YASKAWA

SigmaLogic7 Compact
Hardware Manual

Table of Contents

1 Introduction

1.1 SigmaLogic7 Compact Features

The SigmaLogic7 Compact is a Sigma-7 SERVOPACK that features built-in functionality which can be accessed by a Rockwell PLC using EtherNet/IP protocol. Product features include:

- Easy configuration with Yaskawa's free LogicWorks software
- Add On Instructions (AOIs) are provided for use with Rockwell RSLogix 5000 software
- Ethernet (100Mbps) auto crossover switching
  - EtherNet/IP
  - Allow high-speed communications with PLC
- Sigma-7 servo amplifier I/O features
  - 7 digital inputs
  - 3 digital outputs (200 V models)
  - 5 digital outputs (400 V models)

1.2   SigmaLogic7 Compact Appearance

The following figure shows the external appearance of the SigmaLogic7 Compact servo interface.

Switches (under cover)

LED Indicators

Main Circuit Power Supply

CN6A/B: Ethernet

Control Circuit Power Supply

CN7: USB

Regenerative Resistor Connections

CN1: SERVOPACK I/O

CN8: HWBB

Servo Motor Power

CN2: Encoder

200V Front View

Switches (under cover)

LED Indicators
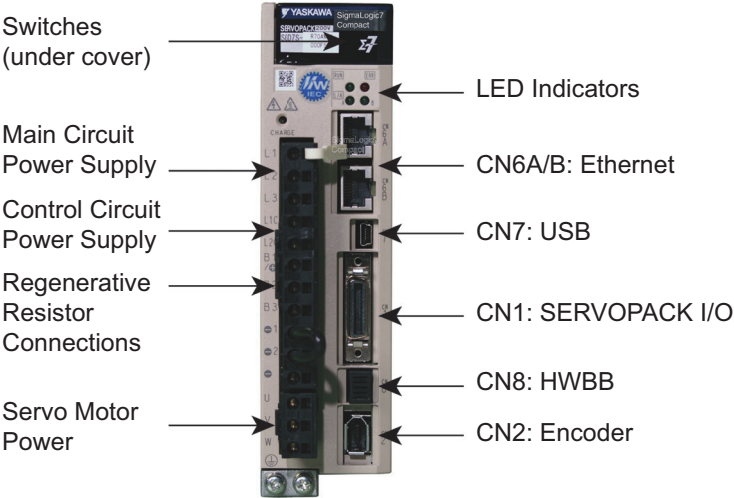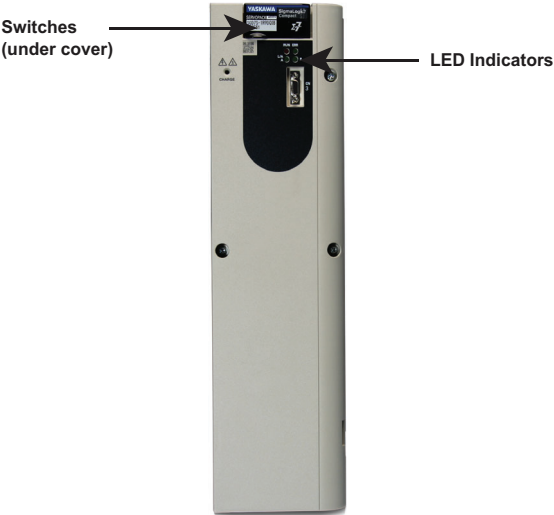
400V Front View
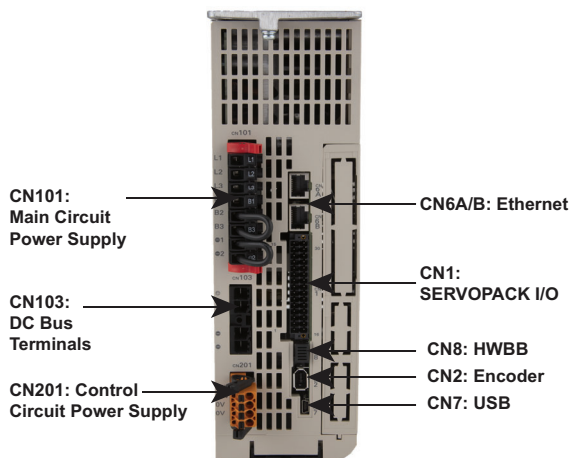
400V Top View

400V Bottom View

1.3 Model Number Designation

SGD7S - 2R8 A Q0 A 000 F51

| Σ-7 Series SERVOPACK | 1st+2nd+3rd digits | 4th digit | 5th+6th digits | 7th digit | 8th+9th+10th digits | 11th+12th+13th digits |

1st+2nd+3rd digits Maximum Applicable Motor Capacity

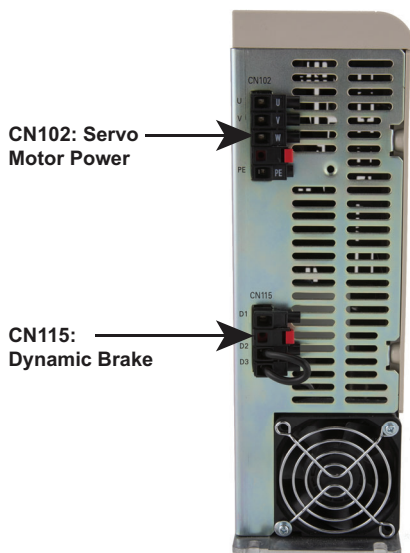| Voltage	Code	Spec.	Voltage	Code	Spec.
Three-phase, 200 VAC	R70[*1]	0.05 kW	Three-phase, 400 VAC	1R9	500 W
	R90[*1]	0.1 kW		3R5	1.0 kW
	1R6[*1]	0.2 kW		5R4	1.5 kW
	2R8[*1]	0.4 kW		8R4	2.0 kW
	3R8	0.5 kW		120	3.0 kW
	5R5[*1]	0.75 kW		170	5.0 kW
	7R6	1.0 kW		210	6.0 kW
	120	1.5 kW		260	7.5 kW
	180	2.0 kW		280	11 kW
	200	3.0 kW		370	15 kW
	330	5.0 kW			
	470	6.0 kW			
	550	7.5 kW			
	590	11 kW			
	780	15 kW			
Single-phase, 100 VAC	R70	0.05 kW			
	R90	0.1 kW			
	2R1	0.2 kW			
	2R8	0.4 kW			

4th digit Voltage

Code	Specification
A	200 VAC
F	100 VAC
D	400 VAC

5th+6th digits Interface

Code	Specification
Q0	SigmaLogic7 Compact

7th digit Design Revision Order

A: Global design revision
B: 400 V global design revision

8th+9th+10th digits Hardware Options Specification

Code	Specification	Applicable Models
000	Without options	All models

11th+12th+13th digits FT/EX Specification

Code	Specification
F51	Application function for SigmaLogic7

*1: These models can be used with either a single-phase or three-phase power supply input

1.4 Accessories

System Components			
Type	Description	Model Number	Note
Accessories and Cables (100 V AC and 200 VAC)	CN1 Terminal Block Conversion Kit	SBK-U-VBA-xx(B)	xx denotes cable length • A5: 0.5 m • 01: 1.0 m • 03: 3.0 m
	CN1 Cable (Flying leads)	JZSP-CSI02-x-E	x denotes cable length • A: 1.0 m • B: 2.0 m • C: 3.0 m
Communication	Ethernet Cable	Customer Supplied	Use high quality shielded industrial Ethernet cables (Yaskawa model JZSP-CM3RRM0-xx-E is recommended)
Accessory (400 VAC)	CN1 Connector	JUSP-7CN001	30 Pin I/O Connector

