



User Manual

Version 1.0.0 Feb 2026

IEC850-211

Modbus TCP to IEC-61850 Gateway



Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year, beginning from the date of delivery to the original purchaser.

Warning

ICP DAS assumes no liability for any damage resulting from the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, nor for any infringements of patents or other rights of third parties resulting from its use.

Copyright

Copyright © 2026 ICP DAS Co., Ltd. All rights are reserved.

Trademarks

Names are used for identification purposes only and may be registered trademarks of their respective companies.

Document Revision

Version	Author	Date	Description
1.0.0	Alina	2026/02/25	First Released Revision

Contents

1. Introduction to Protocols	5
1.1. Modbus TCP Introduction.....	5
1.2. IEC61850 Protocol.....	5
1.2.1. GOOSE	5
1.2.2. MMS	6
2. IEC850-211	7
2.1. Product Introduction	7
2.2. Supported Data Types and Mapping	8
2.3. Features	9
2.4. Specifications	9
3. Hardware	11
3.1. Dimensions.....	11
3.2. Appearance.....	12
3.3. LED Indicator	13
4. Getting Started With IEC850-211	14
4.1. Preparations for Devices	14
4.2. Hardware Wiring.....	14
4.3. IEC850-211 Utility.....	16
4.3.1. Download and install IEC850_211_Utility.....	16
4.3.2. . Network Setting	16
4.3.3. Modbus Slave Parameter Settings	18
4.3.4. Set the object to be polled	19
4.3.5. Report Setting	21
4.3.6. GOOSE Subscribe Setting	23
4.3.7. Mapping Modbus Register Setting	24
4.3.8. GOOSE Publish Setting	25
4.3.9. Generate configuration file	27
4.3.10. Upload configuration file	28
4.3.11. Load configuration file.....	29
4.3.12. Read module settings	30
4.3.13. Read module settings	31
4.4. Update Firmware.....	32

1. Introduction to Protocols

1.1. Modbus TCP Introduction

Modbus TCP is one of the most widely used communication protocols in industrial automation.

It encapsulates standard Modbus frames within TCP/IP packets for transmission over Ethernet.

- Role Definition: Employs a Client/Server (or Master/Slave) architecture.
- Advantages: Simple protocol, high openness, natively supported by almost all SCADA, HMI, and PLC systems.

1.2. IEC61850 Protocol

IEC 61850 is the international standard for global power automation systems (such as substations and distribution automation). It defines not only communication protocols but also object-oriented data models, enabling high interoperability of devices.

This module primarily supports the following two types of IEC 61850 communication services:

1.2.1. GOOSE

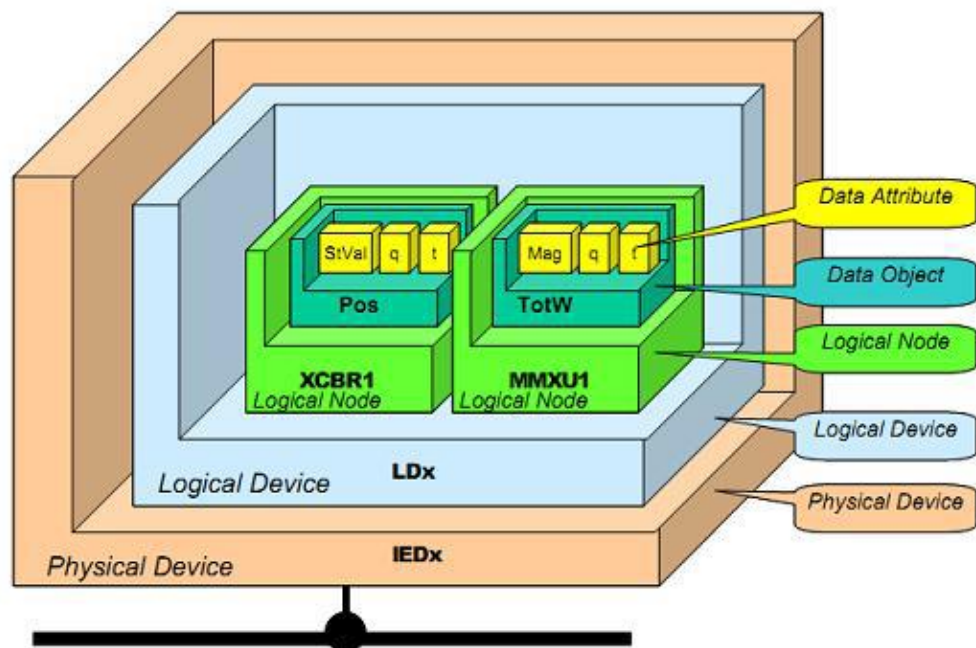
GOOSE is a Layer 2 Ethernet-based horizontal communication mechanism primarily used for rapid data exchange between devices (IED to IED).

- Communication Characteristics: Employs a publish/subscribe model, offering extremely high immediacy (typically less than 4ms).
- Application Scenarios: Commonly used in time-critical applications such as trip signals, interlock signals, or interlocking controls.

1.2.2. MMS

MMS is a TCP/IP-based vertical communication protocol primarily used for communication between the Supervisory Control and Data Acquisition (SCADA) layer and Interval Equipment (IED).

- Communication Characteristics: Confirmed Services, suitable for reading real-time data, issuing control commands, or receiving event reports.
- Data Structure: Object-oriented design; data nodes have explicit names (e.g., MMXU.TotW represents total power) rather than traditional digital addresses. (See diagram below)



2.IEC850-211

2.1. Product Introduction

IEC850-211 is a gateway designed for power automation and industrial control systems. This module is an **IEC 61850 Client and Modbus TCP Slave**, designed to simplify data exchange between substation automation equipment (such as IEDs and protective relays) and higher-level monitoring systems (such as SCADA, PLCs, and HMIs).

Through IEC850-211, users can easily access information from devices supporting the IEC 61850 standard without replacing existing Modbus master equipment, effectively reducing the cost and complexity of system upgrades.

2.2. Supported Data Types and Mapping

Due to the characteristics of the Modbus protocol register structure, IEC 850-211 currently only provides conversion and mapping support for the following commonly used data types when performing IEC 61850 MMS data conversion. When configuring the mapping table, please be sure to confirm the data type of the source node.

Supported MMS Data Types Table

MMS Data Type	introduce	Modbus register handling method
Boolean	Boolean (True/False)	Function code 1 or 2, mapped to a single bit or coil
Integer	Signed integers (16/32-bit)	Function code 3 or 4, depending on its length, occupies 1 to 2 registers.
Unsigned	Unsigned integer (16bit)	Function code 3 or 4 occupies 1 register (16-bit).
Float	floating numbers	Function code 3 or 4 occupies 2 temporary registers (32-bit).
BIT_STRING	Bit string	Function code 4 occupies 1 register (16-bit)
UTC_TIME	UTC time format	Function code 4 occupies 2 register (32-bit)

Important Notes

- **Unsupported Types:** If the object in the IEC 61850 device belongs to a type not listed above (e.g., Visible String or complex structure), this module currently does not support direct conversion.
- **Byte Order:** For multi-register types (such as Float or 32-bit Integer), please confirm the Endian (byte order) setting in the software configuration interface to ensure consistency with your Modbus master's decoding.

