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Warning

All installation works must be performed by a qualified installer and must comply with applicable laws and regulations.

Positioner Main Body Maintenance Manual

HSP1-1000-02

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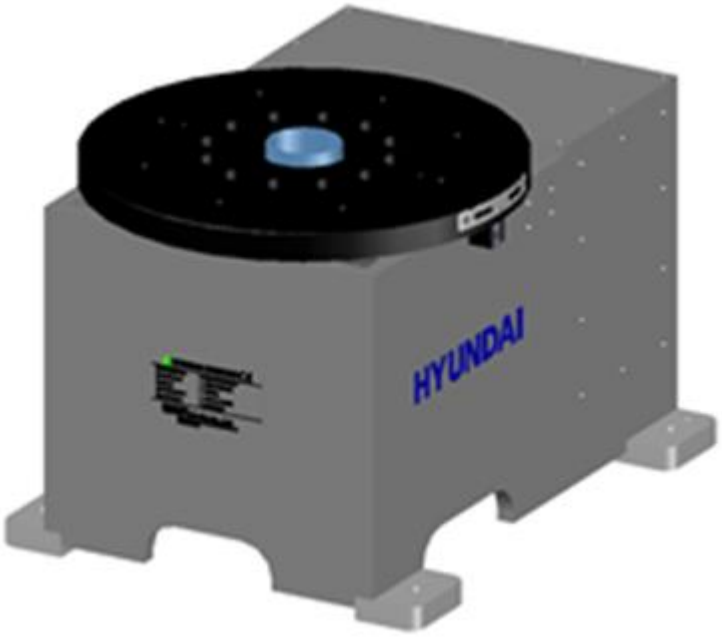

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Printed in Korea – December 2019. First Edition


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1
Specification

1.1. Instrument Part Type of the Positioner

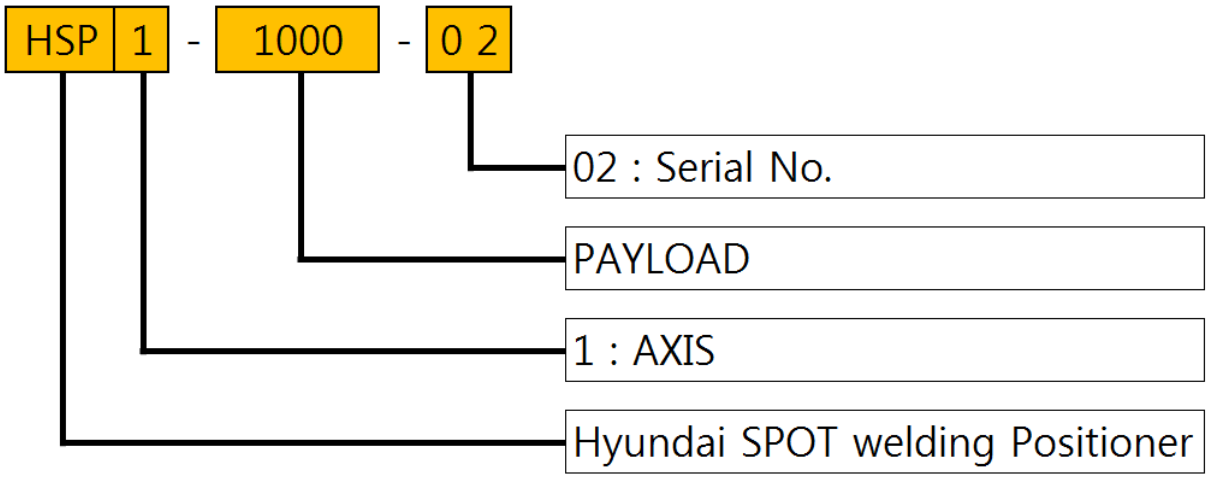


Figure 1.1 Instrument Part Type of the Positioner

1.2. Name Plate Position of the Positioner

The nameplate contains the positioner type, serial number, and date of manufacture.
The nameplate is located on the bottom (left) part of the main body, as shown below.

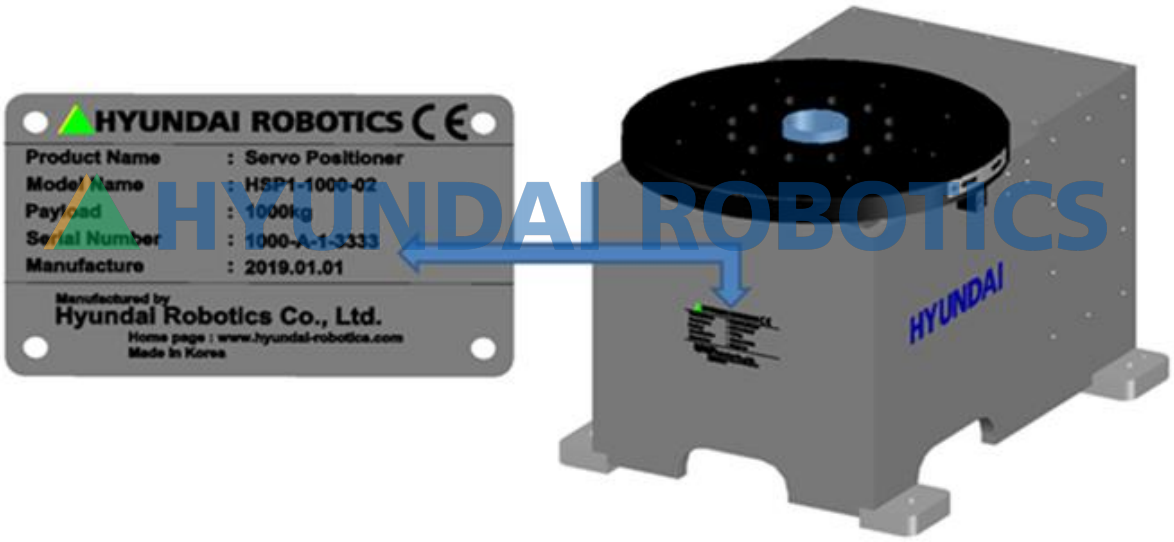
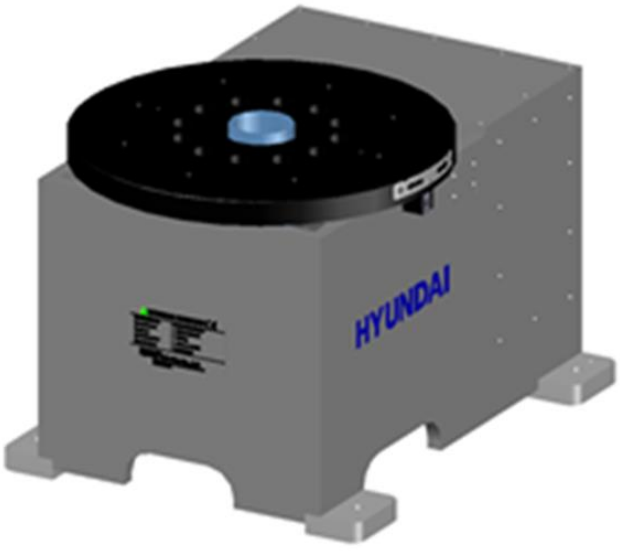


