

General Specifications

Turbomachinery I/O Modules



GS 34P02Q33-01E

■ GENERAL

This document contains hardware specifications of the servo module and high-speed protection module specifically designed for FCN autonomous controllers to implement turbomachinery controller functions.

As for turbomachinery controller functions, refer to Turbomachinery Controller Overview, GS 34P02Q04-01E. For hardware and software specifications of the FCN, refer to FCN Autonomous Controller Hardware, GS 34P02Q12-01E and FCN Autonomous Controller Functions, GS 34P02Q01-01E, respectively.

■ STANDARD SPECIFICATIONS

● Servo Modules (Isolated)

The servo module has DC current outputs (up to ± 50 mA) to control servo valves while receiving linear variable differential transformer (LVDT) signals or 1–5 V DC standardized signals as the position feedback signals. It can perform a quick valve shutoff action in response to a 24 V DC digital input.

Item		Specification		
Model		NFGS813		
Analog inputs	Number of input channels	4, isolated		
	LVDT inputs	Wiring type	3 wires, 5 wires or 6 wires (*1)	
		Excitation voltage	5 Vrms at 30 mArms (*2)	
		Excitation current	Max. 30 mArms	
		Excitation frequency	2.8, 3.0, 3.2 kHz; selectable (independently)	
		Accuracy	$\pm 1\%$ (*3)	
		Drift due to ambient temperature change	$\pm 0.04\%/^{\circ}\text{C}$	
		Input impedance	Powered: 220 k Ω , not powered: 100 k Ω	
		Allowable input voltage	± 30 Vpeak	
		External power supply	+11.4 to +13.2 V, 0.3 A (*2)	-13.2 to -11.4 V, 0.3 A (*2)
	Filtering	Collectively		
	Voltage inputs	Input signal	1 to 5 V	
		Accuracy	± 4 mV	
		Drift due to ambient temperature change	± 0.4 mV/ $^{\circ}\text{C}$	
		Input impedance	Powered: 1 M Ω , not powered: 100 k Ω	
		Allowable input voltage	30 V DC	
		Filtering	Collectively	
Current outputs	Number of output channels	2, isolated		
	Output signal	± 25 mA or ± 50 mA, selectable (independently)		
	Accuracy	± 150 μA or ± 300 μA		
	Drift due to ambient temperature change	± 5 $\mu\text{A}/^{\circ}\text{C}$ or ± 10 $\mu\text{A}/^{\circ}\text{C}$		
	Allowable load resistance	270 Ω at ± 25 mA, 100 Ω at ± 50 mA		
	Circuit-open detection	Available		
	External power supply	+11.4 to +13.2 V, 0.3 A	-13.2 to -11.4 V, 0.3 A	
	Dither	0 to $\pm 20\%$ of the range at 33 Hz		
Digital inputs	Number of input channels	2, isolated		
	Rated input voltage	24 V DC (sink)		
	Input ON voltage	18 to 26.4 V DC		
	Input OFF voltage	5 V DC or less		
	Input current	4.1 mA $\pm 20\%$		
	Maximum allowable input voltage	30 V DC		
Scan cycle	5 ms			
Withstanding voltage	Between system and field: 500 V AC for 1 minute Between inputs/outputs of different types: 500 V AC for 1 minute			
External connection	Dedicated cable (AKB337-M001, M002, M003, M005, M007 or M010)			
Maximum power consumption	500 mA (5 V DC)			
Weight	0.36 kg			

*1: Connect the external power supply and corresponding LVDT to the same channel.

*2: The excitation voltage is adjustable between 4 to 7 Vrms; however, when setting it to a level higher than 5 Vrms, the external power supply voltage (for excitation) must be +14 to 16 V or -16 to -14 V.

*3: Under the condition that the input voltage falls within 0.7 - 5 Vrms and minimum span is set to 2.5 Vrms.

● High Speed Protection Module (Isolated)

The high-speed protection module inputs the pressures or rotating speeds of turbines, and outputs interlock signals. The on-board logic running in the module enables high-speed output of the interlock signals.

