Version V2.01

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GROWATT VPP COMMUNICATION PROTOCOL OF INVERTER

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Version Record

Index	Version	Change content	Author	Date
01	V1.01	First Republic	Meilin Luo	2021.2.19
02	V1.02	(1) Add MOD-XH MID-XH DTC (2) Increase the input register PV parameter information to PV1~PV16 (3) Maintain register battery side parameter fields: hold 31200-31300 Increase battery system battery increase information: Number of battery clusters, number of modules (PACKs) under a single cluster, rated battery power, and rated battery capacity (4) Chapter 30500~30799 of the new safety parameter hold 30500~30799 in the register (reserved) (5) Basic information holding registers 30060-30081 add software version information for inverters, batteries, and meters (6) Work status information Status information 31007-31008 Add fault and alarm sub codes (7) Add 32000~32099 100 registers for energy storage system summary information	Jian Li	2023.8.16
03	V1.03	(1) Holding register System Order Control Information add 30115 SYN enable (2) Holding register AC Power control set parameter add 30155~30157 EPS offline enable, EPS offline frequency, EPS offline voltage, 30203~30204 Export Limitation Failure time/EMS communicating fail time, EMS communicating fail enable，30154 change the remark (3) Holding register Battery Power Control Set Information add 30475 offline discharge cut off SOC, 30496~30499 battery charge stop voltage, battery discharge stop voltage, battery charge max current, battery discharge max current，30400~30403 battery charge max power turn into reserved, 30405 name turn into online discharge stop SOC (4) Input register add 31300~31399 Battery Information 2, 31400~31499 Battery Information 3, 31500~31599 Battery Information 4 (5) Input register working status information 31000 Working state of energy storage machine remark: 5: PV online & battery offline ,6: battery online & PV offline (or offline) (6) Holding register30227~30228 Module Rated Voltage, Module Rated Cap change register number to 1	Ziqi Kang	2023.12.6
04	V2.0	(1) Holding register30500~30999 safety parameter separately sorted out a document and this protocol together with the VPP protocol, common maintenance	Ziqi Kang	2024.3.22

		(2) Holding register 30084 change number from 15 to 16 (3) Holding register 30157 add the type of offline voltage of WIT, 30201 change register range to [-100,100]，and add some description of logic: 30496~30499 add range limitation, 30162 change the description of range (4) Holding register add 30099 VPP protocol version， 30205 super Export Limitation enable, 30206 Export Limitation feed power change slope, 30207 Export Limitation single ctrl, 30208 Export Limitation Protection Mode (5) Input register 31219 change name to full charge capacity(FCC), 31210 and 31224 reserved (6) Standard Modbus protocol definition add data form of single byte		
05	V2.01	(1) Holding register 30001 SN change the type to UINT16, 30157 EPS offline voltage add notes for its range, MIN 7-10KTL-X/X2 and MIC/MIN 2.5-6K TL-X/X2 don’ t use the parameters of battery (2) Holding register 30162 power factor turn its range into [0,2000]∪[18000,20000], the default value turn into 20000 (3) Holding register add 30300 battery cluster index (4) Annexed table 3-1 renew the machine type and DTC, attachment 3.3 to 3.6 add power control position diagram, added Export Limitation, remote charge/discharge control, reactive power control schematic diagram	Ziqi Kang	2024.9.20

Catalog

1 Introduction

1.1 Purpose

The purpose of writing this document is to explain the RTU communication protocol of energy storage / inverter products to realize virtual power plant remote dispatching (VPP) in detail.

1.2 Scope

For the energy storage / inverter products applicable to the remote dispatching of smart grid, see Annex Table 1 for details.

1.3 Terms and abbreviations

Terms and abbreviations	Explanation
LCD	Liquid crystal display
WIFI	Wireless communication module
LAN	Local and network
USB	Universal serial bus
UINT16	Unsigned 16 bit shaping (high byte first, low byte last)
UINT32	Unsigned 32-bit shaping (high word first, low word last)
INT16	Signed 16 bit shaping (high byte first, low byte last)
INT32	Signed 32-bit shaping (high word first, low word last)
STR	String MLD multi-byte
Bitfield16	16Bit wise representation of bit width
Bitfield32	32Bit wise representation of bit width
Register address	The register address corresponds to a 2-byte message
-	Not involved
S	second
RO	Read only data
RW	Readable and writable data
WO	Write data only
DSP	Digital signal processing controller
ENSE	Energy storage integrated cabinet
EMS	Energy Management System
PCS	Power Conversion System

Terms and abbreviations	Explanation
BMS	Battery Management System
VPP	Virtual Power Plant
AC	Alternating Current
DC	Direct Current
PV	Photovoltaic
SN	Serial Number

2 Protocol register

2.1 Hold register

NO.	Parameter name	Read/write	Type	Unit	Address	Number	Range
Basic Parameter:30000~30099							
1.	Equipment type (DTC)	RO	UINT16	-	30000	1	See Table 3-1
2.	SN	RO	UINT16	-	30001	15	-
3.	Rated power (Pn)	RO	UINT32	0.1W	30016	2	-
4.	Maximum active power (Pmax)	RO	UINT32	0.1W	30018	2	-
5.	Maximum reactive power (Qmax fed into the grid)	RO	UINT32	0.1VAR	30020	2	-
6.	Maximum reactive power (Qmax absorption grid)	RO	UINT32	0.1VAR	30022	2	-
7.	Maximum apparent power (Smax)	RO	UINT32	0.1VA	30024	2	-
8.	Rated charging and discharging power of BDC	RO	UINT32	0.1W	30026	2	-
9.	PV input maximum power	RO	UINT32	0.1W	30028	2	-
10.	Battery type	RO	UINT8	-	30030	1	0: lead acid battery 1: lithium battery
11.	Reserve	RO	UINT16	-	30031	29	-
Inverter Version Information							
12.	Machine Model	RO	UINT16	ASCII	30060	1	Example: TL

