AC/DC 2000W CRPS SERVER POWER SUPPLY

LMS2000-P12B

MORNSUN®

RoHS

FEATURES

- Input voltage range: 90 - 264VAC and supports AC & HVDC wide voltage range input
- Operating ambient temperature range: -5℃ to +55℃
- 80 PLUS Platinum efficiency
- N+M Intelligent redundancy N+M≤4 (N=3 max, M=2 max)
- Active current sharing function
- PMBus / I2C communication function
- Black box function
- Over-current alarm, over-current / short-circuit / over-voltage / under-voltage protection, over-temperature protection, fan-fault protection
- Design refer to UL/EN/IEC62368, GB4943

LMS2000-P12B product is the server power supply provided by for customers. It supports AC & HVDC wide voltage range input, hot-plug available and parallel using requirements. It features high efficiency, intelligent backup function, anti-backflow, remote compensation. With PMBus / I2C communication function, it can support online monitoring of input / output voltage / current / power, with fault warning, black box and other functions. The power supply is equipped with a fan for heat dissipation,with a suction heat dissipation mode,and the fan adopts an automatic speed regulation design.EMC and safety specifications meet the standards of UL/EN/IEC62368 and GB4943.

Selection Guide

Part No.*	Rated input voltage	Fan Operation Type	Output Power *(W)	nominal Output Voltage(VDC)		Main Load(A)		Auxiliary Load(A)	Max. Capacitive Load (μF)	
				Main Circuit	Auxiliary Circuit	Min.	Max.	Typ.	Main Circuit	Auxiliary Circuit
LMS2000-P12B	90-140VAC	Forward airflow, from DC to AC	1000	12.2	12.0	1	82.3	3.0	50000	3100
	180-207VAC 180-230VDC		1800			1	150	3.0		
	207-264VAC 230-320VDC		2000			1	163	3.0		

Note: 1.*The maximum power of high-voltage input shall not exceed 1600W, and the maximum power of low-voltage input shall not exceed 1000W;
2.*The product picture is for reference only. For details, please refer to the actual product.

Input Specifications

Item	Operating Conditions			Min.	Typ.	Max.	Unit
Input Voltage Range	Low voltage ac input			90	115	140	VAC
	High voltage ac input			180	230	264	
	DC input			180	240	320	VDC
Input Voltage Frequency	AC input			47	--	63	Hz
Efficiency	TA=25℃, without Fan	Vin: 230VAC/50Hz	10% load	--	89	--	%
			20% load	--	92	--	
			50% load	--	94	--	
			100% load	--	91	--	
Input Current	Vin=115Vac/60Hz Pout=1000W			--	--	12	A
	Vin=230Vac/50Hz Pout=2000W			--	--	10	
Inrush Current	Vin=264Vac/50Hz Pout=2000W		Cold start	--	35	--	
Leakage Current	Vin=264Vac/50Hz			--	--	0.875	mA
Power Factor	Io=10%Imax @ Vin=230Vac/50Hz			0.92	--	--	--
	Io=20%Imax @ Vin=230Vac/50Hz			0.96	--	--	
	Io=50%Imax @ Vin=230Vac/50Hz			0.98	--	--	
	Io=100%Imax @ Vin=230Vac/50Hz			0.99	--	--	

ITHD	5%Imax≤Io≤10%Imax	@ Vin=230Vac/50Hz	--	--	20	%
	10%Imax<Io≤20%Imax	@ Vin=230Vac/50Hz	--	--	15	
	20%Imax<Io≤50%Imax	@ Vin=230Vac/50Hz	--	8	10	
	50%Imax<Io≤100%Imax	@ Vin=230Vac/50Hz	--	--	5	

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Rated Output Voltage	+12V	12.1	12.2	12.3	V
Steady State Output Voltage Range		11.8	12.2	12.6	
Dynamic Output Voltage Range		11.4	--	12.8	
Output Ripple & Noise*		--	--	120	mV
Output Current		1	--	163	A
Current Sharing Accuracy (@400W<Pout< 1000W)		--	--	10	%
Current Sharing Accuracy (@1000W≤Pout≤2000W)		--	--	5	
Hold-up Time		12	--	--	ms
60% load jump; 0.5A/us; Main load parallel 2200uF capacitor with 1A minimum load, auxiliary load parallel 1000uF capacitor		11.4	--	12.8	V
Rated Output Voltage	+12VSB	11.4	12	12.6	V
Steady State Output Voltage Range		11.4	12	12.6	
Dynamic Output Voltage Range		11.4	--	12.8	
Output Ripple & Noise*		--	--	120	mV
Output Current		0	--	3	A
Current Sharing Accuracy (@400W<Pout< 1000W)		--	NA	--	%
Current Sharing Accuracy (@1000W≤Pout≤2000W)		--	NA	--	
Hold-up Time		70	--	--	ms
60% load jump; 0.5A/us; Main load parallel 2200uF capacitor with 1A minimum load, auxiliary load parallel 1000uF capacitor		11.4	--	12.8	V

Note: "Tip and barrel method" is used for ripple and noise test, output parallel 47uF electrolytic capacitor and 0.1uF ceramic capacitor, please refer to Server Power Test Specifications for specific information.

Protective Characteristics

	Item	Min.	Typ.	Max.	Unit	Note
+12V Output	Over-current Alarm(High voltage input)	168	--	175	A	An alarm is generated in the 20s.The main output shuts down in the 2S
	Over-current Alarm(Low voltage input)	85	--	90		
	Over-current Protection 1 (High voltage input)	185	--	210		Blocked, +12VSB output is normal
	Over-current Protection1 (Low voltage input)	94	--	99		
	Over-current Protection 2 (High voltage input)	222	--	236		
	Over-power Protection (High voltage input)	102	--	109		
	Over-power Protection (Low voltage input)	248	--	273		
	Short-circuit Protection	+12.2V output short circuit does not affect the normal operation of +12VSB; The short-circuit protection mode is latching, reset by PSON or AC power off and restart for recovery				
	Over-voltage Protection	13.5	--	15.0	V	Latching, reset by PSON#, AC power off and restart for recovery
	Under-voltage Protection	9.5	--	11		Self-recover

	Over Temperature Alarm Point	60	--	65	℃	Over-temperature protection hysteresis greater than 4℃.Self-recover
	Over-temperature Protection Point	--	--	70		
	Over-temperature Protection Release	58	--	--		
	Clear- point of the over-temperature alarm	55	--	--		
	Fan-fault Protection	When the fan is faulty, the output is turned off. After the fault is rectified, the output automatically recovers				
+12VSB Output	Over-current Alarm	3.2	--	4	A	Alarm
	Over-current Protection	4	--	5		Self-recovery (main output will be protected/self-recovery together)
	Short-circuit Protection	Self-recovery (main output will be protected/self-recovery together)				
	Over-voltage Protection	13.5	--	15	V	Self-recovery (main output will be protected/self-recovery together)

LED Indicator Light

Power Status	Light Status
Power output normal	Green
All power supplies no AC input	Light off
When the fan is faulty, the output is turned off. After the fault is rectified, the AC input is automatically restored to normal. Only the slave machine with +12VSB output or in cold redundancy mode is asleep	The green light flashes at a frequency of 1Hz
One product no AC input, the other one with AC input	Orange
Product failure lead to output off, such as OVP, OCP, Fan Fault	Orange
Product in alarm status but with output on	The orange light flashes at a frequency of 1Hz
The module enters the firmware upgrade mode	The green light flashes at a frequency of 2Hz

Data Online Reading and Monitoring

Item	Accuracy Range		
Output Load	<10%	10%-30%	30%-100%
Input Voltage	±3%	±3%	±3%
Input Current	NA	±0.5A	±10% or ±0.5A
Input Power	NA	±5%or ±12W	±3%
Output Voltage	±5%	±3%	±3%
Output Current	NA	±10%	±5%
Output Power	NA	±10%	±5%

Timing Definition

Item	Description	Min.	Max.	Unit
Tvout_rise	Time for +12.2V output to rise from 0 to 10.8V	5	70	ms
	Time for +12VSB output to rise from 0 to 10.8V	1	25	
Tsb_on_delay	Time from AC power on to +12VSB output reaching at 10.8V	--	1500	
Tac_on_delay	Time from AC power on to +12.2V output reaching at 10.8V	--	2500	
Tvout_holdup	Time from AC power off to +12.2V output reaching at 10.8V@90%Load	12	--	
Tpwok_holdup	Time from AC power off to PWOK signal decreasing@90%Load	11	--	
Tpson_on_delay	Time from high to low of PSON# signal to +12.2V output reaching at 10.8V	5	400	
Tpson_pwok	Time from low to high of PSON# signal to PWOK signal becoming low-level	--	5	
Tpwok_on	Time from +12.2V output reaching at 10.8V to PWOK signal becoming high-level	100	500	
Tpwok_off	Time from PWOK signal becoming low-level to +12.2V output dropping to 10.8V	1	--	
Tpwok_low	Time from PWOK signal becoming low-level to when the PWOK signal	100	--	

	increases through the PSON switch or AC restart			
Tsb_vout	Time from +12VSB output reaching at 10.8V to +12.2V output reaching at 10.8V	50	1000	
T12VSB_holdup	Time from AC power off to +12VSB output voltage dropping to 10.8V	70	--	

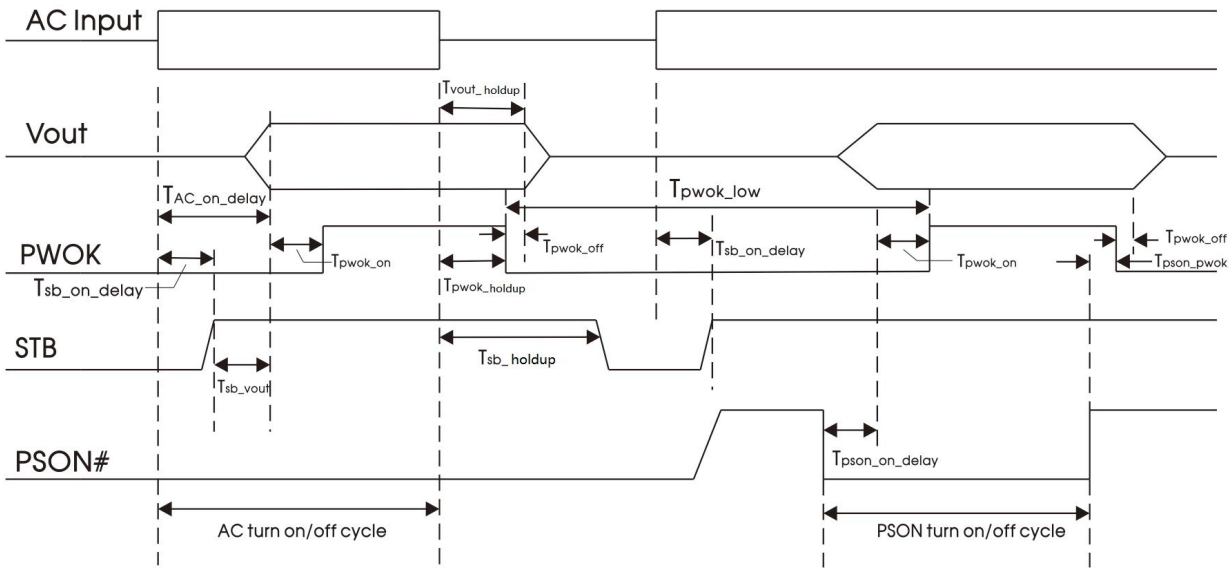
General Specifications

Item		Operating Conditions		Min.	Typ.	Max.	Unit
Isolation Test	Input - ⏚	Electric strength test for 1min., leakage current <5mA		1500	--	--	VAC
	Input - Output*	Electric strength test for 1min., leakage current <10mA		3000	--	--	
Insulation Resistance	Input - ⏚	Ambient temperature: 25 ± 5℃ Relative humidity: < 95%RH, no condensation Test voltage: 500VDC		50	--	--	MΩ
	Input - Output						
Operating Temperature				-5	--	55	℃
Storage Temperature				-40	--	70	
Operating Humidity		Non-condensing		--	--	90	%RH
Storage Humidity				--	--	95	
Operating Altitude				--	--	5000	m
Storage Ambient Height				--	--	15200	
Hot-plug		1. 0.5m/s≤speed≤1m/s, the backplane voltage cannot exceed the dynamic specification of the power module during hot-plug process; 2. Add 1000uF capacitive load at the output.	+12V	11.6	--	12.8	V
			+12VSB	11.4	--	12.8	
MTBF		Rated input, 100% load @ 25℃ Evaluated by Telcordia SR-332	>500,000 h				
Safety Standards		Design refer to UL/EN/IEC62368-1, GB4943.1					
Communication Method		PMBus / I2C					
Warranty		5 years					
Note: * Input-Output isolation voltage refer to PCBA only.							

