3 Wiring

This chapter illustrates the power supply circuit, connectors, and wiring for each control mode of the servo drive.

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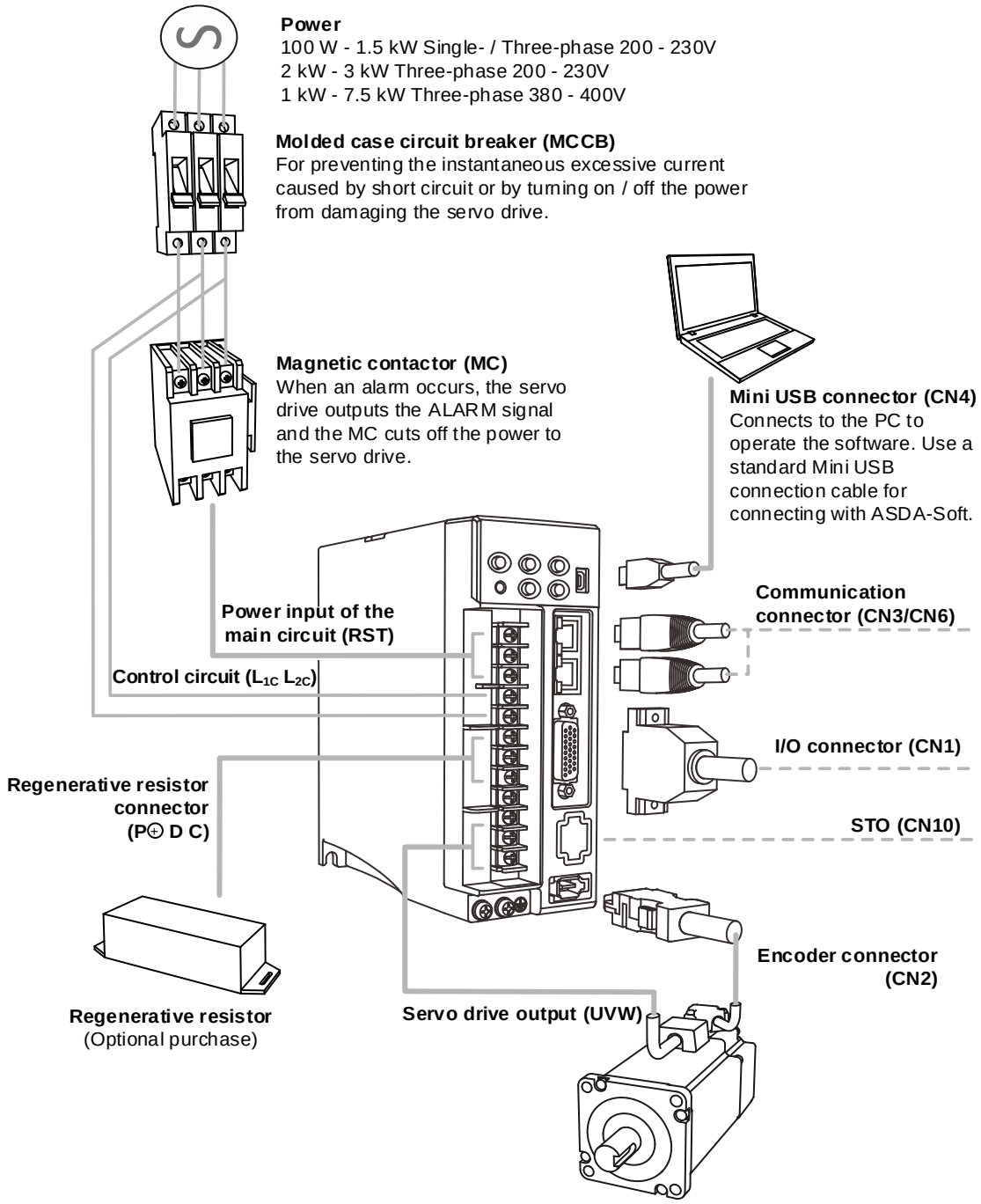
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3.1 System connection

3.1.1 Connecting to peripheral devices (connecting to Delta communication type servo motor)

3



Installation precautions:

1. Make sure the power and wiring connections of the R, S, T, and L_{1C}, L_{2C} are correct. Refer to the specifications of the servo drives in Appendix A for the correct voltage input to avoid any damage to the servo drive and dangerous operating conditions.
2. Make sure the UVW terminal block is correctly wired to avoid abnormal operation of the motor.
3. When an external regenerative resistor is used, P⊕ and D contacts should be left open, and the external regenerative resistor should connect to P⊕ and C contacts. When the built-in regenerative resistor is used. P⊕ and D contacts should be short-circuited, and P⊕ and C contacts should be left open.
4. When an alarm occurs or the system is under emergency stop status, use DO.ALRM or DO.WARN to switch off the magnetic contactor (MC) to cut off the power to the servo drive.

3.1.2 Connectors and terminals

<table>
<tr><th>Terminal</th><th>Name</th><th colspan="3">Description</th></tr>
<tr><td>L_{1C}, L_{2C}</td><td>Power input for the control circuit</td><td colspan="3">Connect to single-phase AC power.
(Refer to the model specification for the proper input voltage.)</td></tr>
<tr><td>R, S, T</td><td>Power input for the main circuit</td><td colspan="3">Connect to three-phase AC power.
(Refer to the model specification for the proper input voltage.)</td></tr>
<tr><td rowspan="6">U, V, W, FG</td><td rowspan="6">Motor power connector</td><td colspan="3">Connect to the servo motor.</td></tr>
<tr><td>Terminal</td><td>Wire color</td><td>Description</td></tr>
<tr><td>U</td><td>Red</td><td rowspan="3">A three-phase main power cable for the motor.</td></tr>
<tr><td>V</td><td>White</td></tr>
<tr><td>W</td><td>Black</td></tr>
<tr><td>FG</td><td>Yellow / Green</td><td>Connect to the ground terminal ⏚ on the servo drive.</td></tr>
<tr><td rowspan="3">P⊕, D, C, ⊖</td><td rowspan="3">Regenerative resistor terminal or power regenerative unit</td><td colspan="2">Use the built-in resistor</td><td>Short-circuit P⊕ and D contacts, and leave P⊕ and C contacts open.</td></tr>
<tr><td colspan="2">Use an external resistor</td><td>Connect P⊕ and C contacts to the resistor, and leave P⊕ and D contacts open.</td></tr>
<tr><td colspan="2">Use an external power regenerative unit</td><td>Connect the power regenerative unit to P⊕ and⊖ on the servo drive. P⊕ & D contacts and P⊕ & C contacts are left open.</td></tr>
<tr><td>⏚</td><td>Ground terminals</td><td colspan="3">Connect to the ground wires for the power and servo motor.</td></tr>
<tr><td>CN1</td><td>I/O connector</td><td colspan="3">Connect to the controller. Refer to Section 3.3 for more information.</td></tr>
<tr><td>CN2</td><td>Encoder connector</td><td colspan="3">Connect to the encoder. Refer to Section 3.4 for more information.</td></tr>
<tr><td>CN3</td><td>Communication connector</td><td colspan="3">For RS-485 or CANopen communication. Refer to Section 3.5 for more information.</td></tr>
<tr><td>CN4</td><td>Mini USB connector</td><td colspan="3">Connect to PC or laptop. Refer to Section 3.6 for more information.</td></tr>
<tr><td>CN6</td><td>Communication connector</td><td colspan="3">For DMCNET, EtherCAT, or PROFINET communication. Refer to Section 3.7 for more information.</td></tr>
<tr><td>CN10</td><td>STO connector</td><td colspan="3">Provides the STO (Safe Torque Off) function. The STO function is supported by the B3A series only. Refer to Sections 3.8 and 3.9 for more information.</td></tr>
</table>

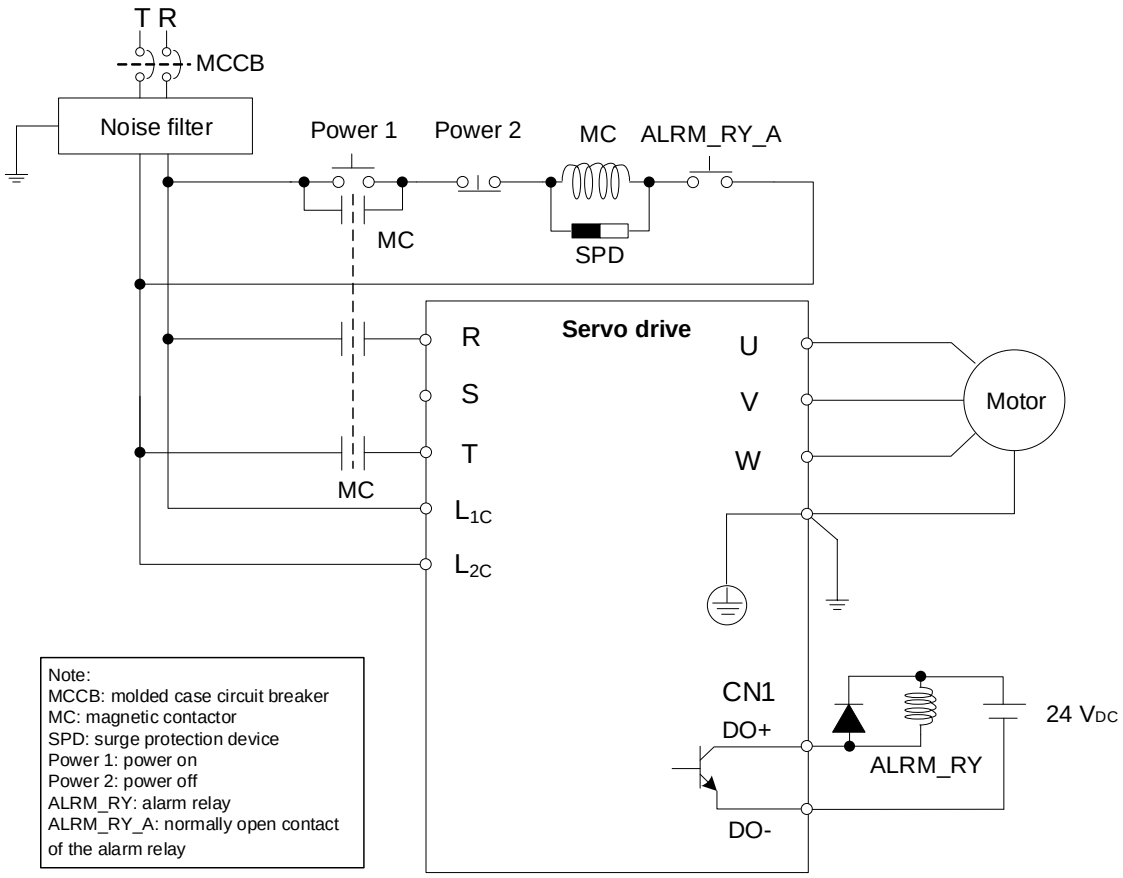
Pay special attention to the following when wiring:

1. When the power is off, do not touch R, S, T and U, V, W, and P⊕, D, C, ⊖ wires since the built-in capacitor of the servo drive can still contain a dangerously large amount of electric charge. Wait until the “CHARGE” indicator is off.
2. Separate the RST power cable and the UVW power cable from other cables. The separation should be at least 30 cm (11.8 inches).
3. For the encoder cable for CN2, use a metal braided shielded twisted-pair cable that conforms to the UL 2464 standard.
4. When using RS-485, CANopen, DMCNET, EtherCAT, or PROFINET, use the shielded twisted-pair communication cable to ensure the communication quality.
5. When selecting the wires, refer to Section 3.1.6.
6. Do not use any external capacitors, or it may damage the servo drive.

3.1.3 Wiring for power supply

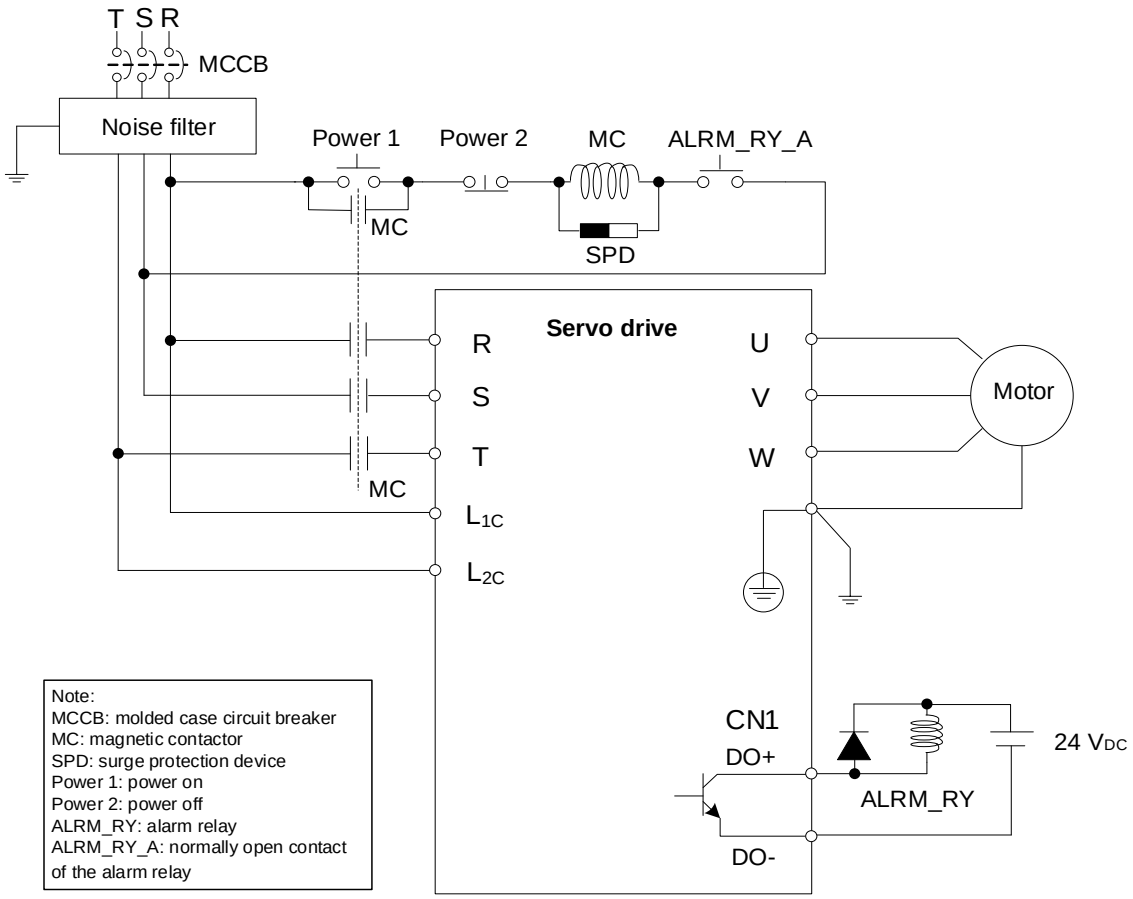
There are two methods for wiring the power supply: single-phase and three-phase.
The single-phase wiring is only applicable to models of 220V 1.5 kW or below. In the following diagram, Power 1 and ALRM_RY_A are normally open contacts, and Power 2 is a normally closed contact. MC (magnetic contactor) is the power relay and the contact for the main power circuit.

■ Wiring method for single-phase power supply (for models of 220V 1.5 kW or below)



Note: wire with the actual DO parameters of each model.

■ Wiring method for three-phase power supply (for all series)



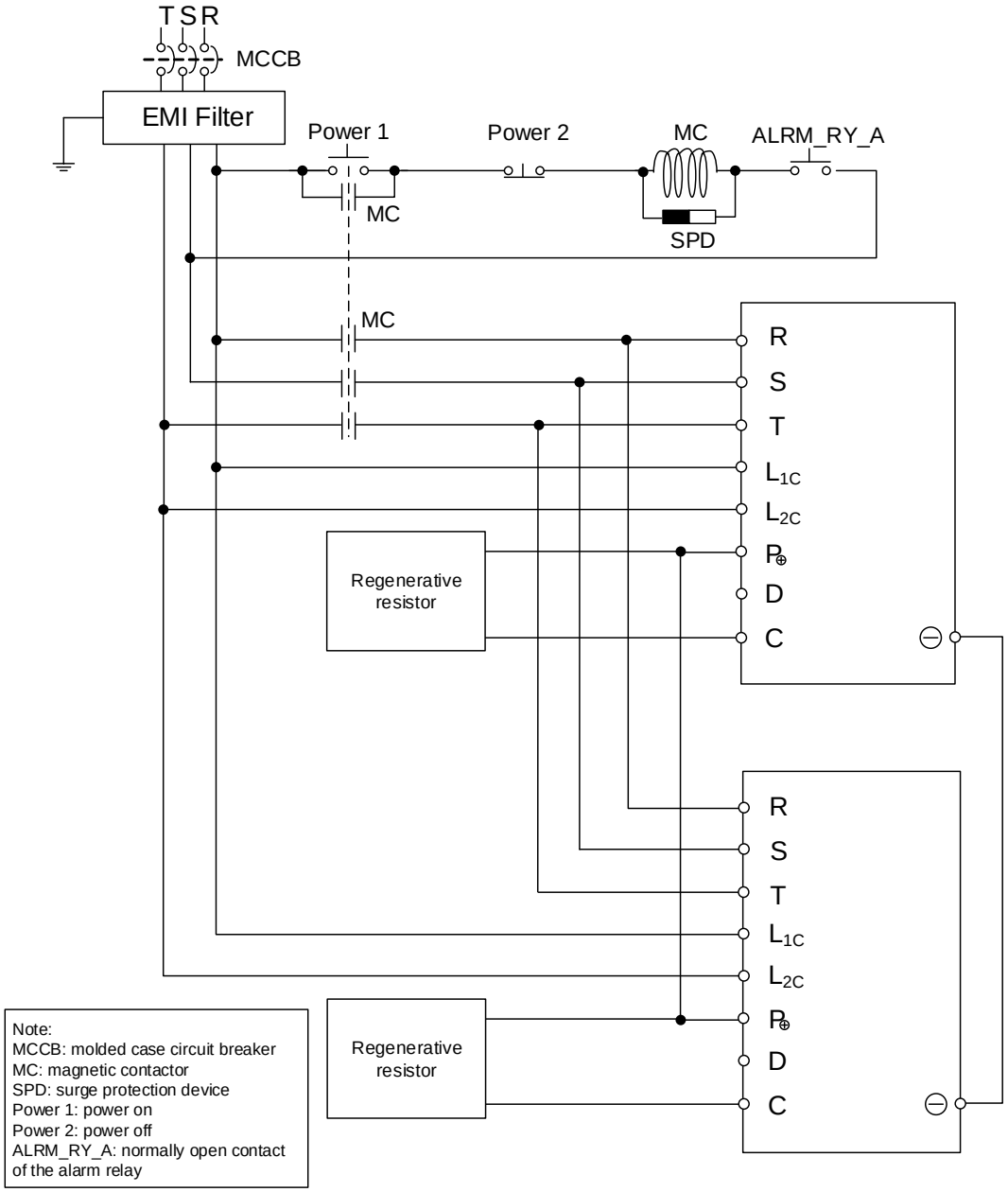
Note: wire with the actual DO parameters of each model.

3

- Connecting multiple servo drives (in parallel)

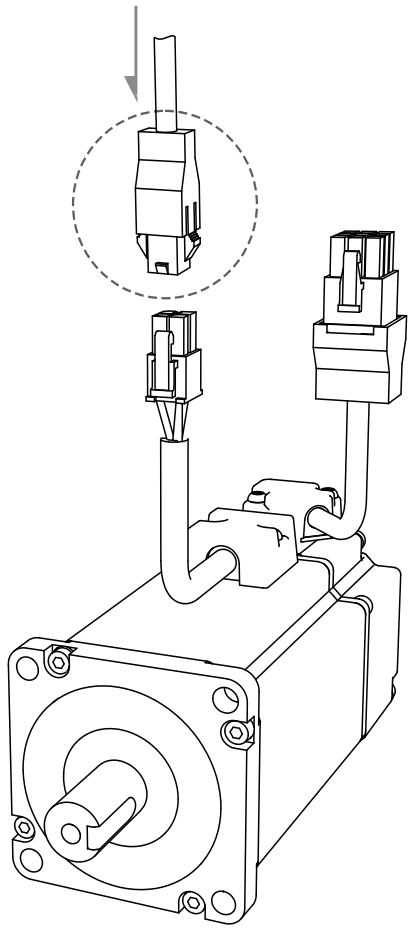
  Using a common DC Bus can make efficient use of the regenerative energy. For instance, while one of the axes is decelerating, the regenerative energy can be supplied to the other axes. If you need to connect servo drives of different power levels, only **models of the same power level or the next upper / lower power level** can be connected; moreover, each servo drive should connect to a regenerative resistor (or a power regenerative unit).

  Example: if there is a 400 W servo drive in the current system, you can add servo drives of the same or different power level which ranges from 200 W to 750 W. This is because the system can only contain servo drives of up to two different power levels.



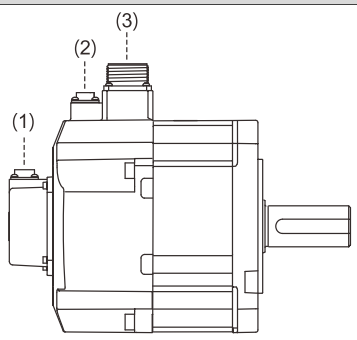
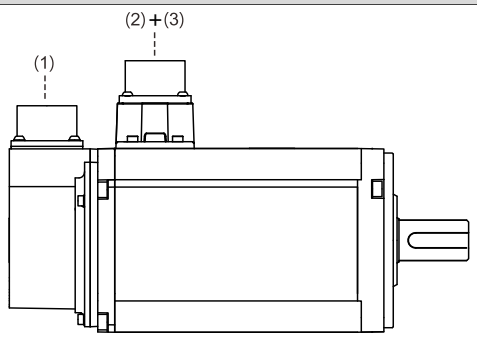
3.1.4 UVW power connector specifications

Select the appropriate connector according to the code of **Shaft diameter and connector type** in the motor model number. Refer to Section 1.2.2 for the model explanation of the servo motor.



Note: pin assignments of the B3 and B2 motor connectors are the same. For easier wiring, B3's connector illustration (angle of viewing) is changed, which is different from that of B2.

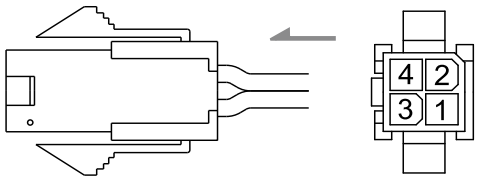
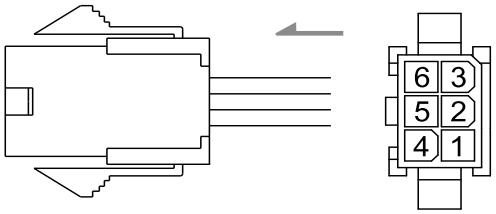
The (2) and (3) in the following figures show the difference between the military connectors of the ECM-B3 motors and those of the ECMA / ECMC (old series) motors.

ECM-B3 (F100 - F180)	ECMA / ECMC (F100 - F180)
	

(1) Encoder connector; (2) Brake connector; (3) UVW power connector

3

3.1.4.1 F40 - F80 motors – Power connectors

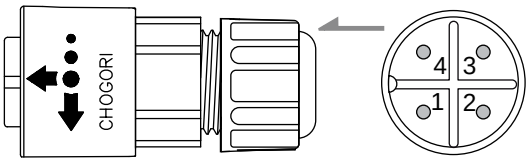
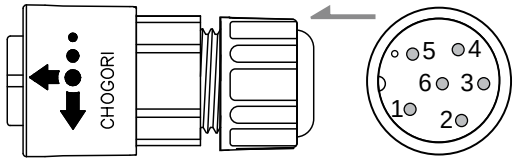
Motor model	UVW connector					
ECM-B3□-C□0401□□□ ECM-B3□-C□0602□□□ ECM-B3□-C□0604□□□ ECM-B3□-C□0804□□□ ECM-B3□-C□0807□□□ ECM-B3□-C□0810□□□ ECM-A3□-C□040F□□□ ECM-A3□-C□0401□□□ ECM-A3□-C□0602□□□ ECM-A3□-C□0604□□□ ECM-A3□-C□0804□□□ ECM-A3□-C□0807□□□						
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1	BRAKE2
	1	2	3	4	-	-
						
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1*3	BRAKE2*3
	1	2	4	5	3	6

Note:

1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 40 - 80 mm: brown and blue.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

	Brand	Model number
UVW	Delta	ACS3-CAPW1000
	Molex	39-01-2041 (case) 39-00-0040 (terminal)
UVW with brake	Brand	Model number
	Delta	ACS3-CAPW2000
	Molex	39-01-2061 (case) 39-00-0040 (terminal)

Motor model	UVW connector					
ECM-B3[1]-C[2]0401[3][4][5] ECM-B3[1]-C[2]0602[3][4][5] ECM-B3[1]-C[2]0604[3][4][5] ECM-B3[1]-C[2]0804[3][4][5] ECM-B3[1]-C[2]0807[3][4][5] ECM-B3[1]-C[2]0810[3][4][5] ECM-A3[1]-C[2]040F[3][4][5] ECM-A3[1]-C[2]0401[3][4][5] ECM-A3[1]-C[2]0602[3][4][5] ECM-A3[1]-C[2]0604[3][4][5] ECM-A3[1]-C[2]0804[3][4][5] ECM-A3[1]-C[2]0807[3][4][5]						
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1	BRAKE2
	1	2	3	4	-	-
						
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1*3	BRAKE2*3
	1	2	3	4	5	6

Note:

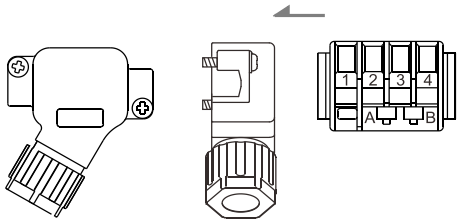
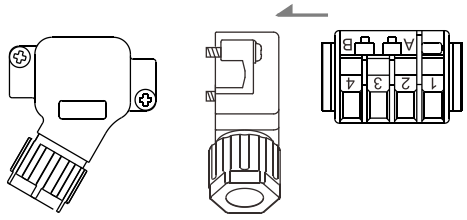
1. In the servo motor model number, [1] represents the motor inertia, [2] represents the encoder type, [3] represents the brake or keyway / oil seal type, [4] represents the shaft diameter and connector type, and [5] represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 40 - 80 mm: brown and blue.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

	Brand	Model number	IP rating
UVW	Delta	ACS3-CNPW1A00	IP67
	CHOGORI	23004231-02	IP67
UVW with brake	Brand	Model number	IP rating
	Delta	ACS3-CNPW2A00	IP67
	CHOGORI	23006231-02	IP67

Note: refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.

3

Motor model	UVW connector					
ECM-B3□1-C□20401□4□5 ECM-B3□1-C□20602□4□5 ECM-B3□1-C□20604□4□5 ECM-B3□1-C□20804□4□5 ECM-B3□1-C□20807□4□5 ECM-B3□1-C□20810□4□5	Cable exit direction towards motor shaft					
	Cable exit direction towards encoder					
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1*3 *5	BRAKE2*3 *5
	1	2	3	4	A	B

Note:

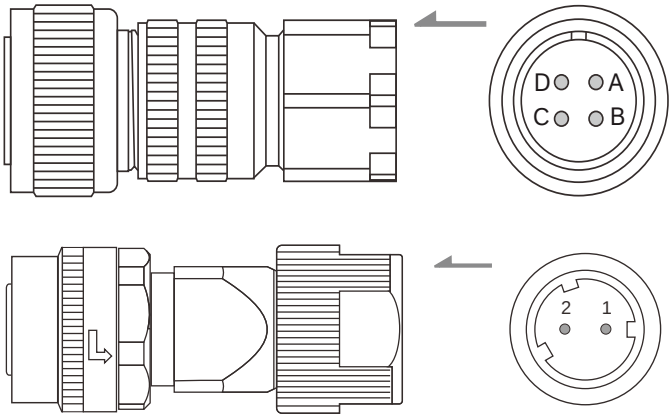
1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 40 - 80 mm: brown and blue.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

UVW with brake	Brand	Model number	IP rating
Bulkhead connector - cable exit direction towards motor shaft	Delta	ACS3-AFPWSS00	IP67
	SUNCHU	SC-ACS3-AFPWSS00	IP67
Bulkhead connector - cable exit direction towards encoder	Delta	ACS3-ABPWSS00	IP67
	SUNCHU	SC-ACS3-ABPWSS00	IP67

Note: refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.

3.1.4.2 F100 - F130 motors – Power connectors

Motor model	UVW connector and brake connector
ECM-B3[1]-C[2]1010[3][4][5] ECM-B3[1]-C[2]1015[3][4][5] ECM-B3[1]-C[2]1020[3][4][5] ECM-B3[1]-E[2]1310[3][4][5] ECM-B3[1]-E[2]1315[3][4][5] ECM-B3[1]-E[2]1320[3][4][5] ECM-B3[1]-F[2]1308[3][4][5] ECM-B3[1]-F[2]1313[3][4][5] ECM-B3[1]-F[2]1318[3][4][5] ECM-B3[1]-J[2]1010[3][4][5] ECM-B3[1]-J[2]1015[3][4][5] ECM-B3[1]-J[2]1020[3][4][5] ECM-B3[1]-K[2]1310[3][4][5] ECM-B3[1]-K[2]1315[3][4][5] ECM-B3[1]-K[2]1320[3][4][5] ECM-B3[1]-L[2]1308[3][4][5] ECM-B3[1]-L[2]1313[3][4][5] ECM-B3[1]-L[2]1318[3][4][5]	

Pin assignment					
U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1*3	BRAKE2*3
A	B	C	D	1	2

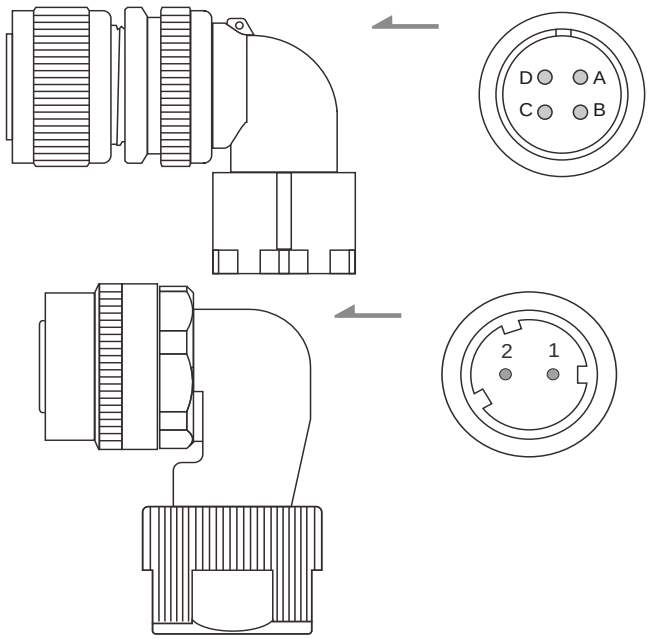
Note:
1. In the servo motor model number, [1] represents the motor inertia, [2] represents the encoder type, [3] represents the brake or keyway / oil seal type, [4] represents the shaft diameter and connector type, and [5] represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 100 mm or above: red and black.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

UVW	Brand	Model number	IP rating
MIL 18-10S	Delta	ACS3-CAPWA000	IP67
	SUNCHU	CMS3106A18-10SBI (connector & compression ring)	IP67
Brake	**Brand**	**Model number**	**IP rating**
CMV1-2S	Delta	ACS3-CABRA000	IP67
	DDK*2	CMV1-SP2S-M1	IP67
	Suntone*3	SM10-SP2S-M1-D6-V	IP67

Note:
1. Refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.
2. The solder contacts (CMV1-#22BCS-S2-100) or crimp contacts (CMV1-#22BCS-C3-100) for the listed DDK connector are sold separately.
3. The solder contacts (SMS-5012 or SMS-5013) or crimp contacts (SMS-5011) for the listed Suntone connector are sold separately.

3

Motor model	UVW connector brake connector
ECM-B3□1-C□2□1010□3□4□5 ECM-B3□1-C□2□1015□3□4□5 ECM-B3□1-C□2□1020□3□4□5 ECM-B3□1-E□2□1310□3□4□5 ECM-B3□1-E□2□1315□3□4□5 ECM-B3□1-E□2□1320□3□4□5 ECM-B3□1-F□2□1308□3□4□5 ECM-B3□1-F□2□1313□3□4□5 ECM-B3□1-F□2□1318□3□4□5 ECM-B3□1-K□2□1310□3□4□5 ECM-B3□1-K□2□1315□3□4□5 ECM-B3□1-K□2□1320□3□4□5 ECM-B3□1-J□2□1010□3□4□5 ECM-B3□1-J□2□1015□3□4□5 ECM-B3□1-J□2□1020□3□4□5 ECM-B3□1-L□2□1308□3□4□5 ECM-B3□1-L□2□1313□3□4□5 ECM-B3□1-L□2□1318□3□4□5	

Pin assignment					
U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1*4	BRAKE2*4
A	B	C	D	1	2

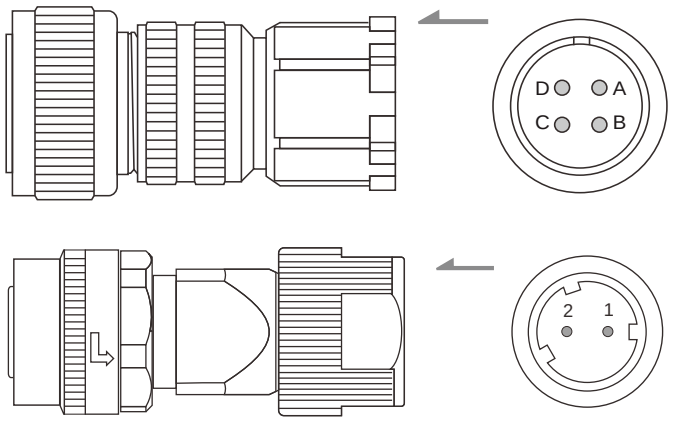
Note:
1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 100 mm or above: red and black.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

UVW	Brand	Model number	IP rating
MIL 18-10S	Delta	ACS3-CRPWA000	IP67
	SUNCHU	CMS3108A18-10SBI (connector & compression ring)	IP67
Brake	Brand	Model number	IP rating
CMV1-2S	Delta	ACS3-CRBRA000	IP67
	DDK*2	CMV1-AP2S-M1	IP67
	Suntone*3	SM10-AP2S-M1-D6-V	IP67

Note:
1. Refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.
2. The solder contacts (CMV1-#22BCS-S2-100) or crimp contacts (CMV1-#22BCS-C3-100) for the listed DDK connector are sold separately.
3. The solder contacts (SMS-5012 or SMS-5013) or crimp contacts (SMS-5011) for the listed Suntone connector are sold separately.

3.1.4.3 F180 4.5 kW (or below) motors – Power connectors

Motor model	UVW connector and brake connector
ECM-B3①-E②1820③④⑤ ECM-B3①-F②1830③④⑤ ECM-B3①-K②1820③④⑤ ECM-B3①-L②1830③④⑤ ECM-B3①-L②1845③④⑤	

Pin assignment					
U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1*3	BRAKE2*3
A	B	C	D	1	2

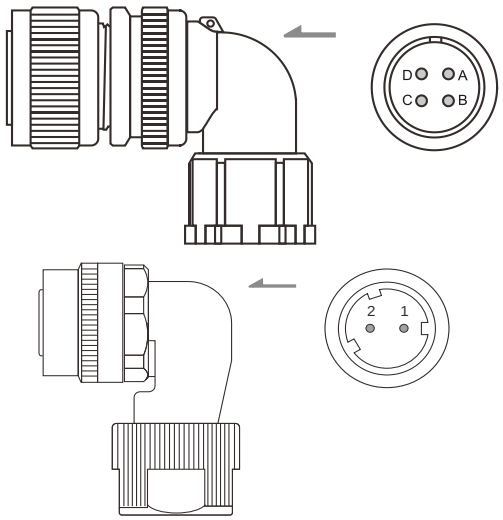
Note:
1. In the servo motor model number, ① represents the motor inertia, ② represents the encoder type, ③ represents the brake or keyway / oil seal type, ④ represents the shaft diameter and connector type, and ⑤ represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 100 mm or above: red and black.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

UVW	Brand	Model number	IP rating
MIL 22-22S	Delta	ACS3-CAPWC000	IP67
	SUNCHU	CMS3106A22-22SBI (connector & compression ring)	IP67
Brake	**Brand**	**Model number**	**IP rating**
CMV1-2S	Delta	ACS3-CABRA000	IP67
	DDK*2	CM1V1-SP2S-M1	IP67
	Suntone*3	SM10-SP2S-M1-D6-V	IP67

Note:
1. Refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.
2. The solder contacts (CMV1-#22BCS-S2-100) or crimp contacts (CMV1-#22BCS-C3-100) for the listed DDK connector are sold separately.
3. The solder contacts (SMS-5012 or SMS-5013) or crimp contacts (SMS-5011) for the listed Suntone connector are sold separately.

3

Motor model	UVW connector and brake connector
ECM-B3□1-E□21820□4□5 ECM-B3□1-F□21830□4□5 ECM-B3□1-K□21820□4□5 ECM-B3□1-L□21830□4□5 ECM-B3□1-L□21845□4□5	

Pin assignment					
U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1*4	BRAKE2*4
A	B	C	D	1	2

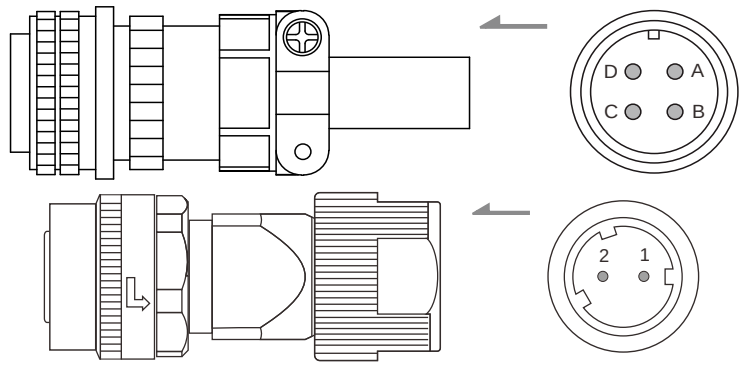
Note:
1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 100 mm or above: red and black.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

UVW	Brand	Model number	IP rating
MIL 22-22S	Delta	ACS3-CRPWC000	IP67
	SUNCHU	CMS3108A22-22SBI (connector & compression ring)	IP67
Brake	**Brand**	**Model number**	**IP rating**
CMV1-2S	Delta	ACS3-CRBRA000	IP67
	DDK*2	CMV1-AP2S-M1	IP67
	Suntone*3	SM10-AP2S-M1-D6-V	IP67

Note:
1. Refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.
2. The solder contacts (CMV1-#22BCS-S2-100) or crimp contacts (CMV1-#22BCS-C3-100) for the listed DDK connector are sold separately.
3. The solder contacts (SMS-5012 or SMS-5013) or crimp contacts (SMS-5011) for the listed Suntone connector are sold separately.

3.1.4.4 F180 5.5 kW (or above) motors – Power connectors

Motor model	UVW connector and brake connector
ECM-B3□1-L□2□1855□3□4□5 ECM-B3□1-L□2□1875□3□4□5	

Pin assignment					
U (Red)	V (White)	W (Black)	CASE GROUND (Green / Yellow)	BRAKE1*3	BRAKE2*3
A	B	C	D	1	2

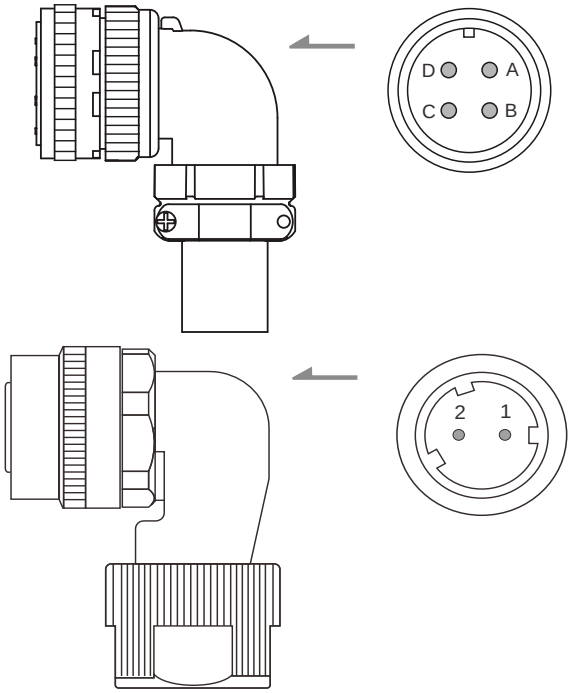
Note:
1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 100 mm or above: red and black.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

UVW	Brand	Model number	IP rating
MIL 32-17S	Delta	ACS3-CAPWE000	IP42
	SUNCHU	CMS3106A32-17S (connector & compression ring)	IP42
	PLT	WPS3106A32-17S-R (connector) AMS3057-20A-R (cable clamp)	IP65
Brake	**Brand**	**Model number**	**IP rating**
CMV1-2S	Delta	ACS3-CABRA000	IP67
	DDK*2	CM1V1-SP2S-M1	IP67
	Suntone*3	SM10-SP2S-M1-D6-V	IP67

Note:
1. Refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.
2. The solder contacts (CMV1-#22BCS-S2-100) or crimp contacts (CMV1-#22BCS-C3-100) for the listed DDK connector are sold separately.
3. The solder contacts (SMS-5012 or SMS-5013) or crimp contacts (SMS-5011) for the listed Suntone connector are sold separately.

3

Motor model	UVW connector and brake connector
ECM-B3□1-L□2□1855□3□4□5 ECM-B3□1-L□2□1875□3□4□5	

Pin assignment					
U (Red)	V (White)	W (Black)	CASE GROUND (Yellow / Green)	BRAKE1*3	BRAKE2*3
A	B	C	D	1	2

Note:
1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. Power supply for the brake is 24 V_{DC}. Do not share the same power supply with control signals.
3. The brake coil has no polarity. Its pin symbols are BRAKE1 and BRAKE2. Color of brake wires for motors with the frame size of 100 mm or above: red and black.
4. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

UVW	Brand	Model number	IP rating
MIL 32-17S	Delta	ACS3-CRPWE000	IP42
	SUNCHU	CMS3108A32-17S (connector & compression ring)	IP42
Brake	Brand	Model number	IP rating
CMV1-2S	Delta	ACS3-CRBRA000	IP67
	DDK*2	CMV1-AP2S-M1	IP67
	Suntone*3	SM10-AP2S-M1-D6-V	IP67

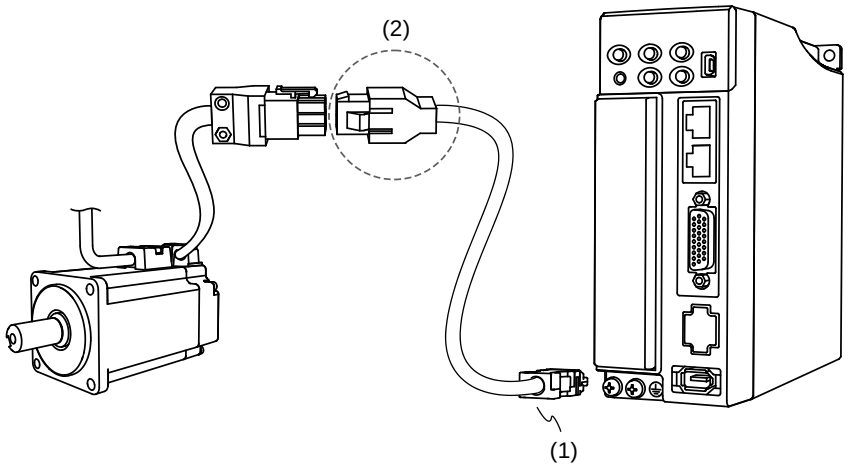
Note:
1. Refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.
2. The solder contacts (CMV1-#22BCS-S2-100) or crimp contacts (CMV1-#22BCS-C3-100) for the listed DDK connector are sold separately.
3. The solder contacts (SMS-5012 or SMS-5013) or crimp contacts (SMS-5011) for the listed Suntone connector are sold separately.

