User Manual

Version 1.7

DC System Monitor FR-DCMG-MMPL

Table of Contents

FR-DCMG-MMPL products are mainly used in DC power transmission and distribution, such as photovoltaic junction boxes, DC cabinets, telecommunications rooms and communication base stations. Collect the node data through the power line carrier method, and then make the gateway communicate with the host computer through RS485. Its main function is to monitor the current of each branch in the DC system, the bus voltage, the temperature of the box, the status of the lightning arrester and the status of the DC circuit breaker. It can realize the functions of automatic alarm in abnormal state, real-time detection of the presence of harmful arcs in the DC circuit and cut off the fault circuit, etc.

The main function

- Power line carrier communication module: Through the power line carrier expansion module DC-DCMG-PLCx, communication of up to 24 nodes is realized
- Monitoring function: real-time monitoring of generating current, voltage, combiner box temperature, lightning arrester status, DC circuit breaker status, and DC arc fault status of each photovoltaic string in the combiner box.
- Display content: For the detected voltage, current, temperature, power generation and other data, the histogram interface can be displayed on the LCD to read the current and other data more intuitively.
- Alarm function: All alarm functions are set to enable bits. You can configure whether to enable it according to your needs.

Product Image

Product number

Type	Model	Description
Host	FR-DCMG-MMPL	Combiner box monitoring host for 1500V and below systems, supporting power line carrier communication function (requires FR-DCMG-PLCD module). The same model supports two working modes: PLC function monitoring host node and PLC communication gateway
Communication Expansion Module	FR-DCMG-PLCD	PLC power line carrier expansion module for 1000V and below systems, needs to be used with FR-DCMG-MMPL
	FR-DCMG-PLCU	For 1500V and below systems

Software version

Manual version	Software version	Date
V1.7	A088	2019.12.13

Note: This manual is applicable to the monitoring host with model FR-DCMG-MMPL and software version A088 and above.

Definition of size and terminal
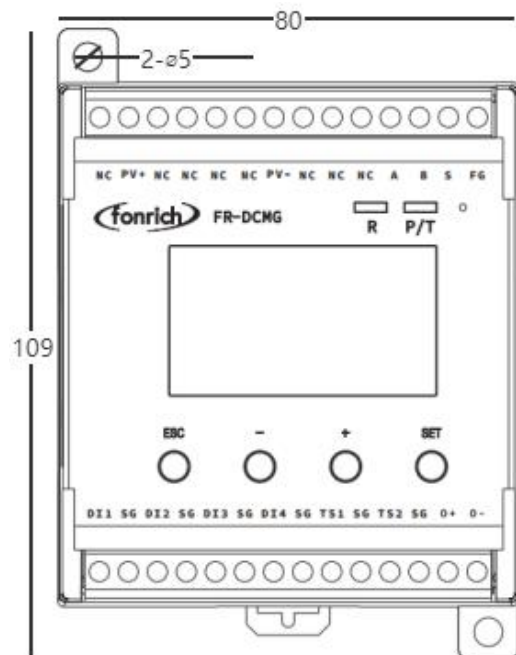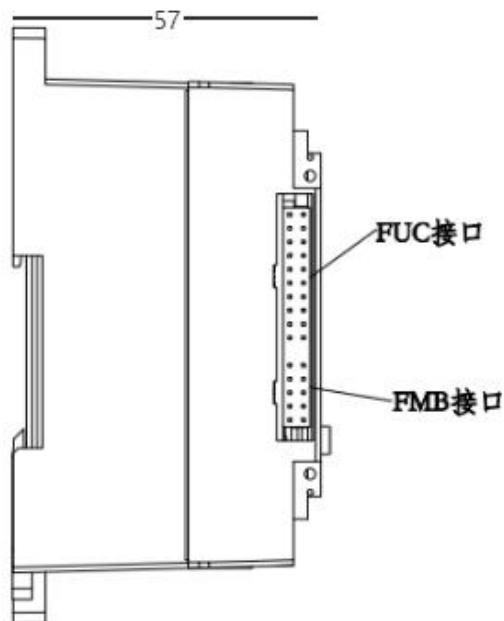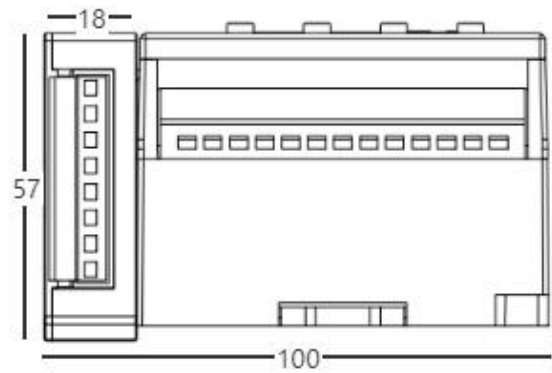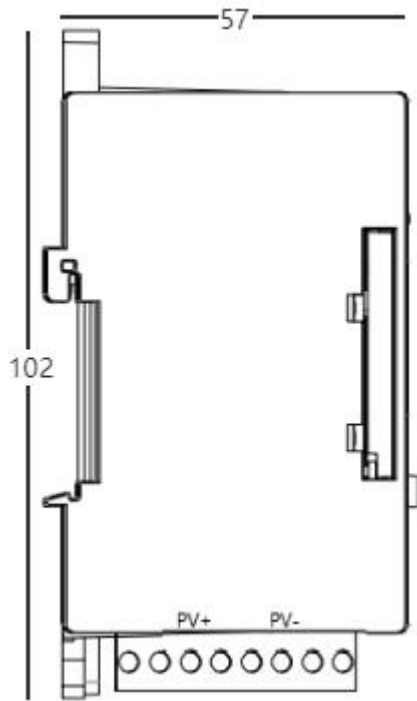
Symbol	Meaning
PV+．PV-	PV DC bus power supply terminal
NC	Not connecion
S	Not connecion
A.B	RS485 Communication terminal
FG	Fixed Ground terminal
TS1.TS2	Externally connected temperature sensor terminals
SG	Temperature sensor and digital input ground terminal
DI1.DI2.DI3.DI4	4 digital input terminals
0+.0-	Connecting the shunt release
FUC	Can connect modules with FUC interface
FMB	Modules with an FMB interface can be connected, such as the FR-DCMG-AS4A DC Arc Detector.
PLCx PV+．PV-	PLCx expansion module DC power supply terminal
SG、O+	Normal output DC 24v voltage