Item		Specification	
Model		NFGP813	
Voltage inputs	Number of input channels	4 channels at fast scan; isolated 6 channels at standard scan; isolated	
	Input signal	1 to 5 V	
	Accuracy	±4 mV	
	Drift due to ambient temperature change	±0.4 mV/°C	
	Input impedance	Powered: 1 MΩ, Not powered: 100 kΩ	
	Allowable input voltage	30 V DC	
	Filtering	Collectively	
Pulse inputs	Number of input channels	4 channels at standard scan; isolated	
	Input impedance	10 kΩ (at the terminals on the AEGP1D)	
	Magnetic pickup (MPU)	Input signal	0.5 to 150 Vpp
		Input frequency	50 Hz to 25 kHz
		Accuracy	±1 Hz (50 Hz to 2 kHz) ±0.05% of reading (2 kHz to 25 kHz)
		Input sensitivity	Without hysteresis 50 to 500 Hz: 0.5 Vpp or more 500 Hz to 5 kHz: 1.0 Vpp or more 5 to 25 kHz: 2.0 Vpp or more With Hysteresis 50 to 500 Hz: 1.0 Vpp or more 500 Hz to 5 kHz: 2.0 Vpp or more 5 to 25 kHz: 4.0 Vpp or more
	Active pickup	Input signal	When TYPE1 is selected for the threshold: V _H : 2.0 to 24 V V _L : 0 to 0.8 V Duty: 50% ± 5%
When TYPE2 is selected for the threshold: V _H : 2.4 to 24 V V _L : 0 to 1.2 V Duty: 50% ± 5%			
Input frequency		0.04 Hz to 2 kHz	
Accuracy	±0.1% of reading		
Digital inputs	Number of input channels	4 channels at fast scan, isolated 8 channels at standard scan, isolated	
	Rated input voltage	24 V DC (sink)	
	Input ON voltage	18 to 26.4 V DC	
	Input OFF voltage	5 V DC or less	
	Input current	4.1 mA ±20%	
	Maximum allowable input voltage	30 V DC	
Digital outputs	Number of output channels	4 channels at fast scan, isolated 8 channels at standard scan, isolated	
	Output type	Current sinking	
	Maximum load (*1)	100 mA / channel, 30 V DC	
	Maximum voltage for on	0.3 V DC (*2)	
	Maximum current leak for off	0.1 mA	
	On/off delay	1 ms (typical)	
Scan cycle	5 ms at fast scan 10 ms at standard scan		
Withstanding voltage	Between system and field: 500 V AC for 1 minute Between inputs/outputs of different types: 500 V AC for 1 minute		
External connection	Dedicated cable (AKB337-M001, M002, M003, M005, M007 or M010)		
Maximum power consumption	900 mA (5 V DC)		
Weight	0.28 kg		

*1: If the load is inductive such as a DC relay, connect a spark killer across the switch to diminish the spark discharge.

*2: Assume extra 0.22 V per each meter of the cable length.

● **Terminal Board**

The servo and high-speed protection modules require the following terminal boards and cables for use:

Model	Application	Number of Channels	Module Connected	Cable Connected	Weight	Specification
AEGS1D	Servo control	LVDT inputs: 4 (*1) Voltage inputs: 4 Current outputs: 2 Digital inputs: 2	NFGS813 (single or redundant)	AKB337-M001, M002, M003, M005, M007, or M010	2.0 kg	Insulation resistance: 10 MΩ or more at 500 V DC Withstanding voltage: 500 V AC for 1 minute (between inputs/outputs and case, and between inputs/outputs of different types)
AEGP1D	High-speed protection	Voltage inputs: 4 or 6 Pulse inputs: 0 or 4 (*2) (*3) Digital inputs: 4 or 8 Digital outputs: 4 or 8	NFGP813 (single or redundant)	AKB8337-M001, M002, M003, M005, M007, or M010	2.0 kg	

1: When connecting a 3-wire LVDT, install shorting bars across terminals A and C, and across terminals B and D.

* Shorting bars (part No. T9084CH): 8 included in standard accessories

*2: Connect the shield of the magnetic or active pickup to terminal SHLD for each pulse input.

