

# Coupler manual

Field Network Devices

## **ARIO-C-MR** **(ModbusRTU compatible)**

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.



# Preface

Thank you for purchasing Autonics product.





Please familiarize yourself with the information contained **in the Safety Considerations section** before using this 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.

# Coupler Manual Guide


- Please familiarize yourself with the information in this manual before using the product.
- This manual provides detailed information on the product's features. It does not offer any guarantee concerning matters beyond the scope of this manual.
- This manual may not be edited or reproduced in either part or whole without permission.
- This manual is not provided as part of the product package.  
Please visit our website ([www.autonics.com](http://www.autonics.com)) to download a copy.
- The manual's content may vary depending on changes to the product's software and other unforeseen developments within Autonics, and is subject to change without prior notice.  
Upgrade notice is provided through our homepage.
- We contrived to describe this manual more easily and correctly. However, if there are any corrections or questions, please notify us these on our website.


# Coupler Manual Symbols

Symbol	Description
 <b>Note</b>	Supplementary information for a particular feature.
 <b>Warning</b>	Failure to follow instructions can result in serious injury or death.
 <b>Caution</b>	Failure to follow instructions can lead to a minor injury or product damage.
 <b>Ex.</b>	An example of the concerned feature's use.
※1	Annotation mark.

# Safety Considerations

- Please observe all safety considerations for safe and proper product operation to avoid hazards.
- Safety considerations consist of 'warning' and 'caution'. The following symbols represent caution due to particular circumstances in which hazards may occur.

 <b>Warning</b>	<b>Warning</b>	Failure to follow instructions can result in serious injury or death.
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 <b>Caution</b>	<b>Caution</b>	Failure to follow instructions can lead to a minor injury or product damage.
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## Warning

- 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, economic loss or fire.
- 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.
- Do not disassemble or modify the unit.  
Failure to follow this instruction may result in fire.
- Do not connect, repair, or inspect the unit while connected to a power source.  
Failure to follow this instruction may result in fire.
- Check 'Connections' before wiring.  
Failure to follow this instruction may result in fire.



## Caution

- Use the unit within the rated specifications.  
Failure to follow this instruction may result in fire or shortening the life cycle of the product.
  - Use a 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.
  - When connecting the power input and I/O wiring, use AWG 22~16 cable.  
After checking the connecting and removing the wire, use the crimp terminal.  
Failure to follow this instruction may result in fire or malfunction due to contact failure.
  - 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.
  - Do not cut off power or disconnect connectors (or terminals) while operating the unit.  
Failure to follow this instruction may result in fire or product damage.
- ※ **The specifications and dimensions of this manual are subject to change without any notice**

# Caution during Use

- Follow instructions in 'Caution during Use'. Otherwise, it may cause unexpected accidents.
- ABUS power and I/O power should be insulated by the individually insulated power device.
- Power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Use the rated standard cables and connectors. Do not apply excessive power when connecting or disconnecting the connectors of the product.
- 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 the stable operation, use shield wire and ferrite core, when wiring communication wire, power wire, or signal wire.
- Do not use near the equipment which generates strong magnetic force or high frequency noise.
- Do not touch the module communication connector part of the base.
- 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.
- This unit may be used in the following environments.
  - ① Indoors
  - ② Altitude max. 2,000m
  - ③ Pollution degree 2
  - ④ Installation category II

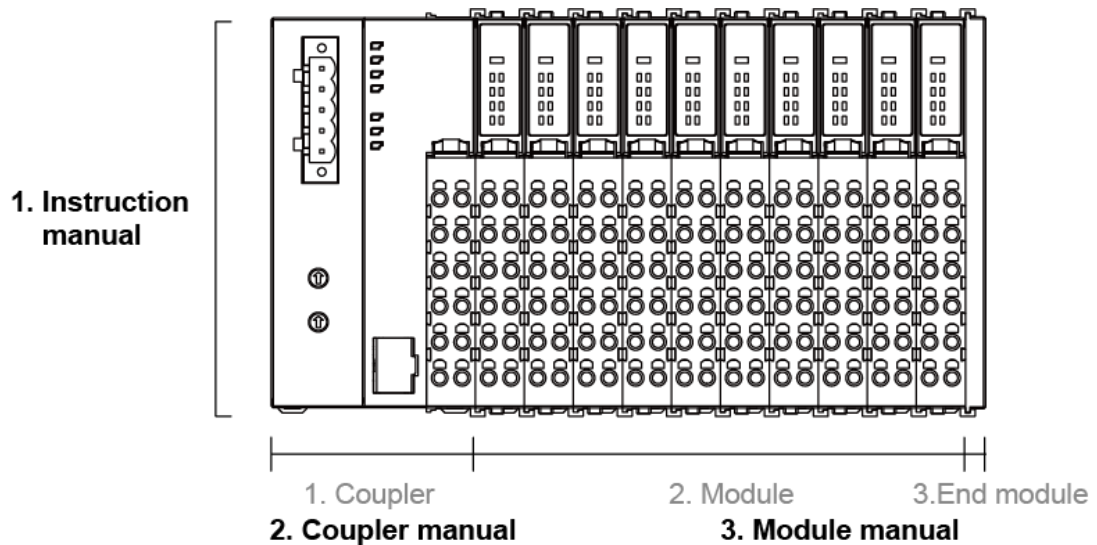
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# 1 Reference manuals