2.3. Features

- Read and write IEC61850 objects via Modbus commands
- Automatically map IEC-61850 data objects to Modbus registers via the Utility
- Supports MMS data types Boolean, Integer, Unsigned, Float, BIT_STRING, UTC_TIME
- Supports Modbus function codes 1, 2, 3, 4, 5, 6, 16
- Supports up to 10 IEC61850 server connections
- Allows a total of 5000 mapping points
- Supports GOOSE Publish & Subscribe
- Supports IEC61850 Reports
- The Utility supports importing SCL (SCD/CID/ICD) files

2.4. Specifications

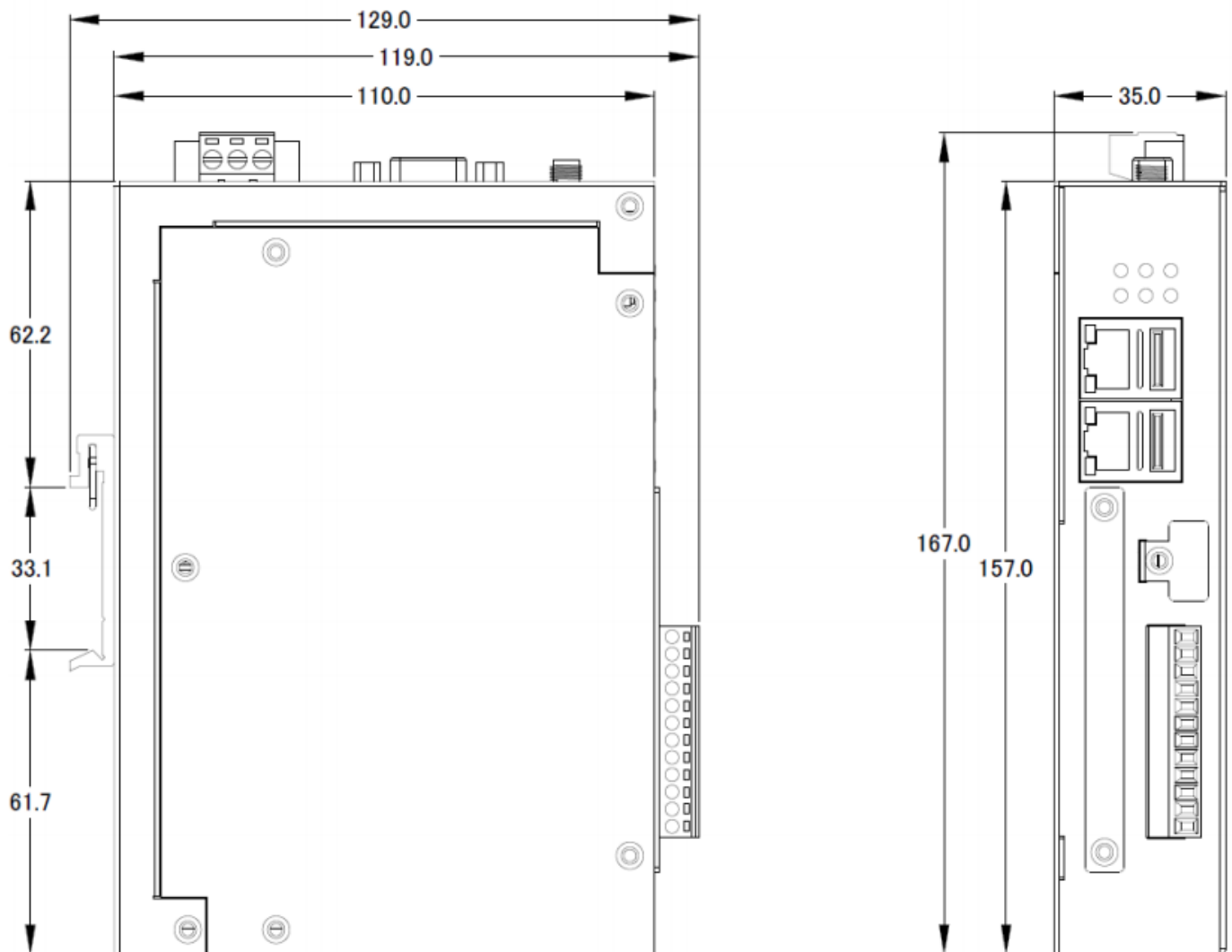
System		
CPU		Cortex-A8, 1 GHz
SDRAM		512 MB
Flash		512 MB
FRAM		64 KB
LED Indicators		PWR(Power), RUN(Running), L1, L2, L3
Communication Ports		
VGA		1 (reserved)
Ethernet		RJ-45 x 2, 10/100/1000 Based-TX (Auto-negotiating, Auto MDI/MDI-X, LED indicators)
USB 2.0		2 (reserved)
Console Port		RS-232 (RxD, TxD and GND); Non-isolated
ttyO2		RS-485 (reserved) (Data+, Data-); Non-isolated
ttyO4		RS-232 (reserved) (RxD, TxD and GND); Non-isolated
ttyO5		RS-485 (reserved) (Data+, Data-); 2500 VDC isolated
Protocol		
Modbus	identity	Modbus TCP Server
	Function	1, 2, 3, 4, 5, 6,16
IEC-61850	identity	IEC-61850 MMS client

	connection	Max. 10 MMS servers
	MMS data types	Boolean, Integer, Unsigned, Float, BIT_STRING, UTC_TIME
	Data Point	5000
	control	status-only direct-with-normal-security direct-with-enhanced-security sbo-with-normal-security sbo-with-enhanced-security
Power		
Supply Voltage	+12 to +48 VDC	
Consumption	4.8 W	
Connector	3-pin Removable Terminal Block	
Mechanism		
Dimensions	35 mm x 167 mm x 119 mm	
Casing	Metal	
Installation	DIN-Rail	
Environment		
Operating Temp.	-25°C ~ +75°C	
Storage Temp	-30°C ~ +85°C	
Humidity	10 ~ 90% RH, non-condensing	

