Enjoypowers Energy Storage PCS Communication Protocol——V.1.17

I. Modification records

Version	Effective Date	Modifier	Modify Description/Acknowledge Status
V1.1.17	2023/12/29	Liu yt	1. Refresh the format; 2. Refresh the description of the work status; 3. Refresh phase A power factor address 0x600D, phase B power factor address 0x600E, and phase C power factor address 0x600F; 4. Adding time's reading address 0x0020~0x0025; 5. Refresh the description of on-grid/off-grid mode enablement; 6. Update the description of PQ mode operation settings. This version is only applicable to energy storage PCS and not applicable to DC voltage source mode; 7. Refresh the process of charging and discharging operations in Appendix 2, and add the process of putting the module on standby.

II. Physical Interface

Specifically refers to the A-side/B-side of the RS485 signal of the PCS module

III. Protocol Description

Standard Modbus, supports 03 read data and 06 write data function codes; supports reading up to 16 words of data.

Baud Rate	Parity Bit	Data Bit	Stop Bit
9600bps	None	8	1

IV. Ⅳ Protocol Address

Item	Address	Explanation
Line AB Va.c.	0x6020	I16, read only, unit V, magnify 10 times. (For example, the grid voltage L1 is 400 V, and the read data is 4000 (0x0FA0))
Line BC Va.c.	0x6021	I16, read only, unit V, magnify 10 times
Line CA Va.c.	0x6022	I16, read only, unit V, magnify 10 times
AC Phase A voltage	0x6023	I16, read only, unit V, magnify 10 times
AC Phase B voltage	0x6024	I16, read only, unit V, magnify 10 times
AC Phase C voltage	0x6025	I16, read only, unit V, magnify 10 times
AC Phase A current	0x6026	I16, read only, unit A, magnify 10 times
AC Phase B current	0x6027	I16, read only, unit A, magnify 10 times
AC Phase C current	0x6028	I16, read only, unit A, magnify 10 times
Inductor phase A current	0x6029	I16, read only, unit A, magnify 10 times

Inductor phase B current	0x602A	I16, read only, unit A, magnify 10 times
Inductor phase C current	0x602B	I16, read only, unit A, magnify 10 times
AC frequency	0x602C	I16, read only, unit Hz, magnify 100 times
AC phase sequence	0x602D	I16, read only, 0 positive, 1 negative
PCS derating coefficient	0x602E	I16, read only, normal: 4096; (3686 means derating by 0.9, derating by 3686/4096=90%) ——Applicable to software version 5.13.0 and above
PCS derating sign	0x602F	I16, read only 0: normal 1: IGBT over-temperature derating 2: Ambient temperature derating 3: Both IGBT and ambient temperature are derated; ——Applicable to software version 5.13.0 and above
AC phase A active power	0x6030	I16, read only, unit KW, magnify 10 times
AC phase B active power	0x6031	I16, read only, unit KW, magnify 10 times
AC phase C active power	0x6032	I16, read only, unit KW, magnify 10 times
AC phase A apparent power	0x6033	I16, read only, unit KVA, magnify 10 times
AC phase B apparent power	0x6034	I16, read only, unit KVA, magnify 10 times
AC phase C apparent power	0x6035	I16, read only, unit KVA, magnify 10 times
AC phase A reactive power	0x6036	I16, read only, unit KVar, magnify 10 times
AC phase B reactive power	0x6037	I16, read only, unit KVar, magnify 10 times
AC phase C reactive power	0x6038	I16, read only, unit KVar, magnify 10 times
AC active power	0x6039	I16, read only, unit KW, magnify 10 times
AC reactive power	0x603A	I16, read only, unit KVar, magnify 10 times
AC apparent power	0x603B	I16, read only, unit KVA, magnify 10 times
AC power factor	0x603C	I16, read only, magnify 10 times
Bus voltage	0x6050	I16, read only, unit V, magnify 10 times
Positive bus voltage	0x6051	I16, read only, unit V, magnify 10 times
Negative bus voltage	0x6052	I16, read only, unit V, magnify 10 times
DC voltage	0x6053	I16, read only, unit V, magnify 10 times
DC current	0x6054	I16, read only, unit A, magnify 10 times
DC power	0x6055	I16, read only, unit KW, magnify 10 times
Total DC current during parallel operation	0x6056	I16, read only, unit A, magnify 10 times, used when modules are connected in parallel
Working status	0x6057	[Shutdown, standby, running, fault] Shutdown: All 0 means shutdown; Powering on: Bit0 is 1, Bit2 is 0; Standby: Bit0 and Bit2 are both 1; (Charging/discharging power=0) Running: Bit0 and Bit3 are both 1 (VF mode); or Bit0 and Bit8 are both 1 (PQ mode). (You can determine whether it is PQ mode or VF mode based on 0x5066.) Fault: Bit6 is 1. PCS panel indicator light description: The green light flashes slowly for 1.5 seconds to indicate shutdown. The green light flashes for 0.5 seconds to indicate standby.

