

ARIO-C-EC

EtherCAT

Coupler User Manual MTO-ARIOCECU1-V2.0-2200US

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

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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).
- 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

EtherCAT Trademark



English

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

German

EtherCAT® ist eine eingetragene Marke und patentierte Technologie lizenziert durch die Beckhoff Automation GmbH, Deutschland.

French

EtherCAT® est une marque déposée et une technologie brevetée sous licence de Beckhoff Automation GmbH, Allemagne.

Italian

EtherCAT® è un marchio registrato, la tecnologia è brevettata ed è concessa in licenza da Beckhoff Automation GmbH, Germania.

Spanish

EtherCAT® es una marca registrada y una tecnología patentada, bajo licencia de Beckhoff Automation GmbH, Alemania.

Japanese

EtherCAT® は、ドイツ Beckhoff Automation GmbH
によりライセンスされた特許取得済み技術であり登録商標です。

Korean

EtherCAT® 독일 Beckhoff Automation GmbH의 허가를 받은 등록 상표이자 특허 기술입니다.

Chinese

EtherCAT® 是注册商标和专利技术, 由德国倍福自动化有限公司授权。

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 metal chip, dust, and wire residue from flowing 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. Use the rated standard cables and connectors. Do not apply excessive power when connecting or disconnecting the connectors of the product.
5. 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.
6. Do not use near the equipment which generates strong magnetic force or high frequency noise.
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.
9. For removing the terminal, body or base, do not operate units for a long time without it.
10. 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

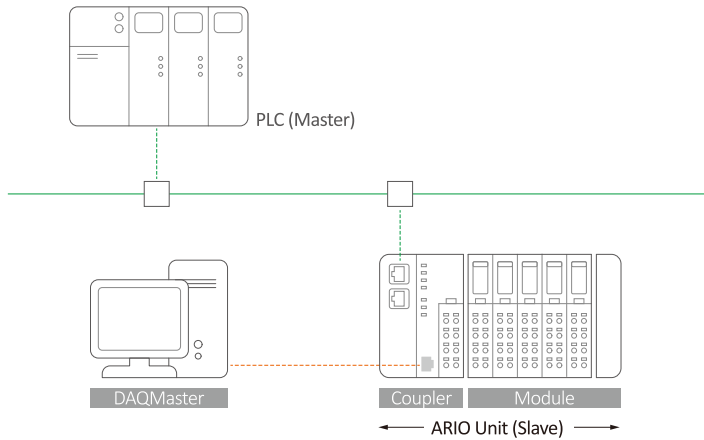
The specifications and dimensions of this manual are subject to change without any notice for product improvement. Be sure to read and follow the considerations written in the instruction manual, other manuals, and technical information on our Autonics website.

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.



Installation 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. Check the diagnostic information of the coupler
5. Update the firmware version of the coupler, etc.

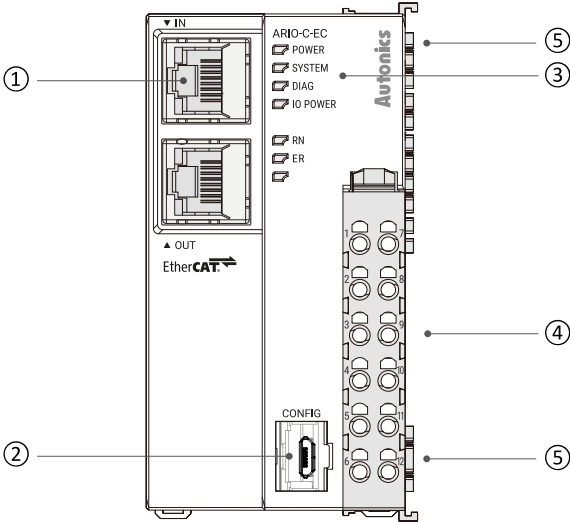
2. Overview of the ARIO-C-EC

2.1. EtherCAT Protocol

The EtherCAT protocol, designed based on the Fieldbus system, supports low-latency control, high flexibility in the topology, and user-friendly environment settings. The data is interpreted and copied at all connected devices without receiving Ethernet packets under the EtherCAT network. And the EtherCAT slave reads the received data while the frame has transmitted to the node.

The ARIO-C-EC supports the EtherCAT protocol. This coupler composes the physical structure of connected modules and devices and creates input and output process images linked with the data of EtherCAT. 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. EtherCAT Communication Connectors

It is a connector to connect with EtherCAT Master such as PLC.
For detailed information on the communication cable, refer to the 2.3, “EtherCAT Communication Connector”.

2. CONFIG Port

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

- 1. Port type: USB Type-B Micro

3. 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. EtherCAT communication status

4. 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 2.4, “Connections of the Power Terminal”.

5. 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.

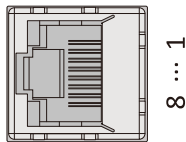
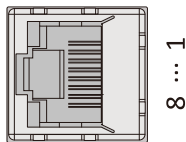
2.3. EtherCAT Communication Connector



- Be sure to use the connector and cable approved by the EtherCAT Technology Group (ETG). Otherwise, use an Ethernet connector and cable that meets the specifications of at least category 5e.
- Be sure not to exceed the cable length of 100 meters.

The RJ45 connector is used for EtherCAT communication connection.
For more information on the pin assignment, refer to the table below.

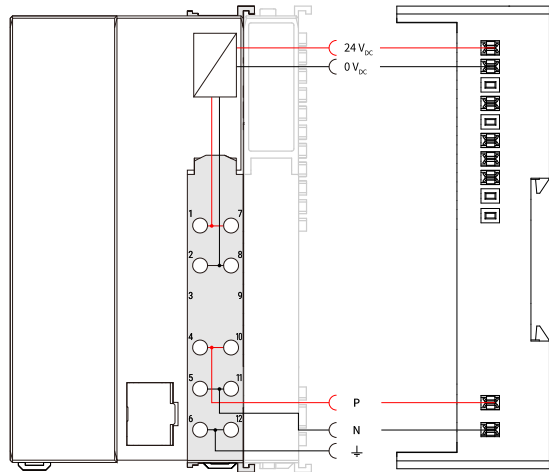
▼ IN



▲ OUT

Pin no.	Color of conductor based on T568A	Signal	Description
1	Green/White	TD +	Transmit Data +
2	Green	TD -	Transmit Data -
3	Orange/White	RD +	Receive Data +
6	Orange	RD -	Receive Data -

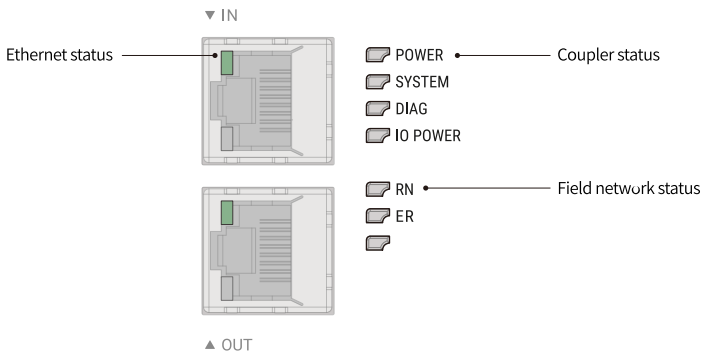
2.4. Connections of the Power Terminal



Terminal no.	Name	Description
1, 7	System Power (24 V _{DC})	Power supply for the coupler, module and ABUS to be operated.
2, 8	System Power (0 V _{DC})	• The terminals feed the power supply to the top input contacts. • The POWER indicator lights up.
3, 9	Not Connected (NC)	-
4, 10	Field Power (Positive: 24 V _{DC})	Power supply for the input and output (I/O) signals of the module.
5, 11	Field Power (Negative: 0 V _{DC})	• The terminals feed the power supply to the bottom input contacts. • The IO POWER indicator lights up.
6, 12	Frame Ground / Shield	Frame ground

3. Indicators

The indicators of the ARIO-C-EC coupler consist of elements indicating the operating status for the coupler, connection status for the field network (EtherCAT), and Ethernet 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	• Coupler initialization failure (non-recoverable) • An unrecoverable error occurred. • The type of field network and firmware version mismatch (non-recoverable)
		Flashing	• Field network initialization failure (non-recoverable) • Changing the settings of rotary switches (applicable models)
		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	• The operation of the coupler stopped • An error occurred
	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 EtherCAT communication

