

Mitsubishi Electric AC Servo System

MITSUBISHI ELECTRIC SERVO SYSTEM
MELSERVO

EMC Installation Guidelines

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1 INTRODUCTION

Point

The EMC counter measures described in this guideline are recommended. Use this guideline as a reference and take additional countermeasures according to the customer's operating environment.

We have carried out EMC standard compliance confirmation tests with the servo amplifier in the installation environment described in this guideline. After incorporating the servo amplifier in the machine or equipment, confirm the EMC standard compliance of the entire machine or equipment on customer side. For the EMC countermeasures, refer to the instruction manual or user's manual of each servo amplifier in addition to this guideline.

1.1 U.S. CUSTOMARY UNITS

U.S. customary units are not shown in this manual. Convert the values if necessary according to the following table.

Quantity	SI (metric) unit	U.S. customary unit
Mass	1 [kg]	2.2046 [lb]
Length	1 [mm]	0.03937 [inch]
Torque	1 [N•m]	141.6 [oz•inch]
Moment of inertia	1 [($\times 10^{-4}$ kg•m ²)]	5.4675 [oz•inch ²]
Load (thrust load/axial load)	1 [N]	0.2248 [lbf]
Temperature	N [°C] \times 9/5 + 32	N [°F]

MEMO

2 EMC STANDARDS

Mitsubishi Electric general-purpose AC servo MELSERVO complies with the product family standard EN 61800-3. This standard largely regulates two types of tolerance, emission and immunity.

Emission (EMI: Electromagnetic Interference) is the ability to prevent equipment from emitting obstructive noise that adversely affects external sources.

Immunity (EMS: Electromagnetic Susceptibility) is the ability to prevent equipment from being affected by obstructive noise from external sources.

The following table shows the classification.

Class	Standard *1	Name	Environment	
Emission Electromagnetic interference (EMI) (Obstructive emission from the product)	IEC 61800-3	—	2nd Environment (Category C3/C2) Commercial, light industrial, and industrial environments (C3: Commercial, light industrial, and industrial environments C2: In addition to C3 environments, the servo motor can be used conditionally in residential environments, provided that it is installed and adjusted by specialists.)	
		EN 55011		Industrial, scientific, and medical radio frequency equipment - Radio-frequency disturbance characteristics
		CISPR 11		Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
Immunity Electromagnetic susceptibility (EMS) (Immunity to interference)	IEC 61800-3	—		
		IEC 61000-4-2		Electrostatic discharge immunity test
		IEC 61000-4-3		Radiated, radio-frequency, electromagnetic field immunity test
		IEC 61000-4-4		Electrical fast transient/burst immunity test
		IEC 61000-4-5		Surge immunity test
		IEC 61000-4-6		Immunity to conducted disturbances, induced by radio-frequency fields
		IEC 61000-4-8		Power-frequency magnetic field immunity test
		IEC 61000-4-11 IEC 61000-4-34		Voltage dips, short interruptions and voltage variations immunity tests

*1 The latest standards applicable to servo systems. For the standards of the servo motor to be used, refer to the instruction manual and user's manual of the servo amplifier to be used.

MEMO


3 EMC COUNTERMEASURES

Install the servo amplifier in a metal cabinet.

3.1 Basic EMC countermeasures

The following measures should be taken as EMC countermeasures.

- Install the device in a sealed metal cabinet.
- Install a noise filter.
- Securely ground the device.
- Use shielded wires for cables and wires.
- Separate the primary-side wiring and the secondary-side wiring as far as possible.
- Install the surge protector.

 Page 23 Surge protector

3.2 Cabinet design

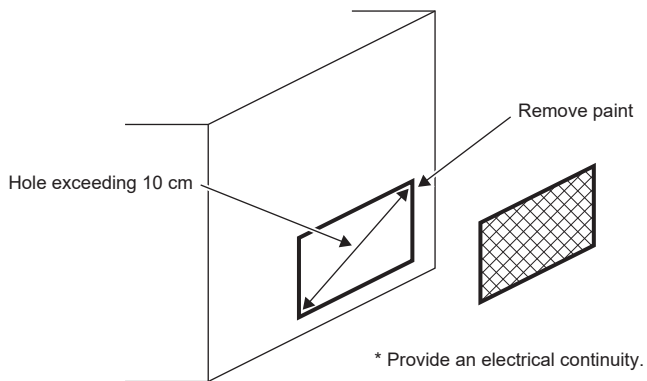
Point

In addition to the EMC countermeasures described in this chapter, NFPA79 approved by the United States requires that the wiring between a servo amplifier and a servo motor be insulated from wiring of other control or signal circuits if a shielded wire is not used. (Example: 100 mm or more for 20 A or less)

The servo is a complex component incorporated into another machine. The servo amplifier must be installed in a cabinet. The design and layout of the cabinet is a very important factor in EMC countermeasures. Consider the following when designing the cabinet.

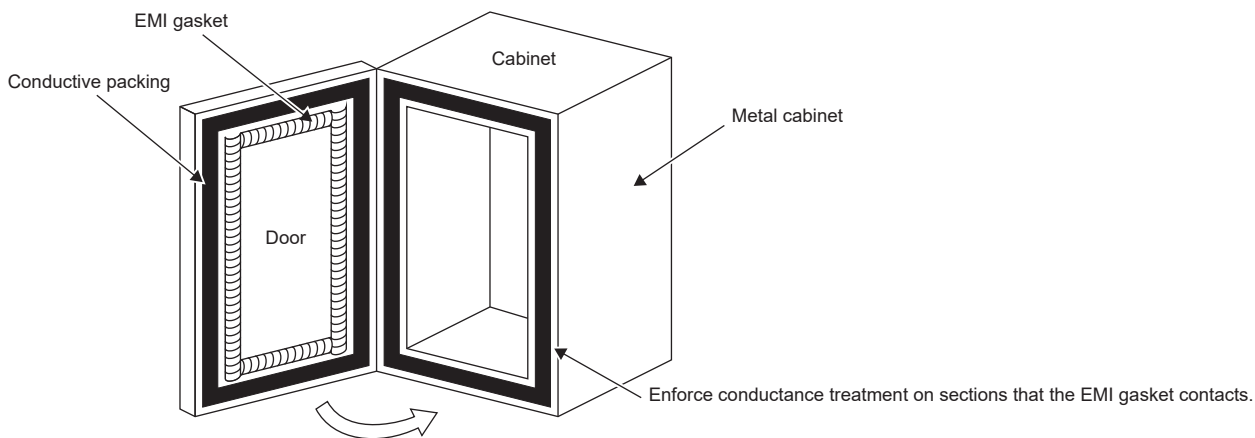
Precautions for cabinet design

1. Use a metal cabinet.
2. Securely ground the cabinet using as thick and short wire as possible.
3. Weld or screw the top and side plates of the cabinet together so that there are no gaps. The distance between the joints should be 10 cm or less. The diameter of the openings on the cabinet such as the ventilation hole should be 10 cm or less. If there are holes larger than this, plug them with metal plates or punched metal. In such a case, make sure that there are no metal or conductor with insufficient electrical connections, such as connection between painted surfaces.

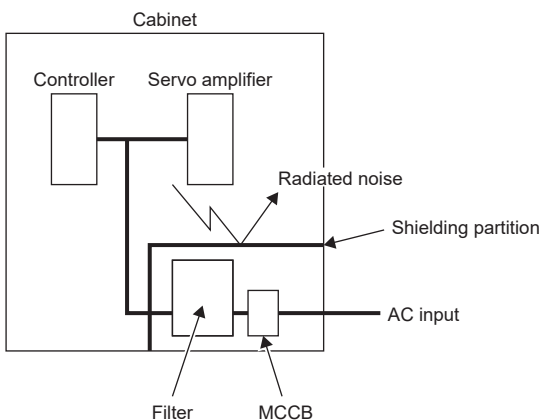


4. Securely ground the cabinet door to the cabinet. If the door is poorly grounded, the door itself becomes a large antenna and radiates noise. Therefore, take the following measures.

- Use a metal door.
- Connect the door and cabinet with thick braided wire at as many points as possible.
- Use an EMI gasket and conductive packing for the joint between the door and cabinet.



5. As a reliable noise countermeasure for input power cables, insulate the input power supply section with a metal shielding plate and install it without gaps to prevent the input power cable from being affected by radiated noise.



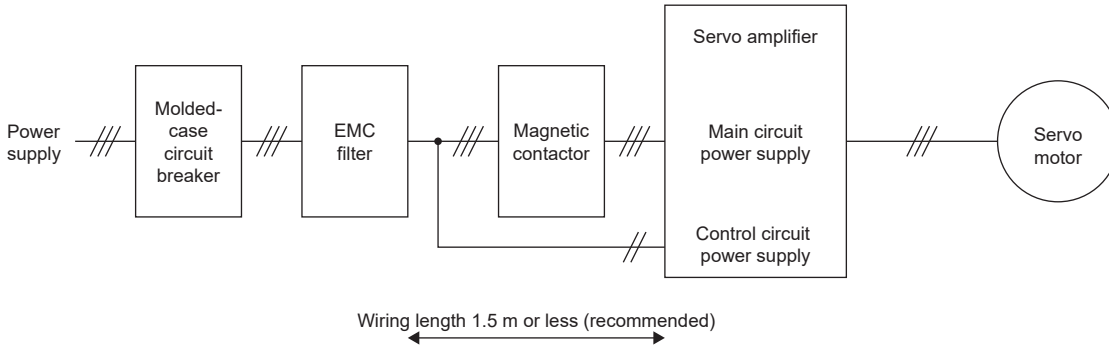
3.3 Filter wiring and installation

When connecting multiple servo amplifiers to one EMC filter, refer to the following.

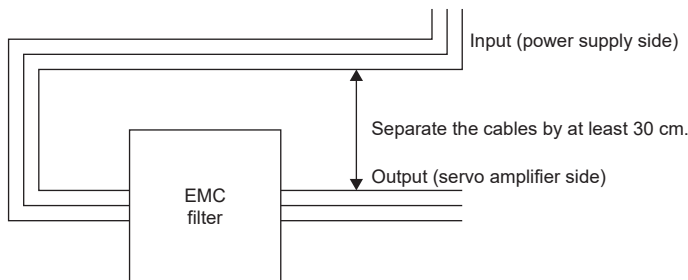
☞ Page 32 Connecting multiple servo amplifiers to one EMC filter

Wiring

Wire the servo and filter as shown below.