13.	Machine Model	RO	UINT16	ASCII	30061	1	Example: AA
14.	Version Num 1	RO	UINT16	Digit	30062	1	-
15.	Version Num 2	RO	UINT16	Digit	30063	1	-
16.	Version Num 3	RO	UINT16	Digit	30064	1	-
17.	M3 Version Name	RO	UINT16	ASCII	30065	1	Example: ZB
18.	M3 Version Name	RO	UINT16	ASCII	30066	1	Example: AA
19.	Version Num 1	RO	UINT16	Digit	30067	1	-
Energy Storage Battery Version Information							
20.	Machine Model	RO	UINT16	ASCII	30068	1	Example: VC
21.	Machine Model	RO	UINT16	ASCII	30069	1	Example: AA
22.	Version Num 1	RO	UINT16	Digit	30070	1	-
23.	DSP2 Software Version Name	RO	UINT16	ASCII	30071	1	Example: VC
24.	DSP2 Software Version Name	RO	UINT16	ASCII	30072	1	Example: BA
25.	Version Num 1	RO	UINT16	Digit	30073	1	-
26.	BCU Software Version Name	RO	UINT16	ASCII	30074	1	Example: QB
27.	BCU Software Version Name	RO	UINT16	ASCII	30075	1	Example: AA
28.	Version Num 1	RO	UINT16	Digit	30076	1	-
29.	M3 Software Version Name	RO	UINT16	ASCII	30077	1	Example: ZE
30.	M3 Software Version Name	RO	UINT16	ASCII	30078	1	Example: BA
31.	Version Num 1	RO	UINT16	Digit	30079	1	-
Meter Version Information							
32.	Machine Model	RO	UINT16	ASCII	30080	1	Example: ZO

33.	Machine Model	RO	UINT16	ASCII	30081	1	Example: AA
34.	Version Num 1	RO	UINT16	1	30082	1	-
35.	Reserved	RO	UINT16	-	30083	1	Reserved
VPP Protocol Version Information							
36.	Reserved	RO	UINT16	-	30084	1	Reserved
37.	VPP Protocol Version	RO	UINT16	-	30099	15	200 represents V2.00, 201 represents V2.01, others are similar
System Order Control Information:30100~30149							
38.	Control authority	RW	UINT16	-	30100	1	0: not enabled 1: Enable Default value: 0
39.	On off command	RW	UINT16	-	30101	1	0: power off 1: power on Default value: 1 **Not storage**
40.	Country / region number	RO	UINT16	-	30102	1	See Table 3-5
41.	Reserve	RW	UINT16	-	30103	1	-
42.	System time	RW	UINT16	-	30104	6	See table 3-6
43.	Reserve	RW	UINT32	-	30110	2	-
44.	Mailing address	RO	UINT16	-	30112	1	[1, 255] Default value: 1
45.	Communication baud rate	RO	UINT16	-	30113	1	0:9600 bps 1:38400 bps Default value: 0
46.	Reserved	RW	UINT16	-	30114	1	
47.	SYN enable	RW	UINT16	-	30115	1	Offline box enable 0: not enabled 1: enable Default value: 0
48.	Reserve	RW	UINT16	-	30116	34	-

AC Power Control Set Parameter:30150~30299							
49.	Reserve	RW	UINT16	-	30150	1	-
50.	Active power percentage derating	RW	UINT16	%	30151	1	Power limit percentage: [0,100] Default value: 100
51.	Reserve	RW	UINT16	-	30152	2	-
52.	Static active power limitation	RW	UINT16	%	30154	1	Power limit percent: [0,100] Default value: 100 Actual active power is the less one between Active power percentage derating and Static active power limitation **Not storage**
53.	EPS offline enable	RW	UINT16	-	30155	1	0: not enabled 1: enable Default value: 0
54.	EPS offline frequency	RW	UINT16	0.01Hz	30156	1	0:50Hz 1:60Hz Default value: 0
55.	EPS offline voltage (3)	RW	UINT16	-	30157	1	Default value: 0
56.	Reserve	RW	UINT16	-	30158	2	-
57.	Fix Q	RW	UINT16	%	30160	1	Power limit percentage: [0,60] Default value: 60
58.	Reactive power mode	RW	UINT16	-	30161	1	0: PF=1 1: Pf value setting

							4: Lagging reactive power (+) 5: Leading reactive power (-) Default value: 0 When the battery is discharged or not connected, negative value indicates capacitive reactive power and positive value indicates inductive reactive power. Reverse charge See Appendix 3.6 for the logic
59.	Power factor	RW	UINT16	-	30162	1	[0, 2000] ∪ [18000,20000] Default value:20000 Actual power factor = (set value - 10000) * 0.0001
60.	Reserve	RW	INT16	%	30163	1	-
61.	Reserve (reactive power curve)	-	UINT16	-	30164	36	-
62.	Export Limitation Enable	RW	UINT16	-	30200	1	0: not enabled 1: single machine Export Limitation enable Default value: 0 See Appendix 3.3 and 3.4 for the logic
63.	Export Limitation power Rate	RW	INT16	%	30201	1	[-100，100] Default value: 0 Positive value is backflow, negative

							value is fair current
64.	Export Limitation Failure power Rate	RW	UINT16	%	30202	1	[0，100] Default value: 0
65.	EMS Communicating Failure Time	RW	UINT16	S	30203	1	Export Limitation Failure time [1,300] Default value: 30
66.	EMS Communication Failure Enable	RW	UINT16	-	30204	1	0: not enabled 1: enable Default value: 0
67.	Super Export Limitation enable	RW	UINT16	-	30205	1	0: not enabled 1: enable Default value: 0
68.	Export Limitation change slope	RW	UINT16	*0.01% Pn/s	30206	1	[1,20000] Default value: 27
69.	Export Limitation single phase control enable	RW	UINT16	-	30207	1	0: not enabled 1: enable Default value: 0
70.	Export Limitation protection mode (2)	RW	UINT16	-	30208	1	0: Default mode 1: Combine control mode 2: software control mode 3: hardware control mode Default value: 0
71.	Reserve	RW	UINT16	-	30209	91	-
Battery Power Control Set Information:30300~30499(4)							
72.	Battery cluster index	RW	UINT16	-	30300	1	[0,3] If the register is set to x, then read/write information [30400,30406], [30474,30475], and [30496,30499] belong to cluster x

