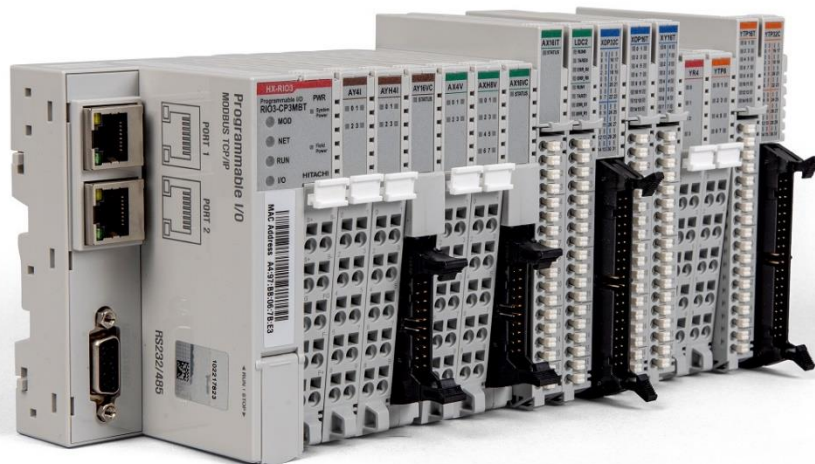


# Analog Output Module (Current)

## RIO3-AY4I, -AYH4I, -AY8I User Manual



Version 1.021

DOCUMENT REVISION				
REV	PAGE	REMARKS	DATE	EDITOR
1.02		New Document	Nov 2020	(OPR)
1.02	29	Remove product list table and add a reference	Aug 2021	Faber
1.021	Several	- RIO3-AY8I data value graph corrected (P22) - Typo edited	Jul 2022	Faber

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## 1 Important Notes

Solid state equipment has operational characteristics differing from those of electromechanical equipment.

Safety Guidelines for the Application, Installation and Maintenance of Solid-State Controls describes some important differences between solid state equipment and hard-wired electromechanical devices.

Because of this difference, and because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will HITACHI be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any installation, HITACHI cannot assume responsibility or liability for actual use based on the examples and diagrams.

### Warning!



- ✓ **If you don't follow the directions, it could cause a personal injury, damage to the equipment or explosion.**
- ✓ Do not assemble the products and wire with power applied to the system. Else it may cause an electric arc, which can result into unexpected and potentially dangerous action by field devices. Arching is explosion risk in hazardous locations. Be sure that the area is non-hazardous or remove system power appropriately before assembling or wiring the modules.
- ✓ Do not touch any terminal blocks or IO modules when system is running. Else it may cause the unit to an electric shock or malfunction.
- ✓ Keep away from the strange metallic materials not related to the unit and wiring works should be controlled by the electric expert engineer. Else it may cause the unit to a fire, electric shock or malfunction.

### Caution!


- ✓ **If you disobey the instructions, there may be possibility of personal injury, damage to equipment or explosion. Please follow below Instructions.**
- ✓ Check the rated voltage and terminal array before wiring. Avoid the circumstances over 50°C of temperature. Avoid placing it directly in the sunlight.
- ✓ Avoid the place under circumstances over 85% of humidity.
- ✓ Do not place Modules near by the inflammable material. Else it may cause a fire.
- ✓ Do not permit any vibration approaching it directly.
- ✓ Go through module specification carefully, ensure inputs, output connections are made with the specifications. Use standard cables for wiring.
- ✓ Use Product under pollution degree 2 environment.

## 1.1 Safety Instruction

### 1.1.1 Symbols.

<p><b>DANGER</b></p> 	<p>Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death property damage, or economic loss</p>
<p><b>IMPORTANT</b></p>	<p>Identifies information that is critical for successful application and understanding of the product.</p>
<p><b>ATTENTION</b></p> 	<p>Identifies information about practices or circumstances that can lead to personal injury, property damage, or economic loss.          Attentions help you to identify a hazard, avoid a hazard, and recognize the consequences.</p>

### 1.1.2 Safety Notes

<p><b>DANGER</b></p> 	<p>The modules are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, GBUS Pin.</p>
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### 1.1.3 Certification

UL Listed Industrial Control Equipment, certified for U.S.

