

User Manual – Analog Output Module

EH-RIO2 Series

RIO2-AY2I, -AY4I, -AY2V, -AY4V, -AY2H

Version 1.05



User Manual – Analog Output Module

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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 also 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 particular 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 55°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.

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1.1. Safety Instruction

1.1.1. Symbols

DANGER 	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
IMPORTANT	Identifies information that is critical for successful application and understanding of the product
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury, property damage, or economic loss. Attentions help you to identity a hazard, avoid a hazard, and recognize the consequences

1.1.2. Safety Notes

DANGER 	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, e.g. FnBUS Pin.
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1.1.3. Certification

CE Certificate

EN 61000-6-2; Industrial Immunity

EN 61000-6-4; Industrial Emissions

RoHS (EU, CHINA)

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2. ANALOG OUTPUT MODULE LIST

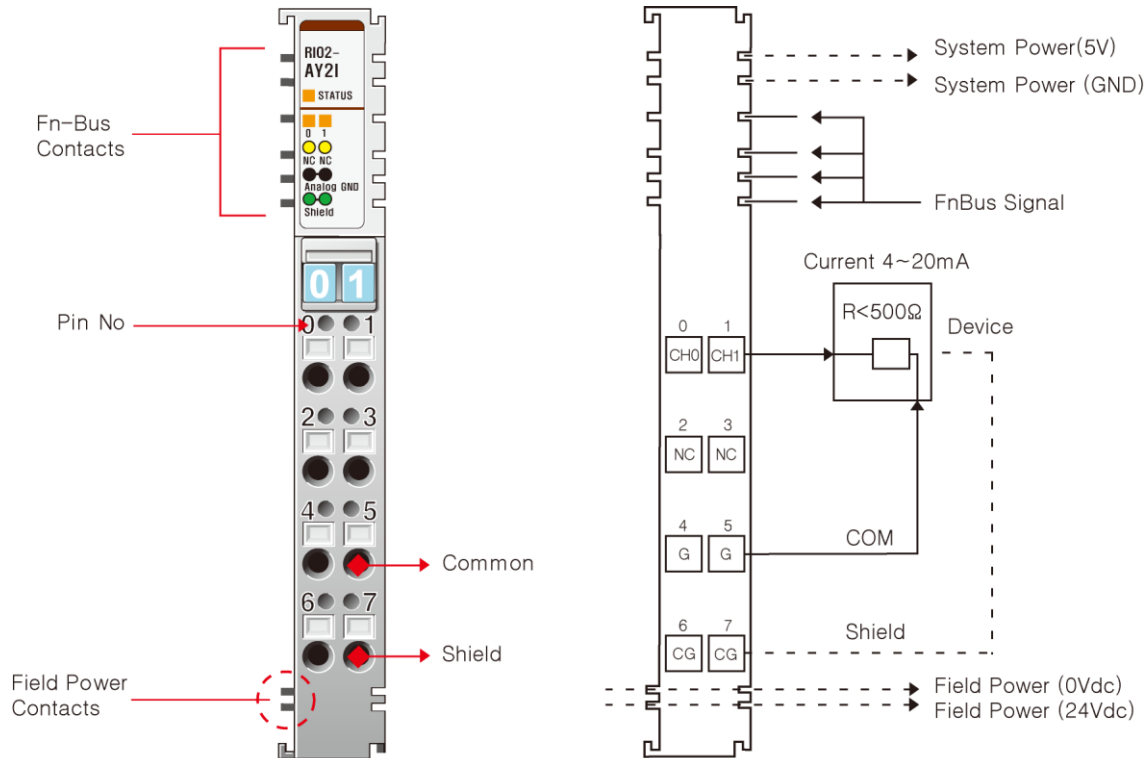
Number	Description	Production Status
RIO2-AY2I	2 Channels, Current, 4~20mA, 12bit	Active
RIO2-AY4I	4 Channels, Current, 4~20mA, 12bit	Active
RIO2-AY2V	2 Channels, Voltage, 0~10Vdc, 12bit	Active
RIO2-AY4V	4 Channels, Voltage, 0~10Vdc, 12bit	Active
RIO2-AY2H	2 Channels, Voltage, -10~10Vdc, 12bit	Active

