



Version 1.0.2 May 2024

# IEC850-211-S

#### Modbus TCP to IEC-61850 Gateway



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#### **Document Revision**

Version	Author	Date	Description
1.0.0	Evan	2021/01/06	First Released Revision
1.0.1	Evan	2021/08/09	
1.0.2	Alina	2024/05/08	Modify object & Utility picture

#### Contents

1
+
4
4
5
5
7
7
8
9
10
10
20
· · · · · · · · · ·

# 1. Introduction

# 1.1.IEC-61850 Introduction

IEC 61850 is an international standard defining communication protocols for intelligent electronic devices at electrical substations. It is developed by the International Electrotechnical Commission's (IEC) Technical Committee 57 reference architecture for electric power systems. The objective of the standard is to specify requirements and to provide a framework to achieve interoperability between the IEDs supplied from different suppliers. This protocol can run over TCP/IP networks or substation LANs using high speed switched Ethernet to obtain the necessary response times below four milliseconds for protective relaying.

## **1.2. Modbus TCP Introduction**

MODBUS/TCP is a variant of the MODBUS family of simple, vendor-neutral communication protocols intended for supervision and control of automation equipment. Specifically, it covers the use of MODBUS messaging in an "Intranet" or "Internet" environment using the TCP/IP protocols. The most common use of the protocols at this time are for Ethernet attachment of PLC's, I/O modules, and gateways to other simple field buses or I/O networks.

## 1.3. About IEC850-211-S

IEC850-211-S is a network gateway allowing IEC-61850 MMS client to access Modbus TCP network as a Modbus TCP client. IEC-61850 protocol is used in substation automation. The IEDs exchange information with other IEDs or SCADA via IEC-61850 protocol for protection and control devices. IEC850-211-S support Logical Node GGIO and Data Object Ind, SPCSO, AnIn, AnOut. It also support data set and unbuffered report function to exchange data with a client. The data mapping rule can be configured via ICPDAS Utility.

### 1.4. Features

- Read/Write Modbus register via IEC-61850
- Configurable IEC-61850 server
- Configurable Modbus TCP client
- Support Logical Node GGIO
- Support common Data Object Ind, SPCSO, AnIn, AnOut
- Support Modbus DI, DO,AI,AO types
- Support Modbus function code 1, 2, 3, 4, 5, 6,16
- Maximum support 32 Modbus TCP servers

#### 1.5. Specifications

System					
CPU		Cortex-A8	3, 1 GHz		
SDRAM		512 MB			
Flash		512 MB			
FRAM		64 KB			
LED Indicate	_ED Indicators PWR(Power), RUN(Running), L1, L2, L3		ver), RUN(Running), L1, L2, L3		
Communication Ports		_			
VGA 1 (rese		1 (reserve	ed)		
Ethernet F		RJ-45 x 2, 10/100/1000 Based-TX (Auto-negotiating,			
		Auto MDI/MDI-X, LED indicators)			
USB 2.0 2 (reserv		2 (reserve	ed)		
Console Po	rt	RS-232 (	S-232 (RxD, TxD and GND); Non-isolated		
ttyO2		RS-485 (	RS-485 (reserved) (Data+, Data-); Non-isolated		
ttyO4		RS-232 (reserved) (RxD, TxD and GND);			
		Non-isola	ted		
ttyO5		RS-485 (	reserved) (Data+, Data-); 2500 VDC isolated		
Protoco	bl				
Modbus	identity		Modbus TCP client		
	Function		1, 2, 3, 4, 5, 6,16		
	connection		Max. 32 Modbus TCP servers		

IEC-61850	identity		IEC-61850 MMS server		
	connection		Max. 5 MMS clients		
	Logical Node		LLN0、LPHD、GGIO		
	Data Object		Ind, SPCSO, AnIn, AnOut		
	control		status-only		
			direct-with-normal-security		
			direct-with-enhanced-security		
			sbo-with-normal-security		
			sbo-with-enhanced-security		
Power					
Supply Voltage +12 to +4		+12 to +4	8 VDC		
Consumption 4.8 W		4.8 W			
Connector		3-pin Ren	novable Terminal Block		
Mechanism	l				
Dimensions		35 mm x	167 mm x 119 mm		
Casing		Metal			
Installation		DIN-Rail			
Environme	nt				
Operating Te	emp.	-25°C ~ +	75°C		
Storage Terr	ър	-30°C ~ +	85°C		
Humidity		10 ~ 90%	RH, non-condensing		

