SUN2000MA V200R024C00SPC001 Modbus Interface Definitions(V3.0)

SUN2000MA V200R024C00SPC001 Modbus Interface Definitions(V3.0)

Issue	01
Date	2024-06-17

HUAWEI

HUAWEI DIGITAL POWER TECHNOLOGIES CO., LTD.

Trademarks and Permissions


and other Huawei trademarks are the property of Huawei Technologies Co., Ltd.
All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between Huawei Digital Power Technologies Co., Ltd. and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied. The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.

Huawei Digital Power Technologies Co., Ltd.

Address: Huawei Digital Power Antuoshan Headquarters

Futian, Shenzhen 518043

People's Republic of China

Website: https://e.huawei.com

Contents

1 Supported Models

1.1 Model Description

Table 1-1 Supported models and firmware versions

Model	Model ID	Earliest Firm Version
SUN2000_5K_MAP0	1001	V200R024C00
SUN2000_6K_MAP0	1002	V200R024C00
SUN2000_8K_MAP0	1003	V200R024C00
SUN2000_10K_MAP0	1004	V200R024C00
SUN2000_10K_MAP0_BE	1005	V200R024C00
SUN2000_12K_MAP0	1006	V200R024C00
SUN2000_5K_MAP0_ZH	1007	V200R024C00
SUN2000_6K_MAP0_ZH	1008	V200R024C00
SUN2000_8K_MAP0_ZH	1009	V200R024C00
SUN2000_10K_MAP0_ZH	1010	V200R024C00
SUN2000_12K_MAP0_ZH	1011	V200R024C00
SUN5000_8K_MAP0	1012	V200R024C00
SUN5000_12K_MAP0	1013	V200R024C00

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.

SUN2000MA V200R024C00SPC001 Modbus Interface Definitions(V3.0)

2 Overview

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)
STR	Character string
MLD	Multiple bytes
Bitfield16	16-bit data expressed by bit
Bitfield32	32-bit data expressed by bit
N/A	Not applicable
s	Second

SUN2000MA V200R024C00SPC001 Modbus Interface Definitions(V3.0)

Name	Description
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

SUN2000MA V200R024C00SPC001 Modbus Interface Definitions(V3.0)

3 Register Definitions

No.	Signal Name	Read / Write	Type	Unit	Gain	Address	Quantity	Scope
1	Model	RO	STR			30000	15	Nameplate name of the device, which was **Model name** in the earlier version.
2	SN	RO	STR			30015	10	Device serial number, which comes from the electronic label of the system.
3	PN	RO	STR			30025	10	Product code
4	Firmware version	RO	STR			30035	15	Character string reported: initial version VX00R00X (VR version by default); difference in certification registration: VX00R00XD01, VX00R00XD02... (D0X is provided by test and certification personnel); subject to change with country codes.
5	Software version	RO	STR			30050	15	V200R023C10SPCXXX. The offering name and software version are combined on the display page.
6	Protocol version [Modbus]	RO	U32			30068	2	High-order characters: main version; upgrade in case of incompatible changes; low-order characters: revision; upgrade in case of compatible changes; baseline version: D8.0; 0x00080000

7	Model ID	RO	U16			30070	1	
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 (P_{max})	RO	U32	kW	1000	30075	2	Read-only interface of 42027
12	Maximum apparent power (S_{max})	RO	U32	kVA	1000	30077	2	Read-only interface of 42025
13	Real-time maximum reactive power (Q_{max}, fed to the power grid)	RO	I32	kVar	1000	30079	2	Reported to the monitoring module to indicate the reactive power adjustment range. Except for model differences, feature data is updated when the grid code or derating changes.
14	Real-time maximum reactive power (–Q_{max}, absorbed from the power grid)	RO	I32	kVar	1000	30081	2	Reported to the monitoring module to indicate the reactive power adjustment range. Except for model differences, feature data is updated when the grid code or derating changes.

15	Maximum active power (P_{max_real})	RO	U32	kW	1000	30083	2	The default maximum active power is fixed on the nameplate of the device and will not change for the device. It is used as the upper limit of the reference range (42027). The relationship is as follows: $0 < P_{max} \le S_{max} \le P_{max\_real} \le S_{max\_real}$ or $0 < P_{max} \le P_{max\_real} \le S_{max} \le S_{max\_real}$.
16	Maximum apparent power (S_{max_real})	RO	U32	kVA	1000	30085	2	The default maximum apparent power is fixed on the nameplate of the device and will not change for the device. It is used as the upper limit of the reference range (42025). The relationship is as follows: $0 < P_{max} \le S_{max} \le P_{max\_real} \le S_{max\_real}$ or $0 < P_{max} \le P_{max\_real} \le S_{max} \le S_{max\_real}$.
17	Offering name	RO	STR			30089	15	Reported to FusionSolar; empty value for OEM devices; not displayed on the customer UI; used for combination with the software version.
18	Product sales area	RO	STR			30105	2	XX: two uppercase letters, indicating the sales area or application area of the product. It is related to the AC power system. CN: Chinese Mainland; EU: Europe; JP: Japan; US: North America (United States/ Canada/areas with the same power grid or certification requirements as the United States); UK: United Kingdom; default - CN/EU: all areas where CE certification requirements are applicable. See *Huawei FusionSolar Smart PV Solution and Product Naming Specifications*.

19	Product software ID	RO	U16			30107	1	Unique ID of the software release entity; used for processing the compatibility of grid codes.
20	Product software version	RO	U16			30108	1	Sequence number of the version released by the software release entity; used for processing the compatibility of grid codes.
21	Grid code protocol version	RO	U16			30109	1	Protocol loading and verification are similar to those in CAN1.0 and CAN2.0.
22	Unique software ID	RO	U16			30110	1	Unique ID of a software version. Upgrade packages with different IDs cannot be used for upgrade between each other. (Broadcast upgrade feature code)
23	Quantity of subpackages in the upgrade package	RO	U16		1	30111	1	Considering the increasing number of southbound devices to be upgraded, sufficient upgrade packages must be reserved.
24	Subpackage 1 information	RO	U32			30112	2	High-order characters: file type ID; low-order characters: device type ID
25	Subpackage 2 information	RO	U32			30114	2	High-order characters: file type ID; low-order characters: device type ID
26	Subpackage 3 information	RO	U32			30116	2	High-order characters: file type ID; low-order characters: device type ID
27	Subpackage 4 information	RO	U32			30118	2	High-order characters: file type ID; low-order characters: device type ID
28	Subpackage 5 information	RO	U32			30120	2	High-order characters: file type ID; low-order characters: device type ID

29	Subpackage 6 information	RO	U32			30122	2	High-order characters: file type ID; low-order characters: device type ID
30	Subpackage 7 information	RO	U32			30124	2	High-order characters: file type ID; low-order characters: device type ID
31	Subpackage 8 information	RO	U32			30126	2	High-order characters: file type ID; low-order characters: device type ID
32	Subpackage 9 information	RO	U32			30128	2	High-order characters: file type ID; low-order characters: device type ID
33	Subpackage 10 information	RO	U32			30130	2	High-order characters: file type ID; low-order characters: device type ID
34	Software package name	RO	STR			30136	30	FusionSolar_V800R021C10SPCXXX_SUN2000: empty value for OEM devices; not displayed on the customer UI
35	Hardware functional unit configuration ID	RO	Bitfield16			30206	1	Indicates whether an optional hardware functional unit is configured. 0: no 1: yes
36	Subdevice support flag	RO	Bitfield32			30207	2	
37	Subdevice presence flag	RO	Bitfield32			30209	2	
38	Feature code 1	RO	E16			30211	2	
39	Feature code 2	RO	E16			30213	2	

40	Feature code 3	RO	E16			30215	2	
41	Feature code 4	RO	E16			30217	2	
42	Grid code mask 1	RO	E16			30219	1	
43	Grid code mask 2	RO	E16			30220	1	
44	Grid code mask 3	RO	E16			30221	1	
45	Grid code mask 4	RO	E16			30222	1	
46	Grid code mask 5	RO	E16			30223	1	
47	Grid code mask 6	RO	E16			30224	1	
48	Grid code mask 7	RO	E16			30225	1	
49	Grid code mask 8	RO	E16			30226	1	
50	Grid code mask 9	RO	E16			30227	1	
51	Grid code mask 10	RO	E16			30228	1	
52	Grid code mask 11	RO	E16			30229	1	
53	Grid code mask 12	RO	E16			30230	1	

54	Grid code mask 13	RO	E16			30231	1	
55	Grid code mask 14	RO	E16			30232	1	
56	Grid code mask 15	RO	E16			30233	1	
57	Grid code mask 16	RO	E16			30234	1	
58	Grid code mask 17	RO	E16			30235	1	
59	Grid code mask 18	RO	E16			30236	1	
60	Grid code mask 19	RO	E16			30237	1	
61	Grid code mask 20	RO	E16			30238	1	
62	Grid code mask 21	RO	E16			30239	1	
63	Grid code mask 22	RO	E16			30240	1	
64	Grid code mask 23	RO	E16			30241	1	
65	Grid code mask 24	RO	E16			30242	1	
66	Grid code mask 25	RO	E16			30243	1	
67	Grid code mask 26	RO	E16			30244	1	

