Charging Power Supply Application Guide 2017

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1. Foreword

The following guide should be carefully read prior to product use. Improper use may result in the risk of electric shock, damaging the power supply, or fire, etc.

1.1 Warnings

(1) The product must be handled with care to avoid the product damage caused by the impact or fall.

(2) Do not open the case or touch internal components to avoid the product damage of electrostatic, components stress, etc.

(3) When the product is in operation, keep a distance away from the product or do not touch the heat sink and case to avoid potential hurts during improper cooperation.

1.2 Precautions

(1) Please make sure that the input terminals, output terminals, signal terminals and necessary peripheral components are properly connected in accordance with the stated datasheet requirements.

(2) Charging Power Supplies are used in the primary transmission stage of a design and thus, should be installed in compliance with certain safety standards；

(3) A fuse is required to be connected in the input AC line (L) to meet the safety requirements in operation. Please refer to the corresponding datasheet for the recommended fuse part number.

(4) The end device manufacturer should ensure that the end user can not touch the product because there is a high voltage in the input of power supply. Manufacturers must ensure that the module's input/output will not cause short circuit due to engineers' mistakes.

(5) The application circuits and parameters shown are for reference only. All parameters and circuits are to be verified before completing the circuit design.

(6) If the product is stored or out of work for more than half a year, it is suggested to have the product aged for 1 hour at no load every half a year to ensure the long lifetime and the application of high reliability.

(7) The device using AC-DC module inside should start operating for half an hour every half a year to get the electrolytic capacitor recharged and ensure the lifetime of the power supply. The general AC-DC product is not suggested to operate for a long time under high temperature, and it is strongly suggested to replace new product every one or two years if it has to be operated under high temperature. There should not be large heating device around the power supply, such CPU, electric machine, etc.

(8) The installation and use of the product should be guided by professional designers.

(9) MORNSUN has the right to update this guide at any time without notice, please check the most up to date information on MORNSUN website before use. For other questions, please

contact our technical person.

2. Selection Guide

First, confirm the specification of the product and select the product according to the required parameters. Then confirm to use a standard product or a custom power supply. If there is no standard part which can meet the specification requirements, customization is acceptable. Below Figure 2-1 is the basic selection diagram for MORNSUN charging power supplies.

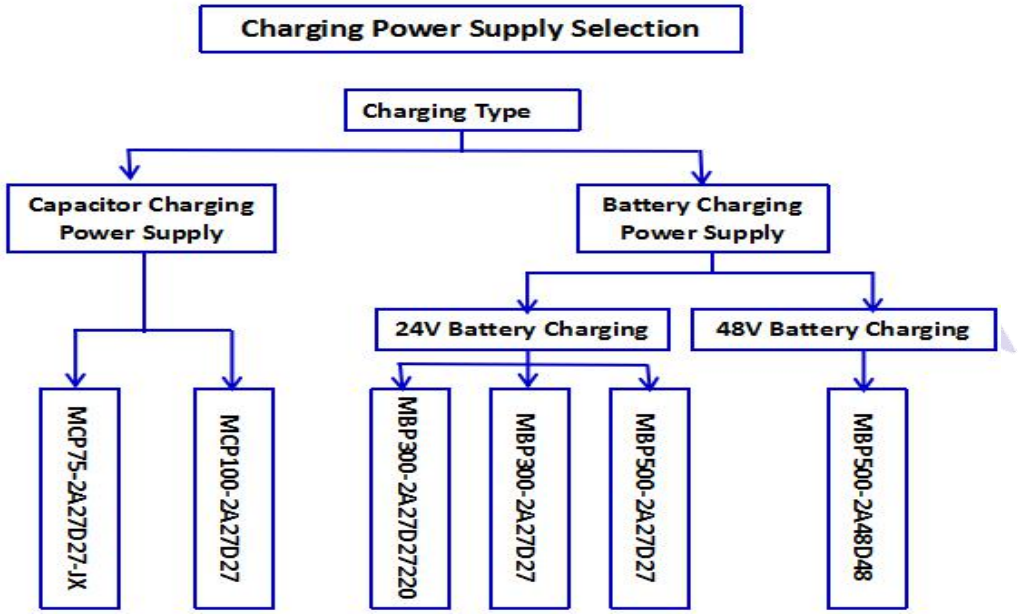


Figure 2-1: Selection Block Diagram

Note: MORNSUN reserves the right to add new product into above selection diagram without notice.

Step 1, confirm the charging type

First, confirm that this power supply is to charge the super capacitor or the lead acid battery. If it is the super capacitor, MCP series is recommended; if it is the lead acid battery, MBP series is recommended.

Step 2, confirm the charging voltage specification

Select the appropriate charging power supply specification based on the voltage specifications of the energy storage components used. If it is a 24V lead acid battery, 27V output voltage product is recommended; if it is a 48V lead acid battery, 54V output voltage product is recommended. The maximum operating voltage of the super capacitor should be more than the charging voltage. The charging voltage of the battery should be more than its rated operating voltage to play the float role, but need to avoid the high float voltage damaged the battery. For detailed voltage, please refer to the datasheet.

Step 3, confirm the power of charging power supply

Charging power supplies are dual output, the one output is to charge the capacitor(battery), the

other is to connect the corresponding load. The power need to be selected based on the actual load.

It is recommended to use MORNSUN standard power supplies because they are more cost-effective, reliable and shorter sample delivery time, etc. For special output voltage, high temperature application, more protections and other special performance requirements, please contact our technical person.

3. Charging Power Supply Test

The product needs to pass the inspection test in customer's device before use. Below are some common test methods.

