ARIO-C-DN

DeviceNet

User Manual MTO-ARIOCDNU1-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

Contents

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

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.

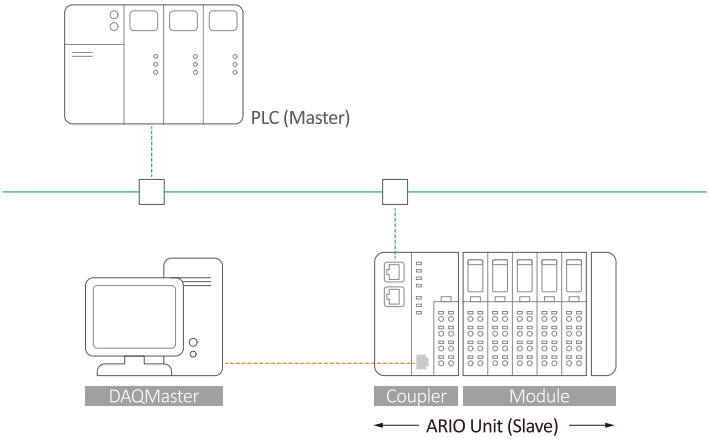
Cautions during Use

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 ARIO Unit.

1. Key features of ARIO 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 ARIO-C-DN

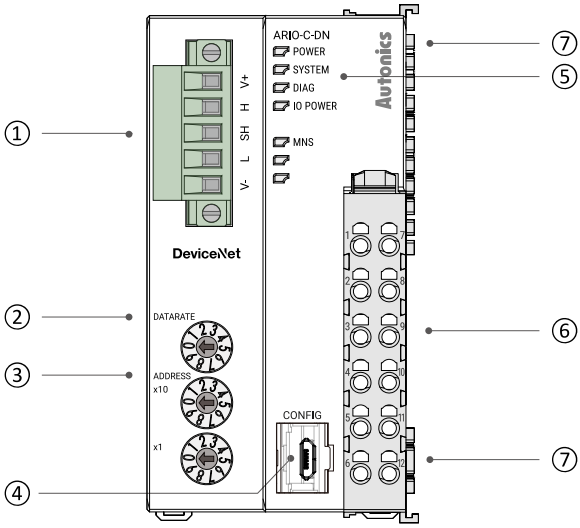
2.1. DeviceNet Protocol

DeviceNet is a multi-drop network that is easy to connect with multiple devices such as PLCs, sensors, and actuators. With DeviceNet, you can reduce costs for wiring and constructing a system in a multi-vendor environment. This protocol is widely used in many industrial sites such as semiconductor equipment and automobile manufacturing facilities.

DeviceNet utilizes the CAN bus on the data link and Common Industrial Protocol (CIP) on the network layer in the OSI layer, similar to the EtherNet/IP protocol. The CIP protocol allows messages to be transmitted to CIP-based networks such as EtherNet/IP so that you can manage control-related data through the services and profiles for real-time control applications from a variety of production systems.

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

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

2. DATARATE Rotary Switch

It is a setting switch to set the baud rate in the DeviceNet communication network.
For detailed information on selecting the baud rate, refer to the 2.4, “Set the Baud Rate”.

3. Decimal Rotary Switches

It is a setting switch to designate the node address (MAC-ID) of the coupler in the DeviceNet communication network. You can also set the node address in the DAQMaster.
For detailed information on addressing method, refer to the 2.5, “Assign the Node Address (MAC-ID)”.

4. CONFIG Port

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

1. Port type: USB Type-B Micro

5. 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. DeviceNet communication status

6. 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”.

7. Power Supply Contacts

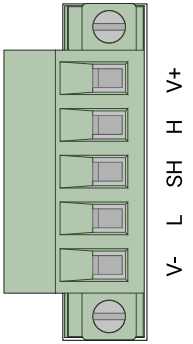
It is a contact that feeds the power input from the power supply terminal.

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. DeviceNet Communication Connector

- Be sure to use the connector and cable approved by the Open DeviceNet Vendors Association (ODVA).

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



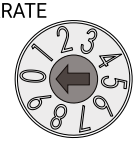
Pin no.	Marking on the connector	Color	Description
1	V+	Red	+24 V_{DC} DeviceNet power input
2	H: CAN_H	White	CAN High signal
3	SH: Shield	-	Shield
4	L: CAN_L	Blue	CAN Low signal
5	V-	Black	Signal ground (-24 V_{DC}, 0 V_{DC})

2.4. Set the Baud Rate

- Be sure to use the connector and cable approved by the Open DeviceNet Vendors Association (ODVA).
- Be sure not to exceed the maximum cable length of each baud rate.

Refer to the table below for you to set the baud rate of DeviceNet via the DATARATE rotary switch. The selected baud rate should be the same as the type of DeviceNet Master.

DATARATE

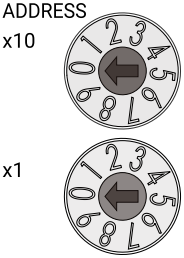


Rotary switch	Baud rate	Trunk cable length	Drop cable length
0	125 kbps	• Thick cable: ≤ 500 m • Thin cable: ≤ 100 m	• Thick/Thin cable: ≤ 6 m • Cumulative drop line: ≤ 156 m
1	250 kbps	• Thick cable: ≤ 250 m • Thin cable: ≤ 100 m	• Thick/Thin cable: ≤ 6 m • Cumulative drop line: ≤ 78 m
2	500 kbps	• Thick cable: ≤ 100 m • Thin cable: ≤ 100 m	• Thick/Thin cable: ≤ 6 m • Cumulative drop line: ≤ 39 m

2.5. Assign the Node Address (MAC-ID)

- 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.

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

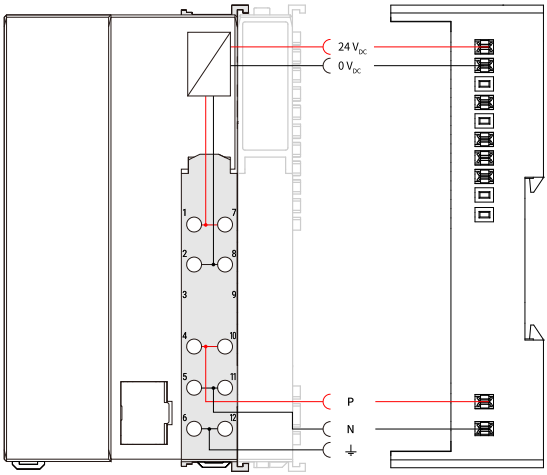


Assign mode	Rotary switches (x10, x1)	Node address
Default node address	00	3
The node address of the coupler	01 to 63	**1** to **63**

2.5.1. 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.

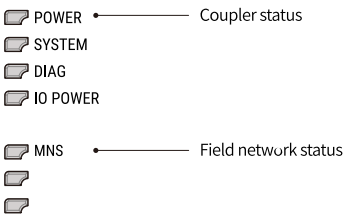
2.6. Connections of the Power Terminal



Terminal no.	Name	Description
1, 7	System Power (24 V_{DC})	Power supply for the coupler, module and ABUS to be operated. • The terminals feed the power supply to the top input contacts. • The POWER indicator lights up.
2, 8	System Power (0 V_{DC})	
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. • The terminals feed the power supply to the bottom input contacts. • The IO POWER indicator lights up.
5, 11	Field Power (Negative: 0 V_{DC})	
6, 12	Frame Ground / Shield	Frame ground

3. Indicators

The indicators of the ARIO-C-DN coupler consist of elements indicating the operating status for the coupler and connection status for the field network (DeviceNet) 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

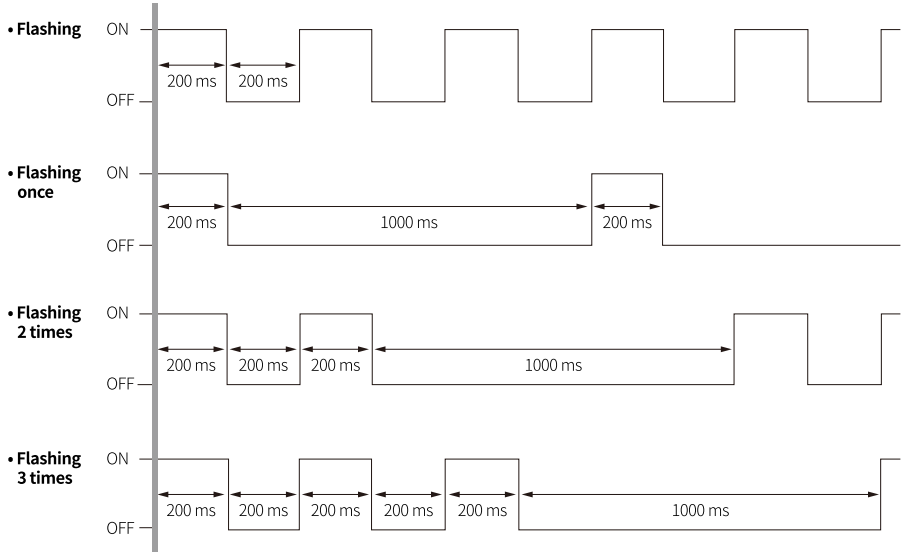
Indicator	LED color	Status	Description
IO POWER	Green	ON	I/O supply voltage of the module: Normal
		OFF	I/O supply voltage of the module: None

