

# ARIO-C-MR

## Modbus/RTU Compatible

Coupler Manual MTO-ARIOCMRU1-V2.4-EN

Thank you for purchasing an Autonics product.

This user manual contains information about the product and its proper use,  
and should be kept in a place where it will be easy to access.

**Autonics**



# Contents

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>Preface</b> .....                                         | <b>5</b>  |
| <b>Manual Guide</b> .....                                    | <b>7</b>  |
| <b>Common Symbols in the Manual</b> .....                    | <b>9</b>  |
| <b>Safety Considerations</b> .....                           | <b>11</b> |
| <b>1. Reference Manuals</b> .....                            | <b>13</b> |
| <b>2. Overview of the ARIO-C-MR</b> .....                    | <b>15</b> |
| 2.1. Modbus/RTU Protocol .....                               | 15        |
| 2.2. Unit Descriptions .....                                 | 16        |
| 2.3. Communication Connector .....                           | 18        |
| 2.4. Assign the Node Address .....                           | 19        |
| 2.4.1. Assign the Node Address in the DAQMaster .....        | 19        |
| 2.5. Set the Baud Rates .....                                | 20        |
| 2.6. Connections of the Power Terminal .....                 | 21        |
| <b>3. Indicators</b> .....                                   | <b>23</b> |
| 3.1. LEDs for the Coupler Status .....                       | 24        |
| 3.2. LEDs for the Field Network Status .....                 | 25        |
| <b>4. Process Images</b> .....                               | <b>27</b> |
| 4.1. Memory Map .....                                        | 27        |
| 4.2. Data Processing in the Module .....                     | 28        |
| 4.2.1. Check the Data of the Modules .....                   | 29        |
| 4.3. Example of the Process Image .....                      | 30        |
| 4.3.1. Input Process Image .....                             | 32        |
| 4.3.2. Output Process Image .....                            | 32        |
| <b>5. Function Codes</b> .....                               | <b>33</b> |
| 5.1. 01 (0x01) Read Coils (0x) .....                         | 34        |
| 5.1.1. The Input Data .....                                  | 34        |
| 5.2. 04 (0x04) Read Input Register (3x) .....                | 34        |
| 5.2.1. The Model Information .....                           | 34        |
| 5.2.2. The Number of Modules .....                           | 35        |
| 5.2.3. The Configuration Information of the Modbus/RTU ..... | 35        |
| 5.2.4. The Input Data .....                                  | 35        |

|                                                                                     |           |
|-------------------------------------------------------------------------------------|-----------|
| 5.3. 03 (0x03) Read Holding Register (4x).....                                      | 36        |
| 5.3.1. The Configuration Information of the Modbus/RTU .....                        | 36        |
| 5.3.2. Read the Output Data .....                                                   | 36        |
| 5.4. 05 (0x05) Write Single Coils (0x).....                                         | 37        |
| 5.4.1. Write the Output Data.....                                                   | 37        |
| 5.5. 06 (0x06) Write Single Register / 16 (0x10) Write Multiple Registers (4x)..... | 37        |
| 5.5.1. Write the Modbus/RTU Settings .....                                          | 37        |
| 5.5.2. Write the Output Data.....                                                   | 38        |
| <b>6. Configure the Modbus/RTU.....</b>                                             | <b>39</b> |
| 6.1. Before You Begin .....                                                         | 39        |
| 6.2. Add Registers .....                                                            | 42        |
| 6.3. Add Tags .....                                                                 | 47        |
| 6.4. Monitor the Data .....                                                         | 48        |
| <b>7. Dimensions .....</b>                                                          | <b>49</b> |
| <b>8. Specifications .....</b>                                                      | <b>51</b> |
| 8.1. Electrical/Mechanical Specifications .....                                     | 51        |
| 8.2. Environmental Conditions .....                                                 | 52        |
| 8.3. Certification .....                                                            | 52        |
| <b>9. Communication Interface .....</b>                                             | <b>53</b> |
| 9.1. RS-485 .....                                                                   | 53        |
| 9.2. ABUS .....                                                                     | 53        |

# Preface

Thank you for purchasing Autonics products.

Be sure to read and follow the **Safety Precautions** thoroughly before use.

This manual contains information about the product and how to use it properly, so keep it in a place where users can easily find it.



# Manual Guide

- Use the product after fully reading the contents of the manual.
- The manual explains the product functions in detail and does not guarantee the contents other than the manual.
- Any or all of the manual may not be edited or copied without permission.
- The manual is not provided with the product.
- Download and use from our website ([www.autonics.com](http://www.autonics.com)).
- The contents of the manual are subject to change without prior notice according to the improvement of the product's performance, and upgrade notices are provided through our website.
- We put a lot of effort to make the contents of the manual a little easier and more accurate. Nevertheless, if you have any corrections or questions, please feel free to comment through our website.



# Common Symbols in the Manual



Failure to follow instructions may result in serious injury or death.



Failure to follow instructions may result in injury or product damage.



Supplementary explanation of the function



Example of that function



Important information about the feature



# Safety Considerations

Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.

---

## **Warning**

1. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g., nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.) Failure to follow this instruction may result in personal injury, fire or economic loss.
  2. Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present. Failure to follow this instruction may result in explosion or fire.
  3. Do not disassemble or modify the unit.  
Failure to follow this instruction may result in fire.
  4. Do not connect, repair, or inspect the unit while connected to a power source.  
Failure to follow this instruction may result in fire.
  5. Check 'Connections' before wiring.  
Failure to follow this instruction may result in fire.
- 

## **Caution**

1. Use the unit within the rated specifications.  
Failure to follow this instruction may result in fire or shortening the life cycle of the product.
  2. Use dry cloth to clean the unit, and do not use water or organic solvent.  
Failure to follow this instruction may result in fire or electric shock.
  3. When connecting the power input and output, use AWG 22-16 cable and check the connecting method of crimp terminal.  
Failure to follow this instruction may result in fire or malfunction due to contact failure.
  4. Keep the product away from metal chip, dust, and wire residue which flow into the unit.  
Failure to follow this instruction may result in fire or product damage.
  5. Do not connect or disconnect connector (terminal) wire or power, when the product is operating.  
Failure to follow this instruction may result in fire or malfunction of the product.
-

## Cautions during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
2. BUS power and I/O power should be insulated by the individually insulated power device.
3. Power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
4. Keep away from high voltage lines or power lines to prevent inductive noise.  
In case installing power line and input signal line closely, use line filter or varistor at power line and shielded wire at input signal line. For stable operation, use shield wire and ferrite core, when wiring communication wire, power wire, or signal wire.
5. Do not use near the equipment which generates strong magnetic force or high frequency noise.
6. Use the rated standard cables and connectors. Do not apply excessive power when connecting or disconnecting the connectors of the product.
7. Do not touch the module communication connector part of the base.
8. Do not connect, or remove the base while connected to a power source.  
For removing the terminal, body or base, do not operate units for a long time without it.
9. This unit may be used in the following environments.
  - ① Indoors (in the environment condition rated in 'Specifications')
  - ② Altitude max. 2,000 m
  - ③ Pollution degree 2
  - ④ Installation category II

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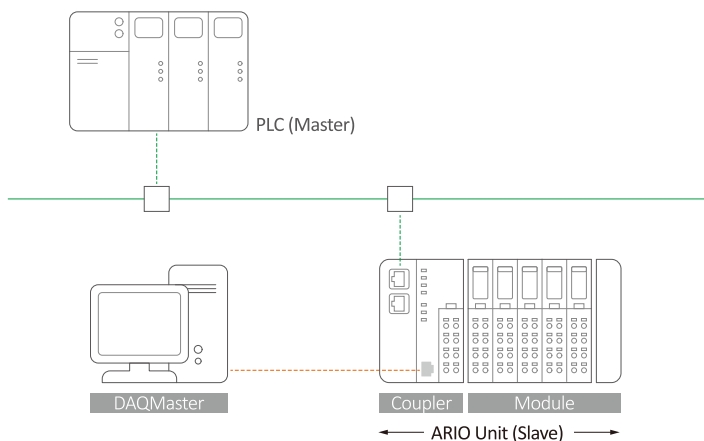
The specifications and dimensions of this manual are subject to change without any notice for product improvement. Be sure to read and follow the considerations written in the instruction manual, other manuals, and technical information on our Autonics website.

# 1. Reference Manuals



Be sure to read the reference manuals below to use the product correctly and follow the precautions written in these manuals.

You can download the reference manuals on our Autonics website.



## Product manual

It contains information for you to setup and install the ARIOS Unit.

1. Key features of ARIOS Series
2. Environmental conditions and handling method for installation
3. Installation precautions
4. Instructions about maintenance, etc.

**Coupler manual**

It contains information for you to configure and use the coupler in the field network.