See UL File E196687

CE Certificate

EN 61000-6-2; Industrial Immunity

EN 61000-6-4; Industrial Emissions

Reach, RoHS (EU, CHINA), EAC

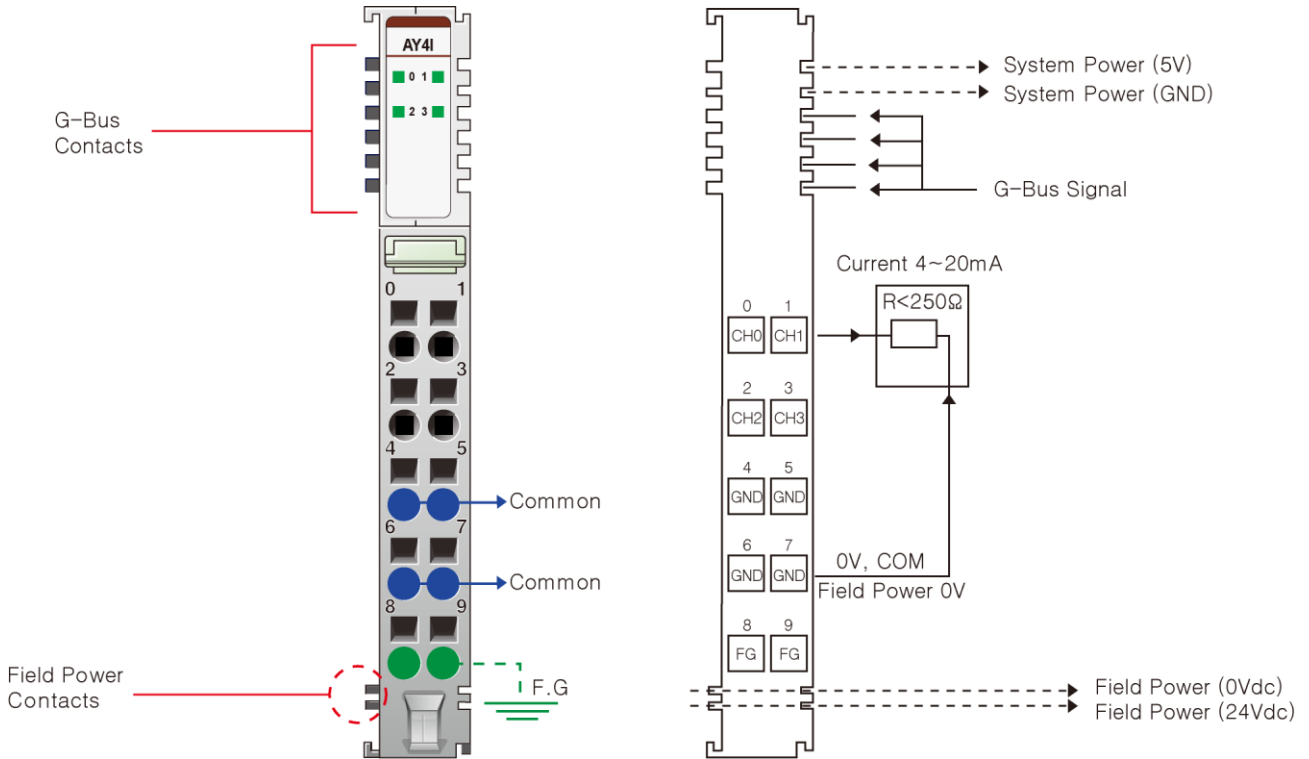
## 2 Analog Input Module List

RIO3-Number	Description	ID (hex)
RIO3-AY4I	Analog Output 4 Channels, Current Output, 4~20mA, 12Bits	4214
RIO3-AYH4I	Analog Output 4 Channels, Current Output, 4~20mA, 16Bits	4254
RIO3-AY8I	Analog Output 8 Channels, Current Output, 4~20mA, 12Bits	4218

### 3 Specification

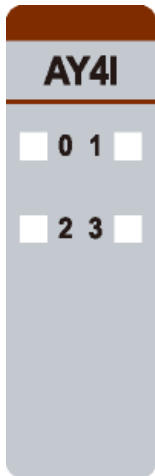
#### 3.1 RIO3-AY4I

##### 3.1.1 Wiring Diagram



Pin No.	Signal Description	Signal Description	Pin No.
0	Analog Output Channel 0	Analog Output Channel 1	1
2	Analog Output Channel 2	Analog Output Channel 3	3
4	Output Channel Common (AGND)	Output Channel Common (AGND)	5
6	Output Channel Common (AGND)	Output Channel Common (AGND)	7
8	F.G	F.G	9

### 3.1.2 LED Indicator



LED No.	LED Function / Description	LED Color
0	Output Channel 0	Green
1	Output Channel 1	Green
2	Output Channel 2	Green
3	Output Channel 3	Green

### 3.1.3 Channel Status LED

Status	LED	To indicate
Normal Operation	Green	Normal Operation
Field Power Error	All Channel Repeat Green and Off	Field Power is unconnected.

### 3.1.4 Environment Specification

Environmental Specification	
Operation Temperature	-40°C ~ 70°C
UL Temperature	-20°C ~ 60°C
Storage Temperature	-40°C ~ 85°C
Relative Humidity	5% ~ 90% Non-condensing
Mounting	DIN Rail
General Specification	
Shock Operating	IEC 60068-2-27: 2008 / 15g, 11ms
Vibration Resistance	Based on IEC 60068-2-6 DNVGL-CG-0039: Vibration Class B, 4g
Industrial Emissions	EN61000-6-4:2007 +A1: 2011
Industrial Immunity	EN 61000-6-2: 2005
Installation Position	Vertical and horizontal installation is possible
Product Certifications	CE, UL, EAC



### 3.1.5 Specification

Items	Specification
<b>Output Specification</b>	
Outputs Per Module	4 Channels Single Ended, Non-Isolated Between Channel
Indicators (Logic side)	4 Green Output Status
Resolution in Ranges	12 Bits: 3.91uA/Bit
Output Range	4~20mA
Data Format	16 Bits Integer (2's complement)
Module Error	±0.1% Full Scale @ 25°C ±0.3% Full Scale @ -40°C ~ 70°C
Load Resistance	Max. 250Ω*
Diagnostic	Field Power Off: LED Blinking Field Power On: Output LED ON
Conversion Time	0.15msec / All Channel
Calibration	Not Required
Common Type	4 Channels / 4 Common
<b>General Specification</b>	
Power Dissipation	Max. 30mA @ 5.0Vdc
Isolation	I/O to Logic: Photocoupler Isolation Field Power: Non-Isolation
UL Field Power	Supply Voltage: 24Vdc nominal, Class 2
Field Power	Supply Voltage: 24Vdc nominal Voltage Range*: 18~30Vdc Power Dissipation: Max. 80mA @ 24Vdc
Wiring	I/O Cable Max. 2.0mm <sup>2</sup> (AWG 14)
Torque	0.8Nm (7lb-in)
Weight	58g
Module Size	12mm x 99mm x 70mm
<b>Environment Condition</b>	<b>Refer to 'Environment Specification'</b>

