Solar Inverter

Modbus Interface Definitions (V3.0)

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Change History

Issue	Date	Description
06	2023-01-16	Add Modbus Register Definitions
05	2022-06-16	Add new model: SUN2000-100KTL-M2, SUN2000-110KTL-M2, SUN2000-125KTL-M2 Add 5 warnings
04	2021-12-02	Add new Japan model, SUN2000-125KTL-JPH1
03	2021-10-08	Add new model,SUN2000-75KTL-M1
02	2021-03-26	Add new model,SUN2000-111KTL-NHM0，SUN2000-200KTL-H3，SUN2000-215KTL-H3,SUN2000-196KTL-H3.
01	2019-10-31	This issue is the first official release.

Contents

1 Supported Models

This chapter describes the solar inverter models that use the Modbus protocol and the earliest firmware version. When a host needs to connect to these solar inverters, ensure that the firmware version is correct.

1.1 Model Description

Table 1-1 Supported models and firmware versions

Model	Model ID	Earliest Firm Version
SUN2000L-2KTL	305	SUN2000L V100R001C00
SUN2000-2KTL-L0	338	SUN2000L V100R001C00
SUN2000L-3KTL	304	SUN2000L V100R001C00
SUN2000L-3KTL-CN	310	SUN2000L V100R001C00
SUN2000L-3KTL-CN-4G	311	SUN2000L V100R001C00
SUN2000-3KTL-CNL0	334	SUN2000L V100R001C20
SUN2000-3KTL-L0	339	SUN2000L V100R001C00
SUN2000-3KTL-M0	410	SUN2000MA V100R001C00
SUN2000-3KTL-M1	424	SUN2000MA V100R001C00
SUN2000L-3.68KTL	303	SUN2000L V100R001C00
SUN2000-3.8KTL-USL0	318	SUN2000L V100R001C10
SUN2000-3.8KTL-USL0	319	SUN2000L V100R001C10
SUN2000L-4KTL	302	SUN2000L V100R001C00
SUN2000L-4KTL-CN	308	SUN2000L V100R001C00

Model	Model ID	Earliest Firm Version
SUN2000L-4KTL-CN-4G	309	SUN2000L V100R001C00
SUN2000-4KTL-CNL0	335	SUN2000L V100R001C20
SUN2000-4KTL-L0	340	SUN2000L V100R001C00
SUN2000-4KTL-M0	411	SUN2000MA V100R001C00
SUN2000-4KTL-M1	425	SUN2000MA V100R001C00
SUN2000L-4.125KTL-JP	331	SUN2000L V100R001C12
SUN2000L-4.6KTL	301	SUN2000L V100R001C00
SUN2000L-4.95KTL-JP	330	SUN2000L V100R001C12
SUN2000-4.95KTL-JPL0	342	SUN2000L V100R001C20
SUN2000L-5KTL	300	SUN2000L V100R001C00
SUN2000L-5KTL-CN	306	SUN2000L V100R001C00
SUN2000L-5KTL-CN-4G	307	SUN2000L V100R001C00
SUN2000-5KTL-USL0	315	SUN2000L V100R001C10
SUN2000-5KTL-USL0	316	SUN2000L V100R001C10
SUN2000-5KTL-CNL0	336	SUN2000L V100R001C20
SUN2000-5KTL-L0	341	SUN2000L V100R001C00
SUN2000-5KTL-M0	400	SUN2000MA V100R001C00
SUN2000-5KTL-M0	401	SUN2000MA V100R001C00
SUN2000-5KTL-M1	426	SUN2000MA V100R001C00
SUN2000-6KTL-CNL0	337	SUN2000L V100R001C20
SUN2000-6KTL-M0	402	SUN2000MA V100R001C00
SUN2000-6KTL-M0	403	SUN2000MA V100R001C00
SUN2000-6KTL-M1	427	SUN2000MA V100R001C00
SUN2000-7.6KTL-USL0	312	SUN2000L V100R001C10
SUN2000-7.6KTL-USL0	313	SUN2000L V100R001C10
SUN2000-8KTL-M0	404	SUN2000MA V100R001C00
SUN2000-8KTL-M0	405	SUN2000MA V100R001C00
SUN2000-8KTL	415	SUN2000MA V100R001C10
SUN2000-8KTL-M0	418	SUN2000MA V100R001C10
SUN2000-8KTL-M1	428	SUN2000MA V100R001C00

Model	Model ID	Earliest Firm Version
SUN2000-8KTL-M2	430	SUN2000MA V100R001C10
SUN2000-9KTL-USL0	324	SUN2000L V100R001C10
SUN2000-9KTL-USL0	325	SUN2000L V100R001C10
SUN2000-10KTL-USL0	332	SUN2000L V100R001C10
SUN2000-10KTL-USL0	333	SUN2000L V100R001C10
SUN2000-10KTL-M0	406	SUN2000MA V100R001C00
SUN2000-10KTL-M0	407	SUN2000MA V100R001C00
SUN2000-10KTL	416	SUN2000MA V100R001C10
SUN2000-10KTL-M0	419	SUN2000MA V100R001C10
SUN2000-10KTL-M1	429	SUN2000MA V100R001C00
SUN2000-10KTL-M2	431	SUN2000MA V100R001C10
SUN2000-11.4KTL-USL0	321	SUN2000L V100R001C10
SUN2000-11.4KTL-USL0	322	SUN2000L V100R001C10
SUN2000-12KTL-M0	408	SUN2000MA V100R001C00
SUN2000-12KTL	417	SUN2000MA V100R001C10
SUN2000-12KTL-M0	420	SUN2000MA V100R001C10
SUN2000-12KTL-M2	432	SUN2000MA V100R001C10
SUN2000-15KTL-M0	412	SUN2000MA V100R001C10
SUN2000-15KTL-M0	421	SUN2000MA V100R001C10
SUN2000-15KTL-M2	433	SUN2000MA V100R001C10
SUN2000-17KTL-M0	413	SUN2000MA V100R001C10
SUN2000-17KTL-M0	422	SUN2000MA V100R001C10
SUN2000-17KTL-M2	434	SUN2000MA V100R001C10
SUN2000-20KTL-M0	414	SUN2000MA V100R001C10
SUN2000-20KTL-M0	423	SUN2000MA V100R001C10
SUN2000-20KTL-M2	435	SUN2000MA V100R001C10
SUN2000-15KTL-M3	436	SUN2000MA V100R001C20
SUN2000-17KTL-M3	437	SUN2000MA V100R001C20
SUN2000-20KTL-M3	438	SUN2000MA V100R001C20
SUN2000-23KTL-M3	439	SUN2000MA V100R001C20

Model	Model ID	Earliest Firm Version
SUN2000-25KTL-NAM3	441	SUN2000MA V100R001C20
SUN2000-28KTL-M3	442	SUN2000MA V100R001C20
SUN2000-29.9KTL-M3	443	SUN2000MA V100R001C20
SUN2000-30KTL-M3	444	SUN2000MA V100R001C20
SUN2000-36KTL-M3	445	SUN2000MA V100R001C20
SUN2000-40KTL-M3	446	SUN2000MA V100R001C20
SUN2000-42KTL-M3	447	SUN2000MA V100R001C20
SUN2000-44KTL-M3	448	SUN2000MA V100R001C20
SUN2000-50KTL-M3	449	SUN2000MA V100R001C20
SUN2000-30KTL-NAM3	450	SUN2000MA V100R001C20
SUN2000-33KTL-NAM3	451	SUN2000MA V100R001C20
SUN2000-36KTL-NAM3	452	SUN2000MA V100R001C20
SUN2000-40KTL-NAM3	453	SUN2000MA V100R001C20
SUN2000-43KTL-INM3	454	SUN2000MA V100R001C20
SUN2000-20KTL-M3	457	SUN2000MA V100R001C20
SUN2000-29.9KTL-M3	458	SUN2000MA V100R001C20
SUN2000-30KTL-M3	459	SUN2000MA V100R001C20
SUN2000-36KTL-M3	460	SUN2000MA V100R001C20
SUN2000-40KTL-M3	461	SUN2000MA V100R001C20
SUN2000-30KTL-M3	462	SUN2000MA V100R001C20
SUN2000-12KTL-M1	463	SUN2000MA V100R001C00
SUN2000-50KTL-JPM1	59	SUN2000 V300R001C00
SUN2000-50KTL-M0	50	SUN2000 V300R001C00
SUN2000-50KTL-JPM0	53	SUN2000 V300R001C00
SUN2000-60KTL-M0	55	SUN2000 V300R001C00
SUN2000-63KTL-JPM0	51	SUN2000 V300R001C00
SUN2000-63KTL-JPH0	76	SUN2000HA V200R001C00
SUN2000-65KTL-M0	46	SUN2000 V300R001C00
SUN2000-70KTL-INM0	48	SUN2000 V300R001C00
SUN2000-70KTL-C1	45	SUN2000 V300R001C00

Model	Model ID	Earliest Firm Version
SUN2000-75KTL-C1	56	SUN2000 V300R001C00
SUN2000-90KTL-H1	73	SUN2000HA V200R001C00
SUN2000-95KTL-INH0	74	SUN2000HA V200R001C00
SUN2000-90KTL-H0	75	SUN2000HA V200R001C00
SUN2000-90KTL-H2	81	SUN2000HA V200R001C00
SUN2000-95KTL-INH1	82	SUN2000HA V200R001C00
SUN2000-100KTL-USH0	70	SUN2000HA V200R001C00
SUN2000-100KTL-H1	71	SUN2000HA V200R001C00
SUN2000-100KTL-H0	72	SUN2000HA V200R001C00
SUN2000-100KTL-H2	78	SUN2000HA V200R001C00
SUN2000-100KTL-M0	141	SUN2000 V500R001C00
SUN2000-100KTL-M1	142	SUN2000 V500R001C00
SUN2000-100KTL-INM0	143	SUN2000 V500R001C00
SUN2000-105KTL-H1	79	SUN2000HA V200R001C00
SUN2000-110KTL-M0	144	SUN2000 V500R001C00
SUN2000-125KTL-M0	145	SUN2000 V500R001C00
SUN2000-125KTL-JPH0	110	SUN2000HA V300R001C00
SUN2000-168KTL-H1	103	SUN2000HA V300R001C00
SUN2000-185KTL-INH0	102	SUN2000HA V300R001C00
SUN2000-175KTL-H0	101	SUN2000HA V300R001C00
SUN2000-185KTL-H1	104	SUN2000HA V300R001C00
SUN2000-193KTL-H0	105	SUN2000HA V300R001C00
SUN2000-196KTL-H0	106	SUN2000HA V300R001C00
SUN2000-200KTL-H2	108	SUN2000HA V300R001C00
SUN2000-215KTL-H0	109	SUN2000HA V300R001C00
SUN2000-196KTL-H3	111	SUN2000HA V300R001C00
SUN2000-200KTL-H3	112	SUN2000HA V300R001C00
SUN2000-215KTL-H3	113	SUN2000HA V300R001C00
SUN2000-111KTL-NHM0	146	SUN2000 V500R001C00
SUN2000-75KTL-M1	147	SUN2000 V500R001C00

Model	Model ID	Earliest Firm Version
SUN2000-125KTL-JPH1	114	SUN2000HA V300R001C00
SUN2000-110KTL-M2	148	SUN2000ME V500R023C00
SUN2000-125KTL-M2	149	SUN2000ME V500R023C00
SUN2000-100KTL-M2	150	SUN2000ME V500R023C00

NOTE

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

2 Overview

Modbus is a widely used protocol for device communications. This document describes the Modbus protocol used by Huawei solar inverters, and can be used to regulate follow-up third-party integrated development. Huawei solar inverters comply with the standard Modbus protocol, and this document focuses on the information specific to Huawei solar inverters. For other information about Modbus, see the standard documents about the Modbus protocol. For details about the standard protocols used by Huawei solar inverters and customized interaction modes and examples, see chapter **6 Overview of the Communications Protocol**.