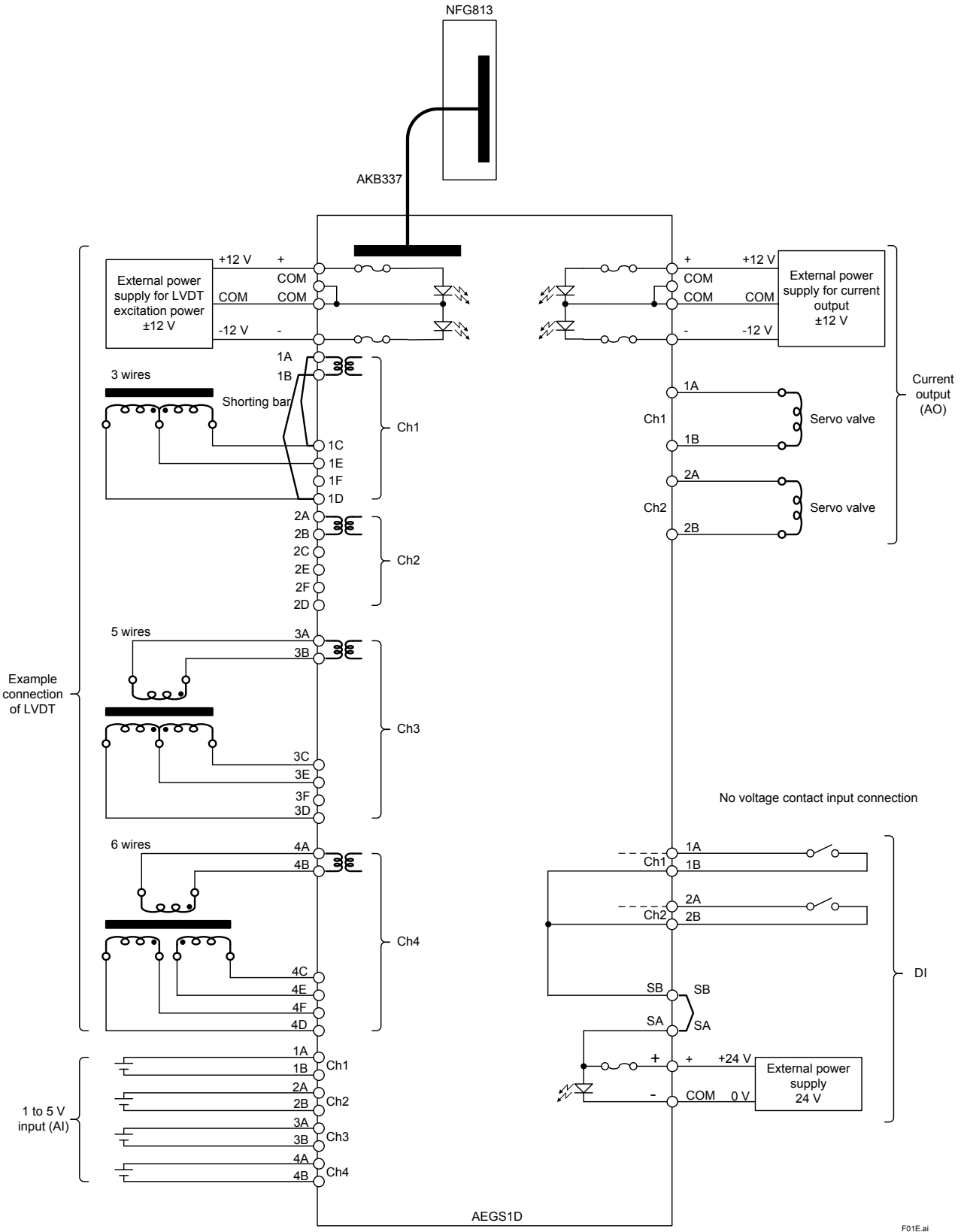
*3: When connecting an active pickup with external power supply, install shorting bars across COM and Terminal C of the channel to which external power supply is to be connected. Do not connect a shorting bar to Terminal C of an unused channel.

Shorting bars for terminals COM-C of channel 4 (part No. T9084CH): 1 in standard accessories

