Shasta Airflyte Reissue 2015 - Introduction to Your Electrical System

You may not think about your Shasta's electrical system until something goes wrong, but knowing in advance some of the higher level details will no doubt add to your enjoyment, even when things are working properly.

Your Shasta is actually wired two ways. There's a 120V AC system, like your house wiring, that's powered when you connect to shore power through the external 30 amp connection. Then there's the 12V DC system which is powered by an onboard deep cycle "house" battery located in the gaucho. Both sets of wiring come together at the Power Converter located behind the door below the microwave.

Think of the Power Converter as the nerve center of your Shasta. The circuit breakers for the line-voltage appliances are located here and supply 120V AC power to your receptacles, the air conditioner, the AC circuit of the refrigerator, the water heater (when set on electric) and the microwave oven. When you're dry camping without shore power, none of these devices will work.

Your interior lights, radio, water pump, ceiling fan, etc. all run on 12V DC and the fuses for them are also located here. Aside from the range hood, the rest of your lights are LED types that use little power. The furnace, though LP fired, relies on battery power for the blower and this does draw around 4 Amps when running. How long you'll be able to run all your DC equipment depends on the size, type and age of your house battery.

The refrigerator is known as a 3-way and can run on AC, DC or LP gas. It's an absorption type so it requires a heat source to cool the interior, thus a 12V heater, a 120V heater and a gas burner. More on this later. The important thing to know is that DC operation should only be used to maintain temperature when cold. Use AC or LP if starting from room temp. Since it's electronically controlled, you'll need a small amount of battery power even if running on LP.

At some point you'll need to charge your house battery, luckily the Converter does this for you when connected to shore power. If traveling, your tow vehicle's 7-pin connector will also maintain charge via your vehicle's alternator. Keep in mind, this also means you can kill your trailer's battery if you leave your key on but the engine off on your vehicle as power will flow the other direction.

Should you have trouble with your 12V system, the first place to check is the Converter fuses. A red indicator will light adjacent to any open fuse. If these fuses check out, your next step should be to check power at the device. The water heater, CO detector and refrigerator all have local fuses in addition to the Converter fuses. I have also found many poor crimps and splices that will pass a visual examination, but the wires pull out when tugged on, or have come loose due to vibration. Thankfully, getting access to these crimps requires little more than removing the screws holding the device in and checking its wiring. I have yet to find any hidden splices. Using

the vehicle diagram you can proceed from source to load until you find the trouble as the loads are diagrammed in order of how they're connected in the trailer.

The AC diagram is organized in the same way. Note that the refrigerator and the air conditioner are on the same 20A circuit. This is adequate for the stock AC but it's something to keep in mind should you upgrade to a more power-hungry unit.

The five accessible 120VAC outlets are on a single 15A breaker that is a GFCI type. In simple terms, this is a special circuit breaker that measures the current flowing from the hot to the neutral conductor and will trip if an imbalance is detected (such as current flowing through you to ground instead of back through neutral). Don't forget to check the exterior mounted receptacle if this breaker won't reset.

Read on for Areas of Improvement, or leaf through the following pages for wiring diagrams and fuse listings.

Areas for Improvement:

DC power has its limitations, especially when it comes to voltage drop. These losses due to resistance of the conductors can usually be overcome by keeping runs from the power source as short as practical and upsizing wire diameter for longer runs. In our Shastas, a 12ga wire pair running from the battery in the gaucho to the converter, powers all the DC equipment onboard. This wiring takes a curious route under the trailer (presumably to keep the run shorter than running up the wall, over the roof and back down). Some have moved the battery to shorten this run or eliminate power wiring under the chassis. However, the good news is that excluding the refrigerator, there are few power hungry devices onboard and so losses are not that significant for the casual camper.

