

■ GENERAL

The FIO (Fieldnetwork I/O) System is connected to the Field Control Unit (FCU) via an ESB, optical ESB, or ER bus.

The Field Control Unit (AFV30□/AFV40□) is connected to an ESB Bus Node Unit (ANB10□) or an Optical ESB Bus Node Unit (ANB11□).

A node unit consists of a power supply module, a bus interface module, and input/output modules that are installed in a base unit. The power supply module, bus interface module, and input/output modules can be configured redundantly.

The Unit for Optical ESB Bus Repeater Module (ANT10U) can be used to connect the optical ESB bus in a chain or star configuration.

The following shows a system configuration example.

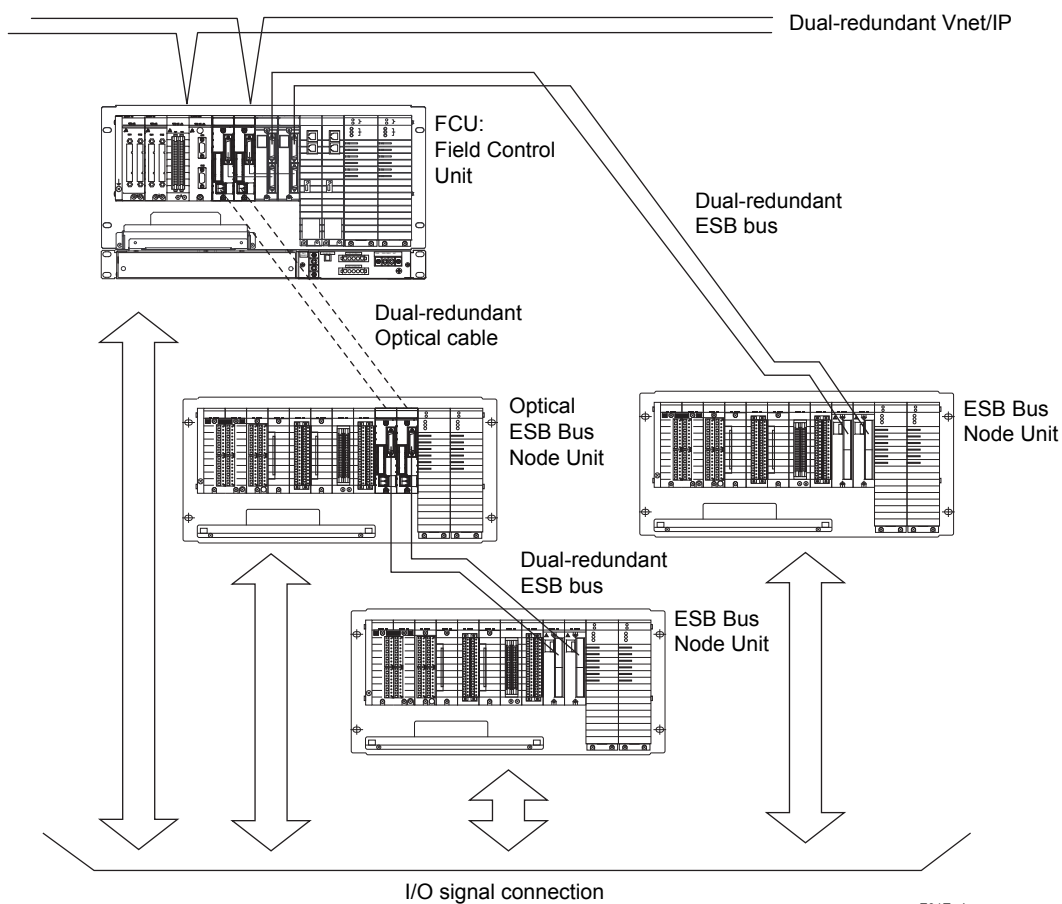


Figure System Configuration

■ COMMON SPECIFICATIONS

● Installation Environment

Item		Specification
Ambient temperature	Normal operating	0 to 50 °C (AFV30□, AFV40□, ACB51) 0 to 60 °C (ANB10□, ANB11□, ANT10U, I/O Modules, Communication Modules, and Bus Interface Modules) (*1) (-20 to 70 °C temperature option for ANB10□, ANB11□, ANT10U, I/O Modules, Communication Modules, and Bus Interface Modules) (*1) (*2)
	Transporting/storing	-20 to 60 °C (avoid direct sunlight.) (-40 to 85 °C temperature option for ANB10□, ANB11□, ANT10U, I/O Modules, Communication Modules, and Bus Interface Modules, avoid direct sunlight)
Ambient humidity	Normal operating	5 to 95 %RH (should have no condensation.)
	Transporting/storing	5 to 95 %RH (should have no condensation.)
Ambient temperature change rate	Normal operating	Within ±10 °C/h
	Transporting/storing	Within ±20 °C/h
Power supply	Voltage range	100 to 120 V AC ±10 %
		220 to 240 V AC ±10 %
		24 V DC ±10 %
	Frequency	50/60 ±3 Hz
	Distortion factor	10 % or less
	Peak value	125 V or more (100 V system)
		274 V or more (220 V system)
Instantaneous power failure	20 ms or less (when receiving rated AC voltage)	
DC power supply ripple rate	1 % p-p or less	
Grounding	100 ohms or less, Independent grounding	
Dust	0.3 mg/m ³ or less	
Corrosive gas	ANSI/ISA S71.04 G2 (standard) (ANSI/ISA S71.04 G3 option)	
Vibration	Continuous vibration	Displacement amplitude 0.25 mm or less (1 to 14 Hz) Acceleration 2.0 m/s ² or less (14 to 100 Hz)
	Earthquake	Acceleration 4.9 m/s ² or less
	Transport vibration	Horizontal 4.9 m/s ² or less, vertical 9.8 m/s ² or less (packed state)
Shock	Transport shock	Horizontal 49.0 m/s ² , vertical 98.0 m/s ² (packed state)
Noise	Electric field	3 V/m or less (26 MHz to 1.0 GHz)
		3 V/m or less (1.4 to 2.0 GHz)
		1 V/m or less (2.0 to 2.7 GHz)
Magnetic field	30 A/m or less (AC), 400 A/m or less (DC)	
Static electricity	4 kV or less (contact discharge), 8 kV or less (aerial discharge)	
Altitude	2000 m or less	

*1: When the following modules are installed in ESB Bus Node Unit, Optical ESB Bus Node Unit or ER Bus Node Unit, the ambient temperature should be 0 to 50 °C.
 AAP149, AAP849, ADV161, ADV561, ADV859, ADV159, ADV559, ADV869, ADV169, ADV569, ALR111, ALR121-S□0, -S□1, ALE111-S□0, -S□1, ALF111, ALP121, and A2LP131
 When AAI543-□6□, -□F□ (fast response) is installed in ESB Bus Node Unit, Optical ESB Bus Node Unit, the ambient temperature should be 0 to 60 °C.

*2: When ANB10□, ANB11□, and ANT10U node units are used with temperature options, I/O Modules, Communication Modules, and Bus Interface Modules must be accompanied with temperature options.

● **ESB bus/Optical ESB bus**

When using Field Control Unit

Application

An ESB bus or an optical ESB bus is an input/output communication bus that connects the ESB bus node unit or optical ESB bus node unit to the intelligent part of the FCS.

