

General Specifications

FIO System Overview



GS 33J60A10-01EN

[Release 6]

■ GENERAL

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

The Field Control Unit (for FIO) is connected to an ESB Bus Node Unit or an Optical ESB Bus Node Unit.

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

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

The following shows a system configuration example.

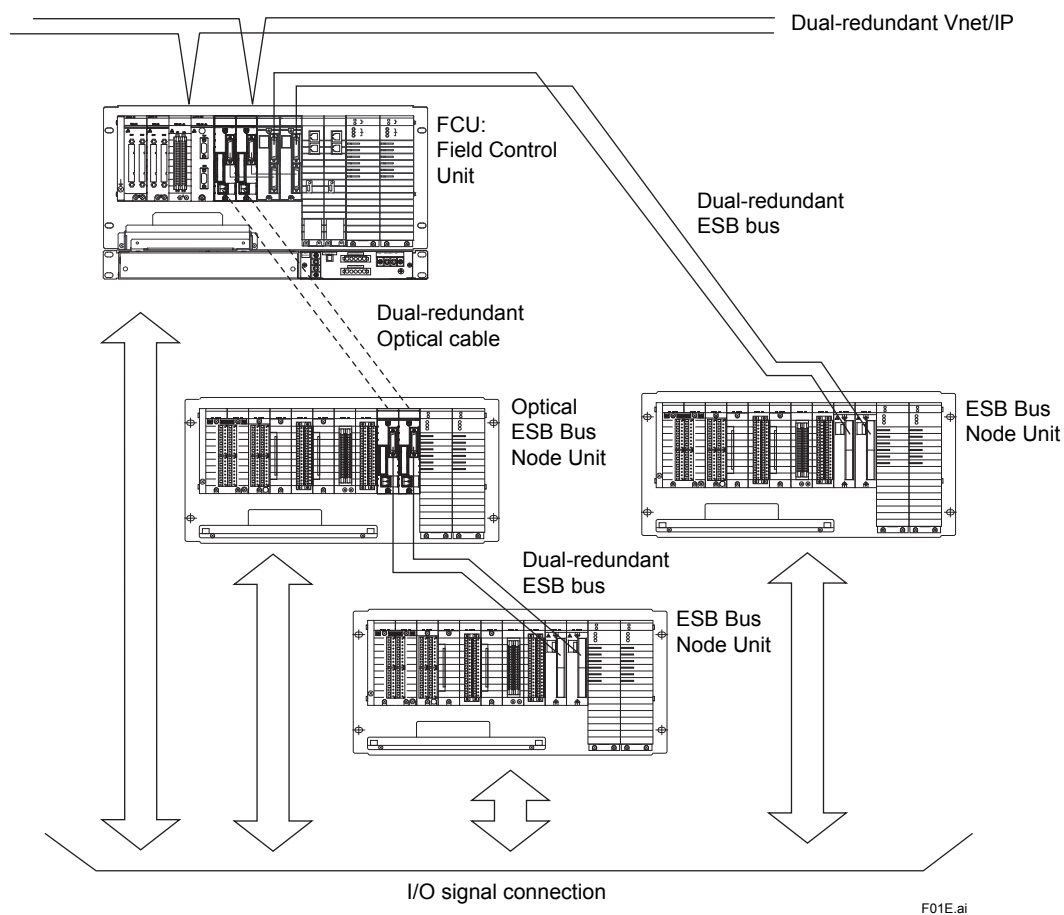


Figure System Configuration

■ 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		Apply the grounding system which is defined by the rules and standards of the country or the region.
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, 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 AA1543-□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 ESB Bus Node Unit, Optical ESB Bus Node Unit and Optical ESB Bus Repeater Unit are used with temperature options, Power Supply Module, 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, Optical ESB Bus Node Unit, and Optical ESB Bus Repeater Unit

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, Optical ESB Bus Node Unit.

Optical ESB Bus Repeater Unit 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 (for FIO), install the ESB Bus Coupler Module (EC401 or EC402) in slots 7 and 8.

EC401 can be connected a maximum of nine Node Units.

EC402 can be connected a maximum of nine Node Units on the upper and lower sides, respectively.

The sum of the total number of FIO Node Units (ESB Bus Node Unit or Optical ESB Bus Node Unit) per FCU should not exceed the specified number.

