-2 Test Run

A test run should always be performed.

1. Checking signal status of unit before turning the power ON.
   (1) Separate motor from machine system to set to the no-load status. Also, separate from upper positioning unit.
   (2) Signals to be input by external sequence before turning the power ON should be set as follows.
   Speed command voltage 0V
   SO ..... ON
   DR ..... OFF
   RESET ..... OFF
   TL ..... OFF
   (3) Set adjustment dial of thermal relay to the rated current value of the motor.

2. Turning the power ON
   (1) When power is turned ON, "POWER" and "SO" LED's come ON. If operation status LEDs other than these come ON, turn OFF power and check external sequence. Remove cause and turn the power ON again.
   (2) If motor rotates, remove cause in accordance with the procedure in Chapter 7 "Faults and Remedies".

3. Turning OFF the shut-off signal (SO)
   (1) Make sure the "SO" LED goes OFF. If LEDs other than this come ON, check the external sequence.
   (2) If error display LED comes ON or motor rotates rapidly, remove the cause in accordance with the procedure in Chapter 7 "Faults and Remedies".
   (3) At this time, the motor outputs torque which is about 20% of the rated torque. Also, due to offsetting the motor may rotate slowly.

4. Turning ON the start signal (DR)
   (1) Make sure the "START" or "DRIVE" LED comes ON. If it does not or other LEDs come ON, check the external sequence.
   (2) If the error display LED comes ON or the motor rotates, remove the cause in accordance with the procedure in Chapter 7 "Faults and Remedies".
   (3) When the motor generates torque and an external force is applied counter force is generated.

5. Increasing the speed command input voltage (for NPSA-PNN/PN, input the pulse train)
   (1) Gradually increase the voltage (input frequency) and make sure the number of motor rotations increases accordingly. (It is recommended that this be measured by putting the revolution counter to the motor shaft.)
   (2) If, at this time, the speed of the motor does not increase or it has not changed in proportion to the voltage (input frequency), or the shaft vibrates, see Chapter 7 Faults and remedies.

6. Turning ON/OFF of the start signal (DR), changing over of forward/reverse
   (1) Repeat turning ON/OFF of start signal (DR) and make sure the motor operates accordingly.
   (2) Repeat forward/reverse rotation change over with the start signal (DR) ON and make sure the motor performs this function.
   (3) If there are no abnormalities, combine with the machine system.

Caution: At the time of shipment from the factory, adjustments for gain, offset and rated rpm are performed but these may vary depending on running conditions, so if necessary readjust in accordance with the 5-7 Adjustment. The NPSA-PN/PNN provides a standard adjustment, so set the dip switches before operating.

7. Connecting to load
   (1) When the test run of the motor and driver is over, perform a test run connected to the machine system.
   (2) Check for any abnormal sound, vibration or any other abnormalities.
   (3) If error display is ON and other abnormalities are discovered, see Chapter 7 "Faults and Remedies".

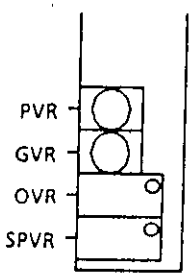
5-7 Adjustment

At time of shipment from the factory, a standard adjustment of the driver is performed, but when the driver is used in combination an adjustment matching the load status is required. After an adjustment matching the load conditions is performed, the adjustment status may vary depending on secular change, temperature changes and so on. Therefore, if following indications are found, adjust using the variable resister of the unit.

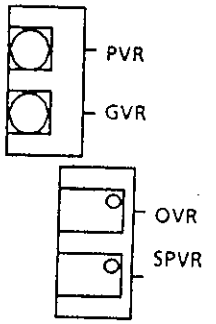
5-7-1 Variable Resistor to be Adjusted for each Problem

(1) The motor vibrates ...PVR, GVR
(2) The over-shoot or under-shoot of the motor is significant ...PVR, GVR
(3) Motor operation follows speed command input voltage with delay ...PVR, GVR
(4) Motor rotates when the speed command input voltage is 0 V. ...0VR
(5) When the speed command input voltage is l0V, motor operation does not reach the rated rpm. ...SPVR

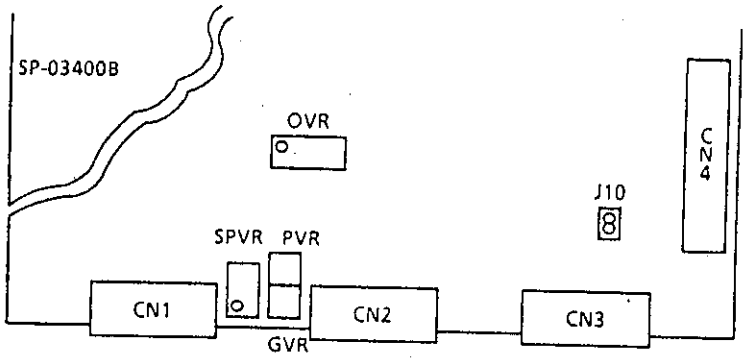
5-7-2 Position of each variable resistor



NPSA-NN/PNN



NPSA-NF/20N/PN



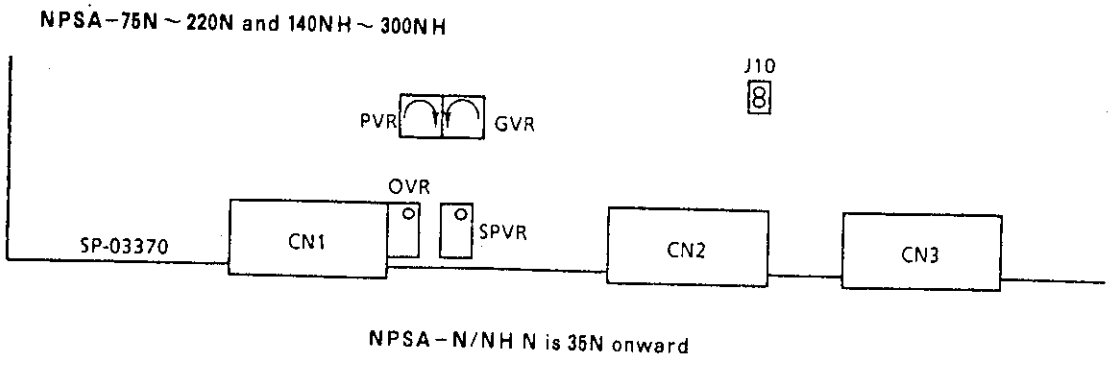


Fig. 5-16 Position of variable resistor

5-7-3 Adjustment method

(1) Adjustment of PVR, GVR

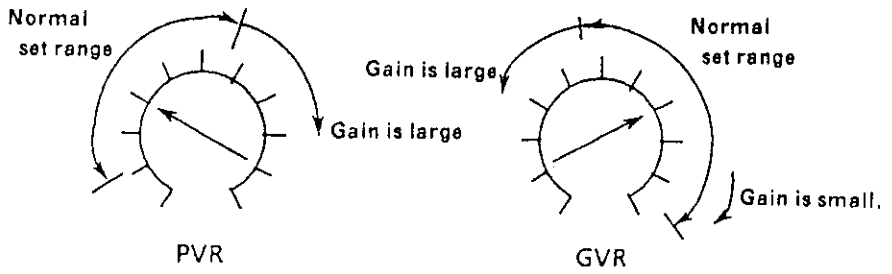


Fig. 5-17 Set range of PVR, GVR

① Set GVR first, then adjust to a stable position using PVR. Before adjusting, make a note of the current position or put a mark on the machine so that the original position can be returned to should adjustment be impossible.

② When the gain is large, the responsibility for GVR is good but stability is small. When the gain is small, responsibility is not good but stability is large. If the gain is set to too large a value, the motor may vibrate, so set it in such a position that vibration will not occur.

③ When the gain is small, the PVR has a large vibration and when the gain is large, the PVR has a small vibration. Set in a position where motor vibration is minimized.

④ Usually, if motor vibrates adjust the PVR. If it cannot be adjusted using the PVR, it is assumed that the load inertia is relatively large compared with the motor inertia. In that case, increase the gain using the GVR, then adjust the stability using the PVR.

⑤ If vibration cannot be prevented by adjusting the GVR and PVR, change the gain constant using the jumper pin on the PCB and adjust the GVR and PVR again. The positions and capacity values of the jumper pins are as shown below. (NPSA-N/PN does not have a jumper pin, so this adjustment is not possible on this model.)

Caution: Since the gain can be changed by a slight adjustment of the PVR or GVR, move them slowly and do not turn the variable resistor to full.

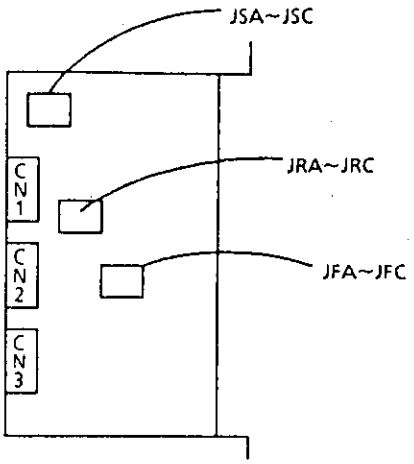


Fig. 5-18 Position of jumper pin

PVR set change

Jumper pin	C capacity
JSA	0.022μF
JSB	0.047μF
JSC	0.1μF

When the C capacity is small, setting is a high responsibility.
Multiple selection is possible.

GVR set change

Jumper pin	Jumper pin	C capacity
JFA	JRA	0.0033μF
JFB	JRB	0.01μF
JFC	JRC	0.022μF

When the C capacity is small, setting is a high responsibility.
Multiple selection is possible.

Fig. 5-19 Setting the jumper pin

Caution: When JFA is selected, always select JRA.
When JFB is selected, always select JRB.
When JFC is selected, always select JRC.

(2) 0VR (Variable resistor for zero speed adjustment)

① Even when speed command input voltage is zero, the motor may rotate slightly. The cause is offsetting of the unit amplifier. This also varies depending on the temperature.

② Using the zero adjustment variable resistor OVR, adjust this offset and to stop the rotation of the motor.

③ When the start signal (DR) is OFF, a slight load may cause the motor to stop rotation. To stop the motor completely, input shut-off signal (SO). At this time, the motor is in a torque free status and if any external force is applied it cannot be braked.

(3) SPVR (Variable resistor for fine adjustment of speed)

The speed of the motor can be adjusted so that the motor can rotate at the rated rpm when the speed setting voltage is about ±10 V. But it may vary depending on the motor combinations. Especially when performing an command input from an external power source without using an auxiliary power source (+10 V, −10 V) as the speed setting voltage, finely adjust so that motor can rotate at the rated rpm within ±10 V. To increase motor speedturn SPVR counterclockwise and to decrease motor speed turn it clockwise.

CHAPTER 6 MAINTENANCE

6-1 Outline

The driver and motor are stationary but periodically check them to prevent failure caused by the temperature, humidity and dust. The motor is maintenance-free but perform periodic checks toalso prevent failure due to environmental changes.

Caution: 1. Operators should check if the power is ON/OFF during operation.
2. When power is cut off, high voltage is charged to the capacitor, so start working one minute or more after cutting off the power.
3. If inserting hand into machine, be careful about shock from static electricity. Do not use a megger tester because it may damage the unit.

6-2 Daily Check

Check the following basic items during operation.

6-2-1 Check Items

(1) Check if motor is operating normally.
(2) Check if operating environment is normal.
(3) Check if cooling system is normal.
(4) Check if regenerative resistance is normal.
(5) Check for abnormal vibration or sound.
(6) Check for any abnormal heating or discoloration.

6-3 Periodical Check

Depending on the operation time, periodically check the following items.

6-3-1 Check Items

(1) Looseness of connections to load, play of shaft key, abnormal sound in motor bearings, belt slackness.
(2) Check if cooling system is normal.
(3) Check for corrosion or damage to insulating material of conductor.
(4) Check or replace cooling blower, capacitor, conductor and relay.
(5) Check cleanliness of air filter.

6-4 Other Checks

6-4-1 Gear

It is necessary to supply or replace oil and grease in the gearing of the motor w/gear. Replace grease every 20,000 hours and replace oil every 5,000 hours. Since the lubricating oil is of great importance in efficient functioning, do not use lubricating oil other than a special lubricating oil with a specified brand name. (Do not use the machine oil or engine oil.)If a special lubricating oil name is not specified, consult NIKKI DENSO. When filling or draining the oil lubrication system, do not mix different kinds of oil or drip the oil. Fill the oil up to the specified level.

6-4-2 Oil Seal

Table 6-1 shows the oil seal for the motor.
When ordering the oil seal, use the order number shown in Table 6-2.

Table 6-1 Oil seal to be used

Machine type	JIS Nominal number	Machine type	JIS Nominal number
NA21-1.5F	S10207	NA30-13F	S15307
NA21-3AF	S10207	NA30-25F	S20358
NA21-6F	S12257	NA30-50F	S25408
NA21-10F	S12257	NA30-110F	S30458
NA20-15F	S15307	NA30-180F	S35508
NA20-20F	S20358		
NA20-40F	S25408		
NA20-75F	S25408		
NA20-110F	S30458		
NA20-180F	S30458		
NA20-270F	S40588		
NA20-370F	S40588		
NA20-550F	S45629		
NA20-750F	S557812		
NA20-1100F	S557812		

The meaning of the JIS nominal number is described below.

Example:

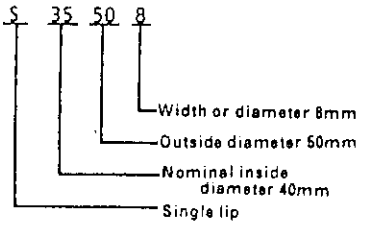


Table 6-2 Ordering number

Number for ordering	JIS Nominal number
056-1012	S12257
056-1013	S15307
056-1014	S20358
056-1015	S25408
056-1016	S30458
056-1017	S40588
056-1018	S10207
056-1019	S45696
056-1020	S557812
056-1021	S35508

CHAPTER 7 FAULTS AND THEIR REMEDIES

7-1 Outline

If any fault is discovered, perform the following checks or fault diagnoses, identify the cause and take appropriate countermeasures. If any of the following items is irrelevant or the part(s) or unit is damaged or has a fault, contact the sales shop where you purchased the unit or the sales staff of our company.