## 1.1 Instruction manual

It describes an overview of Remote I/O, definitions of terms, installation environment, mounting/removing method, wiring and troubleshooting.

## 1.2 Coupler manual

It describes the overview, specification, dimensions, memory map and troubleshooting of each communication.

## 1.3 Module manual

It describes the dimensions, specification, connections and diagnosis function of each module.

## 1.4 DAQMaster user manual

DAQMaster, a device integration management program, provides the expanded user convenience. You can use the module setting, real-time control, and monitoring/diagnosis function of input/output signal (except ARIO-C-PN and ARIO-C-PB). Also, you can arrange products through virtual mode and recommended sorting.

## 2 Protocol overview

### 2.1 Modbus RTU

Modbus RTU, a Fieldbus network, is a serial communication protocol designed for use with programmable logic controllers (PLCs). Simple and robust, Modbus RTU is the de facto standard communication protocol and a means for connecting industrial electronics.

ARIO-C-MR, Modbus RTU-based coupler, synchronizes the data of all connected I / O modules with Modbus RTU. The coupler determines the physical structure of the node and automatically creates a local process image of all the I / O. It also includes a mixed arrangement of analog (word) and digital (byte) modules.

The process image is divided into input and output data areas.

### 2.2 Basic memory map of field network

The memory map is based on the addressing system of Autonics.

#### 2.2.1 Data Register Summary

Address		Type	Description	Initial Value
Function	Register			
04	0101~0114	R	Read the product data	
04	1024~0126	R	Read the product state data	
04	1034~1087	R	Read the product settings	
04	2001~2256	R	Read the input data	
04	2513~xxxx	R	Read the diagnostic data	
03/06/16	1034~1087	R/W	Read and write the product settings	
03	2001~2256	R	Read the output data	
06/16	2001~2256	W	Write the output data	

#### 2.2.2 Data Register

Accessible data register area via the input register and holding register

Address		Type	Description	Initial Value
Function	Register			
04	2001~2256	R	Input Data	
03/06/16	2001~2256	R/W	Output Data	
04	2513~xxxx	R	Diagnostic Data	

The minimum data size is treated as 1 byte unit based on the module information.

### 2.2.3 Input Register

Access to the coupler information via the input register.

Address		Type	Description	Initial Value
Function	Register			
04	0101	R	Product no.H	
04	0102	R	Product no.L	
04	0103	R	Hardware version. (0.1 units : 10 -> 1.0)	10
04	0104	R	Software version. (0.1 units : 10 -> 1.0)	10
04	0105	R	Model name1	"AR"
04	0106	R	Model name2	"IO"
04	0107	R	Model name3	"-C"
04	0108	R	Model name4	"-M"
04	0109	R	Model name5	"R "
04	0110	R	Model name6	" "
04	0111	R	Model name7	" "
04	0112	R	Model name8	" "
04	0113	R	Model name9	" "
04	0114	R	Model name10	" "

Address		Type	Description	Initial Value
Function	Register			
04	1024	R	ABUS Error state - 0: No Error - 1: No Extension Module - 2: Error Initialize - 3: Error of Extension Module	
04	0126	R	The number of connected modules	

Address		Type	Description	Initial Value
Function	Register			
04	1030	R	Baudrate - 0: 2.4 kbps - 1: 4.8 kbps - 2: 9.6 kbps - 3: 19.2 kbps - 4: 38.4 kbps - 5: 57.6 kbps - 6: 115.2 kbps	2

Address		Type	Description	Initial Value
Function	Register			
04	1031	R	Parity bit - 0: None - 1: Even - 2: Odd	0
04	1032	R	Stop bit (1, 2)	2


## 2.2.4 Holding Register

Access to the coupler information via the holding register.

