



OLIVER
TRAVEL TRAILERS



2020

LEGACY ELITE & LEGACY ELITE II

OPTIONAL

FEATURES

COMPONENT MANUALS

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OPTIONAL COMPONENT WARRANTY INFORMATION

Anderson “No-Sway” Weight Distribution Hitch

Andersen Hitches
3125 North Yellowstone Highway, Idaho Falls, ID 83401-1709

Email: N/A
Phone: 800-635-6106
Warranty: Limited Lifetime



Barker’s Auto Drain

Barker Manufacturing
1125 Watkins Road, Battle Creek, MI 49015

Email: sales@barkermfg.com
Phone: (888) 367-6978
Warranty: 2-Year Extended



Bright Way Group Batteries

Bright Way Group
9660 Dilworth Road, Dallas, TX 75243

Email: batterysales@bwgllc.com
Phone: (469) 248-0380
Warranty: 1-Year



Dometic 9500 Series Awning

Dometic
2320 Industrial Pkwy, Elkhart, IN 46516

Email: customersupportcenter@dometicus.com
Phone: 800-544-4881
Warranty: 1-Year Limited - Parts, Labor, Freight



High Pointe Convection Microwave

Collins & Company
17880 Commerce Drive, Bristol, IN 46507

Phone: (574) 848-1118
Warranty: 1-Year



HyperVent Condensation Prevention Matting

HyperVent Marine
1301 4th St., Marysville, WA 98270

Email: hypervent_info@comcast.net
Phone: 360-651-1365
No Warranty



KTT Mattresses

KTT Enterprises
15 Marne St., Handen, CT 06514

Email: info@kttenterprises.com
Phone: 203-288-7883
No Warranty



OPTIONAL COMPONENT WARRANTY INFORMATION



Lifeline Deep Cycle Batteries - Legacy Elite

Lifeline Batteries Inc.
292 E Arrow Highway, San Dimas, CA 91773

Email: N/A
Phone: 909-599-7816
Warranty: 5-Years



Magnadyne Omni-Directional Antenna

Magnadyne Corporation
1111 W. Victoria Street, Compton, CA 90220

Email: support@magnadyne.com
Phone: 1-310-735-2000
Warranty: 1-Year



Nature's Head Composting Toilet

Nature's Head, Inc.
PO Box 250, Van Buren, Ohio 45889

Email: sales@naureshead.com
Phone: 251-295-3043
Warranty: 5-Year



Powertron Deep Cycle 12V Batteries

Trojan Battery Sales
11301 47th Street, Clearwater, FL 33762

Email: sales@trojanbatterysales.com
Phone: 800-282-3750
Warranty: Powerton Deep Cycle 2-Year



SureCall Fusion2Go 3.0 Cell Phone Amplifier

SureCall
48346 Milmont Drive, Fremont, CA 94538

Email: support@surecall.com
Phone: 1-888-365-6283
Warranty: 3-Year



TRUMA AquaGo Comfort Tankless Water Heater

Truma Corp.
825 E Jackson Blvd, Elkhart, IN 46516

Email: info@trumacorp.com
Phone: 1-855-55-TRUMA
Warranty: 1-Year
(2-Year when registered at time of purchase)



Voyager WiSight Rear View Camera

ASA Electronics
2602 Marina Drive, Elkhart, IN 46514

Email: inquiry@asaelectronics.com
Phone: 877-305-0445
Warranty: 1-Year





OPTIONAL COMPONENT WARRANTY INFORMATION

Wifi Ranger WIFI Booster

Mito Corporation
213 County Road 17, Elkhart, IN 46516

Email: questions@wifiranger.com
Phone: (574) 295-2441
Warranty: 1-Year



Winegard Carryout G2 Satellite

Winegard Company
3000 Kirkwood Street, Burlington, IA 52601

Email: help@winegard.com
Phone: 1-800-788-4417
Warranty: 2-Years Parts, 1-Year Labor



Xantrex Freedom XC Inverter

Xantrex
541 Roske Drive, Suite A, Elkhart, IN 46516

Email: N/A
Phone: 800-670-0707
Warranty: 24 Months



ZAMP Solar Package

ZAMP Solar, LLC.
63255 Jamison Rd, Bend, Oregon 97703

Email: support@zAMPsolar.com
Phone: 541-728-0924
Warranty: 1-Year Limited

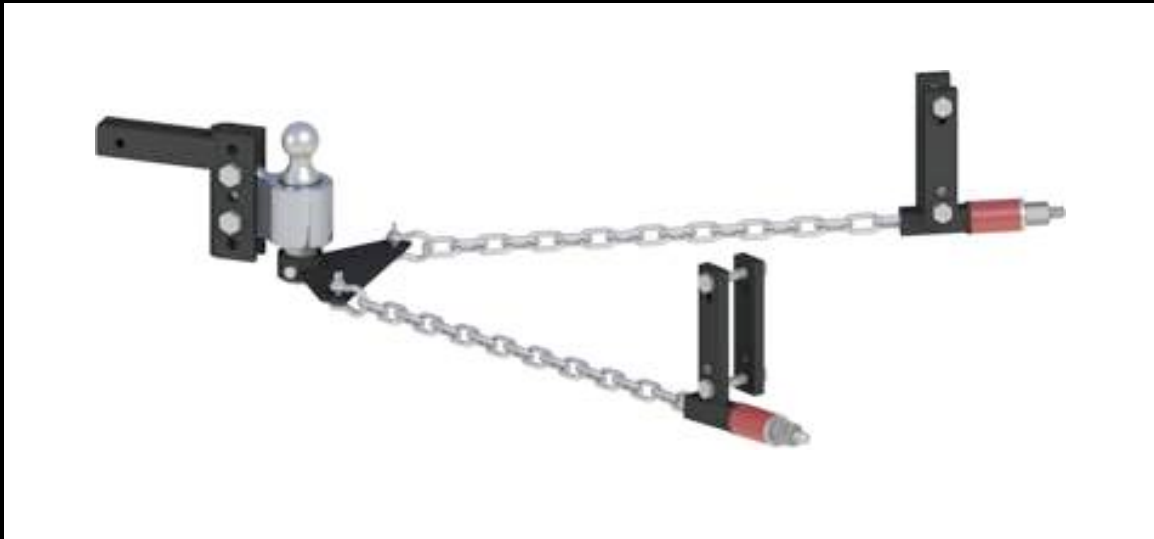




IMPORTANT! DEALER OR INSTALLER:
 Please make sure the customer receives this manual for safety tips, warranty, and future removal or installation help

INSTALLATION MANUAL

Andersen “No-Sway” Weight Distribution Hitch



Featuring the patented, super-quiet Anti-Sway and Anti-Bounce TMD (True Motion-Dampening™) system
 14,000 lbs GTWR (2-5/16" ball) • 10,000 lbs GTWR (2" ball)
 1,400 lbs Tongue

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Want to see a video of the install?



Use your SmartPhone to scan the QR Code above and to go to our Installation Videos on the web.



1-800-635-6106



IMPORTANT SAFETY INFORMATION

Before each trip –and regularly during a trip– check all hardware, bolts and nuts for wear and fatigue. Make sure that they are all properly tightened and that all pins and clips are secured in place.

Secure your trailer with wheel chocks before setting up or adjusting the weight distribution hitch.

The operator is responsible for making necessary adjustments to the weight distribution hitch to maximize performance for each trip and every time the load changes.

REMEMBER Any time you change your load weight in the towing vehicle or trailer, re-check to see how level you are and make adjustments as needed. Also, check the tightness of all nuts and bolts often and re-tighten as necessary.

WARNINGS

Failure to follow all safety warnings could result in severe injury or even death.

Make sure to read and understand all of the manufacturer's instructions of your trailer, tow vehicle, and hitching equipment. Also, follow all safety warnings, setup instructions, and maintenance before installing your hitch.

It is critical to check the tire pressure of each of the tires on the trailer and tow vehicle before towing.

Make sure the trailer coupler is coupled and secured properly before towing, and that safety chains are in place.

Do not modify Weight Distribution Hitch components outside of the recommendations found within this manual.

IMPORTANT: No hitch setup can guarantee that trailer sway will be avoided altogether. It is the driver's responsibility to adjust equipment and driving habits according to towing conditions. The driver is responsible for their own safety and the safety of passengers and those around them.

