



iO-GRID™

Analog Input Module

User Manual

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1. Analog Input Module List

| Product No. | Description | Remarks |
|-------------|---|---------|
| GFAI-RM10 | 4-channel analog input module (-10...10VDC · 0138 terminal block) | |
| GFAI-RM11 | 4-channel analog input module (0...10VDC · 0138 terminal block) | |
| GFAI-RM20 | 4-channel analog input module (0... 20mA · 0138 terminal block) | |
| GFAI-RM21 | 4-channel analog input module (4... 20mA · 0138 terminal block) | |

Product Description

GFAI, analog output module series is specially designed for industrial applications. It's the open-type industrial equipment which is intended for installation within enclosures supplied in the field. Device with four analog inputs, 12-bit analog-to-digital conversion. And its circuit design & all the components of GFAI series are compliant with the latest requirements and standards of UL, CE & RoHS. It has a complete circuit protection design to resist overload, overvoltage and short circuit etc. It is avoided to damage & failure caused from improper operations.

**Caution (ATTENTION):**

1. THIS DEVICE IS FOR INDOOR USE ONLY, DON'T PUT OR USE IT IN HIGH TEMPERATURE AND HIGH MOISTURE ENVIRONMENT.
CET EQUIPEMENT EST DESTINE A UN USAGE INTERIEUR UNIQUEMENT NE PAS STOCKER OU UTILISER DANS UN ENVIRONNEMENT A HAUTE TEMPERATURE ET HAUTE HUMIDITE.
2. AVOID FALLING AND BUMPING OTHERWISE THE ELECTRICAL COMPONENTS WILL BE DAMAGED.
ÉVITEZ DE TOMBER ET DE VOUS ÉCRASER, SINON LES COMPOSANTS ÉLECTRIQUES SERONT ENDOMMAGÉS
3. DON'T TRY TO DISASSEMBLE OR OPEN THE COVER UNDER ANY CIRCUMSTANCE IN ORDER TO AVOID DANGER.
NE TENTEZ JAMAIS DE DEBALLER OU D'OUVRIR LE COUVERCLE POUR EVITER TOUT DANGER.
4. IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.
SI L'APPAREIL N'EST PAS UTILISE DE LA MANIERE INDIQUEE PAR LE FABRICANT, LA PROTECTION FOURNIE PAR L'APPAREIL PEUT ETRE ALTEREE.
5. THE INSTALLATION THAT THE SAFETY OF ANY SYSTEM INCORPORATING THE EQUIPMENT IS THE RESPONSIBILITY OF THE ASSEMBLER OF THE SYSTEM.
L'INSTALLATION DE TOUT SYSTÈME INTÉGRANT CET ÉQUIPEMENT EST LA RESPONSABILITÉ DU CONSTRUCTEUR DU SYSTÈME.
6. USE WITH COPPER CONDUCTORS ONLY. INPUT WIRING: MINIMUM 28 AWG, 85°C, OUTPUT WIRING: MINIMUM 28 AWG, 85°C
DESTINÉ À ÊTRE UTILISÉ AVEC DES CONDUCTEURS EN CUIVRE SEULEMENT. CABLAGE D'ENTREE: MINIMUM 28 AWG, 85 ° C. CABLAGE DE SORTIE: MINIMUM 28 AWG, 85 ° C.
7. FOR USE IN A CONTROLLED ENVIRONMENT. REFER TO MANUAL FOR ENVIRONMENTAL CONDITIONS.
POUR UN ENVIRONNEMENT CONTROLE. REPORTEZ-VOUS AU MANUEL DES CONDITIONS ENVIRONNEMENTALES.
8. DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
COUPER TOUTES LES SOURCES D'ALIMENTATION AVANT DE FAIRE L'ENTRETIEN ET LES RÉPARATIONS.
9. PROPER VENTILATION IS REQUIRED TO REDUCE THE RISK OF HAZARDOUS OR EXPLOSIVE GAS BUILDUP DURING INDOOR CHARGING. SEE OWNERS MANUAL.
UNE VENTILATION ADÉQUATE EST NÉCESSAIRE AFIN DE RÉDUIRE LES RISQUES D'ACCUMULATION DE GAZ DANGEREUX OU EXPLOSIFS DURANT LA RECHARGE À L'INTÉRIEUR. VOIR LE MANUEL D'ENTRETIEN.

2. Analog Input Module Specification

2.1 GFAI-RM10

| Module Specification | |
|---------------------------------------|---|
| Number of Inputs | 4 |
| Voltage Supply | 5 VDC via Dinkle Bus |
| Current Consumption | <105 mA at 5 VDC |
| Resolution | 12 bit |
| Input Signal Type | Voltage ± 10 VDC |
| Input Signal Design | Differential |
| Accuracy | $\pm 0.1\%$ |
| Input Impedance | 400 K Ω (conventional) |
| Sample Rate | 500 / Sec |
| Communication Interface | RS485 via Dinkle Bus |
| Communication Specification | |
| Fieldbus Protocol | Modbus RTU |
| Format | N, 8, 1 |
| Baud Rate Range | 1200-1.5 Mbps |
| General Specification | |
| Dimension (W*D*H) | 12 x 100 x 97mm |
| Weight | 61g |
| Ambient Temperature (operation) | -10...+60°C |
| Storage Temperature | -25°C...+85°C |
| Permissible Humidity (non-condensing) | RH 95%, |
| Altitude Limit | < 2000 m |
| Ingress Protection (IP) | IP 20 |
| Pollution Severity | II |
| Safety Approval | CE |
| Product Certification | UL 61010-1 & UL 61010-2-201 |
| Wiring Range (IEC / UL) | 0.2 mm ² ~ 1.5 mm ² / AWG 28~16 |
| Wiring Ferrules | DN00510D 、 DN00710D |

2.2 GFAI-RM11

| Module Specification | |
|---------------------------------------|---|
| Number of Inputs | 4 |
| Voltage Supply | 5 VDC via Dinkle Bus |
| Current Consumption | <105 mA at 5 VDC |
| Resolution | 12 bit |
| Input Signal Type | Voltage 0...10 VDC |
| Input Signal Design | Differential |
| Accuracy | ±0.1% |
| Input Impedance | 400 KΩ (conventional) |
| Sample Rate | 500 / Sec |
| Communication Interface | RS485 via Dinkle Bus |
| Communication Specification | |
| Fieldbus Protocol | Modbus RTU |
| Format | N, 8, 1 |
| Baud Rate Range | 1200-1.5 Mbps |
| General Specification | |
| Dimension (W*D*H) | 12 x 100 x 97mm |
| Weight | 61g |
| Ambient Temperature (operation) | -10...+60°C |
| Storage Temperature | -25°C...+85°C |
| Permissible Humidity (non-condensing) | RH 95% |
| Altitude Limit | < 2000 m |
| Ingress Protection (IP) | IP 20 |
| Pollution Severity | II |
| Safety Approval | CE |
| Product Certification | UL 61010-1 & UL 61010-2-201 |
| Wiring Range (IEC / UL) | 0.2 mm ² ~ 1.5 mm ² / AWG 28~16 |
| Wiring Ferrules | DN00510D、DN00710D |

2.3 GFAI-RM20

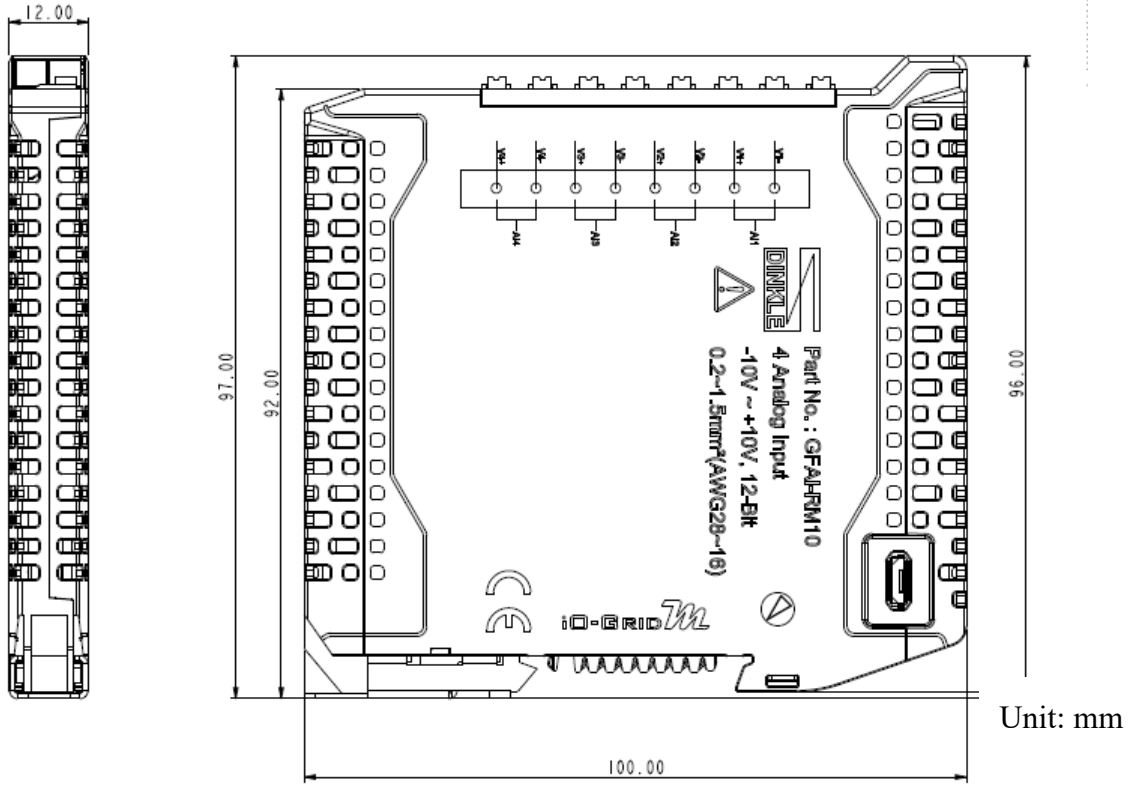
| Module Specification | |
|---------------------------------------|---|
| Number of Inputs | 4 |
| Voltage Supply | 5 VDC via Dinkle Bus |
| Current Consumption | <105 mA at 5 VDC |
| Resolution | 12 bit |
| Input Signal Type | Current 0...20 mA |
| Input Signal Design | Differential |
| Accuracy | ±0.1% |
| Input Impedance | 100Ω (conventional) |
| Sample Rate | 500 / Sec |
| Communication Interface | RS485 via Dinkle Bus |
| Communication Specification | |
| Fieldbus Protocol | Modbus RTU |
| Format | N, 8, 1 |
| Baud Rate Range | 1200-1.5 Mbps |
| General Specification | |
| Dimension (W*D*H) | 12 x 100 x 97mm |
| Weight | 61g |
| Ambient Temperature (operation) | -10...+60°C |
| Storage Temperature | -25°C...+85°C |
| Permissible Humidity (non-condensing) | RH 95% |
| Altitude Limit | < 2000 m |
| Ingress Protection (IP) | IP 20 |
| Pollution Severity | II |
| Safety Approval | CE |
| Product Certification | UL 61010-1 & UL 61010-2-201 |
| Wiring Range (IEC / UL) | 0.2 mm ² ~ 1.5 mm ² / AWG 28~16 |
| Wiring Ferrules | DN00510D、DN00710D |