Mechanical Specifications

Case Material	Metal (SGCC)
Dimensions*	73.50mm x 185.00mm x 40.00/39.00mm (W x D x H)
Weight	950g (Typ.)
Cooling Method	Forced-air cooling
Note: *Tips:Module power supply built-in fan, not air.	

Timing Diagram



Electromagnetic Compatibility (EMC)

Emissions (EMI)	CE	CISPR32/EN55032 CLASS A	
	RE	CISPR32/EN55032 CLASS A	
	Harmonic current	IEC/EN61000-3-2 CLASS A	
Immunity (EMS)	ESD	IEC/EN61000-4-2 Contact ±8KV/Air ±15KV	perf. Criteria A
	RS	IEC/EN61000-4-3 10V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4 Input port: ±2KV	perf. Criteria A
		IEC/EN61000-4-4 Output port: ±1KV	perf. Criteria A
	Surge	IEC/EN61000-4-5 line to line ±1KV 2Ω /line to ground ±2KV 12Ω	perf. Criteria A
	CS	IEC/EN61000-4-6 3Vrms	perf. Criteria A
	Voltage dips, interruption	IEC/EN61000-4-11 >95% dip 0.5 periods	perf. Criteria A

Functional Requirements Of Black Box

General requirements of black box	1. It is necessary to record the alarm when the output is turned off and the input power is down, the alarm status and the time of the fault occur are stored, and the important physical quantities at the fault site are saved and queried, including not limited to input voltage, output voltage, output current, temperature, fan speed, etc. Use the circular storage method (the black box information is written on the current index number +1 in case of failure, and when the index number is "record 9", the next line is written to "record 0"). 2. Support the host to query fault records one by one. Support the host to query the latest input power failure time. 3. Support host timing. The host needs to send the system time (time according to the Unix standard) to the power module, and the send it again every 10 minutes for the time synchronization of the power module. If the host is not timed, the time in the power supply is equivalent to the entire cumulative time of power supply work.				
Storage and reading mechanism of black box records	Described from the time dimension, it is divided into the following stages: 1. Power-up initialization stage After powering on, read the historical fault of the EEPROM record into the cache, and the time is initialized to the last fault record plus 3 seconds. 2. Fault site storage stage The upper computer timings the power time (10min/time), when the output is turned off, the enabling fault record mark writes all the fault scene data to the EEPROM to generate a fault record. 3. Fault data reporting stage When the upper computer queries the alarm log, each time a single query is made, the lower computer takes the corresponding data from the EEPROM storage area and uploads it all to the upper computer.				
Black box	Command	Name of the	Data reading	Data bytes	Description of the order

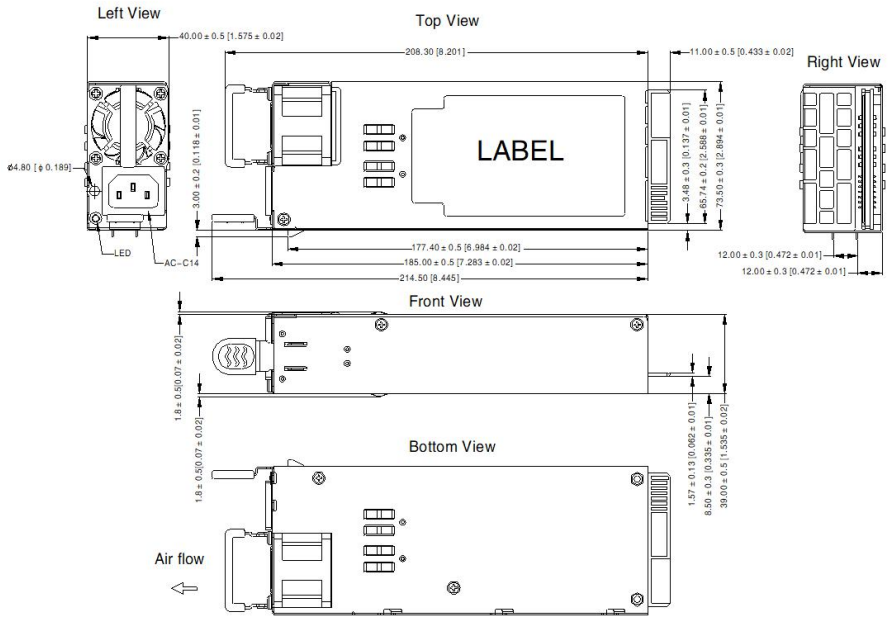
reading protocol		command	type		
	D2h	MFR_READ_BLACK_BOX	Block Read	100	Power supply black box query, Reading: multi-byte (fault record information, you need to write the fault index before reading, 0-9, 0 is the latest record. 9 is the earliest record)
	D3h	MFR_READ_BLACK_BOX_INDEX	Write Byte	1	Write: single byte (request to read the index of the fault record)
System timing mechanism in the black box	The power module needs to be time synchronized through host: Product: -- Synchronization -- Time to send the power module every 10 minutes -- The time to send is in seconds Power supply: -- The initialization time of one power on is equal to the last failure time +3 seconds -- Time synchronization of accepting products -- Interrupt timing, every 1second, the counter is increased by 1, and the time unit is seconds The timing time (time according to the Unix standard) is the number of seconds relative to the base time. The delivery time under the host will be sent to the power supply from the number of seconds from the base time to the current time. The time read in the alarm log is the number of seconds from the base time of the alarm. If the host is not given time, the running time of the power supply will increase by seconds, and the power drop needs to be saved.				
Black box data content	The black box records the real-time physical quantity and state data of the scene. The storage content is divided into two parts: the head and the data department. Each record contains 100 bytes of data.				

Gold-finger Definition

Output Terminal	Definition	Output Terminal	Definition
A1-A9	SGND	B1-B9	SGND
A10-A18	+12.2V	B10-B18	+12.2V
A19	PMBus_SDA	B19	A0
A20	PMBus_SCL	B20	A1
A21	PSON#	B21	+12VSB
A22	SMBAlert#	B22	SMART_ON
A23	+12V_Return sense	B23	+12V_Sharebus#
A24	+12V_Remote sense	B24	PRESENT#
A25	PWOK	B25	VIN_GOOD

Note: The product is equipped with a built-in cooling fan, Keep the air intake clear of Debris, If the environment cannot meet this requirement, a fanless model is recommended.

Dimensions and Recommended Layout



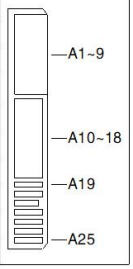
THIRD ANGLE PROJECTION

AC-C14 Pin-Out	
Pin	Mark
1	AC(L)
2	⏚
3	AC(N)

Picture

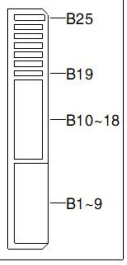
Goldfinger Pin-Out(Top)	
Pin	Mark
A1~9	SGND
A10~18	+12.2V
A19	PMBus_SDA
A20	PMBus_SCL
A21	PSON
A22	SMBAlert#
A23	+12V_Return sense
A24	+12V_Remote sense
A25	PWOK

Picture



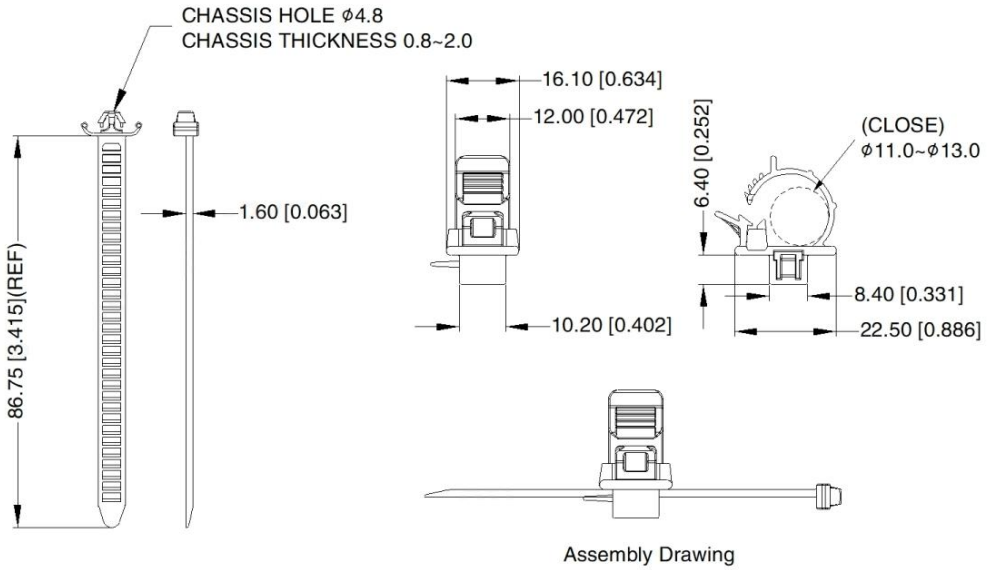
Goldfinger Pin-Out(Bottom)	
Pin	Mark
B1~9	SGND
B10~18	+12.2V
B19	A0
B20	A1
B21	+12VSB
B22	SMART_ON
B23	+12V_Sharebus#
B24	PRESENT#
B25	VIN_GOOD

Picture



Note:
Unit: mm[inch]
General tolerances: ±2[±0.078]

Recommended Tie Type



Assembly Drawing

Note:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58220607;
2. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity <75%RH with nominal input voltage and rated output load;
3. The room temperature derating of 1℃/300m is needed for operating altitude greater than 2000m;
4. All index testing methods in this datasheet are based on our company corporate standards;
5. In order to improve the efficiency at high input voltage, there will be audible noise generated, but it does not affect product performance and reliability;
6. We can provide product customization service, please contact our technicians directly for specific information;
7. Products are related to laws and regulations: see "Features" and "EMC";
8. The out case needs to be connected to PE (⏚)of system when the terminal equipment in operating;
9. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units;
10. The power supply is considered a component which will be installed into a terminal equipment. All EMC tests should be confirmed with the final equipment. Please consult our FAE for EMC test operation instructions.

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LMS2000-P12B Server Power Application Manual

Catalogue

1 Functional Manual

1.1 Input Requirements

The AC input voltage and DC input voltage must be within the defined voltage range (refer to the data sheet), otherwise the power supply may not function properly or even malfunction.

A 250V/16A fuse has been connected in series between the L1 and N wires inside the power module.

1.2 Output Requirements

Under any output voltage value, for long-term normal operation, the maximum output current and power must not exceed the rated/specified value. The output current must not exceed the maximum output current value.

1.3 Output Over-Voltage Protection

1.3.1 Main circuit output over-voltage protection

The over-voltage protection function is to turn off the main circuit output when the output voltage reaches the protection voltage value. When over-voltage protection occurs, the module output voltage is turned off and the output is locked. When the input restarts or PSON# closes again, the output restarts.