3.2. LEDs for the Field Network Status

1. The module/network status

Indicator	LED color	Status	Description
MNS	Green	ON	The device is operating correctly and the connection is established.
		Flashing	• The device is in online mode but has no connection. • Configuration information could not be read • Configuration error (invalid or incomplete configuration)
		OFF	The device is in INIT state (DeviceNet communication initialization, communication unavailable)
	Red	ON	Critical fault or network connection failure • Duplicate MAC-ID • Severe error occurred in CAN network (CAN Bus off)
		Flashing	Minor or recoverable fault • Connection timeout • No data exchange with a slave • No network supply voltage
		OFF	• Device Supply voltage: None • Device power is applied but there is no network supply voltage. • MAC address validation (Dup_MAC_ID test) not yet completed
	Green/Red	OFF	• Device supply voltage: None • Network supply voltage: None • MAC address validation (Dup_MAC_ID test) not yet completed
		Flashing	Self-test: The device is performing its power up testing.

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.

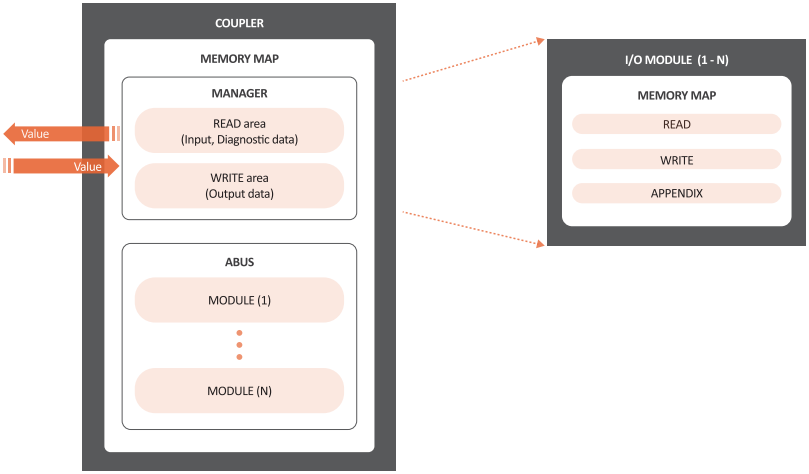


4. Process Images

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 (≈ $10{,}000_{DEC}$)**

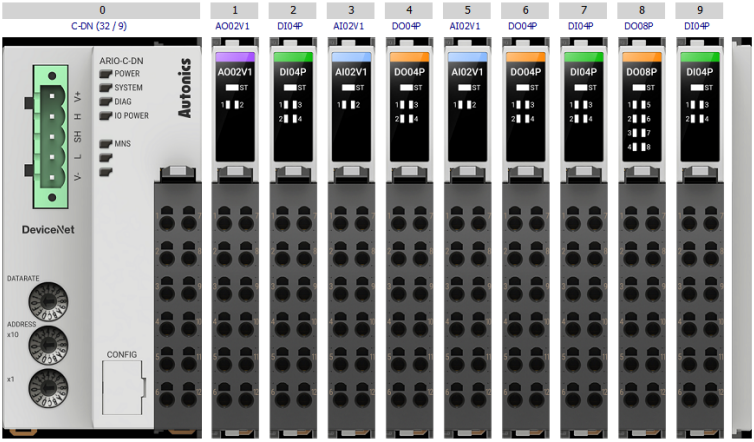
Slot Number : Module Name	Type	Channel	Data	Diagnostic Byte
1 : AI04V1	R	4	0x270D 0003 0003 0000	
Channel 1			0x270D	
Channel 2			0x0003	
Channel 3			0x0003	
Channel 4			0x0000	
2 : AO04V1	W	4	0x2710 0000 0000 0000	
Channel 1			0x2710	
Channel 2			0x0000	
Channel 3			0x0000	
Channel 4			0x0000	

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	Address	Type	7	6	5	4	3	2	1	0
2 : DI04P	0	R					P3	P2	P1	P0
3 : AI02V1 - Channel 0	1	R	C1H	C1H	C1H	C1H	C1H	C1H	C1H	C1H
3 : AI02V1 - Channel 1	2	R	C1L	C1L	C1L	C1L	C1L	C1L	C1L	C1L
3 : AI02V1 - Channel 2	3	R	C2H	C2H	C2H	C2H	C2H	C2H	C2H	C2H
3 : AI02V1 - Channel 3	4	R	C2L	C2L	C2L	C2L	C2L	C2L	C2L	C2L
5 : AI02V1 - Channel 0	5	R	C1H	C1H	C1H	C1H	C1H	C1H	C1H	C1H
5 : AI02V1 - Channel 1	6	R	C1L	C1L	C1L	C1L	C1L	C1L	C1L	C1L
5 : AI02V1 - Channel 2	7	R	C2H	C2H	C2H	C2H	C2H	C2H	C2H	C2H
5 : AI02V1 - Channel 3	8	R	C2L	C2L	C2L	C2L	C2L	C2L	C2L	C2L
7 : DI04P	9	R					P3	P2	P1	P0
9 : DI04P	10	R					P3	P2	P1	P0
1 : AO02V1 - Channel 0	0	W	C1H	C1H	C1H	C1H	C1H	C1H	C1H	C1H
1 : AO02V1 - Channel 1	1	W	C1L	C1L	C1L	C1L	C1L	C1L	C1L	C1L
1 : AO02V1 - Channel 2	2	W	C2H	C2H	C2H	C2H	C2H	C2H	C2H	C2H
1 : AO02V1 - Channel 3	3	W	C2L	C2L	C2L	C2L	C2L	C2L	C2L	C2L
4 : DO04P	4	W					P3	P2	P1	P0
6 : DO04P	5	W					P3	P2	P1	P0
8 : DO08P	6	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
($\leq$ 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. Object Models

In the DeviceNet network, the method and procedures of data exchange among the nodes are designed via multiple object groups. An object is a collection of abstract representations of a specific component in an DeviceNet device, including their class and instances together with services and functions.

- **Terms and definitions for the object model**

Term	Definition
Object	It is an abstract expression of the components of a product, defining its attributes and data, services and functions, and behaviors to determine an object.
Class	It is the generalization of an object, containing the components implemented by the instances.
Instance	It consists of multiple attributes and has the same attributes, behaviors, and services even though the instances within the class are different.
Attributes	It represents the attributes of data or objects provided by the DeviceNet device. It contains the information of the slave device and values of input/output data.
Services	It is the procedure or action performed by an object, applicable to the classes and attributes. CIP defines common services applied to attributes.
Behaviors	It defines the object functions to a specific event.

5.1. Supported Object Classes

Object	Class Code	Reference
Identity	0x01	→ 5.3, “Identity Class (0x01)”
Message Router	0x02	→ 5.4, “Message Router Class (0x02)”
DeviceNet	0x03	→ 5.5, “DeviceNet Class (0x03)”
Connection	0x05	→ 5.6, “Connection Class (0x05)”
Acknowledge Handler	0x2B	→ 5.7, “Acknowledge Handler Class (0x2B)”

5.2. Data Types

Data Type	Data Size	Data Unit
USINT (Unsigned Short Integer)	8-bit	1-byte
UINT (Unsigned Integer)	16-bit	1-word
UDINT (Unsigned Double Integer)	32-bit	2-word
BOOL (Boolean)	True (1) / False (0)	8-bit
STRUCT (Structure of…)	-	-
ARRAY (Array of…)	-	-

5.3. Identity Class (0x01)

It provides the product information about Vendor ID and Device Type to identify the slave device.

5.3.1. Services

Service Code	Service Name	Description
0x01	Get_Attribute_All	It returns the attribute value of an instance or class.
0x0E	Get_Attribute_Single	It returns the value of a specific attribute.
0x05	Reset	It executes the service to reset the device. 0: Restart the device 1: Restart the device to proceed with factory reset

5.3.2. Instance Attributes

• Instance 1

Attribute ID	Access Rule	Name	Data Type	Description
1	Get	Vendor ID	UINT	Vendor ID info.: 801 (0x321)
2	Get	Device Type	UINT	Device type: 12 (0x0C)
3	Get	Product Code	UINT	Product code assigned by the vendor : 201 (0xC9)
4	Get	Revision	STRUCT	F/W Revision info.: Ver 1.2 (Major = 1, Minor = 2)
	Get	Major	USINT	
	Get	Minor	USINT	
5	Get	Status	WORD	The current status of the device
6	Get	Serial Number	UDINT	Serial number of the device: 0xC9
7	Get	Product Name	SHORT_ STRING	Product name: ARIO_C_DN

5.4. Message Router Class (0x02)

It transfers the explicit messages to another object.
The services and instance attributes are not supported.