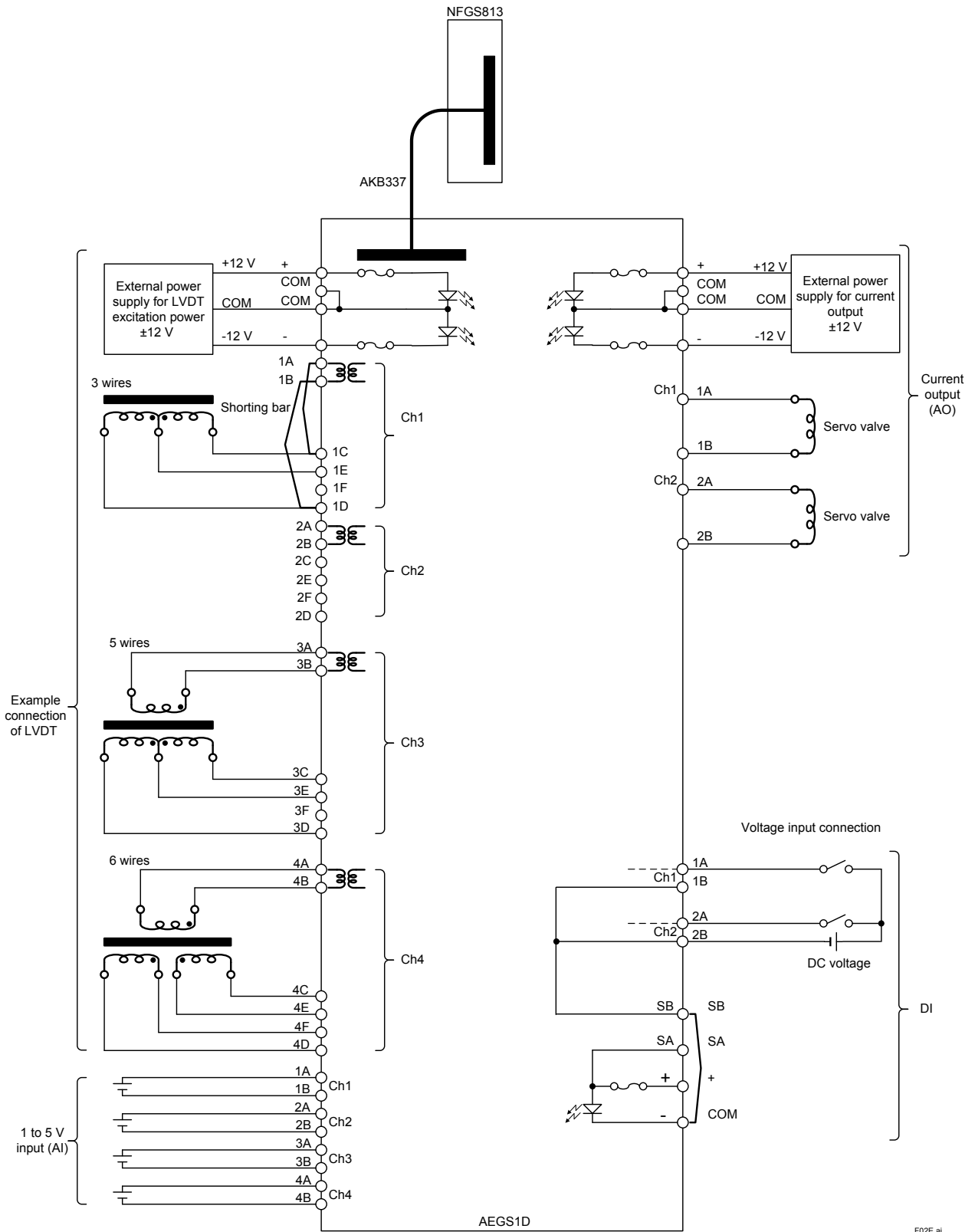
Shorting bars for terminals C of channels 1 to 3 (part No. T9084CJ): 3 in standard accessories