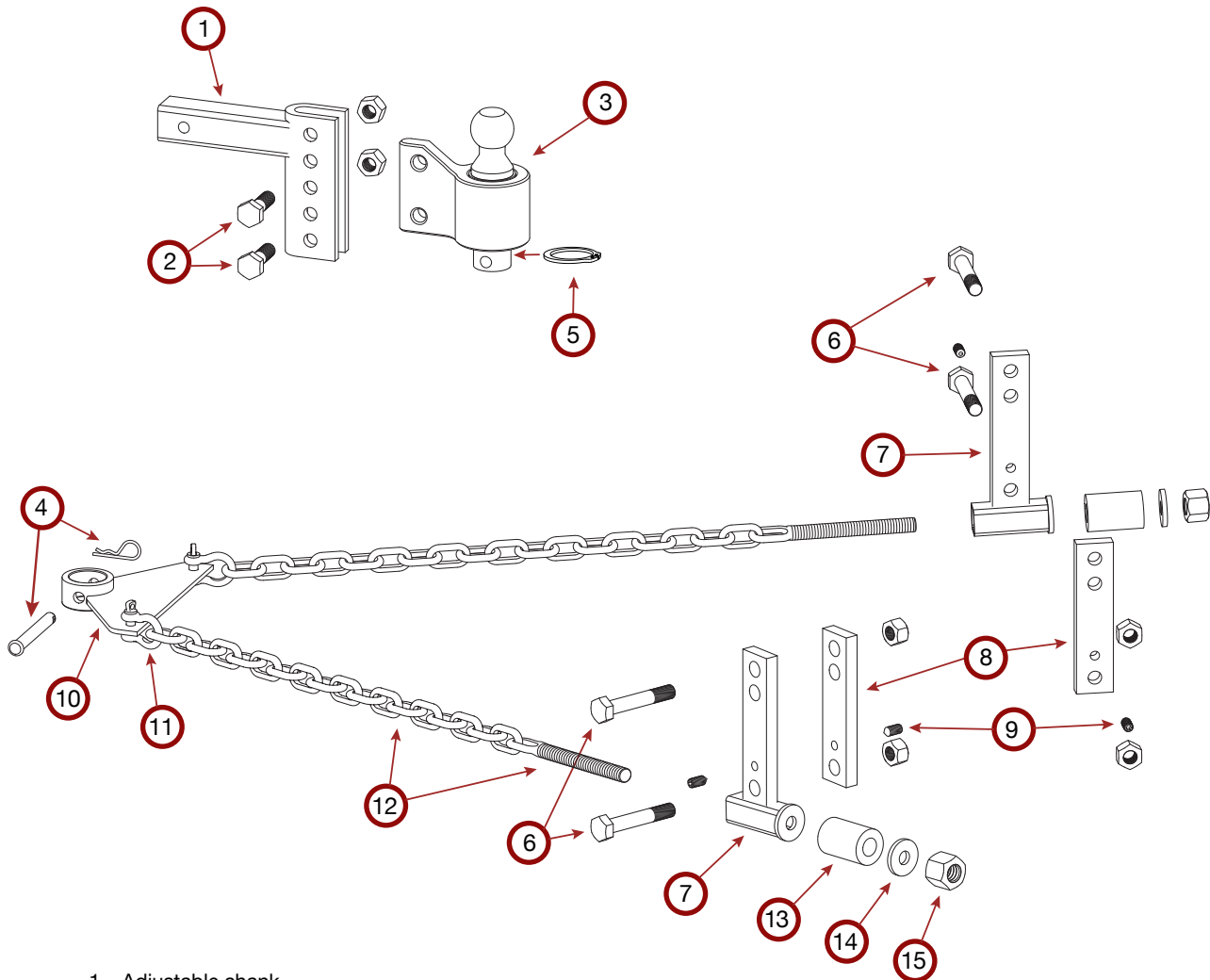
SUSPENSION

Ensure that the suspension of both the tow vehicle and trailer are in good working order before you embark on a trip. Bad suspension may result in the Weight Distribution Hitch not being able to properly even your load. Always load trailer correctly according to the manufacturers recommendations for maximum weight limits and cargo placement. Do not overload trailer or towing vehicle.

We are proud that our Weight Distribution Hitch is rated up to 1,400 lbs tongue weight as far as strength requirements for the SAE J-684 standard. However, if your trailer tongue weight is pushing 1,400 lbs. we recommend improving or 'beefing up' the suspension of both 1/2 ton and 3/4 ton vehicles. One remarkable suspension add-on product that works great is the Timbren SES 'Suspension Enhancement System'. Their heavy-duty rubber cushions absorb road shocks and automatically adjust to uneven loads or road conditions. Here at Andersen Hitches we whole-heartedly recommend the Timbren SES as the perfect companion to the Andersen "No Sway" Weight Distribution Hitch. See your Authorized Andersen Dealer or visit our website for more information.



PARTS ILLUSTRATION



1. Adjustable shank
2. Shank bolt (3/4" x 2-1/2") w/nut (2 pcs)
3. Ball housing (Sway control)
4. Pin and clip for Ball housing (Sway control)
5. Spring clip (attached to tapered ball)
6. Frame bracket bolts (5/8" x 4") w/nuts (4 pcs)
7. Outside frame bracket (2 pcs)
8. Inside frame bracket (2 pcs)
9. 'Pointed' set screw (4 pcs)
10. Triangle plate
11. Chain shackle (2 pcs)
12. Tension chain w/end bolt (2 pcs)
13. High-density urethane spring (2 pcs)
14. Spring washer (2 pcs)
15. Tension nut (1-1/4") (2 pcs)

TOOLS NEEDED FOR INSTALLATION

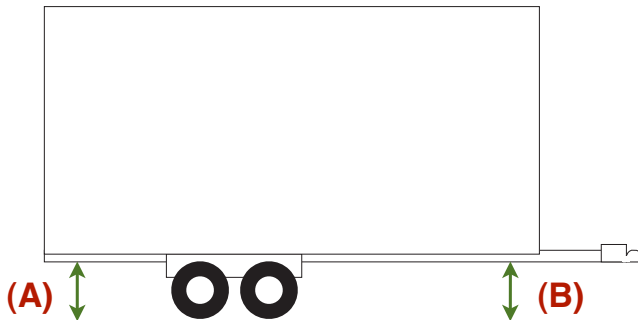
- 5/16" Allen wrench
- Two 15/16" Box End or adjustable wrenches
- Two 1-1/8" Box End or adjustable wrenches
- 1-1/4" socket (provided)
- Torque Wrench capable of 100 Ft-lbs of torque.
- Measuring Tape & Pencil



STEP 1: PREPARATION

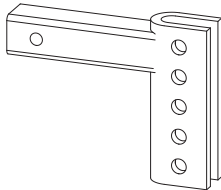
Start on level ground. If you are planning on hauling ATV's or other heavy equipment, you may want to load the trailer and tow vehicle with those items beforehand. Follow proper weight distribution guidelines according to the manufacturer's recommendations for tow vehicle and trailer. Make sure to stay within the limitations of each manufacturer's maximum weight recommendations.

IMPORTANT Make sure that any auto-leveling system is disabled or turned OFF temporarily during installation.

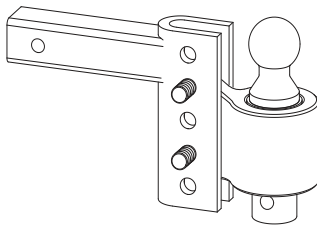


Ensure that the trailer is parallel to the ground by comparing measurements (A) and (B) (see diagram on left). Measure from the ground to the frame on both the front and back of the trailer.

STEP 2: INSTALLING SHANK AND BALL HOUSING (SWAY CONTROL)



Once the trailer is level, place the adjustable shank into the hitch receiver on your towing vehicle. Secure it to the receiver using the standard pin and clip (provided) or your own locking pin.



Place the Ball Housing into the adjustable shank and set the ball height about 1" to 1-1/2" higher than the trailer's coupler (top of ball to top of coupler).

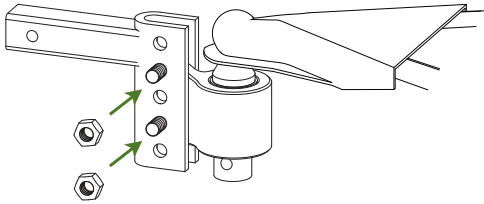
Place the two Ball Housing adjustment bolts through the holes in the shank and Ball Housing unit to hold it in place (we will tighten the shank nuts in step 5).
NOTE: If you purchase the optional combo ball from Andersen

Raise the tongue of the trailer up high enough so that the ball mount can comfortably fit under the trailer coupler. Back up your tow vehicle so the ball mount is directly under the trailer coupler and then set the full weight of the trailer down on the ball.

The front end of your trailer should now be about 1" to 1-1/2" lower than the back. If the front of the trailer is **MORE** than 1-1/2" lower than the back, then raise the trailer coupler off of the Ball Housing and move the Ball Housing up a notch or two as needed so that it is close to level or within 1-1/2" difference.

