Product Manual

WFCO TECHNOLOGIES
Innovating the future of RV POWER.

WF-9500-AD-MBA
MAIN BOARD ASSEMBLY

- WF-9540-AD-MBA
- WF-9560-AD-MBA
- WF-9580-AD-MBA

(The Power Center model number is located on the front panel label next to the breakers)

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Rev: 7/24

TABLE OF CONTENTS

⚠ WARNING

RISK OF ELECTRICAL SHOCK
Disconnector isolate all power supplies before making electrical connections. More than one disconnectionor isolationmay be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

⚠ NOTICE

All wiring must conform to local, national and regional codes and regulations. Use copper conductors ONLY for all wire connections. Do not exceed the electrical ratings for the WF-9500-AD-MBA Series Power center or the equipment connected to it. Failure to follow these precautions may cause permanent failure and/or electrical shock which could result in severe personal injury or death.

⚠ CAUTION

EQUIPMENT SERVICING
This product should be installed by an expereinced and certified technician. CAUTION and care must be taken when servicing this equipment. To prevent severe shock or elctrocution, consult your servicing dealer.

⚠ WARNING

SPARK HAZARD
This unit employs components that can produce arcs or sparks. To prevent fire or explosion, do not install in compartments containing batteries or flammable materials (i.e. gas). This product is NOT ignitions protected.

GENERAL INFORMATION
WF-9500-AD-MBA Series Main Board Assembly Safety Features

AUTOMATIC COOLING FAN
The cooling fan in the WF-9500-AD-MBA Series Converter is incremental and is controlled by the current drawn out of the converter to the applied load. The on-board microprocessor increases fan speed as the total load increases and decreases fan speed as the load decreases. Unlike traditional temperature-controlled fans, the load-controlled fan provides better component cooling by avoiding temperature spikes which can lead to premature component failure.

OVER-TEMPERATURE PROTECTION
If the internal temperature of the converter exceeds a critical point, it will shut down. This protects the unit from excessive heat that may damage sensitive components. The unit will restart once the temperature inside has dropped.

ELECTRONIC CURRENT LIMITING
In the event that the output current exceeds the maximum rating for the WF-9500-AD-MBA Series Converter, the output current will remain constant, but the output voltage will begin to drop. If this occurs, the unit will recover once loads are reduced.

SHORT-CIRCUIT PROTECTION

Should a short circuit occur in the RV, the WF-9500-AD-MBA Series Converter will drop the voltage output to zero volts. If the short-circuit condition is removed and no other fault conditions are detected, the converter will resume normal operation. However, short-circuit conditions are dangerous, and an RV will require inspection by a qualified service technician.

CIRCUIT PROTECTION

WF-9500-AD-MBA Series Main Board Assembly Fuses and Breakers

REVERSE BATTERY PROTECTION

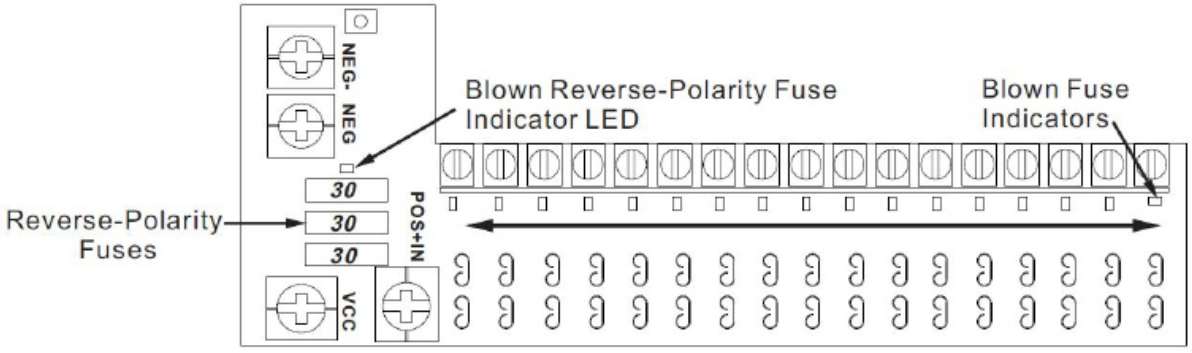
The WF-9500-AD-MBA Series Converter will charge the 12-volt House battery if installed. A battery DOES NOT have to be installed for WF-9500-AD-MBA Series Main Board Assembly to operate. When a battery is installed, two reverse polarity fuses protect the MBA circuitry. The fuses are located along the left-center edge of the DC fuse board below the VCC+ lug. Refer to Figure 1 on page 5. This feature prevents permanent damage to the MBA from a battery connected into the circuit backwards. In addition to protecting the MBA, the reverse polarity fuses are the main connection between the MBA and the DC fuse board.