\* Operating temperature

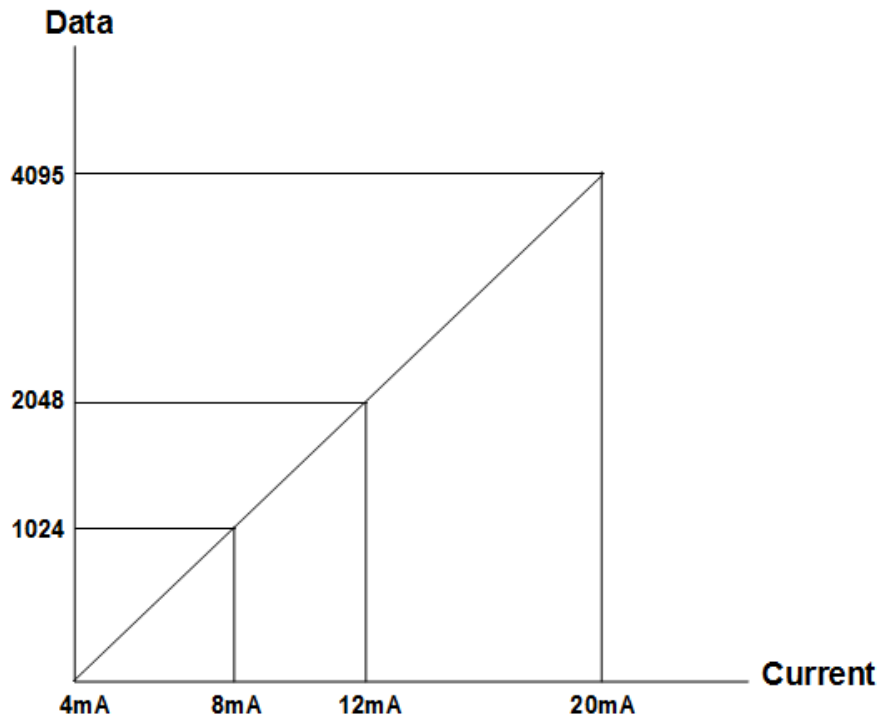
-40 ~ 70°C temperature range specification can be guaranteed under the following conditions.

- Load Resistance: Min 100Ω, Max 250Ω
- Field Power Voltage Range: Max 26.4V
- Otherwise, temperature specification can be guaranteed with -40 ~ 60°C

### 3.1.6 Data Value / Current

Current Range: 4 ~ 20mA

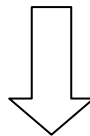
Current	4.0mA	8.0mA	12.0mA	20.0mA
Data(Hex)	H0000	H0400	H0800	H0FFF



### 3.1.7 Mapping Data form the Image Table.

#### Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Analog Output Ch0 Low byte							
Byte 1	Analog Output Ch0 High byte							
Byte 2	Analog Output Ch1 Low byte							
Byte 3	Analog Output Ch1 High byte							
Byte 4	Analog Output Ch2 Low byte							
Byte 5	Analog Output Ch2 High byte							
Byte 6	Analog Output Ch3 Low byte							
Byte 7	Analog Output Ch3 High byte							



#### Output Module Data - 8byte Output Data

Analog Input Ch0							
Analog Input Ch1							
Analog Input Ch2							
Analog Input Ch3							

### 3.1.8 Parameter Data

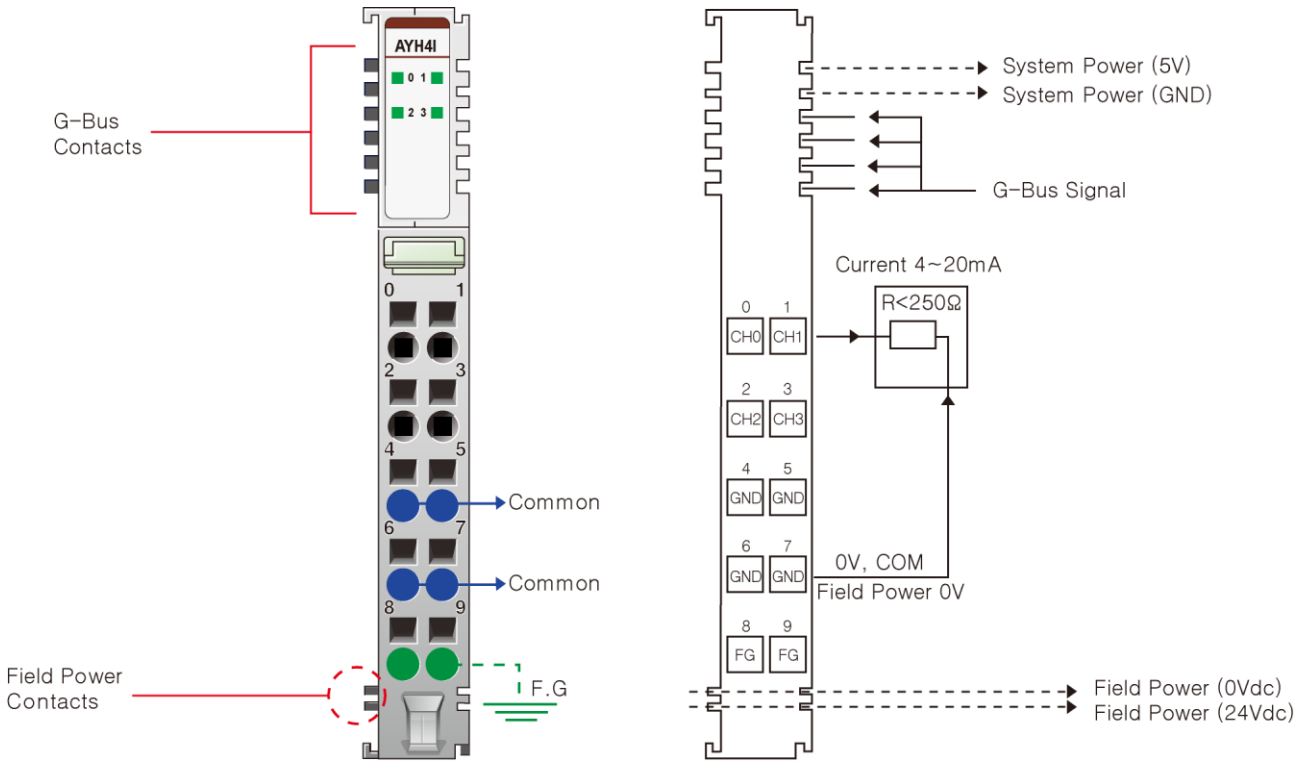
Valid Parameter length: 4 Bytes

#### Parameter Data

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Fault Action for Channel 3		Fault Action for Channel 2		Fault Action for Channel 1		Fault Action for Channel 0	
	00: Fault Value 01: Hold last state 10: Low Limit 11: high Limit							
Byte 1	Not used							
Byte 2	Fault Value Low Byte							
Byte 3	Not used				Fault Value high Byte			

