

ESTUN Positioner Operator's Manual

M-0901EN-04

Thank you for purchasing ESTUN robots.

Before using the robot, be sure to read the SAFETY PRECAUTION and understand the content. ESTUN endeavor to improve the products. All specifications and designs are subject to change without notice.

In this manual, all specifications and information are checked on a regular basis. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. ESTUN assumes no responsibility for any direct or indirect losses arising from use of this manual and products described herein.

Keep this manual handy for easy access at all times.

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SAFETY

This chapter describes the precautions which must be followed to ensure the safe use of the robot. Before using the robot, be sure to read this chapter thoroughly.

ESTUN robots must be transported, mounted and operated in accordance with national laws, regulations and standards. Appropriate safeguards must be correctly performed to protect the users. Before using (mounting, operating, maintaining, repairing) the robot, be sure to read and understand this manual and its relevant manuals. Be sure to have familiarization with the knowledge of robot system and the safety precaution. Even if all instructions are followed, this is not a guarantee that the robot will not cause injuries or damage.

DEFINITION OF USER

The personnel can be defined as follows.

- Operator Turns the robot power ON/OFF.
 Starts the robot program from the panel.
- Programmer
 Operates the robot.

Teaches the robot inside the safety area.

Maintenance engineer
 Operates the robot.
 Teaches the robot inside the safety area.

Maintenance (repair, adjustment, replacement).

Operator must not work in the safety area.

Programmer and maintenance engineer can work in the safety area.

During operation, programming, and maintenance of the robot, the operator, programmer, and maintenance engineer should take precautions to ensure the safety by wearing the following safety items.

- Clothes for operation
- Safety shoes
- A helmet

SPECIAL TRAINING

Tasks in the safety area include transportation, setting, teaching, adjustment, maintenance, etc. Training course must be performed before operating the robot. For more information about training course, contact ESTUN.

DEFINITION OF SAFETY NOTATIONS

Precautions and information are defined as follows.



ESTUN ROBOTICS	SAFETY
Symbol	Definitions
VARNING WARNING	Danger notationDeath or serious injury will be expected to occur if the user fails to follow the approved procedure.
	Caution notationMinor or moderate injury of the user or equipment damage will be expected to occur if the user fails to follow the approved procedure.
IN FO	Information A supplementary explanation helps users operating the robot more efficiently.

SAFETY OF THE USER

- (1) The robot should be transported and installed as procedures recommended by ESTUN. Wrong procedures may cause severe injuries or damage due to the robot fall.
- (2) Draw an area clearly indicates the safety area. Install a fence or hang a warning board to ensure the safety operation of the robot, and keep unauthorized personnel outside the safety area.
- (3) Never hang any tools above the robot. Falling of these tools may cause damage to equipment.
- (4) Never lean on the cabinet. Never touch any buttons without permission. Unexpected movement of the robot may cause personnel injuries and equipment damage.
- (5) Take precautions for falling parts to avoid injuries when disassemble the robot.
- (6) Turn off the power when adjusting peripheral equipment.
- (7) Peripheral equipment must be grounded.
- (8) The robot should be operated in a low speed in the first operation. The speed should be added gradually to check if there is any abnormal situation.
- (9) Do not wear gloves when using the teach pendant. Operate with gloves may cause an operation error.
- (10) Programs, system variables, and other information can be saved on the memory card or USB memories. Be sure to save the data periodically in case that the data is lost.
- (11) Never forcibly move any axis of the robot. Move the axes forcibly may cause injuries or damage.
- (12) Take precautions when wiring and piping between the robot, the cabinet, and peripheral equipment. Put the pipes, wires or cables through a pit or covered with a protective lid, to avoid stepped by personnel or run over by a forklift.
- (13) Unexpected movement may occur on any operating robot, which will cause severe injuries or damages in the working area. Test (safe door, brake, safe indicators, etc.) must be performed on each safety measures before using the robot. Before turn on the system, make sure that no one is in the working space.
- (14) Never set motion range or load condition exceeds the rated range. Incorrect setting may cause personnel injury and equipment damage.
- (15) Observe the following precautions when teaching inside the working space of the robot
- Do not enable the system unless the mode is switched to manual, and make sure that all auto-control is cut off.
- Speed must be limited under 250mm/s at manual mode. Only authorized person with fully understand of the risks can adjust the robot to rated speed manually.
- Be careful about rotating joints to prevent hair and clothes involved. Take precautions of injury or damage caused by the manipulator or other auxiliary devices.