		Steady green light indicates running. A steady red light indicates a fault.
IGBT temperature	0x6058	I16, read only, unit ℃, magnify 10 times
Ambient temperature	0x6059	I16, read only, unit ℃, magnify 10 times
Inductor temperature	0x605A	I16, read only, unit ℃, magnify 10 times
Current charging and discharging working mode	0x605B	UI16, read only, 1: AC and DC are both current source modes; 0: DC is voltage source mode
DSP version	0x6000	Software V information
	0x6001	Software B information
	0x6002	Software D information
CPLDversion	0x6003	Software V information
	0x6004	Software B information
	0x6005	Software D information
Phase A power factor	0x600D	I16, read only, magnify 100 times
Phase B power factor	0x600E	I16, read only, magnify 100 times
Phase C power factor	0x600F	I16, read only, magnify 100 times
DC cumulative charging capacity	0x6010	UI16, read only, higher 16 bits; unit kWh;
	0x6011	UI16, read only,lower 16 bits; unit kWh;
DC daily accumulated charging capacity	0x6012	UI16, read only, higher 16 bits; unit kWh;
	0x6013	UI16, read only,lower 16 bits; unit kWh;
DC cumulative discharging capacity	0x6014	UI16, read only, higher 16 bits; unit kWh;
	0x6015	UI16, read only,lower 16 bits; unit kWh;
DC daily accumulated discharging capacity	0x6016	UI16, read only, higher 16 bits; unit kWh;
	0x6017	UI16, read only,lower 16 bits; unit kWh;
AC history accumulated charging capacity	0x6018	UI16, read only, higher 16 bits; unit kWh;
	0x6019	UI16, read only,lower 16 bits; unit kWh;
AC daily accumulated charging capacity	0x601A	UI16, read only, higher 16 bits; unit kWh;
	0x601B	UI16, read only,lower 16 bits; unit kWh;
AC history accumulated discharging capacity	0x601C	UI16, read only, higher 16 bits; unit kWh;
	0x601D	UI16, read only,lower 16 bits; unit kWh;
AC daily accumulated discharging capacity	0x601E	UI16, read only, higher 16 bits; unit kWh;
	0x601F	UI16, read only,lower 16 bits; unit kWh;
Year	0x0020	U16, read only
Month	0x0021	U16, read only
Day	0x0022	U16, read only
Hour	0x0023	U16, read only
Minute	0x0024	U16, read only
Second	0x0025	U16, read only
Settable parameter		
Charging/discharging active power	0x0D57	I16, read and write, unit KW, magnify 10 times, positive means discharge power; negative means charging power;
Reactive power set value	0x0D58	I16, read and write, unit KVar, magnify 10 times
on-grid/off-grid mode enablement	0x5066	U16, read and write, 1: VF mode; 0: PQ mode
PQ mode operation settings	0x501B	U16, read and write, 1: AC current source;