3.1.5 Specification for encoder cable and connector

Select the appropriate connector according to the code of **Shaft diameter and connector type** in the motor model number. Refer to Section 1.2.2 for the model explanation of the servo motor.

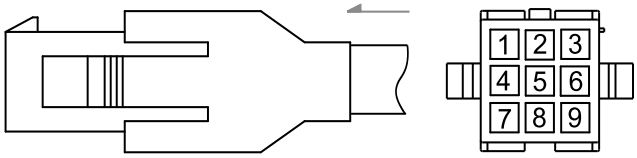
3.1.5.1 F40 - F80 motors – Encoder connectors

Encoder connection (Diagram 1): Standard connector



(1) CN2 connector; (2) Standard connector (female)

Note: the diagram shows the connection between the servo drive and the encoder, and it is not drawn to scale. The specification is subject to change depending on the selected servo drive and motor models.

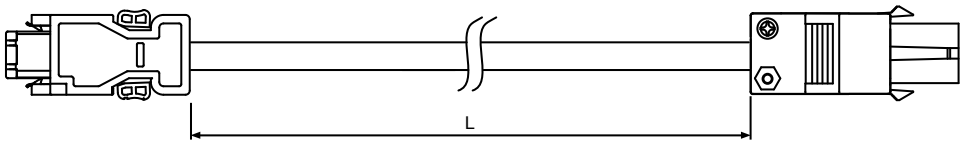
Motor model	Standard connector (female)	
ECM-B3[1]-C[2]0401[3][4][5] ECM-B3[1]-C[2]0602[3][4][5] ECM-B3[1]-C[2]0604[3][4][5] ECM-B3[1]-C[2]0804[3][4][5] ECM-B3[1]-C[2]0807[3][4][5] ECM-B3[1]-C[2]0810[3][4][5] ECM-A3[1]-C[2]040F[3][4][5] ECM-A3[1]-C[2]0401[3][4][5] ECM-A3[1]-C[2]0602[3][4][5] ECM-A3[1]-C[2]0604[3][4][5] ECM-A3[1]-C[2]0804[3][4][5] ECM-A3[1]-C[2]0807[3][4][5]		
	Recommended brand	Model number
	Delta	ACS3-CAEN0000
	TE Connectivity	1-172161-9 or 172161-1 (case) 170359-1 (tin-plated terminal) 170359-3 (gold-plated terminal)

Note:

1. In the servo motor model number, [1] represents the motor inertia, [2] represents the encoder type, [3] represents the brake or keyway / oil seal type, [4] represents the shaft diameter and connector type, and [5] represents the special code.
2. Connectors with tin-plated terminals are recommended. Since the terminal of the connector on the servo motor is tin-plated, we recommend using the connector with tin-plated terminal for the connectors on both ends to have the same metal plating.
3. When selecting the wires, refer to Section 3.1.6 for details.

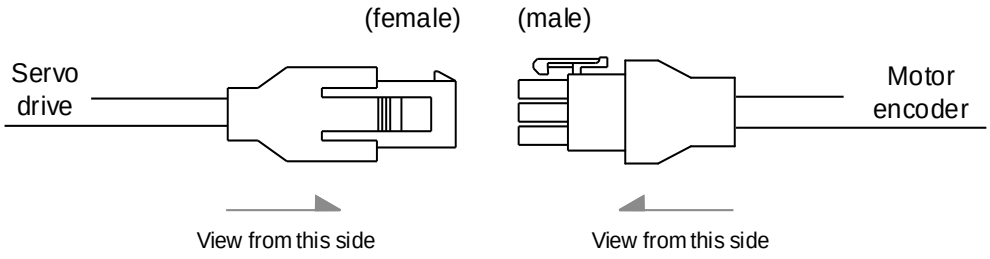
3

Specifications and pin assignment of the standard connector for the incremental encoder of A3 / B3 motors



Model number of incremental encoder cable	L	
	mm	inch
ACS3-CAE□0103	3000 ± 50	118 ± 2
ACS3-CAE□0105	5000 ± 50	197 ± 2
ACS3-CAE□0110	10000 ± 100	394 ± 4
ACS3-CAE□0120	20000 ± 100	787 ± 4

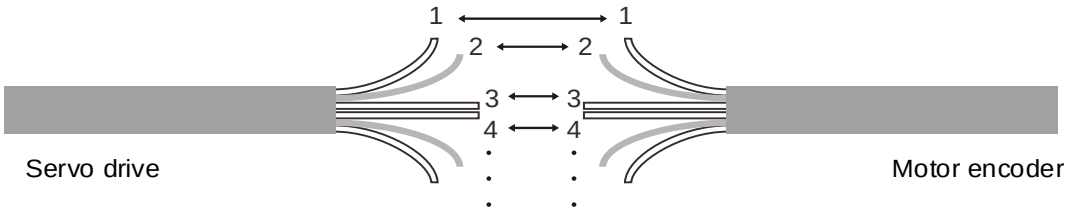
Note: select cables according to the □ in the model number. F represents flexible cables and N represents standard cables.



1 White T+	2 Reserved	3 Reserved
4 White/Red T-	5 Reserved	6 Reserved
7 Brown DC+5V	8 Blue GND	9 Shield

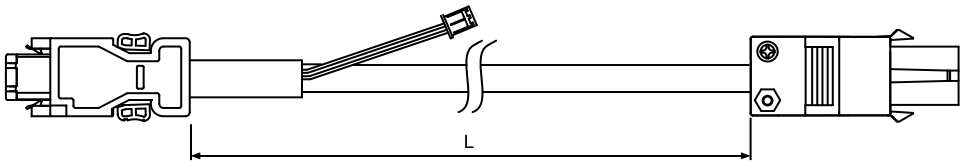
3 Reserved	2 Reserved	1 White T+
6 Reserved	5 Reserved	4 White/Red T-
9 Shield	8 Blue GND	7 Brown DC+5V

Note: the wire colors of the encoder cable for the servo drive are for reference only. Refer to the actual product.



To directly connect the wires without using the connectors, number the wires of the servo drive encoder cable in sequence, and then connect them to the wires of the motor encoder cable. For example, connect wire No. 1 of the servo drive encoder cable to wire No. 1 of the motor encoder cable, and so on.

Specifications and pin assignment of the standard connector for the absolute encoder of A3 / B3 motors

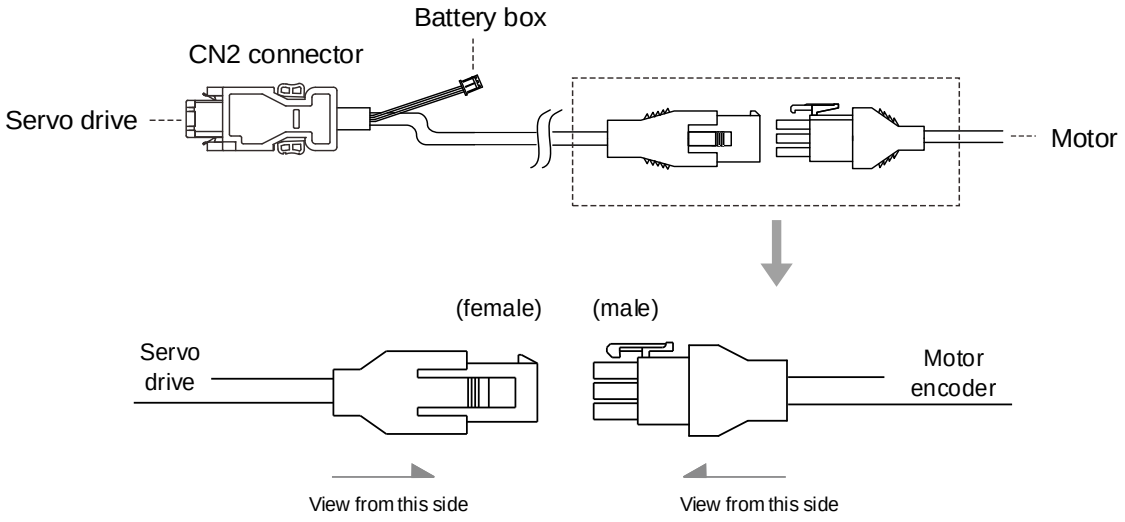


Model number of absolute encoder cable	L	
	mm	inch
ACS3-CAE□0103	3000 ± 50	118 ± 2
ACS3-CAE□0105	5000 ± 50	197 ± 2
ACS3-CAE□0110	10000 ± 100	394 ± 4
ACS3-CAE□0120	20000 ± 100	787 ± 4

Note: select cables according to the □ in the model number. B represents flexible cables and A represents standard cables.

Connection method:

Caution Follow these instructions when wiring. Incorrect wiring may cause battery explosion.



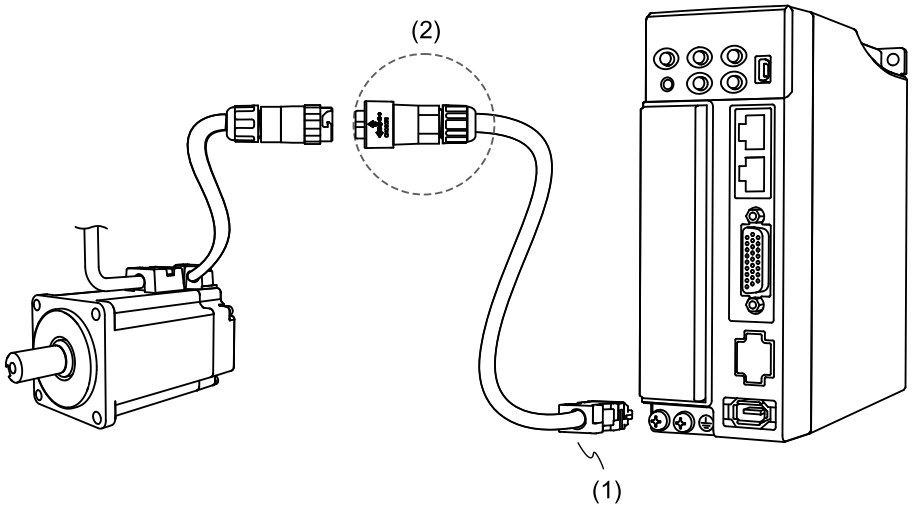
1 White T+	2 Red BAT+	3 Reserved
4 White/Red T-	5 Black BAT-	6 Reserved
7 Brown DC+5V	8 Blue GND	9 Shield

3 Reserved	2 Black BAT+	1 White T+
6 Reserved	5 Black/Red BAT-	4 White/Red T-
9 Shield	8 Blue GND	7 Brown DC+5V

Note: the wire colors of the encoder cable for the servo drive are for reference only. Refer to the actual product.

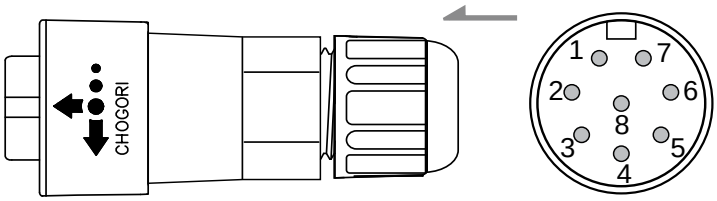
3

Encoder connection (Diagram 2): CHOGORI connector



(1) CN2 connector; (2) CHOGORI connector

Note: the diagram shows the connection between the servo drive and the encoder, and it is not drawn to scale. The specification is subject to change depending on the selected servo drive and motor models.

Motor model	CHOGORI connector
ECM-B3[1]-C[2]0401[3][4][5] ECM-B3[1]-C[2]0602[3][4][5] ECM-B3[1]-C[2]0604[3][4][5] ECM-B3[1]-C[2]0804[3][4][5] ECM-B3[1]-C[2]0807[3][4][5] ECM-B3[1]-C[2]0810[3][4][5] ECM-A3[1]-C[2]040F[3][4][5] ECM-A3[1]-C[2]0401[3][4][5] ECM-A3[1]-C[2]0602[3][4][5] ECM-A3[1]-C[2]0604[3][4][5] ECM-A3[1]-C[2]0804[3][4][5] ECM-A3[1]-C[2]0807[3][4][5]	

Note:

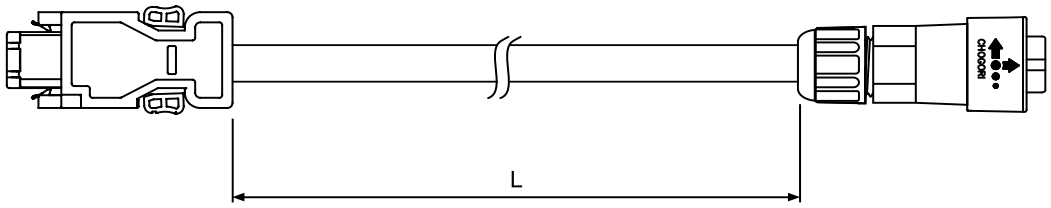
1. In the servo motor model number, [1] represents the motor inertia, [2] represents the encoder type, [3] represents the brake or keyway / oil seal type, [4] represents the shaft diameter and connector type, and [5] represents the special code.
2. When selecting the wires, refer to Section 3.1.6 for details. For the wiring instructions of IP67 connectors, refer to Section 3.1.7.

Connector specifications:

B3 / A3 encoder	Brand	Model number	IP rating
IP67 waterproof connector	Delta	ACS3-CNEN2A00	IP67
	CHOGORI	22008231-01	IP67

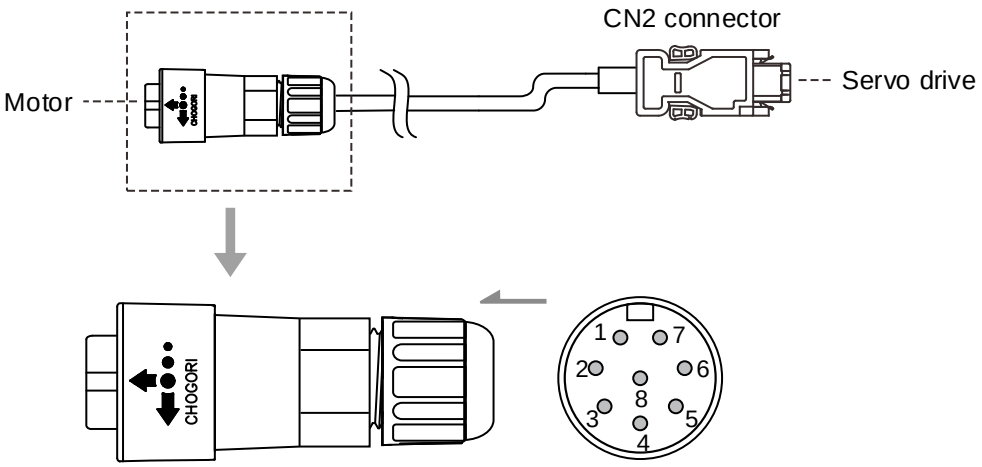
Note: refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.

Specifications and pin assignment of the CHOGORI connector for the incremental encoder of A3 / B3 motors



Model number of incremental encoder cable	Model number of connector	L	
		mm	inch
ACS3-CAE□1103	22008231-01	3000 ± 50	118 ± 2
ACS3-CAE□1105	22008231-01	5000 ± 50	197 ± 2
ACS3-CAE□1110	22008231-01	10000 ± 100	394 ± 4
ACS3-CAE□1120	22008231-01	20000 ± 100	787 ± 4

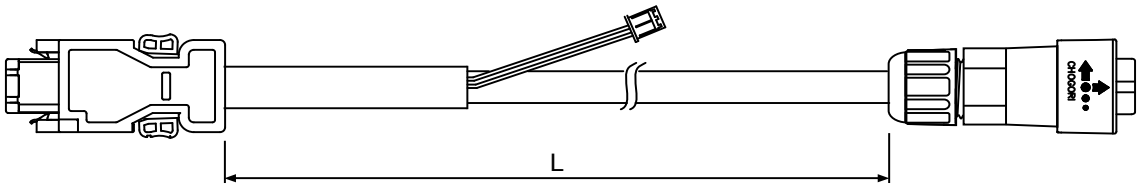
Note: select cables according to the □ in the model number. F represents flexible cables and N represents standard cables.



Pin No.	Terminal	Color
1	T+	White
2	T-	White/Red
3	GND	Blue
4	DC+5V	Brown
5, 6, 7	-	-
8	Shield	-

3

Specifications and pin assignment of the CHOGORI connector for the absolute encoder of A3 / B3 motors

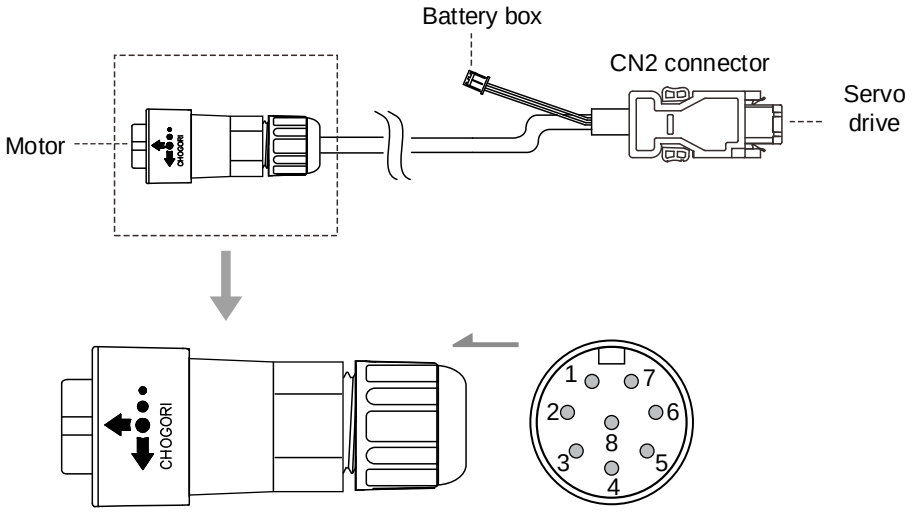


Model number of absolute encoder cable	Model number of connector	L	
		mm	inch
ACS3-CAE□1103	22008231-01	3000 ± 50	118 ± 2
ACS3-CAE□1105	22008231-01	5000 ± 50	197 ± 2
ACS3-CAE□1110	22008231-01	10000 ± 100	394 ± 4
ACS3-CAE□1120	22008231-01	20000 ± 100	787 ± 4

Note: select cables according to the □ in the model number. B represents flexible cables and A represents standard cables.

Connection method:

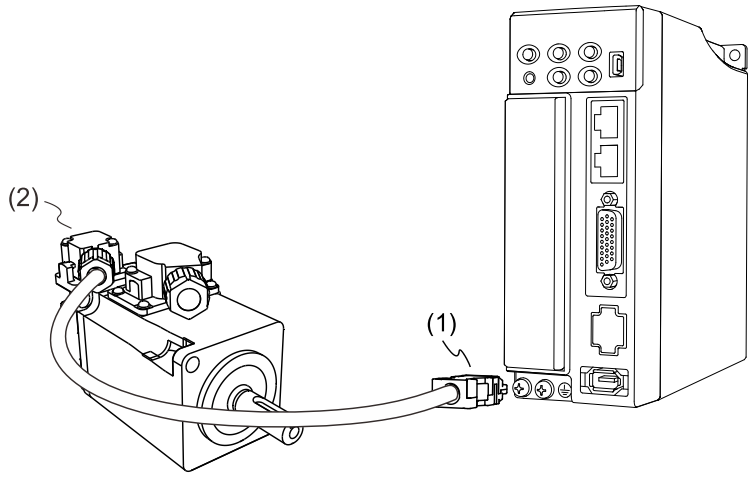
Caution Follow these instructions when wiring. Incorrect wiring may cause battery explosion.



Pin No.	Terminal	Color
1	T+	White
2	T-	White/Red
3	GND	Blue
4	DC+5V	Brown
5	BAT-	Black
6	BAT+	Red
7	-	-
8	Shield	-

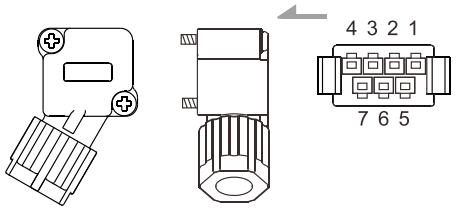
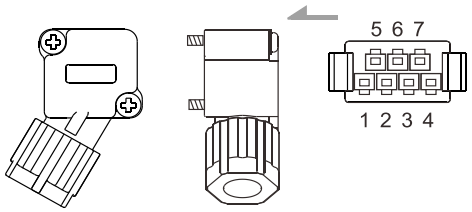
Note: if using an incremental encoder cable, connecting BAT+ and BAT- is not required.

Encoder connection (Diagram 3): Bulkhead connector



(1) CN2 connector; (2) Bulkhead connector (cable exit direction towards motor shaft)

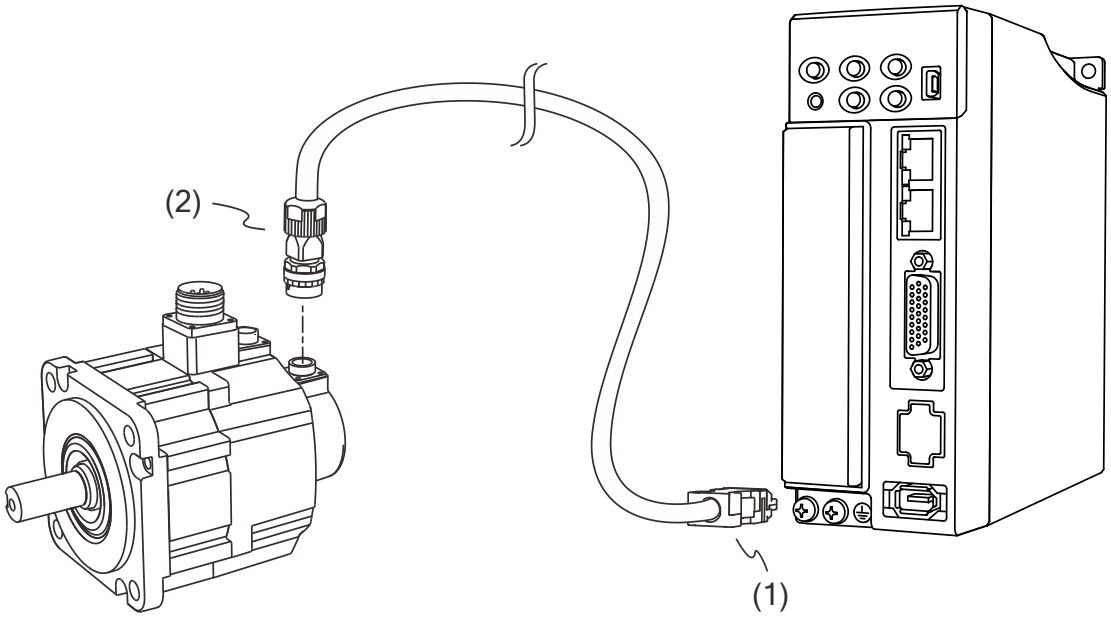
Note: the diagram shows the connection between the servo drive and the encoder, and it is not drawn to scale. The specification is subject to change depending on the selected servo drive and motor models.

Motor model	Bulkhead connector	
ECM-B3□1-C□20401□4□5 ECM-B3□1-C□20602□4□5 ECM-B3□1-C□20604□4□5 ECM-B3□1-C□20804□4□5 ECM-B3□1-C□20807□4□5 ECM-B3□1-C□20810□4□5	Cable exit direction towards motor shaft	
	Cable exit direction towards encoder	
	Brand	Model number
	Delta	ACS3-AFEASA00
	SUNCHU	SC-ACS3-AFEASA00

Note:

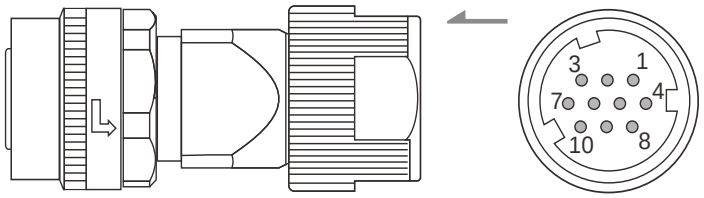
1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. We recommend using the connector with gold-plated terminals since the connector of the encoder cable from the servo motor side is also gold-plated.
3. For the detailed pin assignment, refer to Section 3.4.

3.1.5.2 F100 - F180 motors – Encoder connectors



(1) CN2 connector; (2) Military connector

Note: the diagram shows the connection between the servo drive and the encoder, and it is not drawn to scale. The specification is subject to change depending on the selected servo drive and motor models.

Motor model	Military connector - straight
ECM-B3□-C□1010□□□ ECM-B3□-C□1015□□□ ECM-B3□-C□1020□□□ ECM-B3□-E□1310□□□ ECM-B3□-E□1315□□□ ECM-B3□-E□1320□□□ ECM-B3□-E□1820□□□ ECM-B3□-F□1308□□□ ECM-B3□-F□1313□□□ ECM-B3□-F□1318□□□ ECM-B3□-F□1830□□□ ECM-B3□-J□1010□□□ ECM-B3□-J□1015□□□ ECM-B3□-J□1020□□□ ECM-B3□-K□1310□□□ ECM-B3□-K□1315□□□ ECM-B3□-K□1320□□□ ECM-B3□-L□1308□□□ ECM-B3□-L□1313□□□ ECM-B3□-L□1318□□□	

Note:

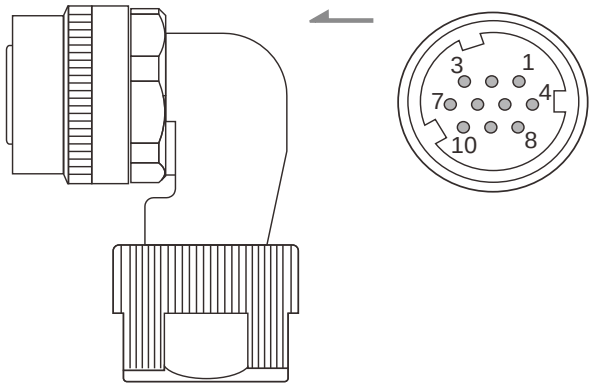
1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. When selecting the wires, refer to Section 3.1.6 for details.

Connector specifications:

B3 encoder	Brand	Model number	IP rating
CMV1-SP10S	Delta	ACS3-CAENA000	IP67
	DDK*2	CMV1-SP10S-M1	IP67
	Suntone*3	SM10-SP10S-M1-D6-V	IP67

Note:

1. Refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.
2. The solder contacts (CMV1-#22ACS-S1-100) or crimp contacts (CMV1-#22ACS-C1-100) for the listed DDK connector are sold separately.
3. The solder contacts (SMS-5012 or SMS-5013) or crimp contacts (SMS-5011) for the listed Suntone connector are sold separately.

Motor model	Military connector - right angle
ECM-B3□-E□1010□□□ ECM-B3□-E□1015□□□ ECM-B3□-E□1020□□□ ECM-B3□-E□1310□□□ ECM-B3□-E□1315□□□ ECM-B3□-E□1320□□□ ECM-B3□-F□1308□□□ ECM-B3□-F□1313□□□ ECM-B3□-F□1318□□□ ECM-B3□-E□1820□□□ ECM-B3□-F□1830□□□ ECM-B3□-J□1010□□□ ECM-B3□-J□1015□□□ ECM-B3□-J□1020□□□ ECM-B3□-K□1310□□□ ECM-B3□-K□1315□□□ ECM-B3□-K□1320□□□ ECM-B3□-L□1308□□□ ECM-B3□-L□1313□□□ ECM-B3□-L□1318□□□	

Note:

1. In the servo motor model number, □1 represents the motor inertia, □2 represents the encoder type, □3 represents the brake or keyway / oil seal type, □4 represents the shaft diameter and connector type, and □5 represents the special code.
2. When selecting the wires, refer to Section 3.1.6 for details.

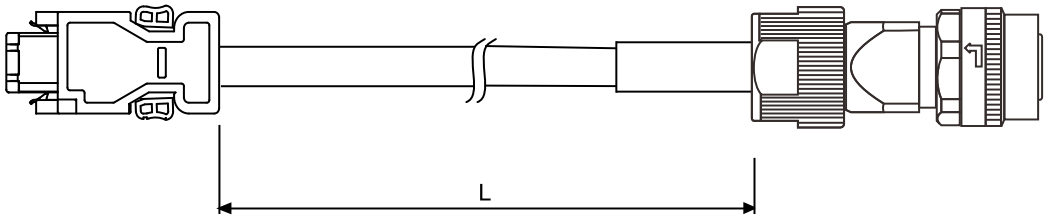
Connector specifications:

B3 encoder	Brand	Model number	IP rating
CMV1-AP10S	Delta	ACS3-CRENA000	IP67
	DDK*2	CMV1-AP10S-M1	IP67
	Suntone*3	SM10-AP10S-M1-D6-V	IP67

Note:

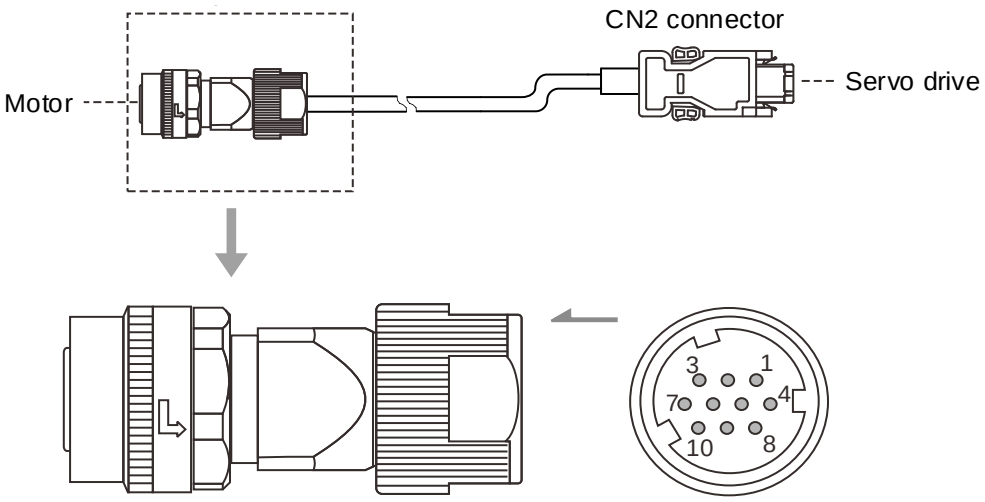
1. Refer to Section 3.1.7 for the wire diameter specification of the IP67 compliant Delta connectors. For connector specification of other brands, contact the manufacturers.
2. The solder contacts (CMV1-#22ACS-S1-100) or crimp contacts (CMV1-#22ACS-C1-100) for the listed DDK connector are sold separately.
3. The solder contacts (SMS-5012 or SMS-5013) or crimp contacts (SMS-5011) for the listed Suntone connector are sold separately.

Specifications and pin assignment of the military connector for the incremental encoder of B3 motors



Model number of incremental encoder cable	Model number of connector	L	
		mm	inch
ACS3-CAE□A103	CMV1-SP10S	3000 ± 50	118 ± 2
ACS3-CAE□A105	CMV1-SP10S	5000 ± 50	197 ± 2
ACS3-CAE□A110	CMV1-SP10S	10000 ± 100	394 ± 4
ACS3-CAE□A120	CMV1-SP10S	20000 ± 100	787 ± 4

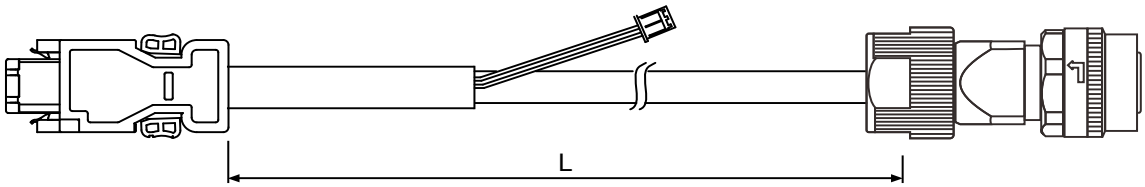
Note: select cables according to the □ in the model number. F represents flexible cables and N represents standard cables.



Pin No.	Terminal	Color
1	T+	White
2	T-	White/Red
3	–	–
4	DC+5V	Brown
5, 6, 7, 8	–	–
9	GND	Blue
10	Shield	–

3

Specifications and pin assignment of the military connector for the absolute encoder of B3 motors

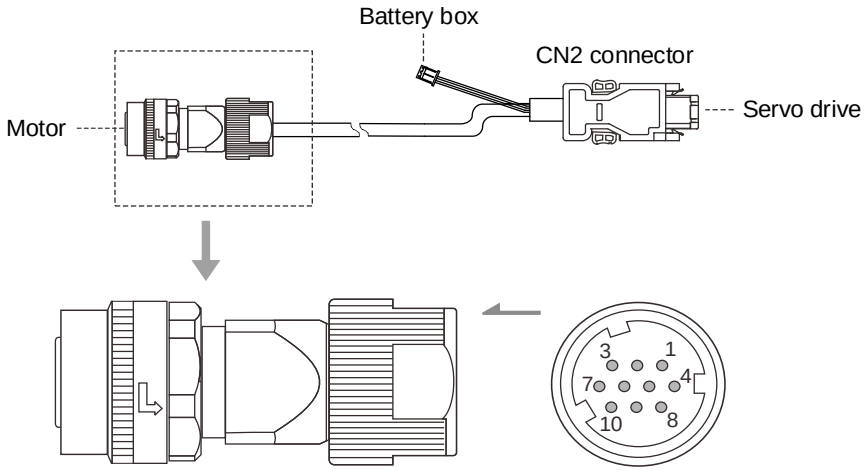


Model number of absolute encoder cable	Model number of connector	L	
		mm	inch
ACS3-CAE□A103	CMV1-SP10S	3000 ± 50	118 ± 2
ACS3-CAE□A105	CMV1-SP10S	5000 ± 50	197 ± 2
ACS3-CAE□A110	CMV1-SP10S	10000 ± 100	394 ± 4
ACS3-CAE□A120	CMV1-SP10S	20000 ± 100	787 ± 4

Note: select cables according to the □ in the model number. B represents flexible cables and A represents standard cables.

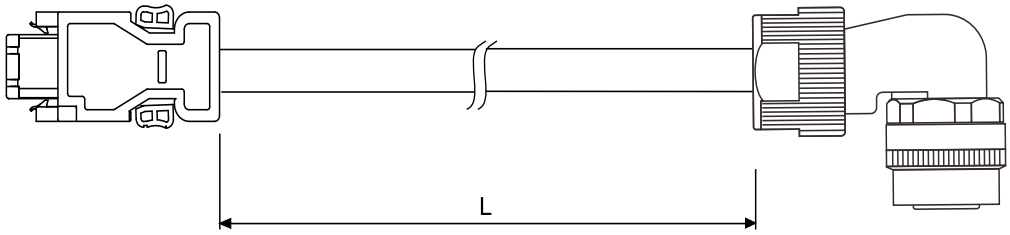
Connection method:

Caution Follow these instructions when wiring. Incorrect wiring may cause battery explosion.



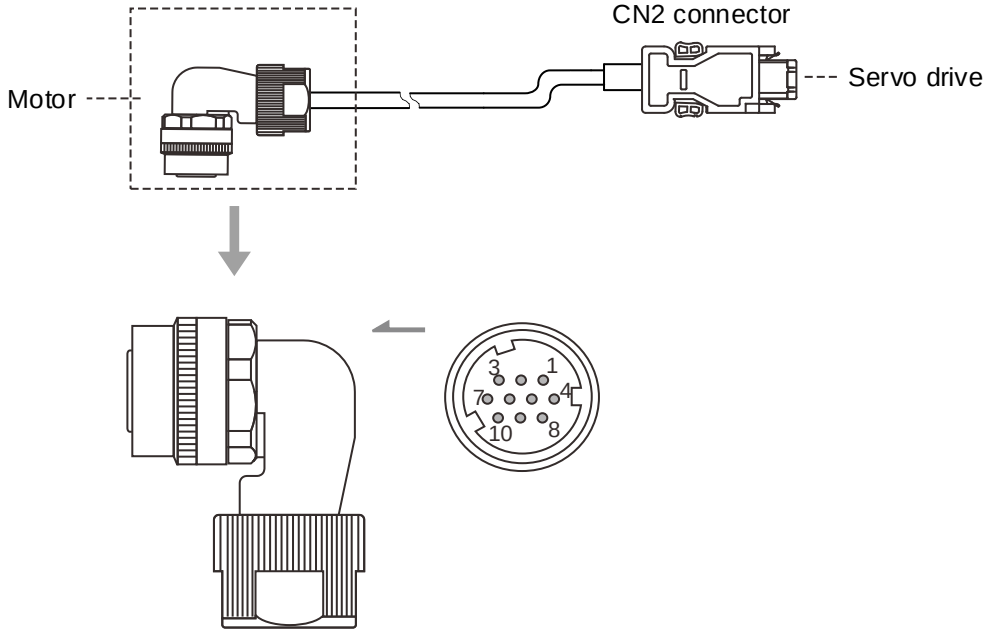
Pin No.	Terminal	Color
1	T+	White
2	T-	White/Red
3	–	–
4	DC+5V	Brown
5	BAT-	Black
6	BAT+	Red
7, 8	–	–
9	GND	Blue
10	Shield	–

Specifications and pin assignment of the military connector for the incremental encoder of B3 motors



Model number of incremental encoder cable	Model number of connector	L	
		mm	inch
ACS3-CRE□A103	CMV1-AP10S	3000 ± 50	118 ± 2
ACS3-CRE□A105	CMV1-AP10S	5000 ± 50	197 ± 2
ACS3-CRE□A110	CMV1-AP10S	10000 ± 100	394 ± 4
ACS3-CRE□A120	CMV1-AP10S	20000 ± 100	787 ± 4

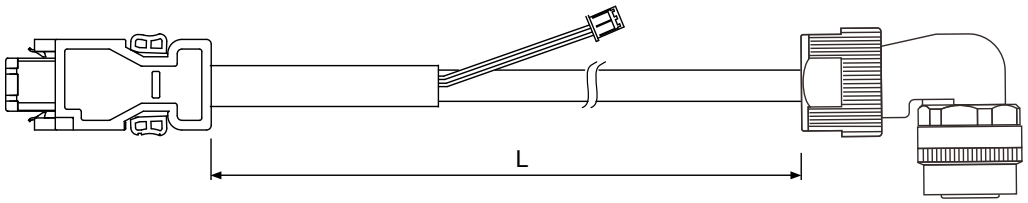
Note: select cables according to the □ in the model number. F represents flexible cables and N represents standard cables.



Pin No.	Terminal	Color
1	T+	White
2	T-	White/Red
3	–	–
4	DC+5V	Brown
5, 6, 7, 8	–	–
9	GND	Blue
10	Shield	–

3

Specifications and pin assignment of the military connector for the absolute encoder of B3 motors

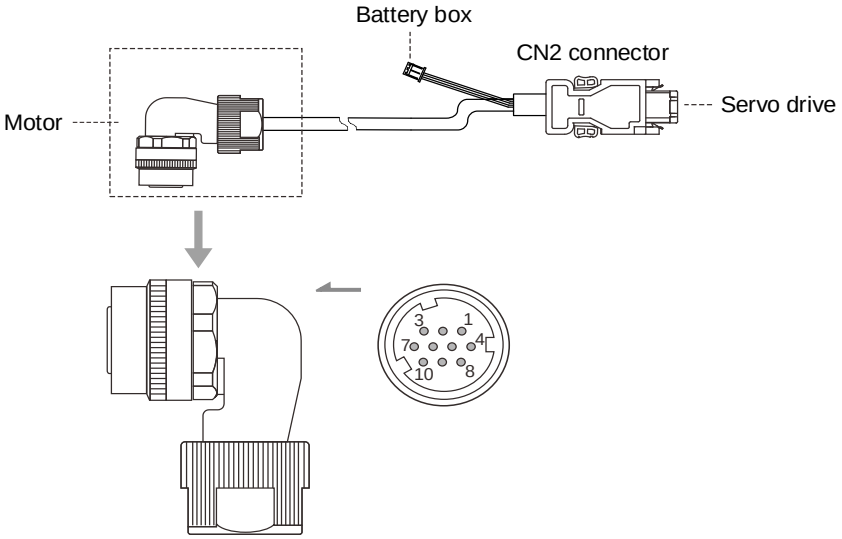


Model number of absolute encoder cable	Model number of connector	L	
		mm	inch
ACS3-CRE□A103	CMV1-AP10S	3000 ± 50	118 ± 2
ACS3-CRE□A105	CMV1-AP10S	5000 ± 50	197 ± 2
ACS3-CRE□A110	CMV1-AP10S	10000 ± 100	394 ± 4
ACS3-CRE□A120	CMV1-AP10S	20000 ± 100	787 ± 4

Note: select cables according to the □ in the model number. B represents flexible cables and A represents standard cables.

Connection method:

Caution Follow these instructions when wiring. Incorrect wiring may cause battery explosion.



Pin No.	Terminal	Color
1	T+	White
2	T-	White/Red
3	–	–
4	DC+5V	Brown
5	BAT-	Black
6	BAT+	Red
7, 8	–	–
9	GND	Blue
10	Shield	–

3.1.6 Wire selection

3.1.6.1 Wire diameters / screw terminal block dimensions / screw and tightening torque specifications

3.1.6.1.1 220V series

The recommended wires for connectors and signal wiring for the servo drive are listed in the following tables:

1. The shield should connect to the ground terminal ⏚.
2. When wiring, use the wires suggested in this section to avoid danger.