							Default value: 0, which indicates that the current battery information applies to all battery clusters
73.	Reserve	RW	UINT16	-	30301	99	-
74.	Reserve(Battery max charging power)	RW	UINT32	0.1W	30400	2	Not used
75.	Reserve (Battery max discharging power)	RW	UINT32	0.1W	30402	2	Not used
76.	Charging cut off SOC	RW	UINT8	%	30404	1	[70，100] Default value: 100
77.	Online discharge cut off SOC	RW	UINT8	%	30405	1	[10，30] Default value: 10
78.	Load priority discharge cut off SOC(1)	RW	UINT8	%	30406	1	[10，20] Default value: 10
79.	Remote power control enable	RW	UINT8	-	30407	1	0: not enabled 1: Enable Default value: 0 **Not storage** See Appendix 3.5 for the logic
80.	Remote power control charging time	RW	UINT16	min	30408	1	0: unlimited time 1 ~ 1440min: control the power duration according to the set time Default value: 0 **Not storage**
81.	Remote charge and discharge power	RW	INT16	-	30409	1	[-100，100] Positive: charging Negative: discharge Default value: 0 **Not storage**

82.	AC charging enable	RW	UINT8	-	30410	1	0: not enabled 1: Enable Default value: 0
83.	Charging and discharging in different periods (20 sections)	RW	UINT16	-	30411	61	See Table 3-2 30412~30471 are time setting, default value: 0
84.	Reserve	RO	UINT16	-	30472	2	-
85.	Actual control value of charging and discharging power	RO	UINT16	-	30474	1	[-100，100] Positive: charging Negative: discharge
86.	Offline discharge cut off SOC	RW	UINT16	%	30475	1	[10,30] Default value:10
87.	Reserve	RW	UINT16	-	30476	20	-
88.	Battery charge stop voltage	RW	UINT16	0.1V	30496	1	**Lead-acid battery used only** [0,15000] Distinguished by voltage level: 127V: 6500 227V: 10000 Others: 8000
89.	Battery discharge stop voltage	RW	UINT16	0.1V	30497	1	**Lead-acid battery used only** [0,15000] Distinguished by voltage level: 127V: 3800 227V: 7500 Others: 6500
90.	Battery max charge current	RW	UINT16	0.1A	30498	1	**Lead-acid battery used only** [0,2000] Default value : 1500
91.	Battery max discharge current	RW	UINT16	0.1A	30499	1	**Lead-acid battery used only**

							[0,2000] Default value : 1500
Safety Information:30500~30999							
92.	See details in GROWATT INVERTER VPP COMMUNICATION PROTOCOL & SAFETY PARAMETERS	RW	UINT16	-	30500	500	-
Energy Storage System Information:32000~32099							
93.	Reserve	RW	UINT16	-	32000	100	-

Notes: all RW parameters will be stored in EEPROM, except for the special notes "Not Storage". High frequency writing is not supported.

(1) Load priority discharge cut off SOC (30406) is only used by SPH/SPA (DTC are 3502\3735\375\3601) type.

(2): SPA 4000-10000TL3 BH-UP/SPH 4000-10000TL3 BH-UP/WIT 100KTL3-H/WIS 215KTL3(DTC are 3725/3601/5601/5800) do not use Export Limitation protection mode (30208), the description of each mode is as follows.

0: Default mode, when the meter is disconnected or communication fails, the inverter will limit the output power to the Export Limitation Failure Power; When the output power is larger than the Export Limitation Power, the inverter will report an error and be off-grid.

1: Combine control mode, when the meter is disconnected or communication fails, the inverter will report an error and be off-grid within 5s; When the anti- backflow fails, the inverter will be off-grid after 15s.

2: Software control mode, when the meter is disconnected or communication fails, the inverter will reduce the output power to the Export Limitation Failure Power within 15s; When the output power is larger than the Export Limitation Power, the inverter reduces the output power to the set Export Limitation Failure Power within 15s.

3: Hardware control mode, when the meter is disconnected or communication fails, the inverter will report an error and be off-grid within 5s; When the output power is larger than the Export Limitation Power, the inverter will be off-grid within 5s.

(3) Different model ranges of EPS offline voltage (30157) are shown in the following table:

Type and DTC	EPS offline voltage
WIT 100KTL3-H（DTC is 5601）	0:230V 1:208V 2:240V

	3:220V 4:127V 5:277V 6:254V
MOD-XH\MID-XH（DTC is 5400）	0:230V 1:208V 2:240V 3:220V
others	Not used

(4) MIN 7-10KTL-X/X2, MIC/MIN 2.5-6K TL-X/X2 (DTC are 5201/5200) do not use parameters about battery (30300-30499, 31200-31599).

2.2 Input register

NO.	Parameter name	Read/write	Type	Unit	Address	Number	Range
Working status information:31000~31009							
1	Working state of energy storage machine	RO	UINT16	1	31000	1	0: standby 1: self-test 2: reserved 3: fault 4: upgrade 5: PV online &battery offline 6: battery online & PV online (or offline) 7: PV & cell on line off grid operation 8: Battery On-line PV off-line operation 9: bypass operation
2	Battery working status	RO	UINT16	1	31001	1	0: battery standby 1: Battery disconnected 2: battery charging operation 3: battery discharge