Note: This test can't connect energy storage components like a super capacitor or a battery, and it mainly use to test the output characteristics parameters as well as the isolation withstanding characteristics

3.1 Single Test Circuit and Operation of Charging Power Supply

As shown in figure 3-1, AC power supply is to provide the corresponding AC input voltage to the power supply, and the electric supply can be replaced directly if there is no such instruments. Power Meter is used to test the input power when the power supply in operation. Oscilloscope is used to test the output voltage ripple noise, dc voltage and other waveform and parameters. Voltage Meter is used to test the output voltage. Current Meter is used to test output current. The load during testing is recommended to use the electronic load instrument or pure resistor load.

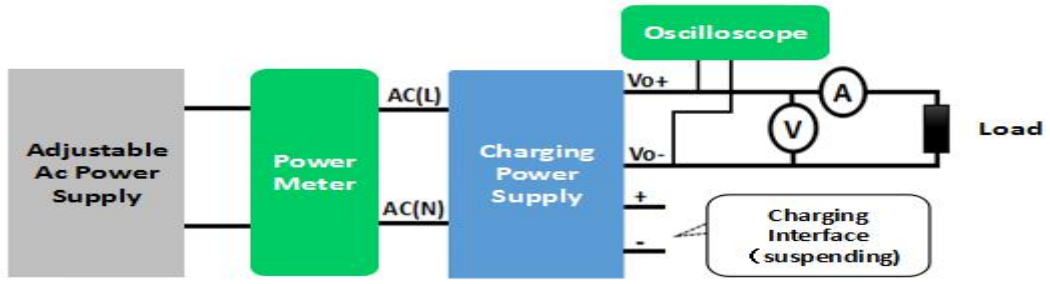


Figure 3-1: Basic Test Circuit Connection

After completing above circuit wiring and checking, ensure that the output voltage setting of the adjustable AC power supply meet the input voltage range provided in the datasheet to avoid high input voltage damaging the power supply. Then confirm whether the load current or resistance is reasonable. Please note that any energy storage components like a super capacitor or a battery can't be connected here. Finally, power on the product and do a basic performance test operation.

Note: The input nominal voltage of MORNSUN AC/DC charging power supply is 220VAC.

3.2 Basic Performance Test

3.2.1 Output Voltage Accuracy

At nominal input voltage, 50% rated current output, output set value voltage reads V_{nom} At nominal input voltage, measured output voltage reads V_{out}	$\text{Output Voltage Accuracy}=\frac{Vout-Vnom}{Vnom}\times 100\%$

3.2.2 Line Regulation

At nominal input voltage, rated load, measured output voltage reads V_{outn} At input voltage upper limit, rated load, measured output voltage reads V_{outh} At input voltage lower limit, rated load, measured output voltage reads V_{outl} V_{mdev} reads the maximum value deviated from V_{outn} between V_{outh} and V_{outl}	$\text{Line Regulation}=\frac{Voutn-Vmdev}{Voutn}\times 100\%$

3.2.3 Load Regulation

At nominal input voltage, 10% load, measured output voltage reads V_{b1} At nominal input voltage, 100% load, measured output voltage reads V_{b2} At nominal input voltage, 50% rated current output, output set value voltage reads V_{b0} V_b reads the maximum value deviated from V_{b0} between V_{b1} and V_{b2}	$\text{Load Regulation}=\frac{V_b-V_{b0}}{V_{b0}}\times 100\%$

3.2.4 Conversion Efficiency η

The conversion efficiency of AC/DC power supply: the voltage and current tested by the multimeter in the input can't be directly calculated as the input power, and it generally uses the power meter to read the input power P_{in} directly. The output power is calculated by the actual output load I_{out} and output voltage V_{out}.

At nominal input voltage P_{in}, full load $Iout$, measured output voltage reads V_{out}	$\text{Efficiency}\quad \eta=\frac{I_{out}\times V_{out}}{P_{in}}\times 100\ \%$

Note: The input is AC, the internal inductive reactance and capacitive reactance can result in phase difference occurred in the input voltage and current and distorted input current wave.

3.2.5 Ripple Noise

The ripple and noise is the periodic and random AC variation superimposed on DC output, and also affects the output accuracy. Generally, ripple and noise is calculated with peak to peak value(mVp-p).

Step 1, set the oscilloscope bandwidth to 20MHz to eliminate high frequency noise effectively.

Step 2, use twisted-pair cable or contact measuring method. Shown as Figure 3-2 and Figure 3-3.

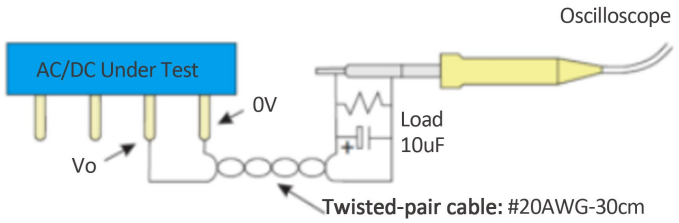


Figure 3-2: Twisted-pair Cable Measured Method

Twisted-pair cable measuring method: connect the twisted-pair cable composed of 30cm long and #20AWG to the Vo and 0V of the switching power supply that needs to be tested, and add a resistance dummy load between Vo and 0V. Then, connect a 10μF electrolytic capacitor at the end of the twisted-pair cable, when the point of measurement connecting, one end is connected to the oscilloscope probe terminal and the other end is connected to Grounding ring.

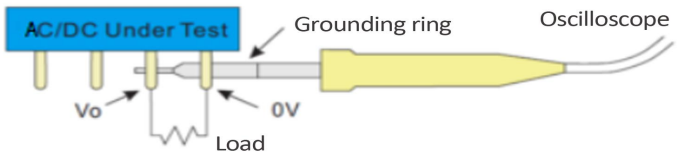


Figure 3-3: Contact Measuring Method

As the variety of high-frequency noise received by the oscilloscope's ground clamp can interfere the measurements, the contact measuring method can be used to eliminate the interference.