68	Grid code mask 27	RO	E16			30245	1	
69	Grid code mask 28	RO	E16			30246	1	
70	Grid code mask 29	RO	E16			30247	1	
71	Grid code mask 30	RO	E16			30248	1	
72	Grid code mask 31	RO	E16			30249	1	
73	Grid code mask 32	RO	E16			30250	1	
74	Feature code 5	RO	E16			30282	2	
75	Level-1 parameter mask 1 (monitoring)	RO	E16			30300	1	
76	Level-1 parameter mask 2 (monitoring)	RO	E16			30301	1	
77	Level-1 parameter mask 3 (monitoring)	RO	E16			30302	1	
78	Level-1 parameter mask 4 (monitoring)	RO	E16			30303	1	

79	Level-1 parameter mask 5 (monitoring)	RO	E16			30304	1	
80	Level-1 parameter mask 6 (monitoring)	RO	E16			30305	1	
81	Level-1 parameter mask 7 (monitoring)	RO	E16			30306	1	
82	Level-1 parameter mask 8 (monitoring)	RO	E16			30307	1	
83	Level-1 parameter mask 1 (DSP)	RO	E16			30308	1	
84	Level-1 parameter mask 2 (DSP)	RO	E16			30309	1	
85	Level-1 parameter mask 3 (DSP)	RO	E16			30310	1	
86	Level-1 parameter mask 4 (DSP)	RO	E16			30311	1	
87	Level-1 parameter mask 5 (DSP)	RO	E16			30312	1	

88	Level-1 parameter mask 6 (DSP)	RO	E16			30313	1	
89	Level-1 parameter mask 7 (DSP)	RO	E16			30314	1	
90	Level-1 parameter mask 8 (DSP)	RO	E16			30315	1	
91	Level-1 parameter mask 9 (DSP)	RO	E16			30316	1	
92	Level-1 parameter mask 10 (DSP)	RO	E16			30317	1	
93	Level-1 parameter mask 11 (DSP)	RO	E16			30318	1	
94	Level-1 parameter mask 12 (DSP)	RO	E16			30319	1	
95	Level-1 parameter mask 13 (DSP)	RO	E16			30320	1	
96	Level-1 parameter mask 14 (DSP)	RO	E16			30321	1	
97	Level-1 parameter mask 15 (DSP)	RO	E16			30322	1	
98	Level-1 parameter mask 16 (DSP)	RO	E16			30323	1	

99	Level-1 parameter mask 9 (monitoring)	RO	E16			30340	1	
100	Level-1 parameter mask 10 (monitoring)	RO	E16			30341	1	
101	Battery parameter mask 1 (monitoring)	RO	E16			30348	1	
102	PID parameter mask 1	RO	E16			30350	1	
103	Last login time [app]; [administrator, preset, installer]	RO	Epoch seconds	s	1	30352	2	Last successful login time of the admin account on the app.
104	Last login time [app]; [common user, preset, user]	RO	Epoch seconds	s	1	30354	2	Last successful login time of an advanced user account on the app.
105	Inverter hardware version	RO	STR		1	31000	15	
106	Monitoring board SN	RO	STR			31015	10	Electronic label of the monitoring board

107	Monitoring software version	RO	STR			31025	15	MCU1 version
108	Master DSP version	RO	STR			31040	15	MCU2 version
109	Slave DSP version	RO	STR			31055	15	MCU3 version
110	CPLD version	RO	STR			31070	15	MCU4 version
111	AFCI version	RO	STR			31085	15	MCU5 version
112	Built-in PID	RO	STR			31100	15	MCU6 version
113	AFCI_M4 software version	RO	STR			31145	15	MCU9 version
114	Registration code	RO	E16			31200	10	
115	[Teleindication] Signal-node remote communication	RO	Bitfield16			32000	1	Reported through IEC 104, merged PCS running status
116	[Teleindication] Running status (monitor processing)	RO	Bitfield16			32002	1	

117	[Teleindication] Running status (power processing)	RO	Bitfield32		1	32003	2	
118	[Teleindication] Alarm 1	RO	Bitfield16			32008	1	
119	[Teleindication] Alarm 2	RO	Bitfield16			32009	1	
120	[Teleindication] Alarm 3	RO	Bitfield16			32010	1	
121	[Teleindication] Alarm 4	RO	Bitfield16			32011	1	
122	Device SN feature code	RO	U16			32015	1	CRC16 value of the SN, which is the key data ID. It is used to prevent the energy yield data from being incorrectly modified due to incorrect energy yield reported by devices with the same address. The CRC value of the SN is added to ensure that the energy yield source is correct.

123	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 power parameter mask 14 is 1, the following logic applies: When DC input display mode 30205 is 0, the signal name is PV1 voltage. When DC input display mode 30205 is 1, the signal name is MPPT1 voltage.
124	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 applies: When DC input display mode 30205 is 0, the signal name is PV1 current. When DC input display mode 30205 is 1, the signal name is MPPT1 current.
125	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 power parameter mask 14 is 1, the following logic applies: When DC input display mode 30205 is 0, the signal name is PV2 voltage. When DC input display mode 30205 is 1, the signal name is MPPT2 voltage.
126	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 power parameter mask 14 is 1, the following logic applies: When DC input display mode 30205 is 0, the signal name is PV2 current. When DC input display mode 30205 is 1, the signal name is MPPT2 current.

127	PV3 voltage	RO	I16	V	10	32020	1	
128	PV3 current	RO	I16	A	100	32021	1	
129	PV4 voltage	RO	I16	V	10	32022	1	
130	PV4 current	RO	I16	A	100	32023	1	
131	PV5 voltage	RO	I16	V	10	32024	1	
132	PV5 current	RO	I16	A	100	32025	1	
133	PV6 voltage	RO	I16	V	10	32026	1	
134	PV6 current	RO	I16	A	100	32027	1	
135	Total input power	RO	I32	kW	1000	32064	2	
136	A-B line voltage of grid	RO	U16	V	10	32066	1	When the output mode is L/N, the signal name is Grid voltage. When the output mode is L1/L2/N or L1/L2, the signal name is UW grid voltage.
137	B-C line voltage of grid	RO	U16	V	10	32067	1	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
138	C-A line voltage of grid	RO	U16	V	10	32068	1	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.

139	Phase A voltage of grid	RO	U16	V	10	32069	1	This parameter is invalid when the output mode is L/N. When the output mode is L1/L2/N or L1/L2, the signal name is UO grid voltage. This parameter is not displayed in off-grid mode.
140	Phase B voltage of grid	RO	U16	V	10	32070	1	This parameter is invalid when the output mode is L/N. When the output mode is L1/L2/N or L1/L2, the signal name is WO grid voltage. This parameter is not displayed in off-grid mode.
141	Phase C voltage of grid	RO	U16	V	10	32071	1	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
142	Phase A current of grid	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.
143	Phase B current of grid	RO	I32	A	1000	32074	2	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
144	Phase C current of grid	RO	I32	A	1000	32076	2	This parameter is invalid when the output mode is L/N, L1/L2/N, or L1/L2.
145	Today's peak active power	RO	I32	kW	1000	32078	2	
146	Active power	RO	I32	kW	1000	32080	2	
147	Reactive power	RO	I32	kVar	1000	32082	2	
148	Power factor	RO	I16		1000	32084	1	

149	Grid frequency	RO	U16	Hz	100	32085	1	
150	Inverter efficiency	RO	U16	%	100	32086	1	Indicates the power generation efficiency when the PCS is used for power generation or the absorption efficiency when the PCS is used for power absorption.
151	Internal temperature	RO	I16	°C	10	32087	1	
152	Insulation resistance	RO	U16	MΩ	1000	32088	1	
153	Device status	RO	E16			32089	1	For details, see the *Inverter Key Signal Extension Description*.
154	Error code	RO	U16			32090	1	Fault code corresponding to the alarm with the highest priority. For details, see the Alarm Description sheet.
155	Startup time	RO	Epoch seconds	s	1	32091	2	Calculated by the monitoring module
156	Shutdown time	RO	Epoch seconds	s	1	32093	2	Calculated by the monitoring module
157	Total yield	RO	U32	kWh	100	32106	2	
158	Total DC input energy	RO	U32	kWh	100	32108	2	

159	Statistical time of current energy yield	RO	Epoch seconds	s	1	32110	2	
160	Energy yield in current hour	RO	U32	kWh	100	32112	2	
161	Yield today	RO	U32	kWh	100	32114	2	
162	Yield this month	RO	U32	kWh	100	32116	2	
163	Yield this year	RO	U32	kWh	100	32118	2	
164	Inverter phase-A active power	RO	I32	kWh	1000	32133	2	
165	Inverter phase-B active power	RO	I32	kWh	1000	32135	2	
166	Inverter phase-C active power	RO	I32	kWh	1000	32137	2	
167	Alarm clearance SN	RO	U16			32155	1	After an alarm is cleared locally, the SN increases by 1. After the alarm is inverted, the SN skips 0 and starts from 1.
168	Statistical time of energy in the previous hour	RO	Epoch seconds	s	1	32156	2	Including generated energy/ absorbed energy

169	Energy generated in the previous hour	RO	U32	kWh	100	32158	2	
170	Statistical time of energy in the previous day	RO	Epoch seconds	s	1	32160	2	Including generated energy/ absorbed energy
171	Energy yield in the previous day	RO	U32	kWh	100	32162	2	
172	Statistical time of energy in the previous month	RO	Epoch seconds	s	1	32164	2	Including generated energy/ absorbed energy
173	Energy yield in the previous month	RO	U32	kWh	100	32166	2	
174	Statistical time of energy in the previous year	RO	Epoch seconds	s	1	32168	2	Including generated energy/ absorbed energy
175	Energy yield in the previous year	RO	U32	kWh	100	32170	2	
176	SN of the latest active alarm	RO	U32			32172	2	When a new active alarm is generated, the SN increases by 1.