Setting master/slave when connected in parallel under off-grid mode	0x5068	U16, read and write, 1: master; 0: slave. (When off-grid, there is one and only one module is set as the master module)
DC coupling bus enable when multiple modules connect in parallel	0X5054	U16, read and write, 1:enable; 0: disable(Default enable);(For DC coupling bus system)
Setting the number of modules connected in parallel	0X5021	U16, read and write, set the number of parallel modules when the module current sources are connected in parallel;
Voltage setting in VF mode	0X2227	I16; read and write, default 4096, (4096 corresponds to line voltage 400V, 3891 corresponds to line voltage 380V);
Frequency setting in VF mode	0X0103	I16; read and write, unit Hz, amplify 100 times, default 50Hz;
Discharge power single-phase control enable	0x5060	U16, read and write, 1: Enable (single-phase power control); 0: Disable (default total power control);
Phase A active power set value	0X02A6	I16, read and write, unit kW, amplify 10 times; (used after 0x5060 single-phase power control is enabled) Write 200, which means the discharge power of phase A is 20KW. Write -200, which means phase A charging power is 20KW
Phase A reactive power set value	0X02A7	I16, read and write, unit kVar, amplify 10 times; (used after 0x5060 single-phase power control is enabled)
Phase B active power set value	0X02A8	I16, read and write, unit kW, amplify 10 times; (used after 0x5060 single-phase power control is enabled)
Phase B reactive power set value	0X02A9	I16, read and write, unit kVar, amplify 10 times; (used after 0x5060 single-phase power control is enabled)
Phase C active power set value	0X02A A	I16, read and write, unit kW, amplify 10 times; (used after 0x5060 single-phase power control is enabled)
Phase C reactive power set value	0X02A B	I16, read and write, unit kVar, amplify 10 times; (used after 0x5060 single-phase power control is enabled)
Insulation detection enable	0X5070	I16, read and write; (Set to 1 to enable, start detection; automatically cleared after detection.) ——Applicable to software version 5.13.0 and above, and please note that it has insulation function when placing an order.
Protection parameters		
Grid overfrequency protection point	0x1604	U16, read and write, unit Hz, magnify 100 times;
Grid underfrequency protection point	0x1605	U16, read and write, unit Hz, magnify 100 times;
Island overfrequency protection point	0x1631	U16, read and write, unit Hz, magnify 100 times;
Island underfrequency protection point	0x1632	U16, read and write, unit Hz, magnify 100 times;
Battery overvoltage protection point	0x1633	U16, read and write, unit V, magnify 10 times;
Battery undervoltage protection point	0x1634	U16, read and write, unit V, magnify 10 times;
Bus overvoltage protection point	0x1611	U16, read and write, unit V, magnify 10 times;

Bus undervoltage protection point	0x1612	U16, read and write, unit V, magnify 10 times;
DC over current protection point	0x1641	U16, read and write, unit A, magnify 10 times;
AC phase voltage overvoltage protection point	0x1600	U16, read and write, unit V, magnify 10 times;
AC phase voltage undervoltage protection point	0x1601	U16, read and write, unit V, magnify 10 times;
AC overcurrent protection point	0x1603	U16, read and write, unit A, magnify 10 times;
Module over temperature protection point	0x1620	U16, read and write, unit °C, magnify 10 times;
Other settable parameters		
Constant current to constant voltage charging battery voltage point	0x1643	U16, read and write, unit V, magnify 10 times; Only for lead -acid battery
Battery constant voltage charging voltage	0x1644	U16, read and write, unit V, magnify 10 times; Only for lead -acid battery
The maximum time limit for constant voltage charging	0x1650	U16, read and write, unit minute, magnify 10 times; Only for lead -acid battery
Constant voltage to float charge current point setting	0x1651	U16, read and write, unit A, magnify 10 times; Only for lead -acid battery
Battery float charge voltage point setting	0x1653	U16, read and write, unit V, magnify 10 times; Only for lead -acid battery
Float charge to constant current current point setting	0x1654	U16, read and write, unit A, magnify 10 times; Only for lead -acid battery In the floating charging state, it converts to constant current state when the DC current is greater than the threshold t
Power on/Power off command	0x0291	I16, read and write. 1:Power on 0: Power off
Fault rest command	0x1400	U16, BIT15 set to 1 (write 0x8000 to address 0x1400)
Store Parameter command	0x1405	U16, bit8 set to 1 (write 0x0100 to address 0x1405), the bit8 will be automatically cleared after storing parameter; (It can be set only after the PCS is shut down)
EMS Modbus address	0x1010	U16, read and write, (when the module is with address dial, it is subject to the dial address)
EMS Modbus Baud rate	0x1007	U16, read and write, 96 indicates 9600 baud rate
HMI Modbus address	0x1011	U16, read and write, (when the module is with address dial, it is subject to the dial address)
HMI Modbus Baud rate	0x1004	U16, read and write, 96 indicates 9600 baud rate
EMS（BMS）communication fault time threshold	0x1648	U16, read and write,unit s
DC maximum charging/discharge current limit point	0x1640	U16, read and write, unit A, magnify 10 times
PCS time proofreading function (recommended proofreading cycle is one day or one week)		
Year	0x1020	U16, write
Month	0x1021	U16, write
Day	0x1022	U16, write