Address		Type	Description	Initial Value
Function	Register			
03/06/16	1030	R/W	Baudrate - 0: 2.4 kbps - 1: 4.8 kbps - 2: 9.6 kbps - 3: 19.2 kbps - 4: 38.4 kbps - 5: 57.6 kbps - 6: 115.2 kbps	2
03/06/16	1031	R/W	Parity bit - 0: None - 1: Even - 2: Odd	0
03/06/16	1032	R/W	Stop bit (1, 2)	2

### 3 Specifications

Model name		ARIO-C-MR
Coupler type		ModbusRTU
Power supply※1	ABUS(external consump.)	24VDC $\overline{=}$ , max. 400mA (Max. 9.6W, Coupler+Module, max. 200mA/CH, 2CH/COM)
	ABUS(internal supply)	5VDC $\overline{=}$ , max. 960mA (max. 4.8W, module)
	I/O	24VDC $\overline{=}$ , max. 4,000mA (max. 96W, max. 2,000mA/CH, 2CH/COM)
Power consumption	Coupler	24VDC $\overline{=}$ standby/run: 200mA, Max. load: 400mA (coupler max. load)
Internal communication	Protocol	ABUS protocol
	Transmission speed	4Mbps only
Memory※2	Input	256 byte
	Output	256 byte
Max. connections for modules ※2		32 units (max. length is up to 384mm)
Higher-level protocols	Transfer rate	Max. 115.2kbps
	Distance between Nodes	Max. 1000m
	Communication connector	5 pin PCB connector
	Concurrent connection of Node	Max. 255 Nodes (32 nodes in a single segment)
	Node setting	Rotary switch for communication setting in ARIO (Station no.)
	Topology	Bus, Trunk, Drop Line, Daisy Chain
Installation method		DIN rail mounting
Setting and monitoring		PC connection with USB 2.0 Micro type connector (comprehensive device management program, DAQMaster)

Model name		ARIO-C-MR
Insulation resistance		Over 100MΩ (at 500VDC= megger)
Dielectric strength		1000VAC 50/60Hz for 1 min
Noise immunity		±500V the square wave noise (pulse width: 1 μs) by the noise simulator
Vibration	Mechanical	0.7mm amplified at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 1 hour
	Malfunction	0.5mm amplified at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 min.
Shock	Mechanical	300m/s <sup>2</sup> (approx. 30G) in each X, Y, Z direction for 3 times.
	Malfunction	100m/s <sup>2</sup> (approx. 10G) in each X, Y, Z direction for 3 times.
Environment	Ambient temp.	-10 to 55°C, storage: -25 to 70°C
	Ambient humi.	35 to 85%RH, storage: 35~85%RH
Protection structure※3		IP20 (IEC standards)
Material		Terminal: polyamide6, Body: modified polyphenylene oxide, Base: polyamide6, poly oxy methylene
Approval		
Weight※4		Approx. 265g (approx. 165g)

※1. It is including power/special modules and excluding coupler/end modules. In case of one coupler module connecting, the ARIO digital module is available to connect up to 8 units, and the ARIO analog and special modules are available to connect up to 4 units. For connecting the modules, consider power consumption of the sensors and drivers connected the ARIO coupler.

※2. If it over the limit size or connected units, system may be error.