177	SN of the latest historical alarm	RO	U32			32174	2	When an active alarm is moved to the historical alarm list, the SN of the historical alarm is the same as that of the last active alarm transferred to the historical alarm list.
178	Total bus voltage	RO	I16	V	10	32176	1	Reported by the PID module; used in single-stage scenarios.
179	Highest PV voltage	RO	I16	V	10	32177	1	Reported by the PID module; used in single-stage scenarios.
180	Lowest PV voltage	RO	I16	V	10	32178	1	Reported by the PID module; used in single-stage scenarios.
181	Average voltage between PV– and ground	RO	I16	V	10	32179	1	Reported by the PID module; used in single-stage scenarios.
182	Highest voltage between PV+ and ground	RO	I16	V	10	32180	1	Reported by the PID module; used in single-stage scenarios.
183	Lowest voltage between PV– and ground	RO	I16	V	10	32181	1	Reported by the PID module; used in single-stage scenarios.
184	Inverter-PE withstand voltage	RO	U16	V	1	32182	1	Reported by the PID module; used in single-stage scenarios. To be compatible with PID2.0, the PCS reports 1502. 0: 1000/1100 V inverter; 1500: HAV1 inverter; 1502: HAV2 inverter.
185	ISO characteristic information	RO	Bitfield16		1	32183	1	Reported by the PID module; used in single-stage scenarios.

186	Running status of built-in PID	RO	E16			32190	1	
187	PV–voltage to ground	RO	I16	V	10	32191	1	
188	MPPT 1 DC total yield	RO	U32	kWh	100	32212	2	Displayed on the management system UI of TD Tech [5 points and 4 lines]
189	MPPT 2 DC total yield	RO	U32	kWh	100	32214	2	Displayed on the management system UI of TD Tech [5 points and 4 lines]
190	MPPT 3 DC total yield	RO	U32	kWh	100	32216	2	Displayed on the management system UI of TD Tech [5 points and 4 lines]
191	MPPT 4 DC total yield	RO	U32	kWh	100	32218	2	Displayed on the management system UI of TD Tech [5 points and 4 lines]
192	Monitoring alarm 1	RO	Bitfield16			32252	1	GroupID: 0xFF00
193	Monitoring alarm 2	RO	Bitfield16			32253	1	GroupID: 0xFF01
194	Monitoring alarm 3	RO	Bitfield16			32254	1	GroupID: 0xFF02
195	[External] Power alarm 1	RO	Bitfield16			32255	1	GroupID: 0x0000

196	[External] Power alarm 2	RO	Bitfield16			32256	1	GroupID: 0x0001
197	[External] Power alarm 3	RO	Bitfield16			32257	1	GroupID: 0x0002
198	[External] Power alarm 4	RO	Bitfield16			32258	1	GroupID: 0x0003
199	[External] Power alarm 5	RO	Bitfield16			32259	1	GroupID: 0x0004
200	[External] Power alarm 6	RO	Bitfield16			32260	1	GroupID: 0x0005
201	[External] Power alarm 7	RO	Bitfield16			32261	1	GroupID: 0x0006
202	[External] Power alarm 8	RO	Bitfield16			32262	1	GroupID: 0x0007
203	[External] Power alarm 9	RO	Bitfield16			32263	1	GroupID: 0x0008
204	[External] Power alarm 10	RO	Bitfield16			32264	1	GroupID: 0x0009

205	[External] Power alarm 11	RO	Bitfield16			32265	1	GroupID: 0x000A
206	[External] Power alarm 12	RO	Bitfield16			32266	1	GroupID: 0x000B
207	[External] Power alarm 13	RO	Bitfield16			32267	1	GroupID: 0x000C
208	Built-in PID alarm	RO	Bitfield16			32268	1	GroupID: 0x000D
209	[External] Power alarm 15	RO	Bitfield16			32269	1	GroupID: 0x000E
210	Monitoring alarm 4	RO	Bitfield16			32271	1	GroupID: 0xFF03
211	Monitoring alarm 5	RO	Bitfield16			32272	1	GroupID: 0xFF04
212	Monitoring alarm 6	RO	Bitfield16			32274	1	GroupID: 0xFF05
213	MPPT1 total input power	RO	U32	kW	1000	32324	2	

214	MPPT2 total input power	RO	U32	kW	10000	32326	2	
215	MPPT3 total input power	RO	U32	kW	10000	32328	2	
216	MPPT4 total input power	RO	U32	kW	10000	32330	2	
217	MPPT 5 total input power	RO	U32	kW	10000	32332	2	
218	MPPT 6 total input power	RO	U32	kW	10000	32334	2	
219	MPPT 7 total input power	RO	U32	kW	10000	32336	2	
220	MPPT 8 total input power	RO	U32	kW	10000	32338	2	
221	MPPT9 total input power	RO	U32	kW	10000	32340	2	
222	PV25 voltage	RO	I16	V	10	32344	1	
223	PV25 current	RO	I16	A	100	32345	1	
224	PV26 voltage	RO	I16	V	10	32346	1	
225	PV26 current	RO	I16	A	100	32347	1	

226	PV27 voltage	RO	I16	V	10	32348	1	
227	PV27 current	RO	I16	A	100	32349	1	
228	PV28 voltage	RO	I16	V	10	32350	1	
229	PV28 current	RO	I16	A	100	32351	1	
230	Capacitor group runtime	RO	U32	hour	10	35000	2	Used for inspection data
231	Internal fan 1 runtime	RO	U32	hour	10	35002	2	Used for inspection data
232	Internal fan 2 runtime	RO	U32	hour	10	35004	2	Used for inspection data
233	Internal fan 3 runtime	RO	U32	hour	10	35006	2	Used for inspection data
234	Internal fan 4 runtime	RO	U32	hour	10	35008	2	Used for inspection data
235	Internal alarm	RO	U16	V	1	35010	1	Stored as R&D data
236	Internal temperature 1	RO	I16	°C	10	35021	1	Temperature of inverter module A; recorded as R&D 5-minute data
237	Internal temperature 2	RO	I16	°C	10	35022	1	Temperature of inverter module B; recorded as R&D 5-minute data
238	Internal temperature 3	RO	I16	°C	10	35023	1	Temperature of inverter module C; recorded as R&D 5-minute data
239	Internal temperature 4	RO	I16	°C	10	35024	1	Sampled temperature of reverse polarity prevention module 1; recorded as R&D 5-minute data

240	Internal temperature 5	RO	I16	°C	10	35025	1	Ambient temperature of the output board relay - highest temperature; recorded as R&D 5-minute data
241	Internal temperature 6	RO	I16	°C	10	35026	1	Sampled temperature of the output board, power board input, and power board inverter – highest temperature; recorded as R&D 5-minute data
242	Internal temperature 7	RO	I16	°C	10	35027	1	Sampled temperature of reverse polarity prevention module 2; recorded as R&D 5-minute data
243	Internal temperature 8	RO	I16	°C	10	35028	1	DC terminal temperature 1/2: highest temperature, recorded as R&D 5-minute data
244	Internal temperature 9	RO	I16	°C	10	35029	1	AC terminal temperature 1/2/3: highest temperature, recorded as R&D 5-minute data
245	Internal temperature 10	RO	I16	°C	10	35030	1	Stored as R&D data
246	Internal temperature 11	RO	I16	°C	10	35031	1	Stored as R&D data
247	Internal temperature 12	RO	I16	°C	10	35032	1	Stored as R&D data
248	Phase A DC component DCI	RO	I16	A	10000	35038	1	Recorded as R&D 5-minute data
249	Phase B DC component DCI	RO	I16	A	10000	35039	1	Recorded as R&D 5-minute data
250	Phase C DC component DCI	RO	I16	A	10000	35040	1	Recorded as R&D 5-minute data

251	Leakage current RCD	RO	I16	mA	1	35041	1	Recorded as R&D 5-minute data
252	Positive bus voltage	RO	I16	V	10	35042	1	Recorded as R&D 5-minute data
253	Negative bus voltage	RO	I16	V	10	35043	1	Recorded as R&D 5-minute data
254	Voltage between bus– and ground	RO	I16	V	10	35044	1	Recorded as R&D 5-minute data
255	I-V curve scanning status	RO	E16			35094	1	
256	I-V curve scanning capability	RO	E16			35095	1	
257	Delayed activation status	RO	E16			35115	1	
258	Active power adjustment status	RO	MLD			35300	4	For details, see the description of "Structure Data."
259	Reactive power adjustment status	RO	MLD			35304	4	For details, see the description of "Structure Data."
260	Meter status	RO	E16			37100	1	
261	Grid voltage (grid phase A voltage)	RO	I32	V	10	37101	2	
262	Phase B voltage of grid	RO	I32	V	10	37103	2	

