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## ■ Glossary of terms used in the module specification

### Absolute maximum ratings

Absolute maximum ratings define maximum operating conditions that, if exceeded even for a short period of time, may cause permanent damage to an output range, a channel or the whole module. Such damage may be exhibited as performance degradation such as a larger offset or gain error, or functional failure such as total output failure.

### Output signal range

The output signal range is the nominal output range. A  $\pm 5\%$  over range is added to the output signal range to give the actual output range, which is simply called the "output range" and indicated within parentheses in the module specification.

### Allowable load resistance

The allowable load resistance specifies either the maximum or minimum load resistance allowed for each output, depending on the output type. If the module is operated with a load exceeding this limit, local overheating may result in component failure or the full output range may not be available.

### Allowable capacitive load

The allowance capacitive load specifies a limit on voltage output as a necessary condition for prevention of output oscillation. This value is tested by evaluation but is not a guaranteed value.

### Allowable inductive load

The allowance inductive load specifies a limit on current output as a necessary condition for prevention of output oscillation. This value is tested by evaluation but is not a guaranteed value.

### Output update time

The output update time is the time required for D/A conversion by the module. It is the time required for D/A conversion plus the time for the required change in voltage or current output to appear at the output terminal of the module after an output value is written to the module by the CPU module.

### Synchronous output

The synchronous output function updates DACs of all active channels of the same module synchronously and is used to suppress difference in update timing between output channels. By specifying an update trigger channel, outputs of the other channels are updated synchronously whenever the output value of the trigger channel is updated.

### Output response time

This is the time required for signal change from 10% to 90% level after an output change is instructed to the module.

### Output resolution

The output resolution is the voltage or current value corresponding to the least significant bit of the DA converter. The smallest change in actual output voltage or current value is affected by the digital values specified for the scaling function.

### Overall accuracy

The overall accuracy specifies output repeatability by expressing output error as a percentage of the output signal range. Two values are specified, one excluding the effect of ambient temperature ( $23^{\circ}\text{C}\pm 2^{\circ}\text{C}$ ) and the other including the effect of ambient temperature (0 to  $55^{\circ}\text{C}$ ). As overall accuracy is affected by scaling, it is specified assuming default values for scaling.

### Scaling function

The scaling function enables the high limit and low limit of the output range to be set to any arbitrary value between -30000 and 30000 independently for each channel. The default values vary with the specified output range.

### CPU fail-time output

Each channel can be configured independently to either hold its current output value or to output a specific value at CPU failure. In the latter case, the value is specified separately.

# General Specification

## F3DA04-6R Analog Output Module

**FA-M3**

GS 34M06H11-05E



### General

The F3DA04-6R is a digital-to-analog conversion output module for use with the range-free controller FA-M3.

### Features

- High-speed conversion and response
  - High DA conversion speed of 2  $\mu$ s per channel
  - Fast output response to update instructions of 2  $\mu$ s + 2  $\mu$ s x (number of channels to be updated)
  - Short output update interval between channels of 2  $\mu$ s
- High resolution and accuracy
  - 16-bit DAC ensures higher resolution and accuracy.
  - High output resolution of 0.2 mV for voltage output; high output resolution of 0.5  $\mu$ A for current output
  - High overall accuracy of voltage range  $\pm 0.1\%$  of full scale (at 23 $\pm 2^\circ$ C) or current range  $\pm 0.2\%$  of full scale (at 23 $\pm 2^\circ$ C)
- High functionality
  - DACs of all active channels of the same module (up to 8 channels) can be updated synchronously with a specified channel.
  - The output type and output range is configurable by software.