							operation 4: fault 5: upgrade
3	Priority of work	RO	UINT16	1	31002	1	0: load first 1: Battery first 2: grid first
4	Reserve	RO	UINT16	-	31003	2	-
5	Fault code	RO	UINT16	-	31005	1	See Table 3-3
6	Fault sub code	RO	UINT16	-	31006	1	See Table 3-3
7	Alarm code	RO	UINT16	-	31007	1	See Table 3-4
8	Alarm sub code	RO	UINT16	-	31008	1	See Table 3-4
9	Reserve	RO	UINT16		31009	1	-
PV Parameter:31010~31099							
10	PV1 voltage	RO	INT16	0.1V	31010	1	-
11	PV1 current	RO	INT16	0.1A	31011	1	-
12	PV2 voltage	RO	INT16	0.1V	31012	1	-
13	PV2 current	RO	INT16	0.1A	31013	1	-
14	PV3 voltage	RO	INT32	0.1W	31014	1	-
15	PV3 current	RO	INT16	0.1A	31015	1	-
16	PV4 voltage	RO	INT16	0.1V	31016	1	-
17	PV4 current	RO	INT16	0.1A	31017	1	-
18	PV5 voltage	RO	INT16	0.1V	31018	1	-
19	PV5 current	RO	INT16	0.1A	31019	1	-
20	PV6 voltage	RO	INT16	0.1V	31020	1	-
21	PV6 current	RO	INT16	0.1A	31021	1	-
22	PV7 voltage	RO	INT16	0.1V	31022	1	-
23	PV7 current	RO	INT16	0.1A	31023	1	-
24	PV8 voltage	RO	INT16	0.1V	31024	1	-
25	PV8 current	RO	INT16	0.1A	31025	1	-
26	PV9 voltage	RO	INT16	0.1V	31026	1	-
27	PV9 current	RO	INT16	0.1A	31027	1	-
28	PV10 voltage	RO	INT16	0.1V	31028	1	-
29	PV10 current	RO	INT16	0.1A	31029	1	-
30	PV11 voltage	RO	INT16	0.1V	31030	1	-
31	PV11 current	RO	INT16	0.1A	31031	1	-
32	PV12 voltage	RO	INT16	0.1V	31032	1	-
33	PV12 current	RO	INT16	0.1A	31033	1	-

34	PV13 voltage	RO	INT16	0.1V	31034	1	-
35	PV13 current	RO	INT16	0.1A	31035	1	-
36	PV14 voltage	RO	INT16	0.1V	31036	1	-
37	PV14 current	RO	INT16	0.1A	31037	1	-
38	PV15 voltage	RO	INT16	0.1V	31038	1	-
39	PV15 current	RO	INT16	0.1A	31039	1	-
40	PV16 voltage	RO	INT16	0.1V	31040	1	-
41	PV16 current	RO	INT16	0.1A	31041	1	-
42	Reserve	RO	INT16	-	31042	16	
43	PV input power	RO	INT32	0.1W	31058	2	-
44	Reserve	RO	UINT32	-	31060	40	-
AC Information:31100~31199							
45	Active power	RO	INT32	0.1W	31100	2	Positive: export to grid Negative: import from grid
46	Reactive power	RO	INT32	0.1VA	31102	2	-
47	Reserve	RO	INT16	-	31104	1	-
48	Grid frequency	RO	UINT16	0.01Hz	31105	1	-
49	Grid voltage / line AB voltage	RO	UINT16	0.1V	31106	1	When the output mode is L/N, the voltage and current are grid voltage and grid current respectively
50	BC line voltage of power grid	RO	UINT16	0.1V	31107	1	-
51	CA line voltage of power grid	RO	UINT16	0.1V	31108	1	-
52	Grid current / A phase current of grid	RO	INT16	0.1A	31109	1	-
53	Phase B current of grid	RO	INT16	0.1A	31110	1	-
54	Phase C current of grid	RO	INT16	0.1A	31111	1	-
55	Meter power	RO	INT32	0.1W	31112	2	Positive: import from

							grid Negative: export to grid
56	Inverter temperature	RO	INT16	0.1℃	31114	1	[-400，1250]
57	Reserve	RO	INT16	-	31115	1	-
58	Reserve	RO	INT16	-	31116	1	-
59	Reserve	RO	INT16	-	31117	1	-
60	Power to user daily	RO	UINT32	0.1KWH	31118	2	-
61	Total power to user	RO	UINT32	0.1KWH	31120	2	-
62	Power to grid daily	RO	UINT32	0.1KWH	31122	2	-
63	Total power to grid	RO	UINT32	0.1KWH	31124	2	-
64	Reserved	RO	INT16	-	31126	74	-
Battery Information 1 (BDC and BMS containing):31200~31299							
65	Charge/discharge power	RO	INT32	0.1W	31200	2	Positive: charging Negative: discharge
66	Daily charge of battery	RO	UINT32	0.1KWH	31202	2	-
67	Cumulative charge of battery	RO	UINT32	0.1KWH	31204	2	-
68	Daily discharge capacity of battery	RO	UINT32	0.1KWH	31206	2	-
69	Cumulative discharge of battery	RO	UINT32	0.1KWH	31208	2	-
70	Maximum allowable charging power of battery	RO	UINT32	0.1W	31210	2	-
71	Maximum allowable	RO	UINT32	0.1W	31212	2	-

	discharge power of battery						
72	Battery voltage	RO	INT16	0.1V	31214	1	-
73	Battery current	RO	INT32	0.1A	31215	2	Positive: charging Negative: discharge
74	SOC	RO	UINT8	-	31217	1	[0，100]
75	SOH	RO	UINT8	-	31218	1	[0，100]
76	Battery capacity rating (FCC)	RO	UINT32	AH	31219	2	-
77	Reserved	RO	UINT32	AH	31221	2	Reserved for Battery remaining capacity (RM)
78	Battery environmental temperature	RO	INT16	0.1℃	31223	1	[-400，1250]
79	Reserved	RO	INT16	0.1℃	31224	1	Reserved for Maximum battery temperature
80	Cluster Sum	RO	UINT16	1	31225	1	-
81	Single Cluster Module Number	RO	UINT16	1	31226	1	-
82	Module Rated Voltage	RO	UINT16	0.1V	31227	1	-
83	Module Rated Cap	RO	UINT16	0.1AH	31228	1	-
84	Reserve	RO	UINT16	-	31229	71	-
Battery Information 2 (BDC and BMS containing):31300~31399							
85	31300~31399 refer to 31200~31299						
Battery Information 3 (BDC and BMS containing):31400~31499							
86	31400~31499 refer to 31200~31299						
Battery Information 4 (BDC and BMS containing):31500~31599							
87	31500~31599 refer to 31200~31299						

3 Attachment

3.1 Annexed table

Table 3-1 DTC code description

model	DTC code
SPH 3000-6000TL BL	3502
SPA 3000-6000TL BL	3735
SPA 4000-10000TL3 BH-UP	3725
SPH 4000-10000TL3 BH-UP	3601
MIN 2500-6000TL-XH/XH(P)	5100
MIC/MIN 2500-6000TL-X/X2	5200
MIN 7000-10000TL-X/X2	5201
MOD-XH\MID-XH	5400
WIT 100KTL3-H	5601
WIS 215KTL3	5800