1. Communication protocol overview
2. Hardware information: specifications, indicators, connection diagram, and dimensions, etc.
3. Software information: process images, and mapping information, etc.

**Module manual**

It contains information on the modules provided by Autonics.

1. Hardware information: specifications, indicators, connection diagram, and dimensions, etc.

**DAQMaster user manual**

It contains information and usage guides on ARIO-related functions supported by DAQMaster, the comprehensive device management program.

1. Change properties of the coupler and modules
2. Module configuration via virtual mode
3. Check the address map of the Unit
4. Update the firmware version of the coupler, etc.

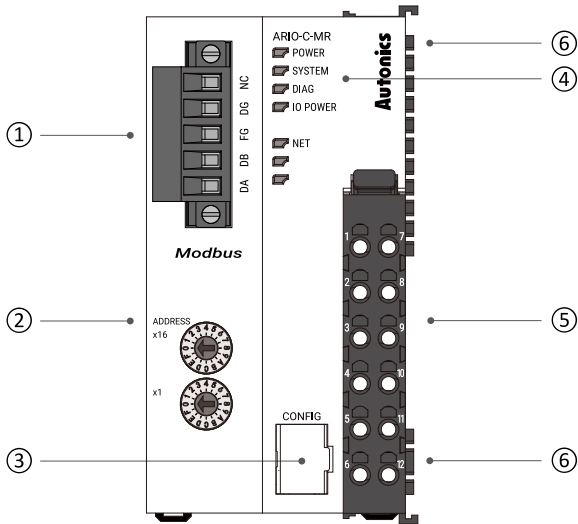
## 2. Overview of the ARIO-C-MR

### 2.1. Modbus/RTU Protocol

The Modbus protocol is commonly used to connect industrial devices because it is relatively easy to implement and can be communicated with robust connections. The versions of Modbus are categorized based on Ethernet and Serial communication: The Modbus/RTU, a type of the Fieldbus, is the Serial-based communication designed for use with the PLC.

The ARIO-C-MR supports the Modbus/RTU protocol. This coupler composes the physical structure of connected modules and devices and creates input and output process images linked with the data of Modbus/RTU. The process images make it possible to experience a flexible installation environment, such as the mixed arrangement of analog and digital modules.

## 2.2. Unit Descriptions



### 1. Communication Connector

It is a connector to connect with Modbus Master (Client) such as PLC.

For detailed information on the communication cable, refer to the 2.3, “Communication Connector”.

### 2. Hexadecimal Rotary Switches

It is a setting switch to designate the node address of the coupler in the Modbus communication network. You can also set the node address in the DAQMaster.

For detailed information on addressing method, refer to the 2.4, “Assign the Node Address”.

### 3. CONFIG Port

It is a port to connect to the PC where DAQMaster is installed.

1. Port type: USB 2.0 type Micro B

#### **4. Indicators**

It displays the status of the coupler and communication connection as shown below.

For detailed information on the indicators, refer to the 3, Indicators.

1. Power and operating status of the coupler
2. Modbus communication status

#### **5. Power Supply Terminal**

It is a terminal block that supplies power to the coupler and peripherals.

For detailed information on the device supply, refer to the 2.6, “Connections of the Power Terminal”.

#### **6. Power Supply contacts**

It is a contact that feeds the power input from the power supply terminal.

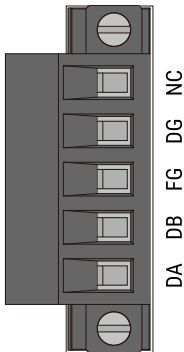
1. Top input contacts: feed the power supply for the coupler, module, and ABUS to be operated.
2. Bottom input contacts: feed the power supply for input and output signals of the connected module.

## 2.3. Communication Connector



- Be sure to use the connector and cable approved by the Modbus Organization. Otherwise, use a connector and cable that meets the specifications of at least EIA RS-485.
- Be sure not to exceed the cable length of 1000 meters.

The 5-pin PCB connector is used for Modbus/RTU communication connection.  
For more information on the pin assignment, refer to the table below.



| Pin no. | Marking on the connector | Color | Description               |
|---------|--------------------------|-------|---------------------------|
| 1       | NC: Not Connected        | Red   | Not used                  |
| 2       | DG: Data Ground          | Black | Grounding for the signals |
| 3       | FG: Frame Ground         | -     | Shielding / Grounding     |
| 4       | DB: DATA B               | White | RS-485 low signal         |
| 5       | DA: DATA A               | Blue  | RS-485 high signal        |

## 2.4. Assign the Node Address



- It is recommended to designate the node address of the coupler the same as the value of the rotary switches.
- The node address cannot be applied while the coupler is operating.
- Be sure to start the coupler again to apply the changed node address.
- The maximum number of nodes is up to 32 nodes within a single segment.

You can assign the coupler's node address via two hexadecimal rotary switches.

ADDRESS

x16



x1



| Assign mode                     | Rotary switches (x16, x1) | Node address |
|---------------------------------|---------------------------|--------------|
| Default node address            | 0x00                      | 3            |
| The node address of the coupler | 0x01 to 0xFF              | 1 to 255     |

### 2.4.1. Assign the Node Address in the DAQMaster

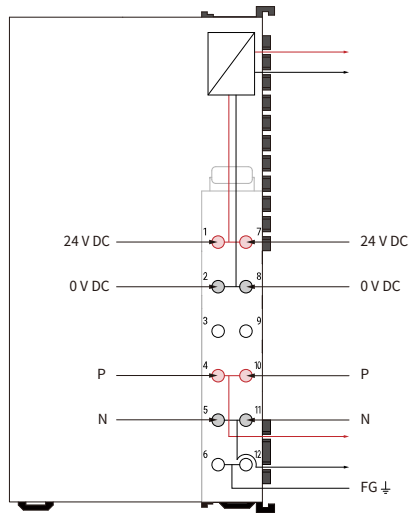
1. Set the positions of the coupler's rotary switches to 0x00.
2. To designate the node address in the DAQMaster, go to the **Comm Mode » Property tab of the coupler » Node Address** and press the Enter key.
3. Reset the ARIO unit in the DAQMaster.
4. The node address assigned by the DAQMaster is applied.

## 2.5. Set the Baud Rates

To select the baud rates in the DAQMaster, go to **Comm Mode » Property tab of the coupler » Baud Rate** and click the drop-down menu.

| Baud rates (bps) | Setting values      |
|------------------|---------------------|
| 2400             | 0                   |
| 4800             | 1                   |
| 9600             | 2 (factory setting) |
| 19200            | 3                   |
| 38400            | 4                   |
| 57600            | 5                   |
| 115200           | 6                   |

## 2.6. Connections of the Power Terminal

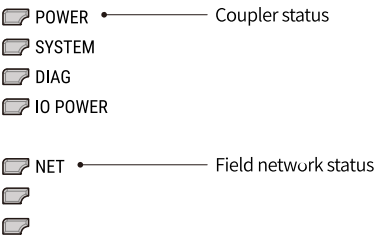


| Power category   | Terminal no. | Function                                            |
|------------------|--------------|-----------------------------------------------------|
| System Bus Power | 1            | Input/output for power supply (24 V <sub>DC</sub> ) |
|                  | 2            | Input/output for power supply (0 V <sub>DC</sub> )  |
|                  | 3            | Not connected                                       |
| Field Power      | 4            | Input/output for power supply (+)                   |
|                  | 5            | Input/output for power supply (–)                   |
| -                | 6            | Frame Ground                                        |
| System Bus Power | 7            | Input/output for power supply (24 V <sub>DC</sub> ) |
|                  | 8            | Input/output for power supply (0 V <sub>DC</sub> )  |
|                  | 9            | Not connected                                       |
| Field Power      | 10           | Input/output for power supply (+)                   |
|                  | 11           | Input/output for power supply (–)                   |
| -                | 12           | Frame Ground                                        |



# 3. Indicators

The indicators of the ARIO-C-MR coupler consist of elements indicating the operating status for the coupler, and connection status for the field network (Modbus/RTU) as shown in the figure below. For detailed information on each indicator, refer to the following tables below.



