

# A research on the specification of servo amplifier

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**ABSTRACT:** AC Servomotors are widely used in the industries for the control of static and dynamic loads. Precise control of position, speed, and torque are the main issues with the AC Servomotor. AC Servomotors are highly demanded by the industries to have a precise response under dynamic load conditions. Many control techniques are commercially available for the control of AC Servomotor under static and dynamic load conditions. In this paper, a research on AC SERVO motor and Servo Amplifier Modules.

**KEYWORDS:** Servomotors, Servo Amplifier Module, 1-axis control

## I. INTRODUCTION

A servomotor is a motor employed for the control of position or speed in the closed-loop control systems. The functions of the servomotor are to turn over a wide range of speed and also to perform the control position and speed instructions given. DC and AC servomotors are utilized in applications due to their machine structure in general. When the condition is low power and variable speed, the AC servomotors are the ones favored in control systems due to its control capabilities [1–4]. Besides, the applications of the AC servomotors can be found in conveying technology, printing, wood processing, textile industry, plastics industry, food and packaging industry, packaging and filling plants, and machine tools. There are two types of AC servomotors available which are a squirrel cage asynchronous and a permanent magnet synchronous. In the field of control of mechanical linkages and robots, research works are mostly done only on the DC motors.

## II. A RESEARCH ON SERVO AMPLIFIER MODULES

Many control methods are available for AC Servomotor. Some of the control systems use moment in Servo Amplifier Modules.

The servo actuator receives the command signal from the control system, amplifies the signal, and transmits current to the servo motor to produce motion proportional to the command signal. Typically, the command signal represents the desired velocity, but may also represent the desired torque or position. A sensor attached to the servo motor reports the actual state of the motor back to the servo drive. The servo actuator then compares the actual motor state with the commanded motor state. It then changes the voltage, frequency, or pulse width to the motor to correct for any deviation from the commanded state [4]

### 2.1. AMPLIFIERMODULE MR-J2

With high efficiency and power from 50W to 37 KW. All use an absolute 131,072 ( $2^{17}$ ) pulses per round of the standard encoder. Other particularly distinguishing features include higher frequency response up to 550Hz. Capable of accepting pulse commands up to 500 KHz along with adaptive real-time. RS232 serial interface for configuration settings. Control mode including speed, position and torque is the best model with built-in positioning controller. CC-Link or SSCNET networking capabilities are UL and CE selectable and globally accepted. Servo Amplifier MR-J2 super 200-230VAC is supported with the following control methods: position, speed, torque, SSCNET network, CC-Link, Profibus-DP, DeviceNet, built-in Motion.

### Introduction of SERVO MR-J2A

The SERVO MR-J2A series is designed to suit position, torque and torque control applications.

With an accuracy of 131072 pulses/rev, the MR-J2A servos are very accurate in position control applications. And with torque and speed control

modes. Servo MR-J2 also shows very high reliability when it can be controlled with an accuracy of 0.1% maximum torque and 0.01% maximum speed.

The suitable voltage range for MR-J2A servos is also very diverse, from 170-253VAC.

Below is an example of the parameter table and connection of the MR-J2S-A(100/200v) series of servos.

#### Introduction of Servo Amplifier MR-J2B

The SERVO MR-J2B series is designed to suit applications that control the axes of 2D, 3D... and more axes systems. Integrated network SSCNET, Profibus-DP, DeviceNet, Motion.

- Theoretically, the SERVO MR-J2B has the same physical parameters as the SERVO MR-J2A. However, these J2B series SERVOS are equipped with SSCNET communication technology to cater for applications where multiple axes are related to each other at the same time.

- With the SSCNET communication system, the MR-J2B SERVOS are linked together to create a flexible axes system for each application.

Below is an example of the connection diagram and parameter table of the SERVO MR-J2S-B(100/200v) series

Table1. Specifications of servo amplifier MR J2-A and MR J2-B

Servo type	SERVO MR-J2A	SERVO MR-J2B
Main parameters		
Encoder resolution	131072 pls/rev	131072 pls/rev
Communication options	RS232 RS422	RS232 SSCNET
Rated voltage and frequency	1P 200-230VAC 3P 200-230VAC 50-60Hz	1P 200-230VAC 3P 200-230VAC 50-60Hz
Overvoltage tolerance	1P 207-253VAC 3P 170-253VAC	1P 207-253VAC 3P 170-253VAC
Control method	Sine wave PWM	Sine wave PWM
Speed options	Analog1:2000 Internal1:5000	Analog1:2000 Internal1:5000
Dynamic brake	none	none

## 2.2. AMPLIFIERMODULE MR-J3

Mitsubishi Servo Amplifier series MR-J3 is a SERVO system with higher efficiency and higher functionality developed on the basis of the MR-J2 series. The MR-J3 Servo Amplifier has modes with position control, speed control and torque control and switch control between them available in application options. SERVO amplifiers are used in a wide range of applications, not only for mechanical tools and general industrial machinery, such as the need for highly precise position control and smooth speed control applications. true, but also for the linear control and tension control areas. The product has USB and RS-422 serial communication function, through the installation of SERVO setup software, the personal computer can set parameters, run test, monitor status display and adjust level increase, the product has a highly self-regulating function and advanced vibration suppression control function.