Indicator	LED color	Status	Description
RN	Green	ON	EtherCAT state: OPERATIONAL (Connection is established.)
		Flashing (2.5 Hz)	EtherCAT state: PRE-OPERATIONAL (Initializing network settings, Mailbox communication)
		OFF	EtherCAT state: INIT (Initializing the EtherCAT communication, communication unavailable)
	Green, Red	Flashing (once)	EtherCAT state: SAFE-OPERATIONAL (TxPDO communication)

2. The field network error

Indicator	LED color	Status	Description
ER	Red	Flashing (2.5 Hz)	Invalid configuration • An PLC error occurred • An error occurred in the settings of the register or object
		Flashing (once)	Local error: The change of state is occurred in the slave device. • Host watchdog timeout • Synchronization error • The device enters SAFE-OPERATIONAL state.
		Flashing (2 times)	Application watchdog timeout • Sync Manager watchdog timeout

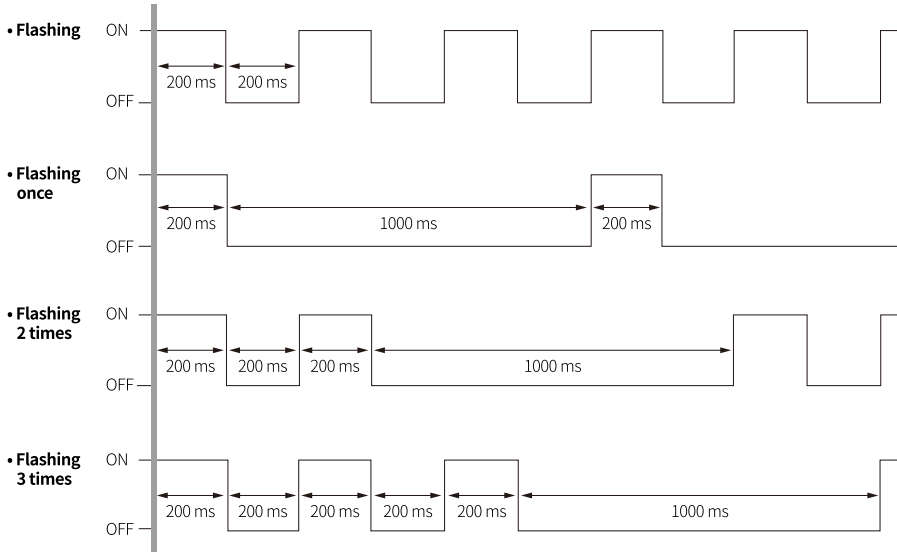
3.3. LEDs for the Ethernet Status

1. The status of the Ethernet connection

Indicator	LED color	Status	Description
L/A IN, L/A OUT	Green	ON	Link: The device is linked to the Ethernet, but does not send/receive Ethernet frames.
		Flashing	Activity: The device is linked to the Ethernet and sends/receives Ethernet frames.
		OFF	The device has no link to the Ethernet.



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.

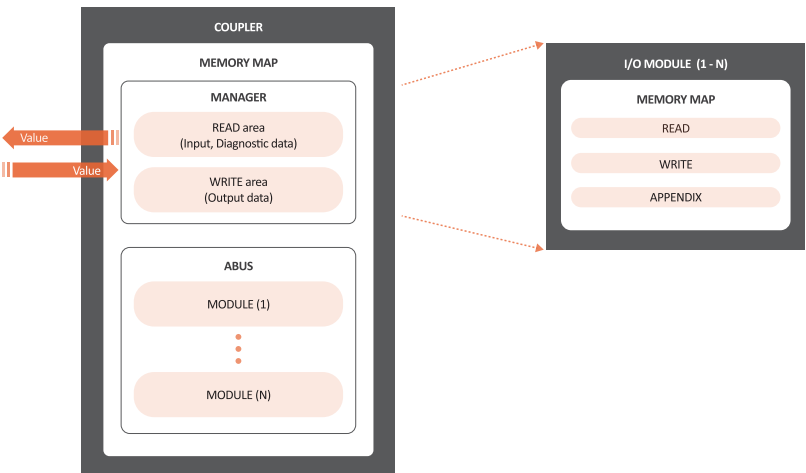


4. Process Images

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 and diagnostic 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 Modules

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 : 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 : 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	



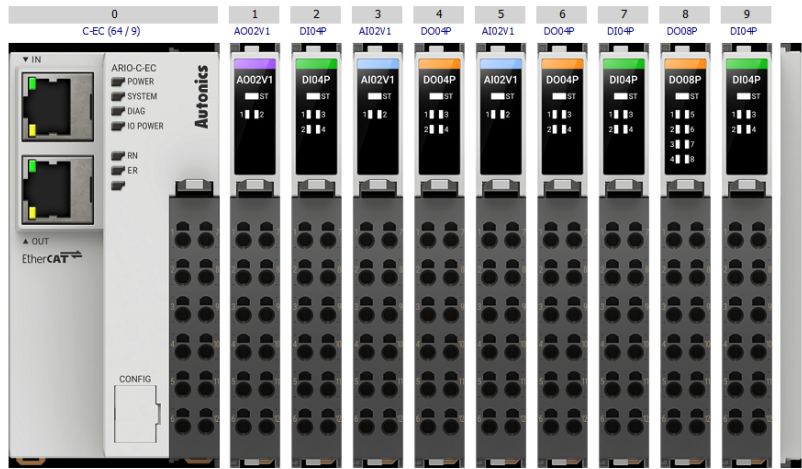
The data arrangements (the order or sequence) of the analog signal can be expressed as big-endian or little-endian in the DAQMaster.

To select the endianness, go to **Comm Mode » Property tab of the coupler » Endian**. (factory setting: 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 first position of the input process image contains diagnostic information of the coupler with a size of 16 bits (1 word).

DAQMaster: An arrangement example of the ARIO unit



DAQMaster: The address map of the ARIO unit

Slot Number : Module Name	Index : SubIndex	Type	7	6	5	4	3	2	1	0
2 : DI04P	0x1A00:1	R					P3	P2	P1	P0
3 : AI02V1 - Channel 0	0x1A00:2	R	C1H	C1H	C1H	C1H	C1H	C1H	C1H	C1H
3 : AI02V1 - Channel 1	0x1A00:3	R	C1L	C1L	C1L	C1L	C1L	C1L	C1L	C1L
3 : AI02V1 - Channel 2	0x1A00:4	R	C2H	C2H	C2H	C2H	C2H	C2H	C2H	C2H
3 : AI02V1 - Channel 3	0x1A00:5	R	C2L	C2L	C2L	C2L	C2L	C2L	C2L	C2L
5 : AI02V1 - Channel 0	0x1A00:6	R	C1H	C1H	C1H	C1H	C1H	C1H	C1H	C1H
5 : AI02V1 - Channel 1	0x1A00:7	R	C1L	C1L	C1L	C1L	C1L	C1L	C1L	C1L
5 : AI02V1 - Channel 2	0x1A00:8	R	C2H	C2H	C2H	C2H	C2H	C2H	C2H	C2H
5 : AI02V1 - Channel 3	0x1A00:9	R	C2L	C2L	C2L	C2L	C2L	C2L	C2L	C2L
7 : DI04P	0x1A00:10	R					P3	P2	P1	P0
9 : DI04P	0x1A00:11	R					P3	P2	P1	P0
1 : AO02V1 - Channel 0	0x1600:1	W	C1H	C1H	C1H	C1H	C1H	C1H	C1H	C1H
1 : AO02V1 - Channel 1	0x1600:2	W	C1L	C1L	C1L	C1L	C1L	C1L	C1L	C1L
1 : AO02V1 - Channel 2	0x1600:3	W	C2H	C2H	C2H	C2H	C2H	C2H	C2H	C2H
1 : AO02V1 - Channel 3	0x1600:4	W	C2L	C2L	C2L	C2L	C2L	C2L	C2L	C2L
4 : DO04P	0x1600:5	W					P3	P2	P1	P0
6 : DO04P	0x1600:6	W					P3	P2	P1	P0
8 : DO08P	0x1600:7	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	0: Coupler	Diagnostic Data High Byte ⁰¹⁾							
1		Diagnostic data Low Byte ⁰¹⁾							
2	2: DI04P	-				Ch.4	Ch.3	Ch.2	Ch.1
3	3: AI02V1	Ch.1 High Byte							
4		Ch.1 Low Byte							
5		Ch.2 High Byte							
6		Ch.2 Low Byte							
7	5: AI02V1	Ch.1 High Byte							
8		Ch.1 Low Byte							
9		Ch.2 High Byte							
10		Ch.2 Low Byte							
11	7: DI04P	-				Ch.4	Ch.3	Ch.2	Ch.1
12	9: DI04P	-				Ch.4	Ch.3	Ch.2	Ch.1

01) Refer to the 4.3.3, “Mapping of the Coupler Diagnostic Data”.