7-2 Checks and Check Items

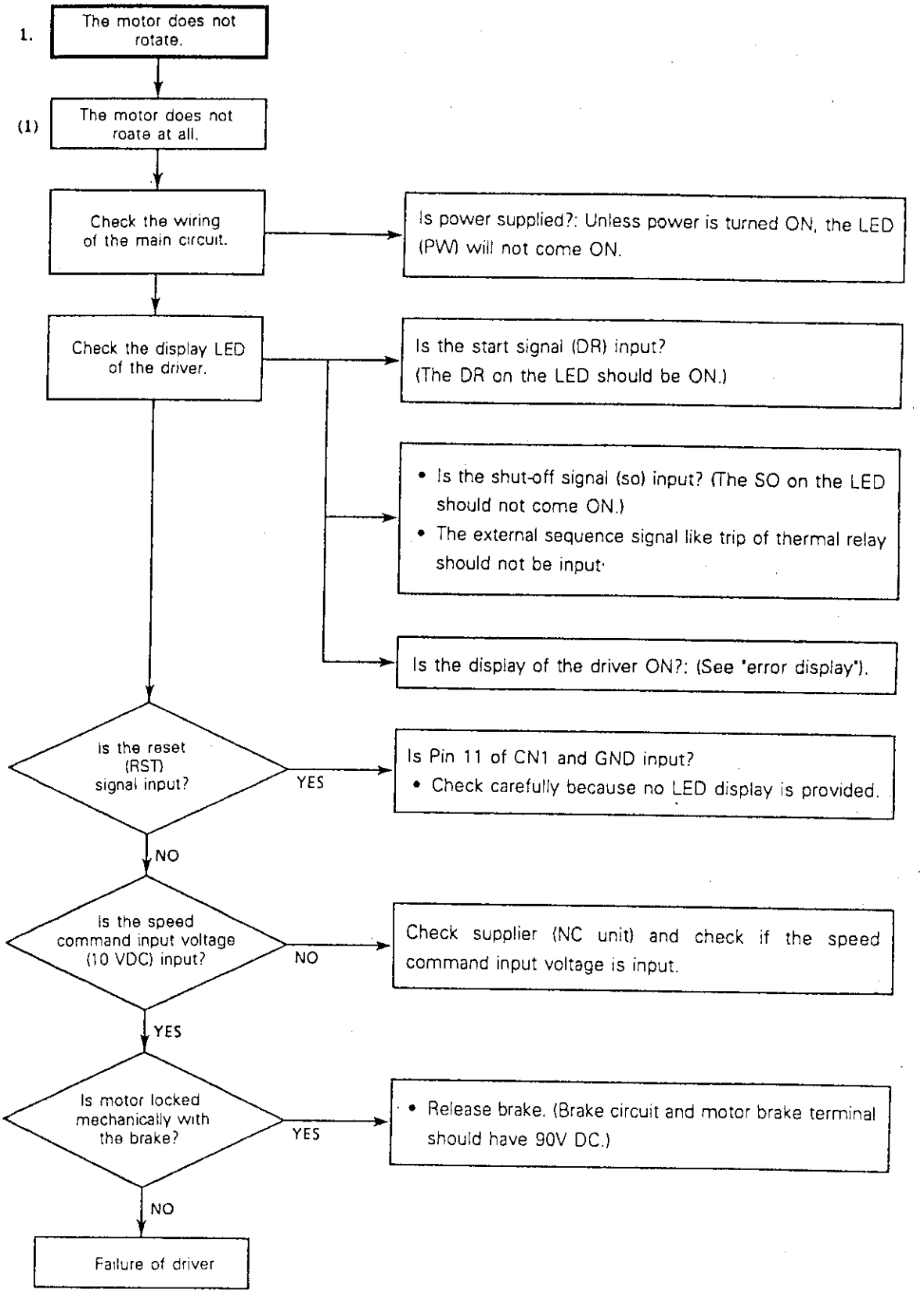
7-2-1 Check Items

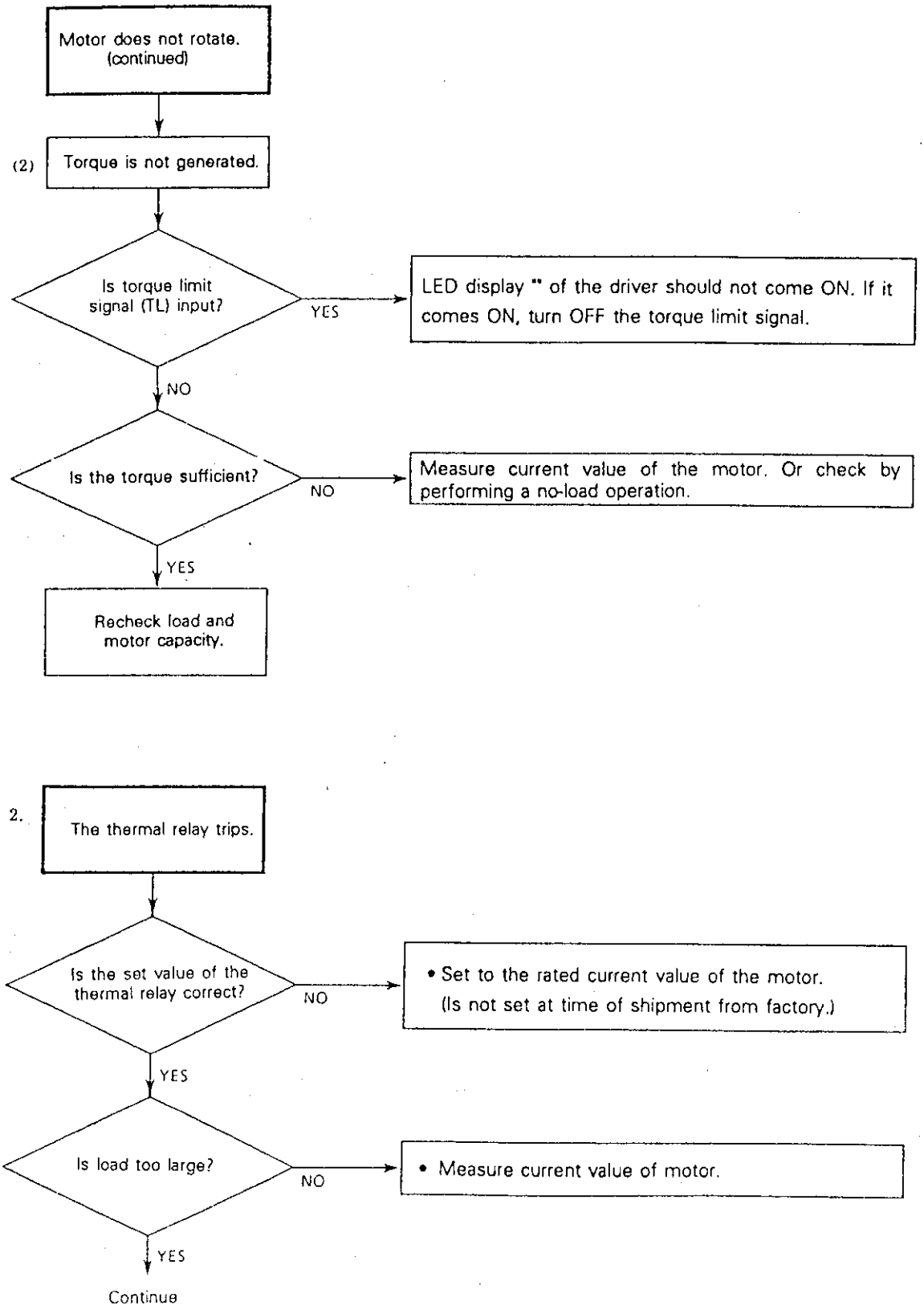
Check the following items.
If there are several identical motors or units, use them to operate the machine and identify which unit has the fault.

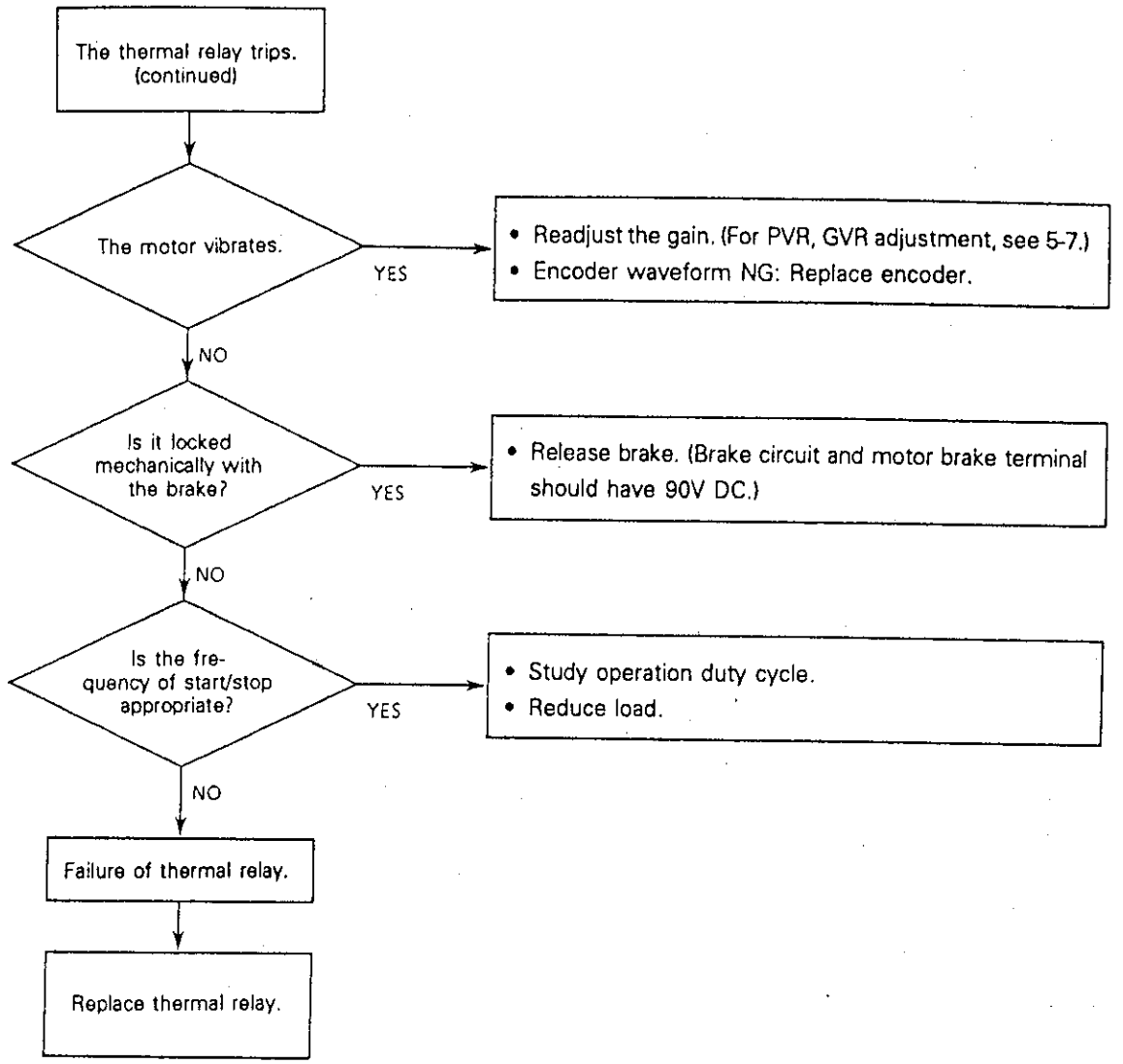
- Visually check for any abnormality.
- Error display indicated?
- Is there any repetition of the abnormality or does it occur only at a special time?
- What is the frequency with which the abnormality occurs?
- What has been the period of use?
- Is the source voltage normal? Does it fluctuate greatly depending on the time of day? Was there any sudden power failure?
- Check if the motor, driver and ambient temperatures are within normal limits.
- Are there water, oil, iron chips and corrosive gas on or around the motor?
- Are there any abnormalities during the no-load operation?

7-2-2 When Motor Operation is Abnormal

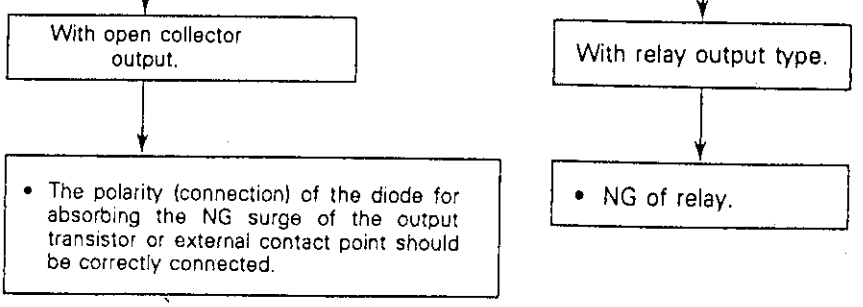
Caution: When motor is combined with upper positioning unit, perform the following checks using only the motor and driver:

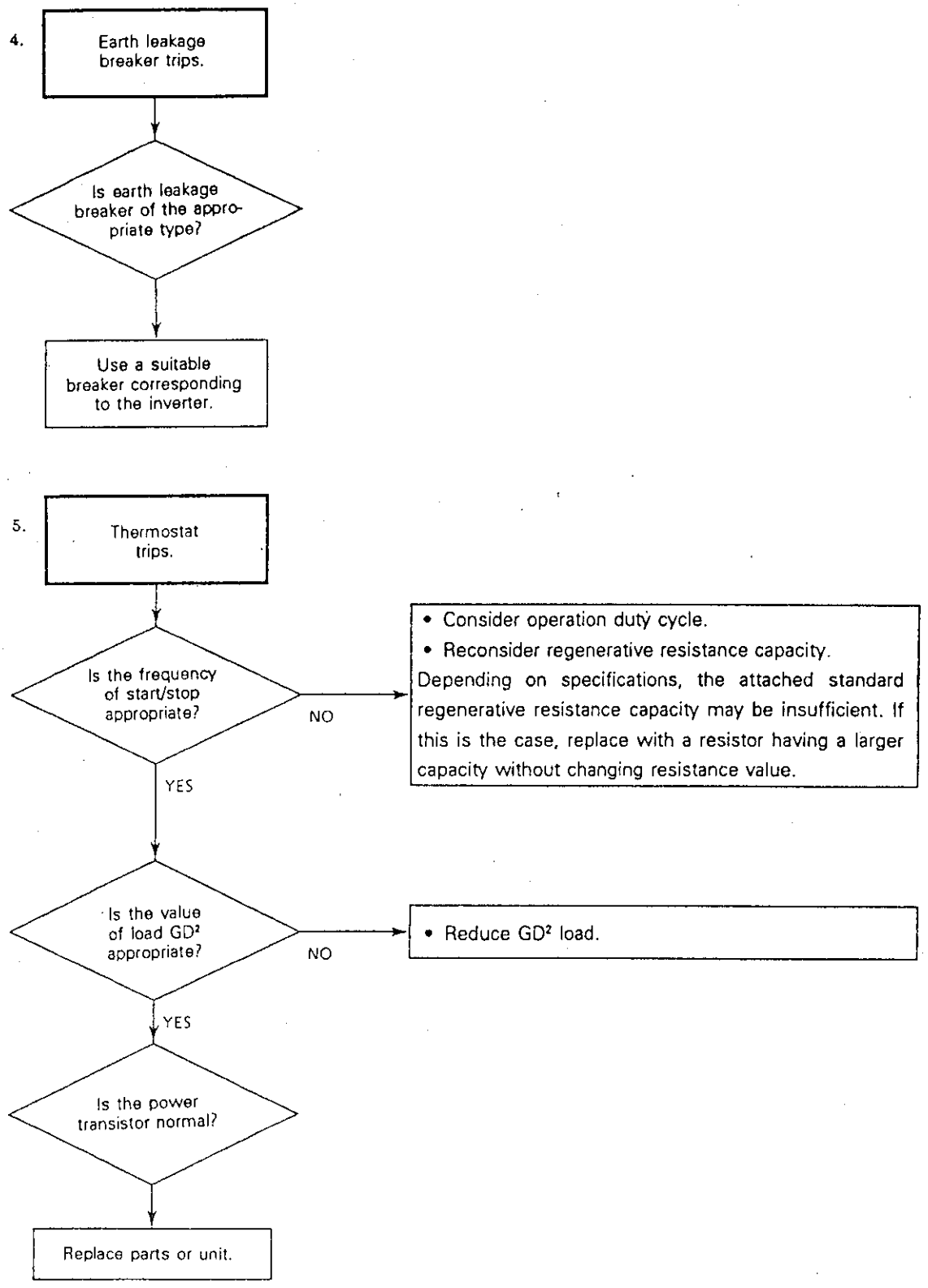

1.
The motor does not rotate.
(1)
The motor does not roate at all.
Check the wiring of the main circuit.
Is power supplied?: Unless power is turned ON, the LED (PW) will not come ON.
Check the display LED of the driver.
Is the start signal (DR) input?
(The DR on the LED should be ON.)
• Is the shut-off signal (so) input? (The SO on the LED should not come ON.)
• The external sequence signal like trip of thermal relay should not be input.
Is the display of the driver ON?: (See "error display").
Is the reset (RST) signal input?
YES
Is Pin 11 of CN1 and GND input?
• Check carefully because no LED display is provided.
NO
Is the speed command input voltage (10 VDC) input?
NO
Check supplier (NC unit) and check if the speed command input voltage is input.
YES
Is motor locked mechanically with the brake?
YES
• Release brake. (Brake circuit and motor brake terminal should have 90V DC.)
NO
Failure of driver