Hour	0x1023	U16, write
Minute	0x1024	U16, write
Second	0x1025	UU16, write
Fault information		
Hardware fault word 1	0x1700	U16，read only
Hardware fault word 2	0x1701	U16，read only
Grid fault word	0x1702	U16，read only
Bus fault word	0x1703	U16，read only
AC capacitor fault word	0x1704	U16，read only
System fault word	0x1705	U16，read only
Switch fault word	0x1706	U16，read only
Other fault word	0x1707	U16，read only

V.Appendix

Appendix 1：Fault analysis information

1. Hardware fault word analysis

Hardware fault word 1：0x1700

bit0 -- EPO fault sign；

bit1 -- IGBT hardware over current sign；

bit2 -- Bus hardware overvoltage sign；

bit4 -- Power module limit current for each cyclic wave；

Bit5 -- Balanced circuit hardware over current sign；

1 means fault, 0 means normal; other bits are retained;

2.Hardware fault word 2：0x1701

bit0 -- 24Vpower source fault sign；

bit1 -- Fan fault sign；

bit2 -- Connection fault sign；

bit6 -- Arrester fault sign；

Bit7 -- Inductor over temperature fault sign；

bit8 -- Power module over temperature sign；

Bit9 -- Balance module over temperature sign；

bit10 --15V power source fault sign；

bit11 -- System fire alarm fault sign；

bit12 -- Battery dry contactor fault sign；

bit13 -- Dry contactor over load fault sign；

bit14 -- Ambient temperature over temperature fault sign；

bit15 -- Dry contactor over temperature fault sign；

1 means fault, 0 means normal; other bits are retained;

3. Grid fault word：0x1702

bit0 -- Phase A over voltage fault sign；

bit1 --Phase B over voltage fault sign；

bit2 -- Phase C over voltage fault sign；

bit3 -- Phase A under voltage fault sign；

bit4 -- Phase B under voltage fault sign；

bit5 -- Phase C under voltage fault sign；

bit6 -- Grid over frequency；

bit7 -- Grid under frequency；

bit8 -- Grid phase sequence fault；

bit9 -- Phase A software over current；

bit10 -- Phase B software over current；

bit11 -- Phase C software over current；

bit12 -- Grid voltage is imbalanced；

bit13 -- Grid current is imbalanced；

Bit14 -- Grid phase loss；

bit15 -- N wire over current；

1 means fault, 0 means normal; other bits are retained;

4. Bus fault word：0x1703

bit0 -- Precharge bus over voltage；

bit1 -- Precharge bus under voltage；

bit2 -- Uncontrolled rectifier bus overvoltage；

bit3 -- Uncontrolled rectifier bus undervoltage

Bit4 -- Running bus overvoltage；

bit5 -- Running bus undervoltage；

bit6 -- Positive/negative bus imbalanced；

bit7 -- Battery undervoltage；

bit8 -- Current mode bus undervoltage；

bit9 -- Battery overvoltage；

bit10 -- DC precharge over current；

bit11 -- DC over current；

bit12 -- Imbalanced module software overcurrent；

bit15 -- Battery connected reversely；

1 means fault, 0 means normal; other bits are retained;

