Modular Field I/O Controller

MODPORT

User's Manual

Last Updated: 2022-06-15

"Everything for Embedded Control"

COMFILE TECHNOLOGY

Comfile Technology Inc.
www.cubloc.com

Introduction

The MODPORT is a modular, field I/O controller supporting Modbus RTU slave communication. There is no need for any programming or Ladder Logic; it is ready to go right out of the box. It can be used with our CUPC, CUPANEL, CUWIN or any other Modbus RTU master for I/O control and data collection.

The MODPORT's modular design enables customers to purchase just the modules needed, and aggregate them in a way that customizes the MODPORT precisely for an application's specific requirements, and provides adaptability should those requirements change. Individual modules include **Digital I/O, Relay Output, Analog-to-Digital and Digital-to-Analog Conversion, Temperature Monitoring,** and the potential for more.

Table of Contents

Introduction....3
Chapter 1 MODPORT Overview....5
Modules....6
Modbus Slave Addresses....6
Header Module: MD-H485....7
Module Board....8
Installing Modules....9
Small System Configuration....10
Chapter 2 Digital I/O Modules....11
8-Channel Digital Module: MD-DIDC8....12
Source and Sink Outputs....13
8-Channel DC Source Output Module: MD-DOSO8....13
8-Channel DC Sink Output Module : MD-DOSI8....14
8-Channel Relay Output Module: MD-DORL8....15
Chapter 3 Analog Modules....18
AD Input Module: MD-ADIN4 & MD-HADIN4....19
AD Input Module's Sampling Frequency....21
MD-ADIN4's Return Values....22
MD-ADIN4's Modbus Addresses....22
MD-HADIN4's Return Values....23
MD-HADIN4's Modbus Addresses....23
DA Voltage Output Module: MD-DAOUT2....24
MD-DAOUT2's Output Voltage....25
MD-DAOUT2's Modbus Addresses....25
DA Current Output Module: MD-DAOUT2B....26
MD-DAOUT2B's Output Current....27
MD-DAOUT2B's Modbus Addresses....27
Temperature Input Module: MD-THRT4....28
MD-THRT4's Sampling Frequency....29
MD-THRT4's Return Values....29
MD-THRT4's Modbus Addresses....29
Chapter 4 Modbus RTU....30
About Modbus....31
Function Code 01: Read Coil/Input Status....33
Function Code 03: Read Holding/Input Registers....34
Function Code 05: Force Single Coil....35
Function Code 06: Preset Single Registers....36
Function Code 15: Force Multiple Coils....37
Function Code 16: Preset Multiple Registers....38
Chapter 5 Appendix....40
External Dimensions....41

Chapter 1 MODPORT Overview

Modules

The MODPORT has several modules that can be purchased to support a variety of features.

DIO Modules (Digital Input/Output Modules)

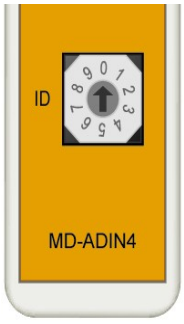
Model Name	Description	Voltage/Current Rating
MD-DOSI8	8-pin DC Sink Output Module	DC 3.3V ~ 27V 1A
MD-DOSO8	8-pin DC Source Output Module	DC 12V ~ 24V 1A
MD-DORL8	8-pin Relay Output Module	DC 6 ~ 27V 4A AC 6 ~ 240V 4A
MD-DIDC8	8-pin DC Input Module	DC 12V ~ 24V

Analog Modules

Model Name	Module Type	Description	Specifications
MD-ADIN4	AD Input Module	4-Channel 13.3 bit AD Conversion	0~10V, 1~5V, 4~20mA
MD-HADIN4	High Resolution AD Input Module	4-Channel 16.6 bit AD Converter	0~10V, 1~5V, 4~20mA
MD-THRT4	Temperature Input Module	4-Channel PT100Ω Temperature Sensor	-100 ~ 500 °C
MD-DAOUT2	2-Channel DA Voltage Output	2-Channel 16-bit DA Converter	0~10V, 0~5V
MD-DAOUT2B	2-Channel DA Current Output	2-Channel 16-bit DA Converter	4~20mA, 0~20mA

Modbus Slave Addresses

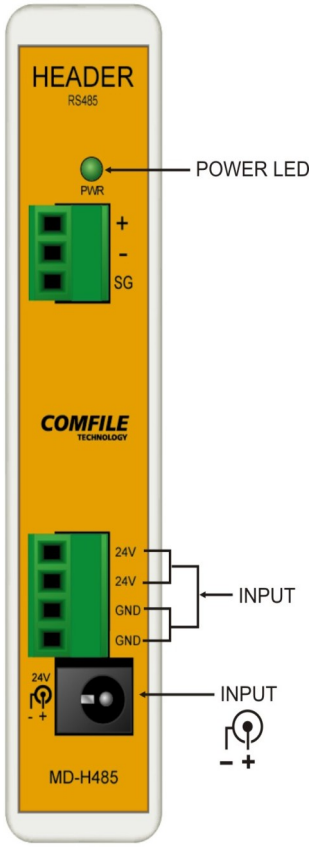
Each module can have a different slave address set using the rotary switch on the face of the module. This provides the ability to have as many as 10 modules of the same type installed simultaneously. Rotary switch positions 1 ~ 9 correspond to Modbus slave address 1 ~ 9 respectively. Rotary switch position 0 corresponds to Modbus address 10.



Use the rotary switch on the face of each module to set its Modbus slave address.

Header Module: MD-H485

The Header Module is the MODPORT's core processing module. Every system must have one and only one Header Module installed.

