INSTRUCTION MANUAL

AC SERVO DRIVER

ＮＰＳ－ＺＱ

General use

NIKKI DENSO CO., LTD.

Manual No.TIE-12820A

PREFACE

Thank you for adopting Nikki 1 axis Synchronous Type AC Servo Driver <NPS-ZQ Series> (hereafter this unit) .

This unit is a high speed / high accuracy AC servo driver and combined with a synchronous type AC servo motor NA 70 series (hereafter NA70 motor) which has various features as compact size, high response, high power, etc.. And 32 bit RISC processor of this unit fully draws out features of the AC servo motor.
The system comosed of this unit and NA70 motor can be available as a drive source of various machines.

This manual expains about installation, wiring, ways to use, maintenance, trouble diagnosis, trouble shooting, etc. of this unit and synchronous type AC servo motor NA70 series (hereafter motor).
In order for you to use this unit, please fully understand the contents of this manual.
At the time of conductiong installation, wiring, operation, maintenance, etc., please follow the conditions and procedures described in this manual.
And if a special version unit is applied, please use both of this manual and the specification of the special version.
(Description in the special version specification is prior to this manual.)

This instruction manual is designed to display the below by the condition diplay mode of data display LED:
CE (software version) : 「 6」

When you received ordered units, please imeediately check outlook of this unit and presence of accessories.
At unpacking, if outlook of this unit is abnormal, non-specified accessories are found or quan tity is wrong, please do not use and inform the fact to our sales man.

【The other manuals】

Additional manuals in regards of this servo driver are as follows:
① Options (The lists of options of cables, terminal units, and regenerative resistor)
② Communication (Connection for communication, communication methods, and explanations for communication data)

【Warranty period】

Warranty period of our products is 1year after the shipment from our factory.
However please note that any failure or abnormality resulting from the following causes is not covered by the warranty.

① Modification implemented by parties other than NIKKI DENSO.
② None standard operaton different from the stipulated ways to use.
③ Natural disasters, etc..
④ Connection with an other maker's unit which is not apprved by us.

When you find a failure or abnormality during the warranty period, please inform our sales man.

Caution for safety

Before conducting installation, operation, maintenance and inspection, please fully under stand the contents of this manual and associated manual / materials as well as knowledge of all the applied equipment, safty informaion and caution items and then use our units.

In this manual, cautions for safety are ranked as [Danger] and [Caution].

And cautions for handling are divided into [Prohibition] and [Compulsion] which are defined (action not to be done) and (action has to be done), respectively.

Danger : If mishandling is made, dangerous situation as death or serious injury could occur.

Caution : If mishandling is made, dangerous situation as medium or slight injury and sole damage of goods could occur.

However **Caution** marked item could cause serious results depending on the actual situation. Since both of the above description includes important information, please be sure to follow them.

Prohibition : **Prohibited action**
If a caution is ignored, this unit does not perform, properly.

Compulsion : **Compulsory action**
If a caution is ignored, this unit does not perform, Properly.

【Caution when using】

⚠Danger

☆ Since electric shock and injury may occur, please keep the following suggestions.

① Never touch inside of the unit (AC servo driver) and terminal blocks.
► 〔Electric shock may occur.〕

② Be sure to conduct grounding of an earth terminal or lead wire of this unit (AC servo driver) and a motor.
Use larger earth cables for JIS Class 3 or better grounding.
► 〔Electric shock may occur.〕

③ Conduct transportation, wiring, maintenance, and inspection at least 3 minutes after turning off the electric power. Since voltage is left in power section, do not touch the unit, carelessly.
► 〔Electric shock may occur.〕

④ Do not damage, force excessively, put on heavy things and nip cables.
► 〔Electric shock may occur.〕

⑤ Never touch the motor rotating section.
► 〔Injury may occur.〕

⚠Caution

① Specified combination of a motor and this unit (AC servo driver) shall be used.
► 〔Fire and failure may occur.〕

② Do not use this unit in the atmosphere such as water splash, corrosive or low flashing point gas and near flammable things.
► 〔Fire and failure may occur.〕

③ Since temperature raises very high, do not touch a motor, this unit (AC servo motor) and peripheral units.
► 〔Burn may occur.〕

④ Since a radiator, a regenerative unit, a motor, etc. are very hot during supplying electric power or for a while after shutting off the power, do not touch them.
► 〔Burn may occur.〕

⑤ Never conduct withstanding voltage test and meggar test of his unit.
► 〔Fire and failure may occur.〕

【Receiving and checking of packages】

⚠Caution

① When you received ordered units, please check contents. If a wrong item (type, rated output , etc.)is found or quantity is wrong, please do not use them and inform the results to our salesman.
► 〔Electric shock., injury, damage, fire and failure may occur.〕

② If received packages are damaged, do not unpack them and inform the fact to our sales man.
► 〔Electric shock., injury, damage, fire and failure may occur.〕

【Storage】

⃠Prohibition

① Do not store units in a place of raining, water dripping, and harmful gas or liquid.

❗Compulsion

① Store units in a place of no sunshine and controlled temperature / humidity within the specified range.
② If storage term became quite long, consult sales office where you purchased or other office before using the unit.

【Transportation】

⚠Caution

① Do not hold cable and a motor shaft during transporting.
► 〔Injury and failure may occur.〕
② Do not drop and damage this unit, a motor, etc. and handle with care during transportation.
► 〔Injury and failure may occur.〕

❗Compulsion

① Since if too many units are piled, whole package may be broken, please follow our instructions.

【Installation】

⚠Caution

① Do not ride on or put heavy things on this unit.
► 〔Injury, failure may occur.〕

② Do not allow foreign things into this unit.
► 〔Fire may occur.〕

③ Be sure to keep this unit attitude to the specified installation direction.
► 〔Fire and failure may occur.。〕

④ Keep specified distance between this unit and inside of a control cabinet panel or other equipment.
► 〔Fire and failure may occur.〕

⑤ Do not give heavy shock to this unit.
► 〔This unit may be damaged.〕

⑥ Proper installation to meet output and weight of this unit shall be conducted.
► 〔This unit may be damaged.〕

⑦ Attach this unit to non-flammable things as metal.
► 〔Fire may occur.〕

【Wiring】

⚠Caution

① Be sure to conduct correct wiring.
► 〔Running away, burning of a motor, injury, and fire may occur.〕

② Never connect power source to motor connection terminal block (U, V, W) of this units.
► 〔Running away, burning of a motor, injury, and fire may occur.〕

③ To prevent this unit from noise influence, use specified length and treatment cables (shielded/ twisted, etc.).
► 〔Running away of a motor, injury, and machine damage may occur.〕

④ To prevent this unit from noise influence, control I/O signal cables of this unit (AC servo motor) shall be separated from other power cables.
► 〔Running away of a motor, injury, and machine damage may occur.〕

⑤ To prevent this unit from electric shock and noise influence, be sure to make proper grounding (earth).
► 〔Running away of a motor, electric shock., injury, and machine damage may occur.〕

【Operation and Run】

⚠Caution

① Since there is no protection to motors. Protect them by over-current protector, earth leakage breaker, over-heat protector and emergency stop devices.
► 〔Injury and fire may occur.〕

② Confirm that the power source specification is correct.
► 〔Injury, fire and machine damage may occur.〕

③ At test run, fix a motor to a place and confirm the motion separating from its machine system, and then install the motor to the machine.
► 〔Injury and machine damage may occur.〕

④ Since a brake is only for holding machine position, do not use it as stop device for safety of the machine. ► 〔Injury and machine damage may occur.〕

⑤ Since excess adjustment may cause this unit unstable, be sure to avoid the situation.
► 〔Injury and machine damage may occur.〕

⑥ When an alarm occurs, eliminate the cause, reset the alarm and then re-start.
► 〔Injury and machine damage may occur.〕

⑦ When power source recovers from black out, sudden re-start may occur, therefore, do not approach the machine.
(Machine design shall be considered to keep safety of workers against such sudden re-start.)
► 〔Injury may occur.〕

⑧ When operation keys on the panel side are used, do not apply static electricity.
(Apply grounding device, etc. to workers in order to eliminate charged electricity when he uses the operation keys.) ► 〔Failure may occur.〕

⃠Prohibition

① Do not supply power in motor running or vibrating condition.
►〔Running away of a motor, injury, and machine damage may occur.〕

② Since the brake installed on the motor is only for holding purpose, do not use it for actual braking. ► 〔Injury and machine damage may occur.〕

❗Compulsion

① In order to stop running, immediately and cut power off, install an external emergency shut down circuit.

【Maintenance and Inspection】

⚠Caution

① Capacity of the capacitors in the power line will be deteriorated.
To prevent secondary damage, we recommend to replace them for about every 5 years.
► 〔Failure may occur.〕

⃠Prohibition

① Overhaul and repair shall be conducted by us or approved shop.

Contents Page

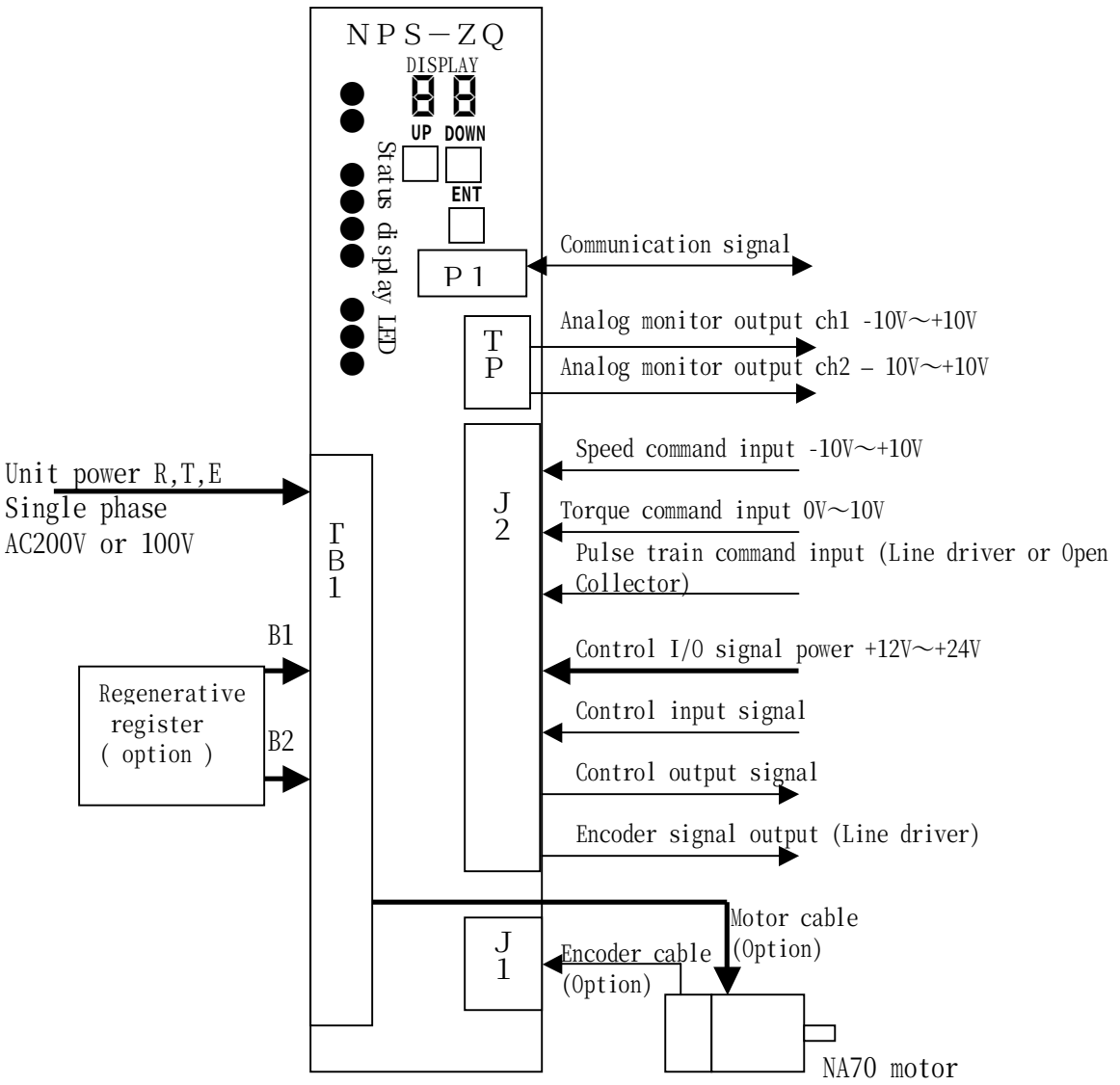
Contents Page

Chapter 1 Outline

1－1 Configuration

1－1－1 Servo Motor Drive System Configuration

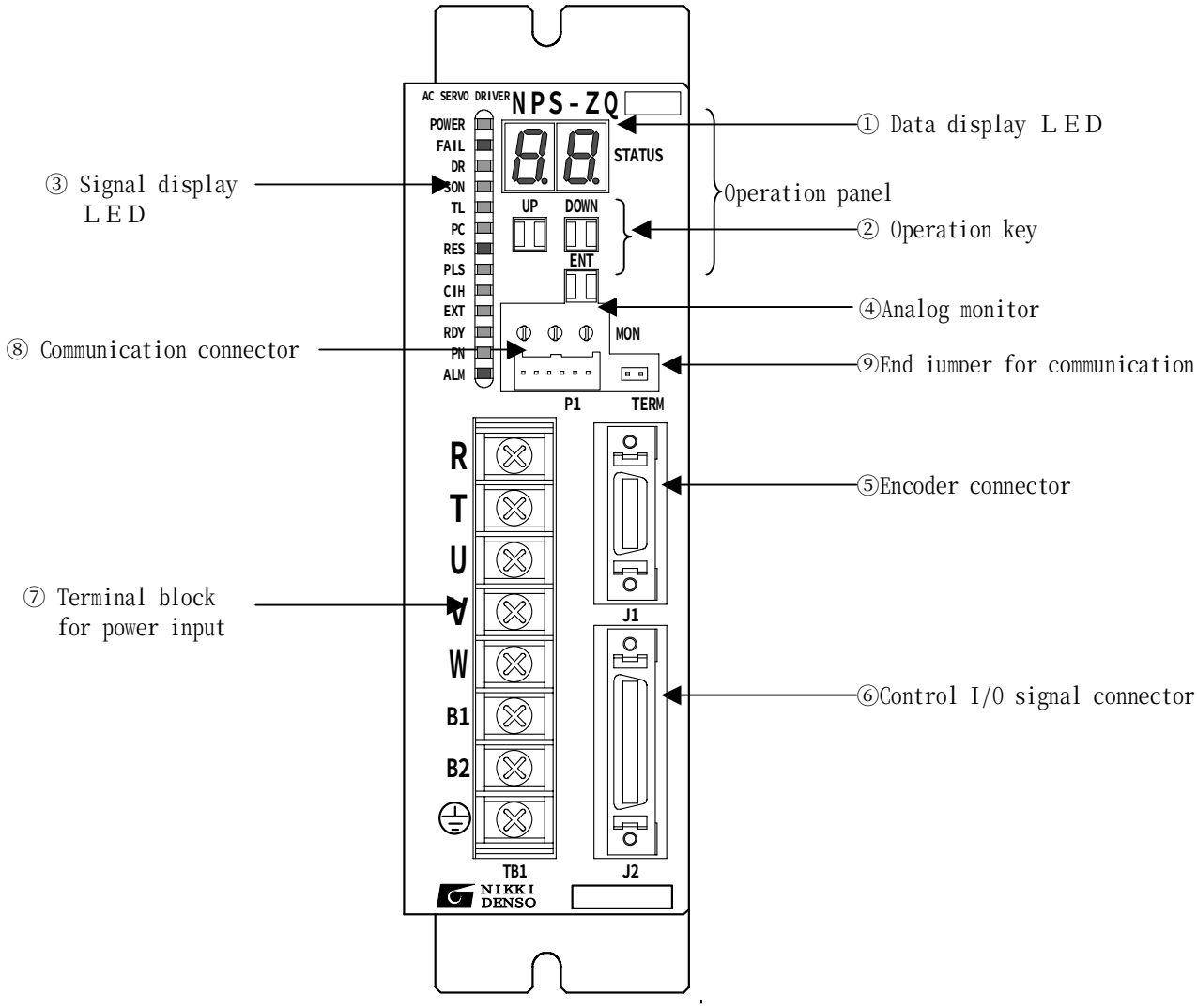
Servo motor drive system is shown as [Fig. 1－1].
This unit, NA70 motor, a speed/ position detecting encoder on a motor unloaded shaft, an optional motor cable , an optional encoder cable and a regenerative resistor compose a basic system.



[Fig. 1－1] Servo Motor Drive System Configuration

This unit can be switched over from Speed control to Pulse train control and vise versa by an external control signal.
And this unit can be applied to various AC servo motor by parameter setting.

1－1－2 Each Component Name and Function of the Unit

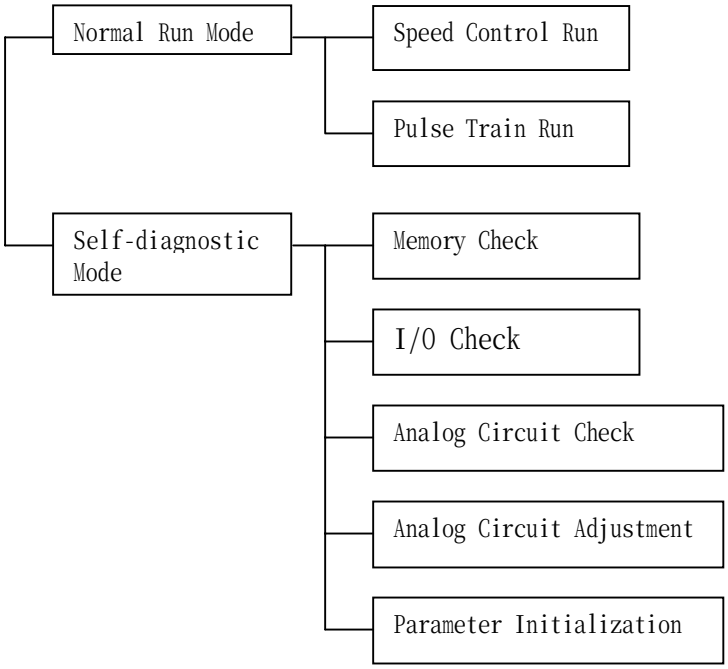


No	Name	Mark	Function
①	Data display LED	STATUS	Status display, Alarm code display, Parameter value display, Self-diagnosis status display
②	Operation key	UP, DOWN, ENT	Selection of status display, Parameter edit, Operation in Self-diagnosis
③	Signal display LED	POWER	Lit ON when power is supplied to the unit.
		FAIL	Lit ON when CPU is abnormal.
		DR～ALM	Lit On when individual control I/O signal is ON.
④	Analog monitor terminal	MON	Outputs Motor speed and Torque command status by analog voltage.
⑤	Encoder connector	J1	Connects Motor encoder cable
⑥	Control I/O signal connector	J2	Connects individual command input and control I/O
⑦	Terminal block for power input	TB1	Connects power source, motor power cables and a regenerative resister.
⑧	Communication connector	P1	The connector to connect serial communication signals.
⑨	End jumper for communication	TERM	The jumper for the end resistor during serial communication connection.

＊ The connector and jumper only for maker are used at maker inspection.
Do not use them unless getting approval of the maker.

1－1－3 Mode Configuration

Individual Run mode can be selected by parameters and control signals as [Fig. 1－2] .



[Fig. 1－2] Mode Configuration

● Individual Mode Outline

Mode	Function and Cobtents
Normal Run Mode	• Speed Control Run Speed control is executed by Speed command input signal. • Pulse Train Run Position control is executed by Pulse train command input. Motor shaft output of Both Run types can be limited by Torque limit command input signal below a constant value.
Self-diagnostic Mode	• Diagnosis of various circuits of the unit is executed. • This mode is started by pushing operation key UP ENT at once and simultaneously inputting power source.

[Tab. 1－1] Run Mode Outline

Chapter 2 Installation

2－1 Check at Receipt of our Products

Please check the following points when receiving our products.

① If the products are exactly the ones what you ordered.(Type, Rated output, etc.)
② If any damage occurred during transportation.(Package damage, abnormal out look of products, etc.)
③ If accessories are packed, together.

If above points are not clear or damage is found, etc., please immediately contact our sales man.

⚠ Cautions

① If packages as cartons are broken, please do not unpack them, and inform our sales man.

2－2 Precautions Before Installation (handling)

When transporting the unit and a motor, handle with care so as not to drop or damage them.

⚠ Cautions

① Be careful not to pile the units and put anything on the unit.
▶〔It may cause bend and damage of the unit.〕

② Be careful not to add shock to a motor shaft.
▶〔It may cause bend and damage of the unit.〕

③ Do not move around with having motor cables.
▶〔It may cause bend and damage of the unit.〕

2－3　Motor Installation

2－3－1　Centering of Motor Shaft

① A flexible joint capable of absorbing center deflecion is recommended when connecting a motor shaft anf a load shaft.

② When connection is conducted by a pully, belt, etc., ensure that the load applied to the shaft end does not exceed the allowable value.
(As for Motor specification, refer to 10-2　Motor specification.)

⚠ Cautions

① Since center deflection increases load to a motor, generate heat on the motor shaft and damages a bearing, be careful when connection is implemented.

2－3－2　Installation Conditions

① Allowable ambient temperature and humidity range of a motor is as follows.
- Ambient temperature：０～＋４０℃
- Ambient humidity：２０～８０％ＲＨ (non-condensing)

⚠ Cautions

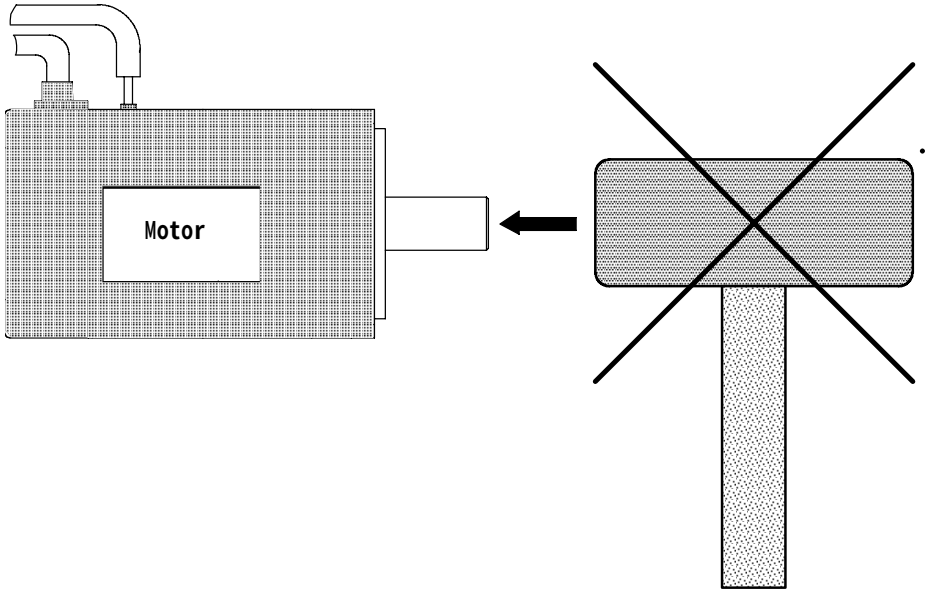
① Since about 10 % of motor capacity is exhausted as heat, take necessary Precautions to strictly keep the above allowable temperature range.

② Please avoid to install a motor in a location affected by high temperature, high humidity, dust, dirt, metal powder, lamp black, corrosive gas, etc..

2－3－3 Cautions of Installation

① When installing a coupling to a motor shaft, be sure not to impact the shaft with grater than 10G shock.
Never strike the end of the shaft with hammer, etc..

[Fig. 2－1] Do Not Strike Motor Shaft



② Direction of an encoder installed on a motor can not be changed.
③ Confirm that a motor shaft key and screws are not loosely attached.
④ When a motor is installed in a location where it could be exposed to oil or water , install cover, etc.to prevent oil or water from entering motor along lead wire.
Also, since oil or water entering via lead wire may have an adverse effect on both motor and encoder, position the lead wire not to soak in oil or water.
Contact our sales man if the motor could be exposed to oil or water.
⑤ For an application of mobile motors, ensure that the cable is not cut or mangled by movement of the motor.
It is also recommended to use anti-bending cable and let the cable bending radius as large as possible.

2－3－4 Cautions of Storage and Transportation

1. Cautions of storage

If our products are not used soon after receiving, store them under the following coditions in order to prevent deterioration of insulation and rust formation. However, unpack the products soon after receiving and check damage and other non-conformance incurred during transportation.

Item		Contents
Ambient Conditions	Temperature	－１０℃～＋８５℃
	Humidity	２０～８０％RH (Non-condensing)
	Storage location	Store in a clean place free of dust and dirt. Do not store in harmful atmosphare as corrosive gas, Grinding liquid, metal powder, oil, etc..
Vibration		Install in a place free from vibration.
Others		Rust prevention is effctive within 3 months after shipment from our factory under the above described conditions. If storage period is planned for longer than 3 months, please make prevension to the motor shaft and the flange face and then inspect them, periodically.

[Tab. 2－1] Motor Storage Conditions

2. Cautions of transportation

When you transport our products after receiving, please follow next conditions.

Item		Contents
A M B.	Temperature	－１０℃～＋８５℃
	Humidity	２０～８０％RH (non-condensing)
	Transportation conditions	Do not store in harmful atmosphare as corrosive gas, grinding liquid, metal powder, oil, etc..
Vibration		０．５G or less

[Tab. 2－2] Motor Transportation Conditions

2－4　Unit Installation

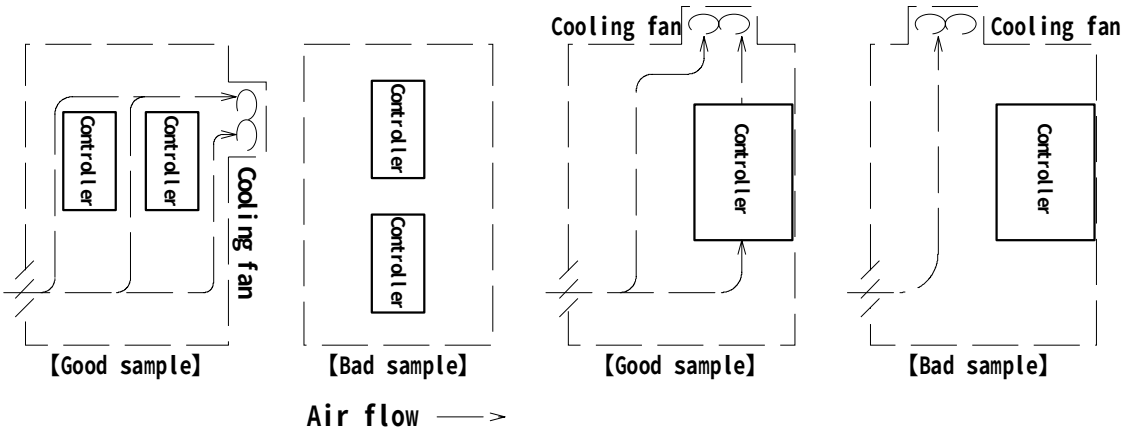
2－4－1　Installation Conditions

① Allowable ambient temperature and humidity range for the unit are as follows.
・Ambient Temperature：０～５５℃
・Ambient Humidity：８５% or less (non-condensing)

② Temperature increase of the enclosed cabinet inside is recommended to be less than 10 ℃ of ambient temperature.
Considering generation loss of equipment and influence of convection and radiation in the cabinet, keep the temperature lower than the allowable range.
Radiating heat energy of the unit is approximately 10 % + 30 W of the capacity.

③ When selecting a radiation fan and a heat exchanger, calculate above described generation loss and select adequate types to sufficiently cover the loss.

④ When plural units are placed in a control cabinet, specially consider cooling.
Note that if the unit layout and cooling fan location are not adequate, ambient temperature of the units may exceed the allowable range and radiation effect will be lowered.　Refer to [Fig.２－２] .



[Fig.２－２]　Location of Cooling Fan when Plural Units are Installed.

⚠ Cautions

① When ambient temperature exceeds allowable range, parts inside of the unit may be failed or damaged due to overheat, etc..
Consequently, the unit may not perform, properly.
Be sure to keep ambient temperature within the specified range.

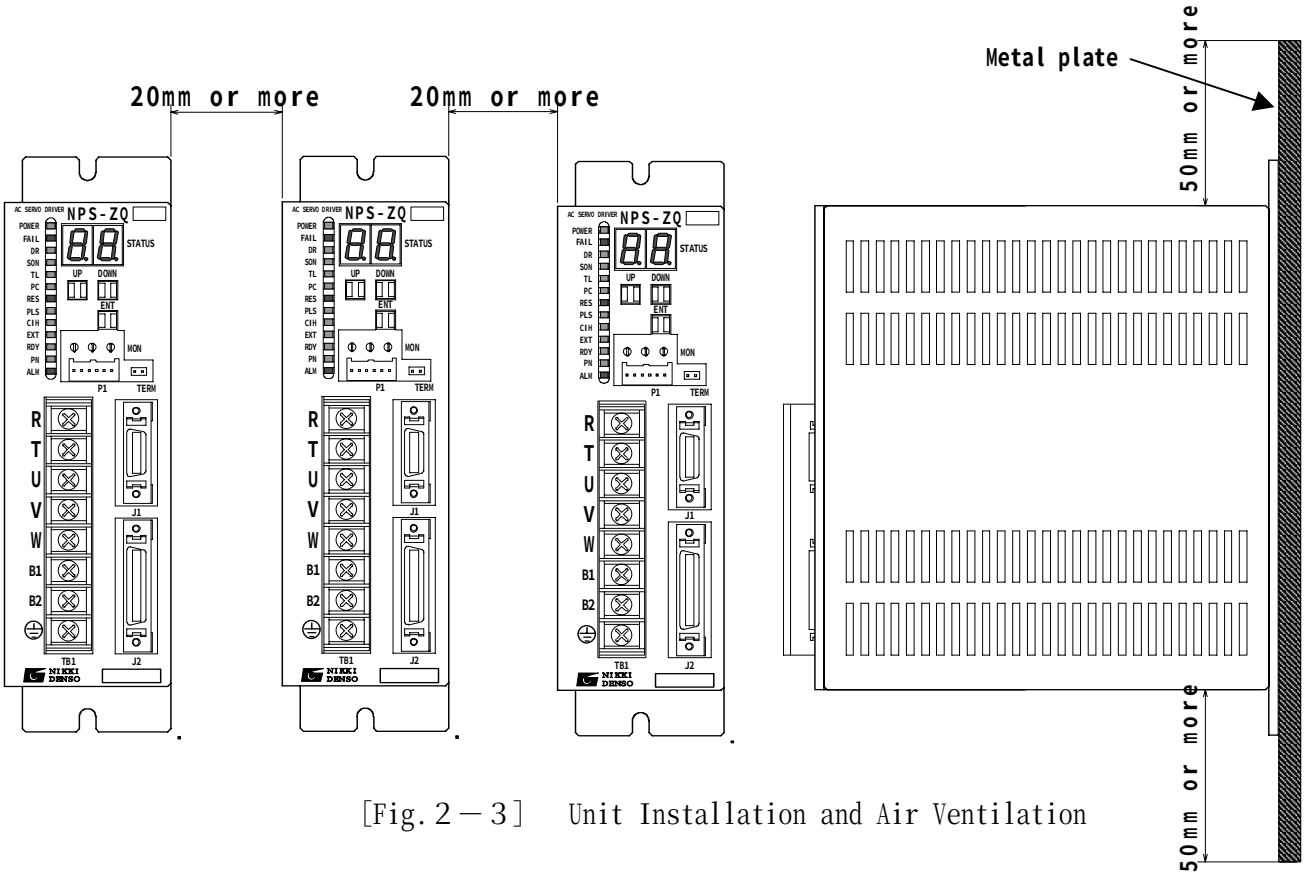
⑤ If a heating element , vibration source, etc. exists near the unit, design the layout to avoid the influence.

⑥ Do not install the unit in harmful atmosphere as high temperature, high humidity, dust, dirt, metal powder, oil black, corrosive gas, etc..

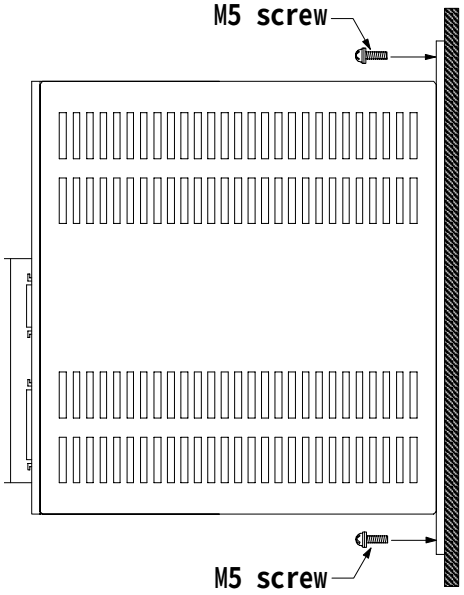
⑦ If there is a noise source such as electric welding machine, etc. near the unit, induction noise may influence the unit. Therefore, please enhance grounding to the unit. And depending on the location, a noise filter may be required.
Refer to [４－３　Anti-noise Measures] and take proper countermeasures.

2－4－2 Installation Method

① In order to get effective radiation, be sure to install the unit, vertically.
② Install the unit on a metal plate.
③ In the point of radiation and maintenance, design to install the unit at least 50mm vertically and 20 mm horizontally, away from other units, parts, and wall of the control cabinet. Refer to [Fig. 2－3] .
④ The unit was designed for panel mounting. Refer to [Fig. 2－4] .



[Fig. 2－3] Unit Installation and Air Ventilation



[Fig. 2－4] Unit Installation Method

2－4－3 Cautions of Storage and Transportation

1. Cautions of storage

If our products are not used soon after receiving, store them under the following coditions in order to prevent deterioration of insulation and rust formation. However, unpack the products soon after receiving and check damage and other Non-conformance incurred during transportation.

Item		Contents
Ambient Conditions	Temperature	－２０℃～＋６０℃
	Humidity	８５％ or less (Non-condensing)
	Storage location	Store in a clean place free of dust and dirt. Do not store in harmful atmosphare as corrosive gas, grinding liquid, metal powder, oil, etc..
Vibration		Install in a place free from vibration.
Others		If storage period is planned for longer than 3 months, please make prevension to screws of theterminal bar and then inspect them, periodically.

[Tab. 2－3] Unit Storage Conditions

2. Cautions of transportation

When you transport our products after receiving, please follow next conditions.