263	Phase C voltage of grid	RO	I32	V	10	37105	2	
264	Grid current (grid phase A current)	RO	I32	A	100	37107	2	
265	Phase B current of grid	RO	I32	A	100	37109	2	
266	Phase C current of grid	RO	I32	A	100	37111	2	
267	Active power	RO	I32	W	1	37113	2	
268	Reactive power	RO	I32	Var	1	37115	2	
269	Power factor	RO	I16		1000	37117	1	
270	Grid frequency	RO	I16	Hz	100	37118	1	
271	Positive active power	RO	I32	kWh	100	37119	2	
272	Reverse active power	RO	I32	kWh	100	37121	2	
273	Cumulative reactive energy	RO	I32	kVarh	100	37123	2	
274	Meter type	RO	E16			37125	1	
275	A-B line voltage	RO	I32	V	10	37126	2	

276	B-C line voltage	RO	I32	V	10	37128	2	
277	C-A line voltage	RO	I32	V	10	37130	2	
278	Phase A active power	RO	I32	W	1	37132	2	
279	Phase B active power	RO	I32	W	1	37134	2	
280	Phase C active power	RO	I32	W	1	37136	2	
281	Meter type check	RO	E16			37138	1	
282	Inverter overall status	RO	Bitfield16			37518	1	
283	Inverter overall status support flag	RO	U16		1	37519	1	
284	System time [local time]	RW	Epoch seconds	s	1	40000	2	The data is in epoch seconds of the local time.
285	Q-U characteristic curve mode	RW	E16			40037	1	

286	Power percentage for triggering Q-U scheduling	RW	I16	%	1	40038	1	
287	Fixed active power derating	RW	U16	kW	10	40120	1	
288	Power factor	RW	I16		1000	40122	1	
289	Reactive power compensation (Q/S) [low precision]	RW	I16		1000	40123	1	The device converts the value to a fixed value of Q for reactive power control. S indicates S_{max}.
290	Reactive power adjustment time	RW	U16	s	1	40124	1	Change requirement: The "Reactive power adjustment time" broadcast interface should be added to the delivery UI of the Q-P characteristic curve and cosphi-P characteristic curve, which is the same as the Q-U characteristic curve 20190918.
291	Active power derating by percentage [low precision]	RW	I16	%	10	40125	1	Interface for fine adjustment of active power
292	Fixed active power derating	RW	U32	W	1	40126	2	Scope: [0, P_{max}]

293	Reactive power compensation at night (Q/S)	RW	I16		1000	40128	1	The device converts the value to a fixed value of Q for reactive power control. S indicates S_{max}.
294	Fixed nighttime reactive power	RW	I32	kVar	1000	40129	2	
295	cosϕ-P/Pn characteristic curve	RW	MLD			40133	21	See the *Inverter Key Signal Extension Description*.
296	Q-U characteristic curve	RW	MLD			40154	21	See the *Inverter Key Signal Extension Description*.
297	PF-U characteristic curve	RW	MLD			40175	21	See the *Inverter Key Signal Extension Description*.
298	[Characteristic curve] Reactive power adjustment time	RW	U16	s	1	40196	1	Change requirement: The "Reactive power adjustment time" broadcast interface should be added to the delivery UI of the Q-P characteristic curve and cosphi-P characteristic curve, which is the same as the Q-U characteristic curve 20190918.
299	Apparent power in percentage	RW	U16	%	10	40197	1	Used for overtemperature derating with the STS
300	Power percentage for exiting Q-U scheduling	RW	I16	%	1	40198	1	

301	Active power percentage control [low precision]	RW	I16	%	10	40199	1	Used in distributed mode. The active power percentage control interface is delivered to the power software in backflow prevention control to control the upper limit of the output active power during underfrequency-caused power raising.
302	Startup	WO	E16			40200	1	
303	Shutdown	WO	E16			40201	1	
304	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 responds to the northbound port and resets 3s later. The device does not restart if the reply fails.
305	Q-P characteristic curve	RW	MLD			40354	21	See the *Inverter Key Signal Extension Description*.
306	Minimum PF of Q-U characteristic curve	RW	U16		1000	40375	1	This interface is used to limit the output reactive power of the Q-U curve by limiting the current PF value. For the country codes for which this function is not required, the value is set to 0 by default, indicating that the reactive power output is not limited. EN 50549 requires that the value ranges from 0 to 1 and is 0.9 by default.

307	Delay for Q-U characteristic curve to take effect	RW	U16	s	1	40376	1	After the voltage value on the Q-U curve reaches the trigger voltage, the reactive power changes after a delay time. Italy CEI0-16/21 requires that the default value be 3s, indicating that the Q-U curve takes effect 3s after the trigger voltage is reached. The delay can be set on the UI. For other country codes, the default value is 0.
308	Grid code	RW	U16		1	42000	1	CHINA_MV800. For details about the value range, see the *Grid Codes*.
309	Output mode	RW	E16			42001	1	Displayed as a read-only signal on the customer UI. Currently, the 8.0 PCS supports only the three-phase three-wire system and the parameter does not need to be set. If the setting is supported, an interface change notification will be sent to each UI involved.
310	Voltage level	RW	U16	V	1	42002	1	Vn
311	Frequency level	RW	U16	Hz	1	42003	1	Fn
312	Remote power scheduling	RW	E16			42014	1	If this parameter is disabled, the inverter is locked.
313	Reactive power change gradient	RW	U32	%/s	1000	42015	2	
314	Active power change gradient	RW	U32	%/s	1000	42017	2	Limits the speed of power change caused by a power scheduling command.
315	Schedule instruction valid duration	RW	U32	s	1	42019	2	The value 0 indicates that the command is valid permanently.

316	Maximum apparent power	RW	U32	kVA	1000	42021	2	[Maximum active power, S_{max}]
317	Maximum active power	RW	U32	kW	1000	42023	2	[0.1,P_{max}]
318	Apparent power baseline	RW	U32	kVar	1000	42025	2	Sn. Upper limit of the maximum active power (P_{max}); also used as the reference for reactive power scheduling (Q/S).
319	Active power baseline	RW	U32	kW	1000	42027	2	Lower limit of the maximum apparent power (S_{max}); also used as the reference for active scheduling (percentage).
320	Plant active power gradient	RW	U16	min/100%	1	42029	1	According to Chinese standards, the active power change caused by irradiance fluctuation must meet certain speed requirements when the device is running properly.
321	Average active power filtering time	RW	U32	ms	1	42030	2	
322	PF-U voltage detection filter time	RW	U16	s	10	42032	1	
323	Frequency detection filter time	RW	U16	ms	1	42037	1	
324	Recovery delay of frequency-based active power derating	RW	U16	s	1	42040	1	

325	Execution delay of frequency-based active power derating	RW	U16	ms	1	42041	1	
326	Hysteresis of frequency-based active power derating	RW	E16			42042	1	
327	Response deadband of frequency-based control	RW	U16	Hz	1000	42043	1	
328	On/Off-grid switching mode	RW	E16			42044	1	
329	Off-grid mode	RW	E16			42045	1	
330	PQ mode	RW	E16			42046	1	
331	PV module type	RW	E16			42047	1	
332	PID compensation direction	RW	E16			42048	1	
333	String connection mode	RW	E16			42049	1	

334	Isolation settings	RW	E16			42050	1	Displayed as a read-only signal on the customer UI. Currently, 8.0 PCS supports only "input not grounded, with transformer" and the parameter does not need to be set. If the setting is supported, an interface change notification will be sent to each UI involved.
335	Power change gradient of frequency-based control	RW	U16	%/min	1	42051	1	
336	Power change limit of frequency-based control	RW	U16	%	10	42052	1	
337	Delay response time of frequency-based control	RW	U16	ms	1	42053	1	This parameter is required in Poland and can be set. Initial delay in the frequency sensitive mode
338	MPPT multi-peak scanning	RW	E16			42054	1	
339	MPPT scanning interval	RW	U16	min	1	42055	1	
340	Predicted MPPT power	RO	U32	kW	1000	42056	2	
341	Auto start upon grid recovery	RW	E16			42061	1	

342	Shutdown at 0% power limit	RW	E16			42062	1	
343	Shutdown on communication failure	RW	E16			42063	1	In a parallel system, 8.0 PCS automatically shuts down upon a communication interruption by default. The communication interruption duration is 1 minute. The customer-defined parameters and default power policy priority are determined by the PCS power. All parameters under **Communication disconnection fail-safe** are affected.
344	Start up array upon communication recovery	RW	E16			42064	1	
345	Power quality optimization mode	RW	E16			42065	1	
346	RCD enhancing	RW	E16			42066	1	
347	Reactive power output at night	RW	E16			42067	1	
348	PID protection at night	RW	E16			42069	1	
349	Apply nighttime reactive power parameters	RW	E16			42070	1	

350	Communication disconnection detection time	RW	U16	s	1	42072	1	This parameter is displayed when **Communication disconnection fail-safe** is set to **Enable**.
351	AFCI	RW	E16			42073	1	
352	AFCI detection mode	RW	E16			42074	1	
353	Communication disconnection fail-safe	RW	E16			42075	1	Used to initiate security protection after the northbound communication of the device is interrupted.
354	Active power mode when communication fails	RW	E16			42076	1	This parameter is displayed when **Communication disconnection fail-safe** is set to **Enable**.
355	Active power threshold when communication fails [kW] [low precision]	RW	U32	kW	10	42077	2	This parameter is displayed when **Communication disconnection fail-safe** is set to **Enable** and **Active power mode when communication fails** is set to a fixed value.
356	Reactive power mode when communication fails	RW	E16			42079	1	This parameter is displayed when **Communication disconnection fail-safe** is set to **Enable**.
357	Frequency change rate protection	RW	E16			42080	1	

