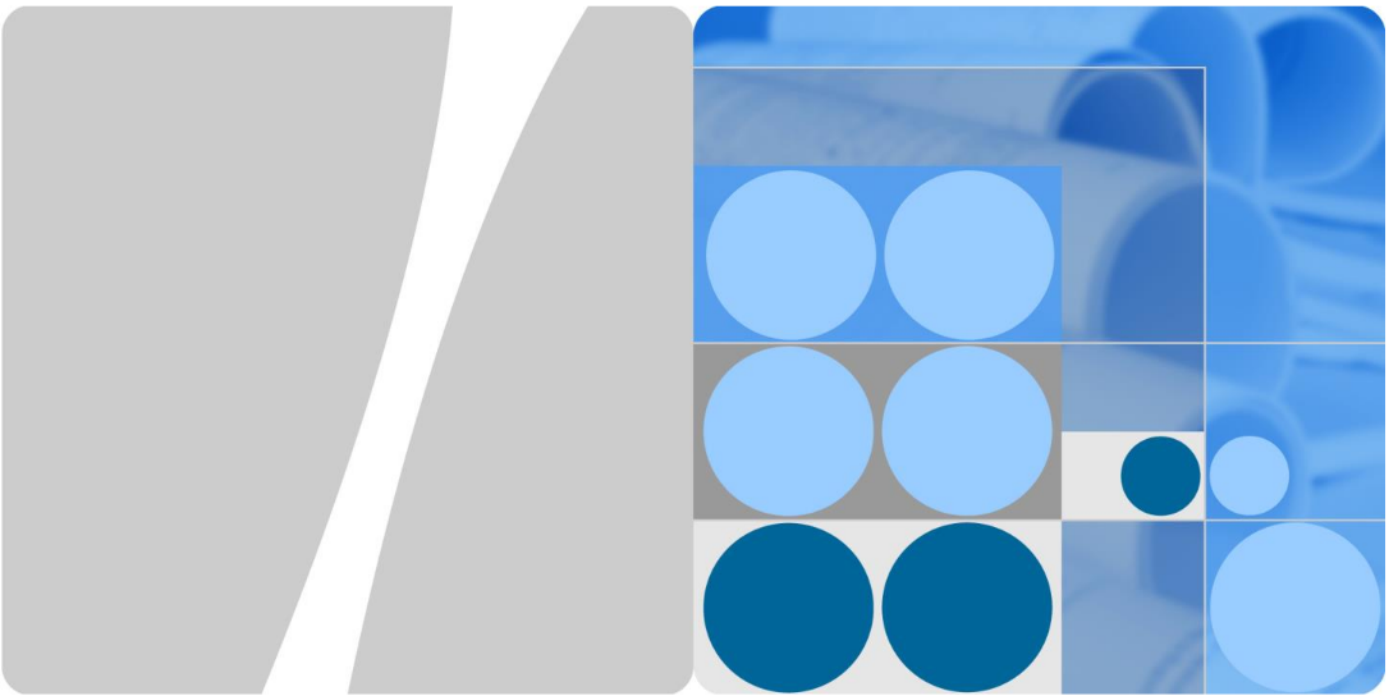


SmartLogger

ModBus Interface Definitions

Issue 35

Date 2020-02-20

HUAWEI TECHNOLOGIES CO., LTD.

HUAWEI

Trademarks and Permissions


and other Huawei trademarks are trademarks of Huawei Technologies Co., Ltd.

All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between Huawei and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

Website: https://e.huawei.com

Change History

Issue	Date	Change Description
35	2020-02-20	Add the following registers in SmartLogger Register Definitions Table: Plant status(40543), Communication abnormal shutdown(41947), Communication anbormal detection time(41948) and Auto start upon communication recovery(41949). Modified about SmartLogger Alarm Definitions Table： Delete Alarm SubID 1-3 of Abnormal Active Schedule(Alarm ID 1100), SubID 1-3 of Abnormal Reactive Schedule(Alarm ID 1101) and Abnormal Power Meter Data(Alarm ID 1102), and add Alarm ID 1116-1131. Meanwhile its detail description are modified in Alarm Descriptions and Impacts Table.
34	2019-05-28	Update enumeration name of "Active power control mode" and "Reactive power control mode"
33	2019-04-22	Added Alarm ID: License Expired (supported by V200R002C20SPC118 and later version)
32	2018-11-15	Added the definition of the power meter register: (supported by V100R001C00SPC118 and later version) **Phase A active power** **Phase B active power** **Phase C active power** **Total active electricity** **Total reactive electricity** **Negative active electricity** **Negative reactive electricity** **Positive active electricity** **Positive reactive electricity**
31	2018-03-13	Added **Duration of daily power generation** Added **Plant status** Added **Uab**, **Ubc**, **Uca**

Issue	Date	Change Description
30	2018-01-12	Added Table 2 Environmental Monitor Instrument Register Definitions of 2.7 Remapped Modbus definitions(supported by V200R002C20 and later version) Changed the power meter **Apparent power** to I32
29	2017-12-14	Added the definition of the power meter register: (supported by V200R002C20 and later version) **Custom 1 ~ Custom 10**
28	2017-12-11	Added **CO2 emission reduction coefficient**
27	2017-11-09	Changed **Reactive power control mode**, add new: Distributed power factor closed-loop control (supported by V100R001C00SPC113 and later version)
26	2017-08-22	Added **Power on/off** (supported by V200R002C10SPC100 and later version) Added **Transfer trip** (supported by V200R002C10SPC100 and later version) Added **Active adjustment** (supported by V200R002C10SPC100 and later version) Added **Reactive adjustment** (supported by V200R002C10SPC100 and later version) Added the definition of the power meter register: (supported by V200R002C10SPC100 and later version) **Electricity in positive active electricity price segment 1** **Electricity in positive active electricity price segment 2** **Electricity in positive active electricity price segment 3** **Electricity in positive active electricity price segment 4** **Electricity in negative active electricity price segment 1** **Electricity in negative active electricity price segment 2** **Electricity in negative active electricity price segment 3** **Electricity in negative active electricity price segment 4** Added 2.7 Remapped Modbus definitions (supported by V200R002C10SPC100 and later version) Changed **Active power control mode**, add new: Remote output control Changed **Reactive power control mode**, add new: Power factor closed-loop control
25	2017-08-15	Added **CO2 reduction** Added the definition of the power meter register: **Positive active electricity** **Positive reactive electricity**

Issue	Date	Change Description
24	2017-07-26	Added **Active scheduling percentage** Added **PV module capacity** Added **Rated plant capacity** Added **Total rated capacity of grid-connected inverters** Added **Conversion coefficient** Added **Communication status** Added **Daily irradiation amount**，Unit: kWh/㎡ Added **Daily irradiation amount 2**，Unit: kWh/㎡ Changed the power meter **Phase A current**、**Phase B current**、**Phase C current** to I32
23	2016-10-22	Added **DC current 2** Deleted **Device feature code 1~4** Added **the 24V power failure alarm**.
22	2016-09-02	Baseline Document for Test.
21	2016-06-02	Added the following signals: • Current error during scanning • Inspection • IV curve scanning Changed **Device feature code 1,** add new Bit9:IV curve scanning
20	2016-05-24	Add alarm **AC SPD fault** and **DI1~8 custom alarm** Added the following signals: • Current radiation 2 • Daily Radiation 2 • Custom 1 • Custom 2
19	2015-11-03	Added the entries of device featurecodes 1–4. Added the entry of device list changenumber.
18	2015-10-19	Added the **Device Address Conflict** alarm.
17	2015-09-21	Added **Reactive electricity** and **Apparentpower** to the power meter. Added **Port number** and **Physicaladdress** to the common register. Added the entry of array reset.
16	2015-04-10	Changed the delete device signal to the device operation signal. Adjusted the register address for the subsequent signals.
15	2015-04-07	Updated the description for City.

