

MR-C□A
MR-C□A1

Instructions and Cautions for Safe Use of AC Servos

If this is the first time for you to use the MELSERVO-C Series, the optionally available MR-C□A Instruction Manual is required. Always purchase them and use the MELSERVO-C Series safely.

M

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Germany	Mitsubishi Electric Europe B.V. German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany	Tel :+49-2102-486-0 Fax :+49-2102-486-1120
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Korea	Mitsubishi Electric Automation Korea Co., Ltd. 3F, 1480-6, Gayang-dong, Gangseo-gu, Seoul 157-200, Korea	Tel :+82-2-3660-9552 Fax :+82-2-3664-8372
Singapore	Mitsubishi Electric Asia Pte, Ltd. 307 Alexandra Road #05-01/02, Mitsubishi Electric Building Singapore 159943	Tel :+65-6470-2460 Fax :+65-6476-7439

MITSUBISHI ELECTRIC CORPORATION

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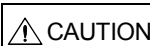
IB(NA)67279-M(1306)MEE Printed in Japan

● Safety Instructions ●

(Please read the instructions carefully before using the equipment.)

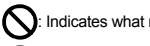

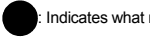

Install, and peruse all this guide and attached documents before the drive and maintenance and the check. After that, use these correctly. Use it after it is skilled of the knowledge of the equipment, information on safety, and all of notes.

In this guide, the safety instruction levels are classified into "WARNING" and "CAUTION".

	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight injury to personnel or may cause physical damage.

Note that the CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

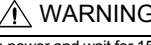
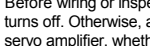
What must not be done and what must be done are indicated by the following diagrammatic symbols.

	Indicates what must not be done. For example, "No Fire" is indicated by  .
	Indicates what must be done. For example, grounding is indicated by  .

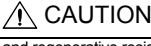
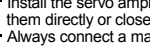
In this guide, instructions at a lower level than the above, instructions for other functions, and so on are classified into "POINT".

After reading this guide, always keep it accessible to the operator.

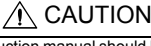
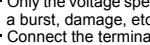
1. To prevent electric shock, note the following

	WARNING
	<ul style="list-style-type: none"> Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier, whether the charge lamp is off or not. Connect the servo amplifier and servo motor to ground. Any person who is involved in wiring and inspection should be fully competent to do the work. Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, you may get an electric shock. Operate the switches with dry hand to prevent an electric shock. The cables should not be damaged, stressed loaded, or pinched. Otherwise, you may get an electric shock. To avoid an electric shock, insulate the connections of the power supply terminals.

2. To prevent fire, note the following

	CAUTION
	<ul style="list-style-type: none"> Install the servo amplifier, servo motor and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to a fire. Always connect a magnetic contactor (MC) between the main circuit power supply and L1, L2, of the servo amplifier, and configure the wiring to be able to shut down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions. When a regenerative resistor is used, use an alarm signal to switch main power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire. Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and servo motor. Always connect a molded-case circuit breaker to the power supply of the servo amplifier.

3. To prevent injury, note the following

	CAUTION
	<ul style="list-style-type: none"> Only the voltage specified in the instruction manual should be applied to each terminal. Otherwise, a burst, damage, etc. may occur. Connect the terminals correctly to prevent a burst, damage, etc. Ensure that polarity (+, -) is correct. Otherwise, a burst, damage, etc. may occur. During power-on or for some time after power-off, do not touch or close a parts (cable etc.) to the servo amplifier heat sink, regenerative resistor, servo motor, etc. Their temperatures may be high and you may get burnt or a parts may be damaged. During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

4. Additional instructions

The following instructions should also be fully noted. Incorrect handling may cause a fault, injury, electric shock, etc.