Servo drive model	Wire diameter	K.S. Terminals Inc.		Kise Terminal		Kss Terminal	
	U, V, W	Fork terminal	Ring terminal	Fork terminal	Ring terminal	Fork terminal	Ring terminal
ASD-B3□-0121-□	18 AWG 0.82 mm²	SVBL1-3.7	RVBM1-3.7	SVS 1.25-3.5	RVS 1.25-3.5	YF1.25-3	RF1.25-3
ASD-B3□-0221-□							
ASD-B3□-0421-□							
ASD-B3□-0721-□							
ASD-B3□-1021-□	16 AWG 1.3 mm²	SVBL2-3.7	RVBM2-3.7	SV 1.25-3	RV 1.25-3	YF1.25-3	RF1.25-3
ASD-B3□-1521-□							
ASD-B3□-2023-□	12 AWG 3.3 mm²	SVB3-4	RVB3-4	SV 3.5-4	RV 3.5-4	YF3.5-4	RF3.5-4
ASD-B3□-3023-□	10 AWG 5.3 mm²	SVBS5-4	RVBS5-4	SVS 5.5-4	RVS 5.5-4	YF5.5-4	RF5.5-4

Servo drive model	Wire diameter	K.S. Terminals Inc.		Kise Terminal		Kss Terminal	
	P⊕, C	Fork terminal	Ring terminal	Fork terminal	Ring terminal	Fork terminal	Ring terminal
ASD-B3□-0121-□	14 AWG 2.1 mm²	SVBL2-3.7	RVBM2-3.7	SV 3.5-3	RV 2-3	YF3.5-3S	RF2-3
ASD-B3□-0221-□							
ASD-B3□-0421-□							
ASD-B3□-0721-□							
ASD-B3□-1021-□							
ASD-B3□-1521-□							
ASD-B3□-2023-□		SVBL2-4	RVBL2-4	SV 3.5-4	RV 3.5-4	YF2-4	RF2-4
ASD-B3□-3023-□							

Servo drive model	Wire diameter	K.S. Terminals Inc.		Kise Terminal		Kss Terminal	
	L_{1C}, L_{2C}	Fork terminal	Ring terminal	Fork terminal	Ring terminal	Fork terminal	Ring terminal
ASD-B3□-0121-□	16 AWG 1.3 mm²	SVBL2-3.7	RVBM2-3.7	SV 1.25-3	RV 1.25-3	YF1.25-3	RF1.25-3
ASD-B3□-0221-□							
ASD-B3□-0421-□							
ASD-B3□-0721-□							
ASD-B3□-1021-□							
ASD-B3□-1521-□							
ASD-B3□-2023-□		SVBL2-4	RVBL2-4	SV 1.25-4	RVL 1.25-4	YF2-4	RF2-4
ASD-B3□-3023-□							

3

Servo drive model	Wire diameter	K.S. Terminals Inc.		Kise Terminal		Kss Terminal	
	R, S, T	Fork terminal	Ring terminal	Fork terminal	Ring terminal	Fork terminal	Ring terminal
ASD-B3□-0121-□	22 AWG 0.32 mm²	SVBL1-3.7	RVBM1-3.7	SV 1.25-3	RV 1.25-3	YF1.25-3	RF1.25-3
ASD-B3□-0221-□							
ASD-B3□-0421-□	20 AWG 0.52 mm²						
ASD-B3□-0721-□	16 AWG 1.3 mm²						
ASD-B3□-1021-□	14 AWG 2.1 mm²	SVBL2-3.7	RVBM2-3.7	SV 3.5-3	RV 2-3	YF3.5-3S	RF2-3
ASD-B3□-1521-□	12 AWG 3.3 mm²	-	-		-		-
ASD-B3□-2023-□	12 AWG 3.3 mm²	SVBS5-4	RVBS5-4	SVS 5.5-4	RVS 5.5-4	YF5.5-4	RF5.5-4
ASD-B3□-3023-□	10 AWG 5.3 mm²						

If you choose terminals of other brands, refer to the following terminal block dimensions.

Servo drive model	Screw terminal block dimensions
ASD-B3□-0121-□	7 mm
ASD-B3□-0221-□	
ASD-B3□-0421-□	
ASD-B3□-0721-□	
ASD-B3□-1021-□	
ASD-B3□-1521-□	
ASD-B3□-2023-□	9.5 mm
ASD-B3□-3023-□	

Note:
1. Choose the corresponding terminals for the servo drive to comply with the wiring specifications.
2. Use a crimping tool to properly crimp the terminals and wires.
3. Do not use bare wires for wiring, or the loose wires may cause accidents.
4. Use a 600 V_{AC} PVC cable with the length less than 20 meters (65.62 feet) for the power cable.
5. In the servo drive model number, □1 represents the product series and □2 represents the model type.

Refer to the following screws specifications and ensure the tightening torque does not exceed the following specifications.

Screw specification and tightening torque (kgf-cm)												
Servo drive model	L_{1C}, L_{2C}		R, S, T		U, V, W		P⊕, D, C, ⊖		Ground screw ⏚		CN1	
ASD-B3□-0121-□	M3	6 - 7	M3	6 - 7	M3	6 - 7	M3	6 - 7	M4	12 - 14	-	2 - 2.5
ASD-B3□-0221-□	M3	6 - 7	M3	6 - 7	M3	6 - 7	M3	6 - 7	M4	12 - 14	-	2 - 2.5
ASD-B3□-0421-□	M3	6 - 7	M3	6 - 7	M3	6 - 7	M3	6 - 7	M4	12 - 14	-	2 - 2.5
ASD-B3□-0721-□	M3	6 - 7	M3	6 - 7	M3	6 - 7	M3	6 - 7	M4	12 - 14	-	2 - 2.5
ASD-B3□-1021-□	M3	6 - 7	M3	6 - 7	M3	6 - 7	M3	6 - 7	M4	12 - 14	-	2 - 2.5
ASD-B3□-1521-□	M3	6 - 7	M3	6 - 7	M3	6 - 7	M3	6 - 7	M4	12 - 14	-	2 - 2.5
ASD-B3□-2023-□	M4	10 - 11	M4	10 - 11	M4	10 - 11	M4	10 - 11	M4	12 - 14	-	2 - 2.5
ASD-B3□-3023-□	M4	10 - 11	M4	10 - 11	M4	10 - 11	M4	10 - 11	M4	12 - 14	-	2 - 2.5

3.1.6.1.2 400V series

The following table lists the recommended wires for connectors and signal wiring for the servo drive and the ring terminals of the suggested terminal brand K.S. Terminals Inc.

1. The shield should connect to the ground terminal ⏚.
2. When wiring, use the wires suggested in this section to avoid danger.

Servo drive model	L_{1C}, L_{2C}		R, S, T		U, V, W		P⊕, D, C, ⊖	
	Wire diameter	Ring terminal	Wire diameter	Ring terminal	Wire diameter	Ring terminal	Wire diameter	Ring terminal
ASD-B3[1]-1043-[2]	15 AWG 1.7 mm^2	RVBS2-3.2	14 AWG 2.1 mm^2	RVBS2-3.2	16 AWG 1.3 mm^2	RVBS2-3.7	14 AWG 2.1 mm^2	RVBS2-3.2
ASD-B3[1]-1543-[2]	15 AWG 1.7 mm^2	RVBS2-3.2	14 AWG 2.1 mm^2	RVBS2-3.2	16 AWG 1.3 mm^2	RVBS2-3.7	14 AWG 2.1 mm^2	RVBS2-3.2
ASD-B3[1]-2043-[2]	15 AWG 1.7 mm^2	RVBS2-3.2	14 AWG 2.1 mm^2	RVBS2-3.2	16 AWG 1.3 mm^2	RVBS2-3.7	14 AWG 2.1 mm^2	RVBS2-3.2
ASD-B3[1]-3043-[2]	15 AWG 1.7 mm^2	RVBS2-3.2	12 AWG 3.3 mm^2	-	14 AWG 2.1 mm^2	RVBS2-3.2	14 AWG 2.1 mm^2	RVBS2-3.2
ASD-B3[1]-4543-[2]	15 AWG 1.7 mm^2	RVBL2-4	12 AWG 3.3 mm^2	RVBS5-4	12 AWG 3.3 mm^2	RVBS5-4	14 AWG 2.1 mm^2	RVBL2-4
ASD-B3[1]-5543-[2]	15 AWG 1.7 mm^2	RVBL2-4	10 AWG 5.3 mm^2	RVBS5-4	8 AWG 8.4 mm^2	RNBS8-4	12 AWG 3.3 mm^2	RVBS5-4
ASD-B3[1]-7543-[2]	15 AWG 1.7 mm^2	RVBL2-4	10 AWG 5.3 mm^2	RVBS5-4	8 AWG 8.4 mm^2	RNBS8-4	12 AWG 3.3 mm^2	RVBS5-4

If you choose terminals of other brands, refer to the following terminal block dimensions.

Servo drive model	Screw terminal block dimensions
ASD-B3[1]-1043-[2]	7 mm
ASD-B3[1]-1543-[2]	
ASD-B3[1]-2043-[2]	
ASD-B3[1]-3043-[2]	
ASD-B3[1]-4543-[2]	9.5 mm
ASD-B3[1]-5543-[2]	
ASD-B3[1]-7543-[2]	

Refer to the following screw specifications and ensure the tightening torque does not exceed the following specifications.

Screw specifications and tightening torque (kgf-cm)												
Servo drive model	L_{1C}, L_{2C}		R, S, T		U, V, W		P⊕, D, C, ⊖		Ground screw ⏚		CN1	
ASD-B3[1]-1043-[2]	M3	8 - 9	M3	8 - 9	M3	8 - 9	M3	8 - 9	M4	12 - 14	-	2 - 2.5
ASD-B3[1]-1543-[2]	M3	8 - 9	M3	8 - 9	M3	8 - 9	M3	8 - 9	M4	12 - 14	-	2 - 2.5
ASD-B3[1]-2043-[2]	M3	8 - 9	M3	8 - 9	M3	8 - 9	M3	8 - 9	M4	12 - 14	-	2 - 2.5
ASD-B3[1]-3043-[2]	M3	8 - 9	M3	8 - 9	M3	8 - 9	M3	8 - 9	M4	12 - 14	-	2 - 2.5
ASD-B3[1]-4543-[2]	M4	9 - 10	M4	9 - 10	M4	9 - 10	M4	9 - 10	M4	12 - 14	-	2 - 2.5
ASD-B3[1]-5543-[2]	M4	9 - 10	M4	9 - 10	M4	9 - 10	M4	9 - 10	M4	12 - 14	-	2 - 2.5
ASD-B3[1]-7543-[2]	M4	9 - 10	M4	9 - 10	M4	9 - 10	M4	9 - 10	M4	12 - 14	-	2 - 2.5

Note:
1. Choose the corresponding ring terminals for the servo drive to comply with the wiring specifications.
2. Use a crimping tool to properly crimp the terminals and wires.
3. Do not use bare wires for wiring, or the loose wires may cause accidents.
4. Use a 600 V_{AC} PVC cable with the length less than 20 meters (65.62 feet) for the power cable.
5. In the servo drive model number, [1] represents the product series and [2] represents the model type.

3.1.6.2 Encoder cable specifications

Item	Standard cable	Flexible cable
Model number	ACS3-CAEN01XX ACS3-CAEA01XX ACS3-CAEN11XX ACS3-CAEA11XX ACS3-CAENA1XX ACS3-CAEAA1XX ACS3-CRENA1XX ACS3-CREAA1XX	ACS3-CAEF01XX ACS3-CAEB01XX ACS3-CAEF11XX ACS3-CAEB11XX ACS3-CAEFA1XX ACS3-CAEBA1XX ACS3-CREFA1XX ACS3-CREBA1XX
Cable type	UL2464 (Temp. rating: 80°C / 221°F)	UL2464 (Temp. rating: 80°C / 221°F)
DC+5V, GND	AWG#22-2C (0.32 mm²) Outer diameter of insulated wire: Φ1.3 mm	AWG#22-2C (0.32 mm²) Outer diameter of insulated wire: Φ1.3 mm
T+, T-	AWG#24-2P (0.21 mm²) Outer diameter of insulated wire: Φ1.1 mm	AWG#24-2P (0.21 mm²) Outer diameter of insulated wire: Φ1.1 mm
Cable diameter	Φ7 mm	
Max. allowable wiring length	20 m	
Standard length provided by Delta	L = 3 m, 5 m, 10 m, 20 m	

Item	Standard cable	Flexible cable
Model number	ACS3-AFEASIXX ACS3-ABEASIXX ACS3-AFEASAXX ACS3-ABEASAXX	ACS3-AFERSIXX ACS3-ABERSIXX ACS3-AFERSAXX ACS3-ABERSAXX
Cable type	UL20276 (Temp. rating: 80°C / 221°F)	UL20276 (Temp. rating: 80°C / 221°F)
DC+5V, GND	AWG#22-2C (0.32 mm²) Outer diameter of insulated wire: Φ1.3 mm	AWG#22-2C (0.32 mm²) Outer diameter of insulated wire: Φ1.3 mm
T+, T-	AWG#26-2P (0.13 mm²) Outer diameter of insulated wire: Φ1.1 mm	AWG#26-2P (0.13 mm²) Outer diameter of insulated wire: Φ1.1 mm
Cable diameter	Φ5.8 ~ Φ6.2 mm	
Max. allowable wiring length	20 m	
Standard length provided by Delta	L = 3 m, 5 m, 10 m, 20 m	

Note:

1. Use a shielded twisted-pair cable to reduce the noise interference.
2. The shield should connect to the ground terminal ⏚.
3. When wiring, use the wires suggested in this section to avoid danger.

3.1.6.3 Power cable specifications

Motor frame: F40 - F80

220V series:

Item	Standard cable	Flexible cable
Model number	ACS3-CAPW11XX ACS3-CAPW21XX ACS3-CAPW51XX ACS3-CAPW61XX	ACS3-CAPF11XX ACS3-CAPF21XX ACS3-CAPF51XX ACS3-CAPF61XX
Cable type	UL2586 (Temp. rating: 105°C / 221°F)	UL2586 (Temp. rating: 105°C / 221°F)
UVW wire	AWG#18-4C (0.82 mm²) Outer diameter of insulated wire: Φ2.1 mm Voltage rating: 600 V_{AC}	AWG#18-4C (0.82 mm²) Outer diameter of insulated wire: Φ2.1 mm Voltage rating: 600 V_{AC}
Brake wire	AWG#22-2C (0.32 mm²) Outer diameter of insulated wire: Φ1.6 mm Voltage rating: 600 V_{AC}	AWG#22-2C (0.32 mm²) Outer diameter of insulated wire: Φ1.6 mm Voltage rating: 600 V_{AC}
Cable diameter	Power cable w/o brake: Φ7.7 mm; power cable with brake: Φ8.6 mm	
Max. allowable wiring length	20 m	
Standard length provided by Delta	L = 3 m, 5 m, 10 m, 20 m	

Item	Standard cable	Flexible cable
Model number	ACS3-AFPWSRXX ACS3-AFPWSSXX	ACS3-AFPRSRXX ACS3-AFPRSSXX
Cable type	UL2517 (Temp. rating: 105°C / 221°F)	UL2517 (Temp. rating: 105°C / 221°F)
UVW wire	AWG#20-4C (0.52 mm²) Outer diameter of insulated wire: Φ1.8 mm Voltage rating: 300 V_{AC}	AWG#20-4C (0.52 mm²) Outer diameter of insulated wire: Φ1.8 mm Voltage rating: 300 V_{AC}
Brake wire	AWG#24-2C (0.21 mm²) Outer diameter of insulated wire: Φ1.2 mm Voltage rating: 300 V_{AC}	AWG#24-2C (0.21 mm²) Outer diameter of insulated wire: Φ1.2 mm Voltage rating: 300 V_{AC}
Cable diameter	Φ6.0 ~ Φ6.8 mm	
Max. allowable wiring length	20 m	
Standard length provided by Delta	L = 3 m, 5 m, 10 m, 20 m	

Note:

1. Refer to Section 3.1.6.1 for detailed specifications for wire diameter, screw terminal block dimensions, screws, and tightening torque.
2. Apart from these specifications, refer to Section 2.7.1 for the motor power cable selection and installation precautions.

400V series:

Item	Standard cable	Flexible cable
Model number	ACS3-CAPW21XX ACS3-CAPW31XX	ACS3-CAPF21XX ACS3-CAPF31XX
Cable type	UL2586 (Temp. rating: 105°C / 221°F)	UL2586 (Temp. rating: 105°C / 221°F)
UVW wire	AWG#18-4C (0.82 mm²) Outer diameter of insulated wire: Φ2.1 mm Voltage rating: 600 V_{AC}	AWG#18-4C (0.82 mm²) Outer diameter of insulated wire: Φ2.1 mm Voltage rating: 600 V_{AC}
Brake wire	AWG#22-2C (0.32 mm²) Outer diameter of insulated wire: Φ1.6 mm Voltage rating: 600 V_{AC}	AWG#22-2C (0.32 mm²) Outer diameter of insulated wire: Φ1.6 mm Voltage rating: 600 V_{AC}
Cable diameter	Power cable w/o brake: Φ7.7 mm; power cable with brake: Φ8.6 mm	
Max. allowable wiring length	20 m	
Standard length provided by Delta	L = 3 m, 5 m, 10 m, 20 m	

Note:

1. Refer to Section 3.1.6.1 for detailed specifications for wire diameter, screw terminal block dimensions, screws, and tightening torque.
2. Apart from these specifications, refer to Section 2.7.1 for the motor power cable selection and installation precautions.

Motor frame: F100 - F130

Item		Standard cable	Flexible cable
Power cable	Model number	ACS3-CAPWA2XX ACS3-CRPWA2XX	ACS3-CAPFA2XX ACS3-CRPFA2XX
	Specification	UL2586 (Temp. rating: 105°C / 221°F) AWG#16-4C (1.3 mm²) Outer diameter of insulated wire: Φ3.2 mm Cable diameter: Φ11 mm Voltage rating: 600 V_{AC}	UL2586 (Temp. rating: 105°C / 221°F) AWG#16-4C (1.3 mm²) Outer diameter of insulated wire: Φ3.2 mm Cable diameter: Φ11 mm Voltage rating: 600 V_{AC}
	Model number	ACS3-CAPWA3XX ACS3-CRPWA3XX	ACS3-CAPFA3XX ACS3-CRPFA3XX
	Specification	UL2586 (Temp. rating: 105°C / 221°F) AWG#14-4C (2.1 mm²) Outer diameter of insulated wire: Φ2.8 mm Cable diameter: Φ9.5 mm Voltage rating: 600 V_{AC}	UL2586 (Temp. rating: 105°C / 221°F) AWG#14-4C (2.1 mm²) Outer diameter of insulated wire: Φ2.8 mm Cable diameter: Φ9.5 mm Voltage rating: 600 V_{AC}
Brake cable	Model number	ACS3-CABRA1XX ACS3-CRBRA1XX	ACS3-CABFA1XX ACS3-CRBFA1XX
	Specification	UL2517 (Temp. rating: 105°C / 221°F) AWG#20-2C (0.52 mm²) Outer diameter of insulated wire: Φ1.8 mm Cable diameter: Φ5.5 mm Voltage rating: 300 V_{AC}	UL2517 (Temp. rating: 105°C / 221°F) AWG#20-2C (0.52 mm²) Outer diameter of insulated wire: Φ1.8 mm Cable diameter: Φ5.5 mm Voltage rating: 300 V_{AC}
Max. allowable wiring length		20 m	
Standard length provided by Delta		L = 3 m, 5 m, 10 m, 20 m	

Note:

1. Refer to Section 3.1.6.1 for detailed specifications for wire diameter, screw terminal block dimensions, screws, and tightening torque.
2. Apart from these specifications, refer to Section 2.7.1 for the motor power cable selection and installation precautions.

3

Motor frame and power: F180 4.5 kW (or below)

Item		Standard cable	Flexible cable
Power cable	Model number	ACS3-CAPWC3XX ACS3-CRPWC3XX	ACS3-CAPFC3XX ACS3-CRPFC3XX
	Specification	UL2586 (Temp. rating: 105°C / 221°F) AWG#14-4C (2.1 mm²) Outer diameter of insulated wire: Φ2.8 mm Cable diameter: Φ9.5 mm Voltage rating: 600 V_{AC}	UL2586 (Temp. rating: 105°C / 221°F) AWG#14-4C (2.1 mm²) Outer diameter of insulated wire: Φ2.8 mm Cable diameter: Φ9.5 mm Voltage rating: 600 V_{AC}
	Model number	ACS3-CAPWC4XX ACS3-CRPWC4XX	ACS3-CAPFC4XX ACS3-CRPFC4XX
	Specification	UL2586 (Temp. rating: 105°C / 221°F) AWG#12-4C (3.3 mm²) Outer diameter of insulated wire: Φ4.0 mm Cable diameter: Φ14.5 mm Voltage rating: 600 V_{AC}	UL2586 (Temp. rating: 105°C / 221°F) AWG#12-4C (3.3 mm²) Outer diameter of insulated wire: Φ4.0 mm Cable diameter: Φ14.5 mm Voltage rating: 600 V_{AC}
	Model number	ACS3-CAPWC5XX ACS3-CRPWC5XX	ACS3-CAPFC5XX ACS3-CRPFC5XX
	Specification	UL2586 (Temp. rating: 105°C / 221°F) AWG#10-4C (5.3 mm²) Outer diameter of insulated wire: Φ4.6 mm Cable diameter: Φ15 mm Voltage rating: 600 V_{AC}	UL2586 (Temp. rating: 105°C / 221°F) AWG#10-4C (5.3 mm²) Outer diameter of insulated wire: Φ4.6 mm Cable diameter: Φ15 mm Voltage rating: 600 V_{AC}
	Model number	ACS3-CAPWC6XX ACS3-CRPWC6XX	ACS3-CAPFC6XX ACS3-CRPFC6XX
	Specification	UL2586 (Temp. rating: 105°C / 221°F) AWG#8-4C (8.4 mm²) Outer diameter of insulated wire: Φ7.0 mm Cable diameter: Φ22 mm Voltage rating: 600 V_{AC}	UL2586 (Temp. rating: 105°C / 221°F) AWG#8-4C (8.4 mm²) Outer diameter of insulated wire: Φ7.0 mm Cable diameter: Φ22 mm Voltage rating: 600 V_{AC}
Brake cable	Model number	ACS3-CABRA1XX ACS3-CRBRA1XX	ACS3-CABFA1XX ACS3-CRBFA1XX
	Specification	UL2517 (Temp. rating: 105°C / 221°F) AWG#20-2C (0.52 mm²) Outer diameter of insulated wire: Φ1.8 mm Cable diameter: Φ5.5 mm Voltage rating: 300 V_{AC}	UL2517 (Temp. rating: 105°C / 221°F) AWG#20-2C (0.52 mm²) Outer diameter of insulated wire: Φ1.8 mm Cable diameter: Φ5.5 mm Voltage rating: 300 V_{AC}
Max. allowable wiring length		20 m	
Standard length provided by Delta		L = 3 m, 5 m, 10 m, 20 m	

Note:

1. Refer to Section 3.1.6.1 for detailed specifications for wire diameter, screw terminal block dimensions, screws, and tightening torque.
2. Apart from these specifications, refer to Section 2.7.1 for the motor power cable selection and installation precautions.

Motor frame and power: F180 5.5 kW (or above)

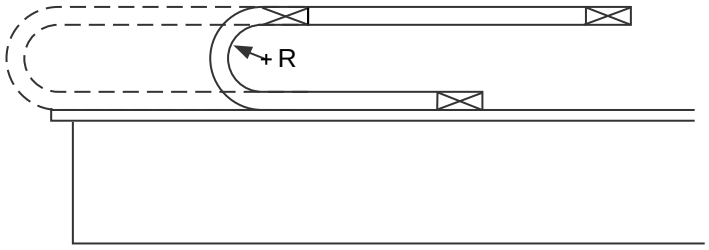
Item		Standard cable	Flexible cable
Power cable	Model number	ACS3-CAPWE6XX ACS3-CRPWE6XX	ACS3-CAPFE6XX ACS3-CRPFE6XX
	Specification	UL2586 (Temp. rating: 105°C / 221°F) AWG#8-4C (8.4 mm²) Outer diameter of insulated wire: Φ7.0 mm Cable diameter: Φ22 mm Voltage rating: 600 V_{AC}	UL2586 (Temp. rating: 105°C / 221°F) AWG#8-4C (8.4 mm²) Outer diameter of insulated wire: Φ7.0 mm Cable diameter: Φ22 mm Voltage rating: 600 V_{AC}
Brake cable	Model number	ACS3-CABRA1XX ACS3-CRBRA1XX	ACS3-CABFA1XX ACS3-CRBFA1XX
	Specification	UL2517 (Temp. rating: 105°C / 221°F) AWG#20-2C (0.52 mm²) Outer diameter of insulated wire: Φ1.8 mm Cable diameter: Φ5.5 mm Voltage rating: 300 V_{AC}	UL2517 (Temp. rating: 105°C / 221°F) AWG#20-2C (0.52 mm²) Outer diameter of insulated wire: Φ1.8 mm Cable diameter: Φ5.5 mm Voltage rating: 300 V_{AC}
Max. allowable wiring length		20 m	
Standard length provided by Delta		L = 3 m, 5 m, 10 m, 20 m	

Note:

1. Refer to Section 3.1.6.1 for detailed specifications for wire diameter, screw terminal block dimensions, screws, and tightening torque.
2. Apart from these specifications, refer to Section 2.7.1 for the motor power cable selection and installation precautions.

3.1.6.4 Flexible cable specifications

Delta provides two types of power and encoder cables[*1]: standard cables and flexible cables. Use flexible cable when connecting to a moving machinery. Refer to the following table for flexible cable specifications.



R = bend radius

Item	Specification
Bend radius	10 times of the cable outer diameter
Number of bending times	10 million times[*2]
Speed	3 m/s
Acceleration	15 m/s^2

Note:

1. Delta provides both standard and flexible power and encoder cables. Refer to Appendix B for more details.
2. Bending the cable into a curve and then straightening it is considered as one time.
3. For precautions relevant to the use of cables, refer to Section 2.10.

3.1.6.5 Wire diameters for the attached terminals of Delta connectors

The following table shows the Delta connectors with terminals attached and the applicable wire diameters. Refer to the actual product specification when wiring.

Connector	Applicable wire diameters for the attached terminals
ACS3-CAPW1000	AWG#24 - #18 (0.21 mm² - 0.82 mm²)
ACS3-CAPW2000	AWG#24 - #18 (0.21 mm² - 0.82 mm²)
ACS3-CAEN0000	AWG#26 - #22 (0.13 mm² - 0.32 mm²)
ACS3-AFPWSS00	UVW: AWG#20 - #18 (0.52 mm² - 0.82 mm²) Brake: AWG#26 - #22 (0.13 mm² - 0.32 mm²)
ACS3-ABPWSS00	
ACS3-AFEASA00	AWG#26 - #22 (0.13 mm² - 0.32 mm²)

3.1.7 Wiring for waterproof connectors

3.1.7.1 Waterproof connector installation and wiring specifications

When selecting the wires, refer to Section 3.1.6.

IP67 waterproof connector installation and wiring specifications

When mating, ensure the connector is fully locked and the diameter of the wire matches that of the rubber ring. If you choose a wire of smaller diameter and a rubber ring of larger diameter, the combination does not meet the IP67 standard.

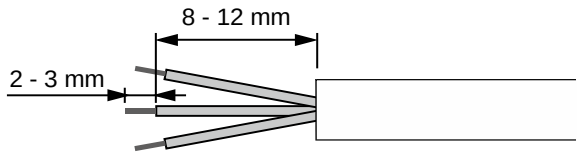
Model number of connector	Diameter of rubber ring (mm)	Torque for tightening the connector
ACS3-CNPW1A00	Φ6.5 - Φ9.5	1.6 Nm
ACS3-CNPW2A00	Φ6.5 - Φ9.5	1.6 Nm
ACS3-CNEN2A00	Φ3.5 - Φ6.8	1.1 Nm
ACS3-AFPWSS00	Φ6.0 - Φ6.8	0.3 Nm
ACW-ABPWSS00	Φ6.0 - Φ6.8	0.3 Nm
ACS3-AFEASA00	Φ5.8 - Φ6.2	0.3 Nm
ACS3-CAPWA000	Two sets of rubber rings attached Φ9 - Φ10 and Φ11 - Φ12	8 - 9 Nm (Φ9 - Φ10) 9 - 10 Nm (Φ11 - Φ12)
ACS3-CRPWA000		
ACS3-CAPWC000	Two sets of rubber rings attached Φ11 - Φ12 and Φ15 - Φ16	7.5 - 8.5 Nm (Φ11 - Φ12) 7.5 Nm (Φ15 - Φ16)
ACS3-CRPWC000		
ACS3-CABRA000	Two sets of rubber rings attached Φ4.5 - Φ5.1 and Φ5.5 - Φ6.1	1 Nm
ACS3-CRBRA000		
ACS3-CAENA000	Two sets of rubber rings attached Φ6.5 - Φ7.1 and Φ8.5 - Φ9.1	1 Nm
ACS3-CRENA000		

IP42 connector installation and wiring specifications

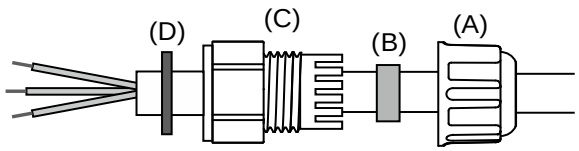
Model number of connector	Wire diameter (mm)	Torque for tightening the connector
ACS3-CAPWE000	Φ20 (Max.)	Tighten until snug
ACS3-CRPWE000		

3.1.7.2 F40 - F80 models – Wiring the waterproof connector

CHOGORI connector

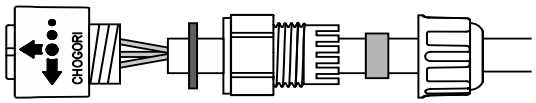


Step 1:
Cut through the cable and expose the shielding. The exposed wire length should be 8 - 12 mm (0.31 - 0.47 inches) and the tinned wire length should be 2 - 3 mm (0.08 - 0.12 inches).

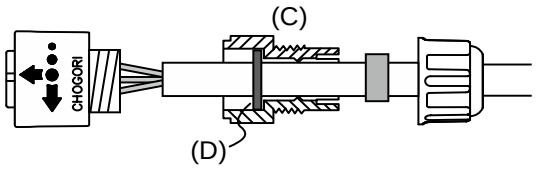


Step 2:
Place the (A) seals nut, (B) seals ring, (C) clamp ring, and (D) gasket on the cable in sequence.

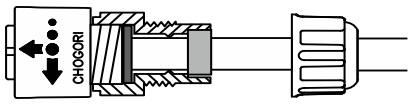
Note: place the flat face of the gasket outwards and the groove face towards the clamp ring for the IP67 design.



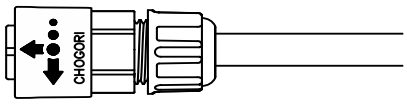
Step 3:
- For the power connector, refer to Section 3.1.4 for the pin assignment to connect the pins.
- For the encoder connector, refer to Section 3.1.5 for the pin assignment to connect the pins.



Step 4:
Place the groove face of the (D) gasket towards the clamp ring and fit it into the (C) clamp ring.

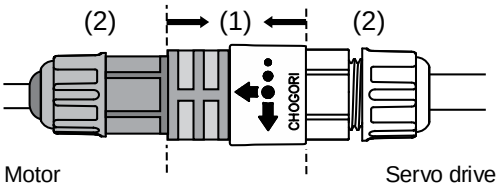


Step 5:
Use a wrench to lock the clamp ring to the housing and **place** the seals ring **in** the clamp ring.



Step 6:
Use a wrench to lock the seals nut to the clamp ring to complete the wiring.

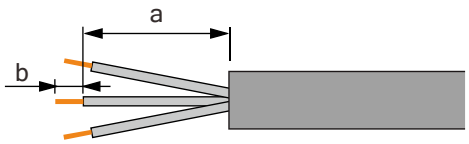
Instruction on mating and unmating the CHOGORI connectors:



After wiring the CHOGORI connector, mate the part (1) to connect the servo motor and drive. Do not pull or rotate the (2) clamp ring and seals nut to avoid loose connection and thus fail to meet the IP67 standard.

Bulkhead connector

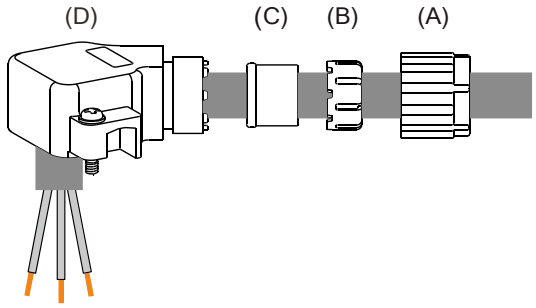
The example here uses the bulkhead connector with the **cable exit direction towards motor shaft**:



Step 1:

Cut through the cable and expose the shielding. The exposed wire length (a) should be 15 mm (0.59 inches) and the tinned wire length (b) should be as follows:

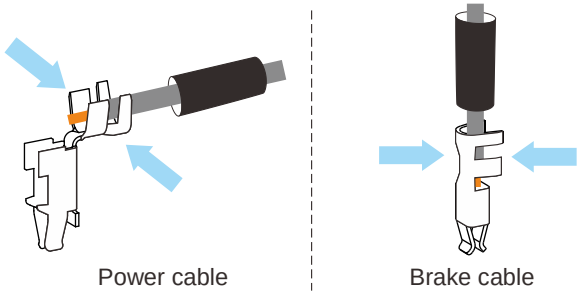
- For encoder cables / brake cables: 1.5 - 1.8 mm (0.059 - 0.071 inches)
- For power cables of bulkhead connectors (cable exit direction towards motor shaft): 2 - 2.2 mm (0.079 - 0.087 inches)
- For power cables of bulkhead connectors (cable exit direction towards encoder): 1.8 - 2 mm (0.071 - 0.079 inches)



Step 2:

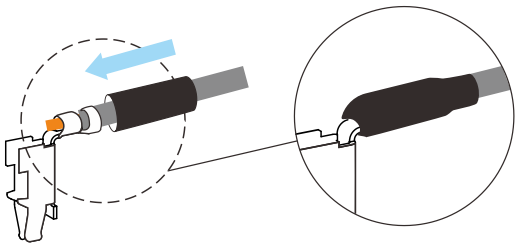
Place the (A) seals nut, (B) compression ring, (C) rubber ring (with the bulge side towards the housing), and (D) housing on the cable in sequence.

Note: use the rubber ring corresponding to the cable in order to meet the IP67 standard.



Step 3:

Slide the heat shrink onto the cable, and then crimp the terminal.



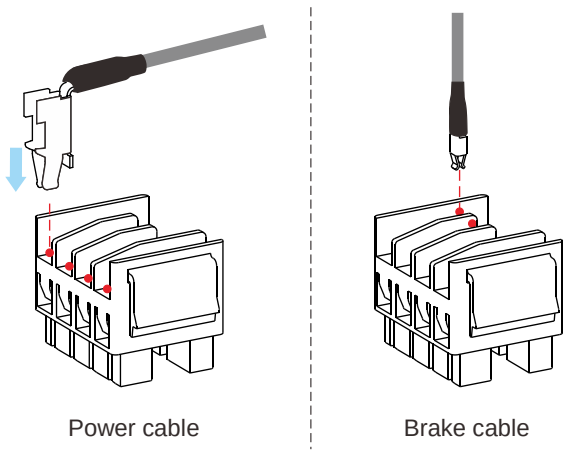
Step 4:

Shrink the tubing at a distance of 1 mm (0.039 inches) away from the terminal.

Specifications of heat shrink:

- For power cables: 5 mm (0.2 inches)
- For brake cables: 10 mm (0.39 inches)
- For shielded cables: 18 mm (0.71 inches)

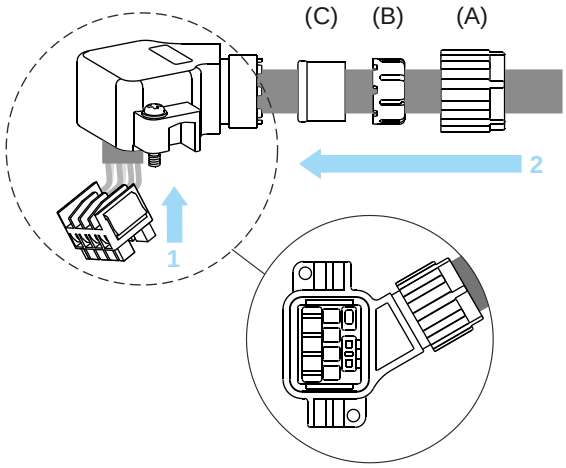
Note: heat shrink is not required for the encoder signal cable.



Step 5:

Plug the terminal into the connector.

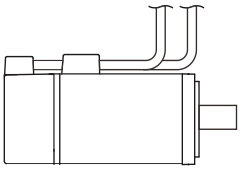
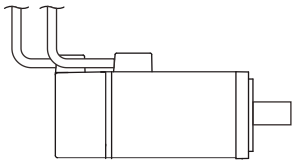
- Refer to Section 3.1.4.1 for pin assignment of power connectors.
- Refer to Section 3.4 for pin assignment of encoder connectors.



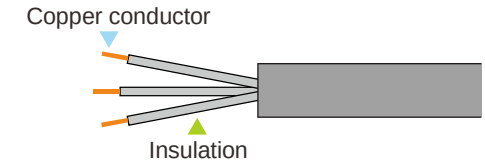
Step 6:

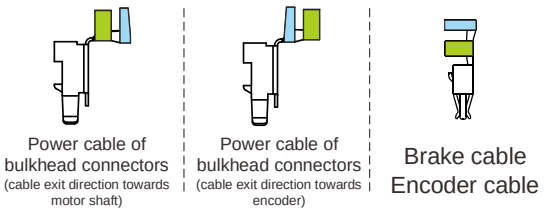
Put the connector in the housing, and secure the (C) rubber ring, (B) compression ring, and (A) seals nut to the housing in sequence.
Use a wrench to lock the seals nut to the housing to complete the wiring.

Note the following:

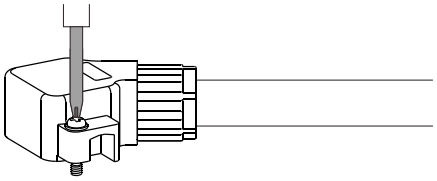
Cable exit direction towards motor shaft	Cable exit direction towards encoder
	

Illustrations for the cable exit direction.



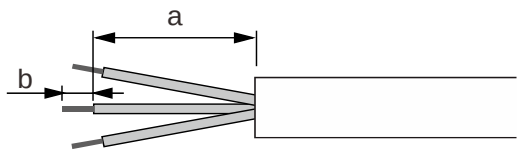


The green highlighted area on the terminal is where you crimp the copper conductor.
The blue highlighted area on the terminal is where you crimp the insulation wire.
Refer to Section 3.1.6.1 for the wire diameters of terminals.



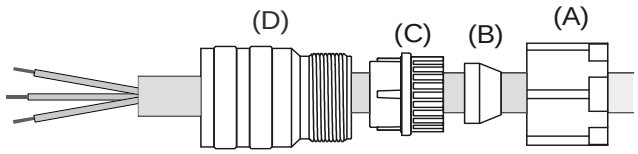
It is advisable to tighten the connector to the motor at the torque of 0.15 Nm.

3.1.7.3 F100 - F180 models – Wiring the waterproof connector



Step 1:

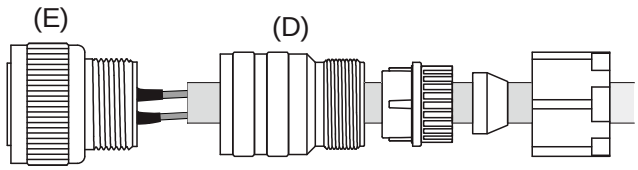
Cut through the cable and expose the shielding. The exposed wire length (a) should be 23 - 27 mm (0.9 - 1.06 inches) for straight connectors and 28 - 32 mm (1.1 - 1.26 inches) for right angle connectors, and the tinned wire length (b) should be 3 - 5 mm (0.12 - 0.2 inches).



Step 2:

Place the (A) seals nut, (B) rubber ring, (C) black compression ring, and (D) straight or angle connector on the cable in sequence.

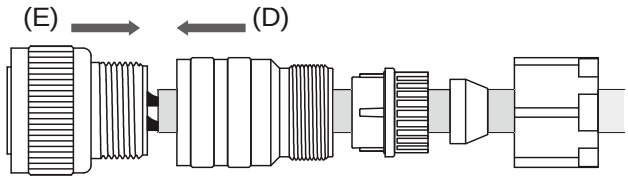
Note: use the rubber ring corresponding to the cable in order to meet the IP67 standard.



Step 3:

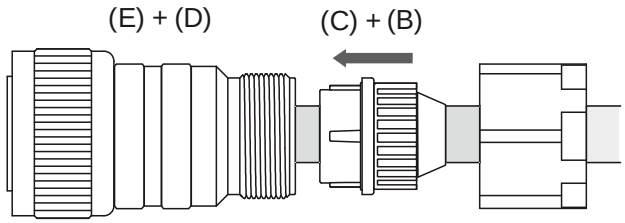
- For the power connector, refer to Section 3.1.4 for the pin assignment to connect the pins.
- For the encoder connector, refer to Section 3.1.5 for the pin assignment to connect the pins.

Note: it is suggested that you use 20 mm (0.79 inches) heat shrink for straight connectors, and 25 mm (0.98 inches) heat shrink for right angle connectors.



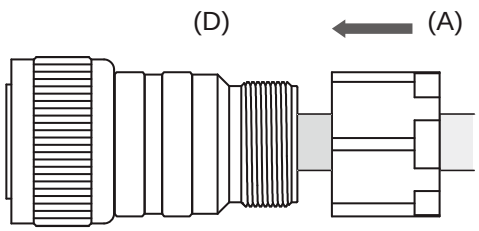
Step 4:

Tighten (D) and (E) with adequate torque. For the torque value, refer to Section 3.1.7.1 for IP67 waterproof connector installation and wiring specifications.



Step 5:

Place (B) in (C), and then place (C) + (B) in (D).