● CONNECTION

1. Example Connection for AEGS1D (No-voltage Contact Inputs Connection)

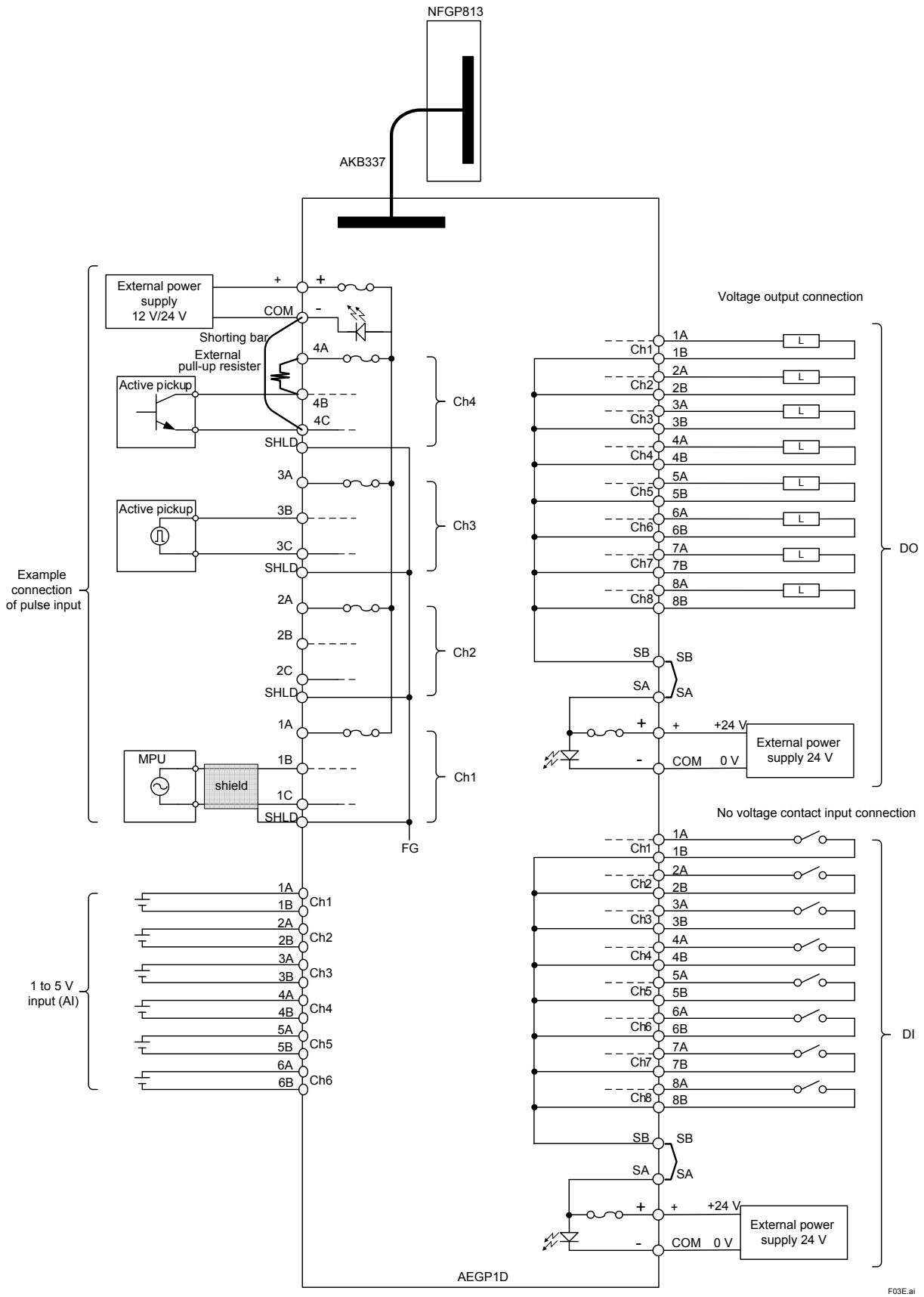


2 Example Connection for AEGS1D (Voltage Inputs Connection)



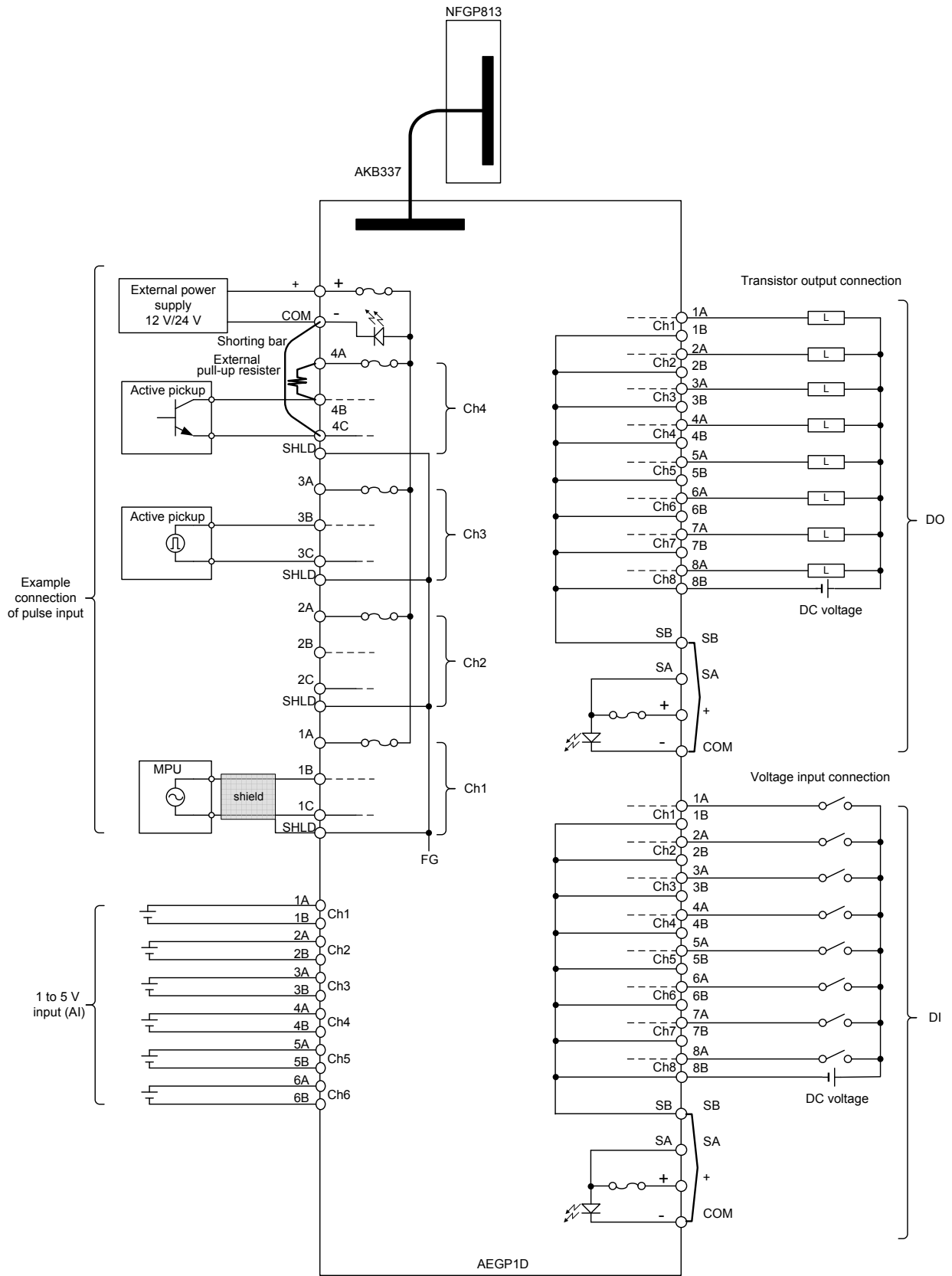
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3 Example Connection for AEGP1D (No-voltage Contact Inputs Connection)