Item		Contents
A M B.	Temperature	－２０℃～＋６０℃
	Humidity	８５% or less (non-condensing)
	Transportation conditions	Do not store in harmful atmosphare as corrosive gas, grinding liquid, metal powder, oil, etc..
Vibration		０．５G or less

[Tab. 2－4] Unit Transportation Conditions

Chapter 3 Wiring

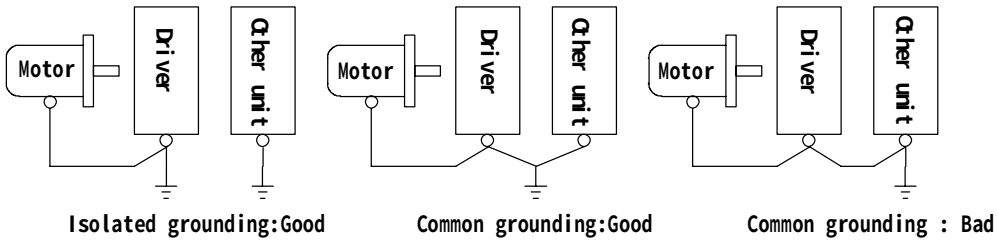
3－1 Wiring Precautions

3－1－1 Main Circuit

1. AC input power source wiring
   ① AC input power source is single phase AC 90V ～ AC 121V 50/60Hz(AC 100V system) or AC 180V ～ AC 242V 50/60Hz (AC 200V system).
   Even if voltage fluctuation of power source due to factory operating situation exists, the voltage shall not exceed the range.
   If the power source exceeds AC 242V or is AC 400V system, be sure to use a step-down transformer.
   ② In order to prevent an accident or fire, be sure to use no fuse breaker.
   Breaker capacity shall be 15 A per 1 unit.
   ③ Since main power source circuit is a capacitor input type, rush current flows when power source is turned ON.
   Depending on power source capacity or impedance, larger voltage drop may occur. Therefore, sufficiently large power source and suitable cables are recommended.
   ④ Do not make wrong connection of AC input power source (R,T,E) to the motor connection terminals (U,V,W) of the driver.
   If wrong connection is made, the driver may be damaged.
2. Motor wiring
   ① Do not connect a motor and driver terminals (U,V,W) in wrong phase sequence.
   If sequence is wrong, the motor will not run correctly and may vibrate or start running without any command input, which is quite dangerous.
   ② Do not connect a magnetic contactor or no-fuse breaker between a motor and a driver.
3. Grounding
   ① Be sure to make grounding as countermeasures of electric shock and noise.
   ② Use 2 mm^2 or larger cable for JIS Class 3 grounding or better (Grounding resistance 100Ω or less).
   Connect the grounding cable to earth terminal (E) of the driver.
   ③ Dedicated grounding is recommended if possible. Also, 1 point grounding shall be used even for common grounding.
   ④ To ground a motor, make wiring securely to both ground terminal (E) of the motor body and (E) of the driver.

⚠ Cautions

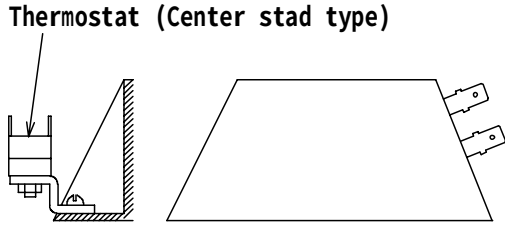
① To reduce common mode noise and prevent malfunction, use isolated ground of JIS Class 3 or better (Grounding resistance 100Ω or less).
② When isolated grounding is not available, sprit the grounding from other units at a common grounding point. Refer to [Fig. 3－1] .
③ Never try to apply common ground with a large power unit, and to ground to iron structures, etc..



[Fig. 3－1] Grounding Method

4. Regenerative resistor connection

① A regenerative resistor assists to radiate regenerative energy over-floating the regenerative capacitor , caused by the large load inertia (GD^2) during motor braking.
② Please use our optional regenerative resistor.
③ Since heat will be generated by the regenerative energy, install it not to affect other unit.
④ A thermostat is an accessory of a regenerative resistor.
The thermostat shall be attached to the regenerative resistor as below.



When a regenerative resistor is over-heated, a thermostat opens the contact.
Please design wiring to shut main power source with the signal.
Thermostat specification is as follows.

Contact Voltage	Contact current
AC200V	1A

⑤ Cable length between a regenerative resistor and the controller shall be shorter than 3 m. The longer the cable is, the higher generated surge voltage is due to power element switching which may damage the controller.

⚠ Cautions

① When abnormal current flows in a regenerative resistor, it becomes hot in a short time, which is quite dangerous.
Be sure to make a circuit to shut the main power source by the thermostat contact signal.

3－1－2 Control Circuit

1. Speed command , Torque limit command, Pulse train command, Encoder pulse output
   ① Use twist pair shield cables and securely connect the shield to the shield metal fitting of the connector J2.
   To avoid malfanction caused by noise, conduct wiring in accordance with the suggestions of [3－3 Anti-noise Measures] and [3－6 Input/ Output Signals].
   ② Since applied cable is thin, be careful not to break it by pulling force, etc..

2. Encoder feedback pulse signal
   ① Use 10 or large core twist pair shield cables and securely connect the shield to thr shield earth terminal of J1.
   To avoid malfanction caused by noise, conduct wiring referring to the suggestions of [3－3 Anti-noise Measures] and [3－6 Input/ Output Signals].
   ② If a mobile motor is required for some application, make the cable bending radius as large as possible to avoid excess stress. Dedicated encoder cable sets are optionally available.

3. Control Input/ Output signals
   ① For control input/ output signals, use micro-current type relays and switches.
   ② To avoid malfanction caused by noise, conduct wiring in accordance with the suggestions of [3－3 Anti-noise Measures] and [3－6 Input/ Output Signals].
   ③ Since applied cable is thin, be careful not to break it by pulling force, etc..

⚠ Cautions

① For control input/ output signal cables, use specified type and diameter and surely connect them in accordance with Wiring precautions.
Improper wiring triggers unexpected malfunction, which is quite dangerous.
② Be sure to separate control input/ output signal cables from power lines (power source, motor, etc.) and never place them in a same duct or bind them, together.

3－2 Applicable Cables

Use cables shown in [Tab.3－1].

Item		Terminal	Applicable cables (Unit:mm²)
Main Circuit	AC power source	R,T	2 or more
	Ground	E	2 or more
	Motor	U,V,W,E	0.75 or more
	Regenerative resistor	B1,B2	1.25 or more
Control Circuit	Speed command input Torque limit command input Analog monitor output	INH／GND TLH／GND M1,M2	Twist pair shield cable 0.1 or more less than 3 m
	Pulse train command	FC/FC*,RC/RC* FC/OFC*,RC/ORC*	Twist pair shield cable 0.1 or more For Line driver: Less than 3 m For Open collector: Less than 1.5 m
	Encoder Pulse	EA/EA*,EB/EB*, EM/EM*	Twist pair shield cable 0.1 or more less than 3 m
	Encoder feedback pulse input	A/A*,B/B*, Z/Z*	Twist pair shield cable 0.1 or more less than 20 m (For power source: 0.2 or or more)
	Other I/O		Shield cable 0.1 or more less than 3 m (For power source and +V:0.2 or or more)

[Tab.3－1] Applicable Cables

⚠ Cautions

① Cable type and size will be changed on the actual running conditions and environment. Please consult our sales man for further information.
② If a control signal cable is long, since signals are likely to be influenced by noise, keep the cable length shorter than specified value.
And be sure to use only specified cable types.

3－3 Anti-noise Measures

External noise may intrude via power source or signal cable.
External noise intrusion may cause malfunction and induce a trouble.
To prevent troubles caused by noise, it is important to depress noise generation and not to induce the noise.
Be sure o make the following measures.

3－3－1 Grounding

Be sure to conduct adequate grounding in accordance with [3－1 Wiring Precautions] and [3－2 Applicable cables] .

3－3－2 Signal cable

Refer to [3－1 Wiring Precautions] and [3－2 Applicable cables] .
As for shield cable tratment, refer to [3－3－3 Wiring] .

1. Analog I/O signal cable

   ① Since Speed command, Torque limit command, and analog monitor outputs are micro-current type analog signals, use twist pair shield cable and securely connect the shield to the shield metal of the connector J2, etc. .
   ② Make the cable length 3 m or less.
   ③ If the cable length exceeds 3 m, use an analog isolation amplifier and locate it to minimize the distance to the driver.

2. Pulse train I/O signal cable

   ① Since Pulse train command and Encoder pulse output are high speed Pulse train signals, use twist pair shield cables and securely connect the shield to the shield metal of the connector J2.
   ② Cable length of Pulse train command and Encoder pulse output for line driver outputs shall be 3 m or less.
   ③ Cable length of Pulse train command for open collector outputs shall be 1.5 m or less and achieve sufficient anti-noise measures.

3. Encoder feedback signal cable

   ① Since Encoder feedback signal is high speed Pulse train signal for position and speed sensing, use twist pair shield cable and securely connect the shield to the shield earth terminal of the connector J1.
   ② Make the cable length 20 m or less.
   Optional encoder cable sets are available.

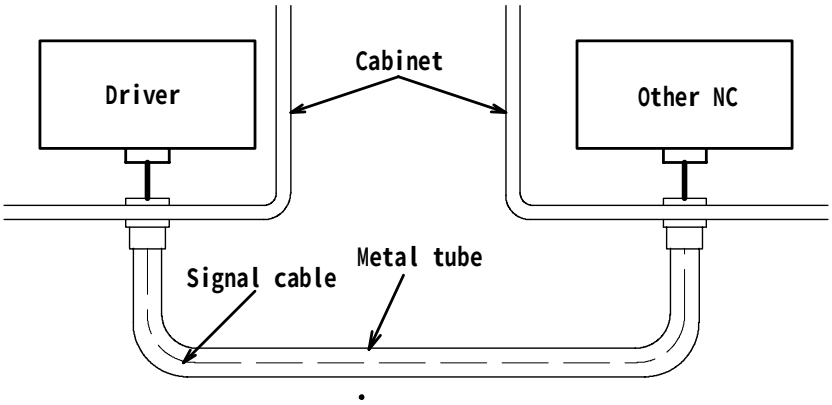
4. Other control I/O signals

   ① Use shield cables for control I/O signals (DR, SON, RES, etc.) and securely connect the shield to the shield metal of the connector J2.
   ② Provide your own +12V～24V with necessary current output power source for control I/O signals.
   ③ Make the cable length 3 m or less.
   ④ If the cable length exceeds 3 m, relay the signal via micro-current type relay to make the cable length between the relay contact and the driver 3 m or less.

3－3－3 Wiring

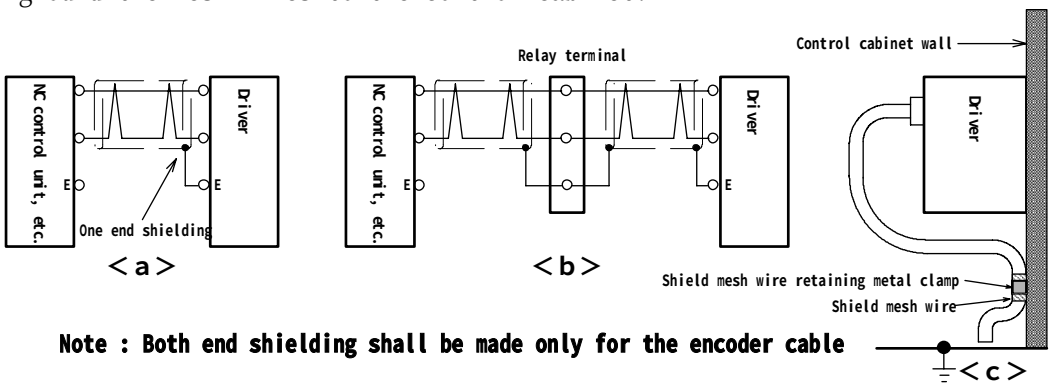
Conduct correct wiring referring to [3-1 Wiring Precautions] and [3-2 Applicable cables].

1. Signal cable treatment
   ① Separate signal cables from power lines (Power source line, Motor line, Power relay, Solenoide, etc.) and never place them in a same duct or bind them together.
   ② Conduct wiring of signal cables at lease 20 cm apart from the power line.
   ③ When it is difficult to separate signal cables from the power line, pass the signal cables through a metal tube to shut noise.



[Fig. 3－2] Anti-noise Measures Using Metal Tube

2. Shield cable treatment
   ① Connect shield mesh wires, securely to the shield metal of the driver connector or the shield earth terminal of the connector and keep other end free. Refer to [Fig. 3－3] a. However in some cases, grounding of the other shield end could improves situation.
   ② Avoid relaying shield cables if possible. If un-avoidable, connect shield of the relay terminal, securely. Refer to [Fig. 3－3] b.
   ③ Connect both end of Encoder feedback signal cables to the driver connector and shield earth terminal of the encoder connector.
   Specially in very noisy environment, it is effective to remove the shield armor (cuticle) of the encoder cable at the nearest place to the driver, and directly ground the mesh wires to the control cabinet.



Note : Both end shielding shall be made only for the encoder cable

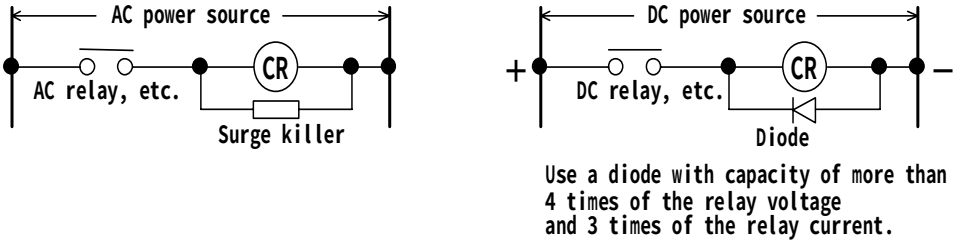
In the case, make electric potential of the wall for driver installation identical to that of the earth terminal of the control cabinet. And do not place any insulator such as piece of rubber between the wall and the driver case. Refer to [Fig. 3－3] c.

[Fig. 3－3] Treatment of Shield Mesh Wire

3－3－4 Installation of Surge Killer and NoiseFilter

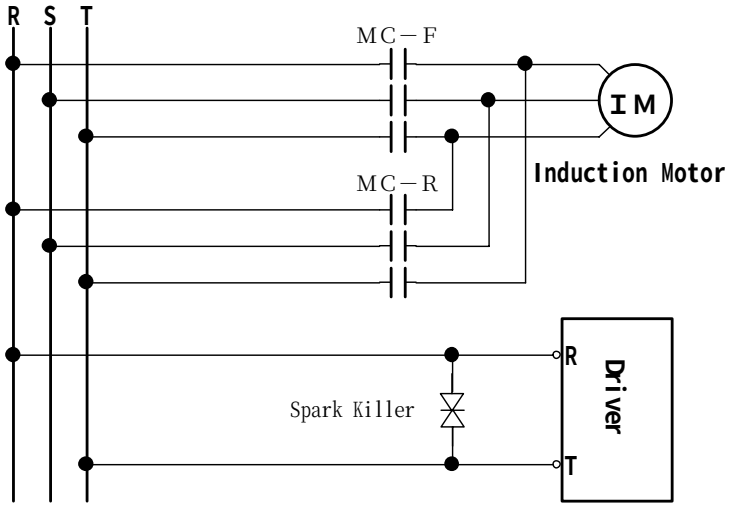
1. Installation of surge killer

① To depress noise generation, install a surge killer (for AC power source) or a diode (for DC power source) on each relay, magnet contact, solenoid, electro magnetic brake, etc. Refe to [Fig.3－4] .



[Fig.3－4] Anti-noise Measures as relay

② As [Fig.3－5] , in case of common main power source to the induction motor is used,spark noise occurred at reversing motor direction of the induction motor (IM) may breake rectifiers of the driver. If large capacity induct motor is used, insert a spark killer, etc. to main power source (between R－T) and depress the spark voltage.



[Fig.3－5] Common Power Source to Induction Motor

2. Installation of noise filter

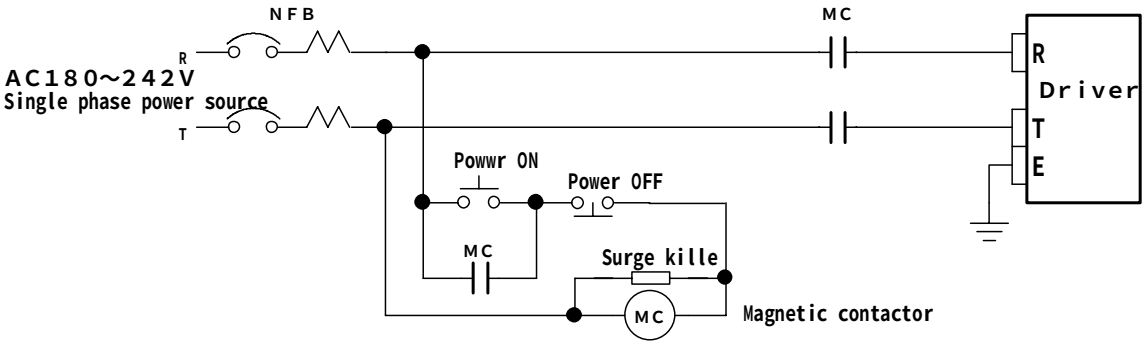
① If power source line is quite noisy, for example when noise sources as welders, electric discharge machines, etc. are operated nearby, install a noise filter or noise cut transformer in the main power source of the driver.
When using a noise filter, be sure to separate the input and output cables of the filter, and never bind them together. Also, do not bind the filter earth cable and filter output cable together and be sure to ground the filter via shortest distance.

② Since a switching power supply is used for the driver, switching noise will occur. If this noise is anticipated to have an adverse effect on other units, conduct anti-noise measures as inserting a noise filter in the main power source of the driver and pass power source line and motor line through a metatube.

3－4　Power Source Connection

3－4－1　Power Source Circuit

Typical power source circuit is shown in ［Fig. 3－6］.



Note: Be sure to install a surge killer.

［Fig. 3－6］　Typical Power Source Circuit

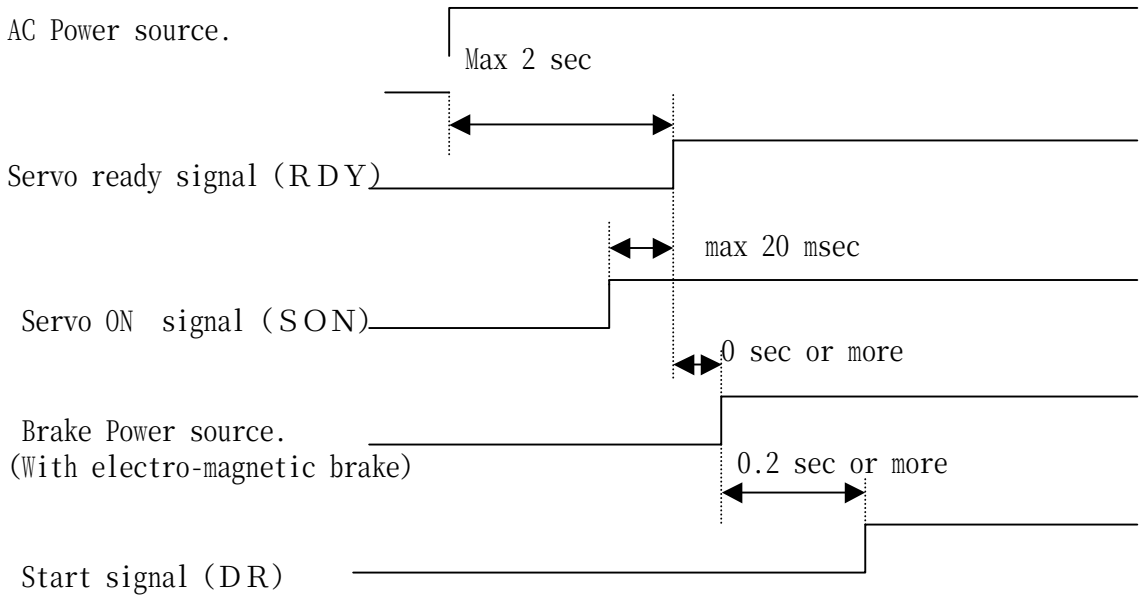
⚠ Cautions

① Please keep the power source within the specified range. If not, the driver could be damaged.
② To protect the power source line or accident as fire, be sure to apply no fuse breaker. Breaker capacity shall be 15 A per one unit.
③ When a magnet contactor is used, be sure to install a surge killer.
④ Please separate the driver power source circuit from other high power unit, if possible.

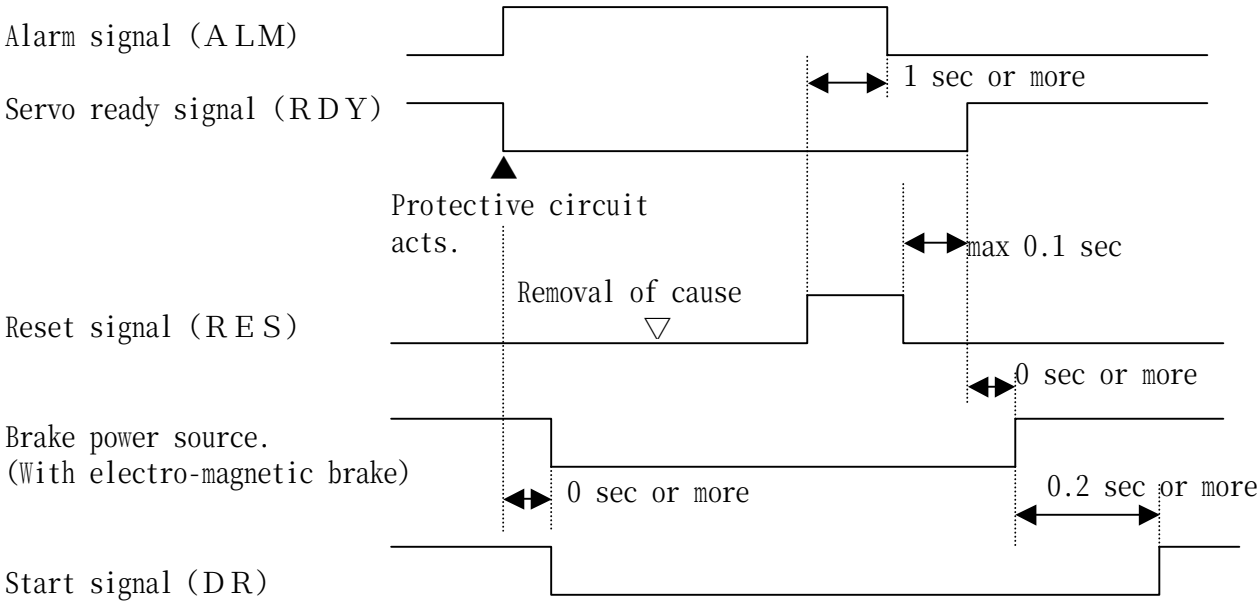
3－4－2 Sequence for Turning Power Source ON

① Since the main power source circuit is capacitor input type, frequent switching ON and OFF causes deterioration of the main power source circuit elements . Power source re-input shall be conducted at least 3 minute after turning the power OFF. However power re-input 30 seconds after turning power OFF can be allowed up to twice.

② ［Fig. 3－7］ and ［Fig. 3－8］ show timing chart when power source is turned ON and a trouble occurs.



［Fig. 3－7］ Timing Chart when Turning Power Source ON



［Fig. 3－8］ Timing Chart when Problem Occurs.

⚠ Cautions

① If IPM failure or Over load error protection occurs and reset is repeatedly conducted in a short time, driver temperature will rise excessively and damage the driver. After deleting the cause, cool the diver about 30 minutes and re-start motion.
② If power black out occurs for 10 ms or longer, Under voltage error may be activated. If power failure continues, control power source will be lost and protective circuit is reset. Then, if Start signal is ON and a command (Speed command, Pulse train command, etc.) is inputted when the power source has recovered, a motor will run. Therefore, make external sequence to turn OFF Start signal and command input when the protective function is activated.

3－4－3 Selection of Earth Leakage Breaker

Since inverter section of the driver is controlled by PWM, the output contains higher harmonic components and leakage current is generated depending on the ground static capacity of wiring route from the driver to a motor and the floating capacity between the motor coil and the iron core.

Since this leakage current from the higher harmonic components could activate an earth leakage breaker, select an inverter use type eath leakage breaker (50/ 60 Hz) for main power source circuit of the driver.

⚠ Cautions

① If a wiring route is long, leakage current from the cable becomes large. To reduce the leakage current, make shortest wiring and place the cables from the ground cable and ground as far as possible (30 cm or longer).

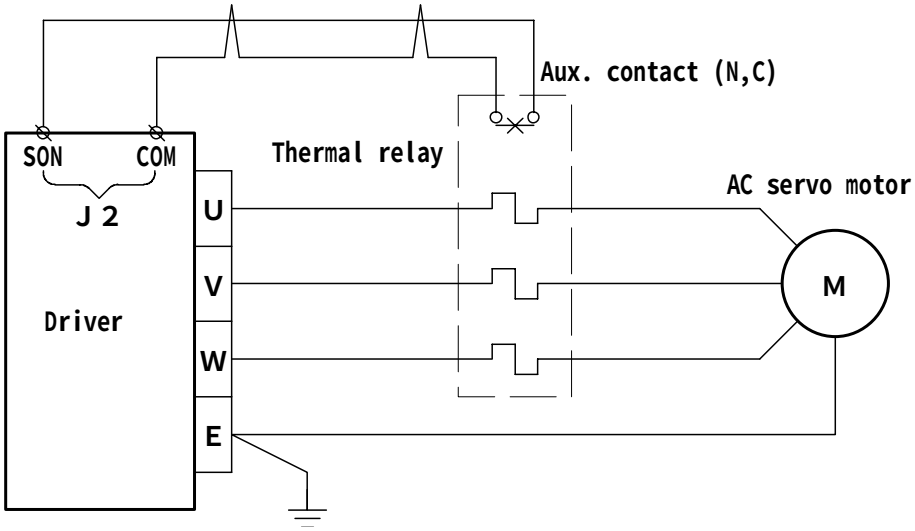
3－5　Connection of Motor

3－5－1　Motor Wiring

① Connect motor terminals (U,V,W) and driver terminals (U,V,W) in correct phase sequence. (Same name terminals shall be connected, respectively.)
When motor cables are distinguished by color, correspond them to U: Red, V: White, and W: Black.

② If a motor with brake is used, be sure to release it before turning ON Start signal (DR). Otherwise, the motor may burn out.
Refer to [Fig. 3－7 Timing Chart when Turning Power Source ON.] .

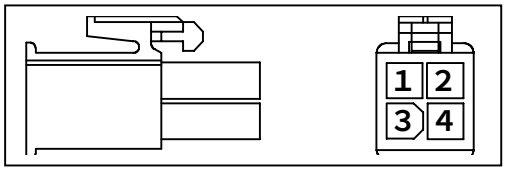
③ A driver has an electronic thermal, internally. In case of adding thermal relay externally, set the current value to the motor rated current.
Using the auxiliary contact of the thermal relay, make sequence to disable the Servo ON signal (SON) and stop the motor when the thermal relay is activated.
Refer to [Fig. 3－9] .

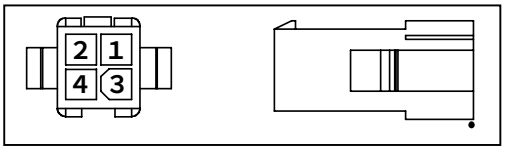


[Fig. 3－9]　Motor Wiring

⚠ Cautions

① Be sure to connect a motor ground terminal (E) to a driver ground terminal (E).

<table>
<tr><td>Connector</td><td colspan="2">Amp Mini-universal MATE-N-LOK connecter (4 pin) / AMP product</td></tr>
<tr><td></td><td>Motor side connector</td><td>Wiring cable side connector</td></tr>
<tr><td>Connector body</td><td>Plug housing`<br>１７２１６７－１</td><td>Cap housing `
１７２１５９－１</td></tr>
<tr><td>Contact</td><td>Pin
170360-1 or 170363－1</td><td>Socket
170362-1 or170366-1</td></tr>
<tr><td rowspan="2">Pin location</td><td> 

Side drawing/ Drawing viewed from connecting section</td><td> 

Drawing viewed from connecting section/ Side drawing</td></tr>
<tr><td colspan="2"><table>
<tr><th>Pin No.</th><th>Signal name</th><th>Cable color</th></tr>
<tr><td>1</td><td>U</td><td>Red</td></tr>
<tr><td>2</td><td>V</td><td>White</td></tr>
<tr><td>3</td><td>W</td><td>Black</td></tr>
<tr><td>4</td><td>E</td><td>Green</td></tr>
</table></td></tr>
</table>

[Tab. 3－2]　Motor Power Connector Pin Layout

3－5－2　Settibg of Motor Rotating Direction

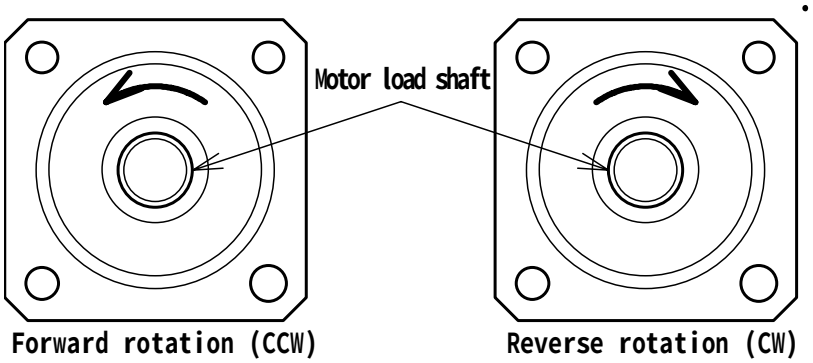
Motor rotating direction is set as follows.

① Relation of each command input polarity and motor rotating direction in case of standard connection of a motor and an encoder is shown in [Tab. 3－3] . (When 0 (forward totation) is set to both parameter P1 (Rotating direction selection), and J2 (Pulse train command phase change).

Command input	Polarity	Motor rotating direction
Speed command	+V (forward)	CCW rot. viewed from load shaft : Forward (CCW)
	-V (reverse)	CW rot. viewed from load shaft : Reverse (CW)
90° phase diiferent pulse train command	B phase ahead (forward)	CCW rot. viewed from load shaft : Forward (CCW)
	A phase ahead (reverse)	CW rot. viewed from load shaft : Reverse (CW)
Directional pulse train command	FC input (forward)	CCW rot. viewed from load shaft : Forward (CCW)
	RC input (reverse)	CW rot. viewed from load shaft : Reverse (CW)
Direcional signal＋ feed pulse command	RC OFF (forward)	CCW rot. viewed from load shaft : Forward (CCW)※
	RC ON (reverse)	CW rot. viewed from load shaft : Reverse (CW)※

[Tab. 3－3]　Each Command Input and Motor Rotating Direction

※ ON of ON/OFF directional signal is defined that current is flowing in the circuit in case of Open collector I/F.(Curret is flowing into Open collector driver.)
And in case of Line driver I/F, when driver positive signal (RC) is“ H ”and negative signal (RC＊) is“ L ”status, it is defined ON and opposite status is defined OFF.



[Fig. 3－10]　Motor Rotating Direction

② By the parameter P1 (Rotating direction selection) and J2 (Pulse train phase phase sequence change) setting, motor rotating direction to Speed command or Pulse train command is changed as [Tab.3－4] .
Hereafter, (Forward) in the sentense means fowrard motor rotation to a forward command while (Revrse)means reverse motor rotation to a reverse command.

Command input	Parameter P 1 (Rotating direction selection) set	Parameter J 2 (Pulse train command phase sequence change) set	Motor rotating direction	
			By Speed command	By Pulse train command
Forward	‘ 0 ’ (Factory set)	‘ 0 ’ (Factory set)	Forward(CCW)	
		‘ 1 ’	Forward(CCW)	Reverse(CW)
	‘ 1 ’	‘ 0 ’ (Factory set)	Reverse(CW)	
		‘ 1 ’	Reverse(CW)	Forward(CCW)
Reverse	‘ 0 ’ (Factory set)	‘ 0 ’ (Factory set)	Reverse(CW)	
		‘ 1 ’	Reverse(CW)	Forward(CCW)
	‘ 1 ’	‘ 0 ’ (Factory set)	Forward(CCW)	
		‘ 1 ’	Forward(CCW)	Reverse(CW)

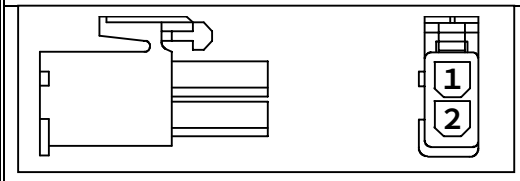
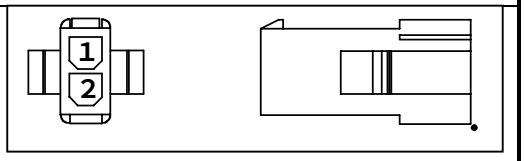
[Tab.3－4] Parameter and Motor Rotating Direction

3－5－3 Electro Magnetic Brake Wiring

Some of our motors are equipped with brake to hold motors during power failure or emergency status. Brakes are de-energized types. They are released when voltage is supplied and are activated when voltage is cut.
For brake power source, separate DC 24V power source is required.
The brake power source capacity is determined by individual motor capacity.

Motor type	Capacity	Brake holding power	Power source capacity
NA70－10	100W	0．32N・m(3.25 kgf・cm) or more	DC24V±10% 6W(at 20℃)
NA70－20	200W	1．27N・m(13kgf・cm) or more	DC24V±10% 8W(at 20℃)
NA70－40	400W	1．27N・m(13kgf・cm) or more	DC24V±10% 8W(at 20℃)
NA70－60	600W	2．55N・m(26kgf・cm) or more	DC24V±10% 9W(at 20℃)

［Tab.3－5］ Motor Capacity and Corresponding Brake Capacity

Connector	Amp Mini-universal MATE-N-LOK connecter (2 pin) / AMP product	
	Brake side connector	Wiring cable side connector
Connector Body	Plug housing 172165－1	Cap housing 172157－1
Contact	Pin 170359-1 or 170363-1	Socket 170362-1 or 170366-1
Pin location	 Side drawing/ Drawing viewed from connecting section	 Drawing viewed from connecting section/ Side drawing

Pin No.	Sgnal name	Cable Color
1	BK	Yellow
2	BK	Yellow

［Tab.3－6］ Electro Magnetic Brake Connector

⚠ Cautions

① Since an electromagnetic brake is released about 0.2 sec. after voltage is supplied, considering this time, set the timing of Servo ON signal (SON) and Start signal (DR) to stop a motor and in torque free status, the brake is activated.
Be sure to turn OFF Servo ON signal (SON), first and then OFF Start signal (DR).