Step 6:

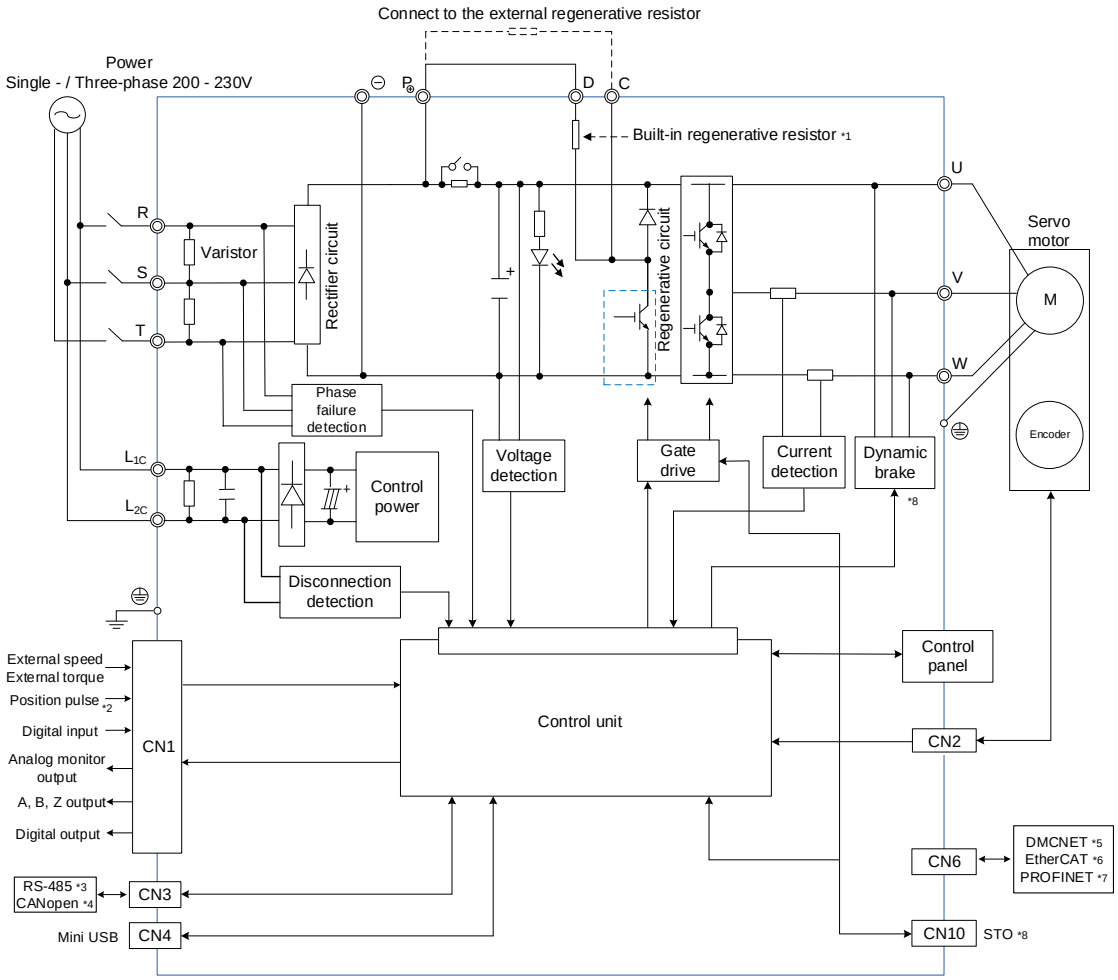
Tighten (A) and (D) at the torque of 10 Nm.

3.2 Wiring diagrams for the servo system

3.2.1 220V series

3

750 W (and below) models



Note:

*1. Models of 200 W and below do not have built-in regenerative resistors; models of 400 W and 750 W have built-in regenerative resistors.

*2. Position pulse is available on B3A-E, B3A-F, and B3A-M models only.

*3. RS-485 is available on -L and B3A-M models only.

*4. CANopen is available on -M models only.

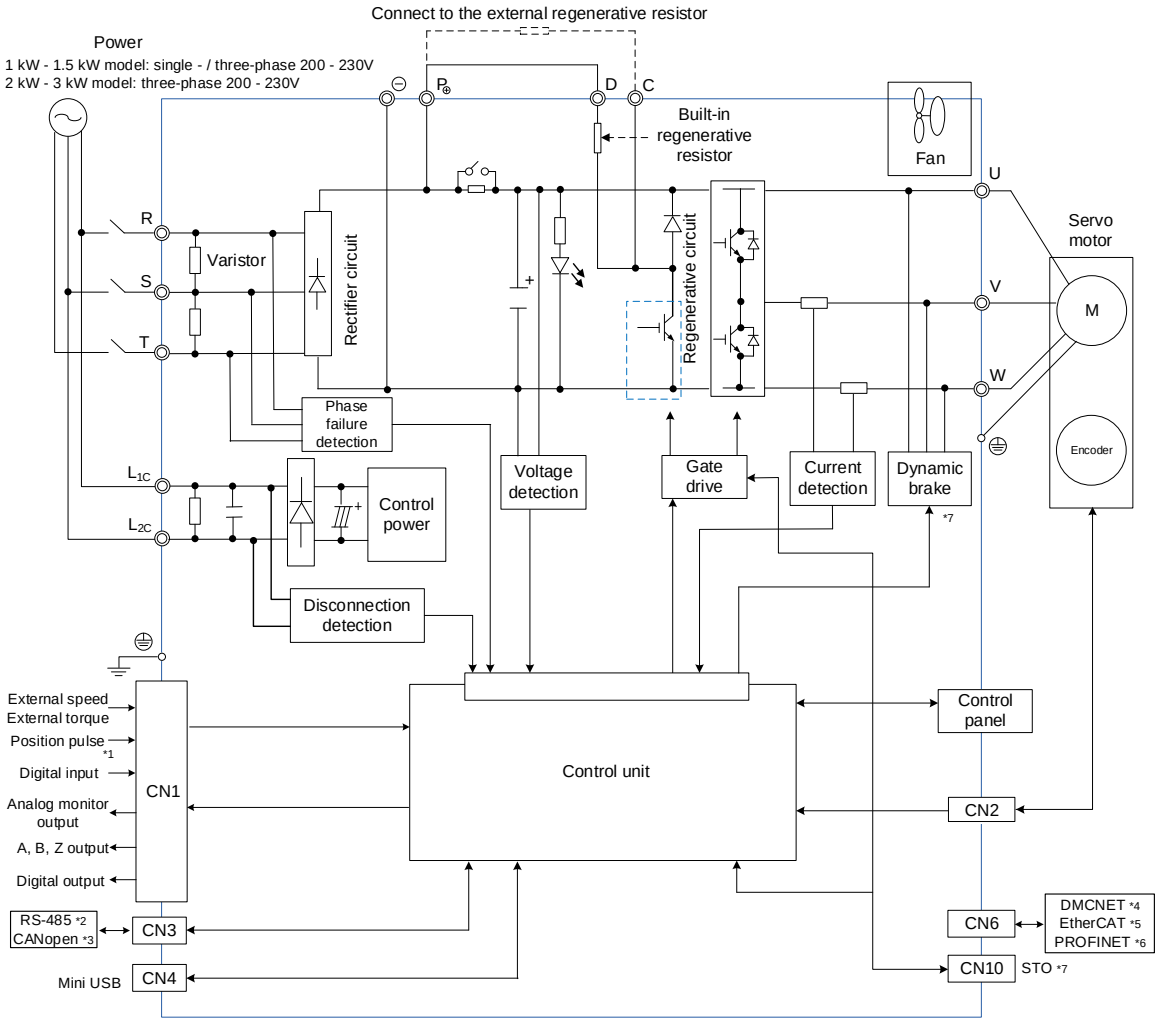
*5. DMCNET is available on -F models only.

*6. EtherCAT is available on -E models only.

*7. PROFINET is available on B3A-P models only.

*8. STO function and dynamic brake are available on B3A series only.

Models of 1 kW - 3 kW (with built-in regenerative resistor and fan)



Note:

*1. Position pulse is available on B3A-E, B3A-F, and B3A-M models only.

*2. RS-485 is available on -L and B3A-M models only.

*3. CANopen is available on -M models only.

*4. DMCNET is available on -F models only.

*5. EtherCAT is available on -E models only.

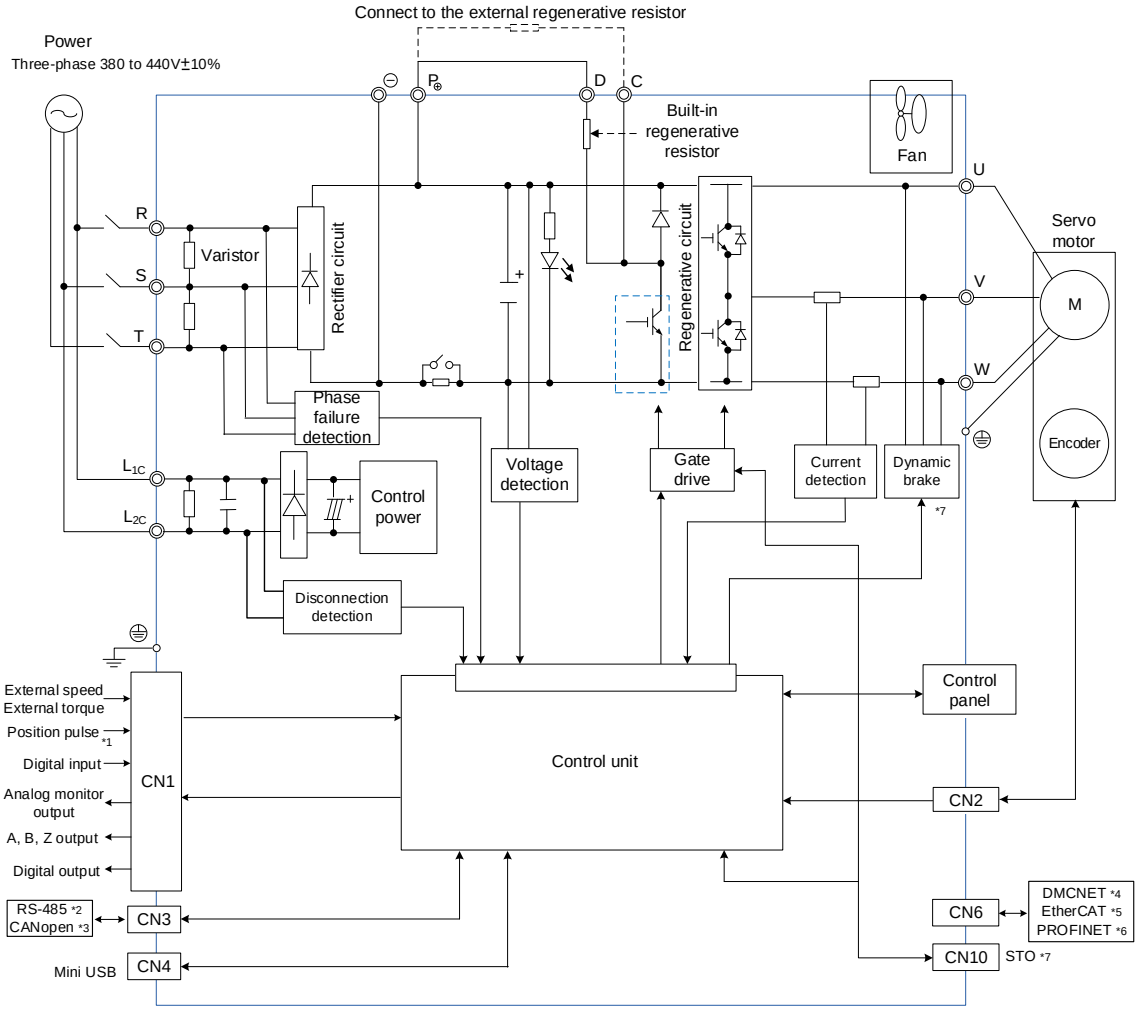
*6. PROFINET is available on B3A-P models only.

*7. STO function and dynamic brake are available on B3A series only.

3

3.2.2 400V series

Models of 1 kW - 7.5 kW (with built-in regenerative resistor and fan)



Note:

*1. Position pulse is available on B3A-E, B3A-F, and B3A-M models only.

*2. RS-485 is available on -L and B3A-M models only.

*3. CANopen is available on -M models only.

*4. DMCNET is available on -F models only.

*5. EtherCAT is available on -E models only.

*6. PROFINET is available on B3A-P models only.

*7. STO function and dynamic brake are available on B3A series only.

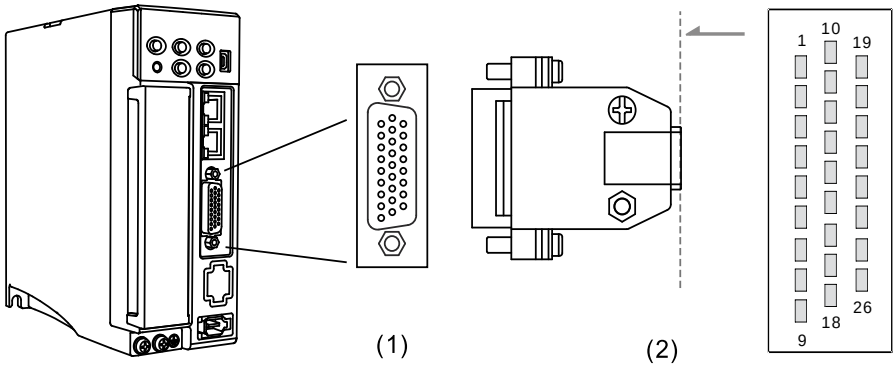
3.3 Wiring for the CN1 I/O connector

Pin assignments of the CN1 terminal differ from model types. Refer to the corresponding wiring information based on the model.

3.3.1 Communication type models (-E, -F, and -M models)

3.3.1.1 Communication type models – CN1 I/O connector pin assignment

On -E, -F, and -M models, the CN1 I/O connector includes 4 inputs and 2 outputs for you to define their functions. The differential output signals (OA, /OA, OB, /OB, OZ, and /OZ) for the encoder are provided. The pin assignments are shown as follows.



(1) CN1 connector (female); (2) CN1 connector (male)

Note: the tightening torque of the CN1 connector is 2 - 2.5 kgf-cm (1.7 - 2.2 lbf-in).

Pin assignment:

Pin	Signal	Description	Pin	Signal	Description
1	OA	Differential output for encoder A pulse	14	PULL HI_P (Pulse) *1	External power input of Sign pulse (24V ± 10%)
2	/OA	Differential output for encoder /A pulse	15	DO1+	Digital output
3	OZ	Differential output for encoder Z pulse	16	DO1-	Digital output
4	/OZ	Differential output for encoder /Z pulse	17	DO2+	Digital output
5	COM+	Power input (24V ± 10%)	18	DO2-	Digital output
6	DI1-	Digital input	19	V_REF	Analog speed / position command input (+)
7	DI2-	Digital input	20	T_REF	Analog torque command input
8	DI3-	Digital input	21	MON1	Analog monitor output 1
9	DI4-	Digital input	22	MON2	Analog monitor output 2
10	GND	Ground for analog / differential output signal	23	SIGN+ *1	Position sign (+)
11	OB	Differential output for encoder B pulse	24	SIGN- *1	Position sign (-)
12	/OB	Differential output for encoder /B pulse	25	PULSE+ *1	Position pulse (+)
13	PULL HI_S (Sign) *1	External power input of Sign pulse (24V ± 10%)	26	PULSE- *1	Position pulse (-)

Note:

1. Only B3A-E, B3A-F, and B3A-M models support the pulse input function.
2. **When the source of the pulse input is open collector NPN or PNP type equipment, you must connect the external power (24V ± 10%) to the PULL HI pins.**
   - **Do not connect the 24V power to the SIGN+ and SIGN- pins at the same time, or the circuit elements will be damaged.**
   - **Do not connect the 24V power to the PULSE+ and PULSE- pins at the same time, or the circuit elements will be damaged.**

The following table details the signals listed in the previous page.

General signals:

Signal		Pin No.	Description	Wiring method (refer to Section 3.3.1.3)
Analog command (input)	V_REF	19	(1) When the motor speed command is set to -10V to +10V, it means the rotation speed is -3000 rpm to +3000 rpm (default). You can set the parameter to change the corresponding range. (2) When the motor position command is set to -10V to +10V, it means the range of the rotation position is -3 to +3 cycles (default).	C1
	T_REF	20	When the motor torque command is set to -10V to +10V, it means the rated torque is -100% to +100%.	C1
Analog monitor (output)	MON1 MON2	21 22	The operation status of motor, such as speed and current, can be displayed in analog voltage. This servo drive provides 2 output channels. You can select the data to be monitored with P0.003. This signal is based on the power ground (GND).	C2
Position pulse (input)	PULSE+ PULSE-	25 26	Position pulse can be sent by line driver (single-phase max. frequency 4 MHz) or open collector (single-phase max. frequency 200 kHz). Three command types can be selected with P1.000, CW/CCW pulse, pulse train + sign, and A phase + B phase.	C3 / C4
	SIGN+ SIGN-	23 24		
	PULL HI_P PULL HI_S	14 13	If using open collector type when sending position pulses, ensure to use an external power supply (24V ± 10%) for pull high.	
Position pulse (output)	OA /OA	1 2	Differential output (line driver) for the encoder signals A, B, and Z.	C9 / C10
	OB /OB	11 12		
	OZ /OZ	3 4		
Power	COM+	5	NPN: COM+ is the positive terminal of the voltage source for DI and requires an external power supply (24V ± 10%). PNP: COM+ is the negative terminal of the voltage source for DI and requires an external power supply (24V ± 10%).	-
	GND	10	The ground for analog signals and differential output signals.	

Caution: only B3A-E, B3A-F, and B3A-M models support the pulse input function.

3

There are various control modes available (refer to Section 6.1) and the I/O configuration differs for each mode. This servo drive provides user-defined I/O for you to set functions according to the application requirements. Refer to Section 8.3 for Table 8.1 Digital input (DI) descriptions and Table 8.2 Digital output (DO) descriptions. The default DI/DO signal configuration for each control mode includes the most commonly used functions and meets the requirements for general applications. To reset the DI/DO signals to the default values of each corresponding mode, set P1.001.U to 1 and cycle the power to the servo drive.

See the following tables for the default DI signals of each control mode:

DI	Control mode						
	PT	PR	S/Sz	T/Tz	PT-S	PT-T	PR-S
	Default	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01	0x01
	SON	SON	SON	SON	SON	SON	SON
2	0x22	0x22	0x22	0x22	0x22	0x22	0x22
	NL	NL	NL	NL	NL	NL	NL
3	0x23	0x23	0x23	0x23	0x23	0x23	0x23
	PL	PL	PL	PL	PL	PL	PL
4	0x21	0x21	0x21	0x21	0x21	0x21	0x21
	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS

DI	Control mode					
	PR-T	S-T	Communication	PT-PR	PT-PR-S	PT-PR-T
	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x00	0x01	0x01	0x01
	SON	SON	-	SON	SON	SON
2	0x22	0x22	0x22	0x22	0x22	0x22
	NL	NL	NL	NL	NL	NL
3	0x23	0x23	0x23	0x23	0x23	0x23
	PL	PL	PL	PL	PL	PL
4	0x21	0x21	0x21	0x21	0x21	0x21
	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS

Note:

1. Description of each DI signal:

DI name	Description	DI name	Description
SON	Servo On	NL	Negative limit
EMGS	Emergency stop	PL	Positive limit

2. Refer to the C7 and C8 diagrams in Section 3.3.1.3 for wiring.

See the following tables for the default DO signals of each control mode:

DO	Control mode						
	PT	PR	S/Sz	T/Tz	PT-S	PT-T	PR-S
	Default	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01	0x01
	SRDY	SRDY	SRDY	SRDY	SRDY	SRDY	SRDY
2	0x07	0x07	0x07	0x07	0x07	0x07	0x07
	ALRM	ALRM	ALRM	ALRM	ALRM	ALRM	ALRM

DO	Control mode					
	PR-T	S-T	Communication	PT-PR	PT-PR-S	PT-PR-T
	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01
	SRDY	SRDY	SRDY	SRDY	SRDY	SRDY
2	0x07	0x07	0x07	0x07	0x07	0x07
	ALRM	ALRM	ALRM	ALRM	ALRM	ALRM

Note:

1. Description of each DO signal:

DO name	Description	DO name	Description
SRDY	Servo ready	ALRM	Servo alarm

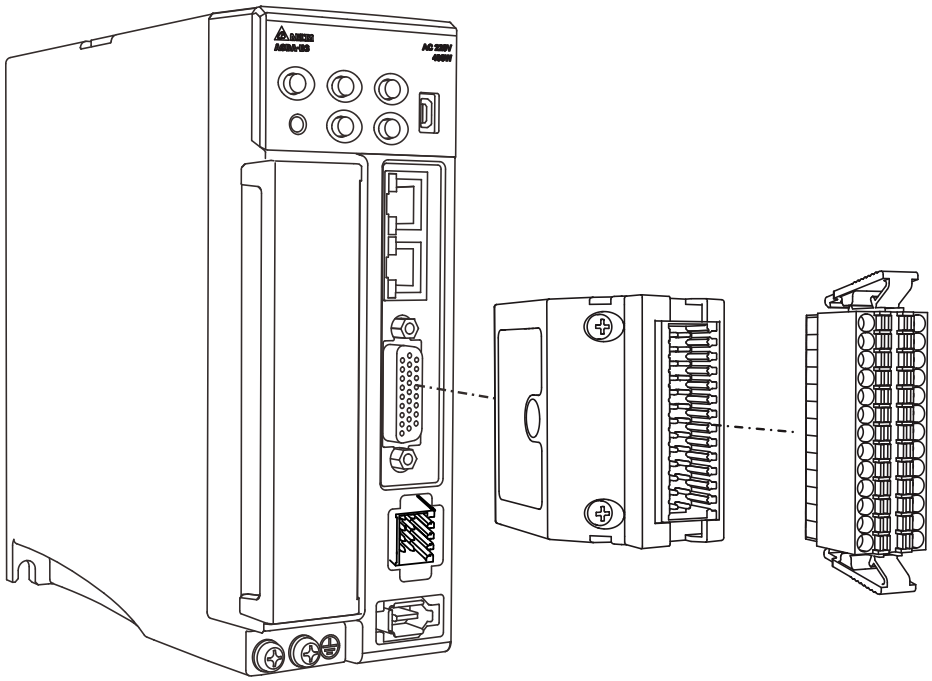
2. Refer to the C5 and C6 diagrams in Section 3.3.1.3 for wiring.

If the default DI/DO functions cannot meet the application requirement, you can refer to the following tables and specify the DI/DO functions by setting the DI and DO codes to the corresponding parameters.

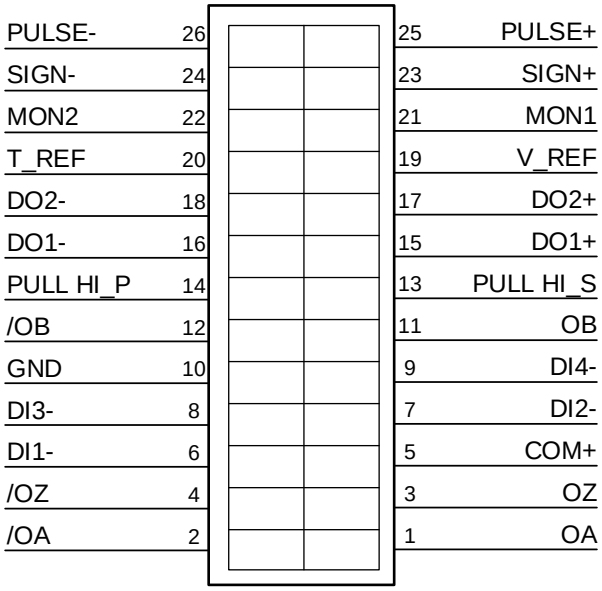
Signal		CN1 Pin No.	Corresponding parameter	Signal		CN1 Pin No.	Corresponding parameter
Standard DI	DI1-	6	P2.010	Standard DO	DO1+	15	P2.018
	DI2-	7	P2.011		DO1-	16	
	DI3-	8	P2.012		DO2+	17	P2.019
	DI4-	9	P2.013		DO2-	18	

3.3.1.2 Communication type models – Wire with CN1 quick connector

The CN1 quick connector ACS3-IFSC2626 is applicable to the -E, -F, and -M models. You do not need to solder the wires; the spring-loaded terminals prevent the wires from loosening caused by vibration, which makes it a good choice for wiring.



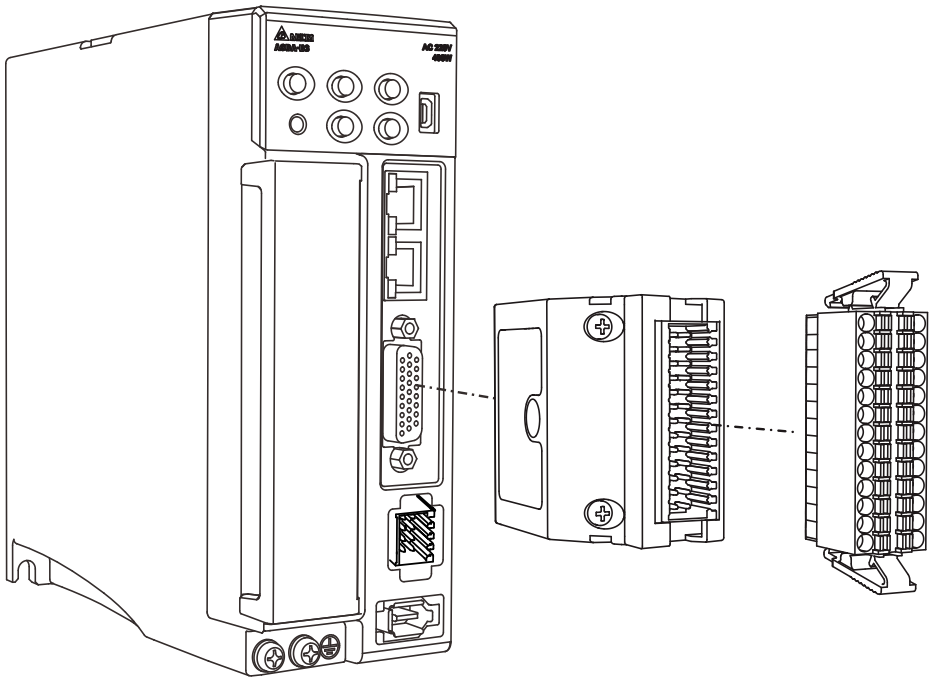
The pin assignments of the CN1 quick connector (ACS3-IFSC2626) are as follows:



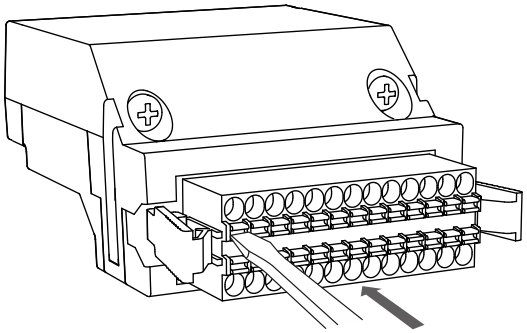
Note: only B3A-E, B3A-F, and B3A-M models support the pulse input function.

Installation and wiring for the CN1 quick connector (ACS3-IFSC2626):

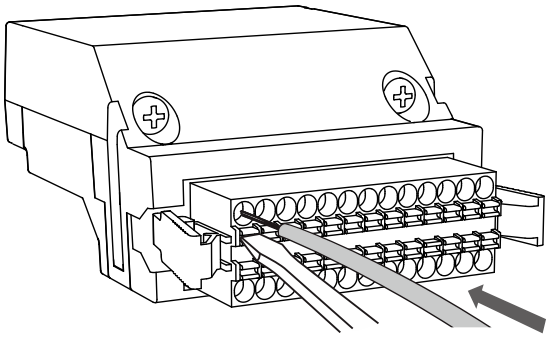
Installation



Wiring



(1) The CN1 quick connector (ACS3-IFSC2626) has multiple spring-loaded terminals. Determine which terminal is to be wired in advance. Use a flathead screwdriver to press the spring down to open the pin.

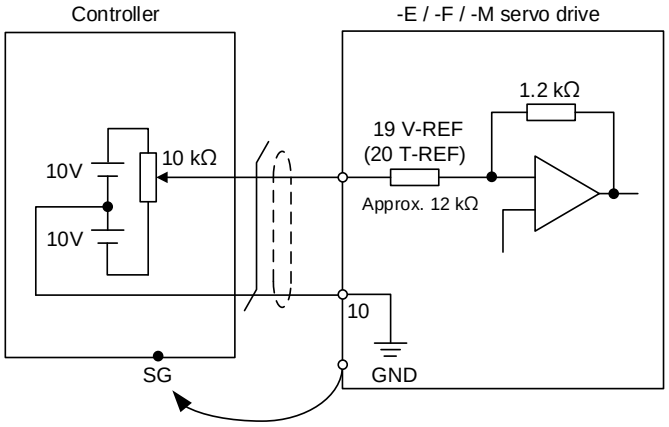


(2) Insert the stripped wire into the pin. Then, withdraw the screwdriver to complete the wiring.

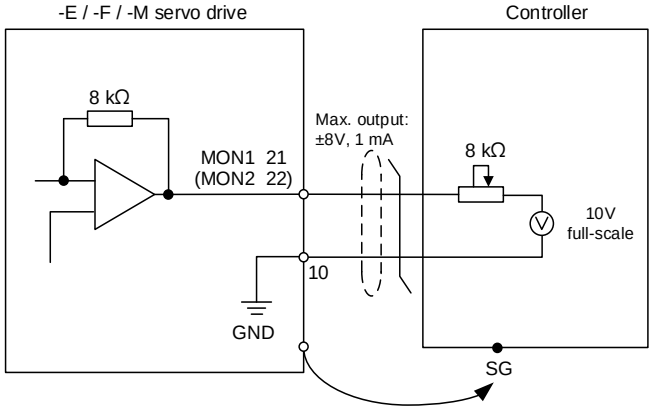
3.3.1.3 Communication type models – CN1 wiring diagrams

For the analog speed command and the analog torque (thrust) command of the -E, -F, and -M models, the valid voltage is between -10V and +10V. You can set the command value that corresponds to the voltage range with the relevant parameters.

C1: input for analog speed / torque (thrust) command



C2: output for analog monitoring command (MON1 and MON2)

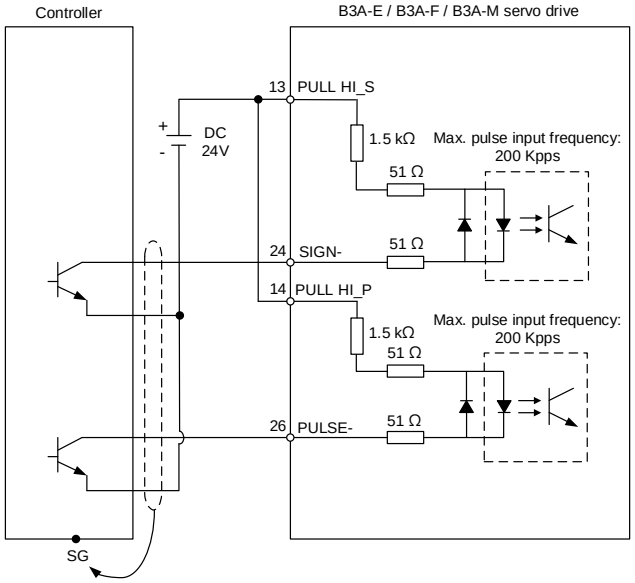


The B3A-E, B3A-F, and B3A-M models support the pulse input function. You can input the pulse command with the open collector or differential line driver. The maximum pulse input is 4 Mpps for the differential line driver and 200 Kpps for the open collector.

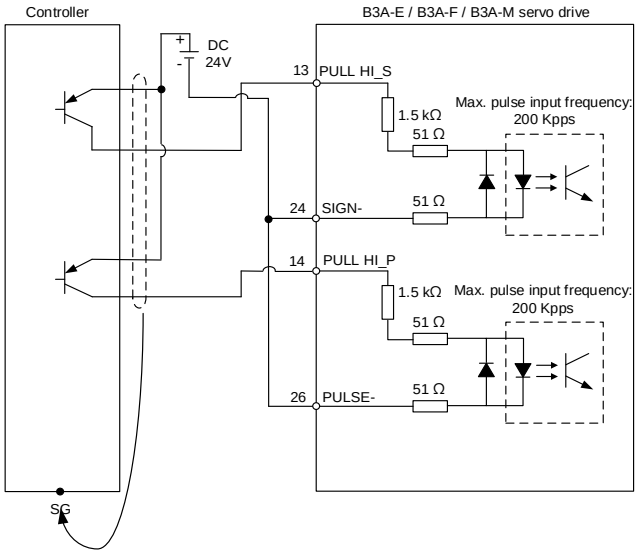
Caution: when the source for the pulse input is open collector NPN type or PNP type equipment, you must connect the external power (24V ± 10%) to the PULL HI pins.

- **Do not connect the 24V power to the SIGN+ and SIGN- pins at the same time, or the circuit elements will be damaged.**
- **Do not connect the 24V power to the PULSE+ and PULSE- pins at the same time, or the circuit elements will be damaged.**

C3-1: the source for the pulse input is open collector NPN type equipment, which uses the external power supply.



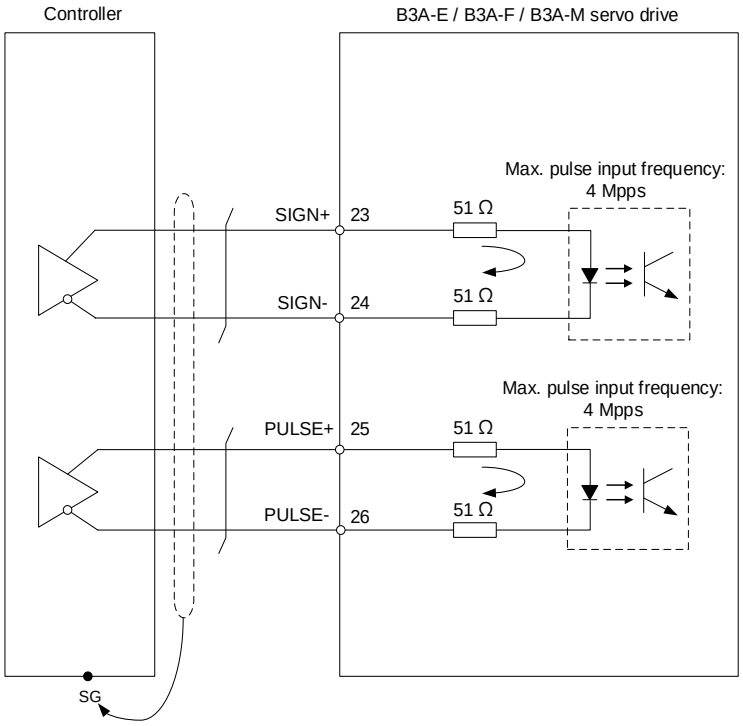
C3-2: the source for the pulse input is open collector PNP type equipment, which uses the external power supply.



C4: pulse input (differential line driver input) can only be used with 2.8V - 3.6V power systems.

Do not use it with 24V power.

Pulse	Type		Maximum input frequency
High speed pulse	Differential signal	Pulse train + sign	4 Mpps
		CW and CCW pulses	
		A phase + B phase	2 Mpps
Low speed pulse	Differential signal		200 Kpps



Note: refer to the description of P1.000 in Chapter 8 for setting details.

Caution: when the drive connects to an inductive load, you must install the diode.

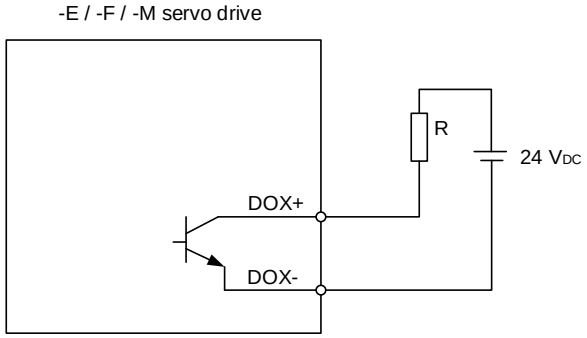
DO specification:

Permissible current: below 40 mA; surge current: below 100 mA; maximum voltage: 30V.

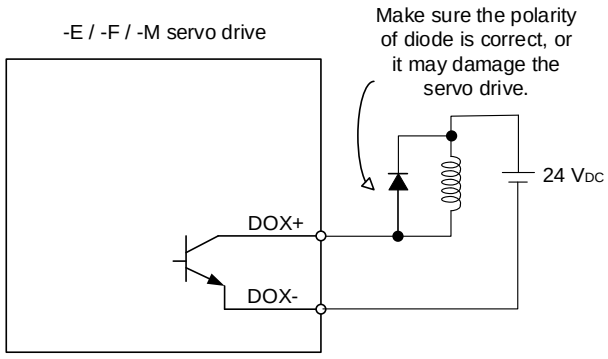
Diode specification:

1A or above, 500V or above (such as the 1N4005 diode).

C5: DO wiring - the servo drive uses an external power supply and the resistor is for general load.



C6: DO wiring - the servo drive uses an external power supply and the resistor is for inductive load.



3

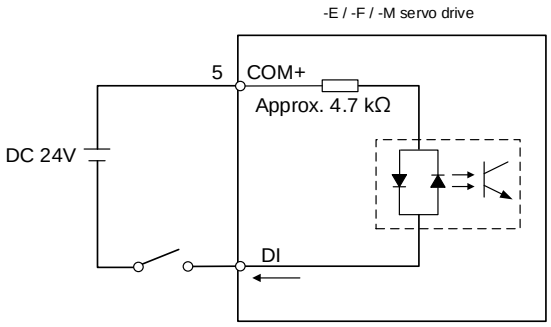
DI wiring - input signals by relay or open collector transistor.

Conditions of DI On / Off:

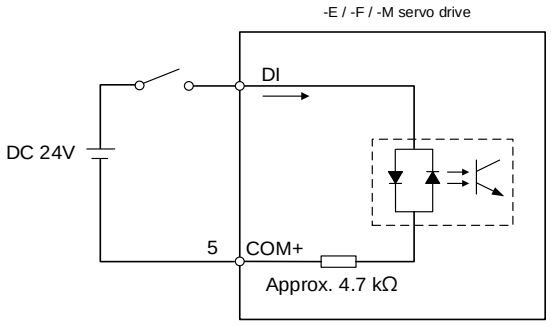
ON: 15V - 24V; input current = 3 mA.

OFF: 5V or below; the input current must not be higher than 0.5 mA.

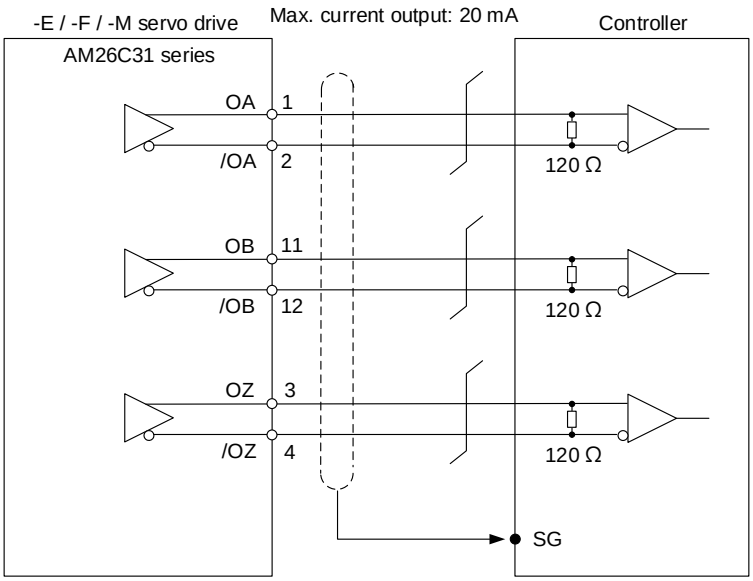
C7: NPN transistor (SINK mode)



C8: PNP transistor (SOURCE mode)

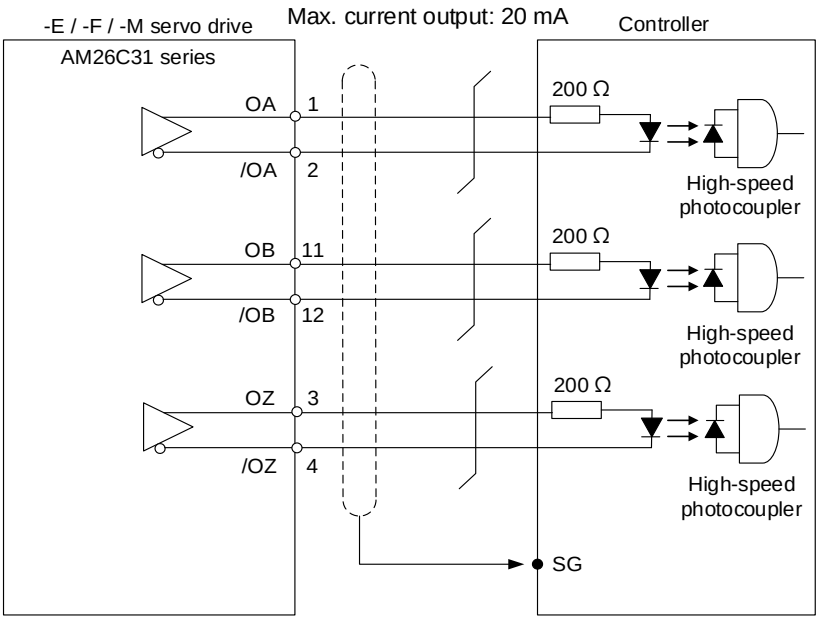


C9: output for encoder position signal (line driver)



Note: it is suggested that you connect the GND of the controller and the GND of the servo drive in parallel when the voltage difference between the two GND terminals is too great.

C10: output for encoder position signal (photocoupler)



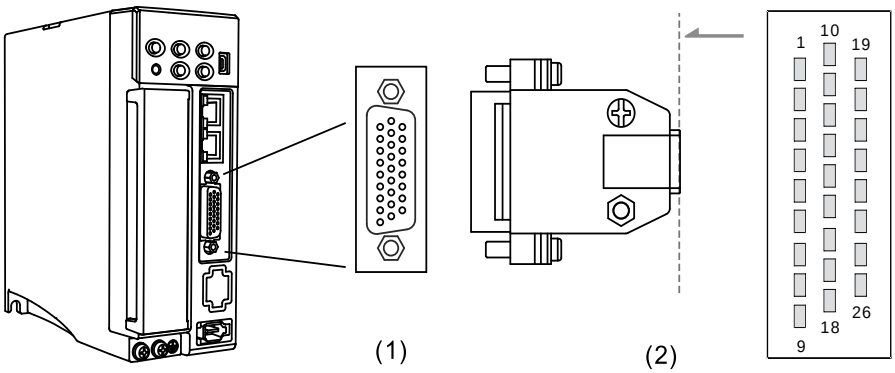
3.3.2 Communication type models (B3A-P model)

3.3.2.1 Communication type models – CN1 I/O connector pin assignment

3

On B3A-P models*, the CN1 I/O connector includes 6 inputs and 3 outputs for you to define their functions. The differential output signals (OA, /OA, OB, /OB, OZ, and /OZ) for the encoder are provided. The pin assignments are shown as follows:

Note: coming soon.



(1) CN1 connector (female); (2) CN1 connector (male)

Note: the tightening torque of the CN1 connector is 2 - 2.5 kgf-cm (1.7 - 2.2 lbf-in).

Pin assignment:

Pin	Signal	Description	Pin	Signal	Description
1	OA	Differential output for encoder A pulse	14	DI6-	Digital input
2	/OA	Differential output for encoder /A pulse	15	DO1+	Digital output
3	OZ	Differential output for encoder Z pulse	16	DO1-	Digital output
4	/OZ	Differential output for encoder /Z pulse	17	DO2+	Digital output
5	COM+	Power input (24V ± 10%)	18	DO2-	Digital output
6	DI1-	Digital input	19	DO3+	Digital output
7	DI2-	Digital input	20	DO3-	Digital output
8	DI3-	Digital input	21	NC	Reserved
9	DI4-	Digital input	22	NC	Reserved
10	GND	Ground for differential output signal	23	NC	Reserved
11	OB	Differential output for encoder B pulse	24	NC	Reserved
12	/OB	Differential output for encoder /B pulse	25	NC	Reserved
13	DI5-	Digital input	26	NC	Reserved

Note: NC represents “No connection”, which is for internal use only. Do not connect to NC, or it may damage the servo drive.

