

# Communication Protocol of PV Grid-Connected String Inverters

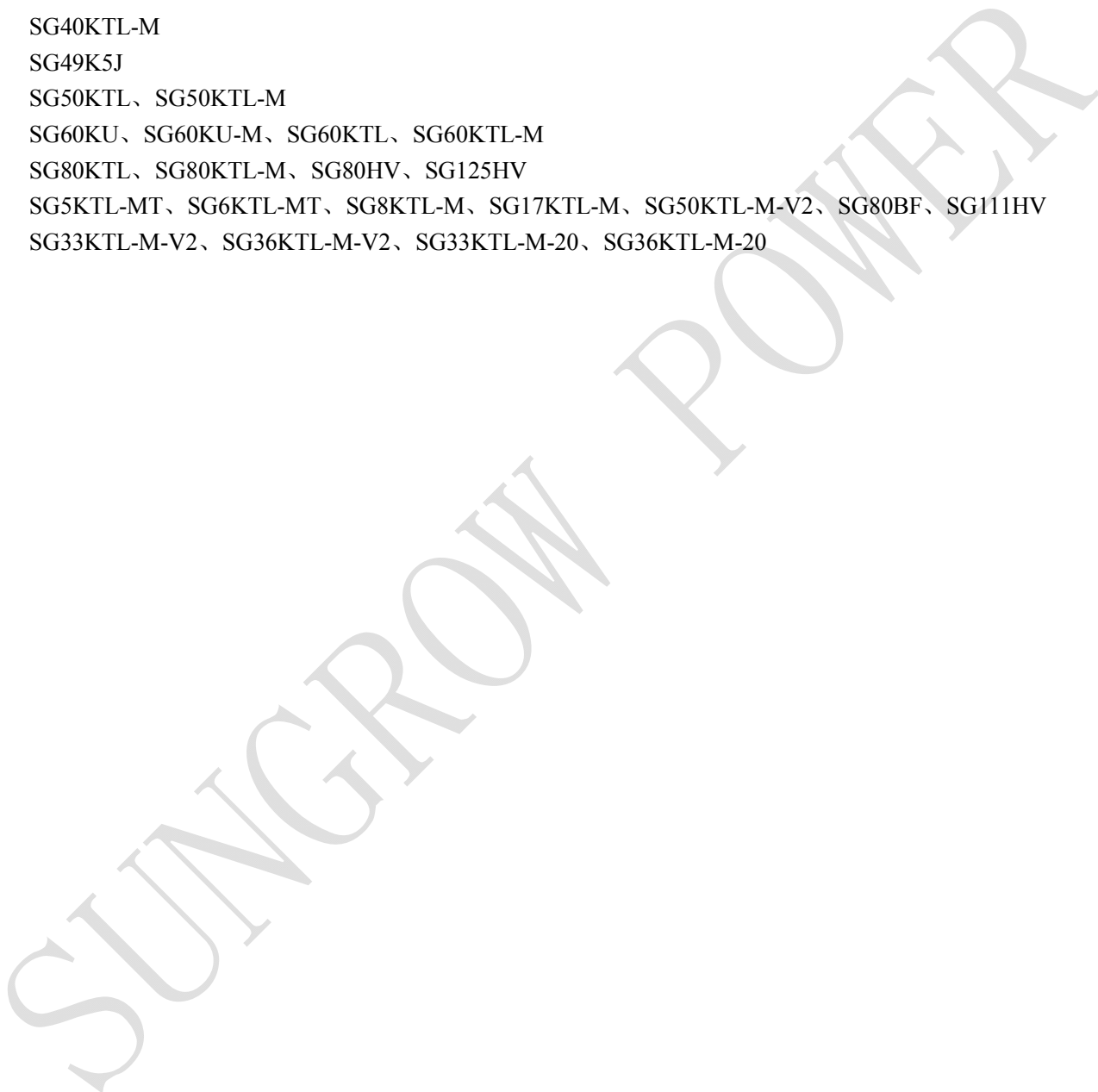
## V1.1.17

Version number	Date	Note
V1.1.0	2016-4-11	initial version. Unofficial version(V1.0.13) is no longer used.
V1.1.1	2016-5-13	modify the register address and some related content: 5039--Power limitation adjustment 5040--Reactive power adjustment
V1.1.2	2017-5-13	Add Inverter model : SG36KTL-M、SG10KTL-M、 SG12KTL-M、SG80KTL、SG80KTL-M、SG80HV、 SG125HV
V1.1.3	2017-6-10	Add Inverter model:SG33K3J、SG50KTL “Fault run” change to “Fault” Add country code:UAE,Israel,Hungary
V1.1.4	2017-6-15	Add SG80HV、SG125HV the number of mppt and combiner board information
V1.1.5	2017-6-20	Add Inverter data point : State setting
V1.1.6	2017-7-10	Add Inverter fault/alarm code 007/030/031/032/033
V1.1.7	2017-8-7	Modify the name of fault code: 003/006/014/016/019/021/022/025/026/041/042//048/049/050
V1.1.8	2017-8-12	Delete Inverter fault/alarm code: 051 Add Inverter fault/alarm code: 053/054/055/056/059/060
V1.1.9	2017-9-20	Add Inverter one working state
V1.1.10	2017-9-26	Modify the code of JP
V1.1.11	2017-10-19	Add Inverter fault/alarm code 564/565/580/581
V1.1.12	2017-10-24	Add country and region code 26/27/28/29/63/64/65/66/67/59/98 Modifyfault/alarmnote: “LCD”changedto“LCD or APP”
V1.1.13	2017-11-2	Add Inverter data point : Total apparent power
V1.1.14	2017-11-18	Add Inverter model: SG15KTL-M、SG20KTL-M
V1.1.15	2017-11-25	Add Inverter model: SG30KTL-M Add Inverter fault/alarm code: 116
V1.1.16	2017-12-22	Add Inverter model: SG5KTL-MT 、SG6KTL-MT 、 SG8KTL-M、SG17KTL-M、SG50KTL-M-V2、SG80BF、 SG111HV Modify SG10KTL-M, SG12KTL-M limit the maximum power ratio of 110%