Separate the EMC filter input cable and output cable as far as possible. If they are too close, the noise generated from the output cable is induced into the input cable, and the filter is not effective. Separate the cables by at least 30 cm if possible.



Installation

Install the servo amplifier and EMC filter to the same cabinet. Install the filter on the right or left side of the servo amplifier as shown in the figure below.

For details of the EMC filter, refer to the following.

☞ Page 18 EMC filter (for servo amplifier power supply)

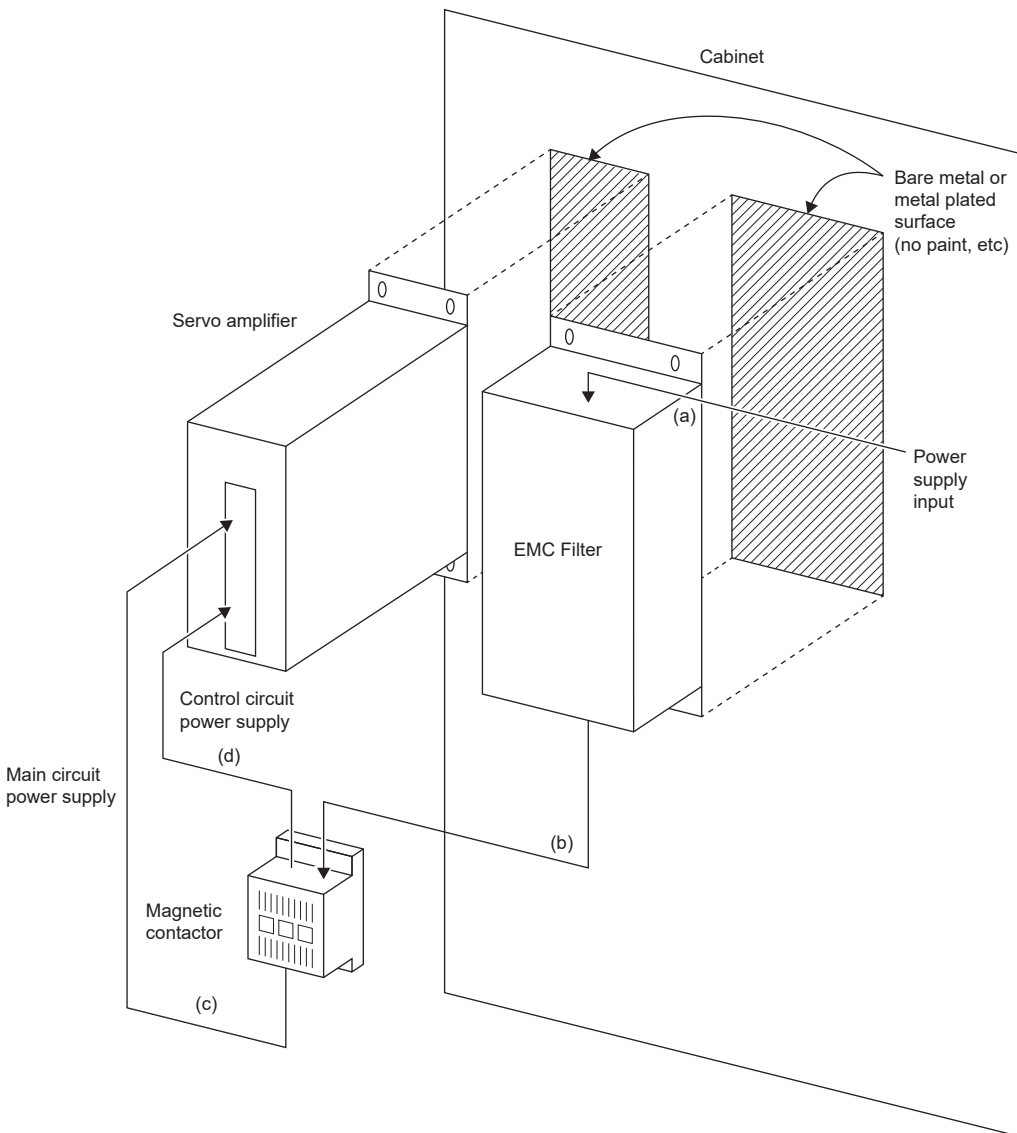
To ensure that the cabinet, filter, and servo amplifier have the same potential, remove or plate paint on the filter surface and securely ground it to the cabinet.

The same applies to the servo amplifier installation.

Separate the filter input cable (a) from the output cables (b), (c) and (d) as far as possible.

Shorten the wiring ((a), (b), and (c)) between the filter and servo amplifier as short as possible.

(The total of (b) and (c) is 1.5 m or less.)



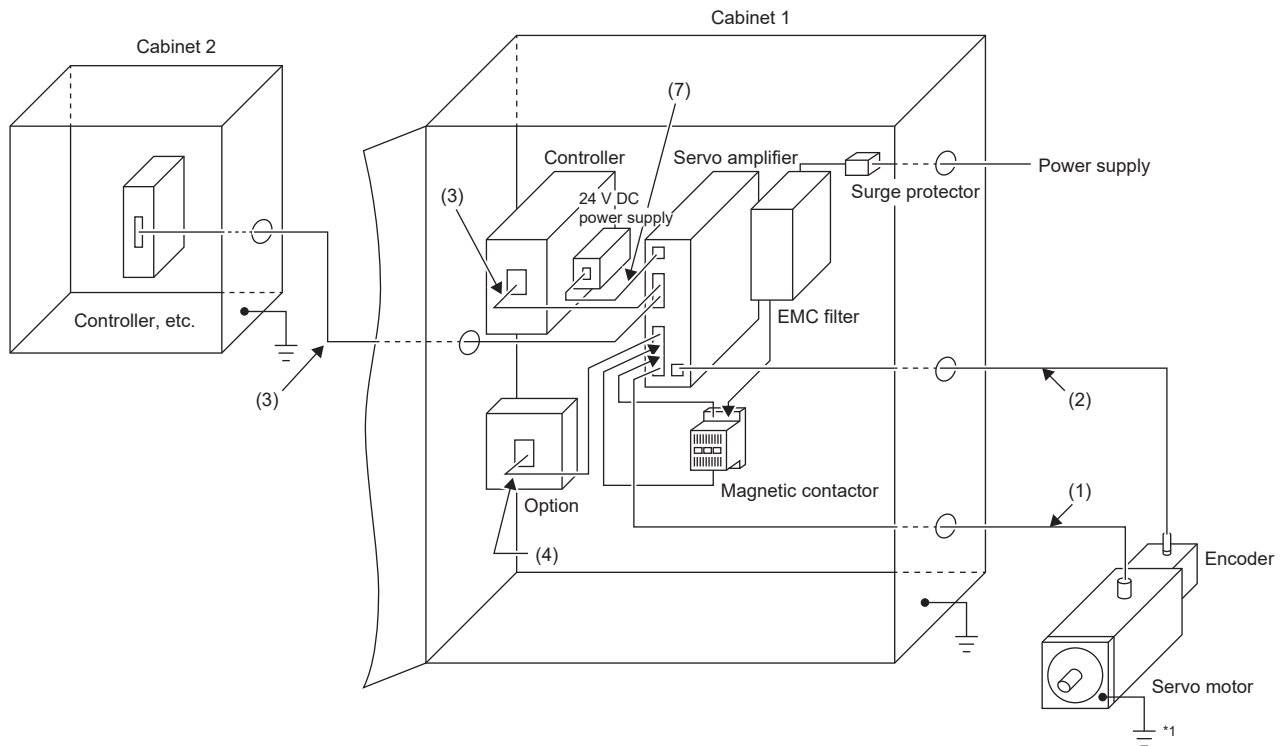
3.4 Cable layout

Securely ground the cabinets 1 and 2 and the servo motor.

Separate the main circuit power cable of the servo amplifier, power cable of the servo motor, and control circuit signal cable by 30 cm or more, and do not wire them in parallel or bundle them.

An installation example is shown in the figure below.

Each cabling method is described separately.

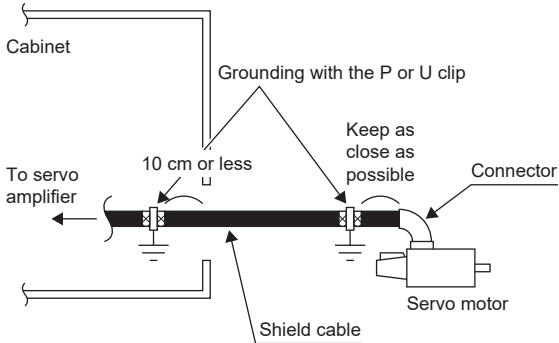


*1 For EMC countermeasures, ground the servo motor from the cabinet via the servo amplifier. The diagram shows the servo motor grounded from the flange for illustrative purposes.

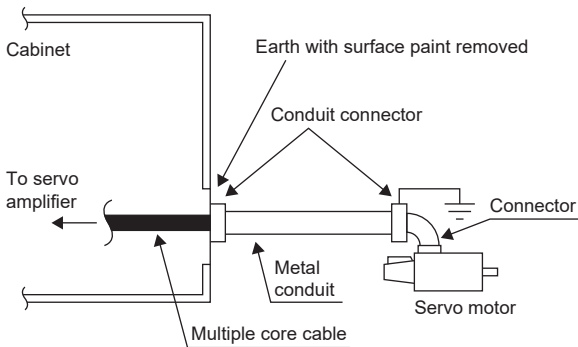
Servo motor power cable (1)

If stripping the cable outer sheath will affect the safety of the machine such as electric shock or injury, it is recommended to install additional protective covers or enclosures.

Shielded cable



Metal conduit



1. Use four shielded cables (3-phase + ground cable) to prevent disconnection outside the cabinet. Connect the grounding terminals of the servo amplifier and servo motor with the grounding cable.
2. Ground the shield on both the cabinet side and servo motor chassis side. For the reason why the shield should be grounded on both the cabinet side and servo motor chassis side, refer to the following.

