General Specifications

GS 34M6H11-04E

FA-M3
Analog Input Modules

FA-M3

Contents

General Specification

F3AD04-0V
Analog Input Module

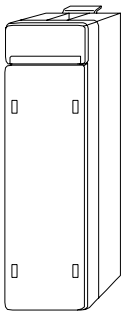
FA-M3

GS 34M6H11-04E

■ General

The F3AD04-0V is an analog-to-digital conversion input module for the FA-M3.

- 3 input signal range options are available: 0 to 5 V DC, 1 to 5 V DC, and -10 to 10 V DC.
- A single module can accommodate four input points.
- Four input points can be multiplexed during scanning.
- The input terminals are isolated from the internal circuit by photocouplers.
- The conversion speed is as fast as 1 ms/point.
- Advanced and easy-to-use features such as scaling and filtering are provided.

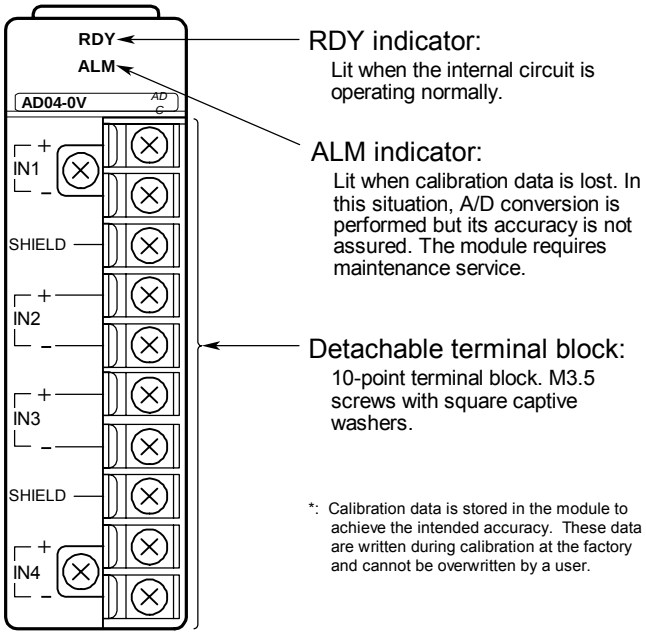


■ Specifications

Item	Specification
Number of inputs	4
Absolute maximum rating	Max.: 18 V DC Min.: -18 V DC
Input signal range[*1]	0 to 5 V DC (-0.25 to 5.25 V DC) 1 to 5 V DC (-0.25 to 5.25 V DC) -10 to 10 V DC (-11.0 to 11.0 V DC)
Isolation method	Between input terminals and internal circuit: Photocoupler insulation Between input terminals: Not isolated, common negative
Withstanding voltage	500 V DC for 1 minute
Input resistance	1 MΩ
Resolution (12-bit A/D)	0 to 5 V or 1 to 5 V DC: 1.4 mV -10 V to 10 V DC : 5.7 mV
Overall accuracy	23 ±2°C : ±0.2% (full scale) 0 to 55°C: ±0.5% (full scale)
Conversion period	1 ms × (number of inputs)
Scaling	Upper and lower limit values can be set to any value between -20,000 to 20,000.
Filter	Channels can be enabled or disabled individually.[*2]
Current consumption	210 mA (5 V DC)
External connection	10-point terminal block, M3.5 screw
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm[*3]
Weight	170 g

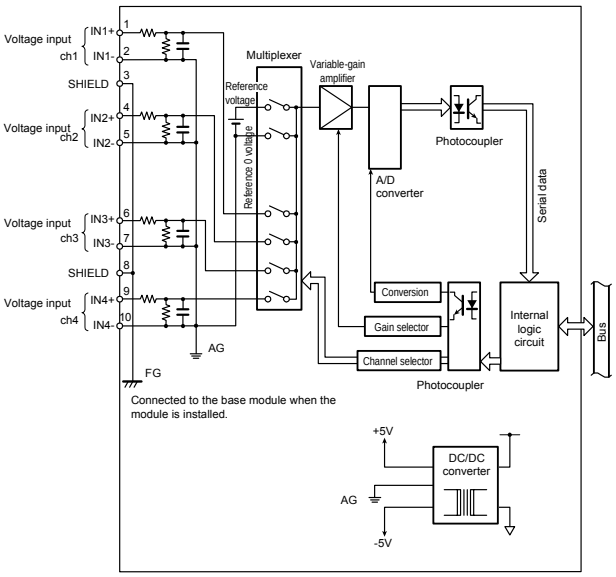
*1: Selectable for each channel using software. The default setting is -10 V to 10 V DC.
*2: The actual time constant value depends the number of unskipped channels and other preset values.
*3: Excluding protrusions (see external dimensions for details).

■ Components and Functions

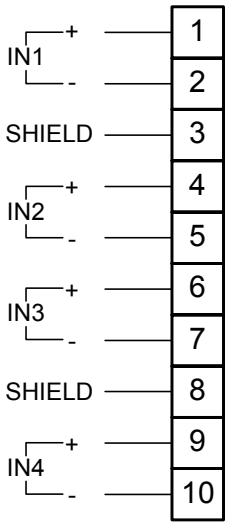


This model has the specification as the F3AD04-0N.

Internal Circuit Diagram



External Connection Diagram



- SHIELD terminal 3 is shared by IN1 and IN2.
- SHIELD terminal 8 is shared by IN3 and IN4.
- SHIELD terminals are connected to the frame ground of the power supply module via the base module.

Operating Environment

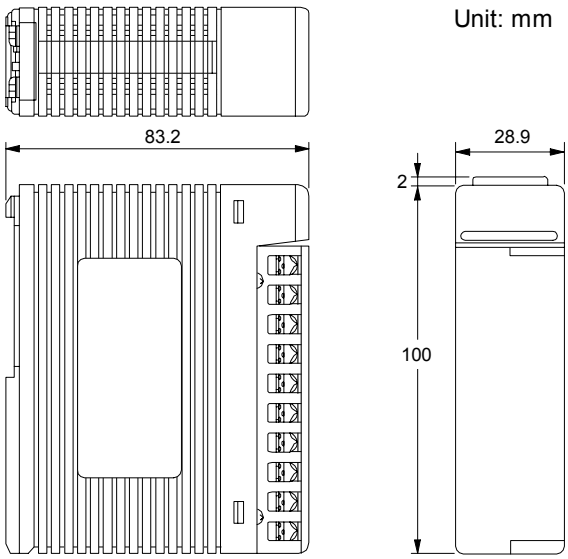
There is no restriction on the type of CPU modules that can be used with this module.

Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
F3AD04	-0V	—	—	0 to 5 V, 1 to 5 V, or -10 to 10 V DC 4 inputs, 12-bit A/D

External Dimensions

Unit: mm



General Specification

F3AD08-1V
Analog Input Module

FA-M3

GS 34M6H11-04E

■ General

The F3AD08-1V is an analog-to-digital conversion input module for the FA-M3.

- 3 input signal range options are available: 0 V to 5 V DC, 1 V to 5 V DC, and -10 V to 10 V DC.
- A single module can accommodate eight input points.
- Eight input points can be multiplexed during scanning.
- The input terminals are isolated from the internal circuit by photocouplers.
- The conversion speed is as fast as 1 ms/point.
- Advanced and easy-to-use features such as scaling and filtering are provided.

■ Specifications

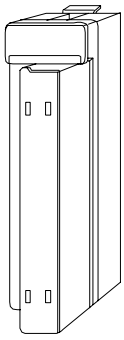
Item	Specification
Number of inputs	8 (differential signal input)
Absolute maximum rating	Max.: 18 V DC Min.: -18 V DC
Input signal range[*1]	0 to 5 V DC (-0.25 to 5.25 V DC) 1 to 5 V DC (-0.25 to 5.25VDC) -10 to 10 V DC (-11.0 to 11.0VDC)
Allowable common-mode voltage	±6 V DC max. (0 to 5 V/1 to 5 V DC) ±1 V DC max. (-10 to 10 V DC)
Isolation method	Between input terminals and internal circuit: Photocoupler insulation Between input terminals: Not isolated
Withstanding voltage	500 V DC for 1 minute
Input resistance	1 MΩ min.[*2]
Resolution (12-bit A/D)	0 to 5 V and 1 to 5 V DC:1.4 mV -10 to 10 V DC: 5.7mV
Overall accuracy	23 ±2ºC : ±0.2% (full scale) 0 to 55ºC: ±0.5% (full scale)
Conversion period	1 ms × (number of inputs)
Scaling	Upper and lower limit values can be set to any value between -20,000 to 20,000.
Filter	Channels can be enabled or disabled individually.[*3]
Current consumption	210mA (5VDC)
External connection	18-point terminal block, M3.5 screw
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm [*4]
Weight	200 g

*1: Selectable for each channel using software. The default setting is -10 to 10 V DC.

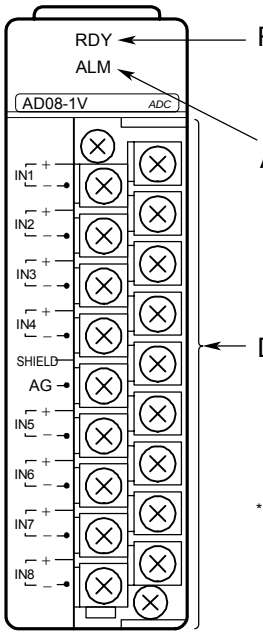
*2: 2 MΩ for channels where the input terminal IN□- is not connected to the AG terminal.

*3: The actual time constant value depends on the number of unskipped channels and other settings.

*4: Excluding protrusions (see external dimensions for details).



■ Components and Functions



RDY indicator:
Lit when the internal circuit is operating normally.

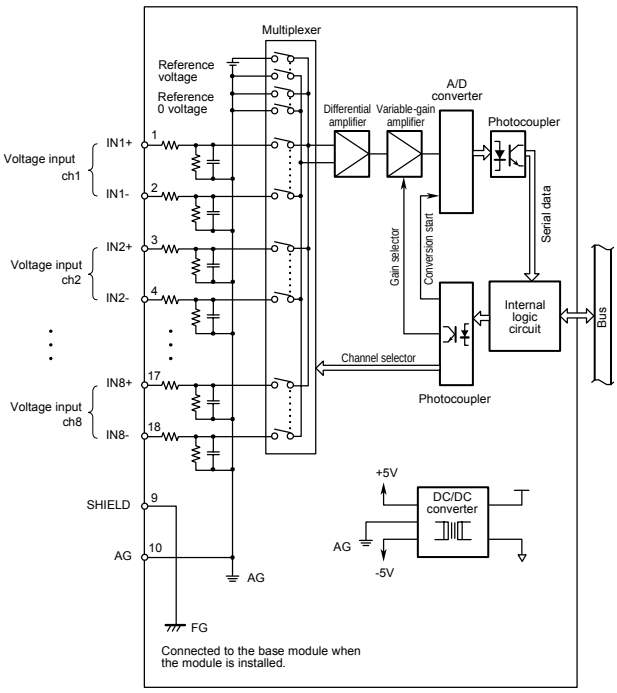
ALM indicator:
Lit when calibration data is lost. In this situation, A/D conversion is performed but its accuracy is not assured. The module requires maintenance service.

Detachable terminal block:
18-point terminal block. M3.5 screws with square captive washers.

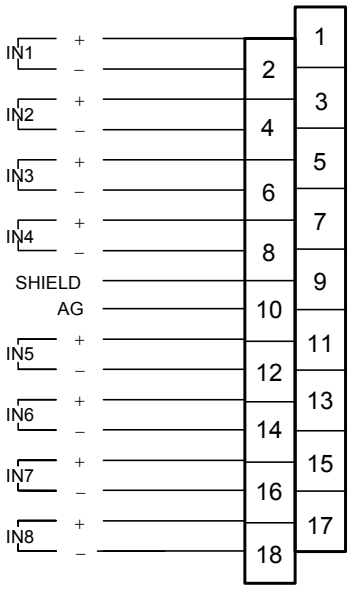
*: Calibration data is stored in the module to achieve the intended accuracy. These data are written during calibration at the factory and cannot be overwritten by a user.

This model has the same specifications as F3AD08-1N.

Internal Circuit Diagram



External Connection Diagram



- The SHIELD terminal is connected to the frame ground of the power supply module via the base module.
- The AG terminal is grounded to the analog ground in the base module.

Operating Environment

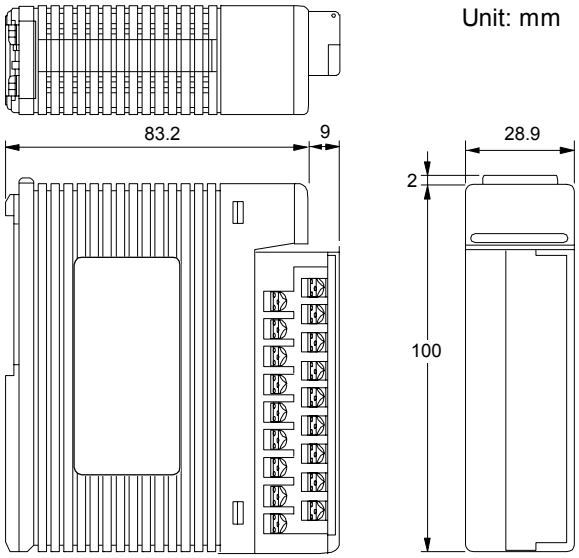
There is no restriction on the type of CPU modules that can be used with this module.

Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
F3AD08	**-1V**	—	—	0 to 5 V, 1 to 5 V, or -10 to 10 VDC, 8 inputs, differential input 12-bit A/D

External Dimensions

Unit: mm



General Specification

F3AD08-4V
Analog Input Module

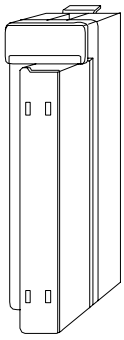
FA-M3

GS 34M6H11-04E

■ General

The F3AD08-4V is an analog-to-digital conversion input module for the FA-M3.

- Input signal range: 4 to 20 mA
- A single module can accommodate eight input points.
- Eight input points are multiplexed during scanning.
- The input terminals are isolated from the internal circuit by photocouplers.
- The conversion speed is as fast as 1 ms/point.
- Advanced and easy-to-use features such as scaling and filtering are provided.



■ Specifications

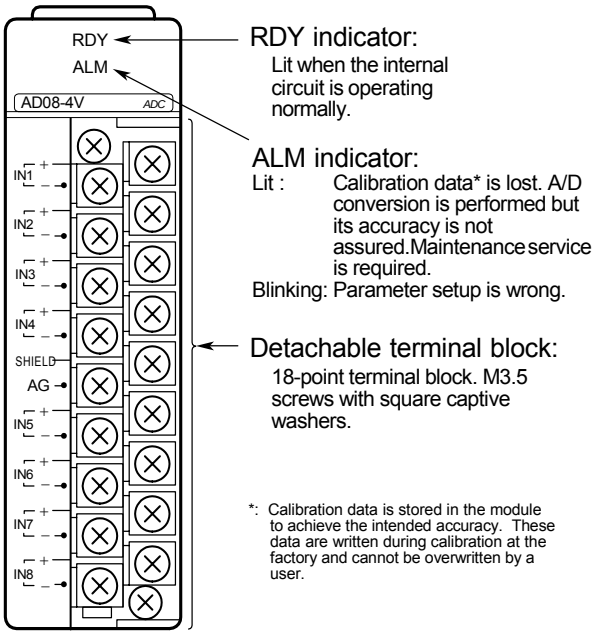
Item	Specification
Number of inputs	8 (differential signal input)
Absolute maximum rating	Max : 25 mA DC Min.: -25 mA DC
Input signal range[*1]	0 to 20 mA DC (-1.0 to 21.0 mA DC) 4 to 20 mA DC (-1.0 to 21.0 mA DC)
Allowable common-mode voltage	±6 V DC max.
Isolation method	Between input terminals and internal circuit: Photocoupler isolation Between input terminals: Not isolated
Withstanding voltage	500 V DC for 1 minute
Input resistance	250 Ω
Resolution (12-bit A/D)	5.6 μA
Overall accuracy	23 ±2°C : ±0.2% (full scale) 0 to 55°C: ±0.5% (full scale)
Conversion period	1 ms × (number of inputs)
Scaling	Upper and lower limit values can be set to any value between -20,000 to 20,000.
Filter	Channels can be enabled or disabled individually.[*2]
Current consumption	210 mA (5 V DC)
External connection	18-point terminal block, M3.5 screw
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm [*3]
Weight	200 g

*1: Default range is 0 to 20 mA.

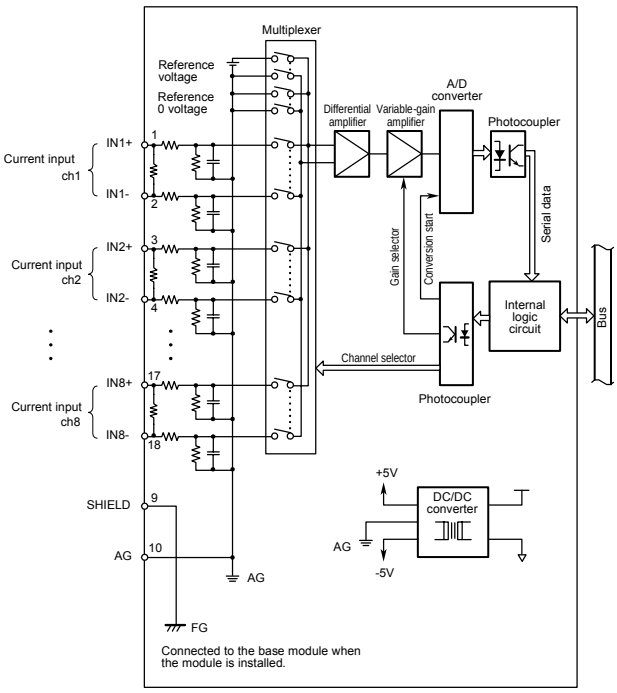
*2: The actual time constant value depends on the number of unskipped channels and other settings.

*3: Excluding protrusions (see external dimensions for details).

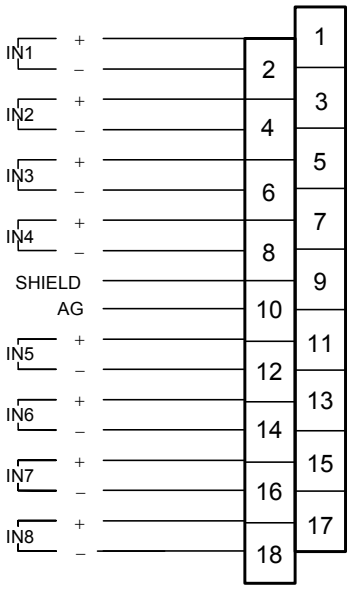
■ Components and Functions



■ Internal Circuit Diagram



■ External Connection Diagram



- The SHIELD terminal is connected to the frame ground of the power supply module via the base module.
- The AG terminal is grounded to the analog ground in the base module.