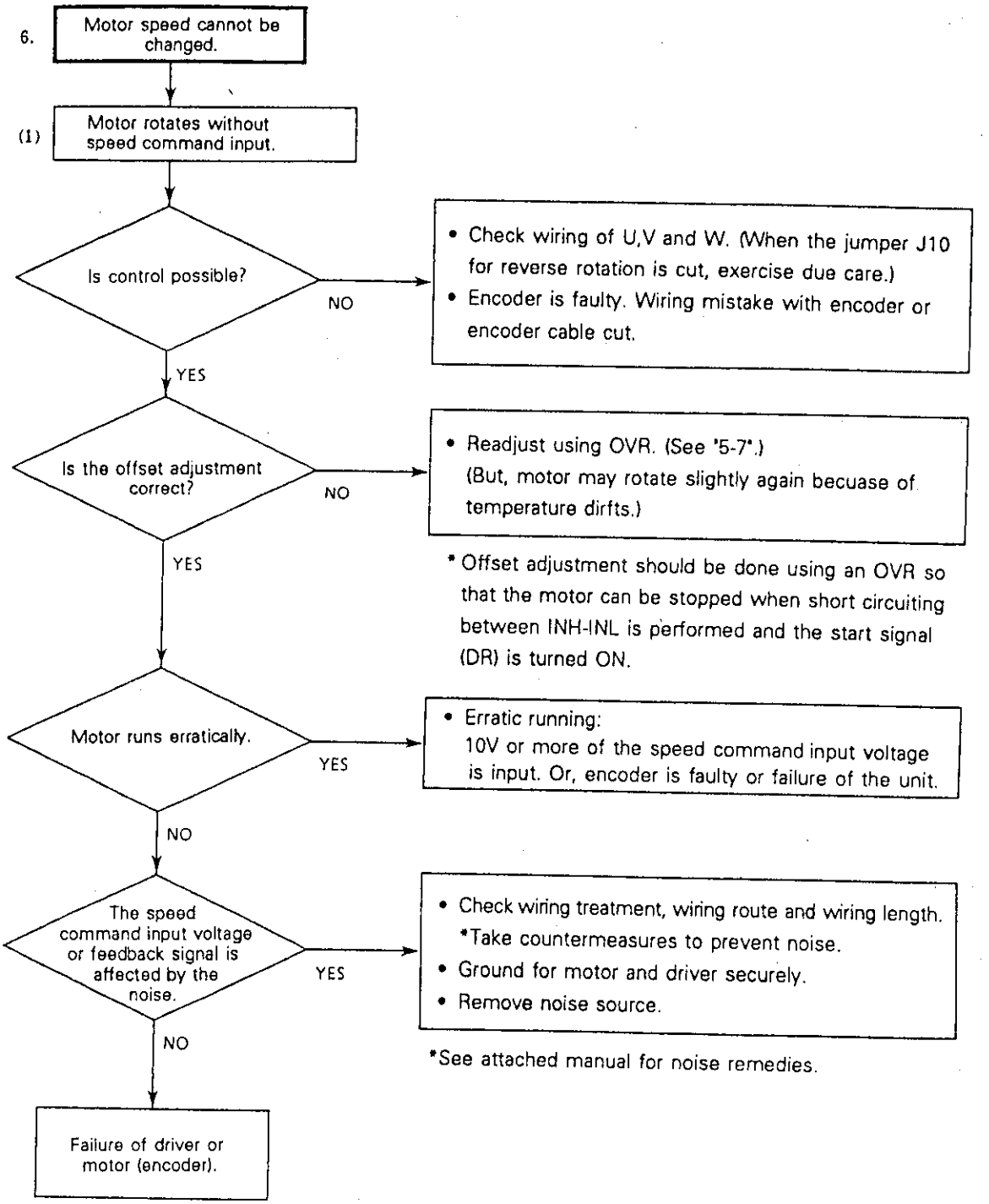

Motor does not rotate. (continued)
(2)
Torque is not generated.
Is torque limit signal (TL) input?
YES
LED display " of the driver should not come ON. If it comes ON, turn OFF the torque limit signal.
NO
Is the torque sufficient?
NO
Measure current value of the motor. Or check by performing a no-load operation.
YES
Recheck load and motor capacity.
2.
The thermal relay trips.
Is the set value of the thermal relay correct?
NO
• Set to the rated current value of the motor. (Is not set at time of shipment from factory.)
YES
Is load too large?
NO
• Measure current value of motor.
YES
Continue



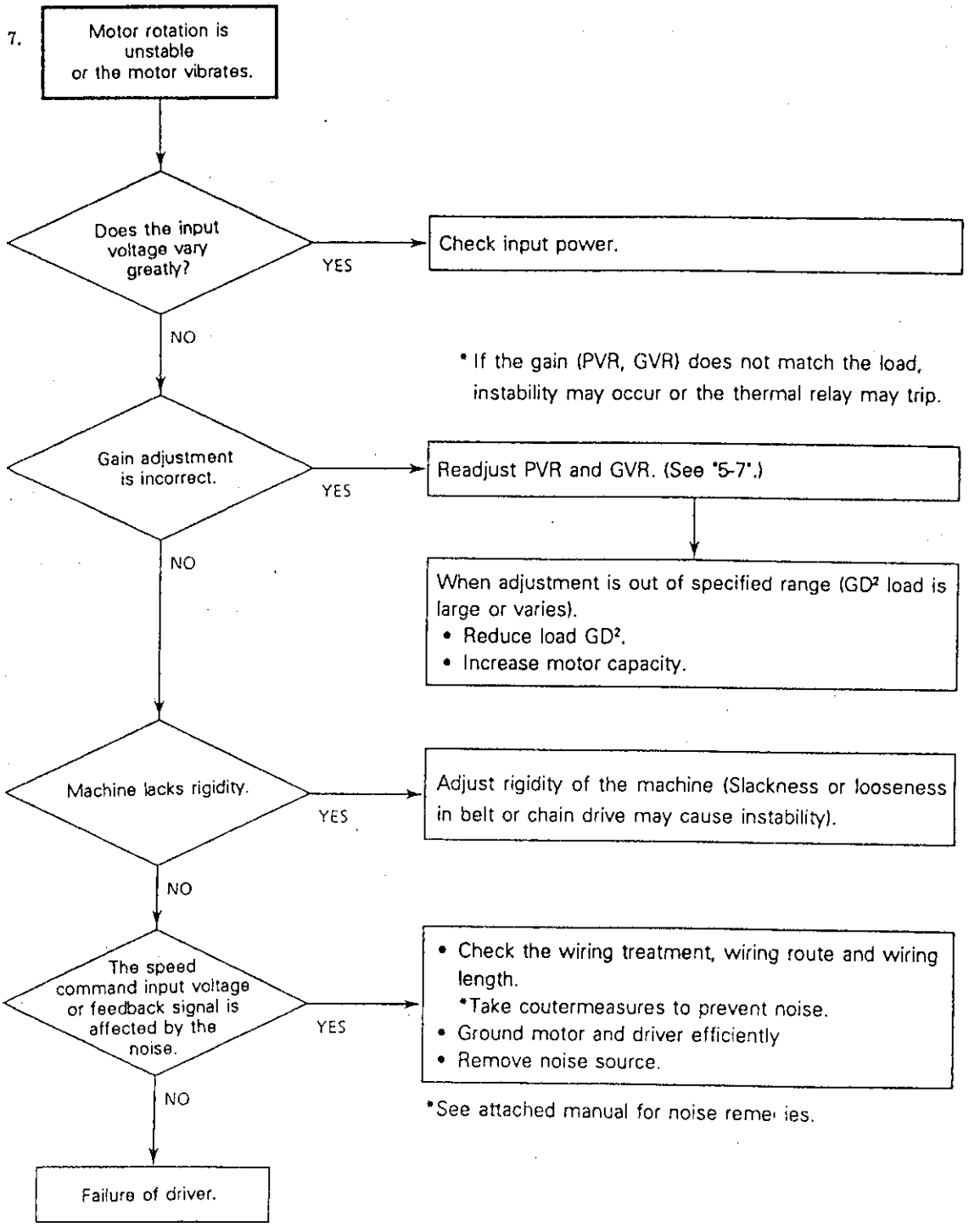
3. Servo ready not given.



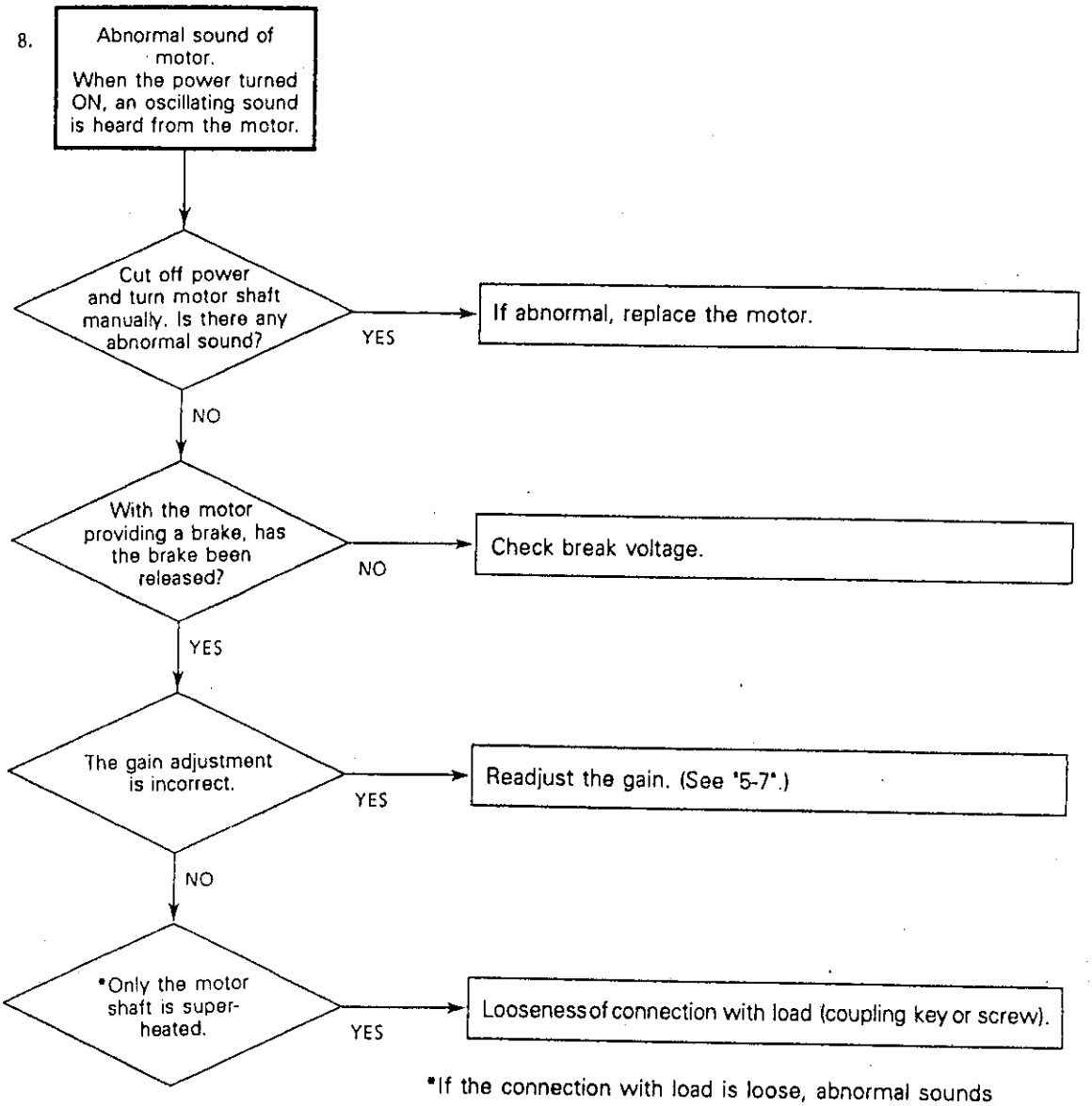

4.
Earth leakage breaker trips.
Is earth leakage breaker of the appropriate type?
Use a suitable breaker corresponding to the inverter.
5.
Thermostat trips.
Is the frequency of start/stop appropriate?
NO
• Consider operation duty cycle.
• Reconsider regenerative resistance capacity.
Depending on specifications, the attached standard regenerative resistance capacity may be insufficient. If this is the case, replace with a resistor having a larger capacity without changing resistance value.
YES
Is the value of load GD² appropriate?
NO
• Reduce GD² load.
YES
Is the power transistor normal?
Replace parts or unit.


6.
Motor speed cannot be changed.
(1)
Motor rotates without speed command input.
Is control possible?
NO
• Check wiring of U,V and W. (When the jumper J10 for reverse rotation is cut, exercise due care.)
• Encoder is faulty. Wiring mistake with encoder or encoder cable cut.
YES
Is the offset adjustment correct?
NO
• Readjust using OVR. (See "5-7".)
(But, motor may rotate slightly again becuase of temperature dirfts.)
* Offset adjustment should be done using an OVR so that the motor can be stopped when short circuiting between INH-INL is performed and the start signal (DR) is turned ON.
YES
Motor runs erratically.
YES
• Erratic running:
10V or more of the speed command input voltage is input. Or, encoder is faulty or failure of the unit.
NO
The speed command input voltage or feedback signal is affected by the noise.
YES
• Check wiring treatment, wiring route and wiring length.
*Take countermeasures to prevent noise.
• Ground for motor and driver securely.
• Remove noise source.
*See attached manual for noise remedies.
NO
Failure of driver or motor (encoder).

7.

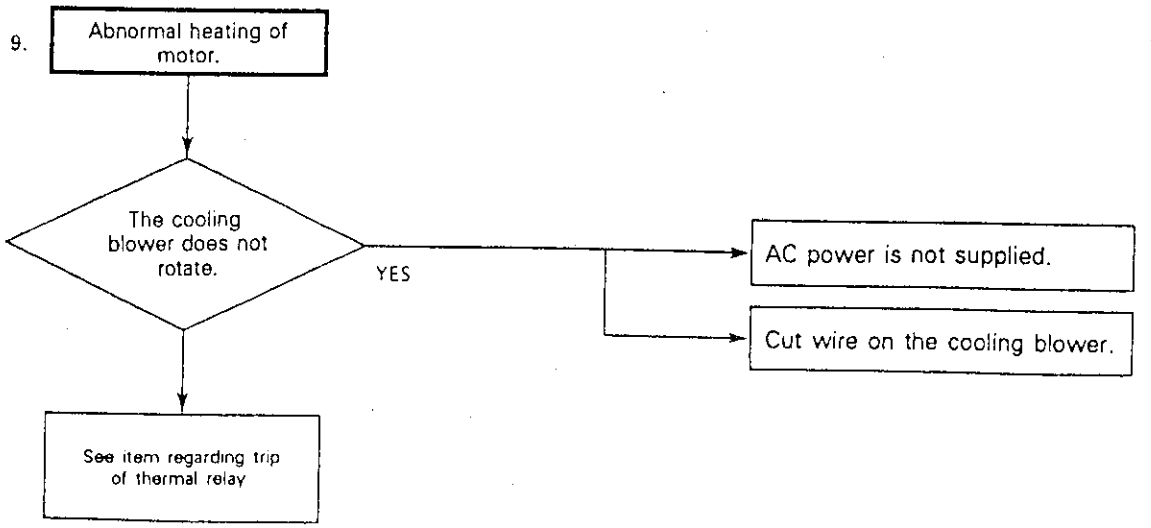

Motor rotation is unstable or the motor vibrates.
Does the input voltage vary greatly?
YES
Check input power.
NO
* If the gain (PVR, GVR) does not match the load, instability may occur or the thermal relay may trip.
Gain adjustment is incorrect.
YES
Readjust PVR and GVR. (See "5-7".)
NO
When adjustment is out of specified range (GD² load is large or varies).
• Reduce load GD².
• Increase motor capacity.
Machine lacks rigidity.
YES
Adjust rigidity of the machine (Slackness or looseness in belt or chain drive may cause instability).
NO
The speed command input voltage or feedback signal is affected by the noise.
YES
• Check the wiring treatment, wiring route and wiring length.
*Take coutermeasures to prevent noise.
• Ground motor and driver efficiently
• Remove noise source.
*See attached manual for noise reme· ies.
NO
Failure of driver.

8.



*If the connection with load is loose, abnormal sounds and superheating of motor shaft may occur.

9.



10. **Shift of position and positioning complete signal are not output. (NPSA-PN/PNN type driver)**

- Not wired according to pulse train input specifications.
- Input pulse is unusable.
- Coupling is loose.
- Encoder retaining screw is loose or damaged.
- Play in machine system.
- Grounding is inadequate.
- Deviation in gain adjustment (adjustment of PVR, GVR).
- Maximum frequency is high (overflow?).
- Is the encoder magnification setting correct? (Check SWEN 1, 2)
- Is there any loud external noise source?
- Pulse remains on deviation counter.
- Is the motor rotated by any external force?
- Deviation in offset (adjustment of OVR).

7-3 Checking Procedure and Remedies for Correcting Errors

7-3-1 Error Display

When the driver detects an abnormality, the error is displayed and the driver is put in stop status. With the NPSA-2.5NN ~ 20NN/20N/NF type and NPSA-PN/PNN type drivers, the LED on the face of the driver lights.

