User Manual

iR-AQ04-VI iR-AM06-VI iR-AI04-VI User Manual

This guide walks through important information about iR-Axxx-VI Series.

UM018013E_20200220

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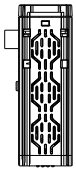
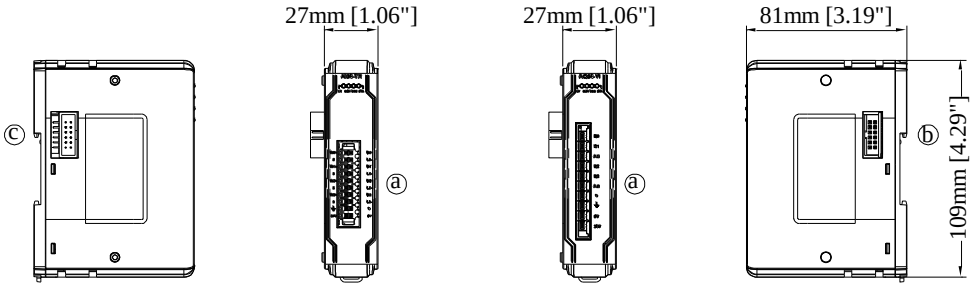
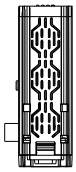
1. Product Overview



Top View



Side View iR-AXXX iR-AQ04-VI Side View



Bottom View

a	Terminal	*b.c*	Expansion Connector

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2. Specifications

2.1 Modules Specification

Module Name		iR-AI04-VI	iR-AM06-VI	iR-AQ04-VI
Number of Analog Inputs		4	4	0
Number of Analog outputs		0	2	4
Current Consumption		70mA@5VDC	70mA@5VDC	65mA@5VDC
Analog Power Supply		24 VDC（20.4 VDC~28.8 VDC）(-15%~+20%)		
Specification	PCB Coating	Yes		
	Enclosure	Plastic		
	Dimensions WxHxD	27 x 109 x 81 mm		
	Weight	Approx. 0.12 kg		
	Mount	35mm DIN rail mounting		
Environment	Protection Structure	IP20		
	Storage Temperature	-20° ~ 70°C (-4° ~ 158°F)		
	Operating Temperature	0° ~ 55°C (32° ~ 131°F)		
	Relative Humidity	10% ~ 90% (non-condensing)		
	Vibration Resistance	Conforms to EN 60068-2-6 / EN 60068-2-27		
Connection	Cross-section	AWG 28-16		AWG 24-16
Certification	EMC Immunity	Conforms to EN 55032: 2012+AC: 2013, Class A EN 61000-6-4: 2007+A1:2011 EN 55024: 2010+A1: 2015 EN 61000-6-2:2005		

2.2 Analog Input Specification

Input Range	-10V~10V、 -20mA~20mA				
Conversion Time	2ms/Channel				
Isolation	500 VDC：(Analog / Digital)				
Data Format	-10~10V	-5V~5V	1~5V	-20~20mA	4~20mA
	±32000	±32000	0~32000	±32000	0~32000
Resolution	0.312mV	0.156mV	0.156mV	0.625uA	0.625uA
	16 bit	16 bit	15 bit	16 bit	15 bit
Input Impedance	1MΩ			250 Ω	
Diagnose	Supply Voltage Wire break (1~5V & 4~20mA) Overflow/underflow				
Accuracy	± 0.2 % Full Scale@25°C ± 0.3 % Full Scale@0° ~ 55°C				

2.3 Analog Output Specification

Output Range	-10V~10V、-20mA~20mA				
Conversion Time	1.6ms/4 channels 1.3ms/3 channels 1ms/2 channels 700us/1 channel				
Isolation	500 VDC：(Analog / Digital)				
Data Format	-10~10V	-5V~5V	1~5V	-20~20mA	4~20mA
	±32000	±32000	0~32000	±32000	0~32000
Resolution	5mV	5mV	5mV	10uA	10uA
	12bit	11bit	10bit	12bit	11bit
Output Impedance	≧1kΩ			≦500Ω	
Diagnose	Supply Voltage Open Circuit Voltage Short Circuit Current				
Accuracy	± 0.2 % Full Scale@25°C ± 0.3 % Full Scale@0° ~ 55°C				

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3. LED Insicators

3.1 L.V LED

State	Description
OFF	24V power normal
Blinking	Detect 24V power
ON	24V power error

3.2 RUN LED

State	Description
OFF	No Power
Blinking	iBus initiating
ON	iBus working

3.3 ERR LED

State	Description
OFF	No error
Blinking	Analog channel error
ON	Unable to perform conversion (Analog hardware error)

3.4 STA LED

State	Description
OFF	No error
Blinking	Conversion in progress

4. Error Handling

State	Description	Error Handling
L.V LED ON	24V power error	Check 24V power
L.V LED Blinking	Detect 24V power	Check 24V power
Run LED is OFF	No Power	Check whether the coupler is properly powered, or if module malfunction occurs. And send the malfunction unit for repair.
ERR LED ON	Unable to perform conversion	Hardware error, send the unit for repair.

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RUN LED Blinking	iBus initiating	Check whether the coupler is functioning, if not, sent the unit for repair.
ERR LED Blinking	Channel conversion error	Check the error code to find out whether the output value exceeds allowable range, or voltage short circuit / current open circuit occurs.