Note: Charging Power Supplies are wiring output. If contact measuring method used, it is required to connect the non-insulation wire to output end so that the the oscilloscope probe can be close to the port for testing.

The actual measured ripple and noise varies with the circuit and the external components, shown as Figure 3-4.

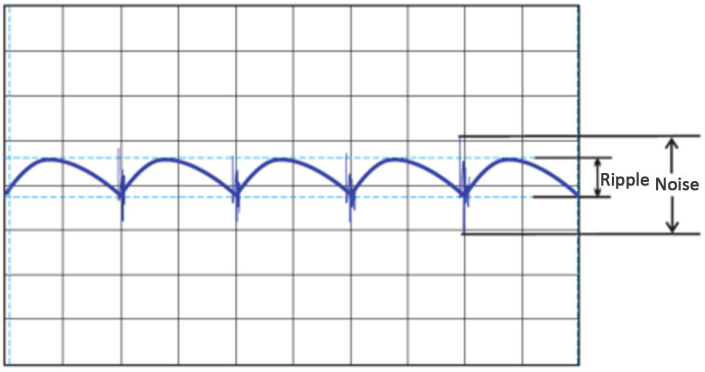


Figure 3-4: Ripple&Noise Test Waveform

3.2.6 Insulation characteristics

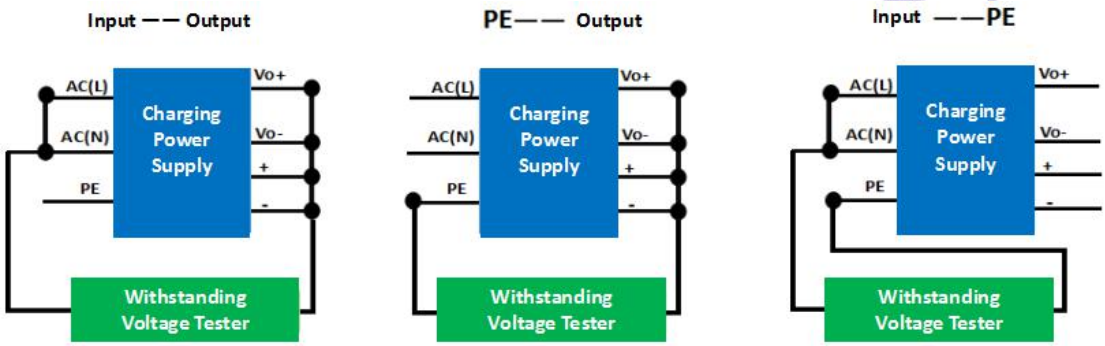


Figure 3-5: Withstand Voltage Test

Withstanding voltage test method:

Connection shown as above Figure 3-5, rise the withstanding voltage from 0 slowly according to the test standard of withstanding voltage, and maintain for one minute at the set point when set to the set value.

Insulating Strength:

To short the pin of input and output respectively, and apply a isolation voltage between the input and output. Test for one minute.

Note: For detailed specification, please refer to the datasheet.

4. Typical Applications

4.1 Typical Application Circuit of Capacitor Charging Power Supply

Below Figure 4-1 is recommended to use in the actual application of Capacitor Charging Power Supply.

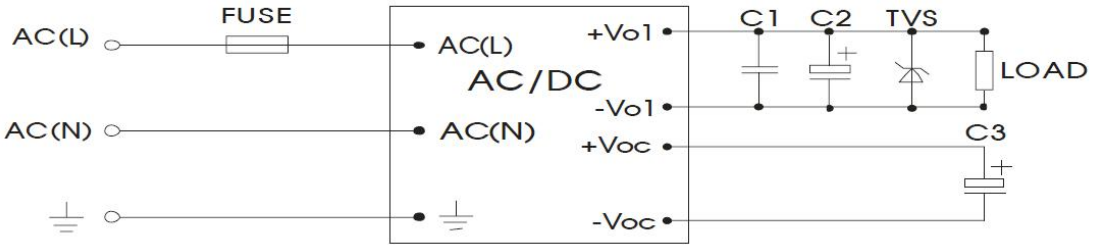


Figure 4-1: Typical Application Circuit of Capacitor Charging Power Supply

(1) FUSE is in the input side which should be the slow blow fuse with safety certification. Recommended value is 3.15A/250V.

Note: If the rated current value of the fuse is too large, there is no protection. While if the rated current value is too small, the internal capacitor charge is easy to cause false blow when power on.

(2) C1 is a ceramic capacitor which is used to remove the high frequency noise. Recommended value is 1μF/50V.

(3) C2 is a output filter electrolytic capacitance, and is recommended to use the high frequency low resistance electrolytic capacitance. The capacitance is recommended to refer to the corresponding datasheet. The derating of the capacitor withstanding voltage should be derated to 80%.

(4) TVS is used to protect the post-stage circuit when the product is abnormal. The recommended value is SMBJ30A.

(5) C3 is a big capacity capacitor which is used for UPS, like super capacitor.

4.2 EMC Recommended Circuit for Capacitor Charging Power Supply

When applied to harsh electromagnetic compatibility environment, EMC filter circuit is needed. Figure 4-2 is a typical kind of input EMC filter circuit only for reference. For specific recommended EMC circuit and parameters, please refer to the corresponding datasheet.