5.5. DeviceNet Class (0x03)

It contains the information for DeviceNet network configuration such as MAC ID and baud rates, etc.

5.5.1. Services

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	It returns the value of a specific attribute.
0x10	Set_Attribute_Single	It modifies the value of a specific attribute.

5.5.2. Instance Attributes

• Instance 1

Attribute ID	Access Rule	Name	Data Type	Description
1	Get/Set	MAC ID	USINT	MAC ID (node address) of the device • Range: 00 to 63
3	Get	BOI (Bus-Off Interrupt)	BOOL	Settings of CAN communication connection status when Bus-Off is detected 0: Maintain Bus-Off state 1: Reset the device t to establish communication
4	Get	Bus-Off Counter	USINT	The counting number of Bus-Off detection • Range: 0 to 255
6	Get	MAC ID Switch Changed	BOOL	Switching the MAC ID of the coupler 0: MAC ID did not change 1: MAC ID changed

5.6. Connection Class (0x05)

It consists of an object representing the connection information between two nodes in the DeviceNet network, and the attributes of each object define the connection behavior of the device. The instance of the Connection object determines how to process and transmit the process data.

5.6.1. Services

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	It returns the value of a specific attribute.
0x10	Set_Attribute_Single	It modifies the value of a specific attribute.
0x05	Reset	It executes the service to reset the device. 0: Restart the device 1: Restart the device to proceed with factory reset

5.6.2. Instances

Instance ID	Connection Type	Description
1	Explicit Messaging	Explicit message connection
2	Poll I/O connection	Data is exchanged cyclically by the request of the master.
3	Bit-Strobe I/O Connection	Data is exchanged by the 1-bit output signal (a command) of the master.
4	Change of State (COS), Cyclic I/O connection	COS: Data is exchanged with the master when a state of slave is changed. Cyclic: The slave sends the data to the master every selected cycle time.

5.6.3. Instance Attributes

Instance 1, 2, 3, 4

Attribute ID	Access Rule	Name	Data Type	Description
1	Get	Connection State	USINT	Status of the object
2	Get	Connection Type	USINT	Explicit messages or I/O connection
3	Get	Transport Type	USINT	Definition of the connection behaviors
4	Get	Produced Connection ID	UINT	Produced connection ID assigned to CAN identifier field
5	Get	Consumed Connection ID	UINT	Consumed connection ID assigned to CAN identifier field
6	Get	Initial Comm Characteristics	USINT	Definition of message groups for production/consumptions data
7	Get	Produced Connection Size	UINT	Maximum size of transmit data (byte)
8	Get	Consumed Connection Size	UINT	Maximum size of received data (byte)
9	Get/Set	Expected Packet Rate	UINT	Definition of timing value related to the Connection
10, 11	-	-	-	Not used

Attribute ID	Access Rule	Name	Data Type	Description
12	Get	Timeout Action	USINT	Definition of the Connection object action (How to handle Inactivity and Watchdog timeout)
13	Get	Produced Path Length	UINT	The byte size of the Produced Connection Path attribute
14	Get/Set	Produced Connection Path ID	Array of USINT	Specifies the Application objects, whose data are generated in this connection object
15	Get	Consumed Path Length	UINT	The byte size of the Consumed Connection Path attribute
16	Get	Consumed Connection Path ID	Array of USINT	Specifies the Application objects, whose data are received by this connection object
17	Get	Inhibit Time	USINT	Definition of the minimum time between data transmission

5.7. Acknowledge Handler Class (0x2B)

Processing the response message of the slave.

5.7.1. Services

Service Code	Service Name	Description
0x0E	Get_Attribute_Single	It returns the value of a specific attribute.
0x10	Set_Attribute_Single	It modifies the value of a specific attribute.

5.7.2. Instance Attributes

• Instance 1

Attribute ID	Access Rule	Name	Data Type	Description
1	Get/Set	Ack. Timer	UINT	Wait time for a confirmation • Range: 1 to 65535 • Default: 16 ms
2	Get/Set	Ack. Handler Retry Limit	USINT	Counting number of Acknowledge Timeouts before the application is notified about a RetryLimit_Reached • Range: 0 to 255 • Default: 1
3	Get	COS Produced ID	UINT	An instance that provides information about Acknowledge Handlers (but, it includes the I/O Application object path) • Default: 0x04

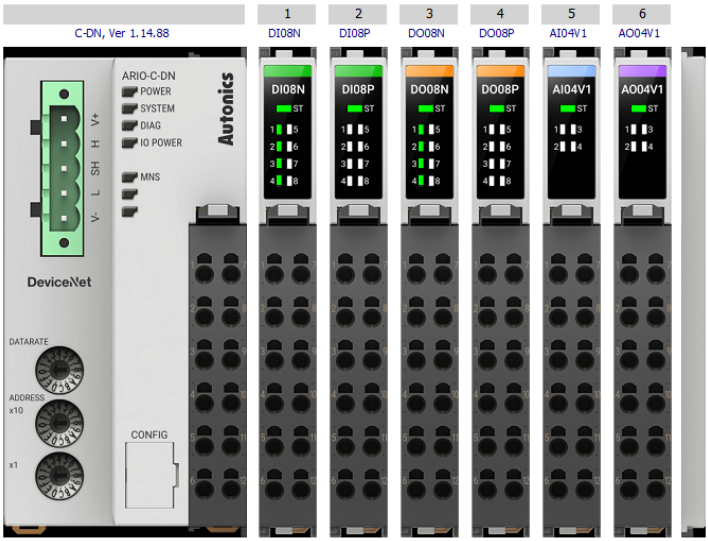
6. CX-Programmer Guide

- Be sure to see the version compatibility table of the ARIO Series on our Autonics website to check the software/firmware(SW) and hardware(HW) versions of the coupler and modules.
- Refer to the 7.2, “Update the Firmware Version” to update to the latest software(firmware) version.

6.1. Before You Begin

Firstly, this chapter describes how to connect the ARIO unit, arranged as shown in the figure below, to the DeviceNet master.
After that, the following descriptions are given in this chapter:
• Read the input signals on channel 1 to 4 of the digital input module (DI08N, slot 1).
• Write the output signals on channel 1 to 4 of the digital output module (DO08N, slot 3).
• Monitor the data of connected modules.

Configuration of the ARIO unit



Configuration of the DeviceNet Master

- OMRON PLC CPU: CJ2M-CPU31
- OMRON DeviceNet Master unit: CJ1W-DRM21
- DeviceNet Baud rate: 125 kbps (DIP switch setting: 1 and 2 OFF)
- Project Planning Software

Software	CX-Programmer Ver 9.5	CX-Integrator Ver 2.58
Device connection and configuration	- PLC CPU - DeviceNet master unit - PC	- PLC CPU - DeviceNet master unit - ARIO unit - PC
Network connections	USB (PLC CPU ↔ PC)	Ethernet (PLC CPU ↔ PC)
Functions	Reading and writing PLC data	DeviceNet network configuration Automatic scan the I/O size Check the I/O memory address

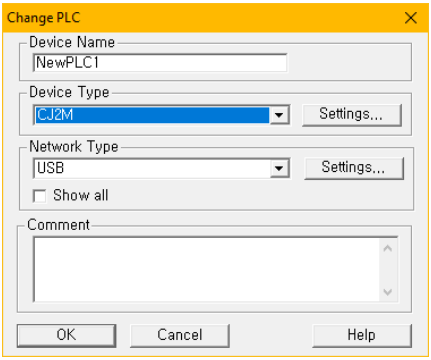
Settings of the ARIO coupler

- The setting of Node address (MAC-ID): 6
  Set the positions of the decimal rotary switches to 06.
- The setting of baud rate: 0 (= 125 kbps)
  Set the position of the DATARATE rotary switch to 0.
  (Set the baud rate same as the type of the DeviceNet master.)

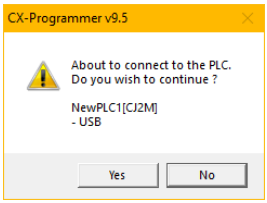
This chapter only describes based on the OMRON's master (PLC) and software.
For detailed information on communication connection and usage method with the master, refer to the user manuals provided by the specific manufacturer.