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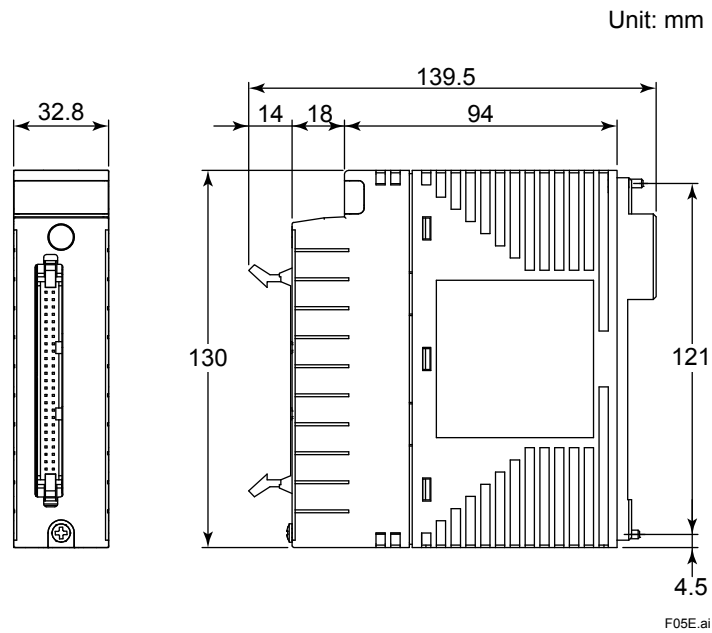
4 Example Connection for AEGP1D (Voltage Inputs Connection)