- Check the motor brake to avoid personnel injuries caused by unexpected situation.
- Always have an escape plan in mind in case the robot comes towards you unexpectedly.
- Ensure that there is a place to retreat to in case of emergency.



Never stand beneath the robot in case of unexpected movement or the system be turned on inadvertently.



Make sure there is a CO2 fire extinguisher at hand.

SAFETY OF OPERATORS

- (1) Before operating the robot, check that the SERVO ON indicator goes out when the EMERGENCY STOP button on the right of the front door of the controller and the pendant are pressed. And confirm that the power is turned off.
- (2) Never allow unauthorized personnel to touch the controller during operation. This may result in unexpected movement of the robot, severe injuries and material damage.
- (3) When attaching tools to the robot, be sure to turn off the power of the controller and the peripheral equipment, and display a warning sign. Turning the power on during equipment installation may cause electric shock or injury due to unexpected movement of the robot.
- (4) Emergency stop

Emergency stop is an external button of the controller that can stop the robot operation.

When emergency button is pressed, the power of the robot (except the power of the servo) is cut off. The system will not run unless the pressed emergency button being released and the system being turned on.



There are several emergency stop buttons in a robot system to stop the robot in case of emergencies. The red button, as shown in the left figure, can be mounted on the teach pendant and the controller. Certainly, the emergency buttons can be mounted by special requirement.

Emergency stop button should be mounted where is easy to reach, so that the buttons can be pressed down immediately in case of emergencies.



Operators must take precautions to avoid high voltage from cables of servo motors, grippers and other devices.



Emergency button is used in case of emergency only. Do not use it to stop the robot for normal operation.

SAFETY OF PROGRAMMERS

While teaching the robot, the programmer must enter the robot operation area. The programmer must ensure the safety especially.







Turn on or off the system by press or release Mot button on the teach pendant.

To use the teach pendant safely, the following precautions should be taken.

- Be sure that the enable switch is effective at any time.
- Turn off the enable switch when pausing, programming or testing the system.
- Teach pendant must be taken with the programmer when teaching in the work space, to avoid inadvertent operation by unauthorized person.
- Teach pendant must not be left within the work space of the robot, as injury or damage can occur if the robot comes in contact with the teach pendant.

SAFETY OF MAINTENANCE ENGINEERS

(1) Heated parts

Some parts of the robot are heated when the robot is operating, especially the servo motor and reducer. If a maintenance engineer needs to touch such a part, the user should wear heat-resistant gloves or use other protective tools.



(2) Disassembly parts

Open the cover or shell only after interior parts such as gears are not moving any more. Never open the cover or shell when the gear or bearing is moving. Use auxiliary device to keep interior part to its position.

Observe the following precaution when performing the first test after installation, inspection or maintenance:

- a) Clear tools to proper locations outside of the working space of the robot.
- b) Make sure that all precaution measures are available.
- c) Make sure that there is no one in the working space of the robot.
- d) Pay special attention to working condition of the maintenance parts when performing test.

Never use the manipulator as a ladder when performing maintenance. Never climb on the manipulator to avoid falling down.

(3) Pneumatic / hydraulic pressure

There may be air/liquid residue in the system when the air pump or hydraulic pump is turned off. Before checking the pneumatic or hydraulic parts, release remaining pressure from the system to avoid personnel injury or equipment damage.



Install a safety valve in case of accident.

- (4) Although the power supply need to be turned on during fault diagnosis, it must be turned off when perform maintenance.
- (5) Brake inspection

Brake may be wearing in daily operation. So brake inspection should be performed by the





- a) Move each joint to the position where the joint bears maximum load.
- b) Turn off the robot. The brake works.
- c) Mark each joint.
- d) Check if the joint moves over a period of time.
- (6) Greasing

Personnel injury or equipment damage may occur during greasing. Observe the following precautions before greasing.

- Take additional care of safety by wearing safety items (such as gloves) to avoid injury from heated oil or reducer.
- Open the oil chamber with caution and keep away from the opening. Oil may spray due to oil pressure.
- Feed the oil according to required quantity and never fill up the oil chamber. Check the oil indicator when finished.
- Never mix different types of oil into one reducer. Clean the oil chamber thoroughly before changing oil type.
- Oil draining must be performed thoroughly. Check the oil indicator when finished.