☞ Page 28 Reason for grounding the shield on both the cabinet side and servo motor chassis side

The grounding position of the shield on the servo amplifier side should be within 10 cm from the cabinet. For the reason why the grounding position of the shield on the servo amplifier side should be within 10 cm from the cabinet, refer to the following.

☞ Page 30 Reason why the grounding position in the cabinet is specified to be 10 cm or less from the cabinet openings

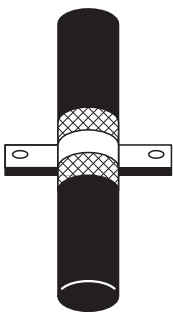
3. Ground the shield with a metal P clip or U clip. For the reasons why the P clip or U clip is specified for grounding, refer to the following.

☞ Page 31 Reason why grounding with P clips or U clips is required

- Example of grounding with P clip

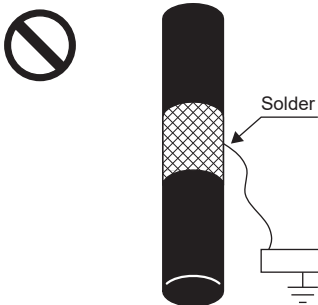


- Example of grounding with U clip



4. Directly ground the shield. It is not recommended to solder the wire to the braided wire (shield) for grounding.

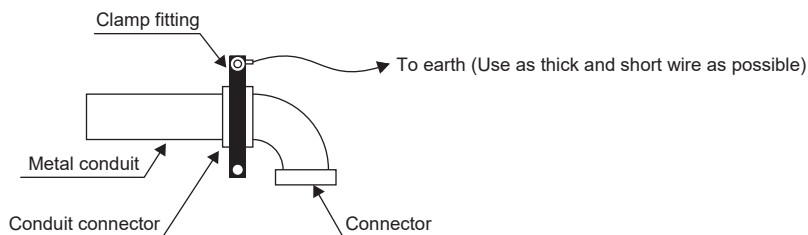
- Example of grounding with wire soldering



5. When not using a shielded cable for the servo motor power cable, route the cable through a metal conduit.

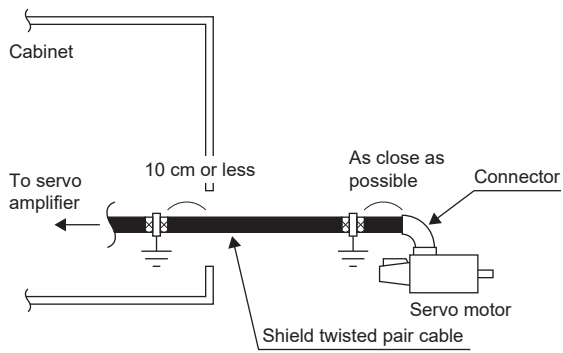
6. Ground the servo motor power cable on the cabinet side with the conduit connector and cabinet side wall. (Remove paint from the side wall of the cabinet.)

7. When grounding the servo motor power cable connected to the servo motor, use the cable clamp to ground the conduit connector as shown below.



8. The cable length should be 50 m or less.

Encoder cable (2)

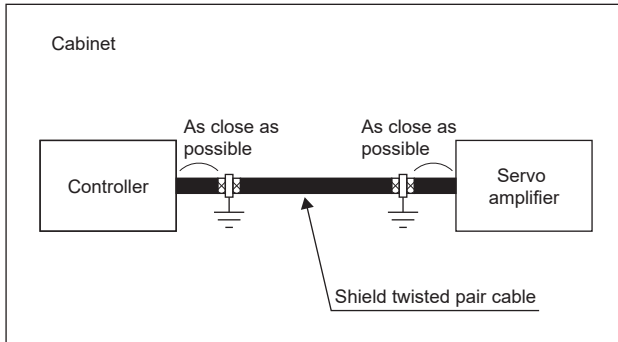


Use a shielded twisted pair cable for the encoder cable, and ground it on both sides of the servo amplifier and encoder with P clips or U clips. The cable length should be 50 m or less.

Controller connection (command) cable (except for SSCNET III cable) (3)

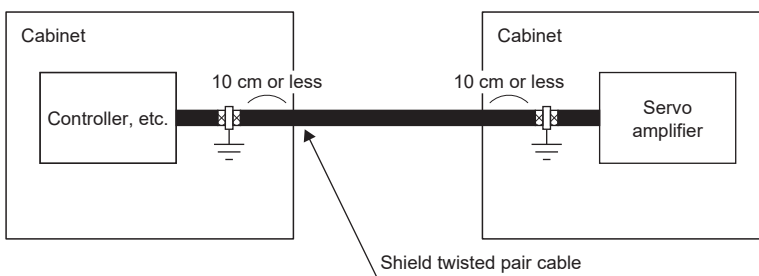
If controller and servo amplifier are in the same cabinet

Use a shielded twisted pair cable, and ground it on both sides of the controller and servo amplifier with P clips or U clips. When the cable length is 2 m or less, ground the cable on the controller side.



If controller or others is in the different cabinet from servo amplifier

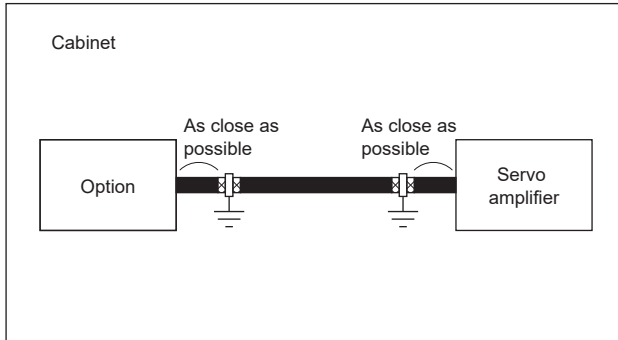
Use a shielded twisted pair cable, and ground it on both sides of the controller or others and servo amplifier with P clips or U clips.



Cables in the same cabinet (4)

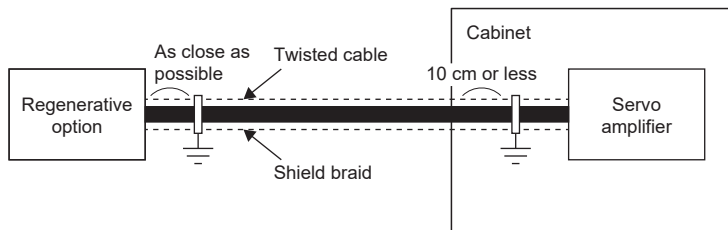
For the connection cables of the options such as the parameter unit or dynamic brake option, which is arranged in the same cabinet as the servo amplifier, use a shielded cable (shielded twisted pair cable for the parameter unit), and ground it on both sides of the option and servo amplifier with P clips or U clips.

When the cable length is 2 m or less, ground the cable on the servo amplifier side.



Regenerative option connection cable (5)

Use a shielded twisted pair cable or twisted cable covered with shield braid for the connection cable of the regenerative option, and ground the shield on the both sides of the option and servo amplifier with P clips or U clips. The following figure shows the treatment when the regenerative option is installed outside the cabinet.



Input power cable (6)

Use a multiple core cable. Using a shielded input power cable increases the effect of EMC countermeasures.

Control circuit power cable (for servo amplifier) (7)

Use a vinyl wire or multiple core cable.

4 EMC COUNTERMEASURE PARTS

For details of each part, contact the parts manufacturer.

4.1 Noise filter (for controller power supply)

For the noise filter installed to the controller, refer to the manual of the controller used.

4.2 EMC filter (for servo amplifier power supply)



MR-J3 series, MR-J3W series, and MR-J2-Super series are discontinued models.

- For the connection method of the EMC filter and servo amplifier, refer to the instruction manual and user's manual of each servo amplifier.
- When connecting multiple servo amplifiers to one EMC filter, refer to the following.
 Page 32 Connecting multiple servo amplifiers to one EMC filter
- Some EMC filters have a large leakage current.
- When selecting a molded-case circuit breaker, consider the increase in leakage current and select one that will not affect the servo amplifier, converter unit, and drive unit.

MR-J5 series/MR-J4 series/MR-JN series

For the combination of the EMC filter with the servo amplifiers, converter units, and drive units, refer to the instruction manual and user's manual of each product.

MR-J3 series/MR-J3W series/MR-J2-Super series

For the combination of the EMC filter with the servo amplifiers, converter units, and drive units, refer to the following.

Page 35 Combination with EMC filters

4.3 Ferrite core (Data line filter)

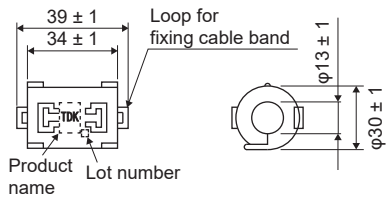
Noise can be prevented by installing a data line filter onto cables such as the encoder cable.

For example, ZCAT3035-1330 by TDK, ESD-SR-250 by TOKIN, GRFC-13 by Kitagawa Industries, and E04SRM563218 by SEIWA ELECTRIC are available as data line filters.

As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below. These impedances are reference values and not guaranteed values.

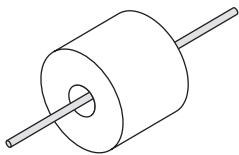
Impedance [Ω]	
10 MHz to 100 MHz	100 MHz to 500 MHz
80	150

[Unit: mm]

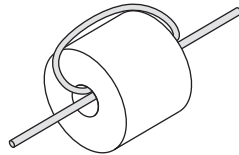


Dimensions (ZCAT3035-1330)

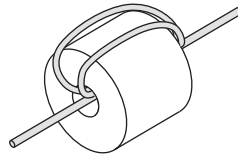
• Usage example



Passing through once



Passing through twice



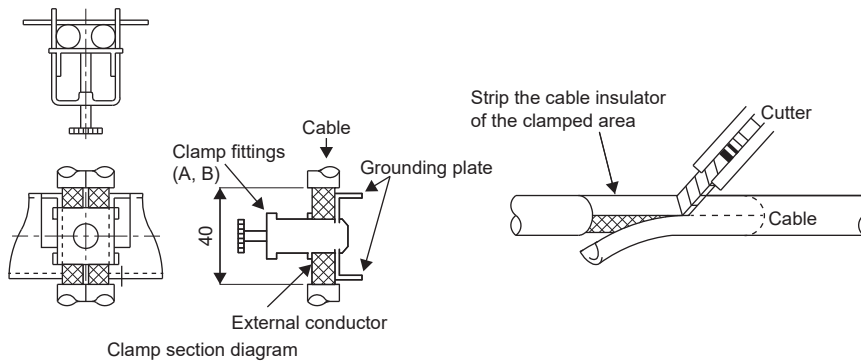
Passing through three times

4.4 Cable clamp fitting

Generally, connecting the grounding wire of the shielded wire to the SD terminal of the connector provides a sufficient effect. However, the effect can be increased when the shielded wire is connected directly to the ground plate as shown below. Install the ground plate near the servo amplifier for the encoder cable. Peel part of the cable insulator to expose the external conductor, and press that part against the ground plate with the cable clamp. If the cable are thin, bunch several cables together and clamp them in place.