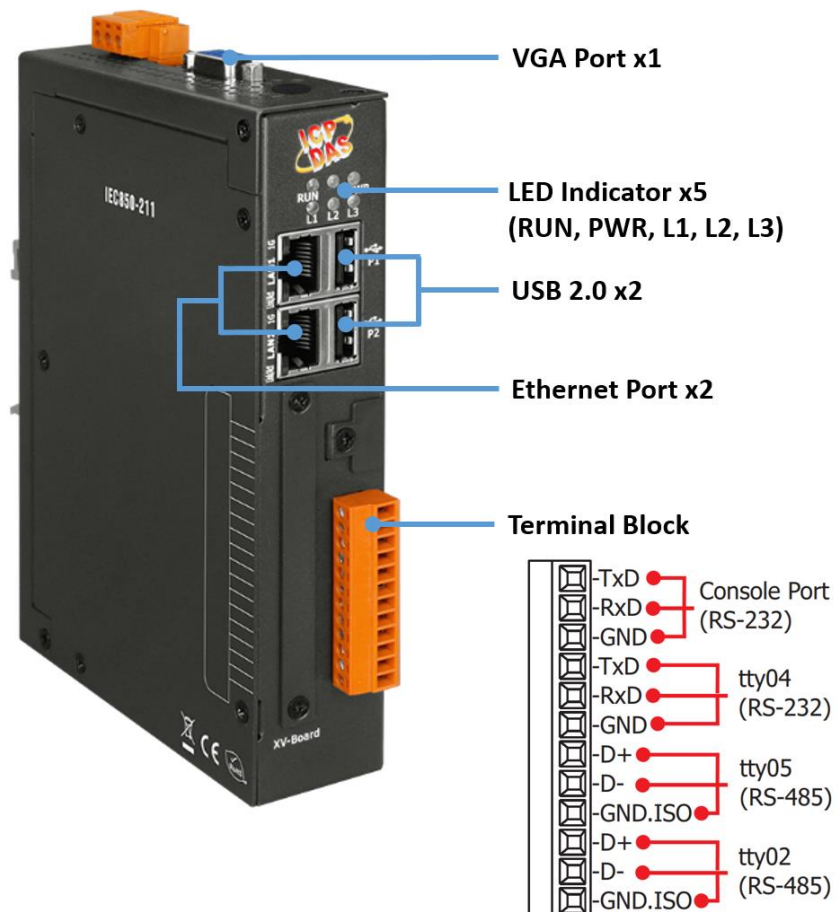
3. Hardware

3.1. Dimensions

Unit: mm

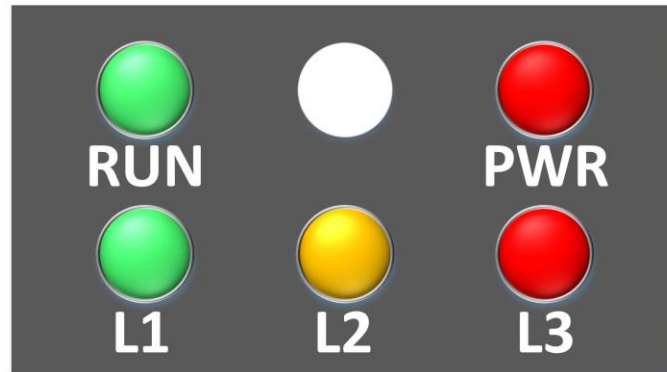


3.2. Appearance



3.3. LED Indicator

There are five LEDs to indicate the various states of the IEC850-211. The following is the illustration of these five LEDs.



LED Name	LED Status	Description
PWR	ON	Power on
	OFF	Power failure
RUN	Blink	OS is running
	OFF	OS stops running
L1	Flash everysecond	Firmware is running
	Other	Firmware stops running
L2	Flash everysecond	Disconnected from Modbus main station
	OFF	No Warning
L3	ON	The Configuration is incorrect
	OFF	No Error

4. Getting Started With IEC850-211

4.1. Preparations for Devices

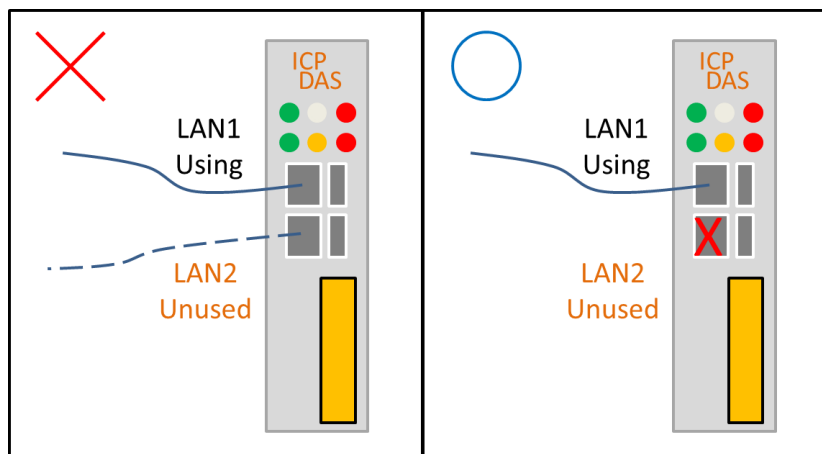
In addition to the IEC850-211, please prepare the following:

1. **Power Supply:** +12 ~ +48 VDC (Ex: DP-665)
2. **Ethernet Hub or Switch** (Ex: NS-205)
3. **PC/NB:** Can connect to the network and set the network

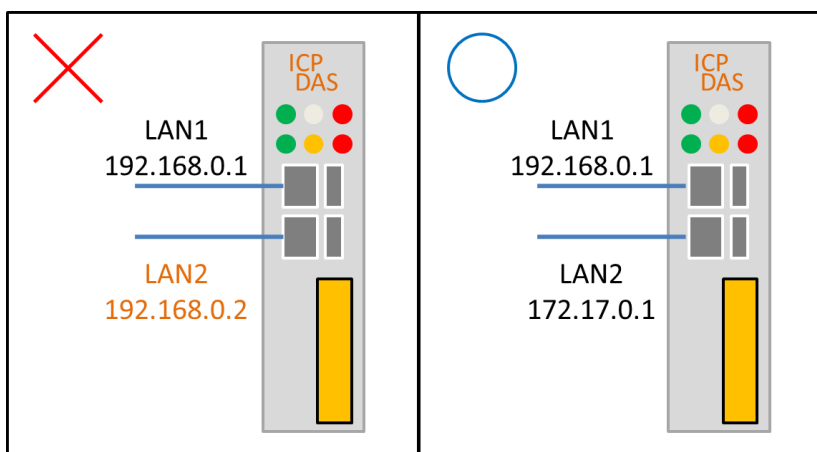
4.2. Hardware Wiring

In order to avoid abnormalities when using Ethernet and RS-485, please follow the following usage rules:

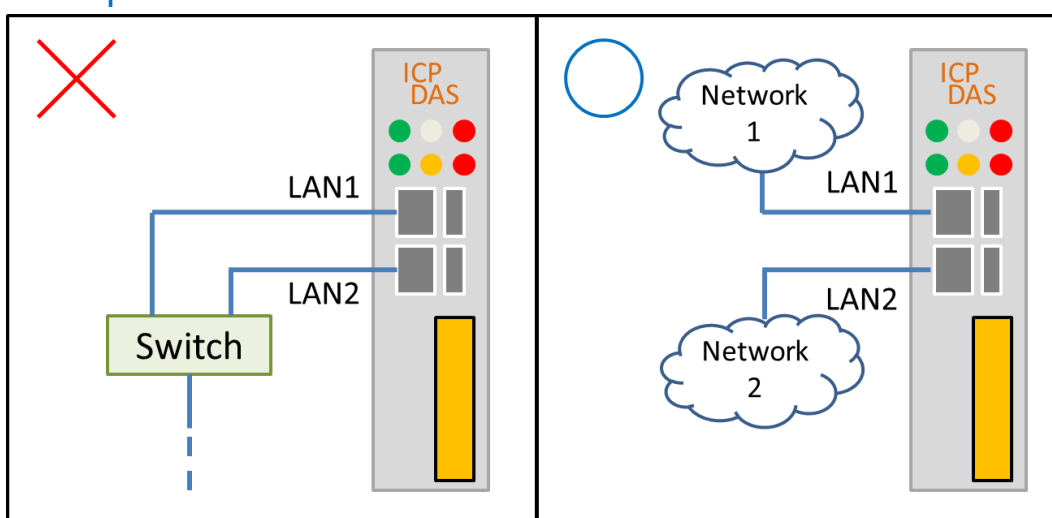
1. **Do not** plug in the network cable if the LAN (LAN1 or LAN2) is not used on IEC850-211.



