



Version 2.0.0 Oct 2024

# IEC850-211-S

#### 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.

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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
2.0.0	Alina	2024/10/01	Modify objects & Utility usage
			changes & add connection
			descriptions

#### **Document Revision**

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# 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 and Data Object as below table. 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.

Logical Node	Data Object
GGIO	Ind . Intln . AnIn . AnOut . SPCSO
MMXU	TotW.TotVAr.TotPF.PhV.A.Hz
MMTR	SupWh . DmdWh
GAPC	SPCSO

#### 1.4. Features

- Read/Write Modbus register via IEC-61850
- Configurable IEC-61850 server
- Configurable Modbus TCP client
- Support Logical Node GGIO. MMXU.MMTR.GAPC
- Support common Data Object Ind, SPCSO, Anln, AnOut. Intln.TotW.TotVAr.TotPF.PhV.A.Hz
- 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

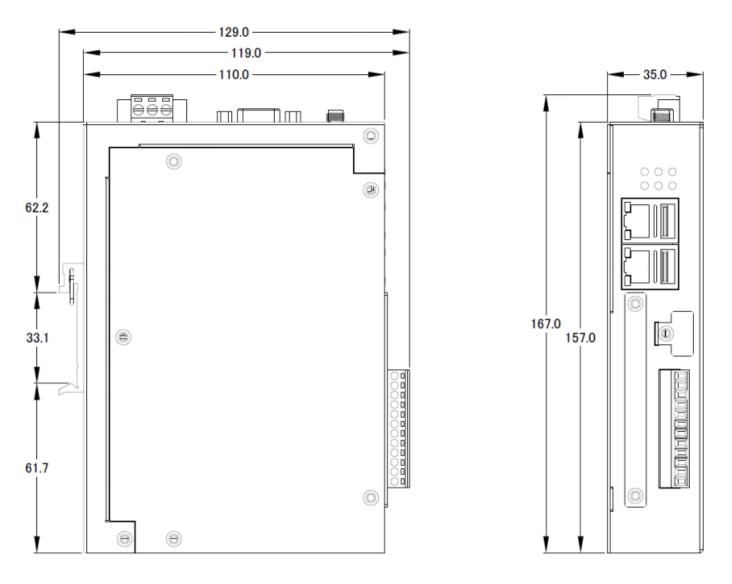
System	
CPU	Cortex-A8, 1 GHz
SDRAM	512 MB
Flash	512 MB
FRAM	64 KB
LED Indicators	PWR(Power), RUN(Running), L1, L2, L3
<b>Communication Ports</b>	
VGA	1 (reserved)
Ethernet	RJ-45 x 2, 10/100/1000 Based-TX (Auto-negotiating,
	Auto MDI/MDI-X, LED indicators)
USB 2.0	2 (reserved)
Console Port	RS-232 (RxD, TxD and GND); Non-isolated
ttyO2	RS-485 (reserved) (Data+, Data-); Non-isolated
ttyO4	RS-232 (reserved) (RxD, TxD and GND);

		Non-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.MMXU.MMTR.GAPC		
	Data Object control		Ind, SPCSO, AnIn, AnOut.		
			IntIn.TotW.TotVAr.TotPF.PhV.A.Hz		
			status-only		
			direct-with-normal-security		
			direct-with-enhanced-security		
			sbo-with-normal-security		
			sbo-with-enhanced-security		
Power		ſ			
Supply Volta	age	+12 to +4	8 VDC		
Consumptio	n	4.8 W			
Connector		3-pin Ren	emovable Terminal Block		
Mechanism	1	r			
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	np	-30°C ~ +	-85°C		
Humidity		10 ~ 90%	RH, non-condensing		

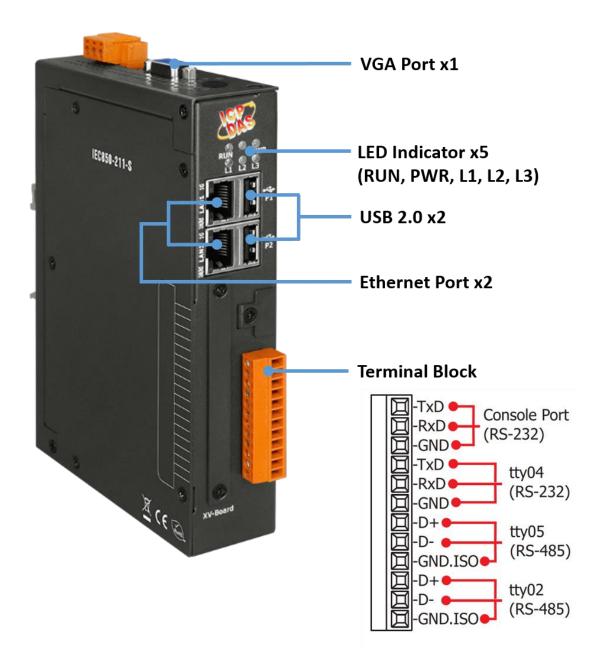
## 2.Hardware

## 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		
PWR	ON	Power on		
FVVR	OFF	Power failure		
RUN	Blink	OS is running		
OFF		OS stops running		
L1	Flash every second	Firmware is running		
<b>L</b> 1	Other	Firmware stops running		
L2	Flash every second	Some Modbus servers are disconnected		
LZ	OFF	No Warning		
L3	ON	The Configuration is incorrect		
LJ	OFF	No Error		

