SUN2000MA
V100R001C20

Modbus Interface Definitions

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1 Supported Models

This section describes the inverter models that use this protocol and the minimum firmware version required for these models. Identify and adapt to these inverters when connecting to the host.

1.1 Model Description

Table 1-1 Supported models and firmware versions

Model	Model ID	Earliest Firm Version
SUN2000-15KTL-M3	436	SUN2000MA V100R001C20
SUN2000-17KTL-M3	437	SUN2000MA V100R001C20
SUN2000-20KTL-M3	438	SUN2000MA V100R001C20
SUN2000-23KTL-M3	439	SUN2000MA V100R001C20
SUN2000-24.5KTL-M3	440	SUN2000MA V100R001C20
SUN2000-25KTL-NAM3	441	SUN2000MA V100R001C20
SUN2000-28KTL-M3	442	SUN2000MA V100R001C20
SUN2000-29.9KTL-M3	443	SUN2000MA V100R001C20
SUN2000-30KTL-M3	444	SUN2000MA V100R001C20
SUN2000-36KTL-M3	445	SUN2000MA V100R001C20
SUN2000-40KTL-M3	446	SUN2000MA V100R001C20
SUN2000-42KTL-M3	447	SUN2000MA V100R001C20
SUN2000-44KTL-M3	448	SUN2000MA V100R001C20
SUN2000-50KTL-M3	449	SUN2000MA V100R001C20
SUN2000-30KTL-NAM3	450	SUN2000MA V100R001C20

Model	Model ID	Earliest Firm Version
SUN2000-33KTL-NAM3	451	SUN2000MA V100R001C20
SUN2000-36KTL-NAM3	452	SUN2000MA V100R001C20
SUN2000-40KTL-NAM3	453	SUN2000MA V100R001C20
SUN2000-43KTL-INM3	454	SUN2000MA V100R001C20
SUN2000-33KTL-NHM3	455	SUN2000MA V100R001C20
SUN2000-40KTL-NHM3	456	SUN2000MA V100R001C20

NOTE

The maximum active power (P_{max}), maximum reactive power (Q_{max}), and rated power (P_n) corresponding to each model can be obtained from the register interface. The model ID is the unique code of the model.

2 Overview

The modbus protocol is released as a general-purpose device-level communication protocol standard. This document describes the ModBus protocol of Huawei inverters to standardize and restrict subsequent third-party integration development. Huawei inverters comply with the standard ModBus specifications. This document focuses on Huawei inverter-specific information. For details about other information, see the ModBus standard specifications document. For details about the standard protocols used by Huawei inverters and the interaction modes and examples of customized parts, see **6 Overview of the Communications Protocol**.

2.1 Terms and Abbreviations

Table 2-1 Terms and abbreviations

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	A register address is recorded in two bytes.
U16	Unsigned integer (16 bits)
U32	Unsigned integer (32 bits)
I16	Signed integer (16 bits)
I32	Signed integer (32 bits)
E16	Enumerated value
STR	Character string

Name	Description
MLD	Multiple bytes
Bitfield16	16-bit data expressed by bit
Bitfield32	32-bit data expressed by bit
N/A	Not applicable
s	Second
Epoch seconds	The number of seconds that have elapsed since 1970-01-01 00:00:00
RO	Data that is readable only
RW	Data that is readable and writable
WO	Data that is writable only

3 Register Definitions

No.	Signal name	Read and write	Type	Unit	Gain	Address	Number of Reg	Scope
1	Model	RO	STR			30000	15	Nameplate name of the machine, original "model name"
2	SN	RO	STR			30015	10	Device SN, which is obtained from the electronic label of the entire system.
3	PN	RO	STR			30025	10	Product Code
4	Firmware Version	RO	STR			30035	15	Character string reporting: initial version VX00R00X (default VR version) VX00R00XD01, VX00R00XD02... (D0X is provided by the test and certification personnel.) Different country codes may be displayed differently.
5	Software version	RO	STR			30050	15	In V800R021C10SPCXXX, the offering name and software version are displayed on the display page.

6	Protocol version [Modbus]	RO	U32			30068	2	high-character: main version; Upgrade on Incompatible Changes low-letter: revision; Compatible upgrade The baseline version is D8.0. 0x00080000
7	Model ID	RO	U16			30070	1	Model ID. For details, see the Inverter Model Definition.xlsm.
8	Number of PV strings	RO	U16		1	30071	1	
9	Number of MPPTs	RO	U16		1	30072	1	
10	Rated power	RO	U32	kW	1000	30073	2	Pn
11	Maximum active power (Pmax)	RO	U32	kW	1000	30075	2	Read-only interface to 42027
12	Maximum apparent (Smax)	RO	U32	kVA	1000	30077	2	Read-only interface to 42025

13	Real-time maximum reactive power (Qmax, fed to the power grid)	RO	I32	kVar	1000	30079	2	Reported to the monitoring, indicating the reactive power adjustment range. Feature data is updated when the power grid standard code and derating change except for model differences.
14	Real-time maximum reactive power (-Qmax, absorbed from the power grid)	RO	I32	kVar	1000	30081	2	Reported to the monitoring, indicating the reactive power adjustment range. Feature data is updated when the power grid standard code and derating change except for model differences.

15	Maximum active power (Pmax_real)	RO	U32	kW	1000	30083	2	The default maximum active power capacity is fixed on the nameplate of the machine, and the maximum active power capacity will not change for one machine. as a set upper limit for the reference range (42027); The relationship is as follows: 0<Pmax≤Smax≤Pmax_real≤Smax_real Or the 0<Pmax≤Pmax_real≤Smax≤Smax_real
16	Maximum apparent capability (Smax_real)	RO	U32	kVA	1000	30085	2	The default apparent maximum capacity value is fixed on the machine nameplate, and one machine will not change. as a set upper limit for the reference range (42025); The relationship is as follows: 0<Pmax≤Smax≤Pmax_real≤Smax_real Or the 0<Pmax≤Pmax_real≤Smax≤Smax_real

17	Product sales area	RO	STR			30105	2	XX: Two uppercase letters, indicating the sales area or application area of the product, mainly related to the AC power system. CN: Chinese mainland; EU: Europe; JP: Japan; US: North America (US/Canada/and regions with the same grid or certification requirements as the US); UK: United Kingdom; Default value: CN/EU: All areas where CE certification requirements are applicable. Huawei FusionSolar Smart PV Solution and Product Naming Specifications
18	Product software ID	RO	U16			30107	1	Unique ID of the software publishing entity. Used for processing the compatibility of the power grid standard code.
19	Product Software Version Number	RO	U16			30108	1	Software release entity specific release version sequence number Used to process the compatibility of the power grid standard code.
20	Power Grid Standard Code Protocol Version	RO	U16			30109	1	Protocol loading and verification is similar to CAN1.0 and CAN2.0.

21	Unique ID of the software.	RO	U16			30110	1	Unique ID of a software version. Upgrade packages with different IDs cannot be upgraded to each other. (Broadcast Upgrade Signature)
22	Number of upgrade packages	RO	U16		1	30111	1	The number of upgrade packages must be sufficient because more and more devices need to be upgraded.
23	Information about subpackage 1	RO	U32			30112	2	high-character: file type ID; Low character: device type ID.
24	Subpackage 2 information	RO	U32			30114	2	high-character: file type ID; Low character: device type ID.
25	Information about subpackage 3	RO	U32			30116	2	high-character: file type ID; Low character: device type ID.
26	Subpackage 4 information	RO	U32			30118	2	high-character: file type ID; Low character: device type ID.
27	Subpackage 5 information	RO	U32			30120	2	high-character: file type ID; Low character: device type ID.

28	Information about subpackage 6	RO	U32			30122	2	high-character: file type ID; Low character: device type ID.
29	Subpackage 7 information	RO	U32			30124	2	high-character: file type ID; Low character: device type ID.
30	Subpackage 8 information	RO	U32			30126	2	high-character: file type ID; Low character: device type ID.
31	Subpackage 9 information	RO	U32			30128	2	high-character: file type ID; Low character: device type ID.
32	Information about subpackage 10	RO	U32			30130	2	high-character: file type ID; Low character: device type ID.
33	[Third-party labeling] SN	RO	STR			30191	10	Serial number of third-party OEM equipment, customized by third-party manufacturers

34	[Third-party label] Manufacturer model	RO	U16			30201	1	Model of third-party OEM equipment manufacturer
35	SubdeviceSupportID	RO	Bitfield32			30207	2	
36	Subdevicepresenceflag.	RO	Bitfield32			30209	2	
37	Number of unique southbound software IDs	RO	U16		1	30500	1	Total number of southbound components that have independent upgrade packages. Note: This flag corresponds to the EquipChrtCode in the upgrade package. For details, see the Inverter Key Signal Extended Description-Monitoring Model Mapping.
38	Unique ID 1 of the southbound software.	RO	U16			30501	1	

39	Unique ID 2 of the southbound software	RO	U16			30502	1	
40	Number of upgrade packages for southbound device 1	RO	U16		1	30506	1	
41	Information about subpackage 1 of southbound device 1	RO	U32			30507	2	high-character: file type ID; Low character: device type ID.

42	Information about subpackage 2 of southbound device 1	RO	U32			30509	2	high-character: file type ID; Low character: device type ID.
43	Information about subpackage 3 of southbound device 1	RO	U32			30511	2	high-character: file type ID; Low character: device type ID.
44	Number of upgrade packages for southbound device 2	RO	U16		1	30517	1	

45	Information about subpackage 1 of southbound device 2	RO	U32			30518	2	high-character: file type ID; Low character: device type ID.
46	Information about subpackage 2 of southbound device 2	RO	U32			30520	2	high-character: file type ID; Low character: device type ID.
47	Information about subpackage 3 of southbound device 2	RO	U32			30522	2	high-character: file type ID; Low character: device type ID.

48	Information about subpackage 4 of southbound device 2	RO	U32			30524	2	high-character: file type ID; Low character: device type ID.
49	Offering name of southbound device 1	RO	STR			30561	15	Distributed inverter southbound device identification: Southbound device 1: optimizer
50	Offering name of southbound device 2	RO	STR			30576	15	Distributed inverter southbound device identification: Southbound device 2: DC-MBUS
51	Offering name of southbound device 3.	RO	STR			30591	15	Distributed inverter southbound device identification: Southbound device 3: LUNA2000 1.0
52	Hardware version	RO	STR		1	31000	15	

53	Monitoring Board SN	RO	STR			31015	10	From the electronic label of the monitoring board
54	Monitoring software version	RO	STR			31025	15	MCU1 version
55	Main DSP version	RO	STR			31040	15	MCU2 version
56	CPLD version number	RO	STR			31070	15	MCU4 version
57	AFCI version number	RO	STR			31085	15	MCU5 version
58	DC-MBUS version number	RO	STR			31115	15	MCU7 version
59	Registration code	RO	STR		1	31200	10	

60	[Remote communication] Single-node remote communication	RO	Bitfield16			32000	1	Reported by IEC104, which indicates the merged PCS running status.
61	[Remote signal] Running status (monitoring)	RO	Bitfield16			32002	1	
62	[Remote signal] Running status (power processing)	RO	Bitfield32		1	32003	2	
63	[Remote signal] Alarm 1	RO	Bitfield16			32008	1	For details, see the Alarm Mapping sheet.

64	[Remote signal] Alarm 2	RO	Bitfield16			32009	1	For details, see the Alarm Mapping sheet.
65	[Remote signal] Alarm 3	RO	Bitfield16			32010	1	For details, see the Alarm Mapping sheet.
66	[Remote signal] Alarm 4	RO	Bitfield16			32011	1	For details, see the Alarm Mapping sheet.
67	[Remote signal] Alarm 5	RO	Bitfield16			32012	1	For details, see the Alarm Mapping sheet.
68	[Remote signal] Alarm 6	RO	Bitfield16			32013	1	For details, see the Alarm Mapping sheet.
69	Device SN feature code	RO	U16			32015	1	Indicates the CRC16 value of the SN, which is the key data ID. Used to prevent incorrect energy yield from being modified due to incorrect energy yield reported by devices with the same address. The SN CRC is added to ensure that the energy yield source is correct.

70	PV1 voltage	RO	I16	V	10	32016	1	When bit 9 of power parameter mask 14 is 0, the signal name is PV1 voltage. When bit 9 of the power parameter mask 14 is 1, the processing logic is as follows: When DC Input Display Mode 30205 is set to 0, the signal name is PV1 Voltage. When DC input 30205 is set to 1, the signal name is MPPT1 Voltage.
71	PV1 current	RO	I16	A	100	32017	1	When bit 9 of power parameter mask 14 is 0, the signal name is PV1 current. When bit 9 of power parameter mask 14 is 1, the following logic is used: When DC input display mode 30205 is set to 0, the signal name is PV1 current. When DC Input Display Mode 30205 is set to 1, the signal name is MPPT1 Current.
72	PV2 Voltage	RO	I16	V	10	32018	1	When bit 9 of power parameter mask 14 is 0, the signal name is PV2 voltage. When bit 9 of the power parameter mask 14 is 1, the processing logic is as follows: When DC Input Display Mode 30205 is set to 0, the signal name is PV2 Voltage. When DC input 30205 is set to 1, the signal name is MPPT2 Voltage.

73	PV2 current	RO	I16	A	100	32019	1	When bit 9 of power parameter mask 14 is 0, the signal name is PV2 current. When bit 9 of the power parameter mask 14 is 1, the following logic is used: When DC Input Display Mode 30205 is set to 0, the signal name is PV2 Current. When DC input display mode 30205 is set to 1, the signal name is MPPT2 current.
74	PV3 Voltage	RO	I16	V	10	32020	1	
75	PV3 current	RO	I16	A	100	32021	1	
76	PV4 Voltage	RO	I16	V	10	32022	1	
77	PV4 current	RO	I16	A	100	32023	1	
78	PV5 voltage	RO	I16	V	10	32024	1	
79	PV5 current	RO	I16	A	100	32025	1	
80	PV6 voltage	RO	I16	V	10	32026	1	
81	PV6 current	RO	I16	A	100	32027	1	
82	PV7 Voltage	RO	I16	V	10	32028	1	
83	PV7 current	RO	I16	A	100	32029	1	

84	PV8 Voltage	RO	I16	V	10	32030	1	
85	PV8 current	RO	I16	A	100	32031	1	
86	DC power	RO	I32	kW	1000	32064	2	
87	Power grid line A and B voltage	RO	U16	V	10	32066	1	When the output mode is L/N, the signal name is Grid Voltage. When Output Mode is set to L1/L2/N or L1/L2, the signal name is UW Grid Voltage.
88	Power grid B/C line voltage	RO	U16	V	10	32067	1	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
89	Power grid CA line voltage	RO	U16	V	10	32068	1	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
90	Power grid phase A voltage	RO	U16	V	10	32069	1	This parameter is invalid when the output mode is L/N. When Output Mode is set to L1/L2/N or L1/L2, the signal name is UO Grid Voltage. Not displayed in off-grid mode

91	Power grid phase B voltage	RO	U16	V	10	32070	1	This parameter is invalid when the output mode is L/N. When Output Mode is set to L1/L2/N or L1/L2, the signal name is WO Grid Voltage. Not displayed in off-grid mode
92	Power grid phase C voltage	RO	U16	V	10	32071	1	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
93	Power grid phase A current	RO	I32	A	1000	32072	2	When the output mode is L/N, L1/L2/N, or L1/L2, the signal name is Grid Current.
94	Power grid phase B current	RO	I32	A	1000	32074	2	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
95	Power grid phase C current	RO	I32	A	1000	32076	2	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
96	Peak active power of the current day	RO	I32	kW	1000	32078	2	

97	Active power	RO	I32	kW	1000	32080	2	
98	reactive power	RO	I32	kVar	1000	32082	2	
99	Power factor	RO	I16		1000	32084	1	
100	Grid frequency	RO	U16	Hz	100	32085	1	
101	Inverter efficiency	RO	U16	%	100	32086	1	When PCS is used to generate power, it indicates the power generation efficiency. When PCS is used to absorb, it indicates the absorption efficiency.
102	Internal temperature	RO	I16	°C	10	32087	1	
103	Insulation impedance	RO	U16	MΩ	1000	32088	1	

104	Device Status	RO	U16			32089	1	0x0000 Standby: initializing 0x0001 Standby: detecting insulation resistance 0x0002 Standby: detecting irradiation 0x0003 Standby: drid detecting 0x0100 Starting 0x0200 On-grid 0x0201 Grid connection: power limited 0x0202 Grid connection: self-derating 0x0300 Shutdown: fault 0x0301 Shutdown: command 0x0302 Shutdown: OVGR 0x0303 Shutdown: communication disconnected 0x0304 Shutdown: power limited 0x0305 Shutdown: manual startup required 0x0307 Shutdown: rapid cutoff 0x0401 Grid scheduling: cosϕ-P curve 0x0402 Grid scheduling: Q-U curve 0x0403 Grid scheduling: PF-U curve 0x0404 Grid scheduling: dry contact 0x0405 Grid scheduling: Q-P curve 0x0500 Spot-check ready 0x0501 Spot-checking 0x0600 Inspecting 0X0700 AFCI self check 0X0800 I-V scanning 0xA000 Standby: no irradiation

105	Fault Code	RO	U16			32090	1	Fault code corresponding to the alarm with the highest priority. For details, see the Alarm Description sheet.
106	Start-up time	RO	Epoch Second	s	1	32091	2	Monitoring Calculation
107	Shutdown time	RO	Epoch Second	s	1	32093	2	Monitoring Calculation
108	Active power [fast]	RO	I32	kW	1000	32095	2	Fast reporting interface, which is not filtered and used for scheduling energy storage.
109	Accumulated power generation	RO	U32	kWh	100	32106	2	
110	Total DC Input Power	RO	U32	kWh	100	32108	2	
111	Statistical time of the current energy yield.	RO	Epoch Second	s	1	32110	2	

112	Current Hour Electricity	RO	U32	kWh	100	32112	2	
113	Current-day power generation	RO	U32	kWh	100	32114	2	
114	Electricity generated in the current month	RO	U32	kWh	100	32116	2	
115	Electricity generated in the current year	RO	U32	kWh	100	32118	2	
116	Number of critical alarms	RO	U16		1	32151	1	
117	Number of major alarms	RO	U16		1	32152	1	