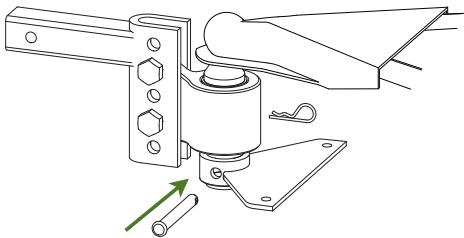


STEP 3: ATTACHING THE TENSION PLATE AND CHAINS



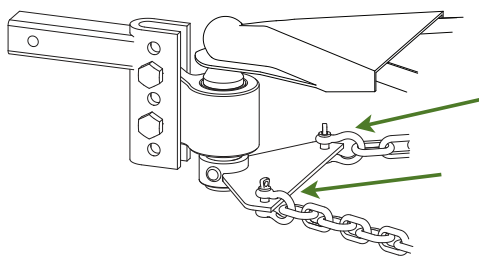
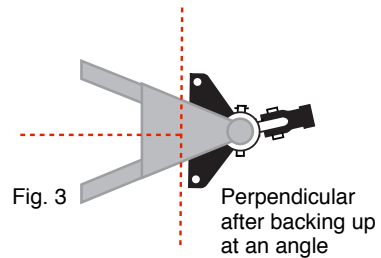
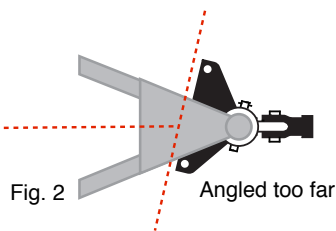
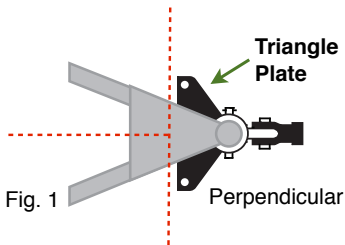
Once you have completed step 2, raise the trailer up so there is almost no weight on the ball. Now place the two nuts onto both of the shank adjustment bolts and tighten to approximately 150 ft-lbs of torque using a 1-1/8" socket or wrench. The idea here is to squeeze the sides of the adjustable shank around the Ball Housing. Then lock the trailer coupler onto the ball.

IMPORTANT Make sure there is **ALMOST NO WEIGHT** being placed on the ball, then lock the trailer coupler in place on the ball.



Continuing with **ALMOST NO WEIGHT** on the ball, attach the Tension Plate to the bottom of the Ball Housing and secure it in place using the pin and clip provided (see left).

Look at a bird's-eye-view of the Triangle Plate (see below). Make sure that the Triangle Plate is close to perpendicular to the trailer frame (fig. 1). If not, raise the trailer jack off the ground and use the tow vehicle to move the Trailer forward or backward at an angle until the plate is close to perpendicular to the trailer frame (fig. 3). **NOTE:** The plate does **NOT** need to be exactly perpendicular.



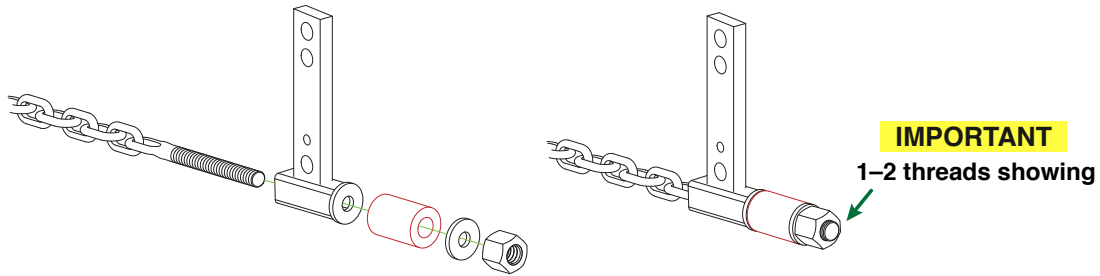
Once the Triangle Plate is correctly in place, attach the chain shackles to the Triangle Plate by threading the shackle pin through the hole on the plate (everything should look like the diagram on the left).

Hand-tighten both shackle pins until they are fully seated, then back them off 1/4 rotation. Doing this prevents them from seating too tightly over time and becoming too difficult to unscrew.



STEP 4: ATTACHING FRAME BRACKETS TO TRAILER

Proceed with **ALMOST NO WEIGHT** on the ball mount. Attach both tension chains to the outside frame brackets using the hardware shown below.



1. Insert the chain bolt into the **SQUARE** opening of the outside frame bracket (**DO NOT** thread it through the round “washer” side first).
2. Place the red high-density urethane spring onto the protruding bolt.
3. Next, place the washer on to the bolt.
4. Finally, thread the Tension Nut on to the bolt until 1–2 bolt threads are protruding from the end.

While keeping the chains tight, attach (hand-tighten) both pairs of frame brackets to the tongue of the trailer. Make sure both chains are relatively straight and not twisted. Do not fully tighten the four bracket bolts. Do not insert the set screws yet. Both pairs of frame brackets should be perpendicular to the frame.

NOTE: The upper hole on the standard bracket is for 6-inch tongue frames, the hole below it is for 5-inch frames. Separate brackets (or complete Kits with custom brackets) are available in the following sizes: 3”–4”, 4-3/8”, 8”.



CAUTION! Check around the trailer frame to see if there are any brake lines, gas lines, or wiring that could be damaged by the installation of the frame brackets. If so, find a way to reroute them before final installation.

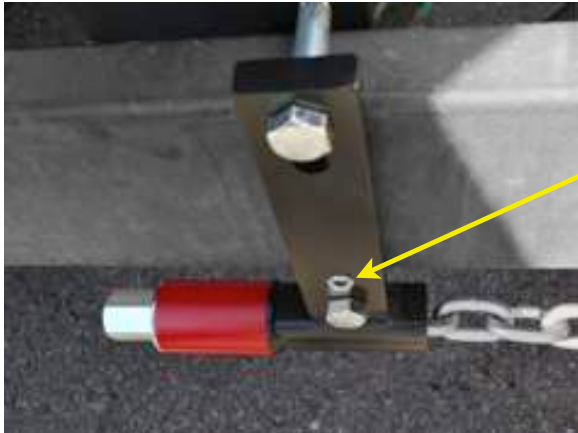
OBSTRUCTIONS? If you have any obstructions on the frame caused by fixtures that are in the way of the frame brackets, there are two options:

1. Move/adjust the item forward or back so it is out of the way. Some items like propane tanks and batteries can be moved or raised using off-the-shelf frames or brackets. See your local Authorized Andersen Dealer for further help and options.
2. If the obstructions cannot be moved or adjusted, you can accommodate them by removing one or more links from the tension chains as necessary (from the shackle end). If you do not have bolt-cutters or other cutting equipment to remove chain links, see your local Authorized Andersen Dealer for help. **IMPORTANT!** If you do remove any chain links, be sure to remove the same number of links from both tension chains.



STEP 4 continued...

Once the frame brackets are in place and you have checked that there are no obstructions (see previous section), tighten down all four bracket bolts using a 15/16" socket or wrench. As you are tightening, keep both sets of frame brackets perpendicular to the frame. Make sure all brackets are clamped tightly –we recommend about 90 ft-lbs of torque.



Using a 5/16" allen ratchet or allen wrench, screw in all of the set screws until they barely touch the trailer frame, then tighten them 3 more full rotations.

C-CHANNEL FRAMES

If your trailer has a 'C-channel' style frame, you will only be able to use the 2 outside set screws to secure the frame brackets to the frame.

To ensure a secure hold, install the set screws or brackets using one of the optional methods below.

OPTIONAL SET SCREW INSTALLATION

(for both Regular and C-Channel frames)

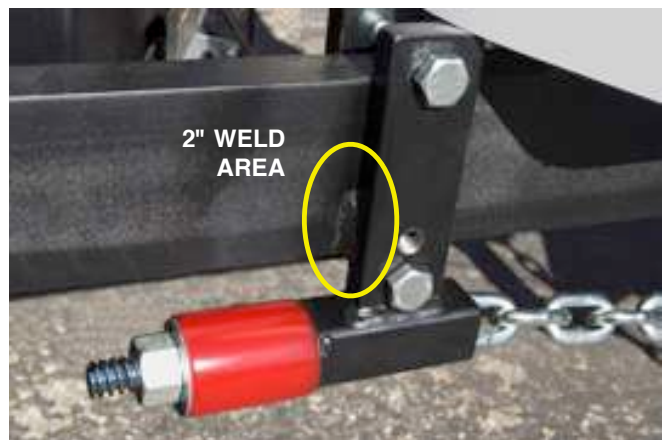
A good option to strengthen and secure the hold of the set screws is to pre-drill a 7/16" hole into the frame where the set screws will be located. Before drilling, insert the set screw into the frame bracket and turn it until the tip makes contact with the frame, then turn it a little more to apply pressure and make a mark on the trailer frame. Remove the set screw and drill a hole in the frame at the point you marked. After drilling, replace and tighten the set screws into the hole to prevent the bracket from slipping.

OPTIONAL FRAME BRACKET INSTALLATION

(for both Regular and C-Channel frames)

Using the services of a certified welder, you can add a 2" weld along the lower back side of both outside frame brackets (on the same side the spring is on). This will give you a very secure installation of the frame brackets without the need for set screws. Before welding you will need to grind the paint off of the area to be welded.

