

EPSON

AX6 / RC-A101

Safety Manual

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The information in this document is subject to change without notice.

Please contact us if you find any errors in this document or if you have any questions about the information in this document.

Limitation of Liability

The safety information provided in this manual is intended to assist in the safe operation and integration of the robot system. However, the information and instructions contained herein shall not be construed as a guarantee or warranty by Seiko Epson Corporation that the industrial manipulator will not cause bodily injury or property damage, even if all safety instructions and guidelines are strictly followed.

As the robot is a component intended for integration into a larger system, the following conditions apply:

- **Integrator Responsibility:** The system integrator is solely responsible for the design, installation, and operation of the complete robot application, including the performance of a comprehensive risk assessment.
- **Operating Conditions:** Seiko Epson Corporation shall not be held liable for any damages or injuries resulting from the use of the robot system outside the specified operating conditions or intended use.
- **Safety Validation:** The effectiveness of safety functions depends on correct configuration and validation by the user; therefore, compliance with this manual does not exempt the user from their obligation to ensure a safe working environment.
- **Information Accuracy:** While every effort has been made to ensure the accuracy of this document, the information is subject to change without notice, and Seiko Epson Corporation assumes no liability for errors or omissions.

1. Introduction

1.1 Introduction

Thank you for purchasing this Epson robot system. This manual provides the information necessary for correctly using the robot system. Before using the system, please read this manual and related manuals to ensure correct use.

After reading this manual, store it in an easily accessible location for future reference. Epson conducts rigorous testing and inspection to ensure that the performance of our robot systems meets our standards. Please note that if the Epson robot system is used outside the operating conditions described in the manual, the product will not perform up to its specified performance.

This manual describes potential hazards and problems that are foreseen. To use the Epson robot system safely and correctly, be sure to follow the safety information contained in this manual.

It furthermore contains important safety information for the use of the Epson robot in applications that may include direct contact with humans. Make sure you have read and understood these instructions before powering on the robot for the first time.

1.2 Manufacturer

Seiko Epson Corporation
3-5, Owa 3-chome, Suwa-shi, Nagano 392-8502 Japan
URL : <https://corporate.epson/>

1.3 Importer

Importer for the EU
EPSON EUROPE B.V.
Azie building, Atlas ArenA, Hoogoorddreef 5,1101
BA Amsterdam Zuidoost The Netherlands
TEL: +31-20-314-5000
FAX: +31-20-314-5010

Importer for the UK
EPSON EUROPE B.V.
Floor 3&4, The Clarendon Works, 37-39 Clarendon Road,
Watford WD17 1JA, U.K.
TEL: +44-1442-261144
FAX: +44-1442-227227

1.4 Contact Information

URL : <https://corporate.epson/en/products/robot-systems.html>



1.5 Disposal

When disposing of this product, please do so in accordance with the laws and regulations of your country.

1.6 Disposal of Batteries

Refer to the following manual for the battery removal and replacement procedures: “Robot Controller RC-A101 Service Manual”.

1.6.1 For Customers in the European Union



The crossed out wheeled bin label that can be found on your product indicates that this product and incorporated batteries should not be disposed of via the normal household waste stream.

To prevent adverse effects on the environment and human health, the product and its batteries should be separated from other waste and recycled in an environmentally responsible manner. Contact your local government or product distributor for information on collection facilities.

The Pb, Cd, or Hg symbol means that these metals are used in the battery.

KEY POINTS

This information only applies to customers in the European Union, according to Directive 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC and legislation transposing and implementing it into the various national legal systems, and to customers in countries in Europe, Middle East and Africa (EMEA) where they have implemented equivalent regulations. For information on recycling products in other countries, please contact your local government.

1.6.2 For Customers in the Taiwan Region



Used batteries should be separated from other waste and recycled in an environmentally responsible manner. Contact your local government or product distributor for information on collection facilities.

1.6.3 For California Customers

The lithium battery used in this product contains perchlorate material that requires special handling. Refer to the following document: <https://dtsc.ca.gov/perchlorate/>

1.7 Conventions

The table below explains the symbols used in this document and on the product itself.

 WARNING	This symbol indicates that a danger of possible serious injury or death exists if the associated instructions are not followed.
 WARNING	This symbol indicates that a danger of possible harm to people or death caused by electric shock exists if the associated instructions are not followed properly.
 CAUTION	This symbol indicates that a danger of possible harm to people or physical damage to equipment and facilities exists if the associated instructions are not followed properly.
	This symbol indicates that safety goggles must be worn.

2. Safety of This Product

2.1 Intended Use

AX6 is normally integrated into a production line and it usually works with grippers or other end effectors. Before AX6 is used for the first time, a risk assessment must be carried out for the final system into which AX6 is to be integrated. This risk assessment must conform to the country-specific safety standards and directives (proposal see under section [Safety Compliance](#)). In the case of collaborative applications, special attention must be paid for avoiding hazards to humans in the risk assessment. AX6 may be used across different industries for stationary or mobile applications. Its main purpose is handling or assembling parts, executing automated processes with end effectors, tools or fixtures and direct interaction with people when the safety functions for collaborative operation are enabled.

 WARNING	Any use that does not fall within the intended use is considered misuse and is not permitted. Some examples of misuse (the list is not exhaustive): • Any application that causes harm to humans or animals. • Any application that could endanger human or animal life or cause injury in the event of a malfunction. • Handling or use of hazardous objects or substances in collaborative applications. • Exceeding the specified operating limits or operating the robot not within the allowed environmental conditions. • Lifting any humans or animals. • Use in explosive environments.
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2.1.1 Scope and System Integration

The robot is a component, not a complete solution.

Please be advised that the information provided in this manual pertains specifically to the robot arm and its integrated control system. It does not cover the design, installation, or operation of a complete robot application.

A "complete application" includes, but is not limited to:

- The end-effector (tooling).
- The specific workpiece being handled.
- Peripheral equipment and safety guarding.
- The operating environment.

The integrator is responsible for ensuring that the final installation complies with all local and national safety laws and regulations (proposal see under section [Safety Compliance](#)). The safety of the entire system depends on how the robot is integrated and utilized within its specific workspace.

2.1.2 Risk Assessment and Compliance

Before operating the robot, a comprehensive Risk Assessment must be conducted in accordance with ISO 12100. This process identifies potential hazards throughout the robot's lifecycle – from commissioning and programming to maintenance and decommissioning.

A thorough risk assessment should evaluate the interaction between the robot, the operator, and the environment. Based on this assessment, appropriate safety configurations must be implemented.

2.1.3 Recommended Safety Configurations

To mitigate identified risks, the following limiting functions should be configured within the robot's safety settings menu (this list is not exhaustive):

- **Safely Limited Position (SLP):** Defines "safety planes" or workspace boundaries to prevent the robot or its tool from entering restricted areas.
- **Safely Limited Joint Angles:** Prevents individual joints of the robot to exceed any given angular position limit.
- **Safely Limited Speed (SLS):** May be used to ensure the robot arm operates at a low, predictable speed during collaborative tasks or when an operator is nearby, reducing the kinetic energy during potential impact.
- **Safe Power and Force Limit (PFL):** Restricts the amount of force the robot can exert during a collision to prevent injury.

Note: These settings must be validated after the final application is built to ensure they meet the safety requirements determined during the risk assessment.

2.2 Installation Environment

A suitable environment is necessary for the robot system to function properly and safely. Be sure to install the robot system in an environment that meets the conditions explained in the chapters “Installation” in the following manuals:

- For the Manipulator: “Collaborative Robot: 6-Axis Robots AX6 Manual”
- For the Controller: “Robot Controller RC-A101 Manual”

Please make sure:

- Install indoors.
- Keep away from direct sunlight.
- Keep away from dust, oily smoke, salinity, metal powder or other contaminants.
- Keep away from flammable or corrosive solvents and gases.
- Keep away from water.
- Keep away from shocks or vibrations.
- Keep away from sources of electronic noise & high electromagnetic radiation.
- Keep away from explosive areas.
- Keep away from a large quantity of radiation.

AX6 is not suitable for the operation in environments that do not fulfil the above conditions. If you want to use the robot in such conditions, please contact your supplier.

Rapid changes in temperature and humidity can lead to condensation inside the manipulator which can lead to damage or degradation. Avoid bringing a cold robot into a warm area to prevent condensation and never power up a robot when it is wet.

2.3 Mounting Considerations

Instructions and requirements for mounting the manipulator can be found in the manual: “Collaborative Robot: 6-Axis Robots AX6 Manual”.

2.4 Residual Risks

For more details about the residual risks present in our manipulator and controller, check the warnings and caution statements in each section.

2.5 Declaration of Conformity (EU member states only)

This declaration may not be the latest one. The latest version can be viewed from the following URL if needed.

<https://download.epson.biz/robots/ww/certificate/>



- Original -
Translation
French (FR)

DECLARATION OF INCORPORATION OF PARTLY COMPLETED MACHINERY

DÉCLARATION D'INCORPORATION POUR LES QUASI-MACHINES

According to the Machinery Directive 2006/42/EC, Annex II, Part 1, sector B for a partly completed machinery.
En accord avec la directive machine 2006/42/CE, Annexe II, Partie 1, Secteur B pour une quasi-machine.