2   Specifications and Settings

2.1   Specifications

2.1.1   200 V Specifications

Item		Specification
Control Method		IGBT-based PWM control, sine wave current drive
Feedback	With Rotary Servomotor	Serial encoder: 20 bits or 24 bits (incremental encoder/ absolute encoder) 22 bits (absolute encoder)
	With Linear Servomotor	• Absolute linear encoder (The signal resolution depends on the absolute linear encoder.) • Incremental linear encoder (The signal resolution depends on the incremental linear encoder or Serial Converter Unit.)
Environmental Conditions	Surrounding Air Temperature	-5°C to 55°C (With derating, usage is possible between 55°C and 60°C.)
	Storage Temperature	-20°C to 85°C
	Surrounding Air Humidity	95% relative humidity max. (with no freezing or condensation)
	Storage Humidity	95% relative humidity max. (with no freezing or condensation)
	Vibration Resistance	4.9 m/s^2
	Shock Resistance	19.6 m/s^2
	Degree of Protection	Degree / SERVOPACK Model: SGD7S- IP20 / R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, R70F, R90F, 2R1F, 2R8F IP10 / 180A, 200A, 330A, 470A, 550A, 590A, 780A
	Pollution Degree	• Must be no corrosive or flammable gases. • Must be no exposure to water, oil, or chemicals. • Must be no dust, salts, or iron dust.
	Altitude	1,000 m or less. (With derating, usage is possible between 1,000 m and 2,000 m.)
	Others	Do not use the SERVOPACK in the following locations: Locations subject to static electricity noise, strong electromagnetic/magnetic fields, or radioactivity
Applicable Standards		Compliance with UL Standards, EU Directives and Other Safety Standards
Mounting		Mounting / SERVOPACK Model: SGD7S- Base-mounted / All Models Rack-mounted / R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A, R70F, R90F, 2R1F, 2R8F Duct-ventilated / 470A, 550A, 590A, 780A

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2.1.1 200 V Specifications

Item			Specification
Performance	Speed Control Range		1:5000 (At the rated torque, the lower limit of the speed control range must not cause the Servomotor to stop.)
	Coefficient of Speed Fluctuation		±0.01% of rated speed max. (for a load fluctuation of 0% to 100%)
			0% of rated speed max. (for a voltage fluctuation of ±10%)
			±0.1% of rated speed max. (for a temperature fluctuation of 25°C ±25°C)
	Torque Control Precision (Repeatability)		±1%
	Soft Start Time Setting		0 s to 10 s (Can be set separately for acceleration and deceleration.)
I/O Signals	Encoder Divided Pulse Output		Phase A, phase B, phase C: Line-driver output Number of divided output pulses: Any setting is allowed.
	Linear Servomotor Overheat Protection Signal Input		Number of input points: 1 Input voltage range: 0 V to +5 V
	Digital Input Signals	Input Signals That Can Be Allocated	Allowable voltage range: 24 VDC ±20% Number of input points: 7
			Input method: Sink inputs or source inputs Input Signals • P-OT (Forward Drive Prohibit) and N-OT (Reverse Drive Prohibit) signals • /EXT1 External latch signal input (General purpose input) • /EXT2 (General Purpose Input) signal • /EXT3 (General Purpose Input) signal • /P-CL (Forward External Torque Limit) and /N-CL (Reverse External Torque Limit) signals • FSTP (Forced Stop Input) signal A signal can be allocated and the positive and negative logic can be changed.
I/O Signals	Digital Output Signals	Fixed Output	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 1 Output signal: ALM (Servo Alarm) signal
		Output Signals That Can Be Allocated	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 3 (A photocoupler output (isolated) is used.)
			Output Signals • /COIN (Positioning Completion) signal • /V-CMP (Speed Coincidence Detection) signal • /TGON (Rotation Detection) signal • /S-RDY (Servo Ready) signal • /CLT (Torque Limit Detection) signal • /VLT (Speed Limit Detection) signal • /BK (Brake) signal • /WARN (Warning) signal • /NEAR (Near) signal A signal can be allocated and the positive and negative logic can be changed.

(cont?d)

Item			Specification
Communica-tions	RS-422A Commu-nica-tions (CN502)	Inter-faces	A JUSP-JC001 Communications Unit is required to connect to a Digital Operator (JUSP-OP05A-1-E).
		1:N Com-muni-cations	Up to N = 15 stations possible for RS-422A port
		Axis Addres s Set-ting	Set with parameters.
	USB Commu-nica-tions (CN7)	Inter-face	Personal computer (with SigmaWin+)
		Com-muni-cations Stan-dard	Conforms to USB2.0 standard (12 Mbps).
Displays/Indicators			CHARGE, PWR, CN, RUN, ERR, and L/A (A and B) indicators, and one-digit seven-segment display
Analog Monitor (CN5)			Number of points: 2 Output voltage range: ±10 VDC (effective linearity range: ±8 V) Resolution: 16 bits Accuracy: ±20 mV (Typ) Maximum output current: ±10 mA Settling time (±1%): 1.2 ms (Typ)
Dynamic Brake (DB)			Activated when a servo alarm or overtravel (OT) occurs, or when the power supply to the main circuit or servo is OFF.
Regenerative Processing			Built-in (An external resistor must be connected to the SGD7S-470A to -780A.) Refer to the following manual for details. 📖 S-7-Series AC Servo Drive Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)
Overtravel (OT) Prevention			Stopping with dynamic brake, deceleration to a stop, or coasting to a stop for the P-OT (Forward Drive Prohibit) or N-OT (Reverse Drive Prohibit) signal
Protective Functions			Overcurrent, overvoltage, low voltage, overload, regeneration error , etc.
Utility Functions			Gain adjustment, alarm history, jogging, origin search, etc.
Safety Func-tions	Inputs		/HWBB1 and /HWBB2: Base block signals for Power Modules
	Output		EDM1: Monitors the status of built-in safety circuit (fixed output).
	Applicable Standards		ISO13849-1 PLe (Category 3), IEC61508 SIL3
Applicable Option Modules			Fully-closed Modules and Safety Modules Note: You cannot use a Fully-closed Module and a Safety Mod-ule together.

2.1.2   400 V Specifications

Item		Specification
Control Method		IGBT-based PWM control, sine wave current drive
Feedback	With Rotary Servomotor	Serial encoder: 24 bits (incremental encoder/absolute encoder)
	With Linear Servomotor	• Absolute linear encoder (The signal resolution depends on the absolute linear encoder.) • Incremental linear encoder (The signal resolution depends on the incremental linear encoder or Serial Converter Unit.)
Environ-mental Conditions	Surrounding Air Temperature[*1]	-5°C to 55°C
	Storage Temperature	-20°C to 85°C
	Surrounding Air Humidity	95% relative humidity max. (with no freezing or condensation)
	Storage Humidity	95% relative humidity max. (with no freezing or condensation)
	Vibration Resistance	4.9 m/s^2
	Shock Resistance	19.6 m/s^2
	Degree of Protection	IP10
	Pollution Degree	2 • Must be no corrosive or flammable gases. • Must be no exposure to water, oil, or chemicals. • Must be no dust, salts, or iron dust.
	Altitude	1,000 m or less.
	Others	Do not use the SERVOPACK in the following locations: Locations subject to static electricity noise, strong electromagnetic/magnetic fields, or radioactivity
Applicable Standards		Refer to the following section for details. ☞ Compliance with UL Standards, EU Directives, and Other Safety Standards on page xxi
Mounting		Base-mounted
Perfor-mance	Speed Control Range	1:5000 (At the rated torque, the lower limit of the speed control range must not cause the Servomotor to stop.)
	Coefficient of Speed Fluctuation[*2]	±0.01% of rated speed max. (for a load fluctuation of 0% to 100%)
		0% of rated speed max. (for a voltage fluctuation of ±10%)
		±0.1% of rated speed max. (for a temperature fluctuation of 25°C ±25°C)
	Torque Control Precision (Repeatability)	±1%
	Soft Start Time Setting	0 s to 10 s (Can be set separately for acceleration and deceleration.)

Item			Specification
I/O Signals	Encoder Divided Pulse Output		Phase A, phase B, phase C: Line-driver output Number of divided output pulses: Any setting is allowed.
	Linear Servomotor Overheat Protection Signal Input		Number of input points: 1 Input voltage range: 0 V to +5 V
	Digital Input Signals	Input Signals That Can Be Allocated	Allowable voltage range: 24 VDC ±20% Number of input points: 7
			Input method: Sink inputs or source inputs Input Signals • P-OT (Forward Drive Prohibit) and N-OT (Reverse Drive Prohibit) signals • /EXT1 External latch signal input (General purpose input) • /EXT2 (General purpose input) signal • /EXT3 (General purpose input) signal • /P-CL (Forward External Torque Limit) and /N-CL (Reverse External Torque Limit) signals • /SI0 and /SI3 (General-Purpose Input) signals A signal can be allocated and the positive and negative logic can be changed.
	Digital Output Signals	Fixed Output	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 1 Output signal: ALM (Servo Alarm) signal
		Output Signals That Can Be Allocated	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 5 (A photocoupler output (isolated) is used.)
			Output Signals • /COIN (Positioning Completion) signal • /V-CMP (Speed Coincidence Detection) signal • /TGON (Rotation Detection) signal • /S-RDY (Servo Ready) signal • /CLT (Torque Limit Detection) signal • /VLT (Speed Limit Detection) signal • /BK (Brake) signal • /WARN (Warning) signal • /NEAR (Near) signal A signal can be allocated and the positive and negative logic can be changed.
Communications	RS-422A Communications (CN502)	Interfaces	Digital Operator (JUSP-OP05A-1-E).
		1:N Communications	Up to N = 15 stations possible for RS-422A port
		Axis Address Setting	Set with parameters.
	USB Communications (CN7)	Interface	Personal computer (with SigmaWin+) The software version of the SigmaWin+ must be version 7.11 or higher.
		Communications Standard	Conforms to USB2.0 standard (12 Mbps).