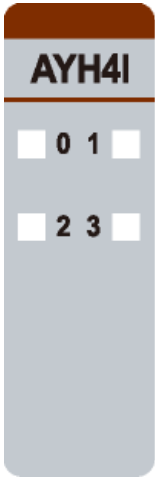
### 3.2 RIO3-AYH4I

#### 3.2.1 Wiring Diagram



Pin No.	Signal Description	Signal Description	Pin No.
0	Analog Output Channel 0	Analog Output Channel 1	1
2	Analog Output Channel 2	Analog Output Channel 3	3
4	Output Channel Common(AGND)	Output Channel Common(AGND)	5
6	Output Channel Common(AGND)	Output Channel Common(AGND)	7
8	F.G	F.G	9

### 3.2.2 LED Indicator



LED No.	LED Function / Description	LED Color
0	Output Channel 0	Green
1	Output Channel 1	Green
2	Output Channel 2	Green
3	Output Channel 3	Green

### 3.2.3 Channel Status LED

Status	LED	To indicate
Normal Operation	Green	Normal Operation
Field Power Error	All Channel Repeat Green and Off	Field Power is unconnected.

### 3.2.4 Environment Specification

<b>Environmental Specification</b>	
Operation Temperature	-40°C ~ 70°C
UL Temperature	-20°C ~ 60°C
Storage Temperature	-40°C ~ 85°C
Relative Humidity	5% ~ 90% Non-condensing
Mounting	DIN Rail
<b>General Specification</b>	
Shock Operating	IEC 60068-2-27: 2008 / 15g, 11ms
Vibration Resistance	Based on IEC 60068-2-6 DNVGL-CG-0039: Vibration Class B, 4g
Industrial Emissions	EN61000-6-4:2007 +A1: 2011
Industrial Immunity	EN 61000-6-2: 2005
Installation Position	Vertical and horizontal installation is possible
Product Certifications	CE, UL, EAC

### 3.2.5 Specification

Items	Specification
<b>Output Specification</b>	
Outputs Per Module	4 Channels Single Ended, Non-Isolated Between Channel
Indicators (Logic side)	4 Green Output Status
Resolution in Ranges	16bit (Include Sign) 15bits: 0.49uA/bit
Output Range	4~20mA
Data Format	16 Bits Integer (2's complement)
Module Error	±0.1% Full Scale @ 25°C ±0.3% Full Scale @ -40°C ~ 70°C
Load Resistance	Max. 250Ω*
Diagnostic	Field Power Off: LED Blinking Field Power On: Output LED ON
Conversion Time	0.15msec / All Channel
Calibration	Not Required
Common Type	4 Channels / 4 Common
<b>General Specification</b>	
Power Dissipation	Max. 30mA @ 5.0Vdc
Isolation	I/O to Logic: Photocoupler Isolation Field Power: Non-Isolation
UL Field Power	Supply Voltage: 24Vdc nominal, Class 2
Field Power	Supply Voltage: 24Vdc nominal Voltage Range*: 18~30Vdc Power Dissipation: Max. 80mA @ 24Vdc
Wiring	I/O Cable Max. 2.0mm <sup>2</sup> (AWG 14)
Torque	0.8Nm (7lb-in)
Weight	58g
Module Size	12mm x 99mm x 70mm
<b>Environment Condition</b>	<b>Refer to 'Environment Specification'</b>

\* Operating temperature

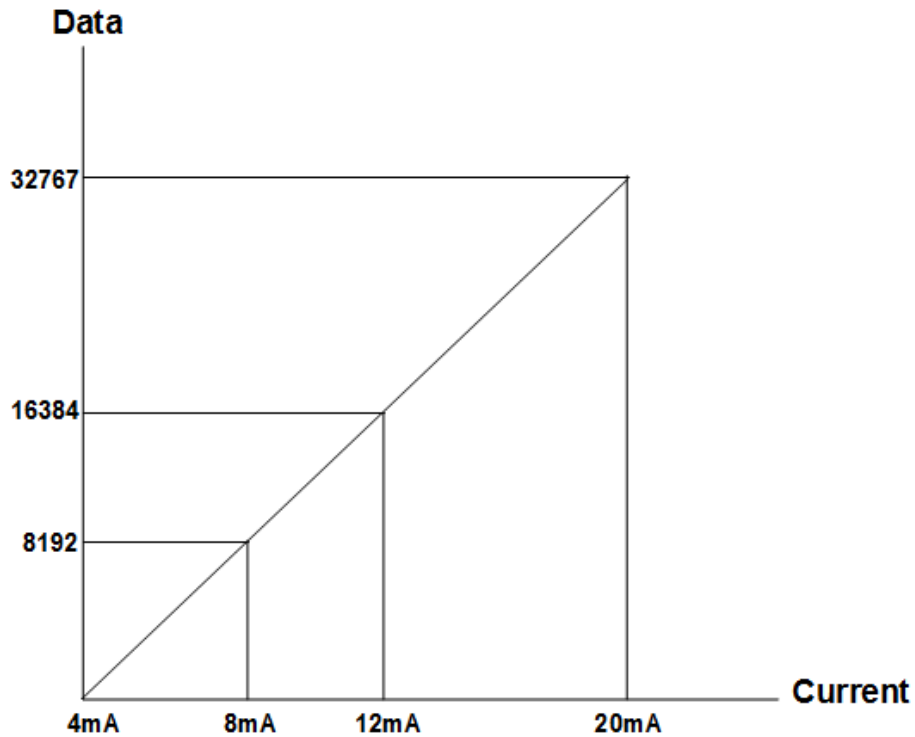
-40 ~ 70°C temperature range specification can be guaranteed under the following conditions.