1.3.2 Auxiliary Circuit Output Over-Voltage Protection

Project	Working Conditions	Min.	Typ.	Max.	Protection Method
Output over-voltage protection	Full voltage, full load, full temperature	13.5V	--	15V	Self recovery of single machine operation; Parallel operation locking, reset through PSON#, AC power outage restart recovery

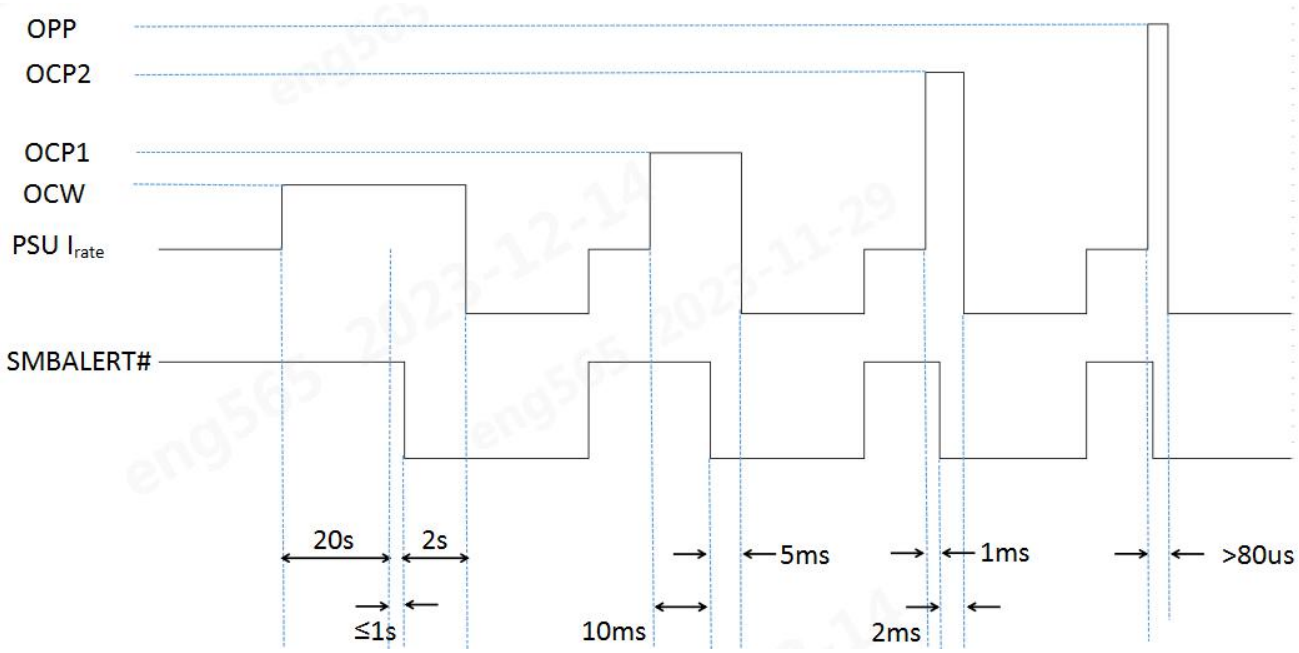
Note: The triggering of over-voltage protection on the auxiliary circuit , the main output circuit also will protect.

1.4 Output Over-Current Protection, Output Short Circuit Protection

1.4.1 Main circuit output over-current protection, short circuit protection

Project	Working Conditions	Min.	Typ.	Max.	Protection Method
Output over-current	Full voltage, full load, full temperature , High voltage input	168A	--	175A	20s after, then 2s the main output off

alarm	Full voltage, full load, full temperature , Low voltage input	85A	--	90A	
Output over-current protection1	Full voltage, full load, full temperature , High voltage input	185A	--	210A	Locked, +12VSB output is normal
	Full voltage, full load, full temperature , Low voltage input	94A	--	99A	
Output over-current protection2	Full voltage, full load, full temperature , High voltage input	222A	--	236A	Locked, +12VSB output is normal
	Full voltage, full load, full temperature , Low voltage input	102A	--	109A	
Output Over-power Protection	Full voltage, full load, full temperature , High voltage input	248A	--	273A	Locked, +12VSB output is normal
	Full voltage, full load, full temperature , Low voltage input	115A	--	--	



Output over-current protection

The main circuit output over-current protection is divided into four stages. The first stage is over-current alarm (OCW). When the output current is in the 168A-175A range（85A-90A at Low Voltage input）, it continuously detects for 20 seconds. After 20 seconds, the MCU sets SMBALERT# low, and then After 2 second(Typ.) to turn off the main circuit LLC drive; The second stage-over-current protection 1 (OCP1), when the output current is between 185A-210A（94A-99A at Low Voltage input）, continuously detects that it is still in this range for 10ms(Typ.). The MCU sets the SMBALERT# low and delays for another 5ms(Typ.) to turn off the main circuit LLC drive; The third stage-over-current protection 2 (OCP2), when the output current is between 222A-236A（102A-109A at Low Voltage input）, continuously detects that it is still in this range for 1ms(Typ.). The MCU sets the SMBALERT# low and delays for another 2ms(Typ.) to turn off the main circuit LLC drive; The forth stage-Overpower Protection (OPP), when the sampling output current of the secondary MCU is between 248A-273A（＞115A at Low Voltage input）, the LED_ AMBER goes high, MCU will quickly set SMBALERT# low, and then delay for more than 80uS to turn off the main LLC drive. Self locking and no output caused by over-voltage, over-current, overpower, short circuit, etc. in the power supply; the power supply will be locked and the fault status will be reported to the system. The triggering of over-current or short circuit protection on the main circuit does not affect the normal operation of the auxiliary circuit.

1.4.2 Auxiliary Circuit Output Over-Current Protection, Short Circuit Protection

Project	Working Conditions	Min.	Typ.	Max.	Protection Method
Output over-current alarm	Full voltage, full load, full temperature	3.2A	--	4A	Alarm
Output over-current protection	Full voltage, full load, full temperature	4A	--	5A	Self recovery
Short circuit protection	When there is a short circuit in the +12VSB output, +12V and +12VSB will be powered off together, After +12VSB detects three consecutive short circuits, +12V and +12VSB will be locked and restored through PSON reset or AC power-off restart				

1.5 Over Temperature Protection (OTP)

When the ambient temperature of the power supply exceeds the rated temperature for a period of time, the power supply will be turned off and output will enter a locked state. After the ambient temperature drops to the set value, the power supply will resume normal operation.

1.6 Output Power Derating

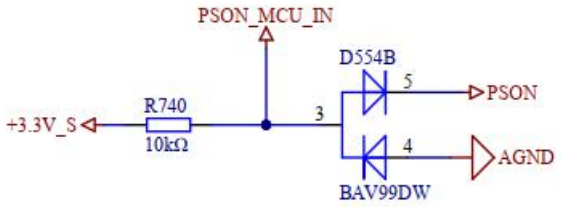
Part No.	Rated input voltage	Fan Operation Type	Output Power (W)	nominal Output Voltage(VDC)		Main Load(A)		Auxiliary Load(A)
				Main Circuit	Auxiliary Circuit	Min.	Max.	Typ.
LMS2000-P12B	100-127VAC	Forward airflow, from DC to AC	1000	12.2	12.0	1	82.3	3.0
	200-230VAC		1800			1	150	3.0
	230-240VAC 240VDC		2000			1	163	3.0

1.7 PSON# (Pin A21)

The PSON# signal is a switch signal used to remotely control the main output of the power module. The PSON# signal defaults to low level active (the active level can be configured by software).

When the PSON# signal is a valid level, the main output of the power module enters the normal output mode. When PS ON# is invalid, the main output is turned off.

PSON# logic principle



PSON# Signal Characteristics

Signal Type	Main output
PSON#=active level	Main output mode
PSON#=invalid	Main output off

PSON# Output

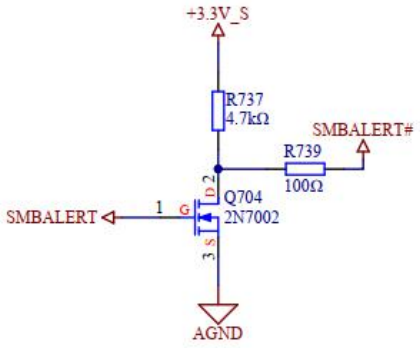
PSON# Output	Min.	Max.
Low level	0V	1V
High level	2.0V	3.465V

1.8 SMBAlert# Signal (Pin A22)

The SMBAlert# signal is a power module alarm interrupt signal, with high level indicating normal power

module operation and low level indicating power module alarms (such as abnormal input and output of the power module, over temperature protection, output overvoltage, fan fault, etc.).

SMBAlert# Logic Principles



SMBAlert# Signal Characteristics

Signal Type	
SMBAlert#=high level	Power module is normal
SMBAlert#=low level	Power module has an alarm

SMBAlert# output

SMBAlert# output	Min.	Max.
Low level	0V	0.4V
High level	2.4V	3.46V

Remarks: 1. When the SMBAlert# signal is set low, the indicator light will always light up orange or the orange light will flash;

2. When the power module triggers an over temperature alarm, set the SMBAlert# signal and PMBus related flags low and do not turn off the power module;

3. When the power module triggers over temperature protection, turn off the power module and set the low PMBus related flag bit at the same time.

1.9 Remote Compensation (Pin A23, A24)

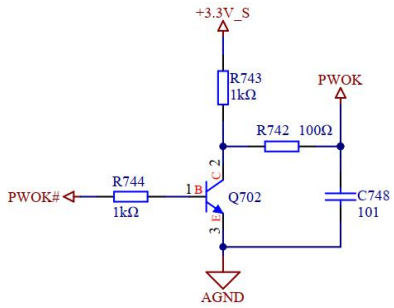
The power supply has 12V on pin A23_ Return sense to adjust the grounding drop of the main output voltage in the system.

The power supply has 12V on pin A24_ Remote sense to adjust the+12V drop of the main output voltage in the system.

1.10 PWOK Signal (Pin A25)

PWOK outputs a normal indication signal for the main circuit. High level main output is normal, while low level main output is abnormal.

PWOK Logic Principle



PWOK Signal Characteristics

Signal Type	Main output
PWOK=high level	The main output of the power supply is normal
PWOK=low level	Abnormal output of power main circuit

PWOK Output

PWOK Output	Min.	Max.
low level	0V	0.4V
high level	2.4V	3.46V

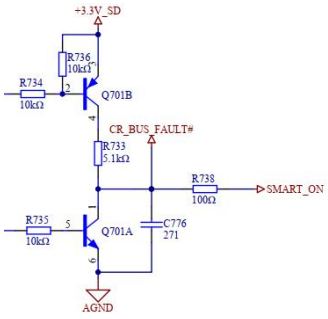
1.11 SMART_ON Signal (Pin B22)

The SMART_ON signal is the cold standby wake-up signal of the power module, which defaults to low level. SMART_Set the ON signal high and issue a standby command (0x02/0x03/0x04/0x05) to enter standby mode.

When the host malfunctions, the microcontroller will SMART_ON signal set low, wake up standby machine.

System side: Connect this signal directly together on the power backplane.

SMART_ON Principles of Logic



SMART_ON Signal Characteristics

Signal Type	Power Input/Output Signal
SMART_ON=low level	Power module exits cold standby mode

SMART_ON=high level	Power module enters cold standby mode

SMART_ON Output

SMART_ON Output	Min.	Max.
low level	0V	0.8V
high level	2.0V	3.6V

1.12 +12V_Sharebus# Signal (Pin B23)

+12V_ Sharebus# is a 12V main circuit output current sharing signal, which is connected together on the system backplane.

Power module side: internal current sharing bus.

System side: Connect the +12V_ Sharebus# signals of all power modules directly together on the system backplane.

1.13 PRESENT# Signal (Pin B24)

The PRESENT# signal is used by the system to detect whether the power module is in place. When PRESENT# is low, the power module is in place.

System side: pull-up voltage 3.3V; Power module side: directly grounded through a 100 Ω resistor.

1.14 PMbus_SDA (Pin A19)

PMbus data: Connected to +3.3V through a 20kΩ resistor inside the PSU.

1.15 PMbus_SCL (Pin A20)

PMbus clock: Connected to +3.3V through a 20kΩ resistor inside the PSU.

1.16 A0 (Pin B19)

Address bit 0: Connected to +3.3V through a 10kΩ resistor inside the PSU.

1.17 A1 (Pin B20)

Address bit 1: Connected to +3.3V through a 10kΩ resistor inside the PSU.

1.18 Cold Backup

The power module has redundant backup function, supporting 1+1, 2+1, 3+1, and 2+2 backups.

When the power module is in the 1+1, 2+1, 3+1, or 2+2 backup working state, it can enter the cold backup state to save energy. The cold standby function has efficiency optimization function, allowing for

the entry and exit of cold standby mode at the optimal efficiency point.

Conditions for entering cold standby mode:

BMC uses the D0h command to write a value of D0h(0x01) to make one of the power modules enter the cold standby host state, and then BMC uses the D0h command to write values of 0x02 - 0x04 to other power modules to make other machines enter the cold standby standby state. When the standby power module detects the SMART of the host power module_ After ON is set to high level, the standby machine enters cold standby mode.

The system detects the voltage of the current sharing bus and can issue different commands to put the power module in different cold standby states.

Standby command	State	Exit the load point of the cold standby machine
0x00	Cold standby host	--
0x01	Standard mode	--
0x02	Cold standby machine 1	⩾ 40% of the rated load of a single power module (with a current sharing bus voltage greater than 3.2V)
0x03	Cold standby machine 2	⩾ 62.5% of the rated load of a single power module (with a current sharing bus voltage greater than 5V)
0x04	Cold standby machine 3	⩾ 84% of the rated load of a single power module (current sharing bus voltage greater than 6.7V)
0x05	Standing mode	Invalid rate optimization function (0x05 command is in standby mode, only exiting the standby machine in case of host failure)

Conditions for exiting cold standby mode:

- Power supply system issues commands
- AC input power failure
- PSON# converting from low level to high level
- Power module failure
- The load is greater than the load point at which the backup machine exits
- Power module MCU restart
- SMART_ON is low level

Note: If any of the above conditions are met, you can exit the cold standby mode.

