MR-C Servo

SERVOMOTORS & AMPLIFIERS

Cost Effective Micro-Servo

MITSUBISHI ELECTRIC

Small, Easy-to-Use, High-Performance. An Extraordinarily Compact, Intelligent Servo.

The MELSERVO-C brushless servo, in a handy super-compact size, is the culmination of Mitsubishi servo technology.

The servo amplifier achieves high performance in an unprecedented compact body, only 40 millimeters wide and 130 millimeters tall. Small but powerful, it comes equipped with a serial encoder, and is packed with high-level features, including real-time auto-tuning and model adaptive control.

This servo can substitute for microstep and five-phase stepping motors, and it can be easily used even by first-time users. A “new age” servo for use in a broad range of fresh applications, including semiconductor manufacturing devices, printing machines and electronic component assembly.

Actual Size

Move Up to the Next Level Now

Handy Super-Compact Size

Servo Amplifier

- For up to 400 watts, a super-compact size of only 40 millimeters by 130 millimeters was achieved through the incorporation of a newly developed power module and an optimal thermal design made possible with computer-aided engineering techniques.
- Mitsubishi servo control technology including model adaptive control and real-time auto-tuning is achieved with a micro-controller, resulting in the maximum performance with the fewest number of parts.
- Select either a single-phase 100 V or 200 V amplifier.

Servomotor

- Improved heat dissipation of the motor and a super-compact design were achieved with a molding process that uses newly developed high-thermal conductivity resin. (Frame diameter on 100-watt and below units is 40 millimeters square.)
- This compact design offers maximum torque of 400% (100-watt and below units) through enhanced coil density made possible through original Mitsubishi technology.
- Motors with failsafe electro-magnetic brakes are available.

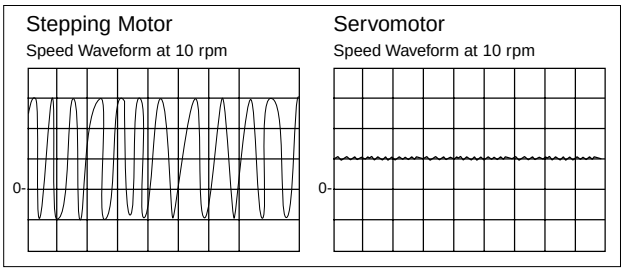
Stepping Motor Replacement

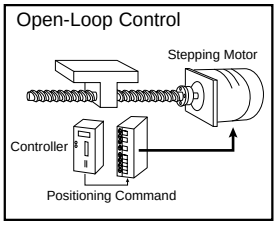
No More Cogging or Stalling

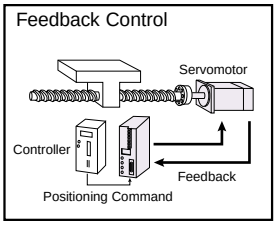
Because control is performed using integral feedback to verify the servomotor's position, this unit can start smoothly, without losing step. This is often a problem with stepping motors responding to sudden load fluctuations and sudden acceleration / deceleration.

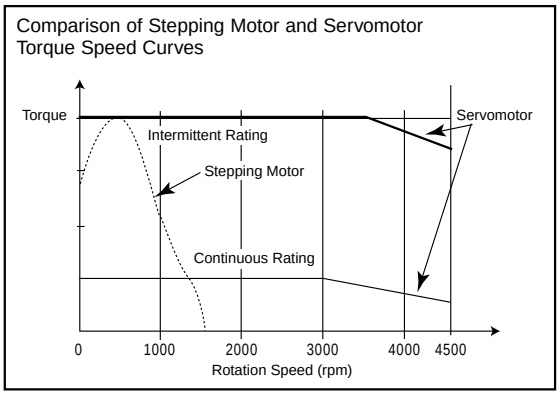
Smooth Operation

Operation is smooth at low speeds and during acceleration / deceleration because feedback control is performed with a 4,000 pulse / rev encoder.









Stable Torque Characteristics

Reduced machine cycle time and greater production speeds are achieved thanks to stable torque characteristics, from low to high-speeds (maximum rotation speed 4,500 rpm).

Controllable Torque

Prevent damage to machines and products by using the torque-limiting feature.