2.1.2 400 V Specifications

| Item		Specification
Displays/Indicators		CHARGE, PWR, RUN, ERR, and L/A (A and B) indicators, and one-digit seven-segment display
Ethernet IP Address Setting Switches		Used to configure IP address
Analog Monitor (CN5)		Number of points: 2 Output voltage range: ±10 VDC (effective linearity range: ±8 V) Resolution: 16 bits Accuracy: ±20 mV (Typ) Maximum output current: ±10 mA Settling time (±1%): 1.2 ms (Typ)
Dynamic Brake (DB)		Activated when a servo alarm or overtravel (OT) occurs, or when the power supply to the main circuit or servo is OFF.
Regenerative Processing		Built-in Refer to the catalog for details.
Overtravel (OT) Prevention		Stopping with dynamic brake, deceleration to a stop, or coasting to a stop for the P-OT (Forward Drive Prohibit) or N-OT (Reverse Drive Prohibit) signal
Protective Functions		Overcurrent, overvoltage, low voltage, overload, regeneration error, etc.
Utility Functions		Gain adjustment, alarm history, jogging, origin search, etc.
Safety Functions	Inputs	/HWBB1 and /HWBB2: Base block signals for Power Modules
	Output	EDM1: Monitors the status of built-in safety circuit (fixed output).
	Applicable Standards[*3]	ISO13849-1 PLe (category 3), IEC61508 SIL3

* 1. If you combine a Σ-7-Series SERVOPACK with a Σ-V-Series Option Module, the surrounding air temperature specification of the Σ-V-Series SERVOPACKs must be used, i.e., 0°C to 55°C. Also, the applicable surrounding range cannot be increased by derating.

* 2. The coefficient of speed fluctuation for load fluctuation is defined as follows:

$$\text{Coefficient of speed fluctuation} = \frac{\text{No-load motor speed - Total-load motor speed}}{\text{Rated motor speed}} \times 100\%$$

* 3. Always perform risk assessment for the system and confirm that the safety requirements are met.

2.2 DIP Switch Settings

DIP Switches

Rotary Switches (used to set IP address)

Rotary Switch 1   Rotary Switch 0
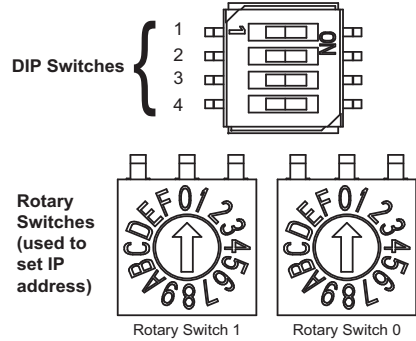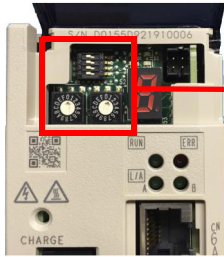
Switch	Name	Setting	Operating Mode	Setting for Normal Operation	Details
1	STOP	ON	User program execution inhibited	OFF	Inhibits user program execution
		OFF	Normal operation		
2	SUP	ON	Firmware programming mode	OFF	Enables servo controller firmware programming. This mode can also be performed via web UI without changing the DIP switch.
		OFF	Normal operation		
3	INIT	ON	Configuration bypass mode	OFF	Set to ON to bypass the stored configuration (e.g. in case of a configuration problem that prevents servo controller startup)
		OFF	Normal operation		
4	E-INIT	ON	Normal operation	OFF	Rotary switches used to set IP address
		OFF	Rotary switches ignored		IP address is set from configuration settings in servo controller

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2.3   Rotary Switches

When DIP switch 4 (E-INIT) is OFF, the rotary switches are ignored. The IP address is set from configuration settings stored on the servo controller.

Rotary switches are normally used to set the IP address. This is the case when DIP switch 4 (E-INIT) is ON

- If both rotary switches are set to 0, use DHCP.

- If either rotary switch is non zero, the last octet of the IP address is set by the value on the switches. Note that the switch values are labeled in hexadecimal. The IP address will be 192.168.1.x where x is 0x01 to 0xFF for a decimal value of 01 to 255.

Rotary Switch 1	Rotary Switch 0	IP Address
0	0	Set by DHCP
0	1	192.168.1.1
0	2	192.168.1.2
...	...	...
0	F	192.168.1.15
1	0	192.168.1.16
...	...	...
1	F	192.168.1.31
2	0	192.168.1.32
...	...	...
F	F	192.168.1.255

2.4   Switch Factory Settings

- All DIP switches off

- Rotary switches at 0 and 1.

- Configured IP address is 192.168.1.1

3   Installation Standards

3.1   Mechanical Installation/Dimensions

The SigmaLogic7 Modbus servo interface is based on the Sigma-7S EtherCAT servo amplifier.   As such, it has the same envelope and mechanical installation directions.

For 200V models, please refer to section 2.3 of the Sigma-7S EtherCAT (CoE) Communications Reference Product Manual (document number SIEPS80000155).

For 400V Models, please refer to section 2.3 of the Sigma-7S with 400V Input Power EtherCAT (CoE) Communications Reference Product Manual (document number SIEPS80000180).

# 3.2 Installing Multiple SERVOPACKS in a Control Panel

3.2.1   200 V SERVOPACKS

Provide the following intervals between the SERVOPACKs and spaces around the SERVOPACKs.

> **Important** Install cooling fans above the SERVOPACKs so that hot spots do not occur around the SERVOPACKs. Provide sufficient intervals and spaces as shown in the following figure to enable cooling by the fans and natural convection.
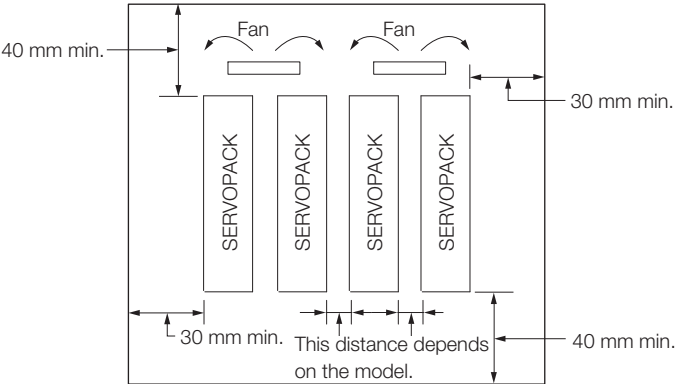
The space required on the right side of a SERVOPACK (when looking at the SERVOPACK from the front) depends on the SERVOPACK models. Refer to the following table.

SERVOPACK Model		Space on Right Side	Cooling Fan Installation Conditions
			10 mm above SERVO-PACK's Top Surface
SGD7S-	R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, R70F, R90F, 2R1F, 2R8F	1 mm min.	Air speed: 1.0 m/s min.
	120A, 180A, 200A, 330A, 470A, 550A, 590A, 780A	10 mm min.	Air speed: 1.0 m/s min.

3.2.2   400 V SERVOPACKS

400 V SERVOPACKS can be mounted side-by-side as shown.

> **Important**
>
> Install cooling fans above the SERVOPACKs so that hot spots do not occur around the SERVOPACKs.
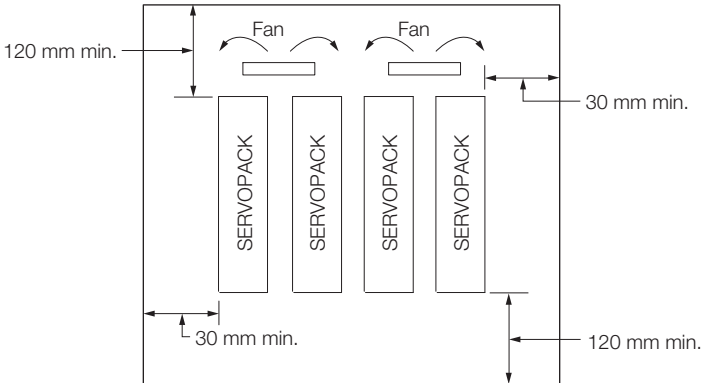
SERVOPACK Model		Cooling Fan Installation Conditions
		10 mm above SERVOPACK's Top Surface
SGD7S-	1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D, 210D, 260D, 280D, 370D	Air speed: 1.0 m/s min.