The bad news is the refrigerator. It's a power-hungry beast on DC that can consume 15 amps while running and even a small loss of power will reduce your cooling performance. I estimate 17' of 12ga wire from the fridge to the converter, then you have your run all the way back to the battery. Per the manufacturer, this should be a minimum of 8ga wire for such a run. This becomes more critical if you haven't made improvements to get trapped heat out from around the refrigerator (manufacturer says 0" clearance for sides and top to avoid trapping heat which our trailers do not adhere to). Additionally, the connection at the fridge is via screw terminals adding additional resistance, especially after vibe and corrosion take hold. Solder and shrinkwrap at this connection would cut more losses (one of my wires actually pulled out from the screw terminal with a light tug).

But there's an easy fix for the wiring situation. 12ga or even 10ga wire can be run in the space below the fridge, under the bath and directly to the battery in the gaucho, eliminating this 25+

foot run. It is about as direct as possible. The fridge is fused at the unit, but it's a good idea to add an inline fuse holder at the battery and steal fuse F5 for your use should you go this route.

Another improvement that can be made is to look at the freshwater water pump. Power for this circuit runs from the converter over to the dinette bench to power the CO detector (adjacent to the pump in question), then doubles back to the converter area to run up the wall with the other wire pairs. It crosses the roof and comes down to the pump switch in the rear. When switched on, power then flows back up to the roof, across, down, and all the way over to the pump in the bench where we just were.

The easy thing to do is to eliminate the first double-back. Follow the supply pair from the converter to the CO monitor and cut the wiring off right after this device. Then follow this recently cut pair to where it goes up the wall (right behind the converter). Pull in the excess, cut it off, and splice the wiring directly to the original pair so it's back on the same circuit. Your wiring now leaves the converter via two branches: one up the wall and the other to the bench. This solution requires only a pair of wire nuts, a wire cutter, and about 20 minutes of your time. Pull the microwave for easier access.

Another option, if you're handy, would be to add a switch on the side of the bench and source the pump power from the CO monitor feed. All easily accessible and can be done with a few minutes work.

Fuse and Breaker Identification / Current Draw

Shasta Airflyte 16' Load Center Information - DC Circuits		
Fuse Position	**Rating** (Amps)	**Loads**
F1	15	Ceiling fan, Grab Handle, Ceiling Lts, Dinette Lts, Radio, 'Gas Lamp'
F2	15	Furnace Blower, Range Hood
F3	15	CO Monitor, Water Pump, Water Htr Controls, Gaucho Lts, Shower Lt
F4	*None*	*Open Position*
F5	30	Refrigerator (DC Only)
F6	30	Primary Load Center Power / Battery Charging
F7	40	Reverse Current Protection
CO Monitor	1	Local inline fuse in dinette bench powered off of F3.
WH Control	2	Local fuse behind WH exterior access door for LV control.
Gaucho	30	Self resetting breaker local to battery to limit charge current.
Refrigerator	3	Local fuse for refrigerator controls
Refrigerator	30	Local fuse for DC heater

Shasta Airflyte 16' Load Center Information - AC Circuits		
Breaker Position *L to R*	**Rating** (Amps)	**Loads**
1	30	Main Power to all breakers and converter
2	15	Water Heater
3	15	Microwave Oven
4	20	Air Conditioner & Refrigerator
5 GFCI	15	Receptacles
Refrigerator	5	Local fuse for AC heater