(1) Transportation and installation

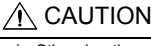
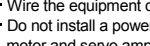
		Environment	
		Servo amplifier	Servo motor
Ambient temperature	Operation	0 to 55 (non-freezing)	0 to 40 (non-freezing)
	Storage	32 to 131 (non-freezing)	32 to 104 (non-freezing)
Ambient humidity	Operation	90%RH or less (non-condensing)	80%RH or less (non-condensing)
	Storage	90%RH or less (non-condensing)	80%RH or less (non-condensing)
Ambience		Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt	
Altitude		Max. 1000m (3280 ft) above sea level	
(Note)		5.9 or less [m/s ²]	X * Y : 19.6
Vibration		19.4 or less [ft/s ²]	X * Y : 64

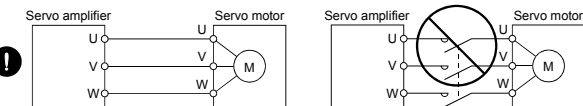
Item	Environment	
	Servo amplifier	Servo motor
Ambient temperature	Operation : 0 to 55 (non-freezing) Storage : 32 to 131 (non-freezing)	Operation : 0 to 40 (non-freezing) Storage : 32 to 104 (non-freezing)
Ambient humidity	Operation : 90%RH or less (non-condensing) Storage : 90%RH or less (non-condensing)	Operation : 80%RH or less (non-condensing) Storage : 80%RH or less (non-condensing)
Ambience	Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt	
Altitude	Max. 1000m (3280 ft) above sea level	
(Note)	5.9 or less [m/s ²]	X * Y : 19.6
Vibration	19.4 or less [ft/s ²]	X * Y : 64


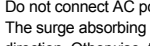
Note: Except the servo motor with reduction gear.

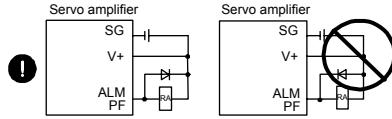
- Securely attach the servo motor to the machine. If attach insecurely, the servo motor may come off during operation.
- The servo motor with reduction gear must be installed in the specified direction to prevent oil leakage.
- Take safety measures, e.g. provide covers, to prevent accidental access to the rotating parts of the servo motor during operation.
- Never hit the servo motor or shaft, especially when coupling the servo motor to the machine. The encoder may become faulty.
- Do not subject the servo motor shaft to more than the permissible load. Otherwise, the shaft may break.
- When the equipment has been stored for an extended period of time, contact your local sales office.
- When treating the servo amplifier, be careful about the edged parts such as the corners of the servo amplifier.
- The servo amplifier must be installed in the metal cabinet (control box).
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

(2) Wiring

	CAUTION
	<ul style="list-style-type: none"> Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly. Do not install a power capacitor, surge killer or radio noise filter (FR-BIF option) between the servo motor and servo amplifier. Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and servo motor. Otherwise, the servo motor does not operate properly. Connect the servo motor power terminal (U, V, W) to the servo motor power input terminal (U, V, W) directly. Do not let a magnetic contactor, etc. intervene.

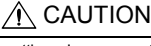
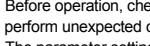


	CAUTION
	<ul style="list-style-type: none"> Do not connect AC power directly to the servo motor. Otherwise, a fault may occur. The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.


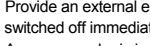


When the cable is not tightened enough to the terminal block (connector), the cable or terminal block (connector) may generate heat because of the poor contact. Be sure to tighten the cable with specified torque.


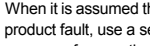
(3) Test run adjustment

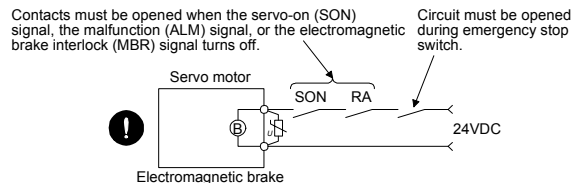
	CAUTION
	<ul style="list-style-type: none"> Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation. The parameter settings must not be changed excessively. Operation will be instable.

(4) Usage

	CAUTION
	<ul style="list-style-type: none"> Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately. Any person who is involved in disassembly and repair should be fully competent to do the work. Before resetting an alarm, make sure that the run signal of the servo amplifier is off to prevent an accident. A sudden restart is made if an alarm is reset with the run signal on. Do not modify the equipment. Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be caused by electronic equipment used near the servo amplifier. Use the servo amplifier with the specified servo motor. The electromagnetic brake on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking. For such reasons as service life and mechanical structure (e.g. where a ball screw and the servo motor are coupled via a timing belt), the electromagnetic brake may not hold the motor shaft. To ensure safety, install a stopper on the machine side. Burning or breaking a servo amplifier may cause a toxic gas. Do not burn or break a servo amplifier.


