



MR-J4 Servo amplifier

The following servo amplifiers will be available in the future.
MR-J4-1TKTM(4) to MR-J4-22KTM(4)

Instructions and Cautions for Safe Use of AC Servos

Table with columns for Country/Region, Sales office, and Tel/Fax. Includes contact information for USA, Germany, China, and Korea.

2.2 Applications of the devices
MR-J4 servo amplifiers comply with the following standards.
• IEC/EN 61800-5-1, IEC/EN 61800-3, IEC/EN 60204-1
• ISO/EN 13849-1 (SIL 3) and MR-BATV1 (SIL CL 3, IEC/EN 61800-5-2 (STO))
MR-J4 servo amplifiers can be used with the MR-J3-DO5 safety logic unit, or safety PLCs.

2.3 Correct use
Always use the MR-J4 servo amplifiers within specifications (voltage, temperature, etc. Refer to each instruction manual for details). Mitsubishi Electric Co. accepts no claims for liability if the equipment is used in any other way or if modifications are made to the device, even in the context of mounting and installation.

WARNING It takes 15 minutes maximum for capacitor discharging. Do not touch the unit and terminals immediately after power off.

2.3.1 Peripheral device and power wiring
The followings are selected based on IEC/EN 61800-5-1, UL 508C, and CSA C22.2 No.14.

(1) Power Wiring (local wiring and crimping tool)
Use only copper wires or copper bus bars for wiring. The following table shows the stranded wire sizes [AWG] and the crimp terminal symbols rated at 75 °C/60 °C.

Table 1. Recommended wires. Table 2. Recommended crimp terminals. Includes columns for Servo amplifier (Note 5), Wire size, and Crimp terminal symbols.

Note 1. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
2. Alphabets in the table indicate crimping tools. Refer to table 2 for the crimp terminals and crimping tools.
3. Select wire sizes depending on the rated output of the servo motors. The values in the table are sizes based on rated output of the servo amplifiers.
4. Use the crimp terminal for the P, U, V, W, PE, and S terminals of the servo amplifier.
5. "S" means 1-phase 200 V AC power input and "T" means 3-phase 200 V AC power input in the table.

(2) Selection example of MCCB and fuse
Use 1 class fuses or molded-case circuit breaker (UL 489 Listed MCCB) as the following table. The T class fuses and molded-case circuit breakers in the table are selected examples based on rated I/O of the servo amplifiers. When you select a smaller capacity servo motor to connect it to the servo amplifier, you can also use smaller capacity T class fuses or molded-case circuit breaker than ones in the table. For selecting ones other than T class fuses and molded-case circuit breakers below, refer to each servo amplifier instruction manual.

Table with columns for Servo amplifier (100 V class), Molded-case circuit breaker (120 V AC), and Fuse (300 V). Includes models like MR-J4-10TM, MR-J4-20TM, MR-J4-30TM, MR-J4-40TM, MR-J4-50TM, MR-J4-70TM, MR-J4-100TM, MR-J4-15KTM, MR-J4-18KTM, MR-J4-15KTM4, MR-J4-22KTM.

Table with columns for Servo amplifier (400 V class), Molded-case circuit breaker (480 V AC), and Fuse (600 V). Includes models like MR-J4-60TM, MR-J4-100TM4, MR-J4-200TM, MR-J4-350TM, MR-J4-500TM, MR-J4-700TM, MR-J4-11KTM, MR-J4-15KTM, MR-J4-22KTM.

(3) Power supply
This servo amplifier can be supplied from star-connected supply with grounded neutral point of overvoltage category III (over 1000 V) for 1-phase servo amplifiers. For the interface power supply, use an external 24 V DC power supply with reinforced insulation on I/O terminals.

(4) Grounding
To prevent an electric shock, always connect the protective earth (PE) terminal (marked with the symbol of the earth) of the servo amplifier to the protective earth (PE) of the cabinet. Do not connect two grounding cables to the same protective earth (PE) terminal. Always connect cables to the terminals one-to-one. This product can cause a DC current in the protective earthing conductor. To protect direct/indirect contact using an earth-leakage current breaker (RCD), only an RCD of type B can be used for the power supply side of the product.

2.3.2 EU compliance
The MR-J4 servo amplifiers are designed to comply with the following directions to meet requirements for mounting, using, and periodic technical inspections: Machinery directive (2006/42/EC), EMC directive (2004/108/EC), and Low-voltage directive (2006/95/EC).