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3. Specification

3.1. The Interface and data

3.1.1. RIO2-AY2I

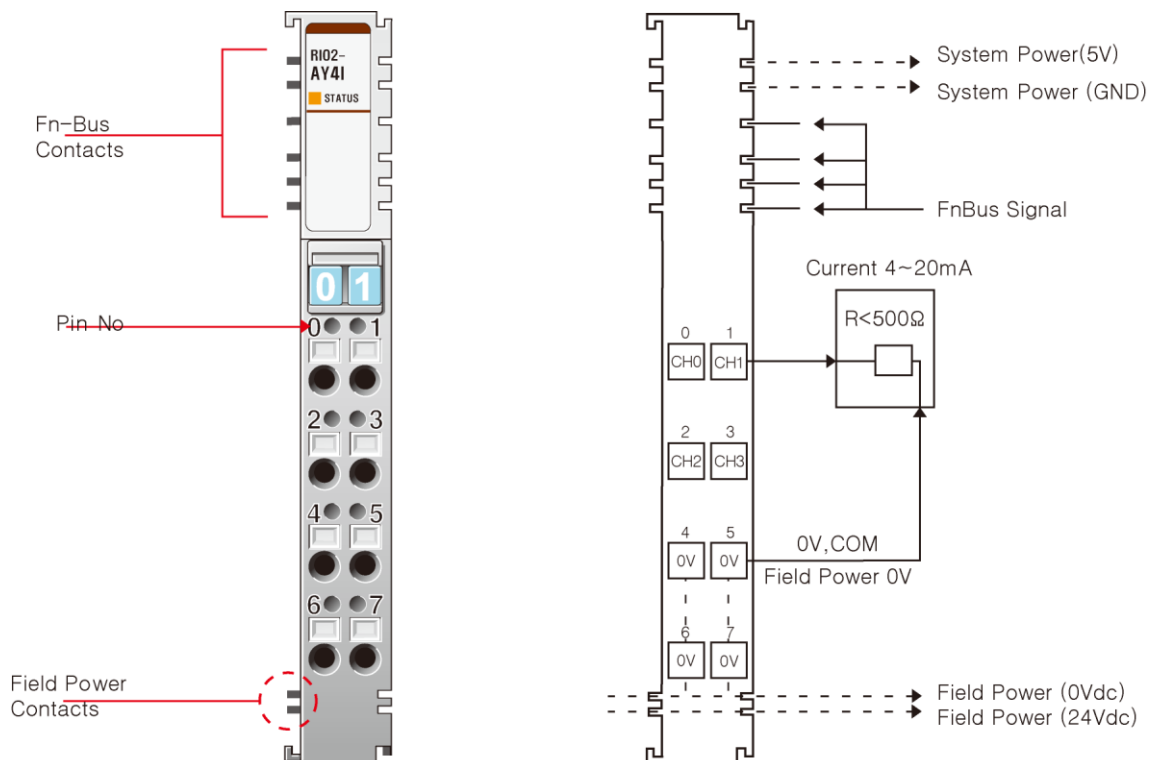


Pin No.	Description	Pin No.	Description
0	Output Channel 0	1	Output Channel 1
2	No Connection	3	No Connection
4	Output Channel Common (0V)	5	Output Channel Common (0V)
6	Chassis Ground / Shield	7	Chassis Ground / Shield

