



Protocol for Solar Inverter Family

1 General information

The guide is to give you the definition of the protocol between Inverter and AP (Application Program, such as EzLogger, EzExplorer, ATS, etc). Through the protocol, data packet will be transmitted between AP and Inverter. Generally, the data packet is regarded as a frame which includes: 2 Bytes Header, 1 Byte Source, Destination Address, control code and Function code, alterable Data parts and 2 Bytes Checksum. AP communicates with Inverter through USB port or RS485 port and its baud rate is set to 9600, besides, data length is 8 bits. The AP is master and Inverter is slave. **There can be several slaves in the communication network, but only one master in it.** Firstly each Inverter must send the register instruction to AP and AP will allocate a unique address for each Inverter after it has received the register request. The detailed illustration is as follows:

1.1 Packet Communication Method

- It is necessary to get address from AP for each Inverter and the register address is unique for each Inverter.
- The communication method is as follows: AP is master and Inverter is slave, that is, firstly AP sends out the instruction to each Inverter and Inverter executes the operation when receiving its own instruction. Inverter can't initiatively send the instruction.
- The packet must include the sender and receiver address when AP sends query or control instruction to each Inverter. These instructions will be seen by all on-line Inverters. But the Inverter can only do when the instruction is suitable to its own address and the packet should include the sender and receiver address when Inverter responds to the instruction in the same way.
- AP routine query using the periodic query method (**10sec as one period**)
- It will firstly be sent when AP needs to write the data or allocate address while the routine query will be postponed.
- If AP can't receive the correct response to the sent command in 0.5Sec, AP will send the instruction again after 0.5Sec(the least interval between instructions). When it can't receive the response for 3 times either, AP will cancel the register and no longer send the instruction to the address.

1.2 Inverter Address Allocation

- If an unregistered Inverter (state =0) wants to enter the communication network, it should send the register request instruction when it has received the 'off-line query' from AP. The request should **include register request code and its serial number**. AP will reply it (the content also should include **allocate address**



code and corresponding serial number and the address allocated) after AP has received the information and allocated the address.

- The address will be used for the identification code for any communication after Inverter has finished the register program. The serial number for this machine will no longer be used.
- It need not wait before sending register request instruction after an unregistered Inverter receives the 'off-line query' info for the first time from AP. It will send again the register request instruction after several 'off-line query' intervals if the Inverter can't receive the response from AP (it is possibly due to noise or disturbances between every two Inverters). In order to get the different register time, the interval times will alter according to the serial number of machine.
- When register conflicts, the rules of interval times are as follows:
 - There is no wait and then to directly send for the first time , SN= the serial number of machine.
 - If it does not succeed , the second wait times=SN%15, SN=SN/15.
 - The third wait times= SN%15, SN=SN/15.
 - The fourth wait times= SN%15, SN=SN/15.in turn
- If AP can't receive the responses to an Inverter during 3 loops consecutively (3 times per loop), it will consider that communication has been halted, then cancel the register and no longer query address info.
- It will consider the communication has been halted if Inverter can't receive any its own instructions in excess of 10 minutes. The Inverter state will be set unregistered automatically. When receiving 'off-line query' again, the Inverter will register again and resume communication.
- The first bit of AP's address should be 1 and the first bit of Inverter's address should be 0.

2 Packet Format

2.1. Packet Format

Table 2-1

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes(0xAA 0x55)	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte(N)

Data0	Data1	Data2	Data3	...	Data(N-1)	Checksum
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Bytes

2.2 Description

Table 2-2

	Description
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Header:	the header of each packet (0xAA 0x55).
Source Address	designate the sender address.(ES default source address : 0xB0)
Destination Address	designate the receiver address.(ES default destination address : 0x7F)
Control Code	there are 2 kinds: 1. Register(0x00) 2. Read(0x01) 3. Execute(0x03)
Function Code	to be described
Data length	designate the data length. (0 if there is no data column)
Data0,1,2..N	data column
Checksum	Header + Source/Dstination Address + Control Code +Function Code + Data length +Data0 + .. +Data (N-1)

Note:

When sending the MSB will be firstly transmitted as a packet of word format.

■ Communication Parameter

Table 2-3

Parameter	Value
Speed	9600bps
Data bit	8
Parity	None
Stop bit	1

■ Communication timing

Table 2-5

Timing parameter	Value
Delay before Inverter begins to send response	<0.5 Sec
Inter-character delay	<0.2 Sec
The interval time between sending same instructions twice	>0.5 Sec
Time out for Inverter communication	10 Min

3 Instruction Set

3.1. Control Code :0x00 'Register'

Table 3-1

Control code	Function code	Vector	Description
0x00	0x00	AP →Inverter	Off-line Query



0x00	0x80	Inverter→AP	Register Request
0x00	0x01	AP →Inverter	Allocate Register Address
0x00	0x81	Inverter→AP	Address Confirm
0x00	0x02	AP →Inverter	Remove Register
0x00	0x82	Inverter→AP	Remove Confirm

Notice : Before slave registers, the address initialized as 0x7F

Off-line Query Data Packet Format:

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes(0xAA 0x55)	0b1*****	0x7F	0x00	0x00	0

Checksum
2 Bytes

Register Request Data Packet Format:

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes(0xAA 0x55)	0x7F	0b1*****	0x00	0x80	16

Data0	Data1	Data2	Data3	...	Data(N-1)	Checksum
SN1	SN2	SN3	SN4	...	SN16	2 Bytes

Allocate Register Address Data Packet Format:

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes(0xAA 0x55)	0b1*****	0x7F	0x00	0x01	17

Data0	Data1	Data2	Data3	...	Data(N-2)	Data(N-2)	Checksum
SN1	SN2	SN3	SN4	...	SN16	Address	2 Bytes

Address Confirm Data Packet Format:

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes(0xAA 0x55)	Address	0b1*****	0x00	0x81	0



Checksum
2 Bytes

Notice : The source address in Address Confirm data packet is address allocated from AP

Remove Register Data Packet Format:

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes(0xAA 0x55)	0b1*****	Address	0x00	0x02	0

Checksum
2 Bytes

Remove Confirm Data Packet Format:

Header	Source Address	Destination Address	Control Code	Function Code	Data length
2 Bytes(0xAA 0x55)	Address	0b1*****	0x00	0x82	0

Checksum
2 Bytes

Notice : After removed from network the address of inverter changes back to 0x7F and status as off-line. And will response if it receives off-line query command.

3.2. Control Code :0x01 'Read'

Table3-2

Control code	Function code	Vector	Description
0x01	0x00	AP →Inverter	Query Read Data List,
0x01	0x80	Inverter→AP	Response Read Data List,
0x01	0x01	AP →Inverter	Query Running Info,
0x01	0x81	Inverter→AP	Response Running Info,
0x01	0x02	AP →Inverter	Query ID Info,
0x01	0x82	Inverter→AP	Response ID Info,
0x01	0x03	AP →Inverter	Query Setting Info,
0x01	0x83	Inverter→AP	Response Setting Info,
0x01	0x04	AP →Inverter	Query Error Message,



0x01	0x84	Inverter→AP	Response Error Message,
0x01	0x06	AP→ Inverter	Read Storage Running Info,
0x01	0x86	Inverter→AP	Response Storage Running Info, Ref. Table 3-4
0x01	0x07	AP →Inverter	Read RTC Time Value
0x01	0x87	Inverter→AP	Response RTC Time, Ref. Table 3-13
0x01	0x09	AP →Inverter	Read ES Setting info
0x01	0x89	Inverter→AP	Response ES Setting, Ref. Table 3-10

Note: Error Message Data Length :4bytes, Ref. Table 3-3 0x10 and 0x11

3.2.1. 'Running Info List' : (Function Code : 0x81)

Table 3-3

Data Index	Measuring Channels	Unit	Description	Length
0x00	Vpv1	0.1V	PV1 voltage	2 Bytes
0x01	Vpv2	0.1V	PV2 voltage	2 Bytes
0x02	Ipv1	0.1A	PV1 current	2 Bytes
0x03	Ipv2	0.1A	PV2 current	2 Bytes
0x04	Vac1	0.1V	Phase L1 voltage	2 Bytes
0x05	Vac2	0.1V	Phase L2 voltage	2 Bytes
0x06	Vac3	0.1V	Phase L3 voltage	2 Bytes
0x07	Iac1	0.1A	Phase L1 current	2 Bytes
0x08	Iac2	0.1A	Phase L2 current	2 Bytes
0x09	Iac3	0.1A	Phase L3 current	2 Bytes
0x0A	Fac1	0.01Hz	Phase L1 frequency	2 Bytes
0x0B	Fac2	0.01Hz	Phase L2 frequency	2 Bytes
0x0C	Fac3	0.01Hz	Phase L3 frequency	2 Bytes
0x0D	Pac L	1W	low Byte of Feeding power	2 Bytes
0x0E	Work Mode	NA	Work Mode Table3-6	2 Bytes
0x0F	Temperature	0.1 degree C	Inverter internal temperature	2 Bytes
0x10	Error Message H	NA	Failure description for status 'failure' Table3-7	2 Bytes
0x11	Error Message L	NA	Failure description for status 'failure' Table3-7	2 Bytes
0x12	E-Total H	0.1KW.Hr	Total Feed Energy to grid	2 Bytes
0x13	E-Total L	0.1KW.Hr	Total Feed Energy to grid	2 Bytes
0x14	h-Total H	Hr	Total feeding hours	2 Bytes
0x15	h-Total L	Hr	Total feeding hours	2 Bytes
0x16	Firmware Version	NA	Firmware Version	2 Bytes