2.1 Terms and Abbreviations

Table 2-1 Terms and abbreviations

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

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

3 Register Definitions

Table1 Register definitions

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
1	Model	RO	STR			30000	15	Nameplate name of machine, original "name of machine type"
2	SN	RO	STR			30015	10	Device serial number, which is obtained from the electronic label of the device.
3	PN	RO	STR			30025	10	Product Code
4	Firmware version	RO	STR			30035	15	
5	Software Version	RO	STR			30050	15	In V800R021C10SPCXXX, the offering name and software version are combined on the display page.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
6	Protocol Version [Modbus]	RO	U32			30068	2	high-word: major version; Upgrade in case of incompatible changes Low word: revised version; Upgrade on the Premise of Compatibility The baseline version is D8.0. 0x00080000
7	Model ID	RO	U16			30070	1	
8	Number of strings	RO	U16		1	30071	1	
9	Number of MPPTs	RO	U16		1	30072	1	
10	Rated power	RO	U32	kW	1000	30073	2	Pn
11	Maximum active power (Pmax)	RO	U32	kW	1000	30075	2	Read-only interface of 42027
12	Maximum apparent (Smax)	RO	U32	kVA	1000	30077	2	Read-only interface of 42025
13	Real-time maximum reactive power (Qmax, feed to grid)	RO	I32	kVar	1000	30079	2	Report monitoring to indicate reactive power adjustment range Feature data is updated when the grid standard code and derating change except the model difference.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
14	Real-time maximum reactive power (-Qmax, absorbed from power grid)	RO	I32	kVar	1000	30081	2	Report monitoring to indicate reactive power adjustment range Feature data is updated when the grid standard code and derating change except the model difference.
15	Maximum active capability (Pmax_real)	RO	U32	kW	1000	30083	2	The default maximum active power capacity is fixed on the nameplate of the machine. The maximum active power capacity of a machine will not change. Set the upper limit of the reference range (42027). The size relationship is as follows: 0<Pmax≤Smax≤Pmax_real≤Smax_real or 0<Pmax≤Pmax_real≤Smax≤Smax_real

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
16	Maximum apparent capability (Smax_real)	RO	U32	kVA	1000	30085	2	The default value of the apparent maximum capability is fixed on the nameplate of the machine. The value of the maximum capability does not change for one machine. Set the upper limit of the reference range (42025). The size relationship is as follows: 0<Pmax≤Smax≤Pmax_real≤Smax_real or 0<Pmax≤Pmax_real≤Smax≤Smax_real

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
17	Product Sales Area	RO	STR			30105	2	XX: two uppercase letters, indicating the sales or use area of the product, mainly related to the AC power system. CN: Chinese mainland; EU: Europe; JP: Japan; US: North America (US/ Canada/and regions with the same requirements as the US grid or certification); UK: United Kingdom; Default -CN/EU: All areas to which CE certification requirements apply. Huawei FusionSolar Smart PV Solution and Product Naming Specifications
18	Product Software Number	RO	U16			30107	1	Unique ID of the software release entity. Used for grid standard code compatibility processing

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
19	Product Software Version Number	RO	U16			30108	1	Software Release Entity Version Sequence Number Used for grid standard code compatibility processing
20	Grid Standard Code Protocol Version	RO	U16			30109	1	Protocol loading verification is similar to CAN1.0 CAN2.0.
21	Unique ID of the software	RO	U16			30110	1	Unique ID of a software version. Upgrade packages with different IDs cannot be upgraded. (Broadcast Upgrade Signature)
22	Number of Packages to be Upgraded	RO	U16		1	30111	1	Considering the increasing number of southbound devices to be upgraded, the number of upgrade packages must be reserved.
23	Subpackage 1 information	RO	U32			30112	2	high character: file type ID; Low word: device type ID;
24	Subpackage 2 information	RO	U32			30114	2	high character: file type ID; Low word: device type ID;

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
25	Subpackage 3 information	RO	U32			30116	2	high character: file type ID; Low word: device type ID;
26	Subpackage 4 Information	RO	U32			30118	2	high character: file type ID; Low word: device type ID;
27	Subpackage 5 information	RO	U32			30120	2	high character: file type ID; Low word: device type ID;
28	Subpackage 6 information	RO	U32			30122	2	high character: file type ID; Low word: device type ID;
29	Subpackage 7 Information	RO	U32			30124	2	high character: file type ID; Low word: device type ID;
30	Subpackage 8 information	RO	U32			30126	2	high character: file type ID; Low word: device type ID;
31	Subpackage 9 Information	RO	U32			30128	2	high character: file type ID; Low word: device type ID;
32	Subpackage 10 Information	RO	U32			30130	2	high character: file type ID; Low word: device type ID;

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
33	Hardware functional unit configuration identifier	RO	Bitfield16			30206	1	Indicates the configuration of the optional hardware functional units. 0: no functional unit hardware configuration; 1: The hardware configuration of the functional unit is available.
34	Sub-device support flag	RO	Bitfield32			30207	2	
35	Subdevice in-position flag	RO	Bitfield32			30209	2	
36	Feature Mask 1	RO	Bitfield32			30211	2	
37	Feature Mask 2	RO	Bitfield32			30213	2	
38	Feature Mask 3	RO	Bitfield32			30215	2	
39	Feature Mask 4	RO	Bitfield32			30217	2	
40	Grid standard code mask 1	RO	Bitfield16			30219	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
41	Grid standard code mask 2	RO	Bitfield16			30220	1	
42	Grid standard code mask 3	RO	Bitfield16			30221	1	
43	Grid standard code mask 4	RO	Bitfield16			30222	1	
44	Grid standard code mask 5	RO	Bitfield16			30223	1	
45	Grid standard code mask 6	RO	Bitfield16			30224	1	
46	Grid standard code mask 7	RO	Bitfield16			30225	1	
47	Grid standard code mask 8	RO	Bitfield16			30226	1	
48	Grid standard code mask 9	RO	Bitfield16			30227	1	
49	Grid standard code mask 10	RO	Bitfield16			30228	1	
50	Grid standard code mask 11	RO	Bitfield16			30229	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
51	Grid standard code mask 12	RO	Bitfield16			30230	1	
52	Grid standard code mask 13	RO	Bitfield16			30231	1	
53	Grid standard code mask 14	RO	Bitfield16			30232	1	
54	Grid standard code mask 15	RO	Bitfield16			30233	1	
55	Grid standard code mask 16	RO	Bitfield16			30234	1	
56	Grid Standard Code Mask 17	RO	Bitfield16			30235	1	
57	Grid standard code mask 18	RO	Bitfield16			30236	1	
58	Grid standard code mask 19	RO	Bitfield16			30237	1	
59	Grid standard code mask 20	RO	Bitfield16			30238	1	
60	Grid standard code mask 21	RO	Bitfield16			30239	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
61	Grid standard code mask 22	RO	Bitfield16			30240	1	
62	Grid standard code mask 23	RO	Bitfield16			30241	1	
63	Grid standard code mask 24	RO	Bitfield16			30242	1	
64	Grid standard code mask 25	RO	Bitfield16			30243	1	
65	Grid standard code mask 26	RO	Bitfield16			30244	1	
66	Grid standard code mask 27	RO	Bitfield16			30245	1	
67	Grid standard code mask 28	RO	Bitfield16			30246	1	
68	Grid standard code mask 29	RO	Bitfield16			30247	1	
69	Grid standard code mask 30	RO	Bitfield16			30248	1	
70	Grid standard code mask 31	RO	Bitfield16			30249	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
71	Grid standard code mask 32	RO	Bitfield16			30250	1	
72	Monitoring parameter mask 1	RO	Bitfield16			30300	1	
73	Monitoring parameter mask 2	RO	Bitfield16			30301	1	
74	Monitoring parameter mask 3	RO	Bitfield16			30302	1	
75	Monitoring parameter mask 4	RO	Bitfield16			30303	1	
76	Monitoring parameter mask 5	RO	Bitfield16			30304	1	
77	Monitoring parameter mask 6	RO	Bitfield16			30305	1	
78	Monitoring parameter mask 7	RO	Bitfield16			30306	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
79	Monitoring parameter mask 8	RO	Bitfield16			30307	1	
80	Power parameter mask 1	RO	Bitfield16			30308	1	
81	Power parameter mask 2	RO	Bitfield16			30309	1	
82	Power parameter mask 3	RO	Bitfield16			30310	1	
83	Power parameter mask 4	RO	Bitfield16			30311	1	
84	Power parameter mask 5	RO	Bitfield16			30312	1	
85	Power parameter mask 6	RO	Bitfield16			30313	1	
86	Power parameter mask 7	RO	Bitfield16			30314	1	
87	Power parameter mask 8	RO	Bitfield16			30315	1	
88	Power parameter mask 9	RO	Bitfield16			30316	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
89	Power parameter mask 10	RO	Bitfield16			30317	1	
90	Power parameter mask 11	RO	Bitfield16			30318	1	
91	Power parameter mask 12	RO	Bitfield16			30319	1	
92	Power parameter mask 13	RO	Bitfield16			30320	1	
93	Power parameter mask 14	RO	Bitfield16			30321	1	
94	Power parameter mask 15	RO	Bitfield16			30322	1	
95	Power parameter mask 16	RO	Bitfield16			30323	1	
96	Power parameter mask 17	RO	Bitfield16			30324	1	
97	Power parameter mask 18	RO	Bitfield16			30325	1	
98	Power parameter mask 19	RO	Bitfield16			30326	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
99	Built-in PID parameter mask	RO	U16		1	30350	1	
100	real-time maximum active capability	RO	U32			30364	2	
101	Real-time maximum capacitive reactive capacity (+)	RO	I32			30366	2	
102	Real-Time Maximum Inductive Reactive Capacity (-)	RO	I32			30368	2	
103	Hardware Version	RO	STR		1	31000	15	
104	Monitoring board SN	RO	STR			31015	10	From the monitoring board electronic label
105	Monitoring software version	RO	STR			31025	15	MCU1 Version
106	Primary DSP version	RO	STR			31040	15	MCU2 Version
107	Slave DSP version	RO	STR			31055	15	MCU3 Version

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
108	CPL D Rev. No.	RO	STR			31070	15	MCU4 Version
109	AFCI Version	RO	STR			31085	15	MCU5 version
110	Built-in PID	RO	STR			31100	15	MCU6 Version
111	EL Module Software Version	RO	STR			31130	15	MCU8 version
112	AFCI - 2 Software Version	RO	STR			31145	15	MCU9 Version
113	[Remote-signaling] Single-machine telesignaling	RO	Bitfield16			32000	1	IEC104 Reported and Merged PCS Running Status
114	[Telesignaling] Running status (monitoring processing)	RO	Bitfield16			32002	1	
115	[Remote signal] Running status (power processing)	RO	Bitfield32		1	32003	2	
116	[Remote signaling] Alarm 1	RO	Bitfield16			32008	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
117	[Remote signaling] Alarm 2	RO	Bitfield16			32009	1	
118	[Remote signaling] Alarm 3	RO	Bitfield16			32010	1	
119	Device SN Signature Code	RO	U16			32015	1	CRC16 value of the SN and identifier of key data This command is used to prevent incorrect energy yield modification caused by incorrect energy yield reported by devices with the same address. The SN CRC is added to ensure that the energy yield source is correct.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
120	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 is used: 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".
121	PV1 current	RO	I16	A	100	32017	1	When bit 9 of power parameter mask 14 is 0, the signal name is PV1 current. When bit 9 of power parameter mask 14 is 1, the following logic is used: When "DC input display mode 30205" is "0", the signal name is "PV1 current". When "DC Input Display Mode 30205" is "1", the signal name is "MPPT1 Current".

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
122	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 is used: 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".
123	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 is used: 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.
124	PV3 voltage	RO	I16	V	10	32020	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
125	PV3 current	RO	I16	A	100	32021	1	
126	PV4 voltage	RO	I16	V	10	32022	1	
127	PV4 current	RO	I16	A	100	32023	1	
128	PV5 voltage	RO	I16	V	10	32024	1	
129	PV5 current	RO	I16	A	100	32025	1	
130	PV6 voltage	RO	I16	V	10	32026	1	
131	PV6 current	RO	I16	A	100	32027	1	
132	PV7 voltage	RO	I16	V	10	32028	1	
133	PV7 current	RO	I16	A	100	32029	1	
134	PV8 voltage	RO	I16	V	10	32030	1	
135	PV8 current	RO	I16	A	100	32031	1	
136	PV9 voltage	RO	I16	V	10	32032	1	
137	PV9 current	RO	I16	A	100	32033	1	
138	PV10 voltage	RO	I16	V	10	32034	1	
139	PV10 current	RO	I16	A	100	32035	1	
140	PV11 voltage	RO	I16	V	10	32036	1	
141	PV11 current	RO	I16	A	100	32037	1	
142	PV12 voltage	RO	I16	V	10	32038	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
143	PV12 current	RO	I16	A	100	32039	1	
144	PV13 voltage	RO	I16	V	10	32040	1	
145	PV13 current	RO	I16	A	100	32041	1	
146	PV14 Voltage	RO	I16	V	10	32042	1	
147	PV14 current	RO	I16	A	100	32043	1	
148	PV15 voltage	RO	I16	V	10	32044	1	
149	PV15 current	RO	I16	A	100	32045	1	
150	PV16 voltage	RO	I16	V	10	32046	1	
151	PV16 current	RO	I16	A	100	32047	1	
152	PV17 Voltage	RO	I16	V	10	32048	1	
153	PV17 Current	RO	I16	A	100	32049	1	
154	PV18 voltage	RO	I16	V	10	32050	1	
155	PV18 Current	RO	I16	A	100	32051	1	
156	PV19 voltage	RO	I16	V	10	32052	1	
157	PV19 current	RO	I16	A	100	32053	1	
158	PV20 voltage	RO	I16	V	10	32054	1	
159	PV20 current	RO	I16	A	100	32055	1	
160	DC power	RO	I32	kW	1000	32064	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
161	Voltage of line A and B of power 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.
162	Power grid BC line voltage	RO	U16	V	10	32067	1	This parameter is invalid when Output Mode is set to L/N, L1/L2/N, or L1/L2.
163	Power grid CA line voltage	RO	U16	V	10	32068	1	This parameter is invalid when Output Mode is set to L/N, L1/L2/N, or L1/L2.
164	Power grid phase A voltage	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. Not displayed in off-net mode