2.4 GFAI-RM21

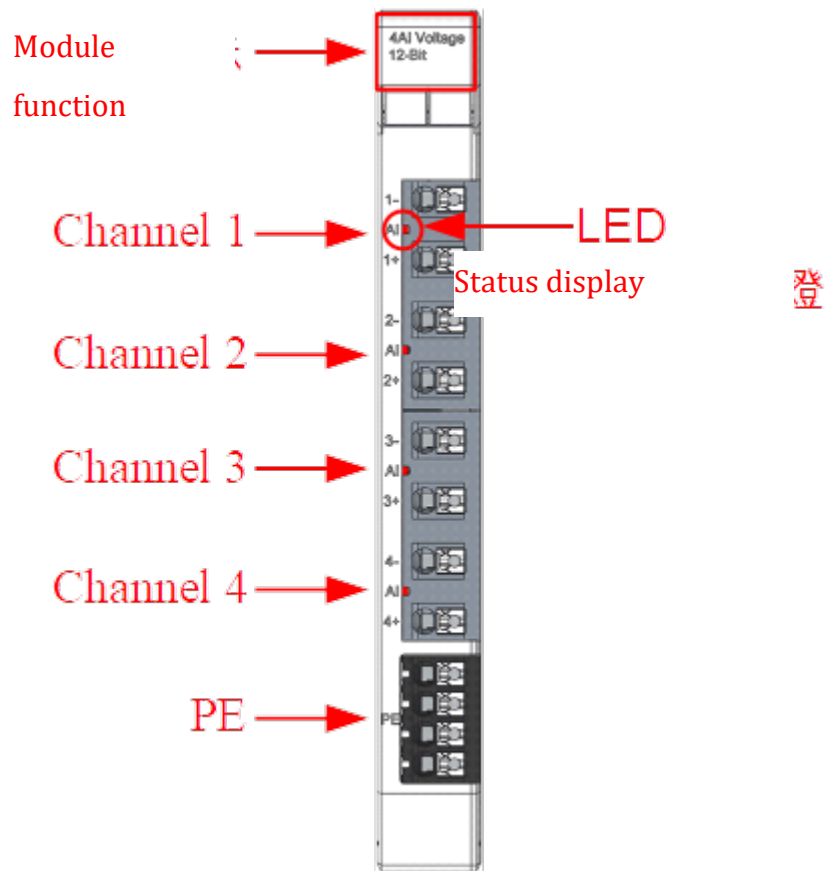
| Module Specification | |
|---------------------------------------|---|
| Number of Inputs | 4 |
| Voltage Supply | 5 VDC via Dinkle Bus |
| Current Consumption | <105 mA at 5 VDC |
| Resolution | 12 bit |
| Input Signal Type | Current:4...20 mA |
| Input Signal Design | Differential |
| Accuracy | ±0.1% |
| Input Impedance | 100Ω (conventional) |
| Sample Rate | 500 / Sec |
| Communication Interface | RS485 via Dinkle Bus |
| Communication Specification | |
| Fieldbus protocol | Modbus RTU |
| Format | N, 8, 1 |
| Baud rate range | 1200-1.5 Mbps |
| General Specification | |
| Dimension (W*D*H) | 12 x 100 x 97mm |
| Weight | 61g |
| Ambient Temperature (operation) | -10...+60°C |
| Storage Temperature | -25°C...+85°C |
| Permissible Humidity (non-condensing) | RH 95% |
| Altitude Limit | < 2000 m |
| Ingress Protection (IP) | IP 20 |
| Pollution Severity | II |
| Safety Approval | CE |
| Product Certification | UL 61010-1 & UL 61010-2-201 |
| Wiring Range (IEC / UL) | 0.2 mm ² ~ 1.5 mm ² / AWG 28~16 |
| Wiring Ferrules | DN00510D · DN00710D |

3. Analog Input Module Introduction

3.1 Analog Input Module Specification



3.2 Analog Input Module Panel Information



I. Terminal block connector definitions

| Terminal block labeling | Connector definitions | Terminal block labeling | Connector definitions |
|-------------------------|----------------------------------|-------------------------|-----------------------|
| 1- | Channel 1 (-) | 3- | Channel 3 (-) |
| 1+ | Channel 1 (+) | 3+ | Channel 3 (+) |
| 2- | Channel 2 (-) | 4- | Channel 4 (-) |
| 2+ | Channel 2 (+) | 4+ | Channel 4 (+) |
| PE | Earth terminal into the DIN rail | | |

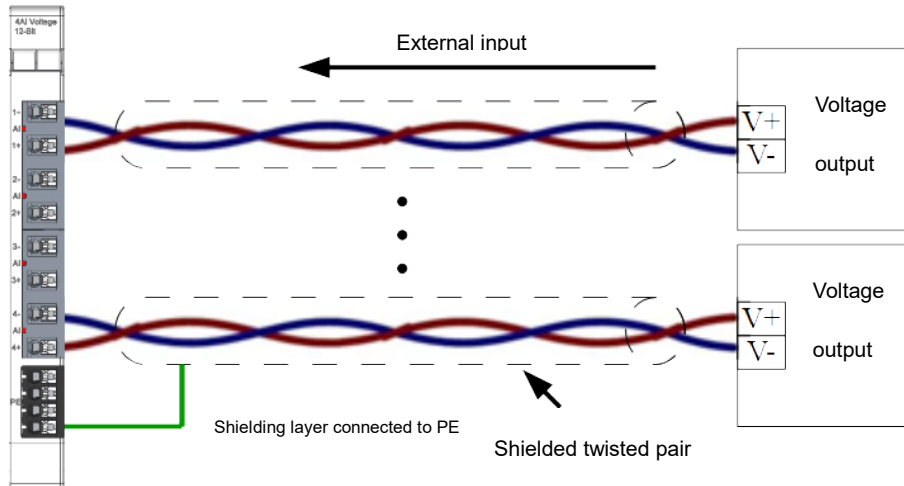
II. LED Channel Indicator Light

Each channel's port has a LED indicator next to it

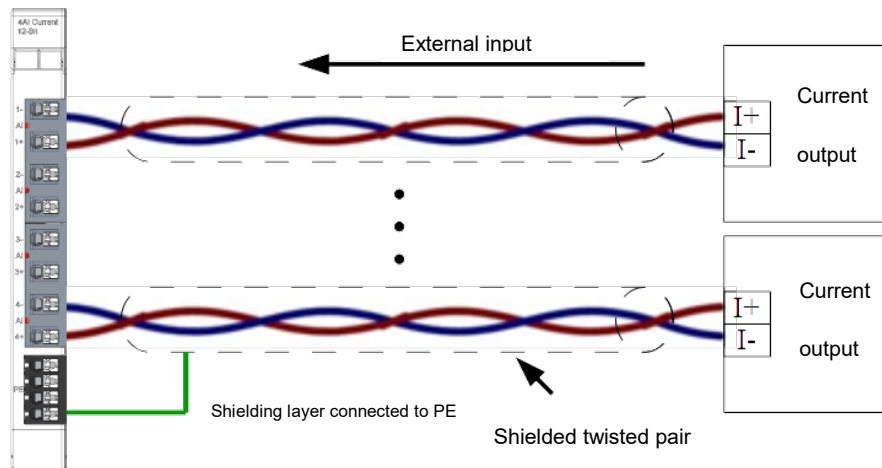
| LED Status | Status |
|------------|---------------------|
| Solid | Normal |
| Blinking | Exceeding the limit |

3.3 Analog Input Module Wiring Diagram

I. GFAI-RM10,GFAI-RM11 (voltage input type)



II. GFAI-RM20,GFAI-RM21 (current input type)

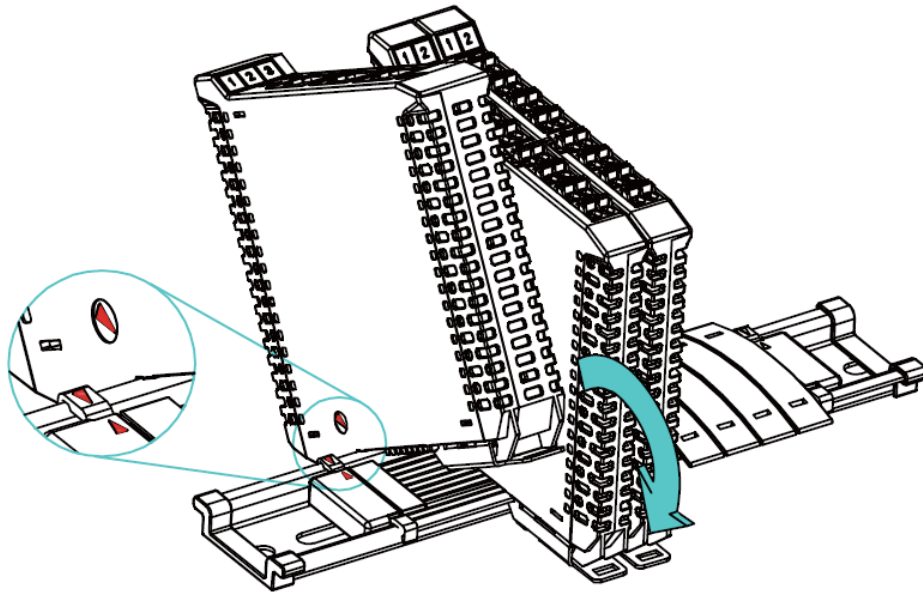


※PE terminal will connect the shielded wire to the DIN rail. The casing of the control box must be grounded properly

4. Module Installation/Disassembly

4.1 Installation

- I. Align the red arrow on the side of the module to the arrow on the DIN rail.
- II. Press the module down and the metal clamp will slide (thanks to its spring mechanism) and grab on the other side of the DIN rail. Continue to push down until the metal clamp “clicks”.