(1) EMC requirement
MR-J4 servo amplifiers comply with category C3 in accordance with EN 61800-3. As for I/O wires (max. length 10 m. However, 3 m for STO cable for CN8), and encoder cables (max. length 50 m), use shielded wires and ground the shields. Install an EMC filter and surge protector on the primary side for input and output of 200 V class and for output of 400 V class servo amplifiers. In addition, use a line noise filter for outputs of the 11 kW and 15 kW of 400 V class servo amplifiers. The following shows recommended products.

(2) For Declaration of Conformity (DoC)
Hereby, MITSUBISHI ELECTRIC EUROPE B.V., declares that the servo amplifiers are in compliance with the necessary requirements and standards (2006/42/EC, 2004/108/EC and 2006/95/EC). For the copy of Declaration of Conformity, contact your local sales office.

2.3.3 USA/Canada compliance
This servo amplifier is designed in compliance with UL 508C and CSA C22.2 No.14.

- (1) Installation: The minimum cabinet size is 150% of each MR-J4 servo amplifier's volume. Also, design the cabinet so that the ambient temperature in the cabinet is 55 °C or less. The servo amplifier must be installed in the metal cabinet. Additionally, mount the servo amplifier on a cabinet that the protective earth based on the standard of IEC/EN 60204-1 is correctly connected. For environment, the units should be used in open type (UL 50) and overvoltage category shown in table in section 5.1. The servo amplifier needs to be installed at or below of pollution degree 2. For connection, use copper wires.
- (2) Short-circuit current rating (SCCR): Suitable For Use At A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum.
- (3) Overload protection characteristics: The MR-J4 servo amplifiers have solid-state servo motor overload protection. (It is set on the basis (full load current) of 120% rated current of the servo amplifier.)
- (4) Over-temperature protection for motor: Motor Over temperature sensing is not provided by the drive. Integral thermal protection(s) is necessary for motor and refer to chapter 4 for the proper connection.
- (5) Branch circuit 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.

2.3.4 South Korea compliance
This product complies with the Radio Wave Law (KC mark). Please note the following to use the product. 이 기기는 열음향 (A급) 전자기파발출기로서 판매자 또는 사용자는 이 점을 주의하시기 바랍니다. 가정외의 지역에서 사용하는 것을 목적으로 합니다. (The product is for business use (Class A) and meets the electromagnetic compatibility requirements. The seller or user must note the above point, and use the product in a place except for home.) In addition, use an EMC filter, surge protector, ferrite core, and line noise filter on the primary side for inputs. Use a ferrite core and line noise filter for outputs. Use a distance greater than 30 m between the product and third party sensitive radio communications for an MR-J4-22KTM(4).

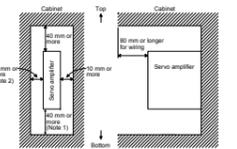
- 2.4 General cautions for safety protection and protective measures
Observe the following items to ensure proper use of the MR-J4 servo amplifiers.
(1) For safety components and installing systems, only qualified personnel and professional engineers should perform.
(2) When mounting, installing, and using the MR-J4 servo amplifier, always observe standards and directives applicable in the country.
(3) The item about noises of the test notices in the manuals should be observed.

- 2.5 Residual risk
(1) Be sure that all safety related switches, relays, sensors, etc., meet the required safety standards.
(2) Perform all risk assessments and safety level certification to the machine or the system as a whole.
(3) If the upper and lower power module in the servo amplifier are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.
(4) Only qualified personnel are authorized to install, start-up, repair or service the machines in which these components are installed. Only trained engineers should install and operate the equipment. (ISO 13849-1 Table F.1 No.5)
(5) Separate the wiring for safety observation function from other signal wirings. (ISO 13849-1 Table F.1 No.1)
(6) Protect the cables with appropriate ways (routing them in a cabinet, using a cable guard, etc.).
(7) Keep the required clearance/creepage distance depending on voltage you use.
- 2.6 Disposal
Disposal of unusable or irreparable devices should always occur in accordance with the applicable country-specific waste disposal regulations. (Example: European Waste 16 02 14)
- 2.7 Lithium battery transportation
To transport lithium batteries, take actions to comply with the instructions and regulations such as the United Nations (UN), the International Civil Aviation Organization (ICAO), and the International Maritime Organization (IMO). The batteries (MR-BATV1 (SET-A) and MR-BATV1) are assembled batteries from two batteries (lithium metal battery CR17335A) which are not subject to the dangerous goods (Class 9) of the UN Recommendations.