Machine type / Name	NPSA-NN/PNN/NF	NPSA-20N/PN	NPSA-NH/N
	Display		
Overcurrent	O.C.	Over current	1
Under current	U.V.	Under current	2
Overvoltage	O.V.	Over voltage	3
Over-speed	O.S.	Over speed	4
PG cut	PG ALARM	PG cut	5
Overload	—	—	6

Error name	Description of Protection	Description of Unit	Description	Cause	Remedies
Over-voltage	DC overvoltage detection	The DC main circuit voltage is high (400V DC or more, NH is 780V DC or more).	When the regenerative energy and DV voltage are too large during speed reduction, the protection circuit operates and the LED comes ON.	1. The regenerative energy of load cannot be sufficiently absorbed. 2. Disconnection of regenerative resistance. 3. Source voltage to be supplied from the factory is high. (Spike type is included.)	• Reduce load or check the motor capacity. • Install regenerative resistance. (With 5.5kW or more, connect the regenerative resistance in parallel.) • Supply the correct power source.
Under voltage	Under voltage detection	Source voltage for the control is low. (170V AC or less, NH is 380V AC or more.)	When the AC input source voltage is about 170V or less, the protection circuit operates and the LED comes ON.	1. Source voltage to be supplied from the factory is low. 2. Voltage is supplied instantaneously. 3. Source voltage is reduced. 4. Power wire is thin. 5. Screw of the power supply terminal is loose.	• Supply the correct power. • Consider using power system. • Capacity of power transformer is insufficient. • Change the wire route.
PG cut	Encoder line cut	No wiring of encoder	When the encoder cable is disconnected, or cut, or the connector of the encoder cable comes OFF, the protection circuit operates and the LED comes ON.	1. The wire is cut or the NG of the feedback (pulse encoder) signal.	• Check the wiring and take appropriate countermeasures.
Over-speed	Over-speed detection	Over-speed is about 130% or more.	When the number of motor rotations reaches about 130% of the rated rpm, the protection circuit operates and the LED comes ON.	1. Pulse number of the pulse encoder is inappropriate. 2. Error in wiring the motor and feedback signal lines. 3. The wire is cut or the wiring of the motor line is NG. 4. The magnet ON/OFF timing of the motor line, insertion is not synchronized. 5. The speed command voltage is 10V or more.	• Replace with the correct pulse encoder. • Reconsider appropriateness of the wiring. • Recheck the wiring for irregularities. • Check the timing and take countermeasures. • Check the input voltage and adjust the maximum voltage to within ±10V.
Over-current	Overcurrent detection	Power transistor current value over normal.	When motor is grounded or the driver has shorted or it has errors in wiring, the protection circuit operates and the LED comes ON.	1. Motor line is shorted or grounded. 2. Malfunction of unit because of noise. 3. Fluctuation of current because of unstable motor operation.	• Check the wiring and take countermeasures. • Motor is defective. • Remove the noise source. • Install a noise killer to the magnet or solenoid. • Adjust stability.
Over-load	Overload detection	The overload detection circuit is under operation.	When a load torque of 120% or more of the rated torque continues for 20 sec. or more, an overload is detected.	1. Load is large. 2. No pulse in encoder. 3. Noise on feedback.	• Reduce load. • Replace encoder. • Reconsider adequacy of wiring.

Note: 1. When the error is not displayed, operation is normal.
2. After protection circuit operates, remove fault status, then reset by using the reset signal or turning ON power the again.

CHAPTER 8 MATERIAL

8-1 Outline

This chapter describes the electrical specifications, overall outline drawing, and the outline drawing for accessories of the NIKKI induction type AC servo sysem "ACTUS POWER" driver on each series using the table.

8-2 Electrical Specifications

8-2-1 NPSA-N, NN Series (200V/50Hz, 220V/60Hz Specifications)

(1) 3000/2000rpm type

*Units up to NPSA-5NN are 3000rpm; NPSA-10NN onward are 2000rpm.

Item \ Type	Unit	NPSA-2.5NN-40A	NPSA-2.5NN-50A	NPSA-2.5NN-60A	NPSA-2.5NN-70A	NPSA-5NN-20	NPSA-5NN-30	NPSA-5NN-40	NPSA-5NN-50	NPSA-10NN-40	NPSA-10NN-50	NPSA-10NN-60	NPSA-10NN-70
Main power supply		Built-in power supply type											
Control power supply	V	AC200V/50Hz, 220V/60Hz 3-phase/single-phase common use						AC200V/220V 50/60Hz Three-phase					
Main circuit system		Transistor, full bridge 3-phase (Sine-wave PWM control)											
Output voltage	V	48 (r.m.s.)	80 (r.m.s.)	120 (r.m.s.)									
Continuous output current	A	1.06	1.05	1.65	2.15	3.4	3.4	4.2	4.2	5.4	5.4	10.0	10.0
Instantaneous output current	A	2.51	2.56	4.47	5.48	8.21	9.14	7.4	10.7	10.0	14.8	17.7	25.8
Braking system		Regenerative brake (No regenerative resistance See Note 1)				Regenerative brake (to be absorbed by regenerative resistance)							
Speed control range		1000 : 1											
Speed regulation: Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)											
Speed regulation: Voltage variation ±10%	%	±0.1 or less (at rated rpm)											
Speed regulation: Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)											
Carrier frequency	Hz	2K											
Input: Command voltage	V	0 – ±10											
Input: Input resistance	KΩ	20 Max											
Auxiliary power supply	V	±10 8mA											
Speed control system		F/V conversion feedback system using encoder											
Output for position detection		1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, 5V, line driver output											
Safety circuit: Current limiting value	A	2.51	2.56	4.47	5.48	8.21	9.14	7.4	10.7	10.0	14.8	17.7	25.8
Safety circuit: Surge absorbing circuit		Surge absorber between lines											
Safety circuit: Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm											
Safety circuit: Servo ready output		Open collector output (DC24V, 50mA)											
Safety circuit: Thermal set value (Accessory)	A	1.06	1.05	1.65	2.15	3.4	3.4	4.2	4.2	5.4	5.4	10	10
Safety circuit: Input breaker	A	10A								10A		15A	
Control signal input		Start (DR), full-stop (SO), torque limit (TL), reset (RST)											
Applied motor		NA21-1.5F NA21-1.5F-B	NA21-3F NA21-3F-B	NA21-6F NA21-6F-B	NA21-10F NA21-10F-B	NA20-15F		NA20-20F NA20-20F-B		NA20-40F NA20-40F-B		NA20-75F NA20-75F-B	
Regenerative resistance (Accessory)		None						60W 80Ω				200W 40Ω	
Power supply capacity	KVA	0.18 (1 or 3φ)		0.35 (1 or 3φ)	0.53 (1 or 3φ)	1.0 (1 or 3φ)		1.0 (1 or 3φ)		1.93 (3φ)		2.9 (3φ)	
	Kg	6.5				6.6		8.1					

Note 1: The GD^2 value of load is to be used within 20 times using GD^2 value which is converted to motor shaft.

(2) 2000rpm type

Item \ Type	Unit	NPSA-15NN-50	NPSA-15NN-60	NPSA-20NN-50	NPSA-20NN-60	NPSA-36N-50	NPSA-45N-50	NPSA-75N-50	NPSA-100N-50	NPSA-140N-50	NPSA-180N-50	NPSA-220N-50
Main power supply		Built-in power supply type										
Control power supply	V	AC200V220V 50/60Hz Three-phase										
Main circuit system		Transistor,full bridge three-phase (Sinusoidal-wave PWM control)										
Output voltage	V	120(r.m.s)									150(r.m.s)	
Continuous output current	A	16.0	16.0	26.0	26.0	38.0	53.0	78.0	103.0	146.0	160.0	196.0
Instantaneous output current	A	29.0	41.9	43.0	57.6	67.0	92.0	142.0	183.0	262.0	305.0	340.0
Braking system		Regenerative braking (absorbed by regenerative resistor)										
Speed control range		1000:1										
Speed regulation: Load variation to 0 to 100%	%	± 0.1 or less (at rated rpm)										
Speed regulation: Voltage variation ± 10%	%	± 0.1 or less (at rated rpm)										
Speed regulation: Temperature variation 10 to 30℃	%	± 0.1 or less (at rated rpm)										
Carrier frequency	Hz	2k										
Input: Command voltage	V	0 ~ ± 10										
Input: Input resistance	KΩ	20 Max										
Auxiliary power supply	V	± 10 8 m A										
Speed control system		Encoder F/V conversion feedback system										
Output for position detection		1000,1200,2000 PPR (To be specified by your order) 90℃ phase difference signal, marking signal, line driver output equivalent to AM26LS31)(5V)										
Safety circuit: Current limiting value	A	29.0	41.9	43.0	57.6	67.0	92.0	142.0	183.0	262.0	305.0	340.0
Safety circuit: Surge absorbing circuit		Surge absorber between lines										
Safety circuit: Protection circuit		Under-power supply, over-voltage, over-speed, over current, overload (due to thermalrelay), PG alarm										
Safety circuit: Servo ready output		Open collector output (DC24V, 50mA)				Contact output capacity (AC200V, 1A)						
Safety circuit: Thermal set value (Accessory)	A	16.0	16.0	26.0	26.0	38.0	53.0	78.0	103.0	146.0	160.0	195.0
Safety circuit: Input breaker	A	30A				50A	60A	100A		150A	200A	250A
Control signal input		Start(DR), full-stop(SO), torque limit(TL), reset(RST)										
Applied motor		NA20-110F NA20-110F-BR	NA20-110F NA20-110F-BR	NA20-180F NA20-180F-BR	NA20-180F NA20-180F-BR	NA20-270F NA20-270F-BR	NA20-370F NA20-370F-BR	NA20-550F NA20-550F-BR	NA20-750F NA20-750F-BR	NA20-1100F	NA20-1500	NA20-1800
Regenerative resistance (Accessory)		200W 40 Ω	200W 40 Ω	400W 20 Ω	400W 20 Ω	200W 40 Ω × 3		300W 30 Ω × 5	300W 30 Ω × 6	500W 24 Ω × 6	500W 24 Ω × 8	1000W 12 Ω × 6
Power supply capacity	KVA	4.7(3φ)	4.7(3φ)	7.7(3φ)	7.7(3φ)	11(3φ)	15(3φ)	22(3φ)	28(3φ)	40(3φ)	65(3φ)	78(3φ)
Weight	Kg	10.0	10.0	10.2	10.5	20.0	20.0	34.0	36.0	50.0	71.0	73.0

8-2-2 NPSA-N, NN Series (200V/50Hz, 220V/60Hz Specifications)

(1) 1000rpm type

Item \ Type	Unit	NPSA-2.5NN-61	NPSA-5NN-41	NPSA-10NN-41	NPSA-10NN-51	NPSA-10NN-61	NPSA-10NN-71	NPSA-15NN-51	NPSA-15NN-61	NPSA-20NN-51	NPSA-20NN-61	NPSA-20NN-71
Main power supply		Built-in power supply type										
Control power supply	V	AC100V/50Hz 220V60Hz 3 phase/single phase common use			AC200V220V 50/60Hz Three-phase							
Main circuit system		Transistor,full bridge 3-phase (Sine-wave PWM control)										
Output voltage	V	120(r.m.s)										
Continuous output current	A	1.4	2.7	5.6	5.6	8.2	8.2	13.5	13.5	19.5	19.5	27.0
Instantaneous output current	A	3.6	7.5	10.3	15.2	15.1	22.3	33.2	46.1	35.3	51.8	48.2
Braking system		Regenerative brake (No regenerative resistance See Note 1)		Regenerative braking (absorbed by regenerative resistance)								
Speed control range		1000:1										
Speed regulation: Load variation to 0 to 100%	%	± 0.1 or less (at rated rpm)										
Speed regulation: Voltage variation ± 10%	%	± 0.1 or less (at rated rpm)										
Speed regulation: Temperature variation 10 to 30℃	%	± 0.1 or less (at rated rpm)										
Carrier frequency	Hz	2k										
Input: Command voltage	V	0 ~ ± 10										
Input: Input resistance	KΩ	20 Max										
Auxiliary power supply	V	± 10 8 m A										
Speed control system		F/V conversion feedback system using encoder										
Output for position detection		1000,1200,2000 PPR (To be specified by your order) 90℃ phase difference signal, marking signal, 5V, line driver output										
Safety circuit: Current limiting value	A	3.6	7.5	10.3	15.2	15.1	22.3	33.2	46.1	35.3	51.8	48.2
Safety circuit: Surge absorbing circuit		Surge absorber between lines										
Safety circuit: Protection circuit		Under-power supply, over-voltage, over-speed, over current, overload (due to thermal relay), PG alarm										
Safety circuit: Servo ready output		Open collector output (DC24V,50mA)										
Safety circuit: Thermal set value (Accessory)	A	1.4	2.7	5.6	5.6	8.2	8.2	13.5	13.5	19.5	19.5	27.0
Safety circuit: Input breaker	A	10A		10A	15A			30A				
Control signal input		Start(DR), full-stop(SO), torque limit(TL), reset(RST)										
Applied motor		NA20-20F-10 NA20-20F-B-10	NA20-40F-10 NA20-40F-B-10	NA20-75F-10 NA20-75F-B-10		NA20-110F-10 NA20-110F-BR-10		NA20-180F-10 NA20-180F-BR-10		NA20-1270F-10 NA20-270F-BR-10	NA20-1270F-10 NA20-270F-BR-10	NA20-370F-10 NA20-370F-BR-10
Regenerative resistance (Accessory)		None	80W 80Ω			200W 40 Ω				400W 20 Ω		
Power supply capacity	KVA	0.53(1or 3ϕ)	1.0(1or3ϕ)	1.83 (3ϕ)		2.9(3ϕ)		4.7(3ϕ)		7.7(3ϕ)		
Weight	Kg	6.8		8.3				10.0		10.2	10.5	

Note 1: The GD² value of load is to be used within 20 times using GD² value which is converted to motor shaft.

(1) 1000rpm type (continued)

Item \ Type		Unit	NPSA 35N-51	NPSA 45N-51	NPSA 75N-51	NPSA 100N-51	NPSA 140N-51	NPSA 180N-51	NPSA 220N-51
Main power supply			Built-in power supply type						
Control power supply		V	AC200V/220V 50/60Hz Three-phase						
Main circuit system			Transistor, full bridge three-phase (Sinusoidal wave PWM control)						
Output voltage		V	135 (r.m.s.)						
Continuous output current		A	34.0	46.0	65.0	87.0	122.0	164.0	230.0
Instantaneous output current		A	64.0	82.0	117.0	167.0	236.0	316.0	410.0
Braking system			Regenerative braking (absorbed by regenerative resistor)						
Speed control range			1000 : 1						
Speed regulation	Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)						
	Voltage variation ±10%	%	±0.1 or less (at rated rpm)						
	Temperature variation 10 to 30°C	%	±1 or less (at rated rpm)						
Carrier frequency		Hz	2K						
Input	Command voltage	V	0 ~ ±10						
	Input resistance	KΩ	20 Max						
Auxiliary power supply		V	±10 8mA						
Speed control system			Encoder F/V conversion feedback system						
Output for position detection			1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, line driver output equivalent to AM26LS31) (5V)						
Safety circuit	Current limiting value	A	64.0	82.0	117.0	167.0	236.0	316.0	410.0
	Surge absorbing circuit		Surge absorber between lines						
	Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due eo thermal relay), PG alarm						
	Servo ready output		Open collector output (DC24V, 50mA)						
	Thermal set value (Accessory)	A	34.0	46.0	65.0	87.0	122.0	164.0	230.0
	Input breaker	A	50A	60A	100A		150A	200A	250A
Control signal input			Start (DR), master stop (SO), torque limit (TL), reset (RST)						
Applied motor			NA20-550F-10 NA20-550F-BR-10	NA20-750F-10 NA20-750F-BR-10	NA20-1100F-10	NA20-1500-10	NA20-2200-10	NA20-2700-10	NA20-3700-10
Regenerative resistance (Accessory)			200W 40Ω X 3		300W 40Ω X 6	300W 30Ω X 6	500W 24Ω X 6	500W 24Ω X 8	1000W12ΩX5
Power supply capacity		KVA	11 (3φ)	15 (3φ)	21 (3φ)	29 (3φ)	42 (3φ)	53 (φ)	68 (3φ)
Weight		Kg	20	20	34	36	50	71	73

8-2-3 NPSA-N, NN Series (200V/50Hz, 220V/60Hz Specifications)