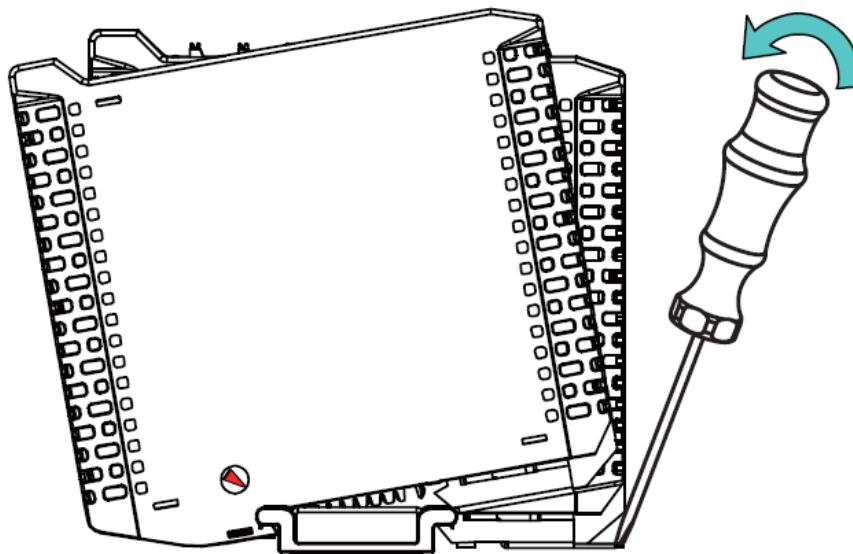


*Note: Make sure the red arrows on the module and the rail are pointing the same direction.

4.2 Removal

- I. Use a screwdriver to pull the metal hook sideways and detach the module from the DIN rail.

- II. Remove all modules from the DIN rail in reverse order of installation.



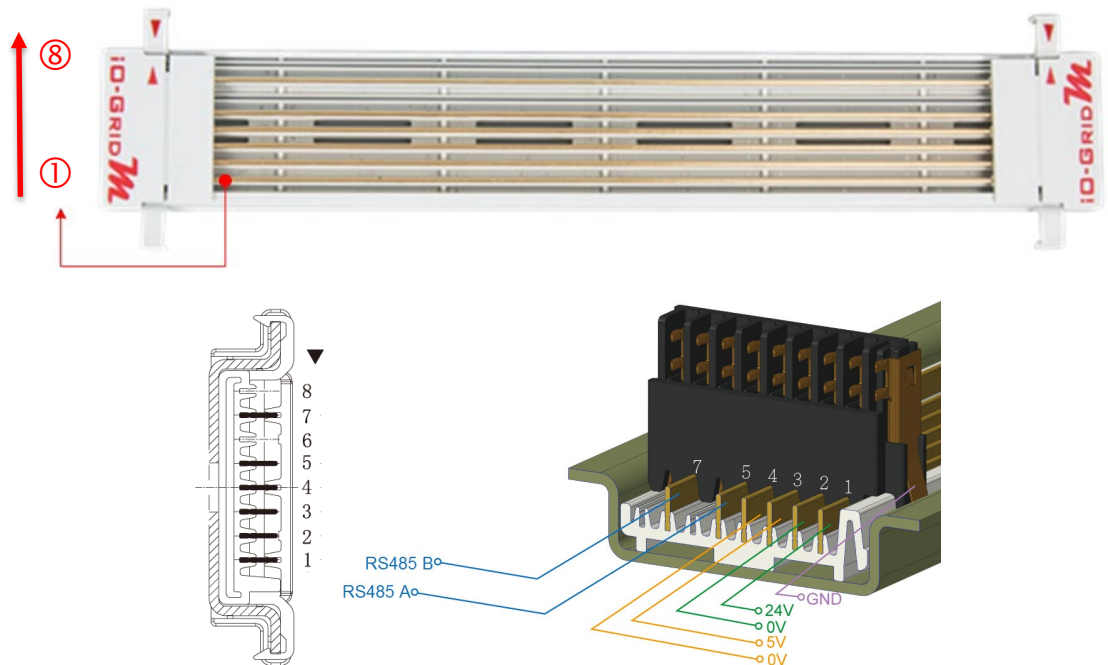
5. iO-GRID^M Series Introduction

iO-GRID^M series utilizes the standard Modbus communication protocol and supports Modbus RTU/ASCII and Modbus TCP. Please choose products and controllers to figure your system based on your communication protocol.

5.1 iO-GRID^M Components

I. DINKLE Bus

Rail 1 to 4 are defined for power supply and rail 5 and rail 7 are defined for communication.



DINKLE Bus Rail Definitions:

| Rail | Definition | Rail | Definition |
|------|------------|------|------------|
| 8 | — | 4 | 0V |
| 7 | RS485B | 3 | 5V |
| 6 | — | 2 | 0V |
| 5 | RS485A | 1 | 24V |

II. Gateway Module

A gateway module converts between Modbus TCP and Modbus RTU/ASCII. The module provides two sets of external Ethernet ports to connect to the controller and the Internet

There are two types of gateway modules available:

4-channel gateway module: Provides 4 RS485 ports to connect to a control module

Single-channel gateway module: No external connectivity for the RS485 ports. The RS485 signals are transmitted via DINKLE Bus and I/O module.

Gateway module products information:

| Product No. | Description |
|-------------|--|
| GFGW-RM01N | Modbus TCP-to-Modbus RTU/ASCII gateway module. 4 Ports |
| GFGW-RM02N | Modbus TCP-to-Modbus RTU/ASCII gateway module. 1 Port |

III. Control module

The control module manages I/O modules and sets up the configuration. Provides external RS485 ports to connect to the controller.

There are two types of control modules available:

3-channel control module:

Provides 3 external RS485 ports, suitable for stations with 2 or more control modules. Among the RS485 ports, 2 of them will be connected to the controller and the control module of the next station.

Single-channel control module:

Provides one single RS485 port to connect to the controller, suitable for single-module stations.

Control module products information:

| Product No. | Description |
|-------------|--|
| GFMS-RM01N | RS485 control module, Modbus RTU/ASCII 3 Ports |
| GFMS-RM01S | RS485 control module, Modbus RTU/ASCII 1 Port |

IV. I/O Module

Daudin offers different types of I/O modules with different functions:

| Product No. | Description |
|--------------------|--|
| GFDI-RM01N | 16-channel digital input module (source/sink) |
| GFDO-RM01N | 16-channel digital output module (sink) |
| GFDO-RM02N | 16-channel digital output module (Source) |
| GFAR-RM11 | 8-Channel relay module, grounded |
| GFAR-RM21 | 4-Channel relay module, grounded |
| GFAI-RM10 | 4-channel analog input module ($\pm 10\text{VDC}$) |
| GFAI-RM11 | 4-channel analog input module (0...10VDC) |
| GFAI-RM20 | 4-channel analog input module (0... 20mA) |
| GFAI-RM21 | 4-channel analog input module (4... 20mA) |
| GFAO-RM10 | 4-channel analog output module ($\pm 10\text{VDC}$) |
| GFAO-RM11 | 4-channel analog output module (-10...10VDC) |
| GFAO-RM20 | 4-channel analog output module (0... 20mA) |
| GFAO-RM21 | 4-channel analog output module (4... 20mA) |
| GFAX-RM10 | 2-channel analog input module, 2-channel analog output module ($\pm 10\text{VDC}$) |
| GFAX-RM11 | 2-channel analog input module, 2-channel analog output module (0...10VDC) |
| GFAX-RM20 | 2-channel analog input module, 2-channel analog output module (0... 20mA) |
| GFAX-RM21 | 2-channel analog input module, 2-channel analog output module (4... 20mA) |

6. I/O Module Parameter Settings and Introduction

6.1 I/O Module Settings and Connections

I. I/O Module System Configuration List

| Name/Product No. | Description |
|------------------|--|
| GFAI-RM10 | 4-channel analog input module ($\pm 10\text{VDC}$) |
| GFAI-RM11 | 4-channel analog input module (0...10VDC) |
| GFAI-RM20 | 4-channel analog input module (0... 20mA) |
| GFAI-RM21 | 4-channel analog input module (4... 20mA) |
| GFAI-RM10 | 4-channel analog input module ($\pm 10\text{VDC}$) |
| GFTL-RM01 | USB-to-RS232 converter |
| Micro USB cable | Must have data transfer functionality |
| Computer | USB-compatible |

II. Module Initial Setting List

| Product No. | Description | Station No. | Baud rate | Format |
|-------------|--|-------------|-----------|------------|
| GFMS-RM01N | RS485 control module, RTU/ASCII | 1 | 115200 | RTU(8,N,1) |
| GFDI-RM01N | 16-channel digital input module (source/sink) | 1 | 115200 | RTU(8,N,1) |
| GFDO-RM01N | 16-channel digital output module (sink) | 1 | 115200 | RTU(8,N,1) |
| GFDO-RM02N | 16-channel digital output module (Source) | 1 | 115200 | RTU(8,N,1) |
| GFAR-RM11 | 8-Channel relay module, grounded | 1 | 115200 | RTU(8,N,1) |
| GFAR-RM21 | 4-Channel relay module, grounded | 1 | 115200 | RTU(8,N,1) |
| GFAI-RM10 | 4-channel analog input module ($\pm 10\text{VDC}$) | 1 | 115200 | RTU(8,N,1) |
| GFAI-RM11 | 4-channel analog input module (0...10VDC) | 1 | 115200 | RTU(8,N,1) |
| GFAI-RM20 | 4-channel analog input module (0... 20mA) | 1 | 115200 | RTU(8,N,1) |
| GFAI-RM21 | 4-channel analog input module (4... 20mA) | 1 | 115200 | RTU(8,N,1) |
| GFAO-RM10 | 4-channel analog output module ($\pm 10\text{VDC}$) | 1 | 115200 | RTU(8,N,1) |
| GFAO-RM11 | 4-channel analog output module (-10...10VDC) | 1 | 115200 | RTU(8,N,1) |
| GFAO-RM20 | 4-channel analog output module (0... 20mA) | 1 | 115200 | RTU(8,N,1) |
| GFAO-RM21 | 4-channel analog output module (4... 20mA) | 1 | 115200 | RTU(8,N,1) |
| GFAX-RM10 | 2-channel analog input module, 2-channel analog output module ($\pm 10\text{VDC}$) | 1 | 115200 | RTU(8,N,1) |
| GFAX-RM11 | 2-channel analog input module, 2-channel analog output module (0...10VDC) | 1 | 115200 | RTU(8,N,1) |
| GFAX-RM20 | 2-channel analog input module, 2-channel analog output module (0... 20mA) | 1 | 115200 | RTU(8,N,1) |
| GFAX-RM21 | 2-channel analog input module, 2-channel analog output module (4... 20mA) | 1 | 115200 | RTU(8,N,1) |

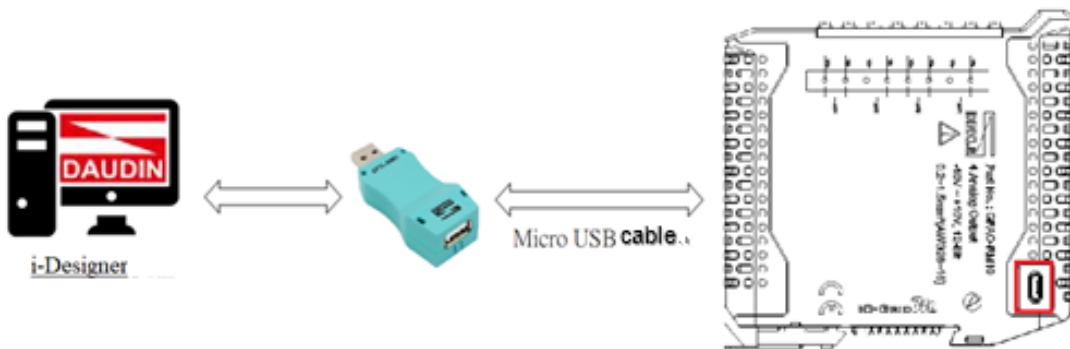
III. Setup Software Functions:

The setup software shows the I/O module station numbers, baud rates and data formats.

