SEC3000C MODBUS Interface Definition Description

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Revision Record

Version	Release Date	Modification Instructions
06	2026-03-11	Newly added on & off-grid status and control mode
05	2026-03-04	Newly added support for scenario scheduling of ET100
04	2025-11-27	Delete the description related to the loop test in the register definition section
03	2025-11-11	Newly added PV, energy storage, and PV energy storage on/off functions
02	2025-10-31	Optimize the text descriptions related to the registers of the data acquisition system itself, and distinguish between PV, energy storage, and PV energy storage
01	2025-10-22	Add ESA261 PV Energy Storage Scenario

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1. Introduction

The MODBUS-TCP protocol was published as a (practical) automation standard. Since MODBUS is already widely known, this document only includes information specific to

SEC3000C. However, this document aims to clarify which functions in MODBUS-TCP are of reference value to both parties involved in the interaction.

1.1 Terminology and Abbreviation Definitions

Table 1-1 Term Definitions

Name	Description
Primary Node	In master-slave communication, the party that actively initiates communication is called the master node
From Node	In master-slave communication, the party that passively responds to commands is called the slave node
Broadcast Address	Fixed at 0
Register Address	The register address corresponds to a 2-byte message
U16	Unsigned 16-bit Integer
U32	Unsigned 32-bit Integer
U64	Unsigned 64-bit Integer
S16	Signed 16-bit Integer
S32	Signed 32-bit Integer
S64	Signed 64-bit Integer
STR	String
MLD	Multi-ByteDance
N/A	Not involved

2. Register Definition

The RW type is a hold-type signal, and the data in the setting operation will remain in effect permanently until the next modification, supporting commands 0X03, 0X06, and 0X10.

WO type signals do not support the 0X03 query command, but support the 0X06 and 0X10 commands. RO type signals only support the 0X03 command and do not support the 0X06 and 0X10 commands.

2.1 SEC3000C Register Definition

The following register operations target either the SEC3000C itself or all inverters connected to the SEC3000C. The logical device ID in the Communication Protocol should be filled in as 0.

Table 2-1 Register Definition Table

Serial Number	Register Name	Read/Write	Type	Unit	Gain	Address	Number	Scope
1	PV Startup	WO	U16	N/A	N/A	20008	1	1: Power On PV equipment startup
2	PV Shutdown	WO	U16	N/A	N/A	20009	1	1: Power Off PV equipment shutdown
3	PV Active Power Regulation	RW	U32	kW	10	20013	2	[0, Total Rated Active Power of System PV Equipment]
4	PV Active Power	RO	S32	kW	1000	20025	2	Actual output active power of the system's PV equipment
5	Maximum value of PV active power regulation	RO	U32	kW	1000	20060	2	The system's PV equipment can output the maximum active power
6	PV Rated Power	RO	U32	kw	1000	20402	2	Total rated power of the system's PV equipment
7	Energy Storage Active Power	RO	S32	kW	1000	25011	2	Actual output active power of the system energy storage device
8	Energy Storage Reactive Power	RO	S32	kW	1000	25015	2	Actual output reactive power of the system energy storage device
9		RO	S32	kW	1000	25017	2	

	Energy Storage Rated Power							Total rated power of the system energy storage device
10	Energy Storage Startup	WO	U16	N/A	N/A	25100	1	1: Power On Energy storage device startup
11	Energy Storage Shutdown	WO	U16	N/A	N/A	25101	1	1: Power Off Energy storage device shutdown
12	Energy Storage Active Power Regulation	RW	S32	kW	1000	25102	2	[-Total rated active power of system ESS, total rated active power of system ESS]
13	Active Power	RO	S32	kW	1000	25202	2	Total output active power of the system's PV and ESS
14	Maximum charging power of energy storage	RO	U32	kW	1000	25217	2	Real-time maximum charging power of system ESS
15	Maximum Discharge Power of Energy Storage	RO	U32	kW	1000	25219	2	Real-time maximum discharge power of the system energy storage device
16	Maximum active power regulation value	RO	S32	kW	1000	25227	2	Maximum adjustable active power of system PV and energy storage
17	Minimum active power regulation value	RO	S32	kW	1000	25229	2	Minimum adjustable active power of system PV and energy storage
18	Grid-connected and off-grid status	RO	U16	N/A	1	25235	1	0: Off-grid; 1: On-grid
19	Power On	WO	U16	N/A	N/A	25300	1	1: Power On PV and ESS startup