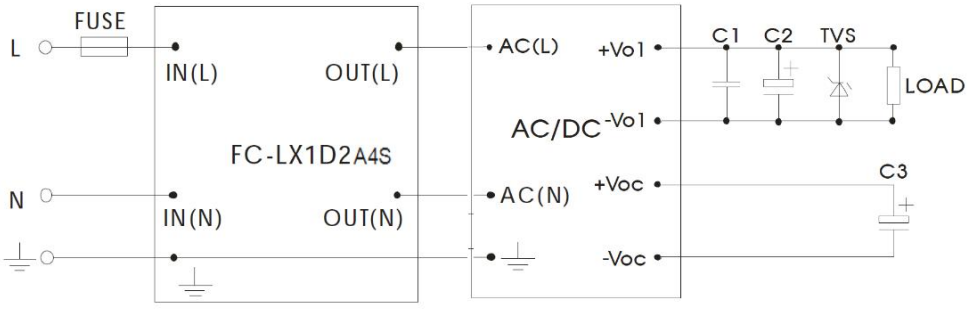


Figure 4-2: Typical Input EMC Filter Circuit

4.3 Precautions

(1)The output pin 4 is defined as K which is the AC power failure alarm terminal. When AC is power on, K terminal to -Vo1 is high level which is more than 23V. When AC is power off, K terminal to -Vo1 is low level which is less than 5V, and K terminal can not be used as load output terminal.

(2) The load of output big capacity capacitor can not be reversed so as to avoid danger.

(3) The output short circuit is not allowed when the capacitor is power on so as not to damage the power supply.

(4) This product can only be used for UPS, and it is not allowed to be continuously and frequently charged and discharged. When the continuous charge and discharge needed, the control of charge and discharge amount is less than 60 seconds, and the interval time need to be increased according to the derating ratio if the temperature is higher than +55℃.

(5) For output regulation please refer to the appearance dimension, the output voltage increases when anticlockwise adjusted. Please ensure that the output voltage of Vo1 is a little more than the limited voltage of Voc when adjusting the output voltage. And it is suggested that Vo1 voltage at full load is more than the limited voltage of Voc.

4.4 Typical Application Circuit for 27V/54V Output Charging Power Supply

Internal functional block diagram for 27V/54V output charging power supply shown as figure 4-3.

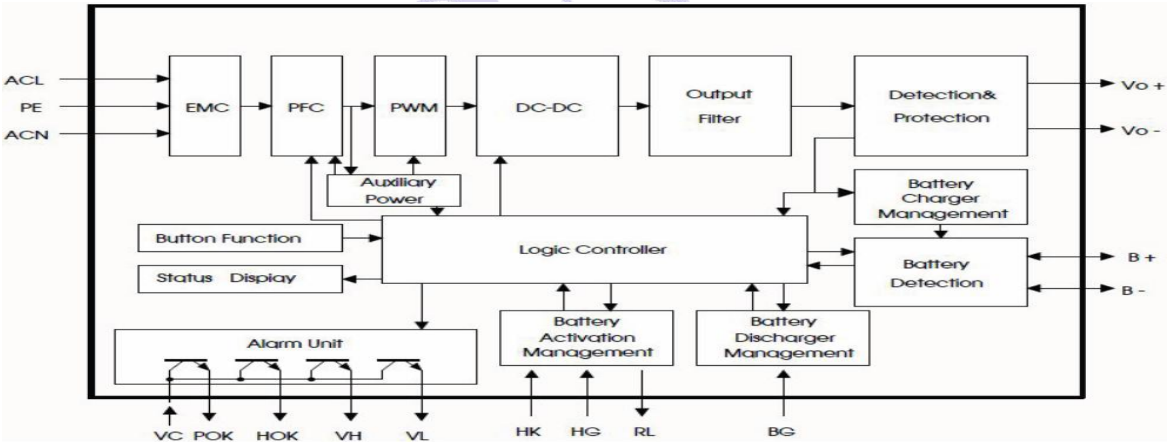


Figure 4-3: The Internal Functional Block Diagram of 27V/54V Output Charging Power Supply

There are four parts of external circuits, shown as figure 4-4. Gridline ① is the high voltage AC input connection. Gridline ② is the various types of alarm signal output terminals which is used to know the product state by detecting the variation of such voltage signals and for remote monitoring. Gridline ③ is the input terminal of the remote signal which is used to control K1/K2/K3 and for remote control operation. Gridline ④ is the connection of load output and energy storage batteries.

For the definition of each terminals, please refer to the corresponding datasheet.

In application, if external monitoring and control operation is not required for the charging power supply, there is no need to design and connect the circuit ②③ of gridline.

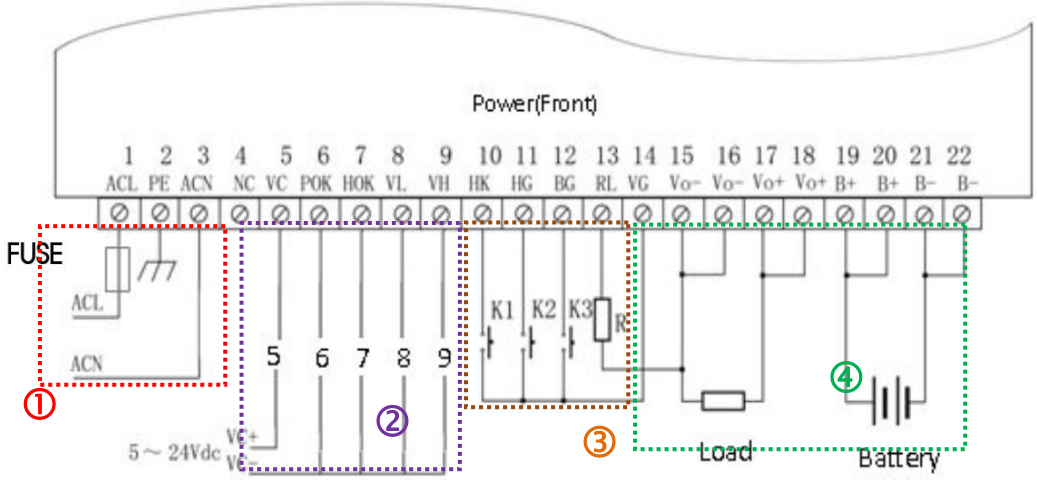


Figure 4-4: Typical Application Circuit of Battery Charging Power Supply

(1) FUSE is in the input side which should be the slow blow fuse with safety certification. Recommended value is 10A/250V.