Issue	Date	Change Description
14	2015-03-28	Added the following signals: • Active power adjustment by percentage • Power factor adjustment
13	2015-03-23	Added the Reactive power scheduling curve mode signal.
12	2015-02-28	Added the following signals: • Active power scheduling mode • Active power scheduling target value • Reactive power scheduling mode • Reactive power scheduling target value
11	2015-02-26	Added System reset, Device search, Device search status , Delete device and Device search status signals.
10	2014-11-21	Added the DI group status.
09	2014-11-10	Added the Daily radiation read-only signals.
08	2014-09-24	Added Max. reactive adjustment, Min. reactive adjustment, and Max. active adjustment read-only signals.
07	2014-08-30	Added the public register device alias.
06	2014-08-21	Added the Abnormal Cubicle alarm.
05	2014-07-29	Changed the gain of Active electricity to 10 for an electricity meter.
04	2014-07-10	Added active alarm serial numbers and historical alarm serial numbers.
03	2014-06-06	Added the device connection status public device interface.
02	2014-03-28	Updated EMI and power meter, and added a time setting interface.
01	2013-09-22	Initial release.

Contents

Change History ii

1 Introduction 1

1.1 Definitions of Terms and Abbreviations 1

1.2 System Requirements 2

2 Register Definitions 3

2.1 Register Definitions for the SmartLogger 3

2.2 Alarm Definitions for the SmartLogger 12

2.3 Register Definitions for the Environmental Monitor Instrument 17

2.4 Register Definitions for the Power Meter 18

2.5 Register Definitions for the SUN2000 20

2.6 Public Register Definitions 20

2.7 Remapped Modbus definitions 21

3 Power Adjustment for Inverters 24

3.1 40420, 40424: Active Adjustment 25

3.2 40422, 40426: Reactive Adjustment 25

3.3 40428: Active Power Adjustment by Percentage 25

3.4 40429: Power Factor Adjustment 26

4 Communication Protocol Overview 27

4.1 Physical Layer 27

4.2 Data Link Layer 27

4.2.1 Addressing Mode 27

4.2.2 Frame Structure 28

4.2.3 Data Encoding 29

4.2.4 Interaction Process 29

4.3 Application Layer 30

4.3.1 Function Code List 30

4.3.2 Exception Code List 30

4.3.3 Reading Registers (0X03) 33

4.3.3.1 Frame Format for a Request from a Master Node 33

4.3.3.2 Frame Format for a Normal Response from a Slave Node 33

4.3.3.3 Frame Format for an Abnormal Response from a Slave Node 33

4.3.3.4 Example 34
4.3.4 Writing a Single Register (0X06) 34
4.3.4.1 Frame Format for a Request from a Master Node 34
4.3.4.2 Frame Format for a Normal Response from a Slave Node 35
4.3.4.3 Frame Format for an Abnormal Response from a Slave Node 35
4.3.4.4 Example 35
4.3.5 Writing Multiple Registers 36
4.3.5.1 Frame Format for a Request from a Master Node 36
4.3.5.2 Frame Format for a Normal Response from a Slave Node 36
4.3.5.3 Frame Format for an Abnormal Response from a Slave Node 36
4.3.5.4 Example 37
4.3.6 Reading Device Identifiers (0X2B) 37
4.3.6.1 Commands for Querying Device Identifiers 38
4.3.6.2 Command for Querying a Device List 39
4.3.6.3 Device Description Definitions 41
5 Reference Documents 42

1 Introduction

The Modbus-TCP protocol is a well-known factual automation standard. This document describes ModBus-TCP functions related to communications in the SmartLogger.

This document provides details about the Modbus protocol used in the SmartLogger and devices managed by the SmartLogger, such as inverters, environment monitor instrument, and power meter. It can be used to regulate and restrict follow-up third-party integration R&D and customizations.

1.1 Definitions of Terms and Abbreviations

1.2 System Requirements

1.1 Definitions of Terms and Abbreviations

Table 1-1 Terms Definitions

Name	Description
Master node	During master-slave communication, the party that initiates a communication request is referred to as the master node.
Slave node	During master-slave communication, the party that responds to a communication request is referred to as the slave node.
Broadcast address	Fixed to 0.
Register address	The address of a register is recorded in two bytes.
U16	Unsigned integer (16 bits)
U32	Unsigned integer (32 bits)
U64	Unsigned integer (64 bits)
I16	Signed integer (16 bits)
I32	Signed integer (32 bits)

Name	Description
I64	Signed integer (64 bits)
STR	String
MLD	Multiple bytes
N/A	Not applicable

1.2 System Requirements

Applicable model: SmartLogger

Firmware version:

SUN2000 V100R001C95 or later

SmartLogger V100R001C00 or later

SmartLogger V100R002C00 or later

SmartLogger V200R001C00 or later

SmartLogger V300R001C00 or later

2 Register Definitions

RW signals are permanently valid, will be retained until updated the next time, and support 0X03, 0X06, and 0X10 instructions.

WO signals do not support the 0X03 query instruction, but support the 0X06 and 0X10 instructions.

RO signals support only the 0X03 instruction.

2.1 Register Definitions for the SmartLogger

2.2 Alarm Definitions for the SmartLogger

2.3 Register Definitions for the Environmental Monitor Instrument

2.4 Register Definitions for the Power Meter

2.5 Register Definitions for the SUN2000

2.6 Public Register Definitions

2.7 Remapped Modbus definitions

2.1 Register Definitions for the SmartLogger

NOTE

In the following table, the operation object of the register is the SmartLogger or all inverters accessed by the SmartLogger. In the Modbus-TCP communications protocol, the logic device ID is fixed to 0.

Table 2-1 SmartLogger Register Definitions

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
1	Date&Time	RW	U32	N/A	1	40000	2	Epoch seconds UTC
2	City	RW	U32	N/A	1	40002	2	
3	Daylight Saving Time (DST)	RW	U16	N/A	1	40004	1	0: Disabled 1: Enabled

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
4	Time Zone	RO	I32	s	1	40005	2	Time zone offset measured in seconds
5	DST state	RO	U16	N/A	1	40007	1	0: DST time not entered 1: DST time entered
6	DST offset	RO	U16	mins	1	40008	1	N/A
7	The Local Time	RO	U32	N/A	1	40009	2	Epoch seconds, local time of theSmartLogger
8	Power on	WO	U16	N/A	1	40200	1	The data field can only be 0 for poweringon all inverters.
9	Power off	WO	U16	N/A	1	40201	1	The data field can only be 0 for powering off all inverters.
10	Power on/off	WO	U16	N/A	1	40202	1	0:Power off all inverters 1:Power on all inverters
11	Power on/off	WO	U16	N/A	1	40203	1	0:Power on all inverters 1:Power off all inverters
12	Transfer trip	RW	U16	N/A	1	40204	1	0:Run 1:Fault outage The device shuts down when it stops due to faults and does not respond to the startup request.
13	Array reset	WO	U16	N/A	1	40205	1	The data domain can only be 0.
14	Active adjustment	RW	U32	kW	10	40420	2	Adjusts the total active output power of all inverters connected to the SmartLogger. The adjustment value that is beyond the range is discarded.
15	Reactive adjustment	RW	I32	kVar	10	40422	2	Adjusts the total reactive output power of all inverters connected to the SmartLogger. The adjustment value that is beyond the range is discarded.