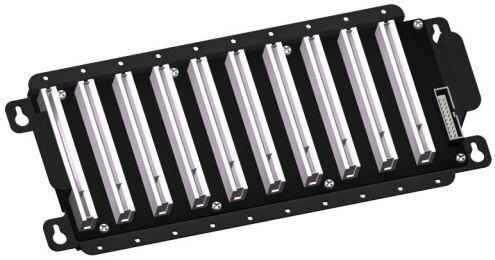


The Header Module features the following:

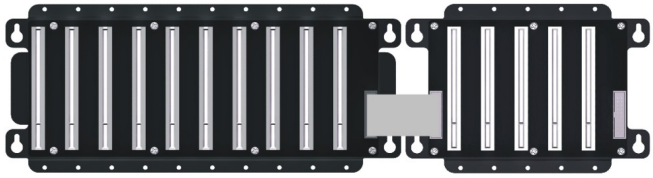
- RS-485 Port (57,600 baud, 8 data bits, 1 stop bit, no parity, Modbus RTU only) (Fixed – Cannot be changed)
- Power LED
- DC 24V power input x2 (barrel jack & 4 pin terminal)
- 5V internal circuitry

Module Board

The main module board comes in a 10-slot configuration.

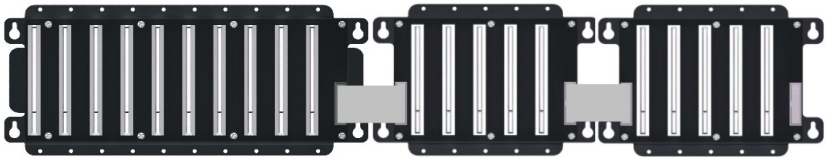


If 10 slots are insufficient, a 5-slot extension board can be connected to the 10-slot board to increase the capacity for additional modules.



10-Slot Main Board 5-Slot Extension Board

If 15 slots are still not enough, an additional 5-slot Extension board can be connected increasing the capacity to a maximum of 20 modules.

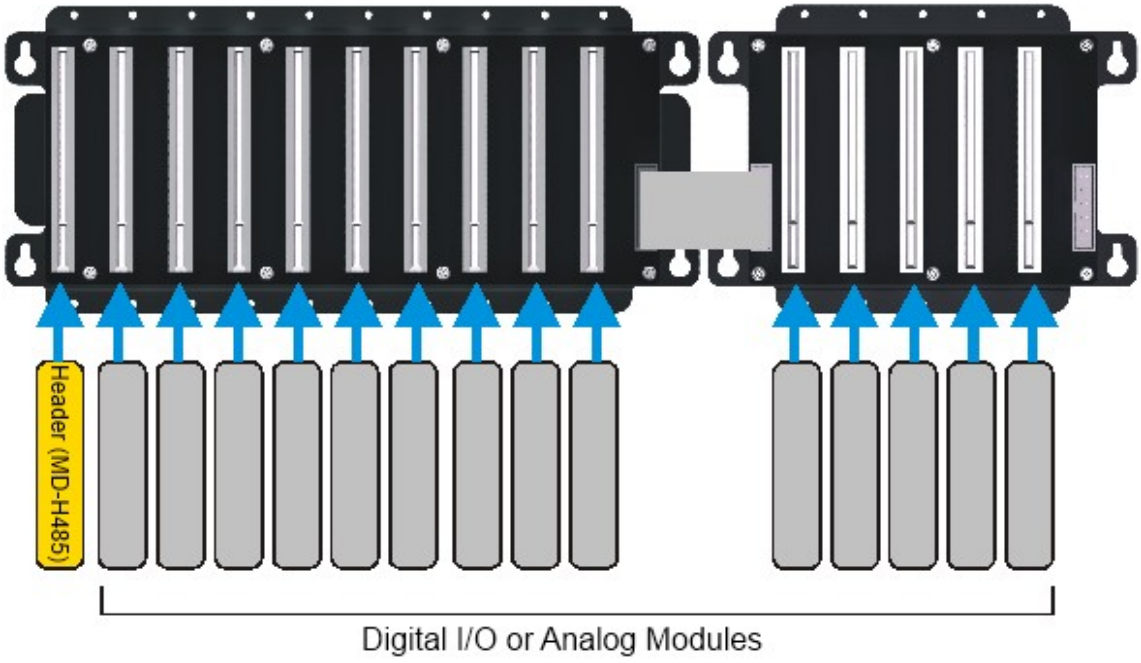


The module board array must be terminated, so if you connected additional module boards, be sure to terminate the last board in the array. A terminator is included with each board.

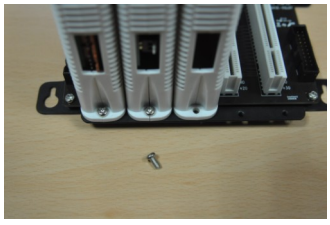
Installing Modules

WARNING: Do not plug or unplug modules while the power is on.

The Header Module must be mounted on the far left of the 10-slot main board in the position labeled "CPU". I/O modules can be installed in any of the remaining slots.

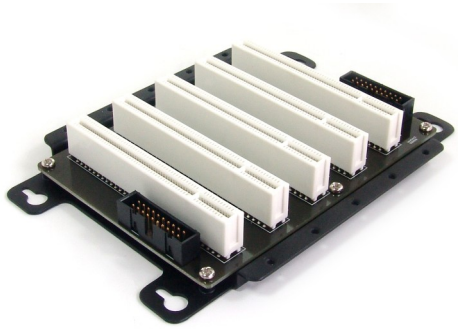


Please be sure to secure all modules to the slot board with screws.

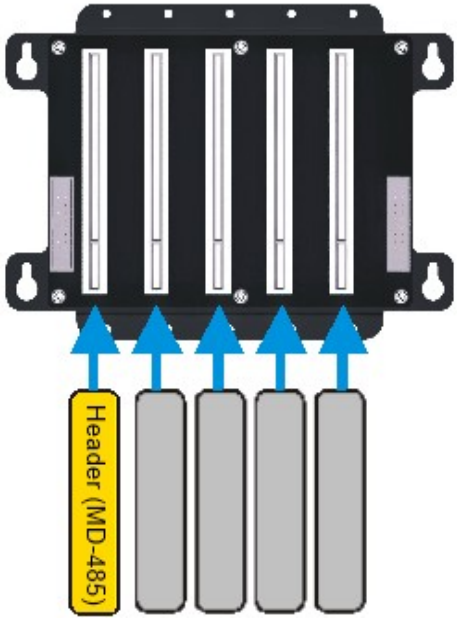


Small System Configuration

If you only require five modules or less, the 5-slot extension board can be used independently as a main board.