System diagram and networking diagram

System diagram
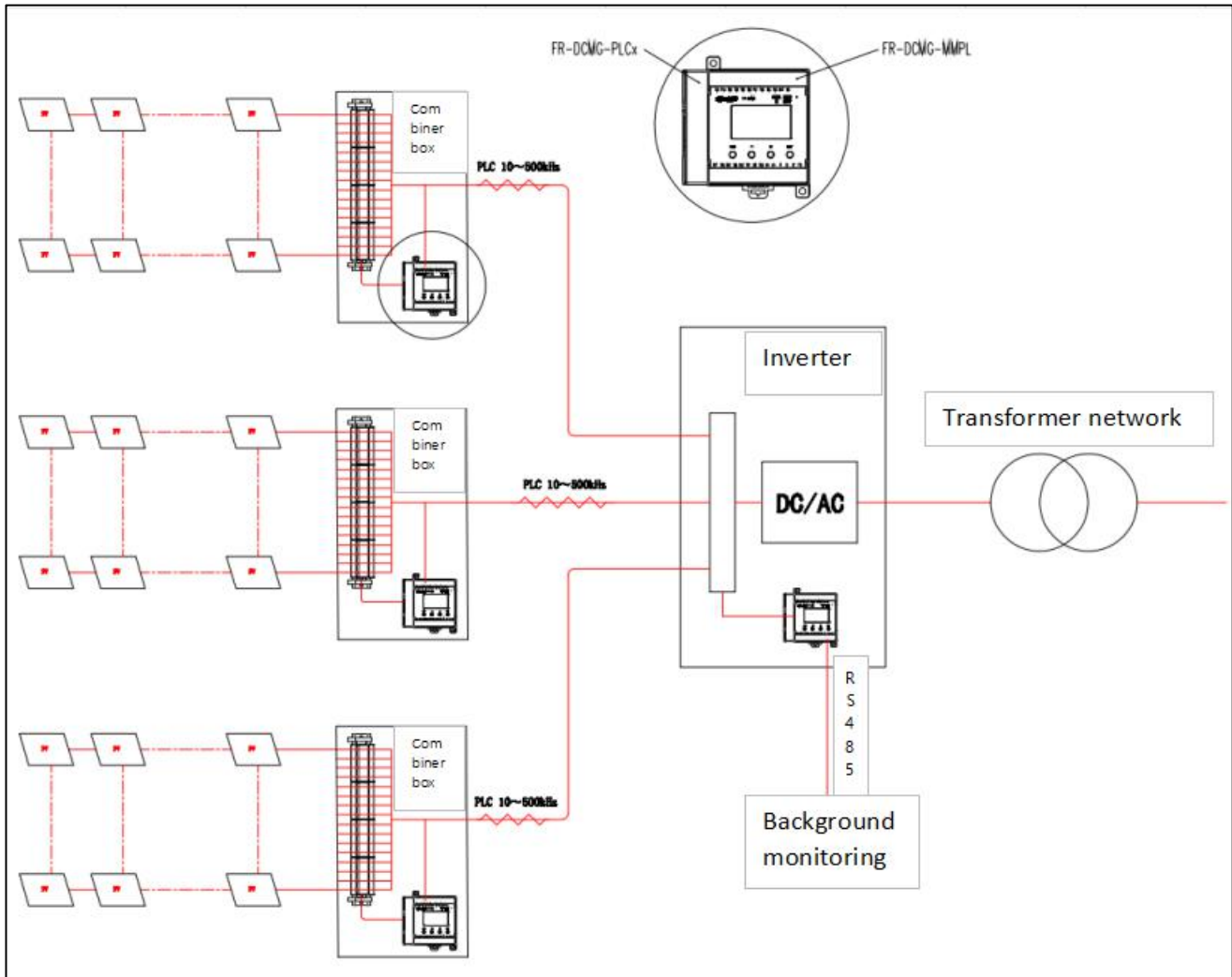
Network diagram

Networking diagram of the gateway in the inverter