The fuse values and quantity vary depending on which WF-9500-AD-MBA Series Main Board Assembly you have. Refer to the table below.

- WF-9540-AD-MBA – 25A (2)
- WF-9560-AD-MBA – 35A (2)
- WF-9580-AD-MBA – 30A (3)

The circuit fuses and the Reverse Battery Protection fuses should be replaced with ATC or ATO automotive type fuses such as:

- Littelfuse type 257
- Bussmann type ATC



OPERATIONAL FEATURES

AUTO-DETECT

his product includes the exclusive “Auto-Detect” feature for the charging of batteries. With this new technology, the power converter will evaluate the charging cycle of a battery, determine the type of battery being used, and then choose the appropriate charging program (profile) to provide for the best performance and maintenance of that battery. Because of the diferences between Lead Acid, AGM and Lithium type batteries, a system that provides a charge to the battery or batteries must be able to accommodate the diferent charging requirements. With the use of the “Auto-Detect” product, the charging requirement can be “detected” and is then automatically set for the type of battery being used. For standard Lead Acid and AGM batteries, WFCO power converters still use the Three-Stage Smart Charging to efectively maximize battery life by monitoring through the diferent phases of the charge cycle. On the other hand, Lithium batteries will prefer the use of only two stages when charging, and therefore the power converter will charge using the WFCO Two-Stage Smart Charging system. NOTE: Regardless of charge profile (lead-acid or lithium), your battery is safe from harm and will still charge.

LED INDICATORS

WFCO converters have integrated LEDs which inform the user on which mode it is in. As it pertains to charging profiles, green is intended for the lead-acid charge profile while blue is intended for the lithium charge profile. The most important light of them all for charging is red, which signals bulk charge mode. When it comes to charging time and performance, green and blue will have much less impact than the red (bulk charge) light. Whether in green or blue, the red light means the converter is fast charging your batteries.

LEAD ACID & AGM THREE-STAGE SMART CHARGING

To maximize battery life for lead acid and AGM batteries, it is best to charge batteries slowly, keep them topped of with a trickle-charge when the RV is not being used. The 3-Stage “smart” charger continuously measures the battery voltage output and regulates the amount of charge using three modes of operation: Power, Charge and Storage modes. All WFCO power converters have automatic three-stage switching power supplies. The converter senses which mode it needs to be in by checking the RV system voltage.

POWER MODE

The converter normally provides a constant target output voltage of 13.6 VDC (nominal) to power all the branch circuits. However, it is current-limited, and if the output (load) current reaches its maximum, the output voltage will drop as necessary to hold the converter’s maximum output current level (the Amperage rating) without exceeding it.

CHARGE MODE

If the output current reaches its maximum (normally caused by a discharged battery), this will cause the converter to go into Charge Mode, which means the target output voltage will change to 14.4 VDC and a timer will start. Although the converter is outputting 14.4 VDC, you will not be able to read that on a voltmeter due to the volt age-current relationship. As mentioned in the paragraph above, as load current increases, output voltage decreases. The actual output voltage will not rise until the load current is reduced, which happens naturally as the battery charges or if 12 VDC appliances are turned of. Charge Mode will be maintained until the current draw drops to approximately five Amps, or until the timer reaches four hours (whichever happens first). Then the target output voltage is changed back to 13.6 VDC for Power Mode. Lights that are powered from the output may change brightness slightly at that time. Note: For a detailed explanation of the charging modes, please refer to our publication “Theory of Operation”, document #AD TD-0001-0. 5

STORAGE MODE

The third mode of charging is what is called the “float” charge. This mode is designed to provide a “trickle charge” to the battery after the system observes no significant variations in current draw over a long period of time. When in Storage Mode, the voltage will reduce from 13.6V to 13.2V and supply the “trickle charge” which helps to preserve the life of the battery while keeping it charged and ready for use. A change in DC current will cause the converter to exit the mode and return to the Absorption mode and then to Bulk mode if required.