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

4.3.3. Mapping of the Coupler Diagnostic Data

To check the value of the coupler diagnosis in the DAQMaster,
go to **Comm Mode » Property tab of the coupler » Coupler State**.

Byte		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	High	Reserved							
1	Low	CS	MS	WP	AEM	-	ACS	AT	AC

AC (ABUS Configuration)

The diagnostic information for the configuration of the coupler and modules

0: Normal state

1: Module configuration error

- Cause 1: No connected modules
- Cause 2: The number of connected modules exceeded
- Cause 3: The data size of module exceeded
- Cause 4: Invalid arrangement of modules

AT (ABUS Timeout)

The occurrence information of timeout

0: Multi-packet state (normal)

1: Single-packet state (timeout occurred)

- Cause 1: The module detached
- Cause 2: The module not recognized due to a noise
- Cause 3: Hot-swap state
- Cause 4: The module operation error

ACS (ABUS Communication State)

ABUS communication status

0: Normal state

1: Communication error

- Cause 1: Replaced module mismatched
- Cause 2: Unknown communication error occurred

AEM (ABUS Empty Module)

Checking the connected module

0: Normal state (one or more modules connected)

1: No module connected

WP (Warranty Period)

Notice of product warranty period

(≤ 3 years, 157,680_{DEC})

0: Within the warranty period

1: End of warranty period

MS (Module State)

The status of connected modules
(running with DIAG indicator)

0: Normal state

1: Error

CS (Coupler State)

The information on the coupler state
(running with SYSTEM indicator)

0: Normal state

1: Error

- Cause 1: Error occurred in the coupler initialization and settings, etc.
- Cause 2: Error occurred in the field network connection, etc.

5. TwinCAT3 Guide

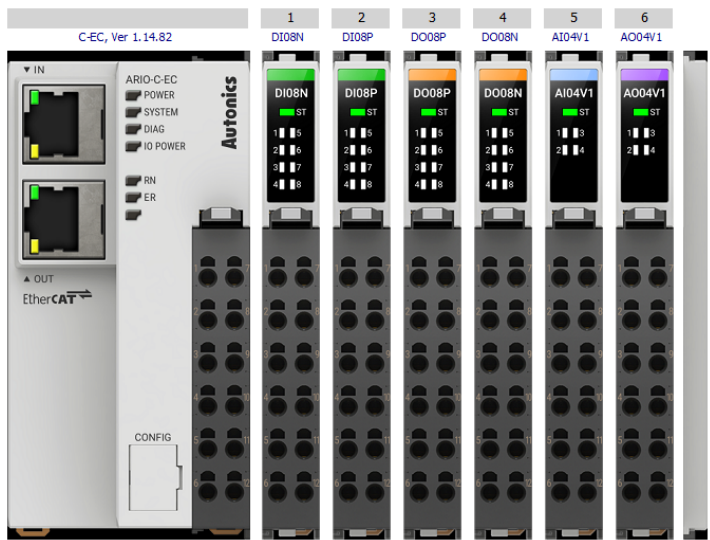


- Be sure to see the version compatibility table of the ARIIO Series on our Autonic website to check the software/firmware(SW) and hardware(HW) versions of the coupler and modules.
- Refer to the 6.2, “Update the Firmware Version” to update to the latest software(firmware) version.

5.1. Before You Begin

Firstly, this chapter describes how to configure EtherCAT communication with the ARIIO unit arranged as shown in the figure below. After that, writing the ladder diagram, and monitoring the data in these modules are given in this chapter.

Configuration of the ARIIO Unit



Configuration of the EtherCAT Master

- BECKHOFF PC-based PLC / Project planning software: TwinCAT3



This chapter describes based on BECKHOFF's master (PLC) and software.
For detailed information on communication connection and usage method with the master, refer to the user manuals provided by the specific manufacturer.

5.2. Install the ESI File



The EtherCAT Slave Information (ESI) file contains specific data of the EtherCAT slave and defines the parameters, process data, valid values and more.

The EtherCAT master recognizes the slave and also obtains the necessary information for the control via the ESI file.

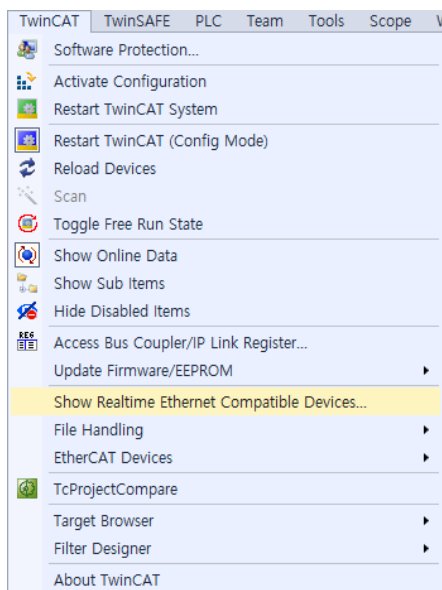
1. Download the ESI file of the ARIO-C-EC on our Autonic website.
2. Refer to the README.txt in the downloaded folder and select the ESI file suitable for the S/W version of the coupler.
3. Copy the selected ESI file to the following subdirectory of the TwinCAT installation directory.
The path of the folder: ~\TwinCAT\3.1\Config\Io\EtherCAT
4. Launch the TwinCAT3.



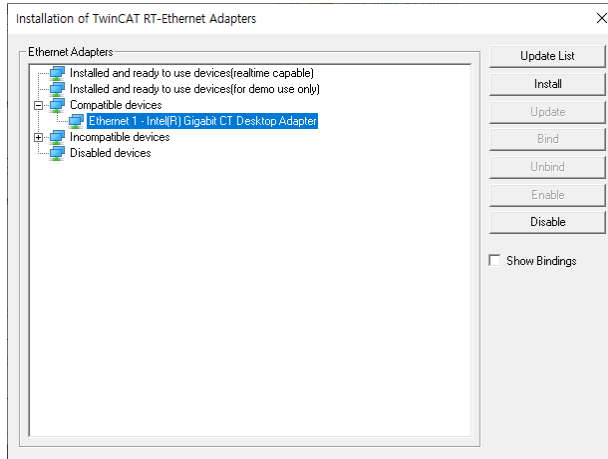
To integrate the ESI file when the project file is running in the TwinCAT3, go to the **TwinCAT » EtherCAT Devices » Reload Device Descriptions** on the top menu.

5.3. Install the Ethernet Adapter

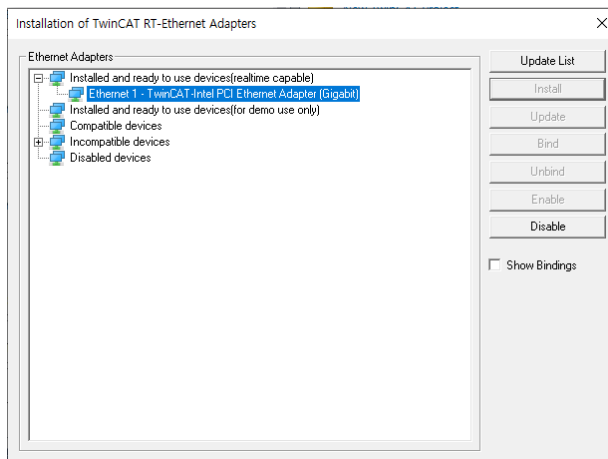
1. Connect the cable connected to the EtherCAT communication connector of the coupler to the port on the device where the TwinCAT3 is installed.
2. Launch the TwinCAT 3.
3. Select the **TwinCAT » Show Realtime Ethernet Compatible Device** on the top menu.



