SERVO COMPASS

(ROUND TYPE LINEAR MOTOR)

Manual

Ver. 1.4

Nikki Denso Co., Ltd.

Document number: TI-14260

Preface

We would like to thank you for adopting the round type linear servo motor **<Servo Compass>**.

[Confirmation items]

1. Inspection at delivery
   Check the following items when receiving our motor:
   (1) Is the motor what you ordered? (Check the model number, rated output, combined driver, accessories, etc.)
   (2) Is no portion damaged during transportation? (Is packing free from breakage? Is the motor free from abnormalities in appearance?)
   (3) Does the motor come with accessories?

   * If you find a packing material such as a cardboard box being broken, contact our sales representative without unpacking the motor.
   If you find any abnormality listed above, contact our sales representative immediately.

2. Precautions before installation (during transportation)

   * When transporting the motor, handle it with care so as not to damage it.

   * Precautions
   Do not stack motors or put anything on the motor.
   Do not apply any shock to the motor.
   Do not handle the motor cable to transport the motor. → This action may cause cable disconnection.

3. Precautions in storage
   Store our motor in an environment in which the following conditions are satisfied if not used for some time after delivery to prevent insulation deterioration and rusting. Immediately after delivery, unpack the motor and be sure to confirm that there is no abnormality caused during transportation including damage on the motor.

Item		Description
Ambient conditions	Temperature	-10°C to +60°C
	Humidity	85% or less (no condensation allowed)
	Storage place	Store the motor at a clean and dust-free place. Do not store the motor in any harmful atmosphere such as corrosive gas, cutting oil, metal dust, or oil.
Vibration		Store the motor in a place where there is no vibration.
Others		The period during which rust prevention treatment is effective is within three months after the shipment from our factory under the above ambient conditions. If you want to store the motor longer, perform rust prevention treatment and periodic inspection.

Motor storage conditions

4. Preventions in transportation

If you want to transport our motor after delivery, transport it under the following conditions.

Item		Description
Ambient conditions	Temperature	-10°C to +60°C
	Humidity	85% or less (no condensation allowed)
	Storage area	Do not transport the motor in any harmful atmosphere such as corrosive gas, cutting oil, metal dust, or oil.
Vibration		0.5 G or less

Motor transportation conditions

⚠ Caution
Storage and transportation at a humidity of 65%RH or less is recommended. If the humidity is higher than 65%RH, contact our sales representative.

[About this manual]

This manual describes the specifications, rotating directions, installation, precautions for use, and others of the servo compass.

To use the motor properly, understand the contents of this manual completely.

When performing installation, operation, and other work, follow the conditions and procedures described in this manual.

When using a pole sensor, read "τ Linear Servo Motor Option Manual" in addition to this manual.

When using a customized motor, read the specifications for the customized motor in addition to this manual.

If the description of an item differs between the specifications and this manual, follow the description in the specifications.

[About the warranty period]

The warranty period for our product is one year from the date of shipment.

However, note that failures and abnormalities resulting from the following causes are not covered by this warranty:

① Modifications by the customer
② Improper use different from the description in this manual
③ Natural disasters
④ Improper connection with any manufacturer's product not approved by Nikki Denso

If you find a failure or abnormality during or not during the warranty period, contact our sales representative.

*** Nikki Denso Co., Ltd. reserves the right to revise this manual at any time. Information in this manual is subject to change without notice.**

Although the information from Nikki Denso is correct and reliable, Nikki Denso assumes no responsibility for the use of the information unless specially guaranteed by Nikki Denso.

Safety precautions

Before performing installation, wiring, operation, maintenance, and inspection, diagnosing abnormalities, and taking action against them, be sure to read this manual and other related instruction manuals thoroughly and use the motor properly.

After getting the proper and adequate knowledge of the motor and understanding the safety information and precautions, use the motor.

In this manual, safety precautions are ranked in the following two categories: "Danger" and "Caution". And, handling precautions are classified in "Prohibition" and "Compulsion". "Action not to be done" is defined as "Prohibition" and "action to be done" is defined as "Compulsion".

Danger : Mishandling may cause a dangerous situation, which could lead to user's death or serious injury.

Caution : Mishandling may cause a dangerous situation, which could lead to user's medium or light injury or property damage.

An item marked with Caution could also lead to serious results depending on the actual situation. Be sure to follow any item marked with Danger or Caution since it describes an important precaution.

Prohibition : **Action not to be done**
If this precaution is ignored, the motor does not operate normally.

Compulsion : **Action to be done**
If this precaution is ignored, the motor does not operate normally.

[Cautions for using the motor]

⚠ Danger

☆ **To avoid the danger of electric shock and injury, be sure to follow the instructions below.**

① Make sure to ground the ground terminal or ground wire of the motor.
Use a ground wire with at least the thickness specified in this manual and apply at least class 3 grounding.
"Electric shock may occur".

② Do not damage the cable, pull it forcibly, apply excessive force to it, put any heavy thing on it, or let it get caught in something.
"Electric shock may occur".

③ Never touch the motor while it is running.
"Injury may occur".

④ Do not touch the terminal for five minutes after a withstand voltage test or insulation resistance test.
"Electric shock may occur".

⚠ Caution

① Use the motor in combination with the specified driver and controller.
"Fire or failure may occur".

② Never use the motor in a place where it will get water, in a corrosive or flammable gas atmosphere, or near a combustible material.
"Fire or failure may occur".

③ The motor, driver, controller, and peripheral devices are very hot during operation. Do not touch them.
"Burn injury may occur".

④ The motor could be very hot while the power is being supplied and for a while after the power is turned off. Do not touch it.
"Burn injury may occur".

[Receiving and checking the motor]

⚠ Caution

① When you receive the motor, if it is not what you ordered or the quantity of any item is not correct, contact our sales representative without using the motor.
"Electric shock, injury, damage, fire, or failure may occur".

② If you find a packing material being broken, notify our sales representative of the fact without unpacking the motor.
"Electric shock, injury, damage, fire, or failure may occur".

[Storage]

Prohibition

Do not store the motor in a place exposed to rain, water, or poisonous gas or liquid.
"Failure may occur".

[Storage]

Compulsion

① Store the motor in a place free from direct sunlight at a temperature and humidity within the ranges specified in this manual.
"Failure may occur".
② When the motor is stored for more than three years after purchased, be sure to contact our sales representative.
"Failure may occur".

[Transportation]

Caution

When transporting the motor, do not hold the cable or motor shaft.
"Injury or failure may occur".

Compulsion

Overloading products may cause load to drop. Follow the instructions.
"Injury or failure may occur".

[Installation]

Caution

① Do not climb on the motor or put any heavy thing on it.
"Injury or failure may occur".
② Prevent foreign matters from getting into the motor.
"Fire may occur".
③ Make sure to install the motor in the specified orientation.
"Fire or failure may occur".
④ Do not apply strong impact to the motor.
"The motor may be damaged".
⑤ Install the motor appropriately according to the output or weight of the main unit.
"The motor may be damaged".
⑥ Install the motor on an incombustible material such as metal.
"Fire may occur".
⑦ Use the motor in an environment free from dust.
⑧ Firmly fix the motor on a mounting surface with enough rigidity.
Protect the installed motor so that it does not get hit by articles such as dropping items.

[Wiring]

⚠ Caution

① Make sure to conduct correct wiring.
"Motor runaway or burning, injury, or fire may occur".
② To avoid the effect of noise, use cables having lengths and following specifications (shielded, twisted, and/or other treatment applied) that are specified in the driver and controller manuals.
"Motor runaway, injury, or damage to the machine may occur".
③ To prevent electric shock and avoid the effect of noise, make sure to perform proper grounding.
"Motor runaway, electric shock, injury, or damage to the machine may occur".

[Operation]

⚠ Caution

① The motor has no protective device. Use an overcurrent protection device, ground-fault circuit interrupter, thermal overtemperature control device, and emergency stop device for protection.
"Injury or fire may occur".
② Make sure that the combination of the motor, driver, and controller is correct.
"Injury, fire, or damage to the machine may occur".
③ Before performing trial operation, fix the motor, separate the motor from the load system, and confirm the operation. Then, mount the load system.
"Injury or damage to the machine may occur".
④ Extreme adjustment or change may make operation unstable. Be careful when making such adjustment or change.
"Injury or damage to the machine may occur".
⑤ When an alarm occurs, reset the alarm. Make sure to remove the cause before restarting the motor.
"Injury or damage to the machine may occur".
⑥ At the recovery from an instantaneous interruption, the machine may restart suddenly. In this case, keep away from the machine.
(Design the machine so that the safety of workers is ensured at the restart of the machine.)
"Injury may occur".
⑦ If any hazardous situation is assumed when the motor stops or fails, install an external braking mechanism to avoid accident.
"Injury or damage to the machine may occur".

⃠ Prohibition

Do not turn the power on in the motor driven or vibrated status.
"Motor runaway, injury, or damage to the machine may occur".

❗ Compulsion

Configure an external emergency stop circuit to stop operation and shut down the power immediately.
"Injury or damage to the machine may occur".

[Maintenance and inspection]

⃠ Prohibition

The motor shall be overhauled only by Nikki Denso or by a company specified by Nikki Denso.
"A failure may be caused".

NIKKI DENSO

Contents

1. Outline

1-1. Features

Coreless linear motor

A coreless linear motor can make smooth movement possible since its coil unit does not have magnetic materials, so no attraction is generated and the speed ripple and cogging can be suppressed.