6.2. Create a OMRON PLC Project

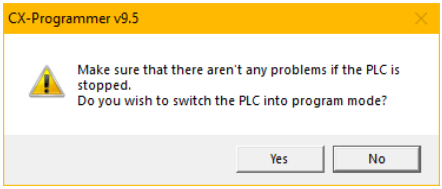
1. Launch the CX-Programmer.
2. Click the (New) button on the toolbar.
3. Configure the connected PLC CPU in the **Change PLC** window and click the **OK**.
   - Device Type: CJ2M, CPU Type: CPU31
   - Network Type: USB



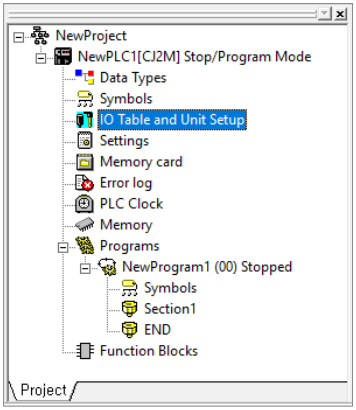
4. Press the **ctrl** + **S** to specify the project file name of the CX-Programmer and save it to the desired location.
5. Click the (Work Online) button on the toolbar. Click the **Yes** in the pop-up window to connect to the PLC.



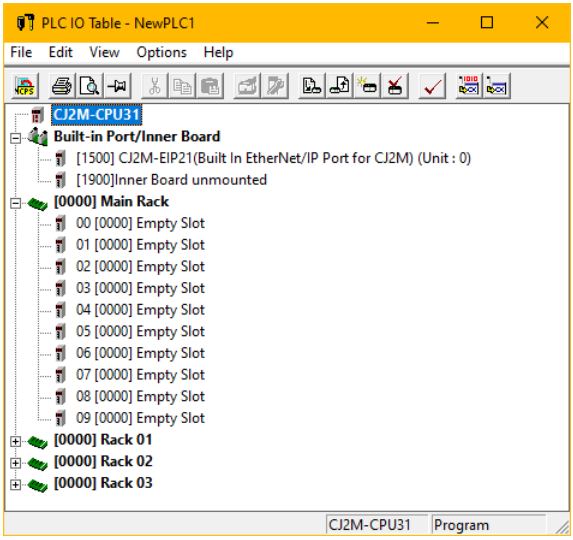
6. Click the (Program Mode) button on the toolbar.
   Click the **Yes** in the pop-up window to change the PLC operating mode to the program mode.



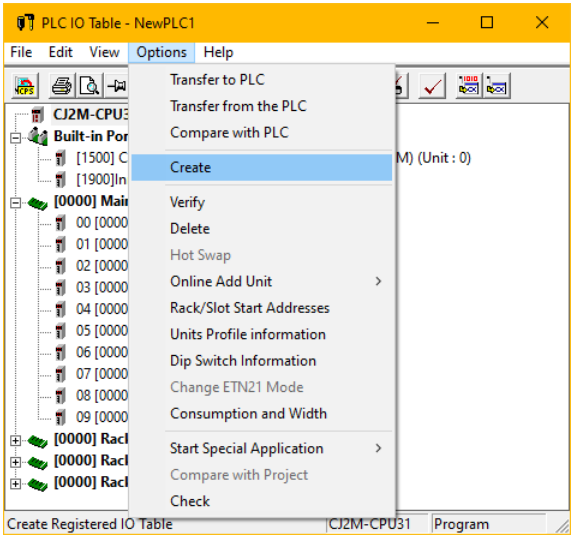
7. Double-click the **IO Table and Unit Setup** in the project workspace.



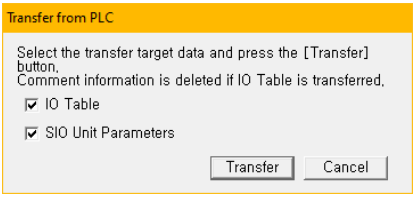
8. When expanding the **Main Rack** in the **PLC IO Table** window, you can figure out that the DeviceNet Master unit is not added.

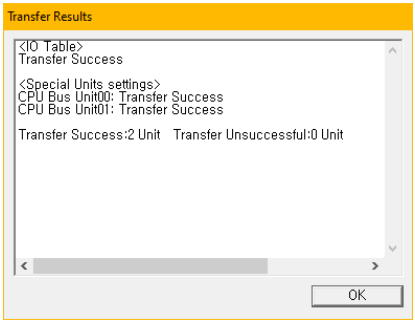


9. Click the **Options** » **Create** in the top menu. Click the `Yes` in the pop-up window to proceed with the create IO table and initialize CPU bus settings.

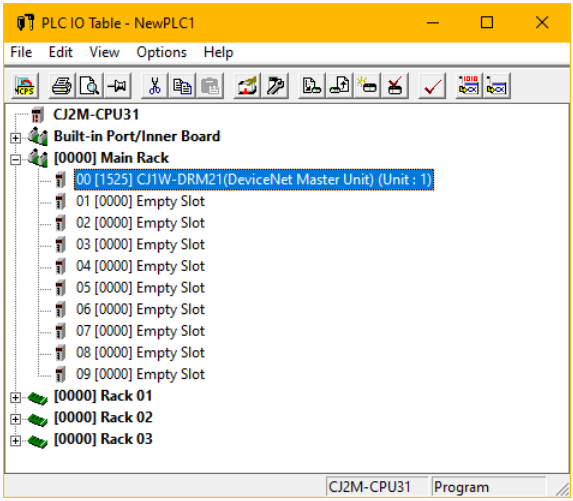


10. Click the **Transfer** in the **Transfer from PLC** window. Click the **OK** in the **Transfer Results** window.



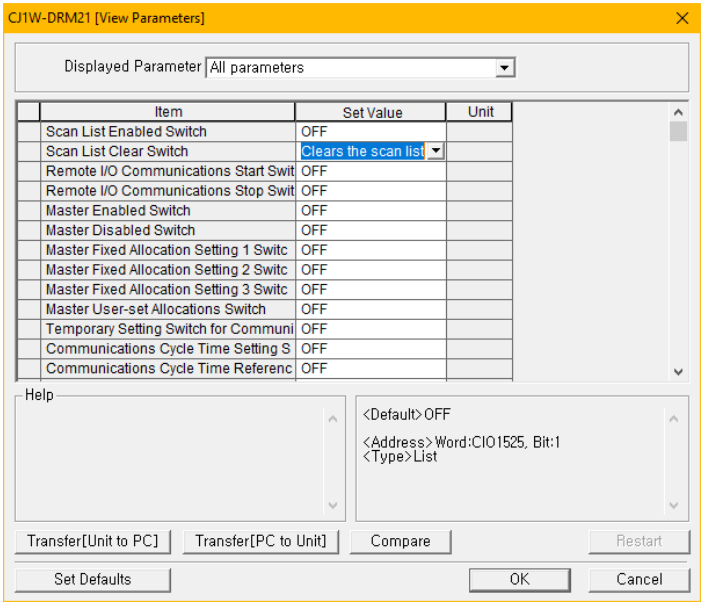


11. The DeviceNet master unit is added to the **Main Rack**.

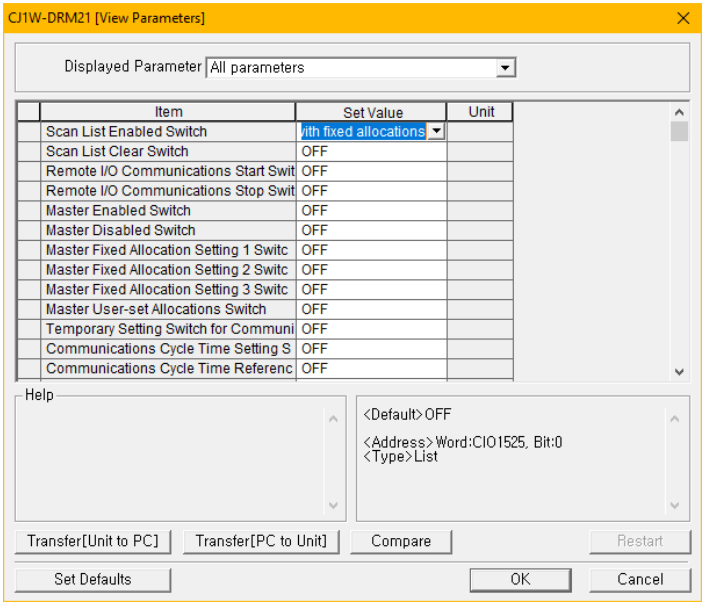


6.3. Validate the Scan List

1. Double-click the added DeviceNet Master unit in the PLC IO Table window to open the parameter list window.
2. Set the value of the **Scan List Clear Switch** parameter to ON and click the **Transfer(PC to Unit)**. Click the **Yes** in the pop-up window to transfer the parameters to the DeviceNet Master unit.