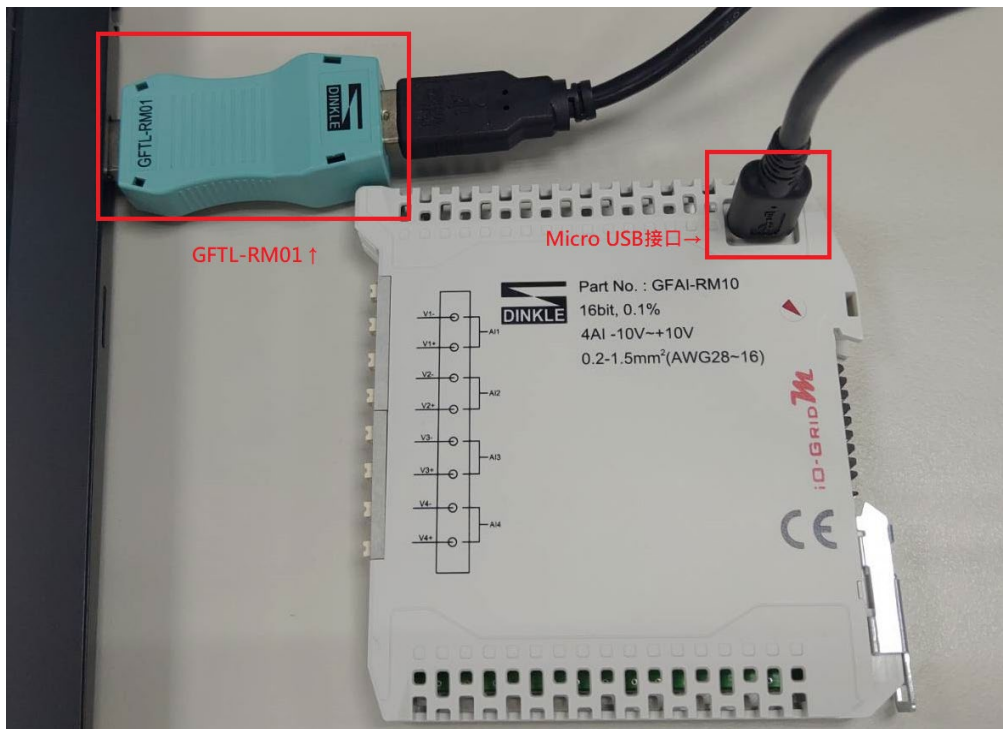
IV. I/O Module Settings and Connections

Connect the Micro USB port and GFTL-RM01 (RS232 converter) to your computer and open the iO-Grid M Utility program to set up I/O module parameters

I/O module connection illustration:



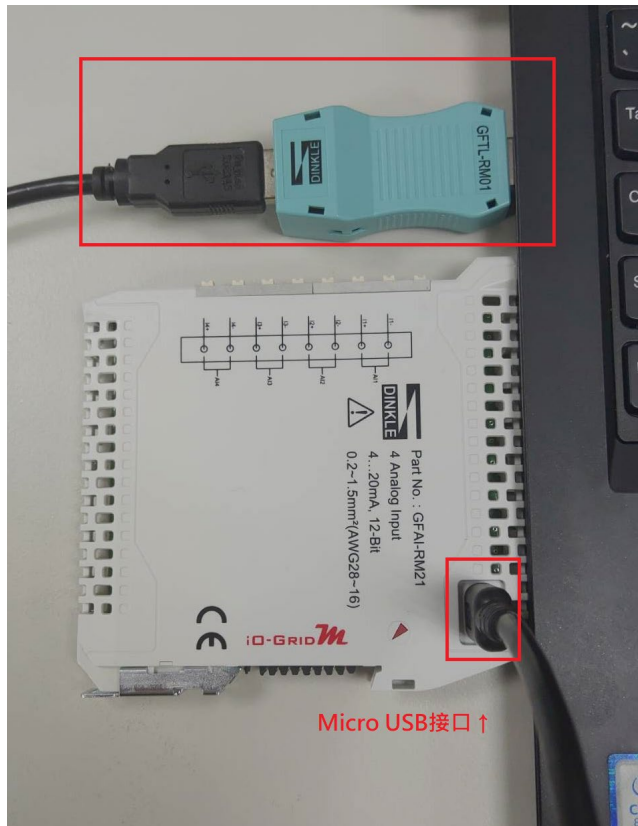
I/O module connection image:



※ Please do not power the I/O module during the setu

6.2 i-Designer Program Tutorial

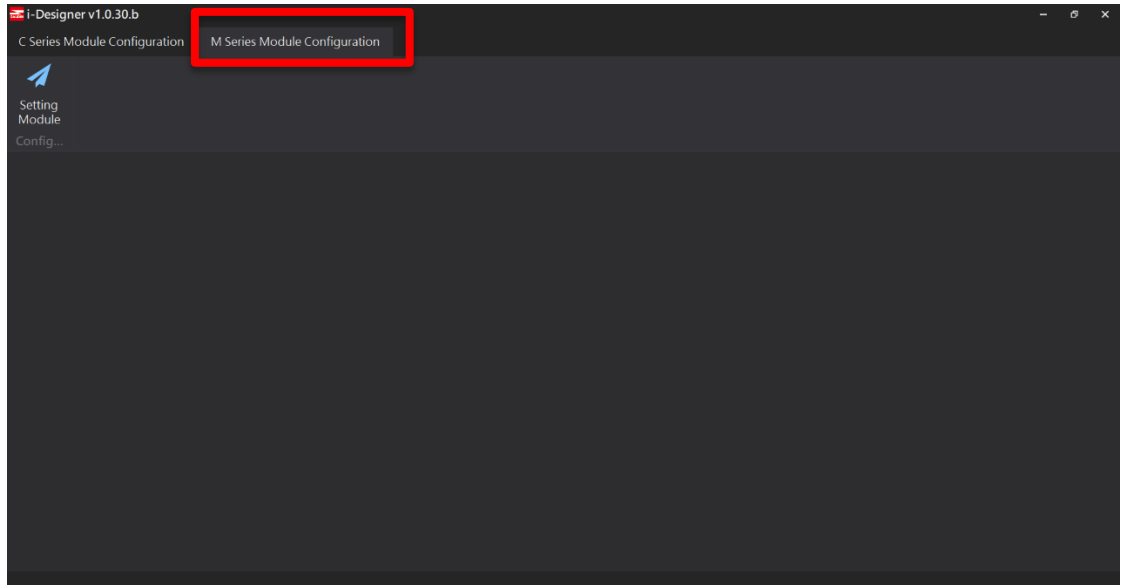
I. Connect to the I/O module using GFTL-RM01 and a Micro USB cable