The following table details the signals listed in the previous page.

General signals:

Signal		Pin No.	Description	Wiring method (refer to Section 3.3.2.2)
Position pulse (output)	OA /OA	1 2	Differential output (line driver) for the encoder signals A, B, and Z.	C9 / C10
	OB /OB	11 12		
	OZ /OZ	3 4		
Power	COM+	5	NPN: COM+ is the positive terminal of the voltage source for DI and requires an external power supply (24V ± 10%). PNP: COM+ is the negative terminal of the voltage source for DI and requires an external power supply (24V ± 10%).	-
	GND	10	The ground for differential output signals.	

There are various control modes available (refer to Section 6.1) and the I/O configuration differs for each mode. This servo drive provides user-defined I/O for you to set functions according to the application requirements. Refer to Section 8.3 for Table 8.1 Digital input (DI) descriptions and Table 8.2 Digital output (DO) descriptions. The default DI/DO signal configuration for each control mode includes the most commonly used functions and meets the requirements for general applications. To reset the signals to the default values of each corresponding mode, set P1.001.U to 1 and cycle the power to the servo drive.

See the following tables for the default DI signals of each control mode:

DI	Control mode						
	PR	S/Sz	T/Tz	PR-S	PR-T	S-T	Communi-cation
	Default	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01	0x00
	SON	SON	SON	SON	SON	SON	-
2	0x22	0x22	0x22	0x22	0x22	0x22	0x22
	NL	NL	NL	NL	NL	NL	NL
3	0x23	0x23	0x23	0x23	0x23	0x23	0x23
	PL	PL	PL	PL	PL	PL	PL
4	0x21	0x21	0x21	0x21	0x21	0x21	0x21
	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS
5	0x00	0x00	0x00	0x00	0x00	0x00	0x00
	-	-	-	-	-	-	-
6	0x00	0x00	0x00	0x00	0x00	0x00	0x00
	-	-	-	-	-	-	-

Note:

1. Description of each DI signal:

DI name	Description	DI name	Description
SON	Servo On	NL	Negative limit
EMGS	Emergency stop	PL	Positive limit

2. Refer to the C7 and C8 diagrams in Section 3.3.2.2 for wiring.

See the following tables for the default DO signals of each control mode:

DO	Control mode						
	PR	S/Sz	T/Tz	PR-S	PR-T	S-T	Communi-cation
	Default	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01	0x01
	SRDY	SRDY	SRDY	SRDY	SRDY	SRDY	SRDY
2	0x07	0x07	0x07	0x07	0x07	0x07	0x07
	ALRM	ALRM	ALRM	ALRM	ALRM	ALRM	ALRM
3	0x00	0x00	0x00	0x00	0x00	0x00	0x00
	-	-	-	-	-	-	-

Note:

1. Description of each DO signal:

DO name	Description	DO name	Description
SRDY	Servo ready	ALRM	Servo alarm

2. Refer to the C5 and C6 diagrams in Section 3.3.2.2 for wiring.

If the default DI/DO functions cannot meet the application requirement, you can refer to the following tables and specify the DI/DO functions by setting the DI and DO codes to the corresponding parameters.

Signal		CN1 Pin No.	Corresponding parameter	Signal		CN1 Pin No.	Corresponding parameter
Standard DI	DI1-	6	P2.010	Standard DO	DO1+	15	P2.018
	DI2-	7	P2.011		DO1-	16	
	DI3-	8	P2.012		DO2+	17	P2.019
	DI4-	9	P2.013		DO2-	18	
	DI5-	13	P2.014		DO3+	19	P2.020
	DI6-	14	P2.015		DO3-	20	

3.3.2.2 Communication type models – CN1 wiring diagrams

Caution: when the drive connects to an inductive load, you must install the diode.

3

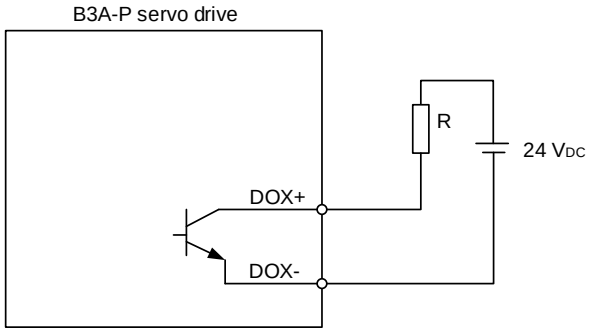
DO specification:

Permissible current: below 40 mA; surge current: below 100 mA; maximum voltage: 30V.

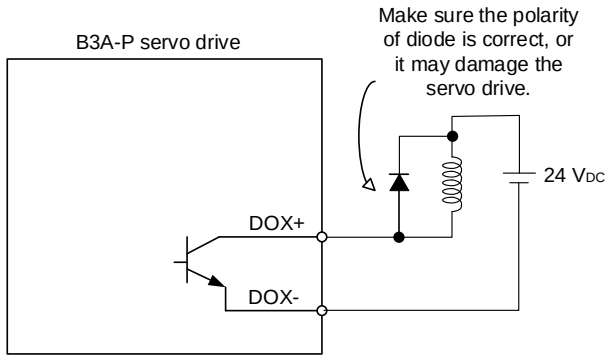
Diode specification:

1A or above, 500V or above (such as the 1N4005 diode).

C5: DO wiring - the servo drive uses an external power supply and the resistor is for general load.



C6: DO wiring - the servo drive uses an external power supply and the resistor is for inductive load.



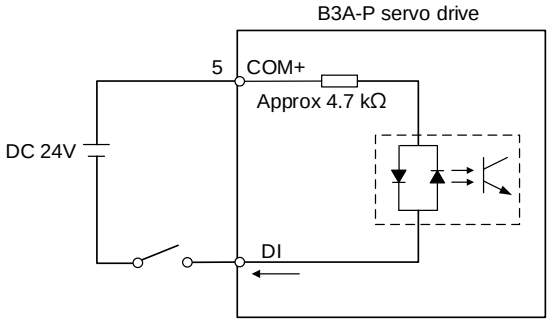
DI wiring - input signals by relay or open collector transistor.

Conditions of DI On / Off:

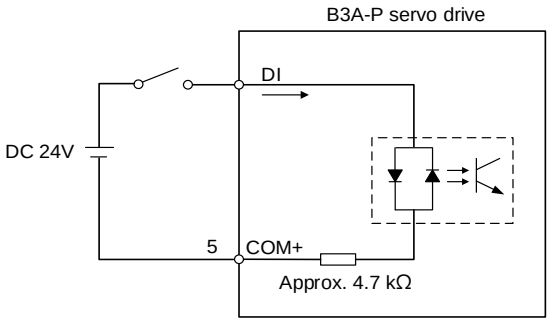
ON: 15V - 24V; input current = 3 mA.

OFF: 5V or below; the input current must not be higher than 0.5 mA.

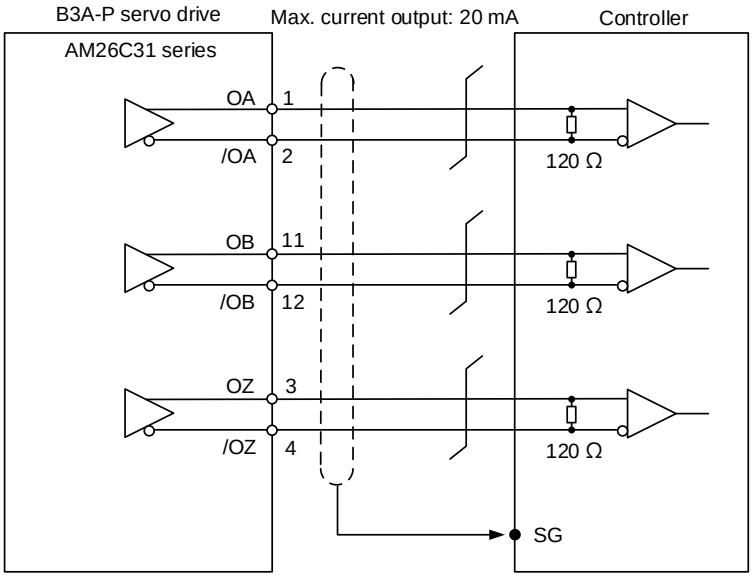
C7: NPN transistor (SINK mode)



C8: PNP transistor (SOURCE mode)

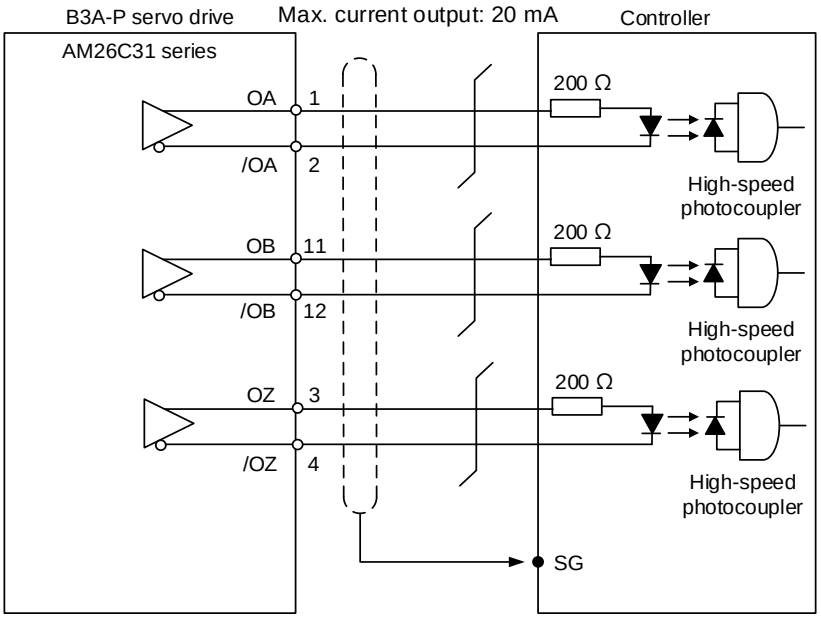


C9: output for encoder position signal (line driver)



Note: it is suggested that you connect the GND of the controller and the GND of the servo drive in parallel when the voltage difference between the two GND terminals is too great.

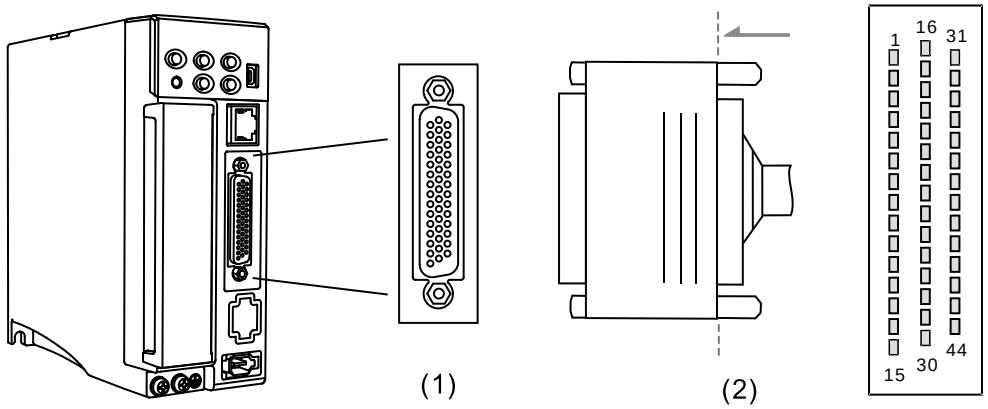
C10: output for encoder position signal (photocoupler)



3.3.3 Pulse type models (-L models)

3.3.3.1 Pulse type models – CN1 I/O connector pin assignment

On -L models, the CN1 I/O connector includes 9 inputs and 6 outputs for you to define their functions. The differential output signals (OA, /OA, OB, /OB, OZ, and /OZ) for the encoder are provided. Analog torque command input, analog speed / position command input, and pulse position command input are also available. The pin assignments are shown as follows:



(1) CN1 connector (female); (2) CN1 connector (male)

Pin assignment:

Pin	Signal	Description	Pin	Signal	Description
1	DO4+	Digital output	23	/OB	Differential output for encoder /B pulse
2	DO3-	Digital output	24	/OZ	Differential output for encoder /Z pulse
3	DO3+	Digital output	25	OB	Differential output for encoder B pulse
4	DO2-	Digital output	26	DO4-	Digital output
5	DO2+	Digital output	27	DO5-	Digital output
6	DO1-	Digital output	28	DO5+	Digital output
7	DO1+	Digital output	29	GND	GND for analog signal and differential output signal
8	DI4-	Digital input	30	DI8-	Digital input
9	DI1-	Digital input	31	DI7-	Digital input
10	DI2-	Digital input	32	DI6-	Digital input
11	COM+	Power input (24V ± 10%)	33	DI5-	Digital input
12	DI9-	Digital input	34	DI3-	Digital input
13	OZ	Differential output for encoder Z pulse	35	PULL HI_S (Sign) *1	External power input of command sign (24V ± 10%)
14	MON2	Analog monitor output 2	36	PULL HI_P (Pulse) *1	External power input of command pulse (24V ± 10%)
15	DO6-	Digital output	37	SIGN- *1	Position sign (-)
16	DO6+	Digital output	38	NC *2	Reserved
17	MON1	Analog monitor output 1	39	SIGN+ *1	Position sign (+)
18	T_REF	Analog torque command input	40	GND	GND for analog signal and differential output signal
19	GND	GND for analog signal and differential output signal	41	PULSE- *1	Position pulse (-)
20	V_REF	Analog speed / position command input (+)	42	NC *2	Reserved
21	OA	Differential output for encoder A pulse	43	PULSE+ *1	Position pulse (+)
22	/OA	Differential output for encoder /A pulse	44	OCZ	Open collector output for encoder Z pulse

Note:

1. Only B3A-L models support the pulse input function.
2. NC represents “No connection”, which is for internal use only. Do not connect to NC, or it may damage the servo drive.
3. **When the source for the pulse input is open collector NPN or PNP type equipment, you must connect the external power (24V ± 10%) to the PULL HI pins.**
   - **Do not connect the 24V power to the SIGN+ and SIGN- pins at the same time, or the circuit elements will be damaged.**
   - **Do not connect the 24V power to the PULSE+ and PULSE- pins at the same time, or the circuit elements will be damaged.**

The following table details the signals listed in the previous page.

General signals:

Signal		Pin No.	Description	Wiring method (refer to Section 3.3.3.3)
Analog command (input)	V_REF	20	(1) When the motor speed command is set to -10V to +10V, it means the rotation speed is -3000 rpm to +3000 rpm (default). You can set the corresponding range with parameters. (2) When the motor position command is set to -10V to +10V, it means the range of the rotation position is -3 to +3 cycles (default).	C1
	T_REF	18	When the motor torque command is set to -10V to +10V, it means the rated torque is -100% to +100%.	C1
Analog monitor (output)	MON1 MON2	17 14	The operation status of motor, such as speed and current, can be displayed in analog voltage. This servo drive provides 2 output channels. You can select the data to be monitored with P0.003. This signal is based on the power ground (GND).	C2
Position pulse (input)	PULSE+ PULSE-	43 41	Position pulse can be sent by Line Driver (single-phase max. frequency 4 MHz) or open collector (single-phase max. frequency 200 kHz). Three command types can be selected with P1.000, CW/CCW pulse, pulse train + sign, and A phase + B phase.	C3 / C4
	SIGN+ SIGN-	39 37		
	PULL HI_P PULL HI_S	36 35	If using open collector type when sending position pulses, ensure to use an external power supply (24V ± 10%) for pull high.	
Position pulse (output)	OA /OA	21 22	Differential output (line driver) for the encoder signals A, B, and Z.	C9 / C10
	OB /OB	25 23		
	OZ /OZ	13 24		
	OCZ	44	Open collector output for the encoder Z pulse.	C11
Power	COM+	11	NPN: COM+ is the positive terminal of the voltage source for DI and requires an external power supply (24V ± 10%). PNP: COM+ is the negative terminal of the voltage source for DI and requires an external power supply (24V ± 10%).	-
	GND	19, 29, 40	The ground for analog signals and differential output signals.	
Others	NC	38, 42	No connection. This is for internal use only. Do not connect to NC, or it may damage the servo drive.	

There are various control modes available (refer to Section 6.1) and the I/O configuration differs for each mode. This servo drive provides user-defined I/O for you to set functions according to the application requirements. Refer to Section 8.3 for Table 8.1 Digital input (DI) descriptions and Table 8.2 Digital output (DO) descriptions. The default DI/DO signal configuration for each control mode includes the most commonly used functions and meets the requirements for general applications. To reset the signals to the default values of each corresponding mode, set P1.001.U to 1 and cycle the power to the servo drive.

See the following tables for the default DI signals of each control mode:

DI	Control mode					
	PT	PR	S/Sz	T/Tz	PT-S	PT-T
	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01
	SON	SON	SON	SON	SON	SON
2	0x04	0x08	0x09	0x10	0x04	0x04
	CCLR	CTRG	TRQLM	SPDLM	CCLR	CCLR
3	0x16	0x11	0x14	0x16	0x14	0x16
	TCM0	POS0	SPD0	TCM0	SPD0	TCM0
4	0x17	0x12	0x15	0x17	0x15	0x17
	TCM1	POS1	SPD1	TCM1	SPD1	TCM1
5	0x02	0x02	0x02	0x02	0x00	0x00
	ARST	ARST	ARST	ARST	-	-
6	0x22	0x22	0x22	0x22	0x00	0x00
	NL	NL	NL	NL	-	-
7	0x23	0x23	0x23	0x23	0x18	0x20
	PL	PL	PL	PL	S-P	T-P
8	0x21	0x21	0x21	0x21	0x21	0x21
	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS
9	0x00	0x00	0x00	0x00	0x00	0x00
	-	-	-	-	-	-

DI	Control mode					
	PR-S	PR-T	S-T	PT-PR	PT-PR-S	PT-PR-T
	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01
	SON	SON	SON	SON	SON	SON
2	0x08	0x08	0x00	0x04	0x04	0x04
	CTRG	CTRG	-	CCLR	CCLR	CCLR
3	0x11	0x11	0x14	0x08	0x08	0x08
	POS0	POS0	SPD0	CTRG	CTRG	CTRG
4	0x12	0x12	0x15	0x11	0x11	0x11
	POS1	POS1	SPD1	POS0	POS0	POS0
5	0x14	0x16	0x16	0x12	0x12	0x12
	SPD0	TCM0	TCM0	POS1	POS1	POS1
6	0x15	0x17	0x17	0x13	0x24	0x24
	SPD1	TCM1	TCM1	POS2	ORGP	ORGP
7	0x18	0x20	0x19	0x24	0x18	0x20
	S-P	T-P	S-T	ORGP	S-P	T-P
8	0x21	0x21	0x21	0x2B	0x2B	0x2B
	EMGS	EMGS	EMGS	PT-PR	PT-PR	PT-PR
9	0x00	0x00	0x00	0x02	0x02	0x02
	-	-	-	ARST	ARST	ARST

Note:

1. Description of each DI signal:

DI name	Description	DI name	Description	DI name	Description
SON	Servo On	NL	Negative limit	PL	Positive limit
CCLR	Pulse clear	ARST	Alarm reset	EMGS	Emergency stop
CTRG	Internal position command triggered	TCM0	Torque command 0	TCM1	Torque command 1
TRQLM	Torque limit	SPD0	Speed selection 0	SPD1	Speed selection 1
SPDLM	Speed limit	POS0	Internal position selection 0	POS1	Internal position selection 1
S-P	Switch between S and P modes (dual / multi-mode)	T-P	Switch between T and P modes (dual / multi-mode)	S-T	Switch between S and T modes (dual / multi-mode)
PT-PR	Switch between PT and PR modes (dual / multi-mode)	POS2	Internal position selection 2	ORGP	ORG signal

2. Refer to the C7 and C8 diagrams in Section 3.3.3.3 for wiring.

3

See the following tables for the default DO signals of each control mode:

DO	Control mode					
	PT	PR	S/Sz	T/Tz	PT-S	PT-T
	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01
	SRDY	SRDY	SRDY	SRDY	SRDY	SRDY
2	0x03	0x03	0x03	0x03	0x03	0x03
	ZSPD	ZSPD	ZSPD	ZSPD	ZSPD	ZSPD
3	0x09	0x09	0x04	0x04	0x04	0x04
	HOME	HOME	TSPD	TSPD	TSPD	TSPD
4	0x05	0x05	0x08	0x08	0x05	0x05
	TPOS	TPOS	BRKR	BRKR	TPOS	TPOS
5	0x07	0x07	0x07	0x07	0x07	0x07
	ALRM	ALRM	ALRM	ALRM	ALRM	ALRM
6	0x00	0x00	0x00	0x00	0x00	0x00
	-	-	-	-	-	-

DO	Control mode					
	PR-S	PR-T	S-T	PT-PR	PT-PR-S	PT-PR-T
	Default	Default	Default	Default	Default	Default
	Symbol	Symbol	Symbol	Symbol	Symbol	Symbol
1	0x01	0x01	0x01	0x01	0x01	0x01
	SRDY	SRDY	SRDY	SRDY	SRDY	SRDY
2	0x03	0x03	0x03	0x03	0x03	0x03
	ZSPD	ZSPD	ZSPD	ZSPD	ZSPD	ZSPD
3	0x04	0x04	0x04	0x09	0x09	0x09
	TSPD	TSPD	TSPD	HOME	HOME	HOME
4	0x05	0x05	0x00	0x05	0x05	0x05
	TPOS	TPOS	-	TPOS	TPOS	TPOS
5	0x07	0x07	0x07	0x07	0x07	0x07
	ALRM	ALRM	ALRM	ALRM	ALRM	ALRM
6	0x00	0x00	0x00	0x00	0x00	0x00
	-	-	-	-	-	-

Note:

Description of each DO signal:

DO name	Description	DO name	Description	DO name	Description
SRDY	Servo ready	HOME	Homing is complete	TSPD	Target speed reached
ZSPD	Zero motor speed	TPOS	Target position reached	ALRM	Servo alarm
BRKR	Magnetic brake	-	-	-	-

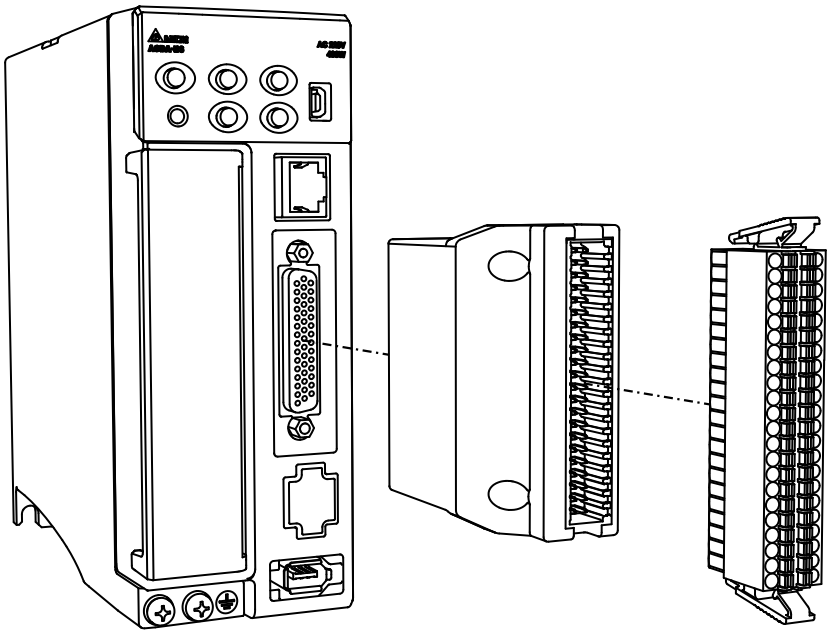
If the default DI/DO functions cannot meet the application requirement, you can refer to the following tables and specify the DI/DO functions by setting the DI and DO codes to the corresponding parameters.

Signal		CN1 Pin No.	Corresponding parameter	Signal		CN1 Pin No.	Corresponding parameter
Standard DI	DI1-	9	P2.010	Standard DI	DI6-	32	P2.015
	DI2-	10	P2.011		DI7-	31	P2.016
	DI3-	34	P2.012		DI8-	30	P2.017
	DI4-	8	P2.013		DI9-	12	P2.036
	DI5-	33	P2.014		-	-	-

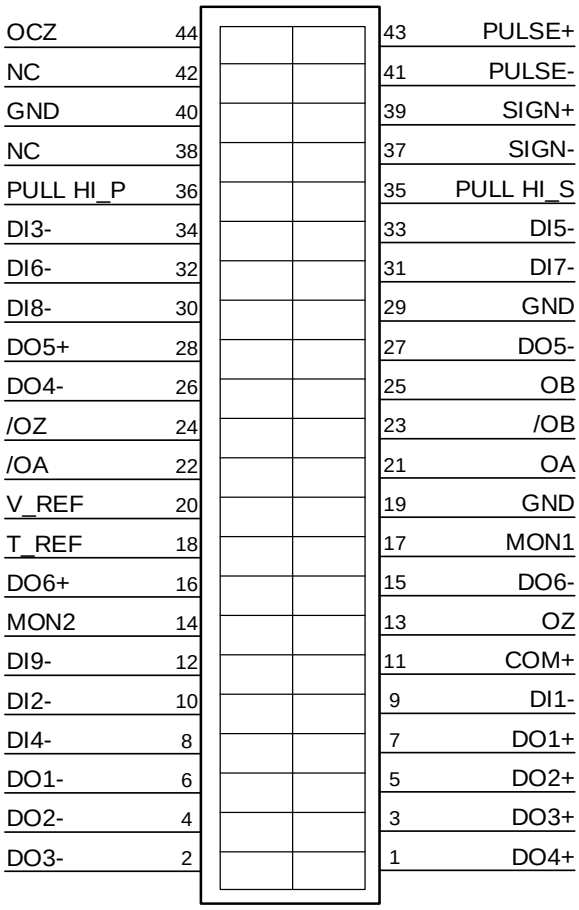
Signal		CN1 Pin No.	Corresponding parameter	Signal		CN1 Pin No.	Corresponding parameter
Standard DO	DO1+	7	P2.018	Standard DO	DO4+	1	P2.021
	DO1-	6			DO4-	26	
	DO2+	5	P2.019		DO5+	28	P2.022
	DO2-	4			DO5-	27	
	DO3+	3	P2.020		DO6+	16	P2.041
	DO3-	2			DO6-	15	

3.3.3.2 Pulse type models – Wire with CN1 quick connector

The CN1 quick connector ACS3-IFSC4444 is applicable to the -L models. You do not need to solder the wires; the spring-loaded terminals prevent the wires from loosening caused by vibration, which makes it a good choice for wiring.



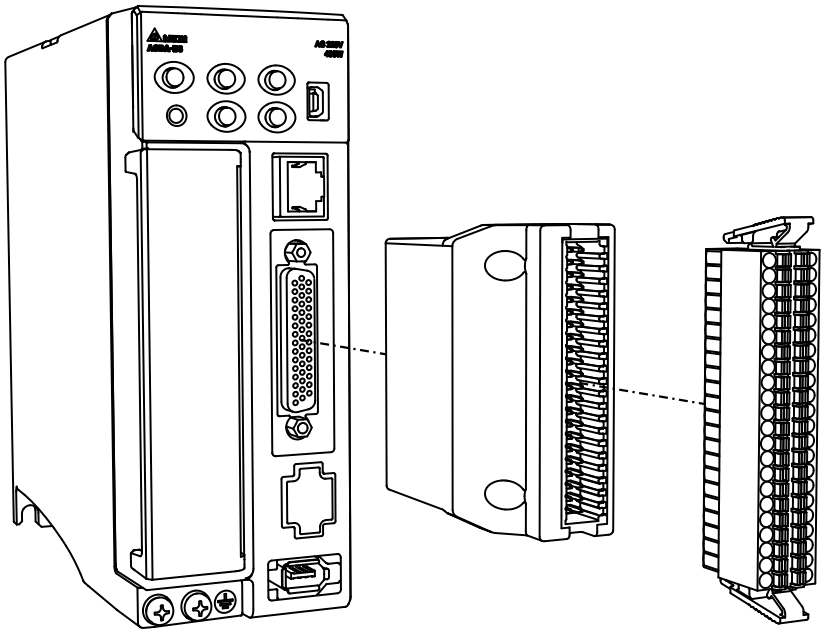
The pin assignments for the CN1 quick connector (ACS3-IFSC4444) are as follows:



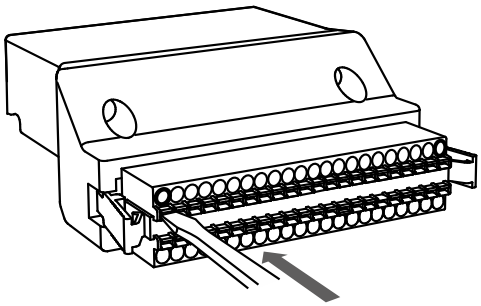
Note: NC represents “No connection”.

Installation and wiring for the CN1 quick connector (ACS3-IFSC4444):

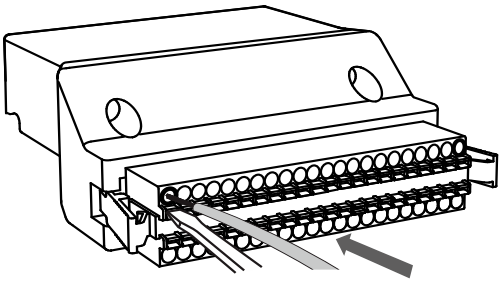
Installation



Wiring



(1) The CN1 quick connector (ACS3-IFSC4444) has multiple spring-loaded terminals. Determine which terminal is to be wired in advance. Use a flathead screwdriver to press the spring down to open the pin.

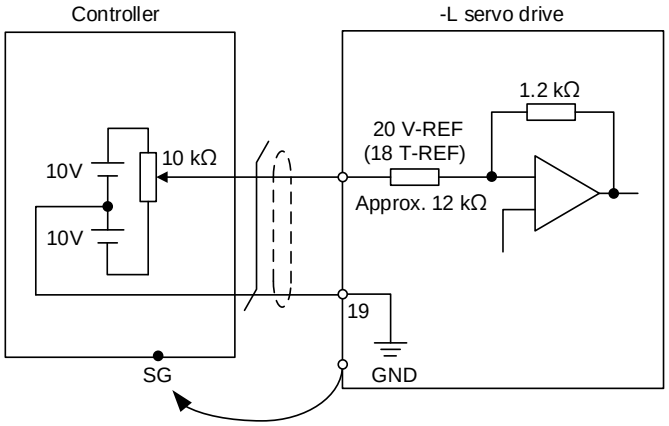


(2) Insert the stripped wire into the pin. Then, withdraw the screwdriver to complete the wiring.

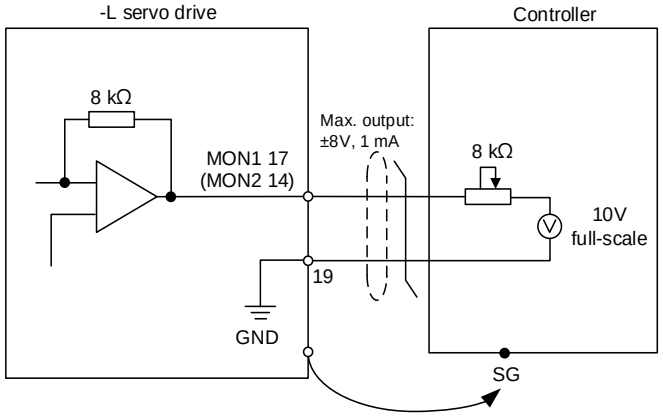
3.3.3.3 Pulse type models – CN1 wiring diagrams

For the analog speed command and the analog torque (thrust) command of the -L models, the valid voltage is between -10V and +10V. You can set the command value that corresponds to the voltage range with the relevant parameters.

C1: input for analog speed / torque (thrust) command



C2: output for analog monitoring command (MON1 and MON2)

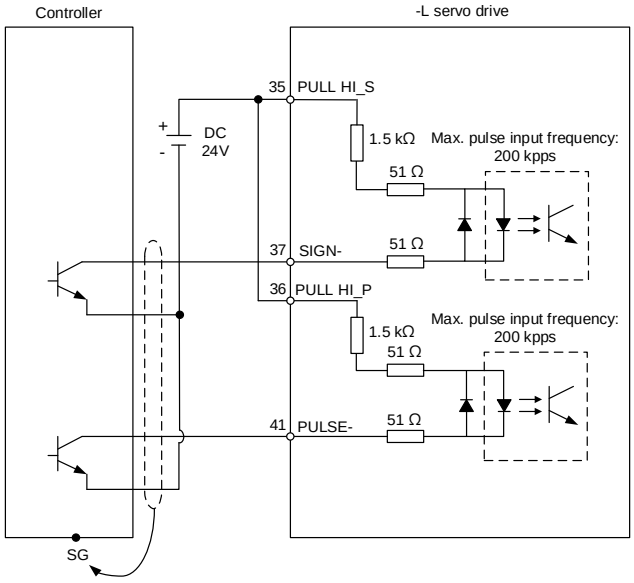


You can input the pulse command with the open collector or differential line driver. The maximum pulse input is 4 Mpps for the differential line driver and 200 Kpps for the open collector.

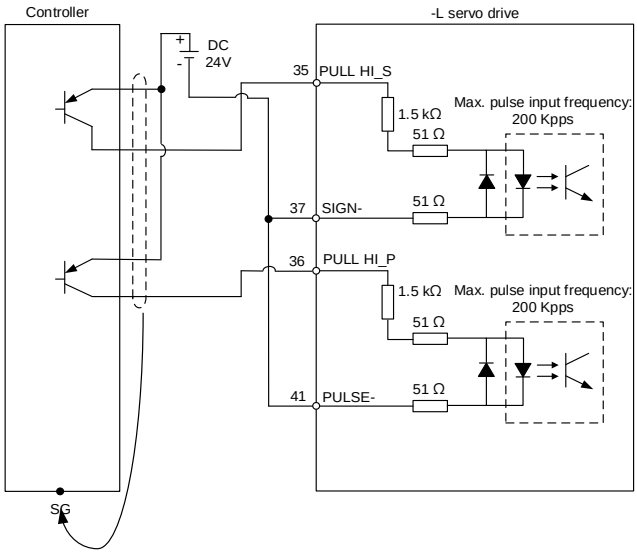
Caution: when the source for the pulse input is open collector NPN type or PNP type equipment, you must connect the external power (24V ± 10%) to the PULL HI pins.

- **Do not connect the 24V power to the SIGN+ and SIGN- pins at the same time, or the circuit elements will be damaged.**
- **Do not connect the 24V power to the PULSE+ and PULSE- pins at the same time, or the circuit elements will be damaged.**

C3-1: the source for the pulse input is open collector NPN type equipment, which uses the external power supply.

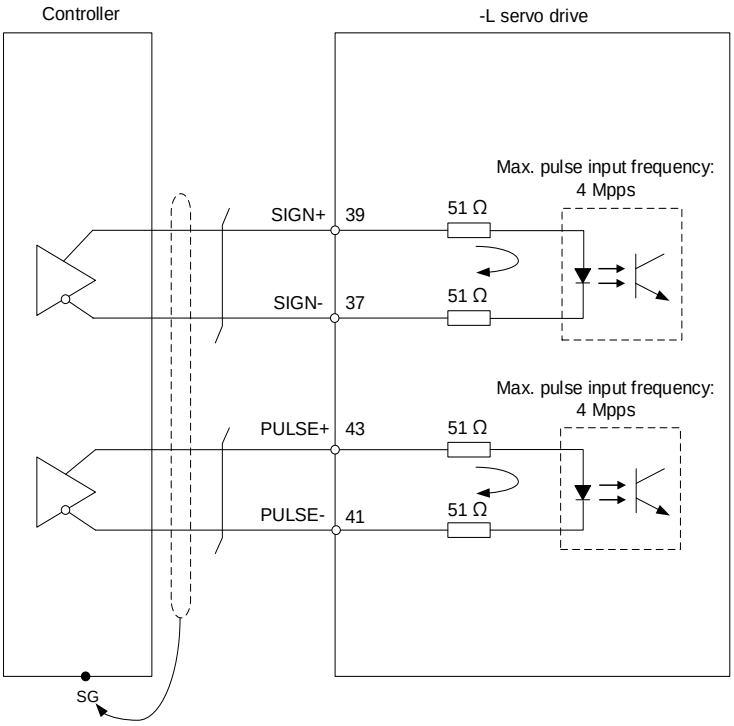


C3-2: the source for the pulse input is open collector PNP type equipment, which uses the external power supply.



C4: pulse input (differential input) can only be used with 2.8V - 3.6V power systems. **Do not use it with 24V power**.

Pulse	Type		Maximum input frequency
High speed pulse	Differential signal	Pulse train + sign	4 Mpps
		CW and CCW pulses	
		A phase + B phase	2 Mpps
Low speed pulse	Differential signal		200 Kpps



Note: refer to the description of P1.000 in Chapter 8 for setting details.

Caution: when the drive connects to an inductive load, you must install the diode.

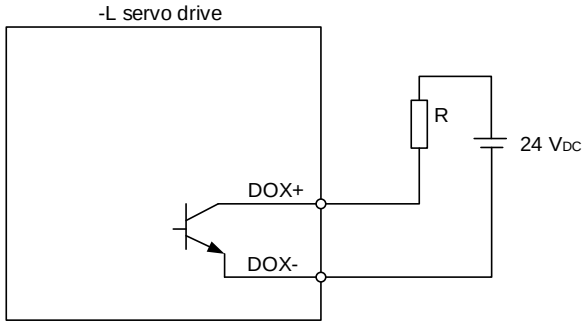
DO specification:

Permissible current: below 40 mA; surge current: below 100 mA; maximum voltage: 30V.

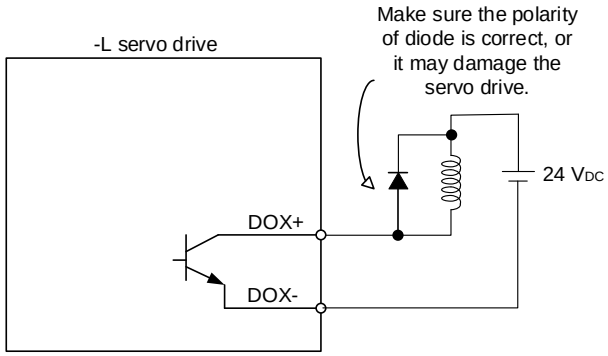
Diode specification:

1A or above, 500V or above (such as the 1N4005 diode).

C5: DO wiring - the servo drive uses an external power supply and the resistor is for general load.



C6: DO wiring - the servo drive uses an external power supply and the resistor is for inductive load.



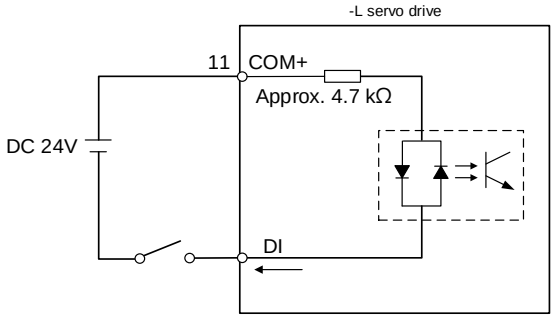
DI wiring - input signals by relay or open collector transistor.

Conditions of DI On / Off:

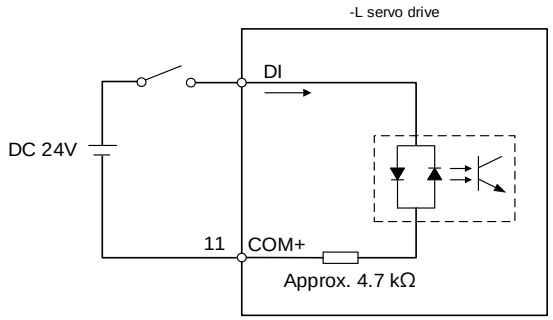
ON: 15V - 24V; input current = 3 mA.

OFF: 5V or below; the input current must not be higher than 0.5 mA.

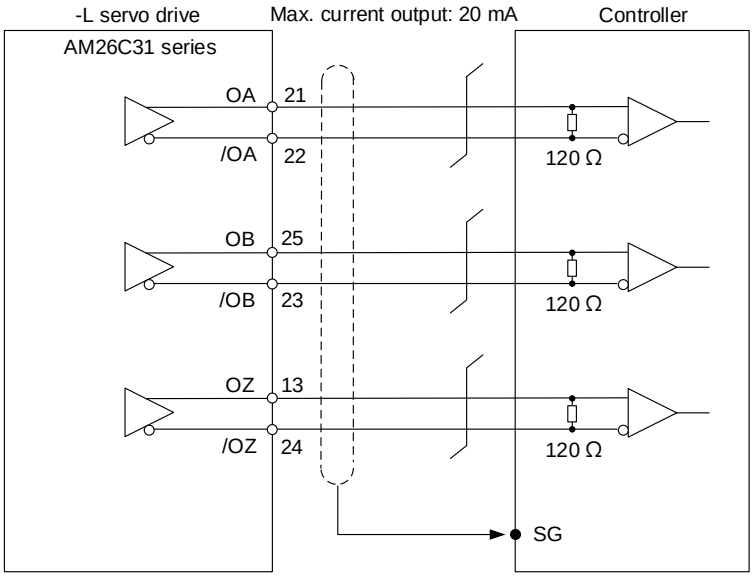
C7: NPN transistor (SINK mode)



C8: PNP transistor (SOURCE mode)

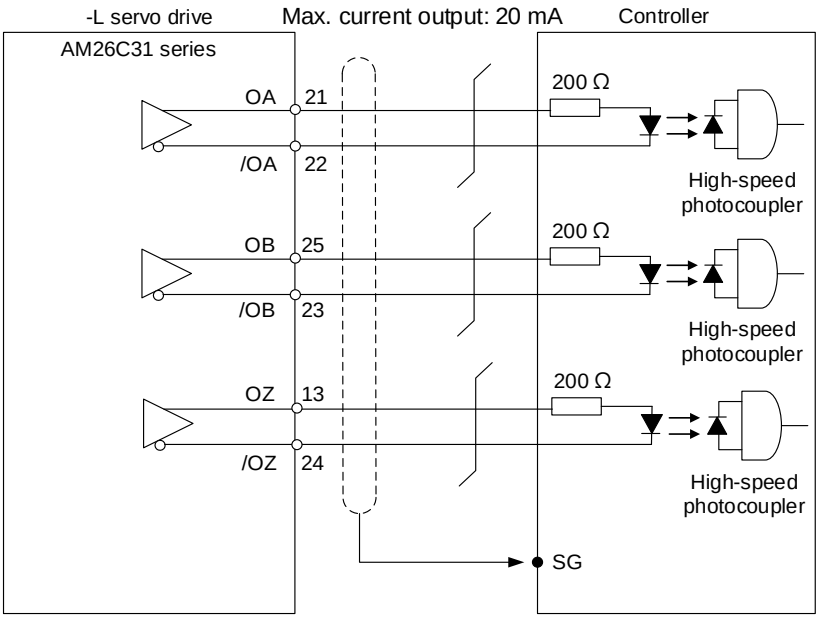


C9: output for encoder position signal (line driver)

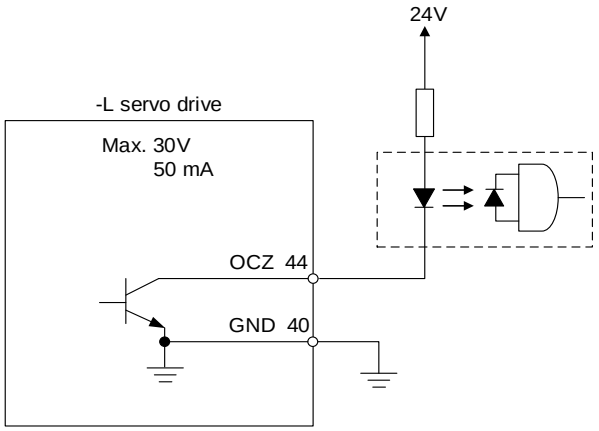


Note: it is suggested that you connect the GND of the controller and the GND of the servo drive in parallel when the voltage difference between the two GND terminals is too great.