Table 3-2 Description of parameter format of charging and discharging by time interval

Description	Data type	Unit	Value range
Number of time periods	UINT8	-	[0, 20] Default value: 0, the following are the same
Start time of period 1	UINT16	Min	[0, 1440], relative to the number of minutes at 0 o’ clock every day, the start time less than end time
End time of period 1	UINT16	Min	
Charging and discharging power of period 1	INT16	%	[-100,100] Positive: charging Negative: discharge
Start time of period 2	UINT16	Min	[0, 1440], relative to the number of minutes at 0 o’ clock every day, the start time less than end time
End time of period 2	UINT16	Min	
Charging and discharging power in period 2	INT16	%	[-100,100]
……			

Start time of period 19	UINT16	Min	[0, 1440], relative to the number of minutes at 0 o’ clock every day, the start time less than end time
End time of period 19	UINT16	Min	
Charge discharge power of period 19	INT16	%	[-100,100]
Start time of period 20	UINT16	Min	[0, 1440], relative to the number of minutes at 0 o’ clock every day, the start time less than the end time
End time of period 20	UINT16	Min	
Charge discharge power of period 20	INT16	%	[-100,100]

Note: The time range setting requires 0x10 to write multiple hold register function codes; the 20-time piece ranges must be mutually exclusive; otherwise, the setting fails.

Table 3-3 Fault codes (Reference product fault list)

Serial number	Fault code	Auxiliary code	Fault name	Causes or measures

Table 3-4 Alarm codes (Reference product fault list)

Serial number	Fault code	Auxiliary code	Fault name	Causes or measures

Table 3-5 Country / region numbers

Number	Standard	Applicable countries
0	SA_NULL	
1	SA_VDE0126	Germany
2	SA_G99	Britain
3	SA_AS4777	Australia
4	SA_CEI0_21	Italy
5	SA_SPAIN	Spain
6	SA_GREECE_CONTINENT	The Greek continent
7	SA_N4105	Germany
8	SA_G98	Britain
9	SA_IRELAND	Ireland
10	SA_CQC_2013	China
11	SA_EN50438	Poland/Norway/Turkey/Switzerland

12	SA_HUNGARY	Hungary
13	SA_BELGIUM	Belgium
14	SA_MEA	Thailand
15	SA_PEA	Thailand
16	SA_NEWZWALAND	New Zealand
17	SA_CQC_PLANT	China
18	SA_INDIA	India
19	SA_DEMARK_DK1	Denmark
20	SA_SWEDEN	Sweden
21	SA_NORWAY	Norway
22	SA_QUEENSLAND	Queensland
23	SA_FRANCE	France
24	SA_KOREA_60HZ	the republic of Korea
25	SA_BRAZIL	Brazil
26	SA_CEI0_16	Italy
27	SA_DEWA	Dubai
28	SA_CHILE	Chile
29	SA_ARGENTINA	Argentina
30	SA_N4110_BDEW	Germany
31	SA_TAIWAN_VPC	Taiwan
32	SA_DEMARK_DK2	Denmark
33	SA_CQC_2018	China
34	SA_DEMARK_TR3_3_1	Denmark
35	SA_POLAND	Poland
36	SA_TAIWAN_TPC	Taiwan Electric Power Bureau
37	SA_IEEE1547_1	North America
38	SA_BRAZIL_240V	Brazil
39	SA_EN50549	Europe
40	SA_AU_VICTORIA	Victoria
41	SA_AU_WESTERN	Western Australia 1
42	SA_AU_HORIZON	Western Australia 2
43	SA_AU_AUSGRID	New South Wales 1
44	SA_AU_ENDEAVOUR	New South Wales 2
45	SA_AU_ERGONENERGY	Queensland 1
46	SA_AU_ENERGEX	Queensland 2
47	SA_AU_SANETWORK	Nan ao electric
48	SA_US_UL1741	North America

49	SA_US_RULE21	North America
50	SA_US_RULE14_HECO	North America
51	SA_NRS097	South Africa
52	SA_TUNISIA	Tunisia
53	SA_PRC_EAST	North America
54	SA_PRC_WEST	North America
55	SA_PRC_QUEBEC	North America
56	SA_AUSTRIA	Austria
57	SA_ESTONIA	Estonia
58	SA_NI_G98	Northern Ireland
59	SA_NI_G99	Northern Ireland
60	SA_INDIA_KERALA	India Kerala

Table 3-6 system time setting

Description	Data type	Unit	Value range
Year	UINT8	-	[12, 99] Default value: 12
Month	UINT8	-	[1, 12] Default value: 1
Day	UINT8	-	[1, 31] Default value: 1
Time	UINT8	-	[0, 24] Default value: 0
Minute	UINT8	-	[0, 59] Default value: 0
Second	UINT8	-	[0, 59] Default value: 0

3.2 Definition of the protocol

3.2.1 Standard Modbus protocol definition

Data format:

Address	Function	Data	CRC Check
8 bits	8 bits	N*8 bits	16 bits

The valid slave address range is 0 - 254 decimal.

The address range assigned to each slave device is 1-254.

0 is a broadcast address.

Each hold or input register is a 16 bit (two bytes) unsigned integer.

Each byte consists of 8-bit binary characters, and each 8-bit byte in the packet contains two 4-bit hexadecimal characters (0~9, A~F).

The data format of each byte (10 bits) is: 1 start bit + 8 data bits + 1 stop bit, and the transmission

process is shown in the figure (each byte is sent in order from left to right).