Figure 1.2 Attachment of the Positioner Name Plate

1.3. Basic Specification

No.	Item	Unit.	SPECIFICATION
			1.0Ton
1	MOTOR	Type No.	TSM3506 N7021 E732
		Capacity	2.5 Kw
2	Reducer	Output Reduction Ratio	I=1:177
3	Maximum Operation Angle	°	± 360
4	Maximum Operation Speed	° /s	75
5	Allowable Output Torque	Kgf.m	250
6	Allowable Output Inertia	$Kg.m^2$	200
7	Repetitive Positioning Accuracy	arc	Within ±60 s
8	Main Body Weight	Kg	300
9	Applicable Controller	-	Hi5a ROBOT Controller
10	Shape	-	

1.4. External Dimensions and Operation Area of the Main Body

1.4.1. External Dimensions of the Main Body (HSP1-1000-02, 1000KG)

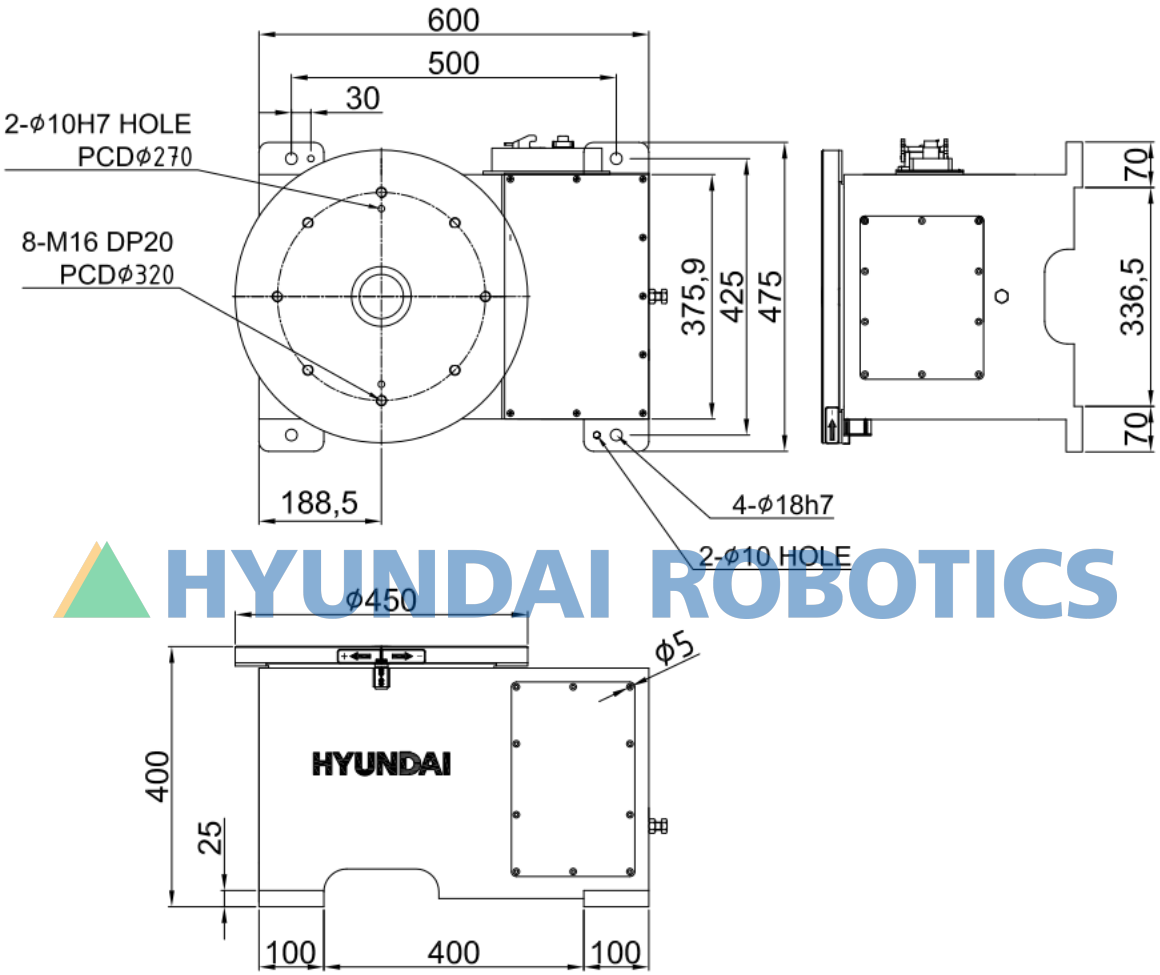


Figure 1.3 External Dimensions of the Main Body

1.4.2. Operation Axes and Their Names

Table 1-1 Rotation Direction of Individual Axes

Axis Name	Operation	Teach Pendant Button	
R	Turning	Left/Right	R

R 축(ROTATING)