■ Operating Environment

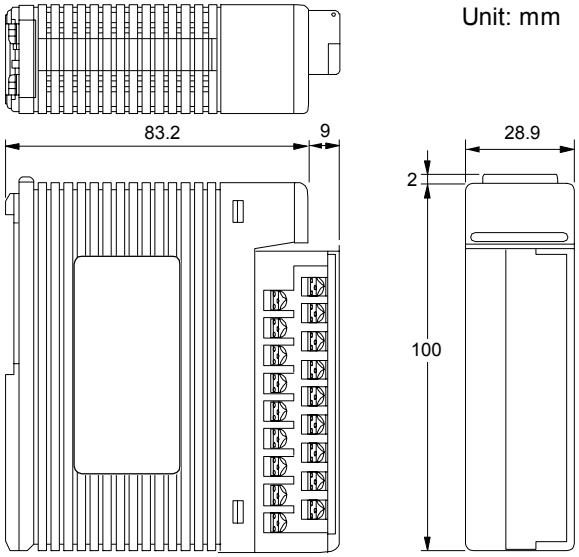
There is no restriction on the type of CPU modules that can be used with this module.

■ Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
F3AD08	-4V	—	—	0 to 20 mA, 4 to 20 mA, 8 inputs, differential input 12-bit A/D

■ External Dimensions

Unit: mm



General Specification

F3AD04-0R
High-Resolution Analog Input Module

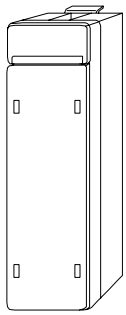
FA-M3

GS 34M6H11-04E

■ General

The F3AD04-0R is a high-resolution analog-to-digital conversion input module for the FA-M3.

- 3 input signal range options are available: 0 V to 5 V DC, 1 V to 5 V DC, and -10 V to 10 V DC.
- A single module can accommodate four input points.
- Four input points can be multiplexed during sequential A/D conversion.
- The input terminals are isolated from the internal circuit by photocouplers.
- The conversion speed is as fast as 1 ms/point.
- Advanced and easy-to-use features such as scaling and filtering are provided.



■ Specifications

Item	Specification
Number of inputs	4
Absolute maximum rating	Max.: 18 V DC Min.: -18 V DC
Input signal range[*1]	0 to 5 V DC (-0.25 to 5.25 V DC) 1 to 5 V DC (-0.25 to 5.25 V DC) -10 to 10 V DC (-11.0 to 11.0 V DC)
Isolation method	Between input terminals and internal circuit: Photocoupler insulation Between input terminals: Not isolated, common negative
Withstanding voltage	500 V DC for 1 minute
Input resistance	1 MΩ
Resolution (16-bit A/D)	0 to 5 V or 1 to 5 V DC: 1.75 mV[*2] -10 V to 10 V DC : 0.72 mV
Overall accuracy	23 ±2°C : ±0.1% (full scale) 0 to 55°C: ±0.3% (full scale)
Conversion period	1 ms × (number of inputs)
Scaling	Upper and lower limit values can be set to any value between -20,000 to 20,000.
Filter	Channels can be enabled or disabled individually.[*3]
Current consumption	210 mA (5 V DC)
External connection	10-point terminal block, M3.5 screw
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm[*3]
Weight	170 g

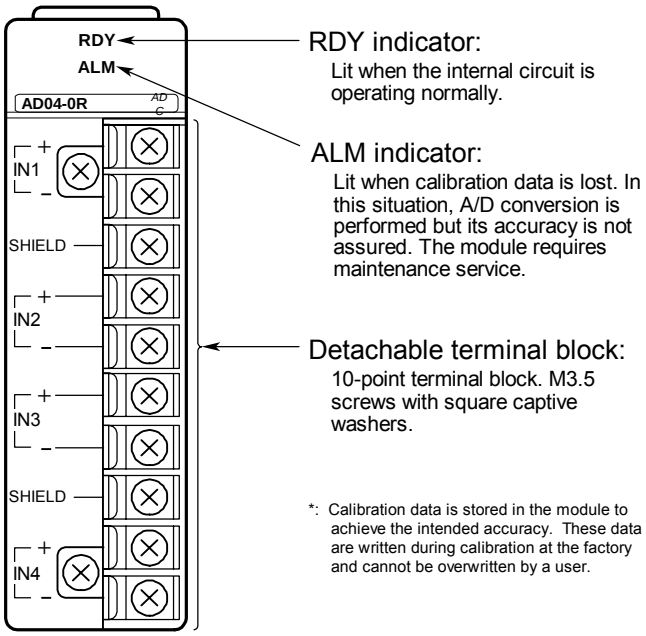
*1: Conversion results are valid within the selected signal range.

*2: Uses 16-bit ADC. This resolution is for internal computations.

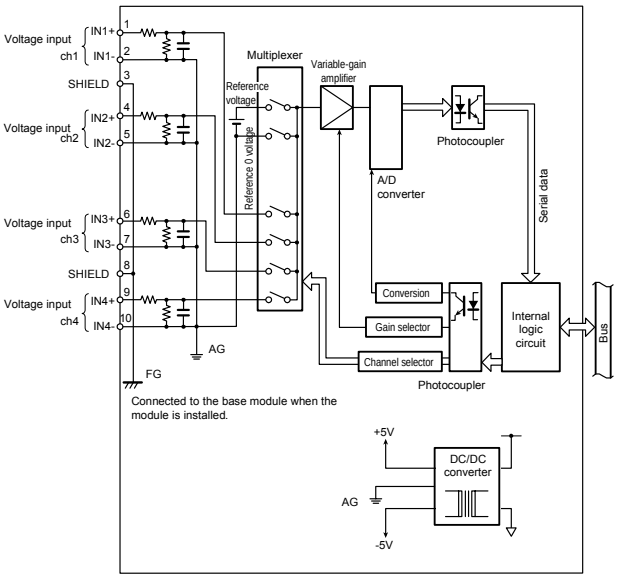
*3: The actual time constant value depends the number of unskipped channels and other preset values.

*4: Excluding protrusions (see external dimensions for details).

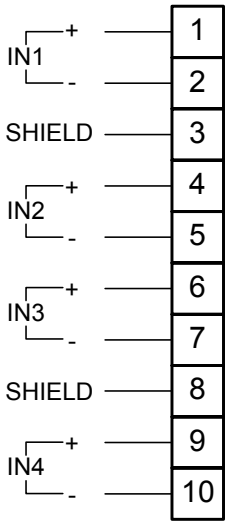
■ Components and Functions



Internal Circuit Diagram



External Connection Diagram



- SHIELD terminal 3 is shared by IN1 and IN2.
- SHIELD terminal 8 is shared by IN3 and IN4.
- SHIELD terminals are connected to the frame ground of the power supply module via the base module.