Communication Specifications

Connectable Units: ESB Bus Node Unit (ANB10□), Optical ESB Bus Node Unit (ANB11□), and Unit for Optical ESB Bus Repeater Module (ANT10U)

Number of Connectable Units:

Field Control Unit	Database	Total Number of ESB Bus and Optical ESB Bus Node Units Connected per FCU (*1)
AFV30□ (*2) AFV40□ (*2) (*3)	Control Function for Field Control Station (VP6F1700)	Max. 13

- *1: ESB Bus Node Unit (ANB10□), Optical ESB Bus Node Unit (ANB11□).
Units for Optical ESB Bus Repeater Module (ANT10U) are not included in the number of connectable units.
- *2: To connect the ESB bus node unit and optical ESB bus node unit to the FCU (AFV30□/AFV40□), install the ESB Bus Coupler Module (EC401 or EC402) in slots 7 and 8.
EC401 can be connected a maximum of nine Node Units (ANB10□ or ANB11□).
EC402 can be connected a maximum of nine Node Units (ANB10□ or ANB11□) on the upper and lower sides, respectively.
The sum of the total number of Node Units (ANB10□ or ANB11□) per FCU should not exceed the specified number.
- *3: The maximum number of ESB bus node units, optical ESB bus node units, and units for optical ESB bus repeater module that can be installed in a single cabinet is 11 for AFV40□.

Transmission Path Specifications

Network Topology: Bus topology
 Transmission Path Redundancy: Available
 Transmission Speed: ESB Bus 128 megabits per second
 Optical ESB Bus 192 megabits per second
 Transmission Cable: Dedicated cable (YCB301), an optical fiber cable (*1)
 Transmission Distance: Max. 10 m (*2), 50 km (when using the ANT411 Optical ESB Bus Repeater Module) (*3)

- *1: Optical Fiber Cable Specifications
 Connector Type: LC (compliant with IEC 61754-20)
 Recommended Cable: Quartz single-mode fiber (JIS C6835 SSMA -9.3/125 IEC 60793-2-50B1.1)
 Number of Cores: 2
- *2: Max. 10 m for EC401 and max. 10 m on the upper and lower sides, respectively, for EC402.
- *3: The distance can be extended to a maximum of 50 km using the optical ESB bus repeater module. Chain and star connection configurations are available.

■ STANDARD SPECIFICATIONS

● Field Control Unit (for Vnet/IP and FIO)

The following types of Field Control Unit (for FIO) are available.

- AFV30S: Field Control Unit (for FIO, 19" Rack Mountable Type)
- AFV30D: Duplexed Field Control Unit (for FIO and 19" Rack Mountable Type)
- AFV40S: Field Control Unit (for FIO, with Cabinet)
- AFV40D: Duplexed Field Control Unit (for FIO and with Cabinet)

For more detail, refer to "Field Control Unit" (GS 33J60E10-01EN) and (GS 33J60E20-01EN).

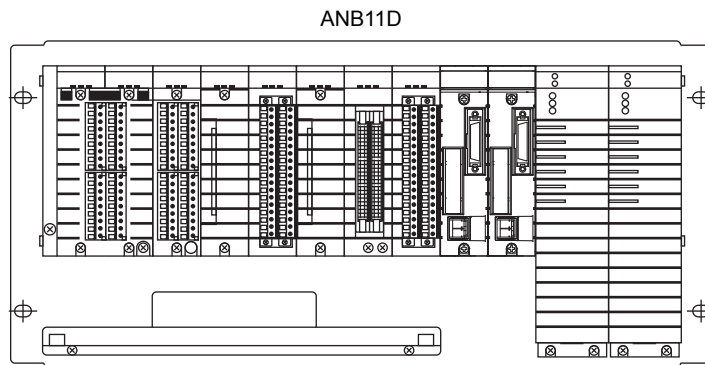
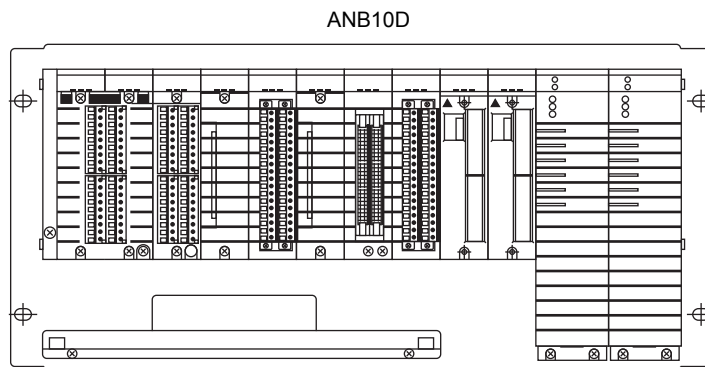
● Node Units

Power Supply Modules, Bus Interface Modules, and I/O Modules (FIO) are installed in a Node Unit.

The following types of Node Units are available, depending on the configuration, being either single/dual-redundant bus or ESB BUS/Optical ESB Bus:

- ANB10S: Node Unit for Single ESB Bus (Rack Mounting)
- ANB10D: Node Unit for Dual-Redundant ESB Bus (Rack Mounting)
- ANB11S: Node unit for Single ESB Bus with Optical Repeater (Rack Mounting)
- ANB11D: Node unit for Dual-Redundant ESB Bus with Optical Repeater (Rack Mounting)

For more details, refer to "Node Units (for N-IO/FIO)" (GS 33J60F20-01EN) and (GS 33J60F30-01EN).

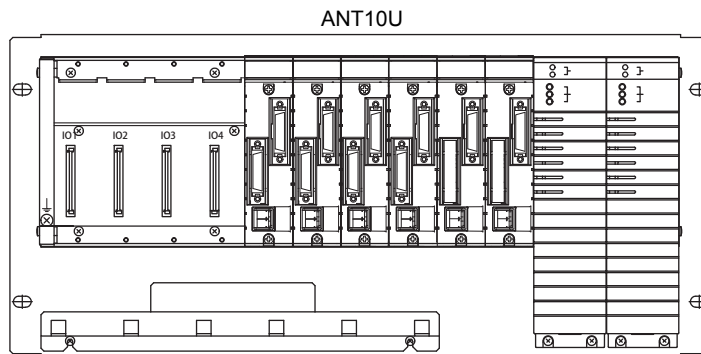


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● **Unit for Optical ESB Bus Repeater Module**

Power Supply Modules, Optical ESB Bus Repeater Module are installed in a Unit.

For more details, refer to “Unit for Optical Bus Repeater Module (for N-IO/FIO)” (GS 33J60F50-01EN).



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● **I/O Modules**

The I/O Modules include Analog I/O Modules, Digital I/O Modules and Communication Modules. There are several types of Analog I/O Modules, including the isolated channel type, isolated type and non-isolated type.

In addition, to enable replacements from CENTUM V, CENTUM-XL and μ XL compatible modules are provided so that the system cable from the Signal Conditioner can be connected to these compatible modules.

For the I/O Modules, the environment-proof support (temperature environment support, G3 support) options can be specified.

The I/O Module is Explosion Protection product. For details, refer to “Explosion Protection” (TI 33Q01J30-01E).