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
165	Power grid phase B voltage	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". Not displayed in off-net mode
166	Power grid phase C voltage	RO	U16	V	10	32071	1	This parameter is invalid when Output Mode is set to L/N, L1/L2/N, or L1/L2.
167	Grid A phase current	RO	I32	A	1000	32072	2	When the output mode is L/N, L1/L2/N, or L1/L2, the signal name is Grid Current.
168	Grid phase B current	RO	I32	A	1000	32074	2	This parameter is invalid when Output Mode is set to L/N, L1/L2/N, or L1/L2.
169	Grid phase C current	RO	I32	A	1000	32076	2	This parameter is invalid when Output Mode is set to L/N, L1/L2/N, or L1/L2.
170	Peak active power of the day	RO	I32	kW	1000	32078	2	
171	active power	RO	I32	kW	1000	32080	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
172	reactive power	RO	I32	kVar	1000	32082	2	
173	power factor	RO	I16		1000	32084	1	
174	Grid frequency	RO	U16	Hz	100	32085	1	
175	Inverter efficiency	RO	U16	%	100	32086	1	When the PCS generates power, it indicates the power generation efficiency; when the PCS absorbs power, it indicates the absorption efficiency.
176	Internal temperature	RO	I16	℃	10	32087	1	
177	Insulation Impedance Value	RO	U16	MΩ	1000	32088	1	
178	Device Status	RO	E16			32089	1	For details, see the Inverter Key Signal Extension Description.
179	Fault Code	RO	U16			32090	1	For details about the fault code corresponding to the alarm with the highest priority, see the Alarm Description sheet.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
180	Startup time	RO	epoch second	s	1	32091	2	Monitoring and calculation
181	Shutdown Time	RO	epoch second	s	1	32093	2	Monitoring and calculation
182	active power [fast]	RO	I32	kW	1000	32095	2	The fast reporting interface is not filtered and is used for energy storage scheduling control.
183	cumulative generated electricity	RO	U32	kWh	100	32106	2	
184	Total DC input power	RO	U32	kWh	100	32108	2	
185	Current electricity generation statistics time	RO	epoch second	s	1	32110	2	
186	Current hourly electricity generated	RO	U32	kWh	100	32112	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
187	Daily generated electricity	RO	U32	kWh	100	32114	2	
188	Electricity generated in current month	RO	U32	kWh	100	32116	2	
189	Electricity generated in the current year	RO	U32	kWh	100	32118	2	
190	Number of critical alarms	RO	U16		1	32151	1	
191	Number of Major Alarms	RO	U16		1	32152	1	
192	Number of minor alarms	RO	U16		1	32153	1	
193	Number of warning alarms	RO	U16		1	32154	1	
194	Alarm clearance serial number	RO	U16			32155	1	After the alarm is cleared on the local monitoring board, the SN is incremented by 1. After the alarm is reversed, the SN starts from 1 and the SN is skipped.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
195	Electricity statistics time in the previous hour	RO	epoch second	s	1	32156	2	Including generated electricity/ absorbed electricity
196	Electricity generated in the previous hour	RO	U32	kWh	100	32158	2	
197	Electricity statistics time of the previous day	RO	epoch second	s	1	32160	2	Including generated electricity/ absorbed electricity
198	Electricity generated on the previous day	RO	U32	kWh	100	32162	2	
199	Electricity statistics time of the previous month	RO	epoch second	s	1	32164	2	Including generated electricity/ absorbed electricity
200	Electricity generated in previous month	RO	U32	kWh	100	32166	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
201	Electricity statistics time of the previous year	RO	epoch second	s	1	32168	2	Including generated electricity/ absorbed electricity
202	Electricity generated in previous year	RO	U32	kWh	100	32170	2	
203	Latest Active Alarm Serial Number	RO	U32			32172	2	When a new active alarm is generated, the SN is + 1.
204	Latest historical alarm serial number	RO	U32			32174	2	When an active alarm is transferred to history, the serial number of the historical alarm is equal to the serial number of the last active alarm transferred to history.
205	Total bus voltage	RO	I16	V	10	32176	1	PID reporting data, which is used in single-level scenarios
206	Maximum value of PV voltage	RO	I16	V	10	32177	1	PID reporting data, which is used in single-level scenarios
207	Minimum PV voltage	RO	I16	V	10	32178	1	PID reporting data, which is used in single-level scenarios

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
208	Average PV negative voltage to ground	RO	I16	V	10	32179	1	PID reporting data, which is used in single-level scenarios
209	Maximum PV positive voltage to ground	RO	I16	V	10	32180	1	PID reporting data, which is used in single-level scenarios
210	PV negative voltage to ground minimum	RO	I16	V	10	32181	1	PID reporting data, which is used in single-level scenarios
211	Inverter to PE voltage tolerance	RO	U16	V	1	32182	1	PID reporting data, which is used in single-level scenarios To be compatible with PID2.0, the PCS reports 1502. 0:1000V/1100V inverter; 1500: HAV1 inverter; 1502: HAV2 inverter;
212	ISO Feature Information	RO	Bitfield16		1	32183	1	PID reporting data, which is used in single-level scenarios
213	Built-in PID running status	RO	E16			32190	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
214	PV negative voltage to ground	RO	I16	V	10	32191	1	
215	Cumulative DC energy yield of MPPT1	RO	U32	kWh	100	32212	2	The TD Tech NMS GUI is displayed in five or four lines.
216	MPPT2 DC cumulative energy yield	RO	U32	kWh	100	32214	2	The TD Tech NMS GUI is displayed in five or four lines.
217	MPPT3 DC cumulative energy yield	RO	U32	kWh	100	32216	2	The TD Tech NMS GUI is displayed in five or four lines.
218	MPPT4 DC cumulative energy yield	RO	U32	kWh	100	32218	2	The TD Tech NMS GUI is displayed in five or four lines.
219	MPPT5 DC cumulative energy yield	RO	U32	kWh	100	32220	2	The TD Tech NMS GUI is displayed in five or four lines.
220	MPPT6 accumulated DC energy yield	RO	U32	kWh	100	32222	2	The TD Tech NMS GUI is displayed in five or four lines.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
221	MPPT7 DC Cumulative Energy Generation	RO	U32	kWh	100	32224	2	The TD Tech NMS GUI is displayed in five or four lines.
222	MPPT8 DC Cumulative Power Generation	RO	U32	kWh	100	32226	2	The TD Tech NMS GUI is displayed in five or four lines.
223	MPPT9 DC cumulative energy yield	RO	U32	kWh	100	32228	2	The TD Tech NMS GUI is displayed in five or four lines.
224	MPPT10 DC cumulative energy yield	RO	U32	kWh	100	32230	2	The TD Tech NMS GUI is displayed in five or four lines.
225	Monitoring alarm 1	RO	Bitfield16			32252	1	GroupID:0xFF00
226	Monitoring alarm 2	RO	Bitfield16			32253	1	GroupID:0xFF01
227	Monitoring alarm 3	RO	Bitfield16			32254	1	GroupID:0xFF02
228	[External] Power alarm 1	RO	Bitfield16			32255	1	GroupID:0x0000

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
229	[External] Power Alarm 2	RO	Bitfield16			32256	1	GroupID:0x0001
230	[External] Power alarm 3	RO	Bitfield16			32257	1	GroupID:0x0002
231	[External] Power alarm 4	RO	Bitfield16			32258	1	GroupID:0x0003
232	[External] Power Alarm 5	RO	Bitfield16			32259	1	GroupID:0x0004
233	[External] Power Alarm 6	RO	Bitfield16			32260	1	GroupID:0x0005
234	[External] Power alarm 7	RO	Bitfield16			32261	1	GroupID:0x0006
235	[External] Power Alarm 8	RO	Bitfield16			32262	1	GroupID:0x0007
236	[External] Power Alarm 9	RO	Bitfield16			32263	1	GroupID:0x0008
237	[External] Power alarm 10	RO	Bitfield16			32264	1	GroupID:0x0009
238	[External] Power alarm 11	RO	Bitfield16			32265	1	GroupID:0x000A