# 2.Hardware

# 2.1. Dimensions

Unit: mm



# 2.2. Appearance



# 2.3. LED Indicator

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



LED Name	LED Status	Description		
DWD	ON	Power on		
OFF		Power failure		
DIIN	RUN OS is running			
KUN	OFF	OS stops running		
14	Flash every second	Firmware is running		
<b>L</b> 1	Other	Firmware stops running		
1.2	Flash every second	Some Modbus servers are disconnected		
LZ	OFF	No Warning		
1.2	ON	The Configuration is incorrect		
LJ	OFF	No Error		

# **3.Getting Started With IEC850-211-S**

#### 3.1. Preparations for Devices

In addition to the IEC850-211-S, 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

#### 3.2. Hardware Wiring

Connect the IEC850-211-S with the RJ-45 Ethernet port LAN1 to an Ethernet hub/switch and PC. You can also link directly the IEC850-211-S to PC with an Ethernet cable.

After power is connected, please **wait 1 minute** for IEC850-211-S 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.

#### 3.3. IEC850-211-S Utility

Step 0:

Download and install IEC850\_211\_S\_Utility

名稱 ^	修改日期	類型	大小
👸 Config_Utility_Setup	2021/1/7 上午 11:42	Windows Installe	931 KB
💽 setup	2021/1/7 上午 11:42	應用程式	518 KB

Step 1:

Open IEC850\_211\_S\_Utility and press "Network" option in the top toolbar.

JEC850-211-S Gateway Configration Utility v1.02 File Upload Network IEC61850 Client					-		×
Gateway Network Configuration         IP Address         TCP Port         102         Get Configuration from module.		Name	Logica	l Device LD	Next Ste	p.	
Polling Configuration GGIO0 New							
Modbus Slave Connection	Function	Start Address	Length	Unit	Poll	ing time (ms)	
Slave ID         IP Address         TCP Port         Add Modbus Commands         FC1 Read multiple coils status (0xxxx) for D0         Start Address :         Unit :       Int16         Length:       << Delete							
DataSet Report					Del	ete Pa	ge
						Finis	sh

Step 2:

Connect to the module and set network parameter.

- > "Set all" is to write the configuration to the module.
- > "Save" is to save the configuration.
  - > "Reboot" is to reboot the module.

🖳 Network Con	figuration		-		×
Connection	8.0.1	Connect	Disc	onne	
LAN1 IP			7	Se	tall
Mask Gateway				Sa	ive
MAC					
LAN2					
IP Mask					
MAC				Rel	poot
MAC				Rel	ooot

Step 3:

Start to set gateway data mapping.

1. Input the IP address that you want to listen for IEC-61850 and input IED name and LD name.

LEC850-211-S Gateway Configration Utility v1.02 File Upload Network IEC61850 Client					- 0	×
Gateway Network Configuration         IP Address       TCP Port         172       17       0       95       102         Get Configuration from module.       0       0       0       0		Name IED		l Device	Next Step.	
Polling Configuration GGI00 New						
Modbus Slave Connection	Function	Start Address	Length	Unit	Polling tin (ms)	ue
Slave ID						
IP Address						
TCP Port Next Step						
Add Modbus Commands						
FC1 Read multiple coils status (0xxxxx) for DO $\qquad \checkmark$						
Start Address :						
Unit : Int16						
Length: << Delete						
Polling Time :						
DataSet Report					Delete	Page
					Fi	nish

2. Input the Node ID, IP address and port of the Modbus TCP server.

📕 IEC850-211-S Gateway Configration Utility v1.02					- 🗆	$\times$
File Upload Network IEC61850 Client						
Gateway Network Configuration         IP Address         172       17         0       95         Get Configuration from module.	IED	Name IED	Logica	l Device	Next Step.	
Polling Configuration GGIO0 New						
Modbus Slave Connection	Function	Start Address	Length	Unit	Polling time (ms)	
Slave ID 1   IP Address 172   IP Address 172   ITCP Port 502     Next Step     Add Modbus Commands     FC1 Read multiple coils status (0xxxx) for DO   Start Address :   Unit : Int16   Add >>   Length: < Delete						
DataSet Report					Delete Pa	age
					Fin	ish

- 3. Input the registers that you want to map to IEC-61850 data object.
- > "Add" is to add command to the right side table.
- > "Delete" is to delete the command you choose from the right side table.