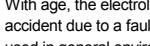
(5) Corrective actions

	CAUTION
	<ul style="list-style-type: none"> When it is assumed that a hazardous condition may take place at the occur due to a power failure or a product fault, use a servo motor with electromagnetic brake or an external brake mechanism for the purpose of prevention. Configure a circuit so that the electromagnetic brake activates with the external emergency stop switch at the same time.



- When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- When power is restored after an instantaneous power failure, keep away from the machine because the machine may be restarted suddenly (design the machine so that it is secured against hazard if restarted).

(6) Maintenance, inspection and parts replacement

	CAUTION
	<ul style="list-style-type: none"> With age, the electrolytic capacitor of the servo amplifier will deteriorate. To prevent a secondary accident due to a fault, it is recommended to replace the electrolytic capacitor every 10 years when used in general environment. Please contact your local sales office.

(7) General instruction

- To illustrate details, the equipment in the diagrams of this guide and instruction manual may have been drawn without covers and safety guards. When the equipment is operated, the covers and safety guards must be installed as specified. Operation must be performed in accordance with this guide and instruction manual.

● DISPOSAL OF WASTE ●

Please dispose a servo amplifier, battery (primary battery) and other options according to your local laws and regulations.

1. INTRODUCTION

1.1 Introduction to the manuals

If this is the first time for you to use the MELSERVO-C Series the optionally available MR-C□A Instruction Manual is required. Please read all carefully to use the MELSERVO-C Series safely.

1.2 Contents of the packing

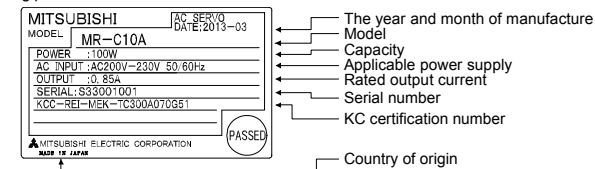
After unpacking, check the rating plate to confirm that the servo amplifier you received are as you ordered.

Contents	Quantity
Servo amplifier	1
(Note) Protective earth (PE) terminals	1
MELSERVO-C Series Instructions and Cautions for Safe Use of AC Servos (This guide)	1

Note. IEC/EN standard-, UL/cUL standard-compliant models.

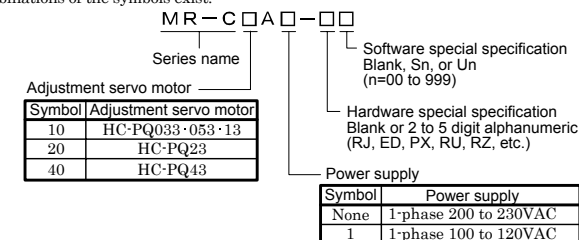
1.3 Model code definition

(1) Rating plate



(2) Model code

The following describes what each block of a model name indicates. Note that not all the combinations of the symbols exist.



2. COMPLIANCE WITH CE MARKING

2.1 What is CE marking?

The CE marking is mandatory and must be affixed to specific products placed on the European Union. When a product conforms to the requirements, the CE marking must be affixed to the product. The CE marking also applies to machines and equipment incorporating servos. When you need a copy of Declaration of Conformity of CE marking, contact your local sales office.

(1) EMC directive

The EMC directive applies to the servo units alone. This servo is designed to comply with the EMC directive. The EMC directive also applies the servo-incorporated machines and equipment. This requires the EMC filters to be used with the servo-incorporated machines and equipment to comply with the EMC directive. For specific EMC directive conforming methods, refer to the EMC Installation Guidelines (IB(NA)67310).

(2) Low voltage directive

The low voltage directive applies also to servo units alone. This servo is designed to comply with the low voltage directive.

2.2 For compliance

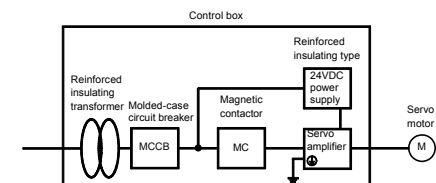
Be sure to perform an appearance inspection of every unit before installation. In addition, have a final performance inspection on the entire machine/system, and keep the inspection record.