Note: If the rated current value of the Fuse is too large, there is no protection. While if the rated current value is too small, the internal capacitor charge is easy to cause false blow when the product started.

(2) VC+/VC- is the operating voltage of related alarm signal output terminal, and it needs to connect a 5-24VDC isolated voltage, which can realize the remote control. And the alarm node, power input, output, case, protection are isolated.

(3) K1 K2 K3 are the relay contacts controlled by user CPU which is used for remote control and operation.

(4) R is a discharge resistance of activation of battery which is used to achieve the rapid activation of the battery process. Select the discharge resistance based on different battery capacity. When this product work normally, this resistor does not work. When the power into AC/DC product activation state, the resistance is automatically connected to the battery discharge circuit. Recommended discharged circuit as below:

Discharge current (A)=0.1x battery capacity(AH) - regular load current(A)

If the calculated discharge current value is negative, the discharge resistance can not be added. If the discharge resistance is hotter, it should be properly cooled and away from power supply.

(5)The battery is the energy storage components, which is used for UPS, such as 24V lead-acid battery pack, 48V lead-acid battery pack.

Note: The output load short circuit protection test is not allowed in the use of batteries and other energy storage components.

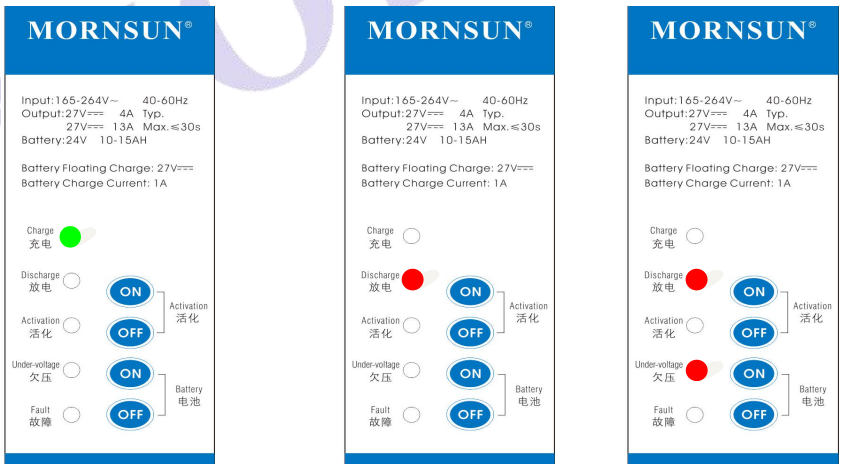
4.5 Management and state Display of Battery Charge and Discharge

This kind of product integrates smart battery charge and discharge, state display and other management functions. In addition, the charging process is automatically monitored and executed by the product itself. Figure 4-5 is the signal change on the label of product case.

Battery Charge: Real-time monitoring of the battery charging process, intelligent switching fast charging and floating charging mode. When there is a AC high voltage input, the battery is always in the state of charging. When the battery storage capacity is low, then automatically switch to fast charge. When the battery storage capacity is almost full and the voltage across the battery is close to the maximum output load voltage, like 27V or 54V, then It is automatically switched to float mode to ensure that the battery will not be overcharged, shown as the charging signals of figure 4-5.

Battery Discharge: Automatic detection of battery discharge under voltage protection point, discharge off point and automatic shutdown output.

When AC input terminal off the power, it is automatically switched to the battery through the product to the load power supply state, shown as figure 4-5 discharge signals. When the battery continued to power the load, if the battery energy is insufficient, the output voltage dropped accordingly. When the output voltage dropped to the corresponding protection point voltage, it shows under voltage alarm signal, shown as the output under voltage signal of figure 4-5. When it continuously discharge after under voltage alarm and it drops to certain extent, the product will automatically turn off the output voltage to avoid excessive discharge of the battery and affect the use.



Charging state Discharging state State of output under voltage

Figure 4-5: Signals Change in the Charging and Discharging of Battery Charging Power Supply

4.6 UPS

When MBP series work with the battery at input power-down, "0" seconds switch to the gap and the

output DC uninterrupted power supply.

Test operation process -Complete the line connection according to figure 4-4(②③ can not access). It uses the differential high-voltage probe to detect the input AC voltage waveform in the input, and uses the oscilloscope probe to detect the voltage waveform across the product of output voltage Vo+/Vo-. Then enter the electric supply power off, on and other operations, and observe the load DC output voltage waveform. When the electric supply power off, the output DC voltage continues to output steadily. Take MBP500-2A27D27 as an example, the actual test UPS is shown as following figure 4-6.

