

480W Uninterruptible Power Supply Unit for Universal Use

LUPS20-24F-N

MORNSUN®



CE Report

UKCA

RoHS 

EN 62368-1

BS EN 61558-1

FEATURES

- Universal 22.5 - 30VDC Input voltage
- Operating ambient temperature range: -40°C to +75°C, 60 °C @ 100% load without derating
- Output over-current, Input over-voltage protection
- Battery temperature abnormal protection
- Selection of battery buffer discharge time
- LED signal and Indication
- The base plate with conformal coating
- 3 years warranty
- Safety according to ANSI/ISA 71.04-2013 G3
- Safety according to IEC/UL62368, UL508, GB4943

LUPS20-24F-N is Mornsun Din rail UPS power supply with battery charge and discharge management function. It features wide input voltage range, cost-effective and high reliability. It offers excellent EMC performance and meet IEC/UL62368, UL508, GB4943 standards and it is widely used in areas of industrial, LED, street light control, electricity, security, telecommunications, smart home etc.

Selection Guide

Certification	Part No.	Output Power (W)	Nominal Output Voltage And Current (Vo/Io)	Battery Pack Rated Voltage (V)	Efficiency (%) Typ.*
EN	LUPS20-24F-N	480	24V/20A	24	98

Note: *Test when the battery is ready.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	DC input	22.5	--	30	VDC
Leakage current	30VDC	<0.5mA			

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Output Voltage Accuracy*	Full load range	Main power supply	22.5	--	30	V
		Battery buffered power supply	18	--	28.8	
Standby Battery Buffer Switching Voltage	Full load range, standby battery charging ready status	--	21	--	V	
Output Over-current Protection	Full input voltage	--	28	30	A	
Output Over-voltage Protection	Full load range	≤35VDC				

Note: *The main power supply voltage changes with the input voltage, which is about the input voltage minus the impedance of the internal device 0.3V. The battery buffer power supply voltage changes with the battery voltage, which is about the battery voltage minus the impedance of the internal device 0.3V. For the output voltage range, see the description in 2.2 Output Terminal in the Application manual.

Battery Management Features

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Battery Charging Voltage Range	Full input voltage range (Temperature compensation)	Serial charging	18	--	28.8*	V
		Single charging	9	--	14.4	
	Full input voltage range (No temperature compensation)	Serial charging	18	--	26.6	
		Single charging	9	--	13.3	
Battery Discharging Voltage Range	Full input voltage range	0.5A load discharging	20	--	28.8	
		20A load discharging	18	--	28.8	

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Battery Temperature Abnormal Protection*	Battery capacity $\leq 3.9\text{AH}$	Protection mode: turn off charging or discharging	High temperature protection	--	50	--	°C
			Low temperature protection	--	-10	--	
	Battery capacity $\leq 10\text{AH}$		High temperature protection	--	50	--	
			Low temperature protection	--	-10	--	
	10AH < Battery capacity $\leq 150\text{AH}$		High temperature protection	--	50	--	
			Low temperature protection	--	-40	--	
Battery Charging Current	Battery capacity $\leq 3.9\text{AH}$		--	1	--	A	
	Battery capacity $\leq 10\text{AH}$		--	2	--		
	Battery capacity $\leq 150\text{AH}$		--	3	--		
Selection of Battery Buffer Discharge Time	0.5 / 1 / 2 / 3 / 5 / 10 / 15 / 20 / 30 / ∞					min	
Battery Capacity Selection	$\leq 3.9\text{AH}$ / $\leq 10\text{AH}$ / $\leq 150\text{AH}$					AH	
Battery Maintenance Mode (Service)	Turn off charging or discharging, replaceable battery						

Note: 1. *It is necessary to connect the PT1000 temperature compensation sensor between the signal connection terminal pin17-18(see the bottom view of the specific connection position), otherwise the charging voltage can only reach 26.3V.
2. *This protection function and the protection temperature are not the allowed working temperature and limit of this product, the battery temperature protection is the battery charging and discharging protection function according to the battery application temperature range. See Application Manual 2.5 Battery temperature protection for details.

Signal And Indication

Name And Status Of Indicator Light					
Indicator Light name	Error	Diagnosis	Status Batt 1	Status Batt 2	
Indicator Light status*	★-----	Check wiring (Need to check the backup battery connection)	Power in (Input power supply normal)	Ready (Backup battery charged)	Ready (Backup battery charged)
	★★-----	Input warning (Input voltage abnormal)	Buffer time expired (The selected discharge time is not supported by the standby battery)	Charging (Standby battery charging)	Charging (Standby battery charging)
	★★★-----	High temperature (High temperature abnormal)	Remote (Remote shut-off standby discharge output)	Replace battery (Need to replace the discharge battery)	Replace battery (Need to replace the discharge battery)
	★★★★-----	Low temperature (Low temperature abnormal)	Overload (Output overload)	Buffering (Discharge output of standby battery)	Buffering (Discharge output of standby battery)
Name And Status Of Contact					
Contact name	Alarm	Bat Charge	Bat Mode		
Alarm status*	Check wiring (Need to check the backup battery connection)	Charging (Standby Battery charging)	Buffering (Discharge output of standby battery)		
	Service (Maintenance mode)				
	Replace battery (Need to replace the discharge battery)				
	Buffer time expired (The selected discharge time is not supported by the standby battery)				

Note: 1. *Indicator status, ★: indicates: ON 200ms, - indicates: OFF 200ms, such as ★★-----: ON 200ms, OFF 200ms, ON 200ms, OFF 1000ms; cycle repeat;
2. *The relay contact is closed in the alarm state, and the relay contact is open in the normal state.

