General Specifications

Analog I/O Modules
(for FIO)

CENTUM VP

GS 33J60F60-01EN

[Release 6]

■ GENERAL

This document describes about hardware specifications of Analog I/O Modules (for FIO) to be installed in the ESB bus node units (ANB10S and ANB10D), Optical ESB bus node units (ANB11S and ANB11D), and field control units (for FIO) (AFV30S, AFV30D, AFV40S, AFV40D, AFV10S, AFV10D).

These analog I/O modules function as signal converters; by inputting field analog signals into these modules, it converts them to internal data for field control stations (FCS), or the FCS's internal data to analog signals for outputs.

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● Current Input Modules (Isolated)

This module provides 16 inputs of 4 to 20 mA signal. It can be used in dual-redundant configuration.

Items		Specifications
Model		**AAI143 (*1)**
Number of input channels		16, isolated
Input signal		4 to 20 mA
Allowable input current		24 mA
Withstanding voltage		Between input and system: 1500 V AC, for 1 minute (*3)
Input resistance	**Power ON**	270 Ω (20 mA) to 350 Ω (4 mA) (*2)
	Power OFF	500 kΩ or larger
Accuracy		±16 μA
Data update period		10 ms
Transmitter power supply		19.0 V or higher (at 20 mA) 25.5 V or less (at 0 mA) (output current limit: 25 mA) (*4)
Setting of 2-wire or 4-wire transmitter		For each channel by setting pin
Drift due to ambient temperature change		±16 μA/10 ˚C
Maximum current consumption		230 mA (5 V DC), 540 mA (24 V DC)
Weight		Approx. 0.30 kg
External communication		Pressure clamp terminal, MIL connector cable, dedicated cable (KS1)
HART communication		Available

*1: A Zener barrier is not allowed to be connected with this module. Use an isolation barrier when the module is used in intrinsically safe application.

*2: The module input resistance viewed from the terminals depends on the current strength as calculated as below:

$$250\ \Omega + \frac{\text{voltage drop in the input protection circuit}}{\text{current value}}$$

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*3: When the dedicated cable is used, the withstanding voltage is 500 V AC (between the input signal and the system). When the ML connector cable is used, the withstanding voltage depends on the electrical specifications of the cable.

*4: This voltage is generated between the connecting terminals for 2-wire transmitters for this module. When calculating the minimum operating voltage for transmitters, consider to allow margins for voltage drop in external wiring.

● Current Output Module (Isolated)

This module provides 16 outputs of 4 – 20 mA signal. It can be used in dual-redundant configuration. (*1)

Items	Specifications	
Model	**AAI543-□5□/-□E□**	**AAI543-□6□/-□F□** (*2)
Number of output channels	16, isolated, standard switch-over response in redundant configuration (*3)	16, isolated, fast switch-over response in redundant configuration (*3)
Output signal	4 to 20 mA	
Withstanding voltage	Between output and system: 1500 V AC, for 1 minute (*4)	
Allowable load resistance	0 to 750 Ω	
Circuit-open detection	Less than 0.65 mA	
Accuracy	±48 μA	
Data update period	10 ms	
Drift due to ambient temperature change	±16 μA/10 ˚C	
Maximum current consumption	230 mA (5 V DC), 540 mA (24 V DC)	
Weight	Approx. 0.40 kg	
External communication	Pressure clamp terminal, MIL connector cable, dedicated cable (KS1)	
HART communication	Available	

*1: A dual-redundant configuration is enabled by using two identical modules with the same switch-over response (standard or fast).

*2: When AAI543-□6□/-□F□ is installed in a node unit that conforms to the temperature environment, use it in the ambient temperature within 0 to 60 ºC range.

*3: When a switch over from control to stand-by module takes place in the dual-redundant configuration, the maximum period of time when the field output falls below 4 mA is 100 ms for AAI543-□5□/-□E□ (standard switch-over response) and 2 ms for AAI543-□6□/-□F□ (fast switch-over response). In case of connecting fast response type field devices, use AAI543-□6□/-□F□ (fast switch-over response) in the dual-redundant configuration.

*4: When the dedicated cable is used, the withstanding voltage is 500 V AC (between the input signal and the system). When the ML connector cable is used, the withstanding voltage depends on the electrical specifications of the cable.

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■ ANALOG I/O MODULE (WITH HART COMMUNICATION)

The analog I/O module (with HART communication function) connected to a transmitter or a valve positioner receives HART variable (*1) in addition to exchange analog input/output data by 4 – 20 mA signal with field control stations (FCS). There are 8 types of analog I/O modules (with HART communication function).