### 3.1. LEDs for the Coupler Status

1. The power supply status of the coupler

| Indicator | LED color | Status | Description            |
|-----------|-----------|--------|------------------------|
| POWER     | Green     | ON     | Supply voltage: Normal |
|           |           | OFF    | Supply voltage: None   |

2. The status of the standby mode

| Indicator | LED color | Status   | Description                                                                                                                                                                                                                       |
|-----------|-----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SYSTEM    | Green     | ON       | Normal operation                                                                                                                                                                                                                  |
|           |           | Flashing | Standby for connecting the master after initialization of the coupler                                                                                                                                                             |
|           |           | OFF      | Stop                                                                                                                                                                                                                              |
|           | Red       | ON       | <ul style="list-style-type: none"><li>• Coupler initialization failure (non-recoverable)</li><li>• An unrecoverable error occurred.</li><li>• The type of field network and firmware version mismatch (non-recoverable)</li></ul> |
|           |           | Flashing | <ul style="list-style-type: none"><li>• Field network initialization failure (non-recoverable)</li><li>• Changing the settings of rotary switches (applicable models)</li></ul>                                                   |
|           |           | OFF      | Normal operation                                                                                                                                                                                                                  |

3. The status of the module communication (ABUS)

| Indicator | LED color | Status             | Description                                                                                                        |
|-----------|-----------|--------------------|--------------------------------------------------------------------------------------------------------------------|
| DIAG      | Green     | ON                 | Normal operation: Multi/Single-packet works                                                                        |
|           |           | Flashing           | Hot-swap (normal state)                                                                                            |
|           |           | OFF                | <ul style="list-style-type: none"><li>• The operation of the coupler stopped</li><li>• An error occurred</li></ul> |
|           | Red       | ON                 | ABUS communication error                                                                                           |
|           |           | Flashing           | The models of the replaced module and the previous one mismatch (normal operation)                                 |
|           |           | Flashing (2 times) | No module connection (non-recoverable)                                                                             |
|           |           | Flashing (3 times) | Abnormal module operation (non-recoverable)                                                                        |
|           |           | Flashing (4 times) | The number of modules and data size exceeded                                                                       |
|           |           | OFF                | Normal operation                                                                                                   |

4. The status of power supply for the module

| Indicator | LED color | Status | Description                                            |
|-----------|-----------|--------|--------------------------------------------------------|
| IO POWER  | Green     | ON     | Supply voltage for the I/O signals of modules : Normal |
|           |           | OFF    | Supply voltage for the I/O signals of modules : None   |

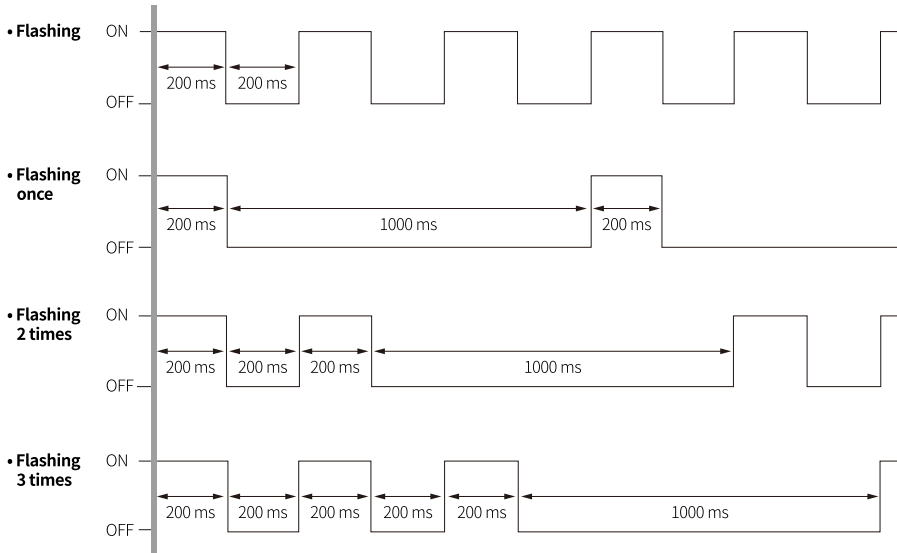
### 3.2. LEDs for the Field Network Status

1. The status of the Modbus/RTU communication and error

| Indicator | LED color | Status   | Description                                                                                                                                                                                                                                                |
|-----------|-----------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NET       | Green     | ON       | Physical and communication connection completed                                                                                                                                                                                                            |
|           |           | Flashing | Disconnected when attempting communication <ul style="list-style-type: none"><li>• Configuring the Connection uncompleted or an error occurred</li></ul>                                                                                                   |
|           |           | OFF      | INIT state (Modbus/RTU communication initialized, communication unavailable)                                                                                                                                                                               |
|           | Red       | ON       | Critical failure or communication connection error <ul style="list-style-type: none"><li>• Network error</li><li>• Duplicate MAC address detected</li><li>• Critical error occurred in the Modbus/RTU network</li></ul>                                    |
|           |           | Flashing | Minor failure or connection timeout <ul style="list-style-type: none"><li>• Data exchange time exceeded</li><li>• Communication establishment time exceeded</li><li>• No connected slave</li><li>• No supply power for the network establishment</li></ul> |
|           |           | OFF      | <ul style="list-style-type: none"><li>• Supply voltage: None</li><li>• Devices offline or no supply power for network</li><li>• MAC address validation test (Dup_MAC_ID test) in progress</li></ul>                                                        |



Refer to the timing chart below for the flashing operation of indicators.  
The operation is repeated as flashing every 200 microseconds and standby for 1 second.

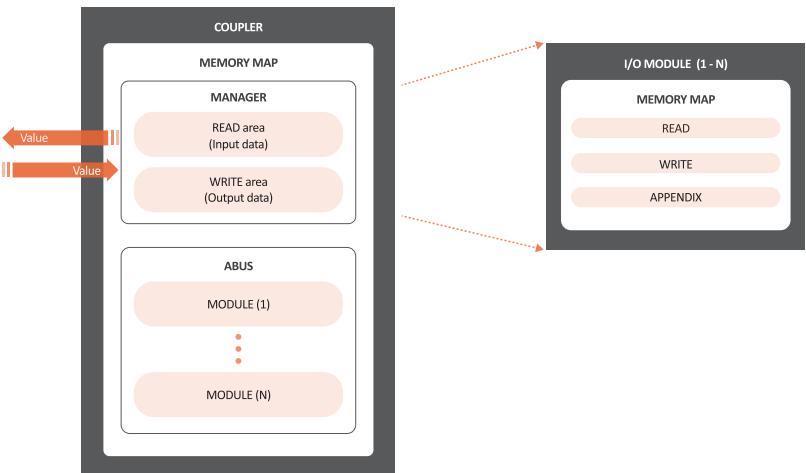


# 4. Process Images

## 4.1. Memory Map

The ARIO unit composes the memory map in its memory space to assign and manage the data collected by the coupler and modules. The master in the field network controls the input and output devices via this memory map generated by the ARIO unit.

The memory map is created based on the arrangement and data structure of the ARIO unit as shown in the figure below. The memory map of modules consists of each module and contains its data. The memory map of the coupler allocates the data considering the type (input or output) and sequence of connected modules (e.g., the slot number of each module), and data size to the read and write areas, making it easy to calculate the location of the master's register. In this way, the memory map comprised by the ARIO unit creates the input and output process images for data exchange.



- **READ area**

It is the area that transmits the data collected by the unit to the master in the field network. It contains the input data.

- **WRITE area**

It is the area that transmits the output commands from the master of the field network. It contains the output data.

## 4.2. Data Processing in the Module

The data of the module is processed depending on the input and output signals.

- **Digital modules**

The bit-oriented digital module indicates the value of the corresponding bit position as 1.

The size of each channel is 1 bit and is grouped into bytes.

- **Analog modules**

The byte-oriented analog module indicates the value of the input or output signal to the corresponding bytes. The size of each channel is grouped into words.

| Module                                 | Example of input/output format    | Data processing size |
|----------------------------------------|-----------------------------------|----------------------|
| Digital input/output<br>: Bit-oriented | 2 channels/module (2-CH/module)   | 1-byte               |
|                                        | 4 channels/module (4-CH/module)   | 1-byte               |
|                                        | 8 channels/module (8-CH/module)   | 1-byte               |
|                                        | 16 channels/module (16-CH/module) | 2-byte (= 1-word)    |
| Analog input/output<br>: Byte-oriented | 8-bit/channel (8-bit/CH)          | 1-byte               |
|                                        | 12-bit/channel (12-bit/CH)        | 2-byte (= 1-word)    |
|                                        | 16-bit/CH (16-bit/CH)             | 2-byte (= 1-word)    |
|                                        | 24-bit/channel (24-bit/CH)        | 4-byte (= 2-word)    |

### 4.2.1. Check the Data of the Modules

You can check the data of modules connected with the coupler as shown in the figure below.  
To check the data, go to **Comm Mode » Run » I/O Monitor** in the DAQMaster.  
The binary, decimal, and hexadecimal are supported as the display format in the DAQMaster.