Current	4.0mA	5.0mA	10.0mA	20.0mA
Data(Hex)	H 0000	H 00FF	H 05FF	H 0FFF

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3.1.2. RIO2-AY4I

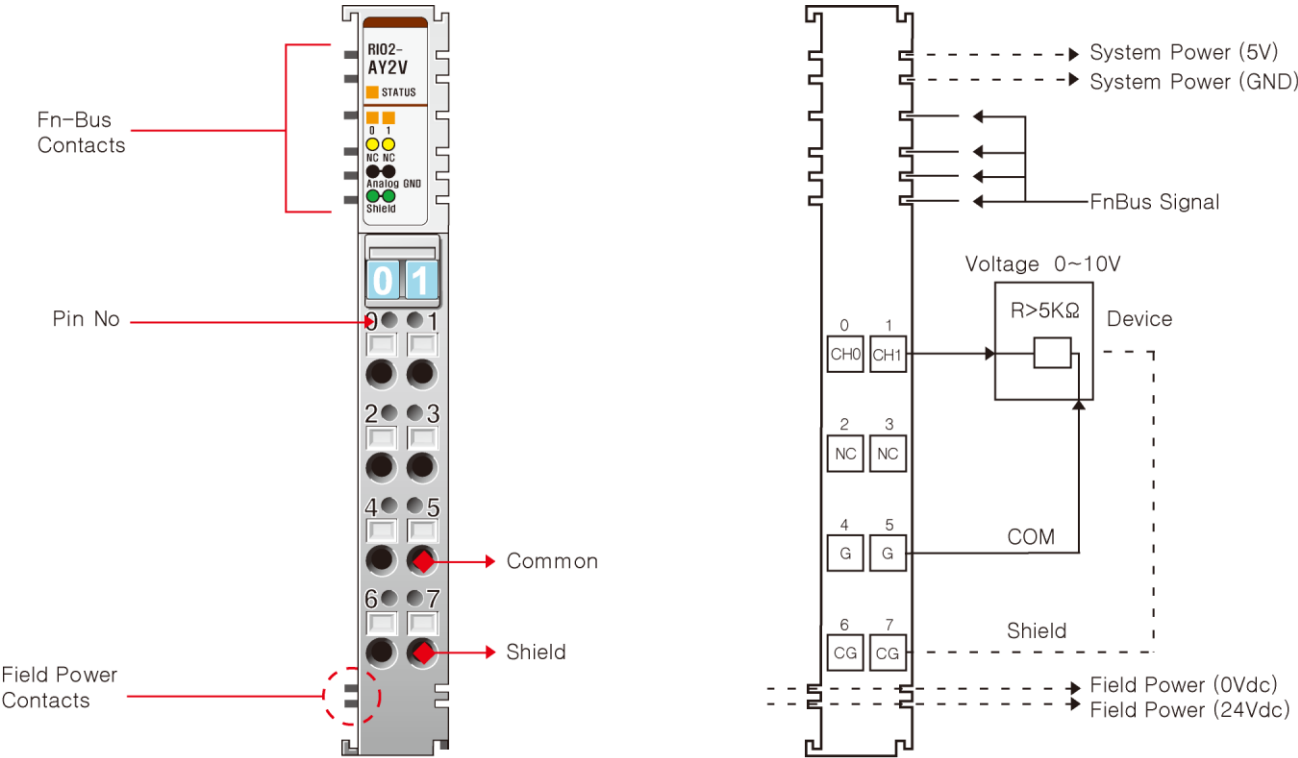


Pin No.	Description	Pin No.	Description
0	Output Channel 0	1	Output Channel 1
2	Output Channel 2	3	Output Channel 3
4	Field Ground 0V(AGND), Common	5	Field Ground 0V(AGND), Common
6	Field Ground 0V(AGND), Common	7	Field Ground 0V(AGND), Common

Current	4.0mA	8.0mA	12.0mA	20.0mA
Data(Hex)	H 0000	H 03FF	H 07FF	H 0FFF

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3.1.3. RIO2-AY2V

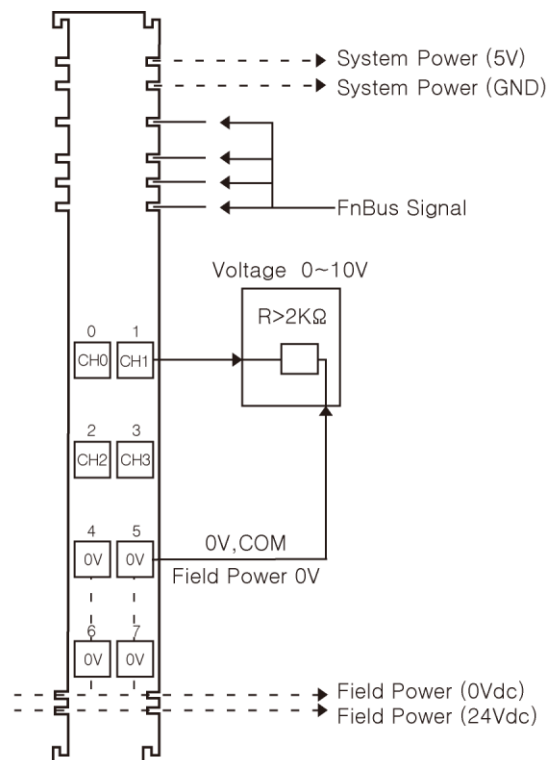
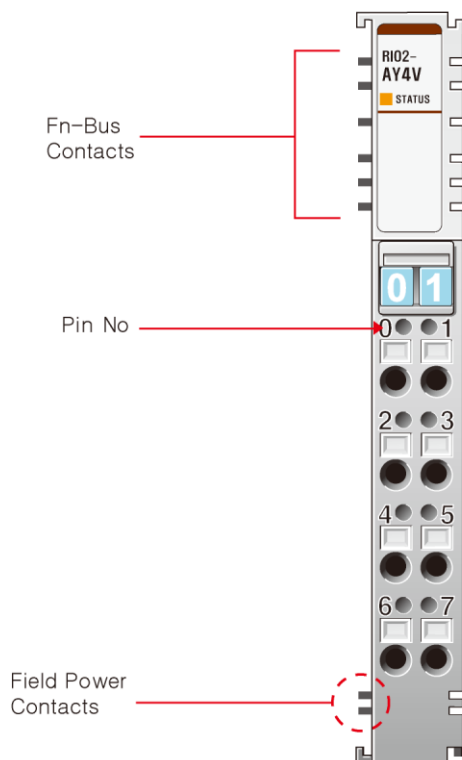