(1) 4000rpm type

Item \ Type	Unit	NPSA-2.5NN-5.4	NPSA-2.5NN-64	NPSA-5NN-44	NPSA-10NN-44	NPSA-10NN-54	NPSA-10NN-64	NPSA-10NN-74	NPSA-15NN-54	NPSA-15NN-64	NPSA-20N-54
Main power supply		Built-in power supply type									
Control power supply	V	AC200V/50Hz, 220V/60Hz 3-phase/single phase common use			AC200V/220V 50/60Hz Three-phase						
Main circuit system		Transistor, full bridge 3-phase (Sine-wave PWM control)									
Output voltage	V	120 (r.m.s.)									
Continuous output current	A	1.0	1.2	2.5	5.5	5.5	8.0	8.0	16.0	16.0	25.0
Instantaneous output current	A	2.4	3.8	6.4	9.6	14.0	14.6	21.5	26.9	38.8	47.5
Braking system		Regenerative brake (No regenerative resistance: See Note 1)		Regenerative brake (to be absorbed by regenerative resistance)							
Speed control range		1000 : 1									
Speed regulation: Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)									
Speed regulation: Voltage variation ±10%	%	±0.1 or less (at rated rpm)									
Speed regulation: Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)									
Carrier frequency	Hz	2K									
Input: Command voltage	V	0 ~ ±10									
Input: Input resistance	KΩ	20 Max.									
Auxiliary power supply	V	±10 8mA									
Speed control system		F/V conversion feedback system using encoder									
Output for position detection		1000, 1200 PPR (To be specified by your order) 90° phase difference signal, marker signal, 5V, line driver output									
Safety circuit: Current limiting value	A	2.4	3.8	6.4	9.6	14.0	14.6	21.5	26.9	38.8	47.5
Safety circuit: Surge absorbing circuit		Surge absorber between lines									
Safety circuit: Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm									
Safety circuit: Servo ready output		Open collector output (DC24V, 50mA)									
Safety circuit: Thermal set value (Accessory)	A	1.0	1.5	2.5	5.5	5.5	8.0	8.0	16.0	16.0	25.0
Safety circuit: Input breaker	A	10A			10A	15A			30A		
Control signal input		Start (DR), full-stop (SO), torque limit (TL), reset (RST)									
Applied motor		NA20-3BF-40	NA20-6BF-40	NA20-10BF-40	NA20-20F-40		NA20-40F-40		NA20-75F-40		NA20-110F-40
Regenerative resistance (Accessory)		None		60W 80Ω			200W 40Ω				400W 20Ω
Power supply capacity	KVA	0.18 (1 or 3φ)	0.35 (1 or 3φ)	1.0 (1 or 3φ)	1.93 (3φ)		2.9 (3φ)		4.7 (3φ)		7.7 (3φ)
Weight	Kg	6.5		6.6	8.1				10.9		11.9

Note 1. The GD^2 value of load is to be used within 20 times using GD^2 value which is converted to motor shaft

(1) 4000rpm type (continued)

Item \ Type		Unit	NPSA-35N-54	NPSA-45N-54	NPSA-75N-54
Main power supply			Built-in power supply type		
Control power supply		V	AC200V/50Hz, 220V/60Hz 3-phase/single -phase common use		
Main circuit system			Transistor, full bridge 3-phase (Sine-wave PWM control)		
Output voltage		V	120 (r.m.s.)		
Continuous output current		A	38	51	77
Instantaneous output current		A	71.4	93.7	144
Braking system			Regenerative brake (to be absorbed by regenerative resistance)		
Speed control range			1000 : 1		
Speed regulation	Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)		
	Voltage variation ±10%	%	±0.1 or less (at rated rpm)		
	Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)		
Carrier frequency		Hz	2K		
Input	Command voltage	V	0 – ±10		
	Input resistance	KΩ	20 Max.		
Auxiliary power supply		V	±10 8mA		
Speed control system			F/V conversion feedback system using encoder		
Output for position detection			1000PPR (To be specified by your order) 90° phase difference signal, marker signal, 5V, line driver output		
Safety circuit	Current limiting value	A	71.4	93.7	14.4
	Surge absorbing circuit		Surge absorber between lines		
	Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm		
	Servo ready output		Open collector output (AC200V, 1A)		
	Thermal set value (Accessory)	A	38	51	77
	Input breaker	A	50A	60A	100A
Control signal input			Start (DR), full-stop (SO), torque limit (TL), reset (RST)		
Applied motor			NA20-180F-40	NA20-270F-40	NA20-370F-40
Regenerative resistance (Accessory)			200W 40Ω x 3	200W 40Ω x 3	200W 40Ω x 5
Power supply capacity		KVA	11 (3φ)	15 (3φ)	22 (3φ)
Weight		Kg	20	20	34

(2) 1500rpm type

Item \ Type		Unit	NPSA-2.5NN-75	NPSA-5NN-45	NPSA-5NN-55	NPSA-10NN-45	NPSA-10NN-55	NPSA-15NN-55	NPSA-15NN-65	NPSA-20NN-55
Main power supply			Built-in power supply type							
Control power supply		V	AC200/220V 50/60HZ 3-phase/single phase common use			AC200V/220V 50/60Hz Three-phase				
Main circuit system			Transistor, full bridge three-phase (Sinusoidal-wave PWM control)							
Output voltage		V	120 (r.m.s)							
Continuous output current		A	1.7	1.7	3.4	6.4	6.4	13.0	13.0	22.0
Instantaneous output current		A	4.4	4.4	8.8	11.5	16.8	23.0	33.6	37.8
Braking system			Regenerative brake (No regenerative resistance)	Regenerative braking (absorbed by regenerative resistor)						
Speed control range			1000 : 1							
Speed regulation	Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)							
	Voltage variation ±10%	%	±0.1 or less (at rated rpm)							
	Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)							
Carrier frequency		Hz	2K							
Input	Command voltage	V	0 ~ ±10							
	Input resistance	KΩ	20 MAX							
Auxiliary power supply		V	±10 8MA							
Speed control system			Encoder F/V conversion feedback system							
Output for position detection			1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, 5V, line driver output							
Safety circuit	Current limiting value	A	4.4	4.4	8.8	11.5	16.8	23.0	33.6	37.8
	Surge absorbing circuit		Surge absorber between lines							
	Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm							
	Servo ready output		Open collector output (DC74V, 50mA)							
	Thermal set value (Accessory)	A	1.7	1.7	3.4	6.4	6.4	13.0	13.0	22.0
	Input breaker	A	10A	10A	10A	10A	15A	30A	30A	30A
Control signal input			Start (DR), master-stop (SO), torque limit (TL), reset (RST)							
Applied motor			NA30-13F-15 NA30-13F-B-15		NA30-25F-15 NA30-25F-B-15	NA30-50F-15 NA30-50F-B-15		NA30-110F-15 NA30-110F-B-15		NA30-180F-15 NA30-180F-B-15
Regenerative resistance (Accessory)			60W 80Ω					200W 40Ω		400W 20Ω
Power supply capacity		KVA	1.0 (1 or 3φ)			1.93 (3φ)		4.7 (3φ)		7.7 (3φ)
Weight		Kg	6.6			8.1		10.0		10.2

Note 1: The GD^2 value of load is to be used within 20 times using GD^2 value which is converted to motor shaft.

8-2-4 NPSA-NF Series (200V/50Hz, 220V/60Hz Specifications)

(1) 3000rpm type

Item \ Type		Unit	NPSA-2.5NF-40A	NPSA-2.5NF-50A	NPSA-2.5NF-60A	NPSA-2.7NF-70A	NPSA-5NF-50
Main power supply			Built-in power supply type				
Control power supply		V	AC200V/50Hz, 220V/60Hz single-phase common use				
Main circuit system			Transistor, full bridge 3-phase (Sine-wave PWM control)				
Output voltage		V	48 (r.m.s.)	80 (r.m.s.)	120 (r.m.s.)		
Continuous output current		A	1.06	1.05	1.65	2.15	4.2
Instantaneous output current		A	2.51	2.56	4.47	5.48	10.7
Braking system			Regenerative brake (to be absorbed by regenerative resistance)				
Speed control range			1000 : 1				
Speed regulation	Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)				
	Voltage variation ±10%	%	±0.1 or less (at rated rpm)				
	Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)				
Carrier frequency		Hz	2K				
Input	Command voltage	V	0 ~ ±10				
	Input resistance	KΩ	20 Max.,				
Auxiliary power supply		V	±10 8mA				
Speed control system			F/V conversion feedback system using encoder				
Output for position detection			1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, 5V, line driver output				
Safety circuit	Current limiting value	A	2.51	2.56	4.47	5.48	10.7
	Surge absorbing circuit		Surge absorber between lines				
	Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm				
	Servo ready output		Open collector output (DC24V, 50mA)				
	Thermal set value (Accessory)	A	1.06	1.05	1.65	2.15	4.2
	Input breaker	A	10A				
Control signal input			Start (DR), full-stop (SO), torque limit (TL), reset (RST)				
Applied motor			NA21-1.5F NA21-1.5F-B	NA21-3F NA21-3F-B	NA21-6F NA21-6F-B	NA21-10F NA21-10F-B	NA20-20F NA20-20F-B
Regenerative resistance (Accessory)			60W 80Ω				
Power supply capacity		KVA	0.18 (3φ)		0.35 (1φ)	0.53 (1 or 3φ)	1.0 (1 φ)
Weight		Kg	6.7				8.1

8-2-5 NPSA-NH series (400V/50H, 460V/60H Specifications)

Item \ Type	Unit	NPSA-20NH-50	NPSA-35NH-50	NPSA-45NH-50	NPSA-75NH-50	NPSA-100NH-50	NPSA-140NH-50	NPSA-180NH-50	NPSA-300NH-30A	NPSA-330N-H-50A
Main power supply		Built-in power supply type							Separate power supply type	
Control power supply	V	AC 440V/460V 50/60Hz Three phase								
Main circuit system		Transistor, full bridge three-phase (Sinusoidal-wave PWM control)								
Output voltage	V	120 (r.m.s.)								
Continuous output current	A	12	17	24	35	46	65	89	108	164
Instantaneous output current	A	20	30	42	64	82	117	170	209	316
Braking system		Regenerative braking (absorbed by regenerative resistor)								
Speed control range		1000 : 1								
Speed regulation: Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)								
Speed regulation: Voltage variation ±10%	%	±0.1 or less (at rated rpm)								
Speed regulation: Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)								
Carrier frequency	Hz	2K								
Input: Command voltage	V	0 – ±10								
Input: Input resistance	KΩ	20 Max.								
Auxiliary power supply	V	±10 8mA								
Speed control system		Encoder F/V conversion feedback system								
Output for position detection		1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, line driver output equivalent to AM26LS31) (5V)								
Safety circuit: Current limiting value	A	20	30	42	64	82	117	170	209	316
Safety circuit: Surge absorbing circuit		Surge absorber between lines								
Safety circuit: Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm								
Safety circuit: Servo ready output		Contact output capacity (AC200V, 1A)								
Safety circuit: Thermal set value (Accessory)	A	12	17	24	35	46	65	89	108	164
Safety circuit: Input breaker	A	20A		30A	40A	60A	100A		125A	200A
Control signal input		Start (DR), full-stop (SO), torque limit (TL), reset (RST)								
Applied motor		NA20-180F-20H NA20-180F-BR-20H	NA20-270AF-20H NA20-270F-BR-20H	NA20-370AF-20H NA20-370F-BR-20H	NA20-550AF-20H NA20-550F-BR-20H	NA20-750AF-20H NA20-750F-BR-20H	NA20-1100F-20H	NA20-1500 -20H	NA20-1800 -20H	NA20-2700 -20H
Regenerative resistance (Accessory)		300W 100Ω x 1	200W 160Ω x 2	200W 160Ω x 3	300W 120Ω x 5	300W 120Ω x 6	500W96Ω x 6	500W 96Ω x 8	1000W 48Ω x 6	1000W 48Ω x 6
Power supply capacity	KVA	7.0	10	14	20	27	38	52	63	95
Weight	Kg	20	20	20	24	26	55	62	54.5	54.5

(2) 1000rpm type

Item \ Type	Unit	NPSA-20NH-S1	NPSA-35NH-S1	NPSA-45NH-S1	NPSA-75NH-S1	NPSA-100NH-S1	NPSA-140NH-S1	NPSA-180NH-S1	NPSA-300NH-31A	NPSA-330N-H-S1A
Main power supply		Built-in power supply type								Separate power supply type
Control power supply	V	AC 440V/460V 50/60Hz Three phase								
Main circuit system		Transistor, full bridge three-phase (Sinusoidal-wave PWM control)								
Output voltage	V	120 (r.m.s.)								
Continuous output current	A	12	18	23	33	45	65	82	115	170
Instantaneous output current	A	21	33	41	60	86	125	158	209	310
Braking system		Regenerative braking (absorbed by regenerative resistor)								
Speed control range		1000 : 1								
Speed regulation: Load variation 0 to 100%	%	±0.1 or less (at rated rpm)								
Speed regulation: Voltage variation ±10%	%	±0.1 or less (at rated rpm)								
Speed regulation: Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)								
Carrier frequency	Hz	2K								
Input: Command voltage	V	0 ~ ±10								
Input: Input resistance	KΩ	20 Max								
Auxiliary power supply	V	±10 8mA								
Speed control system		Encoder F/V conversion feedback system								
Output for position detection		1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, line driver output equivalent to AM26LS31) (5V)								
Safety circuit: Current limiting value	A	21	33	41	60	86	125	158	209	310
Safety circuit: Surge absorbing circuit		Surge absorber between lines								
Safety circuit: Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm								
Safety circuit: Servo ready output		Contact output capacity (AC200V, 1A)								
Safety circuit: Thermal set value (Accessory)	A	12	18	23	33	45	65	82	115	170
Safety circuit: Input breaker	A	20A		30A	40A	60A	100A		125A	200A
Control signal input		Start (DR), full-stop (SO), torque limit (TL), reset (RST)								
Applied motor		NA20-370F-10H	NA20-550F-10H	NA20-750F-10H	NA20-1100F-10H	NA20-1500-10H	NA20-2200-10H	NA20-2700-10H	NA20-3700-10H	NA20-5500-10H
Regenerative resistance (Accessory)		300W 100Ω x 1	200W 160Ω x 2	200W 160Ω x 3	300W 120Ω x 5	300W 120Ω x 6	500W96Ω x 6	500W 96Ω x 8	1000W 48Ω x 6	1000W 48Ω x 8
Power supply capacity	KVA	7.0	11.0	13.4	19.3	26.3	38	48	67	99
Weight	Kg	20	20	20	24	26	55	62	54.5	54.5

8-2-6 NPSA-PNN series (200V/50Hz, 220V/60Hz Specifications)

(1) 3000/2000rpm type

Item \ Type			NPSA-2.5PNN-40A	NPSA-2.5PNN-50A	NPSA-2.5PNN-60A	NPSA-2.5PNN-70A	NPSA-5PNN-20	NPSA-5PNN-30	NPSA-5PNN-40	NPSA-5PNN-50	NPSA-10-PNN-40
Main power supply			Built-in power supply type								
Control power supply		V	AC200/220V, 50/60Hz 3-phase/single phase common use								AC200/220V, 50/60Hz 3-phase
Main circuit system			Transistor, full bridge three-phase (Sinusoidal-wave PWM control)								
Output voltage		V	80 (r.m.s.)	80 (r.m.s.)	120 (r.m.s.)						
Continuous output current		A	1.06	1.05	1.65	2.15	3.4	3.4	4.2	4.2	5.4
Instantaneous output current		A	2.51	2.56	4.47	5.48	6.21	9.14	7.4	10.7	10.0
Braking system			Regenerative brake (No regenerative resistance (See Note)						Regenerative braking (absorbed by regenerative resistor)		
Speed control range			1000 : 1								
Speed regulation	Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)								
	Voltage variation ±10%	%	±0.1 or less (at rated rpm)								
	Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)								
Carrier frequency		Hz	2K								
Speed control system			Encoder F/V conversion feedback system								
Output for detection of position		A	1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, line driver output equivalent to AM26LS31) (5V)								
Safety circuit	Current limiting value		2.51	2.56	4.47	5.48	6.21	9.14	7.4	10.7	10.0
	Surge absorbing circuit		Surge absorber between lines								
	Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due eo thermal relay), PG alarm								
	Servo ready output		Open collector output (DC24V, 50mA)								
	Thermal set value (Accessory)	A	1.06	1.05	1.65	2.15	3.4	3.4	4.2	4.2	5.4
	Input breaker	A	10A						10A	10A	10A
Control signal input			Start (DR), master-stop (SO), torque limit (TL), reset (RST)								
Position control	Frequency for input pulse		Maximum of 300KPPS 5V (for the use of command multiplication of 2 and 4 F/V conversion)								
	Input pulse configuration		Forward- or reverse-rotation pulse input 90° phase difference signal (Applicable to open collector or line drive output)								
	Control output		Positioning finish signal, output below the set deviation value, Overflow signal								
	Command inhibit input		Inhibiting the input of command pulse during inputting this signal								
	Automatic acceleration/ deceleration		Acceleration and deceleration are made by an exponential function curve at the start and stop.								
Applied motor			NA21-1.5F NA21-1.5F-B	NA21-3F NA21-3F-B	NA21-6F NA21-6F-B	NA21-10F NA21-10F-B	NA20-15F		NA20-20F NA20-20F-B		NA20-40F NA40-40F-B
Regenerative resistance (Accessory)			None						60W 80Ω		
Power supply capacity		KV	0.18 (1 or 3φ)	0.18 (1 or 3φ)	0.35 (1 or 3φ)	0.52 (1 or 3φ)	1.0		1.0 (1 or 3φ)	1.0 (1 or 3φ)	1.93 (3φ)
Weight		Kg	6.5						6.6	6.6	8.1

Note 1: The GD² value of load is to be used within 20 times using GD² value which is converted to motor shaft.