20	Shutdown	WO	U16	N/A	N/A	25301	1	1: Power Off PV and ESS shutdown
21	Active Power Regulation	RW	S32	kW	1000	25302	2	Adjust the total active power output of the PV and ESS in the regulating system
22	Control Mode	RW	U16	N/A	1	25401	1	0:Local Control Mode 1:Remote Control Mode

2.2 Smart Meter Register Definition

- Description

The operation object of the following register is the corresponding smart meter, and the Logical Device ID in the Communication Protocol should be filled with the RS485 address of the smart meter.

For specific register definitions, please refer to the description of the Smart Meter MODBUS Interface Definition.

Table 2-2 Definition Table of Smart Meter Registers

Serial Number	Register Name	Read /Write	Type	Unit	Gain	Address	Number	Range
1	Phase A Voltage	RO	U32	V	100	1665	2	
2	Phase B Voltage	RO	U32	V	100	1667	2	
3	Phase C Voltage	RO	U32	V	100	1669	2	
4	Phase A Current	RO	U32	A	100	1671	2	
5	Phase B Current	RO	U32	A	100	1673	2	
6	Phase C Current	RO	U32	A	100	1675	2	
7	Phase A Active Power	RO	U32	kW	1000	1677	2	
8	Phase B Active Power	RO	U32	kW	1000	1679	2	
9	Phase C Active Power	RO	U32	kW	1000	1681	2	

10	Total Active Power	RO	U32	kW	1000	1683	2	
11	Phase A Reactive Power	RO	S32	kVar	1000	1685	2	
12	Phase B Reactive Power	RO	S32	kVar	1000	1687	2	
13	Phase C Reactive Power	RO	S32	kVar	1000	1689	2	
14	Total Reactive Power	RO	S32	kVar	1000	1691	2	
15	A Phase Power	RO	U32	kVA	1000	1693	2	
16	B Phase Power	RO	U32	kVA	1000	1695	2	
17	C Phase Relative Power	RO	U32	kVA	1000	1697	2	
18	Total Apparent Power	RO	U32	kVA	1000	1699	2	
19	Phase A power factor	RO	S32	N/A	N/A	1701	2	
20	Phase B power factor	RO	S32	N/A	N/A	1703	2	
21	Phase C Power Factor	RO	S32	N/A	N/A	1705	2	
22	Total Power Factor	RO	S32	N/A	N/A	1707	2	
23	Frequency	RO	U32	Hz	100	1709	2	
24	Phase A Forward Electric Energy (Sold)	RW	U64	kWh	1000	1711	4	
25	Phase B Positive Energy (Sold)	RW	U64	kWh	1000	1715	4	
26	Phase C Forward Electric Energy (Sold)	RW	U64	kWh	1000	1719	4	
27	Total Positive Electric Energy (Sold)	RW	U64	kWh	1000	1723	4	
28	Phase A Forward Electric Energy (Purchase)	RW	U64	kWh	1000	1727	4	
29	Phase B Forward Electric Energy (Purchase)	RW	U64	kWh	1000	1731	4	
30	Phase C Forward Electric Energy	RW	U64	kWh	1000	1735	4	

	(Purchase)							
31	Total Positive Electric Energy (Purchase)	RW	U64	kWh	1000	1739	4	
32	Reverse power (sale)	RW	U64	kVarh	1000	1743	4	
33	Reverse power (sale)	RW	U64	kVarh	1000	1747	4	
34	C Reverse Direction Electric Energy (Sale)	RW	U64	kVarh	1000	1751	4	
35	Total Reverse Electric Energy (Sold)	RW	U64	kVarh	1000	1755	4	
36	Reverse-direction electricity (purchase)	RW	U64	kVarh	1000	1759	4	
37	Reverse-direction B electrical energy (purchase)	RW	U64	kVarh	1000	1763	4	
38	C Reverse Direction Electric Energy (Purchase)	RW	U64	kVarh	1000	1767	4	
39	Total Reverse Energy (Purchase)	RW	U64	kVarh	1000	1771	4	

2.3 Grid-connected Inverter Register Definitions

- Description

The operation object of the following register is the corresponding inverter, and the Logical Device ID in the Communication Protocol should be filled with the Modbus slave address of the inverter.