V1.1.17	2018-1-18	Add Inverter model: SG33KTL-M-V2、SG36KTL-M-V2、SG33KTL-M-20、SG36KTL-M-20 Increase the support of “Total apparent power” point inverter model information
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**Valid for device types:**

SG10KTL-M、SG12KTL-M、SG15KTL-M、SG20KTL-M  
 SG30KTL-M、SG33KTL-M、SG33K3J  
 SG36KTL-M  
 SG40KTL-M  
 SG49K5J  
 SG50KTL、SG50KTL-M  
 SG60KU、SG60KU-M、SG60KTL、SG60KTL-M  
 SG80KTL、SG80KTL-M、SG80HV、SG125HV  
 SG5KTL-MT、SG6KTL-MT、SG8KTL-M、SG17KTL-M、SG50KTL-M-V2、SG80BF、SG111HV  
 SG33KTL-M-V2、SG36KTL-M-V2、SG33KTL-M-20、SG36KTL-M-20



## 1. Introduction

This communication protocol, adopting Modbus RTU protocol, applies to the communication between Sungrow PV grid-connected string inverters and the upper computer (PC) monitoring software. This protocol can read the real-time operating data and fault states of inverters.

## 2. Communication Interface

### 1) RS485

	Default setting
Address	Inverter: 1 – 247 settable PC: 1 – 247 settable
Broadcast	Yes
Baud rate	9600bit/s
Check bit	Null or settable
Data bit	8
Stop bit	1
Mode	RTU
Appliance interface	RS485-2W cable connection

### 2) Ethernet (optional)

Default:

- IP: 192.168.1.100;
- Sub-Net: 255.255.0.0
- Port: 502

## 3. Definition of Address

### 4. Data type

U16: 16-bit unsigned integer, big-endian

S16: 16-bit signed integer, big-endian

U32: 32-bit unsigned integer; little-endian for double-word data. Big-endian for byte data

S32: 32-bit signed integer; little-endian for double-word data. Big-endian for byte data

Example:

transmission order of U16 data 0x0102 is 01, 02

transmission order of U32 data 0x01020304 is 03, 04, 01, 02

The transmission order of multibyte data UTF-8: the high-byte data is in the front and the low-byte data is at back.

Example: transmission order of UTF-8 data ABCD is A, B, C, D.

### 2. Value description

The decimal parameters are transmitted as integer after expansion. E.g.: 10.333 KW is transmitted as 10333; 800.5 V is transmitted as 8005. Negative numbers are transmitted as complement, 0xFFFF signifying -1.

Unavailable register cannot be viewed or set. The return of unsigned number is F, e.g. “0xFFFF” is the return for U16, “0xFFFFFFFF” is the return for U32; the return of signed number is the max. positive number, e.g. “0x7FFF” for S16, “0x7FFFFFFF” for S32; 0x00 for UTF-8. UTF-8 occupies 1 byte. The length of odd number is complemented by 0x00.

Example:

SG80KTL only one MPPT input, DC Voltage 2(5013)、DC current 2 (5014)、DC Voltage 3(5015)、DC current

3 (5016)、DC Voltage 4(5115)、DC current 4 (5116) , The data for these registers are 0xFFFF.

### 3. Address type

Address of 3x type is read-only register, supporting the cmdcode inquiry of 0x04.

Address of 4x type is holding register, supporting the cmdcode inquiry of 0x03, and cmdcodeswrite-in of 0x10 and 0x06. Cmdcodes 0x10 and 0x06 support the broadcast address.

Support Modbus error code 02 (address error), 04 (setting failure).

Visit all registers by subtracting 1 from the register address. Example: if the address is 5000 –5001, visit it using address 4999 –5000. Entering “01 04 1387 00 02 + CRC” to check the data of address 5000 –5001.

### 4. Verify type

CRC16 generates polynomial 0xA001, little-endian.

#### 3.1 Running information variable address definition (read-only register, Address type: 3X)

No.	Name	Address	Data type	Data range	Unit	Note
Device attributes						
	Protocol No.	4950 – 4951	U32			
	Protocol ver.	4952 – 4953	U32			
	ARM software version	4954~4968	U16*15			Valid for inverters: SG10KTL-M SG12KTL-M SG80KTL-M SG80HV SG125HV SG15KTL-M SG20KTL-M SG5KTL-MT SG6KTL-MT SG8KTL-M SG17KTL-M SG50KTL-M-V2 SG80BF SG111HV
	DSP software version	4969~4983	U16*15			
	Reserved	4984 – 4989	U16*6			
	SN	4990 – 4999	U16*10			Data type :UTF-8
	Device type code	5000	U16			SG60KTL 0x010F SG60KU 0x0136 SG30KTL-M 0x0141 SG33KTL-M 0x0134 SG36KTL-M 0x74 SG40KTL-M 0x0135 SG50KTL-M 0x011B SG60KTL-M 0x0131 SG60KU-M 0x0132 SG49K5J 0x0137 SG10KTL-M 0x013E

						SG12KTL-M 0x013C SG80KTL 0x0138 SG80KTL-M 0x0139 SG80HV 0x013A SG125HV 0x013B SG33K3J 0x013D SG50KTL 0x0116 SG15KTL-M 0x0142 SG20KTL-M 0x0143 SG5KTL-MT 0x0147 SG6KTL-MT 0x0148 SG8KTL-M 0x013F SG17KTL-M 0x0149 SG50KTL-M-V2 0x0144 SG80BF 0x014A SG111HV 0x014C SG33KTL-M-V2 0x0145 SG36KTL-M-V2 0x0146 SG33KTL-M-20 0x014D SG36KTL-M-20 0x014E
	Nominal output power	5001	U16		0.1kW	
	Output type	5002	U16	0-two phase; 1-3P4L; 2-3P3L		
	Daily power yields	5003	U16		0.1 kWh	
	Total power yields	5004~5005	U32		kWh	
	Total running time	5006~5007	U32		h	
	Internal temperature	5008	S16		0.1℃	
	Total apparent power	5009~5010	U32		VA	Valid for inverters: SG80KTL-M SG5KTL-MT SG6KTL-MT SG8KTL-M SG10KTL-M SG12KTL-M SG80KTL-M

