# 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.*

YOKOGAWA

Yokogawa Electric Corporation
2-9-32, Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Tel.: 81-422-52-5634 Fax.: 81-422-52-9802

GS 33J60F60-01EN
©Copyright Feb. 2015 (YK)
6th Edition Mar. 20, 2017 (YK)

## ● 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:

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

F04E.ai

*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.

All Rights Reserved. Copyright © 2015, Yokogawa Electric Corporation

## ■ 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.

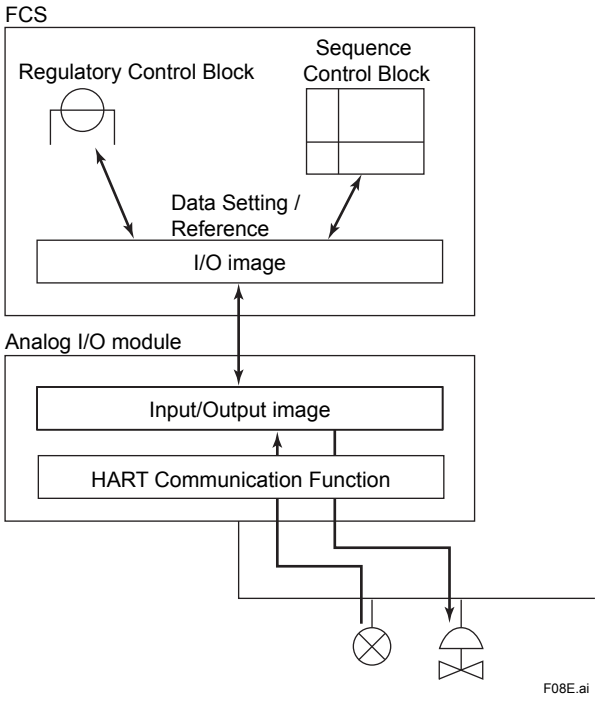
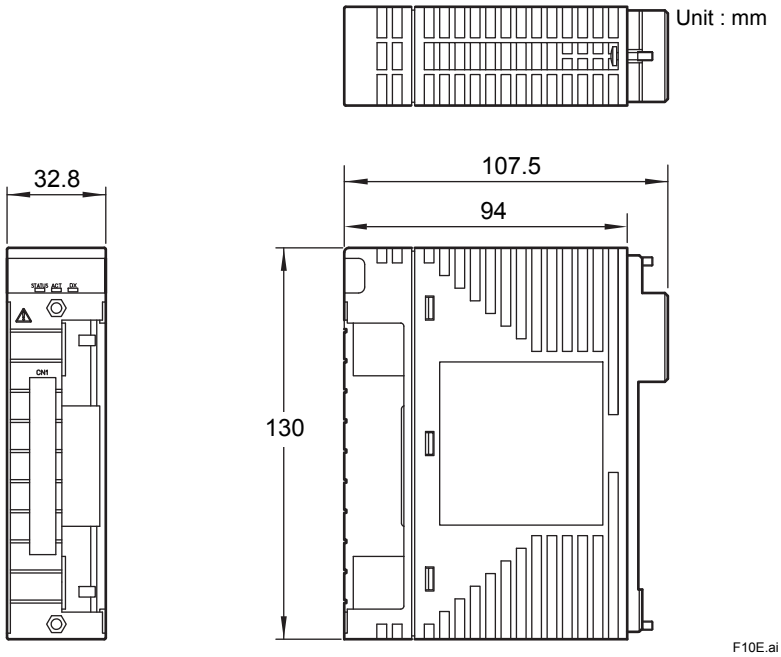