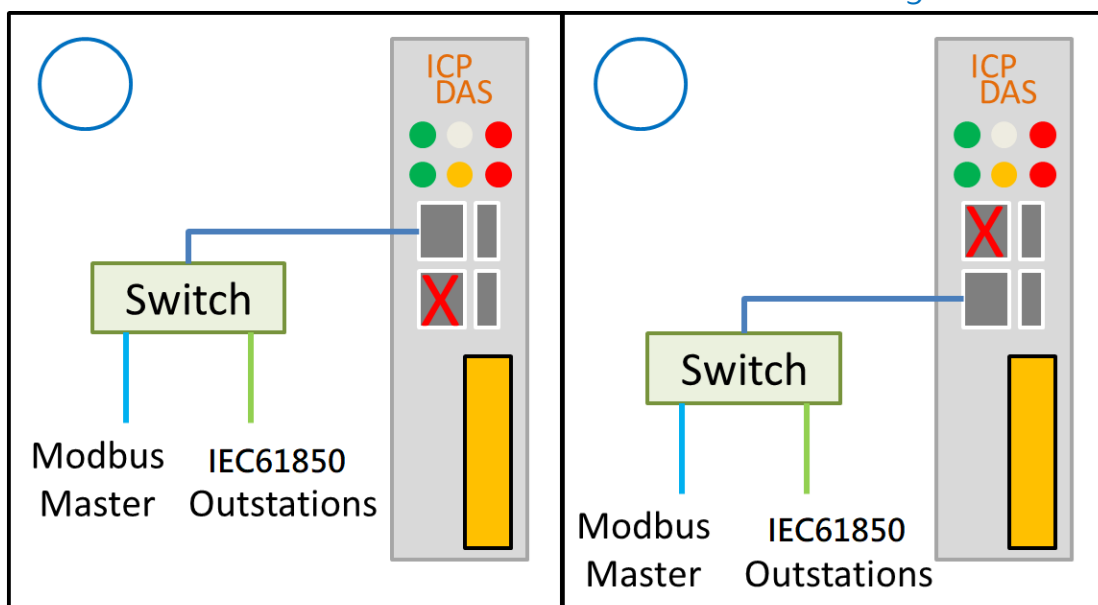
2. When both LAN1 and LAN2 are enabled, they **cannot** be set to the same network segment.

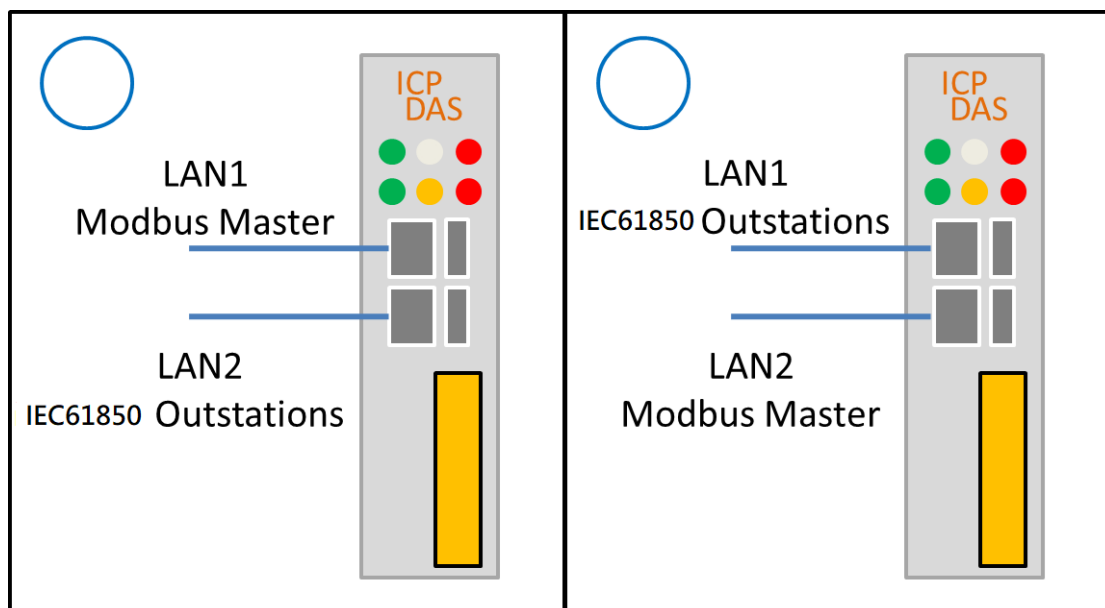


3. When both LAN1 and LAN2 are enabled, **they must be connected to two separate networks.**



4. Modbus TCP and IEC61850 devices **have no fixed LAN settings.**





After power is connected, please **wait 1 minute** for IEC850-211 start-up procedure. When the **"RUN"** indicator starts **flashing** and **"PWR"** indicator is **constantly lit**, it represents the boot is complete. After the module boots successfully, if the **"L1"** indicator flashes every second, it means the firmware is running.