LITHIUM TWO-STAGE SMART CHARGING

The two-stage “smart” charger continuously measures the battery voltage output and regulates the amount of charge using two modes of operation: Charge and Power mode - TWO-STAGE CONVERTER VOLTAGE OUTPUT MODES:

CHARGE MODE

This mode is designed with two purposes in mind. First, to quickly restore the energy back into the battery. Second, to ensure the lithium cells inside the battery remain balanced. This is accomplished by boosting the output voltage to 14.6 VDC and allowing the maximum current to flow as required by the loads. The charge mode stage could last anywhere from one to four hours based on the battery and load current which is being used. For a full battery, the charge stage has a minimum time requirement of one hour, which allows the lithium cells inside the battery the time required to “balance”. For an empty battery, the charge stage has a maximum time requirement of four hours. If your application requires longer than four hours (such as a larger battery bank > 200 Ahr), a simple cycling of power will reset the timers. As the energy is restored into the battery, the DC system voltage will climb and the current from the converter will decrease. If the total amperage-draw from the converter reaches a preset point (within the one-to-four-hour timer), the converter is designed to drop out of charge mode.

POWER MODE

This mode is designed with 1 purpose in mind. This purpose is to provide a safe operating voltage for all loads in the RV. This is accomplished by reducing (from charge mode) the output voltage to 13.6 VDC and remaining at this voltage until the power is cycled to the converter. The power mode stage is the default or normal mode of operation, which has no timer associated with it. In this mode an output of 13.6 VDC is provided to the DC circuits in the RV. This voltage has a long-term history as the acceptable voltage for all loads in the RV, and should not place undue stress (nor reduce the longevity) of the lights and appliances in the RV. This is not to say that all loads will have an issue with a constant higher voltage; however, some loads may have an issue. Please refer to the individual manufacturer’s specifications for acceptable operating voltage range of the connected load.

CHARGING PERFORMANCE

There are many factors that can impact charging performance in charge mode regardless of battery type (some may impact Auto-Detect operation):

- Length and gauge of wire from battery to converter – Can result in voltage drop and current loss, significantly increasing charge time. (See voltage drop chart on the next page).

- Battery brand – Some lithium batteries have a higher operating voltage.
- Solar power installed without solar disconnect – This can cause competition during active charging and potentially disrupt both chargers.
- High current loads during bulk charge – Will extend the battery charge time due to reduced current available for charging. May also interfere with the Auto-Detect algorithm to trigger lithium mode.
- Converter size: A 55-amp converter can charge a battery faster than a 35-amp converter.

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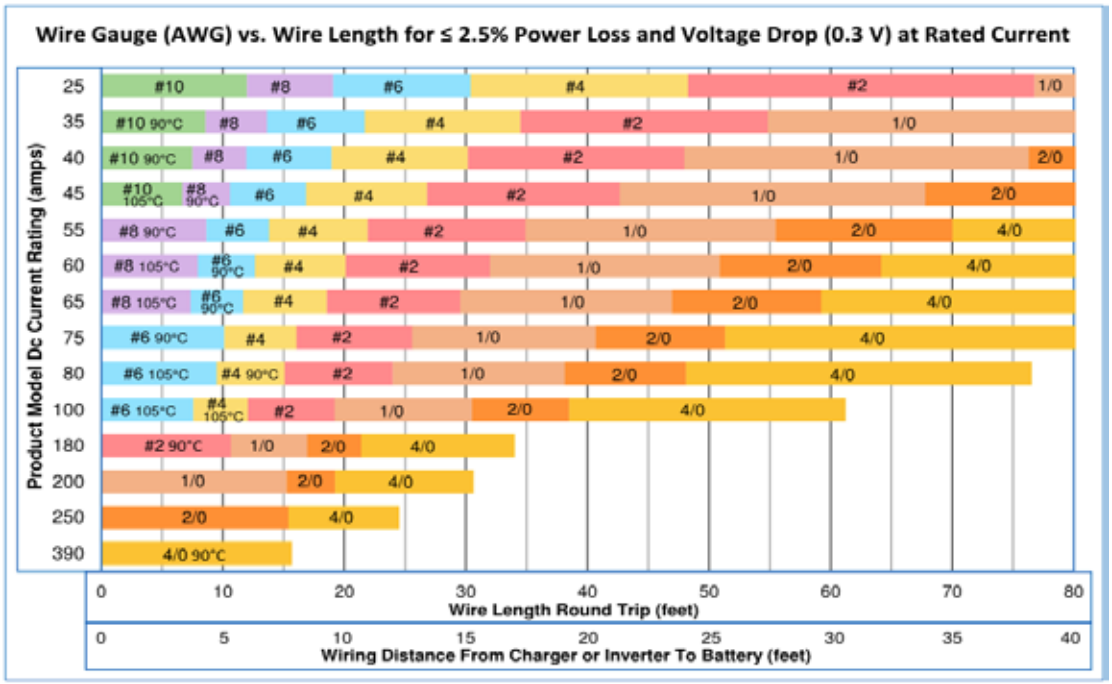
The charging profile is not set in stone. WFCO Auto-Detect converters monitor the current over time at the end of every charge cycle. So, in the event of a misdetection due to external factors, once the factors are addressed or no longer present, the converter can still properly detect the battery type during the next charge cycle.