(1) 3000/2000rpm type (continued)

Item \ Type			NPSA-10PNN-50	NPSA-10PNN-60	NPSA-10-PNN-70	NPSA-15PNN-50	N-SA-15PNN-60	NPSA-20-PNN-50
Main power supply			Built-in power supply type					
Control power supply		V	AC200/220V, 50/60Hz 3-phase/single phase common use					
Main circuit system			Transistor, full bridge three-phase (Sinusoidal-wave PWM control)					
Output voltage		V	120 (r.m.s.)					
Continuous output current		A	5.4	10.0	10.0	16.0	16.0	26.0
Instantaneous output current		A	14.8	17.7	25.8	29.0	41.9	43.0
Braking system			Regenerative braking (absorbed by regenerative resistor)					
Speed control range			1000 : 1					
Speed regulation	Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)					
	Voltage variation ±10%	%	±0.1 or less (at rated rpm)					
	Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)					
Carrier frequency		Hz	2K					
Speed control system			Encoder F/V conversion feedback system					
Output for detection of position		A	1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, line driver output equivalent to AM26LS31) (5V)					
Safety circuit	Current limiting value		14.8	17.7	25.8	29.0	41.9	43.0
	Surge absorbing circuit		Surge absorber between lines					
	Protection circuit		Under-power supply, over-voltage, over speed, over-current, overload (due eo thermal relay), PG alarm					
	Servo ready output		Open collector output (DC24V, 50mA)					
	Thermal set value (Accessory)	A	5.4	10.0	10.0	16.0	16.0	26.0
	Input breaker	A	10A	15A		30A		
Control signal input			Start (DR), master-stop (SO), torque limit (TL), reset (RST)					
Position control	Frequency for input pulse		Maximum of 300KPPS 5V (for the use of command multiplication of 2 and 4 F/V conversion)					
	Input pulse configuration		Forward- or reverse-rotation pulse input 90° phase difference signal (Applicable to open collector or line drive output)					
	Control output		Positioning finish signal, output below the set deviation value,. Overflow signal					
	Command inhibit input		Inhibiting the input of command pulse during inputting this signal					
	Automatic acceleration/ deceleration		Acceleration and deceleration are made by an exponential/function curve at the start and stop					
Applied motor			NA20-40F NA20-40F-B	NA20-75F NA20-75F-B	NA20-75F NA20-75F-B	NA20-110F NA20-110F-BR		NA20-180F NA20-180F-BR
Regenerative resistance (Accessory)			60W 80Ω	200W 40Ω				400W 20Ω
Power supply capacity		KV	1.9 (3φ)	2.9 (3φ)	2.9 (3φ)	4.7 (3φ)		7.7 (3φ)
Weight		Kg	8.1			11.0		11.2

(2) 1000rpm type

Item \ Type	Unit	NPSA-2.5PNN-61	NPSA-5PNN-41	NPSA-10PNN-41	NPSA-10PNN-51	NPSA-10PNN-61	NPSA-10PNN-71	NPSA-15PNN-51	NPSA-15PNN-61	NPSA-20PNN-51	NPSA-20PN-51
Main power supply		Built-in power supply type									
Control power supply	V	AC200/220V 50/60HZ 3-phase/single phase common use		AC200V/220V 50/60Hz Three-phase							
Main circuit system		Transistor, full bridge three-phase (Sinusoidal-wave PWM control)									
Output voltage	V	120 (r.m.s.)									
Continuous output current	A	1.4	2.7	5.6	5.6	8.2	8.2	13.5	13.5	19.5	27.0
Instantaneous output current	A	3.6	7.5	10.3	15.2	15.1	22.3	23.0	33.2	35.5	48.2
Braking system		Regenerative brake (No regenerative resistance)	Regenerative braking (absorbed by regenerative resistor)								
Speed control range		1000 : 1									
Speed regulation: Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)									
Speed regulation: Voltage variation ±10%	%	±0.1 or less (at rated rpm)									
Speed regulation: Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)									
Carrier frequency	Hz	2K									
Speed control system		Encoder F/V conversion feedback system									
Output for detection of position		1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, line driver output equivalent to AM26LS31) (5V)									
Safety circuit: Current limiting value		3.6	7.5	10.3	15.2	15.1	22.3	23.0	33.2	35.3	48.2
Safety circuit: Surge absorbing circuit	A	Surge absorber between lines									
Safety circuit: Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm									
Safety circuit: Servo ready output		Open collector output (DC24V, 50mA)									
Safety circuit: Thermal set value (Accessory)		1.4	2.7	5.6	5.6	8.2	8.2	13.5	13.5	19.5	27.0
Safety circuit: Input breaker	A	10A		10A	15A			30A			
Control signal input	A	Start (DR), master-stop (SO), torque limit (TL), reset (RST)									
Position control: Frequency for input pulse		Maximum of 300KPPS 5V (for the use of command multiplication of 2 and 4, F/V conversion)									
Position control: Input pulse configuration		Forward- or reverse-rotation pulse input 90° phase difference signal (Applicable to open collector or line drive output)									
Position control: Control output		Positioning finish signal, output below the set deviation value. Overflow signal									
Position control: Command inhibit input		Inhibiting the input of command pulse during inputting this signal									
Position control: Automatic acceleration/deceleration		Acceleration and deceleration are made by an exponential function curve at the start and stop									
Applied motor		NA20-20F-10 NA20-20F-B-10	NA20-40F-10 NA20-40F-B-10	NA20-75F-10 NA20-75F-B-10		NA20-110F-10 NA20-110F-BR-10		NA20-180F-10 NA20-180F-BR-10	NA20-270F-10 NA20-270F-BR-10	NA20-370F-10	NA20-370F-BR-10
Regenerative resistance (Accessory)		None	60W 80Ω			200W 40Ω			400W 20Ω		
Power supply capacity	KVA	0.53 (1 or 3φ)	1.0 (1 or 3φ)	1.93 (3φ)		2.9 (3φ)		4.7 (3φ)	7.7 (3φ)		
Weight	Kg	6.8		8.3				11.0		13.0	

Note: The load inertia should be within 20 times the GD² value for motor axis conversion.

(3) 1500rpm type

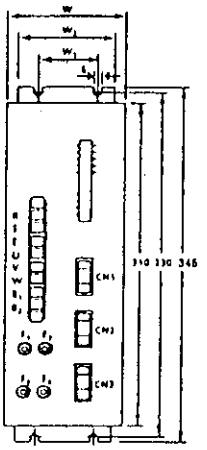
Item \ Type	Unit	NPSA-2.5PNN-75	NPSA-5PNN-45	NPSA-5PNN-55	NPSA-10PNN-45	NPSA-10PNN-55	NPSA-15PNN-55	NPSA-15PNN-65	NPSA-20PNN-55
Main power supply		Built-in power supply type							
Control power supply	V	AC200/220V 50/60HZ 3-phase/single phase common use		AC200V/220V 50/60Hz Three-phase					
Main circuit system		Transistor, full bridge three-phase (Sinusoidal-wave PWM control)							
Output voltage	V	120 (r.m.s.)							
Continuous output current	A	1.7	1.7	3.4	6.4	6.4	13.0	13.0	22.0
Instantaneous output current	A	4.4	4.4	8.8	11.5	16.8	23.0	33.6	37.8
Braking system		Regenerative brake (No regenerative resistance)	Regenerative braking (absorbed by regenerative resistor)						
Speed control range		1000 : 1							
Speed regulation: Load variation to 0 to 100%	%	±0.1 or less (at rated rpm)							
Speed regulation: Voltage variation ±10%	%	±0.1 or less (at rated rpm)							
Speed regulation: Temperature variation 10 to 30°C	%	±1.0 or less (at rated rpm)							
Carrier frequency	Hz	2K							
Speed control system		Encoder F/V conversion feedback system							
Output for detection of position		1000, 1200, 2000 PPR (To be specified by your order) 90° phase difference signal, marker signal, line driver output equivalent to AM26LS31) (5V)							
Safety circuit: Current limiting value		4.4	4.4	8.8	11.5	16.8	23.0	33.6	37.8
Safety circuit: Surge absorbing circuit	A	Surge absorber between lines							
Safety circuit: Protection circuit		Under-power supply, over-voltage, over-speed, over-current, overload (due to thermal relay), PG alarm							
Safety circuit: Servo ready output		Open collector output (DC24V, 50mA)							
Safety circuit: Thermal set value (Accessory)		1.7	1.7	3.4	6.4	6.4	13.0	13.0	22.0
Safety circuit: Input breaker	A	10A			10A	15A	30A		
Control signal input	A	Start (DR), master-stop (SO), torque limit (TL); reset (RST)							
Position control: Frequency for input pulse		Maximum of 300KPPS 5V (for the use of command multiplication of 2 and 4, F/V conversion)							
Position control: Input pulse configuration		Forward- or reverse-rotation pulse input 90° phase difference signal (Applicable to open collector or line drive output)							
Position control: Control output		Positioning finish signal, output below the set deviation value. Overflow signal							
Position control: Command inhibit input		Inhibiting the input of command pulse during inputting this signal							
Position control: Automatic acceleration/ deceleration		Acceleration and deceleration are made by an exponential function curve at the start and stop							
Applied motor		NA30-13F-15 NA30-13F-B-15		NA30-25F-15 NA30-25F-B-15	NA30-50F-15 NA30-50F-B-15		NA30-110F-15 NA30-110F-B-15		NA20-180AF-15 NA20-180F-B-15
Regenerative resistance (Accessory)		None	60W 80Ω				200W 40Ω		400W 20Ω
Power supply capacity	KVA	1.0 (1 or 3φ)			1.93 (3φ)		4.7 (3φ)		7.7(3φ)
Weight	Kg	6.6	6.6		8.1		11.0		11.2

Note: The load inertia should be within 20 times the GD² value for motor axis conversion.

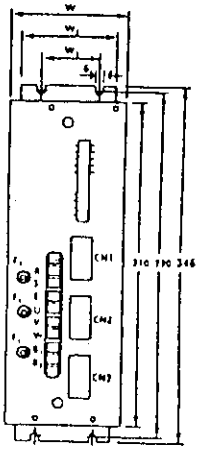
8-3 Outline Drawing of Driver

The outside dimension of each type of driver is shown below.

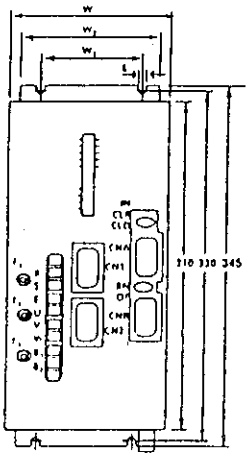
NPSA-NN/NPSA-N type

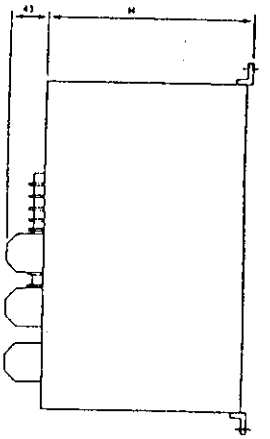


NPSA-NF type



NPSA-PN/PNN type

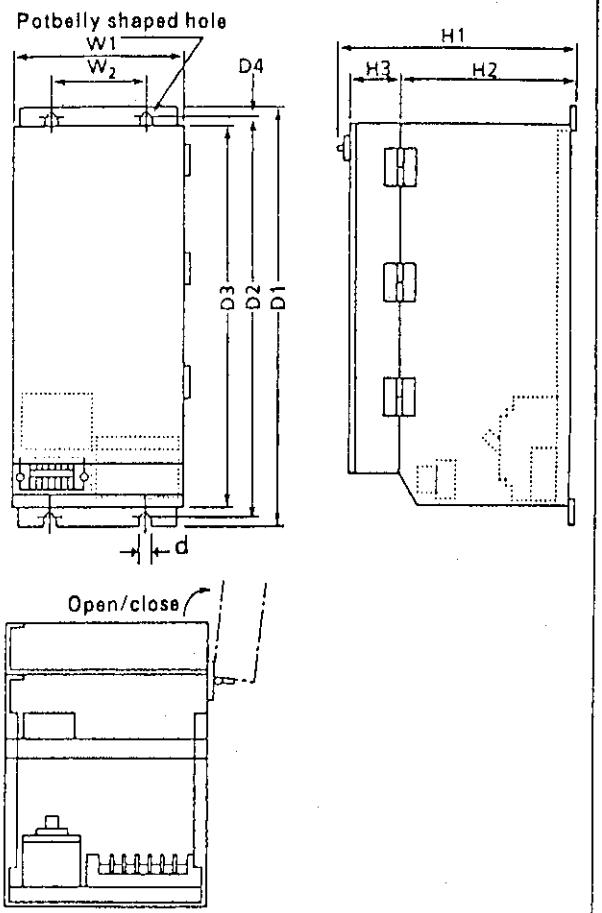




* The outside dimensions of each type of driver are shown below. Unit: mm

Type	W	W1	W2	H
NPSA-2.5NN	110	70	90	242
NPSA-5NN	110	70	90	242
NPSA-10NN	140	70	120	242
NPSA-15NN	170	100	150	282
NPSA-20NN	170	100	150	282
NPSA-2.5NF	110	70	90	242
NPSA-5NF	140	70	120	242
NPSA-2.5PNN	130	70	90	242
NPSA-5PNN	130	70	90	242
NPSA-10PNN	160	70	120	242
NPSA-15PNN	190	100	180	282
NPSA-20PNN	190	100	180	282
NPSA-20PN	200	100	180	282

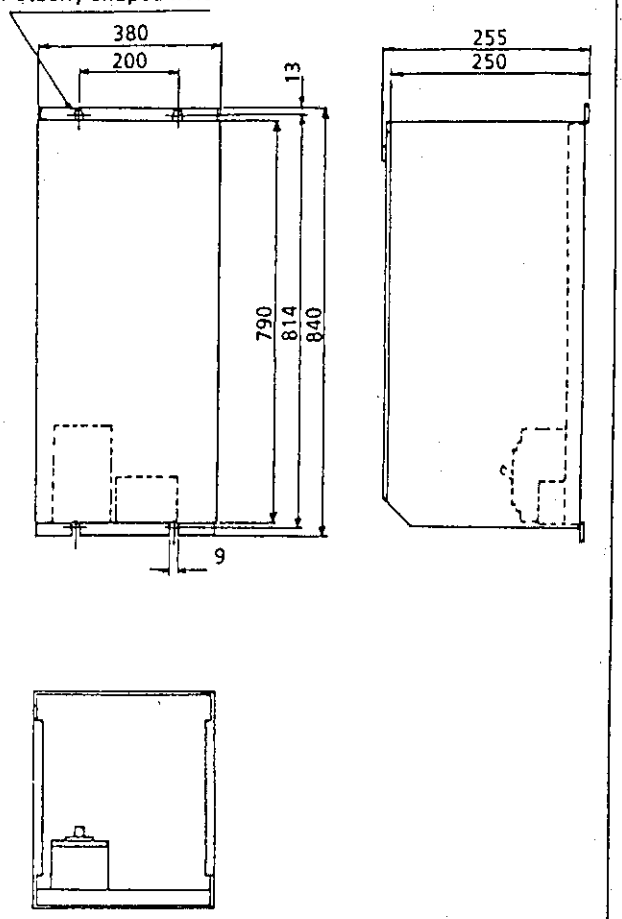
NPSA-N/NPSA-NH type



Unit: mm

* The outside dimensions of each type of driver are shown below.