Table Availability of I/O Modules to Be Installed in Node Units (Part 1)

Model name	Name	AFV30□ AFV40□	ANB10□ ANB11□	ANT10U	Availability for dual-redundant configuration	Temperature environment support, G3 support
—	Analog I/O Modules					
AAI141	Analog Input Module (4 to 20 mA, 16-Channel, Non-Isolated)	X	X	—	X	X
AAV141	Analog Input Module (1 to 5 V, 16-Channel, Non-Isolated)	X	X	—	X	X
AAB141	Analog Input Module (1 to 5 V/4 to 20 mA, 16-Channel, Non-Isolated)	X	X	—	X	X
AAI841	Analog I/O Module (4 to 20 mA Input, 4 to 20 mA Output, 8-Channel Input/8-Channel Output, Non-Isolated)	X	X	—	X	X
AAB841	Analog I/O Module (1 to 5 V Input, 4 to 20 mA Output, 8-Channel Input/8-Channel Output, Non-Isolated)	X	X	—	X	X
AAB842	Analog I/O Module (1 to 5 V/4 to 20 mA Input, 4 to 20 mA Output, 8-Channel Input/8-Channel Output, Non-Isolated)	X	X	—	X	X
AAI143	Analog Input Module (4 to 20 mA, 16-Channel, Isolated)	X	X	—	X	X
AAI543	Analog Output Module (4 to 20 mA, 16-Channel, Isolated)	X	X	—	X	X (*1)
AAV144	Analog Input Module (-10 to 10V, 16-Channel, Isolated)	X	X	—	X	X
AAV544	Analog Output Module (-10 to 10V, 16-Channel, Isolated)	X	X	—	X	X
AAI135	Analog Input Module (4 to 20 mA, 8-Channel, Isolated Channels)	X	X	—	X	X
AAI835	Analog I/O Module (4 to 20 mA, 4-Channel Input/4-Channel Output, Isolated Channels)	X	X	—	X	X
AAT145	TC/mV Input Module (TC: R, J, K, E, T, B, S, N/mV: -100 to 150 mV, 16-Channel, Isolated Channels)	X	X	—	X	X
AAR145	RTD/POT Input Module (RTD: Pt100 Ω/POT: 0 to 10 kΩ, 16-Channel, Isolated Channels)	X	X	—	X	X
AAP135	Pulse Input Module (8-Channel, Pulse Count, 0 to 10 kHz, Isolated Channels)	X	X	—	X	X
AAP149	Pulse Input Module for compatible PM1 (16-Channel, Pulse Count, 0 to 6 kHz, Non-Isolated)	X	X	—	—	X (G3 only)
AAP849	Pulse Input/Analog Output Module for compatible PAC (Pulse Count, 4 to 20 mA, 8-Channel Input/8-Channel Output, Non-Isolated)	X	X	—	X	X (G3 only)

X: Available. —: Not available.

*1: For AAI543-□6□, -□F□ (fast response), only G3 is supported.

Table Availability of I/O Modules to Be Installed in Node Units (Part 2)

Model name	Name	AFV30□ AFV40□	ANB10□ ANB11□	ANT10U	Availability for dual-redundant configuration	Temperature environment support, G3 support
—	Digital I/O Modules					
ADV151	Digital Input Module (32-Channel, 24 V DC, Isolated)	X	X	—	X	X
ADV551	Digital Output Module (32-Channel, 24 V DC, Isolated)	X	X	—	X	X
ADV161	Digital Input Module (64-Channel, 24 V DC, Isolated)	X	X	—	X	X (G3 only)
ADV561	Digital Output Module (64-Channel, 24 V DC, Isolated)	X	X	—	X	X (G3 only)
—	Digital I/O Modules (ST Compatible)					
ADV859	Digital I/O Module for Compatible ST2 (16-Channel Input/16-Channel Output, Isolated Channels)	X	X	—	X (*2)	X (G3 only)
ADV159	Digital Input Module for Compatible ST3 (32-Channel Input, Isolated Channels)	X	X	—	X (*2)	X (G3 only)
ADV559	Digital Output Module for Compatible ST4 (32-Channel Output, Isolated Channels)	X	X	—	X (*2)	X (G3 only)
ADV869	Digital I/O Module for Compatible ST5 (32-Channel Input/32-Channel Output, Isolated, Common Minus Side Every 16-Channel)	X	X	—	X (*2)	X (G3 only)
—	Digital I/O Modules (ST Compatible)					
ADV169	Digital Input Module for Compatible ST6 (64-Channel Input, Isolated, Common Minus Side Every 16-Channel)	X	X	—	X (*2)	X (G3 only)
ADV569	Digital Output Module for Compatible ST7 (64-Channel Output, Isolated, Common Minus Side Every 16-Channel)	X	X	—	X (*2)	X (G3 only)
—	Communication Modules					
ALR111	Serial Communication Module (RS-232C, 2-port)	X	X	—	X (*3)	X (G3 only)
ALR121	Serial Communication Module (RS-422/RS-485, 2-port)	X	X	—	X (*3)	X
ALE111	Ethernet Communication Module	X	X	—	X (*4)	X
ALF111	Foundation Fieldbus Communication Module	X	X	—	X	X (G3 only)
ALP121	PROFIBUS-DP Communication Module	X (*5)	X	—	X	X (G3 only)
A2LP131	PROFINET Communication Module	X	X	—	—	X (G3 only)

X: Available. —: Not available.

*2: Dual-redundant configuration is possible only when the ST card duplexed with the existing CENTUM-XL is replaced.

*3: Dual-redundant communication is applicable according to communication function. For details, see the GS "ALR111/ALR121 Serial Communication Module (for FIO)" (GS 33J60G10-01EN).

*4: Dual-redundant communication is applicable according to communication function. For details, see the GS "ALE111 Ethernet Communication Module (for FIO)" (GS 33J60G11-01EN).

*5: ALP111 and ALP121 cannot be mixedly used in the same Field Control Unit.

Table Availability of I/O Modules to Be Installed in Node Units (Part 3)

Model name	Name	AFV30□ AFV40□	ANB10□ ANB11□	ANT10U	Availability for dual-redundant configuration	Temperature environment support, G3 support
—	Bus Interface Modules					
EC401	ESB Bus Coupler Module	X (*6)	—	—	X	X (G3 only)
EC402	ESB Bus Coupler Module (for AFV30□/AFV40□, 2-port)	X (*7)	—	—	X	X (G3 only)
ANT401	Optical ESB Bus Repeater Master Module 5km (for AFV30□/AFV40□)	X (*8)	X (*9)	X	X	X
ANT502	Optical ESB Bus Repeater Slave Module 5km (for AFV30□/AFV40□)	—	X (*10)	X	X	X
ANT411	Optical ESB Bus Repeater Master Module 5km-50km (for AFV30□/AFV40□)	X (*8)	X (*9)	X	X	X
ANT512	Optical ESB Bus Repeater Slave Module 5km-50km (for AFV30□/AFV40□)	—	X (*10)	X	X	X
—	Turbomachinery I/O Modules					
AGS813	Servo Module (Isolated)	X	X (*9)	—	X	X (G3 only)
AGP813	High Speed Protection Module (Isolated)	X	X (*9)	—	X	X (G3 only)
—	Analog I/O Modules with Built-In Barrier					
ASI133	Analog Input Module (4 to 20 mA, 8-Channel, Isolated)	X (*8)	X	—	X	X
ASI533	Analog Output Module (4 to 20 mA, 8-Channel, Isolated)	X (*8)	X	—	X	X
AST143	TC/mV Input Module (TC: B, E, J, K, N, R, S, T / mV: -100 to 150 mV, -50 to 75 mV, 16-Channel, Isolated)	X (*8)	X	—	X	X
ASR133	RTD/POT Input Module (RTD: Pt50, Pt100, Pt200, Pt500, Pt1000, Ni100, Ni200, Ni120 / POT: 0 to 10 kΩ, 8-Channel, Isolated)	X (*8)	X	—	X	X
—	Digital I/O Modules with Built-In Barrier					
ASD143	Digital Input Module (16-Channel, NAMUR compatible, Isolated)	X (*8)	X	—	X	X
ASD533	Digital Output Module (8-Channel, U>12 V at I=40 mA, Isolated)	X (*8)	X	—	X	X

X: Available. —: Not available.