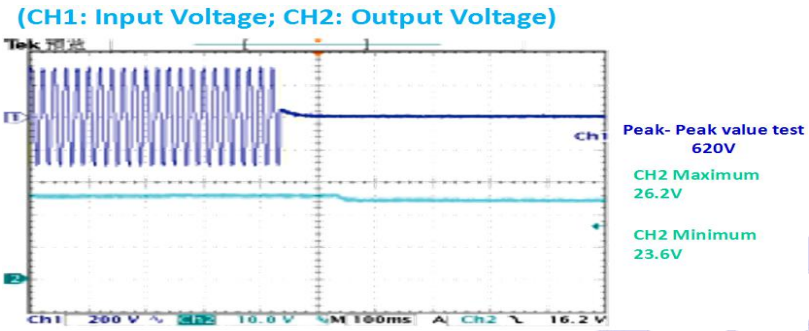


Figure 4-6: The Output UPS Voltage Waveform of Battery Charging Power Supply

4.7 Maximum Instantaneous Overpower

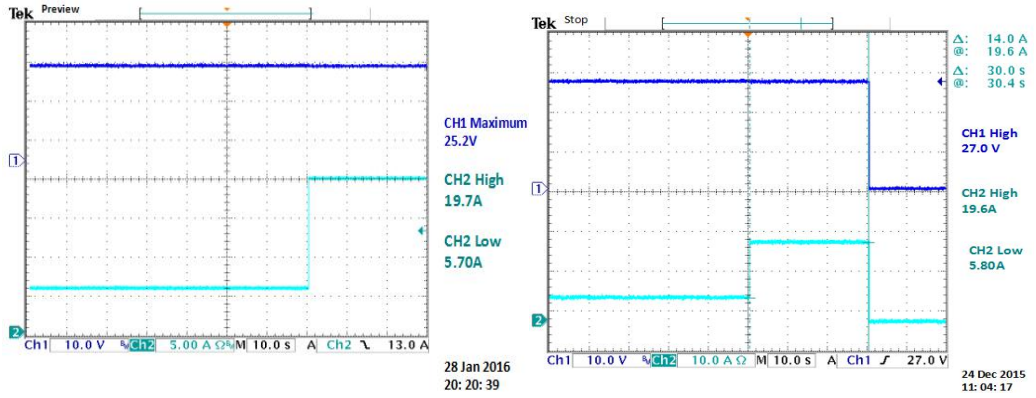
When MBP series works with the battery in steady state operation, the output load will switch from a typical load value to the maximum one: (1) If the typical load is restored within the maximum duration, the product output voltage remains in the normal state. (2) If the maximum duration is exceeded, the product will enter into output protection state. The product will occur self-recovery and restart after 4-5 minutes and enter into above (1)(2) working states.

The above design is to maintain the reliability of the Charging Power Supply and the overall system security when the actuator is in an abnormal operation process.

Test operation process -Complete the line connection according to Figure 4-4(②③ can not access), it uses the oscilloscope probe o detect the voltage waveform across the product of output voltage Vo+/Vo-, and uses the differential high-voltage probe to detect the waveform of output load. The initial output load current is set to the typical load current, and then switch to the maximum load current(or less than the maximum value). The duration is 30s, and the output voltage is normal.

If the load is switched to normal load or typical load current within 30s, the output voltage of the product does not change. If the duration is more than 30s, it will enter into the protection state, turn off the output load and automatically restart after about 5 minutes. If the switch is still in the over-current state, then repeat the protection state.

Take MBP500-2A27D27 as an example, the actual test maximum instantaneous over power voltage and current waveform is shown as following figure 4-7.



Duration is less than 30s　　Duration is less than 30s

Figure 4-7: Maximum Instantaneous Overpower Test Waveform of Battery Charging Power Supply

4.8 External Communication Function - Alarm Signal

Alarm Signal Application Design Reference--Product alarm signal output port and the product itself using the Optocoupler for security isolation and transmission of signals, the specific circuit of alarm signal ports is shown as following figure 4-8.

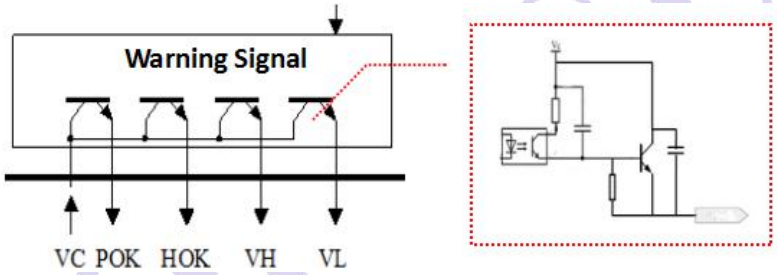


Figure 4-8: Operating Circuit Diagram of the Alarm Signal Port

To apply +5V to +24V DC voltage at the VC terminal, the Optocoupler output terminal is turned on or off when the alarm is on, the load capacity of alarm node needs to refer to the datasheet, the voltage drop of the alarm node is 0.1~3V. This alarm node is not suitable for the load with a large power, if necessary,

It can use a transistor(it can drive the external power) to drive the load. Alarm state true value is as follows,

Alarm terminal	The alarm	Normal (or Non-active)	Alarm (or Activation)
VC	Positive input alarm	--	--
POK	Input loss alarm	on	off
HOK	Activated state	off	on
VL	Battery under voltage alarm	off	on
VH	Fault alarm(over-voltage)	Off	on

Note: In the application design, the voltage provided by the monitoring circuit needs to be isolated from the output load voltage of the product to avoid invalid safety isolation of the alarm signal port.

4.9 Activation and Control of Battery

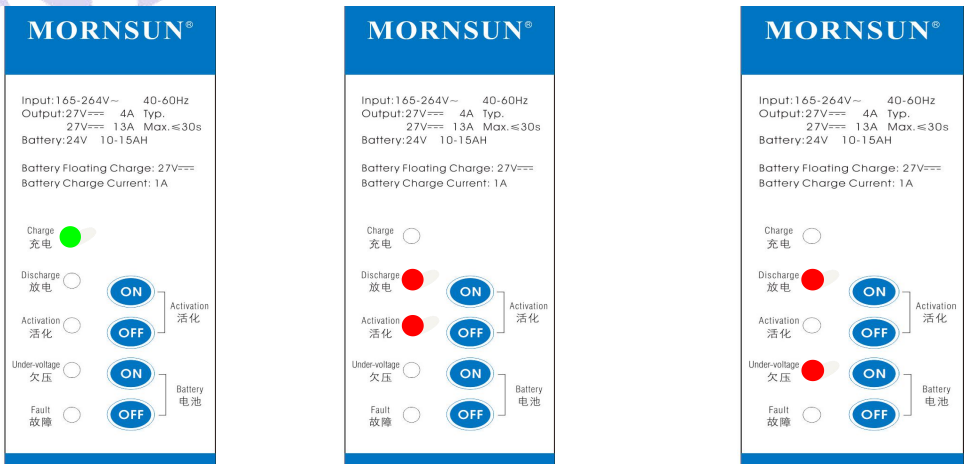
This product has battery activation, battery investment and other management functions.