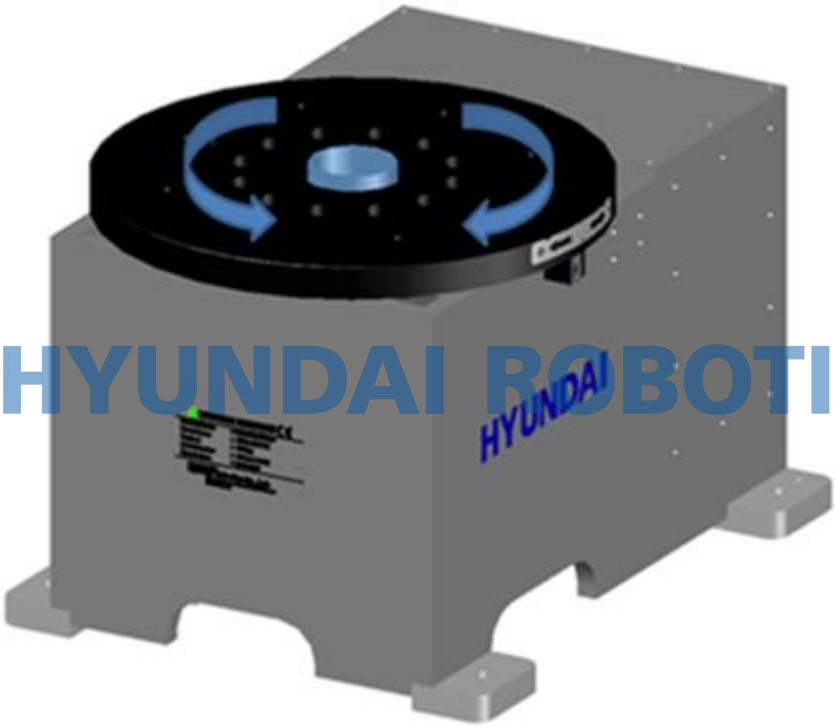


Figure 1.4 Exterior and Operation Axes of the Main Body

1.4.3. Exploded-View Drawing of the Positioner

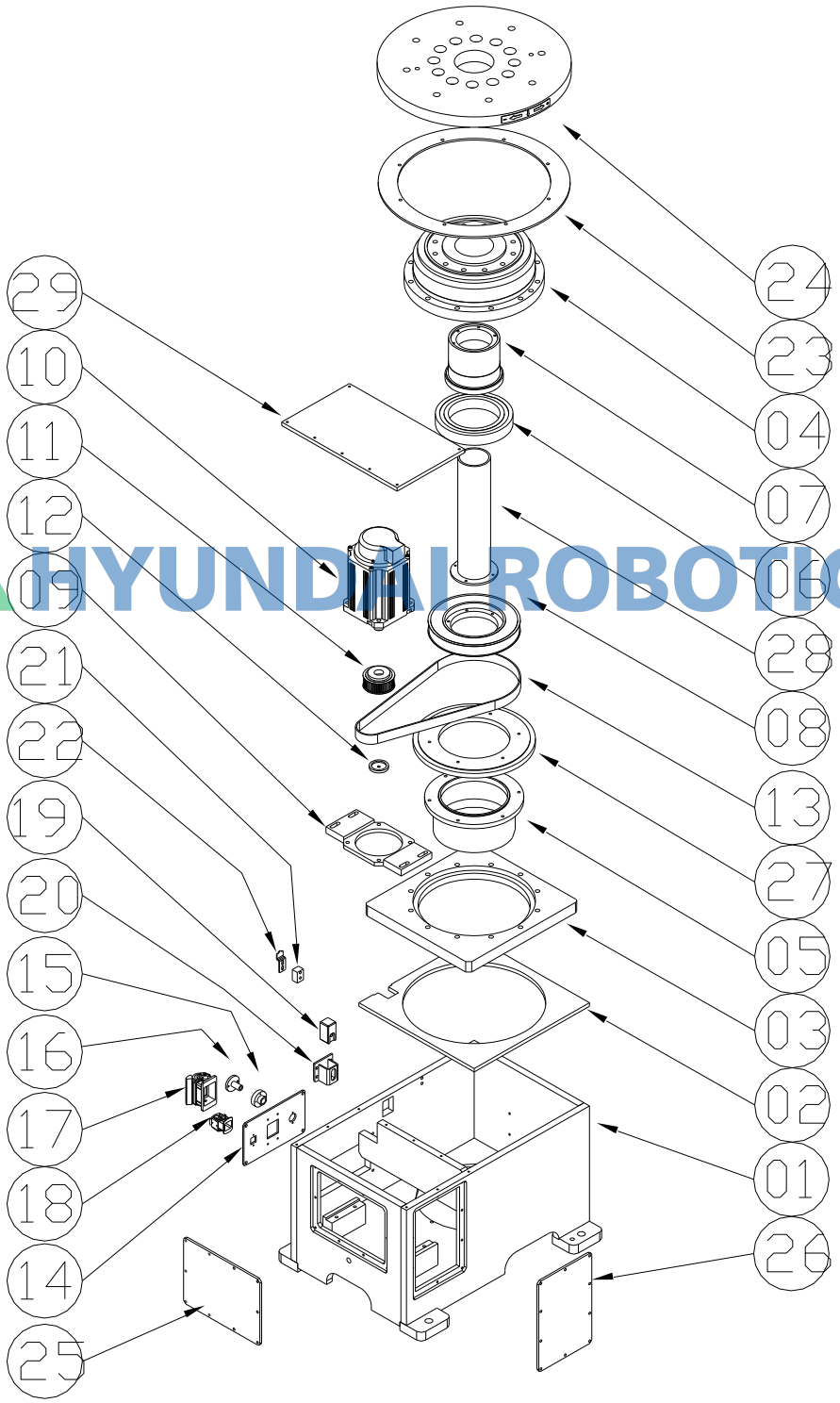


Figure 1.5 Exploded-View Drawing of the Positioner

1.4.4. Positioner Parts List

NO	품명	사양	수량	단위	비고
1	Casting shape iron plate	SS400	1	EA	For the 1 t turntable
2	Disc support plate	SS400	1	EA	For the 1 t turntable
3	Reducer seating plate	SS400	1	EA	For the 1 t turntable
4	Reducer	SUMITOMO F2CF-C55-59	1	EA	Common for 1 t
5	Housing	S45C	1	EA	Common for 1 t
6	Bearing	6024ZZ	1	EA	Common for 1 t
7	Hollow shaft	S45C	1	EA	Common for 1 t
8	Reducer pulley	S45C	1	EA	Common for 1 t
9	Motor plate	SS400	1	EA	Common for 1 t
10	Servo motor	TSM3506 N7201 E732	1	EA	HSP1-1000-02
11	Motor pulley	S45C	1	EA	Common for 0.5 t / 1 t
12	Motor pulley cover	SCM415	1	EA	Common for 0.5 t / 1 t
13	Tension belt	1080 5GT	1	EA	For the 1 t turntable
14	Terminal block	SS400	1	EA	Common for 0.5 t / 1 t
15	Terminal MC	MC	1	EA	Common for 0.5 t / 1 t
16	Terminal copper plate	Brass	1	EA	Common for 0.5 t / 1 t
17	Terminal cable	AMR1	1	EA	Common for 0.5 t / 1 t
18	Terminal cable	AER1	1	EA	Common for 0.5 t / 1 t
19	Earth block	Carbon	1	EA	Common for 0.5 t / 1 t
20	Earth block cover	SS400	1	EA	Common for 0.5 t / 1 t