Manufacturer /Fabricant:	SEIKO EPSON CORPORATION	www.epson.com
Address /Adresse:	3-5, Owa 3-chome, Suwa-shi Nagano-ken 392-8502 Japan	Telephone /Téléphone: +81-266-52-3131 Fax /Fax: +81-266-52-8409

Representative /Représentant:	EPSON EUROPE B.V.	www.epson.eu
Address /Adresse:	Atlas Arena, Asia Building, Hoogoorddreef 5, 1101 BA Amsterdam Zuidoost The Netherlands	Telephone /Téléphone: +31-20-314-5000

This declaration of incorporation is issued under the sole responsibility of the manufacturer.
La présente déclaration d'incorporation est établie sous la seule responsabilité du fabricant.

Brand Name /Nom de la marque:	EPSON
Product Name /Nom du produit:	Industrial Robot/ Robot Controller
Model /Modèle:	AX6 RC-A101

(Serial number A6****0000 - A6****9999)
(Serial number R1A6**0000 - R1A6**9999)
<Note> *: 0 - 9, A - Z

For more details, please refer to the product description
Pour plus de détails, merci de vous référer à la description du produit

Options /Options:
See Technical Data File

Fulfills the following essential health and safety requirements of the Machinery Directive 2006/42/EC:

Répond aux exigences essentielles de santé et de sécurité de la directive machine 2006/42/CE
1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.2.1, 1.2.2, 1.2.3, 1.2.4.1, 1.2.4.2, 1.2.4.3, 1.2.5, 1.2.6, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.6, 1.3.7, 1.3.9, 1.5.1, 1.5.2,
1.5.4, 1.5.6, 1.5.8, 1.5.9, 1.5.10, 1.5.11, 1.6.1, 1.6.2, 1.6.3, 1.6.4, 1.7.1, 1.7.1.1, 1.7.2, 1.7.3, 1.7.4

The manufacturer undertakes to electronically supply the relevant technical documentation, referred to in Annex VII part B for the partly completed machinery, to national authorities upon reasoned request.

La fabricant s'engage à fournir électroniquement la documentation technique pertinente aux autorités Nationales sur demande motivée, selon l'annexe VII Partie B pour les Quasi-machines.

This partly completed machine must not be put into service until the machinery into which it is to be incorporated, has been declared in conformity with the provisions of the Machinery Directive.

La quasi-machine ne doit pas être mise en service tant que l'équipement d'incorporation n'aura pas été déclarée conforme aux dispositions de la directive machine.

Furthermore this partly completed machinery fulfils all relevant provisions of the directive:

En outre, cette quasi-machine remplit toutes les dispositions pertinentes de cette directive:

- Electromagnetic Compatibility (EMC) 2014/30/EU
- Restriction of the use of certain hazardous substances (RoHS) 2011/65/EU

Following harmonized norms and specifications are applied:

L'harmonisation des normes et des spécifications suivantes sont appliquées :

Safety:	EMC:
EN ISO 10218-1 2011	EN 55011 2016/A1:2017/A11:2020 Group1 Class A
EN ISO 12100 2010	EN 61000-6-2 2005
EN 60204-1 2018	EN 61000-6-4 2007/A1:2011
EN ISO 13850 2015	EN 61000-6-7 2015
EN 61800-5-2 2017	
EN ISO 13849-1 2015	RoHS:
ISO/TS15066 2016	EN IEC 63000 2018

2.6 Safety Compliance

Specific requirements and conditions of use for ensuring safety are described in the manuals for the manipulators and controllers. Be sure to also read these manuals.

Observe the safety standards of the respective country and region when installing and operating the robot system. The following are examples of safety standards related to robot systems and other safety standards.

Please refer not only to this chapter but also to these standards and take adequate safety measures.

Note: These standards are not intended to include all of the required safety standards.

- ISO 10218-1 Robots and robotic devices – Safety requirements for industrial robots – Part 1: Robots
- ISO 10218-2 Robots and robotic devices – Safety requirements for industrial robots – Part 2: Robot systems and integration
- ANSI/RIA R15.06 American National Standard for Industrial Robots and Robot Systems – Safety Requirements
- ISO 12100 Safety of machinery – General principles for design – Risk assessment and risk reduction
- ISO 13849-1 Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
- ISO 13850 Safety of machinery – Emergency stop function – Principles for design
- ISO 13855 Safety of machinery – Positioning of safeguards with respect to the approach speeds of parts of the human body.
- ISO 13857 Safety of machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs.
- ISO14120 Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards
- IEC 60204-1 Safety of machinery – Electrical equipment of machines – Part 1: General requirements
- CISPR11 Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement
- IEC 61000-6-2 Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments

2.7 Notes on CE Marking

Epson robot system (manipulators and controllers) is a device that will be incorporated into the end user manufacturing equipment, so it is a “partly completed machinery” as defined in subparagraph 1 (g) of Article 1 (Scope) of the European Machinery Directive (2006/42/EC). Pursuant to the Article 13 (Procedure for partly completed machinery) of the European Machinery Directive, Epson has declared that the Epson robot system conforms to the European Machinery Directive, the European EMC Directive (2014/30/EU), and the European RoHS Directive (2011/65/EU) in the “Declaration of Incorporation of Partly Completed Machinery”. (Please refer to the Declaration of Incorporation of Partly Completed Machinery included with the robot system for details.) Therefore, the Epson manipulators do not bear the CE marking because the Epson robot system is a “partly completed machinery”.

However, the robot controller RC-A101 is considered as a “completed product”. Epson has separately declared that AX6 and RC-A101 conforms to the European EMC Directive and the European RoHS Directive, and RC-A101 bears the CE marking as proof of conformity.

2.8 Notes on UKCA Marking

Epson robot system (manipulators and controllers) is a device that will be incorporated into the end user manufacturing equipment, so it is a “partly completed machinery” as defined in subparagraph (1) of regulation 6 of the Supply of Machinery (Safety) Regulations 2008. Pursuant to the regulation 8 of Supply of Machinery (Safety) Regulations 2008, Epson has declared that the Epson robot system conforms to the Supply of Machinery (Safety) Regulations 2008, the Electromagnetic Compatibility Regulations 2016, and the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 in the “Declaration of Incorporation of Partly Completed Machinery.” (Please refer to the Declaration of Incorporation of Partly Completed Machinery included with the robot system for details.) Therefore, the Epson manipulators do not bear the UKCA marking because the Epson robot system is a “partly completed machinery”.

However, the robot controller RC-A101 is considered as a “completed product”. Epson has separately declared that AX6 and RC-A101 conforms to the Electromagnetic Compatibility Regulations 2016 and the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012, and RC-A101 bears the UKCA marking as proof of conformity.

3. Safety Precautions

This chapter describes caution statements for using the robot system safely. Be sure to read this before using the robot system.

Operating the robot system without understanding the safety precautions is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.

3.1 Precautions for Unpacking and Transportation

Unpacking and transportation of the manipulator and related equipment should be performed by people who have received installation training provided by Epson and the suppliers. Also, the laws and regulations of the installation country must be followed. The following items are safety precautions that must be observed.

 WARNING	• When transporting the Manipulator, use a cart or the like to transport it in the same status as it was delivered. Do not transport with the end effector or peripheral equipment attached. Losing balance may cause the manipulator to fall over, which is extremely hazardous and may result in serious injury to operators and/or severe equipment damage. • Only qualified personnel should perform sling work and operate a crane or a forklift. When these operations are performed by unqualified personnel, it is extremely hazardous and may result in serious injury to operators and/or severe equipment damage. • When hoisting the manipulator, use your hands to balance it. Losing balance may cause the manipulator to fall over, which is extremely hazardous and may result in serious injury to operators and/or severe equipment damage. • During transport, personnel involved in the work should wear helmets and other personal protective equipment. Also, make sure there are no other people in the vicinity.
 CAUTION	• Avoid excessive vibration and shocks when transporting the manipulator. Excessive vibration and shock may cause manipulator damage or malfunctions. • When removing the fixing bolts securing the manipulator to the transportation pallet or the anchor bolts, support the manipulator to prevent it from falling. Removing the fixing bolts or anchor bolts without supporting the manipulator may result in serious injury to operators and/or severe equipment damage. • To transport the manipulator, either secure it to transporting equipment, or use the transport method specified in the manipulator manual.

3.2 Precautions for Installation and Connection

The design and installation of this AX6 must be carried out by personnel who have been trained in robotic systems by us and our suppliers. Users must undergo system-specific training and be informed about all safety aspects.

This collaborative robot comes with integrated collision detection which allows collaborative applications. To declare an application as collaborative, it must be proven in the mandatory risk analysis that the robot is not hazardous. Otherwise the working area of the robot must be safeguarded. Note that the collision detection stops the robot's motion after a collision occurs but it cannot prevent it. Teaching is considered as collaborative as the speed is limited in the manual mode. See [Manual Mode](#).