118	Number of Minor Alarms	RO	U16		1	32153	1	
119	Number of Warning Alarms	RO	U16		1	32154	1	
120	Alarm clearance SN	RO	U16			32155	1	After the alarm is cleared, the serial number increases by 1. After the alarm is reversed, the serial number starts from 1 and skips 0.
121	Last Hour Power Statistics Time	RO	Epoch Second	s	1	32156	2	include generate/absorbed power
122	Electricity generated in the previous hour	RO	U32	kWh	100	32158	2	
123	Electricity statistics time of the previous day	RO	Epoch Second	s	1	32160	2	include generate/absorbed power

124	Electricity generated in the previous day	RO	U32	kWh	100	32162	2	
125	Statistical time of the previous month.	RO	Epoch Second	s	1	32164	2	include generate/absorbed power
126	Electricity generated in the previous month	RO	U32	kWh	100	32166	2	
127	Electricity statistics time of the previous year	RO	Epoch Second	s	1	32168	2	include generate/absorbed power
128	Electricity generated in the previous year	RO	U32	kWh	100	32170	2	

129	Serial number of the latest active alarm.	RO	U32			32172	2	When a new active alarm is generated, the serial number increases by 1.
130	Latest Historical Alarm Serial Number	RO	U32			32174	2	When an active alarm is transferred to the historical alarm, the serial number of the historical alarm is the same as the serial number of the last active alarm transferred to the historical alarm.
131	Total bus voltage	RO	I16	V	10	32176	1	Data reported by PID, used in single-level scenarios
132	Maximum PV voltage	RO	I16	V	10	32177	1	Data reported by PID, used in single-level scenarios
133	Minimum PV voltage	RO	I16	V	10	32178	1	Data reported by PID, used in single-level scenarios
134	Average PV negative-to-ground voltage	RO	I16	V	10	32179	1	Data reported by PID, used in single-level scenarios

135	Maximum PV positive-to-ground voltage	RO	I16	V	10	32180	1	Data reported by PID, used in single-level scenarios
136	Minimum PV negative-to-ground voltage	RO	I16	V	10	32181	1	Data reported by PID, used in single-level scenarios
137	Inverter-to-PE withstand voltage	RO	U16	V	1	32182	1	Data reported by PID, used in single-level scenarios To be compatible with PID 2.0, the PCS reports 1502. 0:100 V or 1100 V inverter; 1500: HAV1 inverter; 1502: HAV2 inverter;
138	ISO feature information	RO	Bitfield16		1	32183	1	Data reported by PID, used in single-level scenarios
139	Built-in PID running status	RO	E16			32190	1	

140	PV negative-to-ground voltage	RO	I16	V	10	32191	1	
141	Direction of the built-in PID compensation	RO	E16			32192	1	
142	Total DC energy yield of MPPT1	RO	U32	kWh	100	32212	2	TD Tech NMS GUI Display [5/4]
143	Total DC energy yield of MPPT2	RO	U32	kWh	100	32214	2	TD Tech NMS GUI Display [5/4]
144	MPPT3 DC Total Energy Yield	RO	U32	kWh	100	32216	2	TD Tech NMS GUI Display [5/4]

145	MPPT4 DC Accumulated Energy Yield	RO	U32	kWh	100	32218	2	TD Tech NMS GUI Display [5/4]
146	Monitoring alarm 1	RO	Bitfield16			32252	1	GroupID:0xFF00
147	Monitoring alarm 2	RO	Bitfield16			32253	1	GroupID:0xFF01
148	Monitor alarm 3	RO	Bitfield16			32254	1	GroupID:0xFF02
149	[External] Power alarm 1	RO	Bitfield16			32255	1	GroupID:0x0000
150	[External] Power alarm 2	RO	Bitfield16			32256	1	GroupID:0x0001
151	[External] Power alarm 3	RO	Bitfield16			32257	1	GroupID:0x0002
152	[External] Power alarm 4	RO	Bitfield16			32258	1	GroupID:0x0003

153	[External] Power alarm 5	RO	Bitfield16			32259	1	GroupID:0x0004
154	[External] Power alarm 6	RO	Bitfield16			32260	1	GroupID:0x0005
155	[External] Power alarm 7	RO	Bitfield16			32261	1	GroupID:0x0006
156	[External] Power alarm 8	RO	Bitfield16			32262	1	GroupID:0x0007
157	[External] Power alarm 9	RO	Bitfield16			32263	1	GroupID:0x0008
158	[External] Power alarm 10	RO	Bitfield16			32264	1	GroupID:0x0009
159	[External] Power alarm 11	RO	Bitfield16			32265	1	GroupID:0x000A

160	[External] Power alarm 12	RO	Bitfield16			32266	1	GroupID:0x000B
161	[External] Power alarm 13	RO	Bitfield16			32267	1	GroupID:0x000C
162	[External] Power alarm 14	RO	Bitfield16			32268	1	GroupID:0x000D
163	[External] Power alarm 15	RO	Bitfield16			32269	1	GroupID:0x000E
164	[External] Power alarm 16	RO	Bitfield16			32270	1	GroupID:0x000F
165	Monitor alarm 4	RO	Bitfield16			32271	1	GroupID:0xFF03
166	Monitor alarm 5	RO	Bitfield16			32272	1	GroupID:0xFF04

167	[External] Power alarm 17	RO	Bitfield16			32273	1	GroupID:0x0010
168	String 1 access status	RO	E16			32300	1	
169	String 2 access status	RO	E16			32301	1	
170	String 3 access status	RO	E16			32302	1	
171	String 4 access status	RO	E16			32303	1	
172	String 5 access status	RO	E16			32304	1	
173	Connection status of string 6	RO	E16			32305	1	

174	String 7 access status	RO	E16			32306	1	
175	String 8 access status	RO	E16			32307	1	
176	Stent System Status	RO	Bitfield32			34000	2	BIT0–BIT15: state of support system 1–16; BIT16–BIT31: reserved for future expansion.
177	Tilt angle 1 sampling	RO	I16	°	100	34002	1	
178	Azimuth 1 sampling	RO	I16	°	100	34003	1	
179	Tilt angle 2 sampling	RO	I16	°	100	34004	1	
180	Azimuth 2 sampling	RO	I16	°	100	34005	1	
181	Tilt angle 3 sampling	RO	I16	°	100	34006	1	

182	Azimuth 3 sampling	RO	I16	°	100	34007	1	
183	Tilt angle 4 sampling	RO	I16	°	100	34008	1	
184	Azimuth 4 sampling	RO	I16	°	100	34009	1	
185	Tilt angle 5 sampling	RO	I16	°	100	34010	1	
186	Azimuth 5 sampling	RO	I16	°	100	34011	1	
187	Tilt angle 6 sampling	RO	I16	°	100	34012	1	
188	Azimuth 6 sampling	RO	I16	°	100	34013	1	
189	Tilt angle 7 sampling	RO	I16	°	100	34014	1	
190	Azimuth 7 sampling	RO	I16	°	100	34015	1	

191	Tilt angle 8 sampling	RO	I16	°	100	34016	1	
192	Azimuth 8 sampling	RO	I16	°	100	34017	1	
193	Tilt angle 9 sampling	RO	I16	°	100	34018	1	
194	Azimuth 9 sampling	RO	I16	°	100	34019	1	
195	Tilt angle 10 sampling	RO	I16	°	100	34020	1	
196	Azimuth 10 sampling	RO	I16	°	100	34021	1	
197	Tilt angle 11 sampling	RO	I16	°	100	34022	1	
198	Azimuth 11 sampling	RO	I16	°	100	34023	1	
199	Tilt angle 12 sampling	RO	I16	°	100	34024	1	

200	Azimuth 12 sampling	RO	I16	°	100	34025	1	
201	Tilt angle 13 sampling	RO	I16	°	100	34026	1	
202	Bearing 13 sampling	RO	I16	°	100	34027	1	
203	Tilt angle 14 sampling	RO	I16	°	100	34028	1	
204	Azimuth 14 sampling	RO	I16	°	100	34029	1	
205	Tilt angle 15 sampling	RO	I16	°	100	34030	1	
206	Bearing angle 15 sampling	RO	I16	°	100	34031	1	
207	Tilt angle 16 sampling	RO	I16	°	100	34032	1	
208	Bearing 16 sampling	RO	I16	°	100	34033	1	

209	Tracking system controller	RO	E16			34034	1	
210	Support System Type	RO	E16			34035	1	If the vendor does not support a support type, the system returns the 03 error code.
211	Operating mode	RO	E16			34036	1	
212	Total number of stents	RO	U16		1	34037	1	For dual-axis control, the maximum number of supports is 8.
213	Support access status	RO	Bitfield32		1	34038	2	BIT0–BIT15: access status of support system 1–16; BIT16–BIT31: reserved for future expansion.
214	Working mode mask	RO	Bitfield32		1	34040	2	Each bit indicates whether a working mode is supported.
215	Support 1 General Fault Status	RO	E16			34075	1	Data reported by the SmartLogger to the management system

216	Support 1 user-defined fault status	RO	U16		1	34076	1	For details about the controller scenario definition, see the corresponding document. Data reported by the SmartLogger to the management system
217	Support 2 General Fault Status	RO	U16		1	34077	1	
218	Support 2 Custom Fault Status	RO	U16		1	34078	1	
219	Support 3 General Fault Status	RO	U16		1	34079	1	
220	Support 3 user-defined fault status	RO	U16		1	34080	1	
221	Support 4 General Fault Status	RO	U16		1	34081	1	

222	Support 4 Custom Fault Status	RO	U16		1	34082	1	
223	Support 5 General Fault Status	RO	U16		1	34083	1	
224	Support 5 Custom Fault Status	RO	U16		1	34084	1	
225	Support 6 General Fault Status	RO	U16		1	34085	1	
226	Support 6 Custom Fault Status	RO	U16		1	34086	1	
227	Support 7 General Fault Status	RO	U16		1	34087	1	

228	Support 7 Custom Fault Status	RO	U16		1	34088	1	
229	Support 8 General Fault Status	RO	U16		1	34089	1	
230	Support 8 Custom Fault Status	RO	U16		1	34090	1	
231	Support 9 General Fault Status	RO	U16		1	34091	1	
232	Support 9 Custom Fault Status	RO	U16		1	34092	1	
233	Support 10 General Fault Status	RO	U16		1	34093	1	

234	Support 10 Custom Fault Status	RO	U16		1	34094	1	
235	Support 11 General Fault Status	RO	U16		1	34095	1	
236	Support 11 Custom Fault Status	RO	U16		1	34096	1	
237	Support 12 General Fault Status	RO	U16		1	34097	1	
238	Support 12 Custom Fault Status	RO	U16		1	34098	1	
239	Support 13 General Fault Status	RO	U16		1	34099	1	

240	Support 13 Custom Fault Status	RO	U16		1	34100	1	
241	Support 14 General Fault Status	RO	U16		1	34101	1	
242	Support 14 Custom Fault Status	RO	U16		1	34102	1	
243	Support 15 General Fault Status	RO	U16		1	34103	1	
244	Support 15 Custom Fault Status	RO	U16		1	34104	1	
245	Support 16 General Fault Status	RO	U16		1	34105	1	

246	Support 16 Custom Fault Status	RO	U16		1	34106	1	
247	Running time of capacitor bank	RO	U32	hour	10	35000	2	Used to inspect data.
248	Internal fan 1 running time	RO	U32	hour	10	35002	2	Used to inspect data.
249	Internal alarm	RO	U16	V	1	35010	1	Used for R&D data storage.
250	Internal Temperature 1	RO	I16	°C	10	35021	1	Temperature of INV module A Used for R&D 5-minute data recording.
251	Internal Temperature 2	RO	I16	°C	10	35022	1	Temperature of INV module B Used for R&D 5-minute data recording.
252	Internal Temperature 3	RO	I16	°C	10	35023	1	INV module C temperature Used for R&D 5-minute data recording.

253	Internal Temperature 4	RO	I16	°C	10	35024	1	Temperature sampling of anti-reverse module 1 Used for R&D 5-minute data recording.
254	Internal Temperature 5	RO	I16	°C	10	35025	1	Output board relay, ambient temperature - maximum temperature Used for R&D 5-minute data recording.
255	Internal Temperature 6	RO	I16	°C	10	35026	1	Output board, power board input, and power board inverter temperature sampling - maximum temperature Used for R&D 5-minute data recording.
256	Internal temperature 7	RO	I16	°C	10	35027	1	Temperature sampling of anti-reverse module 2 Used for R&D 5-minute data recording.
257	Internal temperature 8	RO	I16	°C	10	35028	1	DC terminal temperature 1 / 2 - maximum temperature Used for R&D 5-minute data recording.
258	Internal temperature 9	RO	I16	°C	10	35029	1	AC Terminal Temperature 1 / 2 / 3 - Maximum Temperature Used for R&D 5-minute data recording.
259	Internal temperature 10	RO	I16	°C	10	35030	1	Used for R&D data storage.

260	Internal temperature 11	RO	I16	°C	10	35031	1	Used for R&D data storage.
261	Internal temperature 12	RO	I16	°C	10	35032	1	Used for R&D data storage.
262	Phase A DC component DCI	RO	I16	A	1000	35038	1	Used for R&D 5-minute data recording.
263	Phase B DC component DCI	RO	I16	A	1000	35039	1	Used for R&D 5-minute data recording.
264	Phase C DC component DCI	RO	I16	A	1000	35040	1	Used for R&D 5-minute data recording.
265	Leakage current RCD	RO	I16	mA	1	35041	1	Used for R&D 5-minute data recording.
266	Positive bus voltage	RO	I16	V	10	35042	1	Used for R&D 5-minute data recording.

267	Negative bus voltage	RO	I16	V	10	35043	1	Used for R&D 5-minute data recording.
268	BUS negative voltage to ground	RO	I16	V	10	35044	1	Used for R&D 5-minute data recording.
269	I-V scan status	RO	E16			35094	1	
270	I-V scanning capability	RO	E16			35095	1	
271	[Management System] NMS IP address	RO	U32		1	35102	2	Indicates whether the NMS is successfully connected. After the NMS is connected, fill in the NMS IP address. If there is no access, the value is 0XFFFFFFFF. The customer interface is called NA.
272	[STA] Wireless Routing Access Signal Strength	RO	E16			35104	1	The FE status enumeration is used by the mobile app to effectively identify the current network conditions, switch icons, and provide effective prompts.

273	[STA] WLAN list scanning status	RO	E16			35105	1	
274	Wifi-Mac	RO	MLD		1	35106	3	
275	[NTP] Last NTP synchronization status.	RO	U16		1	35112	1	0: normal 1: abnormal
276	[NTP] NTP Last Synchronization Time	RO	U32		1	35113	2	Epoch Second
277	Deferred activation state	RO	E16			35115	1	
278	[4G] Monthly used traffic	RO	U32	MB	100	35116	2	

279	[4G] Monthly Remaining Traffic	RO	U32	MB	100	35118	2	
280	[4G] Average daily traffic usage	RO	U32	MB	100	35120	2	
281	[4G] Traffic status	RO	E16			35122	1	
282	[STA] Router connection time	RO	U16	s	1	35124	1	This parameter indicates the performance indicators for connecting the inverter or dongle to the router, and the duration for connecting the inverter or dongle to the router after the SSID and password are configured on the user interface. The maximum value given here.
283	[STA] Router connection status	RO	E16			35125	1	Note: 3: Connection failure indicates that the route can be discovered normally and the password is correct but the result fails. 0: Not connected indicates that the required information about the SSID and password is not configured.
284	[FE] Connection status	RO	U16		1	35126	1	0: not connected 1: being connected 2: successful connection 3: connection failure

285	[Smart I-V-V-Diagnosis] Authorization Function	RO	Bitfield32		1	35136	2	2019-02-19 SEG of the Monitoring Development Dept: The original LicC does not support the scenario where different features have different expiration dates. The license features are not supported by different models. Added the mechanism support. The original API is degenerated to support only the IV feature. For subsequent features, two interfaces (status and expiration time) are extended for each additional feature.
286	Smart I-V-V-Diagnosis (License) Status	RO	E16			35138	1	
287	[Smart I-V-V-Diagnosis] License expiration date	RO	Epoch Second	s	1	35139	2	Epoch second 0XF2A52380 (2099-1-1) is reported, indicating that the setting takes effect permanently. If there is no license, 0 or 0XFFFFFFFF is reported and NA is displayed on the GUI.
288	License loading time	RO	Epoch Second	s	1	35141	2	Epoch Second

289	License Deregistration Time	RO	Epoch Second	s	1	35143	2	Epoch second 0XFFFFFFFF is reported when the status is not deregistered.
290	License SN	RO	STR		1	35145	10	
291	Invalidation code.	RO	STR		1	35155	64	
292	Authorization Feature Signature	RO	E16			35219	2	1. If bit is set to 1, the function is licensed. 2. If the bit is cleared, the function does not need to be licensed on the current model. Used to support differentiated management and control policies for models.
293	[String monitoring] License status	RO	E16			35221	1	0: no license; 1: normal; 2: grace period; 3: deregistered; 4: The SN does not match. 5: expired;
294	[String Monitoring] License Expiration Time	RO	Epoch Second	s	1	35222	2	Epoch Second If the feature status is normal, 0XF2A52380(2099-1-1) is reported, indicating that the feature takes effect permanently. If the feature status is abnormal, 0 or 0XFFFFFFFF is reported, and NA is displayed on the GUI.