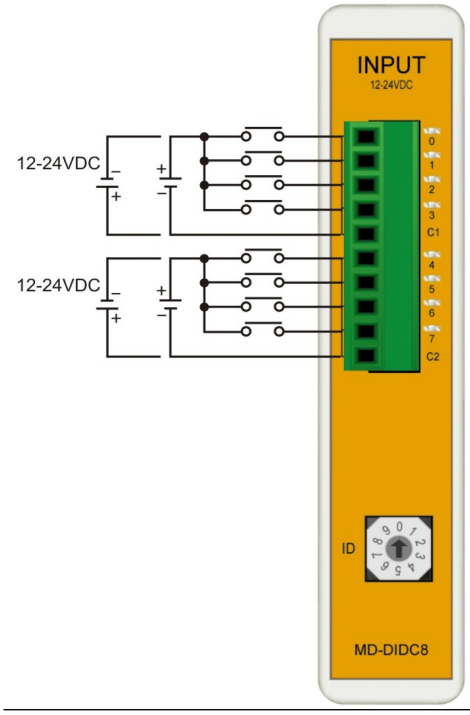


With the Header Module installed in the slot labeled "CPU", I/O modules can be installed in any of the 4 remaining slots.

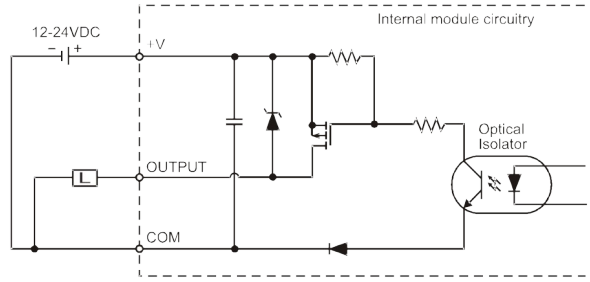


Chapter 2
Digital I/O Modules

8-Channel Digital Module: MD-DIDC8

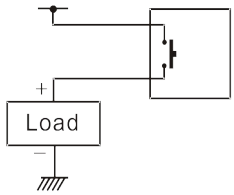
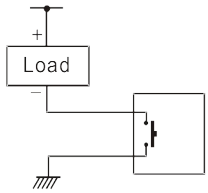


MD-DIDC8 Specifications	
Channel	8
Operating Voltage	12 – 24VDC
Output Voltage	11 – 36VDC
Input Current	5ma @ 24V
Maximum On/Off switching frequency	300 Hz
Input Impedance	4.7kOhm @ 24V
ON/OFF levels	7.2V/6.2V

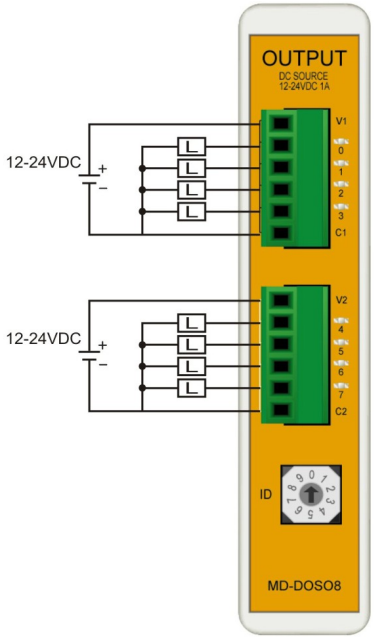


Source and Sink Outputs

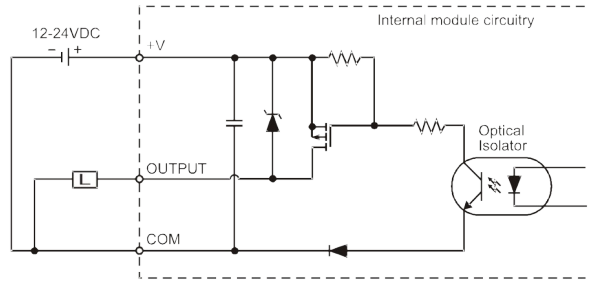
The MODPORT digital output modules come in 2 flavors: the Source Output Module, and the Sink Output Module.

Source Output	Sink Output
When turned on, the load's positive terminal is connected to the positive supply rail. 	When turned on, the load's negative terminal is connected to the negative supply rail. 

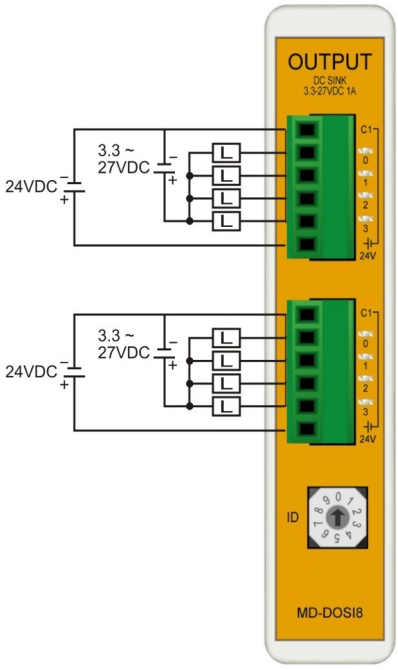
8-Channel DC Source Output Module: MD-DOSO8



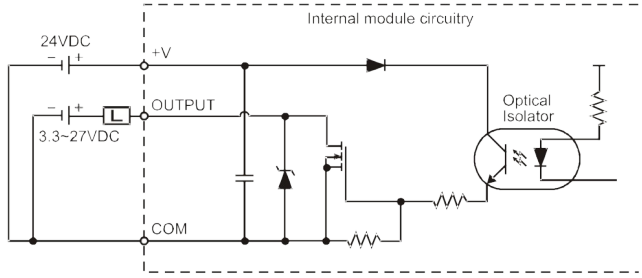
MD-DOSO8 Specifications	
Channel	8
Operating Voltage	12 – 24VDC
Output Voltage	10 – 30VDC
Maximum Output Current	1A / Port, 4A / COMMON
Minimum Output Current	0.5mA
Maximum On/Off switching frequency	1KHz (1000 times per second)
Status LED	Lights when port is ON
Common Terminals	2 (independent)