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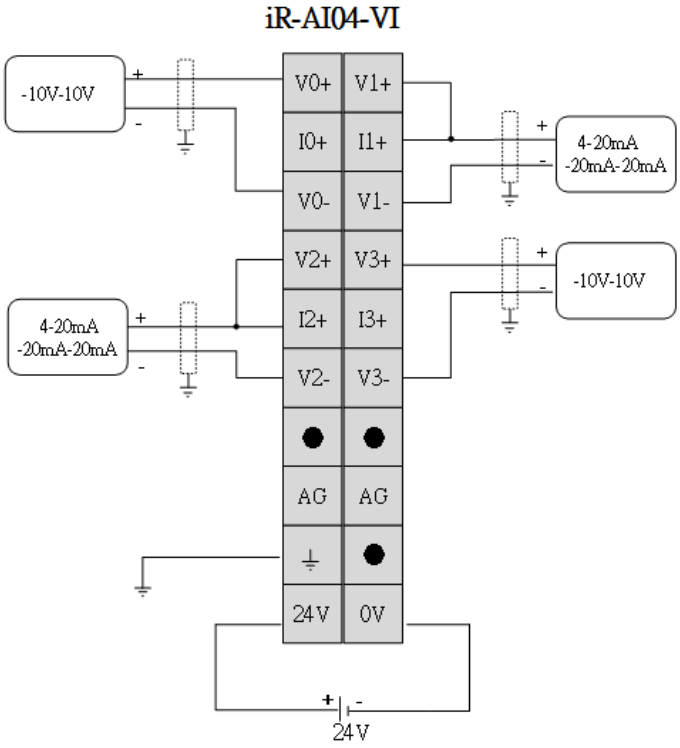
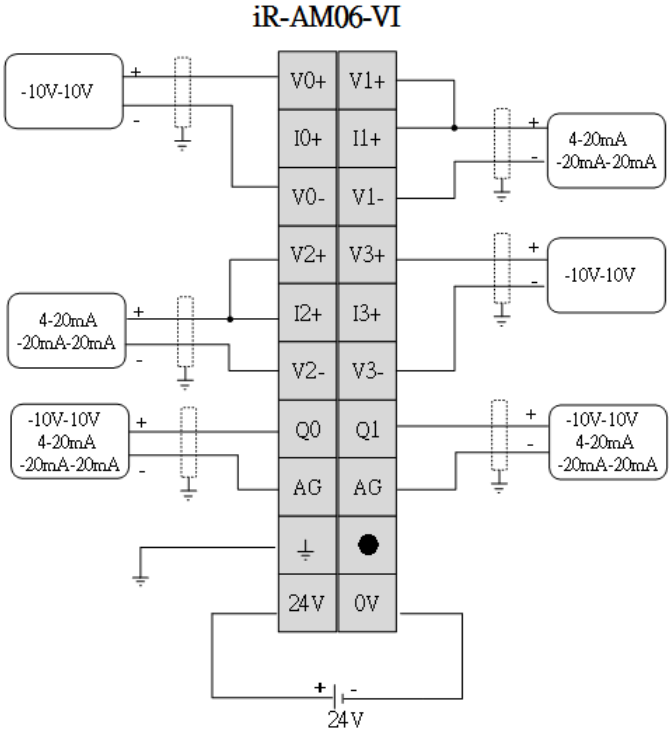
5. Wiring





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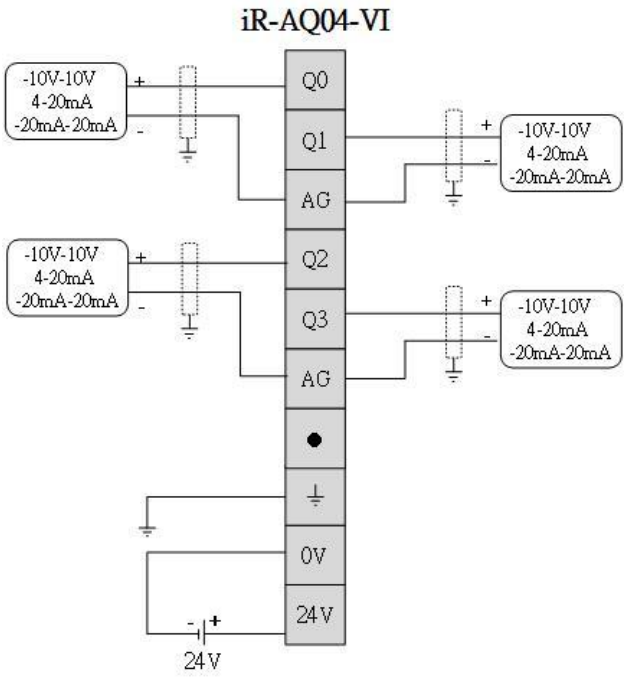
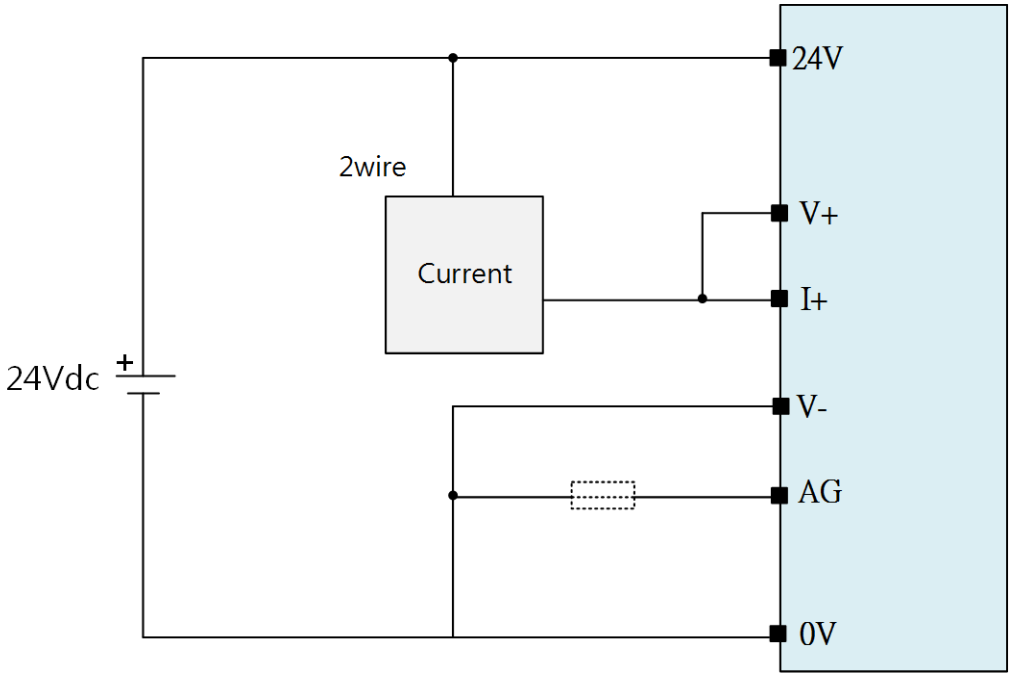