1. The value of input signals on the point (or channels) 1 and 2 of the digital input module

- **Binary 0000 0011 (0x03)**

| Slot Number | Module Name | Type | Channel | Data | Diagnostic Byte |
|-------------|-------------|------|---------|------|-----------------|
| 1           | DI08N       | R    | 8       | 0x03 |                 |
|             | Point 1     |      |         | 1    |                 |
|             | Point 2     |      |         | 1    |                 |
|             | Point 3     |      |         | 0    |                 |
|             | Point 4     |      |         | 0    |                 |
|             | Point 5     |      |         | 0    |                 |
|             | Point 6     |      |         | 0    |                 |
|             | Point 7     |      |         | 0    |                 |
|             | Point 8     |      |         | 0    |                 |

2. The value of a voltage of 10.000 V applied to channel 1 of the analog input module

- **Big endian: 0x270D ( $\approx 10,000_{\text{DEC}}$ )**

| Slot Number | Module Name | Type | Channel | Data                  | Diagnostic Byte |
|-------------|-------------|------|---------|-----------------------|-----------------|
| 1           | AI04V1      | R    | 4       | 0x270D 0003 0003 0000 |                 |
|             | Channel 1   |      |         | 0x270D                |                 |
|             | Channel 2   |      |         | 0x0003                |                 |
|             | Channel 3   |      |         | 0x0003                |                 |
|             | Channel 4   |      |         | 0x0000                |                 |
| 2           | AO04V1      | W    | 4       | 0x2710 0000 0000 0000 |                 |
|             | Channel 1   |      |         | 0x2710                |                 |
|             | Channel 2   |      |         | 0x0000                |                 |
|             | Channel 3   |      |         | 0x0000                |                 |
|             | Channel 4   |      |         | 0x0000                |                 |



The data arrangements (the order or sequence) of the analog signal can be expressed as big-endian or little-endian in the DAQMaster.

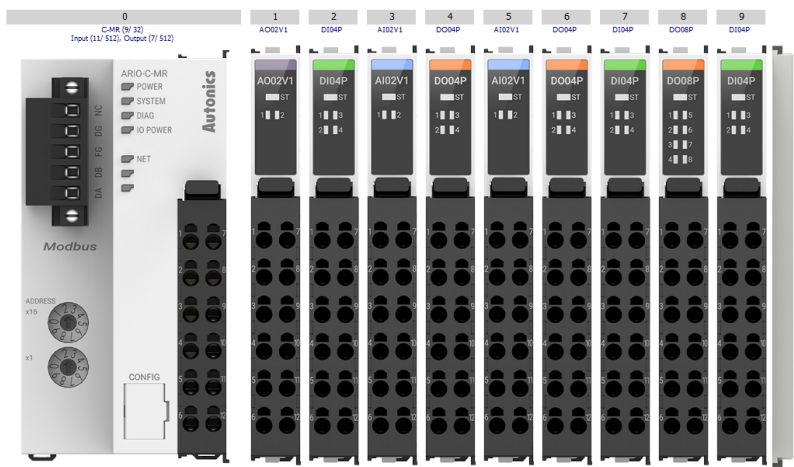
To select the endianness, go to **Comm Mode » Property tab of the coupler » Endian**. (factory default: Big-endian)

### 4.3. Example of the Process Image

You can check the input and output process images of the unit (coupler + modules) on the **AddressMap** menu in the DAQMaster. Firstly, the input modules are mapped, and then the output modules are mapped.

The process image of the Modbus protocol is expressed as big-endian (MSB → LSB) of 16 bits and consists of the input register and holding register.

#### DAQMaster: An arrangement example of the ARIО unit



## DAQMaster: The address map of the ARIO unit

### • Protocol Address (Base 0)

| Slot Number : Module Name                     | Address         | Type | F   | E   | D   | C   | B   | A   | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|-----------------------------------------------|-----------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 3 : AI02V1 - Channel 1_2 : DI04P              | 302000 (0x07CF) | R    |     |     |     |     | P3  | P2  | P1  | P0  | C1H | C1H | C1H | C1H | C1H | C1H | C1H | C1H |
| 3 : AI02V1 - Channel 1                        | 302001 (0x07D0) | R    | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C2H | C2H | C2H | C2H | C2H | C2H | C2H | C2H |
| 5 : AI02V1 - Channel 1_3 : AI02V1 - Channel 1 | 302002 (0x07D1) | R    | C2L | C2L | C2L | C2L | C2L | C2L | C2L | C2L | C1H | C1H | C1H | C1H | C1H | C1H | C1H | C1H |
| 5 : AI02V1 - Channel 1                        | 302003 (0x07D2) | R    | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C2H | C2H | C2H | C2H | C2H | C2H | C2H | C2H |
| 7 : DI04P_5 : AI02V1 - Channel 1              | 302004 (0x07D3) | R    |     |     |     |     | P3  | P2  | P1  | P0  | C2L | C2L | C2L | C2L | C2L | C2L | C2L | C2L |
| 9 : DI04P                                     | 302005 (0x07D4) | R    |     |     |     |     |     |     |     |     |     |     |     |     | P3  | P2  | P1  | P0  |
| 1 : AO02V1 - Channel 1                        | 402000 (0x07CF) | W    | C1H | C1H | C1H | C1H | C1H | C1H | C1H | C1H | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C1L |
| 1 : AO02V1 - Channel 2                        | 402001 (0x07D0) | W    | C2H | C2H | C2H | C2H | C2H | C2H | C2H | C2H | C2L | C2L | C2L | C2L | C2L | C2L | C2L | C2L |
| 6 : DO04P_4 : DO04P                           | 402002 (0x07D1) | W    |     |     |     |     | P3  | P2  | P1  | P0  |     |     |     |     | P3  | P2  | P1  | P0  |
| 8 : DO08P                                     | 402003 (0x07D2) | W    |     |     |     |     |     |     |     |     | P7  | P6  | P5  | P4  | P3  | P2  | P1  | P0  |

### • PLC Address (Base 1)

| Slot Number : Module Name                     | Address         | Type | F   | E   | D   | C   | B   | A   | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|-----------------------------------------------|-----------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 3 : AI02V1 - Channel 1_2 : DI04P              | 302001 (0x07D0) | R    |     |     |     |     | P3  | P2  | P1  | P0  | C1H | C1H | C1H | C1H | C1H | C1H | C1H | C1H |
| 3 : AI02V1 - Channel 1                        | 302002 (0x07D1) | R    | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C2H | C2H | C2H | C2H | C2H | C2H | C2H | C2H |
| 5 : AI02V1 - Channel 1_3 : AI02V1 - Channel 1 | 302003 (0x07D2) | R    | C2L | C2L | C2L | C2L | C2L | C2L | C2L | C2L | C1H | C1H | C1H | C1H | C1H | C1H | C1H | C1H |
| 5 : AI02V1 - Channel 1                        | 302004 (0x07D3) | R    | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C2H | C2H | C2H | C2H | C2H | C2H | C2H | C2H |
| 7 : DI04P_5 : AI02V1 - Channel 1              | 302005 (0x07D4) | R    |     |     |     |     | P3  | P2  | P1  | P0  | C2L | C2L | C2L | C2L | C2L | C2L | C2L | C2L |
| 9 : DI04P                                     | 302006 (0x07D5) | R    |     |     |     |     |     |     |     |     |     |     |     |     | P3  | P2  | P1  | P0  |
| 1 : AO02V1 - Channel 1                        | 402001 (0x07D0) | W    | C1H | C1H | C1H | C1H | C1H | C1H | C1H | C1H | C1L | C1L | C1L | C1L | C1L | C1L | C1L | C1L |
| 1 : AO02V1 - Channel 2                        | 402002 (0x07D1) | W    | C2H | C2H | C2H | C2H | C2H | C2H | C2H | C2H | C2L | C2L | C2L | C2L | C2L | C2L | C2L | C2L |
| 6 : DO04P_4 : DO04P                           | 402003 (0x07D2) | W    |     |     |     |     | P3  | P2  | P1  | P0  |     |     |     |     | P3  | P2  | P1  | P0  |
| 8 : DO08P                                     | 402004 (0x07D3) | W    |     |     |     |     |     |     |     |     | P7  | P6  | P5  | P4  | P3  | P2  | P1  | P0  |

### 4.3.1. Input Process Image

| Byte |           | Bit 7          | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|------|-----------|----------------|-------|-------|-------|-------|-------|-------|-------|
| 0    | 2: DI04P  | -              |       |       |       | Ch.4  | Ch.3  | Ch.2  | Ch.1  |
| 1    | 3: AI02V1 | Ch.1 High Byte |       |       |       |       |       |       |       |
| 2    |           | Ch.1 Low Byte  |       |       |       |       |       |       |       |
| 3    |           | Ch.2 High Byte |       |       |       |       |       |       |       |
| 4    |           | Ch.2 Low Byte  |       |       |       |       |       |       |       |
| 5    | 5: AI02V1 | Ch.1 High Byte |       |       |       |       |       |       |       |
| 6    |           | Ch.1 Low Byte  |       |       |       |       |       |       |       |
| 7    |           | Ch.2 High Byte |       |       |       |       |       |       |       |
| 8    |           | Ch.2 Low Byte  |       |       |       |       |       |       |       |
| 9    | 7: DI04P  | -              |       |       |       | Ch.4  | Ch.3  | Ch.2  | Ch.1  |
| 10   | 9: DI04P  | -              |       |       |       | Ch.4  | Ch.3  | Ch.2  | Ch.1  |

