MITSUBISHI ELECTRIC

AC Servo System

MITSUBISHI ELECTRIC SERVO SYSTEM
MELSERVO-JET

MR-JET Partner's Encoder User's Manual

-MR-JET-_G_
-MR-JET-_G_-_N1

SAFETY INSTRUCTIONS

Please read the instructions carefully before using the equipment.
To use the equipment correctly, do not attempt to install, operate, maintain, or inspect the equipment until you have read through this manual, installation guide, and appended documents carefully. Do not use the equipment until you have a full knowledge of the equipment, safety information and instructions.
In this manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠ **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.

Note that the CAUTION level may lead to a serious consequence depending on conditions.
Please follow the instructions of both levels because they are important to personnel safety.
Forbidden actions and required actions are indicated by the following diagrammatic symbols.

	Indicates a forbidden action. For example, "No Fire" is indicated by .
	Indicates a required action. For example, grounding is indicated by .

In this manual, precautions for hazards that can lead to property damage, instructions for other functions, and other information are shown separately in the "Point" area.
After reading this manual, keep it accessible to the operator.

[Installation/wiring]

⚠WARNING

- To prevent an electric shock, turn off the power and wait for 15 minutes or more before starting wiring and/or inspection.
- To prevent an electric shock, ground the servo amplifier.
- To prevent an electric shock, any person who is involved in wiring should be fully competent to do the work.
- To prevent an electric shock, mount the servo amplifier before wiring.
- To prevent an electric shock, connect the protective earth (PE) terminal of the servo amplifier to the protective earth (PE) of the cabinet, then connect the grounding lead wire to the ground.
- To prevent an electric shock, do not touch the conductive parts.

[Setting/adjustment]

⚠WARNING

- To prevent an electric shock, do not operate the switches with wet hands.

[Operation]

⚠WARNING

- To prevent an electric shock, do not operate the switches with wet hands.

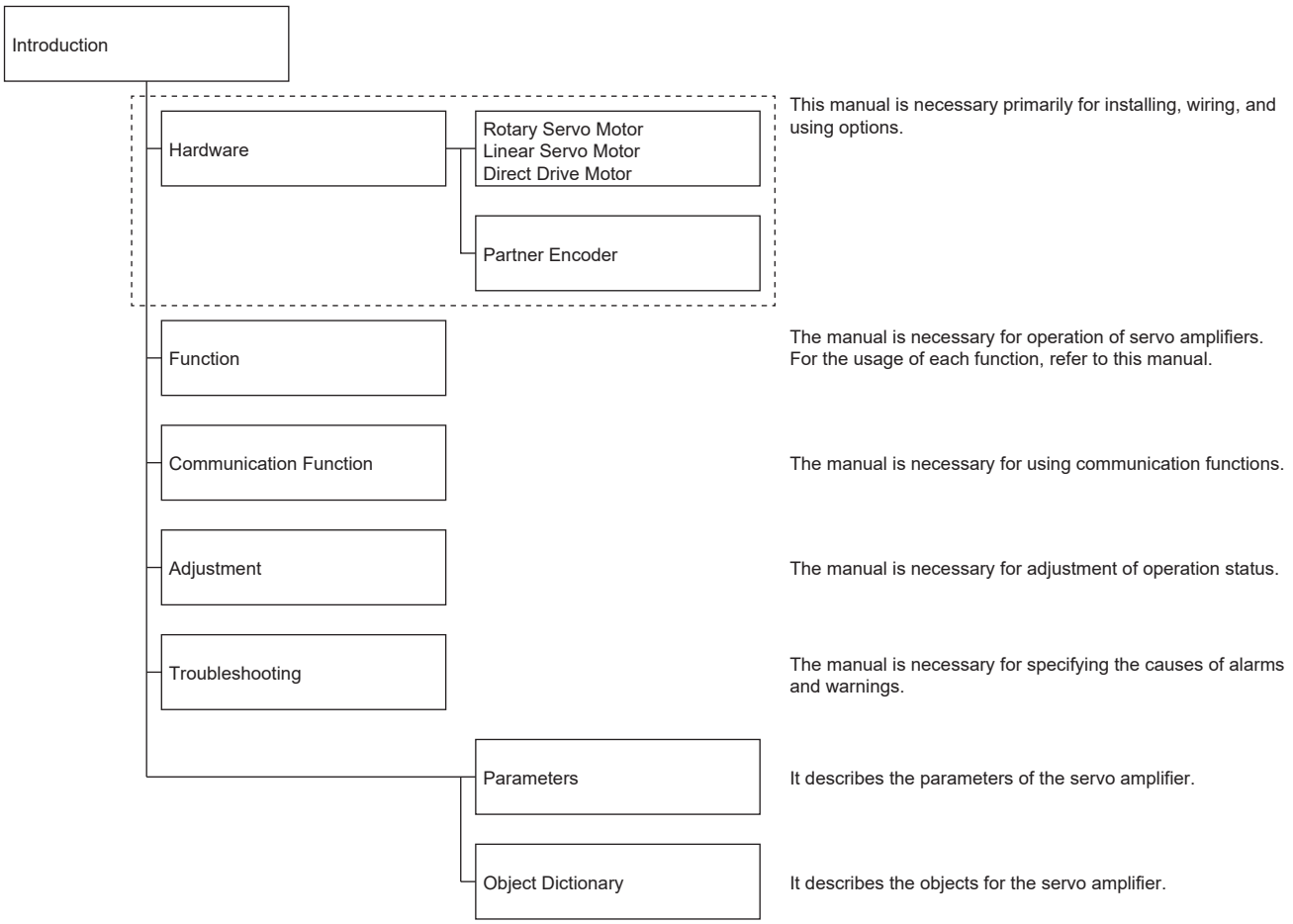
[Maintenance]

⚠WARNING

- To prevent an electric shock, any person who is involved in inspection should be fully competent to do the work.
- To prevent an electric shock, do not operate the switches with wet hands.

ABOUT THE MANUAL

If using the servo for the first time, prepare and use the following related manuals to ensure that the servo is used safely. The manuals used differ depending on the interface of the servo amplifier. For details, refer to the User's Manual (Introduction).



Global standards and regulations

Compliance with the indicated global standards and regulations is current as of the release date of this manual. Some standards and regulations may have been modified or withdrawn.

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 [(× 10^{-4} kg•m^2)]	5.4675 [oz•$inch^2$]
Load (thrust load/axial load)	1 [N]	0.2248 [lbf]
Temperature	N [°C] × 9/5 + 32	N [°F]

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1 LINEAR ENCODER

Precautions

- While the linear encoder and the linear servo motor should be oil and dust proofed, oil and dust proofing are especially important for the linear encoder. Contact the manufacturer of the linear encoder being used.
- Use the linear encoder cables specified in this chapter. Using products other than those specified may cause a malfunction.
- Do not connect or disconnect an encoder cable while the servo amplifier is powered on. Doing so can cause malfunctions or unexpected system behavior.
- Contact the manufacturer of the linear encoder being used for information on specifications, performance and guarantees.
- If the linear encoder is incorrectly installed, an alarm or position mismatch may occur. In such situations, refer to the following check points and ensure that the linear encoder is installed in a suitable environment.

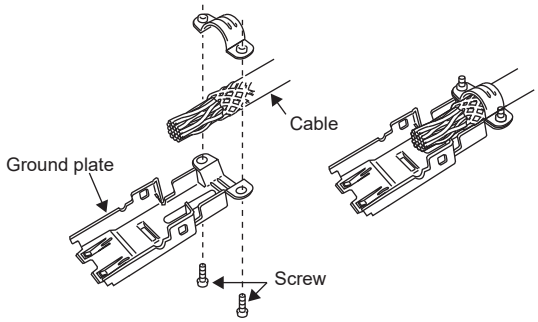
Check that the gap between the head and scale is correct.
Check that the scale head is not rolling or yawing (i.e., that the scale head is not loose).
Check the surface of the scale for dust and scratches.
Check that the vibration and temperature are within the specified range.
Check that the speed is within the permissible range without overshooting.

- Refer to the following page for combinations of linear encoders and servo amplifiers.

☞ Page 9 Compatible encoder list

1.1 Shielding CN2 side connectors

- When using 3M shell kits (36310-3200-008 or 36310-F200-008) or the Molex connector set (54599-101), ensure the external conductor of the shielded cable is firmly in contact with the ground plate before attaching the connector shell.

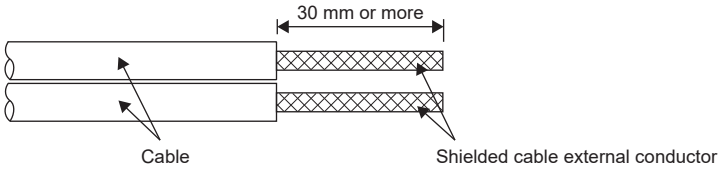


When connecting two cables to one grand plate

When connecting two cables to one grand plate, follow the steps below.

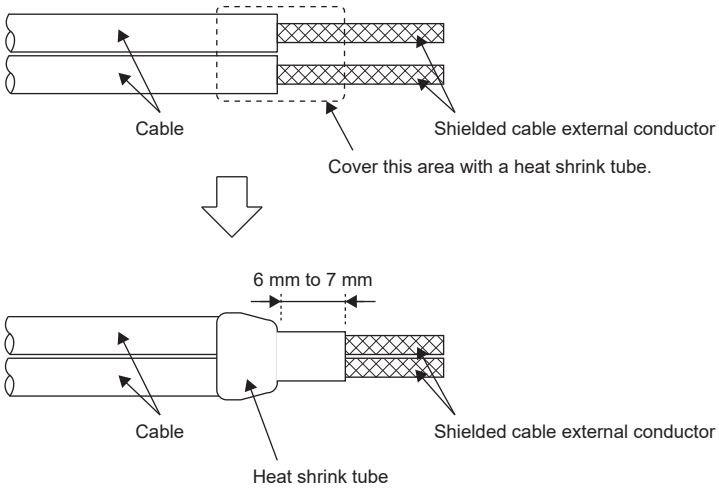
1. Peel 30 mm or more of the cable insulator.

Adjust the length of the part to be peeled in the insulator when attaching the connector shell.

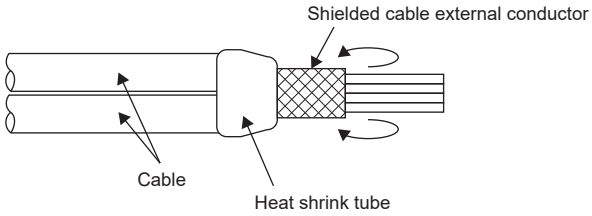


2. Bundle up two cables using a heat shrink tube.

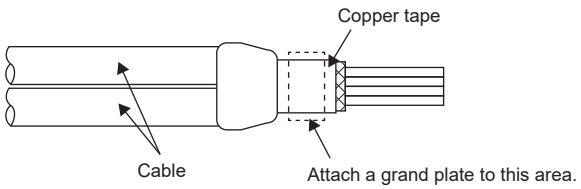
Make sure to cover 6 mm to 7 mm of a part in the external conductor of the shielded cable with the heat shrink tube.



3. Fold the external conductor of the shield cable onto the surface of the heat shrink tube.



4. Wrap copper tape around the folded external conductor of the shield cable and attach the ground plate.



5. Pull the cables to which the grand plate is attached lightly to check that the cables are securely attached.

1.2 Compatible encoder list

For information on suitable operating environments and linear encoder specifications such as temperature, vibration resistance, and IP ratings, contact the product manufacturer.

Precautions

For the encoders that can be used with your servo amplifier, contact your local sales office.

Mitsubishi Electric high-speed serial communication

Absolute position type

Manufacturer	Model	Resolution	Rated speed *1	Effective measurement length (maximum) *2	Communication method	Ver. *3	
						Motor side	Load side
Magnescale	SR77	0.01 μm 0.05 μm	3.3 m/s	2040 mm	Two-wire type	B2	C4
	SR87			3040 mm			
	SR27A	0.01 μm	3.3 m/s	2040 mm	Two-wire type/four-wire type		
	SR67A			3640 mm			
	SQ47	0.005 μm	3.3 m/s	3740 mm			
	SQ57			3770 mm			
Mitutoyo	AT343A	0.05 μm	2.0 m/s	3000 mm	Two-wire type		
	AT543A-SC		2.5 m/s	2200 mm			
	AT545A-SC	20 μm/4096-fold subdivision (approx. 0.005 μm)	2.5 m/s	2200 mm			
	ST743A	0.1 μm	5.0 m/s	6000 mm			
	ST744A						
	ST748A						
	ST1341A	0.01 μm	8.0 m/s	12000 mm			
	ST1342A	0.001 μm		4200 mm			
Renishaw	RESOLUTE RL40M	1 nm	100 m/s	2100 mm	Two-wire type		
		50 nm		20990 mm			
	EVOLUTE EL40M	50 nm 100 nm 500 nm		10010 mm			
	FORTiS-S 40N	1 nm 10 nm 50 nm	4.0 m/s	3240 mm *4	Four-wire type	F0	F0
	FORTiS-N 40N						
Heidenhain	LC 495M	0.001 μm 0.01 μm	3.0 m/s	2040 mm	Four-wire type	B2	—
	LC 496M					E8	
	LC 195M			4240 mm		B2	
	LC 196M					E8	
	LIC 4193M	0.001 μm 0.005 μm 0.01 μm	10.0 m/s	3040 mm	Two-wire type/four-wire type	B2	C4
	LIC 4195M			28440 mm			
	LIC 4197M			6040 mm			
	LIC 4199M			1020 mm			
	LIC 3197M	0.01 μm		10000 mm		E0	E0
	LIC 3199M						
	LIC 2197M	0.05 μm 0.1 μm	10.0 m/s	6020 mm		B2	C4
	LIC 2199M			6020 mm			
	MC15M	0.05 μm 0.1 μm	10.0 m/s	3020 mm			

Manufacturer	Model	Resolution	Rated speed [*1]	Effective measurement length (maximum) [*2]	Communication method	Ver. [*3]	
						Motor side	Load side
NIDEC MACHINE TOOL CORPORATION	MPFA-HZ-M01	0.1 μm	30.0 m/s	8000 mm	Two-wire type	D4	D4

*1 The values shown in this table are the manufacturer specification values. When the linear encoder is used with the servo amplifiers, the specification value is the lowest value of either the value indicated in the table or the maximum speed of the servo motor.

*2 The values shown in this table are the manufacturer specification values. The length of the encoder cable between the linear encoder and the servo amplifier should not exceed 30 m. The length of the encoder cable between the linear encoder manufactured by NIDEC MACHINE TOOL CORPORATION and the servo amplifier should not exceed 20 m.

*3 "Ver." indicates the supported firmware version of the servo amplifier. Encoders can be used with servo amplifiers with the firmware versions shown in the table.

*4 When the resolution is 1 nm, the maximum effective length is 2040 mm.

Incremental type

Point

When using the current position latch function of the touch probe, there are some restrictions. For details, refer to "Touch probe" in the following manual.
MR-JET User's Manual (Function)

Manufacturer	Model	Resolution	Rated speed *1	Effective measurement length (maximum) *2	Communication method	Ver. *3	
						Motor side	Load side
Magnescale	SR75	0.01 μm 0.05 μm	3.3 m/s	2040 mm	Two-wire type	B2	C4
	SR85			3040 mm			
	SL710 + PL101-RM/RHM	0.1 μm	10.0 m/s	100000 mm			
	SQ10 + PQ10 + MQ10	0.05 μm 0.1 μm	10.0 m/s	3800 mm	Two-wire type/four-wire type		
	L50H+BD700	400 nm/800-fold subdivision (0.5 nm) *8*9 400 nm/400-fold subdivision (1 nm) *8	3 m/s	1070 mm	Two-wire type	E8	E8
	BL50H+FSE			1400 mm			—
Heidenhain	LIDA 483 + EIB 3091M (16384-fold subdivision) *4	20 μm/16384-fold subdivision (approx. 1.22 nm)	4.0 m/s	3040 mm	Four-wire type	B2	—
	LIDA 485 + EIB 3091M (16384-fold subdivision) *4			30040 mm			
	LIDA 487 + EIB 3091M (16384-fold subdivision) *4			6040 mm			
	LIDA 489 + EIB 3091M (16384-fold subdivision) *4			1020 mm			
	LIDA 287 + EIB 3091M (16384-fold subdivision) *4	200 μm/16384-fold subdivision (approx. 12.2 nm)		10000 mm			
	LIDA 289 + EIB 3091M (16384-fold subdivision) *4						
	LIF 481 + EIB 3091M (4096-fold subdivision)	4 μm/4096-fold subdivision (approx. 0.977 nm)	1.6 m/s	1640 mm *7			
	LIP 6081 + EIB 3091M (4096-fold subdivision)			3040 mm *7			
NIDEC INSTRUMENTS CORPORATION	PSLH041 *6	0.1 μm	5.0 m/s	2400 mm	Two-wire type		C4
NIDEC MACHINE TOOL CORPORATION	MPFA-HI-M01 *6	0.1 μm	30.0 m/s	10000 mm *5	Two-wire type	D8	D8

*1 The values shown in this table are the manufacturer specification values. When the linear encoder is used with the servo amplifiers, the specification value is the lowest value of either the value indicated in the table or the maximum speed of the servo motor.

*2 The values shown in this table are the manufacturer specification values. The length of the encoder cable between the linear encoder and the servo amplifier should not exceed 30 m. The length of the encoder cable between the linear encoder manufactured by NIDEC MACHINE TOOL CORPORATION and the servo amplifier should not exceed 20 m.

*3 "Ver." indicates the supported firmware version of the servo amplifier. Encoders can be used with servo amplifiers with the firmware versions shown in the table.

*4 For this combination, it is recommended using EIB 3091M with a subdivision of 16384. EIB 3091M with a subdivision of 4096 is also available. For details, contact HEIDENHAIN K.K.

*5 When the required measurement length exceeds 10000 mm, contact NIDEC MACHINE TOOL CORPORATION.

*6 When using this linear encoder as a motor-side encoder, refer to "[Pr. PC27.6_Multipoint Z-phase linear encoder monitor selection]" in the following manual.
MR-JET-G User's Manual (Parameters)

*7 The maximum effective measurement length varies depending on the scale to be used. For details, contact HEIDENHAIN K.K.

*8 The available resolutions in combination with the servo amplifier are 0.5 nm and 1 nm. When the number of fold subdivisions is 800, the resolution is 0.5 nm. When the number of fold subdivisions is 400, the resolution is 1 nm. For details, contact Magnescale.

*9 When the resolution is 0.5 nm, only the LM-AJ series linear servo motors are available.

A/B/Z-phase differential output type

Point

When using the current position latch function of the touch probe, there are some restrictions. For details, refer to "Touch probe" in the following manual.
MR-JET User's Manual (Function)

Encoder type	Manufacturer	Resolution	Rated speed *1	Effective measurement length (maximum) *2	Communication method	Ver. *4		Absolute position detection system
						Motor side	Load side	
Linear encoder *5	Not specified	0.001 μm to 5 μm *3	Depends on the encoder	Depends on the encoder	A/B/Z-phase differential output method	B2	E4	×
Rotary encoder		4096 pulses/rev to 67108864 pulses/rev *3				—	E4	

*1 When the encoder is used with the servo amplifiers, the specification value is the lowest value of either the rated speed of the encoder or the maximum speed of the servo motor.
*2 The length of the encoder cable between the encoder and the servo amplifier should not exceed 30 m.
*3 Select an encoder that has a resolution within this range.
*4 "Ver." indicates the supported firmware version of the servo amplifier. Encoders can be used with servo amplifiers with the firmware versions shown in the table.
*5 When using a linear encoder that has multiple reference marks in a full stroke as a motor-side encoder, refer to "[Pr. PC27.6_Multipoint Z-phase linear encoder monitor selection]" in the following manual.
MR-JET-G User's Manual (Parameters)

External encoder connector

The following table shows the servo amplifier connectors used to connect the servo amplifier to an external encoder.

System architecture	External encoder communication method	Connector	
		MR-JET-_G(-N1)	MR-JET-_G_-HS(N1)
Linear servo system *2	Two-wire type	CN2	—
	Four-wire type		
	A/B/Z-phase differential output method		
Fully closed loop system *3	Two-wire type	CN2 *1	CN2L
	Four-wire type	—	—
	A/B/Z-phase differential output method	CN2 *4*5	CN2L
Scale measurement function *4	Two-wire type	—	—
	Four-wire type		
	A/B/Z-phase differential output method	CN2 *5	CN2L

*1 The MR-J4FCCBL03M branch cable is required.
*2 Available on servo amplifiers with firmware version B2 or later.
*3 Available on servo amplifiers with firmware version C4 or later and manufactured in July 2022 or later.
*4 Available on servo amplifiers with firmware version E4 or later.
*5 The branch cable for A/B/Z-phase differential output encoder is required.

1.3 Linear encoder manufactured by Mitutoyo (absolute position type)

Point

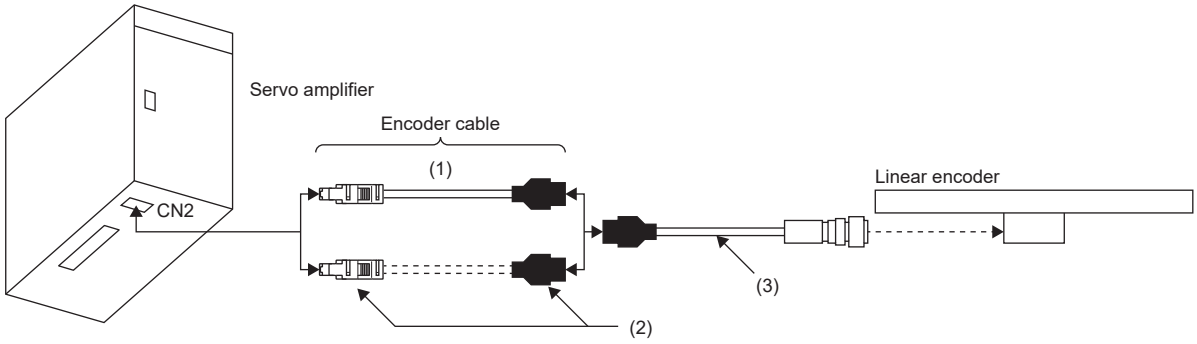
The absolute position battery is not required when constructing an absolute position detection system.

AT343A

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor

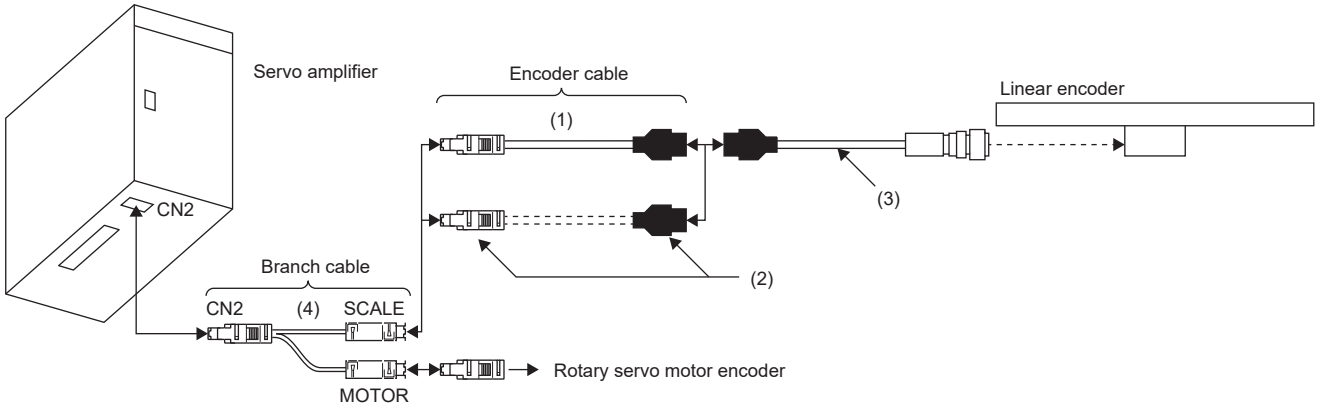


Conditions	Encoder cable	Output cable
When using an optional encoder cable	(1) MR-EKCBL_M-H 2 m/5 m ☞ Page 80 MR-EKCBL_M-H encoder cable	(3) Options manufactured by Mitutoyo *1 Part No.09BAA598A: 0.2 m Part No.09BAA598B: 2 m Part No.09BAA598C: 3 m
When fabricating an encoder cable	(2) MR-ECNM connector set ☞ Page 15 Fabricating the encoder cable	

*1 These items should be prepared by the customer.

■For the fully closed loop system

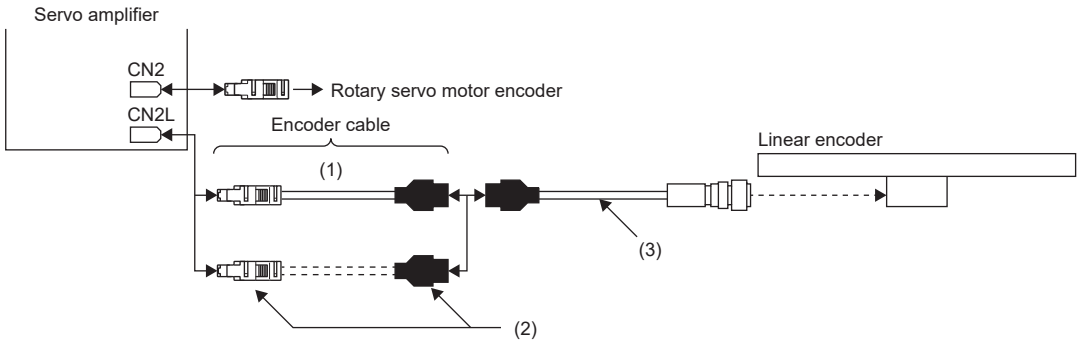
• Servo amplifier without CN2L



Conditions	Branch cable	Encoder cable	Output cable
When using an optional encoder cable	(4) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) MR-EKCBL_M-H 2 m/5 m ☞ Page 80 MR-EKCBL_M-H encoder cable	(3) Options manufactured by Mitutoyo *1 Part No.09BAA598A: 0.2 m Part No.09BAA598B: 2 m Part No.09BAA598C: 3 m
When fabricating an encoder cable		(2) MR-ECNM connector set ☞ Page 15 Fabricating the encoder cable	

*1 These items should be prepared by the customer.

• Servo amplifier with CN2L



Conditions	Encoder cable	Output cable
When using an optional encoder cable	(1) MR-EKCBL_M-H 2 m/5 m ☞ Page 80 MR-EKCBL_M-H encoder cable	(3) Options manufactured by Mitutoyo *1 Part No.09BAA598A: 0.2 m Part No.09BAA598B: 2 m Part No.09BAA598C: 3 m
When fabricating an encoder cable	(2) MR-ECNM connector set ☞ Page 15 Fabricating the encoder cable	

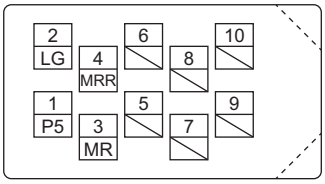
*1 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-ECNM connector set as shown below. The encoder cable may be as long as 30 m.