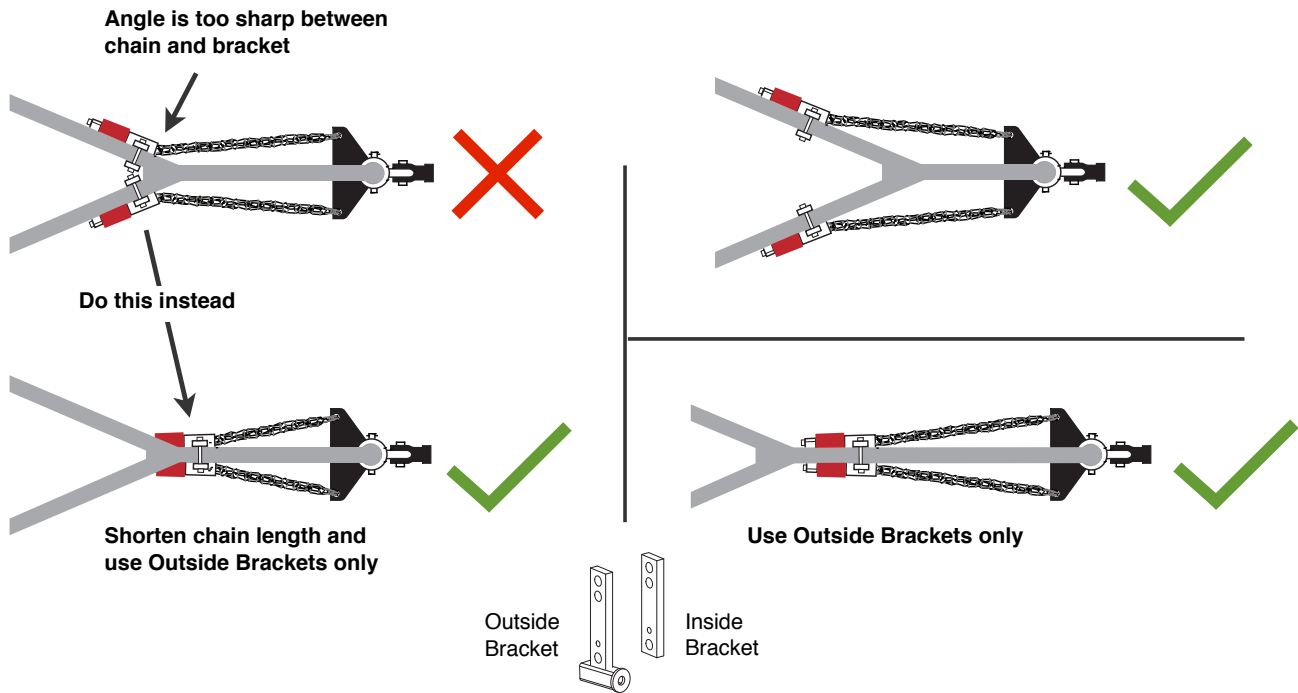
NOTE: You do not need to weld the inside frame brackets. Should you decide to sell your trailer later, the weld could be easily removed by prying the bracket away and grinding off the leftover weld.



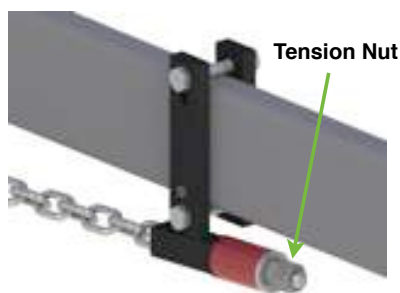


'Y' style Trailer Frames

The Andersen 'No-Sway' Weight Distribution Hitch can accommodate nearly all 'Y-style' trailer frames. In some cases you may need to remove a few –or even several– chain links to allow installation at the optimum position on the trailer frame. In some cases you may need to install the unit using just the outside frame brackets –bolting them to each other rather than to the inside frame brackets. Use the examples below as a guide. If you have any questions about a particular installation please call our customer service center at 800-635-6106.



STEP 5: SETTING THE TENSION



Tighten bolts to xxxx?

Once the frame brackets are firmly and securely in place, use the 1-1/4" socket (provided) to tighten both Tension Nuts so that there are about 7 threads protruding. The urethane spring will be compressed approximately 1/4 of an inch.

Now lower the trailer and set the weight of the trailer fully on the ball. The front and back end of your trailer should now be close to level or within 1" of being level.

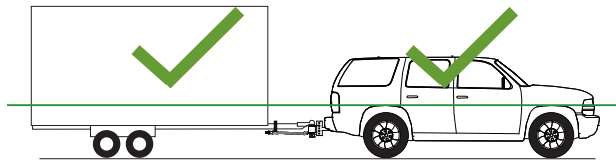
For fine-tuning the weight distribution, you can now tighten or loosen both Tension Nuts one thread at a time. Although it is not crucial, it is a good practice to tighten or loosen both of the Tension Nuts about the same amount. See the next section for further checking and adjustment.



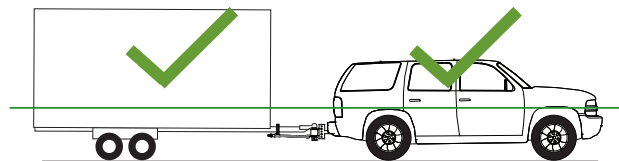
STEP 6: CHECKING AND ADJUSTING THE TENSION

For most circumstances, you can see how well the installation and adjustment is going by standing back and looking at how level the trailer and tow vehicle are. The trailer should be level (within 1") and the tow vehicle should be pretty close to level. If either is drastically uneven follow the steps at the bottom of the page.

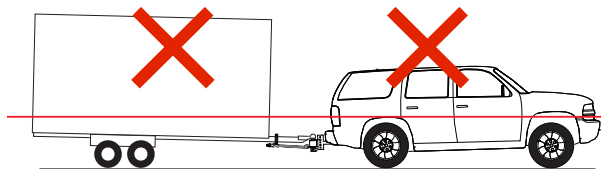
After hundreds of installations we have found that it is just as effective to basically "sight level" the tow vehicle and get it as close to level as you can by tightening/loosening the Tension Nuts. Trying to get the Tow Vehicle to be perfectly level is NOT necessary – you just don't want to be too extreme in either direction (too much towards the tow vehicle's front axle or too much towards the rear axle). We have illustrated some good and bad examples below:



GOOD: Trailer and tow vehicle are level

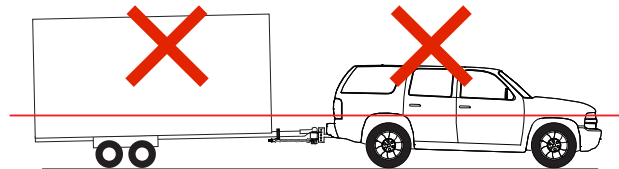


GOOD: Trailer is level, rear of tow vehicle is a little lower than front



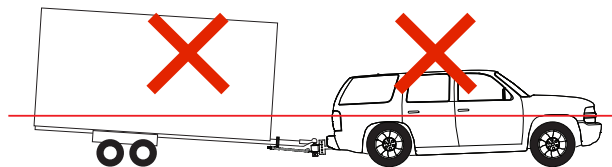
BAD: Trailer is not level and rear of tow vehicle is a lot lower than front

- 1. Check the load 2. Check installation 3. Tighten Tension Nuts



BAD: Trailer is not level, back of tow vehicle is higher than front

- 1. Check the load 2. Check installation 3. Loosen Tension Nuts



BAD: Far too much weight on back of tow vehicle
Trailer is severely off-level

- 1. Check the load 2. Check installation 3. Tighten Tension Nuts

In the 'Bad' examples above, a solution can usually be accomplished by one of the following actions:

1. **Check the load.** Is there too much weight in the trailer or tow vehicle? If not, perhaps the load is too far to the front or back of the trailer or tow vehicle and needs to be distributed better.
TIP: It's better to keep the weight shifted towards the front of the trailer than the back -but not too much.
2. **Check your installation.** Start again from Step 1 and double-check each of the installation steps.
3. **Adjust the Tension Nuts.** Tighten or loosen them both one thread at a time and check the result. Tightening will move the weight distribution towards the front axle of the tow vehicle, loosening the Tension Nuts moves the weight towards the rear axle of the tow vehicle.

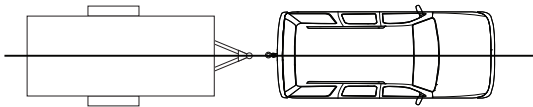
Having trouble installing? If you have read through the safety information on page 2, and followed all of the installation instructions well, but are still having difficulty with the installation, please contact your local Authorized Andersen Dealer, visit our website at www.AndersenHitches.com or call our customer service center at 1-800-635-6106.



If your installation is within the optimum settings, then you're ready to hit the road!

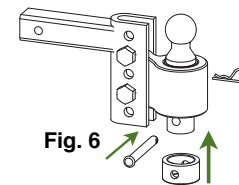
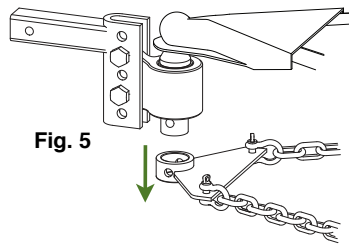
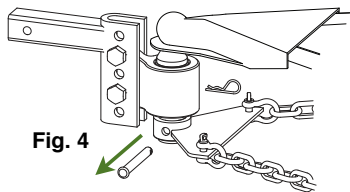
REMEMBER Any time you change your load weight in the towing vehicle or trailer, re-check to see how level you are and make adjustments as needed. Also, check the tightness of all nuts and bolts often and re-tighten as necessary. Remember –if your load changes, then check

UNHOOKING TRAILER FROM TOW VEHICLE



FOR CONVENIENCE IN HOOKING BACK UP LATER:
Before you unhook the trailer from the tow vehicle, try to park the trailer and tow vehicle as close to evenly in line as possible.