(1) Servo amplifiers and servo motors used

Use the servo amplifiers and servo motors which comply with the IEC/EN standard-compliant model.

Servo amplifier	:MR-C10A-UE to MR-C40A-UE
Servo motor	:HC-PQ□□(produced in and after February, 2001) HC-PQ□□-UE

(2) Structure



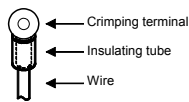
- (3) Environment
Operate the servo amplifier at pollution degree 2 or 1 set forth in EN 60664-1. For this purpose, install the servo amplifier in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).
- (4) Power supply
(a) Operate the servo amplifier to meet the requirements of the overvoltage category II set forth in EN 60664-1. For this purpose, a reinforced insulating transformer conforming to the EN Standard should be used in the power input section.
(b) For the interface power supply, use a 24VDC power supply with reinforced insulation on I/O terminals.

- (5) Grounding
(a) To prevent an electric shock, the protective earth (PE) terminal (marked ⊕) of the servo amplifier must be connected to the protective earth (PE) of the control box.
(b) Do not connect two ground cables to the same protective earth (PE) terminal. Always connect cables to the terminals one-to-one.



- (c) If an earth leakage circuit breaker is used, always earth the protective earth (PE) terminal of the servo amplifier to prevent an electric shock.

- (6) Wiring and Installation
(a) The wires to be connected to the terminal block of the servo amplifier must have crimping terminals provided with insulating tubes to prevent contact with adjacent terminals.



- (b) Connect the power leads of the HC-PQ series servo motor to the servo amplifier using a fixed terminal block. Do not connect cables directly.



- (c) Use the servo motor side power connector which complies with the EN Standard. The EN Standard-compliant power connector sets are available as options.
(d) The servo amplifier must be installed in the metal cabinet (control box).

- (7) Peripheral devices, options
(a) Use the molded-case circuit breaker and magnetic contactor models which are EN Standard-compliant products given in the MR-C□A Instruction Manual.
(b) The sizes of the wires given in the MR-C□A Instruction Manual meet the following conditions. For use in any other conditions, follow Table 5 and Annex C of EN 60204-1.
• Ambient temperature : 40°C (104°F)
• Sheath : PVC (polyvinyl chloride)
• Installation on wall surface or open cable tray
(c) Use the EMC filter for noise reduction.

- (8) Performing EMC tests
When EMC tests are run on a machine/device into which the servo amplifier has been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment/electrical equipment specifications. For the other EMC directive guidelines on the servo amplifier, refer to the EMC Installation Guidelines (IBNA)67310).
- MR-C Series are not intended to be used on a low-voltage public network which supplies domestic premises;
- radio frequency interference is expected if used on such a network.
The installer shall provide a guide for Installation and use, including recommended mitigation devices.

3. CONFORMANCE WITH UL/cUL STANDARD

This servo amplifier complies with UL 508C and CSA C22.2 No.14 standard. Refer to section 1.3 (2) for the servo amplifier model names described in the tables and figures.

- (1) Servo amplifier and servo motor used
Use the servo amplifiers and servo motors which comply with UL/cUL standard-compliant model.
Servo amplifier :MR-C10A-UE to MR-C40A-UE
Servo motor :HC-PQ□□(produced in and after february, 2001)
HC-PQ□□UE

Use a pair of the servo amplifier and servo motor listed below.

Servo amplifier	Servo motor
MR-C10A (1)	HC-PQ033
	HC-PQ053
	HC-PQ13
MR-C20A (1)	HC-PQ23
MR-C40A	HC-PQ43

- (2) Installation
The MR-C series have been approved as the products which have been installed in the electrical enclosure. The minimum enclosure size is based on 150 of each MR-J3 combination. And also, design the enclosure so that the ambient temperature in the enclosure is 55°C (131°F) or less. The servo amplifier must be installed in the metal cabinet. For environment, the units should be used in open type (UL 50) and overvoltage category II or lower. The servo amplifier needs to be installed at or below of pollution degree 2. For connection, use copper wires.

- (3) Short-circuit current rating (SCCR)
Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum.

- (4) Flange
Mount the servo motor on a flange which has the following size or produces an equivalent or higher heat dissipation effect.