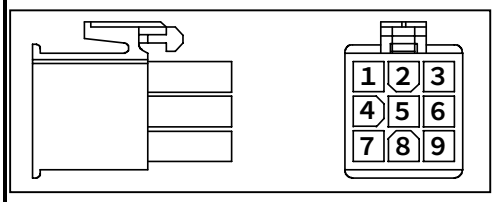
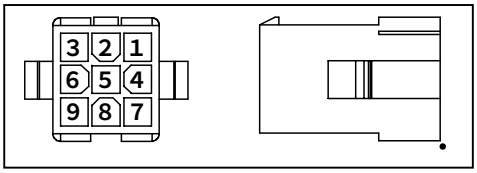
② Since electromagnetic brake is only for holding, never activate it when a motor is running.

3－5－4 Encoder fFedback Pulse Wiring

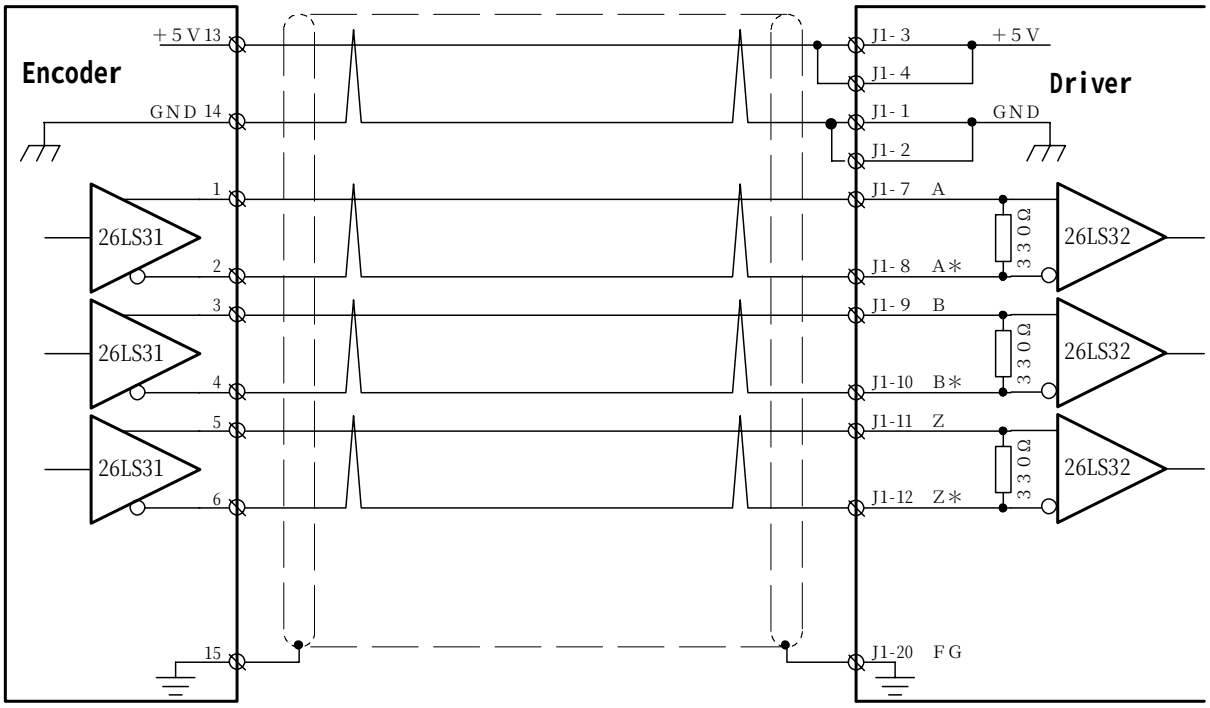
Feedback pulse from an encoder on a motor is very important signal for control. Conduct wiring, correctly in accordance with the following procedure.

① Use 10 core or more twist pair shield cable for wiring.
Wiring length shall be 20 m or shorter.
(Our optional cables are available.)

② Connect encoder feedback pulses to connector J 1 of a driver.
A set of Sumitomo 3M product 10120-3000VE and 10320-52A0-008 is used as the connector.

Connector	Amp Mini-universal MATE-N-LOK connecter (9 pin) / AMP product	
	Encoder side connector	Wiring cable side connector
Connector body	Plug housing 1 7 2 1 6 9－1	Cap housing 1 7 2 1 6 1－1
Contact	Pin 170359-1 or 170363-1	Socket 170361-1 or 170365-1
Pin location	 Side drawing/ Drawing viewed from connecting section	 Drawing viewed from connecting section/ Side drawing

[Tab. 3－7] Encoder Cable Motor Side Connector



[Fig. 3－11] Encoder and Driver Connection

Driver side Connector pin No.	Signal name	Signal contents	Motor side Connector pin No.
FG metal, 20	FG	Frame	9
3, 4	EP5	Power source.+5V	7
1, 2	GND	Power source.GND	8
7	A	A phase pulse +V	3
8	A*	A phase pulse –V	4
9	B	B phase pulse +V	1
10	B*	B phase pulse -V	2
11	Z	Z phase marker +V	5
12	Z*	Z phase marker –V	6
17	RX	Reserved	–
18	RX*	Reserved	–

[Tab.3－8] Encoder Feedback Pulse Input Connector

3－6 Input and Output Signals

3－6－1 Input and Output Signal List

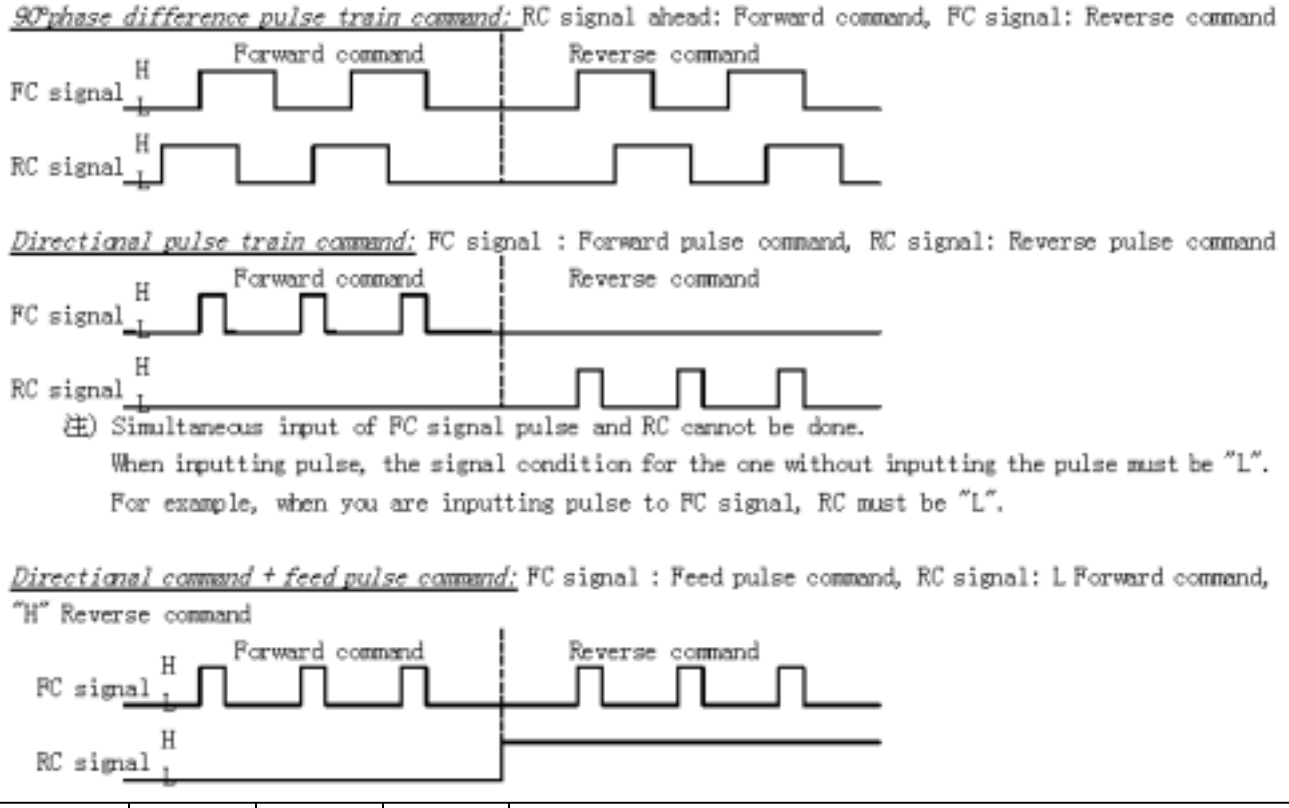
Signal name	Terminal name	Terminal №	I／O	Function
A phase pulse	A	J1－7	I－1	・Balance type A phase pulse connection terminal from a pulse encoder on the un-loaded motor shaft side.
	A＊	J1－8	I－1	・It supposes A is positive and A＊ is negative polarity at connection.
B phase pulse	B	J1－9	I－1	・Balance type B phase pulse connection terminal from a pulse encoder on the un-loaded motor shaft side.
	B＊	J1－10	I－1	・It supposes B is positive and B＊ is negative polarity at connection .
Marker signal	Z	J1－11	I－1	・Balance type Marker signal connection terminal from a pulse encoder on the un-loaded motor shaft side.
	Z＊	J1－12	I－1	・It supposes Z is positive and Z＊ is negative polarity at connection .
Reserved	RX	J1－17	I－1	・Reserved connection terminal from Pulse /Encoder for a balance type magnetic sensor, etc. .
	RX＊	J1－18	I－1	It is not used to connect NA 70 motor.
Power source	EP5	J1－3, 4		・５V Power source terminal for encoder It is connected with internal control power source (5V) of the unit though a filter.
Servo ready	RDY	J2－3	O－1	・When internal control is ready to perform, this signal is turned ON. (This and COM1 terminals are closed.) ・When an Alarm occurs, Servo ON signal(SON) is OFF or a motor is in Torque free, this signal is OFF. (This and COM1 terminals are opened.) ・When an Alarm occurs, if the Alarm is reset by Reset signal (RES) or power re-input, this signal recovers. ・During Reset signal is (RES) ON, this signal is OFF and after Reset signal is OFF again, this signal is ON. ・When power source is turned ON,due to driver internal power source reset time, this signal output is delayed max.2 sec. . And the delay time at Servo ON signal (SON) input is max. 20 ms and at Reset signal (RES) OFF, max. 0.1s until this signal is ON. ・When designing external power source input and trouble shooting sequence, consider above timing. ・This signal is an open collector output isolated to the internal control power source. ・When this signal is outputted, the front panel RDY LED is lit ON.

Signal name	Terminal name	Terminal №	I／O	Function
Alarm	ALM	J2－4	O－1	・This signal is B contact and when Alarm occurs, a motor conducts torque free stop. ・When Alarm occurs, this signal is ON (This and COM1 terminals are opened.) and simultaneously Servo ready signal (RDY) is OFF. ・At normal condition, this signal is OFF. (This and COM1 terminals are closed.) ・Alarm is reset by Reset signal (RES) input or power re-input, and at the time Reset signal is inputted, this signal is OFF. ・This signal is an open collector output isolated to the internal control power source. ・When this signal is outputted, Alarm code is displayed in the front panel data display LED. However it works only in status display mode.
Positioning complete	PN	J2－7	O－1	・This sugnal is effective when the unit is operated in Pulse train run mode and this signal is ON during deviation counter value stays in Positioning complete range set by parameter(J4). (This and COM terminals are closed.) ・This signal is OFF when Start signal (DR) is OFF. (This and COM terminals are opened.). ・This signal is OFF at Servo OFF when ‘Deviation clear enable’ is set to parameter (J0) (Position deviation clear select.). ・This signal is an open collector output isolated to the internal control power source. ・When this signal is outputted, the front panel PN LED is lit ON.
Control output signal common	COM	J2－6	O－1	・Common to control output signal(PN)
Control output signal common1	COM1	J2－5	O－1	・Common to control output signals(RDY,ALM)

Signal name	Terminal name	Terminal №	I／O	Function
Start	DR	J2−19	I－2	・When this and COM of external power source are closed (signal ON), both of Speed and Pulse train command can be accepted. ・When this and COM are opened during motor running, both commands are disabled and the motor stops. ・When this signal is inputted, the front panel DR LED is lit ON .
Servo ON	SON	J2−20	I－2	・When this and COM of external power source are closed (signal ON), power transistors are driven and current is supplied to a motor. ・When this and COM are opened, power transistors drive is disturbed, and the motor becomes in torque free. ・When this and COM are opened during motor running, the motor conducts free run stop. ・When this and COM are opened, Servo ready signal (RDY) is not outputted. ・This signal effective logic can be changed by parameter (P2). In the case, all the above described conditions of closed/ opened between this signal and COM becomes reverese. ・When this signal (Servo ON) is inputted, the front panel SON LED is lit ON.
Torque limit	TL	J2−21	I－2	・When this and COM of external power source are closed (signal ON), motor output torque is restricted by Torque limit command (voltage between TLH-GND) value. (10V input:300%) ・This signal is effective in all Run modes. ・By setting parameter U3, this signal becomes the rotating direction switching signal. ・When this signal (Servo ON) is inputted, the front panel TL LED is lit ON.
Reset	RES	J2−22	I－2	・When this and COM of external power source are closed (signal ON), Alarm is reset and Alarm output signal (ALM) is turned OFF. But resettable Alarm can be referred to (9－2－1 Protective Function List). ・During this signal is ON, a motor is in torque free, and Servo ready signal (RDY) is OFF. ・When this signal is OFF, Servo ready signal is ON and the unit returns normal operation condition. ・Alarm reset can be also made by re-inputting power to the unit. ・When this signal (Servo ON) is inputted, the front panel RES LED is lit ON . 【Note】 Alarm reset shall be made after removing the cause.

Signal name	Terminal name	Terminal №	I／O	Function
Proportional control	PC	J2−23	I－2	・When this and COM of external power source are closed (signal ON), Speed loop changes from proportional/ integral control to proportiona control. ・When it is necessary to restrain slite vibration at Seovo lock, by inputting this signal, a motor stops with small friction torque. ・Speed loop without integral control does not conduct quick response to fine command input due to lower speed loop gain and output torque is restricted. ・This signal is effective in all Run modes. ・By setting parameter U3, this signal becomes the rotating direction switching signal. ・When this signal (Servo ON) is inputted, the front panel PC LED is lit ON.
Pulse train selection	PLS	J2−24	I－2	・When this and COM of external power source are closed (signal ON), Run mode changes from Speed control run to Pulse train run. ・When this signal is inputted, the unit can accept one of 90° phase difference pulse/ Directional pulse/ and Directional signal＋ feed pulse commands. Pulse train command method is selected by parameter(J1). ・When this signal (Servo ON) is inputted, the front panel PLS LED is lit ON.
Count prohibit	CIH	J2−25	I－2	・When this and COM of external power source are closed (signal ON) in Pulse train run, Pulse train command is disabled, a motor is in Seovo lock. ・When this signal is inputted during motor running, the motor stops after consuming deviation pulse in the position deviation counter. ・When this signal (Servo ON) is inputted, the front panel CIH LED is lit ON.
Reserved	EXT	J2−26	I－2	・Do not connect anything to this terminal. Reserved signal by us.
Encoder pulse output	EA EA＊ EB EB＊ EM EM＊	J2−14 J2−32 J2−15 J2−33 J2−16 J2−34	O－2	・Inputted encoder feedback pulse to this unit is outputted as it is. ・Outputs are 90° phase difference 2 signals (A phase, B phase) and Marker signal (Z phase) of line driver outputs (26LS31 or equivalent). Be sure to interface with a line receiver (26LS32 or equivalent) . 【Note】These signals (EA,EA*,EB,EB*,EM,EM*) are not steady for max. 2 seconds after turning power ON.

Signal name	Terminal name	Terminal №	I／O	Function
Pulse train command	FC FC* OFC* RC RC* ORC*	J2－11 J2－29 J2－27 J2－12 J2－30 J2－28	I－3	・It connects one of 90° phase difference pulse/ Directional pulse/ and Directional signal＋ feed pulse signals. Input pulse train command signal method is selected by parameter (J1) (Pulse train command input pulse select.). Any of them can be used to either line driver method or open collecter method. ・In case of line driver method, connect each signal output from line driver to FC-FC* and RC-RC*. ・In case of open collecter method,connect＋12Vto FC and RC, and connect open collecter outputs to OFC* and ORC*. This description is made based on line driver method. In case of open collecter method, change words as below and read it. FC signal "L":between OFC*-OV to be opened, FC signal "H":between OFC*-OV to be short-circuited. RC signal "L":between ORC*-OV to be opened, RC signal "H":between ORC*-OV to be short-circuited. ・Reverse rotation can be executed with forward Directional pulse train comand by setting parameter (Ｊ２). ・Max. input frequency of Pulse train command is 250 Kpps in line driver method and 200 Kpps in open collecter method. ・Command pulse width must be１μｓ or longer.



Signal name	Terminal name	Terminal №	I／O	Function
Torque limit command input	TLH	J2−17	I−4	・When Torque limit signal (TL) is inputted, motor output torque is restricted corresponding to the voltage added to this and GND terminals. ・Positive voltage against GND is inputted to this terminal. ・Input range is DC 0～+10 V, and at+3.3 V input, motor output torque is limited to 100%.
Speed command input	INH	J2−18	I−5	・In Speed control run, a motor runs at speed proportional to the voltage added to this and GND terminals. ・At DC±10V input, a motor runs at rated speed. ・A motor can run at rated speed at ±1V～±10V input by parameter (U0) setting. ・When positive voltage against GND is inputted, a motor runs forward, and negative voltage is inputted, the motor runs reverse. ・By parameter (P1) setting, a motor can run reverse with positive voltage command. ・Motor Accel./ Decel. time can be set by parameter (P5～6).
Analog monitor output	M1 M2		O−3	・The status selected by parameter(P3～4) is outputted to this and GND terminal by DC voltage.
Power source	+5V	J2−13		・Power source for internal control power of the unit.
Power source GND	GND	J1-1,2 J2−31 J2−35 J2−36 TP3		・Common of power source (+5V) for internal control power of the unit.
Shield earth	FG	J1-20		・Shield earth terminal

⃠ Prohibition

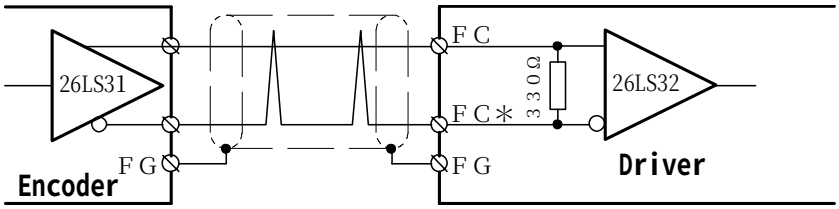
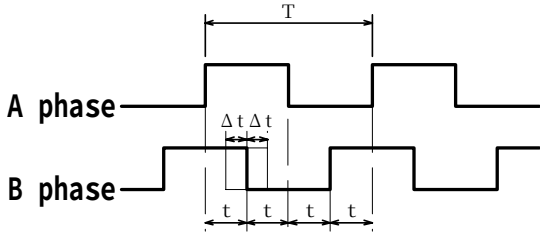
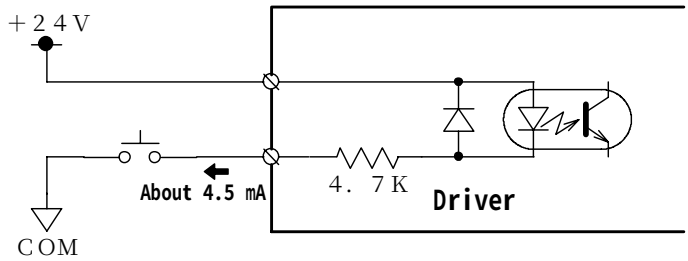
① Since COM, COM1 (Control output signal power common) and GND (Internal control power common) are isolated, avoid to place them in a same duct and cable bundle.
► [**Running away of a motor, injury, and machine damage may occur.**]

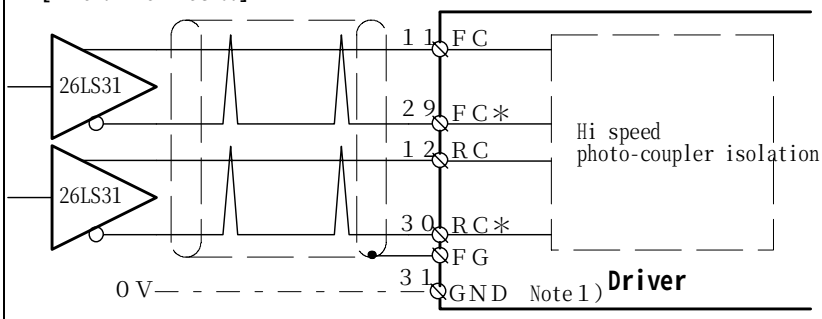
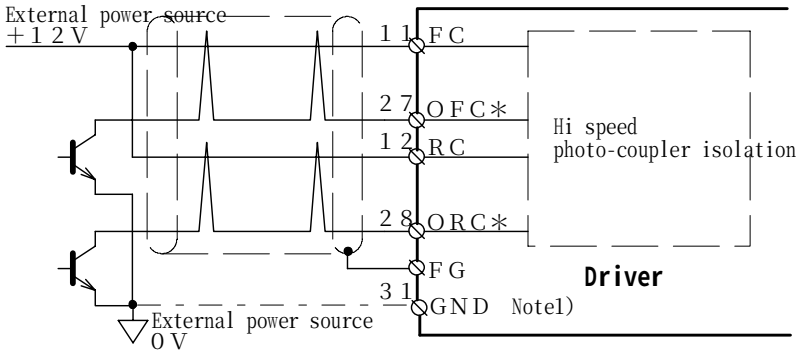
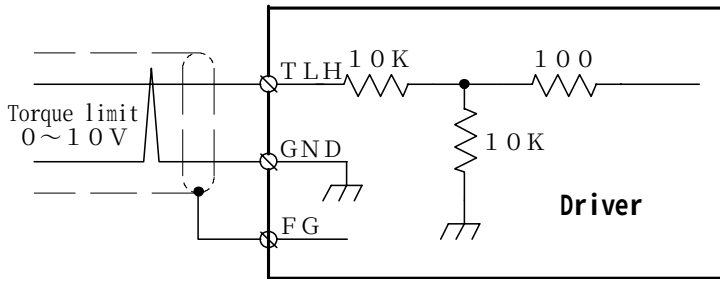
❗ Compulsion

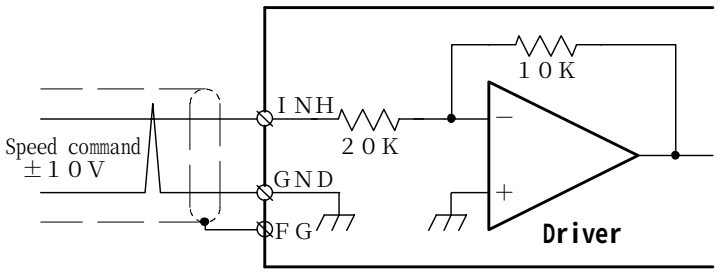
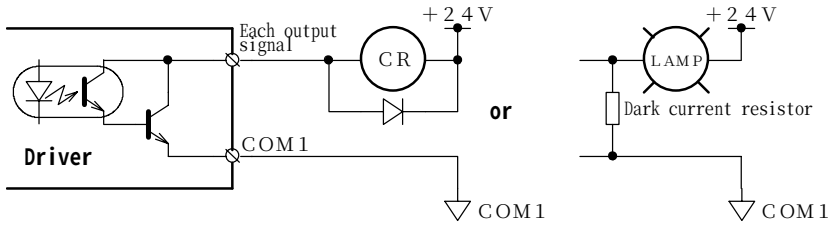
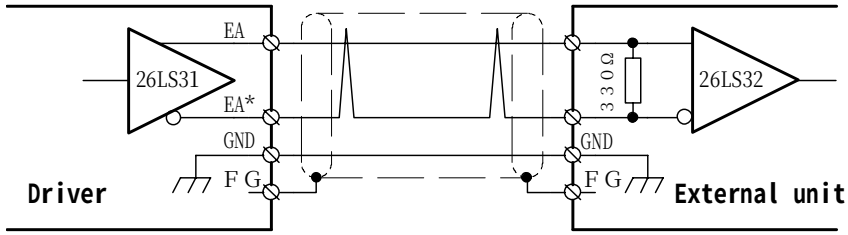
① Provide your own power source with specified voltage and current for control input signals.

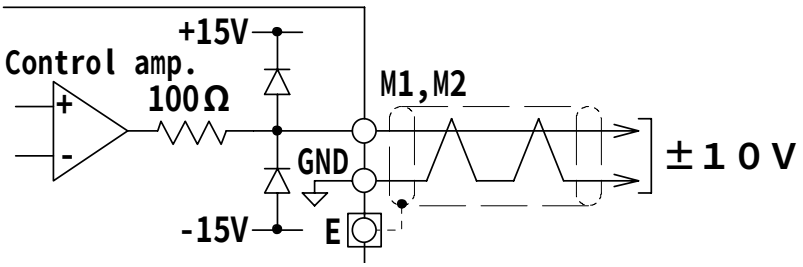
3－6－2 Input/ Output Interface

Individual I/O signals type and equivalent circuit is described in the below tabulation.

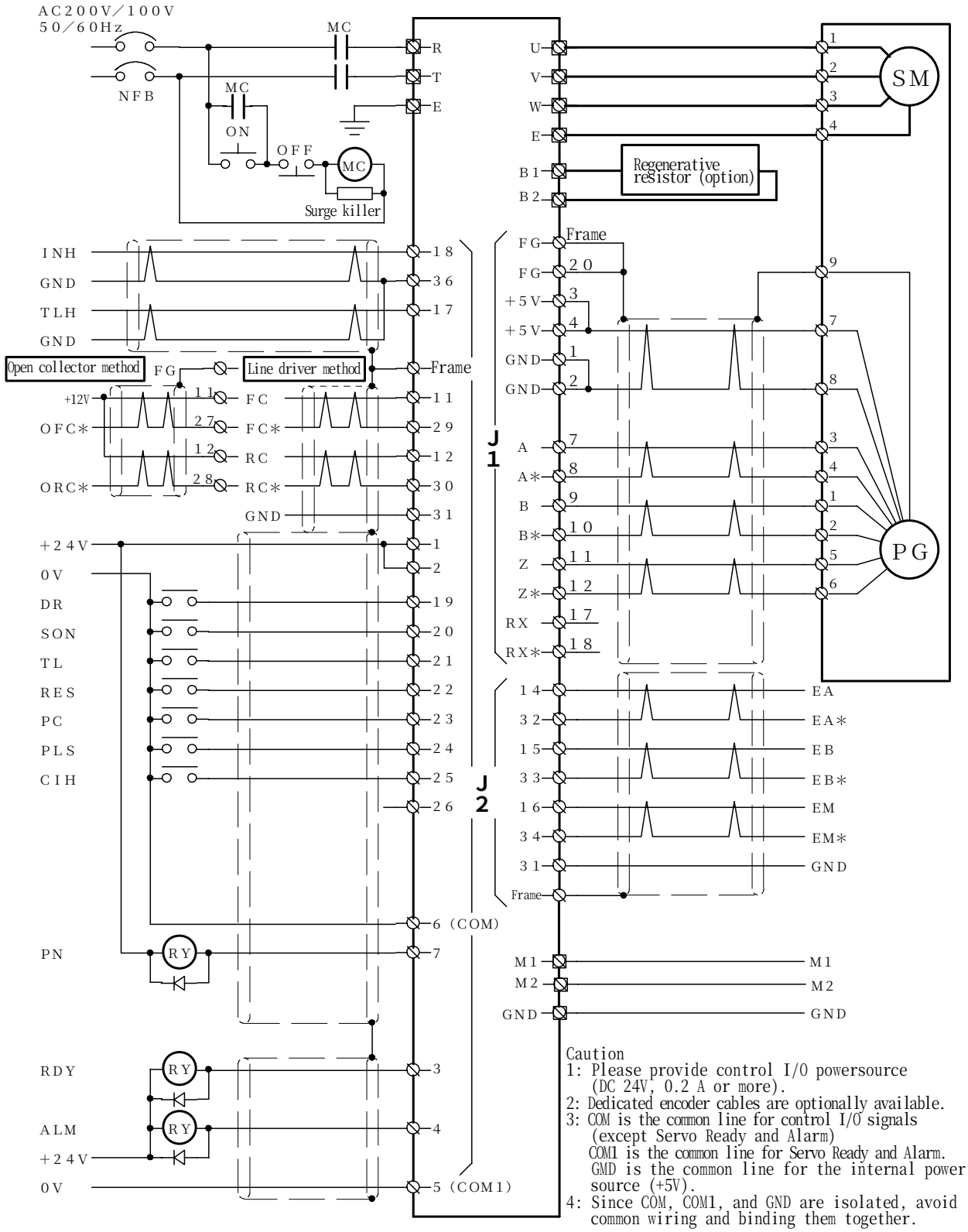
Type	Signal Name	Circuit and Specification
I－1	・Encoder Feedback Pulse （A／A＊） （B／B＊） （Z／Z＊）	 ・Since the input is intefaced with a line receiver (26LS32 or equivalent) ,be sure to use a line driver (26LS31 or equivalent) for the encoder pulse output.  ・ｔ＝Ｔ／４ ， Δｔ＝±Ｔ／８ ・In forwward motor rotation, B phase is ahead of A phase.
I－2	・Start ・Servo ON ・Torque Limit ・Reset ・Proportional Control ・Pulse Train Selection ・Count Inhibit	 ・Micro-current switching relay, or open collector output type transistor is recommended for external contacts. ・Capacity ＤＣ２４Ｖ, about ４．５mA (Typ) Capacity ＤＣ１２Ｖ, about ２mA (Typ) ・Input signal low pass filter time constant: About 3 ms

Type	Signal Name	Circuit and Specification
I－3	・Pulse Train Command	[Line driver method]  [Open collector method]  Note1)When the troubles are caused by noise, it is recommended to connect 0V of the pulse train output side and the unit GND signal for better result. ・In case of line driver method, use the line driver, 26LS31 or equivalent. ・In case of open collecter method, saturation voltage of applied transistor shall be 0.9V or less under the above interface conditions. ・Max.input frequency: 250 Kpps (line driver method) 200 Kpps (open collecter method) ・Min.input pulse width : 1μs
I－4	・Torque Limit Command Input	 ・When a relay is installed in the Torque lomit line, use a micro-current switching relay.

Type	Signal Name	Circuit and Specification
I－5	・Speed Command Input	 ・When a relay is installed in the Speed command line, use a micro-current switching relay. ・In stop status, do not open INH but short-circuit INH-GND terminals or keep the same potential between INH and GND.
O－1	・Servo Ready ・Alarm ・Positioning Complete	 ・In case of applying an inductive load as a relay, etc., be sure to insert a diode in parallel with the load. ・In case of applying a lamp load, insert a dark current resistor to keep the current (including inrush current) lower than the rated. ・Capacity: DC24V, 50mA (Saturated voltage of output transistor : 1.0 V or less) ・Please note that RDY/ ALM signal common (COM1) is separated from PN/ OCM signal common (COM).
O－2	・Encoder Pulse Output （EA／EA＊） （EB／EB＊） （EM／EM＊）	 ・Snce the output is conducted through a line driver (26LS31 or equivalent) , be sure to interface with a line receiver (26LS32 or equivalent) . ・Terminal resitor of receiving side shall be 330Ω (1/2W or more) . ・In forward motor rotation, B phase is outputted ahead of A phase. Phase relation of A and B phases is corresponding to motor rotating direction.

Type	Signal Name	Circuit and Secification
O－3	・Analog Monitor Output	 ・Analog monitor output is selected by the parameter (Monitor output selection). ・Relation of contents and output voltage of individual analog monitor output can be referred to (5-2 Parameter P3 and P4).

3－7 External Connecting Diagram



[Fig.3－12] External Connecting Diagram

3－8　Connector

3－8－1　Encoder Pulse Input Connector （J１）

No.	Signal Name	Contents	No.	Signal Name	Contents
1	GND	Encoder power source common	１１	Z	Encoder marker signal input (positive)
2	GND	〃	１２	Z＊	〃 (negative)
3	EP5	Encoder power source (+5V)	１３	NC	No connection (reserved)
4	EP5	〃	１４	NC	No connection (reserved)
5	NC	No connection (reserved)	１５	NC	No connection (reserved)
6	NC	No connection (reserved)	１６	NC	No connection (reserved)
7	A	Encoder pulse A phase input (+)	１７	RX	No connection (reserved)
8	A＊	〃 (-)	１８	RX＊	No connection (reserved)
9	B	Encoder pulse B phase input (+)	１９	NC	No connection (reserved)
１０	B＊	〃 (-)	２０	FG	Shield earth

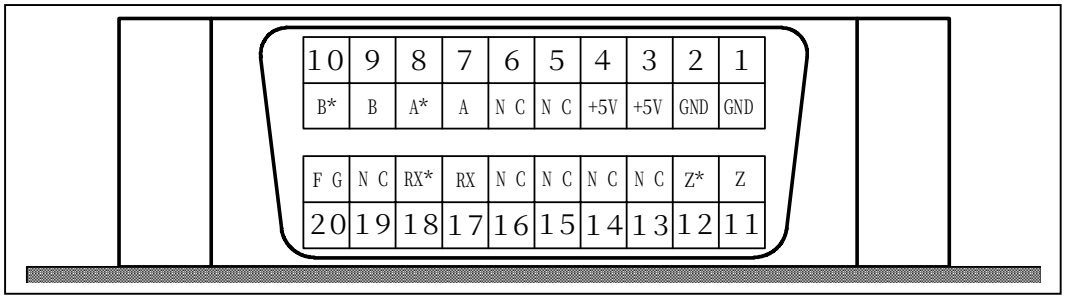
(〔＊〕 of a signal name indicates the signal is negative logic.)

Applied connector ： Receptacle /１０２２０－５２Ａ２ＪＬ （3M product)

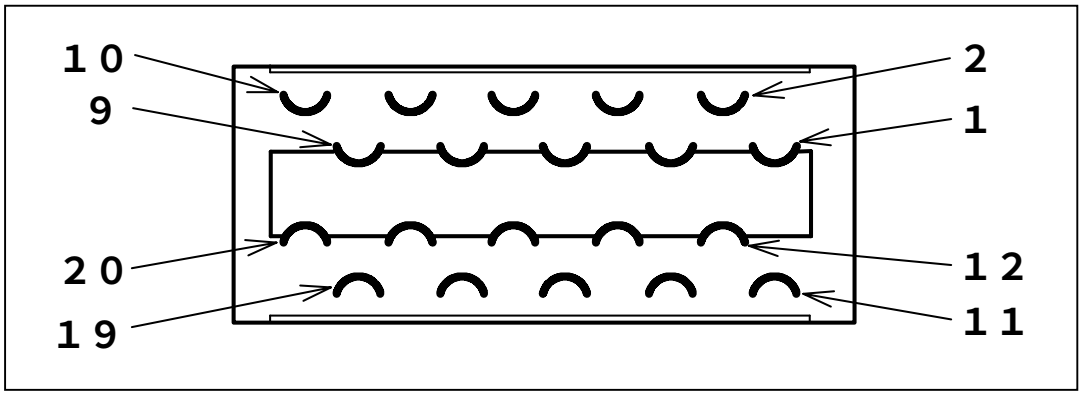
Cable side mating connector ：Soldering plug / １０１２０－３０００ＶＥ

： Case (shell) / １０３２０－５２ＡＯ－００８

※ Below figure is the layout viewd from connecting section to the unit side connector.