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

#### 3.1. Preparations for Devices

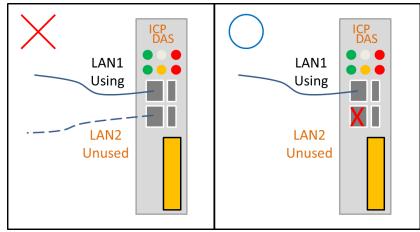
In addition to the IEC850-211-S, please prepare the following:

- 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

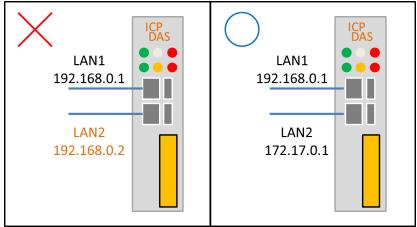
#### 3.2. Hardware Wiring

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

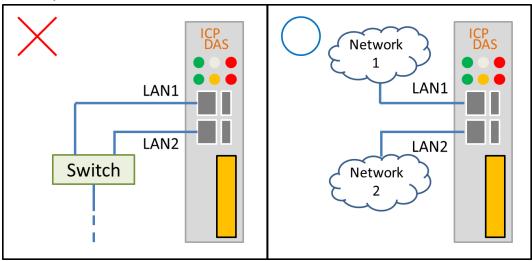
1. Do not plug in the network cable if the LAN (LAN1 or LAN2) is not used on IEC850-211-S.



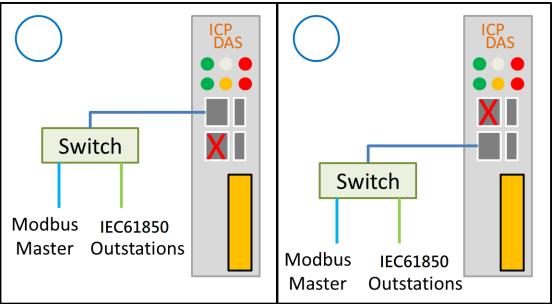
2. When both LAN1 and LAN2 are enabled, they **cannot** be set to the same network segment.

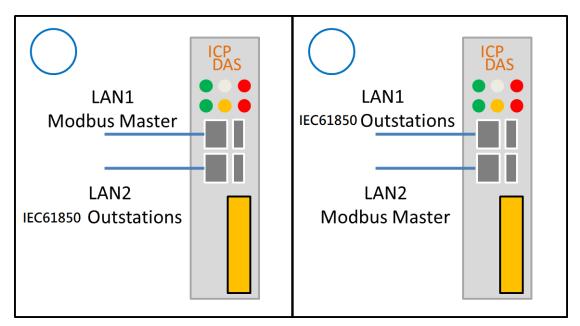


3. When both LAN1 and LAN2 are enabled, they must be connected to two separate networks.



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





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

IEC850-211-S Gateway Configration Utility v2.00 File Upload Network IEC61850 Client			- 🗆 X
ICP IEC850-211-S Modbus TCP Master to IEC-61850 Server Gateway	Gateway Network Configuration  IP Address  TCP Port  102  Get Configuration from module.	IED Name Logical Device LD Next Step.	
Polling Configuration		Object Configuration	
Modbus Slave Connection     Function       Slave ID     Image: Connection       IP Address     Image: Connection       TCP Port     Next Step       Value to 0 When Disconnect     Cancel       Add Modbus Commands     FC1 Read multiple coils status (0xccx) for DD       FC1 Read multiple coils status (0xccx) for DD     Start Address :       Length:     Add >>       Unit:     Int16       Format:     AB CD	Length Polling time (ms) Unit Format	Prefix:AddLogic Node:GGIO DeleteInstance:ClearAddDataObject:DeleteClear	
	Delete Page	Dataset Report	
			Finish

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 Cor	figuration	-		×
Connection	i8.0.1 Connect	Disc	onne	
LAN1 IP Mask Gateway MAC			Set Sa	_
LAN2 IP Mask MAC			Reb	oot

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.