*1: HART variable can be read by HART Command #3.

There are 8 types of analog I/O modules (with HART communication function).

Model	Model Name	Function
AAI141-H	Analog Input Module (Current Input)	16-channel, 4 to 20 mA, non-isolated
AAB141-H	Analog Input Module (Voltage/current Input)	16-channel, 1 to 5 V/4 to 20 mA, non-isolated
AAI841-H	Analog I/O Module (Current I/O)	8-channel input/8-channel output, 4 to 20 mA, non-isolated
AAB842-H	Analog I/O Module (Voltage/current Input, Current Output)	8-channel input/8-channel output, 1 to 5 V/4 to 20 mA input, 4 to 20 mA output, non-isolated
AAI135-H	Analog Input Module (Current Input)	8-channel, 4 to 20 mA, isolated channels
AAI835-H	Analog I/O Module (Current I/O)	4-channel input/4-channel output, 4 to 20 mA, isolated channels
AAI143-H	Analog Input Module (Current Input)	16-channel, 4 to 20 mA, isolated
AAI543-H	Analog Output Module (Current Output)	16-channel, 4 to 20 mA, isolated

● Communication with HART Devices

The analog I/O modules (with HART communication function) communicate with field devices and store analog data and HART variables in the Input/Output image area in the communication module. An FCS refers to and sets the Input/Output image by accessing the analog I/O modules (with HART communication function). The FCS utilizes the field device data via I/O terminals of the function block in the same way as other analog/digital I/O signals.

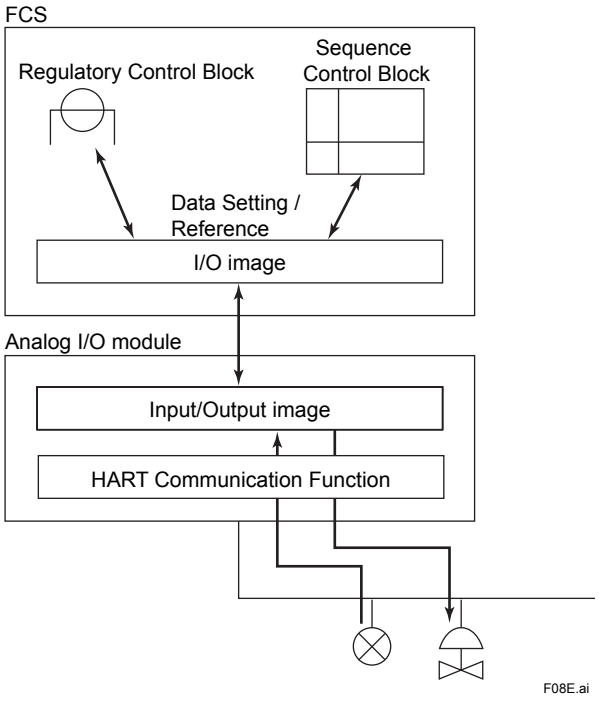


Figure Process Data Flow of HART Communications

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● HART Communication Functional Specifications

The analog I/O modules (with HART communication function) are equipped with HART modems and eable HART communication (*1) by directly connecting the HART devices to he modules.

No. of HART devices: Max. 16 devices/module
HART variables: Max. 32 points/module
HART variables can be treated as ordinary process input data via %Z terminal connection.
HART multidrop connection (*2): Max. 5 devices/channel
HART variables data refresh cycle time :
1 second/device (When maximum of 16 devices are connected, it is 17 seconds per ESB bus connection.)

*1: HART communication refers to HART variable communicaiton, on-demand communication, and hand held terminal (HHT) communication.
*2: It is possible to connect only input devices. This connection does not support analog data value nor burst function.

● HART Communication Specifications

Table HART Communication Specifications

Function	Description
Communication mode	Serial half duplex, start-stop synchronization, 1 start/ 8 bit/ odd parity/ 1 stop
Applicable standard	HART Protocol Revision 5.7 (*1)
Transmission speed	1200 ±2 bps
Modulation technique	Binary phase-continuous FSK 1: 1200 Hz ±1 %, 0: 2200 Hz ±1%
Frame length	5 to 267 bytes Contents of max. 267 bytes: Delimiter: 1 Address: 5 Command: 1 Byte count: 1 Data: 255 (includes two bytes of response code) Check byte: 1
Frame detection	3 byte header byte-count carrier (ON/OFF) Preamble: 5 to 20 bytes
Error detection coding	Longitudinal/vertical parity
Response time	Max. 28 characters (256.7 ms)
No response timer	33 characters (305 ms) for primary, 41 characters (380 ms) for secondary
Bus monitor	8 characters (75 ms)
Response window	20 ms

*1: The HART 5, 6, and 7 devices can be connected but applying the HART protocol 5.7 function.