295	[4G] Module status	RO	E16			35249	1	
296	[4G] IP address	RO	U32		1	35250	2	
297	[4G] Subnet Mask	RO	U32		1	35252	2	
298	[4G] IMEI	RO	STR		1	35254	10	
299	[4G] signal strength	RO	U16		1	35264	1	0 = No signal
300	[4G] PIN number input times	RO	U16		1	35265	1	
301	[4G] PIN check status	RO	E16			35266	1	
302	Active power adjustment status	RO	MLD			35300	4	

303	Reactive power adjustment status	RO	MLD			35304	4	
304	Upgrade status ID.	RO	E16			36033	1	The flag is cleared each time the system is powered on. After the upgrade is successful, the flag is set to 1, indicating that the upgrade is successful and no abnormal restart occurs.
305	[Module 1] Running status of the battery	RO	E16			37000	1	
306	Meter Status	RO	E16			37100	1	
307	Grid voltage (phase A voltage)	RO	I32	V	10	37101	2	
308	Phase B voltage	RO	I32	V	10	37103	2	
309	Phase C voltage	RO	I32	V	10	37105	2	

310	Grid current (phase A current)	RO	I32	A	100	37107	2	
311	Phase B current	RO	I32	A	100	37109	2	
312	Phase C current	RO	I32	A	100	37111	2	
313	Active power	RO	I32	W	1	37113	2	> 0: feeds power to the power grid; < 0: obtains power from the power grid.
314	reactive power	RO	I32	Var	1	37115	2	
315	Power factor	RO	I16		1000	37117	1	
316	Grid frequency	RO	I16	Hz	100	37118	1	
317	Positive active power	RO	I32	kWh	100	37119	2	Inverter power fed to the grid
318	Reverse active power	RO	I32	kWh	100	37121	2	Electricity absorbed by the distributed system from the grid

319	Accumulated reactive power	RO	I32	kVarh	100	37123	2	
320	Meter Type	RO	E16			37125	1	
321	A-B line voltage	RO	I32	V	10	37126	2	
322	BC line voltage	RO	I32	V	10	37128	2	
323	CA line voltage	RO	I32	V	10	37130	2	
324	Phase A active power	RO	I32	W	1	37132	2	> 0: feeds power to the power grid; < 0: obtains power from the power grid.
325	Phase B active power	RO	I32	W	1	37134	2	> 0: feeds power to the power grid; < 0: obtains power from the power grid.
326	Phase C active power	RO	I32	W	1	37136	2	> 0: feeds power to the power grid; < 0: obtains power from the power grid.

327	Meter Model Check Result	RO	E16			37138	1	
328	Total number of optimizers	RO	U16		1	37200	1	
329	Number of online optimizers	RO	U16		1	37201	1	
330	Feature data sequence number	RO	U16		1	37202	1	
331	Physical Location Locating Progress	RO	E16			37203	1	
332	Log export progress	RO	E16			37204	1	

333	Real-time data query progress	RO	E16			37205	1	
334	Current status of the physical location	RO	E16			37206	1	
335	Number of Searched Optimizers	RO	U16		1	37207	1	
336	Relative Positioning Status	RO	E16			37208	1	The previous result needs to be solidified and retained after a power failure.
337	Layout File Storage Progress	RO	U16	%	1	37209	1	0xffff: indicates that saving the data fails.
338	Layout File Change SN	RO	U16		1	37210	1	

339	Disconnection detection progress	RO	U16	%	1	37211	1	Other values are error codes. Error code definitions are as follows: 0xfe02: Off-grid running, operation forbidden 0xfe03: The equipment test is being performed and the operation is forbidden. 0xfe04: The optimizer is searching. Please try again later. 0xfe05: The optimizer is identifying a long PV string. Try again later. 0xfe07: Exporting optimizer logs is in progress. Please try again later. 0xfe08: The fast shutdown is triggered and the operation is disabled. 0xfe09: No illumination at night or all optimizers are offline. 0xfff0: No optimizer is configured or the optimizer is configured. The operation is disabled. 0xfff1: The illumination is weak. If the illumination is normal, perform the disconnection detection function again. 0xfff2: The output voltage of the optimizer is abnormal. Perform the disconnection locating function again.
340	Disconnected status	RO	E16			37212	1	

341	[DC-MBUS] Networking status	RO	E16			37250	1	
342	Number of Networked Networks	RO	U16			37251	1	
343	Number of neighboring networks	RO	U16			37252	1	
344	Fast Shutdown Self Test Status	RO	E16			37253	1	0: not executed, indicating that the system life cycle has never been executed. The previous result needs to be solidified and retained after a power failure.
345	Running status	RO	E16			37254	1	
346	SN	RO	STR			37255	10	
347	SN	RO	STR		1	37400	10	
348	Type	RO	E16			37410	1	

349	Maximum number of connected devices	RO	U16		1	37429	1	
350	RAT	RO	STR		1	37430	10	
351	Carriers	RO	STR		1	37440	15	The default value is reported when no query is found.
352	Total rated capacity of grid-tied inverters	RO	U32	kW	1000	37470	2	Difference from plant capacity: refers only to the total capacity of online grid-tied inverters.
353	Conversion factor	RO	U32		1000	37472	2	Percentage of current control/percentage of control delivered by the electric power company
354	Current Percentage	RO	U16	%	10	37474	1	
355	[Schedule server] Communication status	RO	E16			37475	1	Dongle and Japan Electric Power Huawei server communication status (only for third-party NMSs in Japan): Dispatching server: intelligence distribution, intelligence distribution, intelligence distribution, and information distribution

356	[Schedule server] Latest connection status	RO	E16			37476	1	
357	[Schedule server] Latest connection time	RO	U32			37477	2	
358	Software version	RO	STR			37479	15	Dongle firmware version
359	Number of connected devices	RO	U16			37494	1	
360	Silence flag	RO	E16			37496	1	Note: This API is used only to synchronize dongle silence between the mobile app and inverter. Wait for the dongle to exit bus control in silence. Only the mobile phone app can initiate a request to the slave UPS in parallel mode.
361	Upgrade Status	RO	E16			37497	1	

362	Inverter comprehensive status	RO	Bitfield16			37518	1	
363	Inverter integrated status support flag	RO	U16		1	37519	1	
364	System time (local time)	RW	Epoch Second	s	1	40000	2	The data is in the epoch second format, that is, the local time.
365	Q-U characteristic curve mode	RW	E16			40037	1	
366	Q-U Scheduling Trigger Power Percentage	RW	I16	%	1	40038	1	

367	Active power is derated by a fixed value.	RW	U16	kW	10	40120	1	
368	Power factor	RW	I16		1000	40122	1	
369	Reactive power compensation (Q/S) [low precision]	RW	I16		1000	40123	1	The equipment end converts the value into a fixed Q value for reactive power control. S is Smax.
370	Reactive power adjustment time	RW	U16	s	1	40124	1	Change requirement: The "Reactive power adjustment time" broadcast interface is added to the Q-P characteristic curve and cosphi-P characteristic curve delivery interface, which is the same as the Q-U characteristic curve 20190918.
371	Active power percentage derating (low precision)	RW	I16	%	10	40125	1	Active power fine adjustment interface

372	Active power is derated by a fixed value.	RW	U32	W	1	40126	2	Value range: [0, Pmax]
373	Night reactive power compensation (Q/S)	RW	I16		1000	40128	1	The equipment end converts the value into a fixed Q value for reactive power control. S is Smax.
374	Fixed value of reactive power at night	RW	I32	kVar	1000	40129	2	
375	Cos?-P/Pn characteristic curve	RW	MLD			40133	21	
376	Q-U characteristic curve	RW	MLD			40154	21	

377	PF-U characteristic curve	RW	MLD			40175	21	
378	[Characteristic curve] Reactive power adjustment time	RW	U16	s	1	40196	1	Change requirement: The "Reactive power adjustment time" broadcast interface is added to the Q-P characteristic curve and cosphi-P characteristic curve delivery interface, which is the same as the Q-U characteristic curve 20190918.
379	Q-U Scheduling Exit Power Percentage	RW	I16	%	1	40198	1	
380	Active power percentage control [low precision]	RW	I16	%	10	40199	1	This interface is used in distributed mode. It is used to control the active power percentage. It is issued to the power software in the anti-backflow control, and controls the upper limit of the output active power when the power is increased due to underfrequency.
381	Start the system.	WO	E16			40200	1	
382	Shutdown.	WO	E16			40201	1	

383	Quick power-on and power-off	WO	E16			40202	1	Not affected by shutdown gradient
384	reset	WO	E16			40205	1	After receiving the command, the DSP responds immediately and then resets. After receiving the command, the inverter monitoring module sends the command to the DSP. After receiving a normal response, the inverter monitoring module sends the command to the northbound port. After 3s, the system is reset. Otherwise, the system does not restart.
385	Insulation impedance diagnosis	WO	U16		1	40206	1	[0, 1], 1 action After receiving the instruction, the inverter restarts and performs insulation impedance detection.
386	Dry Contact Scheduling Settings	RW	MLD		1	40300	33	
387	Q-P characteristic curve	RW	MLD			40354	21	

388	Q-U characteristic curve minimum PF limit	RW	U16		1000	40375	1	This MPI is used to limit the reactive power output by the QU curve by limiting the current PF value. The country code that is not required by this function is set to 0 by default, indicating that the reactive power output is not limited. The country code in EN50549 can be set to 0 to 1, and the default value is 0.9.
389	Q-U characteristic curve validity delay time	RW	U16	s	1	40376	1	After the QU curve reaches the trigger voltage, the reactive power starts to change after a period of time is delayed. Italy CEI0-16/21 requires that the default value be 3s, indicating that the QU curve takes effect after the triggering delay is 3s, which can be set on the GUI. For other countries, the default value is 0.
390	System Time (UTC)	WO	Epoch Second	s	1	40500	2	The data is in the UTC time format.
391	Power grid standard code	RW	U16		1	42000	1	CHINA_MV800 For details about the scope, see the Power Grid Standard Code.
392	Output mode	RW	E16			42001	1	On the customer interface, only read signals can be displayed. Currently, only three-phase three-wire signals are supported. No configuration is required. In the future, the interface changes will be used to notify each interface.

393	Voltage level	RW	U16	V	1	42002	1	Vn
394	Frequency Class	RW	U16	Hz	1	42003	1	Fn
395	Replace the target model.	RW	U16		1	42012	1	Enumerated ID of the inverter model. For details, see the Inverter Model Definition. The default value is 65535 (0xFFFF). If the ID is invalid, the replacement requirement is not set.
396	Remote power scheduling	RW	E16			42014	1	0: Disable 1: Enable If this parameter is disabled, the inverter will be locked.
397	reactive power gradient	RW	U32	%/s	1000	42015	2	
398	Active power change gradient	RW	U32	%/s	1000	42017	2	Limits the speed at which the power changes caused by the power scheduling command
399	Scheduled instruction hold time	RW	U32	s	1	42019	2	Permanently valid when the value is 0.

400	Maximum apparent power	RW	U32	kVA	1000	42021	2	["Maximum active power",Smax]
401	Maximum active power	RW	U32	kW	1000	42023	2	[0.1,Pmax]
402	apparent power reference	RW	U32	kVar	1000	42025	2	Sn: upper limit of the maximum active power (PMax), which is used as the reference for reactive power scheduling (Q/S).
403	Active power reference	RW	U32	kW	1000	42027	2	Set the lower limit of the maximum apparent value (SMax), which is also used as the reference for active power scheduling (percentage).
404	Plant active power gradient	RW	U16	min/100%	1	42029	1	China standards require that the active power change caused by light fluctuation must meet the speed requirements during normal operation of the equipment.
405	Plant active average filtering time	RW	U32	ms	1	42030	2	

406	Filtering time for PF-U voltage detection	RW	U16	s	10	42032	1	
407	Dry contact scheduling	RW	E16			42033	1	
408	Audible and visual alarm	RW	E16			42034	1	
409	Frequency Active Power Derating Recovery Delay Time	RW	U16	s	1	42040	1	

410	Frequency Active Power Derating Effective Delay Time	RW	U16	ms	1	42041	1	
411	Frequency active power derating hysteresis	RW	E16			42042	1	
412	Frequency modulation control response deadband	RW	U16	Hz	1000	42043	1	
413	Off-grid switchover mode	RW	E16			42044	1	
414	Off-grid mode	RW	E16			42045	1	

415	PQ mode	RW	E16			42046	1	
416	PV Panel Type	RW	E16			42047	1	
417	PID compensation direction	RW	E16			42048	1	
418	String connection mode	RW	E16			42049	1	
419	Isolation Settings	RW	E16			42050	1	On the customer interface, only read signals can be displayed. Currently, only the input is not grounded and transformer is supported. Interface changes will be used to notify each interface during setting.
420	Frequency modulation control power change gradient	RW	U16	%/min	1	42051	1	

421	Frequency modulation control power change limiting amplitude	RW	U16	%	10	42052	1	
422	FM control delay response time	RW	U16	ms	1	42053	1	Polish national requirements, open and configurable Initial delay in the frequency sensitive mode
423	MPPT multimodal scanning	RW	E16			42054	1	
424	MPPT scanning interval	RW	U16	min	1	42055	1	
425	Predicted MPPT power	RO	U32	kW	1000	42056	2	

426	Power grid fault recovery automatic startup	RW	E16			42061	1	
427	Power limit 0% shutdown	RW	E16			42062	1	
428	Automatic power-off when communication is disconnected	RW	E16			42063	1	In a parallel system, the system automatically shuts down when the communication link is interrupted by default. The communication interruption duration is 1 minute. The PCS power system determines the priority of the default power policy and the parameter setting. The affected parameters include all parameters under "Communication Disconnection Protection".
429	Automatic power-on after communication recovery	RW	E16			42064	1	

430	Power Quality Optimization Mode	RW	E16			42065	1	
431	RCD Enhancement	RW	E16			42066	1	
432	Night reactive power	RW	E16			42067	1	
433	Abnormal grounding shutdown	RW	E16			42068	1	
434	Night PID protection	RW	E16			42069	1	
435	Night reactive power parameters take effect	RW	E16			42070	1	

436	Communication Disconnection Detection Time	RW	U16	s	1	42072	1	This parameter is displayed when the protection against communication disconnection is enabled.
437	AFCI	RW	E16			42073	1	
438	AFCI detection adaptation mode	RW	E16			42074	1	
439	Communication link failure protection	RW	E16			42075	1	Used to initiate the security protection function after the communication between the device and the northbound interface is interrupted.
440	Failure protection active power mode	RW	E16			42076	1	This parameter is displayed when the protection against communication disconnection is enabled.

441	Active Power Limit for Failure Protection [kW] [Low Precision]	RW	U32	kW	10	42077	2	This parameter is displayed only when the communication link failure protection is set to Enable and the active power mode is set to a fixed value.
442	Failure protection reactive power mode	RW	E16			42079	1	This parameter is displayed when the protection against communication disconnection is enabled.
443	Frequency rate protection	RW	E16			42080	1	
444	Frequency change rate protection point	RW	U16	Hz/s	10	42081	1	

445	Frequency change rate protection time	RW	U16	s	10	42082	1	
446	Reactive power limit for failure protection [Q/S] [low precision]	RW	I16		1000	42083	1	(Deliver Q/S value) This parameter is displayed only when Communication Disconnection Failure Protection is set to Enable and Reactive Power Mode is set to Q/S.
447	Power-on voltage upper limit for grid connection	RW	U16	V	10	42084	1	Parameters for normal reconnection

448	Power-on voltage lower limit for grid connection	RW	U16	V	10	42085	1	Parameters for normal reconnection
449	Power-on frequency upper limit for grid connection	RW	U16	Hz	100	42086	1	Parameters for normal reconnection
450	Power-on frequency lower limit for grid connection	RW	U16	Hz	100	42087	1	Parameters for normal reconnection

451	Power grid reconnection voltage upper limit	RW	U16	V	10	42088	1	Parameters for reconnection after a fault
452	Power Grid Reconnection Voltage Lower Threshold	RW	U16	V	10	42089	1	Parameters for reconnection after a fault
453	Power grid reconnection frequency upper limit	RW	U16	Hz	100	42090	1	Parameters for reconnection after a fault
454	Power grid reconnection frequency lower limit	RW	U16	Hz	100	42091	1	Parameters for reconnection after a fault

455	Automatic Power Grid Reconnection Time	RW	U16	s	1	42092	1	
456	Insulation impedance protection point	RW	U16	MΩ	1000	42097	1	Value range: [0.02, 1.5] Actual protection is implemented by the inverter based on the DC voltage. 600 V DC inverter: [0.02, 1.5] 1000 V DC inverter: [0.033, 1.5] 1500 V DC inverter: [0.05, 1.5]
457	Voltage unbalance protection threshold	RW	U16	%	10	42098	1	
458	Phase protection point	RW	U16	°	10	42099	1	

459	Power-on soft start time due to power grid faults	RW	U16	s	1	42100	1	Power rise gradient during equipment startup after a power grid fault
460	Cos?-P/Pn trigger voltage	RW	U16	%	1	42101	1	
461	Cos?-P/Pn exit voltage	RW	U16	%	1	42102	1	
462	Start up soft start time	RW	U16	s	1	42103	1	
463	Power grid fault recovery time	RW	U16	s	1	42104	1	

464	Time for determining short-term power grid interruption	RW	U32	ms	1	42105	2	Quick Start After Power Grid Fault is enabled and can be set.
465	Shutdown gradient	RW	U32	%/s	1000	42107	2	
466	Line loss compensation	RW	U16	%	10	42109	1	
467	Grid fault zero current mode	RW	E16			42110	1	
468	Grid voltage jump trigger threshold	RW	U16	%	10	42111	1	This parameter can be set only for the VDE4120.
469	HVRT	RW	E16			42112	1	

470	HVRT Trigger Threshold	RW	U16	V	10	42113	1	
471	HVRT positive sequence reactive power compensation factor	RW	U16		10	42114	1	
472	V phase to ground	RW	E16			42115	1	For the medium-three-phase 20KTL-M3 model in Japan, the phase wire on the side where the transformer is connected to the inverter must be grounded. The phase wire on the side where the transformer is connected to the inverter can be connected in delta or star topology.

473	Short-term power grid interruption and quick startup	RW	E16			42116	1	Indicates whether to enable the fast startup function after the power grid recovers from a short-term interruption. If this parameter is set to 0, the power grid is connected according to the normal startup process after a short-term interruption. If this parameter is set to 1, the power grid is enabled. After a short-term interruption occurs on the power grid, the quick startup process is used. Some detection items are skipped and the power grid is quickly connected to the power grid. Whether a short-term interruption occurs on the power grid depends on whether the power grid can be recovered within the "short-term interruption time".
474	LVRT active current maintenance coefficient	RW	U16		100	42118	1	
475	LVRT	RW	E16			42119	1	By default, this function is enabled in the BDEW standard. In other standards, this function is disabled by default.
476	LVRT Trigger Threshold	RW	U16	V	10	42120	1	Sets the threshold for triggering low voltage ride-through. The threshold must comply with the local power grid standards.