Servo Compass (round type linear motor)

For the Servo Compass, a linear motor is designed to shape an arc having a large power radius to provide the same torque as with a conventional large-torque motor with a small-capacity linear motor. The Servo Compass can consist of as many components (magnets and coils) as for the required operation angle. So, the Servo Compass enables a simple and high-rigid stage peripherally driven and supported that provides better cost performance compared with a stage using a large-torque motor.

For a rotary mechanism using the Servo Compass, the installation radius of the position sensor can be increased in the same way as for the driving position and support position to increase the resolution easily, which enables extremely high precision positioning.

The Servo Compass enables a large rotary alignment stage that provides good cost performance, has a simple configuration and high rigidity, and can perform ultrahigh precision indexing.

1-2. System configuration

The system configuration of the Servo Compass is shown below.

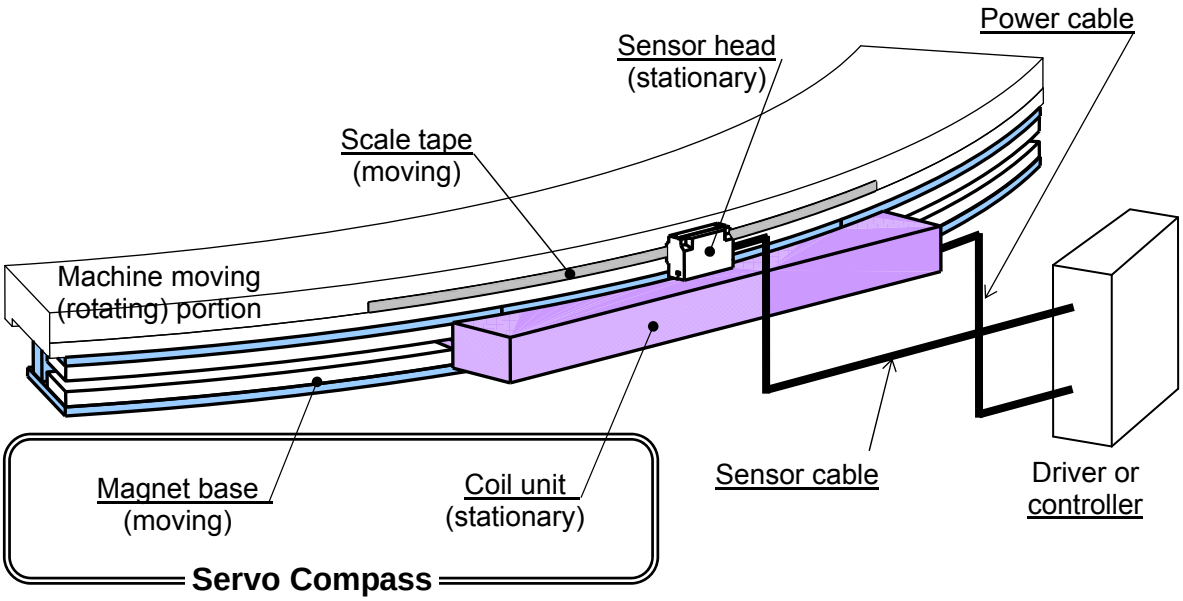


Figure 1. System configuration

2. Specifications

2-1. Model number

2-1-1. Motor model number

A model number of each Servo Compass series is shown below.

a. NVA series

NVA － ① ② ③ ④ ⑤ ⑥ － ⑦

Example) NVA － CMC850A2A － S02

① Motor type		② Magnet type		③ Coil unit type		④ Subtype	⑤ Voltage specification		⑥ Design order		⑦ Customized model	
C	Compass	M	———	C	180 model	Nominal radius	A1	AC 100	A	1st version	None	Standard model
				E	360 model		A2	AC 200	B	2nd version	S01 S02 ・ ・	Customized model (serial number)
										(serial number)		

b. NLD series

NLD － ① ② ③ ④ ⑤ ⑥ － ⑦

Example) NLD － CN53C A2A － S02

① Motor type		② Magnet type		③ Coil unit type		④ Subtype Nominal radius		⑤ Voltage specification		⑥ Design order		⑦ Customized model	
C	Compass	N	———	53	530 model	C	R200	A1	AC 100	A	1st version	None	Standard model
								A2	AC 200	B	2nd version	S01 S02 ・ ・	Customized model (serial number)
											(serial number)		

2-1-2. Magnet base (called MG base below) model number

The model number of an MG base for each series is shown below.

a. NVA series

MBV － ① ② ③ ④ ⑤ － ⑥

Example) MBV － CMA850A － S02

① Motor type		② Magnet type		③ Magnet base type		④ Subtype	⑤ Design order		⑥ Customized model	
C	Compass	M	———	A	96 model	Nominal radius	A	1st version	None	Standard model
				E	288 model		B	2nd version	S01 S02 ・ ・	Customized model (serial number)
								(serial number)		

b. NLD series

MBD － ① ② ③ ④ ⑤－ ⑥

Example) MBD － CN14C A－ S02

① Motor type		② Magnet type		③ Magnet base type		④ Subtype Nominal radius		⑤ Design order		⑥ Customized model	
C	Compass	N	———	14	180 model	C	R200	A	1st version	None	Standard model
								B	2nd version	S01 S02 ・ ・	Customized model (serial number)
									(serial number)		

2-1-3. Coil unit (called CL unit below) model number

The model number of a CL unit for each series is shown below.

a. NVA series

CLV − ① ② ③ ④ ⑤ ⑥ − ⑦

Example) CLV − C M E 850 A2 A − S02

① Motor type		② Magnet type		③ Coil unit type		④ Subtype	⑤ Voltage specification		⑤ Design order		⑥ Customized model	
C	Compass	M	———	C	180 model	Nominal radius	A1	AC 100	A	1st version	None	Standard model
				E	360 model		A2	AC 200	B	2nd version	S01 S02 ・ ・	Customized model (serial number)
										(serial number)		

b. NLD series

CLD − ① ② ③ ④ ⑤ ⑥ − ⑦

Example) CLD − C N 53 C A2 A − S02

① Motor type		② Magnet type		③ Coil unit type		④ Subtype Nominal radius		⑤ Voltage specification		⑤ Design order		⑥ Customized model	
C	Compass	N	———	53	530 model	C	R200	A1	AC 100	A	1st version	None	Standard model
								A2	AC 200	B	2nd version	S01 S02 ・ ・	Customized model (serial number)
											(serial number)		

2-2. General specifications

The following table lists general specifications.

Table 1. General specifications

Item		Description
Ambient conditions	Temperature	0°C to 40°C
	Humidity	85% or less (No condensation allowed)
	Installation area	Do not install the motor in any harmful atmosphere such as corrosive gas, cutting oil, metal dust, or oil.
Installation orientation		Horizontal, vertical
Driving direction		Both directions
Cooling method		Natural cooling
Finished color		Magnet base: White Coil unit: White (unit mounting section), black (plastic section)
Insulation class		Class F
Dielectric strength voltage		1500 V (for 1 minute)
Vibration resistance		1 G (for 2 hours in each of three directions)
Impact resistance		5 G (three times for each of three directions)
Protection class		IP40 * For the coil unit only

2-3. Rated specifications

2-3-1. Rated specifications

The following describes rated specifications.

a. NVA series

Table 2-a. Rated specifications of the NVA series Servo Compass

Motor model	NVA-CM	C850A2A	E850A2A	E1550A2A
Rated tangential thrust	N	150*	300*	300*
Maximum tangential thrust	N	450*	900*	900*
Rated output	W	450	900	900
Power radius	mm	825		1525
Rated torque	Nm	123	247	457
Rated current	A	2.85	5.7	5.7
Maximum tangential speed	m/s	3.0**		
Power supply	ACV	200 VAC, three-phase, 50/60 Hz		
CL unit model	CLV-CM	C850A2A	E850A2A	E1550A2A
MG base model	MBV-CM	A850A	E850A	E1550A
VC driver	NCR-DA	B0A2C401D	B0A2C801D	B0A2C801D
VC controller	NCR-CA	B0A2C401D	B0A2C801D	B0A2C801D

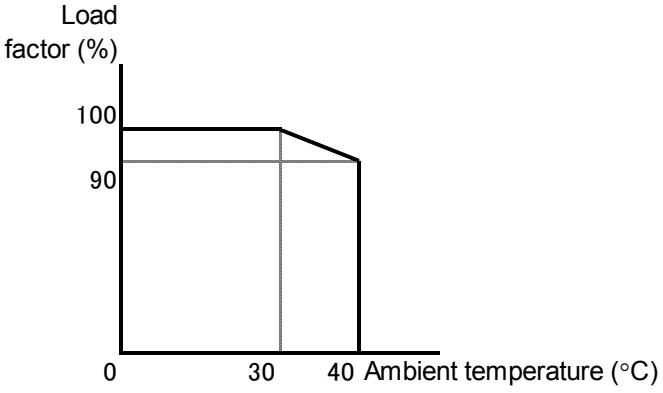
* Thrust for the power radius ** Speed for the power radius

The specification values listed above are measured at an ambient temperature of 25°C when the Servo Compass mounted on the following heatsink (aluminum plate) operates:

Heatsink size	Applicable CL unit(s)
250 × 250 × 15 mm	CLV-CMC850A2A
450 × 450 × 15 mm	CLV-CME850A2A, CLV-CME1550A2A

Load factor-ambient temperature characteristics

The following figure shows Servo Compass characteristics for ambient temperatures.



(For details including setting in the derating mode, see "5-2. Operation".)