#### Introduction of Servo Amplifier MR-J3A

The MR-J3-A series is suitable for common control tasks in terms of speed, torque and

position. With an accuracy of up to 262144 pulses/rev, a significant improvement over the predecessor MR-J2 series. The torque and maximum speed characteristics have also been upgraded in terms of accuracy compared to the predecessor MR-J2 series. In particular, some Servo Amplifier MR-J3-A are also equipped with a brake system to increase safety for applications requiring high safety. The MR-J3-A Servo Amplifiers are also significantly improved in terms of performance and energy efficiency. Below is the connection diagram and detailed specification sheet of Servo Amplifier MR-J3-A product.

#### Introduction of Servo Amplifier MR-J3B

The MR-J3-B series has the same accuracy, adjustment response and torque response parameters as the MR-J3-A series. In addition, the MR-J3-B series is designed specifically for closed-loop control systems, interpolated multi-axis motion systems and especially servo control networks with fiber optic lines. Configuration units (Plug & Play) for Mitsubishi Electric motion control and position control systems, to which they

are connected via the SSCNET III high-speed network, which has a time period of 0, 44

milliseconds. Below is the connection diagram and detailed specification sheet of the MR-J3-B series

Table 2. Specifications of servo amplifier MR J3-A and MR J3-B

Servo type	SERVO MR-J3A	SERVO MR-J3B
Main parameters		
Encoder resolution	262144 pls/rev	262144 pls/rev
Communication options	1P 170-253VAC 3P 200-230VAC 50-60Hz	1P 170-253VAC 3P 200-230VAC 50-60Hz
Rated voltage and frequency	1P 207-253VAC 3P 170-253VAC	1P 207-253VAC 3P 170-253VAC
Overvoltage tolerance	PWM	PWM
Control method	USB RS232	USB SSCNET III
Speed options	Analog 1:2000 Internal 1:5000	Analog 1:2000 Internal 1:5000
Dynamic brake	Options for each model	Options for each model

### 2.3. AMPLIFIERMODULE MR-J4

Mitsubishi Electric automation introduces the SERVO motor, motor amplifier and motion controller MR-J4 Series successor to the MR-J3 amplifier.

In motion control, speed is necessary to get maximum machine productivity. The MR-J4 with a frequency response time of 2500Hz reduces setup times to less than 2 milliseconds (msec), maximizing machine power and output for machine builders and end users.

- With several models and options to suit your single application easily and comfortably:

+ 2500Hz: frequency rate to 2500Hz, it greatly reduces the installation time

+ 150Mbps SSCNETIII/H: can connect via high-speed fiber optic cable, 150Mbps SSCNETII/H motion network

Available models: 200V, 50W-7KW

+ 22-bit resolution system: AC servo motor is equipped with 22bit/~4 million pulses per rev

Advanced tuning algorithms: enhanced One-Touch auto tuning with real-time load control

+ Safety certification: certified TUV safety function

+ Ability to save energy

### Introduction of Servo Amplifier MR-J4-A.

The MR-J4-A series is suitable for common control tasks in terms of speed, torque and position. With an accuracy of up to 4,194,304 pulses/rev and improved response speed compared to that of the MR-J4-A series. predecessor products, SERVO MR-J4-A is showing its superiority in applications that need very high accuracy and safety for people, equipment and machines. Below is the connection diagram and detailed specification sheet of the SERVO MR-J4-A series

### Introduction of Servo Amplifier MR-J4-B

The SERVO MR-J4-B series also inherits the same accuracy features and safety capabilities as the J3-A series. However, like the J2B and J3B series, the MR-J4-B series specializes in used for the overall closed control system, multi-axis interpolated motion system and especially the servo control network with optical cable transmission (fiber). Configuration units (Plug & Play) for Mitsubishi Electric motion control and position control systems, to which they are connected via the SSCNET III high-speed network.

Below is the connection diagram and detailed specification sheet of the SERVO MR-J4- B series.

Table 3. Specifications of servo amplifier MR J4-A and MR J4-B

Servo type	SERVO MR-J4A	SERVO MR-J4B
Main parameters		
Encoder resolution	4194304 p/rev	4194304 p/rev
Communication options	AC 1P/3P 170-264V 50-60Hz DC 241-374V	AC 1P/3P 170-264V 50-60Hz DC 241-374V
Rated voltage and frequency	AC 1P/3P 170-264V 50-60Hz DC 241-374V	AC 1P/3P 170-264V
Overvoltage tolerance	Sine wave PWM	Sine wave PWM
Control method	USB RS485 RS422 STO I/O cable	USB STO I/O cable SSCNET III/H
Speed options	Analog 1:2000 Internal 1:5000	Analog 1:2000 Internal 1:5000
Dynamic brake	Options for each model	Options for each model

### III. CONCLUSION

The choice of Module Amplifier completely depends on the economic and technical criteria of the control system. Therefore, depending on the requirements of each control problem, we decide which type of Amplifier Module to choose. This article has introduced the features and parameters of the Amplifier Module types to help readers better understand the Amplifier Module types when used to control AC SERVO motors.

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