In This Chapter ...

Storage Conditions

The servo system components should be kept in their shipping cartons before installation. In order to retain the warranty coverage, the components should be stored properly when they will not be used for an extended period of time. Some storage suggestions are:

- Store in a clean and dry location free from direct sunlight.
- Store within the ambient storage temperature and humidity ranges stated in the specifications table, Chapter 1, "Getting Started".
- Store components properly packaged and placed on a durable surface.
- Do not store in a place subjected to corrosive gases and liquids.

Installation

Improper installation of the AC servo system will greatly reduce its life. Be sure to observe the following precautions when selecting a mounting location:

⚠️ **WARNING: Failure to observe these precautions may cause damage and void the warranty!**
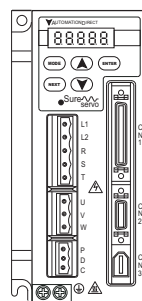
- Do not mount the servo drive and motor near heat-radiating elements or under direct sunlight.

- Do not mount the servo drive and motor in a place subjected to corrosive gases or liquids, or airborne dust or metallic particles.

- Do not mount the servo drive and motor in a place subjected to high temperature or high humidity that exceeds the ratings shown in the specifications table, Chapter 1, "Getting Started". Keeping the drive ambient temperature below 45°C (113°F) will provide even longer term reliability.

- Do not mount the servo drive and motor in a place subjected to excessive vibration and shock.

- Do not mount the servo drive and motor in a place subjected to high electromagnetic radiation, high voltage, or high frequency.

- Do not carry the servo motor by it's shaft or cables.

- Motor shafts are keyless. Use compression couplings. Marring or deforming the shaft with set screws or pins will void the 30-day return policy.

- Do not hit the motor shaft or encoder. Such impact can damage bearing surfaces and the disk inside the encoder.

⚠️ **WARNING: Servo drives and motors generate large amounts of heat, which may cause damage. Allow sufficient space around the units for heat dissipation and, if necessary, provide auxiliary cooling in order to prevent exceeding the specified maximum ambient operating temperatures.**

Servo Drive Mounting

Mount the AC servo drive in a vertical position on a dry and solid surface such as inside a NEMA control panel. Do not install the drive in a horizontal position. The mounting surface should be capable of conducting heat away from the drive. Allow space around the drive for heat dissipation and for wiring.
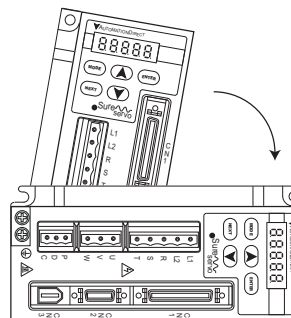
CORRECT   INCORRECT

Servo Drive Minimum Clearances and Air Flow

Fan

50 mm
(2.0 in)
minimum

100 mm
(4.0 in)
minimum

100 mm
(4.0 in)
minimum

air flow

20 mm
(0.8 in)
minimum

20 mm
(0.8 in)
minimum

40 mm
(1.6 in)
minimum

10 mm
(0.4 in)
minimum

40 mm
(1.6 in)
minimum

50 mm
(2.0 in)
minimum

100 mm
(4.0 in)
minimum

100 mm
(4.0 in)
minimum

air flow

Single Servo Drive Installation

inlet

Multiple Servo Drives Installation
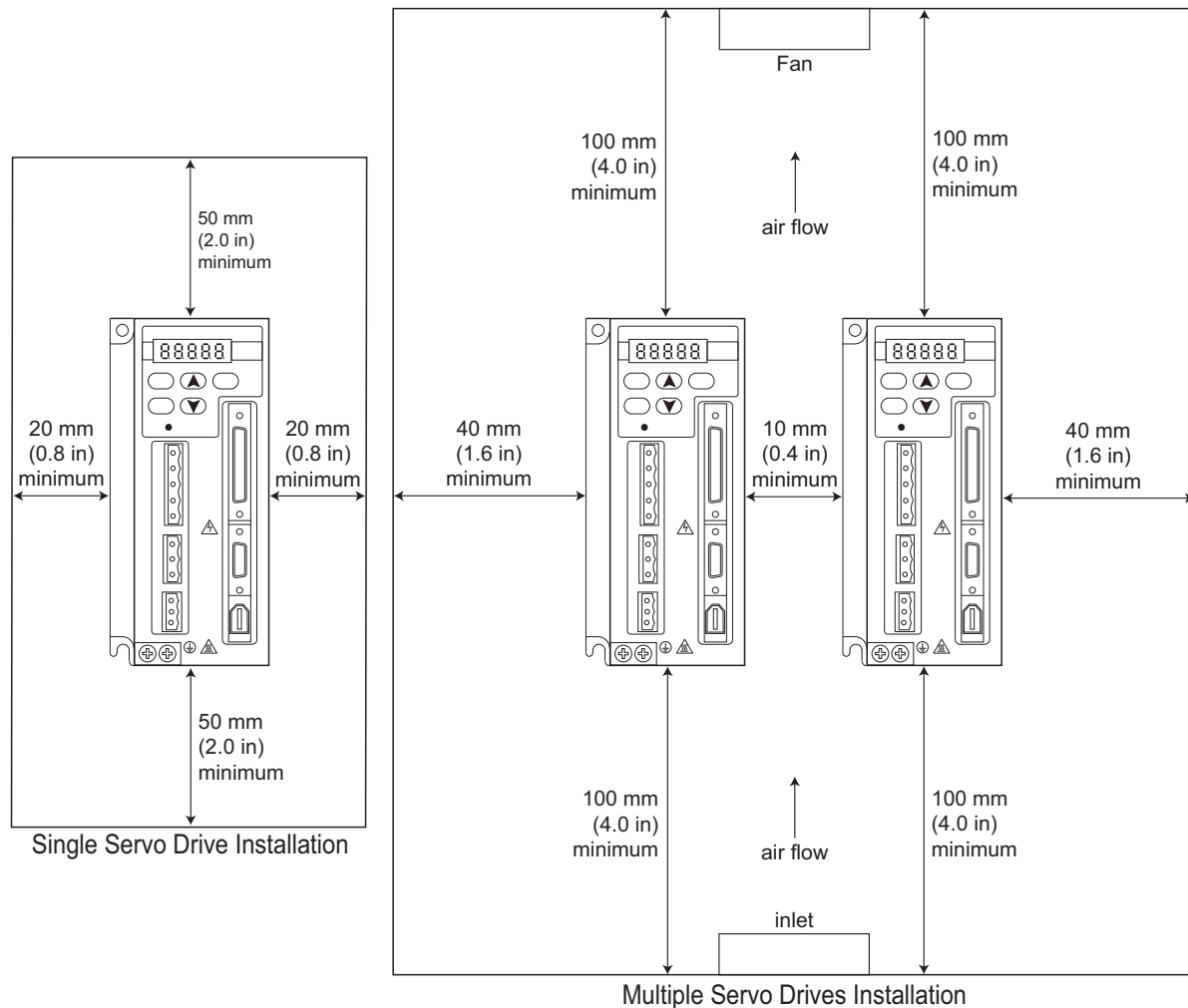
Servo Motor Mounting

The *Sure*Servo motor can be mounted in any orientation. However, mount it in a position that prevents the mechanical drive unit oil from penetrating the motor housing through the shaft seal. The motor cable connections should point downward, and the cables should have drip loops to prevent liquids from entering the motor through the connectors. The motor should be firmly mounted to a dry, solid, and well grounded surface that will conduct heat away from the motor.

Do not mount the motor in an orientation that will allow gearbox oil, etc. to penetrate the motor shaft seal, or that will allow liquids to run down the cables to the connectors.

OIL

INCORRECT

OIL

CORRECT
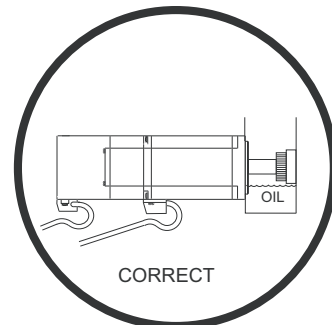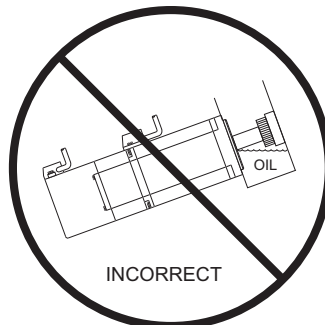
Dimensions

Servo Drive Dimensions

Part Number: SVA-2040

UNITS: mm (in)
(Inch values are for reference only.)
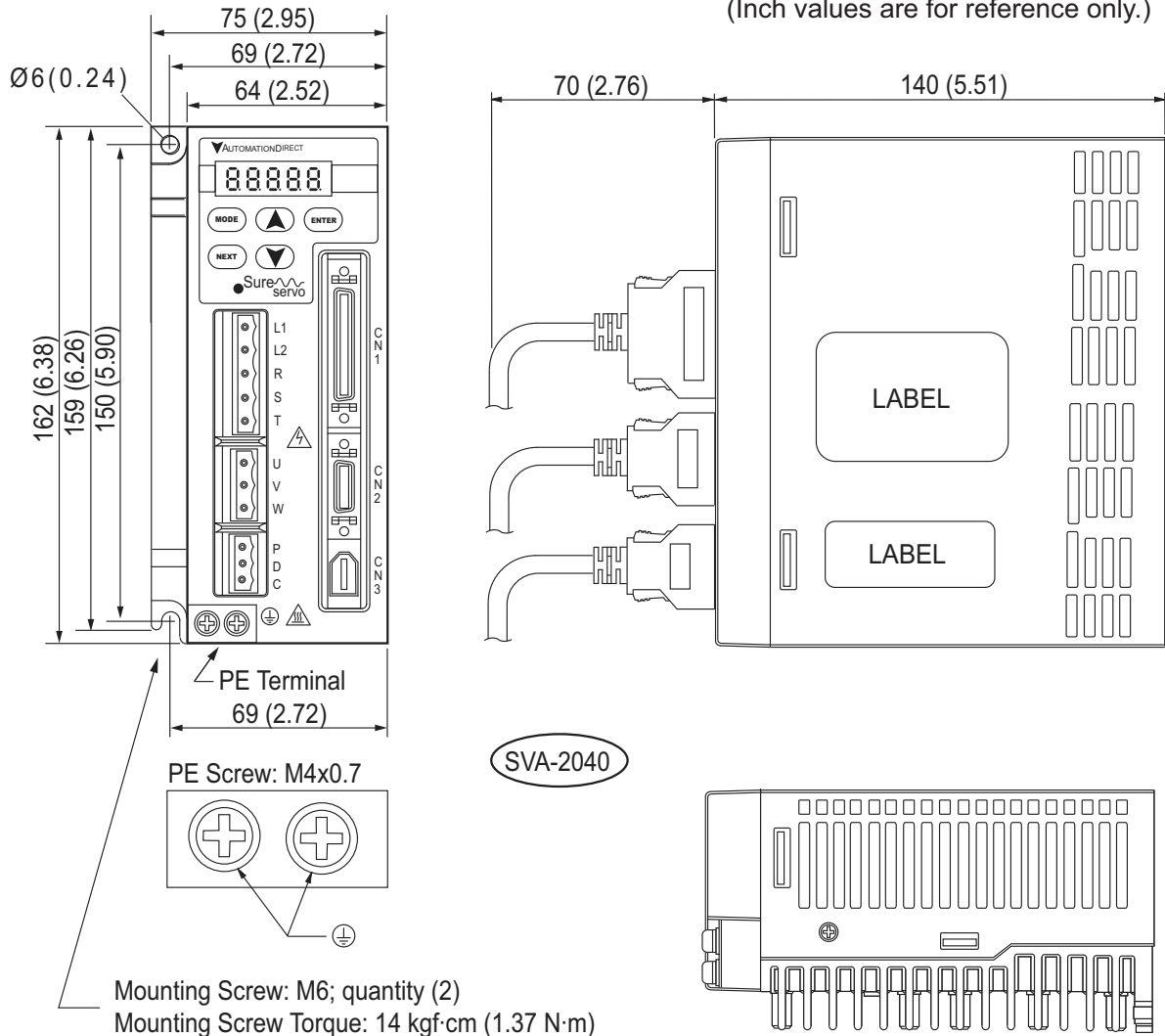
75 (2.95)
69 (2.72)
64 (2.52)

Ø6(0.24)

70 (2.76)   140 (5.51)

162 (6.38)
159 (6.26)
150 (5.90)

L1
L2
R
S
T
U
V
W
P
D
C

CN1
CN2
CN3

LABEL

LABEL

PE Terminal
69 (2.72)

SVA-2040

PE Screw: M4x0.7

Mounting Screw: M6; quantity (2)
Mounting Screw Torque: 14 kgf·cm (1.37 N·m)

Recommended user supplied mounting screw is M6.

