Inverter

Modbus RS485 Communications Protocol V2.2

1. Introduction to the Modbus Protocol

1.1. Overview

This document formulates the communication standard between 1K-60K power system and the PC. This standard is a subset of the Modbus protocol. The Modbus protocol is not described in this document. For details, see the Modbus RTU protocol available at www.modicon.com.

1.2. Communications Port

The RS485 serial port is used.

Information is transmitted in asynchronous mode, which involves 1 start bit, 8 data bits, 1 stop bit, and no parity bit.

Multiple baud rates are supported for data transmission, 2400 bps, 4800 bps and 9600 bps, with 9600 bps as the default rate.

Data is transmitted in big-endian mode. For example, if 0x1234 is to be transmitted, 0x12 is transmitted first and then 0x34.

1.3. Communications Mode

The PC (host) communicates with the inverter (client) in simplex mode. A maximum of 32 clients can be connected to the RS485 bus. The host polls each client. If a client does not respond or if the host receives a response error message, the host considers that the communication fails.

2. Frame

2.1. Frame Format

Endian	0	1	N	N+1	N+2
Byte count	1	1		2	
Content	Client address	Function code	Data domain	Checksum	
Format	ID	FUNC	ADDR	CRC	

2.2. Frame Description

2.3.1 ID

The range of the client address is 0–32. 0 is a broadcast address. The client address is unique on the Modbus.

2.3.2 FUNC

Function codes

Function Code	Description
0x03	Read keep register for querying inverter information.
0x04	Read input register for querying inverter information.
0x06	Single write register for executing remote instructions.

Error codes

Error Code	Description
0x01	Invalid function code
0x02	Invalid data address
0x03	Invalid value
0x06	The instruction is valid because the client is busy.

2.3.3 CRC

The host or client can verify whether received information is correct by using the CRC. Due to electric noise on the bus or other types of interference, errors may occur when information is being transmitted. To address this issue, the recipient can verify whether received information is correct by using the CRC and drop incorrect frames, thus improving the security and reliability of the communication system.

The CRC of Modbus contains two bytes, namely, 16 bits. The sender calculates the CRC and appends it to the information frame. The recipient recalculates the CRC for all received information (including the received CRC) and checks whether the CRC is 0. If so, the received information frame is correct. Otherwise, the received information frame is incorrect.

Only 8 data bits are used for CRC calculation. The start bit and stop bit are excluded from CRC calculation.

- The procedure for calculating the CRC code is as follows:

1. Preset a 16-bit register to FFFF (containing 1 only) in hexadecimal format. This register is called CRC register.
2. Perform an exclusive OR operation for the first 8 bits (the first byte of the information frame) and the lower 8 bits of the 16-bit CRC register. Then store the result in the CRC register.
3. Move the content of the CRC register rightwards by one bit and add a 0 as the most significant bit. Then check the evicted bit.

4. If the evicted bit is 0, repeat step 3 (move the content of the CRC register rightwards by one bit again).

If the evicted bit is 1, perform an exclusive operation for the CRC register and polynomial A001 (1010 0000 0000 0001).

5. Repeat steps 3 and 4 to move the content of the CRC register rightwards for 8 times so that all 8 bits are processed.
6. Repeat steps 2 through 5 to process the next byte of the information frame.
7. After processing all bytes of the information frame, exchange the most significant and least significant bytes of the 16-bit CRC register.
8. The content of the CRC register is the CRC code.

3. Inverter Information Address Table

3.1. Basic Inverter Information (04H Telemetry)

Table 3.1.1

Register Address	Item	Byte	Byte No.	Unit	Data Type	Remark	FUNC
2964	PV12 input voltage	2	0	0.1V	U16	Table 3.1.5	04H
2965	PV12 input current	2	2	0.01A	S16		04H
2966	PV12 input power	4	4	1W	S32		04H
2967							04H
2968	PV11 input voltage	2	8	0.1V	U16		04H
2969	PV11 input current	2	10	0.01A	S16		04H
2970	PV11 input power	4	12	1W	S32		04H
2971							04H
2972	PV10 input voltage	2	16	0.1V	U16		04H
2973	PV10 input current	2	18	0.01A	S16		04H
2974	PV10 input power	4	20	1W	S32		04H
2975							04H
2976	PV9 input voltage	2	24	0.1V	U16		04H
2977	PV9 input current	2	26	0.01A	S16		04H
2978	PV9 input power	4	28	1W	S32		04H
2979							04H
2980	PV8 input voltage	2	32	0.1V	U16		04H
2981	PV8 input current	2	34	0.01A	S16		04H
2982	PV8 input power	4	36	1W	S32		04H
2983							04H
2984	PV7 input voltage	2	40	0.1V	U16		04H
2985	PV7 input current	2	42	0.01A	S16		04H
2986	PV7 input power	4	44	1W	S32		04H
2987							04H
2988	PV6 input voltage	2	48	0.1V	U16		04H
2989	PV6 input current	2	50	0.01A	S16		04H

