

Product Manual



WF-9500-AD SERIES POWER CENTER

•WF-9540-AD

•WF-9560-AD

•WF-9580-AD

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



• 2021 Aeroplex Drive, NorthElkhart, IN 46514 • (574)-294-8997 • www.wfcotech.com

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WARNING

RISK OF ELECTRICAL SHOCK

Disconnect or isolate all power supplies before making electrical connections. More than one disconnection or isolation may 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 regulations. Use copper conductors only for all wire connections. Do not exceed the electrical ratings for the WF-9500 or the equipment connected to it.

CAUTION

EQUIPMENT SERVICING

This product should be installed by an experienced technician. CAUTION and care must be taken when servicing this equipment. To prevent severe shock or electrocution, 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 (LP gas). This product is NOT ignition protected.

CAUTION

DO NOT OBSTRUCT VENTILLATION

To prevent fire, do not cover or obstruct front cover ventilation openings. For continued protection against risk of fire or electric shock, replace faulty DC fuses and AC breakers with ones of the same type and ratings as are installed.

WARNING

BATTERY SYSTEM

When using a battery with the WF-9500 Series, follow battery maintenance procedures. Check the fluid level in any battery connected to RV charging system on a monthly basis.

GENERAL INFORMATION

WF-9500-AD Series Power Center Safety Features

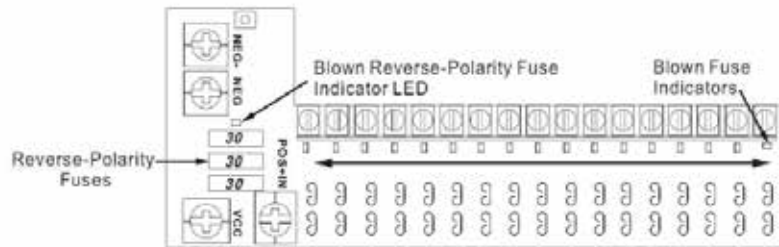
REVERSE BATTERY PROTECTION

The WF-9500 Series Power Centers will charge the 12-volt House battery if installed. A battery does not have to be installed for WF-9500 Series Power Center converter operation. When a battery is installed, two reverse polarity fuses are installed to protect the converter circuitry. The fuses are located along the bottom edge of the DC fuse board near the VCC+ lug (refer to Figure 1 below). This feature prevents permanent damage to the converter from a battery connected into the circuit backwards. Blown polarity fuses are indicated by an illuminated Red LED near the lugs. In addition to protecting the converter section, the reverse polarity fuses are the main connection between the converter and the DC fuse board.

BLOWN FUSE INDICATORS ON DC FUSE BOARD

The DC Fuse Board has individual blown fuse indicators as standard equipment. Each of the 17 DC fuse circuits contain a Red LED to indicate a blown fuse. If one of the circuits draws more current than the rating of the fuse, the fuse will blow. When this occurs, the Red LED for that circuit will illuminate. Replace the blown fuse with a known good fuse of the same rating.

NOTE: If the replacement fuse blows again, check that circuit for a short or an overload condition.

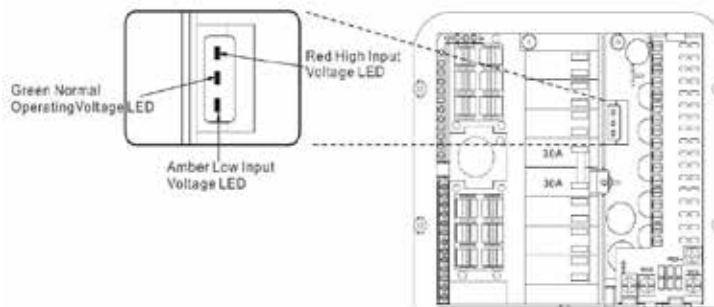


AUTOMATIC COOLING FAN

The cooling fan in the WF-9500 Series Power Center 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.

AC VOLTAGE INPUT INDICATORS

The WF-9500 Series Power Centers have built-in indication of the incoming AC voltage. Three LEDs give at-a-glance status of Low, Normal or High voltage (see Figure 2 below). If the incoming voltage is within the normal operating range of 105 to 130 VAC, the Green LED will be illuminated. However, if the incoming voltage is less than 105 VAC, the Yellow LED will illuminate. If the incoming voltage is greater than 130 VAC, the Red LED will illuminate. If either the Red or Yellow LED is illuminated, shut down the WF-9500 Series Power Center and investigate the cause of the problem.



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 Series Power Center, 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 Series Power Center 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 the RV will require inspection by a qualified service technician.