■Encoder cable

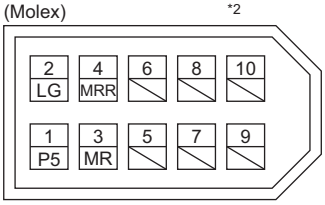
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



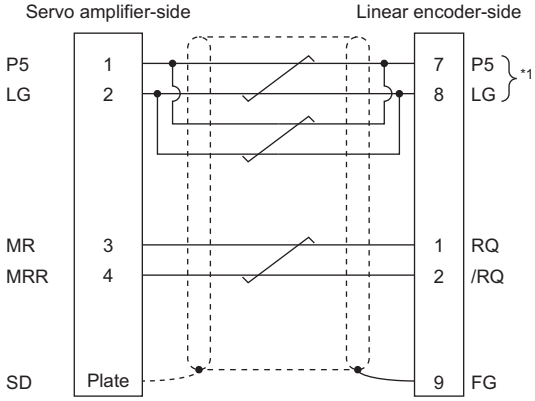
View from the wiring side. *3

or

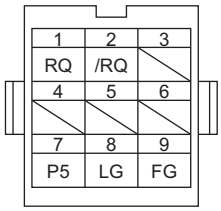
Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



Housing: 1-172161-9
Connector pin: 170359-1
(TE Connectivity or equivalent)
Cable clamp: MTI-0002
(Toa Electric Industrial)



View from the wiring side.

*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections (when the output cable is 3 m or less)	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	
Up to 30 m	5 pairs	

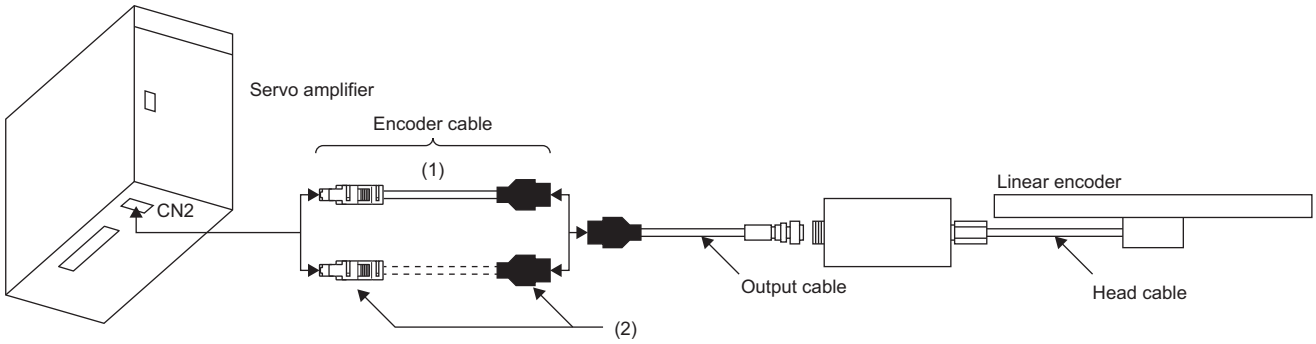
*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

Cable structure

Prepare cables based on the following configuration diagram.

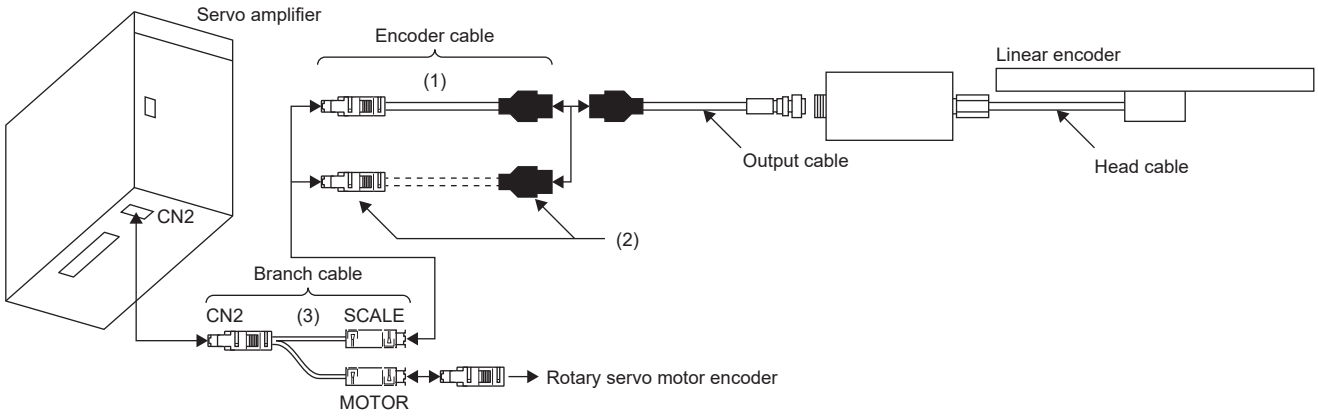
■For the linear servo motor



Conditions	Encoder cable	Output cable	Head cable
When using an optional encoder cable	(1) MR-EKCBL_M-H 2 m/5 m ☞ Page 80 MR-EKCBL_M-H encoder cable	Linear encoder accessory Cable length: 3 m	Linear encoder accessory Cable length: 2 m
When fabricating an encoder cable	(2) MR-ECNM connector set ☞ Page 18 Fabricating the encoder cable		

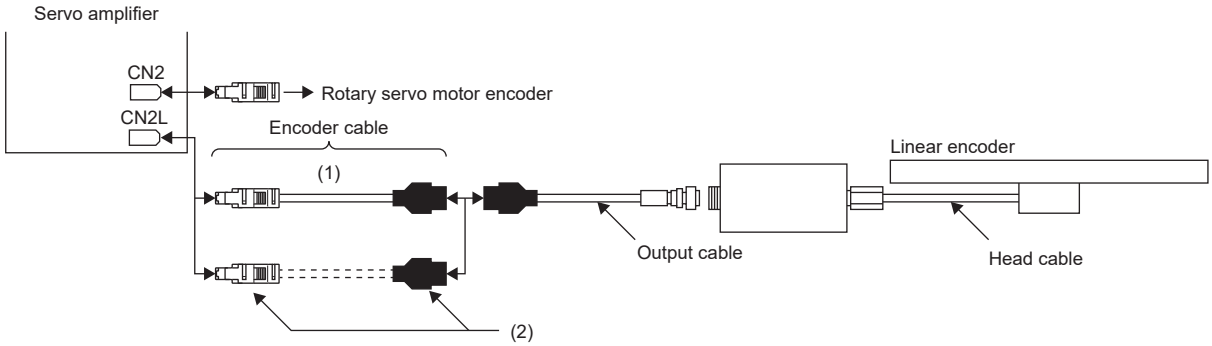
■For the fully closed loop system

• Servo amplifier without CN2L



Conditions	Branch cable	Encoder cable	Output cable	Head cable
When using an optional encoder cable	(3) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) MR-EKCBL_M-H 2 m/5 m ☞ Page 80 MR-EKCBL_M-H encoder cable	Linear encoder accessory Cable length: 3 m	Linear encoder accessory Cable length: 2 m
When fabricating an encoder cable		(2) MR-ECNM connector set ☞ Page 18 Fabricating the encoder cable		

• Servo amplifier with CN2L



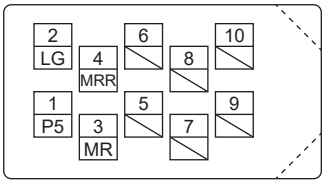
Conditions	Encoder cable	Output cable	Head cable
When using an optional encoder cable	(1) MR-EKCBL_M-H 2 m/5 m ☞ Page 80 MR-EKCBL_M-H encoder cable	Linear encoder accessory Cable length: 3 m	Linear encoder accessory Cable length: 2 m
When fabricating an encoder cable	(2) MR-ECNM connector set ☞ Page 18 Fabricating the encoder cable		

Fabricating the encoder cable

Fabricate the encoder cable using the MR-ECNM connector set as shown below. The encoder cable may be as long as 30 m.

■Encoder cable

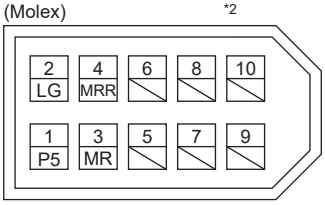
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



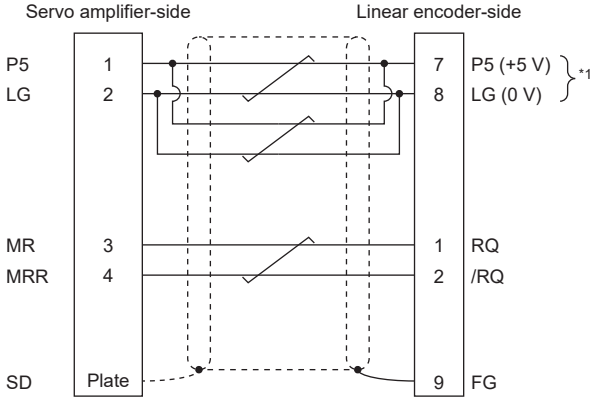
View from the wiring side. *3

or

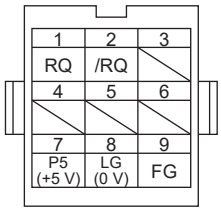
Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



Housing: 1-172161-9
Connector pin: 170359-1
(TE Connectivity or equivalent)
Cable clamp: MTI-0002
(Toa Electric Industrial)



View from the wiring side.

*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections (when the output cable is 3 m or less)	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	4 pairs	
Up to 30 m	5 pairs	

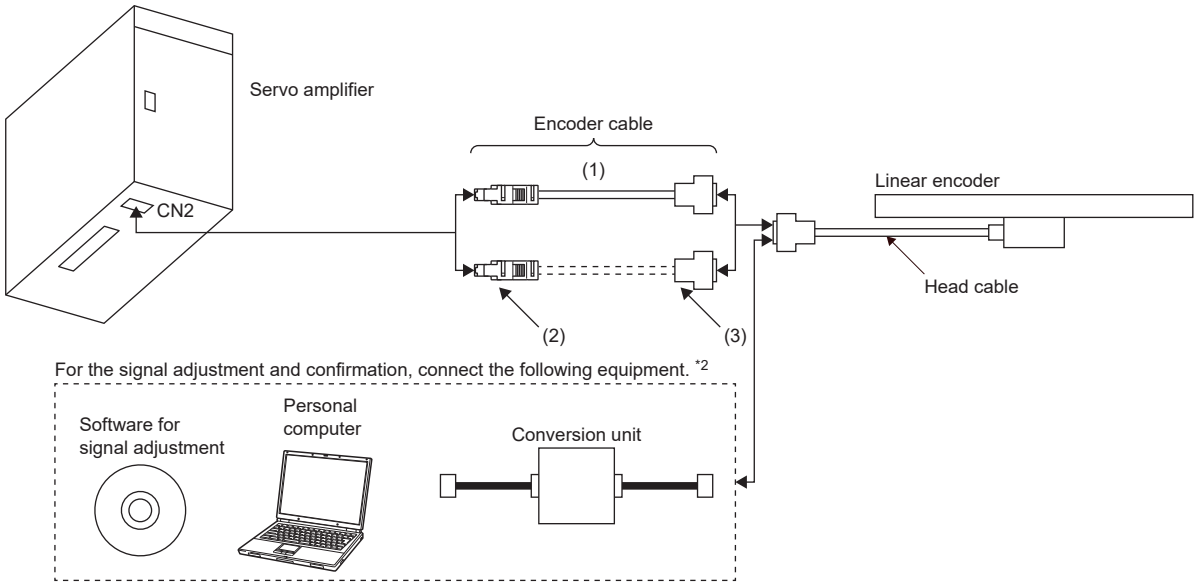
*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



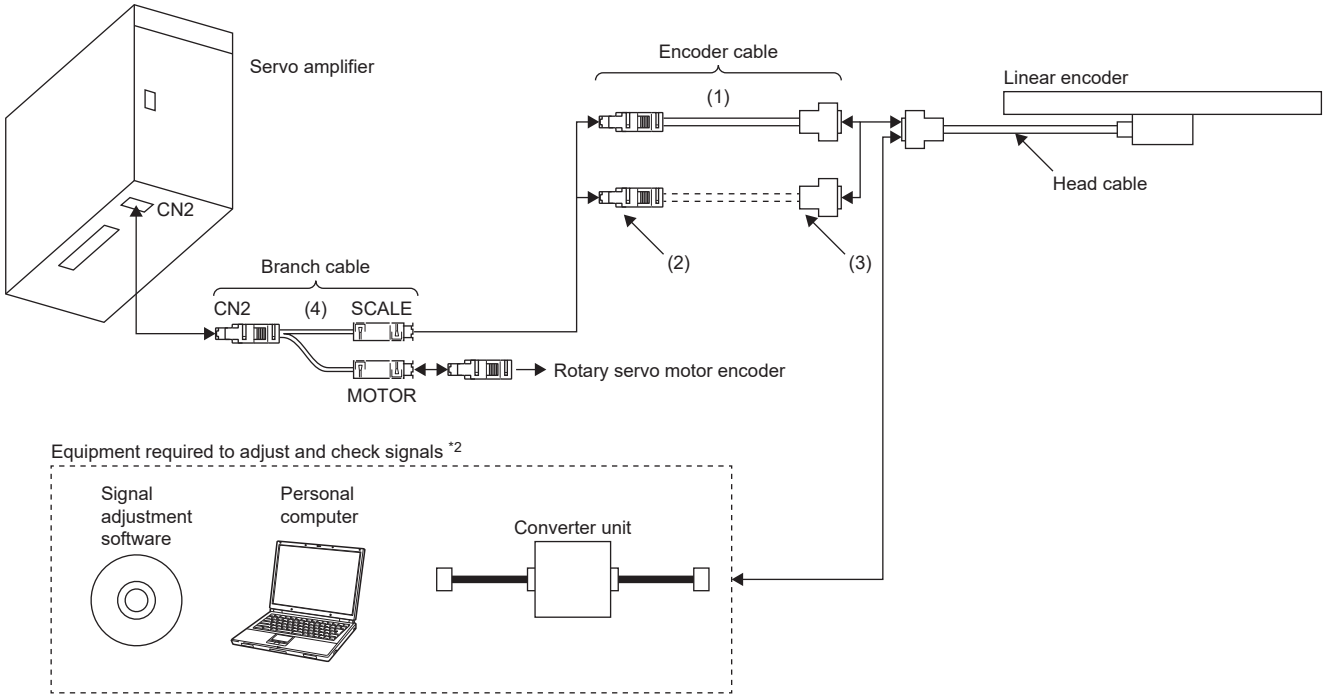
Conditions	Encoder cable		Head cable
When using an optional encoder cable	(1) Options manufactured by Mitutoyo *1 Part No.06ACF117A: 5 m Part No.06ACF117B: 10 m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 22 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female) Shell: HDAB-15S Plug case: HDA-CTH (Hirose Electric)	

*1 These items should be prepared by the customer.

*2 In order to adjust and check signals when installing the ST743A, ST744A, or ST748A, a personal computer, signal adjustment software, and a converter unit are required. For details, contact Mitutoyo Corporation.

■For the fully closed loop system

• Servo amplifier without CN2L

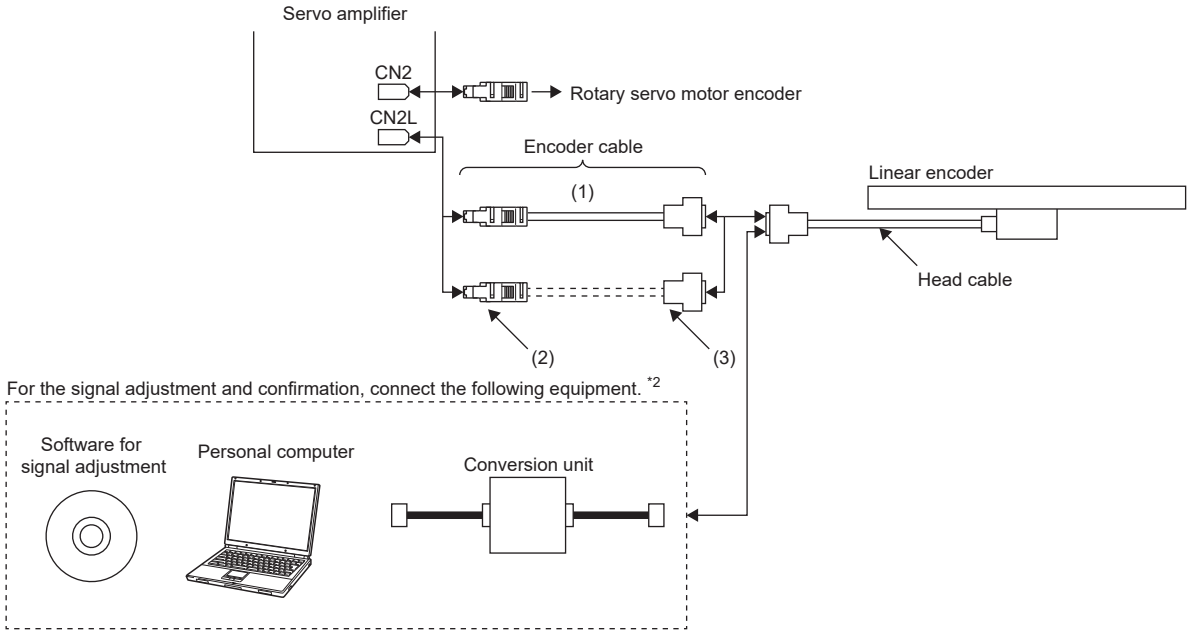


Conditions	Branch cable	Encoder cable		Head cable
When using an optional encoder cable	(4) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) Options manufactured by Mitutoyo *1 Part No.06ACF117A: 5 m Part No.06ACF117B: 10 m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable		(2) MR-J3CN2 connector set ☞ Page 22 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female) Shell: HDAB-15S Plug case: HDA-CTH (Hirose Electric)	

*1 These items should be prepared by the customer.

*2 In order to adjust and check signals when installing the ST743A, ST744A, or ST748A, a personal computer, signal adjustment software, and a converter unit are required. For details, contact Mitutoyo Corporation.

• Servo amplifier with CN2L



Conditions	Encoder cable		Head cable
When using an optional encoder cable	(1) Options manufactured by Mitutoyo *1 Part No.06ACF117A: 5 m Part No.06ACF117B: 10 m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 22 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female) Shell: HDAB-15S Plug case: HDA-CTH (Hirose Electric)	

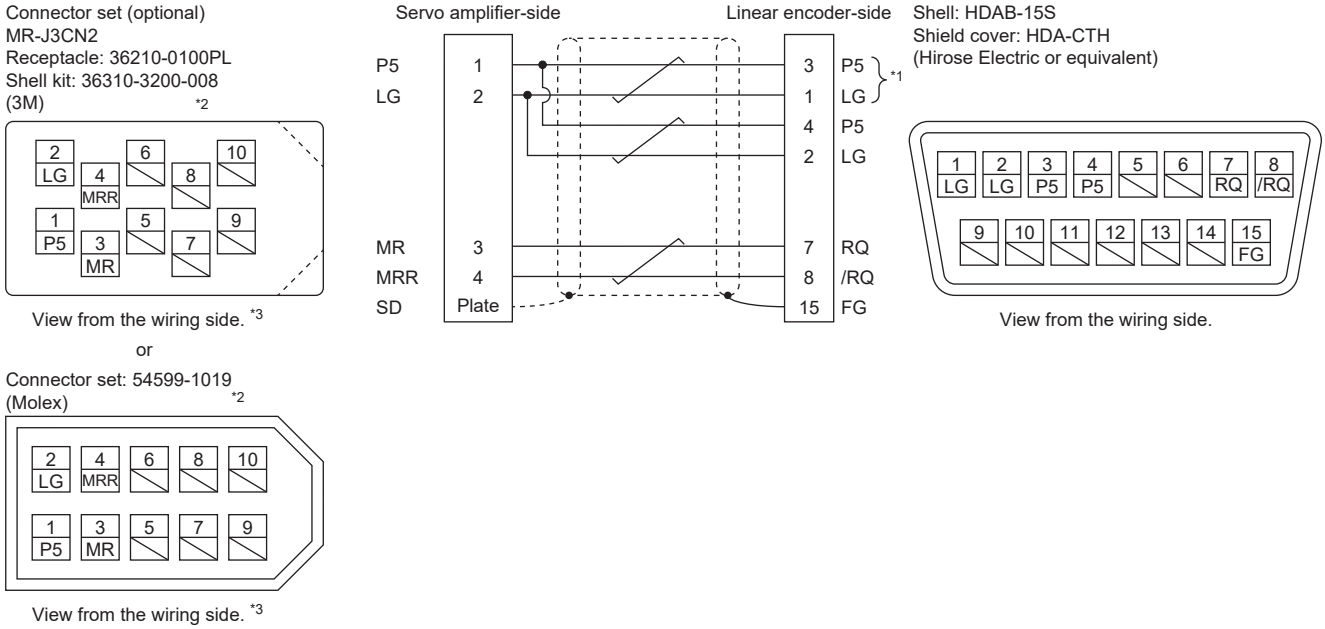
*1 These items should be prepared by the customer.

*2 In order to adjust and check signals when installing the ST743A, ST744A, or ST748A, a personal computer, signal adjustment software, and a converter unit are required. For details, contact Mitutoyo Corporation.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections (when the head cable is 1 m or less)	Wire size
Up to 10 m	1 pair	AWG 22
Up to 20 m	2 pairs	
Up to 30 m	3 pairs	

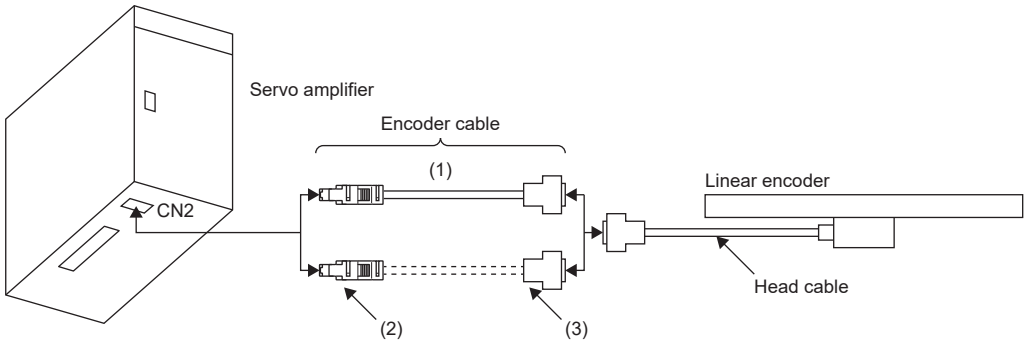
*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor

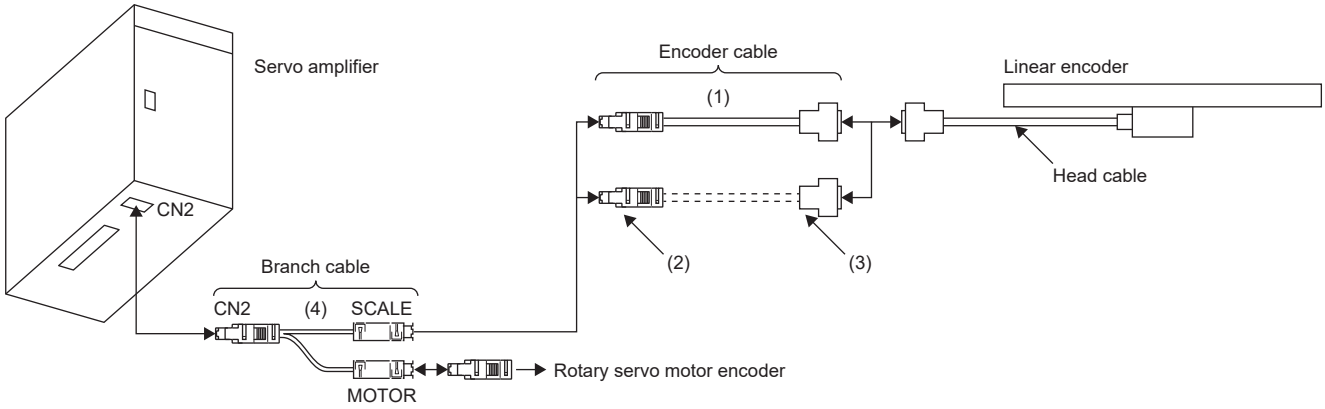


Conditions	Encoder cable		Head cable
When using an optional encoder cable	(1) Options manufactured by Mitutoyo *1 Part No.06ACF117A: 5 m Part No.06ACF117B: 10 m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 25 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female) Shell: HDAB-15S Plug case: HDA-CTH (Hirose Electric)	

*1 These items should be prepared by the customer.

■For the fully closed loop system

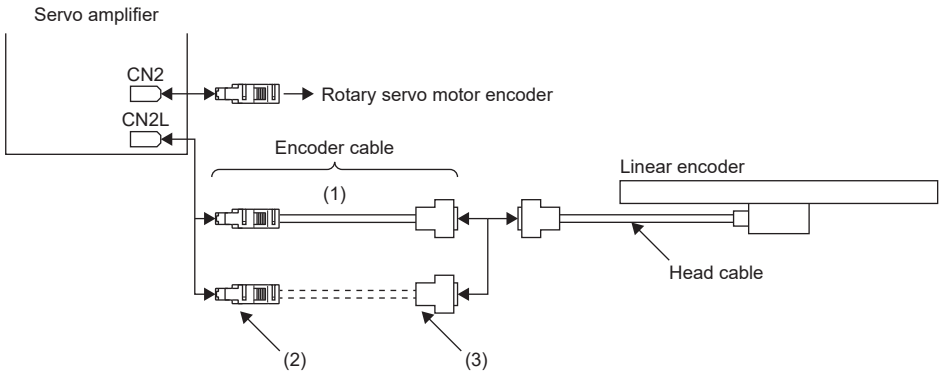
• Servo amplifier without CN2L



Conditions	Branch cable	Encoder cable		Head cable
When using an optional encoder cable	(4) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) Options manufactured by Mitutoyo *1 Part No.06ACF117A: 5 m Part No.06ACF117B: 10 m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable		(2) MR-J3CN2 connector set ☞ Page 25 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female) Shell: HDAB-15S Plug case: HDA-CTH (Hirose Electric)	

*1 These items should be prepared by the customer.