※3. Autonics test standard

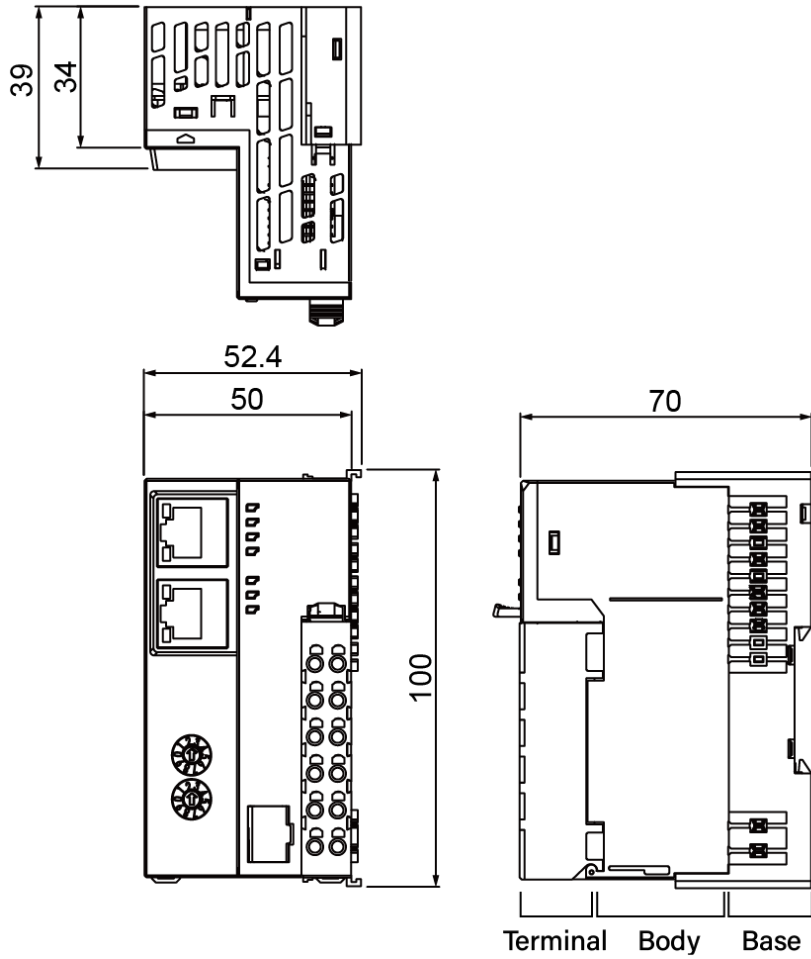
※4. The weight includes packaging. The weight in parenthesis is for unit only.

※ Environment resistance is rated at no freezing or condensation.

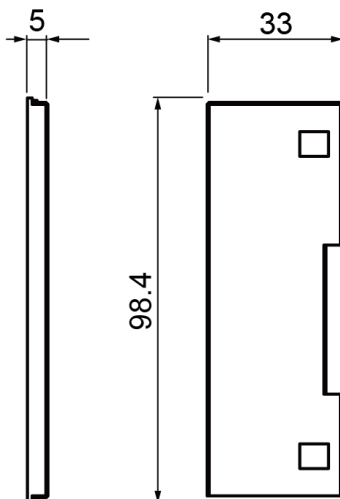
## 4 Hardware

### 4.1 Dimensions

#### (1) Coupler

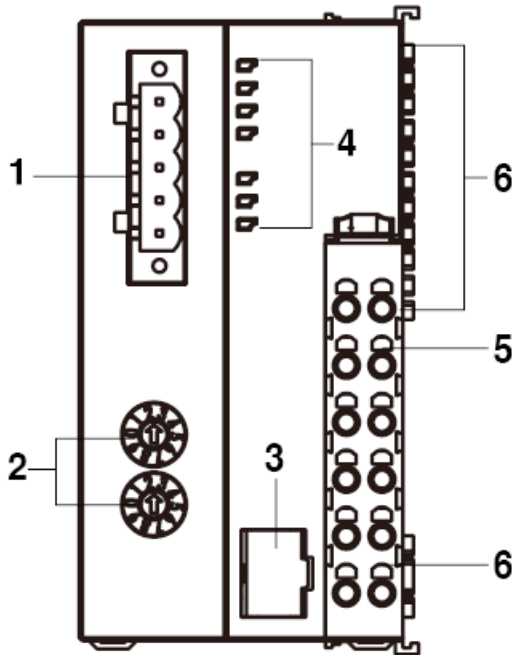


#### (2) End module





## 4.2 Unit descriptions



1. Communication connector: 5 pin PCB connector  
: You can use a universal 5 pin PCB connector and cable, but we recommend using connectors and cables that are certified by the MODBUS (Modbus RTU Association).
2. Communication setting switch (station no: X16, X1)
3. Setting connector (USB 2.0 type Micro B)  
: You can connect DAQMaster to configure and monitor.
4. Indicators for power and comm. status  
4-1 Internal / external state of coupler: Displays the input power / operation state of the coupler.  
4-2 State of Field network: Displays the operation of the field network.

5. Power terminal block

24VDC+	24VDC+
GND	GND
—	—
POS	POS
NEG	NEG
F.G.	F.G.

6. ABUS comm. connector: Input terminal that supplies circuit driving power of the coupler, ABUS, and modul by receiving 24VDC.

I/O power supply : Supplies power for input / output signal of module by receiving DC, AC, etc.



## 4.3 Rotary switch for communication setting

### 4.3.1 Transfer rate

You can change the data rate using a USB and Modbus via the dedicated software.