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
16	Active adjustment	RW	U32	kW	10	40424	2	Adjusts the total active output power of all inverters connected to the SmartLogger.
17	Reactive adjustment	RW	I32	kVar	10	40426	2	Adjusts the total reactive output power of all inverters connected to the SmartLogger.
18	Active power adjustment by percentage	RW	U16	%	10	40428	1	Adjusts the total active output power of all inverters connected to the SmartLogger. The percentage range is 0–100%.
19	Power factor adjustment	RW	I16	N/A	1000	40429	1	Adjusts the total reactive output power of all inverters connected to the SmartLogger. The range is (-1,-0.8]U[0.8,1].
20	DC current	RO	I16	A	10	40500	1	Equals the total input DC current of all inverters. If the value exceeds the range specified by I16, register 40554 is recommended.
21	Input power	RO	U32	kW	1000	40521	2	Equals the total input power of allinverters.
22	CO2 reduction	RO	U32	kg	10	40523	2	Equals the total CO2 reduction of allinverters. If the value exceeds the range specified by U32, register 40550 is recommended.
23	Active power	RO	I32	kW	1000	40525	2	Equals the total active output power ofall inverters.
24	Power factor	RO	I16	N/A	1000	40532	1	Equals the total power factor of allinverters.

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
25	Plant status	RO	U16	N/A	1	40543	1	Used by Qinghai 1: Unlimited power operation 2: Limited power operation 3: Idle 4: Outage (fault, maintenance etc.) 5: Communication interrupt
26	Reactive power	RO	I32	kVar	1000	40544	2	Equals the total reactive output power ofall inverters.
27	CO2 reduction	RO	U64	kg	100	40550	4	Equals the total CO2 reduction of allinverters. This register represents a larger value range compared with register 40523.
28	DC current 2	RO	I32	A	10	40554	2	Equals the total input DC current of allinverters. This register represents a larger value range compared with register 40500.
29	E-Total	RO	U32	kWh	10	40560	2	Equals the total energy yield generatedby all inverters.
30	E-Daily	RO	U32	kWh	10	40562	2	Equals daily energy yield generated byall inverters.
31	Duration of daily power generation	RO	U32	h	10	40564	2	

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
32	Plant status	RO	U16	N/A	1	40566	1	Used by Xinjiang 0: Idle 1: On-grid 2: On-grid: self derating 3: On-grid: Power limit 4: Planned outage 5: Power limit outage 6: Fault outage 7: Communication interrupt
33	Plant status	RO	U16	N/A	1	40567	1	Used by Ningxia 1: On-grid 2: Outage 3: Maintenance 4: Idle
34	Active alarm sequence number	RO	U32	N/A	1	40568	2	N/A
35	Historical alarm sequence number	RO	U32	N/A	1	40570	2	N/A
36	Phase A current	RO	I16	A	1	40572	1	Equals the sum of phase A currents of allinverters.
37	Phase B current	RO	I16	A	1	40573	1	Equals the sum of phase B currents of allinverters.
38	Phase C current	RO	I16	A	1	40574	1	Equals the sum of phase C currents of allinverters.
39	Uab	RO	U16	V	10	40575	1	
40	Ubc	RO	U16	V	10	40576	1	
41	Uca	RO	U16	V	10	40577	1	
42	Reserved	RO	U16	N/A	1	40608	10	N/A
43	Inverter Efficiency	RO	U16	%	100	40685	1	N/A

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
44	Max. reactive adjustment	RO	U32	kVar	10	40693	2	Equals the total maximum power of allinverters connected in parallel multiplied by 60%.
45	Min. reactive adjustment	RO	I32	kVar	10	40695	2	Equals the total maximum power of allinverters connected in parallel multiplied by 60% x (–1).
46	Max. activeadjustment	RO	U32	kW	10	40697	2	Equals the total maximum power of allinverters connected in parallel.
47	Locked	RO	U16	N/A	1	40699	1	0: Locked 1: Unlocked If more than one inverter is on-grid andfeeding power to the grid, the status is Unlocked.
48	DI status	RO	U16	N/A	1	40700	1	Bit0: DI1 – Bit7: DI8 1: Closed 0: Open Equals the status of the eight DIs of theSmartLogger.
49	ESN	RO	STR	N/A	1	40713	10	N/A
50	System reset	WO	U16	N/A	1	40723	1	Resets theSmartLogger. The data domain is not checked.
51	Fast device access	WO	U16	N/A	1	40724	1	Automatically allocates and searches fordevices.

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
52	Device operation	WO	MLD	N/A	1	40725	11	First 10 registers: determine the deviceto be operated based on the ESN. The register content is the device ESN. Last register: If the operation type is0, the SmartLogger deletes inverters. If the operation type is 1, theinverter alarm is reset on the SmartLogger side.
53	Device access status	RO	U16	N/A	1	40736	1	0: Search completed 1: Search in progress 2: Search failed
54	Active power control mode	RO	U16	N/A	1	40737	1	0: No limit 1: DI active scheduling 3: Percentage fixed-value limitation(open loop) 4: Remote scheduling 6: Export Limitation(kW) 200: Remote output control 65533: Slave SmartLogger 65534: no scheduling
55	Active power scheduling target value	RO	U32	kW	10	40738	2	Target total active power for theSmartLogger active power scheduling

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
56	Reactive power control mode	RO	U16	N/A	1	40740	1	0: No output 1: DI reactive scheduling 2: Reactive power fix control 3: Power factor fix control 4: Q-U characteristic curve 5: cos(Phi)-P/Pn characteristic curve 6: Q-U hysteresis curve (CEI0-16) 7: Remote scheduling 9: Power factor closed-loop control(old policy) 10: Power factor closed-loop control 65533: Slave SmartLogger 65534: no scheduling
57	Reactive power scheduling curve mode	RO	U16	N/A	1	40741	1	0: indicates the power factor 1: indicates the reactive power fixedvalue
58	Reactive power scheduling target value	RO	I32	kVar	10/1000	40742	2	SmartLogger reactivepower adjustment target value: power factor or total reactive power. Thespecific meaning depends on the reactive power scheduling mode. When the modeis the power factor, the gain is 1000. When the mode is the reactive powerfixed value, the gain is 10.
59	Active scheduling percentage	RO	U32	%	1	40802	2	[0, 100]

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
60	CO2 emission reduction coefficient	RW	U16	kg/kWh	1000	41124	1	[0, 10]
61	PV module capacity	RO	U32	kW	1000	41934	2	[0, 2000000]
62	Rated plant capacity	RO	U32	kW	1000	41936	2	N/A
63	Total rated capacity of grid-connected inverters	RO	U32	kW	1000	41938	2	N/A
64	Conversion coefficient	RO	U32	N/A	1000	41940	2	N/A
65	Communication status	RO	U16	N/A	1	41942	1	Status of communication between the SmartLogger and the servers of Japanese power companies: 0: Connection success 1: Connection failed
66	Communication abnormal shutdown	RW	U16	N/A	N/A	41947	1	0: Disable 1: Enable
67	Communication anbormal detection time	RW	U16	s	N/A	41948	1	[60, 1800]
68	Auto start upon communication recovery	RW	U16	N/A	N/A	41949	1	0: Disable 1: Enable
69	The SystemTime: year	RW	U16	N/A	1	42017	1	2000–2068 (local time)
70	The SystemTime: month	RW	U16	N/A	1	42018	1	1–12
71	The SystemTime: day	RW	U16	N/A	1	42019	1	1–31