477	Power grid voltage protection shield during VRT	RW	E16			42121	1	It is used to set whether the voltage protection function needs to be shielded during the voltage ride-through.
478	LVRT positive sequence reactive power compensation factor	RW	U16		10	42122	1	During the low voltage ride through (LVRT), the device needs to generate positive-sequence reactive power to support the power grid. This parameter is used to set the positive-sequence reactive power emitted by the device. For example, if the LVRT positive-sequence reactive power compensation factor is set to 2, the positive-sequence reactive current generated by the device increases by 20% of the rated current every time the AC voltage decreases by 10% during the low-voltage ride-through process.
479	VRT exit hysteresis threshold	RW	U16	V	10	42123	1	Sets the LVRT/HVRT recovery threshold. LVRT recovery threshold = LVRT trigger threshold + VRT exit hysteresis threshold HVRT recovery threshold = HVRT trigger threshold – VRT exit hysteresis threshold

480	VRT active current limiting percentage	RW	U16	%	1	42124	1	
481	VRT active power recovery gradient	RW	U16	%/s	1	42125	1	
482	HVRT negative sequence reactive compensation factor	RW	U16		10	42126	1	

483	LVRT negative sequence reactive power compensation factor	RW	U16		10	42127	1	During low voltage ride through (LVRT), the device needs to generate negative-sequence reactive power to support the power grid. This parameter is used to set the negative-sequence reactive power emitted by the device. For example, if the LVRT negative sequence reactive power compensation factor is set to 2, the negative sequence reactive current generated by the device increases by 20% of the rated current every time the AC voltage decreases by 10% during the low voltage ride-through process.
484	phase angle deviation protection	RW	E16			42128	1	
485	Active Islanding Protection	RW	E16			42129	1	
486	Passive Islanding Protection	RW	E16			42130	1	

487	OVGR Associated Shutdown	RW	E16			42131	1	
488	Dry contact function	RW	E16			42132	1	
489	LVRT reactive current limiting percentage	RW	U16	%	1	42133	1	During low voltage ride-through, the equipment needs to limit the reactive current emitted by the equipment. For example, if LVRT Reactive Current Limit Percentage is set to 50, the upper limit of the reactive current of the device is 50% of the rated current during low voltage ride-through.
490	LVRT zero current mode threshold	RW	U16	V	10	42134	1	If the zero current mode is enabled and the voltage of the grid is less than the zero current mode threshold during LVRT, the zero current mode is used. Otherwise, the zero current mode is used.
491	LVRT mode	RW	E16			42135	1	
492	RCD current limit	RW	U16	mA	10	42136	1	
493	Voltage rise suppression	RW	E16			42138	1	

494	Voltage rise suppression reactive power adjustment point	RW	U16	%	10	42139	1	The value of "Voltage Rise Reject Active Derating Point" must be greater than the value of "Voltage Rise Reject Reactive Adjust Point".
495	Voltage rise suppression active derating threshold	RW	U16	%	10	42140	1	The value of "Voltage Rise Reject Active Derating Point" must be greater than the value of "Voltage Rise Reject Reactive Adjust Point".
496	frequency modulation control	RW	E16			42141	1	According to the standards of some countries or regions, the power grid frequency changes around the rated value. If the device needs to fine-tune the active power output based on the frequency modulation control adjustment rate to help stabilize the power grid frequency, set this parameter to Enable. Frequency sensitive mode (FSM), which is required by the G99 standard.

497	frequency modulation control differential modulation rate	RW	U16	%	1	42142	1	Frequency sensitive mode (FSM) Droop, which is required by the G99 standard.
498	Overfrequency derating	RW	E16			42143	1	If this parameter is set to Enable, the device derates the active power based on a certain gradient when the power grid frequency exceeds the triggering frequency of overfrequency derating.
499	Overfrequency derating cutoff frequency	RW	U16	Hz	100	42144	1	Specifies the cutoff frequency for overfrequency derating.
500	Overfrequency derating cut-off power	RW	U16	%	1	42145	1	Indicates the cutoff power point for overfrequency derating.

501	Triggering frequency of overfrequency derating	RW	U16	Hz	100	42146	1	According to the standards in some countries or regions, the active power output by the device must be derated when the power grid frequency exceeds a specified value.
502	Overfrequency derating exit frequency	RW	U16	Hz	100	42147	1	Specifies the exit frequency of overfrequency derating.
503	Overfrequency derating power recovery gradient	RW	U16	%/min	1	42148	1	Indicates the speed at which the overfrequency derating power recovers.
504	Underfrequency Power Increase	RW	E16			42151	1	According to the standards in some countries or regions, the power grid frequency is lower than the triggering frequency of underfrequency power increase. In this case, the active power output needs to be increased to help increase the power grid frequency. In this case, set this parameter to Enable.

505	Underfrequency Power Increase Recovery Gradient	RW	U16	%/min	1	42152	1	Indicates the speed for recovering the underfrequency power increase.
506	LVRT characteristic curve	RW	MLD			42155	21	Set the low-voltage ride-through capability of the equipment. For details, see the Key Information Description Table. The SmartLogger and NMS support batch settings and provide a separate GUI for users to edit.
507	Cutoff frequency of underfrequency power increase	RW	U16	Hz	100	42176	1	Indicates the cutoff frequency for underfrequency power increase.
508	Cut-off power for underfrequency power increase	RW	U16	%	1	42177	1	Indicates the cutoff power point for underfrequency power increase.

509	Underfrequency Power Increase Triggering Frequency	RW	U16	Hz	100	42178	1	Set the triggering frequency for underfrequency power increase.
510	Underfrequency Power Increase Exit Frequency	RW	U16	Hz	100	42179	1	Specifies the exit frequency for underfrequency power increase.
511	Built-in PID mode	RW	E16			42180	1	
512	PID output voltage	RW	I16	V	10	42181	1	Fixed output. This interface is reserved. The GUI is closed.
513	PID	RW	E16			42182	1	Currently reserved only for equipment
514	Night off-grid repair	RW	E16			42183	1	

515	Active power change gradient	RW	U32	%/s	1000	42192	2	Dedicated broadcast interface for the SmartLogger, which does not support incremental reporting and is used in the remote output scenario in Japan.
516	Q-U curve	RW	MLD			42200	21	
517	P-U curve	RW	MLD			42221	21	
518	P-U curve adjustment time	RW	U16	s	100	42242	1	
519	Undervoltage protection threshold for 10 minutes	RW	U16	V	10	42287	1	Vn: indicates the voltage level, which is related to the power grid code.
520	Ten-minute undervoltage protection time	RW	U32	ms	1	42288	2	

521	Ten-minute overvoltage protection threshold	RW	U16	V	10	42290	1	Vn: indicates the voltage level, which is related to the power grid code.
522	Ten-minute overvoltage protection time	RW	U32	ms	1	42291	2	
523	Level-1 overvoltage protection threshold	RW	U16	V	10	42293	1	Vn: indicates the voltage level, which is related to the power grid code.
524	Level-1 overvoltage protection time	RW	U32	ms	1	42294	2	

525	Level-2 overvoltage protection threshold	RW	U16	V	10	42296	1	Vn: indicates the voltage level, which is related to the power grid code.
526	Level 2 Overvoltage Protection Time	RW	U32	ms	1	42297	2	
527	Level-3 overvoltage protection threshold	RW	U16	V	10	42299	1	Vn: indicates the voltage level, which is related to the power grid code.
528	Level-3 overvoltage protection time	RW	U32	ms	1	42300	2	
529	Level-4 overvoltage protection threshold	RW	U16	V	10	42302	1	Vn: indicates the voltage level, which is related to the power grid code.

530	Level-4 overvoltage protection time	RW	U32	ms	1	42303	2	
531	Level-5 overvoltage protection threshold	RW	U16	V	10	42305	1	Vn: indicates the voltage level, which is related to the power grid code.
532	Level-5 overvoltage protection time	RW	U32	ms	1	42306	2	
533	Level-6 overvoltage protection threshold	RW	U16	V	10	42308	1	Vn: indicates the voltage level, which is related to the power grid code.
534	Level-6 overvoltage protection time	RW	U32	ms	1	42309	2	

535	Level-1 undervoltage protection threshold	RW	U16	V	10	42311	1	Vn: indicates the voltage level, which is related to the power grid code.
536	Level-1 Undervoltage Protection Time	RW	U32	ms	1	42312	2	
537	Level-2 undervoltage protection threshold	RW	U16	V	10	42314	1	Vn: indicates the voltage level, which is related to the power grid code.
538	Level 2 Undervoltage Protection Time	RW	U32	ms	1	42315	2	
539	Level-3 undervoltage protection threshold	RW	U16	V	10	42317	1	Vn: indicates the voltage level, which is related to the power grid code.

540	Level-3 Undervoltage Protection Time	RW	U32	ms	1	42318	2	
541	Level-4 undervoltage protection threshold	RW	U16	V	10	42320	1	Vn: indicates the voltage level, which is related to the power grid code.
542	Level-4 Undervoltage Protection Time	RW	U32	ms	1	42321	2	
543	Level-5 undervoltage protection threshold	RW	U16	V	10	42323	1	Vn: indicates the voltage level, which is related to the power grid code.
544	Level-5 Undervoltage Protection Time	RW	U32	ms	1	42324	2	

545	Level-6 undervoltage protection threshold	RW	U16	V	10	42326	1	Vn: indicates the voltage level, which is related to the power grid code.
546	Level-6 Undervoltage Protection Time	RW	U32	ms	1	42327	2	
547	Level-1 overfrequency protection threshold	RW	U16	Hz	100	42329	1	Fn: indicates the frequency level, which is related to the power grid code.
548	Level-1 Overfrequency Protection Time	RW	U32	ms	1	42330	2	
549	Level-2 overfrequency protection threshold	RW	U16	Hz	100	42332	1	Fn: indicates the frequency level, which is related to the power grid code.

550	Level-2 overfrequency protection time	RW	U32	ms	1	42333	2	
551	Level-3 overfrequency protection threshold	RW	U16	Hz	100	42335	1	Fn: indicates the frequency level, which is related to the power grid code.
552	Level-3 overfrequency protection time	RW	U32	ms	1	42336	2	
553	Level-4 overfrequency protection threshold	RW	U16	Hz	100	42338	1	Fn: indicates the frequency level, which is related to the power grid code.
554	Level-4 overfrequency protection time	RW	U32	ms	1	42339	2	

555	Level-5 overfrequency protection threshold	RW	U16	Hz	100	42341	1	Fn: indicates the frequency level, which is related to the power grid code.
556	Level-5 overfrequency protection time	RW	U32	ms	1	42342	2	
557	Level-6 overfrequency protection threshold	RW	U16	Hz	100	42344	1	Fn: indicates the frequency level, which is related to the power grid code.
558	Six-level overfrequency protection time	RW	U32	ms	1	42345	2	
559	Level-1 underfrequency protection threshold	RW	U16	Hz	100	42347	1	Fn: indicates the frequency level, which is related to the power grid code.

560	Level-1 Underfrequency Protection Time	RW	U32	ms	1	42348	2	
561	Level-2 underfrequency protection threshold	RW	U16	Hz	100	42350	1	Fn: indicates the frequency level, which is related to the power grid code.
562	Level-2 underfrequency protection time	RW	U32	ms	1	42351	2	
563	Level-3 underfrequency protection threshold	RW	U16	Hz	100	42353	1	Fn: indicates the frequency level, which is related to the power grid code.

564	Level-3 underfrequency protection time	RW	U32	ms	1	42354	2	
565	Level-4 underfrequency protection threshold	RW	U16	Hz	100	42356	1	Fn: indicates the frequency level, which is related to the power grid code.
566	Level-4 Underfrequency Protection Time	RW	U32	ms	1	42357	2	
567	Level-5 underfrequency protection threshold	RW	U16	Hz	100	42359	1	Fn: indicates the frequency level, which is related to the power grid code.

568	Level-5 Underfrequency Protection Time	RW	U32	ms	1	42360	2	
569	Level-6 underfrequency protection threshold	RW	U16	Hz	100	42362	1	Fn: indicates the frequency level, which is related to the power grid code.
570	Level-6 Underfrequency Protection Time	RW	U32	ms	1	42363	2	
571	Emergency stop switch DI	RW	E16			42400	1	
572	Output impedance enhancement	RW	E16			42403	1	After the output impedance enhancement function is enabled, you can set the output impedance enhancement frequency to increase the output impedance at the frequency.

573	Output impedance enhancement frequency point	RW	U16	Hz	10	42404	1	The default values are 1025.0 Hz for Switzerland, 175.0 Hz for France, and 210.0 Hz for Germany.
574	Microgrid adaptability	RW	E16			42407	1	The microgrid adaptability interface is added to the inverter (including the PCS current source grid-tied). When the microgrid adaptability function is enabled, the inverter (including the PCS current source grid-tied) supports a higher optical storage ratio based on the original country code feature.
575	Operating mode	RW	E16			42409	1	The default value is PQ. You need to set the working mode during site deployment. Set the working mode to VSG in the churn scenario and PQ in the grid-tied scenario. Note: After this parameter is set, the device is powered off.
576	Underfrequency Power Increase Effective Delay Time	RW	U16	ms	1	42429	1	Setting the Underfrequency Power Increase Effective Delay Time

577	String-to-ground short circuit protection automatic recovery	RW	E16			42432	1	Enabled: The string short circuit to ground alarm is automatically cleared when the alarm conditions are not met. Disabled: The string short circuit to ground alarm cannot be automatically cleared. You need to manually clear the alarm.
578	Delayed upgrade	RW	E16			42590	1	
579	Intelligent string monitoring	RW	E16			42594	1	
580	String detection reference asymmetry coefficient	RW	U16		100	42595	1	
581	String detection start power percentage	RW	U16	%	1	42596	1	

582	Communication Interruption Time	RW	I16	min	1	42597	1	
583	Communications	RW	E16			42598	1	
584	[RS485-2] Communication	RW	E16			42599	1	
585	PMI	WO	E16			42730	1	Broadcast command interface Note: The instruction range extension design is made here. The higher eight bits are used to mask specified inspection actions in the inspection function. This feature improves the inspection efficiency for specific purposes. Shen Yanbai 20190702
586	IV Curve Scanning	WO	E16			42779	1	Broadcast command interface
587	Daylight Saving Time	RW	E16			42900	1	
588	[DST] Offset time	RW	I16	min	1	42901	1	

589	[DST] Start Month	RW	U16		1	42902	1	
590	[DST] Start date	RW	U16		1	42903	1	The number of the day in a week is expressed by the number of weeks. The value 1 indicates Monday and the value 7 indicates Sunday. - shenyanbai 20190527
591	[DST] Start time	RW	U16		1	42904	1	
592	[DST] Start minute	RW	U16		1	42905	1	
593	[DST] Start second	RW	U16		1	42906	1	
594	[DST] End month	RW	U16		1	42907	1	
595	[DST] End date	RW	U16		1	42908	1	The number of the day in a week is expressed by the number of weeks. The value 1 indicates Monday and the value 7 indicates Sunday. - shenyanbai 20190527
596	[Daylight Saving Time] Ends	RW	U16		1	42909	1	

597	[DST] End minute	RW	U16		1	42910	1	
598	[DST] End second	RW	U16		1	42911	1	
599	[System Time] Year	WO	U16		1	43000	1	
600	[System Time] Month	WO	U16		1	43001	1	
601	[System time] day	WO	U16		1	43002	1	
602	[System time] hour	WO	U16		1	43003	1	
603	[System Time] Min.	WO	U16		1	43004	1	
604	[System Time] Second	WO	U16		1	43005	1	
605	Time zone	RW	I16	min	1	43006	1	

606	Clock source	RW	E16			43007	1	
607	City code	RW	U32			43008	2	(UTC+08:00) Beijing
608	Inverter Installation Position Longitude	RW	I32	°	1000000000	43014	2	Set this parameter only on the app. The NMS can read the data.
609	Inverter Installation Position Latitude	RW	I32	°	1000000000	43016	2	Set this parameter only on the app. The NMS can read the data.
610	[RS485-1] Protocol Type	RW	E16			43018	1	
611	[RS485-1] Communication address	RW	U16		1	43019	1	0: broadcast address; 1–247: device address; 248–255: reserved
612	[RS485-1] Baud Rate	RW	E16			43020	1	115200 baud rate, corresponding to bit 26 of feature code 3.

613	[RS485-1] Verification mode	RW	E16			43021	1	
614	[RS485-1] Port mode	RW	E16			43022	1	
615	[RS485-1] Modbus Protocol Model Version	RW	E16			43023	1	This parameter is used only when the northbound port is used in the old model replacement scenario.
616	[RS485-2] Protocol Type	RW	E16			43033	1	
617	[RS485-2] Communication address	RW	U16		1	43034	1	0: broadcast address 1–247: device address 248–255: reserved
618	[RS485-2] Baud Rate	RW	E16			43035	1	115200 baud rate, corresponding to bit 27 of feature code 3.