※ Below figure is the layout viewed from soldered terminal side to the cable side connector.



[Tab.３－９]　Connector J1 Terminal Layout

3－8－2 Control Input/ Output Signal Connector （J２）

No.	Signal Name	Contents	No.	Signal Name	Contents
1	＋ V	External power (DC+12V～+24V)	１９	D R	Start
2	＋ V	External power (DC+12V～+24V)	２０	SON	Servo ON
3	RDY	Servo Ready	２１	T L	Torque lomot
4	ALM	Alarm	２２	RES	Reset
5	COM1	RDY,ALM signal common	２３	P C	Proportional control
6	COM	PN signal common	２４	PLS	Pulse train selection
7	P N	Positioning complete	２５	CIH	Count prohibit
8	NC	No connection (reserved)	２６	EXT	No connection (reserved)
9	NC	No connection (reserved)	２７	OFC＊	Open collector input forward pulse train command (-)
１０	NC	No connection (reserved)	２８	ORC＊	Open collector input reverse pulse train command (-)
１１	F C	Forward pulse train command (+)	２９	FC＊	Forward pulse train command (-)
１２	R C	Reverse pulse train command (+)	３０	RC＊	Reverse pulse train command (-)
１３	＋５V	Inernal control power ＋５V	３１	GND	Inernal control power common
１４	E A	Encoder pulse A phase output (+)	３２	EA＊	Encoder pulse A phase output (-)
１５	E B	Encoder pulse B phase output (+)	３３	EB＊	Encoder pulse B phase output (-)
１６	E M	Encoder pulse Z phase output(+)	３４	EM＊	Encoder pulse Z phase output (-)
１７	TLH	Torque limit command input	３５	GND	Inernal control power common
１８	INH	Speed command input	３６	GND	Inernal control power common

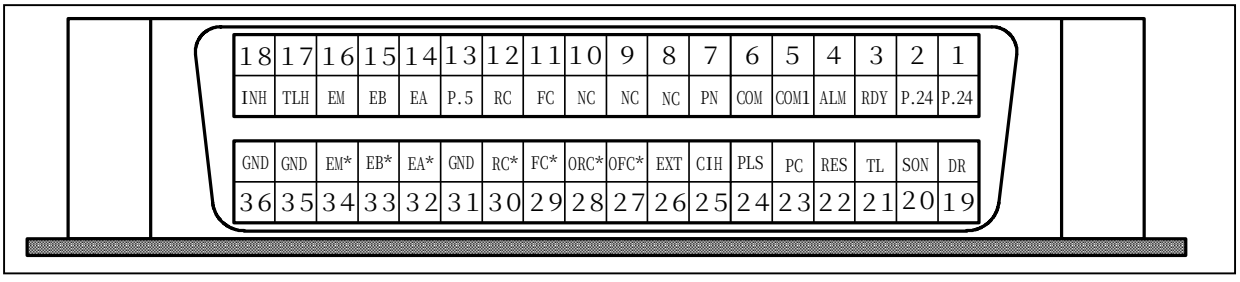
(〔＊〕of a signal name indicates the signal is negative logic.)

Applied connector ： Receptacle / １０２３６－５２A２JL （3M product)

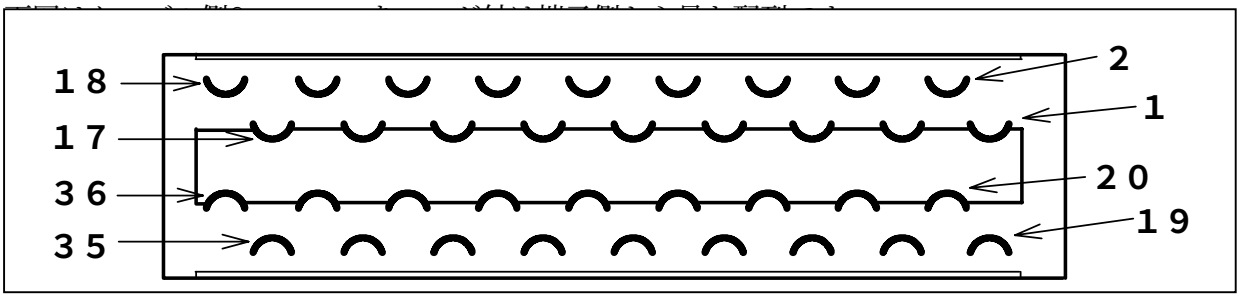
Cable side mating connector ：Soldered plug / １０１３６－３０００VE

：Case (shell) / １０３３６－５２AO－００８

※ Below figure is the layout viewd from connecting section to the unit side connector.



※



[Tab.３－１０] Connector J2 Terminal Layout

3－8－3 Analog Monitor Terminal

Signal list

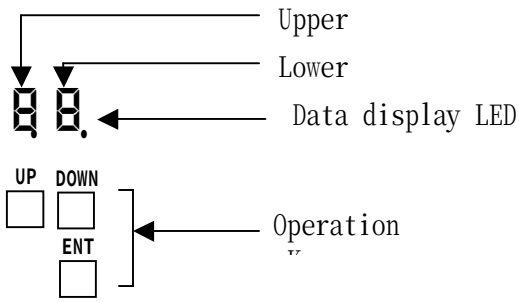
Signal	Contents
M 1	Analog monitor 1 ch. output
M 2	Analog monitor 2 ch. output
G N D	Inernal control power common

Chapter 4 Setting and Display

4－1 Operation Panel

Motor or unit status display, Parameter edit, and Self-diagnosis can be executed by the operation panl.

4－1－1 Individual Section Function of Operation Panel



[Fig.4－1] Operation Panel Outlook

① Data display LED

Data display LED is corresponding to individual operation mode,and displays item name and data associated ith the item.

7 segmant LED display numeric and letter list is as follows.

7 segmant LED display	Numeric	7 segmant LED display	Letter	7 segmant LED display	Letter
0	0	A	A	o	o(O)
1	1	b	b(B)	P	P
2	2	C	C	q	q(Q)
3	3	d	d(D)	r	r(R)
4	4	E	E	t	t(T)
5	5	F	F	U	U
6	6	H	H	. . (decimal)	－*1
7	7	J	J		
8	8	L	L		
9	9	n	n(N)		

*1： When the decimal point of 7 segmant LED is lit ON, it represents negative data.
Sample) 3.4 ：－3.4

[Tab.4－1] 7 Segmant LED Display Numeric and Letter List

Meaning of upper digit of the data display LED is as follows.

Displayed letter	Display meaning	Display sample
A	Displays Alarm code.	A 3
C	Displays Status display item.	C 1
P	Mainly displays Edit items of motor adjustment parameter.	P 2
U	Mainly displays Edit items of Speed control parameters.	U 2
d	Displays Data display item in Self-diagnosis.	d 4
H	Displays Edit items in Self-diagnosis.	H 0

[Tab.Tab.4－2] List of Upper Digit Letter Display Meaning

② Operation key

Operation keys are used to select a display item of individual operation mode, and edit parameters, etc. .

List of individual operation key function is as follows.

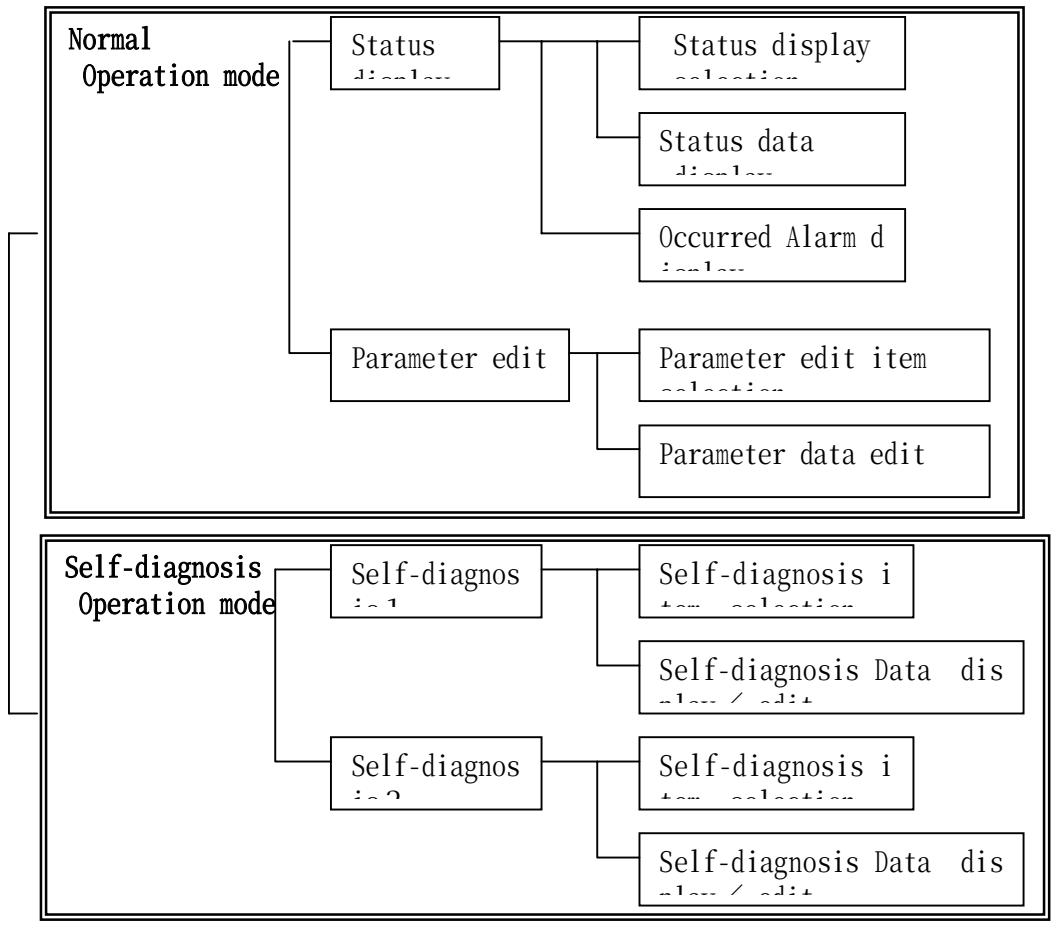
Key	Contents	
UP □	At item selection	Selection of next item
	At status display	Invalid
	At data edit	Changes Edit data number(0～99): small→ big. When Edit data are changed, display data flicker.
DOWN □	At item selection	Selection of back item
	At status display	Invalid
	At data edit	Changes Edit data number(0～99): big→ small When Edit data are changed, display data flicker.
ENT □	At item selection	Moves to Status display or Data edit after a subject item is determined.
	At status display	Moves to item selection display.
	At data edit	Moves to item selection display. But when data are flickering, changed data are canceled, and registered data are again displayed.
ENT □ Press for 1.5 sec.	At item selection	Invalid
	At status display	Invalid
	At data edit	Registers flickering display data. Then, data change from flickering to lit ON status.
UP DOWN □□ ※	At item selection	Invalid
	At status display	Moves to item selection display.
	At data edit	Data changed in data flickering, changed data are canceled, and registered data are again displayed.
UP DOWN □□ ※ Press for 1.5 sec.	At item selection	In normal operation mode: Moves Status display mode → Parameter edit mode, or Parameter edit mode → Status display mode In Self-diagnosis operation mode: Moves Self-diagnosis 1 mode → Self-diagnosis 2 mode. or Self-diagnosis 2 mode → Self-diagnosis1 mode
	At status display	Invalid
	At data edit	Moves to item selection display.
UP ENT □□ ※	At power ON	Moves to Self-diagnosis operation mode.

Note: ※ means simultaneous press.

[Tab.４－３]　List of Operation Key Function

４－１－２　Operation Mode Configuration

Operation mode configuration is as follows.



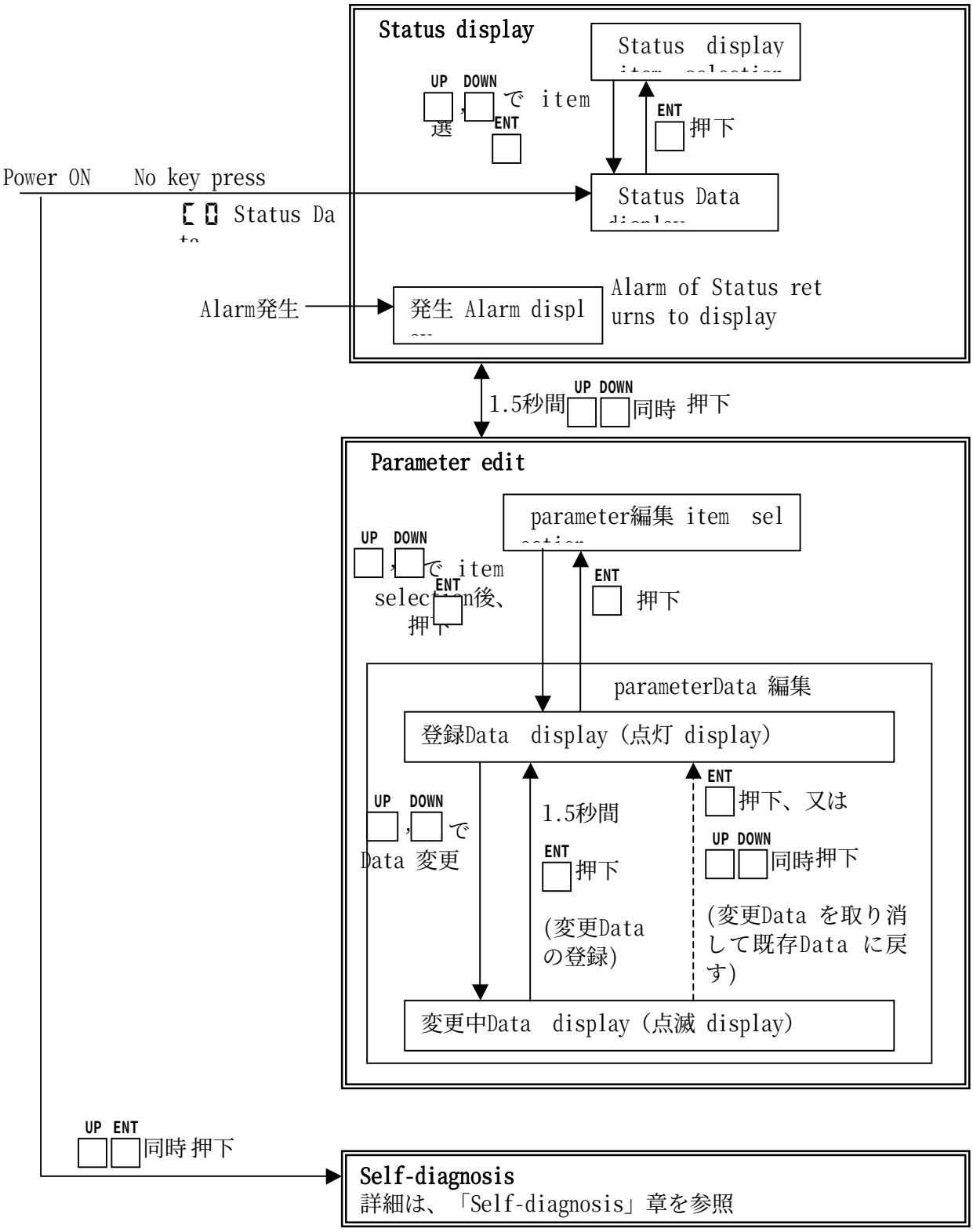
Operation mode contents are as follows.

Ope. mode	Item／Data	Contents	Display sample
Status display	Item selection	Selects display item code of speed, actual torque, software version, etc..	Display item Code 3「C 3」
	Data display	Displays Data of selected display item code.	At speed select. 「12」(1200 rpm is displayed.)
	Occurred Alarm display	Displays Alarm code when Alarm occurs.	Alarm code 4 「A 4」
Parameter edit	Item selection	Selects parameter item code for Edit.	Edit item code 4 「P 4」
	Data edit	Edits data in accordance with selected edit item code.	Speed loop “ P ” gain value 「2 3」
Self-diagnosis 1／2	Item selection	Selects item code for Self-diagnosis. Self-diagnosis 1 : Self-diagnosis to check error of the unit. Self-diagnosis 2 : Self-diagnosis for inspection before shipment.	Diagnosis item code 5 「d 5」
	Data display/ Edit	Displays or edits in accordance with selected diagnosis item code.	Diagnosis value 「 0」

[Tab. 4－4]　Operation Mode Configuration

4－1－3　Operation Procedre

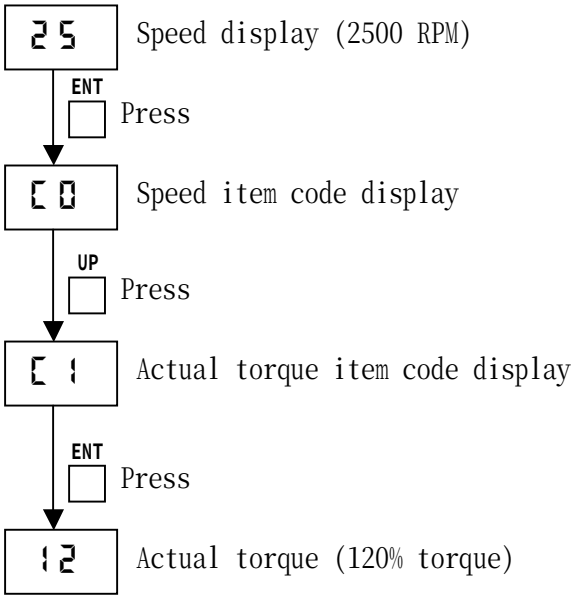
Total Operation procedure is as follows.



[Fig.4－2]　Total Operation Procedure

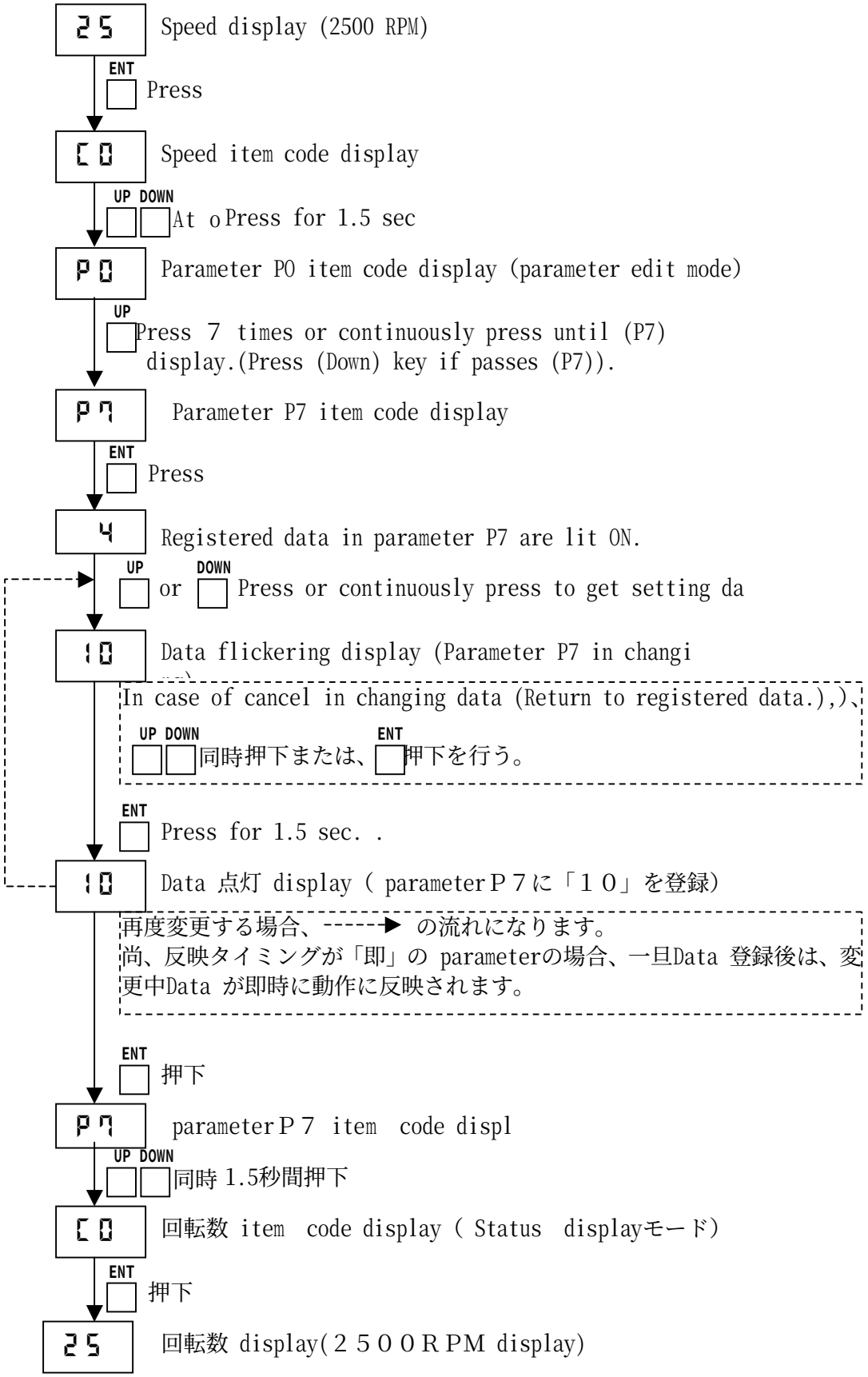
1. LED display at powqer ON
   When power source is turned ON, all LEDs except (FAIL) LED are lit ON for 3 seconds. And regardless to I/O signal status, signal display LED is lit ON.
2. Initial display of Data display LED when the unit is delivered.
   「A 1」 (Moter selection error) is displayed.
   Select parameter edit and register apllied motor number to parameter P 0.

3. Sample of status display operation
   《Speed display at power ON→ Operation of actual torque display》



4. Operation sample of parameter edit

《Speed display→ Edit operation of parameter P7→ Return to speed display》

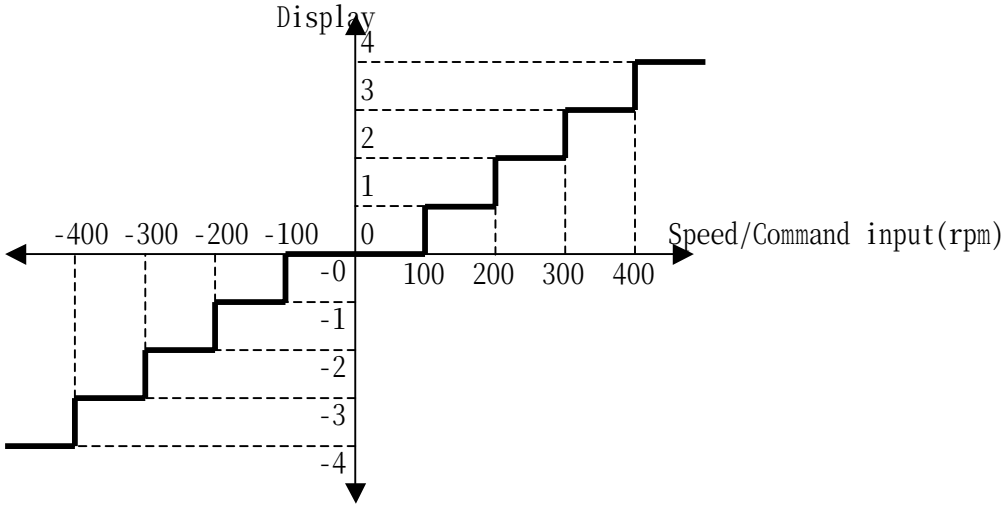


4－2　Status Display Mode

Status display mode items are as follows.

Item No.	Display Data	Display unit	Display range	DisplayD data sample	Reference
C0	Actual motor speed	100rpm	-99～99	FE.: -1200rpm*1	
C1	Actual torque command value At rated torque : 100 %	10%	0～30	21 : 210% torque	
C2	Thermal trip ratio	10%	0～10	5 : 50%	At over load Alarm : 100%
C3	External speed command input value	100rpm	-99～99	23 : 2300rpm*1	
C4	External torque limit input value	10%	0～30	18 : 180%	
C5	Encoder pulse input value	100ﾊﾟﾙｽ	-99～99	20 : 2000 pulse (1 time)	When exceeds display range, returns to 0 display.
C6	Pulse train command input value	100ﾊﾟﾙｽ	-99～99	18 : 1800 pulse	When exceeds display range, returns to 0 display.
C7	Deviation pulse value	1 pusse (1 time)	-99～99	18 : 1800 pulse	
CE	Software version		0～99	1 : Soft.version1	
CF	Type code		0～99	10 : Type code10	

*1： Relaytion of display and Speed/ Command input is as foillows.



[Fig.4－3]　List of Status Display Mode Item

挿入図
頁4-3
Status display
   Status display item selection
   Status data display
   Occurred Alarm display
Parameter edit
   Parameter edit item selection
   Parameter data edit

Self-diagnosis 1
   Self-diagnosis item selection
   Self-diagnosis data display / edit

Self-diagnosis 2
   Self-diagnosis item selection
   Self-diagnosis data display / edit

頁4-4
図の外左側
Power ON　　No key press
　　Status data
　　Alarm occurrence
　　Simultaneous press of"Up","Ent" for 1.5 sec.
Simultaneous press of "Up","Ent"
上図内
Status display
　　Status display item selection
　　After selecting item by "UP","Down" , press "Ent".
　　Press "Ent".
　　Status data display
 Occurred Alarm display　　Returns to Status display when Alarm is released.
中図内
 Parameter edit
　　Parameter edit display item selection
　　After selecting item by "UP","Down" , press "Ent".
　　Press "Ent".
　　Parameter data edit
 Registerd data display (Lit ON display)
  Change by "Up","Down".
　　Press "Ent" for 1.5 sec. (Changed data registration),
　　Press "Ent" or press "Up","Down" at once.
　　(Cancels changed data and gets original data.)
 In changing data display (flickering display)
 下図
 Self-diagnosis
 Details can be referred to the chapter "Self-diagnosis".

頁4-6
同時 At once

4

以下

Registered data in parameter P7 is lit ON.
Press or continuously press “Up” or “Down” key until getting setting data.

Data “flickering” display. (In changing parameter P7)
In case of cancelling data in changing (Retrn to registered data.), press “Up”and “Down” at once or press “Ent”.
Press “Ent” for 1.5 sec. .

Data “lit ON” display (Register “10” to parameter P7.)
When again change is made, - - -→ is the flow.
And when parameter activating timing is “immediate”, after completing the data registration, data in changing will be applied, on the spot.
Press “Ent”

Parameter P7 item code display
Press “Up”,”Down” at once for 1,5 sec. .
Speed item code display (Status display mode)
Press “Ent”
Speed display (2500 RPM display)

5－1 Parameter Contents List

Parameter contents list is as follows.

＊1：Activation timing: E：At power input　I： Immediate activation

Item display	Parameter Name / Contents	＊1	Set unit	Setting range	Init value
P0	Motor selection. Selects a motor to be connected.Relation of Motor selection No. and motor can be referrd to supplement of Parameter contents.	E	None	0～99	0
P1	Rotating direction selection。 Sets Motor Rotating direction to Forward command.	E	None	0～1 0：Forward 1：Reverse	0
P2	Servo ON/ Shut OFF selection。 Selects valid logic of SON signal.	E	None	0～1 When Closing this and COM. 0：Motor power ON 1：Motor power OFF (Servo free)	0
P3	Aanalog monitor 1 output selection. Selects output signal to front panel analog monitor M1 terminal. Concrete contents of analog monitor can be referrd to supplement of parameter contents.	I	None	0～4 0：Speed command input 1：Speed feedback 2：Act. torque command 3：Devi. pulse 4：For us only	1
P4	Aanalog monitor 2 output selection. Selects output signal to front panel analog monitor M2 terminal. Concrete contents of analog monitor can be referrd to supplement of parameter contents.	I	None	Ditto	2
P5	Upper bit of Accel./ Decel. time Sets upper digit of Accel./Decel.time to speed command. Accel./ Decel.time consista of this upper digit and lower digit of next parameter. Setting value sets time Stop → Rated speed. Sample) At Accel./ Decel.time set 7.55sec. Upper digit of Accel./ Decel.time: 7(7sec), Lower digit of Accel./ Decel.time:55(0.55sec)	I	1sec	0～9 (0～9sec)	0
P6	Lower digit of Accel./ Decel.time Sets lower digit of Accel./Decel.time to speed command. Accel./ Decel.time consista of this lower digit and upper digit of above parameter.	I	0.01 sec	0～99 (0.00～0.99sec)	0

＊1 : Activation timing: E : At power input　I : Immediate activation

Item display	Parameter Name / Contents	＊1	Set unit	Setting range	Init. value
P7	Speed loop proportional gain。 Sets Speed loop proportional gain value. Though large setting shorten response time to Speed command, too large setting causes sight vibration. Connect a motor to a machine and set this to minimize the vibration. Relation of setting value and gain can be referrd to the below tabulation of supplement of Parameter contents.(Speed loop proportional gain setting value and gain value).	I	None	0～99	4
P8	Speed loop integral time constant. Sets Speed loop integral time constant value. Though small setting improves compliance to Speed command, too small setting causes large vibration and unstable motion. Connect a motor to a machine and set this to minimize Overshoot of motor speed to Speed command change. When 0 is set, Speed loop integral control is invalid. Relation of setting value and integral time constant can be referrd to the below tabulation of Parameter contents Supplement. (Speed loop integral time constant setting value and time constant value).	I	None	0～99	10
P9	Torque command filter frequency Sets cut off frequency of low pass filter for Torque command. This will be set when machine resonance occurs. Though small setting can depress machine resonance, it causes worse response to Speed command. When 0 is set, this filter is invalid.	I	10Hz	0～50 (0～500Hz)	30

＊1：Activation timing: E：At power input　I： Immediate activation

Item display	Parameter Name / Contents	＊1	Set Unit	Setting range	Init. value
J0	Position deviation clear selection。 In Pulse train run mode, sets Deviation clear Enable/ Disable by Servo OFF (SON) signal.	E	None	0～1 0:Deviation clear enable 1:Deviation clear disable	0
J1	Input pulse selection of Pulse train command Selects signal input type and multiplication ratio of Pulse train command. And when 90° phase difference is used, use 4 times as standard. 4 times can improve control lability.	E	None	0～4 0:90° phase difference 1 times 1:90° phase difference 2 times 2:90° phase difference 4 times 3:Directional pulse 4:Direction change pulse	2
J2	Pulse train command input phase sequence change Selects a motor rotating direction by Pulse train command input. ◎ Forward selection A motor runs forward by Forward or Pulse train command (B phase is ahead.). ◎ Reverse selection A motor runs forward by Forward or Pulse train command (B phase is ahead.). But direction can be reversed by setting reverse to〔P1:Rotation direction selection〕.	E	None	0～1 0:Forward selection 1:Reverse selection	0
J3	Position loop gain。 Sets Position loop gain in Pulse train run. Though large setting shorten response time, it may cause vibration. When “0” is set, Position loop is opened and Pulse train run can not be executed. Relation of Setting value and Position loop gain can be referrd to the below tabulation of supplement of Parameter contents. (Position loop gain setting value and gain value)	I	None	0～99	16
J4	Positioning complete range。 In Pulse train run, sets output range of Positioning complete signal (PN). Sets by the same unit of applied encoder pulse number.	E	1 times pulse	0～99	3

＊1 : Activation timing: E : At power input I : Immediate activation

Item display	Parameter Name / Contents	＊1	Setunit	Setting range	Init. value
J5	Pulse train feed forward ratio。 Sets Feed forward ratio to Speed command in Pulse train run. Though large setting shortenresponse time, it may cause vibration due to wrong matching with machine system. In the case, set a little bit low to have somedeviation amount to a motor so that stable motion can be conducted. When "0" is set, Feedforward control is not made.	I	10%	0～10	10
J6	Pulse train feed forward shift ratio In Pulse train run, reduces specified feedforward amount. Feed forward amount = Input pulse speed－(Rated speed* setting value(%)) But if the results is negative, the value is clamped at 0.	I	0.1%	0～99	0
J7	Pulse train feed forward filter time constant Sets filter time constant to adjust response time of Feed forward control in Pulse train run. Though small setting shorten response time, it may cause vibration.	I	1ms	0～99	0
J8	Pulse train ratio numerator Sets motor running amount to Pulse train command in Pulse train run. This is set together with Pulse train ratio Denominator(J9). Setting sample can be referred to supplement of Parameter contents.	I	None	1～99	1
J9	Pulse train ratio denominator Sets motor running amount to Pulse train command in Pulse train run. This is set together with Pulse train ratio Numerator(J8). Setting sample can be referred to supplement of Parameter contents.	I	None	1～99	1

＊1 : Activation timing: E : At power input I : Immediate activation

Item display	Parameter Name / Contents	＊1	Set unit	Setting range	Init. value
U0	Speed command gain。 Sets external Speed command voltage to motor rated speed command. When 10V or larger is set, Max motor speed command becomes motor speed command corresponding to external Speed command voltage 10V. Sample) When 20V is set. Max motor speed command (External Speed command voltage 10V) becomes motor rated speed/ 2command.	E	V	1～99 (1～99V)	10
U1	Reverse protection selection。 Selects Motion permit/ prohibit to reverse direction command. Concrete contents can be referred to supplement of Parameter contents.	E	None	0～1 0 : Reverse permit 1 : Reverse prohibit	1
U2	Offset speed Set motor speed to Speed command input voltage 0V. Concrete contents can be referred to supplement of Parameter contents.	E	10 rpm	0～99 (0～990rpm)	0
U3	Rotating-direction switching signal selection To select the signal to switch the to the reverse rotating direction against the external speed command input. By ON/OFF of the rotating direction switching signal, the rotating direction against the positive voltage of external speed command input will be as follows: OFF:Rotation following the Parameter P1 ON :Reverse rotation against the Parameter P1 Follow-ups during ON) ①At Reverse Prohibited (U1), it is stopped by the negative voltage of speed command input. ②Off Set RPM (U2) is effective. At this time, speed command input voltage is 0 volt, and it rotates reverse to the parameter 1 at Off Set RPM (U2).	E	None	0～2 0 : Switching ineffective 1:TL signal to be the rotating direction switching signal 2:PC signal to be the rotating direction switching signal Also, signal functions being grouped to the rotating direction switching signal will be ineffective.	0
U4	Communication ID NO. Set up ID NO. during the daisy chain connection by serial communication. When the connection between the external devices and the main unit is 1:1, it is usually used the ID NO. setting 1.	E	None	1～15	1

5－2 Parameter Contents Supplement

1）Parameter P0(Motor selection)

Parameter P0 setting value	Motor				Applicable unit	Reference
	Type, etc.	Rated output (W)	Rate Speed (rpm)	Max. Torque (%)		
0	Motor not selected					
1	Reserved					
2	NA70-10**Z	100	3000	300	NCR-DBA2A2*-401	
3	NA70-20**M	200	3000	300	NCR-DBA2A2*-401	
4	NA70-40**M	400	3000	250	NCR-DBA2A2*-401	
5	NA70-60**M	600	3000	200	NCR-DBA2A2*-601	
6～11	Reserved					
12	NA70-10**Z	100	3000	300	NCR-DBA2A1*-201	
13	NA70-20**L	200	3000	250	NCR-DBA2A1*-201	
14～99	Reserved					

[Tab. 5－1] Motor Selection No.(Parameter P0 Setting value) and Motor

2）Parameter Ｐ３,Ｐ４(Analog monitor output selection」

The selected signal by Parameter (Analog monitor output selection) is outputted to the front panel analog monitor output terminal M1 and M2 by DC voltage.
Motor motion status (tansit, steady state) can be confirmed by observing wave with an oscilloscope, etc. .
Individual analog monitor output and contents are listed below.