Easy Operation

Real-Time Auto-Tuning

Merely selecting the response setting that fits the machine being used eliminates the need for servo gain adjustments. This is because the real-time auto-tuning function automatically adjusts the gain to fit the machine. And Mitsubishi's unique control technology model adaptive control makes possible a highly responsive and stable system.

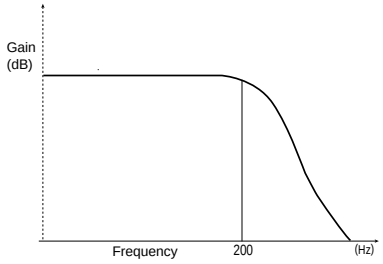
Automatic Recognition of Motor Model

The servo amplifier automatically recognizes the drive motor with the motor ID information (motor model name, etc.) built into the encoder. This eliminates the need to set parameters, thereby removing setting errors as well.

Easy Operation

- Test operation, monitoring, and parameter setting can all be performed easily using just four buttons.
- The monitoring function allows you to display the status of nine parameters, including motor rotation speed, feedback pulse, command pulse, effective load factor, and peak load factor.
- The servo can remember the conditions that existed during the last four alarms.
- Either a 24 V or 5 V power supply can be selected for the I/O that can be user assignable.
- The MR-C can handle three command pulse formats: encoder signals, pulse and direction and CW / CCW pulses.

Speed Response Frequency Characteristics



Encoder Serial Communications

Serial Communications

- Feedback Pulse
- Motor Capacity
- Magnetic Pole Detection
- Alarm Information

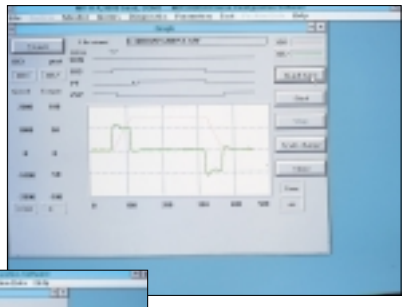
Display Panel and Operation Buttons

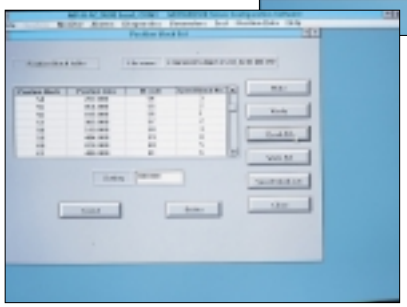
Satisfies Overseas Industrial Standards

Satisfies EN, UL, and cUL Standards

- An EMC filter (optional) is available for meeting EN-standard EMC directives. The MR-C-UE servo amps and HC-PQ-UE servomotors meet low-voltage directives (LVD).
- The MR-C-UE servo amps and HC-PQ-UE servomotors meet UL, cUL and EC standards.

Graph Display Window





Parameter Display Window

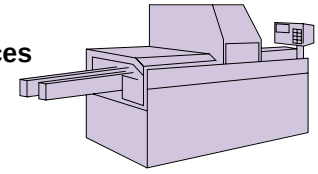
Personal Computer Interface

Communication with a PC is Made Possible

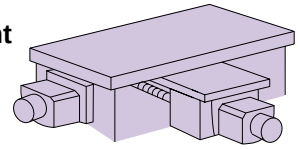
- This servo can be connected to a PC using the optional RS-232C unit.
- Setup software can be used to display various monitoring details and to enter and save all parameters. And with its graphing functions, it is possible to display servomotor speed, torque waveform, and digital I/O status. This makes it possible to check operating conditions.

Applications

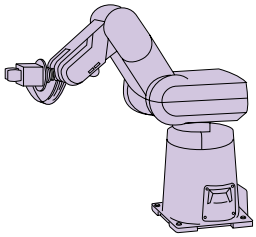
Semiconductor Manufacturing Devices
The MR-C can be used to replace stepping motors in LCD and wafer conveyance devices.



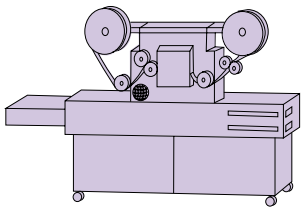
Electronic Component Assembly
Can be used with small loaders and unloaders and simple X-Y positioning tables.