Operating Environment

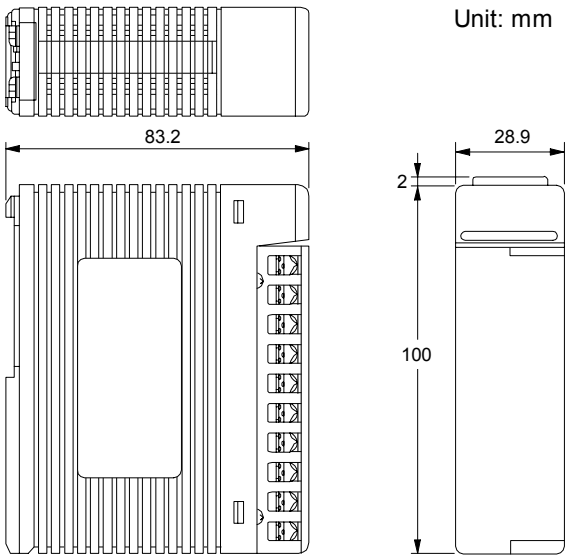
There is no restriction on the type of CPU modules that can be used with this module.

Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
F3AD04	-0R	—	—	0 to 5 V, 1 to 5 V, or -10 to 10 V DC 4 inputs, 16-bit A/D

External Dimensions

Unit: mm



General Specification

F3AD08-1R
High-Resolution Analog Input Module

FA-M3

GS 34M6H11-04E

■ General

The F3AD08-1R is a high-resolution analog-to-digital conversion input module for the FA-M3.

- 3 input signal range options are available: 0 to 5 V DC, 1 to 5 V DC, and -10 to 10 V DC.
- A single module can accommodate eight differential signal inputs.
- Eight input points can be multiplexed during sequential A/D conversion.
- The input terminals are isolated from the internal circuit by photocouplers.
- The conversion speed is as fast as 1 ms/point. It allows adjustment to a noisy environment.
- Advanced and easy-to-use features such as scaling and filtering are provided.

■ Specifications

Item	Specification
Number of inputs	8 (differential signal input)
Absolute maximum rating	Max.: 18 V DC Min.: -18 V DC
Input signal range[*1]	0 to 5 V DC (-0.25 to 5.25 V DC) 1 to 5 V DC (-0.25 to 5.25VDC) -10 to 10 V DC (-11.0 to 11.0VDC)
Allowable common-mode voltage	±6 V DC max. (0 to 5 V/1 to 5 V DC) ±1 V DC max. (-10 to 10 V DC)
Isolation method	Between input terminals and internal circuit: Photocoupler insulation Between input terminals: Not isolated
Withstanding voltage	500 V DC for 1 minute
Input resistance	1 MΩ min.[*2]
Resolution (16-bit A/D)	0 to 5 V and 1 to 5 V DC: 0.175 mV -10 to 10 V DC: 0.72 mV[*3]
Overall accuracy	23 ±2ºC : ±0.1% (full scale) 0 to 55ºC: ±0.3% (full scale)
Conversion period[*3]	1 ms × (number of inputs)
Scaling	Upper and lower limit values can be set to any value between -20,000 to 20,000.
Filter	Channels can be enabled or disabled individually.[*4]
Current consumption	210mA (5VDC)
External connection	18-point terminal block, M3.5 screws
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm [*5]
Weight	200 g

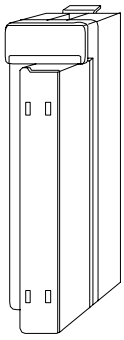
*1: Conversion results are valid within the selected input signal range.

*2: 2 MΩ for channels where the input terminal IN□- is not connected to the AG terminal.

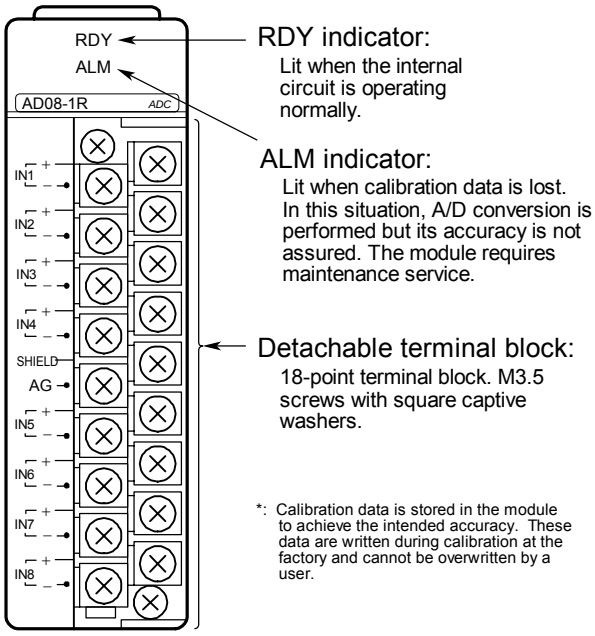
*3: Uses 16-bit ADC. This resolution is for internal computations.

*4: The actual time constant value depends on the number of unskipped channels and other settings.

*5: Excluding protrusions (see external dimensions for details).

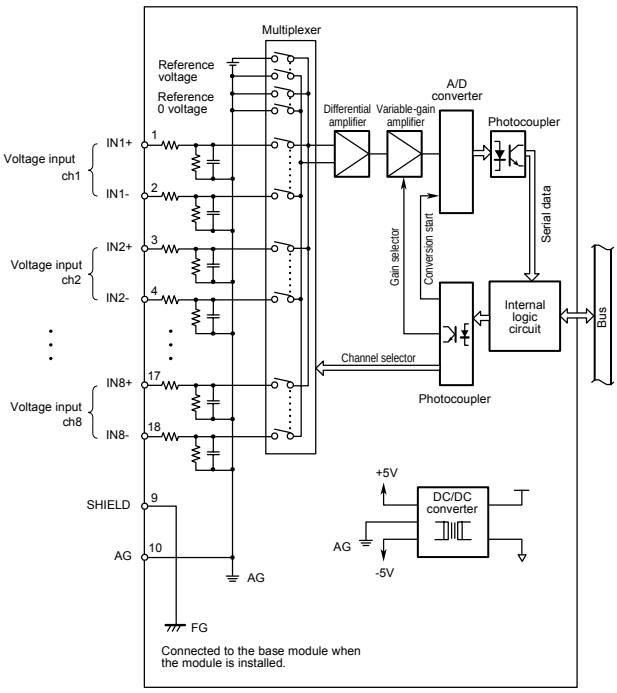


■ Components and Functions

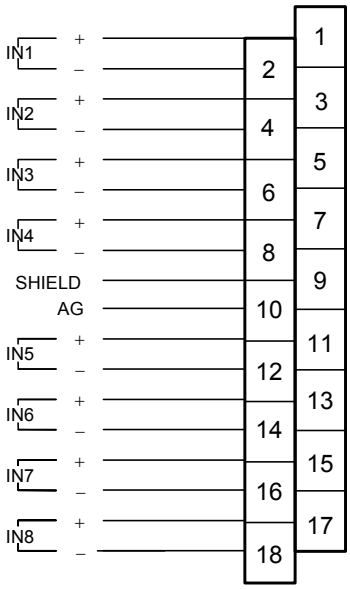


*: Calibration data is stored in the module to achieve the intended accuracy. These data are written during calibration at the factory and cannot be overwritten by a user.