Servo Drive Dimensions (continued)

Part Number: SVA-2100

UNITS: mm (in)
(Inch values are for reference only.)
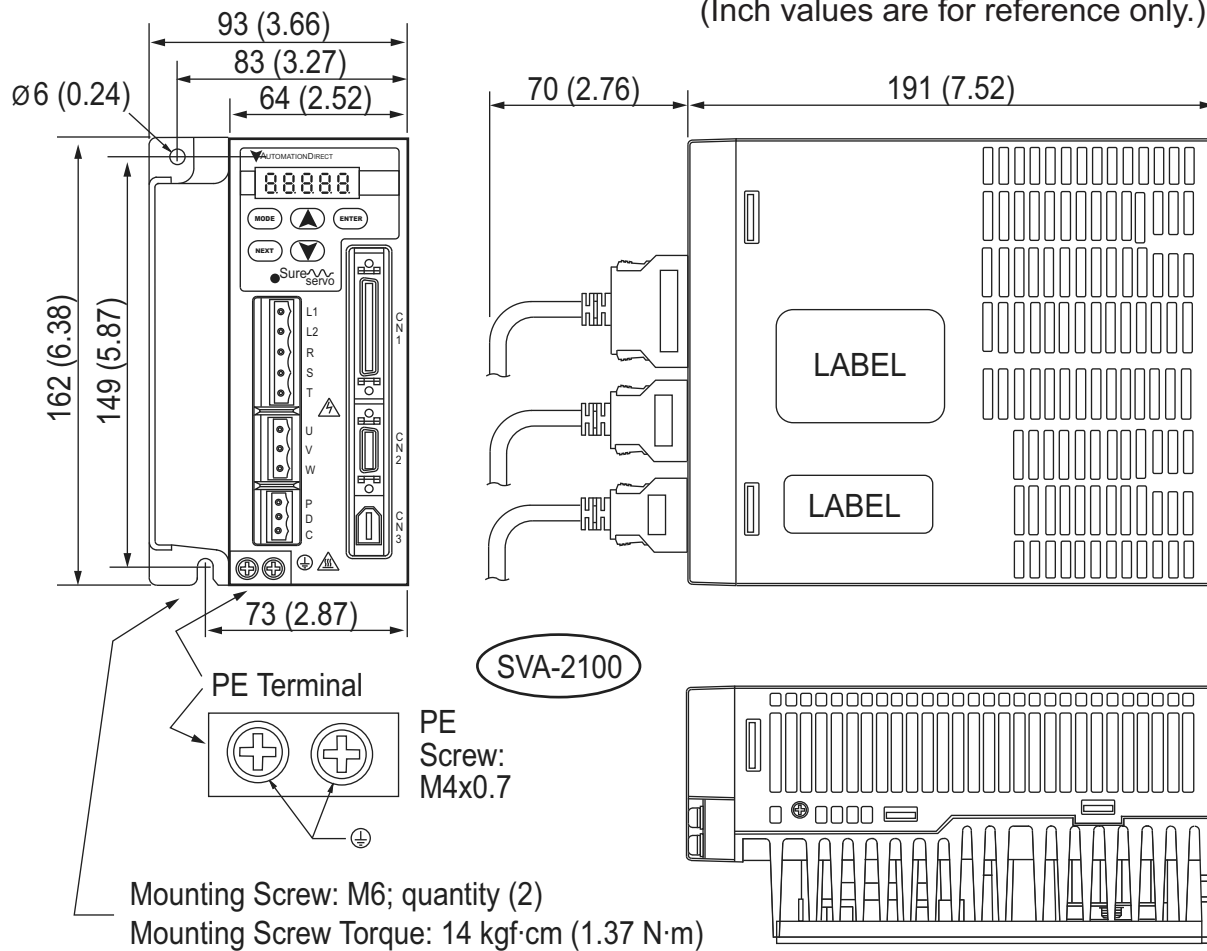
93 (3.66)
83 (3.27)
64 (2.52)
Ø6 (0.24)

162 (6.38)
149 (5.87)

70 (2.76)
191 (7.52)

LABEL

LABEL

73 (2.87)

SVA-2100

PE Terminal

PE
Screw:
M4x0.7

Mounting Screw: M6; quantity (2)
Mounting Screw Torque: 14 kgf·cm (1.37 N·m)

Recommended user supplied mounting screw is M6.

Servo Drive Dimensions (continued)

Part Number: SVA-2300

UNITS: mm (in)
(Inch values are for reference only.)

Ø6 (0.24)

110.0 (4.33)
91.2 (3.59)

229.5 (9.04)

70 (2.76)   206 (8.11)

245

LABEL

LABEL

SVA-2300

PE Terminal

PE
Screw:
M4x0.7

⊕

Mounting Screw: M6; quantity (3)
Mounting Screw Torque: 14 kgf·cm (1.37 N·m)
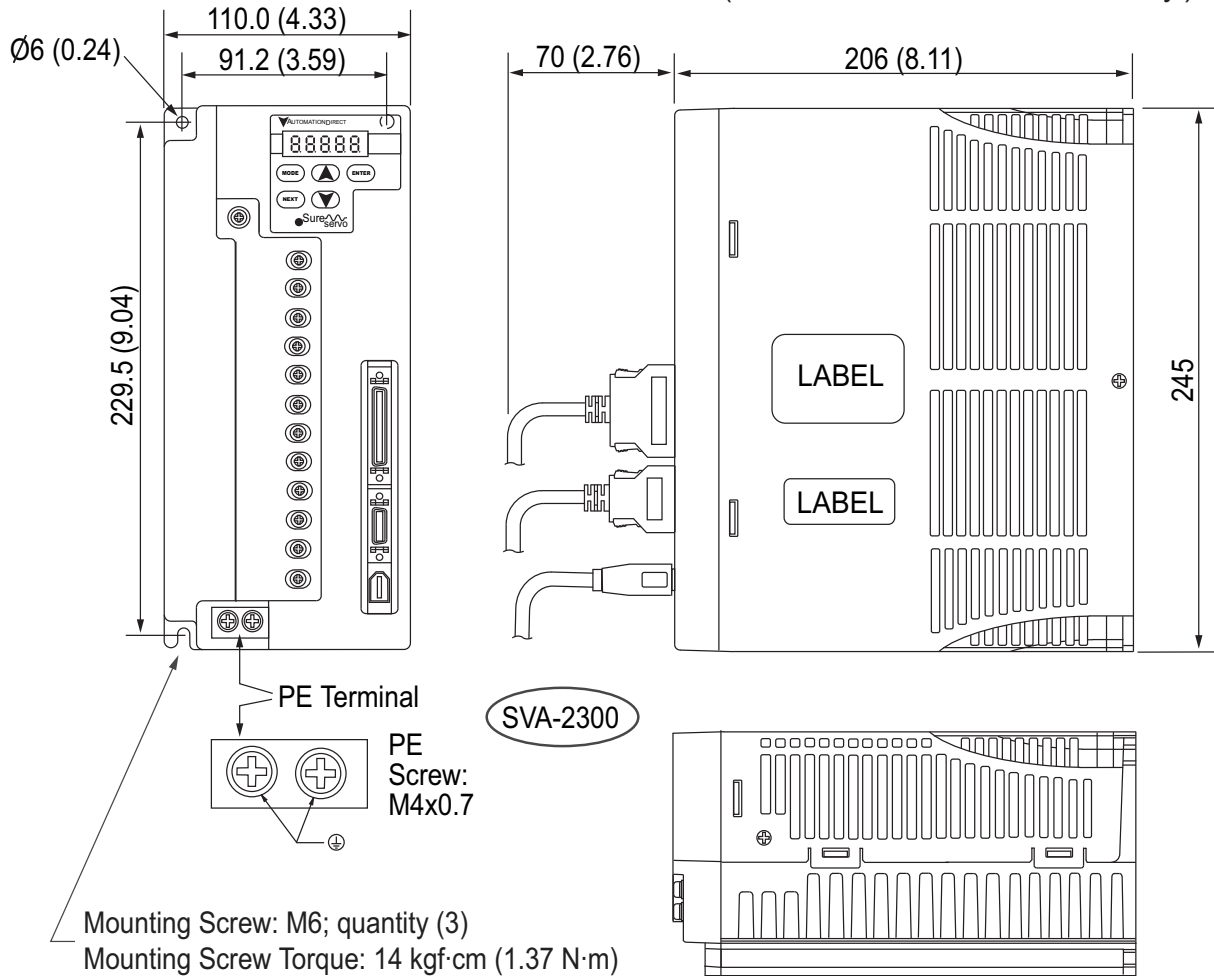
Recommended user supplied mounting screw is M6.

Servo Motor Dimensions

Low Inertia Part Numbers: SVL-201(B), -202(B), -204(B), -207(B)
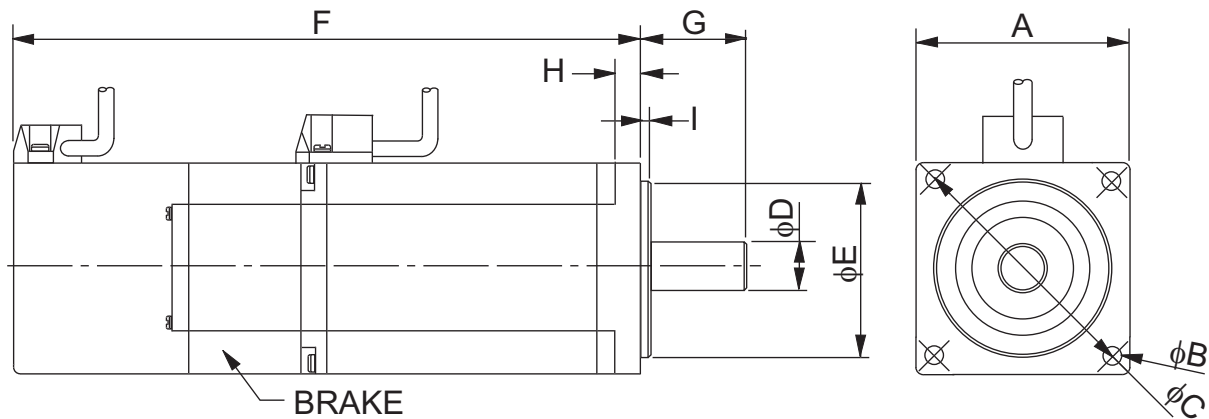
SureServo Motor Dimensions – 100W-750W Low Inertia				
Dimension	SVL-201(B)	SVL-202(B)	SVL-204(B)	SVL-207(B)
A	40 [1.575]	60 [2.362]		80 [3.15]
B	4.5 [0.1772]	5.5 [0.2165]		6.6 [0.2598]
C	46 [1.811]	70 [2.756]		90 [3.543]
D	8 +0.0/-0.009 (8h6)	14 +0.0/-0.011 (14h6)		19 +0.0 -0.013 (19h6)
E	30 +0.0/-0.021 (30h7)	50 +0.0/-0.025 (50h7)		70 +0.0/-0.030 (70h7)
F (w/o brake)	100.1 [3.941]	102.4 [4.032]	124.4 [4.898]	135 [5.315]
F (with brake)	135.7 [5.343]	137 [5.394]	159 [6.26]	171.6 [6.756]
G	25 [0.98]	30 [1.18]		35 [1.38]
H	5 [0.197]	6 [0.236]		8 [0.315]
I	2.5 [0.098]	3 [0.118]		
Cable length	300mm (12 inches)			
UNITS: mm [in] (Inches are for reference only; not included on diameter dimensions for accuracy.)				