SN	Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Range
72	The SystemTime: hour	RW	U16	N/A	1	42020	1	0–23
73	The SystemTime: minute	RW	U16	N/A	1	42021	1	0–59
74	The SystemTime: second	RW	U16	N/A	1	42022	1	0–59
75	Current error during scanning	RW	U16	N/A	100	42150	1	0~2
76	Inspection	WO	U16	N/A	1	42730	1	00:Start 01:Stop
77	IV curve scanning	WO	U16	N/A	1	42779	1	00:Stop 01:Start（64 Points） 02:Start（128 Points） 03:Start（256 Points）
78	Alarm Info 1	RO	U16	N/A	1	50000	1	N/A
79	Alarm Info 2	RO	U16	N/A	1	50001	1	N/A

2.2 Alarm Definitions for the SmartLogger

Table 2-2 Alarm Definitions

Alarm ID	Alarm Name	Alarm Sub-ID	Alarm Cause	Severity	Register Address	Bit
1100	Abnormal Active Schedule	4	If **Active Power Control Mode** is set to **Dry contact remote control,** the four DI ports read instruction combinations not configured.	Major	50000	3
1101	Abnormal Reactive Schedule	4	If **Reactive Power Control Mode** is set to **Dry contact remote control**, the four DI ports read instruction combinations not configured.	Major	50000	11
1103	MCB Disconnect	1	The general AC circuit breaker at the grid-tied point is OFF.	Major	50001	1

Alarm ID	Alarm Name	Alarm Sub-ID	Alarm Cause	Severity	Register Address	Bit
1104	Abnormal Cubicle	1	The Cubicle device has detected an exception at the grid-tied point.	Major	50001	2
1105	Device Address Conflict	1	The address set on the SmartLogger conflicts with an existing access device address.	Major	50001	3
1106	AC SPD fault	1	Communication box SPD fault	Major	50001	4
1107	DI1 custom alarm	1	The dry contact signal from the peripheral to the corresponding DI port on the SmartLogger is abnormal.	Adaptable	50001	5
1108	DI2 custom alarm	1			50001	6
1109	DI3 custom alarm	1			50001	7
1110	DI4 custom alarm	1			50001	8
1111	DI5 custom alarm	1			50001	9
1112	DI6 custom alarm	1			50001	10
1113	DI7 custom alarm	1			50001	11
1114	DI8 custom alarm	1			50001	12
1115	24V power failure	1	Communication box 24V power failure	Major	50001	13
1116	WebUI server certificate invalid	1	WebUI server certificate invalid	Warning	50002	0
1117	WebUI server certificate to expire	1	WebUI server certificate to expire	Warning	50002	1
1118	WebUI server certificate expired	1	WebUI server certificate expired	Major	50002	2
1119	License Expired	1	1. The privilege certificate has entered the grace period. 2. The privilege feature will be invalid soon.	Warning	50001	14

Alarm ID	Alarm Name	Alarm Sub-ID	Alarm Cause	Severity	Register Address	Bit
1120	Management system certificate invalid	1	The management system certificate is not yet valid.	Warning	50002	3
1121	Management system certificate to expire	1	The management system certificate is about to expire.	Warning	50002	4
1122	Management system certificate expired	1	The management system certificate has expired.	Major	50002	5
1123	Remote Control Certificate invalid	1	Remote output control certificate invalid	Warning	50002	6
1124	Remote Control Certificate to expire	1	Remote output control certificate to expire	Warning	50002	7
1125	Remote Control Certificate expired	1	Remote output control certificate expired	Major	50002	8
1126	ESGCC Certificate invalid	1	Poverty alleviation monitoring center certificate invalid	Warning	50002	9
1127	ESGCC Certificate to expire	1	Poverty alleviation monitoring center certificate to expire	Warning	50002	10
1128	ESGCC Certificate expired	1	Poverty alleviation monitoring center certificate expired	Major	50002	11
1129	SmartLogger Certificate Invalid	1	SmartLogger Certificate Invalid	Warning	50002	12
1130	SmartLogger Certificate About to Expire	1	SmartLogger Certificate About to Expire	Warning	50002	13
1131	SmartLogger Certificate Expired	1	SmartLogger Certificate Expired	Major	50002	14

NOTICE

Alarm ID 1106~1115 is only supported in the V200R001 version or later.

Table 2-3 Alarm Descriptions and Impacts

Alarm ID	Alarm Name	Alarm Description	Impact on the System
1100	Abnormal Active Schedule	After the active power control is enabled on the SmartLogger, an abnormal external input occurs or a target device becomes faulty.	The SmartLogger disables the active power control, and the active power output of the power station may fail to satisfy the requirements of the power grid company.
1101	Abnormal Reactive Schedule	After the reactive power control is enabled on the SmartLogger, an abnormal external input occurs or a target device becomes faulty.	The SmartLogger disables the reactive power control, and the reactive power output of the power station may fail to satisfy the requirements of the power grid company.
1103	MCB Disconnect	The SmartLogger has detected that the general AC circuit breaker at the grid-tied point is OFF.	The power station stops feeding the power grid, all inverters shut down, and the SmartLogger disables the power control function.
1104	Abnormal Cubicle	This alarm is triggered when the dry contact point of a cubicle device connected to the SmartLogger is open or closed during the joint test for the relay used in the Japanese market.	The alarm indicates the joint test result for relays, and does not affect other service functions. The SmartLogger displays and reports the alarm.
1105	Device Address Conflict	The SmartLogger address configuredfor data forwarding using Modbus-TCP conflicts with the address of aconnected device.	The SmartLogger forwarding address is 0 by default. If the configured address conflicts with the access deviceaddress, data of the access device fails to be forwarded using Modbus-TCP.
1106	AC SPD fault	This alarm warns you that the dry contact signal sent to the SmartLogger is abnormal in the communication box scenario because the SPD inside the communication box is faulty.	A faulty SPD is unable to protect the SmartLogger from lightning, and therefore the SmartLogger may be damaged under thunderstorms.

Alarm ID	Alarm Name	Alarm Description	Impact on the System
1107~1114	DI1~8 custom alarm	This alarm is generated when the SmartLogger detects that the dry contact signal from the peripheral is abnormal.	The peripheral may be abnormal, which may impact the system running.
1115	24V power failure	This alarm warns you that the dry contact signal sent to the SmartLogger is abnormal in the communication box scenario because the 24V power inside the communication box is faulty.	The meteorological sensor in the communication box does not work properly due to no power supply.
1116	WebUI server certificate invalid	WebUI server certificate valid date is future time	NA
1117	WebUI server certificate to expire	WebUI server certificate will be expire	NA
1118	WebUI server certificate expired	WebUI server certificate is expired	NA
1119	License Expired	1. The privilege certificate has entered the grace period. 2. The privilege feature will be invalid soon.	The privilege feature will be invalid soon.
1120	Management system certificate invalid	Management system certificate valid date is future time	Can't connect to management system
1121	Management system certificate to expire	Management system certificate will be deadline after 60 days	The link to management system will be disconnected after 60 days
1122	Management system certificate expired	Management system certificate is expired	Can't connect to management system
1123	Remote Control Certificate invalid	Remote Control Certificate valid date is future time	Can't connect to remote output control server
1124	Remote Control Certificate to expire	Remote Control Certificate will be deadline after 60 days	The link to remote output control server will be disconnected after 60 days
1125	Remote Control Certificate expired	Remote Control Certificate is expired	Can't connect to remote output control server
1126	ESGCC Certificate invalid	Poverty alleviation monitoring center certificate valid date is future time	Can't connect to poverty alleviation monitoring center