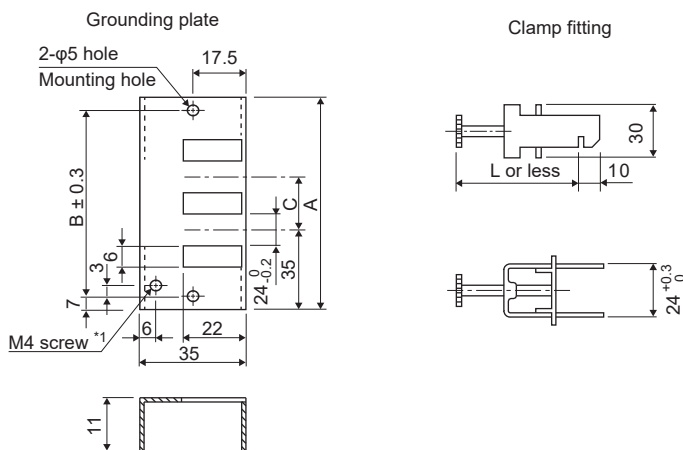
The cable clamp comes as a set with the grounding plate.

[Unit: mm]



• Dimensions

[Unit: mm]



*1 Screw hole for grounding. Connect it to the ground plate of the cabinet.

Model	A	B	C	Accessory fittings
AERSBAN-DSET	100	86	30	Clamp A: 2 pcs.
AERSBAN-ESET	70	56	—	Clamp B: 1 pc.
Clamp fitting		L		
A	70			
B	45			

Precautions

- The motor cable (single cable type) has no shield on the outermost circumference. Therefore, to ground the motor cable with a cable clamp, use a motor cable (dual cable type).

4.5 Line noise filter

This filter is effective in suppressing noise radiated from the power supply side and output side of the servo amplifier and also in suppressing high-frequency leakage current (0-phase current). It is especially effective for noise between 0.5 MHz and 5 MHz band.

Connection example

The line noise filters can be mounted on lines of the main circuit power supply (L1/L2/L3) and of the servo motor power supply (U/V/W). Pass each of the wires through the line noise filter the same number of times in the same direction.

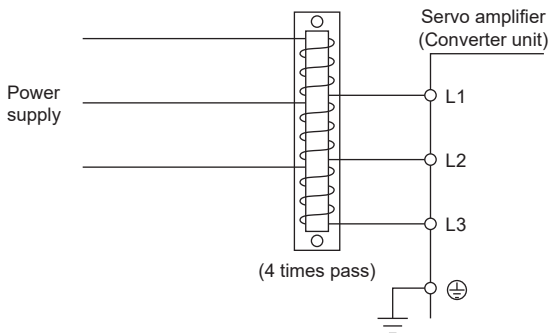
Wind the wires through the line noise filter to satisfy the required number of passes. If the wires are too thick to wind, use two or more line noise filters to have the required number of passes.

Use the following models of the line noise filter in accordance with the capacity of the servo amplifier, converter unit, and drive unit.

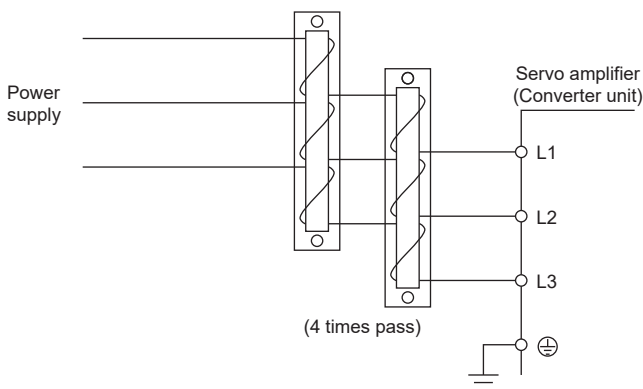
2 kW or less: FR-BSF01 (for the wire size of 3.5 mm² (AWG 12) or less)

3.5 kW or more: FR-BLF (for the wire size of 5.5 mm² (AWG 10) or less)

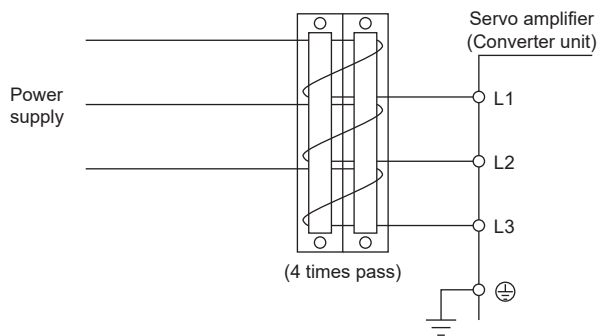
When using one line filter



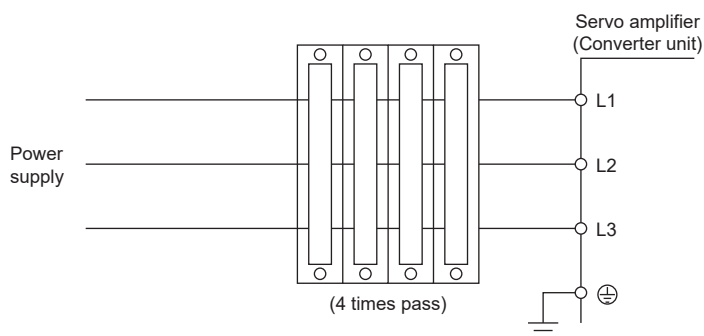
When using two line filters separately



When contacting and using two line filters



When contacting and using four line filters



Precautions

- For wires of the main circuit power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate.
- For the servo motor power supply lines, passes must be four times or less. Do not pass the grounding wire through the filter. Otherwise, the effect of the filter will drop.
- Place the line noise filters as close to the servo amplifier as possible for their best performance. Noise-reducing effect will be enhanced.
- In addition to the servo amplifier (converter unit) main circuit power supply side and servo amplifier power output side, the line noise filter can be used for the servo motor brake cable, encoder cable, control signal cable, and others. In this case, passes must be four times or less. However, consider the flex life and use the encoder cable in such a way that it does not affect the servo amplifier, converter unit, drive unit, and servo motor.

4.6 Surge protector

Point

MR-J3 series, MR-J3W series, and MR-J2-Super series are discontinued models.


To prevent damage due to surges (such as lightning and sparks) applied to the AC power supply lines, connect the surge protectors to the main circuit power supply (L1/L2/L3).

MR-J5 series

For details of the surge protector, refer to the user's manual of each product.

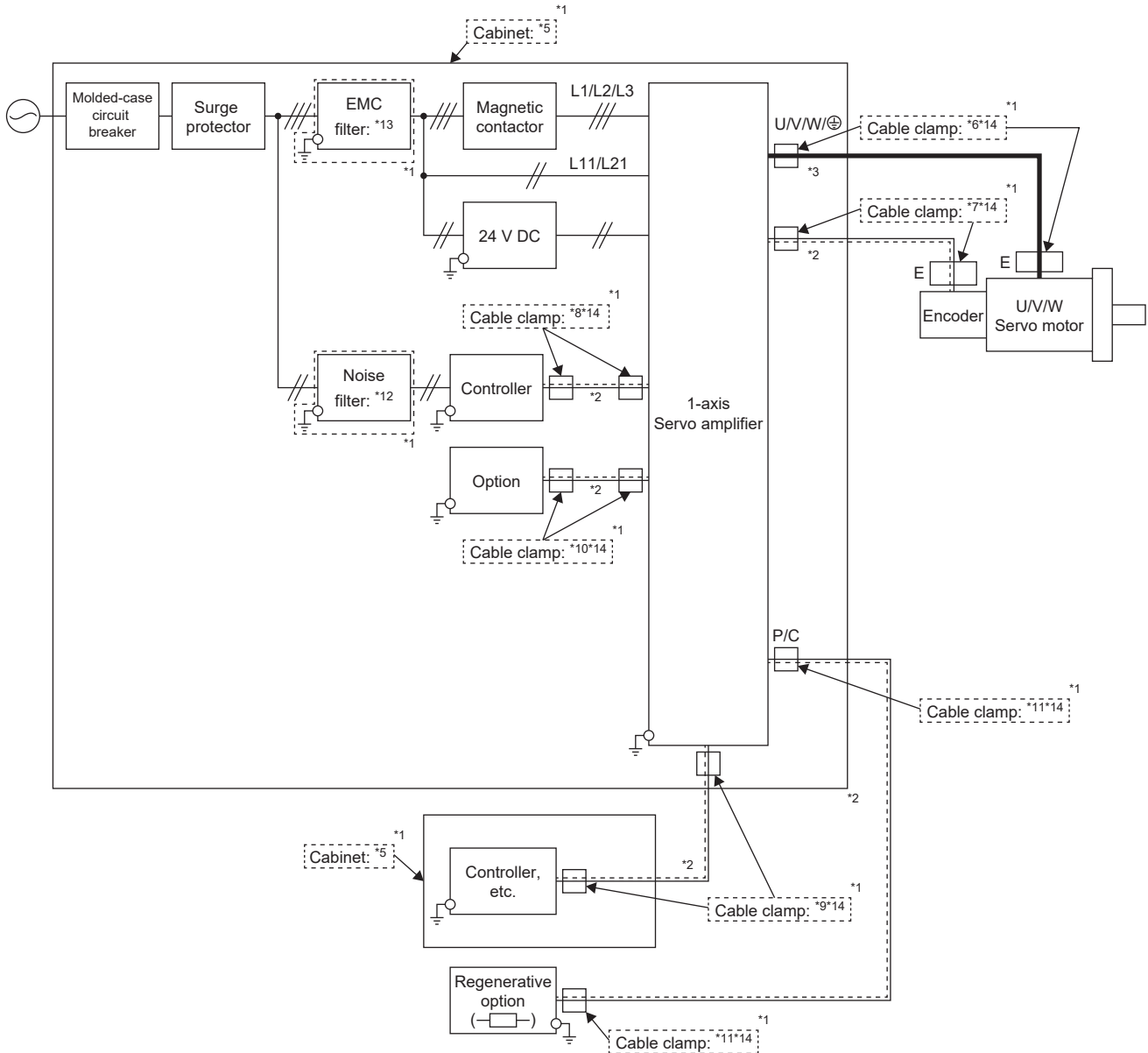
MR-J4 series/MR-JN series/MR-J3 series/MR-J3W series/MR-J2-Super series

For details of the surge protector, refer to the following.