8-Channel DC Sink Output Module : MD-DOSI8



MD-DOSI8 Specifications	
Channels	8
Operating Voltage	3.3 – 27 VDC
Output Voltage	3 – 30VDC
Maximum Output Current	1A / Port, 4A / COMMON
Minimum Output Current	0.5mA
Maximum On/Off switching frequency	1KHz (1000 times per second)
Status LED	Lights when port is ON
Common Terminals	2 (independent)

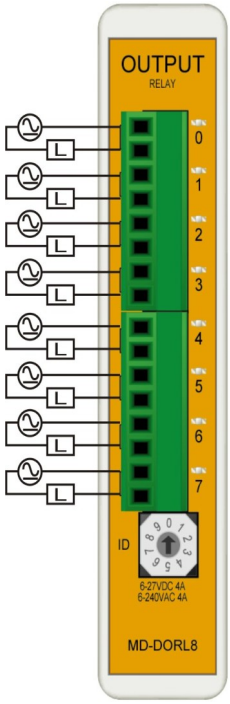


The Sink Output module requires two power sources. The DC 24V power source is used to drive the internal FET.

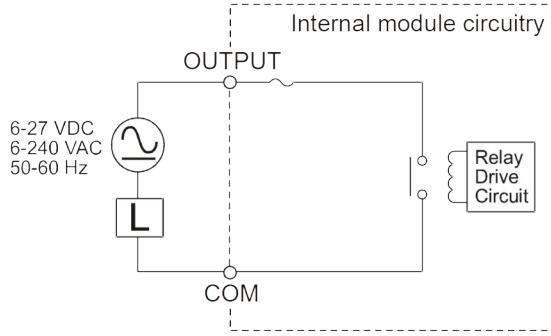
The Sink Output Module has a wider output voltage range than the Source Output Module.

DC Output Modules can output a pulse of up to 1KHz meaning it can be switched on and off at about 1000 times per second.

8-Channel Relay Output Module: MD-DORL8



MD-DORL8 Specifications	
Channels	8
Operating Voltage	6-27VDC / 6-240VAC
Output Voltage	5-30VDC / 5-264 VAC
Maximum Output Current	4 A / Port, 4A / COMMON
Minimum Output Current	100 mA @ 5VDC
Maximum On/Off Switching Frequency	25Hz (25 times per second)
Status LED	Lights when port is ON
Common Terminals	8 (Independent)



This is a 4A load per channel relay output module capable of up to AC 240V.

If a high switching frequency is needed, using the DC Output Modules is recommended.

After prolonged used, the relay's mechanical contacts may become worn and will need to be replaced. (Individual relays are not available, so the entire module will need to be replaced).

Each module has 8 channels, each with its own unique Modbus address. The following table details each module's channel, and the channel's starting address. All values are given in base 10.

DIDC8 (DC Input Module)

Channel	0	1	2	3	4	5	6	7
Starting Address	0	1	2	3	4	5	6	7

DOSO8 (DC Source Output Module)

Channel	0	1	2	3	4	5	6	7
Starting Address	3000	3001	3002	3003	3004	3005	3006	3007

DOSI8 (DC Sink Output Module

Channel	0	1	2	3	4	5	6	7
Starting Address	3100	3101	3102	3103	3104	3105	3106	3107

DORL8 (Relay Output Module)

Channel	0	1	2	3	4	5	6	7
Starting Address	3200	3201	3202	3203	3204	3205	3206	3207

MEMO

Chapter 3
Analog Modules

AD Input Module: MD-ADIN4 & MD-HADIN4

There are 2 types of AD input modules: The MD-ADIN4 is a low resolution module, and the MD-HADIN4 is a high resolution module.

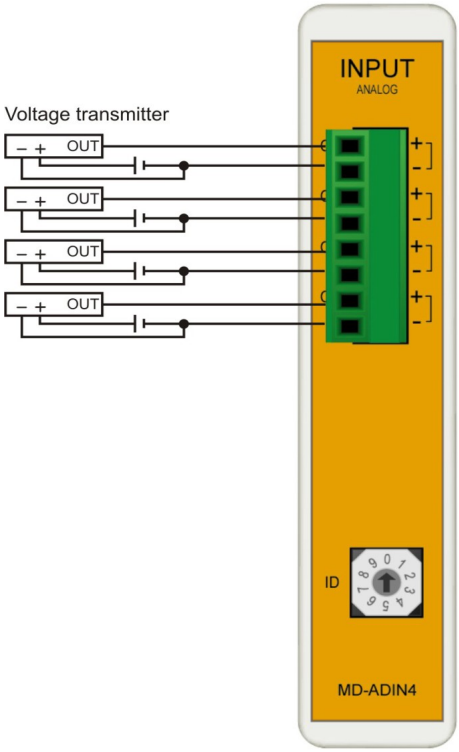
Module Name	Output Value	Resolution	Precision	Conversion Speed
MD-ADIN4	0 ~ 10,000	13.3-bit	±0.1%	30ms per channel
MD-HADIN4	0 ~ 100,000	16.6-bit	±0.1%	240ms per channel

MD-ADIN4, MD-HADIN4 Specifications	
Operating Temperature	-10 ~ 50 °C (no condensation)
Operating Humidity	35 ~ 85%RH
Input Resistance	590KΩ
Input Voltage Range	1~5V mode: 0.5 ~ 5.5V (Single-ended) 0~10V mode: -0.5 ~ 10.5V (Single-ended)
Communication Method	RS-485
Packet Transmission	3ms
Isolation Method	No Isolation

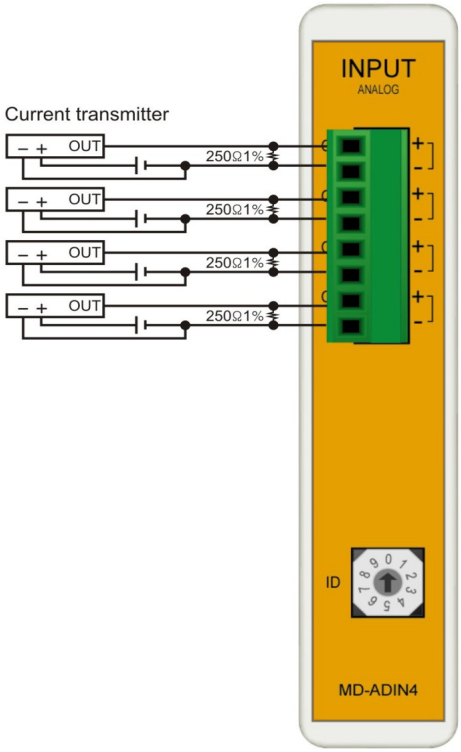
The AD Input Modules' inputs are not isolated, so please be sure not to provide voltage or current in excess of the specified ranges. Doing so could cause permanent damage.