3.2.2 400 V SERVOPACKS

4   Inputs and Outputs

4.1   Input Signals

4.1.1   200 V SERVOPACKS

Default settings are provided in parentheses

Signal	Pin No.	Name	Function
/SI1 (P-OT)	7	General-purpose Digital Input 1 (Forward Drive Prohibit Input)	You can allocate the input signal to use with a parameter. (Stops Servomotor drive (to prevent over-travel) when the moving part of the machine exceeds the range of movement.)
/SI2 (N-OT)	8	General-purpose Digital Input 2 (Reverse Drive Prohibit Input)	
/SI3	9	General-purpose Digital Input 3	You can allocate the input signal to use with parameters. (Used for general-purpose input.)
/SI4 (/EXT1)	10	External latch signal 1 input (General purpose input 4)	You can allocate the input signals to use with parameters.
/SI5 (/EXT2)	11	General-purpose Digital Input 5	
/SI6 (/EXT3)	12	General-purpose Digital Input 6	
/SI0	13	General-purpose Digital Input 0	You can allocate the input signal to use with a parameter. (Used for general-purpose input.)
+24VIN	6	Digital Input Signal Power Supply Input	Inputs the Digital Input signal power supply. Allowable voltage range: 24 VDC ±20% The 24-VDC power supply is not provided by Yaskawa.
BAT+	14	Battery for Absolute Encoder (+)	These are the pins to connect the absolute encoder backup battery. Do not connect these pins if you use the Encoder Cable with a Battery Case.
BAT-	15	Battery for Absolute Encoder (-)	
TH	5	Linear Servomotor Overheat Protection Input	Inputs the overheat protection signal from a Linear Servomotor.

Note: If forward drive prohibition or reverse drive prohibition is used, the SERVOPACK is stopped by software controls. If the application does not satisfy the safety requirements, add external safety circuits as required.

4.1.2　400V SERVOPACKS

Default settings are given in parentheses.

Signal	Pin No.	Name	Function
/SI1 (P-OT)	7	General-purpose Digital Input 1 (Forward Drive Prohibit Input)	You can allocate the input signal to use with a parameter. (Stops Servomotor drive (to prevent overtravel) when the moving part of the machine exceeds the range of movement.)
/SI2 (N-OT)	8	General-purpose Digital Input 2 (Reverse Drive Prohibit Input)	
/SI3	9	General-purpose Digital Input 3	You can allocate the input signal to use with parameters. (Used for general-purpose input.)
/SI4 (/EXT1)	10	External latch signal 1 input(General purpose input 4)	You can allocate the input signals to use with parameters.
/SI5 (/EXT2)	11	General-purpose Digital Input 5	
/SI6 (/EXT3)	12	General-purpose Digital Input 6	You can allocate the input signal to use with parameters.
/SI0	13	General-purpose Digital Input 0	You can allocate the input signal to use with a parameter. (Used for general-purpose input.)
+24VIN	6	Digital Input Signal Power Supply Input	Inputs the Digital input signal power supply. Allowable voltage range: 24 VDC ±20% The 24-VDC power supply is not provided by Yaskawa.
BAT+	14	Battery for Absolute Encoder (+)	These are the pins to connect the absolute encoder backup battery. Do not connect these pins if you use the Encoder Cable with a Battery Case.
BAT-	15	Battery for Absolute Encoder (-)	
TH	5	Linear Servomotor Overheat Protection Input	Inputs the overheat protection signal from a Linear Servomotor.

Note: If forward drive prohibition or reverse drive prohibition is used, the SERVOPACK is stopped by software controls. If the application does not satisfy the safety requirements, add external safety circuits as required.

4.2   Output Signals

4.2.1   200 V SERVOPACKS

Default settings are provided in parentheses.

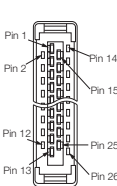| Signal	Pin No.	Name	Function
ALM+	3	Servo Alarm Output	Turns OFF (opens) when an error is detected.
ALM-	4		
/SO1+ (/BK+)	1	General-purpose Digital Output 1 (Brake Output)	You can allocate the output signal to use with a parameter. (Controls the brake. The brake is released when the signal turns ON (closes).)
/SO1- (/BK-)	2		
/SO2+	23	General-purpose Digital Output 2	Used for general-purpose outputs. Set the parameters to allocate functions.
/SO2-	24		
/SO3+	25	General-purpose Digital Output 3	
/SO3-	26		
PAO	17	Encoder Divided Pulse Output, Phase A	Output the encoder divided pulse output signals with a 90° phase differential.
/PAO	18		
PBO	19	Encoder Divided Pulse Output, Phase B	
/PBO	20		
PCO	21	Encoder Divided Pulse Output, Phase C	Outputs the origin signal once every encoder rotation.
/PCO	22		
SG	16	Signal ground	This is the 0-V signal for the control circuits.
FG	Shell	Frame ground	Connected to the frame ground if the shield of the I/O Signal Cable is connected to the connector shell.

4.2.2   400 V SERVOPACKS

Default settings are provided in parentheses.

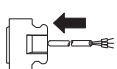| Signal	Pin No.	Name	Function
ALM+	3	Servo Alarm Output	Turns OFF (opens) when an error is detected.
ALM-	4		
/SO1+ (/BK+)	1	General-purpose Digital Output 1 (Brake Output)	You can allocate the output signal to use with a parameter. (Controls the brake. The brake is released when the signal turns ON (closes).)
/SO1- (/BK-)	2		
/SO2+	23	General-purpose Digital Output 2	Used for general-purpose outputs. Set the parameters to allocate functions.
/SO2-	24		
/SO3+	25	General-purpose Digital Output 3	
/SO3-	26		
/SO4+	27	General-purpose Digital Output 4	
/SO4-	28		
/SO5+	29	General-purpose Digital Output 5	
/SO5-	30		
PAO	17	Encoder Divided Pulse Output, Phase A	Output the encoder divided pulse output signals with a 90° phase differential.
/PAO	18		
PBO	19	Encoder Divided Pulse Output, Phase B	
/PBO	20		
SG	16	Signal ground	This is the 0-V signal for the control circuits.

4.3   I/O Signal Connector (CN1) Pin Arrangement

4.3.1   200 V SERVOPACKS

The following figure gives the pin arrangement of the of the I/O signal connector (CN1) for the default settings.

Pin 1
Pin 2
Pin 14
Pin 15
Pin 12
Pin 25
Pin 13
Pin 26

The above view is from the direction of the following arrow without the connector shell attached.

Pin	Signal	Description
1	/SO1+ (/BK+)	General-purpose Digital Output 1
2	/SO1- (/BK-)	General-purpose Digital Output 1
3	ALM+	Servo Alarm Output
4	ALM-	Servo Alarm Output
5	TH	Linear Servomotor Overheat Protection Input
6	+24VIN	Digital Input Signal Power Supply Input
7	/SI1 (P-OT)	General-purpose Digital Input 1
8	/SI2 (N-OT)	General-purpose Digital Input 2
9	/SI3 (/DEC)	General-purpose Digital Input 3
10	/SI4 (/EXT1)	External latch signal 1 input (General purpose input 4)
11	/SI5 (/EXT2)	General-purpose Digital Input 5
12	/SI6 (/EXT3)	General-purpose Digital Input 6
13	/SI0	General-purpose Digital Input 0
14	BAT+	Battery for Absolute Encoder (+)
15	BAT-	Battery for Absolute Encoder (-)
16	SG	Signal Ground
17	PAO	Encoder Divided Pulse Output, Phase A
18	/PAO	Encoder Divided Pulse Output, Phase A
19	PBO	Encoder Divided Pulse Output, Phase B
20	/PBO	Encoder Divided Pulse Output, Phase B
21	PCO	Encoder Divided Pulse Output, Phase C
22	/PCO	Encoder Divided Pulse Output, Phase C
23	/SO2+	General-purpose Digital Output 2
24	/SO2-	General-purpose Digital Output 2
25	/SO3+	General-purpose Digital Output 3
26	/SO3-	General-purpose Digital Output 3