Flange size [mm(in)]	Servo motor (HC-PQ)
150・150・6 (5.91・5.91・0.24)	033・053・13
250・250・6 (9.84・9.84・0.24)	23
250・250・12 (9.84・9.84・0.47)	43

- (5) Capacitor discharge time
The capacitor discharge time is as follows.To ensure safety, do not touch the charging section for 15 minutes after power-off.

Servo amplifier	Discharge time (min)
MR-C10A(1), 20A(1), 40A	3

- (6) Options, peripheral devices
Use the UL/cUL Standard-compliant products.
Use the following molded-case circuit breaker and fuse.

Servo amplifier	Molded-case circuit breaker	Fuse		
		Class	Current [A]	Voltage [V]
MR-C10A MR-C20A MR-C10A1	NF30 type 5A	K5	10	AC250
MR-C20A1 MR-C40A	NF30 type 10A			

- (7) About wiring protection
For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.
For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes.

- (8) Selection example of wires
To comply with the UL/cUL Standard, use UL-approved copper wires rated at 60/75°C (140/167°F) for wiring.

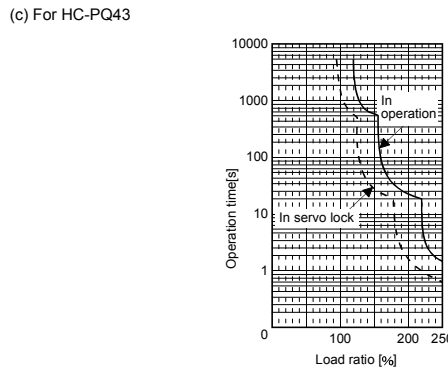
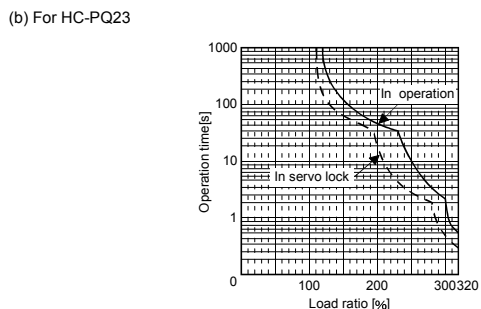
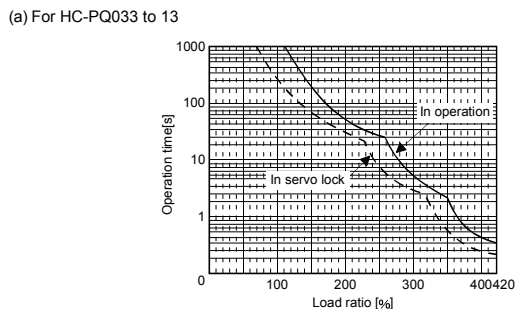
Servo amplifier	(Note 1) Wire [mm ²]			Electromagnetic brake
	(Note 3) L ₁ ・L ₂ ・⊕	(Note 3) U・V・W・⊕	P・C	
MR-C10A MR-C20A MR-C10A1 MR-C20A1 MR-C40A	0.75(AWG18)	0.75(AWG18)	(Note 2) 0.75(AWG18)	0.75(AWG18)
		1.25(AWG16)		

- Note 1. The wires are based on 600V vinyl wires. The wires (U, V, W) in the table assume that the distance between servo motor and servo amplifier is not more than 30m(98.4feet).
2. Before wiring, twist the wires for connection of the regenerative option (P, C).
3. Crimping terminals and crimping tools are required for the protective earth (PE) on the servo motor side. Refer to the recommended crimping terminals table for the crimping terminals and crimping tools.

Crimping terminal	Applicable tool	Manufacturer name
1.25-2	YHT-2210	Japan Solderless Terminals

- (9) Terminal block tightening torque
- | Terminal block | Tightening torque [N・m] [(lb・in)] |
|--|-----------------------------------|
| Main circuit terminal block (TE) | 0.49 to 0.785
(4.34 to 6.95) |
| Protective earth (PE) terminal
Terminal screw: M4 | 1.275
(11.3) |

- (10) Overload Protection Characteristics
An electronic thermal relay is built in the servo amplifier to protect the servo motor, servo amplifier and servo motor power line from overloads. The operation characteristics of the electronic thermal relay are shown below. It is recommended to use an unbalanced torque-generated machine, such as a vertical motion shaft, so that unbalanced torque is not more than 70% of the rated torque.
Servo amplifier MR-C series have servo motor overload protection. (The motor full load current is 115% rated current.)