4. Select the LAN card that is connected with the coupler in the sub-list of the Compatible devices, and then select **Install**. Selecting a device in the sub-list of the Incompatible devices does not guarantee a successful installation.



5. Check that the LAN card is located to the sub-list of the Installed and Ready to use devices (realtime capable). The installation of LAN card is completed.

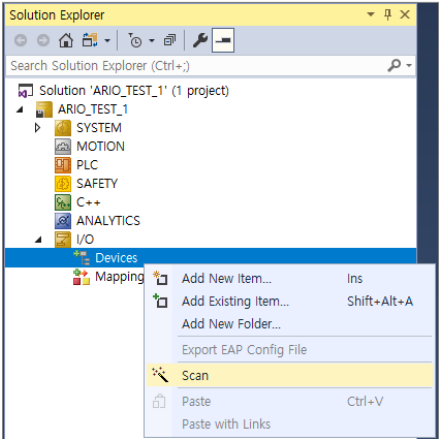


5.4. Add the ARIO Unit

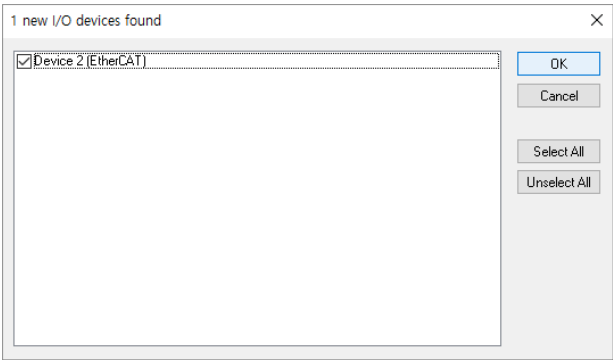


The number next to the Device/Box in the figure below may vary depending on the installation environment.

1. Right-click on the **Solution Explorer » I/O » Devices**.
2. Select the **Scan**.



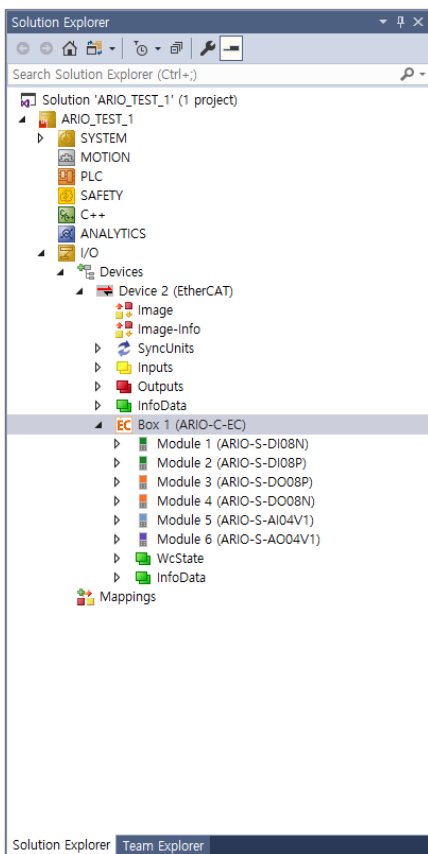
3. In the pop-up window, confirm the checkbox of the **Device 2 (EtherCAT)** and select the **OK**.



4. Check the **Solution Explorer » Box 1 (ARIO-C-EC)**.

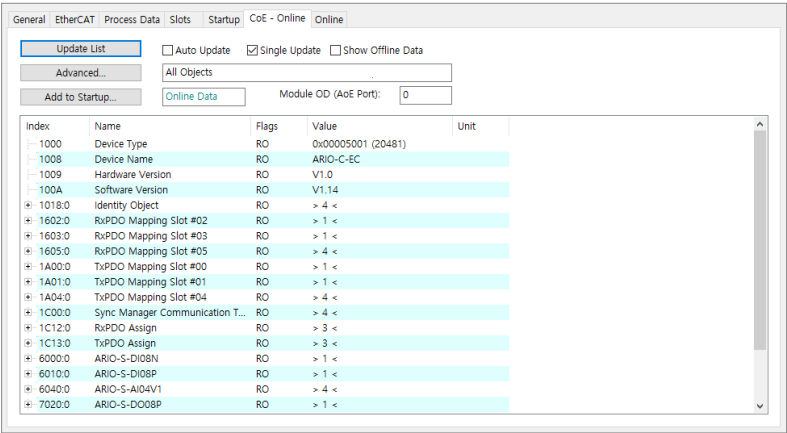
The Device and Box shown in the Solution Explorer are defined as below.

- Device 2 (EtherCAT): EtherCAT master
- Box 1 (ARIO-C-EC): EtherCAT slave

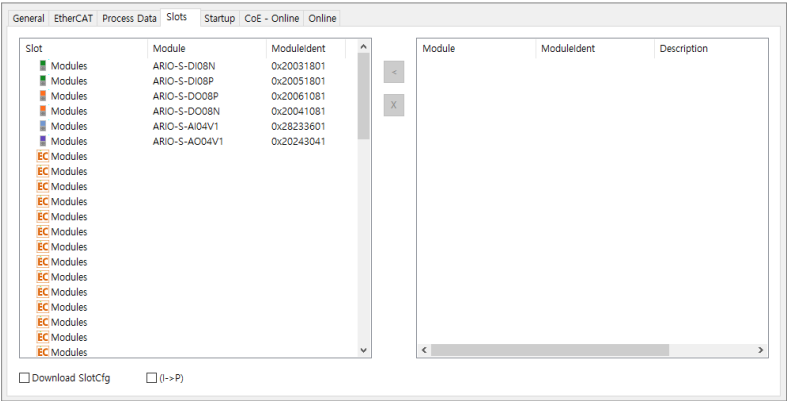


If **Box no.(ARIO-C-EC)** does not appear in the Solution Explorer, check the coupler status of the power supply and the EtherCAT communication cable.

- 5. Double-click the **Solution Explorer » Box 1 (ARIO-C-EC)**.
- 6. Check the Online Data in the **Editor Window » CoE-Online tab**.



- 7. Check the connected modules in the **Editor Window » Slots tab**.



- 8. The ARIO unit has been successfully added.

5.5. Mapping of Connected Unit

5.5.1. CoE-Online Tab

If the EtherCAT slave supports the CAN application protocol over EtherCAT (CoE) protocol, the CoE-Online tab is displayed. In this tab, you can check the object list of the slave device and the modules connected with the coupler.

TwinCAT3: CoE-Online tab (diagnostic function of the coupler: disabled)

The screenshot shows the TwinCAT3 software interface with the 'CoE - Online' tab selected. The 'Online Data' button is active, and the 'Module OD (AoE Port):' is set to 0. The 'Object List' table displays the following data:

Index	Name	Flags	Value	Unit
1000	Device Type	RO	0x00005001 (20481)	
1008	Device Name	RO	ARIO-C-EC	
1009	Hardware Version	RO	V1.0	
100A	Software Version	RO	V1.14	
1018:0	Identity Object	RO	> 4 <	
1602:0	RxPDO Mapping Slot #02	RO	> 1 <	
1603:0	RxPDO Mapping Slot #03	RO	> 1 <	
1605:0	RxPDO Mapping Slot #05	RO	> 4 <	
1A00:0	TxPDO Mapping Slot #00	RO	> 1 <	
1A01:0	TxPDO Mapping Slot #01	RO	> 1 <	
1A04:0	TxPDO Mapping Slot #04	RO	> 4 <	
1C00:0	Sync Manager Communication Types	RO	> 4 <	
1C12:0	RxPDO Assign	RO	> 3 <	
1C13:0	TxPDO Assign	RO	> 3 <	
6000:0	ARIO-S-DI08N	RO	> 1 <	
6010:0	ARIO-S-DI08P	RO	> 1 <	
6040:0	ARIO-S-AI04V1	RO	> 4 <	
7020:0	ARIO-S-DO08P	RO	> 1 <	
7030:0	ARIO-S-DO08N	RO	> 1 <	
7050:0	ARIO-S-AO04V1	RO	> 4 <	
F000:0	Modular Device Profile	RO	> 2 <	
F050:0	Detected Module List	RO	> 6 <	

Object descriptions

0x1000	It has the information on Device type including device name, hardware, and software version of the slave, etc.
0x1018	It is Identity Object which has the information for the identification of the slave device.
0x6000	It shows Input PDOs. (input from the perspective of the EtherCAT master)
0x7000	It shows Output PDOs. (output from the perspective of EtherCAT master)
0x1A00	It shows the objects that can be mapped to TxPDO. (input PDO mapping)
0x1600	It shows the objects that can be mapped to RxPDO. (output PDO mapping)
0x1C13	It assigns the mapping image of TxPDO to Sync Manager.
0x1C12	It assigns the mapping image of RxPDO to Sync Manager.