The AD Input Modules can be wired to read voltage sources or current sources. When reading voltages sources, the modules can be configured for a 0 ~ 10V range or a 1 ~ 5V range using the dipswitch on the side of the module. When reading a current source (4-20mA), connect a 250Ω resister across the input terminals.

Reading a voltage source (0~10V, 1~5V)

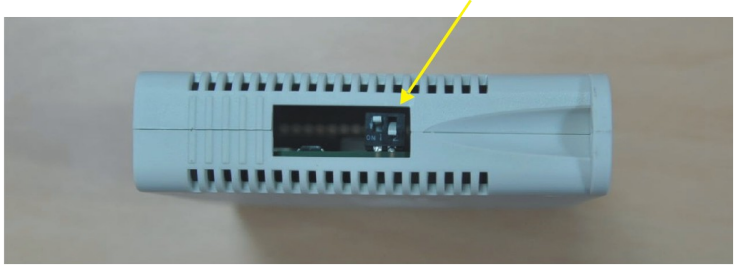


Reading a 4-20mA Current Source



The input voltage range can be adjusted using dipswitch #2. Dipswitch #1 is not used.

Dipswitch #2 ON: 0 ~ 10V
Dipswitch #2 OFF: 1 ~ 5V



AD Input Module's Sampling Frequency

The MD-ADIN4's sampling frequency is 30ms per channel, so sampling all 4 channels will take 120ms. Therefore, it is unnecessary read more than once every 120ms, as it will always return the same value.

The MD-HADIN4's sampling frequency is 240ms per channel, so sampling all 4 channels will take approximately 960ms. Therefore, it is unnecessary read more than once every 960ms, as it too will always return the same value.

When the system is first powered on, all four channels are scanned once. Reading at this time will return an invalid value. When using the MD-ADIN4 module, please allow at least 120 ms from the time the system is powered on before calling reading any data. Similarly, when using the MD-HADIN4 module, please allow at least 960ms from the time the system is powered on before reading and data.

The AD Input Modules have built in low pass filter and noise canceling circuitry. Since the A/D pins are not exposed, the user is not expected to design additional circuitry.

The MD-HADIN4 has the benefit of a higher resolution using Voltage-to-Frequency chips, but takes longer to do the conversion. Therefore, the MD-HADIN4 may not be suitable for high frequency signals.

MD-ADIN4's Return Values

The value returned from the MD-ADIN can be interpreted with the following algorithm:

```
unsigned short rawData = 0;  // Raw 16-bit value from the MD-ADIN

int value = rawData;
if ((rawData & 0x8000) != 0)  // If most significant bit is set
{
    value = (rawData - 0x8000) * -1;
}

if (value == -11111)
{
    // Value is below the lower bound (e.g. below 1V when 1-5V mode is selected).
}
else if (value == 22222)
{
    // Value is above the upper bound. (e.g.  above 5V when 1-5V mode is selected).
}
else
{
    // Value is between 0 and 10,000
}
```

MD-ADIN4's Modbus Addresses

Each module has 4 channels, each with its own unique Modbus address. The following table details each module's channel, and the channel's starting address. All values are given in base 10.

Channel	1	2	3	4
Starting Address	100	101	102	103

MD-HADIN4's Return Values

Read two 16-bit words from the MD-HADIN's starting address to obtain the full value. The data will be returned most significant word first.

The value returned from the MD-HADIN can be interpreted with the following algorithm:

```
unsigned int rawData = 0;  // Raw 32-bit value from the MD-HADIN

long value = rawData;
if ((rawData & 0x80000000) != 0)  // If most significant bit is set
{
    value = (rawData - 0x80000000) * -1;
}

if (value == -111111)
{
    // Value is below the lower bound (e.g. below 1V when 1-5V mode is selected).
}
else if (value == 222222)
{
    // Value is above the upper bound. (e.g.  above 5V when 1-5V mode is selected).
}
else
{
    // Value is between 0 and 100,000
}
```

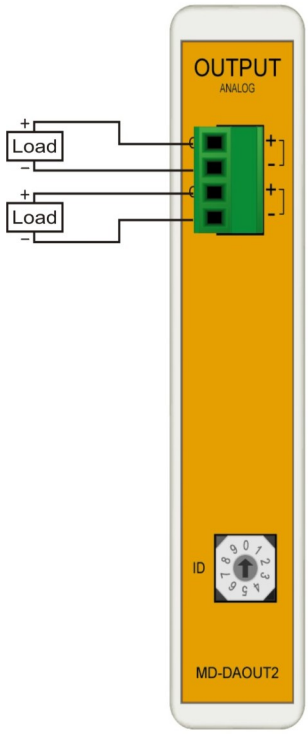
MD-HADIN4's Modbus Addresses

Each module has 4 channels, each with its own unique Modbus address. The following table details each module's channel, and the channel's starting address. All values are given in base 10.

Channel	1	2	3	4
Starting Address	200	201	202	203

DA Voltage Output Module: MD-DAOUT2

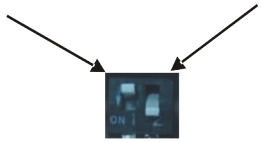
The DA Voltage Output Module is a 2-channel, 0 ~ 5V / 0 ~ 10V digital-to-analog voltage converter module. The voltage range is configured using the dipswitch on the side of the module.