2990	PV6 input power	4	52	1W	S32		04H
2991							04H
2992	PV5 input voltage	2	56	0.1V	U16		04H
2993	PV5 input current	2	58	0.01A	S16		04H
2994	PV5 input power	4	60	1W	S32		04H
2995							04H
2996	PV4 input voltage	2	64	0.1V	U16		04H
2997	PV4 input current	2	66	0.01A	S16		04H
2998	PV4 input power	4	68	1W	S32		04H
2999							04H
3000	PV1 input voltage	2	72	0.1V	U16		04H
3001	PV2 input voltage	2	74	0.1V	U16	1-3K not have.	04H
3002	PV3 input voltage	2	76	0.1V	U16	1-5K not have.	04H
3003	PV1 input current	2	78	0.01A	U16		04H
3004	PV2 input current	2	80	0.01A	U16	1-3K not have.	04H
3005	PV3 input current	2	82	0.01A	U16	1-5K not have.	04H
3006	PV1 input power	4	84	1W	S32		04H
3007							04H
3008	PV2 input power	4	88	1W	S32	1-3K not have.	04H
3009							04H
3010	PV3 input power	4	92	1W	S32	1-5K not have.	04H
3011							04H
3012	PBUS voltage	2	96	0.1V	U16		04H
3013	NBUS voltage	2	98	0.1V	U16	1-5K not have.	04H
3014	RS-phase grid voltage	2	100	0.1V	U16		04H
3015	ST-phase grid voltage	2	102	0.1V	U16	1-5K not have.	04H
3016	TR-phase grid voltage	2	104	0.1V	U16	1-5K not have.	04H
3017	RS-phase grid frequency	2	106	0.01Hz	U16		04H
3018	ST-phase grid frequency	2	108	0.01Hz	U16	1-5K not have.	04H
3019	TR-phase grid frequency	2	110	0.01Hz	U16	1-5K not have.	04H
3020	R-phase grid-tied current	2	112	0.01A	U16		04H
3021	S-phase grid-tied current	2	114	0.01A	U16	1-5K not have.	04H
3022	T-phase grid-tied current	2	116	0.01A	U16	1-5K not have.	04H
3023	Grid-tied power	4	118	1W	S32		04H
3024							04H
3025	Radiator temperature	2	122	0. 1℃	S16		04H

3026	Module temperature	2	124	0. 1℃	S16	1-5K not have.	04H
3027	DSP alarm code	2	126		U16	Table 3.1.2	04H
3028	DSP error code	4	128		U32	Table 3.1.3	04H
3029							04H
3030	Operating mode of the inverter	1	132		U8	Table 3.1.4	04H
	Inverter model	1	133		U8	Table 3.1.5	04H
3031	Rotational speed of fan A	2	134	r/min	U16		04H
3032	Rotational speed of fan B	2	136	r/min	U16	1-5K not have.	04H
3033	Rotational speed of fan C	2	138	r/min	U16	1-5K not have.	04H
3034	Reserve.	4	142		U32		04H
3035							04H
3036	ARM alarm code	1	144		U8	Table 3.1.6	04H
	ARM error code	1	145		U8	Table 3.1.7	04H
3037	Input mode	1	146		U8	Table 3.1.8	04H
	Mains standard	1	147		U8	Table 3.1.9	04H
3038	Total energy yield	4	148	0.1Kwh	U32		04H
3039							04H
3040	Annual energy yield	4	152	Kwh	U32		04H
3041							04H
3042	Daily energy yield	2	156	Kwh	U16		04H
3043	Power-on voltage	2	158	0.1V	U16	2500-9000	04H
3044	Power-on delay	2	160	S	U16	20-300	04H
3045	Lower grid voltage threshold	2	162	0.1V	U16		04H
3046	Upper grid voltage threshold	2	164	0.1V	U16		04H
3047	Lower grid frequency threshold	2	166	0.01Hz	U16		04H
3048	Upper grid frequency threshold	2	168	0.01 Hz	U16		04H
3049	Preset power factor	2	170		U16	Table 3.4.2	04H
3050	Preset active power	2	172	%	U16	Table 3.4.3	04H
3051	Preset reactive power	1	174	1KVar	S8	Table 3.4.4	04H
	Reactive control mode	1	175		U8	Table 3.4.5	04H
3052	Apparent power	4	176	1VA	S32		04H

3053							
3054	Reactive power	4	180	1Var	S32		04H
3055							
3056	Power factor	2	184		U16	Table 3.4.2	04H
3057	DC insulation resistance	2	186	Kohm	U16	1-5K not have.	04H
3058	Overfrequency derating	2	188			0: enabled 1: disabled	04H
3059	Overfrequency derating threshold	2	190			Table 3.4.7	04H
3060	Derating rate	2	192	0.01Hz		Table 3.4.6	04H
3061	Reserved	2	194				04H
3062	Reserved	2	196				04H
3063	Reserved	2	198				04H
3064	PV1 String current 1	2	200	0.01A	S16	No string current in single phase inverter. （No string current in 0x00H~0x06H and 0x64H~0x6BH）	04H
3065	PV1 String current 2	2	202	0.01A	S16		04H
3066	PV1 String current 3	2	204	0.01A	S16		04H
3067	PV1 String current 4	2	206	0.01A	S16		04H
3068	PV2 String current 1	2	208	0.01A	S16		04H
3069	PV2 String current 2	2	210	0.01A	S16		04H
3070	PV2 String current 3	2	212	0.01A	S16		04H
3071	PV2 String current 4	2	214	0.01A	S16		04H
3072	PV3 String current 1	2	216	0.01A	S16		04H
3073	PV3 String current 2	2	218	0.01A	S16		04H
3074	PV3 String current 3	2	220	0.01A	S16		04H
3075	PV3 String current 4	2	222	0.01A	S16		04H
3076	PV4 String current 1	2	224	0.01A	S16		04H
3077	PV4 String current 2	2	226	0.01A	S16		04H
3078	PV4 String current 3	2	228	0.01A	S16		04H
3079	PV4 String current 4	2	230	0.01A	S16		04H
3080	PV5 String current 1	2	232	0.01A	S16		04H
3081	PV5 String current 2	2	234	0.01A	S16		04H
3082	PV5 String current 3	2	236	0.01A	S16		04H
3083	PV5 String current 4	2	238	0.01A	S16		04H
3084	PV6 String current 1	2	240	0.01A	S16		04H
3085	PV6 String current 2	2	242	0.01A	S16		04H
3086	PV6 String current 3	2	244	0.01A	S16		04H