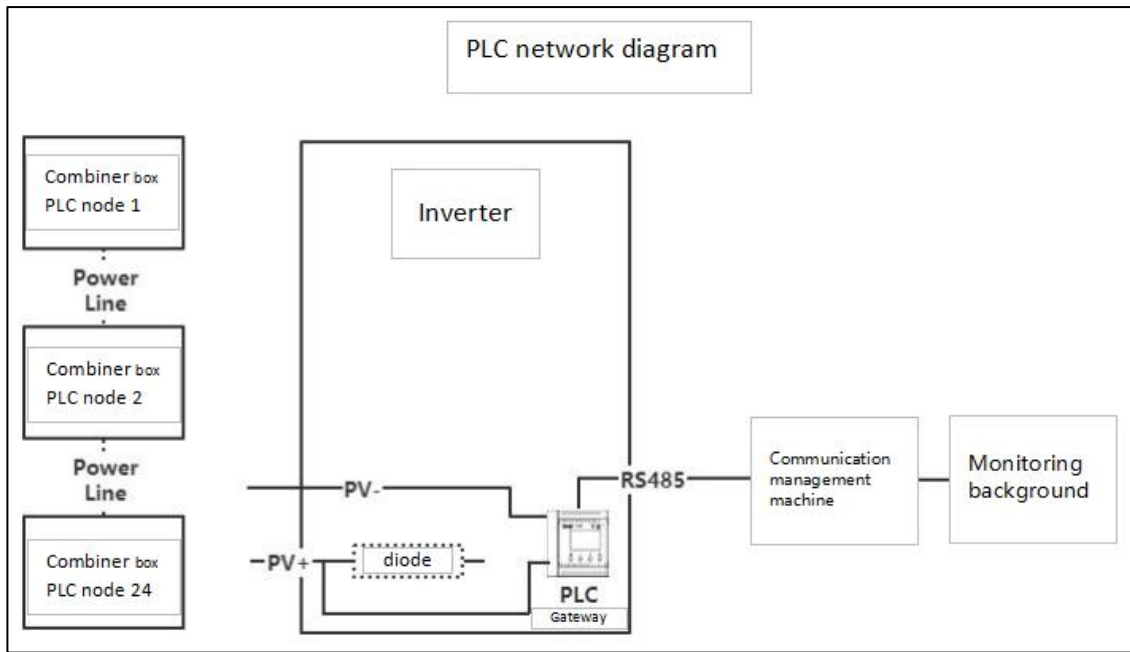
Networking diagram of the gateway in the junction box
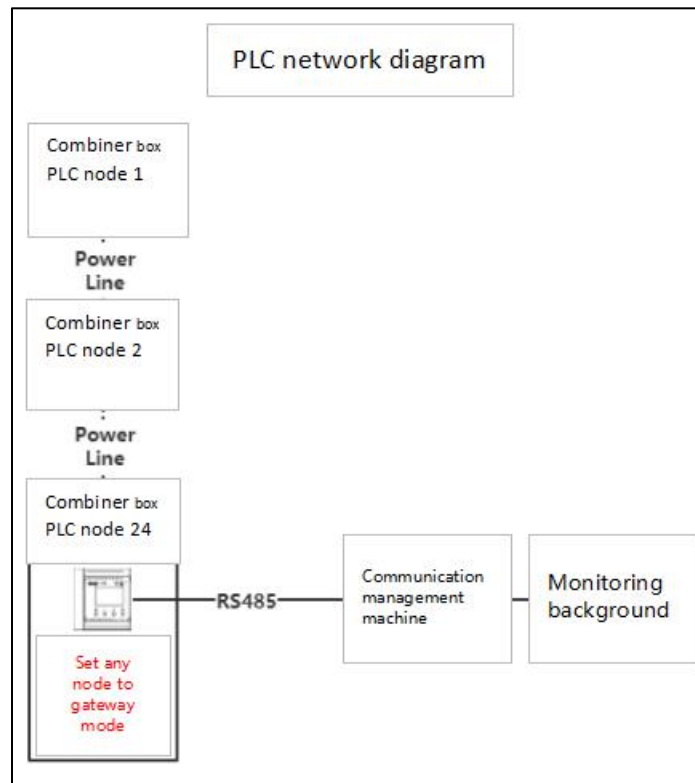
PLC wiring in combiner box and inverter