4.3.2   400 V SERVOPACKS

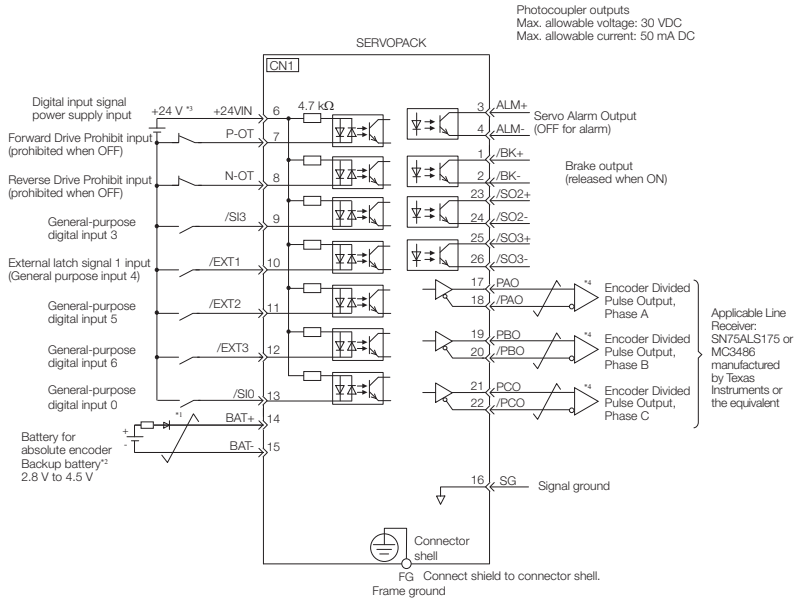The following figure gives the pin arrangement of the of the I/O signal connector (CN1) for the default settings.

Top View of I/O Signal Connector

Pin 15
Pin 30
Pin 2
Pin 17
Pin 1
Pin 16

Side View of I/O Signal Connector
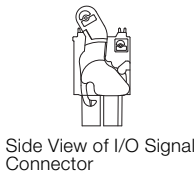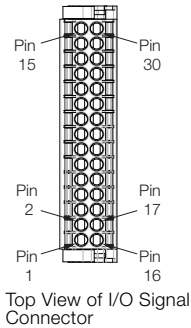
No	Signal	Specification	No	Signal	Specification
15	PG BAT-	Battery for absolute encoder (-)	30	/SO5-	General-purpose Digital Output 5
14	PG BAT+	Battery for absolute encoder (+)	29	/SO5+	General-purpose Digital Output 5
13	/SI0	General-purpose Digital Input 0	28	/SO4-	General-purpose Digital Output 4
12	/SI6 (/EXT3)	General-purpose Digital Input 6	27	/SO4+	General-purpose Digital Output 4
11	/SI5 (/EXT2)	General-purpose Digital Input 5	26	/SO3-	General-purpose Digital Output 3
10	/SI4 (/EXT1)	General-purpose Digital Input 4	25	/SO3+	General-purpose Digital Output 3
9	/SI3	General-purpose Digital Input 3	24	/SO2-	General-purpose Digital Output 2
8	/SI2 (N-OT)	General-purpose Digital Input 2	23	/SO2+	General-purpose Digital Output 2
7	/SI1 (P-OT)	General-purpose Digital Input 1	22	/PCO	Encoder divided pulse output, phase C
6	+24VIN	Digital input signal power supply input	21	PCO	Encoder divided pulse output, phase C
5	TH	Linear Servomotor overheat protection input	20	/PBO	Encoder divided pulse output, phase B
4	ALM-	Servo alarm output	19	PBO	Encoder divided pulse output, phase B
3	ALM+	Servo alarm output	18	/PAO	Encoder divided pulse output, phase A
2	/SO1- (/BK-)	General-purpose Digital Output 1	17	PAO	Encoder divided pulse output, phase A
1	/SO1+ (/BK+)	General-purpose Digital Output 1	16	SG	Signal ground

4.4 I/O Signal Wiring Examples

4.4.1   Using a Rotary Servo Motor

200 V SERVOPACKS

* 1.   ⏚ represents twisted-pair wires.
* 2.   Connect these when using an absolute encoder. If the Encoder Cable with a Battery Case is connected, do not connect a backup battery.
* 3.   The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.
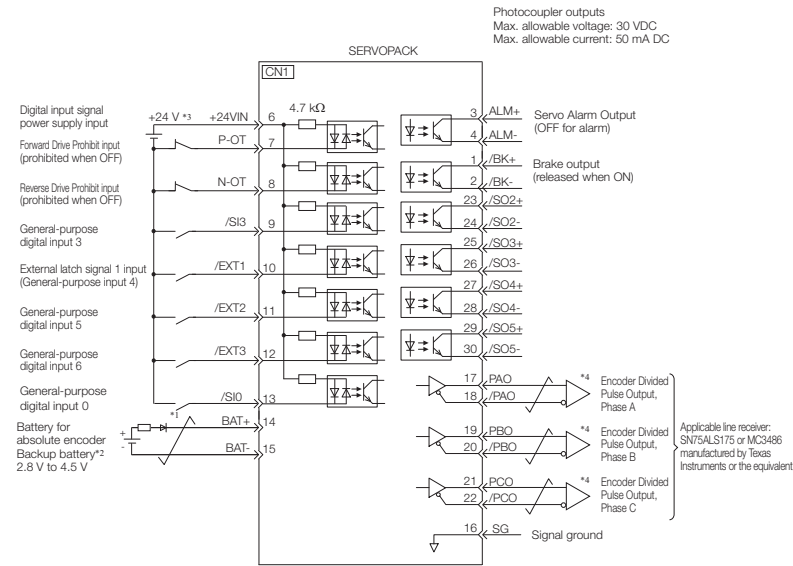* 4.   Always use line receivers to receive the output signals.
Note: 1. You can use parameters to change the functions allocated to the /SI0, /SI3, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, and /SO3 output signals.
       2. If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector.
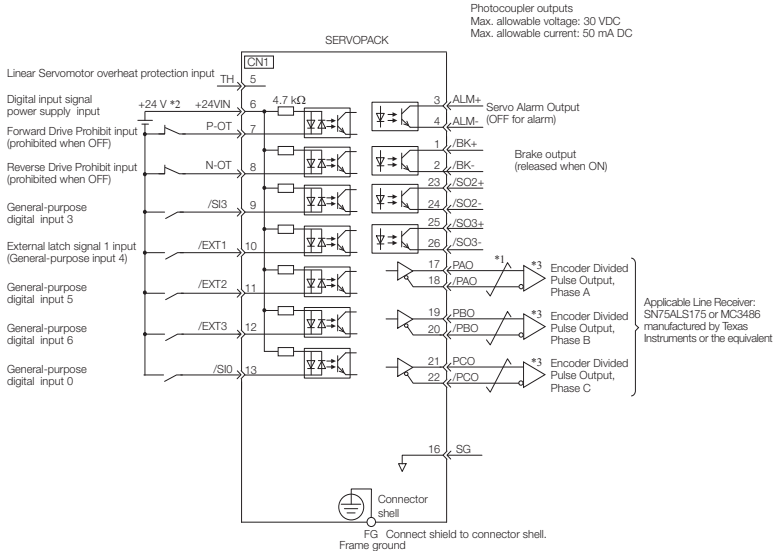   If the power supply is shared, the I/O signals may malfunction.

4.4.1 Using a Rotary Servo Motor

400 V SERVOPACKS

* 1. $\not\neq$ represents twisted-pair wires.
* 2. Connect these when using an absolute encoder. If the Encoder Cable with a Battery Case is connected, do not connect a backup battery.
* 3. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.
* 4. Always use line receivers to receive the output signals.

Note: 1. You can use parameters to change the functions allocated to the /SI0, /SI3, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, and /SO3 output signals.

2. If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.

4.4.2　Using a Linear Servo Motor

200 V SERVOPACKS

* 1. ⌁ represents twisted-pair wires.
* 2. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.
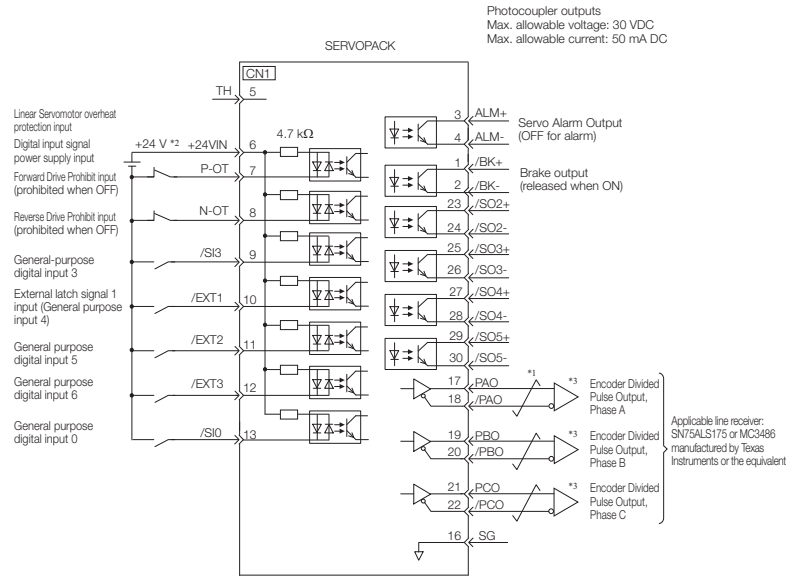* 3. Always use line receivers to receive the output signals.