CIRCUIT PROTECTION

WF-9500 Series Power Center Fuses and Breakers

DC FUSES (12 VOLTS)

The DC fuse board has spaces for seventeen (17) DC circuits. This includes three 30 Amp circuits which may be used for any load requiring up to 30 Amps of current draw (Example: Slide-Outs). These three circuits have a maximum rating of 30 Amps. The remaining 14 circuits have a maximum 20 Amp rating. 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

AC CIRCUIT BREAKERS (120/240 VOLTS)

The AC Breaker side of the WF-9500 Series Power Center is located on the upper left side. The WF-9500 Series Power Center accepts standard residential breakers. A total of 14S breakers can be installed: two 50 Amp Main breaker and up to a maximum of 12 AC Branch circuits when using duplex breakers. A list of factory tested and approved breakers follows. UL-Listed Main Circuit Breakers, rated for 30/50 Amp, 120/240 VAC. The following breakers have been factories tested and approved for use as 50 Amp Main breakers in the WF-9500 Series Power Centers:

Manufacturer	Model/Cat. No./Type
Eaton	Type BR
ITE/Siemens	Type QP or QT
Square D	Type HOM
Murray	Type MP or MH
General Electric	Type THQL

UL-LISTED BRANCH CIRCUIT BREAKERS, RATED FOR 120 V, MAXIMUM 20 A

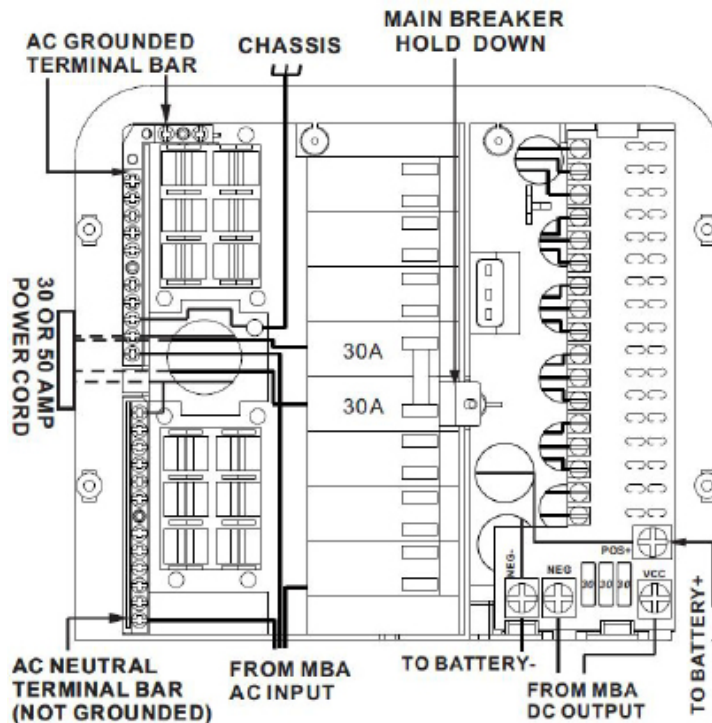
The following breakers have been factory tested and approved for use as Branch Breakers in the WF-9500 Series Power Centers:

Manufacturer	Model/Cat. No./Type
Eaton	Type BRD
ITE/Siemens	Type QP or QT
Square D	Type HOMT
Murray	Type MPT or MHT
General Electric	Type THQL

When replacing any of the installed circuit breakers, the replacement should be of the same manufacturer, type designation, and equal or greater interrupting rating, not to exceed 50 A.

The “Short-Circuit-Current” rating for the breaker should be 10,000 Amps at 120/240 VAC.

Breaker Filler Plates: Model FP-01 or FP-01B (Black)





OPERATIONAL FEATURES

AUTO-DETECT

This 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 differences 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 different 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 effectively maximize battery life by monitoring through the different 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 voltage-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 off. 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 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.