3087	PV6 String current 4	2	246	0.01A	S16		04H
3088	Reserve	2	248				04H
3089	Reserve	2	250				04H
3090 3091	Running Time	4	252	Hour	U32		04H
3092 3093	Generating Time	4	256	Hour	U32		04H
3094 3095	Number of grid connection	4	260		U32		04H
3096 3097	Power Peak After Starting	4	264	W	U32		04H
3098 3099	Day Generation	4	268	W	U32		04H
3100 3101	Week Generation	4	272	Kwh	U32		04H
3102 3103	Month Generation	4	276	Kwh	U32		04H
3104 3105	Last N days Generation	4	280	Kwh	U32		04H
3106	Value of N	2	284		U16		04H
3107	Year	2	286		U16		04H
3108	Month	2	288		U16		04H
3109	Date	2	290		U16		04H
3110	Hour	2	292		U16		04H
3111	Minute	2	294		U16		04H
3112	Second	2	296		U16		04H
3113	Week	2	298		U16		04H
3114	Back-current Power Limit Setting	2	300		U16	W	04H
3115	Active Power of Soft Start Change Rate	2	302		U16	%/min	04H
3116	Reserve	2	304		U16		04H
3117	485Address(2)	2	306		U16	1-64	04H
3118	485 Baud Rate (2)	2	308		U16	Table 3.1.12	04H
3119	485 Agreement	2	310		U16	Table 3.1.11	04H
3120	485 Address(1)	2	312		U16	1-64	04H

3121	485Baud Rate(1)	2	314		U16	Table 3.1.12	04H
3122	Three-phase System	2	316		U16	Table 3.1.13	04H
3123	Remote Control Enable	2	318		U16	0:Disable 1:Enable	04H
3124	String Test Threshold	2	320	A	U16	5-25	04H
3125	Setting Value of Self-check	2	322		U16	Table 3.1.14	04H
3126	I/V Scan-status	2	324		U16	Table 3.1.15	04H
3127	QV Curve	12	326		U16	Table 3.3.4	04H
3128							
3129							
3130							
3131							
3132							
3133	R-phase Voltage Calibration Factor	2	338		U16	Default：4096	04H
3134	S-phase Voltage Calibration Factor	2	340		U16	Default：4096	04H
3135	T-phase Voltage Calibration Factor	2	342		U16	Default：4096	04H
3136	R-phase Current Calibration Factor	2	344		U16	Default：4096	04H
3137	S-phase Calibration Factor	2	346		U16	Default：4096	04H
3138	T-phase Current Calibration Factor	2	348		U16	Default：4096	04H
3139	Battery Voltage Calibration Factor	2	350		U16	Default：4096	04H
3140~3999	Reserve (860 Register)						
4000~4999	Register for Internal Use						04H
5000	PV1 Voltage Point 1			0.1V	U16	IV scans data, occupying 2400 registers. When the register value is 0xFFFF, it represents invalid data.	04H
5001	PV1 Current Point 1			0.01A	S16		04H
5002	PV1 Voltage Point 2			0.1V	U16		04H
5003	PV1 Current Point 2			0.01A	S16		04H
…	…						04H
5196	PV1 Voltage Point 99			0.1V	U16		04H
5197	PV1 Current Point 99			0.01A	S16		04H
5198	PV1 Voltage Point 100			0.1V	U16		04H

5199	PV1 Current Point 100			0.01A	S16		04H
5200	PV2 Voltage Point 1			0.1V	U16		04H
5201	PV2 Current Point 1			0.01A	S16		04H
5202	PV2 Voltage Point 2			0.1V	U16		04H
5203	PV2 Current Point 2			0.01A	S16		04H
...							04H
5396	PV2 Voltage Point 99			0.1V	U16		04H
5397	PV2 Current Point 99			0.01A	S16		04H
5398	PV2 Voltage Point 100			0.1V	U16		04H
5399	PV2 Current Point 100			0.01A	S16		04H
5400~5599	PV3 Voltage and Current Point						04H
5600~5799	PV4 Voltage and Current Point						04H
5800~5999	PV5 Voltage and Current Point						04H
6000~6199	PV6 Voltage and Current Point						04H
6200~6399	PV7 Voltage and Current Point						04H
6400~6599	PV8 Voltage and Current Point						04H
6600~6799	PV9 Voltage and Current Point						04H
6800~6999	PV10 Voltage and Current Point						04H
7000~7199	PV11 Voltage and Current Point						04H
7200~7399	PV12 Voltage and Current Point						04H

Note:

The U16 data type indicates an unsigned 16-digit number and S16 indicates a signed 16-digit number.

The 04H function code indicates hexadecimal number 04.