INFO

Operate the robot for a short period of time before oil draining to heat the oil.

SAFETY OF THE TOOLS AND PERIPHERAL EQUIPMENT

Peripheral device may still be running even after the system has been turned off. Personnel injury may occur due to damaged power lines.

SAFETY OF THE ROBOT MECHANICAL UNIT

For abnormal or emergency situations, e.g. persons trapped in or pinched by the robot, the robot axes should be moved. (Contact ESTUN for more details about dismantling).

Small arms can be moved by hand. Lager arms should be moved by crane or other handling equipment.

Fasten the robot firmly before releasing the brake to avoid secondary injury caused by falling arms.

STOP TYPE OF ROBOT

There are three types of robot stop.

Power-off stop

Servo power is turned off and the robots stops immediately. Servo power is turned off when the robot is moving, the path of the deceleration in uncontrolled.

The following processing is performed at Power-off stop:

- An alarm is generated and servo power is turned off immediately.
- Execution of the program is paused.

Frequent Power-off stop of the robot during operation can cause failures of the robot. Avoid system designs that require routine or frequent Power-off stop conditions.







Alarm stop

The robot system sends alarm (not include power-off alarm), and the robot is decelerated until it stops by control instructions.

The following processing is performed at Alarm stop:

- An alarm (not include power-off alarm) is generated due to overload, system faulty, etc.
- Control instruction is send from servo system. The robot operation is decelerated until it stops. Execution of the program is paused.
- Servo power is off.

Hold

The robot is decelerated until it stops, and servo power remains on.

The following processing is performed at Hold:

• The robot operation is decelerated until it stops. Execution of the program is paused.

LABELS

(1) Electric Shock Warning



Fig 0.1 Electric Shock Warning

This label indicates hazardous voltage or electric shock.

(2) High-temperature Warning



Fig 0.2 High-temperature Warning

Be cautious about a section where this label is affixed, as the section generates heat. If you have to inevitably touch such a section when it is hot, use a protection provision such as heat-resistant gloves.







Fig 0.3 Step-on prohibitive Warning

Never step on or climb the robot or controller as it may adversely affect the robot or controller and may get hurt if you lose your footing as well.

(4) Personal Injury Warning



Fig 0.4 Personal Injury Warning

Never enter the operation area while the Manipulator is moving. This is extremely hazardous and may result in serious safety problems.

(5) No Disassembly Warning



Fig 0.5 No Disassembly Warning

Never perform disassembly arbitrarily where the warning is affixed. Contact ESTUN for disassembly.





PREFACE

PREFACE

This manual describes the following manipulators.

Model	Load capacity
ESP-1D-500	500kg
ESP-2U-500	500kg

Related manuals

ESTUN Robot Mechanical Unit Operator's Manual
ESTUN Robot ER Series Cabinet Operator's Manual
ESTUN Integrate Series Cabinet Operator's Manual
ESTUN RCS2 System Operator's Manual
ESTUN CP System Operator's Manual







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1.SPECIFICATIONS

1.1. BASIC SPECIFICATIONS

Туре	ESP-1D-500	ESP-2U-500		
Max. allowable load	500kg	500kg		
Max. eccentricity of center-of-gravity	100mm(load=500kg)	100mm(load=500kg)		
Max. height of center-of-gravity	240mm(load=500kg)*1	140mm(load=500kg)		
Rotation speed *2	138°/s	J1-axis: 110°/s J2-axis: 165°/s		
Motion range	±360°	J1-axis: ±135° J2-axis: ±360°		
Allowable moment	490N∙m	J1-axis: 1420 N·m J2-axis: 490 N·m		
Allowable inertia	23.9kg ·m²	23.43 kg·m²		
Drive system	AC servo motor 2kW	J1-axis: AC servo motor 3kW J2-axis: AC servo motor 1.5kW		
Repeatability	±0.1mm	J7-axis: 土0.08mm J8-axis: 土0.08mm		
Weight	125kg	265kg		
Position feedback	ABS	O encoder		
Allowable welding current	500A: usage 60%			
Installation type	Floor installation			
Grounding	Exclusive grounding equivalent to class D or higher grounding			
Painting color	Sur	nny yellow		
Ambient *3	0~40°C, 20~80%	6RH (no condensation)		

Tab 1.1 ESTUN positioner specifications

(*1) There are certain limits on both eccentricity and height of center-of-gravity. See more details in 2 ALLOWABLE LOAD.