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General Specifications

Item	Working Conditions	Min.	Typ.	Max.	Unit
Isolation Voltage	I/O - ⊕ Electric strength test for 1 minute, leakage current<5mA	1000	--	--	VAC
Insulation Resistance	I/O - ⊕ Ambient temperature: 25±5℃ Relative humidity: less than 95%, non-condensing Test Voltage: 500VDC	50	--	--	MΩ
Operating Temperature	Rated input voltage, rated output voltage, load	-40	--	75	℃
Storage Temperature		-40	--	85	
Working Humidity	Non-condensing	20	--	90	%RH
Storage Humidity		10	--	95	
Safety Standard		EN62368-1 (Report) Design refer to IEC/UL62368-1, UL508-1, GB4943.1			
Security Level		CLASS II, ANSI/ISA71.04-2013			
MTBF	MIL-HDBK-217F@25℃	>1000,000h			
Warranty		3 years			

Mechanical Specifications

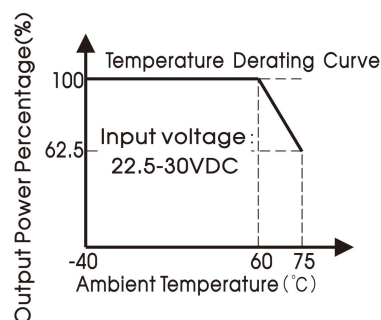
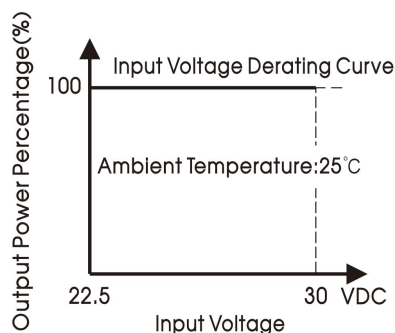
Case Material	Metal (AL5052, SUS)
Package Dimensions	124.00mm x 46.00mm x 124.00 mm (Without installation accessories)
Weight	600g (Typ.)
Cooling Mode	Free air convection

Electromagnetic Compatibility

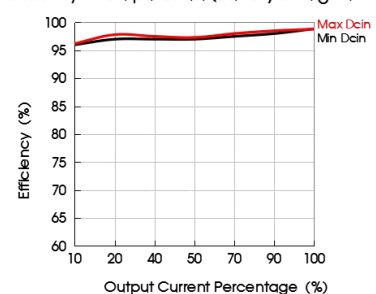
Emissions*	CE	CISPR32/EN55032 CLASS B		
	RE	CISPR32/EN55032 CLASS B		
Immunity	ESD	IEC/EN 61000-4-2	Contact ±8KV/Air ±15KV	perf. Criteria A
	RS	IEC/EN 61000-4-3	10V/m	perf. Criteria A
	EFT	IEC/EN 61000-4-4	±2KV	Input, output, signal perf. Criteria A
	Surge	IEC/EN 61000-4-5	line to line ±1KV/line to ground ±2KV	Input, output, signal perf. Criteria A
	CS	IEC/EN61000-4-6	10 Vr.m.s	perf. Criteria A

Note: *It is tested under the condition of unconnected battery.

Product Characteristic Curve



Efficiency Vs Output Load (Battery charged ready)



Note: This product is suitable for applications using natural air cooling; for applications in closed environment please consult Mornsun FAE.