Output terminal	Parameter Ｐ３、Ｐ４	Monitor item	Monitor contents
Ｍ１／２	０	Speed command input	Outputs Speed command input voltage. Polarity:Same as Speed command input Range：０～±１０Ｖ　±１０% Output data renewal interval:４００［μｓ］
	１	Speed feedback	Outputs motor actual speed. Polarity：Forward=+voltage/Reverse=-voltage Range：０～±１０Ｖ　±１０% Full range:１２５% of rated speed Output data renewal interval:４００［μｓ］
	２	Actual Torque command	Outputs motor output torque. Polarity：Forward=+voltage/Reverse=-voltage Range：０～±１０Ｖ　±１０% Rated torque：±３．３Ｖ Output data renewal interval:４００［μｓ］
	３	Deviation Pulse	Outputs Position deviation pulse number in Pulse train run. Polarity *1：+Deviation pulse=+voltage /-Deviation pulse=-voltage Range：０～±１０Ｖ　±１０% Full range：Deviation 30000 pulses（１times） Output data renewal interval:４００［μｓ］
	４	For maker use only	

＊１：In Forward command, when current position is delayed, Deviation pulse is ＋ and when leading, Deviation pulse is -.
And in Reverse command, when current position is delayed, Deviation pulse is – and when leading, Deviation pulse is +.

［Tab.５－２］　Analog Monitor Output Contents

Note： Resolution of M1/M2 terminal output signal is -10V～ + 10 : 255.

3) Parameter P 7 (Speed loop proportional gain)

Set NO.	Gain No.	Set NO.	Gain No.	Set NO.	Gain No.	Set NO.	Gain No.
0	30	25	155	50	280	75	690
1	35	26	160	51	290	76	710
2	40	27	165	52	300	77	730
3	45	28	170	53	310	78	750
4	50	29	175	54	320	79	770
5	55	30	180	55	330	80	790
6	60	31	185	56	340	81	810
7	65	32	190	57	350	82	830
8	70	33	195	58	360	83	850
9	75	34	200	59	370	84	870
10	80	35	205	60	390	85	890
11	85	36	210	61	410	86	910
12	90	37	215	62	430	87	930
13	95	38	220	63	450	88	950
14	100	39	225	64	470	89	970
15	105	40	230	65	490	90	990
16	110	41	235	66	510	91	1020
17	115	42	240	67	530	92	1050
18	120	43	245	68	550	93	1080
19	125	44	250	69	570	94	1110
20	130	45	255	70	590	95	1140
21	135	46	260	71	610	96	1170
22	140	47	265	72	630	97	1200
23	145	48	270	73	650	98	1230
24	150	49	275	74	670	99	1260

[Tab. 5－3] Speed Loop Proportional Gain Setting vVlue and Gain Value

4) Parameter P 8 (Speed loop integral time constant)

Set No.	T.C [ms].	Set No.	T.C [ms].	Set No.	T.C [ms].	Set No.	T.C [ms].
0	I gain 0	25	30	50	81	75	188
1	1	26	32	51	84	76	196
2	2	27	34	52	87	77	204
3	3	28	36	53	90	78	212
4	4	29	38	54	93	79	220
5	5	30	40	55	96	80	230
6	6	31	42	56	100	81	240
7	7	32	44	57	104	82	250
8	8	33	46	58	108	83	260
9	9	34	48	59	112	84	270
10	10	35	50	60	116	85	280
11	11	36	52	61	120	86	290
12	12	37	54	62	124	87	300
13	13	38	56	63	128	88	310
14	14	39	58	64	132	89	320
15	15	40	60	65	136	90	340
16	16	41	62	66	140	91	360
17	17	42	64	67	144	92	380
18	18	43	66	68	148	93	400
19	19	44	68	69	152	94	420
20	20	45	70	70	156	95	440
21	22	46	72	71	162	96	460
22	24	47	74	72	168	97	480
23	26	48	76	73	174	98	500
24	28	49	78	74	180	99	520

Note: T.C stands for Time constant.

[Tab. 5－4] Speed Loop Integral Time Constant Setting Value and Time Constant

5) Parameter J 3 (Position loop gain)

Set No.	Gain No.	Set No.	Gain No.	Set No.	Gain No.	Set No.	Gain No.
0	0	25	30	50	80	75	175
1	1	26	32	51	82	76	180
2	2	27	34	52	84	77	185
3	3	28	36	53	86	78	190
4	4	29	38	54	88	79	195
5	5	30	40	55	90	80	200
6	6	31	42	56	92	81	205
7	7	32	44	57	94	82	210
8	8	33	46	58	96	83	215
9	9	34	48	59	98	84	220
10	10	35	50	60	100	85	225
11	11	36	52	61	105	86	230
12	12	37	54	62	110	87	235
13	13	38	56	63	115	88	240
14	14	39	58	64	120	89	245
15	15	40	60	65	125	90	250
16	16	41	62	66	130	91	255
17	17	42	64	67	135	92	260
18	18	43	66	68	140	93	265
19	19	44	68	69	145	94	270
20	20	45	70	70	150	95	275
21	22	46	72	71	155	96	280
22	24	47	74	72	160	97	285
23	26	48	76	73	165	98	290
24	28	49	78	74	170	99	295

[Tab. 5－5] Position Loop Gain Setting Value and Gain Value

6) Parameter J8, J9 (Pulse train ratio Numerator/ Denominator)

Setting sample 1)

Pulse train command unit : 0.01mm/ Pulse
Travel per motor 1 turn : 50mm
Motor encoder pulse number : 2000 Pulse
Pulse train command input pulse selection(J1) : Directional pulse

Pulse train ratio Numerator(J8)= Motor pulse number ×4
=2000×4
=8000
Pulse train ratio Denominator(J9)= Travel per motor1 turn/ Pulse train command unit
=50／0.01
=5000
Since the above setting value will exceed the setting range, simple value as below is used for setting.
Pulse train ratio Numerator(J8)/ Pulse train ratio Denominator(J9)=8000/5000
=8／5
Pulse train ratio Numerator (J8)=8
Pulse train ratio Denominator (J9)=5

Setting sample 2)

Pulse train command unit : 0.1° / Pulse(1 time)
Travel angle per motor 1 turn : 360°
Motor enoder pulse number : 2000 Pulsee
Pulse train command input pulse selection(J1) : 90° phase difference 4 times Pulse

Pulse train ratio Numerator (J8)= Motor Pulse nomber×4
=2000×4
=8000
Pulse train ratio Denominator(J9)
= Travel angle per motor 1 turn × multiplication ratio of Pulse train command input pulse / Pulse train command unit
=360×4／0.1
=14400
Since the above setting value will exceed the setting range, simple value as below is used for setting.
Pulse train ratio Numerator(J8)/ Pulse train ratio Denominator(J9)=8000/14400
=80／144
=40／72
Pulse train ratio Numerator (J8)=40
Pulse train ratio Denominator (J9)=72

7) Parameter U 1 (Reverse protection selection)

Reverse protection has the purpose to protect reverse motion even when error of the unit or external signal occurs in normal signal connection status.
Reverse is defined that a motor runs reverse against forward command set by Rotation direction selection [P 1].

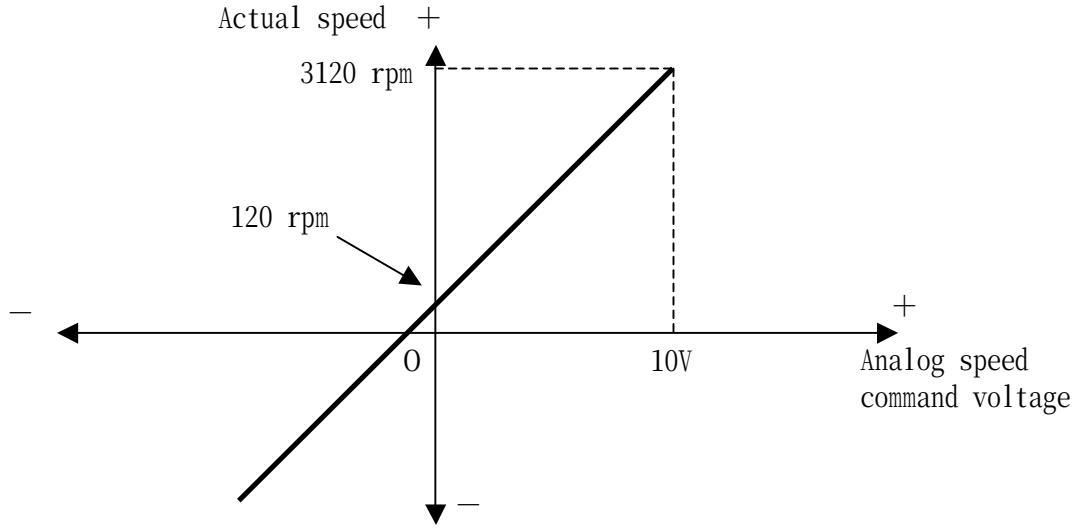
Reverse protection motions are as follows.

①When reverse motion more than 1 turn is detected in Servo ON status, Reverse alarm occurs.

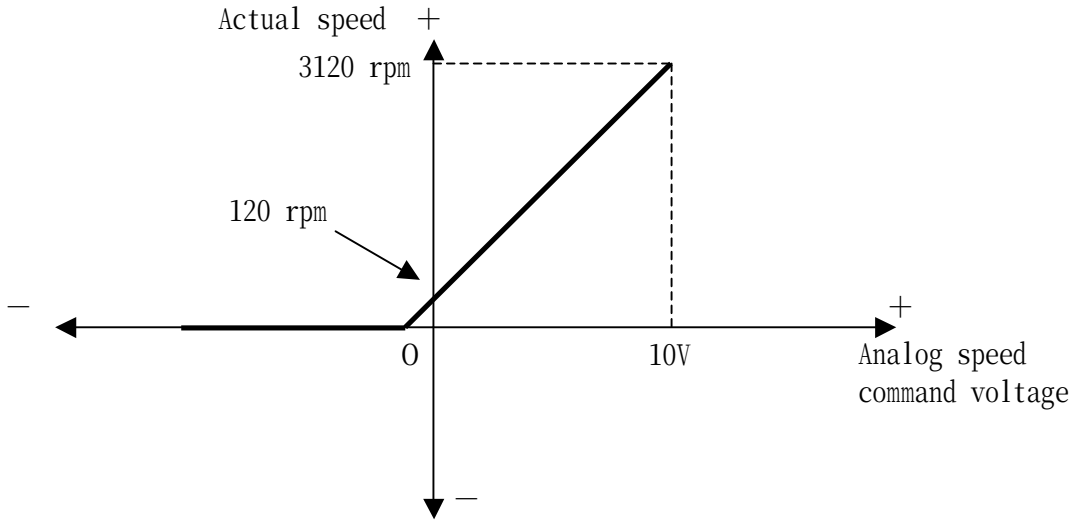
②When Reverse command is inputted in motion command, Speed Command 0 is set to Reverse command and Reverse command will be inhibited.

8) ParameterU 2 (Offset speed)

Offset speed is motor speed when Analog speed command voltage is 0 V in Speed run mode. When offset speed is set, motor speed will be set as below.



[Fig. 5 − 1] Relation of Analog Speed Command and Actual Speed with Offset speed 120 rpm (Reverse protection disable)



[Fig. 5 − 2] Relation of Analog Speed Command and Actual Speed with Offset speed 120 rpm (Reverse protection enable)

Chapter 6 Self-diagnosis

6－1 Self-diagnosis Mode

This unit equipped with Self-diagnosis function to check external I/O signals and internal circuits.

Buy pressing UP ENT keys simultaneously, and turning the unit power source ON , it will be Self-diagnosis operation mode.

Self-diagnosis operation modes are 2 types below.

① Self-diagnosis 1
This executes Self-diagnosis of external wiring or error confirmation of the unit.

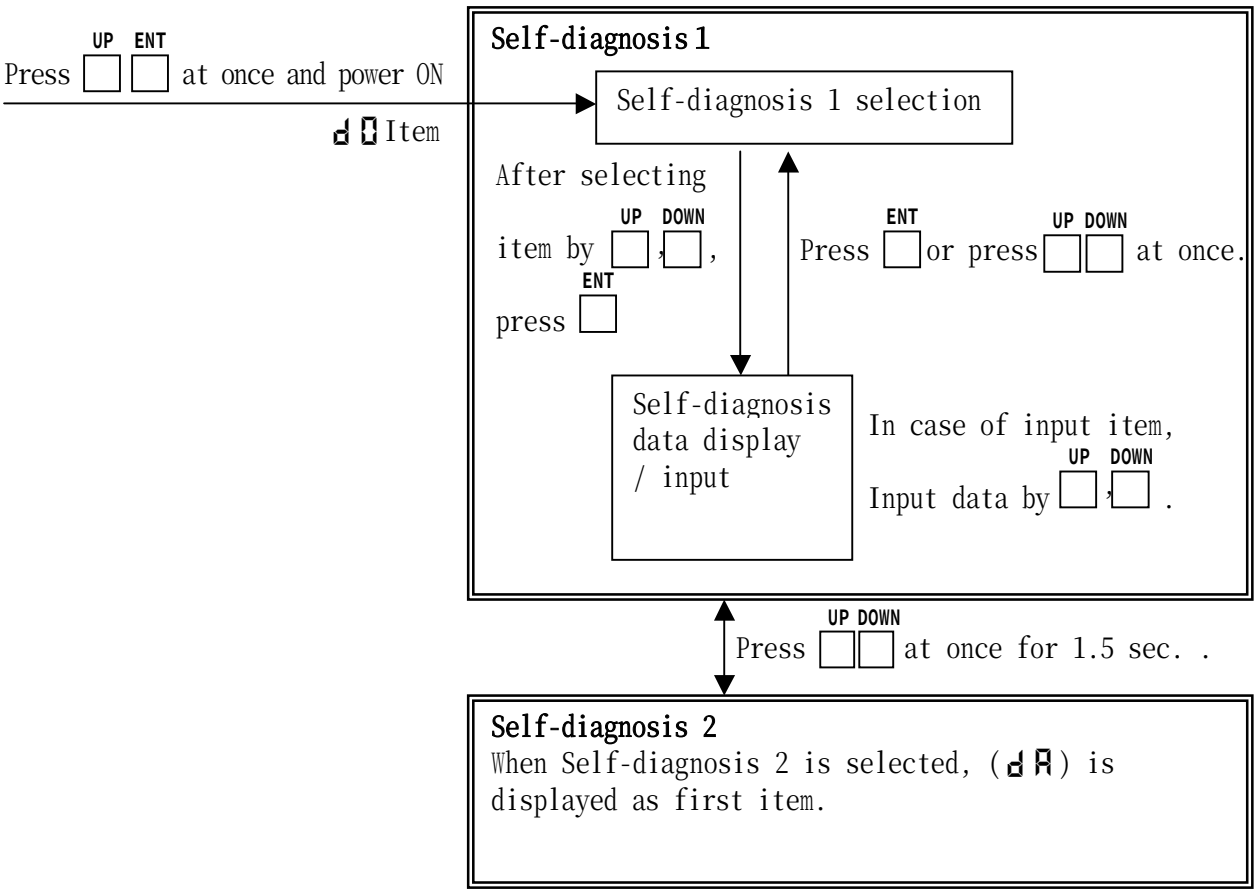
② Self-diagnosis 2
This is dedicated Self-diagnosis only for shipping adjustmant by us.
Unless getting our suggestion, do not execute it.

In this manual, only Self-diagnosis 1 is described.

⃠ Prohibition

① Do not execute Self-diagnosis 2.
If Self-diagnosis 2 is executed without our approval, running away , burning or damage of a motor and burning or damage of the unit may occur.
If internal data are re-written by Self-diagnosis 2, running away, burning or damage of a motor and burning or damage of the unit may occur.

6－2 Self-diagnosis Mode Execution Procedure



6－3 Self-diagnosis Items

6－3－1 Self-diagnosis Items of Input Confirmation

Self-diagnosis Items of Input Confirmation displays status of item selected and set by pushing (ENT) key. The display data can be used to judge input is right or wrong. However RAM check is internally checked automatically and the results are displayed.

Item display	Diagnosis name Diagnosis contents	Diagnosis data display
d0	RAM check Executes Read/ Write check of unit internal RAM.	0 : In check preparation 1 : In checking 2 : RAM normal 3 : RAM faulty ALM LED lit ON at error
d1	External Speed command input display Displays External speed command input voltage Status.	-99～99:A/D conversion value 1 is about 0.005V. To out of this range, (00) is displayed.
d2	External Torque limit input display Displays External torque limit input voltage status.	0～99:A/D conversion value 1 is about 0.01V. To out of this range, (00) is displayed.
d3	U phase current feedback input display Displays detected U phase current when motor power U phase current is 0.	-99～99:A/D conversion value To out of this range,(00) is displayed.
d4	V phase current feedback input display Displays detected V phase current when motor power V phase current is 0.	-99～99:A/D conversion value To out of this range,(00) is displayed.
d5	Encoder input pulse number display Displays input pulse number at multiplication ratio 4 of encoder pulse. Count is going up for forward rotation.	0～99 : Lower 2 digita 99→100 0 display 0→ -1 99 display
d6	Encoder input Speed detection counter display Displays speed by Encoder input speed detection Counter.	-99～99rpm : Lower 2 digits To out of this range,(00) is displayed.
d7	Pulse train command pulse number display Displays input pulse number of Pulse train command pulse. Count is going up for forward rotation.	0～99 : Lower 2 digits 99→100 0 display. 0→-1 99 display.

6－3－2 Self-diagnosis Items of Output Confirmation

In Self-diagnosis Items of Output Confirmation, by selecting item and pushing (ENT) key, data input can be conducted by "UP」" and "DOWN" keys.
In accordance with the input data, this unit outputs individual item contents so that the output status is judged whether normal or abnormal.
However parameter initialization is executed in the unit, automatically but is not outputted.

Item display	Diagnosis name Diagnosis contents	Edit data
H0	Control sigmal output Turns ON control output signal corresponding to Edit data of this item.	0：All control output signal OFF 1：RDY signal ON 2：PN signal ON 3：ALM signal ON
H1	Analog monitor 1 voltage output Outputs voltage value corresponding to Edit data of this item to Analog monitor 1 (M1 signal).	-10～10V：2 digits
H2	Analog monitor 2 voltage output Outputs voltage value corresponding to Edit data of this item to Analog monitor 2(M2 signal).	-10～10V：2 digits
H3	Forced motor run Runs a motor at speed corresponding to Edit data of this item. At the tome, all the control input signals are invalid.	-99～+99：2 digits 1 is 10rpm. ALM LED is lit ON and Alarm code is displayed at error.
H4	Parameter initialization When 18 is set, parameters will be initialized. Definition of initialization is to return to the "Initial value" in the parameter description. Operation is identical to parameter edit operation.	0～99：2 digits

Chapter 7 Run

7－1 Inspection Before Start

After installation and wiring is completed, conduct following inspection before start.

① Is wiring correct?
Specially, is the power source not connected with motor terminals, U,V,W?

② Is there no place in short-circuited status by cable chips, etc..

③ Is there no cable where abnormal force is added?

④ Is not there any loose fit screw, terminal, etc.?
Are connectors inserted, securely?

⑤ Is not there any short-circuited or line-to-ground fault in the external sequence circuit?

⑥ Is not there any mistake in grounding method?
And is the earth ground grade is JIS Class 3 or better?

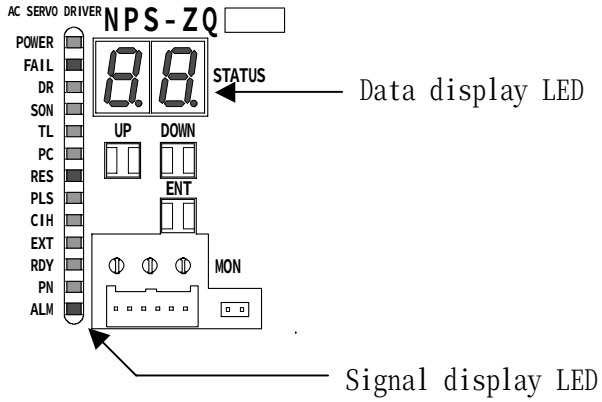
⚠ Cautions

① Never conduct an insulation test as withstand voltage test, megger test, etc. and noise test by noise simulator, etc. to the unit.
Those tests may damage the unit.

7－2 Display and Monitor Function

By the front panel LEDs, Alarm status, Motor motion status, Parameter status, Unit control power status and I/O signal status can be confirmed.
And by Analog monitor output terminals (M1, M2) , Speed command input voltage, Speed feedback, Torque command, and Deviation amount status can be confirmed by analog voltage. Analog monitor can be referred to parameter P3 and 4 items.

7－2－1 LED Display



[Fig. 7－1] Data Display LED and Signal Display LED Layout

① Dada display LED
Displays Alarm status, Motor motion status, and parameter status.
② Signal display LED

LED name	Lit ON status	Refernce
POWER	Displays unit control power is ON status.	
FAIL	Displys unit is in fault status.	Normally, it is lit ON when the unit has some fault.
DR～EXT	Displays each input signal ON status.	
RDY～ALM	Displays each output signal ON status.	

7－3 Run Procedure

Operate the unit in accordance with the following procesure.
Be sure to conduct Trial run.
In order to avoid a trouble at Trial run, at first run the unit without any load, and after confirming no fault, connect the unit to a machine. Pay special attention not to cause any accident.

⚠ Cautions

① Do not touch terminal block of the driver, carelessly.
►[Since there is high voltage, it is quite dangerous.]
② Do not use the unit without the terminal block cover.
►[Electric shock may occur.]
③ Since some residual voltage exists after power source is turned OFF, do not touch terminals and main circuits for 3 minutes.
④ Power source ON/OFF shall be made after cautiously confirming safety.

7－3－1 Confirmation of Power Source Voltage

Please confirm that the power source voltage of the driver satisfy the specification.

【Power source specification】
Driver type：ＮＣＲ－ＤＢＡ２**Ａ１**　**（ＡＣ１００Ｖ syatem）**
ＡＣ１００／１１０Ｖ±１０%, ５０／６０Ｈｚ, single phase power

Driver type：ＮＣＲ－ＤＢＡ２**Ａ２**　**（ＡＣ２００Ｖ syatem）**
ＡＣ２００／２２０Ｖ±１０%, ５０／６０Ｈｚ, single phase power

Supplement)
If power source is turned ON when a motor is still running, Alarm occurs.

7－3－2 Trial Run

1. Separation of motor and load

・ Remove a motor connection from the machine system and make no load status.

2. Servo ON signal (SON) OFF and Start signal (DR) OFF

・Before turning power source ON, turn OFF Servo ON signal (SON) and OFF Start signal (DR).
(When Parameter (P2) (Servo ON/ Shut OFF selection) is‘1’, turn ON SON signal.)

3. Parameter set

・Set individual parameter starting from [Motor selection] to meet with your own conditions.
(Refer to [Capter 5 Parameter].)

4. Power source ON

・When power source is turned ON, Power source LED (PW) in the front panel is lit ON, and simultaneously all the control I/O output signal LEDs and Data display LEDs are lit ON. (Only FAIL LED is not lit ON.)
After 3 seconds has pass, the control I/O output signal LEDs and Data display LEDs become normal display.
(Refer to [7－2 Display and Monitor Function].)

5. Control input signal confirmation

・Turn ON/ OFF control input signals except Servo ON signal (SON) and confirm by control input signal display LEDs if control input signals are correctly connected and if logic is correct.

6. Servo ON signal (SON) ON

・Turn OFF all the control input signals and turn ON Servo ON signal (SON).
(When Parameter (P2) (Servo ON/ Shut OFF selection) is‘1’, turn OFF SON signal.)
・When Servo ON signal (SON) is turned ON, RDY LED is lit ON and a motor is ready to generate driving torque and resisting torque to external force.
・If RDY LED is not lit ON or a motor runs when Servo ON signal (SON) is turned ON, investigate and elimnate the cause in accordance with [Chapter 9 Fault Diagnosis and Corrective Measures].

8. Start signal (DR) ON

・ By turning ON Start signal (DR), the unit is ready to recive Speed command and, Pulse train command.
・ If RDY LED is lit OFF, at the time when Start signal (DR) is turned ON, investigate and elimnatethe cause in accordance with [Chapter 9 Fault Diagnosis and Corrective Measures].

9. Run motion confirmation

- Run a motor by low speed command input in Speed control run or Pulse train run and confirm if speed is correct, there shall be neither abnormal vibration and nor sound. Then, change command input and confirm that motor speed changes proportionally to the command input.
  (It is recommended to measure the speed with a tachometer on the motor load shaft.)
  If the speed can not be increased , not prportional to the command input in the case or motor vibration and abnormal sound occurs, investigate and elimnatethe cause in accordance with [Chapter 9 Fault Diagnosis and Corrective Measures] .
- In case of Pulse train run, confirm if motor rotating amount is correct to command pulse number.
  (It is recommended to mark on a motor load shaft to confirm position.)
  If motor speed amount is constant multiplication ratio or fluctuate, investigate and elimnate the cause in accordance with [Chapter 9 Fault Diagnosis and Corrective Measures].
- Run motion confirmation shall be conducted for both forward and reverse directions. (When parameter (U 1) [Reverse protection selection]is ' 1 ', reverse rotatiion can not be made.)

10. Load run

- After Trial run in no load condition is over, connect the motor to the machine system and conduct Tral run again.
- Before executing Load run, confirm safty devices as Emergency stop, Over travel, etc. surely work.
- Inspect if abnormal sound, abnormal vibration, abnormal heat, etc. does not occur.
- If above abnormality occurs or Alarm display LED is lit ON, investigate and elimnate the cause in accordance with [Chapter 9 Fault Diagnosis and Corrective Measures] .。

Note : Load inertia ratio to a motor inertia shall be within the specified range.
Applicable GD^2 value can be referred to [10-1-4 Electric Specification of the Unit]

7－4 Adjustment

When a motor is coneected with a machine system and Run is executed, parameter setting could be required depending on load status and operation method.
Execute parameter setting referring to the below tabulation.

7－4－1 Adjustment Point for Individual Phenomenon (Parameter)

Phenomenon	Adjustment point (parameter)
A motor vibrates.	[Speed loop gain] [Speed loop Integral time constant] [Torque command filter frequency] [Position loop gain] [Pulse train Feedforward ratio]
Overshoot and undershoot is large at motor start or stop.	[Speed loop gain] [Speed loop Integral time constant] [Accel./ Decel. time]
Over speed error occurs.	[Position loop gain] [Pulse train Feedforward ratio]
Deviation error (Overflow) occurs.	[Speed loop gain] [Speed loop Integral time constant] [Position loop gain] [Pulse train Feedforward ratio] [Reverse protection]
Positioning time is long.	[Speed loop gain] [Speed loop Integral time constant] [Position loop gain] [Pulse train Feedforward ratio] [Positioning complete range]

[Tab. 7－1] Adjustment Point for Individual Phenomenon (Parameter)

※ Individual parameter description can be referred to [Chapter 5 Parameter] .

7－4－2 Adjustment Method

1. Speed loop gain

① Speed loop gain
- The larger the setting value is, the quiker response is.
- Too large gain set causes vibration.
- Too low gain set makes response slow and controller unstable.

② Speed loop Integral time constant
- The smaller the setting value is, the quiker response is.
- Too small time constant set causes vibration.
- Too large time constant set makes response slow and controller unstable.

2. Torque command filter

① Torque command filter frequency
- If machine resonance occurs, fix it to insert a filter to Torque command.
- The higher setting frequency is, the quiker response is.
- Too low frequency set makes response slow and controller unstable.
- When the filter is disabled, response is quickest.

3. Position loop gain

① Position loop gain
- The larger the setting value is, the quiker response is.
- Too large gain set causes overshoot, undershoot, and vibration.
- Too low gain set makes Positioning longer and Positioning accuracy worse.

4. Feedforward ratio

① Pulse train Feedforward ratio
- The larger the setting value is, the better compliance to Pulse train command is.
- Too large Pulse train Feedforward ratio set causes overshoot, undershoot and vibration.
- Too smalll Pulse train Feedforward ratio set makes Positioning longer.

5. Gain adjustment method

- Gain can be adjusted by observing Speed feedback wave at analog monitor output terminals (M1,M2) with oscilloscope, etc..
  Adjust each gain until overshoot, undershoot and vibration become acceptable level.

① In case of Pulse train command run, at first set a little bit low value (about 10) to Position loop gain and set Speed loop gain as high as possible unless a motor vibrates in Servo lock status.
In case Speed command run, Position loop gain setting is not necessary.

② Adjust Speed loop Integral time constant to smaller value in the stable motion range, and readjust Speed loop gain to get optimum motor motion.

③ Set Position loop gain as high as possible in the range where motor vibration, overshoot, and unsershoot does not occur.

Chapter 8 Maintenance

Though our driver and motor are maintenance free, in order to prevent them from unexpected troubles caused by unit circumference change, etc., periodic inspection is recommended.

⚠ Caution

① During maintenance, the operator in charge should conduct and confirm the power ON and OFF by himself.
② Since high voltage is charged in the main circuit capacitors after power is turned OFF, wait 2 to 3 minutes and restart working.
③ Never conduct an insulation test of the driver with a megger tester as it may damage the driver.
And in case of measuring insulation of a motor, before measuring, completely disconnect cables (U,V,W) between the motor and the driver.

8－1 Daily Inspection

Conduct daily inspection on the following items.

【Inspection item】

① Inspect if the motor runs, normally.
② Inspect if the installation environment is normal.
(power source, temperature,humidity, dust, etc.)
③ Inspect if the cooling system is normal.
④ Inspect if terminals and connectors are not loose.
⑤ Inspect if there is no abnormal sound or vibration.
⑥ Inspect if any over heat or disoloration does not exist.

8－2 Periodic inspection

Conduct periodic inspection of the following items after routine operation or certain period (every 6 months, 1 year).

【Inspection item】

① Inspect if there is loose load connection, loose belt, large key shaft backlash, or abnormal motor bearing sound.
② Inspect if the installation environment is normal.
(power source, temperature,humidity, dust, etc.)
③ Inspect if the cooling system is normal.
④ Inspect if terminals and connectors are not loose.
⑤ Inspect if there is no abnormal sound or vibration.
⑥ Inspect if any over heat or disoloration does not exist.
⑦ Inspect if there is no alien substance or dust lump.
⑧ Inspect if cables, etc. are free from flaws and fatigue.
⑨ Inspect control cabinet radiation fans, clean air filters and inspect or replace relays, etc..

8－3　Other Inspection

8－3－1　Gear

It is necessary to supply and replace oil in gear section of geared motors.
Replace oil every 20,000 hours.
Since lubricating oil has a very important role, functionally, use only designated lubricating oil. (Never use machine oil, engine oil, etc..)
If the designated lubricating oil name can not be found, ask our sales man.
And confirm if belts for gears are not loose.

8－3－2　Oil Seal

[Tab.８－１] shows motor oil seals.
Replace oil seals every 5,000 hours.

Motor type	Oil seal type
ＮＡ７０－１０．．Ｓ.	ＡＥ０１４２－Ｅ (ＮＯＫ)
ＮＡ７０－２０．．Ｓ.	ＡＣ０５１３－Ｅ０ (ＮＯＫ)
ＮＡ７０－４０．．Ｓ.	ＡＣ０５１３－Ｅ０ (ＮＯＫ)
ＮＡ７０－６０．．Ｓ.	ＡＣ０９８１－Ｅ２ (ＮＯＫ)

[Tab.８－１]　Applied Oil Seal

※ Since an oil seal is not provided with a standard unit, if requred, describe “With oil seal” on your order sheet.

8－3－3　Motor bearing

Motor bearings are dedicated type as shown in [Tab.８－２].
Though bearing life depends on working conditions, it is generally about 20,000 hours.

Motor type	Load shaft	Unload shaft
ＮＡ７０－１０ (Ｂ)．．．．．．	６０８ＺＺ	６０６ＺＺ×２
ＮＡ７０－２０ (Ｂ)．．．．．．	６００２ＺＺ	６０００ＺＺ×２
ＮＡ７０－４０ (Ｂ)．．．．．．	６００２ＺＺ	６０００ＺＺ×２
ＮＡ７０－６０ (Ｂ)．．．．．．	６００４ＺＺ	６２０１ＺＺ×２

[Tab.８－２]　Applied Motor Bearings

※　(　) means a motor with brake.

8－3－4 Life and Replacement Parts of Driver

Replacenent guidance of each part of the driver is described.
Though applied components of the driver are electric parts, some of them have lifetime.
Standard replacemrnt timing is shown in the below tabulation.

Part name	Standard replacement interval	Replacement method/ others
Smoothing capacitor and other aluminum electrolytic capacitors (In the PC board)	5 years	Replace it with a new PC board (Determine after inspection)
EEPROM	10 years	Parameter re-writing frequency 3 times/ day
Relays, etc.		(Determine after inspection)

[Tab.8－3] Starndard Parts Replacement Interval List 1

Service condition
- ・Ambient temperature : Yealy average 30℃
- ・Load ratio : 80% or less
- ・Availability : 20 hours or less/ day

Note) The data are in conformiy to [Recommendation of Periodic Inspection of General Inverter] issued by a corporate juridical person “The Japan Electrical Manufacturers’ Association”
Standard replacement interval in the above list is just for guidance, and we designed the unit with heavy duty parts.

When any fault occurs, conduct the following inspection or fault diagnosis, in order to investigate the cause and take proper countermeasures.

When the fault of a following item is found, or parts or units are supposed out of order or broken, contact our sales man, immediately.

When conducting corrective measures, the person in charge should check power ON/ OFF by himself.

Since residual voltage remains in the main circuit after turning power OFF, wait for 2 to 3 minutes and re-start working.

Also, when it is required to touch the inside of the unit, be careful not to damage it by static electricity.

Never conduct an insulation test with a megger tester as it could damage the driver.