### 4.3.2. Output Process Image

| Byte |           | Bit 7          | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|------|-----------|----------------|-------|-------|-------|-------|-------|-------|-------|
| 0    | 1: AO02V1 | Ch.1 High Byte |       |       |       |       |       |       |       |
| 1    |           | Ch.1 Low Byte  |       |       |       |       |       |       |       |
| 2    |           | Ch.2 High Byte |       |       |       |       |       |       |       |
| 3    |           | Ch.2 Low Byte  |       |       |       |       |       |       |       |
| 4    | 4: DO04P  | -              |       |       |       | Ch.4  | Ch.3  | Ch.2  | Ch.1  |
| 5    | 6: DO04P  | -              |       |       |       | Ch.4  | Ch.3  | Ch.2  | Ch.1  |
| 6    | 8: DO08P  | Ch.8           | Ch.7  | Ch.6  | Ch.5  | Ch.4  | Ch.3  | Ch.2  | Ch.1  |

# 5. Function Codes

The following tables describe the data model and public function codes for the Modbus protocol supported by the ARIO-C-MR.

• Data model

| Modbus data       | Access unit   | Addr. prefix | Function code | Data type |
|-------------------|---------------|--------------|---------------|-----------|
| Coils             | Bit           | 0x           | 01, 05        | R/W       |
| Input Registers   | Word (16-bit) | 3x           | 04            | RO        |
| Holding Registers | Word (16-bit) | 4x           | 03, 06, 16    | R/W       |

• Public function codes

| Function | Function code                                            | Register range | Service                                               |
|----------|----------------------------------------------------------|----------------|-------------------------------------------------------|
| Read     | 01 Read Coils                                            | 02001 to 02256 | The input data is returned.                           |
|          | 04 Read Input Register                                   | 00101 to 00115 | The data of model information is returned.            |
|          |                                                          | 00126          | The number of connected modules is returned.          |
|          |                                                          | 01030 to 01032 | The configuration data of the Modbus/RTU is returned. |
|          |                                                          | 02001 to 02256 | The input data is returned.                           |
|          | 03 Read Holding Register                                 | 01030 to 01032 | The configuration data of the Modbus/RTU is returned. |
|          |                                                          | 02001 to 02256 | The output data is returned.                          |
| Write    | 05 Write Single Coil                                     | 02001 to 02256 | It writes the output data.                            |
|          | 06 Write Single Register,<br>16 Write Multiple Registers | 01030 to 01032 | It writes the Modbus/RTU settings.                    |
|          |                                                          | 02001 to 02256 | It writes the output data.                            |

## 5.1. 01 (0x01) Read Coils (0x)

### 5.1.1. The Input Data

| Data                           | Register                            | Value |
|--------------------------------|-------------------------------------|-------|
| The data from the input module | 002001 to 002256 (0x07D0 to 0x08CF) |       |



For more information on the address of the input module, refer to the AddressMap in the DAQMaster.

## 5.2. 04 (0x04) Read Input Register (3x)

It reads the data of the input register in the coupler.

### 5.2.1. The Model Information

| Data                  | Register        | Value  |
|-----------------------|-----------------|--------|
| Product number: High  | 300101 (0x0064) | 0x1004 |
| Product number: Low   | 300102 (0x0065) | 0x0001 |
| Production code: High | 300103 (0x0066) |        |
| Production code: Low  | 300104 (0x0067) |        |
| Model name: 1         | 300106 (0x0069) | "AR"   |
| Model name: 2         | 300107 (0x006A) | "IO"   |
| Model name: 3         | 300108 (0x006B) | "-C"   |
| Model name: 4         | 300109 (0x006C) | "-M"   |
| Model name: 5         | 300110 (0x006D) | "R"    |
| Model name: 6         | 300111 (0x006E) | " "    |
| Model name: 7         | 300112 (0x006F) | " "    |
| Model name: 8         | 300113 (0x0070) | " "    |
| Model name: 9         | 300114 (0x0071) | " "    |
| Model name: 10        | 300115 (0x0072) | " "    |

### 5.2.2. The Number of Modules

| Data                                           | Register        | Value |
|------------------------------------------------|-----------------|-------|
| The number of modules connected to the coupler | 300126 (0x007D) |       |

### 5.2.3. The Configuration Information of the Modbus/RTU

| Data                | Register        | Value                                                                                                                                                                                                  |
|---------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Coupler's Baud rate | 301030 (0x0405) | <ul style="list-style-type: none"><li>• 0: 2400 bps</li><li>• 1: 4800 bps</li><li>• 2: 9600 bps</li><li>• 3: 19200 bps</li><li>• 4: 38400 bps</li><li>• 5: 57600 bps</li><li>• 6: 115200 bps</li></ul> |
| Parity bit          | 301031 (0x0406) | <ul style="list-style-type: none"><li>• 0: None</li><li>• 1: Odd</li><li>• 2: Even</li></ul>                                                                                                           |
| Stop bit            | 301032 (0x0407) | <ul style="list-style-type: none"><li>• 1: 1-bit</li><li>• 2: 2-bit</li></ul>                                                                                                                          |

### 5.2.4. The Input Data

| Data                           | Register                            | Value |
|--------------------------------|-------------------------------------|-------|
| The data from the input module | 302001 to 302256 (0x07D0 to 0x08CF) |       |



For more information on the address of the input module, refer to the AddressMap in the DAQMaster.

### 5.3. 03 (0x03) Read Holding Register (4x)

It reads the output data of the holding register in the coupler.

#### 5.3.1. The Configuration Information of the Modbus/RTU

| Data                | Register        | Value                                                                                                                                                                                                  |
|---------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Coupler's Baud rate | 401030 (0x0405) | <ul style="list-style-type: none"><li>• 0: 2400 bps</li><li>• 1: 4800 bps</li><li>• 2: 9600 bps</li><li>• 3: 19200 bps</li><li>• 4: 38400 bps</li><li>• 5: 57600 bps</li><li>• 6: 115200 bps</li></ul> |
| Parity bit          | 401031 (0x0406) | <ul style="list-style-type: none"><li>• 0: None</li><li>• 1: Odd</li><li>• 2: Even</li></ul>                                                                                                           |
| Stop bit            | 401032 (0x0407) | <ul style="list-style-type: none"><li>• 1: 1-bit</li><li>• 2: 2-bit</li></ul>                                                                                                                          |

#### 5.3.2. Read the Output Data

| Data                            | Register                            | Value |
|---------------------------------|-------------------------------------|-------|
| The data from the output module | 402001 to 402256 (0x07D0 to 0x08CF) |       |



For more information on the address of the output module, refer to the AddressMap in the DAQMaster.

# 5.4. 05 (0x05) Write Single Coils (0x)

## 5.4.1. Write the Output Data

| Data                            | Register                            | Value |
|---------------------------------|-------------------------------------|-------|
| The data from the output module | 002001 to 002256 (0x07D0 to 0x08CF) |       |



For more information on the address of the output module, refer to the AddressMap in the DAQMaster.

# 5.5. 06 (0x06) Write Single Register / 16 (0x10) Write Multiple Registers (4x)

- **06 (0x06) Write Single Register**  
: It writes the single value with a size of 1 word (16-bit) to the holding register in the coupler.
- **16 (0x10) Write Multiple Registers**  
: It writes the multiple values with a size of 1 word (16-bit) to the holding register in the coupler.

## 5.5.1. Write the Modbus/RTU Settings

| Data                | Register        | Value                                                                                                                                                                                                  |
|---------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Coupler's Baud rate | 401030 (0x0405) | <ul style="list-style-type: none"><li>• 0: 2400 bps</li><li>• 1: 4800 bps</li><li>• 2: 9600 bps</li><li>• 3: 19200 bps</li><li>• 4: 38400 bps</li><li>• 5: 57600 bps</li><li>• 6: 115200 bps</li></ul> |
| Parity bit          | 401031 (0x0406) | <ul style="list-style-type: none"><li>• 0: None</li><li>• 1: Odd</li><li>• 2: Even</li></ul>                                                                                                           |
| Stop bit            | 401032 (0x0407) | <ul style="list-style-type: none"><li>• 1: 1-bit</li><li>• 2: 2-bit</li></ul>                                                                                                                          |

### 5.5.2. Write the Output Data

| Data                            | Register                            | Value |
|---------------------------------|-------------------------------------|-------|
| The data from the output module | 402001 to 402256 (0x07D0 to 0x08CF) |       |



For more information on the address of the output module, refer to the AddressMap in the DAQMaster.