2-, 3- and 4-wire Analog Sensor connection at inputs:

2 wire：



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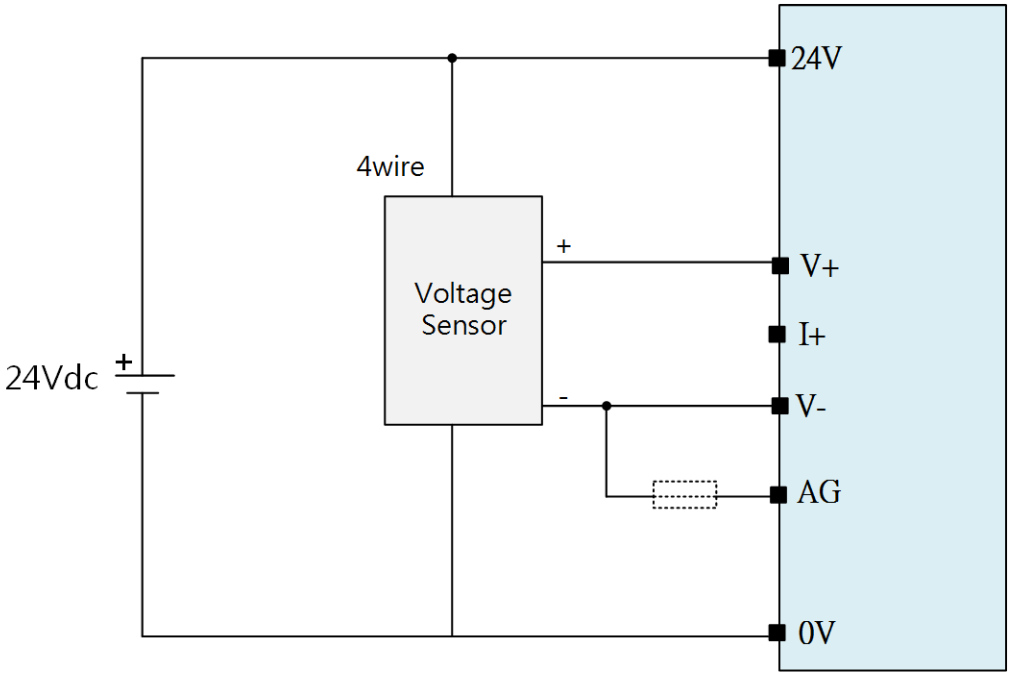
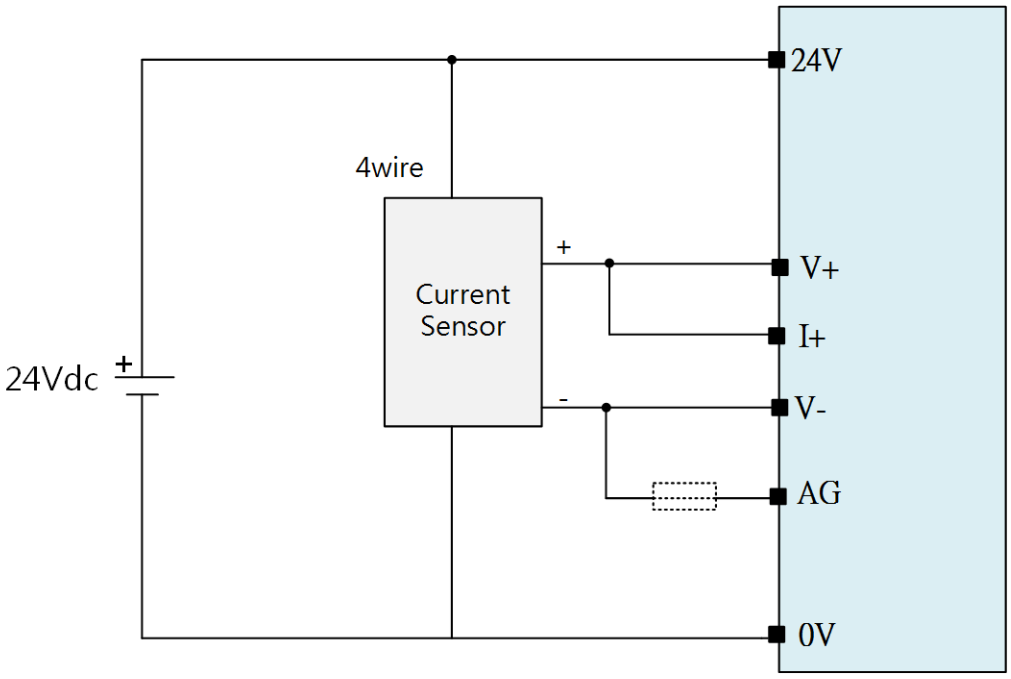
3 wire：