358	Frequency change rate protection threshold	RW	U16	Hz/s	10	42081	1	
359	Duration threshold for frequency change rate protection	RW	U16	s	10	42082	1	
360	Reactive power limit when communication fails [Q/S] [Low precision]	RW	I16		1000	42083	1	(Delivered Q/S value). This parameter is displayed when **Communication disconnection fail-safe** is set to **Enable** and **Reactive power mode when communication fails** is set to **Q/S**.
361	Maximum grid voltage for grid connection	RW	U16	V	10	42084	1	Parameter for normal reconnection
362	Minimum grid voltage for grid connection	RW	U16	V	10	42085	1	Parameter for normal reconnection
363	Maximum grid frequency for grid connection	RW	U16	Hz	100	42086	1	Parameter for normal reconnection

364	Minimum grid frequency for grid connection	RW	U16	Hz	100	42087	1	Parameter for normal reconnection
365	Maximum grid voltage for grid reconnection	RW	U16	V	10	42088	1	Parameter for reconnection after a fault occurs
366	Minimum grid voltage for grid reconnection	RW	U16	V	10	42089	1	Parameter for reconnection after a fault occurs
367	Maximum grid frequency for grid reconnection	RW	U16	Hz	100	42090	1	Parameter for reconnection after a fault occurs
368	Minimum grid frequency for grid reconnection	RW	U16	Hz	100	42091	1	Parameter for reconnection after a fault occurs
369	Delay for automatic grid reconnection	RW	U16	s	1	42092	1	
370	PV module nameplate short-circuit current (STC I_{sc})	RW	U16	A	100	42093	1	Short-circuit current I_{sc} (STC) on the PV module template

371	Insulation resistance protection threshold	RW	U16	MΩ	1000	42097	1	The value range on the customer UI is [0.02, 1.5]. The actual protection is performed by the inverter based on the DC voltage. The value range is [0.02, 1.5] for the 600 V DC inverter, [0.033, 1.5] for the 1000 V DC inverter, and [0.05, 1.5] for the 1500 V DC inverter.
372	Voltage imbalance protection threshold (%)	RW	U16	%	10	42098	1	
373	Phase protection threshold	RW	U16	°	10	42099	1	
374	Soft start time after grid failure	RW	U16	s	1	42100	1	Power raising gradient when the device is started after the power grid is faulty.
375	cosφ-P/Pn trigger voltage	RW	U16	%	1	42101	1	
376	cosφ-P/Pn exit voltage	RW	U16	%	1	42102	1	
377	Soft start time	RW	U16	s	1	42103	1	
378	Grid connection delay after grid recovery	RW	U16	s	1	42104	1	

379	Duration for determining short-time grid disconnection	RW	U32	ms	1	42105	2	This parameter is configurable if **Quick startup after grid fault** is enabled.
380	Shutdown gradient	RW	U32	%/s	1000	42107	2	
381	Line loss compensation	RW	U16	%	10	42109	1	
382	Zero-current mode on power grid fault	RW	E16			42110	1	
383	Grid voltage trip triggering threshold	RW	U16	%	10	42111	1	This parameter can be set only for the VDE4120.
384	HVRT	RW	E16			42112	1	
385	HVRT triggering threshold	RW	U16	V	10	42113	1	
386	Positive-sequence reactive power compensation factor in HVRT	RW	U16		10	42114	1	

387	Quick startup for short-time grid disconnection	RW	E16			42116	1	Indicates whether to enable the quick startup function after the power grid recovers from a short-time interruption. If this parameter is set to 0, the function is disabled, that is, the normal startup process is still used after the power grid recovers from a short-time interruption. If this parameter is set to 1, the quick startup process is used after the power grid recovers from a short-time interruption. In that process, some detection items are skipped and the power grid is quickly connected. Whether the power grid experiences a short-time interruption can be identified depending on whether the power grid recovers within the duration for determining short-time grid disconnection.
388	LVRT active current maintenance coefficient	RW	U16		100	42118	1	
389	LVRT	RW	E16			42119	1	By default, this function is enabled for the BDEW standard and disabled for other standards.
390	LVRT triggering threshold	RW	U16	V	10	42120	1	Specifies the threshold for triggering LVRT. The threshold settings should meet the local grid standard.
391	Deactivate grid voltage protection during VRT	RW	E16			42121	1	Specifies whether to shield the voltage protection function during LVRT or HVRT.

392	Positive-sequence reactive power compensation factor in LVRT	RW	U16		10	42122	1	During 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 generated by the device. For example, if **Positive-sequence reactive power compensation factor in LVRT** is set to **2**, the positive-sequence reactive current generated by the device increases by 20% of the rated current each time the AC voltage decreases by 10% during LVRT.
393	VRT exit hysteresis threshold	RW	U16	V	10	42123	1	Specifies the LVRT/HVRT recovery threshold. LVRT recovery threshold = LVRT triggering threshold + VRT exit hysteresis threshold; HVRT recovery threshold = HVRT triggering threshold – VRT exit hysteresis threshold
394	VRT active current limiting in percentage	RW	U16	%	1	42124	1	
395	VRT active power recovery gradient	RW	U16	%/s	1	42125	1	
396	Negative-sequence reactive power compensation factor in HVRT	RW	U16		10	42126	1	

397	Negative-sequence reactive power compensation factor in LVRT	RW	U16		10	42127	1	During 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 generated by the device. For example, if **Negative-sequence reactive power compensation factor in LVRT** is set to **2**, the negative-sequence reactive current generated by the device increases by 20% of the rated current each time the AC voltage decreases by 10% during LVRT.
398	Phase angle offset protection	RW	E16			42128	1	
399	Active islanding protection	RW	E16			42129	1	
400	Passive islanding protection	RW	E16			42130	1	
401	OVGR linked shutdown	RW	E16			42131	1	
402	Dry contact function	RW	E16			42132	1	
403	LVRT reactive current limiting in percentage	RW	U16	%	1	42133	1	During LVRT, the device needs to limit the reactive current. For example, if **LVRT reactive current limiting in percentage** is set to **50**, the reactive current upper limit of the device is 50% of the rated current during LVRT.

404	Threshold of LVRT zero-current mode	RW	U16	V	10	42134	1	If **Zero-current mode on power grid fault** is enabled and the power grid voltage is less than **Threshold of LVRT zero-current mode** during LVRT, the zero current mode is used. Otherwise, the mode set in LVRT mode is used.
405	LVRT mode	RW	E16			42135	1	
406	Voltage rise suppression	RW	E16			42138	1	
407	Reactive power adjustment threshold for voltage rise suppression	RW	U16	%	10	42139	1	**Active power derating threshold for voltage rise suppression** must be greater than that **Reactive power adjustment threshold for voltage rise suppression**.
408	Active power derating threshold for voltage rise suppression	RW	U16	%	10	42140	1	**Active power derating threshold for voltage rise suppression** must be greater than that **Reactive power adjustment threshold for voltage rise suppression**.
409	Frequency-based control	RW	E16			42141	1	According to the standards of some countries or regions, the power grid frequency may change around the rated value. In this case, the active power output needs to be slightly adjusted based on **Adjustment ratio of frequency-based control** to stabilize the power grid frequency. In this case, set this parameter to **Enable**. Frequency sensitive mode (FSM), which is described in the G99 standard.

410	Adjustment ratio of frequency-based control	RW	U16	%	1	42142	1	Frequency sensitive mode (FSM) Droop, which is described in the G99 standard
411	Overfrequency-caused power derating	RW	E16			42143	1	If this parameter is set to **Enable**, when the power grid frequency exceeds the frequency threshold for triggering overfrequency-caused power derating, the active power of the device is derated based on a certain gradient.
412	Frequency threshold for stopping overfrequency-caused power derating	RW	U16	Hz	100	42144	1	Specifies the frequency threshold for stopping overfrequency derating.
413	Power threshold for stopping overfrequency-caused power derating	RW	U16	%	1	42145	1	Specifies the power threshold for stopping overfrequency-caused derating.
414	Frequency threshold for triggering overfrequency-caused power derating	RW	U16	Hz	100	42146	1	The standards of certain countries and regions require that the output active power of devices be derated when the power grid frequency exceeds a certain value.

415	Frequency threshold for exiting overfrequency-caused power derating	RW	U16	Hz	100	42147	1	Specifies the frequency threshold for exiting overfrequency derating.
416	Overfrequency-caused derating power recovery gradient	RW	U16	%/min	1	42148	1	Specifies the power recovery rate for overfrequency-caused power derating.
417	Underfrequency-caused power raising	RW	E16			42151	1	The standards of certain countries and regions require that if the power grid frequency is lower than **Frequency threshold for triggering underfrequency-caused power raising**, the device needs to increase the active power output to increase the power grid frequency. In this case, set this parameter to **Enable**.
418	Gradient of underfrequency-caused power raising	RW	U16	%/min	1	42152	1	Specifies the power recovery rate for underfrequency-caused power raising.
419	LVRT characteristic curve	RW	MLD			42155	21	Specifies the low voltage ride-through capability of the device. For details, see the *Key Information Description Table*. The SmartLogger and management system support batch setting and provide a separate UI for users to edit.