TROUBLE SHOOTING INSTRUCTIONS
Troubleshooting the WF-9500-AD-MBA Series Converter

Refer to the Troubleshooting Guide for the WF-9500-AD-MBA Series Main Board Assembly (Figure 4) on page 9.

CHECKING CONVERTER OUTPUT VOLTAGE

Before checking the WF-9500-AD-MBA Series Main Board Assembly output voltage, disconnect the battery cables at the battery. Make sure the converter is plugged into an AC source (105-130 Volts). Check the converter output voltage at the battery with a voltmeter. Place the meter probes on the disconnected battery cables; place the Positive (red) meter probe on the + Positive battery wire and place the Negative (black) meter probe on the - Negative wire on the battery cable. Be sure you have good connections at the cables. If the voltage reads 13.6-14.6V, the converter is functioning properly.

If the converter output voltage at the battery reads 0.0 VDC, or if the battery is not charging, check for an open inline fuse in the battery wire circuit. One may have been installed by the RV manufacturer. Also check for loose wiring connections.

CHECKING FOR REVERSE BATTERY HOOKUP (REVERSE POLARITY FUSES)

If there is no DC output coming from the WF-9500-AD-MBA Series Main Board Assembly

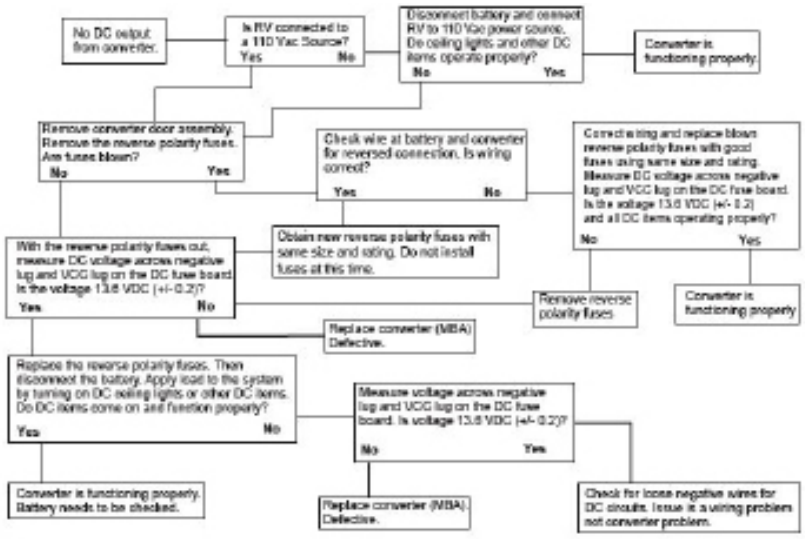
converter section, first check the reverse polarity fuses on the fuse board. Then, visually inspect the fuses for any breaks in the fuse element. If no breaks are found, use a continuity tester to check for continuity. If the reverse polarity fuses are blown, it means the RV battery was accidentally connected in reverse, either at the battery or at the converter. Investigate the connections and reconnect the cables properly. Replace the fuse with the same type and amperage rating as the original.

IMPORTANT: These fuses protect the converter from damage if the RV battery is accidentally connected in reverse. A reversed battery connection, even if for only a second, will cause these fuses to blow.

AC REVERSE POLARITY (AUDIBLE ALARM)

This power center is equipped with an AC REVERSE POLARITY PROTECTION feature. Should the incoming AC neutral wire and lead wire be connected backwards at the power center, an alarm located in the power center enclosure will sound. This alarm will continue to sound until the AC wires are connected correctly.