*3: The maximum number of ESB bus node units, optical ESB bus node units, and Optical ESB Bus Repeater Unit that can be installed in a single cabinet is 11 for FCU (for FIO, with Cabinet).

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).

FCU can also be constructed by combining the following models. Apply the Control Function VP6F1700 (for AFV30□/AFV40□) to the FCU constructed by the following models to be able to use as a FCU (for FIO).

Model	Name	GS No.
A2BE1D	Base Plate (for FCU)	GS 33J60E60-01EN
A2FU1	HKU Interface Unit	GS 33J60E60-01EN
A2FU2	Primary Power Distribution Unit	GS 33J60E60-01EN
PW481, PW482, PW484	Power Supply Module	GS 33J60E70-01EN
CP471	Processor Module	GS 33J60E30-01EN

These models can be ordered individual or as a set. Refer to GS 33J01N20-01EN for details of the model for ordering multi-product. Refer to the GS of each individual model for the functions and the installation of modules on the Base Plate.

In addition, FCU (with cabinet) can be constructed by combining the FCU (for FIO) and a cabinet to which the Cabinet Utility Kit is applied.

Model	Name	GS No.
A2CAB1	Standard Cabinet	GS 33J60K80-01EN
A2CUKT4	Cabinet Utility Kit	GS 33J60K70-01EN

Refer to the GS of each model for details.

● FIO Node Unit (ESB Bus Node Unit, Optical ESB Bus Node Unit)

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

The following types of FIO 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).

FIO Node Unit can also be constructed by combining the following models.

Model	Name	GS No.
A2BE2D	Base Plate (for FIO)	GS 33J60G30-01EN
PW481, PW482, PW484	Power Supply Module	GS 33J60E70-01EN
Bus Interface Module		
SB401	ESB Bus Slave Interface Module	GS 33J60G40-01EN
A2EE1A	ESB Bus Adapter (for SB401)	GS 33J60G40-01EN
ANT502	Optical ESB Bus Repeater Module (for 5km)	GS 33J60F51-01EN
ANT512	Optical ESB Bus Repeater Module (for 50km)	GS 33J60F52-01EN
A2EE3A	ESB Bus Adapter (for ANT5□2)	GS 33J60F51-01EN GS 33J60F52-01EN

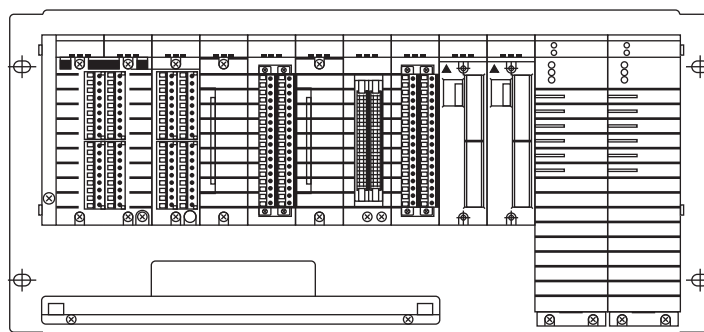
These models can be ordered individual or as a set. Refer to GS 33J01N20-01EN for details of the model for ordering multi-product. Refer to the GS of each individual model for the functions and the installation of modules on the Base Plate.

In addition, I/O Expansion Cabinet can be constructed by combining the FIO Node Unit and a cabinet to which the Cabinet Utility Kit is applied.

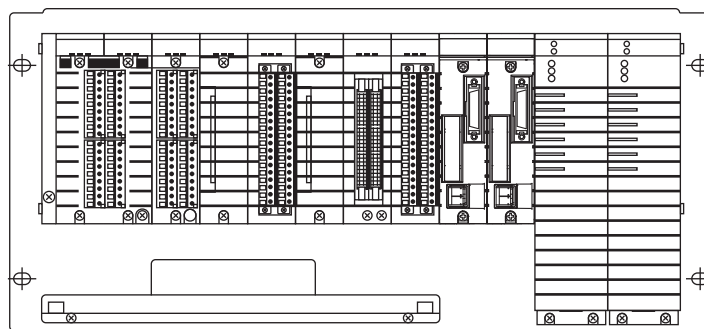
Model	Name	GS No.
A2CAB1	Standard Cabinet	GS 33J60K80-01EN
A2CUKT4	Cabinet Utility Kit	GS 33J60K70-01EN

Refer to the GS of each model for details.

