

DeviceNet Network Adapter

# NA-9211 / 9212

## User Manual



Version 1.03

2014 CREVIS Co.,LTD

DOCUMENT CHANGE SUMMARY				
REV	PAGE	REMARKS	DATE	EDITOR
1.0	New Document	Draft	2013/5/6	JE Kang
1.01		Modify the Pin Description	2014/05/08	YMKIM
1.02		Update vibration specifications	2014/11/12	YMKIM
1.03		Dip Switch Color Black	2014/12/12	YMKIM

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## 1. Important Notes

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will CREVIS be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, CREVIS cannot assume responsibility or liability for actual use based on the examples and diagrams.

### Warning!

- ✓ **If you don't follow the directions, it could cause a personal injury, damage to the equipment or explosion**
- Do not assemble the products and wire with power applied to the system. Else it may cause an electric arc, which can result into unexpected and potentially dangerous action by field devices. Arching is explosion risk in hazardous locations. Be sure that the area is non-hazardous or remove system power appropriately before assembling or wiring the modules.
- Do not touch any terminal blocks or IO modules when system is running. Else it may cause the unit to an electric shock or malfunction.
- Keep away from the strange metallic materials not related to the unit and wiring works should be controlled by the electric expert engineer. Else it may cause the unit to a fire, electric shock or malfunction.

### Caution!

- ✓ **If you disobey the instructions, there may be possibility of personal injury, damage to equipment or explosion. Please follow below Instructions.**
- Check the rated voltage and terminal array before wiring. Avoid the circumstances over 55°C of temperature. Avoid placing it directly in the sunlight.
- Avoid the place under circumstances over 85% of humidity.
- Do not place Modules near by the inflammable material. Else it may cause a fire.
- Do not permit any vibration approaching it directly.
- Go through module specification carefully, ensure inputs, output connections are made with the specifications. Use standard cables for wiring.
- Use Product under pollution degree 2 environment.

## 1.1. Safety Instruction

### 1.1.1. Symbols

<b>DANGER</b> 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death property damage or economic loss
<b>IMPORTANT</b>	Identifies information that is critical for successful application and understanding of the product
<b>ATTENTION</b> 	Identifies information about practices or circumstances that can lead to personal injury, property damage, or economic loss. Attentions help you to identify a hazard, avoid a hazard, and recognize the consequences

### 1.1.2. Safety Notes

<b>DANGER</b> 	The modules are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, e.g. FnBUS Pin.
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### 1.1.3. Certification

c-UL-us UL Listed Industrial Control Equipment, certified for U.S. and Canada

See UL File E235505

CE Certificate

EN 61000-6-2; Industrial Immunity

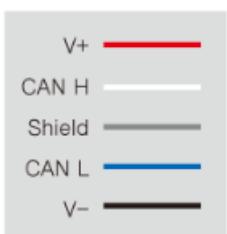
EN 61000-6-4; Industrial Emissions

FCC

## 2. Specification

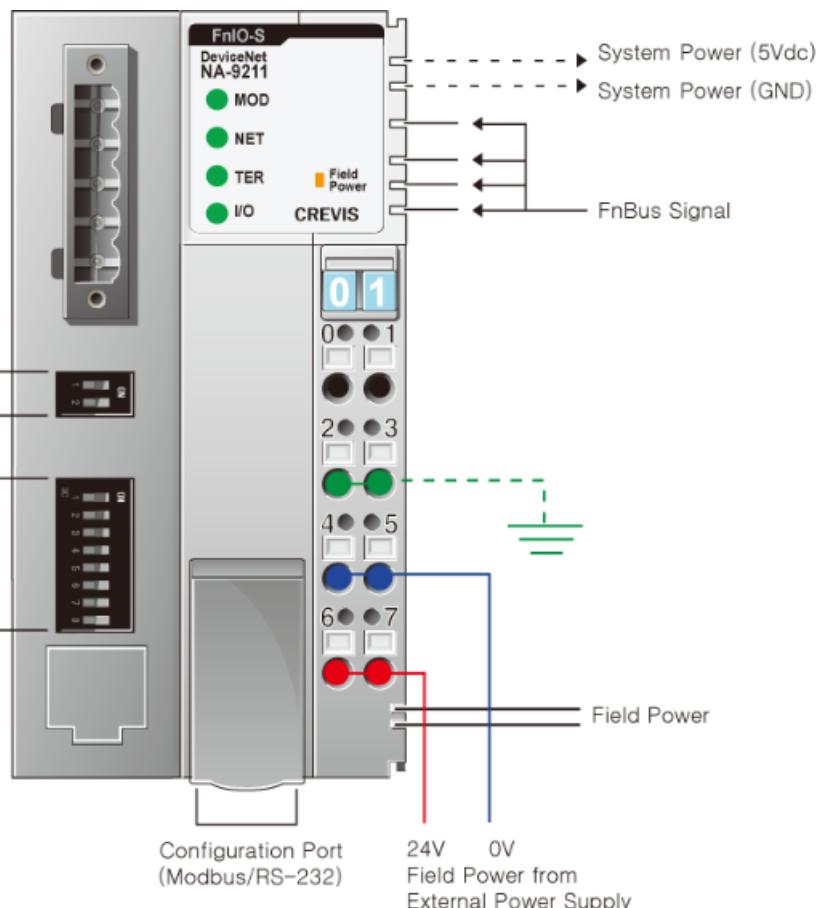
### 2.1. The Interface

DeviceNet Open Connector



Terminating Resistance  
Setup Switch

Node ID & Baud Rate  
Setup Switch



- ✓ The wiring diagram of NA-9211 and NA-9212 are the same.

## 2.2. General Specification

### General Specification

System Power	Supply voltage : 24Vdc nominal Supply voltage range : 11~28.8Vdc Protection : Output current limit(Min. 1.5A) Reverse polarity protection
Power Dissipation	40mA typical @24Vdc
Current for I/O Module	1.5A @5Vdc
Isolation	DeviceNet to internal logic : Non-isolation Internal logic to I/O driver : Isolation
Field Power	Supply voltage : 24Vdc nominal Supply voltage range : 11~28.8Vdc
Max. Current Field Power Contact	DC 10A Max.
Weight	140g
Module Size	54.2mm x 99mm x 70mm

### Environment Condition

#### Environmental Specifications

Operating Temperature	-20 °C ~ 55 °C
Storage Temperature	-40 °C ~ 85 °C
Relative Humidity	5% ~ 90% non-condensing
Operating Altitude	2000m
Mounting	DIN rail

#### General Specifications

Shock Operating	IEC 60068-2-27
Vibration/shock resistance	Sine Vibration (Based on IEC 60068-2-6) 5 ~ 25Hz : ±1.6mm 25 ~ 300Hz : 4g Sweep Rate : 1 Oct/min, 20 Sweeps Random Vibration (Based on IEC 60068-2-64) 10 ~ 40Hz : 0.0125g <sup>2</sup> /Hz 40 ~ 100Hz : 0.0125 → 0.002g <sup>2</sup> /Hz 100 ~ 500Hz : 0.002g <sup>2</sup> /Hz 500 ~ 2000Hz : 0.002 → 1.3 x 10 <sup>-4</sup> g <sup>2</sup> /Hz Test time : 1hrs for each test
EMC resistance burst/ESD	EN 61000-6-2 : 2005, EN 61000-6-4/A11 : 2011
Installation Pos. / Protect. Class	Variable/IP20
Product Certifications	CE, FCC, cUL, UL

### 2.3. Device Net Specification

Interface Specification, NA-9211/9212 (DeviceNet Adapter)											
Adapter Type	Group 2 Only Slave										
Max. Expansion Module	32 slots										
Max. Input Size	NA-9211 : 32 bytes , NA-9212 : 252 bytes										
Max. Output Size	NA-9211 : 32 bytes , NA-9212 : 252 bytes										
Max. Length Bus Line	Max.100m@500Kbps, Max. 250m@250Kbps, Max. 500m@125Kbps										
Max. Nodes	64 nodes										
Communication Speed	125Kbps, 250Kbps, 500Kbps, auto baud supported										
Network Protocol	Poll, Bit-Strobe, Cyclic, COS										
Interface Connector	5pin Open male connector										
Node MAC ID Setup	DIP Switch										
Terminating Resistance Setup	DIP Switch										
Indicator	4 LEDs 1 Green/Red, Module Status (MOD) 1 Green, Network Status (NET) 1 Green, Terminating Resistance Status (TER) 1 Green/Red Expansion I/O Module Status (I/O) 1 Green, Field Power Status										
Module Location	Starter module – left side of FnIO system										
Field Power Detection	About 11Vdc										
Configuration Tool	IO Guide Pro										
Configuration Port	Modus/RS-232 <table border="1"> <tr> <td>Node</td><td>1 (fixed)</td></tr> <tr> <td>Baud rate</td><td>115200 (fixed)</td></tr> <tr> <td>Data bit</td><td>8 (fixed)</td></tr> <tr> <td>Parity bit</td><td>No parity (fixed)</td></tr> <tr> <td>Stop bit</td><td>1 (fixed)</td></tr> </table>	Node	1 (fixed)	Baud rate	115200 (fixed)	Data bit	8 (fixed)	Parity bit	No parity (fixed)	Stop bit	1 (fixed)
Node	1 (fixed)										
Baud rate	115200 (fixed)										
Data bit	8 (fixed)										
Parity bit	No parity (fixed)										
Stop bit	1 (fixed)										
Temp Controller Support	NA-9211: Not supported      NA-9212: Supported										

## 2.4. LED Indicator

### 2.4.1. Module Status LED (MOD)

State	LED is:	To indicate:
No Power	Off	No power is supplied to the unit.
Device Operational	Green	The unit is operating in normal condition.
Device in Standby	Flashing Green	The EEPROM parameter is not initialized yet. Serial Number is zero value (0x00000000)
Minor Fault	Flashing Red	The unit has occurred recoverable fault in self-testing. - EEPROM checksum fault
Unrecoverable Fault	Red	The unit has occurred unrecoverable fault in self-testing. - Firmware fault

### 2.4.2. Network Status LED (NET)

State	LED is:	To indicate:
No Power	Off	Device is not on-line or may not be powered - Not completed the Dup-MAC_ID test yet
On-line, Not connected	Flashing Green	Device is on-line but has no connections in the established state. - Passed the Dup-MAC_ID test - Not allocated to a master
On-line, Connected	Green	Device is on-line and allocated to a master
Connection Time-out	Flashing Red	One or more I/O connections are in the time-out state.
Critical Communication Failure	Red	Failed communication - Duplicate MAC ID - Bus-off

### 2.4.3. Terminating Resistance Status LED (TER)

State	LED is :	To indicate :
Not applied	Off	Terminating resistance is not applied
Applied	Green	Terminating resistance is applied

#### 2.4.4. Expansion I/O Module Status LED (I/O)

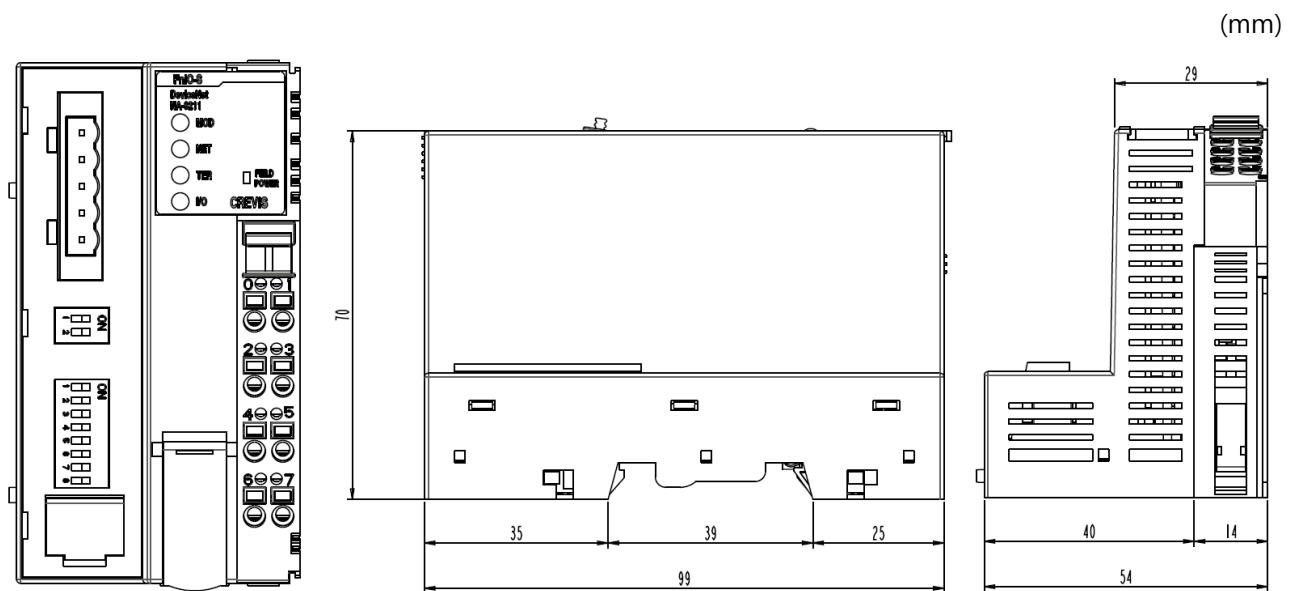
State	LED is:	To indicate:
Not Powered No Expansion Module	Off	Device has no expansion module or may not be powered
FnBus On-line, Do not Exchanging I/O	Flashing Green	FnBus is normal but does not exchanging I/O data (Passed the expansion module configuration).
FnBus Connection, Run Exchanging IO	Green	Exchanging I/O data
FnBus connection fault during exchanging IO	Red	One or more expansion module occurred in fault state. - Changed expansion module configuration. - FnBus communication failure.
Expansion Configuration Failed	Flashing Red	Failed to initialize expansion module - Detected invalid expansion module ID. - Overflowed Input/output Size - Too many expansion module - Initial protocol failure - Mismatch vendor code between adapter and expansion module.

#### 2.4.5. Field Power Status LED

State	LED is :	To indicate :
Not Supplied Field Power	Off	Not supplied 24V dc field power
Supplied Field Power	Green	Supplied 24V dc field power

### 3. Dimension

#### 3.1. NA-9211/NA-9212

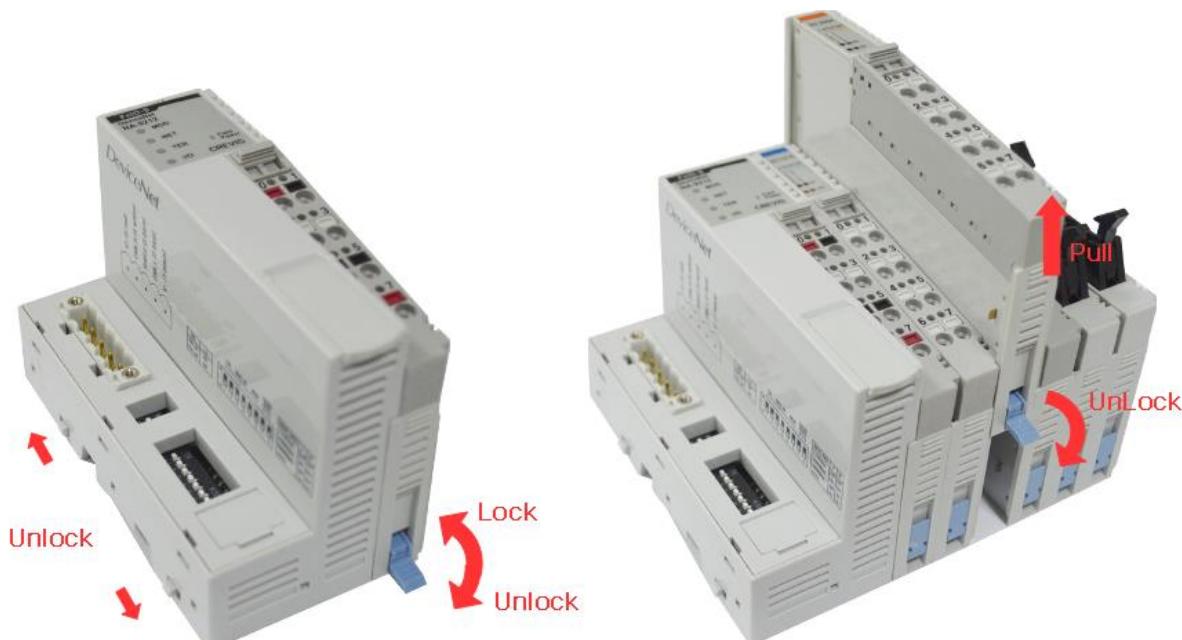


## 4. Mechanical Set Up

### 4.1. Total Expansion

The number of the module assembly that can be connected is 32. So the maximum length is 426mm. Exception ST-2748 is excepted to calculate maximum length because that is double width module.