• Servo amplifier with CN2L



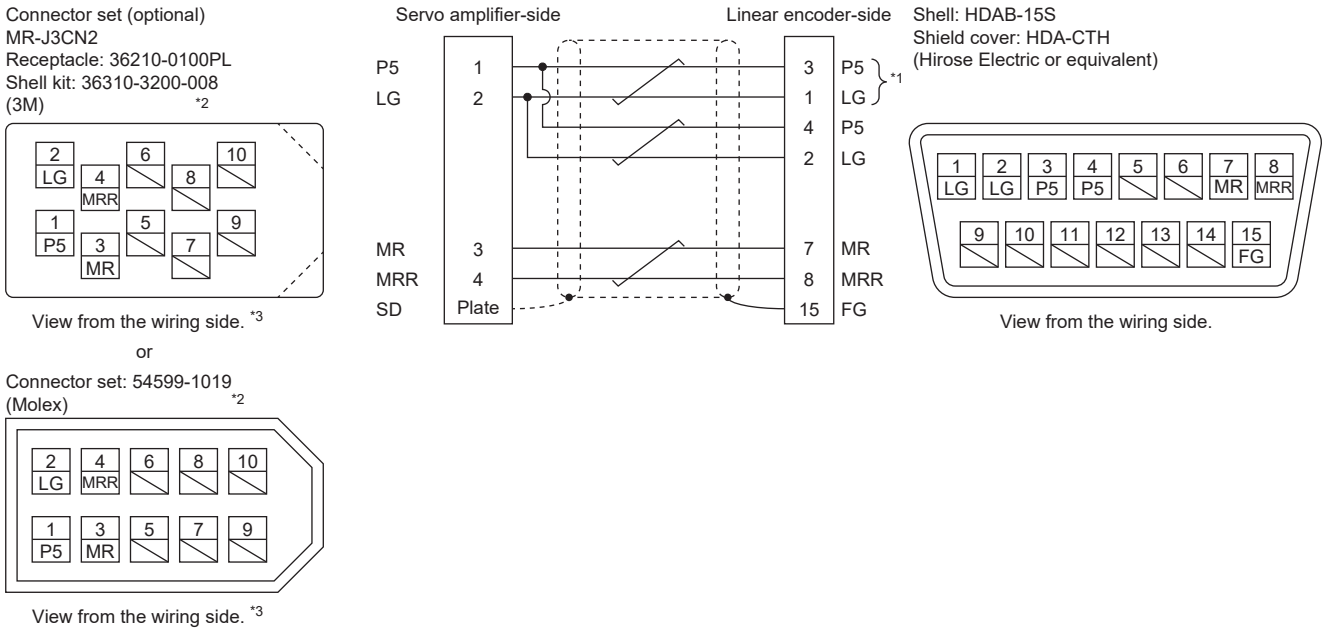
Conditions	Encoder cable		Head cable
When using an optional encoder cable	(1) Options manufactured by Mitutoyo *1 Part No.06ACF117A: 5 m Part No.06ACF117B: 10 m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 25 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female) Shell: HDAB-15S Plug case: HDA-CTH (Hirose Electric)	

*1 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections (when the head cable is 1 m or less)	Wire size
Up to 10 m	1 pair	AWG 22
Up to 20 m	2 pairs	
Up to 30 m	3 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

1.4 Linear encoder manufactured by Heidenhain

Point

The absolute position battery is not required when constructing an absolute position detection system.

LC 495M/LC 496M/LC 195M/LC 196M (absolute position type)

Restriction

- This linear encoder is a four-wire type. To use this linear encoder, change the servo parameter to select the four-wire type. Refer to the following.

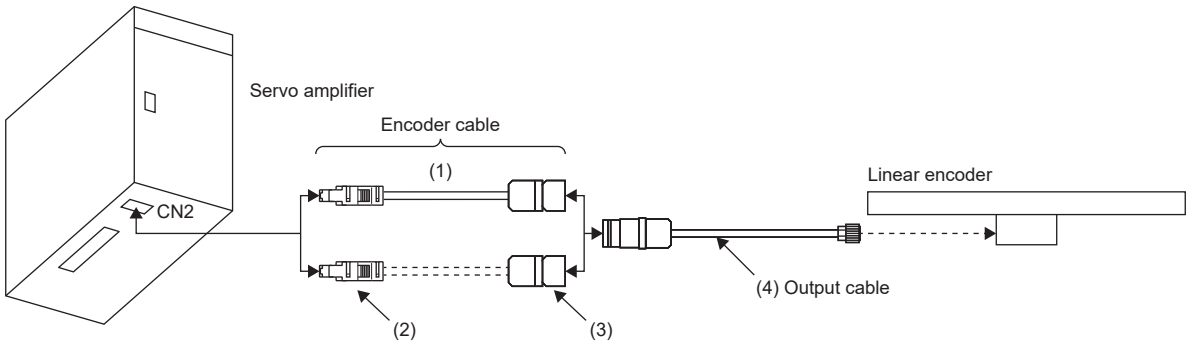
MR-JET-G User's Manual (Parameters)

- This linear encoder cannot be used on a fully closed loop system.

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



Conditions	Encoder cable		Output cable
When using an optional encoder cable	(1) Options manufactured by Heidenhain *1 573661-×× _m		(4) 547300-×× _m 1036549-×× _m (Heidenhain) *1
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 27 Fabricating the encoder cable	(3) Junction connector *1 17-pin coupling (female) 291697-26 (Heidenhain)	

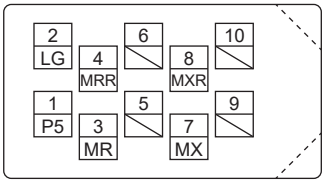
*1 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable

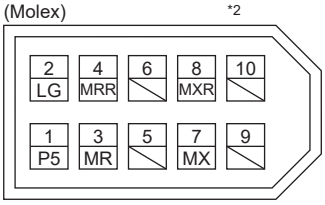
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



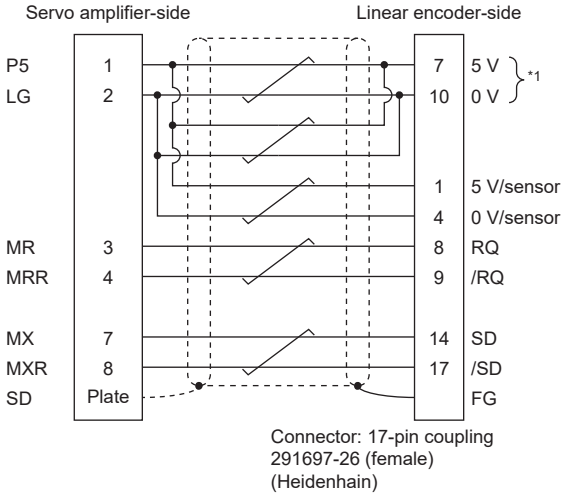
View from the wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



Connector: 17-pin coupling
291697-26 (female)
(Heidenhain)

*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections (when the output cable is 1 m or less)	Wire size
Up to 10 m	1 pair	AWG 22
Up to 20 m	2 pairs	
Up to 30 m	3 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

LIC 4193M/LIC 4195M/LIC 4197M/LIC 4199M/LIC 3197M/LIC 3199M/LIC 2197M/LIC 2199M (absolute position type)

Restriction

- These linear encoders are two-wire type or four-wire type. When using a four-wire type linear encoder, change the servo parameter to select the four-wire type. Refer to the following.

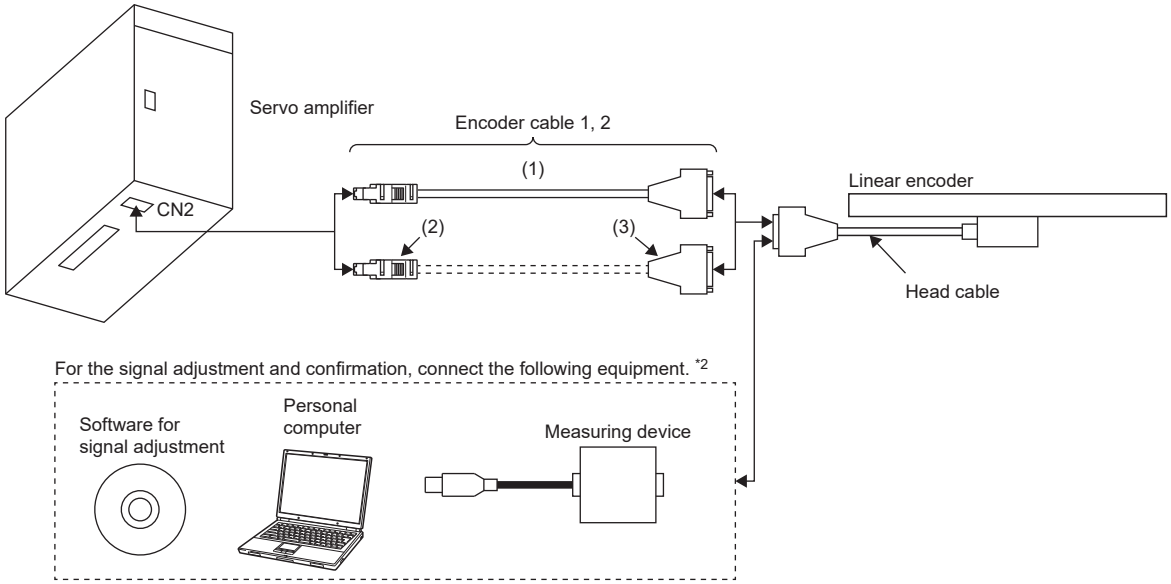
MR-JET-G User's Manual (Parameters)

- When configuring a fully closed loop system, use a two-wire type linear encoder.

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



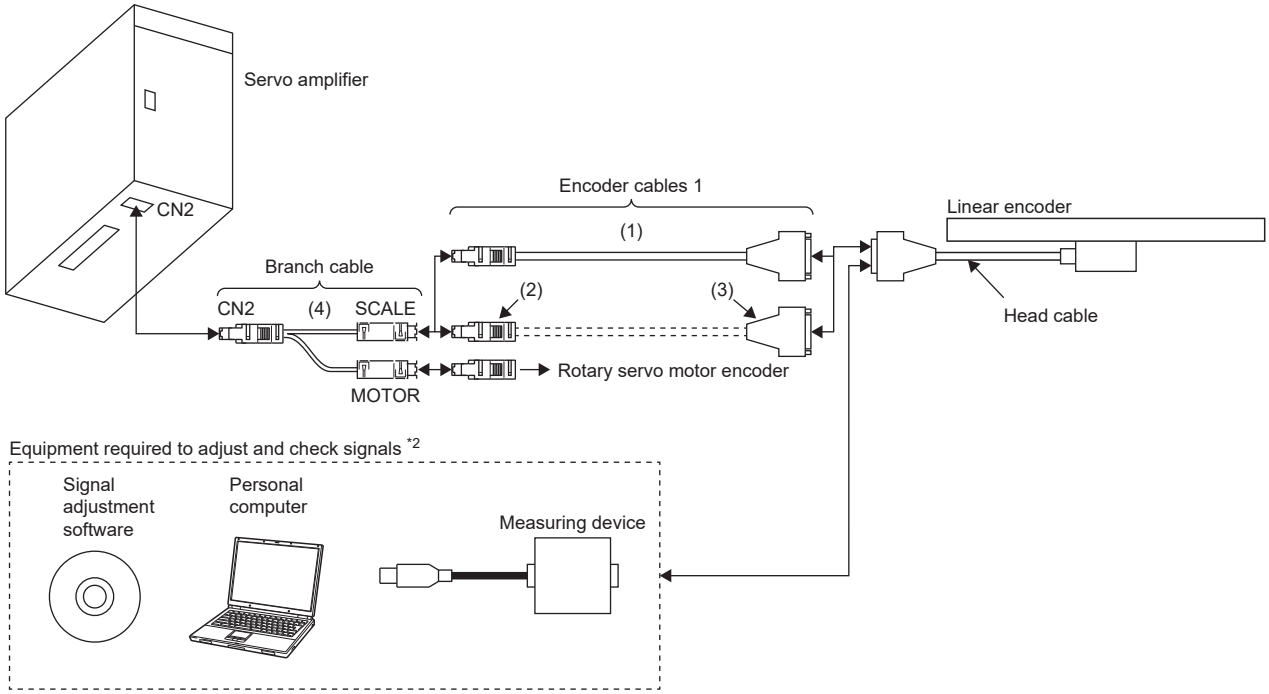
Conditions	Encoder cable		Head cable
When using an optional encoder cable	(1) Options manufactured by Heidenhain *1 630856-×× _m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 31 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female)	

*1 These items should be prepared by the customer.

*2 In order to adjust and check signals when installing the LIC 4193M, LIC 4195M, LIC 4197M, LIC 4199M, LIC 3197M, LIC 3199M, LIC 2197M, or LIC 2199M, a personal computer (with USB port), signal adjustment software, and a measuring device are required. For details, contact HEIDENHAIN K.K.

■For the fully closed loop system

• Servo amplifier without CN2L

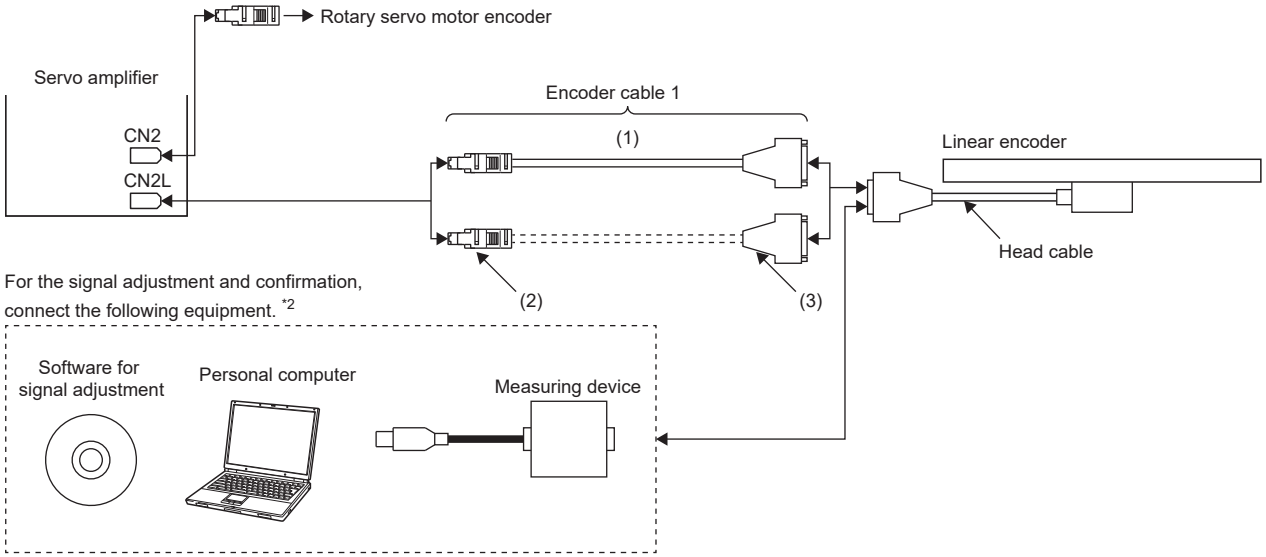


Conditions	Branch cable	Encoder cable		Head cable
When using an optional encoder cable	(4) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) Options manufactured by Heidenhain *1 630 856-×× _m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable		(2) MR-J3CN2 connector set ☞ Page 31 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female)	

*1 These items should be prepared by the customer.

*2 In order to adjust and check signals when installing the LIC 4193M, LIC 4195M, LIC 4197M, LIC 4199M, LIC 3197M, LIC 3199M, LIC 2197M, or LIC 2199M, a personal computer (with USB port), signal adjustment software, and a measuring device are required. For details, contact HEIDENHAIN K.K.

• Servo amplifier with CN2L



Conditions	Encoder cable		Head cable
When using an optional encoder cable	(1) Options manufactured by Heidenhain *1 630856-××_m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 31 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female)	

*1 These items should be prepared by the customer.

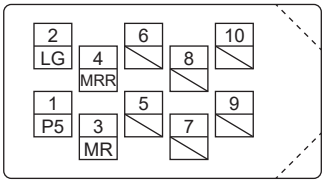
*2 In order to adjust and check signals when installing the LIC 4193M, LIC 4195M, LIC 4197M, LIC 4199M, LIC 3197M, LIC 3199M, LIC 2197M, or LIC 2199M, a personal computer (with USB port), signal adjustment software, and a measuring device are required. For details, contact HEIDENHAIN K.K.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable 1 (two-wire type)

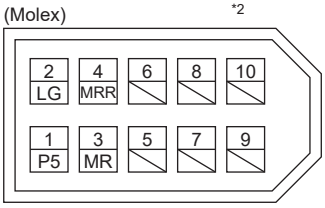
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



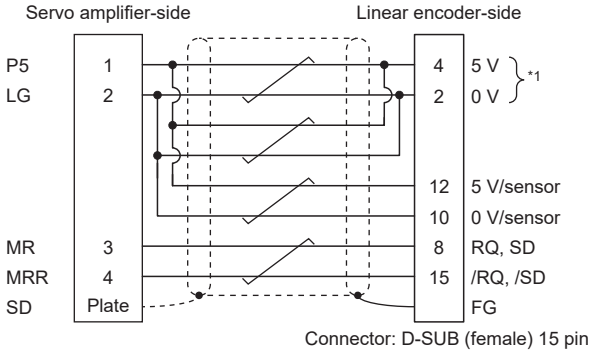
View from the wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



*1 Encoder cables that meet the following specifications are recommended.

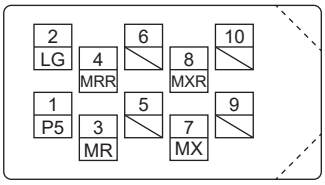
Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	
Up to 30 m	4 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

■Encoder cable 2 (four-wire type)

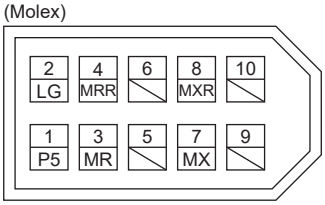
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)



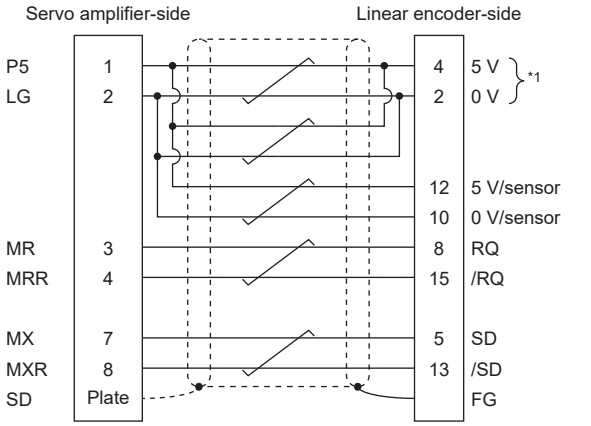
View from the wiring side. *2

or

Connector set: 54599-1019
(Molex)



View from the wiring side. *2



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	
Up to 30 m	4 pairs	

*2 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

LIDA 483/LIDA 485/LIDA 487/LIDA 489/LIDA 287/LIDA 289/LIF 481/ LIP 6081 (incremental type)

Restriction

- This linear encoder is a four-wire type. To use this linear encoder, change the servo parameter to select the four-wire type. Refer to the following.

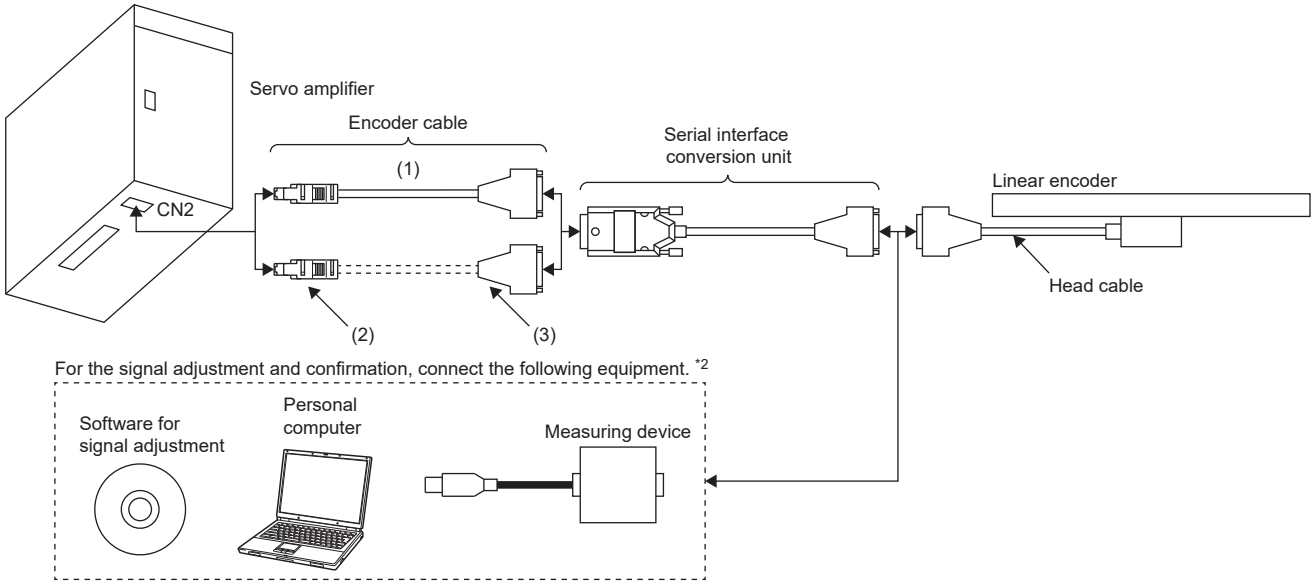
MR-JET-G User's Manual (Parameters)

- This linear encoder cannot be used on a fully closed loop system.

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



Conditions	Encoder cable		Serial interface conversion unit	Head cable
When using an optional encoder cable	(1) Options manufactured by Heidenhain *1 630 856-×× _m		EIB 3091M Cable length: 0.5 m (Heidenhain) *1	Linear encoder accessory Cable length: 3 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 34 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female)		

*1 These items should be prepared by the customer.

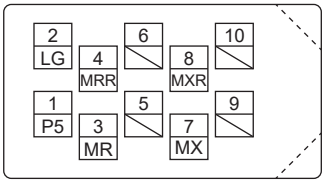
*2 In order to adjust and check signals when installing the LIDA 483, LIDA 485, LIDA 487, LIDA 489, LIDA 287, or LIDA 289, a personal computer (with USB port), signal adjustment software, and a measuring device are required. For details, contact HEIDENHAIN K.K.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable

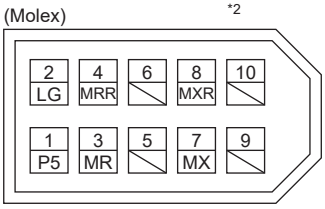
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



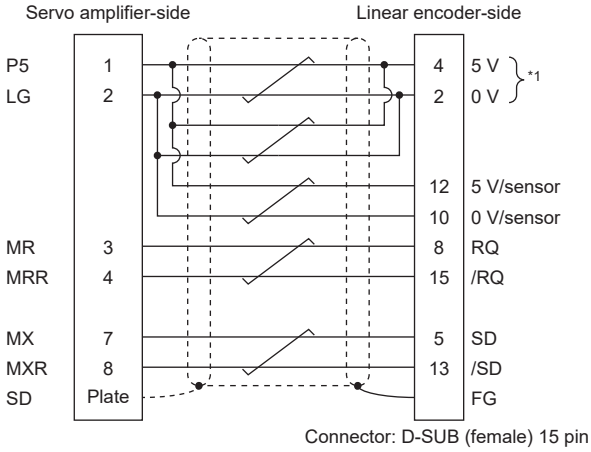
View from the wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	
Up to 30 m	4 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

MC15M (absolute position type)

Restriction

- These linear encoders are two-wire type or four-wire type. When using a four-wire type linear encoder, change the servo parameter to select the four-wire type. Refer to the following.

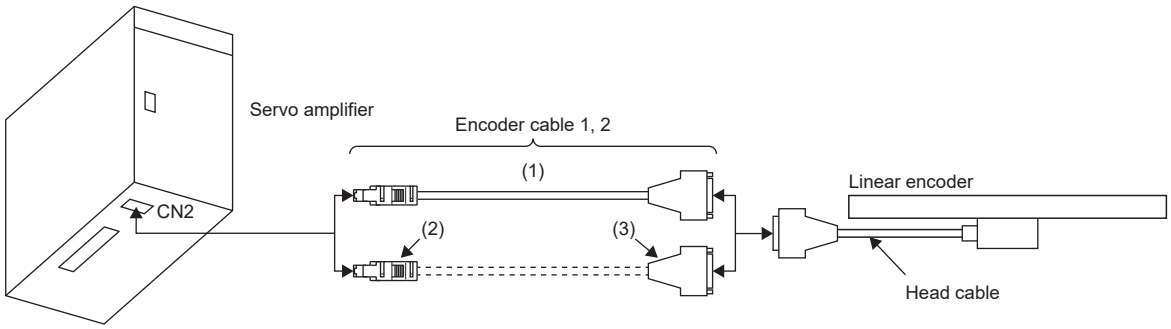
MR-JET-G User's Manual (Parameters)

- When configuring a fully closed loop system, use a two-wire type linear encoder.

Cable structure

Prepare cables based on the following configuration diagram.

■ For the linear servo motor

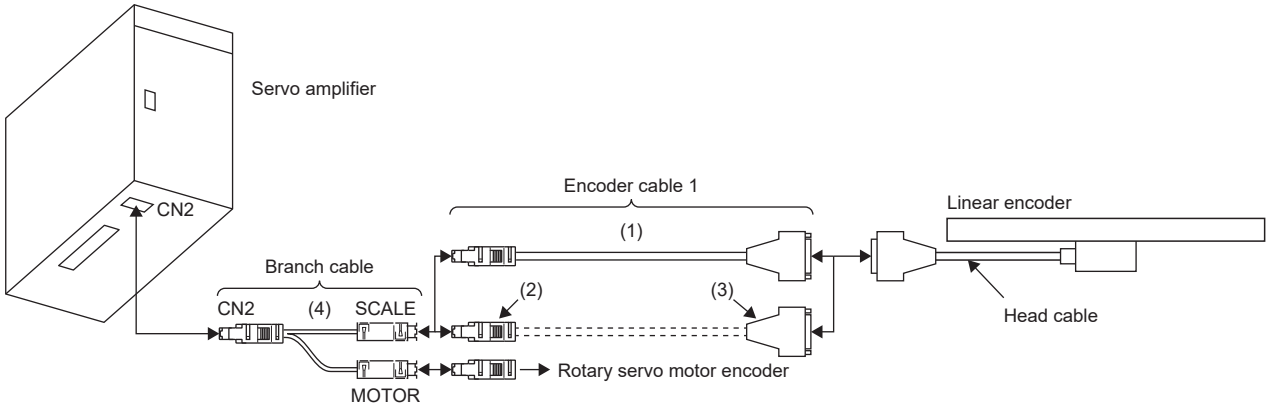


Conditions	Encoder cable		Head cable
When using an optional encoder cable	(1) Options manufactured by Heidenhain *1 630856-×× _m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 37 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female)	

*1 These items should be prepared by the customer.