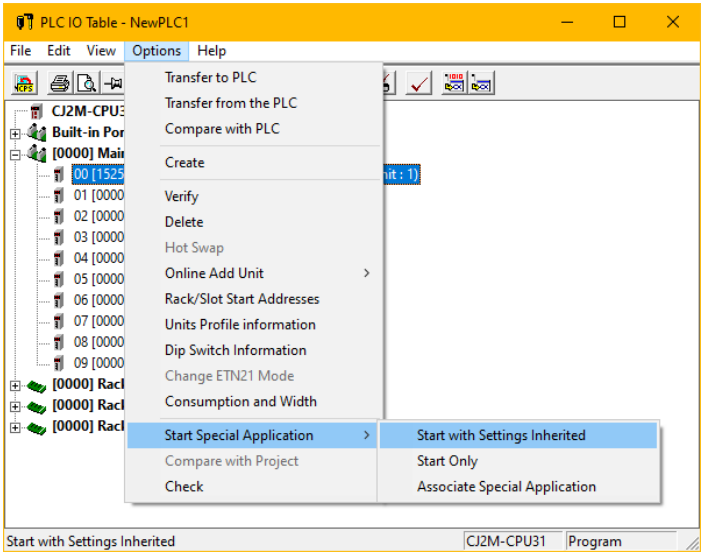


3. Change again the value of the **Scan List Clear Switch** parameter to OFF.
   In this time, set the value of the **Scan List Enabled Switch** parameter to ON and click the **Transfer(PC to Unit)**. Click the **Yes** in the pop-up window to transfer the parameters to the DeviceNet Master unit.
   Click the **OK** at the bottom of the parameter list window after the transmission is completed.



4. The green LED lights up on the SYSTEM and MNS indicators of the ARIO coupler.
   The green LED lights up on the NS indicator of the CJ1W-DRM21 (the DeviceNet Master unit).

5. Click the **Options** » **Start Special Application** » **Start with Settings Inherited** in the top menu to launch the CX-Integrator.

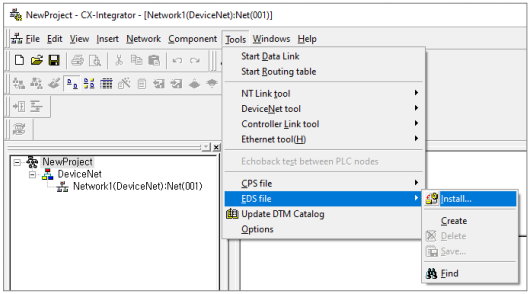


6.4. CX-Integrator Guide

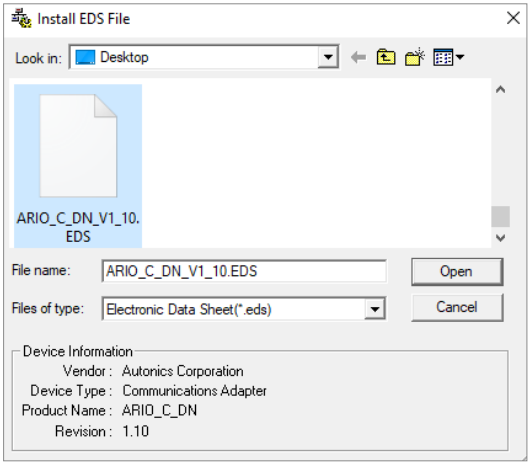
6.4.1. Install the EDS File

Electronic Data Sheets (EDS) files contain information about the data and communication functions of the coupler for DeviceNet connection.
You can install and manage EDS files on your project planning software.

1. Download the EDS file of ARIO-C-DN on our Autonics website.
2. Refer to the README.txt in the downloaded folder and select the EDS file suitable for the S/W version of the coupler.
3. Click the **Tools** » **EDS file** » **Install**⋯ in the top menu of CX-Integrator.

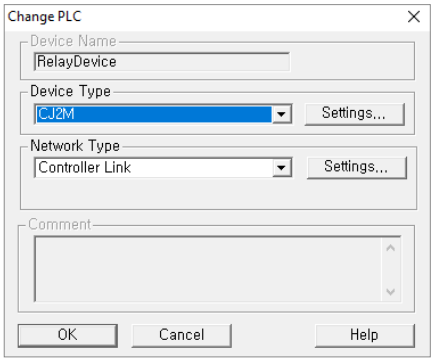


4. Select the EDS file and click the **Open**.

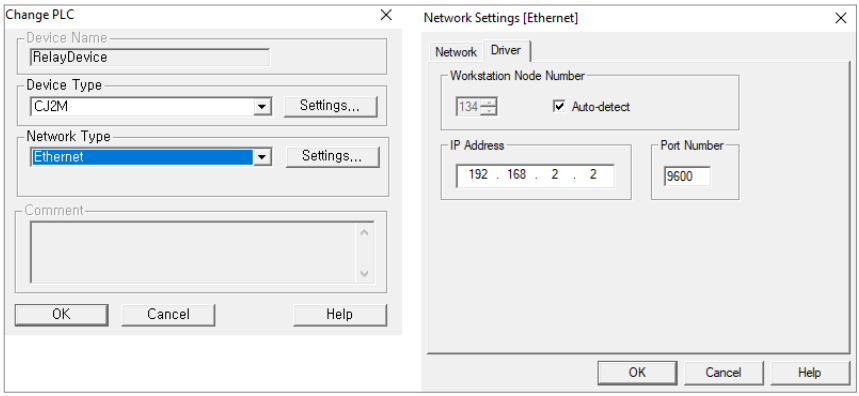


6.4.2. Configure the Communication

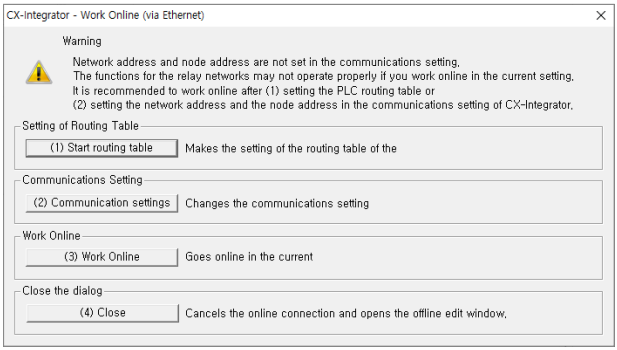
1. Click the (Communication Settings) on the toolbar.
2. Configure the connected PLC CPU in the **Change PLC** window and click the **OK**.
   - Device Type: CJ2M, CPU Type: CPU31



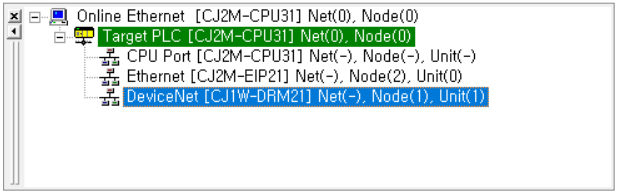
3. Set the Network Type for the connected PLC CPU in the **Change PLC** window and click the **OK**.
   - Network Type: Ethernet
   - Network Settings: Click the Driver tab and set the IP address of the PLC.



4. Click the (Work Online) button on the toolbar. Click the **(3) Work Online** in the pop-up window to connect to the PLC.

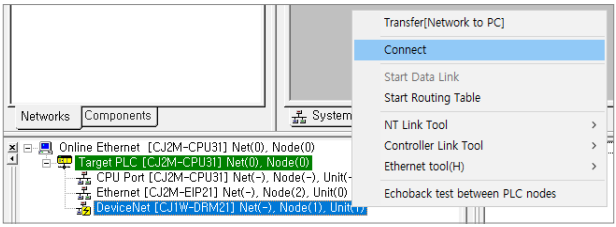


5. You can see that the Target PLC and DeviceNet Master unit are connected to the Relay PLC in the online information window.

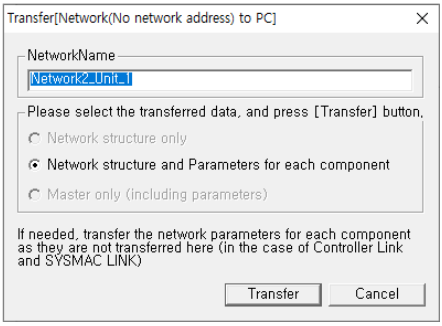


6.4.3. Add the ARIO Unit

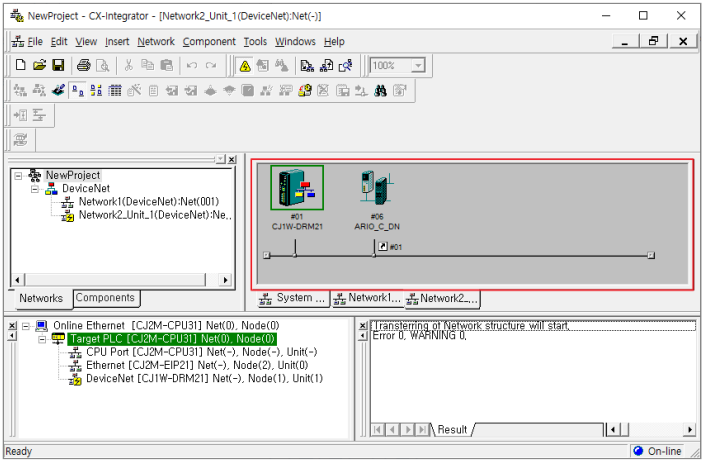
1. **Right-click** » **Connect** on the added DeviceNet Master unit.