Requirements for power module in cold standby state

- PWOK is high level
- Do not report PMBUS faults or alarms

Cold standby function requirements for power supply system BMC:

BMC uses cold standby control commands to define the switch and status of the power module's cold standby mode. BMC rotates the host, cold standby machine 1, cold standby machine 2, and cold standby machine 3 to ensure that each power module carries equal load throughout its lifespan.

1.19 Parallel Fault Isolation

Parameter	Min.	Typ.	Max.	Unit	Note
1+1 parallel operation	11.4	-	12.8	V	In the scenario of power module 1+1 parallel power supply (AC+AC, AC+HVDC, HVDC+HVDC), any power module loses power or malfunctions (input power failure, input line plugging, input over-voltage/under-voltage, output slow over-voltage, fan failure or overheating), and the output voltage of the 12V main circuit is not less than 11.4V. Explanation: 1. The parallel main circuit has a 12V output terminal and a 1000uF capacitor; The total load of the 2 .1+1 current sharing scenario is 100% of the rated load of a single power module.
2+2 parallel operation	11.4	-	12.8	V	In the scenario of power module 2+2 parallel power supply (AC+AC, AC+HVDC, HVDC+HVDC), any input has power failure, over-voltage, under-voltage (2+2 backup, two power modules share one input), or one of the power modules has a fault (input power failure, input line plugging, input over-voltage, under-voltage, output slow over-voltage, fan fault or overheating), the output voltage of the 12V main circuit shall not be less than 11.4V. Explanation: 1. The parallel main circuit has a 12V output terminal and a 1000uF capacitor; Under the 2. 2+2 current sharing scenario, the total load shall not exceed 190% of the rated load of a single power module.
2+1/3+1 parallel operation	11.4	-	12.8	V	In the scenario of power module 2+1/3/1 parallel power supply, only single point faults are considered for fault isolation. Explanation: 1. 2+1 scenario: The total load shall not exceed 190% of the rated load of a single power module; 2. 3+1 scenario: The total load shall not exceed 280% of the rated load of a single power module; 3. The above scenario requires a 2200uF capacitive load at the output end of the 12V main circuit.

Explanation:

1. Short circuit before ORing, output end connected in parallel with 2200uF capacitive load test, power module output voltage drop not less than 11.2V;

2. The maximum load of all starting machines shall not exceed the rated full load of a single power module.

1.20 Hot Plug

The power module supports hot swapping and meets CRPS specifications.

Parameter	Output branch	Min.	Max.	Unit	Note
Hot swap voltage	Vo	11.6	12.8	V	1. 0.5m/s ≤ plugging speed ≤ 1m/s, and the backplane voltage cannot exceed the dynamic specifications of the power module during the plugging process. 2. Add 1000uF capacitive load to the output end.
	Vsb	11.4	12.8	V	

Hot swap method

Parameter	Unit
AC input, power module with live plugging	Unplug: Disconnect the AC input and remove the power module from the system.
	Insertion: The power module is not charged and is inserted into the system. The power module is then powered on.

1.21 LED State Indication

LED indicator light	Power status
green	Power output is normal
light off	All power supplies have no AC input
1Hz green light flashing	AC input is normal, only +12VSB output or module is in cold backup state
orange	One module has no AC input, while the other modules have normal AC input
orange	Power module failure causing output shutdown, such as OVP, OCP, OTP, fan failure
1Hz orange light flashing	The module is in an alarm state and still has output

2 Firmware Description

2.1 Number Format

Decimal digits are represented by suffixes d or missing, such as 1234d and 1234;

Hexadecimal digits are represented by the prefix 0x or suffix h, such as 0xAB and ABh;

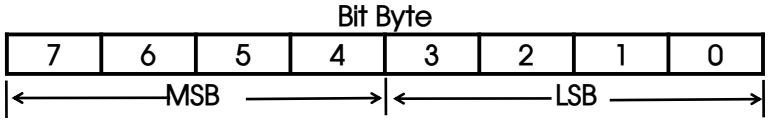
Binary numbers are represented by the suffix b, such as 11010011b.

2.2 Signal Naming

The effective potential is a low level signal identified by the suffix '#', such as SMBALERT#.

2.3 Bit And Byte Order

When transmitting data, the lowest order byte is sent first, followed by the highest order byte. In any byte, the most significant bit MSB is sent first, followed by the least significant bit LSB.



3 Data Formats And Commands

3.1 Linear Data Format

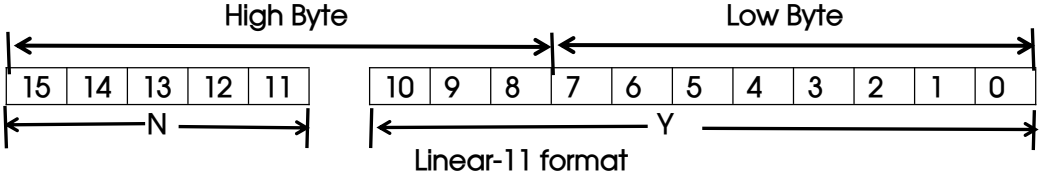
The linear 11 number format is typically used for command and report parameters, such as (but not limited to) the following parameters:

- Output current
- Input voltage
- Input current
- And the voltage of the energy storage capacitor

The LINEAR11 number format is a two byte value with:

- One 11 bit (Y), two complementary mantissas;
- A 5-bit (N), 2-bit complement index (scaling factor).

The format of these two data bytes is shown in the following figure.



The relationship between Y, N and the "real" value is: X=Y * 2 ^ N

As mentioned earlier, X is the 'real' value:

Y is an 11 bit binary complement integer;

N is a 5-bit binary complement integer.

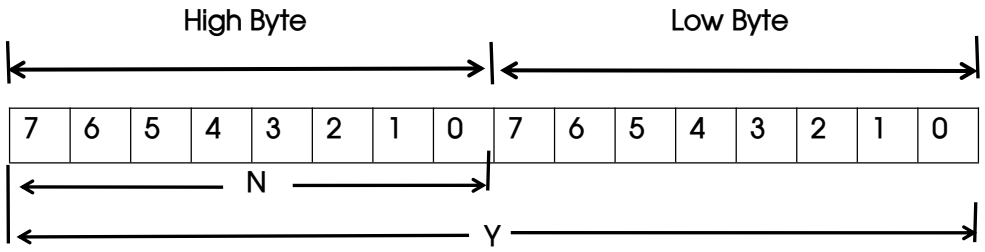
Devices using LINEAR11 format must accept and be able to process.

3.2 Output/Input Current, Input voltage, Output/Input Power, Temperature, Fan Speed

The PMBUS power management bus standard version 1.2 defines the commands for output/input current, input voltage, output/input power, temperature, and fan speed in a linear 11 format.

3.3 Output Voltage

The power management bus standard version 1.2 defines commands related to output voltage in a linear 16 format (assuming the exponent of the command reading output voltage is determined as -9, the calculation formula for the actual value X is X=Y * 2 ^ -9).



Linear-16 format

3.4 Bus Communication Speed

The power unit operates in standard mode with a maximum bus speed of 100kHz, electrical characteristics, and clock signals. The timing specifications for data signals refer to SMBUS version 2.0 released on August 3, 2000.

3.5 Device Addressing

The device address of the power management bus is shown below. For redundant systems, once the power supply is plugged into the system, there are two signals to set the address position, address A0 and address A1.

The Logic lever of A1/A0 at Card edge		PMBus device write/read addresses	FRU device write/read addresses
A1	A0		
0	0	B0h/B1h	A0h/A1h
0	1	B2h/B3h	A2h/A3h
1	0	B4h/B5h	A4h/A5h
1	1	B6h/B7h	A6h/A7h

3.6 Application Layer Requirements

The application layer is based on the PMBus specification version 1.2.

3.7 Reporting Accuracy Of Power Supply Parameters

The accuracy requirements are shown in the table below:

Command	Pout<10%	10%≤Pout<30%	30%≤Pout<100%
READ_VIN	±3%	±3%	±3%
READ_IIN	NA	±0.5A	±10% or ±0.5A
READ_PIN	NA	±5%or ±12W	±3%
READ_VOUT	±5%	±3%	±3%
READ_IOUT	NA	±10%	±5%
READ_POUT	NA	±10%	±5%

Remarks:

1. 115Vac/60Hz, 230Vac/50Hz, and HVDC 240VDC inputs must meet the requirements.
2. Load based on high and low voltage rated load.

Temperature measurement accuracy

Command	Accuracy
Ambient Temperature	±3(℃)
Fan Speed	±500(rpm)

Accuracy (%)=(| PMBus reading value - measurement value of the meter |/measurement value of the meter) * 100%.

Temperature accuracy: | PMBus reading value - measured value of the meter |<=3 ℃.

Fan speed accuracy: | PMBus reading value - measured value of the meter |<=500rpm.

3.8 PMBus Command Table

The communication protocol is the standard PMBUS protocol, and specific requirements can be found in "PMBus ™ Power System Management Protocol Specification Revision 1.2". The specific functional instructions supported by this product are shown in the table below.

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
00h	Status page	PAGE	Read/Write Byte	00h	Read the currently selected Page index number (0-Page0 corresponds to the main channel, 1-Page1 corresponds to the auxiliary channel)
01h	Remote switch on/off	OPERATION	Read/Write Byte	80h	Remote shutdown command, clear the alarm once when starting up. 0x80: Power on; 0x40: Soft shutdown; 0x00: Immediately shut down
02h	Output shutdown enable control	ON_OFF_CONFIG	Read/Write Byte	1Dh	Default reporting value for output switch control feature configuration: Bit4: 0- Regardless of the status of the control pins, the power module is powered on at any time 1- Before pin control and command operation (set in bit 3:0), the power module does not power on Bit3: 0- Ignore bus CMD command word to control power module startup and shutdown 1- According to the bus start command, the power module starts the output. According to bit 2, the power module needs to set the control pin to enable the power module to start the output Bit2: 0- Power module ignores control pins

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
					(power module switches are only controlled by CMD commands) The power module needs to be set to the control pin before starting. According to bit 3, it is necessary to operate the command power module before starting the output. Bit1: 0- Low level active (set low power module to start output) 1- High level active (set high power module to start output) Bit0: Reserved
03h	Clear fault	CLEAR_FAULTS	Send Byte		Clear fault command. After receiving this command, clear the fault alarms that have occurred. This command only supports clearing all faults and does not support single clearing
05h	Clear alarm function	PAGE_PLUS_WRITE	Block Write		Page add write command, page switch, and the write command and data that need to be executed by Page are completed once
06h	Read alarm status	PAGE_PLUS_READ	Block Read		Page add read command, page switch and the read command that Page needs to execute are completed once
0Dh	Input power frequency	MFR_READ_VIN_FREQ	Read/Write Word		Read the AC voltage frequency value of the input source in LINEAR11 data format
0Eh	Input power type	MFR_INPUT_TYPE	Read Byte		Power input source status: 0: No input or abnormal input voltage; 1: AC input

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
					2: High voltage direct current 3: Low voltage direct current
19h	Communication inquiry	CAPABILITY	Read Byte	90h	Communication capability query command Bit7: PEC verification 0- does not support PEC 1- supports PEC Bit6-Bit5: Maximum bus speed 00- Maximum bus speed, 100KHz 01- Maximum bus speed, 400KHz Bit4: SMBALERT#: 0- SMBALERT# alarm signal not supported 1- Support SMBALERT# alarm signal Bit3-Bit0: Reserved
1Ah	Read CMD data format	QUERY	Block Write-Block Read Process Call		PMBus Command Query Bit7: Does it support commands 0- Does it not support commands 1- Supports commands Bit6: Does it support writing 0- Does it not support writing 1- Supports writing Bit5: Does it support reading 0- does not support reading 1- supports reading Bit4-Bit2: Data format 000-- Use Linear data format 001-16 signed numbers 010- Reserved 011- Use Direct data format 100-8-bit ULINEAR16 number 101- Use VID data format