Alarm ID	Alarm Name	Alarm Description	Impact on the System
1127	ESGCC Certificate to expire	Poverty alleviation monitoring center certificate will be deadline after 60 days	The link to poverty alleviation monitoring center will be disconnected after 60 days
1128	ESGCC Certificate expired	Poverty alleviation monitoring center certificate is expired	Can't connect to poverty alleviation monitoring center
1129	SmartLogger Certificate Invalid	SmartLogger Certificate valid date is future time	NA
1130	SmartLogger Certificate About to Expire	SmartLogger Certificate will be deadline after 60 days	Links pose security risks after certificate expired
1131	SmartLogger Certificate Expired	SmartLogger Certificate is expired	Links pose security risks after certificate expired

2.3 Register Definitions for the Environmental Monitor Instrument

NOTE

In the following table, the operating object of the register is an environmental monitor instrument. In the Modbus-TCP communications protocol, the logic device ID is set to the RS485 address of the environmental monitor instrument.

Table 2-4 Register Definitions

SN	Signal Name	Read/ Write	Type	Unit	Gain	Register Address	Quantity
1	Wind speed (WSP)	RO	I16	m/s	10	40031	1
2	Wind direction (WD)	RO	I16	°	1	40032	1
3	PV module temperature	RO	I16	℃	10	40033	1
4	Ambient temperature	RO	I16	℃	10	40034	1
5	Total irradiance	RO	I16	W/m^2	10	40035	1
6	Daily irradiation amount	RO	U32	MJ/m^2	1000	40036	2
7	Total irradiance 2	RO	I16	W/m^2	10	40038	1
8	Daily irradiation amount 2	RO	U32	MJ/m^2	1000	40039	2

SN	Signal Name	Read/ Write	Type	Unit	Gain	Register Address	Quantity
9	Custom 1	RO	I16	N/A	10	40041	1
10	Custom 2	RO	I16	N/A	10	40042	1
11	Daily irradiation amount	RO	U32	kWh/㎡	1000	40043	2
12	Daily irradiation amount 2	RO	U32	kWh/㎡	1000	40045	2

2.4 Register Definitions for the Power Meter

NOTE

In the following table, the operating object of the register is a power meter. In the Modbus-TCP communications protocol, the logic device ID is set to the RS485 address of the power meter.

Table 2-5 Register Definitions

SN	Signal Name	Read/ Write	Type	Unit	Gain	Address	Quantity
1	Phase A voltage	RO	U32	V	100	32260	2
2	Phase B voltage	RO	U32	V	100	32262	2
3	Phase C voltage	RO	U32	V	100	32264	2
4	A-B line voltage	RO	U32	V	100	32266	2
5	B-C line voltage	RO	U32	V	100	32268	2
6	C-A line voltage	RO	U32	V	100	32270	2
7	Phase A current	RO	I32	A	10	32272	2
8	Phase B current	RO	I32	A	10	32274	2
9	Phase C current	RO	I32	A	10	32276	2
10	Active power	RO	I32	kW	1000	32278	2
11	Reactive power	RO	I32	kVar	1000	32280	2
12	Active electricity(Reserved)	RO	I32	kWh	10	32282	2
13	Power factor	RO	I16	N/A	1000	32284	1
14	Reactive electricity(Reserved)	RO	I32	kvarh	10	32285	2
15	Apparent power	RO	I32	kVA	1000	32287	2
16	Positive active electricity(Reserved)	RO	I32	kWh	100	32289	2

SN	Signal Name	Read/ Write	Type	Unit	Gain	Address	Quantity
17	Positive reactive electricity(Reserved)	RO	I32	kvarh	100	32291	2
18	Electricity in positive active electricity price segment 1	RO	I32	kWh	100	32299	2
19	Electricity in positive active electricity price segment 2	RO	I32	kWh	100	32301	2
20	Electricity in positive active electricity price segment 3	RO	I32	kWh	100	32303	2
21	Electricity in positive active electricity price segment 4	RO	I32	kWh	100	32305	2
22	Electricity in negative active electricity price segment 1	RO	I32	kWh	100	32307	2
23	Electricity in negative active electricity price segment 2	RO	I32	kWh	100	32309	2
24	Electricity in negative active electricity price segment 3	RO	I32	kWh	100	32311	2
25	Electricity in negative active electricity price segment 4	RO	I32	kWh	100	32313	2
26	Custom 1	RO	I32	N/A	1000	32315	2
27	Custom 2	RO	I32	N/A	1000	32317	2
28	Custom 3	RO	I32	N/A	1000	32319	2
29	Custom 4	RO	I32	N/A	1000	32321	2
30	Custom 5	RO	I32	N/A	1000	32323	2
31	Custom 6	RO	I32	N/A	1000	32325	2
32	Custom 7	RO	I32	N/A	1000	32327	2
33	Custom 8	RO	I32	N/A	1000	32329	2
34	Custom 9	RO	I32	N/A	1000	32331	2
35	Custom 10	RO	I32	N/A	1000	32333	2
36	Phase A active power	RO	I32	kW	1000	32335	2
37	Phase B active power	RO	I32	kW	1000	32337	2
38	Phase C active power	RO	I32	kW	1000	32339	2
39	Total active electricity	RO	I64	kWh	100	32341	4
40	Total reactive electricity	RO	I64	kvarh	100	32345	4
41	Negative active electricity	RO	I64	kWh	100	32349	4

SN	Signal Name	Read/ Write	Type	Unit	Gain	Address	Quantity
42	Negative reactive electricity	RO	I64	kvarh	100	32353	4
43	Positive active electricity	RO	I64	kWh	100	32357	4
44	Positive reactive electricity	RO	I64	kvarh	100	32361	4

NOTE

SN16 ~ SN25 registers are supported only by DL/T 645 power meters.

2.5 Register Definitions for the SUN2000

NOTE

The operating object of the register is an SUN2000 inverter. In the Modbus-TCP communications protocol, the logic device ID is set to the RS485 address of the inverter.

For the detailed register definitions, see the *SUN2000VXXXRXXXCXX MODBUS Protocol*.

2.6 Public Register Definitions

The SmartLogger provides signals listed in the following table for all types of devices connected to it, even if the devices do not provide the signals.

Table 2-6 Register Definitions

SN	Signal Name	Read/Write	Type	Unit	Gain	Address	Quantity
1	Device list change number	RO	U16	N/A	1	65521	1
2	Port number	RO	U16	N/A	1	65522	1
3	Device Address	RO	U16	N/A	1	65523	1
4	Device name	RW	STR	N/A	1	65524	10
5	Device connection status	RO	U16	N/A	1	65534	1

NOTE

Data definitions for Device connection status are as follows:

0XB000; Disconnection

0XB001; Online

NOTE

Data restrictions for Device name re as follows:

A device name consists of a maximum of 20 bytes (excluding the terminator), and can contain only visible characters whose ASCII codes are in the range from 0x20 to 0x7e, including letters (a–z, A–Z), digits (0–9), and single-byte punctuation (excluding '\').

2.7 Remapped Modbus definitions

NOTE

The mapped registers are accessed by the SmartLogger address. By default, each device takes up 25 registers, the register address is derived from the initial register address, offset address, and device address translation. Device address for Modbus physical address. Supported devices: inverter, environmental monitor instrument.