 Page 37 Details of surge protector

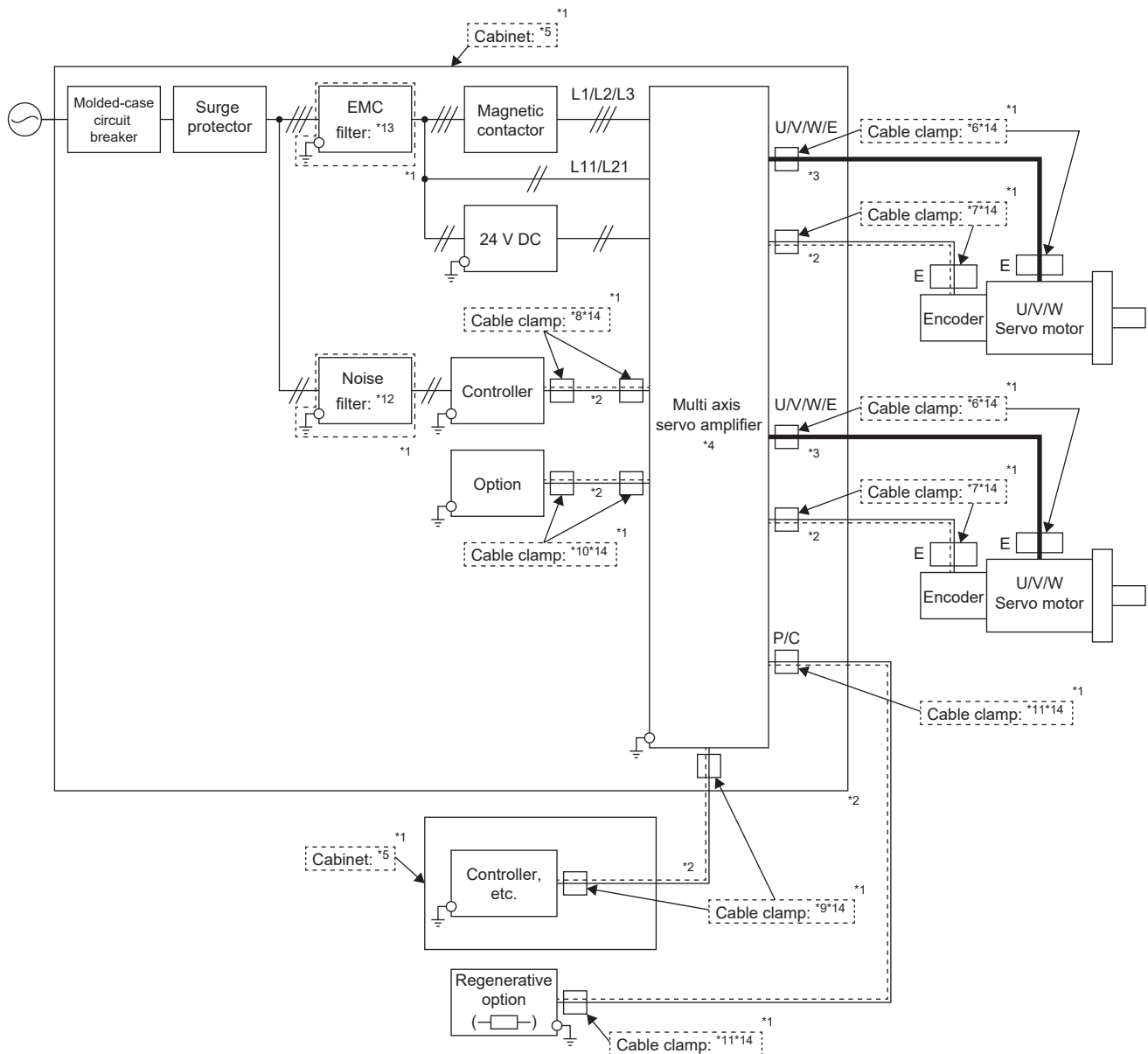
5 CONNECTION EXAMPLE FOR EMC COUNTERMEASURES

5.1 For 1-axis with 22 kW or less



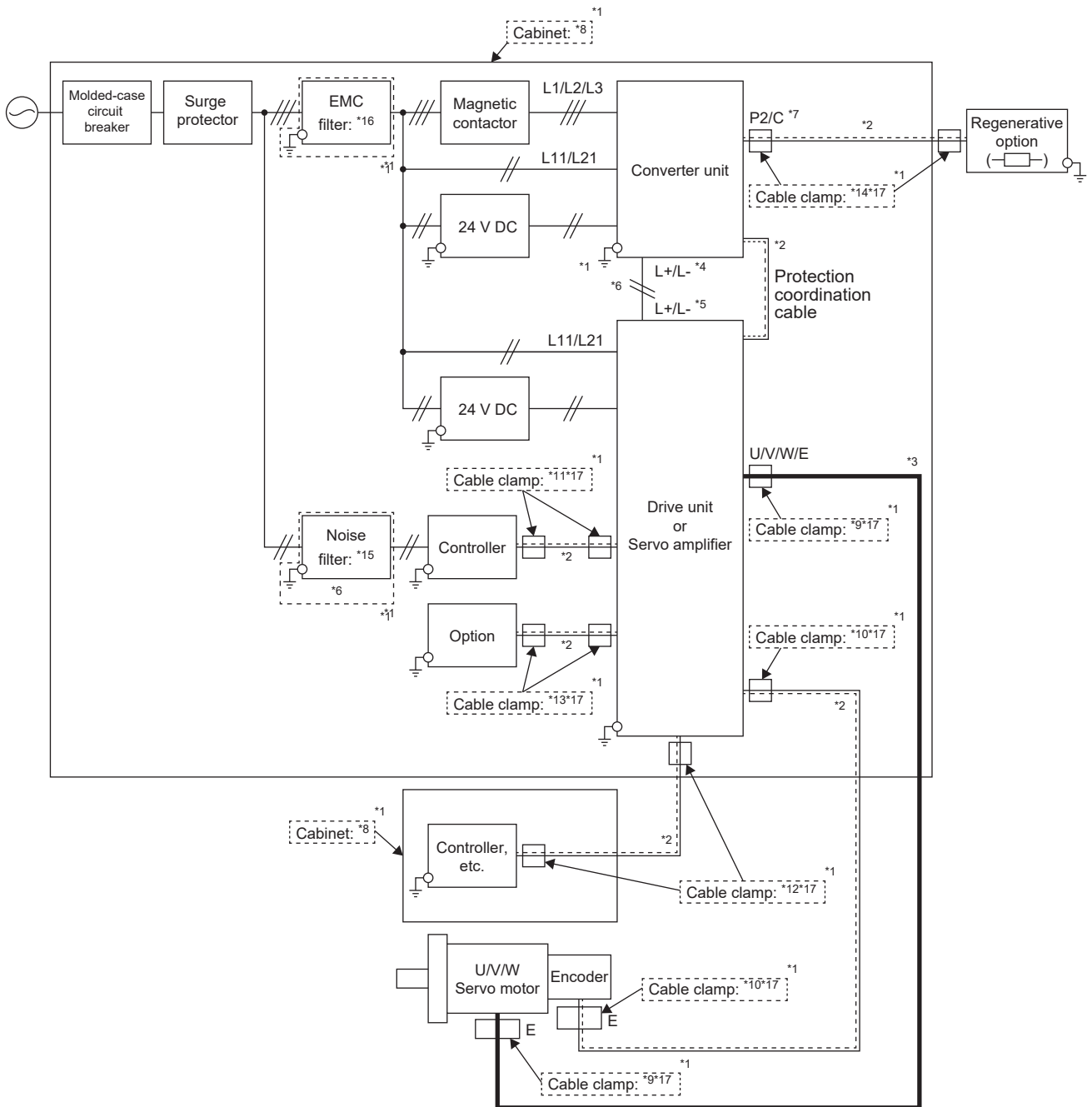
- *1 [] : Specific EMC countermeasure
- *2 - - - : Shielded cable
- *3 ——— : Shielded cable or metal conduit
- *4 When the control circuit power supply (L11/L21) of the servo amplifier is 24 V DC, connect AC/DC power supply.
- *5 Page 8 Cabinet design
- *6 Page 13 Servo motor power cable (1)
- *7 Page 15 Encoder cable (2)
- *8 Page 16 If controller and servo amplifier are in the same cabinet
- *9 Page 16 If controller or others is in the different cabinet from servo amplifier
- *10 Page 17 Cables in the same cabinet (4)
- *11 Page 17 Regenerative option connection cable (5)
- *12 Page 18 Noise filter (for controller power supply)
- *13 Page 18 EMC filter (for servo amplifier power supply)
- *14 Page 20 Cable clamp fitting

5.2 For multiple-axis with 1 kW or less



- *1 [---] : Specific EMC countermeasure
- *2 - - - - : Shielded cable
- *3 ——— : Shielded cable or metal conduit
- *4 The figure is for 2-axis servo amplifiers.
- *5 Page 8 Cabinet design
- *6 Page 13 Servo motor power cable (1)
- *7 Page 15 Encoder cable (2)
- *8 Page 16 If controller and servo amplifier are in the same cabinet
- *9 Page 16 If controller or others is in the different cabinet from servo amplifier
- *10 Page 17 Cables in the same cabinet (4)
- *11 Page 17 Regenerative option connection cable (5)
- *12 Page 18 Noise filter (for controller power supply)
- *13 Page 18 EMC filter (for servo amplifier power supply)
- *14 Page 20 Cable clamp fitting