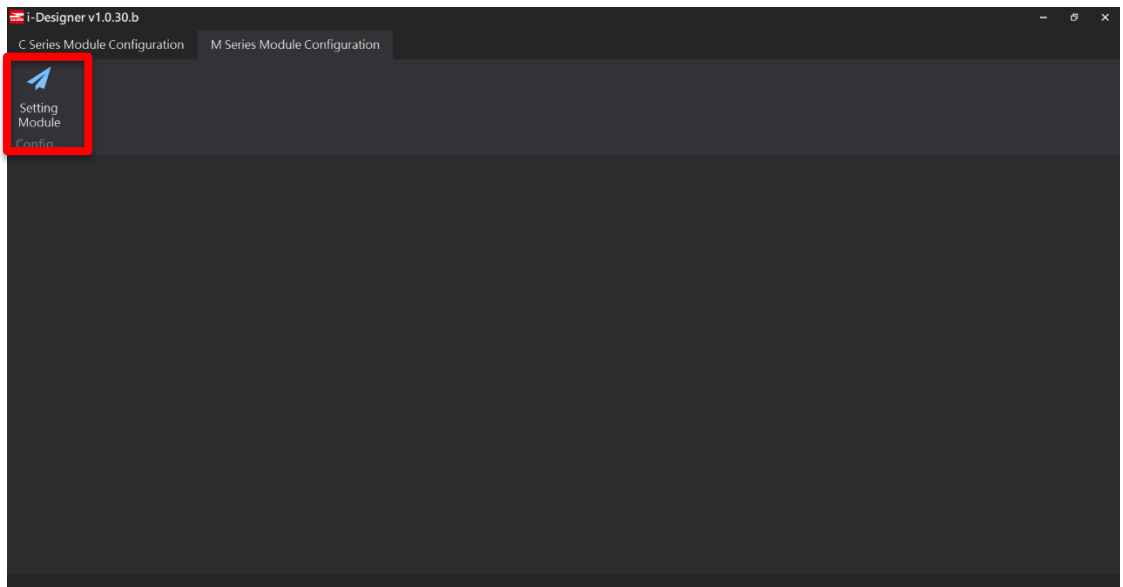
II. Click to launch the software



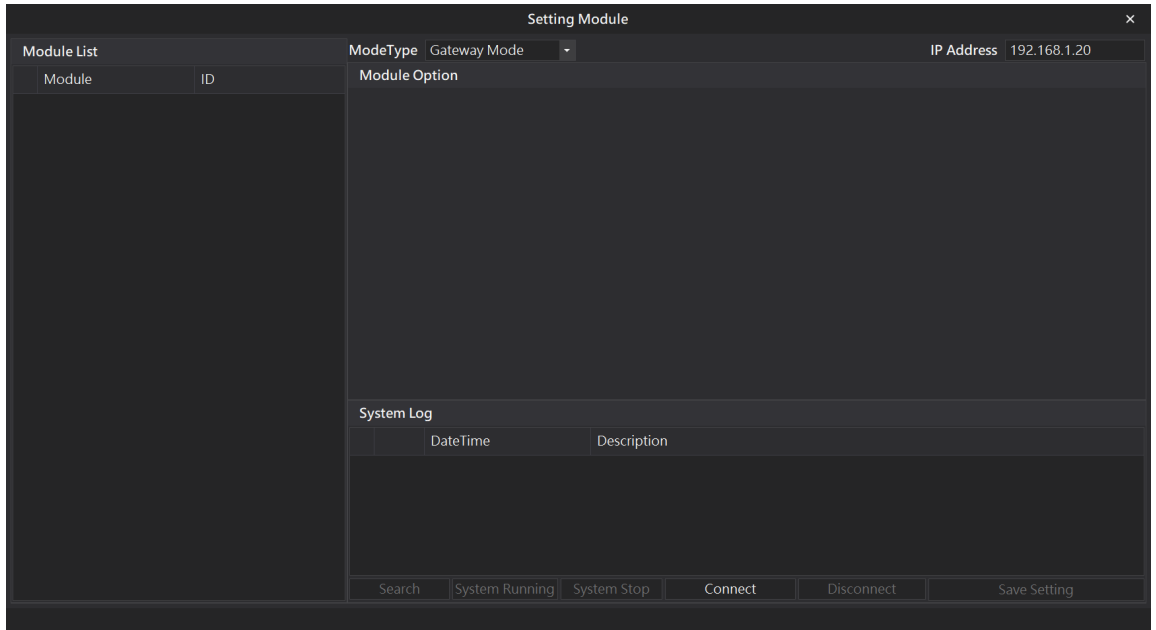
III. Select “M Series Module Configuration”



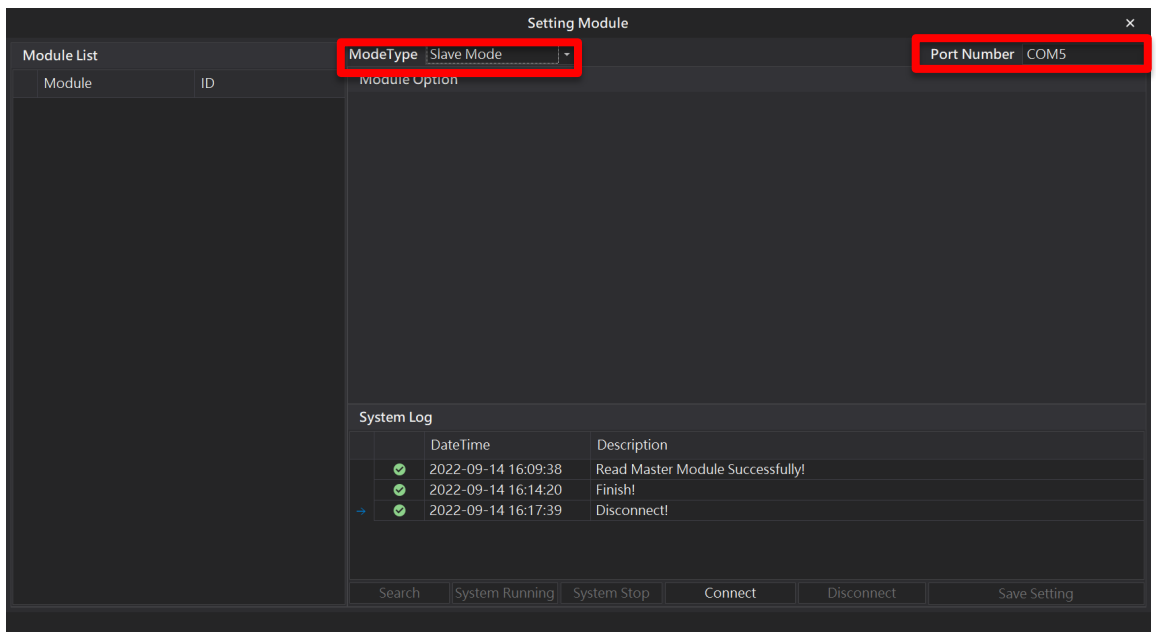
IV. Click on the “Setting Module” icon



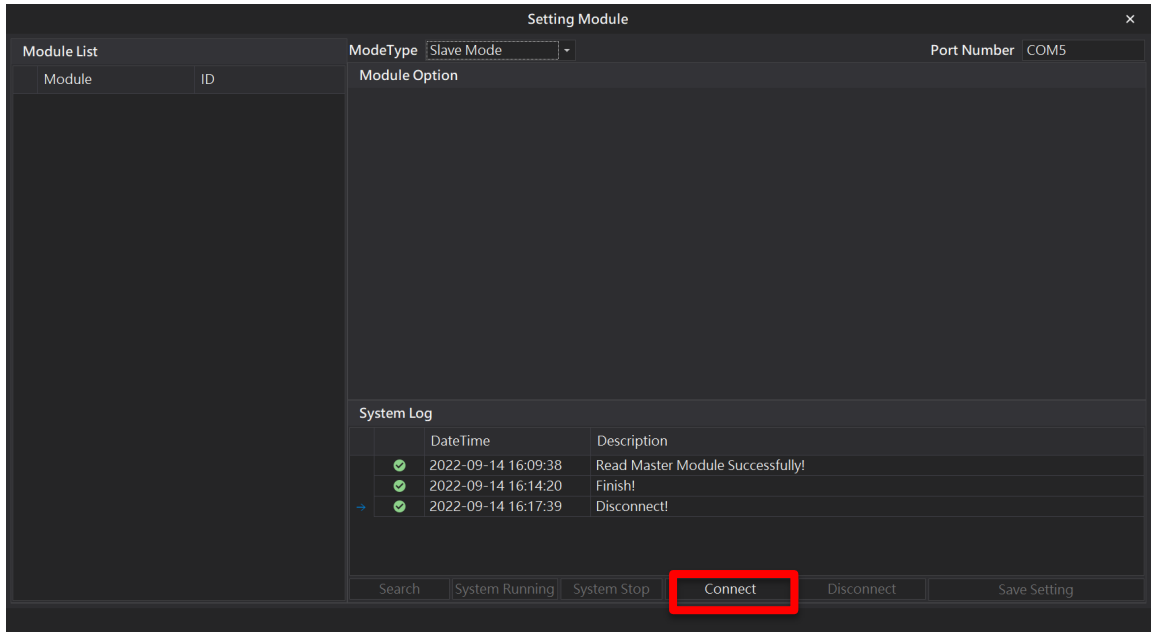
V. Enter the “Setting Module” page for M-series



VI. Select the mode type based on the connected module



VII. Click on “Connect”

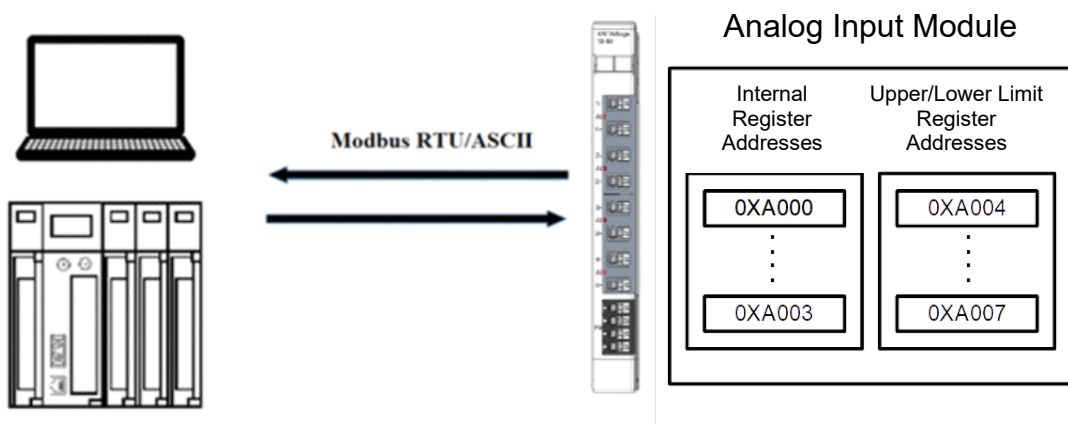


7. Analog Input Module Control Register Description

7.1 Analog Input Module Register Communication Method

I. Use Modbus RTU/ASCII to read single-chip analog input module registers

The address for the analog input module register to be read is: 0xA000...0xA003 and the upper/lower limit conversion input record registers are at 0xA004...0xA007



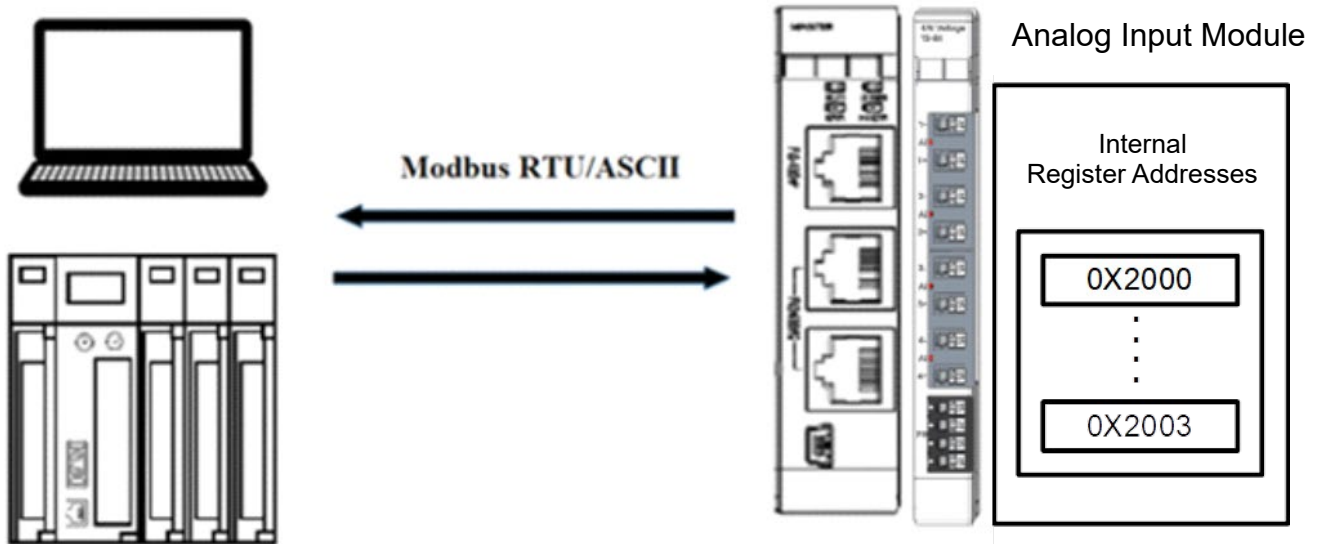
※ With no control module, RS485 wire must be connected with a plug adapter and a socket adapter to send the signal to the Dinkle Bus

The configuration that uses Modbus RTU/ASCII to read single-chip analog input module registers is listed below:

| Name/Product No. | Description |
|------------------|--|
| GFAI-RM10 | 4-channel analog input module ($\pm 10\text{VDC}$) |
| GFAI-RM11 | 4-channel analog input module (0...10VDC) |
| GFAI-RM20 | 4-channel analog input module (0... 20mA) |
| GFAI-RM21 | 4-channel analog input module (4... 20mA) |
| BS-210 | Plug Adapter |
| BS-211 | Socket Adapter |

II. Use Modbus RTU/ASCII with control modules to read analog input module registers

Once an analog input module is set up with a control module, it will automatically assign



analog input modules' input records registers between 0x1000 and 0x1003.