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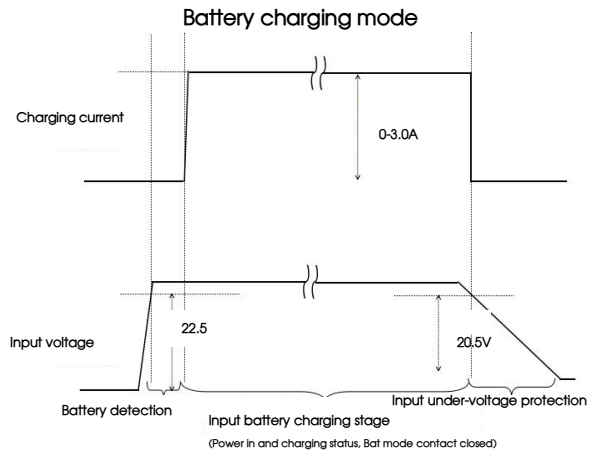
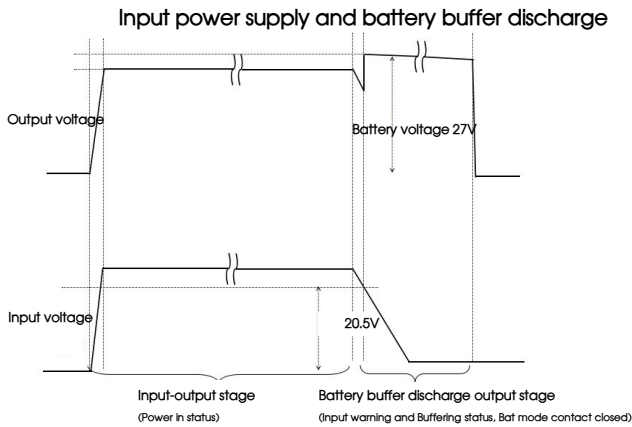
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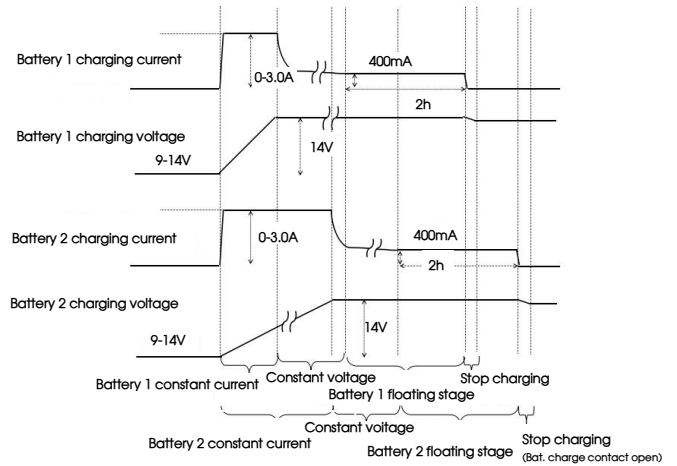
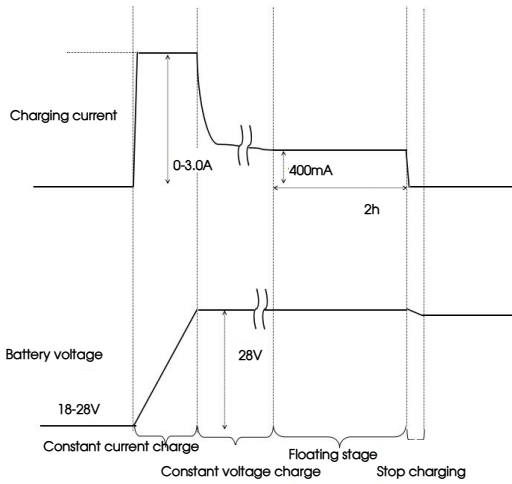
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Definition of Time Series Characteristic And Special status of Product

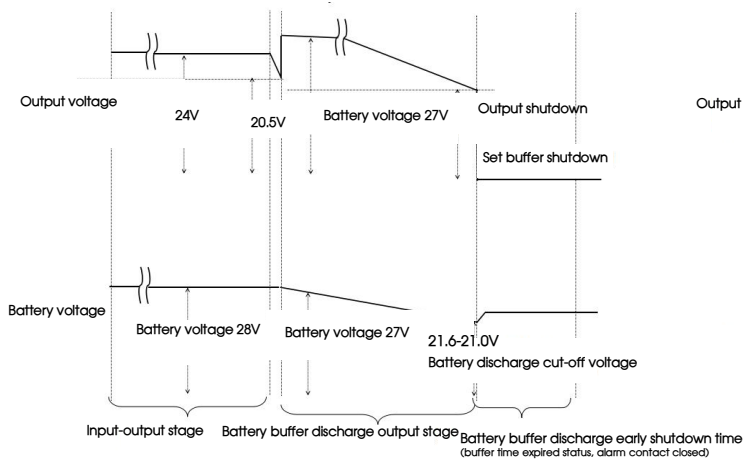


Two batteries are not connected to the neutral line in series charging mode

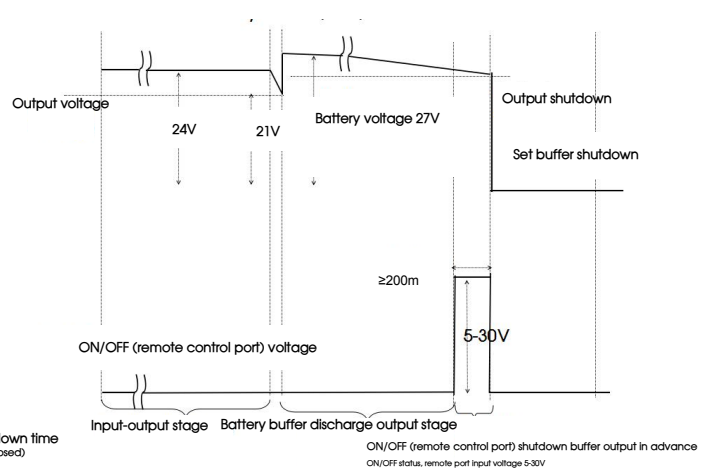
Two batteries connected to the neutral line in series charging mode