 WARNING	• Please read this manual, the “Robot Controller RC-A101 Manual” and the “Collaborative Robot: 6-Axis Robots AX6 Manual” before using this robot system. Operating the robot system without understanding the safety precautions is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system. • The robot system must be used in accordance with the environmental conditions described in the relevant manual. This product has been designed and manufactured for use in a normal indoor environment. Use of the product in an environment that does not meet the operating environmental conditions will not only shorten the product life, but may also cause serious safety issues. • The robot system must be used within the specified specifications. Using the robot system outside of the product specifications will not only shorten the product life, but may also cause serious safety issues. • When installing a robot system, wear at least the following protective gear. Working without protective gear may cause serious safety problems. ○ Work clothes suitable for work ○ Helmet ○ Safety shoes • When designing a robot system using this product, refer to the information in this manual, the “Robot Controller RC-A101 Manual” and refer to the standards to install safety barriers. A collaborative robot is prepared to work without safety barriers. But if safety barriers are installed because they are necessary for the process integration, they must be properly installed. Failure to install safety barriers is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system. • Never operate the robot without an installed emergency stop button. Make sure that an emergency stop button is always accessible. Ignoring this may lead to dangerous situations. For the wiring of the emergency stop button, please check the “Robot Controller RC-A101 Manual”. • Install the Manipulator in a location with enough space so that a tool or a workpiece tip does not reach a wall or safety barriers when the manipulator extends while holding a workpiece. If the tool or the workpiece tip reaches a wall or safety barriers, it is extremely
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	hazardous and may result in serious injury to operators and/or severe equipment damage. • The distance between the safety barriers and the tool or workpiece should be set according to ISO 10218-2. For the stopping time and stopping distance, refer to the following: ○ In chapter Performance Level and Reaction Times of Safety Functions in this manual: Reaction times of the safety functions until robot initiates stop ○ In chapter Total Response Time of the Safety Function and the Robot in this manual: Explanation how to calculate the overall reaction time ○ In “Collaborative Robot: 6-Axis Robots AX6 Manual”: Stopping Time and Stopping Distance of the stopping procedure from initiating robot stop until robot comes to standstill. • Before installing or operating the manipulator, make sure that no parts of the manipulator are missing and that it has no damage or other external defects. Missing parts or damage may cause malfunction of the manipulator, is extremely hazardous and may result in serious injury to operators and/or severe equipment damage. • Do not use the manipulator near devices that generate strong magnetic forces. This may cause manipulator failure or malfunction. • Do not use the Manipulator in areas where there is a risk of electromagnetic interference, electrostatic discharge, or radio frequency interference. This is dangerous because the manipulator may malfunction. • Do not use the manipulator where it is exposed to combustible gases, combustible dusts, gasoline, solvents, or other flammable liquids that may cause an explosion or fire. This may cause serious accidents involving injury or death as well as fires. • Keep hands and other objects away from moving parts of the manipulator. There is a risk of injury due to pinching. • Do not install the controller upside down or at an angle. • For IP protection: ○ The IP54 dustproof and water-resistant rating is based on a design evaluation of the manipulator body, power cable, and signal cable, conducted with reference to the applicable standards. This information is provided for reference only and does not guarantee the performance of the robot at the time of shipment or under actual installation and operating conditions. ○ It is recommended to plug the power cable connector and the signal cable connector immediately after installing the manipulator. Also consider that water and/or dust might enter the airtubes when no tube or plug is connected. • If the manipulator is installed on a movable platform (linear axis, movable cart, AGV, etc.), be sure to design the system so that the movable platform also stops when the manipulator is stopped in an emergency. If the movable platform continues to operate without
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	stopping, it is extremely hazardous and may result in serious injury to operators and/or severe equipment damage.
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 WARNING	• Be sure to connect the AC power cable to a power receptacle. Do not connect it directly to a factory power source. To shut off power to the robot system, disconnect the power plug from the power source. Performing any work or opening the controller or the manipulator while connecting the AC power cable to a factory power source is extremely hazardous and may result in electric shock and/or malfunction of the robot system. • Do not open the cover of the controller or manipulator except during maintenance. There is a high-voltage charging section inside, and there is a risk of electric shock even when the power is turned off. • Be sure to turn off the power to the robot system before connecting or disconnecting cables. Working with the power on may result in electric shock and/or malfunction of the robot system. • Use cables with securely protected high-voltage sections and connect them securely. Also, do not put heavy objects on the cables, bend them severely, pull them forcibly, or pinch them. Damaged cables, broken wires, or contact failure is extremely hazardous and may result in electric shock and/or malfunction of the robot system. • If installing a power plug to match a factory power socket, the installation should be performed by personnel with specialized knowledge and skills in the field. When installing the power plug, be sure to connect the ground wire (green/yellow) of the AC power cable to the ground terminal of the power distribution system. If the ground wire is improperly connected to ground, it may result in the electric shock. • Always use a circuit breaker for the controller's power supply. Failure to use a circuit breaker may result in electric shock and/or malfunction of the robot system. • When connecting the controller power supply to a transformer, make sure the PE terminal of the AC power cable is connected to the transformer's PE terminal or another PE connection point. • Installation for options should be performed by people who have received maintenance training provided by Epson and the suppliers. Be sure to turn off the power to the robot system and disconnect the power cables during work. Working with the power on or with the high-voltage charging sections not fully discharged may result in electric shock and/or serious safety problems. • Remove the power plug when opening the front of the controller. Touching the AC power input terminal block or other components inside the enclosure may result in electric shock and/or serious safety problems. • The manipulator is grounded by connecting it to the Controller. Ensure that the controller is grounded and the cables are correctly connected. If the ground wire is improperly connected to ground, it may result in fire or electric shock.
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	Optionally the robot can be additionally grounded with the extra thread in the base of the manipulator. • Be sure to turn off the power and tag out (e.g., with a “DO NOT TURN ON” sign) before performing wiring. Performing any work procedure with the power turned on is extremely hazardous and may result in electric shock and/or malfunction of the robot system. • Do not touch the terminals. Doing so may cause electric shock, product damage, or malfunction. • Do only connect optional devices to the Teaching Device port, as listed under Teaching Devices in the “Robot Controller RC-A101 Manual”.
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 CAUTION	• Regarding cyber security, organizational measures like those described below should be taken to address cybersecurity risks: ◦ Perform risk analysis based on security threats and vulnerabilities related to your organization's assets. ◦ Establish a security policy to address risks and educate and train appropriate personnel. ◦ Establish guidelines for how to respond when security issues arise and make them known throughout your organization. • Epson robot systems are designed to be used within a closed local area network. Please refrain from connecting to networks with Internet access. If a connection to the Internet is required, we recommend taking the necessary technical measures to protect against malicious attacks and vulnerabilities over the Internet. These measures include, but are not limited to, access controls, firewalls, data diodes, and so on. • Do not connect any devices other than those listed in the manual to the external connection terminals of this product. Do not use the external connection terminals for any purpose other than those described in the manual. Failures such as unauthorized logins, information falsification, information leaks, and robot system stoppages may occur. We recommend taking physical measures to prevent anyone other than the administrator and those authorized by the administrator from touching the controller and control devices. Furthermore, we recommend taking technical and physical measures to prevent access to the network to which the product is connected. • If the manipulator performs an abnormal operation due to a setting or wiring error, do not hesitate to immediately stop the manipulator operation by pressing the emergency stop button or by other means. • Resonance (resonating sound or minute vibrations) may occur during manipulator operation depending on the rigidity of the mounting plate. If resonance occurs, improve the rigidity of the mounting plate or change the speed or acceleration settings of the manipulator. • Only authorized or certified personnel should perform wiring. Wiring carried out by unauthorized or uncertified personnel may result in injury and/or malfunction of the robot system. • In case of wall mounting or ceiling mounting, secure the manipulator to a wall or ceiling with enough strength and rigidity. Also, take measures
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	on the base of the manipulator to prevent it from falling. If the manipulator vibrates or drops, it is extremely hazardous and may result in serious injury and/or severe damage to the robot system. • Be careful to prevent any foreign material, such as shavings or wiring scraps, from entering the controller. Foreign objects may cause malfunction, failure, or fire. • Do not apply shocks or loads to the connectors when connecting cables. When removing a cable, do not pull on the cable but on the connector itself. • Check that the cables between controller and manipulator are properly installed. Improper connection may not only lead to malfunction of the robot system but also safety problems. • Before connecting the connector, check that the pins are not bent. Connecting with bent pins may damage the connector and result in malfunction of the robot system.
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3.3 Precautions for Teaching, Programming and Operation

The following items are safety precautions for personnel performing teaching or programming.