2. Click the **Transfer** in the bottom of the pop-up window.

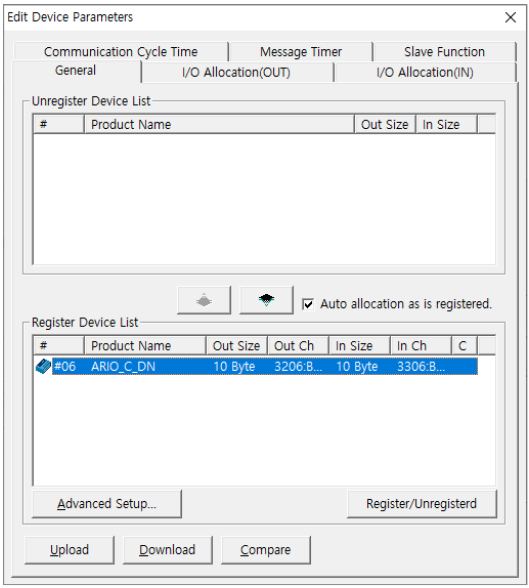


3. The network configuration is represented as shown below after the scan is completed.



4. Double-click the DeviceNet Master unit.

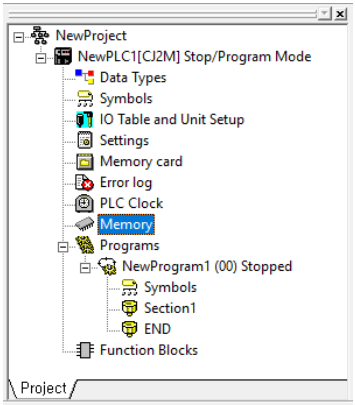
5. Check the data size and memory address of the input/output data of the connected ARIO unit on the **General** tab in the **Edit Device Parameters** window.



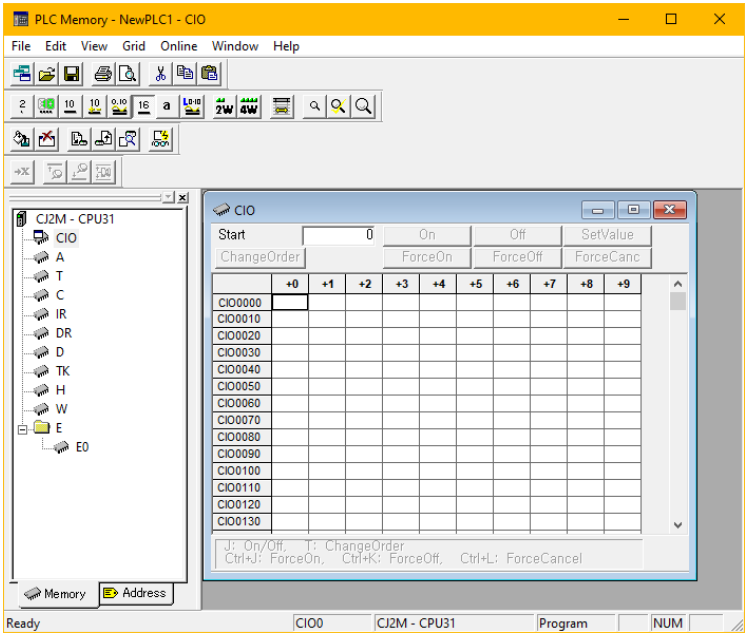
- Data size of output module (Out Size): 10-byte
- Start address of output data (Out Ch): 3206
- Data size of input module (In Size): 10-byte
- Start address of input data (In Ch): 3306

6.5. Read the Input Data

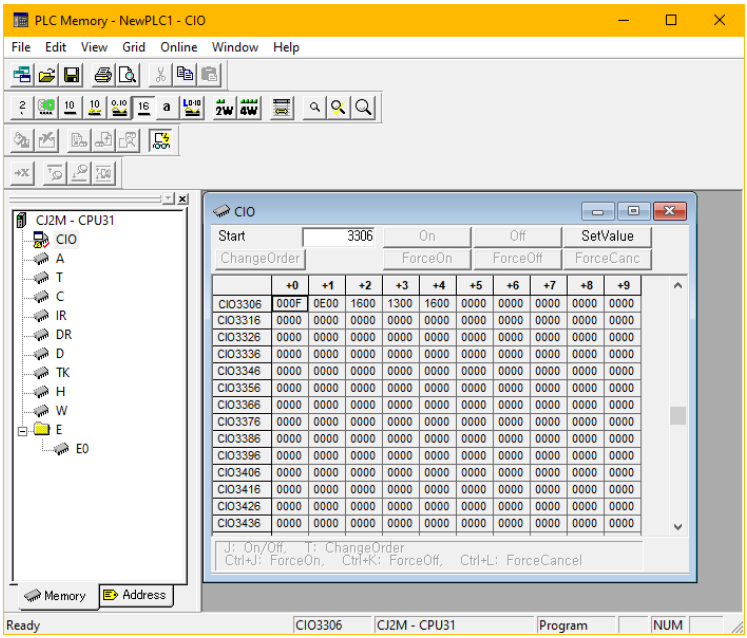
1. Double-click the **Memory** in the project workspace of CX-Programmer.



2. Double-click the **CIO** in the **PLC Memory** window. The CIO window is created on the right side of the screen.



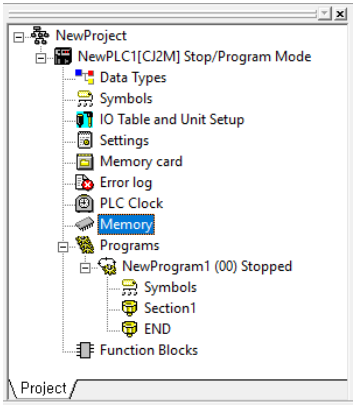
3. Click the **Online** » **Monitor** in the top menu.
   Enter the **3306** of the starting address of the input data in the CIO window and press the **Enter** key.
   You can see that the input signals are given to channel 1 to 4 of the first digital input module.



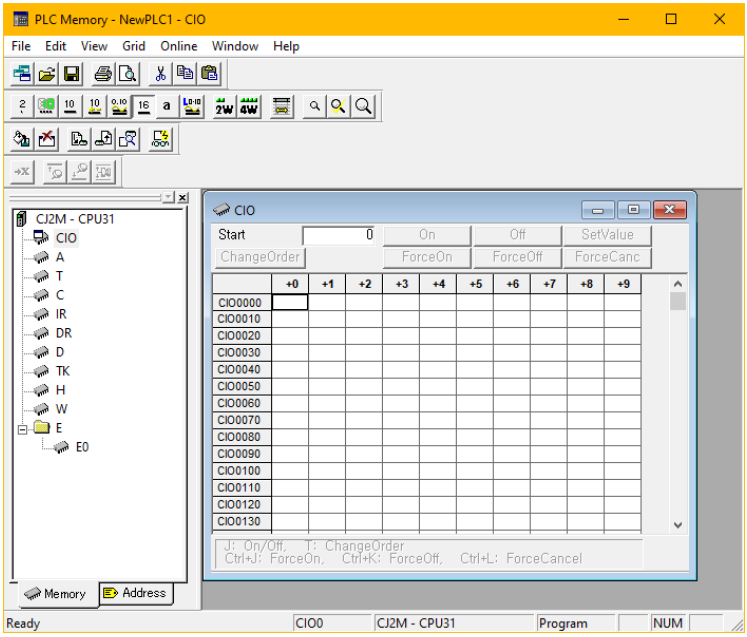
	+0		+1		+2		+3		+4	
CIO3306	00	**0F**	00	00	00	00	00	00	00	00
Channel	Ch. 1 to 8	Ch. 1 to 8	Ch. 4		Ch. 3		Ch. 2		Ch. 1	
Input module	DI 2	DI 1	AI 3							

6.6. Write the Output Data

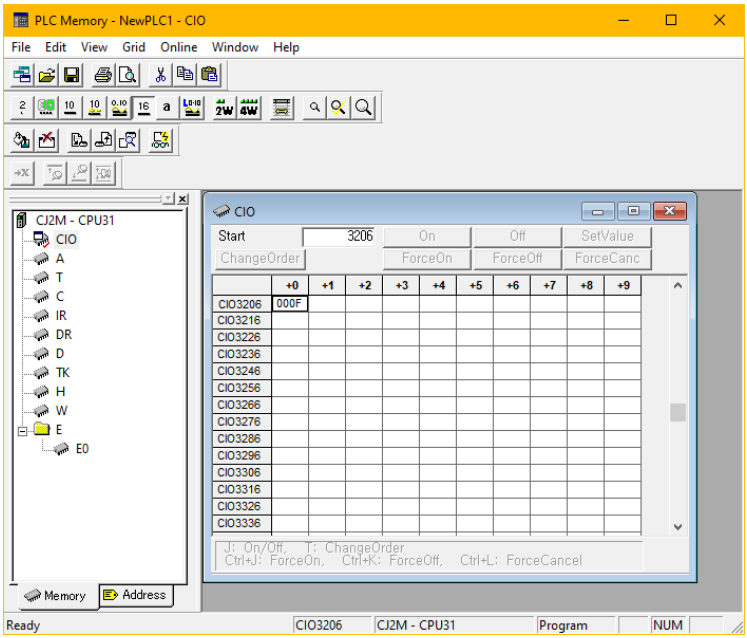
1. Double-click the **Memory** in the project workspace of CX-Programmer.