(*2) During short distance motions, the axis speed may not reach the maximum value stated. The maximum speed is measured at zero position of the robot, and will be limited by the position of other axes.

(*3) When the robot is used in low temperature environment that is near 0° C or not operated for a long time in the environment that is less than 0° C in a holiday or the night, collision detection alarm may occur since the resistance of the drive mechanism could be high immediately after starting the operation. In this case, we recommend performing the warm up operation for several minutes.

1. Repeatable positioning accuracy is measured when the indexer is running smoothly after repeated automatic operation of the indexer.



2. There are brakes in ESTUN positioner motors.

- 3. Specifications are subject to change without notice.
 - 4. There should be a pause time of 4.5s between two movements of the variator, otherwise the system may issue an alarm.







1.2. EXTERNAL DIMENSIONS



Fig 1.1 ESP-1D-500 part name











Fig 1.3 ESP-2U-500 part name



Fig 1.4 ESP-2U-500 dimensions (unit: mm)







1.3. EXTERNAL DIMENSIONS



Fig 1.5 Dimensions for ESP-1D-500 flange (unit: mm)

5

Add additional load on ESP-1D-500 flange:

- 1. Flange center hole φ 100H7 can be used as the base hole.
- 2. 8XM16 deep 22 (diameter 220) and 6XM12 deep 22 (diameter 418) holes are used as fixture threaded holes. 3.
- 3. The bolts for mounting are prepared by the customer. 4.
- Use fixing bolts with a strength of 12.9 and a torque of 255 Nm for M16 bolts and 103 Nm for M16 bolts. alternatively, it is necessary to select bolt lengths within approximately the following ranges, M16: 16 to 20 mm; M12: 12 to 20 mm.
- 5. If a bolt longer than the above length is used, it may interfere with the inner reducer and cause a malfunction.









Fig 1.6 Dimensions for ESP-2U-500 flange (unit: mm)

1.4. Utilization rate during welding

The utilization rate when welding workpieces fixed to the indexing machine is determined by the fixed collector brushes on the front side of the collector and the cable collector capacitance.

The following is an analysis of the ESTUN ESP series of indexers.

The conditions for welding a load to a shifter include a collector capacitance of 500A and an availability of 60%:

$$\left(\frac{\text{actual welding time}(mins)}{\text{reference welding time (ten mins)}}\right) < 0.6 (60\%)$$

If working current is under rated current (500A), allowable utilization rate is calculated as below:

Allowable utilization rate = (rated current²/working current²) \times rated utilization rate

- (1) When the robots work in the environment, using water or liquid, complete draining of J1 base must be done. Incomplete draining of J1base will make the robot break down.
- (2) Do not use unconfirmed liquid.









(3) Do not use the robot immersed in water, neither temporary nor permanent. Robot must not be wet permanently. Example: in case motor surface is exposed to water for a long time, liquid may invade inside the motor and cause failure.

1.4.1.Example

The robot described in this manual can be transported by a forklift. Use eight M12X30 bolts to fix the 4

(1) When the welding current is 350A:

Allowable utilization rate = $(500^2/350^2) \times 0.6 = 1.2 = 120\%$

Continuous welding can be performed when utilization exceeds 100%.

(2) When the welding current is (300A+300A):

Allowable utilization rate =
$$(500^2/(300 + 300)^2) \times 0.6 = 0.41 = 41\%$$

Reference welding time: 10min×0.41=4.1min. Pause: 10min-4.1min=5.9min

According to the 41% availability requirement, 4.1 minutes of welding must be followed by a pause of 5.9 minutes.

Welding in excess of the allowable usage rate can lead to burnt elements (collector brushes) of the collector, abnormal heat generation in the flange, unstable arc, etc.







2. ALLOWABLE LOAD

2.1. INSTRUCTIONS

Eccentricity and height of center-of-gravity should both meet the limited requirements.