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
239	[External] Power Alarm 12	RO	Bitfield16			32266	1	GroupID:0x000B
240	[External] Power alarm 13	RO	Bitfield16			32267	1	GroupID:0x000C
241	[External] Power alarm 14	RO	Bitfield16			32268	1	GroupID:0x000D
242	[External] Power Alarm 16	RO	Bitfield16			32270	1	GroupID:0x000F
243	Monitoring alarm 4	RO	Bitfield16			32271	1	GroupID:0xFF03
244	Monitoring alarm 5	RO	Bitfield16			32272	1	GroupID:0xFF04
245	[External] Power alarm 17	RO	Bitfield16			32273	1	GroupID:0x0010
246	[External] Power alarm 18	RO	Bitfield16			32277	1	GroupID:0x0011
247	String 1 access status	RO	E16			32300	1	
248	String 2 access status	RO	E16			32301	1	
249	String 3 access status	RO	E16			32302	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
250	String 4 access status	RO	E16			32303	1	
251	String 5 access status	RO	E16			32304	1	
252	String 6 access status	RO	E16			32305	1	
253	String 7 access status	RO	E16			32306	1	
254	String 8 access status	RO	E16			32307	1	
255	String 9 access status	RO	E16			32308	1	
256	String 10 access status	RO	E16			32309	1	
257	String 11 access status	RO	E16			32310	1	
258	String 12 access status	RO	E16			32311	1	
259	String 13 access status	RO	E16			32312	1	
260	String 14 access status	RO	E16			32313	1	
261	String 15 access status	RO	E16			32314	1	
262	String 16 access status	RO	E16			32315	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
263	String 17 access status	RO	E16			32316	1	
264	String 18 access status	RO	E16			32317	1	
265	Total input power of MPPT1	RO	U32	kW	1000	32324	2	
266	Total input power of MPPT2	RO	U32	kW	1000	32326	2	
267	Total input power of MPPT3	RO	U32	kW	1000	32328	2	
268	Total input power of MPPT4	RO	U32	kW	1000	32330	2	
269	Total input power of MPPT5	RO	U32	kW	1000	32332	2	
270	Total input power of MPPT6	RO	U32	kW	1000	32334	2	
271	Total input power of MPPT7	RO	U32	kW	1000	32336	2	
272	Total input power of MPPT8	RO	U32	kW	1000	32338	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
273	Total input power of MPPT9	RO	U32	kW	1000	32340	2	
274	Stent System Status	RO	Bitfield32			34000	2	BIT0~BIT15: status of support system 1-16; Bits 16 to 31: reserved for subsequent expansion
275	Tilt Angle 1 Sampling	RO	I16	°	100	34002	1	
276	Direction 1 sampling	RO	I16	°	100	34003	1	
277	Tilt angle 2 sampling	RO	I16	°	100	34004	1	
278	Direction 2 Sampling	RO	I16	°	100	34005	1	
279	Tilt angle 3 sampling	RO	I16	°	100	34006	1	
280	Direction 3 Sampling	RO	I16	°	100	34007	1	
281	Tilt angle 4 sampling	RO	I16	°	100	34008	1	
282	Direction 4 Sampling	RO	I16	°	100	34009	1	
283	Tilt angle 5 sampling	RO	I16	°	100	34010	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
284	Direction 5 sampling	RO	I16	°	100	34011	1	
285	Tilt angle 6 sampling	RO	I16	°	100	34012	1	
286	Direction 6 Sampling	RO	I16	°	100	34013	1	
287	Tilt Angle 7 Sampling	RO	I16	°	100	34014	1	
288	Direction 7 sampling	RO	I16	°	100	34015	1	
289	Tilt angle 8 sampling	RO	I16	°	100	34016	1	
290	Direction 8 sampling	RO	I16	°	100	34017	1	
291	Tilt angle 9 sampling	RO	I16	°	100	34018	1	
292	azimuth 9 sampling	RO	I16	°	100	34019	1	
293	Tilt angle 10 sampling	RO	I16	°	100	34020	1	
294	Direction 10 sampling	RO	I16	°	100	34021	1	
295	Tilt angle 11 sampling	RO	I16	°	100	34022	1	
296	Direction 11 sampling	RO	I16	°	100	34023	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
297	Tilt angle 12 sampling	RO	I16	°	100	34024	1	
298	azimuth 12 sampling	RO	I16	°	100	34025	1	
299	Tilt angle 13 sampling	RO	I16	°	100	34026	1	
300	Direction angle 13 sampling	RO	I16	°	100	34027	1	
301	Tilt angle 14 sampling	RO	I16	°	100	34028	1	
302	Direction angle 14 sampling	RO	I16	°	100	34029	1	
303	Tilt angle 15 sampling	RO	I16	°	100	34030	1	
304	Direction 15 sampling	RO	I16	°	100	34031	1	
305	Tilt angle 16 sampling	RO	I16	°	100	34032	1	
306	16-angle sampling	RO	I16	°	100	34033	1	
307	tracking system controller	RO	E16			34034	1	
308	Stent System Type	RO	E16			34035	1	If the device manufacturer does not support one of the rack types, the error code 03 is returned.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
309	Working mode	RO	E16			34036	1	
310	Total Number of Stents	RO	U16		1	34037	1	For dual axis control, the maximum number of support systems is 8
311	Stand Access Status	RO	Bitfield32		1	34038	2	BIT0~BIT15: access status of support systems 1-16; Bits 16 to 31: reserved for subsequent expansion
312	Working mode mask	RO	Bitfield32		1	34040	2	Each bit indicates whether a working mode is supported.
313	General Fault Status of Bracket 1	RO	E16			34075	1	Data collection reports to the management system.
314	Bracket 1 Custom Fault Status	RO	U16		1	34076	1	For details about the controller scenario definition, see the corresponding document. Data collection reports to the management system.
315	Bracket 2 General Fault Status	RO	U16		1	34077	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
316	Bracket 2 Custom Fault Status	RO	U16		1	34078	1	
317	Common fault status of bracket 3	RO	U16		1	34079	1	
318	Bracket 3 Custom Fault Status	RO	U16		1	34080	1	
319	Bracket 4 General Fault Status	RO	U16		1	34081	1	
320	Bracket 4 Custom Fault Status	RO	U16		1	34082	1	
321	Common Fault Status of Bracket 5	RO	U16		1	34083	1	
322	Bracket 5 Custom Fault Status	RO	U16		1	34084	1	
323	General Fault Status of Bracket 6	RO	U16		1	34085	1	
324	Bracket 6 Custom Fault Status	RO	U16		1	34086	1	
325	Bracket 7 General Fault Status	RO	U16		1	34087	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
326	Bracket 7 Custom Fault Status	RO	U16		1	34088	1	
327	Bracket 8 General Fault Status	RO	U16		1	34089	1	
328	Bracket 8 Custom Fault Status	RO	U16		1	34090	1	
329	Bracket 9 General Fault Status	RO	U16		1	34091	1	
330	Bracket 9 Custom Fault Status	RO	U16		1	34092	1	
331	Bracket 10 General Fault Status	RO	U16		1	34093	1	
332	Bracket 10 Custom Fault Status	RO	U16		1	34094	1	
333	Bracket 11 General Fault Status	RO	U16		1	34095	1	
334	Bracket 11 Custom Fault Status	RO	U16		1	34096	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
335	Bracket 12 General Fault Status	RO	U16		1	34097	1	
336	Bracket 12 Custom Fault Status	RO	U16		1	34098	1	
337	Bracket 13 General Fault Status	RO	U16		1	34099	1	
338	Bracket 13 Custom Fault Status	RO	U16		1	34100	1	
339	Bracket 14 General Fault Status	RO	U16		1	34101	1	
340	Bracket 14 Custom Fault Status	RO	U16		1	34102	1	
341	Bracket 15 General Fault Status	RO	U16		1	34103	1	
342	Bracket 15 Custom Fault Status	RO	U16		1	34104	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
343	Bracket 16 General Fault Status	RO	U16		1	34105	1	
344	Bracket 16 Custom Fault Status	RO	U16		1	34106	1	
345	Capacitor bank running time	RO	U32	hour	10	35000	2	Used to inspect data.
346	Internal Fan 1 Running Time	RO	U32	hour	10	35002	2	Used to inspect data.
347	Internal Fan 2 Running Time	RO	U32	hour	10	35004	2	Used to inspect data.
348	Internal Fan 3 Running Time	RO	U32	hour	10	35006	2	Used to inspect data.
349	Internal Fan 4 Running Time	RO	U32	hour	10	35008	2	Used to inspect data.
350	Internal alarm	RO	U16	V	1	35010	1	Used for R&D data storage
351	Internal temperature 1	RO	I16	°C	10	35021	1	INV module A temperature Used for R&D 5-minute data recording
352	Internal temperature 2	RO	I16	°C	10	35022	1	INV Module B Temperature Used for R&D 5-minute data recording

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
353	Internal temperature 3	RO	I16	℃	10	35023	1	INV Module C Temperature Used for R&D 5-minute data recording
354	Internal temperature 4	RO	I16	℃	10	35024	1	Anti-reverse module 1 temperature sampling Used for R&D 5-minute data recording.
355	Internal temperature 5	RO	I16	℃	10	35025	1	Output board relay, ambient temperature - maximum temperature Used for R&D 5-minute data recording.
356	Internal temperature 6	RO	I16	℃	10	35026	1	Output board, power board input, power board inverter temperature sampling - maximum temperature Used for R&D 5-minute data recording.
357	Internal temperature 7	RO	I16	℃	10	35027	1	Anti-reverse module 2 temperature sampling Used for R&D 5-minute data recording

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
358	Internal temperature 8	RO	I16	°C	10	35028	1	DC terminal temperature 1 / 2 - maximum temperature Used for R&D 5-minute data recording
359	Internal temperature 9	RO	I16	°C	10	35029	1	AC terminal temperature 1 / 2 / 3 - maximum temperature Used for R&D 5-minute data recording
360	Internal temperature 10	RO	I16	°C	10	35030	1	Used for R&D data storage
361	Internal temperature 11	RO	I16	°C	10	35031	1	Used for R&D data storage
362	Internal temperature 12	RO	I16	°C	10	35032	1	Used for R&D data storage
363	Phase A DC component DCI	RO	I16	A	1000	35038	1	Used for R&D 5-minute data recording
364	Phase B DC component DCI	RO	I16	A	1000	35039	1	Used for R&D 5-minute data recording
365	Phase C DC component DCI	RO	I16	A	1000	35040	1	Used for R&D 5-minute data recording
366	Leakage current RCD	RO	I16	mA	1	35041	1	Used for R&D 5-minute data recording
367	Positive bus voltage	RO	I16	V	10	35042	1	Used for R&D 5-minute data recording

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
368	negative bus voltage	RO	I16	V	10	35043	1	Used for R&D 5-minute data recording
369	BUS negative voltage to ground	RO	I16	V	10	35044	1	Used for R&D 5-minute data recording
370	Boost1 output upper capacitance voltage	RO	I16	V	10	35055	1	Used for R&D data storage
371	Voltage of the output capacitor of the Boost2	RO	I16	V	10	35056	1	Used for R&D data storage
372	Boost3 output upper capacitance voltage	RO	I16	V	10	35057	1	Used for R&D data storage
373	Boost4 output upper capacitance voltage	RO	I16	V	10	35058	1	Used for R&D data storage
374	Boost5 output upper capacitance voltage	RO	I16	V	10	35059	1	Used for R&D data storage
375	Boost6 output upper capacitance voltage	RO	I16	V	10	35060	1	Used for R&D data storage

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
376	Voltage of the output capacitor of the Boost7	RO	I16	V	10	35061	1	Used for R&D data storage
377	Boost8 output upper capacitance voltage	RO	I16	V	10	35062	1	Used for R&D data storage
378	Boost9 output upper capacitance voltage	RO	I16	V	10	35063	1	Used for R&D data storage
379	Boost10 output upper capacitance voltage	RO	I16	V	10	35064	1	Used for R&D data storage
380	[EL] Detection Status	RO	E16			35092	1	Note: The detection timeout refers to the situation that the external system starts the detection but does not continue the operation for a period of time.
381	IV Scan Status	RO	E16			35094	1	
382	IV scanning capability	RO	E16			35095	1	
383	Delayed activation state	RO	E16			35115	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
384	[Intelligent IV Diagnosis] Authorization function	RO	Bitfield32		1	35136	2	20190219 SEG of the Monitoring Development Dept: The original Lic cannot support scenarios with different expiration periods for different features. The Lic feature cannot be supported by different models. The mechanism is supported. The original interface supports only the IV feature. For subsequent features, two interfaces (status and end time) are added for each feature.
385	[Intelligent IV Diagnosis] (License) Status	RO	E16			35138	1	
386	[Intelligent IV Diagnosis] License expiration time	RO	epoch second	s	1	35139	2	epoch second If 0XF2A52380(2099-1-1) is reported, it takes effect permanently. If no license is available, 0 or 0XFFFFFFFF is reported, and NA is displayed on the GUI.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
387	License Loading Time	RO	epoch second	s	1	35141	2	epoch second
388	License Deregistration Time	RO	epoch second	s	1	35143	2	epoch second The value 0XFFFFFFFF is reported in the non-deregistered state.
389	License SN	RO	STR		1	35145	10	
390	invalidation code	RO	STR		1	35155	64	
391	Authorization Feature Signature	RO	E16			35219	2	1. Bit 1 indicates that this function is licensed. 2. If bit 0 is cleared, this function is not licensed on the current model. This parameter is used to support differentiated management and control policies for different models.
392	[String monitoring] License status	RO	E16			35221	1	0: no license; 1: normal; 2: grace period; 3: deregistered; 4: SN mismatch; 5: expired;

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
393	[String monitoring] License expiration time	RO	epoch second	s	1	35222	2	epoch second If the feature status is normal and 0XF2A52380(2099-1-1) is reported, the feature takes effect permanently. If the feature status is abnormal, 0 or 0XFFFFFFFF is reported, and NA is displayed on the GUI.
394	[SCR1.5] License Status	RO	E16			35224	1	0: no license; 1: normal; 2: grace period; 3: deregistered; 4: SN mismatch; 5: expired;
395	[SCR1.5] License expiration date	RO	epoch second	s	1	35225	2	epoch second If the feature status is normal and 0XF2A52380(2099-1-1) is reported, the feature takes effect permanently. If the feature status is abnormal, 0 or 0XFFFFFFFF is reported, and NA is displayed on the GUI.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
396	[SCR1.3] License Status	RO	E16			35227	1	0: no license; 1: normal; 2: grace period; 3: deregistered; 4: SN mismatch; 5: expired;
397	[SCR1.3] License Expiration Date	RO	epoch second	s	1	35228	2	epoch second If the feature status is normal and 0XF2A52380(2099-1-1) is reported, the feature takes effect permanently. If the feature status is abnormal, 0 or 0XFFFFFFFF is reported, and NA is displayed on the GUI.
398	active regulation state	RO	MLD			35300	4	For details, see the description of "structural data".
399	Reactive power regulation state	RO	MLD			35304	4	For details, see the description of "structural data".
400	Inverter status	RO	Bitfield16			37518	1	
401	Inverter status support flag	RO	U16		1	37519	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
402	System Time [Local Time]	RW	epoch second	s	1	40000	2	The data is in the format of epoch seconds and the local time.
403	Q-U characteristic curve model	RW	E16			40037	1	
404	Q-U Scheduling Trigger Power Percentage	RW	I16	%	1	40038	1	
405	Active power fixed value derating	RW	U16	kW	10	40120	1	
406	power factor	RW	I16		1000	40122	1	
407	Reactive Power Compensation (Q/S) [Low Precision]	RW	I16		1000	40123	1	The equipment performs reactive power control by converting the value into Q fixed value according to the value. where S is Smax;

