Growatt PV Inverter Modbus RS485 RTU Protocol

V3.05

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Growatt New Energy CO.,LTD

No.	Version	Date	Notice	Signature
1	V1.00	2011-8-30		Paco
2	V1.10	2011-10-20		Lin
3	V2.01	2011-11-2		Xin.Chen
…	…	…		…
19	V3.00	2012-8-15		Jumi
20	V3.01	2012-11-22		Jumi
21	V3.02	2013-01-26		Jumi
22	V3.03	2013-01-30		Jumi
23	V3.04	2013-02-28		Jumi

1 Data format

Address	Function	Data	CRC check
8 bits	8 bits	N×8bits	16bits

Valid slave device addresses are in the range of 0 – 247 decimal.

The individual slave devices are assigned addresses in the range of 1 – 247.

0 is the broadcast address

It is 16bits (two bytes) unsigned integer for each holding and input register;

2 Command Format

Function 3 Read holding register

```
QUERY

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

Field Name                      Example
                                (Hex)

Slave Address                   11
Function                        03
Byte Count                      06
Data Hi (Register 40108)        02
Data Lo (Register 40108)        2B
Data Hi (Register 40109)        00
Data Lo (Register 40109)        00
Data Hi (Register 40110)        00
Data Lo (Register 40110)        64
Error Check (LRC or CRC)        —
```

Response Error:

    11 0x80|0x03 Errornum CRC   (Errornum as a byte)

Function 4 Read input   register

```
QUERY

                           Example
Field Name                 (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

                           Example
Field Name                 (Hex)

Slave Address              11
Function                   04
Byte Count                 02
Data Hi (Register 30009)   00
Data Lo (Register 30009)   0A
Error Check (LRC or CRC)   —
```

Response Error:

    11 0x80|0x04 Errornum CRC   (Errornum as a byte)

Function 6 Preset single register

```
QUERY

                           Example
Field Name                 (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

                          Example
Field Name                (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 Errornum CRC   (Errornum as a byte)

Function 16 Preset multiple register

```
QUERY

                          Example
Field Name                (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

                          Example
Field Name                (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 Errornum CRC   (Errornum as a byte)

3 Device Message Transmission Mode / Framing

RTU Mode

When controllers are setup to communicate on a Modbus network using RTU (Remote Terminal Unit) mode, each 8–bit byte in a message contains two 4–bit hexadecimal characters. Each message must be transmitted in a continuous stream.

The format for each byte in RTU mode is:

Coding System: 8–bit binary, hexadecimal 0–9, A–F

Two hexadecimal characters contained in each

8–bit field of the message

Bits per Byte:

1 start bit

8 data bits, least significant bit sent first

None parity

1 stop bit

Error Check Field: Cyclical Redundancy Check (CRC)

The baud rate of the transmission is:

Baud Rate: 9600 bps

Minimum CMD period (RS485 Time out): 850ms.

Wait for minimum 850ms to send a new CMD after last CMD. Suggestion is 1s;

Maximum Data Length Define:

Maximum read data length is 45 words in read command;

Maximum update data length is 45 words in preset command;

Read or update registers NO. should in the range of times of 45,

eg: 1~45 or 96~123 are OK,   but 40~60 is not OK;

Note:

Except the CEI0-21 and VDE-AR-N 4105 power management registers, you should refer the manufactory's suggestion when writing other registers;

4 Register map

It is 16bits (two bytes) unsigned integer for each holding and input register;

4.1 Holding Reg

Register NO.	Variable Name	Description	Customer Write	Value	Unit	Initial value	Note
00	OnOff	The Inverter On/Off state and the auto start state, The low byte is the on/off(1/0), the high byte is the auto start state or not(1/0).	W	0x0000; 0x0001; 0x0100; 0x0101;		0x0101;	Auto start means the auto power AC when next power on inverter.
02	PF CMD memory state	Set the following 3,4,5,99 CMD will be memory or not(1/0), if not, these settings are the initial value.	W	0or1,		0	Means these settings will be acting or not when next power on
03	Active P Rate	Read Inverter max output active power percent	W	0-100	percent	100	
04	Reactive P Rate	Read Inverter max output reactive power percent	W	0-100	percent		
05	Power factor	Read Inverter output power factor's 10000 times	W	0-20000，0-10000 is underexcitec, other is overexcited		10000	
06	Pmax H	Normal power (high)			0.1VA		
07	Pmax L	Normal power (low)			0.1VA		
08	Vnormal	Normal work PV voltage			0.1V		