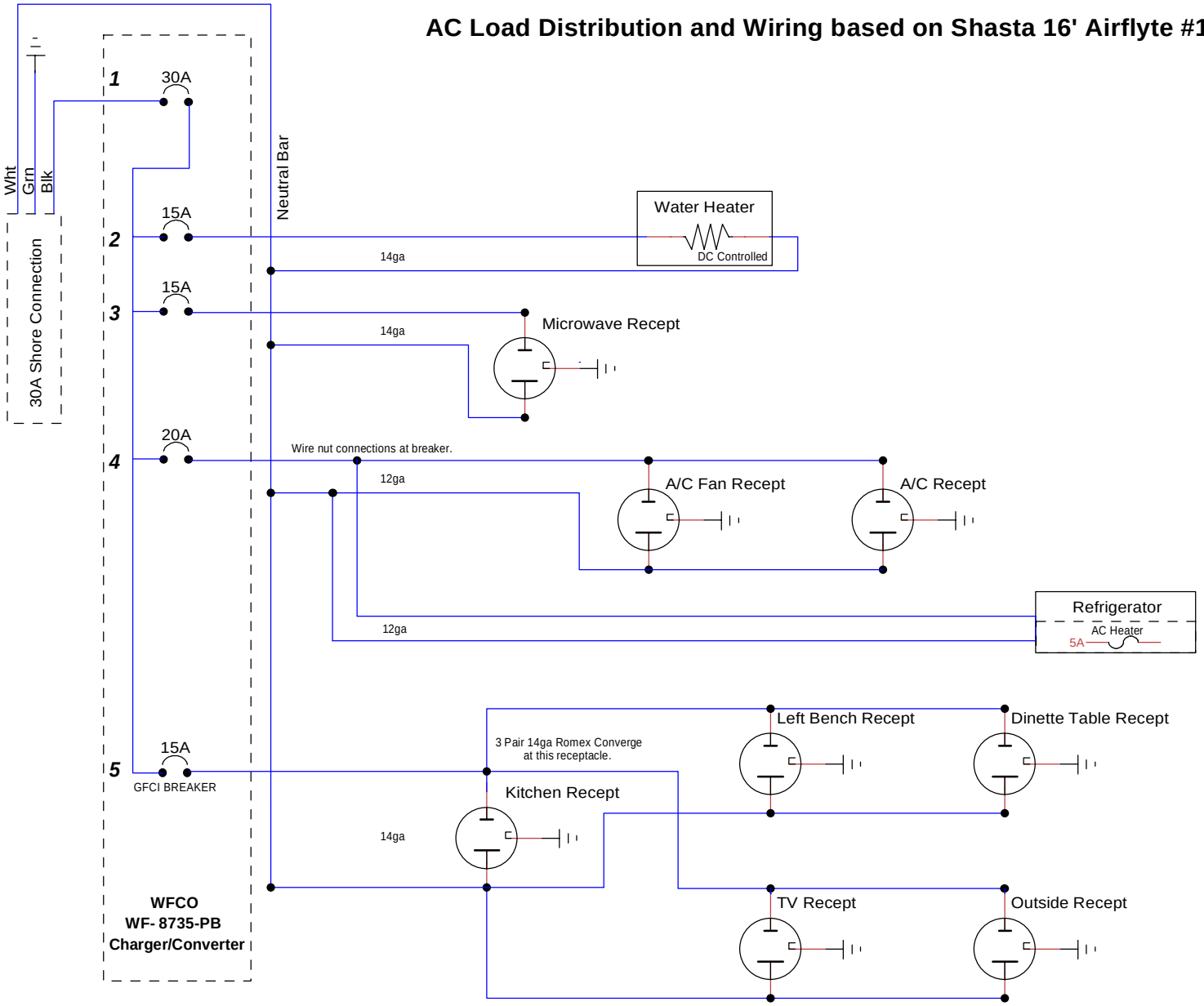
Note: Your fuses and breakers could be arranged in a different order.

Shasta Airflyte 16' - DC Current Draw		
Disconnected from shore power, battery in stock location, voltage 12.6V open circuit.		
Device	**Current Draw** (Amps)	**Remarks**
Power Converter (steady state):	<0.05	May draw more if fan is operating
Radio (steady state):	<0.05	May draw more w/bluetooth
Radio (mid volume):	0.5	
Fantastic Fan (max):	2.5	
Ceiling Lights (three):	1.04	
Gaucho Light (one):	0.173	
Dinette Lights (pair):	0.27	
Bath Light:	0.236	
Water Htr (gas):	0.26	
Water Pump:	1.0	
Grab Handle:	0.077	
Furnace:	4.0	Attributed to blower motor
"Gas Lamp" LED:	0.226	
"Gas Lamp" Edison:	0.766	
Range Hood Fan:	1.14	
Range Hood Lt:	1.43	Incandescent bulb
Refrigerator (DC):	~15.0	From diag manual 3311143.000
Refrigerator (gas):	<3.0	From diag manual 3311143.000
Note: Exact current is dependent on your battery voltage.		
19' Airflyte may differ slightly for similar loads depending on wire losses.		