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
408	Reactive power adjustment time	RW	U16	s	1	40124	1	Change requirement: Add the "Reactive Power Adjustment Time" broadcast interface under the Q-P characteristic curve and cosphi-P characteristic curve, which is the same as the Q-U characteristic curve 20190918.
409	Active Power Percentage Derating [Low Precision]	RW	I16	%	10	40125	1	Active fine adjustment interface
410	Active power fixed value derating	RW	U32	W	1	40126	2	Range: [0,Pmax]
411	Reactive power compensation at night (Q/S)	RW	I16		1000	40128	1	The equipment performs reactive power control by converting the value into Q fixed value according to the value. where S is Smax;
412	Fixed reactive power at night	RW	I32	kVar	1000	40129	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
413	cosphi-P/Pn characteristic curve	RW	MLD			40133	21	
414	Q-U characteristic curve	RW	MLD			40154	21	
415	PF-U characteristic curve	RW	MLD			40175	21	
416	Characteristic curve: reactive power adjustment time	RW	U16	s	1	40196	1	Change requirement: Add the "Reactive Power Adjustment Time" broadcast interface under the Q-P characteristic curve and cosphi-P characteristic curve, which is the same as the Q-U characteristic curve 20190918.
417	Percent apparent power	RW	U16	%	10	40197	1	Used for STS coordination for over-temperature derating
418	Q-U Scheduling Exit Power Percentage	RW	I16	%	1	40198	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
419	Active Power Percentage Control [Low Precision]	RW	I16	%	10	40199	1	The active power percentage control interface is used in distributed mode. The interface is sent to the power software in anti-backcurrent control to control the upper limit of the output active power when the power is increased in underfrequency.
420	Power on	WO	E16			40200	1	
421	Shutdown	WO	E16			40201	1	
422	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 it to the DSP. After receiving a normal response, the inverter monitoring module returns the northbound port. After 3s, the system resets. Otherwise, the system does not restart.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
423	Q-P characteristic curve	RW	MLD			40354	21	
424	Minimum PF limit for Q-U characteristic curve	RW	U16		1000	40375	1	This interface is used to limit the output of the QU curve by limiting the current PF value. If the country code is not required by this function, the default value is 0, indicating that the output of the reactive power is not restricted. If the EN50549 country code requires that the value range from 0 to 1, the value can be set. The default value is 0.9.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
425	Q-U characteristic curve effective delay time	RW	U16	s	1	40376	1	After the QU curve reaches the trigger voltage, the reactive power changes after a period of delay. Italy CEI0-16 requires that the default value be 3s, indicating that the QU curve takes effect 3s after triggering. This parameter can be set on the GUI. The default value is 0 for other country codes.
426	grid standard code	RW	U16		1	42000	1	
427	Output Mode	RW	E16			42001	1	The customer interface can be displayed as read-only signals. Currently, the 8.0 PCS supports only the three-phase three-wire system and does not need to be set. The interface is used to notify each interface during subsequent configuration.
428	Voltage level	RW	U16	V	1	42002	1	Vn
429	Frequency level	RW	U16	Hz	1	42003	1	Fn

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
430	Remote power scheduling	RW	E16			42014	1	Disabling this parameter will cause the inverter to be locked.
431	reactive power variation gradient	RW	U32	%/s	1000	42015	2	
432	active power gradient	RW	U32	%/s	1000	42017	2	Limiting the speed of power change caused by power scheduling instructions
433	Scheduling instruction maintenance time	RW	U32	s	1	42019	2	Permanently valid when equal to 0
434	Maximum apparent power	RW	U32	kVA	1000	42021	2	["Maximum Active Power", Smax]
435	Maximum active power	RW	U32	kW	1000	42023	2	[0.1,Pmax]
436	apparent power reference	RW	U32	kVar	1000	42025	2	Sn. The maximum active power (PMax) setting upper limit is used as the reference for reactive power scheduling (Q/S).

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
437	active power reference	RW	U32	kW	1000	42027	2	Set the lower limit of the maximum apparent value (SMax) and serve as the benchmark of active power scheduling (percentage).
438	active power gradient of power station	RW	U16	min/100%	1	42029	1	The Chinese standard requires that the change of active power caused by illumination fluctuation should meet certain speed requirements during normal operation.
439	Filtering time of the average active power of the power station	RW	U32	ms	1	42030	2	
440	PF-U voltage detection filter time	RW	U16	s	10	42032	1	
441	Frequency detection filter time	RW	U16	ms	1	42037	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
442	Frequency active derating recovery delay time	RW	U16	s	1	42040	1	
443	Effective delay time of active frequency derating	RW	U16	ms	1	42041	1	
444	frequency active derating hysteresis loop	RW	E16			42042	1	
445	FM control response dead zone	RW	U16	Hz	1000	42043	1	
446	PQ mode	RW	E16			42046	1	
447	Panel Type	RW	E16			42047	1	
448	PID compensation direction	RW	E16			42048	1	
449	String connection mode	RW	E16			42049	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
450	Isolation Settings	RW	E16			42050	1	The customer interface displays the read-only signal. Currently, the 8.0 PCS supports only the input without grounding and with transformer. In the subsequent configuration, the interface is changed to notify each interface.
451	frequency modulation control power variation gradient	RW	U16	%/min	1	42051	1	
452	FM control power variation limit	RW	U16	%	10	42052	1	
453	FM Control Delay Response Time	RW	U16	ms	1	42053	1	Polish national requirements, open to the English: Initial delay in the frequency sensitive mode
454	MPPT multimodal scanning	RW	E16			42054	1	
455	MPPT scanning interval	RW	U16	min	1	42055	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
456	MPPT predicted power	RO	U32	kW	1000	42056	2	
457	Automatic power grid fault recovery	RW	E16			42061	1	
458	Power Limit 0% Shutdown	RW	E16			42062	1	
459	Automatic shut-off of communication link disconnection	RW	E16			42063	1	In the parallel system of 8.0 PCS power, the system will be automatically shut down when the communication link is disconnected by default, and the communication interruption duration is 1 minute. The PCS power is determined by the customer's parameters and default power policy priorities. Affected parameters include all parameters under Communication Link Failure Protection.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
460	Communication resumes automatic power-on	RW	E16			42064	1	
461	Power Quality Optimization Mode	RW	E16			42065	1	
462	RCD enhancement	RW	E16			42066	1	
463	no-time work	RW	E16			42067	1	
464	Night PID protection	RW	E16			42069	1	
465	Reactive power parameter takes effect at night	RW	E16			42070	1	
466	Communication disconnection detection time	RW	U16	s	1	42072	1	Displayed when Communication Link Failure Protection is Enabled
467	AFCI	RW	E16			42073	1	
468	AFCI Detection Adaptation Mode	RW	E16			42074	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
469	Communication link disconnection failure protection	RW	E16			42075	1	Used to initiate security protection when the communication between the device and the northbound interface is disconnected.
470	Fail-safe active power mode	RW	E16			42076	1	Displayed when Communication Link Failure Protection is Enabled
471	Active power limit for fail protection [kW] [low precision]	RW	U32	kW	10	42077	2	Displayed when the communication link disconnection failure protection is enabled and the active power mode of the failure protection is set to a fixed value.
472	Fail-safe reactive power mode	RW	E16			42079	1	Displayed when Communication Link Failure Protection is Enabled
473	Frequency change rate protection	RW	E16			42080	1	
474	Frequency change rate protection point	RW	U16	Hz/s	10	42081	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
475	Frequency change rate protection time	RW	U16	s	10	42082	1	
476	Fail protection reactive power limit [Q/S] [low precision]	RW	I16		1000	42083	1	(deliver Q/S value) Displayed when Communication Link Disconnection Failure Protection is Enabled and Fail Protection Reactive Power Mode is Q/S
477	Power-on voltage upper limit	RW	U16	V	10	42084	1	Normal reconnection parameters
478	Lower limit of grid-connected power-on voltage	RW	U16	V	10	42085	1	Normal reconnection parameters
479	Upper limit of grid-coming startup frequency	RW	U16	Hz	100	42086	1	Normal reconnection parameters
480	Lower limit of power-on frequency	RW	U16	Hz	100	42087	1	Normal reconnection parameters

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
481	Upper limit of power grid reconnection voltage	RW	U16	V	10	42088	1	Parameters for re-connected after a fault
482	Lower limit of power grid reconnection voltage	RW	U16	V	10	42089	1	Parameters for re-connected after a fault
483	Upper limit of power grid reconnection frequency	RW	U16	Hz	100	42090	1	Parameters for re-connected after a fault
484	Lower limit of power grid reconnection frequency	RW	U16	Hz	100	42091	1	Parameters for re-connected after a fault
485	Automatic power grid reconnection time	RW	U16	s	1	42092	1	
486	Component nameplate short circuit current (Stc Isc)	RW	U16	A	100	42093	1	Short circuit current of component nameplate (Stc Issc): Refer to short circuit current of component nameplate STC: Isc (STC);