Servo Motor Dimensions (continued)

Low Inertia Part Number: SVL-210(B)

BRAKE
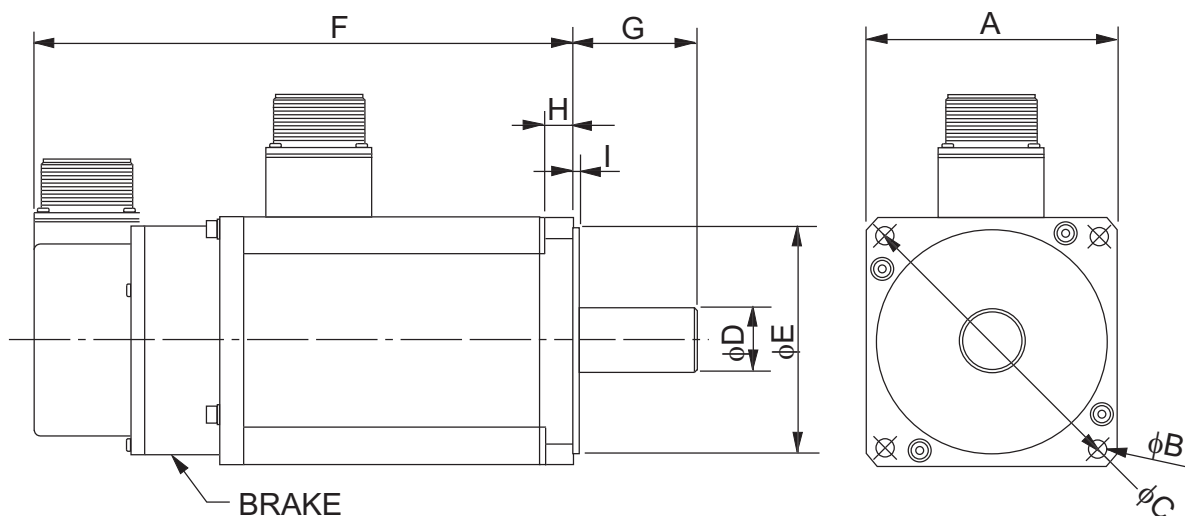
SureServo Motor Dimensions – 1000W Low Inertia	
Dimension	SVL-210(B)
A	100 [3.937]
B	9 [0.3543]
C	115 +0.2/-0.2 [4.258]
D	22 +0.0/-0.013 (22h6)
E	95 +0.0/-0.035 (95h7)
F (w/o brake)	158 [6.22]
F (with brake)	190 [7.48]
G	45 [1.77]
H	17 [0.669]
I	7 [0.28]
UNITS: mm [in] (Inches are for reference only; not included on diameter dimensions for accuracy.)	

Servo Motor Dimensions (continued)

Medium Inertia Part Numbers: SVM-210(B), 220(B), 230(B)
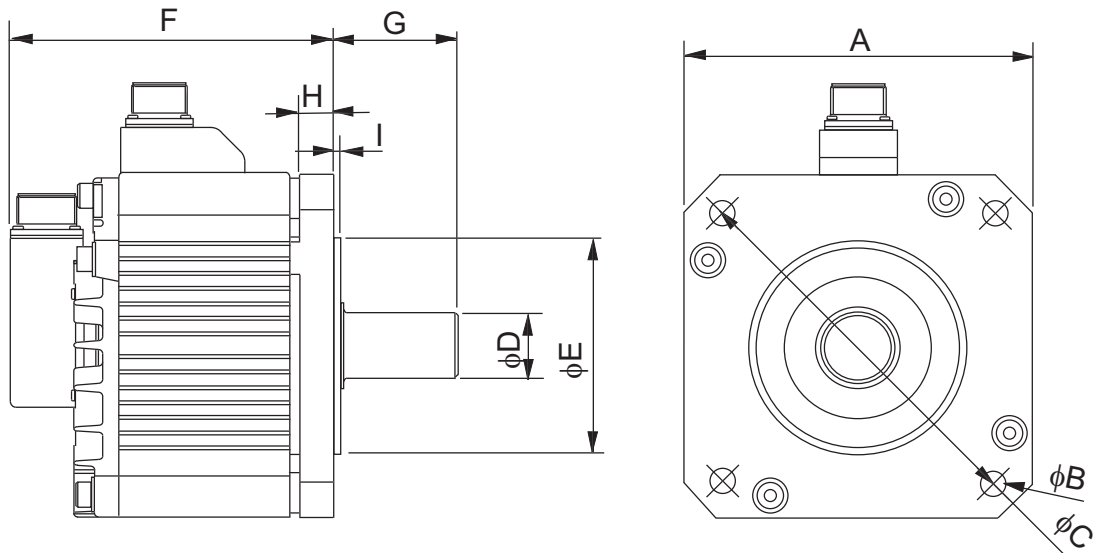
SureServo Motor Dimensions – 1000W-3000W Medium Inertia			
Dimension	SVM-210(B)	SVM-220(B)	SVM-230(B)
A	130 [5.118]	180 [7.087]	
B	9 [0.3543]	13.5 [0.5315]	
C	145 +0.2/-0.2 [5.709]	200 +0.2/-0.2 [7.874]	
D	22 +0.0/-0.013 (22h6)	35 +0.0/-0.016 (35h6)	
E	110 +0.0/-0.035 (110h7)	114.3 +0/-0.035 (114.3h7)	
F (w/o brake)	143 [5.63]	164 [6.457]	212 [8.35]
F (with brake)	181 [7.126]	213 [8.386]	258 [10.16]
G	55 [2.17]	75 [2.95]	
H	15 [0.591]	20 [0.787]	
I	4 [0.157]		
UNITS: mm [in] (Inches are for reference only; not included on diameter dimensions for accuracy.)			

Accessory I/O Terminal Module Dimensions

ZIPLink Terminal Module Part Number: ZL-RTB50
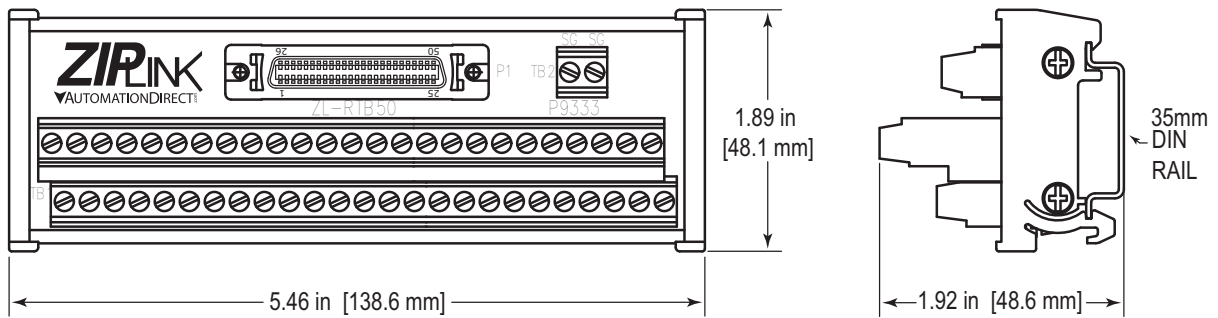
Circuit Connection Warnings

DANGER!

⚠ WARNING: HAZARDOUS VOLTAGE! Before making any connection to the AC servo drive, disconnect all power to the drive, and wait until the charge LED goes out.

⚠ WARNING: Any electrical or mechanical modification to this equipment without prior written consent of AutomationDirect.com, Inc. will void all warranties, may result in a safety hazard, and may void the UL listing.

⚠ WARNING: Do not connect AC input power to the U, V, and W output terminals. This will damage the AC servo drive.

Wiring Notes: PLEASE READ PRIOR TO INSTALLATION.

1. During installation, follow all local electrical, construction, and safety codes for the country in which the AC servo system is to be installed.

2. Make sure that the power source is capable of supplying the correct voltage and required current to the AC servo drive.

3. Make sure that the appropriate protective devices (circuit breaker or fuses) are connected between the power supply and the AC servo drive. (Refer to the "Servo Drive Circuit Protection" section in this chapter.)

4. The power cables connected to the R, S, T and U, V, W terminals should be run separately from the encoder and other signal and control cables. Separate them by at least 30 cm (11.81"). If they must cross, they should cross at 90 degree angles to each other.

5. Do not attach or remove wiring when power is applied to the AC servo drive, or while the drive's "charge" LED is still on. (Even after power is disconnected from the drive, a residual voltage may remain inside the drive until the "charge" LED goes out.)

6. Do not monitor the signals on the circuit board while the AC servo drive is in operation.

7. Make sure that the leads are connected correctly and the AC servo components are properly grounded.

8. Use ground leads that comply with AWG/MCM standards and keep them as short as possible. (Resistance of the cable should not exceed 0.1Ω.)

9. Multiple AC servo units can be installed in one location. All of the units should be grounded directly to a common ground terminal. Do NOT "daisy chain", or connect the ground wires in series. **Make sure there are no ground loops.** Large gauge ground wires with many small strands are recommended (i.e: 4 AWG).

Correct   Incorrect

10. If Emergency Stop is required, a contactor wired into the drive power circuit and controlled by the E-stop, and a servo motor with brake are recommended.

Servo Drive Terminals

Servo Drive Terminals		
Terminal Symbol	**Terminal Description**	**Remarks**
L1, L2	Control Circuit*	Used to connect single-phase AC control circuit power. (Control circuit uses same voltage as the main circuit.)
N	Negative Side of DC Bus*	Model SVA-2300 only. No wiring connection required.
R, S, T	Main Circuit*	Used to connect single-phase or three-phase AC main circuit power, depending upon drive model. For three-phase models, connect power to terminals R, S, and T. For single-phase power, connect power to terminals R and S.
U, V, W	Servo Motor Output*	Used to connect servo motor. **Terminal Symbol / Wire Color** U — Red V — White W — Black
P, D, C	Regenerative resistor*	For Internal Resistor: Jumper between P and D. Open between P and C (no jumper). For External Resistor: Regenerative resistor between P and C. Open between P and D (no jumper).
⏚	Ground (FG)	Used to connect grounding wire of power supply & servo motor.
CN1	I/O	Used to connect PLCs or control signals
CN2	Encoder	Used to connect encoder of servo motor. **Terminal Symbol / Color** A — Blue /A — Blue/White B — Green /B — Green/White Z — Yellow /Z — Yellow/White +5V — Red GND — Black
CN3	Communication	Used to connect personal computer or MODBUS capable controller. (MODBUS RTU or ASCII protocol)

* With the exception of the SVA-2300, removable screwless connectors and wiring tool are provided with the drives for the following terminals: Control Circuit, Main Circuit, Servo Motor Output, and Regenerative Resistor. The largest drive, SVA-2300, has all screw terminals.

Power Terminals

Input and Control Power Terminal Connections (L1, L2, (N), R, S, T)

Motor Output Power Terminal Connections (U, V, W)

Regenerative Resistor Terminal Connections (P, D, C)

Removable Wiring Terminals Included With SVA-2040		
Input & Control Power	L1, L2, R, S, T	WAGO # 231-205/026-000
Motor Output Power	U, V, W	WAGO # 231-203/026-000
Regenerative Resistor	P, D, C	WAGO # 231-103/026-000

Removable Wiring Terminals Included With SVA-2100		
Input & Control Power	L1, L2, R, S, T	WAGO # 231-205/026-000
Motor Output Power	U, V, W	WAGO # 231-203/026-000
Regenerative Resistor	P, D, C	WAGO # 231-103/026-000

Screw Terminals Included With SVA-2300		
Input & Control Power	L1, L2, N, R, S, T	
Motor Output Power	U, V, W	non-removable screw terminals
Regenerative Resistor	P, D, C	

CN1 – Input/Output Terminal

The CN1 connector provides an interface for three signal groups:

1) Analog signals for velocity and torque control, encoder reference from the motor, pulse/direction inputs, and reference voltages.

2) Programmable digital inputs.

3) Programmable digital outputs.

CN1 Terminal Connection

CN1 conveniently connects to AutomationDirect dedicated cables and terminal modules as shown in the "Cables and Terminal Connectors" section of this chapter, or to 3M part #10150-3000VE connector and #10350-52A0-008 shell.