 WARNING	• Incorrectly configured safety functions may cause serious safety problems. • Safety components must be functioning when performing any work. Performing work with disabled safety devices or sensors is extremely hazardous because the safety function will not be activated. This may cause serious safety problems. • Be sure to anchor the manipulator before turning on the power or operating it. Turning on the power or operating the manipulator while it is not anchored may cause the manipulator to fall over, which is extremely hazardous and may result in serious injury to operators and/or severe equipment damage. • Persons who have not undergone training must never approach a manipulator that is turned on. Also, do not enter the work envelope. If the manipulator is turned on, it may make unexpected movements even if it appears to be stopped, which may result in serious safety problems. • Safe work procedures should be established and followed to prevent hazards due to unexpected movement of the manipulator or operator mishandling of the manipulator. • Before beginning full operation, make sure that the safety devices such as the emergency stop button or safety sensors (e.g. door switches) are installed and working properly. Operation without the switches functioning properly may result in the safety functions failing to operate during an emergency, which is extremely hazardous and may result in serious injury to operators and/or severe equipment damage. • Collaborative applications: Although the collision detection reduces the hazard of collisions with the human body to a minimum, the risk of collisions with head and neck must be prevented. • Non-collaborative applications: Do not enter the operating area of the manipulator while the robot is powered-up and make sure that no one is inside this area before powering up. Being within the operating area of a powered-up manipulator is extremely hazardous and may cause serious safety problems as the manipulator may move even if it seems to be stopped. • Immediately press the emergency stop button whenever the manipulator moves abnormally during operation. Continuing the operation while the manipulator moves abnormally is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system. • If the robot is defective or is suspected of being defective, it must not be operated. The robot must not be operated with faulty or worn cables, hoses, peripherals or other devices. • The robot's maximum load capacity must not be exceeded. • The following can lead to hazardous situations and harmful danger: ○ Entrapment of loose clothing and long hair ○ Loose unsecured hoses and components that can separate or whip about.
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	○ Components improperly installed creating unexpected motion/hazard. ○ Overload of robot arm or associated equipment resulting in breaking or buckling of mechanical components. ● Connecting/disconnecting optional air tubes and working with high pressure: ○ Removing air tubes under pressure is not allowed ○ Wear safety goggles and ear plugs for protection against loud noises or hose ends/connector parts that may swirl around ● During teaching points and start-up work, the robot system should be in manual mode, with the emergency stop button ready to be pressed at any time. Mistakes in operation or the like could cause the manipulator to make an unexpected movement, which is extremely hazardous and may cause serious safety problems. ● When working inside the safety barriers, use the manual mode (low speed 250 mm/s).
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 CAUTION	● Whenever possible, only one person should operate the robot system. If it is necessary to operate with more than one person, ensure that all personnel communicate with each other and take all necessary safety precautions. ● If the joints are operated repeatedly with the operating angle less than 5 degrees, they may get damaged early because the bearings are likely to cause oil film shortage in such a situation. To prevent early breakdown, move each joint more than 30 degrees for about once an hour. ● Oscillation (resonance) may occur continuously in low speed manipulator motion (speed: approx. 5 to 20 %) depending on the combination of manipulator orientation and end effector load. Oscillation arises from the natural oscillation frequency of the manipulator and can be controlled by the following measures: ○ Changing manipulator speed or acceleration ○ Changing the teach points ○ Changing the end effector load
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3.4 Precautions for Automatic Operation

The following items are safety precautions for personnel running a program to perform automatic operation.

 WARNING	• Do not carelessly enter the work envelope during automatic operation. This is extremely hazardous and may cause serious safety problems because the manipulator may move, even if it seems to be stopped. • If the manipulator stops for an unknown reason during automatic operation, absolutely do not approach the stopped manipulator. If you need to approach the manipulator, press the emergency stop button or shut off the main power supply before approaching. When shutting off the main power supply, be very careful not to create new hazards. • When interrupting a program and restarting the robot system during automatic operation, make sure that no new hazards are created in relation to peripheral equipment before starting the program. • Before operating the robot system, make sure that no one is inside the safety barriers. If the Manipulator makes an unexpected movement, it is extremely hazardous and may cause serious safety problems. • If the robot is defective or is suspected of being defective, it must not be operated. The robot must not be operated with faulty or worn cables, hoses, peripherals or other devices. • The robot's maximum load capacity must not be exceeded. • The following can lead to hazardous situations and harmful danger: ○ Entrapment of loose clothing and long hair ○ Loose unsecured hoses and components that are separate or whip about. ○ Components improperly installed creating unexpected motion/hazard. ○ Overload of the manipulator or associated equipment resulting in breaking or buckling of mechanical components. • Connecting/disconnecting optional air tubes and working with high pressure: ○ Removing air tubes under pressure is not allowed ○ Wear safety goggles and ear plugs for protection against loud noises or hose ends/connector parts that may swirl around • If the manipulator moves abnormally during operation of the robot system, immediately press the emergency stop button. Continuing the abnormal operation is extremely hazardous and may result in serious injury and/or severe damage to the robot system. • Safety components must be functioning when performing any work. Performing work with disabled safety devices or sensors is extremely hazardous because the safety function will not be activated. This may cause serious safety problems. • If a person is pinched or trapped by the manipulator due to malfunction or abnormality, move the manipulator by hand applying high force and escape.
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	○ Each axis is equipped with a slip clutch and can be moved by hand with considerable force in an emergency. ○ For further details see the manual “Collaborative Robot: 6-Axis Robots AX6 Manual” ● Do not move the manipulator while the movable platform (linear axis, movable cart, AGV, etc.) is in motion. Operating the manipulator while the movable platform is in motion may result in serious injury and/or severe damage to the robot system. ● Exercise caution when touching the manipulator or controller during operation, even in collaborative use. The surfaces of these components may reach elevated temperatures during and after operation; sudden contact may cause a startle response.
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 WARNING	● To perform the power supply lockout, disconnect the main power cable from the power source. ● Do not open the cover of the controller or manipulator except during maintenance. There is a high-voltage charging section inside, and there is a risk of electric shock even when the power is turned off. Do not touch or operate the controller with wet hands. Touching or operating the product with wet hands may cause electric shock or malfunction.
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 CAUTION	● If the manipulator is operated repeatedly with each joint having an operating angle of 5° or less, the bearings used in the joints are likely to cause oil film shortage. Repeated operation may cause premature damage. To prevent premature damage, operate the manipulator to move each joint to an angle of 30° or more about once per hour. ● Depending on the combination of the manipulator motion speed, arm orientation, and hand load, vibration (resonance) may occur continuously throughout operation. Vibration occurs due to the natural vibration frequency of the manipulator and can be reduced by taking the following measures: ○ Changing the manipulator speed and acceleration ○ Changing the teach points ○ Changing the hand load ● If installing the manipulator on a movable platform such as a linear axis, a movable cart or an AGV, make sure all safety functions are properly interconnected and that no dangerous situation is created by combined motions of the platform and the manipulator. ● Immediately after operation is stopped, the manipulator may be hot due to heat generated by the motors. Do not touch the manipulator until the temperature has dropped. Operations such as teaching and maintenance should be performed only after the manipulator temperature has dropped and it does not feel hot to the touch.
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3.5 Precautions for Maintenance

Before performing inspections or part replacements, please read this “Precautions for Maintenance” section carefully and make sure you understand safe procedures. Robot system maintenance should be performed by people who have received maintenance training provided by Epson and the suppliers.

 WARNING	• Do not disassemble the product in areas not described in the service manual or perform maintenance in a manner different from these procedures. Improper disassembly or maintenance may not only lead to a malfunction in the robot system, but can also cause serious safety issues. • Persons who have not undergone training must never approach a manipulator that is turned on. Also, do not enter the work envelope. If the manipulator is turned on, it may make unexpected movements even if it appears to be stopped, which may result in serious safety problems. • Safe work procedures should be established and followed to prevent hazards due to unexpected movement of the manipulator or operator mishandling of the manipulator. • When checking the manipulator's operation after replacing parts, be sure to step outside of the safety barriers. A manipulator that has not been tested may move unexpectedly, which may cause serious safety problems. • Safety components must be functioning when performing any work. Performing work with disabled safety devices or sensors is extremely hazardous because the safety function will not be activated. This may cause serious safety problems. • When touching the external terminals or connectors of the controller for inspection or the like, turn off the controller and shut off the power supply to prevent electric shock. • Shut off the supply power before performing cleaning or retightening terminal screws. Failure to shut off the supply power may cause electric shock, product damage, and malfunctions.
 WARNING	• To perform the power supply lockout, disconnect the main power cable from the power source. • Before performing any replacement work, be sure to display that work is in progress, turn off the power for the robot system and related equipment, and disconnect the power plug from the power source. Performing any work procedure with the power turned on is extremely hazardous and may result in electric shock and/or malfunction of the robot system. • Do not connect or disconnect the motor connector while the power is turned on. There is a risk the manipulator may malfunction, which is extremely hazardous. Also, performing any work procedure with the power turned on may result in electric shock and/or malfunction of the robot system. • Use cables with securely protected high-voltage sections and connect them securely. Also, do not put heavy objects on the cables, bend them severely, pull them forcibly, or pinch them. Damaged cables, broken

	wires, or contact failure is extremely hazardous and may result in electric shock and/or malfunction of the robot system.
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 CAUTION 	- When using alcohol, liquid gaskets, or adhesives, carefully read the precautions for those products and thoroughly ensure safety. Also, pay attention to the following points. Failure to be cautious may result in fire or safety problems. - Do not handle near fire. - Use with good ventilation. - Wear protective equipment (such as goggles, oil-resistant gloves, and a mask). - If it adheres to the skin, rinse with water and soap. - If it enters the eyes or mouth, rinse thoroughly with clean water and seek medical attention. - When applying grease, wear protective equipment such as goggles and oil-resistant gloves and ensure safety when performing work. If grease enters the eyes or mouth or adheres to the skin, take the following measures: - If it enters the eyes: After rinsing the eyes thoroughly with clean water, seek medical attention. - If it enters the mouth: If swallowed, do not force vomiting, and seek medical attention. If the mouth is contaminated, rinse thoroughly with water. - If adhered to skin: Rinse with water and soap. - Immediately after operation is stopped, the manipulator may be hot due to heat generated by the motor. Do not touch the manipulator until the temperature has dropped. Operations such as teaching and maintenance should be performed only after the manipulator temperature has dropped and it does not feel hot to the touch. - During maintenance work on the manipulator, ensure about 50 cm of free space around the manipulator. - For cleaning the manipulator or controller, consult the manuals “Collaborative Robot: 6-Axis Robots AX6 Manual” OR “Robot Controller RC-A101 Manual”.
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3.5.1 Power Failure

Do not turn off the controller while the manipulator is operating. The lifetime of the gears may be reduced and there may be wear on the brakes.