Buffer time expired status definition



ON/OFF status definition

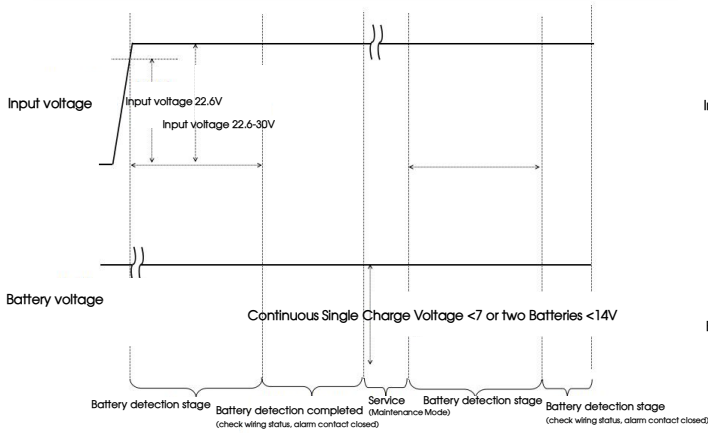


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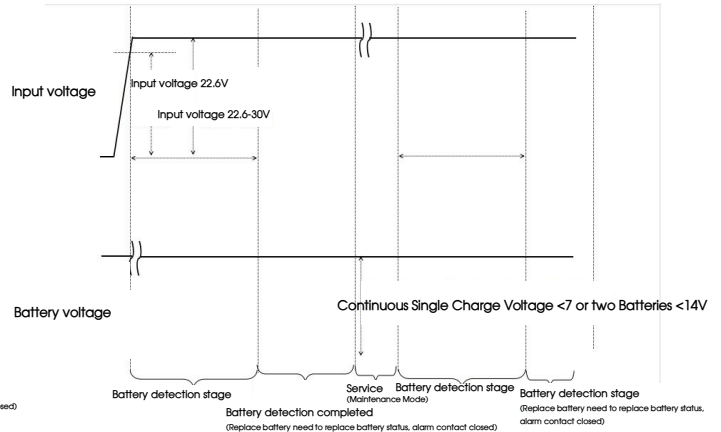
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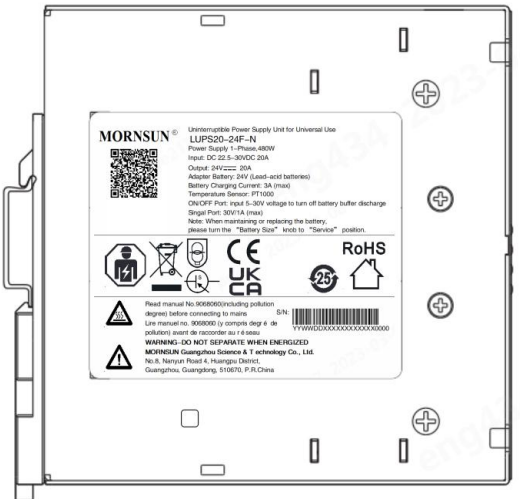
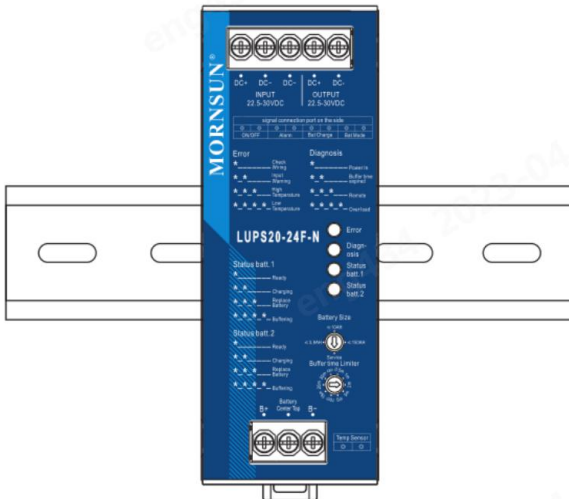
Check wiring status definition



Replace battery status definition



Installation Diagram



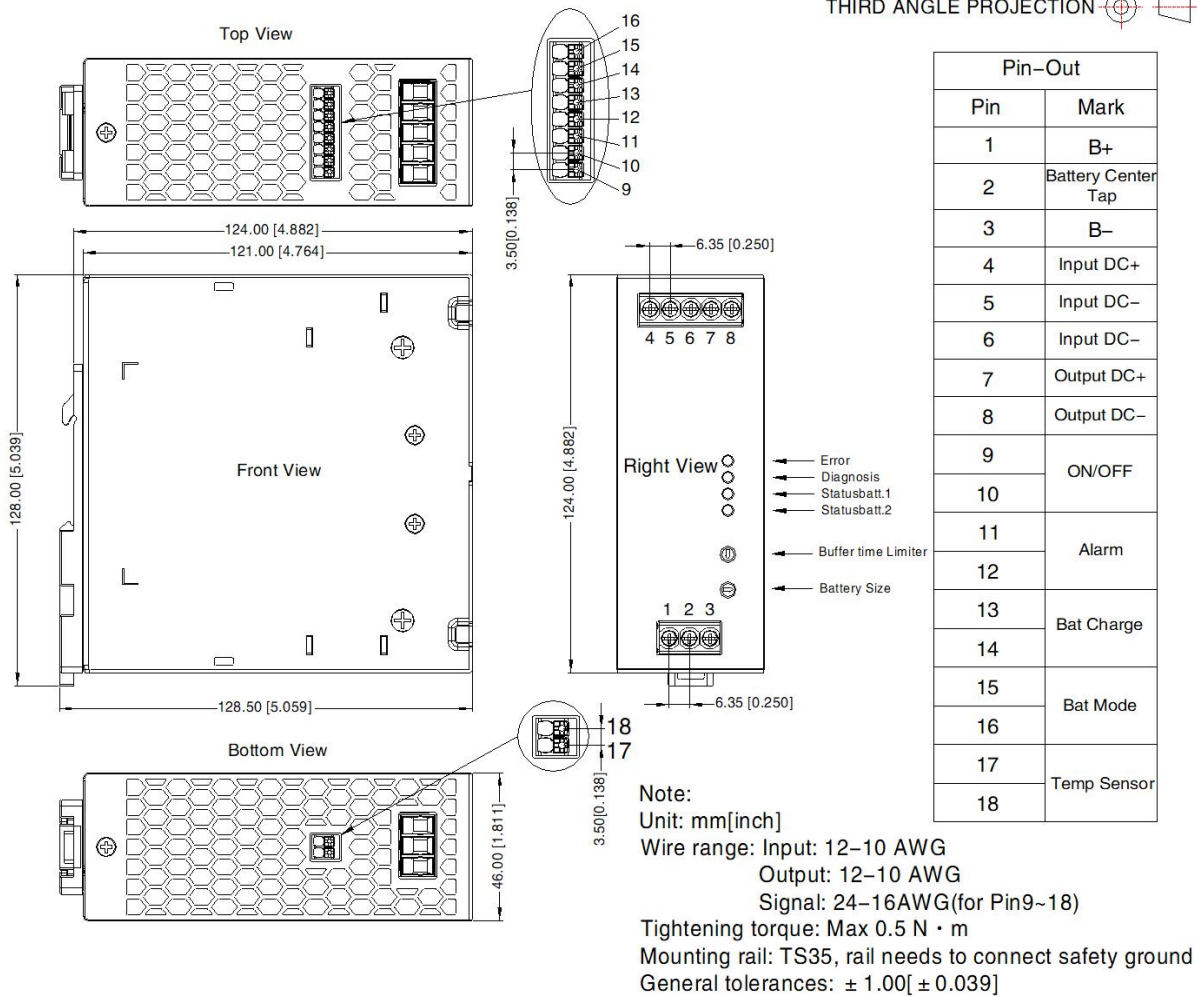
Note: Keep the following installation clearances: 20mm on top, 20mm on the bottom, 5mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15mm in case the adjacent device is a heat source (e.g. another power supply).