CN1 Terminal Signal Identification

#	Signal	Description	#	Signal	Description	#	Signal	Description	#	Signal	Description
2	DO3-	Digital Output	1	DO4+	Digital Output	27	DO5-	Digital Output	26	DO4-	Digital Output
4	DO2-	Digital Output	3	DO3+	Digital Output	29	NC	No Connection	28	DO5+	Digital Output
6	DO1-	Digital Output	5	DO2+	Digital Output	31	DI7	Digital Input	30	DI8	Digital Input
8	DI4	Digital Input	7	DO1+	Digital Output	33	DI5	Digital Input	32	DI6	Digital Input
10	DI2	Digital Input	9	DI1	Digital Input	35	PULL HI	Position Pulse Input	34	DI3	Digital Input
12	GND	Power VCC Ground AI	11	COM+	Power Common DI & DO	37	SIGN	Position Pulse Input	36	/SIGN	Position Pulse Input
14	NC	No Connection	13	GND	Power VCC Ground AI	39	NC	No Connection	38	NC	No Connection
16	MON1	Analog Monitor Output 1	15	MON2	Analog Monitor Output 2	41	PULSE	Position Pulse Input	40	NC	No Connection
18	T_REF	Analog Torque Input	17	VDD	Power 24V Source	43	/PULSE	Position Pulse Input	42	V_REF	Analog Velocity Input
20	VCC	Power 12V Source	19	GND	Power VCC Ground AI	45	COM-	Power VDD Ground DI & DO	44	GND	Power VCC Ground AI
22	/OA	Position Pulse /A Output	21	OA	Position Pulse A Output	47	COM-	Power VDD Ground DI & DO	46	NC	No Connection
24	/OZ	Position Pulse /Z Output	23	/OB	Position Pulse /B Output	49	COM-	Power VDD Ground DI & DO	48	OCZ	Encoder Z Pulse Open Collector Output
			25	OB	Position Pulse B Output				50	OZ	Encoder Z Pulse Line Driver Output

⚠ **The terminals marked NC should be left unconnected (no connection). Do not connect any external wiring to the NC terminals, or the drive could be damaged. The NC terminals are used internally by the servo drive.**

CN1 Terminal Signals Functions – Input Connections

The CN1 "General Signals" are set by the factory, and cannot be changed.

CN1 General Signals			
Signal		**Pin No**	**Function**	**Wiring Diagram**

Signal		Pin No	Function	Wiring Diagram
Analog Signal Input	V_REF	42	External velocity command (±10V) indicates ±P1-40, Analog Full Scale Velocity Command (gain). P4-22 adds Analog Velocity Input Offset. Motor rpm limited by P1-55, max. velocity limit. (resolution: 13 bits @ 0~1V; 13~10 bits @ 1~2V; 10 bits @ 2~10V)	CN1-3
	T_REF	18	External torque command (±10V) indicates ±P1-41, Analog Full Scale Torque Command (gain). P4-23 adds Analog Torque Input Offset. (10-bit resolution)	CN1-3
Analog Monitor Output	MON1 MON2	16 15	Motor operation status: Motor characteristics such as velocity and current can be represented by analog voltages. The drive provides two output channels which can be configured with parameter P0-03 to output the desired characteristic. This output is wired between the MON and GND terminal pins. Bipolar ±8VDC @ 1mA; Resolution 12.8 mV/count	CN1-13
Position Pulse Input	PULSE /PULSE SIGN /SIGN	41 43 37 36	The *Sure*Servo drive has two kinds of position pulse inputs: Line driver (max 500kpps) and Open-collector / Push-pull / PNP (max 200kpps). There are three types of pulse commands: Pulse + Direction, A phase + B phase (quadrature) and CCW pulse + CW pulse. These three pulse types can be selected by using parameter P1-00.	CN1-4 CN1-5 CN1-6
	PULL HI	35	When using Open-collector inputs, this terminal must be connected to a pull-up power supply.	CN1-4
Position Pulse Output	OA /OA	21 22	Encoder signal output A, B, Z. This line driver output is a scalable representation of the motor encoder.	CN1-14 CN1-15
	OB /OB	25 23		
	OZ /OZ	50 24		
Power	VDD	17	VDD is +24VDC provided by the drive to be used for DI power. Maximum available current is 500mA.	-
	COM+ COM–	11 45 47 49	COM+ is the common voltage input end of DI and DO signal. When using VDD, VDD should be connected to COM+. If not using VDD, users have to add an applied power (+12VDC to +24VDC). The positive end of this applied power should be connected to COM+, and the negative end of this applied power should be connected to COM-.	-
Power	VCC	20	VCC is +12V power provided by the drive. It is used for providing simple analog command (speed or torque). Maximum available current is 100mA.	-
	GND	12, 13, 19, 44	The polarity of VCC is with respect to GND.	
Other	NC	14, 29, 38, 39, 40, 46	⚠ *The terminals marked NC should be left unconnected (No connection). Do not connect any external wiring to the NC terminals, or the drive could be damaged. The NC terminals are used internally by the servo drive.*	

CN1 Terminal Signals Explanation – Input Connections (continued)

The CN1 "Digital Input Signal" configurations can be changed by the user. The active state of the inputs can be either active high (N.O.) or active low (N.C.), depending upon how they are configured in parameters P2-10 through P2-17.

DI Signal Configuration					
Signal	Pin No.	Parameter	Signal	Pin No.	Parameter
DI1	9	P2-10	DI5	33	P2-14
DI2	10	P2-11	DI6	32	P2-15
DI3	34	P2-12	DI7	31	P2-16
DI4	8	P2-13	DI8	30	P2-17

CN1 Digital Input Signal Functions		
DI Code	Function [Note 1]	Wiring Diagram
01	Servo Enable	
02	Alarm Reset	
03	Gain Boost Switch	
04	Clear Command	
05	Low Speed Clamp	
06	Command Input Polarity	
07	Position Command Pause (internal indexer only)	
08	Command Trigger	
09	Torque Limit Enable	
10	Speed Limit Enable	
11	Position Command Select 0 (PCS0) [Note 2]	
12	Position Command Select 1 (PCS1) [Note 2]	
13	Position Command Select 2 (PCS2) [Note 2]	CN1-1
14	Velocity Command Select 0 (VCS0) [Note 2]	CN1-2
15	Velocity Command Select 1 (VCS1) [Note 2]	
16	Torque Command Select 0 (TCS0) [Note 2]	
17	Torque Command Select 1 (TCS1) [Note 2]	
18	Position/Velocity Mode Select	
19	Velocity/Torque Mode Select	
20	Position/Torque Mode Select	
21	Fault Stop(N.C.)	
22	Reverse Inhibit (Overtravel) (N.C.)	
23	Forward Inhibit(Overtravel) (N.C.)	
24	Home Sensor	
Table continued on next page		

CN1 Terminal Signals Explanation – Input Connections (continued)

DI Code	Function Note 1	Wiring Diagram
	CN1 Digital Input Signal Functions (continued)	
25	Torque Limit - Reverse Direction	
26	Torque Limit - Forward Direction	
27	Start Home Move Trigger	
28	Index Mode Select 0 (IMS0)	
29	Index Mode Select 1 (IMS1)	
30	Index Mode Select 2 (IMS2)	
31	Index Mode Select 3 (IMS3)	
32	Index Mode Select 4 (IMS4)	
33	Index Mode Control 0 (IMC0)	
34	Index Mode Control 1 (IMC1)	
35	Index Mode - Manual Continuous Operation	CN1-1 CN1-2
36	Index Mode - Manual Single Step Operation	
37	Jog Forward	
38	Jog Reverse	
39	Step Reverse (Pr mode only)	
40	Step Forward (Pr mode only)	
41	Return to Index 1 (Auto Index Mode only)	
42	Auto Index Position Mode	
43	Electronic Gear Numerator Select 0 (EGNS0)	
44	Electronic Gear Numerator Select 1 (EGNS1)	
45	Inhibit Pulse Command - Terminal	

Note 1: Refer to Parameters Chapter 4 for DI function descriptions.
Note 2: Codes for these inputs are defined in parameters Chapter 4, with P1-02, P1-09, P1-12, P1-15.

CN1 Terminal Signals Functions – Output Connections

The CN1 digital output signal configurations can be changed by the user. For most modes of operation, users can set parameters P2-44 and P2-18 through P2-22 to determine the functions and active states [active high (N.O.) or active low (N.C.)] of the individual outputs. For Pr Index and Auto Modes, users can set P2-44 so that the outputs collectively display binary codes that indicate the current status during indexing operations. Refer to the "Parameters for Index Mode Pr Control" and "Parameters for Absolute and Incremental Auto Pr Control" subsections of Chapter 5 for the applicable status indicating binary codes.

DO Signal Configuration (for P2-44 = 0)					
Signal	Pin No.	Parameter	Signal	Pin No.	Parameter
DO1+	7	P2-18	DO4+	1	P2-21
DO1-	6		DO4-	26	
DO2+	5	P2-19	DO5+	28	P2-22
DO2-	4		DO5-	27	
DO3+	3	P2-20	*Refer to Chapter 5 for DO configuration for when P2-44 = 1*		
DO3-	2				

CN1 Digital Output Signal Functions (for P2-44 = 0)			
DO Code	Function	Control Mode	Wiring Diagram
01	Servo Ready	All	CN1-7 CN1-8 CN1-9 CN1-10 CN1-11 CN1-12
02	Servo Enabled	All	
03	At Zero Speed	All	
04	At Speed Reached (Velocity Modes)	All Except: Pt, Pr	
05	At Position (Position Modes)	Pt, Pr, Pt-S, Pt-T, Pr-S, Pr-T	
06	At Torque Limit	All T modes	
07	Active Fault	All	
08	Electromagnetic Brake Control	All	
09	Homing Completed (Position Modes)	All Pt/Pr Modes	
10	At Overload Output Warning Threshold	All	
Note: *Refer to Parameters Chapter 4 for DO function descriptions.* *Refer to Control Modes Chapter 5 for DO binary codes for Pr modes when P2-44 = 1.*			

CN2 – Encoder Terminal

A 2500 line count incremental encoder is integrated within the *Sure*Servo motor.

When power is first applied to the servo drive, control algorithms detect the motor's rotor position through sensors imbedded in the motor. Feedback to the drive of the UVW signals for commutation is via the ABZ encoder signal wires. Following rotor position sensing, the drive automatically switches to encoding for commutation control.

The 2500 line count encoder is automatically multiplied by four inside the drive to produce 10000 ppr for increased control accuracy. The output can be scaled using parameter P1-46.
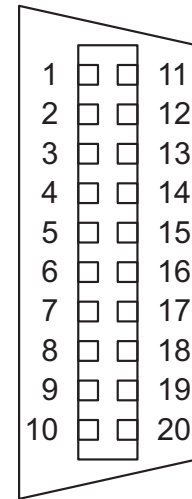
CN2 Drive Connector

CN2 Terminal Connection

CN2 connects to Automation Direct part #SVC-Exx-0x0 encoder feedback cable (as listed in the "Cables and Terminal Connectors" section of this chapter), or to 3M part #10120-3000VE connector and #10330-52A0-008 shell.

CN2 Terminal Signal Identification

CN2 Terminal Signal Identification			
PIN No.	Signal Name	Terminal Identification	Description
2	/Z phase input	/Z	Encoder /Z phase output
4	/A phase input	/A	Encoder /A phase output
5	A phase input	A	Encoder A phase output
7	B phase input	B	Encoder B phase output
9	/B phase input	/B	Encoder /B phase output
10	Z phase input	Z	Encoder Z phase output
14, 16	Encoder power	+5V	Encoder 5V power
13, 15	Encoder power	GND	Grounding

CN3 – Serial Communication Terminal

The servo drive can be connected to a computer or a MODBUS-capable controller (PLC) by a serial communication connector. The communication connector/port of SureServo drive can provide three common serial communication interfaces: RS-232, RS-422, and RS-485 connections. RS-232 is frequently used, but is somewhat limited since the maximum cable length for RS-232 connections is 15 meters (50 feet), and it can only connect two devices. Using RS-485 allows longer transmission distances and supports multiple drives connected on a multidrop network.