Table 3.1.2

SN	Content	Code	Description
0	Bit0	W00	Fan A Lock
1	Bit1	W01	Fan B Lock
2	Bit2	W02	Fan C Lock
3	Bit3	W03	Zero Power
4	Bit4	W04	Array Warning

Table 3.1.3

SN	Content	Code	Description
0	Bit0	F00	Grid Volt Low
1	Bit1	F01	Grid Volt High
2	Bit2	F02	Grid Frequency Low
3	Bit3	F03	Grid Frequency High
4	Bit4	F04	Bus Volt Low
5	Bit5	F05	Bus Volt High
6	Bit6	F06	Bus Volt Unbalance
7	Bit7	F07	Isolation Fault
8	Bit8	F08	PV Current High
9	Bit9	F09	Hard Inverter Current Over
10	Bit10	F10	Inverter Current Over
11	Bit11	F11	Inverter Dc Currernt Over
12	Bit12	F12	Ambient Temperature Over
13	Bit13	F13	Sink Temperature Over
14	Bit14	F14	AC Relay Fault
15	Bit15	F15	Reserve
16	Bit16	F16	Remote Off
17	Bit17	F17	reserve
18	Bit18	F18	SPI Communication Fail
19	Bit19	F19	SPI2 Communication Fail
20	Bit20	F20	GFCI Over Fault
21	Bit21	F21	GFCI Device Fault
22	Bit22	F22	Voltage Consistent Fault
23	Bit23	F23	Frequency Consistent Fault
24	Bit24	F24	Reserve

25	Bit25	F25	Auxiliary power off
26	Bit26	F26	Reserve
27	Bit27	F27	Reserve
28	Bit28	F28	Reserve
29	Bit29	F29	Reserve
30	Bit30	F30	Reserve
31	Bit31	F31	Reserve

Table 3.1.4

SN	Content	Description
0	00H	System initialization
1	01H	Waiting
2	02H	Pre-detection
3	03H	Normal
4	04H	Error
5	05H	Permanent error
6	06H	Aging
7	07H	INV_DSP Burning
8	08H	ARM Burning
9	09H	BST_DSP Burning

Note: when the inverter is in the system initialization, the communication data is invalid data.

Table 3.1.5

Decimal	Hexadecimal	Inverter	Pmax（kw）	MPPT
0	00H	KSG-1KSM3		PV1
1	01H	KSG1.5KSM3		
2	02H	KSG2KSM3		
3	03H	KSG3KSM3		
4	04H	KSG3.2KDM3		PV1~PV2
5	05H	KSG4KDM3		
6	06H	KSG5KDM3		
7	07H	KSG10K/KSG6KDM3	11(KSG10K)	PV1~PV3
8	08H	KSG12K	13	
9	09H	KSG15K	16	

10	0AH	KSG17K	18	
11	0BH	KSG20K	22	
12	0CH	KSG30K	33	
13	0DH	KSG40K	44	
14	0EH	KSG50K	55	
15	0FH	KSG60K	66	
20	14H	KSG25KHV	27	
21	15H	KSG36KHV	37	
22	16H	KSG50KHV	55	
23	17H	KSG60KHV	66	
30	1EH	KSG8KTL	9	
31	1FH	KSG10KTL	11	
32	20H	KSG12KTL	13	
33	21H	KSG25KTL	28	
34	22H	KSG30KTL	33	
35	23H	KSG33KTL	36	
36	24H	KSG36KTL	39	
37	25H	KSG40KTL	42	
38	26H	KSG50KHVC	53	
39	27H	KSG60KHVC	66	
40	28H	KSG50K	55	
41	29H	KSG50KHV	55	
42	2AH	KSG60K	66	
43	2BH	KSG60KHV	66	
44	2CH	KSG70KHV	77	
50	32H	KSG50KTL	55	PV1~PV4
51	33H	KSG60KTL	66	
52	34H	KSG70KTL	77	
53	35H	KSG80KTL	88	
54	36H	KSG60KHVC	66	
55	37H	KSG70KHVC	77	
56	38H	KSG80KHVC	88	
57	39H	KSG100KHVC	100	
59	3BH	KSG110SL	121	PV1
60	3CH	KSG100CL	110	PV1~PV9
61	3DH	KSG136UM	150	PV1~PV12

62	3EH	KSG110CL	121	PV1~PV10
65	41H	KSG100UH	120	PV1~PV6
66	42H	KSG136UH	150	PV1~PV6
67	43H	KSG175UH	200	PV1~PV12
68	44H	KSG200UH	200	PV1~PV12
69	45H	KSG225UH	247.5	PV1~PV12
70~99	46H~63H	Reserve		
100	64H	BluE-G 3000S	3.3	PV1
101	65H	BluE-G 3000D	3.3	PV1~PV2
102	66H	BluE-G 3600D	3.96	PV1~PV2
103	67H	BluE-G 4000D	4.4	PV1~PV2
104	68H	BluE-G 4200D	4.62	PV1~PV2
105	69H	BluE-G 4600D	5.06	PV1~PV2
106	6AH	BluE-G 5000D	5.5	PV1~PV2
107	6BH	BluE-G 6000D	6	PV1~PV2

Note: 07H single phase model is KSG-6K-DM3, three-phase model is KSG-10K;