※When using control modules, RS485 wire can connect to control modules with 0170-0101.

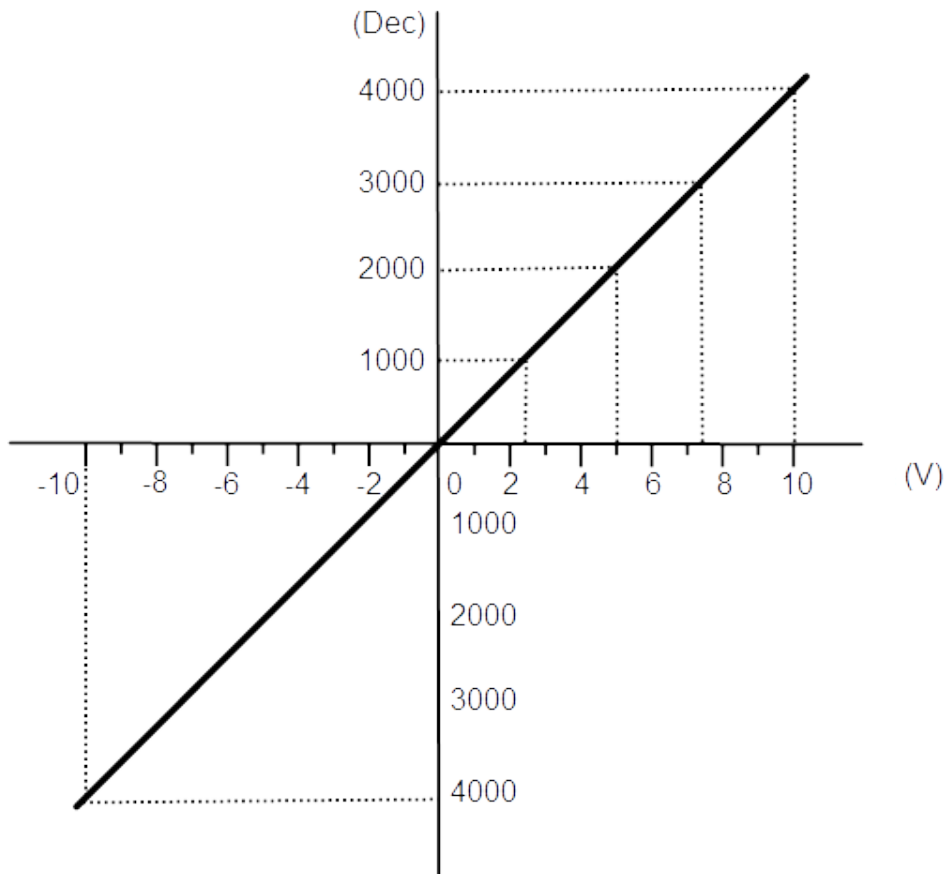
The configuration that uses Modbus RTU/ASCII to read analog input module registers is listed below:

| Name/Product No. | Description |
|------------------|--|
| GFMS-RM01N | Master Modbus RTU, 3Ports |
| GFAI-RM10 | 4-channel analog input module ($\pm 10\text{VDC}$) |
| GFAI-RM11 | 4-channel analog input module ($0 \dots 10\text{VDC}$) |
| GFAI-RM20 | 4-channel analog input module ($0 \dots 20\text{mA}$) |
| GFAI-RM21 | 4-channel analog input module ($4 \dots 20\text{mA}$) |
| 0170-0101 | RS485(2W)-to-RS485(RJ45 interface) |

7.2 Input Module Register A/D Conversion Chart

I. Voltage Input Range: -10V...10V

Conversion Diagram:



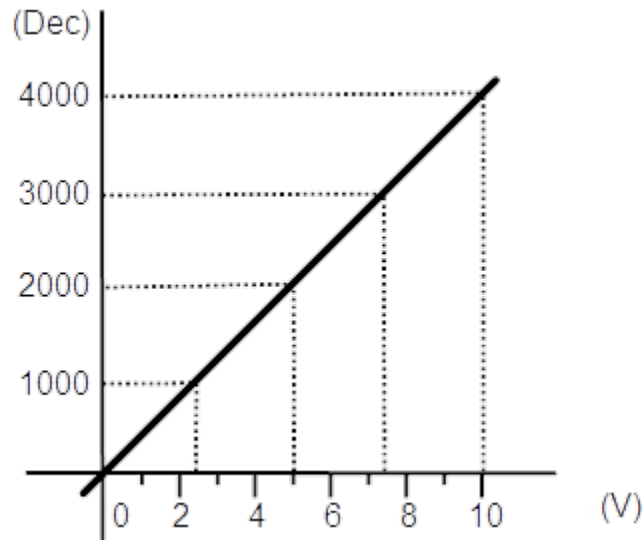
Voltage Conversion Chart:

| | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 10 | 4000 | 4040 | 4080 | 4120 | 4160 | 4200 | - | - | - | - |
| 9 | 3600 | 3640 | 3680 | 3720 | 3760 | 3800 | 3840 | 3880 | 3920 | 3960 |
| 8 | 3200 | 3240 | 3280 | 3320 | 3360 | 3400 | 3440 | 3480 | 3520 | 3560 |
| 7 | 2800 | 2840 | 2880 | 2920 | 2960 | 3000 | 3040 | 3080 | 3120 | 3160 |
| 6 | 2400 | 2440 | 2480 | 2520 | 2560 | 2600 | 2640 | 2680 | 2720 | 2760 |
| 5 | 2000 | 2040 | 2080 | 2120 | 2160 | 2200 | 2240 | 2280 | 2320 | 2360 |
| 4 | 1600 | 1640 | 1680 | 1720 | 1760 | 1800 | 1840 | 1880 | 1920 | 1960 |
| 3 | 1200 | 1240 | 1280 | 1320 | 1360 | 1400 | 1440 | 1480 | 1520 | 1560 |
| 2 | 800 | 840 | 880 | 920 | 960 | 1000 | 1040 | 1080 | 1120 | 1160 |
| 1 | 400 | 440 | 480 | 520 | 560 | 600 | 640 | 680 | 720 | 760 |
| 0 | 0 | 40 | 80 | 120 | 160 | 200 | 240 | 280 | 320 | 360 |
| 0 | 0 | -40 | -80 | -120 | -160 | -200 | -240 | -280 | -320 | -360 |
| -1 | -400 | -440 | -480 | -520 | -560 | -600 | -640 | -680 | -720 | -760 |
| -2 | -800 | -840 | -880 | -920 | -960 | -1000 | -1040 | -1080 | -1120 | -1160 |
| -3 | -1200 | -1240 | -1280 | -1320 | -1360 | -1400 | -1440 | -1480 | -1520 | -1560 |
| -4 | -1600 | -1640 | -1680 | -1720 | -1760 | -1800 | -1840 | -1880 | -1920 | -1960 |
| -5 | -2000 | -2040 | -2080 | -2120 | -2160 | -2200 | -2240 | -2280 | -2320 | -2360 |
| -6 | -2400 | -2440 | -2480 | -2520 | -2560 | -2600 | -2640 | -2680 | -2720 | -2760 |
| -7 | -2800 | -2840 | -2880 | -2920 | -2960 | -3000 | -3040 | -3080 | -3120 | -3160 |
| -8 | -3200 | -3240 | -3280 | -3320 | -3360 | -3400 | -3440 | -3480 | -3520 | -3560 |
| -9 | -3600 | -3640 | -3680 | -3720 | -3760 | -3800 | -3840 | -3880 | -3920 | -3960 |
| -10 | -4000 | -4040 | -4080 | -4120 | -4160 | -4200 | - | - | - | - |

※ A/D conversion range is limited between -4200 (-10.50V) and 4200 (+10.50V). When voltage input exceeds the range, it is limited to 4200 (or -4200).

II. Voltage Input Range: 0V...10V

Conversion Diagram:



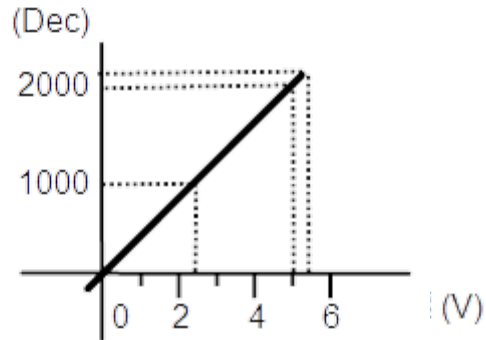
Voltage Conversion Chart:

| | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|----|------|------|------|------|------|------|------|------|------|------|
| 10 | 4000 | 4040 | 4080 | 4120 | 4160 | 4200 | - | - | - | - |
| 9 | 3600 | 3640 | 3680 | 3720 | 3760 | 3800 | 3840 | 3880 | 3920 | 3960 |
| 8 | 3200 | 3240 | 3280 | 3320 | 3360 | 3400 | 3440 | 3480 | 3520 | 3560 |
| 7 | 2800 | 2840 | 2880 | 2920 | 2960 | 3000 | 3040 | 3080 | 3120 | 3160 |
| 6 | 2400 | 2440 | 2480 | 2520 | 2560 | 2600 | 2640 | 2680 | 2720 | 2760 |
| 5 | 2000 | 2040 | 2080 | 2120 | 2160 | 2200 | 2240 | 2280 | 2320 | 2360 |
| 4 | 1600 | 1640 | 1680 | 1720 | 1760 | 1800 | 1840 | 1880 | 1920 | 1960 |
| 3 | 1200 | 1240 | 1280 | 1320 | 1360 | 1400 | 1440 | 1480 | 1520 | 1560 |
| 2 | 800 | 840 | 880 | 920 | 960 | 1000 | 1040 | 1080 | 1120 | 1160 |
| 1 | 400 | 440 | 480 | 520 | 560 | 600 | 640 | 680 | 720 | 760 |
| 0 | 0 | 40 | 80 | 120 | 160 | 200 | 240 | 280 | 320 | 360 |
| 0 | 0 | -40 | -80 | -120 | -160 | -200 | | | | |

※ A/D conversion range is limited between -200 (-0.50V) and 4200 (+10.50V). When voltage input exceeds the range, it is limited to 4200 (or -200).