Data rate	Setting value
2.4kbps	0
4.8kbps	1
9.6kbps	2 (default)
19.2kbps	3
38.4kbps	4
57.6kbps	5
115.2kbps	6

### 4.3.2 Switch for station no.

Switch	Description	
	Station no.: X16	Use to distinguish the order (name) of couplers. Range: 01 to 255
	Station no.: X1	

The rotary switch cannot be changed while the power is operating. To apply the changed rotary switch, the coupler must be turned on again. However, it is available up to 32 nodes in a single segment.

## 4.4 Status indicator

### (1) Definition

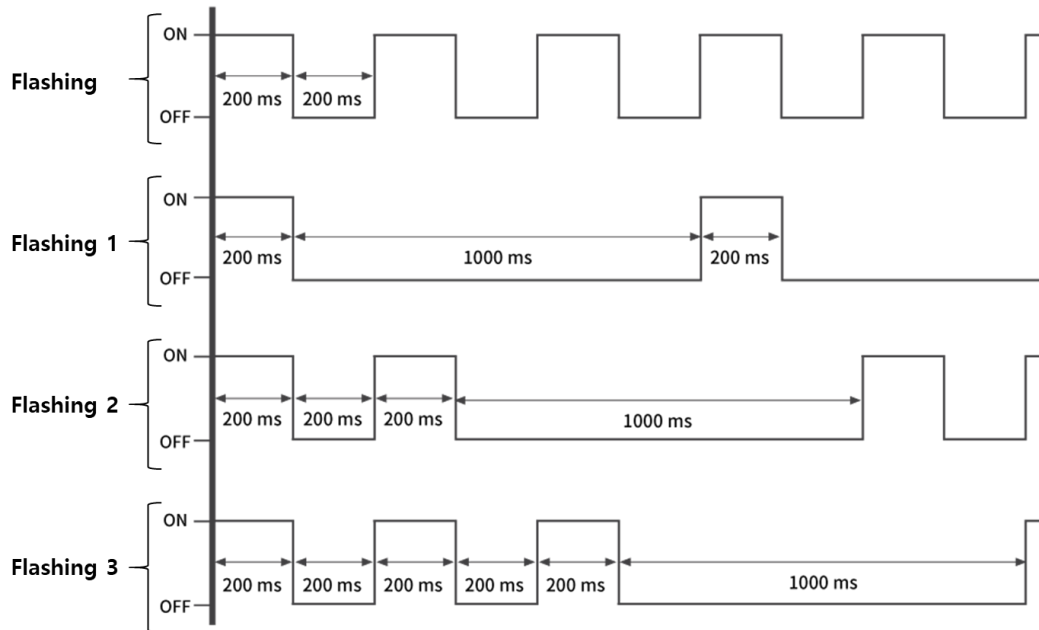
Indicator	Color	ON	OFF
POWER	Green	The power voltage of coupler is connected. (supply 24VDC)	No power supply
SYSTEM	Green	Normal operation (device on online state, communicating with master)	Stop operation
	Red	Failure to initialize coupler (recovery failed) Recovery error during the coupler operation (recovery failed) Difference between field network type and firmware version (recovery failed)	Normal operation
DIAG	Green	Normal operation (Multi Packet and Single Packet are operating)	Stop operation of coupler or in error condition.
	Red	Internal network (ABUS) inoperable state	Normal operation
IO POWER	Green	The I/O power voltage of coupler is connected. (supply 24VDC)	No power supply

### (2) Status

Indicator	Color	Flashing	Flashing 1	Flashing 2	Flashing 3	Flashing 4
POWER	Green	—	—	—	—	—
SYSTEM	Green	Wait for connecting the master after coupler initialization completes	—	—	—	—
	Red	Change during Initializing coupler or rotary switch operation Field network initialization failed (recovery failed)	—	—	—	—
DIAG	Green	Hot-swap state (normal state)	—	—	—	—
	Red	Module, which different from the removed module, is inserted. (normal operation)	—	Initialization failure: There is no connected module.(recovery failed)	Initialization failure: abnormal module is operating (recovery failed)	Initialization failure: maximum module / data size exceeded
IO POWER	Green	—	—	—	—	—

**Note**

- Following chart is a timing diagram of flashing -/1/2/3

**(3) Status of field network**

LED	Color	Status	Description
NET	Green	OFF	Initialization state
		Flashing	State on online but, connection setting incomplete or error
		ON	Device operation: state on online, connection complete
	Red	OFF	No power supply State on offline or no network power MAC address test incomplete
		Flashing	Data exchange timeout Communication connection timeout (slave is not connected, no network power)
		ON	Serious errors in the network such as connection, network, and duplicate MAC address

## 5 Memory map

### 5.1 Memory system

#### 5.1.1 Data handling

classification	I/O type	Method of data handling
Bit	2 point/module	1 byte
	4 point/module	1 byte
	8 point/module	1 byte
	16 point/module	2 byte (= 1 word)
byte	8 bit/channel	1 byte
	12 bit/channel	2 byte (= 1 word)
	16 bit/channel	2 byte (= 1 word)
	24 bit/channel	4 byte (= 2 word)

The module manages arbitrarily transformed data based on its input/output type. It makes a waste of memory size, however, register position (such as PLC) can be easily calculated because the estimates of the data position are separated into the modules.