*6: AFV30□, AFV10□ only. EC401 is installed in AFV40□ as standard.

*7: AFV30□ only. EC402 is installed in AFV40□ as standard.

*8: AFV30□, AFV40□ only.

*9: ANB10□, ANB11□ only.

*10: ANT5□2 is installed in ANB11□ as standard.

For detailed specifications of each I/O Module, refer to GS 33J60E50-01EN, GS 33J60E51-01EN, GS 33J60F51-01EN, GS 33J60F52-01EN, GS 33J60F60-01EN, GS 33J60F70-01EN, GS 33J60F90-01EN, GS 33J60G10-01EN, GS 33J60G11-01EN, GS 33J60G20-01EN, GS 33J60G80-01EN.

For detailed specifications of each I/O Module, refer to the GS "I/O Modules With Built-In Barrier (for FIO)" (GS 33J60F80-01EN).

When installing these apparatuses with intrinsically safe circuit, "Explosion Protection" (TI 33Q01J30-01E) and "Explosion Protection of FIO Products" (IM 33K01J30-50E) for ATEX Approval should be referenced together with this GS.

● Terminal Blocks

To wire between I/O Module and field devices, install a pressure clamp terminal or KS cable interface adapter on the I/O Module.

When a pressure clamp terminal is used, the I/O Module can be wired directly with the field devices. When the KS cable interface adapter is used, the I/O Module is wired with the field devices via terminal boards.

Two types of pressure clamp terminal blocks are available: single and dual-redundant types. Using the dual-redundant type, dual-redundant I/O Modules can be configured on the terminal block.

In addition, a MIL connector cable can be connected directly to an I/O Module without installing a terminal block to the I/O Module. The MIL connector cable are furnished by the customer. A cable connector cover (ACCC01) is provided in order to prevent the MIL connector cable from coming loose.

The table entitled “Combinations of I/O Modules and Terminal Blocks” lists connections among I/O Modules, terminal blocks and connector cables.

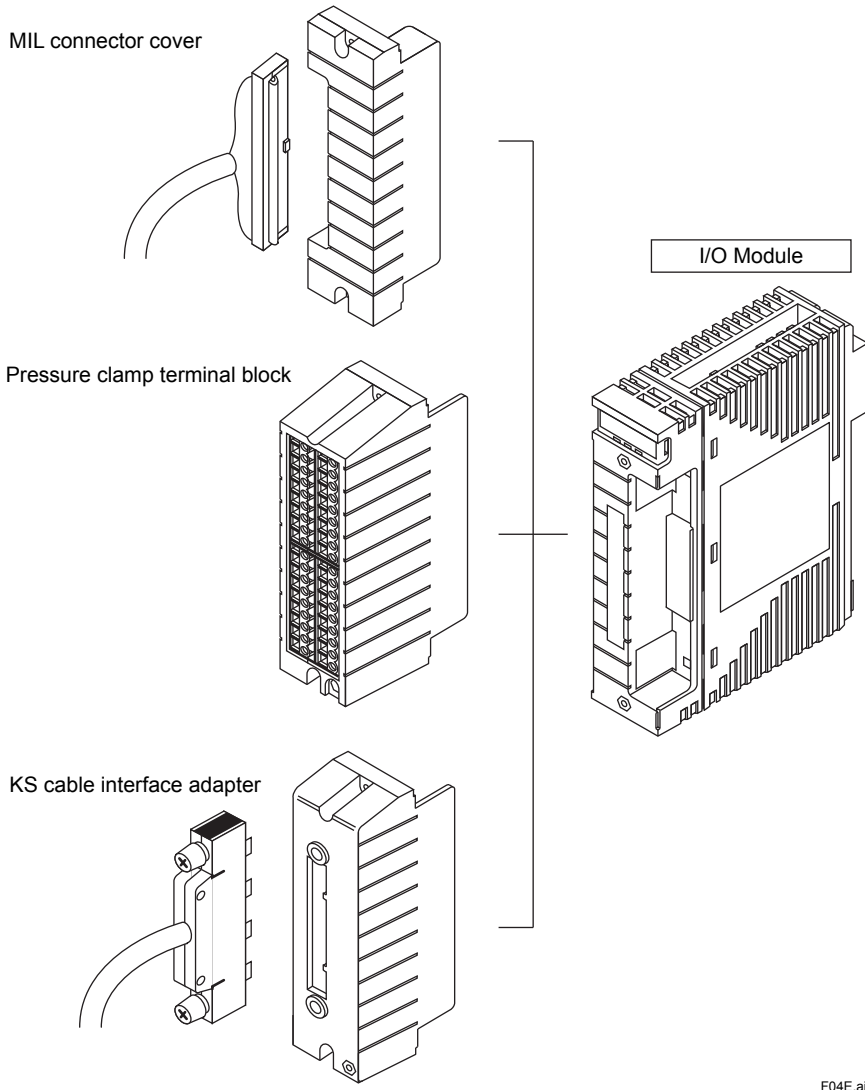


Table I/O Modules and Signal Connection Types (Part 1)

Model name	Name	No. of I/O channels per module	Signal connection		
			Pressure clamp terminal	Dedicated cable (*1)	MIL connector cable
—	Analog I/O Modules				
AAI141	Analog Input Module (4 to 20 mA, Non-Isolated)	16	X	X	X
AAV141	Analog Input Module (1 to 5 V, Non-Isolated)	16	X	X	X
AAB141	Analog Input Module (1 to 5 V/4 to 20 mA, Non-Isolated)	16	—	X	—
AAI841	Analog I/O Module (4 to 20 mA Input, 4 to 20 mA Output, Non-Isolated)	8 input/ 8 output	X	X	X
AAB841	Analog I/O Module (1 to 5 V Input, 4 to 20 mA Output, Non-Isolated)	8 input/ 8 output	X	X	X
AAB842	Analog I/O Module (1 to 5 V/4 to 20 mA Input, 4 to 20 mA Output, Non-Isolated)	8 input/ 8 output	—	X	—
AAI143	Analog Input Module (4 to 20 mA, Isolated)	16	X	X	X
AAI543	Analog Output Module (4 to 20 mA, Isolated)	16	X	X	X
AAV144	Analog Input Module (-10 to 10 V, 16-Channel, Isolated)	16	X	X	X
AAV544	Analog Output Module (-10 to 10 V, 16-Channel, Isolated)	16	X	X	X
AAI135	Analog Input Module (4 to 20 mA, Isolated Channels)	8	X	X	X
AAI835	Analog I/O Module (4 to 20 mA, Isolated Channels)	4 input/ 4 output	X	X	X
AAT145	TC/mV Input Module (TC: R, J, K, E, T, B, S, N/ mV: -100 to 150 mV, Isolated Channels)	16	—	X (*2)	—
AAR145	RTD/POT Input Module (RTD: Pt100 Ω/POT: 0 to 10 kΩ, Isolated Channels)	16	—	X (*2)	—
AAP135	Pulse Input Module (Pulse Count, 0 to 10 kHz, Isolated Channels)	8	X	X	X
AAP149	Pulse Input Module for compatible PM1 (16-Channel, Pulse Count, 0 to 6 kHz, Non-Isolated)	16	—	X	—
AAP849	Pulse Input/Analog Output Module for compatible PAC (Pulse Count, 4 to 20 mA, 8-Channel Input/8-Channel Output, Non-Isolated)	8 input/ 8 output	—	X	—
—	Digital I/O Modules				
ADV151	Digital Input Module (24 V DC, Isolated)	32	X	X	X
ADV551	Digital Output Module (24 V DC, Isolated)	32	X	X	X
ADV161	Digital Input Module (24 V DC, Isolated)	64	—	X (*3)	X
ADV561	Digital Output Module (24 V DC, Isolated)	64	—	X (*3)	X
ADV859	Digital I/O Module for Compatible ST2 (Isolated Channels)	16 input/ 16 output	—	X (*3)	—
ADV159	Digital Input Module for Compatible ST3 (Isolated Channels)	32	—	X (*3)	—
ADV559	Digital Output Module for Compatible ST4 (Isolated Channels)	32	—	X (*3)	—
ADV869	Digital I/O Module for Compatible ST5 (Isolated, Common Minus Side Every 16-Channel)	32 input/ 32 output	—	X (*3)	—
ADV169	Digital Input Module for Compatible ST6 (Isolated, Common Minus Side Every 16-Channel)	64	—	X (*3)	—
ADV569	Digital Output Module for Compatible ST7 (Isolated, Common Minus Side Every 16-Channel)	64	—	X (*3)	—