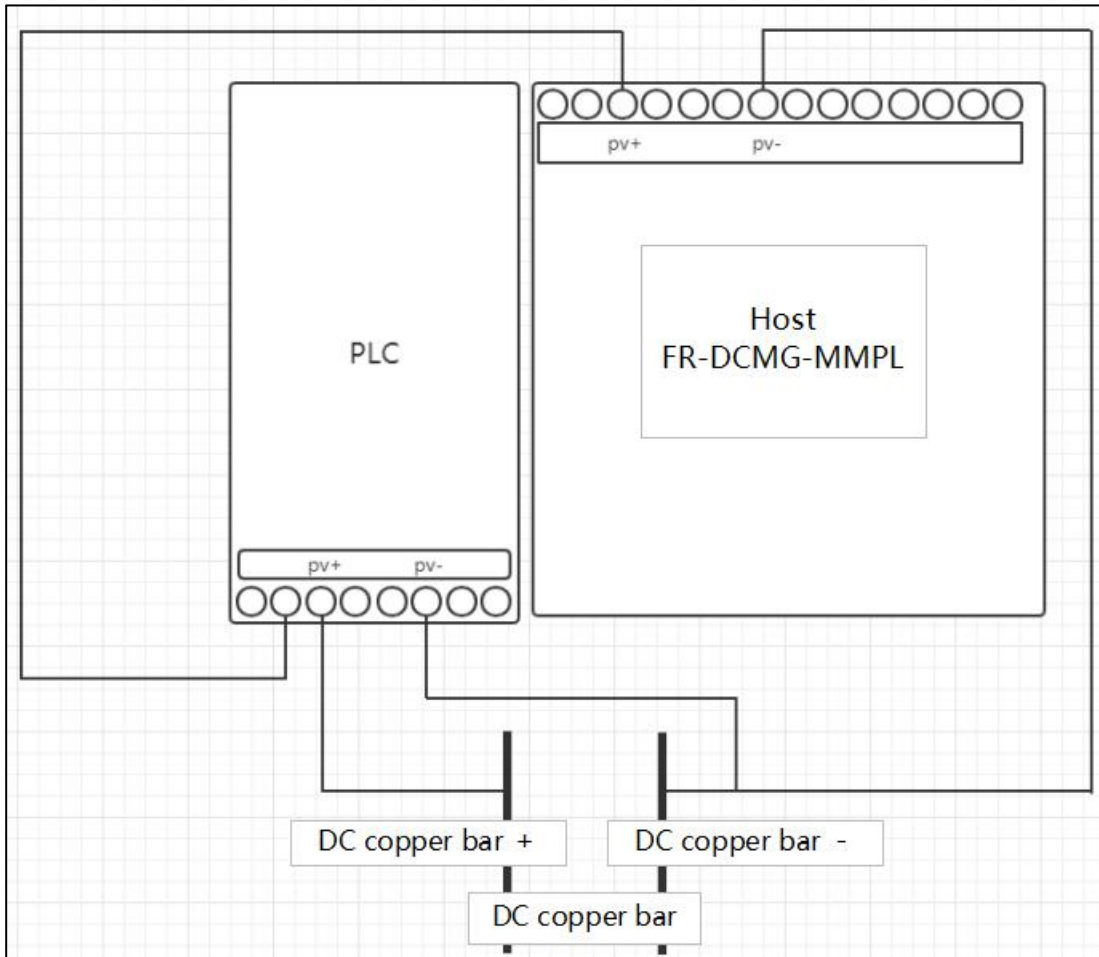
Press the "SET" key to display the first page of the setting interface

```
Device Setting
─────────────────
ADDR  :  247
PAR   :  None
BPS   :  9600
```