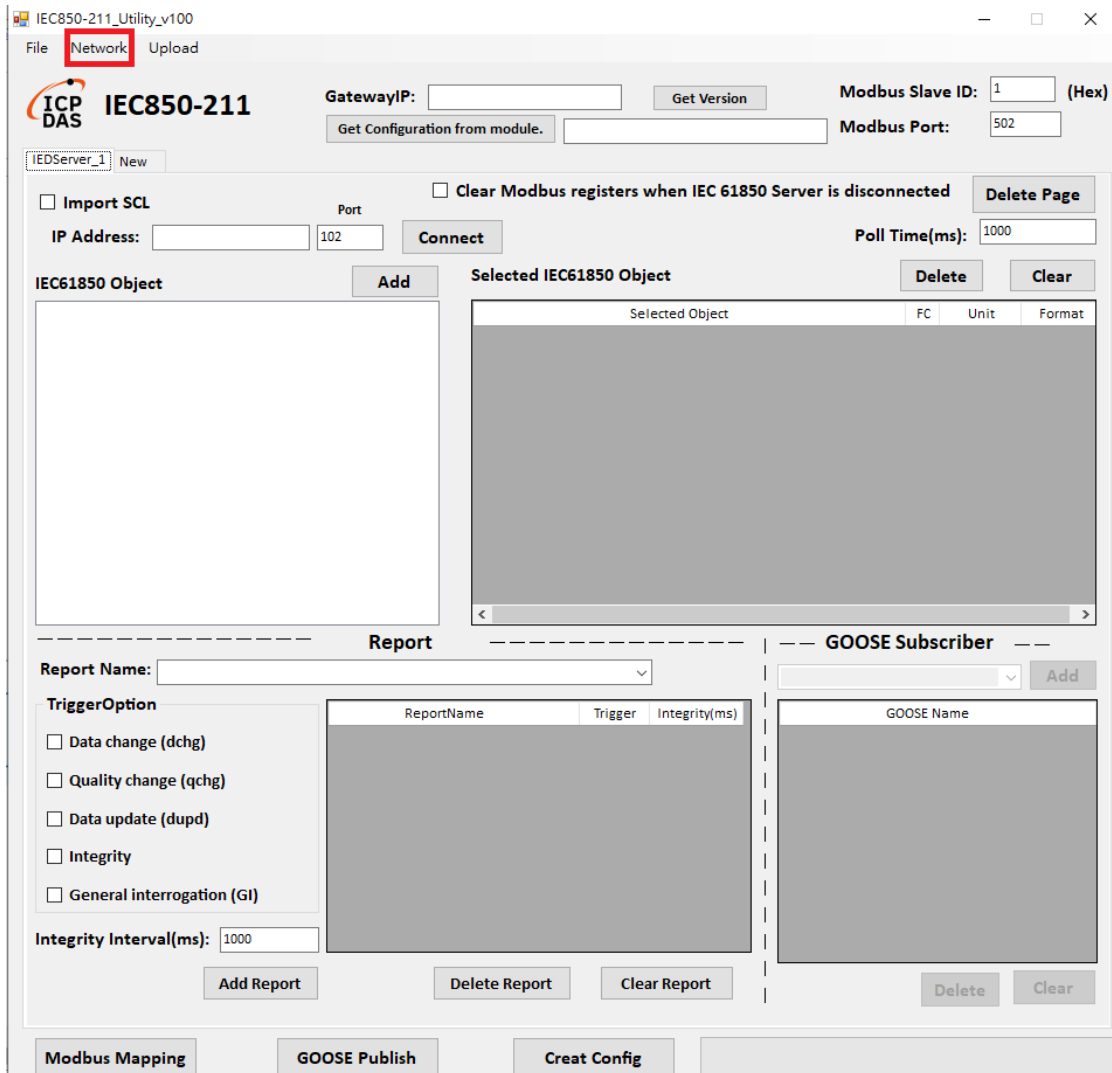
4.3. IEC850-211 Utility

4.3.1. Download and install IEC850_211_Utility

名稱	修改日期	類型	大小
Config_Utility_Setup	2021/1/7 上午 11:42	Windows Install...	931 KB
setup	2021/1/7 上午 11:42	應用程式	518 KB

4.3.2. Network Setting

(1) Open IEC850_211_S_Utility and click the "Network" option in the top toolbar.



(2) Connect to the module and set network parameters

Enter the IP address and press **[Connect]**, then enter the network parameters.

After entering the parameters, press Set all -> Save -> Reboot in sequence.

- [Set all] writes the settings to the module.
- [Save] saves the parameters written to the module.
- [Reboot] restarts the module.

The image shows a 'Network Configuration' window. At the top, there is a 'Connection' section with an IP field set to '192.168.0.1' and buttons for 'Connect' and 'Disconne'. Below this are sections for 'LAN1' and 'LAN2', each with fields for IP, Mask, Gateway, and MAC. To the right of these sections are buttons for 'Set all', 'Save', and 'Reboot'. Red boxes highlight the 'Connection' section and the right-side buttons.

4.3.3. Modbus Slave Parameter Settings

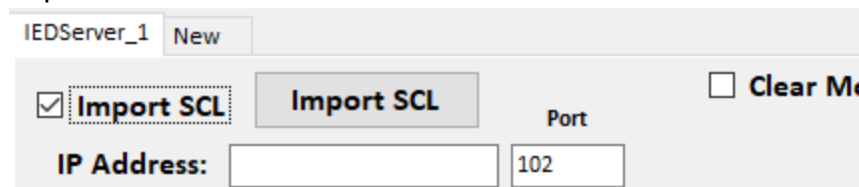
(1) Enter the IEC850-211 IP address, Modbus ID, and Modbus Port

The image shows a form for 'Modbus Slave Parameter Settings'. It includes a 'GatewayIP:' field, a 'Get Version' button, a 'Modbus Slave ID:' field with the value '1' and a '(Hex)' label, a 'Get Configuration from module.' button, an empty text field, and a 'Modbus Port:' field with the value '502'.

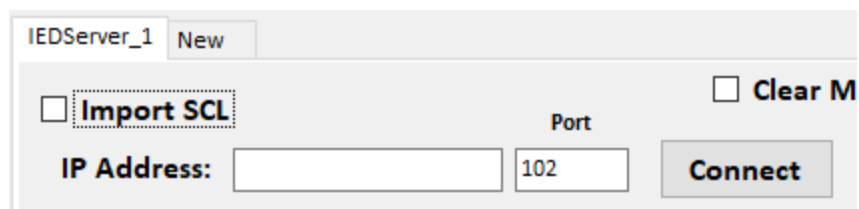
4.3.4. Set the object to be polled

(1) Option to import SCL file / connect to IEC61850 Server

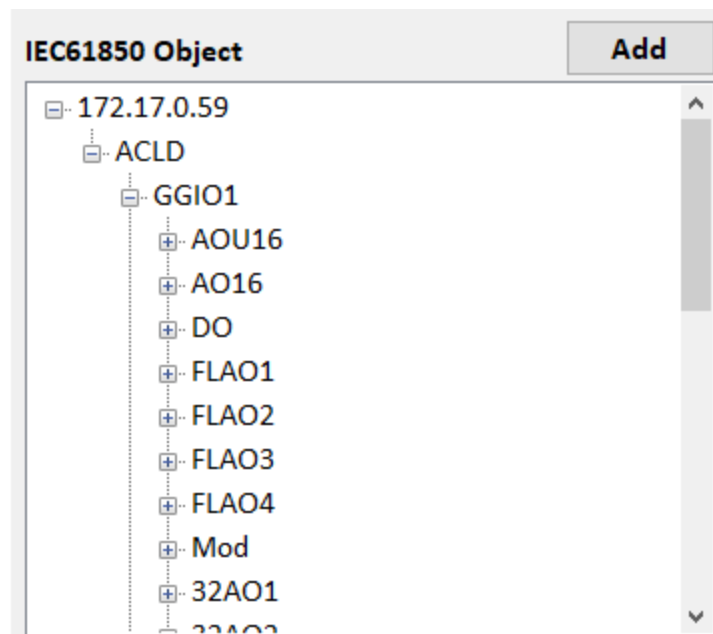
- Check Import SCL: Click **[Import SCL]**, select the SCL file to import.



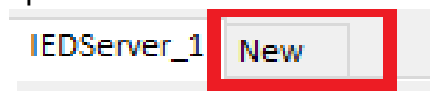
- Uncheck "Import SCL": After entering the Server IP address, press **[Connect]**.



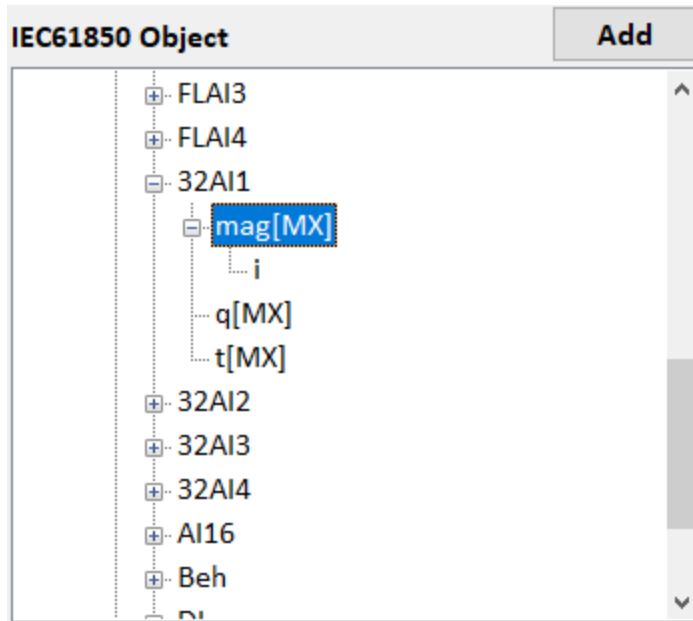
- After importing/connecting, the IEC61850 Object will display objects that can be polled.