### 4.2. Plugging and Removal of the Components.



As above figure in order to safeguard the FnIO module from jamming, it should be fixed onto the DIN rail with locking level. To do so, fold on the upper of the locking lever.

To pull out the FnIO module, unfold the locking lever as below figure.

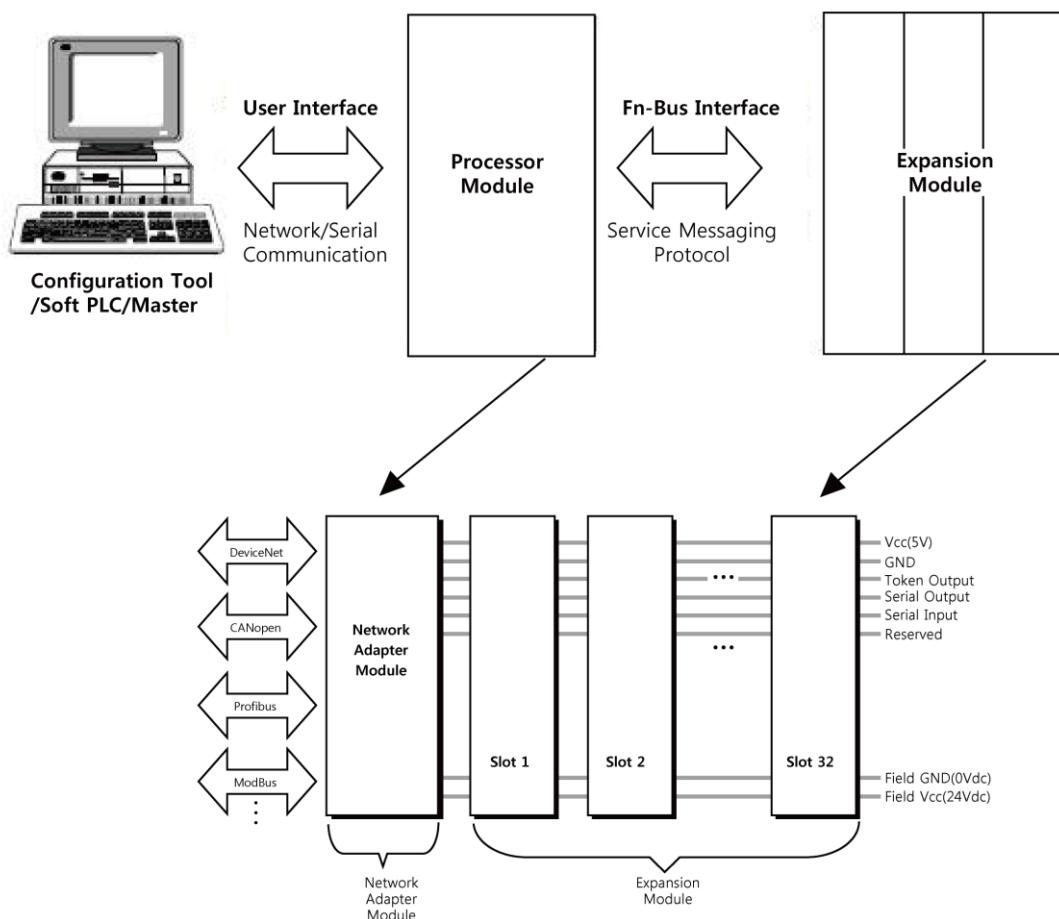
**DANGER**

Before work is done on the components, the voltage supply must be turned off.

## 5. Configuration and Operation

### 5.1. FnBus Specification

#### 5.1.1. FnBus System



### • Network Adapter Module

The Network Adapter Module forms the link between the field bus and the field devices with the Expansion Modules.

The connection to different field bus systems can be established by each of the corresponding Network Adapter Module, e.g. for SyncNet, PROFIBUS, CANopen, DeviceNet, Ethernet/IP, CC-Link, MODBUS/Serial, MODBUS/TCP etc.

### • Expansion Module

The Expansion Modules are supported a variety of input and output field devices.

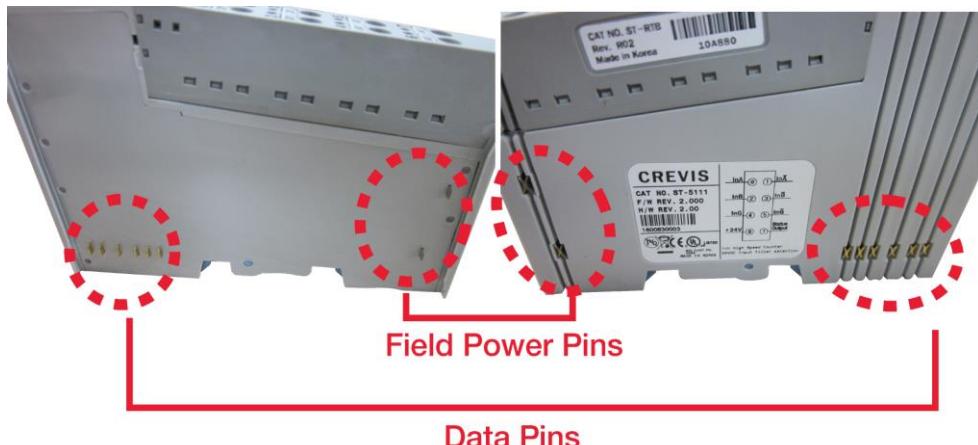
There are digital and analog input/output modules and special function modules.

### • Two types of FnBus Message

- Service Messaging
- I/O Messaging

### 5.1.2. FnBus Pin Description

Communication between the NA series and the expansion module as well as system / field power supply of the bus modules is carried out via the internal bus. It is comprised of 6 data pin and 2 field power pin.



No.	Name	Description
1	Vcc	System supply voltage (5V dc).
2	GND	System Ground.
3	Token Output	Token output port of Processor module.
4	Serial Output	Transmitter output port of Processor module.
5	Serial Input	Receiver input port of Processor module.
6	Reserved	Reserved for bypass Token.
7	Field GND	Field Ground.
8	Field Vcc	Field supply voltage (24Vdc).

**DANGER**


Do not touch data and field power pins in order to avoid soiling and damage by ESD noise.

## 5.2. DeviceNet Composition

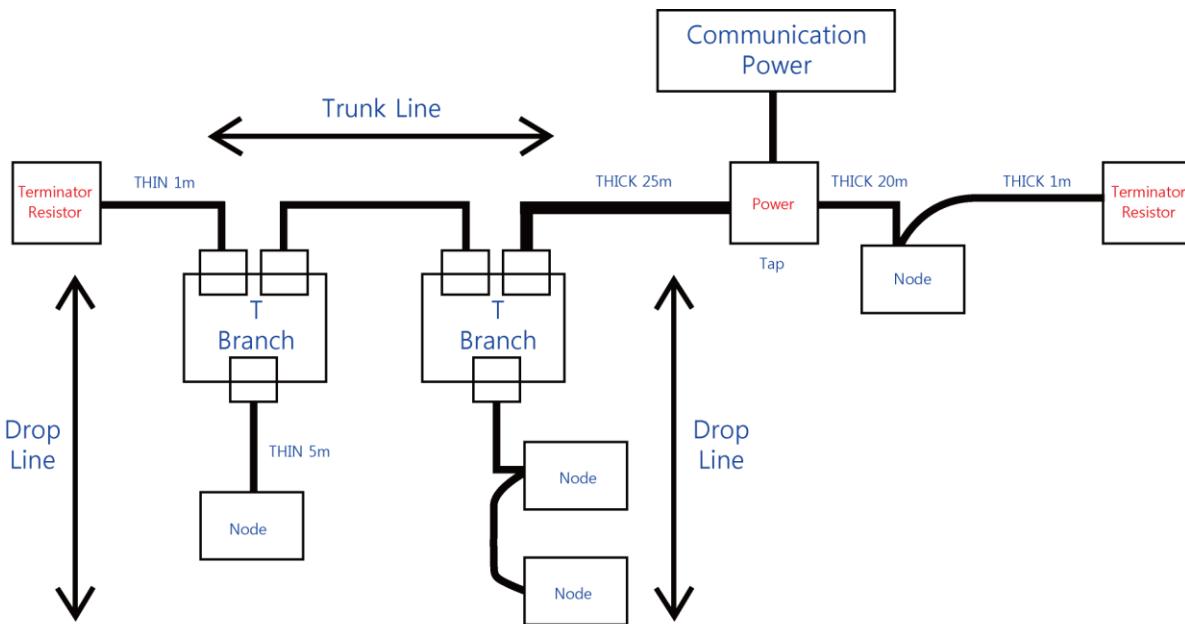


Figure 2. DeviceNet Network Example.

### DeviceNet Network Installation

DeviceNet Network Set up is like following figure2.

#### Network Composition

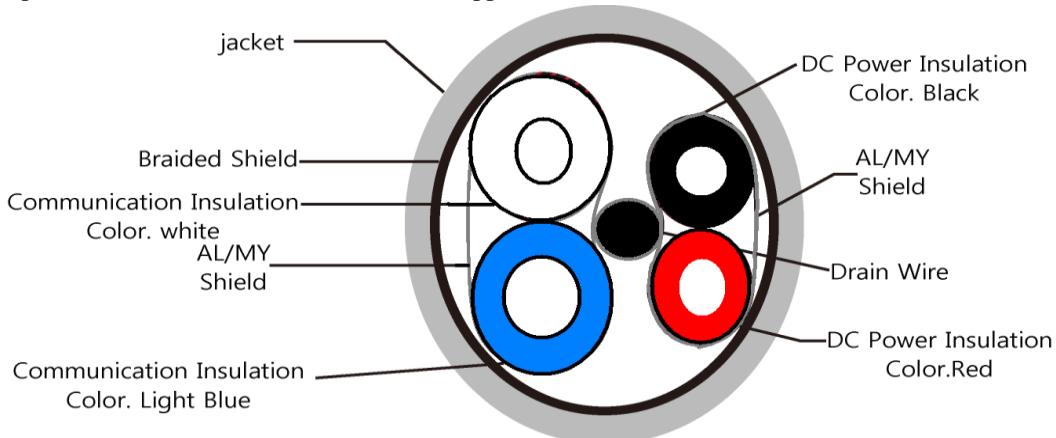
Name	Description
Node	Node is Slave that is charged each address number. DeviceNet is comprised of Master and Slave. Master manages DeviceNet and organizes external I/O in Slave. Slave contacts external I/O.
Trunk / Drop Line	Trunk line is cable that is installed terminator resistor. Drop line is cable that branch from trunk line In the DeviceNet, both trunk and drop line is used.
Connection Mode	Number of Connection mode for DeviceNet is 2 modes. First is T-branch and Second is multi-drop. T-branch is method that branches off drop-line by T-branch tap Multi drop is method what trunk and drop line contacts with node directly.
Terminator Resistor	Terminator resistor is that is installed for reduction a reflected wave in both ends trunk line.
Communication Power	For using DeviceNet, user must supply communication power to each node connector through the DeviceNet cable.

### 5.3. DeviceNet Module (NA-9212) Installations

#### 5.3.1. DeviceNet Cable Specification

#### 5.3.2. Communication Cable Specification

DeviceNet Cable Specification. In the DeviceNet Specification There is the exclusive cable bellows (DeviceNet Specification Volume Release2.0 Errate2, appendix B)



Physical Characteristics	Thick Cable Spec	Thin Cable Spec
Communication cable		
Conductor pair size	#18 Copper(minimum) : 19 strand min(individually tinned)	#24 Copper(minimum) : 19 strand min(individually tinned)
Insulation diameter	0.150 inches	0.077 inches
Colors	Light blue White	Light blue White
Pair twist/ft	3(approx.)	5(approx.)
Impedance	120Ω ± 10% (at 1MHz)	
Power pair		
Conductor pair size	#15 Copper(minimum) : 19 strand min(individually tinned)	#22 Copper(minimum) : 19 strand min(individually tinned)
Insulation diameter	0.098 inches	0.055 inches
Color	Red Black	Red Black
Tape shield over pair	1.0mil/1mil,Al/Mylar Al side out w/shorting fold (pull-on applied)	1.0mil/1mil,Al/Mylar Al side out w/shorting fold (pull-on applied)
Drain wire	#18 Copper(minimum) : 19 strand min	#22 Copper(minimum) : 19 strand min
Roundness	Radius delta to be within 15% of 0.5 O.D	
Agency certification	NEC(UL) type CL2(min.)	
Jacket marker	Vender name & part#, and additional	

The maximum length of network for each cable type is as follows.

**-Thick Cable**

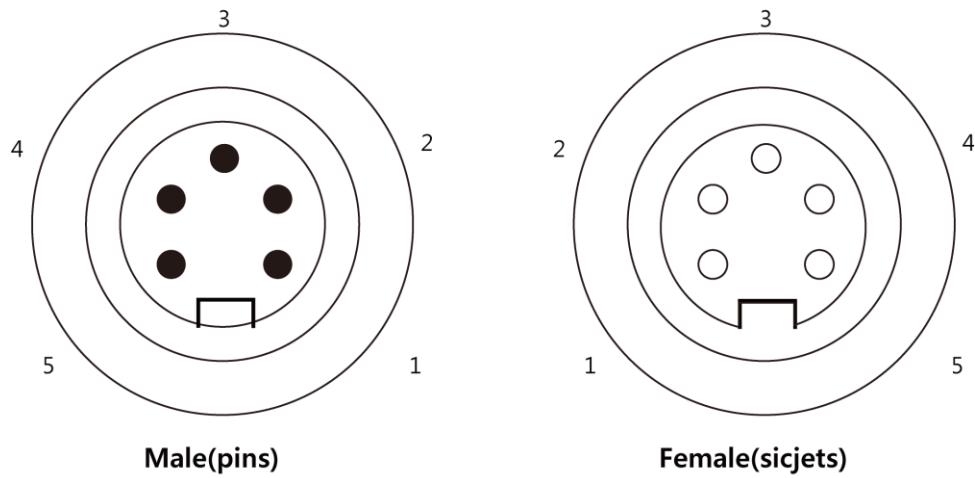
Communication rate	Truck Length	Truck Exchange (Thick Cable)	Cumulative drop	Maximum drop
<b>125Kb</b>	500m(1640ft)	1.0	156m(512ft)	6m(20ft)
<b>250Kb</b>	250m(820ft)	1.0	76m(256ft)	6m(20ft)
<b>500Kb</b>	100m(328ft)	1.0	38m(128ft)	6m(20ft)

**-Thin Cable**

Communication rate	Truck Length	Truck Exchange (Thick Cable)	Cumulative drop	Maximum drop
<b>125Kb</b>	100m(328ft)	5.0	156m(512ft)	6m(20ft)
<b>250Kb</b>	100m(328ft)	2.5	76m(256ft)	6m(20ft)
<b>500Kb</b>	100m(328ft)	1.0	38m(128ft)	6m(20ft)

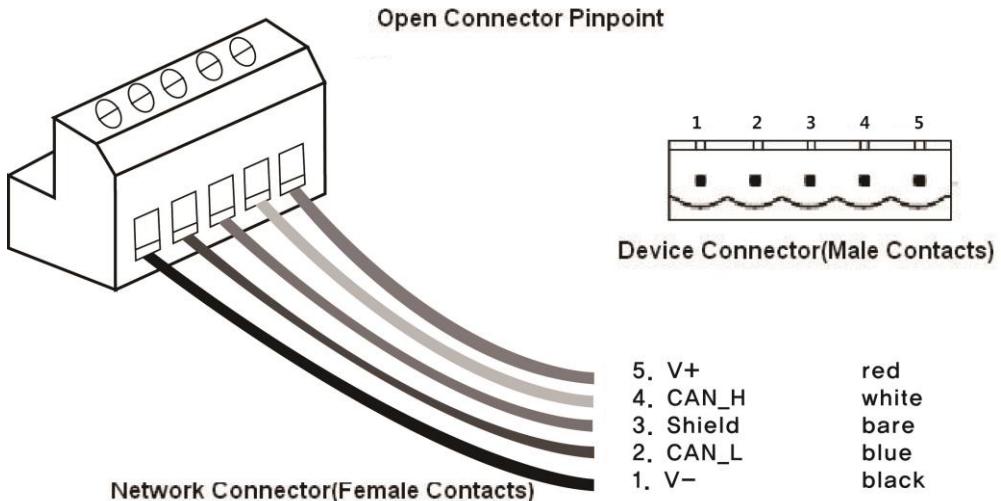
### 5.3.3. DeviceNet Connector Specification