619	[RS485-2] Verification Mode	RW	E16			43036	1	
620	[RS485-2] Port mode	RW	E16			43037	1	
621	Protocol Type	RW	E16			43047	1	
622	Box-type transformer number	RW	U16		1	43048	1	Only the 06 function code is supported. Local application
623	Winding No.	RW	U16		1	43049	1	Only the 06 function code is supported. Local application
624	Mac Offset	RW	U16		1	43050	1	Only the 06 function code is supported. Local application
625	Power settings	RW	U16	dB	1	43052	1	Note: This parameter x 2 corresponds to the dB value.
626	[Management System] TCP Frame Length	RW	U16		1	43063	1	[320, 1500]

627	[Management System] Application-Layer Heartbeat Interval	RW	U16	min	1	43064	1	Default value: 30 minutes
628	[Management System] TCP Heartbeat Interval	RW	U16	s	1	43065	1	0XFFFF indicates that there is no heartbeat. If this parameter is set to 0, the default heartbeat period is 3 minutes.
629	[Management System] Protocol Type	RW	E16			43066	1	
630	[Management System] Server	RW	STR		1	43067	30	Domain name address or IP address

631	[Management system] Port 1	RW	U16		1	43097	1	
632	[Management System] TLS Encryption	RW	E16			43098	1	
633	[Management System] Port mode	RW	E16			43100	1	
634	[FE] Key password	WO	MLD			43102	32	Interface for delivering the key password when the app certificate is replaced
635	[STA] Accessing a Wireless Router	RW	E16			43147	1	

636	[STA] Wireless Routing Network Name	RW	STR		1	43148	16	
637	[STA] Wireless Routing Encryption Mode	RW	E16			43164	1	
638	[STA] Wireless Router Login Password	RW	STR		1	43165	32	This parameter is not displayed in non-encryption mode.
639	[FE] DHCP	RW	E16			43197	1	
640	[FE] IP address	RW	IPv4			43198	2	If the IP address, subnet mask, and gateway address are modified, the other two parameters must be delivered in the same frame.
641	[FE] Subnet Mask	RW	IPv4			43200	2	

642	[FE] Gateway address	RW	IPv4			43202	2	
643	[STA] Preferred DNS Server	RW	U32		1	43204	2	
644	[STA] Standby DNS server	RW	U32		1	43206	2	
645	[FE] DHCP	RW	E16			43208	1	Decoupling mode: Feature code 2:18
646	[FE] IP address	RW	U32		1	43209	2	If the IP address, subnet mask, and gateway address are modified, the other two parameters must be delivered in the same frame.
647	[FE] Subnet Mask	RW	U32		1	43211	2	
648	[FE] Gateway address	RW	U32		1	43213	2	
649	[FE] Preferred DNS server	RW	U32		1	43215	2	Decoupling mode: Feature code 2:18

650	[FE] Secondary DNS server	RW	U32		1	43217	2	Decoupling mode: Feature code 2:18
651	WLAN O&M Policy	RW	E16			43236	1	Configures O&M policies for WLAN ports. For the SACU, policies 0, 1, and 2 can be configured. For the APP, policies 0 and 1. Permanently enabled: The WLAN port function is always available. Idle: Disable the WLAN O&M function after the idle time is 4 hours. Permanently disabled: The WLAN function is unavailable. If the power can be disabled, the power is disabled. If the power cannot be disabled, the O&M capability is disabled. Supported by SDongle and distributed inverters
652	[AP] SSID broadcast	RW	U16		1	43237	1	0: enabled 1: disabled Default value: 0
653	[AP] WLAN name	RW	STR		1	43238	16	Wifi-AP mode
654	[AP] WLAN Login Password	RW	STR		1	43254	32	The password must contain at least eight characters.

655	[AP] Gateway IP address	RW	U32		1	43287	2	
656	[AP] subnet mask	RW	U32		1	43289	2	
657	[NTP] NTP time synchronization	RW	U16		1	43311	1	
658	[NTP] NTP server address	RW	STR		1	43312	30	
659	[NTP] NTP server port	RW	U16		1	43342	1	
660	[NTP] NTP Service Time Interval	RW	U16	min	1	43343	1	
661	Device name	RW	STR			43349	10	This parameter is left blank by default. It is used by the customer to modify the device name.

662	[App] Initial power-on flag	RW	E16			43359	1	After the SmartLogger is deployed, the power-on flag needs to be cleared.
663	Parallel communication mode	RW	E16			43361	1	This interface is used to set the communication mode between the host machine and the parallel slave server in the Sdongle network access scenario. After the setting, the host machine bridges the Dongle or USB expansion module to the interface. Note: This interface is used to replace the cascade channel 43360 interface. The inverter must be compatible with this interface. When the interface has been set, the parameters must be migrated. When the high byte is 0, the SUN2000 automatically determines the parallel control entry based on the request entry.
664	[4G] 4G module	RW	E16			43370	1	
665	[4G] Card No.	RW	MLD		1	43386	10	
666	[4G] Network mode	RW	E16			43430	1	
667	[4G] APN mode	RW	E16			43431	1	

668	[4G] [Default] Identity authentication type	RW	E16			43433	1	
669	[4G] [Default] APN	RW	STR		1	43434	16	
670	[4G] [Default] APN username	RW	STR		1	43466	16	
671	[4G] [Default] APN user password	RW	STR		1	43482	16	
672	[4G] Identity authentication type	RW	E16			43499	1	
673	[4G] APN	RW	STR		1	43500	16	APN name
674	[4G] APN dial-up number	RW	STR		1	43516	16	Dial Number

675	[4G] APN User Name	RW	STR		1	43532	16	APN User Name
676	[4G] APN user password	RW	STR		1	43548	16	APN Password
677	[4G] Traffic package	RW	U32	MB	100	43564	2	
678	[4G] Monthly used traffic	RW	U32	MB	100	43566	2	Used for traffic correction.
679	[4G] PIN	WO	MLD		1	43568	4	
680	String access detection	RW	U16		1	43632	1	0: disabled (default) 1: enabled
681	Start-up current	RW	U16	A	100	43633	1	[3.0, 10.0] Default value: 5.0
682	Two-in-one detection starting current	RW	U16	A	100	43634	1	[10.0, 20.0] Default value: 15.0
683	String 1 access type	RW	E16			43635	1	

684	String 2 Access Type	RW	E16			43636	1	
685	String 3 Access Type	RW	E16			43637	1	
686	String 4 Access Type	RW	E16			43638	1	
687	String 5 Access Type	RW	E16			43639	1	
688	String 6 Access Type	RW	E16			43640	1	
689	String 7 Access Type	RW	E16			43641	1	
690	String 8 Access Type	RW	E16			43642	1	
691	Support System Type	RW	E16			44000	1	If the device vendor does not support one of the modes, the system returns the 03 error code.
692	Operating mode	RW	E16			44001	1	

693	Control period	RW	U16	min	1	44002	1	
694	Start time of reverse tracing in the morning (hour)	RW	U16	hour	1	44003	1	
695	Start time of reverse tracing in the morning (minutes)	RW	U16	min	1	44004	1	
696	Morning Backtracking Duration Minute	RW	U16	min	1	44005	1	
697	Tilt angle control	RW	MLD		1	44006	2	HW: ID of the support system, ranging from 0 to 16. The value 0 indicates full control. LW: tilt angle. The gain is 100. The value range is [0-90]. The control angle range also meets the requirements of the upper and lower limits of tilt angle control.

698	Bearing control	RW	MLD		1	44008	2	HW: ID of the support system, ranging from 0 to 16. 0 indicates full control. LW: azimuth preset value, gain 100, range [-90 to 90] The control angle range must meet the requirements of the upper and lower limits of azimuth control.
699	Number of motors controlled simultaneously	RW	U16		1	44010	1	If the actual number of motors is less than 16, the setting may fail.
700	Start time of the reverse tracing in the evening (hour)	RW	U16	hour	1	44011	1	
701	Start time of the reverse tracing in the evening (minute)	RW	U16	min	1	44012	1	

702	Evening Backtracking Duration Minute	RW	U16	min	1	44013	1	
703	Sensor installation direction	RW	E16			44014	1	
704	Controller time synchronization	RW	E16			44015	1	
705	Number of control boxes	RW	U16		1	44016	1	
706	Total number of stents	RW	U16		1	44050	1	When dual-axis control is used, the maximum number of support systems is 8.
707	Installation Longitude	RW	I16	°	100	44051	1	The east longitude is positive and the west longitude is negative.
708	Installation Dimension	RW	I16	°	100	44052	1	The north latitude is positive and the south latitude is negative.

709	Control address 1	RW	U16		1	44053	1	
710	Control address 2	RW	U16		1	44054	1	
711	Southbound RS485 Check Mode	RW	E16			44055	1	
712	Southbound RS485 baudrate	RW	E16			44056	1	
713	Tilt angle control upper limit	RW	I16	°	100	44057	1	Tilt angle control upper limit must be greater than lower limit
714	Tilt angle control lower limit	RW	I16	°	100	44058	1	Tilt angle control upper limit must be greater than lower limit
715	Upper limit of azimuth control	RW	I16	°	100	44059	1	The upper limit of azimuth control must be greater than the lower limit.

716	Lower limit for azimuth control	RW	I16	°	100	44060	1	The upper limit of azimuth control must be greater than the lower limit.
717	Sensor 1 address	RW	U16		1	44061	1	
718	Sensor 2 Address	RW	U16		1	44062	1	
719	Sensor 3 Address	RW	U16		1	44063	1	
720	Sensor 4 Address	RW	U16		1	44064	1	
721	Sensor 5 Address	RW	U16		1	44065	1	
722	Sensor 6 Address	RW	U16		1	44066	1	
723	Sensor 7 address	RW	U16		1	44067	1	
724	Sensor 8 Address	RW	U16		1	44068	1	
725	Sensor 9 Address	RW	U16		1	44069	1	

726	Sensor 10 Address	RW	U16		1	44070	1	
727	Sensor 11 address	RW	U16		1	44071	1	
728	Sensor 12 Address	RW	U16		1	44072	1	
729	Sensor 13 address	RW	U16		1	44073	1	
730	Sensor 14 Address	RW	U16		1	44074	1	
731	Sensor 15 Address	RW	U16		1	44075	1	
732	Sensor 16 Address	RW	U16		1	44076	1	
733	Tracking system controller	RW	E16			44077	1	
734	Control address 3	RW	U16		1	44079	1	

735	Control address 4	RW	U16		1	44080	1	
736	Southbound RS485 stop bit	RW	E16			44081	1	
737	Support Fault Clearance	WO	U16		1	44082	1	0: Clear all support faults. 1-16: Clear the fault of the specified support.
738	GPS time (local time): year	RW	U16		1	44083	1	
739	wind speed	RW	U16	m/s	1	44089	1	
740	Time zone	RW	I16	min	1	44090	1	
741	Control address 5	RW	U16		1	44091	1	
742	Control address 6	RW	U16		1	44092	1	
743	Control address 7	RW	U16		1	44093	1	
744	Control address 8	RW	U16		1	44094	1	

745	Control address 9	RW	U16		1	44095	1	
746	Control address 10	RW	U16		1	44096	1	
747	Control address 11	RW	U16		1	44097	1	
748	Control address 12	RW	U16		1	44098	1	
749	Control address 13	RW	U16		1	44099	1	
750	Control address 14	RW	U16		1	44100	1	
751	Control address 15	RW	U16		1	44101	1	
752	Control address 16	RW	U16		1	44102	1	

753	Science and Technology Jingke Protocol Version	RW	E16			44103	1	
754	Sensor Range	RW	U16	°	1	44104	1	
755	Control precision	RW	U16	°	100	44105	1	
756	KP	RW	I16		100	44200	1	Debugging interface
757	KI	RW	I16		100	44201	1	Debugging interface
758	KD	RW	I16		100	44202	1	Debugging interface
759	wind speed	WO	U16	m/s	1	44300	1	
760	Wind direction	WO	U16	°	1	44301	1	
761	Start up control	WO	E16			44302	2	BIT0–BIT15: Start command of bracket 1–bracket system 16; BIT16–BIT31: reserved for future expansion.
762	Support Fault Clearance	WO	E16			44304	2	BIT0–BIT15: Clear the faults of support 1–16 in sequence. Bits 16–32: reserved for future expansion.

763	Stop control	WO	E16			44306	2	BIT0~BIT15: stop command of rack 1~rack system 16; BIT16–BIT31: reserved for future expansion.
764	Temperature 1	WO	I16	°C	10	44408	1	
765	Humidity 1	WO	U16	% RH	10	44410	1	
766	Restore factory settings.	WO	E16			45000	1	
767	Clearing active alarms	WO	MLD			45001	2	
768	Alarm setting	WO	MLD			45003	2	
769	Alarm clearance	WO	E16			45005	1	
770	Alarm masking	WO	E16			45006	1	
771	AFCI self-check start	WO	U16		1	45007	1	Set the field to 0. Associate the AFCI controller in the in-position ID of the subdevice.

772	Accumulated energy yield correction	WO	U32	kWh	100	45008	2	
773	Clear historical battery level.	WO	E16			45010	1	Including the accumulated power generation capacity and accumulated charging capacity on the power side
774	Clear the running time information.	WO	E16			45011	1	Clears the accumulated running time, fault duration, and grid-tied running time.
775	Spot Check	WO	E16			45012	1	
776	Clear the flash memory.	WO	U16		1	45014	1	
777	ESN validation command	WO	U16		1	45015	1	
778	Restore the default password.	WO	MLD		1	45016	10	Enter the equipment ESN in the Data field.

779	[STA] Start scanning the available WLAN list.	WO	U16		1	45026	1	0
780	[License Interface] License Deregistration	WO	MLD		1	45027	10	Fill the LSN in the data field.
781	Alarm port self-check start	WO	U16		1	45037	1	The data field is set to 0.
782	Audible and visual alarm confirmation	WO	U16		1	45040	1	Added for the SUN2000 MA. This parameter is added to disable the audible and visual alarm function. After the alarm condition is cleared, the audible and visual alarm function is enabled again.
783	Box-type transformer number	RW	U16		1	47001	1	Remote dedicated, supported only for commercial use, and the addresses of all versions must be the same.

784	Winding No.	RW	U16		1	47002	1	Remote dedicated, supported only for commercial use, and the addresses of all versions must be the same.
785	Mac Offset	RW	U16		1	47003	1	Remote dedicated, supported only for commercial use, and the addresses of all versions must be the same.
786	Operating mode	RW	E16			47004	1	
787	Power limit for grid-tied sites	RW	I32	W	1	47079	2	
788	Optimizer	RW	E16			47120	1	Used to add the safety box. After the safety box is added, the DC-PLC status is set. Shenyanbai: This flag is forcibly set to 1 in the single-phase inverter implementation of the US version.
789	Single Optimizer Data Query	RW	U16		1	47126	1	Optimizer Logical Address
790	Alias Settings	WO	MLD		1	47129	11	W0: optimizer address; (small end) W1–10: alias character string

791	Physical location	WO	E16			47140	1	Anti-crosstalk is disabled.
792	Importing Logs	WO	E16			47141	1	
793	Broken line detection	WO	E16			47143	1	
794	Export complete logs.	WO	E16			47144	1	
795	Setting the Accumulated Energy Yield	WO	MULTIDATA	1		47145	3	Gain: 1000 Unit: kWh
796	Baud Rate	RW	E16			47150	1	The MBUS register is 43113.
797	Anti-crosstalk	RW	E16			47151	1	The MBUS register is 47022.
798	Network frequency band	RW	E16			47152	1	The MBUS register is 43116.
799	Networking	RW	E16			47153	1	The MBUS register is 47010.
800	Packet loss rate test	RW	E16			47154	1	

801	Security mode	RW	E16			47156	1	When the PLC enters and exits the unlock mode, the CCO is reset.
802	Fast power-down enable	RW	E16			47157	1	
803	Fast Shutdown Self-Test	WO	U16			47158	1	
804	Forward power	RW	E16			47300	1	
805	Cable connection position	RW	E16			47301	1	
806	CT rated current	RW	U16	A	1	47302	1	
807	Meter model	RW	E16			47303	1	Note: 47002 conflicts with the winding number of the [Remote Setting]. The winding number is reassigned. This interface will be used in later versions. Naming format: manufacturer-model
808	Meter address	RW	U16		1	47304	1	Note: 47003 conflicts with [Remote Settings] MAC Offset. This interface will be used in later versions.

809	Meter name	RW	MLD		1	47305	15	Used to store the name of the meter during model loading.
810	Enable automatic address allocation.	RW	E16			47400	1	
811	Start address for automatic address assignment	RW	U16		1	47401	1	
812	Communication module address	RW	U16		1	47414	1	
813	Active power control mode	RW	E16			47415	1	

814	Maximum power fed to the grid (kW)	RW	I32	kW	1000	47416	2	
815	Maximum Feed Grid Power (%)	RW	I16	%	10	47418	1	
816	Restriction mode	RW	E16			47419	1	
817	Power decrease adjustment period	RW	U16	s	10	47420	1	
818	Maximum protection time	RW	U16	s	10	47421	1	
819	Power Increase Threshold	RW	U32	kW	1000	47422	2	

820	Active power limit for fail protection [%] [low precision]	RW	I16	%	10	47424	1	Not displayed on the GUI. The gains of the old interface are different. This function is used only to support the batch settings of the SmartLogger.
821	reactive power control mode	RW	E16			47425	1	
822	Reactive fixed value	RW	I32	kVar	1000	47426	2	
823	target power factor	RW	I16		1000	47428	1	
824	Reactive power adjustment period	RW	U16	s	10	47429	1	
825	Adjusting Dead Zone	RW	U16		1000	47430	1	

826	Compensating delay	RW	U16	s	10	47431	1	
827	Failure protection reactive power limit [PF]	RW	I16		1000	47432	1	This parameter is displayed only when Communication Disconnection Failure Protection is set to Enabled and Reactive Power Mode is set to Power Factor.
828	Plant capacity	RW	U32	kW	1000	47433	2	
829	Power plant DC capacity	RW	U32	kW	1000	47435	2	
830	[Remote Output] Certificate	RW	E16			47437	1	Note: "Output Control" is a direct reference in Japanese name, which essentially expresses the active output control under server scheduling. Currently, this function is required only by Japan. Update the name when the general function requires it. 20190223 Shen Yanbai
831	[Remote output] PV plant ID	RW	MLD			47438	13	Only 26 digits are supported.

832	[Remote output] Remote output control server	RW	STR			47451	30	Other server addresses can be manually entered.
833	[Remote Output] Remote Output Control Time	RW	U16	min	1	47481	1	It refers to the time that the output of the plant is controlled from 0% to 100%.
834	[Remote output] Connecting to the dispatch server	WO	U16		1	47482	1	
835	closed loop controller	RW	E16			47483	1	Note: The external controller uses the exponential data source or Dongle. In this case, the inverter does not perform the closed-loop control algorithm.

836	[Local Access] Link Enabled	RW	E16			47594	1	
837	[Local access] Client 1 IP address	RW	IPv4		1	47595	2	
838	Schedule Task	RW	E16			47674	1	South Australia Dynamic Feeder Requirements
839	Maximum Feed Grid Power Default	RW	I32	kW	1000	47675	2	Power limit on the grid-tied point when the default task is executed for the dynamic feeder network in South Australia.
840	Default active power change gradient	RW	U32	%/s	1000	47677	2	Power change rate during switchover between the default task and the planned task in South Australia dynamic feeder network requirements

841	Feeding power over-threshold protection shutdown	RW	U16	1		47950	1	
842	Feed threshold - crossing protection shutdown threshold	RW	I32	1000		47951	2	
843	Feed threshold - crossing protection shutdown time	RW	U16	1		47953	1	

844	[Management System - 1] Management System Access	RW	U16	N/A		48021	1	
845	[Management System-1] Protocol Type	RW	E16			48087	1	Automatically adapt to the "1" protocol for the SkyTeam OEM model.
846	Ground short circuit protection	RW	E16			48090	1	

NOTICE

Signals marked with * are supported only by certain models or standard codes.