5.3 For 30 kW or more



- *1 [] : Specific EMC countermeasure
- *2 [] : Shielded cable
- *3 [] : Shielded cable or metal conduit
- *4 The abbreviations of the terminals are P and N for MR-HP30KA or MR-HP55KA4.
- *5 The abbreviations of the terminals are P and N for MR-J2S-(4).
- *6 Connect the converter unit and drive unit with the provided bus bar.
- *7 The abbreviation of the terminal is P for MR-HP30KA or MR-HP55KA4.
- *8 Page 8 Cabinet design
- *9 Page 13 Servo motor power cable (1)
- *10 Page 15 Encoder cable (2)
- *11 Page 16 If controller and servo amplifier are in the same cabinet
- *12 Page 16 If controller or others is in the different cabinet from servo amplifier
- *13 Page 17 Cables in the same cabinet (4)
- *14 Page 17 Regenerative option connection cable (5)
- *15 Page 18 Noise filter (for controller power supply)
- *16 Page 18 EMC filter (for servo amplifier power supply)
- *17 Page 20 Cable clamp fitting

6 EMC COUNTERMEASURES AND EFFECTS

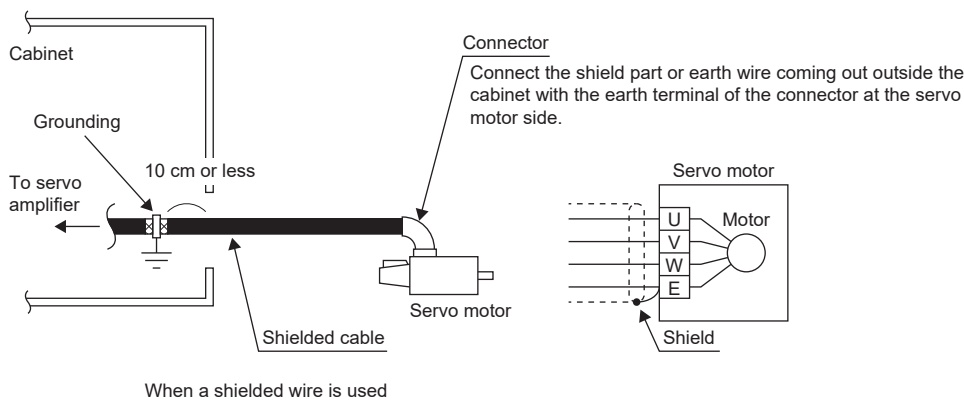
6.1 Reason for grounding the shield on both the cabinet side and servo motor chassis side

For the countermeasure against radiated emissions in inverters and servo amplifiers, multiple point grounding, in which both ends of the servo motor power cable and encoder cable are grounded, tends to suppress unwanted noise.

Grounding the shielded cable only on the servo amplifier side

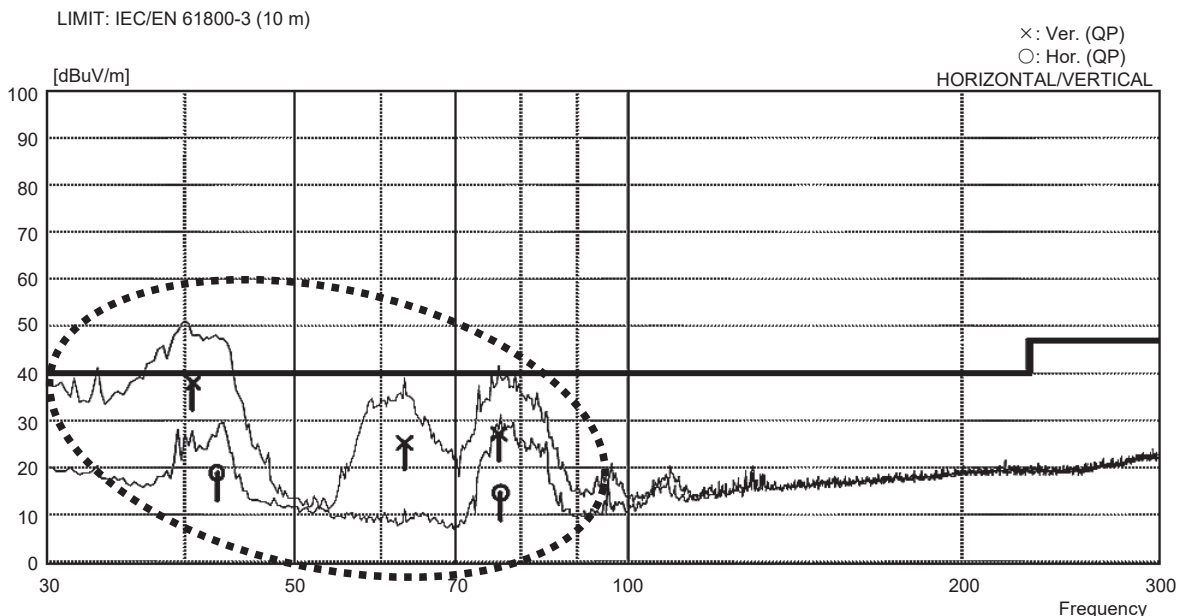
The following figure shows only the wiring of the servo motor power cable. Wire the shielded wire of the encoder cable in the same way as the power cable.

- Example of wiring when the shielded cable is grounded only on the servo amplifier side



- Radiated emissions when the shielded cable is grounded only on the servo amplifier side

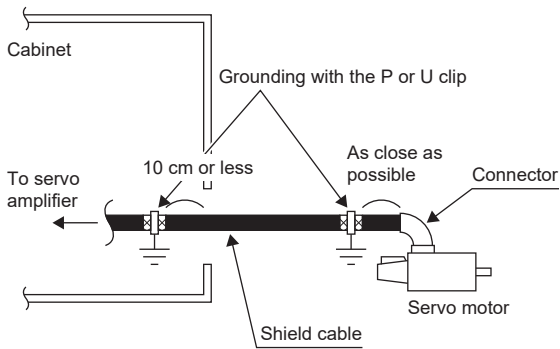
The following figure is an example of a measurement result, and does not guarantee the measurement result.



Grounding both ends of the shielded cable

The following figure shows only the wiring of the servo motor power cable. Wire the shielded wire of the encoder cable in the same way as the power cable.

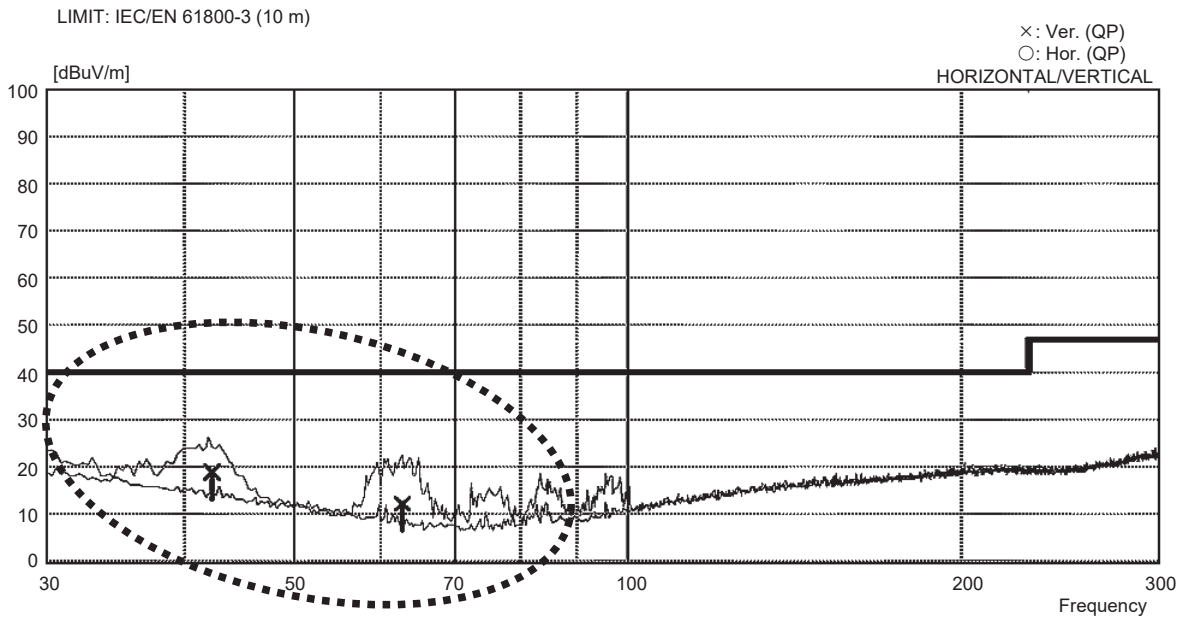
- Example of wiring when both ends of the shielded cable are grounded



When a shielded wire is used

- Radiated emissions when both ends of the shielded cable are grounded

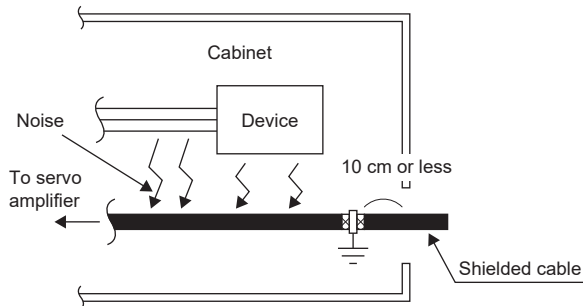
The following figure is an example of a measurement result, and does not guarantee the measurement result.



6.2 Reason why the grounding position in the cabinet is specified to be 10 cm or less from the cabinet openings

Various devices are installed inside the cabinet and these devices radiate or propagate unwanted noise to some extent. Depending on the cable routing method, it may not be possible to suppress the unwanted noise generated in the cabinet. By grounding the cable just before the exit of the cabinet, the noise flowing out of the cabinet can be suppressed even if unwanted noise is superimposed on the cable. Therefore, it is recommended to ground the cable within 10 cm from the exit of the cabinet.