Dipswitch Configuration

Channel 1 Output Voltage

Channel 2 Output Voltage

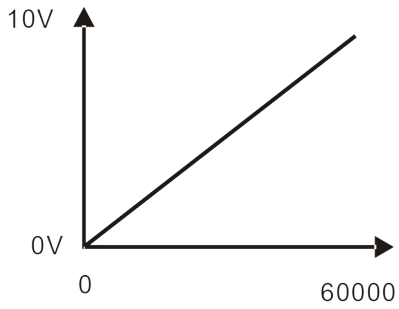


OFF: 0 ~ 10V
ON : 0 ~ 5V

MD-DAOUT2 Specifications	
Analog Output	DC 0~5V Or 0~10V (1KΩ or higher load)
Operating Temperature	-10 ~ 50 °C (no condensation)
Operating Humidity	35 ~ 85%RH
Output Resolution	0 ~ 60,000
Communication Method	RS-485
Maximum Conversion Rate	0 ~ 60,000, 600ms
Isolation Method	No Isolation

MD-DAOUT2's Output Voltage

Values between 0 ~ 60,000 correspond linearly to the output voltage (0 ~ 10V, dipswitch OFF / 0 ~ 5V, dipswitch ON).



MD-DAOUT2's Modbus Addresses

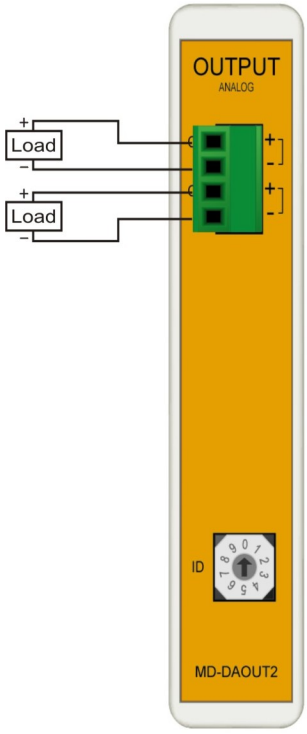
Each module has 2 channels, each with its own unique Modbus address. The following table details each module's channel, and the channel's starting address. All values are given in base 10.

Channel	1	2
Starting Address	3300	3301

DA Current Output Module: MD-DAOUT2B

The DA Current Output Module is a 2-channel 0 ~ 20mA / 4 ~ 20mA digital-to-analog current converter module. The current range is configured using the dipswitch on the side of the module.

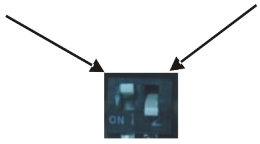
The MD-DAOUT2B's negative terminal controls the current through a connected load; so it should not be connected to a fixed potential. The MD-DAOUT2B should be used to drive differential loads. To drive single-ended loads, an isolation circuit may be required.



Dipswitch Configuration

Channel 1 Output Current
꿀넉넘취

Channel 2 Output Current

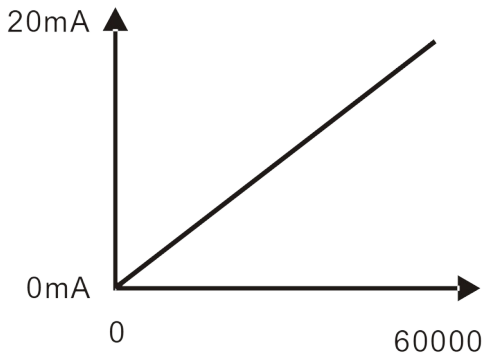


OFF: 4 ~ 20mA
ON : 0 ~ 20mA

MD-DAOUT2B Specifications	
Analog Output	0~20mA Or 4~20mA (600Ω or higher differential load)
Operating Temperature	-10 ~ 50 °C (no condensation)
Operating Humidity	35 ~ 85%RH
Output Resolution	0 ~ 60,000
Communication Method	RS-485
Maximum Conversion Rate	0 ~ 60,000, 600ms
Isolation Method	No Isolation

MD-DAOUT2B's Output Current

Values between 0 ~ 60,000 correspond linearly to the output current (4 ~ 20mA, dipswitch OFF / 0 ~ 20mA, dipswitch ON).



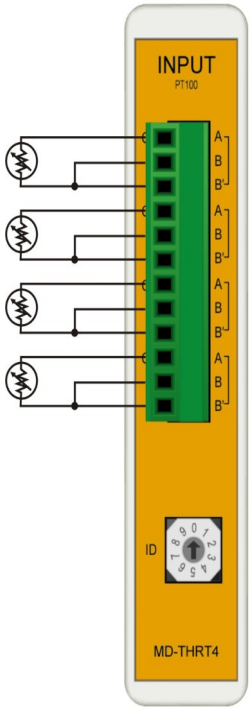
MD-DAOUT2B's Modbus Addresses

Each module has 2 channels, each with its own unique Modbus address. The following table details each module's channel, and the channel's starting address. All values are given in base 10.

Channel	1	2
Starting Address	3400	3401

Temperature Input Module: MD-THRT4

The Temperature Input Modules, used with a PT100Ω temperature sensor, can measure temperatures between −100 and 500 °C with a precision of ±0.5%.



MD-THRT4 Specifications	
Operating Temperature	-10 ~ 50 °C (no condensation)
Operating Humidity	35 ~ 85%RH
Sampling Rate	200ms per channel
Input	RTD Sensor (PT100)
Allowable Line Resistance	10Ω or less per line from the module to the temperature sensor
Precision	±0.5%
Communication Method	RS-485
Packet Transmission Rate	3ms
Isolation Method	No Isolation

MD-THRT4's Sampling Frequency

The sampling rate of the Temperature Input Module is 200ms per channel, and is constantly sampling the temperature sensor. `Reading the temperature` returns the most recently sampled value.

The Temperature Input Module samples all channels at once, so at 200ms per channel, the total sampling time for four channels is 800ms. Therefore, there is no benefit in reading at a rate greater than 800ms, as it will always return the same value.

When the system is first powered on, all four channels are scanned once. Reading at this time will return an invalid value. Please allow at least 800ms from the time the system is powered on before reading from the module.

MD-THRT4's Return Values

The return value is the temperature in °C multiplied by 10. In other words if the module returns the value 205, the actual temperature is 20.5 °C.

If an error occurs, the following values may be returned.