1. Once you are parked, chock the tires of your trailer and remove the safety chains (not the Tension Chains).
2. Use your trailer's support leg or jack to take a little of the weight off of the trailer coupler.
3. Using the 1-1/4" socket, loosen both Tension Nuts (make a note how many threads are showing).
4. Remove the pin and clip attached to the bottom of the ball (fig. 4).
5. Remove the Triangle Plate –you can leave the chains and shackles attached to it (fig. 5).
6. Now attach the separate Retaining Ball Collar with pin & clip (fig. 6). Now you have the option use the Weight Distribution ball as a standard hitch ball for towing other trailers.



HOOKING THE TOW VEHICLE BACK UP TO THE TRAILER

1. Remove the separate Retaining Ball Collar with pin & clip (if you previously attached it). Attach the Ball Housing pin and clip to the bottom of the ball.
2. Using your trailer's support leg or jack lower the trailer coupler onto the ball –make sure there is almost no weight on the ball.
3. Attach the Triangle Plate (with chains and shackles attached) and pin it securely in place (see **NOTE** below).
4. Using the 1-1/4" socket, tighten both Tension Nuts (make sure the same number of bolt threads are showing as when you loosened them).
5. Lower the trailer and set the weight of it fully on the ball. Go back to Step 6 and check how level the Trailer and Tow Vehicle are. Make adjustments if necessary.
6. Replace the trailer's safety chains (not the Tension Chains).

NOTE: If you are unable to back up your tow vehicle to the same angle as when you unhooked your trailer (so the triangle plate is no longer perpendicular to the trailer), then remove the chains from the triangle plate and go back to Step 3 and follow the procedure to straighten out the triangle plate.

Questions or Concerns? If you have read through the safety information on page 2, and followed all of the installation instructions well, but are still having difficulty with the installation, please contact your local Authorized Andersen Dealer, visit our website at www.AndersenHitches.com or call our customer service center at 1-800-635-6106.



OPTIONAL ADD-ONS for YOUR WEIGHT DISTRIBUTION HITCH

More than one trailer?

Adding a WD Trailer Kit to all of your other trailers will let you quickly and easily move from trailer to trailer with your Weight Distribution system.

Includes all mounting hardware shown. Available in optional bracket sizes in next section.



#3372

WD Trailer Kit

Includes triangle plate, chains, nuts, brackets and mounting hardware.
(Need to specify bracket size.)

OPTIONAL BRACKET SETS

Each bracket set includes 1 inside bracket, 1 outside bracket, and necessary mounting hardware



#3360
3"-4" Bracket set



#3361
4-3/8" Bracket set



#3359
5"-6" Bracket set



#3387
8" Bracket set



#3352

2" x 2-5/16" Combo Ball

Use with your WD adjustable shank to pull your other trailers when you don't need Weight Distribution.

NOTE: Do not use above Pins & Clips in place of the bolts & nuts when attaching the Ball Housing.



#3351

WD 6" Drop/Rise Adjustable shank



#3353

WD 4" Drop/Rise Adjustable shank





Andersen ‘No-Sway’ Weight Distribution Hitch Limited Lifetime Warranty

WARNING: The weight ratings and certifications for the Andersen Weight Distribution Hitch are intended to represent only the product capability and in no way reflect the capacity or ratings of any towing system it is used with. In many cases, the rating of our hitch will be greater than those of the vehicle towing system, hitch, and trailer being used with our accessory. We strongly advise the consumer and operator to learn the ratings of the various components of the towing system and to NOT exceed the limits of the lowest rated component.

LIMITED LIFETIME WARRANTY: Andersen Mfg. Inc. (“ANDERSEN”) warrants to the original purchaser (“BUYER”), the Andersen “No Sway” Weight Distribution Hitch (“PRODUCT”) against latent defects in materials and workmanship under normal use and service, rust, corrosion and ordinary wear and tear excepted, from the date of retail purchase for the ownership life of the original BUYER, subject to the limitations as set forth below.

If the PRODUCT is latently defective ANDERSEN will replace or repair the PRODUCT and/or associated parts when a proper Return Merchandise authorization (RMA) number is obtained by the BUYER, and the PRODUCT is returned with transportation charges prepaid to ANDERSEN manufacturing plant.

ANDERSEN shall not be required to replace or repair any items damaged as a result of improper installation, unauthorized alteration, unreasonable use, or improper maintenance including, without limitation, loading the PRODUCT beyond the PRODUCT’s rated load capacity, damaged caused by an accident, sudden impact arising from a collision or other abnormal occurrences. BUYER is responsible for maintenance checks to the PRODUCT on a regular basis.

Since it is beyond ANDERSEN’s control as to what trailers or vehicles the PRODUCT may be used with, and what condition said trailers or vehicles may be in, ANDERSEN will not warrant or assume liability for damages incurred. It is the responsibility of the BUYER to have the trailer braking system checked and maintained on a regular basis. ANDERSEN does not warrant against discontinuation of PRODUCT, acts of God, defects in items or components not manufactured by ANDERSEN, or against damages resulting from such non-ANDERSEN made products or components. ANDERSEN passes on to BUYER the warranty it received (if any) from the maker thereof of such non-ANDERSEN made products or components. This warranty also does not apply to PRODUCT upon which repairs have been affected or attempted by persons other than pursuant to written authorization by ANDERSEN .

THIS WARRANTY IS EXCLUSIVE. To the extent allowed by law, ANDERSEN shall not be liable for any incidental, consequential, or any other damages including, without limitation, breach of any implied warranty, merchantability, or fitness of the PRODUCT for a particular purpose. The sole and exclusive obligation of ANDERSEN shall be to repair or replace the defective PRODUCT in the manner stated above. ANDERSEN shall not have any other obligation with respect to the PRODUCT or any part thereof, whether based on contract, tort, strict liability, or otherwise. It is understood that the seller’s liability, whether in contract, in tort, under any warranty, in negligence or otherwise, shall not exceed the return of the wholesale amount of the purchase price paid by the BUYER. Under no circumstances, whether based on this Limited Warranty or otherwise, shall ANDERSEN be liable for incidental, special, or consequential damages. The price stated for the PRODUCT is considered in limiting ANDERSEN’s liability.

ANDERSEN’s employees, representative’s or Dealers ORAL OR OTHER WRITTEN STATEMENTS DO NOT CONSTITUTE WARRANTIES, shall not be relied upon by BUYER, and are not a part of the contract for sale or this limited warranty.

This warranty does not include labor charges nor does it include transportation charges for returning the PRODUCT to the consumer. Removal, shipping and installation of the replacement PRODUCT or replacement parts shall be at BUYER’s expense.

Return Merchandise Authorization (RMA) and warranty procedure may be obtained by visiting Andersen's website at www.andersenhitches.com and clicking on ‘Return Policy’ at the bottom of the page, or by calling our customer service department at 1-800-635-6106.

Warranty Registration and Validation		Send to: Andersen Hitches Registration	
Andersen 'No-Sway' Weight Distribution Hitch		3125 N. Yellowstone Hwy, Idaho Falls, ID 83401	
*All information must be completed and sent or faxed to Andersen Hitches 208-523-6562			
–or go to www.AndersenHitches.com/register and complete your registration online.			
Name: _____			
Address: _____			
City: _____		State: _____	Zip: _____
Phone: _____		E-mail: _____	
Purchase Date: _____		Installed by: <input type="checkbox"/> Dealer	<input type="checkbox"/> Self
Dealer name: _____		City: _____	State: _____



ANDERSEN HITCHES 

SUPPORT USA JOBS



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HD

BUILT FOR TOUGH LOADS!

14,000 LBS ADJUSTABLE!



EZ-HD#3298

**8" Drop/Rise
2" x 2-5/16" Combo-Ball**

EZ-HD#3294

**4" Drop/Rise
2" x 2-5/16" Combo-Ball**

- Solid Steel Shank (gusset on 3298)
- 14,000 lbs GTWR; 2-5/16" ball
- 10,000 lbs GTWR; 2" ball
- 1,500 lbs Tongue Weight
- Heavy Duty all-steel construction

- Fits standard 2" receivers and sleeved 2-1/2" receivers
- Tested to SAE J684 standards
- Class V adjustable ball mount

BUILT TOUGH • BUILT TO LAST!

ANDERSEN 
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Andersen Manufacturing, Inc.
3125 N. Yellowstone Hwy., Idaho Falls, Idaho 83401
www.andersenhitches.com info@andersenhitches.com

ALSO AVAILABLE...



2-1/2" SLEEVE
Part # 3800

High-tolerance, no rust aluminum adapter sleeve



AUTO-DRAIN 24130-3" & 24140-1.5" INSTRUCTIONS

OPERATION:

Insure drain valve is properly connected to drain hose. Push and hold rocker switch for 3-4 seconds to fully open or close valve. The indicator light on the switch box will be on at any time the valve is not fully closed. Hold the switch in the closed position until the light goes out.