4 Customized Interfaces

4.1 Obtaining the System Information of Optimizers

Data synchronization mechanism: The host is driven to refresh the system information of optimizers by the change of the serial number (SN).

Synchronization process: For details, see **6.3.7.1 Uploading Files**.

Data storage of the solar inverters: After the device search and positioning are complete, the record is updated. The record format is as follows:

File type: 0x45

Table 4-1 File format(V102)

Data	Length (Bytes)	Remarks
File version	4	V103
Feature data sequence number	2	N/A
Length	2	The file version number and feature data sequence number are not included.
Reserved	1	The reserved byte 0 is defined as the status. bit0: inverter disconnection status (1=disconnected)
	3	N/A
Number of optimizers	2	Total number, including the offline optimizers.

Data	Length (Bytes)	Remarks
Feature data of optimizer 1	108	For details about the data domain definition, see **Table2 Feature data unit format(V102)**.
Feature data of optimizer 2	108	N/A
...	...	N/A
Feature data of optimizer N	108	N/A

Table 4-2 Feature data unit format(V102)

Data	Length (Bytes)	Remarks
Optimizer address	2	RS485 address
Online status	2	0: offline 1: online 2: disconnected
String number	2	N/A
Position in current string	2	relative positive connection starting point
SN	20	N/A
Software version	30	N/A
Alias	20	N/A
Model	30	N/A

4.2 Obtaining Real-time Data of Optimizers

Data synchronization mechanism: fifteen-minute interval

Synchronization process: uploads the files and synchronizes data according to the time period; Upload the most recent data if there is no filter condition. For details, see **6.3.7.1 Uploading Files**.

Data storage: stores real-time data at five-minute intervals.

File type: 0x44

Table 4-3 Record format

Data	Length (Byte)	Remarks
File version	4	V101
Reserved	8	N/A
Optimizer data unit 1	N	12 + 26 x Number of optimizers , For details about the definition of this unit, see the data unit format.
Optimizer data unit 2	N	N/A
...	N/A	N/A
Optimizer data unit *n*	N	*n* indicates the number of data records that meet the filter condition. Each piece of data contains all optimizer data for a time node.

Table 4-4 Data unit format (V101)

Data	Length (Byte)	Remarks
Time	4	Epoch seconds, local time
Reserved	4	N/A
Length	2	N/A
Number of optimizers	2	N/A
Real-time data of optimizer 1	26	For details about the definition of this unit, see the real-time data format.
Real-time data of optimizer 2	26	N/A
...	...	N/A
Real-time data of optimizer *n*	26	*n* is the number of optimizers.

Table 4-5 Real-time data format

Data	Length (Byte)	Remarks
Optimizer address	2	Logical communication address

Data	Length (Byte)	Remarks
Output power	2	Gain: 10 Unit: W
Voltage to ground	2	Gain: 10 Unit: V
Alarm	4	Bit00: input overvoltage Bit01: input undervoltage Bit02: output overvoltage Bit04: overtemperature Bit06: output short circuit Bit07: EEPROM fault Bit08: internal hardware fault Bit09: abnormal voltage to ground Bit 10: power-off due to heartbeat timeout Bit 11: fast shutdown Bit 12: request escape alarm Bit 13: version mismatch alarm Bit 16: input overvoltage Bit 17: overtemperature Bit 18: output short circuit Bit 19: internal hardware fault Bit 20: version mismatch alarm Bit 21: backfeed alarm Bit 22: abnormal output voltage Bit 23: upgrade failure Bit 31: alarm display selection, 1=Display bit 16 to bit 30 alarms, 0: Bits 0 to 15 are displayed.
Output voltage	2	Gain: 10 Unit: V
Output current	2	Gain: 100 Unit: A
Input voltage	2	Gain: 10 Unit: V
Input current	2	Gain: 100 Unit: A

Data	Length (Byte)	Remarks
Temperature	2	Gain: 10 Unit: ℃
Running status	2	0: offline 1: standby 3: faulty 4: running 12: power-off
Accumulated energy yield	4	Gain: 1000 Unit: kWh

5 Interface Instructions

5.1 Alarm Information

Table 5-1 Alarm information

No.	Alarm	Bit	Alarm Name	Alarm ID	Level
1	Alarm 1	0	High String Input Voltage	2001	Major
2	Alarm 1	1	DC Arc Fault[1]	2002	Major
3	Alarm 1	2	String Reverse Connection	2011	Major
4	Alarm 1	3	String Current Backfeed	2012	Warning
5	Alarm 1	4	Abnormal String Power	2013	Warning
6	Alarm 1	5	AFCI Self-Check Fail.[1]	2021	Major
7	Alarm 1	6	Phase Wire Short-Circuited to PE	2031	Major
8	Alarm 1	7	Grid Loss	2032	Major
9	Alarm 1	8	Grid Undervoltage	2033	Major
10	Alarm 1	9	Grid Overvoltage	2034	Major

No.	Alarm	Bit	Alarm Name	Alarm ID	Level
11	Alarm 1	10	Grid Volt. Imbalance	2035	Major
12	Alarm 1	11	Grid Overfrequency	2036	Major
13	Alarm 1	12	Grid Underfrequency	2037	Major
14	Alarm 1	13	Unstable Grid Frequency	2038	Major
15	Alarm 1	14	Output Overcurrent	2039	Major
16	Alarm 1	15	Output DC Component Overhigh	2040	Major
17	Alarm 2	0	Abnormal Residual Current	2051	Major
18	Alarm 2	1	Abnormal Grounding	2061	Major
19	Alarm 2	2	Low Insulation Resistance	2062	Major
20	Alarm 2	3	Overtemperature	2063	Minor
21	Alarm 2	4	Device Fault	2064	Major
22	Alarm 2	5	Upgrade Failed or Version Mismatch	2065	Minor
23	Alarm 2	6	License Expired	2066	Warning
24	Alarm 2	7	Faulty Monitoring Unit	61440	Minor
25	Alarm 2	8	Faulty Power Collector[2]	2067	Major
26	Alarm 2	9	Battery abnormal	2068	Minor
27	Alarm 2	10	Active Islanding	2070	Major
28	Alarm 2	11	Passive Islanding	2071	Major

No.	Alarm	Bit	Alarm Name	Alarm ID	Level
29	Alarm 2	12	Transient AC Overvoltage	2072	Major
30	Alarm 2	13	Peripheral port short circuit[3]	2075	Warning
31	Alarm 2	14	Churn output overload[4]	2077	Major
32	Alarm 2	15	Abnormal PV module configuration	2080	Major
33	Alarm 3	0	Optimizer fault[5]	2081	Warning
34	Alarm 3	1	Built-in PID operation abnormal[6]	2085	Minor
35	Alarm 3	2	High input string voltage to ground.	2014	Major
36	Alarm 3	3	External Fan Abnormal	2086	Major
37	Alarm 3	4	Battery Reverse Connection[7]	2069	Major
38	Alarm 3	5	On-grid/Off-grid controller abnormal[4]	2082	Major
39	Alarm 3	6	PV String Loss	2015	Warning
40	Alarm 3	7	Internal Fan Abnormal	2087	Major
41	Alarm 3	8	DC Protection Unit Abnormal[8]	2088	Major

NOTICE

The preceding table lists the alarm information about Huawei solar inverters. Some alarms can be detected only after corresponding functional modules are configured.

[1] AFCI functional unit

[2] Power collector or power meter connected to the solar inverters

[3] Detection of the external ports of the solar inverters that provide the 12 V power supply

[4] This item can be detected when a built-in or external on-grid/off-grid functional unit is configured.

[5] This item can be detected when optimizers are configured on the DC side.

[6] This item can be detected when the solar inverters are configured with PID functional units.

[7] This item can be detected when energy storage units (ESUs) are configured.

[8] Some models have DC protection units.

5.2 Power Grid Scheduling

This section describes the curve configuration format and precautions for power grid scheduling by curve.

5.2.1 cosϕ-P/Pn Characteristic Curve

Table 5-2 cosϕ-P/P_n characteristic curve definition

Description	Data Type	Gain	Unit	Value Range
Number of points	U16	1	N/A	[2, 10]
P/P_n value at point 1	U16	10	%	[0, 100]
cosϕ value at point 1	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
P/P_n value at point 2	U16	10	%	[0, 100]
cosϕ value at point 2	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
P/P_n value at point 3	U16	10	%	[0, 100]
cosϕ value at point 3	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
P/P_n value at point 4	U16	10	%	[0, 100]
cosϕ value at point 4	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
P/P_n value at point 5	U16	10	%	[0, 100]
cosϕ value at point 5	I16	1000	N/A	(–1, –0.8]U[0.8, 1]

Description	Data Type	Gain	Unit	Value Range
P/P_n value at point 6	U16	10	%	[0, 100]
cosϕ value at point 6	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
P/P_n value at point 7	U16	10	%	[0,100]
cosϕ value at point 7	I16	1000	N/A	(–1,–0.8]U[0.8,1]
P/P_n value at point 8	U16	10	%	[0, 100]
cosϕ value at point 8	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
P/P_n value at point 9	U16	10	%	[0, 100]
cosϕ value at point 9	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
P/P_n value at point 10	U16	10	%	[0, 100]
cosϕ value at point 10	I16	1000	N/A	(–1, –0.8]U[0.8, 1]

5.2.2 Q-U Characteristic Curve

Table 5-3 Q-U Characteristic Curve definition

Description	Data Type	Gain	Unit	Value Range
Number of points	U16	1	N/A	[2, 10]
U/U_n value at point 1	U16	10	%	[80, 136]
Q/S value at point 1	I16	1000	N/A	[–0.6, 0.6]
U/U_n value at point 2	U16	10	%	[80, 136]
Q/S value at point 2	I16	1000	N/A	[–0.6, 0.6]
U/U_n value at point 3	U16	10	%	[80, 136]
Q/S value at point 3	I16	1000	N/A	[–0.6, 0.6]
U/U_n value at point 4	U16	10	%	[80, 136]
Q/S value at point 4	I16	1000	N/A	[–0.6, 0.6]
U/U_n value at point 5	U16	10	%	[80, 136]
Q/S value at point 5	I16	1000	N/A	[–0.6, 0.6]
U/U_n value at point 6	U16	10	%	[80, 136]
Q/S value at point 6	I16	1000	N/A	[–0.6, 0.6]

Description	Data Type	Gain	Unit	Value Range
U/U_n value at point 7	U16	10	%	[80, 136]
Q/S value at point 7	I16	1000	N/A	[–0.6, 0.6]
U/U_n value at point 8	U16	10	%	[80, 136]
Q/S value at point 8	I16	1000	N/A	[–0.6, 0.6]
U/U_n value at point 9	U16	10	%	[80, 136]
Q/S value at point 9	I16	1000	N/A	[–0.6, 0.6]
U/U_n value at point 10	U16	10	%	[80, 136]
Q/S value at point 10	I16	1000	N/A	[–0.6, 0.6]

NOTICE

In Italian standards, this curve may be used together with the **Q-U characteristic curve mode**, **Q-U dispatch trigger power (%)**, and **Q-U power percentage to exit scheduling** parameters.

5.2.3 PF-U Characteristic Curve

Table 5-4 PF-U Characteristic Curve definition

Description	Data Type	Gain	Unit	Value Range
Number of points	U16	1	N/A	[2, 10]
U/U_n value at point 1	U16	10	%	[80, 136]
PF value at point 1	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
U/U_n value at point 2	U16	10	%	[80, 136]
PF value at point 2	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
U/U_n value at point 3	U16	10	%	[80, 136]
PF value at point 3	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
U/U_n value at point 4	U16	10	%	[80, 136]
PF value at point 4	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
U/U_n value at point 5	U16	10	%	[80, 136]
PF value at point 5	I16	1000	N/A	(–1, –0.8]U[0.8, 1]

Description	Data Type	Gain	Unit	Value Range
U/U_n value at point 6	U16	10	%	[80, 136]
PF value at point 6	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
U/U_n value at point 7	U16	10	%	[80, 136]
PF value at point 7	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
U/U_n value at point 8	U16	10	%	[80, 136]
PF value at point 8	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
U/U_n value at point 9	U16	10	%	[80, 136]
PF value at point 9	I16	1000	N/A	(–1, –0.8]U[0.8, 1]
U/U_n value at point 10	U16	10	%	[80, 136]
PF value at point 10	I16	1000	N/A	(–1, –0.8]U[0.8, 1]

5.3 Grid Codes

Table 5-5 List of grid codes

No.	Standard	Applicable Country or Region
0	VDE-AR-N-4105	Germany
1	NB/T 32004	China
2	UTE C 15-712-1(A)	France
3	UTE C 15-712-1(B)	France
4	UTE C 15-712-1(C)	France
5	VDE 0126-1-1-BU	Bulgaria
6	VDE 0126-1-1-GR(A)	Greece
7	VDE 0126-1-1-GR(B)	Greece
8	BDEW-MV	Germany
9	G59-England	UK
10	G59-Scotland	UK
11	G83-England	UK
12	G83-Scotland	UK

No.	Standard	Applicable Country or Region
13	CEI0-21	Italy
14	EN50438-CZ	Czech Republic
15	RD1699/661	Spain
16	RD1699/661-MV480	Spain
17	EN50438-NL	Netherlands
18	C10/11	Belgium
19	AS4777	Australia
20	IEC61727	General
21	Custom (50 Hz)	Custom
22	Custom (60 Hz)	Custom
23	CEI0-16	Italy
24	CHINA-MV480	China
25	CHINA-MV	China
26	TAI-PEA	Thailand
27	TAI-MEA	Thailand
28	BDEW-MV480	Germany
29	Custom MV480 (50 Hz)	Custom
30	Custom MV480 (60 Hz)	Custom
31	G59-England-MV480	UK
32	IEC61727-MV480	General
33	UTE C 15-712-1-MV480	France
34	TAI-PEA-MV480	Thailand
35	TAI-MEA-MV480	Thailand
36	EN50438-DK-MV480	Denmark
37	Japan standard (50 Hz)	Japan
38	Japan standard (60 Hz)	Japan
39	EN50438-TR-MV480	Turkey
40	EN50438-TR	Turkey
41	C11/C10-MV480	Belgium

No.	Standard	Applicable Country or Region
42	Philippines	Philippines
43	Philippines-MV480	Philippines
44	AS4777-MV480	Australia
45	NRS-097-2-1	South Africa
46	NRS-097-2-1-MV480	South Africa
47	KOREA	South Korea
48	IEEE 1547-MV480	USA
49	IEC61727-60Hz	General
50	IEC61727-60Hz-MV480	General
51	CHINA_MV500	China
52	ANRE	Romania
53	ANRE-MV480	Romania
54	ELECTRIC RULE NO.21-MV480	California, USA
55	HECO-MV480	Hawaii, USA
56	PRC_024_Eastern-MV480	Eastern USA
57	PRC_024_Western-MV480	Western USA
58	PRC_024_Quebec-MV480	Quebec, Canada
59	PRC_024_ERCOT-MV480	Texas, USA
60	PO12.3-MV480	Spain
61	EN50438_IE-MV480	Ireland
62	EN50438_IE	Ireland
63	IEEE 1547a-MV480	USA
64	Japan standard (MV420-50 Hz)	Japan
65	Japan standard (MV420-60 Hz)	Japan
66	Japan standard (MV440-50 Hz)	Japan
67	Japan standard (MV440-60 Hz)	Japan

No.	Standard	Applicable Country or Region
68	IEC61727-50Hz-MV500	General
70	CEI0-16-MV480	Italy
71	PO12.3	Spain
72	Japan standard (MV400-50 Hz)	Japan
73	Japan standard (MV400-60 Hz)	Japan
74	CEI0-21-MV480	Italy
75	KOREA-MV480	South Korea
76	Egypt ETEC	Egypt
77	Egypt ETEC-MV480	Egypt
78	CHINA_MV800	China
79	IEEE 1547-MV600	USA
80	ELECTRIC RULE NO.21-MV600	California, USA
81	HECO-MV600	Hawaii, USA
82	PRC_024_Eastern-MV600	Eastern USA
83	PRC_024_Western-MV600	Western USA
84	PRC_024_Quebec-MV600	Quebec, Canada
85	PRC_024_ERCOT-MV600	Texas, USA
86	IEEE 1547a-MV600	USA
87	EN50549-LV	Ireland
88	EN50549-MV480	Ireland
89	Jordan-Transmission	Jordan
90	Jordan-Transmission-MV480	Jordan
91	NAMIBIA	Namibia
92	ABNT NBR 16149	Brazil
93	ABNT NBR 16149-MV480	Brazil
94	SA_RPPs	South Africa

No.	Standard	Applicable Country or Region
95	SA_RPPs-MV480	South Africa
96	INDIA	India
97	INDIA-MV500	India
98	ZAMBIA	Zambia
99	ZAMBIA-MV480	Zambia
100	Chile	Chile
101	Chile-MV480	Chile
102	CHINA-MV500-STD	China
103	CHINA-MV480-STD	China
104	Mexico-MV480	Mexico
105	Malaysian	Malaysia
106	Malaysian-MV480	Malaysia
107	KENYA_ETHIOPIA	East Africa
108	KENYA_ETHIOPIA-MV480	East Africa
109	G59-England-MV800	UK
110	NIGERIA	Nigeria
111	NIGERIA-MV480	Nigeria
112	DUBAI	Dubai
113	DUBAI-MV480	Dubai
114	Northern Ireland	Northern Ireland
115	Northern Ireland-MV480	Northern Ireland
116	Cameroon	Cameroon
117	Cameroon-MV480	Cameroon
118	Jordan-Distribution	Jordan
119	Jordan-Distribution-MV480	Jordan
120	Custom MV600-50 Hz	Custom
121	AS4777-MV800	Australia
122	INDIA-MV800	India