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Dimensions and Recommended Layout



Note:

- For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58220298;
- Unless otherwise specified, parameters in this data sheet were measured under the conditions of $T_a=25^{\circ}\text{C}$, humidity<75%RH with nominal input voltage and rated output load;
- The room temperature derating of $5^{\circ}\text{C}/1000\text{m}$ is needed for operating altitude greater than 2000m;
- All index testing methods in this datasheet are based on our company corporate standards;
- 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;
- We can provide product customization service, please contact our technicians directly for specific information;
- Products are related to laws and regulations: see "Features" and "EMC";
- The out case needs to be connected to PE (\oplus) of system when the terminal equipment in operating;
- Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units;
- 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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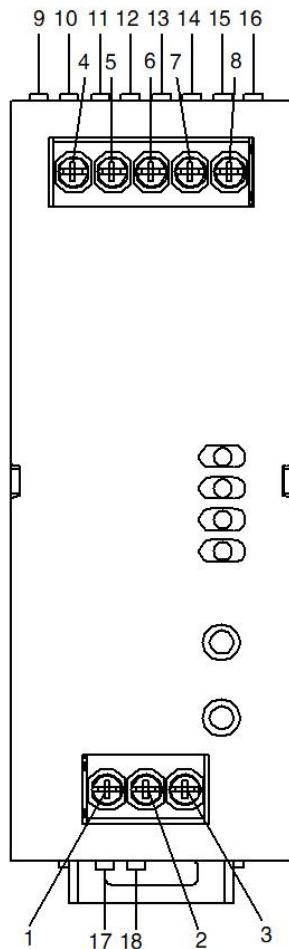
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LUPS20-24F-N Application Notes

Content

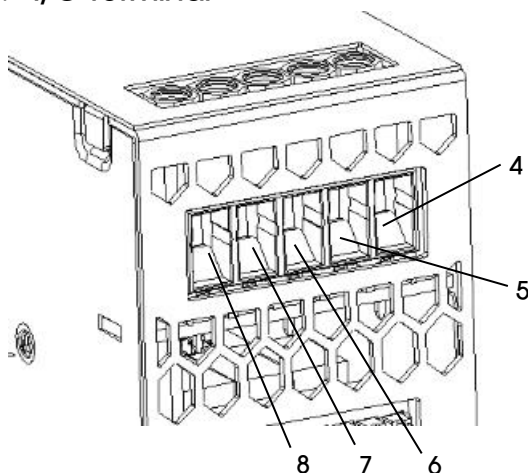
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1. Appearance



Pin Description	
Pin	Function
1	B+
2	Battery Center
3	B-
4	Input DC+
5	Input DC-
6	Input DC-
7	Output DC+
8	Output DC-
9	ON/OFF
10	
11	Alarm
12	
13	Bat Charge
14	
15	Bat Mode
16	
17	Temp Sensor
18	

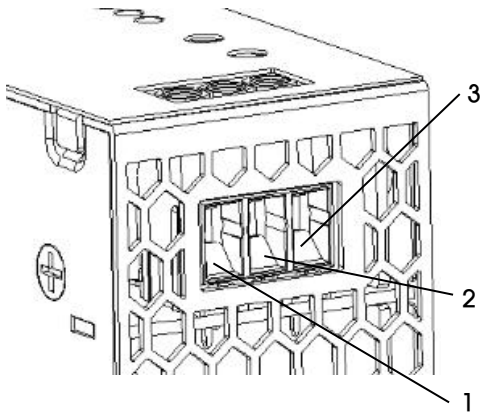
1.1 I/O terminal



Serial number	Pin Name	Pin Definition
4	Input DC+	Input Power supply
5	Input DC-	Input negative
6	Input DC-	Input negative
7	Output DC+	Output positive
8	Output DC-	Output negative

The input and output connection terminals use screw-type PCB terminals, the rated working current of the terminals is 32A, suitable for wire connection of 12 - 10AWG or 3.33 - 5.26 mm², the insulation stripping length of the wire connection end is 7 - 8 mm, and the screw tightening torque is: 0.5N/m or 4.43Lb/in.