						SG80HV SG125HV SG15KTL-M SG20KTL-M SG17KTL-M SG80BF SG50KTL-M-V2 SG111HV SG33KTL-M-V2 SG36KTL-M-V2 SG33KTL-M-20 SG36KTL-M-20
	DC Voltage1	5011	U16		0.1V	
	DC current1	5012	U16		0.1A	
	DC Voltage 2	5013	U16		0.1V	Valid for inverters:
	DC current 2	5014	U16		0.1A	SG30KTL-M 0x0141 SG33KTL-M 0x0134 SG40KTL-M 0x0135 SG50KTL-M 0x011B SG60KTL-M 0x0131 SG60KU-M 0x0132 SG49K5J 0x0137 SG80KTL-M 0x0139 SG36KTL-M 0x74 SG33K3J 0x013D SG50KTL 0x0116 SG80HV 0x013A SG10KTL-M 0x013E SG12KTL-M 0x013C SG15KTL-M 0x0142 SG20KTL-M 0x0143 SG80BF 0x014A SG5KTL-MT 0x0147 SG6KTL-MT 0x0148 SG8KTL-M 0x013F SG17KTL-M 0x0149 SG50KTL-M-V2 0x0144 SG33KTL-M-V2 0x0145 SG36KTL-M-V2 0x0146 SG33KTL-M-20 0x014D SG36KTL-M-20 0x014E
	DC Voltage 3	5015	U16		0.1V	Valid for inverters:
	DC current 3	5016	U16		0.1A	SG30KTL-M 0x0141 SG33KTL-M 0x0134 SG40KTL-M 0x0135 SG50KTL-M 0x011B

						SG60KTL-M 0x0131 SG60KU-M 0x0132 SG49K5J 0x0137 SG80KTL-M 0x0139 SG36KTL-M 0x74 SG33K3J 0x013D SG50KTL 0x0116 SG80HV 0x013A SG80BF 0x014A
	Total DC power	5017~5018	U32		W	
	A-B line voltage/phase A voltage	5019	U16		0.1 V	Output type (address: 5002) is 1: upload phase voltage; 2: upload line voltage
	B-C line Voltage/phase B Voltage	5020	U16		0.1 V	Output type (address: 5002) is 1: upload phase voltage; 2: upload line voltage
	C-A line Voltage/phase C Voltage	5021	U16		0.1 V	Output type (address: 5002) is 1: upload phase voltage; 2: upload line voltage
	Phase A current	5022	U16		0.1 A	
	Phase B current	5023	U16		0.1 A	
	Phase C current	5024	U16		0.1 A	
	Reserved	5025~5026	U32		W	
	Reserved	5027~5028	U32		W	
	Reserved	5029~5030	U32		W	
	Total active power	5031~5032	U32		W	
	Reactive power	5033~5034	S32		var	
	Power factor	5035	S16		0.001	>0 means leading <0 means lagging
	Grid frequency	5036	U16		0.1 Hz	
	Reserved	5037	U16			
	Work state	5038	U16	See Appendix 1		Data of address 5039 – 5045 are additional
	Fault/Alarm time: Year	5039	U16			Fault/Alarm time and Fault/Alarm code (5039 – 5045) are valid only when the device work state is fault (0x5500) or alarm (0x9100).
	Fault/Alarm time: Month	5040	U16			
	Fault/Alarm	5041	U16			

	time: Day					
	Fault/Alarm time: Hour	5042	U16			
	Fault/Alarm time: Minute	5043	U16			
	Fault/Alarm time: Second	5044	U16			
	Fault/Alarm code 1	5045	U16	See Appendix 3		
	Reserved	5046 – 5048	U16			
	Nominal reactive output power	5049	U16		0.1kvar	
	Reserved	5050~5070	U32			
	Impedance to the ground in parallel connection	5071	U16	1 – 20000(0xFFFF F: invalid)	1kΩ	
	Reserved	5072	U16			
	Reserved	5073 – 5080				
	Work state	5081 – 5082	U32			See Appendix 2
	Reserved	5083 – 5112				
	Daily running time	5113	U16		1min	
	Present country	5114	U16			See Appendix 4
	DC Voltage 4	5115	U16		0.1V	Valid for inverters: SG49K5J 0x0137
	DC current 4	5116	U16		0.1A	SG50KTL-M 0x011B SG60KTL-M 0x0131 SG60KU-M 0x0132 SG80KTL-M 0x0139 SG80HV 0x013A SG80BF 0x014A
	DC Voltage 5	5117	U16		0.1V	Valid for inverters:
	DC current 5	5118	U16		0.1A	SG80HV 0x013A SG80BF 0x014A
	Reserved	5119 – 5127	U16			
	Monthly power yields	5128 – 5129	U32		0.1kWh	
	Reserved	5130 – 5145	U16			
	Negative voltage to the ground	5146	S16	-10000 -10000	0.1V	
	Bus voltage	5147	U16	0 – 15000	0.1V	