Note:　1.　You can use parameters to change the functions allocated to the /SI0, /SI3, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, and /SO3 output signals.
　　　　2.　If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector.
　　　　　　If the power supply is shared, the I/O signals may malfunction.

4.4.2 Using a Linear Servo Motor

400 V SERVOPACKS

* 1. $\overline{\diagup}$ represents twisted-pair wires.
* 2. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.
* 3. Always use line receivers to receive the output signals.

Note: 1. You can use parameters to change the functions allocated to the /SI0, /SI3, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, and /SO3 output signals.
2. If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector.
If the power supply is shared, the I/O signals may malfunction.

4.5   I/O Circuits
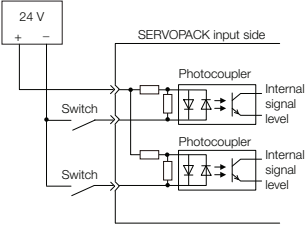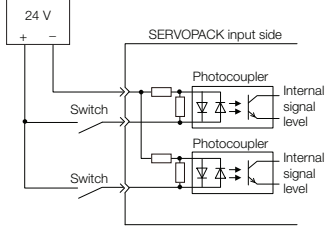
4.5.1   Digital Input Circuits

◆ **Photocoupler Input Circuits**
This section describes CN1 connector terminals 6 to 13.

Examples for Relay Circuits	Examples for Open-Collector Circuits
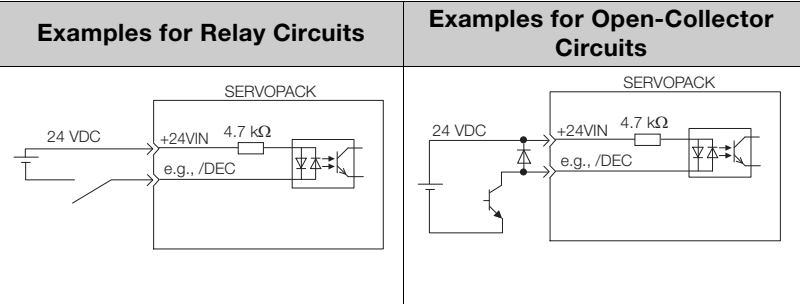
Note: The 24-VDC external power supply capacity must be 50 mA minimum.

The SERVOPACK input circuits use bi-directional photocouplers. Select either a sink circuit or source circuit according to the specifications required by the machine.

Note: The connection examples in 4.4 I/O Signal Wiring Examples are for sink circuit connections.

Sink Circuits	Source Circuits

| Input Signal Polarity		Input Signal Polarity	
Photocoupler	Internal Signal Level	Photocoupler	Internal Signal Level
ON	Low level	ON	Low level
OFF	High level	OFF	High level

4.5.2 Digital Output Circuits

> Incorrect wiring or incorrect voltage application to the output circuits
> may cause short-circuit failures.
> If a short-circuit failure occurs as a result of any of these causes, the
> holding brake will not work. This could damage the machine or cause
> an accident that may result in death or injury.
>
> **Important**

◆ Photocoupler Output Circuits

Photocoupler output circuits are used for the ALM (Servo Alarm), /S-RDY (Servo
Ready), and other digital output signals. Connect a photocoupler output circuit to a
relay or line-receiver circuit.

| Example for Relay Circuit	Example for Line-Receiver Circuit
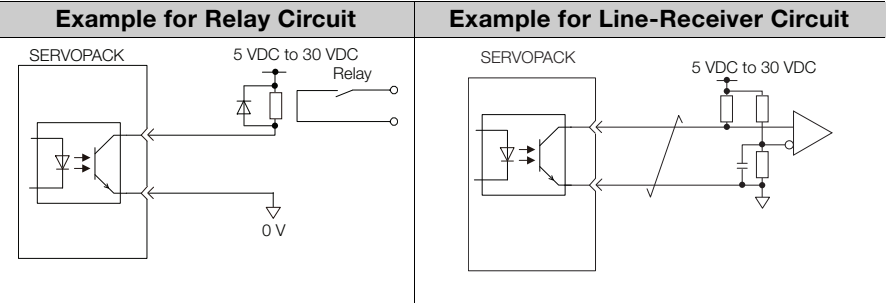
Note: The maximum allowable voltage and current range for photocoupler output circuits are
as follows:
- Maximum allowable voltage: 30 VDC
- Current range: 5 mA to 50 mA DC

◆ Line-Driver Output Circuits

This section describes CN1 connector terminals 17-18 (Phase-A Signal), 19-20
(Phase-B Signal), and 21-22 (Phase-C Signal).

The serial data from the encoder is converted to two-phase (phases A and B)
pulses. The resulting output signals (PAO, /PAO and PBO, /PBO) and origin pulse
signal (PCO and /PCO) are output with line-driver output circuits. Connect the line-
driver output circuits to line-receiver circuits at the host controller.

Example for Line-Receiver Circuit
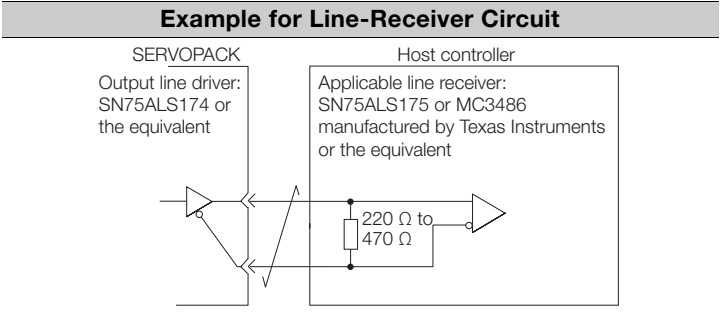
5   LED Outputs

The following indicators show the operating status of the servo controller and error information.

ERR:

- Solid at power up
- Off when there is no error
- Solid when there is an alarm
- Blinking when there is a critical error

RUN:

- Solid when internal logic controller is booted and ready
- Blinking when internal logic controller is running a program

Ethernet Link/Activity:

- Off when CN6A/B does not have an active Ethernet connection
- Solid when CN6A/B has an active Ethernet connection
- Blinking when CN6A/B is transmitting or receiving data

6   Ethernet Connectivity

The SigmaLogic7 Compact supports both 100 Mbps/100Base-TX and 10 Mbps/10Base-T connections. One single network is accessed using both CN6A and CN6B. The same IP address is set for both ports. The Ethernet address (MAC address) can be found on the nameplate.

6.1   Ethernet Connector Details

Ethernet Connector Specification and Pin Array

The following table provides the Ethernet connector specifications.

Connector Name	Number of Pins	Connector Model		
		Module Side	Cable Side	Manufacturer
Ethernet	8	RJ-45 CAT5 Socket	RJ-45 CAT5 Plug	TE Connectivity

The following table provides Ethernet connector pin array details.

Ethernet

Pin Number	Signal Name	Description
1	TXD+	Transmitted data + side
2	TXD-	Transmitted data – side
3	RXD+	Received data + side
4	–	–
5	–	–
6	RXD-	Received data – side
7	–	–
8	–	–

6.2   Ethernet Cable

For the Ethernet cable, use a twisted pair cable with RJ-45
connector. Yaskawa strongly recommends the use of shielded
ethernet cables (Yaskawa model JZSP-CM3RRM0-xx-E).   Ethernet
ports are capable of auto-crossover, so crossover cables are not
necessary.