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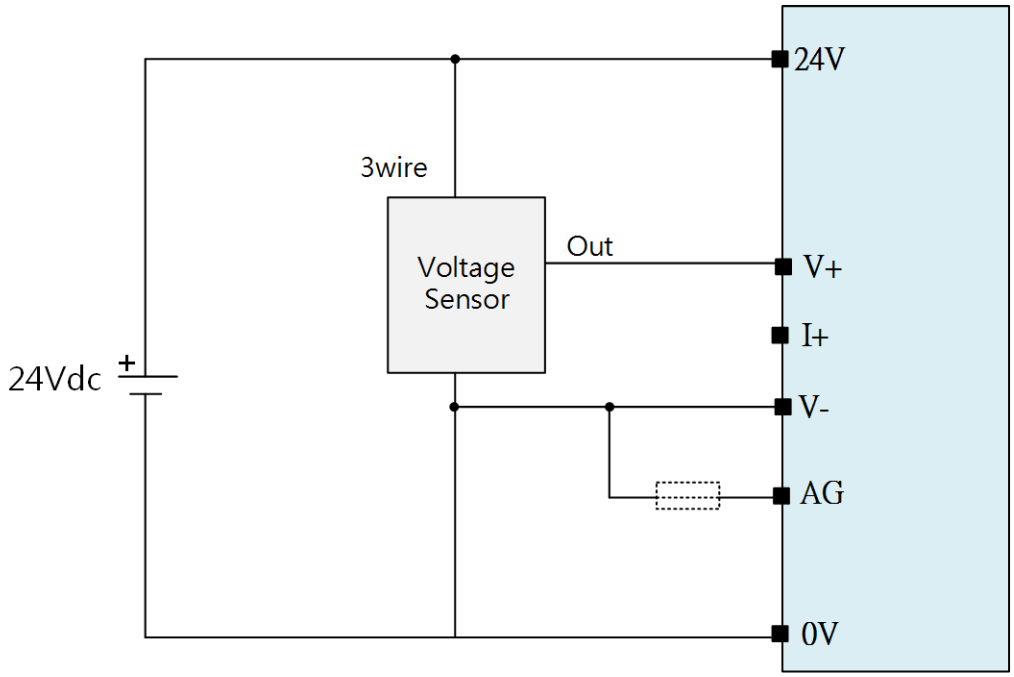
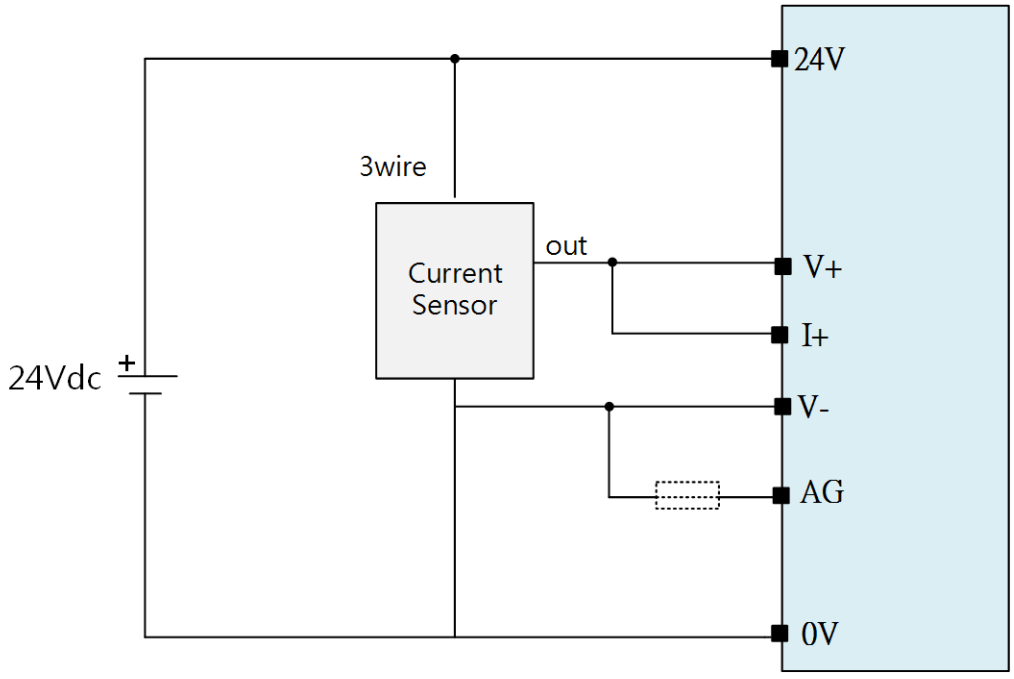
4 wire：





※ AG connected to V- contact with low-resistance.

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6. Analog I/O Features

6.1 Feature List

No.	Feature		Descriptions
1	User-Defined Conversion Rate		
2	Analog Output – Soft Start		
3	Diagnose	Analog Output	Voltage Short Circuit Detection & Protection
			Current Open Circuit Detection & Protection
4		Analog Input	Disconnection Detection (1-5v / 4-20mA)
5	Analog Input – Fast Conversion Mode		
6	Analog Input – Digital Filter		

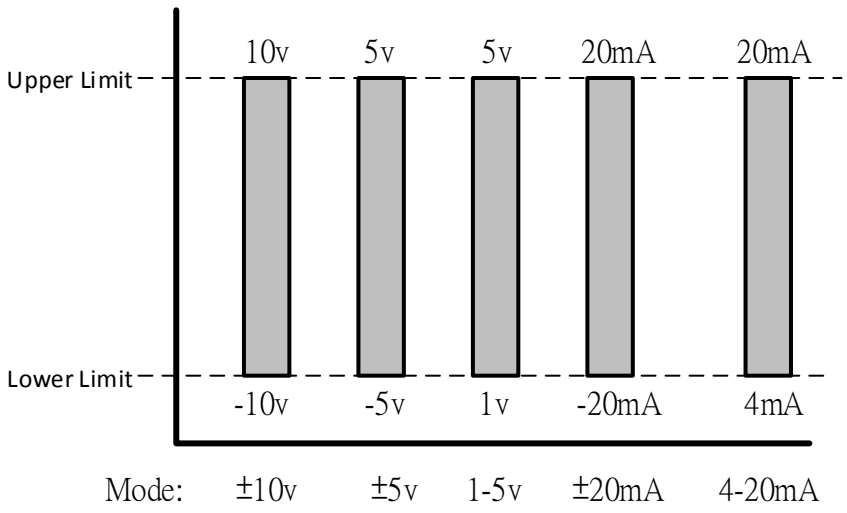
6.2 User-Defined Conversion Rate

iR-Axxx-VI Series models support built-in digital-to-analog conversion with user-defined range. Available ranges are: ±10V, ±5v, 1-5v, ±20m, 4-20mA.