See separate sheet for Improvements that can be made to reduce voltage drop and increase performance of some devices.

Title: Fuse and Breaker Listings		
Author: C. Heisterkamp		
File: E:\Shasta Related\Shasta DC.dsn		Document
Revision: 1.0	Date: 10Aug16	Sheets

AC Load Distribution and Wiring based on Shasta 16' Airflyte #147.

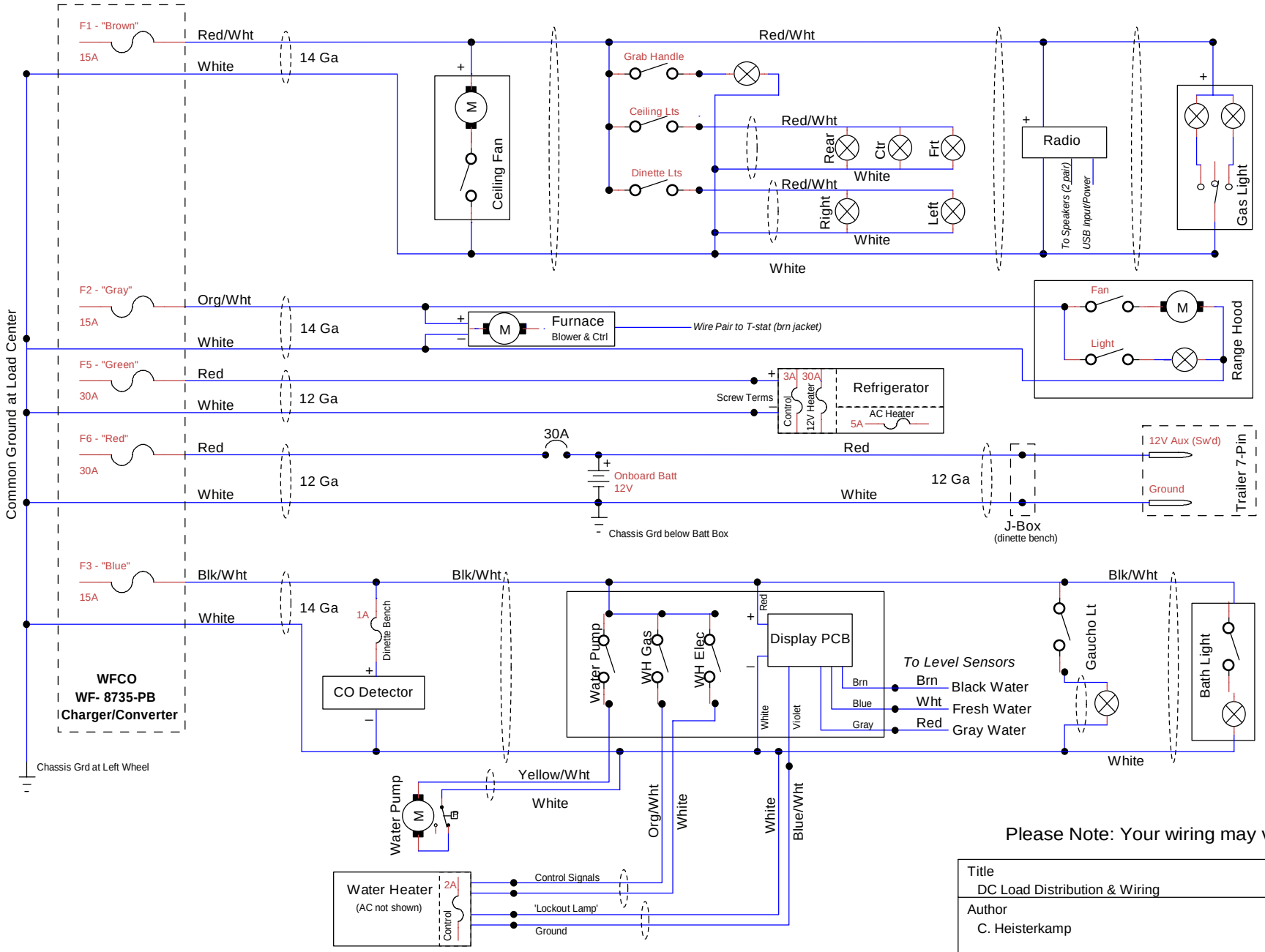


Notes:

All wiring either 14ga or 12ga Romex.
Devices shown left to right as geographically wired.
Ground wiring & ground bar not shown for simplicity.
All recepts are RV screwless type.

Title: AC Load Distribution & Wiring		
Author: C. Heisterkamp		
File: E:\Shasta Related\Shasta DC.dsn		Document:
Revision: 1.0	Date: 10Aug16	Sheets: 5

DC Load Distribution and Wiring based on Shasta 16' Airflyte #147.



Please Note: Your wiring may vary!

Title DC Load Distribution & Wiring		
Author C. Heisterkamp		
File E:\Shasta Related\Shasta DC.dsn		Document