2.2. MAXIMUM ALLOWABLE LOAD

Туре	Max. allowable load	Allowable moment		Allowable inertia	Max. eccentricity of center-of-gravity	Max. height of center-of-gravity	
ESP-1D-500	500kg	49	0N∙m	23.9kg∙m²	100mm	205mm	
ESP-2U-500	500kg	J1-axis 1420 N·m		$22.42 kg m^2$	100mm	140mm	
	SUUKG	J2-axis	490 N∙m	23.43 Kg·m-	TOOMIN	140MM	

Tab 2.1 Max. allowable load

2.3. LOAD MOMENT



Fig 2.1 Eccentricity and height of center-of-gravity (ESP-1D-500)







Fig 2.2 Eccentricity and height of center-of-gravity (ESP-2U-500)

2.4. ALLOWABLE MOMENT

The torque of each axis of this shifter must be within the permissible range at maximum load. Depending on the weight of the load, the torque can be found by the following equation:

```
moment = load \times acceleration of gravity \times eccentricity of center_of_gravit (1)
```

Alternatively, if there is an external force applied to the load, the load moment applied to each axis can likewise be found:

```
torque = external force \times eccentricity of external force point (2)
```

Max. moment is the total value of (1) and (2).

2.4.1.Example

Load=500kg, height of center-of-gravity =230, eccentricity of center-of-gravity =90, with no external force applied.

(1) Calculate allowable load moment *M*

```
\begin{split} M = load \times acceleration \ of \ gravity \times eccentricity \ of \ center\_of\_gravity = 500 \times 9.8 \times 0.14 = 686 (N \cdot m) \\ < 490 (N \cdot m) \end{split}
```

(2) While calculating M in step (1), check the height between the center-of-gravity of load and flange.







3. INSTRUCTIONS FOR INSTALLATION

3.1. MOUNTING THE BASE

The positioner should be installed correctly to ensure its function. The base, which is an essential part for positional and filling accuracy, should bear not only the static load but also the reaction forces generated in acceleration and deceleration. Therefore, the floor which the base is installed on, should be strong and rigid. To ensure safety, requirements for ambient, installation and dimensions should be strictly applied.

3.2. ENVIRONMENT

The following figures show the robot operating space. When installing peripheral devices, be careful not to interfere with the robot and its motion range.

Ambient requirements of installation site are listed below.

- 1) The ambient temperature must be in the 0 to 45°C range, and with no direct sun exposure.
- 2) The ambient humidity must be less than 80%RH.
- 3) The amounts of dust, dirt, oil vapors, water, etc. must be minimal.
- 4) There must be no flammable or corrosive liquids or gases present.
- 5) the vibration level of devices around the positioner must be less than 0.5G (1G=9.8m/s).
- 6) No major sources of electrical noise (plasma, high frequency, etc.).

3.3. MOUNTING THE SAFETY FENCE

Erect a safety fence to keep the operators at a distance from the robot while the robot is operating, so that the operator will not come into contact with the robot inadvertently.



Robot control device, welding machine, pedant and other peripheral devices must be placed outside the safety fence.







Fig 3.1 Safety fence

Notes for safety fence installation.

- The cabinet should be installed outside the motion range of the robot and the positioner (outside the safety fence).
- There should be a separate control cabinet for the positioner. Never install the positioner driver into the control cabinet.
- The positioner control cabinet should be installed on the top of the robot control cabinet.
- The positioner control cabinet should be installed at a place where it is easy to open the door for inspection.
- To ensure the maintenance channel open, the positioner control cabinet should be 500mm away from the wall.







4. MOUNTING METHODS

Dimensions for positioner installation are shown in the figure below. For the convenience of installation, there are mounting surface (machined surface) and pin holes on the base.



Fig 4.1 Dimensions for ESP-1D-500 installation







Fig 4.2 Dimensions for ESP-2U-500 installation

Movements of the positioner cause a large force of inertia, requiring the installation floor to be strong and rigid. Therefore, when the positioner and jigs are to be mounted together on the same common frame base, the frame base must be at least 20mm in thickness and the positioner must be firmly fixed using four pieces of hexagon socket head cap screws (M16), spring washer and washer with a tightening torque of 215Nm. Then put two pieces of φ 10×45 cylindrical pins into the pin holes.

See more details for mounting the single axis positioner in the figure below. Same method can be applied to mount double axes positioner.







Fig 4.3 Mounting ESP-1D-500







5. GROUNDING

To ensure safety, grounding system shown in the figure below must be applied (The user is responsible for providing the grounding wires).

Ground the robot and positioner separately using grounding cables with a diameter no less than 3.5 mm².

Securely connect a welding cable to the connecting terminal on the work side in the rear of the positioner.