Pin No.	Description	Pin No.	Description
0	Output Channel 0	1	Output Channel 1
2	No Connection	3	No Connection
4	Output Channel Common (0V)	5	Output Channel Common (0V)
6	Chassis Ground / Shield	7	Chassis Ground / Shield

Voltage	0V	2.5V	5V	10V
Data(Hex)	H 0000	H 03FF	H 07FF	H 0FFF

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3.1.4. RIO2-AY4V

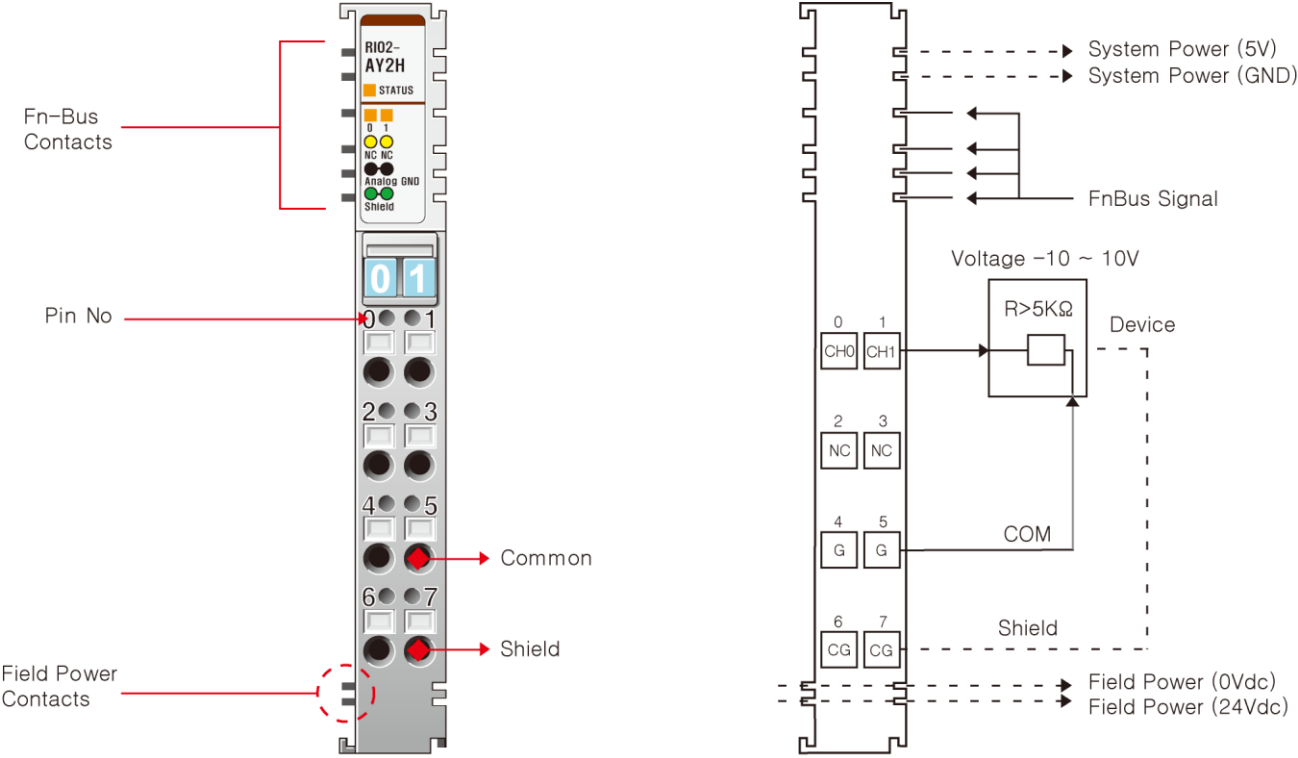


Pin No.	Description	Pin No.	Description
1	Output Channel 0	1	Output Channel 1
2	Output Channel 2	2	Output Channel 3
3	Field Ground 0V(AGND), Common	3	Field Ground 0V(AGND), Common
4	Field Ground 0V(AGND), Common	4	Field Ground 0V(AGND), Common

Voltage	0V	2.5V	5V	10V
Data(Hex)	H 0000	H 03FF	H 07FF	H 0FFF

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3.1.5. RIO2-AY2H



Pin No.	Description	Pin No.	Description
0	Output Channel 0	1	Output Channel 1
2	No Connection	3	No Connection
4	Output Channel Common (0V)	5	Output Channel Common (0V)
6	Chassis Ground / Shield	7	Chassis Ground / Shield

Voltage	-10V	-5V	0V	5V	10V
Data(Hex)	H F800	H FC00	H 0000	H 03FF	H 7FFF

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3.2. Environment Specification

Environmental Specifications

Operating Temperature	-20 to 55°C (Discrete I/O) 0 to 55°C (Analog I/O)
Non-Operating Temperature	-40°C to 85°C
Relative Humidity	5%~90% non-condensing
Operating Altitude	2000m
Mounting	DIN rail

General Specifications

Shock Operating	10g
Shock Non-Operating	30g