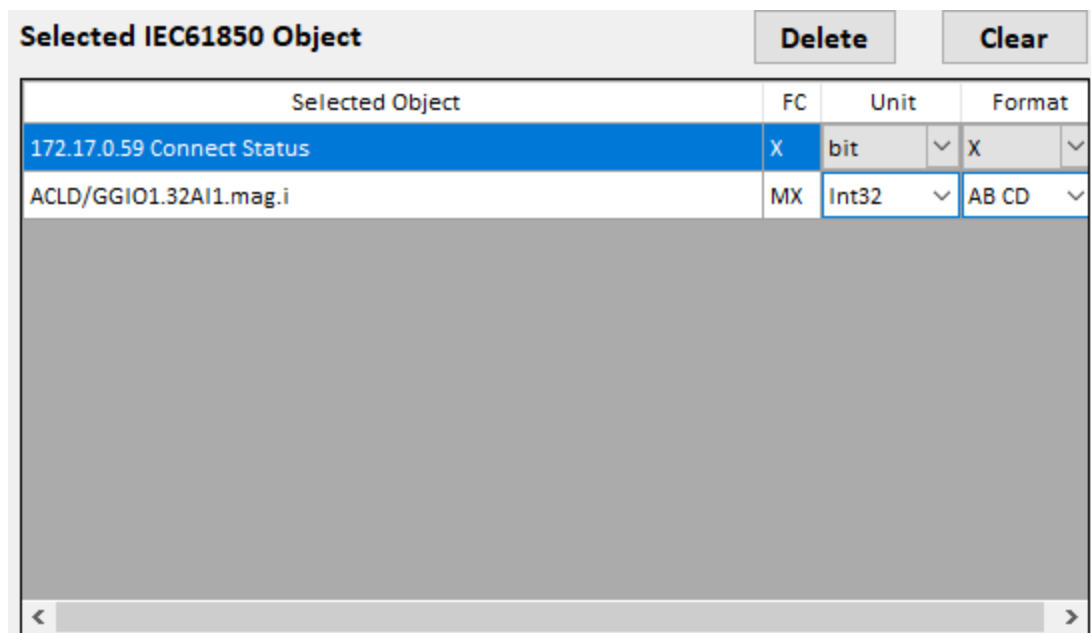
- Press "New" to add a new configuration page, which can configure up to 10 IEC61850 Servers.



(2) Select the object you want to map and press [Add].



(3) The set objects will be displayed below “Select IEC61850 Object”..



- [Delete]: Select the object you want to delete and press the button to delete the object.
- [Clear]: Clear all settings for objects.

(4) Other parameters

☐ Import SCL
 Port: 102

☐ Clear Modbus registers when IEC 61850 Server is disconnected

IP Address: 172.17.0.59
 Poll Time(ms)

IEC61850 Object

- FLAI3
- FLAI4
- 32AI1
 - mag[MX]
 - i
 - q[MX]
 - t[MX]
- 32AI2
- 32AI3
- 32AI4
- AI16
- Beh

Selected IEC61850 Object

Selected Object	FC	Unit	Format
172.17.0.59 Connect Status	X	bit	X
ACLD/GGIO1.32AI1.mag.i	MX	Int32	AB CD

- Clear Modbus registers when IEC61850 Server is disconnected:
Selecting this setting will clear the Modbus register value corresponding to this Server object to 0 when the module is disconnected from the Server.
- Poll Time (ms): Sets the polling interval in milliseconds.
- Connect Status (green box): The connection status with the Server. This parameter is fixed for each Server and cannot be deleted.

4.3.5. Report Setting

(1) After importing SCL / connecting to the server, the configurable Report will be displayed below the Report.

Report

Report Name:

TriggerOption

- ☐ Data change (dchg)
- ☐ Quality change (qchg)
- ☐ Data update (dupd)
- ☐ Integrity
- ☐ General interrogation (GI)

Integrity Interval(ms):

ReportName	Trigger	Integrity(ms)
------------	---------	---------------

- (2) Select the report you want to set and set the trigger method parameters, then click **[Add Report]**. The table below will display the reports that have been set.

ReportName	Trigger	Integrity(ms)
simpleIOGenericIO/LLN0.RP.EventsRC...	8	1000

Parameter Description:

- Data change (dchg): Triggers a report when the data value changes.
 - Quality change (qchg): Triggers a report when the data's "Quality" changes.
 - Data update (dupd): Triggers a report when the data is updated. Unlike Data Change, it triggers even if the updated value is the same as the previous one.
 - Integrity: When enabled, the device will proactively send a complete data report at fixed time intervals.
 - Integrity Interval: Sets the fixed transmission interval (milliseconds).
 - General interrogation: Used to obtain the current status and data from remote terminal devices.
- (3) The objects contained in the configured report will be displayed in “Select IEC61850 Object” below.

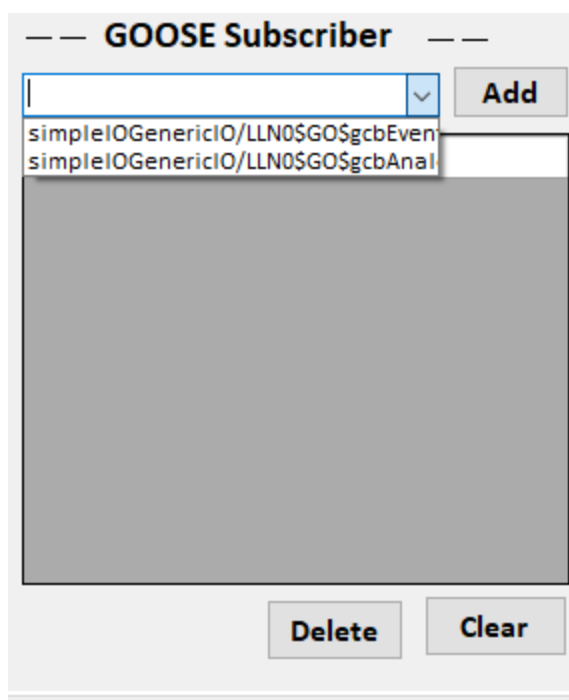
Selected IEC61850 Object				Delete	Clear
Selected Object	FC	Unit	Format		
10.0.0.2 Connect Status	X	bit	✓ X	✓	
EventsRCB01:simpleIOGenericIO/GGIO1.SPCSO1.stVal	ST	bit	✓ X	✓	
EventsRCB01:simpleIOGenericIO/GGIO1.SPCSO2.stVal	ST	bit	✓ X	✓	
EventsRCB01:simpleIOGenericIO/GGIO1.SPCSO3.stVal	ST	bit	✓ X	✓	
EventsRCB01:simpleIOGenericIO/GGIO1.SPCSO4.stVal	ST	bit	✓ X	✓	

- **Note: Instructions for Removing Report Objects**
Items displayed in the list in the format "**Report Name: Object Name**" are part of the Report service and cannot be deleted individually using the **[Delete]** or **[Clear]** buttons on the right side of the "Select IEC61850 Object" block.

To remove such objects, go to the **Report block**, select the Report item you wish to remove, and press **[Delete Report]** or **[Clear Report]**. When a Report is removed, all associated objects below it will be removed from the list.

4.3.6. GOOSE Subscribe Setting

- (1) After importing the SCL file, the GOOSE Subscriber will display the GOOSE files that can be subscribed to.



- **Note: GOOSE subscription display instructions**
To configure a GOOSE subscribe, you must provide a correctly formatted and complete SCL file (such as .SCD, .CID, .ICD). This module does not support automatically retrieving the GOOSE subscribe list via a server connection.
- (2) After selecting the GOOSE you wish to subscribe to, press the **[Add]** button on the right. The table below will display the GOOSE you have subscribed to.