3. Mounting/dismounting

Installation direction and clearances

● The devices must be installed in the specified direction. Not doing so may cause a malfunction.
● Mount the servo amplifier on a cabinet which meets IP54 in the correct vertical direction to maintain pollution degree 2.
● The regenerative resistor supplied with 11 kW to 22 kW servo amplifiers does not have a protect cover. Touching the resistor (including wiring/screw hole area) may cause a burn injury and electric shock. Even if the power was shut-off, be careful until the bus voltage discharged and the temperature decreased because of the following reasons.
• It may cause a burn injury due to very high temperature without cooling.
• It may cause an electric shock due to charged capacitor of the servo amplifier.



Note 1. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.
2. For MR-J4-500TM, the clearance on the left side will be 25 mm or more.

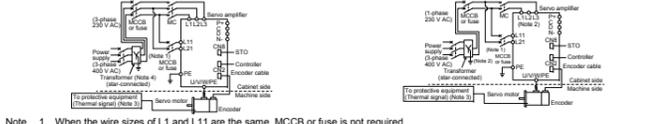
4. Electrical Installation and configuration diagram

WARNING Turn off the molded-case circuit breaker (MCCB) to avoid electrical shocks or damages to the product before starting the installation or wiring.

CAUTION The installation complies with IEC/EN 60204-1. The voltage supply to machines must be 20 ms or more of tolerance against instantaneous power failure as specified in IEC/EN 60204-1.
● Connecting a servo motor for different axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

The following shows representative configuration examples to conform to the IEC/EN/UL/CSA standards.

(1) 3-phase input



Note 1. When the wire sizes of L1 and L11 are the same, MCCB or fuse is not required.
2. When using a 100 V class servo amplifier, step down the power supply voltage to 100 V and connect the main circuit power supply lines to L1 and L2. For 1-phase 200 V AC servo amplifiers, connect the lines to L1 and L3.
3. Please use a thermal sensor, etc. for thermal protection of the servo motor.
4. For 400 V class, a step-down transformer is not required.

The connectors described by rectangles are safely separated from the main circuits described by circles.

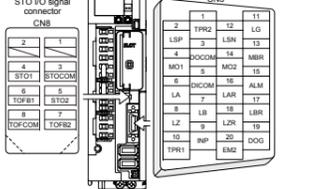
The connected motors will be limited as follows.

- (1) HG/HH/HCH/A series servo motors (Mfg.: Mitsubishi Electric)
- (2) Using a servo motor complied with IEC 60034-1 and Mitsubishi Electric encoder (OBA, OSA)

5. Signals

5.1 Signal

The following shows MR-J4-10TM signals as a typical example. For other servo amplifiers, refer to each servo amplifier instruction manual.



5.2 I/O device

Table with columns for Symbol, Device, Connector, and Pin No. Includes sections for Input device, Output device, and Power supply.

6. Maintenance and service

WARNING To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

6.1 Inspection items

- It is recommended that the following points periodically be checked.
(1) Check for loose terminal block screws. Retighten any loose screws.

Table showing lightning surge limits for MR-J4-10TM, MR-J4-20TM, MR-J4-30TM, MR-J4-40TM, MR-J4-50TM, MR-J4-70TM, MR-J4-100TM, MR-J4-15KTM, MR-J4-18KTM, MR-J4-15KTM4, MR-J4-22KTM(4).

- (2) Servo motor bearings, brake section, etc. for unusual noise.
- (3) Check the cables and the link for scratches or cracks. Perform periodic inspection according to operating conditions.
- (4) Check that the connectors are securely connected to the servo motor.
- (5) Check that the wires are not coming out from the connector.
- (6) Check for dust accumulation on the servo amplifier.
- (7) Check for unusual noise generated from the servo amplifier.
- (8) Check the servo motor shaft and coupling for connection.

6.2 Parts having service lives

Service lives of the following parts are listed below. However, the service lives vary depending on operation and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service lives. For parts replacement, please contact your local sales office.

Table with columns for Part name, Life guideline, and Notes. Includes Smoothing capacitor, Relay, and Cooling fan.

- Note 1. The time is for using MR-J4 servo amplifier with an rotary servo motor using MR-BATV1SET-A. For details and other battery backup time.
- Note 2. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection.
- Note 3. The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operation conditions. The capacitor will be the end of its life in 10 years of continuous operation in normal air conditioned environment (40 °C surrounding air temperature or less for use at the maximum 1000 m above sea level, 30 °C or less for over 1000 m to 2000 m).