5. AC capacitor fault word：0x1704

Bit0 -- Precharge time out；

Bit1 -- Precharge phase A over current；

Bit2 -- Precharge phase B over current；

Bit3 -- Precharge phase C over current。

1 means fault, 0 means normal; other bits are retained;

6. System fault word：0x1705

bit1 --Control board EEPROM fault；

bit2 -- AD sampling zero float fault；

bit3 -- Backstage communication protocol fault；

bit8 -- Insulation detection fault；

bit11 -- BMSbattery system fault；

bit12 -- STS communication fault；

bit13 -- BMS communication fault；

bit14 -- Slave module CAN communication fault；

bit15 -- EMS communication fault；

1 means fault, 0 means normal; other bits are retained;

7. Switch fault word：0x1706

Bit0 -- Precharging relay switching on fault；

Bit1 -- Precharging relay switching off fault；

Bit2 -- Precharging relay switching on state fault；

Bit3 -- Precharging relay switching off state fault；

Bit4 -- Main relay switching on failure；

Bit5 -- Main relay switching off failure；

Bit6 -- Main relay switching on state fault；

Bit7 -- Main relay switching off state fault；

Bit8 -- Ac main relay adhesion fault；

Bit9 --DC relay disconnected fault；

1 means fault, 0 means normal; other bits are retained;

8. Other fault word：0x1707

Bit0 -- Inverting voltage phase A overvoltage fault sign；

Bit1 -- Inverting voltage phase B overvoltage fault sign；

Bit2 -- Inverting voltage phase C overvoltage fault sign；

Bit3 -- Grid island fault sign；

Bit5 -- System resonance fault sign；

Bit6 -- Software overvoltage/ overcurrent sign；

Bit8 -- High -voltage crossing time out fault sign；

Bit9 -- Inverting voltage phase A under voltage fault sign；

Bit10 -- Inverting voltage phase B under voltage fault sign；

Bit11 --Inverting voltage phase C under voltage fault sign；

Bit12 -- No synchronization signal under off-grid mode fault sign；

Bit14 -- Short -circuit fault sign；

Bit15 -- Low voltage crossing time out fault sign；

1 means fault, 0 means normal; other bits are retained;

Remark:

For faults in hardware fault word 1 and hardware fault word 2 (except lightning protector fault 0x1701 bit6 and power module over-temperature fault 0x1701 bit8), the PCS must be powered off before it can be reset.

Battery undervoltage fault (0x1703 bit7), battery overvoltage fault (0x1703 bit9), battery reverse connection fault (0x1703 bit15), power module overtemperature fault (0x1701 bit8), after these faults are restored, the PCS can be automatically reset.

For other faults, the PCS can be reset only by issuing a reset command when the PCS is shutdown.

Appendix 2：Power on/power off related information

Operation command

Power on【set 0x0291 to 1】

Power off【set 0x0291 to 0】

Reset【set 0x1400 Bit15 to 1 under power off state】

Store Parameter commands【When the PCS is powered off, set 0x1405's BIT8 to 1, and the BIT8 will automatically clear to zero after Storing Parameter】

Charging operation

Standby -- > Charge -- > Standby -- > Power Off

1. Write 1 in 0x0291to power on，the machine starts up after10s；

2. Write a negative value to 0x0d57 to adjust the charging power, such as writing -200, which means the charging power is 20KW

3. After EMS judges that the battery is full, write 0 to 0x0d57 and set the PCS to standby;

4、Control powering off，write 0 to 0x0291.

Discharging operation

Standby -- > Discharge -- > Standby -- > Power Off

1.Write 0 in 0x0291to power on，the machine starts up after10s；

2. Write a positive value to 0x0d57 to adjust the charging power, such as writing -200, which means the charging power is 20KW

3. After the EMS determines that the battery is exhausted,write 0 to 0x0d57 and set the PCS to standby；

4. Control powering off，write 0 to 0x0291.

Other illustration:

Conventional power-on process: issue a power on command and set the charging/discharging power.

Conventional power-off process: Set the charge/discharge power to 0, and then issue a power off command.