PUB-300NH type



Unit: mm

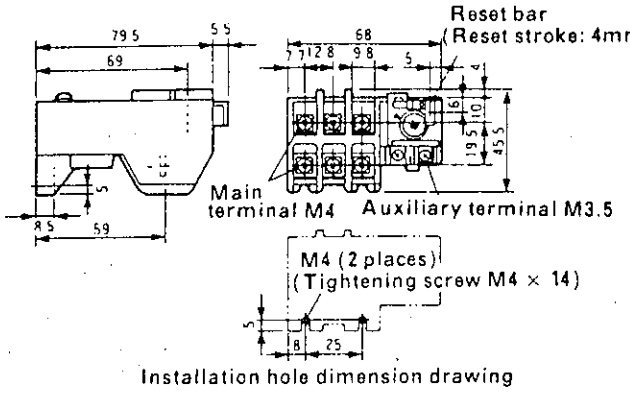
Type	D_1	D_2	D_3	D_4	W_1	W_2	H_1	H_2	H_3	d
NPSA-35N	530	513	500	8.5	230	126	316	245	65	7
NPSA-45N	530	513	500	8.5	230	126	316	245	65	7
NPSA-75N	656	632	617	10	365	205	300	228	70	7
NPSA-100N	656	632	617	10	365	205	300	228	70	7
NPSA-140N	730	705	680	13	510	260	320	243	70	9
NPSA-180N	800	770	750	15	510	260	322	248	70	7
NPSA-220N	850	830	800	15	560	350	322	248	70	10
NPSA-20NH	530	513	500	8.5	230	126	316	245	65	7
NPSA-35NH	530	513	500	8.5	230	126	316	245	65	7
NPSA-45NH	530	513	500	8.5	230	126	316	245	65	7
NPSA-75NH	605	588	575	8.5	270	165	315	243	70	7
NPSA-100NH	605	588	575	8.5	270	165	315	243	70	7
NPSA-140NH	700	674	650	13	450	260	300	230	70	9
NPSA-180NH	820	794	770	13	523	260	325	250	70	9
NPSA-300NH	860	834	810	13	433	270	324	250	70	9

8-4 Outline Drawing of Accessoris

8-4-1 Thermal Relay

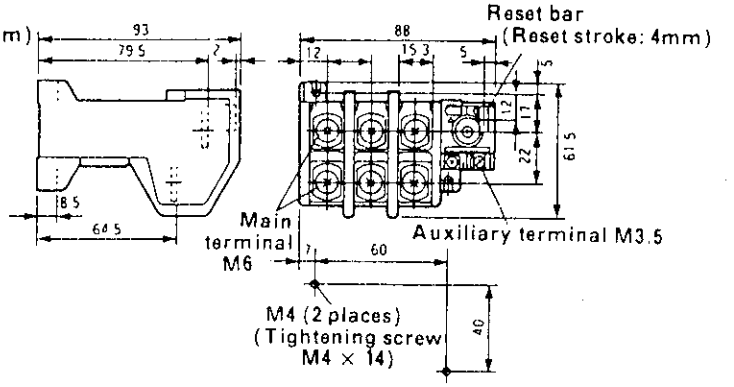
The external appearance and dimensions of the thermal relay are shown below.

TR-1SN type



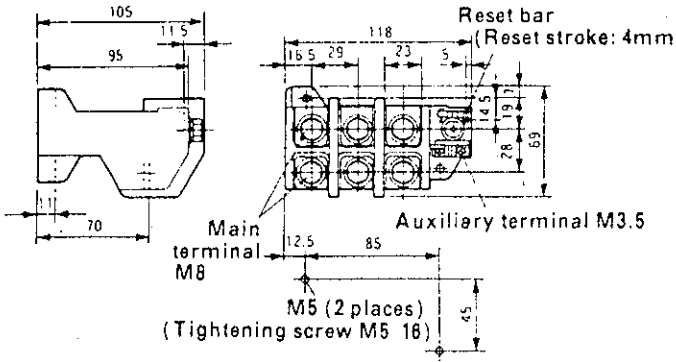
Installation hole dimension drawing

TR-6N type



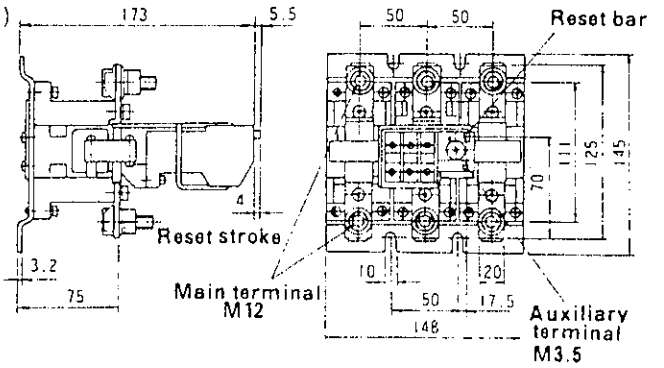
Installation hole dimension drawing

TR-3N type



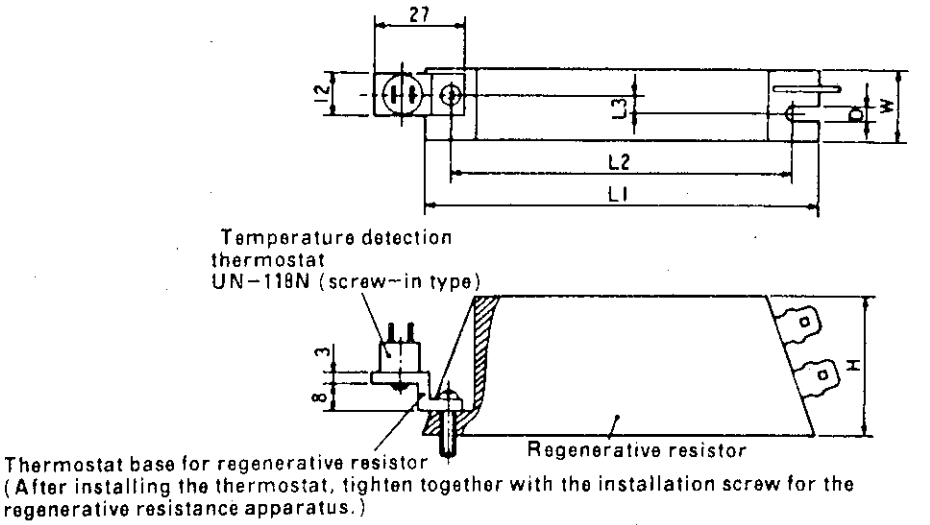
Installation hole dimension drawing

TR-10NH type

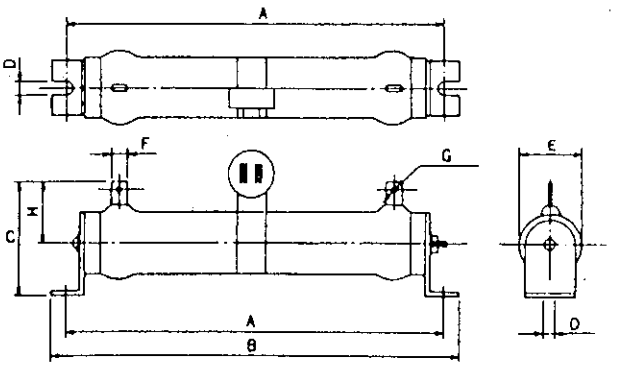


8-4-2 Regenerative Resistor

The external appearance and dimensions of the regenerative resistor and the location of the thermostat are shown below.



Type	Rating	L_1	L_2	W	H	L_3	D
RGH 60	60W	115	100	20	40	5	4.3
RGH200	200W	215	200	25	50	8	5.3
RGH400	400W	265	250	30	60	13	5.3



Type	Rating	A	B	C	D	E	F	G	H
RGH 200-0S	200W	292	318	55	6.2	32	7	2.8 or more	31
RGH 300-0S	300W	312	340	82	9.5	45	10	5.2 or more	38
RGH 500-0S	500W	348	382	94	10	60	10	5.2 or more	44
RGH1000-0S	1 kW	400	442	160	7.5	120	13	5.2 or more	76

8-5 Combination of Driver, Motor and Accessories

The following table shows the possible combinations of driver, motor and accessories, which are components of the complete unit, according to type of driver, motor and each rotation. The regnerative resistor and thermostat are attached to all machine types excluding the NPSA-2.5NN/2.5PNN.

NPSA-N/NN/PNN type 3000/2000rpm type

Driver type	Thermal relay	Regenerative resistor	Applicable servo motor
NPSA-2.5NN-40A	TR-1SN 0.95 ~ 1.45A	None	NA21-1.5F/NA21-1.5F-B (50W 1.06A)
NPSA-2.5PNN-40A			
NPSA-2.5NN-50A			NA21-3F/NA21-3F-B (100W 1.05A)
NPSA-2.5PNN-50A			
NPSA-2.5NN-60A			NA21-6F/NA21-6F-B (200W 1.65A)
NPSA-2.5PNN-60A			
NPSA-2.5NN-70A	TR-1SN 1.4 ~ 2.2A		NA21-10F/NA21-10F-B (300W 2.15A)
NPSA-2.5PNN-70A			
NPSA-5NN-20	TR-1SN 2.8 ~ 4.2A		NA20-15F
NPSA-5PNN-20			
NPSA-5NN-30			
NPSA-5PNN-30			
NPSA-5NN-40	TR-1SN 4.0 ~ 6.0A	RGH-60-FV-80 60W 80Ω	NA20-20F/NA20-20F-B (600W 4.2A)
NPSA-5PNN-40			
NPSA-5NN-50			
NPSA-5PNN-50			NA20-40F/NA20-40F-B (800W 5.4A)
NPSA-10NN-40			
NPSA-10PNN-40			
NPSA-10NN-50			
NPSA-10PNN-50			
NPSA-10NN-60	TR-1SN 9.0 ~ 13.0A	RGH-200-FV-40 200W 40Ω	NA20-75F/NA20-75F-B (1.5W 10A)
NPSA-10PNN-60			
NPSA-10NN-70			
NPSA-10PNN-70			
NPSA-15NN-50	TR-1SN 13.0 ~ 20.0A		NA20-110F/NA20-110F-BR (2.2W 16A)
NPSA-15PNN-50			
NPSA-15NN-60			
NPSA-15PNN-60			
NPSA-20NN-50	TR-3N 24 ~ 36A	RGH-400-FV-20 400W 20W (thermostat attached)	NA20-180F/NA20-180F-BR (3.7W 26A)
NPSA-20NN-60			
NPSA-20PNN-50			
NPSA-35N-50	TR-3N 28 ~ 40A	RGH-200G-0S 200W 40Ω x 3	NA20-270F/NA20-270F-BR (5.5kW 38A)
NPSA-45N-50	TR-3N 45 ~ 67A	RGH-200G-0S 200W 40Ω x 3	NA20-370F/NA20-370F-BR (7.5kW 53A)
NPSA-75N-50	TR-6N 65 ~ 95A	RGH-300G-0S 300W 30Ω x 5	NA20-550F/NA-20-550F-BR (11kW 78A)
NPSA-100N-50	TR-6N 85 ~ 125A	RGH-300G-0S 300W 30Ω x 6	NA20-750F/NA20-750F-BR (15kW 103A)
NPSA-140N-50	TR-6N 110 ~ 160A	RGH-500G-0S 500W 24Ω x 6	NA20-1100F (22kW 146A)
NPSA-180N-50	TR-10NH 125 ~ 185A	RGH-500G-0S 500W 24Ω x 8	NA20-1500 (30kW 160A)
NPSA-220N-50	TR-10NH 160 ~ 240A	RGH-1000G-0S 1kW 12Ω x 5	NA20-1800 (37kW 195A)

*Regenerative resistor and thermostats are attached to all machines excluding the NPSA-2.5NN/NPSA-2.5PNN

NPSA-N/NN type 4000rpm type

Driver type	Thermal relay	Regenerative resistor	Applied servo motor
NPSA-2.5NN-54	TR-ISN 0.95 ~ 1.45A	None	NA20-3BF-40 (0.1kW 1.0A)
NPSA-2.5NN-64	TR-ISN 0.95 ~ 1.45A		NA20-6BF-40 (0.2kW 1.2A)
NPSA-5NN-44	TR-ISN 2.2 ~ 3.4A	RGH-60-FV-80 60W 80Ω	NA20-10BF-40 (0.3kW 2.5A)
NPSA-10NN-44	TR-ISN 4.0 ~ 6.0A		NA20-20F-40 (0.8kW 5.3A)
NPSA-10NN-54	TR-ISN 4.0 ~ 6.0A		
NPSA-10NN-64	TR-ISN 6.0 ~ 9.0A	RGH-200-FV-40 200W 40Ω	NA20-40F-40 (1.2kW 7.5A)
NPSA-10NN-74	TR-ISN 6.0 ~ 9.0A		
NPSA-15NN-54	TR-ISN 13.0 ~ 20.0A		NA20-75F-40 (2.2kW 16A)
NPSA-15NN-64	TR-ISN 13.0 ~ 20.0A		
NPSA-20INN-54	TR-3N 24 ~ 36A	RGH-400-FV-20 400W 20Ω	NA20-110F-40 (3.7kW25A)
NPSA-35N-54	TR-3N 28~ 40A	RGH-200G-0S 200W 40Ω x 3	NA20-180F-40 (5.5kW 38A)
NPSA-45N-54	TR-3N 45 ~ 67A	RGH-200G-0S 200W 40Ω x 3	NA20-270F-40 (7.5kW 51A)
NSPA-75N-54	TR-6N 65~ 95A	RGH-300G-0S 300W 30Ω x 5	NA20-370F-40 (11kW 77A)

*Regenerative resisitor and thermostats are attached to all machines excluding NPSA-2 5NN/NPSA-2.5PNN.

NPSA-NN/PNN type 1500rpm type

Driver type	Thermal relay	Regenerative resistor	Applied servo motor
NPSA-2.5NN-75	TR-ISN 1.4 ~ 2 2A	None	NA30-13F-15/NA30-13F-B-15 (0.2kW 1.7A)
NPSA-2.5PNN-75			
NPSA-5NN-45			
NPSA-5PNN-45			
NPSA-5NN-55	TR-ISN 2 8 ~ 4 2A	RGH-60-FV-80 60W 80Ω	NA30-25F-15/NA30-25F-B-15 (0.4kW 3.4A)
NPSA-5PNN-55			
NPSA-10NN-45	TR-ISN 6.0 ~ 9.0A		NA30-50F-15/NA30-50F-B-15 (0 8kW 6.4A)
NPSA-10PNN-45			
NPSA-10NN-55			
NPSA-10PNN-55			
NPSA-15NN-55	TR-ISN 9 0 ~ 13.0A	RGH-200-FV-40 200W 40Ω	NA30-110F-15/NA30-110F-B-15 (1.6kW 13A)
NPSA-15PNN-55			
NSPA-15NN-65			
NPSA-15-PNN-65			
NPSA-20NN-55	TR-ISN 20 0 ~ 26.0A	RGH-400-FV-20 400W 20Ω	NA30-180F-15/NA30-180F-B-15 (2 8kW 22A)
NPSA-20-PNN-55			

*Regenerative resisitor and thermostats are attached to all machines excluding NPSA-2 5NN/NPSA-2 5PNN

NPSA-N/NNPN/PNN type 1000rpm type

Driver type	Thermal relay	Regenerative resistor	Applied servo motor
NPSA-2.5NN-61	TR-ISN 0.95 ~ 1.45A	None	NA20-20F-10/NA20-20F-B-10 (0.2kW 1.4A)
NPSA-2.5PNN-61			
NPSA-5NN-41	TR-ISN 2.2 ~ 3.4A	RGH-60-FV-80 60W 80Ω	NA20-40F-10/NA20-40F-B-10 (0.4kW 2.7A)
NPSA-5PNN-41			
NPSA-10NN-41	TR-ISN 4.0 ~ 6.0A		NA20-75F-10/NA20-75F-B-10 (0.8kW 5.6A)
NPSA-10PNN-41			
NPSA-10NN-51			
NPSA-10PNN-51			
NPSA-10NN-61	TR-ISN 6.0 ~ 9.0A	RGH-200-FV-40 200W 40Ω	NA20-180F-10/NA20-110F-BR-10 (1.2kW 8.2A)
NPSA-10PNN-61			
NPSA-10NN-71			
NPSA-10PNN-71			
NPSA-15NN-51	TR-ISN 13.0 ~ 20.0A		NA20-110F-10/NA20-180F-BR-10 (1.9kW 13.5A)
NPSA-15PNN-51			
NPSA-15NN-61			
NPSA-15PNN-61			
NPSA-20NN-51			
NPSA-20PNN-51		RGH-400-FV-40 400W 20Ω	NA20-270F-10/NA20-270F-BR-10 (2.8kW 19.5A)
NPSA-20NN-71	TR-3SN 24 ~ 36A		NA20-370F-10/NA20-370FB-10 (3.7kW 27A)
NPSA-20PN-51			
NPSA-35N-51	TR-3N 28 ~ 40A	RGH-200G-0S 200W 40Ω x 3	NA20-550F-10/NA20-550F-BR-10 (6.5kW 34A)
NPSA-45N-51	TR-3N 45 ~ 67A		NA20-750F-10/NA20-750F-BR-10 (7.5kW 46A)
NPSA-75N-51	TR-6N 65 ~ 95A	RGH-300G-0S 300W 30Ω x 5	NA20-1100F-10 (11kW 65A)
NPSA-100N-51	TR-6N 85 ~ 125A	RGH-300G-0S 300W 30Ω x 6	NA20-1500-10 (15kW 87A)
NPSA-140N-51	TR-6N 110 ~ 160A	RGH-500G-0S 500W 24Ω x 6	NA20-2200-10 (22kW 122A)
NPSA-180N-51	TR-10NH 125 ~ 185A	RGH-500G-0S 500W 24Ω x 8	NA20-2700-10 (27kW 164A)
NPSA-220N-51	TR-10NH 160 ~ 240A	RGH-1000G-0S 1kW 12Ω x 5	NA20-3700-10 (37kW 230A)

*Regenerative resisitor and thermostats are attached to all machines excluding NPSA-2.5NN/NPSA-2.5PNN.