In case of measuring the insulation of a motor, before measuring, completely disconnect cables (U,V,W) between the motor and the driver.

9－1 Inspection and Confirmation Items

When a fault occurs, inspect and confirm the following items.

If spare of a motor or driver is available, replace the suspected unit and run it to confirm whether the driver or the motor is out of order or if any other external factor exists.

【Inspection and Confirmation Items】

① Inspect what Alarm display is.
② Inspect if no fault is found by visual check.
③ Inspect if the fault is reproduced or occurs in a particular motion.
④ Inspect how often the fault occurs.
⑤ Inspect how long the unit is in service.
⑥ Inspect if the power source voltage is normal and if it fluctuates greatly during a particular time.
⑦ Inspect if power black out occurred.
⑧ Inspect if temperature of the motor and diver is normal as well as ambient temperature.
⑨ Inspect if installation environment of the motor and driver is normal. (water, oil, metal powder, paper fragments, corrosive gas, etc.)
⑩ Inspect when the fault occurs, whether during acceleration, deceleration, or at constant speed run of the motor.
⑪ Inspect if the fault occurs at load fluctuation. (at load increase or decrease)
⑫ Inspect if there is any difference in motor forward and reverse rotation.
⑬ Inspect if there is no fault in no load run.

⚠ Cautions

① If reset is repeatedly conducted when IPM fault, and Overload error occurs, the driver will be damaged and a motor may burn out. Therefore, be sure to completely remove the cause of the fault and restart.

9－2 Protective Function

In order to prevent this unit and a motor from damage by abnormal status, the unit has several protective functions, internally.

When a fault is detected, the motor stops (torque free), Alarm signal is outputted and simultaneouly Alarm code is displayed in data display LED.

9－2－1 Protective Function List

Tab. 9－1 is [Protective function list].
As for trouble cause discovery and corrective measures when Protective function acts, please refer to Chapter 9 [Fault Diagnosis and Corrective Measures].

Disply code	Item	Contents	Detection Timing	Motion at error	Way to release
A0	RAM fault	RAM(memory) is faulty.	At Power ON	Motor free	Our service fix it.
A1	Motor selection error	Not selectable motor No. by parameter P0 motor selection is selected.	At Power ON	Motor free	Set correct No. to parameter P0 motor selection, then re-input power.
A2	Motor Shaft errort at Power ON	Motor shaft runs at 15rpm or more at unit power ON.In the case, since an encoder can not be initialized, Alarm occurs.	At Power ON	Motor free	When motor shaft speed is less than 15rpm, re-input power.
A3	Encoder fault	Encoder is disconnected, faulty, or encoder cable is broken.	Always	Motor free	Re-input power.
A4	Overspeed error	Motor speed reaches more than about 160% of rated speed.	Always except Reset signal input time.	Motor free	Input Reset signal. Or re-input power.
A5	Over load error	Internal electric thermal acts.	Always except Reset signal input time.	Motor free	After cooling the unit or a motor, inputReset signal or re-input power.
A6	Under voltage error	Power supply voltage or control power voltage is down.	Always except Reset signal input time.	Motor free	Input Reset signal. Or re-input power.
A7	Over voltage error	DC power voltage of main circuits exceeds specified value.	Always except Reset signal input time.	Motor free	Input Reset signal. Or re-input power.
A8	IPM fault	Excess current more than specified value flows in power transistor section.	Always except Reset signal input time.	Motor free	Input Reset signal. Or re-input power.
A9	Parameter Hold error	Held parameter data are broken.	At Power ON	Motor free	Reset parameter and re-input power.
AA	Adj. data Hold error	Held adjustment data at our shipping are broken.	At Power ON	Motor free	Our service fix it.
AC	Deviation over flow	Deviation more than 30000 pulses (1 time) occurs.	At Pulse train run	Motor free	Input Reset signal. Or re-input power.
AE	Regenera. over crrnt error	Excess current more than specified value flows in transistors of the regeneration circuit.	Always except Reset signal input time.	Motor free	Reset parameter and re-input power.
AF	AC power error	AC power voltage is lost for 50ms or more.	Always except Reset signal input time.	Motor free	Reset parameter and re-input power.
AP	Reverse error	Motor shaft runs reverse 1 turn at Servo ON.Alarm is detected when [Reverse protection] is set to parameter U1.	Always except Reset signal input time.	Motor free	Reset parameter and re-input power.
FAIL LED ON	CPU Fault	Watch dog timer is up due to fault of CPU, memory, etc. .	Always	Motor free	Re-input power.

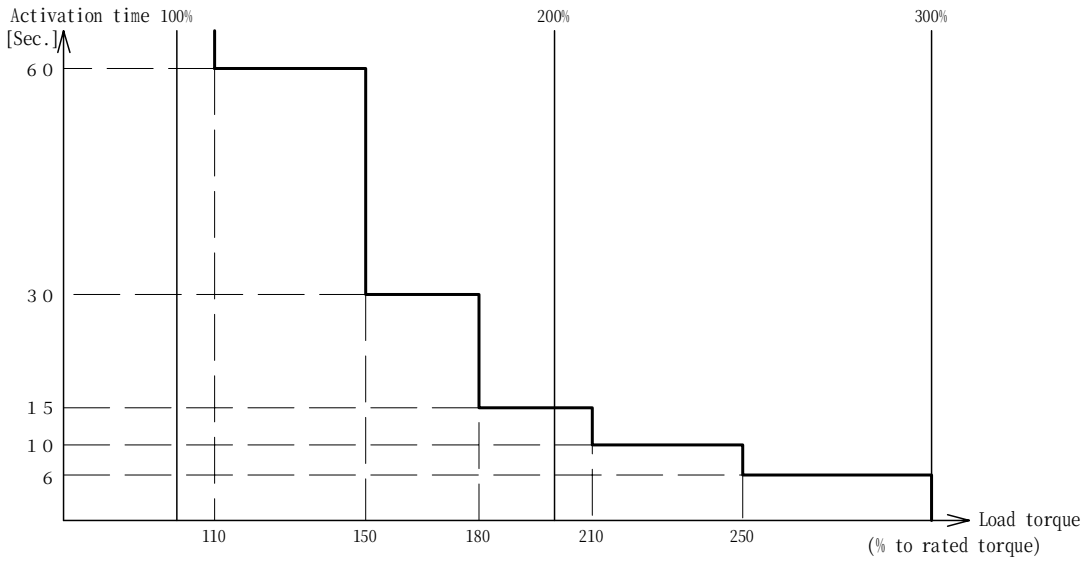
[Tab. 9－1] Protective Function List

9－2－2 Inspection Method and Corrective Action when Alarm Occurs

When a fault occurs, confirm the cause by Alarm display LEDs and take proper countermeasiures.
Be sure to remove the cause and then release Alarm.
If faults occur repeatedly, the unit could be damaged.

Fault description	Cause	Countermeasures
【RAM Fault 】 ・RAM(memory) is faulty.	・Malfunction due to noise	・Remove noise source ・Take anti-noise measures.
	・Failure of the unit	・Repair or replace unit.
【Motor selection error】 ・Not selectable motor No. by parameter P0 motor selection is selected.	・Not selectable motor for proper combination with unit sis selected.	・Confirm combination of units and motors and set parameter P0.
【Motor shaft error at Power ON】 ・Motor shaft runs at 15rpm or more at unit power ON.	・Motor shaft runs at 15rpm or more at unit power ON.	・When motor shaft speed is less than 15 rpm, turn power ON.
【Encoder fault 】 ・Encoder is faulty, an encoder cable is broken/ disconnected, or a connector comes out.	・Encoder cable is broken/ disconnected or wrong wiring was made.	・Correct wiring.
	・Connector connection error	・Securely insert connector.
	・Encoder failure	・Replace motor (encoder) .
	・Unit failure	・Repair or replace unit.
【Overspeed error 】 ・Motor speed reaches more than about 160% of rated speed.	・Wrong wiring of cables (U,V, W) between driver and motor.	・Correct wiring.
	・Wrong wiring of Encoder feed back signal cables.	
	・Encoder failure	・Replace motor (encoder) .
	・Load inertia is excessive or overshoot is large due to wrong gain adjustment.	・Reduce load inertia. Or set longer accel.time. ・Adjust stability (Adjust gain and improve backlash, looseness of connecting sec. and weak rigidity of machine system.
	・Encoder feedback signal is affected by noise.	・Remove noise source ・Take anti-noise measures.
	・Wrong parameter set	・Confirm parameter P0 motor selection.

Fault description	Cause	Countermeasures
【Over load error 】	・Excess load	・Reduce load
・Due to over load or too frequent command change than allowable time, the internal electric thermal is activated. Internal electric thermal activation time can be referred to [Fig. 9－1] .	・Start and stop of motor is too frequent	・Reduce motor start and stop frequency.
	・Wrong wiring of cables (U,V,W) between driver and motor.	・Correct wiring.
	・Wrong wiring of Encoder feedback signal cables	
	・Encoder feedback signal is affected by noise.	・Remove noise source ・Take anti-noise measures.
	・Encoder failure	・Replace motor (encoder)
	・Mechanical locking with brake, etc.	・Release brake. If machine has fault, fix it.
	・Proportional control signal(PC) is inputted in motor running.	・Turn OFF proportional control signal.
	・Current fluctuation due to unstable motor motion and vibration	・Adjust stability (Adjust gain and improve backlash, looseness of connecting section and weak rigidity of machine system.
	・High ambient temperature or bad ventilation	・Decrease ambient temp.. Improve ventilation and cooling system.
	・Wrong parameter set	・Confirm parameter P0 motor selection.



[Fig. 9－1] Internal Electric Thermal Activation Time

Fault description	Cause	Countermeasures
【Under voltage error 】	・Supply voltage is low. (includes insufficient capacity.)	・Supply correct power source and reconsider power source system, capacity, and cable diameter.
・Power supply voltage or control power voltage is down.	・Power black out occurred.	
	・Power cable is thin.	
	・Loose fit screw in power terminal	
	・Malfunction due to noise	・Remove noise source ・Take anti-noise measures.
	・Unit failure	・Repair or replace unit.
【Over voltage error 】	・Supply voltage is high.	・Supply correct power source.
・Due to excess load inertia, etc., at motor stop or decel., regenerarive energy is beyond the capacity and DC power source voltage of main circuits exceeds specified value..	・Excessive regenerative energy by too large load inertia.	・Reduce load inertia, decr ease motor speed or set longer decel.time. ・Connect Regenerative resi stor or re-select it.
	・Malfunction due to noise	・Remove noise source ・Take anti-noise measuress
	・Unit failure	・Repair or replace unit
【I PM fault 】	・Line-to-ground fault of motor	・Replace motor.
・Due to line-to-ground fault of a motor or same fault, short-circuit,mis-wiring, etc. of cables (U,V,W) between the driver and motor,over-current flows in the main circuit power elements.	・Line-to-ground fault or short-c ircuit of cables(U,V,W) between the driver and motor	・Correct wiring
	・Current fluctuation due to unst able motor motion and vibration	・Adjust stability (Adjust gain and improve backlash, etc.of machine system.)
	・Wrong parameter set	・Confirm parameter P0 motor selection.
	・Malfunction due to noise	・Remove noise source ・Take anti-noise measuress
	・Unit failure	・Repair or replace unit
【 Parameter hold error 】	・Power is OFF during saving parameter.	・Set all parameters.
・Held parameter data are broken.	・Malfunction due to noise	・Remove noise source ・Take anti-noise measuress
	・Unit failure	・Repair or replace unit
【Adjusment data hold error 】	・Malfunction due to noise	・Remove noise source ・Take anti-noise measuress
・Held adjustment data are broken	・Unit failure	・Repair or replace unit

Fault description	Cause	Countermeasures
【Deviation overflow】	・Excess load	・Reduce load.
・Position deviation exceeds 30,000 pulses (1 time).	・Load inertia is excessive or overshoot is large due to wrong gain adjustment.	・Reduce load inertia,or set longer Accel./decel. time. ・Adjust stability (Adjust gain and improve backlash, looseness of connecting sec. and weak rigidity etc. of machine system).
	・Wrong wiring of cables (U,V,W) between driver and motor.	・Correct wiring
	・Wrong wiring of Encoder feedback signal cables.	
	・Encoder failure	・Replace motor (Encoder) .
	・Encoder feedback signal or command pulse is affected by noise.	・Remove noise source ・Take anti-noise measuress
	・Torque limit and Proportional control signal (TL,PC) is inputted in motor running.	・Turn OFF Torque limit,and proportional control signals.
	・Mechanical locking with brake, etc.	・Release brake. ・If machine has fault, fix it.
	・Wrong parameter set	・Confirm parameter P0 motor selection and U1 reverse pr otection selection.
	・Pulse train command larger than rated speed is inputted.	・Confurm Pulse train command frequency. ・Confirm parameter J1,8,9.
【Regenerative over current error 】	・Regenerative resistor is small.	・Replace with proper Regener ative resistor.
Excess current more than specified value flows in transistors of the regeneration circuit.	・Malfunction due to noise	・Remove noise source ・Take anti-noise measuress
	・Unit failure	・Repair or replace unit
【AC power error 】	・Supply voltage is low. (includes insufficient capacity.)	・Supply correct power source and reconsider power source system, capacity, and cable diameter.
・AC power voltage is lost for 50ms or more.	・Black out occurred.	
	・Power cable is thin.	
	・Loose fit screw in power terminal	
	・Malfunction due to noise	・Remove noise source ・Take anti-noise measuress
	・Unit failure	・Repair or replace unit

Fault description	Cause	Countermeasures
【Reverse error 】	・Excess load	・Reduxe load.
・Motor shaft runs reverse 1 turnat Servo ON.	・Load inertia is excessive or overshoot is large due to wrong gain adjustment.	・Reduce load inertia,or set longer Accel./decel. time. ・Adjust stability (Adjust gain and improve backlash, looseness of connecting sec. and weak rigidity etc. of machine system).
	・Wrong wiring of cables (U,V,W) between driver and motor.	・Correct wiring
	・Wrong wiring of Encoder feedback signal cables	
	・Encoder filure	・Replace motor (encoder) .
	・Encoder feedback signal or command pulse is affected by noise.	・Remove noise source ・Take anti-noise measuress
	・Torque limit and Proportional con trol signal (TL,PC) is inputted in motor running.	・Turn OFF Torque limit, and proportional control signals.
	・Wrong parameter set	・Confirm parameter P0 motor selection and U1 reverse protection selection.
【CPU fault 】 ・Watch dog timer is up due to fault of CPU, memory, etc. .	・Malfunction due to noise	・Remove noise source ・Take anti-noise measuress
	・Unit failure	・Repair or replace unit

[Tab. 9－2]　Inspection Method and Countermeasures when Alarm Occurs

⚠ Cautions

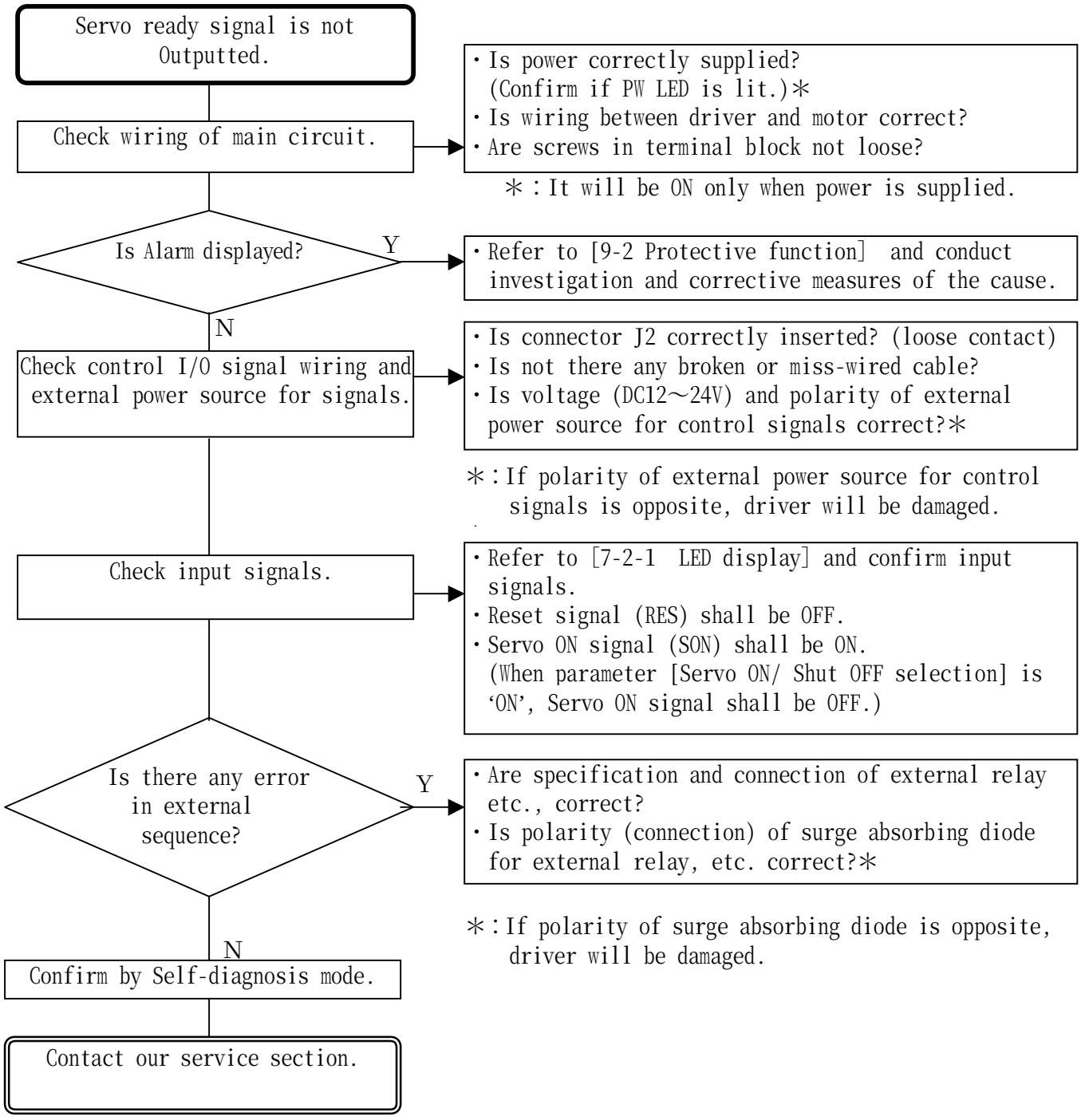
① If reset is repeatedly conducted when IPM fault, and Overload error occur, the driver will be damaged and a motor may burn out. Therefore, be sure to completely remove the cause of the fault and restart.

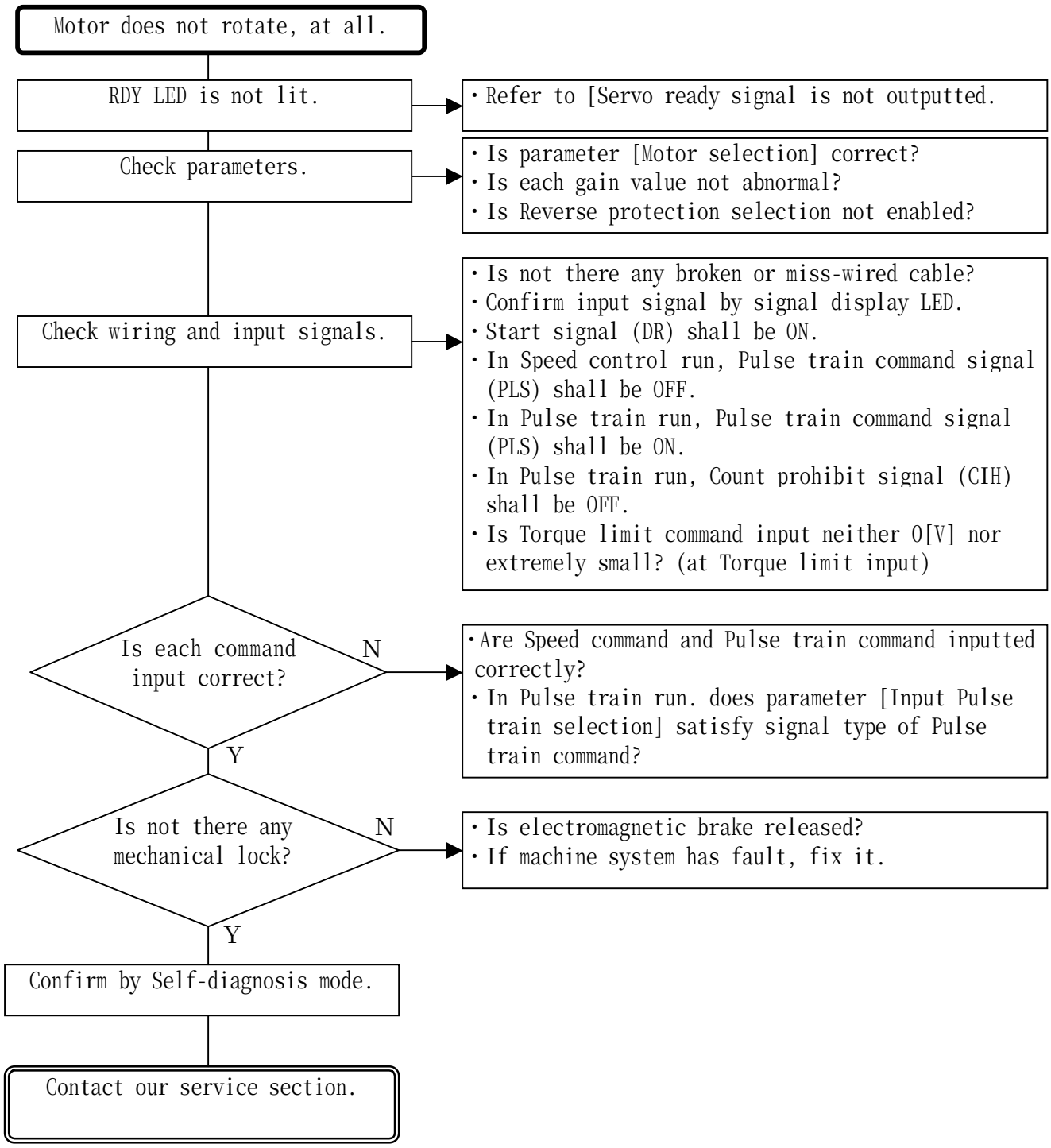
9－3 Trouble Shooting

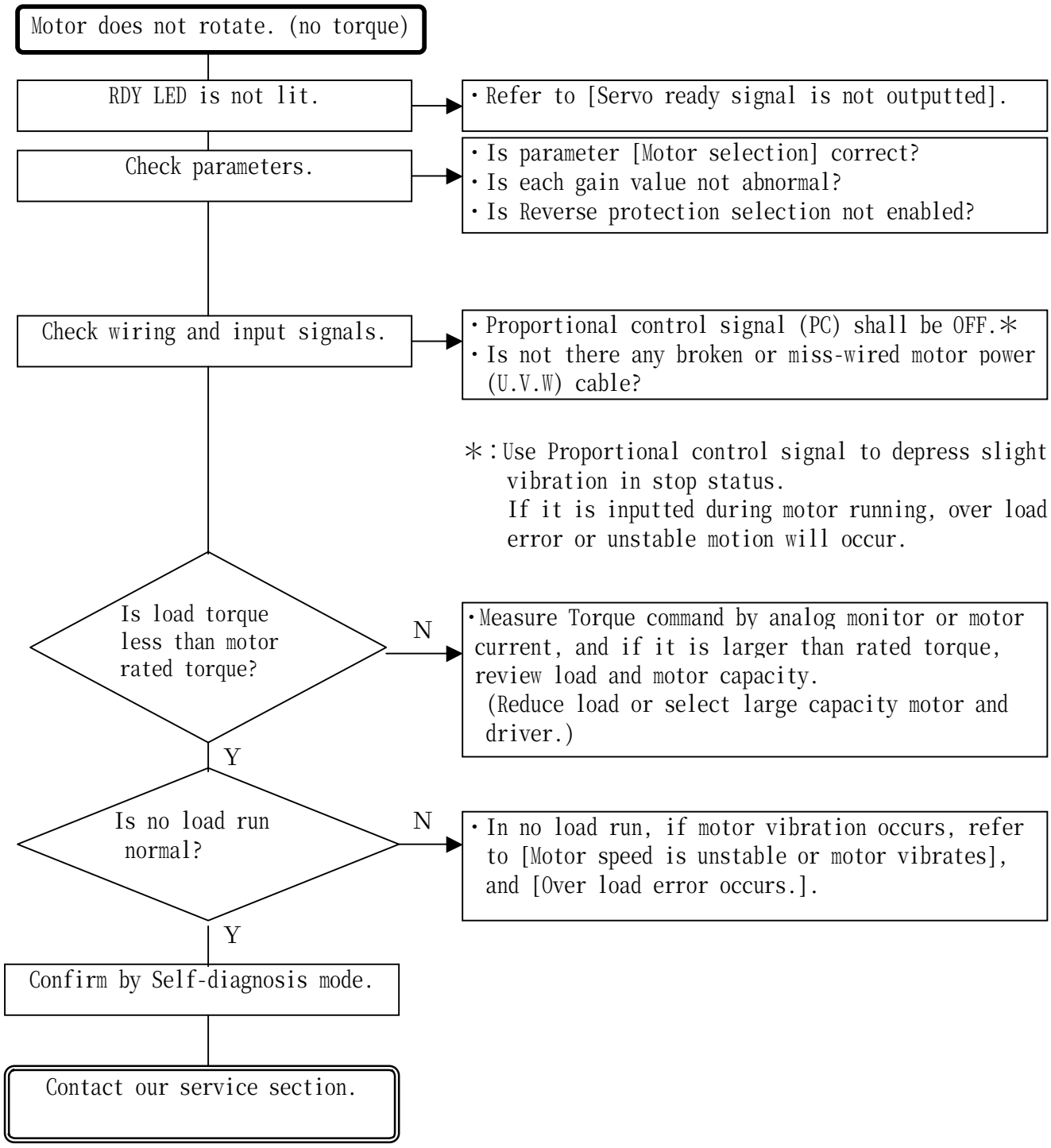
When a fault occurs, investigate cause and take proper countermeasures in accordance with the following procedure.
When the fault of a following item is found, contact our sales man.

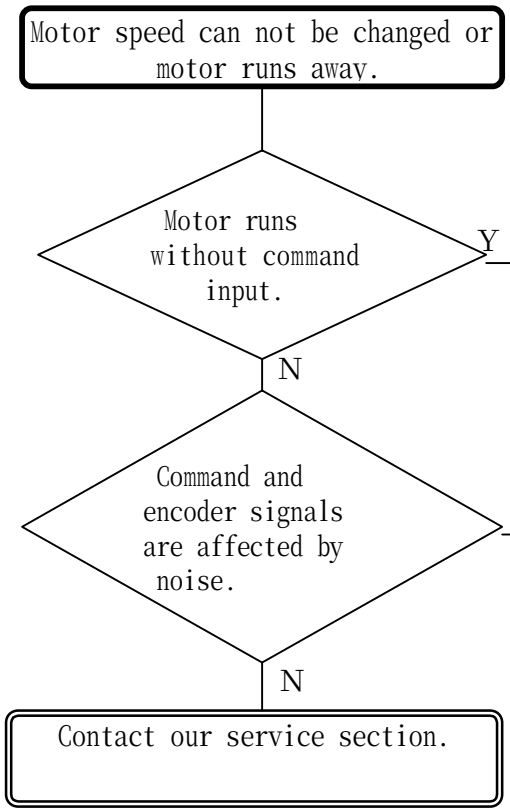
⚠ Cautions

① When a driver is connected with a main controller, separate the connection and inspect the following items only to a combination of our motor and driver.




Motor does not rotate, at all.
RDY LED is not lit.
・Refer to [Servo ready signal is not outputted.
Check parameters.
・Is parameter [Motor selection] correct?
・Is each gain value not abnormal?
・Is Reverse protection selection not enabled?
Check wiring and input signals.
・Is not there any broken or miss-wired cable?
・Confirm input signal by signal display LED.
・Start signal (DR) shall be ON.
・In Speed control run, Pulse train command signal (PLS) shall be OFF.
・In Pulse train run, Pulse train command signal (PLS) shall be ON.
・In Pulse train run, Count prohibit signal (CIH) shall be OFF.
・Is Torque limit command input neither 0[V] nor extremely small? (at Torque limit input)
Is each command input correct?
N
・Are Speed command and Pulse train command inputted correctly?
・In Pulse train run. does parameter [Input Pulse train selection] satisfy signal type of Pulse train command?
Y
Is not there any mechanical lock?
N
・Is electromagnetic brake released?
・If machine system has fault, fix it.
Y
Confirm by Self-diagnosis mode.
Contact our service section.

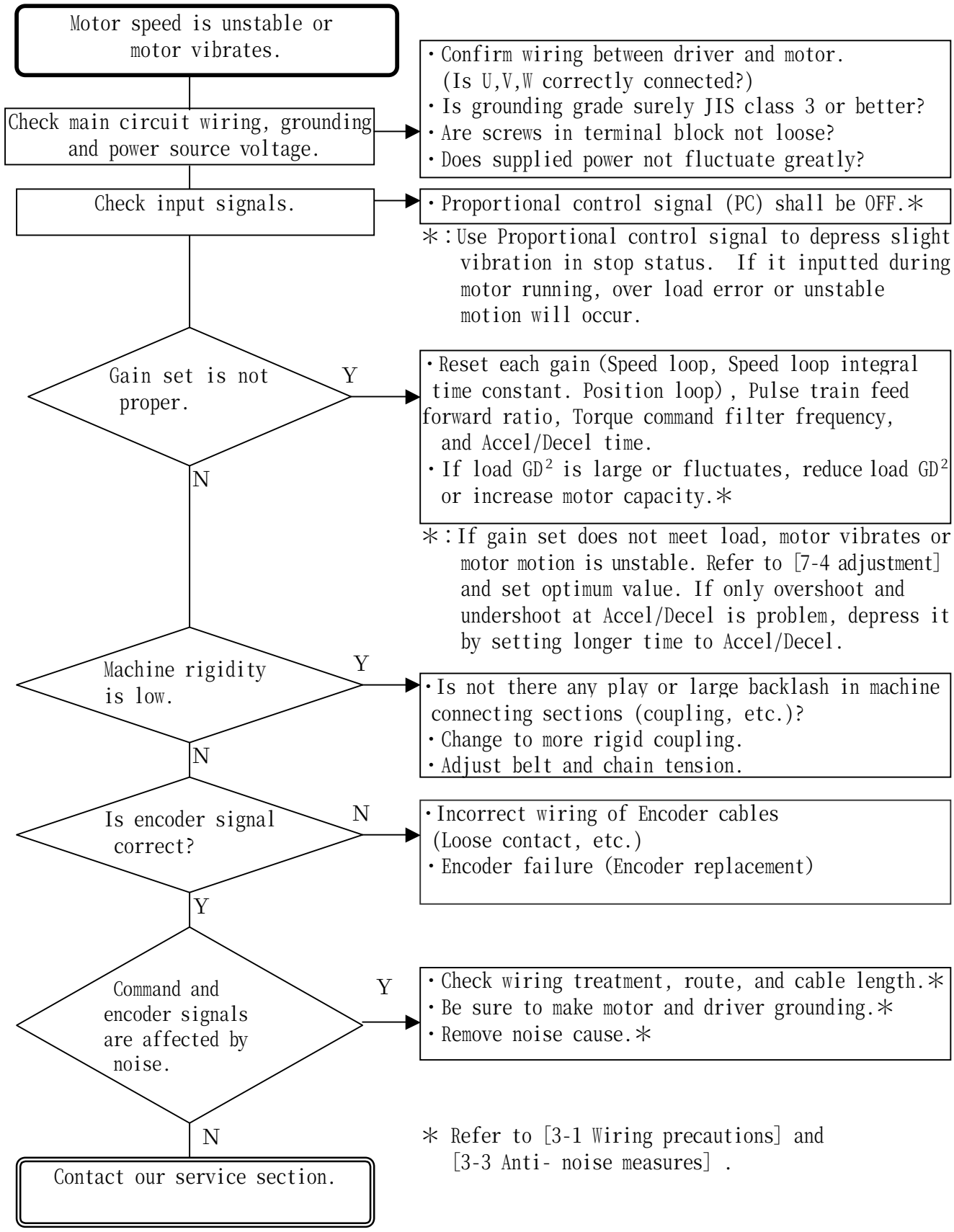

Motor does not rotate. (no torque)
RDY LED is not lit.
・Refer to [Servo ready signal is not outputted].
Check parameters.
・Is parameter [Motor selection] correct?
・Is each gain value not abnormal?
・Is Reverse protection selection not enabled?
Check wiring and input signals.
・Proportional control signal (PC) shall be OFF.＊
・Is not there any broken or miss-wired motor power (U.V.W) cable?
＊：Use Proportional control signal to depress slight vibration in stop status.
If it is inputted during motor running, over load error or unstable motion will occur.
Is load torque less than motor rated torque?
N
・Measure Torque command by analog monitor or motor current, and if it is larger than rated torque, review load and motor capacity.
(Reduce load or select large capacity motor and driver.)
Y
Is no load run normal?
N
・In no load run, if motor vibration occurs, refer to [Motor speed is unstable or motor vibrates], and [Over load error occurs.].
Y
Confirm by Self-diagnosis mode.
Contact our service section.