### Specifications

| Item                              | Specifications <sup>†1</sup>   |
|-----------------------------------|--|
| Number of outputs                 | 4  |
| Absolute maximum ratings          | Output terminals:<br>No external voltage or current must be applied.<br>Between the terminals of external power supply:<br>30 V max.   |
| Isolation                         | Between output terminals and internal circuitry:<br>Isolated (capacitance coupling), capable of withstanding 500 V DC for 1 minute.<br>Between output terminals or between output terminals and external power supply:<br>Not isolated, common negative  |
| Output signal range               | Voltage output:<br>-10 to 10 V (-11 to 11 V) (default)<br>0 to 10 V (-0.5 to 10.5 V)<br>0 to 5 V (-0.25 to 5.25 V)<br>1 to 5 V (0.1 to 5.25 V)<br>Current output:<br>4 to 20 mA (1.25 to 21 mA)<br>0 to 20 mA (-1 to 21 mA)<br>-20 to 20 mA (-21 to 21 mA)   |
| Output impedance                  | Voltage output: 0.5 $\Omega$ max.<br>Current output: 3 M $\Omega$ max.<br>Impedance at disabled output: 1 M $\Omega$ min.<br>Leakage current at disabled output: $\pm 0.5$ $\mu$ A max.  |
| Allowable load resistance         | Voltage output:<br>1 k $\Omega$ min. (for -10 to 10 V or 0 to 10 V range);<br>500 $\Omega$ min. (for 0 to 5 V or 1 to 5 V range)<br>Current output: 600 $\Omega$ min.  |
| Allowable capacitive load         | Voltage output: 20 nF max.   |
| Allowable inductive load          | Current output:<br>1 mH max.,<br>electropneumatic converter PK-5502 or equivalent  |
| Output update time <sup>†2</sup>  | 2 $\mu$ s + 2 $\mu$ s x (number of channels to be updated)<br>For instance, 4 $\mu$ s if one channel is updated, or 10 $\mu$ s if 4 channels are updated.  |
| Synchronous output <sup>†3</sup>  | DAC of all active channels of the same module can be updated synchronously.  |
| Output response time              | Voltage output:<br>$\approx 20$ $\mu$ s (for -10 to 10 V range with 2 k $\Omega$ load)<br>Current output:<br>$\approx 10$ $\mu$ s (for 4 to 20 mA range with 250 $\Omega$ load)  |
| Output resolution (16-bit DAC)    | Voltage output:<br>$\approx 0.5$ mV (for -10 to 10 V or 0 to 10 V range);<br>$\approx 0.2$ mV (for 0 to 5 V or 1 to 5 V range).<br>Current output:<br>$\approx 0.5$ $\mu$ A (for 4 to 20 mA range)<br>$\approx 1$ $\mu$ A (for 0 to 20 mA or -20 to 20 mA range)   |
| Overall accuracy                  | Voltage output:<br>$\pm 0.1\%$ of FS (23 $\pm 2^\circ$ C with 10 M $\Omega$ load);<br>$\pm 0.3\%$ of FS (0 to 55 $^\circ$ C with 10 M $\Omega$ load)<br>Current output:<br>$\pm 0.2\%$ of FS (23 $\pm 2^\circ$ C with 100 $\Omega$ load);<br>$\pm 0.3\%$ of FS (0 to 55 $^\circ$ C with 100 $\Omega$ load) |
| Scaling                           | Output signal range can be set to any digital range within -30,000 and 30,000.   |
| CPU fail-time output              | The output behavior at CPU failure is configurable for each channel independently.   |
| Current consumption               | 60 mA (excluding that of external power supply)  |
| External power supply             | Rated voltage: 24 V DC<br>Allowable voltage range: 19.2 to 30 V DC<br>Current consumption: 200 mA (inrush current: 1A)   |
| External connection               | 18-point terminal block, M3.5 screws   |
| External dimensions <sup>†4</sup> | 28.9 (W) x 100 (H) x 106.2 (D) mm  |
| Weight                            | 180 g  |

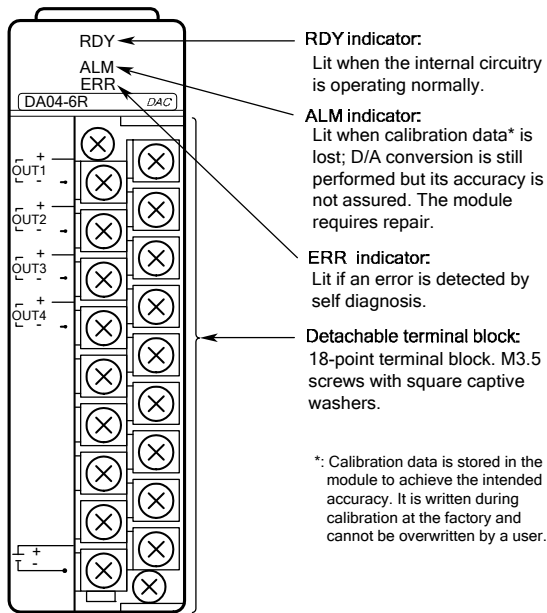
<sup>†1</sup>: The module must be supplied with an external power supply. All specifications assume that the external power supply is on.