NPSA-NF type 3000rpm type

Driver type	Thermal relay	Regenerative resistor	Applied servo motor
NPSA-2.5NF-40A	TR-ISN 0.95 ~ 1.45A	RGH-60-FV-80 60W 80Ω	NA21-1.5F/NA21-1.5F-B (50W 1.06A)
NPSA-2.5NF-50A			NA21-3F/NA21-3F-B (100W 1.05A)
NPSA-2.5NF-60A	TR-ISN 1.4 ~ 2.2A		NA21-6F/NA20-6F-B (200W 1.65A)
NPSA-2.5NF-70A			NA21-10F/NA21-10F-B (300W 2.15A)
NPSA-5NF-50	TR-ISN4.0 ~ 6.0A		NA20-20F/NA20-20F-B (600W 4.2A)

NPSA-NH type 2000rpm type

Driver type	Thermal relay	Regenerative resistor	Applied servo motor
NPSA-20NH-50	TR-ISN 9.0 ~ 13.0A	RGH300G-OS 300W 100Ω	NA20-180F-20H/NA20-180F-BR20H (3.7kW 12A)
NPSA-35NH-50	TR-ISN 13.0 ~ 20.0A	RGH200G-OS 200W 160Ω x 2	NA20-270F-20H/NA20-270F-BR-20H (5.5kW 17A)
NPSA-45NH-50	TR-ISN 20.0 ~ 26.0A	RGH200G-OS 200W 160Ω x 3	NA20-370F-20H/NA20 370F-BR-20H (7.5kW 24A)
NPSA-75NH-50	TR-3N 28.0 ~ 40.0A	RGH300G-OS 300W 120Ω x 5	NA20-550F-20H/NA20-550F-BR-20H (11kW 35A)
NPSA-100NH-50	TR-3N 35.0 ~ 50.0A	RGH300G-OS 300W 120Ω x 6	NA20-750F-20H/NA20-750F-BR-20H (15kW 46A)
NPSA-140NH-50	TR-3N 45.0 ~ 67.0A	RGH500G-OS 500W 96Ω x 6	NA20-1100F-20H (22kW 65A)
NPSA-180NH-50	TR-6N 65.0 ~ 95.0A	RGH500G-OS 500W 96Ω x 8	NA20-1500-20H (30kW 89A)
NPSA-300NH-30A	TR-6N 85.0 ~ 125.0A	RGH1000G-OS 1kW 48Ω x 5	NA20-1800-20H (37kW 108A)
NPSA-300NH-50A	TR-10NH 125.0 ~ 185.0A	RGH-1000G-OS 1kW 48Ω x 6 (Attached to PUB-300NH)	NA20-2700-20H (55kW 164A)

NPSA-NH type 1000rpm

Driver type	Thermal relay	Regenerative resistor	Applied servo motor
NPSA-20NH-51	TR-ISN 9.0 ~ 13.0A	RGH300G-OS 300W 100Ω	NA20-370F-10H (3.7kW 12A)
NPSA-35NH-51	TR-ISN 13.0 ~ 20.0A	RGH200G-OS 200W 160Ω x 2	NA20-550F-10H (5.5kW 18A)
NPSA-45NH-51	TR-ISN 20.0 ~ 26.0A	RGH200G-OS 200W 160Ω x 3	NA20-750F-10H (7.5kW 24A)
NPSA-75NH-51		RGH300G-OS 300W 120Ω x 5	NA20-1100F-10H (11kW 33A)
NPSA-100NH-51	TR-3N 35.0 ~ 50.0A	RGH300G-OS 300W 120Ω x 6	NA20-1500-10H (15kW 45A)
NPSA-140NH-51	TR-3N 45.0 ~ 67.0A	RGH500G-OS 500W 96Ω x 6	NA20-2200-10H (22kW 65A)
NPSA-180NH-51	TR-6N 65.0 ~ 95.0A	RGH500G-OS 500W 96Ω x 8	NA20-2700-10H (30kW 82A)
NPSA-300NH-31A	TR-6N 85.0 ~ 125.0A	RGH1000G-OS 1kW 48Ω x 6	NA20-3700-10H (37kW 115A)
NPSA-300NH-51A	TR-10NH 125.0 ~ 185.0A	RGH1000G-OS 1kW 48Ω x 6 (Attached to PUB-300NH)	NA20-5500-10H (55kW 170A)

*When connecting multiple regenerative resistor, connect in parallel

8-6 Cooling Blower

8-6-1 Cooling Blower Motor

The following table shows the specifications for the cooling blower motors.

(1) AC 200V/50Hz, 220V/60Hz, specifications motor

AC servo motor type \ Input power		200V/50Hz	200V/60Hz	220V/60Hz	Number of power source poles
NA20-110F NA20-110F-BR NA20-180F NA20-180F-BR	Power consumption (W)	80	80	90	1φ 2p
	Rated current (A)	0.66	0.68	0.75	
NA20-270F NA20-270F-BR NA20-370F NA20-370F-BR	Power consumption (W)	105	110	120	1φ 2p
	Rated current (A)	0.8	0.93	0.8	
NA20-550F NA20-550F-BR	Power consumption (W)	60	60	70	1φ 4p
	Rated current (A)	0.6	0.56	0.55	
NA20-750F NA20-750F-BR NA20-1100F	Power consumption (W)	150	180	195	3φ 2p
	Rated current (A)	1.0	0.82	0.9	
NA20-1500 NA20-2700	Power consumption (W)	620	650	700	3φ 2p
	Rated current (A)	2.0	2.0	2.0	

(2) AC 440V/50Hz, 460V/60Hz specifications motor

AC servo motor type \ Input power		100V/50Hz	100V/60Hz	110V/60Hz	Number of power source poles
NA20-180F NA20-180F-BR	Power consumption (W)	80	80	90	1φ 2p
	Rated current (A)	1.4	1.2	1.4	
NA20-270F NA20-270F-BR NA20-370F NA20-370F-BR	Power consumption (W)	105	110	120	1φ 2p
	Rated current (A)	1.7	1.6	1.7	
NA20-550F NA20-550F-BR	Power consumption (W)	60	60	70	1φ 4p
	Rated current (A)	1.2	1.1	1.2	

AC servo motor type \ Input power		400V/60Hz	400V/60Hz	440V/60Hz	Number of power source poles
NA20-750F NA20-750F-BR	Power consumption (W)	150	180	195	3φ 2p
NA20-1100F	Rated current (A)	0.5	0.41	0.45	
NA20-1500	Power consumption (W)	620	650	700	3φ 2p
NA20-3700	Rated current (A)	1.0	1.0	1.0	
NA20-5500	Power consumption (W)	1,500	1,500	1,500	3φ 4p
	Rated current (A)	3.2	2.9	2.9	

8-6-2 Recommended Thermal Relay for the Cooling Blower Motor

The recommended themal relays for the cooling blower motor are shown in the following tables. For the set value of the thermal relay, see 8-6-1 Cooling Blower Motor.

(1) AC 200V/50Hz, 220V/60Hz, specifications motor

Motor type	Rated current (A)	Recommended thermal relay (manufactured by Fuji Electric Co., Ltd.)	Power supply for fan
NA20-110F NA20-110F-BR NA20-180F NA20-180F-BR	0.66~0.75	TR-1SN 0.64~0.96	200V/50Hz, 200V/60Hz, 220V/60Hz
NA20-270F NA20-270F-BR NA20-370F NA20-370F-BR	0.8~0.93	TR-1SN 0.64 ~ 0.96	
NA20-550F NA20-550F-BR	0.55~0.6	TR-1SN 0.48~0.72	
NA20-750F NA20-750F-BR NA20-1100F	0.82 ~ 1.0	TR-1SN 0.8 ~ 1.2	
NA20-1500 ʃ NA20-2700	2.0	TR-1SN 1.7 ~ 2.6	

(2) AC 440V/50Hz, 460V/60Hz specifications motor tor

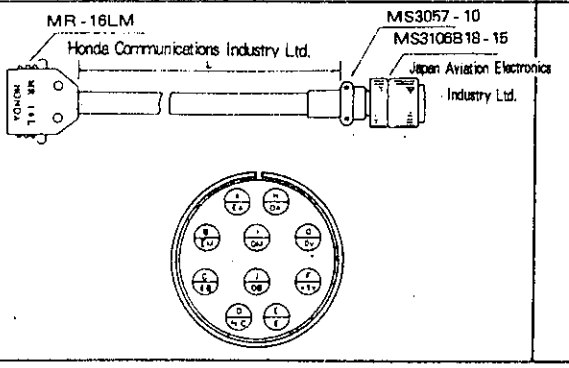
Motor type	Rated current (A)	Recommended thermal relay (manufactured by Fuji Electric Co., Ltd.)	Power supply for fan
NA20-180F NA20-180F-BR	1.2~1.4	TR-1SN 0.95 ~ 1.45	100V/50Hz, 100V/60Hz, 110V/60Hz
NA20-270F NA20-270F-BR NA20-370F NA20-370F-BR	1.6~1.7	TR-1SN 1.4~2.2	
NA20-550F NA20-550F-BR	1.1~1.2	TR-1SN 0.95~1.45	
NA20-750F NA20-750F-BR NA20-1100F	0.41 ~ 0.5	TR-1SN 0.36 ~ 0.54	400V/50Hz, 400V/60Hz, 440V/60Hz
NA20-1500 ʃ NA20-3700	1.0	TR-1SN 0.95 ~ 1.45	
NA20-5500	2.8 ~ 3.2	TR-1SN 2.8 ~ 4.2	400V/50Hz, 400V/60Hz, 440V/60Hz

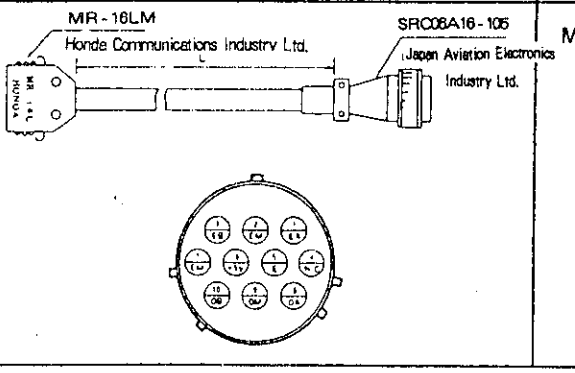
8-7 Optional Items

The optional items prepare by NIKKI DENSO are shown below.

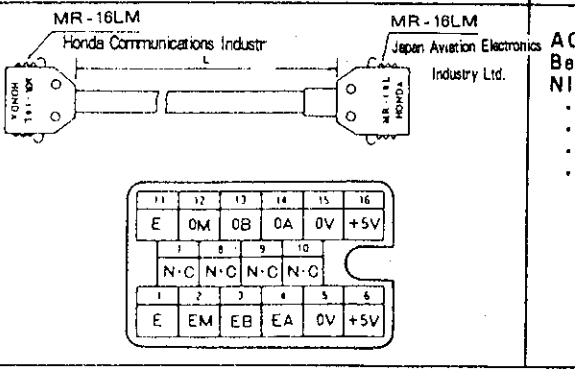
8-7-1 Encoder Cable Set

(1) This is used as a connection between driver and encoder which is assembled in the motor.

Name	Cable Length (J)	Outline Drawing	Applicable Motor
ECC -3	3m		Motor · NA20–20F & onward · NA30 series
-5	5m		
-10	10m		
-20	20m		
-30	30m		
-50	50m		

Name	Cable Length (J)	Outline Drawing	Applicable Motor
ECF -3	3m		Motor · NA21–1.5F–10F · NA20–1.5F
-5	5m		
-10	10m		
-20	20m		
-30	30m		
-50	50m		

(2) Connection between the NC unit and AC servo driver

Name	Cable Length (J)	Outline Drawing	Applicable NC
ECJ -OR3	0.3m		AC servo driver Between N, NN, NF, NH and NIKKI DENSO's NC unit · NDS–402A/412AP · NDS–501A/B/C · PNC · Multicom– 20/60
-1	1m		
-2	2m		
-3	3m		
-5	5m		

8-7-2 Brake Power Source

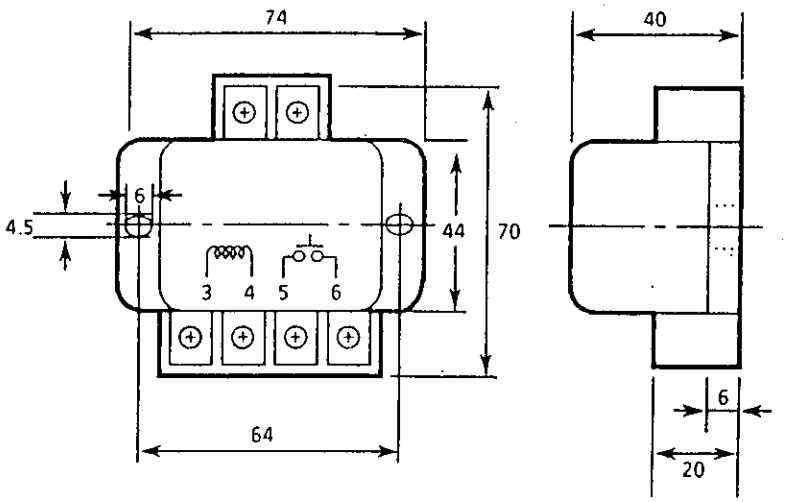
Type, outside dimensions and method of connection method of the power source for the brake are shown below.

	Type
For 100V AC	OPR 109F
For 200V AC	OPR 109A

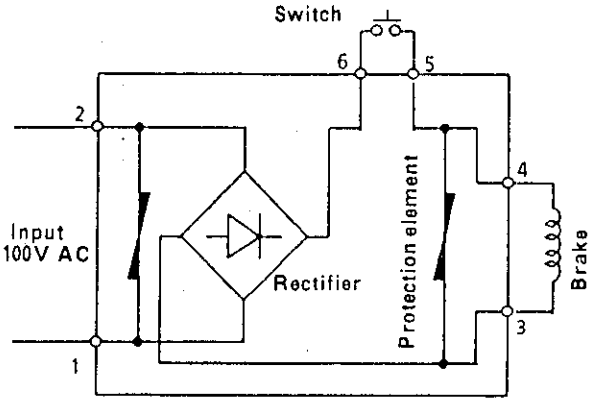
Output voltage 90 VDC
Current capacity 1A

Manufactured by Ogura Clutch Co., Ltd.

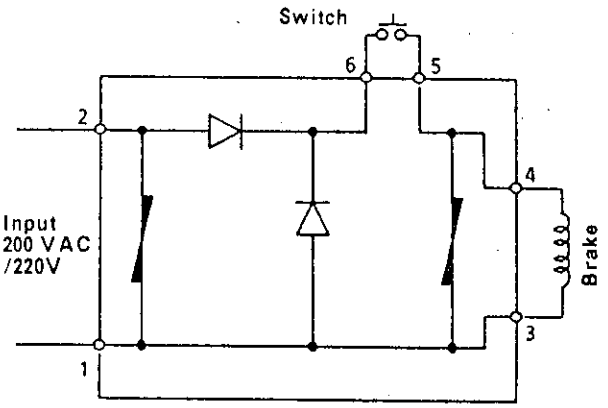
Dimensional drawing



Connection and Circuit



OPR109F



OPR109A

*Do not short output terminals 3 and 4.

The brake terminal does not have polarity. When the motor brake terminal P is connected to output terminal 3, connect the motor brake terminal N to output terminal 4.

The contact point capacity to be connected to output terminals 5 and 6 should be 5 ~ 6 times the total capacity of the brake to be used.

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