No.	Standard	Applicable Country or Region
123	IEC61727-MV800	General
124	BDEW-MV800	Germany
125	ABNT NBR 16149-MV800	Brazil
126	UTE C 15-712-1-MV800	France
127	Chile-MV800	Chile
128	Mexico-MV800	Mexico
129	EN50438-TR-MV800	Turkey
130	TAI-PEA-MV800	Thailand
131	Philippines-MV800	Philippines
132	Malaysian-MV800	Malaysia
133	NRS-097-2-1-MV800	South Africa
134	SA_RPPs-MV800	South Africa
135	Jordan-Transmission-MV800	Jordan
136	Jordan-Distribution-MV800	Jordan
137	Egypt ETEC-MV800	Egypt
138	DUBAI-MV800	Dubai
139	SAUDI-MV800	Saudi Arabia
140	EN50438_IE-MV800	Ireland
141	EN50549-MV800	Ireland
142	Northern Ireland-MV800	Northern Ireland
143	CEI0-21-MV800	Italy
144	IEC 61727-MV800-60Hz	General
145	NAMIBIA_MV480	Namibia
146	Japan (LV202-50 Hz)	Japan
147	Japan (LV202-60 Hz)	Japan
148	Pakistan-MV800	Pakistan
149	BRASIL-ANEEL-MV800	Brazil
150	Israel-MV800	Israel

No.	Standard	Applicable Country or Region
151	CEI0-16-MV800	Italy
152	ZAMBIA-MV800	Zambia
153	KENYA_ETHIOPIA-MV800	East Africa
154	NAMIBIA_MV800	Namibia
155	Cameroon-MV800	Cameroon
156	NIGERIA-MV800	Nigeria
157	ABUDHABI-MV800	Abu Dhabi
158	LEBANON	Lebanon
159	LEBANON-MV480	Lebanon
160	LEBANON-MV800	Lebanon
161	ARGENTINA-MV800	Argentina
162	ARGENTINA-MV500	Argentina
163	Jordan-Transmission-HV	Jordan
164	Jordan-Transmission-HV480	Jordan
165	Jordan-Transmission-HV800	Jordan
166	TUNISIA	Tunisia
167	TUNISIA-MV480	Tunisia
168	TUNISIA-MV800	Tunisia
169	JAMAICA-MV800	Jamaica
170	AUSTRALIA-NER	Australia
171	AUSTRALIA-NER-MV480	Australia
172	AUSTRALIA-NER-MV800	Australia
173	SAUDI	Saudi Arabia
174	SAUDI-MV480	Saudi Arabia
175	Ghana-MV480	Ghana
176	Israel	Israel
177	Israel-MV480	Israel
178	Chile-PMGD	Chile

No.	Standard	Applicable Country or Region
179	Chile-PMGD-MV480	Chile
180	VDE-AR-N4120-HV	Germany
181	VDE-AR-N4120-HV480	Germany
182	VDE-AR-N4120-HV800	Germany
183	IEEE 1547-MV800	USA
184	Nicaragua-MV800	Nicaragua
185	IEEE 1547a-MV800	USA
186	ELECTRIC RULE NO.21-MV800	California, USA
187	HECO-MV800	Hawaii, USA
188	PRC_024_Eastern-MV800	Eastern USA
189	PRC_024_Western-MV800	Western USA
190	PRC_024_Quebec-MV800	Quebec, Canada
191	PRC_024_ERCOT-MV800	Texas, USA
192	Custom-MV800-50Hz	Custom
193	RD1699/661-MV800	Spain
194	PO12.3-MV800	Spain
195	Mexico-MV600	Mexico
196	Vietnam-MV800	Vietnam
197	CHINA-LV220/380	China
198	SVG-LV	Dedicated
199	Vietnam	Vietnam
200	Vietnam-MV480	Vietnam
201	Chile-PMGD-MV800	Chile
202	Ghana-MV800	Ghana
203	TAIPOWER	Taiwan
204	TAIPOWER-MV480	Taiwan
205	TAIPOWER-MV800	Taiwan
206	IEEE 1547-LV208	USA

No.	Standard	Applicable Country or Region
207	IEEE 1547-LV240	USA
208	IEEE 1547a-LV208	USA
209	IEEE 1547a-LV240	USA
210	ELECTRIC RULE NO.21-LV208	USA
211	ELECTRIC RULE NO.21-LV240	USA
212	HECO-O+M+H-LV208	USA
213	HECO-O+M+H-LV240	USA
214	PRC_024_Eastern-LV208	USA
215	PRC_024_Eastern-LV240	USA
216	PRC_024_Western-LV208	USA
217	PRC_024_Western-LV240	USA
218	PRC_024_ERCOT-LV208	USA
219	PRC_024_ERCOT-LV240	USA
220	PRC_024_Quebec-LV208	USA
221	PRC_024_Quebec-LV240	USA
222	ARGENTINA-MV480	Argentina
223	Oman	Oman
224	Oman-MV480	Oman
225	Oman-MV800	Oman
226	Kuwait	Kuwait
227	Kuwait-MV480	Kuwait
228	Kuwait-MV800	Kuwait
229	Bangladesh	Bangladesh
230	Bangladesh-MV480	Bangladesh
231	Bangladesh-MV800	Bangladesh
232	Chile-Net_Billing	Chile
233	EN50438-NL-MV480	Netherlands
234	Bahrain	Bahrain

No.	Standard	Applicable Country or Region
235	Bahrain-MV480	Bahrain
236	Bahrain-MV800	Bahrain
238	Japan-MV550-50Hz	Japan
239	Japan-MV550-60Hz	Japan
241	ARGENTINA	Argentina
242	KAZAKHSTAN-MV800	Kazakhstan
243	Mauritius	Mauritius
244	Mauritius-MV480	Mauritius
245	Mauritius-MV800	Mauritius
246	Oman-PDO-MV800	Oman
247	EN50438-SE	Sweden
248	TAI-MEA-MV800	Thailand
249	Pakistan	Pakistan
250	Pakistan-MV480	Pakistan
251	PORTUGAL-MV800	Portugal
252	HECO-L+M-LV208	USA
253	HECO-L+M-LV240	USA
254	C10/11-MV800	Belgium
255	Austria	Austria
256	Austria-MV480	Austria
257	G98	UK
258	G99-TYPEA-LV	UK
259	G99-TYPEB-LV	UK
260	G99-TYPEB-HV	UK
261	G99-TYPEB-HV-MV480	UK
262	G99-TYPEB-HV-MV800	UK
263	G99-TYPEC-HV-MV800	UK
264	G99-TYPED-MV800	UK
265	G99-TYPEA-HV	UK

No.	Standard	Applicable Country or Region
266	CEA-MV800	India
267	EN50549-MV400	Europe
268	VDE-AR-N4110	Germany
269	VDE-AR-N4110-MV480	Germany
270	VDE-AR-N4110-MV800	Germany
271	Panama-MV800	Panama
272	North Macedonia-MV800	Nprth Macedonia
273	NTS	Spain
274	NTS-MV480	Spain
275	NTS-MV800	Spain

NOTICE

Set the grid code based on local laws and regulations.

5.4 Energy Storage Specifications

Table 5-6 Format description of parameters for time-of-use electricity price periods

Description	Data Type	Gain	Unit	Value Range
Number of periods	U16	1	N/A	[0, 10]
Start time of period 1	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
End time of period 1	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.

Description	Data Type	Gain	Unit	Value Range
Electricity price in period 1	U32	1000	N/A	N/A
Start time of period 2	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
End time of period 2	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
Electricity price in period 2	U32	1000	N/A	N/A
...	...	...	...	...
Start time of period 10	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
End time of period 10	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
Electricity price in period 10	U32	1000	N/A	N/A

Table 5-7 Format description of parameters for fixed charging and discharging periods

Description	Data Type	Gain	Unit	Value Range
Number of periods	U16	1	N/A	[0, 10]

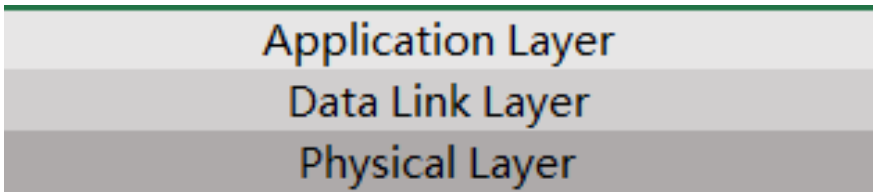
Description	Data Type	Gain	Unit	Value Range
Start time of period 1	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
End time of period 1	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
Charging and discharging power in period 1	I32	1	W	[Discharging power limit, Charging power limit]. For details, see the description of the supported model.
Start time of period 2	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
End time of period 2	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
Charging and discharging power in period 2	I32	1	W	[Discharging power limit, Charging power limit]. For details, see the description of the supported model.
...	...	...	...	...
Start time of period 10	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.

Description	Data Type	Gain	Unit	Value Range
End time of period 10	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
Charging and discharging power in period 10	I32	1	W	[Discharging power limit, Charging power limit]. For details, see the description of the supported model.

6 Overview of the Communications Protocol

The Modbus communication protocol is divided into the following layers:

Figure 6-1 Modbus Protocol Layer



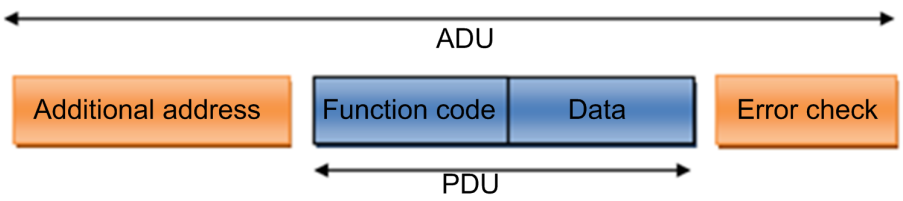
6.1 Physical Layer

Huawei solar inverters provide Modbus communication based on physical media such as MBUS, RS485, WLAN, FE, and 4G. MBUS and RS485 comply with the Modbus-RTU format. The communication through the WLAN, FE, and 4G media is based on the TCP link and complies with the Modbus-TCP format.

6.2 Data Link Layer

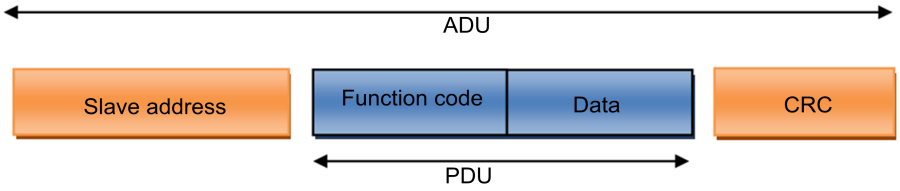
The following figure shows the generic frame structure of the Modbus protocol.

Figure 6-2 Modbus generic frame format



6.2.1 Modbus-RTU

Figure 6-3 Modbus-RTU frame format



6.2.1.1 ADU Length

The application data unit (ADU) consists of 256 bytes based on the serial bus.

1. Slave address: 1 byte
2. Cyclic redundancy check (CRC): 2 bytes
3. PDU: 253 bytes

6.2.1.2 Communications Address

As shown in **6.2.1 Modbus-RTU**, Modbus-RTU is usually used for serial communication. Slave address represents the address of a slave solar inverter. The address range is allocated as follows:

Table 6-1 Serial link address allocation

Broadcast Address	Slave Node Address	Reserved Address
0	1–247	248–255

Reserved addresses are used for access control of the communication extension modules. Huawei reserves the right to allocate the reserved addresses.

6.2.1.3 CRC

CRC applies to all bytes in front of the CRC code, which consists of 16 bits. The reference code is as follows:

```
static unsigned char auchCRCHi[] = {
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01,
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01,
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01,
0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01,
```

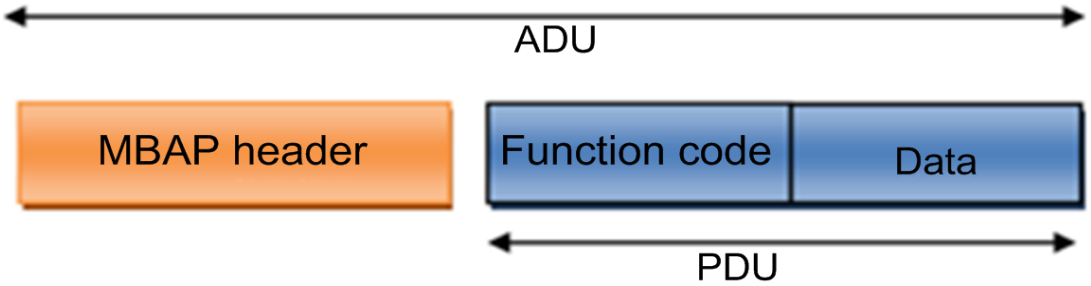


```
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40
} ;
/*CRC values for the low-order byte*/
static char auchCRCLo[] = {
0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7, 0x05, 0xC5, 0xC4,
0x04, 0xCC, 0x0C, 0x0D, 0xCD, 0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B, 0xC9, 0x09,
0x08, 0xC8, 0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB, 0xDA, 0x1A, 0x1E, 0xDE, 0xDF, 0x1F, 0xDD,
0x1D, 0x1C, 0xDC, 0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13, 0xD3,
0x11, 0xD1, 0xD0, 0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32, 0x36, 0xF6, 0xF7,
0x37, 0xF5, 0x35, 0x34, 0xF4, 0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A,
0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8, 0xE9, 0x29, 0xEB, 0x2B, 0x2A, 0xEA, 0xEE,
0x2E, 0x2F, 0xEF, 0x2D, 0xED, 0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26,
0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60, 0x61, 0xA1, 0x63, 0xA3, 0xA2,
0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F,
0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68, 0x78, 0xB8, 0xB9, 0x79, 0xBB,
0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5,
0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71, 0x70, 0xB0, 0x50, 0x90, 0x91,
0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94, 0x54, 0x9C, 0x5C,
0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B, 0x99, 0x59, 0x58, 0x98, 0x88,
0x48, 0x49, 0x89, 0x4B, 0x8B, 0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D, 0x4C, 0x8C,
0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83, 0x41, 0x81, 0x80, 0x40
};
unsigned short CRC16 ( puchMsg, usDataLen ) /* The function returns the CRC as a unsigned short type */
unsigned char *puchMsg ; /* message to calculate CRC upon */
unsigned short usDataLen ; /* quantity of bytes in message */
{
unsigned char uchCRCHi = 0xFF ; /* high byte of CRC initialized */
unsigned char uchCRCLo = 0xFF ; /* low byte of CRC initialized */
unsigned uIndex ; /* will index into CRC lookup table */
while (usDataLen--) /* pass through message buffer */
{
uIndex = uchCRCLo ^ *puchMsg++ ; /* calculate the CRC */
uchCRCLo = uchCRCHi ^ auchCRCHi[uIndex] ;
uchCRCHi = auchCRCLo[uIndex] ;
}
return (uchCRCHi << 8 | uchCRCLo) ;
}
```

Code source: *MODBUS over Serial Line Specification and Implementation Guide V1.02*

6.2.2 Modbus-TCP

Figure 6-4 Modbus-TCP frame format



6.2.2.1 ADU Length

The recommended frame length is 260 bytes based on the standard. When some extended functions are applied, the data service provider may extend the ADU to a proper length based on the resources it possesses, to improve network

transmission efficiency. The ADU length is indicated by the length field in the MBAP packet header.

6.2.2.2 MBAP Packet Header

If Modbus is applied to TCP/IP, a dedicated MBAP packet header (Modbus application protocol packet header) is used to identify the Modbus ADU. The Modbus packet header consists of four fields and seven bytes, which are defined as follows.

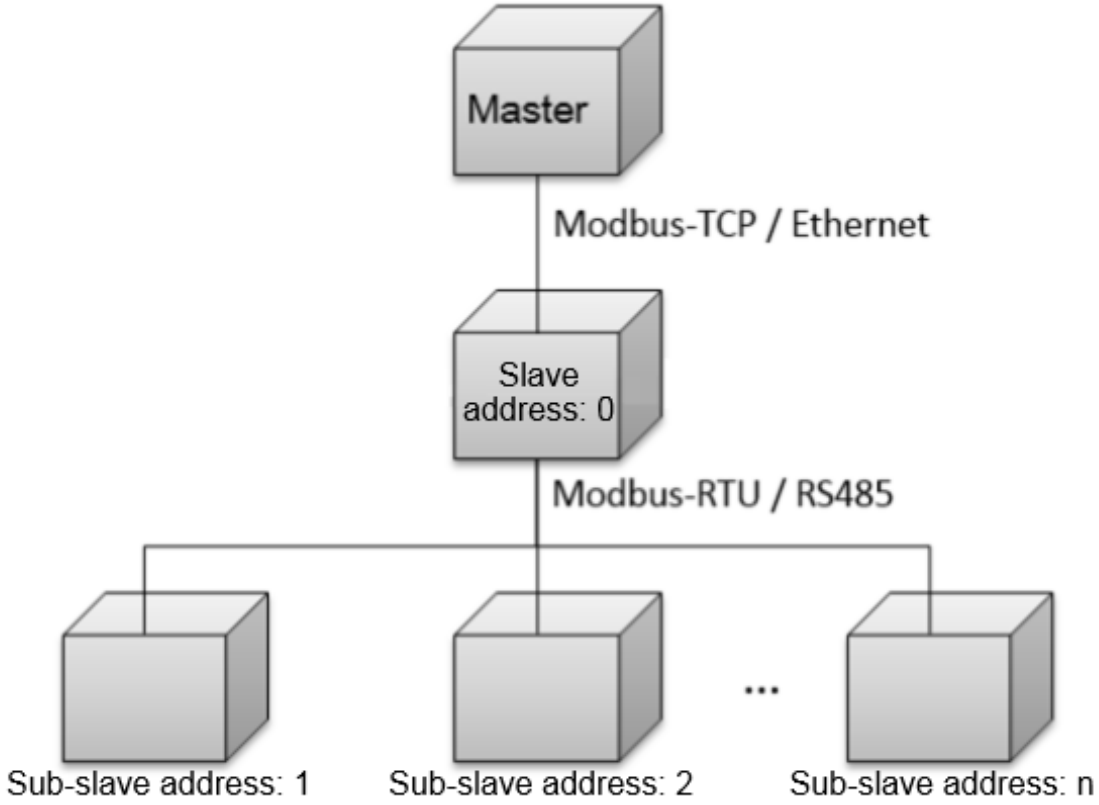
Table 6-2 MBAP definition

Data Field	Length (Byte)	Description	Client	Server
Transmission identifier	2	Matching identifier between a request frame and a response frame	Assigned by the client; better be unique for each data frame	The identifier of the response frame from the server must be consistent with that of the request frame.
Protocol type	2	0 = Modbus protocol	Assigned by the client; 0 by default	The identifier of the response frame from the server must be consistent with that of the request frame.
Data length	2	Follow-up data length	Assigned by the client based on the actual data frame	Assigned by the server based on the actual frame length
Logical device ID	1	0	Assigned by the client based on the actual data frame request	The identifier of the response frame from the server must be consistent with that of the request frame.