0x17	WarningCode	NA	Warning Code	2 Bytes
0x18	PV2FaultValue	0.1V	PV2 voltage fault value	2 Bytes
0x19	Functions Value	N/A	Functions Value	2 Bytes
0x1A	Line2VfaultValue	0.1V	Phase L2 voltage fault value	2 Bytes
0x1B	Line3VfaultValue	0.1V	Phase L3 voltage fault value	2 Bytes
0x1C	BUSVoltage	0.1V	BUSVoltage	2 Bytes
0x1D	NBUSVoltage	0.1V	NBUSVoltage	2 Bytes
0x1E	Line3FfaultValue	0.01Hz	Phase L3 frequency fault value	2 Bytes
0x1F	Safety Country	N/A	Safety Conutry	2 Bytes
0x20	E-Day	0.1KW.Hr	Feed Engery to grid in today	2 Bytes
0x21	Vbattery1	0.1V	First group battery voltage	2 Bytes
0x22	PV_ETotal_H	0.1kW.Hr	Total PV Energy (H)	2 Bytes
0x23	Cbattery1	0.1%	First group battery capacity	2 Bytes
0x24	Ibattery1	0.1A	First group battery current	2 Bytes
0x25	PV_ETotal_L	0.1kW.Hr	Total PV Energy (L)	2 Bytes
0x26	ES Warning Or BMS Error	0.1%	Warning Code Or BMS Error Code	2 Bytes
0x27	LoadPower	1VA	Power of Load	2 Bytes
0x28	E-Load-Day	0.1KW.Hr	Energy of load in day	2 Bytes
0x29	E-Total-Load H	0.1KW.Hr	High Byte of total Energy of Load	2 Bytes
0x2A	E-Total-Load L	0.1KW.Hr	Low Byte of total Energy of Load	2 Bytes
0x2B	TotalPower	1W	Total Power of Inverter	2 Bytes
0x2C	Vload	0.1V	Load voltage	2 Bytes
0x2D	Iload	0.1A	Load current	2 Bytes
0x2E	Operation Mode	NA	Storage Inverter work mode, refer to Table 3-17	2 Bytes
0x2F	BMS_Alarm	NA	BMS Alarm	2 Bytes
0x30	BMS_Warning	NA	BMS Warning	2 Bytes
0x31	SOH	%	SOH	2 Bytes
0x32	BMS_Temperature	0.1 Degree C	BMS Temperature	2 Bytes
0x33	BMS_Charge_I_Max	1A	BMS Charge I Max	2 Bytes
0x34	BMS_Discharge_I_Max	1A	BMS Discharge I Max	2 Bytes
0x35	Battery_Work_Mode	NA	Battary Work Mode	2 Bytes
0x36	Pmeter	1W	Pmeter	2 Bytes
0x37	Pbackup	1W	Pbackup	2 Bytes
0x38	VdcForBP	0.1V	VdcForBP	2 Bytes
0x39	IdcForBP	0.1A	IdcForBP	2 Bytes



0x3A	WorkModeForBP	INT	0x10 FaultMode 0x00 CheckMode 0x01 WaitMode 0x20 Battery Standby 0x40 Battery Charging 0x80 Battery Discharging	2 Bytes
0x3B	Year :Month	NA	High byte :Year; Low byte:Month	2 Bytes
0x3C	Date :Hour	NA	High byte :Date; Low byte:Hour	2 Bytes
0x3D	Minute :Second	NA	High byte :Minute; low byte:Second	2 Bytes
0x3E	Manufacture ID	NA	Manufacturer Identifier for Hanneng	2 Bytes
0x3F	RSSI	%	Strength of Signal (WiFi/GPRS 有效)	2 Bytes
0x40	PV mode	NA	HighByte:PV2; LowByte:PV1 Refer to Table-18	2 Bytes
0x41	Vbattery2	0.1V	Second group battery voltage	2 Bytes
0x42	Meter Status	NA	1: OK 0: NG	2 Bytes
0x43	Grid Mode	NA	Grid mode, refer to Table 3-20	2 Bytes
0x44	Fload	0.01Hz	Load Frequency	2 Bytes
0x45	Load Mode	NA	Load work mode, refer to Table 3-21	2 Bytes
0x46	EffectiveWorkMode	NA	Current effective work mode, refer to Table 3-24	2 Bytes
0x47	EffectiveRelayControl	NA	Current effective relay control, refer to Table 3-25	2 Bytes
0x48	Grid in-out flag	NA	It displays inverter send power to Grid or get power from Grid, refer to Table 3-26	2 Bytes
0x49	WgPowerMode	NA		2 Bytes
0x4A	WgPowerSet	1w		2 Bytes
0x4B	MeterPowerFactor	1%		2 Bytes
0x4C	DiagStatusH	NA	Refer Table 3-40	2 Bytes
0x4D	DiagStatusL	NA	Refer Table 3-40	2 Bytes
0x54	FM version of ARM	NA	Firmware Version of ARM	2 Bytes
0x55	GPRS Burn-in Mode	NA	0x00: normal mode 0x01: burn-in mode	2 Bytes
0x56	Pac H	1W	High Byte of Feeding power	2 Bytes
0x57	Vpv3	0.1V	PV3 voltage	2 Bytes
0x58	Vpv4	0.1V	PV4 voltage	2 Bytes
0x59	Ipv3	0.1A	PV3 current	2 Bytes
0x5A	Ipv4	0.1A	PV4 current	2 Bytes
0x5B	Istr1	0.1A	PV String1 Current	2 Bytes
0x5C	Istr2	0.1A	PV String2 Current	2 Bytes
0x5D	Istr3	0.1A	PV String3 Current	2 Bytes



0x5E	Istr4	0.1A	PV String4 Current	2 Bytes
0x5F	Istr5	0.1A	PV String5 Current	2 Bytes
0x60	Istr6	0.1A	PV String6 Current	2 Bytes
0x61	Istr7	0.1A	PV String7 Current	2 Bytes
0x62	Istr8	0.1A	PV String8 Current	2 Bytes
0x63	Istr9	0.1A	PV String9 Current	2 Bytes
0x64	Istr10	0.1A	PV String10 Current	2 Bytes
0x65	Istr11	0.1A	PV String11 Current	2 Bytes
0x66	Istr12	0.1A	PV String12 Current	2 Bytes
0x67	Istr13	0.1A	PV String13 Current	2 Bytes
0x68	Istr14	0.1A	PV String14 Current	2 Bytes
0x69	Istr15	0.1A	PV String15 Current	2 Bytes
0x6A	Istr16	0.1A	PV String16 Current	2 Bytes
0x6B	Istring Status	0.1A	Table 3-37	2 Bytes
0x6C	Istr18	0.1A	PV String18 Current	2 Bytes
0x6D	Istr19	0.1A	PV String19 Current	2 Bytes
0x6E	Istr20	0.1A	PV String20 Current	2 Bytes
0x6F	PID&Wietap Status	NA	Table 3-36	2 Bytes
0x70	Ppv1	1W	Power of PV1	2 Bytes
0x71	Ppv2	1W	Power of PV2	2 Bytes
0x72	Ppv3	1W	Power of PV3	2 Bytes
0x73	Ppv4	1W	Power of PV4	2 Bytes
0x74	Prated_High	1W	Rated power High bytes	2 Bytes
0x75	Prated_Low	1W	Rated power low bytes	2 Bytes
0x76	Power Factor	0.001	Power Factor	2 Bytes
0x77	Model Name	NA	Example"GW5000-DHF"	2 Bytes
0x78				2 Bytes
0x79				2 Bytes
0x7A				2 Bytes
0x7B				2 Bytes