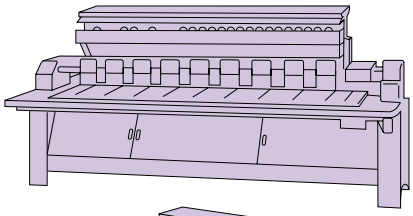
Robots
Suited for use at the tips of small and ultra-compact robots.



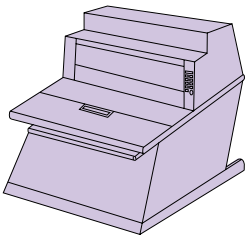
Printing Machines
Well suited for use in positioning for registration presses and label printing.



Textile Machines
Well suited for use in positioning with knitting, embroidering, and laundry machines.

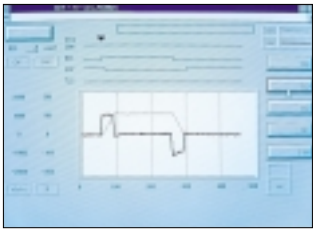


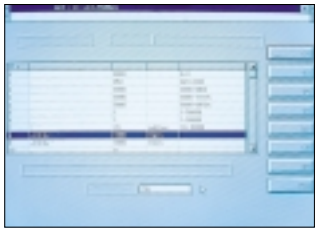
Other Applications
The MR-C can be used to replace microstepping and five-phase step motors in office, medical and experimental machinery.



MCOMM Configuration Software

With this software everything from setup to monitoring, diagnostics, parameter entry and recall, and test operation can be performed easily with a personal computer. To use this software, the optional RS-232C unit must be attached to the servo amplifier. Version 21 and above can be used with the MR-C series.





Features

- **Windows 3.1, Windows 95 Compatible**
  Compatible with PCs running Microsoft Windows 3.1 (note 1), Windows 95. Setup can be performed with a PC.
  Required memory: 4MB (more recommended)
  Required hard disk space: 1MB (more recommended)
  Serial port required
- **Wide Range of Monitoring Functions**
  Equipped with graphing functions capable of displaying servomotor status through input signal triggers, such as command pulse, standing pulse, and rotation speed.
- **PC Test Operation**
  Servomotor test operation can be performed easily with a PC.

Specifications (Those inside parentheses are not available with the MR-C.)

Function	Description
Monitoring	Comprehensive display, high-speed display, graphing
Alarm	Alarm display, alarm history, (alarm data display), (pre-alarm graph display)
Diagnosis	DI / DO display, (display of reasons for failure to rotate), (time setting display), (cumulative power on display), software number display, tuning data display, (ABS data display), (VC automatic offset display)
Parameters	Data setting, list display, list display of changes, detailed information display, (feed method selection [note 2])
Test Operation	JOG operation, (positioning operation), (motor-less operation), DO forced output, (programmed operation through simplified language), (one-step feed [note 2])
Point Data [note 2]	(Comprehensive position / speed block data display, data setting, teaching function)
File Management	Data entry / saving, printing
Other Functions	(Automatic operation), help display

Notes: 1. Windows is a trademark of the Microsoft Corporation.
2. Available with MR-H-AC.
3. This software may not operate properly on all personal computers.

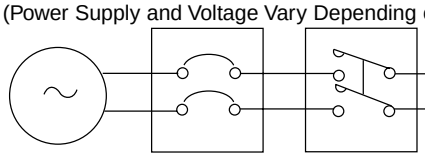
Connections with Peripheral Equipment

Connections between the MR-C and peripheral equipment. Required connectors and options have been listed to allow users to set up their systems and use immediately after purchase.

MR-C Servo Amplifier
MR-C☐A or MR-C☐A1

Power Supply

Single-Phase 100 V or 200 V Power Supply
(Power Supply and Voltage Vary Depending on the Series)



L1
L2
P
C
U
V
W

Twist to Less than 10 Meters

No-Fuse Circuit Breaker (NFB)

Used to protect the power supply line.
Models: NF30 type A for: MR-C10A,
MR-C10A1 and MR-C2OA
NF30 type 10A for: MR-C20A1
and MR-C40A
(See manual)

Magnetic Contactor (MC)

Used to turn off the servo amplifier's power when an alarm has been triggered.
Models: S-N18,
S-N21
(See manual)

Optional Regeneration Unit

Attached as necessary when regeneration frequency is high or load's moment of inertia is large.
Models: MR-RB013, MR-RB033
(See manual)

Display Panel

Displays alarms, parameter and system function values.
(See page 7)

Setting Section

Parameters, system functions, and modes are selected and set with push buttons.
(See page 7)

CN2

Connector for encoder feedback.