IEC850-211-S Gateway Configration Utility v1.02					_		$\times$
File Upload Network IEC61850 Client							
Gateway Network Configuration         IP Address         172       17         0       95         Get Configuration from module.	IED	Name IED	Logical	LD	Next Ste	p.	
Polling Configuration GGIO0 New							
Modbus Slave Connection	Function	Start Address	Length	Unit	Poll	ing time (ms)	
Slave ID 1	1	0	2	bit		1000	
IP Address         172         17         11         225           TCP Port         502         Next Step							
Add Modbus Commands FC1 Read multiple coils status (0xxxx) for DO v Start Address : 0 Unit : Int16 v Add >> Length: 2 v Oelete Polling Time : 1000							
DataSet Report					De	ete Pag	ge
						Finis	sh

- 4. Press "DataSet" button and start to configure data set function.
- > "New" is to create a data set named after the text in the top text box.
- > The drop-down menu is to choose which data set can be configured now.
- > "Delete" is to delete the data set chosen now.
- "Add Data" is to add the data object in the left side table to the data set chosen now.
- "Delete Data" is to delete the chosen data object in the right side table from the data set.
- > "Finish" is to leave this window.

Data Object	I/O type	Function	Address	Data Set		InClass	fc	lnInst	doName	daName
SPCSO0	DO	1	0		•	GGIO	ST	0	SPCSOO	ALL
SPCSO1	DO	1	1	DataSet Name		GGIO	ST	0	SPCSO1	ALL
IndO	DI	2	0	New		GGIO	ST	0	IndO	ALL
Ind1	DI	2	1			GGIO	ST	0	Ind1	ALL
ISCSO0	AO	3	0	ET-7026 ~		GGIO	ST	0	ISCSOO	ALL
ISCSO1	AO	3	1			GGIO	ST	0	ISCSO1	ALL
IntIn0	AI	4	0	Delete		GGIO	ST	0	IntInO	ALL
IntIn1	AI	4	1			GGIO	ST	0	IntIn1	ALL
IntIn2	AI	4	2	Data Object		GGIO	ST	0	IntIn2	ALL
IntIn3	AI	4	3			GGIO	ST	0	IntIn3	ALL
IntIn4	AI	4	4	Add Data		GGIO	ST	0	IntIn4	ALL
IntIn5	AI	4	5	Delete Data		GGIO	ST	0	IntIn5	ALL
				Delete Data						
				Finish						

- 5. Press "Report" button and start to configure report function.
- "Create" is to create a report control block with parameter in the text boxes, check boxes and drop-down menu.
- > "Modify" is to modify the report control block chosen now.
- > "Delete" is to delete the report control block chosen now.

d Gateway Config U	Report Control Bloc	k							$\times$
File Upload Ne Gateway Netv IP Address 192 168 Polling Config Slave_1 New Modbus Sl	Report Control Bloc name: RCB1 rptiD: report1 intgPd: 1000 datSet: ET-7026 Create	<	Trigger Options Data change (dchg) Quality change (qchg) Data update (dupd) Integrity General interrogation	) n (Gl)	Optional Seque Repor Reaso Data s Data r Buffer Entryl	Fields ence number t time stamp n for inclusion et name eference overflow D	time (m. 1000	- (2	
Slave ID		Delete			Conf-r	evision	1000		_
IP Address 192	name	datSet	ıptID	intgPd		TrgOps	1000		-
TCP Port 502	▶ RCB1	ET-7026	report1	1000		8			
Add Modb FCI Read multiple co Start Address : 0									
Length:				_	_		-		
Polling Time: 100						Finish			
DataSet	Report						Delete	Page	2 2
							F	ms	1

 Press "Finish" button to convert the configuration to a file named "GatewayConfig.toml" and it is put in the folder "Gateway\_Configuration" which is next to the utility.