#### Mini Connector Pinpoint



- |          |       |
|----------|-------|
| 1. drain | bare  |
| 2. V+    | red   |
| 3. V-    | black |
| 4. CAN_H | white |
| 5. CAN_L | blue  |

Male General Characteristics	Specification
Number of Pins	5
Coupling Nut	Male
Coupling Nut Thread	7/8-166 UN-2A THD
Rotation	Optional
Pin out	Drain : Pin1, V+ : Pin2, V- : Pin3, CAN_H : Pin4, CAN_L : Pin5
Female General Characteristics	Specification
Number of Pins	5
Coupling Nut	Female
Coupling Nut Thread	7/8-166 UN-2B THD
Rotation	Required
Pin out	Drain : Pin1, V+ : Pin2, V- : Pin3, CAN_H : Pin4, CAN_L : Pin5
Physical Characteristics	Specification
Wiping Contact Plating Requirements	30 micro inch gold minimum over 50 micro inch nickel minimum or 5 micro inch gold minimum over 20 micro inch  Palladium-nickel minimum over 50 micro inch nickels. All gold must be 24 karat



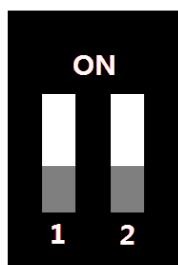
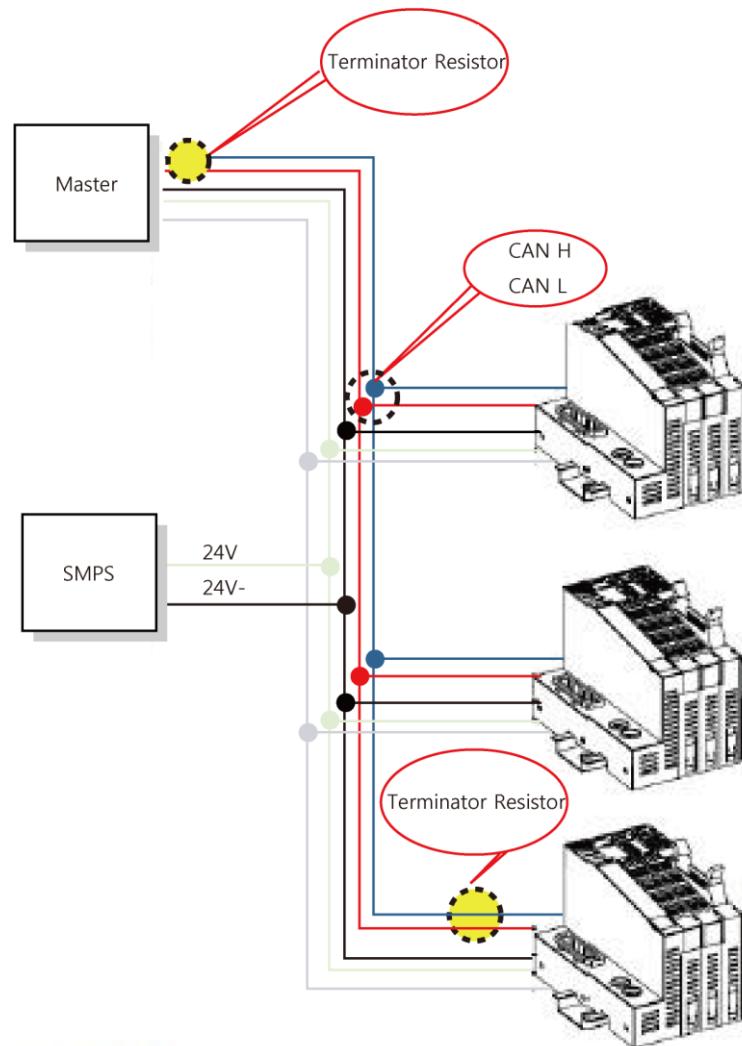
<b>Male General Characteristics</b>	<b>Specification</b>
Number of Pins	5
Coupling Nut	None
Coupling Nut Thread	None
Rotation	None
Pin out	V- : Pin1, CAN_L : Pin2, Shield : Pin3, CAN_H : Pin4, V+ : Pin5
<b>Female General Characteristics</b>	<b>Specification</b>
Number of Pins	5
Coupling Nut	None
Coupling Nut Thread	None
Rotation	None
Pin out	V- : Pin1, CAN_L : Pin2, Shield : Pin3, CAN_H : Pin4, V+ : Pin5
<b>Physical Characteristics</b>	<b>Specification</b>
Wiping Contact Plating Requirements	30 micro inch gold minimum over 50 micro inch nickel minimum or 5 micro inch gold minimum over 20 micro inch  Palladium-nickel minimum over 50 micro inch nickels. All gold must be 24 karat
Wiping Contract Life	1000 insertion - extractions
<b>Electrical Characteristics</b>	<b>Specification</b>
Operating Voltage	25 Volt minimum
Contact Rating	8 Amps minimum

Device network power is 24V. Network and I/O field power must be separated  
One power is provided per network

**ATTENTION**


The use of an incorrect supply voltage or frequency can cause severe damage to the component.

### 5.3.4. Terminator Resistor Specification

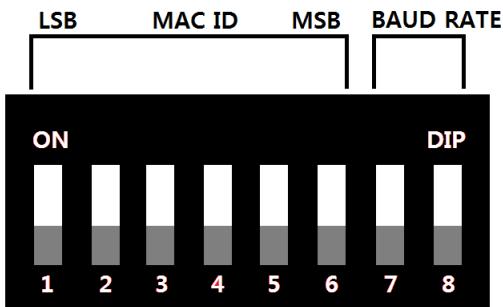


Terminating Resistance Switch	#1	#2
Applied	On	On
Not applied	Off	Off

## 5.4. DeviceNet Module (NA-9212/9211) Configurations

### 5.4.1. DeviceNet MAC ID Setup

Each DeviceNet Adapter must have a unique MAC ID (from 0 to 63) so that it can be addressed independently from other nodes.



MAC ID (Node No.)	#1	#2	#3	#4	#5	#6	BAUD RATE	#7	#8
0	OFF	OFF	OFF	OFF	OFF	OFF	125Kbps	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	OFF	250Kbps	ON	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	500Kbps	OFF	ON
3	ON	ON	OFF	OFF	OFF	OFF	AUTO	ON	ON
...	...	...	...	...	...	...	...	...	...
62	OFF	ON	ON	ON	ON	ON	ON	ON	ON
63	ON	ON	ON						

#### ATTENTION

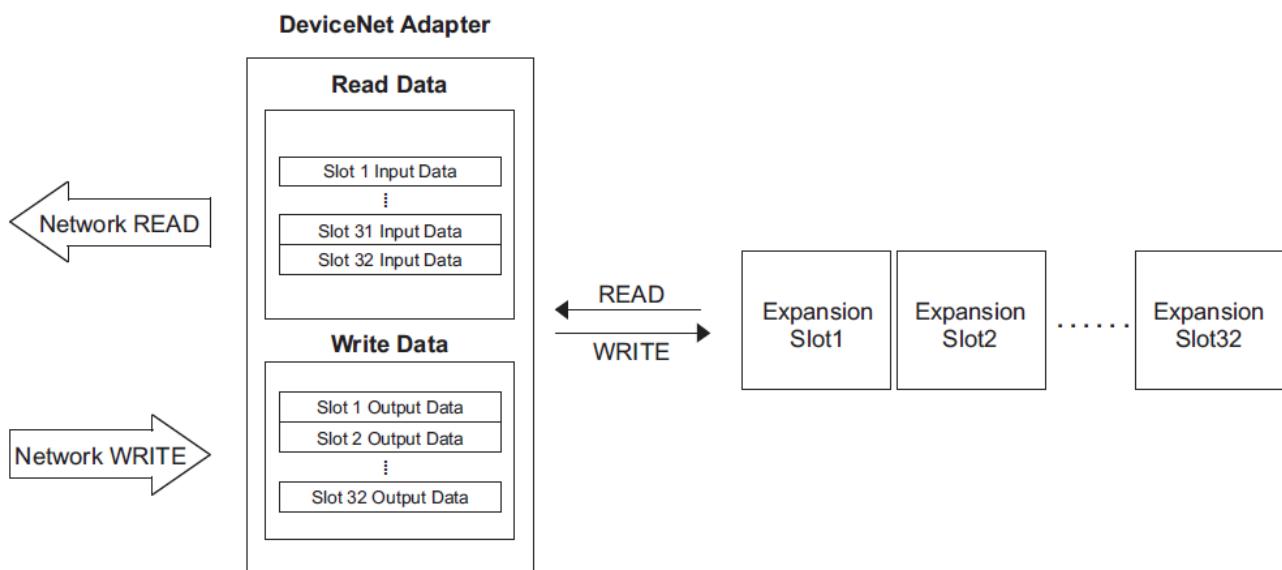


MAC ID addresses have to be unique throughout the entire interconnected Networks.

### 5.4.2. I/O Process Image Map

An expansion module may have 3 types of data as I/O data, configuration parameter and memory register.

The data exchange between network adapter and expansion modules is done via an I/O process image data by FnBus protocol. The following figure shows the data flow of process image between network adapter and expansion modules.



### 5.4.3. Object Models

A DeviceNet node is modeled as a collection of Objects. An Object provides an abstract representation of a particular component within a product. The realization of this abstract object model within a product is implementation dependent. In other words, a product internally maps this object model in a fashion specific to its implementation.

The objects and their components are addressed by a uniform addressing scheme consisting of:

Media Access Control Identifier (MAC ID), an integer identification value assigned to each node on a DeviceNet network.

Class Identifier (Class ID), an integer identification value assigned to each Object Class accessible from the network.

Instance Identifier (Instance ID), an integer identification value assigned to an Object Instance that identifies it among all Instances of the same Class.

Attribute Identifier (Attribute ID), an integer identification value assigned to a Class and/or Instance Attribute.

Service Code, an integer identification value which denotes a particular Object Instance and/or Object Class function.

Supported Objects

- Device Type Number: 0C<sub>HEX</sub> (Communications Adapter)

Name of Object	Type	Number of Instances	Class Code
Identity	Required	1	01 <sub>HEX</sub>
Message Router	Required	1	02 <sub>HEX</sub>
DeviceNet	Required	1	03 <sub>HEX</sub>
Assembly	Required	2	04 <sub>HEX</sub>
Connection	Required	4	05 <sub>HEX</sub>
Acknowledge Handler	Required	1	2B <sub>HEX</sub>
FnBus Manager	Vendor-specific	1	70 <sub>HEX</sub>
Expansion Slot	Vendor-specific	1~32	71 <sub>HEX</sub>

Objects Behavior, Interface

Object	Behavior	Interface
Identity	Device identification, reset service	Message Router
DeviceNet	Configures port attributes	Message Router
Assembly	Defines I/O data format and concatenates configuration data	I/O Connection or Message Router
Connection	Contains the number of logical ports into or out-of the device	Message Router
Acknowledge Handler	Manage the reception of message acknowledgments	Message Router
FnBus Manager	Management functions for the Fn-Bus	Message Router
Expansion Slot	Management functions for the expansion slot	Message Router

## 5.5. Object Setting

### 5.5.1. Identity Object

Class Code: 01<sub>HEX</sub>

#### Common Services

Service Code	Implemented for		Service Name	Value
	Class	Instance		
0x05	No	Yes	Reset	0: Reset Only 1: Reset and Factory Default
0x0E	No	Yes	Get_Attribute_Single	

#### Class Attributes

None

#### Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Vendor ID	UINT	741 (Crevis Co., Ltd)
	2	Get	Device Type	UINT	0C <sub>HEX</sub> (Communications Adapter)
	3	Get	Product Code	UINT	0x1100(NA-9211), 0x1101(NA-9212)
	4	Get	Revision - Major - Minor	Structure of: USINT USINT	1 ~ 9 1 ~ 255
	5	Get	Status	WORD	Defined in Spec
	6	Get	Serial Number	UDINT	Unique Number
	7	Get	Product Name - String Length - ASCII String	Structure of: USINT STRING	24 “NA9212_DeviceNet_Adapter” or “NA9211_DeviceNet_Adapter”
	9	Get	CRC	UINT	EEPROM Checksum Code *0x11B8
	100(64h)	Get	Device Fault Code	USINT	00 <sub>HEX</sub> : Normal Operation Bit 0: No expansion slot Bit 1: Too many expansion slot Bit 2: Overflow I/O size Bit 3: I/O Configuration failure Bit 4: EEPROM Checksum fault Bit 6: Invalid Module ID Bit 7: Firmware fault
	Vendor-specific				
102(66h)	Get	Firmware Code	USINT	113: NA-9211, NA-9212	
103(67h)	Get	ODVA Conformance Test Revision	UINT	0x0A17 → “A-17”	
104(68h)	Get	Firmware Release Date	UDINT	0xYYYYMMDD ex) 0x20030417 → 2003/04/17	
107(6Bh)	Get	Inspection Date	UDINT	0xYYYYMMDD	

### 5.5.2. Message Router Object

Class Code: 02<sub>HEX</sub>

**Common Services**

None

**Class Attributes**

None

**Instance Attributes**

None

### 5.5.3. DeviceNet Object

Class Code: 03<sub>HEX</sub>

#### Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x4B	No	Yes	Allocate_Master/Slave_Connection_Set
0x4C	No	Yes	Release_Master/Slave_Connection_Set

#### Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	02, 00

#### Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get/Set*	MAC ID	USINT	0 ~ 63
	2	Get/Set**	Baud Rate	USINT	0=125K, 1=250K, 2=500K
	3	Get/Set	Bus off Interrupt	BOOL	faulted node recovery
	4	Get	Bus-Off Counter	USINT	0 ~ 255
	5	Get	Allocation Information - Allocation Choice - Master's MAC ID	Structure of: BYTE USINT	0~63: Master MAC ID, 255: unallocated
	8	Get	MACID Switch Value	USINT	0 ~ 99 Actual value of Rotary Switch
	Vendor-specific				
	100(64h)	Get/Set	Auto-Baud Action	BOOL	0: Enabled (default) (Not allowed to set the Baud Rate from Network) 1: Disabled (Allowed to set the Baud Rate from Network)
	101(65h) (Only NA-9212)	Get/Set	Quick Start	BOOL	0:Normal Start-up 1:Quick Start-up

\*The MAC ID DIP Switch value = 0~63: Not allowed to set the MAC ID from Network.

Behavior: Changed new MAC ID → Device will be restarted.

\*\*The Auto-Baud Action (attribute #100) value = 0: Not allowed to set the Baud Rate form Network

The Auto-Baud Action (attribute #100) value = 1: Allowed to set the Baud Rate form Network

Behavior: Changed new Baudrate → Device won't be restarted. (Waiting for reset service or power reset)

### 5.5.4. Assembly Object

Class Code: 04<sub>HEX</sub>

#### Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

#### Class Attributes

None

#### Input Instance Attributes

##### Input/output Instance ID

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
100(64h)	3	Get	Input (Produced) Process Image Data	Array n BYTE	Input process current image data
150(96h)	3	Set/Get	Output (Consumed) Process Image Data	Array n BYTE	Output process current image data

### 5.5.5. Connection Object

Class Code: 05<sub>HEX</sub>

#### Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	No	Set_Attribute_Single

#### Class Attributes

None

#### Instance Attributes for Explicit Messaging Connection

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	state	USINT	Defined in Spec * 0x03 : The connection has been validly/fully configured and the configuration has been successfully applied.
	2	Get	instance_type	USINT	0: Explicit Message
	3	Get	transportClass_trigger	BYTE	83 <sub>HEX</sub>
	4	Get	produced_connection_id	UINT	*0x040B : MAC ID=01, Message group 2, Message ID 3
	5	Get	consumed_connection_id	UINT	*0x040C : MAC ID=01, Message ID 4
	6	Get	initial_comm_characteristics	BYTE	21 <sub>HEX</sub>
	7	Get	produced_connection_size	UINT	NA-9211: 38, NA-9212 : 258
	8	Get	consumed_connection_size	UINT	NA-9211: 38, NA-9212 : 258
	9	Get/Set	expacted_packet_rate	UINT	2504 (default) Timer Resolution of 8msec
	12	Get/Set	watchdog_timeout_action	USINT	3 : Deferred Delete (default)
	13	Get	produced_connection_path_length	UINT	00, 00
	14	Get	produced_connection_path	Array of USINT	Empty
	15	Get	consumed_connection_path_length	UINT	00, 00
	16	Get	consumed_connection_path	Array of USINT	Empty

✓ attribute 3 transport Class trigger = 0x83 → Direction=Server,  
 Production Trigger=IGNORED,  
 Transport Class = 3.