When the product works with the battery under the electric supply input, the internal plate of the battery is easily to be passivated. Because the battery works for a long time under the high voltage floating state, which can effect the lifetime and storage capacity of the battery. Battery activation is to discharge the battery to protect the battery plate from passivating and extend the lifetime of the battery.

4.10 Local Debug Operation

There are control buttons on the product surface to perform the system debugging or on-site inspection maintenance, and perform the function of parameter debugging or product maintenance operations.

Test Operation Process(Activation)--Complete the line connection according to figure 4-4(②③can not access), the normal charging state shown as below figures. Press the activation on button to enter the active state, discharge and activation indicator light on, shown as following figure *Activated discharge state.* Press the activation off button to end/exit the active stat, the discharge and activation indicator light off. In activation, if the battery storage is not enough, the output voltage drops to the under voltage protection point, shown as following figure *state of output under voltage,* and it will automatically exit the activation state after a while, then discharge and activation indicator light off and go back to the normal charge state.



Charging state Activated discharging state state of output under voltage

Figure 4-9: The activated signal changes of the battery charging power

Test Operation Process(Battery Control)--Complete the line connection according to figure 4-4(②③can not access), disconnect the electric supply at normal operating state, the charging indicator lights off. And the battery uninterrupted power supply to the load, then the discharging indicator lights on. Next, press the battery end button(for about 5 seconds), the output load is off and the discharging indicator lights off. Press the battery start button(click), the load powers on and the discharging indicator lights off.

When there is no electric supply and the battery enters into the under voltage protection state due to lack of energy, by pressing the battery start button, the emergency forced battery output to the load.

Note: The function of the battery button does not work when AC is power on. The forced output time should not be too long so as not to damage the battery.

4.11 Remote Control operation

Confirm the product real-time operating state based on the product external communication function. According to the user's battery activation cycle settings, remote control of product access and exit the battery activation function. When the electric supply powers off, the customer can remotely cut off the power supply to the battery so that the remote system can stop running.

Design reference for remote functional application--Complete the line connection according to Figure 4-4, and wiring instructions are: K1 K2 K3 are user's CPU and other control's delay contacts.

Remote Control:

When the battery needs to be activated, HK and VG needs to be shorted to K1 to enter into the activation state by user CPU controlling the relay(high pulse duration is not less than 0.5s).

When the battery needs to exit the activation state in advance, HK and VG needs to be shorted to K2 to exit the activation state in advance by user CPU controlling the relay contact.

When the electric supply powers off, battery is not allowed to continue to power supply. BG and VG needs to be shorted to K3 to turn off the output load in advance by user CPU controlling the relay.

4.12 Application Precaution

(1) Please use a wire with cross-sectional area more than 2.5mm², and the input terminal should add a 10A/250VAC fuse.

(2) Please follow the wiring diagram correctly. The output side of the battery is not allowed to connect reversely, the input side is not allowed to connect wrong with other terminals , otherwise it will cause permanent damage to the power supply.

(3) If heat sink needed, the channels of heat sink should be installed vertically upward to

ensure that heat sink is vertical to the ground for heat dissipation.

(4) The allowable current through the wire is 15A. There are two pins connecting the battery, and both pins need to connect.

(5) Alarm terminal is not allowed over loaded and short-circuit, otherwise the electronic alarm contact will be burned down.

(6) To further reduce the output's ripple&noise, the user can connect a 470-1000 μ F electrolytic capacitor(derating to 80% or more) and a 1 μ F multilayer capacitor in parallel at the input terminal.

(7) Parallel connection is not allowed for this type of product.

(8) The PE terminal should be connected to the ground reliably to improve the anti-interference ability.

(9) Because the case will dissipate heat when the power supply operates. In order to ensure good heat dissipation of it, there is a need to keep a certain gap around the power supply to ensure smooth air flow and the temperature sensitive device should be kept away from the power supply.

4.13 Typical Application Circuit for 220VDC Output Charging Power Supply

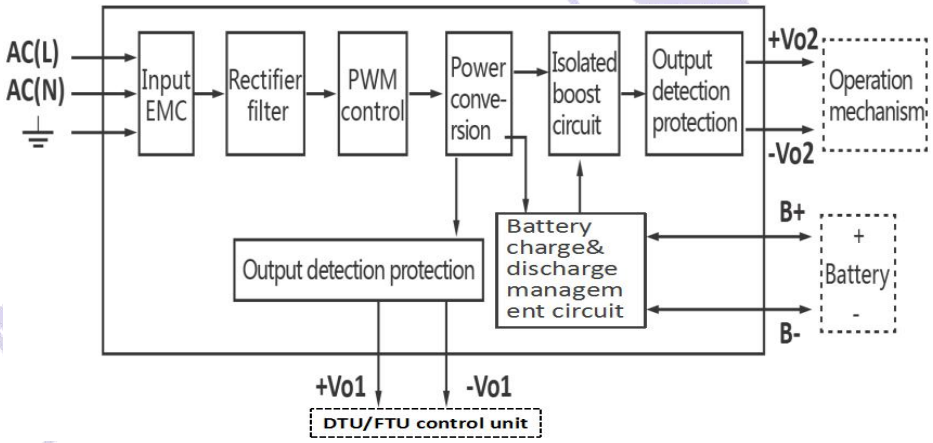


Figure 4-10: The Internal Functional Block Diagram for 220VDC Output Charging Power Supply