Terminal Block

The power supply, optional regeneration unit, and motor's U, V, W ground wires are connected to the terminal block. Use a regular flat head screwdriver to connect the power supply to the terminal block. (See manual)

Upper Controller

This servo can be connected to a Mitsubishi motion controller or any pulse output controller.

FX-1PG

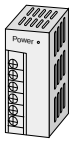
AD75 P1-P3,
A1SD75 P1-P3

MR-TB20
Junction Terminal Block

Signals can be easily wired to the optional terminal block and optional CN1 cable.

External 24 V or 5 V Power Supply

Connects to an external power supply. (24 or 5 volts, 0.2 amperes or greater)



Control Signal (for Operation Panel)

Connects to the PLC I/O or the machine's operation panel.

MR-C-TO1
Optional RS232-C Unit

Mounting this optional unit on the underside of the servo amplifier makes RS-232C communications possible. Turn the power off when mounting or removing this unit.

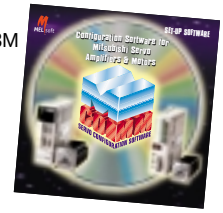
CN1

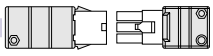
Control signal connector. (See manual)

CN3

RS-232C Communications (CN3)

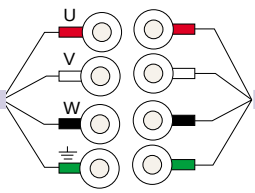
Connects the unit to user's personal computer, making possible monitoring, batch parameter entry and storage, graph display, and test operation. Dedicated cables and setup software are available also.
Cables: For IBM compatibles: MR-CPCATCBL3M
Setup software: MCOMM and above
(See page 6)





Encoder Cable

This cable connects the servomotor encoder to the servo amplifier. Extended-life cables with a long bending life are also available. This cable comes in standard lengths of 5 and 10 meters.
Models: MR-JCCBL☐M-L (Standard model)
MR-JCCBL☐M-H (Extended-life model)
(See manual)



Servomotor Cable

The motor's power cable and the encoder cable are extended 0.3 meter.