This is the value assigned to this attribute within the server end-point of an Explicit Messaging Connection

**Instance Attributes for Poll I/O Connection**

<b>Instance ID</b>	<b>Attribute ID</b>	<b>Access Rule</b>	<b>Name</b>	<b>Data Type</b>	<b>Value</b>
2	1	Get	State	USINT	Defined in Spec
	2	Get	instance_type	USINT	1: I/O Message
	3	Get	transportClass_trigger	BYTE	82 <sub>HEX</sub>
	4	Get	produced_connection_id	UINT	* 0x03C1 : MAC ID=01, Message ID=6, Unconnected Explicit Request Message
	5	Get	consumed_connection_id	UINT	* 0x040D : MAC ID=01, Message ID=5, Group 2 message Identifier
	6	Get	initial_comm_characteristics	BYTE	01 <sub>HEX</sub>
	7	Get	produced_connection_size	UINT	9211 : 0 to 32, 9212 : 0 to 252
	8	Get	consumed_connection_size	UINT	9211 : 0 to 32, 9212 : 0 to 252
	9	Get/Set	expacted_packet_rate	UINT	Timer Resolution of 8msec * 200(decimal)
	12	Get	watchdog_timeout_action	USINT	0: Time Out (default)
	13	Get	produced_connection_path_length	UINT	0 or 6
	14	Get	produced_connection_path	Array of USINT	
	15	Get	consumed_connection_path_length	UINT	0 or 6
	16	Get	consumed_connection_path	Array of USINT	

**Instance Attributes for Bit-Strobe I/O Connection**

<b>Instance ID</b>	<b>Attribute ID</b>	<b>Access Rule</b>	<b>Name</b>	<b>Data Type</b>	<b>Value</b>
3	1	Get	state	USINT	Defined in Spec
	2	Get	instance_type	USINT	1: I/O Message
	3	Get	transportClass_trigger	BYTE	82 <sub>HEX</sub>
	4	Get	produced_connection_id	UINT	*0x0381 : MAC ID=01, Message ID=14, Message group 1
	5	Get	consumed_connection_id	UINT	*0X0400 : MAC ID = 00, Message ID = 0, Message group 2
	6	Get	initial_comm_characteristics	BYTE	02 <sub>HEX</sub>
	7	Get	produced_connection_size	UINT	0 to 8
	8	Get	consumed_connection_size	UINT	8
	9	Get/Set	expacted_packet_rate	UINT	Timer Resolution of 8msec * 200
	12	Get	watchdog_timeout_action	USINT	0: Time Out (default)
	13	Get	produced_connection_path_length	UINT	0 or 6
	14	Get	produced_connection_path	Array of USINT	
	15	Get	consumed_connection_path_length	UINT	0 or 6
	16	Get	consumed_connection_path	Array of USINT	

**Instance Attributes for COS I/O Connection (Acknowledged)**

<b>Instance ID</b>	<b>Attribute ID</b>	<b>Access Rule</b>	<b>Name</b>	<b>Data Type</b>	<b>Value</b>
4	1	Get	State	USINT	Defined in Spec
	2	Get	instance_type	USINT	1: I/O Message
	3	Get	transportClass_trigger	BYTE	12 <sub>HEX</sub>
	4	Get	produced_connection_id	UINT	
	5	Get	consumed_connection_id	UINT	
	6	Get	initial_comm_characteristics	BYTE	1
	7	Get	produced_connection_size	UINT	9211 : 0 to 33, 9212 : 0 to 252
	8	Get	consumed_connection_size	UINT	0
	9	Get/Set	expacted_packet_rate	UINT	Timer Resolution of 8msec
	12	Get/Set	watchdog_timeout_action	USINT	0: Time Out (default)
	13	Get	produced_connection_path_length	UINT	0 or 6
	14	Get	produced_connection_path	Array of USINT	
	15	Get	consumed_connection_path_length	UINT	4
	16	Get	consumed_connection_path	Array of USINT	20 2B 24 01
	17	Get/Set	production_inhibit_time	UINT	00, 00

**Instance Attributes for COS I/O Connection (Unacknowledged)**

<b>Instance ID</b>	<b>Attribute ID</b>	<b>Access Rule</b>	<b>Name</b>	<b>Data Type</b>	<b>Value</b>
4	1	Get	State	USINT	Defined in Spec * 0x01 : Configuring
	2	Get	instance_type	USINT	1: I/O Message
	3	Get	transportClass_trigger	BYTE	10 <sub>HEX</sub>
	4	Get	produced_connection_id	UINT	* 0x0341 MAC ID : 01, Message ID=13, Message Group 1
	5	Get	consumed_connection_id	UINT	0FFF <sub>HEX</sub>
	6	Get	initial_comm_characteristics	BYTE	0F <sub>HEX</sub>
	7	Get	produced_connection_size	UINT	9211 : 0 to 32, 9212 : 0 to 252
	8	Get	consumed_connection_size	UINT	0
	9	Get/Set	expacted_packet_rate	UINT	Timer Resolution of 8msec * 0x00
	12	Get/Set	watchdog_timeout_action	USINT	0: Time Out (default)
	13	Get	produced_connection_path_length	UINT	0 or 6
	14	Get	produced_connection_path	Array of USINT	
	15	Get	consumed_connection_path_length	UINT	0
	16	Get	consumed_connection_path	Array of USINT	Empty
	17	Get/Set	production_inhibit_time	UINT	00, 00

### 5.5.6. Acknowledge Handler Object

Class Code: 2B<sub>HEX</sub>

#### Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single

#### Class Attributes

None

#### Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Set	Acknowledge Timer	UNIT	Default: 10
	2	Get	Retry Limit	USINT	1
	3	Get	COS Producing Connection Instance	UINT	4

### 5.5.7. FnBus Manager Object

Class Code: 70<sub>HEX</sub>

#### Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

#### Class Attributes

None

#### Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Number of Slot	USINT	(include deactivated slot)
	2	Get	Num of Activated Slot	USINT	
	3	Get	Num of Deactivated Slot	USINT	
	4	Get	External IDs	Array of 33 BYTE	See Table 5.6. See Appendix A.1.
	5	Get/Set*	Selection of Produced Connection Type	USINT	See Table 5.1. Valid value range is 0,1,2,3 (default 2)
	6	Get/Set*	Selection of Consumed Connection Type	USINT	See Table 5.2. Valid value range is 0,1 (default 0)
	7	Get/Set*	Slot Active Flag	DWORD	See Table 5.3
	8	Get	Slot Live List	DWORD	See Table 5.4.
	9	Get	Slot Alarm List	DWORD	See Table 5.5.
	10	Get	Fn-Bus Status	USINT	0: Normal Operation 1: Fn-Bus Standby 2: Fn-Bus Connection Fault 3: Expansion Configuration Fault 4: No Expansion Module
	11	Get	Input (Produced) Byte Size	UINT	IO input byte size
	12	Get	Output (Consumed) Byte Size	UINT	IO output byte size

\*After the system is reset, the new “Set Value” action is applied.

If changed slot location, set default value automatically.

**Table 5.1. Selection of Input (Produced) Process Image Mode**

Selection Input Image Mode	Description	
0	Status(1byte) + Uncompressed Input Processing Data	
1	Status(1byte) + Compressed Input Processing Data	
2	Uncompressed Input Processing Data	Default
3	Compressed Input Processing Data	

**Table 5.2. Selection of Output (Consumed) Process Image Mode**

Selection Image Mode	Output Image Mode	Description	
0	Uncompressed Output Processing Data		default
1	Compressed Output Processing Data		

**Table 5.3. Slot Active Flag**

DWORD(32bits)	Decimal Bit	Description
Get/Set	Bit 00	Activate/Deactivate flag for slot position #1 (0:Active, 1:Decative)
	Bit 01	Activate/Deactivate flag for slot position #2 (0:Active, 1:Decative)
	Bit 02	Activate/Deactivate flag for slot position #3 (0:Active, 1:Decative)
	.	.
	.	.
	.	.
	Bit 30	Activate/Deactivate flag for slot position #31 (0:Active, 1:Decative)
	Bit 31	Activate/Deactivate flag for slot position #32 (0:Active, 1:Decative)

**Table 5.4. Slot Live List**

DWORD(32bits)	Decimal Bit	Description
Get/Set	Bit 00	This bit is set (1) when slot position #1 is available to exchange IO
	Bit 01	This bit is set (1) when slot position #2 is available to exchange IO
	Bit 02	This bit is set (1) when slot position #3 is available to exchange IO
	.	.
	.	.
	.	.
	Bit 30	This bit is set (1) when slot position #31 is available to exchange IO
	Bit 31	This bit is set (1) when slot position #32 is available to exchange IO

**Table 5.5. Slot Alarm List**

DWORD(32bits)	Decimal Bit	Description
Get/Set	Bit 00	This bit is set (1) when an error is detected in slot position #1
	Bit 01	This bit is set (1) when an error is detected in slot position #2
	Bit 02	This bit is set (1) when an error is detected in slot position #3
	.	.
	.	.
	.	.
	Bit 30	This bit is set (1) when an error is detected in slot position #31
	Bit 31	This bit is set (1) when an error is detected in slot position #32

**Table 5.6. External IDs (=Expansion Module ID)**

Byte	Description
0	Network Adapter Module External ID = 0x00
1	External ID for slot position #1
2	External ID for slot position #2
3	External ID for slot position #3
4	External ID for slot position #4
5	External ID for slot position #5
6	External ID for slot position #6
7	External ID for slot position #7
8	External ID for slot position #8
9	External ID for slot position #9
10	External ID for slot position #10
11	External ID for slot position #11
12	External ID for slot position #12
13	External ID for slot position #13
14	External ID for slot position #14
15	External ID for slot position #15
16	External ID for slot position #16
17	External ID for slot position #17
18	External ID for slot position #18
19	External ID for slot position #19
20	External ID for slot position #20
21	External ID for slot position #21
22	External ID for slot position #22
23	External ID for slot position #23
24	External ID for slot position #24
25	External ID for slot position #25
26	External ID for slot position #26
27	External ID for slot position #27
28	External ID for slot position #28
29	External ID for slot position #29
30	External ID for slot position #30
31	External ID for slot position #31
32	External ID for slot position #32

### 5.5.8. Expansion Slot Object

Class Code: 71<sub>HEX</sub>

#### Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

#### Class Attributes

None

#### Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1~32 (Slot Address)	1	Get	Module External ID	USINT	See Appendix A.1.
	2	Get	I/O Data Code - Input Data Code - Output Data Code	Structure of: USINT USINT	See Table 5.7.
	3	Get	Input Offset Table - Byte Offset - Bit Offset	Structure of: USINT USINT	Byte offset in the Input Assembly Corresponding bit offset in the byte (If Input data length is zero, then return Empty.)
	4	Get	Output Offset Table - Byte Offset - Bit Offset	Structure of: USINT USINT	Byte offset in the Output Assembly Corresponding bit offset in the byte (If Output data length is zero, then return Empty.)
	5	Get	Input Data	Array of BYTE	Read Input data size defined by attributes 2. If Input data length is zero, then return Empty.
	6	Get/Set	Output Data	Array of BYTE	Read/Write Output data size defined by attributes 2. If Output data length is zero, then return Empty.
	7	Get/Set*	Active Flag	BOOL	0: This slot is activated 1: This slot is deactivated
	8	Get	Configuration Parameter Data length	USINT	Refer to Configuration Parameter document
	9	Get/Set	R/W Configuration Data	n Byte	Data array size defined by attributes 8.
	10	Get	Register Data Length	USINT	Refer to Configuration Parameter document
	11	Get/Set	R/W Register Data - Offset Low - Offset High - R/W Length - Write Data	Structure of: USINT USINT USINT n Byte	Read data array size defined by attribute 10. . R/W Length ≤ 32byte . Offset Length ≤ attribute 9

	15	Get/Set	R/W Maintenance Data - Module Serial ID - Offset - R/W Length - Write Data	Structure of: USINT USINT USINT n Byte	Vendor only Module Serial ID = Attribute 1 R/W Length ≤ 32byte
	100	Get	Product Code	4 Byte	See Table 5.8. And Appendix A.1.
	101	Get	Catalog Number	4 Byte	See Appendix A.1.
	102	Get	Firmware Revision	Structure of: USINT USINT	Expansion Module Firmware Revision

\*After the system is reset, the new “Set Value” action is applied.

If changed slot location, set default value automatically.

**Table 5.7. I/O Data Code Format**

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+0	Input Data Type		Input Data Length					
+1	Output Data Type		Output Data Length					

**Input/output Type:**

0 0: No I/O Data

0 1: Byte Data

1 0: Word Data

1 1: Bit Data

**Input/output Data Length:**

0 0 0 0 0 0: 0 Bit/Byte/Word

0 0 0 0 0 1: 1 Bit/Byte/Word

0 0 0 0 0 1 0: 2 Bit/Byte/Word

0 0 0 0 0 1 1: 3 Bit/Byte/Word

...

1 1 1 1 1 1 1: 63 Bit/Byte/Word

**Table 5.8. Product Code Format**

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+0	<i>Connection Type</i>							
+1	<i>Assembly Type</i>							
+2	<i>Output Information</i>							
+3	<i>Input Information</i>							

**Connection Type**

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+0	Reserved					<b>Mem</b>	<b>IO</b>	

**IO (Input/output Connection):**

IO = 0: does not support Input/output Connection

IO = 1: support Input/output Connection

**MEM (Memory Register Service):**

MEM = 0: does not support Memory Register Service Connection

MEM = 1: support Memory Register Service Connection

**Assembly Type**

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+1	<b>Unit_Type</b>		<b>Priority</b>		S	Reserved		

**Unit\_Type:**

0 0: Not Used

0 1: Input Module

1 0: Output Module

1 1: I/O Both Modules

**Priority (Input/output Data Priority for assembly):**

- 0 0: Priority 0 (low) - usually it is used by Byte/Bit Type Discrete module.  
 0 1: Priority 1  
 1 0: Priority 2 - usually it is used by Analog I/O module.  
 1 1: Priority 3 (high)

**S (Status for Profibus Slot Diagnostic) :**

- 0: No Status  
 1: Support Word Input Diagnostic(0x8000 = -32678)

for example: ST-3234(current analog input 4~20mA, 14bit)

Status	Input Data
Normal	0x0000 (4mA) ~ 0x3FFF (20mA)
Open Wire or Under range (0~3mA)	0x8000 (-32678)

**Input/ Output Information**

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
+2	Data_Type	Data_Length							Output Information
+3	Data_Type	Data_Length							Input Information

**Data\_Type :**

- 0 0 : Byte Data  
 0 1 : Word Data  
 1 0 : Bit Data  
 1 1 : have no Input or Output Data

**Data\_Length :**

- 0 0 0 0 0 0 0 : 1 Bit/Byte/Word  
 0 0 0 0 0 0 1 : 2 Bit/Byte/Word  
 0 0 0 0 0 1 0 : 3 Bit/Byte/Word  
 0 0 0 0 0 1 1 : 4 Bit/Byte/Word  
 0 0 0 0 1 0 0 : 5 Bit/Byte/Word  
 0 0 0 0 1 0 1 : 6 Bit/Byte/Word  
 0 0 0 0 1 1 0 : 7 Bit/Byte/Word  
 0 0 0 0 1 1 1 : 8 Byte/Word  
 0 0 0 1 0 0 0 : 9 Byte/Word  
 ...  
 1 1 1 1 1 1 0 : 63 Byte/Word  
 1 1 1 1 1 1 1 : 64 Byte/Word

### 5.5.9. I/O Format Setting

DeviceNet I/O Data Format Setting

I/O Data Format of NA-9211/9212 can be changed by DeviceNet Configuration Software

Data format is set by change FnBUS Manager Object value in Configuration Software.

Refer FnBUS Manager Object for detail values.

#### 5.5.9.1. Example

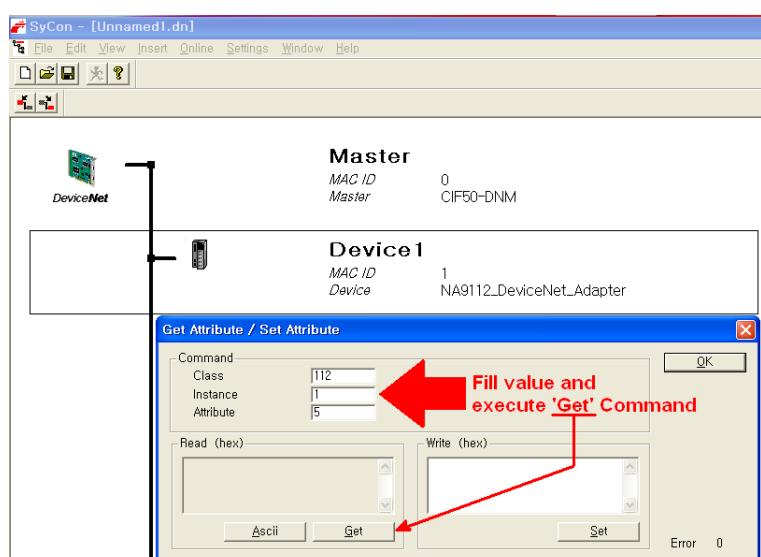
Example what Produced Connection Type of NA-9211 is changed from “Status(1byte) +Exp. Uncompressed Input Processing Data” to Exp. “Uncompressed Input Processing Data” with Sycon

##### Sycon

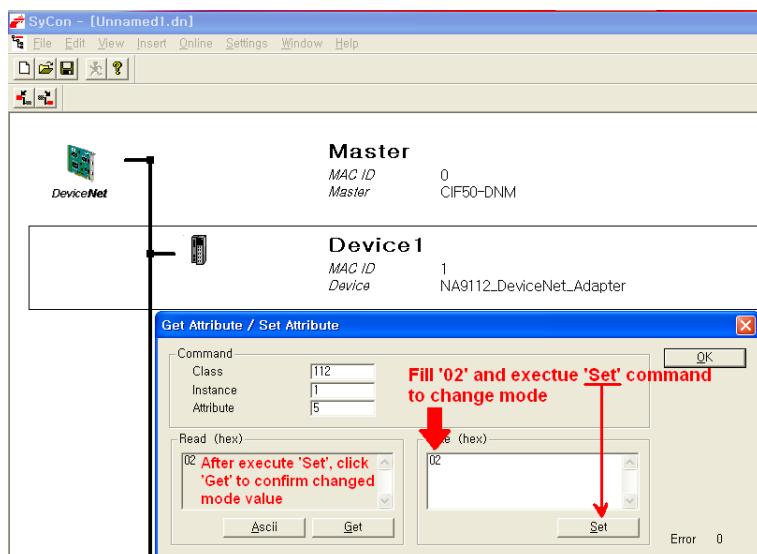
- After setting up NA-9211 and configuration system with Sycon, select NA-9211 as follows



- After Execution “Get Device Attribute / Set Device Attribute” menu in Online Menu, set 70hex(112dec) to Class Code, 1 to Instance ID, 5 to Attribute ID for ‘Change Produced Connection Type’ and execute “Get” command for confirming current value.

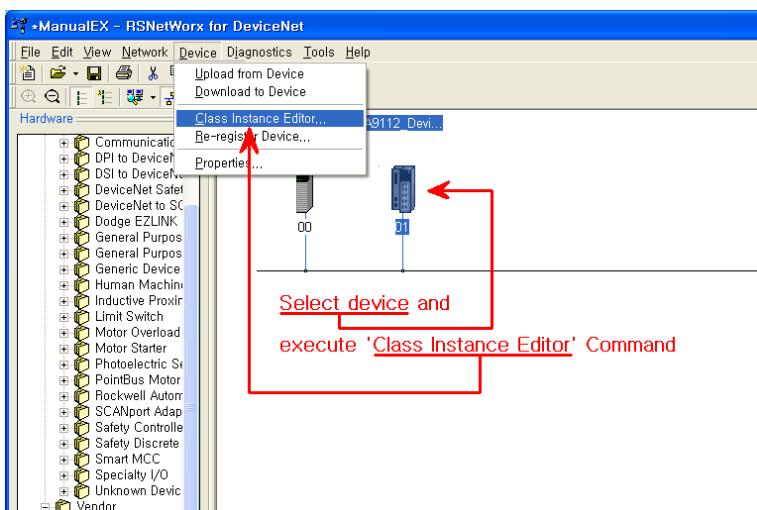


- Fill 02(refer to table 1) in setting value and execute “Set” command and then confirm what current value is 02 by executing “Get” command.

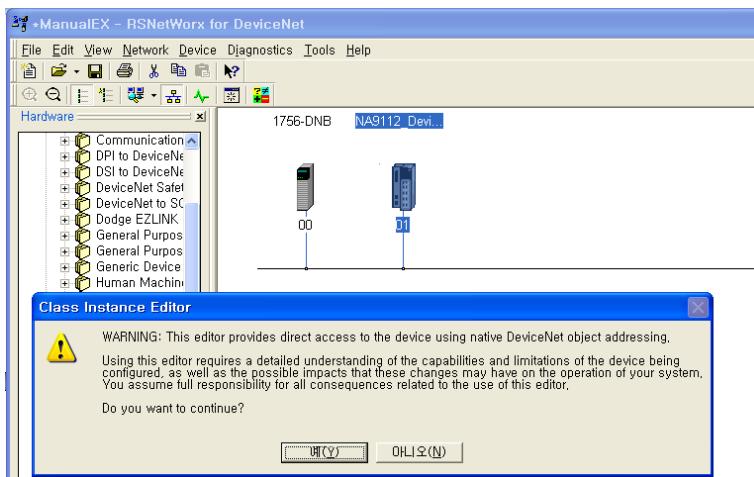


## DeviceNet RSNetworx

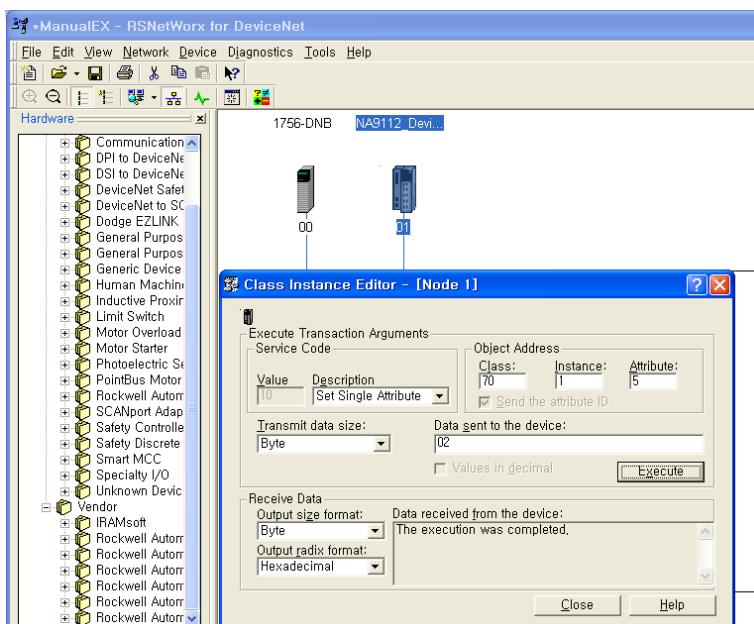
- After setting up NA-9211 and configuration system with DeviceNet RSNetworx then select NA-9211and execute ‘Class Instance Editor’ command as follows



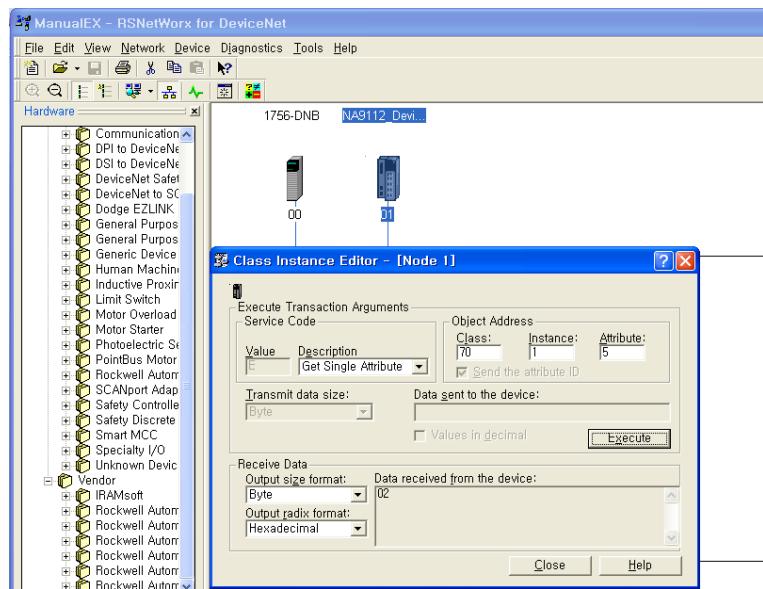
- This message is only that you have to understand its command in details. Click ‘Yes’.



- After setting below, click ‘execute’. The ‘Transmit data size’ , ‘Output size format’ and ‘Output radix format is only format to show value. So that is not important. After execution if you can see ‘The execurtion was completed’ in region of ‘Data received from the device’, ‘Set’ command is completed.



- For confirming changed mode value, click ‘execute’ after setting below.



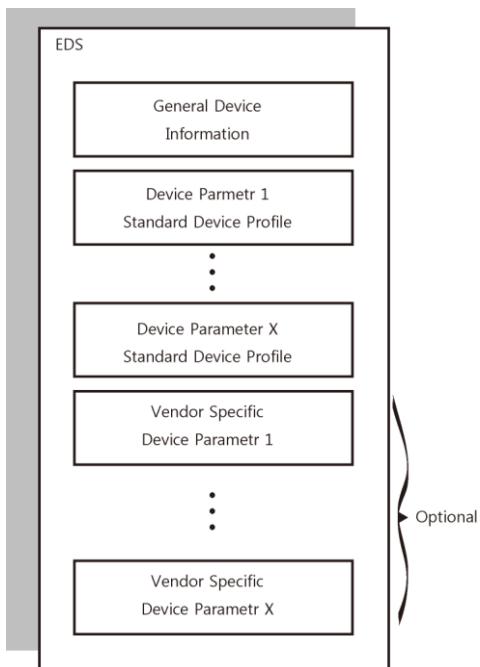
### 5.5.10. EDS Setting

#### EDS Setting

An Electronic Data Sheet(EDS) Provides information necessary to access and alter the configuration parameter of a device.

EDS is an external file that contains information about configurable attributes for the device, including object addresses of each parameter

the application objects in a device represent the destination addresses for configuration data. These addresses are encoded in EDS



General block diagram of an EDS file

When Configuration tool is started, it automatically retrieves all the EDS files stored in the EDS directory. The device names are placed into an internal list.

During the configuration, the device-specific data is retrieved directly from EDS files.

If a DeviceNet device does not appear in the selection list, a corresponding EDS file can be copied into the EDS directory with File > Copy EDS.

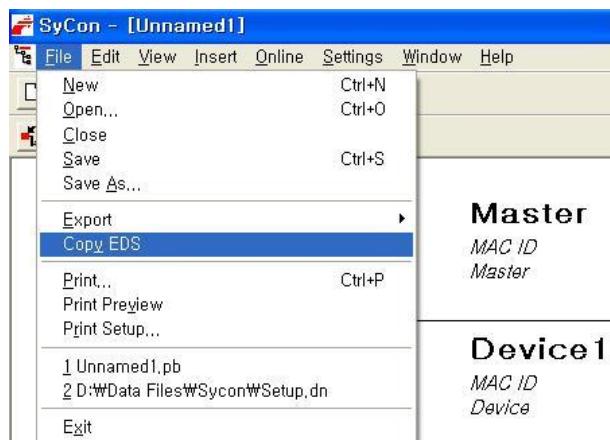
The EDS files of some vendors are available on the DeviceNet homepage <http://www.odva.org> or visit the homepage of the manufacturer.

The EDS directory is adjustable. In order to alter the directory from a previous setting in another directory, use the menu Settings > Path.

All EDS files must be places in this directory.

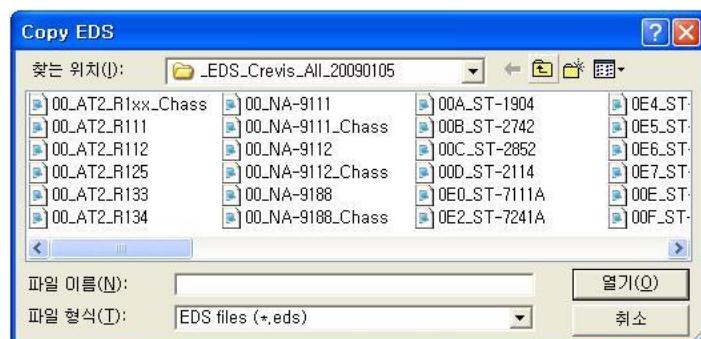
### Exmple for addition EDS file with Sycon

- Execute “Copy EDS” command in File menu

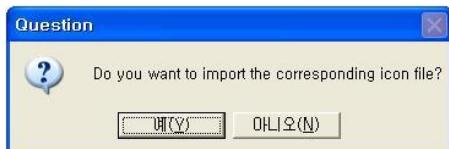


- After selection EDS file of NA-9211 and NA-9211\_Chass, click “Open”.

(It is necessary to register Chassis EDS file because NA Series is product what can add Expansion Module.)



- Click Yes.

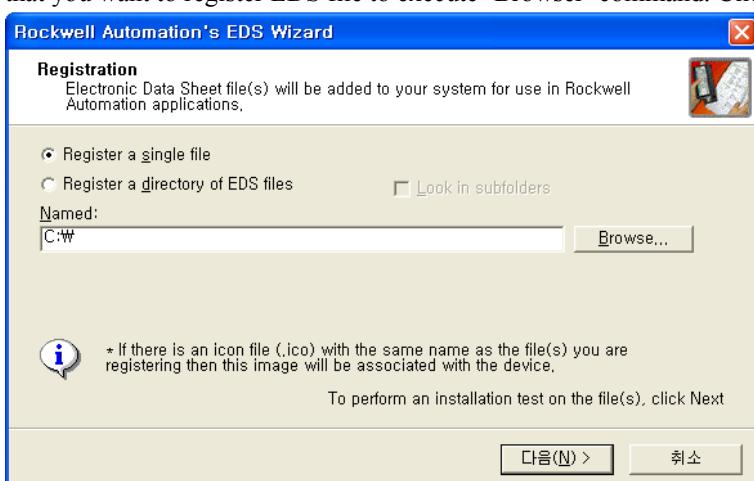


### Exmple for addition EDS file with Hardware Installation Tool in RS Linx

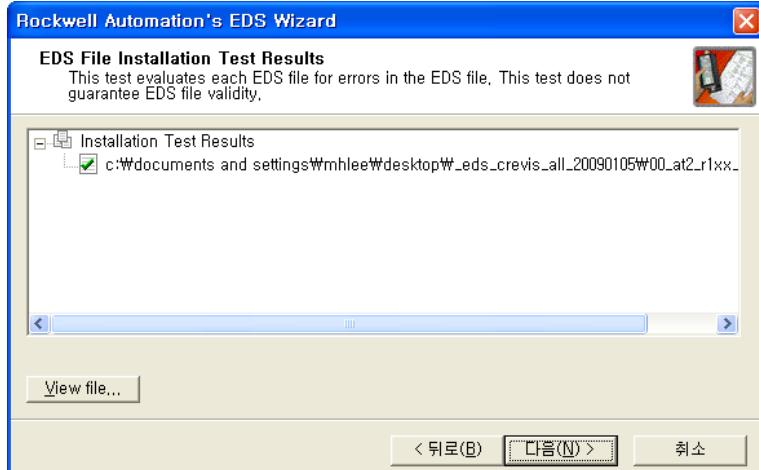
- Execute ‘Add’ command.



- ‘Register a single file’ is that registers one EDS file and ‘Register a directory of EDS files’ is that registers all EDS files in selected directory. In this example, it chooses ‘Register a single file’. Check ‘Register a single file’ and find out that you want to register EDS file to execute ‘Browser’ command. Click ‘Next’.



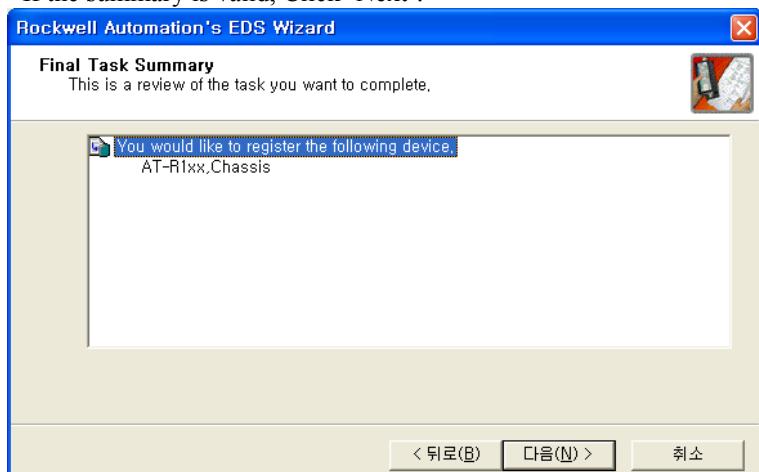
- If error doesn't occur, Click 'Next'.