ADDR : Modbus slave address, also PLC node address, default is 247
PAR：Check digit, default None
BPS：Baud rate, default 9600

Press the "+" key to select down to the second page of the setting interface

```
Device Setting
─────────────────
MODE :  Node
BAND :  FCC
TEI   :   0
```

MODE：PLC mode (Gate Gateway, Node)
BAND：PLC frequency band (default use FCC, please consult technician for other options)
TEI：PLC network identification (the TEI in the same network must be consistent, otherwise communication is not possible)

Press the "+" key to continue the selection down to the third page of the setting interface

```
         Device Setting
       _____

         THR  :  50
         Lang :  EN
```

THR：Arc alarm threshold (default: 50)
LANG：language settings （default: EN）

Gateway status (Mode: Gate) interface, the following figure is displayed after pressing ESC

```
          PLC  STATUS
       _____

        | 1  2  3  4  5  6  7  8
      1 | 0  0  0  0  0  0  0  0
      2 | 0  0  0  0  0  0  0  0
      3 | 0  0  0  0  0  0  0  0
```

The figure mainly displays the node PLC status information, the rows and columns of the table, such as

The 5th row shows the node with the address of 5

The first row 2 shows the node with the address 9

The second row in the third row shows the node with the address of 18

The current communication quality supports a maximum of 24 nodes, and the address range of these 24 nodes is 1 ~ 24

Communication quality is represented by numbers 0-9

Node status (Mode: Node) interface, the following figure is displayed after pressing ESC

```
      PLC STATUS
   PLC  NODE
   SNR : 0
                SEND 0
```
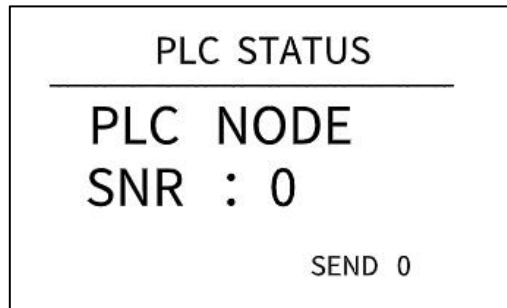
SNR is the signal-to-noise ratio of the current PLC line

SEND xxx is the number of packets sent by the current node

Parameter setting range

- Mode supports Gate / Node mode

- The address range supported by Node mode is 1 ~ 24

- The PLC address is the same as the MODBUS address

- BAND only supports FCC

- TEI can only use 0-99

Modbus protocol definition

The address range of the Modbus node is 1-24 (inclusive). When set to other addresses, the PLC ignores its data packets.

Function code 03

Modbus address		Function description	instruction
Hex	Decimal		
0x3000	12290	Read current TEI	0-99
0x3001	12290	Read the number of packets currently sent	
0x3002	12290	Read the current working mode	1: gateway mode, 0: node mode
0x3003	12291	Read the number of nodes online	The value range is 0 ~ 16, the current number of online nodes
0x3004	12292	Read the tonemap (high 16 bits) at the time of transmission	The tonemap is 3 bytes in size and requires two register descriptions
0x3005	12293	Read the tonemap (lower 16 bits) when sending	
0x3006	12294	Read test results for production testing	
0x3007	12295	Read current band	0: CEN-A 1: CEN-B 3: FCC
0x3008	12296	Read receive SNR for production test	Not open
0x3009	12297	Reads whether it is currently in test mode	0: Normal mode 1: Test mode is not open
Reserved	...	...	...
0x3010	12304	Node1's tonemap (high 16 bits)	The tonemap is 3 bytes in size and requires two register descriptions
0x3011	12305	Node1's tonemap (low 16 bits)	
0x3012	12306	Node2's tonemap (high 16 bits)	
0x3013	12307	Node2's tonemap (low 16 bits)	