	Grid frequency	5148	U16		0.01Hz	Valid for inverters: SG5KTL-MT SG6KTL-MT SG8KTL-M SG10KTL-M SG12KTL-M SG80KTL-M SG80HV SG125HV SG15KTL-M SG20KTL-M SG17KTL-M SG80BF SG50KTL-M-V2 SG111HV SG33KTL-M-V2 SG36KTL-M-V2 SG33KTL-M-20 SG36KTL-M-20
	Reserved	5149	U16	0~15000	0.1V	
	Reserved	5150–7012				
<b>Combiner board information</b>						
	Current of 1 <sup>st</sup> input	7013	U16		0.01A	<p>Before checking the current information of one input, please make sure the hardware supports this function. If parameter can be viewed in the LCD panel or APP software(default menu-running information), the corresponding address is readable.</p> <p>1. SG30KTL-M SG36KTL-M SG33KTL-M SG60KU SG33KTL-M-V2 SG36KTL-M-V2 SG33KTL-M-20 SG36KTL-M-20 8 input (7013 - 7020)</p> <p>2. SG40KTL-M SG33K3J SG50KTL</p>
	Current of 2 <sup>nd</sup> input	7014	U16		0.01A	
	Current of 3 <sup>rd</sup> input	7015	U16		0.01A	
	Current of 4 <sup>th</sup> input	7016	U16		0.01A	
	Current of 5 <sup>th</sup> input	7017	U16		0.01A	
	Current of 6 <sup>th</sup> input	7018	U16		0.01A	
	Current of 7 <sup>th</sup> input	7019	U16		0.01A	
	Current of 8 <sup>th</sup> input	7020	U16		0.01A	
	Current of 9 <sup>th</sup> input	7021	U16		0.01A	

	input					9 input (7013~7021)
	Current of 10 <sup>th</sup> input	7022	U16		0.01A	3. SG80HV SG80BF SG50KTL-M-V2
	Current of 11 <sup>th</sup> input	7023	U16		0.01A	10 input (7013 - 7022)
	Current of 12 <sup>th</sup> input	7024	U16		0.01A	4. SG50KTL-M, SG60KTL-M, SG49K5J,
	Current of 13 <sup>th</sup> input	7025	U16		0.01A	12 input (7013~7024)
	Current of 14 <sup>th</sup> input	7026	U16		0.01A	5. SG60KTL (include 12-input version and 14-input version)
	Current of 15 <sup>th</sup> input	7027	U16		0.01A	12 input (7013~7024) 14 input (7013~7026)
	Current of 16 <sup>th</sup> input	7028	U16		0.01A	
	Current of 17 <sup>th</sup> input	7029	U16		0.01A	6. SG60KU-M SG80KTL-M
	Current of 18 <sup>th</sup> input	7030	U16		0.01A	16 input (7013 - 7028)
						7. SG80KTL 18 input (7013 - 7030)
						8. SG15KTL-M SG17KTL-M SG20KTL-M 4 input (7013 - 7016)

a) Parameter setting address definition (holding register, Address type: 4X)

No.	Name	Address	Data type	Data range	Unit	Note
<b>Setting data</b>						
	System clock: Year	5000	U16			Receive time synchronization setting of the monitoring system or GPS
	System clock: Month	5001	U16			
	System clock: Day	5002	U16			
	System clock: Hour	5003	U16			
	System clock: Minute	5004	U16			

	System clock: Second	5005	U16			
	Start/Stop	5006	U16	0xCF (Start) 0xCE (Stop) 0xBB(Emergency stop)		
	Power limitation switch	5007	U16	0xAA: Enable;0x55: Disable		
	Power limitation setting	5008	U16	SG50KTL-M SG60KTL-M SG60KU-M SG33KTL-M SG40KTL-M SG60KTL SG60KU SG80KTL-M SG50KTL SG80HV SG15KTL-M SG20KTL-M SG10KTL-M SG12KTL-M SG5KTLMT SG6KTL-MT SG8KTL-M SG17KTL-M SG50KTL-M-V2 SG33KTL-M-V2 SG33KTL-M-20 0 – 1100  SG80BF 0 - 1300  SG49K5J SG33K3J SG30KTL-M SG36KTL-M SG80KTL SG125HV SG111HV SG36KTL-M-V2 SG36KTL-M-20 0 -1000	0.1%	Available when the power limitation switch (5007) is enabled

		5009 – 5018	U16			
	Power factor setting	5019		-1000 - -800 800 – 1000	0.001	Available when the reactive power adjustment switch (5036) is set to power factor setting valid (0xA1) > 0 means leading < 0 means lagging
	Reserved	5020 – 5033	U16			
	State setting	5034	U16	0–Invalid: 1–Valid: BIT0—Remote control (default value: 1); BIT 1—Local control (default value: 1);		Valid for inverters: SG80HV
	Reserved	5035	U16			
	Reactive power adjustment switch	5036	U16	0x55: OFF, power factor returns to 1, reactive power percentage returns to 0; 0xA1: power factor setting valid, Reactive power percentage returns to 0; 0xA2: Reactive power percentage setting valid, power factor returns to 1; 0xA3: Enable Q(P) curve configuration; 0xA4: Enable Q(U) curve configuration		
	Reactive power percentage setting	5037	S16	0 – 1000 0 - -1000	0.1%	Available when the reactive power adjustment switch (5036) is set to Reactive power percentage setting valid (0xA2)

	Reserved	5038				
	Power limitation adjustment	5039	U16	Parameter range for different devices: SG5KTL-MT 0 – 55 SG6KTL-MT 0 – 66 SG8KTL-M 0 - 88 SG10KTL-M 0 - 110 SG12KTL-M 0 – 132 SG15KTL-M 0 – 165 SG17KTL-M 0 – 187 SG20KTL-M 0 – 220 SG30KTL-M 0 ~ 300 SG33KTL-M SG33KTL-M-V2 SG33KTL-M-20 0 ~ 363 SG33K3J 0 - 333 SG36KTL-M SG36KTL-M-V2 SG36KTL-M-20 0 - 360 SG40KTL-M 0 ~ 440 SG49K5J 0 ~ 495 SG50KTL 0 – 530 SG50KTL-M 0 ~ 550 SG50KTL-M-V2 0 ~ 550 SG60KTL-M	0.1k W	Available when the power limitation switch (5007) is enabled