For specific register definitions, please refer to the corresponding <Inverter MODBUS Interface Definition Description>.

2.4 Hybrid Inverter Register Definition

- Description

The operation object of the following register is the corresponding inverter, and the Logical Device ID in the Communication Protocol should be filled with the Modbus slave address of the

inverter.

For specific register definitions, please refer to the corresponding <Inverter MODBUS Interface Definition Description>.

2.5 Register Definition of Energy Storage Integrated Cabinet

- Description

The operation object of the following register is the corresponding inverter, and the logical device ID in the Communication Protocol should be filled with the Modbus slave address of the integrated cabinet.

For specific register definitions, please refer to the corresponding <Inverter MODBUS Interface Definition Description>.

2.6 Environmental Monitor Register Definition

- Description

The mapped registers are accessed using the SEC3000C address. By default, each device occupies 25 registers, and the register address is calculated from the starting register address, offset address, and device address. The device address is the Modbus physical address of the device. Devices that support mapping: environmental monitors.

The calculation formula is as follows:

- Register Address = Starting Register Address + (25 * (Device Address – 1)) + Offset Address;
- Starting register address = 51000;
- To ensure register continuity, device addresses must also be strictly allocated in sequence.

Table 2-3 Environmental Monitor Register Definition Table

Serial Number	Register Name	Read /Write	Type	Unit	Gain	Offset Address	Number	Scope
1	Wind Speed	RO	S16	m/s	10	0	1	
2	Wind Direction	RO	S16	°	1	1	1	
3	PV module temperature	RO	S16	℃	10	2	1	
4	Ambient Temperature	RO	S16	℃	10	3	1	
5	Total irradiance	RO	S16	W/㎡	10	4	1	

6	Daily Irradiation	RO	U32	MJ/㎡	10	5	2	
7	Total Irradiance 2	RO	S16	W/㎡	10	7	1	
8	Daily Irradiation 2	RO	U32	MJ/㎡	1000	8	2	
9	Custom 1	RO	S16	N/A	10	10	1	
10	Custom 2	RO	S16	N/A	10	11	1	
11	Daily Irradiation	RO	U32	kWh/㎡	1000	12	2	
12	Daily Irradiation 2	RO	U32	kWh/㎡	1000	14	2	
13	Keep 1	RO	U16	N/A	N/A	16	1	
14	Keep 2	RO	U16	N/A	N/A	17	1	
15	Keep 3	RO	U16	N/A	N/A	18	1	
16	Keep 4	RO	U16	N/A	N/A	19	1	
17	Keep 5	RO	U16	N/A	N/A	20	1	
18	Keep 6	RO	U16	N/A	N/A	21	1	
19	Keep 7	RO	U16	N/A	N/A	22	1	
20	Keep 8	RO	U16	N/A	N/A	23	1	
21	Keep 9	RO	U16	N/A	N/A	24	1	

3. Overview of Communication Protocol

ModBus-TCP Communication Protocol includes the physical layer, data link layer, and application layer.

3.1 Physical Layer

Communicate via Ethernet; Port Number: 502;

3.2 Data Link Layer

3.2.1 Addressing Mode

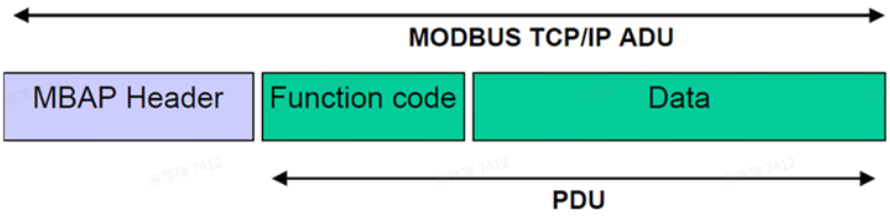
MODBUS-TCP data frames distinguish different devices through logical addresses, and the logical address allocation rules are shown in the following table.