21	Zeroing block	SS400	1	EA	Common for 0.5 t / 1 t
22	Zeroing scale plate	SUS 304	1	EA	For the 1 t turntable
23	Round BC copper plate	Brass	4	EA	Common for 1 t
24	Disc	S45C	1	EA	Common for 1 t
25	Front plate cover	SS400	1	EA	For the 1 t turntable
226	Side plate cover	SS400	1	EA	For the 1 t turntable
27	Bottom plate cover	SS400	1	EA	For the 1 t turntable
28	Guide pipe	65A	1	EA	Common for 1 t
29	Top plate cover	SS400	1	EA	For the 1 t turntable

1.5. Detailed Drawing of the Output Side Attachment Surface

Specific types of bolts for individual models should be used to attach a working tool to the mechanical interface of the R axis.

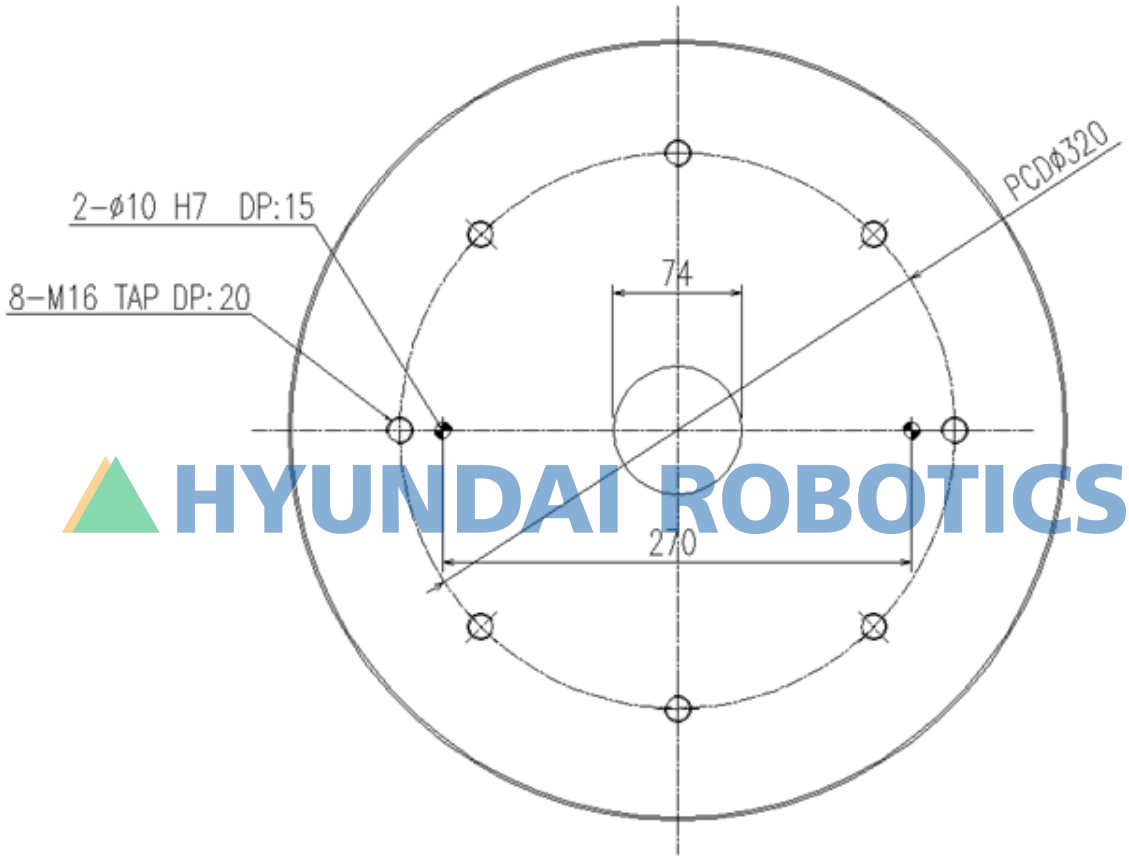


Figure 1.6 Detailed Drawing of the Mechanical Interface Attachment Surface

1.6. Restriction of the Operation Range

When installing the positioner, it should be taken into consideration that the operation range can be freely adjusted within the entire operating area.

It will be useful to restrict the operating range in the following environments:

- ✓ When trying to restrict the operation area when the positioner operates;
- ✓ When a collision with a peripheral device could occur; and
- ✓ If the length of the application cable or hose is restricted.