				0 ~ 660 SG60KU-M 0 ~ 660 SG60KTL 0 ~ 660 SG60KU 0 ~ 660 SG80KTL-M 0 - 880 SG80HV 0 - 880 SG80BF 0 - 1040 SG80KTL 0 - 800 SG111HV 0 - 1110 SG125HV 0 - 1250		
	Reactive power adjustment	5040	S16	Parameter range for different devices: SG5KTL-MT -25~25 SG6KTL-MT -30~30 SG8KTL-M -40 - 40 SG10KTL-M -50 ~ 50 SG12KTL-M -60 ~ 60 SG15KTL-M -75 ~ 75 SG17KTL-M -85 ~ 85 SG20KTL-M -100 ~ 100 SG30KTL-M -150 ~ 150 SG33KTL-M SG33KTL-M-V2 SG33KTL-M-20 -165 ~ 165 SG33K3J -166 - 166	0.1K var	Available when the reactive power adjustment switch (5036) is set to Reactive power percentage setting valid (0xA2)

				SG36KTL-M SG36KTL-M-V2 SG36KTL-M-20 -180 ~ 180 SG40KTL-M -200 ~ 200 SG49K5J -247 ~ 247 SG50KTL-M -250 ~ 250 SG50KTL-M-V2 -250 ~ 250 SG50KTL -240 ~ 240 SG60KTL-M -300 ~ 300 SG60KU-M -300 ~ 300 SG60KTL -300 ~ 300 SG60KU -300 ~ 300 SG80KTL -400 ~ 400 SG80KTL-M -400 ~ 400 SG80HV -400 ~ 400 SG80BF -400 ~ 400 SG111HV -555 ~ 555 SG125HV -620 ~ 620		
	Reserved	5041 – 5050	U16			
18-29 are available when the reactive power adjustment switch (5036) is set to Enable Q(P) curve (0xA3)						
Not Italy						
	Lower Power	5051	U16	0 – 500; default: 500	0.1%	Lower Power < Upper Power
	Upper Power	5052	U16	500 – 1000; default: 1000	0.1%	
	Upper limit-PF (Cap)	5053	U16	900 – 1000; default: 1000	0.001	
	Lower	5054	U16	900 – 1000;	0.001	

	limit-PF (Ind)			default: 900		
	Reserved	5055 – 5064	U16*10			
Addresses 5065 – 5080 are for Italy						
	powerA (Italy)	5065	U16	200 – 1000; default: 200	0.1%	powerA<=powerB<powerC
	powerB (Italy)	5066	U16	200 – 1000; default: 500	0.1%	
	powerC (Italy)	5067	U16	200 – 1000; default: 1000	0.1%	
	pf_max (Italy)	5068	U16	900 – 1000; default: 900	0.001	
	Uin (Italy)	5069	U16	1000 – 1100; default: 1050	0.1%	Uin>Uout
	Uout (Italy)	5070	U16	900 – 1000; default: 1000	0.1%	
	Reserved	5071 – 5080	U16*10			
30-46 are available when the reactive power adjustment switch (5036) is set to Enable Q(U) curve configuration(0xA4)						
Not Italy						
	Lower U Limit	5081	U16	800 – 1000; default: 800	0.1%	
	Upper U Limit	5082	U16	1000 – 1200; default: 1150	0.1%	
	U1 Limit	5083	U16	900 – 1100; default: 800	0.1%	U1 Limit+Hysteresis < U2 Limit-Hysteresis
	U2 Limit	5084	U16	1000 – 1100; default: 1050	0.1%	
	Hysteresis	5085	U16	0 – 50; default:0	0.1%	
	Lower Q/Sn	5086	U16	(Ind) 0 – 500; default: 250	0.1%	
	Upper Q/Sn	5087	U16	(Cap) 0 – 500; default: 250	0.1%	
	Reserved	5088 – 5097	U16*10			



Addresses 5098 – 5115 are for Italy						
V1i (Italy)	5098	U16	900– 1100; default: 920	0.1%		
V2i (Italy)	5099	U16	900– 1100; default: 900	0.1%	V2i < V1i < V1s < V2s	
V1s (Italy)	5100	U16	900– 1100; default: 1080	0.1%		
V2s (Italy)	5101	U16	900– 1100; default: 1100	0.1%		
Qmax (Italy)	5102	U16	500 – 1000; default: 900	0.001		
Pin (Italy)	5103	U16	200 – 1000; default: 200	0.1%	Pin > Pout	
Pout (Italy)	5104	U16	10 – 200; default: 90	0.1%		
Curve selection (Italy)	5105	U16	Curve selection: 0 or 1		0: Curve A 1: Curve B	
Reserved	5106–5115					

## Appendix

### Appendix 1 Device Work State 1

Device state (register 5038)	
State	Value read by register 5038
Run	0x0
Stop	0x8000
Key stop	0x1300
Emergency Stop	0x1500
Standby	0x1400
Initial standby	0x1200
Starting	0x1600
Alarm run	0x9100
Derating run	0x8100
Dispatch run	0x8200
Fault	0x5500
Communicate fault	0x2500

### Appendix 2 Device Work State2

Work State (5081 – 5082)		Note
State	Corresponding BIT in address 5081-5082	
Run	0	Total run state bit BIT17
Stop	1	1
Key stop	3	3
Emergency Stop	5	5
Standby	4	4
Initial standby	2	2
Starting	6	6
Alarm run	10	Total run state bit BIT17
Derating run	11	Total run state bit BIT17
Dispatch run	12	Total run state bit BIT17
Fault	9	Total fault state bit BIT18
Communicate fault	13	Total fault state bit BIT18
Total run bit (device is grid-connected running)	17	
Total fault bit (device is in fault stop state)	18	