Grounding the welding power supply using a grounding cable with a diameter of at least 14 mm² for the model 350A and at least 22 mm² for the model 500A. If connecting two or more welding power supplies, ground each one of them independently. For details, refer to the operating instructions of the welding power supply concerned.

Use as short cables as possible to ground the positioner.

Set the ground resistance to less than 4Ω .

Separate each grounding cables. Never use it as a grounding cable or electrode for other power lines. When using metal pipes, ducts or distributing frames to install grounding cables, ground the metal pipes etc. in compliance with the technical standards governing electrical apparatus.



Fig 5.1 Grounding method







6. TRANSPORTATION

Use a crane to transport the positioner for unpacking or installing. When lifting the positioner with a crane, hook a sling on the eyebolts of positioner and lift it up as shown in the figure below. Be careful with the cover which may be damaged by the eyebolts and slings.







The center-of-gravity of the positioner is shown above. Be careful about positioner falling when it is over-inclined. Proper measures to avoid falling should be applied when the positioner is temporarily placed, such as placing it at a stable surface.







OPTIONS

7. OPTIONS

This product provides a slave as an option, to support a longer work piece. It is applied to single-axis positioner ESP-1D-500 only.



Fig 7.1 Dimensions for ESP-1F-500 slave



Fig 7.2 Installation of ESP-1D/1F-500



ESTUN ROBOTICS

8. PERIODIC INSPECTION

8.1. INSTRUCTIONS

To perform inspection, maintenance, adjustments, repairs or other similar work on the positioner, access to the robot (include a positioner) working range may be required, or work with the primary-side power or the servo power turned on may be necessary. In any case, be sure to observe the following precautions for inspection, maintenance, adjustments and repairs.

	1.	Never modify our products.
DANGER	2.	Fire, malfunction, and malfunction caused by unauthorized modification may result in injury and machine damage.
	3.	The customer's own modification of the product is outside the company's warranty, so it will not be responsible for it.



Whenever the power is ON, never enter the robot working range. Approaching the operating robot may result in series personnel injury.



Never touch any charged parts. Touching any charged parts may result in series electric shock or burn.



Never put your hand, finger, hair or clothes close to the rotating part of cooling fans or wire-feeding machines. Putting your hand, finger, hair or clothes close to the rotating part may result in series injury.

8.2. SAFETY MEASURES FOR CHECK

- When inspecting, maintaining, adjusting, or repairing the shifter, the operator must be equipped with the necessary protective equipment such as helmet (protective headgear), safety shoes, and gloves as specified by Flange, and wear safety clothing suitable for the work to be performed.
- 2. Before operation, make sure to stop the machine and the robot in case of emergency or temporary stop. In addition, if safety devices such as safety bolts and safety buttons are installed, make sure that they are functioning properly. If an abnormality is recognized, stop the operation, immediately disconnect the main power supply, investigate the cause, and implement countermeasures to solve the problem.
- 3. Keep persons unrelated to robot operation away from the robot guardrail.
- 4. Before starting work, place a warning sign that reads "Inspection in progress" in a conspicuous place to notify people around you that inspection work is in progress.
- 5. Do not use equipment that generates electromagnetic noise in or around the workplace





where inspections are performed.

- 6. When carrying out inspections, etc., there must be at least two workers, one in charge of the inspection, etc., and the other to assist as a supervisor.
- 7. The operator who inspects, maintains, adjusts, or repairs the robot must be trained in the performance, operation, and maintenance of the robot. In addition, in the case of special equipment, they must be familiar with all movements of the equipment.
- 8. Only personnel who have received specialized training and qualifications for inspecting, maintaining, adjusting, and repairing robots may perform the above operations. However, even if you have received specialized training, do not perform inspections of machines other than those that you are familiar with and are responsible for.
- 9. Please execute the hand signals given to the maintenance and other operators, supervisors, and related machine operators in accordance with the customer's safety management standard specifications.
- 10. Supervisors must observe the following.
 - Concentrate on monitoring from a place where you can see the entire robot movement area.
 - Hold the emergency stop button at all times and press the emergency stop button immediately in the event of an abnormality.
 - Do not allow anyone other than the person performing inspection, etc. to enter the action area of the robot.
- 11. Persons performing inspection, etc. must observe the following.
 - If it is possible to work outside the robot's operating area, confirm the contents of the work in advance. In any case, work only outside the robot's operating area.
 - As a rule, inspections, etc., should be performed only after the robot has stopped operation. If you have to perform work during operation, report to the person in charge of safety management and obtain permission to perform work outside the robot's operating area.
 - If the robot is required to be in an operable state during the work, confirm the work procedure in advance and perform the work properly and safely. Ÿ If you are not specifically required to work in an operational state, turn off the input power to the robot control unit and the welding power supply. If no special procedure is required, disconnect or deactivate the input power to the fixtures or peripheral devices.
 - If you need to enter the robot's operating area, work in a position that allows you to press the emergency stop button immediately in order to prevent the robot from malfunctioning in the unlikely event of a malfunction.
 - When working, make sure that your footing is safe and proceed with caution. Ÿ Do not use unstable scaffolding or use a high place as scaffolding.
 - Do not work with your back to the robot in the robot operating area.
 - When replacing the printed circuit board inside the robot control unit or teaching box, take anti-static measures such as static protection film.
- 12. If an abnormality occurs during operation, take the following measures.
 - If abnormal robot operation occurs, press the emergency stop button immediately.
 - Immediately contact a supervisor, disconnect the power supply to the robot control unit, and set up a "Do not turn on the switch" warning sign.