Start bits	1	2	3	4	5	6	7	8	Stop bits

3.2.2 Command format

(1) Function code 0x03 read hold register

Send Message:

Field Name	Example(HEX)
Slave Address	11
Function	03
Starting Address Hi	00
Starting Address Lo	6B
No. of Points Hi	00
No. of Points Lo	03
Error Check(LRC or CRC)	-

Response Message:

Field Name	Example(HEX)
Slave Address	11
Function	03
Byte Count	06
Data Hi	02
Data Lo	2B
Data Hi	00
Data Lo	00
Data Hi	00
Data Lo	64
Error Check(LRC or CRC)	-

Response error:11 0x80 | 0x03 Error number CRC (Error number is a byte)

(2) Function code 0x04 read input register

Send Message:

Field Name	Example(HEX)
Slave Address	11
Function	04
Starting Address Hi	00

Starting Address Lo	08
No. of Points Hi	00
No. of Points Lo	01
Error Check(LRC or CRC)	-

Response Message:

Field Name	Example(HEX)
Slave Address	11
Function	04
Byte Count	02
Data Hi	00
Data Lo	0A
Error Check(LRC or CRC)	-

Response error:11 0x80 | 0x04 Error number CRC (Error number is a byte)

(3) Function code 0x06 preset single register

Send Message:

Field Name	Example(HEX)
Slave Address	11
Function	06
Register Address Hi	00
Register Address Lo	01
Preset Data Hi	00
Preset Data Lo	03
Error Check(LRC or CRC)	-

Response Message:

Field Name	Example(HEX)
Slave Address	11
Function	06
Register Address Hi	00
Register Address Lo	01
Preset Data Hi	00
Preset Data Lo	03
Error Check(LRC or CRC)	-

Response error:11 0x80|0x06 Error number CRC (Error number is a byte)

(4) Function code 0x10: preset multiple registers

Send Message:

Field Name	Example(HEX)
Slave Address	11
Function	10
Starting Address Hi	00
Starting Address Lo	01
No. of Registers Hi	00
No. of Registers Lo	02
Byte Count	04
Data Hi	00
Data Lo	0A
Data Hi	01
Data Lo	02
Error Check(LRC or CRC)	-

Response Message:

Field Name	Example(HEX)
Slave Address	11
Function	10
Starting Address Hi	00
Starting Address Lo	01
No. of Registers Hi	00
No. of Registers Lo	02
Error Check(LRC or CRC)	-

Response Error:11 0x80|0x10 Error number CRC (Error number is a byte)

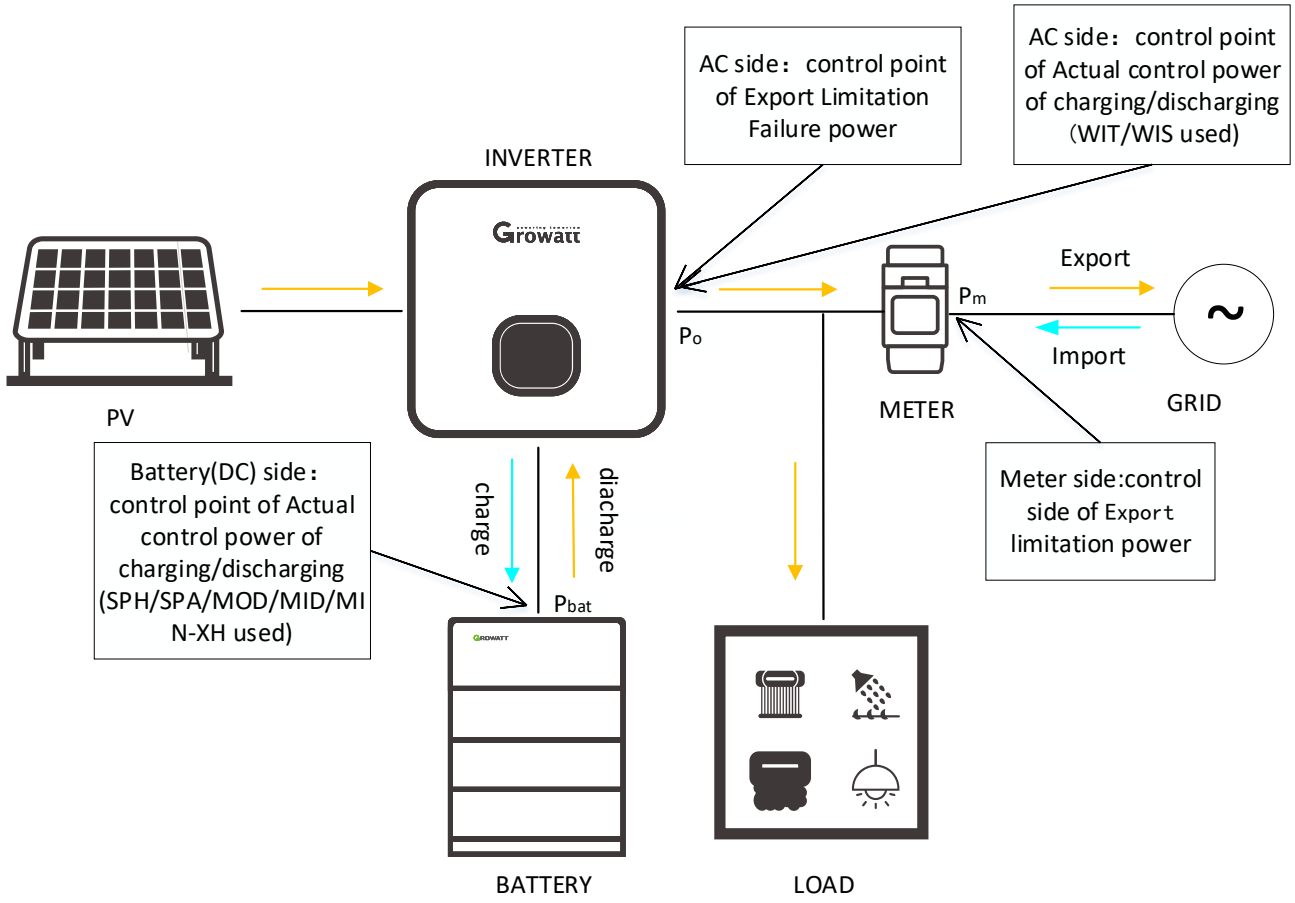
Error codes:

Description	Code	Meaning
Illegal function	0x01	1 write undefined function code 2 write reading only registers 3 read writing only registers
Illegal data address	0x02	1 write undefined address 2 read undefined address 3 read data crossing multi-groups

Illegal data	0x03	1 write data over prescribed scope
Checkout fault	0x08	1 CRC checkout error