■For the fully closed loop system

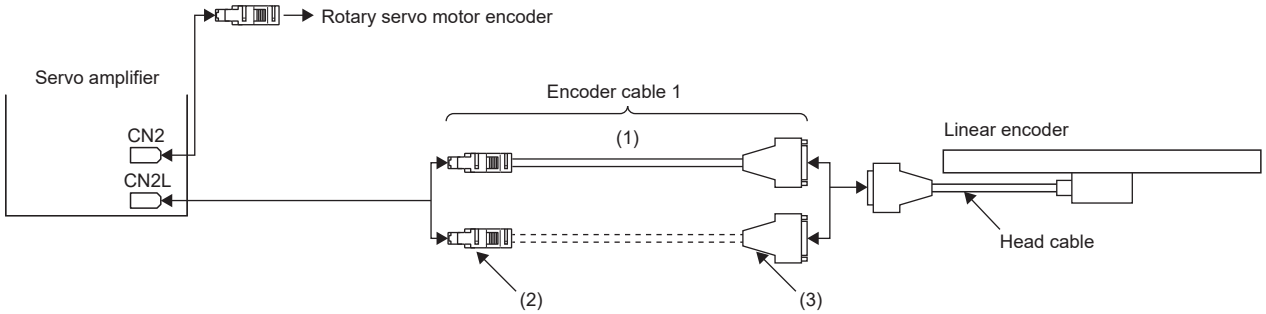
• Servo amplifier without CN2L



Conditions	Branch cable	Encoder cable		Head cable
When using an optional encoder cable	(4) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) Options manufactured by Heidenhain *1 630 856-×× _m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable		(2) MR-J3CN2 connector set ☞ Page 37 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female)	

*1 These items should be prepared by the customer.

• Servo amplifier with CN2L



Conditions	Encoder cable		Head cable
When using an optional encoder cable	(1) Options manufactured by Heidenhain *1 630856-××_m		Linear encoder accessory Cable length: 1 m
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 37 Fabricating the encoder cable	(3) Junction connector *1 15-pin D-SUB (female)	

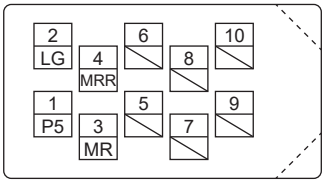
*1 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable 1 (two-wire type)

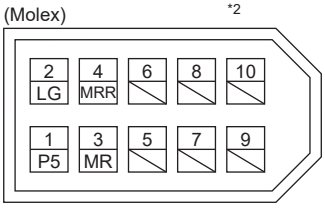
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



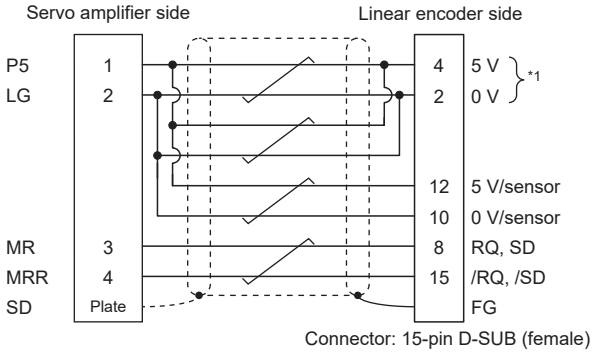
View seen from wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View seen from wiring side. *3



*1 Encoder cables that meet the following specifications are recommended.

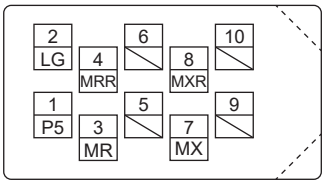
Wiring length	Number of paired LG and P5 connections	Wire size
Up to 20 m	2 pairs	AWG 22
Up to 30 m	3 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

■Encoder cable 2 (four-wire type)

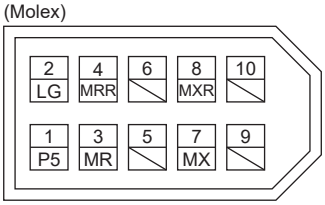
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)



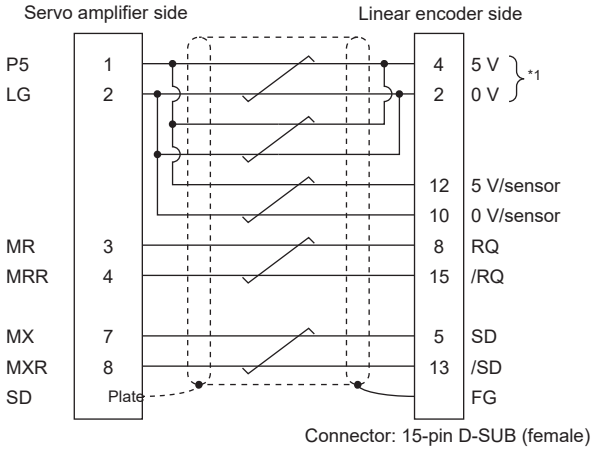
View seen from wiring side. *2

or

Connector set: 54599-1019
(Molex)



View seen from wiring side. *2



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 20 m	2 pairs	AWG 22
Up to 30 m	3 pairs	

*2 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

1.5 Linear encoder manufactured by Magnescale

Point

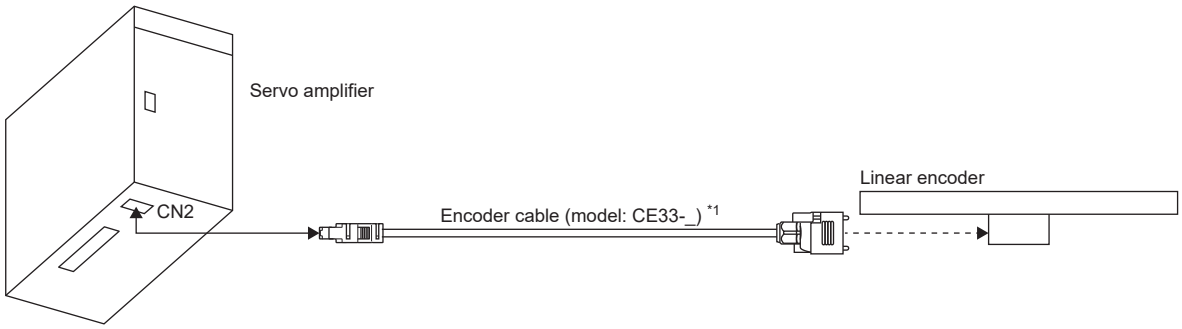
- SR27A, SR67A, SR77, SR87, SQ47 and SQ57 are absolute position type encoders. SR75 and SR85 are incremental type encoders.
- The absolute position battery is not required when constructing an absolute position detection system.

SR77/SR87/SR75/SR85

Cable structure

Prepare cables based on the following configuration diagram.

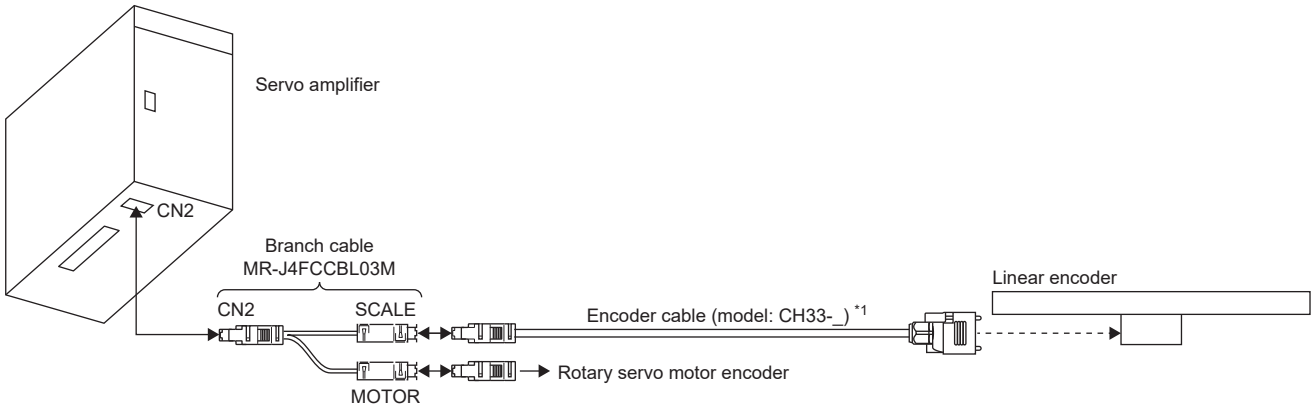
■For the linear servo motor



*1 This optional cable is manufactured by Magnescale and should be prepared by the customer.

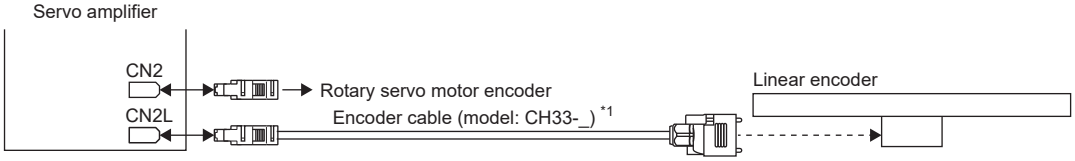
■For the fully closed loop system

- Servo amplifier without CN2L



*1 This optional cable is manufactured by Magnescale and should be prepared by the customer.

- Servo amplifier without CN2L



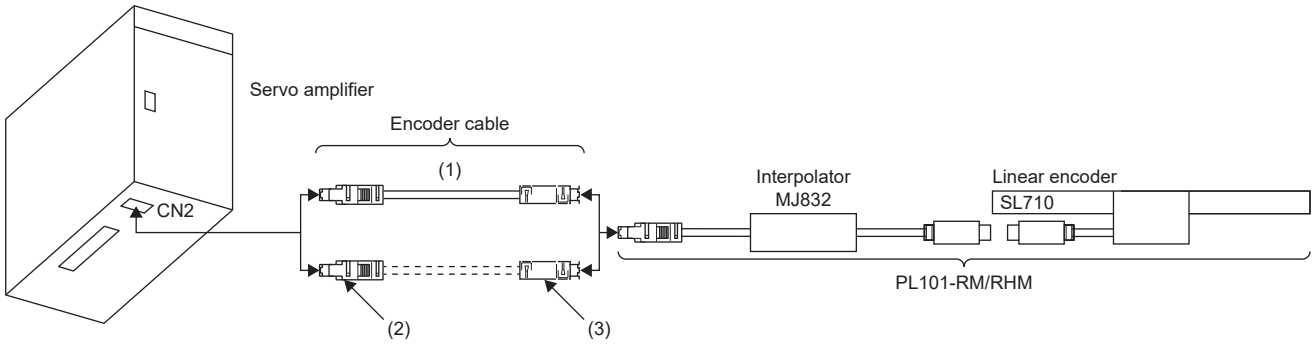
*1 This optional cable is manufactured by Magnescale and should be prepared by the customer.

SL710 + PL101-RM/RHM (incremental type)

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor

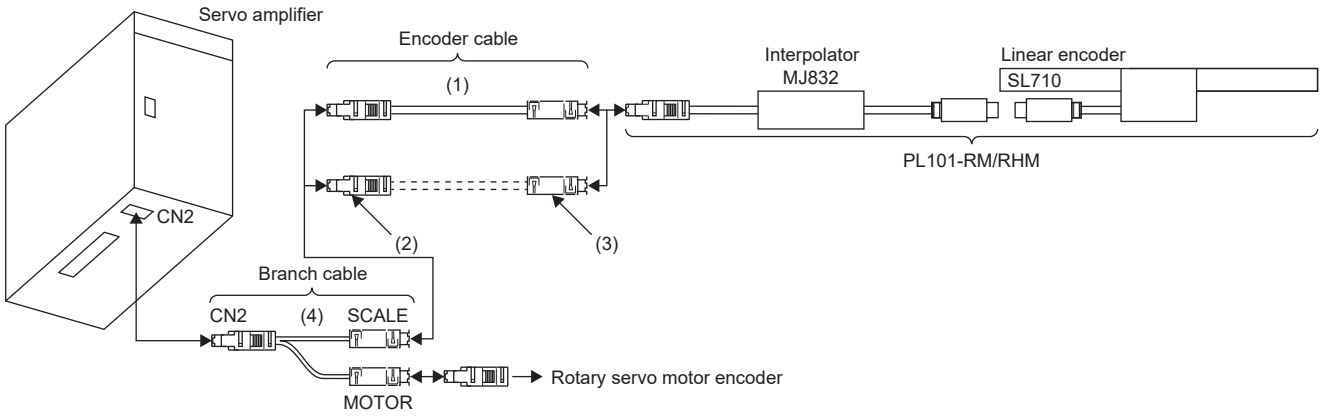


Conditions	Encoder cable		Interpolator
When using an optional encoder cable	(1) Options manufactured by Magnescale *1 CE33-_		Linear encoder accessory MJ832
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 42 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(3) Junction connector *1 Plug: 36110-3000FD Shell kit: 36310-F200-008 (3M or equivalent)	

*1 These items should be prepared by the customer.

■For the fully closed loop system

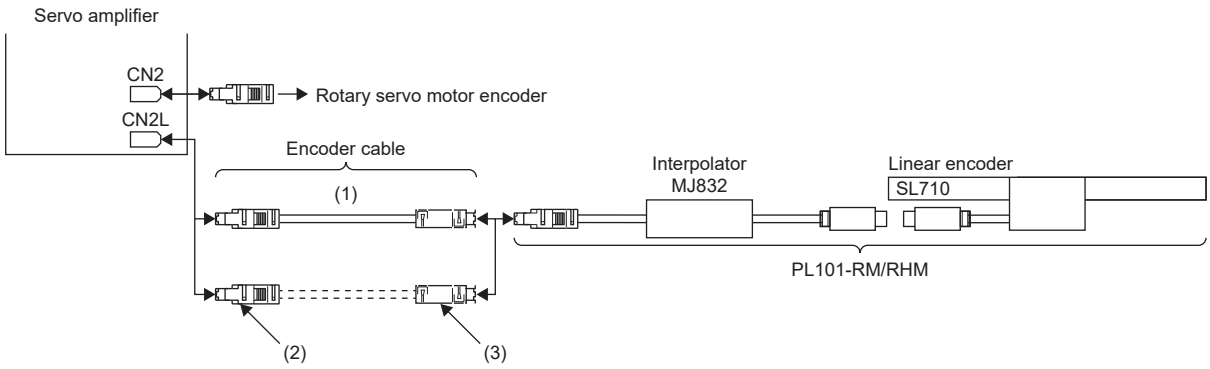
• Servo amplifier without CN2L



Conditions	Branch cable	Encoder cable		Interpolator
When using an optional encoder cable	(4) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) Options manufactured by Magnescale *1 CE33-_		Linear encoder accessory MJ832
When fabricating an encoder cable		(2) MR-J3CN2 connector set ☞ Page 42 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(3) Junction connector *1 Plug: 36110-3000FD Shell kit: 36310-F200-008 (3M or equivalent)	

*1 These items should be prepared by the customer.

• Servo amplifier with CN2L



Conditions	Encoder cable		Interpolator
When using an optional encoder cable	(1) Options manufactured by Magnescale *1 CE33-_		Linear encoder accessory MJ832
When fabricating an encoder cable	(2) MR-J3CN2 connector set ☞ Page 42 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(3) Junction connector *1 Plug: 36110-3000FD Shell kit: 36310-F200-008 (3M or equivalent)	

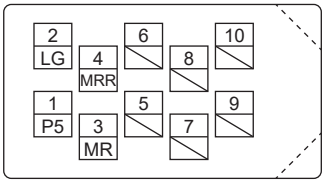
*1 These items should be prepared by the customer.

Fabricating the encoder cable used to connect the servo amplifier and interpolator

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable

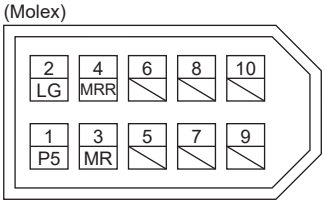
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



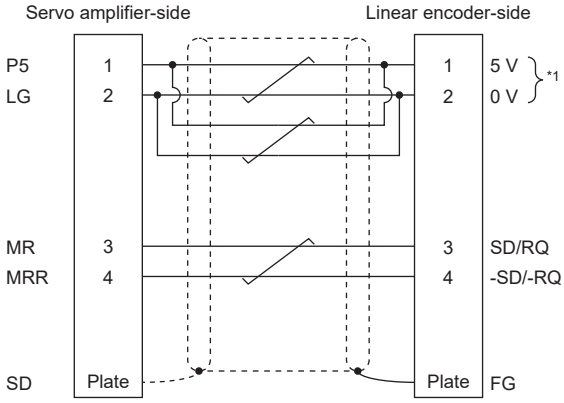
View from the wiring side. *3

or

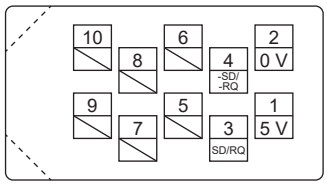
Connector set: 54599-1019
(Molex)



View from the wiring side. *3



Plug: 36110-3000FD
Shell kit: 36310-F200-008
(3M or equivalent)



View from the wiring side.

*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	
Up to 30 m	4 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

SR27A/SR67A/SQ47/SQ57

Restriction

- These linear encoders are two-wire type or four-wire type. When using a four-wire type linear encoder, change the servo parameter to select the four-wire type. Refer to the following.

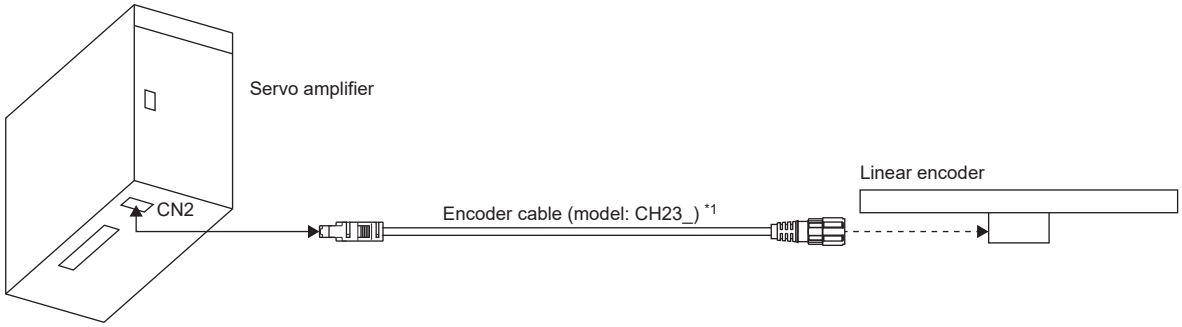
MR-JET-G User's Manual (Parameters)

- When configuring a fully closed loop system, use a two-wire type linear encoder.

Cable structure

Prepare cables based on the following configuration diagram.

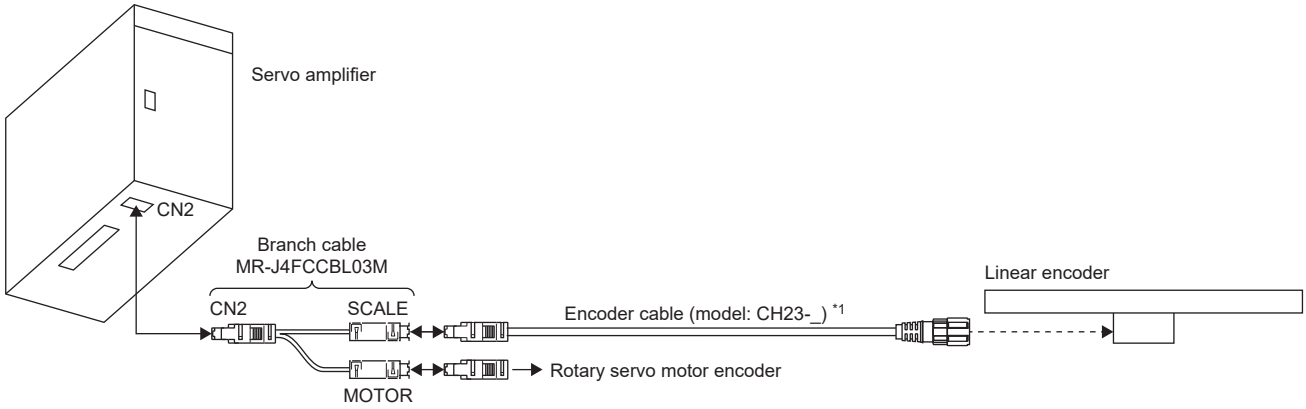
■For the linear servo motor



*1 This optional cable is manufactured by Magnescale and should be prepared by the customer.

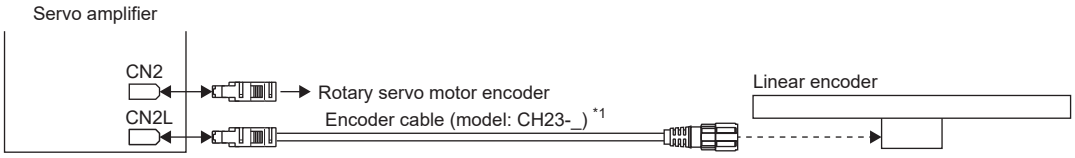
■For the fully closed loop system

- Servo amplifier without CN2L



*1 This optional cable is manufactured by Magnescale and should be prepared by the customer.

- Servo amplifier with CN2L



*1 This optional cable is manufactured by Magnescale and should be prepared by the customer.

SQ10 + PQ10 + MQ10 (incremental type)

Restriction

- These linear encoders are two-wire type or four-wire type. When using a four-wire type linear encoder, change the servo parameter to select the four-wire type. Refer to the following.

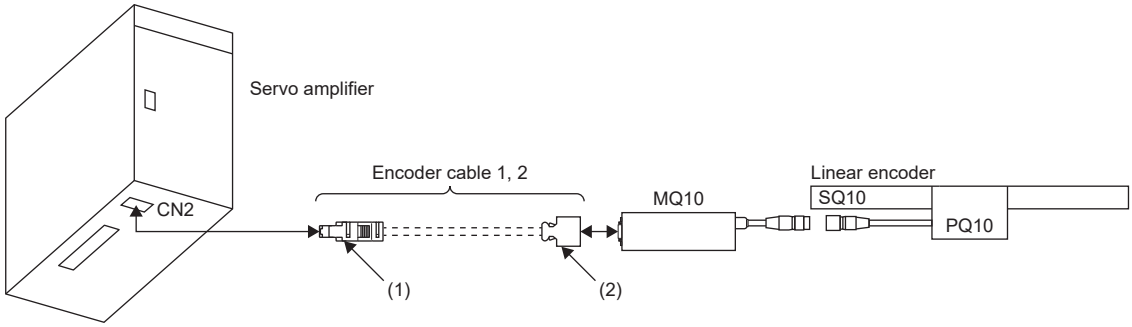
MR-JET-G User's Manual (Parameters)

- When configuring a fully closed loop system, use a two-wire type linear encoder.

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



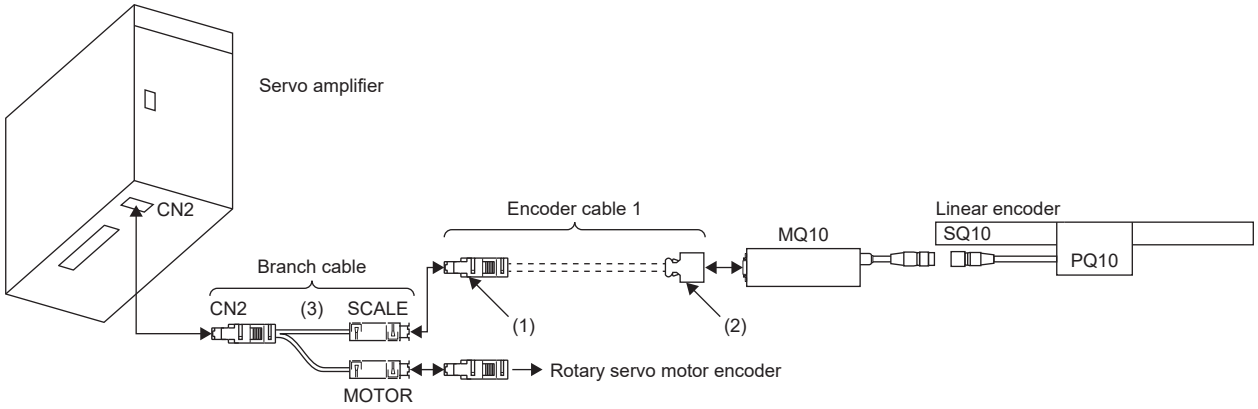
Encoder cable [*1]	
(1) MR-J3CN2 connector set ☞ Page 46 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(2) Junction connector [*2] Plug: 10114-3000PE (3M) Shell kit: 10314-52F0-008 (3M)

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

■For the fully closed loop system

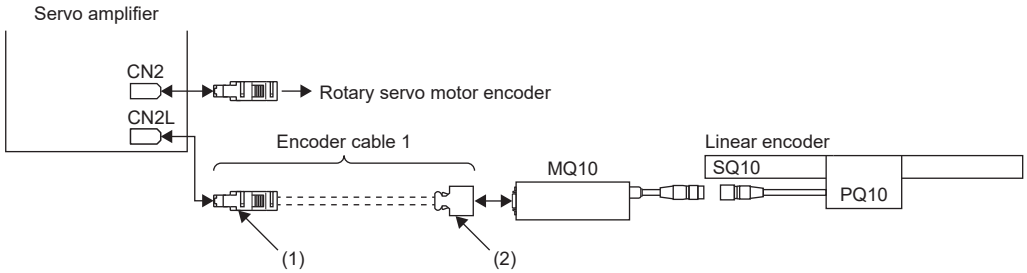
• Servo amplifier without CN2L



Condition	Branch cable	Encoder cable	
When fabricating an encoder cable	(3) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) MR-J3CN2 connector set ☞ Page 46 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(2) Junction connector *1 Plug: 10114-3000PE (3M) Shell kit: 10314-52F0-008 (3M)

*1 These items should be prepared by the customer.

• Servo amplifier with CN2L



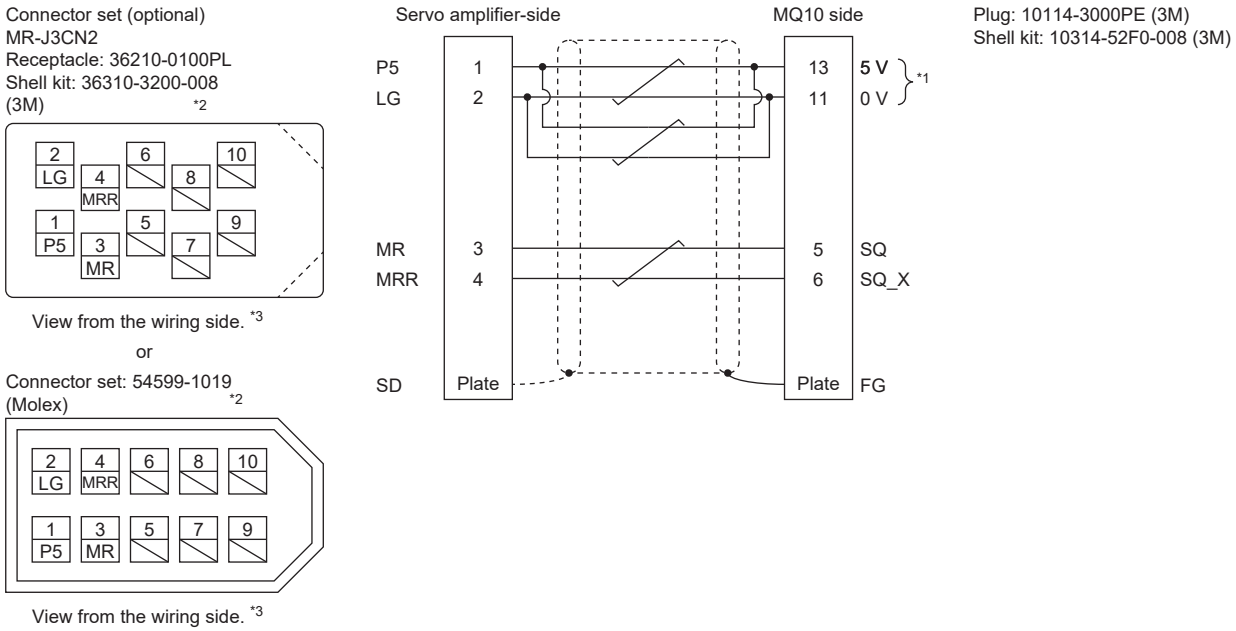
Condition	Encoder cable	
When fabricating an encoder cable	(1) MR-J3CN2 connector set ☞ Page 46 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(2) Junction connector *1 Plug: 10114-3000PE (3M) Shell kit: 10314-52F0-008 (3M)

*1 These items should be prepared by the customer.