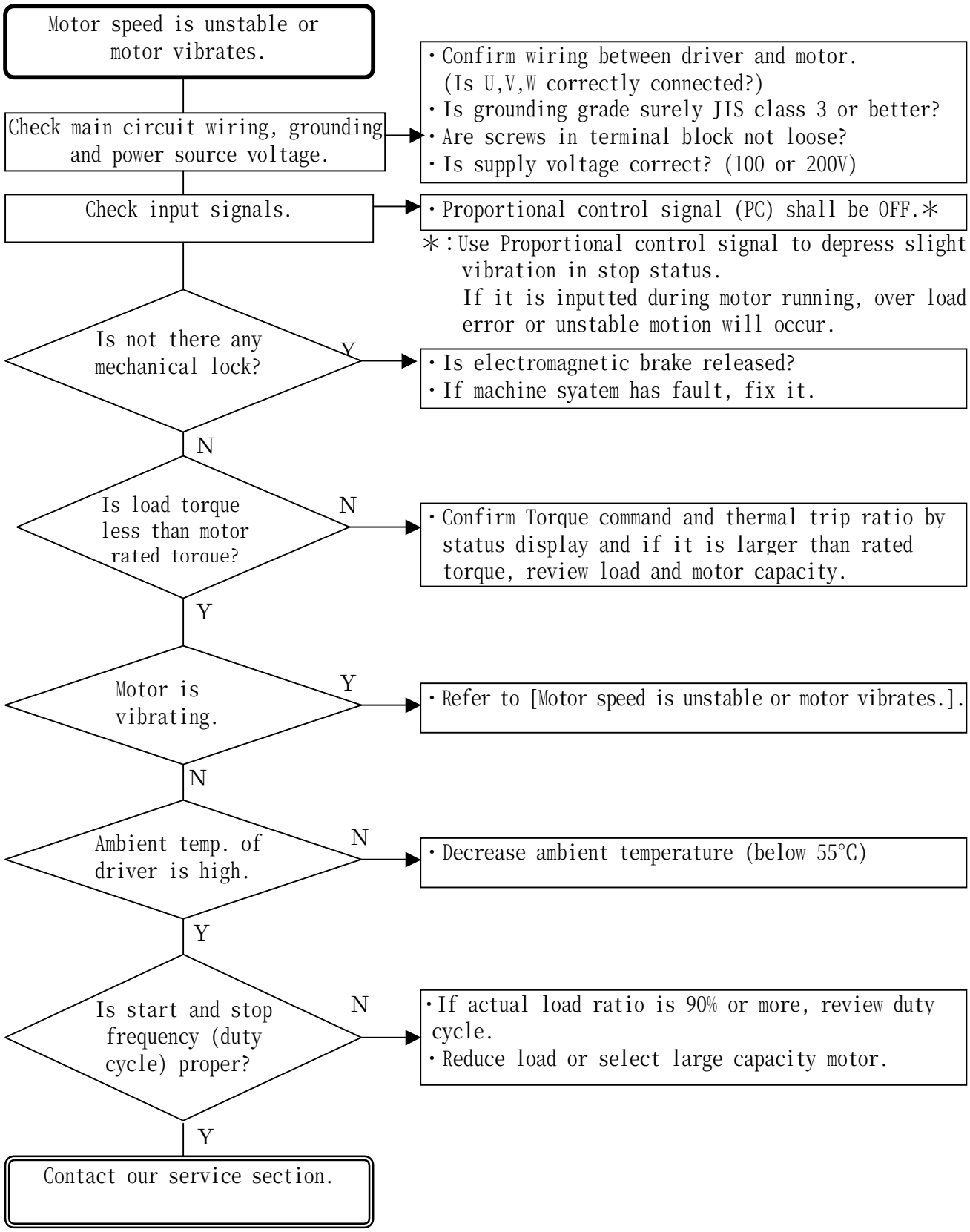


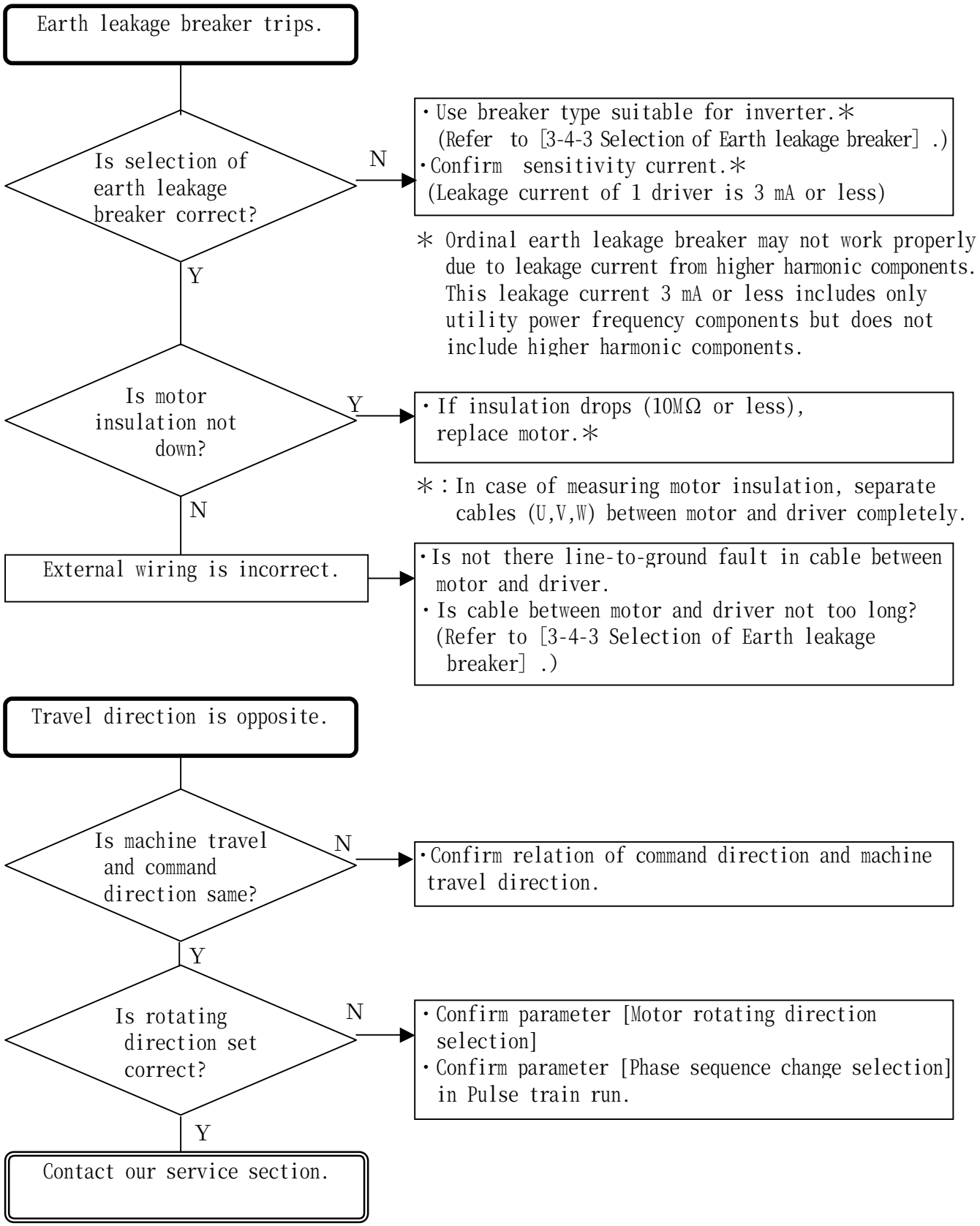
・Is not there any broken or miss-wired motor power (UVW) cable?
・Confirm Encoder cable wiring. (miss-wiring)
・Encoder failure (Encoder replacement)
・Is parameter [Motor selection] correct?

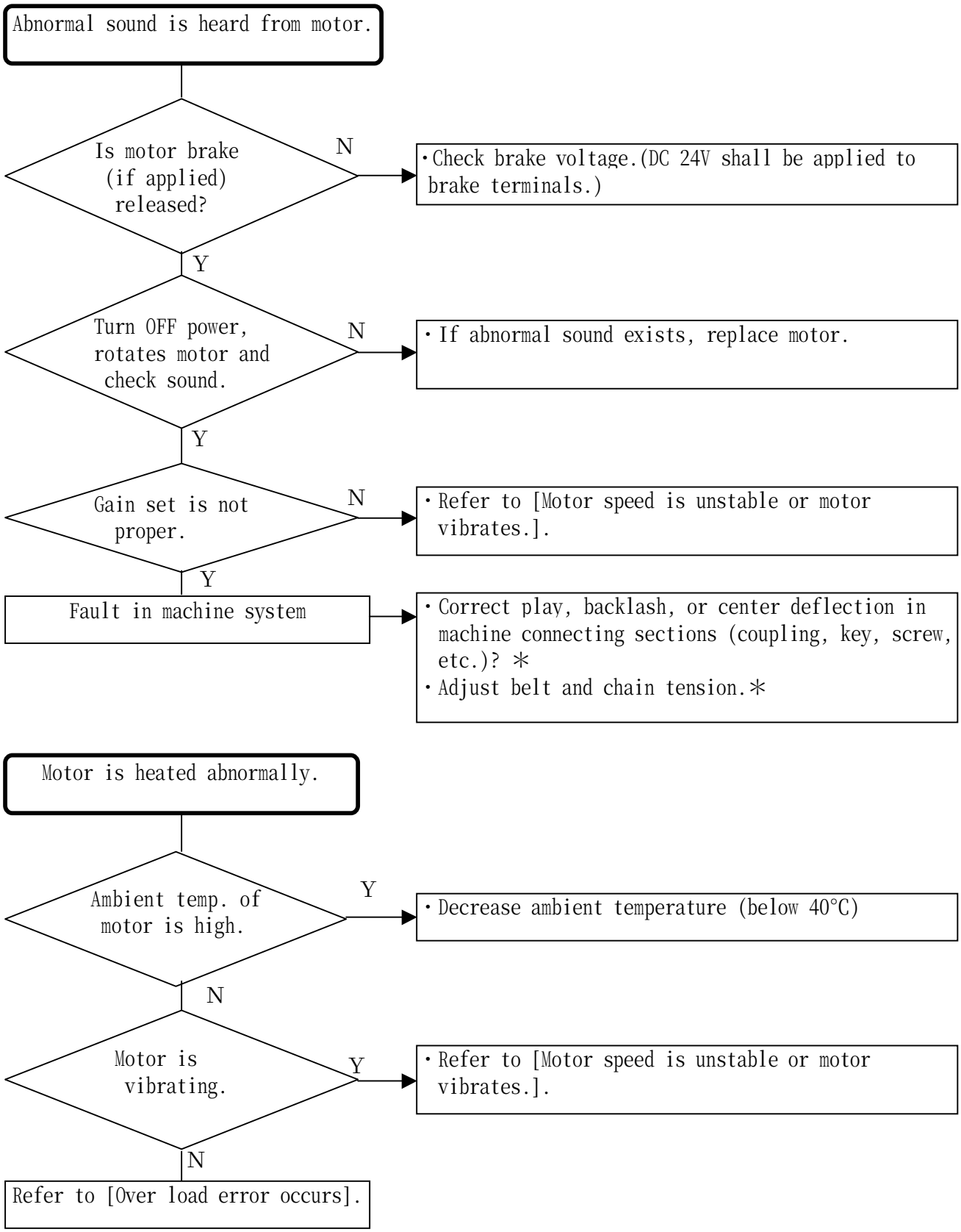
・Check wiring treatment, route, and cable length.＊
・Be sure to make motor and driver grounding.＊
・Remove noise cause.＊

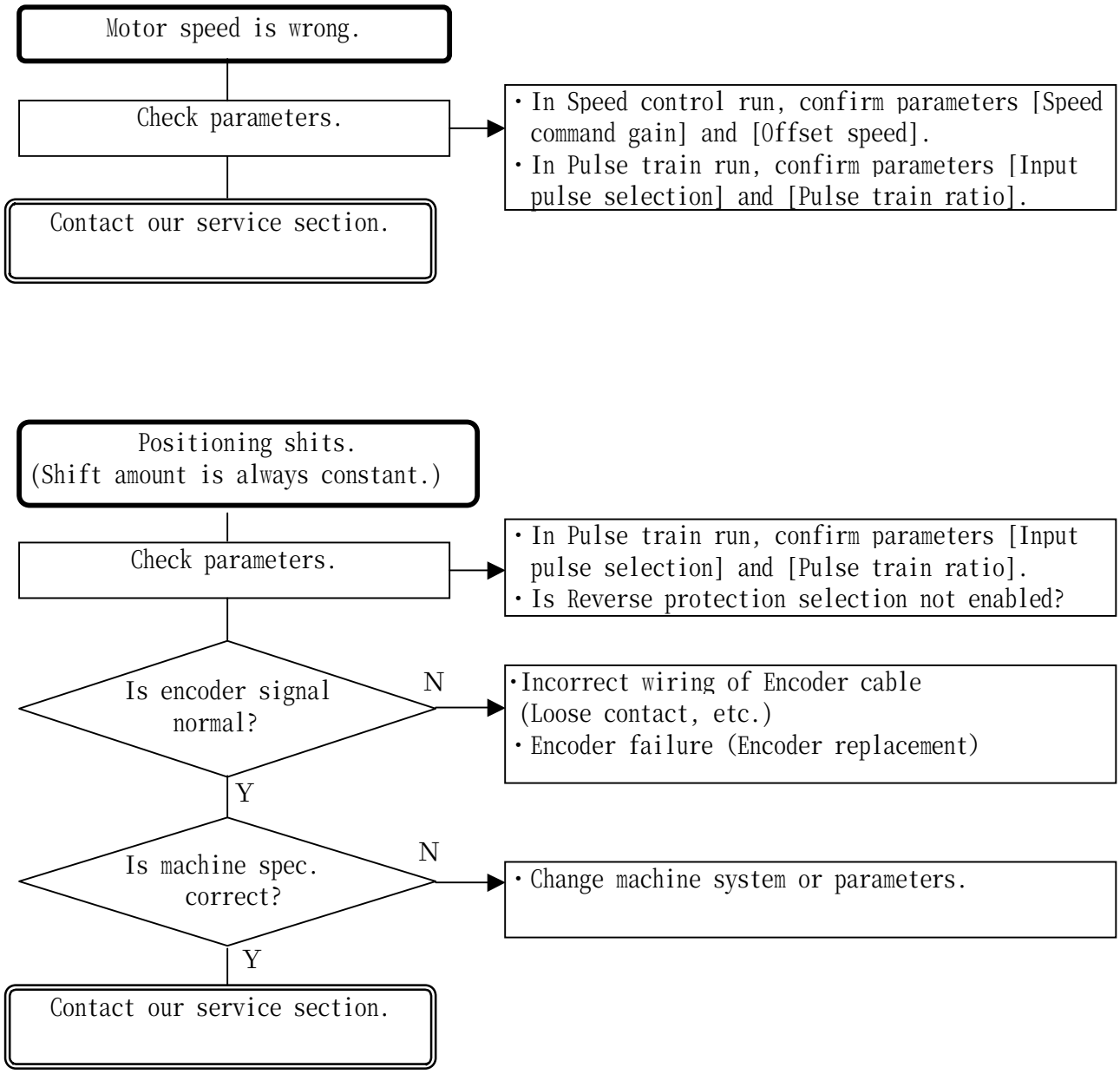
＊ Refer to [3-1 Wiring precautions] and [3-3 Anti- noise measures] .

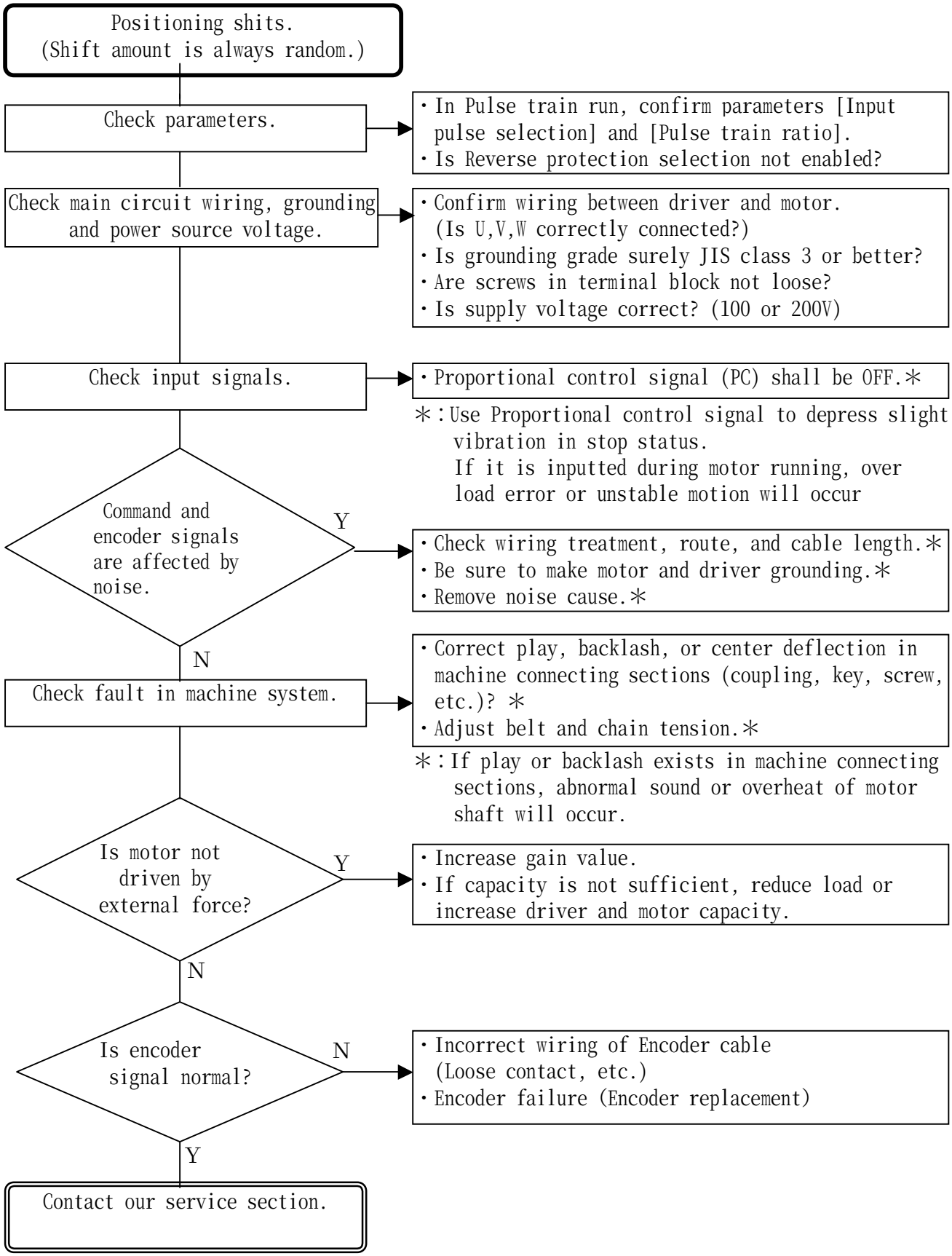

Motor speed is unstable or motor vibrates.
Check main circuit wiring, grounding and power source voltage.
・Confirm wiring between driver and motor. (Is U,V,W correctly connected?)
・Is grounding grade surely JIS class 3 or better?
・Are screws in terminal block not loose?
・Does supplied power not fluctuate greatly?
Check input signals.
・Proportional control signal (PC) shall be OFF.＊
＊：Use Proportional control signal to depress slight vibration in stop status. If it inputted during motor running, over load error or unstable motion will occur.
Gain set is not proper.
Y
N
・Reset each gain (Speed loop, Speed loop integral time constant. Position loop), Pulse train feed forward ratio, Torque command filter frequency, and Accel/Decel time.
・If load GD2 is large or fluctuates, reduce load GD2 or increase motor capacity.＊
＊：If gain set does not meet load, motor vibrates or motor motion is unstable. Refer to [7-4 adjustment] and set optimum value. If only overshoot and undershoot at Accel/Decel is problem, depress it by setting longer time to Accel/Decel.
Machine rigidity is low.
Y
N
・Is not there any play or large backlash in machine connecting sections (coupling, etc.)?
・Change to more rigid coupling.
・Adjust belt and chain tension.
Is encoder signal correct?
N
Y
・Incorrect wiring of Encoder cables (Loose contact, etc.)
・Encoder failure (Encoder replacement)
Command and encoder signals are affected by noise.
Y
N
・Check wiring treatment, route, and cable length.＊
・Be sure to make motor and driver grounding.＊
・Remove noise cause.＊
＊ Refer to [3-1 Wiring precautions] and [3-3 Anti- noise measures] .
Contact our service section.


Motor speed is unstable or motor vibrates.
Check main circuit wiring, grounding and power source voltage.
・Confirm wiring between driver and motor. (Is U,V,W correctly connected?)
・Is grounding grade surely JIS class 3 or better?
・Are screws in terminal block not loose?
・Is supply voltage correct? (100 or 200V)
Check input signals.
・Proportional control signal (PC) shall be OFF.＊
＊：Use Proportional control signal to depress slight vibration in stop status. If it is inputted during motor running, over load error or unstable motion will occur.
Is not there any mechanical lock?
Y
・Is electromagnetic brake released?
・If machine syatem has fault, fix it.
N
Is load torque less than motor rated torque?
N
・Confirm Torque command and thermal trip ratio by status display and if it is larger than rated torque, review load and motor capacity.
Y
Motor is vibrating.
Y
・Refer to [Motor speed is unstable or motor vibrates.].
N
Ambient temp. of driver is high.
N
・Decrease ambient temperature (below 55°C)
Y
Is start and stop frequency (duty cycle) proper?
N
・If actual load ratio is 90% or more, review duty cycle.
・Reduce load or select large capacity motor.
Y
Contact our service section.


Earth leakage breaker trips.
Is selection of earth leakage breaker correct?
N
・Use breaker type suitable for inverter.＊
(Refer to [3-4-3 Selection of Earth leakage breaker] .)
・Confirm sensitivity current.＊
(Leakage current of 1 driver is 3 mA or less)
＊ Ordinal earth leakage breaker may not work properly due to leakage current from higher harmonic components. This leakage current 3 mA or less includes only utility power frequency components but does not include higher harmonic components.
Y
Is motor insulation not down?
Y
・If insulation drops (10MΩ or less), replace motor.＊
＊：In case of measuring motor insulation, separate cables (U,V,W) between motor and driver completely.
N
External wiring is incorrect.
・Is not there line-to-ground fault in cable between motor and driver.
・Is cable between motor and driver not too long? (Refer to [3-4-3 Selection of Earth leakage breaker] .)
Travel direction is opposite.
Is machine travel and command direction same?
N
・Confirm relation of command direction and machine travel direction.
Y
Is rotating direction set correct?
N
・Confirm parameter [Motor rotating direction selection]
・Confirm parameter [Phase sequence change selection] in Pulse train run.
Y
Contact our service section.

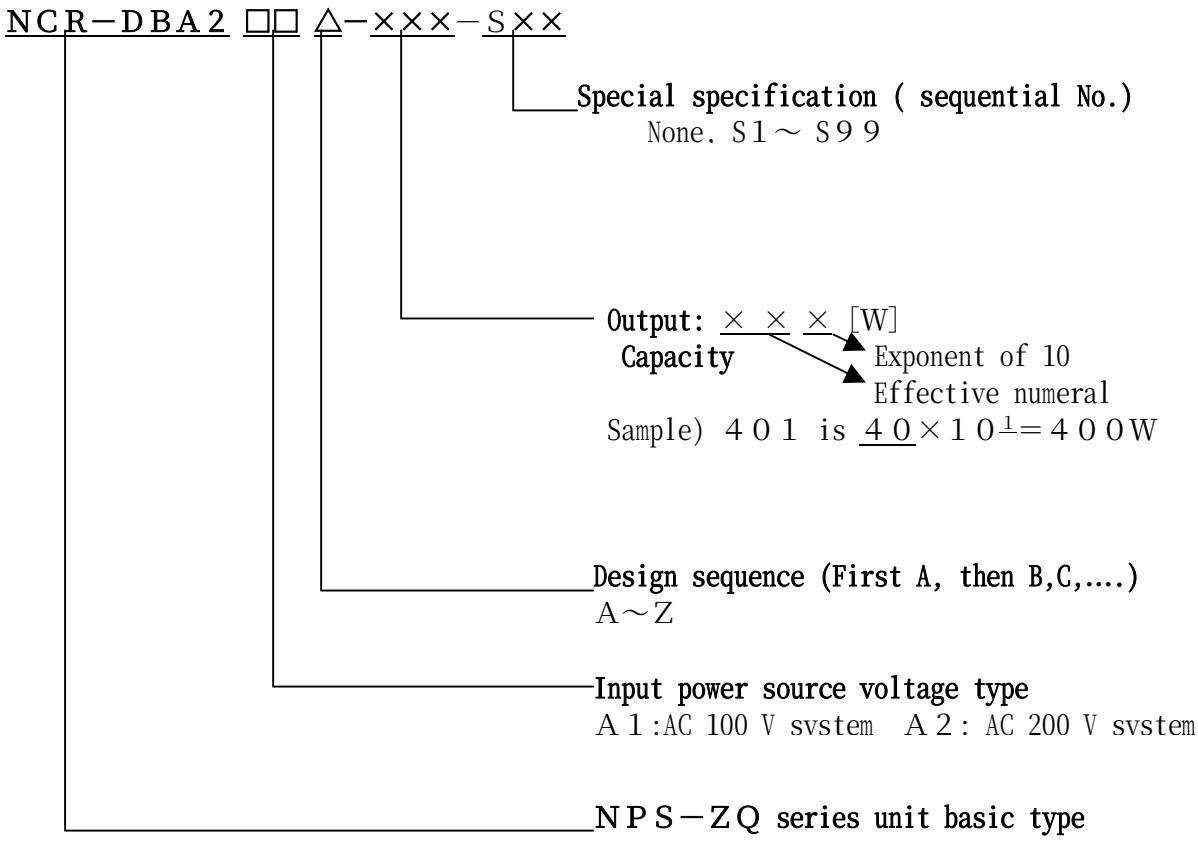

Abnormal sound is heard from motor.
Is motor brake (if applied) released?
N
・Check brake voltage.(DC 24V shall be applied to brake terminals.)
Y
Turn OFF power, rotates motor and check sound.
N
・If abnormal sound exists, replace motor.
Y
Gain set is not proper.
N
・Refer to [Motor speed is unstable or motor vibrates.].
Y
Fault in machine system
・Correct play, backlash, or center deflection in machine connecting sections (coupling, key, screw, etc.)? ＊
・Adjust belt and chain tension.＊
Motor is heated abnormally.
Ambient temp. of motor is high.
Y
・Decrease ambient temperature (below 40°C)
N
Motor is vibrating.
Y
・Refer to [Motor speed is unstable or motor vibrates.].
N
Refer to [Over load error occurs].


Motor speed is wrong.
Check parameters.
・In Speed control run, confirm parameters [Speed command gain] and [Offset speed].
・In Pulse train run, confirm parameters [Input pulse selection] and [Pulse train ratio].
Contact our service section.
Positioning shits.
(Shift amount is always constant.)
Check parameters.
・In Pulse train run, confirm parameters [Input pulse selection] and [Pulse train ratio].
・Is Reverse protection selection not enabled?
Is encoder signal normal?
N
・Incorrect wiring of Encoder cable (Loose contact, etc.)
・Encoder failure (Encoder replacement)
Y
Is machine spec. correct?
N
・Change machine system or parameters.
Y
Contact our service section.


Positioning shits.
(Shift amount is always random.)
Check parameters.
・In Pulse train run, confirm parameters [Input pulse selection] and [Pulse train ratio].
・Is Reverse protection selection not enabled?
Check main circuit wiring, grounding and power source voltage.
・Confirm wiring between driver and motor. (Is U,V,W correctly connected?)
・Is grounding grade surely JIS class 3 or better?
・Are screws in terminal block not loose?
・Is supply voltage correct? (100 or 200V)
Check input signals.
・Proportional control signal (PC) shall be OFF.＊
＊：Use Proportional control signal to depress slight vibration in stop status.
If it is inputted during motor running, over load error or unstable motion will occur
Command and encoder signals are affected by noise.
Y
・Check wiring treatment, route, and cable length.＊
・Be sure to make motor and driver grounding.＊
・Remove noise cause.＊
N
Check fault in machine system.
・Correct play, backlash, or center deflection in machine connecting sections (coupling, key, screw, etc.)? ＊
・Adjust belt and chain tension.＊
＊：If play or backlash exists in machine connecting sections, abnormal sound or overheat of motor shaft will occur.
Is motor not driven by external force?
Y
・Increase gain value.
・If capacity is not sufficient, reduce load or increase driver and motor capacity.
N
Is encoder signal normal?
N
・Incorrect wiring of Encoder cable (Loose contact, etc.)
・Encoder failure (Encoder replacement)
Y
Contact our service section.

１０－１ Unit

１０－１－１ Unit Type



１０－１－２ Unit General Specification

Item		Contents
Outline		Refer to [10-1-5 Unit Outline Drwaing] .
Environmental condition	Temperature	0～ 55℃
	Humidity	85% or less None-condensing
	Location	Do not install it in harmful atmosphere as corrosive gas, grinding liquid, metal powder, oil, etc.. Refer to [2-4 Unit Installation] .
Power source		Single phase AC 90～ 121 V 50/60 Hz (AC100 V system) Single phase AC180～ 242 V 50/60 Hz(AC200V system)
Cooling method		Natural air cooling
Mounting method		Panel mounting
Vibration resitance		0.5 G (10～ 50Hz) but no resonance
Shock resistance		5 G
Noise resistance		Line noise: 2000 V (50 ns, 1 μｓ) 1 minute Radiation noise:1000 V (50 ns/ 10ｃｍ) 1 minute Electro static noise: 10 k V (between earth and unit body)

[Tab.１０－１] Unit General Specification

１０－１－３ Specification of Unit Function

Item	Contents and Specification
Control axes	1 axis
Max. speed	500 Kpps (but applied motor rated speed or less)
Command type	Speed command: Analog Voltage (±10 V) Torque limit command: Analog Voltage (+10 V) Position command: Pulse train One of 90° Phase difference pulse/ Directional pulse/ Direction signal + Feed pulse is used.
Speed command	Analog voltage: DC 0～±10 V Motor rated speed at ±10 V input
Torque limit command	Analog voltage: DC 0～+10 V But motor output torque is limited to 100% at +3.3V input.
Pulse train command	One of 90° Phase difference pulse/ Directional pulse/ Direction signal + Feed pulse Max. input frequency: 250 Kpps (200 Kpps when open collecter is used.) Applicable to line drver and open collecter output
Accel/Decel patern	Accel/Decel time 0～ 9.99 sec (in Speed control run)
Protective function	Encoder fault, Overspeed, Over load (Electric thermal), Under Voltage, Over Voltage, IPM fault, Deviation error, CPU fault, Alarm code is displayed when individual fault occurs. (Over current is detected as IPM fault.) 'FAIL' LED is lit ON when CPU fault occous.
Monitor function	Analog monitor 2ch (0～±10V) Selects Speed command input, Speed feedback, Torque command,or Deviation amount and output voltage. Analog monitor output signal is selected by parameter. Data display LED (7 segment LED 2 digits) Selects Alarm, Speed, Torque, Deviation amount, Speed command input, Parameter status or other and displays. Signal display LED Displays power source, CPU fault, and control I/O signal status.
Major function	Speed control run, Pulse train run, Torque limit, Self-diagnosis

[Tab.１０－２] Specification of Unit Function

１０－１－４ Electric Specification of UNit

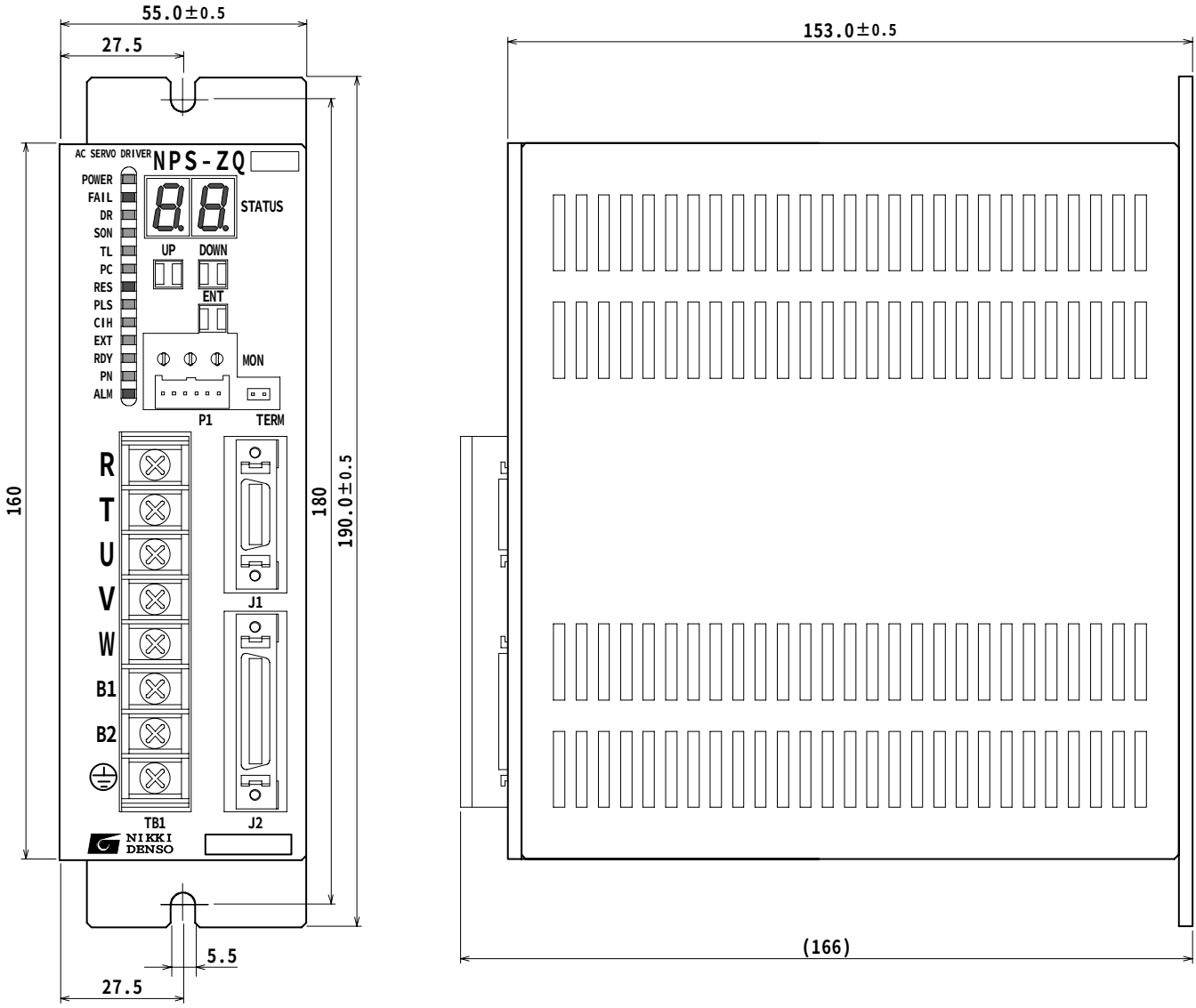
Item		Unit	Specification		
Type			NCR-DBA2A1*-201	NCR-DBA2A2*-401	NCR-DBA2A2*-601
Input power source			Integrated power type single phase AC90～121V ,	Integrated power type single phase AC180～242 V, 50/ 60 Hz	
Main circuit method			Transistor full bridge (Sine wave PWM control)		
Continuous output current (rms)		A	3.2	3.2	4.2
Mimentary output current (rms)		A	8.0	8.0	8.4
Rated torque		N・m	0.318: 100W / 0.64 : 200W / 1.27 : 400W		1.91 : 600W
Momentary output torque ＊2		N・m	0.95 : 100W 1.60 : 200W	0.95 : 100W 1.91 : 200W 3.175: 400W	3.82 : 600W
Control method			Semi-closed loop by encoder feedback		
Brake method			Regenerative braking		
Carrier frequency		Hz	10 K		
Speed control	Speed regulation	%	Load fluctuation (0～ 100%):±0.1 Voltage fluctuation (±10%):±0.02 Temperature fluctuation (0～ 55℃):±0.3		
	Spd.control range		1: 2000 ＊1		
	Spd.command	V	0～±10(Rated speed at ±10V input: 3000 rpm±10%)		
	Torque limit	V	0～+10(Torque is limited to 100% at +3.3 V input.)		
Poition control	Pulse train command		90° Phase difference 2 phase pulse/ Directional pulse/ Direction signal + Feed pulse Line driver method: Max. 250 Kpps Open collecter method: Max. 200 Kpps		
	Pulse output		90° Phase difference 2 phase pulse signal + Marker signal Output style: Line driver output		
Protective function			Encoder fault, Overspeed, Over load, Under Voltage, Over Voltage, IPM fault, Deviation overflow, CPU fault (Alarm code is displayed in front panel data display when each protective function acts.)		
Input signal			Start(DR), Servo ON (SON), Torque limit(TL), Proportional control (PC), Reset(RES),Pulse train selection(PLS), Count inhibit(CIH)		
Output signal			Servo ready(RDY), Alarm(ALM), Positioning complete(PN)		
Option			Various cables, Regenerative resistor		
Applicable motor			NA70-10**Z NA70-20**L	NA70-10**Z NA70-40**M NA70-20**M	NA70-60**M
Applicable DG^2			30 times or less of motor GD^2		
Power source capacity (3000rpm)		KVA	100W: 0.33 / 200W: 0.52 / 400W: 0.92 (At rated torque output)		600W: 1.30 (Same as left type)
Weight		Kg	About 1.2		About 1.7
Dimension (W×D×H)		mm	55×153×160 (Excludes tolerance and projections.)		67×153×160 (Same as left type.)