1.2 Battery connector

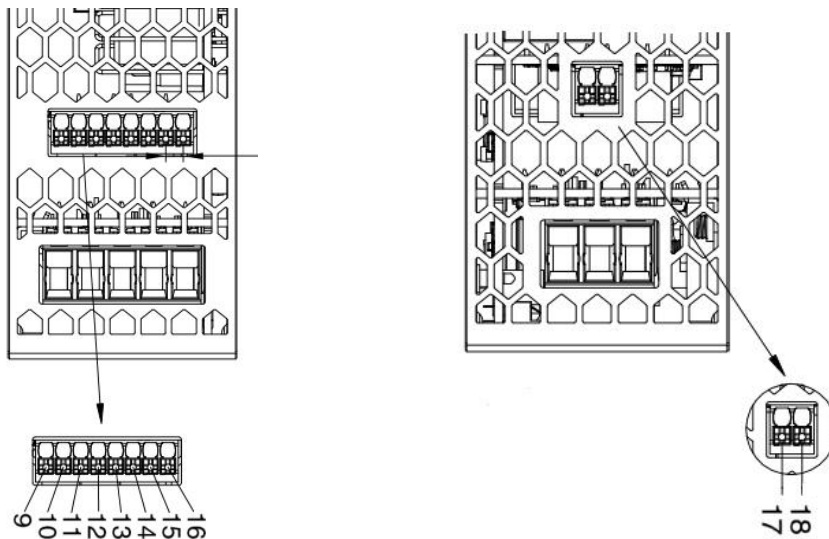


Serial number	Pin Name	Pin Definition
1	B+	Battery Pack Input Positive
2	Battery Center Tap	Neutral point and wire connector of series battery pack*
3	B-	Battery Pack Input Negative

Note: *When the battery has no midpoint, the battery midpoint line connection end does not need to be connected.

The battery connection terminal use screw-type PCB terminal, the rated working current of the terminal is 32A, suitable for wire connection of 12 - 10AWG or 3.33 - 5.26 mm², the insulation stripping length of the wire connection end is 7 - 8 mm, and the screw tightening torque is: 0.5 N/m or 4.43Lb/in.

1.3 Signal Connection Terminal



Serial number	Pin Name	Pin Definition	Note
9	ON/OFF	Remote Control Terminal, can be turned off remotely battery buffer discharge	Ports are not polarized
10			
11	Alarm	Alarm signal normally-closed contact output terminal	Ports are not polarized
12			
13	Bat Charge	Battery charge signal normally-closed contact output terminal	Ports are not polarized
14			
15	Bat Mode	Battery buffer discharge signal normally-closed contact output end	Ports are not polarized
16			
17	Temp Sensor	Battery temperature sensor connector	Ports are not polarized
18			

The signal connection terminal uses spring terminal, suitable for 24-16AWG or 0.2 - 1.32 mm² wire connection, the insulation stripping length of wire connection is 8-9 mm.

2. Function manual

2.1 Input Terminal

This power supply is not suitable for AC input and allows DC input voltage in the range of 22.5 V-30V. In the normal input voltage range of 22.5V-30V, the power supply and battery connection are normal. When the power supply detects that the input voltage is below 21V, the main power supply is switched to standby power supply to realize the output uninterruptible power supply output.

2.2 Output Terminal

The normal output voltage range of the power supply is 22.5V-30V. When the main power supply is supplied, the output voltage $V_{OUT} = V_{IN} - V_F$, V_{IN} is the input voltage, V_F is the internal voltage drop of the circuit, about 0.25-0.35V. When the battery pack buffer discharge output, the output voltage $V_{OUT} = V_{IN} - V_F$, V_{IN} is the battery voltage, V_F is the internal voltage drop of the circuit, about 0.1V-0.2V.

With the increase of the output load current of the power supply, the voltage drop at both ends of the lead-wire connected to the battery increases. In order to ensure that the capacity of the battery pack can be fully used and to prevent the battery pack from being damaged by over-discharge, the discharge cut-off voltage of the battery decreases linearly with the increase of load current when the battery is discharged and buffered. When the load current ≤ 0.5 A, the battery discharge cut-off voltage is 21V, when the load current ≥ 20 A, the battery discharge cut-off voltage is 20V. Therefore, when the load current ≥ 20 A, the minimum output voltage of the power supply is 20V.

When the voltage of the standby battery string is not equal to the input voltage of the main power supply and the output voltage of the standby power supply, and the load current is greater than or equal to 20A, the output voltage is $V_{OUT} = V_{BAT} - V_F$, V_{BAT} is the input voltage, V_F is the internal voltage drop of the circuit about 0.1V to 0.2V, and the standby power supply does not provide voltage stability.

2.3 Input Over-voltage protection

Power supply with input over-voltage protection function, when the input voltage is equal to about 32.5V, will trigger the power supply input over-voltage protection function.

2.4 Output Over-current protection

When the output current is > 28 A, it will enter the output over-current protection mode. At this time, if it works in the battery buffer discharge mode, the battery buffer discharge is stopped, that is, the output is stopped, and the corresponding abnormal status indication is output.