Fabricating the encoder cable used to connect the servo amplifier and interpolator

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable 1 (two-wire type)



*1 Encoder cables that meet the following specifications are recommended.

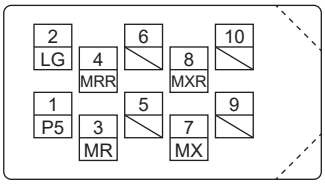
Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	
Up to 30 m	4 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

■Encoder cable 2 (four-wire type)

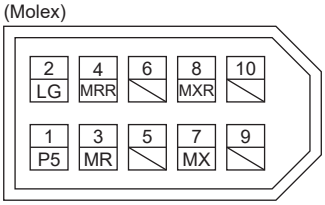
Connector set (option)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)



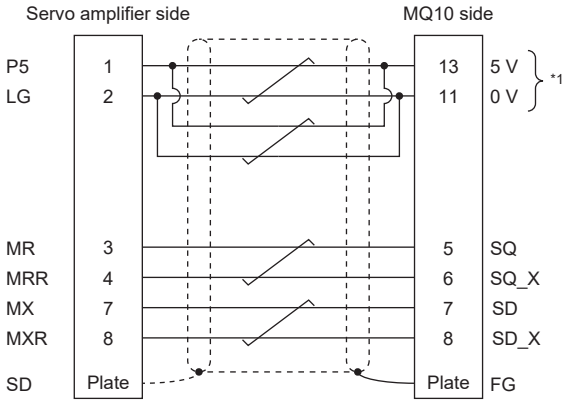
View from the wiring side. *2

or

Connector set: 54599-1019
(Molex)



View from the wiring side. *2



Plug: 10114-3000PE (3M)
Shell kit: 10314-52F0-008 (3M)

*1 Encoder cables that meet the following specifications are recommended.

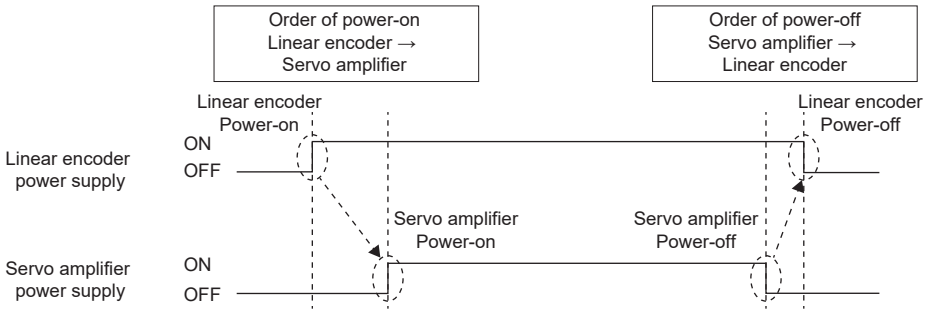
Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	
Up to 30 m	4 pairs	

*2 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

BL50H + BD700 (incremental type)

Precautions

- Connect the external power supply to BL50H + BD700. The external power supply should be prepared by the customer. Do not apply the voltage outside of the specifications. Doing so can cause malfunctions or unexpected system behavior. For details, contact Magnescale. When turning on the power, turn on the linear encoder, and then turn on the servo amplifier. When turning off the power, turn off the servo amplifier, and then turn off the linear encoder. If the power is not turned on/off in the above order, [AL. 016 Encoder initial communication error 1] or [AL. 020 Encoder normal communication error 1] occurs.

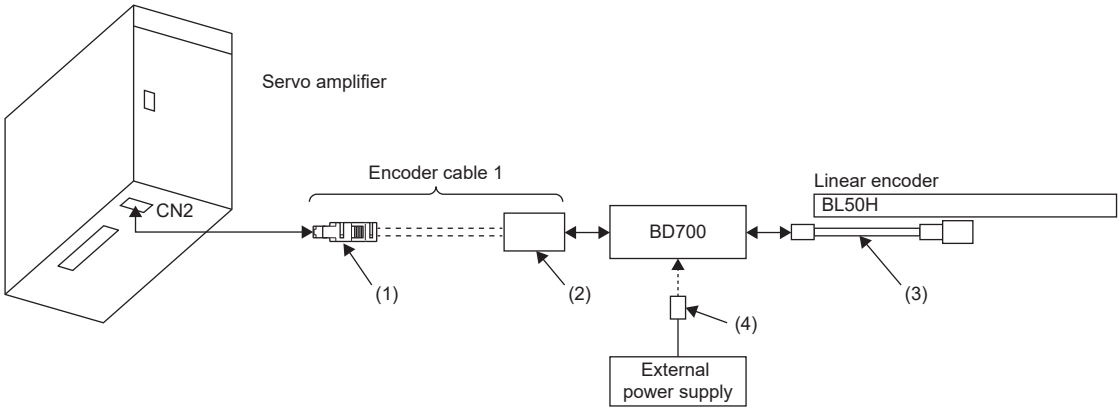


- This linear encoder is the one direction home position (Z-phase) specification. To execute homing securely, pay attention to the mounting direction of the scale, move the linear servo motor with the JOG operation from the controller or by other means so that it can pass the home position (Z-phase) from the home position (Z-phase) importing direction, and then start homing.

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor

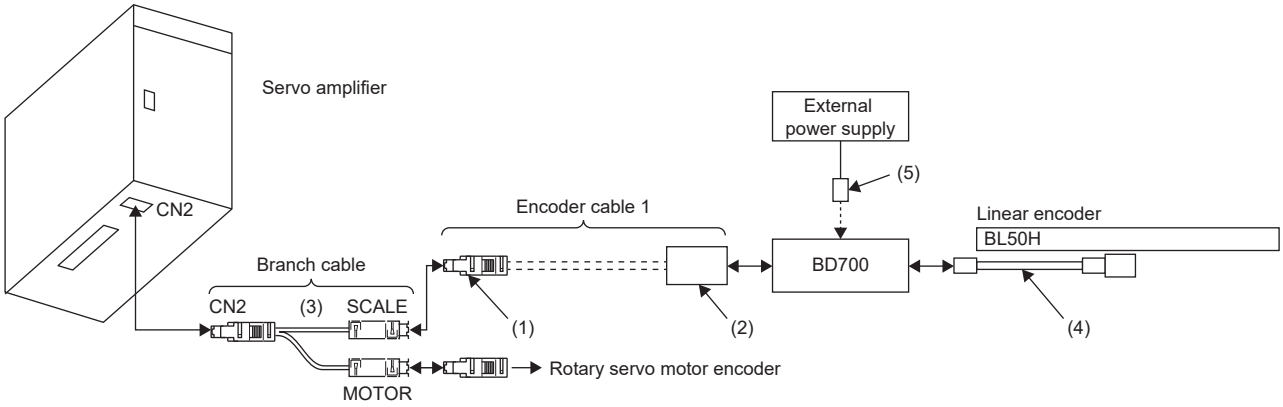


Condition	Encoder cable		Output cable	Cable for external power supply
When fabricating an encoder cable	(1) MR-J3CN2 connector set ☞ Page 50 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(2) Junction connector *1 Plug: HDR-E26M_G1+ (Honda Tsushin Kogyo) Shell kit: HDR-E26LP_P_+ (Honda Tsushin Kogyo)	(3) Attached cables 1 m, 3 m, 6 m	(4) Connector for external power supply (Interpolator accessory) Applicable connector: MC1.5/2-STF-3.81 (Phoenix Contact)

*1 These items should be prepared by the customer.

■For the fully closed loop system

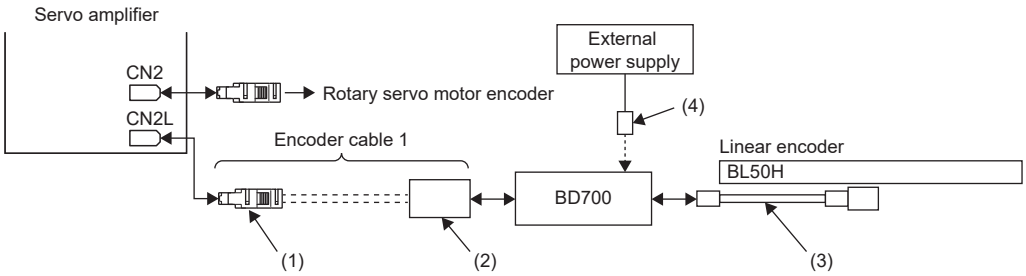
• Servo amplifier without CN2L



Condition	Branch cable	Encoder cable		Output cable	Cable for external power supply
When fabricating an encoder cable	(3) MR-J4FCCBL03M ☞ Page 50 Fabricating the encoder cable used to connect the servo amplifier and interpolator MR-J4FCCBL03M branch cable	(1) MR-J3CN2 connector set ☞ Page 50 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(2) Junction connector *1 Plug: HDR-E26M_G1+ (Honda Tsushin Kogyo) Shell kit: HDR-E26LP_P_+ (Honda Tsushin Kogyo)	(4) Attached cables 1 m, 3 m, 6 m	(5) Connector for external power supply (Interpolator accessory) Applicable connector: MC1.5/2-STF-3.81 (Phoenix Contact)

*1 These items should be prepared by the customer.

• Servo amplifier with CN2L



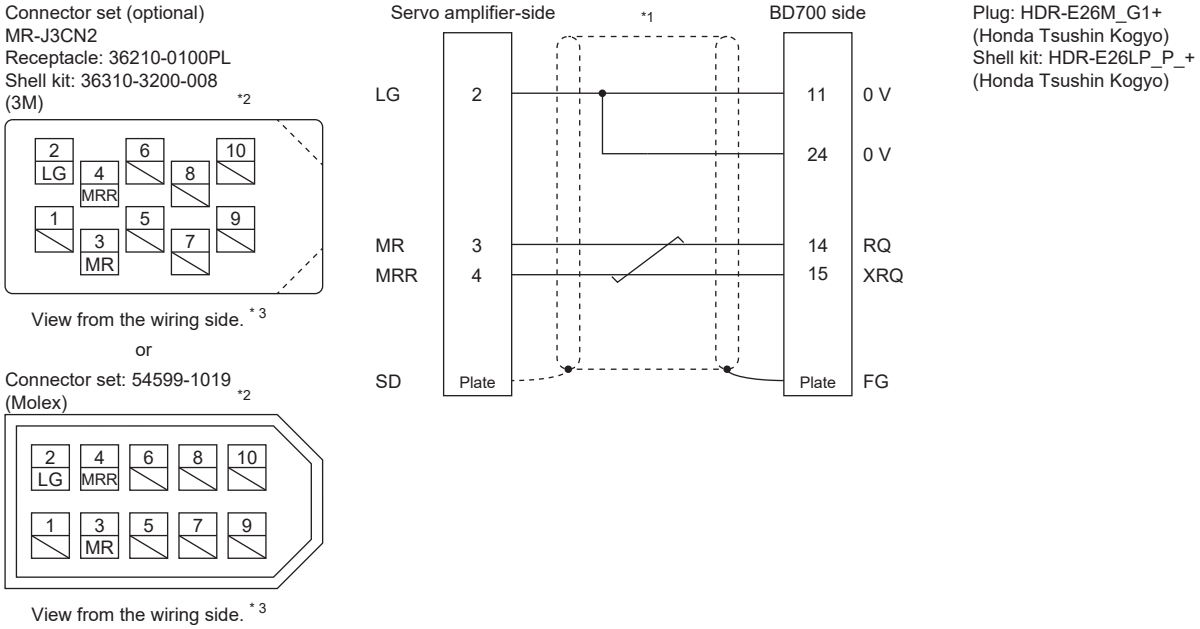
Condition	Encoder cable		Output cable	Cable for external power supply
When fabricating an encoder cable	(1) MR-J3CN2 connector set ☞ Page 50 Fabricating the encoder cable used to connect the servo amplifier and interpolator	(2) Junction connector *1 Plug: HDR-E26M_G1+ (Honda Tsushin Kogyo) Shell kit: HDR-E26LP_P_+ (Honda Tsushin Kogyo)	(3) Attached cables 1 m, 3 m, 6 m	(4) Connector for external power supply (Interpolator accessory) Applicable connector: MC1.5/2-STF-3.81 (Phoenix Contact)

*1 These items should be prepared by the customer.

Fabricating the encoder cable used to connect the servo amplifier and interpolator

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 15 m.

■Encoder cable 1



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 15 m	—	AWG 28

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

BL50H-FSE (incremental type)

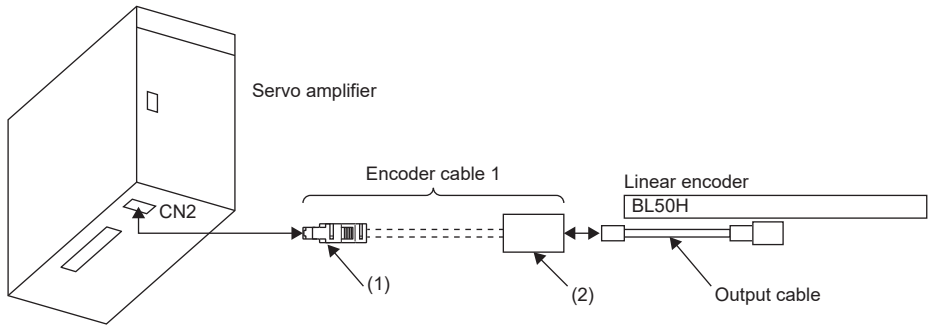
Precautions

- This linear encoder is the one direction home position (Z-phase) specification. To execute homing securely, pay attention to the mounting direction of the scale, move the linear servo motor with the JOG operation from the controller or by other means so that it can pass the home position (Z-phase) from the home position (Z-phase) importing direction, and then start homing.
- This linear encoder cannot be used on a fully closed loop system or with the scale measurement function.

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



Condition	Encoder cable *1		Output cable
When fabricating an encoder cable	(1) MR-J3CN2 connector set ☞ Page 52 Fabricating the encoder cable	(2) Junction connector *2 Plug: PCR-E20FS+ (Honda Tsushin Kogyo) Shell kit: PCS-20L (Honda Tsushin Kogyo)	Linear encoder accessory

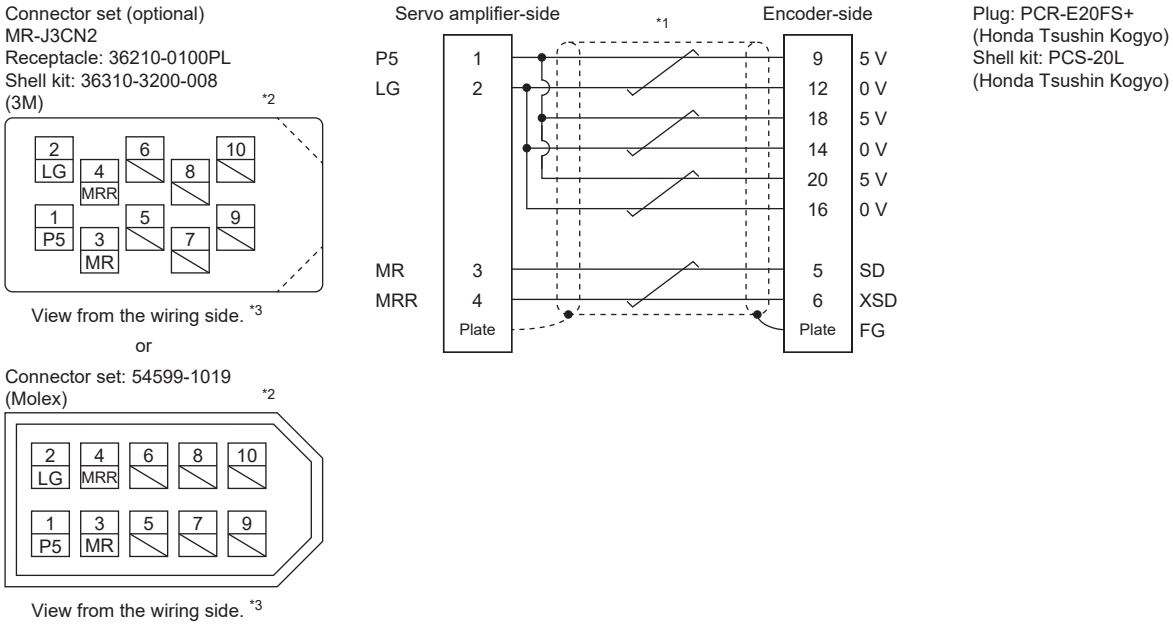
*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 15 m.

■Encoder cable 1



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 15 m	3 pairs	AWG 22

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

1.6 Linear encoder manufactured by Renishaw

Point

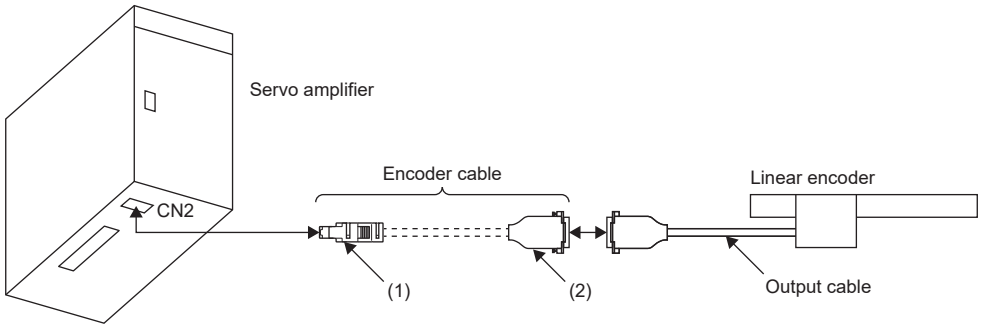
• The absolute position battery is not required when constructing an absolute position detection system.

RESOLUTE RL40M (absolute position type)

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



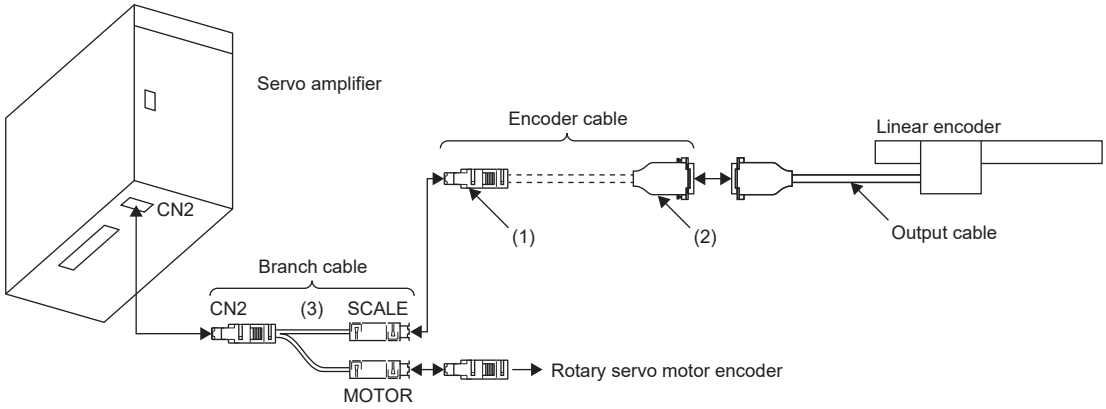
Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 55 Encoder cable	(2) Junction connector *2 15-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

■For the fully closed loop system

• Servo amplifier without CN2L

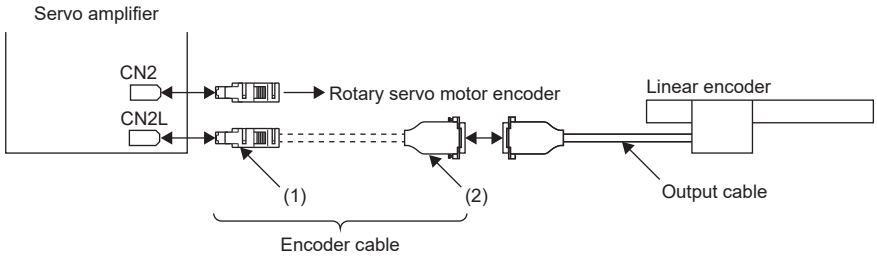


Branch cable	Encoder cable *1		Output cable
(3) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) MR-J3CN2 connector set ☞ Page 55 Fabricating the encoder cable	(2) Junction connector *2 15-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

• Servo amplifier with CN2L



Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 55 Fabricating the encoder cable	(2) Junction connector *2 15-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

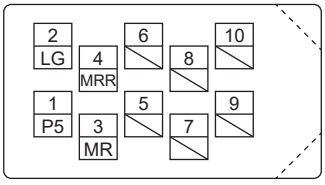
*2 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable

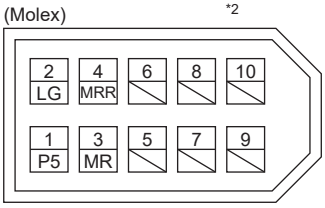
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



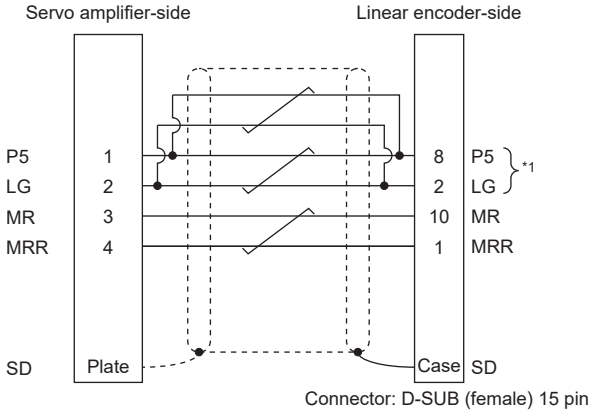
View from the wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



Connector: D-SUB (female) 15 pin

*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections (when the output cable is 0.5 m or less)	Wire size
Up to 10 m	1 pair	AWG 22
Up to 20 m	2 pairs	
Up to 30 m	3 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

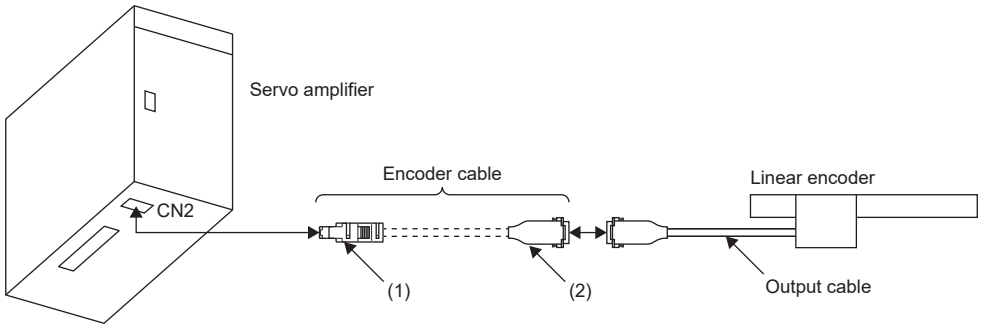
*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

EVOLUTE EL40M (absolute position type)

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



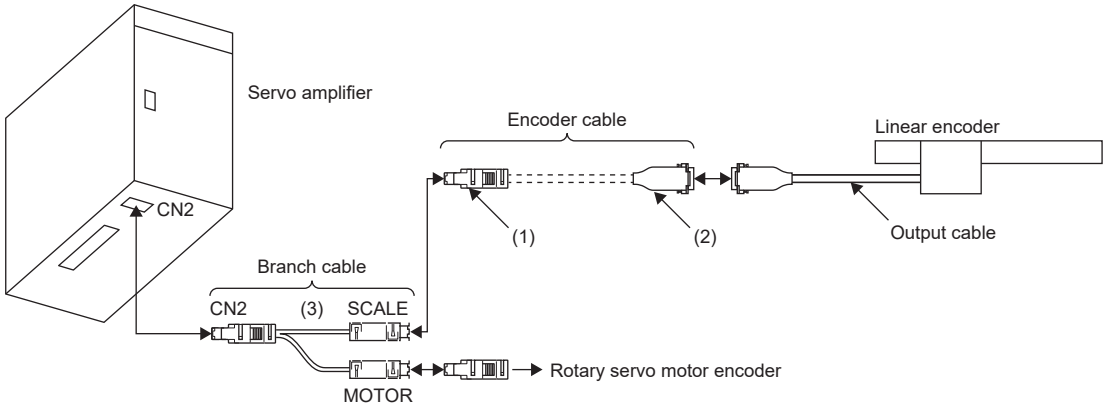
Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 58 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

■For the fully closed loop system

• Servo amplifier without CN2L

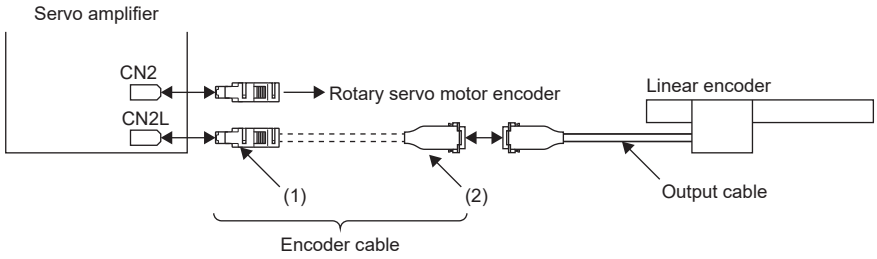


Branch cable	Encoder cable *1		Output cable
(3) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) MR-J3CN2 connector set ☞ Page 58 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

• Servo amplifier with CN2L



Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 58 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

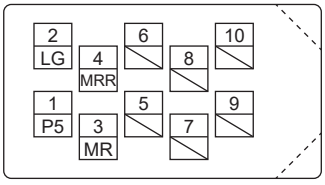
*2 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable

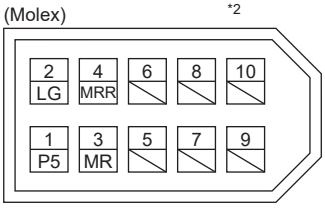
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



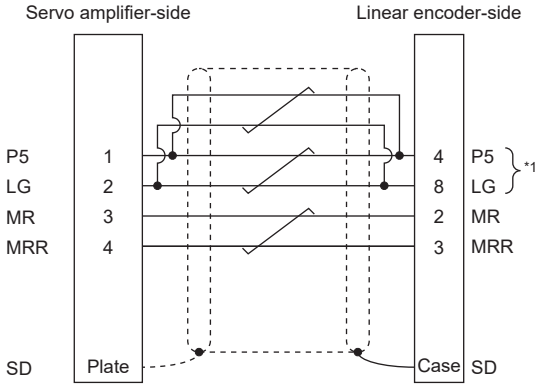
View from the wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



Connector: D-SUB (female) 9 pin

*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections (when the output cable is 0.5 m or less)	Wire size
Up to 10 m	1 pair	AWG 22
Up to 20 m	2 pairs	
Up to 30 m	3 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

FORTiS-S 40N/FORTiS-N 40N

Restriction

- This linear encoder is a four-wire type. To use this linear encoder, change the servo parameter to select the four-wire type. Refer to the following.