Example: When the defined mode is ±10V, the default scale range is ±32000.

Converting analog value 10v will get the upper limit of the range, which is 32000.

Converting analog value -10v will get the lower limit of the range, which is -32000.



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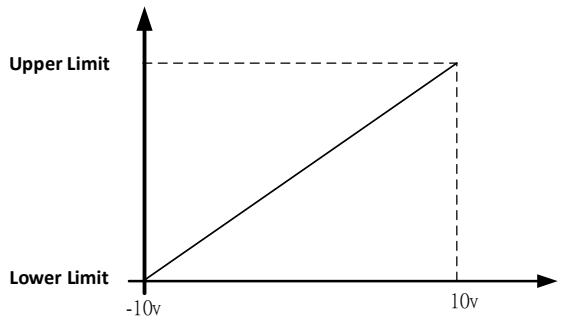
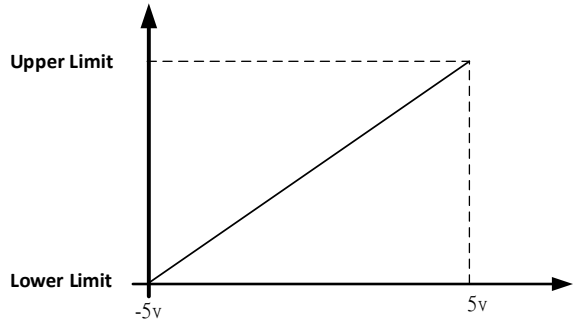
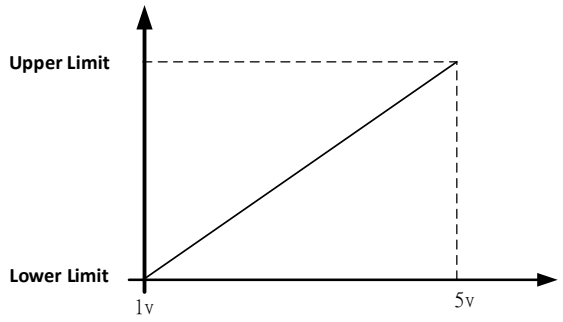
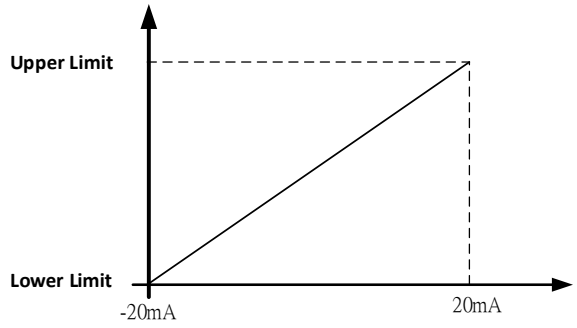
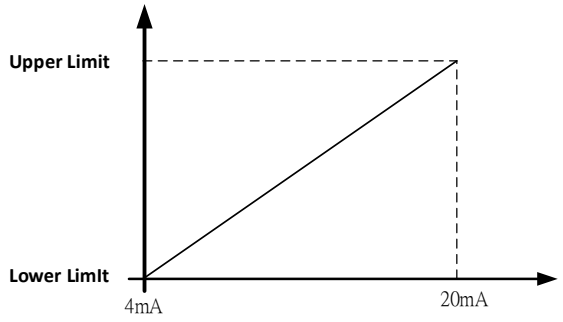
Mode: ±10v	Mode: ±5v
	
Mode: 1-5v	**Mode: ±20mA**
	
Mode: 4-20mA	
	

The upper and lower limit of the scale range can be configured for each mode. When switching from one mode to another, the upper and lower limit will return to default; therefore, when using this feature, please set the mode before configuring the range. By default the upper and lower limit of the range for each mode is as below:

Mode	Minimum	Maximum
-10~10V	-32000	32000
-5V~5V	-32000	32000
1~5V	0	32000
-20~20mA	-32000	32000
4~20mA	0	32000