420	Frequency threshold for stopping underfrequency-caused power raising	RW	U16	Hz	100	42176	1	Specifies the frequency threshold for stopping underfrequency-caused power raising.
421	Power threshold for stopping underfrequency-caused power raising	RW	U16	%	1	42177	1	Specifies the power threshold for stopping underfrequency-caused power raising.
422	Frequency threshold for triggering underfrequency-caused power raising	RW	U16	Hz	100	42178	1	Specifies the frequency threshold for triggering underfrequency-caused power raising.
423	Frequency threshold for exiting underfrequency-caused power raising	RW	U16	Hz	100	42179	1	Specifies the frequency threshold for exiting underfrequency-caused power raising.
424	Built-in PID running mode	RW	E16			42180	1	
425	PID output voltage	RW	I16	V	10	42181	1	Fixed output. This interface is reserved. The UI is not open.

426	PID	RW	E16			42182	1	Currently, this parameter is reserved only for testing.
427	Active power change gradient	RW	U32	%/s	1000	42192	2	This is a broadcast interface dedicated for the SmartLogger and does not support incremental reporting. It is used in remote output scenarios in Japan.
428	P-U curve	RW	MLD			42221	21	
429	P-U curve adjustment time	RW	U16	s	100	42242	1	
430	10-minute overvoltage protection threshold	RW	U16	V	10	42290	1	Vn: voltage level, which is related to the grid code
431	10-minute overvoltage protection duration	RW	U32	ms	1	42291	2	
432	Level-1 overvoltage protection threshold	RW	U16	V	10	42293	1	Vn: voltage level, which is related to the grid code
433	Level-1 overvoltage protection duration	RW	U32	ms	1	42294	2	

434	Level-2 overvoltage protection threshold	RW	U16	V	10	42296	1	Vn: voltage level, which is related to the grid code
435	Level-2 overvoltage protection duration	RW	U32	ms	1	42297	2	
436	Level-3 overvoltage protection threshold	RW	U16	V	10	42299	1	Vn: voltage level, which is related to the grid code
437	Level-3 overvoltage protection duration	RW	U32	ms	1	42300	2	
438	Level-4 overvoltage protection threshold	RW	U16	V	10	42302	1	Vn: voltage level, which is related to the grid code
439	Level-4 overvoltage protection duration	RW	U32	ms	1	42303	2	
440	Level-5 overvoltage protection threshold	RW	U16	V	10	42305	1	Vn: voltage level, which is related to the grid code

441	Level-5 overvoltage protection duration	RW	U32	ms	1	42306	2	
442	Level-6 overvoltage protection threshold	RW	U16	V	10	42308	1	Vn: voltage level, which is related to the grid code
443	Level-6 overvoltage protection duration	RW	U32	ms	1	42309	2	
444	Level-1 undervoltage protection threshold	RW	U16	V	10	42311	1	Vn: voltage level, which is related to the grid code
445	Level-1 undervoltage protection duration	RW	U32	ms	1	42312	2	
446	Level-2 undervoltage protection threshold	RW	U16	V	10	42314	1	Vn: voltage level, which is related to the grid code
447	Level-2 undervoltage protection duration	RW	U32	ms	1	42315	2	

448	Level-3 undervoltage protection threshold	RW	U16	V	10	42317	1	Vn: voltage level, which is related to the grid code
449	Level-3 undervoltage protection duration	RW	U32	ms	1	42318	2	
450	Level-4 undervoltage protection threshold	RW	U16	V	10	42320	1	Vn: voltage level, which is related to the grid code
451	Level-4 undervoltage protection duration	RW	U32	ms	1	42321	2	
452	Level-5 undervoltage protection threshold	RW	U16	V	10	42323	1	Vn: voltage level, which is related to the grid code
453	Level-5 undervoltage protection duration	RW	U32	ms	1	42324	2	
454	Level-6 undervoltage protection threshold	RW	U16	V	10	42326	1	Vn: voltage level, which is related to the grid code

455	Level-6 undervoltage protection duration	RW	U32	ms	1	42327	2	
456	Level-1 overfrequency protection threshold	RW	U16	Hz	100	42329	1	Fn: indicates the frequency level, which is related to the grid code.
457	Level-1 overfrequency protection duration	RW	U32	ms	1	42330	2	
458	Level-2 overfrequency protection threshold	RW	U16	Hz	100	42332	1	Fn: indicates the frequency level, which is related to the grid code.
459	Level-2 overfrequency protection duration	RW	U32	ms	1	42333	2	
460	Level-3 overfrequency protection threshold	RW	U16	Hz	100	42335	1	Fn: indicates the frequency level, which is related to the grid code.
461	Level-3 overfrequency protection duration	RW	U32	ms	1	42336	2	

462	Level-4 overfrequency protection threshold	RW	U16	Hz	100	42338	1	Fn: indicates the frequency level, which is related to the grid code.
463	Level-4 overfrequency protection duration	RW	U32	ms	1	42339	2	
464	Level-5 overfrequency protection threshold	RW	U16	Hz	100	42341	1	Fn: indicates the frequency level, which is related to the grid code.
465	Level-5 overfrequency protection duration	RW	U32	ms	1	42342	2	
466	Level-6 overfrequency protection threshold	RW	U16	Hz	100	42344	1	Fn: indicates the frequency level, which is related to the grid code.
467	Level-6 overfrequency protection duration	RW	U32	ms	1	42345	2	
468	Level-1 underfrequency protection threshold	RW	U16	Hz	100	42347	1	Fn: indicates the frequency level, which is related to the grid code.

469	Level-1 underfrequency protection duration	RW	U32	ms	1	42348	2	
470	Level-2 underfrequency protection threshold	RW	U16	Hz	100	42350	1	Fn: indicates the frequency level, which is related to the grid code.
471	Level-2 underfrequency protection duration	RW	U32	ms	1	42351	2	
472	Level-3 underfrequency protection threshold	RW	U16	Hz	100	42353	1	Fn: indicates the frequency level, which is related to the grid code.
473	Level-3 underfrequency protection duration	RW	U32	ms	1	42354	2	
474	Level-4 underfrequency protection threshold	RW	U16	Hz	100	42356	1	Fn: indicates the frequency level, which is related to the grid code.
475	Level-4 underfrequency protection duration	RW	U32	ms	1	42357	2	

476	Level-5 underfrequency protection threshold	RW	U16	Hz	100	42359	1	Fn: indicates the frequency level, which is related to the grid code.
477	Level-5 underfrequency protection duration	RW	U32	ms	1	42360	2	
478	Level-6 underfrequency protection threshold	RW	U16	Hz	100	42362	1	Fn: indicates the frequency level, which is related to the grid code.
479	Level-6 underfrequency protection duration	RW	U32	ms	1	42363	2	
480	Delayed upgrade	RW	E16			42590	1	
481	Hibernate at night	RW	E16			42591	1	
482	Smart string monitoring	RW	E16			42594	1	
483	String detection reference asymmetric coefficient	RW	U16		100	42595	1	
484	String detection startup power percentage	RW	U16	%	1	42596	1	

485	Communication interruption duration	RW	I16	min	1	42597	1	
486	Inspection	WO	E16			42730	1	Broadcast command interface. Note: The command value range is extended here. The most significant eight bits are used to mask the specified inspection action in the inspection function. This feature improves the inspection efficiency for specific purposes. Shen Yanbai 2019-07-02
487	I-V curve scanning	WO	E16			42779	1	Broadcast command interface
488	[System time] Year	WO	U16		1	43000	1	
489	[System time] Month	WO	U16		1	43001	1	
490	[System time] Day	WO	U16		1	43002	1	
491	[System time] Hour	WO	U16		1	43003	1	
492	[System time] Minute	WO	U16		1	43004	1	
493	[System time] Second	WO	U16		1	43005	1	
494	[RS485-1] Protocol type	RW	E16			43018	1	

495	[RS485-1] Communications address	RW	U16		1	43019	1	0: broadcast address; 1–247: device address; 248–255: reserved
496	[RS485-1] Baud rate	RW	E16			43020	1	The baud rate 115200 corresponds to bit 26 of feature code 3.
497	[RS485-1] Verification mode	RW	E16			43021	1	
498	[RS485-1] Port mode	RW	E16			43022	1	
499	[RS485-2] Protocol type	RW	E16			43033	1	
500	[RS485-2] Communications address	RW	U16		1	43034	1	0: broadcast address; 1–247: device address; 248–255: reserved
501	[RS485-2] Baud rate	RW	E16			43035	1	The baud rate 115200 corresponds to bit 27 of feature code 3.
502	[RS485-2] Verification mode	RW	E16			43036	1	
503	[RS485-2] Port mode	RW	E16			43037	1	
504	Device name	RW	STR			43349	10	This parameter is left empty by default and is used by customers to change the device name.
505	[App] First power-on flag	RW	E16			43359	1	After the SmartLogger is deployed, the power-on flag also needs to be cleared.