Set parameter P3-05 to select which communication configuration is being used. Refer to Chapter 4 for information regarding parameter settings.
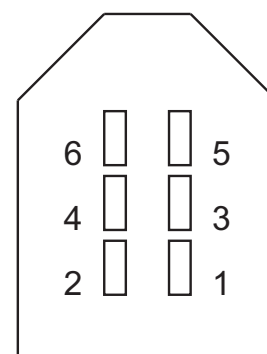
CN3 Drive Connector

CN3 Terminal Connection
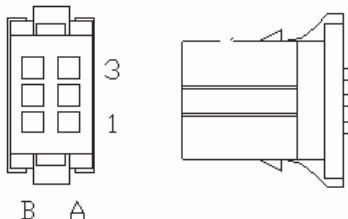
CN3 connects to Automation Direct part #SVC-MDCOM-CBL or #SVC-PCCFG-CBL communication cables (as described in the "Cables and Terminal Connectors" section of this chapter), or to an IEEE 1394 plug.
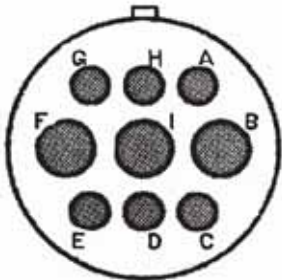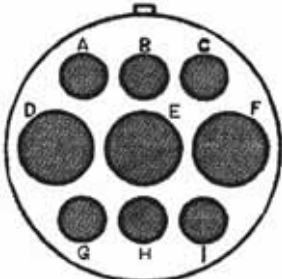
CN3 Terminal Signal Identification

CN3 Terminal Signal Identification			
PIN No.	Signal Name	Terminal Identification	Description
1	Grounding	GND	Ground
2	RS-232 data transmission	RS-232 TX	For data transmission of the servo drive. Connected to the RS-232 interface of PC.
3	RS-422/485 data receiving	RS-422/485 RXD+	For data receiving of the servo drive. (differential line driver + end)
4	RS-232 data receiving	RS-232 RX	For data receiving of the servo drive. Connected to the RS-232 interface of PC.
	RS-422/485 data receiving	RS-422/485 RXD-	For data receiving of the servo drive. (differential line driver - end)
5	RS-422/485 data transmission	RS-422/485 TXD+	For data transmission of the servo drive. (differential line driver + end)
6	RS-422/485 data transmission	RS-422/485 TXD-	For data transmission of the servo drive. (differential line driver - end)
Note: For RS-485 connection, jumper pin 5 to pin 3, and jumper pin 4 to pin 6; otherwise same as RS-422 connection.			

Servo Motor Terminal Connections
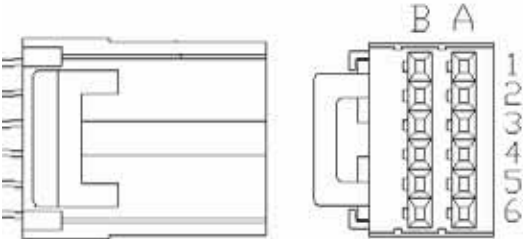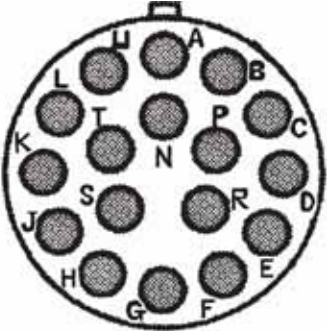
Power Connections

Motor Part Number	U, V, W / Electromagnetic Brake Connector	Terminal ID
SVL-201(B) SVL-202(B) SVL-204(B) SVL-207(B)		A

Motor Part Number	U, V, W / Electromagnetic Brake Connector	Terminal ID
SVL-210(B) SVM-210(B)		B
SVM-220(B) SVM-230(B)		C

Terminal ID	W (Black)	V (White)	U (Red)	Case Ground (Green)	Brake 1 (Orange)	Brake 2 (Yellow)	Mating Connector
A	A3	A2	A1	B1	B2	B3	AMP - 178289-3
B	B	I	F	E	G	H	Amphenol- MS3106-20-18S
C	F	E	D	G	A	B	Amphenol- MS3106-24-11S

Encoder Connections

Encoder Connectors		
Motor Part Number	**Encoder Connector**	**Terminal ID**
SVL-201(B) SVL-202(B) SVL-204(B) SVL-207(B)		A
SVL-210(B) SVM-210(B) SVM-220(B) SVM-230(B)		B

Terminal ID	A (BL)	/A (BL/BK)	B (GN)	/B (GN/BK)	Z (YL)	/Z (YL/BK)	5V (RD)	GND (BK)	BRAID SHIELD	Mating connector
A	A1	B1	A2	B2	A3	B3	A5	B5	B6	AMP - 1-1318118-6
B	A	B	C	D	F	G	S	R	-	Amphenol - MS3106-20-29S

Wiring Diagrams

Connecting to Peripheral Devices

Power
100W~1kW: 1-phase 200~255VAC or
3-phase 170~255VAC

2kW~3kW: 3-phase 170~255VAC

MCCB
or
Fused
Disconnect

Electromagnetic
Contactor (MC)

SureServo Drive

P0-00

MODE ▲ ENTER

NEXT ▼

●Sure⌄⌄servo

L1
L2
R
S
T

U
V
W

P
D
C

C
N
1

C
N
2

C
N
3

DirectLOGIC PLC

ZIPLink
Cable &
Terminal
(Refer to "Cables and
Terminal Connectors"
section of this chapter)

CN1
I/O connection

CN2
Encoder connection

PC or
PLC

CN3
RS-232, RS485, RS422
communication connection
(Refer to "Cables and Terminal
Connectors" section of this chapter)

P
C

Regenerative
resistor

When using an external
regenerative resistor,
connect it between
P and C, and leave
the circuit open
between P and D.

When using the internal
regenerative resistor,
close the circuit between
P and D, and leave the
circuit open between P and C.

Electromagnetic Brake Control:
Refer to wiring diagrams CN1-11 and CN1-12
for electromagnetic brake wiring information
(if used). All *Sure*Servo motor power
cables include brake control wiring.

SureServo Motor

Power Wiring Connections

Three Phase Power Supply – All *Sure*Servo Drive Models (except as noted)

A B C

MCCB or Fused Disconnect

Noise filter

On

Off

E-Stop

M

M

Servo Drive

R
S
T
N*
L1 } Control
L2 } Circuit

Control Circuit Fusing

SVC-Pxx-xxx cable set

U   RD
V   WH
W   BK
     GN

M

PE
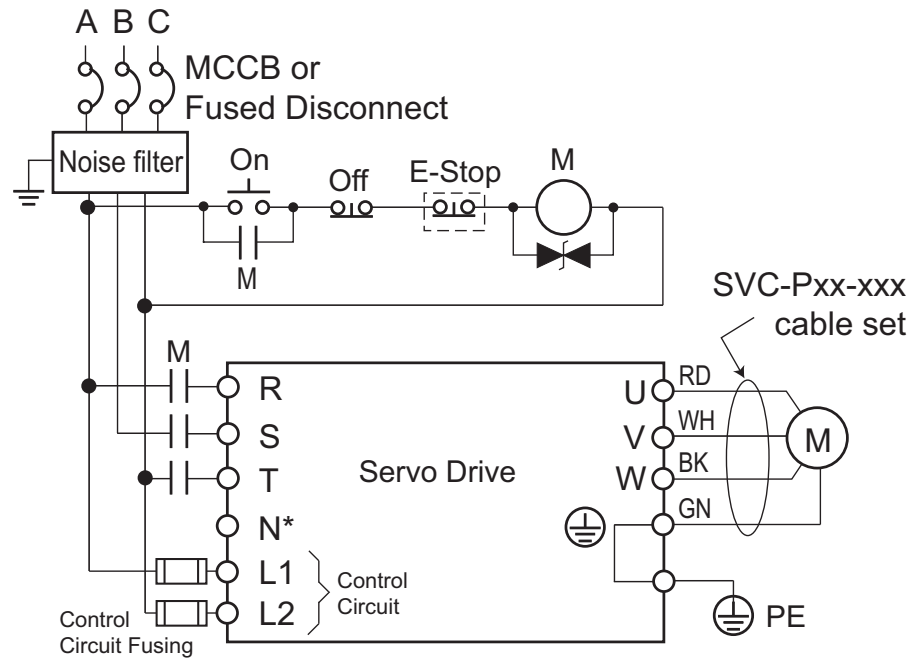
* - N terminal SVA-2300 only;
     negative side of DC bus;
     no wiring connection required;

Single Phase Power Supply – *Sure*Servo Drive Models SVA-2040, SVA-2100

A B

MCCB or Fused Disconnect

Noise filter

On

Off

E-Stop

M

M

Servo Drive

R
S
T
L1 } Control
L2 } Circuit

Control Circuit Fusing

SVC-Pxx-xxx cable set

U   RD
V   WH
W   BK
     GN

M

PE
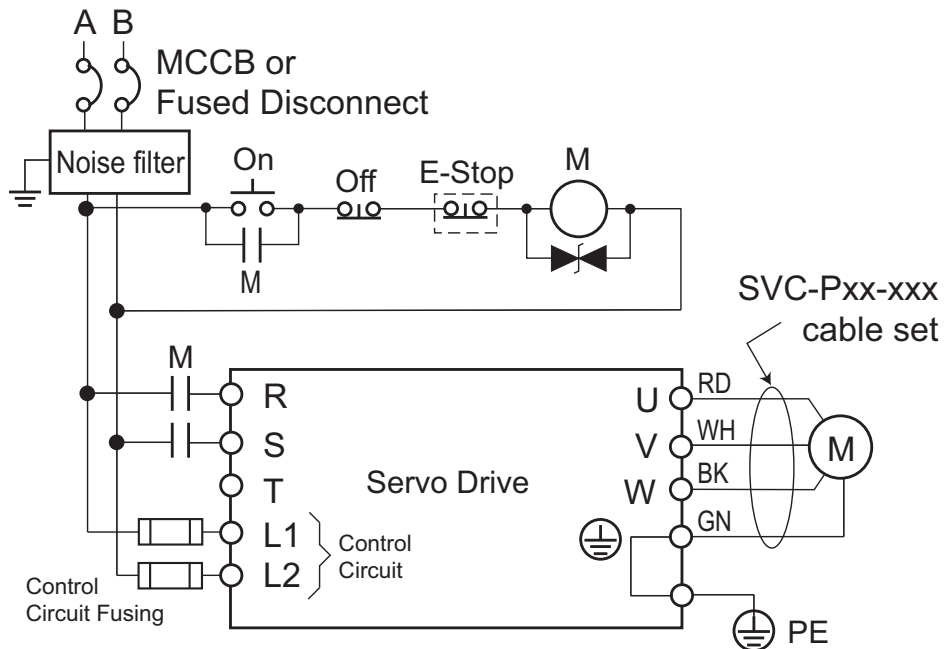
Wiring for Position (Pr & Pt) Control Modes

This wiring diagram shows basic wiring only, and additional wiring configurations are possible for some I/O.
Refer to subsequent subsections of this chapter for more detailed wiring information.

Position (Pr & Pt) Control Modes
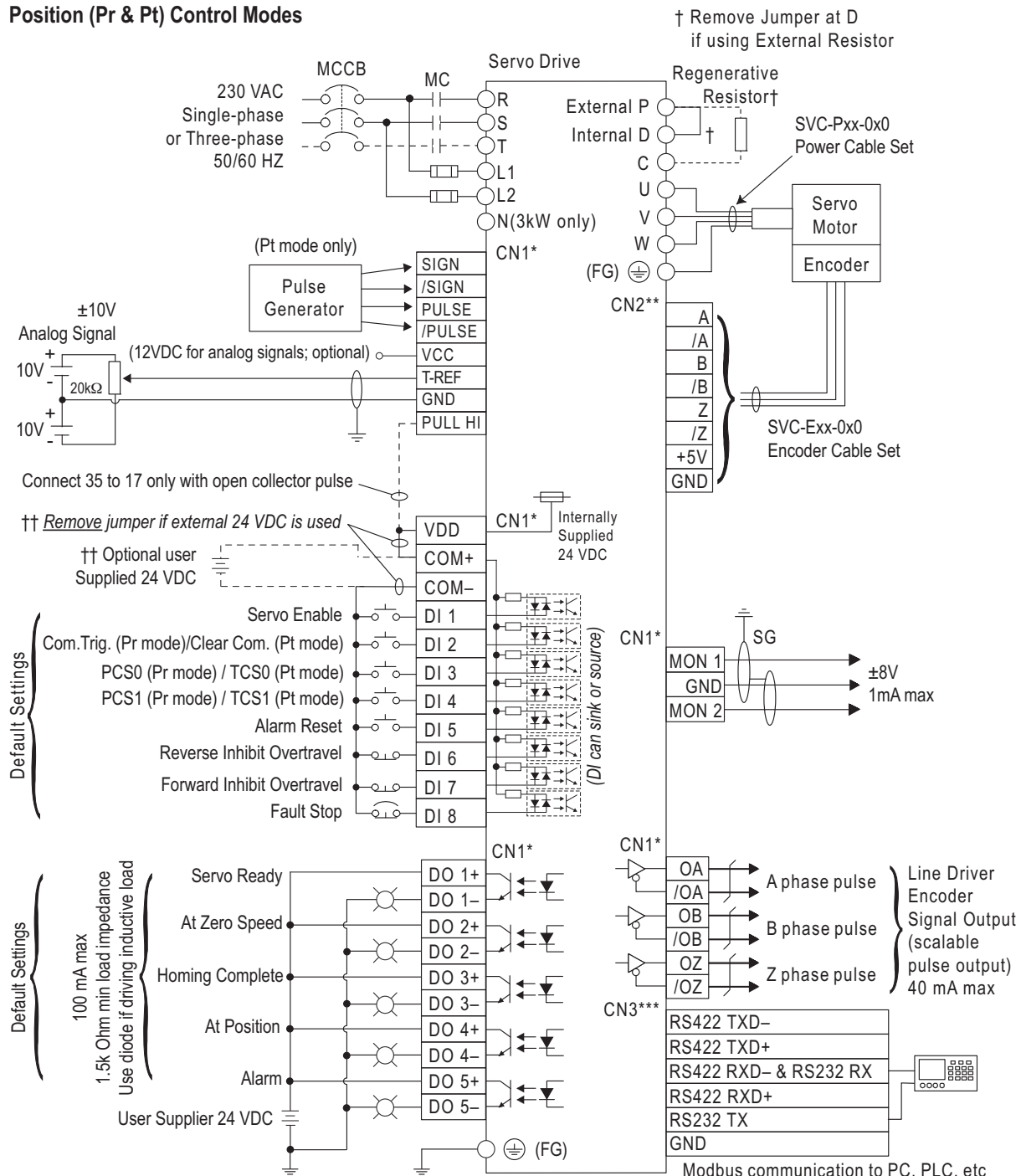
* Use connection kit part #s ZL-RTB50 & ZL-SVC-CBL-50(-x) for CN1 terminal connections.
** Use cable part # SVC-Exx-0x0 for CN2 terminal connections.
*** Use cable part # SVC-MDCOM-CBL for CN3 terminal Modbus network connections.