2.5 Battery temperature protection

When Battery Size is selected as battery capacity ≤ 10 AH, Battery temperature range from 50°C to -10°C , the battery will not be charged and discharged. This protective function and protection temperature are not the permissible operating temperature and limit of the product. When Battery Size is selected as battery capacity ≤ 150 AH, the allowable working temperature range from -40°C to -50°C , Battery temperature protection is based on the temperature range of the battery application battery charge, discharge protection functions.

2.6 Over-temperature protection

A thermistor is installed inside the product to detect the internal temperature of the case. When the internal working temperature is $>95^{\circ}\text{C}$, it will stop working and shut down the output to prevent the product from being damaged due to high internal temperature.

2.7 ON/OFF

The product provides the function of ON/OFF (remotely shut down the discharge output of the slow backup battery pack). greater than 500ms), the product will turn off the discharge output of the backup battery pack, and the Diagnosis indicator will display the Remote (remotely shut down the discharge output of the backup battery pack) status.

For example, set the Buffer time Limiter to 10m. At this time, the time of the discharge output of the backup battery pack is 10 minutes. However, at the moment when the discharge output of the backup battery pack is counted for 5 minutes, the customer system has already completed the work of power consumption, then it can The ON/OFF terminal inputs 12V signal voltage, and turns off the discharge output of the backup battery pack in advance to save battery power.

Special instructions: ON/OFF (remotely shut off the discharge output of the backup battery pack) function can only turn off the discharge output of the backup battery pack in advance when the backup battery pack is discharging output, and cannot turn on the backup battery pack in other status discharge output. When the main power supply of the product is normal, if the valid signal voltage is continuously input to the ON/OFF terminal, and the input terminal cuts off the main power supply at this time, the product will not enter the discharge output status of the backup battery pack.

3. Signal And Status Indication

3.1 Light Flashing

The product has a total of 4 LED indicators including Error, Diagnosis, Status batt 1 and Status batt 2. Error is a red LED indicator, indicating error and warning information; Diagnosis, Status batt 1, Status batt 2 are green LED indicators, indicating special status information.

According to the flickering of the indicator light, the rhythmic lighting and extinguishing, lighting up once, and then going out once, it is called lighting up for one beat, divided into 4 indication status:

Graphic method:

★-★—— indicates continuous lighting for 2 beats and continuous extinguishing for 2 beats;

★-★-★— Indicates 3 beats continuously lit and 1 beat turned off;

Take the Diagnosis indicator as an example:

★—— 1 beat on, 3 beats off continuously, indicating Power in status;

★-★—— Continuously lit for 2 beats, and continuously off for 2 beats, indicating Buffer time expired status;

★-★-★— Continuously light up for 3 beats, and turn off 1 beat, indicating the Remote status;

★-★-★-★- Lights up for 4 beats continuously, indicating the Overload status.

3.2 Special Status Definition

3.2.1 Error Indicator Indicates Status

Check wiring: This status will be displayed when the product does not detect the connection of the backup battery. It is necessary to check whether the backup battery is connected correctly and whether the backup battery is correct. When the voltage of a single battery is lower than 5V, the backup battery is considered damaged.

Input warning: This status will be displayed when the main power has no input voltage or the input voltage is lower than the under-voltage protection point and higher than the input voltage range, indicating that the input voltage is abnormal.

High temperature: The High temperature status is displayed when the battery temperature is above the set charging or discharging temperature range and when the product is in an environment beyond the maximum operating temperature range.

Low temperature: Low temperature is displayed when the battery temperature is below the set charging or discharging temperature range.

3.2.2 Diagnosis Indicator Indicates Status

Power in: This status will be displayed when the input voltage of the main power is within the input voltage range, indicating that input voltage is normal, and there is output voltage at the output terminal of the product.

Buffer time expired: When the product is in the battery pack discharge buffer output status, before the end of the Buffer time Limiter selection time, due to the backup battery under-voltage cut-off discharge, the discharge output of the backup battery pack is turned off early, and this status will be displayed, indicating the battery does not support the discharge output time of the backup battery selected by Buffer time Limiter.

Remote: When the output of the backup battery pack is discharged, the product can be turned off by inputting a reliable voltage 10-30V DC voltage signal (reliable duration greater than 500ms) to the ON/OFF terminal, displaying the Remote status.

Overload: When the output current is greater than 28A, it will enter the output overload protection mode. If it is working in the battery buffer discharge mode, it will stop the battery buffer discharge, stop the output, and output the corresponding abnormal status indication, displaying the Overload status.

3.2.3 Status Bat 1, Status Bat 2 Indicator Indicates Status

Ready: Battery charged.

Charging: Battery charging status.

Replace battery: When the battery impedance is higher than the set value, or when the voltage of two batteries is lower than 16V, the status of Replace battery is displayed, indicating the need to Replace the battery.

Buffering: Discharge output status of standby battery.