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2

Precautions in Handling

2.1. Names of Individual Parts

The names of individual parts of the main body are shown below in [Figure 2.1]

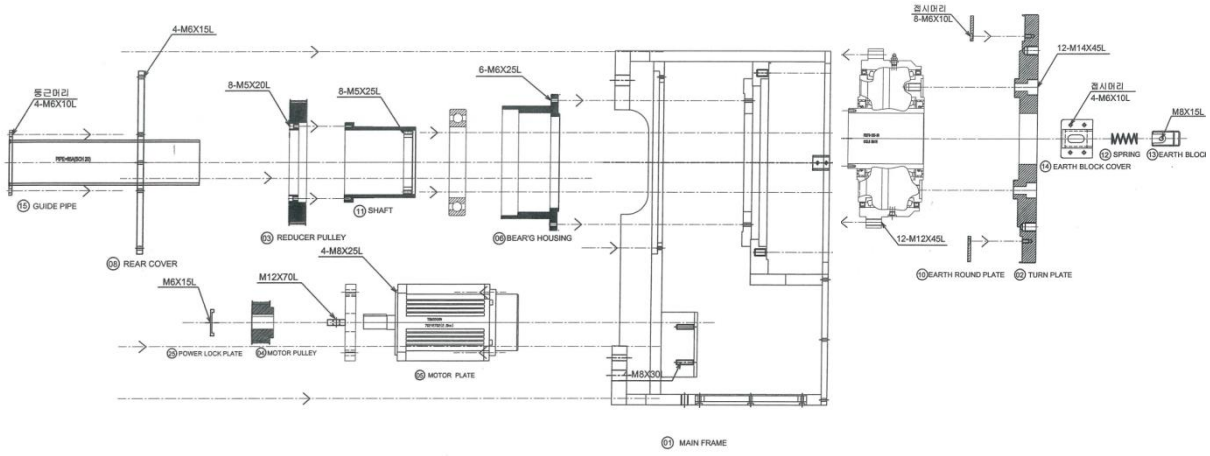

Figure 2.1 Names of Individual Parts of the Main Body

Table 2-1 Names of Individual Parts of the Main Body

No.	Names of Individual Parts	No.	Names of Individual Parts
1	MAIN FRAME	11	MOTER PLATE
2	CYCLO DRIVE	12	MOTOR PULLEY
3	BEARING HOUSING	13	POWER LOCK PLATE
4	BEARING	14	TURN PLATE
5	SHAFT	15	ROUND PLATE
6	REDUCER PULLY	16	REAR COVER
7	EARTH BLOCK COVER	17	GUIDE PIPE
8	SPRING	18	
9	EARTH BLOCK	19	
10	MOTOR	20	

2.2. Position of Precaution Plates for Safety

Caution plates for safety are attached to the main body of the positioner to prevent safety accidents, as shown in [Figure 2.2]. Do not replace or remove them unnecessarily.

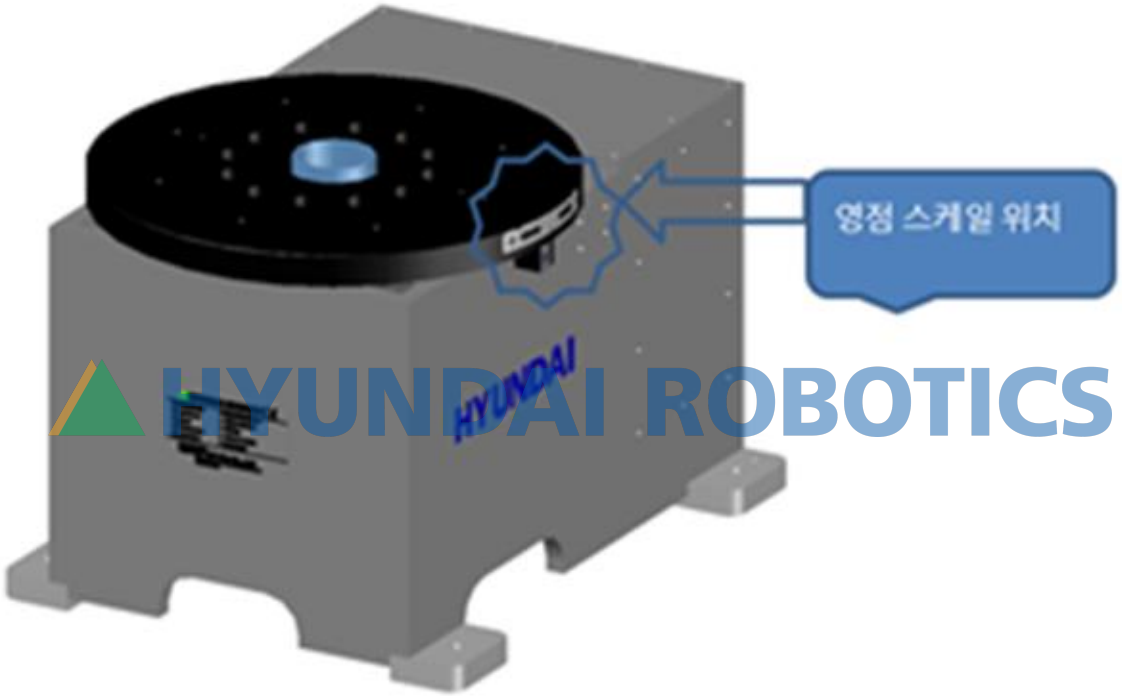

Figure 2.2 Position of the Caution Plates for Safety

2.3. Transport Method

2.3.1. Use of a Crane

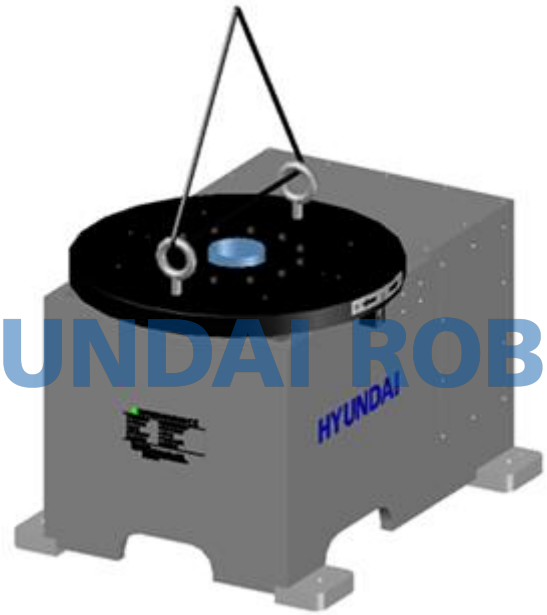

Figure 2.3 Transport Method: Use of a Crane

2.3.2. Use of a Forklift

Forklifts can be used to transport the main body of the positioner.