Wiring for Velocity and Torque Control Modes

This wiring diagram shows basic wiring only, and additional wiring configurations are possible for some I/O.
Refer to subsequent subsections of this chapter for more detailed wiring information.

Velocity and Torque Control Modes
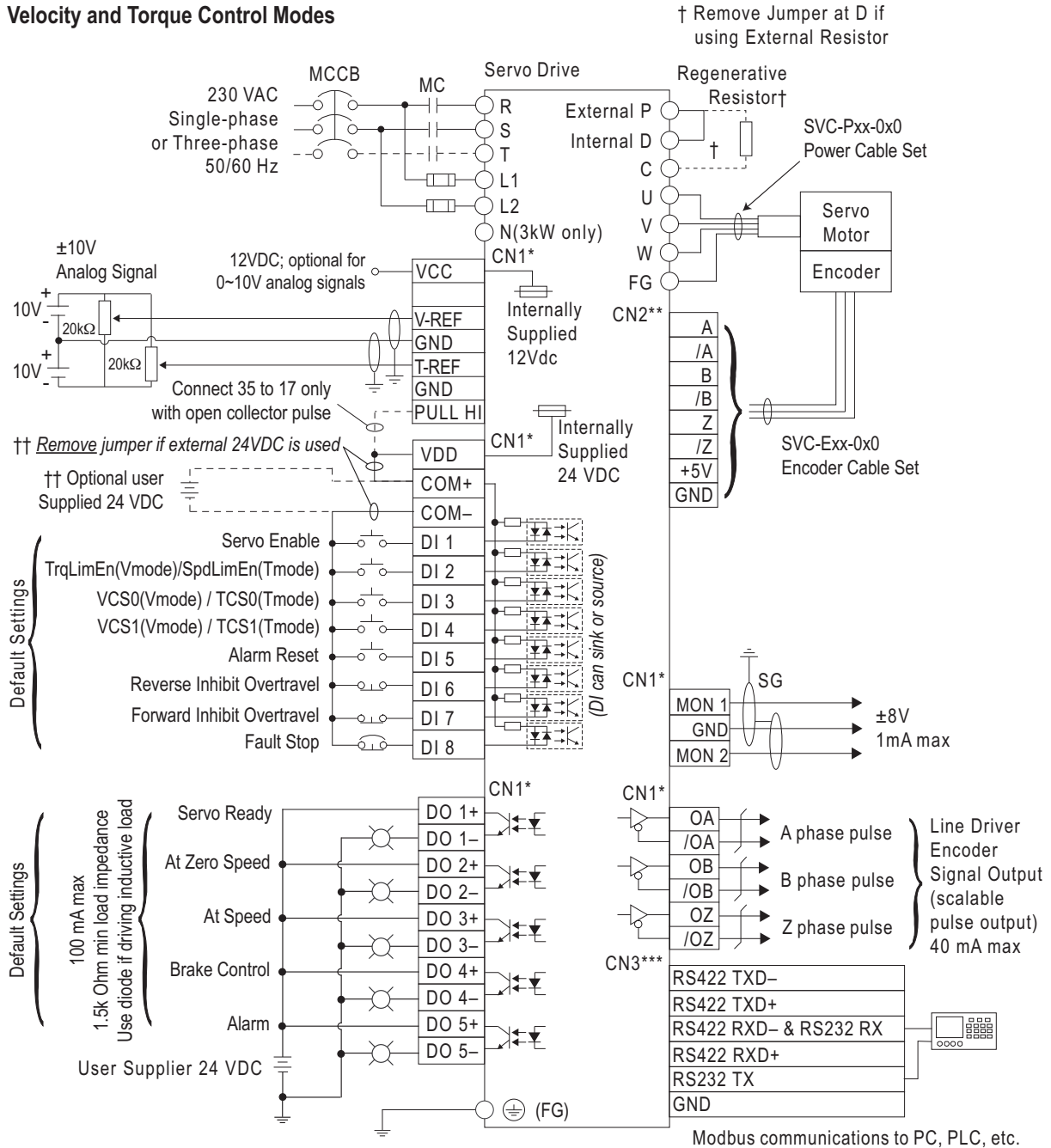
† Remove Jumper at D if using External Resistor

* Use connection kit part #s ZL-RTB50 & ZL-SVC-CBL-50(-x) for CN1 terminal connections.
** Use cable part # SVC-Exx-0x0 for CN2 terminal connections.
*** Use cable part # SVC-MDCOM-CBL for CN3 terminal Modbus network connections.

CN1 Input/Output Wiring Diagrams

Refer to the "Cables and Terminal Connectors" section of this chapter for a cable and terminal module to connect to this terminal.

Refer to Appendix C for Koyo Encoder and PLC wiring examples.

CN1-DI_1:
Wiring of **Digital Input** using **internal power supply**
(sinking output field device connected to sourcing input)

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50 — Servo Drive

Use a relay or open-collector transistor for input signal

Approx 5mA for a transistor

24Vdc
VDD
COM+
Approx 4.7kΩ
DIx
NPN TR
COM–
$V_{ces} \leqq 1.0V$
$I_{ceo} \leqq 100\mu A$
VDD GND

CN1-DI_2:
Wiring of **Digital Input** using **external power supply**
(sinking output field device connected to sourcing input)

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50 — Servo Drive

Do not connect VDD to COM+

24Vdc 200mA min

24Vdc
COM+
Approx 4.7kΩ
DIx
Use a relay or open-collector transistor for input signal
VDD GND
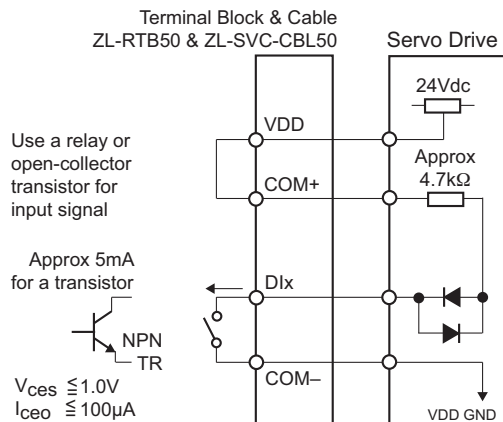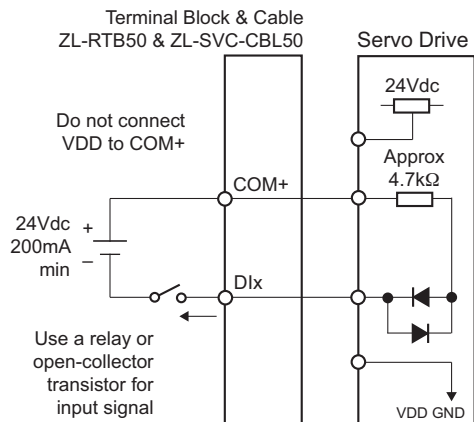
CN1-DI_3:
Wiring of **Digital Input** using **internal power supply**
(sourcing output field device connected to sinking input)

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50 — Servo Drive

Approx 5mA for a transistor

PNP TR
$V_{ces} \leqq 1.0V$
$I_{ceo} \leqq 100\mu A$

24Vdc
VDD
DIx
COM+
Approx 4.7kΩ
COM–
VDD GND
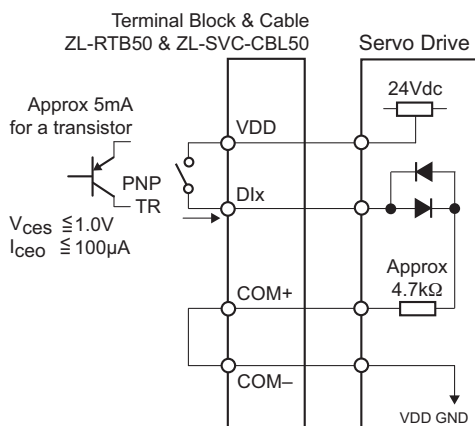
CN1-DI_4:
Wiring of **Digital Input** using **external power supply**
(sourcing output field device connected to sinking input)

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50 — Servo Drive

Do not connect VDD to COM+

24Vdc 200mA min

24Vdc
DIx
COM+
Approx 4.7kΩ
VDD GND

CN1 Input/Output Wiring Diagrams (continued)

CN1-AI: Velocity / Torque **analog signal input**

For Unidirectional 0~10V Signal:

Terminal Block & Cable ZL-RTB50 & ZL-SVC-CBL50

Servo Drive

(optional) (instead of external p.s.)

VCC — 12Vdc

2kΩ

V-REF (T-REF)

10kΩ

+ 10V −

GND

Approx 10kΩ

VCC GND

For Bidirectional ±10V Signal:

V-REF (T-REF)

20kΩ

+ 10V −
+ 10V −

GND

Approx 10kΩ

VCC GND

CN1-PI_1: **Pulse Input**
(NPN / Sinking / Open-collector encoder)

Terminal Block & Cable ZL-RTB50 & ZL-SVC-CBL50

Servo Drive

24Vdc Max input pulse frequency is 200kpps

VDD

PULL HI

/SIGN   approx 1kΩ
              270Ω

Encoder

SIGN

COM−

/PULSE   approx 1kΩ
               270Ω

Encoder

PULSE

COM−

VDD GND

CN1-PI_2: **Pulse Input** (line driver encoder)

Terminal Block & Cable ZL-RTB50 & ZL-SVC-CBL50

Servo Drive

Encoder

24Vdc Max. input pulse frequency is 500kpps

+2.5V

/SIGN

270Ω

5V

−2.5V

SIGN

SG   COM−

+2.5V

/PULSE

270Ω

5V

−2.5V

PULSE

SG   COM−

VDD GND

CN1-PI_3: **Pulse Input** (Push-pull/Totem-Pole encoder)

Terminal Block & Cable ZL-RTB50 & ZL-SVC-CBL50

Servo Drive

Encoder

24Vdc max input pulse frequency is 200kpps

VDD

PULL HI

/SIGN   approx 1kΩ
              270Ω

+ A

SIGN

/PULSE   approx 1kΩ
               270Ω

+ B

PULSE

COM−

VDD GND

CN1 Input/Output Wiring Diagrams (continued)

CN1-PI_4: **Pulse Input** (PNP/Sourcing encoder)

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50

Servo Drive

Encoder

VDD

24Vdc
max input pulse
frequency is
200kpps

/SIGN

1kΩ   270Ω

SIGN

/PULSE

1kΩ   270Ω

PULSE

COM–

VDD GND

CN1-PI_5: **Pulse Input** (+5V output encoder)

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50

Servo Drive

Encoder

24Vdc
max input pulse
frequency is
200kpps

+5V CCW   /SIGN

270Ω

SIGN

+5V CW   /PULSE

270Ω

PULSE

0V   COM–

VDD GND

CN1 Input/Output Wiring Diagrams (continued)

CN1-DO_1: Wiring of **DO Signal**, for use of **internal power supply**, resistive load