GOOSE Name
simpleIOGenericIO/LLN0\$GO\$gcbEvents

- (3) The "Select IEC61850 Object" section below will display the subscribed GOOSE connection status and all included objects.

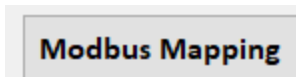
➤ **Note: Instructions for removing GOOSE subscribe Objects.**

Items displayed in the list in the format "**GOOSE Subscription Name: Object Name**" and "**GOOSE Subscription Full Location: Connect Status**" are part of a GOOSE subscription and cannot be deleted individually using the **[Delete]** or **[Clear]** buttons on the right side of the "Select IEC61850 Object" block.

To remove such objects, go to the **GOOSE Subscriber block**, select the GOOSE subscription item you wish to remove, and press **[Delete]** or **[Clear]**. When a GOOSE subscription is removed, all associated objects below it will be removed from the list.

4.3.7. Mapping Modbus Register Setting

- (1) Click the **[Modbus Mapping]** button below, and the system will automatically assign the corresponding Modbus register address based on the selected IEC 61850 object.



- (2) A "Show Modbus Mapping" window will then pop up, displaying an allocation table for confirming the mapping results and making adjustments.
- **Start Address:** Custom start address is supported, but considering the rationality of temporary memory space allocation, it is recommended that users use the system default address to reduce the risk of configuration errors.
 - **Confirm Save:** After verifying the Modbus Address corresponding to each object, click **[Mapping Done]** to close the window and apply the settings.

Can be changed

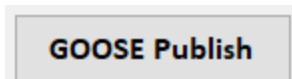
Server IP:Port	Object	Modbus Register	Start Address	Register Len
10.0.0.2:102	gcbEvents:simpleIOGenericIO/GGIO1.SPCSO1.stVal	01 Coil Status(0x)	0	1-bit
10.0.0.2:102	gcbEvents:simpleIOGenericIO/GGIO1.SPCSO2.stVal	01 Coil Status(0x)	1	1-bit
10.0.0.2:102	gcbEvents:simpleIOGenericIO/GGIO1.SPCSO3.stVal	01 Coil Status(0x)	2	1-bit
10.0.0.2:102	gcbEvents:simpleIOGenericIO/GGIO1.SPCSO4.stVal	01 Coil Status(0x)	3	1-bit
10.0.0.2:102	10.0.0.2 Connect Status	02 Input Status(1x)	0	1-bit
10.0.0.2:102	simpleIOGenericIO/LLN0\$GO\$gcbEvents: Connect Status	02 Input Status(1x)	1	1-bit
10.0.0.2:102	gcbEvents:simpleIOGenericIO/GGIO1.SPCSO1.q	04 Input Register(3x)	1	16-bit
10.0.0.2:102	gcbEvents:simpleIOGenericIO/GGIO1.SPCSO2.q	04 Input Register(3x)	2	16-bit
10.0.0.2:102	gcbEvents:simpleIOGenericIO/GGIO1.SPCSO3.q	04 Input Register(3x)	3	16-bit
10.0.0.2:102	gcbEvents:simpleIOGenericIO/GGIO1.SPCSO4.q	04 Input Register(3x)	4	16-bit
10.0.0.2:102	simpleIOGenericIO/GGIO1.AnIn1.mag.f	04 Input Register(3x)	5	32-bit

Mapping Done

- **Note: Instructions for Automatic mapping**
IEC850-211 specifies that the starting address Address 0 of Modbus Input Registers (3x) is used to store the firmware version number. Automatic mapping will start from Address 1 and cannot be manually changed to 0 by the user.

4.3.8. GOOSE Publish Setting

- (1) Click the **[GOOSE Publish]** button below.



- (2) The "GOOSE Publisher Setting" window will appear. After setting, press **[Setting]**.

Parameter description:

- GoCBRef: The full path to the GOOSE control block. This parameter is fixed and cannot be changed.
- AppID: A unique identifier for GOOSE, which cannot be duplicated.
- TTL (Time To Live): The maximum lifespan of a packet, measured in milliseconds (ms).
- Network-related settings (VlanID / VlanPriority / DsMAC): Define the virtual area network label, priority, and destination MAC address (Multicast) of packets.

- ConfRev & Dataset: Dataset related settings (version number & name)
- Publish Data: For the object to be published, please refer to "Show Modbus Mapping" window of Section 4.3.5 to set the Modbus Function Code and Modbus Address corresponding to the object to be published.
 - [ADD]: Add a new object
 - [Delete]: Delete a new object
 - [Clear]: Clear all objects

GOOSE Publisher Setting

Publish_1 New

GoCBRef: IEC850211LD/LLN0\$GO\$gcbValues1 Delete Page

AppID: 1 (Hex) VlanID: 1 (Hex)

TTL: 5000 (ms) VlanPriority: 4

DataSet: DataSet1 ConfRev: 1

DstMAC: 01 - 0c - cd - 01 - 00 - 01

Publish Data (Please refer to Modbus Mapping)

Modbus Function Code: 01 Coil Status(0x) ▾

Modbus Address: ADD

Delete Clear

FC	Address

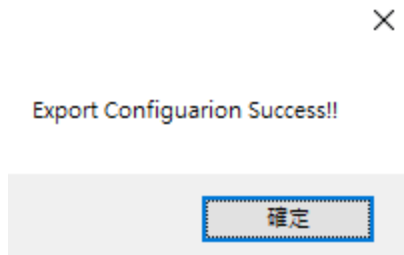
Setting

4.3.9. Generate configuration file

(1) Click the **[Create Config]** button below.



(2) The process is complete when the following window appears.



■ **Note: Configuration file generation instructions**

The configuration file is generated in: **Utility**

location\Gateway_Configuration\GatewayConfig.toml

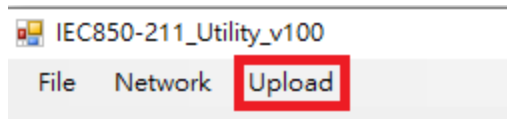
If GOOSE Publish is configured, an SCL file will be generated (if not configured, it will not be generated).

The SCL file is located in: **Utility**

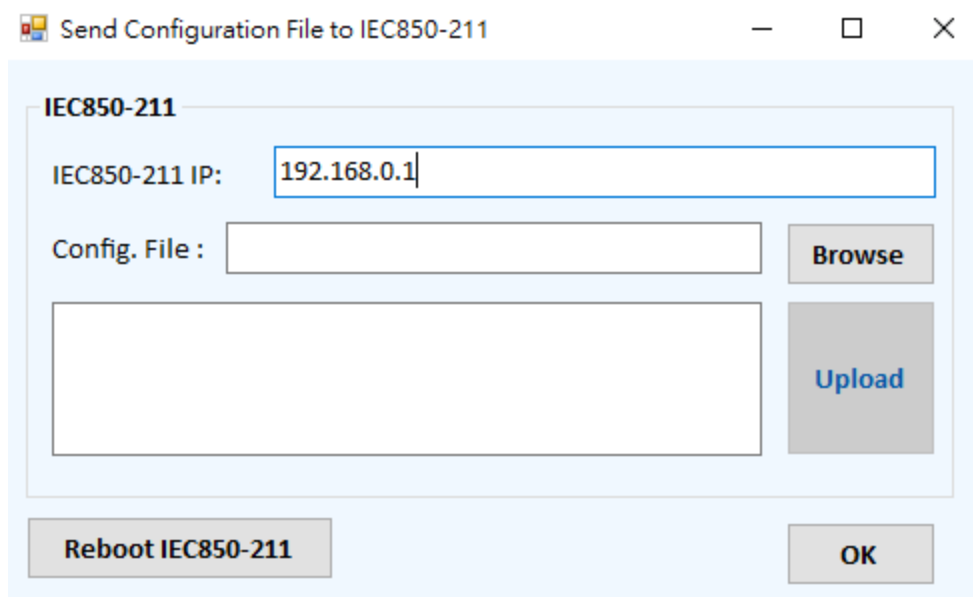
location\Gateway_Configuration\IEC850-211.scl

4.3.10. Upload configuration file

- (1) Click the "Upload" option in the top toolbar to upload the configuration file to IEC850-211.