3.2.2. 'Running Info List' : (Function Code : 0x86) (Only ES Inverter)

Table 3-4

Data Index	Measuring Channels	Unit	Description	Length
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0x00	Vpv1	0.1V	PV1 voltage	2 Bytes
0x01	Ipv1	0.1A	PV1 current	2 Bytes
0x02	PV1 Mode	NA	PV1 Module work mode, refer to Table 3-18	1 Byte
0x03	Vpv2	0.1V	PV2 voltage	2 Bytes
0x04	Ipv2	0.1A	PV2 current	2 Bytes
0x05	PV2 Mode	NA	PV2 Module work mode, refer to Table 3-18	1 Byte
0x06	Vbattery1	0.1V	First group battery voltage	2 Bytes
0x07	Vbattery2	0.1V	Second group battery voltage	2 Bytes
0x08	BMS Status	0.1V	BMS Work Status	2 Bytes
0x09	BMS Pack Temperature	0.1 degree		2 Bytes
0x0A	Ibattery1	0.1A	First group battery current	2 Bytes
0x0B	BMS Charge Imax	1A		2 Bytes
0x0C	BMS Discharge Imax	1A		2 Bytes
0x0D	BMS Error Code	NA	refer to Table 3-28	2 Bytes
0x0E	Cbattery1	1%	First group battery capacity	1 Byte
0x0F	ES Warning	NA	Warning Code	1 Byte
0x10	TBD	NA		1 Byte
0x11	BMS SOH	1%		1 Byte
0x12	Battery1 Mode	NA	First group battery work mode, refer to Table 3-19	1 Byte
0x13	BMS Warning Code H	NA	refer to Table 3-28	1 Byte
0x14	BMS Warning Code L	NA	refer to Table 3-28	1 Byte
0x15	Meter Status	NA	1: OK 0: NG	1 Byte
0x16	Vgrid	0.1V	Grid voltage	2 Bytes
0x17	Igrid	0.1A	Grid current	2 Bytes
0x18	Pgrid	1W	Grid Power	2 Bytes
0x19	Fgrid	0.01Hz	Grid Frequency	2 Bytes
0x1A	Grid Mode	NA	Grid mode, refer to Table 3-20	1 Byte
0x1B	Vload	0.1V	Load voltage	2 Bytes
0x1C	Iload	0.1A	Load current	2 Bytes
0x1D	Pload	1W	Load Power	2 Bytes
0x1E	Fload	0.01Hz	Load Frequency	2 Bytes
0x1F	Load Mode	NA	Load work mode, refer to Table 3-21	1 Byte
0x20	Work Mode	NA	Storage Inverter work mode, refer to Table 3-17	1 Byte
0x21	Temperature	0.1 degree C	Inverter internal temperature	2 Bytes
0x22	Error Message H	NA	Failure description for status 'failure' Table 3-7	2 Bytes
0x23	Error Message L	NA	Failure description for status 'failure' Table 3-7	2 Bytes
0x24	E-Total H	0.1KW.Hr	Total Feed Energy to grid	2 Bytes
0x25	E-Total L	0.1KW.Hr	Total Feed Energy to grid	2 Bytes



0x26	h-Total H	Hr	Total feeding hours	2 Bytes
0x27	h-Total L	Hr	Total feeding hours	2 Bytes
0x28	E-Day	0.1KW.Hr	Feed Energy to grid in today	2 Bytes
0x29	E-Load-Day	0.1KW.Hr	Energy of load in day	2 Bytes
0x2A	E-Total-Load H	0.1KW.Hr	High Byte of total Energy of Load	2 Bytes
0x2B	E-Total-Load L	0.1KW.Hr	Low Byte of total Energy of Load	2 Bytes
0x2C	TotalPower	1W	Total Power of Inverter	2 Bytes
0x2D	EffectiveWorkMode	NA	Current effective work mode, refer to Table 3-24	1 Byte
0x2E	EffectiveRelayControl	NA	Current effective relay control, refer to Table 3-25	2 Bytes
0x2F	Grid in-out flag	NA	It displays inverter send power to Grid or get power from Grid, refer to Table 3-26	1 Byte
0x30	Back-Up Load	1w	Load Power of Back-Up	2Bytes
0x31	WgPowerMode	NA		2Bytes
0x32	WgPowerSet	1w		2Bytes
0x33	MeterPowerFactor	1%		2Bytes
0x34	DiagStatusH	NA	Refer Table 3-40	2Bytes
0x35	DiagStatusL	NA	Refer Table 3-40	2Bytes
0x36	DRMStatus	NA	Refer Table 3-45	2Bytes