The formula is as follows:

- Register address = Initial register address + (25 * (Device address – 1)) + Offset address
- Initial register address = 51000
- For the registers must be set in sequence, the device address must be in strict accordance with the continuous number to avoid waste of registers.

Table 2-7 Inverter Register Definitions

SN	Signal Name	Read/ Write	Type	Unit	Gain	Offset address	Quantity	Scope
1	Active power	RO	I32	kW	1000	0	2	
2	Reactive power	RO	I32	kVAR	1000	2	2	
3	Total DC input current	RO	I16	A	100	4	1	
4	Total input power	RO	U32	kW	1000	5	2	
5	Insulation resistance	RO	U16	MΩ	1000	7	1	
6	Power factor	RO	I16	N/A	1000	8	1	
7	Inverter status	RO	U16	N/A	1	9	1	In addition to the Modbus interface protocol of the specific inverter, the following two states are added by the SmartLogger: 0xB000: Communication interrupt 0xC000: Uploading
8	Spare8	RO	I16	N/A	N/A	10	1	

SN	Signal Name	Read/ Write	Type	Unit	Gain	Offset address	Quantity	Scope
9	Cabinet temperature	RO	I16	℃	10	11	1	
10	Major Fault Code	RO	U32	N/A	N/A	12	2	Alarm ID(Bit31~16) + Cause ID(Bit15~0)
11	Minor Fault Code	RO	U32	N/A	N/A	14	2	Alarm ID(Bit31~16) + Cause ID(Bit15~0)
12	Warning Code	RO	U32	N/A	N/A	16	2	Alarm ID(Bit31~16) + Cause ID(Bit15~0)
13	Spare1	RO	U16	N/A	N/A	18	1	
14	Spare2	RO	U16	N/A	N/A	19	1	
15	Spare3	RO	U16	N/A	N/A	20	1	
16	Spare4	RO	U16	N/A	N/A	21	1	
17	Spare5	RO	U16	N/A	N/A	22	1	
18	Spare6	RO	U16	N/A	N/A	23	1	
19	Spare7	RO	U16	N/A	N/A	24	1	

Table 2-8 Environmental Monitor Instrument Register Definitions

SN	Signal Name	Read/ Write	Type	Unit	Gain	Offset address	Quantity	Scope
1	Wind speed (WSP)	RO	I16	m/s	10	0	1	
2	Wind direction (WD)	RO	I16	°	1	1	1	
3	PV module temperature	RO	I16	℃	10	2	1	
4	Ambient temperature	RO	I16	℃	10	3	1	
5	Total irradiance	RO	I16	W/㎡	10	4	1	
6	Daily irradiation amount	RO	U32	MJ/ ㎡	1000	5	2	
7	Total irradiance 2	RO	I16	W/㎡	10	7	1	

SN	Signal Name	Read/ Write	Type	Unit	Gain	Offset address	Quantity	Scope
8	Daily irradiation amount 2	RO	U32	MJ/ ㎡	1000	8	2	
9	Custom 1	RO	I16	N/A	10	10	1	
10	Custom 2	RO	I16	N/A	10	11	1	
11	Daily irradiation amount	RO	U32	kWh/ ㎡	1000	12	2	
12	Daily irradiation amount 2	RO	U32	kWh/ ㎡	1000	14	2	
13	Spare1	RO	U16	N/A	N/A	16	1	
14	Spare2	RO	U16	N/A	N/A	17	1	
15	Spare3	RO	U16	N/A	N/A	18	1	
16	Spare4	RO	U16	N/A	N/A	19	1	
17	Spare5	RO	U16	N/A	N/A	20	1	
18	Spare6	RO	U16	N/A	N/A	21	1	
19	Spare7	RO	U16	N/A	N/A	22	1	
20	Spare8	RO	U16	N/A	N/A	23	1	
21	Spare9	RO	U16	N/A	N/A	24	1	

3 Power Adjustment for Inverters

The MODBUS-TCP interface provided by the SmartLogger can directly access the inverter.

The built-in power interface of the SmartLogger can be used for array-level power adjustment. If the power interface is used, the power adjustment instruction is first processed by the SmartLogger and then forwarded to the inverter.

Related interfaces are as follows.

Table 3-1 Register Definitions

SN	Interface Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Restraints
1	Active adjustment	RW	U32	kW	10	40420	2	This interface stores data and the adjustment value should be issued at intervals of not less than 1 seconds. The adjustment value that is beyond the range is discarded.
2	Reactive adjustment	RW	I32	kVar	10	40422	2	
1	Active adjustment	RW	U32	kW	10	40424	2	This interface stores data and the adjustment value should be issued at intervals of not less than 1 seconds.
2	Reactive adjustment	RW	I32	kVar	10	40426	2	
3	Active power adjustment by percentage	RW	U16	%	10	40428	1	This interface stores data and the adjustment value should be issued at intervals of not less than 1 seconds.
4	Power factor adjustment	RW	I16	N/A	1000	40429	1	
5	Max. reactive adjustment	RO	U32	kVar	10	40693	2	Read only interfaces

SN	Interface Name	Read/ Write	Type	Unit	Gain	Address	Quantity	Restraints
6	Min. reactive adjustment	RO	I32	kVar	10	40695	2	
7	Max. active adjustment	RO	U32	kW	10	40697	2	

3.1 40420, 40424: Active Adjustment

3.2 40422, 40426: Reactive Adjustment

3.3 40428: Active Power Adjustment by Percentage

3.4 40429: Power Factor Adjustment

3.1 40420, 40424: Active Adjustment

The external device sends an absolute active power value for active power adjustment. The value is the sum of all inverters connected to the SmartLogger.

After the SmartLogger receives the instruction value, it synchronizes the value in percentage to all connected inverters.

The real-time range for active power adjustment can be queried through Max. active adjustment (register 40697).

3.2 40422, 40426: Reactive Adjustment

The external device sends an absolute reactive power value for reactive power adjustment. The value is the sum of all inverters connected to the SmartLogger.

After the SmartLogger receives the instruction value, it synchronizes the value in the form of Q/S to all connected inverters.

The real-time range for reactive power adjustment can be queried through Max. reactive adjustment (register 40693) and Min. reactive adjustment (register 40695).

3.3 40428: Active Power Adjustment by Percentage

The external device sends the active power adjustment target value in percentage.

After the SmartLogger receives the instruction value, it synchronizes the value in percentage to all connected inverters.

The reference value of this percentage value is the sum of the rated power of all inverters.

3.4 40429: Power Factor Adjustment

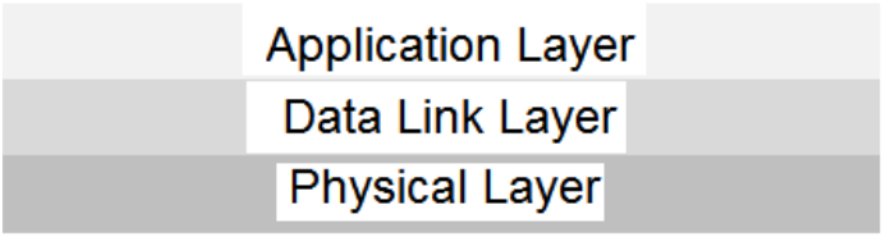
The external device sends the reactive power adjustment target value in the form of a power factor.

After the SmartLogger receives the instruction value, it synchronizes the value in the form of a power factor to all connected inverters.

4 Communication Protocol Overview

The ModBus-TCP communication protocol consists of the following layers:

Figure 4-1 Layers of the ModBus-TCP communication protocol



4.1 Physical Layer
4.2 Data Link Layer
4.3 Application Layer

4.1 Physical Layer

Communicates over an Ethernet.