If the above checks have been made but the converter output still reads 0.0 VDC, the converter is not functioning properly. Contact the WFCO Power PROs at (574) 294-8997.



Should it be determined that the WF-9500-AD-MBA Series Main Board Assembly needs to be replaced, removal of the Main Board Assembly Is a simple process.

REPLACING THE CONVERTER SECTION (MBA)

DC WIRE REMOVAL

1. Drop door down and remove the door assembly by loosening the two screws in the upper left and right corners of the door assembly. The screws are captive and will not fall out. Pull out at the top of the door assembly to remove from case.
2. On the bottom left side of the fuse board find the lug that is marked NEG and has a white wire going to it. Loosen screw and remove wire.
3. On the bottom right side of the fuse board find the lug that is marked VCC and has a red wire going to it. Loosen screw and remove wire.

AC WIRE REMOVAL: CAUTION: MAKE SURE THE RV IS UNPLUGGED FROM ANY 110V POWER SOURCE (SHORE CORD, GENERATOR, OR INVERTER).

4. Remove the converter black wire from the breaker. NOTE: This wire has a metal pin that is inserted into the breaker with a pigtail wire added to it. If the pigtail wire is connected to another wire, disconnect that wire from the pigtail.
5. Remove the converter white wire from the neutral bus bar.
6. Remove the converter green wire from the ground bus bar.
7. In the converter compartment, remove the two screws at the front of the MBA holding it in place. Slide the MBA forward routing the wires through the slots in the case until you see most of the MBA board. Disconnect the 3-pin connector on the MBA control board by pulling it out of the socket. At this time, you can pull the MBA out of the case.

NOTE: When installing a replacement MBA, reverse the order of steps 1-7. If the MBA is being returned under a warranty claim, follow the packaging instructions in your warranty claim packet.

GENERAL COMPLIANCE INFORMATION
Agency Listings

UL
The WF-9500-AD-MBA Series Main Board Assemblies are UL-Listed, and cUL-Listed (Canadian).

FCC COMPLIANCE CLASS B
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at thier own expense.

INSTALLATION INSTRUCTIONS
Installing the WF-8900-AD Series Power Center

MOUNTING THE CONVERTER SECTION (MBA)
Refer to Replacing the Converter Section (MBA) on page 10 for complete removal and installation instructions.

CONSUMER LIMITED WARRANTY
for WFCO Technologies Products

WFCO extends, to the original owner, a Two-Year Limited Product Warranty. This warranty is in effect from the date of original purchase for a period of two (2) years. This limited warranty is extended specifically for and is limited to Recreational Vehicle application and is only valid within the continental United States, Alaska, Hawaii and the Provinces of Canada. WFCO warrants, to the owner, that its products are free from defects in material and workmanship under normal use and service based on its intended use and function. This warranty is limited to the repair or replacement, at WFCO's discretion, of any defective parts or defective assembly. Any implied warranties of merchantability or fitness for intended use are limited in duration unless applicable State Law provides otherwise. You may have other rights as specified by each individual state.

EXCLUSIONS AND LIMITATIONS

The OEM warranty specifically does not apply to the following:

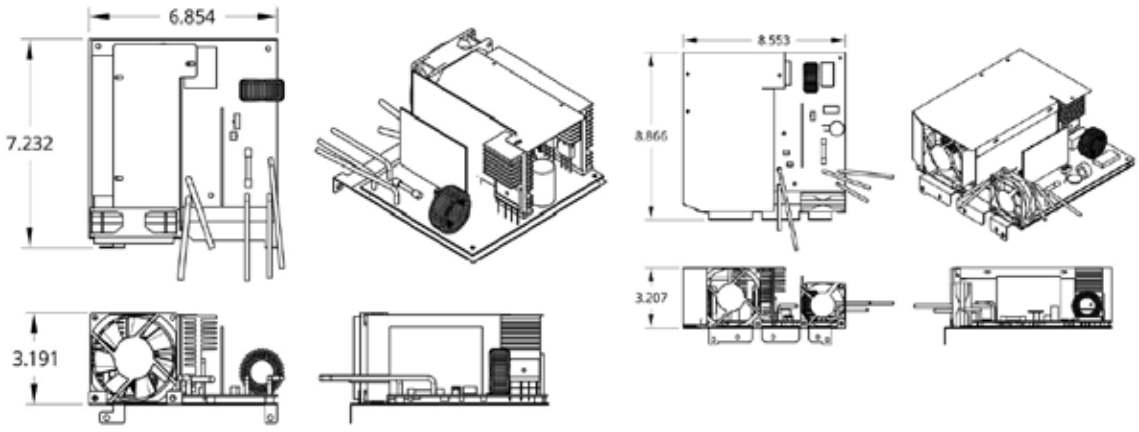
- Any WFCO product that has been repaired or altered by an unauthorized person.
- Any damage caused by misuse, faulty installation, testing, negligence, accident or any WFCO product installed in a commercial vehicle.
- Any WFCO product, whose serial number has been defaced, altered or removed.
- Any WFCO product, whose installation has not been in accordance with the WFCO written instructions.
- Any consequential damages arising from the loss of use of the product including but not limited to inconvenience, loss of service, loss of revenue, loss or damage to personal property, cost of all services performed in removing or replacing the WFCO product. Specifications are subject to change without notice or obligation.
- Any WFCO products sold through unauthorized Internet sources (Example: eBay) will be excluded from all warranty coverage offered by WFCO Technologies.