C10: output for encoder position signal (photocoupler)

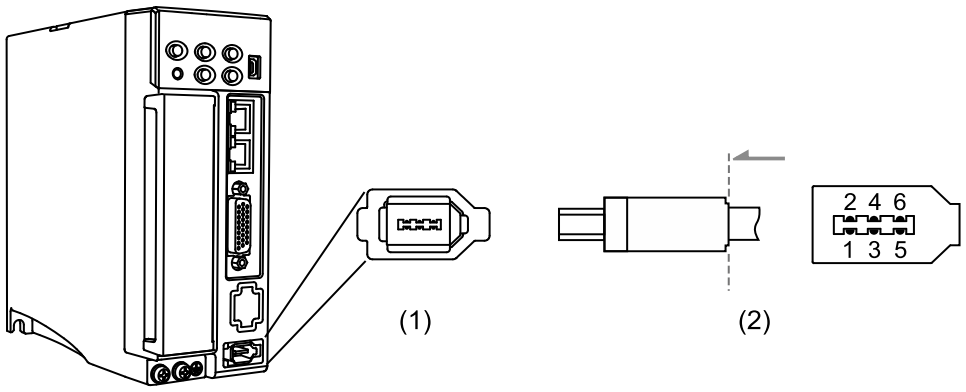


C11: output for encoder OCZ signal (open collector output for Z pulse)



3.4 Wiring for the CN2 encoder connector

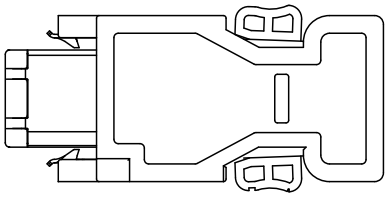
The wiring of the CN2 encoder connector is shown as follows:



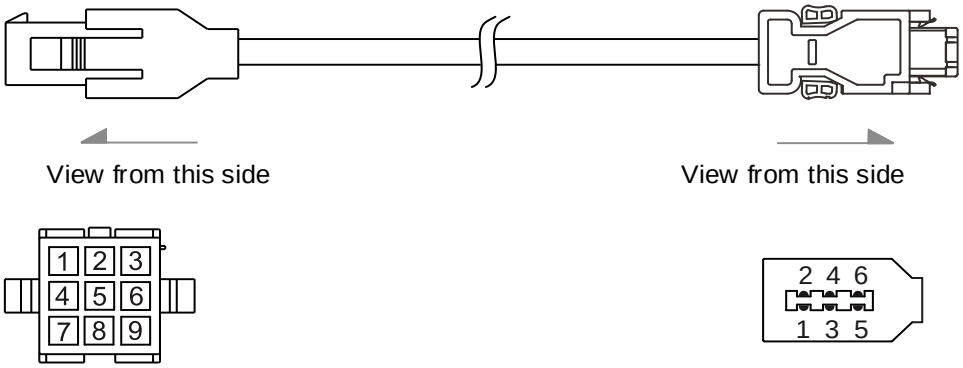
(1) CN2 connector (female); (2) CN2 connector (male)

WARNING

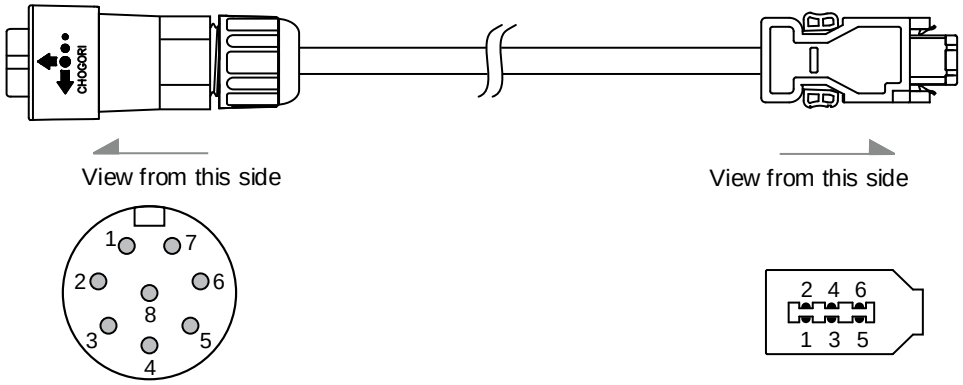
- DO NOT connect to Pin 3 and Pin 4 of the servo drive CN2 connector. These pins are for internal use only. Wiring them will cause damage to the internal circuit.
- When an absolute encoder is used, the battery supplies power directly to the encoder, so wiring the battery wires to the CN2 connector of the servo drive is not required.

Illustration of connector	Recommended brand	Model number
	Delta	ACS3-CNENC200
	JAWS	IES06G7AQB1

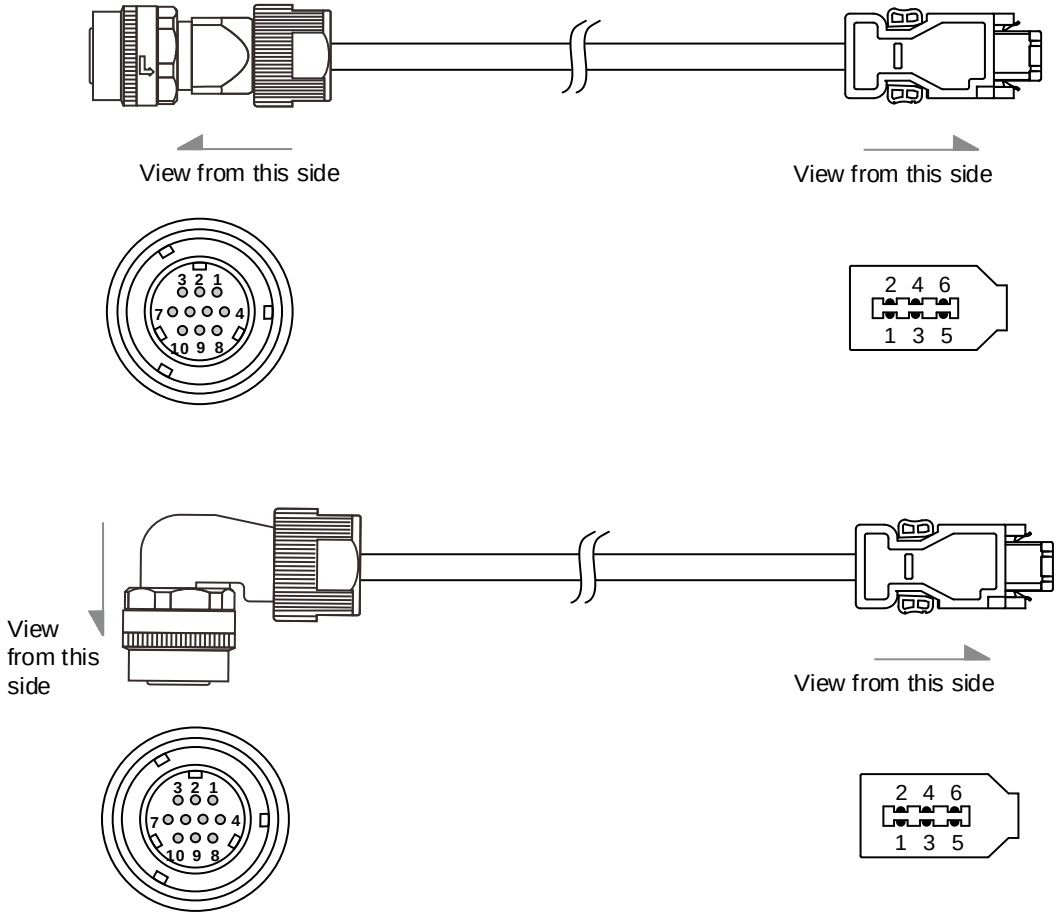
Connectors (standard connector / CN2 connector) of the encoder cable (for ECM-A3 / B3 220V F40 to F80 motors):



Connectors (CHOGORI connector / CN2 connector) of the encoder cable (for ECM-A3 / B3 220V F40 to F80 motors):

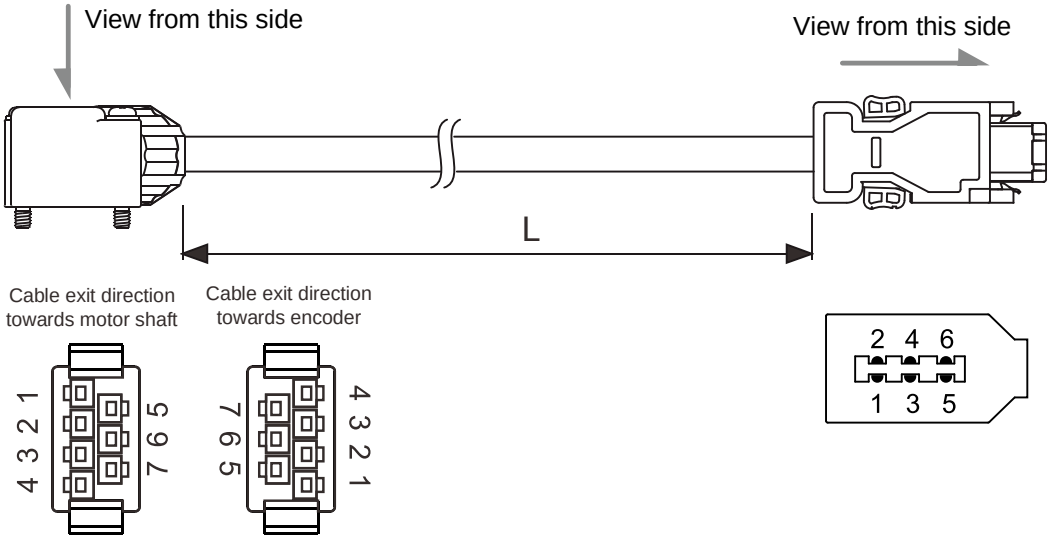


Connectors (military connector / CN2 connector) of the encoder cable (for ECM-B3 F100 to F180 motors):



3

Connectors (bulkhead connector / CN2 connector) of the encoder cable (for ECM-B3 220V F40 to F80 motors):

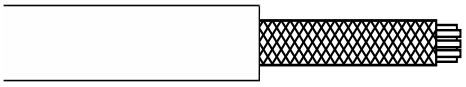


Pin assignment of the connectors:

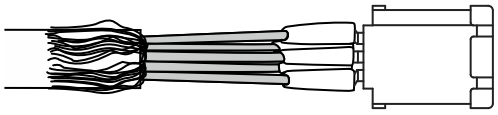
Encoder cable connector						CN2 of servo drive		Description
Motor with cables				Motor with bulkhead connectors				
B3 military	CHOGORI	Standard	Color	Bulkhead	Color	Pin No.	Signal	
4	4	7	Brown	3	Red	1	+5V	+5V power supply
9	3	8	Blue	4	Orange	2	GND	Power ground
-	-	-	-	-	-	3	-	**DO NOT connect these pins. They are for internal use only.**
-	-	-	-	-	-	4	-	
1	1	1	White	1	Blue	5	T+	Serial communication signal (+)
2	2	4	White/ Red	2	Purple	6	T-	Serial communication signal (-)
10	8	9	-	7	-	Case	Shielding	Shielding
6	6	2	Red	5	Brown	-	-	+3.6V battery
5	5	5	Black	6	Black	-	-	Battery ground

Note: for the wiring details of the absolute encoder connector, refer to Section 3.1.5 Specification for encoder cable and connector.

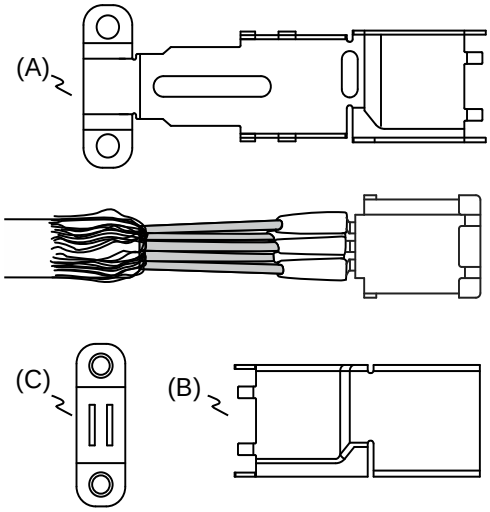
Connect the shielded wires to the CN2 encoder connector as follows:



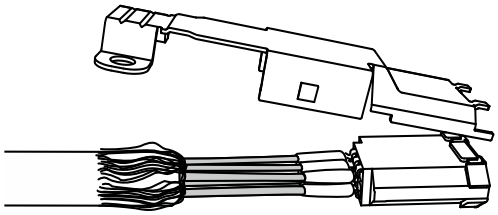
Step 1:
Strip the cable and expose the wires covered by the metal shield. The exposed wire length should be 20 - 30 mm (0.79 - 1.18 inches).



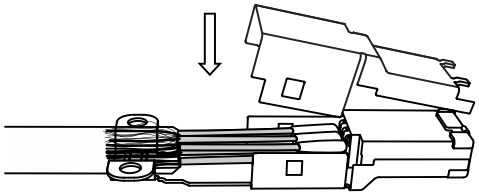
Step 2:
Spread the metal shield and fold it back. Refer to the pin assignment in the preceding table to connect the wires.



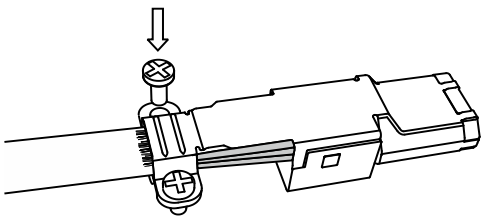
Step 3:
You need the following items to assemble the connector:
(A) Big metal case
(B) Small metal case
(C) U-shaped bracket



Step 4:
Place the big metal case to cover the exposed metal shield. Make sure the metal shield is completely covered to maintain the integrity of the shielding.

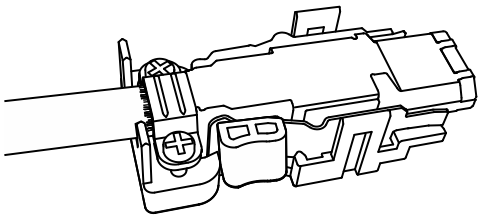


Step 5:
Fasten the small metal case on the other side.

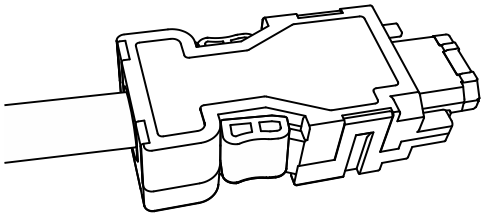


Step 6:
Place the U-shaped bracket over the big metal case and fasten them with screws.

3



Step 7:
Fit one side of the plastic case over the connector.



Step 8:
Place and fasten the other side of the case to complete assembling the connector.

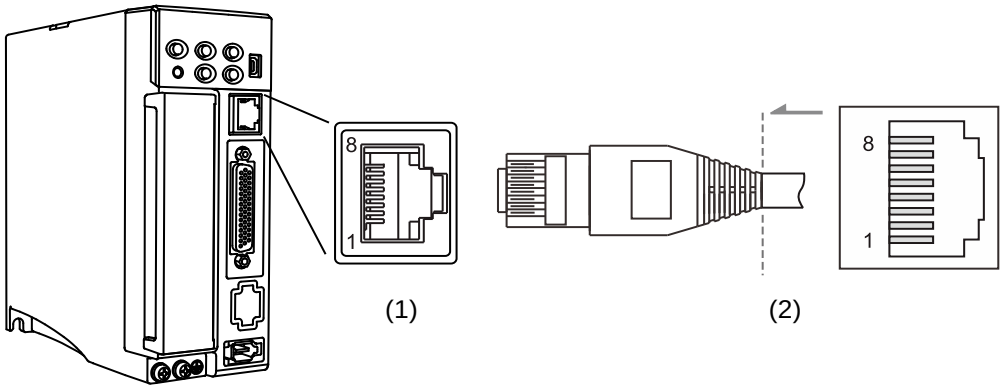
3.5 Wiring for the CN3 connector

3.5.1 Wiring for the Modbus communication connector

When the servo drive is connected to the PC via the CN3 connector, you can operate the servo drive, PLC, or HMI through Modbus using the assembly language. The CN3 connector supports RS-485 communication interface, allowing you to connect multiple servo drives simultaneously.

Note:

1. -L models have a single port (Pin 1 - Pin 8) which only supports RS-485 communication.
2. B3A-M models have dual ports which support both RS-485 and high-speed communication (CANopen). Refer to Section 3.5.2 for more information.



(1) CN3 connector (female); (2) CN3 connector (male)

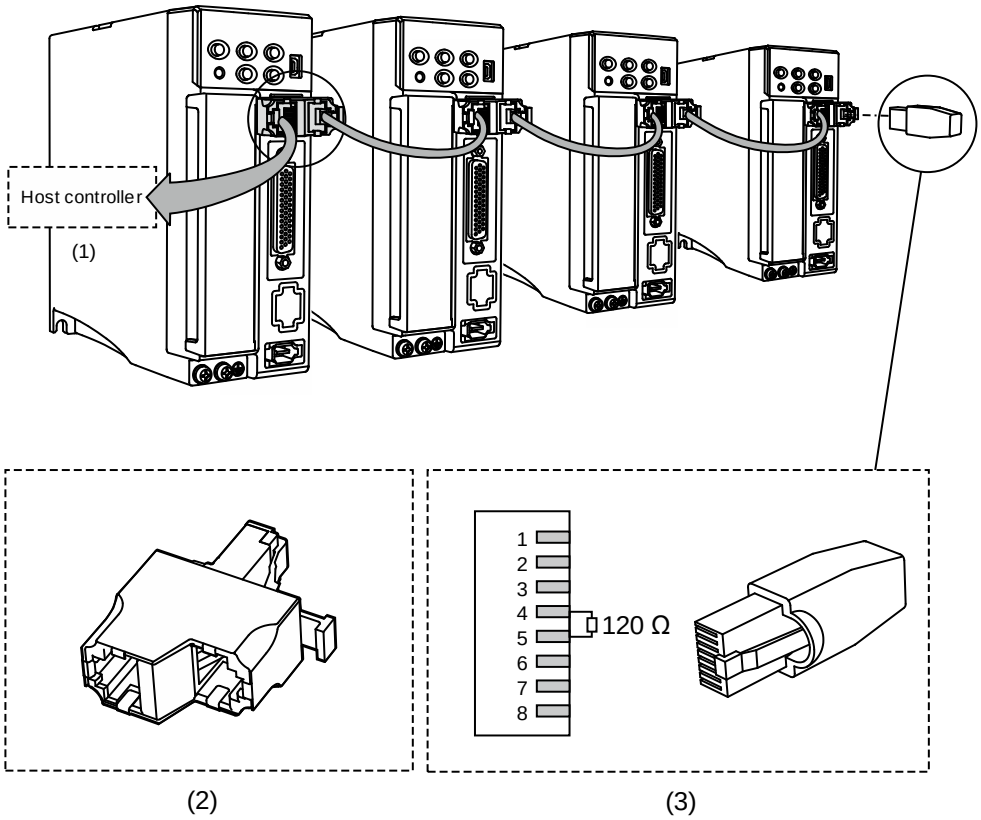
Pin assignment:

Pin No.	Signal	Description
1	-	Reserved
2	-	Reserved
3, 7	GND_ISO	Signal GND
4	RS-485-	For the servo drive to transmit the data to differential terminal (-).
5	RS-485+	For the servo drive to transmit the data to differential terminal (+).
6, 8	-	Reserved

Note: refer to Chapter 9 for the RS-485 wiring.

3

Connecting multiple servo drives:



(1) Connect to the controller / PLC; (2) Modbus connector;

(3) Wiring for RS-485 terminal resistor

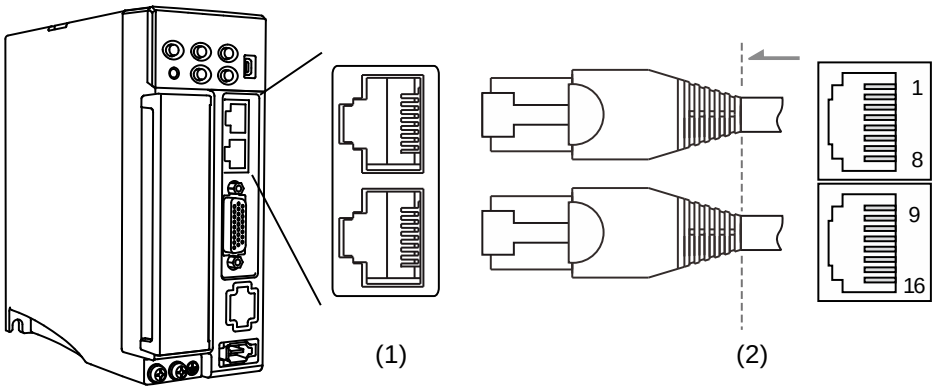
Note:

1. You can connect up to 32 axes through RS-485. The communication quality and the allowable number of connected axes are determined by the controller's specifications, quality of wires, grounding, interference, and whether a shielded twisted-pair cable is used.
2. It is suggested that you use a terminal resistor of 120 Ω (Ohm) and 0.5 W (or more).
3. Connect multiple servo drives in parallel through the Modbus connector and put the terminal resistor in the last servo drive.

3.5.2 Wiring for the CANopen communication connector

Conforming to the CANopen DS301 and DS402 standards, the CN3 connector use the standard CANopen communication interface to control the position, torque, and speed of the motor, and access or monitor the servo status, allowing you to connect multiple servo drives simultaneously.

Note: -M models have dual ports; B3-M models only support high-speed communication (CANopen), and B3A-M models support both RS-485 and high-speed communication (CANopen).



(1) CN3 connector (female); (2) CN3 connector (male)

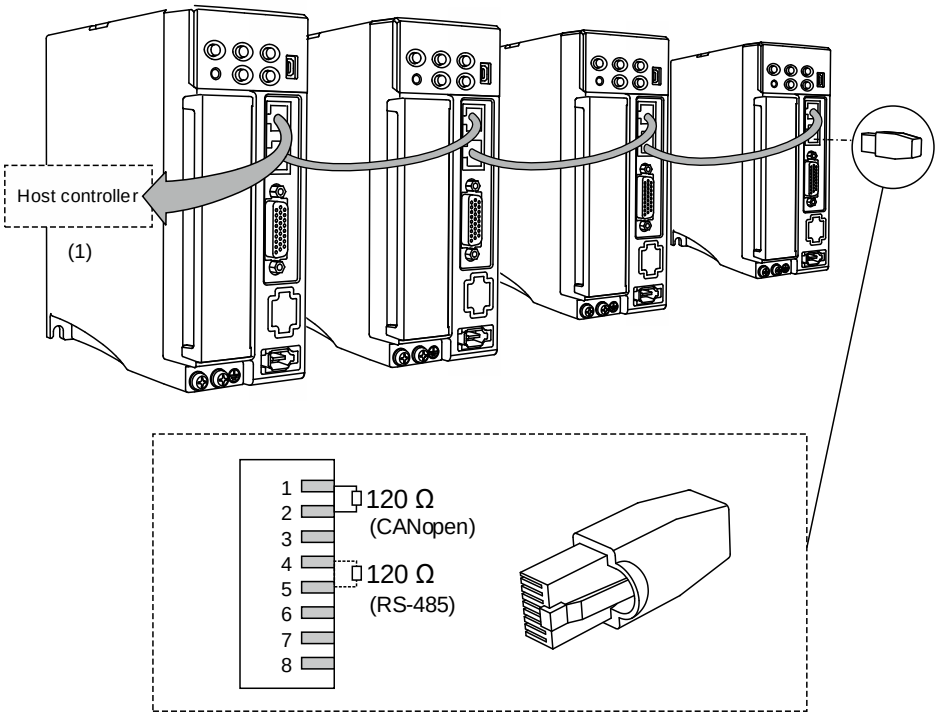
Pin assignment:

Pin No.	Signal	Description
1, 9	CAN_H	CAN_H bus line (dominant high)
2, 10	CAN_L	CAN_L bus line (dominant low)
3, 11	GND_ISO	Signal GND
4, 12	RS-485-	For the servo drive to transmit the data to differential terminal (-).
5, 13	RS-485+	For the servo drive to transmit the data to differential terminal (+).
6, 14	-	Reserved
7, 15	GND_ISO	Signal GND
8, 16	-	Reserved

3

Connecting multiple servo drives:

Configure the terminal resistor according to the communication interface in use.



(1) Connect to the controller / PLC; (2) Wiring for CANopen / RS-485 terminal resistor

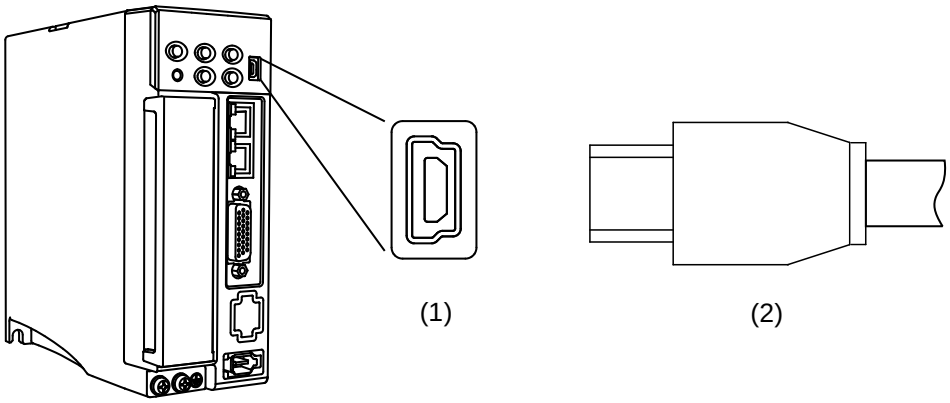
Note:

1. CANopen cable length can be up to 30 m (98.43 ft). You can connect up to 32 axes through RS-485. The communication quality and the allowable number of connected axes are determined by the controller's specifications, quality of wires, grounding, interference, and whether a shielded twisted-pair cable is used.
2. It is suggested that you use a terminal resistor of 120 Ω (Ohm) and 0.5 W (or more).
3. Connect multiple servo drives in parallel through the two ports and put the terminal resistor in the last servo drive.

3.6 CN4 connector (Mini USB)

CN4 is a serial communication port through which you can connect the servo drive to a PC and operate the servo drive with the software.

This is a Type B Mini USB connector that is compatible with the USB 2.0 specification, and installing the USB isolator (Delta model number: UC-ADP01-A) is required.



(1) Mini USB connector (female); (2) Mini USB connector (male)

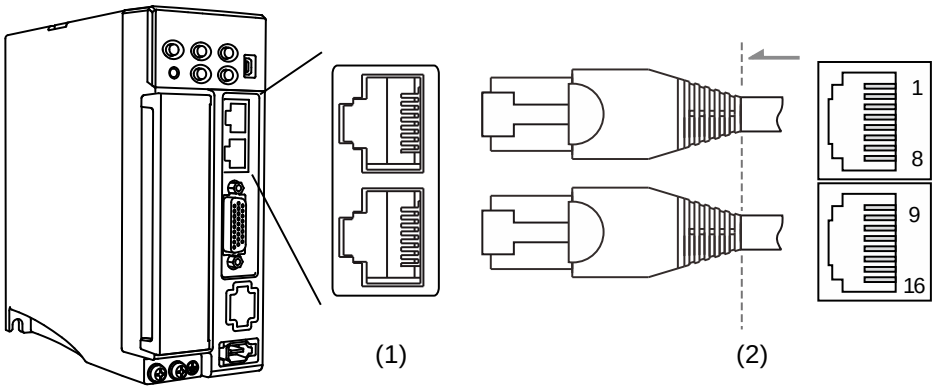
3.7 Wiring for the CN6 connector

3.7.1 Wiring for the DMCNET communication connector

3

The CN6 connector of the -F models allows you to connect the servo drive to the controller or motion control card using a standard RJ45 connector and a shielded network cable, controlling the position, torque, and speed of the motor, as well as accessing or monitoring the servo status with Delta's DMCNET system.

You can set the address with P3.000 when using DMCNET communication. Its maximum transmission rate is 20 Mbps. The -F models provide two DMCNET ports for connecting multiple servo drives, with one way in and the other way out. Remember to put the terminal resistor that comes with the accessory kit of the controller or motion control card in the last servo drive.

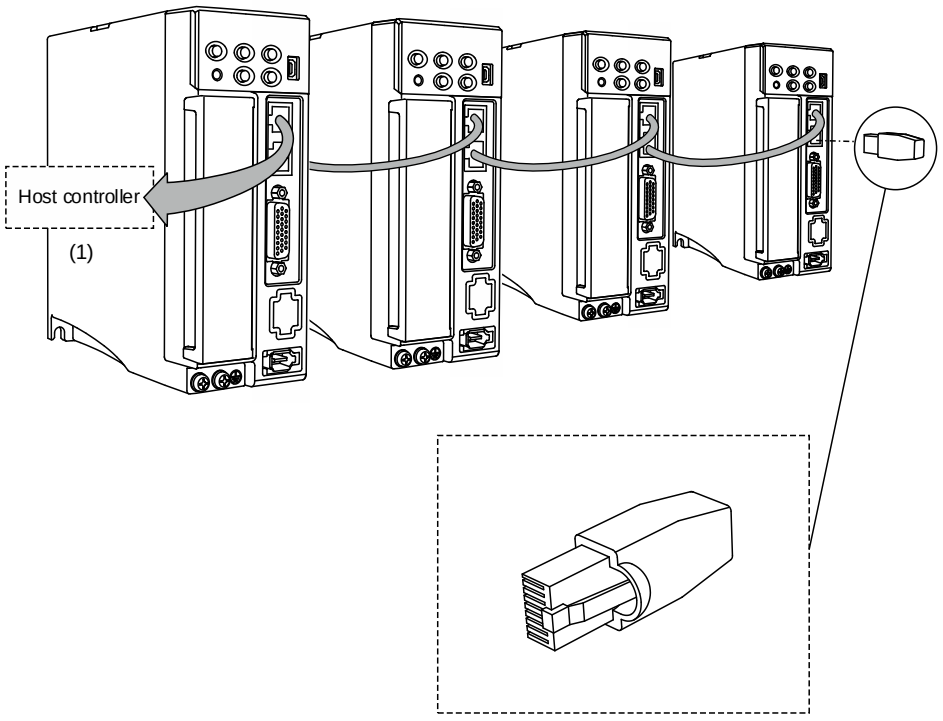


(1) CN6 connector (female); (2) CN6 connector (male)

Pin assignment:

Pin No.	Signal	Description
1, 9	DMCNET_1A	DMCNET Channel 1 bus line (+)
2, 10	DMCNET_1B	DMCNET Channel 1 bus line (-)
3, 11	DMCNET_2A	DMCNET Channel 2 bus line (+)
4, 12 5, 13	-	Reserved
6, 14	DMCNET_2B	DMCNET Channel 2 bus line (-)
7, 15 8, 16	-	Reserved

Connecting multiple servo drives:



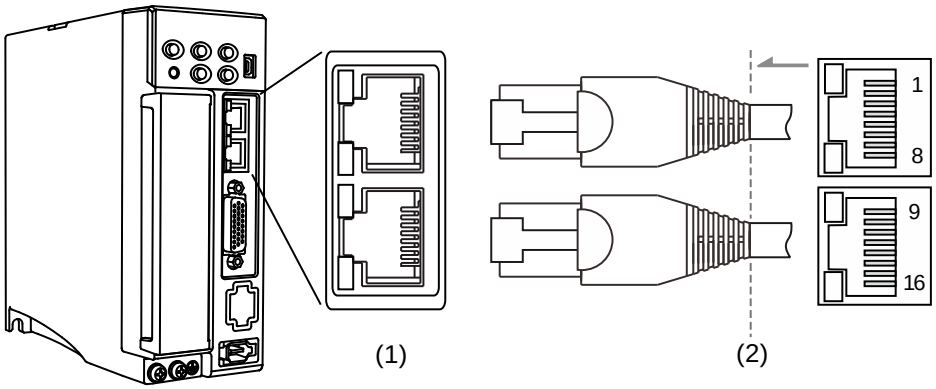
(1) Connect to the controller / motion control card; (2) Illustration of DMCNET terminal resistor

Note:

1. You can connect up to 12 axes through DMCNET communication with the cable length up to 30 m (98.43 ft).
2. To connect multiple servo drives in serial, use the two DMCNET ports with one way in and the other way out, and then put the terminal resistor in the last servo drive.
3. The required resistance value of the terminal resistor varies depending on the specification of the controller or motion control card. Contact the Customer Service Center of the controller or motion control card for details.

3.7.2 Wiring for the EtherCAT communication connector

The CN6 connector of the -E models provides two EtherCAT ports for connecting multiple servo drives, with one way in and the other way out.



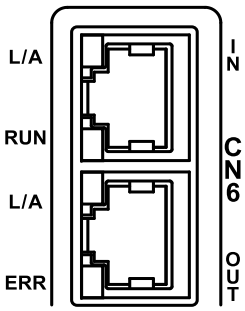
(1) CN6 connector (female); (2) CN6 connector (male)

Pin assignment:

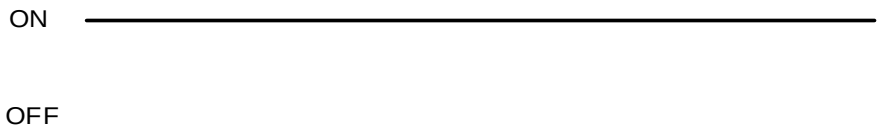
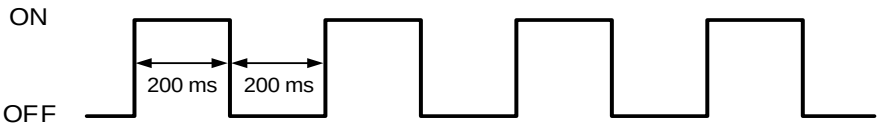
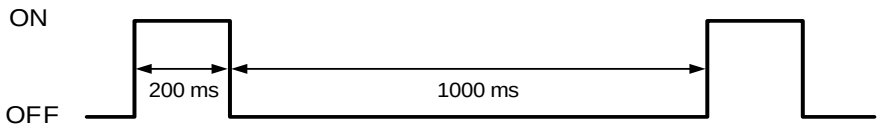
Transmission port	Pin No.	Signal	Function description
IN	1	TX+	Transmit +
	2	TX-	Transmit -
	3	RX+	Receive +
	4	-	Reserved
	5	-	Reserved
	6	RX-	Receive -
	7	-	Reserved
	8	-	Reserved
OUT	9	TX+	Transmit +
	10	TX-	Transmit -
	11	RX+	Receive +
	12	-	Reserved
	13	-	Reserved
	14	RX-	Receive -
	15	-	Reserved
	16	-	Reserved

Note: the IN port is for connecting the controller or the previous servo drive, and the OUT port is for connecting the next servo drive or not connecting to other devices. Incorrect wiring will lead to communication error.

Description of each indicator for the CN6 connector:



■ LED indicator status description

Indicator	Description
On	
Blinking	
Single flash	
Off	

■ Network status indicator (L/A)

Indicator	Status	Description
On	Network is connected	Network connection is established but no data transmission.
Blinking	Network connection is established and data is in transmission	Data is in transmission.
Off	No connection	Network connection is not established.

■ EtherCAT connection status indicator (RUN)

Indicator	Status	Description
Off	Initial	After power cycling and the initialization of the servo drive is complete, the communication has not yet started, but the controller can access the servo drive's register.
On	Operational	SDO, TxPDO, and RxPDO data packets can be transmitted.
Blinking	Pre-Operational	The controller can exchange data through the mailbox.
Single flash	Safe-Operational	The servo drive can use the SDO and TxPDO data packets to exchange data with the controller.

■ EtherCAT error indicator (ERR)

Indicator	Status	Description
Off	No error	No error has occurred.
On	PDI Watchdog timeout	Servo drive malfunction. Contact the distributor for assistance.
Blinking	State change error	Parameter setting error causes the system unable to switch the state. Refer to the following diagram.
Single flash	Synchronization error / SyncManager error	The synchronization between the controller and the servo drive failed or the data was lost during data reception.

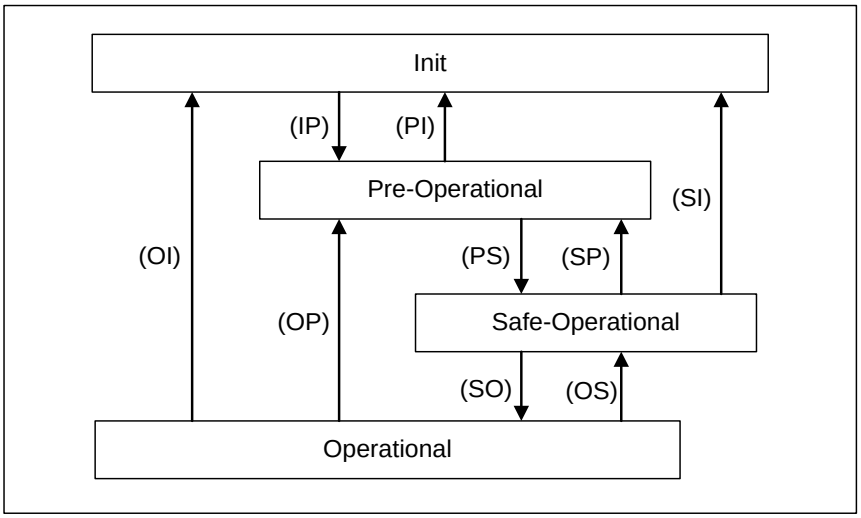
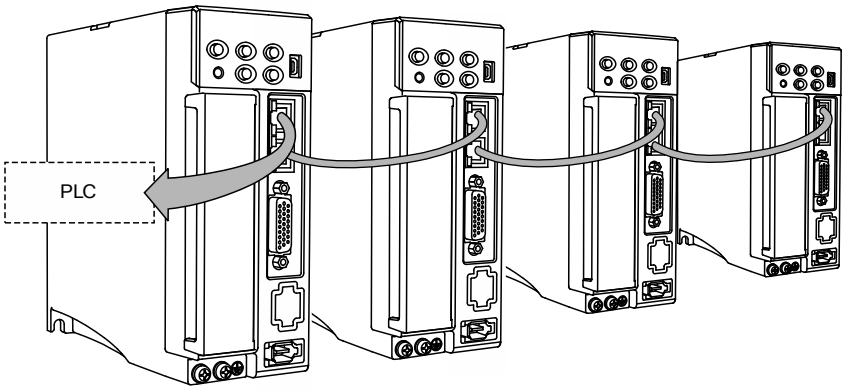


Figure 3.7.2.1 EtherCAT State Machine

Connecting multiple servo drives:



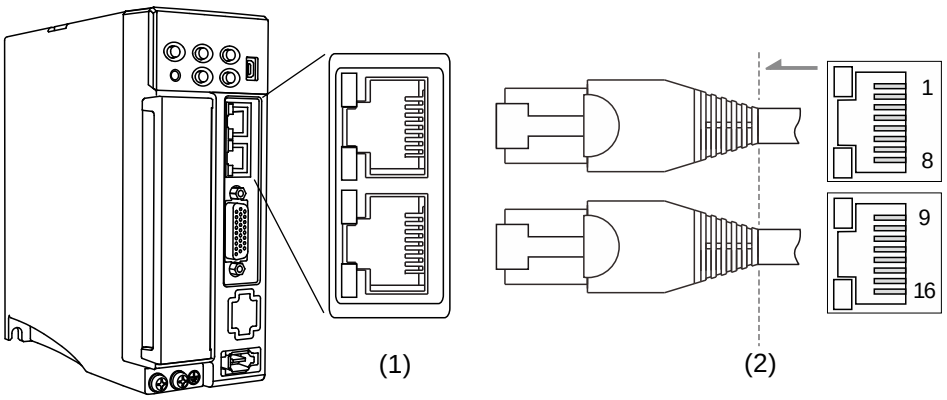
Note:

1. When multiple servo drives are connected, the maximum distance between each drive is 50 m (164.04 inches)
2. Use CAT5e STP cable.
3. It is suggested that you use a Beckhoff cable (model number: ZB9020).
4. Ensure the wiring is correct. The IN port is for connecting the controller or the previous servo drive, and the OUT port is for connecting the next servo drive or not connecting to other devices.

3.7.3 Wiring for the PROFINET communication connector

The CN6 connector of the B3A-P models* allows you to connect the servo drive to the controller using standard RJ45 connectors and shielded network cables, controlling the position and speed of the motor, as well as accessing or monitoring the servo status with Siemens' PROFINET system.

Note: coming soon.

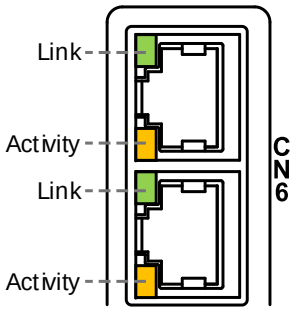


(1) CN6 connector (female); (2) CN6 connector (male)

Pin assignment:

Pin No.	Signal	Description
1, 9	TX+	Transmit +
2, 10	TX-	Transmit -
3, 11	RX+	Receive +
4, 12	-	Reserved
5, 13	-	Reserved
6, 14	RX-	Receive -
7, 15	-	Reserved
8, 16	-	Reserved

Description of each indicator for the CN6 connector:



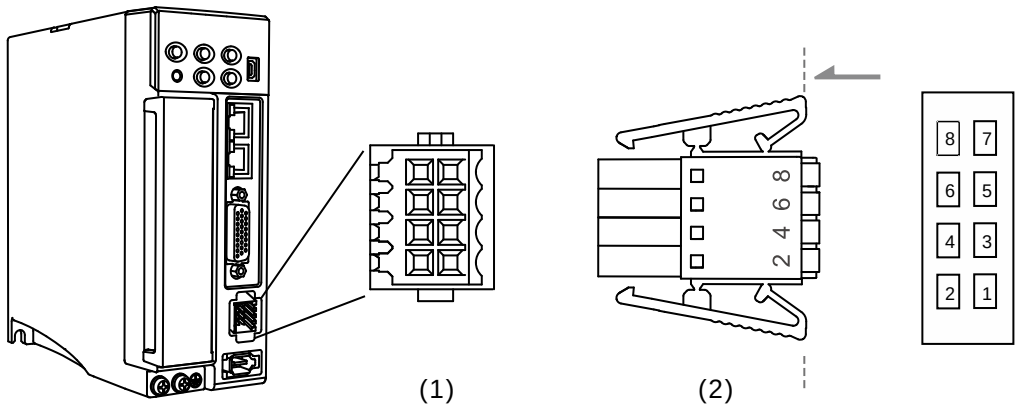
Name	Color	Indicator	Status
Link	Green	On	Network is connected.
		Off	No connection or connection error.
Activity	Orange	On	Data exchange in progress.
		Off	No data exchange.