Servo Drive

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50

24Vdc

VDD

R

DOx: (DOx+, DOx-)
x = 1,2,3,4,5

DOx+

DO1: (7,   6)
DO2: (5,   4)
DO3: (3,   2)
DO4: (1, 26)
DO5: (28,27)

DOx–

COM–

VDD GND
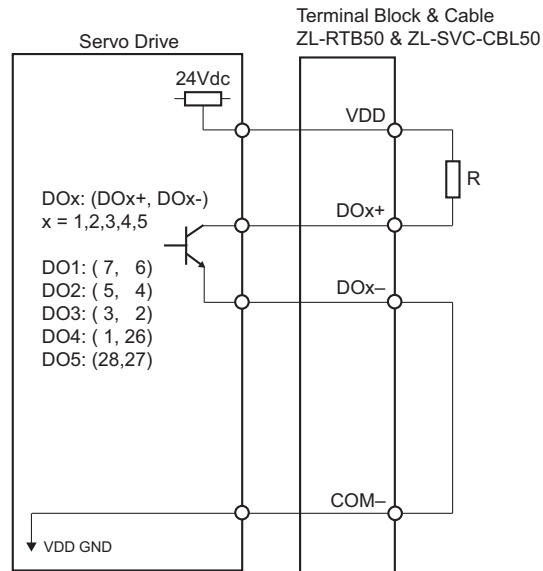
CN1-DO_2: Wiring of **DO Signal**, for use of **internal power supply**, inductive load

Servo Drive

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50

24Vdc

VDD

L

DOx: (DOx+, DOx-)
x = 1,2,3,4,5

DOx+

DO1: (7,   6)
DO2: (5,   4)
DO3: (3,   2)
DO4: (1, 26)
DO5: (28,27)

DOx–

COM–

VDD GND

Connect a surge suppressing diode when drive DO is connected to an inductive load.
100mA max permissible current
400mA instantaneous peak current

Ensure the polarity (+,-) of diode is correct, or it may damage the drive.
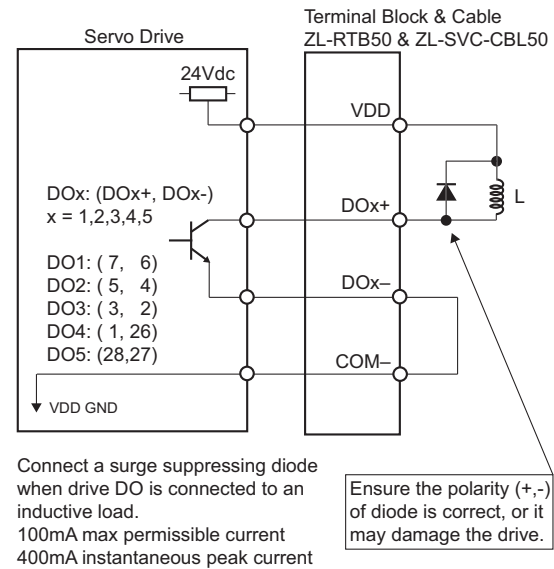
CN1-DO_3: Wiring of **DO Signal**, for use of **external power supply**, resistive load

Servo Drive

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50

24Vdc

DOx: (DOx+, DOx-)
x = 1,2,3,4,5

DOx+

R

24Vdc

DO1: (7,   6)
DO2: (5,   4)
DO3: (3,   2)
DO4: (1, 26)
DO5: (28,27)

DOx–

VDD GND

Do not connect VDD or COM-
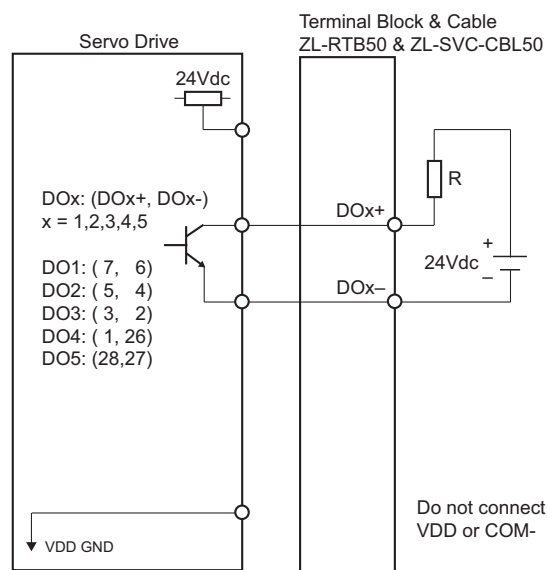
CN1-DO_4: Wiring of **DO Signal**, for use of **external power supply**, inductive load

Servo Drive

Terminal Block & Cable
ZL-RTB50 & ZL-SVC-CBL50

24Vdc

Do not connect VDD or COM–

L

DOx: (DOx+, DOx-)
x = 1,2,3,4,5

DOx+

DO1: (7,   6)
DO2: (5,   4)
DO3: (3,   2)
DO4: (1, 26)
DO5: (28,27)

DOx–

24Vdc

VDD GND

Connect a surge suppressing diode when drive DO is connected to an inductive load.
100mA max permissible current
400mA instantaneous peak current

Ensure the polarity (+,-) of diode is correct, or it may damage the drive.
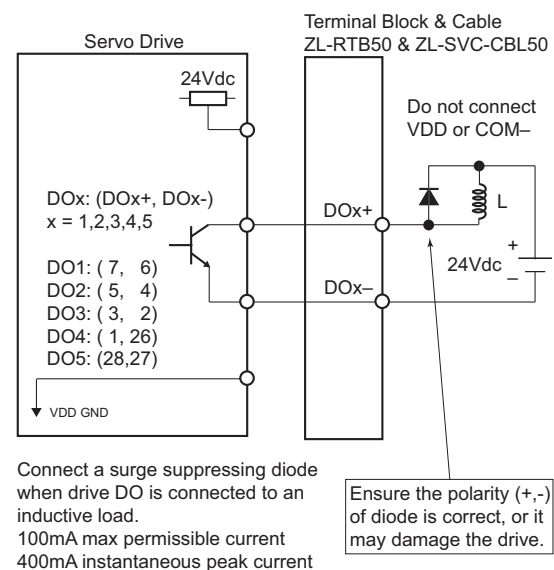
CN1 Input/Output Wiring Diagrams (continued)

CN1-DO_5: Wiring of **DO signal**, for the use of **internal power supply**, electromagnetic **brake**
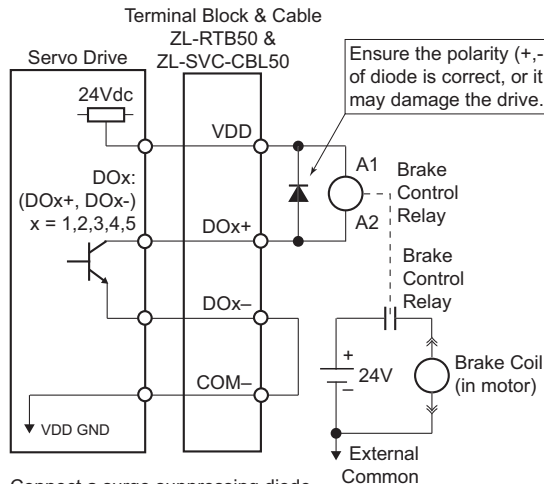
Servo Drive

Terminal Block & Cable
ZL-RTB50 &
ZL-SVC-CBL50

Ensure the polarity (+,-) of diode is correct, or it may damage the drive.

24Vdc

VDD

DOx: (DOx+, DOx-) x = 1,2,3,4,5
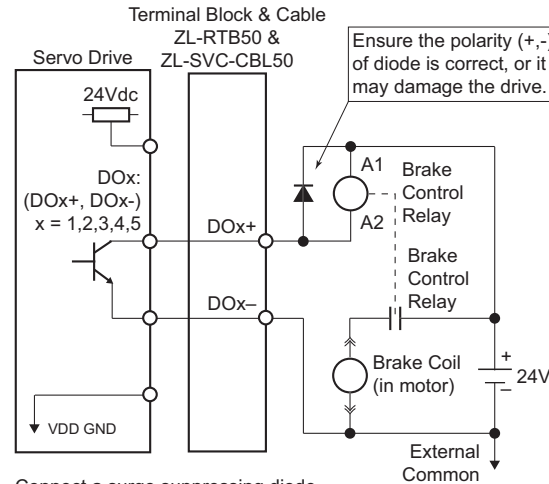
DOx+

DOx−

COM−

VDD GND

A1 / A2 Brake Control Relay

Brake Control Relay

24V

Brake Coil (in motor)

External Common

Connect a surge suppressing diode when drive DO is connected to an inductive load.
100mA max permissible current
400mA instantaneous peak current

CN1-DO_6: Wiring of **DO signal**, for the use of **external power supply**, electromagnetic **brake**

Servo Drive

Terminal Block & Cable
ZL-RTB50 &
ZL-SVC-CBL50

Ensure the polarity (+,-) of diode is correct, or it may damage the drive.

24Vdc

DOx: (DOx+, DOx-) x = 1,2,3,4,5

DOx+

DOx−

VDD GND

A1 / A2 Brake Control Relay

Brake Control Relay

Brake Coil (in motor)

24V

External Common

Connect a surge suppressing diode when drive DO is connected to an inductive load.
100mA max permissible current
400mA instantaneous peak current

Do not connect VDD or COM−

Electromagnetic Brake Notes:
1) Use a surge suppressing diode on the coil of the Brake Control Relay.
*2) Do not use VDD for **Brake Coil** power; use it only for **Relay Coil** power.*
3) All SureServo motor power cables are equipped with brake wires.
4) The Electromagnetic Brake Control DO setting should be 108 (P2-18~P2-22).
5) P1-42 sets the brake On Delay, and P1-43 sets the brake Off Delay.

| Recommended Electromagnetic Brake Control Components ||
Component	AutomationDirect Part Number
Brake Control Relay	782-2C-24D
Brake Control Relay Socket	782-2C-SKT
Surge Suppressing Diode	AD-BSMD-250

CN1 Input/Output Wiring Diagrams (continued)

CN1-AO: **Analog Monitor output** (MON1, MON2)

CN1-EO_1: Line driver **Encoder output** (Line driver signal)

CN1-EO_2: Line driver **Encoder output** (Photocoupler signal)
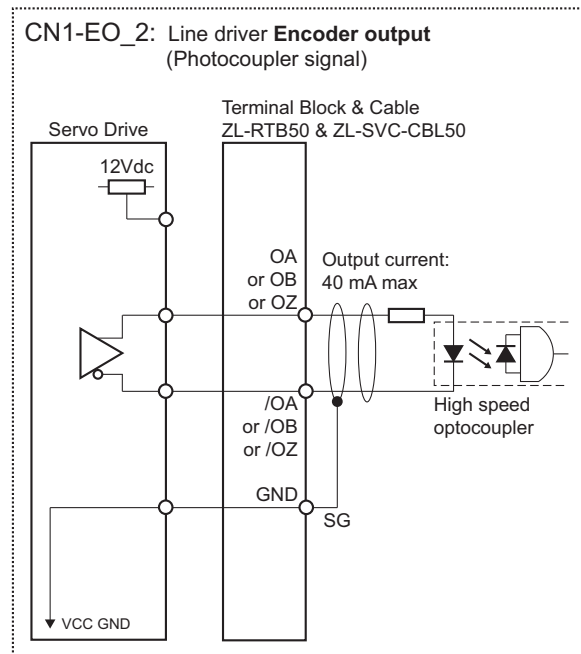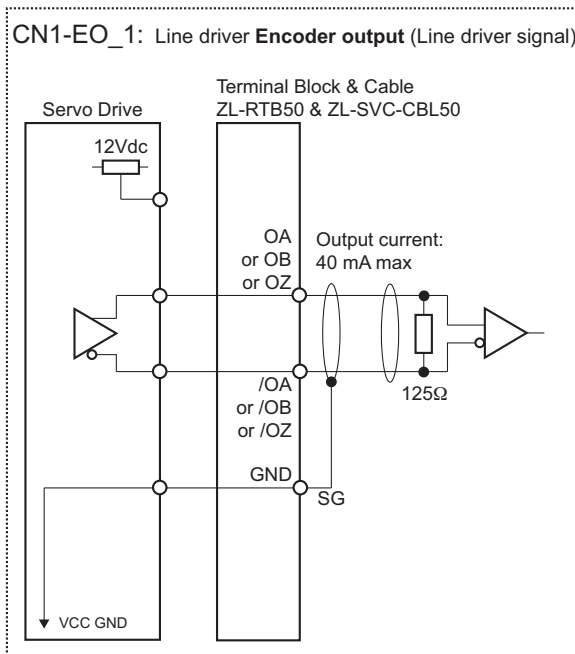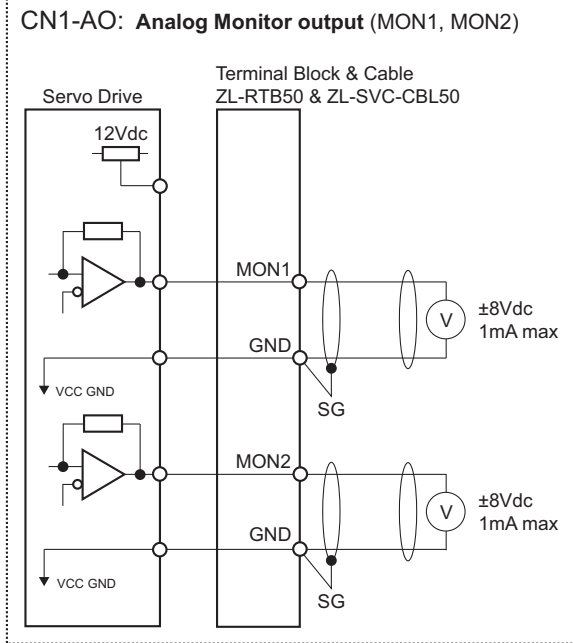
CN2 Encoder Wiring Diagram

Refer to the "Cables and Terminal Connectors" section of this chapter for cables to connect directly from *Sure*Servo motor encoders to this terminal.