X: Can be connected. —: Cannot be connected.

*1: Dedicated cable provided by Yokogawa that is used for connecting I/O Modules and terminal boards (etc.).

*2: The KS cable can be connected directly with an I/O Module without the use of a terminal block.

*3: Dedicated cable can be connected directly to an I/O Module without the use of a terminal block.

For more detail, refer to the GS "Connection Specifications (for FIO)" (GS 33J60A20-01EN).

Table I/O Modules and Signal Connection Types (Part 2)

Model name	Name	No. of I/O channels per module	Signal connection		
			Pressure clamp terminal	Dedicated cable (*1)	MIL connector cable
—	Communication Modules				
ALR111	RS-232C Communication Module (1200 bps to 115.2 kbps)	2 ports	—	X (D-sub 9-pin) (*3)	—
ALR121	RS-422/RS-485 Communication Module (1200 bps to 115.2 kbps)	2 ports	—	X (M4 terminal block 10-pole) (*3)	—
ALE111	Ethernet Communication Module (10 Mbps)	1 port	—	—	—
ALF111	Foundation Fieldbus (FF-H1) Communication Module (31.25 kbps)	4 ports	X	X (*3)	—
ALP121	PROFIBUS-DP Communication Module	1 port	—	—	—
A2LP131	PROFINET Communication Module	1 port	—	—	—
—	Turbomachinery I/O Modules				
AGS813	Servo Module (Isolated)	12	—	X (*4)	—
AGP813	High Speed Protection Module (Isolated)	26	—	X (*4)	—
—	Analog I/O Modules with Built-In Barrier				
ASI133	Analog Input Module (4 to 20 mA, Isolated)	8	X	—	—
ASO133	Analog Output Module (4 to 20 mA, Isolated)	8	X	—	—
AST143	TC/mV Input Module (TC: B, E, J, K, N, R, S, T / mV: -100 to 150 mV, -50 to 75 mV, Isolated)	16	X	—	—
ASR133	RTD/POT Input Module (RTD: Pt50, Pt100, Pt200, Pt500, Pt1000, Ni100, Ni200, Ni120 / POT: 0 to 10 kΩ, Isolated)	8	X	—	—
—	Digital I/O Modules with Built-In Barrier				
ASD143	Digital Input Module (NAMUR compatible, Isolated)	16	X	—	—
ASD533	Digital Output Module (U>12 V at I=40 mA, Isolated)	8	X	—	—

X: Can be connected. —: Cannot be connected.

*1: Dedicated cable provided by Yokogawa that is used for connecting I/O Modules and terminal boards (etc.).

*3: Dedicated cable can be connected directly to an I/O Module without the use of a terminal block.

*4: Available cables are AKB337-M005, M007 and M010.

For more detail, refer to the GS "Connection Specifications (for FIO)" (GS 33J60A20-01EN).

● Current Consumption of I/O Modules

Table Current Consumption of I/O Modules (Part 1)

Model name	Name	Max. current consumption 5 V DC (mA)	Max. current consumption 24 V DC (mA)
—	Bus Interface Modules		
EC401	ESB Bus Coupler Module	500	—
EC402	ESB Bus Coupler Module	500	—
ANT401	Optical ESB Bus Repeater Master Module 5km	500	—
ANT502	Optical ESB Bus Repeater Slave Module 5km	500	—
ANT411	Optical ESB Bus Repeater Master Module 5km-50km	500	—
ANT512	Optical ESB Bus Repeater Slave Module 5km-50km	500	—
—	Analog I/O Modules		
AAI141	Analog Input Module (4 to 20 mA, 16-Channel, Non-Isolated)	310	450
AAV141	Analog Input Module (1 to 5 V, 16-Channel, Non-Isolated)	350	—
AAB141	Analog Input Module (1 to 5 V/4 to 20 mA, 16-Channel, Non-Isolated)	480	120
AAI841	Analog I/O Module (4 to 20 mA, 8-Channel Input/8-Channel Output, Non-Isolated)	310	500
AAB841	Analog I/O Module (1 to 5 V Input, 4 to 20 mA Output, 8-Channel Input/8-Channel Output, Non-Isolated)	310	250
AAB842	Analog I/O Module (1 to 5 V/4 to 20 mA Input, 4 to 20 mA Output, 8-Channel Input/8-Channel Output, Non-Isolated)	410	290
AAI143	Analog Input Module (4 to 20 mA, 16-Channel, Isolated)	230	540
AAI543	Analog Output Module (4 to 20 mA, 16-Channel, Isolated)	230	540
AAV144	Analog Input Module (-10 to 10 V, 16-Channel, Isolated)	500	—
AAV544	Analog Output Module (-10 to 10 V, 16-Channel, Isolated)	860	—
AAI135	Analog Input Module (4 to 20 mA, 8-Channel, Isolated Channels)	360	450
AAI835	Analog I/O Module (4 to 20 mA, 4-Channel Input/4-Channel Output, Isolated Channels)	360	450
AAT145	TC/mV Input Module (TC: R, J, K, E, T, B, S, N/mV: -100 to 150 mV, 16-Channel, Isolated Channels)	350	—
AAR145	RTD/POT Input Module (RTD: Pt100 Ω/POT: 0 to 10 kΩ, 16-Channel, Isolated Channels)	350	—
AAP135	Pulse Input Module (8-Channel, Pulse Count, 0 to 10 kHz, Isolated Channels)	300	400
AAP149	Pulse Input Module for compatible PM1 (16-Channel, Pulse Count, 0 to 6 kHz, Non-Isolated)	400	—
AAP849	Pulse Input/Analog Output Module for compatible PAC (Pulse Count, 4 to 20 mA, 8-Channel Input/8-Channel Output, Non-Isolated)	310	250
—	Digital I/O Modules		
ADV151	Digital Input Module (32-Channel, 24 V DC, Isolated)	500	—
ADV551	Digital Output Module (32-Channel, 24 V DC, Isolated)	700	—
ADV161	Digital Input Module (64-Channel, 24 V DC, Isolated)	550	—
ADV561	Digital Output Module (64-Channel, 24 V DC, Isolated)	780	—
ADV859	Digital I/O Module for Compatible ST2 (16-Channel Input/16-Channel Output, Isolated Channels)	450	—
ADV159	Digital Input Module for Compatible ST3 (32-Channel Input, Isolated Channels)	330	—
ADV559	Digital Output Module for Compatible ST4 (32-Channel Output, Isolated Channels)	570	—
ADV869	Digital I/O Module for Compatible ST5 (32-Channel Input/ 32-Channel Output, Common Minus Side Every 16-Channel)	800	—
ADV169	Digital Input Module for Compatible ST6 (64-Channel Input, Common Minus Side Every 16-Channel)	800	—
ADV569	Digital Output Module for Compatible ST7 (64-Channel Output, Common Minus Side Every 16-Channel)	800	—