Be careful when cleaning drain valve, Auto-Drain applies enough force to cause injury.

To manually open valve, remove the 2 (12) screws. This will free the Auto-Drain from the valve housing and allow you to pull/push on the Auto-Drain to open or close the valve.

Reminder!! Leave proper spacing between spacer and rack gear (1/8"-3/16") when assembling. **Prior to tightening bolt (10) see installation notes under IMPORTANT on page 1.**

ORANGE WIRE TO MOTOR
VIOLET WIRE TO MOTOR
GREEN WIRE
BROWN WIRE

SWITCH BOX ASSY #34

(ONE SCREW SUPPLIED WITH MOTOR BOX ASSY)

ITEM	DESCRIPTION	QTY	PART#
16	SHAFT	1	24749
17	CAM	2	30376
18	SWITCH	1	738-0055
19	SCREW(#4-40 X .62)	2	602-0005
20	WASHER	2	80208
21	CONNECTOR ASSY	1	31478
22	STRAIN RELIEF	1	12819
23	SWITCH BOX	1	31471
24	SCREW(#6 X 1")	2	606-0002
25	ROCKER SWTCH	1	738-0007
26	LAMP ASSY	1	31479
27	HEX BOLT	1	600-0077
28	PATENT LABEL	1	27129
29	PLATE SUPPORT	1	26429
30	BOX LABEL	1	23087
31	WARNING LABEL	1	25476
32	MALE CONNECTOR ASSY	1	31477
33	IN-LINE FUSE ASSY	1	31855
34	SWITCH BOX ASSY	1	31472
35	STRAIN RELIEF	1	17311
36	STRAIN RELIEF	1	743-0016
37	TERMINAL	2	742-0051
38	WIRE BLACK 24"	1	23136
39	WIRE WHITE 24"	1	23137
40	SCREW(#5-40X .63)	1	602-0035

(NOT SHOWN- COVER FOR SWITCH BOX- P/N 24006)

PARTS LIST FOR 3" AUTO-DRAIN

ITEM	DESCRIPTION	QTY	PART#
1	BASE, MACHINED	1	31473
2	RACK GEAR	1	24131
3	COVER, MACHINED	1	26876
4	AUTO DRAIN LABEL	1	25012
5	WARNING/SERIAL LABEL	1	25366
6	DRIVE GEAR	1	24134
7	MOTOR BOX ASSY	1	24122
8	SPACER	1	30992
9	HEX NUT .25-20	1	610-0006
10	UNIVERSAL BRACKET	1	30993
11	SCREW(#4-24)	4	605-0007
12	SCREW(#10-32 X 1.12")	2	601-1006
13	WASHER	1	80225
14	LOCKNUT(#10-32)	2	611-2100
15	"E" RING	1	634-1250



Microwave Oven
INSTRUCTION MANUAL
Model:EC028KD7

Read these instructions carefully before using your microwave oven.

If you follow the instructions, your oven will provide you with many years of good service.

PUT THESE INSTRUCTIONS IN A SAFE PLACE FOR REFERENCE



PRECAUTIONS TO AVOID POSSIBLE EXPOSURE TO EXCESSIVE MICROWAVE ENERGY

- (a) Do not attempt to operate this oven with the door open since open-door operation can result in harmful exposure to microwave energy. It is important not to defeat or tamper with the safety interlocks.
- (b) Do not place any object between the oven front face and the door or allows soil or cleaner residue to accumulate on sealing surfaces.
- (c) Do not operate the oven if it is damaged. It is particularly important that the oven door close properly and that there is no damage to the:
 - (1) DOOR (bent)
 - (2) HINGES AND LATCHES (broken or loosened)
 - (3) DOOR SEALS AND SEALING SURFACES
- (d) The oven should not be adjusted or repaired by anyone except properly qualified service personnel.

Specifications

Model:	EC028KD7
Rated Voltage:	120V~60Hz
Rated Input Power(Microwave):	1500W
Rated Output Power(Microwave):	1000W
Rated Input Power(Grill):	1150W
Rated Input Power(Convection):	1500W
Oven Capacity:	1.1 Cu.ft (28 Litre)
Turntable Diameter:	12.4 inch (315 mm)
External Dimensions(LxWxH):	20.47 X18.7 X14.76h (520X475X375 mm)
Net Weight:	Approx 45.41 Lbs (20.6 kg)
Warning:	Handling the cord on this unit or cords associated with accessories sold with this product, will expose you to a chemical known to the state of California to cause cancer, and birth defects or other reproductive harm. Wash hands after handling.



SAFETY

1. The oven must be on a leveled surface.
2. The turntable and turntable roller rest must be in the oven during cooking. Place the cookware gently on the turntable and handle it carefully to avoid possible breakage.
3. Incorrect use of browning dish may cause the turntable to break.
4. Use only the specified bag size when using Direct Access Popcorn.
5. The oven has several built-in safety switches to ensure that the power remains off when the door is open. Do not tamper with these switches.
6. Do not operate the microwave oven empty. Operating the oven with no food or food that is extremely low in moisture can cause fire, charring or sparking.
7. Do not cook bacon directly on the turntable. Excessive local heating of the turntable may cause the turntable to break.
8. Do not heat baby bottles or baby food in the microwave oven. Uneven heating may occur and could cause physical injury.
9. Do not heat narrow-necked containers, such as syrup bottles.
10. Do not attempt to deep-fry in your microwave oven.
11. Do not attempt home canning in this microwave oven, as it is impossible to be sure all contents of the jar have reached boiling temperature.
12. Do not use this microwave oven for commercial purpose. This microwave oven is made for household use only.
13. To prevent delayed eruptive boiling of hot liquids and beverages or scalding yourself, stir liquid before placing the container in the oven and again halfway through cooking time. Let stand in the oven for a short time and stir again before removing the container.
14. Use carefully when cooking food in the microwave oven to avoid burning due to excessive cooking.
15. When the appliance is operated in the combination mode, children should only use the oven under adult supervision due to the temperatures generated.
16. Failure to maintain the oven in a clean condition could lead to deterioration that could adversely affect the life of the appliance and possibly result in a hazardous situation.



IMPORTANT SAFETY INSTRUCTIONS

When using electrical appliances basic safety precautions should be followed, including the following:

WARNING - To reduce the risk of burns, electric shock, fire, injury to persons or exposure to excessive microwave energy:

1. Read all instructions before using the appliance.
2. Read and follow the specific: "PRECAUTIONS TO AVOID POSSIBLE EXPOSURE TO EXCESSIVE MICROWAVE ENERGY" found on page 2.
3. This appliance must be grounded. Connect only to properly grounded outlet. See "GROUNDING INSTRUCTIONS" found on page 5.
4. Install or locate this appliance only in accordance with the provided installation instructions.
5. Some products such as whole eggs and sealed containers - for example, closed glass jars - are able to explode and should not be heated in this oven.
6. Use this appliance only for its intended use as described in the manual. Do not use corrosive chemicals or vapors in this appliance. This type of oven is specifically designed to heat, cook or dry food. It is not designed for industrial or laboratory use.
7. As with any appliance, close supervision is necessary when used by children.
8. Do not operate this appliance if it has a damaged cord or plug, if it is not working properly, or if it has been damaged or dropped.
9. This appliance should be serviced only by qualified service personnel. Contact nearest authorized service facility for examination, repair, or adjustment.
10. Do not cover or block any openings on the appliance.
11. Do not store this appliance outdoors. Do not use this product near water - for example, near a kitchen sink, in a wet basement, near a swimming pool, or similar location.
12. Do not immerse cord or plug in water.
13. Keep cord away from heated surface.
14. Do not let cord hang over edge of table or counter.
15. When cleaning surfaces of door and oven that comes together on closing the door, use only mild, nonabrasive soaps, or detergent applied with a sponge or soft cloth.
16. To reduce the risk of fire in the oven cavity:
 - 1). Do not overcook food. Carefully attend appliance when paper, plastic, or other combustible materials are placed inside the oven to facilitate cooking.
 - 2). Remove wire twist-ties from paper or plastic bag before placing bag in oven.
 - 3). If material inside of the oven ignites, keep oven door closed, turn oven off, and disconnect the power cord, or shut off power at the fuse or circuit breaker panel.
 - 4). Do not use the cavity for storage purposes. Do not leave paper products, cooking utensils, or food in the cavity when not in use.
17. Liquids, such as water, coffee, or tea are able to be overheated beyond the boiling point without appearing to be boiling. Visible bubbling or boiling when the container is removed from the microwave oven is not always present.



THIS COULD RESULT IN VERY HOT LIQUID SUDDENLY BOILING OVER WHEN THE CONTAINER IS DISTURBED OR A UTENSIL IS INSERTED INTO THE LIQUID.

To reduce the risk of injury to persons:

- 1) Do not overheat the liquid.
- 2) Stir the liquid both before and halfway through heating it.
- 3) Do not use straight-sided containers with narrow necks.
- 4) After heating, allow the container to stand in the microwave oven for a short time before removing the container.
- 5) Use extreme care when inserting a spoon or other utensil into the container.