Work Mode

Table 3-6

Mode	Code	Description
Wait	0x00 0x00	Loss, inverter disconnects to Grid
Normal	0x00 0x01	OK, inverter connects to Grid
Fault	0x00 0x02	Fault, system is abnormal, inverter stop discharging



Permanent Fault	0x00 0x03	<p>System is seriously abnormal. Inverter will restart after 20s. The conditions to enter this status are as follows</p> <ol style="list-style-type: none"> 1. Grid current DC offset 2. Eeprom cannot be read or write in 3. Communication between CPU failure 4. Bus Voltage too high 5. Compare measured values from two CPU 6. relay check fail 7. GFCI Device check fail 8. HCT check fail
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➤ **Description :**

Table 3-7

Bit NO	Error message	Description
Bit31	Internal Communication Failure	Communication between microcontrollers is failure
Bit30	EEPROM R/W Failure	EEPROM cannot be read or written
Bit29	Fac Failure	The grid frequency is out of tolerable range
Bit28	TBD	NA
Bit27	TBD	NA
Bit26	TBD	NA
Bit25	Relay Check Failure	Relay check is failure
Bit24	TBD	NA
Bit23	Vac Consistency Failure	Different value between Master and Slave for grid voltage
Bit22	Fac Consistency Failure	Different value between Master and Slave for grid frequency
Bit21	TBD	NA
Bit20	TBD	NA
Bit19	DC Injection High	The DC injection to grid is too high
Bit18	Isolation Failure	Isolation resistance of PV-plant out of tolerable range
Bit17	Vac Failure	Grid voltage out of tolerable range
Bit16	External Fan Failure	The external fan failure
Bit15	PV Over Voltage	Pv input voltage is over the tolerable maximum value
Bit14	Auto Test Failure	Auto test failure
Bit13	Over Temperature	Temperature is too high
Bit12	Internal Fan Failure	The fan in case failure
Bit11	DC Bus High	Dc bus is too high
Bit10	Ground I Failure	Ground current is too high
Bit9	Utility Loss	Utility is unavailable
Bit8	TBD	NA
Bit7	TBD	NA



Bit6	TBD	NA
Bit5	TBD	NA
Bit4	GFCI Consistency Failure	Different value between Master and Slave for GFCI
Bit3	DCI Consistency Failure	Different value between Master and Slave for output DC current
Bit2	TBD	NA
Bit1	AC HCT Failure	The output current sensor is abnormal
Bit0	GFCI Device Failure	The GFCI detecting circuit is abnormal

3.2.3. 'Response ID Info Packet Format' : (Function Code : 0x82)

Table 3-8

Data NO	Length	Content	Description
0~4	5 Bytes	Firmware Ver.	Firmware Version, Example '01.00' = '30h 31h 2Eh 30h 30h'
5~14	10 Bytes	Model Name	Example 'GW3000-SS'
15~30	16 Bytes	Manufacturer	'GOODWE' = 'xxh xxh xxh xxh xxh xxh 20h 20h...20h'
31~46	16 Bytes	Serial number	Example '13000SSU11000008'
47~50	4 Bytes	Nom_Vpv	Nominal PV voltage : Example 360.0V= '33h 36h 30h 30h' Unit :0.1V
51~62	12 Bytes	Internal Version	Example '410-00000-00'
63	1 Byte	Safety Country Code	Table 3-12

3.2.4. 'Response Setting Info Packet Format' : (Function Code : 0x83)

Table 3-9

Data NO	Length	Name	Unit	Description
0~1	2 Bytes	Vpv-Start	0.1V	PV start-up voltage
2~3	2 Bytes	T-Start	1Sec	Time to connect grid
4~5	2 Bytes	Vac-Min	0.1V	Minimum operational grid voltage
6~7	2 Bytes	Vac-Max	0.1V	Maximum operational grid voltage
8~9	2 Bytes	Fac-Min	0.01Hz	Minimum operational grid Frequency
10~11	2 Bytes	Fac-Max	0.01Hz	Maximum operational grid Frequency