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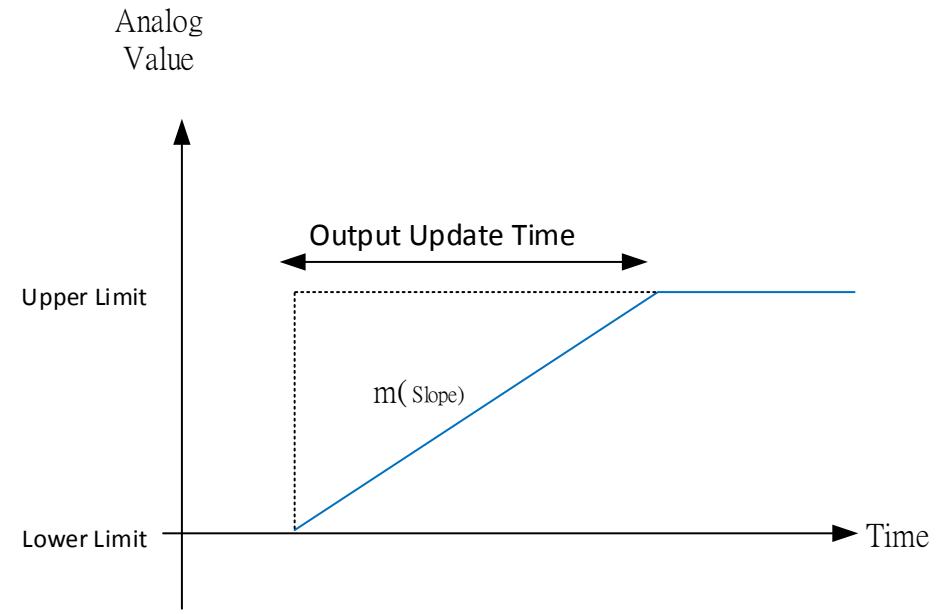
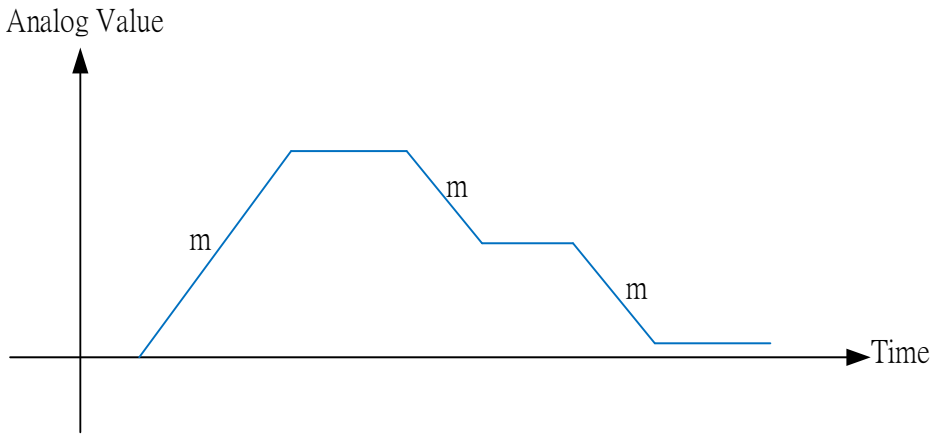
6.3 Analog Output – Soft Start

Generally, when changing analog output value, the voltage or current output will change immediately. To gradually increase or decrease output for reducing potential system impact, an [Output Update Time] parameter can be configured. Adjusting Output Update Time can get a slew rate where the change of voltage or current from minimum to maximum value per unit of time is defined, as illustrated in the following figures.





Parameter	Description	Default
Output Update Time	The time unit is 10ms. By default this parameter is set to 0 (disabled). The maximum allowable setting is 3200 (32 seconds)	0

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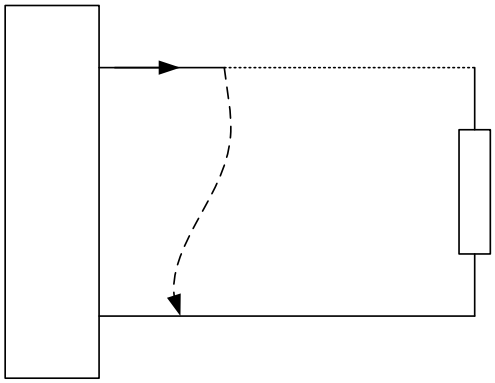
6.4 Diagnose

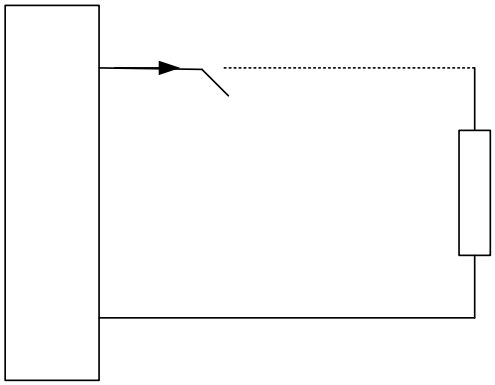
- Analog Voltage Output

When voltage short circuit is detected, the module will generate an alarm and stop output. An error code can be used to find out which channel is reporting error. (No alarm will be generated when output is 0V)



- Analog Current Output

When current open circuit is detected, the module will generate an alarm and stop output. An error code can be used to find out which channel is reporting error. (No alarm will be generated when output is 0mA)



- Disconnection Detection

A channel alarm will be generated when input exceeds allowable range. In 1-5V / 4-20mA mode, disconnection can be detected when voltage is 0v or current is 0mA.

6.5 Analog Input – Fast Conversion Mode

The conversion time per channel is 2ms. The total required conversion time is calculated by multiplying 2ms by the number of channels, for example, 4 channels will take 8ms for conversion. In fast conversion mode, where only one channel is used, the conversion time can be reduced to 500us.

Fast Conversion Mode can be enabled by setting the corresponding register to 0.5ms. Under this mode, only one channel can be used. If channel 0 is not closed, the rest of the channels will not be able to perform conversion. If channel 0 is closed where

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channel 1 is opened, only channel 1 can perform conversion while the rest cannot.

6.6 Analog Input – Digital Filter

The built-in filter enhances signal precision to achieve better control. Setting a slower conversion rate will get a better signal quality. By default the conversion time is 2ms. Setting 60ms can effectively filter out noises in a 50/60Hz environment.

The Filter Frame Size can stabilize the signal by averaging sampled values, in order to achieve better control.