SAVE THESE INSTRUCTIONS

GROUNDING INSTRUCTIONS

This appliance must be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This appliance is equipped with a cord having a grounding wire with a grounding plug. The plug must be plugged into an outlet that is properly installed and grounded.

WARNING - Improper use of the grounding can result in a risk of electric shock.

Consult a qualified electrician or serviceman if the grounding instructions are not completely understood, or if doubt exists as to whether the appliance is properly grounded. If it is necessary to use an extension cord, use only a 3-wire extension cord that has a 3-blade grounded plug, and 3-slot receptacle that will accept the plug on the appliance. The marked rating of the extension cord shall be equal to or greater than the electrical rating of the appliance.

DANGER - Electric Shock Hazard

Touching some of the internal components can cause serious personal injury or death. Do not disassemble this appliance.

WARNING - Electric Shock Hazard

Improper use of the grounding can result in electric shock. Do not plug into an outlet until appliance is properly installed and grounded.

1. A short power-supply cord is provided to reduce the risks resulting from becoming entangled in or tripping over a longer cord.
2. Longer cord sets or extension cords are available and may be used if care is exercised in their use.
3. If a long cord or extension cord is used:
 - 1) The marked electrical rating of the cord set or extension cord should be at least as great as the electrical rating of the appliance.
 - 2) The extension cord must be a grounding-type 3-wire cord.
 - 3) The longer cord should be arranged so that it will not drape over the counter top or tabletop where it can be pulled on by children or tripped over unintentionally.



RADIO INTERFERENCE

1. Operation of the microwave oven may cause interference to your radio, TV or similar equipment.
2. When there is interference, it may be reduced or eliminated by taking the following measures:
 - 1) Clean door and sealing surface of the oven
 - 2) Reorient the receiving antenna of radio or television.
 - 3) Relocate the microwave oven with respect to the receiver.
 - 4) Move the microwave oven away from the receiver.
 - 5) Plug the microwave oven into a different outlet so that microwave oven and receiver are on different branch circuits.

UTENSILS

CAUTION - Personal Injury Hazard

Tightly-closed utensils could explode. Closed containers should be opened and plastic pouches should be pierced before cooking.

See the instructions on "Materials you can use in microwave oven or to be avoided in microwave oven."

There may be certain non-metallic utensils that are not safe to use for microwaving. If in doubt, you can test the utensil in question following the procedure below.

Utensil Test:

1. Fill a microwave-safe container with 1 cup of cold water (250ml) along with the utensil in question.
2. Cook on maximum power for 1 minute.
3. Carefully feel the utensil. If the empty utensil is warm, do not use it for microwave cooking.
4. Do not exceed 1 minute cooking time.



Materials you can use in microwave oven

Utensils	Remarks
Aluminum foil	Shielding only. Small smooth pieces can be used to cover thin parts of meat or poultry to prevent overcooking. Arcing can occur if foil is too close to oven walls. The foil should be at least 1 inch (2.5cm) away from oven walls.
Browning dish	Follow manufacturer* instructions. The bottom of browning dish must be at least 3/16 inch (5mm) above the turntable. Incorrect usage may cause the turntable to break.
Dinnerware	Microwave-safe only. Follow manufacturer's instructions. Do not use cracked or chipped dishes.
Glass jars	Always remove lid. Use only to heat food until just warm. Most glass jars are not heat resistant and may break.
Glassware	Heat-resistant oven glassware only. Make sure there is no metallic trim. Do not use cracked or chipped dishes.
Oven cooking bags	Follow manufacturer* instructions. Do not close with metal tie. Make slits to allow steam to escape.
Paper plates and cups	Use for short term cooking/warming only. Do not leave oven unattended while cooking.
Paper towels	Use to cover food for reheating and absorbing fat. Use with supervision for a short-term cooking only.
Parchment paper	Use as a cover to prevent splattering or a wrap for steaming.
Plastic	Microwave-safe only. Follow the manufacturer* instructions. Should be labeled "Microwave Safe". Some plastic containers soften, as the food inside gets hot. "Boiling bags" and tightly closed plastic bags should be slit, pierced or vented as directed by package.
Plastic wrap	Microwave-safe only. Use to cover food during cooking to retain moisture. Do not allow plastic wrap to touch food.
Thermometers	Microwave-safe only (meat and candy thermometers).
Wax paper	Use as a cover to prevent splattering and retain moisture.

Materials to be avoided in microwave oven

Utensils	Remarks
Aluminum tray	May cause arcing. Transfer food into microwave-safe dish.
Food carton with metal handle	May cause arcing. Transfer food into microwave-safe dish.
Metal or metal-trimmed utensils	Metal shields the food from microwave energy. Metal trim may cause arcing.
Metal twist ties	May cause arcing and could cause a fire in the oven.
Paper bags	May cause a fire in the oven.
Plastic foam	Plastic foam may melt or contaminate the liquid inside when exposed to high temperature.
Wood	Wood will dry out when used in the microwave oven and may split or crack.



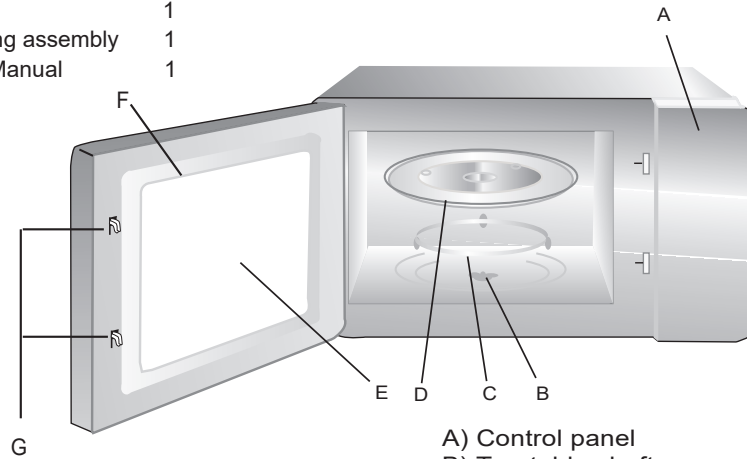
SETTING UP YOUR OVEN

Names of Oven Parts and Accessories

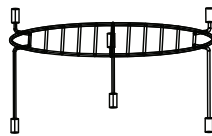
Remove the oven and all materials from the carton and oven cavity.

Your oven comes with the following accessories:

Glass tray	1
Turntable ring assembly	1
Instruction Manual	1

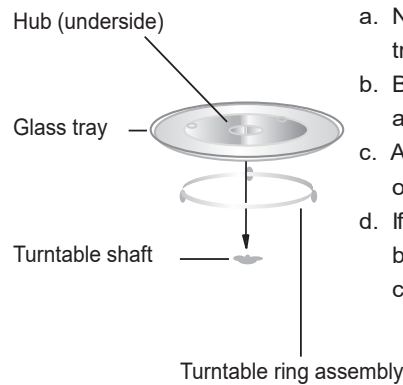


- A) Control panel
- B) Turntable shaft
- C) Turntable ring assembly
- D) Glass tray
- E) Observation window
- F) Door assembly
- G) Safety interlock system



Grill Rack (Only for Grill series)