3.2.5 Response ES Setting Info (Function Code :0x89)



Table 3-10

Data Index	Measuring Channels	Unit	Description	Length
0~1	ChargerTimeStart	HM	Grid charge start time(Hbyte :hour Lbyte :minute)	2 Bytes
2~3	ChargerTimeEnd	HM	Grid charge end time	2 Bytes
4~5	BatChargePowerMax	1%	Grid charge power	2 Bytes
6~7	DisChargerTimeStart	HM	Discharge start time	2 Bytes
8~9	DisChargerTimeEnd	HM	Discharge end time	2 Bytes
10~11	BatDisPowerSet	1%	Discharge power set	2 Bytes
12~13	BackUpEnable	NA	Backup Output on	2 Bytes
14~15	OffGridAutoCharge	NA	PV Offgrid auto charge	2 Bytes
16~17	EnableMPPT4Shadow	NA	MPPT shadow scan enable	2 Bytes
18~19	FeedPowerEnable	NA	Feed power to grid (0 :yes 1 :no)	2 Bytes
20~21	ManufacturerCode	NA	Meter protocol code	2 Bytes
22~23	LeadBatCapacity	Ah	Lead acid battery capacity	2 Bytes
24~25	BattChargeVoltMax	0.1V	Battery charge volt setting	2 Bytes
26~27	BattChargeCurrMax	0.1A	Battery charge curr setting	2 Bytes
28~29	BattDisChgCurrMax	0.1A	Battery discharge curr setting	2 Bytes
30~31	BattVoltUnderMin	0.1V	Battery volt under setting	2 Bytes
32~33	BattSOCUnderMin	1%	Battery SOC under setting	2 Bytes
34~35	BMSConfigSucess	NA	BMS protocol config status	2 Bytes
36~37	NoGridChargeEnable	NA	No grid charge enable (1: on 2: off)	2 Bytes
38~39	DisChgWithPVEnable	NA	Discharge with PV enable (1: on 2: off)	2 Bytes
40~41	ProtocolCode	NA	BMS protocol set (0: Ezconverter 1: LG)	2 Bytes
42~43	RPCControlPara	NA	Power Factor Setting Table 3-22	2 Bytes
44~45	BattFloatVolt	0.1V	Battery float charge volt setting	2 Bytes
46~47	BattFloatCurr	0.1A	Battery float charge curr setting	2 Bytes
48~49	BattToFloatTime	1 min	Battery CV charge Time	2 Bytes
50~51	BattTypeIndex	NA	Battery manufactor index setting	2 Bytes
52~53	FeedPowerPara	1w	Feeding power limit	2 Bytes
54~55	AutoStartBackup	NA	Offgrid Auto startup	2 Bytes
56~57	StopSocProtect	NA	No soc protect	2 Bytes
58~59	KeepBattVoltOn	NA	No battery charge voltage on	2 Bytes
60~61	BattAvgChgVolt	0.1v	Battery maintain charge voltage	2 Bytes
62~63	BatAvgChgHours	1 Hour	Battery maintain charge cycle	2 Bytes
64~65	AS477Parameters	NA		2 Bytes
66~67	AppModeIndex	NA		2 Bytes



3.3. Control Code :0x03 'Excute

Table 3-11

Control code	Function code	Vector	Data Format	Data Length	Description
0x03	0x01	AP → Inverter	Table 3-12	1 byte	Set Satey Country
0x03	0x81	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x02	AP → Inverter	Table 3-13	6 bytes	Set RTC Time
0x03	0x82	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x10	AP → Inverter	Grid Voltage (0.1V)	2 bytes	Grid Voltage Calibrate (ATS Only)
0x03	0x90	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x12	AP → Inverter	Table 3-15	2 bytes	Set Power Adjust Rating (ATS Only)
0x03	0x92	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x13	AP → Inverter	Meter AC Power Value(1W)	2 bytes	Maximum Pac Adjust (ATS Only)
0x03	0x93	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x14	AP → Inverter	PV Voltage (0.1V)	2 bytes	PV Voltage Calibrate (ATS Only)
0x03	0x94	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x15	AP → Inverter	Meter AC Power Value (1W)	2 bytes	Set WattRatio (ATS Only)
0x03	0x95	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x16	AP → Inverter	Meter AC Current Value(0.1A)	6byte	Grid Current Calibrate (ATS Only) Every two byte mean one phase current,just fill first value for single phase model,fill all value for three phase model
0x03	0x96	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x1D	AP → Inverter	Restart Inverter	0	Reconnect (wait)
0x03	0x9D	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x1E	AP → Inverter	0~100 (0~100% Rating power)	1 byte	Adjust Real Power
0x03	0x9E	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x1F	AP → Inverter	Table 3-22	1 byte	Adjust Reactive Power
0x03	0x9F	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x20	AP → Inverter	NA	0	Start Standard PF Curve
0x03	0xA0	Inverter → AP	ACK or NAK	1 byte	Response



0x03	0x21	AP → Inverter	NA	0	Stop Standard PF Curve
0x03	0xA1	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x26	AP → Inverter	0~7, Ttable 3-17	1 byte	Set Storage Inverter work Mode
0x03	0xA6	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x27	AP → Inverter	0x0000~0xFFFF, Table 3-25	2 byte	Set relay driver, control battery relay, charger, load...
0x03	0xA7	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x28	AP → Inverter	0x0000~0xFFFF, Table 3-27	2 bytes	Function switch command
0x03	0xA8	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x2A	AP → Inverter	0x00 或 0x01	1 bytes	SCI channel switch : 0 : RS485 connect to slaver, WiFi to master 1 : RS485 connect to master, WiFi to slaver
0x03	0xAA	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x2C	AP → Inverter	Table 3-29	5 bytes	Set charge time schedule and power percent limit which buy from grid.
0x03	0xAC	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x2D	AP → Inverter	Table 3-29	5 bytes	Set discharge time shcedule and power percent limit which sell to grid.
0x03	0xAD	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x50(S)	AP → Inverter	Type(1)+Capacit y(2)+String(1)	4 bytes	Set Lead-acid Battery Information Type 1- 16 ;Capacity 1-500(Ah) ;String 1-100
0x03	0xD0	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x51(S)	AP → Inverter	Charge Voltage(2 bytes)+Charge Current(2 bytes)	4 bytes	Set Charge Parament Voltage 480-600(0.1V) Current 0-500(0.1A)
0x03	0xD1	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x52(S)	AP → Inverter	Dsicharge Stop Voltage(2 bytes)+Current Limit(2 bytes)	4 bytes	Set Discharge Parament Voltage 400-480 (0.1V) Current 0-1000 (0.1A)
0x03	0xD2	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x53	AP → Inverter	0/1	1 byte	Feeding power to grid functon 0: enable 1: disable
0x03	0xD3	Inverter → AP	ACK or NAK	1 byte	Response
0x03	0x54	AP → Inverter	Power(W)	2 bytes	Simulate meter power(ES)