5.5.2. Mapping Example of Process Data Objects (PDO)

• TxPDO

TxPDO Mapping Slot		Application Object		
Index	Subindex	Index	Subindex	Modules
0x1A00	0x01	0x6000	0x01	ARIO-S-DIO8N
0x1A01	0x01	0x6010	0x01	ARIO-S-DIO8P
0x1A02	0x01	0x6040	0x01	ARIO-S-AI04V1, Ch.1
	0x02		0x02	ARIO-S-AI04V1, Ch.2
	0x03		0x03	ARIO-S-AI04V1, Ch.3
	0x04		0x04	ARIO-S-AI04V1, Ch.4



When the diagnostic function of the coupler is activated, the data area is allocated as shown below.

Index	Subindex	Allocation Data
0x1A00	0x01	Coupler Diagnostic Data (MSB)
0x1A00	0x02	Coupler Diagnostic Data (LSB)

• RxPDO

RxPDO Mapping Slot		Application Object		
Index	Subindex	Index	Subindex	Modules
0x1602	0x01	0x7020	0x01	ARIO-S-DO08P
0x1603	0x01	0x7030	0x01	ARIO-S-DO08N
0x1605	0x01	0x7050	0x01	ARIO-S-AO04V1, Ch.1
	0x02		0x02	ARIO-S-AO04V1, Ch.2
	0x03		0x03	ARIO-S-AO04V1, Ch.3
	0x04		0x04	ARIO-S-AO04V1, Ch.4

5.5.3. Mapping Example of PDO Assign

• TxPDO Assign

Index	Subindex	Allocation Data
0x1C13	0x01	ARIO-S-DIO8N
	0x02	ARIO-S-DIO8P
	0x03	ARIO-S-AI04V1

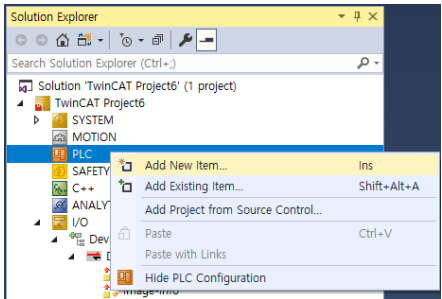
• RxPDO Assign

Index	Subindex	Allocation Data
0x1C12	0x01	ARIO-S-DO08P
	0x02	ARIO-S-DO08N
	0x03	ARIO-S-AO04V1

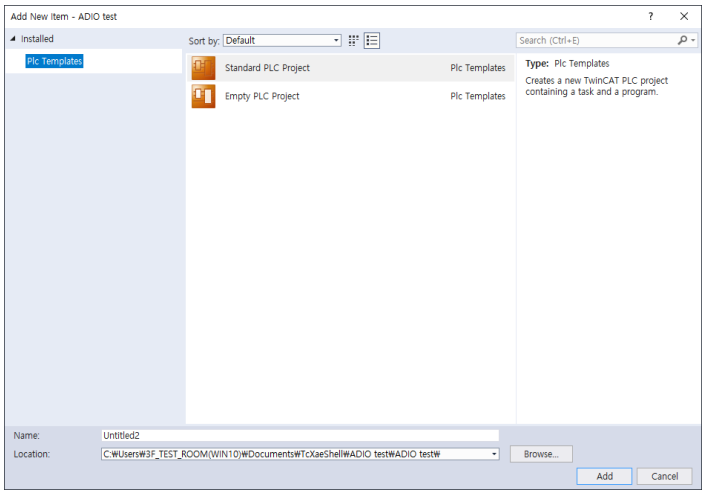
5.6. PLC Project

5.6.1. Create a Project File

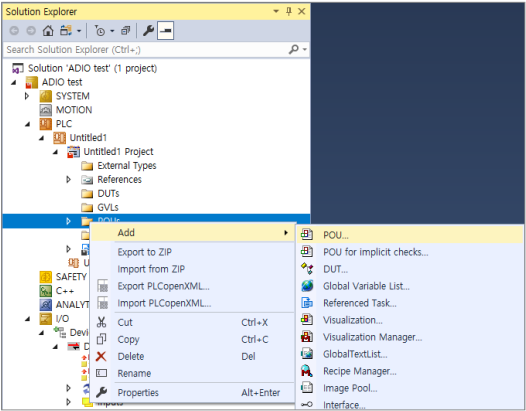
1. Select the **Solution Explorer » PLC » Add New item.**



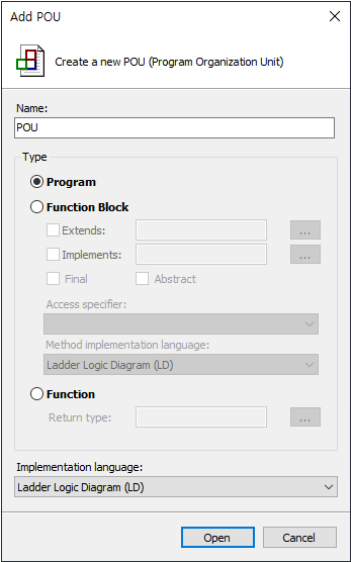
2. In the pop-up window, select the Standard PLC Project. Enter a project name and select the **Add.**



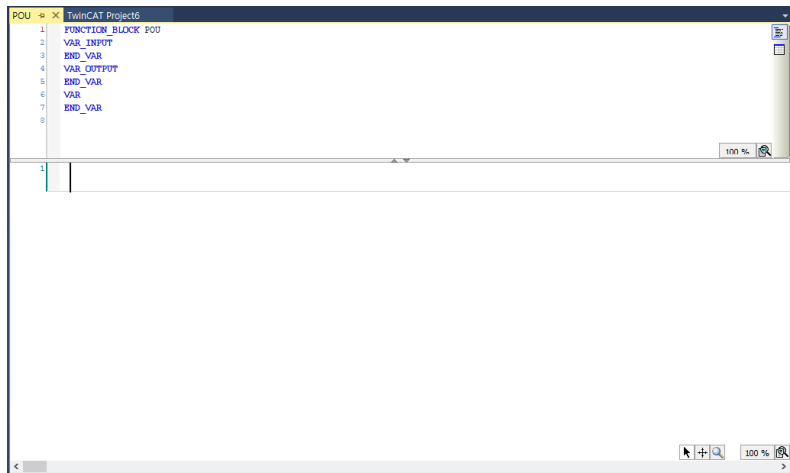
3. MAIN (PRG) is created by default in the sub-list of the **Solution Explorer » POU**s.
MAIN (PRG) only supports ST language.
4. Right-click on the **Solution Explorer » PLC » POU**s and select the **Add » POU...**.



5. In the pop-up window, designate the Name, Type, and Language and select the **Open**.
The Ladder Logic Diagram (LD) is selected in the figure below.