Internal Circuit Diagram



External Connection Diagram



- The SHIELD terminal is connected to the frame ground of the power supply module via the base module.
- The AG terminal is grounded to the analog ground in the base module.

Operating Environment

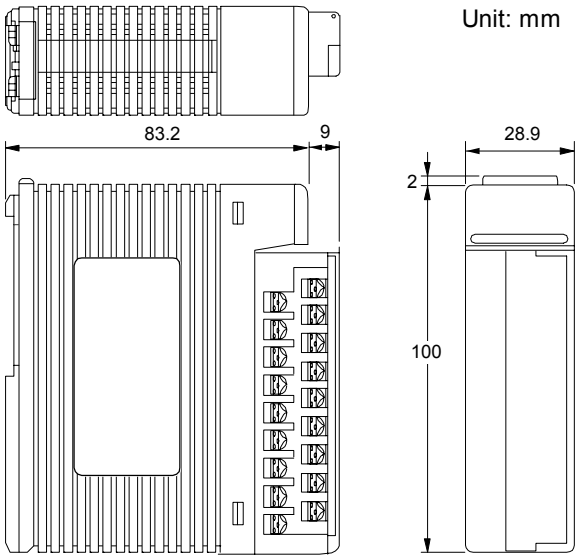
There is no restriction on the type of CPU modules that can be used with this module.

Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
F3AD08	-1R	—	—	0 to 5 V, 1 to 5 V, or -10 to 10 VDC, 8 inputs, differential input 16-bit A/D

External Dimensions

Unit: mm



General Specification

F3AD08-4R, -5R, -6R
High-Resolution Analog Input Module

FA-M3

GS 34M6H11-04E

■ General

F3AD08-4R, F3AD08-5R and F3AD08-6R are analog-to-digital conversion input modules for the FA-M3.

All F3AD08-□R models are equipped with 16-bit A/D converters.

- Super-high conversion speed of 50 µs per point
- A single module can handle eight differential signal inputs.
- Input signal range can be selected on channel basis from 0 to 5V, 1 to 5V, -10 to 10V, 0 to 10 VDC, 0 to 20mA DC and 4 to 20 mA DC.
- Eight input points can be multiplexed during sequential A/D conversion.
- The input terminals are isolated from the internal circuit by photocouplers.
- Conversion period can be selected on module basis from 50µs, 100µs, 250µs, 500µs, 1ms, 16.6ms, 20ms and 100ms.
- Advanced and easy-to-use features such as scaling and filtering are provided.

■ Specifications

Item	Specifications		
	F3AD08-4R	**F3AD08-5R**	**F3AD08-6R**
Number of inputs	8 differential inputs		
Absolute maximum rating	18 V DC or 25 mA DC maximum -18 V DC or -25 mA DC minimum		
Input signal range[*1]	Current signal only 0 to 20mADC (-1.0 to 21.0 mADC) 4 to 20mADC (-1.0 to 21.0 mADC)	Voltage signal only 0 to 5 VDC (-0.25 to 5.25 VDC) 1 to 5 VDC (-0.25 to 5.25 VDC) -10 to 10 VDC (-11.0 to 11.0 VDC) 0 to 10 VDC (-0.5 to 10.5 VDC)	Voltage signal or current signal 0 to 5 VDC (-0.25 to 5.25 VDC) 1 to 5 VDC (-0.25 to 5.25 VDC) -10 to 10 VDC (-11.0 to 11.0 VDC) 0 to 10 VDC (-0.5 to 10.5 VDC) 0 to 20mADC (-1.0 to 21.0 mADC) 4 to 20mADC (-1.0 to 21.0 mADC)
Allowable common-mode voltage	±6 VDC max. (0 to 5 VDC, 1 to 5 VDC, 0 to 20mA DC, 4 to 20mA DC) ±1 VDC max. (-10 to 10 VDC, 0 to 10 VDC)		
Isolation method	Across input terminals and internal circuit: Photocoupler isolation Across input terminals: Not isolated		
Withstanding voltage	500 V DC for one minute		
Input resistance	250Ω	1M Ω min. [*2]	1M Ω min. when configured for voltage input[*2] 250 Ω when configured for current input
Maximum Resolution[*3] **(16-bit A/D conversion)**	0.4 mV for 0 to 5 VDC, 1 to 5 VDC or 0 to 10 VDC input signal range 0.5 mV for -10 to 10 VDC input signal range 1.6 µA for 0 to 20mA DC or 4 to 20mA DC input signal range		
Overall accuracy	23±2ºC: ± 0.1% (full scale) 0 to 55ºC: ± 0.2% (full scale) [*4]		
Conversion period [*5]	50 µs, 100 µs, 250 µs, 500 µs, 1 ms, 16.6 ms, 20 ms, 100 ms per channel Configurable on module basis		

Item	Specifications		
	F3AD08-6R	F3AD08-5R	F3AD08-4R
Scaling	Upper and lower limit values can be set to any value between -20,000 and 20,000.		
Offset	Offset value can be set to any value between -5000 and 5000		
Filter	First-order lag low-pass filter or moving average computation can be enabled or disabled for individual channels *6 *7		
Hold data	Supports recording of peak values and trough values		
Self diagnosis	Hardware self-diagnosis during operation Over-range input detection		
Current consumption	210 mA (5 V DC)		
External connection	18-point terminal block, M3.5 screws		
External dimensions	28.9 (W) × 100 (H) × 106.1 (D) mm *8		
Weight	200 g		

*1: Conversion results are valid within the selected input signal range.
The default input signal range is 0 to 20mADC for F3AD08-4R, and -10 to 10 VDC for F3AD08-5R and F3AD08-6R

*2: The input resistance is about 2 MΩ for channels where the input terminal IN□- is not connected to the AG terminal.

*3: The module uses 16-bit A/D converters internally. The maximum resolution given here is due to scaling computation. The available input signal ranges vary with module type (see “Input Signal Range” row)

*4: Accuracy is ±1% (full scale) when drift compensation is disabled.