0x03	0xD4	Inverter→AP	ACK or NAK	1 byte	Response
0x03	0x55	AP→Inverter	Power(2)+function switch(1)	3 bytes	Set battery safety curve, power 0-4600w, 0 :disable, 1 :enable
0x03	0xD5	Inverter→AP	ACK or NAK	1 byte	Response
0x03	0x56	AP→Inverter	Float charging voltage(2)+Float charging current(2) +Float charging time(2)+Battery index(1)	6 bytes	Voltage 480-600(0.1V) Current 0-500(0.1A) Time(0-60000 Minutes) Battery index(0-254)
0x03	0xD6	Inverter→AP	ACK or NAK	1 byte	Response
0x03	0x57	AP→Inverter	Equalization voltage (2)+ Equalization time (2)	4 bytes	Voltage 500-600 (0.1V) Time(0-5000 Hours)
0x03	0xD7	Inverter→AP	ACK or NAK	1 byte	Response
0x03	0x58	AP→Inverter	Power Control	3 byte	Power Mode
0x03	0xD8	Inverter→AP	ACK or NAK		
0x03	0x5A	AP→Inverter	Control ES WiFi LED	1 byte	0: NA 1: Blink1 2: Blink2 3: Blink4 0xFE: ON
0x03	0xDA	Inverter→AP	ACK or NAK	1 byte	Response
0x03	0x5B	AP→Inverter	Grid wave quality detect level	1 byte	0: High 1: low 2: close
0x03	0xDB	Inverter→AP	ACK or NAK	1 byte	Response

3.4. Safety Country Code :

Table 3-12

Code	Description
0x00	Italy
0x01	Czech
0x02	Germany
0x03	Spain
0x04	GreeceMainland
0x05	Danmark
0x06	Belgium
0x07	Romania



0x08	G83 or G59, according to model
0x09	Australia
0x0A	France
0x0B	China
0x0C	60Hz Grid Default
0x0D	Poland
0x0E	South Africa
0x0F	AustraliaL
0x10	Brazil
0x11	Thailand MEA
0x12	Thailand PEA
0x13	Mauritius
0x14	Holland
0x15	Northern Ireland
0x16	China Higher
0x17	French 50Hz
0x18	French 60Hz
0x19	Australia Ergon
0x1A	Australia Energex
0x1B	Holland 16/20A
0x1C	Korea
0x1D	China Station
0x1E	Austria
0x1F	India
0x20	50Hz Grid Default
0x21	Warehouse
0x22	Philippines
0x23	Ireland
0x24	Taiwan
0x25	Bulgaria
0x26	Barbados
0x27	China Highest
0x28	G59/3
0x29	Sweden
0x2A	Chile
0x2B	Brazil LV
0x2C	NewZealand
0x2D	IEEE1547 208Vac
0x2E	IEEE1547 220Vac
0x2F	IEEE1547 240Vac



0x30	60Hz LV Default
0x31	50Hz LV Default

3.5. Time Fomat

Table 3-13

Data NO	Data Length	Data Name	Valid Range
0	1 Bytes	Year	11~99
1	1 Bytes	Month	1~12
2	1 Bytes	Date	1~31
3	1 Bytes	Hour	0~23
4	1 Bytes	Minute	0~59
5	1 Bytes	Second	0~59

Table 3-15

Data Code	Load Condition
0x0010	10% Load
0x0020	20% Load
0x0030	30% Load
0x0040	40% Load
0x0050	50% Load
0x0060	60% Load
0x0070	70% Load
0x0080	80% Load
0x0090	90% Load
0x0100	100% Load

Power Adujst Step:

1. Send 0x0312 command, Set Inverter output power in limit range. Ref. Table 3-15;
2. Send 0x0315 command, Send meter AC power value to inverter;
3. Repeat step 1-2, complete 5 stage power adjust.

3.6. Receiver Response Packet Format

Header	Source Address	Destination Address	Control Code	Function Code	Data length	Data
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2 Bytes(0xAA 0x55)	Address	0b1*****	AP Control Code	AP Function Code+0x80	0x01	Table 3-16
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Checksum
2 Bytes

Table 3-16

Data(8 bits)	Condition
0x00	Checksum Fail (NULL)
0x06	Excute Success (ACK)
0x15	Excute Fail (NAK)

ES Inverter **Work Mode**

Table 3-17

Mode Code	Description
0x01	cut off all the connection to Inverter(wait mode), (Manual set)
0x02	PV intputs to Inverter,Inverter outputs to Grid(online mode)(Inverter Auto manage)
0x04	PV inputs to Inverter(First),Battery inputs to Inverter(Second),Inverter work as AC source(offline mode),(Manual set)
0x10	Fault,fault mode,something is in fault mode(fault mode)(Inverter Auto manage)
0x20	Electromotor,connect to motor(VF start mode)

PV Mode :

Table 3-18

Mode Code	Description
0x00	No PV,inverter disconnects to PV
0x01	Standby,PV does not output power
0x02	Work, PV output power

Battery Mode :

Table 3-19

Mode Code	Description
0x00	No Battery,inverter disconnects to Battery
0x01	Standby,no diacharging and no charging
0x02	Discharging
0x03	Charging

Grid Mode :



Table 3-20

Mode Code	Description
0x00	Loss, inverter disconnects to Grid
0x01	OK, inverter connects to Grid
0x02	Fault,something is wrong