3.2.4 Relay Dry Contact Output And Indication Status

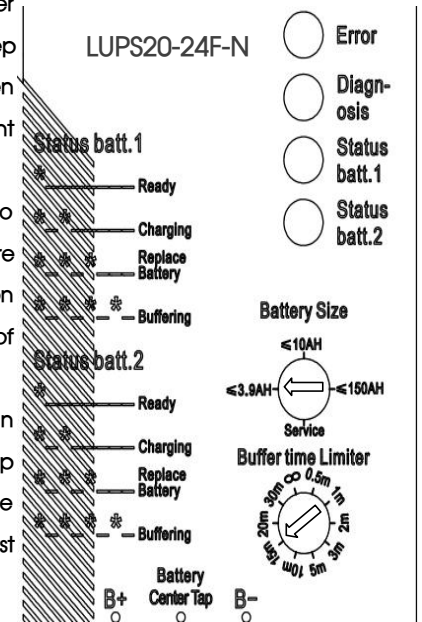
Relay Dry Contact Output And Indication Status			
Contact name	Alarm	Bat Charge	Bat Mode
Alarm status*	Check wiring (Need to check the backup battery connection)	Charging (Standby Battery charging)	Buffering (Discharge output of standby battery)
	Service (Maintenance mode)		
	Replace battery (Need to replace the discharge battery)		
	Buffer time expired (The selected discharge time is not supported by the standby battery)		
Note: *The relay contact is closed in the alarm state, and the relay contact is open in the normal state.			

3.2.5 Buffer Time Limiter And Battery Size Select Operation

The appropriate battery discharge output buffer timing time can be selected through the Buffer time Limiter knob. In order to facilitate accurate selection, this knob uses a selection knob with a step positioning effect, and there is a marked pointing arrow on the top of the operating handle. When performing a selection operation, just rotate the operation handle to make the pointing arrow point to the time scale to be selected, Buffer time Limiter scale mark time unit is (m, minute).

The required battery capacity can be selected through the Battery Size knob. In order to facilitate accurate selection, this knob uses a selection knob with a step positioning effect, and there is a marked pointing arrow on the top of the operating handle. When performing the selection operation, just rotate the operating handle so that the pointing arrow points to the capacity scale of the backup battery to be selected, and the scale marks the battery capacity unit as (AH).

When the operating handle is rotated to make the pointing arrow point to the Service scale in the scale mark, the product will prohibit charging or discharging the buffer output of the backup battery. At this time, the battery can be replaced and other maintenance operations can be performed. When pointing to the scale of the selected backup battery capacity, the product will first perform a backup battery connection detection and battery status detection.



4. Buffer Time

Buffer time refers to the timing of the discharge output of the backup battery. It provides a choice of 10 gears in the product to save power and prolong the service life of the backup battery while meeting the demand. The two main factors related to Buffer time are the reserve battery capacity and the discharge output load current of the reserve battery, i.e. the larger the reserve battery capacity, the longer the Buffer time and the smaller the load current, the longer the Buffer time, as follows:

Load Current (A)	Time for discharge output of standby battery (d: days, h: hours, m: minutes)						
	Battery Capacity (AH)						
	3.4	7.2	12	26	38	65	100
0	3d: 12h	8d	13d	30d	43d	77d	115d
0.5	5h: 13m	13h: 20m	2d: 5h: 14m	2d: 5h: 14m	3d: 9h: 1m	6d: 1h: 50m	9d: 3h: 54m
1	2h: 43m	5h: 15m	11h: 20m	1d: 1h: 27m	1d: 11h: 18m	2d: 23h: 45m	4d: 12h: 13m
2	1h: 31m	3h: 10m	5h: 29m	12h: 9m	19h: 5m	1d: 9h: 13m	2d: 5h: 14m
5	21m	56m	2h	4h: 44m	7h: 24m	13h: 53m	20h: 50m
10	8m	22m	47m	2h: 17m	3h: 28m	6h: 49m	10h: 7m
15	3m	7m	27m	1h: 21m	2h: 8m	4h: 23m	6h: 33m
20	/	2m	13m	55m	1h: 31m	3h: 4m	4h: 48m

5. Battery Size

Battery Size refers to the selection of backup battery capacity. Choose batteries with different capacities, the charging current will be different when the main power supply is normal.

For example: when different capacities of $\leq 3.9\text{AH}$ / $\leq 10\text{AH}$ / $\leq 150\text{AH}$ are selected, the corresponding maximum charging currents are 1A/2A/3A respectively. The allowable operating temperature is also different when selecting batteries with different capacities. For example, when selecting $\leq 3.9\text{AH}$ / $\leq 10\text{AH}$ / $\leq 150\text{AH}$, the allowable operating temperature of the backup battery is $-10^{\circ}\text{C} - 50^{\circ}\text{C}$; when selecting $\leq 150\text{AH}$, the allowable operating temperature of the backup battery is $-40^{\circ}\text{C} - 50^{\circ}\text{C}$, when the lead-acid battery is in a low temperature environment, the chemical activity of the electrolyte and the electrode plate is greatly reduced, resulting in an increase in the internal resistance of the battery and a decrease in the battery capacity. When using high power, it will accelerate battery aging.

Especially for small-capacity batteries, it is even more serious. Therefore, when selecting a small-capacity battery, the operating temperature is limited according to the battery specification. The battery temperature detection adopts a precise temperature sensor (PT1000), which can accurately detect the working temperature of the battery and protect the normal operation of the battery.

6. Input Power and output power

When the battery is recharged, the output power is $\text{POUT} = \text{PIN} - \text{Plosses} - \text{PCharging}$, so the output power is not equal to the input power.

7. Installation requirements

7.1 Installation mode

The design of product structure and temperature characteristic is based on the vertical-up installation, which is beneficial to the ventilation and heat dissipation of the product and the stability of the structure.