Revision 1.0	Date 10Aug16	Sheets

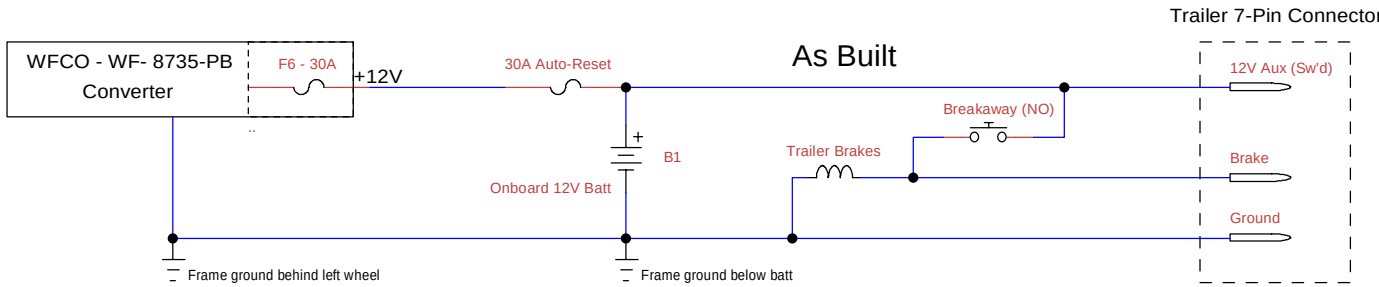
See Page 2 for "Notes and Observations"

Battery Charging System

Notes:

30A breaker located with batt in rear gaucho.
Feed to/from Converter & 7-Pin to rear gaucho have paired grounds; identical markings. For both Wht=grd, Wht/Red=+12
Relies on vehicle fuse/brkr to limit current from 7-pin feed.
WF-8735 Spec: Self limited to 35A charging; 40A fault protection.
During key on, engine off, backfeed from Shasta possible.
Converter 12V and 7-pin 12V run underneath chassis.
7-Pin feed is 8' to J-box + length to batt. This line unprotected.
Should short occur, towing vehicle fuse will open; full potential of onboard batt still on wiring.
Wire length from J-box and Converter add to voltage drop.
If a batt disconnect is added in rear gaucho, brakes will not be available for breakaway feature when disc. is open.