3.3 Power control position diagram

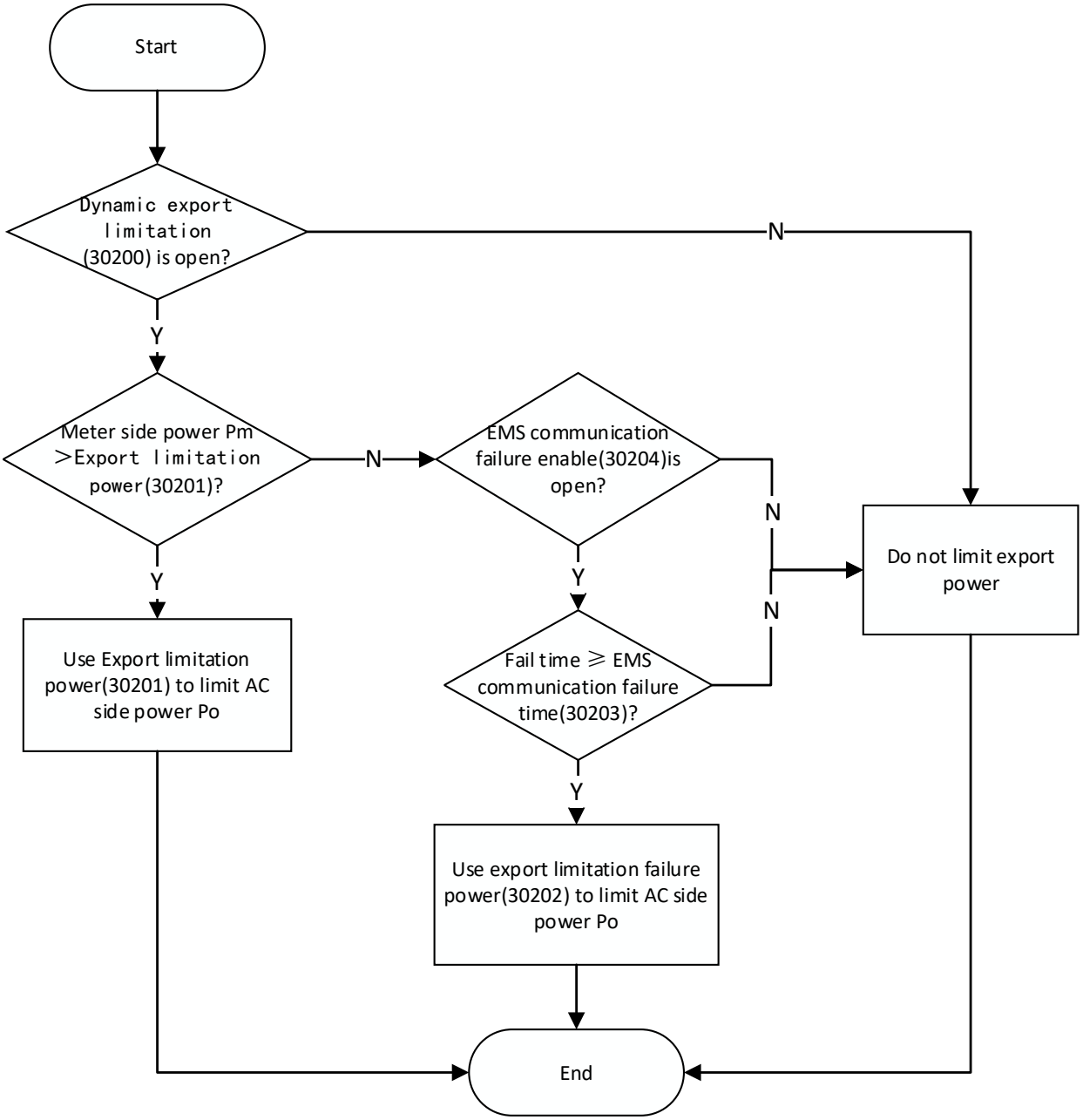
The following figure shows the limits of the Export Limitation power, Export Limitation Failure Power Rate, and battery charging/discharging power percentage.



The parameters involved in the figure above can be read from the following registers:

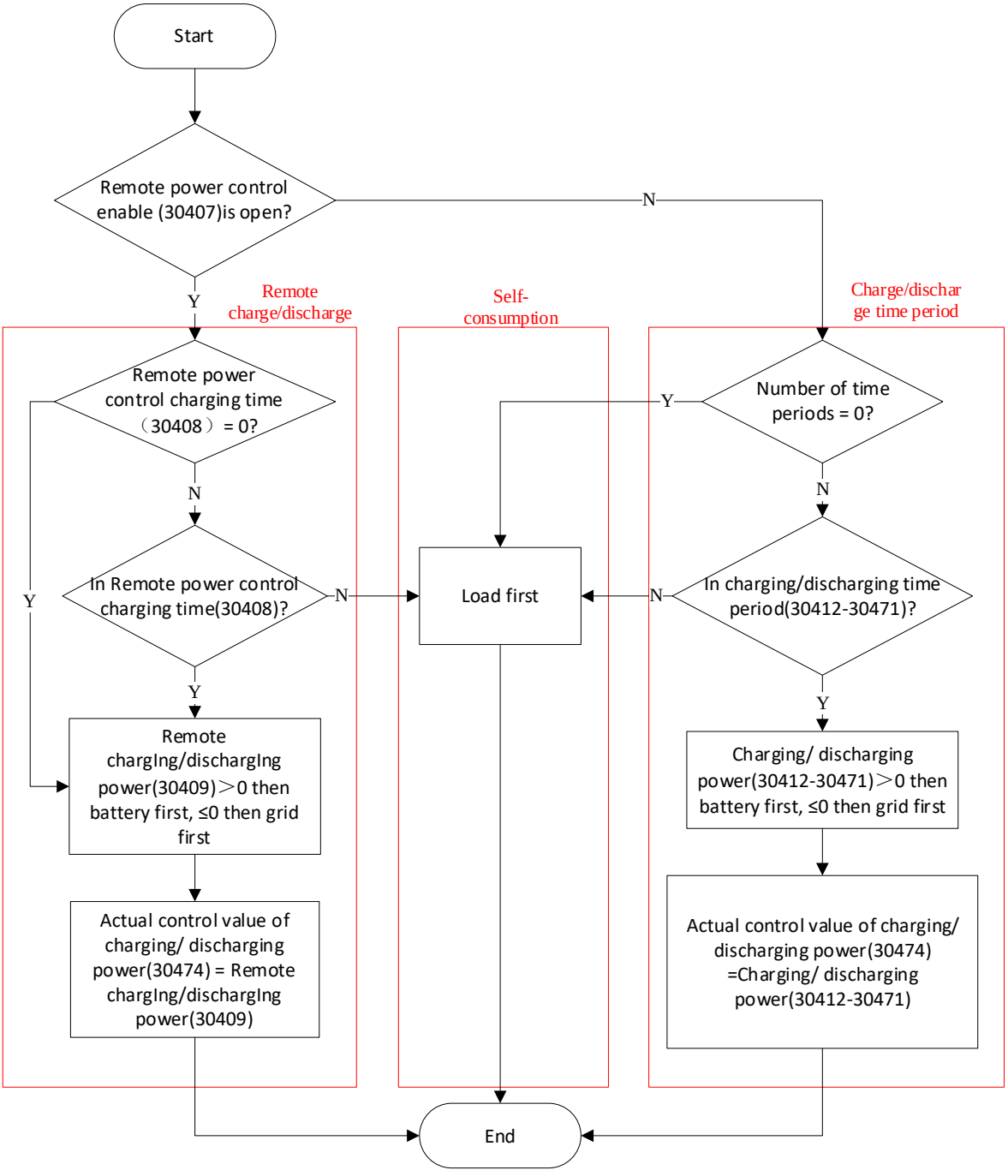
Parameter name	Holding register(setting value)	Input register(actual value)
Actual control value of charging/ discharging power	30474	/
Export Limitation Power Rate	30201	/
Export Limitation Failure Power Rate	30202	/
Charge/discharge power P_{bat}	/	31200
Active power P_o	/	31100
Meter power P_m	/	31112

3.4 Export Limitation power control schematic diagram



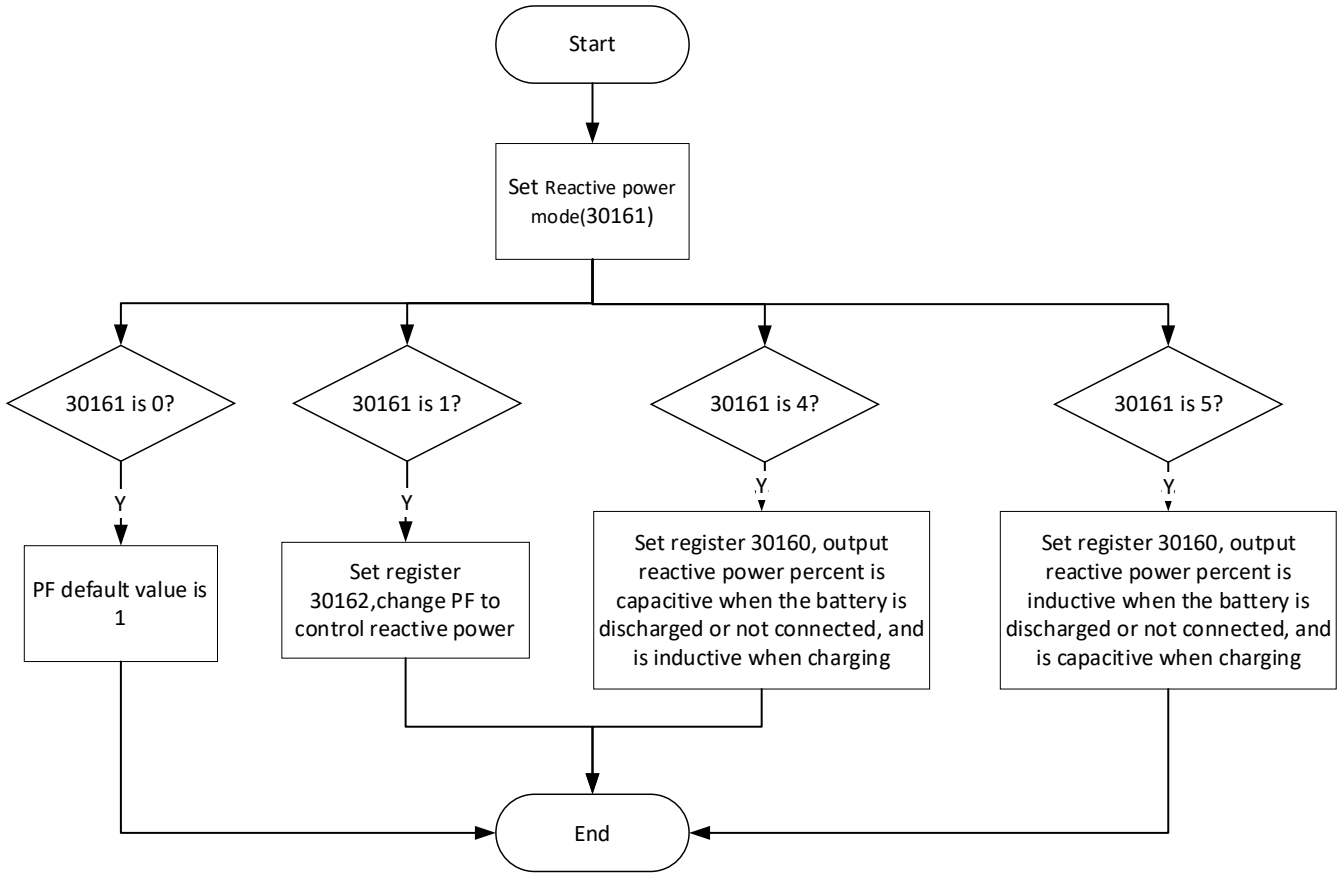
3.5 Remote power control schematic diagram

Remote power control 30407~30474 logical diagram are as follows.



3.6 Reactive power control schematic diagram

Reactive power control 30160~30162 logical diagram are as follows.



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