3.8 CN10 STO connector (Safe torque off)

This connector provides the STO function. More details are provided in the next section.

3

Note: the STO function is supported by B3A series only.



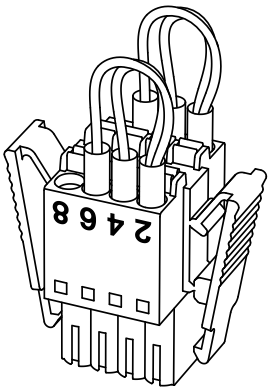
(1) CN10 STO connector (female); (2) CN10 quick connector (male)

Pin assignment:

Pin No.	Signal	Description
1	-	Reserved
2	-	Reserved
3	SF1+	STO input: safety input 1+
4	SF1-	STO input: safety input 1-
5	SF2+	STO input: safety input 2+
6	SF2-	STO input: safety input 2-
7	EDM+	STO output: feedback monitoring Max. rating: 80 V_{DC}, 0.5 A
8	EDM-	STO output: feedback monitoring Max. rating: 80 V_{DC}, 0.5 A

If you do not need the STO function, plug in the STO connector that comes with the servo drive. The short-circuit wiring has been done as shown in the figure on the right.

If the wiring is removed, refer to the wiring information in Section 3.9.5.1 Not using the STO function.



3.9 STO function (Safe torque off)

3.9.1 Introduction to STO

Once the STO function is enabled, the servo drive stops supplying current to the motor, cutting off the power supply and torque force. Do not repeatedly use this function for it cannot control the time the motor stops and the motor speed with parameters. (The STO function is not a stop function.)

Note: the STO function is supported by B3A series only.

3.9.2 Precautions for using STO function

After the STO function is activated, the servo drive can no longer control the motor. Hence, take all the potential danger resulted from activating the STO function into consideration. Delta is not liable for mechanical damage and personnel injury if you fail to observe the following instructions:

1. For a safety circuit design, make sure the selected components conform to the safety specifications.
2. Before installation and wiring, read the operation manuals of all the peripheral devices carefully.
3. Do not touch the servo drive after activating the STO function. The STO function stops the servo drive from supplying power to the motor but the power supply is not removed from the servo drive. Thus, there is a potential risk of electric shock.
4. When maintaining the servo drive, use the molded-case circuit breaker (MCCB) or magnetic contactor (MC) to cut off the power.
5. When the STO function is activated, the servo drive can no longer control, stop, or decelerate the motor.
6. After the STO function is activated, the servo drive can no longer control the motor, but the motor can still be moved by other external forces.
7. The EDM signals are not safety output signals. The EDM signals are only for inspecting the STO function status.
8. The STO function must be powered by the safety extra-low voltage (SELV) power source with reinforced insulation.
9. Supply power to the STO signals with a single power source, or the leakage current will result in STO misoperation.

3.9.3 Specifications of STO

The ASDA-A3 series servo drive conforms to the following safety specifications:

Item	Definition	Standard	Performance
SFF	Safe failure fraction	IEC 61508	Channel 1: 80.08% Channel 2: 68.91%
HFT (Type A subsystem)	Hardware fault tolerance	IEC 61508	1
SIL	Safety integrity level	IEC 61508	SIL2
		IEC 62061	SILCL2
PFH	Probability of dangerous failure per hour [h^{-1}]	IEC 61508	9.56×10^{-10}
PFD_{avg}	Average probability of failure on demand	IEC 61508	4.18×10^{-6}
Category	Category	ISO 13849-1	Category 3
PL	Performance level	ISO 13849-1	d
$MTTF_d$	Mean time to dangerous failure	ISO 13849-1	High
DC	Diagnostic coverage	ISO 13849-1	Low

3.9.4 How does the STO function work?

The STO function controls the motor current by two individual circuits. The two circuits cut off the power supply to the motor when needed, making the motor free from torque force. When an STO alarm occurs, determine which alarm is triggered according to the EDM (External Device Monitoring) status. The following table details how this function works.

Description of STO ON/OFF and EDM status

Signal		Status of opto-isolator			
STO	SF1+ SF1-	ON	ON	OFF	OFF
	SF2+ SF2-	ON	OFF	ON	OFF
Servo drive output status		Ready	Torque off (SF2 lost)	Torque off (SF1 lost)	Torque off (STO activated)
Feedback monitoring (EDM status)		Open	Open	Open	Close
Alarm		N/A	AL502	AL501	AL500

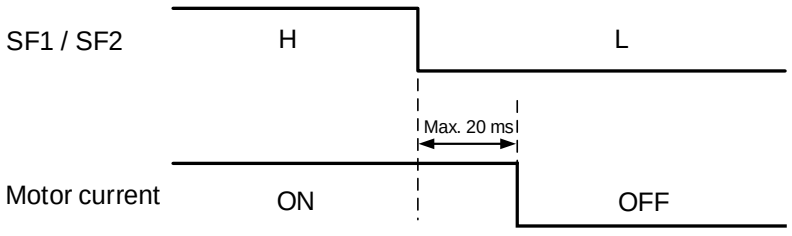
Note:

1. ON = 24 V; OFF = 0 V.
2. Open = open circuit; Close = closed circuit.
3. The status of the feedback monitor signal changes at once according to the status of the safety signals (SF1 and SF2 signals).
4. Contact the distributor if AL503 (STO self-diagnostic error) occurs. Refer to Chapter 14 Troubleshooting for more details of the alarms.

3.9.4.1 Activation status

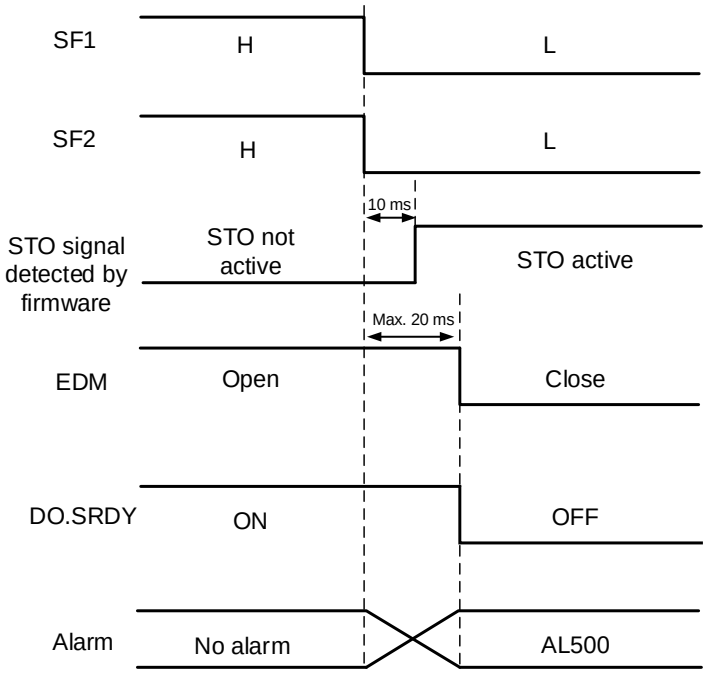
STO response time:

When either SF1 or SF2 signal (safety signal source) is low, the circuit cuts off the motor current within 20 ms.

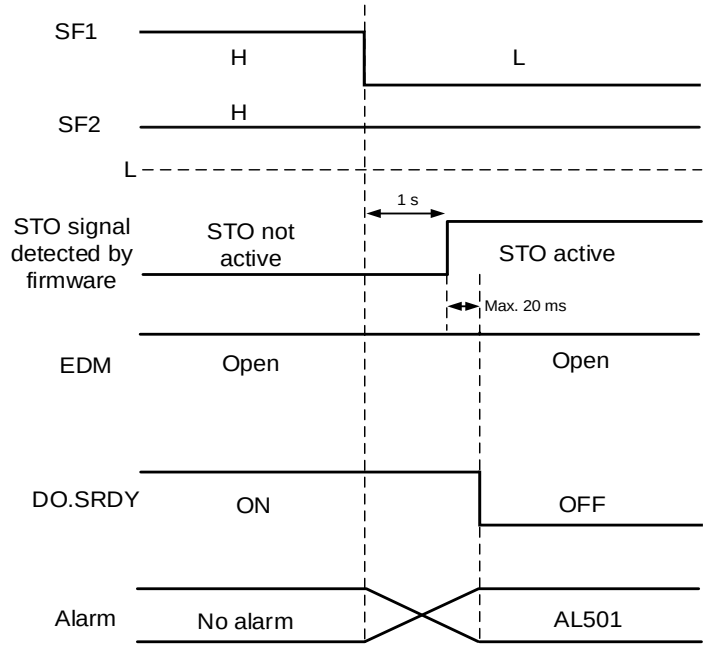


3

AL500 STO function is activated: see the following diagram. When the motor runs normally, but both SF1 and SF2 signals are low for 10 ms **simultaneously**, the “STO signal detected by firmware” flag is on and the servo drive becomes off, triggering AL500.



AL501 SF1 lost / AL502 SF2 lost (signal loss or signal error): see the following diagram. When the motor runs normally, but one of the safety signal source is low for 1 second, the “STO signal detected by firmware” flag is on, and the servo drive becomes off, triggering AL501 or AL502. The following diagram illustrates how AL501 occurs.

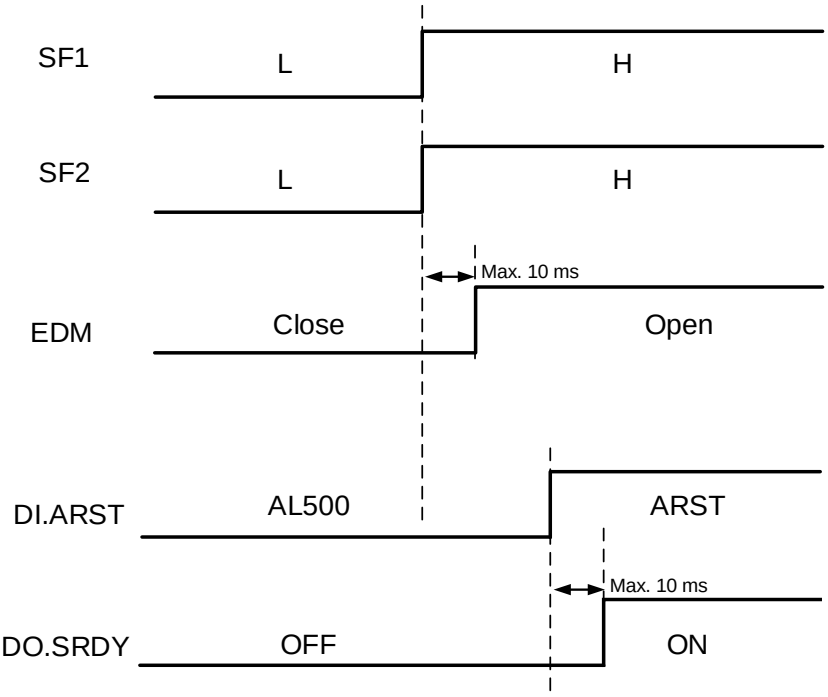


Note:

1. Contact the distributor if AL503 (STO self-diagnostic error) occurs.
2. Refer to Section 3.9.4 for the EDM signal.

3.9.4.2 Deactivation status

When the safety signal source (SF1 and SF2 signals) switches back to high, the alarm will not be cleared automatically. Of all the STO alarms, only AL500 can be cleared with DI.ARST.



Note: refer to Section 3.9.4 for the EDM signal.

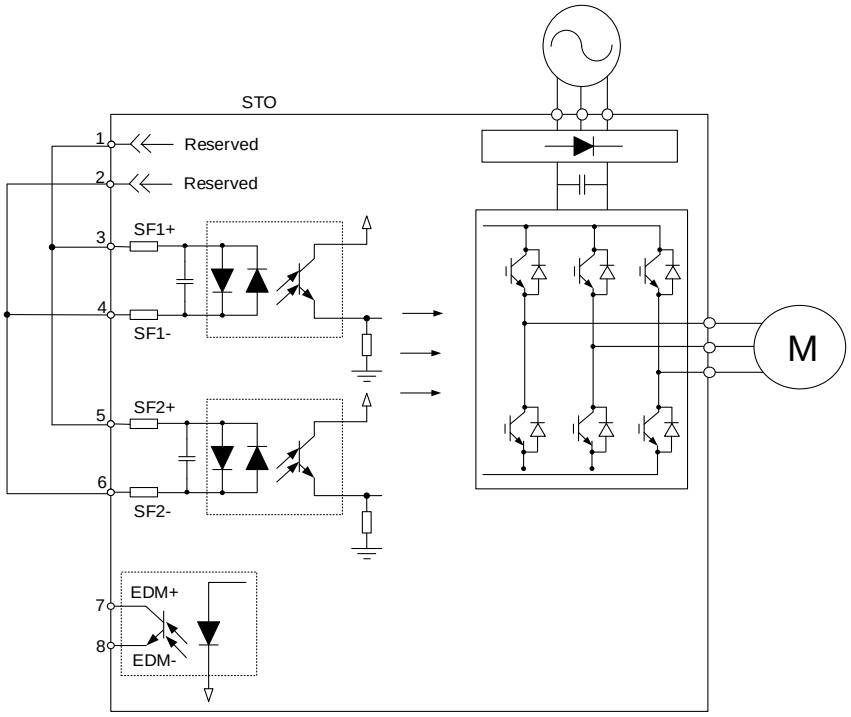
3.9.5 Wiring for STO

For STO wiring, the recommended wire gauge is 0.11 - 0.52 mm^2 (AWG 30 - 20).

3

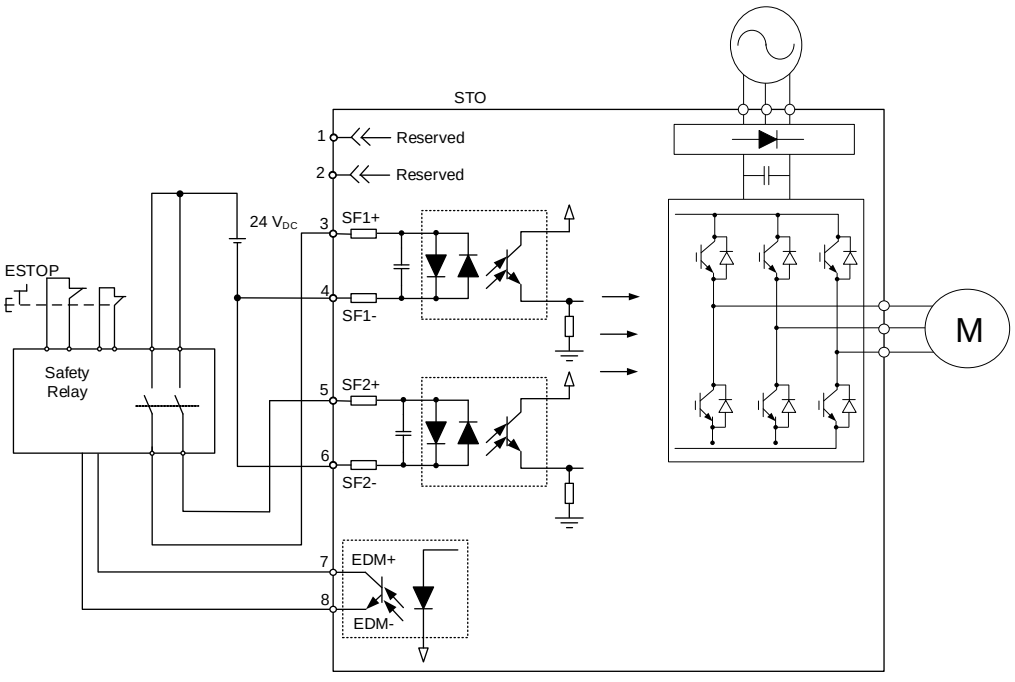
3.9.5.1 Not using the STO function

You can short-circuit the connector or plug in the short-circuit connector that comes with the servo drive. The wiring is as follows.



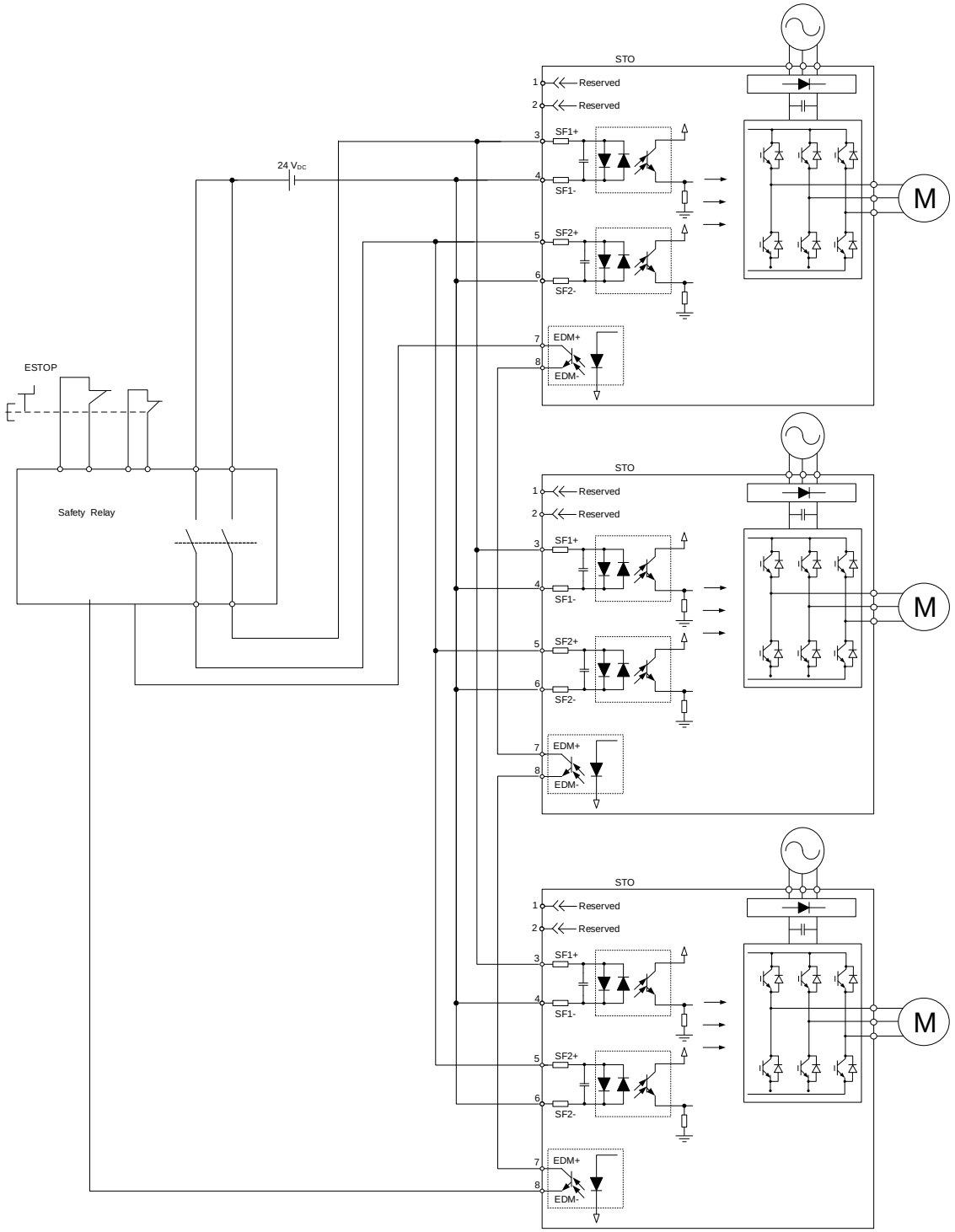
3.9.5.2 Using the STO function for a single drive

To use a safety relay to trigger the STO function, following the diagram for wiring.



3.9.5.3 Using the STO function for multiple drives

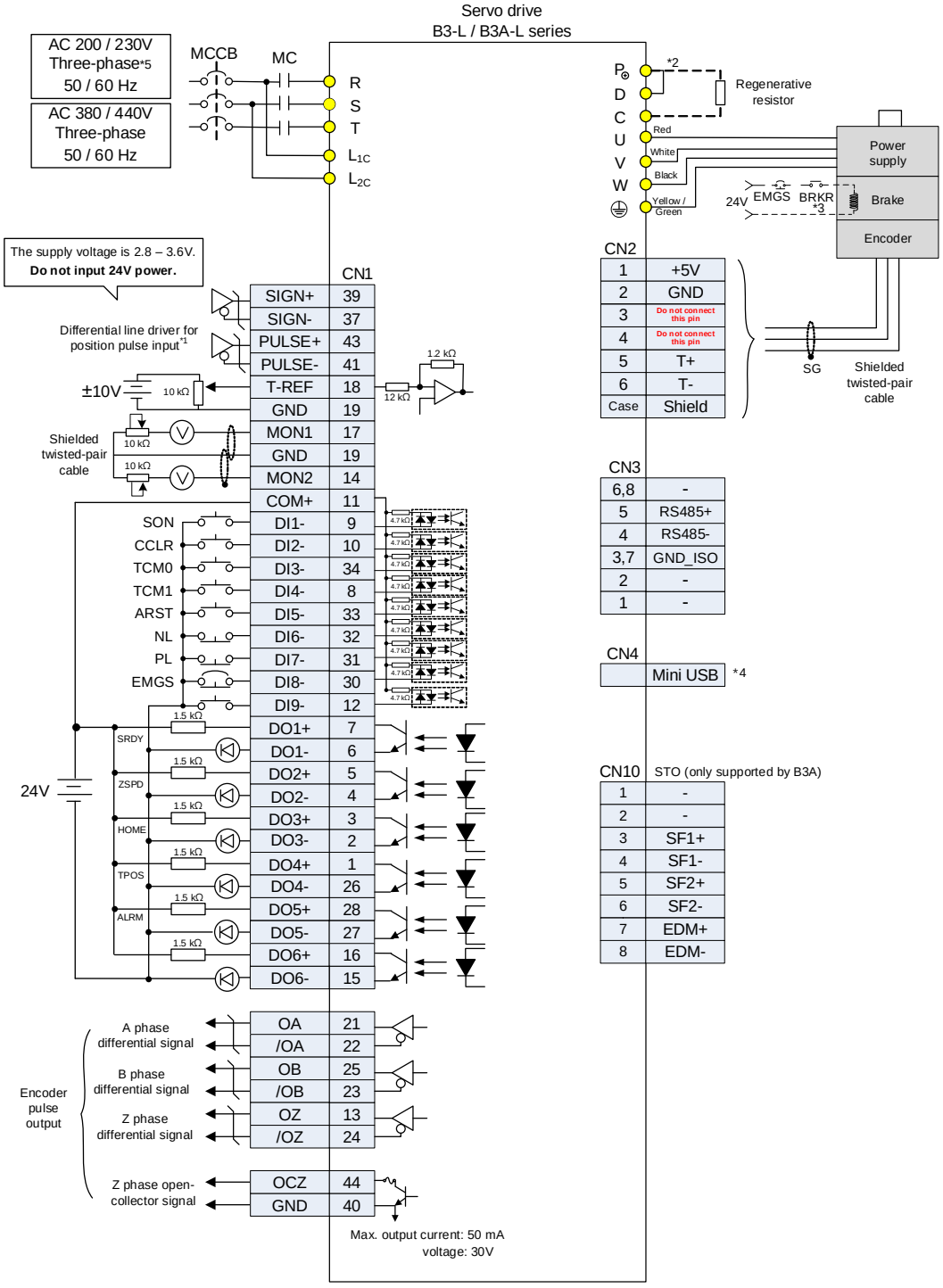
In the multi-drive system, the values of (PFD x number of drives) and (PFH x number of drives) must not exceed the safety values of the device specification.



3

3.10 Standard wiring example

3.10.1 Position (PT) control mode – differential line driver input



Note:

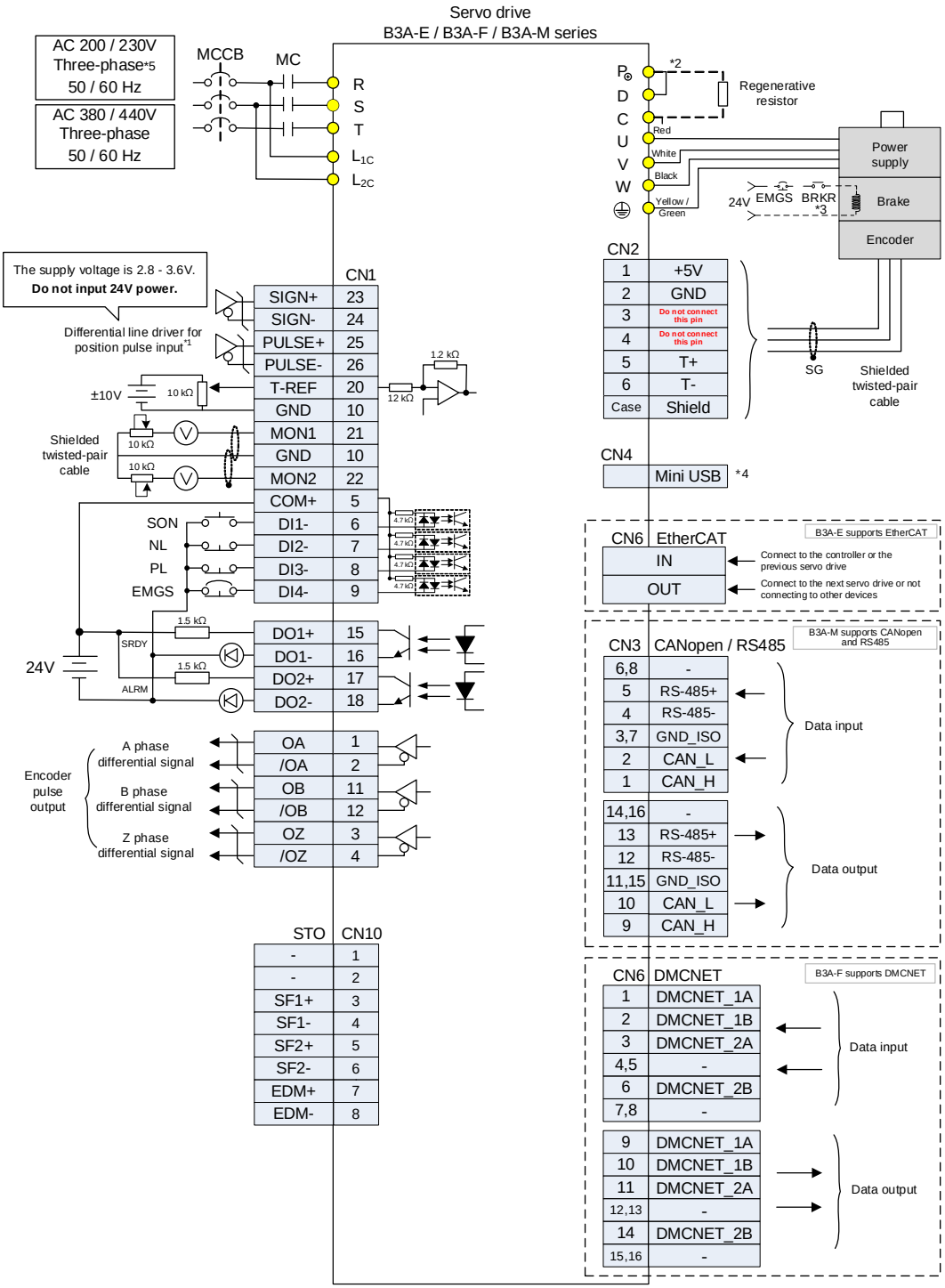
*1. The preceding figure uses the differential line driver for position pulse input. For open collector input, refer to Section 3.10.2.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.



Note:

*1. The preceding figure uses the differential line driver for position pulse input. For open collector input, refer to Section 3.10.2.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

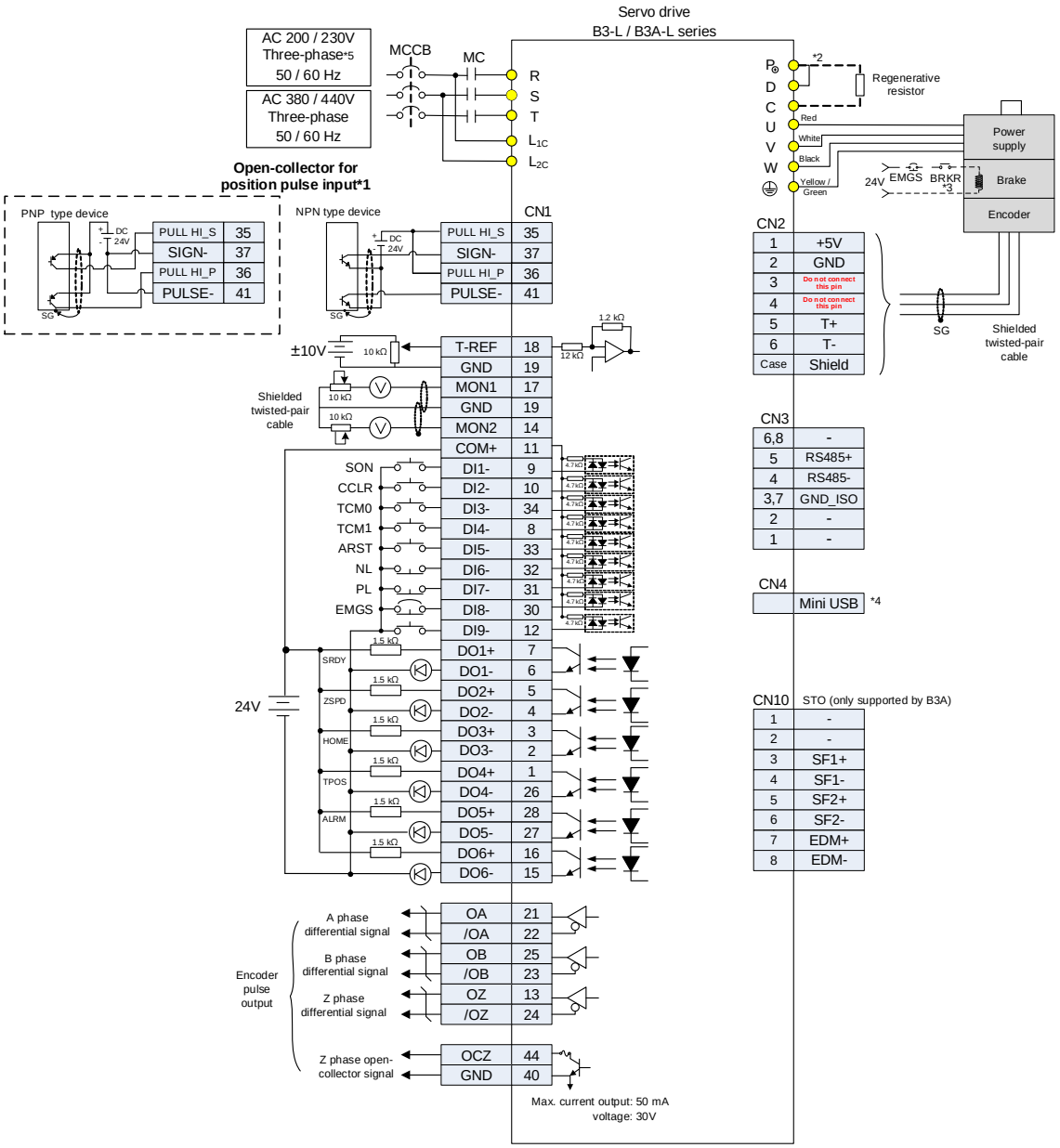
*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3

3.10.2 Position (PT) control mode – open collector input



Note:

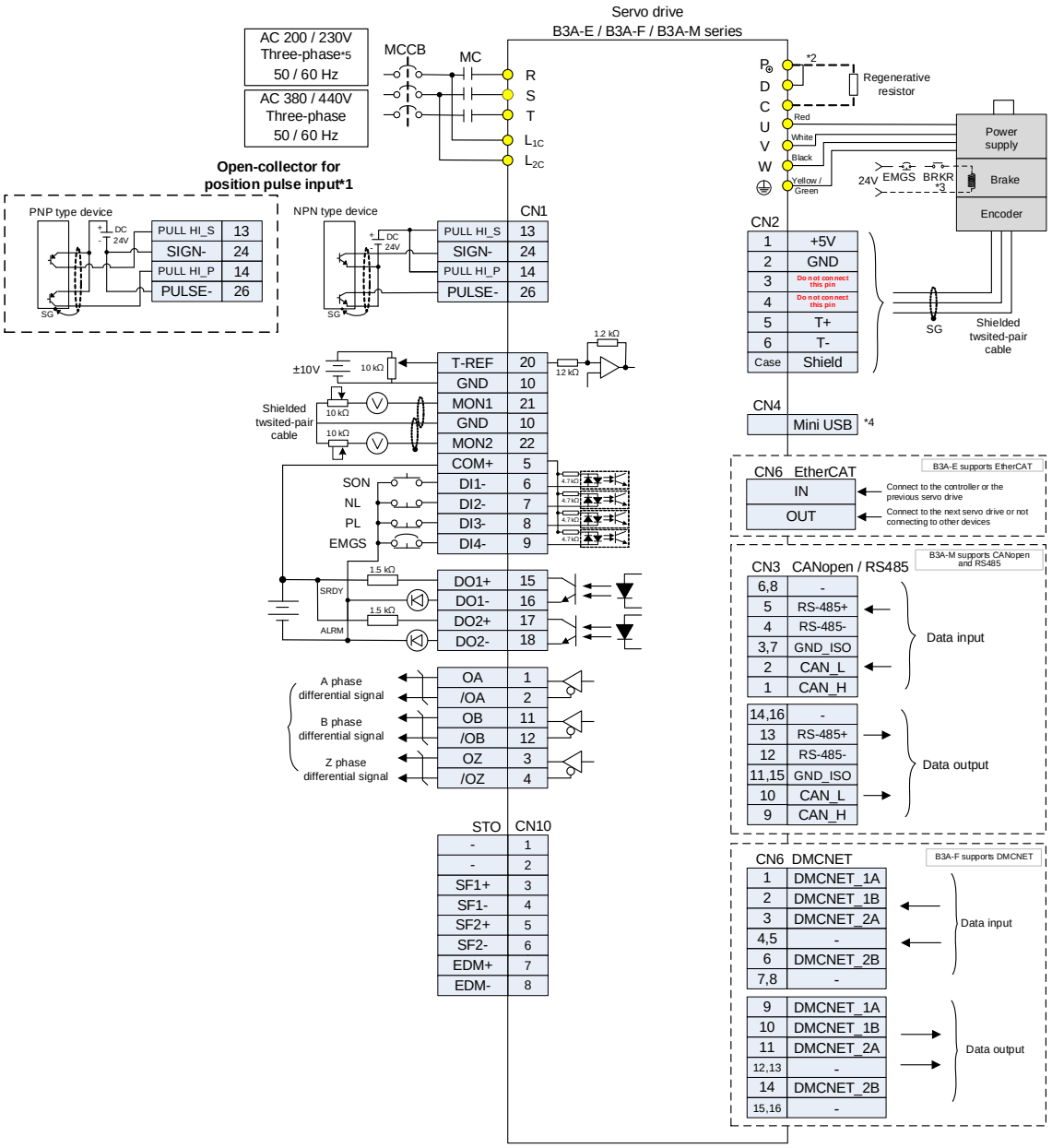
*1. The preceding figure uses the open collector for position pulse input. For differential line driver input, refer to Section 3.10.1.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.



Note:

*1. The preceding figure uses the open collector for position pulse input. For differential line driver input, refer to Section 3.10.1.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

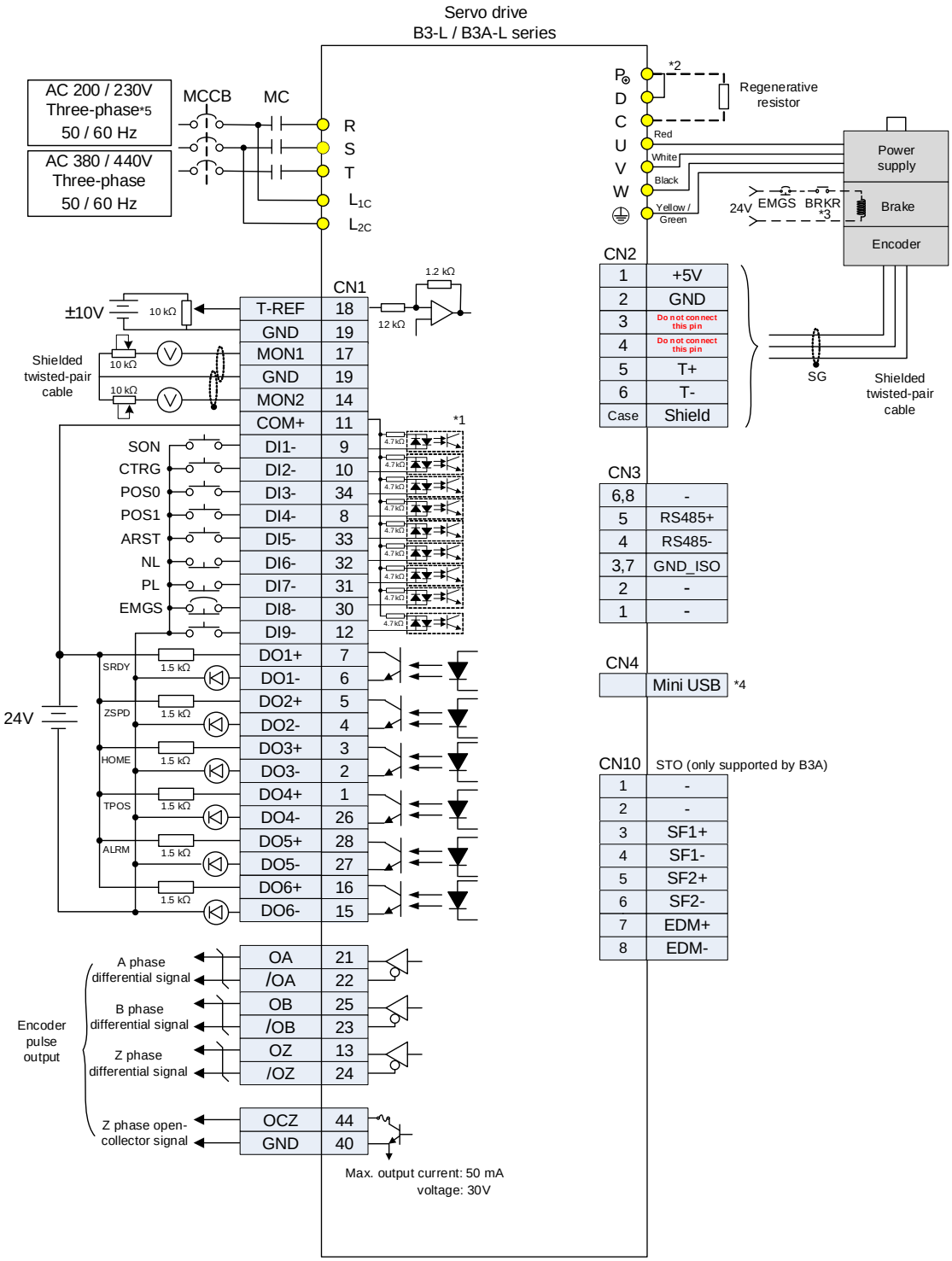
*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3

3.10.3 Position (PR) control mode – internal position commands



Note:

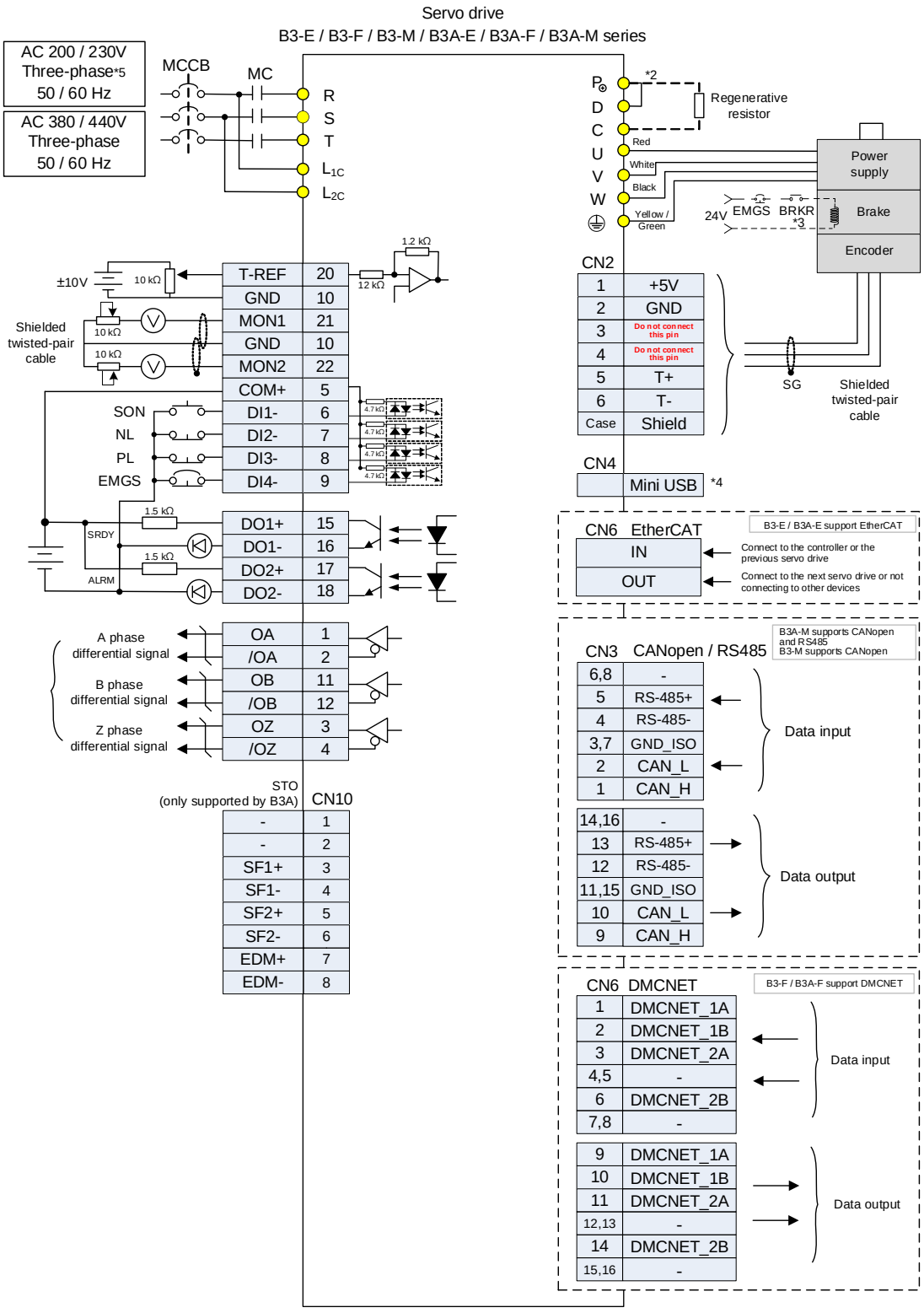
*1. Refer to Section 3.3 for wiring.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.