- Load Resistance: Min 100Ω, Max 250Ω
- Field Power Voltage Range: Max 26.4V
- Otherwise, temperature specification can be guaranteed with -40 ~ 60°C

### 3.2.6 Data Value / Current

Current Range: 4 ~ 20mA

Current	4.0mA	8.0mA	12.0mA	20.0mA
Data(Hex)	H0000	H2000	H4000	H7FFF

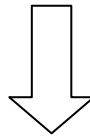




### 3.2.7 Mapping Data form the Image Table.

#### Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Analog Output Ch0 Low byte							
Byte 1	Analog Output Ch0 High byte							
Byte 2	Analog Output Ch1 Low byte							
Byte 3	Analog Output Ch1 High byte							
Byte 4	Analog Output Ch2 Low byte							
Byte 5	Analog Output Ch2 High byte							
Byte 6	Analog Output Ch3 Low byte							
Byte 7	Analog Output Ch3 High byte							



#### Output Module Data - 8byte Output Data

Analog Input Ch0
Analog Input Ch1
Analog Input Ch2
Analog Input Ch3

### 3.2.8 Parameter Data

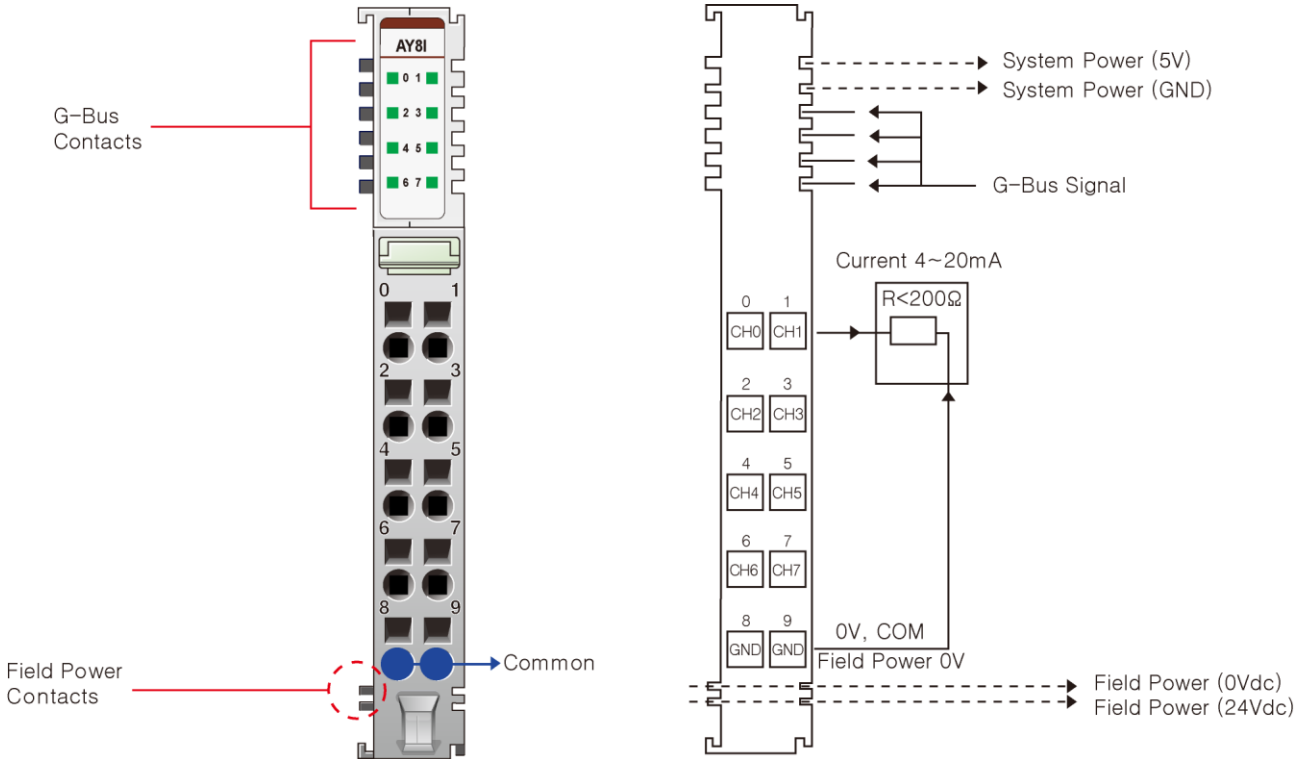
Valid Parameter length: 4 Bytes

#### Parameter Data

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Fault Action for Channel 3		Fault Action for Channel 2		Fault Action for Channel 1		Fault Action for Channel 0	
	00: Fault Value		01: Hold last state		10: Low Limit		11: high Limit	
Byte 1	Not used							
Byte 2	Fault Value Low Byte							
Byte 3	Fault Value high Byte							

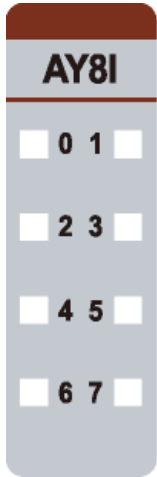
### 3.3 RIO3-AY8I

#### 3.3.1 Wiring Diagram



Pin No.	Signal Description	Signal Description	Pin No.
0	Analog Output Channel 0	Analog Output Channel 1	1
2	Analog Output Channel 2	Analog Output Channel 3	3
4	Analog Output Channel 4	Analog Output Channel 5	5
6	Analog Output Channel 6	Analog Output Channel 7	7
8	Output Channel Common (AGND)	Output Channel Common (AGND)	9

### 3.3.2 LED Indicator



LED No.	LED Function / Description	LED Color
0	Output Channel 0	Green
1	Output Channel 1	Green
2	Output Channel 2	Green
3	Output Channel 3	Green
4	Output Channel 4	Green
5	Output Channel 5	Green
6	Output Channel 6	Green
7	Output Channel 7	Green

### 3.3.3 Channel Status LED

Status	LED	To indicate
Normal Operation	Green	Normal Operation
Field Power Error	All Channel Repeat Green and Off	Field Power is unconnected.