Table 3.1.6

SN	Content	Code	Description
0	Bit0	W16	Clock Warning
1	Bit1	W17	Fan4 Lock
2	Bit2	W18	Fan5 Lock
3	Bit3	W19	Fan7 Lock
4	Bit4	W20	Fan8 Lock
5	Bit5	W21	Lighting Warning
6	Bit6	W22	DSP Version Warning
7	Bit7	W23	Fuse Wire Warning

Table 3.1.7

SN	Content	Code	Description
0	Bit 0	F32	Error in communication with the DSP

Table 3.1.8

SN	Content	Input Mode
0	00H	Independent mode
1	01H	Parallel mode
2	02H	Hybrid mode

Table 3.1.9

		Inverter of Table3.1.5 07H~3CH and 3EH(1100V Inverter 400VAC)				
SN	Content	Grid Connection Standard	Lower limit of Voltage	Upper Limit of Voltage	Lower Limit of Frequency	Upper Limit of Frequency
0	00H	China	LN:1955-2200 LL:3400-3900	LN:2300-2760 LL:4100-4800	4800-4980	5020-5050
1	01H	German	LN:1960-2200 LL:3400-3900	LN:2400-2640 LL:4100-4600	4750-4980	5020-5150
2	02H	Australia	LN:2000-2200 LL:3400-3900	LN:2400-2700 LL:4100-4800	4800-4980	5020-5200
3	03H	Italy	LN:1840-2200 LL:3200-3900	LN:2400-2760 LL:4100-4800	4970-4980	5020-5030
4	04H	Spain	LN:1960-2200 LL:3400-3900	LN:2400-2530 LL:4100-4400	4800-4980	5020-5050
5	05H	Britain	LN:1840-2200 LL:3200-3900	LN:2400-2640 LL:4100-4600	4700-4980	5020-5200
6	06H	Hungary	LN:1960-2200 LL:3600-3900	LN:2400-2530 LL:4100-4400	4900-4980	5020-5100
7	07H	Belgium	LN:1840-2200 LL:3200-3900	LN:2400-2640 LL:4100-4600	4750-4980	5020-5150
8	08H	Western Australia	LN:2000-2200 LL:3400-3900	LN:2400-2700 LL:4100-4800	4750-4980	5020-5050
9	09H	Greece	LN:1840-2200 LL:3200-3900	LN:2400-2640 LL:4100-4600	4950-4980	5020-5050
10	0AH	France	LN:1840-2200 LL:3200-3900	LN:2400-2640 LL:4100-4600	4750-4980	5020-5040
11	0BH	Bangkok	LN:2000-2200 LL:3200-3900	LN:2300-2640 LL:3900-4800	4900-4980	5020-5100

12	0CH	Thailand	LN:1760-2200 LL:3200-3900	LN:2300-2640 LL:3900-4800	4700-4980	5020-5200
13	0DH	Plant	LN:1840-2200 LL:3200-3900	LN:2400-2760 LL:4100-4800	4800-4980	5020-5200
14	0EH	Local	LN:1500-2200 LL:2600-3900	LN:2400-2900 LL:4100-5020	4500-4980	5020-5500
15	0FH	60 Hz	LN:1840-2200 LL:3200-3900	LN:2400-2760 LL:4100-4800	5800-5980	6020-6200
Inverter of Table 3.1.5 3DH(1100V Inverter 500VAC)						
SN	Content	Grid Connection Standard	Lower limit of Voltage	Upper Limit of Voltage	Lower Limit of Frequency	Upper Limit of Frequency
0	00H	China	LN:3910-4400 LL:6800-7800	LN:4600-5520 LL:8200-9600	4800-4980	5020-5050
1	01H	German	LN:3920-4400 LL:6800-7800	LN:4800-5280 LL:8200-9200	4750-4980	5020-5150
2	02H	Australia	LN:4000-4400 LL:6800-7800	LN:4800-5400 LL:8200-9600	4800-4980	5020-5200
3	03H	Italy	LN:3680-4400 LL:6400-7800	LN:4800-5520 LL:8200-9600	4970-4980	5020-5030
4	04H	Spain	LN:3920-4400 LL:6800-7800	LN:4800-5060 LL:8200-8800	4800-4980	5020-5050
5	05H	Britain	LN:3680-4400 LL:6400-7800	LN:4800-5280 LL:8200-9200	4700-4980	5020-5200
6	06H	Hungary	LN:3920-4400 LL:7200-7800	LN:4800-5060 LL:8200-8800	4900-4980	5020-5100
7	07H	Belgium	LN:3680-4400 LL:6400-7800	LN:4800-5280 LL:8200-9200	4750-4980	5020-5150
8	08H	Western Australia	LN:4000-4400 LL:6800-7800	LN:4800-5400 LL:8200-9600	4750-4980	5020-5050
9	09H	Greece	LN:3680-4400 LL:6400-7800	LN:4800-5280 LL:8200-9200	4950-4980	5020-5050
10	0AH	France	LN:3680-4400 LL:6400-7800	LN:4800-5280 LL:8200-9200	4750-4980	5020-5040
11	0BH	Bangkok	LN:4000-4400 LL:6400-7800	LN:4600-5280 LL:7800-9600	4900-4980	5020-5100

12	0CH	Thailand	LN:3520-4400 LL:6400-7800	LN:4600-5280 LL:7800-9600	4700-4980	5020-5200
13	0DH	Plant	LN:3680-4400 LL:6400-7800	LN:4800-5520 LL:8200-9600	4800-4980	5020-5200
14	0EH	Local	LN:3000-4400 LL:5200-7800	LN:4800-5800 LL:8200-10040	4500-4980	5020-5500
15	0FH	60Hz	LN:3680-4400 LL:6400-7800	LN:4800-5520 LL:8200-9600	5800-5980	6020-6200