# 6. Configure the Modbus/RTU

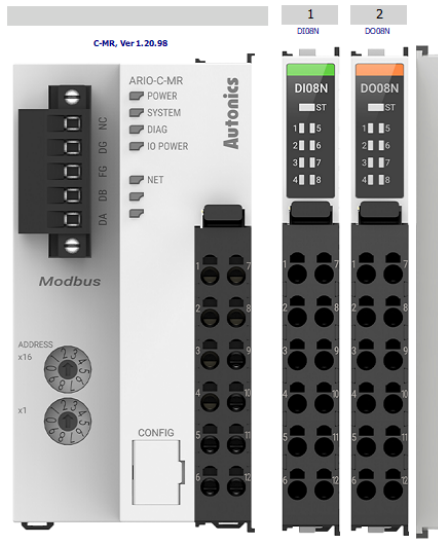


If the coupler's software (firmware) requires an update, refer to the DAQMaster user manual to update it to the latest version.

## 6.1. Before You Begin

Firstly, this chapter describes how to configure Modbus/RTU communication under the connection of the DAQMaster and the communication connector of the coupler. After that, writing the output signals on channels 1 and 2 of the digital output module, reading the input signals of the digital input module, and monitoring the data in these modules are given in this chapter.

### Configuration of the ARIO Unit



Settings of the ARIO Coupler

- Node address of the coupler: 1  
Set the positions of Hexadecimal Rotary Switches to 0x01.
- Connection Timeout setting: Supported



Connection Timeout function:

This function sets the maximum waiting time for a response in communication between the client and the server. If the Modbus connection is lost, after the set time elapses, the NET LED on the coupler will flash to indicate the disconnection state.

Setting method:

To enter the desired value in the DAQMaster, go to **communication mode »**

**Properties tab of coupler » Connect Timeout.**

- Unit: ms

- Fault Action setting: HOLD  
To select the HOLD in the DAQMaster, go to **communication mode » Properties tab of coupler » Fault Action Mode.**





### Fault Action function:

In the event of a field communication disruption, the output status of the expansion output module is automatically switched to a predefined value.

### Setting range:

SET / RESET / HOLD

| Setting | Digital output model                                                                      | Analog output model                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SET     | All outputs of the module are switched to ON.                                             | The default voltage/current setting is switched to the maximum value within the rated voltage/current range.<br>(Ex. If the voltage range is $\pm 10 V_{DC}$ , then upon SET operation, $10 V_{DC}$ is applied.)                                                                                                                                                                                                         |
| RESET   | All outputs of the module are switched to OFF.                                            | <b>Voltage output model:</b><br>The default voltage setting is switched to $0 V_{DC}$ .<br>(Ex. If the voltage range is $\pm 10 V_{DC}$ , then upon RESET operation, $0 V_{DC}$ is applied.)<br><br><b>Current output model:</b><br>The default current setting is applied as the minimum value within the rated current range.<br>(Ex. If the current range is 4 to 20 mA, then upon RESET operation, 4 mA is applied.) |
| HOLD    | The module's output status is maintained as it was prior to the communication disruption. | The module's output status is maintained as it was prior to the communication disruption.                                                                                                                                                                                                                                                                                                                                |

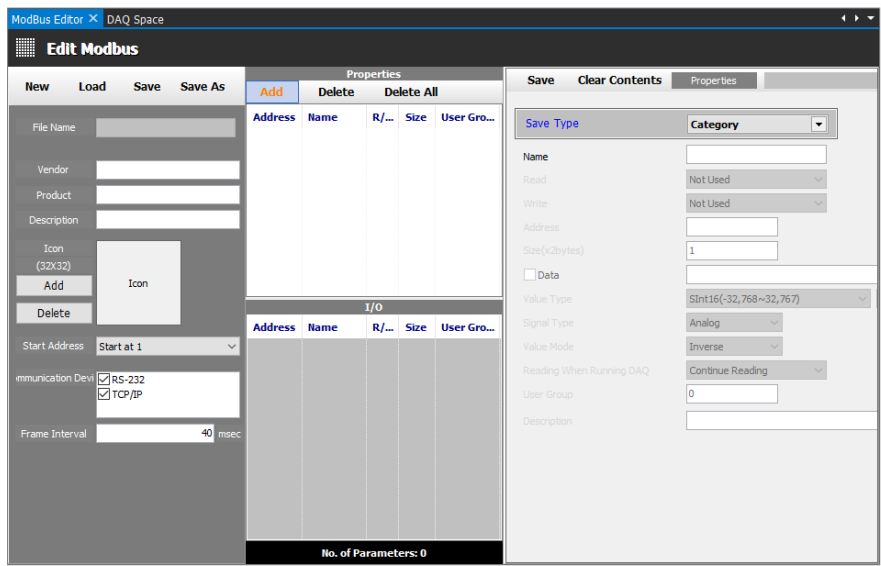


This chapter only describes based on our software, DAQMaster.

For detailed information on communication connection and usage method with the master, refer to the user manuals provided by the specific manufacturer.

# 6.2. Add Registers

- 1. Connect the communication connector on the ARIO-C-MR to the PC where the DAQMaster is installed.
- 2. Select **Tool » Edit ModBus Device** on the top menu of the DAQMaster.
- 3. Select **ModBus Editor » Properties » Add**.



4. Set a register for reading and writing the module data as below and select the **OK**.

- Auto Add Multiple
- Save Type: I/O
- Name: Desired name (The name was similarly designated to Function Code in this chapter.)
- Read: 03 or 04
- Write: 06
- Start Address: 2001 (based on the PC)
- Value Type: UInt16 (0 to 65535)
- Signal Type: Analog fixed
- Value Mode: Normal
- Reading When Run DAQMaster: Continue Reading
- Others: Fixed values

### Example of the registers

The image shows two side-by-side "Add" dialog boxes for configuring registers. Both dialogs have "Auto Add Multiple" selected and "Save Type" set to "I/O".

**Left Dialog (03 Read 1):**

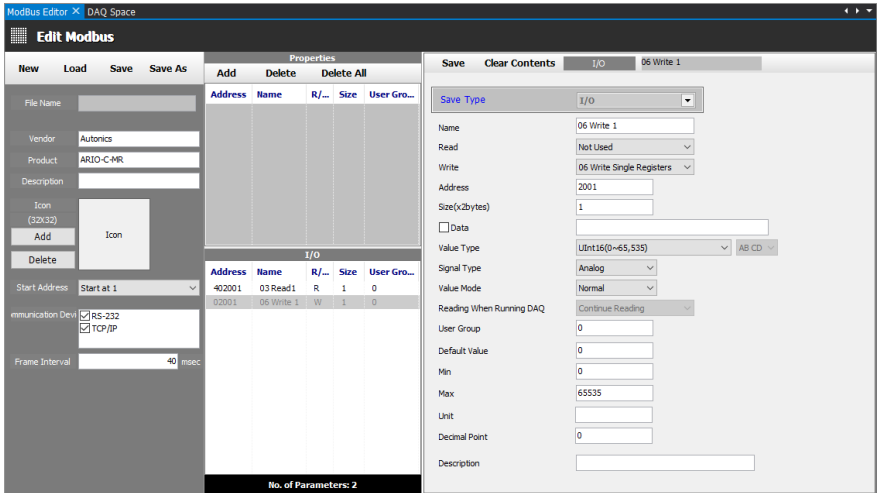
- Name: 03 Read 1
- Read: 03 Read Holding Registers
- Write: Not Used
- Start Address: 2001
- Value Type: UInt16(0~65,535)
- Signal Type: Analog
- Value Mode: Normal
- Reading When Run: Continue Reading
- Start Address: 1
- Add Num: 1
- User Group: 0

**Right Dialog (06 Write 1):**

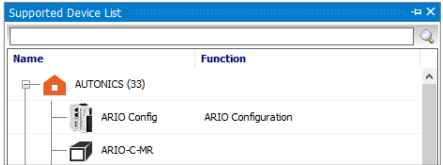
- Name: 06 Write 1
- Read: Not Used
- Write: 06 Write Single Registers
- Start Address: 2001
- Value Type: UInt16(0~65,535)
- Signal Type: Analog
- Value Mode: Normal
- Reading When Run: Continue Reading
- Start Address: 1
- Add Num: 1
- User Group: 0

5. Enter the information about Vendor and Product at the left side of the ModBus Editor and select **Save** to save the register in your PC.