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
					110- Use manufacturer specific format 111- Command that does not return numerical data, used to return data blocks
1Bh	Shield SMBAlert alarms	SMBALERT_MASK	Block Write-Block Read Process Call		Shield the SMBAlert command, enable the SMBAlert# signal alarm, configure whether to enable each alarm, set the SMBAlert# signal alarm, and configure input, temperature, and output current alarm words; When blocking alarms, it is recommended to also block pre alarms to prevent SMBLAERT flipping caused by pre alarms. SMBALERT_ The definition of MASK byte bit is the same as that of STATUS byte bit; For specific requirements, please refer to "PMBus ™ Power System Management Protocol Specification Revision 1.2
20h	Output mode	VOUT_MODE	Write Byte Read Byte	17h	Definition of Output Related Data Format 0x17: The data related to output voltage is in Linear16 format, with Q=-9 data format
30h	DIRECT format parameter	COEFFICIENTS	Block Write-Block Read Process Call		The direct format parameter only supports the direct format parameters of the 0x86 and 0x87 commands. Send a 2-byte block and read back a 5-byte block
3Ah	Fan configuration	FAN_CONFIG_1_2	Read/Write Byte	90h	Fan configuration Is there a fan in Bit7: Position1 0- No fan, 1- With fan Bit6: Format of Fan Speed Control

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
					Command 0 – duty cycle (default), 1- RPM, Bit5-4: The speed is measured in pulses per second, Bit4=1, bit5=0 Is there a fan in Bit3: Position2 0- No fan, 1- With fan Bit2: Format of Fan Speed Control Command 0 – duty cycle (default), 1- RPM, Bit1-0: The speed is measured in pulses per second
3Bh	Fan speed setting	FAN_COMMAND_1	Read/Write Word		Fan speed control command, percentage control, LINEAR11 data format The set speed is only effective when it is higher than the speed required by the power supply itself
78h	Status single byte	STATUS_BYTE	Read/Write Byte		Power status low byte, by STATUS_ Map VOUT and other status bytes Bit7 BUSY Bit6 OFF Bit5 VOUT_OV_FAULT Bit4 IOUT_OC_FAULT Bit3 VIN_UV_FAULT Bit2 TEMPERATURE

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
					Bit1 CML Bit0 reserve
79h	Status Double Byte	STATUS_WORD	Read/Write Word		Power status double byte, determined by STATUS_ Map VOUT and other status bytes Low Byte Bit7 BUSY Bit6 OFF Bit5 VOUT_OV_FAULT Bit4 IOUT_OC_FAULT Bit3 VIN_UV_FAULT Bit2 TEMPERATURE Bit1 CML Bit0 reserve High Byte Bit7 VOUT Bit6 IOUT/POUT Bit5 INPUT Bit4 MFR Bit3 POWER_GOOD# Bit2 FANS Bit1 OTHER Bit0 reserve
7Ah	Output voltage status	STATUS_VOUT	Read/Write Byte		Power output voltage related status, write 1 to clear the alarm, reset if the fault is not cleared Bit7 VOUT_OV_FAULT Bit6 VOUT_OV_WARNING

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
					Bit5 VOUT_UV_WARNING Bit4 VOUT_UV_FAULT Bit3 VOUT_MAX_MIN Warning Bit2 TON MAX FAULT Bit1 TOFF MAX Warning Bit0 VOUT Tracking Error
7Bh	Output current status	STATUS_IOUT	Read/Write Byte		Power output current related status, write 1 to clear the alarm, reset if the fault is not cleared Bit7 IOUT_OC_FAULT Bit6 IOUT OC Fault Bit5 IOUT_OC_WARNING Bit4 reserve Bit3 reserve Bit2 reserve Bit1 POUT OP Fault Bit0 POUT OP Warning
7Ch	Input Status	STATUS_INPUT	Read/Write Byte		Power input related status, write 1 to clear the alarm, reset if the fault is not cleared Bit7 VIN_OV_FAULT Bit6 VIN_OV_WARNING Bit5 VIN UV Warning Bit4 VIN UV Fault Bit3 Unit Off For Low Input Voltage Bit2 IIN OC Fault Bit1 IIN OC Warning

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
					Bit0 PIN OP Warning
7Dh	Temperature state	STATUS_TEMP	Read/Write Byte		Power supply temperature related status, write 1 to clear the alarm, reset if the fault is not cleared Bit7 OT_FAULT Bit6 OT_WARNING
7Eh	Instruction Status	STATUS_CML	Read/Write Byte		Bit7 Invalid/Unsupported Command Bit6 Invalid/Unsupported Data Bit5 Packet Error Check Failed Bit4 Memory Fault Detected Bit3 Processor Fault Detected
80h	Plant Status	STATUS_MFR_SPECIFIC	Read/Write Byte		Power supply manufacturer custom status: Bit7: Power input AC over frequency protection, Bit6: AC underfrequency protection for power input, Bit5 PFC over temperature protection Bit4 reserved Bit3: Power input AC over frequency warning, Bit2: Power input AC underfrequency warning, Bit1 reserved Bit0 reserved
81h	Fan status	STATUS_FANS_1_2	Read/Write Byte		Fan status, write 1 to clear alarm, reset if fault not cleared Bit7 Fan 1 Fault

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
					Bit6 Fan 2 Fault Bit5 Fan 1 Warning Bit4 Fan 2 Warning Bit3 Fan 1 Speed Override Bit2 Fan 2 Speed Override Bit1 Air Flow Fault Bit0 Air Flow Warning
86h	Input power accumulation value	READ_EIN	Block Read		Input power accumulation value and counter value, DICT data format M=1, r=0, b=0, the system can record the number of counter overflow rounds
87h	Accumulated value of output power	READ_EOUT	Block Read		Output power accumulation value and counter value, DICT data format M=1, r=0, b=0, the system can record the number of counter overflow rounds
88h	Input voltage	READ_VIN	Read Word		Input voltage value, LINEAR11 data format
89h	Input current	READ_IIN	Read Word		Input current value, LINEAR11 data format
8Bh	Output voltage	READ_VOUT	Read Word		Output voltage value, LINEAR16 data format, Q=-9
8Ch	Output current	READ_IOUT	Read Word		Output current value, LINEAR11 data format
8Dh	Environmental temperature	READ_TEMPERATURE_1	Read Word		Environmental temperature, LINEAR11 data format
8Eh	Hot spot temperatur	READ_TEMPERATURE_2	Read Word		Power supply front-end hot spot temperature, LINEAR11 data format

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
	e 1				
8Fh	Hot spot temperature 2	READ_TEMPERATURE_3	Read Word		Post power hot spot temperature, LINEAR11 data format
90h	Fan Speed	READ_FAN_SPEED_1	Read Word		Fan speed in revolutions per minute, LINEAR11 data format
96h	Output power	READ_POUT	Read Word		Output power value, LINEAR11 data format
97h	Input power	READ_PIN	Read Word		Input power value, LINEAR11 data format
98h	PMBus version number	PMBUS_REVISION	Read Byte	22h	Indicates PMBus protocol version V1.2
99h	Manufacturer's name	MFR_ID	Block Read		Manufacturer code, ASCII code string
9Ah	Power supply name	MFR_MODEL	Block Read		Product model, ASCII code string
9Bh	Power firmware version	MFR_REVERSION	Block Read		Firmware version number
9Ch	Production address	MFR_LOCATION	Block Read		Product manufacturing address, ASCII code string
9Dh	Production date	MFR_DATE	Block Read		Product production date, ASCII string,
9Eh	Product ID	MFR_SERIAL	Block Read		Product serial number, ASCII code string
A0h	Minimum input voltage (fixed)	MFR_VIN_MIN	Read Word		Input minimum voltage, varies with input source type, LINEAR11 data format

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
A1h	Maximum input voltage (fixed)	MFR_VIN_MAX	Read Word		Input the highest voltage, which varies with the input source type, in LINEAR11 data format
A4h	Minimum output voltage (fixed)	MFR_VOUT_MIN	Read Word		Output minimum voltage, LINEAR16 data format, Q=-9
A5h	Maximum output voltage (fixed)	MFR_VOUT_MAX	Read Word		Output highest voltage, LINEAR16 data format, Q=-9
A6h	Maximum output current (fixed)	MFR_IOUT_MAX	Read Word		Maximum output current value, LINEAR11 data format
A7h	Maximum output power (fixed)	MFR_POUT_MAX	Read Word		Maximum output power value, LINEAR11 data format
A8h	Maximum operating temperature (fixed)	MFR_TAMBIENT_MAX	Read Word		Maximum allowable ambient temperature, LINEAR11 data format
A9h	Minimum operating temperature (fixed)	MFR_TAMBIENT_MIN	Read Word		Minimum allowable ambient temperature, LINEAR11 data format
DBh	FRU write enable	MFR_FRU_EN	Read/Write Byte		0- FRU allows writing 1- FRU prohibits writing
C0h	The power supply	MFR_MAX_TEMP_1(Ambie	Read Word		Power supply withstands maximum ambient temperature (fixed value),

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
	withstands the highest hot spot temperature (fixed value)	nt)			LINEAR11 data format
C1h	Power supply withstands the highest hot spot temperature (fixed value)	MFR_MAX_TEMP_3(hotSpot-primary)	Read Word		The primary side of the power supply bears the highest hot spot temperature (fixed value), in LINEAR11 data format
C2h	Power supply withstands the highest hot spot temperature (fixed value)	MFR_MAX_TEMP_2(hotSpot-Secondary)	Read Word		The secondary side of the power supply is subjected to the highest hot spot temperature (fixed value), in LINEAR11 data format
D0h	Cold backup control command	CR_Mode	Read/Write Byte	00h	Power supply cold standby control command 00--Cold Standby Active 01--Normal 02--Cold Standby 1 03--Cold Standby 2 04--Cold Standby 3 05--Always Standby
DBh	FRU write	MFR_FRU_PR	Read/Write		0- FRU allows writing

Command	Command Description	Command Name	data Read Write Type	Default value	Command Description
	enable	OTECTION	Byte		1- FRU prohibits writing
DCh	Reading the Black Box	MFR_READ_BLACK_BOX	Block Read		Power black box query, Read: Multi byte (fault record information)
DDh	Timing command	MFR_REAL_TIME_BLACK_BOX	Block Read/Write		Power real-time clock calibration command, Uint32 data high byte first, send high byte first when sending data, UNIX format time standard, cumulative second value starting from January 1, 1970
DEh	System tracking data	MFR_SYSTEM_BLACK_BOX	Block Read/Write		The system uses this command to write system tracking data to the PSU.
DFh	Black Box Record Index	MFR_BLACKBOX_CONFIG	Read/Write Byte		0 = disable black box function 1 = enable black box function
E0h	clear all black box records	MFR_CLEAR_BLACKBOX	Send byte		This command is write only. There is no data byte for this command.

3.9 SMBALERT# Signal

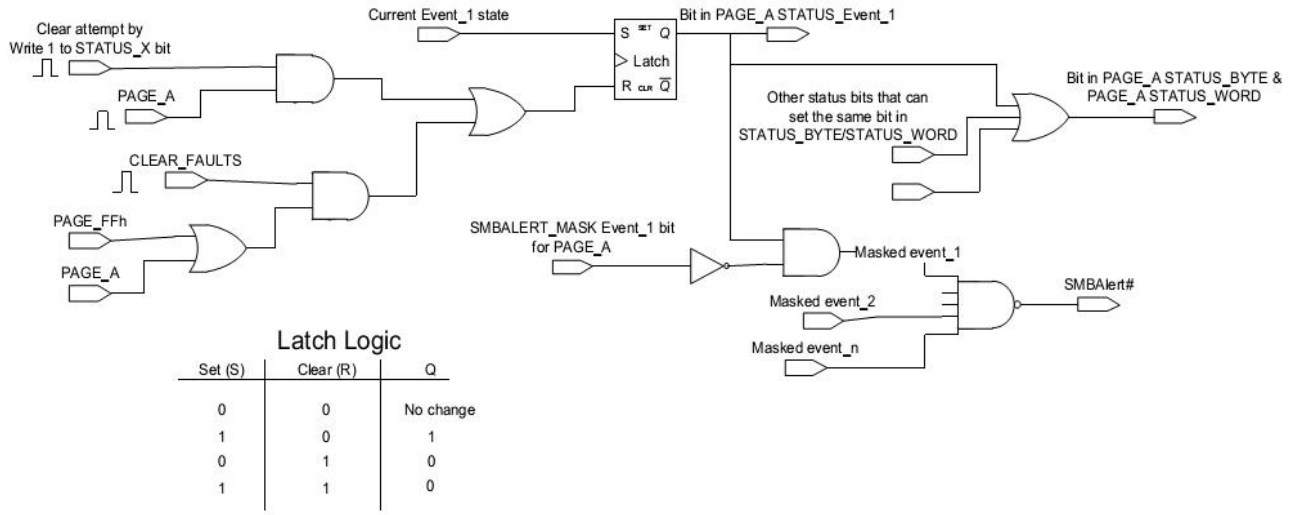
SMBALERT# is a low potential effective signal used to indicate when the status register bit is asserted. If a state is set to "1" for assertion and the corresponding SMBALERT_ The MASK bit is cleared to "0", and as long as the underlying condition exists, the SMBAlert# signal must be driven and asserted.