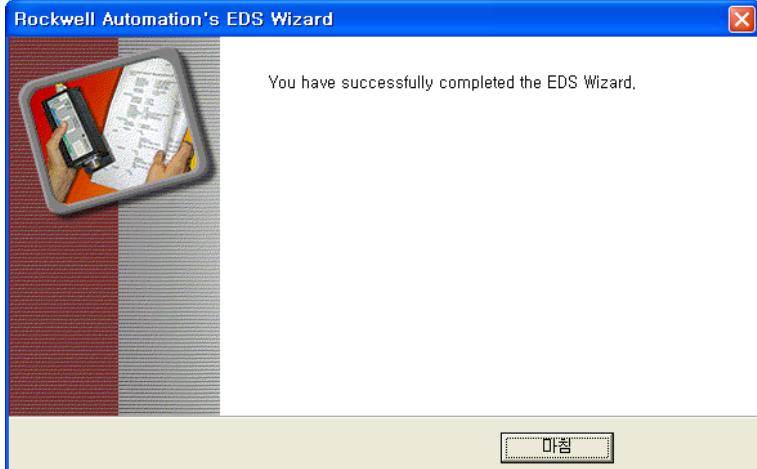
- This window is that registers icon image, Click 'Next' after selecting image.



- If the summary is valid, Click 'Next'.



- This window means all process is done, Click 'Finish'.



## 6. MODBUS INTERFACE

### 6.1. MODBUS Transmission Mode

Two different serial transmission modes are defined: The RTU mode and the ASCII mode. It defines the bit contents of message fields transmitted serially on the line. It determines how information is packed into the message fields and decoded.

#### 6.1.1. RTU Transmission Mode

When devices communicate on a MODBUS serial line using the RTU (Remote Terminal Unit) mode, each 8-bit byte in a message contains two 4-bit hexadecimal characters. The main advantage of this mode is that its greater character density allows better data throughput than ASCII mode for the same baud rate. Each message must be transmitted in a continuous stream of characters.

Start	Address	Function	Data	CRC Check	End
≥ 3.5 chars	1 char	1 char	Up to 252 chars	2 chars	≥ 3.5 chars

#### 6.1.2. ASCII Transmission Mode

When devices are setup to communicate on a MODBUS serial line using ASCII (American Standard Code for Information Interchange) mode, each 8-bit byte in a message is sent as two ASCII characters. This mode is used when the physical communication link or the capabilities of the device does not allow the conformance with RTU mode requirement regarding timers management.

Start	Address	Function	Data	CRC Check	End
1 char	2 chars	2 chars	Up to 252 chars	2 chars	2 chars CR,LF

### 6.2. Supported MODBUS Function Codes

Function Code	Function	Description	Unicast / Broadcast
1 (0x01)	Read Coils	Read output bit	Unicast
2 (0x02)	Read Discrete Inputs	Read input bit	Unicast
3 (0x03)	Read Holding Registers	Read output word	Unicast
4 (0x04)	Read Input Registers	Read input word	Unicast
5 (0x05)	Write Single Coil	Write one bit output	Unicast / Broadcast
6 (0x06)	Write Single Register	Write one word output	Unicast / Broadcast
8 (0x08)	Diagnostics (Serial Line only)	Read diagnostic register	Unicast
15 (0x0F)	Write Multiple Coils	Write a number of output bits	Unicast / Broadcast
16 (0x10)	Write Multiple registers	Write a number of output words	Unicast / Broadcast
23 (0x17)	Read / Write Multiple register	Read a number of input words / Write a number of output words	Unicast

- Refer to MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1a

### 6.2.1. 1 (0x01) Read Coils

This function code is used to read from 1 to 2000 contiguous status of coils in a remote device. The Request PDU specifies the starting address, i.e. the address of the first coil specified, and the number of coils. In the PDU Coils are addressed starting at zero. Therefore coils numbered 1-16 are addressed as 0-15. The coils in the response message are packed as one coil per bit of the data field. Status is indicated as 1= ON and 0= OFF.

#### ● Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x01	0x01
Starting Address Hi	0x10	0x10
Starting Address Lo	0x00	0x00
Quantity of Outputs Hi	0x00	0x00
Quantity of Outputs Lo	0x0A	0x0A
Error Check (CRC/LRC)	-	0xB8, 0xAB
End of Frame	-	t1-t2-t3

#### ● Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x01	0x01
Byte Count	0x02	0x02
Output Status	0x55	0x55
Output Status	0x02	0x02
Error Check (CRC/LRC)	-	0x8F, 0x6D
End of Frame	-	t1-t2-t3

\* In case of address 0x1015~0x1000 output bit value: 00000010\_01010101.

### 6.2.2. 2 (0x02) Read Discrete Inputs

This function code is used to read from 1 to 2000 contiguous status of discrete inputs in a remote device. The Request PDU specifies the starting address, i.e. the address of the first input specified, and the number of inputs. In the PDU Discrete Inputs are addressed starting at zero. Therefore Discrete inputs numbered 1-16 are addressed as 0-15. The discrete inputs in the response message are packed as one input per bit of the data field. Status is indicated as 1= ON; 0= OFF.

#### ● Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x02	0x02
Starting Address Hi	0x00	0x00
Starting Address Lo	0x00	0x00
Quantity of Inputs Hi	0x00	0x00
Quantity of Inputs Lo	0x0A	0x0A
Error Check (CRC/LRC)	-	0xF8, 0x6B
End of Frame	-	t1-t2-t3

#### ● Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x02	0x02
Byte Count	0x02	0x02
Input Status	0x80	0x80
Input Status	0x00	0x00
Error Check (CRC/LRC)	-	0x50, 0x78
End of Frame	-	t1-t2-t3

- In case of address 0x0015~0x0000 output bit value: 00000000\_10000000.

### 6.2.3. 3 (0x03) Read Holding Registers

This function code is used to read the contents of a contiguous block of holding registers in a remote device. The Request PDU specifies the starting register address and the number of registers.

The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

#### ● Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x03	0x03
Starting Address Hi	0x08	0x08
Starting Address Lo	0x00	0x00
Quantity of Register Hi	0x00	0x00
Quantity of Register Lo	0x02	0x02
Error Check (CRC/LRC)	-	0xC6, 0x0D
End of Frame	-	t1-t2-t3

#### ● Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x03	0x03
Byte Count	0x04	0x04
Output Register #0 Hi	0x11	0x11
Output Register #0 Lo	0x22	0x22
Output Register #1 Hi	0x33	0x33
Output Register #1 Lo	0x44	0x44
Error Check (CRC/LRC)	-	0x2D, 0xC6
End of Frame	-	t1-t2-t3

- In case of address 0x0800, 0x0801 output register value: 0x1122, 0x3344.

### 6.2.4. 4 (0x04) Read Input Registers

This function code is used to read from 1 to approx. 125 contiguous input registers in a remote device. The Request PDU specifies the starting register address and the number of registers. The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

#### ● Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x04	0x04
Starting Address Hi	0x00	0x00
Starting Address Lo	0x00	0x00
Quantity of Register Hi	0x00	0x00
Quantity of Register Lo	0x02	0x02
Error Check (CRC/LRC)	-	0x71, 0xAD
End of Frame	-	t1-t2-t3

#### ● Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x04	0x04
Byte Count	0x04	0x04
Input Register #0 Hi	0x00	0x00
Input Register #0 Lo	0x80	0x80
Input Register #1 Hi	0x00	0x00
Input Register #1 Lo	0x00	0x00
Error Check (CRC/LRC)	-	0x9C, 0x6C
End of Frame	-	t1-t2-t3

- In case of address 0x0000, 0x0001 input register value: 0x0080, 0x0000.

### 6.2.5. 5 (0x05) Write Single Coil

This function code is used to write a single output to either ON or OFF in a remote device. The requested ON/OFF state is specified by a constant in the request data field. A value of FF 00 hex requests the output to be ON. A value of 00 00 requests it to be OFF. All other values are illegal and will not affect the output.

#### ● Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x05	0x05
Starting Address Hi	0x10	0x10
Starting Address Lo	0x01	0x01
Quantity of Outputs Hi	0xFF	0xFF
Quantity of Outputs Lo	0x00	0x00
Error Check (CRC/LRC)	-	0xD9, 0x5C
End of Frame	-	t1-t2-t3

#### ● Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x05	0x05
Output Address Hi	0x10	0x10
Output Address Lo	0x01	0x01
Output Value Hi	0xFF	0xFF
Output Value Lo	0x00	0x00
Error Check (CRC/LRC)	-	0xD9, 0x5C
End of Frame	-	t1-t2-t3

- Output bit of address 0x1001 turns ON.

### 6.2.6. 6 (0x06) Write Single Register

This function code is used to write a single holding register in a remote device. Therefore register numbered 1 is addressed as 0. The normal response is an echo of the request, returned after the register contents have been written.

- Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x06	0x06
Starting Address Hi	0x08	0x08
Starting Address Lo	0x00	0x00
Quantity of Outputs Hi	0x11	0x11
Quantity of Outputs Lo	0x22	0x22
Error Check (CRC/LRC)	-	0x07, 0x85
End of Frame	-	t1-t2-t3

- Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x06	0x06
Output Address Hi	0x08	0x08
Output Address Lo	0x00	0x00
Output Value Hi	0x11	0x11
Output Value Lo	0x22	0x22
Error Check (CRC/LRC)	-	0x07, 0x85
End of Frame	-	t1-t2-t3

- In case of address 0x0800 outputs register value: 0x0000 changes to 0x1122.

### 6.2.7. 8 (0x08) Diagnostics

MODBUS function code 08 provides a series of tests for checking the communication system between a client (Master) device and a server (Slave), or for checking various internal error conditions within a server.

The function uses a two-byte sub-function code field in the query to define the type of test to be performed. The server echoes both the function code and sub-function code in a normal response. Some of the diagnostics cause data to be returned from the remote device in the data field of a normal response.

#### ● Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x08	0x08
Sub-Function Hi	0x00	0x00
Sub-Function Lo	0x00	0x00
Data Hi	0x11	0x11
Data Lo	0x22	0x22
Error Check (CRC/LRC)	-	0x6C, 0x24
End of Frame	-	t1-t2-t3

#### ● Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x08	0x08
Sub-Function Hi	0x00	0x00
Sub-Function Lo	0x00	0x00
Data Hi	0x11	0x11
Data Lo	0x22	0x22
Error Check (CRC/LRC)	-	0x6C, 0x24
End of Frame	-	t1-t2-t3

#### ✓ Sub-function 0x0000(0) Return Query Data

The data passed in the request data field is to be returned (looped back) in the response.

The entire response message should be identical to the request.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0000(0)	Any	Echo Request Data	

#### ✓ Sub-function 0x0001(1) Restart Communications Option

The remote device could be initialized and restarted, and all of its communications event counters are cleared. Especially, data field 0x55AA makes the remote device to restart with factory default setup of EEPROM.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0001(1)	0x0000, 0xFF00	Echo Request Data	Reset
0x0001(1)	0x55AA	Echo Request Data	Reset with Factory Default*

\*All expansion slot configuration parameters are cleared.

✓ **Sub-function 0x000A(10) Clear Counters and Diagnostic Register**

The goal is to clear all counters and the diagnostic register. Counters are also cleared upon power-up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000A(10)	0x0000	Echo Request Data	Clear All Outputs
0x000A(10)	0x0001	Echo Request Data	Stay Last Output state

✓ **Sub-function 0x000B(11) Return Bus Message Count**

The response data field returns the quantity of messages that the remote device has detected on the communications system since its last restart, clear counters operation, or power-up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000B(11)	0x0000	Total Message Count	

✓ **Sub-function 0x000C(12) Return Bus Communication Error Count**

The response data field returns the quantity of CRC errors encountered by the remote device since its last restart, clear counters operation, or power-up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000C(12)	0x0000	CRC Error Count	

✓ **Sub-function 0x000D(13) Return Bus Exception Error Count**

The response data field returns the quantity of MODBUS exception responses returned by the remote device since its last restart, clear counters operation, or power-up.

Exception responses are described and listed in section 6.2.11.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000D(13)	0x0000	Exception Error Count	

✓ **Sub-function 0x000E(14) Return Slave Message Count**

The response data field returns the quantity of messages addressed to the remote device, or broadcast, that the remote device has processed since its last restart, clear counters operation, or power-up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000E(14)	0x0000	Slave Message Count	

✓ **Sub-function 0x000F(15) Return Slave No Response Count**

The response data field returns the quantity of messages addressed to the remote device for which it has returned no response (neither a normal response nor an exception response), since its last restart, clear counters operation, or power-up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000F(15)	0x0000	Slave No Response Count	

✓ **Sub-function 0x0064(100) Return Slave MODBUS, FnBus Status**

The response data field returns the status of MODBUS and FnBus addressed to the remote device. This status values are identical with status 1word of input process image. Refer to 5.3.1.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0064(100)	0x0000	MODBUS, FnBus Status	Same as status 1word

✓ **Sub-function 0x0065(101) Return Slave MODBUS, Error Count**

The response data field returns the quantity of watchdog error addressed to the remote device since its last restart, clear counters operation, or power-up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0065(101)	0x0000	Watchdog Error Count	

✓ **Sub-function 0x0066(102) Change Slave IO Output Status**

The sub-function with data fields is to clear watchdog counter and change IO output status. This may be used to simulate clear output and fault output.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0066(102)	0x0000	Echo Request Data	Ready output, Automatically turns Normal output
0x0066(102)	0x0001, 0x0002, 0x0003	Echo Request Data	Clear output
0x0066(102)	0x0004	Echo Request Data	Normal output
0x0066(102)	0x0005, 0x0006, 0x0007	Echo Request Data	Fault output

### 6.2.8. 15 (0x0F) Write Multiple Coils

This function code is used to force each coil in a sequence of coils to either ON or OFF in a remote device. The Request PDU specifies the coil references to be forced. Coils are addressed starting at zero. A logical '1' in a bit position of the field requests the corresponding output to be ON. A logical '0' requests it to be OFF. The normal response returns the function code, starting address, and quantity of coils forced.

#### ● Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x0F	0x0F
Starting Address Hi	0x10	0x10
Starting Address Lo	0x00	0x00
Quantity of Outputs Hi	0x00	0x00
Quantity of Outputs Lo	0x0A	0x0A
Byte Count	0x02	0x02
Output Value #0	0x55	0x55
Output Value #1	0x01	0x01
Error Check (CRC/LRC)	-	0x21, 0XC9
End of Frame	-	t1-t2-t3

#### ● Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x0F	0x0F
Starting Address Hi	0x10	0x10
Starting Address Lo	0x00	0x00
Quantity of Outputs Hi	0x00	0x00
Quantity of Outputs Lo	0x0A	0x0A
Error Check (CRC/LRC)	-	0xD1, 0x6A
End of Frame	-	t1-t2-t3

- In case of address 0x1015~0x1000 output bit value: 00000000\_00000000 changes to 00000001\_01010101.

### 6.2.9. 16 (0x10) Write Multiple Registers

This function code is used to write a block of contiguous registers (1 to approx. 120 registers) in a remote device. The requested written values are specified in the request data field. Data is packed as two bytes per register. The normal response returns the function code, starting address, and quantity of registers written.

- Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x0F	0x0F
Starting Address Hi	0x10	0x10
Starting Address Lo	0x08	0x08
Quantity of Registers Hi	0x00	0x00
Quantity of Registers Lo	0x02	0x02
Byte Count	0x04	0x04
Register Value #0 Hi	0x11	0x11
Register Value #0 Lo	0x22	0x22
Register Value #1 Hi	0x33	0x33
Register Value #1 Lo	0x44	0x44
Error Check (CRC/LRC)	-	0x3B, 0x12
End of Frame	-	t1-t2-t3

- Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x0F	0x0F
Starting Address Hi	0x10	0x10
Starting Address Lo	0x08	0x08
Quantity of Outputs Hi	0x00	0x00
Quantity of Outputs Lo	0x02	0x02
Error Check (CRC/LRC)	-	0x43, 0xCE
End of Frame	-	t1-t2-t3

- In case of address 0x0800, 0x0801 output register value: 0x0000, 0x0000 changes to 0x1122, 0x3344.

### 6.2.10. 23 (0x17) Read/Write Multiple Registers

This function code performs a combination of one read operation and one write operation in a single MODBUS transaction. The write operation is performed before the read. The request specifies the starting address and number of holding registers to be read as well as the starting address, number of holding registers, and the data to be written. The byte count specifies the number of bytes to follow in the write data field.

The normal response contains the data from the group of registers that were read. The byte count field specifies the quantity of bytes to follow in the read data field.