Table Current Consumption of I/O Modules (Part 2)

Model name	Name	Max. current consumption 5 V DC (mA)	Max. current consumption 24 V DC (mA)
—	Communication Modules		
ALR111	RS-232C Communication Module (2-Port, 1200 bps to 115.2 kbps)	500	—
ALR121	RS-422/RS-485 Communication Module (2-Port, 1200 bps to 115.2 kbps)	500	—
ALE111	Ethernet Communication Module (1-Port, 10 Mbps)	500	—
ALF111	Foundation Fieldbus (FF-H1) Communication Module (4-Port, 31.25 kbps)	500	—
ALP121	PROFIBUS-DP Communication Module	700	—
A2LP131	PROFINET Communication Module	800	—
—	Turbomachinery I/O Modules		
AGS813	Servo Module (Isolated)	500	—
AGP813	High Speed Protection Module (Isolated)	900	—
—	I/O Modules with Built-In Barrier		
ASI133	Analog Input Module (4 to 20 mA, 8-Channel, Isolated)	150	450
ASO533	Analog Output Module (4 to 20 mA, 8-Channel, Isolated)	150	350
AST143	TC/mV Input Module (TC: B, E, J, K, N, R, S, T / mV: -100 to 150 mV, -50 to 75 mV, 16-Channel, Isolated)	150	80
ASR133	RTD/POT Input Module (RTD: Pt50, Pt100, Pt200, Pt500, Pt1000, Ni100, Ni200, Ni120 / POT: 0 to 10 kΩ, 8-Channel, Isolated)	150	60
ASD143	Digital Input Module (16-Channel, NAMUR compatible, Isolated)	150	110
ASD533	Digital Output Module (8-Channel, U>12 V at I=40 mA, Isolated)	150	500

■ LIMITATIONS AND PRECAUTIONS FOR INSTALLATION

● Limitations of Installation of Modules Imposed by Capacity of Power Supply to Transmitters

Installation of modules in any one of Node Units (ANB10□ and ANB11□) and Field Control Units (AFV30□, AFV40□, and AFV10□) imposes a limitation on the total number of modules considering the power supply.

ANB10□ and ANB11□:

For application to non-hazardous area

$$\Sigma (\text{factor B for each module to be installed}) \leq 100 (*1)$$

For application to hazardous area

ANB10□-□□E, □□G and ANB11□-□□E:

$$\Sigma (\text{factor B for each module to be installed}) \leq 88$$

ANB10□-□□F and ANB11□-□□F:

$$\Sigma (\text{factor B for each module to be installed}) \leq 80 (*1)$$

AFV30S and AFV40S (*2):

For application to non-hazardous area or hazardous area

$$\Sigma (\text{factor A for each module to be installed}) + \Sigma (\text{factor B for each module to be installed}) \leq 85$$

AFV30D and AFV40D (*2):

For application to non-hazardous area

$$\Sigma (\text{factor A for each module to be installed}) \leq 20 \text{ and}$$

$$\Sigma (\text{factor A for each module to be installed}) +$$

$$\Sigma (\text{factor B for each module to be installed}) \leq 65$$

AFV30D:

For application to hazardous area

$$\Sigma (\text{factor A for each module to be installed}) \leq 5 \text{ and}$$

$$\Sigma (\text{factor A for each module to be installed}) +$$

$$\Sigma (\text{factor B for each module to be installed}) \leq 65$$

*1: Mount a node (-20 to 70 °C optional temperature environment) under the condition, and a condition of "Limitations of Installation under the Ambient Operating Temperature Conditions" described later.

*2: AFV40□ is prohibited to use in hazardous area.

Table Factor for Each Module

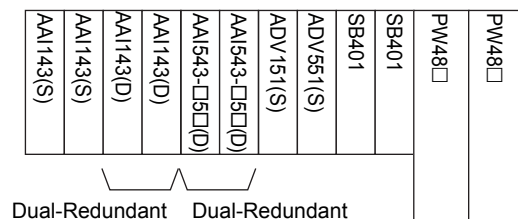
	Model	Factor	
		Single	Each Pair in Dual-redundant Configuration
A	ADV869 (ST5)	3	-
	ADV169 (ST6)	3	-
	ADV569 (ST7)	3	-
	AAV544	3	3
	AGP813	3	6
	AAI841	17	26
B	AAAB841(MAC2/VM2)	9	17
	AAI141	16	16
	AAI143	22	24
	AAI543-□5□, -□E□ (standard response)	21	25
	AAI543-□6□, -□F□ (fast response)	21	29
	AAP135	16	25
	AAP849	9	17
	AAI135	15	19
	AAI835	15	22
	AAAB141	1	2
	AAAB842	11	20
	ASI133	22	33
	ASI533	17	26
	AST143	5	10
	ASR133	3	6
	ASD143	6	12
	ASD533	25	38
		Others	0

When all channels are connected in 4-wire connection (example: Barrier connection); however, refer to the next table.

Table Factor when all channels are connected in 4-wire connection

	Model	Factor	
		Single	Each Pair in Dual-redundant Configuration
B	AAI841-S□□	10	19
	AAI841-H□□	10	20
	AAI141-S□□	0	0
	AAI141-H□□	1	1
	AAI143	4	7
	AAI135-S□□	4	8
	AAI135-H□□	6	11
	AAI835-S□□	8	16
	AAI835-H□□	11	22

Example: When installing modules in an ANB10D as follows where "(S)" indicates Single and "(D)" indicates Dual-Redundant.

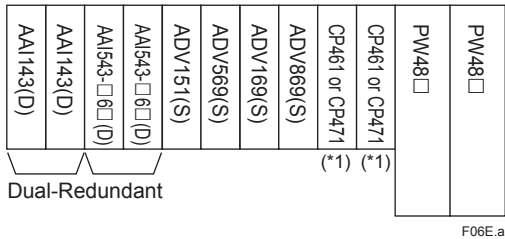


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The total sum of the factors for this installation plan is less than 100 as shown below, hence, the acceptance of this plan is ensured:

$$\sum (\text{factor for each module to be installed}) = 22 + 22 + 24 + 25 + 0 + 0 = 93 < 100$$

Example: When installing modules in an AFV30D as follows.