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• Be sure to check that the machine is stopped.





- When it is necessary to enter the guard fence, the entrant must pull out the safety pin and hold it in his/her hand for operation.
- If there is an abnormality in the power supply to the robot, or in the hydraulics or air pressure of the related equipment, even if the robot stops automatically, manually stop the robot completely before investigating the cause and implementing countermeasures.
- If the emergency stop button or other safety devices fail, immediately disconnect the main power supply, investigate the cause, and implement countermeasures.
- If you want to restart the robot after an emergency stop, find out the cause of the abnormality and take countermeasures, then plug in the safety pin and restart the robot outside the guardrail.
- 13. After completing the work, carefully check to make sure that the necessary connectors, covers, panels, etc. are not incorrectly installed or wired.

8.3. SCHEDUAL OF PERIODIC CHECK

The periodic inspection is indispensable in order to continue operating the positioner in a safe and efficient manner. Perform the periodic inspection in accordance with the following schedule.

Be sure to overhaul in either a period of whole 6 years or 30,000 cumulative operating hours, whichever is shorter.

The inspection and maintenance period is estimated, supposing the positioner only for arc welding use. For more frequent use such as handling operation, that period may be shorter.

8.4. NOTES FOR PERIODIC CHECK

- 1. Periodic inspection must be performed by those who have received special training program and maintenance instructions, or at their presence.
- 2. Be sure to turn off the external breaker before performing inspection or maintenance.

Note that, with turning off only the non-fuse breaker of the robot controller, the primary side of the non-fuse breaker is still being applied with voltage.

In order to show that inspection or maintenance is underway, hang a noticeable sign on the switch of the external breaker.

8.5. DELIVERY AND MAINTENANCE DURATION

Repair of repair parts is in principle permitted only within the above mentioned period, but if stock is available, we will do our best to serve our customers as much as possible.

We are committed to meeting the needs of our customers and ensuring the supply of the required repair parts. However, there may be cases where external factors such as changes in market conditions lead to stock-outs within the warranty period.

8.6. INSPECTION ITEMS

No.	In	spectior	n, mai	intenar	nce	Lagation		Corrective action	
	Daily	3mths	1yr	3yrs	6yrs	Location	Item		
1	0					Appearance	Attached spatter, dust or	Visible check and cleaning	



PERIODIC INSPECTION								
							other foreign matter	
2	0					Matchmark panel	Peeling, soiling	Visible check
3	0					External cable	Scratches, soiling	Visible check
4		\bullet				Base bolts	Looseness	Retightening
5						Cannon plug	Looseness	Retightening
	0							Visible check, replace if
6						Copper brush	Scratches, soiling, abrasion	necessary. Remove abrasion
								and clean.
7	0					Current-collecting	Damaga soiling	Visible check and cleaning
1						board	Damage, solling	VISIBLE CHECK and Cleaning
0				($\left(\right)$	Internal cable	Damaged cable, bolt for	Visible check and retightening.
0			\cup	\bigcirc	0		mounting	Replace it if necessary.
0						Peducer	Grease replenishment,	Grease replenishment,
9						Reducer	abnormal check	replacing if necessary.
10						Overhaul		

OInspection

Replacement

8.7. PERIODIC CHECK FOR POWER COLLECTOR

Inspect for abrasion of the copper brush (or carbon brush) on the end of power collector part periodically. If the V-groove at the end of the collector guide shaft is beyond the reference plane or the V-groove cannot be seen, the copper brush (carbon brush) must be replaced with a new one.