0x3014	12308	Node3's tonemap (high 16 bits)	
0x3015	12309	Node3's tonemap (low 16 bits)	
0x3016	12310	Node4's tonemap (high 16 bits)	
0x3017	12311	Node4's tonemap (low 16 bits)	
0x3018	12312	Node5's tonemap (high 16 bits)	
0x3019	12313	Node5's tonemap (low 16 bits)	
0x301A	12314	Node6's tonemap (high 16 bits)	
0x301B	12315	Node6's tonemap (low 16 bits)	
0x301C	12316	Node7's tonemap (high 16 bits)	
0x301D	12317	Node7's tonemap (low 16 bits)	
0x301E	12318	Node8's tonemap (high 16 bits)	
0x301F	12319	Node8's tonemap (low 16 bits)	
0x3020	12320	Node9's tonemap (high 16 bits)	
0x3021	12321	Node9's tonemap (low 16 bits)	
0x3022	12322	Node10's tonemap (high 16 bits)	
0x3023	12323	Node10's tonemap (low 16 bits)	
0x3024	12324	Node11's tonemap (high 16 bits)	
0x3025	12325	Node11's tonemap (low 16 bits)	
0x3026	12326	Node12's tonemap (high 16 bits)	
0x3027	12327	Node12's tonemap (low 16 bits)	
0x3028	12328	Node13's tonemap (high 16 bits)	
0x3029	12329	Node13's tonemap (low 16 bits)	
0x302A	12330	Node14's tonemap (high 16 bits)	
0x302B	12331	Node14's tonemap (low 16 bits)	
0x302C	12332	Node15's tonemap (high 16 bits)	

0x302D	12333	Node15's tonemap (low 16 bits)	
0x302E	12334	Node16's tonemap (high 16 bits)	
0x302F	12335	Node16's tonemap (low 16 bits)	
	…	…	
0x3040	12352	Node24's tonemap (high 16 bits)	
0x3041	12353	Node24's tonemap (low 16 bits)	
Reserved	…	…	…
0x3050	12368	Communication quality of node 1	Range 0--9,9 means the best communication quality
0x3051	12369	Communication quality of node 2	Range 0--9,9 means the best communication quality
0x3052	12370	Communication quality of node 3	Range 0--9,9 means the best communication quality
0x3053	12371	Communication quality of node 4	Range 0--9,9 means the best communication quality
0x3054	12372	Communication quality of node 5	Range 0--9,9 means the best communication quality
0x3055	12373	Communication quality of node 6	Range 0--9,9 means the best communication quality
0x3056	12374	Communication quality of node 7	Range 0--9,9 means the best communication quality
0x3057	12375	Communication quality of node 8	Range 0--9,9 means the best communication quality
0x3058	12376	Communication quality of node 9	Range 0--9,9 means the best communication quality
0x3059	12377	Communication quality of node 10	Range 0--9,9 means the best communication quality
0x305A	12378	Communication quality of node 11	Range 0--9,9 means the best communication quality
0x305B	12379	Communication quality of node 12	Range 0--9,9 means the best communication quality
0x305C	12380	Communication quality of node 13	Range 0--9,9 means the best communication quality

0x305D	12381	Communication quality of node 14	Range 0--9,9 means the best communication quality
0x305E	12382	Communication quality of node 15	Range 0--9,9 means the best communication quality
0x305F	12383	Communication quality of node 16	Range 0--9,9 means the best communication quality
	...	...	...
0x3067	12391	Communication quality of node 24	Range 0--9,9 means the best communication quality
Reserved	...	...	...
0x3068	12392	Connection quality of node 1	The range is 0--255, the larger the value, the better the connection quality
0x3069	12393	Connection quality of node 2	The range is 0--255, the larger the value, the better the connection quality
0x306A	12394	Connection quality of node 3	The range is 0--255, the larger the value, the better the connection quality
0x306B	12395	Connection quality of node 4	The range is 0--255, the larger the value, the better the connection quality
0x306C	12396	Connection quality of node 5	The range is 0--255, the larger the value, the better the connection quality
0x306D	12397	Connection quality of node 6	The range is 0--255, the larger the value, the better the connection quality
0x306E	12398	Connection quality of node 7	The range is 0--255, the larger the value, the better the connection quality
0x306F	12399	Connection quality of node 8	The range is 0--255, the larger the value, the better the connection quality
0x3070	12400	Connection quality of node 9	The range is 0--255, the larger the value, the better the connection quality
0x3071	12401	Connection quality of node 10	The range is 0--255, the larger the value, the better the connection quality
0x3072	12402	Connection quality of node 11	The range is 0--255, the larger the value, the better the connection quality
0x3073	12403	Connection quality of node 12	The range is 0--255, the larger the value, the better the connection quality
0x3074	12404	Connection quality of node 13	The range is 0--255, the larger the value, the better the connection quality
0x3075	12405	Connection quality of node 14	The range is 0--255, the larger the value, the better the connection quality