Load factor-operation characteristics

Derating may be applied depending on the operation condition. For the condition and setting, see "5-2. Operation".

b. NLD series

Table 2-b. Rated specifications of the NLD series Servo Compass

Motor model	NLD-CN	53CA2A
Rated tangential thrust	N	120*
Maximum tangential thrust	N	360*
Rated output	W	360
Power radius	mm	178
Rated torque	Nm	21.3
Rated current	A	2.8
Maximum tangential speed	m/s	3.0**
Power supply	ACV	200 VAC, three-phase, 50/60 Hz
CL unit model	CLD-CN	53CA2A
MG base model	MBD-CN	14CA
VC driver	NCR-DA	B0A2C401D
VC controller	NCR-CA	B0A2C401D

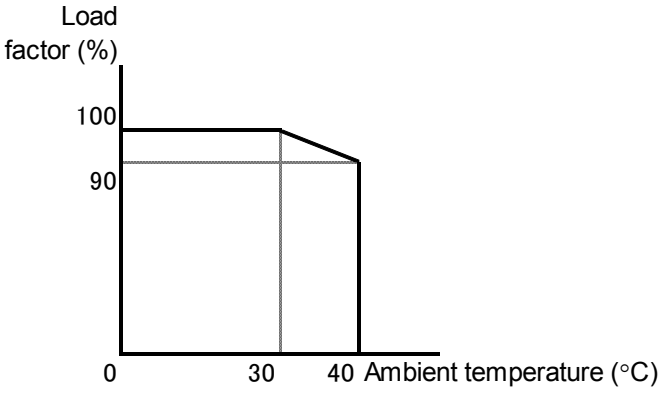
* Thrust for the power radius ** Speed for the power radius

The specification values listed above are measured at an ambient temperature of 25°C when the Servo Compass mounted on the following heatsink (aluminum plate) operates:

Heatsink size	Applicable CL unit
450 × 450 × 15 mm	CLD-CN53CA2A

Load factor-ambient temperature characteristics

The following figure shows Servo Compass characteristics for ambient temperatures.



(For details including setting in the derating mode, see "5-2. Operation".)

Load factor-operation characteristics

Derating may be applied depending on the operation condition. For the condition and setting, see "5-2. Operation".

2-3-2. Notes on the sensor used in combination with the Servo Compass

The angle resolution of the Servo Compass is determined according to the outer radius of the scale tape attached on an arc (see "1-2. System configuration") and sensor resolution.

Note the following points for the sensor used in combination with the Servo Compass.

a. Notes on the sensor resolution and attached scale radius

For the sensor used in combination with the Servo Compass, follow the instructions below:

・**Attach the scale based on at least the nominal radius of each Servo Compass model and** with the outer radius of the scale not exceeding the value obtained by the following calculation formula. (For the nominal radius of each Servo Compass model, see "2-1. Model number".)

Outer radius of scale R ≤ 2,147,483,647 × resolution [mm]/2π × (360/θ_M)

θ_M of each motor model

Motor model	NVA-CN53CA2A	NVA-CM*850A2A	NVA-CM*1550A2A
θ_M	11.25°	1.72°	0.92°

・**Be sure to use a scale with a resolution of up to 0.5 μm.**

Example) When Servo Compass NLD-CN53CA2A series (with a nominal radius of 200) is used

・Attach the scale based on at least R200 mm with the outer radius of the scale not exceeding the following value.

When the sensor resolution is 0.5 μm

Outer radius of scale R ≤ 2,147,483,647 × 0.0005 [mm]/2π × (360/11.25)

Outer radius of scale R ≤ 5,468,522 [mm]

・Use a sensor with a resolution of up to 0.5 μm.

If you want to use a sensor which does not satisfy any of the above conditions, contact Nikki Denso.

b. Angle resolution

The angle resolution of the Servo Compass is determined according to the outer radius of the scale tape attached on an arc (see "1-2. System configuration") and sensor resolution.

Example) When the outer radius of the scale is 850.2 mm and the sensor resolution is 0.1 μm

Angle resolution = 360 [°]/(850.2 [mm] × 2π/0.0001 [mm])

= 6.74 × 10^-6 [°/pulse] = 0.024 [seconds/pulse]

2-3-3. Stroke angle

The stroke angle is obtained by the following formula:

Stroke angle [deg] = (total angle of MG base) - (angle of CL unit) - (angle required for pole sensor)

Angle required for a pole sensor for each motor model

Motor model	NVA-CN53CA2A	NVA-CM*850A2A	NVA-CM*1550A2A
Angle required for a pole sensor	7.4°	1°	0.55°

Caution: When automatic pole detection is performed without using a pole sensor, the motor moves in the positive and negative directions at up to the following angle during pole detection. When the required stroke angle is very small and smaller than the required operation angle listed below, set the total angle of the MG base so that this operation can be performed.

Operation angle required for automatic pole detection for each motor model

Motor model	NVA-CN53CA2A	NVA-CM*850A2A	NVA-CM*1550A2A
Required operation angle	±5.625°	±0.86°	±0.46°

Also, **use the CL unit and pole sensor within the operation range of the MG base.**

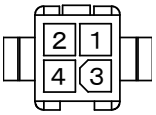
2-3-4. Note on performing operation at a very small angle

If the Servo Compass is operated (rotated) only at a very small angle for a purpose such as alignment, fretting corrosion (excessive abrasion) may be generated on the used guide. If you want to perform operation at a very small angle, consult with the manufacturer of the guide.

2-4. Wiring specifications

In the Servo Compass, MATE-N-LOK connectors are used for connecting terminals (U, V, W, and E) of the motor. Prepare wiring cable side connectors by yourself or use our options. The following table lists connector and contact model numbers, used wire, and pin configuration.

Table 3. Wiring specifications

<table>
<tr><td rowspan="2">Used connectors</td><td colspan="2">AMP mini-universal MATE-N-LOK connectors (4-pin) of AMP</td></tr>
<tr><td>Motor side connector</td><td>Wiring cable side connector</td></tr>
<tr><td>Connector main unit</td><td>Plug housing
172167-1</td><td>Cap housing
172159-1</td></tr>
<tr><td>Contact</td><td>Pin
170360-1 or 170364-1</td><td>Socket
170362-1 or 170366-1</td></tr>
<tr><td>Used wire</td><td>U,V,W,E: 0.75 mm^2</td><td>U,V,W,E: At least 0.75 mm^2</td></tr>
<tr><td>Wiring cable side pin configuration</td><td> 

View from the connection side</td><td>
<table>
<tr><th>Pin No.</th><th>Signal name</th></tr>
<tr><td>1</td><td>U</td></tr>
<tr><td>2</td><td>V</td></tr>
<tr><td>3</td><td>W</td></tr>
<tr><td>4</td><td>E</td></tr>
</table>
</td></tr>
</table>

3. Rotation direction

When the MG base is movable and the CL unit is fixed, for the rotation direction of the MG base, the direction opposite to the cable from the CL unit is determined to be the forward direction. (This is independent of the orientation of the MG base.)

* Installing the Servo Compass so that the forward direction of the Servo Compass and that of the linear sensor are the same. (Refer to the sensor specifications to check the rotation (driving) direction of the linear sensor. For our drivers, the Servo Compass moves in the forward direction when phase B is ahead.)

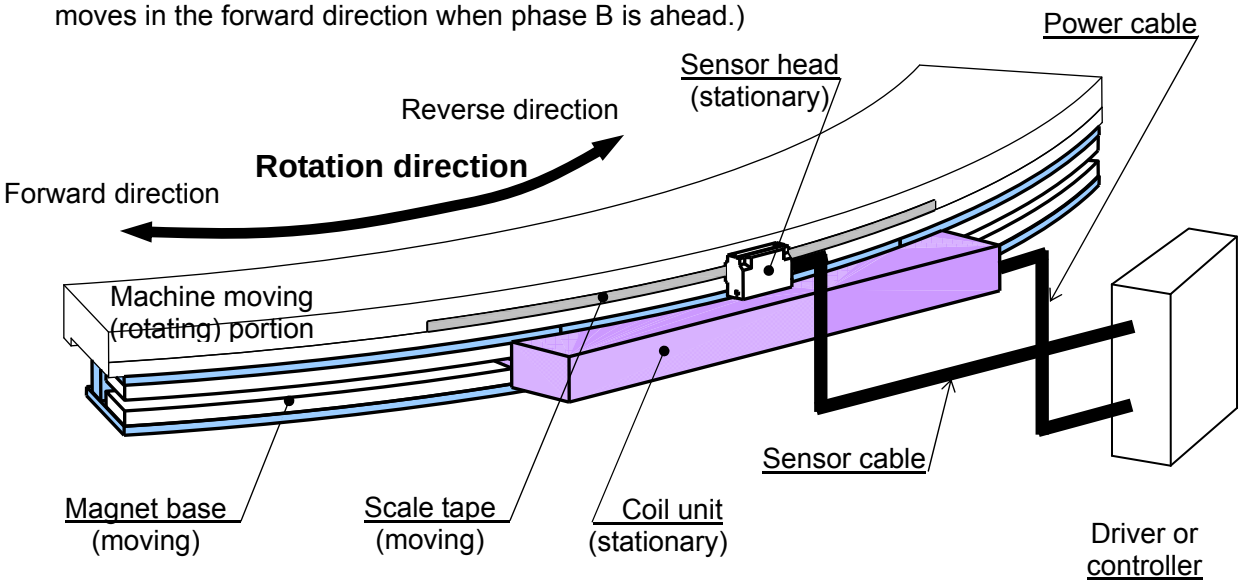


Figure 2. Rotation directions of the Servo Compass

Reference)

When you use a linear sensor (our option), the cable from the coil unit (power cable) and that from the sensor head (sensor cable) are connected in the same direction as shown in the figure above.