- Grounding within 10 cm from the exit of the cabinet



6.3 Reason why grounding with P clips or U clips is required

Point

If stripping the cable outer sheath will affect the safety of the machine such as electric shock or injury, it is recommended to install additional protective covers or enclosures.

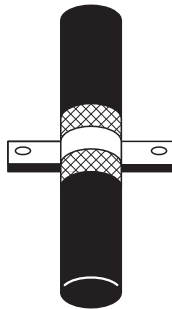
A shielded cable is a cable covered with metal foil or braid (mesh braid). High-frequency noise passes through the shield and releases unwanted noise to the ground, thereby suppressing the radiated emission level.

Grounding a shielded cable using a P clip or U clip reduces the impedance to the ground and allows noise current to flow more smoothly than soldering a wire to the shield or twisting and stretching the shield to ground. Thus, grounding with the P clips or U clips is recommended.

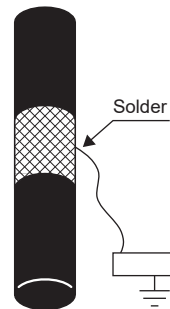
- Grounding example of shielded cable



Example of grounding with the P clip



Example of grounding with the U clip

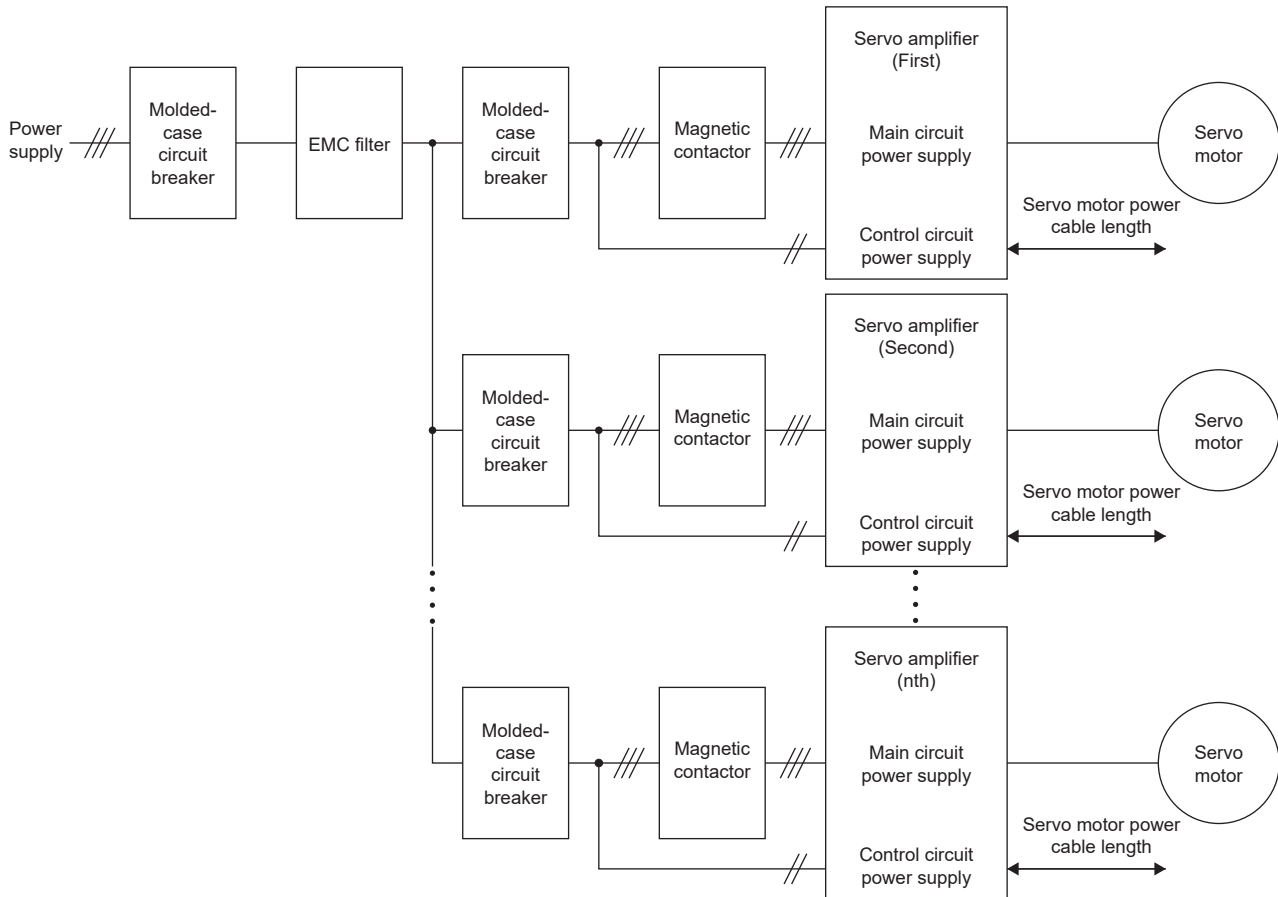


Example of grounding with wire soldering

6.4 Connecting multiple servo amplifiers to one EMC filter

Confirm the EMC standard compliance of the entire machine or equipment on customer side.

Selection method



When multiple servo amplifiers are connected to one EMC filter, if the total length of servo motor power cable is long, the magnetic material used in the EMC filter may cause magnetic saturation and the expected noise attenuation properties may not be obtained.

To obtain the expected noise attenuation properties for any servo amplifier, use an EMC filter that satisfies the following table and calculation formula.

Selection table of EMC filter by total length of servo motor power cable

■200 V class

Application environment	Total length of servo motor power cable	EMC filter					
		Model	Rated current [A]	Rated voltage [VAC]	Operating temperature [°C]	Mass [kg]	Manufacturer
IEC/EN 61800-3 Category C2, C3 *1	50 m or less	FSB-10-254-HU	10	250	-40 to 85	1.8	COSEL Co., Ltd.
		FSB-20-254-HU	20				
		FSB-30-254-HU	30				
		FSB-40-324-HU	40	250		3.3	
IEC/EN 61800-3 Category C3 *1	50 m or less	HF3010C-SZB	10	500	-20 to 50	0.9	Soshin Electric Co., Ltd.
		HF3020C-SZB	20			1.3	
		HF3030C-SZB	30			2.0	
		HF3040C-SZB	40			2.0	
	100 m or less	HF3030C-SZL	30	500	-20 to 50	1.3	Soshin Electric Co., Ltd.
	200 m or less	HF3060C-SZL	60			2.1	
	250 m or less	HF3100C-SZL	100			5.8	
	250 m or less	HF3150C-SZL	150			9.0	

*1 Category C2: First environment (residential, commercial, light industrial, and industrial environments)

Category C3: Second environment (commercial, light industrial, and industrial environments)

■400 V class

Application environment	Total length of servo motor power cable	EMC filter					
		Model	Rated current [A]	Rated voltage [VAC]	Operating temperature [°C]	Mass [kg]	Manufacturer
IEC/EN 61800-3 Category C2, C3 *1	50 m or less	FSB-10-355	10	500	-40 to 85	1.8	COSEL Co., Ltd.
		FSB-20-355	20				

*1 Category C2: First environment (residential, commercial, light industrial, and industrial environments)

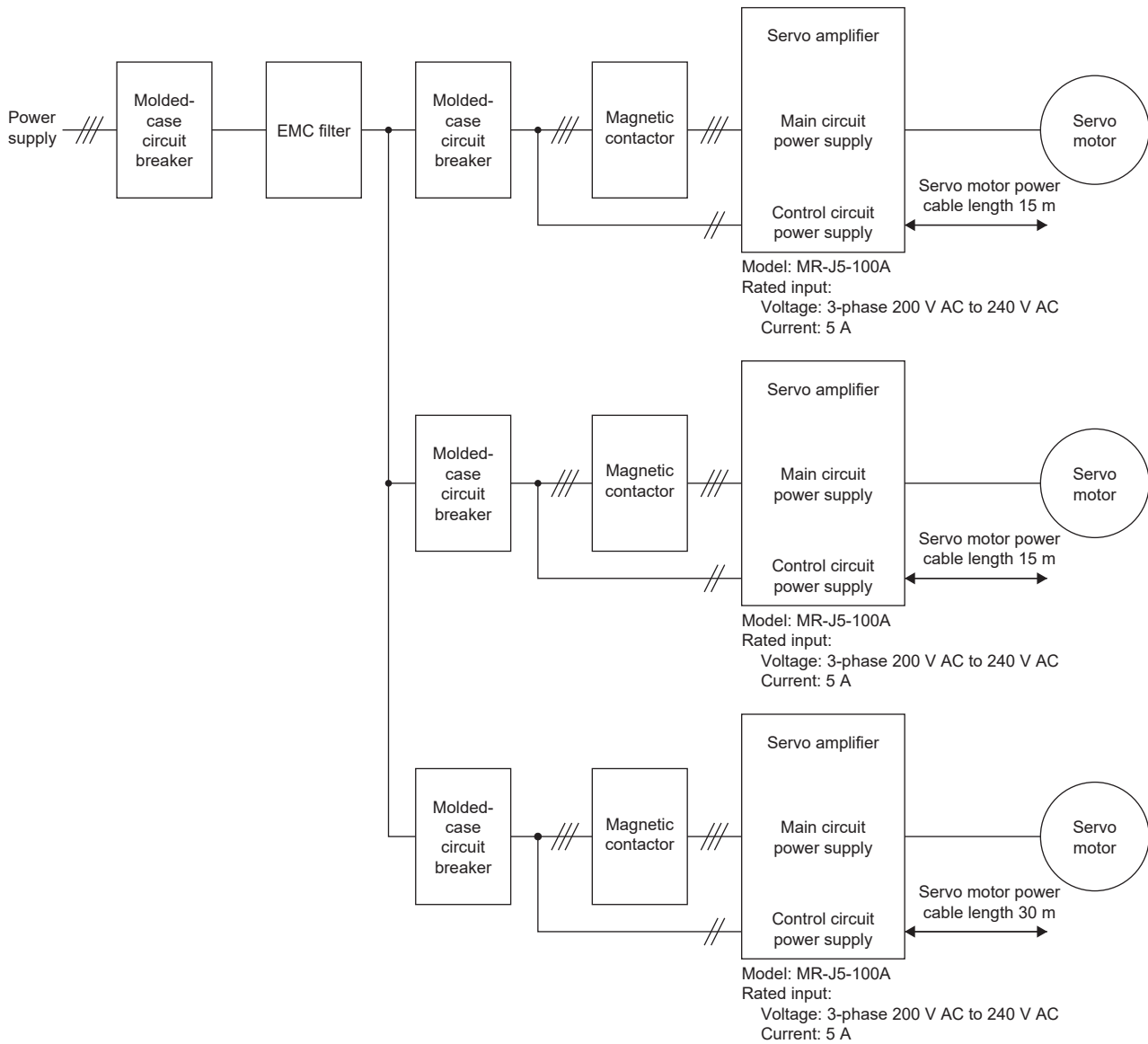
Category C3: Second environment (commercial, light industrial, and industrial environments)

Calculation formula

- Rated voltage of the EMC filter [V] \geq Rated voltage of the servo amplifiers [V]
- Rated current of the EMC filter [A] \geq Rated current of each servo amplifier [A]
- Total length of servo motor power supply cable [m] acceptable for the EMC filter \geq Total length of servo motor power supply cable [m]

Selection example

The following figure shows the connection example when three MR-J5-100A are connected with one EMC filter.