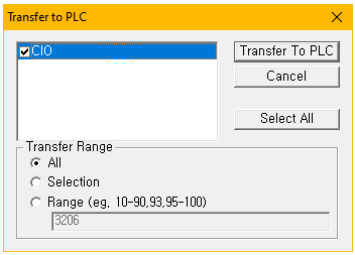
2. Double-click the **CIO** in the **PLC Memory** window. The CIO window is created on the right side of the screen.



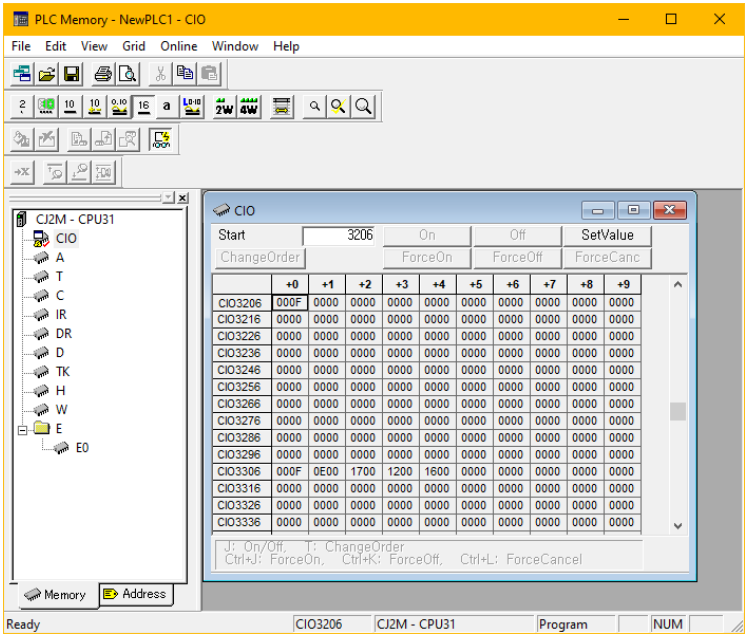
3. Enter **3206** of the starting address of the output data in the CIO window and press the **Enter** key. Enter the **0F** to give output signals to channel 1 to 4 of the first digital output module and press the **Enter** key.



4. Click the **Online** » **Transfer to PLC** on the top menu. Firstly, check the Transfer Range in the pop-up window and then click the **Transfer To PLC**. (The green LEDs light up on the 1 to 4 channel indicators of the digital output module.)



5. You can see the output channels under the Monitor mode.

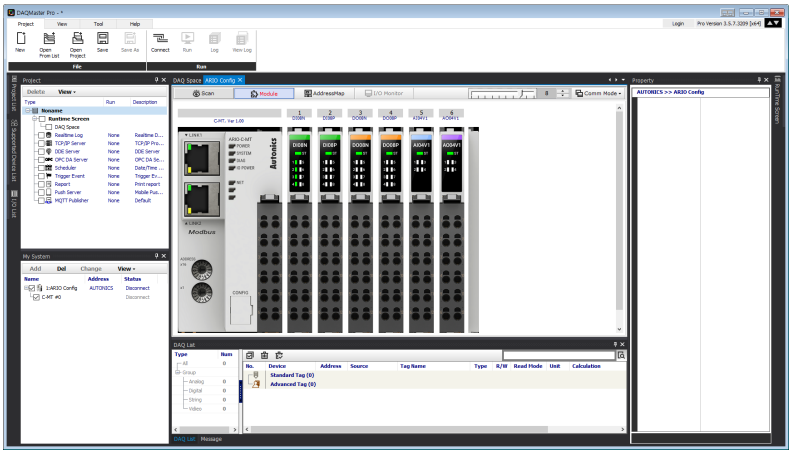


	+0		+1		+2		+3		+4	
CIO3206	00	**0F**	00	00	00	00	00	00	00	00
Channel	Ch. 1 to 8	Ch. 1 to 8	Ch. 4		Ch. 3		Ch. 2		Ch. 1	
Output module	DO 2	DO 1	AO 3							

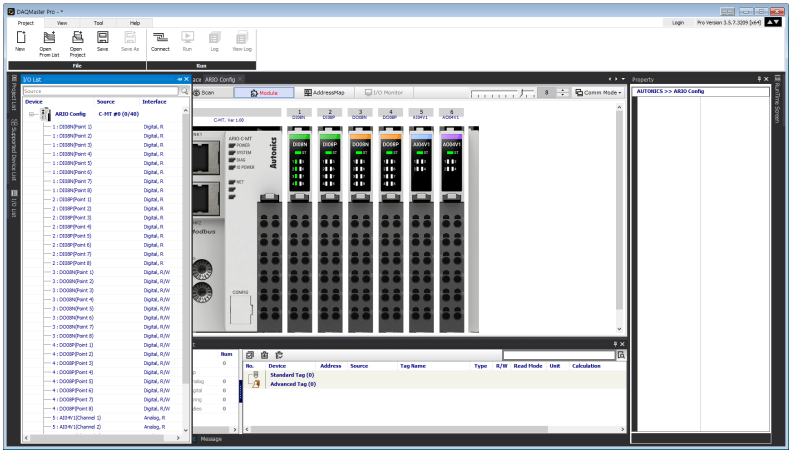
7. DAQMaster

7.1. Monitor the ARIO Unit

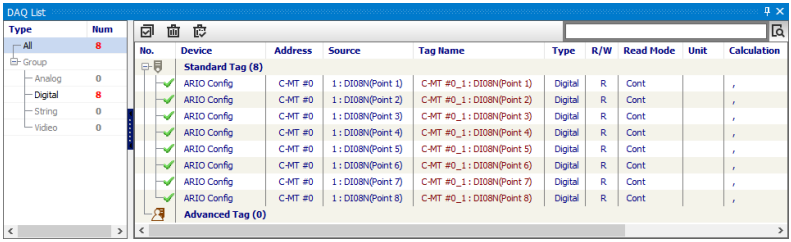
1. Connect the CONFIG port of the ARIO coupler to the PC where the DAQMaster is installed.
2. Select the **Supported Device List** » **AUTONICS** » **ARIO Config** to add the ARIO coupler and then select the **Connect** » **Scan** to import the connected ARIO unit. (Comm Mode state)



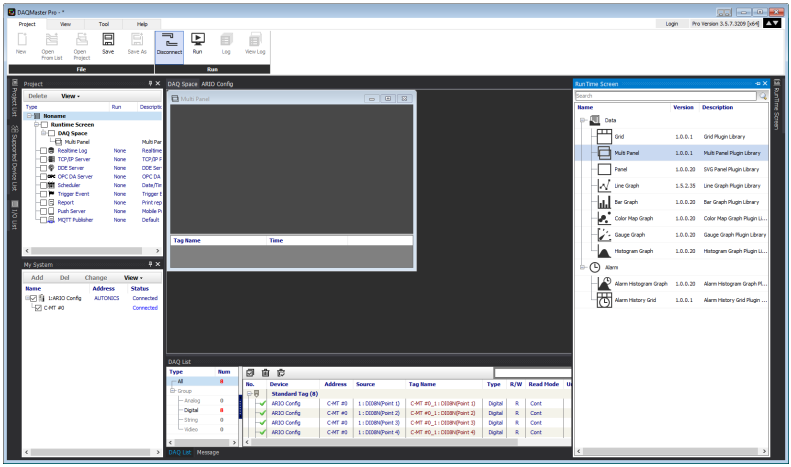
3. When Selecting the **I/O List** » **ARIO Config**, the tag list of the connected input/output module is displayed. Double-click the tag to be monitored to add it on the DAQ List window.