4. Installation

4-1. Mounting the MG base and CL unit

The following figures show mounting dimensions of the Servo Compass and recommended surface accuracy.

a. NVA series

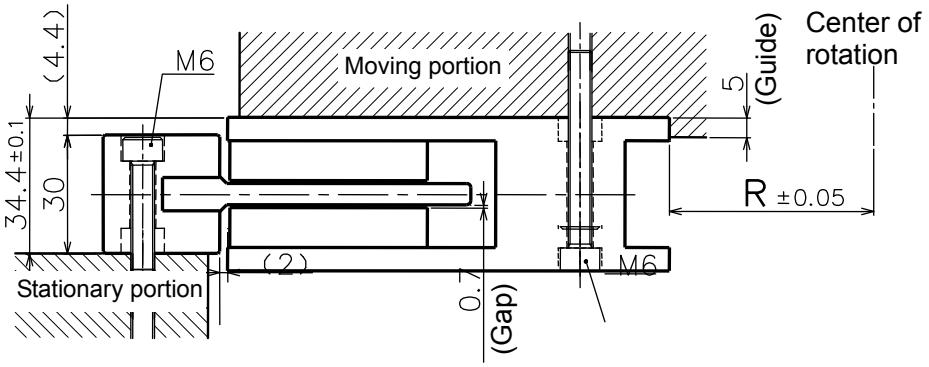


Figure 3a1. Mounting dimensions

Use a mounting guide (such as level differences and dowel pins) to mount the MG base and CL unit so that the dimensions and surface accuracy shown in the left figure are satisfied.

Mount the CL unit on a portion having a high heat capacity so that the heat from the coil can be transferred.

Motor model	NVA-CM*850A2A	NVA-CM*1550A2A
R	750mm	1450mm

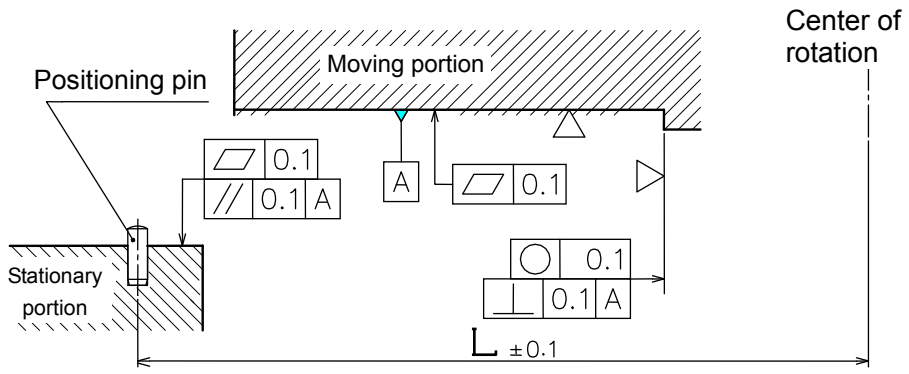


Figure 3a2. Recommended surface accuracy

* Remove foreign matters including remaining coating materials and burrs completely from the Servo Compass installation surfaces so that the surfaces are free from gaps and differences in level.

▽: Ry 50S (Rmax 50S)

Motor type	NVA-CM*850A2A	NVA-CM*1550A2A
L	872mm	1572mm

b. NLD series

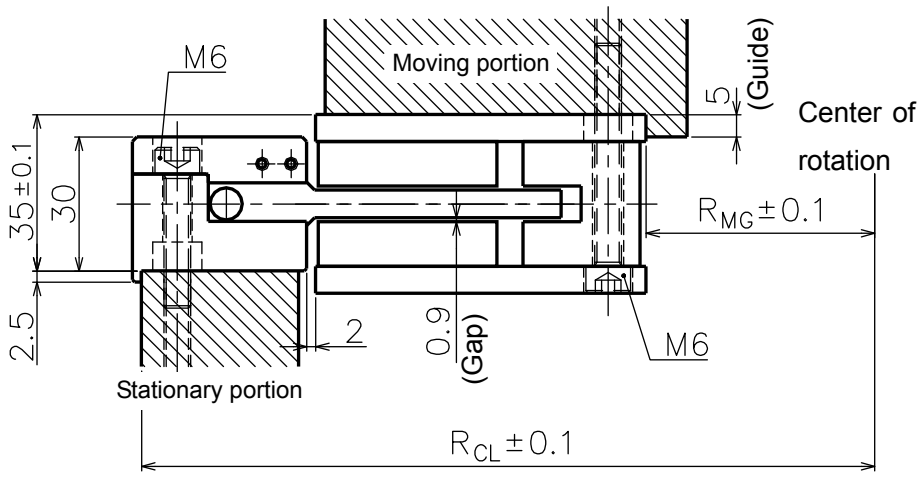


Figure 3b1. Mounting dimensions

Use a mounting guide (such as level differences and dowel pins) to mount the MG base and CL unit so that the dimensions and surface accuracy shown in the left figure are satisfied.

Mount the CL unit on a portion having a high heat capacity so that the heat from the coil can be transferred.

Motor model	R_{MG}	R_{CL}
NVA-CM*850A2A	125mm	238mm

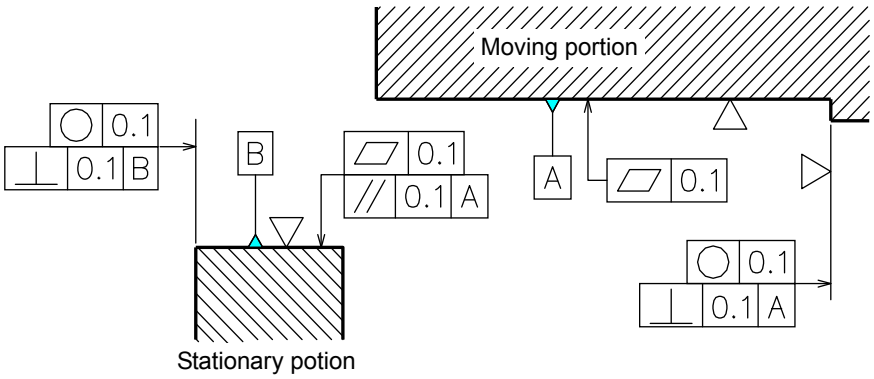


Figure 3b2. Recommended surface accuracy

* Remove foreign matters including remaining coating materials and burrs completely from the Servo Compass installation surfaces so that the surfaces are free from gaps and differences in level.

▽: Ry 50S
(Rmax 50S)

4-2. Corner shape

The following describes the "corner shape" of the MG base. Be careful about the "corner shape" when designing the target machine so that precise butting is made.

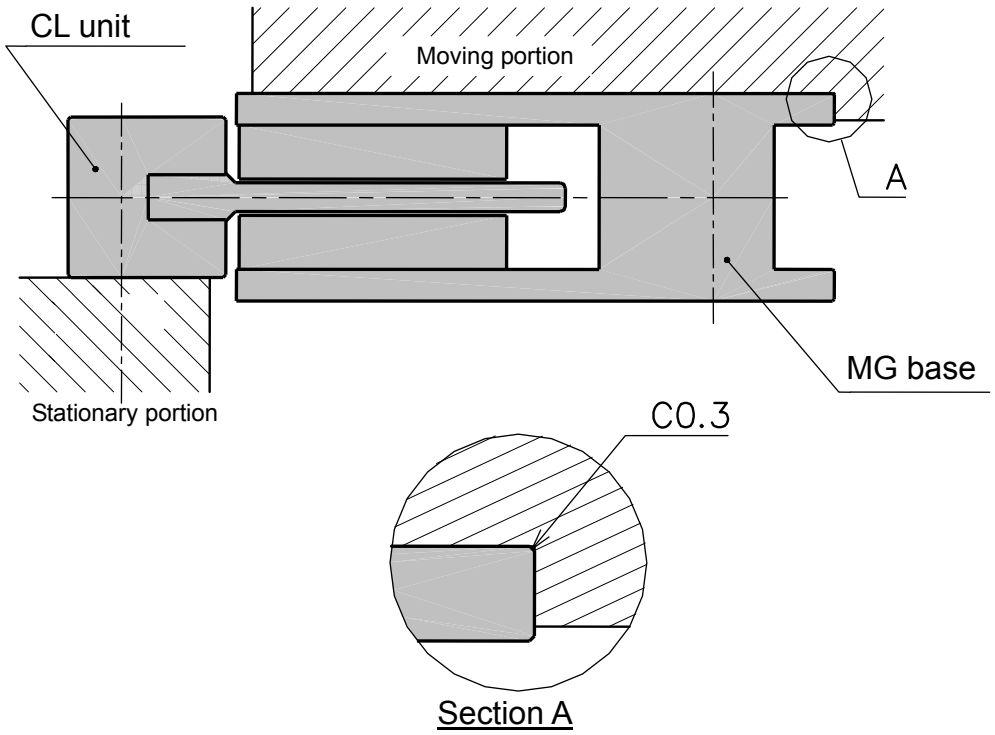


Figure 4. Corner shape

4-3. Connecting MG bases

Connect MG bases **from the left** in the descending order of size by following the procedure below.

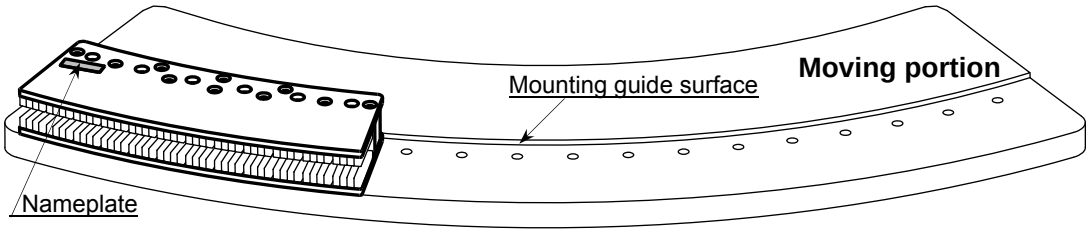


Figure 5a. Connecting MG bases ①

1) Fix the first MG base.