### 3.3.4 Environment Specification

<b>Environmental Specification</b>	
Operation Temperature	-40°C ~ 60°C
UL Temperature	-20°C ~ 60°C
Storage Temperature	-40°C ~ 85°C
Relative Humidity	5% ~ 90% Non-condensing
Mounting	DIN Rail
<b>General Specification</b>	
Shock Operating	IEC 60068-2-27 : 2008 / 15g, 11ms
Vibration Resistance	Based on IEC 60068-2-6 DNVGL-CG-0039: Vibration Class B, 4g
Industrial Emissions	EN 61000-6-4: 2007 +A1: 2011
Industrial Immunity	EN 61000-6-2: 2005
Installation Position	Vertical and horizontal installation is possible.
Product Certifications	CE, UL, EAC

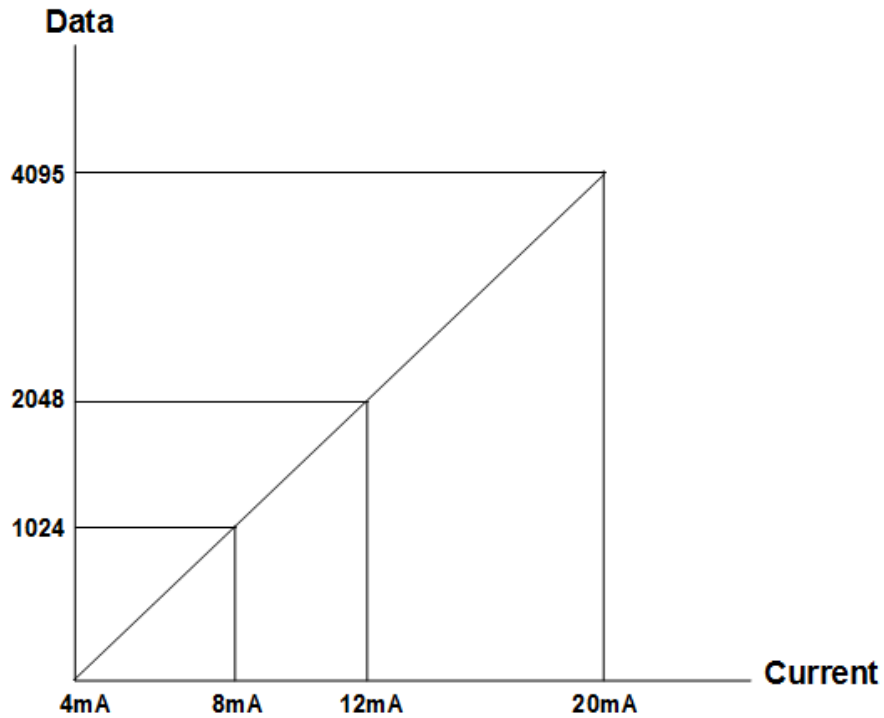
### 3.3.5 Specification

Items	Specification
<b>Output Specification</b>	
Outputs Per Module	8 Channels Single Ended, Non-Isolated Between Channel
Indicators (Logic side)	8 Green Output Status
Resolution in Ranges	12 Bits: 3.91uA/Bit
Output Range	4 ~ 20mA
Data Format	16 Bits Integer (2' complement)
Module Error	±0.1% Full Scale @ 25°C ±0.3% Full Scale @ -40°C ~ 60°C
Load Resistance	Max. 200Ω
Diagnostic	Field Power Off: LED Blinking Field Power On: Output LED ON
Conversion Time	0.2msec / All Channel
Calibration	Not Required
Common Type	2 Common, Field Power 0V is Common (AGND)
<b>General Specification</b>	
Power Dissipation	Max. 30mA @ 5.0Vdc
Isolation	I/O to Logic: Photocoupler Isolation Field Power: Non-Isolation
UL Field Power	Supply Voltage: 24Vdc nominal, Class 2
Field Power	Supply Voltage: 24Vdc nominal Voltage Range: 18 ~ 30Vdc Power Dissipation: Max. 130mA @ 24Vdc
Wiring	I/O Cable Max. 2.0mm <sup>2</sup> (AWG 14)
Torque	0.8Nm (7lb-in)
Weight	58g
Module Size	12mm x 99mm x 70mm
<b>Environment Condition</b>	<b>Refer to 'Environment Specification'</b>

### 3.3.6 Data Value / Current

Current Range: 4 ~ 20mA

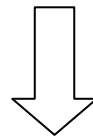
Current	4.0mA	8.0mA	12.0mA	20.0mA
Data(Hex)	H0000	H0400	H0800	H0FFF



### 3.3.7 Mapping Data form the Image Table.

#### Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Analog Output Ch0 Low byte							
Byte 1	Analog Output Ch0 High byte							
Byte 2	Analog Output Ch1 Low byte							
Byte 3	Analog Output Ch1 High byte							
Byte 4	Analog Output Ch2 Low byte							
Byte 5	Analog Output Ch2 High byte							
Byte 6	Analog Output Ch3 Low byte							
Byte 7	Analog Output Ch3 High byte							
Byte 8	Analog Output Ch4 Low byte							
Byte 9	Analog Output Ch4 High byte							
Byte 10	Analog Output Ch5 Low byte							
Byte 11	Analog Output Ch5 High byte							
Byte 12	Analog Output Ch6 Low byte							
Byte 13	Analog Output Ch6 High byte							
Byte 14	Analog Output Ch7 Low byte							
Byte 15	Analog Output Ch7 High byte							