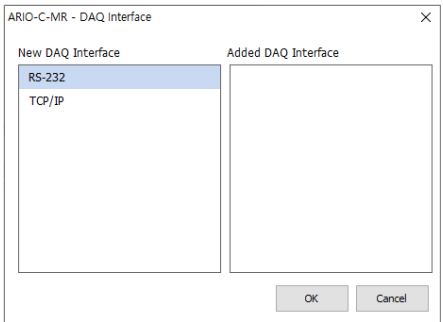
- Vendor: Desired vendor name (e.g., Autonics)
- Product: Desired product name (e.g., ARIO-C-MR)
- Start Address: Start at 1
- Communication Device: Both RS-232 and TCP/IP selected
- Frame cycle: 40 fixed
- Others: Optional



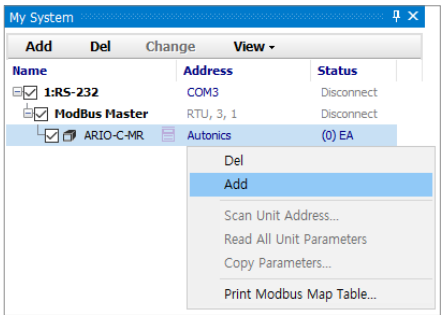
6. Right-click on the **Supported Device List** » **AUTONICS** and select **Refresh**.  
Proceed to Device Search.
7. Double-click on the **Supported Device List** » **AUTONICS** » **ARIO-C-MR**.



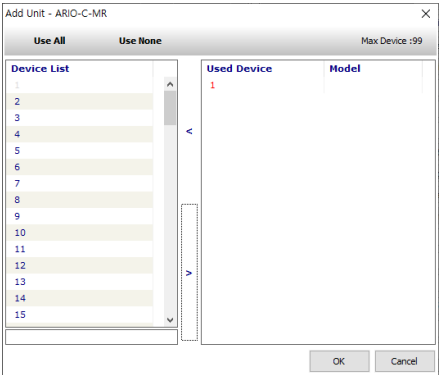
8. Select the **RS-232** on the DAQ Interface window and click the **OK**.



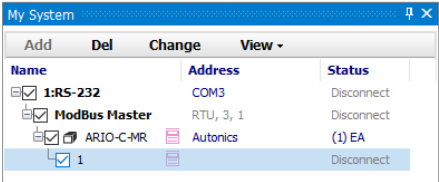
9. Right-click on the **My System** » **RS-232** » **ARIO-C-MR** and select the **Add**.  
(If necessary, you can change the communication settings in the property window on the right side of the screen when the RS-232 is selected.)



10. Select the node address of coupler at the Device List and click **>** to add it to the Used Device on the right side of the window. Click the **OK** to add the coupler.

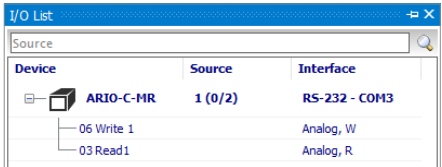


11. The coupler is added to My System as shown below.



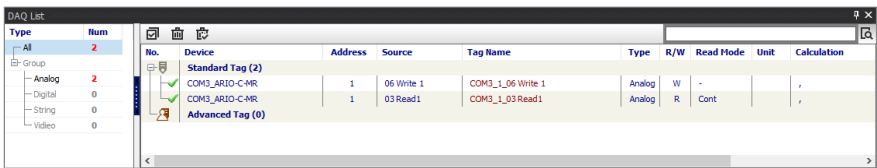
### 6.3. Add Tags

1. When selecting the **I/O List » ARIO-C-MR**, the I/O registers added on the ModBus Editor are displayed. Select the register to use, right-click and select the **Add to DAQ list**.



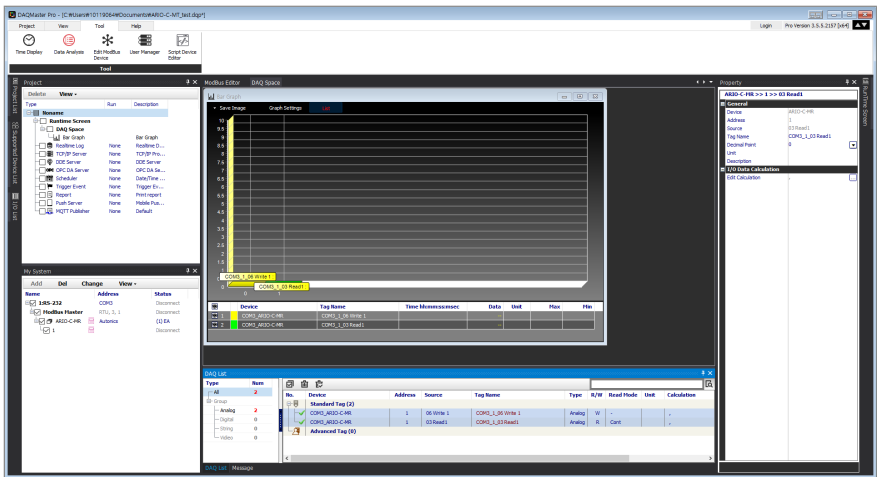
| Device     | Source  | Interface     |
|------------|---------|---------------|
| ARIO-C-MR  | 1 (0/2) | RS-232 - COM3 |
| 06 Write 1 |         | Analog, W     |
| 03 Read1   |         | Analog, R     |

2. The tags are added to the DAQ List window as shown below.



| No.                     | Device         | Address | Source     | Tag Name          | Type   | R/W | Read Mode | Unit | Calculation |
|-------------------------|----------------|---------|------------|-------------------|--------|-----|-----------|------|-------------|
| <b>Standard Tag (2)</b> |                |         |            |                   |        |     |           |      |             |
| 1                       | COM3_ARIO-C-MR | 1       | 06 Write 1 | COM3_1_06 Write 1 | Analog | W   | -         |      |             |
| <b>Advanced Tag (0)</b> |                |         |            |                   |        |     |           |      |             |
| 1                       | COM3_ARIO-C-MR | 1       | 03 Read1   | COM3_1_03 Read1   | Analog | R   | Cont      |      |             |

3. Double-click on the **RunTime Screen » Data » (e.g.) Bar Graph** to configure the visualized monitoring screen. Drag and drop the tags added on the DAQ List window to the bar graph on the DAQ Space window.



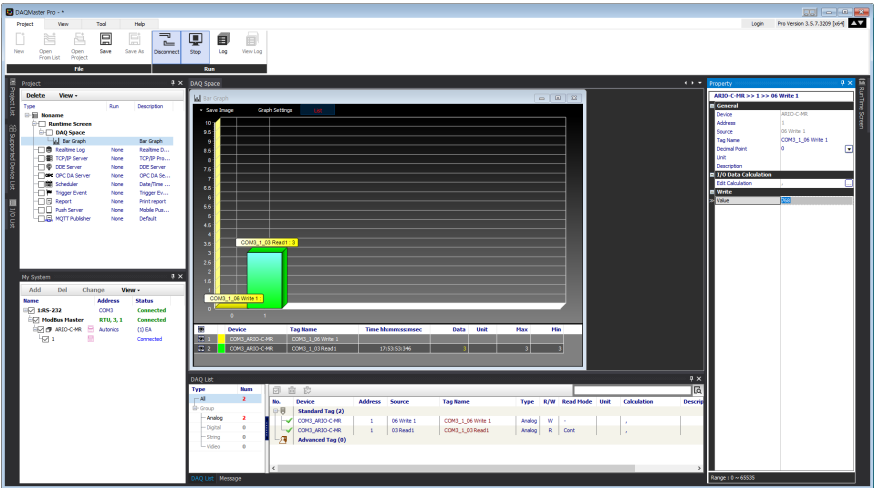
The screenshot shows the DAQMaster Pro software interface. The main window is divided into several panes. On the left, there is a 'Project' pane showing the 'RunTime Screen' and 'Data' sections. The 'Data' section is expanded, showing a list of tags. The 'DAQ List' pane at the bottom shows the tags added to the DAQ list. The 'Bar Graph' tag is selected, and its configuration is shown in the 'Tag Properties' pane on the right. The 'Tag Properties' pane shows the tag name 'COM3\_1\_03 Read1' and the device 'COM3\_ARIO-C-MR'. The 'Tag Properties' pane also shows the tag's address, source, and interface. The 'Tag Properties' pane also shows the tag's type, R/W, Read Mode, Unit, and Calculation. The 'Tag Properties' pane also shows the tag's status and description.