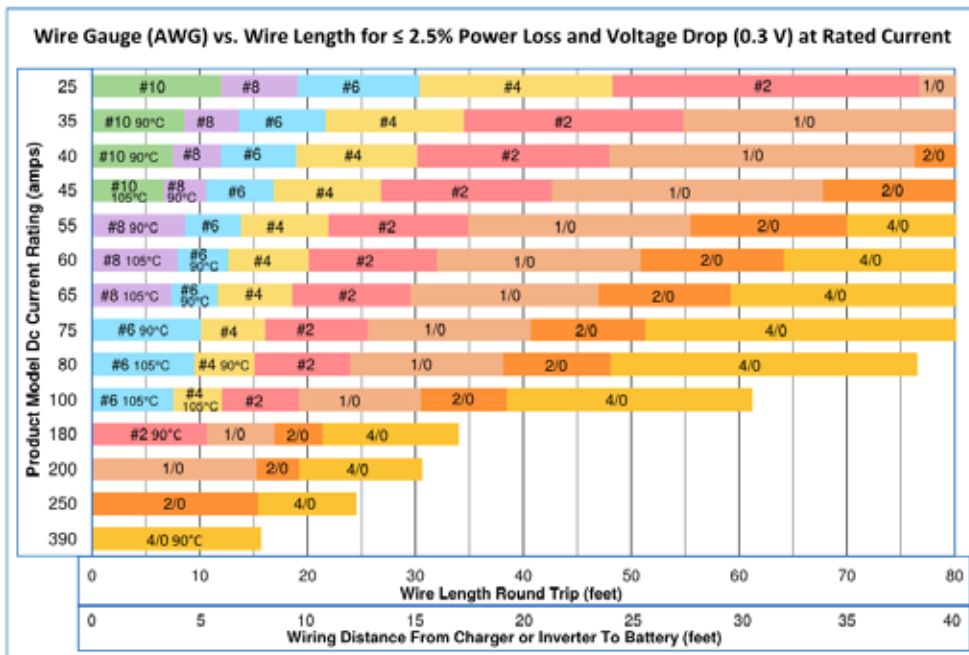
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- High current loads during bulk charge: Will extend the battery charge time due to reduced current available for charging. May also interfere with the Auto-Detect algorithm to trigger lithium mode.
- Converter size: A 55-amp converter can charge a battery faster than a 35-amp converter.

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.

Below is a guide to minimize voltage drop to 2.5% or less. This is a reference guide for optimized charging performance and does not take priority over code requirements.



TROUBLESHOOTING INSTRUCTIONS

Troubleshooting the WF-9500 Series Power Center

Refer to the Troubleshooting Guide for the WF-9500 Series Power Center below.

CONVERTER OUTPUT VOLTAGE

Before checking the WF-9500 Series Power Center 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 red battery wire and place the Negative (black) meter probe on the – Negative black wire on the battery cable. Be sure you have good connections at the cables. If the voltage reads 13.6 VDC (+/- 0.2) with no load, the converter is functioning properly.

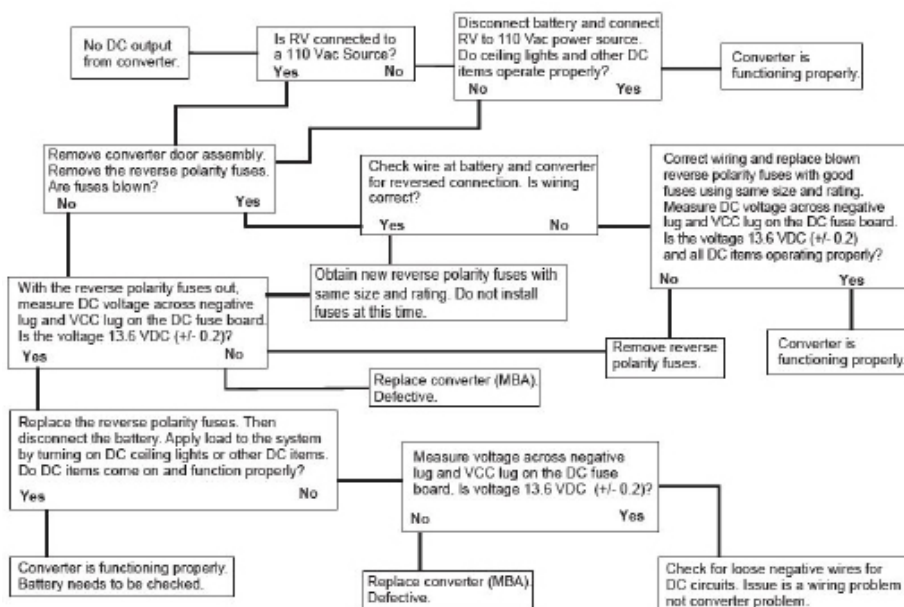
If the converter output voltage at the battery reads 0.0 VDC, or if the battery is not charging, check for an open in-line fuse in the battery wire circuit. One may have been installed by the RV manufacturer. Also check for loose wiring connections.

REVERSE-POLARITY FUSES

If there is no DC output coming from the WF-9500 Series Power Center 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 re-connect 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.

If the above checks have been made but the converter output still reads 0.0 VDC, the converter is not functioning properly.