SMBALERT_ MASK defaults to only state bits in the PAGE 01h (ME) interrupt, and the instance will generate SMBALERT#. Normally, in the FW default design, the SMBALERT# signal is asserted for the following situations.

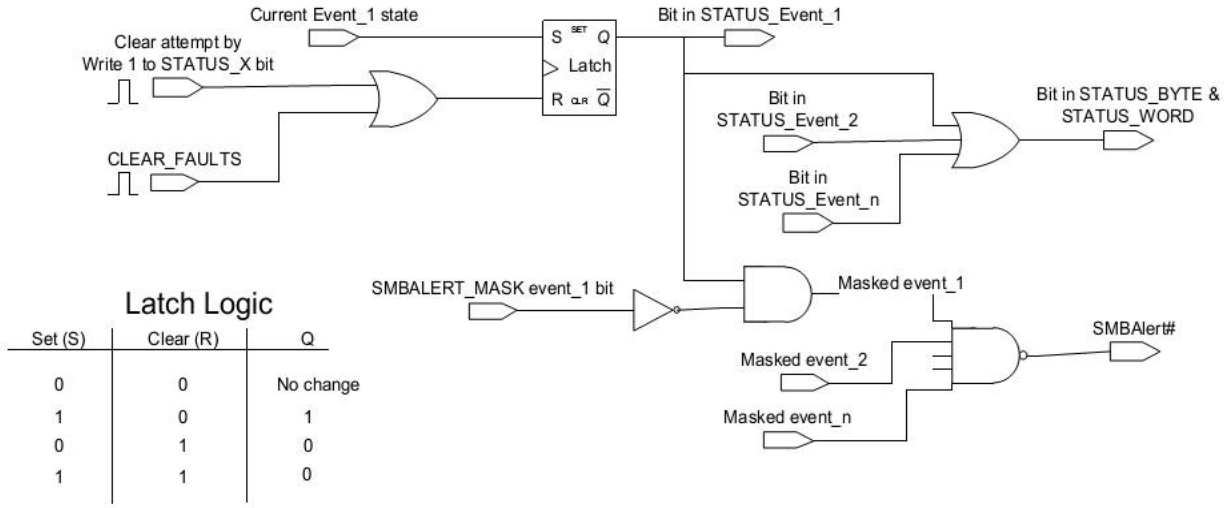
(1)STATUS_IOUT (Iout OC Warning/Iout OC fault)

(2)STATUS_TEMPERATURE (OT Warning/OT fault)

(3)STATUS_FAN (FAN Warning/FAN fault/)



Support for PAGE_ Schematic diagram of the status bits of the PLUS command and the concept of SMBAlert#



Without PAGE_ Schematic diagram of the status bits of the PLUS command and the concept of SMBAlert#

3.10 Main And Backup Cold Redundancy Mode

Cold_Redundancy_Config Cold redundancy setting (D0h)		
Value	State	Description
00h	Standard Redundancy (default power on state)	The power supply is in a standard redundant state.
01h	Cold Redundant Active 1	Define this power supply as a power supply that always outputs normally in cold redundancy.

02h	Cold Standby 1	Define the power supply that first becomes a normal output in a cold redundant configuration when the load increases.
03h	Cold Standby 2	Define the second power supply in a cold redundancy configuration that becomes a normal output when the load increases.
04h	Cold Standby 3	Define the third power supply in a cold redundancy configuration that becomes a normal output when the load increases.
05h	Always Standby	Define that this power supply is always in a cold redundant sleep state regardless of load conditions.

(1)Redundant mode (normal mode)

The default value of D0h is 0x00, which is in a redundant standard state.

(2)Master/slave

CR mode setting description (taking 1+1 parallel: 0x01+0x02 as an example):

1.1 During normal parallel operation (the D0h values of both PSUs default to 00), both PSUs perform CR_ Set BUS to LOW;

1.2 If PSU1 is set to host 01 and PSU2 is still in 00 normal mode, then CR_ The BUS bus signal remains LOW and in a ready state until PSU2 issues command 02, CR_ The BUS bus signal will be HIGH, and PSU2 will enter the slave state at this time.

The following instruction table:

Instruct	PSU1	PSU2	CR_ BUS	State
D0h	00	00	LOW	Normal mode
D0h	01	02	HIGH	Enter CR mode (PSU2 as slave)
D0h	02	01	HIGH	Enter CR mode (PSU1 is the slave)

Note: When the PSU reaches 02, the CR of that PSU_ BUS (non bus) is in a suspended state; CR_ The BUS bus is determined by another PSU;

1.3 The system load determines the working status of the cold redundant PSU, with PSU1 set to host 01 and PSU2 set to slave 02.

System load<(TBD1), CR_ The BUS bus signal remains high, and PSU2 enters sleep,

System load>(TBD2), CR_ The BUS bus signal remains at a high potential, and PSU2 wakes up,

System load<(TBD1), CR_ The BUS bus signal remains high, and PSU2 enters sleep again,

Note: Load TBD1<TBD2.

1.4 The events for exiting the cold redundancy mode are as follows:

1.4.1 Command Exit:

When two PSUs enter cold redundancy mode and one PSU is given the 0xD0 0x00 command from the slave machine, both PSUs exit cold redundancy mode, that is, both PSUs will enter normal mode;

1.4.2 AC power failure:

When two PSUs enter cold redundancy mode and either PSU loses power, both PSUs will exit cold redundancy mode, that is, both PSUs will enter normal mode;

1.4.3 PS_ ON to OFF:

When the PS of any PSU_ When ON (set high or suspended) is turned off, both PSUs will exit the cold redundancy mode command, that is, both PSUs will enter normal mode;

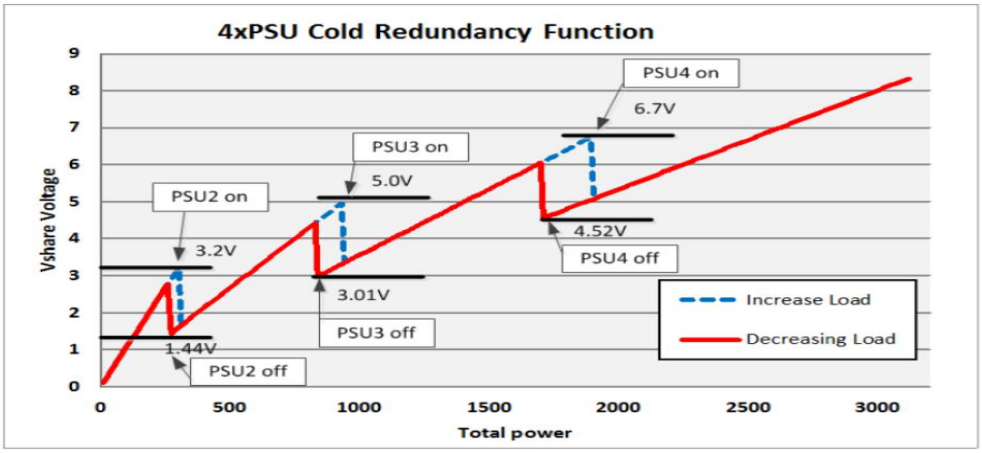
1.4.4 Power Module Fault Event:

When two PSUs enter cold redundancy mode and the host PSU experiences a Fault event, the slave will immediately exit cold redundancy mode and enter normal mode;

1.4.5 CR_ BUS bus abnormally pulled low:

When two PSUs enter cold redundancy mode, CR_ When the BUS bus is pulled down, both PSUs will exit cold redundancy mode, that is, both PSUs will enter normal mode;

Note: When the above wake-up or exit events occur, the 12V output bus voltage cannot exceed the dynamic specification range (except for OVP of the host). In the sleep state of the cold redundant slave, the PWOK signal and Alert signal are at normal high levels.



Power on/off in cold redundancy mode (4x PSUs)

4 Black Boxes

4.1 Black Box Communication Protocol

This specification defines the requirements for power supplies with PMBus capability to store PMBus and other data into non-volatile memory inside the power supply. The data shall be saved to non-volatile memory upon a critical failure that caused the power supply to shut-down. The data can be accessed via the PMBus interface by applying power to the 12Vstby pins. No AC power need to be applied to the power supply .

- OCP/OPP
- Vout OVP
- Vout UVP
- Fan Fault
- OTP
- Vin UVP

Command	Command Name	Data read/write type	Data Bytes	Command Description
DCh	MFR_READ_BLACK_BOX	Block Read	237	Power black box query, Read: Multi byte (fault record information)
DDh	MFR_REAL_TIME_BLACK_BOX	Block Read/Write	4	Power real-time clock calibration command, Uint32 data high byte first, send high byte first when sending data, UNIX format time standard, cumulative second value starting from January 1, 1970
DEh	MFR_SYSTEM_BLACK_BOX	Block Read/Write	40	Include 1)System top assembly number,1-10 bytes(Low bytes) 2)System serial number,11-20 bytes 3)Motherboard assembly number,21-30 bytes 4)Motherboard serial number,31-40 bytes(High byes)

DFh	MFR_BLACKBOX_CONFIG	Read/Write Byte	1	Writing a 1 enables the power supply with black box function. Writing a 0 disables the power supply black box function. The state of MFR_BLACKBOX_CONFIG shall be saved in nonvolatile memory so that it is not lost during power cycling.
E0h	MFR_CLEAR_BLACKBOX	Send byte	0	The MFR_CLEAR_BLACKBOX command is used to clear all black box records simultaneously. This command is write only. There is no data byte for this command.

4.2 Black Box Data Content

The black box records real-time physical quantities and status data at the fault site, with each record containing 38 bytes of data. A total of five latest fault records can be saved, and the data is written in a cyclic manner. The detailed data format is shown in the table below.

Table 4-1: Record Data Format

	Item	Number of Bytes	Description
System Tracking Data	System top assembly number	10	The system will write its Intel part number for the system top assembly to the power supply when it is powered ON. This is 9 ASCI characters.
	System serial number	10	The system shall write the system serial number to the power supply when it is powered ON. This include the serial number and date code.
	Motherboard assembly	10	The system will write the motherboard Intel

	number		part number for the assembly to the power supply when it is powered ON. This is 9 ASCI characters.
	Motherboard serial number	10	The system shall write the motherboard’ s serial number to the power supply when it is powered ON. This includes the serial number and date code.
	Present total PSU ON time	3	Total on time of the power supply with PSON asserted in minutes. LSB = 1 minute.
	Present number of AC power cycles	2	Total number of times the power supply powered OFF then back ON due to loss of AC power. This is only counted when the power supply’ s PSON# signal is asserted. This counter shall stay at FFFFh once the max. is reached.
	Present number of PSON power cycles	2	Total number of times the power supply is powered OFF then back ON due to the PSON# signal deasserting. This is only counted when AC power is present to the power supply. This counter shall stay at FFFFh once the max. is reached.
Power supply event data(N)		38	Most recent occurrence of saved black box data
Time Stamp			The power supply shall track these time and power cycle counters in RAM. When the black box event occurs the data is saved into the Black Box.
	Power supply total power on time	3	Total on time of the power supply in minutes. LSB = 1 minute.
	Real Time Clock Data from System(reserved for future use)	4	This time stamp does not need to be generated by the power supply. The system rights a real time clock value periodically to the power supply using the MFR_REAL_TIME command.