<sup>†2</sup>: The given output update time applies if the module is installed in the main unit and data to be updated is written collectively to the module using a WRITE instruction. Otherwise, 4  $\mu$ s per channel is required.

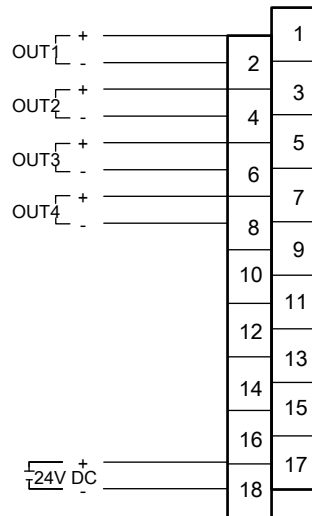
<sup>†3</sup>: The update period for synchronous output depends on the number of channels used and the user application.

<sup>†4</sup>: Excluding protrusions (see External Dimensions for details).

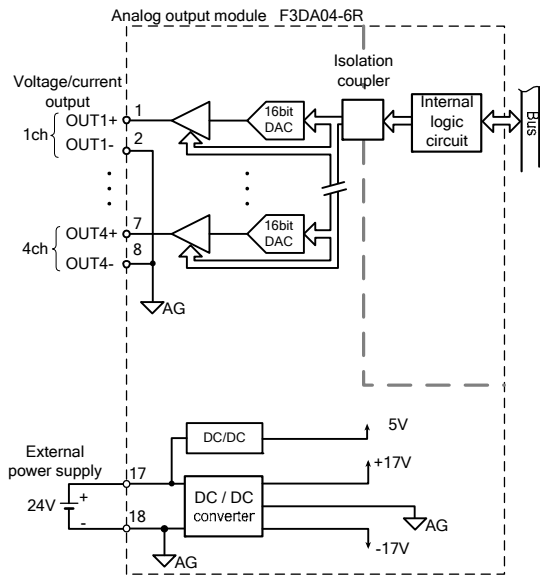
### ■ Components and Functions



### ■ External Connection Diagram



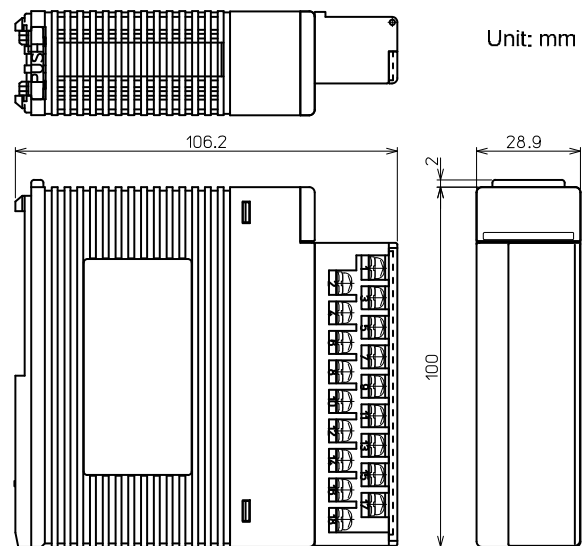
### ■ Internal Circuit Diagram



### ■ Model and Suffix Codes

| Model  | Suffix Code | Style Code | Option Code | Description   |
|--------|-------------|------------|-------------|---|
| F3DA04 | -6R         | .....      | .....       | -10 to 10 V, 0 to 10 V, 0 to 5 V, 1 to 5 V, 4 to 20 mA, 0 to 20 mA and -20 to 20 mA, 4 outputs, 16-bit D/A conversion, 2 μs per channel |

### ■ External Dimensions



### ■ Operating Environment

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

# General Specification

## F3DA08-5R Analog Output Module

**FA-M3**

GS 34M06H11-05E



### General

The F3DA08-5R is a digital-to-analog conversion output module for use with the range-free controller FA-M3.