As Built

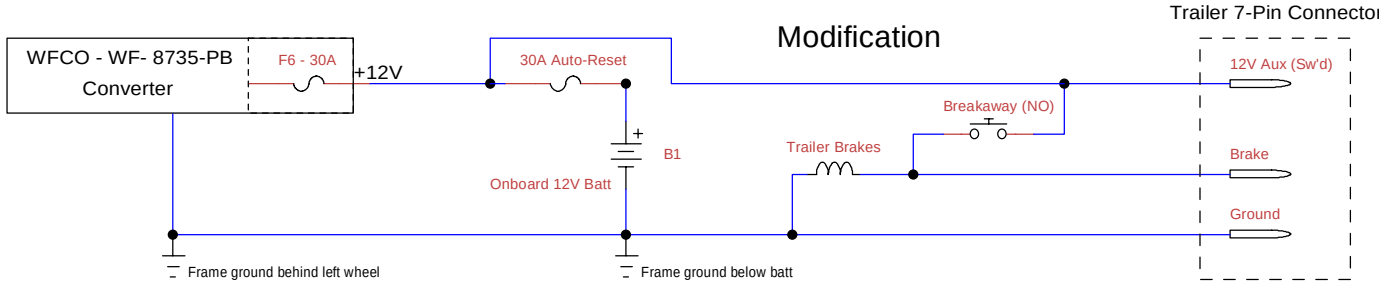


Note: Trailer Brake Connection and Breakaway Switch connect in dinette bench J-box.

Notes:

Battery is still current limited by existing breaker.
12V feed from vehicle now protected on trailer side.
Modification: Move vehicle feed from one side of breaker to the other; both ring terms opposite of batt.

Modification



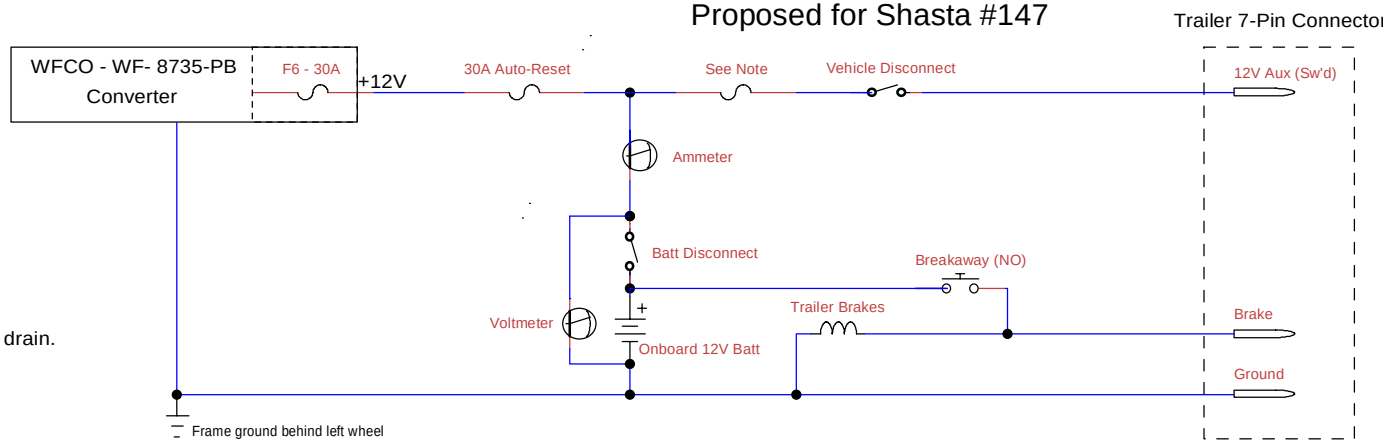
Note: Trailer Brake Connection and Breakaway Switch connect in dinette bench J-box.

Notes:

Batt moved to LH dinette bench - AGM type non-venting.
Eliminated vent, grd wire to frame, 12v wire from J-box.
Re-routed converter wire from under chassis to through the wall following existing WH wiring.

Disconnect added downstream of breakaway power.
Breaker on vehicle feed sized for smallest wire in vehicle ckt.
Vehicle Disc. prevents overcharging of AGM or isolation to prevent drain.