🛔 IEC850-211-S Gateway Configration Utility v1.02					- 🗆 X
File Upload Network IEC61850 Client					
Gateway Network Configuration         IP Address       TCP Port         172       17       0       95       102         Get Configuration from module.	IED	Name IED	Logica	l Device LD	Next Step.
Polling Configuration					
Modbus Slave Connection	Function	Start Address	Length	Unit	Polling time (ms)
Slave ID 1	1	0	2	bit	1000
IP Address 172 17 11 225 TCP Port 502 Next Step E	ixport Config	guarion Success!! 確定	×		
FC1 Read multiple coils status (0xxxx) for DO         Start Address :         0         Unit :       Int16         Length:       2         Polling Time :       1000					
DataSet Report					Delete Page
					Finish

Step 4:

Press "Upload" option in the top toolbar to upload the setting file to IEC850-211-S.

- > "Browse" is to choose the file that you want to upload to module.
- > "Upload" is to upload the file to module.
  - "Reboot" is to reboot the module. Note: After uploading the file, you must press "Reboot" button to reboot module, or the file will be lost.

Send Configuration File to IEC850-211-S

IEC850-211-S	
IEC850-211-S IP: 192.168.0.1	
Config. File :	Browse
	Upload
Reboot IEC850-211-S	ОК

#### Step 5:

Press "Test" option in the top toolbar to test IEC850-211-S.

🖳 Client for testing IEC850-211-S						-	×
(ICP IEC850-211-S	-D- Connect	C=D Disconnect	(/0) Control	Read	Repört		
묡 DataModel	Name	Valu	e				
JataSet							
Report							

#### 3.4. Update Firmware

Open IEC850\_211\_S\_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-S and reboot. After reboot the module, it will automatically replace the old firmware with the new one and run it.

Send Configuration File to IEC850-211-S	
IEC850-211-S	
IEC850-211-S IP: 192.168.0.1	
Config. File :	Browse
	Upload
Reboot IEC850-211-S	ОК

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← → ▼ ↑ □ ≪ 眞面 > Alina > IEC850-211-S > Config_Utility > v102 > bin > x86 > Release > ▼ む 提尋 Release	م ?
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▲ OneDrive - Perso ▲ 名稱 ▲ 像改日期 類型 大小	
Gateway_Configuration 2024/2/26下午03:06 檔案資料夾	
→ ◆ k ModuleConfig 2024/4/17 下午 02:51 檔案資料夾	
■ 3D 杨件 目 5566.txt 2024/2/21上午 09:39 文字文件 13 KB	
↓ home (naskh (n demo.conf 2024/2/21上午 09:39 CONF 檔案 2 KB	
↓下載 図 DiffieHellman.dll 2024/2/21 上午 09:39 應用程式擴充 52 KB	
賞文件 ☐ Gateway.conf 2024/3/6 下午 03:26 CONF 檔案 1 KB	
▶ 音樂 Gateway1.conf 2024/2/21上午 09:39 CONF 福案 1 KB	
□ Gateway2.conf 2024/2/21上午 09:39 CONF 檔案 2 KB	
□ Gateway3.conf 2024/2/21上午 09:39 CONF 檔案 3 KB	
■ 国内 4 IEC850-211-S_Utility.exe 2024/4/11上午 09:51 應用程式 313 KB	
■ 影片 B IEC850-211-S_Utility.exe.config 2024/2/21上午 09:39 XML Configurati 1 KB	
Windows (C:) Di IEC850-211-S_Utility.pdb 2024/4/11上午 09:51 Intermediate file 174 KB	
■ Data (D:)	
→ Windows (E:) ③ iec61850dotnet.dll 2024/2/21 上午 09:40 應用程式擴充 114 KB	
▲ gee 图 Org.Mentalis.Security.dll 2024/2/21上午 09:39 應用程式擴充 180 KB	
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