506	Restore factory settings	WO	E16			45000	1	
507	Clear active alarms	WO	MLD			45001	2	
508	Reset alarms	WO	MLD			45003	2	
509	Clear alarms	WO	E16			45005	1	
510	Mask alarms	WO	E16			45006	1	
511	Start AFCI check	WO	U16		1	45007	1	Set the data field to 0. It is associated with the AFCI controller in the subdevice presence flag.
512	Adjust total energy yield	WO	U32	kWh	100	45008	2	
513	Clear historical yield	WO	E16			45010	1	Includes the total energy generated and total energy charged on the power side.
514	Clear runtime info	WO	E16			45011	1	Clears information such as the total runtime, total fault duration, and total grid-tied runtime.
515	Spot-check	WO	E16			45012	1	
516	ESN application command	WO	U16		1	45015	1	
517	Information restore	WO	MLD		1	45016	10	Enter the device ESN in the data field.
518	Clearing User Data	WO	E16			45223	1	

519	Phase A active power percentage	RW	I16	%	100	45235	1	
520	Phase B active power percentage	RW	I16	%	100	45236	1	
521	Phase C active power percentage	RW	I16	%	100	45237	1	
522	Three-phase imbalance control	RW	E16			45238	1	

NOTICE

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

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	
Length	2	
Reserved	1	The reserved byte 0 is defined as the status. bit0: inverter disconnection status (1=disconnected)
	3	
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 the Optimizer Feature Data Domain Definition.
Feature data of optimizer 2	108	
Feature data of optimizer…	108	
Feature data of optimizer N	108	

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	
Position in current string	2	relative positive connection starting point
SN	20	
Software version	30	
Alias	20	
Model	30	

Table 4-3 Record format(V101)

Data	Length (Byte)	Remarks
Format version	4	V101
SN	2	-
Length	2	-
Reserved	4	-
Number of optimizers	2	*n*, including the offline optimizers

Data	Length (Byte)	Remarks
Feature data of optimizer 1	78	-
Feature data of optimizer 2	78	-
...	...	-
Feature data of optimizer *n*	78	-

Table 4-4 Feature data format (V101)

Data	Length (Byte)	Remarks
Optimizer address	2	Logical communication address
Status	2	0: offline 1: online
String number	2	-
Relative position of the PV string	2	1: near DC wiring terminals of the solar inverters
SN	20	-
Software version	30	-
Alias	20	-

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; uploads 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 4-5 Record format

Data	Length (Byte)	Remarks
File version	4	V101

Data	Length (Byte)	Remarks
Reserved	8	-
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	-
...	-	-
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 4-6 Data unit format (V101)

Data	Length (Byte)	Remarks
Time	4	Epoch seconds, local time
Reserved	4	-
Length	2	-
Number of optimizers	2	-
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	-
...	-	-
Real-time data of optimizer *n*	26	*n* is the number of optimizers.

Table 4-7 Real-time data format

Data	Length (Byte)	Remarks
Optimizer address	2	Logical communication address
Output power	2	Gain: 10 Unit: W

Data	Length (Byte)	Remarks
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
Temperature	2	Gain: 10 Unit: °C

SUN2000MA V200R024C00SPC001 Modbus Interface Definitions(V3.0)

Data	Length (Byte)	Remarks
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

No.	Alarm	Bit	Alarm Name	Alarm ID	Level
9	Alarm 1	8	Grid Undervoltage	2033	Major
10	Alarm 1	9	Grid Overvoltage	2034	Major
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

No.	Alarm	Bit	Alarm Name	Alarm ID	Level
27	Alarm 2	10	Active Islanding	2070	Major
28	Alarm 2	11	Passive Islanding	2071	Major
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.

NOTE

[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]
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]

Description	Data Type	Gain	Unit	Value Range
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

Table2 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]
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]

Description	Data Type	Gain	Unit	Value Range
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

Table3 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]
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]

Description	Data Type	Gain	Unit	Value Range
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 5-3 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
13	CEI0-21	Italy
14	EN50438-CZ	Czech Republic
15	RD1699/661	Spain
16	RD1699/661-MV480	Spain

No.	Standard	Applicable Country or Region
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
42	Philippines	Philippines
43	Philippines-MV480	Philippines
44	AS4777-MV480	Australia
45	NRS-097-2-1	South Africa

No.	Standard	Applicable Country or Region
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
68	IEC61727-50Hz-MV500	General
70	CEI0-16-MV480	Italy
71	PO12.3	Spain

No.	Standard	Applicable Country or Region
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
95	SA_RPPs-MV480	South Africa
96	INDIA	India
97	INDIA-MV500	India

No.	Standard	Applicable Country or Region
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
123	IEC61727-MV800	General
124	BDEW-MV800	Germany
125	ABNT NBR 16149-MV800	Brazil

No.	Standard	Applicable Country or Region
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
151	CEI0-16-MV800	Italy
152	ZAMBIA-MV800	Zambia
153	KENYA_ETHIOPIA-MV800	East Africa

No.	Standard	Applicable Country or Region
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
179	Chile-PMGD-MV480	Chile
180	VDE-AR-N4120-HV	Germany
181	VDE-AR-N4120-HV480	Germany

No.	Standard	Applicable Country or Region
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
207	IEEE 1547-LV240	USA
208	IEEE 1547a-LV208	USA
209	IEEE 1547a-LV240	USA

No.	Standard	Applicable Country or Region
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
235	Bahrain-MV480	Bahrain
236	Bahrain-MV800	Bahrain
238	Japan-MV550-50Hz	Japan

No.	Standard	Applicable Country or Region
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
266	CEA-MV800	India
267	EN50549-MV400	Europe
268	VDE-AR-N4110	Germany

No.	Standard	Applicable Country or Region
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 5-4 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.
Electricity price in period 1	U32	1000	N/A	N/A

Description	Data Type	Gain	Unit	Value Range
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 5-5 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]
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.

Description	Data Type	Gain	Unit	Value Range
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.
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.

SUN2000MA V200R024C00SPC001 Modbus Interface Definitions(V3.0)

Description	Data Type	Gain	Unit	Value Range
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

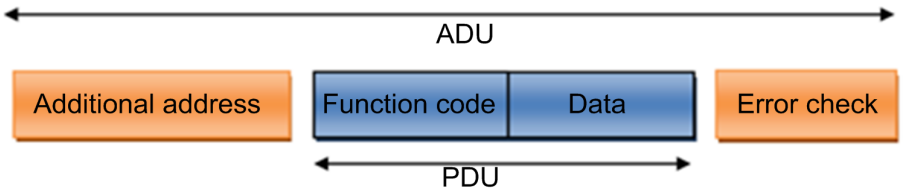
6.1 Physical Layer

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

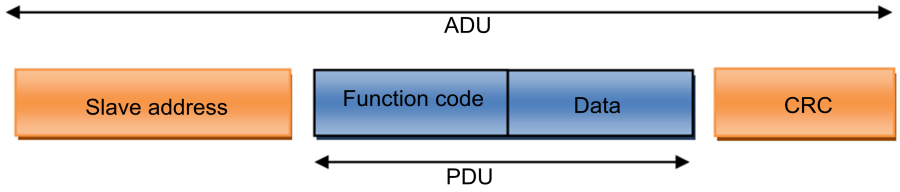
The following figure shows the generic frame structure of the Modbus protocol.

Figure 6-1 Modbus generic frame format



6.2.1 Modbus-RTU

Figure 6-2 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 **Figure 6-2**, 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,
```

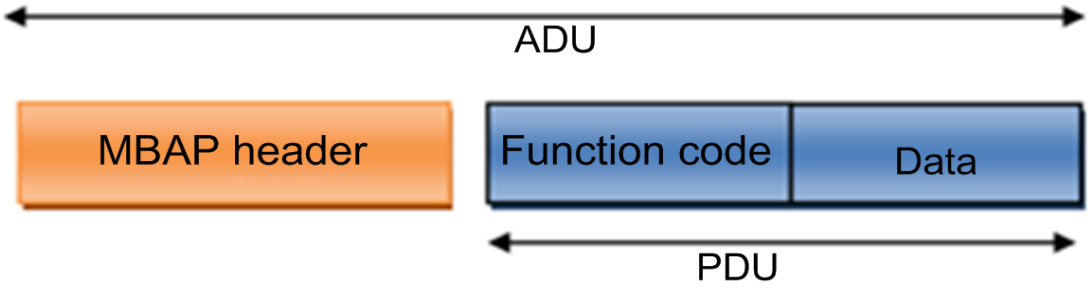


```
0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F,
0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68, 0x78, 0xB8, 0xB9, 0x79, 0xBB,
0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5,
0x77, 0xB7, 0xB6, 0x76, 0x72, 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 6-3 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.