- (11) Over-temperature protection for motor
Motor Over temperature sensing is not provided by the drive.

4. INSPECTION

⚠ WARNING

- Before starting maintenance and/or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier whether the charge lamp is off or not.
- Any person who is involved in inspection should be fully competent to do the work. Otherwise, you may get an electric shock. For repair and parts replacement, contact your safes representative.

⚠ CAUTION

- Do not perform insulation resistance test on the servo amplifier as damage may result.
- Do not disassemble and/or repair the equipment on customer side.

- (1) Inspection
It is recommended to make the following checks periodically.
(a) Check for loose terminal block screws. Retighten any loose screws.
(b) Check the servo motor bearings, brake section, etc. for unusual noise.
(c) Check the cables and the like for scratches and cracks. Perform periodic inspection according to operating conditions.
(d) Check the servo motor shaft and coupling for misalignment.
- (2) Life
The following parts must be changed periodically as listed below. If any part is found faulty, it must be changed immediately even when it has not yet reached the end of its life, which depends on the operating method and environmental conditions.
For use in the atmosphere having much oil mist, dust, etc., clean and inspect every three months. For parts replacement, please contact your sales representative.

	Part name	Standard life
Servo amplifier	Smoothing capacitor	10 years
	Bearings	20,000 to 30,000 hours
Servo motor	Encoder	20,000 to 30,000 hours
	V ring	5,000 hours

- (a) Smoothing capacitor
Affected by ripple currents, etc. and deteriorates in characteristic. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment (surrounding air temperature of 40°C (104°F) or less).
- (b) Servo motor bearings
When the servo motor is run at rated speed under rated load, change the bearings in 20,000 to 30,000 hours as a guideline. This differs on the operating conditions. The bearings must also be changed if unusual noise or vibration is found during inspection.
- (c) Servo motor V ring
Must be changed in 5,000 hours of operation at rated speed as a guideline. This differs on the operating conditions. These parts must also be changed if oil leakage, etc. is found during inspection.

5. ALARMS

Indication	Name	Indication	Name	Indication	Name
10	Under voltage	17	Board error	35	Command pulse error
12	Memory error 1	20	Encoder error	37	Parameter error
14	Watch dog	30	Regenerative error	50	Over load
15	Memory error 2	31	Over speed	52	Error excessive
16	Motor combination error	32	Over current		
		33	Over voltage		

EEP-ROM life

The number of write times to the EEPROM, which stores parameter settings, etc., is limited to 100,000. If the total number of the following operations exceeds 100,000, the servo amplifier may fail when the EEPROM reaches the end of its useful life.
• Writing to the EEPROM due to parameter setting changes.

South Korea compliance
This product complies with the Radio Wave Law (KC mark). Please note the following to use the product.
이 기기는 업무용 (A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
(The product is for business use (Class A) and meets the electromagnetic compatibility requirements. The seller and the user must note the above point, and use the product in a place except for home.)

Warranty

1. Warranty period and coverage
We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]
The term of warranty for Product is twelve (12) months after your purchase or delivery of the Product to a place designated by you or eighteen (18) months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Limitations]
(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged.
However, it will not be charged if we are responsible for the cause of the failure.
(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
(3) Even during the term of warranty, the repair cost will be charged on you in the following cases:
(i) : a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
(ii) : a failure caused by any alteration, etc. to the Product made on your side without our approval
(iii) : a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
(iv) : a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
(v) : any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
(vi) : a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
(vii) : a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
(viii) : any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production
(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries
Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of responsibility for compensation against loss of opportunity, secondary loss, etc.
Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

5. Change of Product specifications
Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product
(1) For the use of our General-Purpose AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in General-Purpose AC Servo, and a backup or fail-safe function should operate on an external system to General-Purpose AC Servo when any failure or malfunction occurs.
(2) Our General-Purpose AC Servo is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.