09	Fw version H	Firmware version (high)			ASCII		
10	Fw version M	Firmware version (middle)					
11	Fw version L	Firmware version (low)					
12	Fw version2 H	Control Firmware version (high)			ASCII		
13	Fw version2 M	Control Firmware version (middle)					
14	Fw version2 L	Control Firmware version (low)					
15	LCD language	LCD language	W	0-4,5			
23	Serial NO. 5	Serial number 5			ASCII		
24	Serial No. 4	Serial number 4					
25	Serial No. 3	Serial number 3					
26	Serial No. 2	Serial number 2					
27	Serial No. 1	Serial number 1					
28	Moudle H	Inverter Moudle (high)		&*5			
29	Moudle L	Inverter Moudle (low)					
30	Com Address	Communicate address	W			1	
34	AutoTestStart	AutoTestStart	W	0x0001			
45	Sys Year	System time-year	W	Year offset is 0			
46	Sys Month	System time- Month	W				
47	Sys Day	System time- Day	W				
48	Sys Hour	System time- Hour	W				
49	Sys Min	System time- Min	W				
50	Sys Sec	System time- Second	W				
73	ModbusVersion	Modbus Version		Eg：207 is V2.07	Int(16bits)		
81	FreqDerateStart	Frequency derating start point	W		0.01HZ		
90	PFLineP1_LP	PF limit line point 1 load percent	W	0-255	percent		255 means no this point

91	PFLineP1_PF	PF limit line point 1 power factor	W	0-20000			
92	PFLineP2_LP	PF limit line point 2 load percent	W	0-255	percent		255 means no this point
93	PFLineP2_PF	PF limit line point 2power factor	W	0-20000			
94	PFLineP3_LP	PF limit line point 3 load percent	W	0-255	percent		255 means no this point
95	PFLineP3_PF	PF limit line point 3 power factor	W	0-20000			
96	PFLineP4_LP	PF limit line point 4 load percent	W	0-255	percent		255 means no this point
97	PFLineP4_PF	PF limit line point 4 power factor	W	0-20000			
99	PFModel	Set PF function Model	W	0: PF=1 1: PF by set 2: default PF line 3: User PF line 4：UnderExcited (Inda) Reactive Power 5：OverExcited(Capa) Reactive Power 6：Q(v)model			
100	FLrate	Frequency – load limit rate	W	0-100	10times		

4.2 Input Reg

Register NO.	Variable Name	Description	Value	Unit	Note
00	Inverter Status	Inverter run state	0:waiting, 1:normal, 3:fault		
01	Ppv H	Input power (high)		0.1W	
02	Ppv L	Input power (low)		0.1W	
03	Vpv1	PV1 voltage		0.1V	
04	PV1Curr	PV1 input current		0.1A	
05	PV1Watt H	PV1 input watt (high)		0.1W	
06	PV1Watt L	PV1 input watt (low)		0.1W	
07	Vpv2	PV2 voltage		0.1V	
08	PV2Curr	PV2 input current		0.1A	
09	PV2Watt H	PV2 input watt (high)		0.1W	
10	PV2Watt L	PV2 input watt (low)		0.1W	
11	Pac H	Output power (high)		0.1W	
12	Pac L	Output power (low)		0.1W	
13	Fac	Grid frequency		0.01Hz	
14	Vac1	Three/single phase grid voltage		0.1V	
15	Iac1	Three/single phase grid output current		0.1A	
16	Pac1 H	Three/single phase grid output watt (high)		0.1VA	
17	Pac1 L	Three/single phase grid output watt (low)		0.1VA	
18	Vac2	Three phase grid voltage		0.1V	
19	Iac2	Three phase grid output current		0.1A	
20	Pac2 H	Three phase grid output power (high)		0.1VA	
21	Pac2 L	Three phase grid output power (low)		0.1VA	
22	Vac3	Three phase grid voltage		0.1V	
23	Iac3	Three phase grid output current		0.1A	
24	Pac3 H	Three phase grid output power (high)		0.1VA	
25	Pac3 L	Three phase grid output		0.1VA	

		power (low)			
26	Energy today H	Today generate energy (high)		0.1KWH	
27	Energy today L	Today generate energy today (low)		0.1KWH	
28	Energy total H	Total generate energy (high)		0.1KWH	
29	Energy total L	Total generate energy (low)		0.1KWH	
30	Time total H	Work time total (high)		0.5S	
31	Time total L	Work time total (low)		0.5S	
32	Temperature	Inverter temperature		0.1C	
40	Fault code	Inverter fault bit	&*1		
41	IPM Temperature	The inside IPM in inverter Temperature		0.1C	
64	WarningCode	Warning Code			
90	Grid Fault record 1 - code	Grid Fault record 1 - code			
91	Grid Fault record 1 - year|month	Grid Fault record 1 - year|month	Year offset is 2000		
92	Grid Fault record 1 - day|hour	Grid Fault record 1 - day|hour			
93	Grid Fault record 1 - min|sec	Grid Fault record 1 - min|sec			
94	Grid Fault record 1-value	Grid Fault record 1-value	&*2		
95	Grid Fault record 2 - code	Grid Fault record 2 - code			
96	Grid Fault record 2 - year|month	Grid Fault record 2 - year|month	Year offset is 2000		
97	Grid Fault record 2 - day|hour	Grid Fault record 2 - day|hour			
98	Grid Fault record 2 - min|sec	Grid Fault record 2 - min|sec			
99	Grid Fault record 2-value	Grid Fault record 2-value			