Vibration/Shock resistance	Displacement : 0.012Inch p-p from 10~57Hz Acceleration : 2G's from 57~500Hz Sweep Rate : 1 octave Per Minute Axes to test : x, y, z Frequency Sweeps Per Axis : 10
EMC resistance burst/ESD	Conforms to EN-61000-6-2
EMI	Conforms to EN-61000-6-4
Installation Pos./Protect. Class	Variable / IP20
Product Certification	CE
Network Conformance	RIO2-PBA : PTO Conformance Test Completion
Isolation	DC Module (Included Analog Module) : Terminal Block to F.G 500Vac/1min AC Module : Terminal Block to F.G 1500Vac/1min Relay Module : Terminal Block to F.G 2500Vac/1min

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3.3. Specification

3.3.1. RIO2-AY2I

Items	Specification
Output Specification	
Outputs Per Module	2Channels single ended, Non-isolated between channels
Indicators	2 Green States, 1 Green/Red FnBUS State
Resolution in Ranges	12 bits : 3.9uA/Bit
Output Current Range	4 ~ 20mA
Data Format	16bits Integer (2'scompliment)
Module Error	±0.1% Full Scale @25°C ±0.3% Full Scale @0°C , 60°C
Load Resistance	Max. 500Ω
Conversion Time	2msec / All channel
Calibration	Not Required
Diagnostic	No
Common Type	2Channels / 2COM (Single Channel)
General Specification	
Power Dissipation	Max. 60mA @ 5.0Vdc
Isolation	I/O to Logic : Photocoupler Isolation Field power : Non-isolation
Field Power	Supply Voltage : 24Vdc nominal Voltage Range : 15~28.8Vdc Power Dissipation: Max. 60mA @24Vdc
Wiring	I/O Cable Max. 2.0 mm ²
Weight	70g
Module Size	12mm x 99mm x 70mm
Environment Condition	Refer to " Environment Specification"(page : 9)

