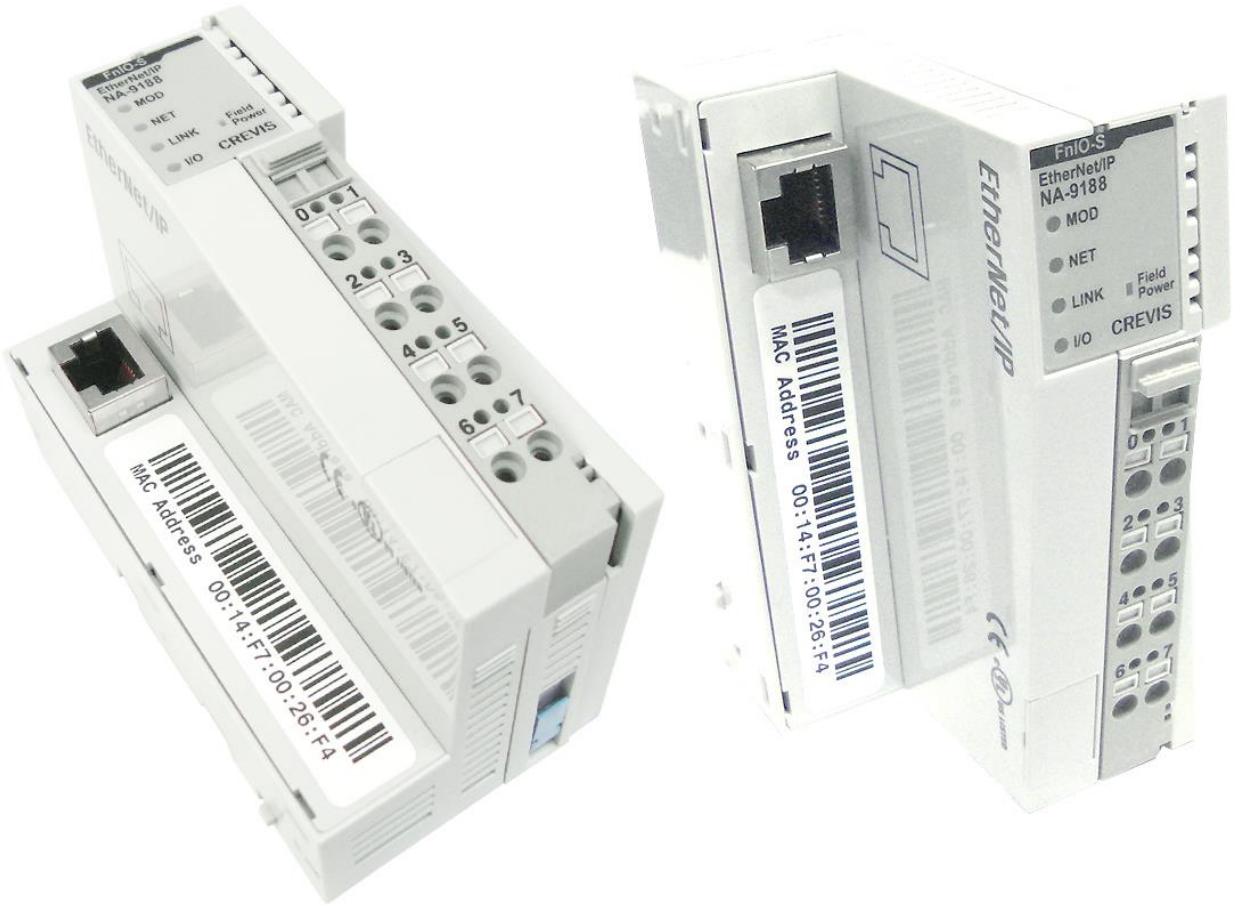
EtherNET/IP Adapter

NA-9188

User Manual



Version 1.05

2013 CREVIS Co.,Ltd

DOCUMENT CHANGE SUMMARY				
REV	PAGE	REMARKS	DATE	EDITOR
1.0	New Document		2011/10/21	JE Kang
1.01	6	Add your experience	2012/1/13	JE Kang
1.02		Modify the wrong letters and value	2012/2/15	JE Kang
		Changed Cover	2012/2/28	JE Kang
1.03		Changed Crevis TEL	2013/4/4	JE KANG
1.04		Environment Spec. 50℃→55℃ (UL Temp)	2013/7/3	JE Kang
1.05		Modify the Pin Description	2014/05/08	YMKIM

CONTENTS

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℃ 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

DANGER 	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.
IMPORTANT	Identifies information that is critical for successful application and understanding of the Product.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury, property damage, or economic loss. Attentions help you to identity a hazard, avoid a hazard, and recognize the consequences.

1.1.2. Safety Notes

DANGER 	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.

1.1.3. Certification

c-UL-us UL Listed Industrial Control Equipment, certified for U.S. and Canada
See UL File E235505

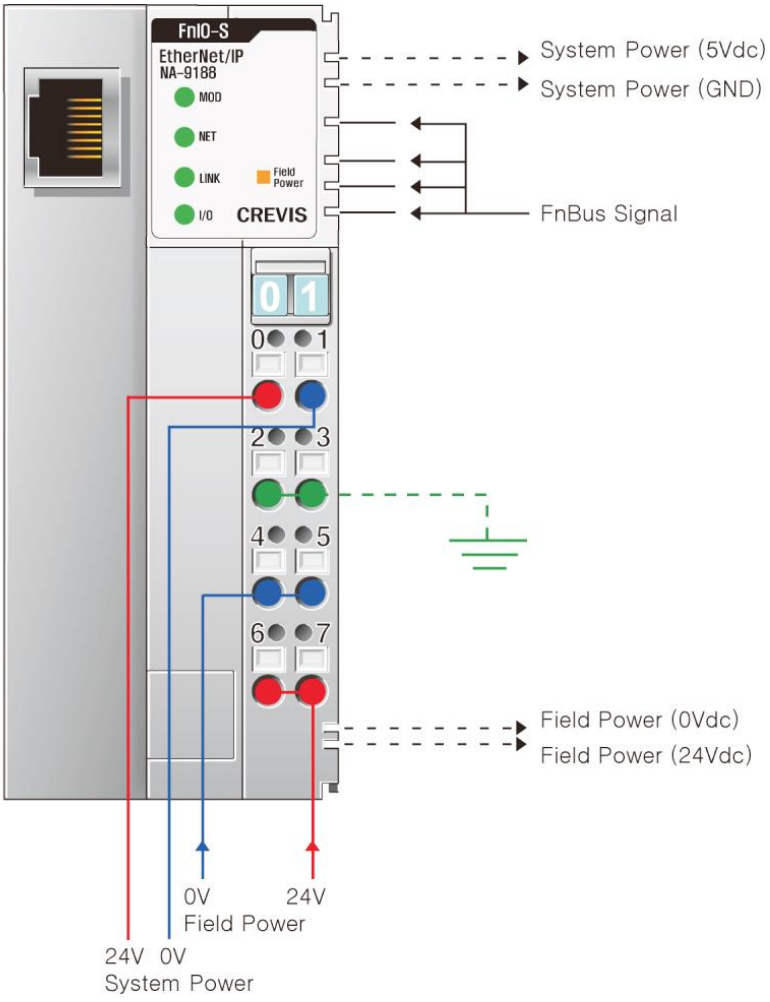
CE Certificate
EN 61000-6-2; Industrial Immunity
EN 61000-6-4; Industrial Emissions

2. Specification

2.1. The Interface

2.1.1. NA-9188 (Ethernet/IP)

RJ-45	Signal Name	Description
1	TD+	Transmit +
2	TD-	Transmit -
3	RD+	Receive +
4	-	-
5	-	-
6	RD-	Receive -
7	-	-
8	-	-
Case	Shield	-



2.2. Specification

2.2.1. 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	60mA typical @24Vdc
Current for I/O Module	1.5A @5Vdc
Isolation	System power to internal logic : Non-isolation System power 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	150g
Module Size	45mm x 99mm x 70mm
Environment Condition	Refer to Environment Specification

Environmental Specifications	
Operating Temperature	-20 to 55℃
Non-Operating Temperature	-40℃ to 85℃
Relative Humidity	5%~90% non-condensing
Operating Altitude	2000m
Mounting	DIN rail

2.2.2. Interface Specification

Interface Specification, NA-9188 (Ethernet/IP Adapter)	
Adapter Type	Level 2 I/O Server (Explicit, I/O Message)
Max. Expansion Module	32 slots
Max. Input Size	252bytes
Max. Output Size	252bytes
Max. Length Bus Line	Up to 100m from Ethernet Hub/Switch with twisted CAT 3 UTP/STP
Max. Nodes	Limited by Ethernet Specification
Max. Connection	16 IO message connections 64 CIP connections 64 Explicit message connections
Baud rate	10/100Mbps, Auto-negotiation, Full duplex
Protocol	Ethernet/IP, BOOTP
Interface Connector	RJ-45 socket
IP Address Setup	Via BOOTP
Indicator	5 LEDs 1 Green/Red, Module Status (MOD) 1 Green, Network Status (NET) 1 Green, Link/Active Status (LINK) 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

2.3. LED Indicator

2.3.1. 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 device needs commissioning due to configuration missing, incomplete or incorrect.
Minor Fault	Flashing Red	Recoverable Fault - EEPROM sum check error.
Unrecoverable Fault	Red	The device has an unrecoverable fault. - Memory error or CPU watchdog error.

2.3.2. Network Status LED (NET)

State	LED is :	To indicate :
Not Powered No IP Address	Off	Module is not powered. Does not have an IP address
No Connections	Flashing Green	Module has obtained an IP address, but has no established connections.
CIP Connections	Green	Module has an IP address and at least one established connections.
Connection Time-out	Flashing Red	One or more of the connections in which the module is the target has time out.
Duplicate IP Address	Red	Module has detected that its IP address is already in use. Configure the module with a unique IP address.

2.3.3. Link/Active Status LED(LINK)

State	LED is :	To indicate :
Not Powered Physical network not ready	Off	May not be powered
Link Operational	Green	Physical Network communication ready
Act Operational	Flashing Green	some data communication on the base Ethernet 802.3

2.3.4. Expansion 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.

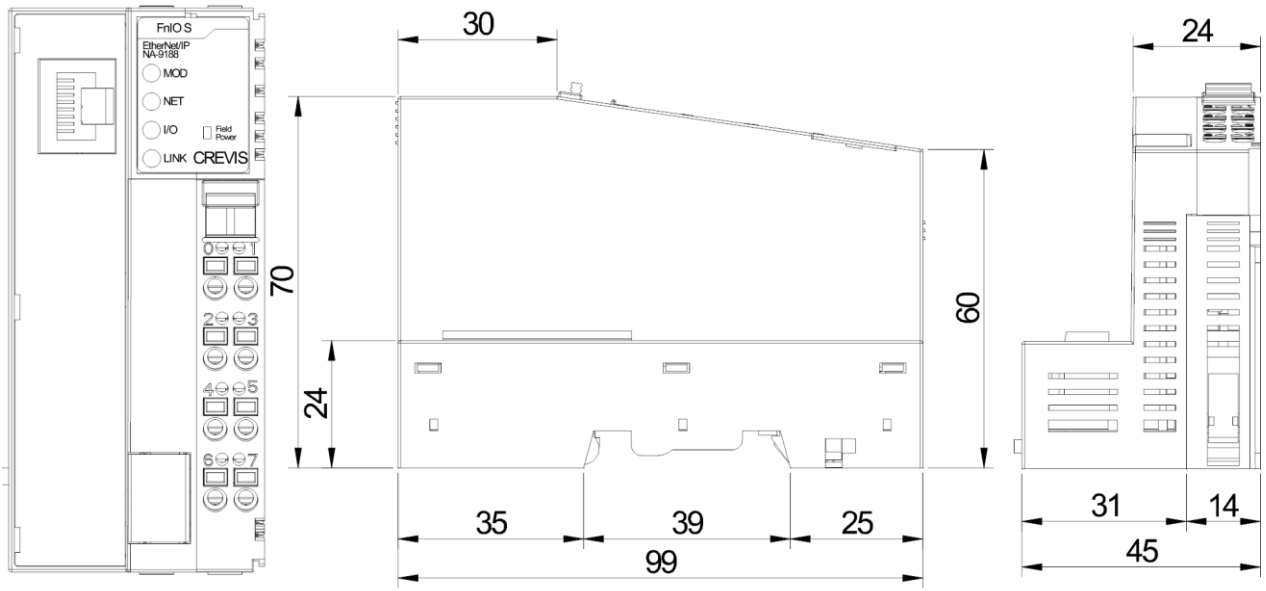
2.3.5. Field Power Status LED

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-9188

(mm)

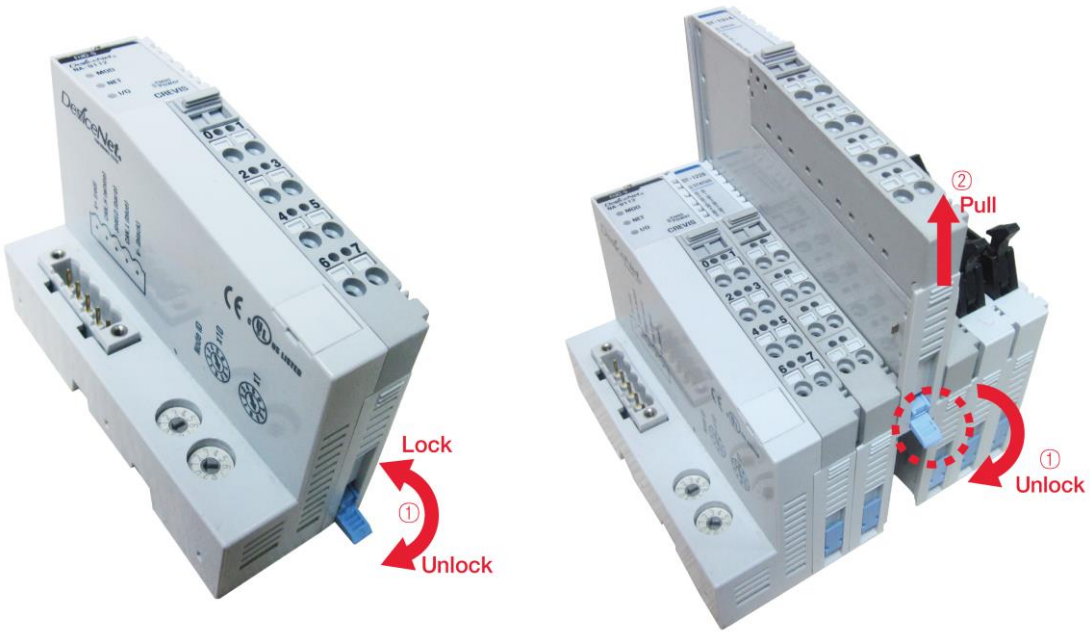


4. Mechanical Setup

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.

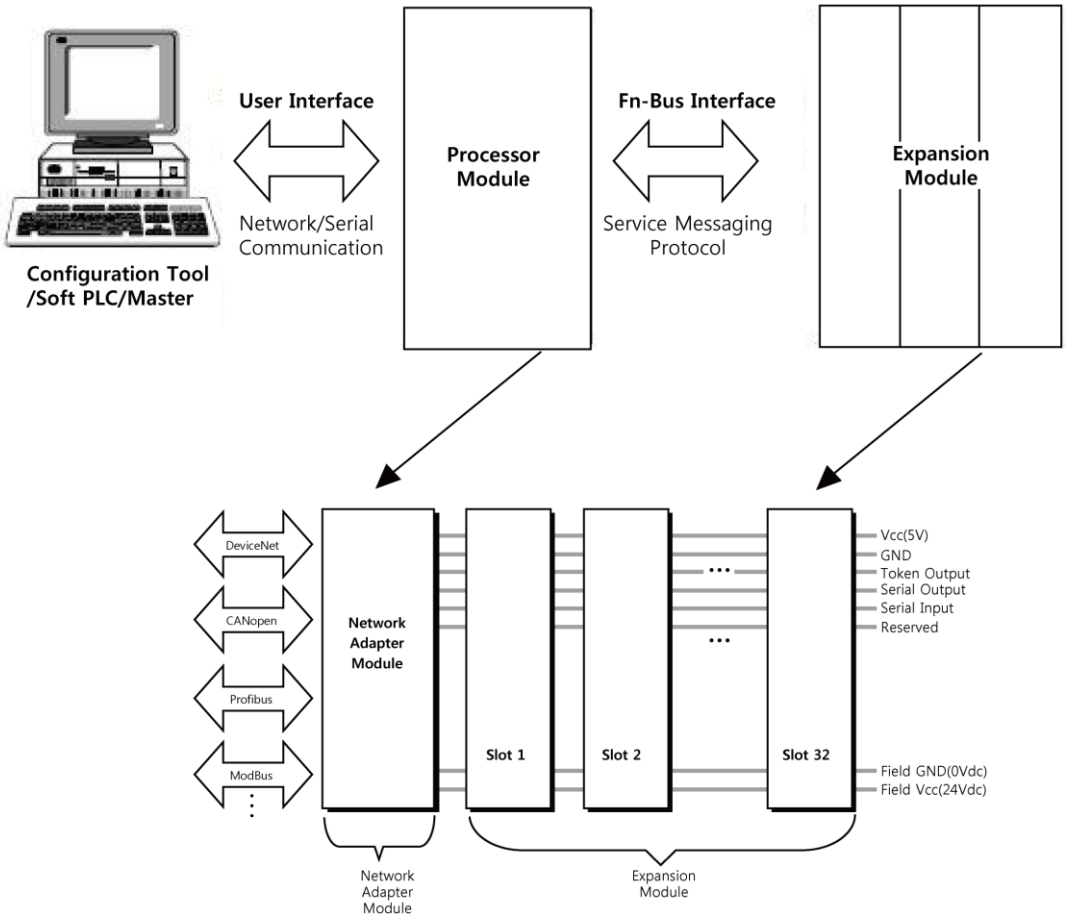


As above figure in order to safeguard the FnIO module from jamming, it should be fixed onto the DIN rail with locking level. To do so, fold on the upper of the locking lever.
To pull out the FnIO module, unfold the locking lever as below figure.

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

5. EHERNET/IP Electrical Interface

5.1. 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

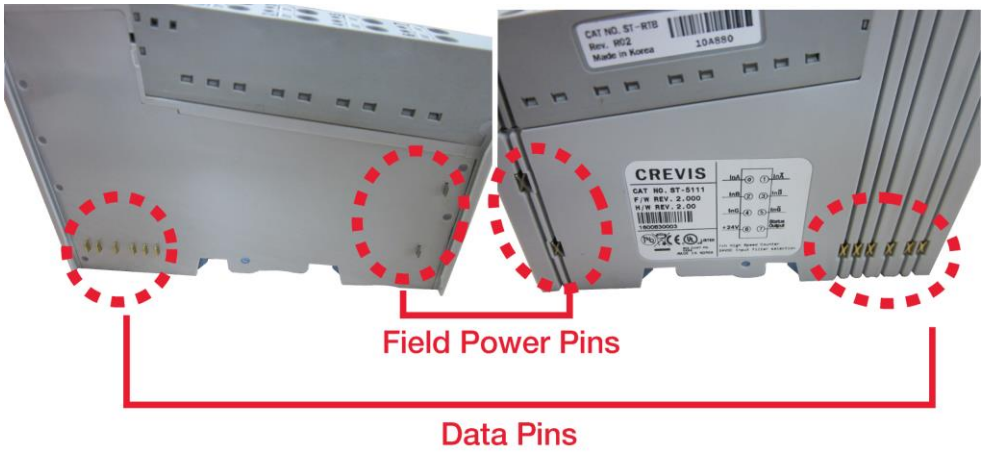
The Expansion Modules are supported a variety of input and output field devices.
There are digital and analog input/output modules and special function modules.

• Two types of FnBus Message

- Service Messaging
- I/O Messaging

5.2. 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.

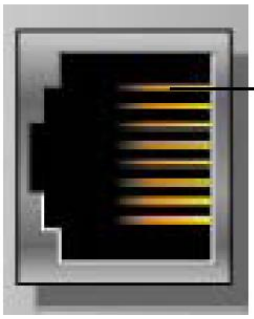


No.	Name	Description
1	Vcc	System supply voltage (5V dc).
2	GND	System Ground.
3	Token Output	Token output port of Processor module.
4	Serial Output	Transmitter output port of Processor module.
5	Serial Input	Receiver input port of Processor module.
6	Reserved	Reserved for bypass Token.
7	Field GND	Field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

5.3. ETHERNET/IP Electrical Interface

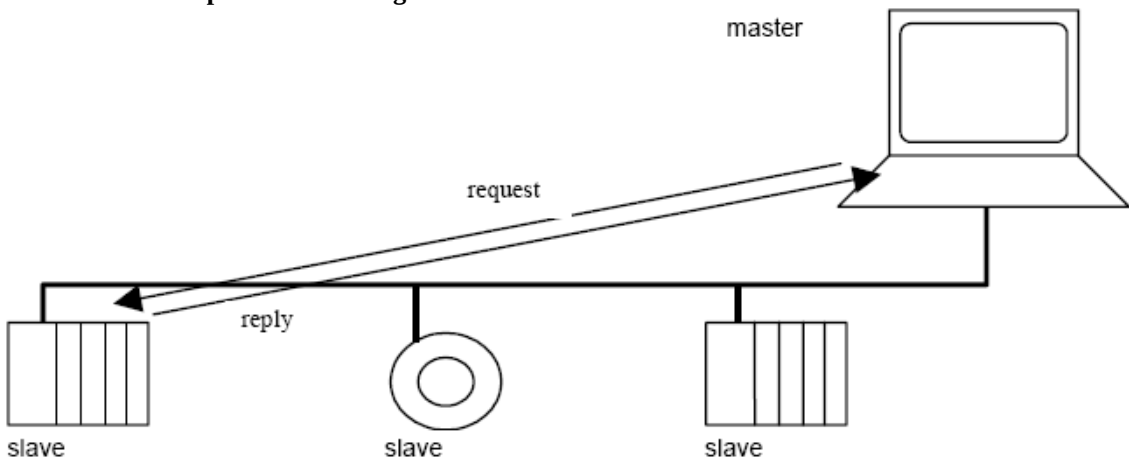
5.3.1. NA-9188



Shielded RJ-45 Socket

RJ-45	Signal Name	Description
1	TD+	Transmit +
2	TD-	Transmit -
3	RD+	Receive +
4	-	
5	-	
6	RD-	Receive -
7	-	
8	-	
Case	Shield	

Ethernet/IP Network Setup is like following.



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

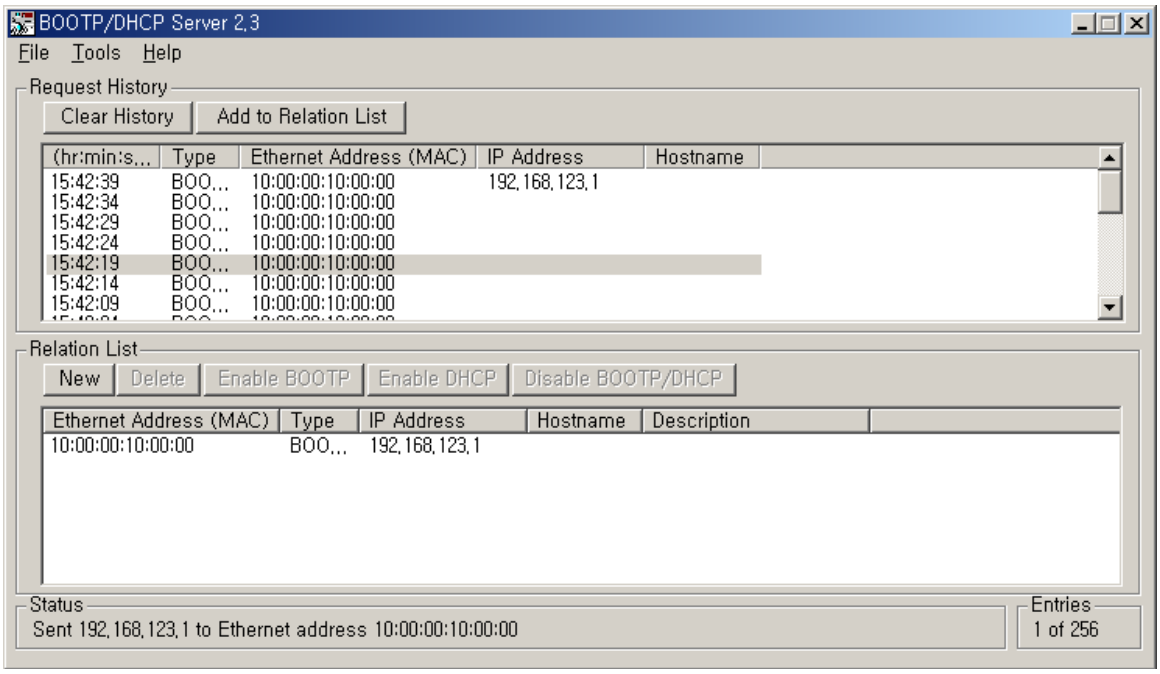
5.3.2.

Ethernet/IP IP Address Setup

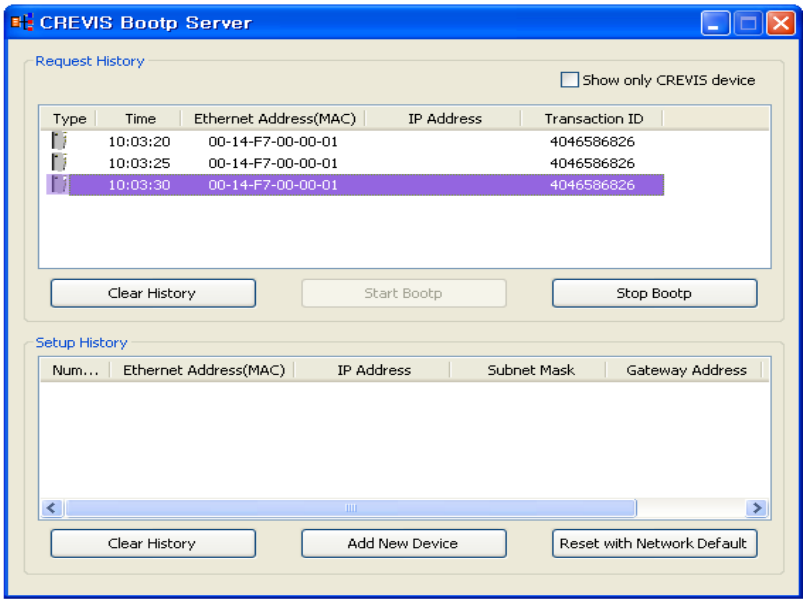
- **IP-Address Setup using BOOTP**

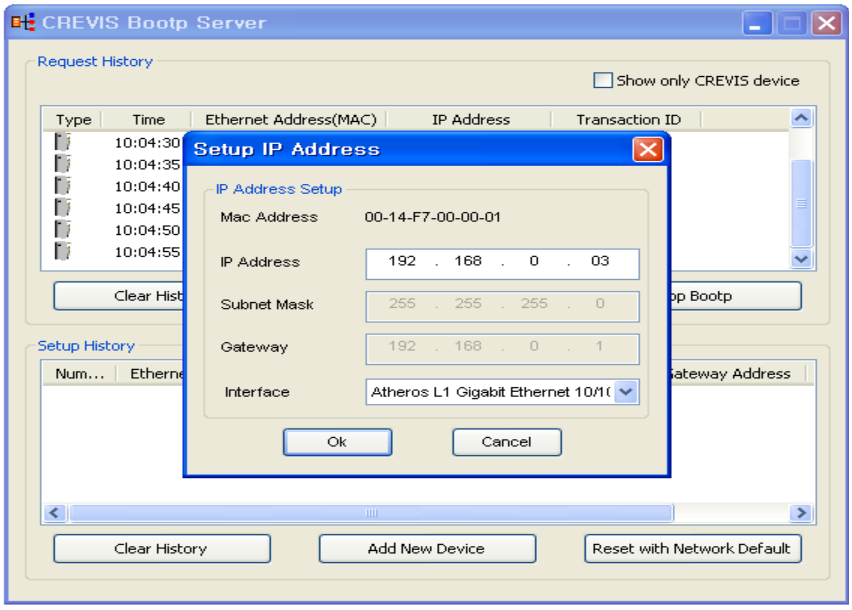
If the adapter BOOTP enabled, the adapter sends BOOTP request message of 20 times every 5sec.
The following is an example of adapter IP-Address setup that can be used with a third party BOOTP server.

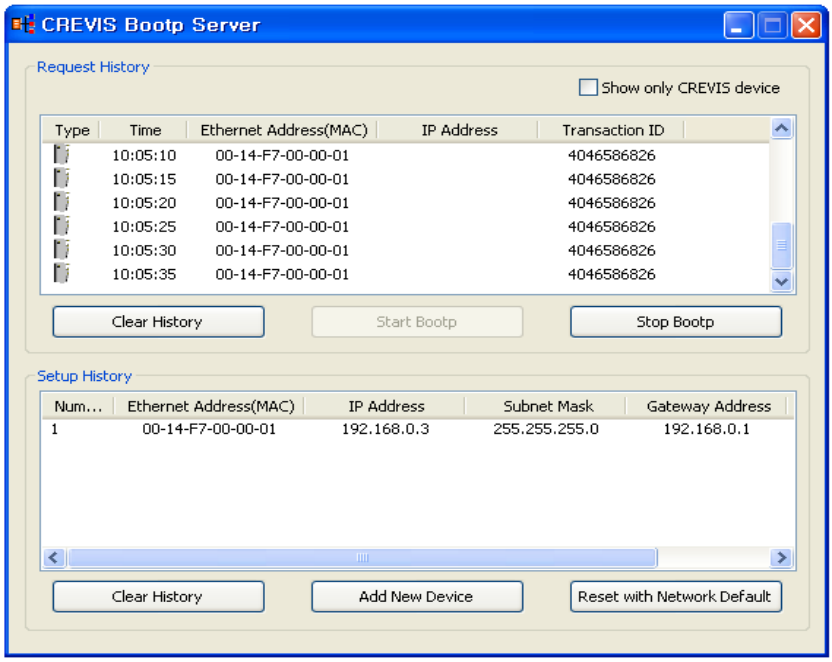
✓ Rockwell Automation' s BOOTP server



✓ CREVIS's BOOTP server

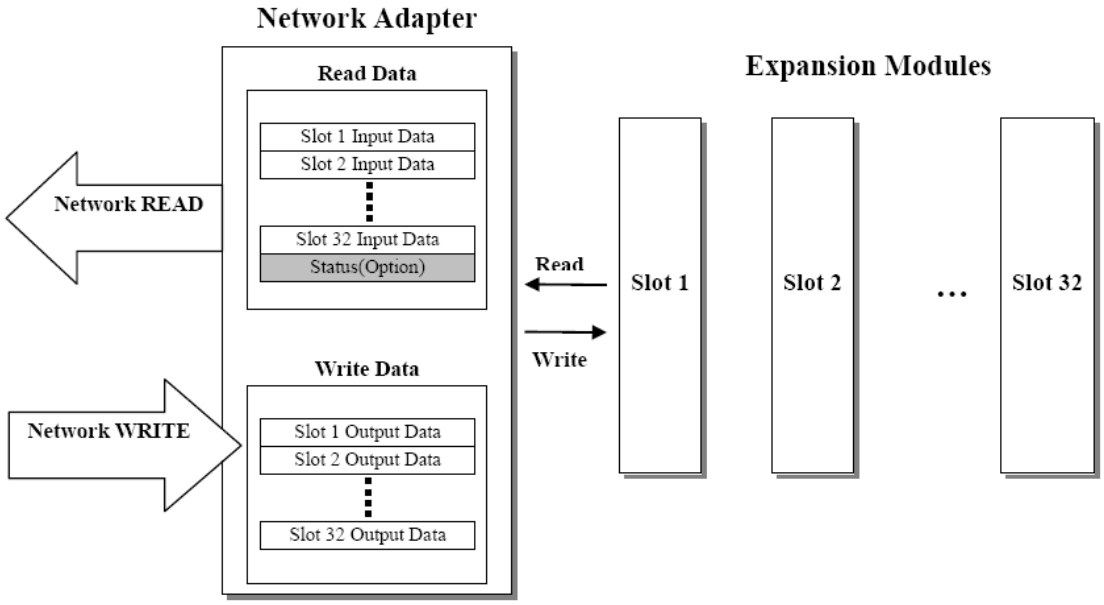



CREVIS Bootp Server
Request History
Show only CREVIS device
Type
Time
Ethernet Address(MAC)
IP Address
Transaction ID
10:04:30
10:04:35
10:04:40
10:04:45
10:04:50
10:04:55
Clear Hist
op Bootp
Setup History
Num...
Ethern
ateway Address
Clear History
Add New Device
Reset with Network Default
Setup IP Address
IP Address Setup
Mac Address
00-14-F7-00-00-01
IP Address
192 . 168 . 0 . 03
Subnet Mask
255 . 255 . 255 . 0
Gateway
192 . 168 . 0 . 1
Interface
Atheros L1 Gigabit Ethernet 10/1(
Ok
Cancel


CREVIS Bootp Server
Request History
Show only CREVIS device
Type
Time
Ethernet Address(MAC)
IP Address
Transaction ID
10:05:10 00-14-F7-00-00-01 4046586826
10:05:15 00-14-F7-00-00-01 4046586826
10:05:20 00-14-F7-00-00-01 4046586826
10:05:25 00-14-F7-00-00-01 4046586826
10:05:30 00-14-F7-00-00-01 4046586826
10:05:35 00-14-F7-00-00-01 4046586826
Clear History
Start Bootp
Stop Bootp
Setup History
Num...
Ethernet Address(MAC)
IP Address
Subnet Mask
Gateway Address
1 00-14-F7-00-00-01 192.168.0.3 255.255.255.0 192.168.0.1
Clear History
Add New Device
Reset with Network Default

5.3.3. 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.

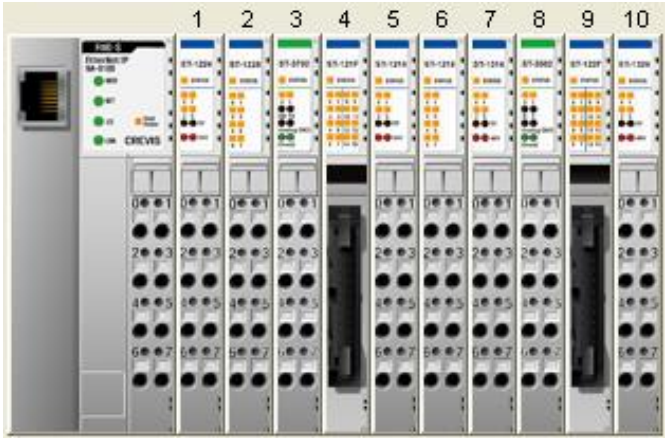


5.4. Example

5.4.1. Example of Input Process Image(Input Register) 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. Refer to 6.9.

- **For example slot configuration**



Slot Address	Module Description
#0	Ethernet/IP 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

- **Input Process Image Mode#0** (Status(2 bytes) + Uncompressed Input Processing Data)

Status (2 bytes)

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

✓ **FP (Field Power) :**

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

✓ **FnBus Status :**

0: Normal Operation 1: FnBus Standby
2: FnBus Communication Fault 3: Slot Configuration Failed
4: No Expansion Slot

Status (1word)

● **Input Process Image Mode#1** (Status(2 bytes) + Compressed Input Processing Data)

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

***Enable Input Run/Idle Header' and 'Enable Output Run/Idle Header' must be Disabled. Should do so is Image mode. (Refer to 6.9)**

- **Input Process Image Mode#2** (Uncompressed Input Processing Data without Status), **default input image**

Byte	Bit 7	Bit 6	Bit 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	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
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#5)				Discrete Input 4 pts. (Slot#1)			
15	Discrete Input 4 pts. (Slot#10)				Discrete Input 4 pts. (Slot#7)			

✓ **Input Assembly Priority :**

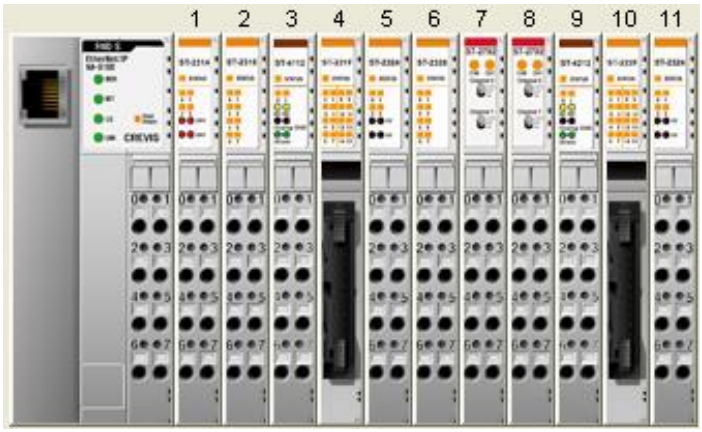
1) Analog Input Data (Word type)
2) 8 or 16 points Discrete Input Data (Byte type)
3) 4 points Input Data (Bit type)
4) 2 points Input Data (Bit type)

5.4.2. Example of Output Process Image(Output Register) 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. Refer to 6.9.

- **For example slot configuration**



Slot Address	Module Description
#0	Ethernet/IP 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** (Uncompressed Output Processing Data), **default output image**

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 Output 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)			

6. OBJECT MODELS

Every CIP node is modeled as a collection of objects. An object provides an abstract representation of a particular component within a device. Anything not described in object form is not visible through the CIP protocol. CIP objects are structured into classes, instances, and attributes.
A class of objects represents the same kind of system component. An object instance is the actual representation of a particular object within a class. Each instance of a class has the same attributes, but it has its own particular set of attribute values.

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 CIP 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.

6.1. Supported Objects

- **Supported Object**

Name of Object	Type	Number of Instances	Class Code
Identity	Required	1	01 HEX
Message Router	Required	1	02 HEX
Assembly	Required	2	04 HEX
Connection Manager	Required	1	06 HEX
Port	Required	1	F4 HEX
TCP/IP Interface	Required	1	F5 HEX
Ethernet Link	Required	1	F6 HEX
FnBus Manager	Vendor-specific	1	70 HEX
Expansion Slot	Vendor-specific	1..32	71 HEX

6.2. Identity Object

Class Code: 01 HEX

6.2.1. Common Services

Service Code	Implemented for		Service Name	Value
	Class	Instance		
0x01	Yes	Yes	Get_ Attribute_ All	
0x05	No	Yes	Reset	0 : Reset Only 1 : Reset and Factory Default
0x0E	No	Yes	Get_ Attribute_ Single	

6.2.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0001 HEX
	2	Get	Max Instance	UINT	0001 HEX
	6	Get	Maximum ID Number Class Attributes	UINT	0000 HEX
	7	Get	Maximum ID Number Instance Attributes	UINT	0000 HEX

6.2.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Vendor ID	UINT	741 $_{HEX}$ (Crevis Co.,Ltd)
	2	Get	Device Type	UINT	0C $_{HEX}$ (Communications Adapter)
	3	Get	Product Code	UINT	512 $_{DEC}$ (NA-9188)
	4	Get	Revision - Major - Minor	Structure of: UINT UINT	 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	Short_ String USINT STRING	 28 $_{DEC}$ “NA9188_EtherNET/IP_ Adapter”
	Vendor-specific				
	100	Get	Device Fault Code	USINT	00 $_{HEX}$: 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
	104	Get	Firmware Release Date	UDINT	YYYYMMDD $_{HEX}$

6.3. Message Router Object

Class Code: 02 HEX

6.3.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x01	Yes	No	Get_ Attribute_ All
0x0E	No	Yes	Get_ Attribute_ Single

6.3.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0001 HEX
	4	Get	Number of Attribute	UINT	0000 HEX
	5		Number of Service	UINT	0000 HEX
	6	Get	Maximum ID Number Class Attributes	UINT	0000 HEX
	7	Get	Maximum ID Number Instance Attributes	UINT	0000 HEX

6.3.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Object List	STRUCT of UINT Array of UINT	9 DEC 01 00 02 00 04 00 06 00 F4 00 F5 00 F6 00 70 00 71 00
	2	Get	Number Available	UINT	16 DEC Maximum number of connections supported

6.4. Assembly Object

Class Code : 04 $_{HEX}$

6.4.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_ Attribute_ Single
0x10	No	Yes	Set_ Attribute_ Single

6.4.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0002 $_{HEX}$
	2	Get	Max Instance	UINT	0020 $_{HEX}$

6.4.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
Input / Output Instance ID	3	Get / Set	Data	Array n Byte	Input / Output process image data

- **Input / Output Instance ID**

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1 (0x01)	3	Get	Input (Produced) Process Image Data	Array n Byte	Input process image data
2 (0x02)	3	Set / Get	Output (Consumed) Process Image Data	Array n Byte	Output process image data

✓ Configuration Instance is 170(AA_{HEX}). There is no configuration data needed.
✓ Heartbeat Instance is 171(AB_{HEX}) for input only connection.
✓ Listen only Instance is 172(AC_{HEX}) for multicast listening.

6.5. Connection Manager Object

Class Code: 06 HEX

6.5.1. Class Attributes, Instance Attribute

None

6.6. Port Object

Class Code: F4 $_{HEX}$

6.6.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x01	Yes	Yes	Get_ Attribute_ All
0x0E	Yes	Yes	Get_ Attribute_ Single

6.6.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0001 $_{HEX}$
	2	Get	Max Instance	UINT	0001 $_{HEX}$
	3	Get	Num Instances	UINT	0001 $_{HEX}$
	8	Get	Entry Port	UINT	0001 $_{HEX}$
	9	Get	All Ports	Array of STRUCT UINT UINT	0000 $_{HEX}$ 0000 $_{HEX}$ 0004 $_{HEX}$ 0002 $_{HEX}$

6.6.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Port Type	UINT	0004 $_{HEX}$, TCP/IP Port
	2	Get	Port Number	UINT	0002 $_{HEX}$, CIP port number associate with port
	3	Get	Port Object	UINT Padded EPATH	0002 $_{HEX}$ 20 F5 24 01
	4	Get	Port Name	Short_ String	=0
	7	Get	Node Address	Padded EPATH	

6.7. TCP/IP Object

Class Code : F5 HEX

6.7.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x01	Yes	Yes	Get_ Attribute_ All
0x0E	Yes	Yes	Get_ Attribute_ Single
0x02	No	Yes	Set_ Attribute_ All
0x10	No	Yes	Set_ Attribute_ Single

6.7.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0001 HEX
	2	Get	Max Instance	UINT	0001 HEX
	3	Get	Num Instances	UINT	

6.7.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Status	DWORD	00000001 HEX
	2	Get	Configuration Capability	DWORD	00000006 HEX
	3	Get / Set	Configuration Control	DWORD	00000010 HEX
	4	Get	Physical Link Path Size of Path Path	STRUCT of: UINT Padded PATH	20 F6 24 01 0000 HEX
	5	Get / Set	Interface Configuration IP address Network Mask Gateway Address Name Server Name server 2 Domain name	STRUCT of: UDINT UDINT UDINT UDINT UDINT STRING	
	6	Get / Set	HOST Name	STRING	EthernetIP Adapter

6.8. EtherNET/IP Object

Class Code: F6 $_{HEX}$

6.8.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x01	Yes	Yes	Get_ Attribute_ All
0x0E	Yes	Yes	Get_ Attribute_ Single

6.8.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0002 $_{HEX}$
	2	Get	Max Instance	UINT	0001 $_{HEX}$
	3	Get	Num Instances	UINT	0001 $_{HEX}$

6.8.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Interface Speed	UDINT	10 $_{DEC,}$ 100 $_{DEC}$
	2	Get	Interface Flags	DWORD	Bit 0 : Link Active Bit 1 : Full Duplex Bit 2~4 : Auto negotiation Bit 5 : Manual Setting required Reset Bit 6 : Local Hardware Fault Others : 0
	3	Get	Physical Address	Array of 6 USINTs	Same as MAC address

6.9. FnBus Manager Object

Class Code: 70 HEX

6.9.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_ Attribute_ Single
0x10	No	Yes	Set_ Attribute_ Single

6.9.2. Class Attributes

None

6.9.3. 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 6.9.6. See Appendix A.1.
	5	Get / Set*	Selection of Input (Produced) Process Image Mode	USINT	See Table 6.9.1. Valid value range is 0,1,2,3 (default 2)
	6	Get / Set*	Selection of Output (Consumed) Process Image Mode	USINT	See Table 6.9.2. Valid value range is 0,1 (default 0)
	7	Get / Set*	Slot Active Flag		See Table 6.9.3
	8	Get	Slot Live List		See Table 6.9.4
	9	Get	Slot Alarm List		See Table 6.9.5
	10	Get	FnBus Status	USINT	0: Normal Operation 1: FnBus Standby 2: FnBus Connection Fault 3: Expansion Configuration Fault 4: No Expansion Module
	11	Get	Input (Produced) Byte Size	UINT	Read IO input data size
	12	Get	Output (Consumed) Byte	UINT	Read IO output data size

			Size		
	13	Get / Set* TBD	Enable Input Run/Idle Header (Default)	BOOL	0:Disabled 1:Enabled Input Run/Idle Header
	14	Get / Set* TBD	Enable Output Run/Idle Header (Default)	BOOL	0:Disabled 1:Enabled Output Run/Idle Header
	32	Get	Real IO Input Data	Array of BYTE	Real IO Input Data
	33	Get / Set	Real IO Output Data	Array of BYTE	Real IO Output Data

*After the system is reset, the new "Set Value" action is applied.
If changed slot location, set default value automatically.

- **Table 6.9.1. Selection of Input (Produced) Process Image Mode**

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

- **Table 6.9.2. Selection of Output (Consumed) Process Image Mode**

Selection Input Image Mode	Description	
0	Uncompressed Output Processing Data (default)	default

- **Table 6.9.3. 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 6.9.4. Slot Live List**

DWORD (32bits)	Decimal Bit	Description
Get	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 6.9.5. Slot Alarm List**

DWORD (32bits)	Decimal Bit	Description
Get	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 6.9.6. 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

6.10. Expansion Slot Object

Class Code: 71 HEX

6.10.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_ Attribute_ Single
0x10	No	Yes	Set_ Attribute_ Single

6.10.2. Class Attributes

None

6.10.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1~32 (slot No.)	1	Get	Module External ID	USINT	See Appendix A.1.
	2	Get	I/O Data Code - Input Data Code - Output Data Code	STRUCT of: USINT USINT	See Table 6.10.1.
	3	Get	Input Offset Table - Byte Offset - Bit Offset	STRUCT 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	STRUCT 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	See "FnIO_Configuration_Parameter_Memory_Register_Rev1.01"
	9	Get/Set	R/W Configuration Data	n Bytes	Data array size defined by attributes 8.
	10	Get	Register Data Length	USINT	See "FnIO_Configuration_Parameter_Memory_Register_Rev1.01"
	11	Get/Set	R/W Register Data - Offset Low - Offset High - R/W Length - Write Data	STRUCT of: USINT USINT USINT n Bytes	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	STRUCT of: USINT USINT USINT n Bytes	Vendor only Module Serial ID = Attribute 1 R/W Length ≤ 32byte
	100	Get	Product Code	4 Bytes	See Table 6.10.2. and Appendix A.1.
	101	Get	Catalog Number	4 Bytes	See Appendix A.1.
	102	Get	Firmware Revision	STRUCT 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 6.10.1. 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: 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

- **Table 6.10.2. Product Code Format**

Byte #	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	***Connection Type***							
1	***Assembly Type***							
2	***Output Information***							
3	***Input Information***							

■ ***Connection Type***

Byte #	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved						**MEM**	**IO**

✓ **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	**Unit_ Type**		**Priority**		**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 Ethernet 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 Underage (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(Output)	**Data_Type**		**Data_Length**					
3(Input)	**Data_Type**		**Data_Length**					

✓ **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

6.11. Ethernet/IP Reference

Ethernet/IP Reference Documents
http://www.odva.org
http://www.ethernet-ip.org

Ethernet/IP Tools
http://www.pyramid-solutions.com

7. Trouble Shooting

7.1. 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.

7.2. 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 node

Ground and environment

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

APPENDIX A

A.1. Product List

No.	ST-Number	Description	ID(hex)	Production Status
Digital Input Module				
	ST-1114	4 Points, Sink(Positive), 5Vdc,	41 00 01	Active
	ST-111F	16 Points, Sink(Positive), 5Vdc,	41 01 19	Active
	ST-1124	4 Points, Source(Negative), 5Vdc,	41 00 02	Active
	ST-112F	16 Points, Source(Negative), 5Vdc,	41 01 1A	Active
	ST-1214	4 Points, Sink(Positive), 12V/24Vdc,	41 00 03	Active
	ST-1218	8 Points, Sink(Positive), 12V/24Vdc,	41 00 07	Active
	ST-121F	16 Points, Sink(Positive), 12V/24Vdc,	41 01 13	Active
	ST-1224	4 Points, Source(Negative), 12V/24Vdc,	41 00 04	Active
	ST-1228	8 Points, Source(Negative), 12V/24Vdc,	41 00 08	Active
	ST-122F	16 Points, Source(Negative), 12V/24Vdc,	41 01 14	Active
	ST-1314	4 Points, Sink(Positive), 48Vdc,	41 00 05	Active
	ST-131F	16 Points, Sink(Positive), 48Vdc,	41 01 17	Active
	ST-1324	4 Points, Source(Negative), 48Vdc,	41 00 06	Active
	ST-132F	16 Points, Source(Negative), 48Vdc,	41 01 18	Active
	ST-1804	4 Points, 110Vac,	41 00 09	Active
	ST-1904	4 Points, 220Vac,	41 00 0A	Active
Digital Output Module				
	ST-2114	4 Points TTL Inverting, 5Vdc/20mA,	81 00 0D	Active
	ST-2124	4 Points TTL Non-Inverting, 5Vdc/20mA,	81 00 0F	Active
	ST-221F	16 Points Sink(Negative Logic), 24Vdc/0.5A,	81 01 15	Active
	ST-222F	16 Points Source(Positive Logic), 24Vdc/0.5A,	81 01 16	Active
	ST-2314	4 Points Sink(Negative Logic), 24Vdc/0.5A,	81 00 0E	Active
	ST-2318	8 Points Sink(Negative Logic), 24Vdc/0.5A,	81 00 11	Active
	ST-2324	4 Points Source(Positive Logic), 24Vdc/0.5A,	81 00 10	Active
	ST-2328	8 Points Source(Positive Logic), 24Vdc/0.5A,	81 00 12	Active
	ST-2414	4 Points Sink(Negative Logic), 24Vdc/0.5A, Diagnostics	81 00 08	Active
	ST-2424	4 Points Source(Positive Logic),24Vdc/0.5A, Diagnostics	C1 00 00 38	Active
	ST-2514	4 Points Sink(Negative Logic), 24Vdc/2A, Diagnostics	C1 00 00 35	Active
	ST-2524	4 Points Source(Positive Logic), 24Vdc/2A, Diagnostics	C1 00 00 36	Active
	ST-2614	4 Points Sink(Negative Logic), 24Vdc/2A,	81 00 3B	Active
	ST-2624	4 Points Source(Positive Logic), 24Vdc/2A,	81 00 3C	Active
	ST-2742	2 Points, 230Vac/2A, 24Vdc/2A, Relay	81 00 0B	Active
	ST-2744	4 Points, 230Vac/2A, 24Vdc/2A, Relay	81 00 51	Active
	ST-2748	8 Points, 230Vac/2A, 24Vdc/2A, Relay	81 00 50	Active

	ST-2792	2 Points, 230Vac/2A, 24Vdc/2A, Relay, Manual/Auto	C1 00 01 BE	Active
	ST-2852	2 Points, 12~125Vac/0.5A, Triac	81 00 0C	Active
	ST-2924	4 Points, 24Vac/2A, 24Vdc/2A, 4 Points/4COM	81 00 C0	NEW
	ST-2944	4 Points, 24Vac/2A, 24Vdc/2A, 1 Points/1COM	81 00 C1	NEW
	ST-2734	4 Points, 24~220Vac,dc/0.5A, 1 Points/1COM	81 00 C2	NEW
Analog Input Module				
	ST-3114	4 Channels, Current, 0~20mA, 12bit	41 43 1C	Active
	ST-3118	8 Channels, Current, 0~20mA, 12bit	41 47 82	Active
	ST-3134	4 Channels, Current, 0~20mA, 14bit	41 43 1E	Active
	ST-3214	4 Channels, Current, 4~20mA, 12bit	41 43 1D	Active
	ST-3218	8 Channels, Current, 4~20mA, 12bit	41 47 83	Active
	ST-3234	4 Channels, Current, 4~20mA, 14bit	41 43 1F	Active
	ST-3274	4 Channels, Current, 4~20mA, 12bit, Sensor Connector	41 43 A3	Active
	ST-3424	4 Channels, Voltage, 0~10Vdc, 12bit	41 43 20	Active
	ST-3428	8 Channels, Voltage, 0~10Vdc, 12bit	41 47 22	Active
	ST-3444	4 Channels, Voltage, 0~10Vdc, 14bit	41 43 22	Active
	ST-3474	4 Channels, Voltage, 0~10Vdc, 12bit, Sensor Connector	41 43 A0	Active
	ST-3524	4 Channels, Voltage, -10Vdc~10Vdc, 12bit	41 43 21	Active
	ST-3544	4 Channels, Voltage, -10Vdc~10Vdc, 14bit	41 43 23	Active
	ST-3624	4 Channels, Voltage, 0~5Vdc, 12bit	41 43 24	Active
	ST-3644	4 Channels, Voltage, 0~5Vdc, 14bit	41 43 25	Active
	ST-3702	2 Channels, RTD, Status	41 41 28	Active
	ST-3704	4 Channels, RTD, Status	41 43 64	Active
	ST-3708	8 Channels, RTD, Status	41 47 65	Active
	ST-3802	2 Channels, TC	41 41 2A	Active
	ST-3804	4 Channels, TC	41 43 66	Active
	ST-3808	8 Channels, TC	41 47 67	Active
Analog Output Module				
	ST-4112	2 Channels, Current, 0~20mA, 12bit	81 41 2C	Active
	ST-4114	4 Channels, Current, 0~20mA, 12bit	81 43 6D	Active
	ST-4212	2 Channels, Current, 4~20mA, 12bit	81 41 2D	Active
	ST-4214	4 Channels, Current, 4~20mA, 12bit	81 43 6E	Active
	ST-4274	4 Channels, Current, 4~20mA, 12bit, Sensor Connector	81 43 B3	Active
	ST-4422	2 Channels, Voltage, 0~10Vdc, 12bit	81 41 2E	Active
	ST-4424	4 Channels, Voltage, 0~10Vdc, 12bit	81 43 6A	Active
	ST-4474	4 Channels, Voltage, 0~10Vdc, 12bit, Sensor Connector	81 43 B0	Active
	ST-4491	1 Channel, Voltage, 0~10Vdc, 12bit, Manual Type	C1 40 41 BF	Active
	ST-4522	2 Channels, Voltage, -10~10Vdc, 12bit	81 41 2F	Active
	ST-4622	2 Channels, Voltage, 0~5Vdc, 12bit	81 41 30	Active
	ST-4911	1 Channel, Current, 0~1A, 12bit	81 40 31	Active

Special Module				
	ST-5101	1 Channel, High Speed Counter, 5V Input	C1 01 05 34	Active
	ST-5111	1 Channel, High Speed Counter, 24V Input	C1 01 05 39	Active
	ST-5112	2 Channel, High Speed Counter, 24V Sink Input	C1 01 07 4D	Active
	ST-5114	4 Channel, High Speed Counter, 24V Sink Input	C1 03 0F 4C	Active
	ST-5211	RS232 Communication, 1Channel, RTS/CTS Flow Control	C1 05 05 42	Active
	ST-5212	RS232 Communication, 2Channel	C1 0B 0B 43	Active
	ST-5221	RS422 Communication, 1Channel	C1 05 05 44	Active
	ST-5231	RS485 Communication, 1Channel	C1 05 05 45	Active
	ST-5232	RS485 Communication, 2Channel	C1 0B 0B 46	Active
	ST-5351	SSI Interface 1CH	C1 01 09 9E	Active
	ST-5422	2 CH PWM output, 1.5A/24Vdc, source	C1 05 01 57	Active
	ST-5442	2 CH PWM output, 0.5A/24Vdc, source	C1 05 01 56	Active
	ST-5444	4 CH PWM output, 0.5A/24Vdc, source	C1 0B 03 54	Active
	ST-5641	1 CH Pulse output, 0.5A/24Vdc, source	C1 05 03 92	Active
	ST-5642	2 CH Pulse output, 0.5A/24Vdc, source	C1 09 07 90	Active
	ST-5651	1 CH Pulse output, RS422	C1 05 03 98	Active
Power Module				
	ST-7408	8 Channels, Shield, ID Type	02 00 E4	Active
	ST-7508	8 Channels, Common, 0Vdc, ID Type	02 00 E5	Active
	ST-7511	1 Channel, Expansion Power, Input 24Vdc, Output 1.0A/5Vdc, ID Type	02 00 E0	Active
	ST-7518	8 Channels, Common, 24Vdc, ID Type	02 00 E6	Active
	ST-7588	8 Channels, Common, 0Vdc and 24Vdc, ID Type	02 00 E7	Active
	ST-7641	1 Channel, Field Distributor, 5Vdc~48Vdc, 110Vac~220Vac, ID Type	02 00 E2	Active

A.2. 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.