6. The screen for writing a ladder logic appears. A function block (FB) is also added.

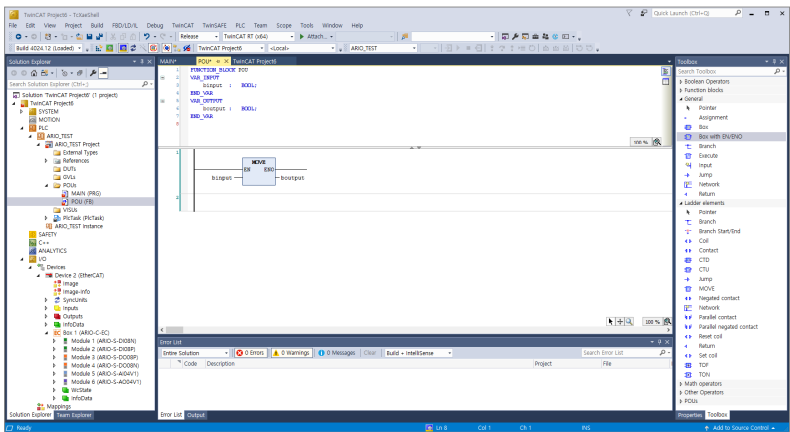


5.6.2. Configure a Ladder Logic

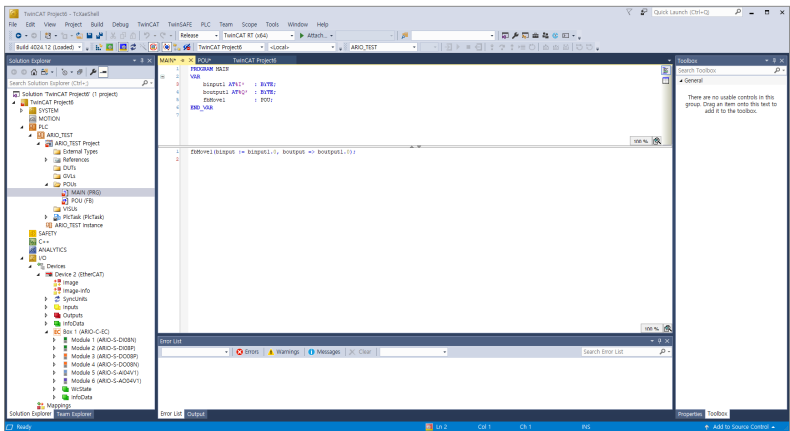


This chapter describes how to configure the logic about giving the input signal on ch.1 of the digital input module and writing the output signal to ch.1 of the digital output module. After that, monitoring the data of the logic on a real-time basis is given in this chapter.

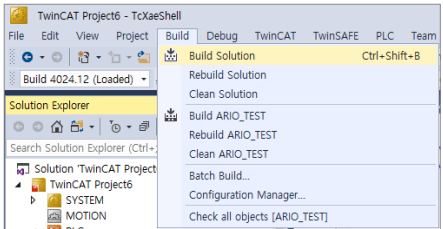
1. Declare a variable in the **Textual view** of the POU tab.
To configure a logic, drag the desired elements from the **Toolbox** to the area below.



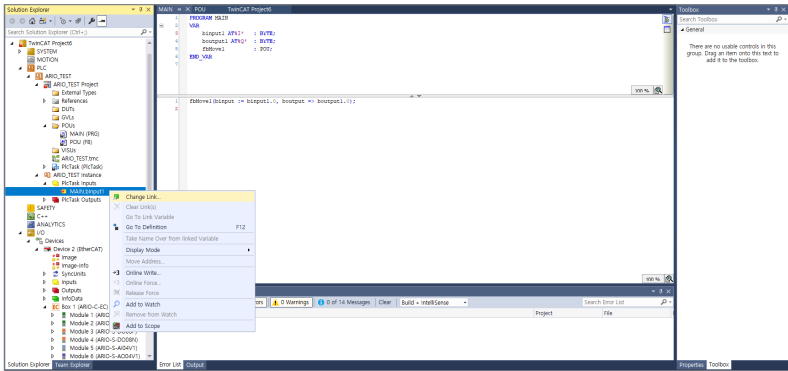
2. Configure the main logic on the **Solution Explorer » POU » MAIN (PRG)**.



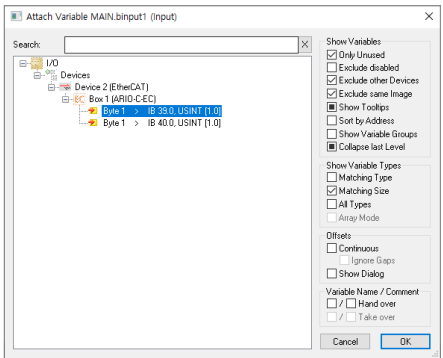
3. Select the **Build » Build Solution** and continue.



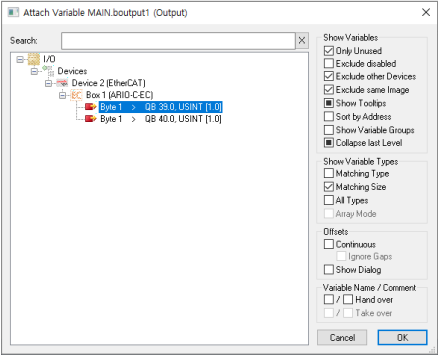
4. Right-click on the **Solution Explorer » Instance » PlcTask Inputs » MAIN.binput1**, and select the **Change Link...**.



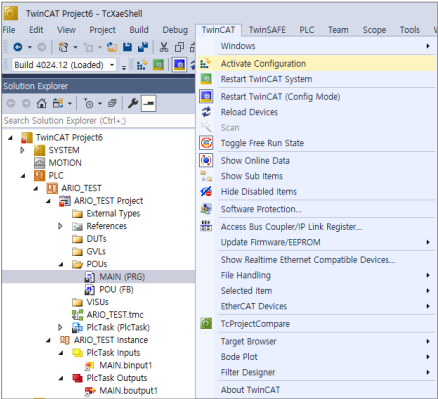
5. Select the **OK** for a mapping of input variables.



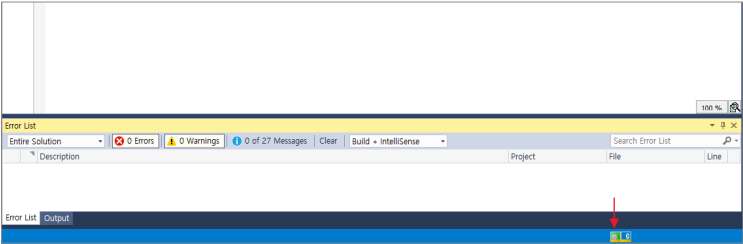
6. In the same way as above, right-click on the **Solution Explorer » Instance » PlcTask Outputs » MAIN.boutput1** and select the **Change Link...**. Select the **OK** for mapping of output variables.



7. Select the **TwinCAT » Active Configuration** and continue.

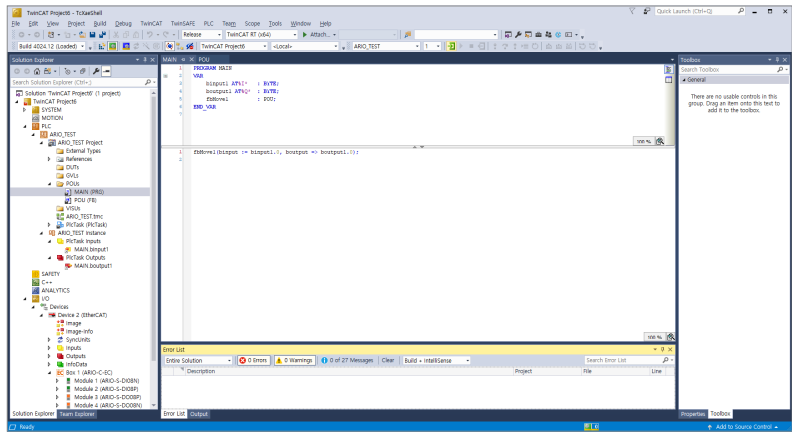


8. When the process is completed, you will see the **Run Mode** icon at the bottom of the screen.

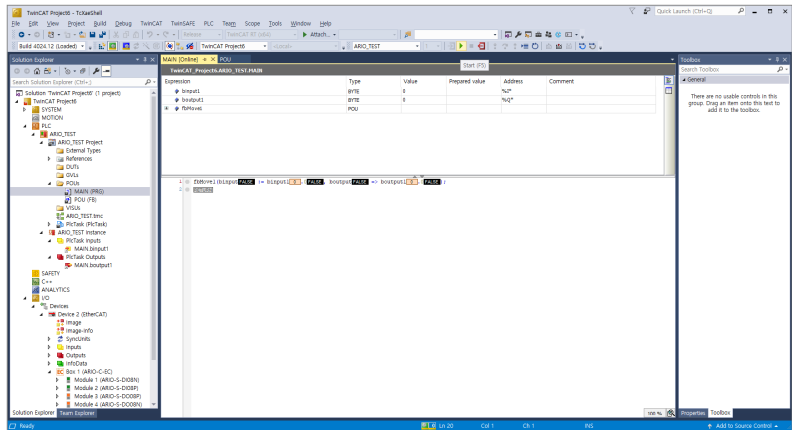


5.6.2.1. Monitor the Ladder

1. Select the **Login** icon to enter monitoring mode.



2. Select the **Start** icon to start monitoring.



3. You can check that the input signal on the ch.1 of the digital input module and the output signal on the ch.1 of the digital output module.