Apply each data to the following calculation formula.

☞ Page 33 Calculation formula

The calculation results are as follows.

Rated input voltage of EMC filter: 500 V ≥ Rated input voltage of servo amplifier: 3-phase 200 V AC to 240 V AC

Rated input current of EMC filter: 30 [A] ≥ Total rated input current of servo amplifier: 15 [A]

Total length of servo motor power cable [m] acceptable for the EMC filter 100 [m] ≥ Total length of servo motor power cable 60 [m]

Apply the calculation result to the following table.

☞ Page 33 Selection table of EMC filter by total length of servo motor power cable

The table shows that the available EMC filter is "HF3030C-SZL".

7 APPENDIX

7.1 Combination with EMC filters



MR-J3 series, MR-J3W series, and MR-J2-Super series are discontinued models.

Combination with servo amplifiers of 22 kW or less

MR-J3 series/MR-J3W series

Servo amplifier	Recommended filter (Soshin Electric)				Mass [kg]
	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-J3-10_ to MR-J3-100_ MR-J3-10_1 to MR-J3-40_1	HF3010A-UN *1	10	250	5	3.5
MR-J3-200_/MR-J3-350_	HF3030A-UN *1	30			5.5
MR-J3-500_/MR-J3-700_	HF3040A-UN *1	40		6	
MR-J3-11K_ to MR-J3-22K_	HF3100A-UN *1	100		12	
MR-J3-60_4/MR-J3-100_4	TF3005C-TX	5	500	5.5	6
MR-J3-200_4 to MR-J3-700_4	TF3020C-TX	20			7.5
MR-J3-11K_4	TF3030C-TX	30			12.5
MR-J3-15K_4	TF3040C-TX	40			
MR-J3-22K_4	TF3060C-TX	60			
MR-J3W-22B/MR-J3W-44B	HF3010A-UN *1	10	250	5	3.5
MR-J3W-77B/MR-J3W-1010B	HF3030A-UN *1	30			5.5

*1 To use this EMC filter, a surge protector is required.

Page 37 Details of surge protector

MR-J2-Super series

Servo amplifier	Recommended filter (DEM Manufacturing)				Mass [kg]
	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-J2S-10_ to MR-J2S-100_ MR-J2S-10_1 to MR-J2S-40_1	SF1252	10.5	250	38	0.75
MR-J2S-200_/MR-J2S-350_	SF1253	27.5		57	1.37

Servo amplifier	Recommended filter (Soshin Electric)				Mass [kg]
	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-J2S-500_	HF3040A-TM *1	40	250	1.5	5.5
MR-J2S-700_	HF3050A-TM *1	50			6.7
MR-J2S-11K_	HF3060A-TMA *1	60		3.0	10.0
MR-J2S-15K_	HF3080A-TMA *1	80		13.0	
MR-J2S-22K_	HF3100A-TMA *1	100		14.5	
MR-J2S-60_4 to MR-J2S-200_4	TF3005C-TX	5	500	5.5	6
MR-J2S-350_4 to MR-J2S-700_4	TF3020C-TX	20			7.5
MR-J2S-11K_4	TF3030C-TX	30			12.5
MR-J2S-15K_4	TF3040C-TX	40			
MR-J2S-22K_4	TF3060C-TX	60			

*1 To use this EMC filter, a surge protector is required.


Page 37 Details of surge protector

Combination with converter units and drive units of 30 kW or more

MR-J3 series

Converter unit	Drive unit	Recommended filter (Soshin Electric)				Mass [kg]
		Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-J3-CR55K	MR-J3-DU30K_/MR-J3-DU37K_	HF3200A-UN *1	200	250	9	18
MR-J3-CR55K4	MR-J3-DU30K_4 to MR-J3-DU55K_4	TF3150C-TX	150	500	5.5	31


*1 To use this EMC filter, a surge protector is required.

 Page 37 Details of surge protector

MR-J2-Super series

Converter unit	Servo amplifier	Recommended filter (Soshin Electric)				Mass [kg]
		Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-HP30KA	MR-J2S-30K_/MR-J2S-37K_	HF3200A-TMA *1	200	250	3	23.5
MR-HP55KA4	MR-J2S-30K_4 to MR-J2S-45K_4	TF3150C-TX	150	500	5.5	31
	MR-J2S-55K_4					

*1 To use this EMC filter, a surge protector is required.

 Page 37 Details of surge protector

7.2 Details of surge protector

Point

- MR-J3 series, MR-J3W series, and MR-J2-Super series are discontinued models.
- To use an EMC filter on the 200 V class servo amplifier, a surge protector is required.
- To use an EMC filter manufactured by COSEL on the 400 V class servo amplifier, a surge protector is required.

MR-J4 series

Surge protector model	Maximum continuous operating voltage 50/60 Hz	DC operating start voltage	Voltage protection level	Nominal discharge current 8/20 μ s	Maximum discharge current 8/20 μ s	Impulse current life 8/20 μ s-1000 A	Manufacturer
RSPD-250-U4	3 AC 250 V	700 V \pm 25 %	1300 V	2500 A	5000 A	About 300 times	Okaya Electric
RSPD-500-U4	3 AC 500 V	1300 V \pm 25 %	2000 V	2500 A	5000 A	About 300 times	Okaya Electric
LT-CS32G801WS	3 AC 275 V	660 V \pm 10 %	1400 V	5000 A	8000 A	About 1000 times	Soshin Electric

MR-JN series/MR-J3 series/MR-J3W series/MR-J2-Super series

Surge protector model	Circuit voltage 50/60 Hz	Maximum permissible circuit voltage	Camp voltage	Surge current withstand 8/20 μ s	Surge voltage withstand 1.2/50 μ s	Capacitance
RAV-781BYZ-2	3 AC 250 V	300 V	783 V \pm 10 %	2500 A	20 kV	75 pF
RAV-781BXZ-4	3 AC 250 V	300 V	1700 V \pm 10 %	2500 A	2 kV	75 pF

REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
April 1996	IB(NA)-67310-*	First edition
November 1997	IB(NA)-67310-A	<ul style="list-style-type: none"> ■Chapter 2 Table revisions ■Chapter 5 Addition ■Chapter 6 Addition
November 2008	IB(NA)-67310-B	All pages change
July 2009	IB(NA)-67310-C	<ul style="list-style-type: none"> ■Chapter 2 Change of table ■Section 4.2 Part added ■Section 4.2 (2) (b) Part changed ■Section 5.1 Note 4 and 5 added
January 2012	IB(NA)-67310-D	<ul style="list-style-type: none"> ■Chapter 1 All pages change ■Chapter 3 CAUTION added ■Section 3.1 Part changed ■Section 3.2 Part changed ■Section 3.3 Part changed ■Section 3.4 Part changed ■Section 4.1 Part changed ■Section 4.2 Part added, part changed ■Section 4.3 Part changed ■Section 4.6 Added ■Section 5.1 Title changed "For 22kW or less" → "For 22kW or less of 1-axis" Part change of diagram ■Section 5.2 Added as "For 1kW or less of multi axis" Changes to section 5.3 to section 5.2 of the C version Part change of diagram ■Section 5.3
February 2013	IB(NA)-67310-E	<ul style="list-style-type: none"> ■Section 4.2 POINT is added ■Section 4.2 (1) (a) Part added ■Section 4.2 (1) (f) Deleted ■Section 4.2 (2) (c) Deleted ■Section 4.6 POINT is added
March 2014	IB(NA)-67310-F	<ul style="list-style-type: none"> 100V class MR-J4 series servo amplifiers are added. ■Section 4.2 (1) (a) MR-J4-10_1 to MR-J4-40_1 are added. ■Section 4.3 E04SRM563218 is added.

Revision date	*Manual number	Description
October 2014	IB(NA)-67310-G	MR-J4-DU_ is added. ■Section 4.2 (2) (a) MR-J4-DU30K_ to MR-J4-DU55K_ are added. ■Section 5.3 MR-CR55K_ and MR-J4-DU_ are added.
December 2015	IB(NA)-67310-H	Chapter 6 is added. ■Section 3.1 POINT is added. Partially changed. ■Section 3.3 POINT is added. Partially changed. ■Section 3.3 (1) Partially added. ■Section 3.4 (1) POINT is added. Partially changed. ■Section 3.4 (3) Partially added. ■Section 4.2 POINT is added. Partially changed. ■Section 4.6 POINT is added. Partially changed. ■Chapter 6 Newly added.
July 2019	IB(NA)-67310ENG-J	■Section 4.2 (1) (a) Part added ■Section 4.2 (3) Added ■Section 4.6 (a) Part added ■Item 6.4.1 Part changed
July 2020	IB(NA)-67310ENG-K	■Section 4.2 (1) (a) Part added
March 2021	IB(NA)-67310ENG-L	All pages change
November 2021	IB(NA)-67310ENG-M	■Section 3.4 Partially added. ■Section 4.6 Partially added.

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IB(NA)-67310ENG-M(2111)MEE

MODEL: EMC INSTRUCTION GUIDELINES

MODEL CODE: 1CW950

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