Gateway Network Configurat	tion			
IP Address	TCP Port	IED Name	Logical Device	
Get Configuration from module.	102		LD	Next Step.

2. Enter the station number, IP address, communication port, Modbus device of the Modbus TCP server you want to poll, and whether you want to clear the object value to 0 if it is disconnected from IEC850-211-S.

Polling Configuration MBSlave_1 New						
Modbus Slave Connection	Function	Start Address	Length	Polling time (ms)	Unit	Format
Slave ID 1						
IP Address 172 17 12 36						
TCP Port 502 Next Step						
Value to 0 When Disconnect Cancel						
Add Modbus commands						
FC1 Read multiple coils status (0xxxx) for DO $~\sim$						
Start Address :						
Length:						
Polling Time : Add >>						
Unit: Int16 V Celete						
Format:						
					D	elete Page

- 3. Enter the Modbus register address, data length, unit and data format.
- > "Add" is to add command to the right side table.
- > "Delete" is to delete the command you choose from the right side table.

	Connection		Function	Start Address	Length	Polling time (ms)	Unit	Format
Slave ID 1			4	0	10	1000	Int32	AB CI
IP Address 172	17 12	36						
TCP Port 502		Next Step						
Value to 0 When	n Disconnect	Cancel						
Add Modbus Co FC4 Read multiple inp Start Address : 0		k) for AI 🗸 🗸						
Length:								
	00	Add >>						
Polling Time : 10								
roning time .	B2 🗸	<< Delete						

- 4. Add a new logical node: Enter Prefix (can be filled in or not). Select the logical node to be created. Fill in Instance (required)
  - > "Add" adds a logical node to the list on the right
  - > "Delete" deletes the currently selected list from the list on the right
  - > "Clear" deletes all lists on the right

Object Conf	iguration						
			ABCGGIO1				
Prefix: Logic Node:	ABC GGIO	Add	DOType	DOName	sub	MappingModbus	DOUnit
Instance:	1	Clear					
DataObject:		Add Delete Clear					
Dataset		Report					

- 5. Add a new data object: Select the data object to be added and click the "DOName" field to modify the object name.
  - > "Add" adds a Data Object to the list on the right

"Delete" deletes the currently selected Data Object from the list on the right

Object Con	figuration						
			ABCGGIO1				
Drofter			DOType	DOName	sub	MappingModbus	DOUnit
Prefix:	ABC	Add	AnIn	AnIn1	mag		
Logic Node:	GGIO 🕔	Delete	AnIn	AnIn2	mag		
Instance:	1	Clear					
		Add					
DataObject:	Anln 🕔	Delete					
		Clear					
	_						
Dataset		Report					

> "Clear" deletes all Data Object on the right

- 6. Mapping Modbus Address
  - Double-click the "MappingModbus" field and the following window will pop up showing all the Modbus Addresses that can be mapped.

🖳 Mapping	_		×
Modbus Addr	ess	Unit	
MBSlave_1/A	10/0	Int32	
MBSlave_1/A	10/1	Int32	
MBSlave_1/A	10/2	Int32	
MBSlave_1/A	10/3	Int32	
MBSlave_1/A	10/4	Int32	
MBSlave_1/A	10/5	Int32	
MBSlave_1/A	10/6	Int32	
MBSlave_1/A	10/7	Int32	
MBSlave_1/A	10/8	Int32	
MBSlave_1/A	10/9	Int32	
[	Datal	Mapping	

The meaning of MBSIave\_1/AI0/0 is:

MBSlave\_1: Modbus device number (up to 32 devices can be connected) AIO: This command is the AI type + Modbus command setting sequence on the left (users can ignore this sequence)

0:Address 0

#### Remark:

1. If the selected unit is Int32/Int64, so the unit occupies 2/4 of the Modbus register, it will be automatically selected in sequence (ex: select MBSlave\_1/Al0/0. Since the unit is Int32, the actual Mapping address of this object is MBSlave\_1 /Al0/0 and MBSlave\_1/Al0/1)

2. Following point 1, if the selected address does not have enough addresses, Mapping will not be possible.

3. Unable to cross commands Ex: If two Modbus commands are set, 0~9 and 10~20, the addresses of 9&10 cannot be mapped.

- Double-click the address field to be mapped and press the "DataMapping" button
- 7. 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	
SPCSOO	DO	1	0	DataSet Name	•	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	
ISCSOO	AO	3	0	ET-7026 ~		GGIO	ST	0	ISCS00	ALL	
ISCSO1	AO	3	1			GGIO	ST	0	ISCSO1	ALL	
IntInO	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			GGIO	ST	0	IntIn5	ALL	
				Delete Data							
				Finish							
Polling T	ime: 1000										

- 8. 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.