III. Voltage Input Range: 0V...5V

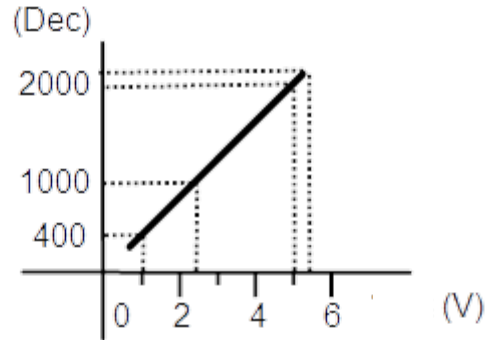
Conversion Diagram:



Voltage Conversion Chart:

| | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|---|------|------|------|------|------|------|------|------|------|------|
| 5 | 2000 | 2040 | 2080 | 2120 | 2160 | 2200 | | | | |
| 4 | 1600 | 1640 | 1680 | 1720 | 1760 | 1800 | 1840 | 1880 | 1920 | 1960 |
| 3 | 1200 | 1240 | 1280 | 1320 | 1360 | 1400 | 1440 | 1480 | 1520 | 1560 |
| 2 | 800 | 840 | 880 | 920 | 960 | 1000 | 1040 | 1080 | 1120 | 1160 |
| 1 | 400 | 440 | 480 | 520 | 560 | 600 | 640 | 680 | 720 | 760 |
| 0 | 0 | 40 | 80 | 120 | 160 | 200 | 240 | 280 | 320 | 360 |
| 0 | 0 | -40 | -80 | -120 | -160 | -200 | | | | |

※ A/D conversion range is limited between -200 (-0.50V) and 2200 (+5.50V). When voltage input exceeds the range, it is limited to 2200 (or -200).

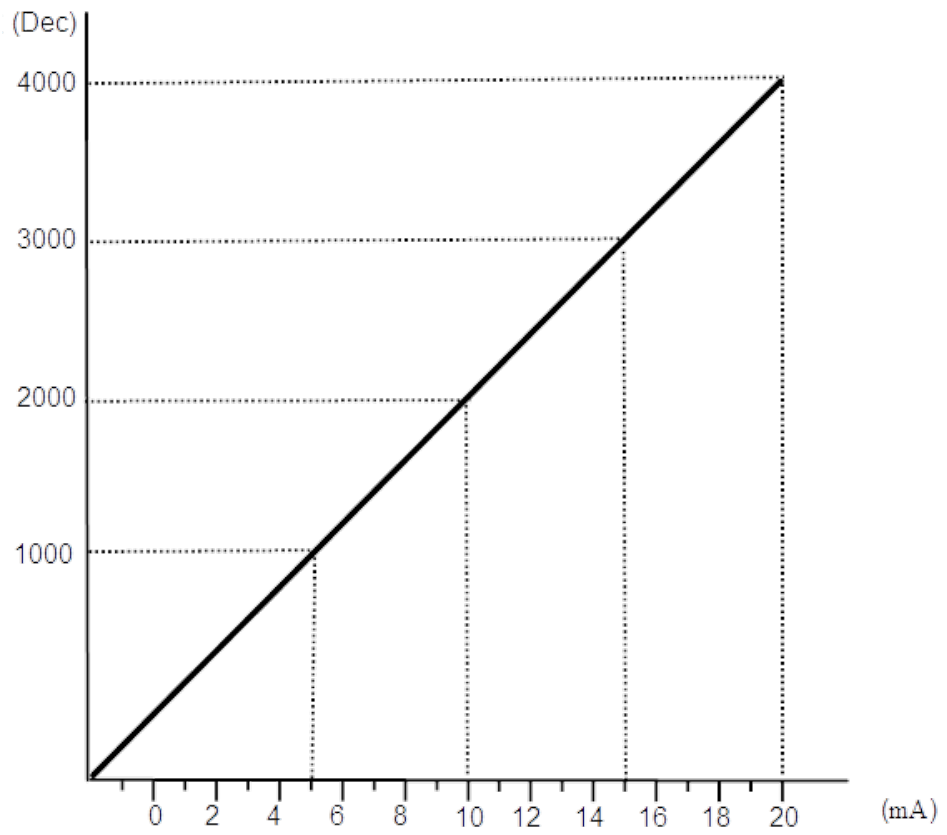
IV. Voltage Input Range: 1V...5V
Conversion Diagram:

Voltage Conversion Chart:

| | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|---|------|------|------|------|------|------|------|------|------|------|
| 5 | 2000 | 2040 | 2080 | 2120 | 2160 | 2200 | | | | |
| 4 | 1600 | 1640 | 1680 | 1720 | 1760 | 1800 | 1840 | 1880 | 1920 | 1960 |
| 3 | 1200 | 1240 | 1280 | 1320 | 1360 | 1400 | 1440 | 1480 | 1520 | 1560 |
| 2 | 800 | 840 | 880 | 920 | 960 | 1000 | 1040 | 1080 | 1120 | 1160 |
| 1 | 400 | 440 | 480 | 520 | 560 | 600 | 640 | 680 | 720 | 760 |
| 0 | | | | | | 200 | 240 | 280 | 320 | 360 |

※ A/D conversion range is limited between 200 (0.50V) and 2200 (+5.50V). When voltage input exceeds the range, it is limited to 2200 (or 200).

V. Current Input Range: 0-20mA

Conversion Diagram:



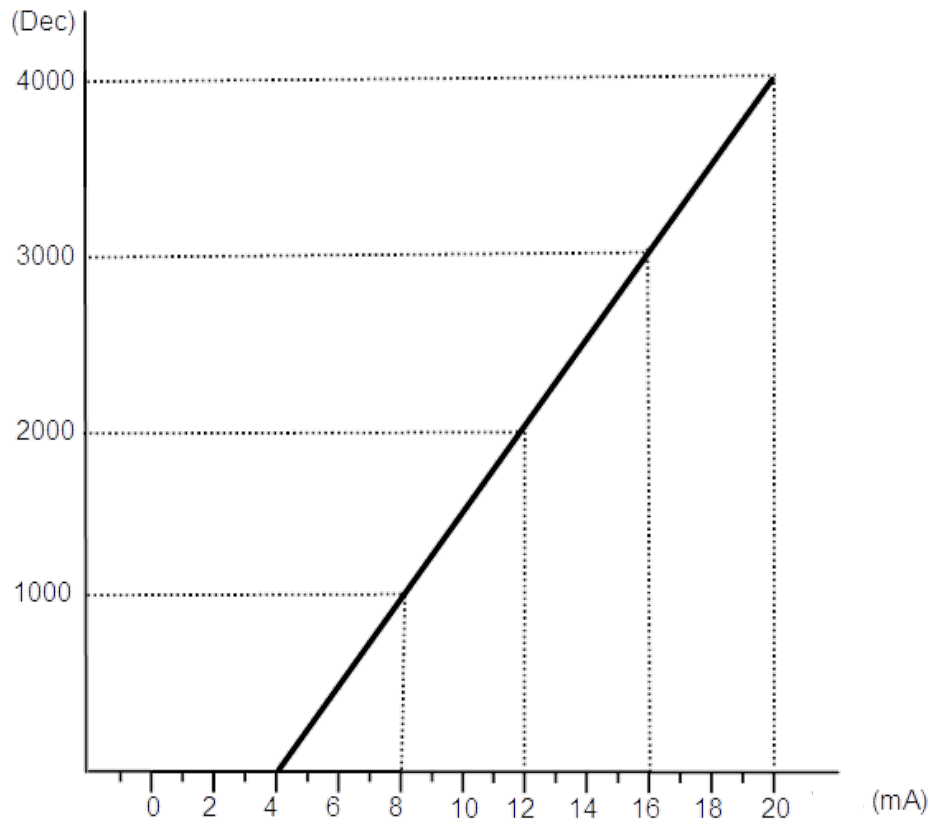
Current Conversion Chart:

| | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|-----------|----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 20 | 4000 | 4020 | 4040 | 4060 | 4080 | 4100 | 4120 | 4140 | 4160 | 4180 |
| 19 | 3800 | 3820 | 3840 | 3860 | 3880 | 3900 | 3920 | 3940 | 3960 | 3980 |
| 18 | 3600 | 3620 | 3640 | 3660 | 3680 | 3700 | 3720 | 3740 | 3760 | 3780 |
| 17 | 3400 | 3420 | 3440 | 3460 | 3480 | 3500 | 3520 | 3540 | 3560 | 3580 |
| 16 | 3200 | 3220 | 3240 | 3260 | 3280 | 3300 | 3320 | 3340 | 3360 | 3380 |
| 15 | 3000 | 3020 | 3040 | 3060 | 3080 | 3100 | 3120 | 3140 | 3160 | 3180 |
| 14 | 2800 | 2820 | 2840 | 2860 | 2880 | 2900 | 2920 | 2940 | 2960 | 2980 |
| 13 | 2600 | 2620 | 2640 | 2660 | 2680 | 2700 | 2720 | 2740 | 2760 | 2780 |
| 12 | 2400 | 2420 | 2440 | 2460 | 2480 | 2500 | 2520 | 2540 | 2560 | 2580 |
| 11 | 2200 | 2220 | 2240 | 2260 | 2280 | 2300 | 2320 | 2340 | 2360 | 2380 |
| 10 | 2000 | 2020 | 2040 | 2060 | 2080 | 2100 | 2120 | 2140 | 2160 | 2180 |
| 9 | 1800 | 1820 | 1840 | 1860 | 1880 | 1900 | 1920 | 1940 | 1960 | 1980 |
| 8 | 1600 | 1620 | 1640 | 1660 | 1680 | 1700 | 1720 | 1740 | 1760 | 1780 |
| 7 | 1400 | 1420 | 1440 | 1460 | 1480 | 1500 | 1520 | 1540 | 1560 | 1580 |
| 6 | 1200 | 1220 | 1240 | 1260 | 1280 | 1300 | 1320 | 1340 | 1360 | 1380 |
| 5 | 1000 | 1020 | 1040 | 1060 | 1080 | 1100 | 1120 | 1140 | 1160 | 1180 |
| 4 | 800 | 820 | 840 | 860 | 880 | 900 | 920 | 940 | 960 | 980 |
| 3 | 600 | 620 | 640 | 660 | 680 | 700 | 720 | 740 | 760 | 780 |
| 2 | 400 | 420 | 440 | 460 | 480 | 500 | 520 | 540 | 560 | 580 |
| 1 | 200 | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 |
| 0 | 0 | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| 0 | 0 | -20 | -40 | -60 | -80 | -100 | -120 | -140 | -160 | -180 |

※ A/D conversion range is limited between -200 (-1.0mA) and 4200 (+21.0mA). When voltage input exceeds the range, it is limited to 4200 (or -200).