Inverter of Table 3.1.5 00H~06H and 64H~6BH (Single-Phase)

SN	Content	Grid Connection Standard	Lower limit of Voltage	Upper Limit of Voltage	Lower Limit of Frequency	Upper Limit of Frequency
0	00H	China	1870-2100	2300-2520	4800-4980	5020-5050
1	01H	German	1840-2200	2400-2640	4750-4980	5020-5150
2	02H	Australia	1800-2200	2400-2650	4700-4980	5020-5200
3	03H	Italy	1840-2200	2400-2760	4970-4980	5020-5030
4	04H	Spain	1960-2200	2400-2530	4800-4980	5020-5050
5	05H	Britain	1840-2200	2400-2640	4700-4980	5020-5200
6	06H	Hungary	1960-2200	2400-2530	4900-4980	5020-5100
7	07H	Belgium	1840-2200	2400-2640	4750-4980	5020-5150
8	08H	Western Australia	1800-2200	2400-2650	4500-4980	5020-5200
9	09H	Greece	1840-2200	2400-2530	4700-4980	5020-5150
10	0AH	France	1840-2200	2400-2640	4750-4980	5020-5040
11	0BH	Bangkok	1500-2200	2400-2640	4700-4980	5020-5200
12	0CH	Thailand	1500-2200	2400-2640	4700-4980	5020-5200
13	0DH	Plant	1500-2200	2400-2900	4500-4980	5020-5500
14	0EH	Local	1500-2200	2400-2900	5500-5980	6020-6500
15	0FH	60Hz	/	/	/	/

Table 3.1.11

Value	Agreement
0	KSTAR
1	MODBUS

表 3.1.12

Value	Baud Rate(bps)
0	2400
1	4800
2	9600
3	19200
4	38400
5	115200

表 3.1.13

Value	Meaning
0	3W+N+PE
1	3W+PE

Table 3.1.14

Byte	Content	0	1
0	CONSISTENT	Enable	Disable
1	GFCI		
2 （No 1-5K）	ISO		
3 （No 1-5K）	RELAY		
4	CURR INV		
5	DCI		
6	ISLAND		
7 （No 1-5K）	ChkArray		
8	VoltLoad		
9 （No 1-5K）	IGBT CHECK		
10 （No 1-5K）	HARMONIC		
11	Reserve		
12	Reserve		
13	Reserve		

14	Reserve		
15（only 1-5K）	Drm（Drm）		

Table 3.1.15

	Value	Meaning
Lower 8 byte	0	I/V is scanning
	1	I/V is not scanning(default)
Higher 8 byte	0—124	IV scan progress0—100

Note：We recommend following these steps for IV scanning:

1. First, use the 04 function code to read the IV scanning state. If it is scanning，do not need to turn it on again. If it isn't scanning, follow next step.

2. Use function code 06 to start I/V scanning.

3. Every 10s, use 04 function code to read I/V scanning state. If it isn't scanning, it means that scanning is completed and PV voltage and current data can be read. If it is scanning, scan progress can be showed based on the higher 8 bits of information and then repeat step 3.

3.2. Inverter System Information (03H)

Table 3.2.1

Register Address	Item	Byte	Byte No.	Data Type	Remarks	FUNC
3200-3204	Machine model	10	0	U8	ASCII code	03H
3205	DSP version	1	10	U8	10 indicates V1.0.	03H
	ARM version	1	11	U8	10 indicates V1.0.	03H
3206-3216	Inverter SN	22	12	U8	ASCII character	03H
3217-3219	PLC MAC Address	6	34	U8	MAC address	03H
3220	LCD Model Setting	1	40	U8	Table 3.3.5	03H
	Present identified model	1	41	U8		03H
3221-3228	Inverter Model（New）	16	42	U8	ASCII character	03H
3229	DSP1 Test version number	1	58	U8	Note 1	03H

	ARM1 Test version number	1	59	U8	Note 1	03H
3230	DSP2 version number	1	60	U8	10 means V1.0	03H
	DSP2 Test version number	1	61	U8	Note 1	03H
3231-3232	Reserve	4	62	U8		03H

Note1: Test version number ranges from 0 to 99. If DSP1 version number is V1.0，DSP1 test version number is 2 and DSP1 complete version number is V1.0.2.

3.3. Inverter Setup (10H)

Table 3.3.1

Register Address	Item	Byte	Byte No.	Data Type	Remarks	FUNC
3300-3306	Clock information	14	0	U8	Table 3.2.2	10H
3307-3310	QV Active Factor Curve (1)	8	14	U16	Table 3.3.3	10H
3311-3322	Setting Inverter SN	24	22	ASCII		10H
3323-3325	Setting PLC MAC	6	46	U8		10H
3326-3331	QV Curve (2)	12	52	U16	Table 3.3.4	10H
3332	LCD Model Setting	2	64	U8	Table 3.3.5	10H
3333-3340	Inverter Model	16	66	U8		10H

Note: When setting information, write the address at a time. For example, write clock setup information into register addresses 3300 to 3306 at a time.