Exception	Description
20001 ~ 20003	An error occurred while transmitting the value to the CPU
20004	Invalid module ID
20005	Sensor is not connected
55555	Value exceeds valid maximum (500.0 °C)
11111	Value is below valid minimum (-100.0 °C)

MD-THRT4's Modbus Addresses

Each MD-THRT4 has 4 channels, each with its own unique Modbus address. The following table details each module's channel, and the channel's starting address. All values are given in base 10.

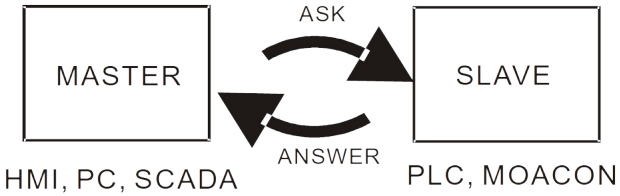
Channel	1	2	4	5
Starting Address	300	301	302	303

Chapter 4
Modbus RTU

About Modbus

Modbus is a protocol created by Modicon in 1979 to communicate with industrial electronic devices, and has proliferated to become the de facto standard in the industry.

Modbus uses a request/reply protocol with a single master device and one or more slave devices. The master sends a request to a single slave, and that slave replies with a response to the master's request. A slave can only respond to requests from the master; it cannot initiate communication on its own.



Each slave has its own, unique address. The master can only communicate with one slave at a time.

These requests and replies are called frames. Modbus supports two frame formats: Remote Terminal Unit (RTU) and American Standard Code for Information Interchange (ASCII). The RTU format encodes each frame in a compact, binary form and uses a Cyclic Redundancy Check (CRC) to verify the integrity of the transmission. The ASCII format encodes each frame as a set of ASCII characters and uses a Longitudinal Redundancy Check (LRC) to verify the integrity of the transmission.

Modubus request frames vary, but typically they contain the following:

1. Slave Address – The address of the slave device the request is intended for
2. Function Code – The function to performed on the slave device (read, write, etc...)
3. Data – Information needed to perform the given function
4. Error Code – CRC for RTU, or LRC for ASCII to verify the transmission integrity

Modbus reply frames also vary, but typically they contain the following:

1. Slave Address – The address of slave device the reply is from
2. Function Code – The function performed by the slave device
3. Data – Information about the function performed
4. Error Code – CRC for RTU, or LRC for ASCII to verify the transmission integrity

This very brief introduction to Modbus is all that is needed to understand the information to follow. It is out of the scope of this document to explain Modbus in detail so, to learn more, please see The Modbus Organization.

The MODPORT only supports Modbus RTU.

Modbus RTU Function Codes

The Modbus specification defines a set of function codes that specify how to read and write bits or words (16 bits). Modbus uses the term "coil" to refer to a bit, and "register" to refer to a word.

The MODPORT supports the following function codes:

Function Code (Decimal)	Function	Description
1	Read Coil Status	Read 1 or more bits
3	Read Holding Registers	Read 1 or more words
5	Force Single Coil	Write 1 bit
6	Preset Single Register	Write 1 word
15	Force Multiple Coils	Write multiple bits
16	Preset Multiple Registers	Write multiple words

The MODPORT does not support function codes 2 and 4.

The following table shows the different modules, their starting address range, and their supported function codes. All values are given in base 10.

Input			Output		
Start Address	**Module**	**Function Codes**	**Start Address**	**Module**	**Function Codes**
0-7	MD-DIDC8	1	3000-3007	MD-DOSO8	1, 5, 15
100-103	MD-ADIN4	3	3100-3107	MD-DOSI8	1, 5, 15
200-207	MD-HADIN4	3	3200-3207	MD-DORL8	1, 5, 15
300-303	MD-THRT4	3	3300-3301	MD-DAOUT2	3, 6, 16
Baud Rate: 57600, Data Bits: 8, Parity: None, Stop Bits: 1					

Function Code 01: Read Coil/Input Status

These two functions read bit values starting at a given address.

Example Query Frame from Master:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x01	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x00	1
Length (Most Significant Byte)	0x00	1
Length (Least Significant Byte)	0x08	1
Error Check	CRC	2

Response Frame from Slave:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x01	1
Byte Count	0x01	1
Data 1	0x53	1
Error Check	CRC	2

The *start address* is the address of the first bit to read. *Length* is the number of bits to read, however, the response will always be in multiples of 8 bits. For example, if *length* is 5, the response will contain 8 bits. If *length* is 14, the response will be 16 bits.

Function Code 03: Read Holding/Input Registers

These two functions read one or more word (16 bits) values starting at a given address.

Example Query Frame from Master:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x03	1
Register Address (Most Significant Byte)	0x00	1
Register Address (Least Significant Byte)	0x00	1
Length (Most Significant Byte)	0x00	1
Length (Least Significant Byte)	0x03	1
Error Check	CRC	2

Response Frame from Slave:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x03	1
Byte Count	0x06	1
Data 1 (Most Significant Byte)	0x03	1
Data 1 (Least Significant Byte)	0xE8	1
Data 2 (Most Significant Byte)	0x01	1
Data 2 (Least Significant Byte)	0xF4	1
Data 3 (Most Significant Byte)	0x05	1
Data 4 (Least Significant Byte)	0x33	1
Error Check	CRC	2

The *register address* is the address of the first register to read. *Length* is the number of bytes to read.

Function Code 05: Force Single Coil

This function sets the value of a single bit at a given address.

Example Query Frame from Master:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x05	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x01	1
Data (Most Significant Byte)	0xFF	1
Data (Least Significant Byte)	0x00	1
Error Check	CRC	2

Response Frame from Slave:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x05	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x01	1
Data (Most Significant Byte)	0xFF	1
Data (Least Significant Byte)	0x00	1
Error Check	CRC	2

Start address is the address of the bit to set, and *data* is the value to set the bit to. To turn a bit ON, *data* must be 0xFF00. To turn a bit OFF, *data* must b 0x0000.

Function Code 06: Preset Single Registers

This function set the value of a single word (16 bits) at a given address.

Example Query Frame from master:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x06	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x01	1
Data (Most Significant Byte)	0x12	1
Data (Least Significant Byte)	0x34	1
Error Check	CRC	2

Response Frame from Slave:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x06	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x01	1
Data (Most Significant Byte)	0x12	1
Data (Least Significant Byte)	0x34	1
Error Check	CRC	2

Start address is the address of the word to set, and *data* is the value to set the word to.