100	Grid Fault record 3 - code	Grid Fault record 3 - code			
101	Grid Fault record 3 - year|month	Grid Fault record 3 - year|month	Year offset is 2000		
102	Grid Fault record 3 - day|hour	Grid Fault record 3 - day|hour			
103	Grid Fault record 3 - min|sec	Grid Fault record 3 - min|sec			
104	Grid Fault record 3-value	Grid Fault record 3-value			
105	Grid Fault record 4 - code	Grid Fault record 4 - code			
106	Grid Fault record 4 - year|month	Grid Fault record 4 - year|month	Year offset is 2000		
107	Grid Fault record 4 - day|hour	Grid Fault record 4 - day|hour			
108	Grid Fault record 4 - min|sec	Grid Fault record 4 - min|sec			
109	Grid Fault record 4-value	Grid Fault record 4-value			
110	Grid Fault record 5 - code	Grid Fault record 5 - code			
111	Grid Fault record 5 - year|month	Grid Fault record 5 - year|month	Year offset is 2000		
112	Grid Fault record 5 - day|hour	Grid Fault record 5 - day|hour			
113	Grid Fault record 5 - min|sec	Grid Fault record 5 - min|sec			
114	Grid Fault record 5-value	Grid Fault record 5-value			
115					
116					
...					
...					

...					
133					
134					
135	bTestProcess<<8 | bAutoTestStep	Auto test process or auto test step	&*3		
136	wAutoTestResult	Auto test result	&*4		
137	cTestStepStop	Auto test stop step	&*4		
138	0	0		0	
139	Value Limit	Safety voltage/frequency limit value		0.1V	
140	Time Limit	Safety time limit value		1ms	
141	Real value	Real voltage/frequency value		0.1V	
142	Test value	Auto testing voltage/frequency value		0.1V	
143	Test treat value	Auto test voltage/frequency treat value		0.1V	
144	Test treat time	Auto test treat time		1ms	
145					
146					
...					
...					
....					
178					
179					

&*1: Inverter fault code:

Fault type value	Means(The message showed on the inverter when the inverter has fault)
1~23	" Error: 99+x ",
24	"Auto Test Failed",
25	"No AC Connection",
26	"PV Isolation Low",
27	" Residual I High",
28	" Output High DCI",
29	" PV Voltage High",

30	" AC V Outrange ",
31	" AC F Outrange ",
32	" Module Hot "

&*2:   The value is 0.1V when the fault is the voltage, is 0.01Hz when the fault is the frequency;

&*3:

High byte value	Means		low byte value	Means
0	Auto test stop		0	No test
1	Auto test starting		1	Testing grid volt high pro
2	Auto testing		2	Testing grid volt low pro
			3	Testing grid frequency high pro
			4	Testing grid frequency low pro

&*4: The variable "wAutoTestResult" and "cTestStepStop": wAutoTestResult is the step test time counter, when it reach cTestStepStop, this step test will stop and fail.

&*5: Inverter Model: A , could be show: "T0 Q0 PF U1 M5 S1" or "00F151"

$$Tx=(A\&0XF00000)>>20$$
$$Qx=(A\&0X0F0000)>>16$$
$$Px=(A\&0x00F000)>>12$$
$$Ux=(A\&0x000F00)>>8$$
$$Mx=(A\&0x0000F0)>>4$$
$$Sx=(A\&0x00000F)$$

5 Set address

Refer to the Inverter user manual.   Always is :

Knock the pv inverter to let the lcd display to the "COM Addr: xxx", then double knock, if displays "Move", you should another double knock, until it displays a address number, then you can give a single knock to change the address, this address will be remembered when the lcd backlight off.

6 Notice

1) It can drive mostly 32 pv inverters for one rs485 comport.

2) There are only read input and hold registers commands even the newest version.

3) App user could only care the input register.

4) App user could not care the holding registers.

5) Except the CEI0-21 and VDE-AR-N 4105 power management registers, you should refer the manufactory's suggestion when writing the other registers;