#### 5.1.2 Data type

Coupler and modules handle data in big endian fashion without the specified settings.

In addition, bit unit writes in the position of masking value, and byte unit writes the actual value.

Ex) If the point 3 of the digital input module is in the input, indicating as 0b 0000 0100 (0x04).

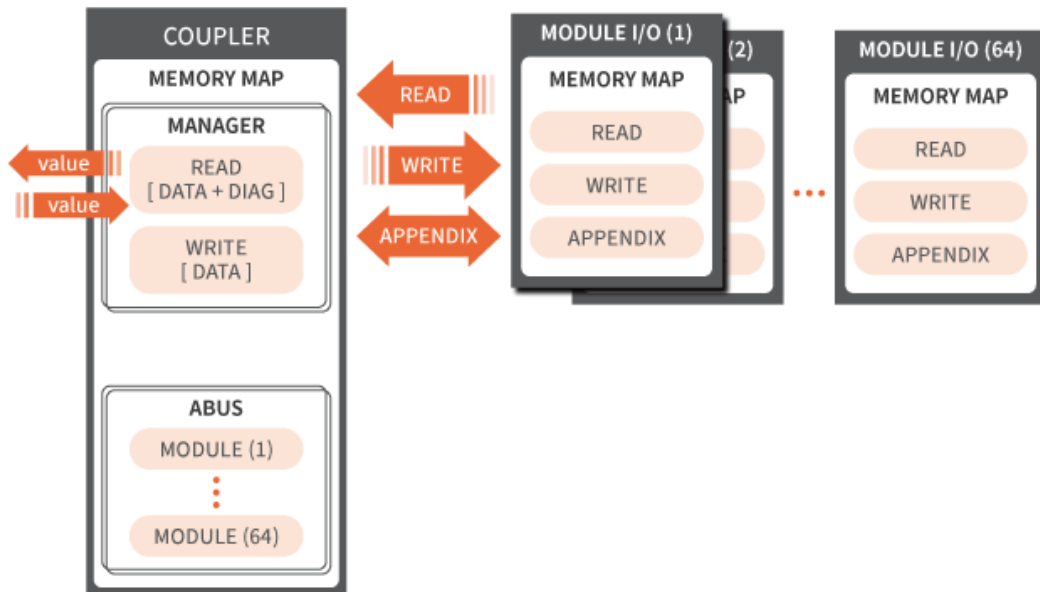
(□□□□■□□ = 0x04).

Ex) If the channel 1 of the analog input module is in the input with 10,000V, indicating as 0x 27 10 (10,000).

If the I / O form is smaller than the data handling method, the space is filled with zeros (pending) and managed.

Ex) ARIO-S-DI04P has 4 bits of data. In this case, □□□□ B B B B but, ARIO series transfers 0000BBBB by replacing □ area with number 0.

## 5.2 Memory structure



The memory structure manages each own area for couplers and modules are to efficiently manage data. This separates the coupler from the module's data area, making the module's data format has no limitation. It also helps the coupler and modules are freely add data if they have diagnosis function.

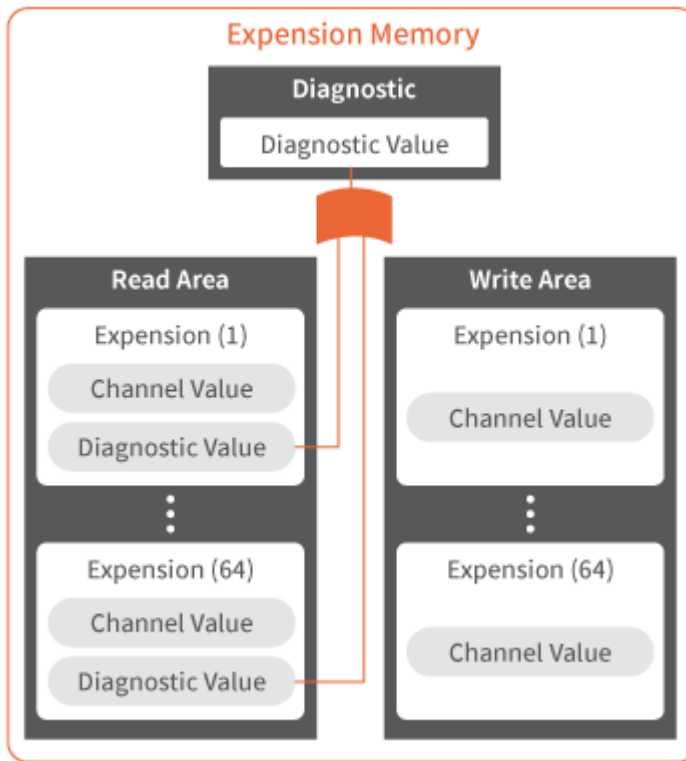
In other words, the coupler independently manages the module's data in an order that the modules are connected. And it provides information that appropriately processed, requested from the host device (master of field network or DAQMaster).