Align the first MG base with the mounting guide surface as shown in the figure above (with the nameplate side facing upward) and fix it.

2) Make the second MG base ready on the right.

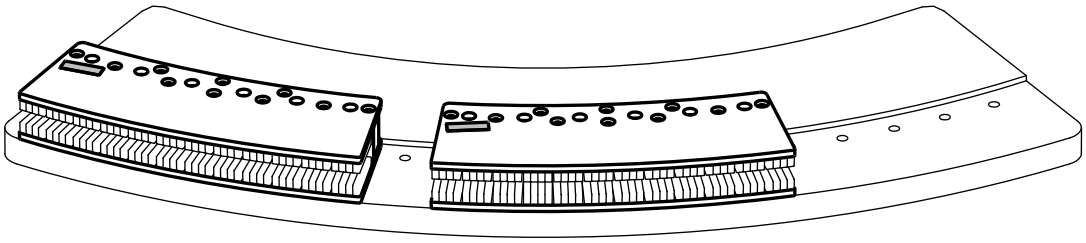


Figure 5b. Connecting MG bases ②

Place the second MG base to the right of the first MG base (side opposite to the nameplate side of the first MG base), but keep them away, and align it with the mounting guide surface as shown in the figure above. (*** Make sure to place the second MG base so that the nameplate side faces upward.**)

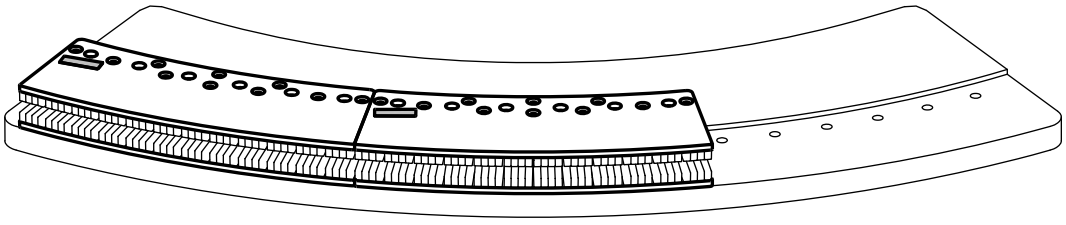


Figure 5c. Connecting MG bases ③

3) Butt the second MG base to the first MG base and fix it.

While holding the second MG base so that it does not lift due to reaction force, slide it along the mounting guide surface, butt it to the first MG base slowly until there is no space between them, and fix the second MG base. (*** When they are arranged correctly, they repel each other. If they attract each other, they are not arranged correctly. Carefully connect them since thrust is not generated with wrong connection.**)

* To mount MG bases upside-down, perform the above procedure upside-down. (When MG

bases are mounted upside-down, the nameplate side is faced down.)

⚠ Caution

① When connecting MG bases, be careful not to catch your finger between them.
② Things made of magnetic materials, such as a wrench, are strongly attracted to the magnet. Be careful about them.

4-4. Mounting multiple CL units

If you want to increase thrust, you can mount multiple CL units. When multiple CL units are mounted, the total thrust of the CL units is applied.

"Adjacent mounting" and "multiple set mounting" described below are available for mounting multiple CL units.

Use a driver/controller whose capacity is at least the total capacity of the CL units and connect them via terminal block in parallel. (See the figure below.)

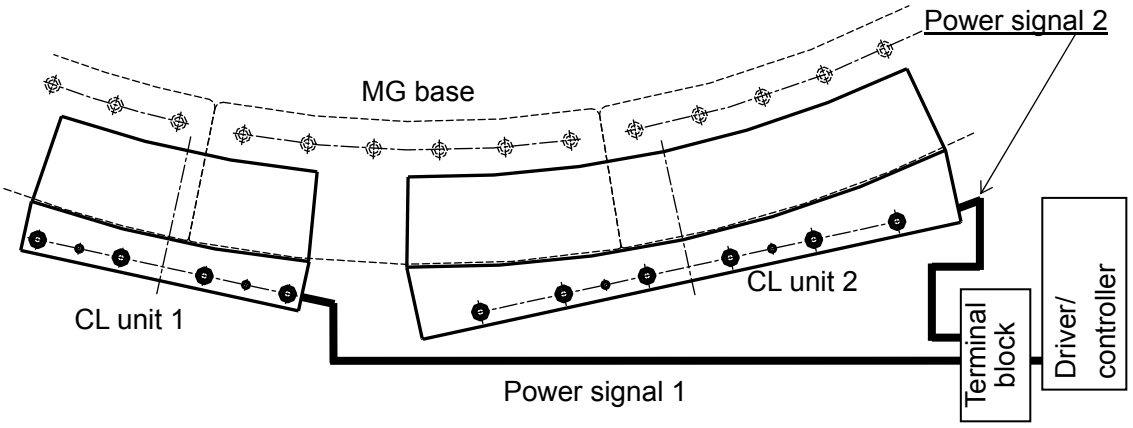


Figure 6a. CL unit wiring (for adjacent mounting)

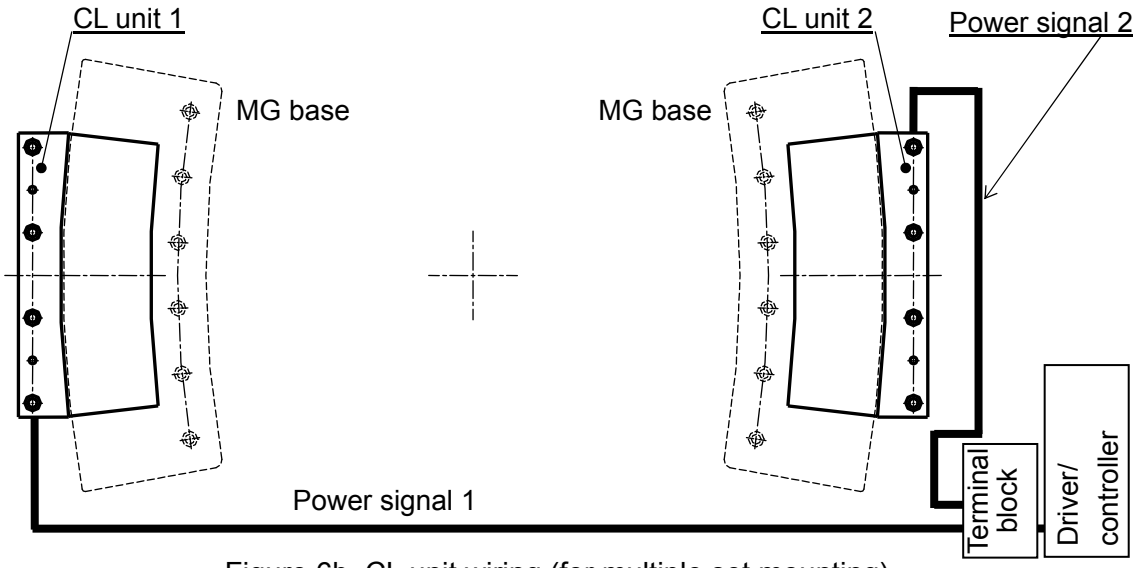


Figure 6b. CL unit wiring (for multiple set mounting)