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● HART Communication System Configuration

The analog I/O modules (with HART communication function) can be configured dual-redundant by placing the two modules in the adjacent slots (odd number and even number slots) on the same node unit.

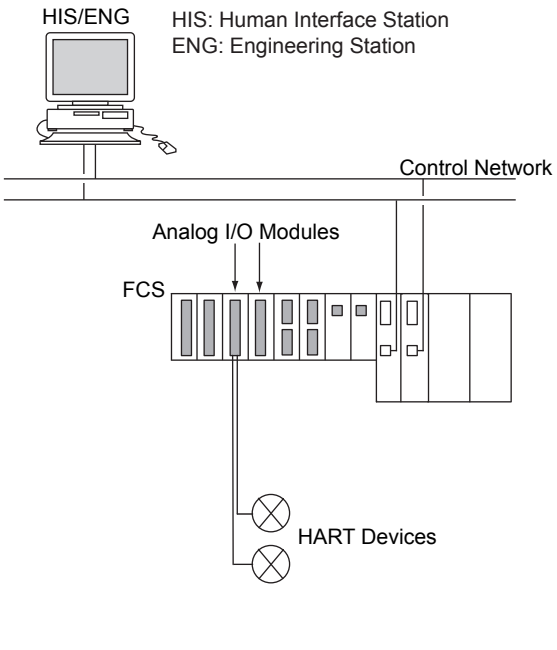


Figure HART Communication System Configuration (Dual-redundant)

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		Description
Model	AAB841	Analog I/O Module (1 to 5 V input, 4 to 20 mA output, 8-channel input/8-channel output, Non-Isolated)
Suffix Codes	-S	Standard type
	5	With no explosion protection
	E	With explosion protection
	0	Basic type
	3	With ISA Standard G3 option and temperature (-20 to 70 °C) option
Option Codes	/K4A00	With KS Cable Interface Adapter [Model : ATK4A-00]
	/M4A00	With MAC2 Compatible Adapter [Model : ATM4A-00]
	/V4A00	With VM2 Compatible Adapter [Model : ATV4A-00] (*1)
	/A4S00	With Pressure Clamp Terminal Block for Analog [Model : ATA4S-00]
	/A4S10	With Pressure Clamp Terminal Block for Analog (surge absorber) [Model : ATA4S-10]
	/A4D00	With Dual Pressure Clamp Terminal Block for Analog [Model : ATA4D-00]
	/A4D10	With Dual Pressure Clamp Terminal Block for Analog (surge absorber) [Model : ATA4D-10]
	/CCC01	With Connector Cover for MIL Cable [Model : ACCC01]

*1: When using this adapter, 4 to 20 mA output (8-channel) of AAB841 varies to 1 to 5 V output.

		Description
Model	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)
Suffix Codes	-H	With digital communication (HART protocol)
	5	With no explosion protection
	E	With explosion protection
	0	Basic type
	3	With ISA Standard G3 option and temperature (-20 to 70 °C) option
Option Codes	/M4A00	With MAC2 Compatible Adapter [Model : ATM4A-00]
	/V4A00	With VM2 Compatible Adapter [Model : ATV4A-00] (*1)

*1: When using this adapter, 4 to 20 mA output (8-channel) of AAB842 varies to 1 to 5 V output.

		Description
Model	AAI143	Analog Input Module (4 to 20 mA, 16-channel, Isolated)
Suffix Codes	-S	Standard type
	-H	With digital communication (HART protocol)
	5	With no explosion protection
	E	With explosion protection
	0	Basic type
	3	With ISA Standard G3 option and temperature (-20 to 70 °C) option
Option Codes	/K4A00	With KS Cable Interface Adapter (For connecting AEA4D Terminal Board) [Model: ATK4A-00]
	/A4S00	With Pressure Clamp Terminal Block [Model: ATA4S-00]
	/A4S10	With Pressure Clamp Terminal Block (surge absorber) [Model: ATA4S-10]
	/A4D00	With Dual Pressure Clamp Terminal Block [Model: ATA4D-00]
	/A4D10	With Dual Pressure Clamp Terminal Block (surge absorber) [Model: ATA4D-10]
	/CCC01	With Connector Cover for MIL Cable [Model: ACCC01]

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