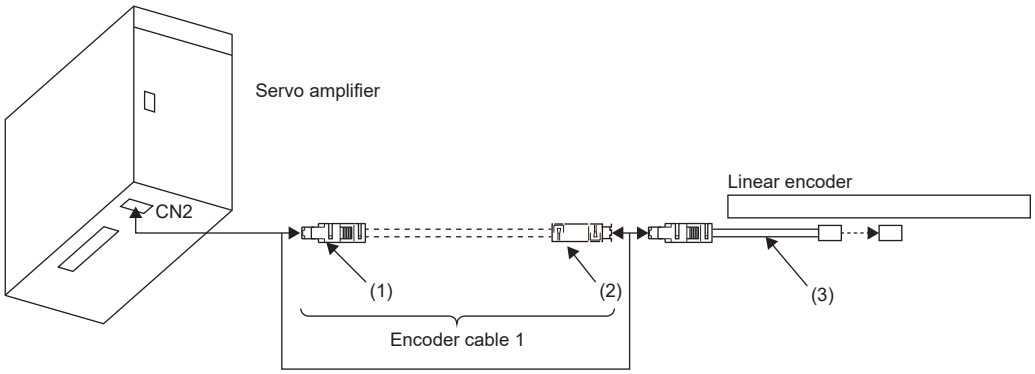
MR-JET-G User's Manual (Parameters)

- This linear encoder cannot be used on a fully closed loop system.

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



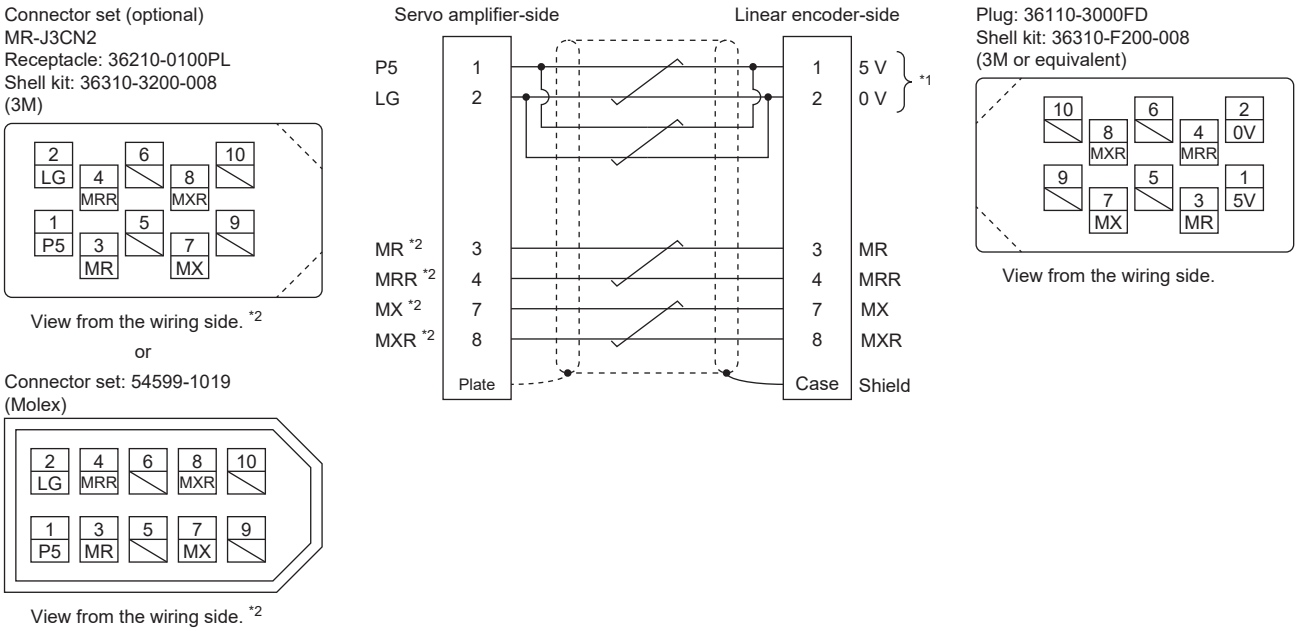
Condition	Encoder cable		Output cable
When not fabricating an encoder cable	—		(2) Option *1 AB-_-RPX: Up to 10 m (Renishaw)
When fabricating an encoder cable	(1) MR-J3CN2 connector set ☞ Page 60 Fabricating the encoder cable	(2) Junction connector *1 Plug: 36110-3000FD Shell kit: 36310-F200-008 (3M or equivalent)	(2) Option *1 AB-_-RPX: Up to 0.5 m (Renishaw)

*1 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable 1



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 10 m	1 pair	AWG 22
Up to 20 m	2 pairs	
Up to 30 m	3 pairs	

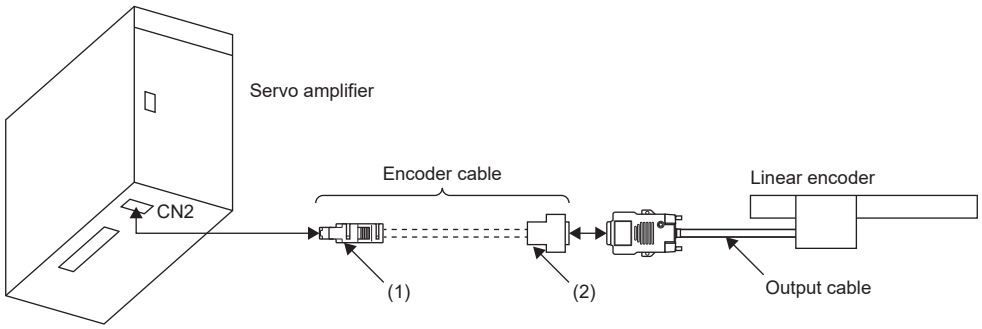
*2 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

1.7 Linear encoder PSLH041 manufactured by NIDEC INSTRUMENTS CORPORATION (Incremental type)

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



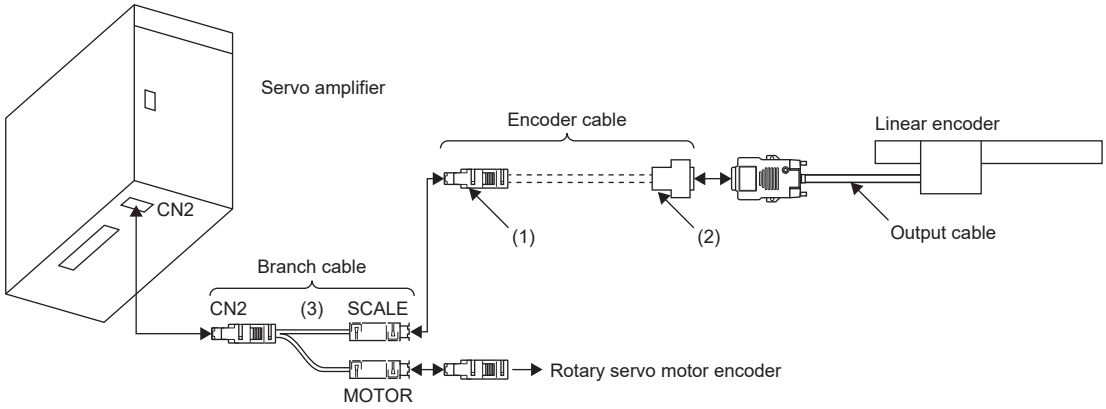
Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 63 Fabricating the encoder cable	(2) Junction connector *2 15-pin D-SUB (female)	Linear encoder accessory Cable length: 0.4 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

■For the fully closed loop system

• Servo amplifier without CN2L

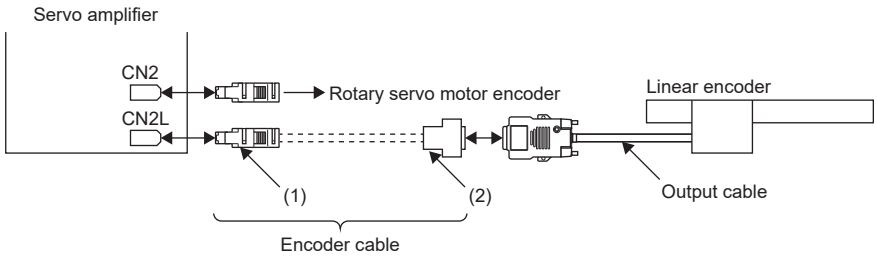


Branch cable	Encoder cable *1		Output cable
(3) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) MR-J3CN2 connector set ☞ Page 63 Fabricating the encoder cable	(2) Junction connector *2 15-pin D-SUB (female)	Linear encoder accessory Cable length: 0.4 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

• Servo amplifier with CN2L



Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 63 Fabricating the encoder cable	(2) Junction connector *2 15-pin D-SUB (female)	Linear encoder accessory Cable length: 0.4 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

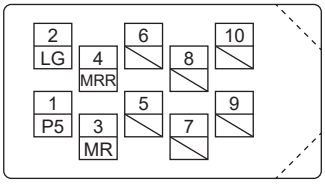
*2 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 30 m.

■Encoder cable

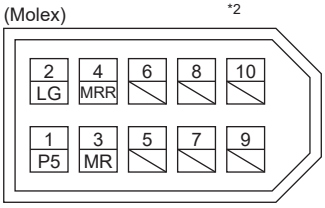
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



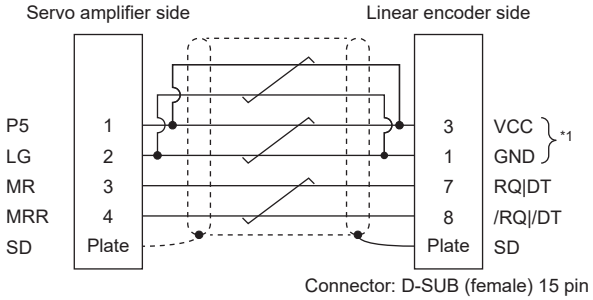
View from the wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



Connector: D-SUB (female) 15 pin

*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections (when the output cable is 0.5 m or less)	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	4 pairs	
Up to 30 m	5 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

1.8 Linear encoder manufactured by NIDEC MACHINE TOOL CORPORATION

MPFA-HZ-M01 (absolute position type)

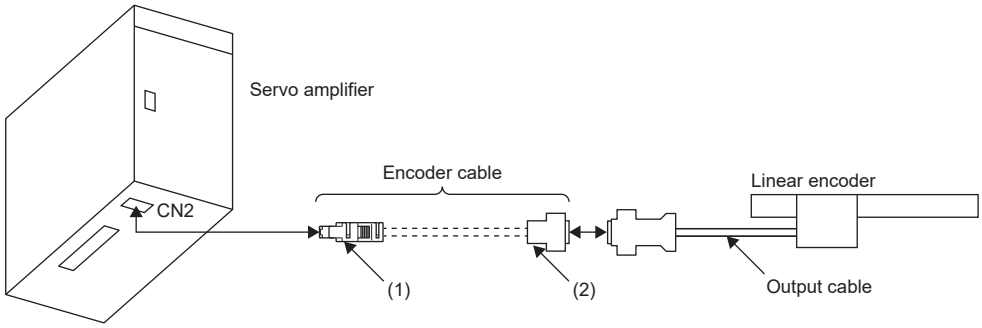
Point

The absolute position battery is not required when constructing an absolute position detection system.

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



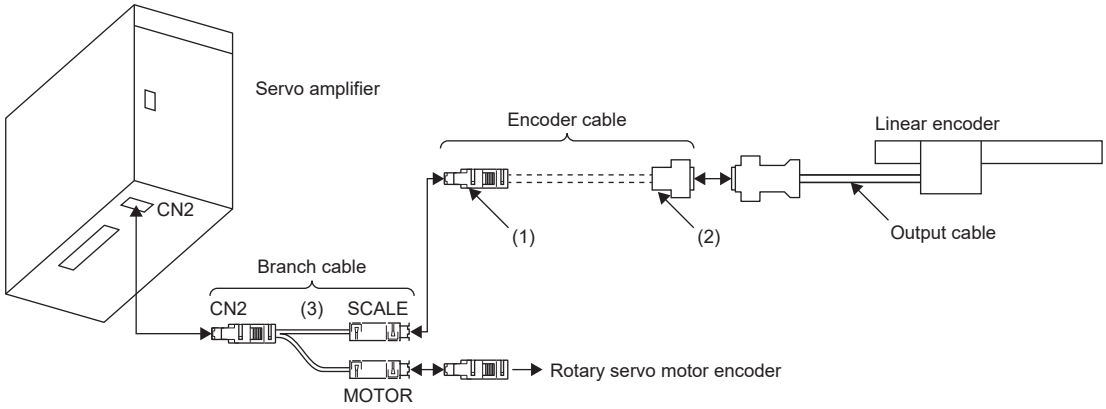
Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 66 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

■For the fully closed loop system

• Servo amplifier without CN2L

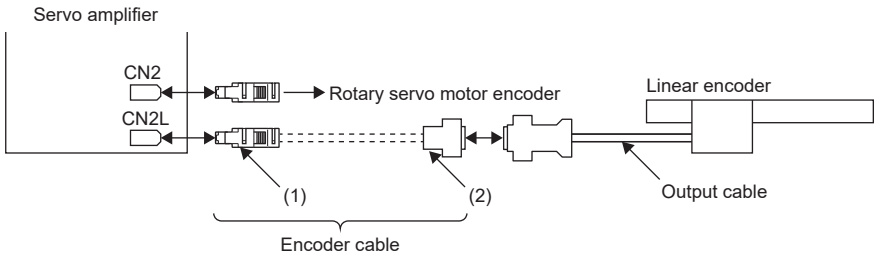


Branch cable	Encoder cable *1		Output cable
(3) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) MR-J3CN2 connector set ☞ Page 66 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

• Servo amplifier with CN2L



Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 66 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

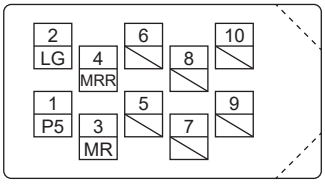
*2 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 20 m.

■Encoder cable

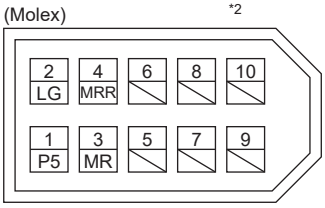
Connector set (option)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



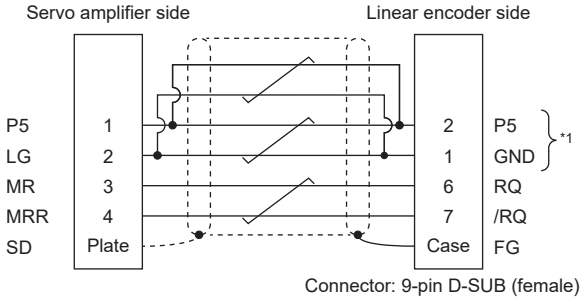
View from the wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

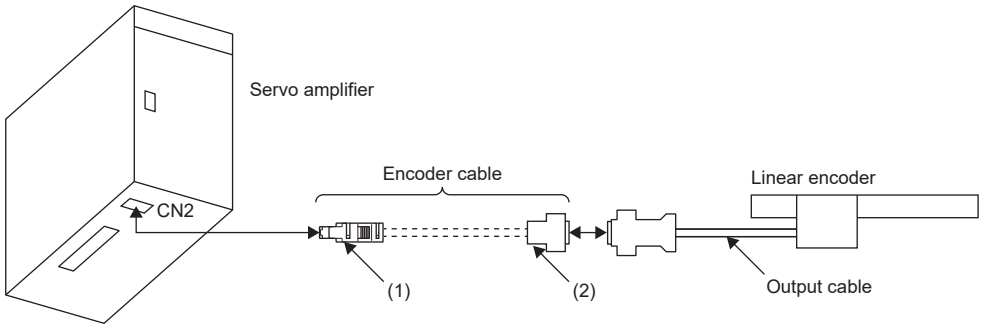
*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

MPFA-HI-M01 (incremental type)

Cable structure

Prepare cables based on the following configuration diagram.

■For the linear servo motor



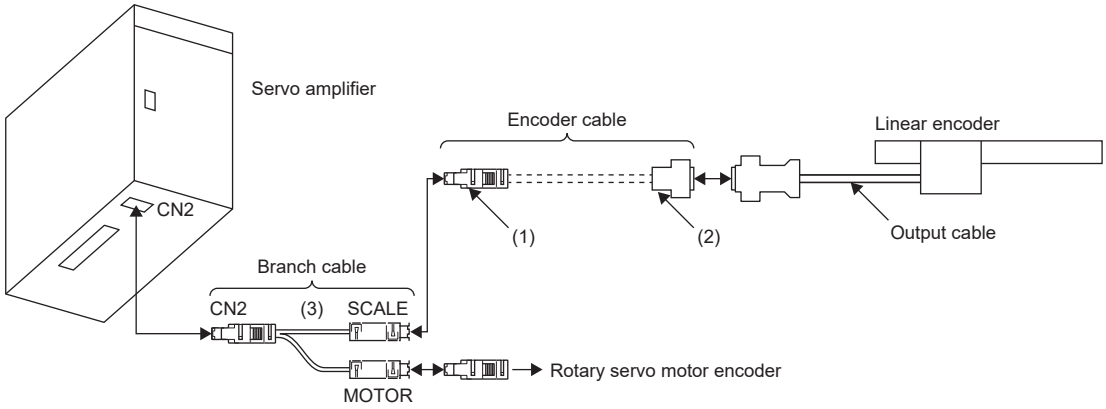
Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 69 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

■For the fully closed loop system

• Servo amplifier without CN2L

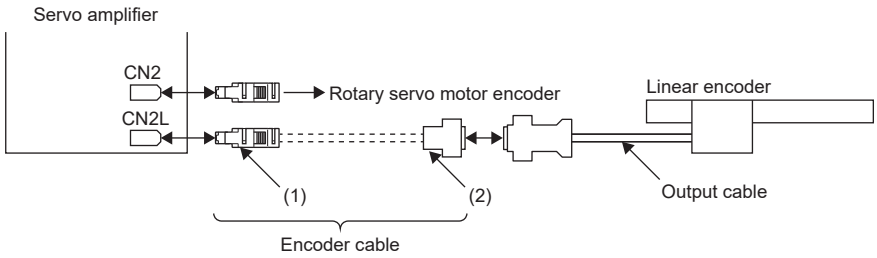


Branch cable	Encoder cable *1		Output cable
(3) MR-J4FCCBL03M ☞ Page 82 MR-J4FCCBL03M branch cable	(1) MR-J3CN2 connector set ☞ Page 69 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

*2 These items should be prepared by the customer.

• Servo amplifier with CN2L



Encoder cable *1		Output cable
(1) MR-J3CN2 connector set ☞ Page 69 Fabricating the encoder cable	(2) Junction connector *2 9-pin D-SUB (female)	Linear encoder accessory Cable length: 0.5 m

*1 Encoder cables are to be fabricated by the customer. Optional cables are not available.

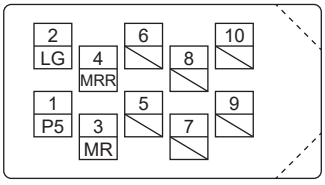
*2 These items should be prepared by the customer.

Fabricating the encoder cable

Fabricate the encoder cable using the MR-J3CN2 connector set and junction connector as shown below. The encoder cable may be as long as 20 m.

■Encoder cable

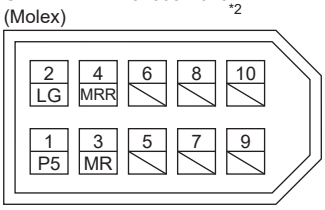
Connector set (optional)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M) *2



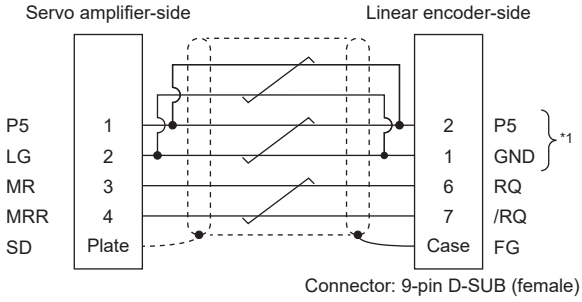
View from the wiring side. *3

or

Connector set: 54599-1019
(Molex) *2



View from the wiring side. *3



*1 Encoder cables that meet the following specifications are recommended.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	1 pair	AWG 22
Up to 10 m	2 pairs	
Up to 20 m	3 pairs	

*2 The signals of pins 3 and 4 of the CN2L connector are as follows.
Pin 3: MR2
Pin 4: MRR2

*3 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

1.9 A/B/Z-phase differential output type encoder

This section explains how to connect an A/B/Z-phase differential output type encoder to a servo amplifier.

Precautions

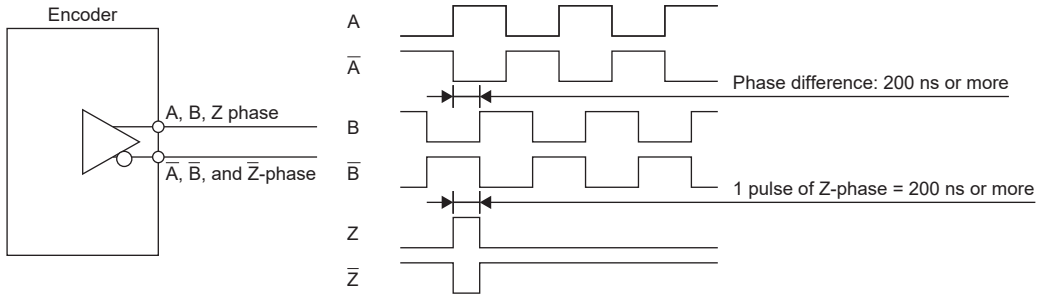
A/B/Z-phase differential output rotary encoders cannot be connected to the servo motor side.

Point

Use the encoder that satisfies the specifications described in this section. For information on the encoder specifications (resolution and output specifications), contact the manufacturer of the encoder being used.

A/B/Z-phase differential output type encoder specifications

The signals of A/B/Z-phase encoders are output by a differential line driver. Open collector outputs cannot be used.
The phase differences of the A-phase and B-phase pulses and the pulse width of the Z-phase pulse need to be 200 ns or more.
If the phase difference is less than 200 ns, a signal from the encoder may not be read and a position mismatch may occur.
The multiply-by-four count method is used for A-phase and B-phase output pulses of the A/B/Z-phase differential output type encoder.



Tolerable resolution range

The following table shows the tolerable resolution range of the A/B/Z-phase differential output type encoder. Select an encoder that has a resolution within this range.

Encoder type	Tolerable resolution range
Linear encoder	0.001 µm to 5 µm
Rotary encoder	4096 pulses/rev to 67108864 pulses/rev *1

*1 If speed ripples/torque ripples occur, change the encoder to the one with a higher resolution.

Upper speed limit

The upper speed limit depends on the phase difference and the encoder resolution.
The following tables show examples of the relation between the encoder resolution and the upper speed limit when the phase difference is 200 ns.

Item	Linear encoder resolution [µm]							
	0.001	0.005	0.01	0.05	0.1	0.5	1	5
Upper limit speed [m/s] *1	0.005	0.025	0.05	0.25	0.50	2.50	5.00	25.00

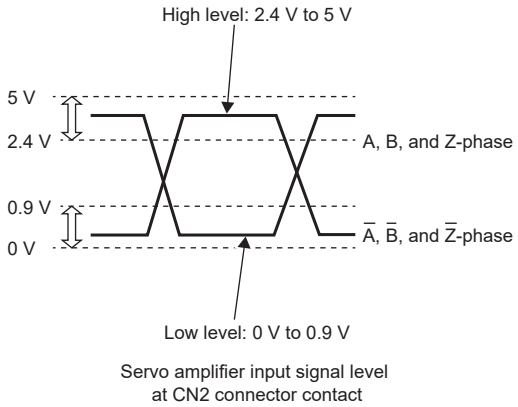
Item	Rotary encoder resolution [pulse/rev]							
	4096	65536	163840	1048576	4194304	8388608	16777216	67108864
Upper limit speed [r/min] *1	73242.19	4577.64	1831.05	286.10	71.53	35.76	17.88	4.47

*1 The upper limit speed of the encoders that can be used in the servo amplifiers. For information on the upper speed limit, contact the manufacturer of the encoder being used.

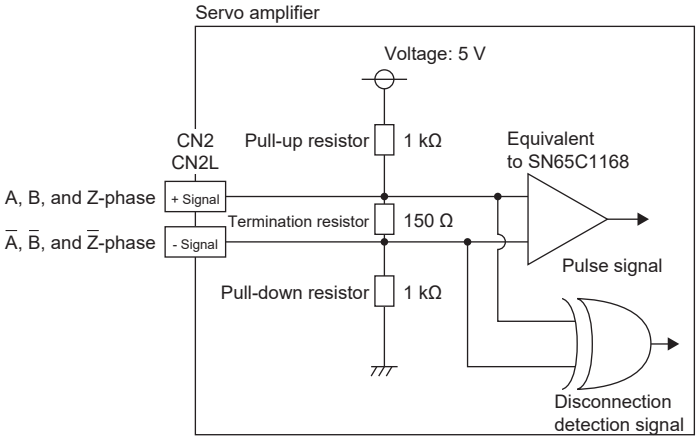
Servo amplifier input signal level

The input circuit of the servo amplifier is as shown in the following diagram. Use the encoder whose high and low signal levels at the CN2 and CN2L connector contacts of each phase are within the following specified values.