#### Output Module Data - 16byte Output Data

Analog Input Ch0
Analog Input Ch1
Analog Input Ch2
Analog Input Ch3
Analog Input Ch4
Analog Input Ch5
Analog Input Ch6
Analog Input Ch7

### 3.3.8 Parameter Data

Valid Parameter length: 4 Bytes

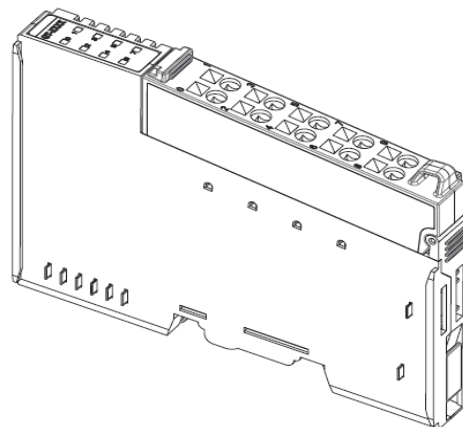
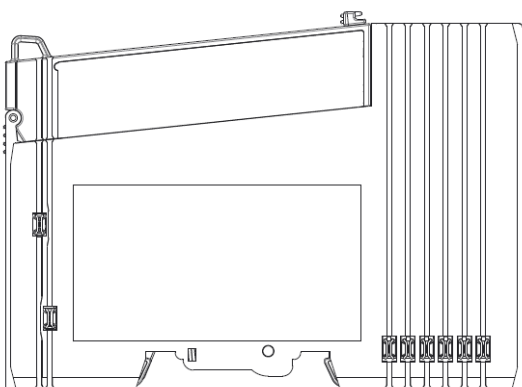
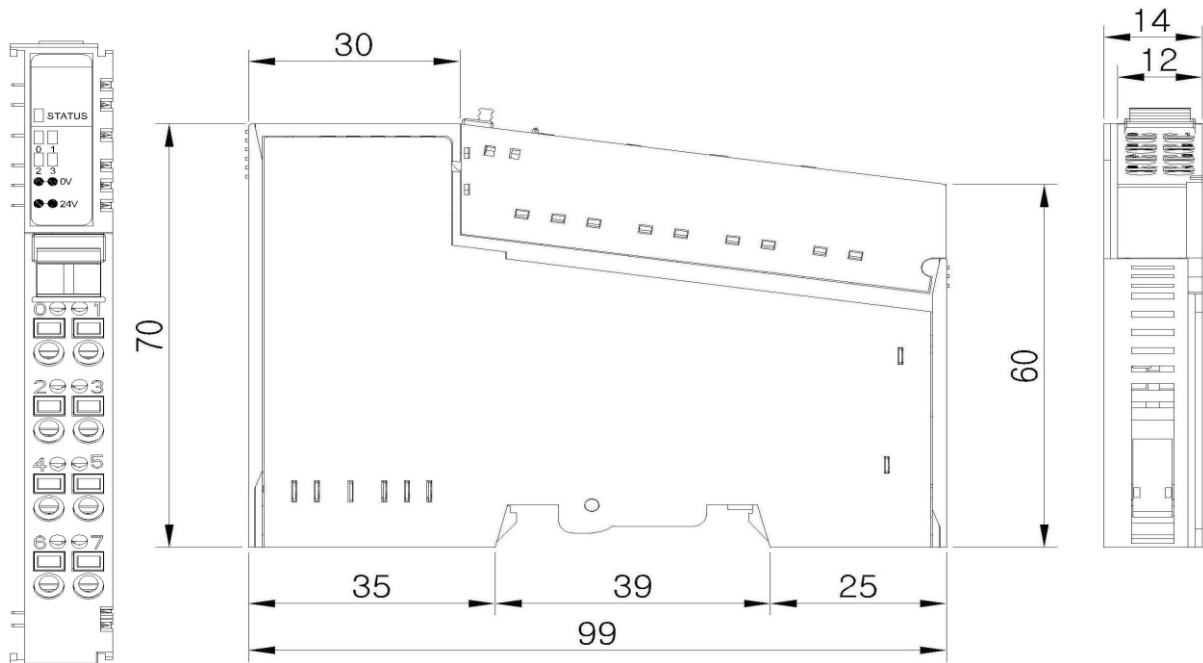
Parameter Data

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Fault Action for Channel 3		Fault Action for Channel 2		Fault Action for Channel 1		Fault Action for Channel 0	
	00: Fault Value 01: Hold last state				10: Low Limit 11: High Limit			
Byte 1	Fault Action for Channel 7		Fault Action for Channel 6		Fault Action for Channel 5		Fault Action for Channel 4	
	00: Fault Value 01: Hold last state				10: Low Limit 11: High Limit			
Byte 2	Fault Value Low Byte							
Byte 3	Not used				Fault Value high Byte			