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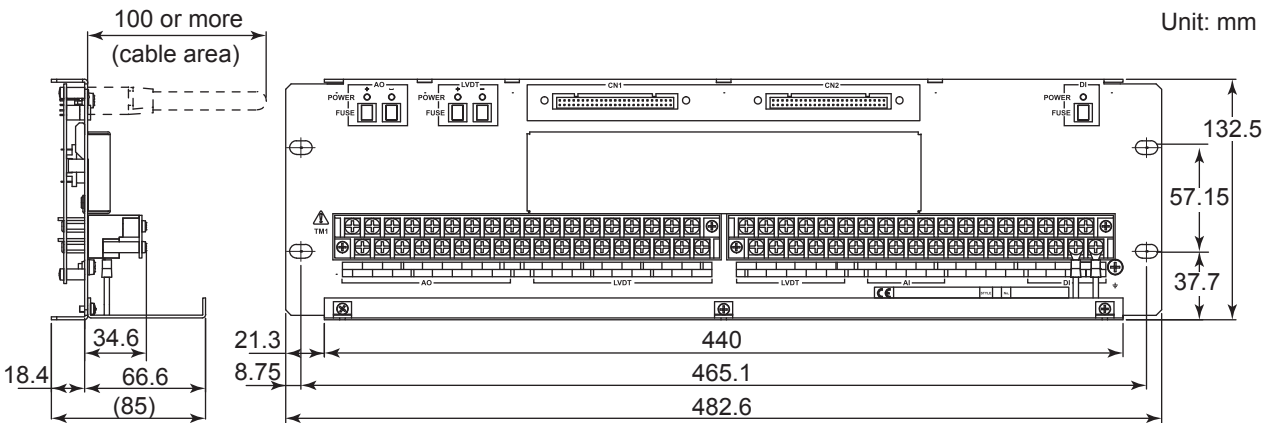
EXTERNAL DIMENSIONS

● NFGS813, NFGP813 I/O Module



● Terminal Boards

AEGS1D



Left side terminal block

1A	NC	NC	2A	NC	NC	+	COM	NC	1A	1C	1E	2A	2C	2E	3A	3C	3E	
	1B	NC	NC	2B	NC	NC	COM	-	NC	1B	1D	1F	2B	2D	2F	3B	3D	3F
AO									LVDT									

Right side terminal block

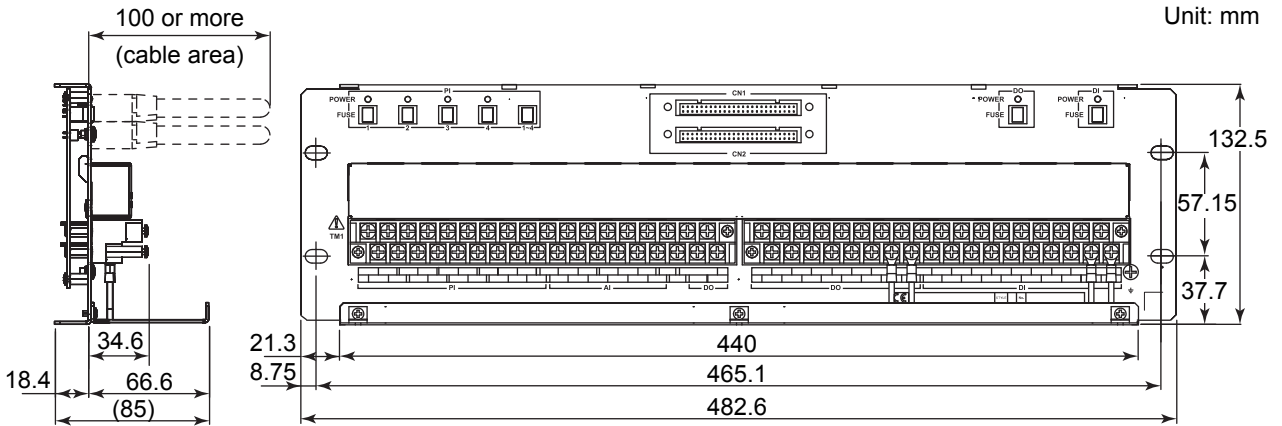
4A	4C	4E	+	COM	NC	1A	2A	3A	4A	NC	NC	NC	NC	1A	2A	SA	+	
	4B	4D	4F	COM	-	NC	1B	2B	3B	4B	NC	NC	NC	NC	1B	2B	SB	COM
LVDT					AI					DI								

NC: Not connected.

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AEGP1D

Unit: mm



Left side terminal block

1A	1B	2A	2B	3A	3B	4A	4B	+	1A	2A	3A	4A	5A	6A	NC	1A	2A
SHLD	1C	SHLD	2C	SHLD	3C	SHLD	4C	COM	1B	2B	3B	4B	5B	6B	NC	1B	2B
PI									AI						DO		