GENERAL COMPLIANCE INFORMATION

Agency Listings

UL

The WF-9500 Series Power Centers 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 his own expense.

INSTALLATION INSTRUCTIONS

Installing the WF-9500-AD Series Power Center

Mounting the Enclosure

The WF-9500 Series Power Center enclosure should be mounted in an accessible area such as a wall or in the side of a cabinet. The front of the enclosure should not be obstructed to allow free air flow for the cooling fan. The enclosure will slide into a rough opening of 13.23 (in) H x 10.12 (in) W. The enclosure depth is 10.04 (in). After wiring is completed, the enclosure fastens to the wall or cabinet using 4 wood screws, not supplied.

WIRING THE AC BREAKERS

** Make sure no AC power is coming into the RV from either the Shore Power cord or an n-board generator. Determine the proper size breakers for the loads the WF-9500 Series will be powering. You can use either single or duplex breakers, or a combination of both. We recommend that all the breakers used be of the same brand. When using duplex style circuit breakers, a total of fourteen (14) breakers can be mounted in the WF-9500 Series Power Center, two (2) Main breakers and twelve (12) Branch breakers. Refer to the tables on pages 5 and 6 for a selection of approved breakers. The Main breaker should be a 2-pole, 50 Amp type and should be installed in the center position (See Figure 6 on page 13). A hold down clip is provided to keep the breaker securely in place.

The 50 Amp power cord is routed through the largest knockout in the wiring compartment and secured with a listed strain relief clamp. A 50 Amp power cord has 4 leads: Black (HOT1), Red (HOT2), Neutral (White), and Ground (Green). The Black (HOT1) wire is connected to one side of the 2-pole 50 Amp Main breaker as shown in Figure 6 on page 13. The Red (HOT2) is connected to the other side. The White (Neutral) wire is connected to the Neutral Terminal bar at the bottom left of the wiring compartment. The Green (Ground) wire is connected to the Ground Terminal bar located at the top left of the compartment.

An 8AWG copper conductor shall be used to bond the WF-9500 Series Power Center to the vehicle frame.

Route the Romex leads for the Branch circuits through the Strain Reliefs in the back of the wiring compartment. In a similar fashion, connect the Black wire to the Branch breaker, and the White and Green wires to the appropriate Terminal bar.

The Black power wire for the converter has a pigtail connection. The metal pin is inserted in the Branch breaker designated for converter power. The end with the wire nut can be used to power another circuit if necessary. If not used, leave the wire nut installed and push the wire to the side. Make sure all terminals are torqued to the specifications listed on the back of the enclosure.

WIRING THE DC FUSE BOARD

** Make sure the house battery is disconnected and there is no AC Power connected to the system before beginning the DC wiring. Determine what DC loads are to be connected to the fuse board and what position they will occupy. The 3 circuits closest to the battery lugs may be used for 30 Amp Max loads and can accept a maximum 30 Amp ATO or ATC fuses installed. The remaining fourteen circuits are general purpose and can accept up to 20 Amp ATO or ATC fuses installed. Make sure the fuses are seated properly.

Depending on the WF-9500 Series Power Center model, there are 3 different methods of connecting the DC loads to the fuse board.