If welding slag, soot, oil mist, etc. accumulates and is attached to the copper brushes (carbon brushes) and the collector plate, please use compressed air to clean them out.

Use a lint-free cloth to gently wipe off the oil mist.

Please clean the sediment from time to time to maintain the collector's ability to collect electricity.



Fig 8.1 Current-collecting unit





9. QUALITY ASSURANCE

Our company can provide quality assurance on the system of the shifter and offer free maintenance, which will be free of charge if the failure occurs within the following period and the user has operated the system of the shifter properly and inspected it regularly as described in the instruction manual or if there is a failure caused by a defect in production fabrication.

Warranty Period:

Within 14 months from the date of the bill of lading for the shipment of the product.

The actual accumulated operating time is 2000 hours.

Warranty service is not applicable to the following cases even during the warranty period. The customer is required to pay for the repair.

1. malfunctions caused by incorrect use or operation of the physical object.

2. Failure caused by unauthorized repair or alteration by the gas repairer, which the Company believes to be unauthorized.

3. Damage or malfunction caused by natural disasters such as earthquakes, fires, and floods.

4. Malfunction caused by improper handling or storage after delivery.

5. Other similar cases.

6. wearable and maintenance parts.





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APPENDIX

APPENDIX A BOLT TORQUE LIST

Bolt Models (GB/T 70.1)	М3	M4	M5	M6	M8	M10	M12	M14	M16	M18
Tightening Torque /N.m (Level 12.9)	2	4	9.01 ±0.49	15.6 ±0.78	37.2 ±1.86	73.5 ±3.43	129 ±6.37	205 ±10.2	319 ±15.9	441 ±22

APPENDIX B SPECIFICATION OF BOLT

Nominal diameter	Screw dimension	Drill diameter	Anchor depth(mm)	Max. anchor thickness(mm)	Designed pulling force(kN)	Designed shearing force(kN)	Anti-pull force(kN)
M8	φ8×110	φ10	80	13	10.3	12.3	≥20KN
M10	φ10×130	φ12	90	20	12.3	14.2	≥30KN
M12	φ12×160	φ14	110	25	16.8	17.5	≥40KN
M16	φ16×190	φ18	125	35	28.9	35	≥60KN
M20	φ20×260	φ25	170	65	50.1	51.5	≥90KN
M24	φ24×300	φ28	210	65	75.5	80	≥140KN
M30	φ30×380	φ35	280	70	121.3	163.7	≥200KN
M33	φ33×420	φ38	300	90	135	182	≥260KN

APPENDIX C ESP-1D-500 Parts List

No.	SAP	Name	Amount	Note
1	49H05000361	Collector plate ESP-1D-600-07T0.1	1	
2	49H05000372	Copper brush ESP-1D-600-18T0.1	1	
3	12509231002	Robot servo motor EMR-20GDSA34-G111	1	
4	11231100120	PRONET Servo Drive PRONET-20DEA-EC	1	
5	A2144000001	Grease MolyWhite RE00(16Kg/drum)	1	

APPENDIX D ESP-2U-500 Parts List

No.	SAP	Name	Amount	Note
1	49H05000361	Collector plate ESP-1D-600-07T0.1	1	
2	49H05000372	Copper brush ESP-1D-600-18T0.1	1	
3	12508231001	Robot servo motor EMR-15GDSA34-G111	1	
4	12510231001	Robot servo motor EMR-30GDSA24-G511	1	
5	11261100010	Robot Servo Drive PRONET-15DEA-EC-R	1	
6	11261100013	Robot Servo Drive PRONET-30DEA-EC-R	1	
7	A2144000001	Grease MolyWhite RE00(16Kg/drum)	1	





REVISION RECORD

Revision	Date	Contents	
01	2018.04	New edition.	
02	2019.12	Addition of ER30-1880, ER12-1510. Addition of transportation method. Deletion of ER20/10-2000. Addition of ER12-1510-H5. Modification of parts list. Modification of errors.	
03	2018.07	Add ESP-2U-500; update the layout; modify some error descriptions.	
04	2019.07	Modify ESP-1D-600 to ESP-1D-500. update the screw tightening torque table.	









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