Proposed for Shasta #147



Note: Trailer Brake Connection and Breakaway Switch connect in dinette bench J-box.

For Reference Only - Any changes made to your Shasta are done so at your own risk.

Title: Batt Charging Arrangement		
Author: C. Heisterkamp		
File: E:\Shasta Related\Shasta DC.dsn		Document
Revision: 2.0	Date: 10Aug16	Sheets

Electrical Notes & Observations in No Particular Order:

1. Loads and devices are shown left to right as they are geographically wired. For example, the power and ground to the radio can be accessed at the light switch assembly by the door.

2. Excluding F2, batt and level-sensor wiring, all pairs eventually transition up the wall behind the cooktop (accessible in overhead cabinet & behind microwave), through the roof and down around bath.
   This includes the return pairs to the water pump and water heater as well as the t-stat wiring.

3. House battery located in rear goucho. Two identical 12ga pairs run under chassis, up through floor under bath and terminate at batt.
   Pair 1 connects to converter through local 30A self-resetting breaker. Pair 2 runs to J-box in front dinette bench to interface with trailer 7-pin.

4. Level Sensor wiring for greywater and freshwater run under chassis, diverging behind left wheel where freshwater re-enters interior to be run through wall.

5. AC and vehicle-powered DC wiring not shown.
   - AC loads diagrammed on separate sheet.
   - Vehicle-powered stop/run/turn wiring interfaces trailer 7-pin connector in dinette bench J-box, runs under chassis,
     emerges under bath and terminates at right rear taillight where distribution to other lights takes place. Remove light for access.

6. Wire pairs are 14ga stranded except for refrigerator power and batt supply which are 12ga.

7. The dominant color of a pair is denoted by the positive lead which is white with a colored stripe; the ground is white.

8. Each fused circuit leaves the load center via a wire pair so all grounds are home-run. Colors indicated adjacent to fuses in load center are NOT the wire pair colors.

9. Fuse position F4 is not populated and could be used for accessory equipment.

10. CO Monitor has a local 1A fuse.

11. The WH control board (exterior WH access door) has a local 2A fuse, presumably for the LV control wiring.

12. The refrigerator has onboard fusing for control as well as the 12V and 120V heaters, accessible through the lower exterior vent door.

13. Your wiring may vary due to production changes or availability of a given wire color during manufacture.

14. 19' Airflytes are probably different.

15. Trailer brake wiring is independent of load center and is shown on 'Batt Charging' sheet.

16. As far as I can determine, there are no hidden splices. Switch-controlled loads are homerun back to the switch, including ground, and connection points can be accessed by pulling the device.

17. The 30A breaker (to limit charge current) in series with the 30A fuse F6 is a curious choice.

18. All lights other than in the range hood and the Edison bulb are LED with built-in current regulators. They will maintain the same brightness over varying battery voltage.

19. The blk/wht pair really does run to the CO monitor before doubling back to the converter, running up the wall and then down to the rear controls.
    The only high-current load on this circuit is the water pump, which would see significant voltage drop in this wiring strategy.
    Cutting and paralleling the feed to the rear switches at the converter output would reduce these losses.

20. Speaker wiring not shown, however rear speakers are located above refrigerator and wire pairs can be accessed through upper exterior ref door.

21. Current is bi-directional on fuse F6.
    When connected to shore power, this line charges the house battery.
    When off-shore, this line becomes the source for the rest of the load center.
    When connected to a vehicle, and if a batt disconnect is installed and open, the vehicle will backfeed through this line to the load center.
    See 'Batt Charging' sheet for more information on this topic.

22. It's widely known the freshwater levels read incorrectly. This is not a wiring problem but an issue with sensor placement on the tank.

23. When in doubt, suspect a bad crimp. Many pass a visual check but a light tug will often dislodge a critical wire.

Title Notes		
Author C. Heisterkamp		
File E:\Shasta Related\Shasta DC.dsn		Document
Revision 1.0	Date 10Aug16	Sheets