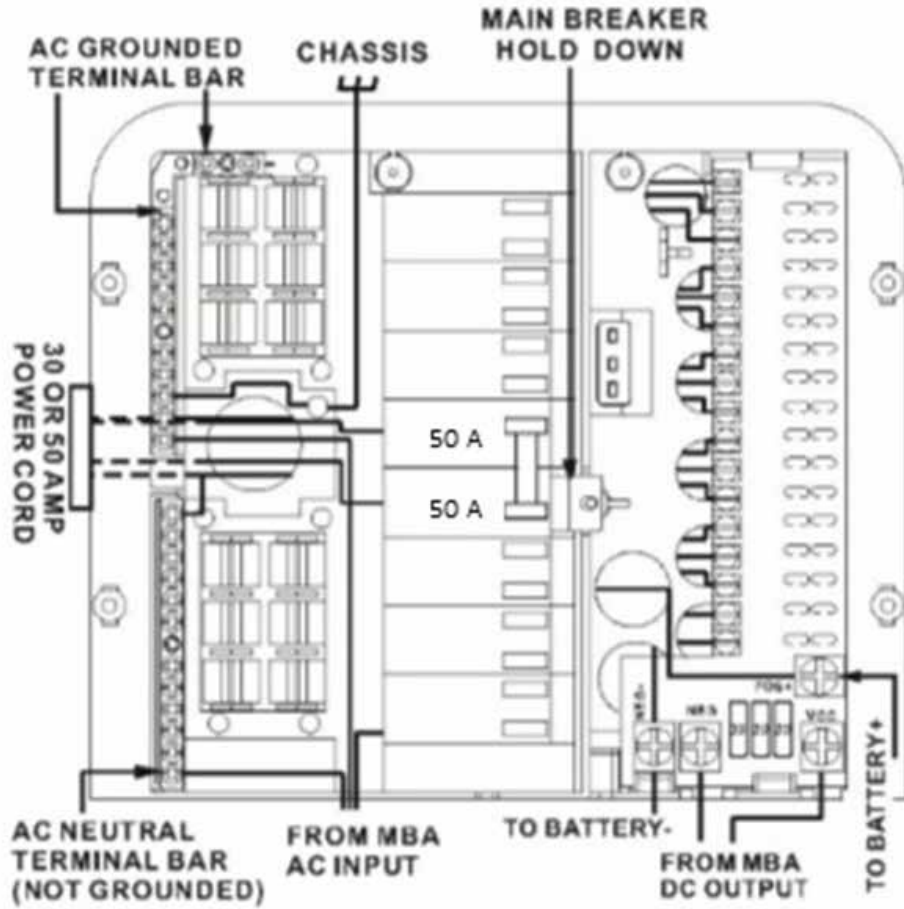
-S Models: These models have screw terminal connections. Strip approximately .25" of insulation from the load's wire and insert into the screw terminal. Tighten the terminal to the torque specified on the back of the enclosure.

-Q Models. These models have a male Quick Connect tab on the fuse board and mate with a female Quick Connect on the load wire. When installing this terminal, be sure the female terminal is fully seated on the fuse board.

-W Models. These models have a 12" wire for each circuit extending from the back of the enclosure. Strip approximately .50" insulation from the load's wire, twist the bare wire from the appropriate fuse position together with the load wire, and securely fasten with a suitably listed connector.

Connect the heavy wire (Red) coming from the battery to the BAT+ lug located directly above the VCC lug on the fuse board. Make sure this lug is torqued properly.

As a last step, install a separate bus bar in a location behind the converter. Run a 6 AWG wire from the NEG- lug on the bottom left of the DC fuse board to this bus bar. Connect the battery negative wire to this bus bar along with all the negative DC load wires. Also, run a wire from the bus bar to chassis ground.



WF-9500 Power Center Specification			
Product Features:	1. Ultra high power density 2. 50A Mains application with 12 AC branches 3. Total 35 DC loops with 3 x 30A for Slide-out Usage 4. All DC loops with red chip-LED to monitor Fuse blown status 5. Bulk mode status monitored by amber chip-LED 6. Reverse Battery Polarity monitored by red chip-LED 7. Bulk mode manual switch 8. Zero clearance design 9. Optional separate battery lug connection 10. 3 LEDs (Green, Amber & Red) Utility power status indicator		
Model No.	WF-9540	WF-9560	WF-9580
Converter Input Power:			
Voltage:	105-150Vac		
Frequency:	60Hz		
Max. input current @105Vac	8A	12A	16A
Max Power	685 watt	1090 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 micro-processor		
Charging Modes	3-stage intelligent charge		
Intelligent charge mode	Absorption, Bulk and Storage		
Battery Adeptability	LA/AGM		
Absorption charge voltage	13.6V		
Bulk charge voltage: (4 Hrs)	14.4V		
Storage charge voltage	13.2V		
Regulation	± 1% accuracy against input or load changes		
Cooling Fan	Two speed according to the DC load amperage		
VA Efficiency:	> 80% (under 70% of load condition)		> 85% (under 70% of load condition)
Protections:			
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 loops	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 space		
Dimension: W x H x D	11.96 x 15.04 x 10.04 inch / 304 x 382 x 255 mm		
Cutout Size: W x H	10.12 x 13.28 inch / 257 x 336 mm		
Weight:	3.5kg	3.6kg	4.2kg
Environmental Condition:	20 ~ 90% Non-condensing		
Safety	UL458 /UL67 certified; FCC Class B (in compliance)		



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 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 Technologies 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 wfcotech.com. Once these forms have been completed, email the forms along with Proof of Purchase to warranty@wfcotelectronics.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.

WARRANTY ASSISTANCE

The consumer may contact the selling Dealer or OEM for warranty assistance. The consumer may also contact WFCO Technologies at: (574) 294-8997, Option #1, or Fax (574) 294-8698.



*Innovating the future of **RV POWER.***

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Power Pros Technical Support
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Warranty Information
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