[Tab.１０－３] Electric Specification of Unit

＊１：Motor may not run smoothly at 1/ 2000 of rated speed.
Speed control range is defined that a motor will not stop with 100% load in the range.
＊２：Input power source Voltage AC100V or AC200V is the value in controlling.

１０－１－５ Unit Outline Drawing

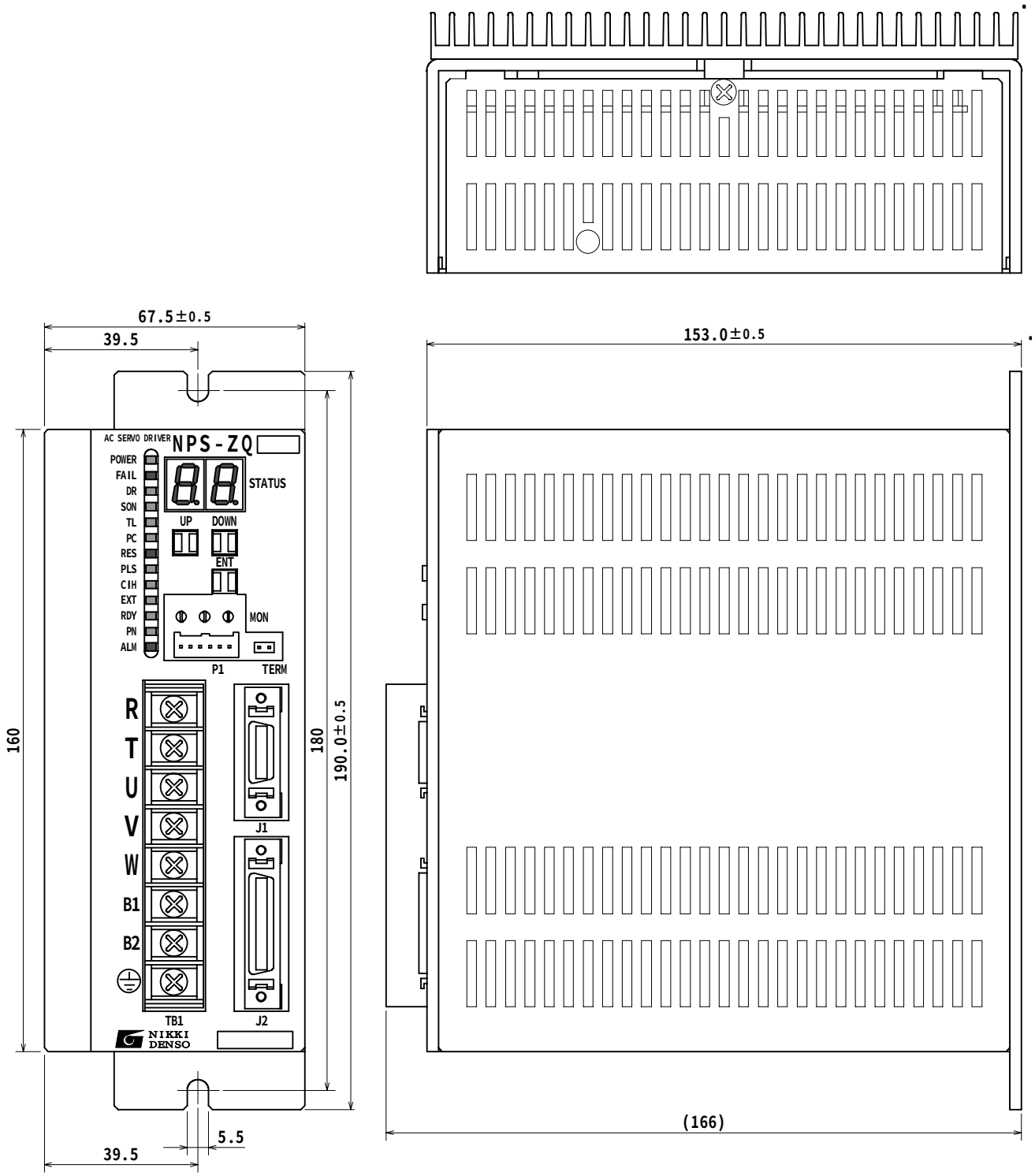
≪ＮＣＲ－ＤＢＡ２Ａ１＊－２０１，ＮＣＲ－ＤＢＡ２Ａ２＊－４０１≫



[Fig.１０－１]　Unit Outline Drawing (200W,400W)

１０－１－５ Unit Outline Drawing

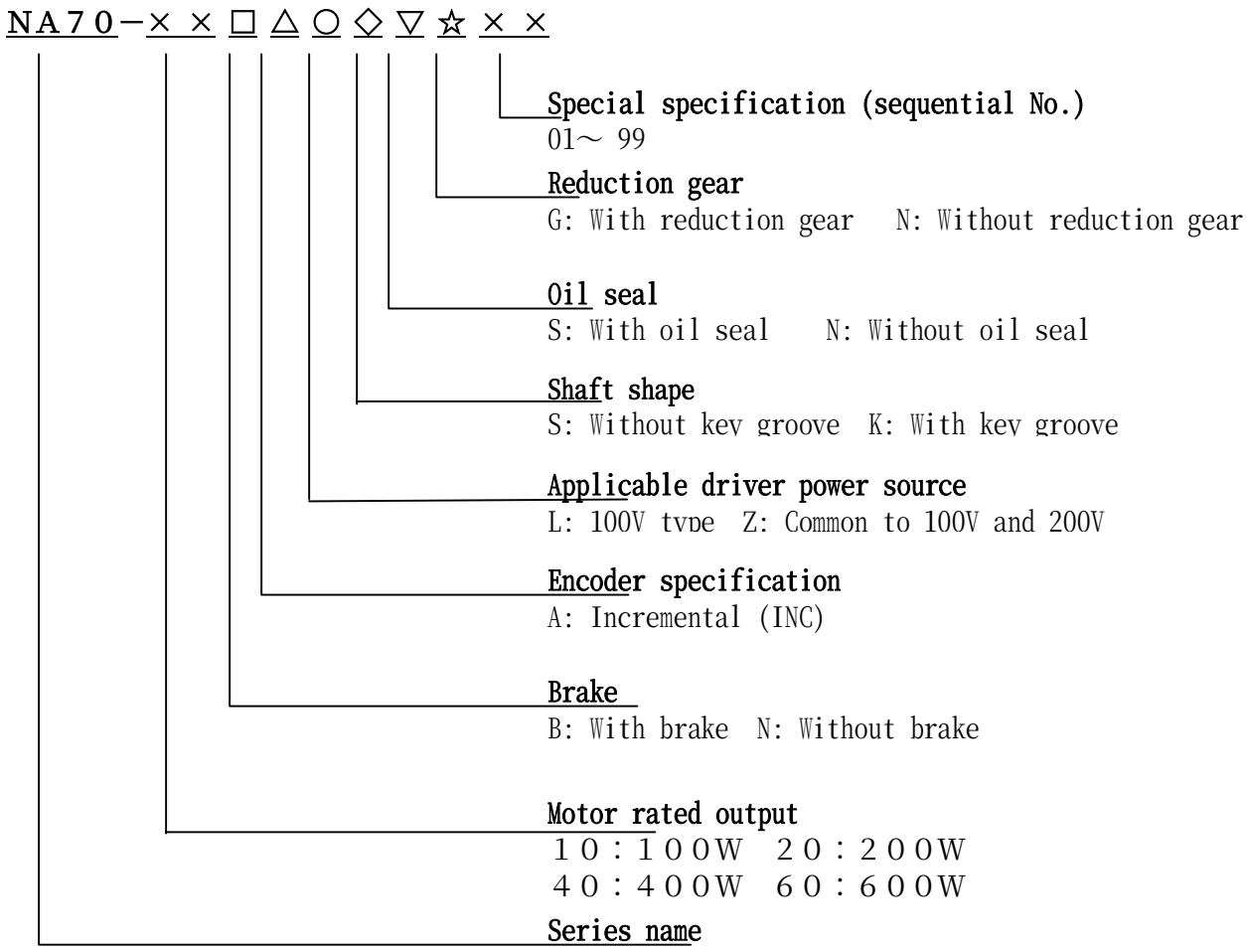
≪ＮＣＲ－ＤＢＡ２Ａ２＊－６０１≫



[Fig.１０－２] Unit Outline Drawing (600W)

１０－２　Motor Specification

１０－２－１　Motor Type



- All the NA70 series motors are frange mounting type.
- Rated speed of all the motors is 3000 prm.

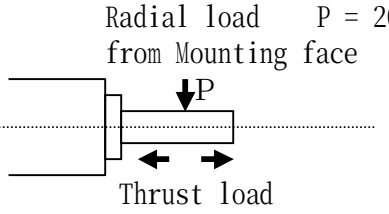
１０－２－２ Motor General Specification

Item		Contents
Outline		Refer to [10-2-4 Motor Outline Drawing] .
Environmental conditin	Temperature	0～ +40℃
	Humidity	20～ 80% RH none-condensing
	Location	Do not install it in harmful atmosphere as corrosive gas, grinding liquid, metal powder, oil, etc.. Refer to [２－３ Motor Installation] .
Mounting method		Frange face mounting
Mounting attitude		Horizontal, downward shaft, upward shaft*1
Protection type		IP44 or equivalent (exept output shaft section)
Cooling method		Natural air cooling
Paint color		Black half frosted paint color
Rotating direction		Both directions
Insulation class		Class B
Withstand voltage		AC1000V 1 minute
Insulation resistance		DC500V 100MΩ or more
Vibration resistance		5G or less X,Y,Z, each 2 hours, 10～2000 Hz,but no resonance (2.5 G or less in motor stop status) (includes encoder)
Shock resistance		10G X,Y,Z, each 3 times, (includes encoder)

[Tab.１０－４] Motor General Specification

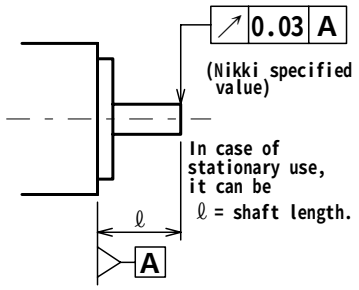
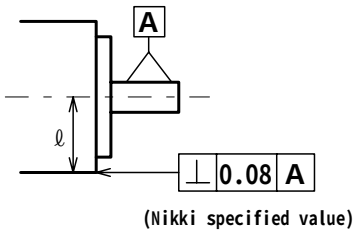
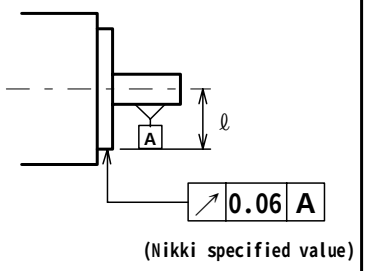
Motor type	Output [w]	Radial load	Thrust load	Thrust load direction
ＮＡ７０－１０	１００	８ [kgf]	４ [kgf]	Bi-lateral
ＮＡ７０－２０	２００	２０ [kgf]	７ [kgf]	Bi-lateral
ＮＡ７０－４０	４００	２０ [kgf]	７ [kgf]	Bi-lateral
ＮＡ７０－６０	６００	３５ [kgf]	１０ [kgf]	Bi-lateral

※ Values in the above tabulation is indicated in motor running status.



Note: If thrust load and radial load are applied at once, valus in the tabulation are different.

[Tab.１０－５] Motor Output Shaft Allowable Load

		
Deflection of output shaft against frange face.	Squareness of frange face against output shaft	Deflection of in-load against output shaft

Values in figures are applicable when $\ell \leqq 100$ In case of $\ell > 100$, value is specified value $\times \sqrt{\ell/100}$

[Tab. 10－6] Machining Accuracy of Motor Output Shaft

１０－２－３ Motor Specification

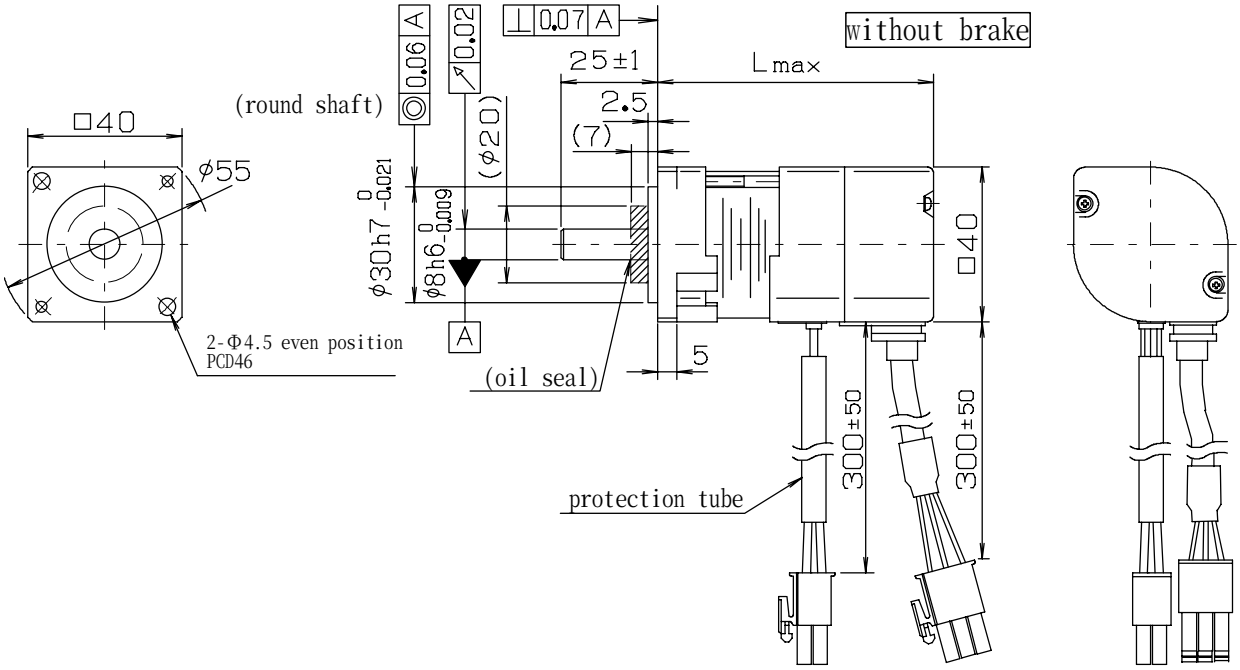
Item	Unit	NA70-10**Z	NA70-20**L	NA70-20**M	NA70-40**M	NA70-60**M
Appliable driver power souece		100V/200V common	100V type	200V type		
Rared output *1	W	１００	２００		４００	６００
Number of poles	P	8				
Rated speed *1	ｒｐｍ	３０００				
Rated torque *1	N・m (kgf・cm)	0.318 (3.25)	0.64 (6.5)	0.64 (6.5)	1.27 (13)	1.91 (19.5)
Momentary max. torque *2	N・m (kgf・cm)	0.95 (9.7)	1.91 (19.5)	1.91 (19.5)	3.82 (39)	5.73 (58.5)
Rated current*1	A(rms)	１．５	３．２	１．４	３．２	４．２
Rotor inertia	$[GD^2/4]Kg\cdot m^2 \times 10^{-4}$	0.042	0.20	0.20	0.36	1.00
	$gf\cdot cm\cdot s^2$	0.043	0.20	0.20	0.37	1.02
Eletric time constant	ｍｓ	１．４	３．５	３．５	３．８	６．４
Mechanical Time constant	ｍｓ	０．７	０．７	０．７	０．５	０．６
Power rate	kW／ｓ	２４．１	２０．７	２０．７	４４．８	３６．５
Momentary max, current	A(rms)	４．５	９．６	４．２	９．６	１２．６
Induced voltage constant	$V/rpm\times10^{-3}$ ±10%	７．７	７．１	１６．８	１４．５	１６．３
Torque constant	N・m／A±10%	０．２２	０．２０	０．４８	０．４２	０．４７
	kgf・cm／A±10%	２．２	２．１	４．９	４．２	４．８
Phase resistance	Ω ±１０%	２．５	０．５	２．５	０．８	０．４
Phase inductance	mH±３０%	３．３	１．６	９．０	３．０	２．７
Insulation class		Class B				
Cooling method		Enclosed self cooling				
Weight	ｋｇｆ	０．５	１．１	１．１	１．６	２．６
Applied driver		NCR-DBA2A1*-201		NCR-DBA2A2*-401		NCR-DBA2A2 *-601
		NCR-DBA2A 2*-401				

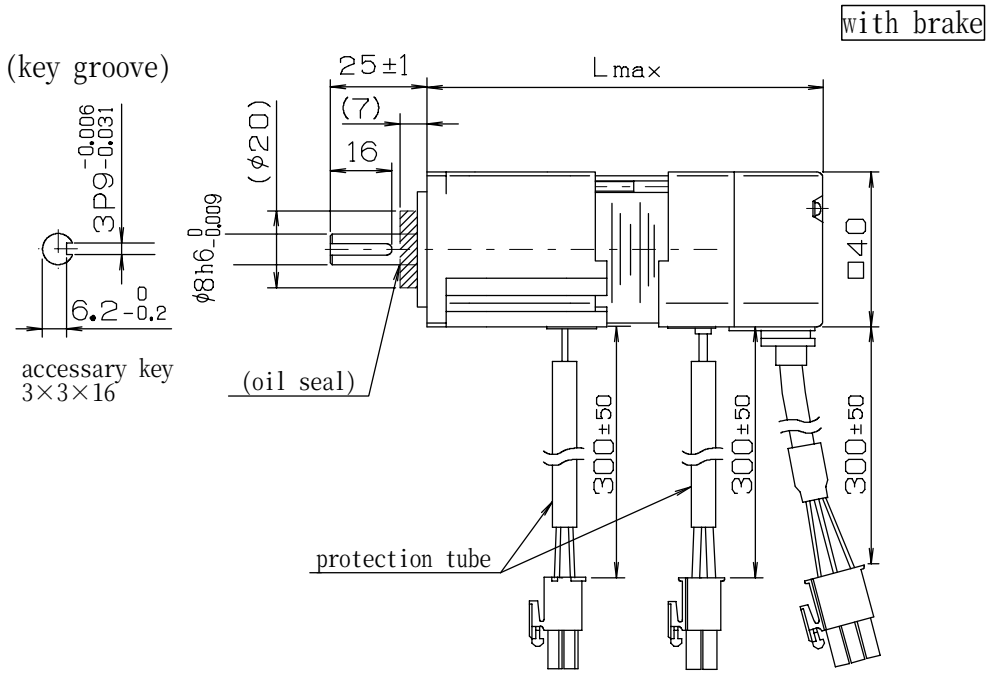
[Tab.１０－７] Motor Specification

＊1: Values of specification are defined with specified heat sinks at ambient temperature 40°C.
Heat sink dimension : NA70-10・・・・・・・・・・・・・200×200×T6 Aluminum plate
NA70-20, NA70-40・・・・250×250×T6 Aluminum plate
NA70-60・・・・・・・・・・・・・300×300×T6 Aluminum plate

＊2: The shown momentary torque is motor own.
The value combined with a driver can be referred to specification of drivers.

１０－２－４ Motor Outline Drawing
《１００W》





L section dimension

Rated output	NA70-10
With brake	89. 5
Without brake	120. 5

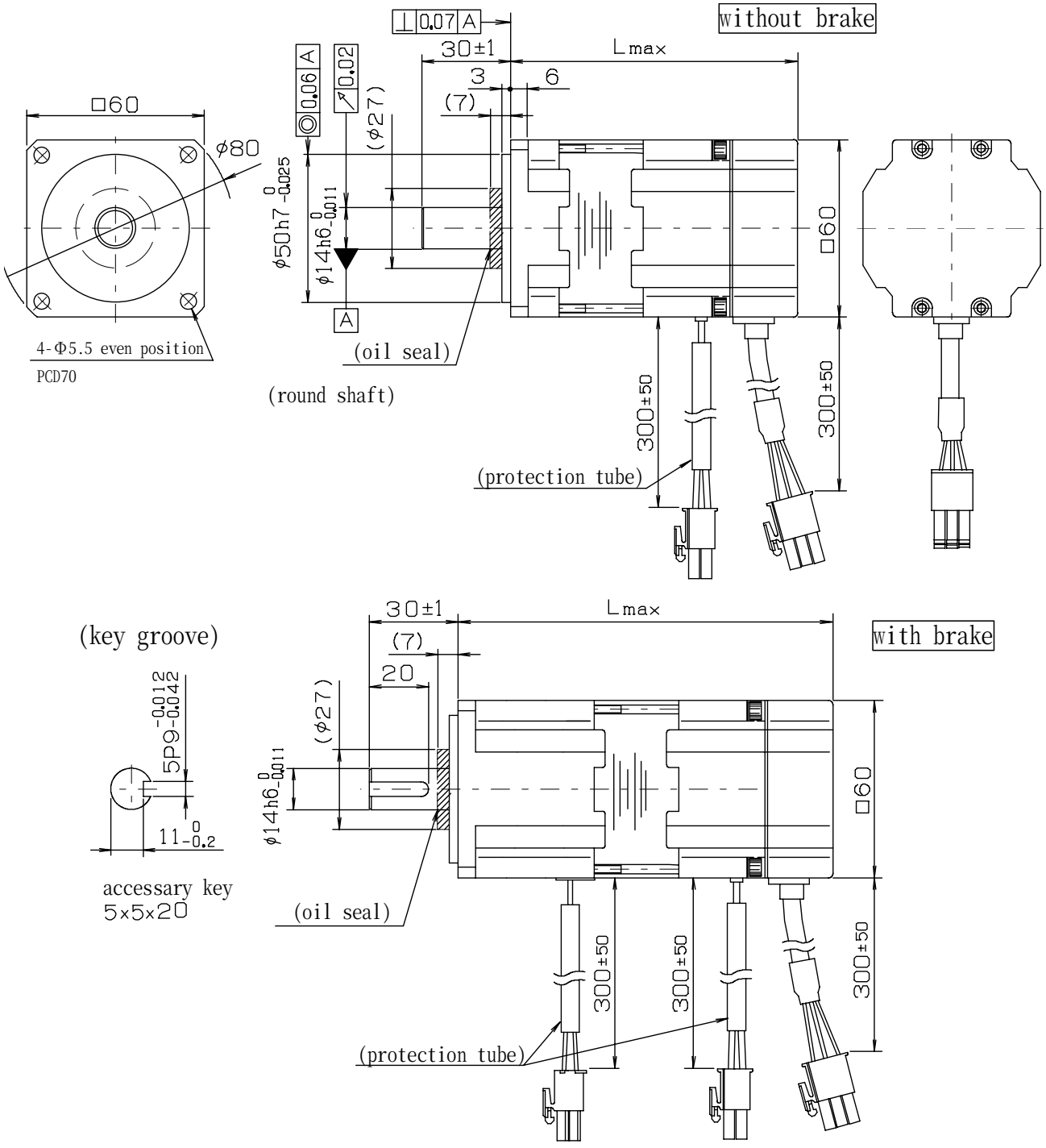
(Unit: mm)

※ Paint color: Black half frosted paint color

※ A shaft without key groove is standard. If a shaft with key groove is necessary, please specify, separately.

[Fig.１０－３] Motor Outline Drawing (100W)

《２００W、４００W》



L section dimemsion

Rated output	NA70-20	NA70-40
Without brake	97	125
With brake	126.5	154.5

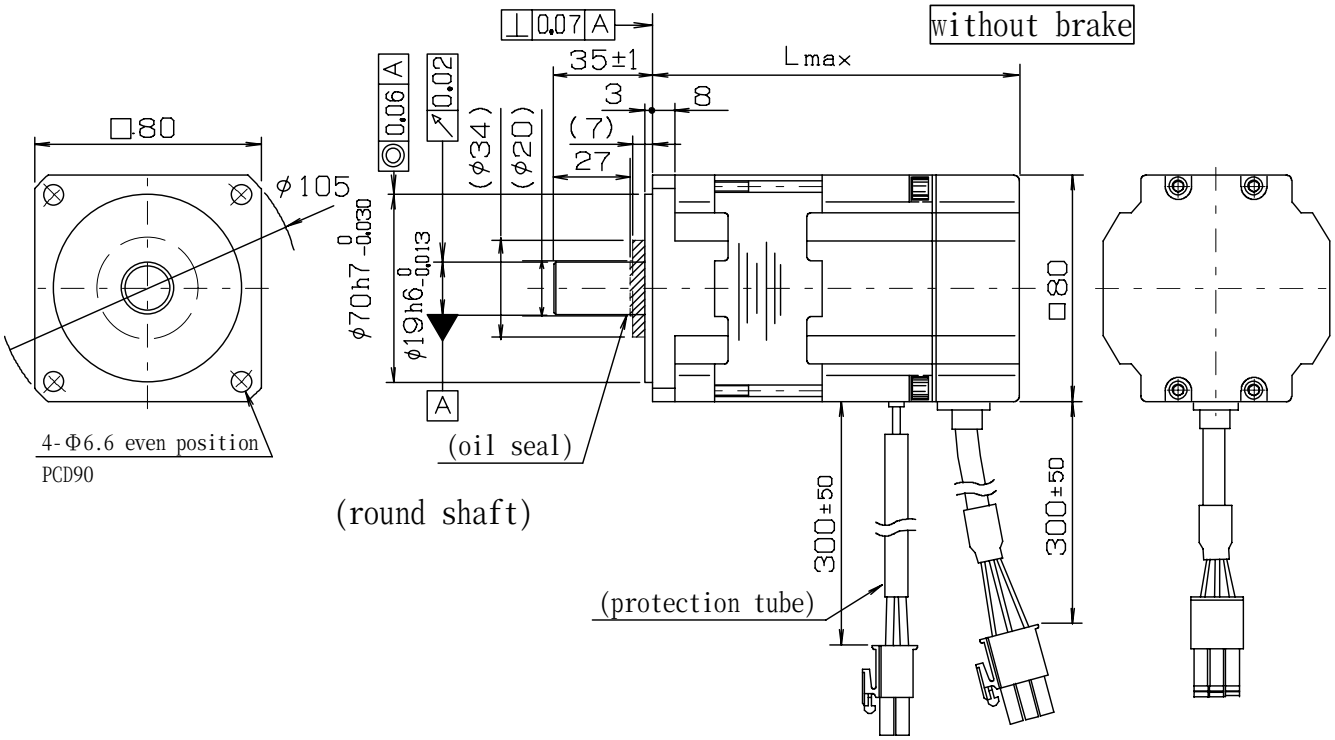
(Unit:mm)

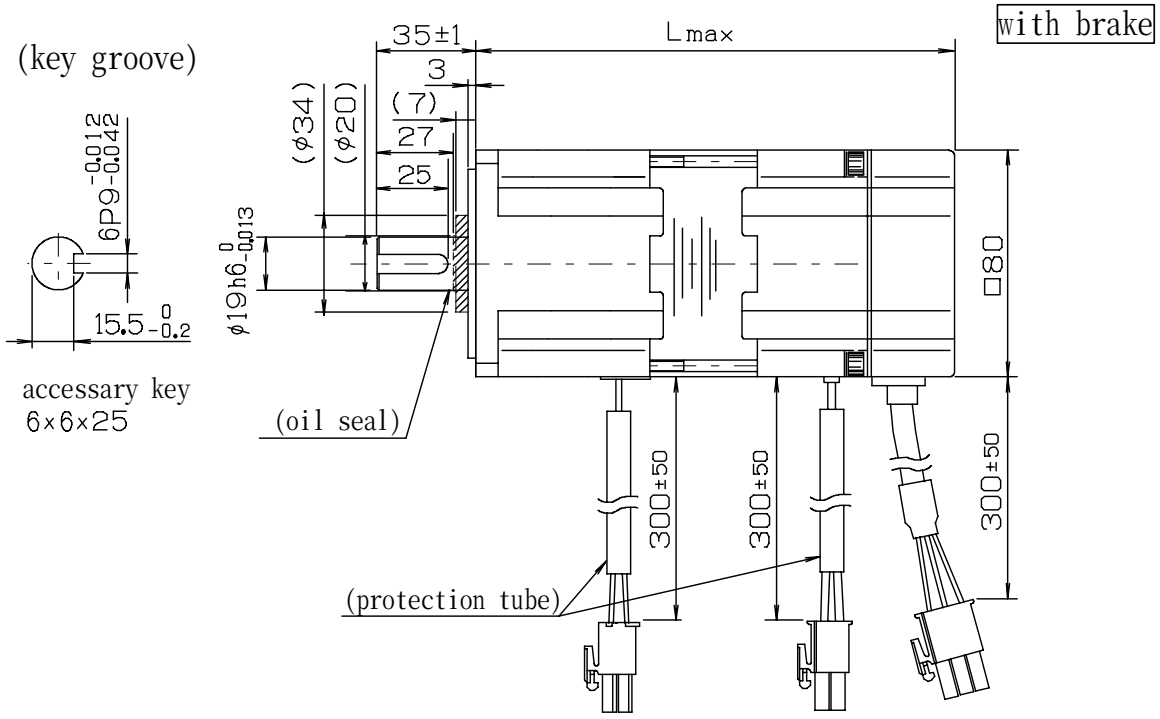
※ Paint color: Black half frosted paint color

※ A shaft without key groove is standard. If a shaft with key groove is necessary, please specify, separately.

[Fig.10－4] Motor Outline Drawing (200W,400W)

《６００W》





L section dimension

Rated output	NA70-60
Without brake	129
With brake	160

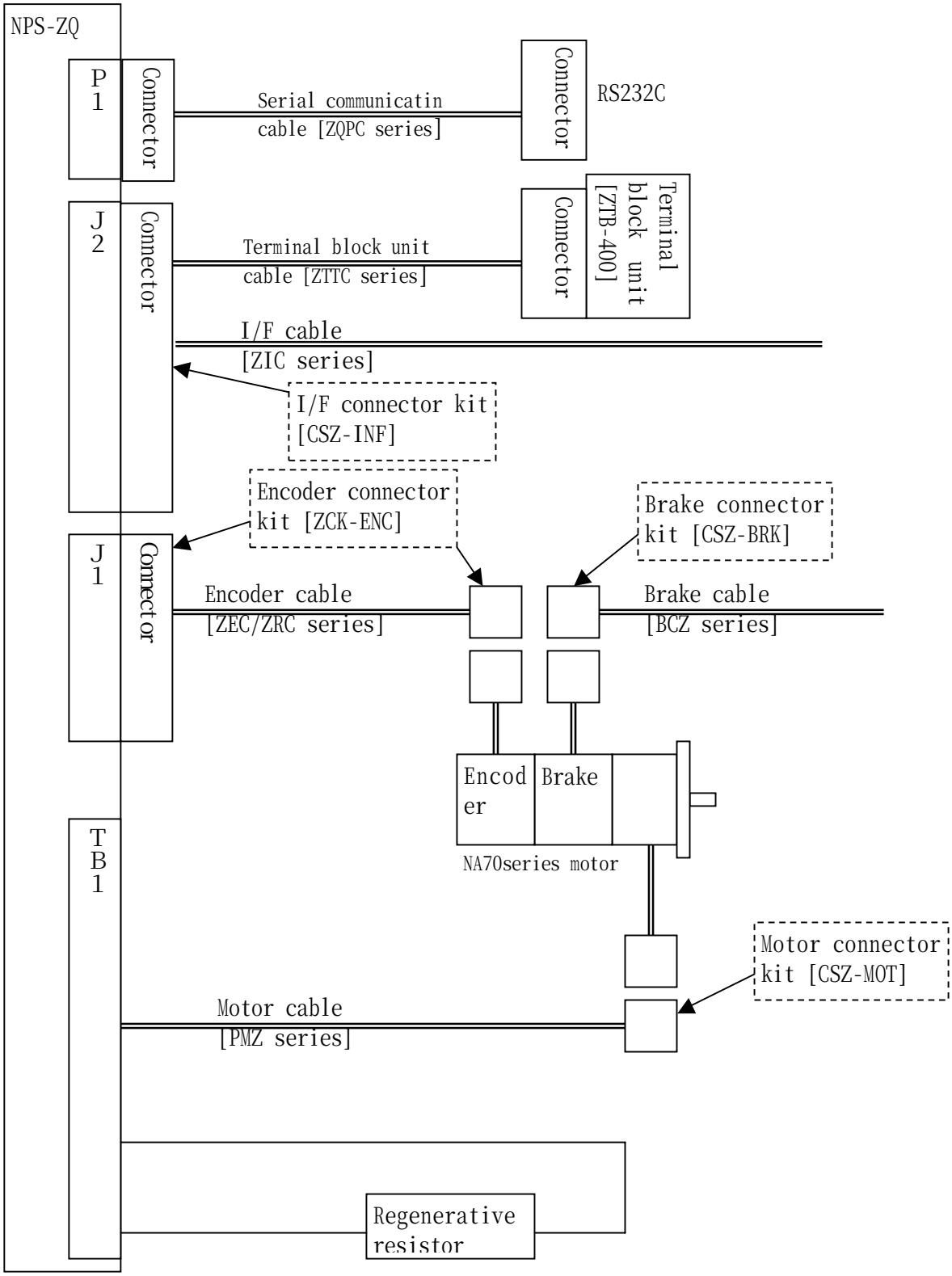
(Unit: mm)

※ Paint color: Black half frosted paint color
※ A shaft without key groove is standard. If a shaft with key groove is necessary, please specify, separately.

[Fig.10－5] Motor Outline Drawing (600W)

１０－３　Option

１０－３－１　Option Configuration



※ Option description can be referred to the instruction manual, [Volume: Option].