Table 3.3.2

Register Address	Item	Byte	Byte No.	Data Type	Remark
3300	Year (tens place)	1	0	U8	ASCII code
	Year (ones place)	1	1	U8	ASCII code
3301	Month (tens place)	1	2	U8	ASCII code
	Month (ones place)	1	3	U8	ASCII code
3302	Day (tens place)	1	4	U8	ASCII code
	Day (ones place)	1	5	U8	ASCII code

3303	Hour (tens place)	1	6	U8	ASCII code
	Hour (ones place)	1	7	U8	ASCII code
3304	Minute (tens place)	1	8	U8	ASCII code
	Minute (ones place)	1	9	U8	ASCII code
3305	Second (tens place)	1	10	U8	ASCII code
	Second (ones place)	1	11	U8	ASCII code
3306	Week	1	12	U8	ASCII code
		1	13	U8	ASCII code

Table 3.3.3

Register Address （W/R）	Content	Value Ranges	Unit	Description
3307/3058	High voltage V1 of the QV curve (end)	2400 – 2800	0.01V	Utility phase voltage（LN）ranges from 240 to V1，and reactive power ranges from 0 to Q1
3308/3059	High-voltage reactive power percent(Q1) of the QV curve	-60 - +60	%	Utility phase voltage（LN）is above V1 and reactive power keeps at Q1.
3309/3060	Low voltage V2 of the QV curve	1500 – 2100	0.01V	Utility phase voltage（LN）ranges from 240 to V1，and reactive power ranges from 0 to Q1
3310/3061	Low-voltage reactive power percent(Q2) of the QV curve	-60 - +60	%	Utility phase voltage（LN）is above V1 and reactive power keeps at Q1.

Note: The table applies to inverters with power under 100K.

Table 3.3.4

Register Address（W/R）	Content	Value Ranges	Default	Unit	Description
3326/3127	QV Curve Reactive Power Overvoltage End Value	Overvoltage start value - 1300	1300	0.1%	
3327/3128	QV Curve Reactive Power	1010 - 1300	1300	0.1%	

	Overvoltage Start Value				
3328/3129	QV Curve Max Reactive Power （Negtive）	0 - 60	0	%	
3329/3130	QV Curve Reactive Power Undervoltage End Value	700 - 990	700	0.1%	
3330/3131	QV Curve Reactive Power Undervoltage Start Value	700 – Undervoltage start value	700	0.1%	
3331/3132	QV Curve Max Reactive Power （Positive）	0 - 60	0	%	

Note: The table only applies to inverters with power above 100K.

Table 3.3.5

Register Address（W/R）	Content	Ranges	Default	Unit	Description
3332	LCD Model Setting	0,1,2	0	null	0: Self- recognition The inverter will be automatically recognized after boot User Settings are disabled in this mode. 1: Topway If set to Topway, the external screen is Topway LCD. 2: Kasun If set to Kasun, the external screen is Kasun LCD.

3.4. Instruction Execution (06H Telemetry)

Table 3.4.1

Register Address	Item	Byte	Byte No.	Unit	Data Type	Remarks	FUNC
4000	Clear statistical information	2	0		U16	DATA arbitrary number	06H
4001	Remote power-off	2	2		U16	DATA arbitrary number	06H
4002	Revoke remote power-off	2	4		U16	DATA arbitrary number	06H

4003	Set the power factor	2	6		U16	Table 3.4.2	06H
4004	Set the active power	2	8	%	U16	Table 3.4.3	06H
4005	Set the reactive power	2	10	1KVar	S16	Table 3.4.4	06H
4006	Set the reactive control mode	2	12		U16	Table 3.4.5	06H
4007	Overfrequency derating	2	14		U16	0: enabled 1: disabled	06H
4008	Overfrequency derating threshold	2	16	0.01Hz	U16	Table 3.4.6	06H
4009	Set the derating rate	2	18	%/0.1 Hz	U16	0-20 ,the default is 4	06H
4010	Set the active power	2	20	KW	U16	Table 3.4.3	06H
4011	LOGO Settings	2	22		U16	Table 3.4.7	06H
4012	Input Mode Settings	2	24		U16	Table 3.1.8	06H
4013	Grid Connection Standard Settings	2	26		U16	Table 3.1.9	06H
4014	Start Voltage Settings	2	28		U16	(1-1.5K:1000-4500 2K-5K:1500-4500 10K-150K:2500-9000 175K-250K:6500-14500)	06H
4015	Start Delay Settings	2	30		U16	20-300	06H
4016	Grid Voltage Lower Limit Settings	2	32		U16	Table 3.1.9, Table 3.1.10	06H
4017	Grid Voltage Upper Limit	2	34		U16		06H

	Settings						
4018	Grid Frequency Lower Limit Settings	2	36		U16		06H
4019	Grid Frequency Upper Limit Settings	2	38		U16		06H
4020	Back Current Power Limit Settings	2	40	W	U16		06H
4021	Overvoltage Derating Threshold Value	2	42	0.1%	U16		06H
4022	Reserve	2	44		U16		06H
4023	485 Address Settings(U2)	2	46		U16	1-64	06H
4024	485 Baud Rate Settings(U2)	2	48		U16	Table 3.1.12	06H
4025	485 Protocol Settings	2	50		U16	Table 3.1.11	06H
4026	485 Address Settings(U4)	2	52		U16	1-64	06H
4027	485 Baud Rate Settings (U4)	2	54		U16	Table 3.1.12	06H
4028	Three-phase Settings	2	56		U16	Table 3.1.13	06H
4029	Remote Control Settings	2	58		U16	0:Disable 1:Enable	06H
4030	String Test Threshold Value Settings	2	60	A	U16	5-25	06H
4031	Self-check (Enable)	2	62		U16	0-15,Table 3.1.14	06H