*1: A dual-redundant configuration is enabled by using 2 identical modules with same model code (CP461 or CP471).

$$\begin{aligned} &\sum (\text{factor A for each module to be installed}) + (\text{factor B for each module to be installed}) \\ &= (3 + 3 + 3) + (24 + 29 + 0) \\ &= 9 + 53 \\ &= 62 < 65 \end{aligned}$$

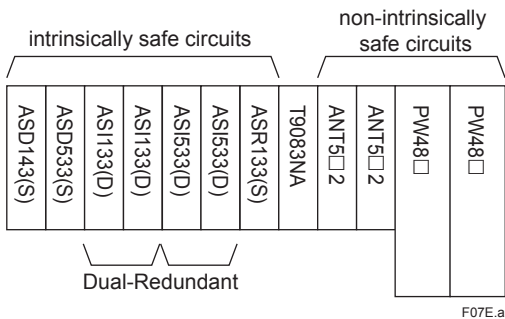
● **Restriction on Installation of Modules with Built-in Barrier**

Please keep a distance of 50 mm or more between the intrinsically safe area and the non-intrinsically safe area.

Modules with built-in barriers should be installed in an area separate from the area of other modules in one node unit. In case of ANB10□ and ANB11□, an insulating partition (Part No. T9083NA) must be installed between the area of Modules with Built-in Barrier and the area of other Modules.

In case of AFV30□, an insulating partition kit (Part No. T9083ND) must be installed to keep a distance between the intrinsically safe area and the non-intrinsically safe area.

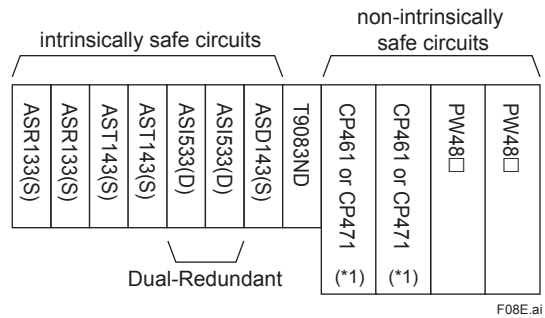
Example: When isolating the two areas in an ANB11D as follows where “(S)” indicates Single and “(D)” indicates Dual-Redundant.



The total sum of the factors for this installation plan is less than 100 as shown below, hence, the acceptance of this plan is ensured:

$$\sum (\text{factor for each module to be installed}) = 6 + 25 + 33 + 26 + 3 = 93 < 100$$

Example: When installing modules in AFV10D and AFV30□ as follows.

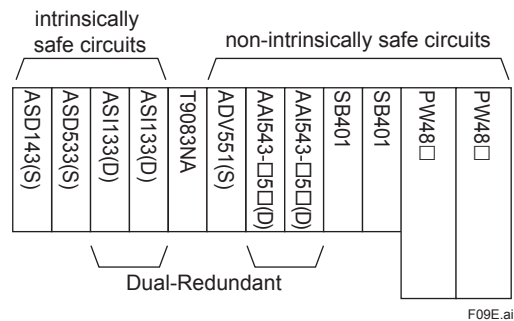


*1: A dual-redundant configuration is enabled by using 2 identical modules with same model code (CP461 or CP471).

The total sum of the factors for this installation plan is less than 65 as shown below, hence, the acceptance of this plan is ensured:

$$\sum (\text{factor module to be installed}) = 3 + 3 + 5 + 5 + 26 + 6 = 48 < 65$$

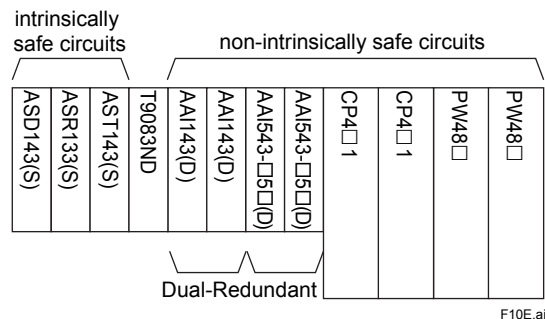
Example: When installing modules in an ANB10D as follows where “(S)” indicates Single and “(D)” indicates Dual-Redundant.



The total sum of the factors for this installation plan is less than 100 as shown below, hence, the acceptance of this plan is ensured:

$$\sum (\text{factor for each module to be installed}) = 6 + 25 + 33 + 0 + 25 = 89 < 100$$

Example: When installing modules in AFV30□ as follows.



The total sum of the factors for this installation plan is less than 65 as shown below, hence, the acceptance of this plan is ensured:

$$\sum (\text{factor module to be installed}) = 6 + 3 + 5 + 24 + 25 = 63 < 65$$

● **Limitations of Installing the ALR111, ALR121, ALE111, ALP111, ALP121, A2LP131, ALF111, AGS813, and AGP813**

For AFV30□/AFV40□

Control Function for Field Control Station (VP6F1700)

No. of ALR111/ALR121/ALE111/ALP111/ALP121/A2LP131/AGS813/AGP813 modules (*1)	Max. 32 units/FCS (Max. 16 pairs for dual-redundant operation) (*2)
No. of ALF111 modules	Max. 64 units/FCS (Max. 32 pairs for dual-redundant operation)
No. of all the communication modules	Max. 64 modules/FCS (*3)

- *1: ALP111 and ALP121 cannot be mixedly used in the same Field Control Unit.
- *2: A2LP131 supports a single configuration with only 1 module.
- *3: This is the sum of ALR111, ALR121, ALE111, ALF111, ALP111, ALP121, A2LP131, AGS813, and AGP813 modules.

● **EC401 and EC402**

When using an EC401 as a Dual, install them slot 7th and 8th.
 When using it as a single, install it slot 7th and leave the immediate right slot empty.
 When using an EC402 as a Dual, install them slot 7th and 8th.
 When using it as a single, install it slot 7th and leave the immediate right slot empty.

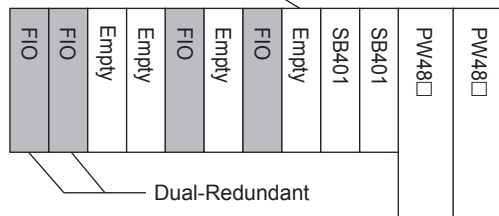
● **Limitations of Installation under the Ambient Operating Temperature Conditions**

When the node (-20 to 70 °C - optional temperature environment) is to be used under the temperature environment (60 to 70 °C), please follow the restrictions below:

ANT10U can be used at temperatures from 60 to 70°C without any additional restrictions in the same way as at temperatures from -20 to 50°C.

- Max. number of installable input/output modules (IOM): Up to 4 modules can be installed per node.
- Make an empty slot (one or more) between SB401, ANT401, ANT411, ANT502, ANT512, and IOM. When installing modules with built-in barriers, insulating partition (Part No. T9083NA) must be installed in slot No. 8.
- When installing IOM, make an empty slot (one or more) between IOM and IOM.
- When installing duplexed IOM, make an empty slot (at least two slots) for each duplexed IOM.
- The external load resistance of output channel must be 200 Ω or more when using current IOM (AAI841, AAI835 or AAI543-□5□, -□E□(standard response)).
- AAI543-□6□, -□F□ (fast response) cannot be installed.

Make an empty slot (one or more) between SB401, ANT502, ANT512, and IOM



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Figure IOM Installation in a Node

Note: When the following modules are installed in a node, the ambient temperature should be 0 to 50 °C.
 AAP149, AAP849, ADV161, ADV561, ADV859, ADV159, ADV559, ADV869, ADV169, ADV569, ALR111, ALF111, ALP111, ALP121, A2LP131
 When AAI543-□6□, -□F□ (fast response), ALR121-S□3, and ALE111-S□3 are installed in a node, the ambient temperature should be 0 to 60 °C.