In addition, the coupler provides input and output information of the unit in accordance with the data size set in the field network. When the diagnosis function is activated, the coupler provides data embed with additional input area.

### 5.3 Memory area

Classification	Items	Description
Memory Management		Manage read and write data in order of module combination for providing information to field network
Fieldbus Memory	Read Area	Data area including the input data and diagnostic information, transmits the information collected from the remote IO unit to the master of field network
	Write Area	Data area including output data information, outputs information from the master of field network via the remote IO unit

### 5.4 Gather diagnostic information of modules



Save and Manage the information collected from each module in a contiguous memory. The read area includes diagnostic information as well as its own channel information. If the output module includes the diagnostic information, it provides the information by utilizing the read and write area at the same time.

The coupler transmits the diagnostic information of itself and modules to the master of field network according to the settings, which is cyclically updated. This information allows you to remotely check the status of each coupler.

## 5.5 Process image

When power is supplied, the coupler recognizes all connected modules.

The coupler organizes a memory map that takes into account the module's type / data size as well as the module's location, creating an internal process image. This area consists of the input and output data area, as mentioned before.

Since digital I / O modules are managed in bit format and analog I / O modules are managed in byte format, digital channels are grouped in byte units and add new bytes when they exceed 8 bits.

## 5.6 Example of memory map

### 5.6.1 Device

[0] ARIO-C-MR	Modbus RTU Coupler
[1] ARIO-S-AO02V	2-channel analog output modules (AO)
[2] ARIO-S-DI04P	4-channel digital input modules (DI)
[3] ARIO-S-AI02V	2-channel analog input modules (AI)
[4] ARIO-S-DO04P	4-channel digital output modules (DO)
[5] ARIO-S-AI02V	2-channel analog input modules (AI)
[6] ARIO-S-DO04P	4-channel digital output modules (DO)
[7] ARIO-S-DI04P	4-channel digital input modules (DI)
[8] ARIO-S-DO08P	8-channel digital output modules (DO)
[9] ARIO-S-DI04P	4-channel digital input modules (DI)

The coupler's diagnostic function is in-activated unless user intervention. In this example, however, the process image (memory map) is assumed to be active to explain the add of diagnostic data.

### 5.6.2 Input process image

Byte	.7	.6	.5	.4	.3	.2	.1	.0
0	High Byte of Coupler Diagnostic							
1	Low Byte of Coupler Diagnostic							
2					DI1P4	DI1P3	DI1P2	DI1P1
3	Analog input module 1, channel 1, High byte							
4	Analog input module 1, channel 1, Low byte							
5	Analog input module 1, channel 2, High byte							
6	Analog input module 1, channel 2, Low byte							
7	Analog input module 2, channel 1, High byte							
8	Analog input module 2, channel 1, Low byte							
9	Analog input module 2, channel 2, High byte							
10	Analog input module 2, channel 2, Low byte							
11					DI2P4	DI2P3	DI2P2	DI2P1
12					DI3P4	DI3P3	DI3P2	DI3P1

DI1P1 stands for 1st Point of Digital Input Module 1.



### 5.6.3 Output process image

Byte	.7	.6	.5	.4	.3	.2	.1	.0
0	Analog Output module 1, channel 1, High byte							
1	Analog Output module 1, channel 1, Low byte							
2	Analog Output module 1, channel 2, High byte							
3	Analog Output module 1, channel 2, Low byte							
4					DO1P4	DO1P3	DO1P2	DO1P1
5					DO2P4	DO2P3	DO2P2	DO2P1
6	DO3P8	DO3P7	DO3P6	DOP5	DO3P4	DO3P3	DO3P2	DO3P1

DO1P1 stands for 1st Point of Digital Output Module 1

### 5.6.4 Memory map based on field network

MSB stands for Most Significant Byte, and LSB stands for Least Significant Byte.