VI. Current Input Range: 4-20mA

Conversion Diagram:



Current Conversion Chart:

| | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|----|------|------|------|------|------|------|------|------|------|------|
| 20 | 4000 | 4025 | 4025 | 4075 | 4100 | 4125 | 4150 | 4175 | 4200 | - |
| 19 | 3750 | 3775 | 3800 | 3825 | 3850 | 3875 | 3900 | 3925 | 3950 | 3975 |
| 18 | 3500 | 3525 | 3550 | 3575 | 3600 | 3625 | 3650 | 3675 | 3700 | 3725 |
| 17 | 3250 | 3275 | 3300 | 3325 | 3350 | 3375 | 3400 | 3425 | 3450 | 3475 |
| 16 | 3000 | 3025 | 3050 | 3075 | 3100 | 3125 | 3150 | 3175 | 3200 | 3225 |
| 15 | 2750 | 2775 | 2800 | 2825 | 2850 | 2875 | 2900 | 2925 | 2950 | 2975 |
| 14 | 2500 | 2525 | 2550 | 2575 | 2600 | 2625 | 2650 | 2675 | 2700 | 2725 |
| 13 | 2250 | 2275 | 2300 | 2325 | 2350 | 2375 | 2400 | 2425 | 2450 | 2475 |
| 12 | 2000 | 2025 | 2050 | 2075 | 2100 | 2125 | 2150 | 2175 | 2200 | 2225 |
| 11 | 1750 | 1775 | 1800 | 1825 | 1850 | 1875 | 1900 | 1925 | 1950 | 1975 |
| 10 | 1500 | 1525 | 1550 | 1575 | 1600 | 1625 | 1650 | 1675 | 1700 | 1725 |
| 9 | 1250 | 1275 | 1300 | 1325 | 1350 | 1375 | 1400 | 1425 | 1450 | 1475 |
| 8 | 1000 | 1025 | 1050 | 1075 | 1100 | 1125 | 1150 | 1175 | 1200 | 1225 |
| 7 | 750 | 775 | 800 | 825 | 850 | 875 | 900 | 925 | 950 | 975 |
| 6 | 500 | 525 | 550 | 575 | 600 | 625 | 650 | 675 | 700 | 725 |
| 5 | 250 | 275 | 300 | 325 | 350 | 375 | 400 | 425 | 450 | 475 |
| 4 | 0 | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 |
| 3 | - | - | -200 | -175 | -150 | -125 | -100 | -75 | -50 | -25 |

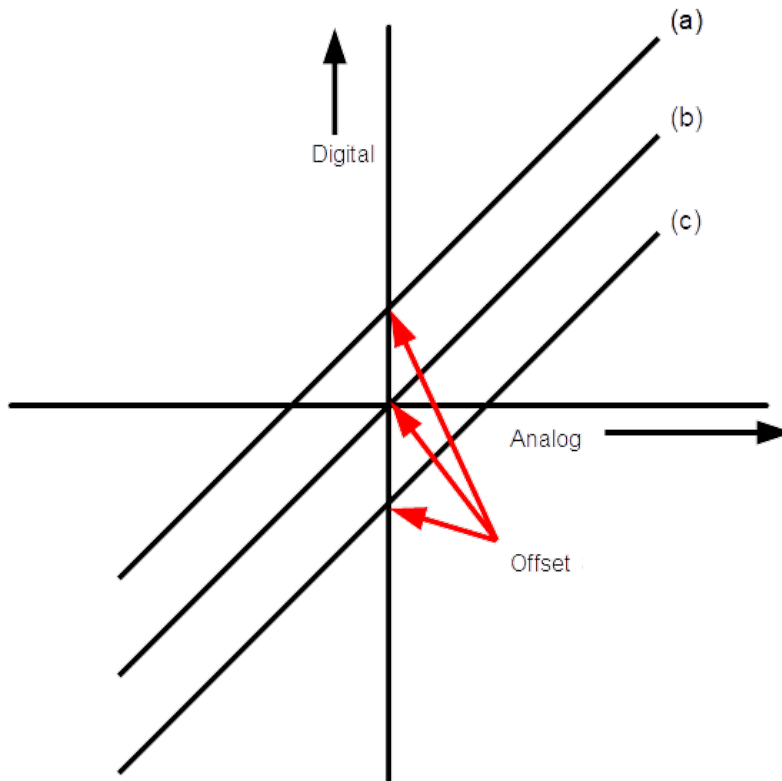
※ A/D conversion range is limited between -200 (3.2mA) and 4200 (+20.8mA). When voltage input exceeds the range, it is limited to 4200 (or -200).

7.3 Function Settings

I. OFFSET Setting

OFFSET should be adjusted when an external equipment has 0 output while the reading is not zero.

Example: If the external equipment output 0V to the module and the reading is -50 (DEC), then the OFFSET should be set at 50.



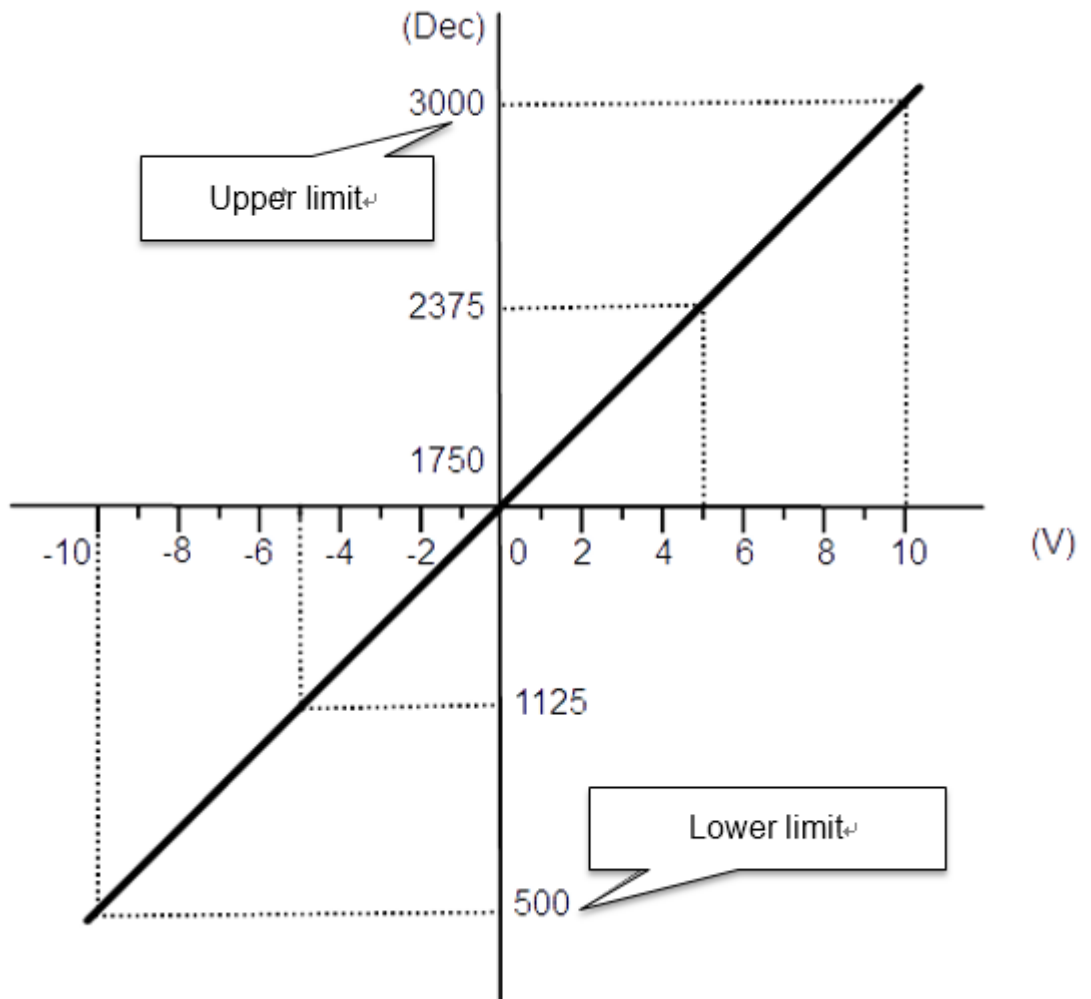
(a): Offset is set at -100 when the reading is 100

(b): 0

(c): Offset is set at 100 when the reading is -100

II. Upper/Lower Limit Setting Demonstration

With voltage input between -10V and 10V, upper limit of 3000 (DEC) and lower limit of 500 (DEC):



| Analog Input Voltage | Internal Register Reading (DEC) | Upper/Lower Limit Register Reading (DEC) |
|----------------------|---------------------------------|--|
| 10 | 4000 | 3000 |
| 5 | 2000 | 2375 |
| 0 | 0 | 1750 |
| -5 | -2000 | 1125 |
| -10 | -400 | 500 |

※ When using upper/lower limits, upper/lower limits must have been established for all four channels

7.4 Modbus function code 0x03 Demonstration

I. Use Modbus RTU/ASCII to read single-chip analog input module registers

| Modbus function code | Code sent example (ID:0x01) | Code replied example (ID:0x01) |
|----------------------|--------------------------------|-----------------------------------|
| 0x03 | 01 03 A0 00 00 01 | 01 03 02 00 00 |

※ In this example, the reading is from Channel 1 with module ID of “01”

※ When not using control modules for communications, the registers will be assigned between 0xA000 and 0xA003

II. Use Modbus RTU/ASCII to read single-chip analog input module upper/lower limit registers

| Modbus function code | Code sent example (ID:0x01) | Code replied example (ID:0x01) |
|----------------------|--------------------------------|-----------------------------------|
| 0x03 | 01 03 A0 04 00 01 | 01 03 02 00 00 |

※ In this example, the reading is from Channel 1 with module ID of “01”

※ When not using control modules for communications, the registers will be assigned between 0xA004 and 0xA007

III. Use Modbus RTU/ASCII with control modules to read single-chip analog input module registers

| Modbus function code | Code sent example (ID:0x01) | Code replied example (ID:0x01) |
|----------------------|--------------------------------|-----------------------------------|
| 0x03 | 01 03 10 00 00 01 | 01 03 02 00 00 |

※ In this example, the reading is from Channel 1 with module ID of “01”

※ When using control modules for communications, the registers will be assigned between 0x1000 and 0x1003