● **Limitations of Installation for AAT145 (the combination of Thermocouple input and Terminal Board)**

To keep the reference junction compensation accuracy, make sure to meet the following conditions. The terminal board should not be affected by radiated heat.

For details of the reference junction compensation accuracy, refer to “Analog I/O Modules” (GS 33J60F60-01EN).

Specifications for terminal board only

Install any heat sources in the above of a terminal board or terminal board wiring. Provide a heat shield when installing heat sources in the side or below of a terminal board.

Installation in Cabinet

To install a heat source in the same cabinet, install it in a position that is higher than the terminal board and the terminal board wiring. If the heat source must be installed besides the terminal board or in a position that is lower than it, install a heat shield plate.

Note: The reference junction compensation accuracy is for when the temperature environment is in stability condition. If the temperature environment is varied, accuracy error may occur until the temperature becomes stability condition.

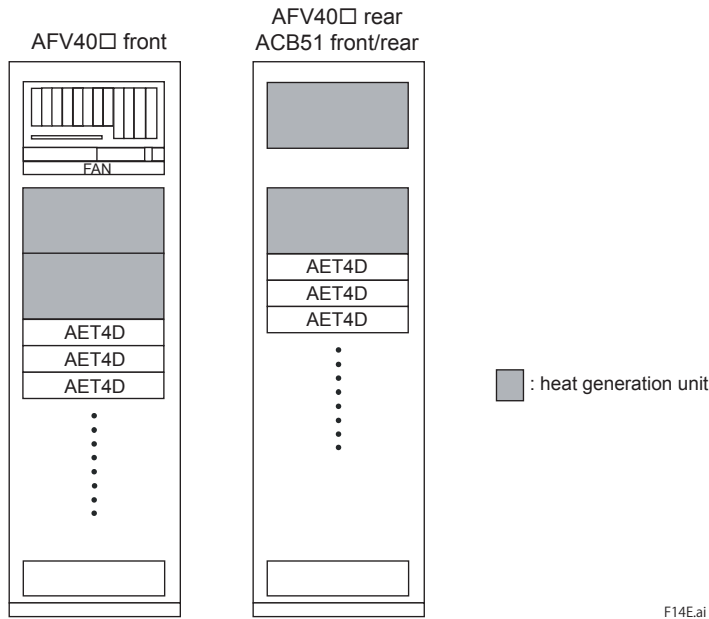


Figure Installation Position of AET4D in Cabinet

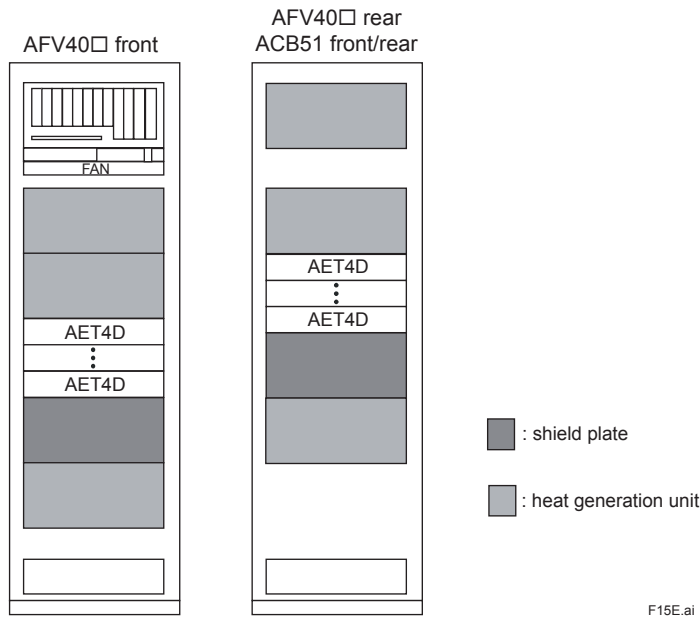


Figure Installation Position of AET4D in cabinet (When Installed with Heat Shields)

**● Limitations of Installation for AST143
(the combination of Thermocouple input and Pressure clamp terminal)**

To keep the reference junction compensation accuracy, make sure to meet the following conditions. The pressure clamp terminal should not be affected by radiated heat.

For details of the reference junction compensation accuracy, refer to “Analog I/O Modules” (GS 33J60F60-01EN).

- Do not install a heat-radiating unit beneath the AST143 installed node.
- Do not install AST143 in the place where airflow affects directly.
- The installable modules in the next to AST143 is AST143 or ASR133. When installing other than AST143 or ASR133, make an empty slot (one or more) in each side.
- Do not install cooling near the AST143 installed node. When a FAN is located above node, make sure the IOM installing place is 3 units (unit: 44.45 mm) away from the FAN place.

Field wiring

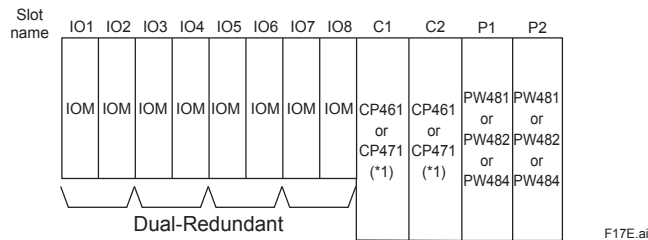
Nominal conductor cross-sectional area of this module is 1.25mm² or less. Connect to from the CH1 of terminal.

Note: The reference junction compensation accuracy is for when the temperature environment is in stability condition. If the temperature environment is varied, accuracy error may occur until the temperature becomes stability condition.

● Installation to Make I/O Modules Dual-Redundant

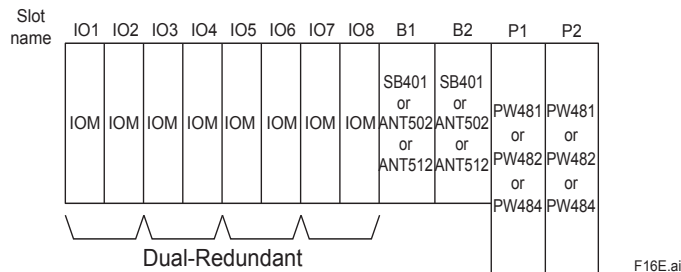
To make I/O Modules dual-redundant, install the I/O Modules in slots numbered IO1-IO2, IO3-IO4, IO5-IO6 and/or IO7-IO8, as shown in the figure below.

Field Control Unit (for FIO)

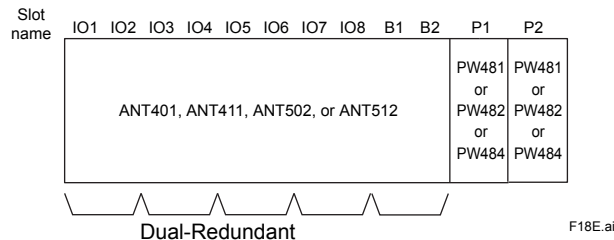


*1: A dual-redundant configuration is enabled by using 2 identical modules with same model code (CP461 or CP471).

Node Unit



Unit (ANT10U)



● Protection of Empty Slots

When I/O Modules are not installed, be sure to use a dummy cover (ADCV01) to protect the empty slots.

■ APPLICABLE STANDARDS

Refer to the GS “Integrated Production Control System CENTUM VP System Overview (GS 33J01A10-01EN).”

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