👌 Gateway Config U	Report Control Blog	·k				
File Upload Ne	report control bloc	~				_
Gateway Netv	Report Control Bl	ock (RCB)	Trigger Options		Optional Fields	
IP Address	name: RCB1		Data change (dchg)		Sequence number	
192 168	rptID: report	L	Quality change (qchg	g)	Report time stamp	
	intgPd: 1000		🗌 Data update (dupd)		Reason for inclusion	
Polling Config	Intgru. 1000		🗹 Integrity		🗹 Data set name	
Slave_1 New	datSet: ET-7026	i ~	General interrogation	on (GI)	Data reference	
	Create	Modify			Buffer overflow	time (ms)
Modbus Sl					EntryID	1000
Slave ID 1		Delete			Conf-revision	1000
IP Address 192						1000
	name	datSet	ıptID	intgPd	TrgOps	1000
TCP Port 502	RCB1	ET-7026	report1	1000	8	
Add Modb FC1 Read multiple co						
Start Address : 0						
Length: 2	<					>
Polling Time : 100					Finish	
DataSet	Report					Delete Page
						Finish

9. 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		ateway	IP Addro	Network C ess 17 0 uration from me	95	ON TCP Port 102 ecting OK!	IED Name AAS		Logical Device	Next Ste	p.			
Polling Configuration							Object Conf	figuratior	I	GGIO1				
Modbus Slave Connection Slave ID 1	Function 4	Start Address 10	Length 2	Polling time (ms) 1000	Unit Int32	Format AB CD	Prefix:		Add	DOType Anln	DONam Anin1	e sub mag	MappingModbus MBSlave_1/Al2/24	DOU Int32
IP Address 172 17 12 36 TCP Port 502 Next Step	4	24 30	4	1000	Int32 Int3	AB CD	Logic Node: ×	GGIO	<ul><li>Delete</li><li>Clear</li></ul>	Anin Anin Anin	Anin2 Anin3 Anin4	mag mag mag	MBSlave_1/AI3/32 MBSlave_1/AI1/72 MBSlave_1/AI0/10	Int32 Int32 Int32
Value to 0 When Disconnect     Cancel       Add Modbus Commands     RC4 Read multiple input registers (3xxxx) for AI ∨       Start Address : 30	4	70	4	1000	Int <sup>3</sup> Exp	port Configuarion	Success!! 確定 DataObject:	Anin	Add ✓ Delete Clear	Anin	Anin5	mag	MBSIave_1/AI3/38	Int32
Julit: Int32 v <>> Celete					[	Delete Page	Dataset		Report					
														Fini

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						-	$\times$
(ICP IEC850-211-S	-D- Connect	C=D Disconnect	(/@ Control	Read	Report		
뎚 DataModel	Name	Valu	e				
ataSet							
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: 1	92.168.0.1	
Config. File :		Browse
		Upload
Reboot IEC850-211-	S	ОК

→ × ↑ 📙 « 🚊	直 > Alina > IEC850-211-S > Config_Utili	ity > v102 > bin > x86 >	Release > v	・ 👌 _ 搜尋 Relea	se	p
合管理 ▼ 新増資料	夾				== -	?
OneDrive - Perso	名稱	修改日期	類型	大小		
+ + + + + + + + + + + + + + + + + + + +	Gateway_Configuration	2024/2/26 下午 03:06	檔案資料夾			
■ 本機	ModuleConfig	2024/4/17 下午 02:51	檔案資料夾			
🔰 3D 物件	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	🗟 DiffieHellman.dll	2024/2/21 上午 09:39	應用程式擴充	52 KB		
🔮 文件	Gateway.conf	2024/3/6 下午 03:26	CONF 檔案	1 KB		
	Gateway1.conf	2024/2/21 上午 09:39	CONF 檔案	1 KB		
<b>卓</b> 面	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		
	🗼 IEC850-211-S_Utility.exe	2024/4/11 上午 09:51	應用程式	313 KB		
📲 影片	🚯 IEC850-211-S_Utility.exe.config	2024/2/21 上午 09:39	XML Configurati	1 KB		
Windows (C:)	IEC850-211-S_Utility.pdb	2024/4/11 上午 09:51	Intermediate file	174 KB		
🕳 Data (D:)	🗟 iec61850.dll	2024/2/21 上午 09:39	應用程式擴充	360 KB		
Windows (E:)	iec61850dotnet.dll	2024/2/21 上午 09:40	應用程式擴充	114 KB		
	Org.Mentalis.Security.dll	2024/2/21 上午 09:39	應用程式擴充	180 KB		
▶ 網路 🗸 🗸		2024/2/21 上午 09-39	CONF 檔案	1 KR		
檔案	名稱(N):			<ul> <li>✓ All files(*.*</li> </ul>	;)	~
				 開啟(O	)) 取消	