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
487	insulation impedance protection point	RW	U16	MΩ	1000	42097	1	The value range on the customer interface is [0.02 to 1.5]. The actual protection is implemented by the inverter based on the DC voltage. 600 V DC inverter: [0.02, 1.5] 1000 V DC inverter: [0.033, 1.5] 1500 V DC inverter: [0.05, 1.5]
488	Voltage Unbalance Protection Point	RW	U16	%	10	42098	1	
489	Phase protection point	RW	U16	°	10	42099	1	
490	Power grid fault startup soft start time	RW	U16	s	1	42100	1	Power rise gradient when the equipment starts up after the power grid is faulty
491	cosphi-P/Pn trigger voltage	RW	U16	%	1	42101	1	
492	cosphi-P/Pn exit voltage	RW	U16	%	1	42102	1	
493	Soft start time	RW	U16	s	1	42103	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
494	Power grid fault recovery and grid-connected time	RW	U16	s	1	42104	1	
495	Short-time power grid interruption judgment time	RW	U32	ms	1	42105	2	configurable after "Fast Start After Power Grid Fault" is enabled
496	Shutdown Gradient	RW	U32	%/s	1000	42107	2	
497	line loss compensation	RW	U16	%	10	42109	1	
498	Grid fault zero current mode	RW	E16			42110	1	
499	Power grid voltage jump trigger threshold	RW	U16	%	10	42111	1	Available only for VDE4120
500	HVRT	RW	E16			42112	1	
501	HVRT Trigger Threshold	RW	U16	V	10	42113	1	
502	HVRT positive reactive compensation factor	RW	U16		10	42114	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
503	Short-time power grid interruption and quick start-up	RW	E16			42116	1	Indicates whether to enable the quick startup function after the power grid is recovered from short-term interruption. If it is set to 0, the power grid is disabled. That is, the power grid is still connected according to the normal startup process after the power grid is interrupted for a short time. If it is set to 1, the power is enabled. After the power grid recovers from short-term interruption, the quick startup process is followed. Some detection items are skipped. Whether the power grid is interrupted for short time depends on whether the power grid can be restored within the short-term interruption judgment time.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
504	LVRT active current maintenance coefficient	RW	U16		100	42118	1	
505	LVRT	RW	E16			42119	1	By default, this function is enabled for BDEW standards and is disabled for other standards.
506	LVRT trigger threshold	RW	U16	V	10	42120	1	Sets the threshold for triggering low-voltage traversal. The threshold must comply with the local power grid standards.
507	Power grid voltage protection shielding during VRT	RW	E16			42121	1	This parameter specifies whether the voltage protection function is shielded during voltage crossing.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
508	LVRT positive-sequence reactive compensation factor	RW	U16		10	42122	1	During low voltage crossing, the device needs to send positive reactive power to support the power grid. This parameter is used to set the positive reactive power sent by the device. For example, if the LVRT positive-sequence reactive power compensation factor is set to 2, the positive-sequence reactive current emitted by the equipment increases by 20% of the rated current every time the AC voltage decreases by 10% during the low-voltage traversing process.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
509	VRT exit hysteresis threshold	RW	U16	V	10	42123	1	Sets the LVRT/ HVRT recovery threshold. LVRT recovery threshold = LVRT trigger threshold + VRT exit hysteresis threshold HVRT recovery threshold = HVRT trigger threshold - VRT exit hysteresis threshold
510	VRT active current limit percentage	RW	U16	%	1	42124	1	
511	VRT active power recovery gradient	RW	U16	%/s	1	42125	1	
512	HVRT negative-sequence reactive power compensation factor	RW	U16		10	42126	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
513	LVRT negative-sequence reactive power compensation factor	RW	U16		10	42127	1	During low voltage crossing, the device needs to send negative-sequence reactive power to support the power grid. This parameter is used to set the negative-sequence reactive power sent by the device. For example, if the LVRT negative-sequence reactive power compensation factor is set to 2, the negative-sequence reactive current generated by the equipment increases by 20% of the rated current every time the AC voltage decreases by 10% during the low-voltage traversing process.
514	phase angle offset protection	RW	E16			42128	1	
515	Active island protection	RW	E16			42129	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
516	Passive island protection	RW	E16			42130	1	
517	OVGR associated shutdown	RW	E16			42131	1	
518	Dry contact function	RW	E16			42132	1	
519	LVRT reactive current limit percentage	RW	U16	%	1	42133	1	In the low voltage crossing process, the equipment needs to limit the reactive current. For example, setting the LVRT Reactive Current Limit Percentage to 50, the upper limit of the reactive current of the device is 50% of the rated current during low voltage crossing.
520	LVRT Zero Current Mode Threshold	RW	U16	V	10	42134	1	If the grid fault zero current mode is enabled, the grid voltage is less than the LVRT zero current mode threshold during LVRT, the zero current mode is used. Otherwise, the LVRT mode is used.
521	LVRT mode	RW	E16			42135	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
522	Voltage rise suppression	RW	E16			42138	1	
523	Voltage rise suppression reactive power adjustment point	RW	U16	%	10	42139	1	The value of Voltage Rise Suppression Active Power Derating Point must be greater than that of Voltage Rise Suppression Reactive Power Adjusting Point.
524	Voltage rise suppression active derating point	RW	U16	%	10	42140	1	The value of Voltage Rise Suppression Active Power Derating Point must be greater than that of Voltage Rise Suppression Reactive Power Adjusting Point.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
525	FM Control	RW	E16			42141	1	According to the standards of some countries/ regions, if the power grid frequency changes near the rated value, the equipment needs to finely adjust the active power output based on the "Frequency Control Adjustment Rate" to help stabilize the power grid frequency, set this parameter to "Energable". Frequency sensitive mode (FSM) and G99 standard requirements.
526	frequency modulation control differential rate	RW	U16	%	1	42142	1	English: Frequency sensitive mode (FSM) Drop, G99 standard requirements.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
527	overfrequency derating	RW	E16			42143	1	When this parameter is set to Enabled, when the power grid frequency exceeds the overfrequency derating triggering frequency, the device performs active power derating according to a certain gradient.
528	overfrequency derating cutoff frequency	RW	U16	Hz	100	42144	1	Sets the cutoff frequency point for overfrequency derating.
529	overfrequency derating cutoff power	RW	U16	%	1	42145	1	Sets the cutoff power point for overfrequency derating.
530	Overfrequency derating trigger frequency	RW	U16	Hz	100	42146	1	The standards of some countries/ regions require that the active power output by the equipment be derated when the power grid frequency exceeds a specified value.
531	Overfrequency derating exit frequency	RW	U16	Hz	100	42147	1	Sets the exit frequency of overfrequency derating.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
532	Overfrequency derating power recovery gradient	RW	U16	%/min	1	42148	1	Sets the speed at which the overfrequency derating power is restored.
533	underfrequency power increase	RW	E16			42151	1	In some countries/regions, if the power grid frequency is lower than the trigger frequency of underfrequency power increase, the active power output needs to be increased to help increase the power grid frequency. In this case, set this parameter to Enable.
534	underfrequency power recovery gradient	RW	U16	%/min	1	42152	1	Sets the speed at which the underfrequency power is recovered.
535	LVRT characteristic curve	RW	MLD			42155	21	
536	underfrequency rising power cutoff frequency	RW	U16	Hz	100	42176	1	Sets the cutoff frequency of the underfrequency power increase.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
537	underfrequency rising power cutoff power	RW	U16	%	1	42177	1	Sets the cutoff power point of the underfrequency power increase.
538	Underfrequency power trigger frequency	RW	U16	Hz	100	42178	1	Sets the trigger frequency of the underfrequency power increase.
539	underfrequency rising power exit frequency	RW	U16	Hz	100	42179	1	Sets the exit frequency of the underfrequency power rise.
540	Built-in PID operating mode	RW	E16			42180	1	
541	PID output voltage	RW	I16	V	10	42181	1	Fixed output. This interface is reserved. The interface is not open.
542	PID	RW	E16			42182	1	Currently reserved only for equipment
543	active power gradient	RW	U32	%/s	1000	42192	2	Dedicated broadcast interface for data collection. Incremental reporting is not supported. This interface is used in remote output scenarios in Japan.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
544	P-U curve	RW	MLD			42221	21	
545	P-U curve adjustment time	RW	U16	s	100	42242	1	
546	Ten-minute overpressure protection point	RW	U16	V	10	42290	1	Vn: voltage level, which is related to the grid code.
547	Ten minutes overpressure protection time	RW	U32	ms	1	42291	2	
548	Level 1 Overpressure Protection Point	RW	U16	V	10	42293	1	Vn: voltage level, which is related to the grid code.
549	Level 1 Overpressure Protection Time	RW	U32	ms	1	42294	2	
550	Secondary Overpressure Protection Point	RW	U16	V	10	42296	1	Vn: voltage level, which is related to the grid code.
551	Secondary Overpressure Protection Time	RW	U32	ms	1	42297	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
552	Level-3 overpressure protection point	RW	U16	V	10	42299	1	Vn: voltage level, which is related to the grid code.
553	Level-3 Overvoltage Protection Time	RW	U32	ms	1	42300	2	
554	Four-level overpressure protection point	RW	U16	V	10	42302	1	Vn: voltage level, which is related to the grid code.
555	Level-4 Overvoltage Protection Time	RW	U32	ms	1	42303	2	
556	Five-level overvoltage protection point	RW	U16	V	10	42305	1	Vn: voltage level, which is related to the grid code.
557	Five-level overvoltage protection time	RW	U32	ms	1	42306	2	
558	Six-level overvoltage protection point	RW	U16	V	10	42308	1	Vn: voltage level, which is related to the grid code.
559	Six-level overvoltage protection time	RW	U32	ms	1	42309	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
560	Level-1 undervoltage protection point	RW	U16	V	10	42311	1	Vn: voltage level, which is related to the grid code.
561	Level 1 undervoltage protection time	RW	U32	ms	1	42312	2	
562	Level-2 undervoltage protection point	RW	U16	V	10	42314	1	Vn: voltage level, which is related to the grid code.
563	Level-2 undervoltage protection time	RW	U32	ms	1	42315	2	
564	Level-3 undervoltage protection point	RW	U16	V	10	42317	1	Vn: voltage level, which is related to the grid code.
565	Level-3 undervoltage protection time	RW	U32	ms	1	42318	2	
566	Level-4 undervoltage protection point	RW	U16	V	10	42320	1	Vn: voltage level, which is related to the grid code.
567	Level-4 undervoltage protection time	RW	U32	ms	1	42321	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
568	Five-level undervoltage protection point	RW	U16	V	10	42323	1	Vn: voltage level, which is related to the grid code.
569	Five-level undervoltage protection time	RW	U32	ms	1	42324	2	
570	Six-level undervoltage protection point	RW	U16	V	10	42326	1	Vn: voltage level, which is related to the grid code.
571	Six-level undervoltage protection time	RW	U32	ms	1	42327	2	
572	Level-1 Overfrequency Protection Point	RW	U16	Hz	100	42329	1	Fn: frequency level, which is related to the grid code.
573	Level 1 Overfrequency Protection Time	RW	U32	ms	1	42330	2	
574	Secondary Overfrequency Protection Point	RW	U16	Hz	100	42332	1	Fn: frequency level, which is related to the grid code.
575	Secondary Overfrequency Protection Time	RW	U32	ms	1	42333	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
576	Level-3 Overfrequency Protection Point	RW	U16	Hz	100	42335	1	Fn: frequency level, which is related to the grid code.
577	Three-stage overfrequency protection time	RW	U32	ms	1	42336	2	
578	Four-level overfrequency protection point	RW	U16	Hz	100	42338	1	Fn: frequency level, which is related to the grid code.
579	Four-level overfrequency protection time	RW	U32	ms	1	42339	2	
580	Five-level overfrequency protection point	RW	U16	Hz	100	42341	1	Fn: frequency level, which is related to the grid code.
581	Five-level overfrequency protection time	RW	U32	ms	1	42342	2	
582	Six-level overfrequency protection point	RW	U16	Hz	100	42344	1	Fn: frequency level, which is related to the grid code.
583	Six-level overfrequency protection time	RW	U32	ms	1	42345	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
584	Level-1 underfrequency protection point	RW	U16	Hz	100	42347	1	Fn: frequency level, which is related to the grid code.
585	Level-1 underfrequency protection time	RW	U32	ms	1	42348	2	
586	Level-2 underfrequency protection point	RW	U16	Hz	100	42350	1	Fn: frequency level, which is related to the grid code.
587	Level-2 underfrequency protection time	RW	U32	ms	1	42351	2	
588	Level-3 underfrequency protection point	RW	U16	Hz	100	42353	1	Fn: frequency level, which is related to the grid code.
589	Level-3 underfrequency protection time	RW	U32	ms	1	42354	2	
590	Four-level underfrequency protection point	RW	U16	Hz	100	42356	1	Fn: frequency level, which is related to the grid code.
591	Four-level underfrequency protection time	RW	U32	ms	1	42357	2	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
592	Five-level underfrequency protection point	RW	U16	Hz	100	42359	1	Fn: frequency level, which is related to the grid code.
593	Five-level underfrequency protection time	RW	U32	ms	1	42360	2	
594	Six-level underfrequency protection point	RW	U16	Hz	100	42362	1	Fn: frequency level, which is related to the grid code.
595	Six-level underfrequency protection time	RW	U32	ms	1	42363	2	
596	output impedance enhancement	RW	E16			42403	1	After the output impedance enhancement is enabled, the output impedance at the frequency can be increased by setting the output impedance enhancement frequency point.
597	output impedance enhancement frequency point	RW	U16	Hz	10	42404	1	The default values are 1025.0 Hz for Switzerland, 175.0 Hz for France, and 210.0 Hz for Germany.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
598	micro grid adaptability	RW	E16			42407	1	Inverters (including PCS current source grid connection) add the "micro grid adaptability" interface. When "micro grid adaptability" is enabled, inverters (including PCS current source grid connection) support higher optical storage ratio based on the original country code features.
599	Underfrequency power increase effective delay time	RW	U16	ms	1	42429	1	To set the delay time for underfrequency power increase to take effect
600	Delayed upgrade	RW	E16			42590	1	
601	Sleeping at night	RW	E16			42591	1	
602	Intelligent monitoring of strings	RW	E16			42594	1	
603	String detection reference asymmetry coefficient	RW	U16		100	42595	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
604	PV string detection start power percentage	RW	U16	%	1	42596	1	
605	Communication Interruption Time	RW	I16	min	1	42597	1	
606	Communications	RW	E16			42598	1	
607	[RS485-2] Communications	RW	E16			42599	1	
608	Inspection	WO	E16			42730	1	Broadcast instruction interface Note: The instruction range extension design is designed here. The high eight bits are used to mask the specified inspection action in the inspection function. Improves inspection efficiency for specific purposes.
609	IV Curve Scan	WO	E16			42779	1	Broadcast instruction interface
610	[System Time] Year	WO	U16		1	43000	1	
611	[System Time] Month	WO	U16		1	43001	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
612	[System Time] Day	WO	U16		1	43002	1	
613	[System Time]	WO	U16		1	43003	1	
614	[System Time] minute	WO	U16		1	43004	1	
615	[System Time] Seconds	WO	U16		1	43005	1	
616	Solar Inverter Installation Position Longitude	RW	I32	°	10000000	43014	2	This parameter is set only on the app. The NMS supports reading.
617	Inverter installation position latitude	RW	I32	°	10000000	43016	2	This parameter is set only on the app. The NMS supports reading.
618	[RS485-1] Protocol Type	RW	E16			43018	1	
619	[RS485-1]Communication address	RW	U16		1	43019	1	0: broadcast address; 1-247: device address; 248–255: reserved
620	[RS485-1] Baud Rate	RW	E16			43020	1	115200 baud rate corresponds to bit 26 of feature code 3.
621	[RS485-1] Verification Mode	RW	E16			43021	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
622	[RS485-1] Port Mode	RW	E16			43022	1	
623	[RS485-2] Protocol Type	RW	E16			43033	1	
624	[RS485-2] Communication address	RW	U16		1	43034	1	0: broadcast address 1–247: device address 248–255: reserved
625	[RS485-2] Baud Rate	RW	E16			43035	1	115200 baud rate corresponds to bit 27 of feature code 3.
626	[RS485-2] Verification Mode	RW	E16			43036	1	
627	[RS485-2] Port Mode	RW	E16			43037	1	
628	Protocol Type	RW	E16			43047	1	
629	Box transformer No.	RW	U16		1	43048	1	Only the 06 function code can be set. Local application
630	Winding No.	RW	U16		1	43049	1	Only the 06 function code can be set. Local application
631	Mac Offset	RW	U16		1	43050	1	Only the 06 function code can be set. Local application