7. Registers

Address	Description		Default	Read/Write
0	Analog Output	Channel 0 Output Mode	1	Read/Write
1		Channel 1 Output Mode	1	Read/Write
2		Channel 2 Output Mode	1	Read/Write
3		Channel 3 Output Mode	1	Read/Write
4		Channel 0 Scale Range Upper Limit	32000	Read/Write
5		Channel 1 Scale Range Upper Limit	32000	Read/Write
6		Channel 2 Scale Range Upper Limit	32000	Read/Write
7		Channel 3 Scale Range Upper Limit	32000	Read/Write
8		Channel 0 Scale Range Lower Limit	-32000	Read/Write
9		Channel 1 Scale Range Lower Limit	-32000	Read/Write
10		Channel 2 Scale Range Lower Limit	-32000	Read/Write
11		Channel 3 Scale Range Lower Limit	-32000	Read/Write
12		Channel 0 Update Time	0	Read/Write
13		Channel 1 Update Time	0	Read/Write
14		Channel 2 Update Time	0	Read/Write
15		Channel 3 Update Time	0	Read/Write
16	Error Code		0	Read
17	Command		0	Read/Write
18	Channel Detection		FFh	Read/Write
19	Analog Input	Conversion Time	0	Read/Write
20		Channel 0 Input Mode	1	Read/Write
21		Channel 1 Input Mode	1	Read/Write
22		Channel 2 Input t Mode	1	Read/Write
23		Channel 3 Input Mode	1	Read/Write
24		Channel 0 Scale Range Upper Limit	32000	Read/Write

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25		Channel 1 Scale Range Upper Limit	32000	Read/Write
26		Channel 2 Scale Range Upper Limit	32000	Read/Write
27		Channel 3 Scale Range Upper Limit	32000	Read/Write
28		Channel 0 Scale Range Lower Limit	-32000	Read/Write
29		Channel 1 Scale Range Lower Limit	-32000	Read/Write
30		Channel 2 Scale Range Lower Limit	-32000	Read/Write
31		Channel 3 Scale Range Lower Limit	-32000	Read/Write
32		Channel 0 Filter Frame Size	5	Read/Write
33		Channel 1 Filter Frame Size	5	Read/Write
34		Channel 2 Filter Frame Size	5	Read/Write
35		Channel 3 Filter Frame Size	5	Read/Write
36		Channel 0 Maximum Value	0	Read
37		Channel 1 Maximum Value	0	Read
38		Channel 2 Maximum Value	0	Read
39		Channel 3 Maximum Value	0	Read
40		Channel 0 Minimum Value	0	Read
41		Channel 1 Minimum Value	0	Read
42		Channel 2 Minimum Value	0	Read
43		Channel 3 Minimum Value	0	Read

- Analog Output Mode

Value	Mode	Resolution	
0	Close Channel	N/A	
1	-10V-10V(Default)	12bit	5mV
2	-5V-5V	11bit	5mV
3	1-5v	11bit	5mV
4	±20mA	12bit	0.01mA
5	4-20mA	11bit	0.01mA

- Analog Input Mode

Value	Mode	Conversion Time	Resolution	
0	Close Channel	N/A	N/A	
1	-10V-10V(Default)	2ms	16bit	312uV
2	-5V-5V	2ms	16bit	156.25uV
3	1-5v	2ms	16bit	156.25uV

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4	±20mA	2ms	16bit	0.625uA
5	4-20mA	2ms	16bit	0.625uA

- Analog Input Conversion Time

Value	Conversion Time
0	2ms
1 (Default)	2ms
2	5ms
3	10ms
4	15ms
5	25ms
6	60ms
7	0.5ms (Fast Conversion Mode)

When changing from one mode to another, the closest conversion time to 2ms x number of channels will be set. Users can adjust the conversion time to get better signal precision, for example, setting 60ms in 50/60Hz environment.

- Scale Range Setting

Setting	Description	Default
Upper Limit	Allowable range: -32768~32767	32000
Lower Limit	Allowable range: -32768~32767	-32000

Please note that setting the upper limit and lower limit to the same value will make the system use the default value.

- Analog Output Update Time

Setting	Description	Default
Analog Output Update Time	Allowable range: 0~3200 Time unit: 10ms By default this setting is disabled.	0

- Analog Input - Filter Frame Size

• Setting	Description	Default
Filter Frame Size	Allowable range: 0~20 Setting value 0 will disable this setting.	5

- Analog Input maximum / minimum value

This setting keeps on recording the maximum and minimum digital value. The record

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can be cleared by giving a command (restart recording).

Setting	Description	Default
Input Max./Min. Value	Allowable range: -32768~32767	0

- Error Code

Error Code	Description
0	Power error
1	Hardware error
2	Device isn't calibrated
3	Reserved
4	Conversion cannot be performed.
5-7	Reserved
8	Input Channel 0 error
9	Input Channel 1 error
10	Input Channel 2 error
11	Input Channel 3 error
12	Output Channel 0 error
13	Output Channel 1 error
14	Output Channel 2 error
15	Output Channel 3 error

- Command

Value	Description
0x0001	Restore factory default
0x0002	Reset the max./min. value of analog input channel 0
0x0003	Reset the max./min. value of analog input channel 1
0x0004	Reset the max./min. value of analog input channel 2
0x0005	Reset the max./min. value of analog input channel 3
0x0006	Reset the max./min. value of analog input channel 0-3

- Channel Detection

Bit	Description	Value	
		1	0
0	Analog Input Channel 0 Detection	Enable	Disable
1	Analog Input Channel 1 Detection	Enable	Disable
2	Analog Input Channel 2 Detection	Enable	Disable
3	Analog Input Channel 3 Detection	Enable	Disable

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4	Analog Output Channel 0 Detection	Enable	Disable
5	Analog Output Channel 1 Detection	Enable	Disable
6	Analog Output Channel 2 Detection	Enable	Disable
7	Analog Output Channel 3 Detection	Enable	Disable
8-15	Reserved		