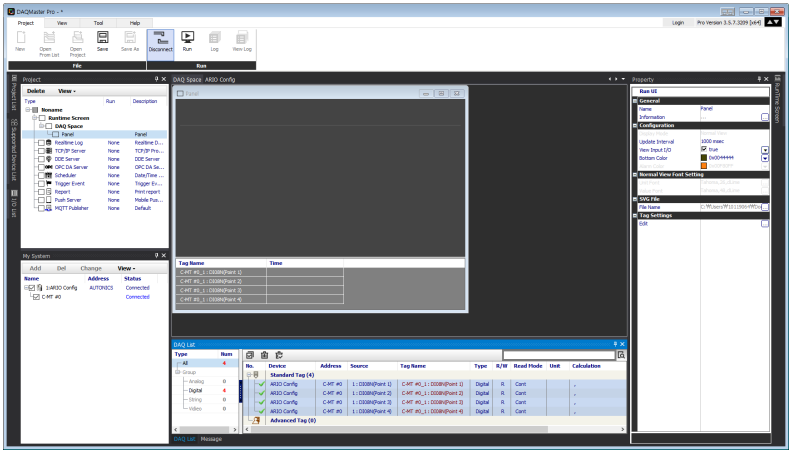
4. The tags are added on the DAQ List window as shown below.



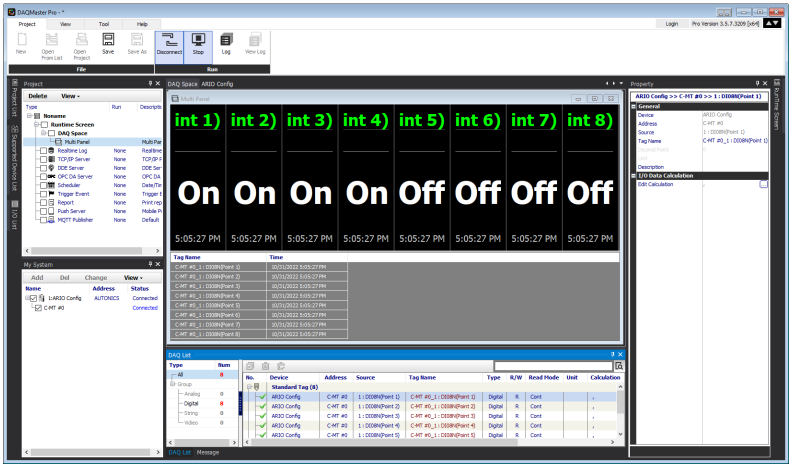
5. Double-click the **RunTime Screen** » **Data** » **(e.g.) Multi Panel** to configure the visualized monitoring screen. A multi-panel window will be created on the DAQ Space window.



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

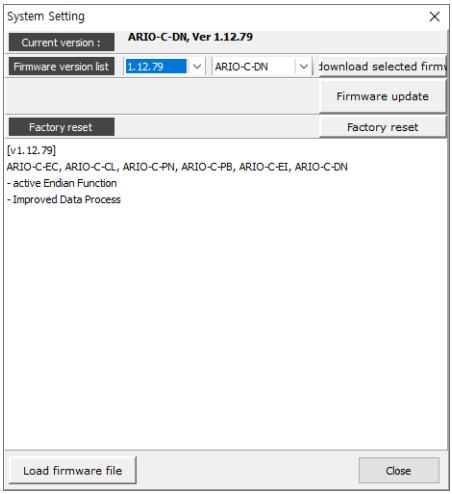


7. When selecting the **Project** » **Run**, you can monitor the channel status of the module.



7.2. 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.

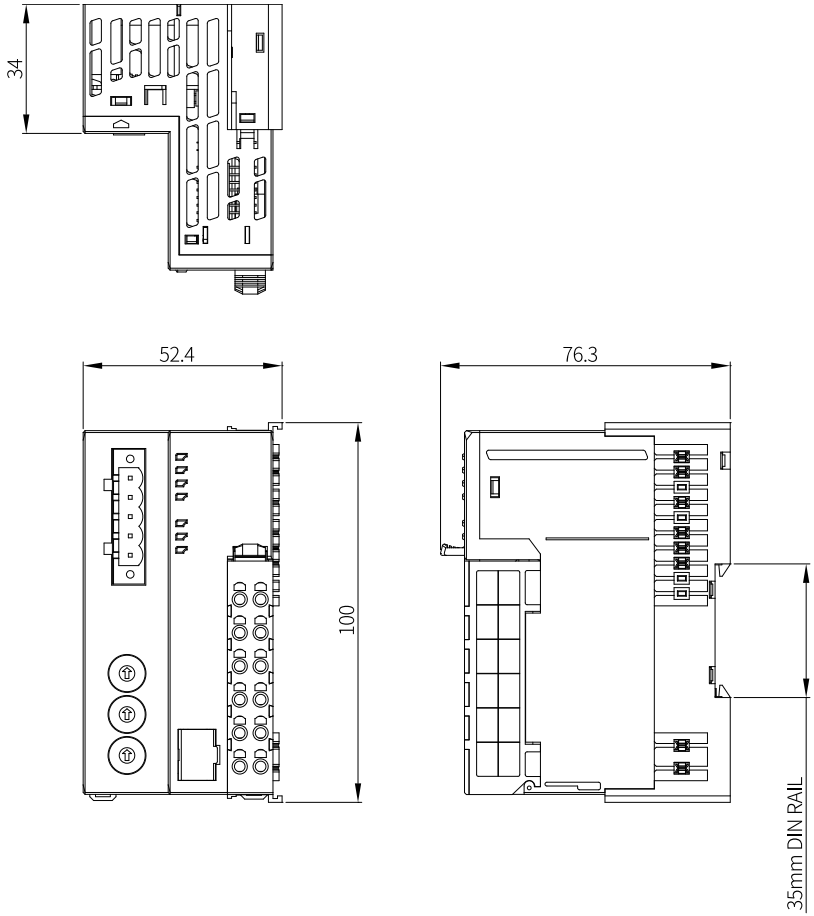
Without Internet connection

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 ARIO-C-DN at the **Firmware version list**.
4. Select the **Firmware update** to perform the update.

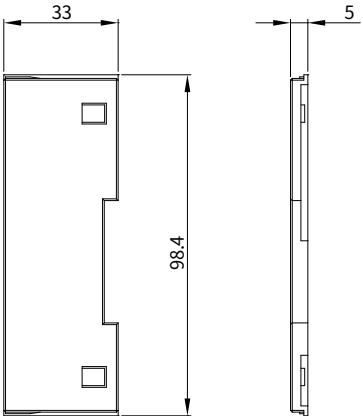
8. Dimensions

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

Coupler



End module



9. Specifications

9.1. Electrical/Mechanical Specifications

Max. number of connectable modules	≤ 32 (The length of connected modules: ≤ 384 mm)
Memory size	• Input: 255-byte • Output: 255-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	5-pin PCB connector
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)

9.2. Environmental Conditions

Insulation resistance	≥ 100 MΩ (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 μs) 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 (≈ 30 G) in each X, Y, Z direction for 3 times
Shock (malfunction)	100 m/s^2 (≈ 10 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)

10. Communication Interface

10.1. CAN Bus

<table>
<tr><td>Comm. standard</td><td>CAN (Controller Area Network)</td></tr>
<tr><td>Cable spec.</td><td>The cable approved by the Open DeviceNet Vendors Association (ODVA)</td></tr>
<tr><td>Baud rates</td><td>125 / 250 / 500 kbps (via rotary switch)</td></tr>
<tr><td>Cable length</td><td>• Baud rate: 125 kbps
<table><tr><th>Trunk cable</th><th>Drop cable</th></tr><tr><td>Thick cable: ≤ 500 m
Thin cable: ≤ 100 m</td><td>Thick/Thin cable: ≤ 6 m
Cumulative drop line: ≤ 156 m</td></tr></table>• Baud rate: 250 kbps
<table><tr><th>Trunk cable</th><th>Drop cable</th></tr><tr><td>Thick cable: ≤ 250 m
Thin cable: ≤ 100 m</td><td>Thick/Thin cable: ≤ 6 m
Cumulative drop line: ≤ 78 m</td></tr></table>• Baud rate: 500 kbps
<table><tr><th>Trunk cable</th><th>Drop cable</th></tr><tr><td>Thick cable: ≤ 100 m
Thin cable: ≤ 100 m</td><td>Thick/Thin cable: ≤ 6 m
Cumulative drop line: ≤ 39 m</td></tr></table></td></tr>
<tr><td>Protocol</td><td>DeviceNet (Type: Group 2 Only Slave)</td></tr>
<tr><td>Connection object</td><td>Explicit messages, I/O messages</td></tr>
<tr><td>Communication type</td><td>Poll, Bit-Strobe, Cyclic, COS (Change of State)</td></tr>
<tr><td>Number of nodes</td><td>≤ 64</td></tr>
<tr><td>Address settings</td><td>Decimal rotary switches, DAQMaster</td></tr>
<tr><td>Topology</td><td>Trunk, Drop Line, Daisy Chain</td></tr>
<tr><td>EDS file</td><td>Download the EDS file on our Autonics website</td></tr>
</table>

10.2. 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