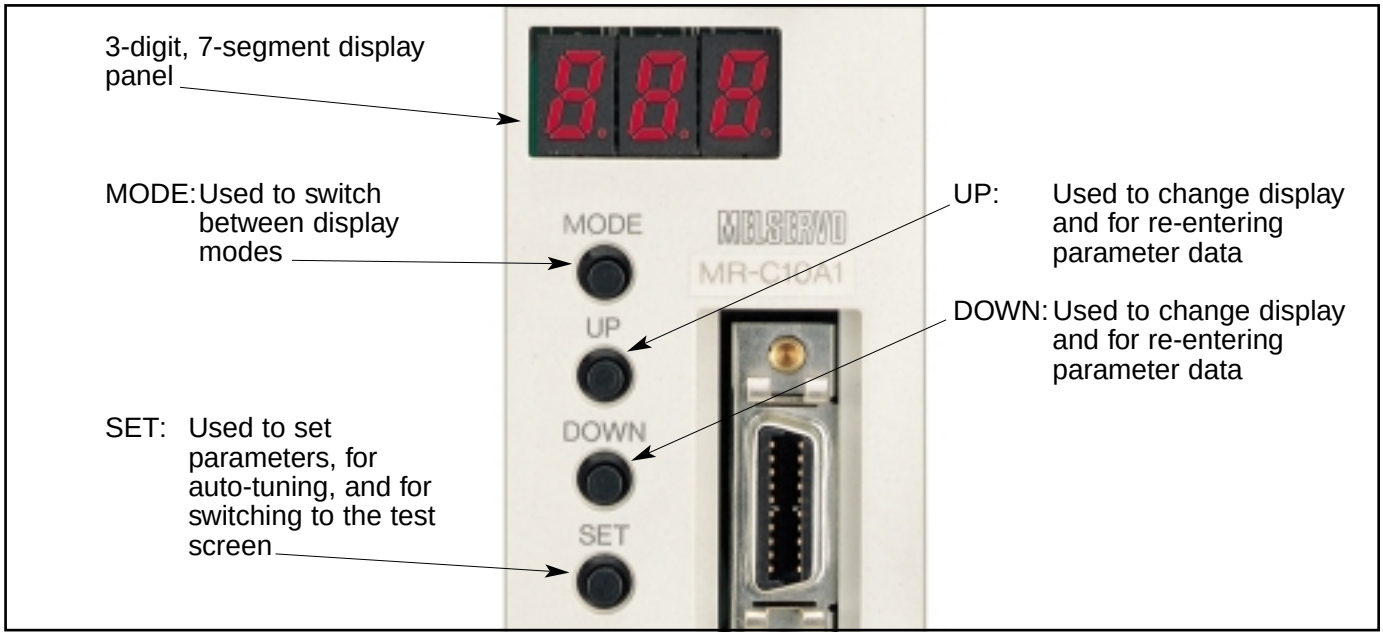
Encoder

Detects position, speed and magnetic pole position.