Function Code 15: Force Multiple Coils

This function sets the value of multiple bits starting at a given address.

Example Query Frame from Master:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x0F	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x00	1
Length (Most Significant Byte)	0x00	1
Length (Least Significant Byte)	0x10	1
Byte Count	0x02	1
Data (Most Significant Byte)	0xD1	1
Data (Least Significant Byte)	0x05	1
Error Check	CRC	2

Response Frame from Slave:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x0F	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x00	1
Length (Most Significant Byte)	0x00	1
Length (Least Significant Byte)	0x10	1
Error Check	CRC	2

Start address is the address of the first bit to set, and *data* is a bit array containing the value for each bit to set. *Length* is the number of bits to set, and *byte count* is size of the data in bytes.

Function Code 16: Preset Multiple Registers

This function sets the value of multiple words (16 bits each) starting at a given address.

Example Query Frame from Master:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x10	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x00	1
Length (Most Significant Byte)	0x00	1
Length (Least Significant Byte)	0x03	1
Byte Count	0x06	1
Data 1 (Most Significant Byte)	0xD1	1
Data 1 (Least Significant Byte)	0x03	1
Data 2 (Most Significant Byte)	0x0A	1
Data 2 (Least Significant Byte)	0x12	1
Data 3 (Most Significant Byte)	0x04	1
Data 3 (Least Significant Byte)	0x05	1
Error Check	CRC	2

Response Frame from Slave:

	Data	Byte Count
Slave Address	0x03	1
Function Code	0x10	1
Start Address (Most Significant Byte)	0x00	1
Start Address (Least Significant Byte)	0x00	1
Length (Most Significant Byte)	0x00	1
Length (Least Significant Byte)	0x03	1
Error Check	CRC	2

Start address is the address of the first word to set, and *data* is a byte array containing the value for each byte to set. *Length* is the number of words to set, and *byte count* is size of the data in bytes.

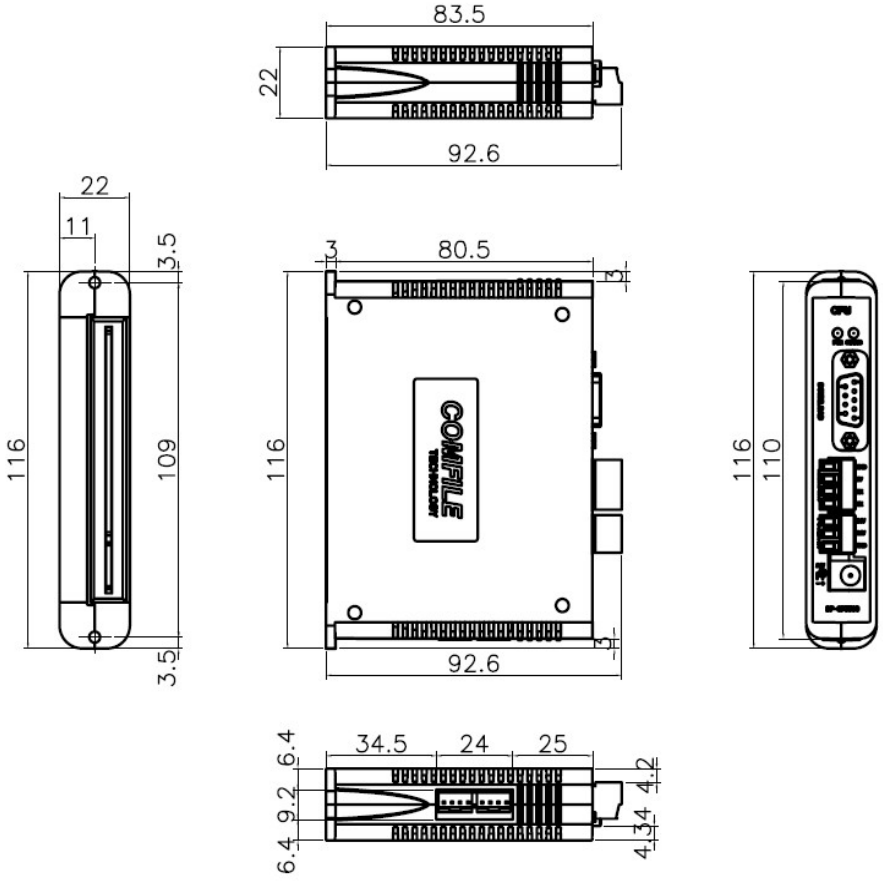
MEMO

Chapter 5
Appendix

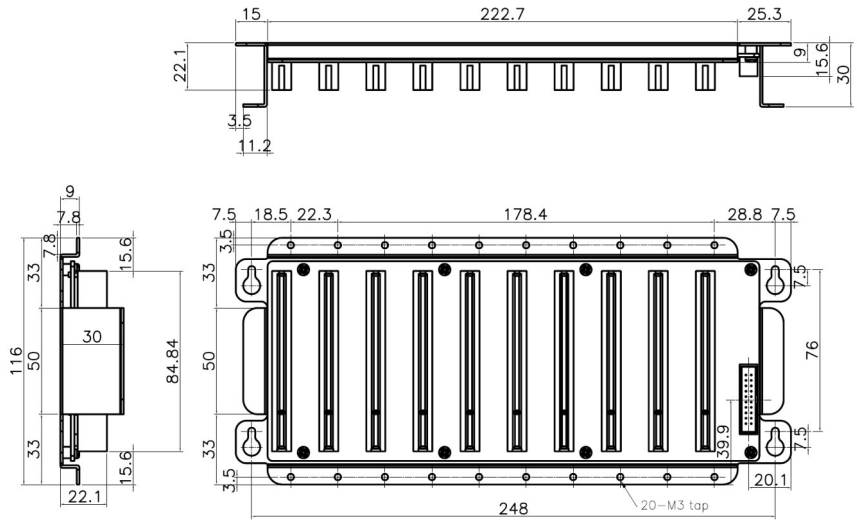
External Dimensions

All units are in millimeters (mm).

MODPORT Module:



10-Slot Board:



5-Slot Board: