MODBUS Programmable I/O

NA-9371/72/73

User Manual

Version 1.07

2016 CREVIS Co.,Ltd

DOCUMENT CHANGE SUMMARY				
REV	PAGE	REMARKS	DATE	EDITOR
1.00	New Document	Draft	2015/06/2	JH Kim
1.01	65 page	Release, Web visualization remark	2015/08/3	JH Kim
1.02	86 page	RS232/485 serial connection function block Even/odd changed	2015/09/30	JH Kim
1.03	99 page	ModbusTCP connection example changed	2015/10/02	JH Kim
1.04	-	Variety pages are changed.	2015/12/07	JH Kim
1.05	63 page	ModbusRTU master function added	2015/12/30	JH Kim
1.06	12 page	Ethernet specifications are added	2016/1/11	JH Kim
1.07	11page	The Task numbers were changed.	2016/10/17	JH Kim

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

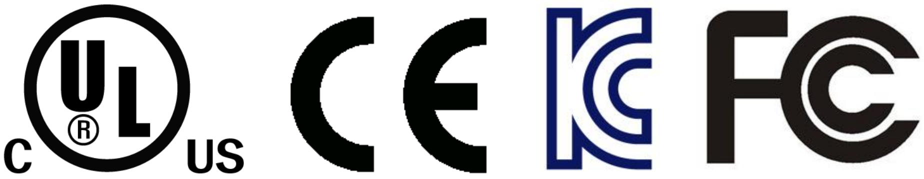
1.1.1. Symbols

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

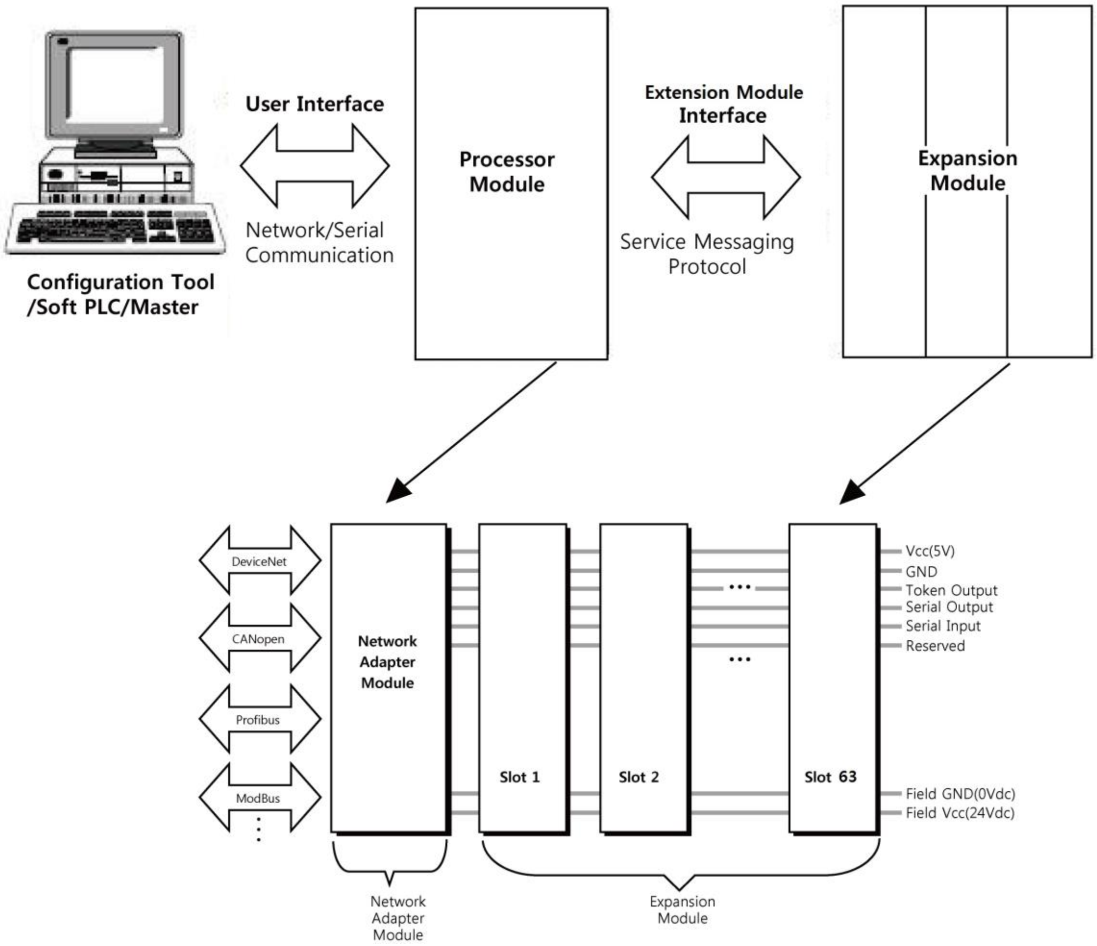
DANGER ⚠	The modules are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the modules, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components.

1.1.3. Certifications



2. S-Series System

2.1. Electrical Interface



- **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**

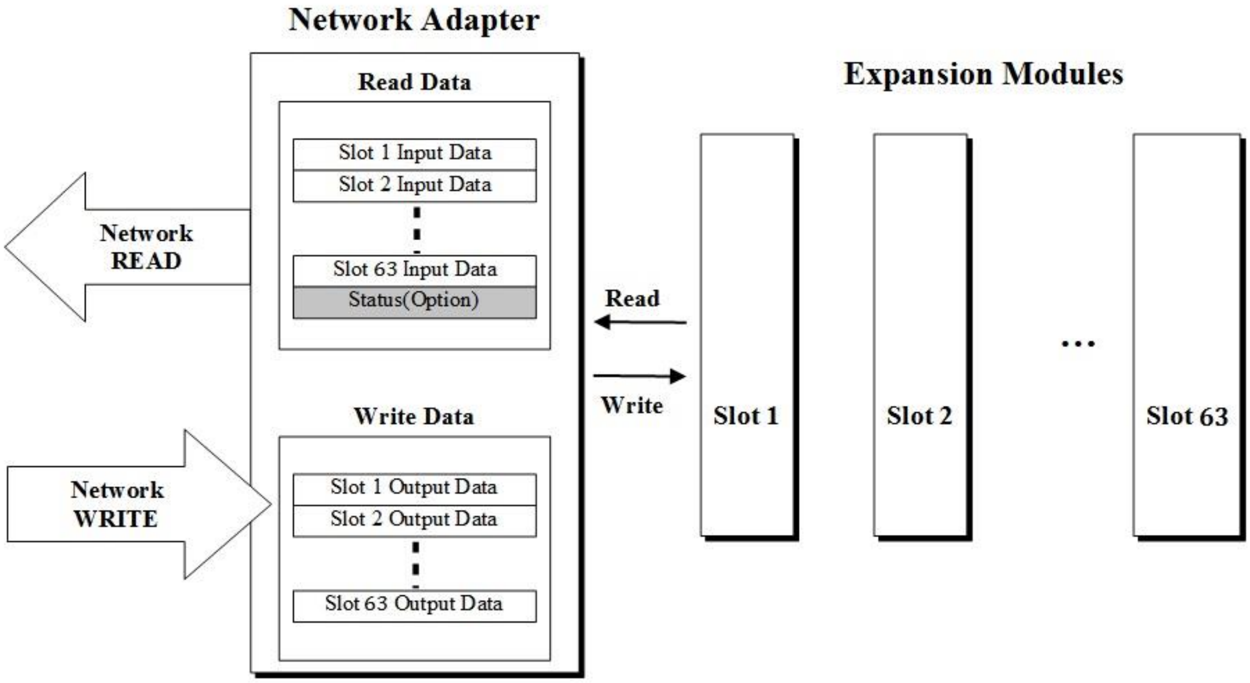
The Expansion Modules are supported a variety of input and output field devices. There are digital and analog input/output modules and special function modules.

- **Two types of Message**

Service Messaging / I/O Messaging

2.2. 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 internal-protocol. The following figure shows the data flow of process image between network adapter and expansion modules.



3. Specification

3.1. 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	110mA typical @ 24Vdc
Current for I/O Module	1.5A @5Vdc
Isolation	System power to internal logic : Non-isolation System power I/O driver : Isolation
Field Power	Supply voltage : 24Vdc nominal Supply voltage range : 11~28Vdc
Max. Current Field Power Contact	DC 10A Max.
Weight	167g
Module Size	54mm x 99mm x 70mm
Environment Condition	
Environmental Specifications	
Operating Temperature Storage Temperature Relative Humidity Mounting	-20℃~55℃ -40℃~85℃ 5% ~ 90% non-condensing DIN rail
General Specifications	
Shock Operating	IEC 60068-2-6
Vibration/shock resistance	Based on IEC 60068-2-6 Sine Vibration - 10 ~ 25 Hz : 0.5mm - 50 ~ 150 Hz : 5g - 150 ~ 1000 Hz : 2g - Sweep Rate : 1 Oct/min, 50 cycles Sine Vibration - 10 ~ 25 Hz : 0.03 g²/Hz - 25 ~ 50 Hz : 0.05 g²/Hz - 50 ~ 150 Hz : 0.15 g²/Hz - 150 ~ 1000 Hz : 0.01 g²/Hz - Test time : 5hrs for each test
EMC resistance burst/ESD	EN 61000-6-2 : 2005 EN 61000-6-4/ALL : 2011
Installation Pos. / Protect. Class	Variable/IP20
Product Certifications	UL, CE, RoHS2, KCC, FCC

3.2. Interface Specification

Programmable Specification			
Programming		CoDeSys V3.5 SP3 Patch 1	
Program Memory	NA-9371*	256 KBytes	
	NA-9372/9373	4MByte	
Data Memory	NA-9371	48 KBytes	Input %IW0 ~ %IW2047 (2048 words) Output %QW0~%QW2047 (2048 words) Memory %MW0~%MW8191 (8192 words)
	NA-9372/9373	4MByte	
Non-Volatile Memory	NA-9371	4 Kbytes (Retain : 2Kbytes, Flag : 2Kbytes)	
	NA-9372/9373	32 Kbytes (Retain : 16Kbytes, Flag : 16Kbytes)	
Run-Time system		Multiple PLC Task	
Program Languages		IEC 61131-3 (LD, IL, ST, FBD, SFC)	
OPC Server	NA-9371	Not supporting	
	NA-9372/9373	Supporting	
Web Visualization	NA-9371/9372	Not supporting	
	NA-9373	Supporting	
RTC	NA-9371	Retain Time : 1 day	Accuracy : <2min/month
	NA-9372/9373	Retain Time : 6 days	
Max. Task		4	
Max. Cycle Task		4	
Max. Status Task		2	
Process Time	NA-9371	1us (90Instructions)	
	NA-9372/9373	7us (90Instructions)	
Interface Specification			
Adapter Type		Master & Slave Node (MODBUS TCP)	
Max. Expansion Module		63 slots	
Max. Input Size		126 Words (252 Byte)	
Max. Output Size		126 Words (252 Byte)	
Max. Nodes		Limited by Ethernet Specification	
Baud rate		10/100Mps, Auto-negotiation, Full Duplex	
Interface Connector		RJ-45 socket * 2pcs	
Ethernet Protocols**		Modbus TCP, Modbus UDP, Modbus RTU, DHCP/BOOTP, OPC server(72/73 only), HTTP(Webserver, Web Visualization for 73 only***)	
Max. Socket		24 (UDP : 8, TCP : 16, TCP_LISTEN : 10)	
Other Serial Port		RS232/485 for MODBUS RTU, Touch Panel or IO Guide Pro	
Serial Configuration (RS232/485)		Modbus/RTU, Baud rate : 2400~115200bps (115200 default)	
Indicator		5 LEDs 1 Green/Red, Module Status (MOD) 1 Green/Red, Network Status (NET) 1 Green/Red, Run Status (RUN) 1 Green/Red, Extension Module Status (I/O) 1 Green, Field Power Status	

* NA-9371 is an economic version derived from NA-9372.
** NA-9372/73 can be simultaneously work two functions among Web visualization, OPC server, Network-variable, and CodeSys link.
*** Webvisualization can not be supported in Internet Explorer.

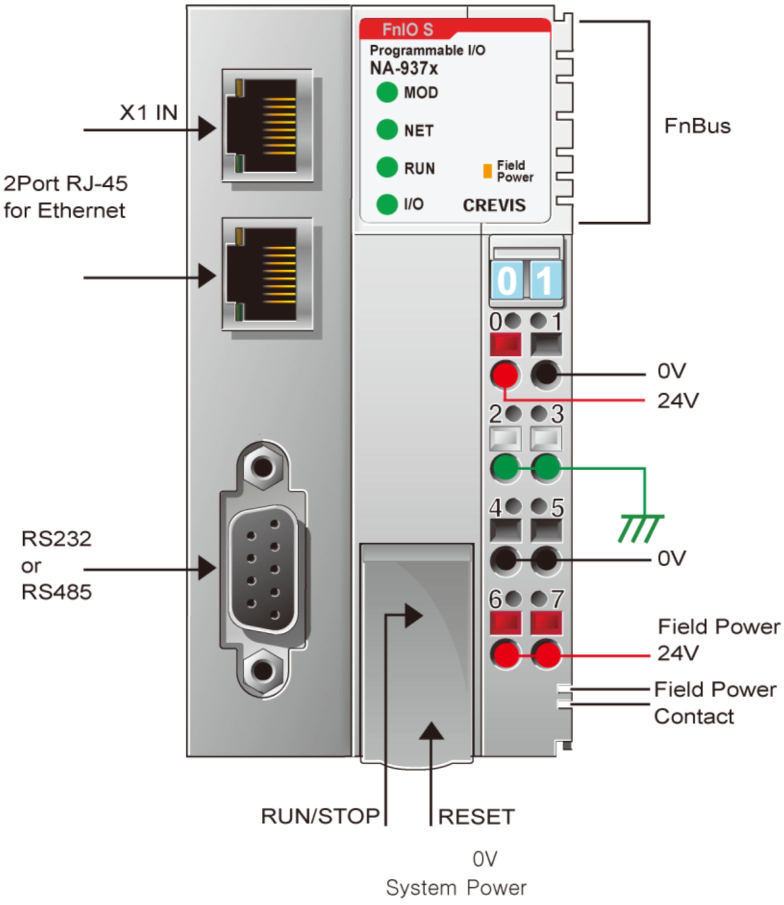
3.3. NA-9371/9372/9373 Ethernet Connection Specification

Function*	**Model**	**Max. number of concurrent communications.**
Webvisualization1)	NA-9373 only	2 of them 1)2)3)4) are available at same time.
ARTI(OPC server)2)	NA-9372/9373	
CoDeSys Link3)	NA-9371/9372/9373	
Network Variables4)	NA-9371/9372/9373	
Modbus/TCP Master	NA-9372/9373	9 Modbus/TCP Slaves are available.
	NA-9371	8 Modbus/TCP Slaves are available.
Modbus/TCP Slave	NA-9371/9372/9373	15 Modbus/TCP Masters are available.
Web-Server	NA-9371/9372/9373	16 clients are available.

* While using these functions, 16 socket are available at the same time.

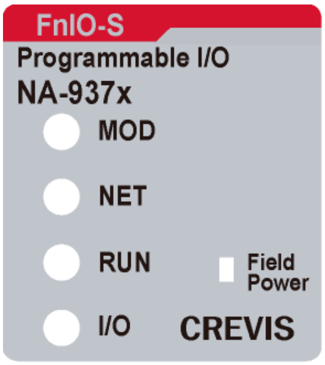
4. Module Description

4.1. NA-9371/72/73 (MODBUS Programmable I/O)



ATTENTION ⚠	The modules are not hot swappable and should be not removed in power on condition.

4.2. LED Indicator



4.2.2. 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	Blinking Green	The EEPROM parameter is not initialized yet. Serial Number is zero value (0x00000000)
IAP Mode	Toggle Green/Red	IAP Mode : Available for firmware download using FireFox.
Unrecoverable Fault	Red	The unit has occurred unrecoverable fault in self-testing. - Firmware fault

- The IP address to access IAP web server during IAP Mode : 192.168.0.100 (Recommended to use Firefox)

4.2.3. Network Status LED (NET)

State	LED is :	To indicate :
Off-line	OFF	Network Offline.
On-line (Connect)	Green	On-line Mode and network is connected.
BootP/DHCP mode	Blinking Green	BootP or DHCP is available.
Error	Red	Network Error

- Blinking MOD & NET LED : BootP/DHCP is requesting for new IP address.
  (You can change the IP setting mode.)

4.2.4. PLC Run/Stop Status LED (RUN)

State	LED is :	To indicate :
Not Programmed	OFF	Not Power is supplied or the unit or Not programmed
Run	Green	PLC Run
Stop	Blinking Green	PLC Stop
Program Error	Blinking Red	User PLC Program Error occured

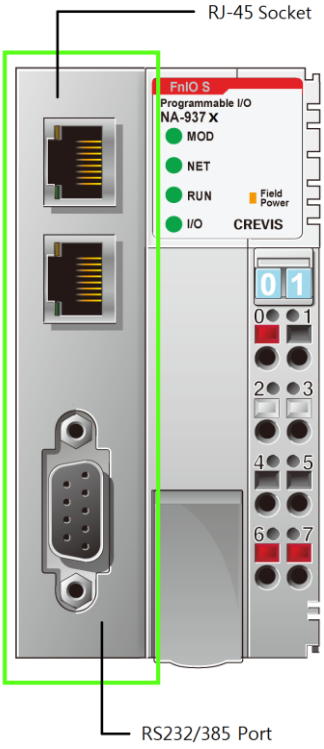
4.2.5. Extension Module Status LED (I/O)

State	LED is :	To indicate :
Not Powered No Expansion Module	Off	Device has no expansion module or may not be powered
On-line, Do not Exchanging I/O	Blinking Green	Extension module is normal but does not exchanging I/O data (Passed the expansion module configuration).
Connection, Run Exchanging IO	Green	Exchanging I/O data
Connection fault during exchanging IO	Blinking Red	One or more expansion module occurred in fault state. - Changed expansion module configuration. - expansion module communication failure.
Expansion Configuration Failed	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.

4.2.6. 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.

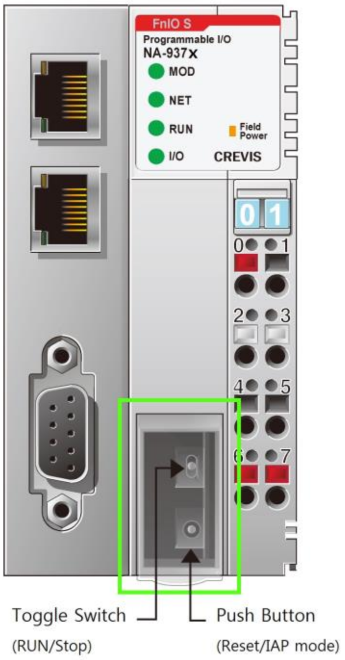
4.3. RJ-45 Socket , RS232/485 Port



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

RS 232/485	Signal Name	Description
1	-	
2	TXD	RS232 TXD
3	RXD	RS232 RXD
4	-	
5	GND	RS232 GND
6	D+	RS 485 D+
7	-	
8	D-	RS485 D-
9	-	

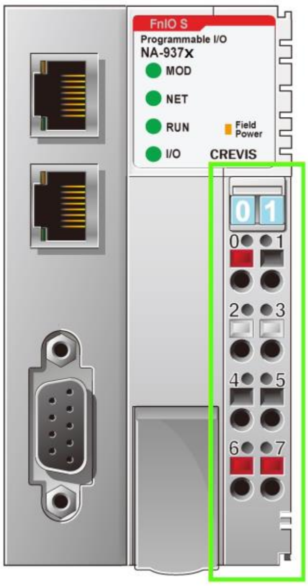
4.4. Toggle Switch , Push Button



Toggle Switch Status	Module is	Description
UP	RUN	PLC Run
DOWN	STOP	PLC Stop

Push Button	Module is	Description
Press and detach.	Reset	Reset the PLC and then stop.
Push for 5sec and power Reset	PLC Reset	Erase PLC user program and Retain memory
Push for 20sec and power reset	Factory default	Erase PLC user program and PLC parameter reset
Hold down and reset the power.	IAP mode	Available for firmware download using FireFox

4.5. RTB Terminal Block



Pin	Signal Description	Signal Description	Pin
0	System Power 24V	System Power 0V	1
2	F.G	F.G	3
4	Field Power 0V	Field Power 0V	5
6	Field Power 24V	Field Power 24V	7

- System Power: The power for starting up CPU.

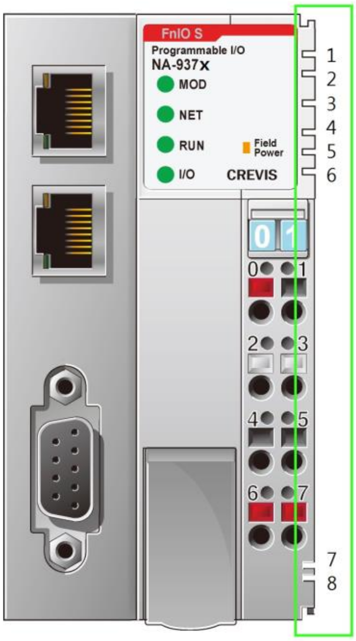
- Field Power: The power for input and output line.

DANGER

Do not use an incorrect voltage/frequency!
The use of an incorrect supply voltage or frequency can cause severe damage to the component.

4.6. Pin Description

Communication between the Network adapter 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.

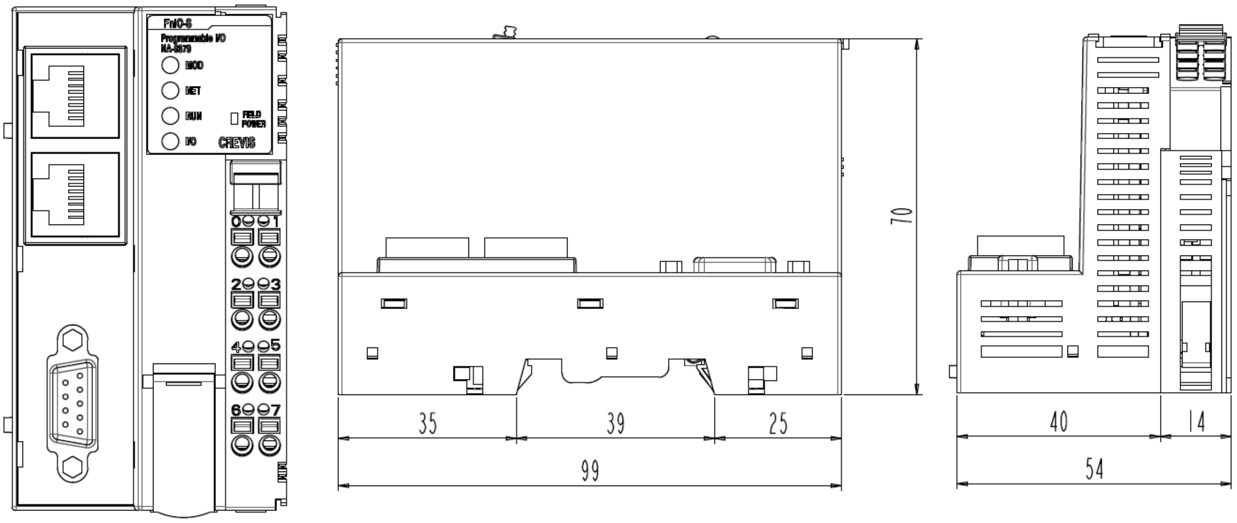


No.	Name	Description
1	System Vcc	System supply voltage (5V dc).
2	System GND	System Ground.
3	Token Output	Token output port of Processor module.
4	Serial Output	Transmitter output port of Processor module.
5	Serial Input	Receiver input port of Processor module.
6	Reserved	Reserved for bypass Token.
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.
To prevent ESD noise, it is recommended to use the END module.

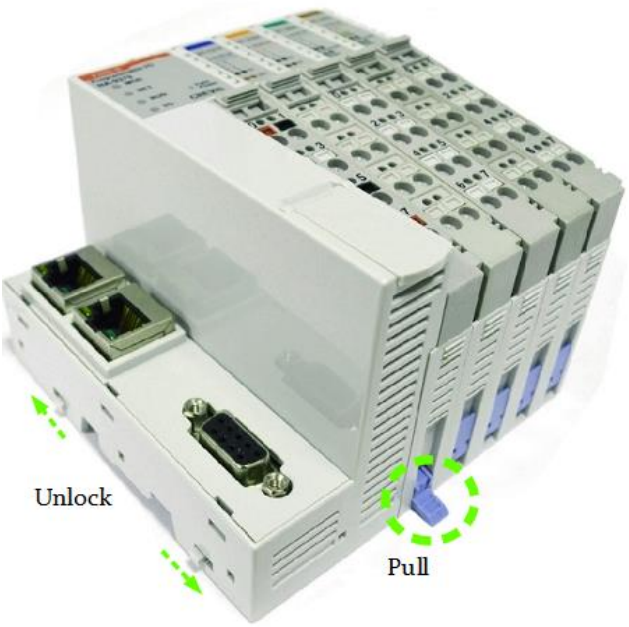
4.7. Dimension

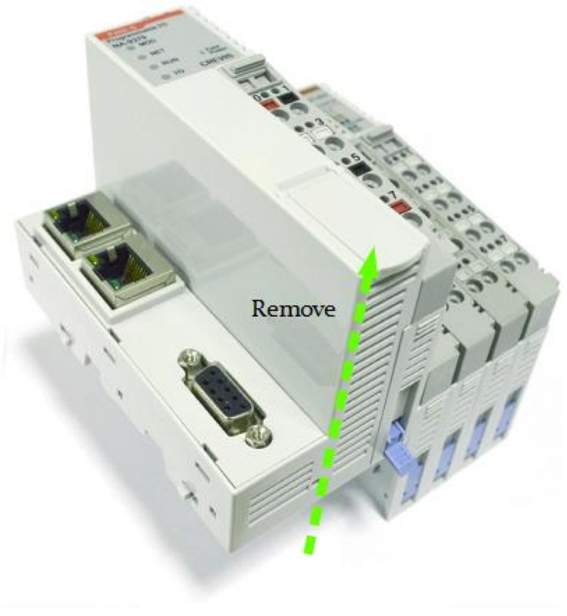


(mm)

5. Mechanical Setup

5.1. Inserting and Removing the Module.

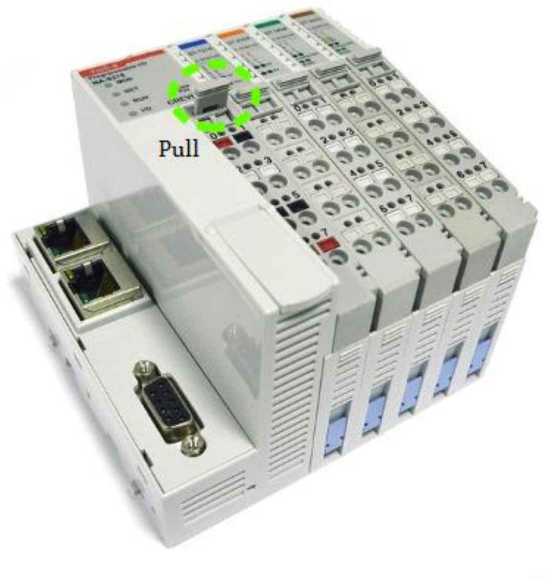


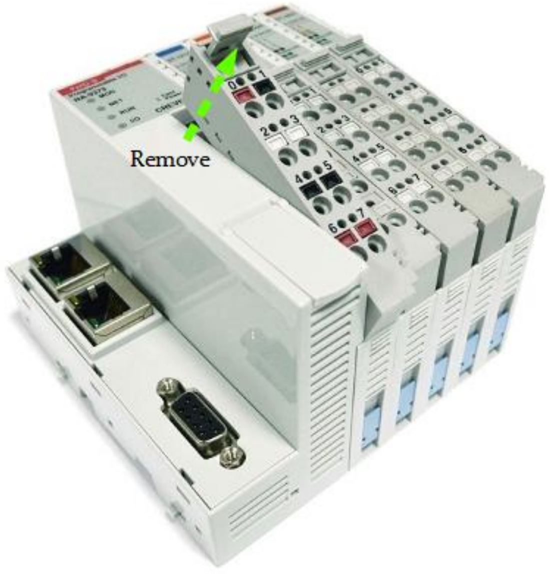


As above figure in order to safeguard the FnIO module from jamming, it should be fixed onto the DIN rail with locking level. To do so, fold on the upper of the locking lever.
To pull out the FnIO module, unfold the locking lever as below figure.

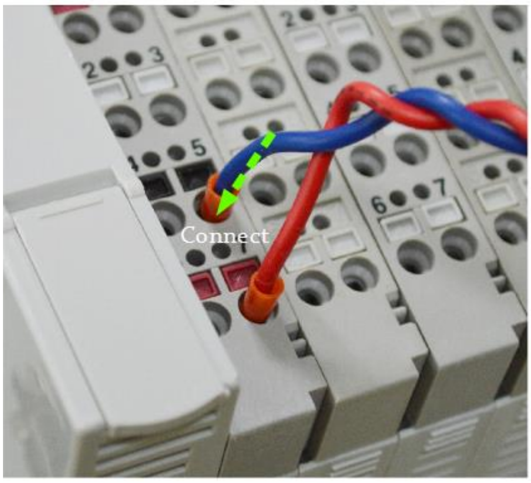
DANGER ⚠	Before work is done on the components, the voltage supply must be turned off.

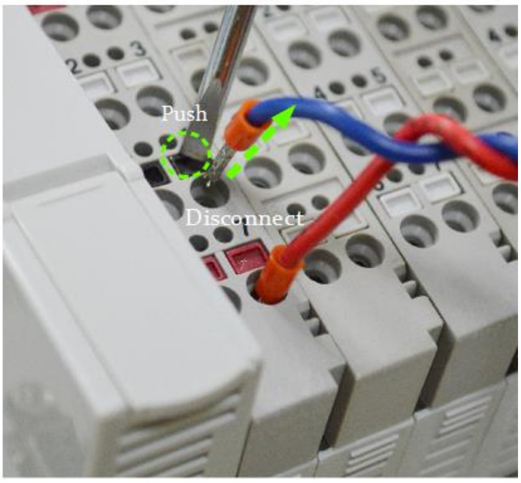
5.2. Removable Terminal Block (RTB)





5.3. Method of Wiring.





Connecting or removing the cable by pushing the terminal button for the relevant points.

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

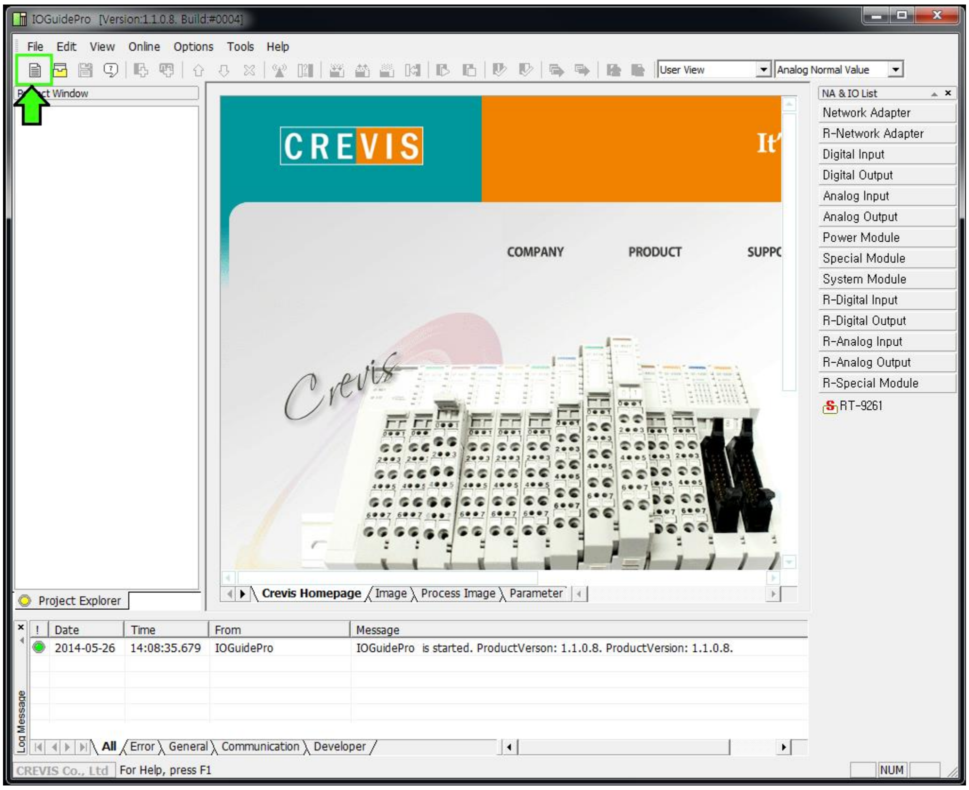
6. Various Functions of PIO

CREVIS IO Guide Pro is compatible with the PIO(NA-9371/2/3).
The basic parameter set-up and configuration for the PIO is available via the IO Guide Pro.
Using the Webserver page, User can set the IP, RTC setting.

6.1. Connect IO Guide Pro (ModBus RTU)

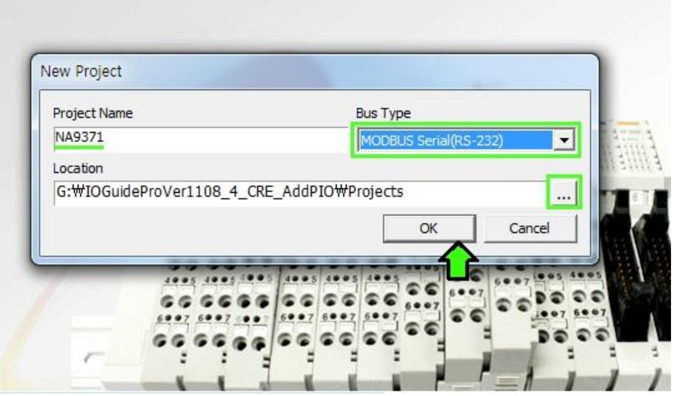
(1) Installation program-IO Guide Pro that provides CREVIS(www.crevis.co.kr).

(2) Open the IO Guide and Click on the 'New project' Icon.



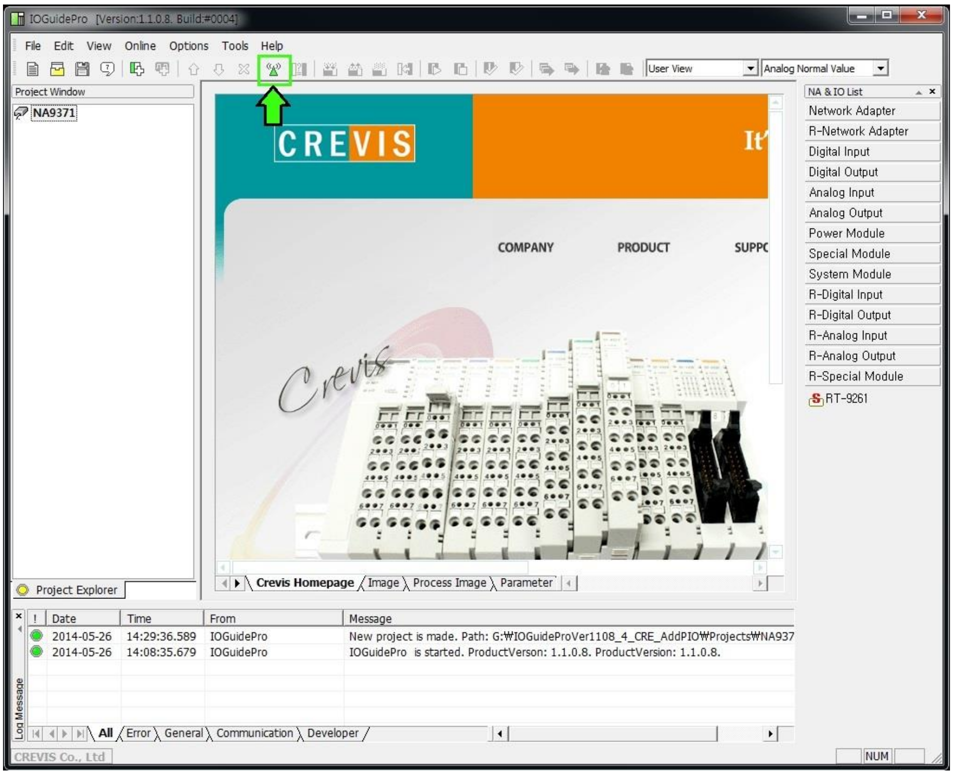
!	Date	Time	From	Message
●	2014-05-26	14:08:35.679	IOGuidePro	IOGuidePro is started. ProductVerson: 1.1.0.8. ProductVersion: 1.1.0.8.

(3) Write the 'Project Name' and Select of bus type Specify the local and Click on the 'OK' button.



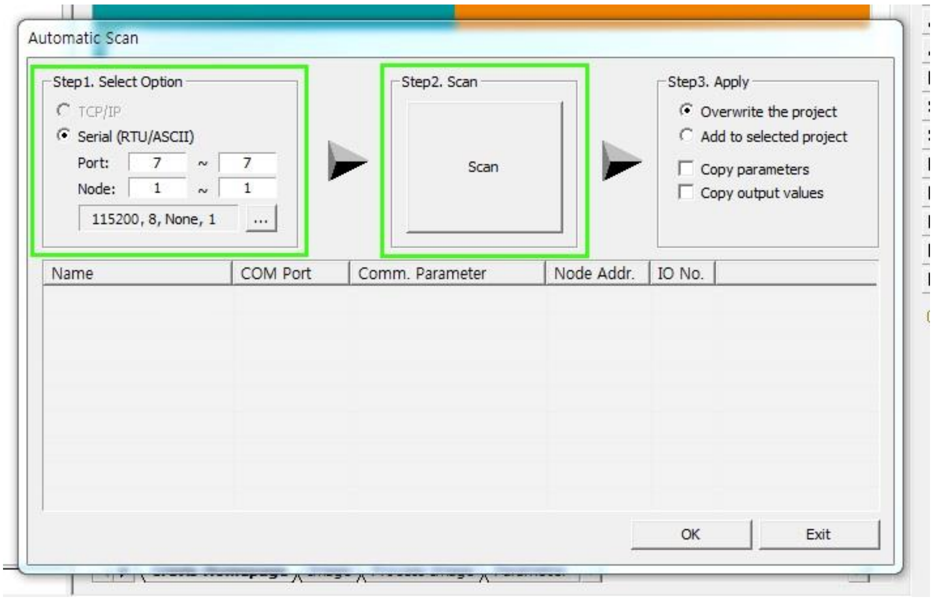
Project Name: NA9371
Bus Type: MODBUS Serial(RS-232)
Location: G:₩IOGuideProVer1108_4_CRE_AddPIO₩Projects

(4) After creating a project and click the 'Automatic scan' Icon.



!	Date	Time	From	Message
●	2014-05-26	14:29:36.589	IOGuidePro	New project is made. Path: G:₩IOGuideProVer1108_4_CRE_AddPIO₩Projects₩NA937
●	2014-05-26	14:08:35.679	IOGuidePro	IOGuidePro is started. ProductVerson: 1.1.0.8. ProductVersion: 1.1.0.8.

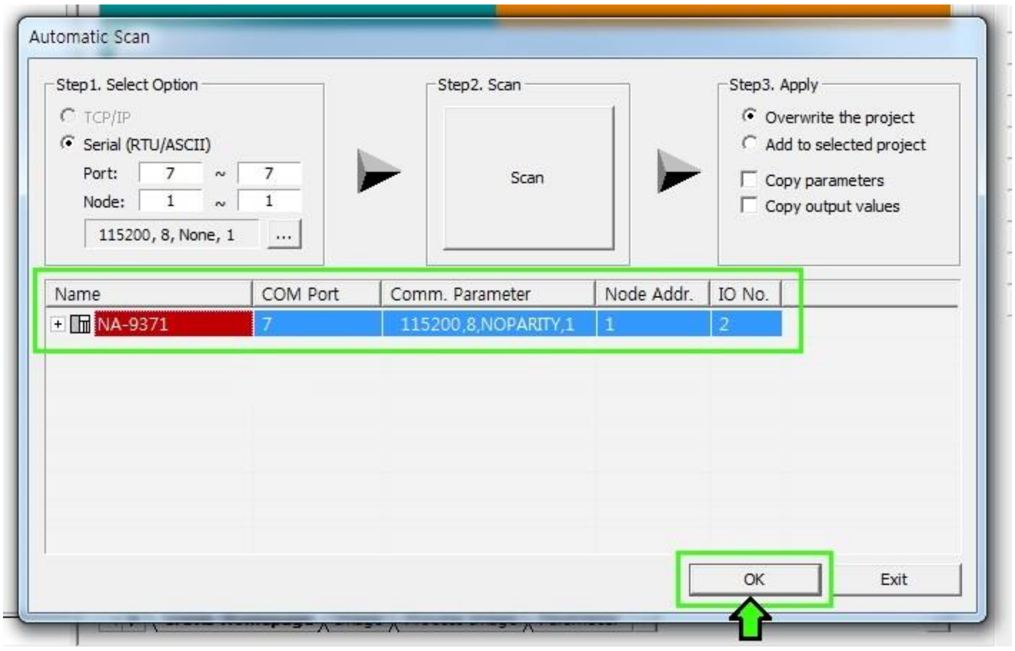
(5) Write the value(Port, node, Baudrate) click the 'Automatic scan' button.



○ TCP/IP
● Serial (RTU/ASCII)
Port: 7 ~ 7
Node: 1 ~ 1
115200, 8, None, 1 ...

● Overwrite the project
○ Add to selected project
☐ Copy parameters
☐ Copy output values

(6) After the scan completes, click the ‘OK’ button.



Automatic Scan

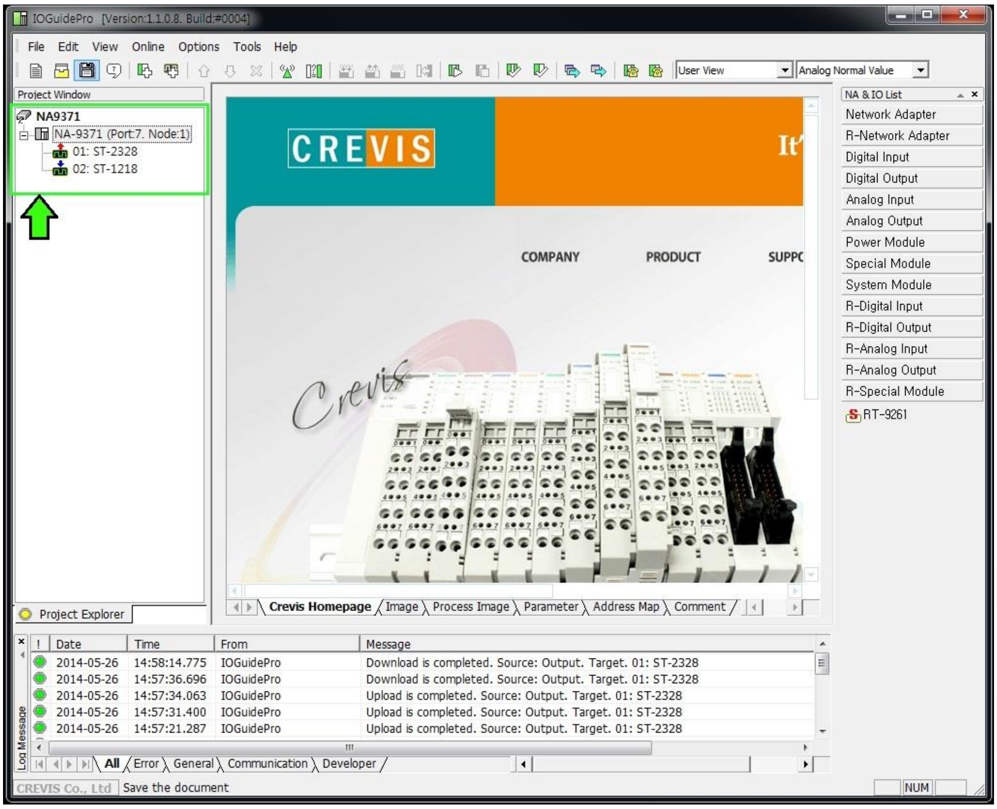
Step1. Select Option
○ TCP/IP
● Serial (RTU/ASCII)
Port: 7 ~ 7
Node: 1 ~ 1
115200, 8, None, 1

Step2. Scan

Step3. Apply
● Overwrite the project
○ Add to selected project
☐ Copy parameters
☐ Copy output values

Name	COM Port	Comm. Parameter	Node Addr.	IO No.
NA-9371	7	115200,8,NOPARITY,1	1	2

(7) It is ready to use the IO Guide Pro with RTU.



IOGuidePro [Version:1.1.0.8. Build:#0004]

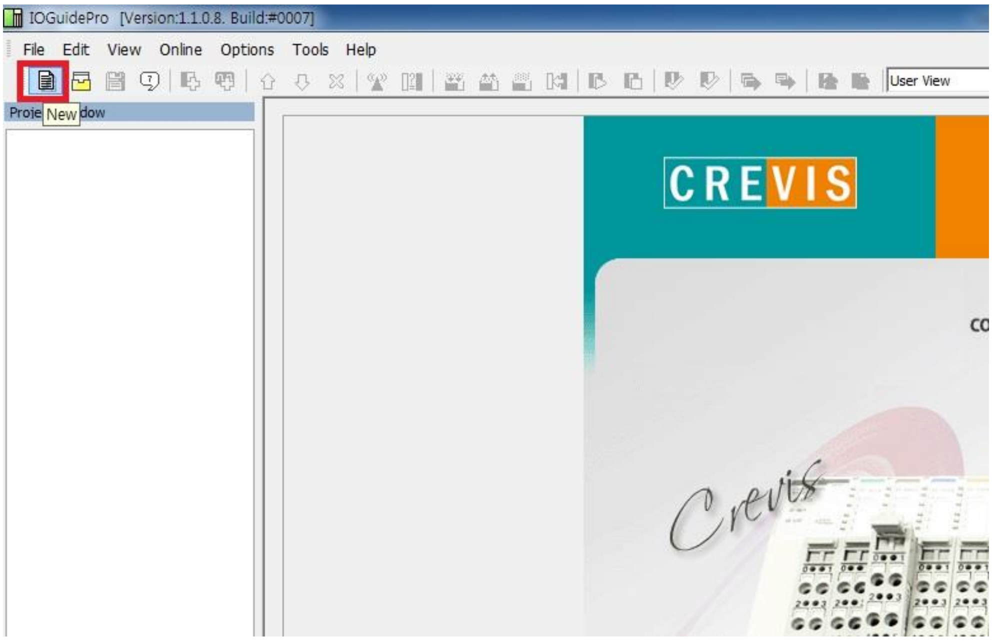
NA9371
NA-9371 (Port:7. Node:1)
01: ST-2328
02: ST-1218

!	Date	Time	From	Message
●	2014-05-26	14:58:14.775	IOGuidePro	Download is completed. Source: Output. Target. 01: ST-2328
●	2014-05-26	14:57:36.696	IOGuidePro	Download is completed. Source: Output. Target. 01: ST-2328
●	2014-05-26	14:57:34.063	IOGuidePro	Upload is completed. Source: Output. Target. 01: ST-2328
●	2014-05-26	14:57:31.400	IOGuidePro	Upload is completed. Source: Output. Target. 01: ST-2328
●	2014-05-26	14:57:21.287	IOGuidePro	Upload is completed. Source: Output. Target. 01: ST-2328

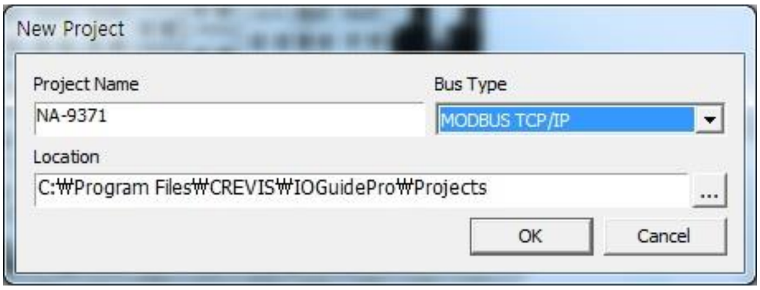
CREVIS Co., Ltd Save the document

6.2. Connect IO Guide Pro (ModBus TCP)

(1) Open the IO Guide and Click on the 'New project' Icon(Same as RTU).


IOGuidePro [Version:1.1.0.8. Build:#0007]
File Edit View Online Options Tools Help
User View
Proje
New
dow
CREVIS
Crevis

(2) Write the 'Project Name' and Select of bus type Specify the local and Click on the 'OK' button.

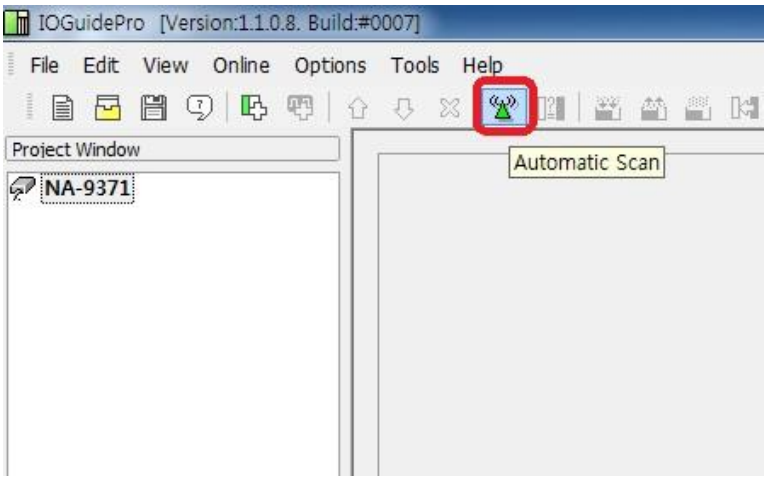

New Project

Project Name: NA-9371

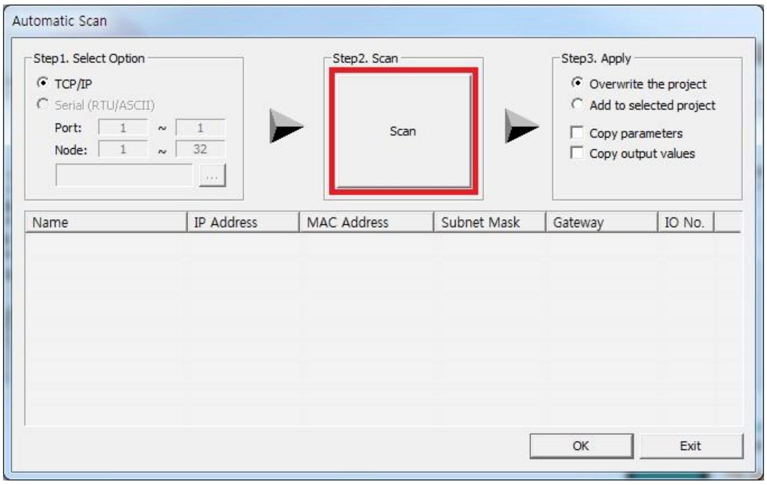
Bus Type: MODBUS TCP/IP

Location: C:₩Program Files₩CREVIS₩IOGuidePro₩Projects

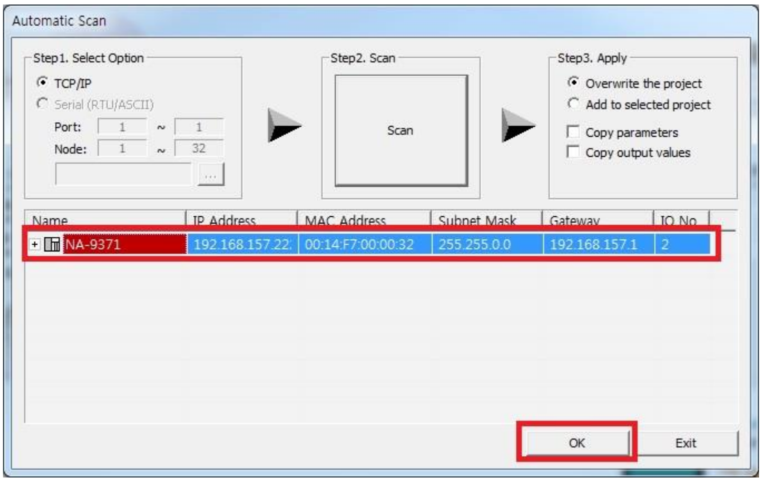
(3) After creating a project and click the 'Automatic scan' Icon.


IOGuidePro [Version:1.1.0.8. Build:#0007]
File Edit View Online Options Tools Help
Project Window
NA-9371
Automatic Scan

(4) Click the ‘Automatic scan’ button.

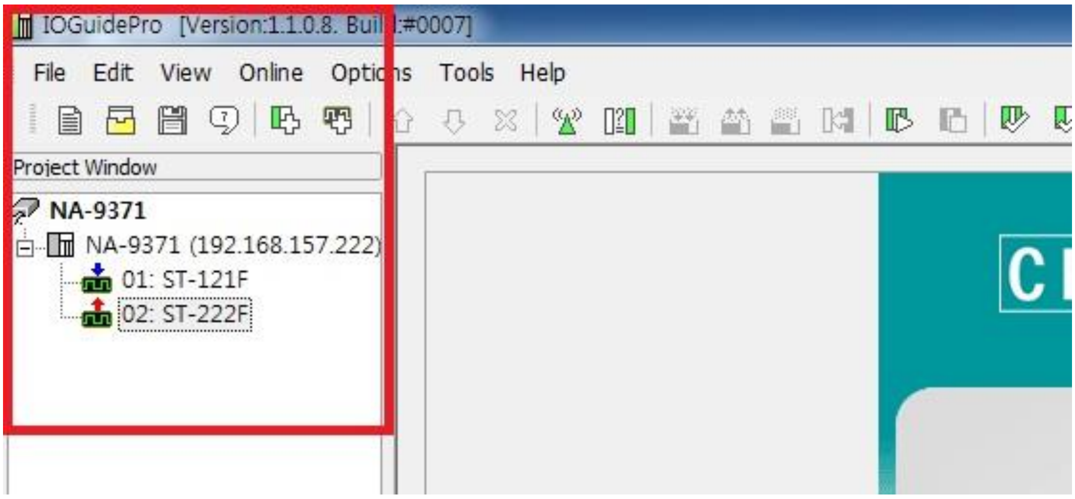


(5) After the scan completes, click the ‘OK’ button.



Name	IP Address	MAC Address	Subnet Mask	Gateway	IO No.
NA-9371	192.168.157.22	00:14:F7:00:00:32	255.255.0.0	192.168.157.1	2

(6) It is ready to use the IO Guide Pro with TCP.



6.3. Confirmation of Network Information.

You can see by checking the IP Address , Subnet Mask, Gate Way, Mac Address of NA-9371/2/3 .

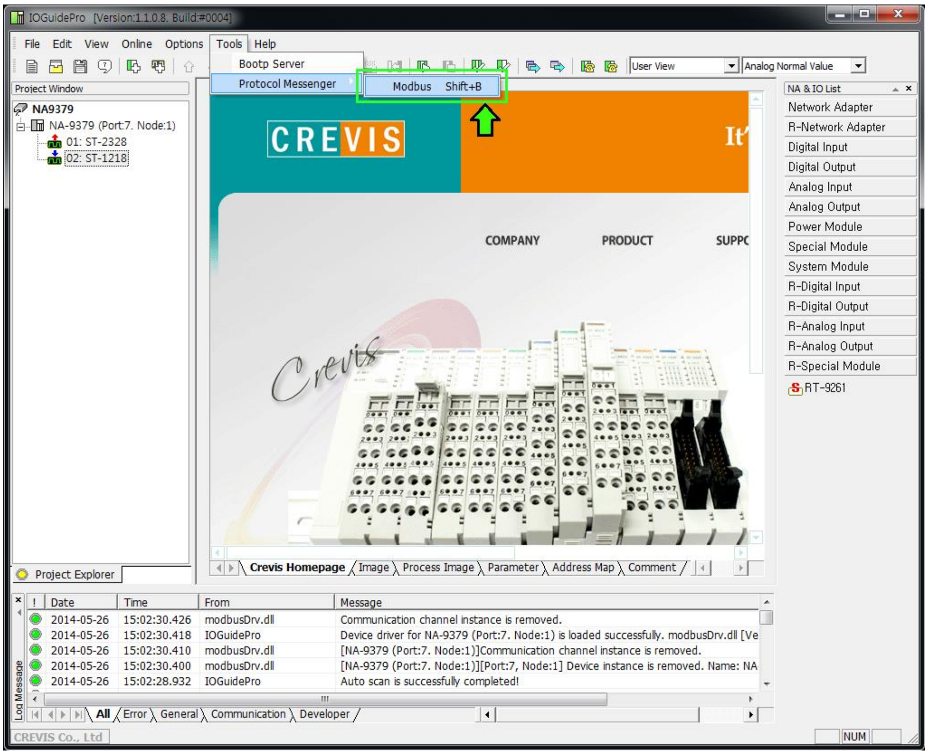
* IP Address : Also known as an "IP number" or simply an "IP," this is a code made up of numbers separated by three dots that identifies a particular computer on the Internet. Every computer, whether it be a Web server or the computer you're using right now, requires an IP address to connect to the Internet. IP addresses consist of four sets of numbers from 0 to 255, separated by three dots.

* Subnet Mask : A subnet mask is a number that defines a range of IP addresses that can be used in a network. (It is not something you wear on your head to keep subnets out.) Subnet masks are used to designate sub networks, or subnets, which are typically local networks LANs that are connected to the Internet. Systems within the same subnet can communicate directly with each other, while systems on different subnets must communicate through a router.

* Gate Way : A gateway is either hardware or software that acts as a bridge between two networks so that data can be transferred between a number of computers.

* Mac Address : A MAC address is a hardware identification number that uniquely identifies each device on a network. The MAC address is manufactured into every network card, such as an Ethernet card or Wi-Fi card, and therefore cannot be changed.

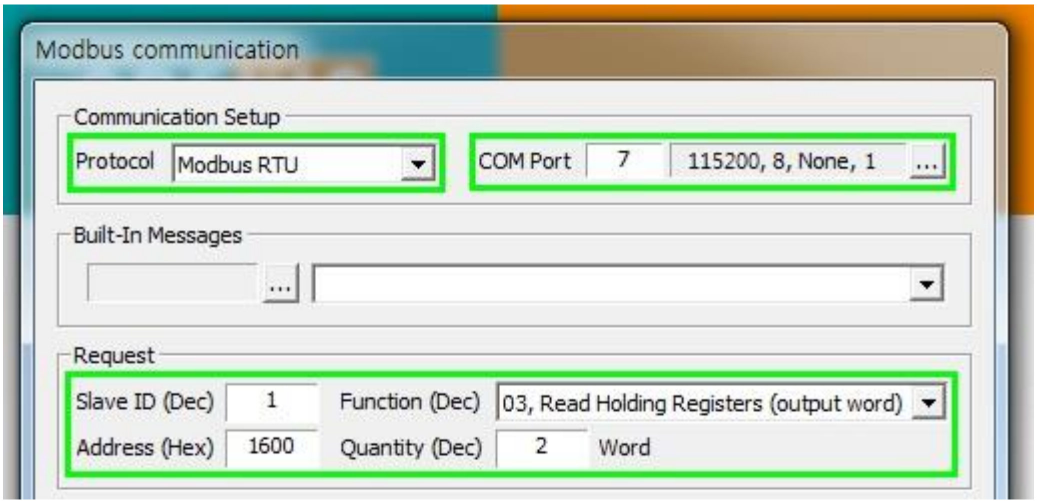
(1) Run '[Crevis] -> [IOGuidePro] -> [Protocol Messenger] -> [Modbus]'



```
!  Date        Time          From           Message
●  2014-05-26  15:02:30.426  modbusDrv.dll  Communication channel instance is removed.
●  2014-05-26  15:02:30.418  IOGuidePro     Device driver for NA-9379 (Port:7. Node:1) is loaded successfully. modbusDrv.dll [Ve
●  2014-05-26  15:02:30.410  modbusDrv.dll  [NA-9379 (Port:7. Node:1)]Communication channel instance is removed.
●  2014-05-26  15:02:30.400  modbusDrv.dll  [NA-9379 (Port:7. Node:1)][Port:7, Node:1] Device instance is removed. Name: NA
●  2014-05-26  15:02:28.932  IOGuidePro     Auto scan is successfully completed!
```

(2) Write the value of each.

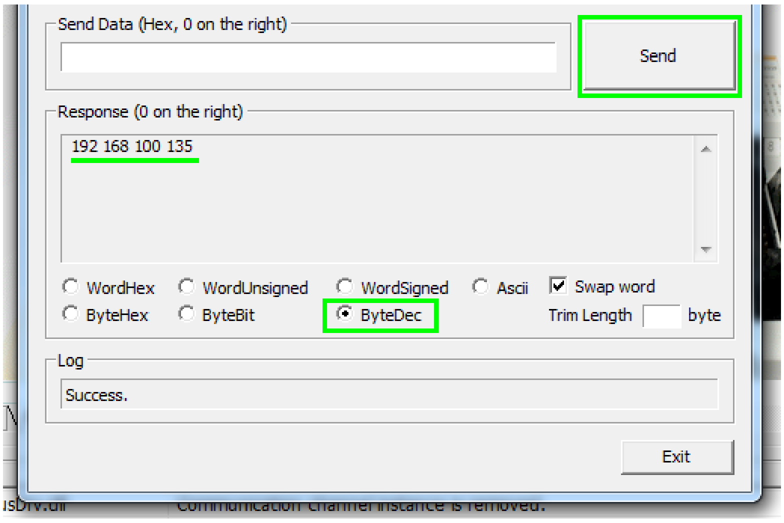
*Protocol : Modbus TCP, Modbus RTU
*ComPort : User Port / Baudrate : 115200(default)
*Address(Hex) : 1600 (IP Address Register)
1602 (IP Subnet Mask Register)
1604 (Gate way Register)
1610 (Mac Address Register)
*Function(Dec) : 03, Read Holding Registers



Protocol: Modbus RTU
COM Port: 7 115200, 8, None, 1
Slave ID (Dec): 1
Function (Dec): 03, Read Holding Registers (output word)
Address (Hex): 1600
Quantity (Dec): 2 Word

(3) After clicking the ‘send’ button and confirm the necessary information.

If you choose to 'ByteDec', More easy to see.



Response (0 on the right):

```
192 168 100 135
```

○ WordHex ○ WordUnsigned ○ WordSigned ○ Ascii ☑ Swap word
○ ByteHex ○ ByteBit ● ByteDec Trim Length byte

Log: Success.

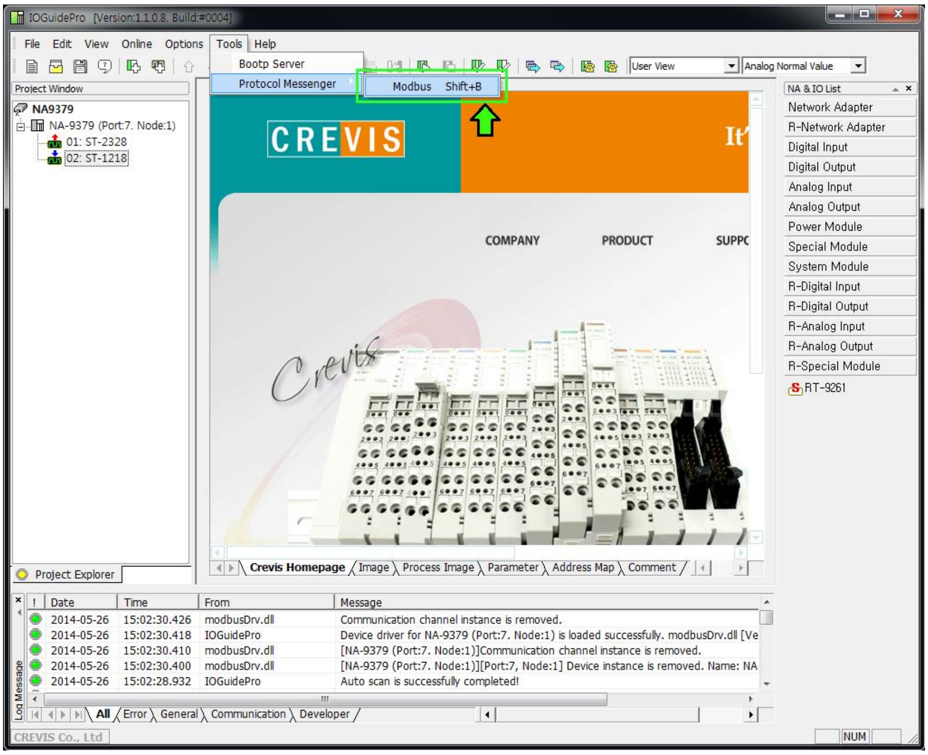
6.4. BootP/DHCP Setting

You can selected to ‘IP Setting method’.

* BOOTP: short for Bootstrap Protocol, is a UDP network protocol used by a network client to obtain its IP address automatically. This is usually done in the bootstrap process of computers or operating systems running on them. The BOOTP servers assign the IP address from a pool of addresses to each client.

* DHCP: set of rules used by communications devices such as a computer, router or network adapter to allow the device to request and obtain an IP address from a server which has a list of addresses available for assignment.

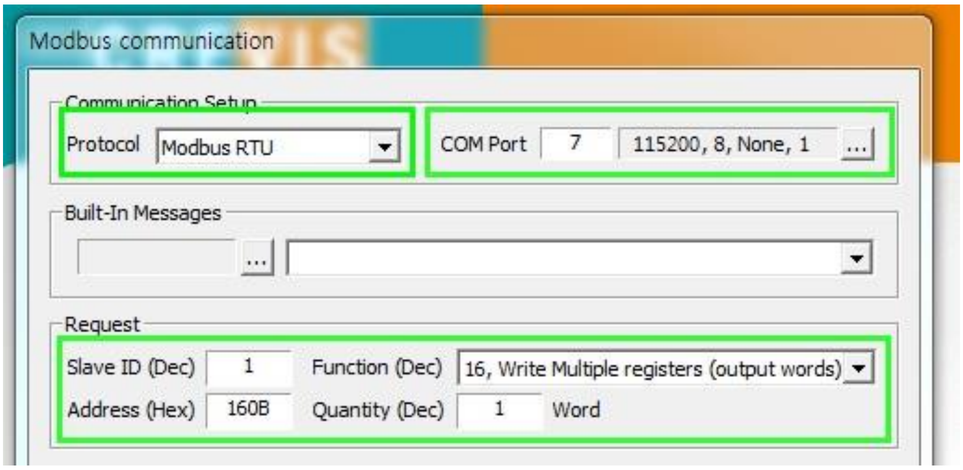
(1) Run ‘[Crevis] -> [IOGuidePro] -> [Protocol Messenger] -> [Modbus]’



```
!  Date        Time          From          Message
   2014-05-26  15:02:30.426  modbusDrv.dll Communication channel instance is removed.
   2014-05-26  15:02:30.418  IOGuidePro    Device driver for NA-9379 (Port:7. Node:1) is loaded successfully. modbusDrv.dll [Ve
   2014-05-26  15:02:30.410  modbusDrv.dll [NA-9379 (Port:7. Node:1)]Communication channel instance is removed.
   2014-05-26  15:02:30.400  modbusDrv.dll [NA-9379 (Port:7. Node:1)][Port:7, Node:1] Device instance is removed. Name: NA
   2014-05-26  15:02:28.932  IOGuidePro    Auto scan is successfully completed!
```

(2) Write the value of each.

*Protocol : Modbut TCP, Modbus RTU
*ComPort : User Port / Baudrate : 115200(default)
*Address(Hex) : 160B (IP Setting Method Register)
*Function(Dec) : 16, Write Multiple registers



Modbus communication

Communication Setup

Protocol: Modbus RTU

COM Port: 7 — 115200, 8, None, 1

Built-In Messages

Request

Slave ID (Dec): 1

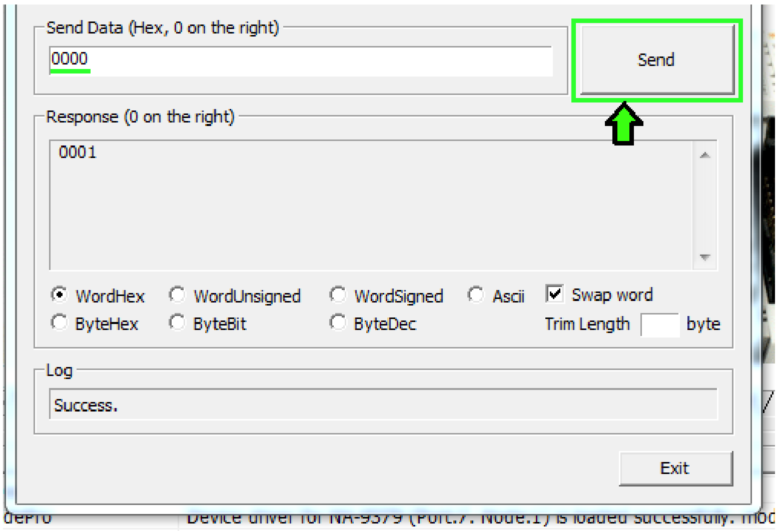
Function (Dec): 16, Write Multiple registers (output words)

Address (Hex): 160B

Quantity (Dec): 1 Word

(3) Write the register value and click the ‘Send’ button.

*Not Use : 0000 / *BootP Setting : 8000 / *DHCP Setting : 8001



Send Data (Hex, 0 on the right): 0000

Response (0 on the right): 0001

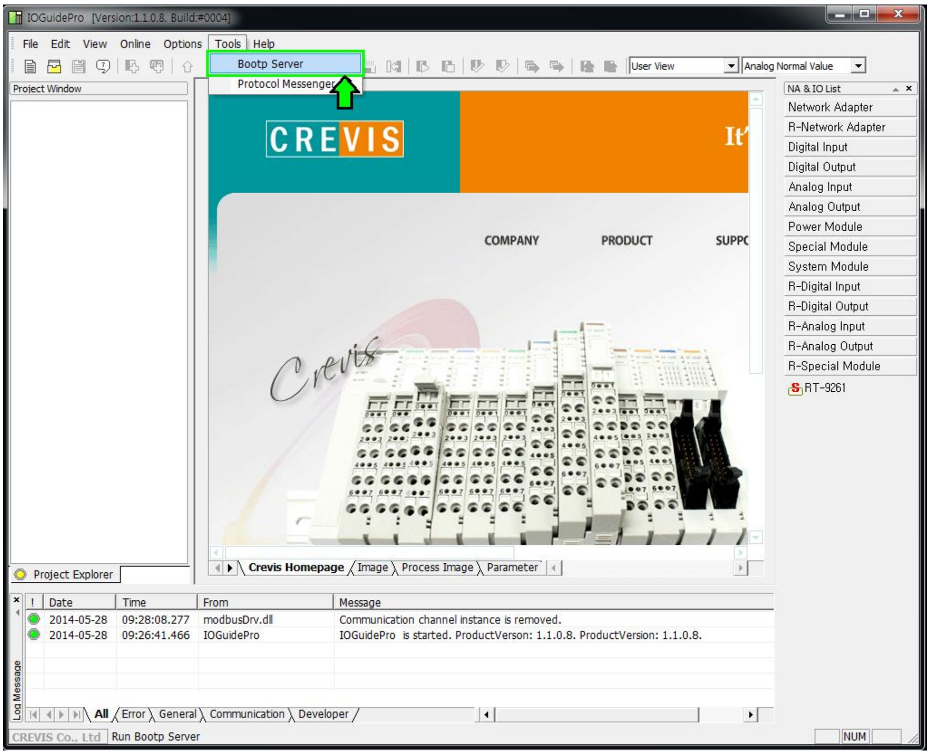
● WordHex ○ WordUnsigned ○ WordSigned ○ Ascii ☑ Swap word
○ ByteHex ○ ByteBit ○ ByteDec Trim Length byte

Log: Success.

6.5. Setup IP Address

You can assign the IP Address manually via the setting of Bootp server.
Default IP Address is 192.168.100.100

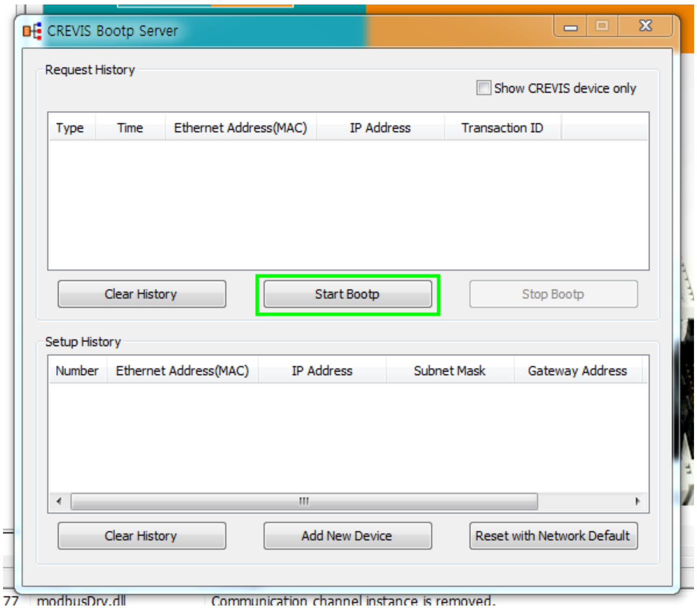
(1) Run '[Crevis] → [IOGuidePro] → [Bootp Server]'



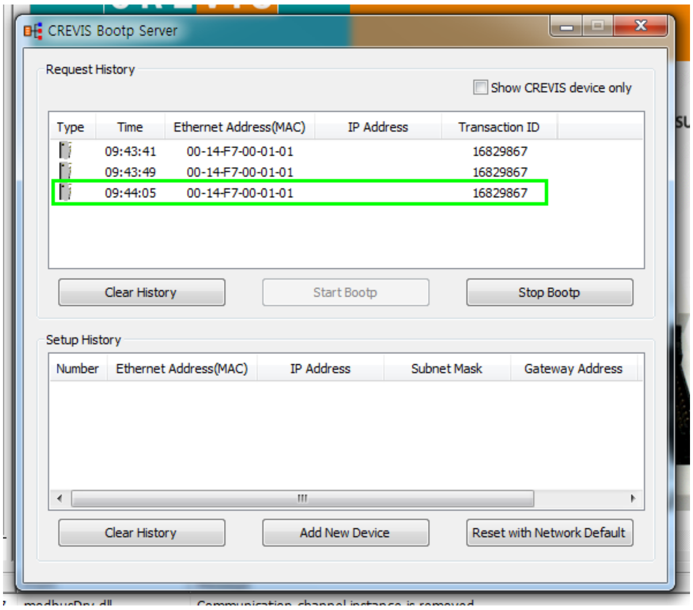
```
!  Date        Time          From           Message
   2014-05-28  09:28:08.277  modbusDrv.dll  Communication channel instance is removed.
   2014-05-28  09:26:41.466  IOGuidePro     IOGuidePro  is started. ProductVerson: 1.1.0.8. ProductVersion: 1.1.0.8.
```

IMPORTANT	NA9371/2/3 is a model that supports DHCP and Bootp. If you have a DHCP server on the same communications, IP settings from Bootp is impossible. In this case, set the IP from the DHCP server.

(2) Power on the NA9371/2/3, and Click the ‘Start Bootp’ button.



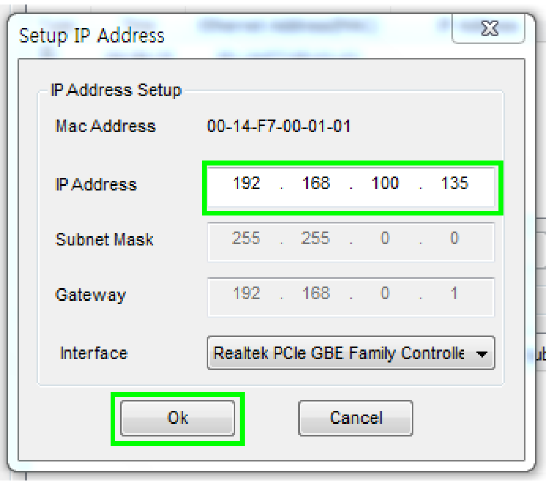
(3) Double Click ‘MAC address of NA9371/2/3’



Type	Time	Ethernet Address(MAC)	IP Address	Transaction ID
	09:43:41	00-14-F7-00-01-01		16829867
	09:43:49	00-14-F7-00-01-01		16829867
	09:44:05	00-14-F7-00-01-01		16829867

IMPORTANT	Turn on the power of NA-9371/2/3, and Retry 2imes for 4 seconds. IP settings will be within that time.

(4) Set the IP, and click ‘OK’.



IP Address Setup

Mac Address 00-14-F7-00-01-01

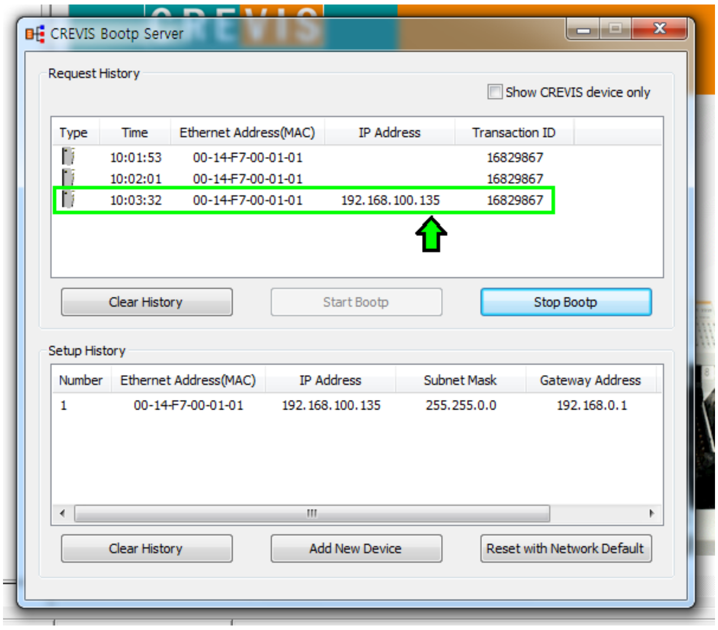
IP Address 192 . 168 . 100 . 135

Subnet Mask 255 . 255 . 0 . 0

Gateway 192 . 168 . 0 . 1

Interface Realtek PCIe GBE Family Controlle

(5) Finish



Request History

Type	Time	Ethernet Address(MAC)	IP Address	Transaction ID
	10:01:53	00-14-F7-00-01-01		16829867
	10:02:01	00-14-F7-00-01-01		16829867
	10:03:32	00-14-F7-00-01-01	192.168.100.135	16829867

Setup History

Number	Ethernet Address(MAC)	IP Address	Subnet Mask	Gateway Address
1	00-14-F7-00-01-01	192.168.100.135	255.255.0.0	192.168.0.1

IMPORTANT	Subnet Mask and Gateway is assigned automatically by the value that is set in the computer.

6.6. Serial Communication Settings

Setting according to the each communication state is possible Because NA-9371/2/3 is available the RS232 and RS485 Serial Communications.

- **Station Setting**

The following illustration is an area of Register 0x160A address that can be used to set the code of Serial communication. High 1byte is the area of rs232, and Low 1byte is the area of rs485.
It is possible to set a maximum of 247 for each area. (default : 1)

	MSB															LSB
0x160A	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	RS232C Modbus station								RS485 Modbus station							

- **RS232/ RS485 Communication setting**

The options for the communication can be selected.
RS232 can be selected from the register address, “0x1606”.
RS485 can be selected from the register address, “0x1608”.

- 1 nibble : Data bit(0 : 8bit(default), 1 : 9bit)
- 2 nibble : Stop bit(0 : 1bit(default), 1 : 2bit)
- 3 nibble : Parity bit(0 : none(default), 1: even, 2 : odd)
- 4 nibble : Reserve

	MSB															LSB
0x1607	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Data bit				Stop bit				Parity bit				Reserve			

RS232

MSB														LSB		
0x1609	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Data bit				Stop bit				Parity bit				Reserve			

RS485

- **Baud rate setting**

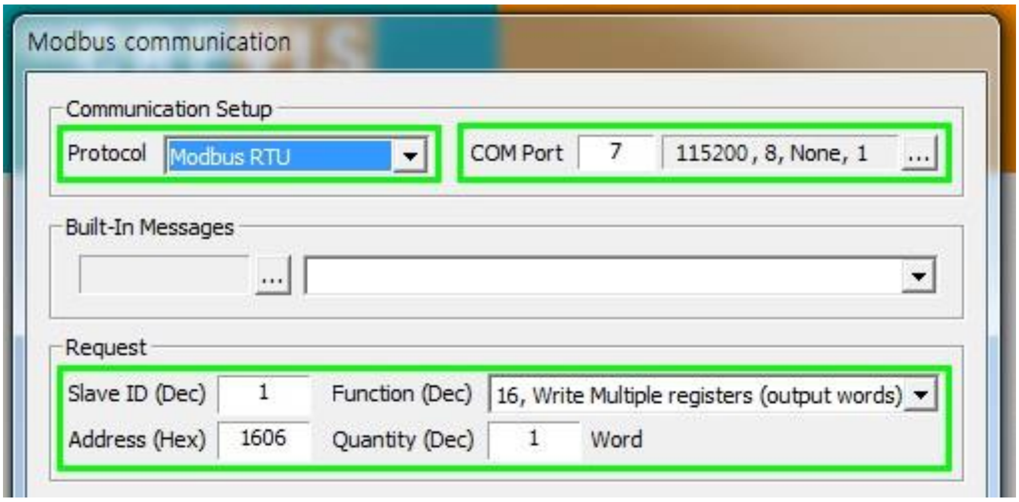
The baud rate from 2400bps to 115200bps is supported.
RS232 can be selected from the register address, “0x1606”.
RS485 can be selected from the register address, “0x1608”.

0 : 115200(Default) 1 : 2400 2 : 4800 3 : 9600
4 : 19200 5 : 38400 6 : 57600 7 : 115200

(1) Run '[Crevis] -> [IOGuidePro] -> [Protocol Messenger] -> [Modbus]'

(2) Write the value of each.

*Protocol : Modbus RTU
*ComPort : User Port / Baud rate : 115200(default)
*Address(Hex) : 1606 (RS232 Baud rate Register)
:1607 (RS232 Use bit Setting Register)
:1608 (RS485 Baud rate Register)
:1609 (RS485 Use bit Setting Register)
*Function(Dec) : When the value is write - 16, Write Multiple registers
When the value is read - 03, Read Holding Registers



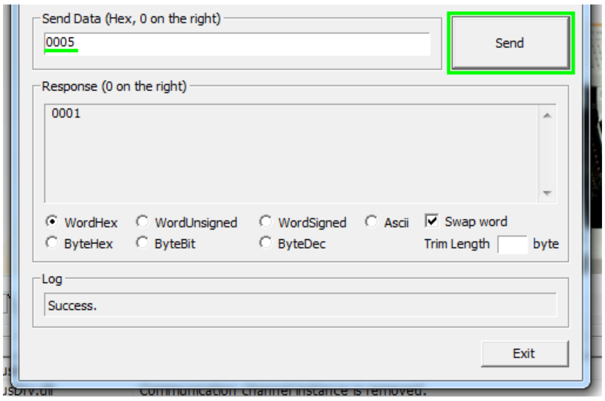
Modbus communication

Communication Setup
Protocol: Modbus RTU
COM Port: 7 115200, 8, None, 1

Request
Slave ID (Dec): 1
Function (Dec): 16, Write Multiple registers (output words)
Address (Hex): 1606
Quantity (Dec): 1 Word

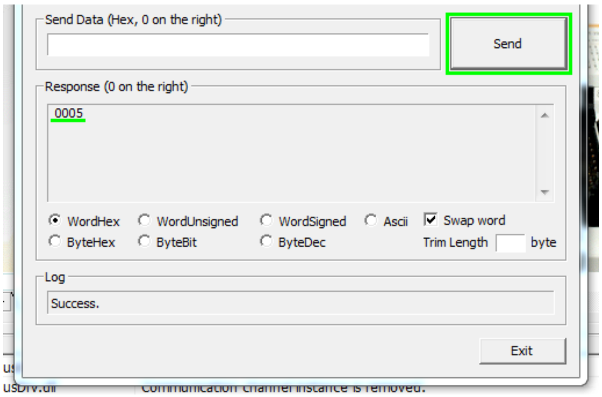
(3) confirm the necessary information.

*When the value is write
write the desired value and click the Send button.



Send Data (Hex, 0 on the right): 0005
Response (0 on the right): 0001
● WordHex ○ WordUnsigned ○ WordSigned ○ Ascii ☑ Swap word
○ ByteHex ○ ByteBit ○ ByteDec Trim Length byte
Log: Success.

*When the value is read
Click the Send button and confirm the value.



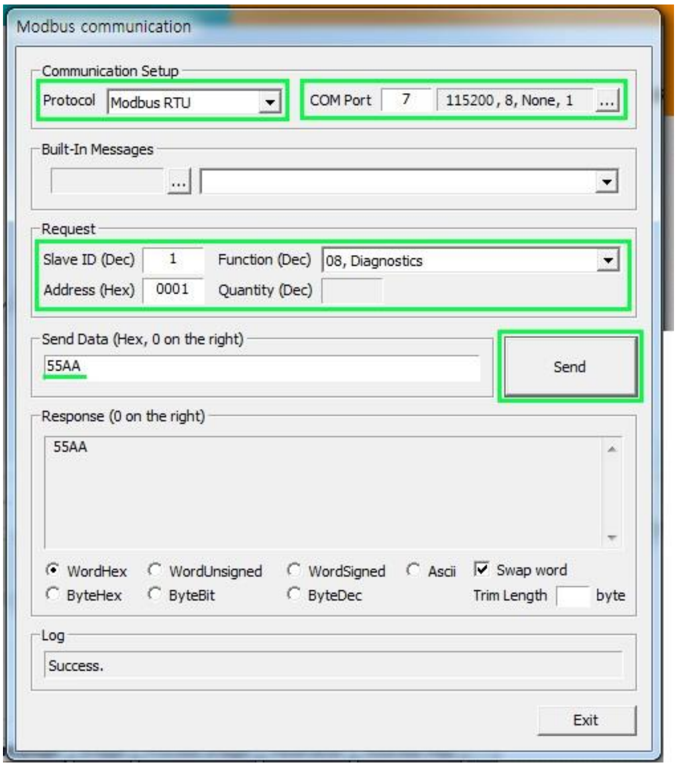
Send Data (Hex, 0 on the right):
Response (0 on the right): 0005
● WordHex ○ WordUnsigned ○ WordSigned ○ Ascii ☑ Swap word
○ ByteHex ○ ByteBit ○ ByteDec Trim Length byte
Log: Success.

6.7. Memory Reset

data field 0x55AA makes the remote device to restart with factory default setup of EEPROM.
*All expansion slot configuration parameters are cleared.

(1) Run '[Crevis] -> [IOGuidePro] -> [Protocol Messenger] -> [Modbus]'

(2) Write the value of each.
*Protocol : Modbus RTU
*ComPort : User Port / Baudrate : 115200(default)
*Address(Hex) : 0001 (Factory default setup)
*Function(Dec) : When the value is write – 08, Diagnostics



Protocol: Modbus RTU
COM Port: 7 115200, 8, None, 1
Slave ID (Dec): 1
Function (Dec): 08, Diagnostics
Address (Hex): 0001
Quantity (Dec):
Send Data (Hex, 0 on the right): 55AA
Response (0 on the right): 55AA
● WordHex ○ WordUnsigned ○ WordSigned ○ Ascii ☑ Swap word
○ ByteHex ○ ByteBit ○ ByteDec Trim Length byte
Log: Success.

(3) Write the register value and click the 'Send' button.
*Value : 0x55AA

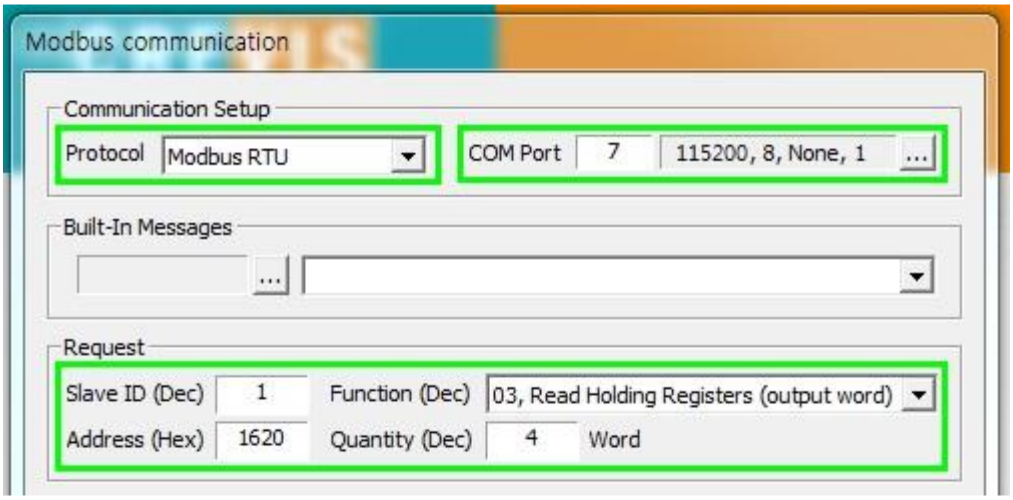
6.8. RTC(Real Time Clock) Function

A real-time clock (RTC) is a computer clock (most often in the form of an integrated circuit) that keeps track of the current time. RTC information of NA-9371/72/73 is stored in address 0x1620 in the Register, also can be read.

(1) Run '[Crevis] -> [IOGuidePro] -> [Protocol Messenger] -> [Modbus]'

(2) Write the value of each.

*Protocol : Modbus TCP, Modbus RTU
*ComPort : User Port / Baudrate : 115200(default)
*Address(Hex) : 1620 (RTC Register)
*Function(Dec) : When the value is write - 16, Write Multiple registers
When the value is read - 03, Read Holding Registers



Modbus communication

Communication Setup

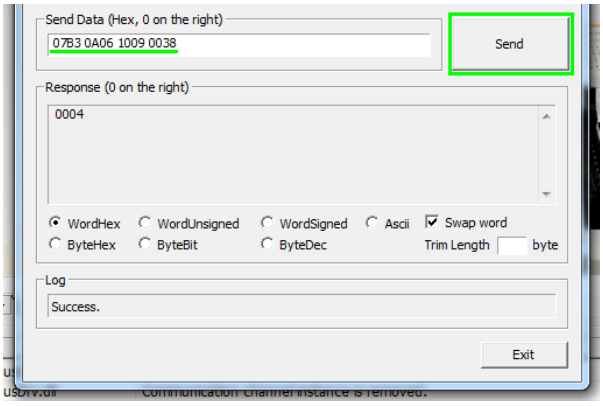
Protocol: Modbus RTU
COM Port: 7 115200, 8, None, 1

Request

Slave ID (Dec): 1
Function (Dec): 03, Read Holding Registers (output word)
Address (Hex): 1620
Quantity (Dec): 4 Word

(3) confirm the necessary information.

*When the value is write
write the desired value and click the Send button.



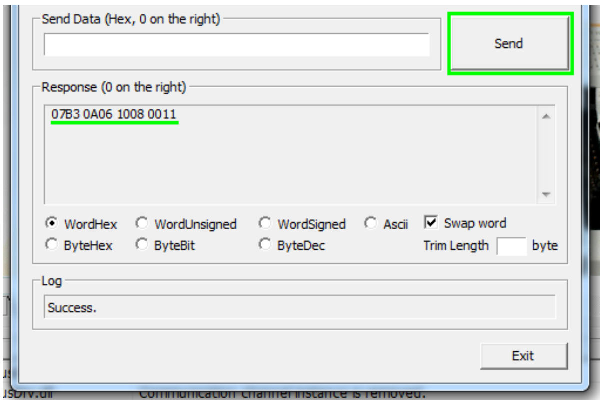
Send Data (Hex, 0 on the right): 07B3 0A06 1009 0038

Response (0 on the right): 0004

● WordHex ○ WordUnsigned ○ WordSigned ○ Ascii ☑ Swap word
○ ByteHex ○ ByteBit ○ ByteDec Trim Length byte

Log: Success.

*When the value is read
Click the Send button and confirm the value.



Send Data (Hex, 0 on the right):

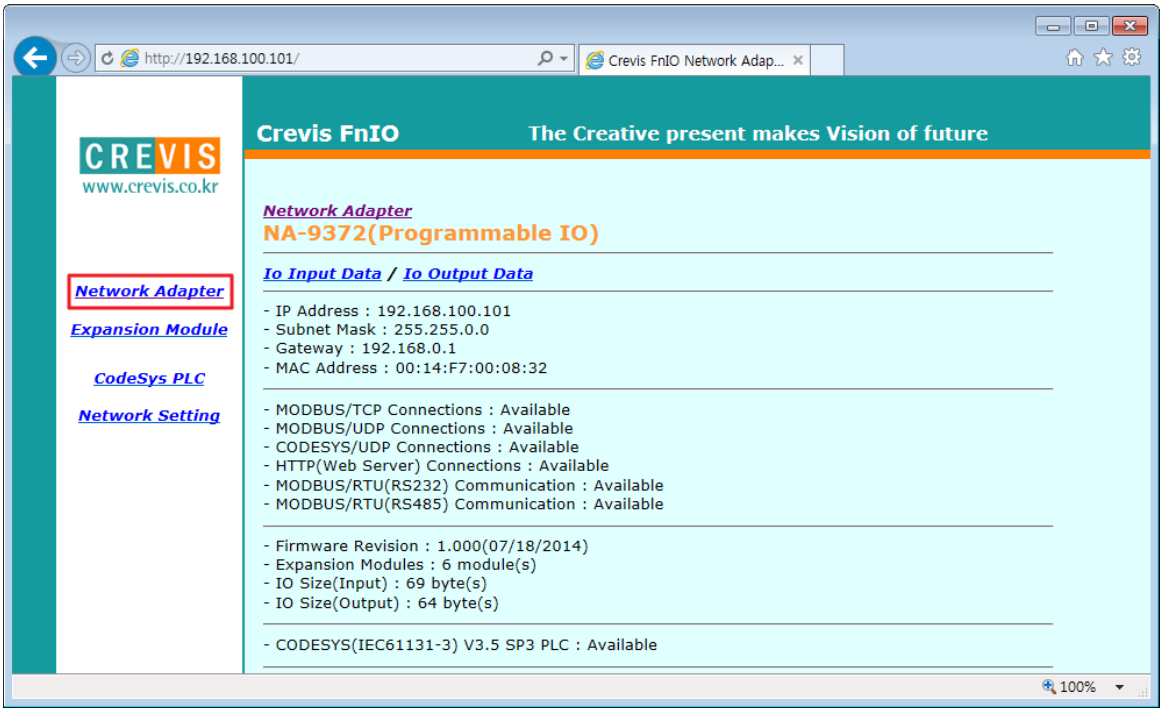
Response (0 on the right): 07B3 0A06 1008 0011

● WordHex ○ WordUnsigned ○ WordSigned ○ Ascii ☑ Swap word
○ ByteHex ○ ByteBit ○ ByteDec Trim Length byte

Log: Success.

6.9. NA-9371/2/3 Webserver.

(1) Main page is showing various information for PIO status.



Network Adapter

NA-9372(Programmable IO)

Io Input Data / Io Output Data

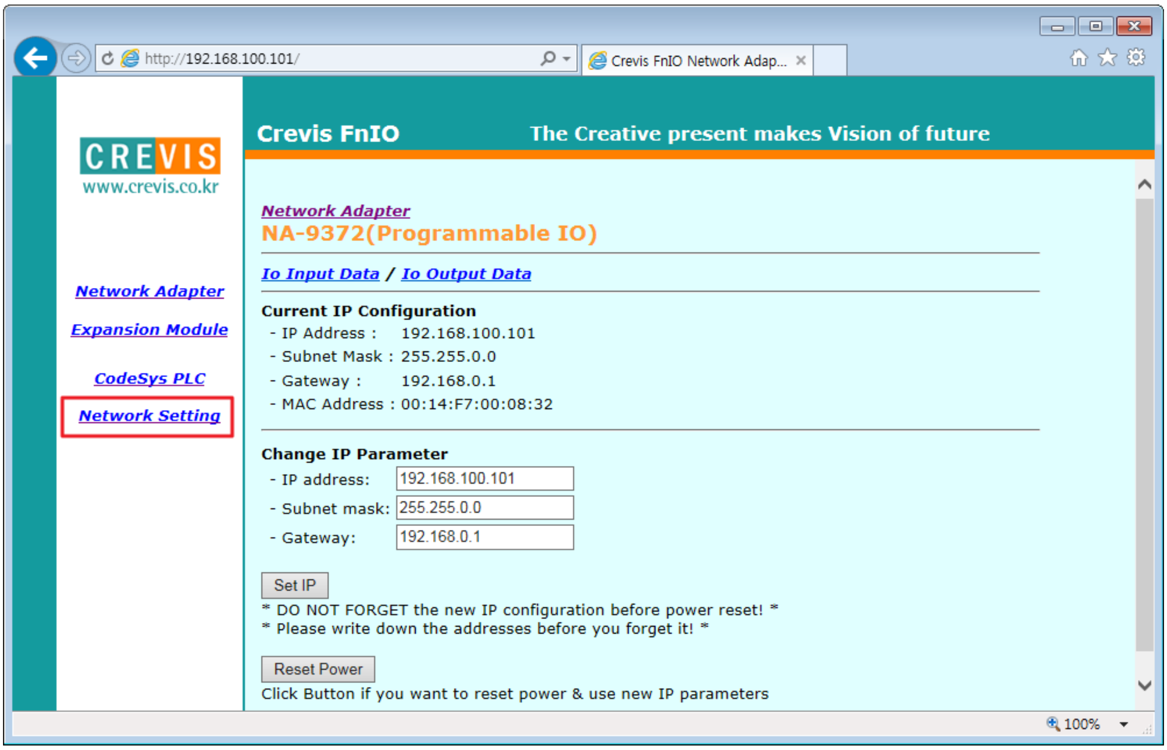
- IP Address : 192.168.100.101
- Subnet Mask : 255.255.0.0
- Gateway : 192.168.0.1
- MAC Address : 00:14:F7:00:08:32

- MODBUS/TCP Connections : Available
- MODBUS/UDP Connections : Available
- CODESYS/UDP Connections : Available
- HTTP(Web Server) Connections : Available
- MODBUS/RTU(RS232) Communication : Available
- MODBUS/RTU(RS485) Communication : Available

- Firmware Revision : 1.000(07/18/2014)
- Expansion Modules : 6 module(s)
- IO Size(Input) : 69 byte(s)
- IO Size(Output) : 64 byte(s)

- CODESYS(IEC61131-3) V3.5 SP3 PLC : Available

(2) When you click the expansion menu, user can check the extension module status.



Network Adapter

NA-9372(Programmable IO)

Io Input Data / Io Output Data

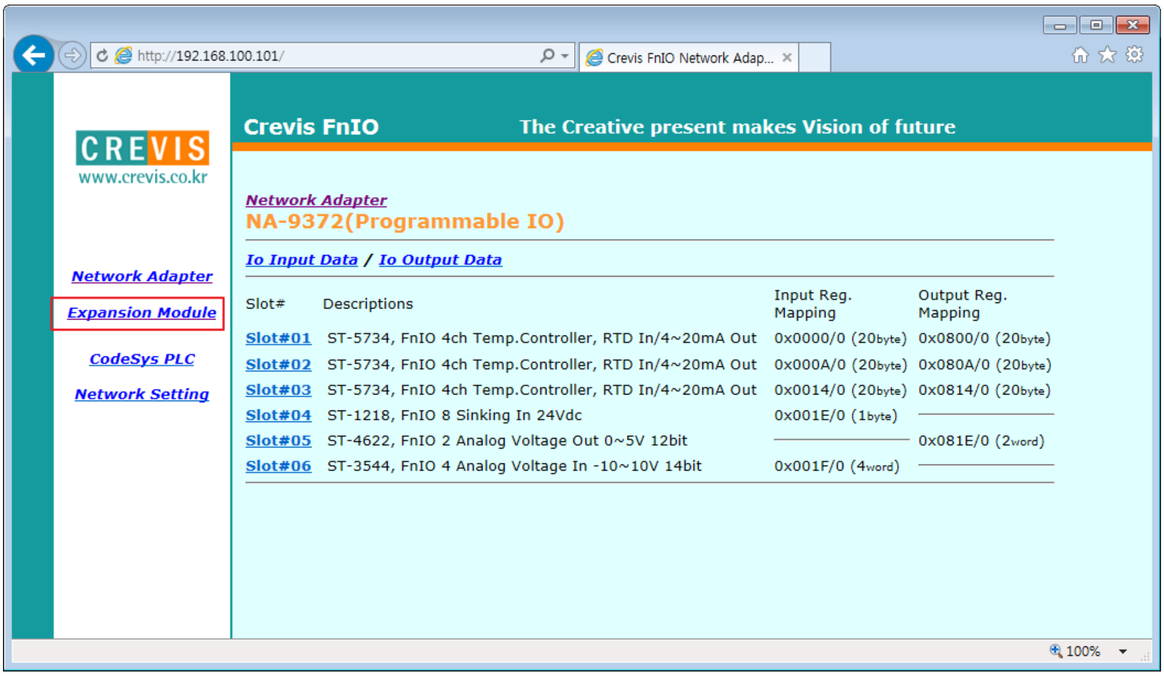
Current IP Configuration
- IP Address : 192.168.100.101
- Subnet Mask : 255.255.0.0
- Gateway : 192.168.0.1
- MAC Address : 00:14:F7:00:08:32

Change IP Parameter
- IP address: 192.168.100.101
- Subnet mask: 255.255.0.0
- Gateway: 192.168.0.1

* DO NOT FORGET the new IP configuration before power reset! *
* Please write down the addresses before you forget it! *

Click Button if you want to reset power & use new IP parameters

(3) User can easily change and set the RTC time. If you click the get time button, PIO set the clock time from PC.



Crevis FnIO The Creative present makes Vision of future

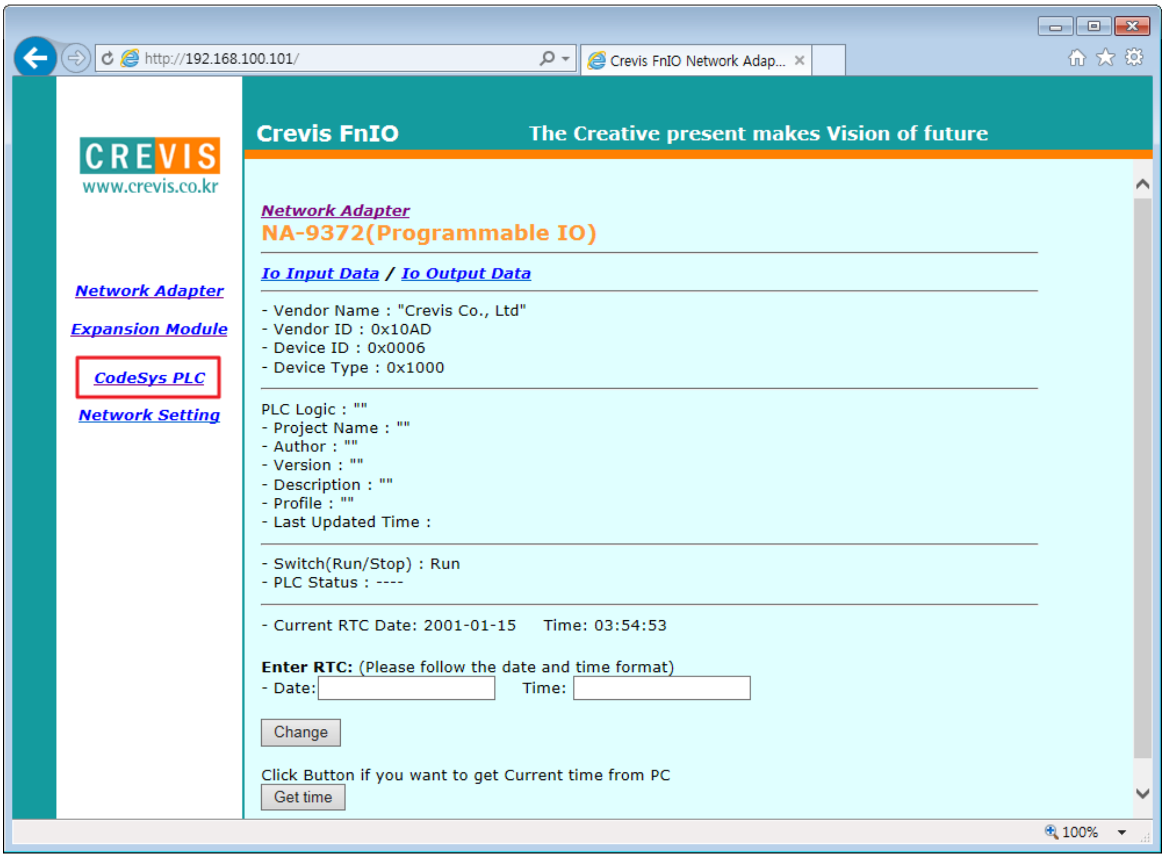
Network Adapter

NA-9372(Programmable IO)

Io Input Data / *Io Output Data*

Slot#	Descriptions	Input Reg. Mapping	Output Reg. Mapping
Slot#01	ST-5734, FnIO 4ch Temp.Controller, RTD In/4~20mA Out	0x0000/0 (20byte)	0x0800/0 (20byte)
Slot#02	ST-5734, FnIO 4ch Temp.Controller, RTD In/4~20mA Out	0x000A/0 (20byte)	0x080A/0 (20byte)
Slot#03	ST-5734, FnIO 4ch Temp.Controller, RTD In/4~20mA Out	0x0014/0 (20byte)	0x0814/0 (20byte)
Slot#04	ST-1218, FnIO 8 Sinking In 24Vdc	0x001E/0 (1byte)	—
Slot#05	ST-4622, FnIO 2 Analog Voltage Out 0~5V 12bit	—	0x081E/0 (2word)
Slot#06	ST-3544, FnIO 4 Analog Voltage In -10~10V 14bit	0x001F/0 (4word)	—

(4) Using the Network setting, user can set the IP/Subnet mask/Gateway.



Crevis FnIO The Creative present makes Vision of future

Network Adapter

NA-9372(Programmable IO)

Io Input Data / *Io Output Data*

- Vendor Name : "Crevis Co., Ltd"
- Vendor ID : 0x10AD
- Device ID : 0x0006
- Device Type : 0x1000

PLC Logic : ""
- Project Name : ""
- Author : ""
- Version : ""
- Description : ""
- Profile : ""
- Last Updated Time :

- Switch(Run/Stop) : Run
- PLC Status : ----

- Current RTC Date: 2001-01-15 Time: 03:54:53

Enter RTC: (Please follow the date and time format)
- Date: ____ Time: ____

Change

Click Button if you want to get Current time from PC

Get time

6.10. IP default setting

When user forget the IP address, After power on the PIO and push the Reset switch in front of PIO. The switch should be pushed 20 second at least. PIO will be fall into the factory default mode.

All of PIO LED will be blank Green/Red.
The default IP setting is

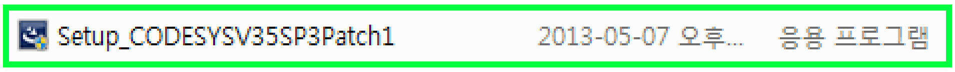
IP address	192.168.100.100
Subnet Mask	255.255.255.0
Gateway	192.168.100.254

7. Programing the PIO (CoDeSys)

7.1. Download and Install the CoDeSys

IMPORTANT	Please use the CoDeSys version V3.5.3.1 (V3.5 SP3 Patch 1) Except for the above version, any versions including the latest version will not be allowed for PIO.

Unzip the downloaded file, and Installation 'Setup_CoDeSysV35SP3Patch1.exe'



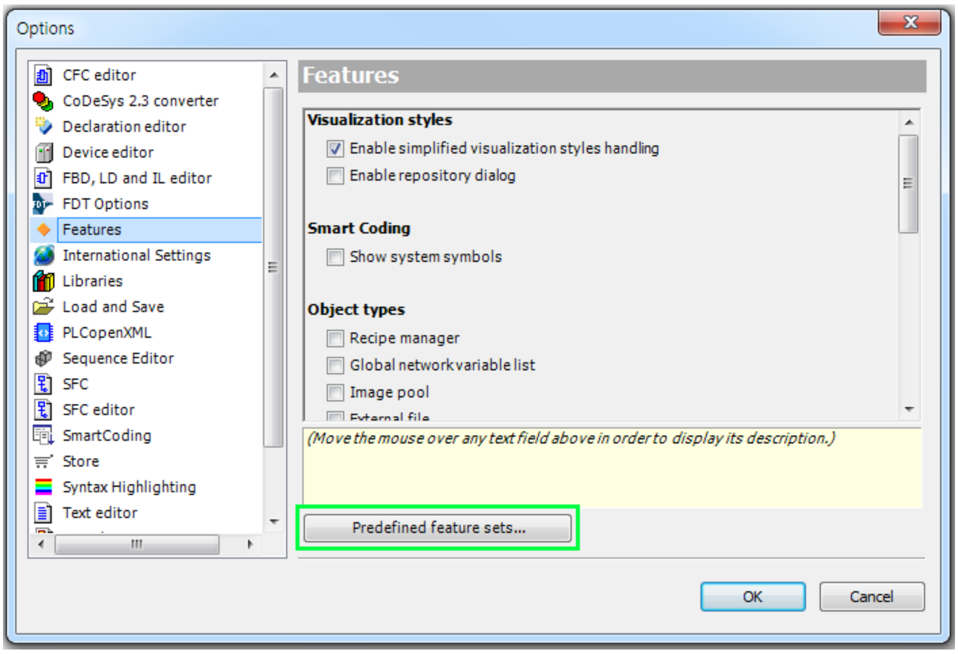
Setup_CODESYSV35SP3Patch1 2013-05-07 오후... 응용 프로그램

7.2. The Basic Configuration CoDeSys

7.2.1. Installation of XML

(1) Run the CoDeSys program

(2) [Tools] → [Options], Click 'Predefined feature sets...'



Visualization styles

☑ Enable simplified visualization styles handling

☐ Enable repository dialog

Smart Coding

☐ Show system symbols

Object types

☐ Recipe manager

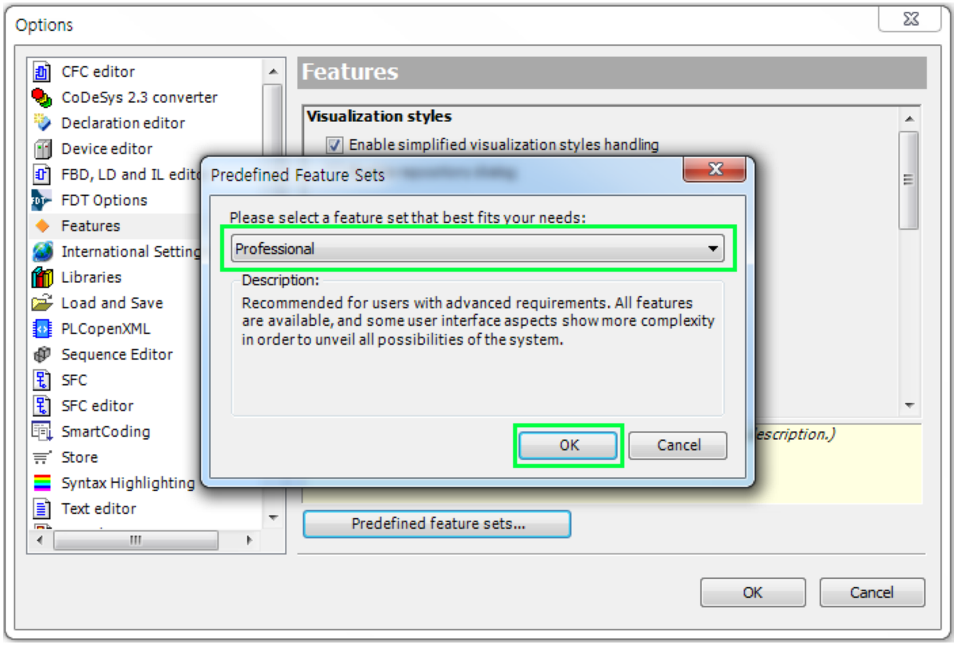
☐ Global network variable list

☐ Image pool

☐ External file

(Move the mouse over any text field above in order to display its description.)

(3) Standard → Professional, Click 'OK'



☑ Enable simplified visualization styles handling

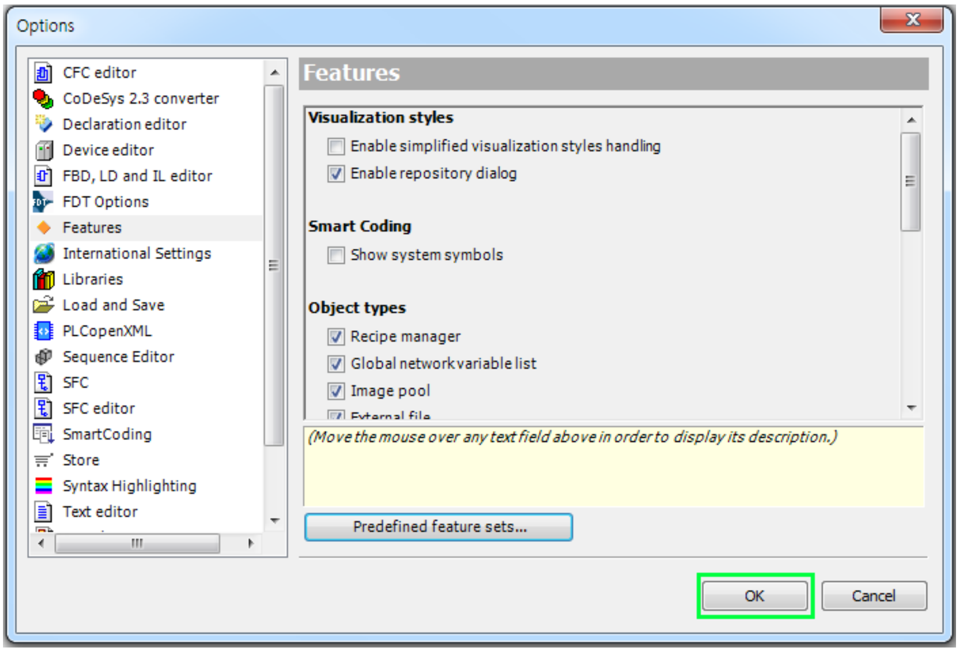
Please select a feature set that best fits your needs:

Professional

Description:

Recommended for users with advanced requirements. All features are available, and some user interface aspects show more complexity in order to unveil all possibilities of the system.

(4) Click 'OK'



Visualization styles

☐ Enable simplified visualization styles handling

☑ Enable repository dialog

Smart Coding

☐ Show system symbols

Object types

☑ Recipe manager

☑ Global network variable list

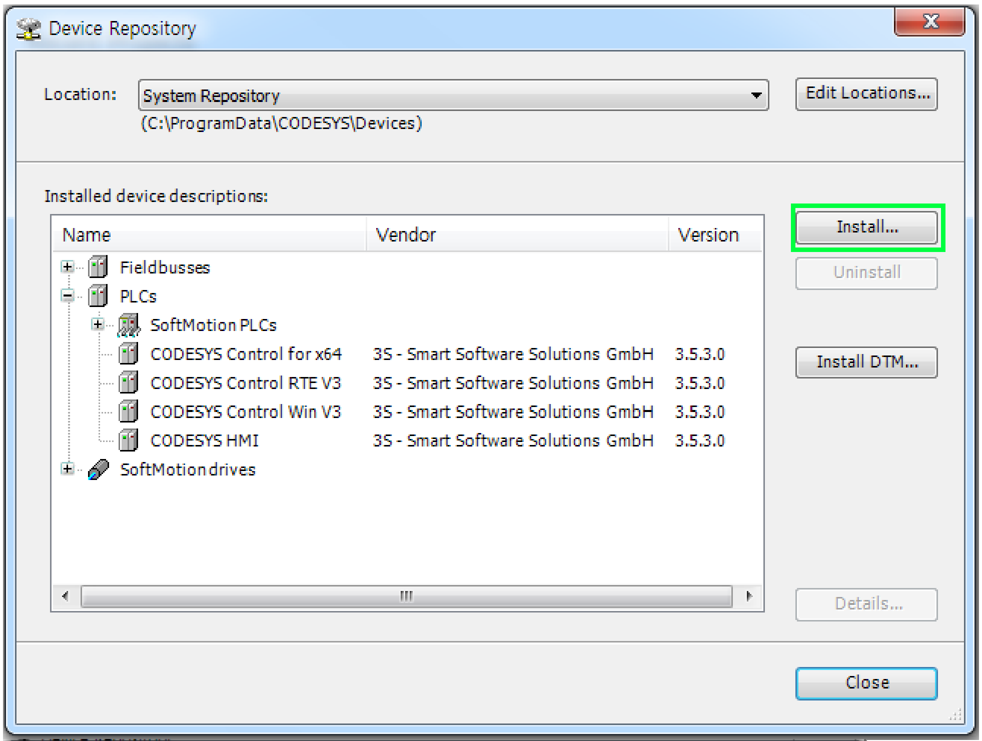
☑ Image pool

☑ External file

(Move the mouse over any text field above in order to display its description.)

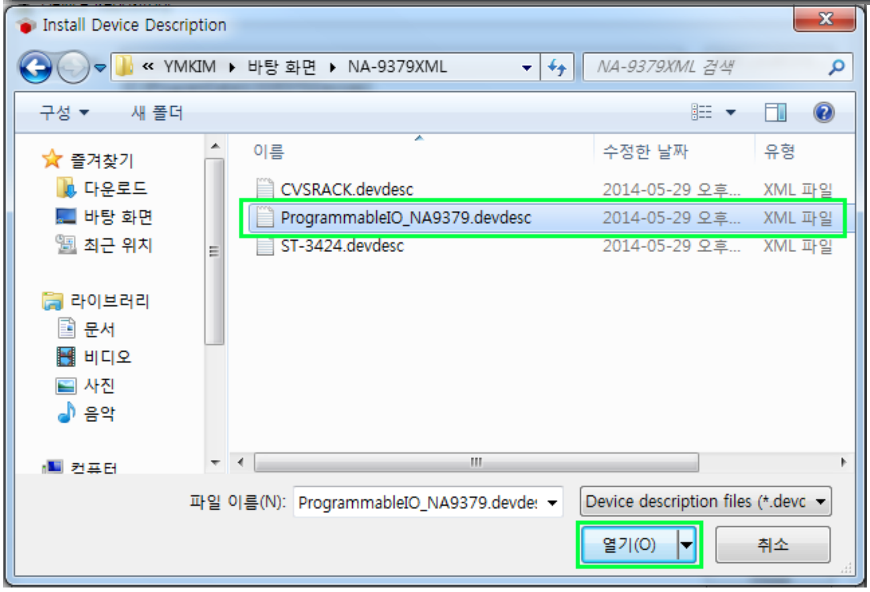
(5) [Tools] → [Device Repository], Click 'PLCs' and select PIO Description (download to CREVIS website), Install...

(ProgrammableIO_NA937x.devdesc.xml)



Location: System Repository
(C:\ProgramData\CODESYS\Devices)

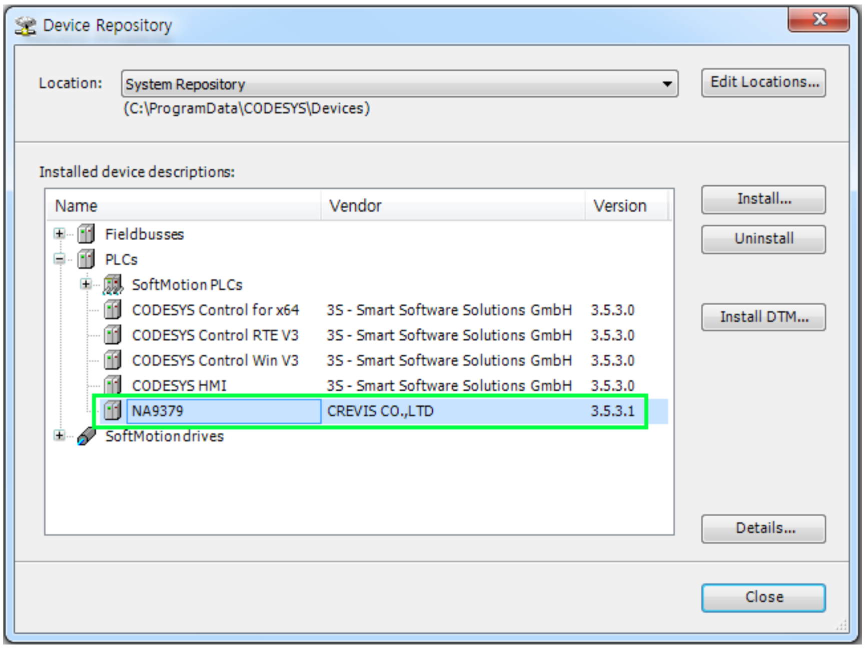
Name	Vendor	Version
Fieldbusses		
PLCs		
SoftMotion PLCs		
CODESYS Control for x64	3S - Smart Software Solutions GmbH	3.5.3.0
CODESYS Control RTE V3	3S - Smart Software Solutions GmbH	3.5.3.0
CODESYS Control Win V3	3S - Smart Software Solutions GmbH	3.5.3.0
CODESYS HMI	3S - Smart Software Solutions GmbH	3.5.3.0
SoftMotion drives		



이름	수정한 날짜	유형
CVSRACK.devdesc	2014-05-29 오후...	XML 파일
ProgrammableIO_NA9379.devdesc	2014-05-29 오후...	XML 파일
ST-3424.devdesc	2014-05-29 오후...	XML 파일

파일 이름(N): ProgrammableIO_NA9379.devde:
Device description files (*.devc

*Please check whether they are installed correctly or not.

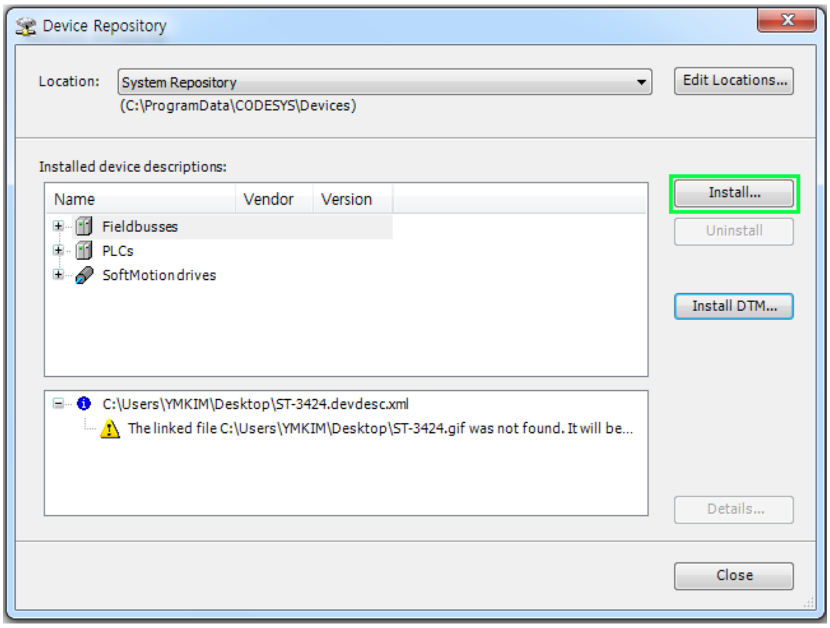


Location: System Repository
(C:\ProgramData\CODESYS\Devices)

Name	Vendor	Version
Fieldbusses		
PLCs		
SoftMotion PLCs		
CODESYS Control for x64	3S - Smart Software Solutions GmbH	3.5.3.0
CODESYS Control RTE V3	3S - Smart Software Solutions GmbH	3.5.3.0
CODESYS Control Win V3	3S - Smart Software Solutions GmbH	3.5.3.0
CODESYS HMI	3S - Smart Software Solutions GmbH	3.5.3.0
NA9379	CREVIS CO.,LTD	3.5.3.1
SoftMotion drives		

(6) [Tools] → [Device Repository], Click 'Miscellaneous' and install the slot description and I/O Description (download to CREVIS website).

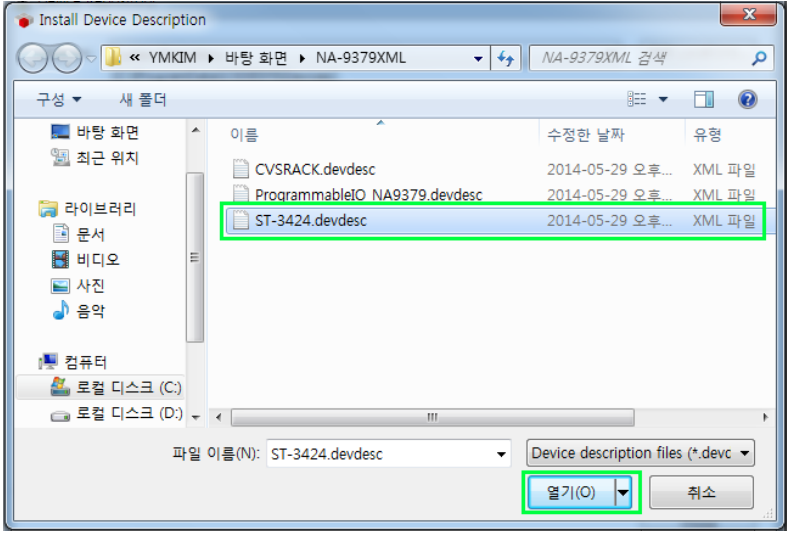
(ST-xxxx.devdesc.xml)



Location: System Repository
(C:\ProgramData\CODESYS\Devices)

C:\Users\YMKIM\Desktop\ST-3424.devdesc.xml
The linked file C:\Users\YMKIM\Desktop\ST-3424.gif was not found. It will be...

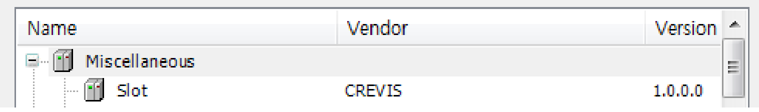
*Please check whether they are installed correctly or not.



이름	수정한 날짜	유형
CVSRACK.devdesc	2014-05-29 오후...	XML 파일
ProgrammableIO_NA9379.devdesc	2014-05-29 오후...	XML 파일
ST-3424.devdesc	2014-05-29 오후...	XML 파일

파일 이름(N): ST-3424.devdesc

(CVSRACK.devdesc.xml)

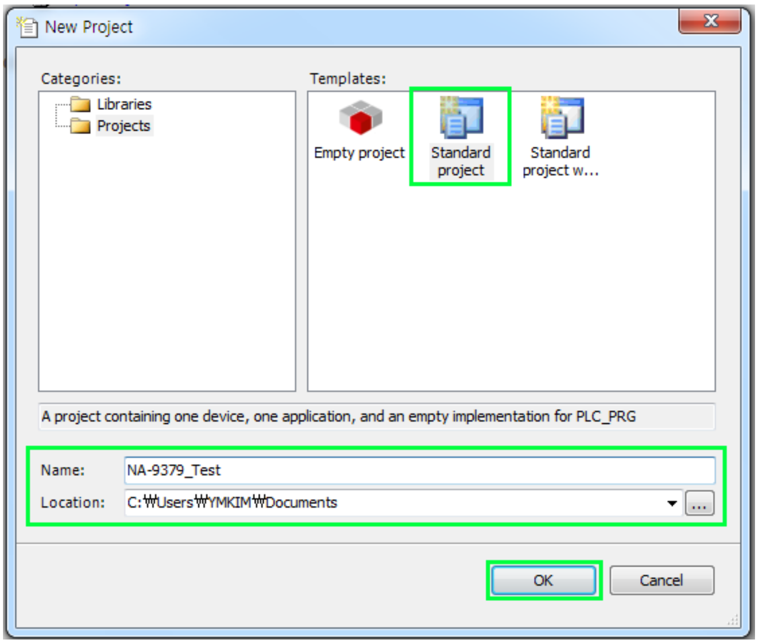


Name	Vendor	Version
Miscellaneous		
Slot	CREVIS	1.0.0.0

7.2.2. Created Project

(1) Run the CoDeSys program.

(2) [File] → [New Project], select 'Standard project'. Write the Project Name and Location. Click 'OK'

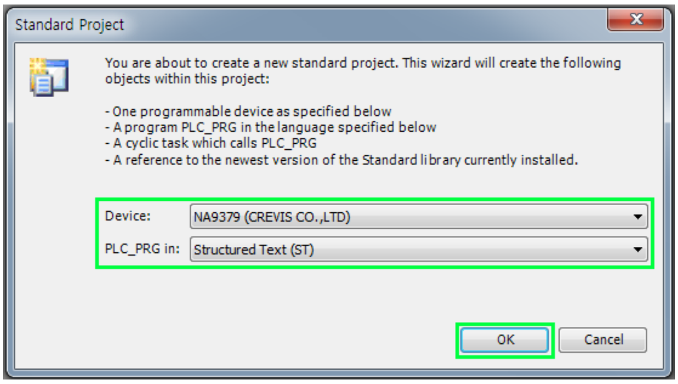


A project containing one device, one application, and an empty implementation for PLC_PRG

Name: NA-9379_Test

Location: C:₩Users₩YMKIM₩Documents

(3) Select Device : NA-9371/2/3, select the Programming Language.



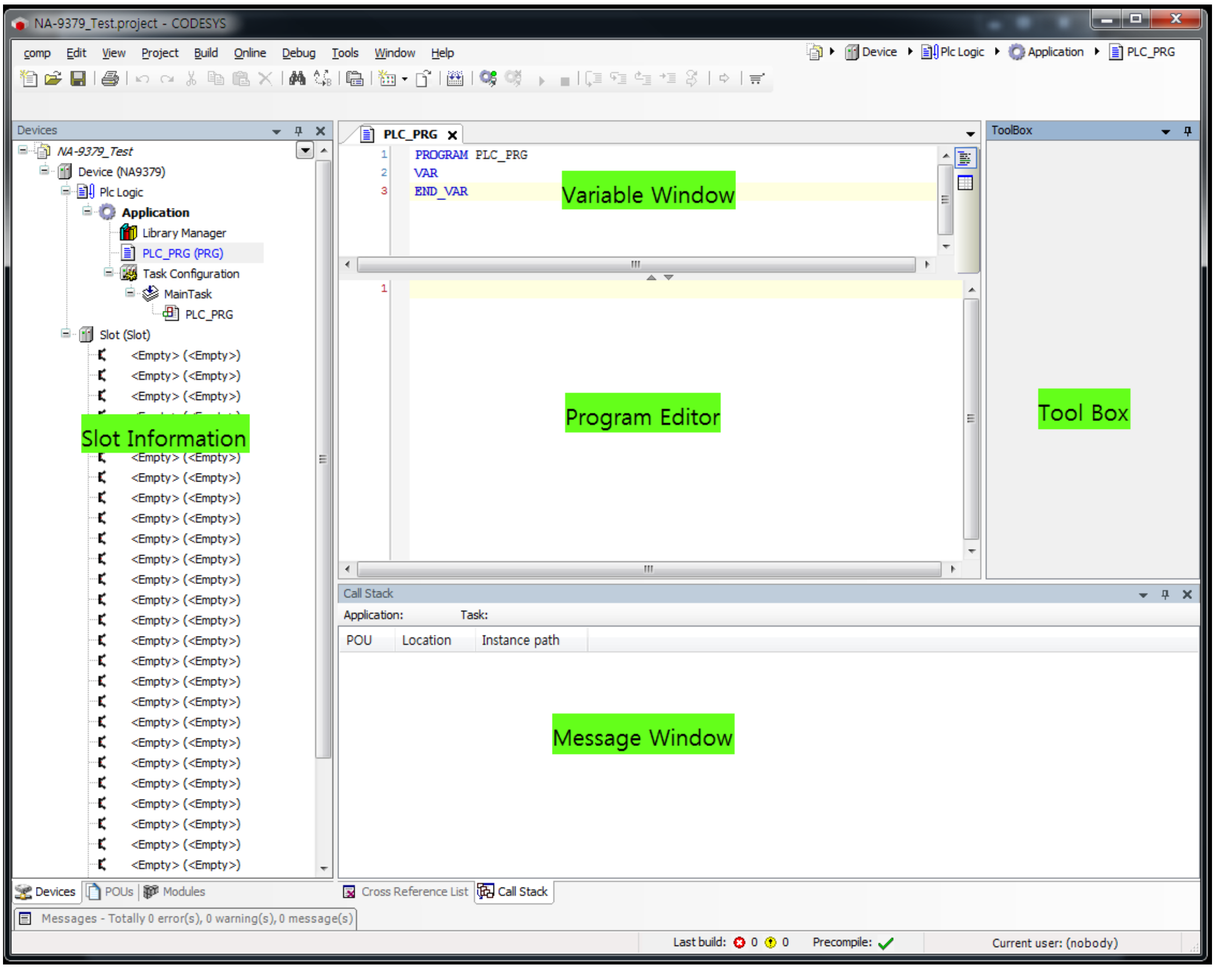
Standard Project

You are about to create a new standard project. This wizard will create the following objects within this project:

- One programmable device as specified below
- A program PLC_PRG in the language specified below
- A cyclic task which calls PLC_PRG
- A reference to the newest version of the Standard library currently installed.

Device: NA9379 (CREVIS CO.,LTD)
PLC_PRG in: Structured Text (ST)

7.2.3. CoDeSys User Interface



NA-9379_Test.project - CODESYS

```
PROGRAM PLC_PRG
VAR
END_VAR
```

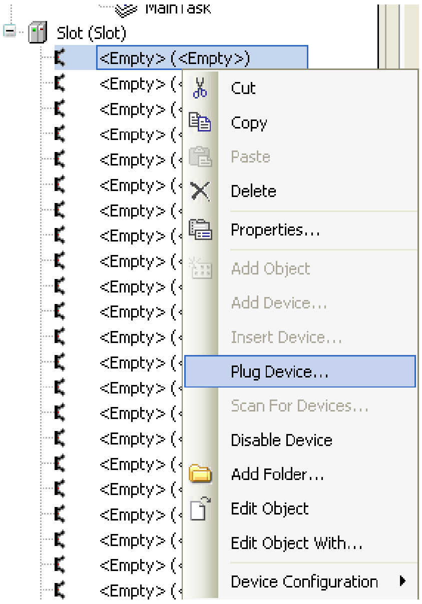
Messages - Totally 0 error(s), 0 warning(s), 0 message(s)

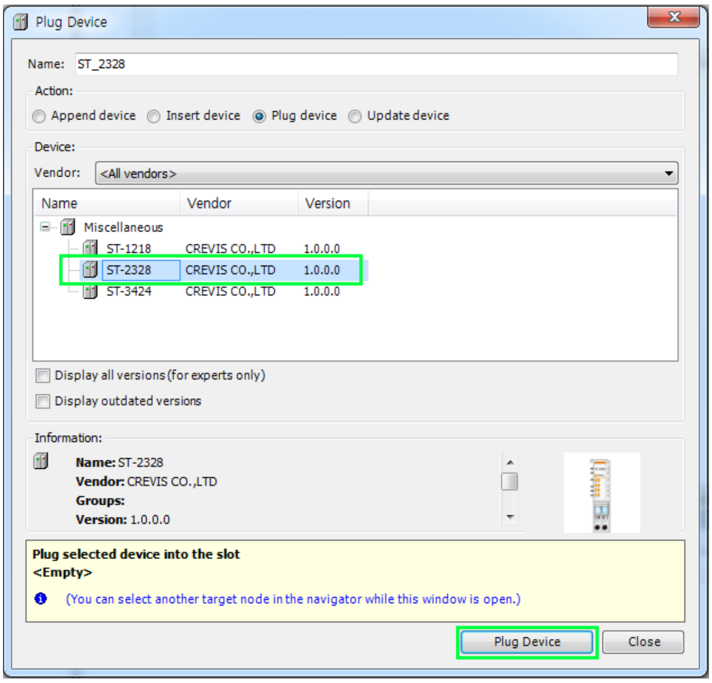
Last build: 0 0 Precompile: ✓ Current user: (nobody)

7.2.4. Setup I/O

(1) Additional Device

Click on the model you want to use, and click ‘Plug Device’.





Name: ST_2328

Action:
○ Append device ○ Insert device ● Plug device ○ Update device

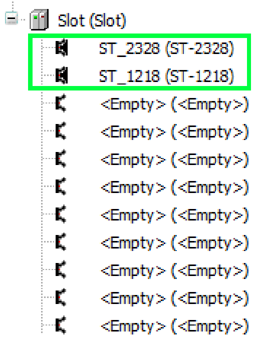
Device:
Vendor: <All vendors>

Name	Vendor	Version
Miscellaneous		
ST-1218	CREVIS CO.,LTD	1.0.0.0
ST-2328	CREVIS CO.,LTD	1.0.0.0
ST-3424	CREVIS CO.,LTD	1.0.0.0

☐ Display all versions (for experts only)
☐ Display outdated versions

Information:
Name: ST-2328
Vendor: CREVIS CO.,LTD
Groups:
Version: 1.0.0.0

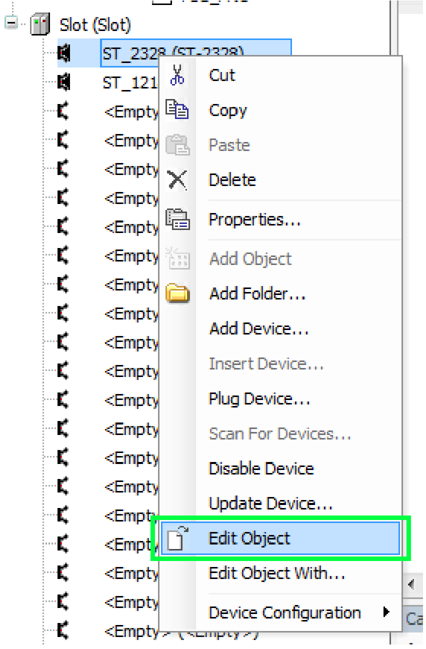
Plug selected device into the slot
<Empty>
(You can select another target node in the navigator while this window is open.)



IMPORTANT	For the normal operation, you must select the module image in order through the CoDeSys like the user configuration. Auto Scan is not supported.

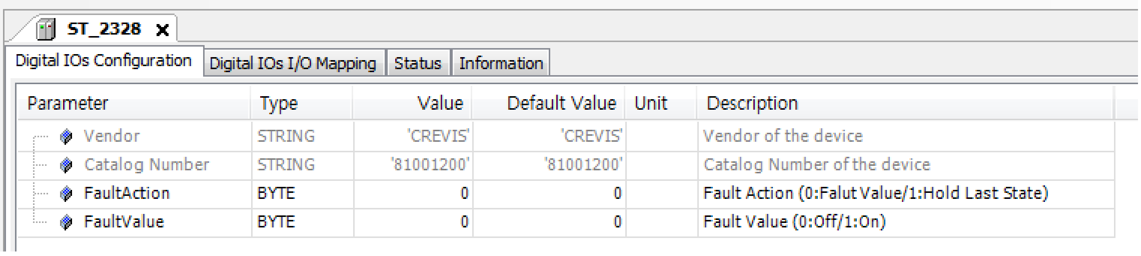
(2) Setting Device Parameter and IO Mapping

Click IO → Right click → Click ‘Edit object’.



- **Parameter setting**

  Click ‘Digital IOs Configuration’

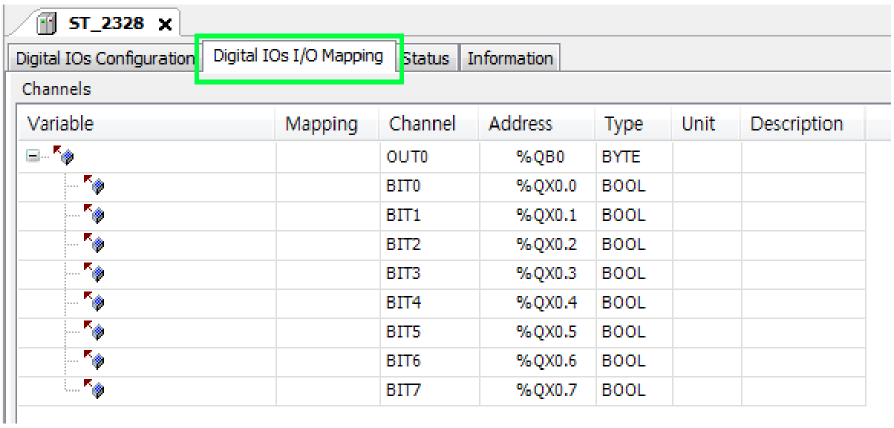


Parameter	Type	Value	Default Value	Unit	Description
Vendor	STRING	'CREVIS'	'CREVIS'		Vendor of the device
Catalog Number	STRING	'81001200'	'81001200'		Catalog Number of the device
FaultAction	BYTE	0	0		Fault Action (0:Falut Value/1:Hold Last State)
FaultValue	BYTE	0	0		Fault Value (0:Off/1:On)

<u> The setting unit of the parameter is bytes.</u>*

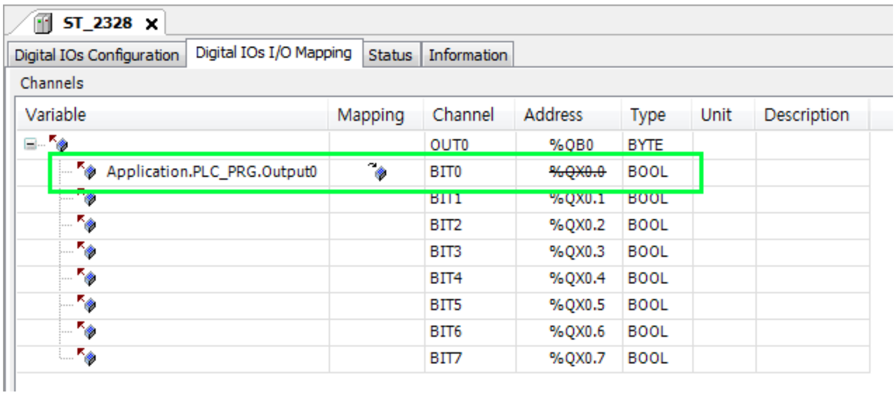
- **IO Mapping**
  Click 'Digital IOs I/O Mapping'

If there are no set values in the red square, you can program the variable area set by the address.



Variable	Mapping	Channel	Address	Type	Unit	Description
		OUT0	%QB0	BYTE		
		BIT0	%QX0.0	BOOL		
		BIT1	%QX0.1	BOOL		
		BIT2	%QX0.2	BOOL		
		BIT3	%QX0.3	BOOL		
		BIT4	%QX0.4	BOOL		
		BIT5	%QX0.5	BOOL		
		BIT6	%QX0.6	BOOL		
		BIT7	%QX0.7	BOOL		

If you use the variable set by the POU or GVL, you can use the variable area after deleting the variable in the address.



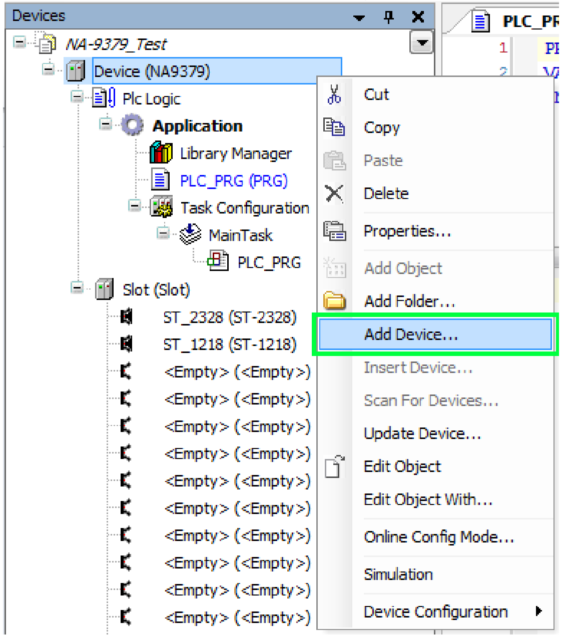
Variable	Mapping	Channel	Address	Type	Unit	Description
		OUT0	%QB0	BYTE		
Application.PLC_PRG.Output0		BIT0	~~%QX0.0~~	BOOL		
		BIT1	%QX0.1	BOOL		
		BIT2	%QX0.2	BOOL		
		BIT3	%QX0.3	BOOL		
		BIT4	%QX0.4	BOOL		
		BIT5	%QX0.5	BOOL		
		BIT6	%QX0.6	BOOL		
		BIT7	%QX0.7	BOOL		

7.3. MODBUS TCP Setting

7.3.1. TCP Master and slave Setting

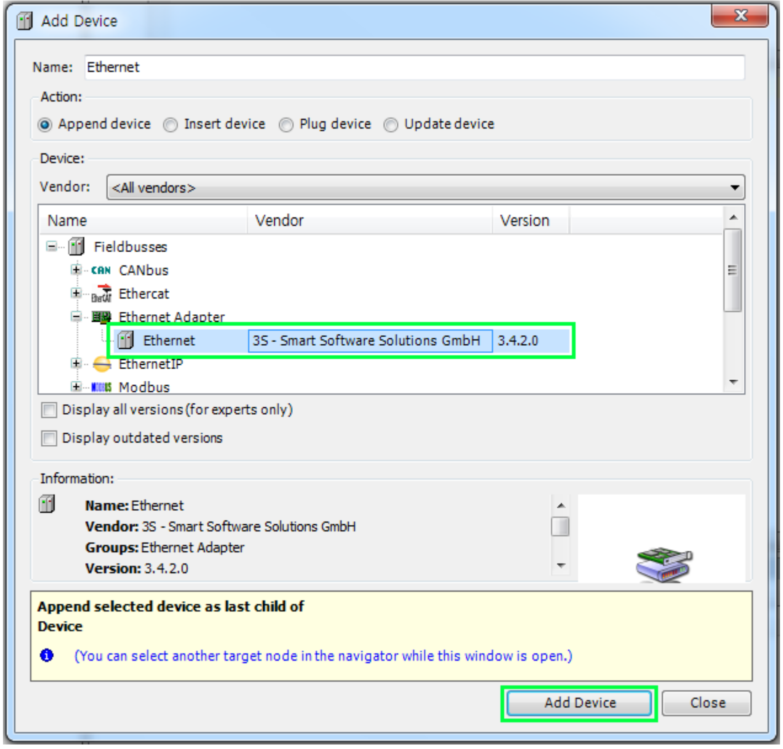
(1) Add Device

Click Device(NA-9371/2/3) → right click → Click ‘Add Device…’.



(2) Add Ethernet Adapter

Click ‘Fieldbus’ → ‘Ethernet Adapter’ → ‘Ethernet’ and ‘Add Device’ Click.



Name: Ethernet

Action: ● Append device ○ Insert device ○ Plug device ○ Update device

Vendor: <All vendors>

Name	Vendor	Version
Ethernet	3S - Smart Software Solutions GmbH	3.4.2.0

☐ Display all versions (for experts only)

☐ Display outdated versions

Information:

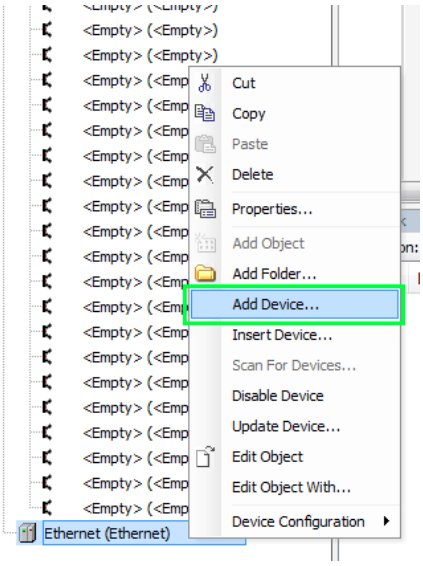
Name: Ethernet
Vendor: 3S - Smart Software Solutions GmbH
Groups: Ethernet Adapter
Version: 3.4.2.0

Append selected device as last child of
Device

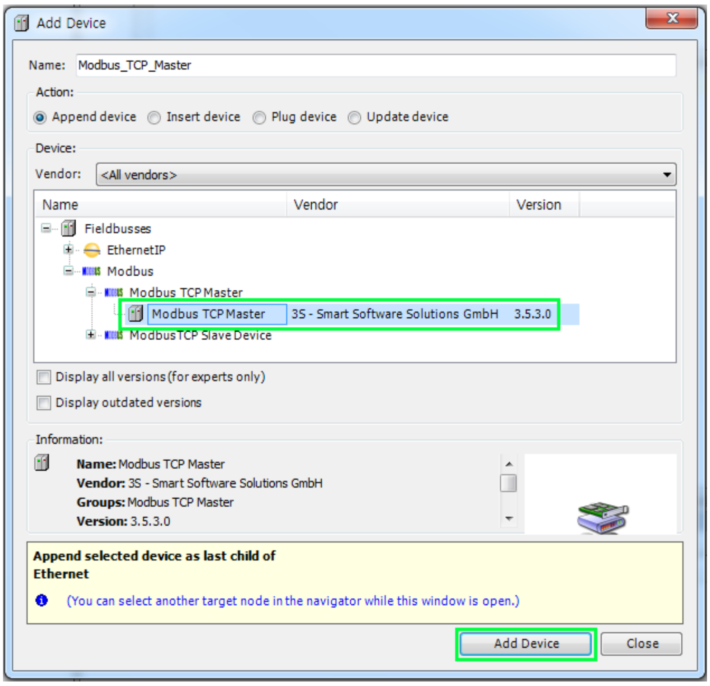
(You can select another target node in the navigator while this window is open.)

(3) Add Device after Selecting Ethernet and Add MODBUS TCP Master

Click Ethernet (Ethernet) → right click → Click 'Add Device'



Click 'Fieldbuses' → 'Modbus TCP Master' → 'Modbus TCP Master' and 'Add Device' Click.



Name: Modbus_TCP_Master

Action:

● Append device ○ Insert device ○ Plug device ○ Update device

Device:

Vendor: <All vendors>

Name	Vendor	Version
Fieldbusses		
EthernetIP		
Modbus		
Modbus TCP Master		
Modbus TCP Master	3S - Smart Software Solutions GmbH	3.5.3.0
ModbusTCP Slave Device		

☐ Display all versions (for experts only)

☐ Display outdated versions

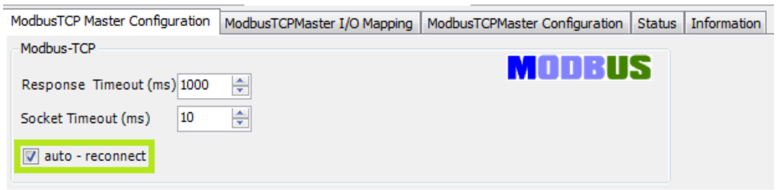
Information:

Name: Modbus TCP Master
Vendor: 3S - Smart Software Solutions GmbH
Groups: Modbus TCP Master
Version: 3.5.3.0

Append selected device as last child of Ethernet

(You can select another target node in the navigator while this window is open.)

To use the continuously without disconnection, it should be checked the "auto-reconnect".


ModbusTCP Master Configuration
ModbusTCPMaster I/O Mapping
ModbusTCPMaster Configuration
Status
Information
MODBUS

Modbus-TCP

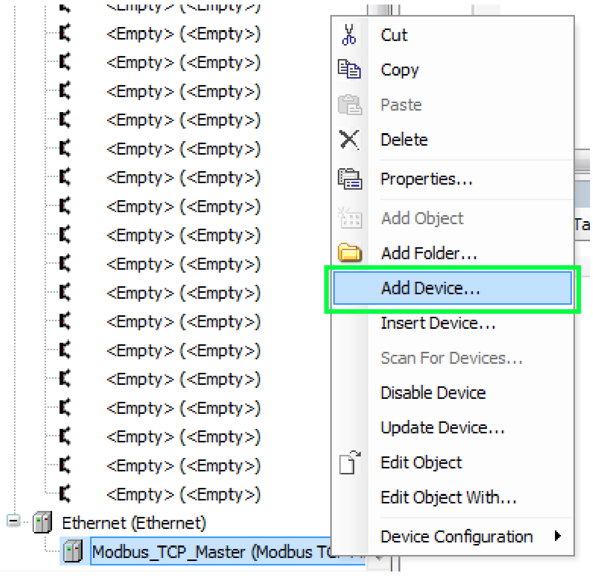
Response Timeout (ms) 1000

Socket Timeout (ms) 10

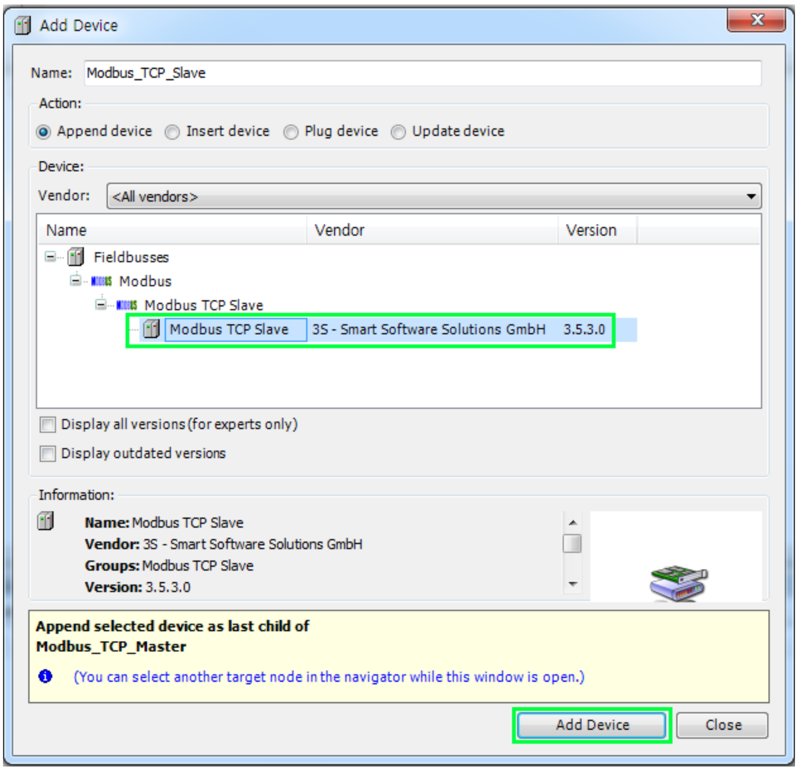
☑ auto - reconnect

(4) Add Device after adding MODBUS TCP Master and Add Modbus TCP Slave

Click Modbus_TCP_Master → right click → Click ‘Add Device’



Click ‘Fieldbuses’ → ‘Modbus’ → ‘Modbus TCP Slave’ → ‘Modbus TCP Slave’ and ‘Add Device’ Click.



Name: Modbus_TCP_Slave

Action:

● Append device ○ Insert device ○ Plug device ○ Update device

Device:

Vendor: <All vendors>

Name	Vendor	Version
Fieldbusses		
Modbus		
Modbus TCP Slave		
Modbus TCP Slave	3S - Smart Software Solutions GmbH	3.5.3.0

☐ Display all versions (for experts only)

☐ Display outdated versions

Information:

Name: Modbus TCP Slave
Vendor: 3S - Smart Software Solutions GmbH
Groups: Modbus TCP Slave
Version: 3.5.3.0

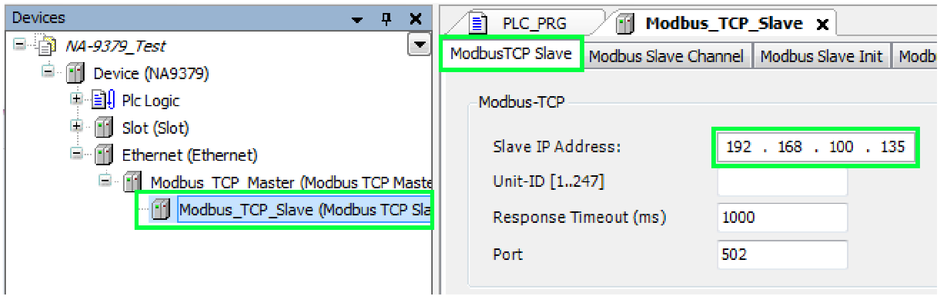
Append selected device as last child of
Modbus_TCP_Master

(You can select another target node in the navigator while this window is open.)

(5) Configuration the ModbusTCP Slave

Click ‘Modbus_TCP_Slave’(Modbus TCP Slave)

Write Slave IP Address (NA-9371/2/3)



Slave IP Address: 192 . 168 . 100 . 135

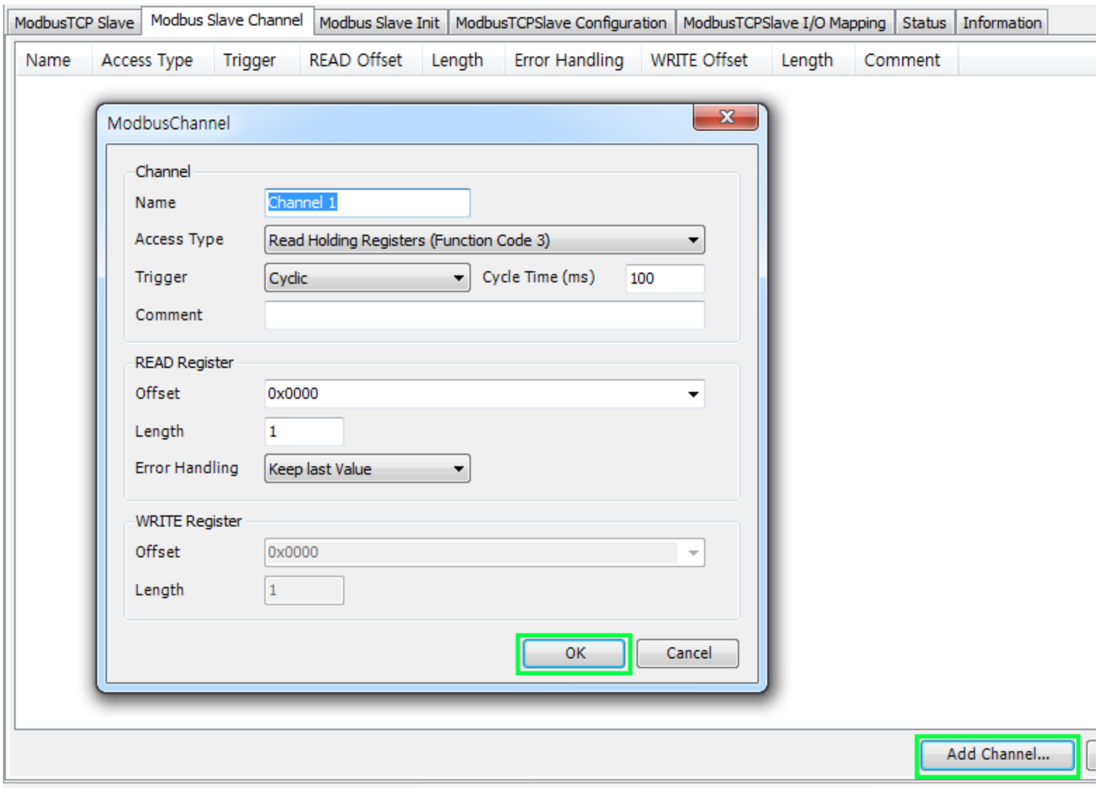
Unit-ID [1..247]

Response Timeout (ms) 1000

Port 502

Click ‘Modbus Slave Channel’

Add a channel of NA-9371/2/3 and Modify Cycle Time



Channel

Name: Channel 1

Access Type: Read Holding Registers (Function Code 3)

Trigger: Cyclic Cycle Time (ms): 100

Comment:

READ Register

Offset: 0x0000

Length: 1

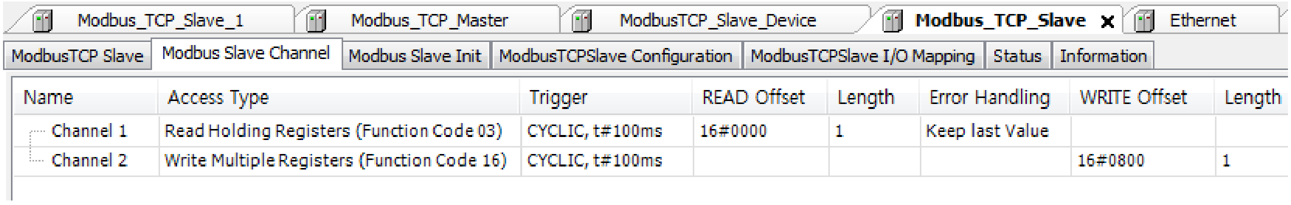
Error Handling: Keep last Value

WRITE Register

Offset: 0x0000

Length: 1

** Default Cycle Time(ms) : 100ms.*



Name	Access Type	Trigger	READ Offset	Length	Error Handling	WRITE Offset	Length
Channel 1	Read Holding Registers (Function Code 03)	CYCLIC, t#100ms	16#0000	1	Keep last Value		
Channel 2	Write Multiple Registers (Function Code 16)	CYCLIC, t#100ms				16#0800	1

7.3.2. TCP Slave Setting

(1) PIO TCP slave Device

In order to use the PIO as TCP slave, it does not need to set nothing.
PIO address is assigned as like other CREVIS modbus slave module address.

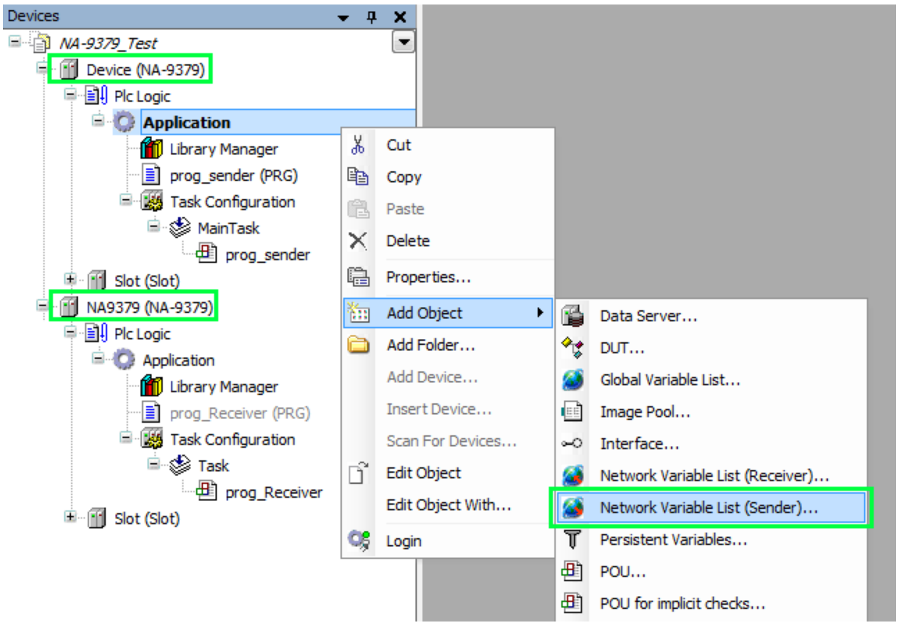
Address	IEC Address	Contents
0x0000~0x07FF	%IW0~%IW2047	2048 words Input and Internal memory (Area is write-protected)
0x0800~0x0FFF	%QW0~%QW2047	2048 words Output and Internal memory (Area is write-enabled)
0x1000~0x1FFF	-	Special Function Register (PIO Information)
0x2000~0x2FFF	-	Special Function Register (Slot Information)
0x4000~0x5FFF	%MW0~%MW8191	2048 words Internal memory (Area is write-enabled)

User can set the variable set as like below.

```
Variable_Bit : BOOL TO PIONTER :=ADR(%MX0.0);
Variable_Byte : BYTE TO PIONTER :=ADR(%MB0);
Variable_Word : WORD TO PIONTER :=ADR(%MW0);
```

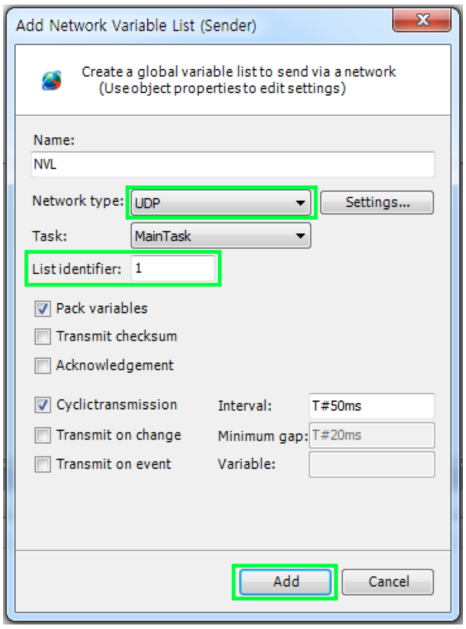
7.4. Network Variable

(1) Click 'Application' → Right click and click 'Add Object' → Click 'Network Variable List (Sender)'.



<u> You have to add one more devices in the devices tree.</u>*

(2) Define the network properties of the sender GVL



Create a global variable list to send via a network
(Use object properties to edit settings)

Name: NVL

Network type: UDP

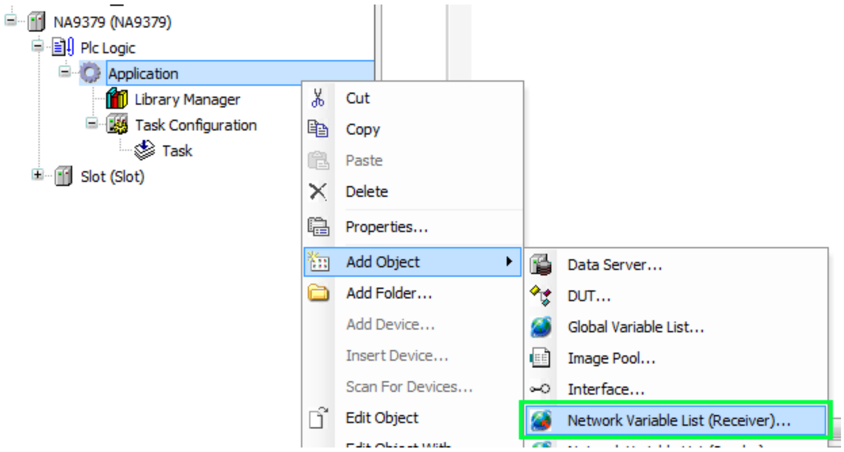
Task: MainTask

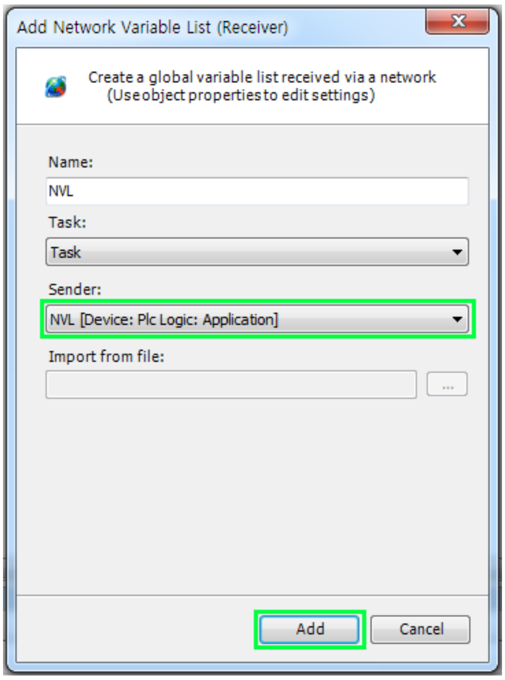
List identifier: 1

☑ Pack variables
☐ Transmit checksum
☐ Acknowledgement
☑ Cyclictransmission Interval: T#50ms
☐ Transmit on change Minimum gap: T#20ms
☐ Transmit on event Variable:

<u> You have to select UDP as network type.</u>*
<u> List identifier and Node ID is the same concept.</u>*

(3) Add a Global Network Variable List in the Receiver




Add Network Variable List (Receiver)
Create a global variable list received via a network
(Use object properties to edit settings)

Name: NVL

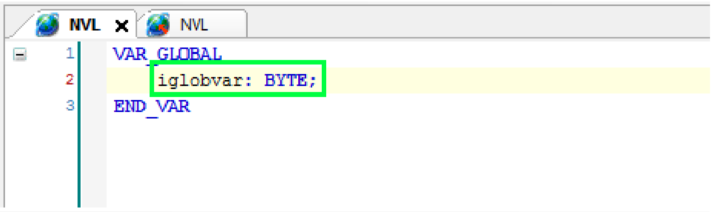
Task: Task

Sender: NVL [Device: Plc Logic: Application]

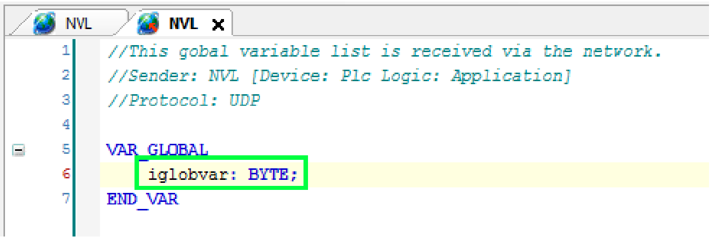
Import from file:

* You find a selection list of all GVLs with network properties currently available in the project.

(4) Created by Global Variables.



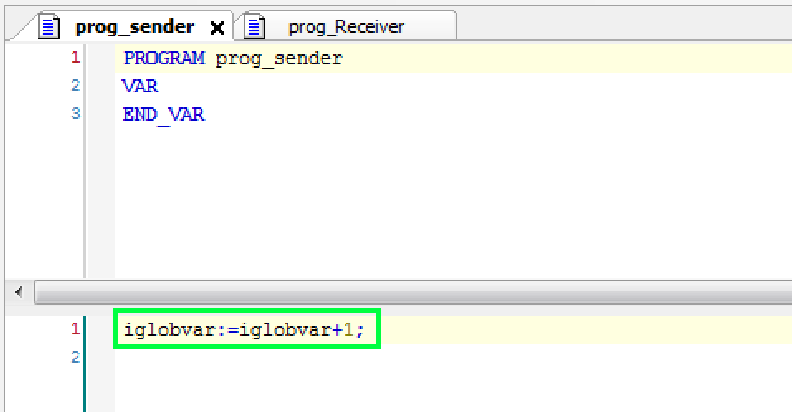
```
VAR_GLOBAL
    iglobvar: BYTE;
END_VAR
```



```
//This gobal variable list is received via the network.
//Sender: NVL [Device: Plc Logic: Application]
//Protocol: UDP

VAR_GLOBAL
    iglobvar: BYTE;
END_VAR
```

(5) It is possible to create a program using a global variable.

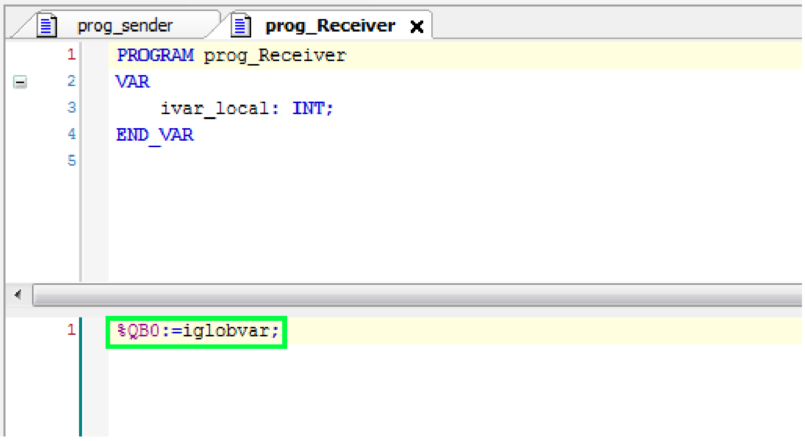
- in prog_sender in the sender application enter the following use of variable iglobvar.



```
PROGRAM prog_sender
VAR
END_VAR
```

```
iglobvar:=iglobvar+1;
```

- in prog_Receiver in the receiver application also use variable iglobvar.



```
PROGRAM prog_Receiver
VAR
    ivar_local: INT;
END_VAR
```

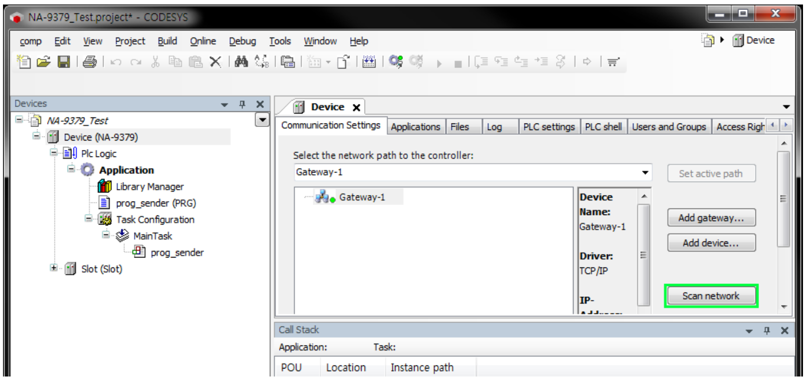
```
%QB0:=iglobvar;
```

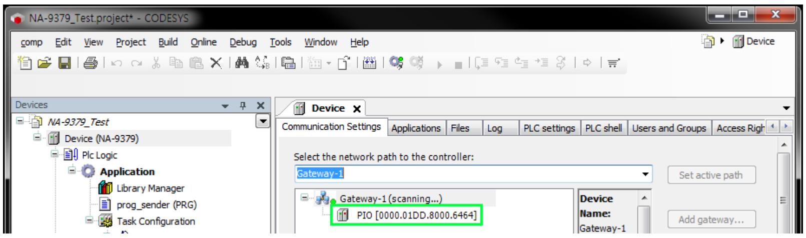
7.5. Download and Monitoring

(1) Communication Settings

- **Scan network(UDP)**

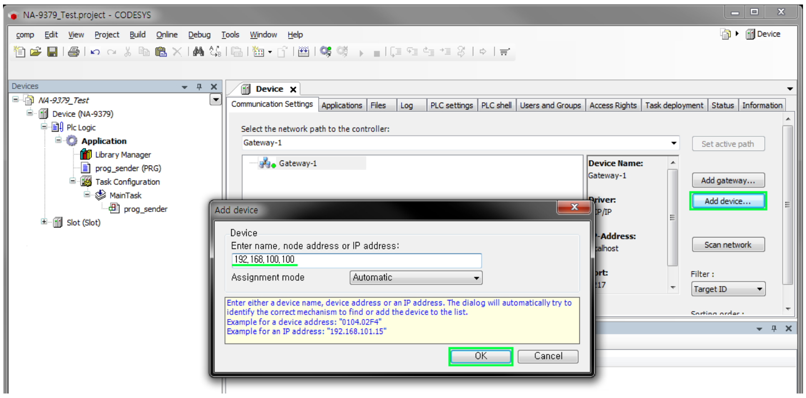
[Device] → [Communication Settings], click ‘Scan network’.
After completing the search, double click the Gateway icon to make it activated.





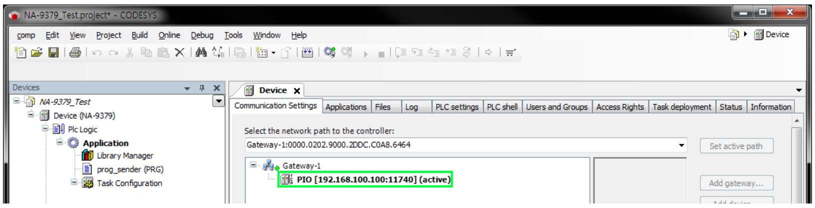
- **Add device(TCP)**

[Device] → [Communication Settings], click ‘Add device’.
After write the IP address and click ‘OK’ , double click the Gateway icon to make it activated.



Enter name, node address or IP address: 192.168.100.100
Assignment mode: Automatic

Enter either a device name, device address or an IP address. The dialog will automatically try to identify the correct mechanism to find or add the device to the list.
Example for a device address: "0104.02F4"
Example for an IP address: "192.168.101.15"

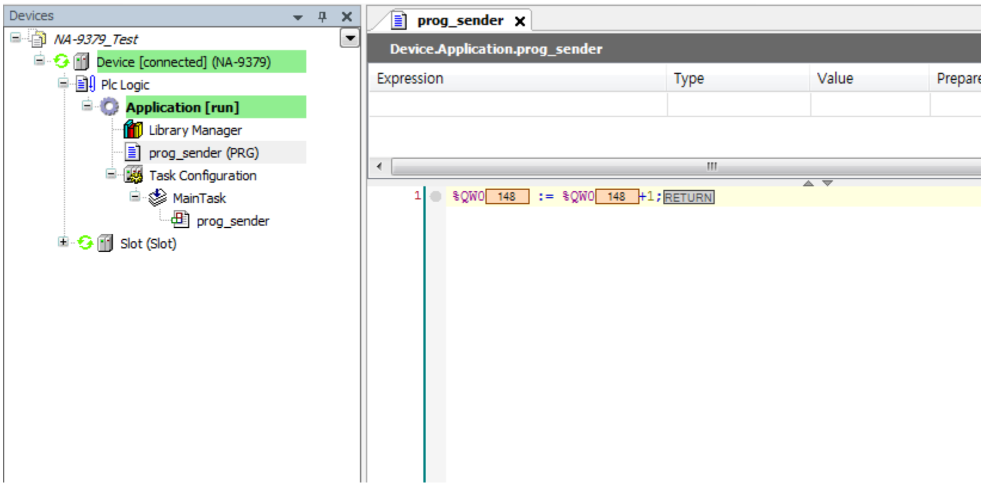

NA-9379_Test.project* - CODESYS
Device
Communication Settings
Select the network path to the controller:
Gateway-1
Set active path
Add gateway...

Gateway-1:0000.0202.9000.2DDC.C0A8.6464

PIO [192.168.100.100:11740] (active)

(2) Login

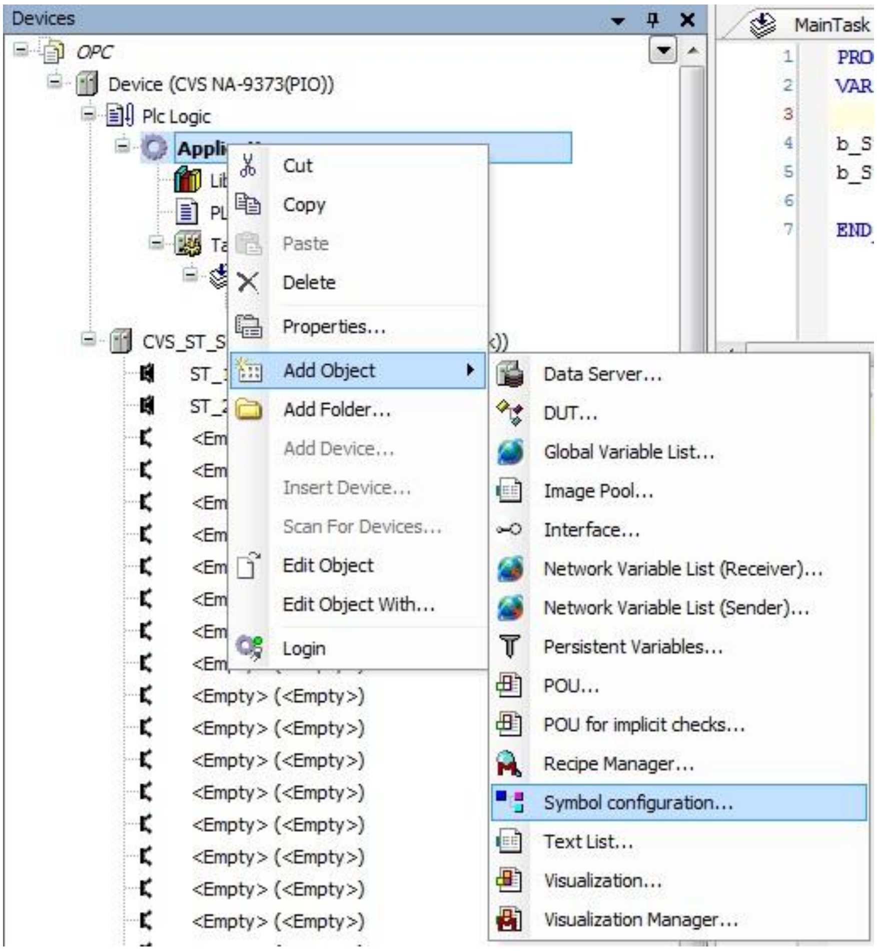
[Online] → [Login] → Download to Application → Entry into Monitoring Mode → [Debug] → [RUN]



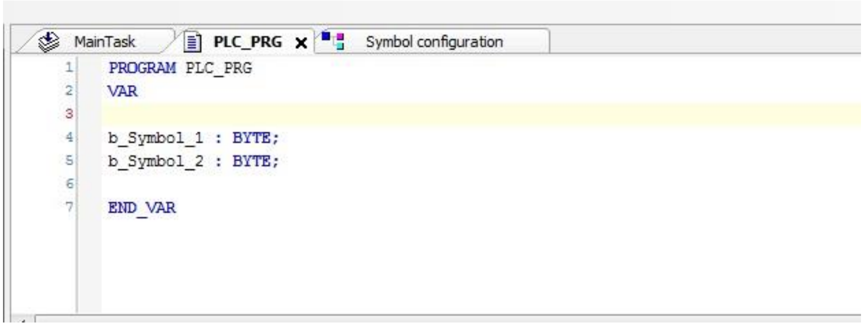
```
%QW0 148 := %QW0 148 +1; RETURN
```

7.6. OPC Server (NA-9372/73 only)

(1) Add the Symbolic Configuration to Application project

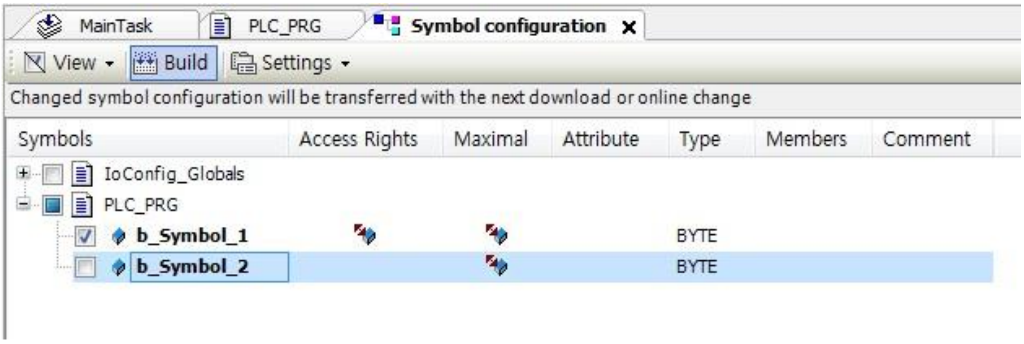


(2) Define the Symbolic variable to make with OPC variable.



```
PROGRAM PLC_PRG
VAR

b_Symbol_1 : BYTE;
b_Symbol_2 : BYTE;

END_VAR
```

(3) At the Symbol configuration screen, after click the “build” button, the defined variable will be appeared. In order to OPC server activate,

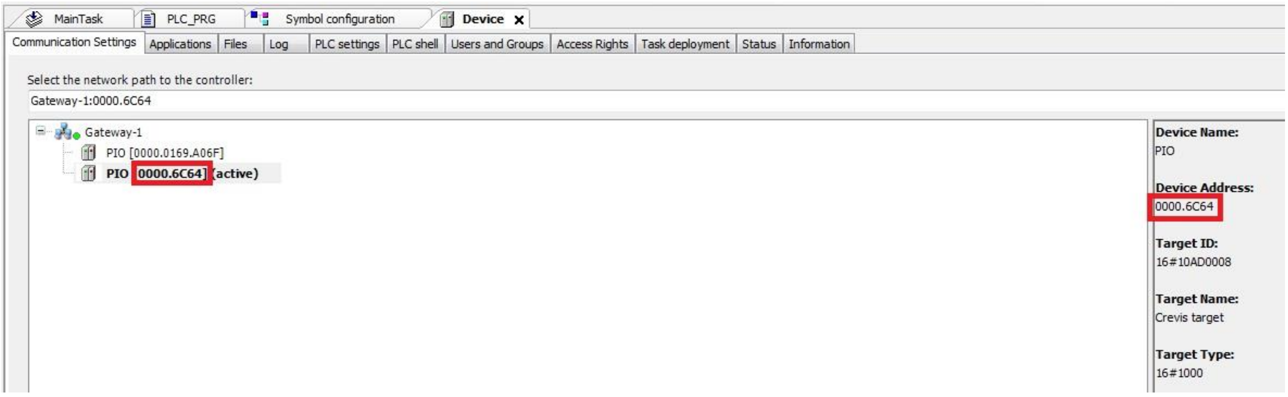


Changed symbol configuration will be transferred with the next download or online change

Symbols	Access Rights	Maximal	Attribute	Type	Members	Comment
☐ IoConfig_Globals						
PLC_PRG						
☑ b_Symbol_1				BYTE		
☐ b_Symbol_2				BYTE		

User can set this variable to expose to outside or not as OPC variable in using click the radio button on it.

(4) In order to set the OPC configurator, user should know either Device address or IP address when it used by TCP/IP mode.



Select the network path to the controller:
Gateway-1:0000.6C64

Gateway-1
PIO [0000.0169.A06F]
PIO [0000.6C64] (active)

Device Name:
PIO

Device Address:
0000.6C64

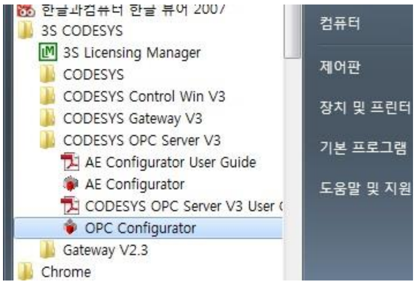
Target ID:
16#10AD0008

Target Name:
Crevis target

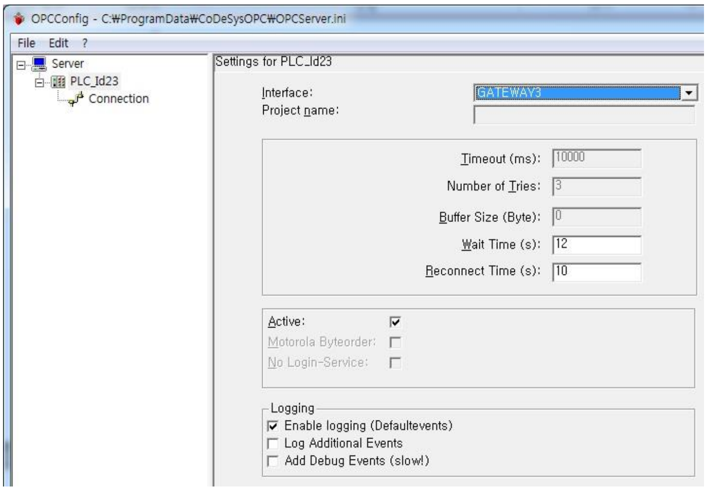
Target Type:
16#1000

Click the add device, user can choose the TCP/IP mode.

(5) To use the OPC server variable at outside of PIO, user should Set the OPC configurator, Click the OPC configurator in the windows menu.



(6) On the OPC configurator, choose the "GATEWAY3" interface.



Settings for PLC_Id23

Interface: GATEWAY3
Project name:

Timeout (ms): 10000
Number of Tries: 3
Buffer Size (Byte): 0
Wait Time (s): 12
Reconnect Time (s): 10

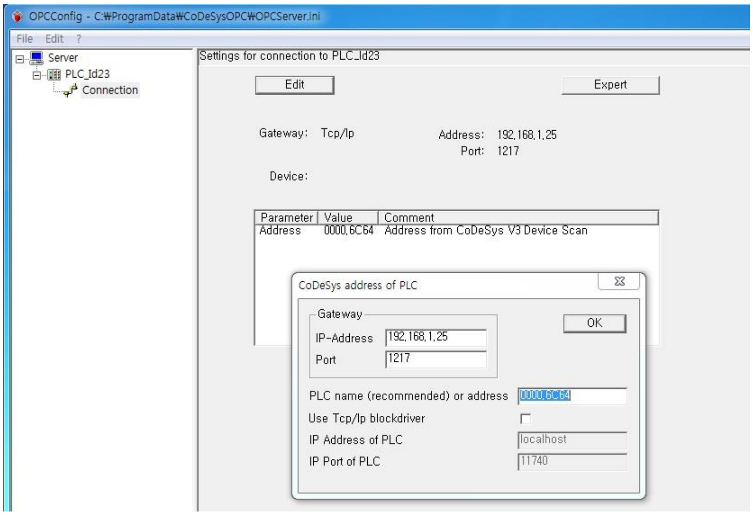
Active: ☑
Motorola Byteorder: ☐
No Login-Service: ☐

☑ Enable logging (Defaultevents)
☐ Log Additional Events
☐ Add Debug Events (slow!)

(7) At the Connection tap, click the Edit button.

Input the PLC name(Refer the (4) section.).

Gateway IP address should be set the PC address(gateway), the Port number should be 1217.



Settings for connection to PLC_Id23

Gateway: Tcp/Ip
Address: 192.168.1.25
Port: 1217

Device:

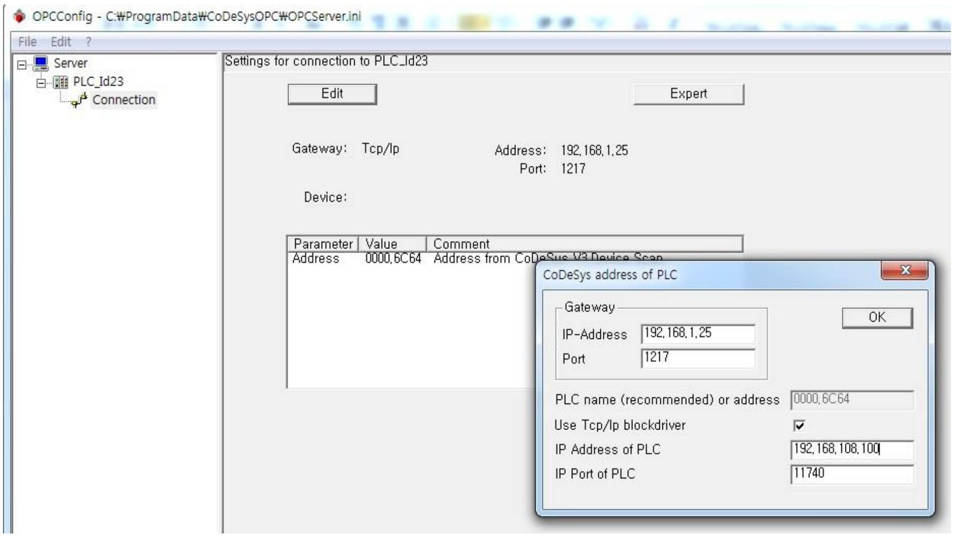
Parameter	Value	Comment
Address	0000.6C64	Address from CoDeSys V3 Device Scan

IP-Address: 192.168.1.25
Port: 1217

PLC name (recommended) or address: 0000.6C64
Use Tcp/Ip blockdriver: ☐
IP Address of PLC: localhost
IP Port of PLC: 11740

(8) TCP mode OPC configuration setting

If it is operated with TCP/IP mode, check the "Use TCP/IP blockdriver" tap and put the IP address of PLC. Set the PIO IP address into the IP address of PLC. The IP Port of PLC should be '11740'.



OPCConfig - C:₩ProgramData₩CoDeSysOPC₩OPCServer.ini

Settings for connection to PLC_Id23

Gateway: Tcp/Ip

Address: 192.168.1.25
Port: 1217

Device:

Parameter	Value	Comment
Address	0000.6C64	Address from CoDeSys V3 Device Scan

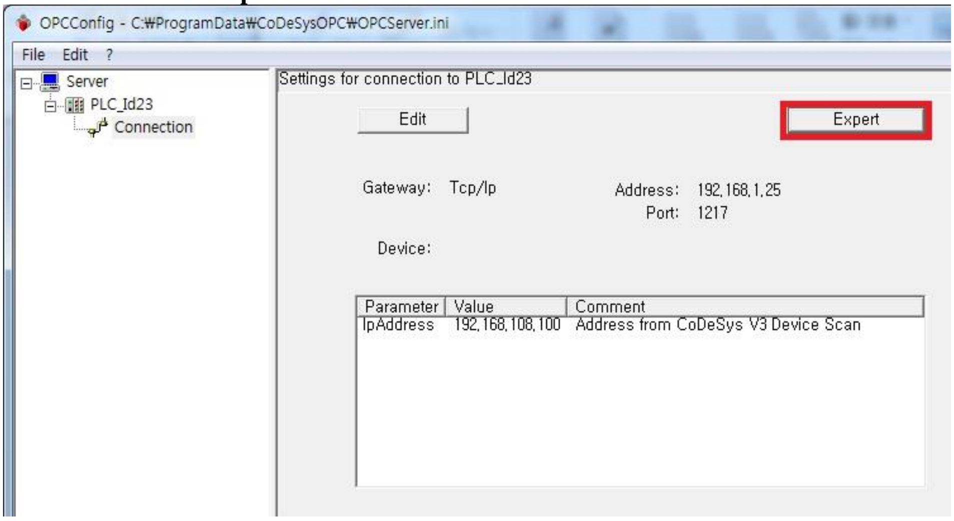
CoDeSys address of PLC

Gateway
IP-Address 192.168.1.25
Port 1217

PLC name (recommended) or address 0000.6C64
Use Tcp/Ip blockdriver ☑
IP Address of PLC 192.168.108.100
IP Port of PLC 11740

(9) Save and completion

After set the all of OPC configurator setting, user should click the expert and save. If it doesn`t do that, OPC server could not be operated.



OPCConfig - C:₩ProgramData₩CoDeSysOPC₩OPCServer.ini

Settings for connection to PLC_Id23

Gateway: Tcp/Ip

Address: 192.168.1.25
Port: 1217

Device:

Parameter	Value	Comment
IpAddress	192.168.108.100	Address from CoDeSys V3 Device Scan

7.7. ModBusRTU Master(NA-9372/93 only)

(1) **In oder to use the ModbusRTU master function, user should set the Modbus Register 1614.**

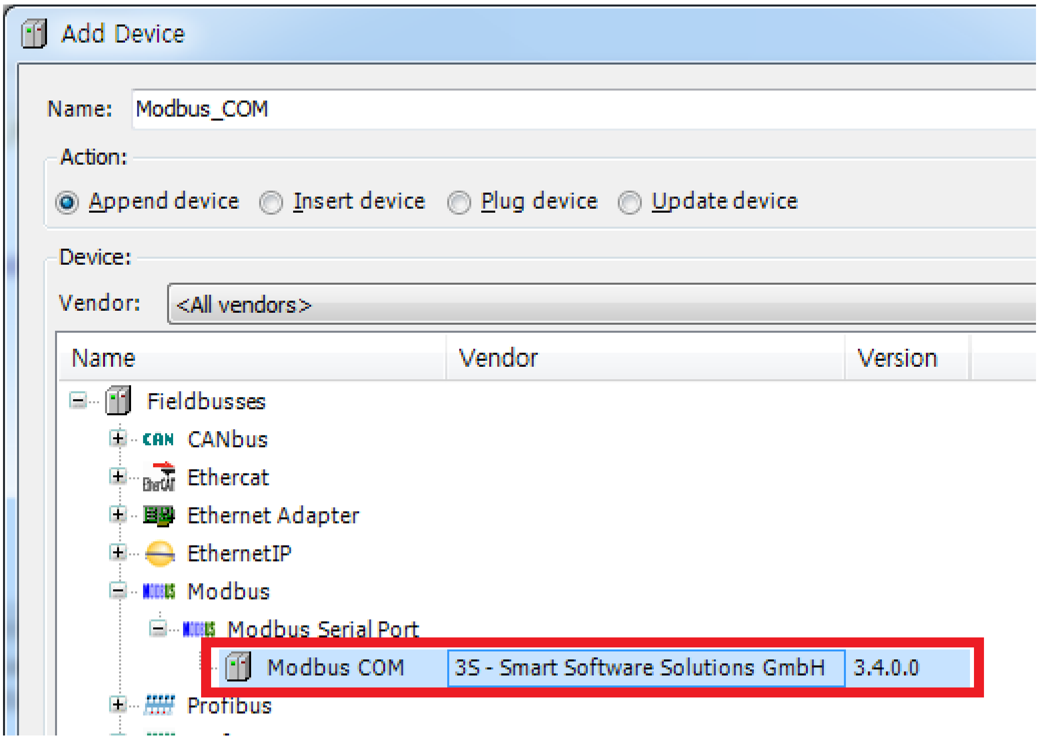
Address	Access	Type, Size	Description
0x1614(5652)*	Read/Write	1word	Serial connection Method - 0x0000 : CREVIS Modbus/RTU(Default) - 0x8000 : RS232 Enable for CoDeSys Function block - 0x8001 : RS485 Enable for CoDeSys Function block

User can set using by IO guide pro or Modbus communication tool.

Address value	RS232C port	RS485 port
0x0000	Default (Modbus Slave)	Default (Modbus Slave)
0x8000	Codesys Setting(RTU M/Serial com)*	Default (Modbus Slave)
0x8001	Default (Modbus Slave)	Codesys Setting(RTU M/Serial com)*

*RTU Master mode or Serial communication mode for example Barcode and so on.

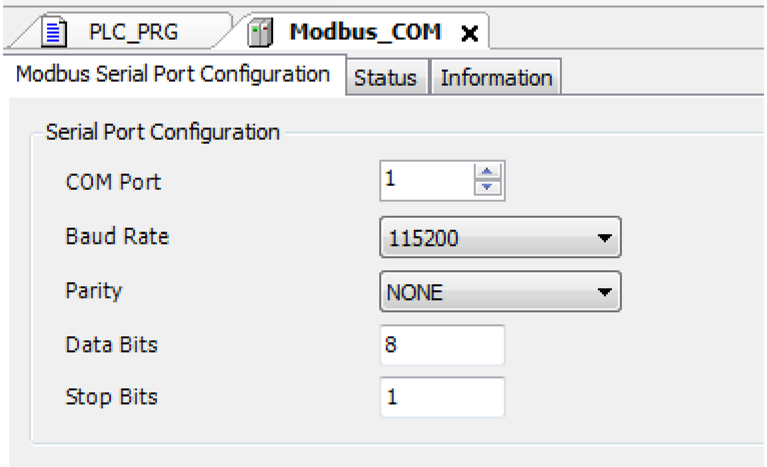
(2) **Add device for Modbus Com from ModbusSerial Port at Device tree menu.**



Name: Modbus_COM

Action: ● Append device

(3) **Set the Master port number, Baud rate, parity, Data Bits, Stop Bit and so on in Modbus Com configuration tap.**



COM Port: 1

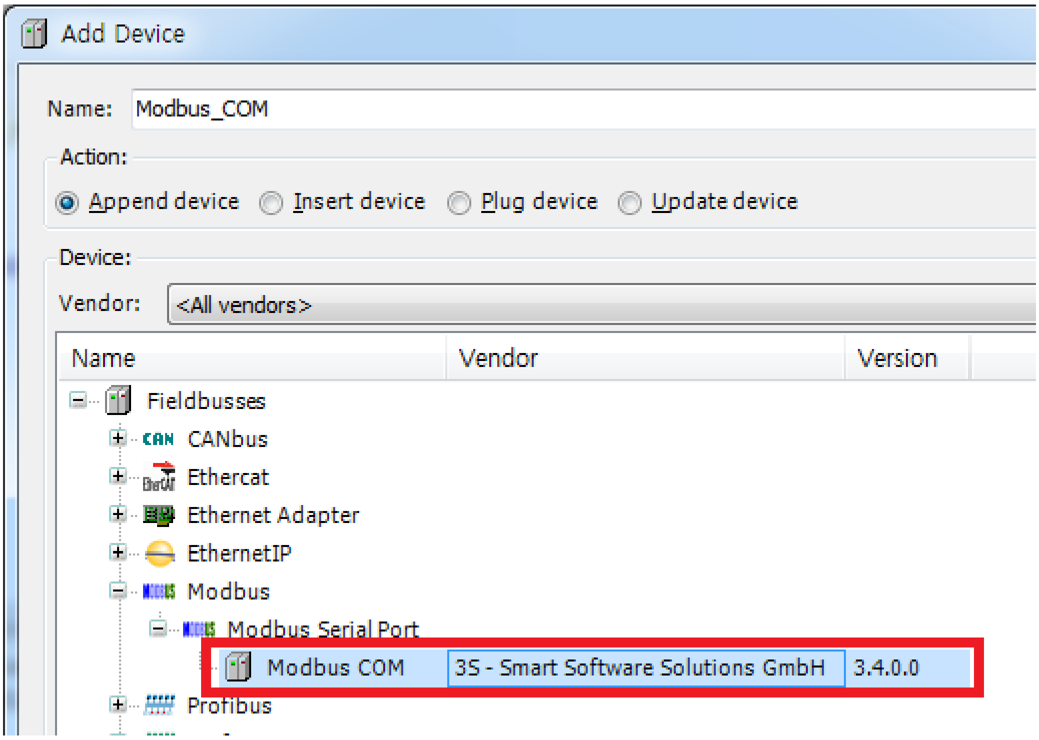
Baud Rate: 115200

Parity: NONE

Data Bits: 8

Stop Bits: 1

(4) **Add device the Modbus_Master_COM_Port at the Modbus_COM tree manu.**

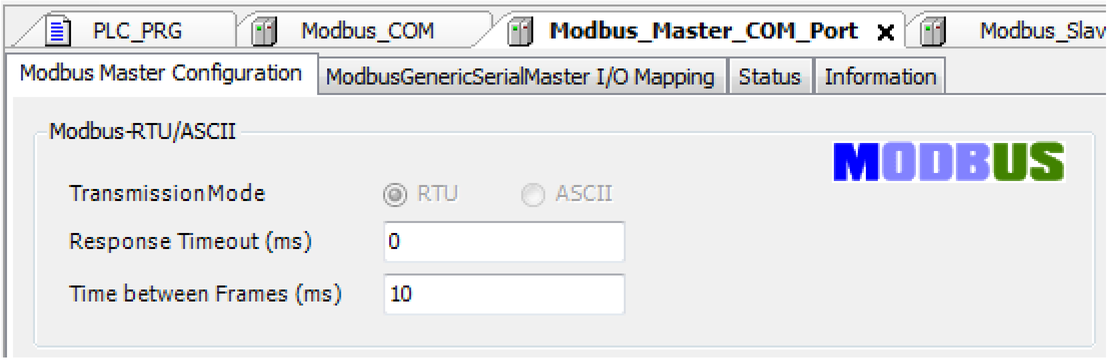


Name: Modbus_COM

Vendor: <All vendors>

Name	Vendor	Version
Modbus COM	3S - Smart Software Solutions GmbH	3.4.0.0

(5) **Set the Response Timeout and Time between frames at the Modbus_Master_COM_Port configuration tap. (It does not support the ASCII mode in PIO)**



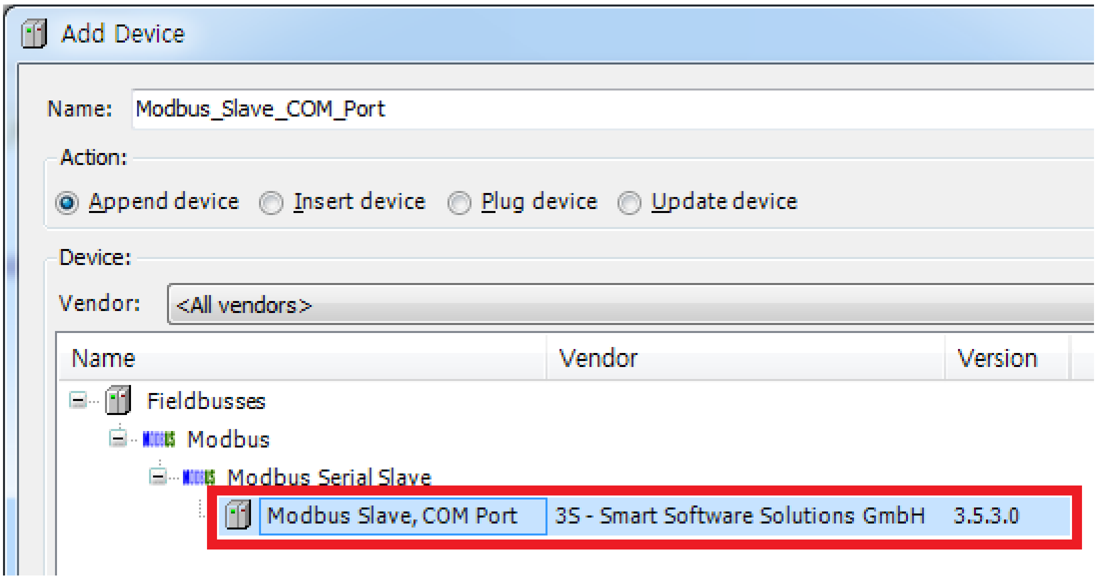
Modbus-RTU/ASCII

Transmission Mode ● RTU ○ ASCII

Response Timeout (ms) 0

Time between Frames (ms) 10

(6) **Add the device the Modbus_Slave_COM_Port at the Modbus_Master_COM_Port tree manu.**



Name: Modbus_Slave_COM_Port

Action:

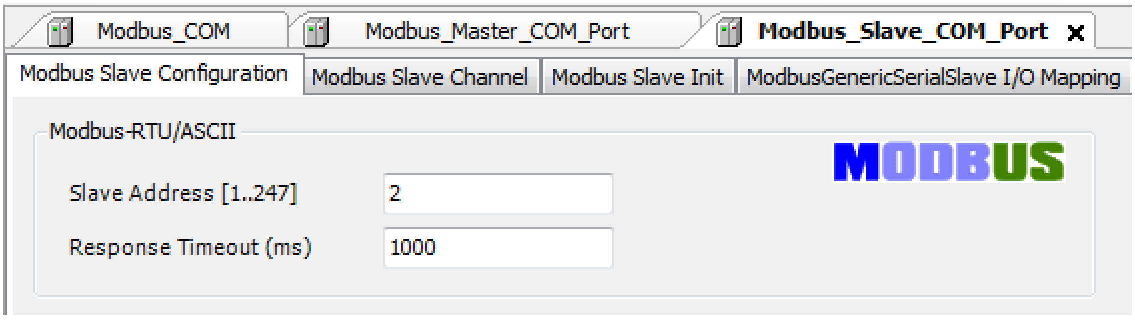
● Append device ○ Insert device ○ Plug device ○ Update device

Device:

Vendor: <All vendors>

Name	Vendor	Version
Fieldbusses		
Modbus		
Modbus Serial Slave		
Modbus Slave, COM Port	3S - Smart Software Solutions GmbH	3.5.3.0

(7) **Set the Slave address number and Response Timeout at the Modbus_Slave_COM_Port configuration tap.**

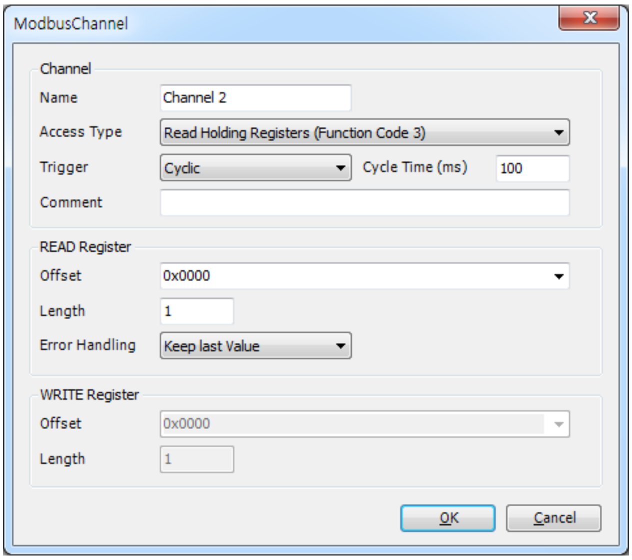


Modbus-RTU/ASCII

Slave Address [1..247] 2

Response Timeout (ms) 1000

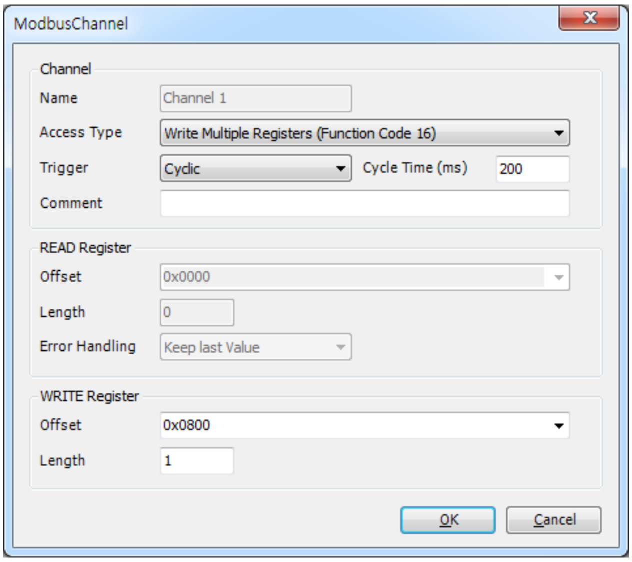
(8) **At the Modbus Slave channel tap, user can set the modbus address.**


ModbusChannel

Channel
Name: Channel 2
Access Type: Read Holding Registers (Function Code 3)
Trigger: Cyclic
Cycle Time (ms): 100
Comment:

READ Register
Offset: 0x0000
Length: 1
Error Handling: Keep last Value

WRITE Register
Offset: 0x0000
Length: 1

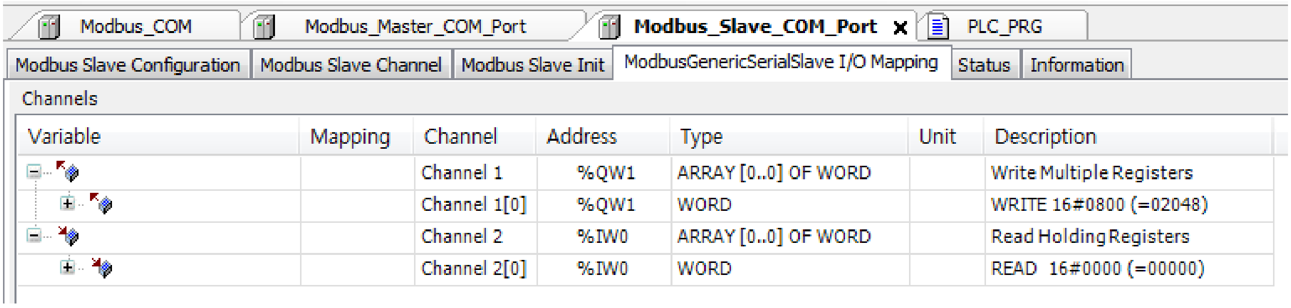

ModbusChannel

Channel
Name: Channel 1
Access Type: Write Multiple Registers (Function Code 16)
Trigger: Cyclic
Cycle Time (ms): 200
Comment:

READ Register
Offset: 0x0000
Length: 0
Error Handling: Keep last Value

WRITE Register
Offset: 0x0800
Length: 1

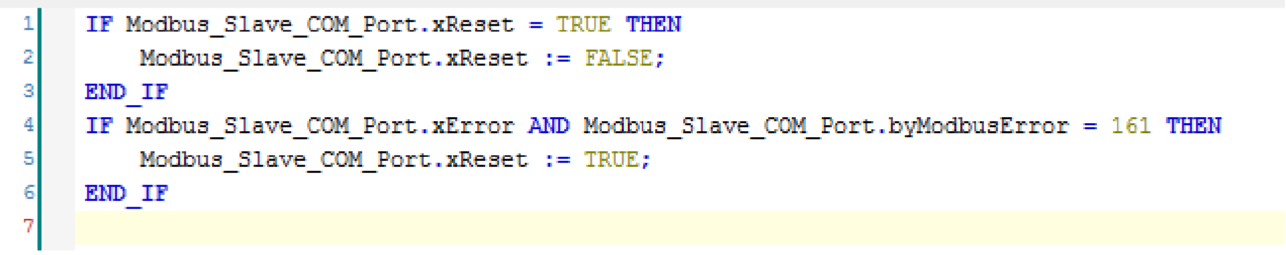
(9) **The address are as below screenshot.**



Channels

Variable	Mapping	Channel	Address	Type	Unit	Description
		Channel 1	%QW1	ARRAY [0..0] OF WORD		Write Multiple Registers
		Channel 1[0]	%QW1	WORD		WRITE 16#0800 (=02048)
		Channel 2	%IW0	ARRAY [0..0] OF WORD		Read Holding Registers
		Channel 2[0]	%IW0	WORD		READ 16#0000 (=00000)

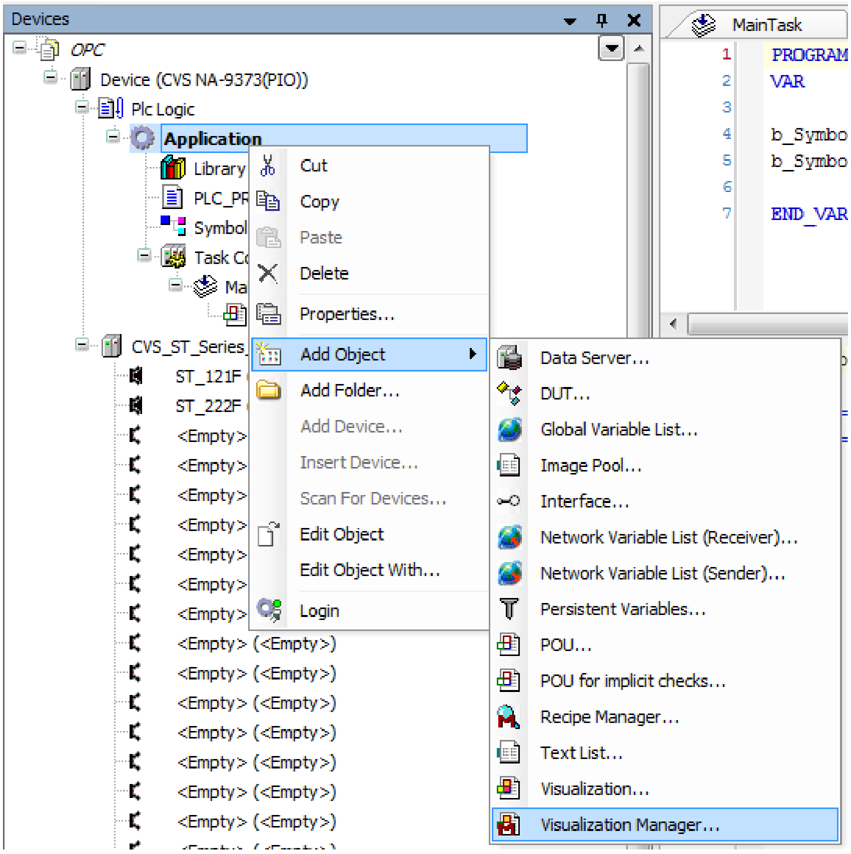
(10) **After set the all of parameter, user should make this code into the main task.**


```
IF Modbus_Slave_COM_Port.xReset = TRUE THEN
    Modbus_Slave_COM_Port.xReset := FALSE;
END_IF
IF Modbus_Slave_COM_Port.xError AND Modbus_Slave_COM_Port.byModbusError = 161 THEN
    Modbus_Slave_COM_Port.xReset := TRUE;
END_IF

```

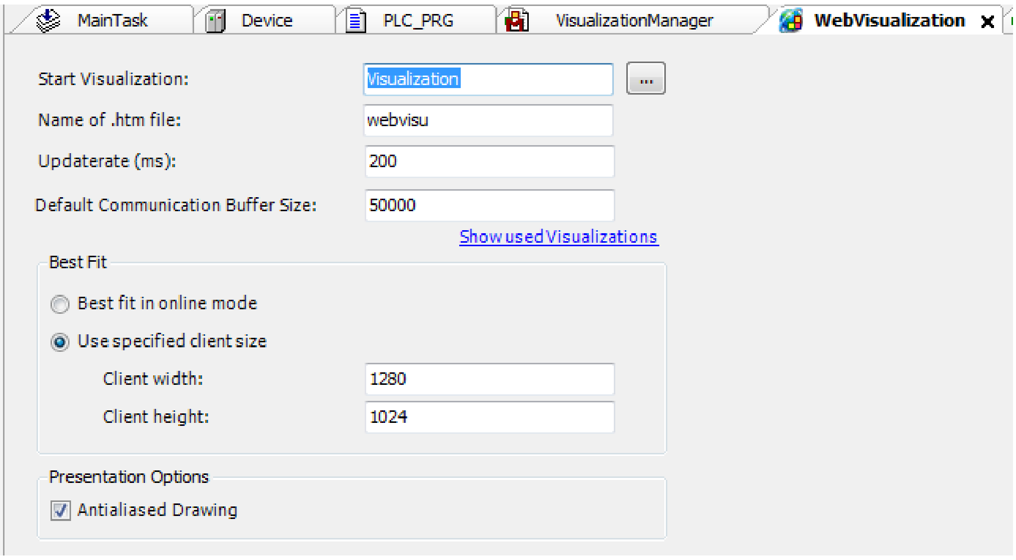
Avoid the disconnection for the unpredictable communication error, this code should be appended into the main task.

7.8. Web Visualization (NA-9373 only)

(1) Add Webvisualization manager to Application project



(2) Set the Webvisualization option on the Webvisualization manager.



Start Visualization: Visualization

Name of .htm file: webvisu

Updaterate (ms): 200

Default Communication Buffer Size: 50000

Best Fit

○ Best fit in online mode

● Use specified client size

Client width: 1280

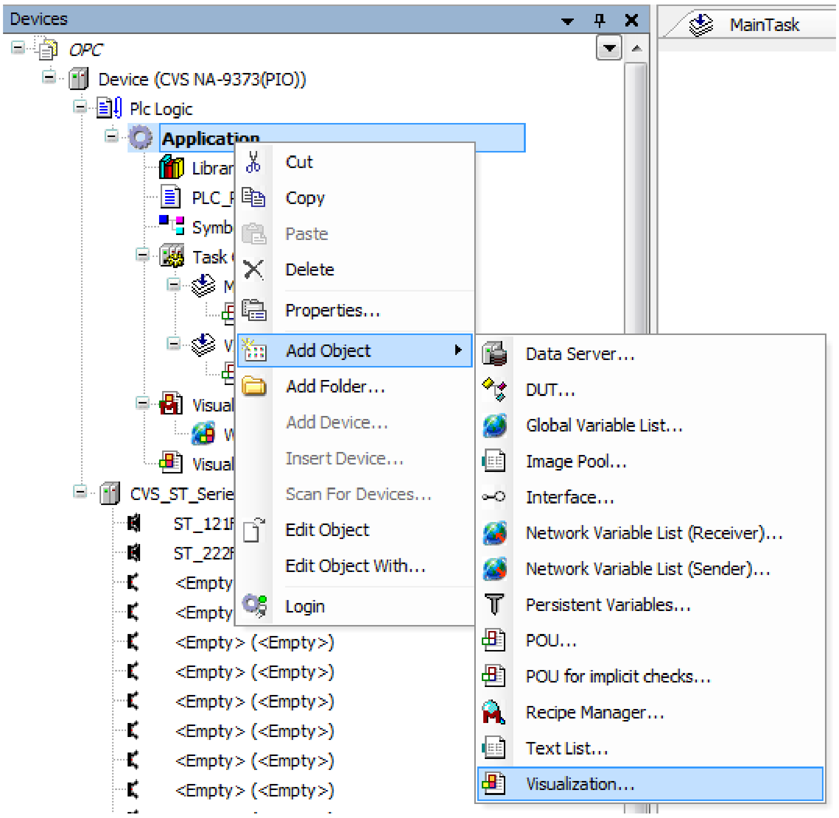
Client height: 1024

Presentation Options

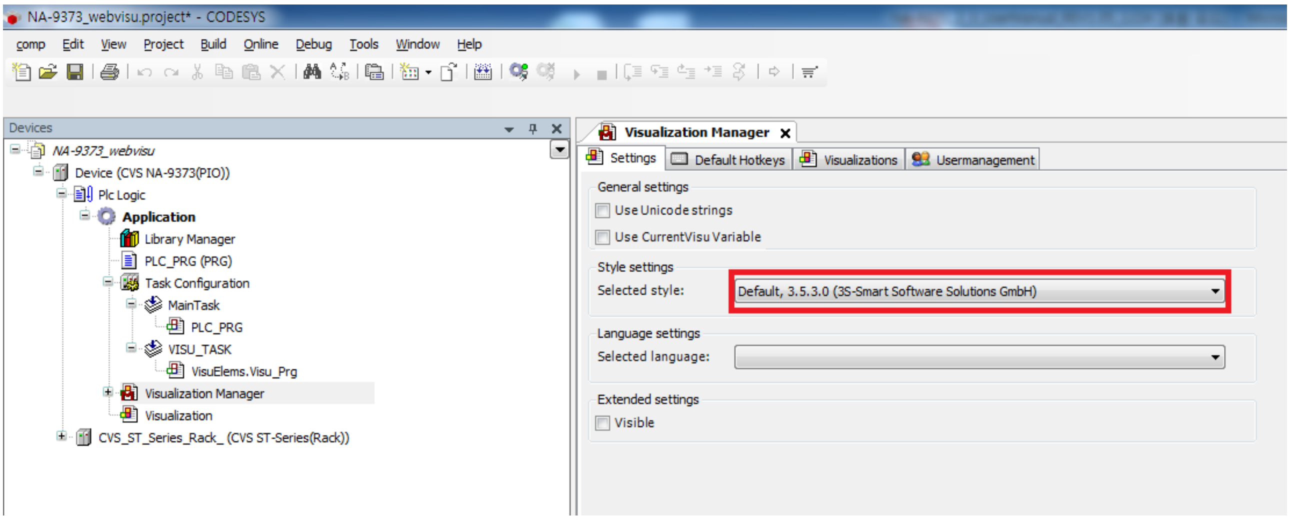
☑ Antialiased Drawing

User should set the Start Visualization path, and user can set the visualization windows size.

(3) Add the visualization object to Application project



(4) Set the Visualization Manager should be 3.5.3.0.



General settings

☐ Use Unicode strings

☐ Use CurrentVisu Variable

Style settings

Selected style: Default, 3.5.3.0 (3S-Smart Software Solutions GmbH)

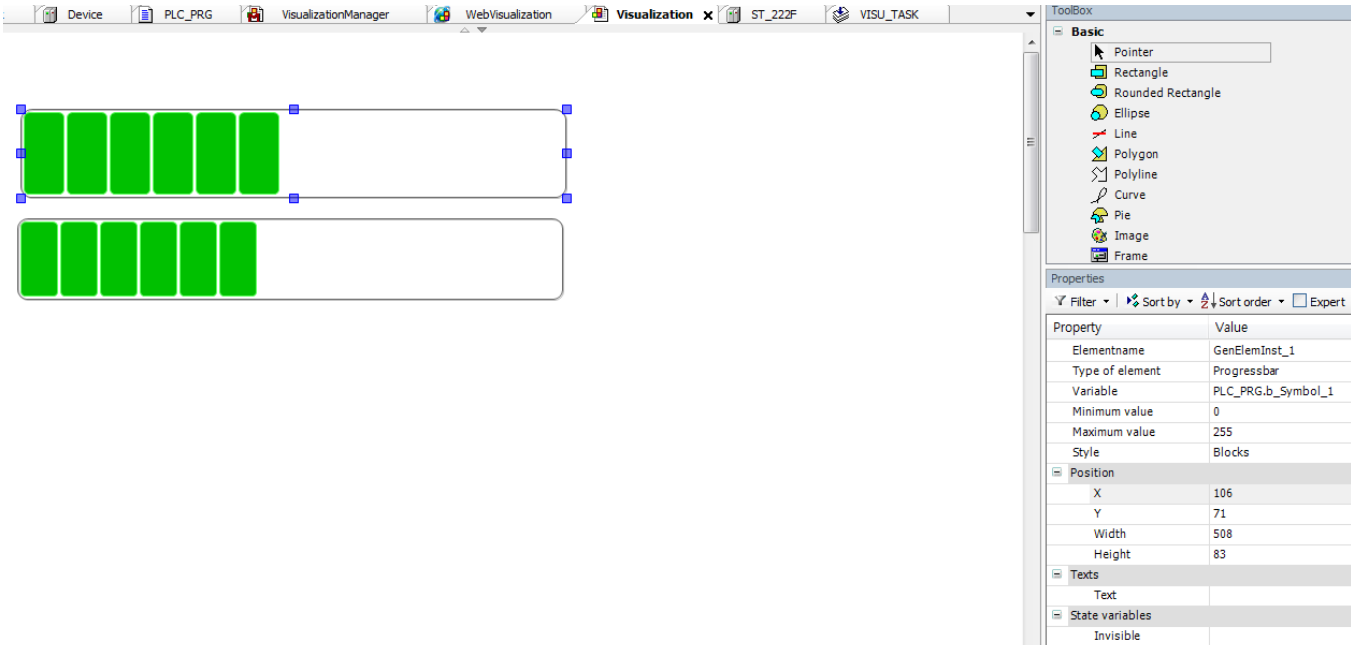
Language settings

Selected language:

Extended settings

☐ Visible

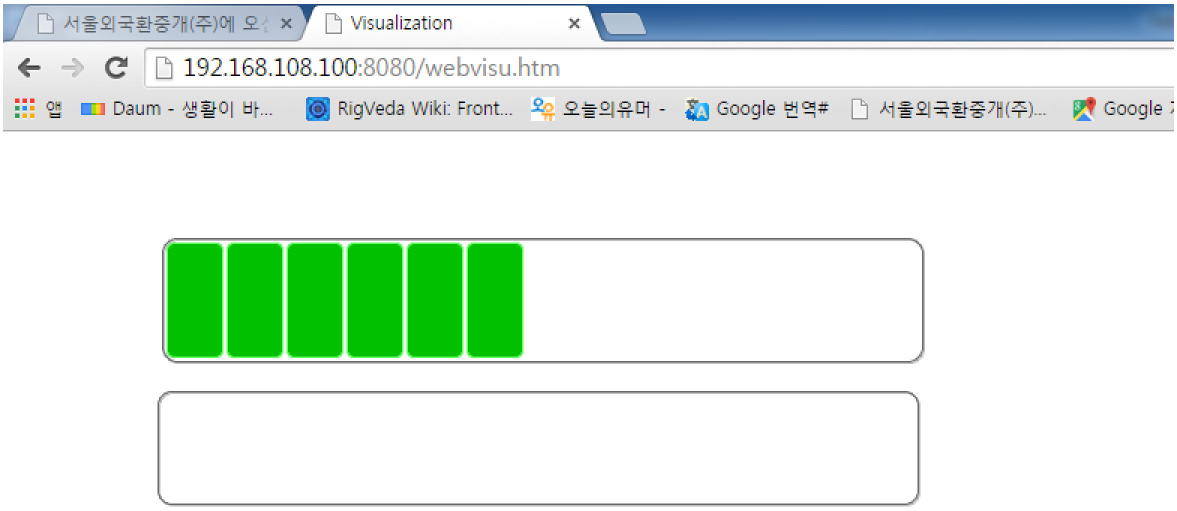
(5) Make the Web visualization page



Property	Value
Elementname	GenElemInst_1
Type of element	Progressbar
Variable	PLC_PRG.b_Symbol_1
Minimum value	0
Maximum value	255
Style	Blocks
Position	
X	106
Y	71
Width	508
Height	83
Texts	
Text	
State variables	
Invisible	

(6) Web visualization page on the Web Browser.

On the web browser, type the "IP address:8080/webvisu.htm" as like below.

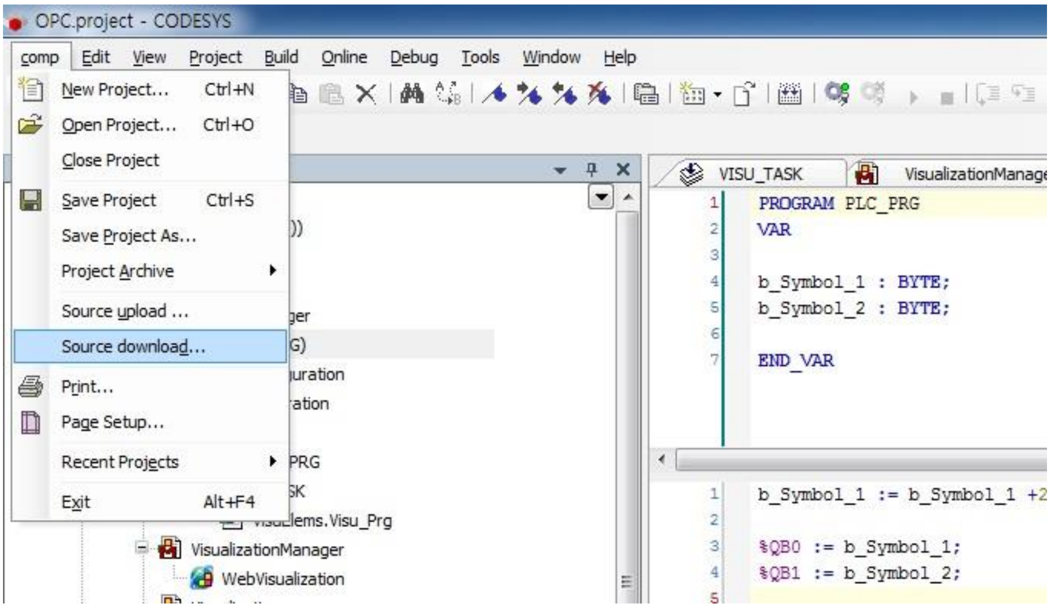


192.168.108.100:8080/webvisu.htm

- **Web Visualization can not be supported in Internet Explorer.**
- **It is recommended to use at Chrome and FireFox browser.**

7.9. Source download and upload (NA-9373 only)

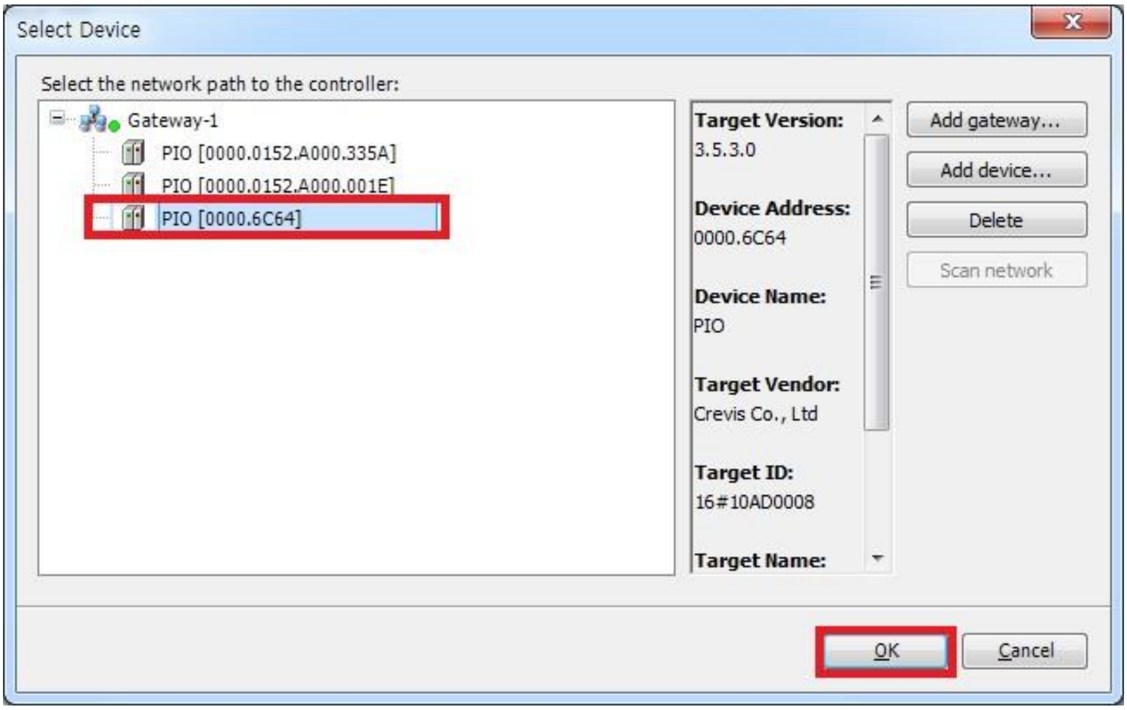
(1) **User can download the project file to PIO. Click the Source Download menu in Comp.**



```
PROGRAM PLC_PRG
VAR

b_Symbol_1 : BYTE;
b_Symbol_2 : BYTE;

END_VAR
```

```
b_Symbol_1 := b_Symbol_1 +2

%QB0 := b_Symbol_1;
%QB1 := b_Symbol_2;
```

(2) **Select the your PIO and click Ok..**


Select Device
Select the network path to the controller:
Gateway-1
PIO [0000.0152.A000.335A]
PIO [0000.0152.A000.001E]
PIO [0000.6C64]
Add gateway...
Add device...
Delete
Scan network
OK
Cancel

Target Version:
3.5.3.0

Device Address:
0000.6C64

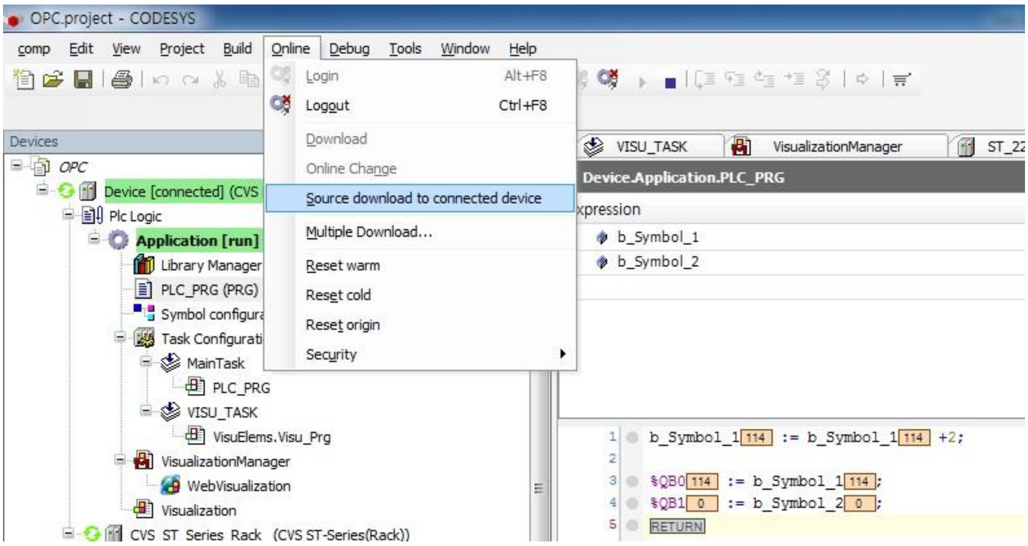
Device Name:
PIO

Target Vendor:
Crevis Co., Ltd

Target ID:
16#10AD0008

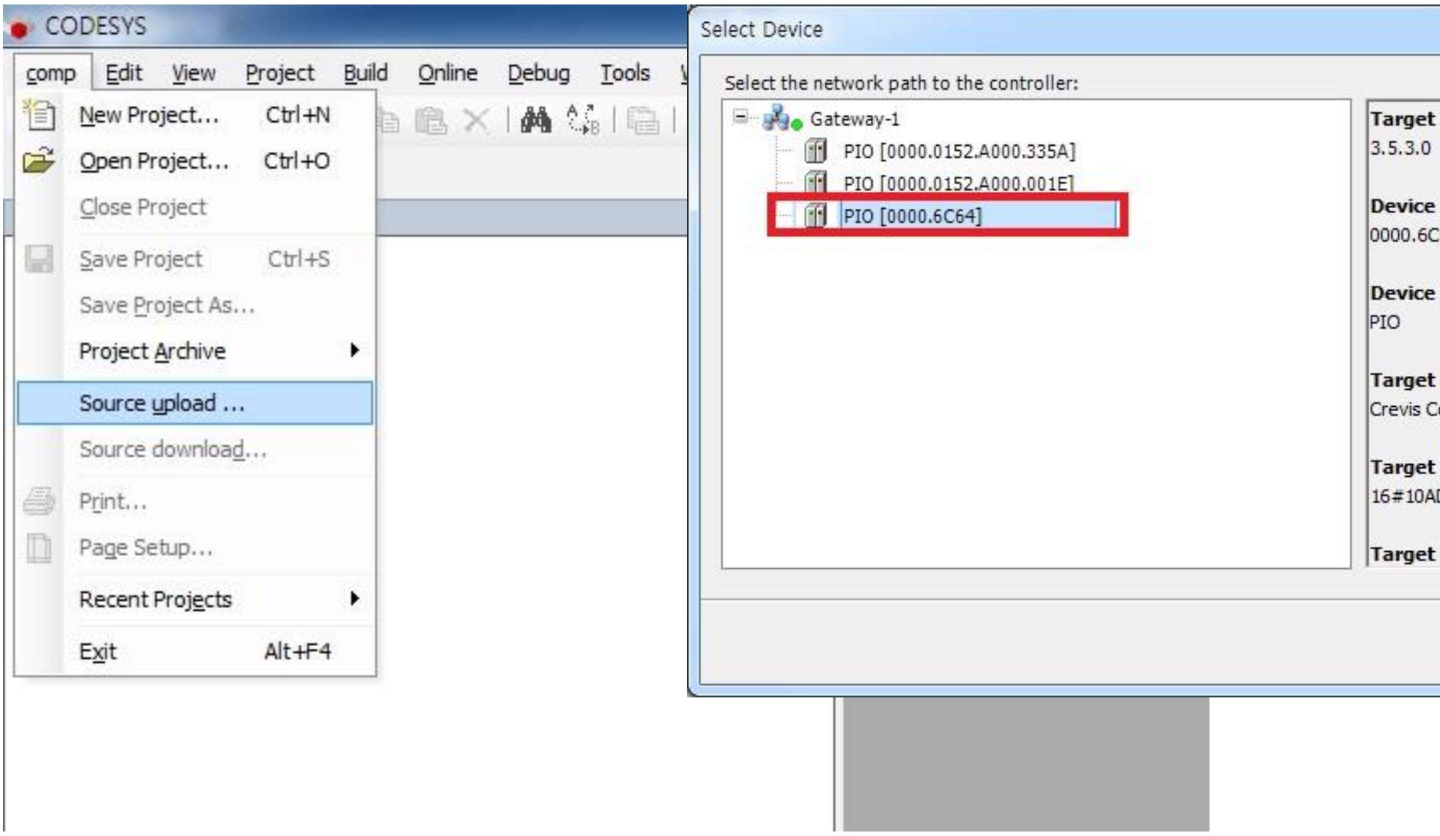
Target Name:

(3) **When the Online mode, user can download the source file using the Source download to Connected device in Online pop up menu. After click this, it will be downloaded immediately.**



```
b_Symbol_1[114] := b_Symbol_1[114] +2;

%QB0[114] := b_Symbol_1[114];
%QB1[0] := b_Symbol_2[0];
RETURN
```

(4) **If user wand to extract the project file from the PIO, click the Source Upload menu in Comp. Select the activated PIO.**



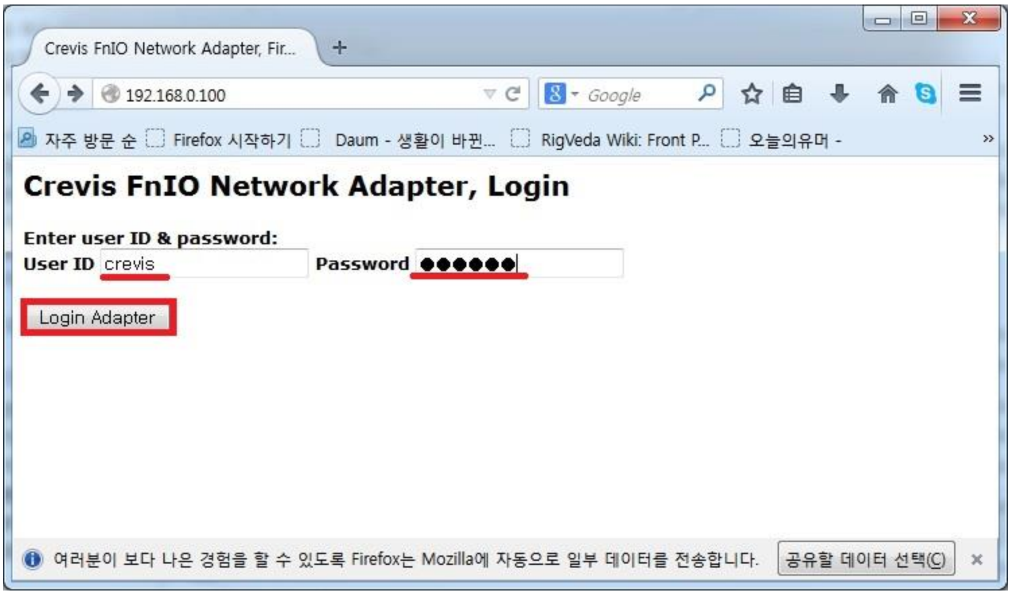
8. Upgrade Firmware

8.1. Using IAP over Ethernet

(1) Apply a power with pushing a reset button(Mod LED will blink Green/Red).

(2) Execute Firefox.(It is recommended to using Firefox)

(3) Connect to 192.168.0.100 and login (User ID :crevis / Password : crevis)



Crevis FnIO Network Adapter, Login

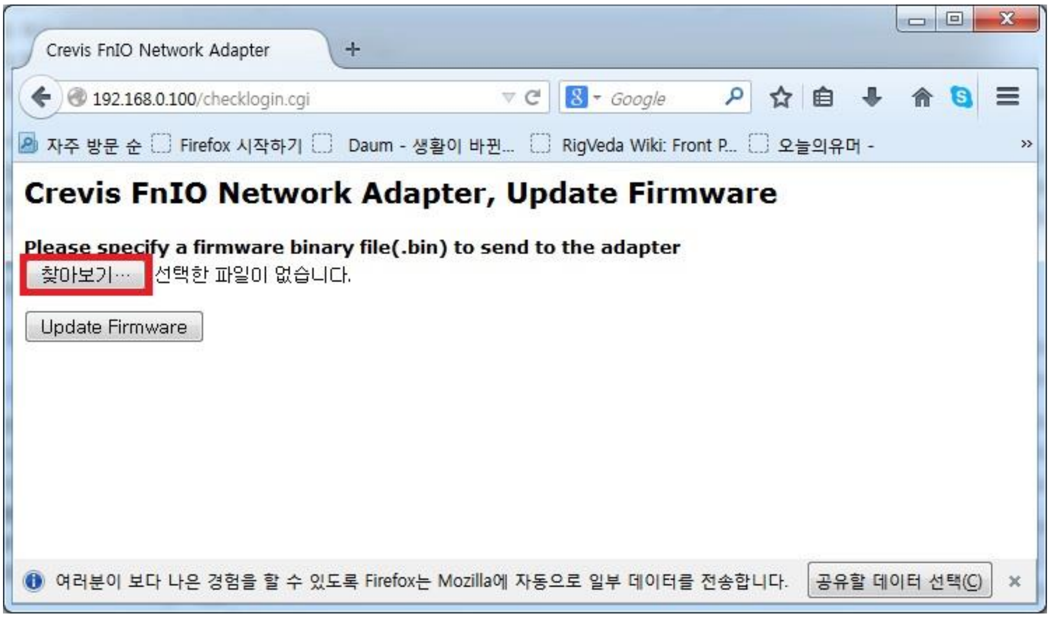
Enter user ID & password:

User ID crevis **Password** ●●●●●●

Login Adapter

여러분이 보다 나은 경험을 할 수 있도록 Firefox는 Mozilla에 자동으로 일부 데이터를 전송합니다. 공유할 데이터 선택(C)

(4) Search the file to download using a search button.



Crevis FnIO Network Adapter, Update Firmware

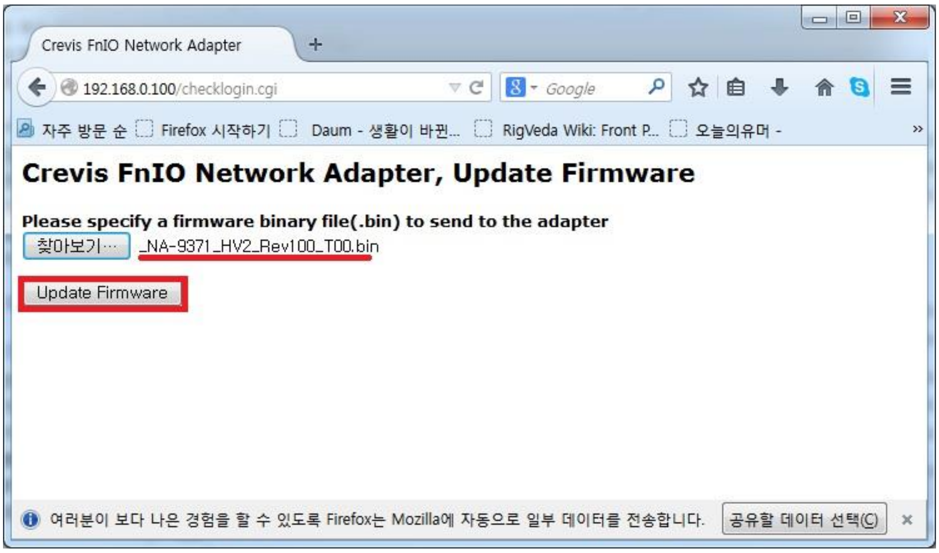
Please specify a firmware binary file(.bin) to send to the adapter

찾아보기... 선택한 파일이 없습니다.

Update Firmware

여러분이 보다 나은 경험을 할 수 있도록 Firefox는 Mozilla에 자동으로 일부 데이터를 전송합니다. 공유할 데이터 선택(C)

(5) Click a Upload Button.



Crevis FnIO Network Adapter, Update Firmware

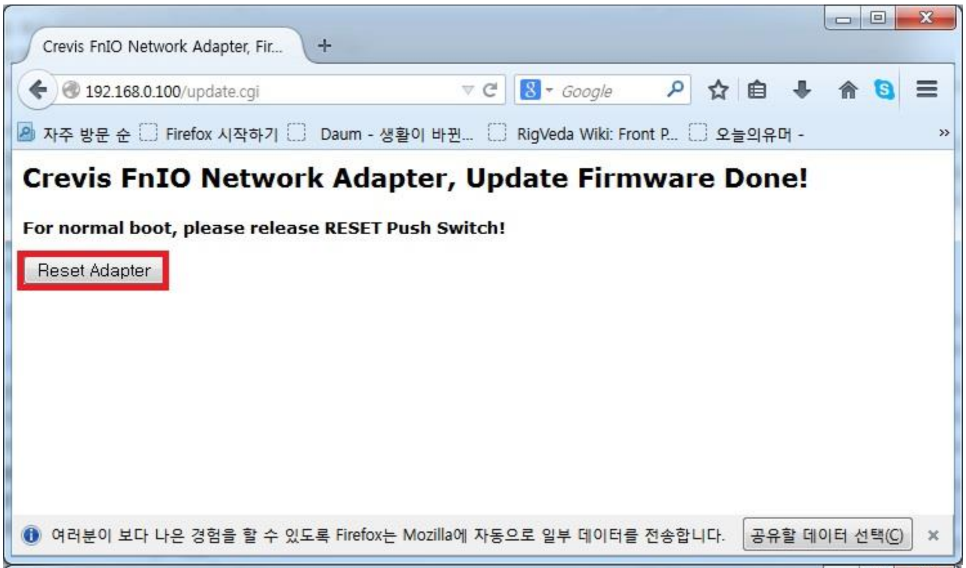
Please specify a firmware binary file(.bin) to send to the adapter

_NA-9371_HV2_Rev100_T00.bin

여러분이 보다 나은 경험을 할 수 있도록 Firefox는 Mozilla에 자동으로 일부 데이터를 전송합니다.

(6) If it finish, you can see a below message (File Upload Done!)

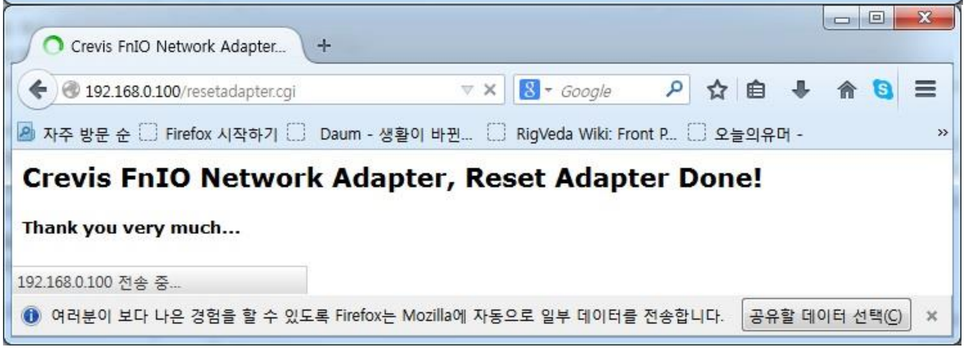
And click a 'Reset Adapter' button.



Crevis FnIO Network Adapter, Update Firmware Done!

For normal boot, please release RESET Push Switch!

여러분이 보다 나은 경험을 할 수 있도록 Firefox는 Mozilla에 자동으로 일부 데이터를 전송합니다.



Crevis FnIO Network Adapter, Reset Adapter Done!

Thank you very much...

192.168.0.100 전송 중...

여러분이 보다 나은 경험을 할 수 있도록 Firefox는 Mozilla에 자동으로 일부 데이터를 전송합니다.

9. Trouble Shooting

9.1. 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 63. - 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 63. - 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.
RUN LED flashed Green	-PLC program stop	Check the toggle switch is up.
RUN LED flashed red	-Failure of Module Configuration	Check the module hardware and software configurations are the same.

9.2. 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 - MODBUS INTERFACE

A.1 MODBUS Interface Register / Bit Map

- **Register Map**

Start Address	Read/Write	Description	Func. Code
0x0000 ~	Read	Process input image registers (Real Input Register)	4, 23
0x0800 ~	Read/Write	Process output image registers (Real Output Register)	3, 16, 23
0x1000 ~	Read	Adapter Identification special registers.	3, 4, 23
0x1020 ~	Read/Write	Adapter Watchdog, other time special register.	3, 4, 6, 16, 23
0x1100 ~	Read/Write	Adapter Information special registers.	3, 4, 6, 16, 23
0x2000 ~	Read/Write	Expansion Slot Information special registers.	3, 4, 6, 16, 23

* The special register map must be accessed by read/write of every each address (one address).

- **Bit Map**

Start Address	Read/Write	Description	Func. Code
0x0000 ~	Read	Process input image bits All input registers area is addressable by bit address. Size of input image bit is size of input image register * 16.	2
0x0800 ~	Read/Write	Process output image bits All output registers area is addressable by bit address. Size of output image bit is size of output image register * 16.	1, 5, 15

A.2 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.

A.2.1. 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 baudrate. 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

A.2.2. 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

A.3 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

A.3.1. 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.

A.3.2. 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.

A.3.3. 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.

A.3.4. 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.

A.3.5. 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.

A.3.6. 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.

A.3.7. 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 Default setting 1)
0x0001(1)	0x55AA+0xAB7B+sumcheck 4)	Echo Request Data	Reset with Factory Default 2)
0x0001(1)	0x55AA+0xAA55+sumcheck 4)	Echo Request Data	Reset with Factory Default 3)

1),2),3)All expansion slot configuration parameters are cleared.

2),3) IP address, Subnet Mask Address, Gateway Address, RS232/485 setting, and BootP/DHCP mode will be the factor default value

3)Mac address will be the factory default value

4)Refer the A.4.2 sumcheck(0x1006)

- ✓ **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	

- ✓ **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 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, Extension module Status**

The response data field returns the status of MODBUS and Extension module 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, Extension module Status	Same as status 1word

A.3.8. 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.

A.3.9. 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	0x08	0x08
Starting Address Lo	0x00	0x00
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	0x08	0x08
Starting Address Lo	0x00	0x00
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.

A.3.10. 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.

A.4 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).

A.4.1. Adapter Register Mapping

Address	IEC Address	Contents
0x0000~0x07FF	%IW0~%IW2047	2048 words Input and Internal memory (Area is write-protected)
0x0800~0x0FFF	%QW0~%QW2047	2048 words Output and Internal memory (Area is write-enabled)
0x1000~0x1FFF	-	Special Function Register (PIO Information)
0x2000~0x2FFF	-	Special Function Register (Slot Information)
0x4000~0x5FFF	%MW0~%MW8191	2048 words Internal memory (Area is write-enabled)

A.4.2. 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 = 0x1004(NA-9371) / 0x1006(NA-9372)/0x1008(NA-9373)
0x1003(4099)	Read	1 word	Firmware revision, if 0x0101, revision 1.001
0x1005(4101)	Read	String up to 34bytes	Product name string First 1word is length of valid character string Example) response as following “00 1D 52 4E 2D 39 32 32 32 2C 50 72 6F 66 69 62 75 73 20 41 64 61 70 74 65 72 2C 52 42 55 53 00 00 000” Valid character size = 0x0017 =29 characters "NA-9372(PIO)"
0x1006(4102)	Read	1 word	Sum check of EEPROM
0x1010(4112)	Read	2 words	Firmware release date
0x101E(4126)	Read	15words	Composite Id of following address 0x1600(5632),0x1602(5634),0x1604(5636),0x1610(5648), 0x1000(4096),0x1001(4097),0x1002(4098),0x1003(4099),0x1010(4112).

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

A.4.4. Adapter Information Special Register (0x1100, 4352)

Address	Access	Type, Size	Description
0x1100(4352)			Reserved.
0x1101(4353)			Reserved.
0x1102(4354)	Read	1word	Start address of input image word register. =0x0000
0x1103(4355)	Read	1word	Start address of output image word register. =0x0800
0x1104(4356)	Read	1word	Size of input image word register.
0x1105(4357)	Read	1word	Size of output image word register.
0x1106(4358)	Read	1word	Start address of input image bit. = 0x0000
0x1107(4359)	Read	1word	Start address of output image bit. =0x1000
0x1108(4360)	Read	1word	Size of input image bit.
0x1109(4361)	Read	1word	Size of output image bit.
0x110D(4365)	Read/Write	1word	Field Power On/Off, Run/Stop Switch On/Off, Reset Switch On/Off check
0x110E(4366)	Read	Up to 64 words	Expansion slot's ST-number including NA First 1word is adapter's number, if NA-9372, then 0x9372
0x1110(4368)	Read	1word	Number of expansion slot
0x1111(4369)	Read	1word	Number of active slot
0x1112(4370)	Read	1word	Number of inactive slot
0x1113(4371)	Read	Up to 64 words	Expansion slot Module Id. Refer to Appendix A.1 Product List. First 1word is adapter's module id.
0x1116(4374)*	Read/Write	4words	Inactive slot list, The corresponding bit represents slot position. 0:Active slot, 1:Inactive slot. Ex) if value is 0x0001, 0x8000, then slot#1,#16 are inactive slots
0x1117(4375)	Read	4words	Live slot list. , The corresponding bit represents slot position. 1:live slot, 0:not live slot
0x1118(4376)	Read	4words	Alarm slot list. The corresponding bit represents slot position. 1:Alarm slot, 0:Normal slot
0x1119(4377)	Read	1word	Hi byte is ModBus status, low byte is FnBus status. It is identical with address 0x1040.
0x111D(4381)	Read	1word	Adapter FnBus Revision. If 0x013C, FnBus Revision is 1.60
0x111E(4382)	Read	1word	Reserved. Adapter IO identification vendor code.

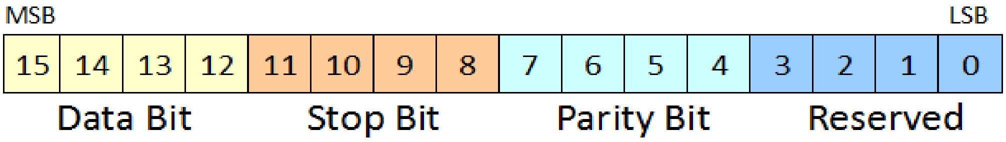
* After the system is reset, the new "Set Value" action is applied.
* If the slot location is changed, set default value automatically (all expansion slots are live).

A.4.5. Adapter Setting Special Register (0x1600, 5632)

Address	Access	Type, Size	Description
0x1600(5632)	Read	2words	IP Address. (ex : C0A8 6464 = 192.168.100.100)
0x1602(5634)	Read	2words	Subnet Mask. (ex : FFFF FF00 = 255.255.255.0)
0x1604(5636)	Read	2words	Gate way. (ex : C0A8 0001 = 192.168.0.1)
0x1606(5638)	Read/Write	1word	RS-232 Baudrate. (2400bps~115200bps) 0 : 115200(Default) 1 : 2400 2 : 4800 3 : 9600 4 : 19200 5 : 38400 6 : 57600 7 : 115200
0x1607(5639)	Read/Write	1word	RS-232 Setting. - 1 nibble : Data bit(0 : 8bit(default), 1 : 9bit) - 2 nibble : Stop bit(0 : 1bit(default), 1 : 2bit) - 3 nibble : Parity bit(0 : none(default), 1: odd, 2 : even) - 4 nibble : Reserve
0x1608(5640)	Read/Write	1word	RS-485 Baudrate. (2400bps~115200bps) 0 : 115200(Default) 1 : 2400 2 : 4800 3 : 9600 4 : 19200 5 : 38400 6 : 57600 7 : 115200
0x1609(5641)	Read/Write	1word	RS-485 Setting. - 1 nibble : Data bit(0 : 8bit(default), 1 : 9bit) - 2 nibble : Stop bit(0 : 1bit(default), 1 : 2bit) - 3 nibble : Parity bit(0 : none(default), 1: odd, 2 : even) - 4 nibble : Reserve
0x160A(5642)	Read/Write	1word	MODBUS Station. - High 1byte : Station No. of RS-232C (default : 1) - Low 1byte : Station No. of RS-485 (default : 1)
0x160B(5643)	Read/Write	1word	IP Setting Method. - Not Use : 0x0000 - BootP : 0x8000 (default) - DHCP : 0x8001
0x1610(5648)	Read	3words	Mac Address (ex : 0014 F700 0101 = 00.14.F7.00.01.01)
0x1614(5652)*	Read/Write	1word	Serial connection Method - 0x0000 : CREVIS Modbus/RTU(Default) - 0x8000 : RS232 Enable for CoDeSys Function block - 0x8001 : RS485 Enable for CoDeSys Function block
0x1620(5664)	Read/Write	4words	RTC - 1 word : 00ss (ss : sec) - 2 word : hhmm (hh : hour, mm : min) - 3 word : mmdd (mm : month, dd : day) - 4 word : yyyy (yyyy : year) (ex : 07D8 0514 0F19 0006 = 2008. 05.20. 15.25. 06)

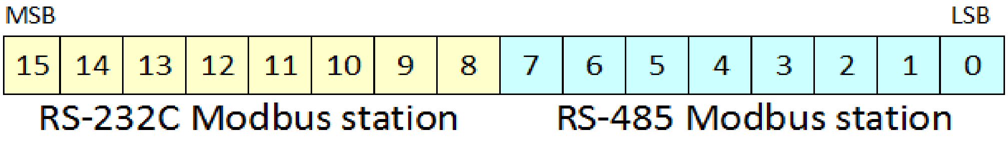
*0x1614(5652) is not supported for NA-9371.