◦ MAIN screen

MAIN [Online] 9 TwinCAT Project6 POU [Online]

TwinCAT_Project6.ARIO_TEST.MAIN

Expression	Type	Value	Prepared value	Address	Comment
binout1	BYTE	1		%I*	
boutput1	BYTE	1		%Q*	
*fbMove1	POU				

fbMove1(binout1 TRUE := binout1 FALSE, boutput TRUE => boutput2 FALSE ;

RETURN

◦ POU screen

MAIN [Online] 9 TwinCAT Project6 POU [Online]

TwinCAT_Project6.ARIO_TEST.MAIN.fbMove1

Expression	Type	Value	Prepared value	Address	Comment
binout	BOOL	TRUE			
boutput	BOOL	FALSE			

1

2

RET

MOVE

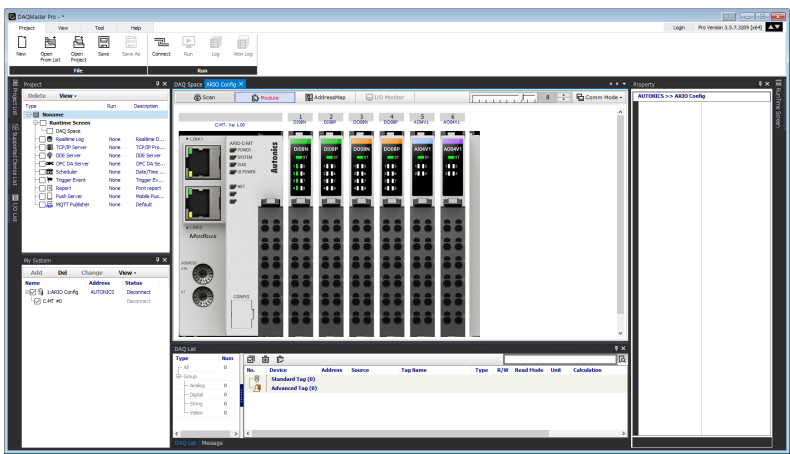
binout TRUE

boutput FALSE

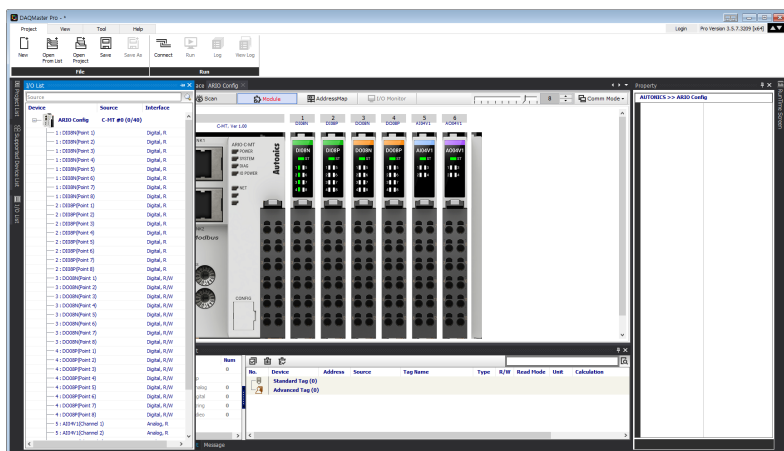
6. DAQMaster

6.1. Monitor the ARI0 Unit

1. Connect the CONFIG port of the ARI0 coupler to the PC where the DAQMaster is installed.
2. Select the **Supported Device List » AUTONICS » ARI0 Config** to add the ARI0 coupler and then select the **Connect » Scan** to import the connected ARI0 unit. (Comm Mode state)



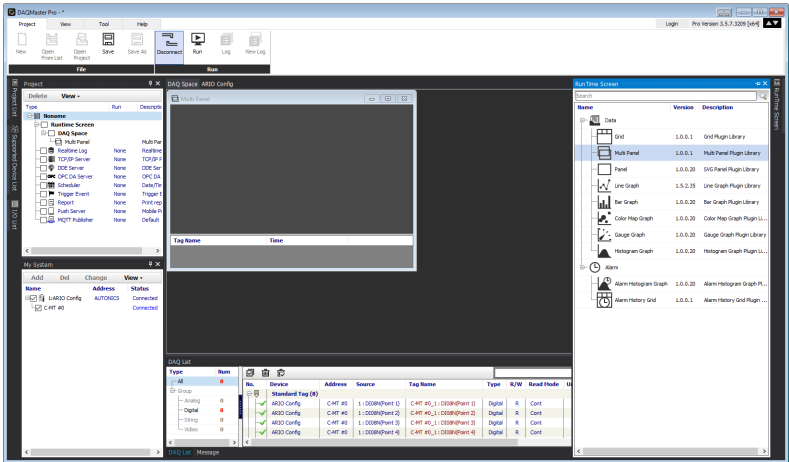
- When Selecting the **I/O List » ARIO Config**, the tag list of the connected input/output module is displayed. Double-click the tag to be monitored to add it on the DAQ List window.



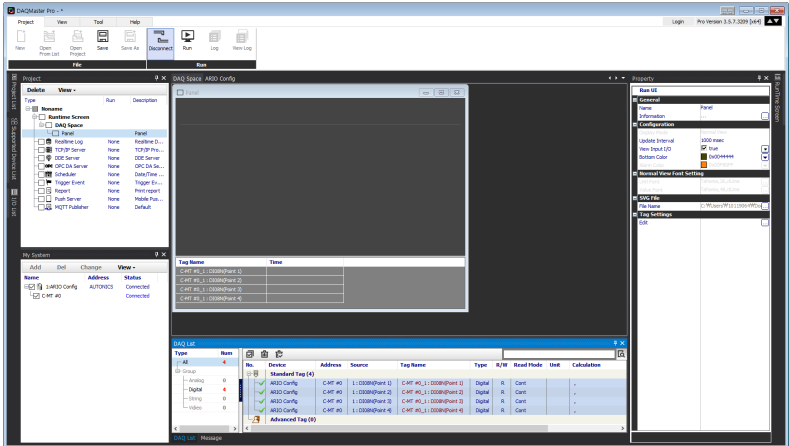
4. The tags are added on the DAQ List window as shown below.

DAQ List											
Type	Num	No.	Device	Address	Source	Tag Name	Type	R/W	Read Mode	Unit	Calculation
All	8										
Group											
Analog	0										
Digital	8										
String	0										
Video	0										
Standard Tag (8)											
			ARIO Config	C-MT #0	1: DIO8N(Point 1)	C-MT_#0_1: DIO8N(Point 1)	Digital	R	Cont		
			ARIO Config	C-MT #0	1: DIO8N(Point 2)	C-MT_#0_1: DIO8N(Point 2)	Digital	R	Cont		
			ARIO Config	C-MT #0	1: DIO8N(Point 3)	C-MT_#0_1: DIO8N(Point 3)	Digital	R	Cont		
			ARIO Config	C-MT #0	1: DIO8N(Point 4)	C-MT_#0_1: DIO8N(Point 4)	Digital	R	Cont		
			ARIO Config	C-MT #0	1: DIO8N(Point 5)	C-MT_#0_1: DIO8N(Point 5)	Digital	R	Cont		
			ARIO Config	C-MT #0	1: DIO8N(Point 6)	C-MT_#0_1: DIO8N(Point 6)	Digital	R	Cont		
			ARIO Config	C-MT #0	1: DIO8N(Point 7)	C-MT_#0_1: DIO8N(Point 7)	Digital	R	Cont		
			ARIO Config	C-MT #0	1: DIO8N(Point 8)	C-MT_#0_1: DIO8N(Point 8)	Digital	R	Cont		
Advanced Tag (0)											