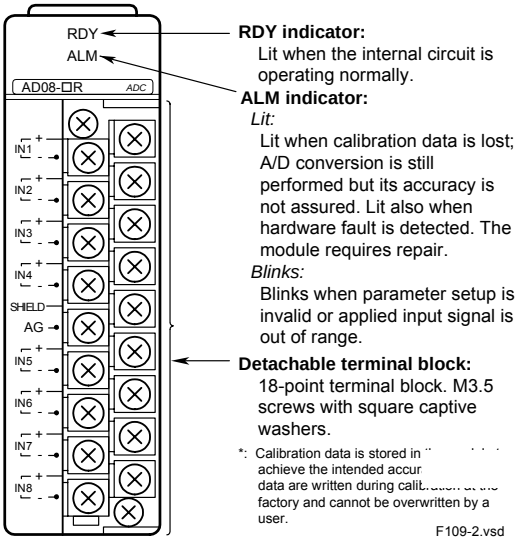
*5: The conversion period is configurable on module basis. It is affected by the number of channels in use (number of unskipped channels).
By default, the conversion period is 1 ms and data of each channel is updated every 8 ms (=1 ms × 8 inputs).

*6: Filtering and moving average computation cannot be used concurrently on the same channel.
The actual filter time constant value depends on the number of number of channels in use (number of unskipped channels) and the conversion period setting.
The filter time constant is specified in units of ms.
The number of data points to be used for moving average computation can be set to any integer from 2 to 32.

*7: Filtering cannot be used when the conversion period is set to 50 µs.

*8: Dimensions excluding protrusions (for details, see external dimensions drawing)

■ Components and Functions



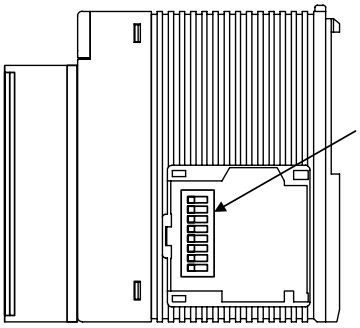
RDY indicator:
Lit when the internal circuit is operating normally.

ALM indicator:
Lit:
Lit when calibration data is lost; A/D conversion is still performed but its accuracy is not assured. Lit also when hardware fault is detected. The module requires repair.
Blinks:
Blinks when parameter setup is invalid or applied input signal is out of range.

Detachable terminal block:
18-point terminal block. M3.5 screws with square captive washers.

*: Calibration data is stored in ... achieve the intended accur... data are written during calib... factory and cannot be overwritten by a user.

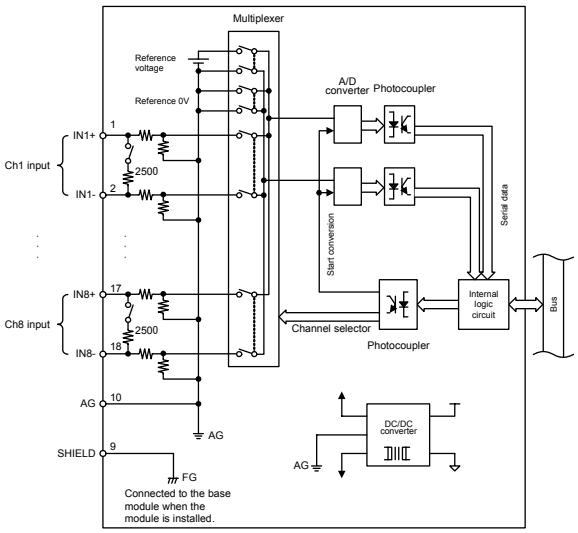
F109-2.vsd



This figure shows the F3AD08-6R module with its cover removed.

F109-3.vsd

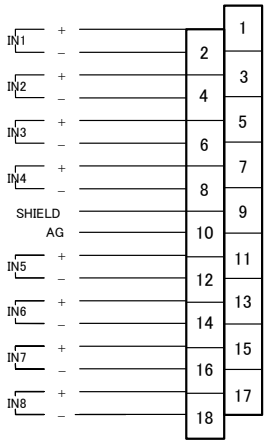
Internal Circuit Diagram



Note: The above figure shows a schematic of the internal circuit of F3AD08-6R.

The 250Ω resistor is not provided in F3AD08-5R, but is always connected in F3AD08-4R.

External Connection Diagram



- The SHIELD terminal is connected to the frame ground of the power supply module via the base module.
- The AG terminal is grounded to the analog ground in the base module.

F111.vsd

Operating Environment

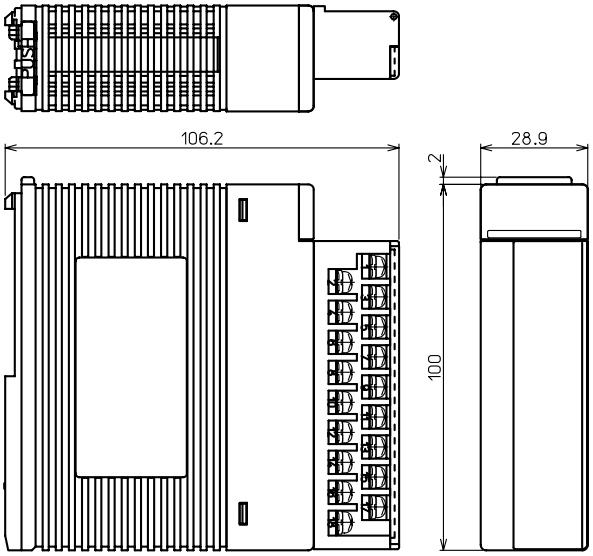
There is no restriction on the type of CPU modules that can be used with this module.

Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
F3AD08	-4R	.....	.....	0 to 20 mA, 4 to 20 mA DC 8 differential inputs, 16-bit A/D conversion
	-5R	.....	.....	0 to 5 V, 1 to 5 V, -10 to 10 V, 0 to 10 VDC 8 differential inputs, 16-bit A/D conversion
	-6R	.....	.....	0 to 5 V, 1 to 5 V, -10 to 10 V, 0 to 10 VDC, 0 to 20 mA, 4 to 20 mA DC 8 differential inputs, 16-bit A/D conversion

External Dimensions

Unit: mm



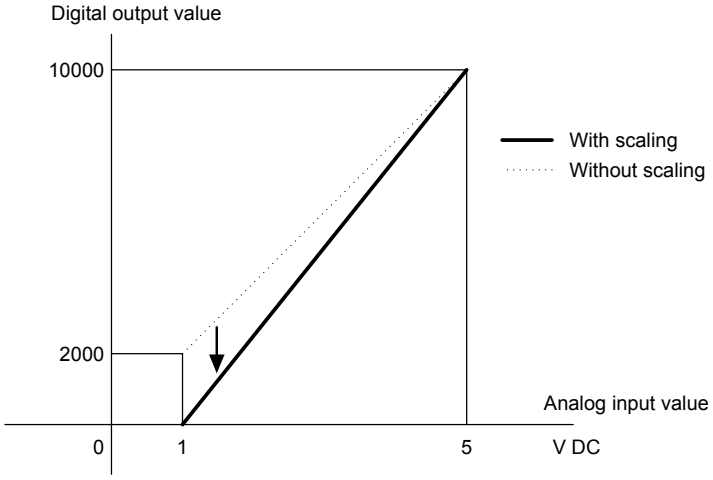
Functional Overview

1. Scaling

1.1 Scaling

The scaling function maps the digital output values of the upper limit and lower limit of the input signal range to user-specified values between -20000 and 20000.