For your safety, please observe the following procedure.

- It is required to secure the basic posture for each model by referring to the following figure.
- Fix the positioner to the pallet using bolts, slide the fork of the forklift into the pallet, and transport it. The pallet must have sufficient rigidity to endure the work.
- Transport at a low speed.
- Observe safety regulations.

Cautions

- Do not lean on the main body of the positioner during transportation.
- It is required to ensure that the main body of the positioner does not collide with the floor while loading and unloading it.
- Follow the safety rules when working with the forklift.

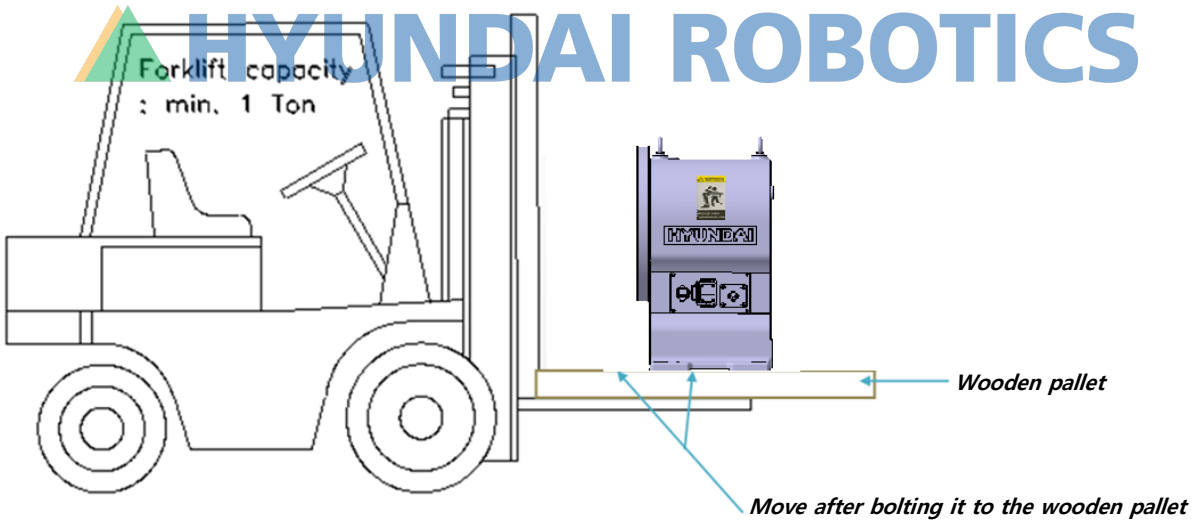

Figure 2.4 Transport Method: Use of a Forklift

2.4. Installation Method

Caution:
It is required to read the safety regulations and related instructions carefully before unpacking and installing the positioner.

Warning:
Installation must be carried out by the installation specialist and must comply with the relevant regulations in your country or region.

When unpacking the package of the positioner, it is required to check whether any damage has occurred during transport or unpacking. In addition, the installation method and foundation for the position are crucial for maintaining the functions, and it is strictly required to observe the following items.

2.4.1. Conditions for the Use

(1) The ambient temperature should be in the range of 0° C–45° C.
(2) The ambient humidity should be 20%–85% RH, and there should be no condensation.
(3) There should be a low level of dust, oil, and moisture.
(4) There should be no flammable or corrosive liquids or gas.
(5) No heavy shock or vibration should be applied.
(6) There should be no large source of electrical noise.
(7) If the positioner will not be installed immediately, it is required to keep it in a dry place with a temperature from -15° C to 40° C.

2.4.2. Installation of the Main Body of the Positioner

The main body of the positioner should be firmly fixed with four M16 bolts. All four bolts should be used.

- Bolt: M16 Socket head bolt
- Washer: Spring and plain washers
- Fastening torque: 293 Nm

The rigidity of the foundation floor on which the positioner will be installed should be designed to minimize the dynamic influence of the robot.

When the positioner is to be installed on the floor if the concrete thickness of the floor is 200 mm or more, it is required to maintain the floor; if there is any irregularity or crack on the floor first, then fix the mounting plate using anchor bolts. If the concrete thickness of the floor is less than 200 mm, foundation work is required additionally, which means that a prior review should be performed before building the foundation.

2.4.3. Accuracy of the Installation Surface

It is required to attach the main body of the positioner by fixing the bottom surface of the turn base. Refer to the figures below for dimensions.

Figure 2.5 Dimensions of the Installation Surface

The flatness of the installation surface of the four plate attachment surfaces of the main body of the positioner should satisfy designated specifications, and shims should be used as necessary. The flatness of the others should be within ±2mm.

■ Precautions

(1) The flatness of the four mounting plates should be within 1.0 mm.
(2) The flatness of the four plate attachment surfaces should be within 1.0 mm (± 0.5 mm).
(3) This positioner should be installed horizontally for use (cannot be installed vertically for use).

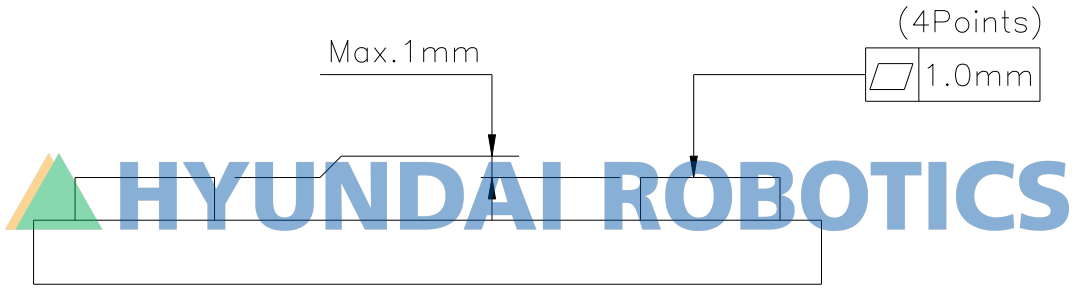

Figure 2.6 Accuracy of the Positioner Installation Surface

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3

Inspection

This section describes the periodic inspection, overhaul, adjustment, etc., which are necessary to maintain the performance of the positioner for a long period.