6.2.2.3 Communications Address

Based on the TCP communications host, unit 0 is used by default to access the directly connected slave node, and other addresses are used to access the downstream devices of the slave node. The default address of the slave node is 0. The address is adjustable.

Figure 6-5 Communications address of the three-layer object structure



6.2.2.4 TCP Port

In a local area network or VPN environment, the master node may actively initiate TCP socket link establishment to the slave node. The master node can use the 502 port to request data services from the slave node.

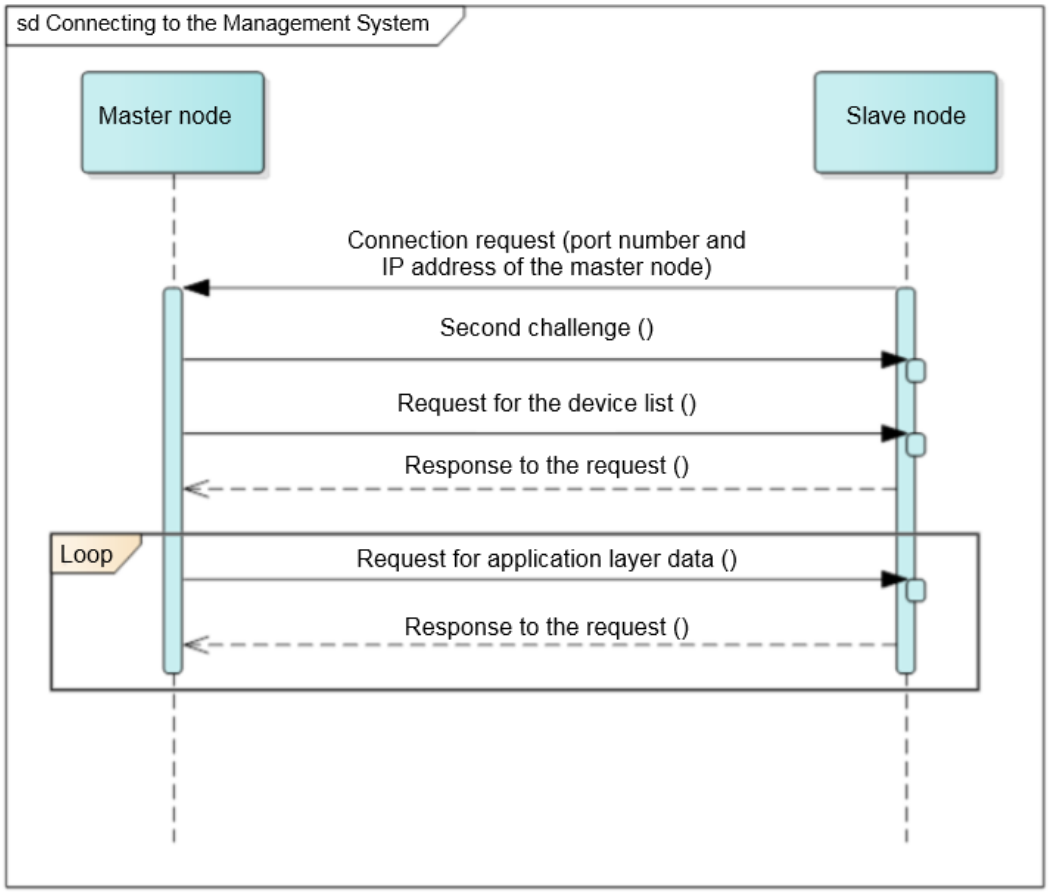
In a non-VPN environment across the public network, the device deployed on the internal network needs to initiate TCP socket link establishment to the master node exposed on the public network. In this case, you need to preset the fixed access port number of the master node on the slave node. To ensure security and reduce traffic, the master node must provide at least one encrypted port and one non-encrypted port.

6.2.2.5 TCP Link Establishment Process

This section focuses on the cross-public network application.

The following figure shows the process of connecting a slave node.

Figure 6-6 Process of establishing a secure TCP connection



6.3 Application Layer

6.3.1 Function Code List

Table 6-3 Function code list

Function Code	Meaning	Remarks
0x03	Read registers.	Continuously reads a single register or multiple registers.
0x06	Write a single register.	Writes into a single register.
0x10	Write multiple registers.	Continuously writes into multiple registers.

6.3.2 Exception Code List

The exception codes must be unique for each network element (NE) type. The names and descriptions should be provided in both the Chinese and English 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 6-4 Exception codes returned by an NE (0x00–0x8F are for common exception codes)

Code	Name	Description
0x01	Illegal function	The function code received in the query is not an allowable action for the server (or slave node). 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 (or slave node) is in the wrong state to process a request of this type, for example because it is not configured and is being asked to return register values.
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 operate on registers 96, 97, 98, 99 and 100, and there is no register with address 100.
0x03	Illegal data value	The value contained in the query data field is not an allowable value for the server (or slave). The value indicates a fault in the structure of the remainder of a complex request, such as an incorrectly implied length. 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	Slave node failure	An error occurred while the server was attempting to perform the requested action.
0x06	Slave device busy	The server cannot accept a Modbus request PDU. A client application determines whether and when to resend the request.

Code	Name	Description
0x80	No permission	An operation is not allowed because of a permission authentication failure or permission expiration.

6.3.3 Reading Registers (0x03)

6.3.3.1 Frame Format of a Request from a Master Node

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

6.3.3.2 Frame Format of a Normal Response from a Slave Node

Data Field	Length (Byte)	Description
Function code	1	0x03
Number of bytes	1	2 x N
Register value	2 x N	N/A

NOTE

N refers to the number of registers.

6.3.3.3 Frame Format of an Abnormal Response from a Slave Node

Data Field	Length (Byte)	Description
Function code	1	0x83
Exception code	1	See 6.3.2 .

6.3.3.4 Examples

This section takes the Modbus-TCP communications frames as an example. The differences between Modbus-RTU and Modbus-TCP lie in the additional address field and the CRC. Pay attention to the differences when using the Modbus-RTU frames. This also works for the follow-up examples.

The master node sends a query request (register address: 32306/0X7E32) to the slave node (logical device ID: 00).

Description		Frame Data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		06
	Logical device ID	00
Function code		03
Data	Register address	7E
		32
	Number of registers	00
		02

Normal response from the slave node

Description		Frame Data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		07
	Logical device ID	00
Function code		03
Data	Number of bytes	04
	Register data	00
		00
		00
		01

Abnormal response from the slave node

Description		Frame data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		03
	Logical device ID	00
Function code		83
Data	Error code	03

6.3.4 Writing a Single Register (0x06)

6.3.4.1 Frame Format of a Request from a Master Node

Data Field	Length (Byte)	Description
Function code	1	0x06
Register address	2	0x0000–0xFFFF
Register value	2	0x0000–0xFFFF

6.3.4.2 Frame Format of a Normal Response from a Slave Node

Data Field	Length (Byte)	Description
Function code	1	0x06
Register address	2	0x0000–0xFFFF
Register value	2	0x0000–0xFFFF

6.3.4.3 Frame Format of an Abnormal Response from a Slave Node

Data Field	Length (Byte)	Description
Function code	1	0x86

Data Field	Length (Byte)	Description
Exception code	1	See 6.3.2 .

6.3.4.4 Examples

A master node sends a command (register address: 40200/0X9D08) to a slave node (address: 00).

Description		Frame data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		06
	Logical device ID	00
Function code		06
Data	Register address	9D
		08
	Register data	00
		00

Normal response from the slave node

Description		Frame Data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		06
	Logical device ID	00
Function code		06

Description		Frame Data
Data	Register address	9D
		08
	Register data	00
		00

Abnormal response from the slave node

Description		Frame Data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		03
	Logical device ID	00
Function code		86
Data	Error code	04

6.3.5 Writing Multiple Registers (0x10)

6.3.5.1 Frame Format of a Request from a Master Node

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

NOTE

N refers to the number of registers.

6.3.5.2 Frame Format of a Normal Response from a Slave Node

Data Field	Length (Byte)	Description
Function code	1	0x10
Register address	2	0x0000–0xFFFF
Number of registers	2	0x0000–0x007b

6.3.5.3 Frame Format of an Abnormal Response from a Slave Node

Data Field	Length (Byte)	Description
Function code	1	0x90
Exception code	1	See 6.3.2 .

6.3.5.4 Examples

The master node sets the register address 40118/0X9CB6 to 2 and the register address 40119/0X9CB7 to 50 for the slave node (address: 00). The request frame format is as follows.

Description		Frame Data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		0B
	Logical device ID	00
Function code		10
Data	Register address	9C
		B6
	Number of registers	00
		02
	Number of bytes	04
	Register data	00

Description		Frame Data
		02
		00
		32

Normal response from the slave node

Description		Frame Data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		06
	Logical device ID	00
Function code		10
Data	Register address	9C
		B6
	Number of registers	00
		02

Abnormal response from the slave node

Description		Frame Data
MBAP header	Protocol identifier	00
		01
	Protocol type	00
		00
	Data length	00
		03
	Logical device ID	00
Function code		90

Description		Frame Data
Data	Error code	04

6.3.6 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 interface 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:

1. Basic device identifier: All objects of this type are mandatory, such as the vendor name, product code, and revision version.
2. Normal device identifier: Except basic data objects, the device provides additional and optional identifiers and data object description. Define all types of objects according to definitions in the standard, but the execution of this type of objects is optional.
3. Extended device identifier: In addition to the normal data objects, the device provides additional and optional identifiers and special data object description. All the data is related to the device.

Table 6-5 Reading device identifiers

Object ID	Object Name or Description	Type	Mandatory or Optional (M/O)	Type
0x00	Manufacturer name	ASCII character string	M	Basic
0x01	Product code	ASCII character string	M	
0x02	Main revision version	ASCII character string	M	
0x03–0x7F	N/A	N/A	N/A	Normal
0x80–0xFF	N/A	N/A	N/A	Expansion

6.3.6.1 Command for Querying Device Identifiers

Table 6-6 Request frame format

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

Table 6-7 Frame format for a normal response

Data Field			Length (Byte)	Description
Function code			1	0x2B
MEI type			1	0x0E
ReadDevId code			1	01
Consistency level			1	01
More			1	N/A
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 6-8 Object list

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

Table 6-9 Frame format for an abnormal response

Data Field	Length (Byte)	Description
Function code	1	0xAB
Exception code	1	See 6.3.2 .

6.3.6.2 Command for Querying a Device List

Table 6-10 Request frame format

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

Table 6-11 Frame format for a normal response

Data Field			Length (Byte)	Description
Function code			1	0x2B
MEI type			1	0x0E
ReadDevId 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 6-12 Object list

Object ID	Object Name	Type	Description
0x80–0x86	Reserved	N/A	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	Description about the first device	ASCII character string See the device description definitions.	Returns only description about the first device if a NE allows only one device to be connected to each RS485 address.
0x8A	Description about the second device	N/A	N/A
...	N/A	N/A	N/A
0xFF	Description about the 120th device	N/A	N/A

6.3.6.3 Device Description Definition

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

"Attribute ID=%s;attribute ID=%s;... attribute ID=%s"

For example: "1=SUN2000MA-XXKTL;2=V100R001C00SPC100;3=P1.0-D5.0;4=123232323;5=1;6=1.1"

Table 6-13 Attribute definition

Attribute ID	Name	Type	Description
1	Device model	ASCII character string	SUN2000
2	Device software version	ASCII character string	N/A
3	Port protocol version	ASCII character string	See the interface protocol version definitions.

Attribute ID	Name	Type	Description
4	ESN	ASCII character string	N/A
5	Device ID	int	0, 1, 2, 3...(assigned by NEs; 0 indicates the master device into which the Modbus card is inserted)
6	Feature version	ASCII character string	N/A

Table 6-14 Frame format for an abnormal response

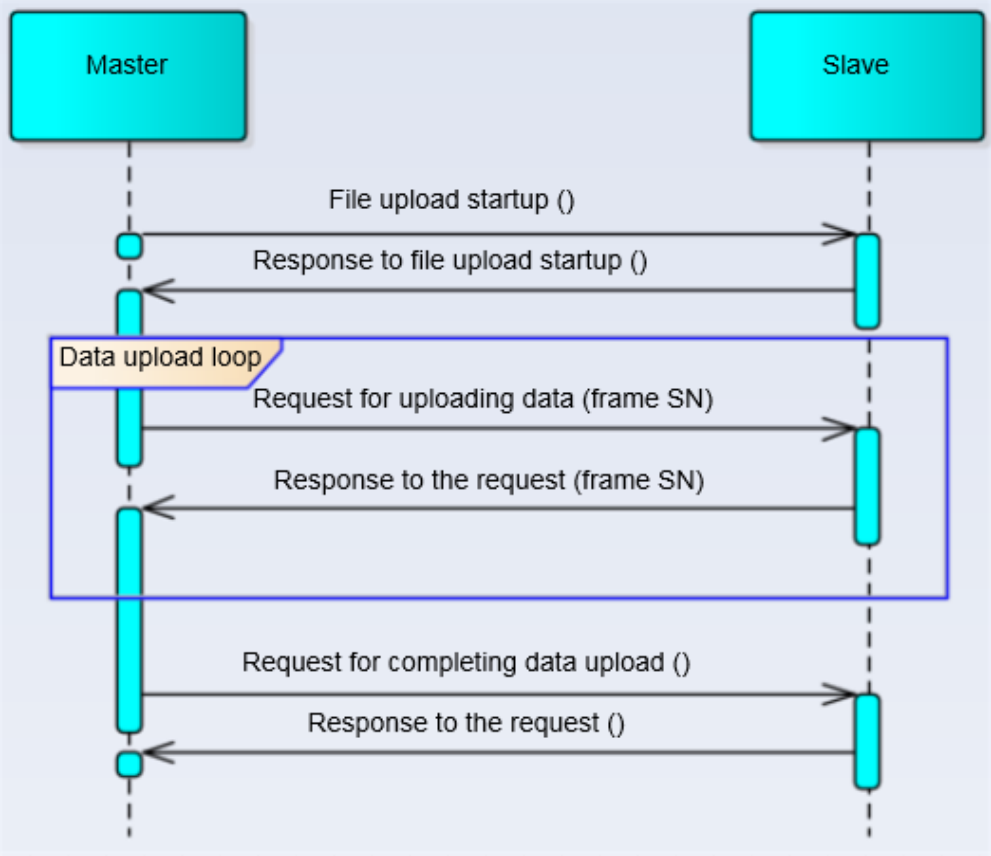
Data Field	Length (Byte)	Description
Function code	1	0xAB
Exception code	1	See 6.3.2 .

6.3.7 Huawei-defined Functions (0x41)

6.3.7.1 Uploading Files

Uploading files means uploading them by stream data from a slave node to a master node. The following figure shows the file uploading process.

Figure 6-7 File uploading process



6.3.7.1.1 Starting the Upload

Frame format of a request from a master node

Table 6-15 PDU data field of the request frame for starting upload (0x05)

PDU Data Field	Length (Byte)	Description
Function code	1	0x41
Sub-function code	1	0x05
Data length	1	1 + N
File type	1	Unique ID of a file
Customized data	N	N/A

Table 6-16 PDU data field of the response frame for starting upload (0x05)

Data Field	Length (Byte)	Description
Function code	1	0x41
Sub-function code	1	0x05
Data length	1	6 + N
File type	1	Unique ID of a file
File length	4	N/A
Data frame length	1	N/A
Customized data	N	N/A

Table 6-17 PDU data field in the abnormal response frame of the slave node

PDU Data Field	Length (Byte)	Description
Error code	1	0xC1
Exception code	1	See 6.3.2 .

NOTE

If the exception code is 0x06, resend the request after 10 seconds. A request can be resent for no more than six times.

6.3.7.1.2 Uploading Data

Table 6-18 Request frame for uploading data (0x06)

PDU Data Field	Length (Byte)	Description
Function code	1	0x41
Sub-function code	1	0x06
Data length	1	3

PDU Data Field	Length (Byte)	Description
File type	1	Unique ID of a file
Frame No.	2	0x0000–0xFFFF

Table 6-19 Response frame for uploading data (0x06)

PDU Data Field	Length (Byte)	Description
Function code	1	0x41
Sub-function code	1	0x06
Data length	1	3 + N
File type	1	N/A
Frame No.	2	0x0000–0xFFFF
Frame data	N	N/A

Table 6-20 Abnormal response frame for uploading data

PDU Data Field	Length (Byte)	Description
Error code	1	0xC1
Exception code	1	See 6.3.2 .

6.3.7.1.3 Completing the Data Upload

Table 6-21 Request frame for completing the data upload

PDU Data Field	Length (Byte)	Description
Function code	1	0x41
Sub-function code	1	0x0c
Data length	1	1
File type	1	N/A

Table 6-22 Response frame for completing the data upload

PDU Data Field	Length (Byte)	Description
Function code	1	0x41
Sub-function code	1	0x0c
Data length	1	3
File type	1	N/A
File CRC	2	N/A

Table 6-23 Abnormal response frame for completing the data upload

Data Field	Length (Byte)	Description
Error code	1	0xC1
Exception code	1	See **6.3.2 Exception Code List**.

6.3.7.1.4 Timeout Processing

Table 6-24 Processing specifications of sub-process timeout

Name	Restraints
Response timeout period for starting an upload	10s
Response timeout period for uploading data	10s
Number of times of resending a data upload command	6
Response timeout period for completing a data upload	10s