#### ● Request

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x17	0x17
Read Starting Address Hi	0x08	0x08
Read Starting Address Lo	0x00	0x00
Quantity of Read Hi	0x00	0x00
Quantity of Read Lo	0x02	0x02
Write Starting Address Hi	0x08	0x08
Write Starting Address Lo	0x00	0x00
Quantity of Write Hi	0x00	0x00
Quantity of Write Lo	0x02	0x02
Byte Count	0x04	0x04
Write Reg. Value #0 Hi	0x11	0x11
Write Reg. Value #0 Lo	0x22	0x22
Write Reg. Value #1 Hi	0x33	0x33
Write Reg. Value #1 Lo	0x44	0x44
Error Check (CRC/LRC)	-	0x88, 0x3F
End of Frame	-	t1-t2-t3

#### ● Response

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x17	0x17
Byte Count	0x04	0x04
Write Reg. Value #0 Hi	0x11	0x11
Write Reg. Value #0 Lo	0x22	0x22
Write Reg. Value #1 Hi	0x33	0x33
Write Reg. Value #1 Lo	0x44	0x44
Error Check (CRC/LRC)	-	0x2E, 0xD2
End of Frame	-	t1-t2-t3

- In case of address 0x0800, 0x0801 output register value: 0x0000, 0x0000 changes to 0x1122, 0x3344.

### 6.2.11. Error Response

In an exception response, the server sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response.

- **Exception Response Example**

Field name	Example	RTU
Start of Frame	-	t1-t2-t3
Slave Address	0x07	0x07
Function Code	0x81	0x81
Exception Code	0x02	0x02
Error Check (CRC/LRC)	-	0x22, 0xC0
End of Frame	-	t1-t2-t3

- **Exception Codes**

Exception Code	Name	Description
01	Illegal Function	The function code received in the query is not an allowable action for the server (or slave).
02	Illegal Data Address	The data address received in the query is not an allowable address for the server (or slave).
03	Illegal Data Value	A value contained in the query data field is not an allowable value for server (or slave).
04	Slave Device Failure	An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.
05	Acknowledge	The server (or slave) has accepted the request and is processing it, but a long duration of time will be required to do so.
06	Slave Device Busy	Specialized use in conjunction with programming commands. The server (or slave) is engaged in processing a long-duration program command. The client (or master) should retransmit the message later when the server (or slave) is free.
08	Memory Parity Error	The server (or slave) attempted to read record file, but detected a parity error in the memory. The client (or master) can retry the request, but service may be required on the server (or slave) device.
0A	Gateway Path Unavailable	Specialized use in conjunction with gateways, indicates that the gateway was unable to allocate an internal communication path from the input port to the output port for processing the request.

- NA-9473 response exception code 01, 02, 03, 04 and 06.

### 6.2.12. MODBUS Special Register Map

The special register map can be accessed by function code 3, 4, 6 and 16. Also the special register map must be accessed by read/write of every each address (one address).

### 6.2.13. Adapter Identification Special Register (0x1000, 4096)

Address	Access	Type, Size	Description
0x1000(4096)	Read	1 word	Vendor ID = 0x02E5 (741), Crevis. Co., Ltd.
0x1001(4097)	Read	1 word	Device type = 0x000C, Network Adapter
0x1002(4098)	Read	1 word	Product code. 0x1101(NA-9212, DeviceNet) 0x0A00(NA-9186, EtherCAT) 0x0401(AT-R791, Modbus/RS485) 0x0300(NA-9171, Modbus/RS232) 0x0301(NA-9173, Modbus/RS485)
0x1003(4099)	Read	1 word	Firmware revision, if 0x0101, revision 1.01
0x1004(4100)	Read	2 words	Product unique serial number
0x1005(4101)	Read	String upto 34bytes	Product name string First 1word is length of valid character string Example) response as following Valid character size = 0x0015 =21 characters “NA9212_MODBUS_Adapter”
0x1006(4102)	Read	1 word	Sum check of EEPROM
0x1010(4112)	Read	2 words	Firmware release date
0x1011(4113)	Read	2 words	Product manufacturing inspection date
0x1012(4114)	Read	String upto 34bytes	Vendor name string First 1word is length of valid character string.
0x1013(4115)	Read	1word	Firmware Code = 0x9211 Firmware Code = 0x9212
0x101E(4126)	Read	7 words - 1 word - 1 word - 1 word - 1 word - 1 word - 2 words	Composite Id of following address 0x1100(4352), Rotary switch value, Slave Node Id. 0x1000(4096), Vendor ID 0x1001(4097), Device type 0x1002(4098), Product code 0x1003(4099), Firmware revision 0x1004(4100), Product serial number

- String Type consists of valid string length (first 1word) and array of characters.

### 6.2.14. Adapter Watchdog Time, other Time Special Register (0x1020, 4128)

A watchdog timer can be configured for timeout periods up to 65535(1unit=100msec). The Watchdog timer will timeout (timer decreased, reached 0) if MODBUS operation to the slave node does not occur over the configured watchdog value, then the slave adapter forces that slot output value is automatically set to user-configured fault actions and values.

Address	Access	Type, Size	Description
0x1020(4128)	Read/Write	1 word	Watchdog time value 16bit unsigned. The time value is represented by multiples of 100msec. The default value is 50 (50*100msec=5sec). A changing of watchdog time value resets watchdog error.
0x1021(4129)	Read	1 word	Watchdog time remain value This value decreases every 100msec
0x1024(4132)	Read/Write	1 word	Transmission response delay time. The value can be set 16bit unsigned (1msec unit). The default value is 0 (no delay).
0x1025(4133)	Read/Write	1 word	Valid byte-byte time gap in ASCII mode. (1msec unit) In ASCII mode byte-byte time gap is over setting value during receiving frame, this frame will be cancelled (dropped).
0x1028(4136)	Read	2 words	IO update time, main loop time. (100usec unit)

### 6.2.15. Adapter Information Special Register (0x1100, 4352)

Address	Access	Type, Size	Description
0x1100(4352)	Read/Write	1 word	Hi byte is two rotary switch values; low byte is current slave node address. MODBUS slave node address. If two rotary switches value are 0, the slave node address is assigned with last valid address and can be changed by software (1~247).
0x1101(4353)	Read	1 word	Hi byte is a current dip switch value; low byte is used current setup value.
0x1102(4354)	Read	1 word	Start address of input image word register. =0x0000
0x1103(4355)	Read	1 word	Start address of output image word register. =0x0800
0x1104(4356)	Read	1 word	Size of input image word register.
0x1105(4357)	Read	1 word	Size of output image word register.
0x1106(4358)	Read	1 word	Start address of input image bit. = 0x0000
0x1107(4359)	Read	1 word	Start address of output image bit. =0x1000
0x1108(4360)	Read	1 word	Size of input image bit.
0x1109(4361)	Read	1 word	Size of output image bit.
0x110E(4366)	Read	upto 33 word	Expansion slot's ST-number including NA. First 1word is adapter's number, if NA-9173, then 0x9173
0x1110(4368)	Read	1 word	Number of expansion slot
0x1111(4369)	Read	1 word	Number of active slot
0x1112(4370)	Read	1 word	Number of inactive slot
0x1113(4371)	Read	upto 33 word	Expansion slot Module Id. Refer to Appendix A.1 Product List. First 1word is adapter's module id.
0x1114(4372)*	Read/Write	1 word	Input process image mode. The default value is 2. Valid value range is from 0 to 3. Refer to 5.3.1.
0x1115(4373)*	Read/Write	1 word	Output process image mode. The default value is 0. Valid value range is from 0 to 1. Refer to 5.3.2.
0x1116(4374)**	Read/Write	2 words	Inactive slot list, The corresponding bit represents slot position. 0: Active slot, 1: Inactive slot. Ex) if value is 0x0001, 0x8000, then slot#1,#32 are inactive slots
0x1117(4375)	Read	2 words	Live slot list. , The corresponding bit represents slot position. 1: live slot, 0: not live slot
0x1118(4376)	Read	2 words	Alarm slot list. The corresponding bit represents slot position. 1: Alarm slot, 0: Normal slot
0x1119(4377)	Read	1 word	Hi byte is MODBUS status, low byte is FnBus status. Refer to 5.3.1.
0x111A(4378)	Write	1 word	Reserved. Adapter Scan command.
0x111B(4379)	Read/Write	1 word	Reserved. IO State machine.
0x111C(4380)	Read	2 words	Reserved. Runtime fault code.
0x111D(4381)	Read	1 word	Adapter FnBus Revision. If 0x013C, FnBus Revision is 1.60
0x111E(4382)	Read	1 word	Reserved. Adapter IO identification vendor code.

\*, \*\* After the system is reset, the new “Set Value” action is applied.

\*\* If the slot location is changed, set default value automatically (all expansion slots are live).

### 6.2.16. Expansion Slot Information Special Register (0x2000, 8192)

Each expansion slot has 0x20(32) address offset and same information structure.

Slot#1	0x2000(8192) ~0x201F (8223)	Slot#17	0x2200(8704) ~0x221F (8735)
Slot#2	0x2020(8224) ~0x203F (8255)	Slot#18	0x2220(8736) ~0x223F (8767)
Slot#3	0x2040(8256) ~0x205F (8287)	Slot#19	0x2240(8768) ~0x225F (8799)
Slot#4	0x2060(8288) ~0x207F (8319)	Slot#20	0x2260(8800) ~0x227F (8831)
Slot#5	0x2080(8320) ~0x209F (8351)	Slot#21	0x2280(8832) ~0x229F (8863)
Slot#6	0x20A0 (8352) ~0x20BF (8383)	Slot#22	0x22A0 (8864) ~0x22BF (8895)
Slot#7	0x20C0 (8384) ~0x20DF (8415)	Slot#23	0x22C0 (8896) ~0x22DF (8927)
Slot#8	0x20E0 (8416) ~0x20FF (8447)	Slot#24	0x22E0 (8928) ~0x22FF (8959)
Slot#9	0x2100(8448) ~0x211F (8479)	Slot#25	0x2300(8960) ~0x231F (8991)
Slot#10	0x2120(8480) ~0x213F (8511)	Slot#26	0x2320(8992) ~0x233F (9023)
Slot#11	0x2140(8512) ~0x215F (8543)	Slot#27	0x2340(9024) ~0x235F (9055)
Slot#12	0x2160(8544) ~0x217F (8575)	Slot#29	0x2360(9056) ~0x237F (9087)
Slot#13	0x2180(8576) ~0x219F (8607)	Slot#20	0x2380(9088) ~0x239F (9119)
Slot#14	0x21A0 (8608) ~0x21BF (8639)	Slot#30	0x23A0 (9120) ~0x23BF (9151)
Slot#15	0x21C0 (8640) ~0x21DF (8671)	Slot#31	0x23C0 (9152) ~0x23DF (9183)
Slot#16	0x21E0 (8672) ~0x21FF (8703)	Slot#32	0x23E0 (9184) ~0x23FF (9215)

Address Offset	Expansion Slot#1	Expansion Slot#2	Expansion Slot#3	.....	Expansion Slot#31	Expansion Slot#32
+ 0x00(+0)	0x2000(8192)	0x2020(8224)	0x2040(8256)	.....	0x23C0(9152)	0x23E0(9184)
+ 0x01(+1)	0x2001(8193)	0x2021(8225)	0x2041(8257)	.....	0x23C1(9153)	0x23E1(9185)
+ 0x02(+2)	0x2002(8194)	0x2022(8226)	0x2042(8258)	.....	0x23C2(9154)	0x23E2(9186)
+ 0x03(+3)	0x2003(8195)	0x2023(8227)	0x2043(8259)	.....	0x23C3(9155)	0x23E3(9187)
+ 0x04(+4)	0x2004(8196)	0x2024(8228)	0x2044(8260)	.....	0x23C4(9156)	0x23E4(9188)
+ 0x05(+5)	0x2005(8197)	0x2025(8229)	0x2045(8261)	.....	0x23C5(9157)	0x23E5(9189)
+ 0x06(+6)	0x2006(8198)	0x2026(8230)	0x2046(8262)	.....	0x23C6(9158)	0x23E6(9190)
+ 0x07(+7)	0x2007(8199)	0x2027(8231)	0x2047(8263)	.....	0x23C7(9159)	0x23E7(9191)
+ 0x08(+8)	0x2008(8200)	0x2028(8232)	0x2048(8264)	.....	0x23C8(9160)	0x23E8(9192)
+ 0x09(+9)	0x2009(8201)	0x2029(8233)	0x2049(8265)	.....	0x23C9(9161)	0x23E9(9193)
+ 0x0A(+10)	0x200A(8202)	0x202A(8234)	0x204A(8266)	.....	0x23CA(9162)	0x23EA(9194)
+ 0x0B(+11)	0x200B(8203)	0x202B(8235)	0x204B(8267)	.....	0x23CB(9163)	0x23EB(9195)
+ 0x0C(+12)	0x200C(8204)	0x202C(8236)	0x204C(8268)	.....	0x23CC(9164)	0x23EC(9196)
+ 0x0D(+13)	0x200D(8205)	0x202D(8237)	0x204D(8269)	.....	0x23CD(9165)	0x23ED(9197)
+ 0x0E(+14)	0x200E(8206)	0x202E(8238)	0x204E(8270)	.....	0x23CE(9166)	0x23EE(9198)
+ 0x0F(+15)	0x200F(8207)	0x202F(8239)	0x204F(8271)	.....	0x23CF(9167)	0x23EF(9199)
+ 0x10(+16)	0x2010(8208)	0x2030(8240)	0x2050(8272)	.....	0x23D0(9168)	0x23F0(9200)
+ 0x11(+17)	0x2011(8209)	0x2031(8241)	0x2051(8273)	.....	0x23D1(9169)	0x23F1(9201)
+ 0x12(+18)	0x2012(8210)	0x2032(8242)	0x2052(8274)	.....	0x23D2(9170)	0x23F2(9202)
+ 0x13(+19)	0x2013(8211)	0x2033(8243)	0x2053(8275)	.....	0x23D3(9171)	0x23F3(9203)
+ 0x14(+20)	0x2014(8212)	0x2034(8244)	0x2054(8276)	.....	0x23D4(9172)	0x23F4(9204)
+ 0x15(+21)	0x2015(8213)	0x2035(8245)	0x2055(8277)	.....	0x23D5(9173)	0x23F5(9205)
+ 0x16(+22)	0x2016(8214)	0x2036(8246)	0x2056(8278)	.....	0x23D6(9174)	0x23F6(9206)
+ 0x17(+23)	0x2017(8215)	0x2037(8247)	0x2057(8279)	.....	0x23D7(9175)	0x23F7(9207)
+ 0x18(+24)	0x2018(8216)	0x2038(8248)	0x2058(8280)	.....	0x23D8(9176)	0x23F8(9208)
+ 0x19(+25)	0x2019(8217)	0x2039(8249)	0x2059(8281)	.....	0x23D9(9177)	0x23F9(9209)
+ 0x1A(+26)	0x201A(8218)	0x203A(8250)	0x205A(8282)	.....	0x23DA(9178)	0x23FA(9210)
+ 0x1B(+27)	0x201B(8219)	0x203B(8251)	0x205B(8283)	.....	0x23DB(9179)	0x23FB(9211)
+ 0x1C(+28)	0x201C(8220)	0x203C(8252)	0x205C(8284)	.....	0x23DC(9180)	0x23FC(9212)

+ 0x1D(+29)	0x201D(8221)	0x203D(8253)	0x205D(8285)	.....	0x23DD(9181)	0x23FD(9213)
+ 0x1E(+30)	0x201E(8222)	0x203E(8254)	0x205E(8286)	.....	0x23DE(9182)	0x23FE(9214)
+ 0x1F(+31)	0x201F(8223)	0x203F(8255)	0x205F(8287)	.....	0x23DF(9183)	0x23FF(9215)

Address	Access	Type, Size	Description
+ 0x00(+0)	Read	1 word	Slot module id. Refer to Appendix A.1 Product List.
+ 0x01(+1)	Read	1 word	Expansion Slot IO code. Refer to Table IO Data Code Format.
+ 0x02(+2)**	Read	1 word	Input start register address of input image word this slot.
+ 0x03(+3)**	Read	1 word	Input word's bit offset of input image word this slot.
+ 0x04(+4)**	Read	1 word	Output start register address of output image word this slot.
+ 0x05(+5)**	Read	1 word	Output word's bit offset of output image word this slot.
+ 0x06(+6)**	Read	1 word	Input bit start address of input image bit this slot.
+ 0x07(+7)**	Read	1 word	Output bit start address of output image bit this slot.
+ 0x08(+8)**	Read	1 word	Size of input bit this slot
+ 0x09(+9)**	Read	1 word	Size of output bit this slot
+ 0x0A(+10)**	Read	n words	Read input data this slot
+ 0x0B(+11)**	Read/Write	n words	Read/write output data this slot
+ 0x0C(+12)*	Read/Write	1 word	Inactive slot, 0x0000:active, 0x0001:inactive
+ 0x0E(+14)	Read	1 word	ST-number, if ST-1324, returns 0x1324
+ 0x0F(+15)	Read	String upto 74 words	First 1word is length of valid character string. If ST-1324, returns “00 21 53 54 2D 31 33 32 34 2C 20 46 6E 49 4F 20 34 20 53 6F 75 72 63 69 6E 67 20 49 6E 20 34 38 56 64 63 00” Valid character size = 0x0021 =33 characters, “ST-1324, FnIO 4 Sourcing In 48Vdc”
+ 0x10(+16)	Read	1 word	Size of configuration parameter byte
+ 0x11(+17)**	Read/Write	n words	Read/write Configuration parameter data, up to 8byte. Refer to document(FnIO_Configuration_Parameter_Memory_Register_Rev1.01) ***
+ 0x12(+18)	Read	1 word	Size of memory byte.
+ 0x13(+19)**	Read/Write	n words	Read/write Memory data. Offset of memory is fixed with 0.
+ 0x14(+20)**	Read/Write	n words	Read/write Memory data. First 2byte of write data is memory offset.
+ 0x15(+21)	Read	2 words	Product code Refer to Appendix A.1 Product List.
+ 0x16(+22)	Read	2 words	Catalog number. Refer to Appendix A.1 Product List.
+ 0x17(+23)	Read	1 word	Firmware Revision
+ 0x18(+24)	Read	1 word	FnBus Revision
+ 0x1A(+26)	Read/Write	n words	Reserved. Read/write expansion class access.
+ 0x1B(+27)	Read/Write	n words	Reserved. Read/write maintenance data access.