3.1. Inspection Items and Cycle

Inspection must be performed to maintain a high performance when the positioner is to be operated for a long duration.

Inspections are divided into daily inspections and regular inspections, and the personnel responsible for inspections must carry out inspections according to the basic inspection cycles, as shown in [Table 3-1].

Overhaul should be carried out every 20,000 operating hours.

The inspection cycle has been reviewed for arc welding. If the inspection and adjustment methods are difficult to understand, please contact our after-sales service center (customer support department) for inquiries.

Table 3-1 Inspection Plan

Inspections over one year				Inspections over one year			
Upon 3 months	Upon 6 months	Upon 9 months	Upon 12 months	Upon 3 months	Upon 6 months	Upon 9 months	Upon 12 months
Upon 3 months	Upon 6 months	Upon 9 months	Upon 1 year	Upon 1 year and 3 months	Upon 1 year and 6 months	Upon 1 year and 9 months	Upon 2 years
Daily inspection							

Table 3-2 Inspection Items and Cycle

No.	Inspection cycle			Inspection items	Inspection method	Reference	Remarks
	Daily	3 months	1 year				
Common for the main body and individual axes of the positioner							
1	○			Cleaning of the main body	Visually checking for impurities		
2		○		Inspection of the wiring	· Visually checking for damages to the cables · Visually checking the paint markings of the cable fixing bracket fastening bolts · Visually checking for damages to the cable covers		
3		○		Main bolts	Visually checking the paint markings		
4	○			Motor	Checking for the abnormal heat generation Checking for the abnormal sound generation		
5	○			Reducer	Checking for the abnormal sound generation Checking for the vibration generation		

- If the positioner is used under adverse conditions, it is recommended to take a shorter inspection cycle to ensure the performance of the positioner.
- Inspect all visible cables and replace any damaged cables.
- Check the fastening torque of the key bolts in [Table 3-3].
- Check for any abnormal sound in the automatic or teaching mode to check the power transmission system (motor, reducer, etc.) for abnormalities.

3.2. Inspection of Key External Bolts

A torque wrench must be used to carry out fastening with a proper torque, and then marking with paint should be performed.

Table 3-3 Key Bolts to Inspect

No.	Bolts to inspect	No.	Bolts to inspect
1	Mechanical interface attachment bolt	5	Earth lock cover attachment bolt
2	Reducer attachment bolt	6	Earth bush set screw
3	Power lock attachment bolt	7	Earth block attachment bolt
4	Motor plate attachment bolt	8	Bearing housing attachment bolt

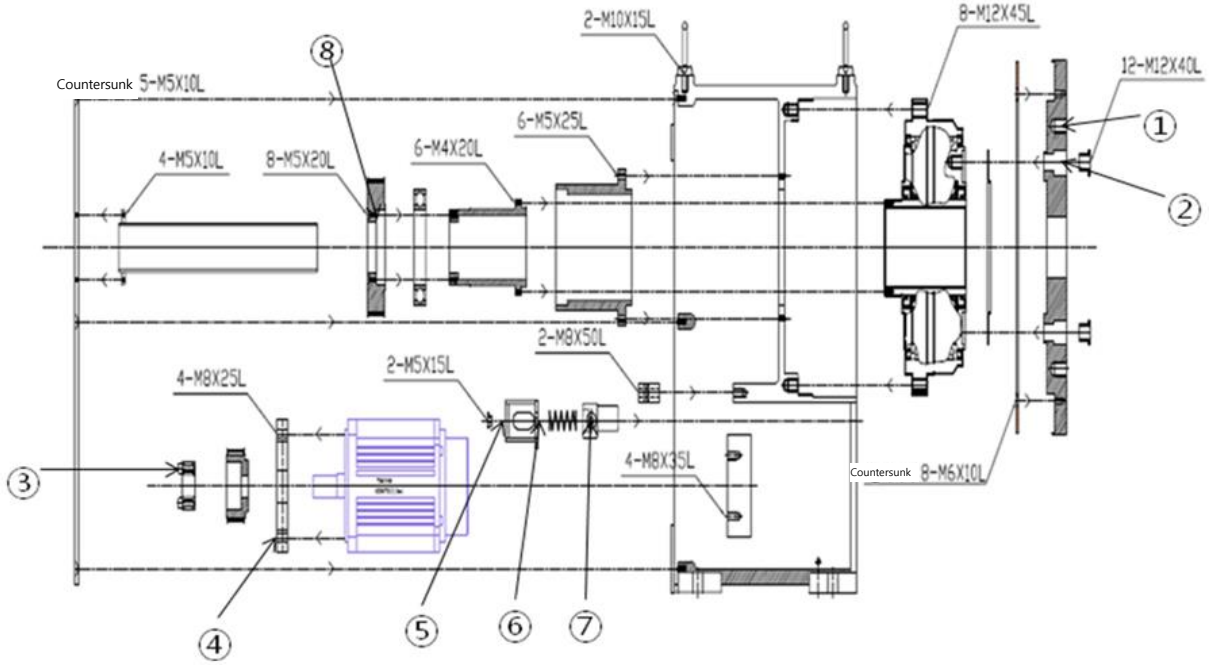

Figure 3.1 Key Bolts to Inspect

3.3. Inspection of Wiring in the Main Body

The internal wiring of the main body of the positioner is designed to withstand flexibility. However, if disconnection or short-circuiting occurs caused by damages to or wire breakage, there could be a problem with the robot operation, which requires the user to perform daily inspection surely. In addition, the user must carry out a prior inspection when he/she plans to perform the works within the operation range according to the conditions for a safety inspection.

3.3.1. Conditions for Safety Inspection

When planning to carry out works such as the teaching of the positioner within the operation range of the positioner (except for shutting off the driving source of the positioner), the user should check the following items before starting the works. If any abnormality is confirmed, the user should correct it immediately and take other necessary measures.