4032	Self-check (Disable)	2	64		U16	0-15, Table 3.1.14	06H
4033	Clear Fault Record	2	66		U16	DATA arbitrary number	06H
4034	Factory Data Reset	2	68		U16	DATA arbitrary number	06H
4035	Start I/V Scan	2	70		U16	DATA arbitrary number	06H
4036	Active Power Increment (KW)	2	72	KW	S16	The machine comes with saturation calculation.	06H
4037	Active Power Increment (W)	2	74	W	S16	The machine comes with saturation calculation.	06H
4038	Soft Start Active Power Change Rate	2	76	%/min	S16		06H
4039	Active Power Settings (Decimals)	2	78	0.1%	U16	0-9	06H
4040	R-phase Voltage Calibration Factor	2	80		U16	Default :4096	06H
4041	S-phase Voltage Calibration Factor	2	82		U16		06H
4042	T-phase Voltage Calibration Factor	2	84		U16		06H
4043	R-phase Current Calibration Factor	2	86		U16		06H
4044	S-phase Calibration	2	88		U16		06H

	Factor						
4045	T-phase Current Calibration Factor	2	90		U16		06H
4046	Battery Voltage Calibration Factor	2	92		U16		06H
4047~4398	Reserve(358 registers)		94		U16		06H
4399	Record Position Pointer		798		U16	Table 3.1.16	06H
9000	Aging Enable	2	800		U16	0:Disable 1:Enable	06H

Note: Only the instruction of setting broadcast address 0 can be executed.

Table 3.4.2

Value Range	Description
800-1000	If the reactive power is negative, the power factor ranges from 0.800 to 1.000
10800-11000	If the reactive power is positive, the power factor ranges from 0.800 to 1.000
0xFFFF	Cancel power factor control (default power factor: 1)

Table 3.4.3

Value Range	Description
0-100	Maximum percentage of rated power

Table 3.4.4

Value Range	Description
-60 - +60	Set the reactive power (%). The acceptable maximum reactive power is +/- 60%

Table 3.4.5

Value Range	Description
0	Control based on the power factor
1	Control based on the reactive power
2	Control based on the QV curve

Table 3.4.6

Value Range	Description
5020 – 6500	1. If the mains frequency reaches this threshold, the current power of the inverter is locked, which is P_{frozen}. 2. If the mains frequency exceeds this threshold, the power decreases based on derating rate.

Table 3.4.7

序号	内容	LOGO
0	00H	KSTAR
1	01H	NONE
2	02H	VIS
3	03H	Effekta

4. Examples

4.1. Querying Basic Information

Read the input register. The start address is 3000 and the length is 1 unit (2 bytes).

Host

Endian	0	1	2	3	4	5	6	7
Content	01	04	0B	B8	00	01	B3	CB
Format	ID	FUNC	ADDR		DATA	DATA	CRC	

Client

Endian	0	1	2	3	4	6	7
Content	01	04	02	00	65	79	1B
Format	ID	FUNC	BYTE LEN	DATA	DATA	CRC	

4.2. Querying System Information

Read the keep register. The start address is 3200 and the length is 1 unit (2 bytes).

Host

Endian	0	1	2	3	4	5	6	7
Content	01	03	0C	80	00	01	86	B2
Format	ID	FUNC	ADDR		DATA	DATA	CRC	

Client

Endian	0	1	2	3	4	6	7
Content	01	03	02	4B	53	CE	89
Format	ID	FUNC	BYTE LEN	DATA	DATA	CRC	

4.3. Setting the Clock of the Inverter

Set the clock of the inverter to 2010-11-02 14:30:00 Tuesday.

Host

Endian	0	1	2	3	4	5	6	7

Content	01	10	0C	E4	00	07	0E	31
Format	ID	FUNC	ADDR		REGISTER QUANTITY		BYTE COUNT	DATA

Endian	8	9	10	11	12	13	14	15
Content	30	31	31	30	32	31	34	33
Format	DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA

Endian	16	17	18	19	20	21	22
Content	30	30	30	32	00	F2	AA
Format	DATA	DATA	DATA	DATA	DATA	CRC	

Host

Endian	0	1	2	3	4	5	6	7
Content	01	10	0C	E4	00	07	AC	C2
Format	ID	FUNC	ADDR		DATA	DATA	CRC	

4.4. Executing Remote Instructions

Maximum rated power: 85%

Host

Endian	0	1	2	3	4	5	6	7
Content	01	06	0F	A4	00	55	0B	02
Format	ID	FUNC	ADDR		DATA	DATA	CRC	

Client

Endian	0	1	2	3	4	5	6	7
Content	01	06	0F	A4	00	55	0B	02
Format	ID	FUNC	ADDR		DATA	DATA	CRC	

4.1. Number of read error records

Host

Endian	0	1	2	3	4	5	6	7
Content	01	41	19	64	00	01	BA	86

Format	ID	FUNC	ADDR	FIXED	CRC

Client

Endian	0	1	2	3	4	6	7
Content	01	41	02	00	8E	2C	58
Format	ID	FUNC	BYTE LEN	DATA	DATA	CRC	