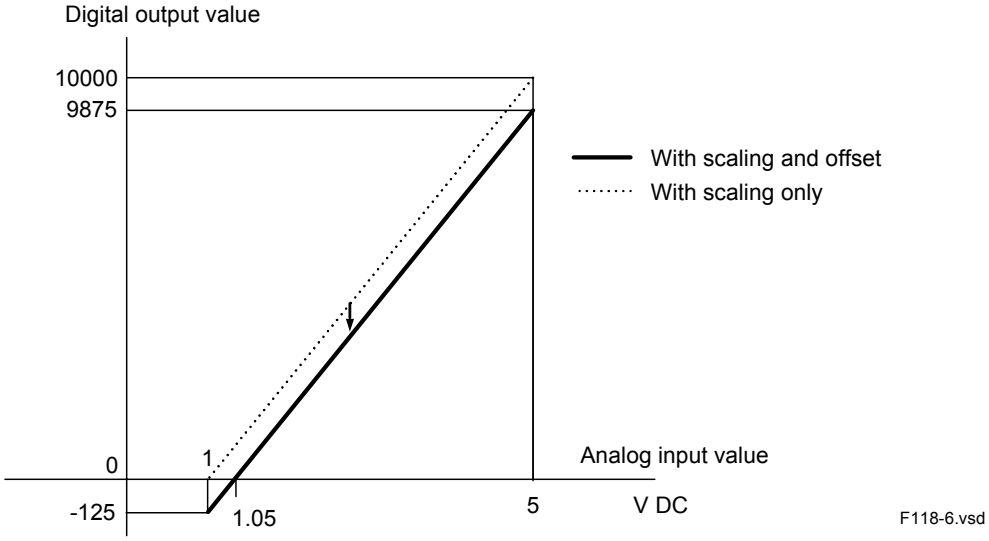
Example: Input signal range: 1 to 5 VDC; upper limit for scaling: 10000; lower limit for scaling: 0



1.2 Offset

The offset function applies a user-specified offset amount between -5000 and 5000 to the digital output.

**Example: Input signal range: 1-5VDC; upper limit for scaling: 10000;
lower limit for scaling: 0; offset amount: -125**

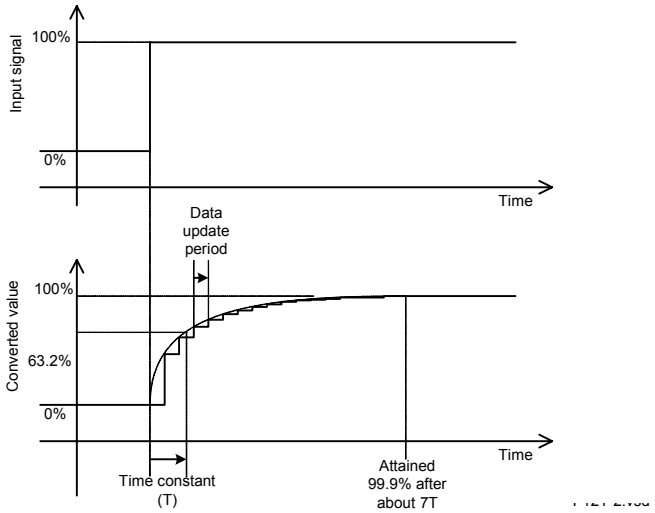


2. Filtering

2.1 First-order Lag Filter

Filtering is used to suppress sudden changes in the digital output. A digital low-pass first-order lag filter can be configured for each input channel by specifying the time constant in ms.

Response of Filter to Step Change in Input Signal



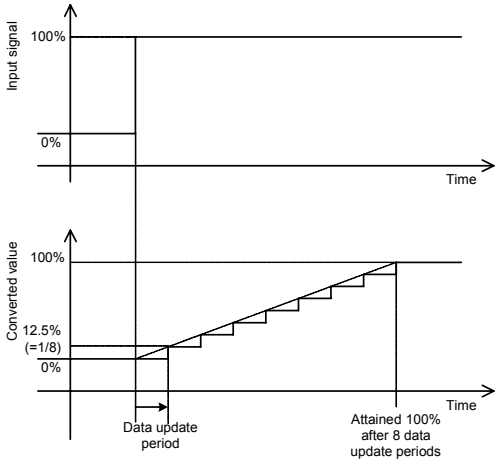
Note: The conversion output responds in small steps at each data update period, given by conversion period × number of channels in use.

TIP: Time constant (*T*) and the cutoff frequency (*fc*) are related by the equation: $fc = \frac{1}{2\pi T}$

2.2 Moving Average Computation

The moving average function is used to suppress sudden changes in the digital output by computing moving averages of converted values for an input channel using a user-specified number of up to 32 data points.

Example: Response of Moving Average Computation to Step Change in Input Signal (when 8 data points are using for averaging)

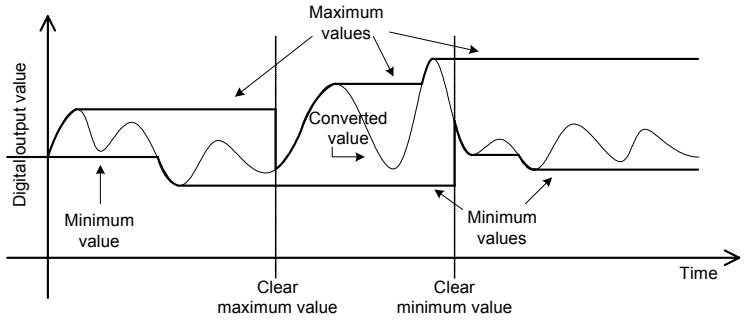


Note: The conversion output responds in small steps at each data update period, given by conversion period × number of channels in use.

3. Hold Data

The Hold Data function records maximum and minimum digital output values for each channel internally. These values can be read by a program, just like conversion output values, or cleared by a program at any time.

Conceptual Diagram of Hold Data Operation



Note: The hold data function stores final conversion output values after scaling, offset and filtering. It records the minimum and maximum values periodically according to the data update period, given by conversion period × number of channels in use.