LCD or APP display (decimal)	Communication send data (hexadecimal)	Description	Note
002	0x0002	Grid overvoltage	<p>Fault is occurred because the grid voltage exceeds the permissible range. Inverter can operate normally when the grid recovers.</p> <ol style="list-style-type: none"> <li>1. Check the grid voltage; If the grid voltage exceeds the permissible range, ask utility grid company for solution.</li> <li>2. Check if the protection parameter setting of the LCD or APP meets requirements.</li> <li>3. If the fault still exists, please contact Sungrow.</li> </ol>
003	0x0003	Grid overvoltage	<p>This is a short-term fault because the grid transient voltage exceeds the permissible range. Inverter can operate normally when the grid recovers. Please refer to troubleshooting of fault 002 if this fault repeats.</p>
004	0x0004	Grid undervoltage	<p>Fault is occurred because the grid voltage is lower than the permissible range. Inverter can operate normally when the grid recovers.</p> <ol style="list-style-type: none"> <li>1. Check the grid voltage; If the grid voltage is lower than the permissible range, ask utility grid company for solution.</li> <li>2. Check if the protection parameter setting of the LCD or APP meets requirements.</li> <li>3. If the grid voltage is normal, check if the AC cables are secure.</li> <li>4. If the fault still exists, please contact Sungrow.</li> </ol>
005	0x0005	Grid undervoltage	<p>This fault occurs because the grid voltage is lower than the set undervoltage protection value II. Inverter can operate normally when the grid recovers. Please refer to troubleshooting of fault 004 if this fault repeats.</p>
006	0x0006	Hardware fault	Please contact Sungrow.
007	0x0007	Transient AC overcurrent	The inverter will self-recover after several seconds.
008	0x0008	Grid over-frequency	<p>Check the grid frequency.</p> <p>If the grid voltage exceeds the inverter permissible range, ask utility grid company for solution.</p>
009	0x0009	Grid under-frequency	<p>Check the grid frequency.</p> <p>If the grid voltage exceeds the inverter</p>

			permissible range, ask utility grid company for solution.
010	0x000A	Islanding	Inverter can operate normally when the grid recovers. If this fault occurs repeatedly: 1. Check if the grid power supply is normal; 2. Check if AC cables are all firmly connected. 3. Check if AC cables are connected to the correct terminals (no reverse connection). 4. If the fault still exists, please contact Sungrow.
011	0x000B	The DC current exceeds limit	Wait for inverter recovery. If the fault still occurs, contact Sungrow.
012	0x000C	Leakage current exceeds limit	1. Check if the PV cells are in poor environment conditions, i.e. bad rainy or damp weather. 2. Check the PV strings for poor contact. 3. If the fault occurs repeatedly, contact Sungrow
013	0x000D	Grid abnormal	Wait for inverter recovery. If the grid voltage exceeds the inverter permissible range, ask utility grid company for solution.
014	0x000E	Grid overvoltage	① Wait for inverter recovery. ② Check the grid voltage. ③ If the fault still exists, please contact Sungrow.
015	0x000F	Grid overvoltage	Fault is occurred because the grid voltage exceeds the permissible range. Inverter can operate normally when the grid recovers. 1. Check the grid voltage; If the grid voltage exceeds the permissible range, ask utility grid company for solution. 2. Check if the protection parameter setting of the LCD or APP meets requirements. 3. If the fault still exists, please contact Sungrow.
016	0x0010	Pv power module overload	Contact SUNGROW.
017	0x0011	Grid voltage unbalance	Wait for inverter recovery. 1. If the grid voltage unbalance exceeds the inverter permissible range, ask utility grid company for solution. 2. Change the unbalanced degree from the LCD or APP. 3. If the fault still exists, please contact Sungrow.
019	0x0013	Bus voltage is high	Wait for inverter recovery. 1. Check the LCD or APP display to make sure

			<p>if the PV voltage is normal. If the PV voltage exceeds the max. voltage, the PV cells configuration is too high. Please optimize the PV cell configuration.</p> <p>2. If the fault still exists, please contact Sungrow.</p>
020	0x0014	Bus voltage is high	Ditto
021	0x0015	Overcurrentprotection	Contact SUNGROW.
022	0x0016	Overcurrent protection	Contact SUNGROW.
023	0x0017	PV input setting changes during inverter operation	Check the PV input settings; Restart the inverter.
024	0x0018	Bus voltage unbalance	Wait for inverter recovery. If the fault still exists, please contact Sungrow.
025	0x0019	Bus voltage unbalance	Ditto
026	0x001A	Bus voltage unbalance	Bus voltage fluctuation. Please contact SUNGROW
030	0x001E	Clamp capacitance over-voltage	Wait for inverter to return normal; If the fault occurs repeatedly, please contact SUNGROW
031	0x001F	Clamp capacitance under-voltage	Wait for inverter to return normal; If the fault occurs repeatedly, please contact SUNGROW.
032	0x0020	Clamp capacitance imbalance	Wait for inverter to return normal; If the fault occurs repeatedly, please contact SUNGROW.
033	0x0021	Clamp capacitance precharge fault	Wait for inverter to return normal; If the fault occurs repeatedly, please contact SUNGROW.
036	0x0024	Power power module over-temperature	<p>Wait for inverter recovery.If this fault reoccurs,</p> <ol style="list-style-type: none"> <li>1. Check the LCD or APP to make sure if the ambient temperature is too high;</li> <li>2. Check if the device is placed in well-ventilated place;</li> <li>3. Check if the device is in direct sunlight. If so, please shield it.</li> <li>4. Check if the fans are normal. Replace the fan if otherwise.</li> <li>5. If the fault still exists, please contact Sungrow.</li> </ol>
037	0x0025	Ambient over-temperature	Ditto
038	0x0026	Relay fault	Contact Sungrow.
039	0x0027	System low insulation	Wait for inverter recovery.If this fault occurs