0x3076	12406	Connection quality of node 15	The range is 0--255, the larger the value, the better the connection quality
0x3077	12407	Connection quality of node 16	The range is 0--255, the larger the value, the better the connection quality
	...	...	...
0x307F	12415	Connection quality of node 24	The range is 0--255, the larger the value, the better the connection quality
Reserved	...	...	...
0x3080	12416	Number of packets received from node 1	
0x3081	12417	Number of packets received from node 2	
0x3082	12418	Number of packets received from node 3	
0x3083	12419	Number of packets received from node 4	
0x3084	12420	Number of packets received from node 5	
0x3085	12421	Number of packets received from node 6	
0x3086	12422	Number of packets received from node 7	
0x3087	12423	Number of packets received from node 8	
0x3088	12424	Number of packets received from node 9	
0x3089	12425	Number of packets received from node 10	
0x308A	12426	Number of packets received from node 11	
0x308B	12427	Number of packets received from node 12	
0x308C	12428	Number of packets received from node 13	
0x308D	12429	Number of packets received from node 14	
0x308E	12430	Number of packets received from node 15	

0x308F	12431	Number of packets received from node 16	
	…	…	…
0x3097	12439	Number of packets received from node 24	
Reserved	…	…	…
0x4000 ~ 0x4050	16384 ~ 16464	Read node 1 data	
Reserved	…	…	…
0x4100 ~ 0x4150	16640 ~ 16720	Read node 2 data	
Reserved	…	…	…
0x4200 ~ 0x4250	16896 ~ 16976	Read node 3 data	
Reserved	…	…	…
0x4300 ~ 0x4350	17152 ~ 17232	Read node 4 data	
Reserved	…	…	…
0x4400 ~ 0x4450	17408 ~ 17488	Read node 5 data	
Reserved	…	…	…
0x4500 ~ 0x4550	17664 ~ 17744	Read node 6 data	
Reserved	…	…	…
0x4600 ~ 0x4650	17920 ~ 18000	Read node 7 data	
Reserved	…	…	…
0x4700 ~ 0x4750	18176 ~ 18256	Read node 8 data	
Reserved	…	…	…

0x4800 ~ 0x4850	18432 ~ 18512	Read node 9 data	
Reserved	...	...	...
0x4900 ~ 0x4950	18688 ~ 18768	Read node 10 data	
Reserved	...	...	...
0x4A00 ~ 0x4A50	18944 ~ 19024	Read node 11 data	
Reserved	...	...	...
0x4B00 ~ 0x4B50	19200 ~ 19280	Read node 12 data	
Reserved	...	...	...
0x4C00 ~ 0x4C50	19456 ~ 19536	Read node 13 data	
Reserved	...	...	...
0x4D00 ~ 0x4D50	19712 ~ 19792	Read node 14 data	
Reserved	...	...	...
0x4E00 ~ 0x4E50	19968 ~ 20048	Read node 15 data	
Reserved	...	...	...
0x4F00 ~ 0x4F50	20224 ~ 20304	Read node 16 data	
Reserved	...	...	...
0x5000 ~ 0x5050	20580 ~ 20560	Read node 17 data	
Reserved	...	...	...
0x5100 ~	20736 ~	Read node 18 data	

0x5150	20816		
Reserved	...	...	...
0x5200 ~ 0x5250	20992 ~ 21072	Read node 19 data	
Reserved	...	...	...
0x5300 ~ 0x5350	21284 ~ 21328	Read node 20 data	
Reserved	...	...	...
0x5400 ~ 0x5450	21504 ~ 21584	Read node 21 data	
Reserved	...	...	...
0x5500 ~ 0x5550	21760 ~ 21840	Read node 22 data	
Reserved	...	...	...
0x5600 ~ 0x5650	22016 ~ 22096	Read node 23 data	
Reserved	...	...	...
0x5700 ~ 0x5750	22272 ~ 22352	Read node 24 data	
Reserved	...	...	...