**Figure Process Data Flow of HART Communications**

All Rights Reserved. Copyright © 2015, Yokogawa Electric Corporation

## ■ EXTERNAL DIMENSIONS

### ● AAI141, AAV141, AAV144, AAI841, AAB841, AAV544, AAI143, AAI543, AAI135, AAI835, AAP135, AAB141, AAB842

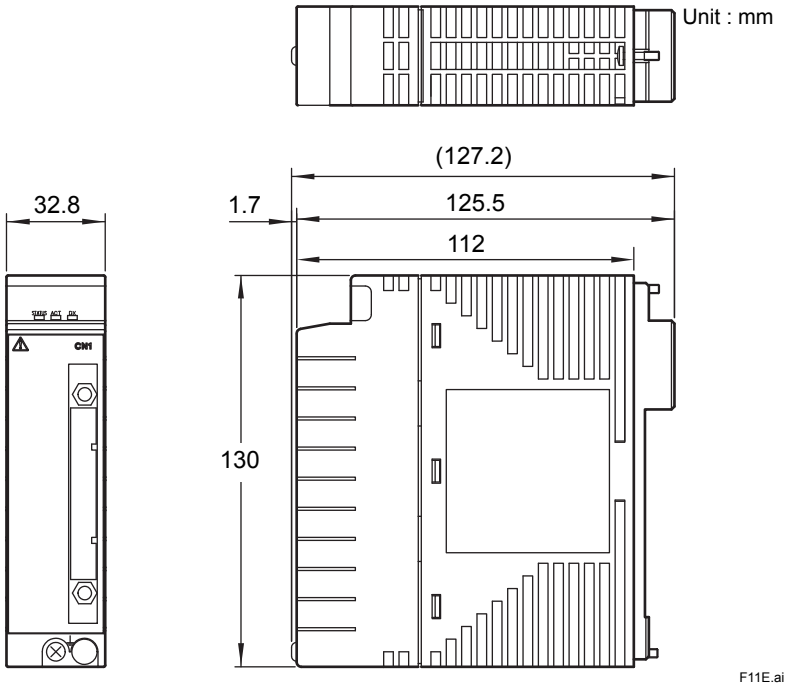



Nominal Tolerances :

When the reference dimension is over 0.5 mm and equal or less than 120 mm, its nominal tolerance is ± 0.8 mm, while its combination of nominal tolerance is ± 1.5 mm.

When the reference dimension is over 120 mm, its nominal tolerance is in accordance with JEM 1459.

### ● AAT145, AAP849




Nominal Tolerances :

When the reference dimension is over 0.5 mm and equal or less than 120 mm, its nominal tolerance is ± 0.8 mm, while its combination of nominal tolerance is ± 1.5 mm.

When the reference dimension is over 120 mm, its nominal tolerance is in accordance with JEM 1459.

All Rights Reserved. Copyright © 2015, Yokogawa Electric Corporation

| | | Description |
|---|---|---|
| **Model** | AAI543 | Analog Output Module (4 to 20 mA, 16-channel, Isolated) |
| **Suffix Codes** | -S | Standard type |
| | -H | With digital communication (HART protocol) |
| | 5 | Standard switch-over response in redundant configuration with no explosion protection(*1) |
| | 6 | Fast switch-over response in redundant configuration with no explosion protection(*2) |
| | E | Standard switch-over response in redundant configuration with explosion protection(*1) |
| | F | Fast switch-over response in redundant configuration with explosion protection(*2) |
| | 0 | Basic type |
| | 1 | With ISA Standard G3 option |
| | 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] |

*1: If “standard switch-over response in redundant configuration” is selected, “basic type” or “with ISA Standard G3 option and temperature (-20 to 70 °C) option” may be specified.
*2: If “fast switch-over response in redundant configuration” is selected, “basic type” or “with ISA Standard G3 option” may be specified.

| | | Description |
|---|---|---|
| **Model** | AAV144 | Analog Input Module (-10 to +10 V, 16-channel, 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] |
| | /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] |

| | | Description |
|---|---|---|
| **Model** | AAV544 | Analog Output Module (-10 to +10 V, 16-channel, 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] |
| | /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] |

All Rights Reserved. Copyright © 2015, Yokogawa Electric Corporation