		resistance	repeatedly and device cannot operate normally, 1. Check if the ISO protection value is set too high from the LCD or APP. 2. Check if the low insulation situation occurs in rainy days or damp weather. Measure if the positive and PV cell negative polarities to the ground is too low. 3. If the fault still exists, please contact Sungrow.
040	0x0028	Overcurrent protection	Wait for inverter recovery.If the fault occurs repeatedly, please contact Sungrow.
041	0x0029	Hardware fault	Wait for inverter recovery.If the fault occurs repeatedly, please contact Sungrow.
042	0x002A	Hardware fault	Wait for inverter recovery.If the fault occurs repeatedly, please contact Sungrow.
043	0x002B	Temperature low	Stop and disconnect the inverter. Restart the inverter when temperature increases to the allowable range. If the fault still exists, please contact Sungrow.
044	0x002C	Ac & DC inversion circuit fault	Wait for inverter recovery.If the fault occurs repeatedly, please contact Sungrow.
047	0x002F	PV input setting does not match the actual connection	Stop and disconnect the inverter. Reset the PV array input.
048	0x0030	Hardware fault	Wait for inverter recovery.If the fault occurs repeatedly, please contact Sungrow.
049	0x0031	Hardware fault	Ditto
050	0x0032	Hardware fault	Ditto
053	0x0035	Grid voltage redundancy detection fault	Check the grid voltage; If the grid voltage exceeds the permissible range, ask the local utility grid company for solution. If the grid voltage is within the permissible range, please contact Sungrow.
054	0x0036	Grid frequency redundancy detection fault	Check the grid frequency; If the grid frequency exceeds the permissible range, ask the local utility grid company for solution. If the grid frequency is within the permissible range, please contact Sungrow.
055	0x0037	Inverter insulation resistance redundancy detection fault	Wait for inverter recovery. If the fault still exists, please contact Sungrow.
056	0x0038	Inverter leakage current redundancy	Check if there is ground fault to the PV string; If the fault occurs repeatedly, please contact

		detection fault	Sungrow.
059	0x003B	Main DSP and redundant DSP communication fault	Wait for inverter recovery. If the fault still exists, please contact Sungrow.
060	0x003C	Main DSP and redundant DSP data comparison abnormal fault	Wait for inverter recovery. If the fault still exists, please contact Sungrow.
070	0x0046	Fan fault	Check the inverter fans. Stop and disconnect the inverter to remove foreign objects. Replace the fan if it is broken.
071	0x0047	AC SPD alarm	Check if the SPD is loose or broken. Replace the SPD if necessary.
072	0x0048	DC SPD alarm	Ditto
074	0x004A	Communication fault	Check the communication cable between the ARM and the DSP
075	0x004B	Insufficient sunlight	Wait for sufficient sunlight; If this fault occurs repeatedly in sufficient sunlight, check and change the PV input setting.
076	0x004C	PV overload	Wait for inverter recovery. 4. Check if the PV cell setting are reasonable; 2If the fault occurs repeatedly, please contact Sungrow.
078	0x004E	PV1 abnormal alarm	Caused because the PV1 is not connected. Ignore this alarm if PV1 is not connected at beginning. If PV1 is connected, 1. Check if the PV1 cables are loose. 2. Check if the PV1 DC fuse is broken. 3. If the fault occurs repeatedly, please contact Sungrow.
079	0x004F	PV2 abnormal alarm	Caused because the PV2 is not connected. Ignore this alarm if PV2 is not connected at beginning. If PV2 is connected, 1. Check if the PV2 cables are loose. 2. Check if the PV2 DC fuse is broken. 3. If the fault occurs repeatedly, please contact Sungrow.
080	0x0050	PV3 abnormal alarm	Caused because the PV3 is not connected. Ignore this alarm if PV3 is not connected at beginning. If PV3 is connected, 1. Check if the PV3 cables are loose. 2. Check if the PV3 DC fuse is broken. 3. If the fault occurs repeatedly, please contact Sungrow.
081	0x0051	PV4 abnormal alarm	Caused because the PV4 is not connected. Ignore this alarm if PV4 is not connected at

			beginning. If PV4 is connected, 1. Check if the PV4 cables are loose. 2. Check if the PV4 DC fuse is broken. 3. If the fault occurs repeatedly, please contact Sungrow.
087	0x0057	AFDpower module abnormal alarm	Contact SUNGROW.
088	0x0058	Arc fault	1. Check the PV cell cable connection and fuse for arc. 2. If the fault occurs repeatedly, please contact Sungrow.
089	0x0059	AFD stop alarm	Restart the AFD function through the LCD or APPoperation.
116	0x0074	Circuit abnormal	Wait for inverter recovery. If the fault still exists, please contact Sungrow.
532	0x0214	String 1 reverse connection alarm	1. Check the completeness of the string settings. 2. Check the polarity of the PV input side. Reconnect the input if the polarities are reversed.
533	0x0215	String 2 reverse connection alarm	Ditto
534	0x0216	String 3 reverse connection alarm	Ditto
535	0x0217	String 4 reverse connection alarm	Ditto
536	0x0218	String 5 reverse connection alarm	Ditto
537	0x0219	String 6 reverse connection alarm	Ditto
538	0x021A	String 7 reverse connection alarm	Ditto
539	0x021B	String 8 reverse connection alarm	Ditto
540	0x021C	String 9 reverse connection alarm	Ditto
541	0x021D	String 10 reverse connection alarm	Ditto
542	0x021E	String 11 reverse connection alarm	Ditto
543	0x021F	String 12 reverse connection alarm	Ditto
544	0x0220	String 13 reverse connection alarm	Ditto
545	0x0221	String 14 reverse connection alarm	Ditto



546	0x0222	String 15 reverse connection alarm	Ditto
547	0x0223	String 16 reverse connection alarm	Ditto
564	0x0234	String 17 reverse connection alarm	Ditto
565	0x0235	String 18 reverse connection alarm	Ditto
548	0x0224	String 1 power module abnormal alarm	<p>Caused by short-circuit, open circuit or low current of one input. Check if the voltage or current is abnormal through the LCD or APP.</p> <ol style="list-style-type: none"> <li>1. Check if the strings are broken.</li> <li>2. Check if the PV cell cables are loose.</li> <li>3. Check if the DC fuse is broken.</li> <li>4. If the fault still exists, please contact Sungrow.</li> </ol>
549	0x0225	String 2 power module abnormal alarm	Ditto
550	0x0226	String 3 power module abnormal alarm	Ditto
551	0x0227	String 4 power module abnormal alarm	Ditto
552	0x0228	String 5 power module abnormal alarm	Ditto
553	0x0229	String 6 power module abnormal alarm	Ditto
554	0x022A	String 7 power module abnormal alarm	Ditto
555	0x022B	String 8 power module abnormal alarm	Ditto
556	0x022C	String 9 power module abnormal alarm	Ditto
557	0x022D	String 10 power module abnormal alarm	Ditto
558	0x022E	String 11 power module abnormal alarm	Ditto
559	0x022F	String 12 power module abnormal alarm	Ditto
560	0x0230	String 13 power module abnormal alarm	Ditto
561	0x0231	String 14 power module abnormal alarm	Ditto