			Format is based on IPMI 2.0. Time is an unsigned 32-bit value representing the local time as the number of seconds from 00:00:00, January 1, 1970. This format is sufficient to maintain time stamping with 1s resolution past the year 2100. This is based on a longstanding UNIX-based standard for time keeping, which represents time as the number of seconds from 00:00:00, January 1, 1970 GMT. Similar time formats are used in ANSI C.
	Number of AC power cycles	2	Number of times the power supply powered OFF then back ON due to loss of AC power at the time of the event. This is only counted when the power supply's PSON# signal is asserted.
	Number of PSON power cycles	2	Number of times the power supply is powered OFF then back ON due to the PSON# signal de-asserting at the time of the event. This is only counted when AC power is present to the power supply.
PMBus			The power supply shall save these PMBus values into the Black Box when a black box event occurs. Fast events may be missed due to the filtering effects of the PMBus sensors.
	STATUS_WORD	2	
	STATUS_IOUT	1	
	STATUS_INPUT	1	
	STATUS_TEMPERTATURE	1	
	STATUS_FAN_1_2	1	
	READ_VIN	2	
	READ_IIN	2	

	READ_IOUT	2	
	READ_TEMPERATURE_1	2	
	READ_TEMPERATURE_2	2	
	READ_FAN_SPEED_1	2	
	READ_PIN	2	
	READ_VOUT	2	
Event Counters			The power supply shall track the total number for each of the following events. These values shall be saved to the black box when a black box event occurs. Once a value has reached 15, it shall stay at 15 and not reset.
	AC shutdown due to under voltage on input	Lower½	The power supply shall save a count of these critical events to nonvolatile memory each time they occur. The counters will increment each time the associated STATUS bit is asserted.
	Thermal shutdown	Upper½	
	Over current or over power shutdown on output	Lower½	
	General failure shutdown	Upper½	
	Fan failure shutdown	Lower½	
	Shutdown due to over voltage on output	Upper½	
	Input voltage warning;no shutdown	Lower½	The power supply shall save into RAM a count of these warning events. Events are count only at the initial assertion of the event/bit. If the event persists without clearing the bit, the counter will not be incremented. When the power supply shuts down it shall save these warning event counters to nonvolatile memory. The counters will increment each time the associated STATUS bit is asserted.
	Thermal warning;no shutdown	Upper½	
	Output current power warning;no shutdown	Lower½	
	Fan slow warning;no shutdown	Upper½	
Power supply		38	

event data(N-1)			
Power supply event data(N-2)		38	
Power supply event data(N-3)		38	
Power supply event data(N-4)		38	

Note: The unit of current type variable is A, the unit of voltage type variable is V, and the unit of temperature type variable is ℃;

Uint16 type variable has 2 bytes, Float type variable has 4 bytes, and Uint32 type variable has 4 bytes.

5 Firmware Upgrade

Equipped with firmware upgrade functionality, in order to prevent product abnormalities caused by third-party operations, it is temporarily only open for use by maintenance personnel from the manufacturer.

6 FRU

6.1 FRU Data

The FRU data format should comply with the specifications of IPMI Version 1.0.

6.2 FRU Device Protocol

The FRU device will execute the same protocol as the commonly used AT24C02 device, including byte read, sequential read, byte write, and page read protocols.

6.3 FRU Data Format

The information that FRU devices need to include is shown in the table below:

Area Type	Describe
Common header	Defined by FRU document
Internal Use Area	Not required, not reserved
Chassis Info Area	Not applicable, not reserved
Board Info Area	Not applicable, not reserved
Product Info Area	Defined by IPMI FRU document
The product information is defined as follows	
Field name	Field Description
Manufacturer Name	Supplier Name
Product Name	Product or model
Product part/model number	Customer model number
Product Version	Customer's current version
Product Serial Number	Product ID
Asset Tag	Not used, code is 0 length bytes
FRU File ID	Not required
PAD Bytes	Add if necessary, allowing 8 bytes to be offset to the next region
Multi-Record Area	As defined in the IPMI FRU document, this power supply should use the following record types
Area Type	Describe
	Power information (record type 0x00) DC output (record type 0X01) There are no other record types for the power supply
Field Name(PS Info)	Field Information Definition
Overall Capacity(watts)	2000
Peak VA	2000

Inrush current(A)	35
Inrush interval(ms)	5
Low end input voltage range 1	90
High end input voltage range 1	140
Low end input voltage range 2	180
High end input voltage range 2	264
AC dropout total.(ms)	10
Binary flags	Used to set up: supports hot swapping, automatic switching, and PFC
Peak Wattage	2000
Combined wattage	Blank
Predictive fail tach support	Support
Field Name(Output)	Field Description: Define two outputs from #1 to #2, namely+12V and+12VSB
Output Information	Only+12VSB is enabled in standby mode, and other outputs are enabled in non standby mode
All other output fields	Format according to IPMI specifications and use the parameters in this specification

6.4 FRU Write Protected

Use the PMBUS command MFR for the content of FRU_ FRU_ Protection (instruction DBh), using the byte write command (with PEC) to enable or disable write protection. A reading value of 00h indicates that the FRU can write, while a reading value of 01h indicates that the device cannot write (write protection activated), and the write operation values are the same.

6.5 FRU Table

2000W VERSION:S01 DATE:2024/12/09					
Project	Address	Numeric value (decimal)	Value (HEX)	Describe	Block Title

1	0000H	01	01	FORMAT VERSION NUMBER	COMMON HEADER
2	0001H	01	01	INTERNAL USE AREA OFFSET	
3	0002H	00	00	CHASSIS INFO AREA OFFSET	
4	0003H	00	00	BOARD AREA OFFSET	
5	0004H	03	03	PRODUCT INFO AREA OFFSET	
6	0005H	11	0B	MULTI RECORD AREA OFFSET	
7	0006H	00	00	PAD(ALWAYS ZERO)	
8	0007H	240	F0	ZERO CHECK SUM (100H-(TOTAL BYTES))	
1	0008H	00	00	PAD(ALWAYS ZERO)	INTERNAL USE AREA
2	0009H	00	00	PAD(ALWAYS ZERO)	
3	000AH	00	00	PAD(ALWAYS ZERO)	
4	000BH	00	00	PAD(ALWAYS ZERO)	
5	000CH	00	00	PAD(ALWAYS ZERO)	
6	000DH	00	00	PAD(ALWAYS ZERO)	
7	000EH	00	00	PAD(ALWAYS ZERO)	
8	000FH	00	00	PAD(ALWAYS ZERO)	
9	0010H	00	00	PAD(ALWAYS ZERO)	
10	0011H	00	00	PAD(ALWAYS ZERO)	
11	0012H	00	00	PAD(ALWAYS ZERO)	
12	0013H	00	00	PAD(ALWAYS ZERO)	
13	0014H	00	00	PAD(ALWAYS ZERO)	
14	0015H	00	00	PAD(ALWAYS ZERO)	
15	0016H	00	00	PAD(ALWAYS ZERO)	
16	0017H	00	00	PAD(ALWAYS ZERO)	
1	0018H	01	01	PRODUCT AREA FORMAT VERSION	PRODUCT

					INFORMATION AREA
2	0019H	08	08	PRODUCT AREA LENGTH(#BYTES/S)	
3	001AH	25	19	LANGUAGE(ENGLISH)	
4	001BH	199	C7	PRODUCT MANUFACTURER NAME LENGTH/BYTE	
5	001CH	88	58	X	
6	001DH	88	58	X	
7	001EH	88	58	X	
8	001FH	88	58	X	
9	0020H	88	58	X	
10	0021H	88	58	X	
11	0022H	88	58	X	
12	0023H	206	CE	PRODUCT NAME LENGTH	
13	0024H	50	32	2	
14	0025H	48	30	0	
15	0026H	48	30	0	
16	0027H	48	30	0	
17	0028H	87	57	W	
18	0029H	32	20		
19	002AH	32	20		
20	002BH	32	20		
21	002CH	32	20		
22	002DH	32	20		
23	002EH	32	20		
24	002FH	32	20		
25	0030H	32	20		

26	0031H	32	20		
27	0032H	192	C0	CUSTOMER PRODUCT PART NO.LENGTH	
28	0033H	195	C3	BOARD VERSION type/length	
29	0034H	83	53	S	To be updated
30	0035H	48	30	0	To be updated
31	0036H	49	31	1	To be updated
32	0037H	220	DC	PRODUCT SERIAL NO. LENGTH	
33	0038H	88	58	X	To be updated
34	0039H	88	58	X	To be updated
35	003AH	88	58	X	To be updated
36	003BH	88	58	X	To be updated
37	003CH	88	58	X	To be updated
38	003DH	88	58	X	To be updated
39	003EH	88	58	X	To be updated
40	003FH	88	58	X	To be updated
41	0040H	88	58	X	To be updated
42	0041H	88	58	X	To be updated
43	0042H	88	58	X	To be updated
44	0043H	88	58	X	To be updated
45	0044H	88	58	X	To be updated
46	0045H	88	58	X	To be updated
47	0046H	88	58	X	To be updated
48	0047H	88	58	X	To be updated
49	0048H	88	58	X	To be updated
50	0049H	88	58	X	To be updated
51	004AH	88	58	X	To be updated

52	004BH	88	58	X	To be updated
53	004CH	88	58	X	To be updated
54	004DH	88	58	X	To be updated
55	004EH	88	58	X	To be updated
56	004FH	88	58	X	To be updated
57	0050H	88	58	X	To be updated
58	0051H	88	58	X	To be updated
59	0052H	88	58	X	To be updated
60	0053H	88	58	X	To be updated
61	0054H	192	C0	ASSET TAG type/length byte	
62	0055H	192	C0	FRU Filed ID type/length byte	
63	0056H	193	C1	NO MORE FIELDS MARKER	
64	0057H	180	B4	CHECKSUM(100H-(LOWER BYTE(SUM OF BYTES))	To be updated
1	0058H	00	00	RECORD TYPE ID 0X00=POWER SUPPLY INFORMATION	MULTICORD
2	0059H	02	02	7:7 END OF LIST, 6:4=000B, 3:0 RECORD FORMAT VERSION=2	HEADER
3	005AH	24	18	RECORD LENGTH OF MULTIRECORD	
4	005BH	161	A1	RECORD CHECKSUM	To be updated
5	005CH	69	45	HEADER CHECKSUM	To be updated
1	005DH	64	40	15-12: RESERVED, WRITE AS 0000B	2000W
2	005EH	06	06	11-0: OVERALL CAPACITY(WATTS)	2000W
3	005FH	64	40	PEAK VALUE	2000W
4	0060H	06	06	LSB FIRST	2000W
5	0061H	35	23	INRUSH CURRENT FFH IF NOT SPECIFIED	35A
6	0062H	05	05	SET TO 0 IF NO INRUSH CURRENT	5mS

				SEPCIFIED	
7	0063H	16	10	LOW END INPUT VOLTAGE RANGE 1 100V=2710H	100V
8	0064H	39	27		100V
9	0065H	156	9C	HIGH END INPUT VOLTAGE RANGE 1 127V=319CH	127V
10	0066H	49	31		127V
11	0067H	32	20	LOW END INPUT VOLTAGE RANGE 2 200V=4E20H	200V
12	0068H	78	4E		200V
13	0069H	192	C0	HIGH END INPUT VOLTAGE RANGE 2 240V=5DC0H	240V
14	006AH	93	5D		240V
15	006BH	47	2F	LOW END INPUT FREQUENCY RANGE 47HZ=2FH	47Hz
16	006CH	63	3F	HIGH END INPUT FREQUENCY RANGE 63HZ=3FH	63Hz
17	006DH	11	0B	A/C DROPOUT TOLERANCE IN mS 11mS=0BH	11mS
18	006EH	31	1F	BINARY FLAGS: 7:5-RERERVED, WRITE AS 000b	
				4:4-TECHOMETER PULSES PER ROTATION/PREDICTIVE FAIL PIN POLARITY	
				3:3-HOT SWAP SUPPORT	
				2:2-AUTOWITCH	
				1:1-POWER FACTOR CORRECTION	
				0:0-PREDICTIVE FAIL SUPPORT	
19	006FH	208	D0	PEAK WATTAGE 15-12:HOLD UP TIME IN SECOND 1mS=1H 11-0 PEAK CAPACITY(WATTS)(LSB FIRST)	11ms 2000W
20	0070H	167	A7		
21	0071H	00	00	COMMBINED WATTAGE	