### Features

- High-speed conversion and response
  - High DA conversion speed of 2  $\mu$ s per channel
  - Fast output response to update instructions of 2  $\mu$ s + 2  $\mu$ s x (number of channels to be updated)
  - Short output update interval between channels of 2  $\mu$ s
- High resolution and accuracy
  - 16-bit DAC ensures higher resolution and accuracy.
  - High output resolution of 0.2 mV for voltage output
  - High overall accuracy of  $\pm 0.1\%$  of full scale (at 23 $\pm 2^\circ$ C)
- High functionality
  - DACs of all active channels of the same module (up to 8 channels) can be updated synchronously with a specified channel.
  - The output range is configurable by software.

### Specifications

| Item                             | Specifications <sup>1</sup>  |
|----------------------------------|--|
| Number of outputs                | 8  |
| Absolute maximum ratings         | Output terminals:<br>No external voltage or current must be applied.<br>Between the terminals of external power supply:<br>30 V max.   |
| Isolation                        | Between output terminals and internal circuitry:<br>Isolated (capacitance coupling), capable of withstanding 500 V DC for 1 minute.<br>Between output terminals or between output terminals and external power supply:<br>Not isolated, common negative. |
| Output signal range              | Voltage output:<br>-10 to 10 V (-11 to 11 V) (default)<br>0 to 10 V (-0.5 to 10.5 V)<br>0 to 5 V (-0.25 to 5.25 V)<br>1 to 5 V (0.1 to 5.25 V)   |
| Output impedance                 | Voltage output: 0.5 $\Omega$ max.<br>Impedance at disabled output: 1 M $\Omega$ min.<br>Leakage current at disabled output: $\pm 0.5$ $\mu$ A max.   |
| Allowable load resistance        | Voltage output:<br>1 k $\Omega$ min. (for -10 to 10 V or 0 to 10 V range);<br>500 $\Omega$ min. (for 0 to 5 V or 1 to 5 V range).  |
| Allowable capacitive load        | Voltage output: 20 nF max.   |
| Output update time <sup>2</sup>  | 2 $\mu$ s + 2 $\mu$ s x (number of channels to be updated)<br>For instance, 4 $\mu$ s if one channel is updated, or 18 $\mu$ s if 8 channels are updated.  |
| Synchronous output <sup>3</sup>  | DAC of all active channels of the same module can be updated synchronously.  |
| Output response time             | Voltage output:<br>About 20 $\mu$ s (for -10 to 10 V range with 2 k $\Omega$ load)   |
| Output resolution (16-bit DAC)   | Voltage output:<br>$\approx 0.5$ mV (for -10 to 10 V or 0 to 10 V range);<br>$\approx 0.2$ mV (for 0 to 5 V or 1 to 5 V range).  |
| Overall accuracy                 | Voltage output:<br>$\pm 0.1\%$ of FS (23 $\pm 2^\circ$ C with 10 M $\Omega$ load);<br>$\pm 0.3\%$ of FS (0 to 55 $^\circ$ C with 10 M $\Omega$ load)   |
| Scaling                          | Output signal range can be set to any digital range within -30,000 and 30,000.   |
| CPU fail-time output             | The output behavior at CPU failure is configurable for each channel independently.   |
| Current consumption              | 60 mA (excluding that of external power supply)  |
| External power supply            | Rated voltage: 24 V DC<br>Allowable voltage range: 19.2 to 30 V DC<br>Current consumption: 200 mA (inrush current: 1A)   |
| External connection              | 18-point terminal block, M3.5 screws   |
| External dimensions <sup>4</sup> | 28.9 (W) x 100 (H) x 106.2 (D) mm  |
| Weight                           | 180 g  |