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
632	Device Name	RW	STR			43349	10	This parameter is left blank by default. This parameter is used by customers to change the device name.
633	[APP] First power-on flag	RW	E16			43359	1	After the data collection is started, the power-on flag needs to be cleared.
634	[EL] Test string	RW	Bitfield32		1	43601	2	Each bit corresponds to one string. Bit 0 corresponds to string 1, and bit 31 corresponds to string 32.
635	[EL] Detect backfeed current reference	RW	I16	A	100	43603	1	
636	[EL] Test Startup	WO	U16		1	43604	1	
637	String access detection	RW	U16		1	43632	1	0: disabled (default) 1: enabled
638	Start-up current	RW	U16	A	100	43633	1	[3.0, 10.0] Default value: 5.0
639	Two-sink-one detection starting current	RW	U16	A	100	43634	1	[10.0, 20.0] Default value: 15.0
640	String 1 access type	RW	E16			43635	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
641	String 2 access type	RW	E16			43636	1	
642	String 3 access type	RW	E16			43637	1	
643	String 4 access type	RW	E16			43638	1	
644	String 5 access type	RW	E16			43639	1	
645	String 6 Access Type	RW	E16			43640	1	
646	String 7 Access Type	RW	E16			43641	1	
647	String 8 access type	RW	E16			43642	1	
648	String 9 Access Type	RW	E16			43643	1	
649	String 10 access type	RW	E16			43644	1	
650	String 11 access type	RW	E16			43645	1	
651	String 12 Access Type	RW	E16			43646	1	
652	String 13 Access Type	RW	E16			43647	1	
653	String 14 Access Type	RW	E16			43648	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
654	String 15 Access Type	RW	E16			43649	1	
655	String 16 Access Type	RW	E16			43650	1	
656	String 17 Access Type	RW	E16			43651	1	
657	String 18 Access Type	RW	E16			43652	1	
658	Stent System Type	RW	E16			44000	1	If the device vendor does not support one of the modes, the error code 03 is returned.
659	Working mode	RW	E16			44001	1	
660	Control period	RW	U16	min	1	44002	1	
661	tilt angle control	RW	MLD		1	44006	2	HW: stent system number, ranging from 0 to 16. 0 indicates full control. LW: tilt angle setting value, gain 100, range [0-90] The range of angle control should also meet the requirements of upper and lower limits of tilt angle control.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
662	azimuth control	RW	MLD		1	44008	2	HW: support system number, ranging from 0 to 16. 0 indicates full control. LW: azimuth setting value, gain 100, range [- 90 ~ 90] The control angle range must also meet the requirements of upper and lower limits of azimuth control.
663	Number of simultaneous control motors	RW	U16		1	44010	1	If the actual number of current motors is less than 16, the setting may fail.
664	Controller Time Synchronization	RW	E16			44015	1	
665	Number of Control Boxes	RW	U16		1	44016	1	
666	Total Number of Stents	RW	U16		1	44050	1	In dual-axis control, the maximum number of support systems is 8;
667	Installation Longitude	RW	I16	°	100	44051	1	The Eastern meitra is positive and the Western meitra is negative.

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
668	Installation latitude	RW	I16	°	100	44052	1	The north latitude is positive and the south latitude is negative.
669	Control Address 1	RW	U16		1	44053	1	
670	Control Address 2	RW	U16		1	44054	1	
671	Southbound 485 verification mode	RW	E16			44055	1	
672	Southbound 485 baud rate	RW	E16			44056	1	
673	Upper limit of tilt angle control	RW	I16	°	100	44057	1	The upper limit of tilt angle control must be greater than the lower limit.
674	lower limit of tilt angle control	RW	I16	°	100	44058	1	The upper limit of tilt angle control must be greater than the lower limit.
675	Upper limit of azimuth control	RW	I16	°	100	44059	1	The upper limit of azimuth control must be greater than the lower limit.
676	Lower limit of azimuth control	RW	I16	°	100	44060	1	The upper limit of azimuth control must be greater than the lower limit.
677	Sensor 1 Address	RW	U16		1	44061	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
678	Sensor 2 Address	RW	U16		1	44062	1	
679	Sensor 3 Address	RW	U16		1	44063	1	
680	Sensor 4 Address	RW	U16		1	44064	1	
681	Sensor 5 Address	RW	U16		1	44065	1	
682	Sensor 6 Address	RW	U16		1	44066	1	
683	Sensor 7 Address	RW	U16		1	44067	1	
684	Sensor 8 Address	RW	U16		1	44068	1	
685	Sensor 9 Address	RW	U16		1	44069	1	
686	Sensor 10 Address	RW	U16		1	44070	1	
687	Sensor 11 Address	RW	U16		1	44071	1	
688	Sensor 12 Address	RW	U16		1	44072	1	
689	Sensor 13 Address	RW	U16		1	44073	1	
690	Sensor 14 Address	RW	U16		1	44074	1	
691	Sensor 15 Address	RW	U16		1	44075	1	
692	Sensor 16 Address	RW	U16		1	44076	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
693	tracking system controller	RW	E16			44077	1	
694	Control Address 3	RW	U16		1	44079	1	
695	Control Address 4	RW	U16		1	44080	1	
696	Southbound RS485 stop bit	RW	E16			44081	1	
697	Clearing the Bracket Fault	WO	U16		1	44082	1	0: Clear all support faults. 1-16: Clear the fault of the specified support.
698	Time Zone	RW	I16	min	1	44090	1	
699	Control Address 5	RW	U16		1	44091	1	
700	Control Address 6	RW	U16		1	44092	1	
701	Control Address 7	RW	U16		1	44093	1	
702	Control Address 8	RW	U16		1	44094	1	
703	Control Address 9	RW	U16		1	44095	1	
704	Control Address 10	RW	U16		1	44096	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
705	Control Address 11	RW	U16		1	44097	1	
706	Control Address 12	RW	U16		1	44098	1	
707	Control Address 13	RW	U16		1	44099	1	
708	Control Address 14	RW	U16		1	44100	1	
709	Control Address 15	RW	U16		1	44101	1	
710	Control Address 16	RW	U16		1	44102	1	
711	Protocol Version	RW	E16			44103	1	
712	Sensor range	RW	U16	°	1	44104	1	
713	control accuracy	RW	U16	°	100	44105	1	
714	KP	RW	I16		100	44200	1	Debug Interface
715	KI	RW	I16		100	44201	1	Debug Interface
716	KD	RW	I16		100	44202	1	Debug Interface
717	wind speed	WO	U16	m / s	1	44300	1	
718	wind direction	WO	U16	°	1	44301	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
719	Start control	WO	E16			44302	2	BIT0~BIT15: start instruction of support system 1-16; BIT16-31: reserved for subsequent expansion
720	Clearing the Bracket Fault	WO	E16			44304	2	Bits 0 to 15: Clear the faults of supports 1 to 16 in sequence. BIT16–BIT32: reserved for future extension.
721	Stop Control	WO	E16			44306	2	BIT0~BIT15: stop command of bracket 1~rack system 16. Bits 16 to 31: reserved for subsequent expansion
722	Temperature 1	WO	I16	℃	10	44408	1	
723	Humidity 1	WO	U16	% RH	10	44410	1	
724	Restore factory settings.	WO	E16			45000	1	
725	Clearing Active Alarms	WO	MLD			45001	2	For details, see the description of "structural data".
726	Alarm setting	WO	MLD			45003	2	For details, see the description of "structural data".
727	Alarm Clearance	WO	E16			45005	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
728	Shielding alarms	WO	E16			45006	1	
729	AFCI self-test start	WO	U16		1	45007	1	Set this parameter to 0. AFCI Controller in Associated Sub-Device In-position Identification
730	Accumulated electricity generation correction	WO	U32	kWh	100	45008	2	
731	Historical power clearance	WO	E16			45010	1	Accumulated generated electricity and accumulated charged electricity on the power side
732	Clearing Running Time Information	WO	E16			45011	1	Clears the accumulated running time, accumulated fault time, and accumulated grid-coming running time.
733	spot check	WO	E16			45012	1	
734	Clear the flash memory.	WO	U16		1	45014	1	
735	ESN effective instruction	WO	U16		1	45015	1	

No.	Signal Name	Read and write	Type	Unit	gain	address	Number of	Scope
736	Restoring the Default Password	WO	MLD		1	45016	10	Enter the ESN of the entire system in the data field.
737	[License Interface] License Deregistration	WO	MLD		1	45027	10	Enter the LSN in the data domain.

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 Record format

Data	Length (Byte)	Remarks
Format version	4	V101
SN	2	-
Length	2	-
Reserved	4	-
Number of optimizers	2	*n*, including the offline optimizers
Feature data of optimizer 1	78	-
Feature data of optimizer 2	78	-
...	...	-

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

Table 4-2 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: five-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 4-3 Record format

Data	Length (Byte)	Remarks
File version	4	V101
Reserved	8	-
Optimizer data unit 1	N	12 + 26 x Number of optimizers
Optimizer data unit 2	N	-

Data	Length (Byte)	Remarks
...	-	-
Optimizer data unit *n*	N	*n* indicates the number of data records that meet the filter condition. Each piece of data contains all optimizer data for a time node.

Table 4-4 Data unit format (V101)

Data	Length (Byte)	Remarks
Time	4	Epoch seconds, local time
Reserved	4	-
Length	2	-
Number of optimizers	2	-
Real-time data of optimizer 1	26	-
Real-time data of optimizer 2	26	-
...	-	-
Real-time data of optimizer *n*	26	*n* is the number of optimizers.

Table 4-5 Real-time data format

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

Data	Length (Byte)	Remarks
Alarm	4	Bit 00: abnormal PV module: input overvoltage Bit 01: abnormal PV module: input undervoltage Bit 02: abnormal PV module: output overvoltage Bit 04: overtemperature alarm: overtemperature Bit 06: short circuit alarm: output short circuit Bit 07: abnormal device: EEPROM fault Bit 08: abnormal device: internal hardware fault Bit 09: abnormal device: abnormal voltage to ground Bit 10: abnormal communication: shutdown due to heartbeat timeout
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
Running status	2	0: offline 1: standby 2: locking 3: faulty 4: running 5: pass-through 6: inspecting 7: escaping 8: current limiting 9: secure

Data	Length (Byte)	Remarks
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
42	Alarm 4	10	Management System Cert Valid Time Ineffective	2095	Major
43	Alarm 4	11	Management System Cert Valid Time Being Overdue	2096	Major
44	Alarm 4	12	Management System Cert Valid Time Overdue	2097	Major

No.	Alarm	Bit	Alarm Name	Alarm ID	Level
45	Alarm 5	3	CT Disconnection	2067	Major
46	Alarm 5	4	PT Disconnection	2067	Major

NOTICE

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

[1] AFCI functional unit

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

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

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

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

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

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

[8] Some models have DC protection units.

5.2 Power Grid Scheduling

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

5.2.1 cosϕ-P/Pn Characteristic Curve

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

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

Description	Data Type	Gain	Unit	Value Range
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]
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]

Description	Data Type	Gain	Unit	Value Range
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]
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]

Description	Data Type	Gain	Unit	Value Range
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]
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
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

No.	Standard	Applicable Country or Region
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
269	VDE-AR-N4110-MV480	Germany
270	VDE-AR-N4110-MV800	Germany
271	Panama-MV800	Panama
272	North Macedonia-MV800	North 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]

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

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

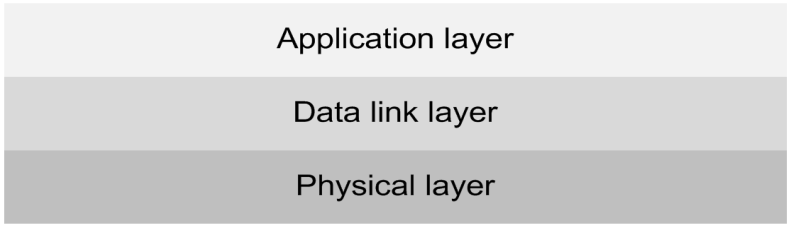
Description	Data Type	Gain	Unit	Value Range
Number of periods	U16	1	N/A	[0, 10]
Start time of period 1	U16	1	min	[0, 1440]. The value is the elapsed minutes since 00:00 a.m. The start time should be earlier than the end time.
End time of period 1	U16	1	min	[0, 1440]. The value is the elapsed minutes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

Description	Data Type	Gain	Unit	Value Range
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.
Charging and discharging power in period 10	I32	1	W	[Discharging power limit, Charging power limit]. For details, see the description of the supported model.

6 Overview of the Communications Protocol

The Modbus communications protocol consists of the following layers.

Figure 6-1 Modbus protocol layers



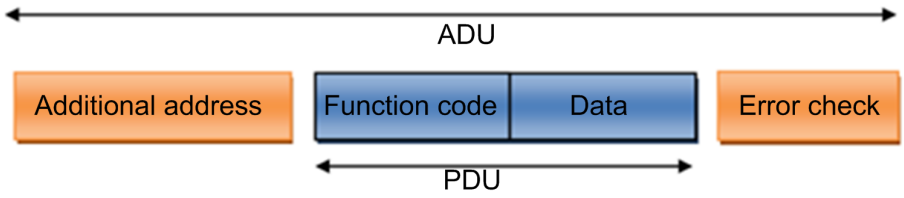
6.1 Physical Layer

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

6.2 Data Link Layer

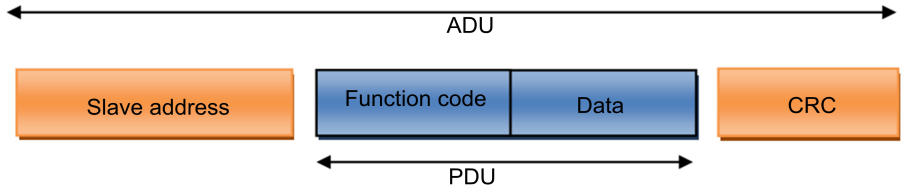
The following figure shows the generic frame structure of the Modbus protocol.