CONSUMER WARRANTY CLAIM PROCEDURE

Upon determination and validation by an authorized OEM dealer that a WFCO product has a defect, a Return Goods Authorization (RGA) number will be required before the product can be returned. The RGA number can be requested by completing the Warranty Information Fax Sheet and appropriate Troubleshooting Form found at wfcoelectronics.com. Once these forms have been completed, email the forms along with Proof of Purchase to warranty@wfcotech.com or fax the three documents to the Warranty Department at (574) 294-8698. After receipt of the forms, an RGA number will be issued. This number shall appear on all correspondence with warranty service. Upon validation of the warranty, WFCO shall replace the product with a like product. The RGA number shall be placed on the outside of the carton used to return the product for ease of identification.

Do not mark directly on the product. The product must be packaged properly to avoid further product damage which could cause a non-warrantable condition.

WF-9500-AD-MBA Main Board Assembly Specification			
Model No.	**WF-0540-AD-MBA**	**WF-0560-AD-MBA**	**WF-0580-AD-MBA**
Converter Input Power:			
Voltage:	105-130Vac		
Frequency:	60Hz		
Max. input current @105V	6A	12A	16A
Max Power	685 watt	1030 watt	1370 watt
Converter Output Power			
Continuous power:	545 watt	820 watt	1090 watt
Rated DC Output Voltage	13.6V		
Rated DC Current	40A	60A	80A
Charging Control	automatically controlled by microprocessor		
Charging Modes	3-stage Intelligent charge / 2 stage intelligent charge		
Intelligent charge mode	Absorption + Bulk and Storage / Absorption & Bulk		
Battery Adaptability	LA/AGM / Lithium Ion		
Absorption charge voltage	13.6V		
Bulk charge voltage: (4 H	14.4V		
Storage charge voltage	13.2V		
Regulation	± 1% accuracy against input or load changes		
Cooling Fan	speed according to the DC load amperage		
VA Efficiency:	> 80% (under 70% of load condition)		> 85% (under 70% of load condition)
Protection:			
Overload	current-limiting & shut down; auto recovery upon normal load		
Short-circuit	shut down & auto recovery upon normal		
Over-temperature	shut down & auto recovery upon normal		
Battery reverse polarity	protected by Fuse; same rated fuse replacement required		
AC Distribution			
Mains Rating	Max. 50A/120VAC		
Breakers	Two-50A Mains with up to 12 AC Branch Circuits		
Romex strain reliefs	12 position Romex strain reliefs for AC Branch Circuits		
DC Distribution Board			
Standard DC Output loop	3 x 30 AMP ; 12 x 20 AMP max. each		
LED on Fuse Board:	Total 17 chip-LEDs: Red indicating fuse blown status of loops and reverse polarity; 1 x Amber LED indicating Bulk mode On status		
Visual Window:	Special design transparent window for reading LED status easily		
Mechanical:			
Zero Clearance:	Special design air cooling duct to avoid heat dissipating into confined		
Dimension: W x H x D	7.795"W x 3.780"H x 9.912"D		
Weight:	4 lbs	5 lbs	5 lbs
Environmental Condition:	20 ~ 90% Non-condensing		
Safety	UL458/UL67 certified; FCC Class B (in compliance)		



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THE POWER PROS
WFCO
EXPERT PRODUCT SUPPORT

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