562	0x0232	String module alarm	15power abnormal	Ditto
563	0x0233	String module alarm	16power abnormal	Ditto
580	0x0244	String module alarm	17power abnormal	Ditto
581	0x0245	String module alarm	18power abnormal	Ditto

## Appendix 4 Country Information

Code	Country	Country (English)	Note
0	GB	Great Britain	
1	DE	Germany	
2	FR	France	
3	IT	Italy	
4	ES	Spain	
5	AT	Austria	
6	AU	Australia	
7	CZ	Czech	
8	BE	Belgium	
9	DK	Denmark	
10	GR_L	Greece Land	
11	GR_IS	Greece Island	
12	NL	Netherlands	
13	PT	Portugal	
14	CHN	China	
15	SE	Sweden	
16	Other 50Hz		
17	RO	Romania	
18	TH	Thailand	
19	TK	Turkey	
20	AU-WEST	Australia(west)	
21	Reserved		
25	Vorarlberg (Austria)	Vorarlberg	District
26	IND	India	
27	ARE	Arab Emirates	
28	ISR	Israel	
29	HUN	Hungary	
30~58	Reserved		

59	US-HWE	America(Hawaii)	
60	CA	Canada	
61	US	America	
62	Other 60Hz		
63	KOR	Korea	
64	ZAF	South Africa	
65	CHL	Chile	
66	BRA	Brazil	
67	TPE	Chinese Taipei	
69	JP	Japan	
98	US-SA	America(1741-SA)	

## 8. Examples

Take ComTest for example.

a) Acquire one piece of running information

Supposed that the inverter address is 1, it needs to acquire data from address 5000 of 3x address type.

The PC sends (HEX):

01 04 13 87 00 01 85 67

The inverter replies (HEX):

01 04 02 01 32 39 75

Note: The type code of inverter SG60KU-M is 0x0132.

b) Acquire multiple running information

Supposed that the inverter address is 1, it needs to acquire 10 data from address starting from 5000 of 3x address type

The PC sends (HEX):

01 04 13 87 00 0A C4 A0

The inverter replies (HEX):

01 04 14 01 32 00 28 00 00 00 00 00 05 00 00 00 26 00 00 00 00 00 00 56 EA

Note: The type code of inverter SG60KU-M is 0x0132. The nominal output power is 4.0kW, two-phase. Daily power generation is 0. The total power generation is 5kWh. The total running time is 38h. The internal temperature is 0°C. The internal transformer temperature is 0°C.

c) Acquire SN

Supposed that the inverter address is 1, it needs to acquire 10 data from address starting from 4990 of 3x address type

The PC sends (HEX):

01 04 13 7D 00 0A E4 91

The inverter replies (HEX):

01 04 14 31 32 31 32 31 32 30 30 31 00 00 00 00 00 00 00 00 00 00 00 00 9B 56

Note:

1. SN data type is UTF-8;
2. Serial number is: 121212001

d) Read one setting datum

Supposed that the inverter address is 1, it needs to read data from address 5000 of 4x address type.

The PC sends (HEX):

01 03 13 87 00 01 30 A7

# SUNGROW

The inverter replies (HEX):

01 03 02 07 D8 BA 2E

Note: the data read out is year 2008.

e) Read multiple setting data

Supposed that the inverter address is 1, it needs to read 10 data from address starting from 5000 of 4x address type.

The PC sends (HEX):

01 03 13 87 00 0A 71 60

The inverter replies (HEX):

01 03 14 07 DA 00 0A 00 1E 00 09 00 28 00 25 00 CE 00 AA 01 F4 00 00 80 53

Note: The data are October, 10, 2010, 09:40:37; Stop; power limitation on, power limitation value is 50 %.

f) Set one datum

Supposed that the inverter address is 1, it needs to set data from address 5000 of 4x address type.

The PC sends (HEX):

01 10 13 87 00 01 02 07 DA 19 4D

The inverter replies (HEX):

01 10 13 87 00 01 B5 64

Or

The PC sends (HEX):

01 06 13 87 07 DA BE CC

The inverter replies (HEX):

01 06 13 87 07 DA BE CC

Note: The setting data is year 2010

g) Set multiple data

Supposed that the inverter address is 1, it needs to set 10 data to address starting from 5000 of 4x address type.

The PC sends (HEX):

01 10 13 87 00 0A 14 07 D9 00 0A 00 1E 00 09 00 10 00 00 00 CE 00 AA 01 F4 00 00 3E 65

The inverter replies (HEX):

01 10 13 87 00 0A F4 A3

Note: The data are October, 30, 2009, 09:16:00, stop, power limitation on, power limitation value is 50 %.

h) Read device running information

Supposed that the inverter address is 1, it needs to set 8 data to address starting from 5038 of 3x address type.

The PC sends (HEX):

01 04 13 AD 00 0864 A9

The inverter replies (HEX):

01 04 10 55 00 07 DF 00 0C 00 15 00 04 00 0C 00 3B 00 0A EE D1

Note:

1) Device running state is Fault(0x5500); the fault/alarm time and code are valid in this state;

2) Fault time: 4 (0x0004):12(0x000C): 59(0x003B), Dec. (0x000C), 21(0x0015), 2015(0x07DF); the fault is island (0x000A).