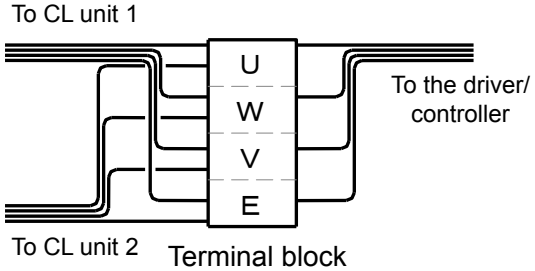


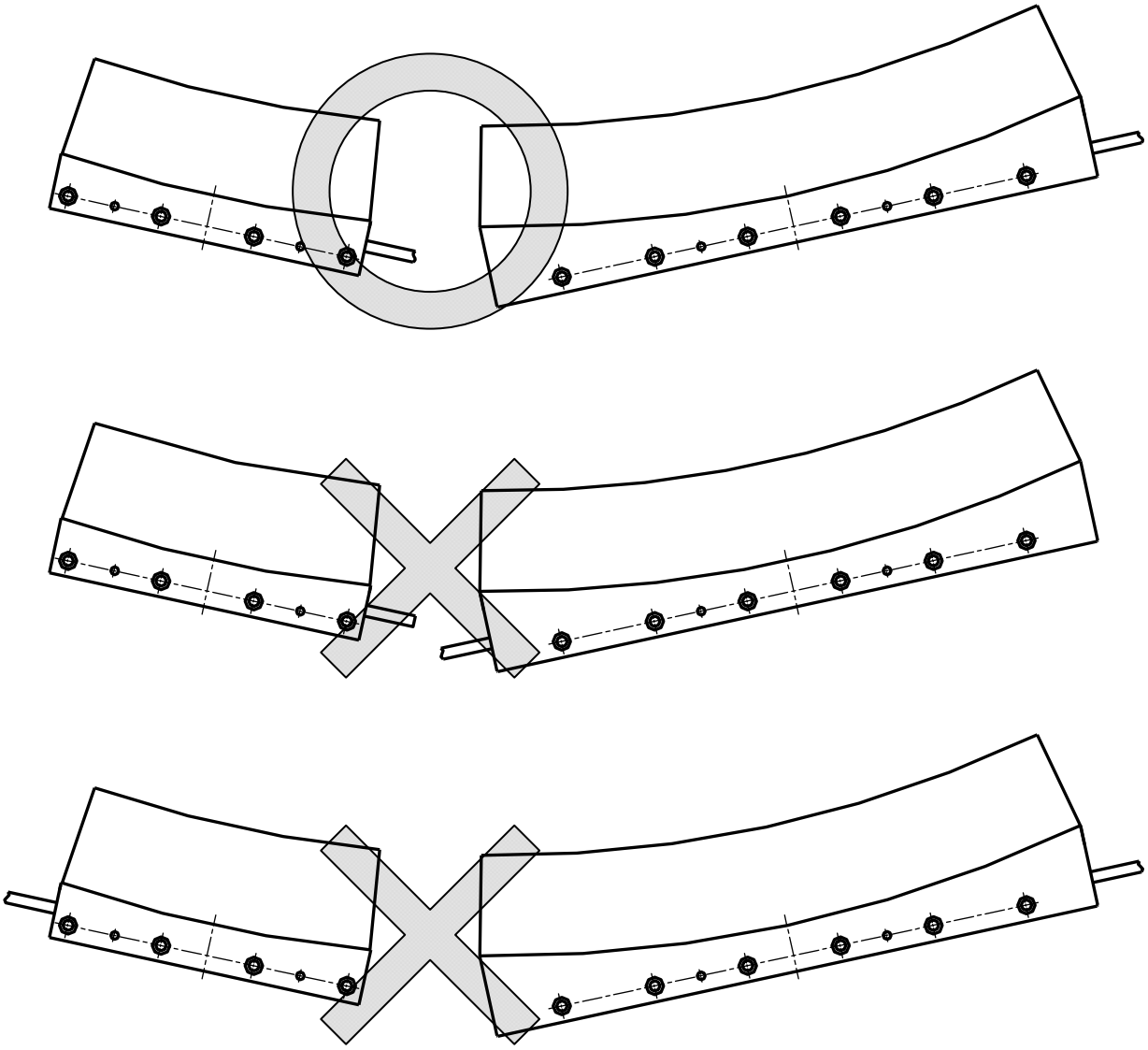
Figure 6c. Connection terminal block wiring specifications

4-4-1. Adjacent mounting

If you want to install two CL units side by side to use them as one CL unit, mount them according to the instructions below.

a. Orientation

Be sure to make the cables of the two CL units face in the same direction and align the direction with the linear sensor as described in "3. Rotation direction".



b. Mounting pitch

b-1. NVA-CM*850A2A series (nominal radius: 850 mm)

To use the NVA-CM*850A2A series, see the figures below to follow the mounting pitch between the two CL units. To satisfy an angle pitch of up to ±0.010°, set the tolerance of the positioning pin hole positions to up to ±0.15 mm as shown in the figures below. To satisfy the above condition, the following method is recommended: Make either positioning pin hole of each CL unit with an elongate hole as long as the tolerance shown in the figure is satisfied to give clearance.

Mount a pole sensor so that it is placed between the CL units if required. (Mount only one pole sensor.)

* The angle pitch between the CL units is independent of whether a pole sensor is mounted.

a) NVA-CMA850A2A(R850_150N) and NVA-CME850A2A(R850_300N)

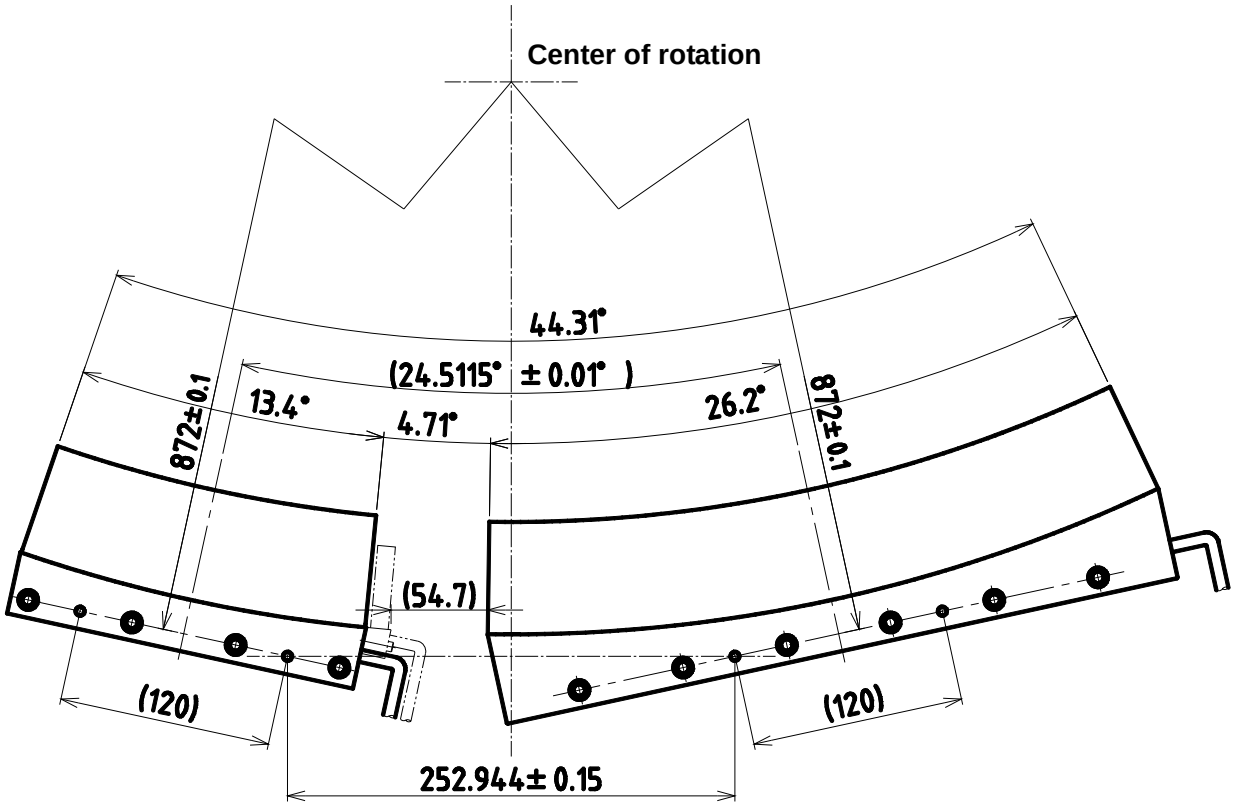
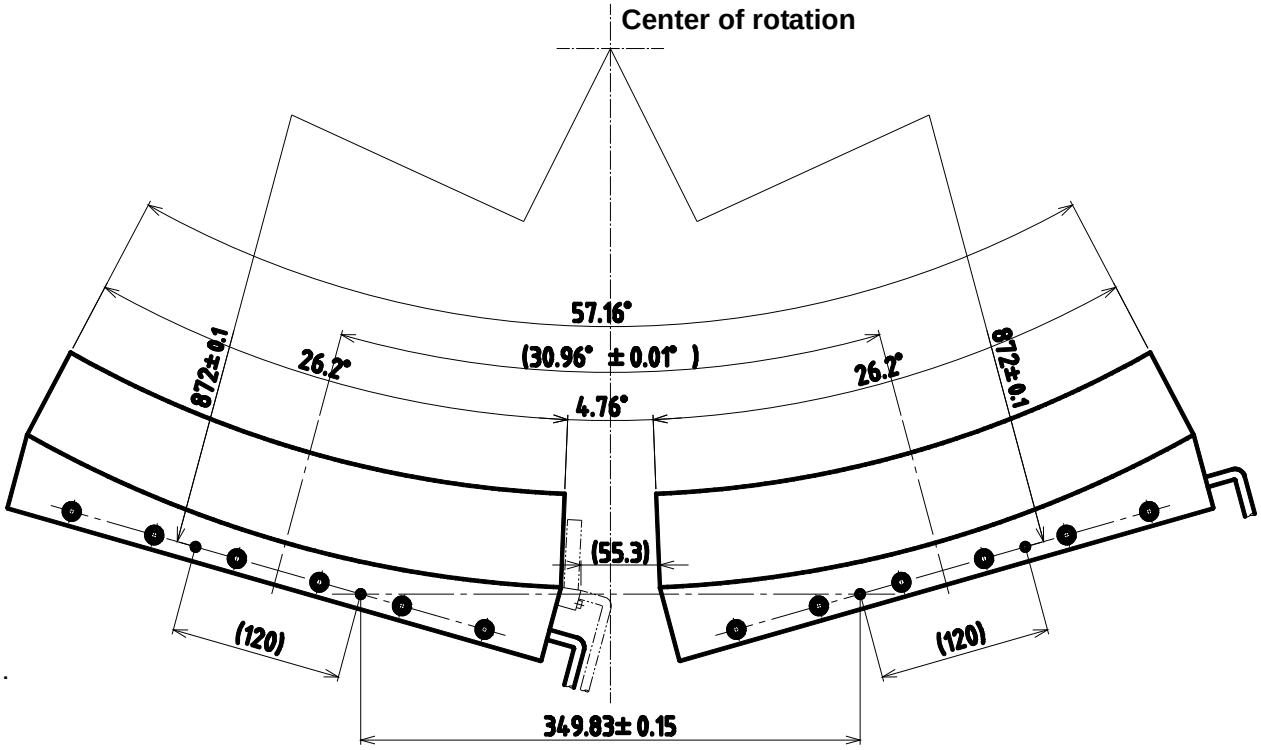