6.3   Ethernet Connection Examples
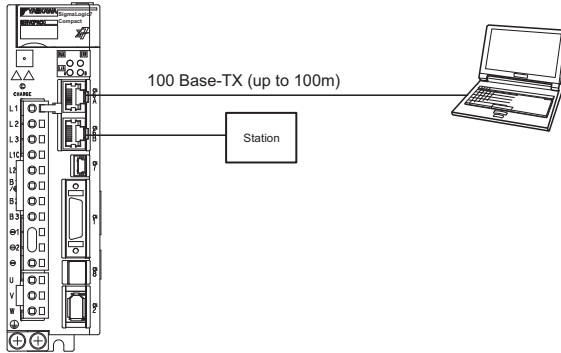
Connection Example 1 (When using a Repeater Hub)

SigmaLogic7 Compact
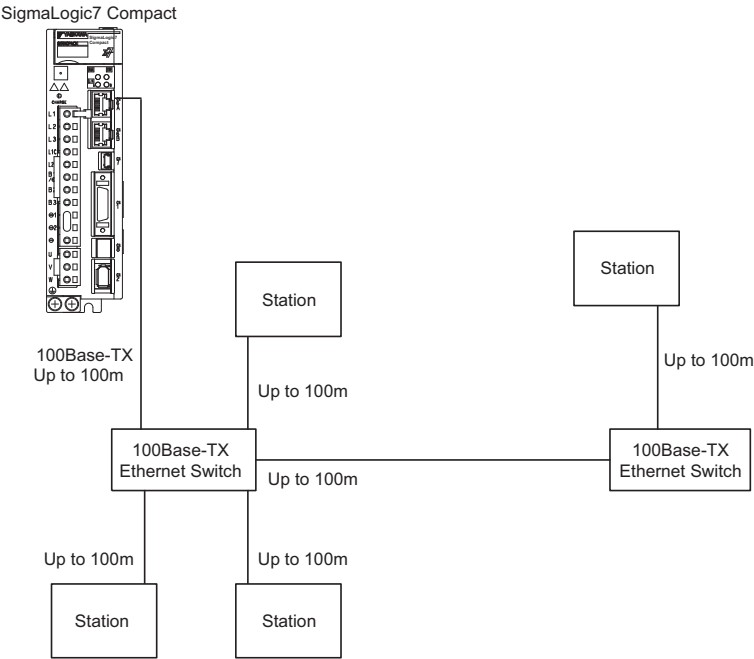
Specification

Cable length from node to Ethernet hub or switch	100 m or less
Cable length between Ethernet hubs or switches	100 m or less
Number of Ethernet hubs or switches between nodes	Unlimited

Connection Example 2
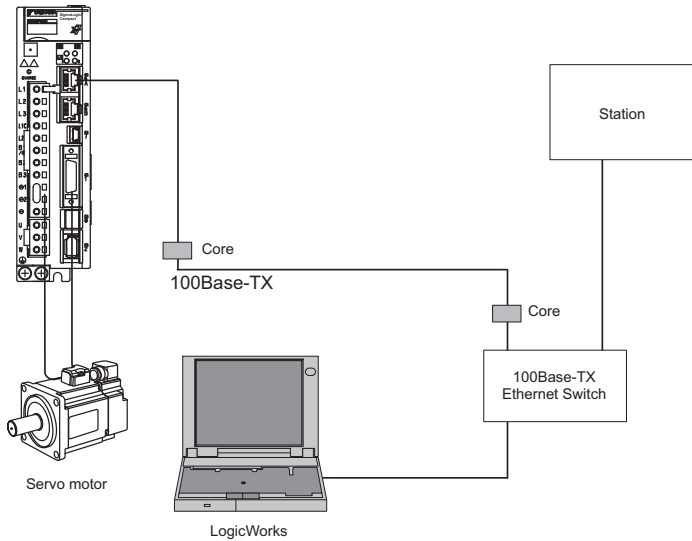
SigmaLogic7 Compact

100 Base-TX (up to 100m)

Station

Connection Example 3

SigmaLogic7 Compact

Station

Core

100Base-TX

Core

100Base-TX
Ethernet Switch

Servo motor

LogicWorks

■ Caution

Electromagnetic interference (EMI) may interfere with Ethernet communication. The following measures can help minimize the influence of EMI:

1. Locate Ethernet cables so that they are well-separated from power cables or other sources of EMI
2. Yaskawa strongly recommends the use of high-quality shielded Ethernet cables such as JZSP-CM3RRM0-xx-E
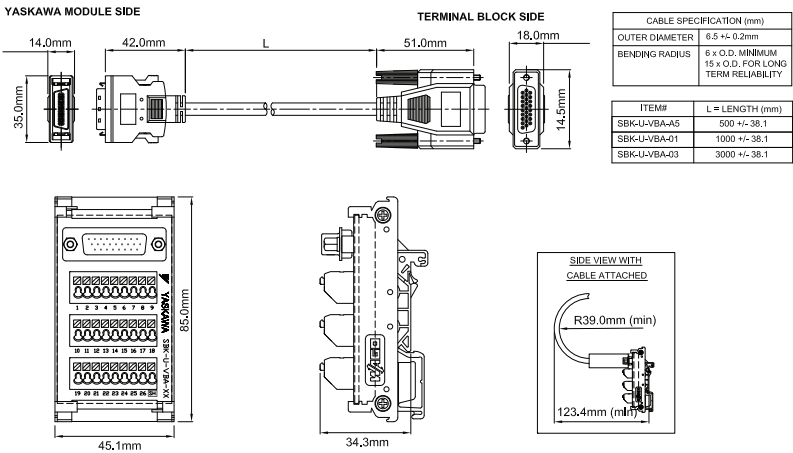3. Attach ferrite cores to Ethernet cables that are subjected to EMI

Recommended ferrite core:

Model	Manufacturer
E04SR301334	Seiwa Electric Mfg. Co., Ltd

7   Cable Diagrams

7.1   SBK-U-VBA-xx (200 V Only)

Terminal Block - CN1 I/O.

SBK-U-VBA-xx Function Chart for Sigma-5 or Sigma-7 Servo Amplifier

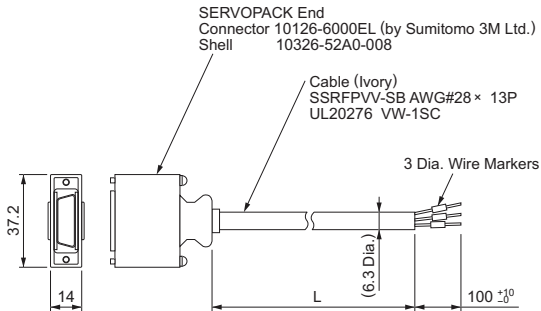| Pin No.	Mechatrolink-II type Servo Amplifier / Option type	
	Signal	**Function**
1	/BK+ (/SO1+)	Brake interlock output (+) (General purpose output 1 (+))
2	/BK- (/SO1-)	Brake interlock output (-) (General purpose output 1 (-))
3	ALM+	Servo alarm output (+)
4	ALM-	Servo alarm output (-)
5	-	
6	+24VIN	Control power supply for digital signal input
7	P-OT (/SI1)	Forward run prohibited input (General purpose input 1)
8	N-OT (/SI2)	Reverse run prohibited input (General purpose input 2)
9	/DEC (/SI3)	Zero-point return deceleration switch input (General purpose input 3)
10	/EXT1 (/SI4)	External latch signal 1 input (General purpose input 4)
11	/EXT2 (/SI5)	External latch signal 2 input (General purpose input 5)
12	/EXT3 (/SI6)	External latch signal 3 input (General purpose input 6)
13	/SI0	General purpose input 0
14	BAT (+)	Battery (+) input
15	BAT (-)	Battery (-) input
16	SG	Signal ground
17	PAO	Phase-A pulse output (+)
18	/PAO	Phase-A pulse output (-)
19	PBO	Phase-B pulse output (+)
20	/PBO	Phase-B pulse output (-)
21	PCO	Phase-C pulse output (+)
22	/PCO	Phase-C pulse output (-)
23	/SO2+	General purpose output 2 (+)
24	/SO2-	General purpose output 2 (-)
25	/SO3+	General purpose output 3 (+)
26	/SO3-	General purpose output 3 (-)

Note: General purpose input and output signals are shown with their default signals assigned - signal assignment may have been changed by parameter

7.2   JZSP-CSI02-x-E (200 V Only)

Flying Lead - CN1 I/O.

SERVOPACK End
Connector 10126-6000EL (by Sumitomo 3M Ltd.)
Shell   10326-52A0-008

Cable (Ivory)
SSRFPVV-SB AWG#28 × 13P
UL20276 VW-1SC

3 Dia. Wire Markers

37.2

14

L

(6.3 Dia.)