				7-4:VOLTAGE1,3-0:VOLTAGE2=00H	
22	0072H	00	00	BYTE 2:3 TOTAL COMBINED WATTAGE(LSB FIRST) 1300W=0514H	
23	0073H	00	00		
24	0074H	13	0D	PREDICTIVE FAIL TACHOMETER LOWER THRESHOLD(RPS)	
1	0075H	01	01	RECORG TYPE ID 0X01=DC OUTPUT Record	MULTIRECORD
2	0076H	02	02	7:7 END OF LIST, 6:4=000B,3:0 RECORD FORAMT VERSION=2	HEADER
3	0077H	13	0D	RECORD LENGTH OF MULTIRECORD	
4	0078H	122	7A	RECORD CHECKSUM	To be updated
5	0079H	118	76	HEADER CHECKSUM	To be updated
1	007AH	01	01	+12.2V 7:STANDBY=0, 6-4=000B, 3-0 :OUTPUT NUMBER=0001B	+12.2V
2	007BH	196	C4	NORMAL VOLTAGE DEVIATION(10mV)1220=04C4H	12.2V
3	007CH	04	04		12.2V
4	007DH	136	88	MAXIMUM NEGATIVE VOLTAGE DEVIATION(10mV) 1160=0488H	11.6V
5	007EH	04	04		11.6V
6	007FH	00	00	MAXIMUM POSITIVE VOLTAGE DEVIATION(10mV) 1280=0500H	12.8V
7	0080H	05	05		12.8V
8	0081H	120	78	RIPPLE AND NOISE PK-PK 10Hz TO 20MHz(mV) 120mV=0078H	120mV
9	0082H	00	00		120mV
10	0083H	100	64	MINMUM CURRENT DRAW(mA)	1A
11	0084H	00	00		1A
12	0085H	16	10	MAXIMUM CURRENT DRAW(10mA) 16400=4010H（10mA）	164A
13	0086H	64	40		164A
1	0087H	01	01	RECORD TYPE ID 0X01=DC OUTPUT	MULTICORD

				Record	
2	0088H	130	82	7:7 END OF LIST, 6:4=000B,3:0 RECORD FORMAT VERSION=2	HEADER
3	0089H	13	0D	RECORD LENGTH OF MULTIRECORD	
4	008AH	39	27	RECORD CHECKSUM	To be updated
5	008BH	73	49	HEADER CHECKSUM	To be updated
1	008CH	130	82	+12VSB 7:STANDBY=0, 6-4:RESERVED 000B, 3-0:OUTPUT NUMBER=0010B	+12VSB
2	008DH	176	B0	NORMAL VOLTAGE DEVIATION(10mV)	12.0V
3	008EH	04	04		12.0V
4	008FH	116	74	MAXIMUM NEGATIVE VOLTAGE DEVIATION(10mV)	11.4V
5	0090H	04	04		11.4V
6	0091H	236	EC	MAXIMUM POSITIVE VOLTAGE DEVIATION(10mV)	12.6V
7	0092H	04	04		12.6V
8	0093H	120	78	RIPPLE AND NOISE PK-PK 10Hz TO 20MHz(mV) 120mV=0078H	120mV
9	0094H	00	00		120mV
10	0095H	00	00	MINMUM CURRENT DRAW(mA) 0mA=0000H	0A
11	0096H	00	00		0A
12	0097H	184	B8	MAXIMUM CURRENT DRAW(mA)	3A
13	0098H	11	0B		3A
1	0099H	00	00	Unused Area	
2	009AH	00	00	Unused Area	
3	009BH	00	00	Unused Area	
4	009CH	00	00	Unused Area	
5	009DH	00	00	Unused Area	
6	009EH	00	00	Unused Area	
7	009FH	00	00	Unused Area	

8	00A0H	00	00	Unused Area	
9	00A1H	00	00	Unused Area	
10	00A2H	00	00	Unused Area	
11	00A3H	00	00	Unused Area	
12	00A4H	00	00	Unused Area	
13	00A5H	00	00	Unused Area	
14	00A6H	00	00	Unused Area	
15	00A7H	00	00	Unused Area	
16	00A8H	00	00	Unused Area	
17	00A9H	00	00	Unused Area	
18	00AAH	00	00	Unused Area	
19	00ABH	00	00	Unused Area	
20	00ACH	00	00	Unused Area	
21	00ADH	00	00	Unused Area	
22	00AEH	00	00	Unused Area	
23	00AFH	00	00	Unused Area	
24	00B0H	00	00	Unused Area	
25	00B1H	00	00	Unused Area	
26	00B2H	00	00	Unused Area	
27	00B3H	00	00	Unused Area	
28	00B4H	00	00	Unused Area	
29	00B5H	00	00	Unused Area	
30	00B6H	00	00	Unused Area	
31	00B7H	00	00	Unused Area	
32	00B8H	00	00	Unused Area	
33	00B9H	00	00	Unused Area	
34	00BAH	00	00	Unused Area	

35	00BBH	00	00	Unused Area	
36	00BCH	00	00	Unused Area	
37	00BDH	00	00	Unused Area	
38	00BEH	00	00	Unused Area	
39	00BFH	00	00	Unused Area	
40	00C0H	00	00	Unused Area	
41	00C1H	00	00	Unused Area	
42	00C2H	00	00	Unused Area	
43	00C3H	00	00	Unused Area	
44	00C4H	00	00	Unused Area	
45	00C5H	00	00	Unused Area	
46	00C6H	00	00	Unused Area	
47	00C7H	00	00	Unused Area	
48	00C8H	00	00	Unused Area	
49	00C9H	00	00	Unused Area	
50	00CAH	00	00	Unused Area	
51	00CBH	00	00	Unused Area	
52	00CCH	00	00	Unused Area	
53	00CDH	00	00	Unused Area	
54	00CEH	00	00	Unused Area	
55	00CFH	00	00	Unused Area	
56	00D0H	00	00	Unused Area	
57	00D1H	00	00	Unused Area	
58	00D2H	00	00	Unused Area	
59	00D3H	00	00	Unused Area	
60	00D4H	00	00	Unused Area	
61	00D5H	00	00	Unused Area	

62	00D6H	00	00	Unused Area	
63	00D7H	00	00	Unused Area	
64	00D8H	00	00	Unused Area	
65	00D9H	00	00	Unused Area	
66	00DAH	00	00	Unused Area	
67	00DBH	00	00	Unused Area	
68	00DCH	00	00	Unused Area	
69	00DDH	00	00	Unused Area	
70	00DEH	00	00	Unused Area	
71	00DFH	00	00	Unused Area	
72	00E0H	00	00	Unused Area	
73	00E1H	00	00	Unused Area	
74	00E2H	00	00	Unused Area	
75	00E3H	00	00	Unused Area	
76	00E4H	00	00	Unused Area	
77	00E5H	00	00	Unused Area	
78	00E6H	00	00	Unused Area	
79	00E7H	00	00	Unused Area	
80	00E8H	00	00	Unused Area	
81	00E9H	00	00	Unused Area	
82	00EAH	00	00	Unused Area	
83	00EBH	00	00	Unused Area	
84	00ECH	00	00	Unused Area	
85	00EDH	00	00	Unused Area	
86	00EEH	00	00	Unused Area	
87	00EFH	00	00	Unused Area	
88	00F0H	00	00	Unused Area	

89	00F1H	00	00	Unused Area	
90	00F2H	00	00	Unused Area	
91	00F3H	00	00	Unused Area	
92	00F4H	00	00	Unused Area	
93	00F5H	00	00	Unused Area	
94	00F6H	00	00	Unused Area	
95	00F7H	00	00	Unused Area	
96	00F8H	00	00	Unused Area	
97	00F9H	00	00	Unused Area	
98	00FAH	00	00	Unused Area	
99	00FBH	00	00	Unused Area	
100	00FCH	00	00	Unused Area	
101	00FDH	00	00	Unused Area	
102	00FEH	00	00	Unused Area	
103	00FFH	00	00	Unused Area	

FRU address and data example:

Addr	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	01	01	00	00	03	0B	00	F0	00	00	00	00	00	00	00	00
1	00	00	00	00	00	00	00	00	01	08	19	C7	58	58	58	58
2	58	58	58	CE	32	30	30	30	57	20	20	20	20	20	20	20
3	20	20	C0	C3	53	30	31	DC	58	58	58	58	58	58	58	58
4	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58
5	58	58	58	58	C0	C0	C1	B4	00	02	18	A1	45	40	06	40
6	06	23	05	10	27	9C	31	20	4E	C0	5D	2F	3F	0B	1F	D0
7	A7	00	00	00	0D	01	02	0D	7A	76	01	C4	04	88	04	00

8	05	78	00	64	00	10	40	01	82	0D	27	49	82	B0	04	74
9	04	EC	04	78	00	00	00	B8	0B	00	00	00	00	00	00	00
A	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
B	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
C	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
E	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
F	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

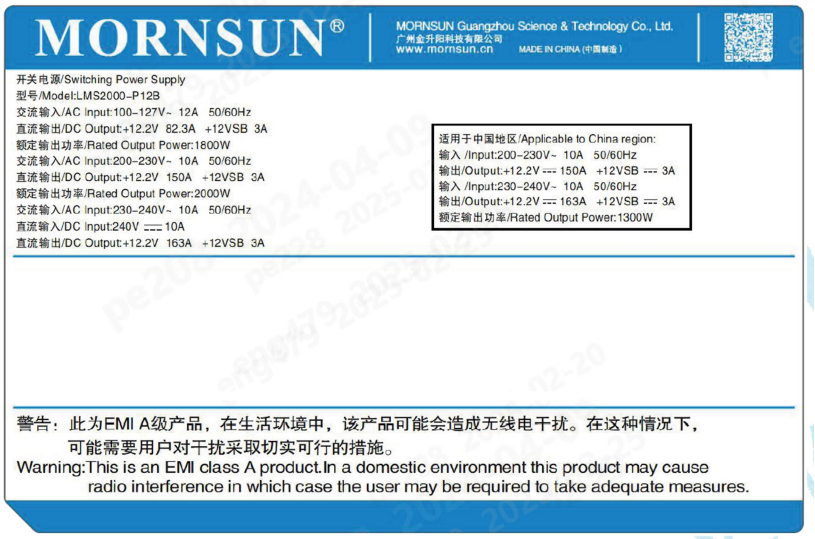
All data written to EEPROM should be ASCII code in hexadecimal format, and all checksums should be calculated by zero checksum.

Number	Items	Address	Bytes	Description	Numerical value
1	Checksum1	07H	1	100H-(Low Byte Sum(00H-06H))	F0
2	Checksum2	57H	1	100H-(Low Byte Sum(18H-56H))	Updated
3	Checksum3	5BH	1	100H-(Low Byte Sum(5DH-74H))	A1
4	Checksum4	5CH	1	100H-(Low Byte Sum(58H-5BH))	45
5	Checksum6	78H	1	100H-(Low Byte Sum(7AH-86H))	7A
6	Checksum7	79H	1	100H-(Low Byte Sum(75H-78H))	76
7	Checksum8	8AH	1	100H-(Low Byte Sum(8CH-98H))	23
8	Checksum9	8BH	1	100H-(Low Byte Sum(87H-8AH))	49
9	Manufacturer Name	1CH-22H	7	Use the ACSII Code	"XXXXXXX"
10	Product Name	24H-31H	14	Use the ACSII Code	"2000W"
11	Product Version No.	34H-36H	3	Use the ACSII Code (#1)	Updated
12	Product Serial No.	37H-53H	28	Use the ACSII Code (#2)	Updated

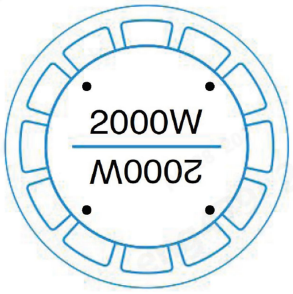
13	Unused Area	99H-FFH			00

7 Nameplate Information

Main label paper:



Fan label:



Barcode label:

1) Barcode content: YYMMDDPxxxxxxxxxxXXXX; Simply scan the QR code of the label on the product during production and automatically generate it.

2) YYMMDD: Production date, such as 230606, which is June 6, 2023;

3) Pxxxxxxxxxxx: Work order number, 12 digits;

4) XXXX: Serial number, starting from 0001. When filling in the serial number, it will be stacked within the same week, and the next week will start from 0001 again (such as: daily production capacity of 1000PCS, production capacity of 1000PCS on Monday in the first week, serial number of 0001-1000, production capacity of 1000PCS on Tuesday, serial number of 1001-2000, and so on until production capacity of 1000PCS on Sunday, serial number of 6001-7000; production capacity of 1000PCS on Monday in the second week, serial number of 0001-1000, and so on); When the number of serial numbers exceeds 9999, A represents 10, B represents 11, C represents 12... and so on until Z represents 26 (e.g. A000 represents 10000, A001 represents 10001; B000 represents 11000, B001 represents 11001).

5) HW: XX -- For example, HW: 01 represents hardware version 1, HW: 02 represents hardware version 2

6) FW: XX.XX.XX - For example, FW: 03.08.00 represents software version, secondary side version 1， primary side version 08, major version 00.

7) The time information involved needs to be replaced by codes, namely the fourth to seventh time information of YYMMDD and PXXXXXXXXX; The code information is as follows: for example, when YYMMDD is 20230727, hidden represents AAZNT7; When PXXXXXXXXXX is 727230723451, hidden indicates 727AAZN23451;

8 Packaging Package Information