Figure 7. Orientation of the CL units (when the two CL units are connected)

b) Two NVA-CME850A2A(R850_300N) units

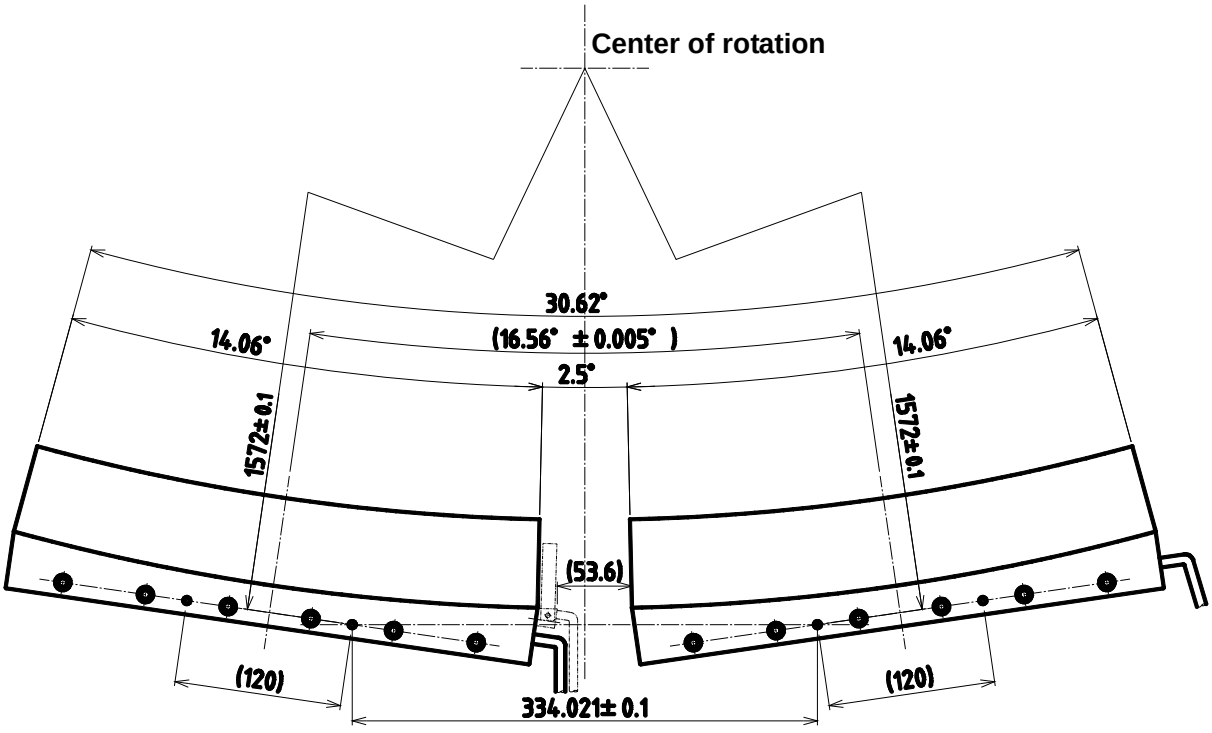


b-2. NVA-CM*1550A2A series (nominal radius: 1550 mm)

To use the NVA-CM*1550A2A series, see the figure below to follow the mounting pitch between the two CL units. To satisfy an angle pitch of up to ±0.005°, set the tolerance of the positioning pin hole positions to up to ±0.10 mm. To satisfy the above condition, the following method is recommended: Make either positioning pin hole of each CL unit with an elongate hole as long as the tolerance shown in the figure is satisfied to give clearance.

Mount a pole sensor so that it is placed between the CL units if required. (Mount only one pole sensor.)

* The angle pitch between the CL units is independent of whether a pole sensor is mounted.

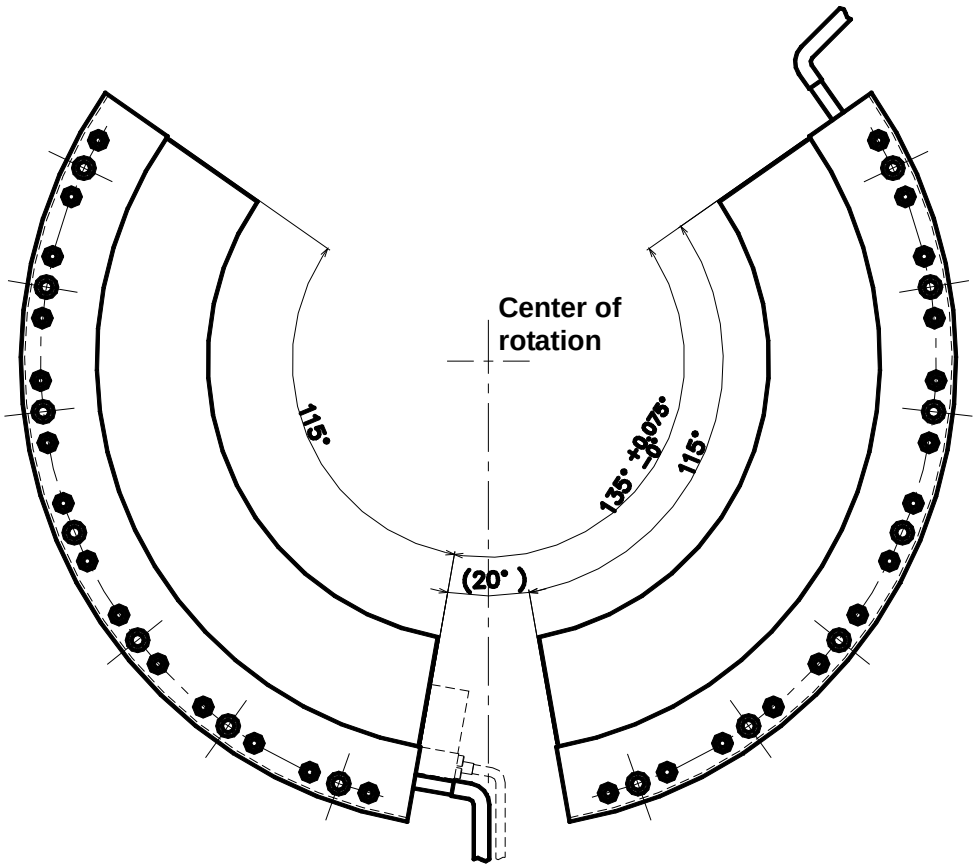


b-3. NLD-CN53CA2A series (nominal radius: 200 mm)

To use the NLD-CN53CA2A series, see the figures below to follow the mounting pitch between the two CL units. Mount them so that the angle pitch does not exceed ±0.075°.

Mount a pole sensor so that it is placed between the CL units if required. (Mount only one pole sensor.)

* The angle pitch between the CL units is independent of whether a pole sensor is mounted.



4-4-2. Multiple set mounting

If you want to arrange multiple sets on the same circle (when a set is assumed to consist of multiple MG bases and one CL unit), mount them according to the instructions below.

・Be sure to make the cables of the CL units face in the same rotation direction and align the direction with the linear sensor as described in "3. Rotation direction".

・Mount the MG bases so that the sides on which the nameplate is attached face the same direction.

・The pitch angle (θ_0 in the figure below) between sets is arbitrary, but an equal pitch is recommended.

・When multiple CL units having the same capacity are used, mount the sets so that θ_1 between the MG base and CL unit in each set is equal and each relative position error is within the value listed in the table below. (A large difference may cause a malfunction. See θ_1 in the figure below. θ_1 is an arbitrary value, however.)

Motor model	NVA-CN53CA2A	NVA-CM*850A2A	NVA-CM*1550A2A
$\theta_1 \pm \alpha°$	$\theta_1 \pm 0.075°$	$\theta_1 \pm 0.010°$	$\theta_1 \pm 0.005°$

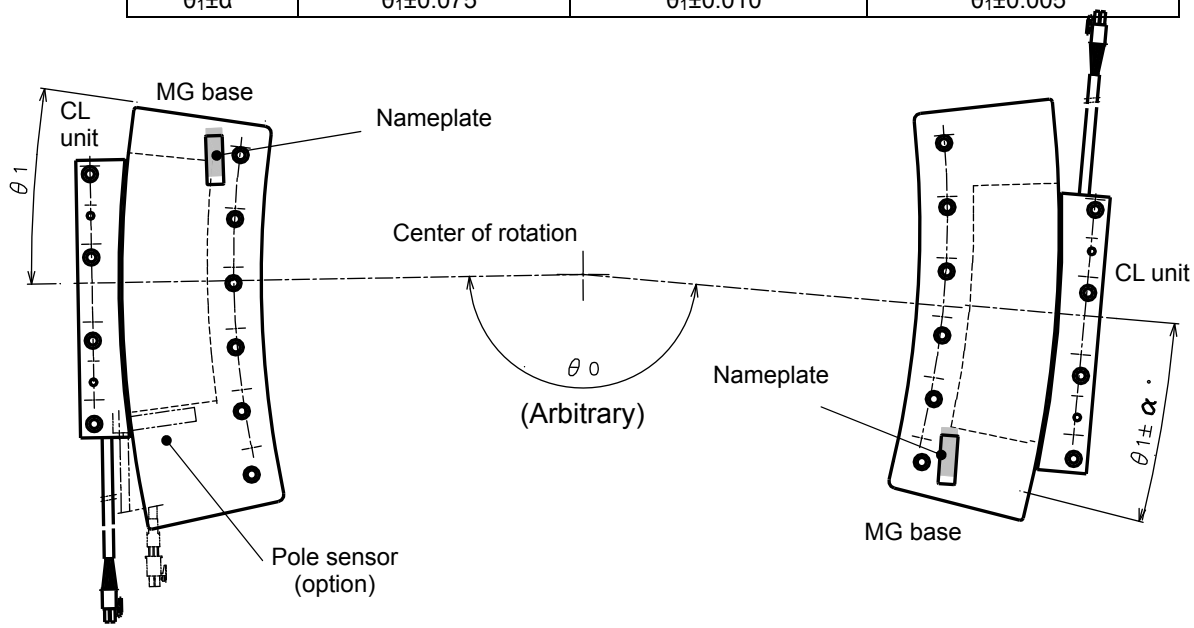


Figure 9a. Relative position relationship between MG bases and CL units (when the CL units have the same capacity)

・When you want to use a pole sensor, mount it only on one CL unit.