\* After the system is reset, the new “Set Value” action is applied.

\*\* Nothing of output, input, and memory or configuration parameter corresponding slot returns Exception 02.

\*\*\* Slot Configuration parameter saved by internal EEPROM during power cycle until slot position changed.

\*\*\* All of output modules and special modules have the slot configuration parameter data. Refer to Document.

(FnIO\_Configuration\_Parameter\_Memory\_Register\_Rev1.0x)

● IO Data Code Format (1 word)

Item	#15	#14	#13	#12	#11	#10	#9	#8	#7	#6	#5	#4	#3	#2	#1	#0	Word
Field	Output IO code																
Field	Date Type   Data Length																

**Example)**

ST-3214	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0x0084
ST-1224	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0x00C4
ST-1228	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0x0041
ST-4123	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0x8200
ST-221F	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0x4200
ST-2324	1	1	0	0	0	1	0	0	1	1	0	0	0	1	0	0xC4C4

**Input/output Data Type:**

0 0: No I/O Data

0 1: Byte Data

1 0: Word Data

1 1: Bit Data

**Input/output Data Length:**

0 0 0 0 0 0 0: 0 Bit/Byte/Word

0 0 0 0 0 0 1: 1 Bit/Byte/Word

0 0 0 0 0 1 0: 2 Bit/Byte/Word

0 0 0 0 0 1 1: 3 Bit/Byte/Word

.....

1 1 1 1 1 1 1: 63 Bit/Byte/Word

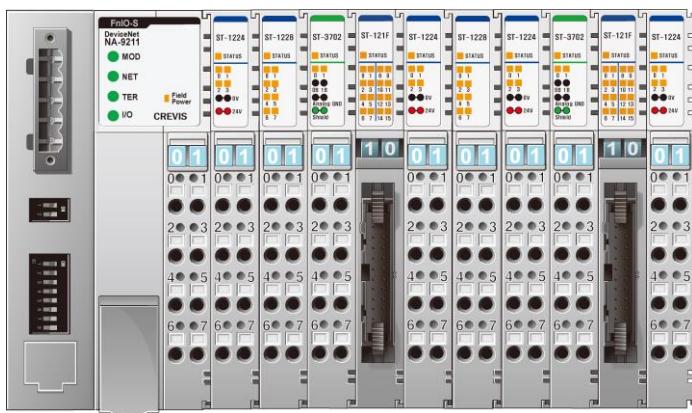
### 6.3. Example

#### 6.3.1. Example of Input Process Image Map

Input image data depends on slot position and expansion slot data type. Input process image data is only ordered by expansion slot position when input image mode is uncompressed (mode 0, 2). But, when input image mode is compressed (mode 1, 3), input process image data is ordered by expansion slot position and slot data type.

Input process image mode can be set by FnBus Manager Object attribute#5.

For example slot configuration



Slot Address	Module Description
#0	DeviceNet Adapter
#1	4-discrete input
#2	8-discrete input
#3	2-analog input
#4	16-discrete input
#5	4-discrete input
#6	8-discrete input
#7	4-discrete input
#8	2-analog input
#9	16-discrete input
#10	4-discrete input

Status  
(1byte)

#### Input Process Image Mode#0(Status(1byte) + Uncompressed Input Processing Data)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Field Power	Fn-Bus Status						
1	Empty, Always 0				Discrete Input 4 pts (Slot#1)			
2					Discrete Input 8 pts (Slot#2)			
3					Analog Input Ch0 low byte (Slot#3)			
4					Analog Input Ch0 high byte (Slot#3)			
5					Analog Input Ch1 low byte (Slot#3)			
6					Analog Input Ch1 high byte (Slot#3)			
7					Discrete Input low 8 pts (Slot#4)			
8					Discrete Input high 8 pts (Slot#4)			
9	Empty, Always 0				Discrete Input 4 pts (Slot#5)			
10					Discrete Input 8 pts (Slot#6)			
11	Empty, Always 0				Discrete Input 4 pts (Slot#7)			
12					Analog Input Ch0 low byte (Slot#8)			
13					Analog Input Ch0 high byte (Slot#8)			
14					Analog Input Ch1 low byte (Slot#8)			
15					Analog Input Ch1 high byte (Slot#8)			
16					Discrete Input low 8 pts (Slot#9)			
17					Discrete Input high 8 pts (Slot#9)			
18	Empty, Always 0				Discrete Input 4 pts (Slot#10)			

**Field Power:**

0: 24Vdc Field Power On. 1: 24Vdc Field Power Off

**Fn-Bus Status:**

0: Normal Operation 1: Fn-Bus Standby

2: Fn-Bus Communication Fault 3: Slot Configuration Failed

4: No Expansion Slot

Status  
(1byte)**Input Process Image Mode#1 (Status(1byte) + Compressed Input Processing Data)**

Byte	Bit 7	Bit 6	Bti 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Field Power							Fn-Bus Status
1								Analog Input Ch0 low byte (Slot#3)
2								Analog Input Ch0 high byte (Slot#3)
3								Analog Input Ch1 low byte (Slot#3)
4								Analog Input Ch1 high byte (Slot#3)
5								Analog Input Ch0 low byte (Slot#8)
6								Analog Input Ch0 high byte (Slot#8)
7								Analog Input Ch1 low byte (Slot#8)
8								Analog Input Ch1 high byte (Slot#8)
9								Discrete Input 8 pts (Slot#2)
10								Discrete Input low 8 pts (Slot#4)
11								Discrete Input high 8 pts (Slot#4)
12								Discrete Input 8 pts (Slot#6)
13								Discrete Input low 8 pts (Slot#9)
14								Discrete Input high 8 pts (Slot#9)
15				Discrete Input 4 pts (Slot#5)				Discrete Input 4 pts (Slot#1)
16				Discrete Input 4 pts (Slot#10)				Discrete Input 4 pts (Slot#7)

**Input Assembly Priority:**

- 1) Analog Input Data (Word type)
- 2) 8 or 16 points Discrete Input Data (Byte type)
- 3) 4 points Input Data (Bit type)
- 4) 2 points Input Data (Bit type)

**Input Process Image Mode#2 (Uncompressed Input Processing Data without Status)**

Byte	Bit 7	Bit 6	Bti 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Empty, Always 0							Discrete Input 4 pts (Slot#1)
1								Discrete Input 8 pts (Slot#2)
2								Analog Input Ch0 low byte (Slot#3)
3								Analog Input Ch0 high byte (Slot#3)
4								Analog Input Ch1 low byte (Slot#3)
5								Analog Input Ch1 high byte (Slot#3)
6								Discrete Input low 8 pts (Slot#4)
7								Discrete Input high 8 pts (Slot#4)
8	Empty, Always 0							Discrete Input 4 pts (Slot#5)
9								Discrete Input 8 pts (Slot#6)
10	Empty, Always 0							Discrete Input 4 pts (Slot#7)
11								Analog Input Ch0 low byte (Slot#8)
12								Analog Input Ch0 high byte (Slot#8)
13								Analog Input Ch1 low byte (Slot#8)
14								Analog Input Ch1 high byte (Slot#8)
15								Discrete Input low 8 pts (Slot#9)
16								Discrete Input high 8 pts (Slot#9)
17	Empty, Always 0							Discrete Input 4 pts (Slot#10)

**Input Process Image Mode#3 (Compressed Input Processing Data without Status)**

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0								Analog Input Ch0 low byte (Slot#3)
1								Analog Input Ch0 high byte (Slot#3)
2								Analog Input Ch1 low byte (Slot#3)
3								Analog Input Ch1 high byte (Slot#3)
4								Analog Input Ch0 low byte (Slot#8)
5								Analog Input Ch0 high byte (Slot#8)
6								Analog Input Ch1 low byte (Slot#8)
7								Analog Input Ch1 high byte (Slot#8)
8								Discrete Input 8 pts (Slot#2)
9								Discrete Input low 8 pts (Slot#4)
10								Discrete Input high 8 pts (Slot#4)
11								Discrete Input 8 pts (Slot#6)
12								Discrete Input low 8 pts (Slot#9)
13								Discrete Input high 8 pts (Slot#9)
14								Discrete Input 4 pts (Slot#1)
15								Discrete Input 4 pts (Slot#7)

**Input Assembly Priority:**

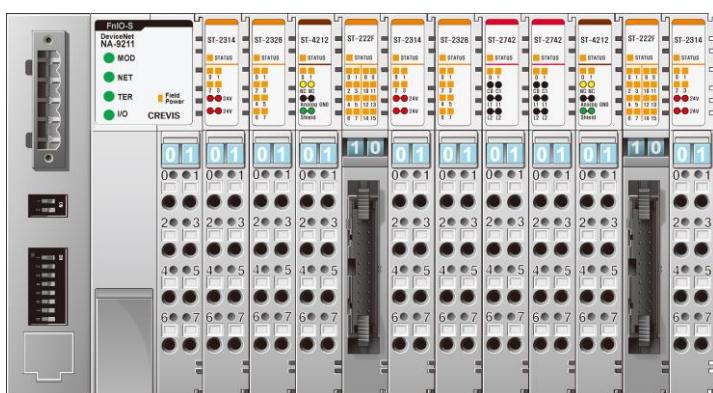
- 1) Analog Input Data (Word type)
- 2) 8 or 16 points Discrete Input Data (Byte type)
- 3) 4 points Input Data (Bit type)
- 4) 2 points Input Data (Bit type)

### 6.3.2. Example of Output Process Image Map

Output image data depends on slot position and expansion slot data type. Output process image data is only ordered by expansion slot position when output image mode is uncompressed (mode 0). But, when output image mode is compressed (mode 1), output process image data is ordered by expansion slot position and slot data type.

Output process image mode can be set by FnBus Manager Object attribute#6.

For example slot configuration



Slot Address	Module Description
#0	DeviceNet Adapter
#1	4-discrete output
#2	8-discrete output
#3	2-analog output
#4	16-discrete output
#5	4-discrete output
#6	8-discrete output
#7	2-relay output
#8	2-relay output
#9	2-analog output
#10	16-discrete output
#11	4-discrete output

#### Output Process Image Mode#0 (Status(1byte) + Uncompressed Input Processing Data)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		
0	Empty, Don't care						Discrete Output 4 pts (Slot#1)			
1	Discrete Output 8 pts (Slot#2)									
2	Analog Output Ch0 low byte (Slot#3)									
3	Analog Output Ch0 high byte (Slot#3)									
4	Analog Output Ch1 low byte (Slot#3)									
5	Analog Output Ch1 high byte (Slot#3)									
6	Discrete Output low 8 pts (Slot#4)									
7	Discrete Output high 8 pts (Slot#4)									
8	Empty, Don't care				Discrete Output 4 pts (Slot#5)					
9	Discrete Input 8 pts (Slot#6)									
10	Empty, Don't care						Discrete Output 2 pts (Slot#7)			
11	Empty, Don't care						Discrete Output 2 pts (Slot#8)			
12	Analog Output Ch0 low byte (Slot#9)									
13	Analog Output Ch0 high byte (Slot#9)									
14	Analog Output Ch1 low byte (Slot#9)									
15	Analog Output Ch1 high byte (Slot#9)									
16	Discrete Output low 8 pts (Slot#10)									
17	Discrete Output high 8 pts (Slot#10)									
18	Empty, Don't care				Discrete Output 4 pts (Slot#11)					

**Output Process Image Mode#1 (Compressed Output Processing Data)**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Analog Output Ch0 low byte (Slot#3)
1								Analog Output Ch0 high byte (Slot#3)
2								Analog Output Ch1 low byte (Slot#3)
3								Analog Output Ch1 high byte (Slot#3)
4								Analog Output Ch0 low byte (Slot#9)
5								Analog Output Ch0 high byte (Slot#9)
6								Analog Output Ch1 low byte (Slot#9)
7								Analog Output Ch1 high byte (Slot#9)
8								Discrete Output 8 pts (Slot#2)
9								Discrete Output low 8 pts (Slot#4)
10								Discrete Output high 8 pts (Slot#4)
11								Discrete Input 8 pts (Slot#6)
12								Discrete Output low 8 pts (Slot#10)
13								Discrete Output high 8 pts (Slot#10)
14								Discrete Output 4 pts (Slot#1)
15	Discrete Output 2 pts (Slot#8)		Discrete Output 2 pts (Slot#7)					Discrete Output 4 pts (Slot#11)

Output Assembly Priority:

- 1) Analog Output Data (Word type)
- 2) 8 or 16 points Discrete Output Data (Byte type)
- 3) 4 points Output Data (Bit type)
- 4) 2 points Output Data (Bit type)

## Trouble Shooting

### How to diagnose by LED indicator

LED Status	Cause	Action
All LED turns off	-No power	-Check main power Cable
	-System power is not supplied.	-Contact Sales team and send module for repair.
MOD LED flashes green	-Failure of initialization EEPROM parameter.	-Contact Sales team and send module for repair.
MOD LED flashes red	-Excess of expansion slot - Excess of IO size - Wrong IO composition -Occurrence of EEPROM checksum error	-Use expansion slot up to 32. -Compose that IO total size is not excess. -Check composition I/O Module
MOD LED is red	-Wrong address ID -Occurrence critical error in firmware	-Contact Sales team and send module for repair.
I/O LED turns off	-Failure of realization expansion Module -None expansion Module	-Check connector status both NA series and expansion module.
I/O LED flashes red	Failure of configuration baud rate	-Check communication cable with Master -Check power for master.
	Failure of initialization I/O	-Use expansion slot up to 32. -Compose that IO total size is not excess.  NA series notice unidentified expansion module ID. Check status of expansion module.
I/O LED is red	Failure of exchanging I/O data	Check status of expansion IO connection.
NET LED turns off	Failure of communication with Master	Check main power for master and communication cable.
NET LED flashed green	Failure of exchanging data with master	Check status in software for Master configuration.
NET LED is red	Communication connecting lost	Check BUS line cable for connection with master.
		Check duplication address.

## How to diagnose when device couldn't communicate network

### Inspection of wrong or omission cable connection.

- Check status of cable connection for each node.
- Check that all color matches between connector and cable.
- Check wire omission.

### Terminator resistor

- If terminator resistor is not installed, install terminator resistor
- Check location of terminator resistor

### Configuration of Node address

- Check duplication node address.

### Configuration of Master

- Check configuration of master
- Check whether to do download or don't
- Check composition is right
  - Configuration of communication baud rate
  - I/O size
  - Configuration of each nodes

### Ground and environment

- Check ground is contacted
- Check environment factor(temperature, humidity, etc) is in less than regular limit

## Appendix

### A.1. Glossary

- System Power : The power for starting up CPU.
- Field Power : The power for input and output line.
- Terminator Resistor : Resistor for prevention reflected wave.
- EDS : Electronic Data Sheet.
- sinking : The method of input and output what device does not have power source.
- sourcing : The method of input and output what device have power source.