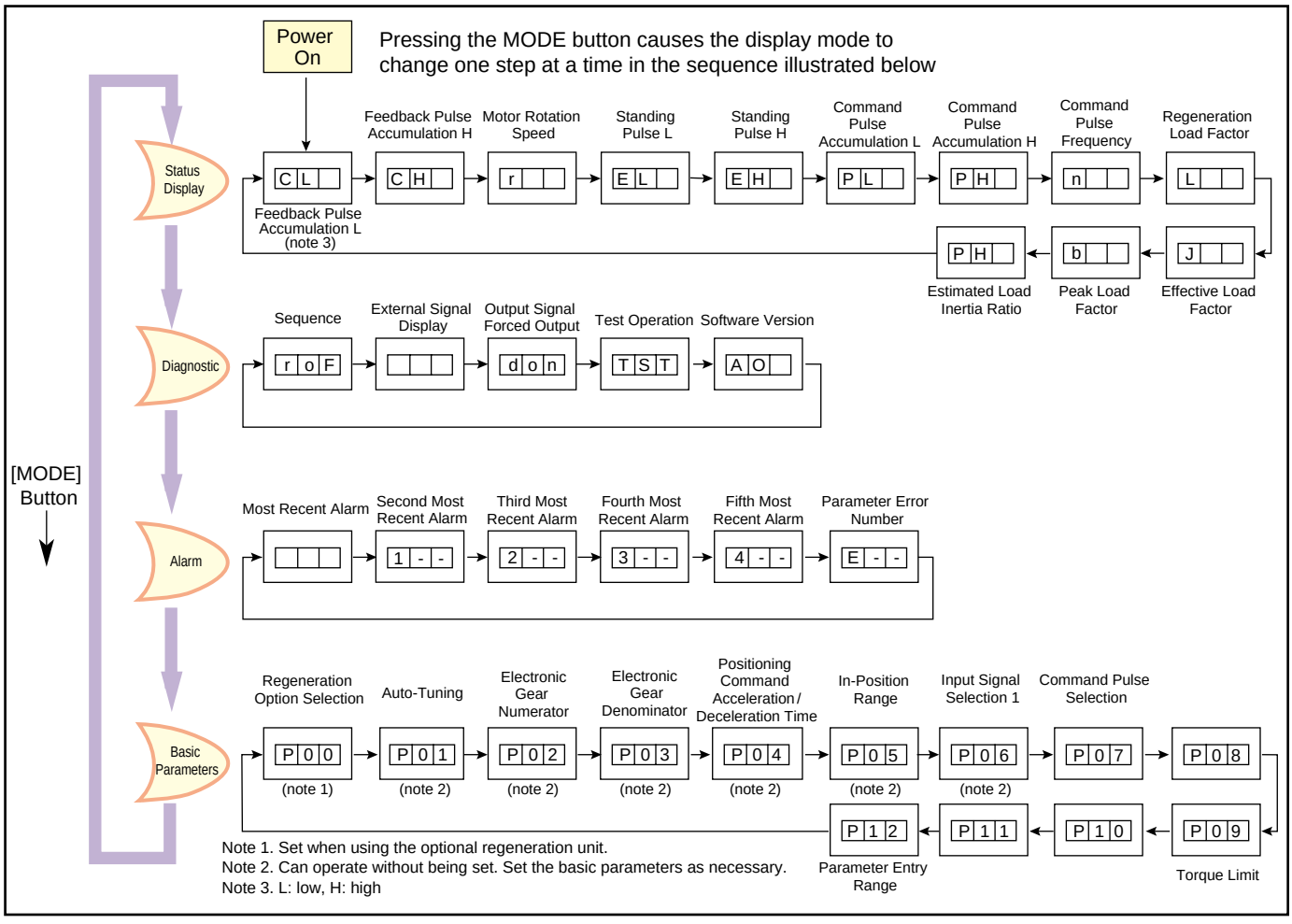
HC-PQ Servomotor

(See manual)

Local Operation



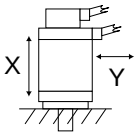
Explanation of 7-Segment Display Device



Standard Specifications

Specification \ Model			Servomotor Model*	HC-PQ033(B)	HC-PQ053(B)	HC-PQ13(B)	HC-PQ23(B)	HC-PQ43(B)	HC-PQ033(B)	HC-PQ053(B)	HC-PQ13(B)	HC-PQ23(B)
			Servo Amplifier Model*	MR-C10A			MR-C20A	MR-C40A	MR-C10A1			MR-C20A1
Servomotor (note 1)	Continuous Characteristics		Rated Output (W)	30	50	100	200	400	30	50	100	200
			Rated Torque (N•m (oz•in))	0.095 (13.45)	0.16 (22.66)	0.32 (45.32)	0.64 (90.63)	1.3 (184)	0.095 (13.45)	0.16 (22.66)	0.32 (45.32)	0.64 (90.63)
	Maximum Torque (N•m (oz•in))			0.38 (53.8)	0.64 (90.63)	1.28 (181)	1.92 (271.9)	3.0 (432)	3.0 (432)	0.64 (90.63)	1.28 (181)	1.92 (271.9)
	Rated Rotation Speed (rpm)			3,000								
	Maximum Rotation Speed (rpm)			4,500								
	Permissible Instantaneous Rotation Speed (rpm)			5,400				5,175	5,400			
	Power Rate at Continuous Rated Torque (kW/s)			6.45	13.47	34.13	46.02	116.55	6.45	13.47	34.13	46.02
	Moment of Inertia J (kg•cm^2(oz•in^2)) (note 7)			0.014 (0.077)	0.019 (0.104)	0.03 (0.164)	0.089 (0.487)	0.145 (0.793)	0.014 (0.077)	0.019 (0.104)	0.03 (0.164)	0.089 (0.487)
	Speed / Position Encoder			Encoder (resolution: 4,000 P / rev)								
	Attachments			Encoder, serial								
	Structure			Totally enclosed, self-cooling (protection method: IP44)								
	Environment		Ambient Temperature / Humidity	0-40°C (avoid freezing), storage: -15-70°C / 80% RH or below (avoid condensation), storage: 90% RH or below								
			Atmosphere	Indoor (avoid exposure to direct sunlight); no corrosive gas, inflammable gas, oil mist or dust								
			Elevation / Oscillation (note 6)	1,000 meters or less above sea level, X:19.6 m / S^2 (2G), Y:19.6 m / S^2 (2G)								
	Weight (kg) (lb)			0.32 (0.71)	0.37 (0.82)	0.50 (1.1)	0.96 (2.1)	1.42 (3.13)	0.32 (0.71)	0.37 (0.82)	0.50 (1.1)	0.96 (2.1)
Servo Amplifier (note 2)	Power Supply (note 3)		Voltage / Frequency	Single-Phase AC 200 ~ 230 V 50 / 60 Hz					Single-Phase AC 100 ~ 115 V 50 / 60 Hz			
			Permissible Voltage Fluctuation	Single-Phase AC170 ~ 253 V					Single-Phase AC85 ~ 126 V			
			Permissible Frequency Fluctuation	±5% or Less								
			Power Facility Capacity (kVA)	0.1	0.2	0.3	0.5	0.9	0.1	0.2	0.3	0.5
	Control System			Sinusoidal PWM control / control system								
	Control Mode			Pulse-train input position control								
	Control Logic			Model adaptive control								
	Auto-Tuning			Real-time auto-tuning								
	Rated Output Current (A)			0.85	0.85	0.85	1.5	2.8	0.85	0.85	0.85	1.5
	Maximum Output Current (A)			5.0	5.0	5.0	6.0	6.44	5.0	5.0	5.0	6.0
	Regeneration Brake Frequency (times / min)(note 4)		No Options	△	△	(note 4-1)	(note 4-2)	(note 4-3)	△	△	(note 4-1)	(note 4-2)
			MR-RB013 (10W)	△	△	4,660	1,400	800	△	△	4,660	1,400
			MR-RB033 (30W)	△	△	△	4,300	2,400	△	△	△	4,300
	Recommended Load's Moment of Inertia Ratio			30 times the servomotor's moment of inertia or less (note 5)								
	Safety Features			Excess current, regeneration error (electronic thermal), excess voltage, motor-amp combination error, encoder error, insufficient voltage / sudden power outage, excess speed, large error								
	Position Control Specifications		Maximum Input Pulse Frequency	Max. 200kpps								
			Positioning Feedback Pulse	4,000 pulse / revolution								
			Command Pulse Multiple	Electronic gear A / B multiple ; A, B: 1-199 1/50<A / B<20								
			Positioning Complete Width Setting	0-999 pulses								
			Excess Error	±50k pulses								
	Power Supply			External DC 24 V or DC 5 V power supply								
	PC Communication Functions		Necessary Options	Optional RS-232C unit (MR-C-T01), optional dedicated cable, and PC setup software required								
			Functions	Status display, diagnostic display, alarm display, parameter setting, operation waveform monitoring								
	Structure			Open								
	Environment		Ambient Temperature / Humidity	0-50°C (avoid freezing), storage: -20-65°C / 90% RH or below (avoid condensation), storage: 90% RH or below								
			Atmosphere	Inside control panel; no corrosive gas, inflammable gas, oil mist, or dust								
			Elevation / Oscillation (note 6)	1,000 meters or less above sea level; 5.9 m / S^2 or below, (0.6G) or below								
	Weight (kg) (lb)			0.6 (1.323)	0.6 (1.323)	0.6 (1.323)	0.6 (1.323)	1.0 (2.205)	0.6 (1.323)	0.6 (1.323)	0.6 (1.323)	0.6 (1.323)