Port number: 502

4.2 Data Link Layer

4.2.1 Addressing Mode

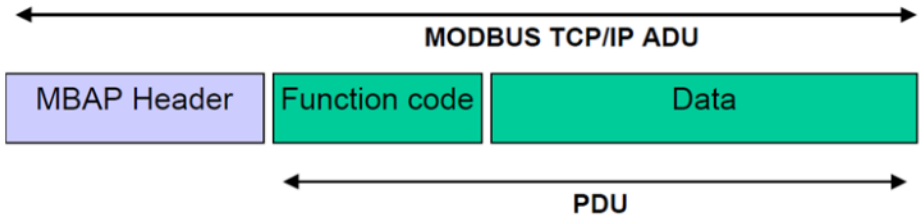
ModBus-TCP data frames identify devices by logic device IDs. The following table describes how logic device IDs are allocated.

NOTE

The address of an access device is an RS485 address which can be read on the LCD or built-in WebUI of the SmartLogger.

SmartLogger Local Address	Access Device Address	Reserved
0	1–247	248–255

4.2.2 Frame Structure



WARNING

A ModBus-TCP frame can contain a maximum of 256 bytes.

The following table describes the format of an MBAP header:

Table 4-1 MBAP Definitions

Data Field	Length (Bytes)	Description	Master Node	Slave Node
Transmission identifier	2	Matching identifier between a request frame and a response frames	Assigned by the master node; better be unique for each data frame.	The identifier of the response frame from the slave node must be consistent with that of the request frame.
Protocol type	2	0 = Modbus protocol	Assigned by the master node; 0 by default.	The identifier of the response frame from the slave node must be consistent with that of the request frame.
Data length	2	Follow-up data length	Assigned by the master node based on the actual data frame.	Assigned by the slave node based on the actual frame length.

Data Field	Length (Bytes)	Description	Master Node	Slave Node
Logic device ID	1	Identifies a SmartLogger device or a subdevice accessed by the SmartLogger. 0: SmartLogger 1–247: Inverters or other device	Assigned by the master node based on the actual data frame request.	The identifier of the response frame from the slave node must be consistent with that of the request frame.

4.2.3 Data Encoding

Modbus uses a big-Endian to represent addresses and data. When multiple bytes are sent, the payload digit leftmost is sent first.

Example:

Register Size	Value
16 bits	0x1234

The system sends 0x12, and then sends 0x34.

4.2.4 Interaction Process

A communication process is always initiated by a master node. Slave nodes do not initiate communication processes.

In unicast mode, a slave node returns one response for each request from the master node. If the master node does not receive any response from the slave node in 5s, the communication process is regarded as timed out.

In broadcast mode, slave nodes receive instructions from the master node, but do not respond to the instructions.

4.3 Application Layer

4.3.1 Function Code List

Table 4-2 Function code list

Function Code	Meaning	Remarks
0x03	Read registers.	Supports continuous reading of single or multiple registers.
0x06	Write a single register.	Supports writing into a single register.
0x10	Write multiple registers.	Supports continuous writing into multiple registers.
0x2B	Read device identifiers.	Obtains device types and version numbers.

4.3.2 Exception Code List

The exception codes must be unique for each NE type. The names and descriptions are provided in the NE interface document. Different versions of the same NE type must be backward compatible. Exception codes in use cannot be assigned to other exceptions.

Table 4-3 Table of exception codes returned by an NE (0x00–0x8F are for common exception codes)

Code	Name	Meaning
0x01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server. This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the server is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.

Code	Name	Meaning
0x02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the server. More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, the PDU addresses the first register as 0, and the last one as 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 4, then this request will successfully operate (address-wise at least) on registers 96, 97, 98, 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 5, then this request will fail with Exception Code 0x02 "Illegal Data Address" since it attempts to perform operations on registers 96, 97, 98, 99 and 100, and there is no register with address 100.
0x03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for server. This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does not mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the Modbus protocol is unaware of the significance of any particular value of any particular register.
0x04	SERVER DEVICE FAILURE	An unrecoverable error occurred while the server was attempting to perform the requested action.

Code	Name	Meaning
0x05	ACKNOWLEDGE	Specialized use in conjunction with programming commands. The server has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the client. The client can next issue a Poll Program Complete message to determine if processing is completed.
0x06	SERVER DEVICE BUSY	Specialized use in conjunction with programming commands. The server is engaged in processing a long–duration program command. The client should retransmit the message later when the server is free.
0x08	MEMORY PARITY ERROR	Specialized use in conjunction with function codes 20 and 21 and reference type 6, to indicate that the extended file area failed to pass a consistency check. The server attempted to read record file, but detected a parity error in the memory. The client can retry the request, but service may be required on the server device.
0x0A	GATEWAY PATH UNAVAILABLE	Specialized use in conjunction with gateways, indicates that the gateway was unable to allocate an internal communication path from the input port to the output port for processing the request. Usually means that the gateway is misconfigured or overloaded.

Code	Name	Meaning
0x0B	GATEWAY TARGET DEVICE FAILED TO RESPOND	Specialized use in conjunction with gateways, indicates that no response was obtained from the target device. Usually means that the device is not present on the network.
0x80	NO PERMISSION	An operation is not allowed because of a permission authentication failure or permission expiration.

4.3.3 Reading Registers (0X03)

4.3.3.1 Frame Format for a Request from a Master Node

Data Field	Length	Description
Function code	1 byte	0x03
Register start address	2 byte	0x0000–0xFFFF
Number of registers	2 byte	1–125

4.3.3.2 Frame Format for a Normal Response from a Slave Node

Data Field	Length	Description
Function code	1 byte	0x03
Number of bytes	1 byte	2×N
Register value	2xN byte	N/A

NOTE

N indicates the number of registers.

4.3.3.3 Frame Format for an Abnormal Response from a Slave Node

Data Field	Length	Description
Function code	1 byte	0x83
Exception code	1 byte	See the 4.3.2 Exception Code List

4.3.3.4 Example

A master node sends a request to a slave node (logic device ID: 01) to query register whose address is 32306/0X7E32. The request frame format is as follows:

Description	MBAP Header							Function Code	Data			
	Protocol Identifier		Protocol Type		Data Length		Logic Device ID		Register Address		Number of Registers	
Data frame	00	01	00	00	00	06	00	03	7E	32	00	02

Frame format of a normal response from the slave node:

Description	MBAP Header							Function Code	Data				
	ProtocolIdentifier		Protocol Type		Data Length		Logic DeviceID		Bytes	RegisterValue			
Data frame	00	01	00	00	00	07	00	03	04	00	00	00	01

Frame format of an abnormal response from the slave node:

Description	MBAP Header							Function Code	Data
	ProtocolIdentifier		Protocol Type		Data Length		Logic DeviceID		Error Code
Data frame	00	01	00	00	00	03	00	83	03

4.3.4 Writing a Single Register (0X06)

4.3.4.1 Frame Format for a Request from a Master Node

Data Field	Length	Description
Function code	1 byte	0x06
Register Address	2 bytes	0x0000–0xFFFF
Register Value	2 bytes	0x0000–0xFFFF

4.3.4.2 Frame Format for a Normal Response from a Slave Node

Data Field	Length	Description
Function code	1 byte	0x06
Register Address	2 bytes	0x0000–0xFFFF
Register Value	2 bytes	0x0000–0xFFFF