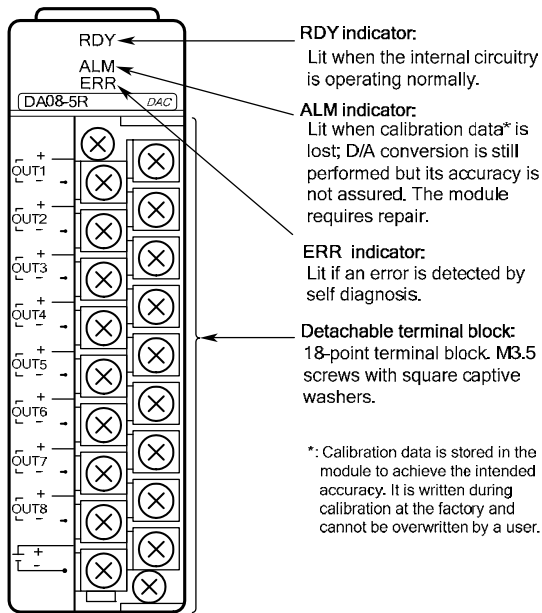
<sup>1</sup>: The module must be supplied with an external power supply. All specifications assume that the external power supply is on.

<sup>2</sup>: The given output update time applies if the module is installed in the main unit and data to be updated is written collectively to the module using a WRITE instruction. Otherwise, 4  $\mu$ s per channel is required.

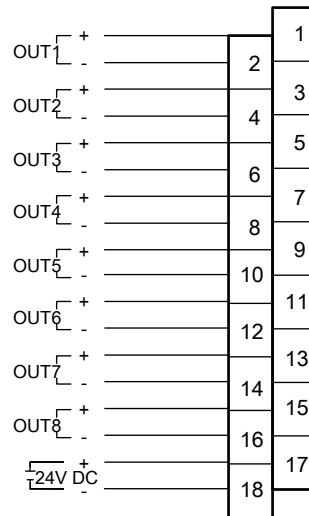
<sup>3</sup>: The update period for synchronous output depends on the number of channels used and the user application.

<sup>4</sup>: Excluding protrusions (see External Dimensions for details).

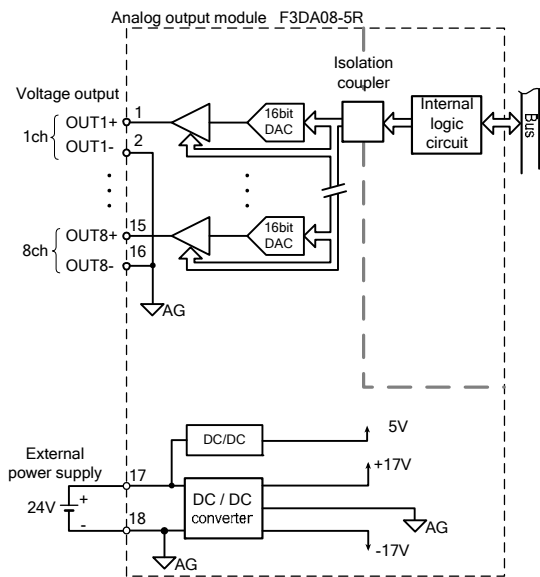
### ■ Components and Functions



### ■ External Connection Diagram



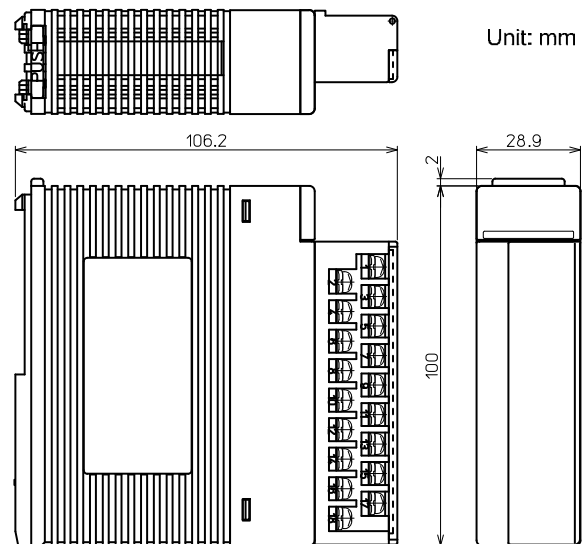
### ■ Internal Circuit Diagram



### ■ Model and Suffix Codes

| Model  | Suffix Code | Style Code | Option Code | Description  |
|--------|-------------|------------|-------------|--|
| F3DA08 | -5R         | .....      | .....       | -10 to 10 V, 0 to 10 V, 0 to 5 V, 1 to 5 V, 8 outputs, 16-bit D/A conversion, 2 μs per channel |

### ■ External Dimensions



### ■ Operating Environment

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