Function code 06

Modbus address		Function description	instruction
Hex	Decimal		
0x3000	12288	Setting up TEI	0-99
0x3002	12290	Set working mode	Low byte is valid, 1: gateway mode, 0: node mode, others are invalid
0x3003	12291	Set up BAND	0: CEN-A 1: CEN_B 3: FCC
0x3004	12292	Write tonemap (high 16 bits)	The tonemap is 3 bytes in size and requires two register descriptions PLC setting interface When BAND is CEN_A, the range of tonemap values can be set to 0--0x3F (inclusive) When BAND is FCC, set the range of tonemap value to 0--0xFFFFFF (inclusive)
0x3005	12293	Write tonemap (low 16 bits)	
0x3006	12294	Send test data once	Used for production test, this register is not 0, send test data once
0x3007	12295	Set test mode	0: Normal mode, 1: Test mode, resume normal mode after power on again

The data of PLC node 1 is as follows, the data of other nodes are similar:

Modbus address		Function description	Data Type	instruction
Hex	Decimal			
0x4000	16384	bus voltage	Unsigned Short	Unit V, default 0
0x4001	16385	Temperature sensor 1	Short	Unit: 0.1 ° C, default -500
0x4002	16386	Temperature sensor 2	Short	Unit: 0.1 ° C, default -500
0x4003	16387	Switch input	Unsigned Short	bit0: DI1, bit1: DI2, bit2: DI3, bit3: DI4 0: open, 1: closed, default 0
0x4004	16388	Quantity of online Hall channels	Unsigned Short	Shows the quantity of Hall channels currently connected. default 0
0x4005	16389	The high 16bit of the total generated energy	Unsigned Short	
0x4006	16390	The low 16bit of the total generated energy	Unsigned Short	
0x4007	16391	Total reverse current	Short	Unit is 10mA, default is 0
0x4008	16392	Total current	Short	Unit is 10mA, default is 0
0x4009	16393	Average current	Short	Unit mA, default 0
0x400a ~ 0x4029	16394 ~ 16425	Channel 1 to 24 current	Short	Unit mA, default 0
0x402a	-	-	-	-
0x402b	-	-	-	-
0x402c	-	-	-	-
0x402d	16429	Alarm status 1	Unsigned Short	Bit0 bus arc, bit1 channel arc, bit2 low voltage, bit3 high voltage, bit4 high temperature 1,

				bit5 high temperature 2,
				bit6 channel current value reverse
				bit7 total reverse current is high,
				bit8 total current is low,
				bit9 total current is high,
				bit10 channel current value is zero,
				bit11 channel current value undercurrent
				bit12 channel current value overcurrent
				bit13 channel current value is low
				bit14 channel current value is high
				0: no alarm, 1: alarm, default 0
0x402e	16430	Alarm status 2	Unsigned Short	bit0: DI1 bit1: DI2 bit2: DI3 bit3: DI4 0: no alarm, 1: alarm, default 0
0x402f	16431	Alarm status 3	Unsigned Short	bit15: Total alarm status (not open) For alarm status 3 extension
0x4030	16432	Channel 1 ~ 16 arc alarm	Unsigned Short	Default 0 0: No alarm, 1: Alarm
0x4031	16433	Channel 17 ~ 24 arc alarm	Unsigned Short	Default 0 0: No alarm, 1: Alarm
0x4032	16434	The quantity of Bus arc history alarm	Unsigned Short	If the current channel alarms continuously, the value will increase by 1. If there are alarms on other channels, the count will restart.
0x4033 ~ 0x404a	16435 ~ 16458	The quantity of Channel 1~24 arc history alarm	Unsigned Short	This value is incremented by 1 for each channel arc alarm. default 0

Version history

version	description	date
V1.0	create	2019.4.16
V1.1	Increase total power generation	2019.10.10
V1.2	Delete upload channel alarm times	2019.10.14
V1.3	Rebase A025 Increase the number of nodes Increase network number	2019.11.28
V1.4	Optimize power generation statistics Fix node number issue	2019.12.04
V1.5	Register address update	2019.12.20
V1.6	Update of PLC wiring of combiner box Maximum number of supported nodes updated to 24	2019.12.26
V1.7	Appearance size diagram, networking diagram, interface diagram update	2020.1.8

Contact us

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