Note:

*1. Refer to Section 3.3 for wiring.

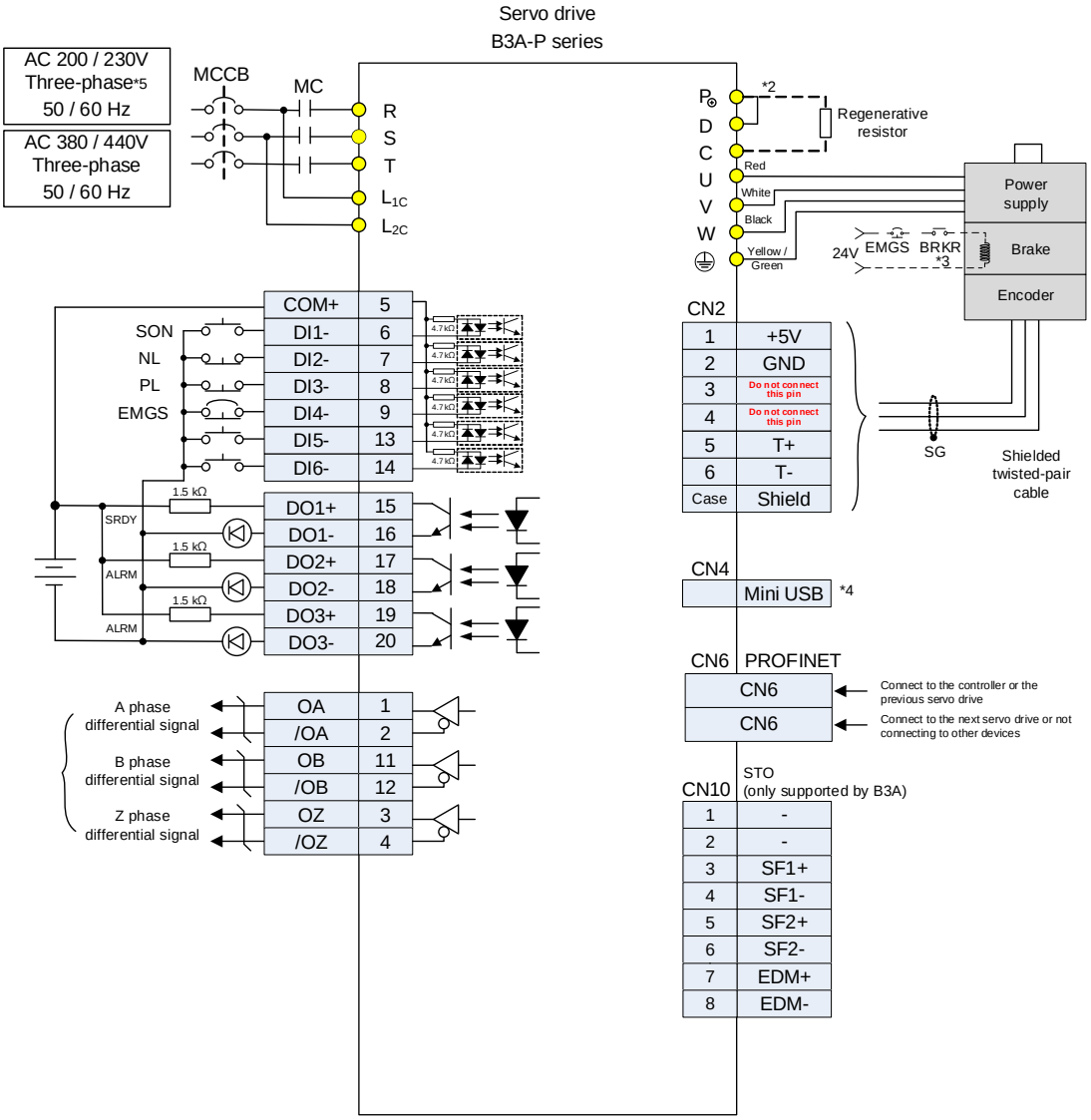
*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3



Note:

*1. Refer to Section 3.3 for wiring.

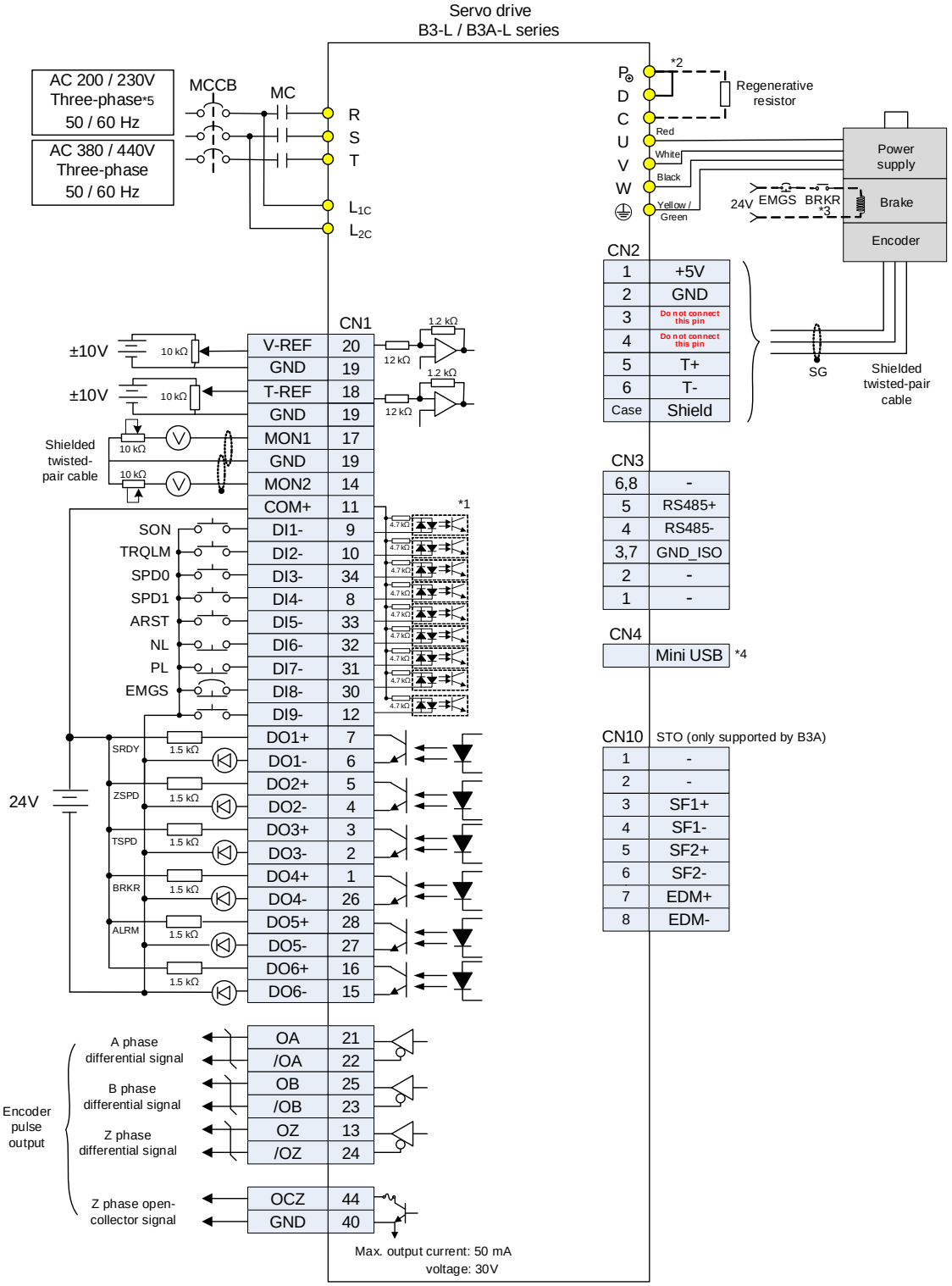
*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3.10.4 Speed (S) control mode



Note:

*1. Refer to Section 3.3 for wiring.

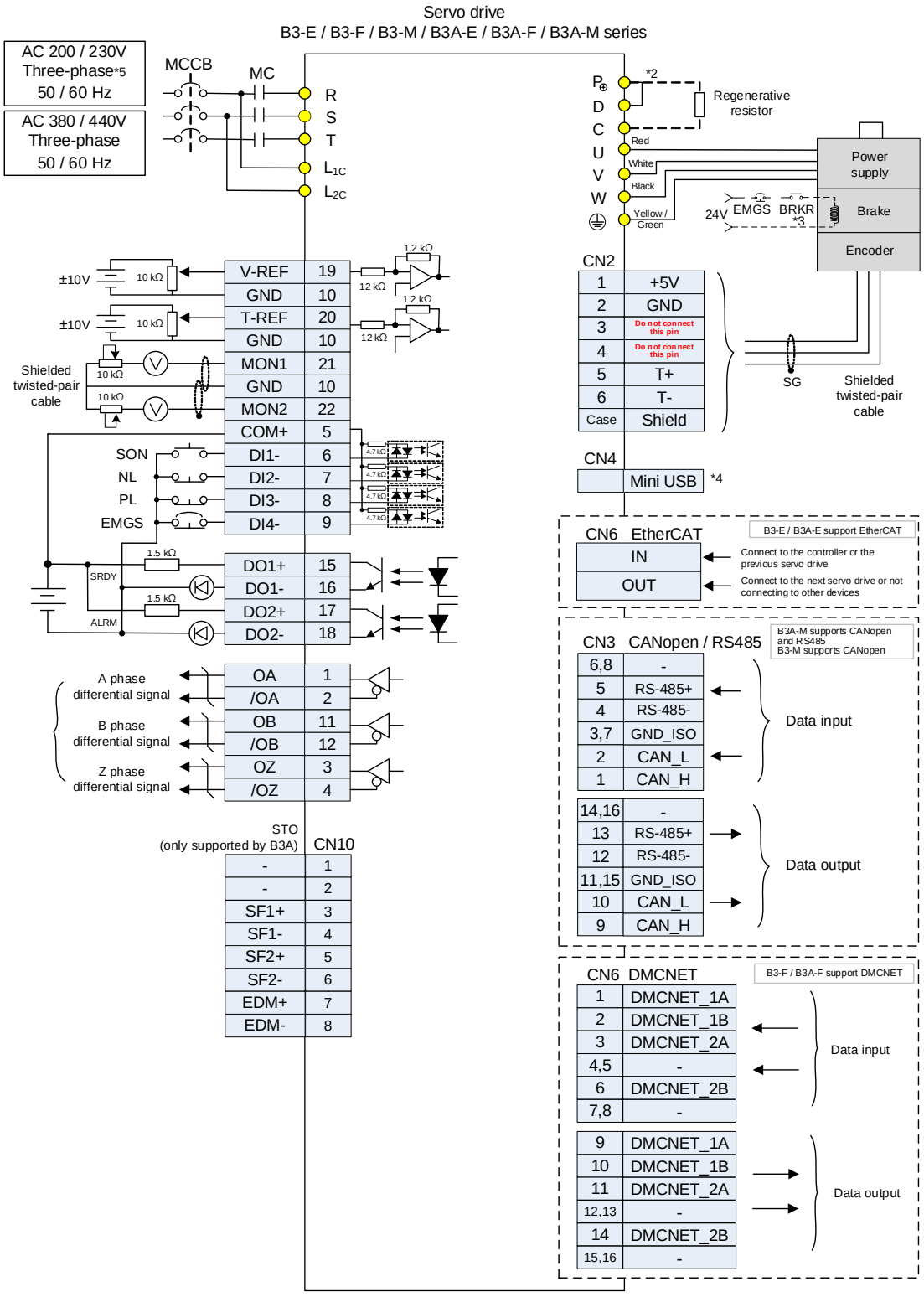
*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3



Note:

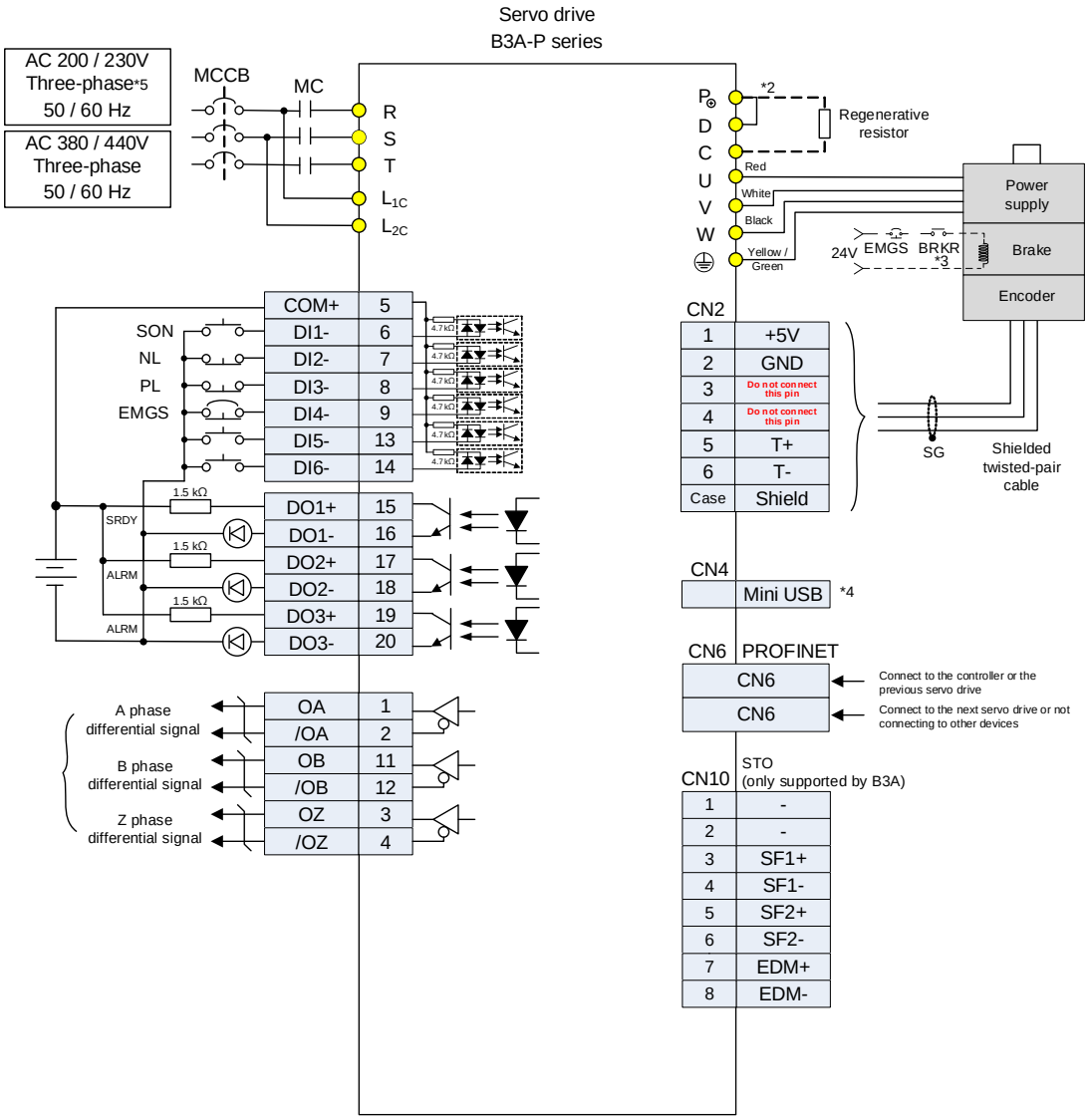
*1. Refer to Section 3.3 for wiring.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.



Note:

*1. Refer to Section 3.3 for wiring.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

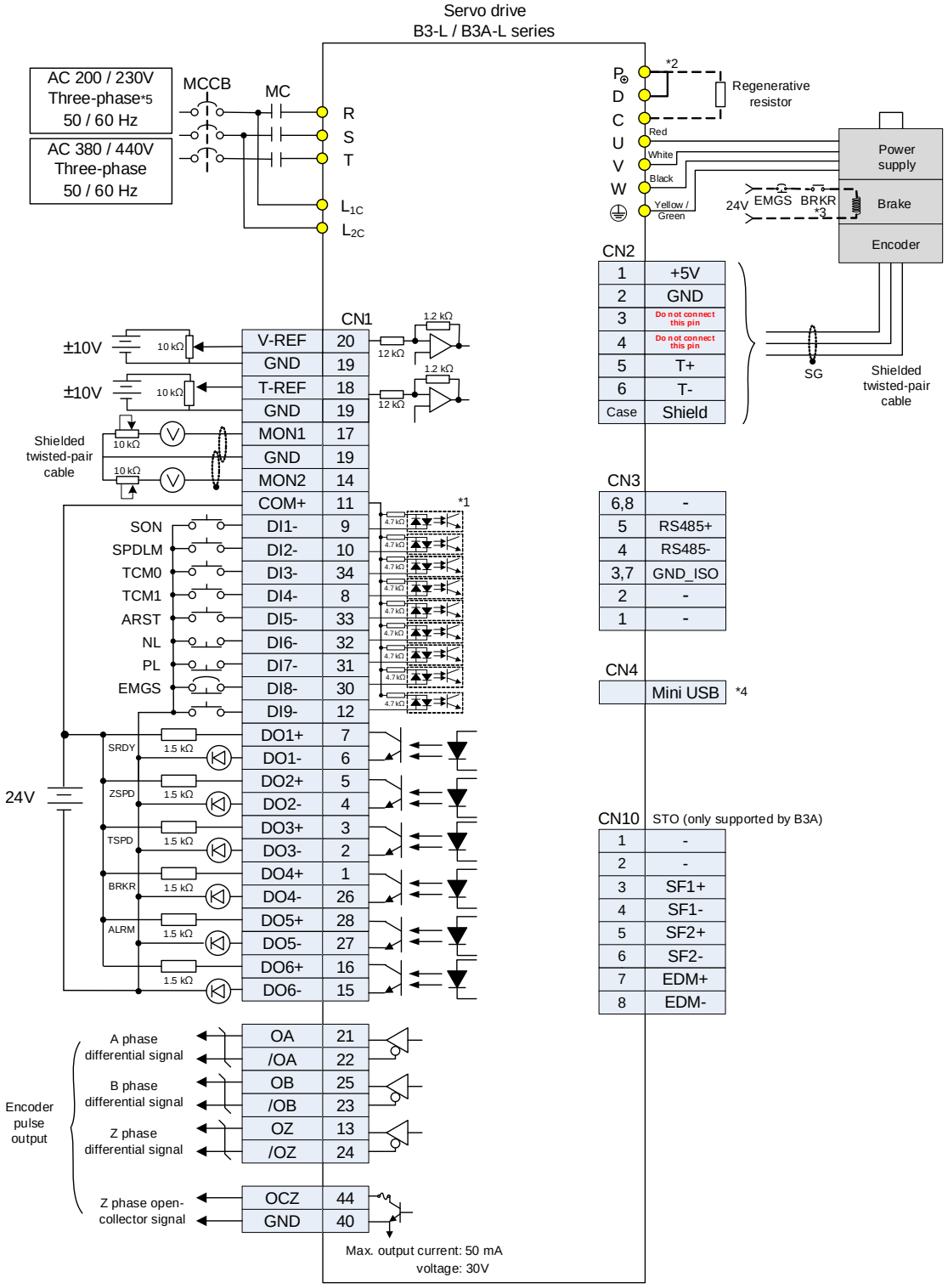
*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3

3.10.5 Torque (T) control mode



Note:

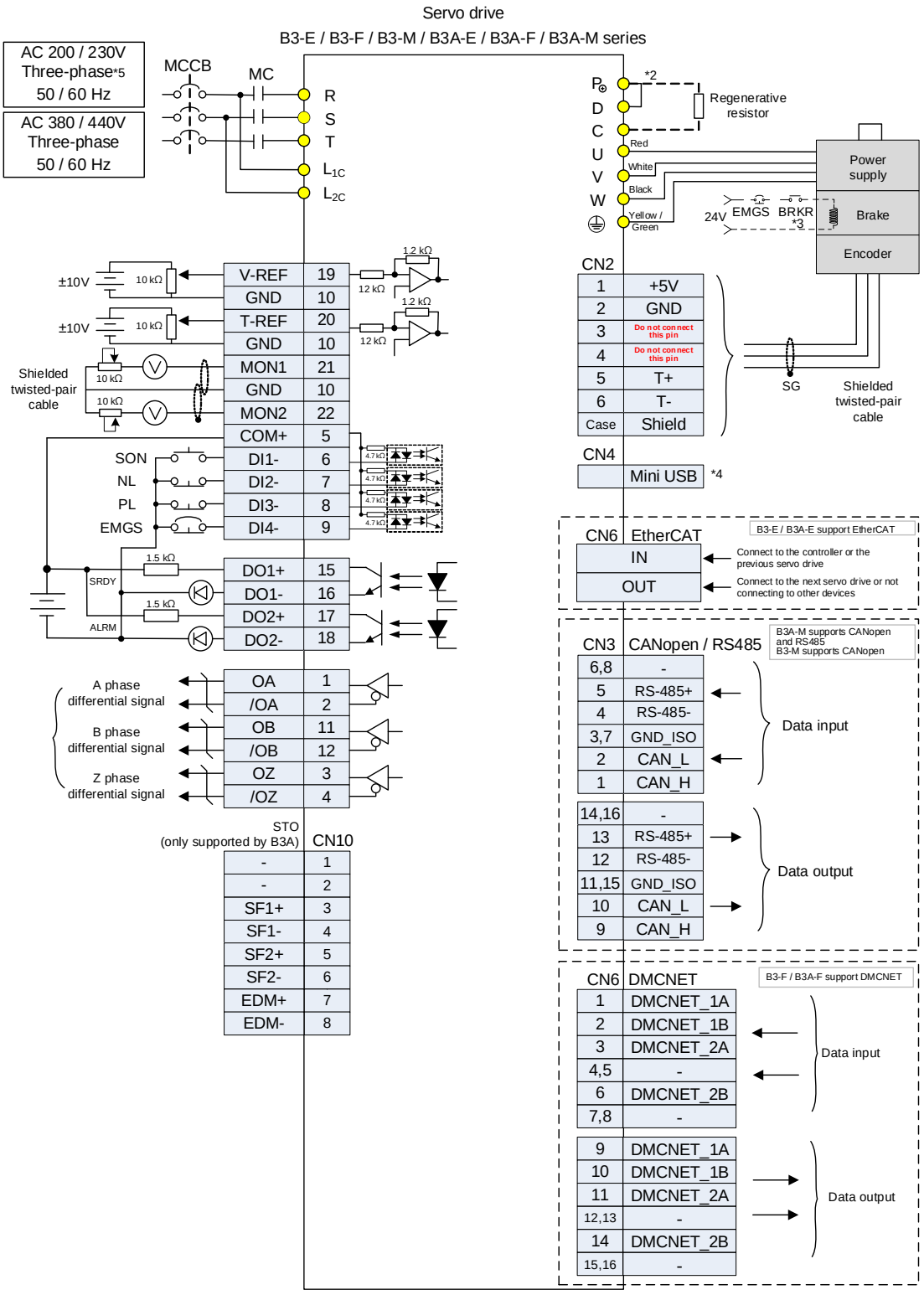
*1. Refer to Section 3.3 for wiring.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.



Note:

*1. Refer to Section 3.3 for wiring.

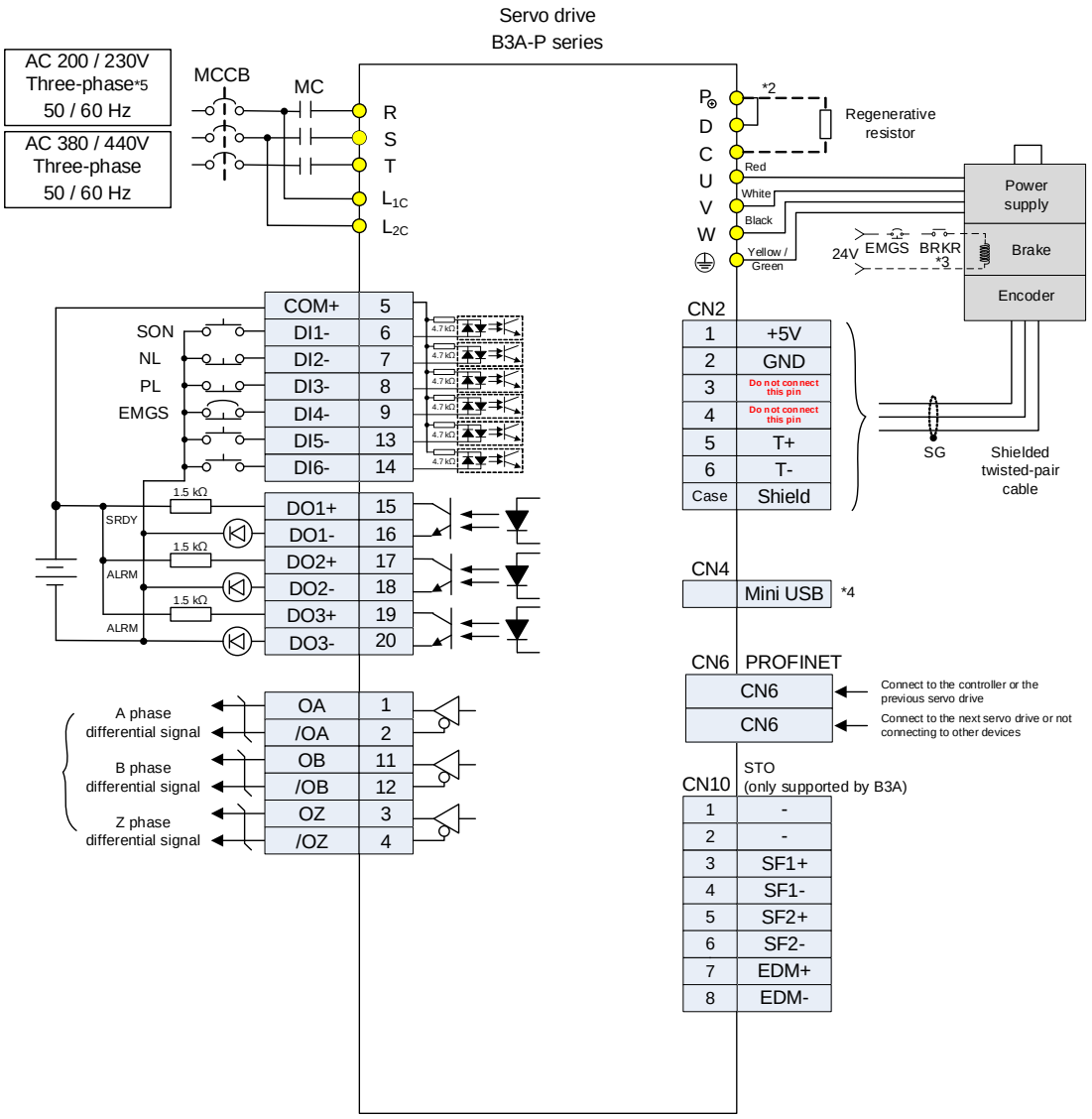
*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3



Note:

*1. Refer to Section 3.3 for wiring.

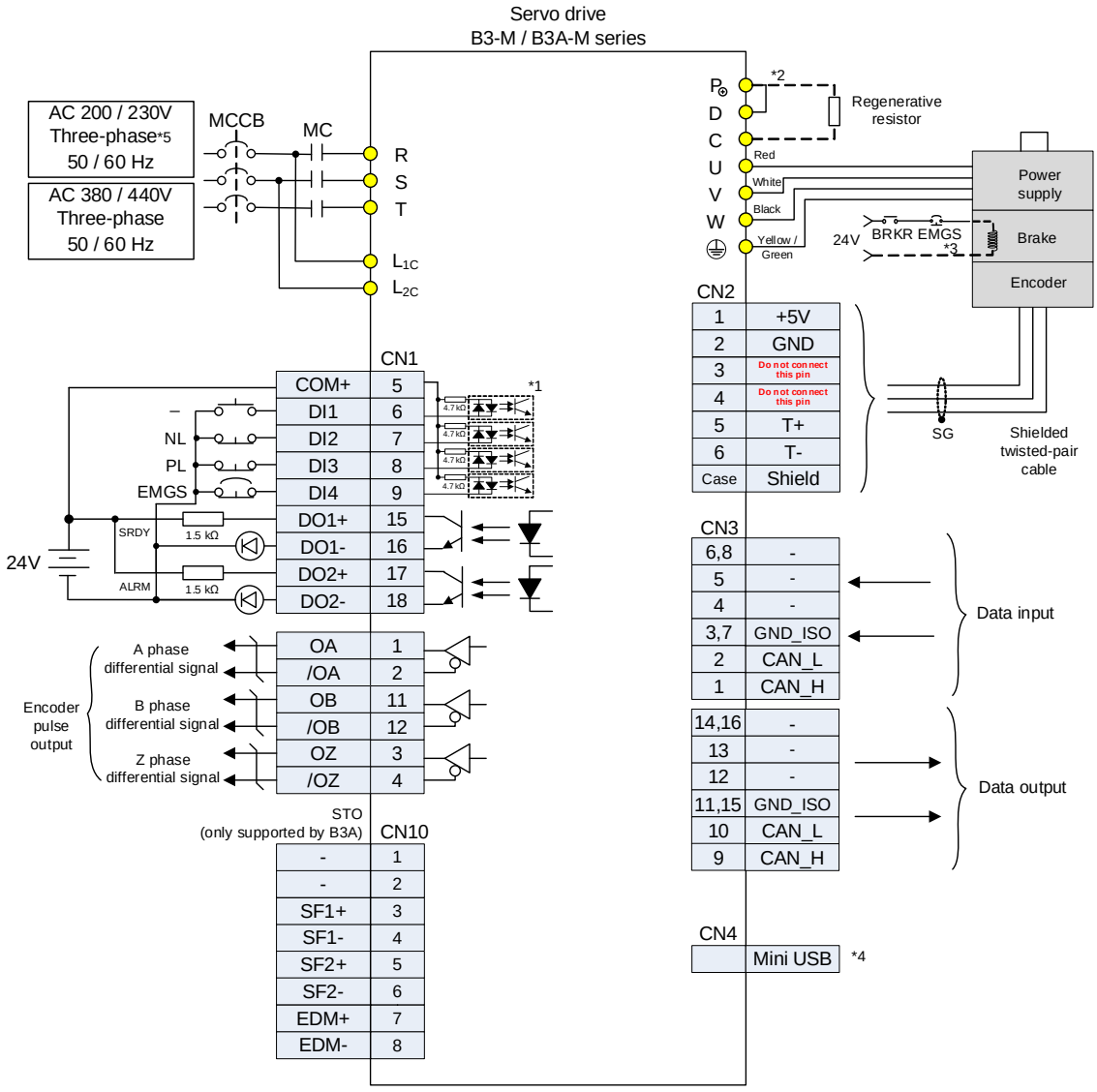
*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3.10.6 Communication mode – CANopen



Note:

*1. Refer to Section 3.3 for wiring.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

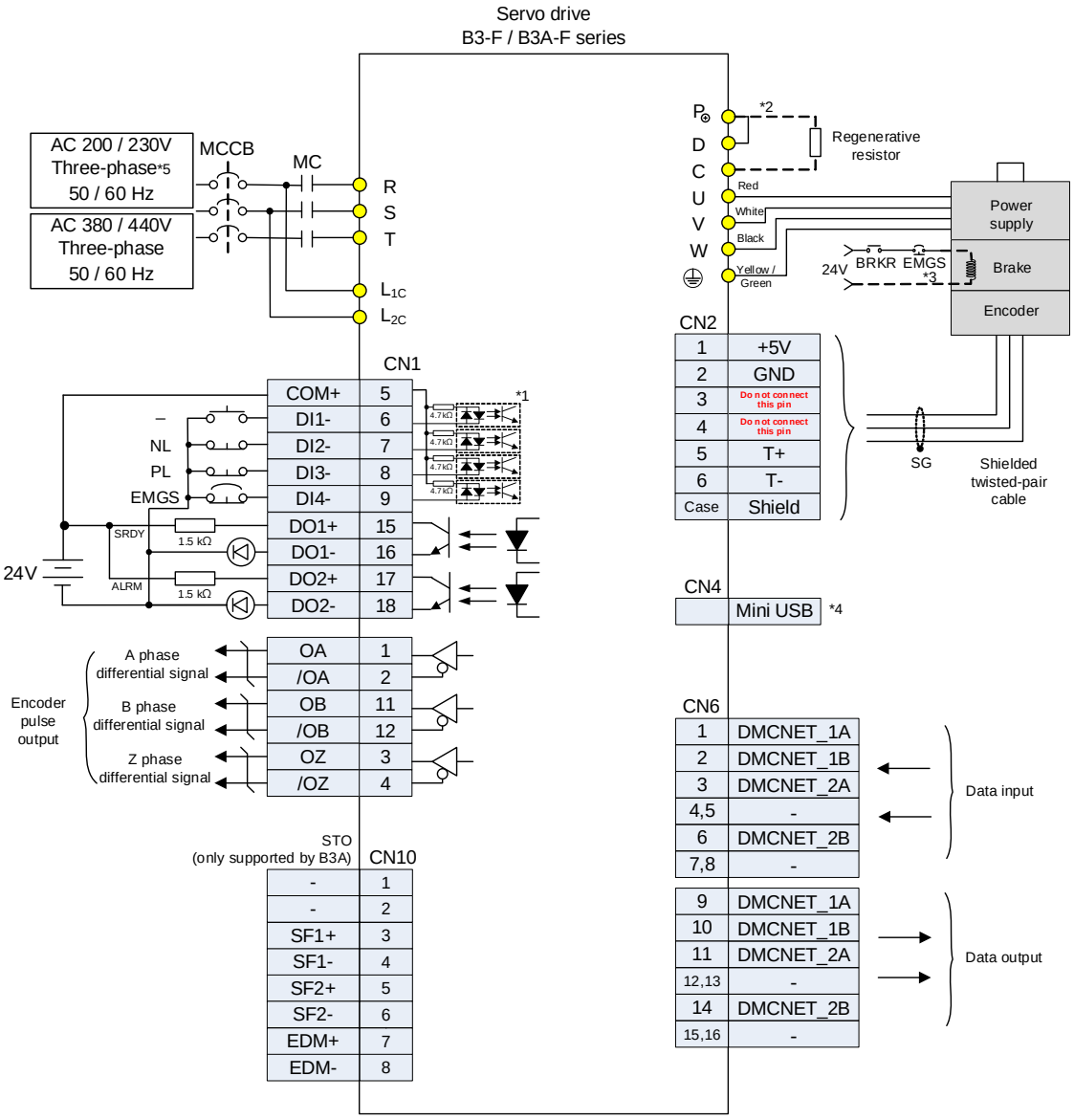
*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3

3.10.7 Communication mode – DMCNET



Note:

*1. Refer to Section 3.3 for wiring.

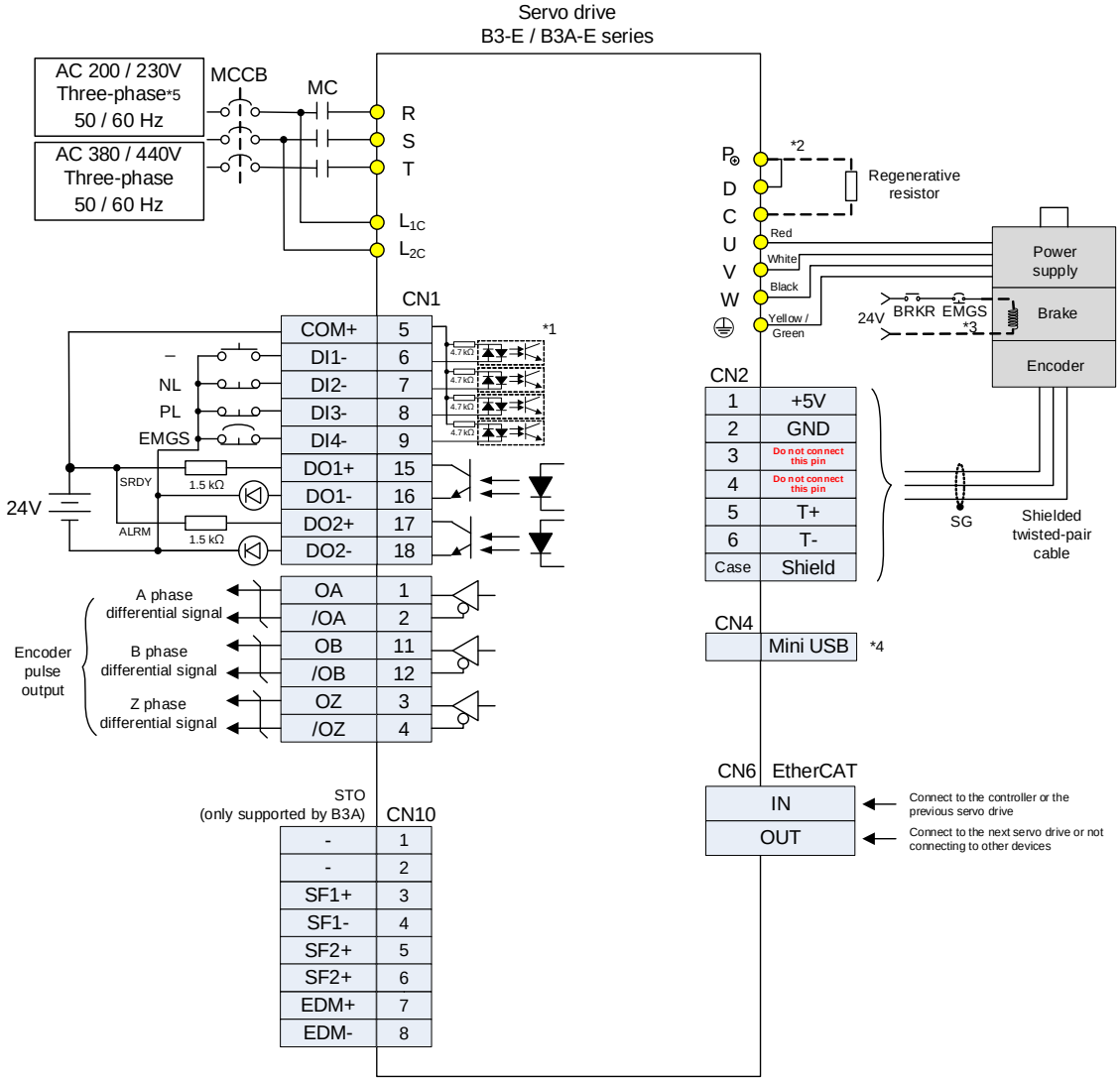
*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3.10.8 Communication mode – EtherCAT



Note:

*1. Refer to Section 3.3 for wiring.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

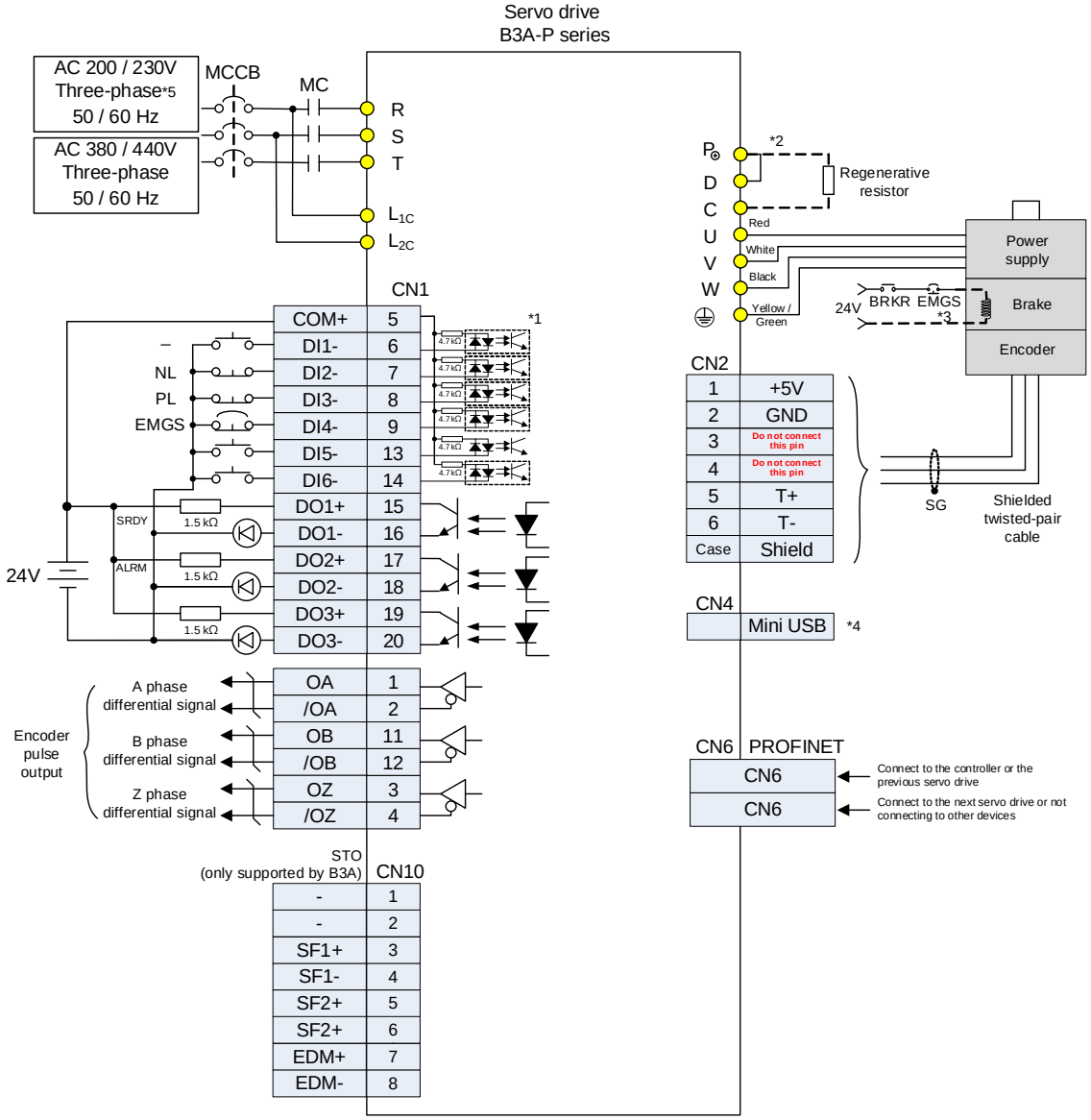
*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.

3

3.10.9 Communication mode – PROFINET



Note:

*1. Refer to Section 3.3 for wiring.

*2. The 220V series 200 W models and below have no built-in regenerative resistor.

*3. The brake coil has no polarity.

*4. The Mini USB connector for connecting to the PC.

*5. The 220V series 1.5 kW models and below can use single-phase power supply.