ESB Bus Node Unit



Optical ESB Bus Node Unit



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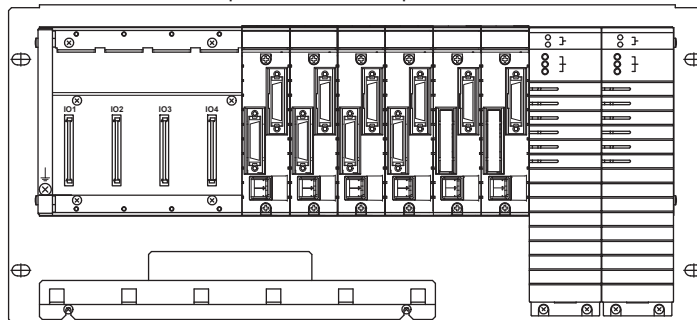
● Optical ESB Bus Repeater Unit

Power Supply Modules, Optical ESB Bus Repeater Modules are installed in an Optical ESB Bus Repeater Unit. For more details, refer to “Unit for Optical Bus Repeater Module (for N-IO/FIO)” (GS 33J60F50-01EN). Optical ESB Bus Repeater Unit can also be constructed by combining the following models.

Model	Name	GS No.
A2BE2D	Base Plate (for FIO)	GS 33J60G30-01EN
PW481, PW482, PW484	Power Supply Module	GS 33J60E70-01EN
Optical ESB Bus Repeater Module		
ANT401,ANT502	Optical ESB Bus Repeater Module (for 5km)	GS 33J60F51-01EN
ANT411,ANT512	Optical ESB Bus Repeater Module (for 50km)	GS 33J60F52-01EN
A2EE2A	ESB Bus Adapter (for ANT4□1)	GS 33J60F51-01EN GS 33J60F52-01EN
A2EE3A	ESB Bus Adapter (for ANT5□2)	GS 33J60F51-01EN GS 33J60F52-01EN

These models can be ordered individual or as a set. Refer to GS 33J01N20-01EN for details of the model for ordering multi-product. Refer to the GS of each individual model for the functions and the installation of modules on the Base Plate.

Optical ESB Bus Repeater Unit



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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	FCU (for FIO)	ESB Bus Node Unit Optical ESB Bus Node Unit	Optical ESB Bus Repeater Unit	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 k Ω , 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)

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	FCU (for FIO)	ESB Bus Node Unit Optical ESB Bus Node Unit	Optical ESB Bus Repeater Unit	Availability for dual-redundant configuration	Temperature environment support, G3 support
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)
—	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	FCU (for FIO)	ESB Bus Node Unit Optical ESB Bus Node Unit	Optical ESB Bus Repeater Unit	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	X	X	X	X
ANT502	Optical ESB Bus Repeater Slave Module 5km (for AFV30□/AFV40□)	—	X (*8)	X	X	X
ANT411	Optical ESB Bus Repeater Master Module 5km-50km (for AFV30□/AFV40□)	X	X	X	X	X
ANT512	Optical ESB Bus Repeater Slave Module 5km-50km (for AFV30□/AFV40□)	—	X (*8)	X	X	X
—	Turbomachinery I/O Modules					
AGS813	Servo Module (Isolated)	X	X	—	X	X (G3 only)
AGP813	High Speed Protection Module (Isolated)	X	X	—	X	X (G3 only)

X: Available. —: Not available.

*6: EC401 is installed in AFV40□ as standard.

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

*8: 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.