***RS-232C/485 Setting :** This description for 0x1607/0x1609 register with bit.



MSB															LSB
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Bit				Stop Bit				Parity Bit				Reserved			

****Modbus Station :** This description for 0x160A register with bit.



MSB															LSB
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RS-232C Modbus station								RS-485 Modbus station							

A.4.6. 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#2	0x2020(8224)~0x203F(8255)
Slot#3	0x2040(8256)~0x205F(8287)	Slot#4	0x2060(8288)~0x207F(8319)
Slot#5	0x2080(8320)~0x209F(8351)	Slot#6	0x20A0(8352)~0x20BF(8383)
Slot#7	0x20C0(8384)~0x20DF(8415)	Slot#8	0x20E0(8416)~0x20FF(8447)
Slot#9	0x2100(8448)~0x211F(8479)	Slot#10	0x2120(8480)~0x213F(8511)
Slot#11	0x2140(8512)~0x215F(8543)	Slot#12	0x2160(8544)~0x217F(8575)
Slot#13	0x2180(8576)~0x219F(8607)	Slot#14	0x21A0(8608)~0x21BF(8639)
Slot#15	0x21C0(8640)~0x21DF(8671)	Slot#16	0x21E0(8672)~0x21FF(8703)
Slot#17	0x2200(8704)~0x221F(8735)	Slot#18	0x2220(8736)~0x223F(8767)
Slot#19	0x2240(8768)~0x225F(8799)	Slot#20	0x2260(8800)~0x227F(8831)
Slot#21	0x2280(8832)~0x229F(8863)	Slot#22	0x22A0(8864)~0x22BF(8895)
Slot#23	0x22C0(8896)~0x22DF(8927)	Slot#24	0x22E0(8928)~0x22FF(8959)
Slot#25	0x2300(8960)~0x231F(8991)	Slot#26	0x2320(8992)~0x233F(9023)
Slot#27	0x2340(9024)~0x235F(9055)	Slot#28	0x2360(9056)~0x237F(9087)
Slot#29	0x2380(9088)~0x239F(9119)	Slot#30	0x23A0(9120)~0x23BF(9151)
Slot#31	0x23C0(9152)~0x23DF(9183)	Slot#32	0x23E0(9184)~0x23FF(9215)
Slot#33	0x2400(9216)~0x241F(9247)	Slot#34	0x2420(9248)~0x243F(9279)
Slot#35	0x2440(9280)~0x245F(9311)	Slot#36	0x2460(9312)~0x247F(9343)
Slot#37	0x2480(9344)~0x249F(9375)	Slot#38	0x24A0(9376)~0x24BF(9407)
Slot#39	0x24C0(9408)~0x24DF(9439)	Slot#40	0x24E0(9440)~0x24FF(9471)
Slot#41	0x2500(9472)~0x251F(9503)	Slot#42	0x2520(9504)~0x253F(9535)
Slot#43	0x2540(9536)~0x255F(9567)	Slot#44	0x2560(9568)~0x257F(9599)
Slot#45	0x2580(9600)~0x259F(9631)	Slot#46	0x25A0(9632)~0x25BF(9663)
Slot#47	0x25C0(9664)~0x25DF(9695)	Slot#48	0x25E0(9696)~0x25FF(9727)
Slot#49	0x2600(9728)~0x261F(9759)	Slot#50	0x2620(9760)~0x263F(9791)
Slot#51	0x2640(9792)~0x265F(9823)	Slot#52	0x2660(9824)~0x267F(9855)
Slot#53	0x2680(9856)~0x269F(9887)	Slot#54	0x26A0(9888)~0x26BF(9919)
Slot#55	0x26C0(9920)~0x26DF(9951)	Slot#56	0x26E0(9952)~0x26FF(9983)
Slot#57	0x2700(9984)~0x271F(10015)	Slot#58	0x2720(10016)~0x273F(10047)
Slot#59	0x2740(10048)~0x275F(10079)	Slot#60	0x2760(10080)~0x277F(10111)
Slot#61	0x2780(10112)~0x279F(10143)	Slot#62	0x27A0(10144)~0x27BF(10175)
Slot#63	0x27C0(10176)~0x27DF(10207)		

Address Offset	**Expansion Slot#1**	**Expansion Slot#2**	**Expansion Slot#3**	……..	**Expansion Slot#62**	**Expansion Slot#63**
+ 0x00(+0)	0x2000(8192)	0x2020(8224)	0x2040(8256)	…….	0x27A0(9120)	0x27C0(9152)
+ 0x01(+1)	0x2001(8193)	0x2021(8225)	0x2041(8257)	…….	0x27A1(9121)	0x27C1(9153)
+ 0x02(+2)	0x2002(8194)	0x2022(8226)	0x2042(8258)	…….	0x27A2(9122)	0x27C2(9154)
+ 0x03(+3)	0x2003(8195)	0x2023(8227)	0x2043(8259)	…….	0x27A3(9123)	0x27C3(9155)
+ 0x04(+4)	0x2004(8196)	0x2024(8228)	0x2044(8260)	…….	0x27A4(9124)	0x27C4(9156)
+ 0x05(+5)	0x2005(8197)	0x2025(8229)	0x2045(8261)	…….	0x27A5(9125)	0x27C5(9157)
+ 0x06(+6)	0x2006(8198)	0x2026(8230)	0x2046(8262)	…….	0x27A6(9126)	0x27C6(9158)
+ 0x07(+7)	0x2007(8199)	0x2027(8231)	0x2047(8263)	…….	0x27A7(9127)	0x27C7(9159)
+ 0x08(+8)	0x2008(8200)	0x2028(8232)	0x2048(8264)	…….	0x27A8(9128)	0x27C8(9160)
+ 0x09(+9)	0x2009(8201)	0x2029(8233)	0x2049(8265)	…….	0x27A9(9129)	0x27C9(9161)
+ 0x0A(+10)	0x200A(8202)	0x202A(8234)	0x204A(8266)	…….	0x27AA(9130)	0x27CA(9162)
+ 0x0B(+11)	0x200B(8203)	0x202B(8235)	0x204B(8267)	…….	0x27AB(9131)	0x27CB(9163)
+ 0x0C(+12)	0x200C(8204)	0x202C(8236)	0x204C(8268)	…….	0x27AC(9132)	0x27CC(9164)
+ 0x0D(+13)	0x200D(8205)	0x202D(8237)	0x204D(8269)	…….	0x27AD(9133)	0x27CD(9165)
+ 0x0E(+14)	0x200E(8206)	0x202E(8238)	0x204E(8270)	…….	0x27AE(9134)	0x27CE(9166)
+ 0x0F(+15)	0x200F(8207)	0x202F(8239)	0x204F(8271)	…….	0x27AF(9135)	0x27CF(9167)
+ 0x10(+16)	0x2010(8208)	0x2030(8240)	0x2050(8272)	…….	0x27B0(9136)	0x27D0(9168)
+ 0x11(+17)	0x2011(8209)	0x2031(8241)	0x2051(8273)	…….	0x27B1(9137)	0x27D1(9169)
+ 0x12(+18)	0x2012(8210)	0x2032(8242)	0x2052(8274)	…….	0x27B2(9138)	0x27D2(9170)
+ 0x13(+19)	0x2013(8211)	0x2033(8243)	0x2053(8275)	…….	0x27B3(9139)	0x27D3(9171)
+ 0x14(+20)	0x2014(8212)	0x2034(8244)	0x2054(8276)	…….	0x27B4(9140)	0x27D4(9172)
+ 0x15(+21)	0x2015(8213)	0x2035(8245)	0x2055(8277)	…….	0x27B5(9141)	0x27D5(9173)
+ 0x16(+22)	0x2016(8214)	0x2036(8246)	0x2056(8278)	…….	0x27B6(9142)	0x27D6(9174)
+ 0x17(+23)	0x2017(8215)	0x2037(8247)	0x2057(8279)	…….	0x27B7(9143)	0x27D7(9175)
+ 0x18(+24)	0x2018(8216)	0x2038(8248)	0x2058(8280)	…….	0x27B8(9144)	0x27D8(9176)
+ 0x19(+25)	0x2018(8217)	0x2038(8249)	0x2058(8281)	…….	0x27B9(9145)	0x27D9(9177)
+ 0x1A(+26)	0x201A(8218)	0x203A(8250)	0x205A(8282)	…….	0x27BA(9146)	0x27DA(9178)
+ 0x1B(+27)	0x201B(8219)	0x203B(8251)	0x205B(8283)	…….	0x27BB(9147)	0x27DB(9179)
+ 0x1C(+28)	0x201C(8220)	0x203C(8252)	0x205C(8284)	…….	0x27BC(9148)	0x27DC(9180)
+ 0x1D(+29)	0x201D(8221)	0x203D(8253)	0x205D(8285)	…….	0x27BD(9149)	0x27DD(9181)
+ 0x1E(+30)	0x201E(8222)	0x203E(8254)	0x205E(8286)	…….	0x27BE(9150)	0x27DE(9182)
+ 0x1F(+31)	0x201F(8223)	0x203F(8255)	0x205F(8287)	…….	0x23BF(9151)	0x27DF(9183)

Address Offset	**Access**	**Type, Size**	**Description**
+ 0x00(+0)	Read	1word	Slot module id. Refer to Appendix A.1 Product List.
+ 0x01(+1)	Read	1word	Expansion Slot IO code. Refer to Table IO Data Code Format.
+ 0x02(+2) **	Read	1word	Input start register address of input image word this slot.
+ 0x03(+3) **	Read	1word	Input word’s bit offset of input image word this slot.
+ 0x04(+4) **	Read	1word	Output start register address of output image word this slot.
+ 0x05(+5) **	Read	1word	Output word’s bit offset of output image word this slot.
+ 0x06(+6) **	Read	1word	Input bit start address of input image bit this slot.
+ 0x07(+7) **	Read	1word	Output bit start address of output image bit this slot.
+ 0x08(+8) **	Read	1word	Size of input bit this slot
+ 0x09(+9) **	Read	1word	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	1word	Inactive slot, 0x0000:active, 0x0001:inactive
+ 0x0E(+14)	Read	1word	ST-number, if ST-1218, returns 0x1218
+ 0x0F(+15)	Read	String Up to 72bytes	First 1word is length of valid character string. If ST-1218, returns “00 1E 52 54 2D 31 32 33 38 2C 20 38 44 49 2C 20 32 34 56 64 63 2C 20 55 6E 69 76 65 72 73 61 6C 00 00” Valid character size = 0x001E =30 characters, “ST-1218, 8DI, 24Vdc, Sink”
+ 0x10(+16)	Read	1word	Size of configuration parameter byte
+ 0x11(+17)**	Read/Write	n words	Read/write Configuration parameter data, up to 8byte. ***
+ 0x12(+18)	Read	1word	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	2words	Product code Refer to Appendix B.1 Product List.
+ 0x16(+22)	Read	2words	Catalog number. Refer to Appendix B.1 Product List.
+ 0x17(+23)	Read	1word	Firmware Revision
+ 0x18(+24)	Read	1word	Expansion Module Revision

* 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_Rev1.01)

- **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								Input IO code								
Field	Date Type		Data Length						Date Type		Data Length						
Example)																	
ST-3214	0	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	0	1	1	0	0	0	1	0	0	0x00C4
ST-1228	0	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	0	0x8200
ST-221F	0	1	0	0	0	0	0	1	0	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	0	0xC4C4

Input/output Data Type: 0 0: No I/O Data / 0 1: Byte Data / 1 0: Word Data / 1 1: Bit Data

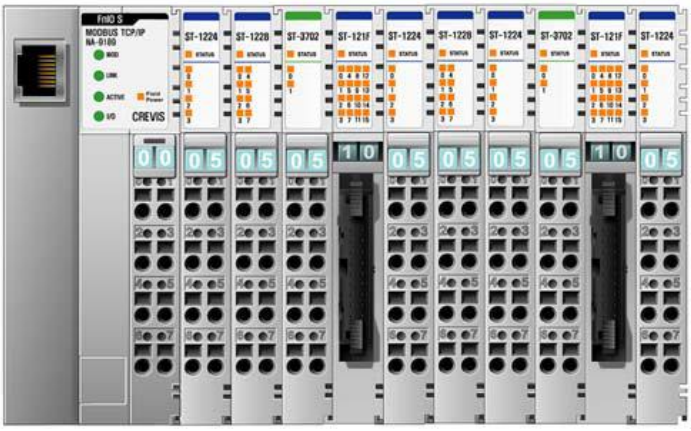
Input/output Data Length: 0 0 0 0 0 0 0: 0 Bit/Byte/Word / 0 0 0 0 0 0 1: 1 Bit/Byte/Word / 0 0 0 0 0 1 0: 2 Bit/Byte/Word /0 0 0 0 0 1 1: 3 Bit/Byte/Word / 0 0 0 0 0 1 1: 3 Bit/Byte/Word

A.5 Example

A.5.1. 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 special register 0x1114(4372). Refer to 6.3.3.

- **For example slot configuration**



Slot Address	Module Description
#0	MODBUS 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(1word) + Uncompressed Input Processing Data)

Status
(1word)

Addr.	#15	#14	#13	#12	#11	#10	#9	#8	#7	#6	#5	#4	#3	#2	#1	#0
0x0000	EW	0	0	0	0	0	0	0	FP	Internal protocol Status						
0x0001	Discrete In 8pts (Slot#2)								Empty, Always 0				Discrete In 4pts (Slot#1)			
0x0002	Analog Input Ch0 high byte (Slot#3)								Analog Input Ch0 low byte (Slot#3)							
0x0003	Analog Input Ch1 high byte (Slot#3)								Analog Input Ch1 low byte (Slot#3)							
0x0004	Discrete In high 8pts (Slot#4)								Discrete In low 8pts (Slot#4)							
0x0005	Discrete In 8pts (Slot#6)								Empty, Always 0				Discrete In 4pts (Slot#5)			
0x0006	Analog Input Ch0 low byte (Slot#8)								Empty, Always 0				Discrete In 4pts (Slot#7)			
0x0007	Analog Input Ch1 low byte (Slot#8)								Analog Input Ch0 high byte (Slot#8)							
0x0008	Discrete In low 8pts (Slot#9)								Analog Input Ch1 high byte (Slot#8)							
0x0009	Empty, Always 0				Discrete In 4pts (Slot#10)				Discrete In high 8pts (Slot#9)							

✓ **Expansion Module Status :**

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

✓ **FP (Field Power) :**

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

✓ **EW (MODBUS Error Watchdog) :**

0: No Error Watchdog
1: Error Watchdog once more since its last restart, clear counters operation, or power-up.

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

Status
(1word)

Addr.	#15	#14	#13	#12	#11	#10	#9	#8	#7	#6	#5	#4	#3	#2	#1	#0
0x0000	EW	0	0	0	0	0	0	0	FP	Internal protocol Status						
0x0001	Analog Input Ch0 high byte (Slot#3)								Analog Input Ch0 low byte (Slot#3)							
0x0002	Analog Input Ch1 high byte (Slot#3)								Analog Input Ch1 low byte (Slot#3)							
0x0003	Analog Input Ch0 high byte (Slot#8)								Analog Input Ch0 low byte (Slot#8)							
0x0004	Analog Input Ch1 high byte (Slot#8)								Analog Input Ch1 low byte (Slot#8)							
0x0005	Discrete In low 8pts (Slot#4)								Discrete In 8pts (Slot#2)							
0x0006	Discrete In 8pts (Slot#6)								Discrete In high 8pts (Slot#4)							
0x0007	Discrete In high 8pts (Slot#9)								Discrete In low 8pts (Slot#9)							
0x0008	Discrete In 4pts (Slot#10)				Discrete In 4pts (Slot#7)				Discrete In 4pts (Slot#5)				Discrete In 4pts (Slot#1)			

✓ **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), **default input image**

Addr.	#15	#14	#13	#12	#11	#10	#9	#8	#7	#6	#5	#4	#3	#2	#1	#0
0x0000	Discrete In 8pts (Slot#2)								Empty, Always 0				Discrete In 4pts (Slot#1)			
0x0001	Analog Input Ch0 high byte (Slot#3)								Analog Input Ch0 low byte (Slot#3)							
0x0002	Analog Input Ch1 high byte (Slot#3)								Analog Input Ch1 low byte (Slot#3)							
0x0003	Discrete In high 8pts (Slot#4)								Discrete In low 8pts (Slot#4)							
0x0004	Discrete In 8pts (Slot#6)								Empty, Always 0				Discrete In 4pts (Slot#5)			
0x0005	Analog Input Ch0 low byte (Slot#8)								Empty, Always 0				Discrete In 4pts (Slot#7)			
0x0006	Analog Input Ch1 low byte (Slot#8)								Analog Input Ch0 high byte (Slot#8)							
0x0007	Discrete In low 8pts (Slot#9)								Analog Input Ch1 high byte (Slot#8)							
0x0008	Empty, Always 0				Discrete In 4pts (Slot#10)				Discrete In high 8pts (Slot#9)							

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

Addr.	#15	#14	#13	#12	#11	#10	#9	#8	#7	#6	#5	#4	#3	#2	#1	#0
0x0000	Analog Input Ch0 high byte (Slot#3)								Analog Input Ch0 low byte (Slot#3)							
0x0001	Analog Input Ch1 high byte (Slot#3)								Analog Input Ch1 low byte (Slot#3)							
0x0002	Analog Input Ch0 high byte (Slot#8)								Analog Input Ch0 low byte (Slot#8)							
0x0003	Analog Input Ch1 high byte (Slot#8)								Analog Input Ch1 low byte (Slot#8)							
0x0004	Discrete In low 8pts (Slot#4)								Discrete In 8pts (Slot#2)							
0x0005	Discrete In 8pts (Slot#6)								Discrete In high 8pts (Slot#4)							
0x0006	Discrete In high 8pts (Slot#9)								Discrete In low 8pts (Slot#9)							
0x0007	Discrete In 4pts (Slot#10)				Discrete In 4pts (Slot#7)				Discrete In 4pts (Slot#5)				Discrete In 4pts (Slot#1)			

* S-Series uses the byte-oriented register mapping.
* Size of input image bit is size of input image register *16.

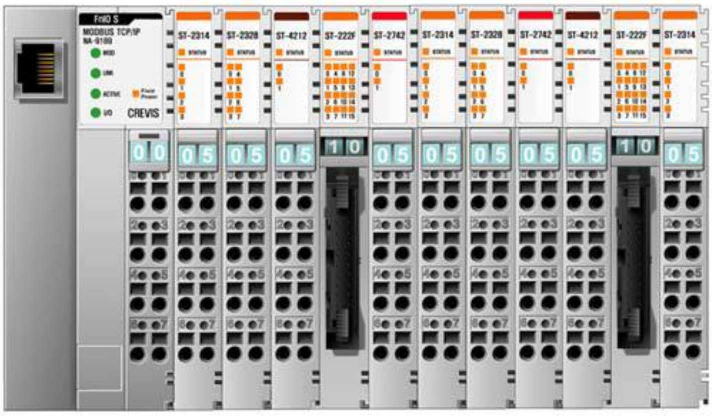
✓ **Input Assembly Priority :**

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)

A.5.2. 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 special register 0x1115(4373). Refer to 6.3.3.

- **For example slot configuration**



Slot Address	Module Description
#0	MODBUS 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**

Addr.	#15	#14	#13	#12	#11	#10	#9	#8	#7	#6	#5	#4	#3	#2	#1	#0
0x0800	Discrete out 8pts (Slot#2)								Empty, Don't care				Discrete out 4pts (Slot#1)			
0x0801	Analog out Ch0 high byte (Slot#3)								Analog out Ch0 low byte (Slot#3)							
0x0802	Analog out Ch1 high byte (Slot#3)								Analog out Ch1 low byte (Slot#3)							
0x0803	Discrete out high 8pts (Slot#4)								Discrete out low 8pts (Slot#4)							
0x0804	Discrete out 8pts (Slot#6)								Empty, Don't care				Discrete out 4pts (Slot#5)			
0x0805	Empty, Don't care						Discrete out 2pts (Slot#8)		Empty, Don't care						Discrete out 2pts (Slot#7)	
0x0806	Analog out Ch0 high byte (Slot#9)								Analog out Ch0 low byte (Slot#9)							
0x0807	Analog out Ch1 high byte (Slot#9)								Analog out Ch1 low byte (Slot#9)							
0x0808	Discrete out high 8pts (Slot#10)								Discrete out low 8pts (Slot#10)							
0x0809	Empty, Don't care								Empty, Don't care				Discrete out 4pts (Slot#11)			

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

Addr.	#15	#14	#13	#12	#11	#10	#9	#8	#7	#6	#5	#4	#3	#2	#1	#0
0x0800	Analog out Ch0 high byte (Slot#3)								Analog out Ch0 low byte (Slot#3)							
0x0801	Analog out Ch1 high byte (Slot#3)								Analog out Ch1 low byte (Slot#3)							
0x0802	Analog out Ch0 high byte (Slot#9)								Analog out Ch0 low byte (Slot#9)							
0x0803	Analog out Ch1 high byte (Slot#9)								Analog out Ch1 low byte (Slot#9)							
0x0804	Discrete out low 8pts (Slot#4)								Discrete out 8pts (Slot#2)							
0x0805	Discrete out 8pts (Slot#6)								Discrete out high 8pts (Slot#4)							
0x0806	Discrete out high 8pts (Slot#10)								Discrete out low 8pts (Slot#10)							
0x0807	Discrete Out 2pts (Slot#8)		Discrete Out 2pts (Slot#7)		Discrete out 4pts (Slot#11)				Discrete out 4pts (Slot#5)				Discrete out 4pts (Slot#1)			

* S-Series uses the byte-oriented register mapping.
* Size of input image bit is size of input image register *16.

✓ **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)

A.6 MODBUS Reference

MODBUS Reference Documents
http://www.modbus.org

MODBUS Tools
http://www.modbustools.com , MODBUS poll
http://www.win-tech.com , MODSCAN32

APPENDIX B - 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
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-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-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-4422	2 Channels, Voltage, 0~10Vdc, 12bit	81 41 2E	Active
	ST-4424	4 Channels, Voltage, 0~10Vdc, 12bit	81 43 6A	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
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

APPENDIX C – HMI connection example

C.1 Beijer HMI Master- PLC Slave(TCP)

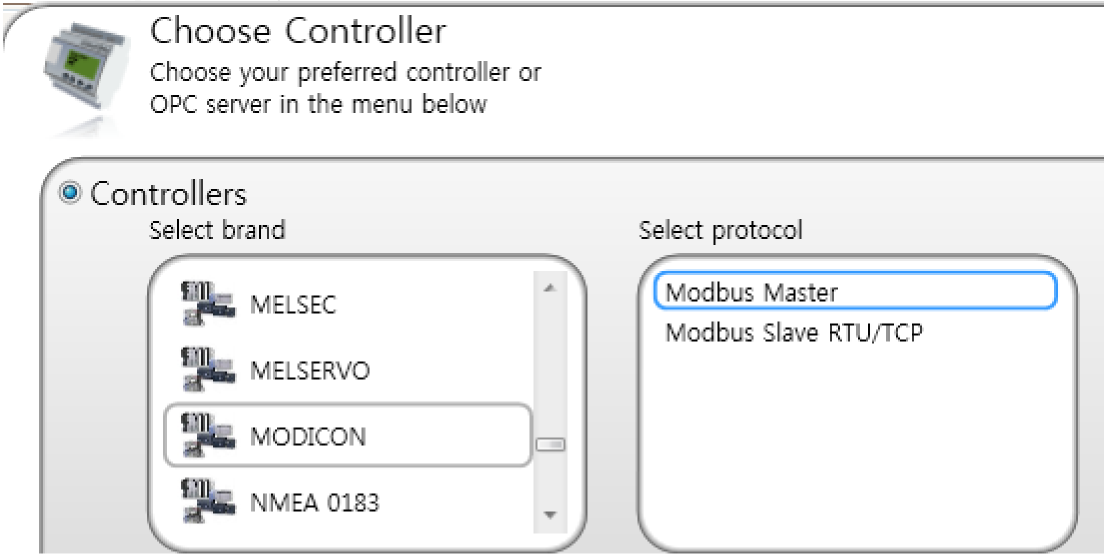
Set the HMI connect and PIO with same network system by LAN.

PIO can support the ModbusTCP slave communication, separately Codesys ModbusTCP master/slave function.
This function can be available for the connection IO guide pro connection, HMI connection and so on.

The ModbusTCP slave will be access to codesys address directly for as below address.
This address can be access able at ModbusRTU slave as well.

Address	IEC Address	Contents
0x0000~0x07FF	%IW0~%IW2047	2048 words Input and Internal memory (Area is write-protected)
0x0800~0x0FFF	%QW0~%QW2047	2048 words Output and Internal memory (Area is write-enabled)
0x1000~0x1FFF	-	Special Function Register (PIO Information)
0x2000~0x2FFF	-	Special Function Register (Slot Information)
0x4000~0x5FFF	%MW0~%MW8191	8192 words Internal memory (Area is write-enabled)

Set the HMI for the Modbus Master system.
It could be different for depends on the HMI system.
In this example, it is set by Modcon Modbus Master for HMI



Choose Controller

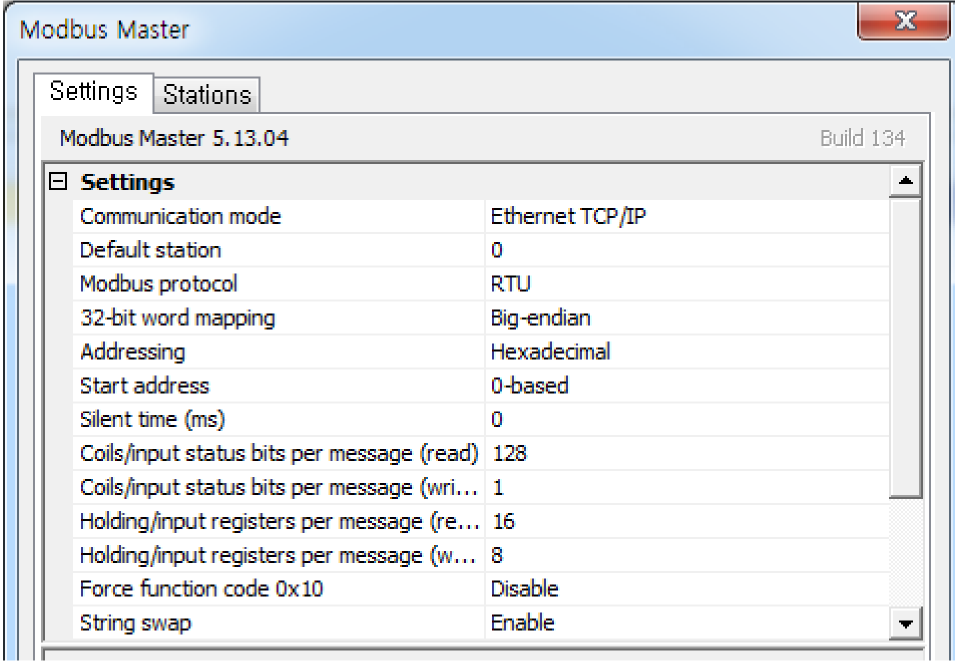
Choose your preferred controller or OPC server in the menu below

● Controllers

Select brand: MODICON

Select protocol: Modbus Master

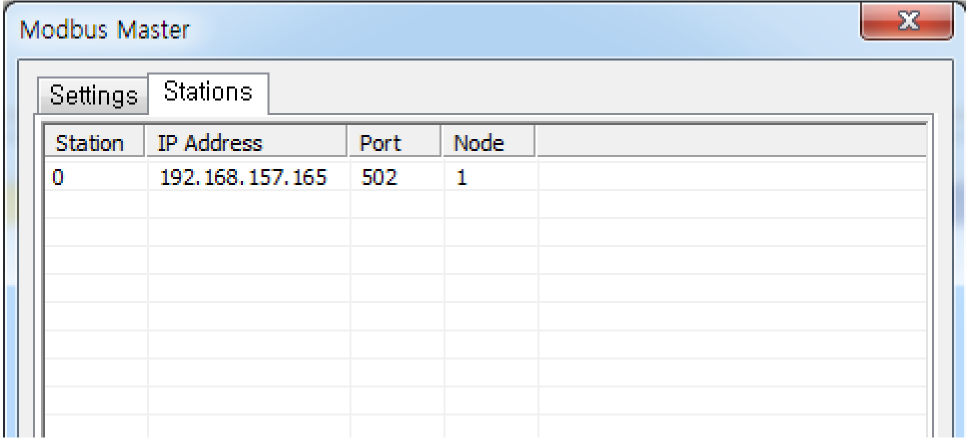
Set the Hexadecimal address system and address.



Settings

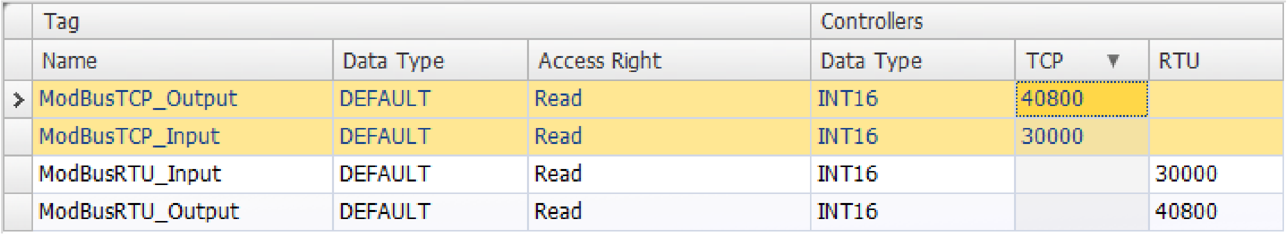
Communication mode	Ethernet TCP/IP
Default station	0
Modbus protocol	RTU
32-bit word mapping	Big-endian
Addressing	Hexadecimal
Start address	0-based
Silent time (ms)	0
Coils/input status bits per message (read)	128
Coils/input status bits per message (wri…	1
Holding/input registers per message (re…	16
Holding/input registers per message (w…	8
Force function code 0x10	Disable
String swap	Enable

Set the station IP address for PIO(Slave).



Station	IP Address	Port	Node
0	192.168.157.165	502	1

Read the 30000 address for the PIO slave input address.
Read/Write the 40800 for the PIO slave output address.



Tag			Controllers		
Name	Data Type	Access Right	Data Type	TCP	RTU
ModBusTCP_Output	DEFAULT	Read	INT16	40800	
ModBusTCP_Input	DEFAULT	Read	INT16	30000	
ModBusRTU_Input	DEFAULT	Read	INT16		30000
ModBusRTU_Output	DEFAULT	Read	INT16		40800

C.2 Beijer HMI Master- PLC Slave(RTU)

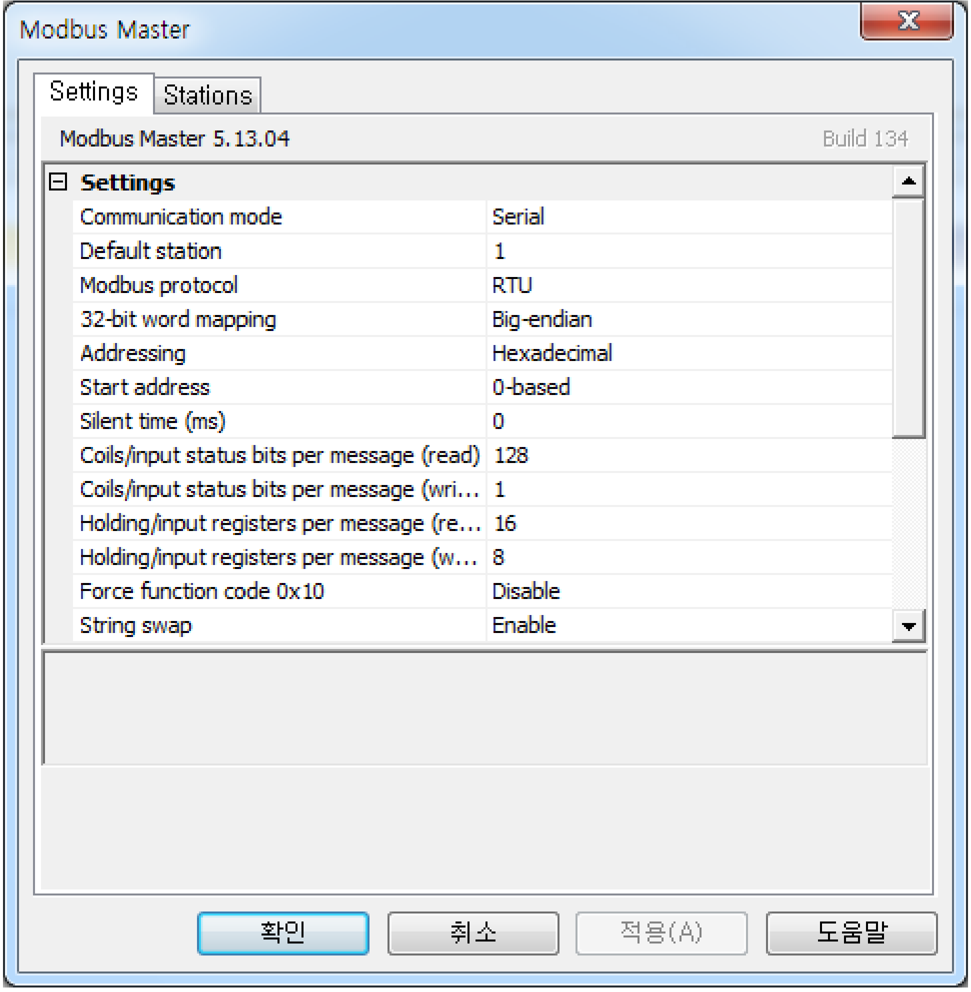
Connect the PIO with HMI using the serial cable.
PIO can support the RS232 and RS485 port simultaneously.

HMI should be supported the RS232 or RS485 for ModbusRTU master.
PIO can support the ModbusRTU slave only. Not supported the master mode.

It does not need to set into the PIO for the modbusRTU slave mode.
The modebusRTU slave will be access to codesys address directly for as below address.

Address	IEC Address	Contents
0x0000~0x07FF	%IW0~%IW2047	2048 words Input and Internal memory (Area is write-protected)
0x0800~0x0FFF	%QW0~%QW2047	2048 words Output and Internal memory (Area is write-enabled)
0x1000~0x1FFF	-	Special Function Register (PIO Information)
0x2000~0x2FFF	-	Special Function Register (Slot Information)
0x4000~0x5FFF	%MW0~%MW8191	8192 words Internal memory (Area is write-enabled)

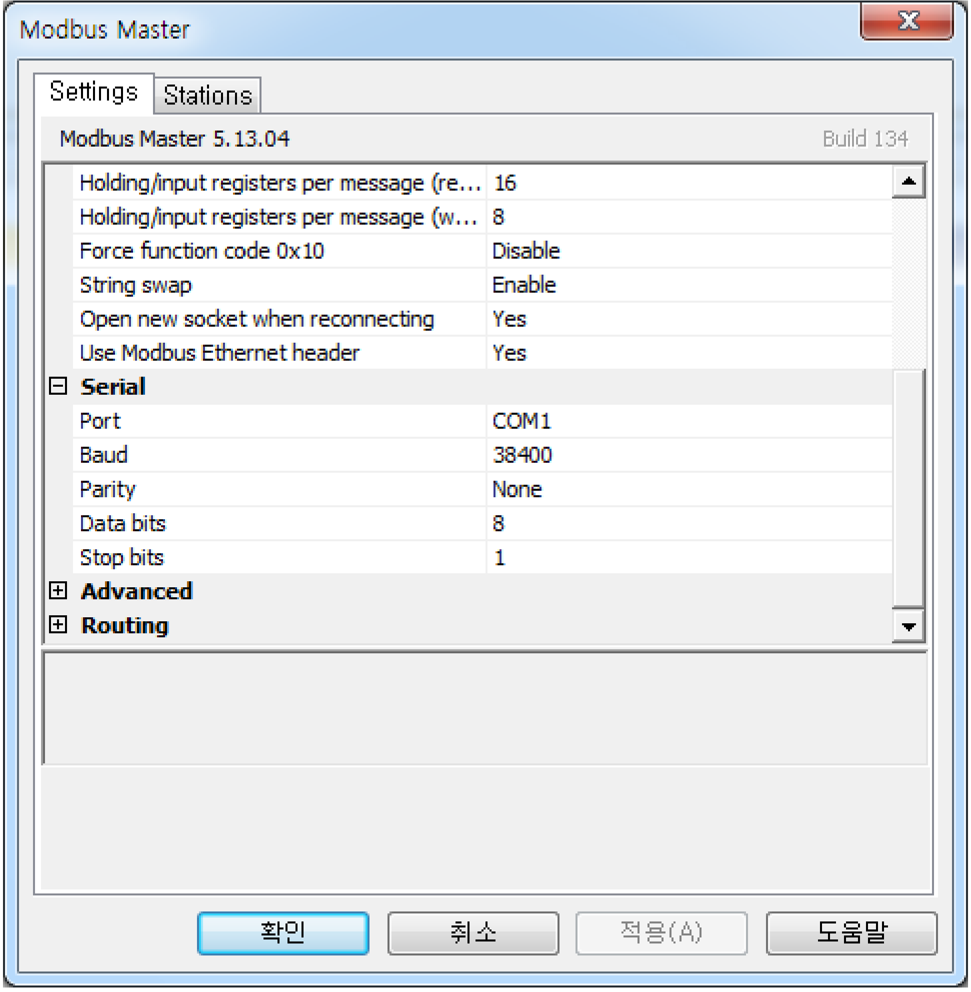
Set the HMI for the Modbus Master system.
Set the Hexadecimal address system and address.



Modbus Master 5.13.04 Build 134

Settings	
Communication mode	Serial
Default station	1
Modbus protocol	RTU
32-bit word mapping	Big-endian
Addressing	Hexadecimal
Start address	0-based
Silent time (ms)	0
Coils/input status bits per message (read)	128
Coils/input status bits per message (wri…	1
Holding/input registers per message (re…	16
Holding/input registers per message (w…	8
Force function code 0x10	Disable
String swap	Enable

Default Baud rate is 115200, set the COM port in HMI.



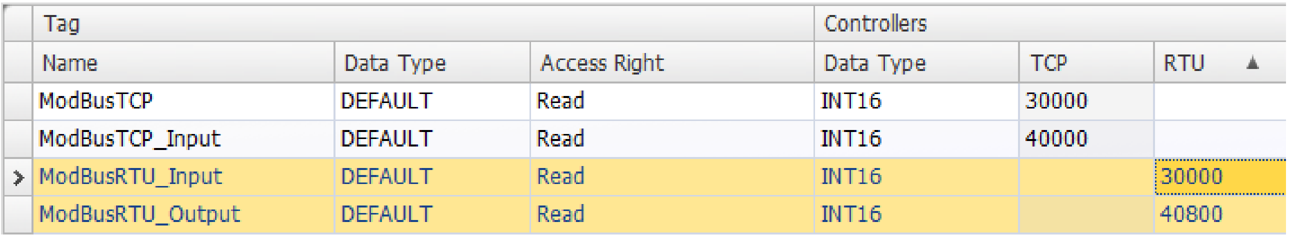
Modbus Master

Settings | Stations

Modbus Master 5.13.04 Build 134

Holding/input registers per message (re…	16
Holding/input registers per message (w…	8
Force function code 0x10	Disable
String swap	Enable
Open new socket when reconnecting	Yes
Use Modbus Ethernet header	Yes
⊟ **Serial**	
Port	COM1
Baud	38400
Parity	None
Data bits	8
Stop bits	1
⊞ **Advanced**	
⊞ **Routing**	

Read the 30000 address for the PIO slave input address.
Read/Write the 40800 for the PIO slave output address.
It is same as other CREVIS Modbus slave system address.



Tag			Controllers		
Name	Data Type	Access Right	Data Type	TCP	RTU ▲
ModBusTCP	DEFAULT	Read	INT16	30000	
ModBusTCP_Input	DEFAULT	Read	INT16	40000	
ModBusRTU_Input	DEFAULT	Read	INT16		30000
ModBusRTU_Output	DEFAULT	Read	INT16		40800

These example are for using Beijer TXA series.
In other HMI systems, it could be another way to use.