4.3.4.3 Frame Format for an Abnormal Response from a Slave Node

Data Field	Length	Description
Function code	1 byte	0x86
Exception code	1 byte	See the 4.3.2 Exception Code List

4.3.4.4 Example

A master node sends a Power-On instruction(register address: 40200/0X9D08) to a slave node whose address is 01. The request frame format is as follows:

Description	MBAP Header							Function Code	Data			
	Protocol Identifier		Protocol Type		Data Length		Logic device ID		Register Address		Register Value	
Data frame	00	01	00	00	00	06	00	06	9D	08	00	00

Frame format of a normal response from the slave node:

Description	MBAP Header							Function Code	Data			
	Protocol Identifier		Protocol Type		Data Length		Logic Device ID		Register Address		Register Value	
Data frame	00	01	00	00	00	06	00	06	9D	08	00	00

Frame format of an abnormal response from the slave node:

Description	MBAP Header							Function Code	Data
	Protocol Identifier		Protocol Type		Data Length		Logic Device ID		Error Code
Data frame	00	01	00	00	00	03	00	86	04

4.3.5 Writing Multiple Registers

4.3.5.1 Frame Format for a Request from a Master Node

Data Field	Length	Description
Function code	1 byte	0x10
Register start address	2 byte	0x0000–0xFFFF
Number of registers	2 byte	0x0000–0x007b
Number of bytes	1 byte	2×N
Register value	2×N byte	Value

NOTE

N indicates the number of registers.

4.3.5.2 Frame Format for a Normal Response from a Slave Node

Data Field	Length	Description
Function code	1 byte	0x10
Register address	2 bytes	0x0000–0xFFFF
Number of registers	2 bytes	0x0000–0x007b

4.3.5.3 Frame Format for an Abnormal Response from a Slave Node

Data Field	Length	Description
Function code	1 byte	0x90
Exception code	1 byte	See the 4.3.2 Exception Code List

4.3.5.4 Example

A master node sends an instruction to a slave node whose address is 01 to set the active power control mode (register address: 40118/0X9CB6) to 2, and set the active power deration (register address: 40119/0X9CB7) to 50%. The request frame format is as follows:

Description	MBAP Header							Function Code	Data								
	Protocol Identifier		Protocol Type		Data Length		Logic device ID		Register Address		Number of Registers		Bytes	Register Value			
Data frame	00	01	00	00	00	0B	00	10	9C	B6	00	02	04	00	02	00	32

Frame format of a normal response from the slave node:

Description	MBAP Header							Function Code	Data			
	Protocol Identifier		Protocol Type		Data Length		Logic Device ID		Register Address		Number of Registers	
Dataframe	00	01	00	00	00	06	00	10	9C	B6	00	02

Frame format of an abnormal response from the slave node:

Description	MBAP Header							Function Code	Data
	Protocol Identifier		Protocol Type		Data Length		Logic Device ID		Error Code
Data frame	00	01	00	00	00	03	00	90	04

4.3.6 Reading Device Identifiers (0X2B)

This command code allows reading identifiers and added packets that are relevant to the physical and function description of the remote devices.

Simulate the port of the read device identifier as an address space. This address space consists of a set of addressable data elements. The data elements are objects to be read, and the object IDs determine these data elements.

A data element consists of three objects:

- Basic device identifier: All objects of this type are mandatory, such as the manufacturer name, product code, and revision version.
- Normal device identifier:Except the basic data objects, the device provides additional and optional identifiers and data object description. Normal device identifiers define all types of objects according to standard definitions, but the execution of this type of objects is optional.
- Extensive device identifier:Except the basic data objects, the device provides additional and optional identifiers and special data object description. All these data objects are related to the device.

Table 4-4 Reading Device Identifiers

Object ID	Object Name or Description	Type	M/O	Category
0x00	Manufacturer name	ASCII character string	M	Basic
0x01	Product code	ASCII character string	M	
0x02	Main revision	ASCII character string	M	
0x03–0x7F				Normal
0x80–0xFF				Extensive

4.3.6.1 Commands for Querying Device Identifiers

Table 4-5 Request frame format

Data Field	Length (Byte)	Description
Function code	1	0x2B
MEI type	1	0x0E
ReadDeviId code	1	01
Object ID	1	0x00

Table 4-6 Frame format for a normal response

Data Field	Length (Byte)	Description
Slave node address	1	1–247
Function code	1	0x2B
MEI type	1	0x0E
ReadDeviId code	1	01
Consistency level	1	01
More	1	N/A

Data Field			Length (Byte)	Description
Next object ID			1	N/A
Number of objects			1	N/A
Object list	First object	Object ID	1	0x00
		Object length	1	N
		Object value	N	N/A

Table 4-7 Object list

Object ID	Object Name or Description	Description	Category
0x00	Manufacturer name	HUAWEI	Basic
0x01	Product code	SUN2000	
0x02	Main revision	ASCII character string, software version	

Table 4-8 Frame format for an abnormal response

Data Field	Length (Byte)	Description
Function code	1	0xAB
Exception code	1	See the 4.3.2 Exception Code List

4.3.6.2 Command for Querying a Device List

Table 4-9 Request frame format

Data Field	Length (Byte)	Description
Function code	1	0x2B
MEI type	1	0x0E
ReadDeviId code	1	03
Object ID	1	0x87

Table 4-10 Frame format for a normal response

Data Field			Length (Byte)	Description
Function code			1	0x2B
MEI type			1	0x0E
ReadDeviId code			1	03
Consistency level			1	03
More			1	N/A
Next object ID			1	N/A
Number of objects			1	N/A
Object list	First object	Object ID	1	0x87
		Object length	1	N
		Object value	N	N/A
	...			

Table 4-11 Object list

Object ID	Object Name	Type	Description
0x80-0x86	Reserved		Returns a null object with a length of 0.
0x87	Number of devices	int	Returns the number of devices connected to the RS485 address.
0x88	Information about the first device	ASCII character string See the device description definitions below.	Returns information only for the first device if a network element allows only one device to be connected to each RS485 address.
0x89	Information about the second device	same as above	same as above
...	...	...	...
0xFF	Information about the 120th device	same as above	same as above
0x00	Information about the 121th device	same as above	same as above

Object ID	Object Name	Type	Description
0x01	Information about the 122th device	same as above	same as above
...	...	...	...

4.3.6.3 Device Description Definitions

Each device description consists of all"attribute = value" strings.

Attribute label=%s;attribute label=%s;…attribute label=%s

For example:1=SUN2000;2=V100R001C01SPC120;3=P1.0-D1.0;4=123232323;5=2;6=1.

Table 4-12 Attribute definitions

Attribute Label	Attribute Name	Type	Description
1	Device Model	ASCII character string	SUN2000
2	Software version	ASCII character string	N/A
3	Version of the communications protocol	ASCII character string	See the interface protocol version definitions.
4	ESN	ASCII character string	N/A
5	Device number	int	0,1,2,3...(Assigned by NE; 0 indicates the master device to which the ModBus card is inserted)
6	Parallel network number	int	0, 1,2, 3, … (assigned by NE) 0xFF:invalid value; indicates that a unit does not belong to any parallel system If not applicable, this attribute is not returned.

Table 4-13 Frame format for an abnormal response

Data Field	Length (Byte)	Description
Function code	1	0xAB
Exception code	1	See the 4.3.2 Exception Code List

5 Reference Documents

Modbus_Application_Protocol_V1_1b3

Modbus over serial line specification and implementation guide V1.02

Modbus_Messaging_Implementation_Guide_V1_0b