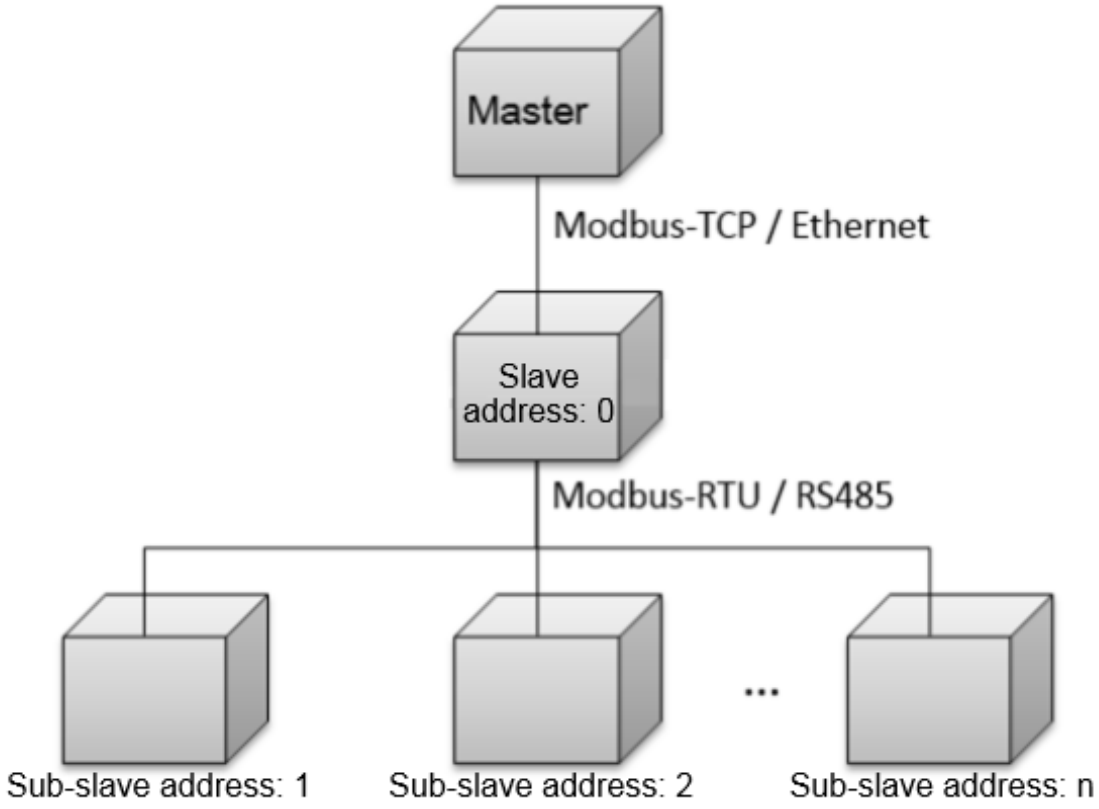
Table 6-2 MBAP definition

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 6-4 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.

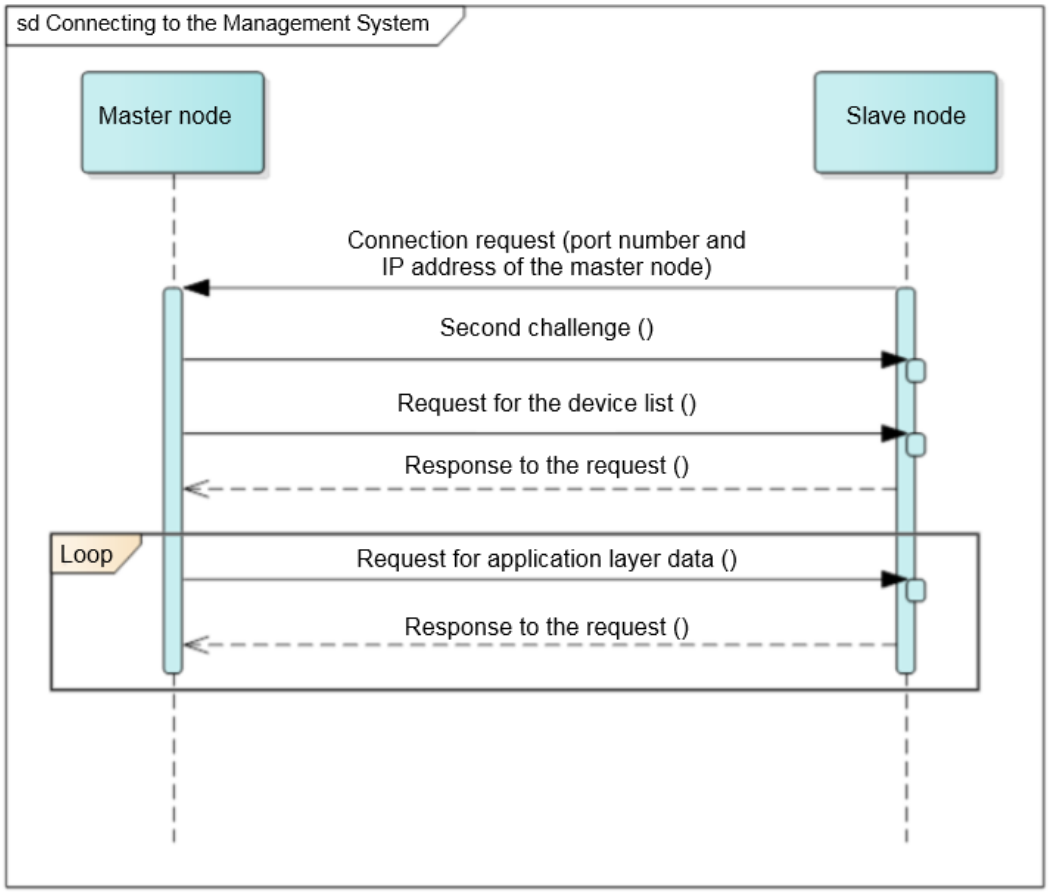
In a non-VPN environment across the public network, the device deployed on the internal network needs to initiate TCP socket link establishment to the master node exposed on the public network. In this case, you need to preset the fixed access port number of the master node on the slave node. To ensure 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 6-5 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

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 Exception Code List**.

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 Exception Code List**.

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

Description		Frame Data
Function code		06
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

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 Exception Code List**.

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	-	-	-	Normal
0x80–0xFF	-	-	-	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	-
Next object ID			1	-
Number of objects			1	-
Object list	First object	Object ID	1	0x00
		Object length	1	N
		Object value	N	-
	...	...	...	...

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 Exception Code List**.

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	-
Next object ID			1	-
Number of objects			1	-
Object list	First object	Object ID	1	0x87
		Object length	1	N
		Object value	N	-
	...	...	...	...

Table 6-12 Object list

Object ID	Object Name	Type	Description
0x80–0x86	Reserved	--	Returns a null object with a length of 0.
0x87	Number of devices	int	Returns the number of devices connected to the RS485 address.
0x88	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	-	-
-	-	-	-
0xFF	Description about the 120th device	-	-

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	-
3	Port protocol version	ASCII character string	See the interface protocol version definitions.

Attribute ID	Name	Type	Description
4	ESN	ASCII character string	-
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	-

Table 6-14 Frame format for an abnormal response

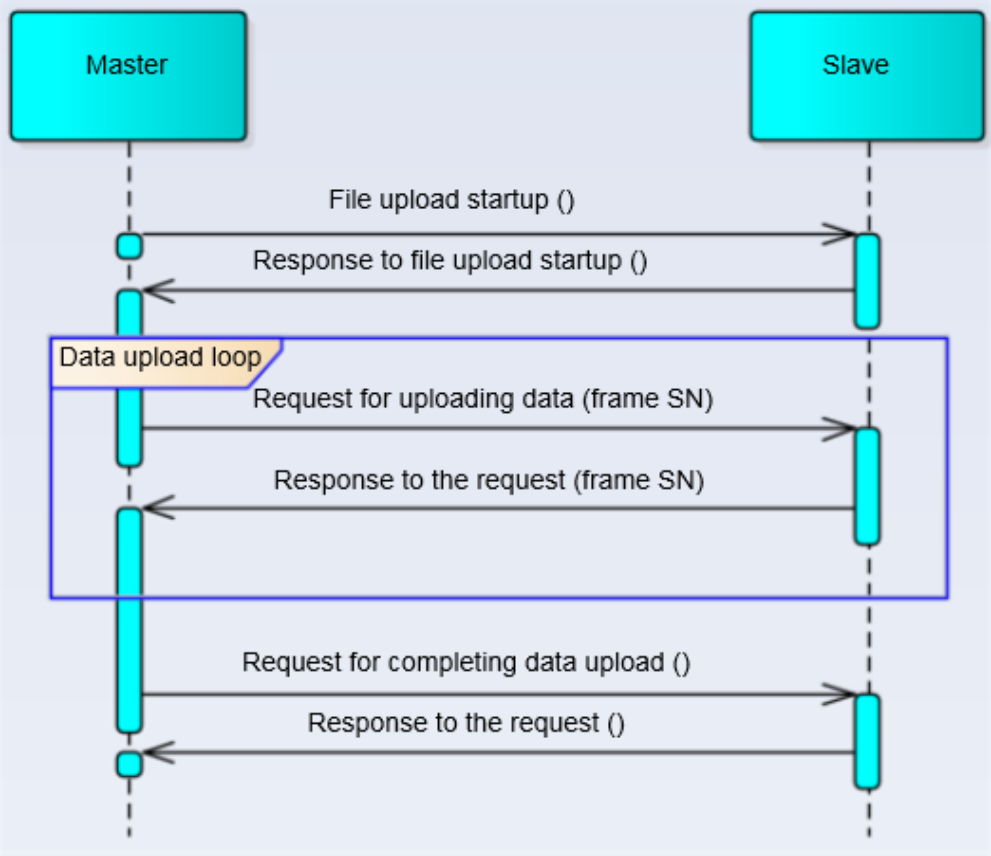
Data Field	Length (Byte)	Description
Function code	1	0xAB
Exception code	1	See **6.3.2 Exception Code List**.

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 6-6 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	-

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	-
Data frame length	1	-
Customized data	N	-

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 Exception Code List**.

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	-
Frame No.	2	0x0000–0xFFFF
Frame data	N	-

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 Exception Code List**.

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	-

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	-
File CRC	2	-

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