CN3 Serial Communication Wiring Diagram

Refer to the "Cables and Terminal Connectors" section of this chapter for cables to connect directly to this terminal.
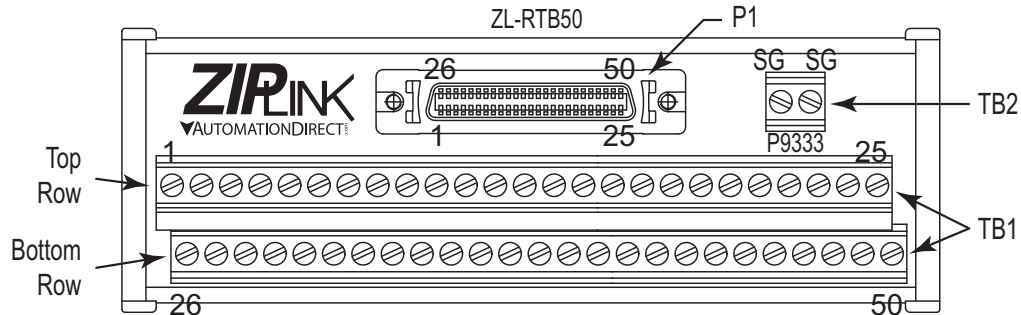
Cables and Terminal Connectors

Drive, Motor, and Cable Combinations

SureServo Drive, Motor, and Cable Combinations												
Servo Drive	Servo Motor without Brake[1]	Servo Motor with Brake[1]	Power Cable[2] - 10ft	Power Cable[2] - 20ft	Power Cable[2] - 30ft	Power Cable[2] - 60ft	CN2 - Encoder Feedback Cable - 10ft	CN2 - Encoder Feedback Cable - 20ft	CN2 - Encoder Feedback Cable - 30ft	CN2 - Encoder Feedback Cable - 60ft	CN1 - I/O Cable[3]	CN3 - Serial Cable - 3ft
SVA-2040	SVL-201	SVL-201B	SVC-PFL-010	SVC-PFL-020	SVC-PFL-030	SVC-PFL-060	SVC-EFL-010	SVC-EFL-020	SVC-EFL-030	SVC-EFL-060	ZL-SVC-CBL50 or ZL-SVC-CBL50-1 or ZL-SVC-CBL50-2 (0.5, 1, or 2 m)	SVC-MDCOM-CBL
SVA-2040	SVL-202	SVL-202B	SVC-PFL-010	SVC-PFL-020	SVC-PFL-030	SVC-PFL-060	SVC-EFL-010	SVC-EFL-020	SVC-EFL-030	SVC-EFL-060		
SVA-2040	SVL-204	SVL-204B	SVC-PFL-010	SVC-PFL-020	SVC-PFL-030	SVC-PFL-060	SVC-EFL-010	SVC-EFL-020	SVC-EFL-030	SVC-EFL-060		
SVA-2100	SVL-207	SVL-207B	SVC-PHM-010	SVC-PHM-020	SVC-PHM-030	SVC-PHM-060	SVC-EFL-010	SVC-EFL-020	SVC-EFL-030	SVC-EFL-060		
SVA-2100	SVL-210	SVL-210B	SVC-PHM-010	SVC-PHM-020	SVC-PHM-030	SVC-PHM-060	SVC-EHH-010	SVC-EHH-020	SVC-EHH-030	SVC-EHH-060		
SVA-2100	SVM-210	SVM-210B	SVC-PHM-010	SVC-PHM-020	SVC-PHM-030	SVC-PHM-060	SVC-EHH-010	SVC-EHH-020	SVC-EHH-030	SVC-EHH-060		
SVA-2300	SVM-220	SVM-220B	SVC-PHH-010	SVC-PHH-020	SVC-PHH-030	SVC-PHH-060	SVC-EHH-010	SVC-EHH-020	SVC-EHH-030	SVC-EHH-060		
SVA-2300	SVM-230	SVM-230B	SVC-PHH-010	SVC-PHH-020	SVC-PHH-030	SVC-PHH-060	SVC-EHH-010	SVC-EHH-020	SVC-EHH-030	SVC-EHH-060		

NOTE 1: Each servo motor requires a power cable and an encoder feedback cable.
NOTE 2: All SureServo power cables include brake wires.
NOTE 3: CN1 I/O cable requires a ZIPLink DIN rail mountable breakout terminal block.

Drive Terminal Connection Module & Cables

ZIPLink Terminal Connector Module & Cable for CN1

- **ZL-RTB50 connector module**

ZL-RTB50 Pin-out – TB1																									
Top Row																									
P1 Pin #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
TB1 Terminal #	1	2	3	4	5	6	7	8	9	10	11	12	13	–	15	16	17	18	19	20	21	22	23	24	25
Description	DO4+	DO3–	DO3+	DO2–	DO2+	DO1–	DO1+	DI4	DI1	DI2	COM+	GND	GND	n/c *	MON2	MON1	VDD	T_REF	GND	VCC	OA	/OA	/OB	/OZ	OB
Bottom Row																									
P1 Pin #	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
TB1 Terminal #	26	27	28	–	30	31	32	33	34	35	36	37	–	–	–	41	42	43	44	45	–	47	48	49	50
Description	DO4–	DO5–	DO5+	n/c *	DI8	DI7	DI6	DI5	DI3	Pull Hi	/SIGN	SIGN	n/c *	n/c *	n/c *	PULSE	V_REF	/PULSE	GND	COM–	n/c *	COM–	OCZ	COM–	OZ

"n/c" indicates "no connection". Terminals marked "n/c" should be left unconnected; otherwise the SureServo drive could be damaged.

ZL-RTB50 Pin-out – TB2
TB2 is internally connected to the shield drain wire and should be field connected to earth ground.

- **ZL-SVC-CBL50-x cable**

ZL-SVC-CBL50

50-pin connector to 50-pin connector
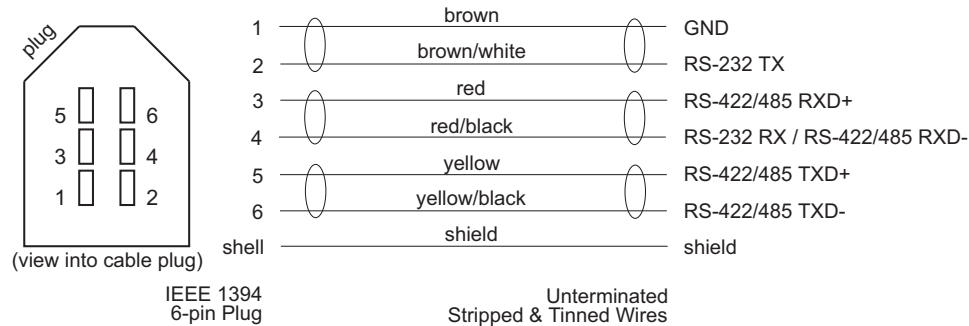straight-through connection
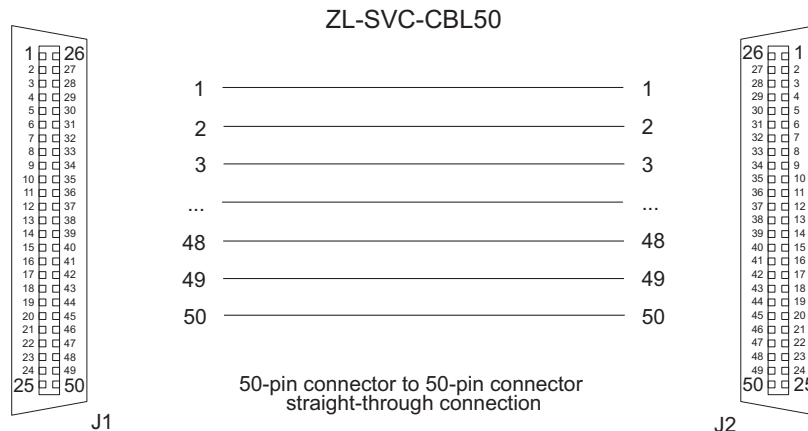
Serial Cables for Connection to CN3
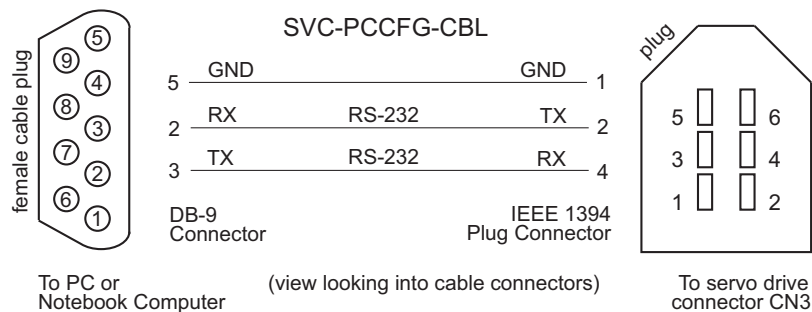
SVC-MDCOM-CBL

RS232/422/485 communication cable for use with multidrop networks; 3ft length; IEEE 1394 plug to unterminated wires; compatible with all *Sure*Servo systems.

SVC-MDCOM-CBL

plug		pin	wire	signal
		1	brown	GND
		2	brown/white	RS-232 TX
5 6		3	red	RS-422/485 RXD+
3 4		4	red/black	RS-232 RX / RS-422/485 RXD-
1 2		5	yellow	RS-422/485 TXD+
		6	yellow/black	RS-422/485 TXD-
(view into cable plug)		shell	shield	shield

IEEE 1394
6-pin Plug

Unterminated
Stripped & Tinned Wires

SVC-PCCFG-CBL

RS-232 serial cable primarily for use with *Sure*Servo configuration software; connects the drive CN3 terminal to a PC or PLC with a DB-9 serial port; 6ft length. (A USB converter, part # USB-RS232, is also available for PCs or PLCs with USB ports.)

SVC-PCCFG-CBL

female cable plug
⑤ ⑨ ④ ⑧ ③ ⑦ ② ⑥ ①

5	GND		GND	1
2	RX	RS-232	TX	2
3	TX	RS-232	RX	4

plug
5 6
3 4
1 2

DB-9
Connector

IEEE 1394
Plug Connector

(view looking into cable connectors)

To PC or
Notebook Computer

To servo drive
connector CN3

Servo Drive Circuit Protection

Servo Drive Circuit Protection				
Drive	Input Type	Input Voltage / Phase	Recommended Fuse or CB Rating	Recommended Edison Type CC Fuse
SVA-2040	Power Circuit	230V / 1φ	4A time delay (D curve)	HCTR4
		230V / 3φ		
SVA-2100	Power Circuit	230V / 1φ	10A time delay (D curve)	HCTR10
		230V / 3φ	7.5A time delay (D curve)	HCTR7-5
SVA-2300	Power Circuit	230V / 3φ	15A time delay (D curve)	HCTR15
All	Control Circuit	230V / 1φ	2.5A time delay (D curve)	HCTR2-5