If the control unit was switched off due to a power failure while the manipulator was in operation, you should check the following points once the power supply has been restored (see: Chapter “Maintenance” in “Collaborative Robot: 6-Axis Robots AX6 Manual”):

- If a reduction gear is damaged.
- Proper functioning of the brakes in all 6 joints
- If there is a shift of the TCP (check taught positions)

3.6 Controller Warnings and Labels

Please consider the labels attached to the Controller.

Although there are no specific warning labels on the device, specific hazards exist. Be thoroughly careful in handling.

To safely operate and maintain the robot system, be sure to observe the cautions and warnings described in the following section. Also, do not tear, damage, or remove any labels.

3.6.1 Warnings for Opening the Controller

Touching any internal electrified parts while the power is turned on may cause electric shock.

Turn off the main power switch before starting maintenance or repair. The controller does not have a lock out mechanism. When you perform maintenance or the like with the AC power input sections turned off, lock out or tag out the disconnecting device used with the power cable.

3.6.2 Warnings for Connecting Devices to the Controller

Do only connect optional devices to the Teaching Device port, as listed under Teaching Devices in the “Robot Controller RC-A101 Manual”. Connecting any other customized device may damage the Controller.

3.6.3 Labels

1 Battery (see under Labelled Locations)

Battery: CR2032

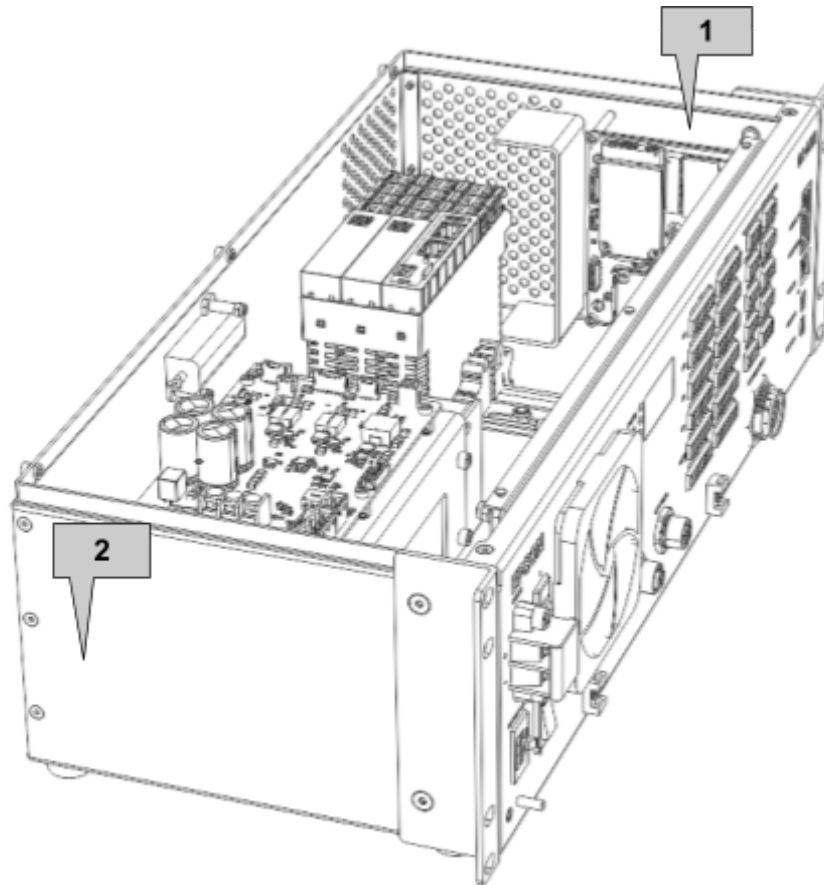
This label indicates the battery type. It is applied to the device interior.

2 Product Label (see under Labelled Locations)

This indicates the product name, model name, serial number, information of supported laws and regulations, product specifications (Rated, Full load Current, SCCR, Weight, Largest Motor Rating), Main document No., manufacturer, importer, date of manufacture, country of manufacture, and the like.

For details, see the label affixed to the product.

3.6.4 Labelled Locations



3.7 Manipulator Warnings and Labels

Please consider the labels attached to the Manipulator.

Although there are no specific warning labels on the device, specific hazards exist. Be thoroughly careful in handling.

To safely operate and maintain the robot system, be sure to observe the cautions and warnings described in the following section. Also, do not tear, damage, or remove any labels.

3.7.1 Warnings for Electrical parts inside the manipulator

Although the maximum voltage inside the manipulator does not exceed 48 V, manipulating or touching any electrified components inside the manipulator can cause damage to the robot.

3.7.2 Warnings of Surface Temperature

The surface of the manipulator may reach elevated temperatures during and after operation; sudden contact may cause a **startle response**.

3.7.3 Labels

1 Product Label (see under Labelled Locations)

This indicates the product name, model name, serial number, information of supported laws and regulations, product specifications (Mass, MAX. REACH, MAX. PAYLOAD, AIR PRESSURE,

Motor Power), Main document No., manufacturer, importer, date of manufacture, country of manufacture, and the like.

For details, see the label affixed to the product.

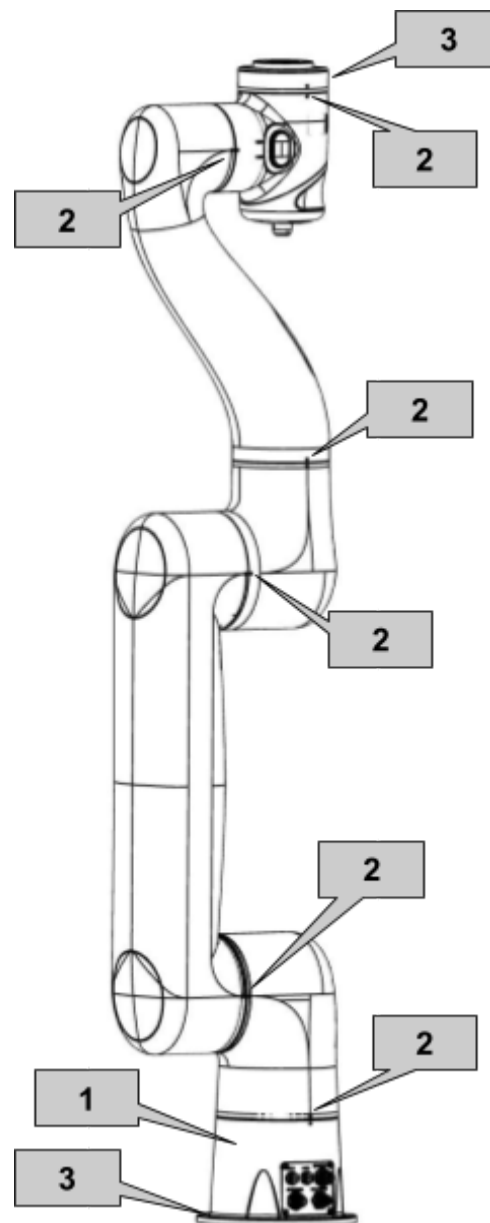
2 Joint Zero Position (see under Labelled Locations)

Arrows for zero position of all joints.

3 Coordinate Frames (see under Labelled Locations)

Information about the base and flange coordinate frames.

3.7.4 Labelled Locations



3.8 Protective Functions

The robot system is equipped with protective functions to protect peripheral devices and the robot system itself from damage in case of unexpected events.

3.8.1 CPU Error or Device Malfunction Detection

Any malfunction due to CPU errors in the internal safety components and the internal computer is detected by the internal functional safety over Ethercat bus (FSOE). Any abnormality on the bus causes an error and immediately activates the STO command. The robot immediately comes to a standstill.

3.8.2 Position and Speed Observation

The controller observes position and speed based on redundant encoder signals and triggers an immediate stop if any limit is violated or a discrepancy is detected.

3.8.3 Overtemperature Protection

Temperature sensors are placed at multiple locations inside the robot system. In case the temperature rises above a defined threshold, they will raise an error and stop the system from operation and further temperature rise.