AI1CH1H stands for Analog input module 1, channel 1, and high byte (MSB).

#### (1) Input memory map

Address			In/Out Data		etc.
Autonics Type	Function	Register	MSB	LSB	
302001	04	2001	Data of Coupler Diagnostic		only read
302002	04	2002	DI1	AI1CH1H	only read
302003	04	2003	AI1CH1L	AI1CH2H	only read
302004	04	2004	AI1CH2L	AI2CH1H	only read
302005	04	2005	AI2CH1L	AI2CH2H	only read
302006	04	2006	AI2CH2L	DI2	only read
302007	04	2007	DI3	-	only read

#### (2) Output memory map

Address			In/Out Data		etc.
Autonics Type	Function	Register	MSB	LSB	
402001	03	2001	AO1CH1H	AO1CH1L	only read
402002	03	2002	AO1CH1H	AO1CH1L	only read
402003	03	2003	DO1	DO2	only read
402004	03	2004	DO3	-	only read
402001	06 / 16	2001	AO1CH1H	AO1CH1L	only write
402002	06 / 16	2002	AO1CH1H	AO1CH1L	only write
402003	06 / 16	2003	DO1	DO2	only write
402004	06 / 16	2004	DO3	-	only write

## 6 Diagnosis function

### 6.1 Overview

Units, configured via the coupler and modules, have the function to diagnose their condition. The diagnostic function is provided for each of the coupler and module, and it can be verified via the master of field network or the exclusive software. This allows the host controller to monitor the unit's status and respond at the appropriate time.

This function is that each module can check its status and generate a warning message so that it can identify the problem. Therefore, it provides functions and information for self-diagnosis such as location and type of error, and status. It does not suggest self-settings and self-optimization, self-restoration, functional integrity, etc., but can provide a procedure to automatically troubleshoot and handle the problem. (Maintenance: Some support, trouble shooting: Not supported)

The diagnostics of the coupler can only transmit information to the master of field network if the activation is set via the exclusive software. In other cases, information can be collected by using the exclusive software via USB.

### 6.2 Diagnostic type

Classification	Description	
Storage area	Diagnostics in the appendix area of the memory map 1word/coupler	
Supporting area	Determination of access from the master according to field network Monitoring and logs of the product	
Diagnostic area	Problems with the product (coupler) itself, base of the module, body and terminal	
	Diagnostic information	The product operating state
		External error state in the product (noise, input state, etc.)
		Internal error state in the product (ABUS, hardware, etc.)
		Error state in the memory management of the product
		Operating state of each module
		External error state in each module(I/O, ABUS, etc.)
		Internal error state in each module
Error state in the memory management of the module		
Message transfer method	Include the importance and structure of diagnostic information in the data set Save to the memory map via the cyclic internal bus communication of the product In case of the interrupt setting, immediate bus communication starts when an error occurs Display on the product (coupler) and module according to the diagnostic information	

### 6.3 Definition

byte	MSB								LSB							
bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
means	-	-	-	-	-	-	-	-	CS	ES	MTO	-	AEM	ACS	ASS	AC

Bit	Name	Description
F~8		Reserved
7	Coupler State	Represent status, product settings, field network status with the system LED 0: Internal coupler is in normal state 1: Internal coupler is in an error state
6	Module State	Represent status of channel, field bus power and ARIO power by or calculating the module state with DIAG LED 0: Module is in normal state 1: Module is in an error state
5	Maintenance Time Over	Notification exceeds of the product warranty period (three years or more). (1 year = 52,560, 3 years = 157,680) 0: within the warranty period 1: after product warranty period
4		Reserved
3	ABUS Empty Module	The coupler is operating alone (1 coupler, 0 module) Configure one or more modules 0: Configure one or more modules 1: Modules are not connected
2	ABUS Communication State	Module replacement error, ABUS communication error, etc. 0: ABUS communication is in normal state 1: ABUS communication is in error state
1	ABUS Stable Status	Hot-swap, failure, abnormal operation due to the module error 0: Multi Packet state (Normal) 1: Single Packet state (Error)
0	ABUS Constructor	All module is not connected, the number of modules is out of the range, module size is out of range, module is not recognized via ABUS due to the abnormal coupler configuration. 0: Module configuration completed (configuration state of ABUS) 1: Incomplete module configuration

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

MOO-ARICMRU-V1.1-1905US