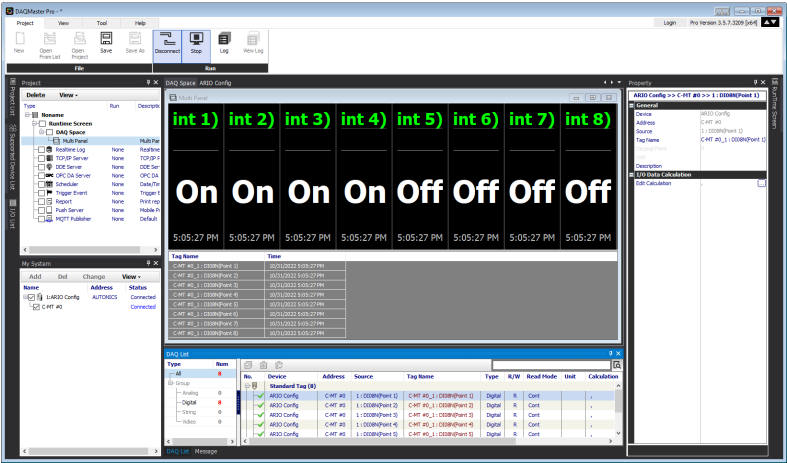
- Double-click the **RunTime Screen » Data » (e.g.) Multi Panel** to configure the visualized monitoring screen. A multi-panel window will be created on the DAQ Space window.



- Drag and drop the tags added on the DAQ List window to the Multi Panel window.

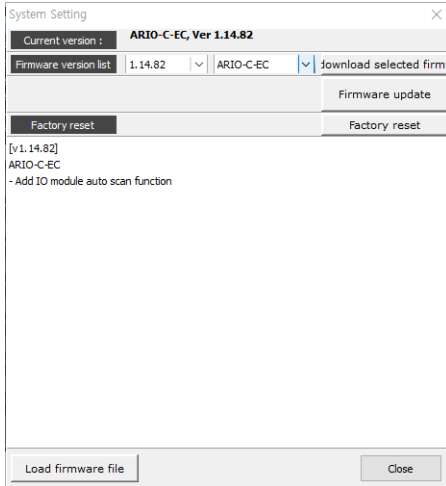


7. When selecting the **Project » Run**, you can monitor the channel status of the module.



6.2. Update the Firmware Version

You can check the firmware (software) version of the coupler on the **Comm Mode » Property tab of the coupler » FW Version** in the DAQMaster. To update the coupler's firmware, you need to select the **Comm Mode » Property tab of the coupler » System configuration**.



With Internet connection

1. Select the **Firmware update** to perform the update.

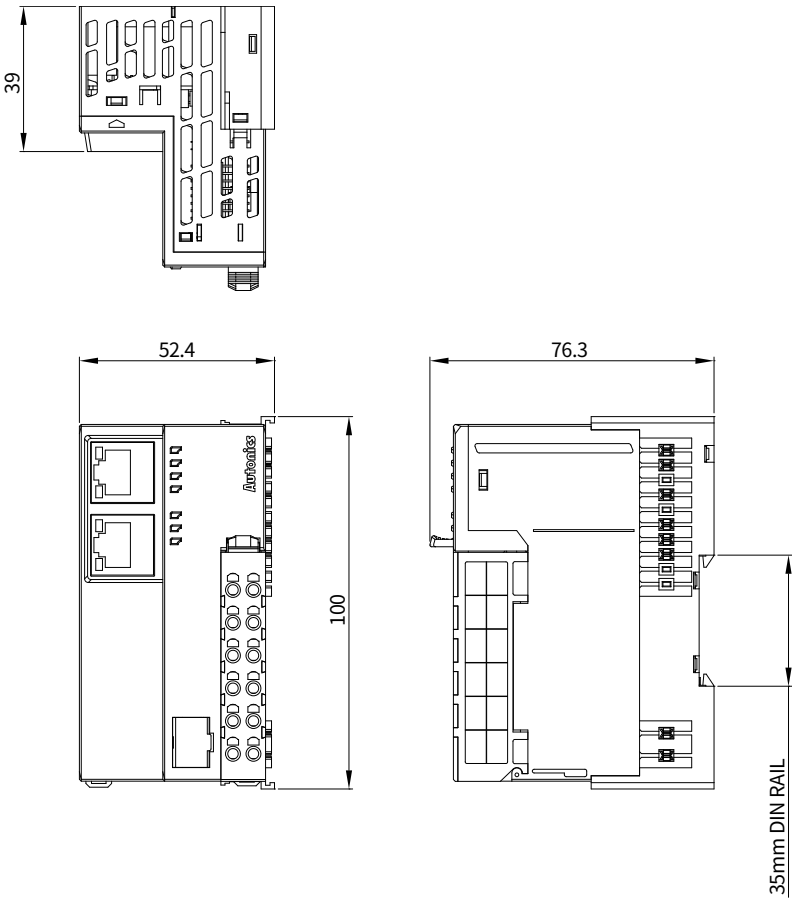
Without Internet connection

1. Download the latest firmware version of the coupler from the Autonics website.
2. Select the **Load firmware file** to import the downloaded .zip file.
3. Select the latest version of ARI0-C-EC at the **Firmware version list**.
4. Select the **Firmware update** to perform the update.

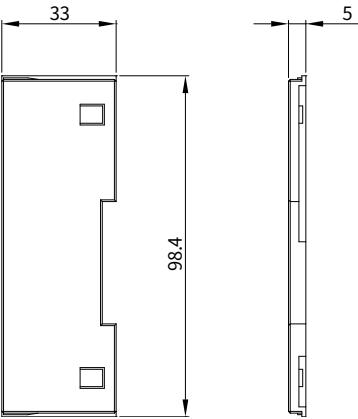
7. Dimensions

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

Coupler



End module



8. Specifications

8.1. Electrical/Mechanical Specifications

Max. number of connectable modules	≤ 64 (The length of connected modules: ≤ 768 mm)
Memory size	• Input: 512-byte • Output: 512-byte
Power supply	• Unit (coupler + module): ≤ 9.6 W, ≤ 400 mA (≤ 200 mA/CH, 2-CH/COM) • I/O: ≤ 96 W, ≤ 4,000 mA (≤ 2,000 mA/CH, 2-CH/COM)
Supply voltage	• Coupler input voltage: 24 V_{DC} • ABUS supply voltage: 5 V_{DC}, ≤ 960 mA • I/O supply voltage: 24 V_{DC}
Current consumption	• The standby and run mode: 200 mA • The maximum load: 400 mA (at coupler max. load)
Field network connection	RJ45 X 2
DAQMaster connection	USB 2.0 type Micro B
Installation method	DIN rail mounting
Material	Terminal: PA6, Body: MPPO, Base: PA6, POM
Unit weight (packaged)	≈ 165 g (≈ 265 g)

8.2. Environmental Conditions

Insulation resistance	$\geq 100\text{ M}\Omega$ (500 V _{DC} megger)
Dielectric strength	1000 V _{AC} 50/60 Hz for 1 minute
Noise immunity	500 V _{DC} the square wave noise (pulse width: 1 μ s) by the noise simulator
Vibration	0.7 mm double amplitude at frequency of 10 to 55 Hz (for 1 minute) in each X, Y, Z direction for 1 hour
Vibration (malfunction)	0.5 mm double amplitude at frequency of 10 to 55 Hz (for 1 minute) in each X, Y, Z direction for 10 minutes
Shock	300 m/s ² ($\approx 30\text{ G}$) in each X, Y, Z direction for 3 times
Shock (malfunction)	100 m/s ² ($\approx 10\text{ G}$) 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)

9. Communication Interface

9.1. Ethernet

Ethernet standard	100BASE-TX
Cable spec.	The cable approved by the EtherCAT Technology Group (ETG) or meets at least Cat 5e
Transmission rate	100 Mbps
Cable length	≤ 100 m
Protocol	EtherCAT
Number of nodes	≤ 65,535
Address settings	Auto
Topology	Bus, Line, Star, Tree, Drop Line
ESI file	Download the ESI file on our Autonics website

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