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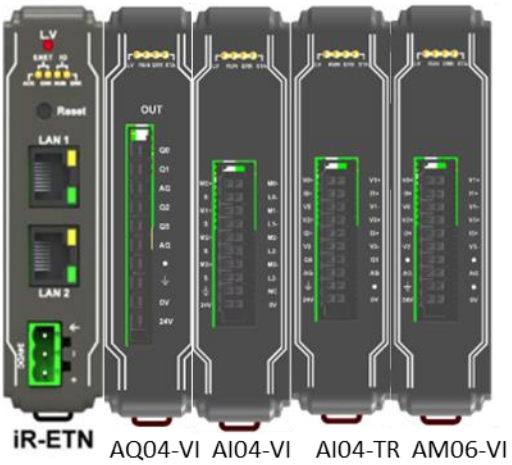
8. iR-ETN Coupler Address Mapping

Module No.	Module Registers	iR-ETN Modbus Address
1st	500	20000-20499
2nd	500	20500-20999
3rd	500	21000-21499
4th	500	21500-21999
……	……	……
16th	500	27500-27999

- Example:



Module No.	Module Name
0	iR-ETN
1	iR-AQ04-VI
2	iR-AI04-VI
3	iR-AI04-TR
4	iR-AM06-VI

Module	Module Register	iR-ETN Modbus Address
iR-AQ04-VI	0# Channel 0 Output Mode	20000
	1# Channel 1 Output Mode	20001
	2# Channel 2 Output Mode	20002
	3# Channel 3 Output Mode	20003
	……	……..
	16# Error Code	20016
	……	……..
iR-AI04-VI	20# Channel 0 Input Mode	20520
	21# Channel 1 Input Mode	20521
	22# Channel 2 Input Mode	20522
	23# Channel 3 Input Mode	20523
	……	……..
iR-AI04-TR	0# Channel 0 Input Mode	21000
	1# Channel 1 Input Mode	21001
	2# Channel 2 Input Mode	21002

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	3# Channel 3 Input Mode	21003
	……	……..
iR-AM06-VI	0# Channel 0 Output Mode	21500
	1# Channel 1 Output Mode	21501
	……	……..
	20# Channel 0 Input Mode	21520
	21# Channel 1 Input Mode	21521
	22# Channel 2 Input Mode	21522
	23# Channel 3 Input Mode	21523
	……	……..

Module	Module Analog Channel		iR-ETN Modbus Address
iR-AI04-VI	Analog Input	Channel 0 Digital Value	0
		Channel 1 Digital Value	1
		Channel 2 Digital Value	2
		Channel 3 Digital Value	3
iR-AI04-TR		Channel 0 Digital Value	4
		Channel 1 Digital Value	5
		Channel 2 Digital Value	6
		Channel 3 Digital Value	7
iR-AM06-VI		Channel 0 Digital Value	8
		Channel 1 Digital Value	9
		Channel 2 Digital Value	10
		Channel 3 Digital Value	11
iR-AQ04-VI	Analog Output	Channel 0 Digital Value	256
		Channel 1 Digital Value	257
		Channel 2 Digital Value	258
		Channel 3 Digital Value	259
iR-AM06-VI		Channel 0 Digital Value	260
		Channel 1 Digital Value	261

*Modbus Read Function Codes: 03h, 04h, 17h; Write Function Code: 06h, 10h, 17h

*This Modbus address starts from address 0 for CODESYS and Weintek_RemoteIO configuration. If you use common Modbus TCP\IP, the Modbus address starts from address 1 so that all parameter addresses should be increased by 1.

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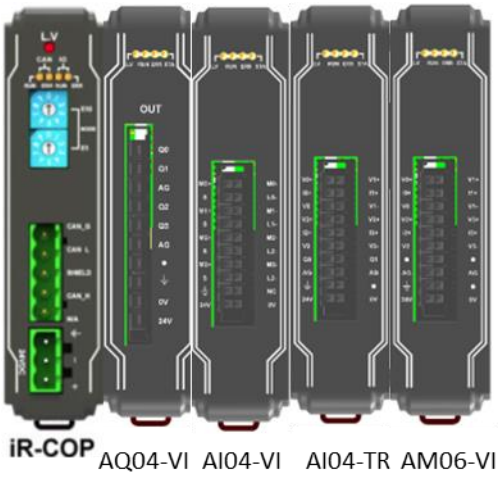
9. iR-COP Coupler Address Mapping

Module No.	Module Registers	Object Dictionary	
		Index	Sub-Index
1st	127	3000h	01h-80h
2nd	127	3001h	01h-80h
3rd	127	3002h	01h-80h
4th	127	3003h	01h-80h
……	……	……	01h-80h
16th	127	300Fh	01h-80h

- Example:



Module No.	Module Name
0	iR-COP
1	iR-AQ04-VI
2	iR-AI04-VI
3	iR-AI04-TR
4	iR-AM06-VI

Module	Module Register	Index	Sub-Index
iR-AQ04-VI	0# Channel 0 Output Mode	3000h	01h
	1# Channel 1 Output Mode	3000h	02h
	2# Channel 2 Output Mode	3000h	03h
	3# Channel 3 Output Mode	3000h	04h
	……	……	……
	16# Error Code	3000h	10h
	……	……	……
iR-AI04-VI	20# Channel 0 Input Mode	3001h	15h
	21# Channel 1 Input Mode	3001h	16h
	22# Channel 2 Input Mode	3001h	17h
	23# Channel 3 Input Mode	3001h	18h
	……	……	……

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iR-AI04-TR	0# Channel 0 Input Mode	3002h	01h
	1# Channel 1 Input Mode	3002h	02h
	2# Channel 2 Input Mode	3002h	03h
	3# Channel 3 Input Mode	3002h	04h
	……	……	……
iR-AM06-VI	0# Channel 0 Output Mode	3003h	01h
	1# Channel 1 Output Mode	3003h	02h
	……	……	……
	20# Channel 0 Input Mode	3003h	15h
	21# Channel 1 Input Mode	3003h	16h
	22# Channel 2 Input Mode	3003h	17h
	23# Channel 3 Input Mode	3003h	18h
	……	……	……

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