- High level: 2.4 V to 5 V
- Low level: 0 V to 0.9 V



Servo amplifier input signal level
at CN2 connector contact

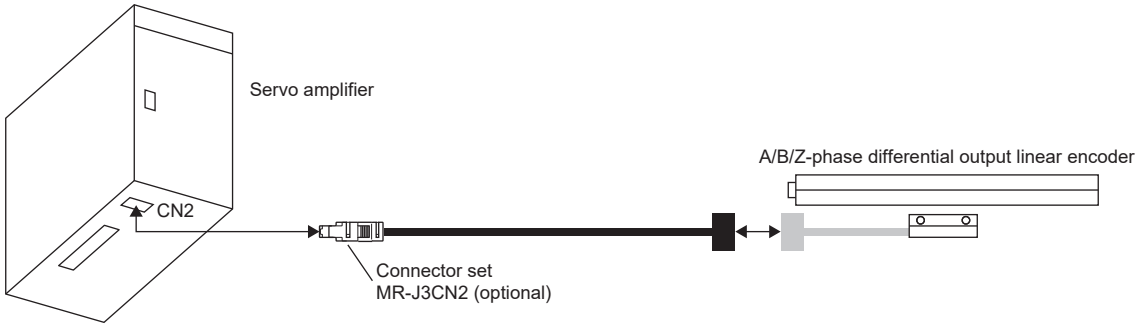


Connection for the linear servo motor

Precautions

When using an A/B/Z-phase differential output type encoder, set [Pr. PC26.0 A/B/Z-phase input encoder connection selection] to "2" (enabled (only A/B/Z-phase input encoders are supported)).

Servo amplifier without CN2L

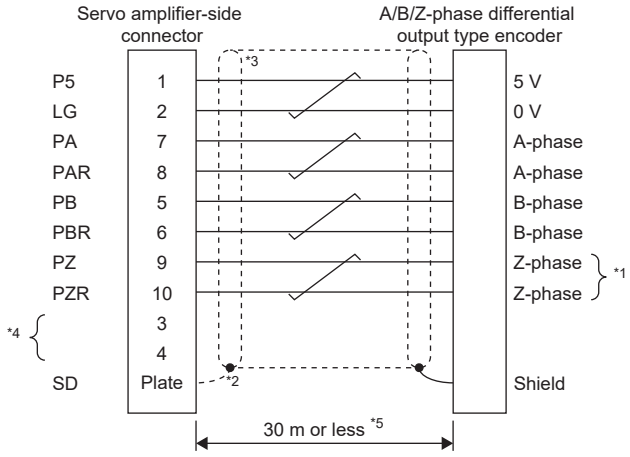


■Internal wiring diagram

Fabricate cables using wire that can withstand repetitive bending. The maximum cable length is 30 m, however, the length may need to be shortened due to the power supply voltage drop or the specifications of the encoder being used.

A connection example is shown below. For further information, contact the manufacturer of the encoder being used.

• For encoders with a current consumption of 350 mA or less



*1 For the encoder without Z-phase, set [Pr. PC27.2] to "1".

*2 Securely connect the shielded wire to the ground plate (plate) of the connector.

☞ Page 7 Shielding CN2 side connectors

*3 Encoder cables that meet the following specifications are recommended when the current consumption of the encoder is 350 mA. If the current consumption of the encoder is less than 350 mA, the number of paired connections can be decreased.

Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	2 pairs	AWG 22
Up to 10 m	3 pairs	
Up to 20 m	6 pairs	
Up to 30 m	8 pairs	

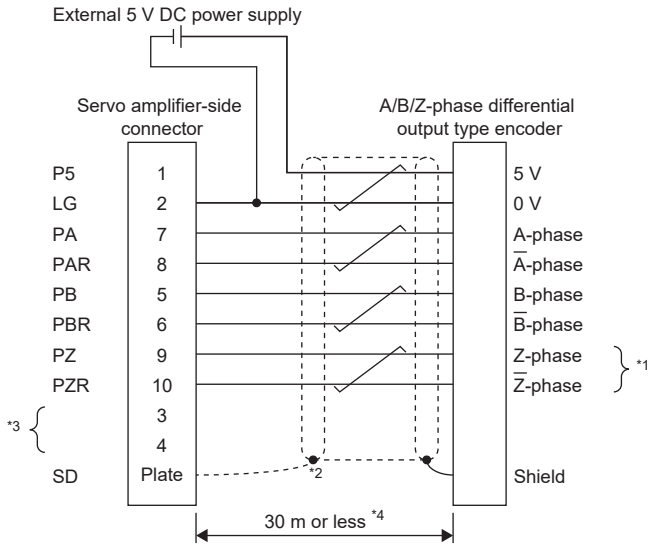
*4 Do not connect anything to pins 3 and 4.

*5 The maximum cable length from the CN2 connector to the encoder must be 30 m.

- For encoders with a current consumption of more than 350 mA

Precautions

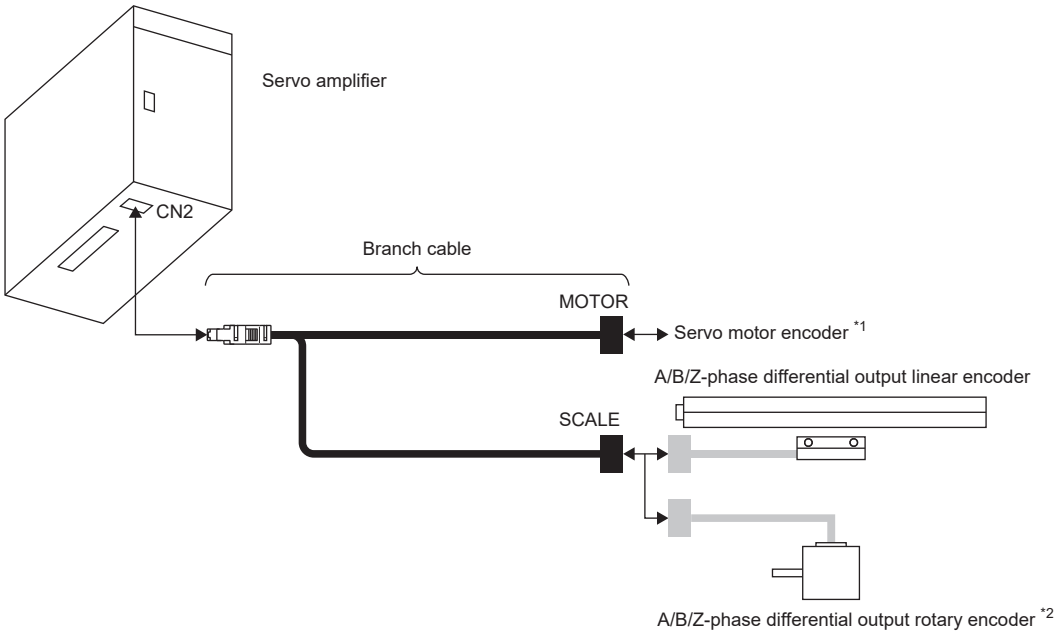
- When turning on the power, turn on the encoder, and then turn on the servo amplifier. When turning off the power, turn off the servo amplifier, and then turn off the linear encoder.



*1 For the encoder without Z-phase, set [Pr. PC27.2] to "1".
*2 Securely connect the shielded wire to the ground plate (plate) of the connector.
☞ Page 7 Shielding CN2 side connectors
*3 Do not connect anything to pins 3 and 4.
*4 The maximum cable length from the CN2 connector to the encoder must be 30 m.

Connection for the fully closed loop system and scale measurement function

Servo amplifier without CN2L



*1 Use a two-wire type encoder cable. A four-wire type encoder cable cannot be used.

*2 When a servo motor is used for the rotary encoder, a voltage is output from the power cable or the connector. Insulation is therefore required. The output voltage depends on the servo motor specifications. Insulate each wire of the power cable or connector according to the maximum voltage.

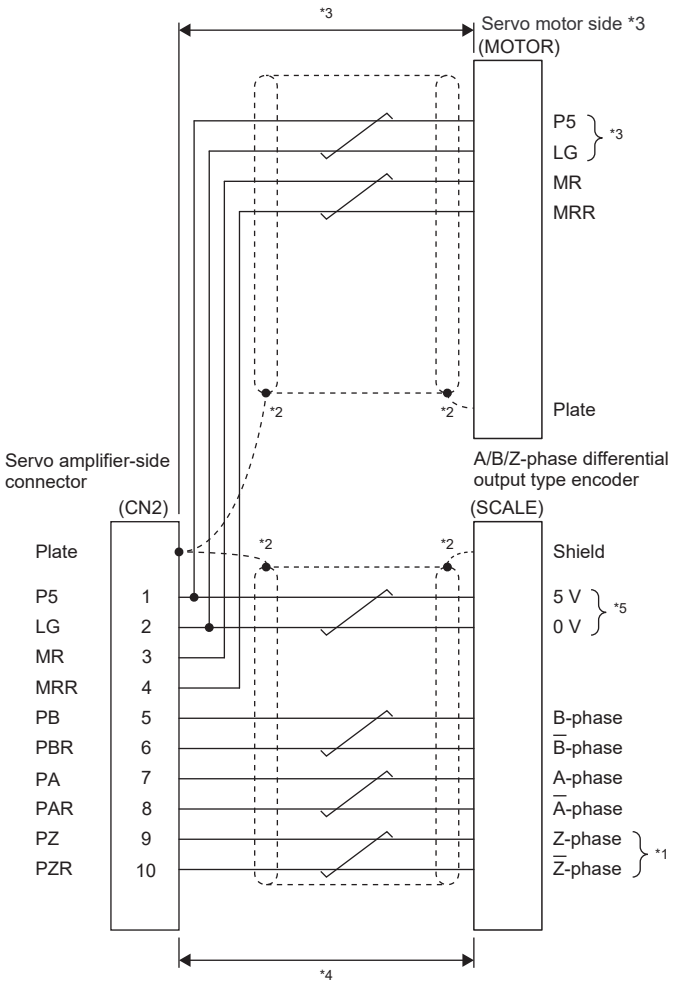
■Internal wiring diagram

Prepare the encoder connector set that supports the servo motor to be used and fabricate the branch cable. For the encoder connector set, refer to the "Combinations of cables/connector sets" in the following manual.

📖Rotary Servo Motor User's Manual (For MR-JET)

The length of the branch cable may need to be shortened due to the power supply voltage drop or the specifications of the encoder being used.

- For encoders with a current consumption of 350 mA or less



*1 For the encoder without Z-phase, set [Pr. PC27.2] to "1".

*2 Securely connect the extended conductor of the shielded cable to the ground plate (plate) of the connector.
☞ Page 7 Shielding CN2 side connectors

*3 For the information on connectors on the servo motor side, number of LG and P5 connections, and cable length to fabricate the branch cable, refer to the internal wiring diagram that supports the encoder connector set to be used. However, the maximum cable length from the CN2 connector to the encoder must be 50 m including the length of the branch cable. For the internal wiring diagram, refer to the following manual.
📖Rotary Servo Motor User's Manual (For MR-JET)

*4 The length of the encoder cable that can be fabricated depends on the specifications of the encoder. For the length of the encoder on the SCALE side, contact the manufacturer of the encoder being used. However, the maximum cable length from the CN2 connector to the encoder must be 30 m including the length of the branch cable.

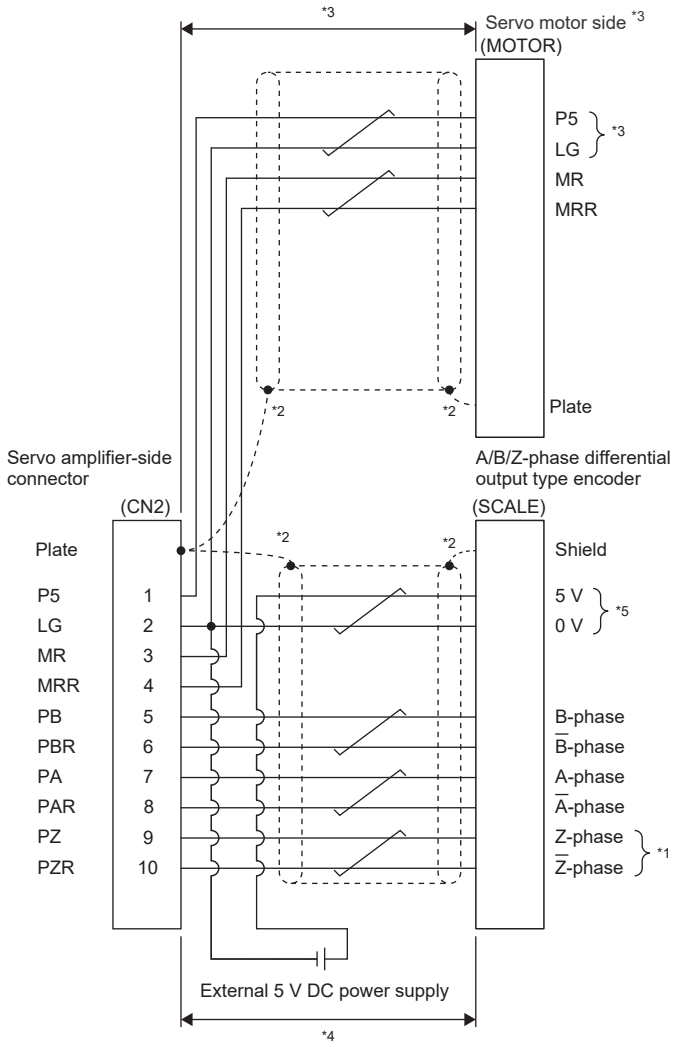
*5 Encoder cables that meet the following specifications are recommended when the current consumption of the encoder is 350 mA. If the current consumption of the encoder is less than 350 mA, the number of paired connections can be decreased.

Wiring length	Number of paired 5 V and 0 V connections	Wire size
Up to 5 m	2 pairs	AWG 22
Up to 10 m	3 pairs	
Up to 20 m	6 pairs	
Up to 30 m	8 pairs	

• For encoders with a current consumption of more than 350 mA

Precautions

When turning on the power, turn on the encoder, and then turn on the servo amplifier. When turning off the power, turn off the servo amplifier, and then turn off the linear encoder.



*1 For the encoder without Z-phase, set [Pr. PC27.2] to "1".

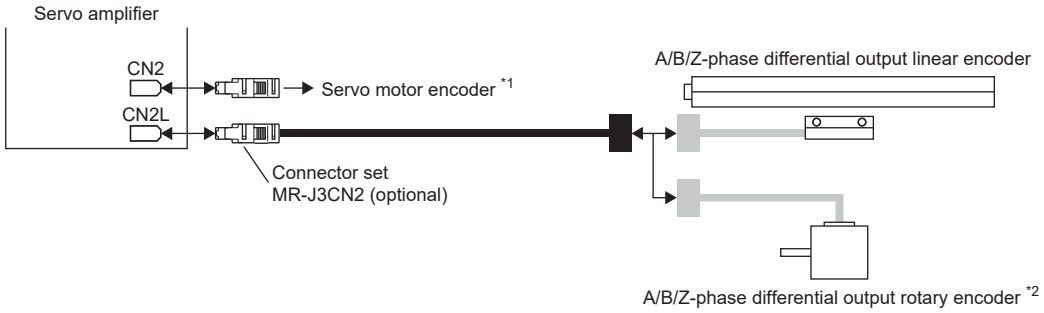
*2 Securely connect the extended conductor of the shielded cable to the ground plate (plate) of the connector.
☞ Page 7 Shielding CN2 side connectors

*3 For the information on connectors on the servo motor side, number of LG and P5 connections, and cable length to fabricate the branch cable, refer to the internal wiring diagram that supports the encoder connector set to be used. However, the maximum cable length from the CN2 connector to the encoder must be 50 m including the length of the branch cable. For the internal wiring diagram, refer to the following manual.
Rotary Servo Motor User's Manual (For MR-JET)

*4 The length of the encoder cable that can be fabricated depends on the specifications of the encoder. For the length of the encoder on the SCALE side, contact the manufacturer of the encoder being used. However, the maximum cable length from the CN2 connector to the encoder must be 30 m including the length of the branch cable.

*5 For the wiring 5 V and 0 V, contact the manufacturer of the encoder being used.

Servo amplifier with CN2L



*1 Use a two-wire type encoder cable. A four-wire type encoder cable cannot be used.

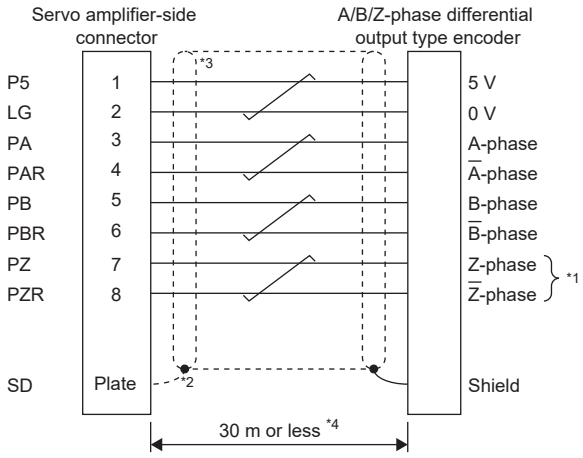
*2 When a servo motor is used for the rotary encoder, a voltage is output from the power cable or the connector. Insulation is therefore required. The output voltage depends on the servo motor specifications. Insulate each wire of the power cable or connector according to the maximum voltage.

■Internal wiring diagram

Fabricate cables using wire that can withstand repetitive bending. The maximum cable length is 30 m, however, the length may need to be shortened due to the power supply voltage drop or the specifications of the encoder being used.

A connection example is shown below. For further information, contact the manufacturer of the encoder being used.

- For encoders with a current consumption of 350 mA or less



*1 For the encoder without Z-phase, set [Pr. PC27.2] to "1".

*2 Securely connect the shielded wire to the ground plate (plate) of the connector.
☞ Page 7 Shielding CN2 side connectors

*3 Encoder cables that meet the following specifications are recommended when the current consumption of the encoder is 350 mA. If the current consumption of the encoder is less than 350 mA, the number of paired connections can be decreased.

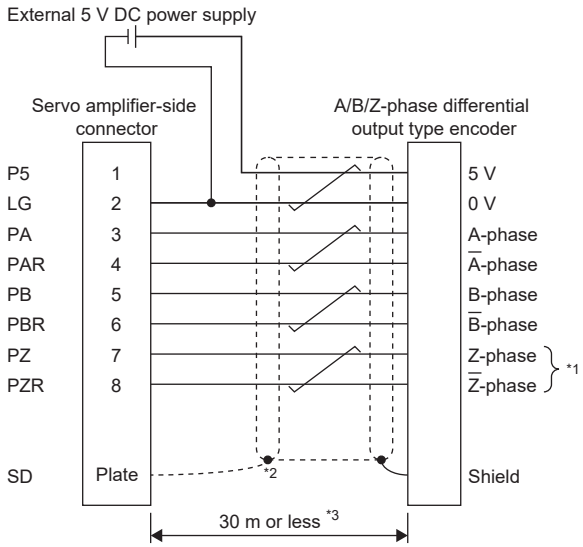
Wiring length	Number of paired LG and P5 connections	Wire size
Up to 5 m	2 pairs	AWG 22
Up to 10 m	3 pairs	
Up to 20 m	6 pairs	
Up to 30 m	8 pairs	

*4 The maximum cable length from the CN2 connector to the encoder must be 30 m.

• For encoders with a current consumption of more than 350 mA

Precautions

• When turning on the power, turn on the encoder, and then turn on the servo amplifier. When turning off the power, turn off the servo amplifier, and then turn off the linear encoder.



*1 For the encoder without Z-phase, set [Pr. PC27.2] to "1".

*2 Securely connect the shielded wire to the ground plate (plate) of the connector.
☞ Page 7 Shielding CN2 side connectors

*3 The maximum cable length from the CN2 connector to the encoder must be 30 m.

MEMO

2 OPTION CABLES/CONNECTOR SETS

2.1 MR-EKCBL_M-H encoder cable

Model explanations

Model: M R - E K C B L 2 M - H
Long bending life

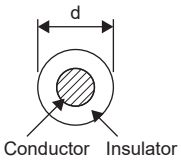
Symbol	Cable length [m]
2	2
5	5

Cable structure

The table below shows the structure of this option cable.

IP rating	Bending life	Length [m]	Core size [mm^2]	Number of cores [Numbers]	Characteristics of one core			Cable OD [mm] *2	Recommended wire model (Manufacturer)
					Structure [Wires/ mm]	Conductor resistance [Ω/km]	Insulator OD d [mm] *1		
IP20	Long bending life	2/5	0.2	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	A14B2339 6P (Junkosha) *3

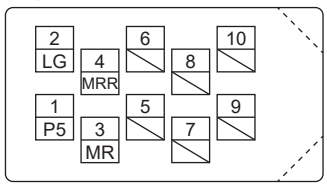
*1 The dimensions (d) are as shown below.



*2 Standard OD. The maximum OD is about 10 % greater for dimensions without tolerances.
*3 Supplier: Toa Electric Industrial Co. Ltd., Nagoya Branch

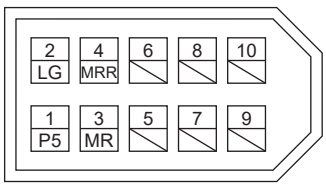


Cable model	(1) SCALE-side connector on the branch cable		(2) Junction connector
MR-EKCBL_M-H	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M)	Connector set: 54599-1019 (Molex)	Housing: 1-172161-9 Connector pin: 170359-1 (TE Connectivity or equivalent) Cable clamp: MTI-0002 (Toa Electric Industrial)

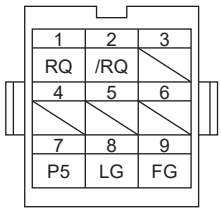


View from the wiring side. *1

or



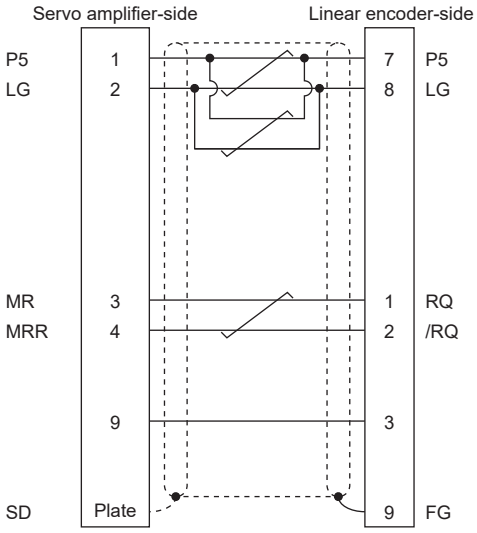
View from the wiring side. *1



View from the wiring side.

*1 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.
☞ Page 7 Shielding CN2 side connectors

Internal wiring diagram



2.2 MR-ECNM connector set

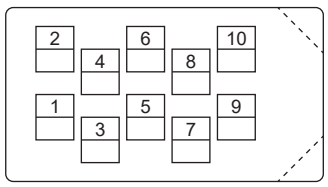
The following shows the connector combination for this connector set.

IP rating	Parts	Description
IP20	Connector set	MR-ECNM  Servo amplifier-side connector Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) or Connector set: 54599-1019 (Molex)  Junction connector Housing: 1-172161-9 Connector pin: 170359-1 (TE Connectivity or equivalent) Cable clamp: MTI-0002 (Toa Electric Industrial)

2.3 MR-J3CN2 connector set

The following shows the details of this connector set.

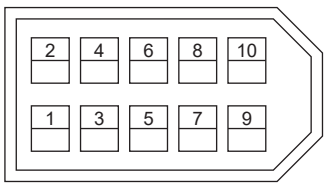
Connector set
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M or equivalent)



View from the wiring side.

or

Connector set: 54599-1019
(Molex)



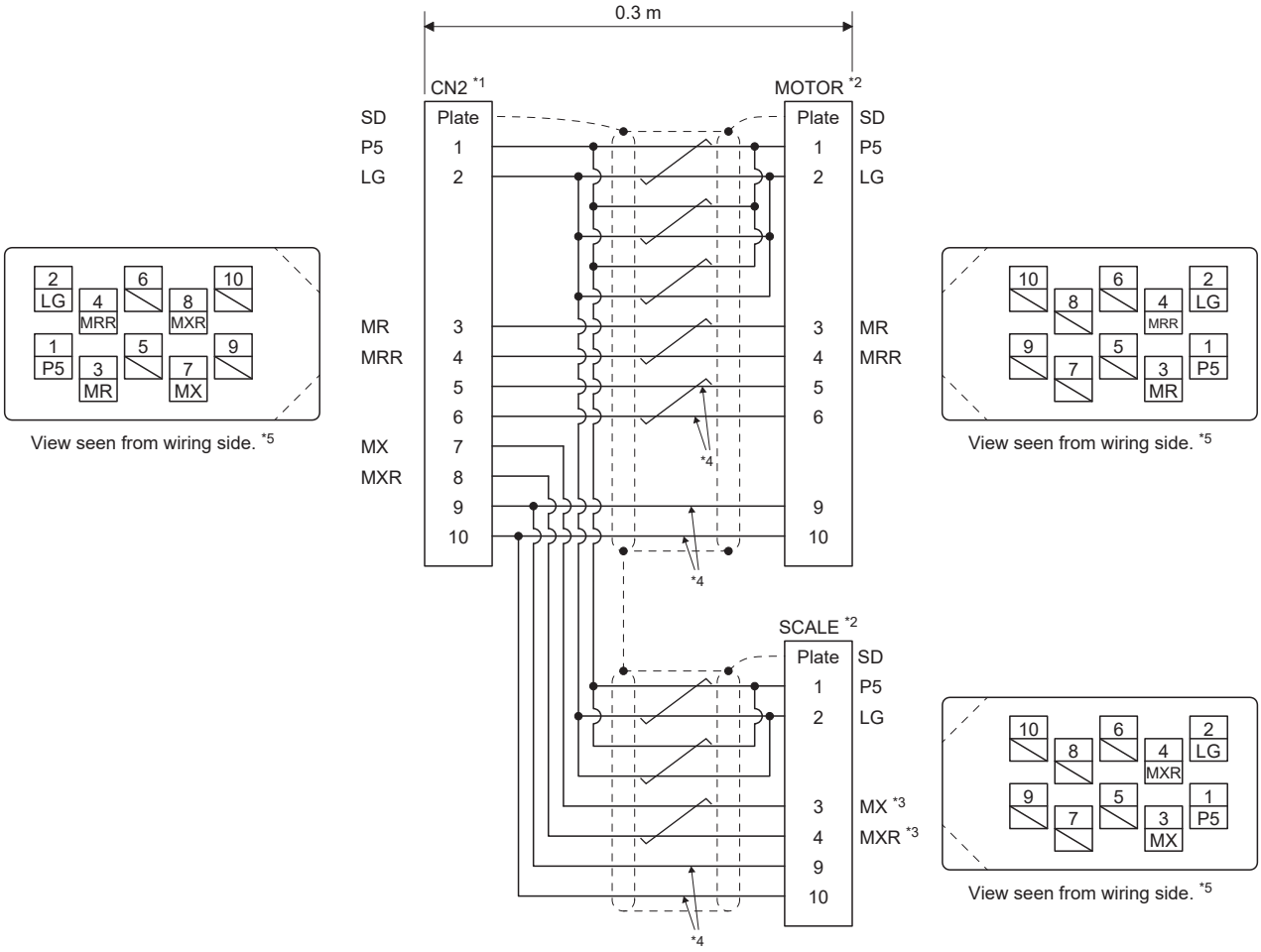
View from the wiring side.