Right side terminal block

3A	4A	5A	6A	7A	8A	SA	+	1A	2A	3A	4A	5A	6A	7A	8A	SA	+
3B	4B	5B	6B	7B	8B	SB	COM	1B	2B	3B	4B	5B	6B	7B	8B	SB	COM
DO								DI									

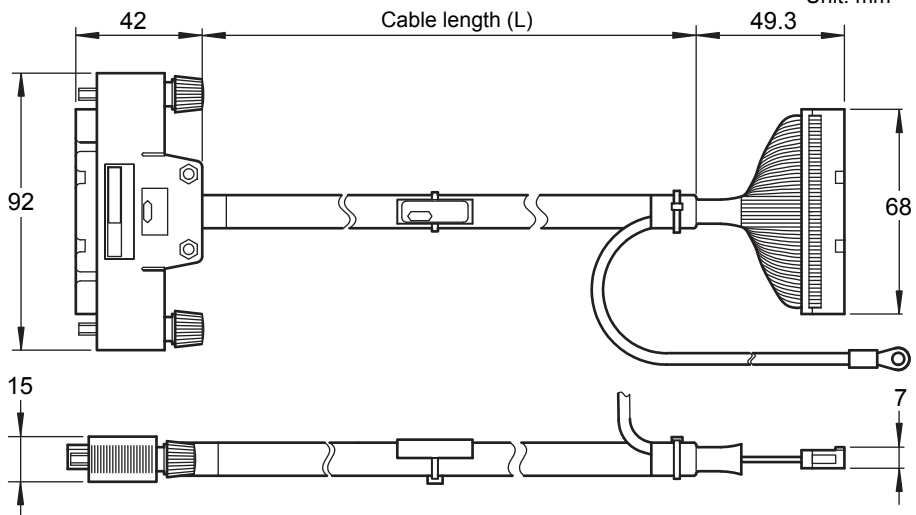
NC: Not connected.

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● **Cable**

AKB337

Unit: mm



L= 1, 2, 3, 5, 7, or 10 m

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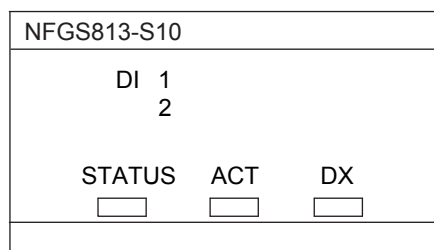
■ LED DISPLAYS

● Status Indicators

LED Indicators	color	Description
STATUS	Green	Lights when diagnosis successfully completed and the module is ready
ACT	Green	Lights when the module is running normally
DX	-	Not used

● Individual Channels' Status Indicators (NFGS813)

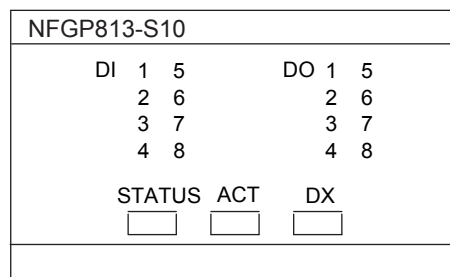
LED Indicators	color	Description
DI 1 and 2	Green	Lights when the corresponding contact input is ON



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● Individual Channels' Status Indicators (NFGP813)

LED Indicators	color	Description
DI 1 to 8	Green	Lights when the corresponding contact input is ON
DO 1 to 8	Green	Lights when the corresponding contact output is ON



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■ MODEL AND SUFFIX CODES

● I/O Modules

		Description
Model	NFGS813	Servo Module (Isolated)
Suffix Codes	-S	Standard type
	1	Always 1
	0	Basic type
	1	With ISA Standard G3 option

		Description
Model	NFGP813	High Speed Protection Module (Isolated)
Suffix Codes	-S	Standard type
	1	Always 1
	0	Basic type
	1	With ISA Standard G3 option

● Terminal Boards

		Description
Model	AEGS1D	Terminal Board for Servo Module
Suffix Codes	-0	Always 0
	0	Basic type
	1	With ISA Standard G3 option

		Description
Model	AEGP1D	Terminal Board for High Speed Protection Module
Suffix Codes	-0	Always 0
	0	Basic type
	1	With ISA Standard G3 option

● Cable

		Description
Model	AKB337	Signal cable (50-50 pins)
Suffix Codes	-M001	Cable length 1 m
	-M002	Cable length 2 m
	-M003	Cable length 3 m
	-M005	Cable length 5 m
	-M007	Cable length 7 m
	-M010	Cable length 10 m

■ RESTRICTIONS AND PRECAUTIONS ON INSTALLATION

- When you install these I/O modules, ensure that the total required power does not exceed the rated output of the power supply module used.
- Up to eight servo and high-speed protection modules in total can be installed in each FCN.
- For further restrictions and precautions for module installation, see Installation Guide for FCN/FCJ Autonomous Controllers, TI 34P02Q91-01E.

■ ORDERING INFORMATION

When placing an order, the models and suffix codes must be correctly specified.

■ TRADEMARKS

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