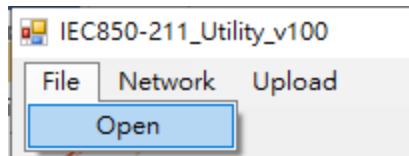


- (2) The "Send Configuration File to IEC850-211" window will be displayed.
- [Browse] :Browse and select the configuration file to upload.
 - [Upload] : Start uploading files.
 - [Reboot] : The module was restarted. **Note: After uploading the configuration file, you must press the "Reboot" button to restart the module; otherwise, the file will be lost.**

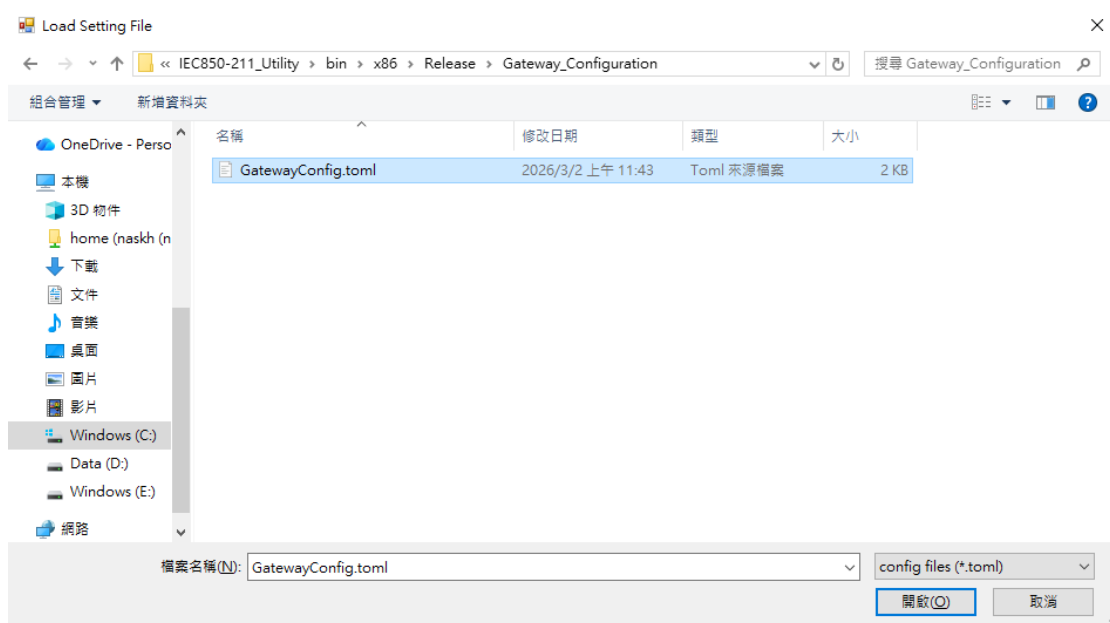


4.3.11. Load configuration file

(1) Click the "File" option in the toolbar above, and then click "Open".



(2) The "Load Setting File" window will appear; select the setting file you wish to read.



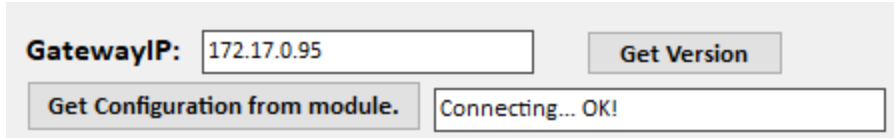
(3) The Utility will display the settings of the selected configuration file.

■ **Note: Read the configuration file instructions.**

This function is for **viewing configuration files only**. Settings cannot be modified after loading; please reconfigure the settings if changes are required.

4.3.12. Read module settings

- (1) After entering the IP address from IEC 850-211, click the **[Get configuration from module]** button.

A screenshot of a web-based utility interface. At the top, there is a label "GatewayIP:" followed by a text input field containing the IP address "172.17.0.95". To the right of this field is a button labeled "Get Version". Below the "GatewayIP:" field is another button labeled "Get Configuration from module.". To the right of this button is a text area containing the text "Connecting... OK!".

GatewayIP: 172.17.0.95 Get Version

Get Configuration from module. Connecting... OK!

- (2) After "Connecting... OK!" appears to the right of the button, the Utility will display the current module settings.

■ **Note: Read the module settings instructions.**

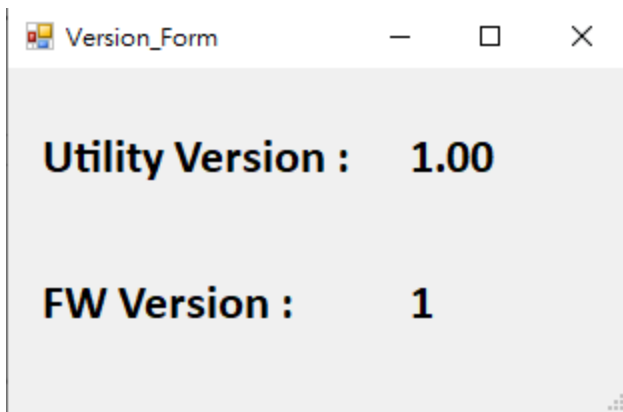
This function is for **reading module configurations only**. Settings cannot be modified after retrieval. To make changes, please reconfigure the settings.

4.3.13. Read module settings

- (1) After entering the IP address from IEC850-211, click the [Get Version] button.

A screenshot of a user interface element. It features a label 'GatewayIP:' followed by a text input field containing the IP address '172.17.0.95'. To the right of the input field is a button labeled 'Get Version'.

- (2) The "Version_Form" window will be displayed.

A screenshot of a window titled 'Version_Form'. The window has a standard Windows-style title bar with minimize, maximize, and close buttons. The main content area displays two lines of text: 'Utility Version : 1.00' and 'FW Version : 1'. The text is in a bold, black font.

■ **Note: Reading version number instructions**

When using the Utility to read the module firmware version, ensure that TCP Port 502 is not occupied by other Modbus master devices.

Additionally, IEC850-211 specifies that the starting address Address 0 of the Modbus Input Registers (3x) is used to store the firmware version number. Automatic mapping will start from Address 1, and the user cannot manually change it to 0.

4.4. Update Firmware

Open IEC850_211_Utility and press “Upload” option in the top toolbar. Connect to the module and choose the new firmware(After clicking Browse, you must change the lower right corner to All file to see the firmware update file). Then upload the new firmware to IEC850-211 and reboot. After reboot the module, it will automatically replace the old firmware with the new one and run it.