● Terminal Blocks

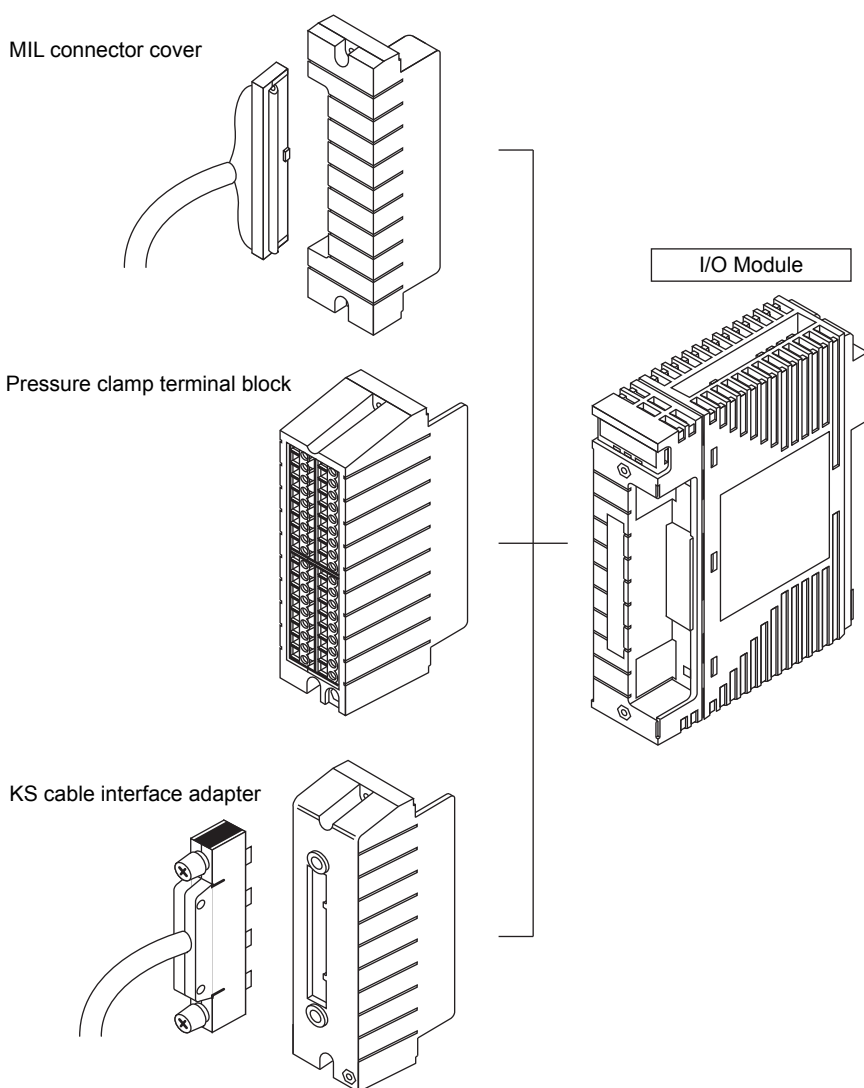
To wire between I/O Module and field devices, install a pressure clamp terminal or KS cable interface adapter on the I/O Module.

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.



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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)	—

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 k Ω , 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	—

■ 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 FIO Node Units and Field Control Units imposes a limitation on the total number of modules considering the power supply.

FIO Node Unit:

For application to non-hazardous area

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

For application to hazardous area

Non temperature option:

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

Temperature option(When use in 60°C to 70°C):

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

FCU (Processor Module: Single configuration) (*2):

For application to non-hazardous area or hazardous area

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

FCU (Processor Module: Dual-Redundant configuration) (*2):

For application to non-hazardous area

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

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

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°C 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: FCU (with cabinet) is prohibited to use in hazardous area.

Table Factor for Each Module

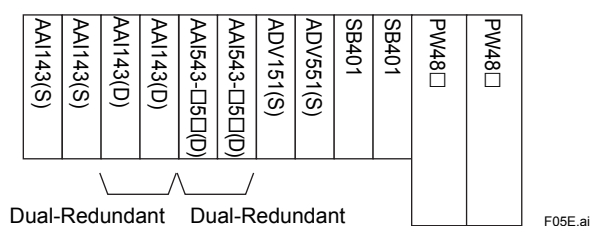
	Model	Factor	
		Single	Each Pair in Dual-redundant Configuration
A	ADV869 (ST5)	3	-
	ADV169 (ST6)	3	-
	ADV569 (ST7)	3	-
	AAV544	3	3
	AGP813	3	6
B	AAI841	17	26
	AAB841(MAC2/VM2)	9	17
	AAI141	16	16
	AAI143	22	24
	AAI543-□5□, -□E□ (standard response)	21	25
	AAI543-□6□, -□F□ (fast response)	21	29
	AAP135	16	25
	AAP849	9	17
	AAI135	15	19
	AAI835	15	22
	AAB141	1	2
	AAB842	11	20
	Others	0	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

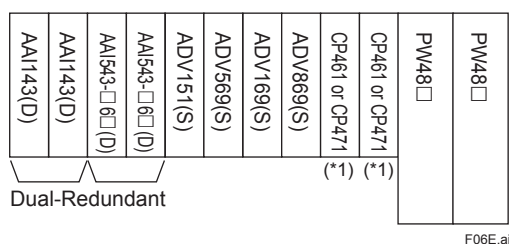
Example: When installing modules in an ANB10D as follows where “(S)” indicates Single and “(D)” indicates Dual-Redundant.