2.4 MR-J4FCCBL03M branch cable

This branch cable is for connecting the encoder and of a rotary servo motor and the load-side linear encoder to the CN2 connector.

Refer to the following when fabricating the branch cable using the MR-J3THMCN2 connector set.

☞ Page 96 Fabricating a branch cable for a fully closed loop system



*1 Receptacle: 36210-0100PL, Shell kit: 36310-3200-008 (3M)

*2 Plug: 36110-3000FD, Shell kit: 36310-F200-008 (3M)

*3 MX of the SCALE connector is connected to MR of the load-side linear encoder, and MXR of the SCALE connector is connected to MRR of the load-side linear encoder.

*4 Wiring is not necessary for when a branch cable is fabricated.

*5 Do not connect anything to the pins that are marked with a diagonal line. Securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.

☞ Page 7 Shielding CN2 side connectors

3 ALARM HANDLING METHODS

If the actions described in this chapter do not solve the alarm, contact the manufacturer of the product being used.

3.1 Detailed explanation of [AL. 028 Linear encoder error 2]

Linear encoder manufactured by Mitutoyo

AT343A/AT54_A

Detail No.	Details	Cause	Check/action method
028.1	Thermal alarm	The alarm is output when a thermal alarm is detected in the detection head. • The ambient temperature of the detection head is high. • Failure of the detection head	If the ambient temperature of the detection head is 60 °C or higher, review the operation conditions or the mounting position of the scale.

ST74_A

Detail No.	Details	Cause	Check/action method
028.1	Signal strength alarm	The alarm is output when the detected signal strength enters the error range. • Position relation between the detection head and scale outside of specifications • Disconnection caused by flaws of the scale • Failure of the detection head	Check if the position relation between the detection head and scale satisfies the specifications. Check if the signal strength is within the normal range for the total length of the scale. Check for errors at a specific position, and check for flaws and dirt on the scale around the error occurrence position. Adjust the signal as necessary.
	Thermal alarm	The alarm is output when a thermal alarm is detected in the detection head. • The ambient temperature of the detection head is high. • Failure of the detection head	If the ambient temperature of the detection head is 60 °C or higher, review the operation conditions or the mounting position of the scale.

ST134_A

Detail No.	Details	Cause	Check/action method
028.1 028.2	Signal strength alarm	The alarm is output when the detected signal strength enters the error range. • Position relation between the detection head and scale outside of specifications • Disconnection caused by flaws of the scale • Failure of the detection head	Check if the position relation between the detection head and scale satisfies the specifications. Check if the signal strength is within the normal range for the total length of the scale. Check for errors at a specific position, and check for flaws and dirt on the scale around the error occurrence position. Adjust the signal as necessary.
	Thermal alarm	The alarm is output when a thermal alarm is detected in the detection head. • The ambient temperature of the detection head is high. • Failure of the detection head	If the ambient temperature of the detection head is 60 °C or higher, review the operation conditions or the mounting position of the scale.

Linear encoder manufactured by Magnescale

SR77/SR87/SR27A/SR67A/SQ47/SQ57

Detail No.	Details	Cause	Check/action method
028.1	Encoder warning	The signal level has decreased or excessive level (signal level overflow) has occurred.	Check if the reading position relation between the scale and head such as the gap satisfy the specifications. If the error repeats at the same position, contact Magnescale.

SR75/SR85/SL710+PL101-RM/SL710+PL101-RHM/SQ10+PQ10+MQ10/BL50H+BD700/BL50H+FSE

Detail No.	Details	Cause	Check/action method
028.1	Encoder warning	The signal level has decreased or excessive level (signal level overflow) has occurred.	Check if the reading position relation between the scale and head such as the gap satisfy the specifications. If the error repeats at the same position, contact Magnescale.

Linear encoder manufactured by Renishaw

Detail No.	Details	Cause	Check/action method
028.1	Insufficient signal strength	The mounting conditions of the readhead and scale are poor. • Dirt on the scale • Flaws of the readhead and scale • Dirt on the readhead	Remove the readhead, then clean the detection window. Clean the entire scale. If there is a flaw on the scale or detection window of the readhead, identify the cause of the flaw and remove the cause. Mount the readhead in accordance with the installation guide.
	Excessive temperature	The ambient temperature exceeded the specified value.	Check the ambient temperature, and if the temperature exceeds the specified value, lower the ambient temperature.

3.2 Detailed explanation of [AL. 02A Linear encoder error 1]

Linear encoder manufactured by Mitutoyo

AT343A/AT54_A

Detail No.	Details	Cause	Check/action method
02A.1	Initialization error	The alarm occurs when the initialization process of the linear encoder does not terminate normally when the servo amplifier is powered on. • Detection head mounting alignment outside of specifications • Detection of an error caused by flaws or dirt of the scale • Communication error between the detection head and interface box caused by disconnection of the encoder cable or voltage drop of the power supply to the linear encoder (AT54_A) • Failure of the detection head	Check if the power supply voltage to the linear encoder satisfies the specifications. Check if the position relation between the scale frame and mounted detection head satisfies the specifications. If the alarm occurs when the servo amplifier is powered on, check for flaws and dirt around the detection head. If the alarm occurs again even after cycling the power of the servo amplifier, replace the scale.
02A.2	Photoelectric capacitive data mismatch	The alarm occurs when the detected difference between the incremental value and absolute value is outside the range. • Detection head mounting alignment outside of specifications • Detection of an error caused by flaws or dirt of the scale • Malfunction caused by excessive noise • Failure of the detection head	Check if the position relation between the scale frame and mounted detection head satisfies the specifications. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Check if the cable from the servo amplifier to the detection head connector or interface box is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the detection head connector or interface box is grounded.
02A.3	Photoelectric error	The alarm occurs when the detected incremental signal amplitude is out of the acceptable range. • Detection head mounting alignment outside of specifications • Detection of an error caused by flaws or dirt of the scale • Malfunction caused by excessive noise • Communication error between the detection head and interface box caused by disconnection of the encoder cable or voltage drop of the power supply to the linear encoder (AT54_A) • Failure of the detection head	Check if the power supply voltage to the linear encoder satisfies the specifications. Check if the position relation between the scale frame and mounted detection head satisfies the specifications. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. If the alarm occurs again even after cycling the power of the servo amplifier, replace the scale.
02A.4	Capacitive error	The alarm occurs when the detected absolute position signal amplitude is out of the acceptable range. • Detection head mounting alignment outside of specifications • Detection of an error caused by flaws or dirt of the scale • Malfunction caused by excessive noise • Failure of the detection head	Check if the position relation between the scale frame and mounted detection head satisfies the specifications. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Check if the cable from the servo amplifier to the detection head connector or interface box is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the detection head connector or interface box is grounded.
02A.5	CPU error	The alarm occurs when an internal CPU error of the linear encoder is detected. • Malfunction caused by excessive noise • Communication error between the detection head and interface box caused by disconnection of the encoder cable or voltage drop of the power supply to the linear encoder (AT54_A) • Failure of the detection head	Check if the power supply voltage to the linear encoder satisfies the specifications. Check if the cable from the servo amplifier to the detection head connector or interface box is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the detection head connector or interface box is grounded.

Detail No.	Details	Cause	Check/action method
02A.6	EEP-ROM error	The alarm occurs when a data error or communication error in the internal memory of the linear encoder is detected. • Malfunction caused by excessive noise • Failure of the detection head	Check if the power supply voltage to the linear encoder satisfies the specifications. Check if the cable from the servo amplifier to the detection head connector or interface box is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the detection head connector or interface box is grounded.
02A.7	ROM/RAM error	The alarm occurs when an error is found in a CPU internal memory check of the linear encoder when the servo amplifier is powered on. • Malfunction caused by excessive noise • Failure of the detection head	Check if the power supply voltage to the linear encoder satisfies the specifications. Check if the cable from the servo amplifier to the detection head connector or interface box is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the detection head connector or interface box is grounded.
02A.8	Photoelectric overspeed	The alarm occurs when the travel speed of the detection head exceeds the specified limit value. • Detection head mounting alignment outside of specifications • Detection of an error caused by flaws or dirt of the scale • Signal error caused by excessive noise • Failure of the detection head	If the detection head speed exceeds the specified limit value for the scale, review the operation conditions. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Check if the cable from the servo amplifier to the detection head connector or interface box is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the detection head connector or interface box is grounded.

ST74_A

Detail No.	Details	Cause	Check/action method
02A.1	Overspeed error	The alarm occurs when the detection head detects that the maximum feed speed (5 m/s) is exceeded. • Overspeed of the detection head • Disconnection in the coil pattern caused by flaws of the scale • Failure of the detection head	If the detection head speed exceeds 5 m/s, review the operation conditions. Check for flaws on the scale and disconnection in the coil pattern. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Check if the signal strength is within the normal range for the total length of the scale.
02A.2	Initialization error	The alarm occurs when the system initialization of the linear encoder does not terminate normally when the servo amplifier is powered on. • Position relation between the detection head and scale outside of specifications • Failure of the detection head	Check if the position relation between the detection head and scale satisfies the specifications. Check if the signal strength is within the normal range for the total length of the scale. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Adjust the signal as necessary.
02A.3	Hardware error	The alarm occurs when an internal hardware error of the linear encoder is detected. • Malfunction caused by excessive noise • Failure of the detection head	Check if the cable from the servo amplifier to the connector on the detection head is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the connector on the detection head is grounded. Check if the signal strength is within the normal range for the total length of the scale.
02A.4	ABS detection error	The alarm occurs when an error occurs in the absolute position data. • Position relation between the detection head and scale outside of specifications • Disconnection in the coil pattern caused by flaws of the scale • Malfunction caused by excessive noise	Check if the position relation between the detection head and scale satisfies the specifications. Check if the signal strength is within the normal range for the total length of the scale. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Check if the cable from the servo amplifier to the connector on the detection head is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the connector on the detection head is grounded.
02A.5	Transducer error	The alarm occurs when the detected signal balance enters the error range. • Position relation between the detection head and scale outside of specifications • Disconnection in the coil pattern caused by flaws of the scale • Failure of the detection head	Check if the position relation between the detection head and scale satisfies the specifications. Check if the signal strength is within the normal range for the total length of the scale. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Adjust the signal as necessary.
02A.6	Signal strength error	The alarm occurs when the detected signal strength enters the error range. • Position relation between the detection head and scale outside of specifications • Disconnection in the coil pattern caused by flaws of the scale • Failure of the detection head	Check if the position relation between the detection head and scale satisfies the specifications. Check if the signal strength is within the normal range for the total length of the scale. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Adjust the signal as necessary.

ST134_A

Detail No.	Details	Cause	Check/action method
02A.1	Overspeed	The alarm occurs when the detection head detects that the maximum feed speed (8 m/s) is exceeded. • Overspeed of the detection head • Detection of an error caused by flaws or dirt of the scale • Failure of the detection head	If the detection head speed exceeds 8 m/s, review the operation conditions. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Check if the signal strength is within the normal range for the total length of the scale. Adjust the signal as necessary.
02A.2	Initialization error	The alarm occurs when the system initialization of the linear encoder does not terminate normally when the servo amplifier is powered on. • Position relation between the detection head and scale outside of specifications • Failure of the detection head	Check if the position relation between the detection head and scale satisfies the specifications. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position.
02A.3	Hardware error	The alarm occurs when an error occurs in self-diagnosis. • Malfunction caused by excessive noise • Failure of the detection head	Check if the cable from the servo amplifier to the connector on the detection head is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the connector on the detection head is grounded.
02A.4	ABS detection error	The alarm occurs when there is an error in composition of the absolute position. • Detection of an error caused by flaws or dirt of the scale • Malfunction caused by excessive noise • Position relation between the detection head and scale outside of specifications • Failure of the detection head	Check if the position relation between the detection head and scale satisfies the specifications. Check if the signal strength is within the normal range for the total length of the scale. Adjust the signal as necessary. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Check if the cable from the servo amplifier to the connector on the detection head is routed parallel to the cable where a large current flows. Check if the cable shield from the servo amplifier to the connector on the detection head is grounded.
02A.5	Communication error	The alarm occurs when a communication error is detected between the detection head and electrical connector. • Malfunction caused by excessive noise • Failure of the detection head	Check if the cable from the electrical connector to the detection head is routed parallel to the cable where a large current flows.
02A.6	Signal strength error	The alarm occurs when the detected signal strength enters the warning range. • Position relation between the detection head and scale outside of specifications • Detection of an error caused by flaws or dirt of the scale • Failure of the detection head	Check if the position relation between the detection head and scale satisfies the specifications. Check if the signal strength is within the normal range for the total length of the scale. If the alarm occurs at a specific position in the scale, check for flaws and dirt on the scale around the alarm occurrence position. Adjust the signal as necessary.

Linear encoder manufactured by Heidenhain

Detail No.	Details	Cause	Check/action method
02A.1	Initialization error	• Encoder cable disconnection and short-circuit • Problems in the power supplied to the linear encoder	If there is a problem with the encoder cable, replace or repair the cable. Check if the encoder cable is connected correctly.
02A.2	Scale level error INC/ABS data mismatch error	• Dirt on the scale reading surface or head reading surface • The head mounting position including the gap are outside of specifications.	Check for flaws and dirt on the scale surface, then wipe the reading surface of the scale and head with a clean cloth or by other means as necessary. Check if the gap between the scale and head satisfies the specifications.
02A.3	INC data error	• Dirt on the scale reading surface or head reading surface • The head mounting position including the gap are outside of specifications.	Check for flaws and dirt on the scale surface, then wipe the reading surface of the scale and head with a clean cloth or by other means as necessary. Check if the gap between the scale and head satisfies the specifications.
02A.4	ABS data error	• Dirt on the scale reading surface or head reading surface • The head mounting position including the gap are outside of specifications.	Check for flaws and dirt on the scale surface, then wipe the reading surface of the scale and head with a clean cloth or by other means as necessary. Check if the gap between the scale and head satisfies the specifications.
02A.5	CPU error	• Encoder cable disconnection and short-circuit • Problems in the power supplied to the linear encoder	Check for disconnection and short-circuit of the encoder cable. Check if the connector of the linear encoder is properly fit.
02A.6	EEP-ROM error	• Encoder cable disconnection and short-circuit • Problems in the power supplied to the linear encoder	Check for disconnection and short-circuit of the encoder cable. Check if the connector of the linear encoder is properly fit.
02A.8	Overspeed error	• Overspeed of the head during operation	Check the operation speed settings.

Linear encoder manufactured by Magnescale

SR77/SR87/SR27A/SR67A/SQ47/SQ57

Detail No.	Details	Cause	Check/action method
02A.2	Data mismatch	There is a mismatch between the position data currently being output and the position data generated from the ABS signal.	Check the relation between the mounting positions of the scale and head. For the open type, check the gap between the detection surfaces as well. If the alarm repeats at the same position of the scale even though the relation between the mounting positions is correct, contact Magnescale.
02A.3	Data error	The incremental signal level is too low to perform signal process.	Check the relation between the mounting positions of the scale and head. For the open type, check the gap between the detection surfaces as well. If the alarm repeats at the same position of the scale even though the relation between the mounting positions is correct, contact Magnescale.
02A.4	Detection error	The ABS signal level is too low to perform signal process.	Check the relation between the mounting positions of the scale and head. For the open type, check the gap between the detection surfaces as well. If the alarm repeats at the same position of the scale even though the relation between the mounting positions is correct, contact Magnescale.
02A.6	Memory error	Errors have occurred in various setting values of the linear encoder.	Noise may have caused the errors. Take countermeasures against the noise, such as placing the encoder apart from the power line or checking the grounding status, and then cycle the power. If the error repeats even after cycling the power to the servo amplifier, contact Magnescale.
02A.8	Overspeed	The position information is not reliable due to overspeed, excessive noise, or other factors.	Check the setting speed. In addition, noise may have caused the error. Take countermeasures against the noise, such as placing the encoder apart from the power line or checking the grounding status, and then cycle the power.

SR75/SR85/SL710 + PL101-RM/SL710 + PL101-RHM/SQ10 + PQ10 + MQ10/ BL50H+BD700/BL50H+FSE

Detail No.	Details	Cause	Check/action method
02A.6	Encoder alarm	The position information is not reliable due to overspeed, signal level error, home position signal error.	Check if the reading position relation between the scale and head such as the gap satisfy the specifications. Noise may have caused the errors. Take countermeasures against the noise (by placing the encoder apart from the power line or by other means), then cycle the power to the servo amplifier. Check the setting speed.

Linear encoder manufactured by Renishaw

Detail No.	Details	Cause	Check/action method
02A.1	Initial	An error occurred at startup.	Cycle the power of the servo amplifier, then check the conditions of the readhead setup LED. If the above action does not solve the error, contact Renishaw.
02A.4	Absolute position information	The mounting conditions of the readhead and scale are poor. • Excessive dirt on the scale • Excessive dirt on the detection window of the readhead • Excessive flaws and damage of the readhead and scale	Remove the readhead, then clean the detection window. Clean the entire scale. Check the scale and replace it if damaged. Check the detection window of the readhead and replace it if damaged. Mount the readhead in accordance with the Renishaw's installation guide.
02A.6	Excessive temperature	The ambient temperature exceeded the specified value.	Check the ambient temperature, and if the temperature exceeds the specified value, lower the ambient temperature.
02A.8	Overspeed (Excessive speed)	The encoder speed exceeded the specified value.	If the actual linear servo motor speed exceeds the specified value, reduce the operation speed.

Linear encoder manufactured by NIDEC INSTRUMENTS CORPORATION

PSLH041

Detail No.	Details	Cause	Check/action method
02A.1	EEP-ROM error	The setting values of EEP-ROM were not properly read immediately after the servo amplifier was powered on. • Malfunction caused by noise • Sensor malfunction	If the error does not occur after cycling the power to the servo amplifier, electrical noise may be the cause of the malfunction. Check the shielded wire or other parts of the cable. If the error repeats even after cycling the power to the servo amplifier for several times, the sensor may have malfunctioned.
02A.2	Temperature error	The thermometer in the sensor indicated that the temperature rose to the neighborhood of the guaranteed temperature of the electronic components. • Sensor malfunction	Lower the ambient temperature. If the error repeats even after turning on the sensor only and leaving it for about 10 minutes, the sensor may have malfunctioned. Replace the sensor.
02A.3	Speed error	While the analog signal was being monitored, the speed was equal to the specified speed or exceeded the specified speed. • Speed equal to or exceeding the specified speed • Scale damage • Scale out of place	Check if the speed is within specifications. If the error repeats at a specific position on the scale, the scale may have been physically or magnetically damaged. Replace and check the scale. The error may occur when the signal is out of the effective range of the scale.
02A.4	Offset error	The analog signal is out of the specified range. • Improper mounting position • Effect of the external magnetic field • Sensor malfunction • Scale out of place	Check if the mounting positions of the sensor and scale are appropriate. If the error repeats at a specific position on the scale, the scale may have been affected by the external magnetic field. Check the surroundings for a strong magnetic field. If the error occurs constantly, the sensor may have malfunctioned for some reason. Replace and check the sensor. The error may occur when the signal is out of the effective range of the scale.
02A.5	Amplitude error	The amplitude of the analog signal is out of the specified range. • Improper mounting position • Damage and malfunction of the scale • Scale out of place	Check if the mounting positions of the sensor and scale are appropriate. Check the gap between the sensor head and scale. If the error repeats at a specific position on the scale, replace the scale because it may have been physically or magnetically damaged. The error may occur when the signal is out of the effective range of the scale.

Linear encoder manufactured by NIDEC MACHINE TOOL CORPORATION

MPFA-HZ-M01

Detail No.	Details	Cause	Check/action method
02A.1	Feedback error 1	A weak signal was detected during the continuous signal check. • Wide mounting gap for the head • The head mounting position outside of specifications • Disconnection in the scale pattern	The alarm will not be cleared until the cause is removed and the power is cycled. • Check that the head mounting gap is within the specifications and perform adjustment. • Check that the mounting positions of the scale and head are within the specifications and perform adjustment. • Check if the scale pattern is disconnected and if it is disconnected, replace the scale. • Replace the head.
02A.2	Absolute value calculation error	The absolute value code read by the head is incorrect.	The alarm will not be cleared until the cause is removed and the power is cycled. • Check that the mounting positions of the scale and head are within the specifications and perform adjustment. • Check if the scale pattern is disconnected and if it is disconnected, replace the scale. • Replace the head.
02A.3	Internal signal phase problem	The feedback signal inside the head is out of phase.	• Replace the head.
02A.4	Feedback error 2	A weak feedback signal inside the head was detected at startup. • Wide mounting gap for the head • The head mounting position outside of specifications • Disconnection in the scale pattern	The alarm will not be cleared until the cause is removed and the power is cycled. • Check that the head mounting gap is within the specifications and perform adjustment. • Check that the mounting positions of the scale and head are within the specifications and perform adjustment. • Check if the scale pattern is disconnected and if it is disconnected, replace the scale. • Replace the head.
02A.5	Incomplete startup	The startup process of the head is not complete. • Head does not start due to noise. • Head malfunction	The alarm will not be cleared until the cause is removed and the power is cycled. • Move the head away from the noise source. • Attach a ferrite core to the signal cable of the head. • Connect the case of the head to the ground.
02A.6	Incomplete absolute value detection	Detection of the absolute value code inside the head is not complete. ([AL. 02A.2] occurs at the same time.)	• Replace the head.
02A.7	Noise malfunction	Noise or other factors caused a discrepancy in the reference signal inside the head.	The alarm will not be cleared until the cause is removed and the power is cycled. • Move the head away from the noise source. • Attach a ferrite core to the signal cable of the head. • Connect the case of the head to the ground.

MPFA-HI-M01

Detail No.	Details	Cause	Check/action method
02A.1	Feedback error 1	A weak signal was detected during the continuous signal check. • Wide mounting gap for the head • The head mounting position outside of specifications • Disconnection in the scale pattern	The alarm will not be cleared until the cause is removed and the power is cycled. • Check that the head mounting gap is within the specifications and perform adjustment. • Check that the mounting positions of the scale and head are within the specifications and perform adjustment. • Check if the scale pattern is disconnected and if it is disconnected, replace the scale. • Replace the head.
02A.3	Internal signal phase problem	The feedback signal inside the head is out of phase.	• Replace the head.
02A.4	Feedback error 2	A weak feedback signal inside the head was detected at startup. • Wide mounting gap for the head • The head mounting position outside of specifications • Disconnection in the scale pattern	The alarm will not be cleared until the cause is removed and the power is cycled. • Check that the head mounting gap is within the specifications and perform adjustment. • Check that the mounting positions of the scale and head are within the specifications and perform adjustment. • Check if the scale pattern is disconnected and if it is disconnected, replace the scale. • Replace the head.
02A.5	Incomplete startup	The startup process of the head is not complete. • Head does not start due to noise. • Head malfunction	The alarm will not be cleared until the cause is removed and the power is cycled. • Move the head away from the noise source. • Attach a ferrite core to the signal cable of the head. • Connect the case of the head to the ground.
02A.7	Noise malfunction	Noise or other factors caused a discrepancy in the reference signal inside the head.	The alarm will not be cleared until the cause is removed and the power is cycled. • Move the head away from the noise source. • Attach a ferrite core to the signal cable of the head. • Connect the case of the head to the ground.

3.3 Trouble which does not trigger an alarm/warning

This section shows examples of trouble which will not trigger an alarm or warning as well as the possible causes of such trouble. Refer to this section and remove each cause of trouble.

Linear encoder manufactured by Magnescale

BL50H+BD700/BL50H+FSE

■The servo motor does not operate

Possible cause	Check/action
The clearance between the scale and head is outside of the specifications.	Mount the scale and head within the range where the reading position relation between the scale and head satisfies the specifications. For specific procedures for mounting and checking, contact Magnescale.

4 APPENDIX

4.1 Fabricating a branch cable for a fully closed loop system

Fabricate the branch cable using the MR-J3THMCN2 connector set as shown in the connection diagram of the following section.

☞ Page 82 MR-J4FCCBL03M branch cable

The branch cable length should be 0.3 m or less.

Parts	Description
MR-J3THMCN2 connector set	 Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) or Connector set: 54599-1019 (Molex)
	 Plug: 36110-3000FD Shell kit: 36310-F200-008 (3M)
Cable	ETFE-SVP 40/0.08 mm (24 AWG or equivalent) × 6P (Bando Densen) (between CN2 and MOTOR) *1 VSVP 7/0.16 (26 AWG or equivalent) - 4P (Bando Densen) (between CN2 and SCALE) *1

*1 Supplier: Toa Electric Industrial Co. Ltd., Nagoya Branch

MEMO

REVISIONS

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

Revision date	*Manual number	Description
July 2020	IB(NA)-0300523ENG-A	First edition
July 2022	IB(NA)-0300523ENG-B	■Detailed explanation of [AL. 02A Linear encoder error 1] is changed. ■The following function is added: Fully closed loop system ■Edited: Section 1.2, Section 1.3, Section 1.4, Section 1.5, Section 1.6, Section 1.7, Section 1.8, Section 2.4, Chapter 3
January 2023	IB(NA)-0300523ENG-C	■Linear encoder manufactured by NIDEC MACHINE TOOL CORPORATION is added. MPFA-HZ-M01, MPFA-HI-M01 ■Detailed explanation of [AL. 02A Linear encoder error 1] is changed. ■Edited: Chapter 1, Chapter 3
July 2023	IB(NA)-0300523ENG-D	■Details of MPFA-HI-M01 are added. ■Edited: Section 1.2, Section 1.8, Section 3.6
January 2024	IB(NA)-0300523ENG-E	■The following linear encoders are added: LIC 3197M, LIC 3199M, MC15M ■Detailed explanation of [AL. 028 Linear encoder error 2] is added. ■Edited: Chapter 1, Section 1.2, Section 1.4, Chapter 3, Section 3.1, Section 3.2
November 2024	IB(NA)-0300523ENG-F	■The following model is added: MR-JET-_G_-HS(N1) ■The following linear encoders are added: SQ47, SQ57, BL50H+BD700 ■Added/edited: Section 1.2, Section 1.3, Section 1.4, Section 1.5, Section 1.6, Section 1.7, Section 1.8, Section 1.9, Section 3.1, Section 3.2, Section 3.3
July 2025	IB(NA)-0300523ENG-G	■The following linear encoders are added: BL50H+FSE, FORTiS-S 40N, FORTiS-N 40N ■Added/edited: Section 1.2, Section 1.5, Section 1.6, Section 3.2, Section 3.3

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WARRANTY

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]

For terms of warranty, please contact your original place of purchase.

[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;

1. a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2. a failure caused by any alteration, etc. to the Product made on your side without our approval
3. 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
4. a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5. any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
6. 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
7. 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
8. 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 loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

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 AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in AC Servo, and a backup or fail-safe function should operate on an external system to AC Servo when any failure or malfunction occurs.

(2) Our AC Servo is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

(3) Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

TRADEMARKS

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IB(NA)-0300523ENG-G(2507)MEE
MODEL:
MODEL CODE:

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When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.
Compliance with the indicated global standards and regulations is current as of the release date of this manual.