Notes 1. Inquire about use in special conditions, e.g. where oil and water are present in the machine site.
2. Output and rated rotation speed cannot be guaranteed when the power supply's voltage falls. The currents indicated are the amplifier's rated and maximum current.
3. The power facility capacity varies depending on the power supply's impedance.
4. The figures for regeneration brake frequency indicate the permissible frequency when the motor alone decelerates to a stop from the rated rotation speed. The triangle marks in the table indicate that there are no limits on regeneration if the effective torque is less than the rated torque. When load is applied, regeneration frequency is 1/(m+1) of the figures in the table (m = load's moment of inertia / motor's moment of inertia). When the rated rotation speed is exceeded, the permissible number of times is in inverse proportion to the square of operating speed divided by rated speed. When the operation rotation speed is frequently changing, or when a continuous regeneration condition exists, such as during up / down feed, the regeneration heat during operation must be assessed and measures taken to ensure that it does not exceed the permissible range.
4-1. When the load's moment of inertia is 30 times or less, there are no limits on regeneration brake frequency if the effective torque is less than the rated torque.
4-2. When the load's moment of inertia is 10 times or less, there are no limits on regeneration brake frequency if the effective torque is less than the rated torque.
4-3. When the load's moment of inertia is 1 time or less, there are no limits on regeneration brake frequency if the effective torque is less than the rated torque.
5. Contact Mitsubishi if the load's moment of inertia ratio exceeds the figure in the table.
6. The direction of oscillation is as shown in this diagram.



7. The moment of inertia of a motor with a built-in electromagnetic brake is noted in the diagram of external dimensions.

*See Product Manual or Selection Guide for complete part numbers.

MR-C Servo

SERVOMOTORS & AMPLIFIERS

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