3.3.2. RIO2-AY4I

Items	Specification
Output Specification	
Outputs Per Module	4Channels single ended
Indicators	1 Green/Red FnBus State
Resolution in Ranges	12 bits : 3.9uA/Bit
Output Current Range	4 ~ 20mA
Data Format	16bits Integer (2'scompliment)
Module Error	±0.1% Full Scale @25°C ±0.3% Full Scale @0°C , 60°C
Load Resistance	Max. 500Ω
Conversion Time	4msec / All channel
Calibration	Not Required
Diagnostic	No
Common Type	4 Common, Field Power 0V is Common(AGND)
General Specification	
Power Dissipation	Max. 60mA @ 5.0Vdc
Isolation	I/O to Logic : Photocoupler Isolation Field power : Non-isolation
Field Power	Supply Voltage : 24Vdc nominal Voltage Range : 18~28.8Vdc Power Dissipation: Max. 60mA @24Vdc
Wiring	I/O Cable Max. 2.0 mm ²
Weight	70g
Module Size	12mm x 99mm x 70mm
Environment Condition	Refer to " Environment Specification"(page : 9)

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3.3.3. RIO2-AY2V

Items	Specification
Output Specification	
Outputs Per Module	2Channels single ended, Non-isolated between channel
Indicators	2 Green States, 1 Green/Red FnBUS State
Resolution in Ranges	12 bits : 2.44mV/Bit
Output Current Range	0 ~ 10Vdc
Data Format	16bits Integer (2's complement)
Module Error	±0.1% Full Scale @25°C ±0.3% Full Scale @0°C, 60°C
Load Resistance	Min. 5kΩ
Conversion Time	2msec / All Channel
Calibration	Not Required
Diagnostic	No
Common Type	2Channels / 2COM (Single Common)
General Specification	
Power Dissipation	Max.155mA @ 5.0Vdc
Power Supply	From System Power DC/DC
Isolation	I/O to Logic : Photocoupler Isolation Field power : Not Connected
Wiring	I/O Cable Max. 2.0 mm ²
Weight	70g
Module Size	12mm x 99mm x 70mm
Environment Condition	Refer to " Environment Specification"(page : 9)

3.3.4. RIO2-AY4V

Items	Specification
Output Specification	
Outputs Per Module	4Channels single ended
Indicators	1 Green/Red FnBus State
Resolution in Ranges	12 bits : 2.44mV/Bit
Output Current Range	0 ~ 10Vdc
Data Format	16bits Integer (2's complement)
Module Error	±0.1% Full Scale @25°C ±0.3% Full Scale @-20°C, 60°C,
Load Resistance	Min. 2kΩ
Conversion Time	4 msec / All channel
Calibration	Not Required
Diagnostic	No
Common Type	4 Common,, Field Power 0V is Common(AGND)
General Specification	
Power Dissipation	Max. 60mA @ 5.0Vdc
Isolation	I/O to Logic : Photocoupler Isolation Field power : Non-isolation
Field Power	Supply Voltage : 24Vdc nominal Voltage Range : 18~28.8Vdc Power Dissipation: Max. 60mA @24Vdc
Wiring	I/O Cable Max. 2.0 mm ² (AWG#14)
Weight	70g
Module Size	12mm x 99mm x 70mm
Environment Condition	Refer to " Environment Specification"(page : 9)