100 $^{+10}_{0}$

Dimensions in mm

Model	Cable Length
JZSP-CSI02-1-E	1000 mm
JZSP-CSI02-2-E	2000 mm
JZSP-CSI02-3-E	3000 mm

Host
Controller End

SERVOPACK End

Pin No.	Signal	Wire Color	Marking Color	Marking Dots	Lead Marker
1	/BK+	Blue	Red	1	1
2	/BK−	Blue	Black	1	2
3	ALM+	Pink	Red	1	3
4	ALM−	Pink	Black	1	4
5	−	Green	Red	1	5
6	+24VIN	Green	Black	1	6
7	P-OT	Orange	Red	1	7
8	N-OT	Orange	Black	1	8
9	/DEC	Gray	Red	1	9
10	/EXT1	Gray	Black	1	10
11	/EXT2	Blue	Red	2	11
12	/EXT3	Blue	Black	2	12
13	/SI0	Pink	Red	2	13
14	BAT (+)	Pink	Black	2	14
15	BAT (−)	Green	Red	2	15
16	SG	Green	Black	2	16
17	PAO	Orange	Red	2	17
18	/PAO	Orange	Black	2	18
19	PBO	Gray	Red	2	19
20	/PBO	Gray	Black	2	20
21	PCO	Blue	Red	3	21
22	/PCO	Blue	Black	3	22
23	/SO2+	Pink	Red	3	23
24	/SO2−	Pink	Black	3	24
25	/SO3+	Green	Red	3	25
26	/SO3−	Green	Black	3	26

: Represents twisted-pair wires.

8 EMC Installation Conditions

This section gives the installation conditions that were used for EMC certification testing.

The EMC installation conditions that are given here are the conditions that were used to pass testing criteria at Yaskawa. The EMC level may change under other conditions, such as the actual installation structure and wiring conditions. These Yaskawa products are designed to be built into equipment. Therefore, you must implement EMC measures and confirm compliance for the final equipment.

The applicable standards are EN 55011 group 1 class A, EN 61000-6-2, EN 61000-6-4, and EN 61800-3 (category C2, second environment).

- **Three-Phase, 200 VAC**
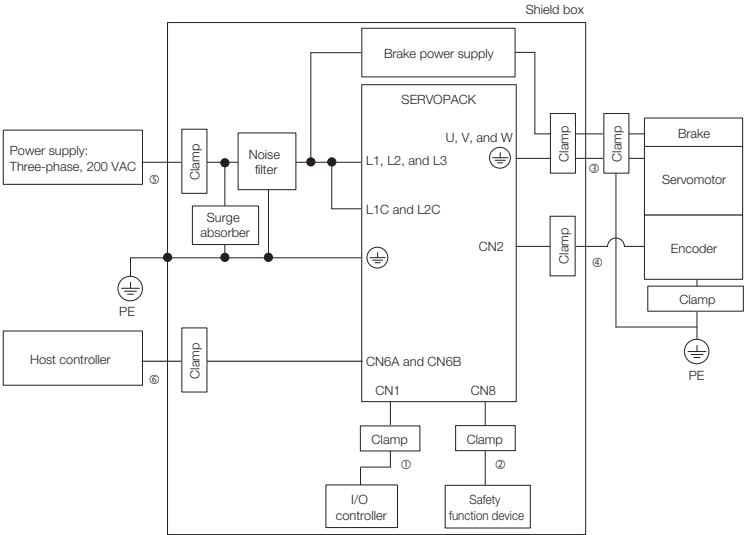
Symbol	Cable Name	Specification
①	I/O Signal Cable	Shielded cable
②	Safety Function Device Cable	Shielded cable
③	Servomotor Main Circuit Cable	Shielded cable
④	Encoder Cable	Shielded cable
⑤	Main Circuit Power Cable	Shielded cable
⑥	Ethernet Communications Cable	Shielded cable

• Single-Phase, 200 VAC
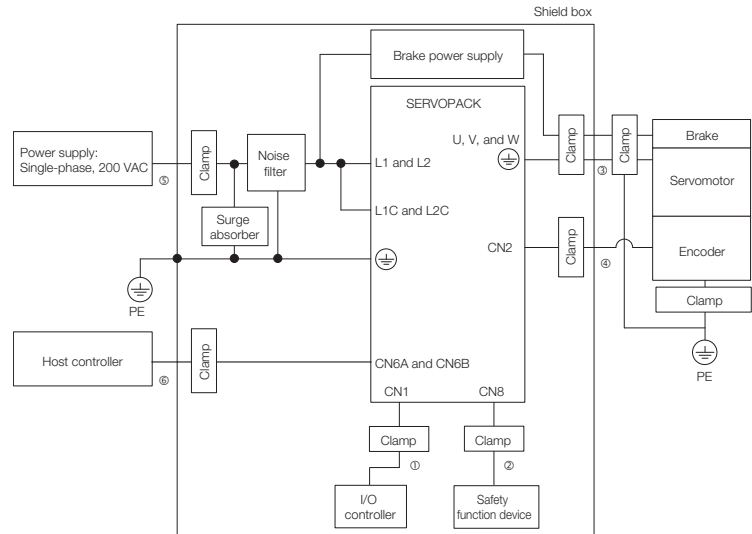
Symbol	Cable Name	Specification
①	I/O Signal Cable	Shielded cable
②	Safety Function Device Cable	Shielded cable
③	Servomotor Main Circuit Cable	Shielded cable
④	Encoder Cable	Shielded cable
⑤	Main Circuit Power Cable	Shielded cable
⑥	Ethernet Communications Cable	Shielded cable

• Single-Phase, 100 VAC
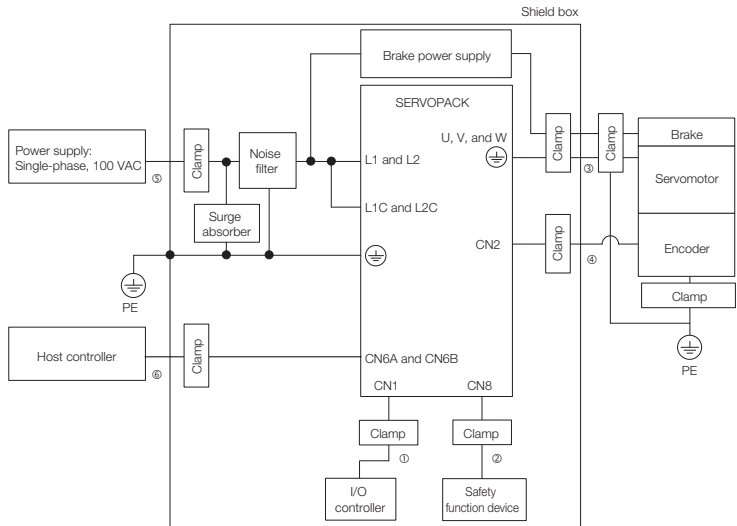
Symbol	Cable Name	Specification
①	I/O Signal Cable	Shielded cable
②	Safety Function Device Cable	Shielded cable
③	Servomotor Main Circuit Cable	Shielded cable
④	Encoder Cable	Shielded cable
⑤	Main Circuit Power Cable	Shielded cable
⑥	Ethernet Communications Cable	Shielded cable

• Three-Phase, 400 VAC
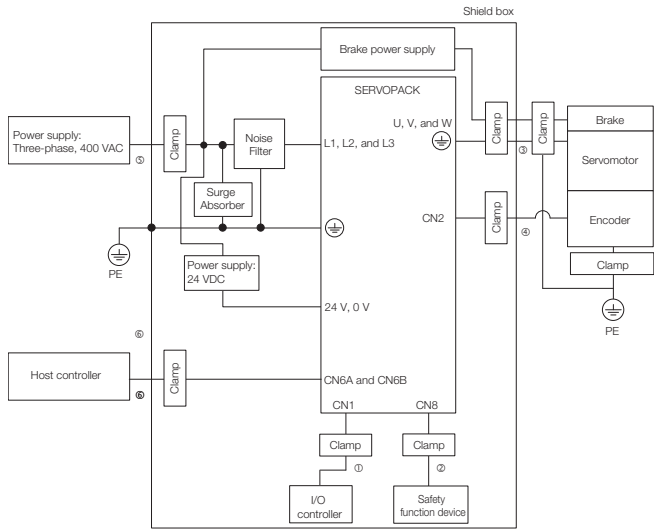
Symbol	Cable Name	Specification
①	I/O Signal Cable	Shielded cable
②	Safety Function Device Cable	Shielded cable
③	Servomotor Main Circuit Cable	Shielded cable
④	Encoder Cable	Shielded cable
⑤	Main Circuit Power Supply Cable	Shielded cable
⑥	Ethernet Communications Cable	Shielded cable

YASKAWA