To use NVA-C_R850_150N and NVA-C_R850_300N together

To use NVA-CMA850A2A(R850_150N) and NVA-CME850A2A(R850_300N) together, mount each set so that the relative position relationship satisfies the value obtained by the following formula and as shown in the figure below. Reduce the error to up to ±0.010°. (A large difference may cause a malfunction.)

$\theta_{1B} := (\theta_{1A} + 7.312°) \pm 0.010°$

(θ_{1A}: θ_1 of the 150N CL unit
θ_{1B}: θ_1 of the 300N CL unit)

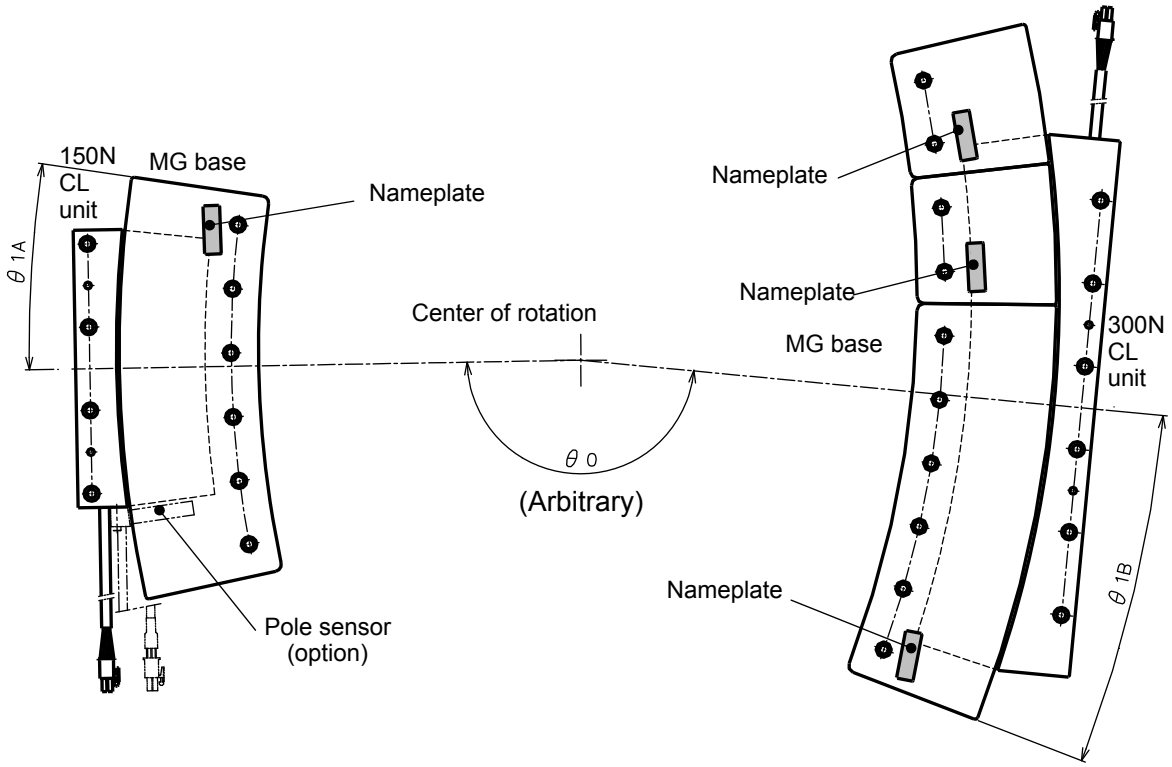


Figure 9b. Relative position relationship between MG bases and CL units (when 150N and 300N are used)

・When you want to use a pole sensor, mount it only on one CL unit.

5. Notes on use

When using and operating the motor, follow the precautions below and handle the motor paying due attention to the safety.

5-1. Preparations

- Make sure to properly connect the power lines (including ground wire) and signal cables to the driver.
- Before wiring work, make sure to turn the power to the used driver off.
- Carefully conduct wiring so that external noise does not affect the motor or encoder.
- Fix the wires from the motor and encoder appropriately so that they are not moved or no force is applied to them.
- Before running the motor by supplying the power, move the motor moving portion at very low speed manually and confirm that there is no abnormal sound from the motor and the motor does not interfere with any peripheral device.
- Before turning the power on, confirm that nobody is within the machine operation range.

5-2. Operation

5-2-1. Servo amplifier settings

Use either of servo amplifier parameters.

1. Motor standard parameters (recommended)

- When the software version of the servo amplifier is Ver. 2.8 or later and the operation angle is less than 360°

2. Special specification parameters

- When the software version of the servo amplifier is earlier than Ver. 2.8
- The NLD-CN53CA2A is used for multirotation.

If you want to use 2. special specification parameters, contact Nikki Denso.

When using 1. motor standard parameters, follow the instructions below:
Specify the motor number of the motor to be used for driver parameter "P000: Motor type" correctly. Also set other parameters corresponding to the motor number. (The motor number is listed in "Applicable motors" in the driver manual.)

5-2-2. Inter-pole distance

For the Servo Compass, the inter-pole distance differs depending on the outer radius of the scale. Set the outer radius of the scale of the unit for the relevant servo amplifier parameter (P159: Sensor installation radius).

5-2-3. Others

・Parameter "P144: Electronic thermal detection selection" is factory-set to "STD: Standard" to prevent the CL unit from being damaged by heat concentrating on one phase. When using the motor under any of the following conditions, set this parameter to "O.L.70%":

1) Repetitive positioning operation within a move angle listed below

Motor model	NVA-CN53CA2A	NVA-CM*850A2A	NVA-CM*1550A2A
Move angle	11.25°	1.72°	0.92°

2) Torque control for pushing motion against the motor direction in the zero speed state (Set the above value if the above condition is satisfied also when the master controller performs torque control over a Nikki Denso motor.)

3) Low-speed operation at a speed lower than that listed below

Motor model	NVA-CN53CA2A	NVA-CM*850A2A	NVA-CM*1550A2A
Move speed	11.25°/s(0.0031rps)	1.72°/s(0.0047rps)	0.92°/s(0.0026rps)

・

・As described in "Load factor-ambient temperature characteristics" in "2-3-1. Rated specifications", when degrading is applied according to the ambient temperature, set "P144: Electronic thermal detection selection" to "O.L.90%". When "O.L.70%" setting is required as described in 1) to 3) above, set the parameter to "O.L.70%".

・Conduct a test run while supplying power, without mounting load or workpiece, that is, in the no load state, when required.

* For details of parameter setting and operation procedure, read the manual of the driver you use to perform them properly.

6. Maintenance

The motor is maintenance-free; however, to prevent a failure due to a change in the use environment, periodically inspect it according to the following instructions.

・Before inspecting the motor, be sure to turn the power to the used driver off.
・The worker who inspects the motor should check the on and off states of the used driver.
・Inspect the motor according to the precautions for maintaining the driver that are described in the manual of the used driver.
・Before measuring the insulation of the motor, completely disconnect the wires between the motor and driver (U, V, and W).

6-1. Daily inspection

Inspect the following items as daily inspection.

・Whether the motor runs normally
・Whether there is any abnormality in the installation environment (check the power supply, temperature, humidity, dust, and other items.)
・Whether there is any abnormality in the cooling system (such as whether anything blocks airflow)
・Whether any terminal or connector is loose
・Whether there is any abnormal sound or vibration
・Whether there is abnormal heat or discoloration

6-2. Periodic inspection

Inspect the following items at intervals of the specified operating time or period (for such as once half a year or once a year) as periodic inspection.

・Whether the section connecting to the load is loose
・Whether there is any abnormality in the installation environment (check the power supply, temperature, humidity, dust, and other items.)
・Whether there is any abnormality in the cooling system (such as whether anything blocks airflow)
・Whether any terminal or connector is loose
・Whether there is any abnormal sound or vibration
・Whether there is abnormal heat or discoloration
・Whether there is any scratch or wear on any cable

6-3. Warranty period

The warranty period for the motor is one year from the date of shipment. However, note that failures and abnormalities resulting from the following causes are not covered by this warranty.

- Modifications by the customer
- Improper use different from the description in this manual
- Natural disasters
- Improper connection with any manufacturer's product not approved by Nikki Denso

This warranty shall cover only repair of the driver and motor main units. Any damage and loss of chance at your side, which will be induced by a failure of the delivered product, is excluded from the warranty.

⚠ Caution

Our products have been designed and manufactured for general-purpose applications in the general industry and are not intended to be used in any equipment or system that may be involved with human life.
For this reason, Nikki Denso assumes no responsibility if our product is used for any other application than we intend.
(Examples: Applications in equipment and systems for atomic, aerospace, medical, and passenger vehicles that may greatly be involved with human-life and assets)
If you want to install the motor on a device for which a serious accident or loss may occur by a motor failure or external noise higher than the specified noise resistance level, install an appropriate backup or failsafe function in the system.
When the motor is used in an environment in which sulfur or sulfidizing gas is generated, a chip resistor may be corroded and broken and a contact failure may occur.