3.8.4 Torque Protection

The maximum torque which can be generated from the motors is limited with a permanent setting in the internal certified safety motor drive.

3.8.5 Overvoltage Protection

Overvoltage at both the AC and DC input will trigger the respective circuit breaker. Additional fuses inside the controller protect the system from overvoltage. An internal circuit including a braking resistor will protect from excessive voltage due to backfeeding from the motors during deceleration.

3.9 Moving the Manipulator in Case of an Emergency

There are two ways to move the manipulator without drive power. For details please refer to “Collaborative Robot: 6-Axis Robots AX6 Manual”

4. Safety System and Functions

4.1 Internal Safety Features

The robot covers certified safety components providing the following major safety features that are used by the safety functions:

4.1.1 Safe Torque OFF (STO)

A command on the safety bus (FSoE) activates the STO state in the motor drives. The motor drives in the joints remove the power from the motors and stop the robot by activating the brakes. This is a safe state for the robot safety controller and motor drive. STO is initiated indirectly from an emergency stop or any other emergency state initiated by the robot safety controller. It cannot be initiated directly by an external trigger.

4.1.2 Safe Brake Control (SBC)

SBC is an inherent safety feature of the motor drives. It is activated on the drives together with the STO feature and ensures the safe activation of the brakes.

4.1.3 Safe Operating Stop (SOS)

A command on the safety bus (FSoE) activates the SOS state in the safety system. The safety system monitors the position of each motor to guarantee it does not move more than a predefined limit. If any violation is detected, STO and SBC are immediately activated. SOS is initiated indirectly from a protective stop (if configured as SS2) or any other SS2 request initiated by the safety controller (e.g. when the enabling switch is not enabled in manual mode). It cannot be initiated directly by an external trigger.

4.2 Modes of Operation

This chapter describes the different modes and related states of the robot. For further information and how to switch between the modes see the “AX Portal User’s Guide”.

4.2.1 Manual Mode

The manual operation mode serves to move the robot via jogging buttons or by inserting specific values. It is used for moving the robot in special situations, verifying applications, teaching or moving the robot out of a problematic configuration.

- Limitations
 - In manual mode the speed is limited to 250mm/s
 - SLP limitations are deactivated. This allows the user to recover from a SLP violation
- Enabling Switch
 - The robot can only move when the the 3-position enabling switch is held in the middle position
 - Releasing or fully pressing the enabling switch initiates an SS2 stop
- Active Safety Functions
 - Emergency stop
 - Protective stop (can be set to either SS1, SS2 or disabled in the safety settings)

- Normal Stop
- Safely Limited Speed
- Safe Power and Force Limiting

4.2.2 Automatic Mode

The automatic operation mode is usually used for normal operation, meaning when the applications have been verified to run properly. This mode allows the full speed range of the robot.

- Full Functionality
 - All limits (speed, position, force) active according to user defined cases
- Active Safety Functions
 - Emergency stop
 - Protective stop (can be set to either SS1, SS2 or disabled in the safety settings)
 - Normal Stop
 - Safely Limited Position
 - Safety-Rated Soft Axis Limiting
 - Safely Limited Speed
 - Safe Power and Force Limiting

4.2.3 Hand Guided Control (HGC)

- HGC enables direct manual guidance of the robot by the operator for teaching or positioning tasks.
- HGC can be activated when the 3-position enabling switch on the teaching device or the HGC button on the manipulator is held in the middle position.
- The HGC speed is limited to 250mm/s in manual mode and limited by the user specified speed as defined by the safe digital inputs SDI1-3 (user safe cases) or the default values.
- The operator moves the robot directly by hand within defined and monitored safety limits.
- When HGC is deactivated (button released or fully pressed) under normal operating conditions, the system performs a controlled stop (SS2) and goes to SOS state.

4.2.4 Single Point of Control

At any instance of time, only one source can control the robot:

- This is implemented for the AX portal where multiple users can be logged in at the same time to the interface, but cannot control the robot simultaneously. The user who logs in to the system, while another user is already controlling the robot, needs to request access that has to be granted through the user that is currently in control.
- The same applies when controlling the robot through the HGC button (or the other control buttons). The AX portal user loses access to the robot and needs to request the access after the HGC action is concluded.
- Points of control can be:
 - User PCs (over Network)

- Device connected to Display Port (controller box)
- Tablet as teaching device in the tablet holder
- Digital inputs
- Buttons on the robot

4.2.5 Safety Validation Mode

Special state of the robot where new safety settings can only be tested by the safety officer. Further explanation see chapter [Role for Safety Officers](#).

4.2.6 Status of operational mode and safety functions

The LED ring on the TCP of the manipulator informs the user about the robot's status.

For detailed information consult "Collaborative Robot: 6-Axis Robots AX6 Manual".

4.3 Safety Functions

The robot system has the following safety functions. Because of their particular importance for safety, always make sure that they are working before using the robot system.

Configuration is done in the safety settings in AX Portal (see in "AX Portal User's Guide"). Settings can only be changed by authorized safety users. All changes have to be reflected according to a structured validation process (see chapter [Safety Validation Process](#)).

4.3.1 Emergency Stop (SS1)

If the manipulator moves abnormally during operation or in case of any danger, immediately press the emergency stop button. Pressing the emergency stop causes the manipulator to stop with maximum deceleration and then cut the motor power and immediately apply the brakes (Stop Category 1 according to EN 60204). During the emergency stop state, the LED ring on the tool flange lights up red. The emergency stop is designed according to ISO 10218-1:2011 and ISO EN ISO13849-1:2023 with Performance Level (PL) d, Category 3.

Avoid pressing the emergency stop button unnecessarily while the manipulator is running normally. The applied maximum deceleration causes high loads of the gears and may reduce the lifetime if done repeatedly.

Note that the manipulator may slightly deviate from its target trajectory during the braking process. After releasing the emergency stop and after manual confirmation, the manipulator will return to the point at which the emergency stop was pressed. Be aware that both – pressing and releasing the emergency stop button – may cause collisions with the surroundings.

The emergency stop safe digital input allows the robot to perform an emergency stop triggered by an external safety relay or from an emergency stop button.

Input characteristics:

There are two emergency stop circuits for the robot controller:

- Emergency stop input connector of the safety I/Os
- Emergency stop button attached to the Teaching Device (Tablet Holder or Enabling Device)

Refer to the “Robot Controller RC-A101 Manual” for instructions on how to wire the emergency stop button circuit.

4.3.2 Protective Stop (SS2)

Note: The protective stop input can be configured as SS2 or SS1

The protective stop differs from the emergency stop in the regard that the motors are still powered and the controller keeps all joints safely in position (SOS) after a controlled declaration of the robot if configured as SS2. Furthermore, the robot may be configured to continue automatically when the protective stop is released. The protective stop is designed according to ISO 10218-1:2011 and ISO EN ISO13849-1:2023 with Performance Level (PL) d, Category 3. During the protective stop state, the LED ring on the tool flange lights up yellow.

Please note that if the protective stop is configured as SS1, the power to the motors is removed and the same points regarding trajectory accuracy as for the emergency stop apply.

 WARNING	Never use the protective stop input as an emergency stop. An unintended automatic start is extremely hazardous and may result in serious bodily injury and/or severe equipment damage to the robot system.
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Input characteristics:

The robot controller provides one protective stop safe digital input:

- The input is by default configured as SS2
- The effect of the protective stop in manual mode can be activated or deactivated in the safety settings menu
- The protective stop input can also be configured to trigger SS1 instead of SS2

For detailed information about wiring and configuration, consult “Robot Controller RC-A101 Manual” and “AX Portal User’s Guide”.

4.3.3 Normal Stop

This function is provided over a single channel safe digital input to stop the robot in normal situations without using the emergency stop button. When the normal stop is activated, the robot performs a controlled stop true to path, then removes power from the motors and applies the brakes (SS1).

For detailed information consult “Robot Controller RC-A101 Manual”.

4.3.4 Enabling (Enabling Switch)

Enabling is the function connected to the enabling switch when the Teaching Device (Tablet Holder or Enabling Device) is connected. Only Teaching Devices listed as option parts in the “Robot Controller RC-A101 Manual” may be used.

In manual mode, the enabling switch must be held in the middle position to allow any motion of the robot. If the enabling switch is either released or fully pressed, SS2 is executed and the robot goes to SOS state.

4.3.5 Safety-Rated Soft Axis Limiting

This function safely monitors whether each joint is within the configured limits and performs an SS2 if the limit is exceeded.

Note: This function is only active in automatic mode!

The angular limits for each joint can be configured in the safety settings in AX Portal by an authorized safety user. Three individual safe cases can be selectively activated through safe digital inputs (SDI1–3). See the manual “AX Portal User’s Guide” for more information.

4.3.6 Safely Limited Position (SLP)

This function safely monitors the robot's TCP (including tools) and elbow position in cartesian space and performs an SS2 if any configured limit is exceeded.

Note: This function is only active in automatic mode!

The position limits can be configured in the safety settings in AX Portal by an authorized safety user. Three individual safe cases can be selectively activated through safe digital inputs (SDI1–3). See the manual “AX Portal User’s Guide” for more information.