In figure 4-10, there are three outputs: 1) Power supply voltage for operation mechanism, 220VDC; 2) Battery power supply voltage, 27VDC; 3) Power supply voltage for control unit, 27VDC. Connection is as follows,

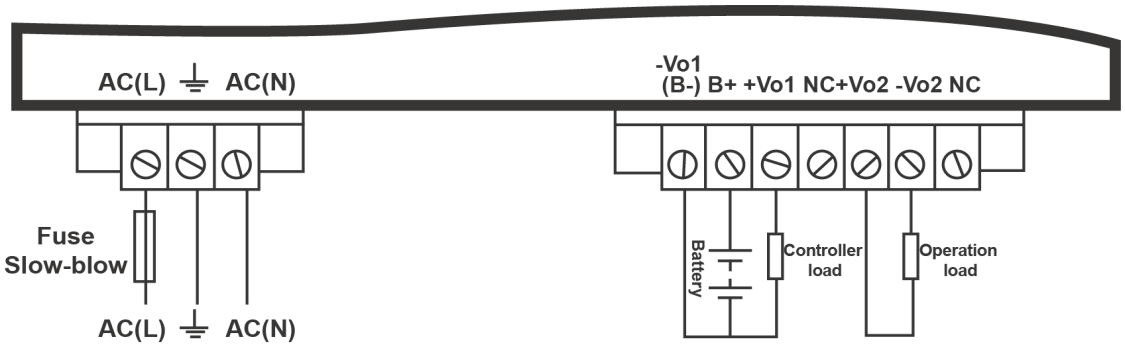


Figure 4-11: Pin Definition for 220VDC Output Charging Power Supply

Manual Instruction:

(1)Power supply status indicator

Charging: When green light is on, but red one off, the battery is on the status of charging or floating.

Discharging: When green light is off, but red one on, the battery is on the status of discharging, and the AC input is cut off**.**

Reverse Connection: In normal input, if Vo1 and Vo2 output normally, both green light and red light is off. Then the polarity of the battery is connected reversely. Please follow the wiring connect diagram to re-connect the battery if reverse connection happens.

(2) Use of Power

The power supply can start to work after input AC power, the power supply outputs current to load, and charge the battery with a constant current and a constant voltage. After the battery completes the charge, the power supply automatically switches to the floating state, and then the power supply provides a floating voltage and current to recharge the battery to normal self-discharged.

When AC is off, the battery power the load without interruption, 0 switching time. When the battery discharge is below the under voltage protection point and remains for 3 to 10 seconds, the power supply automatically turns off the load output.

If there is no AC input, Vo1+ can be shorted to B+ via an external passive node, so that the battery can start output.

Vo2 output voltage of 200Vdc-240Vdc can adjust continuously. The user can choose the needed output voltage by adjusting “output voltage adjustment” button.

(3) Use of Battery

This power supply can work with a 6-30AH lead-acid battery or a free of colloid maintenance. The battery needs to connect to the battery terminals of power supply (B+, B-), but the battery terminals can not be shorted. Then output current and short circuit protection function of the

power supply Vo1 are not available.

The simple calculation of approximate charge time for the battery: Battery Capacity C(AH) ÷ Charging Current(A)

5. FAQs

5.1 AC/DC Input

Usually the full-bridge rectifier is used at the input terminal of AC/DC power supply to meet the AC and DC power supply requirements. For example, the AC operating temperature range of MBP series is 165-264VAC, and its DC operating temperature range is 200-375VDC. For detailed operating voltage of each part, please refer to the datasheet.

5.2 Relations between the Class I, II equipment and the protection ground terminal PE

EN60950 clearly defines the Class I and II equipment:

Class I equipment is provided with the basic insulation and a connecting device capable of connecting the conductive part with dangerous voltage to the protective earthing conductor in case of the basic insulation failure. Class I equipment is also equipped with the protection ground terminal FG pin.

Class II equipment means the equipment which electric shock prevention depends on both the basic insulation and the additional safety protection measure(for example the equipment with dual insulation or enhanced insulation). Such equipment does not rely on the protection grounding or the protection measures of mounting condition. Class II equipment has no protection ground terminal PE pin.

5.3 Operating Temperature

When the product operates in a high temperature environment, the temperature of its internal components will be much higher than the ambient temperature. In order to ensure the reliable operation of the power supply, the maximum operating ambient temperature of the conventional product should be 70° C, and derating is required or take other heat dissipation measures when the ambient temperature reaches 50° C.

When the product operates in a low temperature environment, the power derating is also required because of the low-temperature characteristics of internal electrolytic capacitor and other components. Moreover, the output ripple and noise are higher than that of constant-temperature value. For the specific contents of derating curve, please refer to datasheet for details.

6. Charging Power Supply Application Safety Design

6.1 Marking Requirements

Wherever, there are fuses, protective grounds, or switches, clear symbols should be indicated according safety standards. Touchable dangerous high voltage and energy sources should be marked with “Caution!” indications.

6.2 Material Requirements

Input cables of L, N and PE should be brown, blue and yellow/green cables respectively. Ensure that the ground cable (yellow & green cable) of Type I devices which rely on basic insulation and protection ground to avoid electric shock.

6.3 Clearance and Creepage

Ensure that the clearance of L and N that are in front of the fuse is above 2mm, and the creepage is above 2.5mm. The clearance between the input and metal case or SELV circuit is above 5mm, and the creepage is above 6.4mm.