Load Mode :

Table 3-21

Mode Code	Description
0x00	ON,inverter connects to Load
0x01	OFF, inverter disconnects to Load

CosPhy Data Definition :

Table 3-22

Data	Description	Data	Description
1	0.99 lagging	80	0.80 leading
2	0.98 lagging	81	0.81 leading
3	0.97 lagging	82	0.82 leading
4	0.96 lagging	83	0.83 leading
5	0.95 lagging	84	0.84 leading
6	0.94 lagging	85	0.85 leading
7	0.93 lagging	86	0.86 leading
8	0.92 lagging	87	0.87 leading
9	0.91 lagging	88	0.88 leading
10	0.90 lagging	89	0.89 leading
11	0.89 lagging	90	0.90 leading
12	0.88 lagging	91	0.91 leading
13	0.87 lagging	92	0.92 leading
14	0.86 lagging	93	0.93 leading
15	0.85 lagging	94	0.94 leading
16	0.84 lagging	95	0.95 leading
17	0.83 lagging	96	0.96 leading
18	0.82 lagging	97	0.97 leading
19	0.81 lagging	98	0.98 leading
20	0.80 lagging	99	0.99 leading
		100	1

Table 3-23 Destination of Data

Code	Destination
------	-------------



0x00	AP (such as Monitor or EzExplorer)
0x01	WebServer

Table 3-24 Current effective work module

Code	Description
0x00	No effective work mode now.
0x01	Mode 0 Wait mode is effective now.
0x02	Mode 1 Online mode is effective now.
0x04	Mode 2 Offline mode is effective now.

Table 3-25 Current effective Relay control

Bit NO.	False	True
Bit 0	TBD	TBD
Bit 1	TBD	TBD
Bit 2	TBD	TBD
Bit 3	TBD	TBD
Bit 4	Charger off	Charger on
Bit 5	Load relay off	Load relay on
Bit 6	TBD	TBD
...
Bit 15	TBD	TBD

Table 3-26 Grid in-out flag

Code	Description
0x00	Inverter neither send power to Grid, nor get power from Grid.
0x01	Inverter sends power to Grid
0x02	Inverter gets power from Grid.

Table 3-27 Function Switch Definition

Bit No	Definition	Byte1 (Setting Flag)		Byte2 (Setting Value)	
		1	0	1	0
Bit7	MPPT for Shadow(On-Grid Only)	Setting Function 7#	To be ignored	ON	OFF
Bit6	TBD	Setting Function 6#	To be ignored	ON	OFF
Bit5	TBD	Setting Function 5#	To be ignored	ON	OFF
Bit4	TBD	Setting Function 4#	To be ignored	ON	OFF
Bit3	TBD	Setting Function 3#	To be ignored	ON	OFF
Bit2	TBD	Setting Function 2#	To be ignored	ON	OFF
Bit1	TBD	Setting Function 1#	To be ignored	ON	OFF



Bit0	TBD	Setting Function 0#	To be ignored	ON	OFF
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Table 3-28 BMS Error Information

Bit NO	Error message	Description
Bit0	Battery Over Temperature	Charging: Stop charge, Discharging: reduce discharge current
Bit1	Battery Under Temperature	Charging: Stop charge, Discharging: reduce discharge current
Bit2	Battery Cell Voltage Differences	NA
Bit3	Battery Over Total Voltage	Stop charge
Bit4	Battery Discharge Over Current	Stop discharge
Bit5	Battery Charge Over Current	reduce charge current
Bit6	Battery Under SOC	Stop discharge
Bit7	Battery Under Total Voltage	Stop discharge
Bit8	Battery Communication Fail	Stop BMS Function, Inverter manage battery
Bit9	Battery Output Short	Inverter shutdown
Bit10		
Bit11		
Bit12		
Bit13		
Bit...		
Bit31		

Table 3-29 Charger And Discharge Management Parament

Start Time(2 Bytes)		End Time(2Bytes)		Power Percent(1 Byte)
Hour	Minute	Hour	Minute	1-100

Table 3-36

Bit No	Definition	Status	
		1	0
Bit15	TBD	-	-
Bit14	TBD	-	-
Bit13	TBD	-	-
Bit12	Wietap5	Normal	Failure
Bit11	Wietap4	Normal	Failure
Bit10	Wietap3	Normal	Failure
Bit9	Wietap2	Normal	Failure
Bit8	Wietap1	Normal	Failure



Bit7	TBD	-	-
Bit6	TBD	-	-
Bit5	TBD	-	-
Bit4	TBD	-	-
Bit3	TBD	-	-
Bit2	TBD	-	-
Bit1	PIDBox Status	Normal	Failure
Bit0	PIDBox	Connect	Disconnect

Table 3-37

Bit No	Definition	Status	
		1	0
Bit15	Istring16	Normal	Failure
Bit14	Istring15	Normal	Failure
Bit13	Istring14	Normal	Failure
Bit12	Istring13	Normal	Failure
Bit11	Istring12	Normal	Failure
Bit10	Istring11	Normal	Failure
Bit9	Istring10	Normal	Failure
Bit8	Istring9	Normal	Failure
Bit7	Istring8	Normal	Failure
Bit6	Istring7	Normal	Failure
Bit5	Istring6	Normal	Failure
Bit4	Istring5	Normal	Failure
Bit3	Istring4	Normal	Failure
Bit2	Istring3	Normal	Failure
Bit1	Istring2	Normal	Failure
Bit0	Istring1	Normal	Failure