4.3.7 Safely Limited Speed (SLS)

This function safely monitors the robot's speed and performs an SS1 if any configured limit is exceeded. Both the joint speeds (in °/s) and the overall linear speed (in mm/s) of the robot’s TCP or any other part of the robot are monitored.

In manual mode, a reduced speed of 250mm/s is always monitored.

The speed limits can be configured in the safety settings in AX Portal by an authorized safety user. Three individual safe cases can be selectively activated through safe digital inputs (SDI1–3). See the manual “AX Portal User’s Guide” for more information.

4.3.8 Power and Force Limiting (PFL)

This function safely monitors the force that the robot applies to any surroundings based on the torques in each joint. The motion controller will detect any abnormal raise in force and stop the motion immediately. If the stop is achieved without exceeding the defined force limits, the application may resume automatically depending on the configuration. If any violation of the force limit is detected, an SS2 is initiated.

Note: This function is active in automatic mode and in manual mode.

The force limits can be configured in the safety settings in AX Portal by an authorized safety user. Three individual safe cases can be selectively activated through safe digital inputs (SDI1–3). See the manual “AX Portal User’s Guide” for more information.

PFL is intended for collaborative applications according to ISO/TS 15066. Note that the actual forces during impact greatly depend on the speed, configuration and inertia of the manipulator and payload. In addition, the maximum allowed force and pressure during impact also depend on the affected body region. For a collaborative application, consult ISO/TS 15066 for proper implementation and validation.

4.3.9 Safe Digital Inputs

The safe digital inputs are used to trigger the three individual safe cases that are defined in the safety settings. Any activated case may be active simultaneously and the lowest limit will be applied.

For detailed information consult “Robot Controller RC-A101 Manual” and “AX Portal User’s Guide”.

4.3.10 Safe Outputs

External devices or monitoring systems can be connected to the safe outputs of the robot controller to react to the status of specific safety functions. Each output is permanently connected to the status of a specific safety function.

For more information about the available outputs, consult the chapter “Safe Outputs Status Overview” in the “Robot Controller RC-A101 Manual”.

 WARNING	Never use a standard digital output of the controller to connect a safety device in order to implement a safety function.
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4.4 Safety Information (Performance, Category and Reaction Times)

4.4.1 Performance Level and Reaction Times of Safety Functions

The following table provides the safety levels and reaction times of the described safety functions:

Mission Time: 20 years

Safety Function	Enable Mode	Performance Level (PL), Category (Cat.) ISO 13849-1	PFHd 10^{-7}	Reaction Time (ms) from start to end event
Emergency Stop	Auto/Manual	d, 3	3.10	60 - 88 start: push button end: robot initiates stop*
Emergency Stop (Tablet Holder)	Auto/Manual	d, 3	3.10	60 - 88 start: push button end: robot initiates stop*
Protective Stop (General)	Auto/Manual	d, 3	3.10	90 - 158 start: push button end: robot initiates stop*
Normal Stop	Auto/Manual	b, 1	42.3	90 - 158 start: push button end: robot initiates stop*
Enable Switch (General)	Manual	d, 3	3.10	100 - 188 start: release button end: robot initiates stop*
Enable Switch (Tablet Holder)	Manual	d, 3	3.10	90 - 158 start: release button end: robot initiates stop*
Soft Axis Limiting Function	Auto/Manual	d, 3	1.78	100 - 178 start: limit exceeded end: robot initiates stop*
SLP (Safely-Limited Position)	Auto/Manual	d, 3	1.78	70 - 128 start: limit exceeded end: robot initiates stop*
SLS (Safely- Limited Speed)	Auto/Manual	d, 3	1.78	70 - 128 start: limit exceeded end: robot initiates stop*

PFL (Power and Force Limiting)	Auto/Manual	d, 3	1.78	70 - 128 start: limit exceeded end: robot initiates stop*
Safe outputs	Auto/Manual	d, 3	1.78	70 - 128 start: Safety event (logic) end: digital output signal
HGC (Hand Guided Control)	Auto/Manual	d, 3	3.10	90 - 158 start: release button end: robot initiates stop*
* robot initiates stop: The robot drive has initiated the stopping procedure; however, this does not indicate that the robot has reached a complete standstill.				

Table: Performance Level and Reaction Times of Safety Functions

4.4.2 Total Response Time of the Safety Function and the Robot

The reaction times of the safety functions provided in the table “Performance Level and Reaction Times of Safety Functions” measure the interval from the initial trigger event until the robot initiates its stopping procedure. Because the robot is still in motion at this point, the actual time to reach a complete standstill depends on its current speed and payload. This stopping time and stopping distance is given in “Collaborative Robot: 6-Axis Robots AX6 Manual”. To calculate the total time from the trigger event to zero velocity, the applicable values from the “Stopping Time and Stopping Distance” in “Collaborative Robot: 6-Axis Robots AX6 Manual” must be added to those from Table “Performance Level and Reaction Times of Safety Functions”.

 WARNING	It is necessary to regularly check the safety functions according to a safety inspection plan (defined by the safety officer). Safety functions (e.g. emergency stop) have to be checked in clearly defined periods (e.g. monthly) to be inline with the regulation applicable in each country.
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5. Role and Training for Safety Officers

5.1 Role for Safety Officers

Safety officers should perform the following:

- Password management
- Training implementation
- Implement changes in the safety settings
- Validation of safety settings

5.1.1 System Access for Safety Officer

Safety officers should manage the following passwords:

- AX Portal safety officer user password

For further details consult the “AX Portal User’s Guide”

5.1.2 Training Implementation

Safety officers should ensure that personnel responsible for programming, operating, and maintaining the manipulator and robot system undergo proper training. Also, they should make sure that personnel have the ability to safely perform that work.

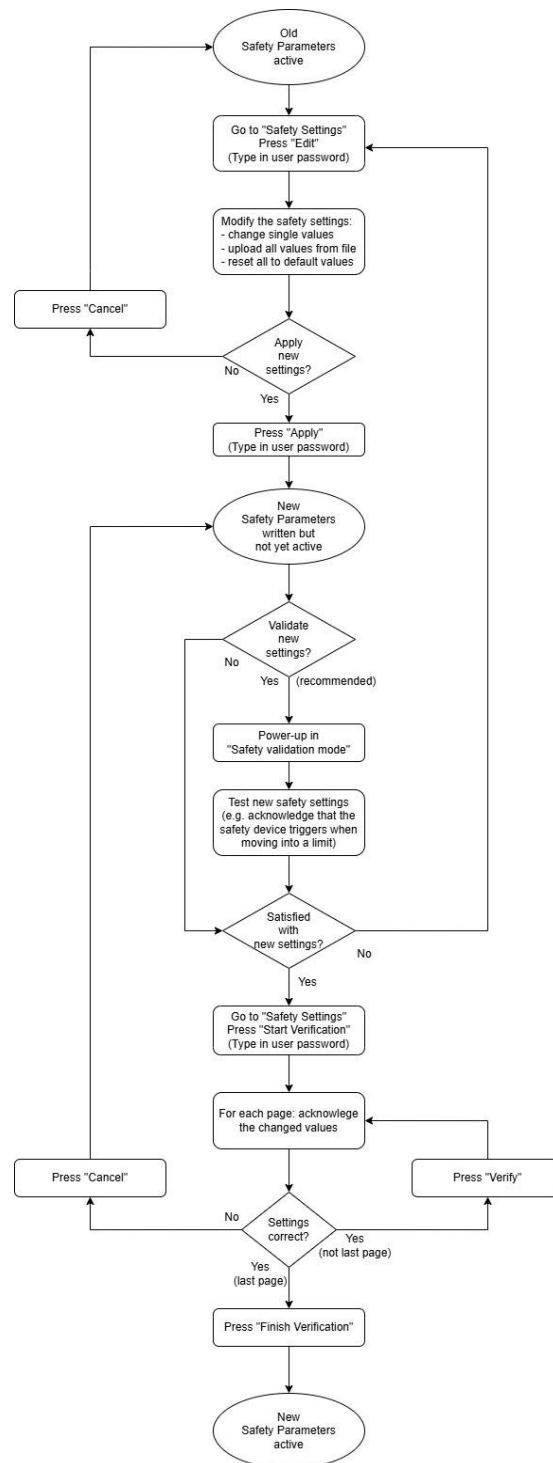
Training should include at least the following items:

- Description of standard safety procedures and safety recommendations by robot manufacturers and robot system designers
- Description of the response to an emergency or abnormal situation (e.g., means of escape if caught by a manipulator)
- Clear description of the work
- Description of all control devices required for the work and their functions
- Description of hazards associated with the work
- Specific methods to avoid foreseeable hazards, including safe work procedures
- Description of the method for testing the functions of safety devices and interlocks or description of the method to check that they are functioning properly
- Description of the method for checking safety function parameters and of the method for setting safety function parameters correctly
- Safety checks before the first use of the robot or using the robot after changing safety parameters
- Regular inspection intervals of safety critical functions and definition of inspection plans

5.1.3 Implement Changes in the Safety Settings

Only safety officers are authorized to modify safety parameters. The safety officer is responsible for validating the entire system following any modification. Furthermore, the safety officer must ensure the system remains in compliance with all relevant safety standards.