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:

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

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).

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

● 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

Optical ESB Bus Repeater Unit 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.

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

- 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 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

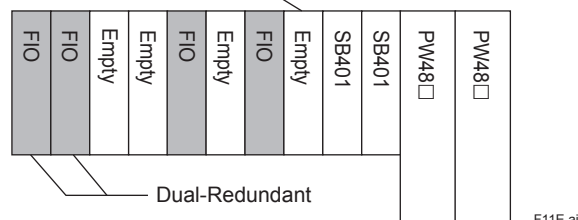


Figure IOM Installation in a Node

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 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

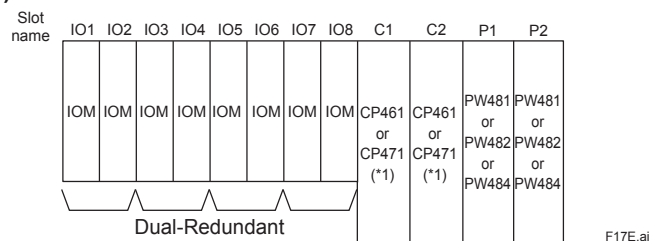
Nominal conductor cross-sectional area of this module is 1.25mm² or less. Connect to from the CH1 of terminal.

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

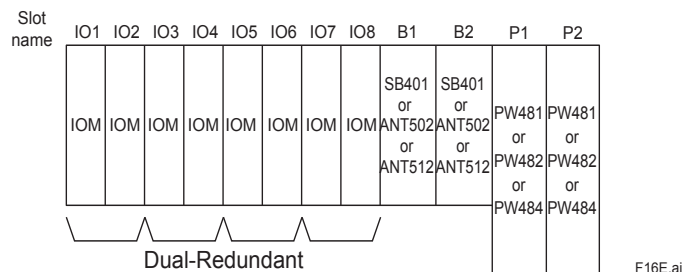
To make I/O Modules dual-redundant, install the I/O Modules in slots numbered IO1-IO2, IO3-IO4, IO5-IO6 and/or IO7-IO8, as shown in the figure below.

Field Control Unit (for FIO)

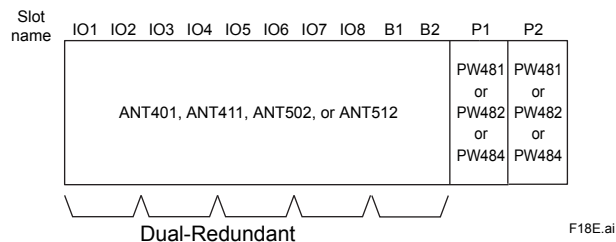


*1: A dual-redundant configuration is enabled by using 2 identical modules with same model code (CP461 or CP471).

FIO Node Unit



Optical ESB Bus Repeater Unit

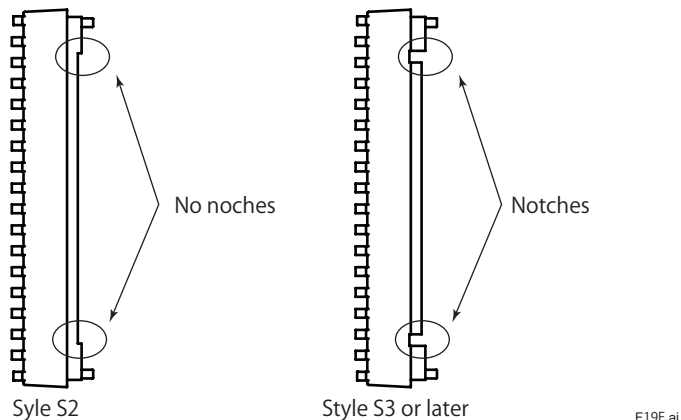


● Protection of Empty Slots

When the modules are not installed, be sure to use the following dummy cover to protect the empty slots.

Model	Description
ADCV01	Dummy Cover (for Processor Module (*1), I/O Module, Bus Interface Module)
ADCV02	Dummy Cover (for Power Supply Module)

*1: Style S2 cannot be used for Processor Module. For details about the differences of style, refer to the following drawings.



■ APPLICABLE STANDARDS

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

■ TRADEMARK ACKNOWLEDGMENT

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