7. Transportation and storage

● Transport the products correctly according to their mass.
● Stacking in excess of the limited number of product packages is not allowed.
● Do not hold the front cover to transport the servo amplifier. Otherwise, it may drop.
● Install the product in a load-bearing place of servo amplifier and servo motor in accordance with the instruction manual.
● Do not get on or put heavy load on the equipment.
● For detailed information on transportation and handling of the battery, refer to the servo amplifier instruction manual.

When you keep or use it, please follow the following environment.

Table with columns for Item, Environment, and Notes. Includes Ambient temperature, Ambient humidity, Vibration resistance, and Pollution degree.

Table with columns for Item and Environment. Includes IP rating, Altitude, and Note.

8. Technical data

8.1 MR-J4 servo amplifier

Table with columns for Item, Environment, and Notes. Includes Main circuit (line voltage), Control circuit (line voltage), Control method, Safety observation function (STO), Mean time to dangerous failure, Effectiveness of fault monitoring, Average probability of dangerous failure per hour, Mission time, Response performance, Pollution degree, Overvoltage category, Protective class, and Short-circuit current rating (SCCR).

Note. 283 V DC to 340 V DC are also supported.

8.2 Dimensions/mounting hole process drawing

Table with columns for Servo amplifier, Variable dimension table (mm), and Mass (kg). Includes models like MR-J4-10TM, MR-J4-20TM, MR-J4-30TM, MR-J4-40TM, MR-J4-50TM, MR-J4-70TM, MR-J4-100TM, MR-J4-15KTM, MR-J4-18KTM, MR-J4-15KTM4, MR-J4-22KTM.

Table with columns for Servo amplifier, Variable dimensions (mm), and Screw size. Includes models like MR-J4-10TM, MR-J4-20TM, MR-J4-30TM, MR-J4-40TM, MR-J4-50TM, MR-J4-70TM, MR-J4-100TM, MR-J4-15KTM, MR-J4-18KTM, MR-J4-15KTM4, MR-J4-22KTM.

9. Check list for user documentation

MR-J4 installation checklist for manufacturer/installer
The following items must be satisfied by the initial test operation at least. The manufacturer/installer must be responsible for checking the standards in the items. Maintain and keep this checklist with related documents of machines to use this for periodic inspection.
1. Is it based on directive/standard applied to the machine? Yes [] No []
2. Is directive/standard contained in Declaration of Conformity (DoC)? Yes [] No []
3. Does the protection function conform to the category required? Yes [] No []
4. Are electric shock protective measures (protective class) effective? Yes [] No []
5. Is the STO function checked (test of all the shut-off wiring)? Yes [] No []
Checking the items will not be instead of the first test operation or periodic inspection by professional engineers.

[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 thirteen (13) 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 described 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 which may be 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 above-mentioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

Warning plate and CAUTION symbols. Includes text: "Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury." and "Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight injury to personnel or may cause physical damage."

- 1. About the manuals
1.1 MELSERVO-J4 relevant manuals
This installation guide explains how to mount MR-J4 servo amplifiers. You can also check it with our website for free. <http://www.mitsubishielectric.com/>
If you have any questions about the operation or programming of the equipment described in this guide, contact your local sales office.
In addition, when you mount a protective device, specific technical skills which are not detailed in the guide will be required.
- 1.2 Purpose of this guide
This installation guide explains the safe operation of MR-J4 servo amplifiers for engineers of machinery manufacturers and machine operators. This installation guide does not exclude the use of the machines in which the safe system is, or will be integrated. For detailed information of the products, refer to each servo amplifier instruction manual.
- 1.3 Terms related to safety
1.3.1 IEC 61800-5-2 Stop function
STO function (Refer to IEC 61800-5-2:2007 4.2.2 STO.) The MR-J4 servo amplifiers have the STO function. The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in the servo amplifier.
- 2. About safety
This chapter explains safety of users and machine operators. Please read the chapter carefully before mounting the equipment. In this installation guide, the specific warnings and cautions levels are classified as follows.
WARNING Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
CAUTION Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight injury to personnel or may cause physical damage.
- 2.1 Professional engineer
Only professional engineers should mount MR-J4 servo amplifiers.
Here, professional engineers should meet the all conditions below.
(1) Persons who took a proper training of related work of electrical equipment or persons who can avoid risk based on past experience.
(2) Persons who have read and familiarized himself/herself with this installation guide and operating manuals for the protective devices (e.g. light curtain) connected to the safety control system.