- Check for any damage to the cover and cable of the external power supply.
- Check for any abnormality with the operation of the main body of the positioner.


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4 Maintenance

4.1. Replacement of the Batteries

The position data of each axis is to be preserved using the backup batteries. The batteries should be replaced every two years. It is required to comply with the following procedures in replacing the batteries.

① Press the emergency stop button when the controller power is on.

Caution
If you turn off the power and replace the batteries, all current position data will be lost. Therefore, the origin should be reset.

② Remove the cover of the battery at the position of each axis.

③ Remove the existing battery.

④ Install the new battery while being careful about the direction of installing it.

- ✓ Specification: ER6C(AA) 3.6 V
- ✓ Manufacturer: Maxell

⑤ Install the cover back to its original position.

4.1.1. Precautions in Storing the Batteries

① Do not store batteries in a place with high temperature or humidity, and keep them in a well-ventilated place to avoid condensation.

② Store batteries at room temperature (20° C ± 15° C) wherein the variation of temperature is low, and the relative humidity can be kept at 70% or less.

③ The reference period for storing batteries should be six months, and they should be managed based on the first-in and first-out method.

5
Troubleshooting

5.1. Method of Progressing an Investigation of the Causes of Problems

When an abnormality occurs during the operation of the positioner, and it is not attributable to an abnormality with the controller, it will be a problem because of damages to the mechanical parts. To solve the problem quickly and easily, it is necessary first to identify the phenomenon correctly and determine which part is defective.

(1) First step: Which axis has an abnormality?

First of all, check which axis that shows the abnormal phenomenon. When it is difficult to make a judgment because the abnormality does not appear during the operation, it is required to carry out an investigation as follows.

- Is there any part generating an abnormal sound?
- Is there any part generating an abnormal heat?
- Is there any part with a gap?

(2) Second step: Are there any damaged parts?
If an axis is determined to have an abnormality, it is required to investigate which part is causing the abnormality. There can be several causes of one phenomenon.

(3) Third step: Handling of defective parts
Parts that are determined to be defective should be handled according to the methods described in Section 5.2 Methods for Investigating and Handling Individual Parts. Please contact our service department for items that your company cannot handle.

5.2. Methods for Investigating and Handling Individual Parts

5.2.1. Reducer

If the reducer is damaged, vibration or abnormal sound will occur. This may cause overloading and an error because of the deviation that interferes with the normal operation and may generate an abnormal sound. As a result, the reducer may not move at all or have a positional deviation.

[R axis]

- Investigation method

  ① Investigate whether there is clearance in bearings by applying force to the R axis.
  ② Investigate whether there is clearance in bearings without a load being applied to the reducer.
  ③ Before abnormality occurs, investigate whether there is any contact with a peripheral system near the positioner.

- Handling method

  Replace the reducer. Then, you need facilities such as a chain block to hang up the R axis frame. If you have any difficulties, please contact our service department.

[T axis]

- Investigation method

  ① Investigate whether vibration or abnormal noise occurs, and also whether abnormal heat is generated in the reducer part.
  ② Investigate whether there is clearance in the reducer.
  Before an emergency occurs, investigate whether there is any contact with a peripheral system near the positioner.
  ③ (The reducer can be damaged because of an impact from contact)

- Handling method
  Replace the reducer.

5.2.2. Motor

If any abnormality occurs to the motor, abnormal operation such as shaking when stopping, irregular cycle (pulsation), and vibration during operation will occur. In addition, abnormal heat and sound may occur.

As the phenomena similar to the ones caused by damages to the reducer may occur, investigate the reducer and the bearing part at the same time to determine where the abnormality is caused.

- Investigation method
  Investigate whether there is any abnormal sound or heat generated.

- Handling method
  Replace the motor.

5.2.3. Encoder

If an error occurs to the encoder, it may cause position deviation, malfunction, runaway, etc., and it may cause shaking during stop and irregular cycles (pulsation). Those problems are not related to the phenomenon of mechanical abnormal noise, heat generation, vibration, etc.

- Investigation method

  ① Check if there is any problem with the encoder data.
  ② Set the customized scale to the reference position, and then investigate whether there is an error with the position data.
  ③ Move each axis of the positioner and investigate whether there is an axis with data that changes irregularly.
  ④ Replace the servo amplifier circuit board BD440, and then investigate whether an error occurs.

- Handling method

  ① Check the wiring and replace the encoder if the wiring is not disconnected.
  ② If the error does not occur when the servo amplifier circuit board is replaced, it should be replaced.

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6
Recommended Spare Parts

The parts recommended as the spare parts for the positioner are as follows. When purchasing them, it is required to check the serial number and manufacture date on the main body of the positioner and contact our service department.

[Classification]
A: Parts for regular maintenance (to be replaced regularly)
B: Key spare parts (recommended to be prepared in advance by considering the high frequency of an operation)
C: Key components
D: Instrument parts

Table 6-1 Spare Parts List

Classification	Name of Part	Manufacturer / Specification	Per Unit: Number for use	Per Unit: Number recommended	Applicable part
A	Encoder battery	HHI / ER6C(AA)3.6 V	1 EA	1 EA	Should be replaced every two years regardless of hours of operation
B	AC servo motor	HHI / TSM3506 N7021 E732	1 EA	1 EA	2.5 kW
B	Encoder	HHI / R112504000	1 EA	1 EA	
B	Reducer	SUMITOMO / F2CF-C55-59 (1,000 kg)	1 EA	1 EA	

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7

Dismantling

The positioner consists of various materials, as shown in [Table 7-1]. Some parts should be properly sorted out and sealed to prevent adverse effects on the human body or the environment.

Table 7-1 Table of Materials of Individual Parts

Parts	Materials
Battery	NiCad or Lithium
Wiring, Motor	Copper
Brakes, Motors	Samarium Cobalt(or Neodymium)
Wiring, Connectors	Plastic / Rubber
Reducers, Bearings	Oil / Grease

● **Daegu Office (Head Office)**

50, Techno sunhwan-ro 3-gil, yuga, Dalseong-gun, Daegu, 43022, Korea

● **Bundang Office**

42, Dolma-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, 13630, Korea

● **대구 사무소**

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