The procedure for changing the parameters is as follows:



For further details consult the “AX Portal User’s Guide”

5.1.4 Safety Validation Process

The safety validation mode exists only for the safety officer in order to test and validate new safety settings or limits. The above described diagram of the parameter change procedure shows that the safety officer enters the safety validation mode after pressing “Apply” and the new values are written but not active yet. The safety officer logged in as a safety user can power up and enter the safety validation mode which allows the motion controller to ignore all safety limits during the validation process to test that the safety system triggers as expected. The safety validation process is completed after pressing the “Verify” button of the last sub-menu. For more details consult the “AX Portal User’s Guide”.

Note: It is necessary and mandatory for the safety officer (or any other safety user) to test and validate new settings with the complete robot setup. After changing any safety setting, it is the safety officer’s responsibility to ensure that the robot system is handed over in a manner that still complies with safety standards.

 WARNING	The Safety Validation mode must only be used by authorised safety officers. During this mode, collisions can occur due to untested limits. Use this mode with care!
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5.2 Knowledge and Training Required to Work with Robot Systems

User definition	Work description	Required qualifications and training
Operator	Work with robot systems	Persons who have attended <i>Safety Training</i> , see 1)
	Daily/periodic inspections (work that does not require disassembly)	
Installers/ Instructors	Installation work, see 4)	Persons who have attended <i>Safety Training</i> , see 1); and have attended <i>Introduction Training</i> , see 2)
	Teaching	
Service Engineers	Repair	Persons who have attended <i>Safety Training</i> , see 1), and have attended <i>Maintenance Training</i> , see 3)
	Maintain & Overhaul	
	Installation of optional devices	
	Replace components inside the manipulator or controller	

1) *Safety Training* refers to “safety training for workers engaged in work related to industrial robots” as required by the laws and regulations of the respective country. The safety training for workers engaged in work related to industrial robots must include the following content.

- Knowledge of industrial robots
- Knowledge of industrial robot operation, teaching, etc.
- Knowledge of inspection and other work
- Education on relevant laws and regulations

2) *Introduction Training* refers to training provided by Epson and the supplier.

3) *Maintenance Training* refers to training provided by Epson and the supplier.

4) The transportation of materials using cranes and forklifts and power plug installation (e.g., when installing a power plug to match a factory power socket) must be performed by persons with the necessary qualifications and skills.

6. Manuals for This Product

6.1 Manual Types

This section describes the typical types of manuals for this product and presents an overview of their content.

6.1.1 AX6 / RC-A101 Safety Manual (PDF manual)

This manual contains safety-related information intended for all people who use this product. It also guides the user through the process from unpacking to disposal and the manuals that should be referred to next.

Please read this manual first.

- Safety information and residual risks of robot systems
- Declaration of Conformity
- Role and training for safety officer
- Process from unpacking to disposal

6.1.2 AX6 Quick Start / Setup Manual (PDF manual)

This manual briefly describes the commissioning of the robot and preparing the robot for the first use. It also explains the very basics of teaching and programming.

6.1.3 Collaborative Robot: 6-Axis Robots AX6 Manual (PDF manual)

This manual describes the specifications and functions of the Manipulator. It is primarily intended for those who design robot systems.

- General system overview
- Robot system installation procedure (specific details on the process from unpacking to disposal)
- Manipulator installation, technical information needed for design, function and specification tables, etc.
- Manipulator daily inspection points

6.1.4 Robot Controller RC-A101 Manual (PDF manual)

This manual describes the installation of the entire robot system and explains the specifications and functions of the controller. It is primarily intended for those who design robot systems.

- Controller specifications and basic functions
- Controller electrical interfaces
- Controller daily inspection points

6.1.5 AX Portal User's Guide (PDF manual)

This manual presents an overview of the programming and operating software AX Portal. Among other things, it explains the user interface, teaching processes, applications, connection modules and also the safety settings. The manual explains user applications by using the programming language Python and block programming.

6.1.6 AX Portal Software Function Reference (HTML, online)

This manual explains the functions of the robot programming language.

6.1.7 AX Portal Error Code / Message List (PDF manual)

This provides the code numbers displayed on the controller and messages displayed in the message area of the software. It is primarily intended for those who design and program robot systems.

6.1.8 AX Portal Troubleshooting Manual (PDF manual)

This manual explains the typical issues that may occur during the installation, programming and usage of the robot. For each issue a solution is proposed.

6.1.9 Other Manuals (PDF manuals)

Manuals for maintenance and service are not included with the product. Maintenance should be performed by people who have received maintenance training provided by Epson and the suppliers. For more information, please contact the supplier.

6.2 Viewing Manuals

You can view and download the PDF manuals from the following website:

<https://download.epson.biz/robots/>

The “AX Portal Software Function Reference” is available in the help menu of AX Portal. For connecting to AX Portal consult the “AX Portal User’s Guide” or “AX6 Quick Start / Setup Manual”.

7. Process from Unpacking to Disposal

7.1 Handling from Unpacking to Disposal

Device lifecycle	Work outline
1. Unpacking, transporting 2. Installing, connecting	Unpack the products* and transport them to the installation location Install the products* and connect the wires Do an initial check of the setup (screws, wiring, connected buttons, ...)
3. Teaching, programming	Turn on the controller and check initial operation
	• Perform initial setup of AX Portal • Check the safety function parameters • Perform initial setup of the safety function parameters (only for customers who want to edit the safety functions) • Check the operation of the safety devices (emergency stop button, protective stop, ...) • Move the manipulator to the initial position
	Connect the external equipment (peripherals)
	Teach the manipulator • Create an AX Portal user application program (in block programming or Python)
4. Test operation 5. Automatic operation	Perform program test operation Run the program and operate automatically
6. Maintenance	• Perform daily inspection of the products* • Perform regular inspection of the products* • Overhaul the products* (replace parts)
7. Storage, disposal 8. Troubleshooting	Store the products*, dispose of the products*, support for products* trouble and errors

*: Manipulator and controller

For more details, refer to the manual for the product you are using.

For details about how to view manuals, refer to the following section: [Manuals for This Product](#).

KEY POINTS

When an error occurs, be careful of the following:

Error numbers displayed on the controller or AX Portal user interface provide clues about the cause of the abnormality. When an error occurs, be sure to write down the error number, refer to the information in the error code message and the following manual to take corrective measures.

“Software Error Code Messages”

If the abnormality is caused solely by the Epson robot system and is beyond the scope of the customer's capability, please contact our service department (the supplier).

8. Appendix

8.1 Appendix: China RoHS

This table and the environmental protection expiration date labels on the product are based on the laws and regulations in mainland China, and are not applicable outside of mainland China.

产品中有害物质的名称及含有的信息表：
(适用的机器人型号：AX6)

产品中有害物质的名称及含有的信息表										
部件名称	有害物质									
	Pb	Hg	Cd	Cr(VI)	PBBs	PBDEs	DBP	DIBP	BBP	DEHP
机械手臂	×	○	○	○	○	○	○	○	○	○
电机	×	○	○	○	○	○	○	○	○	○
减速机单元	×	○	○	○	○	○	○	○	○	○
电磁制动器	×	○	○	○	○	○	○	○	○	○
密封	○	○	○	○	○	○	○	○	○	○
润滑脂	○	○	○	○	○	○	○	○	○	○
电路板	×	○	○	○	○	○	○	○	○	○
电缆	○	○	○	○	○	○	○	○	○	○
LED指示灯	○	○	○	○	○	○	○	○	○	○
外罩	×	○	○	○	○	○	○	○	○	○
控制器	×	○	○	○	○	○	○	○	○	○
机壳	×	○	○	○	○	○	○	○	○	○
电路板	×	○	○	○	○	○	○	○	○	○
开关电源	×	○	○	○	○	○	○	○	○	○
风扇	○	○	○	○	○	○	○	○	○	○
线束	○	○	○	○	○	○	○	○	○	○
电源保护装置	○	○	○	○	○	○	○	○	○	○
电池	○	○	○	○	○	○	○	○	○	○
连接器附件	○	○	○	○	○	○	○	○	○	○

注1: ○：表示该有害物质在该部件所有均质材料中的含量均不超出电器电子产品有害物质限制使用国家标准要求。
×：表示该有害物质至少在该部件的某一均质材料中的含量超出电器电子产品有害物质限制使用国家标准要求。
注2: 以上未列出的部件，表明其有害物质含量均不超出电器电子产品有害物质限制使用国家标准要求。

产品环保使用期限的使用条件

本产品的环保使用期限，表示按照本产品的安全使用注意事项使用的情况下，从生产日开始，在标志的年限内使用，本产品含有的有害物质不会对环境，人身和财产造成严重影响。

附注：本表格及环保使用期限标志依据中国大陆地区的有关规定而制定，中国大陆地区以外的国家/地区则无需关注。

Note: This sheet and Environment Friendly Use Period label on the product are based on the laws and regulations in Chinese mainland. These are not applicable outside of Chinese mainland.