- Description

The access device address is the RS485 address of the device, which can be read via the embedded Web of SEC3000C.

Data Acquisition Local Address	From Node Address	Retain
0	1～247	248～255

3.2.2 Frame Structure



Note: The maximum frame length is no more than 256 ByteDance;

All frame structure definitions in this article only include the function code and data section;

Table 3-1 MBAP Definition Table

Data Domain	Length (ByteDance)	Description	Client	Server
Transmission Identifier	2	Request Frame and Response Frame Matching Identifier	Client allocation, it is recommended that the transmission identifier for each frame of data request be different	This identifier in the server-side response frame must be consistent with that in the request frame
Protocol Type	2	0 = MODBUS protocol	Client Allocation, default is 0	This identifier in the server-side

				response frame must be consistent with that in the request frame
Data Length	2	Subsequent Data Length	The Client allocates based on the actual frame	The server allocates based on the actual frame length
Logical Device ID	1	identifies whether the device is a data acquisition device itself or a sub-device connected to the data acquisition device 0 SEC3000C 1~247 Inverters or other device	The Client allocates based on the actual frame request	This identifier in the server-side response frame must be consistent with that in the request frame

3.2.3 Data Encoding

MODBUS uses a 'big-Endian' representation for addresses and data items. This means that when sending multiple bytes, the most significant byte is sent first.

For example:

Register Size	Value
16-bit	0x1234

The first ByteDance sent is 0x12, followed by 0x34;

3.2.4 Interaction Process

Under any circumstances, the communication process is initiated by the master node, and the slave node does not initiate communication actively.

In unicast mode, using a one-question-one-answer approach, the slave node responds to the master node's commands. If the master node does not receive a response from the slave node within 5 seconds, it is considered a communication timeout.

In broadcast mode, slave nodes only receive commands issued by the master node and do not respond to command frames issued by the master node.

3.3 Application Layer

3.3.1 Function Code List

Table 3-2 Function Code List

Function Code	Meaning	Remarks
0x03	Read Register	Supports continuous reading of single and multiple registers
0x06	Write a single register	Supports single register write operations
0x10	Write Multiple Registers	Supports continuous write operations for multiple registers

3.3.2 Exception Code List

Table 3-3 Exception Code Table

Code	Name	Meaning
0x01	Illegal Function	For the server (or slave), the function code received in the query is an unauthorized operation. This may be because the function code is only applicable to new devices and cannot be implemented in the selected unit. Additionally, it indicates that the server (or slave) is handling this request in an error state, for example: because it is unconfigured and requires the return of register values.
0x02	Illegal data address	For a server (or slave), the data address received in the query is an unacceptable address. In particular, the combination of reference number and transfer length is invalid. For a controller with 100 registers, a request with an offset of 96 and a length of 4 will succeed, while a request with an offset of 96 and a length of 5 will generate exception code 02.
0x03	Illegal data value	For the server (or slave), the value included in the query is an unacceptable value. This value indicates a fault in the remaining structure of the

		combined request, for example: the implied length is incorrect. It does not mean that, because the MODBUS protocol does not know the significance of any special value of any special register, the data item submitted for storage in the register has a value outside the application's expectation.
0x06	Device busy	The server cannot accept the MODBUS request PDU. The client application is responsible for deciding whether and when to resend the request.

3.3.3 Read Register (0x03)

3.3.3.1 Master Node Request Frame Format

Data Domain	Length	Description
Function Code	1 byte	0x03
Register start address	2 byte	0x0000～0xFFFF
Number of Registers	2 byte	1～125

3.3.3.2 Normal Response Frame Format from Node

Data Domain	Length	Description
Function Code	1 byte	0x03
ByteDance	1 byte	2×N
Register Value	2×N byte	N/A

Note: N is the number of registers

3.3.3.3 Format of Abnormal Response Frame from Node

Data Domain	Length	Description
Function Code	1 byte	0x83
Exception Code	1 byte	

		See 3.3.2 Exception Code List

3.3.3.4 For example

The master node sends a query request (register address: 50000/0XC350) to the slave node (logical device ID: 00):