Figure 6-2 Modbus generic frame format



6.2.1 Modbus-RTU

Figure 6-3 Modbus-RTU frame format



6.2.1.1 ADU Length

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

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

6.2.1.2 Communications Address

As shown in the figure below, 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:

Figure 6-4 Modbus generic frame format

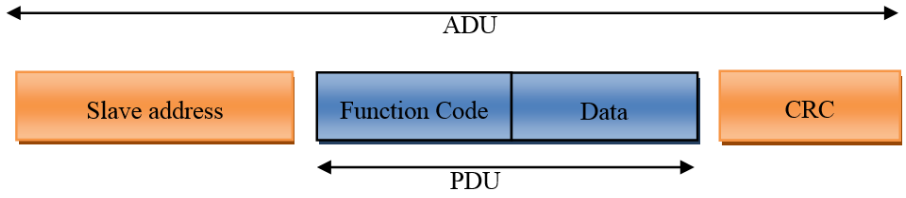


Table 6-1 Serial link address allocation

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

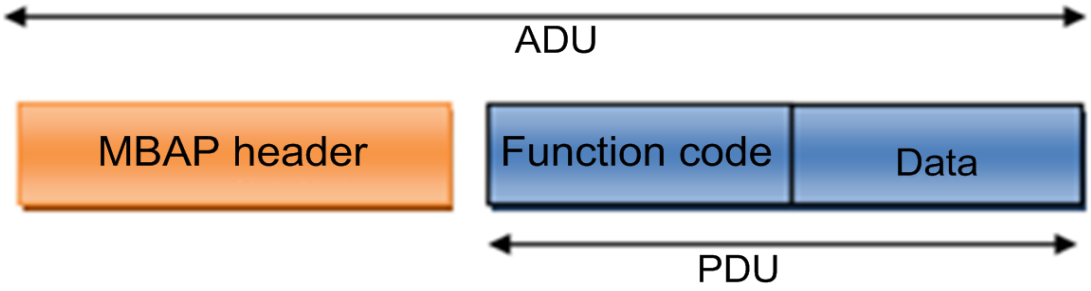
CRC applies to all bytes in front of the CRC code, which consists of 16 bits. The reference code is as follows:

```
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 6-5 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

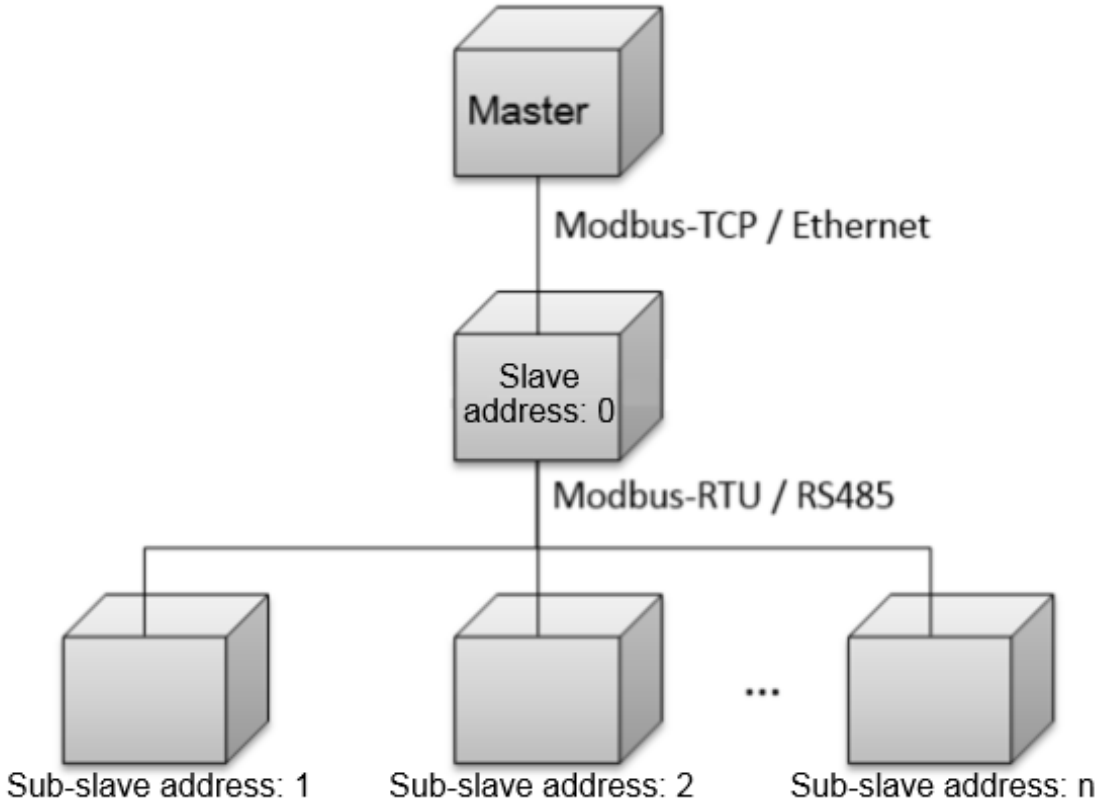
Data Field	Length (Byte)	Description	Client	Server
Transmission identifier	2	Matching identifier between a request frame and a response frame	Assigned by the client; better be unique for each data frame	The identifier of the response frame from the server must be consistent with that of the request frame.

Data Field	Length (Byte)	Description	Client	Server
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 6-6 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.

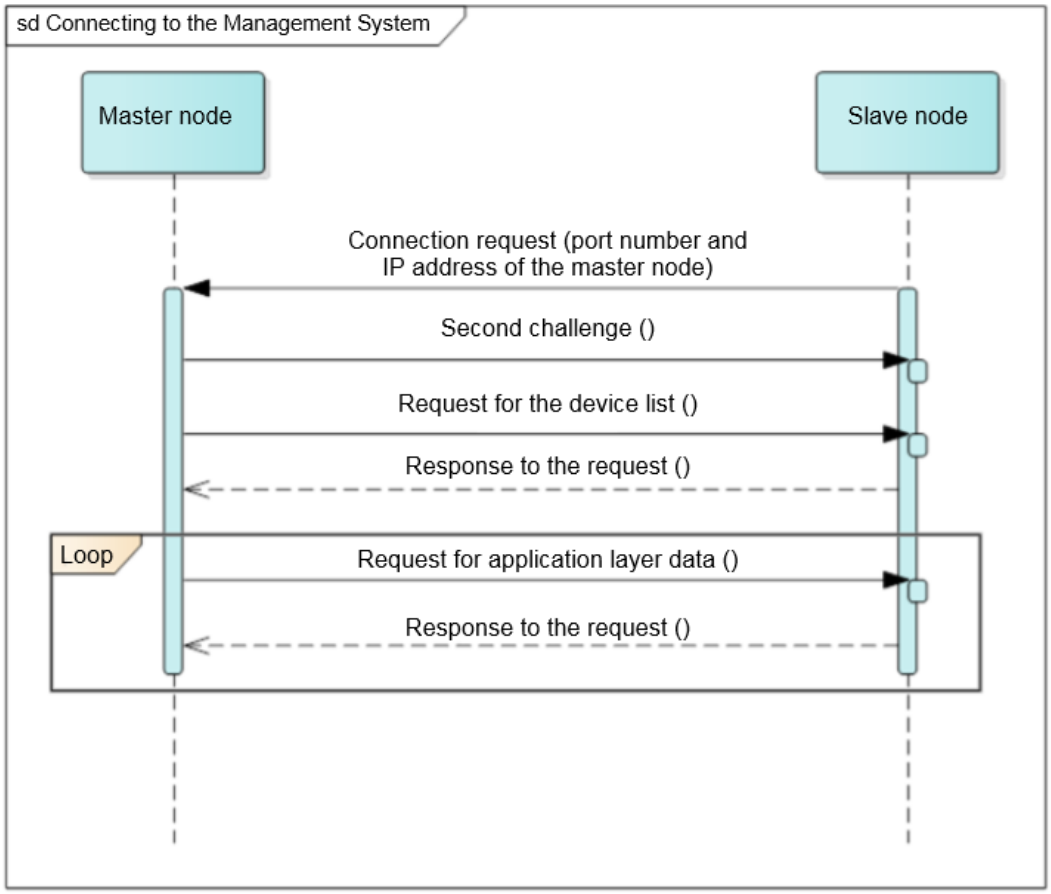
In a non-VPN environment across the public network, the device deployed on the internal network needs to initiate TCP socket link establishment to the master node exposed on the public network. In this case, you need to preset the fixed access port number of the master node on the slave node. To ensure 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 6-7 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.

Code	Name	Description
0x06	Slave device busy	The server cannot accept a Modbus request PDU. A client application determines whether and when to resend the request.
0x80	No permission	An operation is not allowed because of a permission authentication failure or permission expiration.

6.3.3 Reading Registers (0x03)

6.3.3.1 Frame Format of a Request from a Master Node

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

6.3.3.2 Frame Format of a Normal Response from a Slave Node

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

NOTE

N refers to the number of registers.

6.3.3.3 Frame Format of an Abnormal Response from a Slave Node

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

Description		Frame Data
	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

Data Field	Length (Byte)	Description
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
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

Description		Frame Data
		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

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

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

NOTE

N refers to the number of registers.

6.3.5.2 Frame Format of a Normal Response from a Slave Node

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

6.3.5.3 Frame Format of an Abnormal Response from a Slave Node

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

Description		Frame Data
		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
		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
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	

Object ID	Object Name or Description	Type	Mandatory or Optional (M/O)	Type
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	-

Data Field			Length (Byte)	Description
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.
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

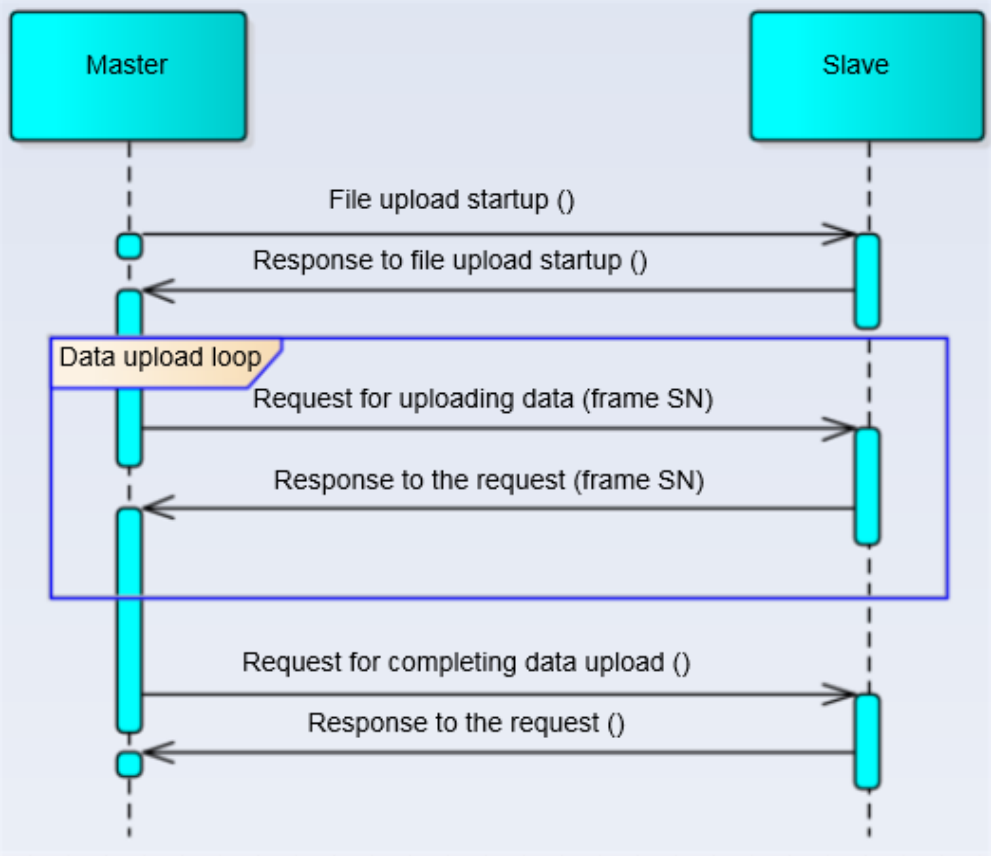
Data Field	Length (Byte)	Description
Function code	1	0xAB
Exception code	1	See **6.3.2 Exception Code List**.

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 6-8 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**.

NOTE

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

6.3.7.1.2 Uploading Data

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

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

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

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

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