## 4 Dimension

### 4.1 10-Pts. Spring Type



## 5 Mounting

### Caution!

#### Hot surface!

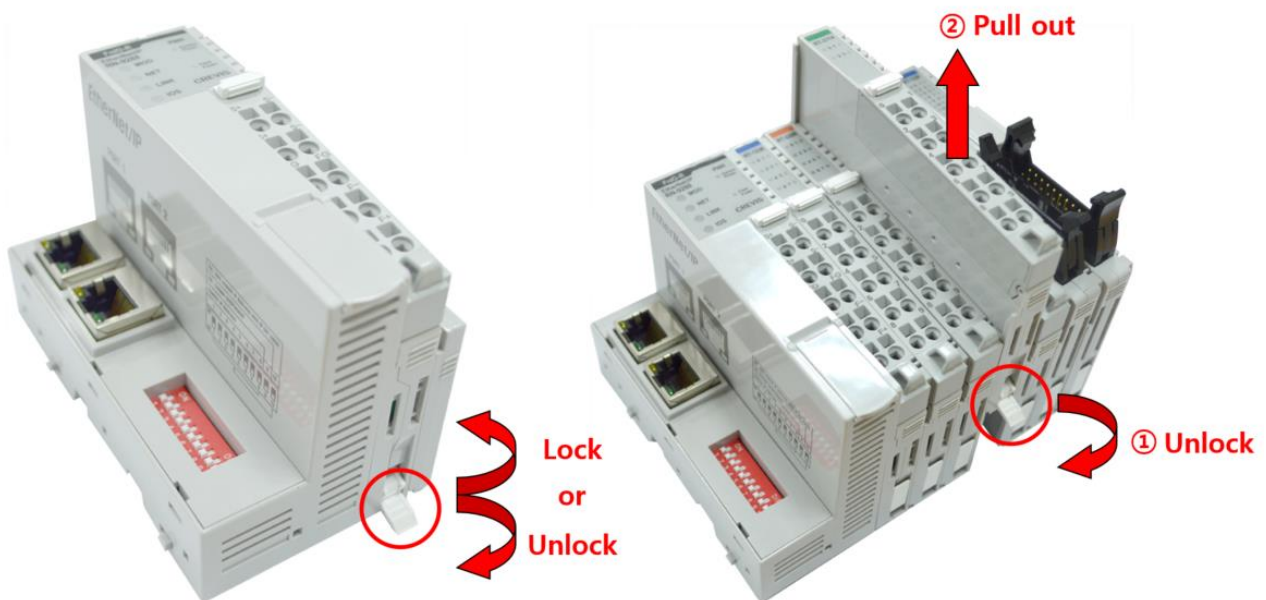
The surface of the housing can become hot during operation. If the device was operated at high ambient temperatures, allow it to be cool before touching it.

### Notice!

#### Perform work on devices only if they are de-energized!

Working on energized devices can damage them. Therefore, turn off the power supply before working on the devices.

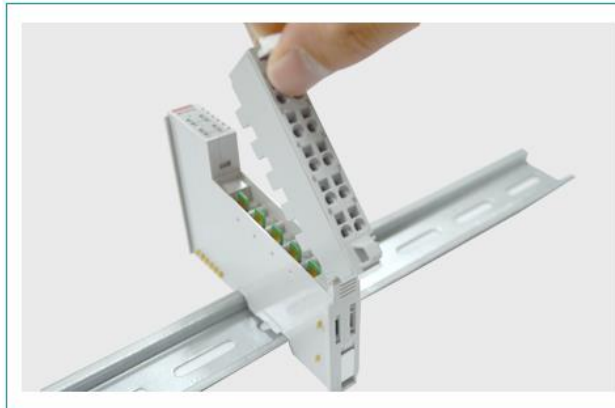
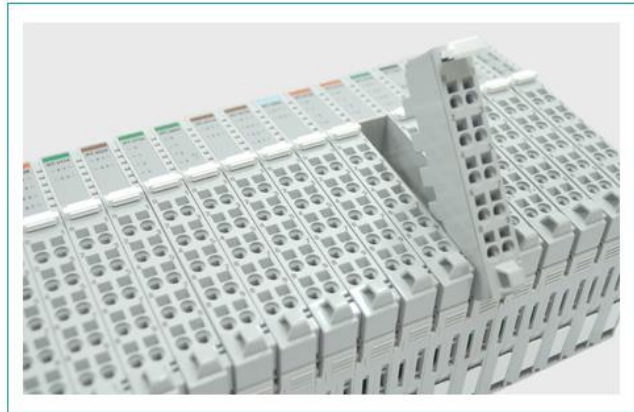
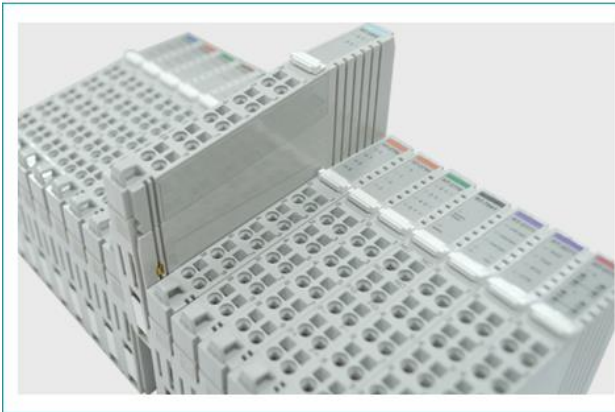
### 5.1 I/O Inserting and Removing Devices



As above figure in order to safeguard the RIO3 module from jamming, it should be fixed onto the DIN rail with locking lever. To do so, fold on the upper of the locking lever.

To pull out the HX-RIO3 module, unfold the locking lever as below figure.

## 5.2 RTB (Removable Terminal Block)



Whole terminal block can be combined and removed for the convenience.

There is a locking switch on the RTB for the easy combination and easy removal.

Easy combination and easy removal for IO modules on the din rail through One Touch Locking Switch.

## 6 G-Bus Pin Description

Communication between the Network Adapter and the expansion module as well as system / field power supply of the bus modules is carried out via the internal bus. It is comprised of 6 data pin and 2 field power pin.



\*Please refer to the table below regarding the pin description from P1 to P8.

No.	Description
P1	System Power (VCC)
P2	System Power (GND)
P3	GBUS TX +
P4	GBUS TX -
P5	GBUS RX +
P6	GBUS RX -
P7	Field Power (GND)
P8	Field Power (VCC)

**DANGER**



Do not touch data and field power pins in order to avoid soiling and damage by ESD noise.

## 7 APPENDIX

### 7.1 Product Overview

Please refer the separate HX-RIO3 product list document

### 7.2 Glossary

System Power: The power for starting up CPU.

Field Power: The power for input and output line.

Terminator Resistor: Resistor for prevention reflected wave.

EDS: Electronic Data Sheet.

Sink: The method of in/output power supply if a device has no power source.

Source: The method of in/output power supply if a device has the power source.