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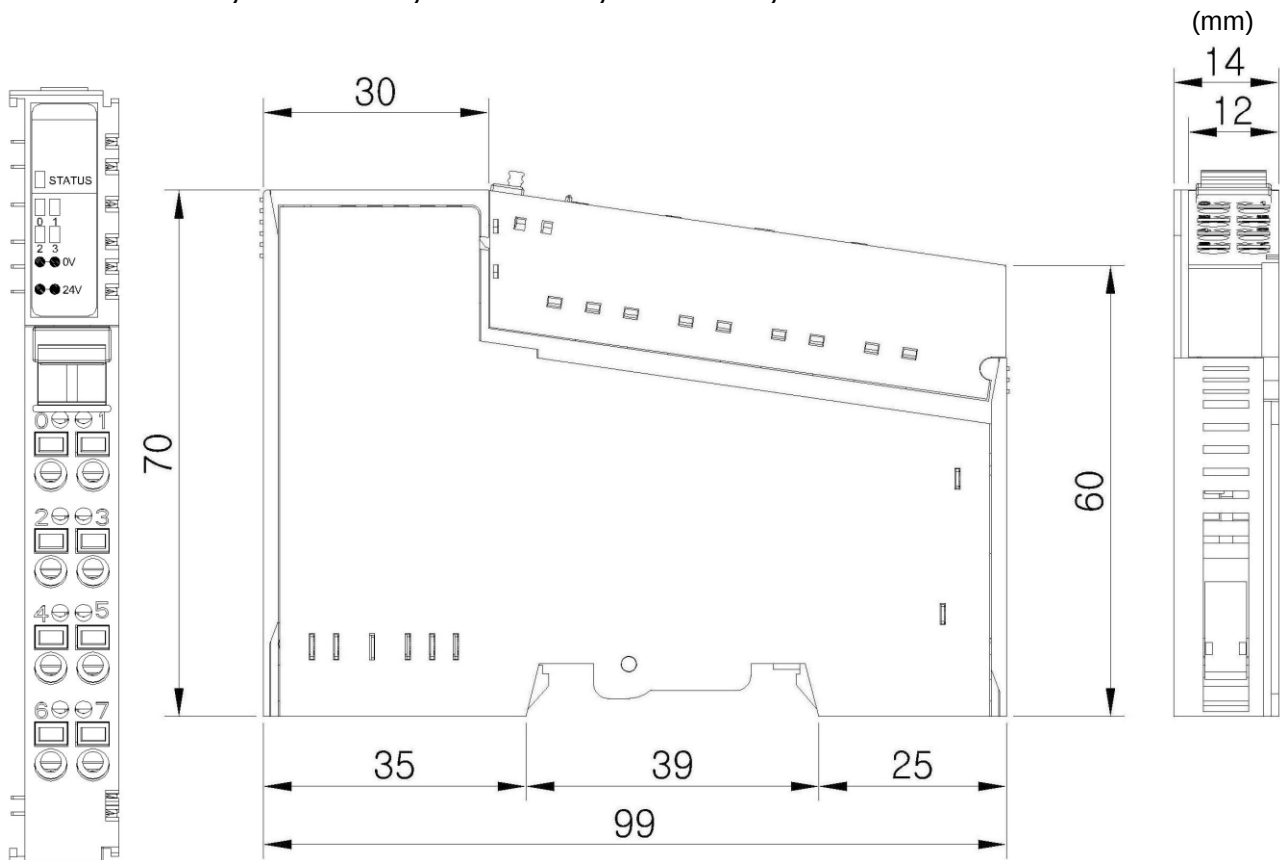
3.3.5. RIO2-AY2H

Items	Specification
Output Specification	
Outputs Per Module	2Channels single ended, Non-isolated between channel
Indicators	2 Green States, 1 Green/Red FnBUS State
Resolution in Ranges	12 bits : 4.88mV/Bit
Output Current Range	-10 ~ 10Vdc
Data Format	16bits Integer (2's complement)
Module Error	±0.1% Full Scale @25°C ±0.3% Full Scale @-20°C, 60°C,
Load Resistance	Min. 5kΩ
Conversion Time	2 msec / All channel
Calibration	Not Required
Diagnostic	No
Common Type	2Channels / 2COM(Single common)
General Specification	
Power Dissipation	Max. 155mA @ 5.0Vdc
Isolation	I/O to Logic : Photocoupler Isolation I/O to Field Power : Not Connected
Power Supply	From System Power DC/DC
Wiring	I/O Cable Max. 2.0 mm ² (AWG#14)
Weight	70g
Module Size	12mm x 99mm x 70mm
Environment Condition	Refer to " Environment Specification"(page : 9)

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4. Dimension

4.1. RIO2-AY2I, RIO2-AY2V, RIO2-AY2H, RIO2-AY4I, RIO2-AY4V



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5. Mapping Data into the image Table

5.1. RIO2-AY2I, RIO2-AY2V, RIO2-AY2H

Output Module Data

-4byte Output Data

Analog Output Ch 0
Analog Output Ch 1



Output Image Value

Bit No	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte 0	Analog Output Ch 0 Low byte							
Byte 1	Analog Output Ch 0 High byte							
Byte 2	Analog Output Ch 1 Low byte							
Byte 3	Analog Output Ch 1 High byte							

5.2. RIO2-AY4I, RIO2-AY4V

Output Module Data

-8byte Output Data

Analog Output Ch 0
Analog Output Ch 1
Analog Output Ch 2
Analog Output Ch 3



Output Image Value

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

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6. Configuration parameter

6.1. Configuration parameter

6.1.1. RIO2-AY2I

- Valid parameter length: 6 bytes
- Parameter data:

Offset	Decimal bit	Description	Default value
0	00-01	Fault Action for channel 0 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	02-03	Fault Action for channel 1 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	04-07	Reserved	0
1	00-07	Reserved	0
2	00-07	Channel 0 Fault Value Low Byte	0
3	00-03	Channel 0 Fault Value High Byte	0
	04-07	Reserved	0
4	00-07	Channel 1 Fault Value Low Byte	0
5	00-03	Channel 1 Fault Value High Byte	0
	04-07	Reserved	0
6	00-07	Not used	0
7	00-07	Not used	0

* All values are stored in Adapter's EEPROM

6.1.2. RIO2-AY4I

- Valid parameter length: 4 bytes
- Parameter data:

Offset	Decimal bit	Description	Default value
0	00-01	Fault Action for channel 0 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	02-03	Fault Action for channel 1 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	04-05	Fault Action for channel 2 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	06-07	Fault Action for channel 3 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
1	00-07	Reserved	0
2	00-07	Channel 0-3 Fault Value Low Byte	0
3	00-03	Channel 0-3 Fault Value High Byte	0
	04-07	Reserved	0
4	00-07	Not used	0
5	00-07	Not used	0
6	00-07	Not used	0
7	00-07	Not used	0

* All values are stored in Adapter's EEPROM

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6.1.3. RIO2-AY2V

- Valid parameter length: 6 bytes
- Parameter data:

Offset	Decimal bit	Description	Default value
0	00-01	Fault Action for channel 0 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	02-03	Fault Action for channel 1 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	04-07	Reserved	0
1	00-07	Reserved	0
2	00-07	Channel 0 Fault Value Low Byte	0
3	00-03	Channel 0 Fault Value High Byte	0
	04-07	Reserved	0
4	00-07	Channel 1 Fault Value Low Byte	0
5	00-03	Channel 1 Fault Value High Byte	0
	04-07	Reserved	0
6	00-07	Not used	0
7	00-07	Not used	0

* All values are stored in Adapter's EEPROM

6.1.4. RIO2-AY4V

- Valid parameter length: 4 bytes
- Parameter data:

Offset	Decimal bit	Description	Default value
0	00-01	Fault Action for channel 0 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	02-03	Fault Action for channel 1 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	04-05	Fault Action for channel 2 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	06-07	Fault Action for channel 3 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
1	00-07	Reserved	0
2	00-07	Channel 0-3 Fault Value Low Byte	0
3	00-03	Channel 0-3 Fault Value High Byte	0
	04-07	Reserved	0
4	00-07	Not used	0
5	00-07	Not used	0
6	00-07	Not used	0
7	00-07	Not used	0

* All values are stored in Adapter's EEPROM

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6.1.5. RIO2-AY2H

- Valid parameter length: 6 bytes
- Parameter data:

Offset	Decimal bit	Description	Default value
0	00-01	Fault Action for channel 0 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	02-03	Fault Action for channel 1 00: Fault Value, 01: Hold last state, 10: Low Limit, 11:High Limit	0 (Fault Value)
	04-07	Reserved	0
1	00-07	Reserved	0
2	00-07	Channel 0 Fault Value Low Byte	0
3	00-07	Channel 0 Fault Value High Byte	0
4	00-07	Channel 1 Fault Value Low Byte	0
5	00-07	Channel 1 Fault Value High Byte	0
6	00-07	Not used	0
7	00-07	Not used	0

* All values are stored in Adapter's EEPROM

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7. Trouble Shooting

ATTENTION


In this manual, it couldn't be described all variety case with Network Adapter of several protocols. So if you couldn't find any fault after investigating all below cases, refer to NA user manual.

7.1. Normal Module

LED Status	Cause	Action
EXPANSION MODULE STATUS LED		Device has no expansion Module or may not be powered
Off	Not Power No Initialized	The Parameter is not initialized yet.
Green	Fn-Bus Connection	FnBus normal Operation
Flashing Green	Fn-Bus Ready	FnBus ready
Flashing Red	Fn-Bus Fault	FnBus Time Out, FnBus Failed Communication
Red	Device Fault	Device fault
CHANNEL STATUS LED		
Off	Not Signal	Normal Operation
Green	On Signal	Normal Operation

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