4. Select the **Project » Connect » Run**. Then the green LED lights up on the NET indicator of the coupler. Check the connection status on the My System as shown below.

| Name                                              | Address   | Status    |
|---------------------------------------------------|-----------|-----------|
| <input checked="" type="checkbox"/> 1:RS-232      | COM3      | Connected |
| <input checked="" type="checkbox"/> ModBus Master | RTU, 3, 1 | Connected |
| <input checked="" type="checkbox"/> ARIQ-C-MR     | Autonics  | (1) EA    |
| <input checked="" type="checkbox"/> 1             |           | Connected |

## 6.4. Monitor the Data

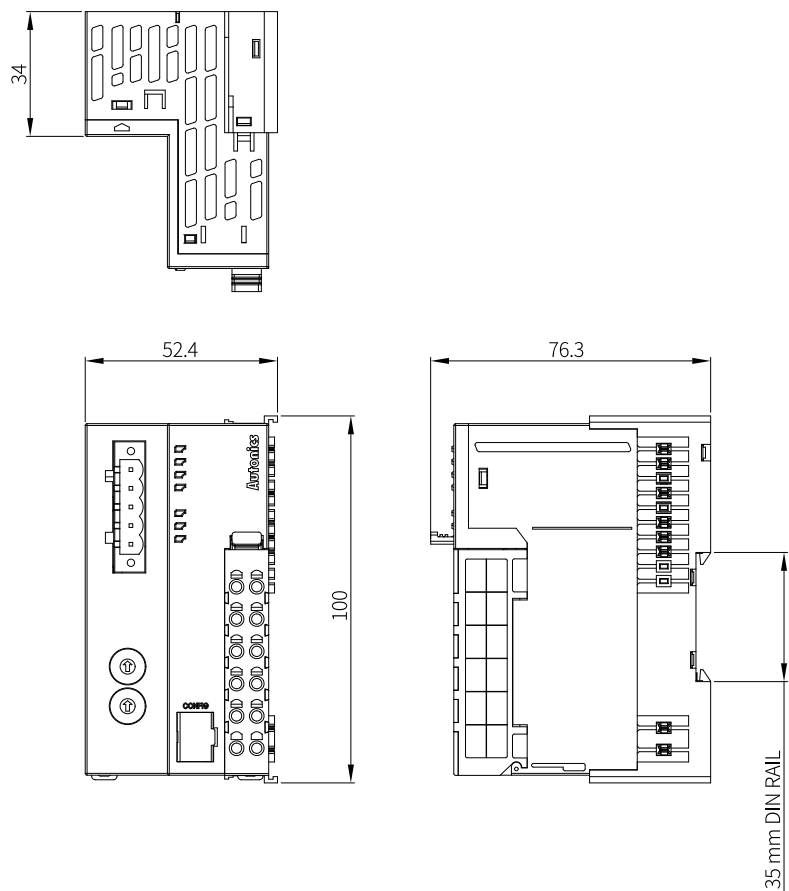
1. Select the tag **06 Write** on the DAQ List window to give output signals on channels 1 and 2 of the digital output module.
2. Enter **768** at the **Property » Write » Value** on the right side of the screen and press the Enter key.  
You can see that the green LEDs light up on channel indicators 1 and 2 of the digital output module.  
※ **768<sub>dec</sub> = Binary 0000 0011 0000 0000**
3. You can see the input data from the tag **03 Read** on the Bar Graph window.



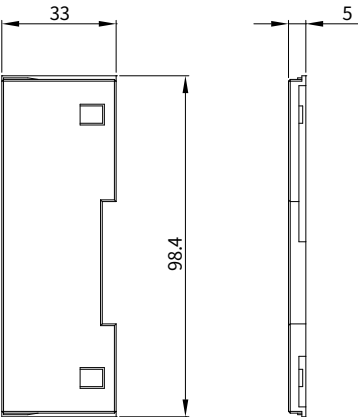
# 7. Dimensions

- For the detailed drawings, follow the Autonics website.
- Unit: mm

## Coupler



**End module**



# 8. Specifications

## 8.1. Electrical/Mechanical Specifications

|                           |                                                                                                                                                                                                                                                                                                                            |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Protection circuit        | Reverse field and supply power protection circuit                                                                                                                                                                                                                                                                          |
| Power supply              | <ul style="list-style-type: none"><li>• Unit (coupler + module): <math>\leq 9.6\text{ W}</math>, <math>\leq 400\text{ mA}</math> (<math>\leq 200\text{ mA/CH}</math>, 2-CH/COM)</li><li>• I/O: <math>\leq 96\text{ W}</math>, <math>\leq 4,000\text{ mA}</math> (<math>\leq 2,000\text{ mA/CH}</math>, 2-CH/COM)</li></ul> |
| Supply voltage            | <ul style="list-style-type: none"><li>• Coupler input voltage: <math>24\text{ V}_{\text{DC}}</math></li><li>• ABUS supply voltage: <math>5\text{ V}_{\text{DC}}</math>, <math>\leq 960\text{ mA}</math></li><li>• I/O supply voltage: <math>24\text{ V}_{\text{DC}}</math></li></ul>                                       |
| Current consumption       | <ul style="list-style-type: none"><li>• The standby and run mode: <math>200\text{ mA}</math></li><li>• The maximum load: <math>400\text{ mA}</math> (at coupler max. load)</li></ul>                                                                                                                                       |
| Comm. connector           | 5-pin PCB connector                                                                                                                                                                                                                                                                                                        |
| CONFIG port               | USB 2.0 type Micro B                                                                                                                                                                                                                                                                                                       |
| Installation method       | DIN rail mounting                                                                                                                                                                                                                                                                                                          |
| Material                  | Terminal: PBT, Body: PC, Base: PA6, POM                                                                                                                                                                                                                                                                                    |
| Unit weight<br>(packaged) | $\approx 165\text{ g}$<br>( $\approx 265\text{ g}$ )                                                                                                                                                                                                                                                                       |

## 8.2. Environmental Conditions

|                            |                                                                                                      |
|----------------------------|------------------------------------------------------------------------------------------------------|
| Insulation resistance      | $\geq 100\text{ M}\Omega$ (500 V <sub>DC</sub> megger)                                               |
| Dielectric strength        | Between the charging part and the case: 1000 V <sub>AC</sub> 50 / 60 Hz for 1 minute                 |
| Noise immunity             | $\pm 500\text{ V}_{DC}$ the square wave noise (pulse width: 1 $\mu\text{s}$ ) by the noise simulator |
| Vibration                  | 0.7 mm double amplitude at frequency of 10 to 55 Hz<br>in each X, Y, Z direction for 1 hour          |
| Vibration<br>(malfunction) | 0.5 mm double amplitude at frequency of 10 to 55 Hz<br>in each X, Y, Z direction for 10 minutes      |
| Shock                      | 300 m/s <sup>2</sup> ( $\approx 30\text{ G}$ ) in each X, Y, Z direction for 3 times                 |
| Shock (malfunction)        | 100 m/s <sup>2</sup> ( $\approx 10\text{ G}$ ) in each X, Y, Z direction for 3 times                 |
| Ambient temperature        | -10 to 55 °C, storage: -25 to 70 °C (no freezing or condensation)                                    |
| Ambient humidity           | 35 to 85 %RH, storage: 35 to 85 %RH (no freezing or condensation)                                    |
| Protection rating          | IP20 (IEC standard)                                                                                  |

## 8.3. Certification

|               |                              |
|---------------|------------------------------|
| Certification | CE, UKCA, UL Listed, KC, EAC |
|---------------|------------------------------|

# 9. Communication Interface

## 9.1. RS-485

|                                    |                                                                                         |
|------------------------------------|-----------------------------------------------------------------------------------------|
| Comm. standard                     | EIA RS-485 compliant                                                                    |
| Synchronous method                 | Asynchronous                                                                            |
| Comm. method                       | 2-wire Half-Duplex                                                                      |
| Memory size                        | • Input: 256-byte<br>• Output: 256-byte                                                 |
| Max. number of connectable modules | ≤ 32 (The length of connected modules: ≤ 384 mm)                                        |
| Baud rates                         | 2400 / 4800 / 9600 (factory setting) / 19200 / 38400 / 57600 / 115200 bps               |
| Cable spec.                        | The cable approved by the Modbus Organization<br>or meets at least EIA RS-485 compliant |
| Cable length                       | ≤ 1000 m                                                                                |
| Protocol                           | Modbus/RTU compatible                                                                   |
| The number of nodes                | ≤ 255 (a single segment: ≤ 32)                                                          |
| Node address settings              | Hexadecimal rotary switches, DAQMaster                                                  |
| Comm. timeout                      | 1000 ms                                                                                 |
| Start bit                          | -                                                                                       |
| Data bit                           | -                                                                                       |
| Parity bit                         | None (factory setting), Even, Odd                                                       |
| Stop bit                           | 1-bit, 2-bit (factory setting)                                                          |
| Topology                           | Bus, Trunk, Drop Line, Daisy Chain                                                      |

## 9.2. ABUS

|                   |                |
|-------------------|----------------|
| Transmission rate | 4 Mbps         |
| Topology          | Bus, Drop Line |

# Autonics

Dimensions or specifications on this manual are subject to change and some models may be discontinued without notice.

[www.autonics.com](http://www.autonics.com)