Description	MBAP							Merit can Code	Data			
	Protocol Identifier		Protocol Type		Data Length		Logical Device ID		Register Address		Number of Registers	
Frame Data	00	01	00	00	00	06	00	03	C3	50	00	02

Normal response from node:

Description	MBAP Header							Function Code	Data				
	Protocol Identifier		Protocol Type		Data Length		Logic Device ID		Byte Dance	Register Data			
Frame Data	00	01	00	00	00	07	00	03	04	00	00	00	01

Abnormal response from node:

Description	MBAP Header							Merit can Code	Data
	Protocol Identifier		Protocol Type		Data Length		Logical Device ID		Error Code
Frame Data	00	01	00	00	00	03	00	83	03

3.3.4 Write Single Register (0x06)

3.3.4.1 Master Node Request Frame Format

Data Domain	Length	Description
Function Code	1 byte	0x06
Register Address	2 byte	0x0000～0xFFFF
Register Value	2 byte	0x0000～0xFFFF

3.3.4.2 Normal Response Frame Format from Node

Data Domain	Length	Description
Function Code	1 byte	0x06
Register Address	2 byte	0x0000～0xFFFF
Register Value	2 byte	0x0000～0xFFFF

3.3.4.3 Format of Abnormal Response Frame from Node

Data Domain	Length	Description
Function Code	1 byte	0x86
Exception Code	1 byte	See **3.3.2 Exception Code List**

3.3.4.4 For example

Request from the master node to send an instruction (register address: 20074/0X4E6A) to the slave node (address: 00):

Description	MBAP							Function Code	Data			
	Protocol Identifier		Protocol Type		Data Length		Logical Device ID		Register Address		Register Data	
Frame	00	01	00	00	00	06	00	06	4E	6A	00	00

Data												

Normal response from the node:

Description	MBAP							Merit can Code	Data			
	Protocol Identifier		Protocol Type		Data Length		Logic Device ID		Register Address		Register Data	
Frame Data	00	01	00	00	00	06	00	06	4E	6A	00	00

Abnormal response from node:

Description	MBAP							Merit can Code	Data
	Protocol Identifier		Protocol Type		Data Length		Logical Device ID		Error Code
Frame Data	00	01	00	00	00	03	00	86	04

3.3.5 Write Multiple Registers (0x10)

3.3.5.1 Master Node Request Frame Format

Data Domain	Length	Description
Function Code	1 byte	0x10
Register Start Address	2 byte	0x0000～0xFFFF
Number of Registers	2 byte	0x0000～0x007b
ByteDance	1 byte	2×N
Register Value	2×N byte	Value

Note: N is the number of registers.

3.3.5.2 Normal Response Frame Format from Node

Data Domain	Length	Description
Function Code	1 byte	0x10
Register Address	2 byte	0x0000～0xFFFF
Number of Registers	2 byte	0x0000～0x007b

3.3.5.3 Abnormal Response Frame Format from Node

Data Domain	Length	Description
Function Code	1 byte	0x90
Exception Code	1 byte	See**3.3.2 Exception Code List**

3.3.5.4 For example

The master node sets the slave node (address: 00) (register address: 20085/0X4E75) to 2, (register address:

20086/0X4E76) is set to 3, and the request frame format is as follows:

Description	MBAP		Meritcan Code		Data									
	Protocol Identifier		Protocol Type		Data Length		Logical Device ID		Register Address		Number of Registers		Byte Dance	R
Frame Data	00	01	00	00	00	0B	00	10	4E	75	00	02	04	0

Normal response from the node:

	MBAP		Data

Description	Protocol Identifier		Protocol Type		Data Length		Logic Device ID	Function Code	Register Address		Number of Registers	
Frame Data	00	01	00	00	00	06	00	10	4E	75	00	02

Abnormal response from the node:

Description	MBAP							Meritcan Code	Data
	Protocol Identifier		Protocol Type		Data Length		Logical Device ID		Error Code
Frame Data	00	01	00	00	00	03	00	90	04