Turntable Installation

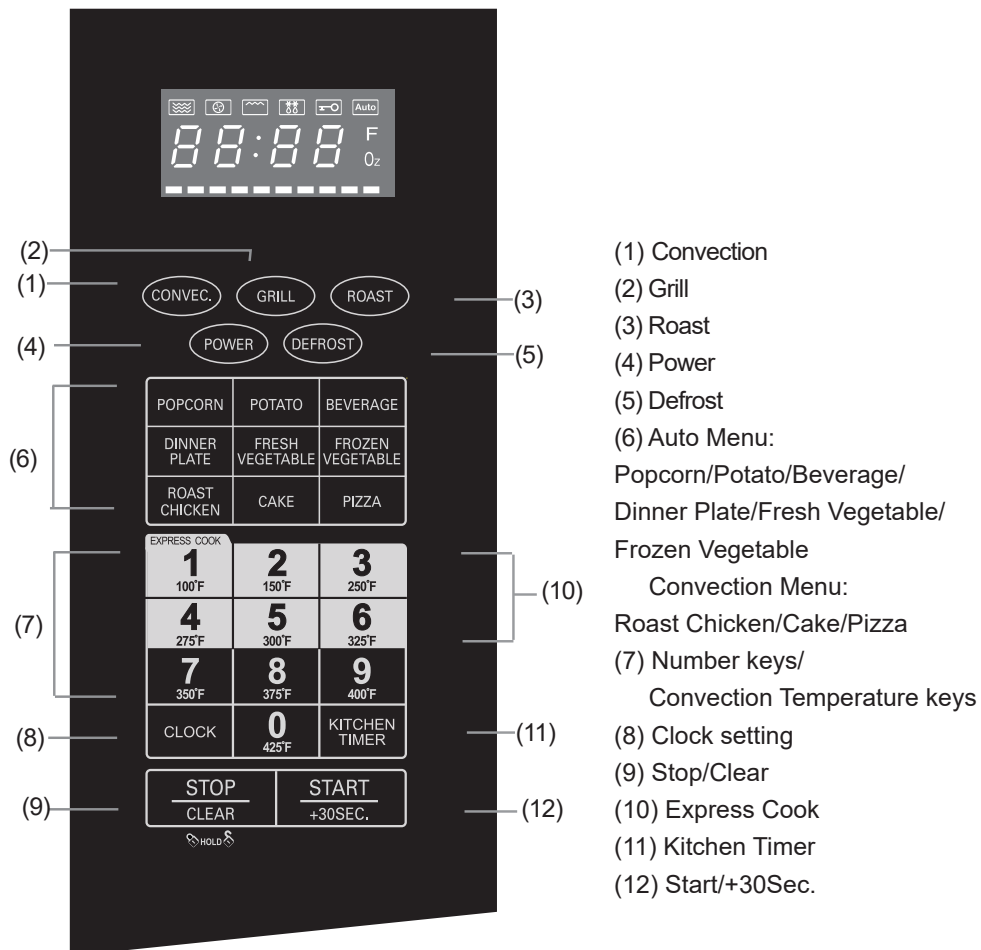


- a. Never place the glass tray upside down. The glass tray should never be restricted.
- b. Both glass tray and turntable ring assembly must always be used during cooking.
- c. All food and containers of food are always placed on the glass tray for cooking.
- d. If glass tray or turntable ring assembly cracks or breaks, contact your nearest authorized service center.



OPERATION

Control Panel and Features





OPERATION INSTRUCTION

1. Clock Setting

When the microwave oven is electrified, the oven will display "0:00", and buzzer will ring once.

The input time should be within 1:00-12:59.

Example: To set 12:12 .

- (1) Press the "**Clock**" button, and the buzzer will ring once.
- (2) Press the number keys: "1","2","1","2" in order.
- (3) Press "**Clock**" to finish clock setting. ":" will flash, and the time will light.

Note: 1) If the clock is not set, "0:00" is displayed and the clock will not count.
 2) During the process of clock setting, if you press "**Stop/Clear**", the oven will go back to the previous status automatically.

2. Kitchen Timer

- (1) Press "**Kitchen Timer**" , "0:00" is displayed.
- (2) Press the number keys to set the timing within the range of 99 minutes and 99 seconds.

For example:

set kitchen timer as 12 minutes and 12 seconds, please press "1,2,1,2" in turn.

- (3) Press "**Start/+30SEC.**" to confirm; time will count down and display.
- (4) When time counts to "0", the buzzer will sound 5 times and the oven will turn back to the normal state.

Note: (1) Kitchen timer is a timer as an alarm clock.
 (2) In the timing state, the oven will not start with any program and the oven light will not light.

3. Microwave Cooking

Select different microwave power level and set cooking time as you wish. There are 10 power levels available for choosing. Keep on pressing "**Power**" to choose the power.

Level	10	9	8	7	6	5	4	3	2	1
Power	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Display	PL10	PL9	PL8	PL7	PL6	PL5	PL4	PL3	PL2	PL1

Example: If you want to use 80% microwave power to cook for 10 minutes, you can operate the oven as the following steps.

- 1) Press "**Power**" once, the oven will display "PL10".
- 2) Press "**Power**" twice again to choose 80% power, the oven will display "PL8".
- 3) Press the number buttons of "1","0","0","0" in order, the oven will display "10:00"
- 4) Press "**Start/+30SEC.**" to start cooking, ":" will light and the "Micro." indicator will flash.

4. Grill/Micro.+Grill Combination Cooking

- (1) Press the "**Grill**" button once to choose the grill function, the oven will display "G-1" and " Grill " indicator will light.(Press twice or thrice to choose the combination function with "G-2" or "G-3" displaying)



(2) Set the cooking time.

Example: Set 12 minutes 50 seconds, press "1", "2", "5", "0" in order.

(3) Press "**Start/+30SEC.**" to start cooking. The cooking time counts down, ":" will light and "Grill" indicator will flash.

Note: If half the grill time passes, the oven sounds twice, and this is normal. It denotes turning food over in order to have a better effect of grilling food, and you should turn the food over, close the door, and then press "**Start/+30SEC.**" to continue cooking.

Note: "Grill" Pad presses instructions

Presses Instructions	Display	Microwave	Grill
1	G-1	—	100%
2	G-2	36%	64%
3	G-3	55%	45%

5. Convection Cooking

The convection cooking can let you cook the food as a traditional oven. Microwave is not used. It is recommended that you should preheat the oven to the appropriate temperature before placing the food in the oven.

There are ten temperatures of convection: 100F,150F,250F,275F,300F,325F,350F, 375F,400F,425F.

A. With preheating convection

- 1) Press the "**CONVEC.**" once, the oven will display "100". "F" and "Conv."indicator will light. (Press the convection temperature key to select the temperature you need.)
- 2) Press "**Start/+30SEC.**" button to start preheating.
The temperature figure will flash when the oven reaches the temperature set, and buzzer will ring twice to remind you to put food into the oven, then close the door.
- 3) Press the number keys to set cooking time.
Once the temperature arrives, door must be opened and then closed to input the cooking time.
- 4) Press the "**Start/+30SEC.**" button to start cooking.
"Conv." indicator will flash, ":" will light, and cooking time will count down.

- Note:**
- a. Cooking time cannot be input until the preheating temperature arrives.
 - b. If the time is not input in 5 minutes, the oven will stop preheating. The buzzer sounds five times and turns back to waiting status.

B. Convection Cooking(Without preheating function)

- 1) Press the "**Convec**" once, the oven will display "100". "F" and "Conv."indicator will light. (Press the convection temperature key to select the temperature you need.)
- 2) Press the "**Convec**" button to confirm the temperature.
- 3) Press the number keys to set cooking time.
- 4) Press the "**Start/+30SEC.**" button to start cooking.
"Conv." indicator will flash, ":" will light, and cooking time will count down.



CONVECTION MICROWAVE - HIGH POINTE

6. Convection Roast Cooking

- 1) Press " Roast " once, the oven will display "325F", and the "Micro.", "Conv." indicator will light. (Press the convection temperature key to select the temperature you need.)
- 2) Press " Roast " button to confirm the temperature.
- 3) Press the number keys to set cooking time.
- 4) Press " Start/+30SEC. " button to start cooking, ":" will light, and cooking time will count down.

7. Defrost By Weight

- 1) Press " Defrost " once, the oven will display "dEF1"."Micr." , "Defrost" indicators will light.
- 2) Press the number keys to set defrosting weight within the range of 4 to 100 oz, and "Oz" will light.
- 3) Press " Start/+30SEC. " button to start defrosting, and "Oz" will disappear.

8. Defrost By Time

- 1) Press " Defrost " twice, the oven will display "dEF2"."Micr." , "Defrost" indicators will light.
- 2) Press the number keys to set defrosting time. The max.time is 99 minutes 99 seconds.
- 3) Press " Start/+30SEC. " button to start defrosting.

9. Multi-Stage Cooking

A maximum of two stages of cooking can be set. If one of the stages is defrosting, then it should be put in the first stage. The buzzer will ring once after each stage cooking and the next stage will begin.

Note: Auto menu cooking cannot be set as one of the multi-stage.

Example: cooking with 100% microwave power for 5 minutes and then 70% microwave power for 10 minutes. The steps are as the following:

- 1) Press " Power " once, "PL10" is displayed;
- 2) Press number keys "5","0","0" to adjust the cooking time as you need;
- 3) Press " Power " four times to choose 70% microwave power, "PL7" is displayed;
- 4) Press number keys "1","0","0","0" to adjust the cooking time as you need.
- 5) Press " Start/ +30 SEC. " to start cooking.

10. Speedy Cooking

- (1) In waiting state, instant cooking at 100% power level can be started by selecting cooking time from 1 to 6 minutes by pressing numeral pads 1 to 6. Press " Start/ +30 SEC. " to increase the cooking time 30 seconds by each added pressing; the maximum cooking time is 99 minutes and 99 seconds.
- (2) In waiting state, instant cooking at 100% power level with 30 seconds' cooking time can be started by pressing " Start/ +30 SEC. ". Each press on the same button will increase cooking time by 30 seconds. the maximum cooking time is 99 minutes and 99 seconds.



Note: In microwave, grill, convection or combination cooking state, 30 seconds' cooking time can be added by each pressing of "**Start/ +30 SEC.**" button, and it's invalid at the function of defrost, multi-stage or auto menu cooking.

11. Auto Menu Cooking

1) In waiting state, press the button of "**Popcorn**", "**Potato**", "**Beverage**", "**Dinner Plate**", "**Fresh Vegetable**", "**Frozen Vegetable**", "**Roast Chicken**", "**Cake**" or "**Pizza**" to choose the function and weight of food as you need.

2) Press "**Start / +30 SEC.**" to start cooking.

Note: Refers to the next page for auto menu chart.

12. Lock-out Function for Children

Lock: In waiting state, press "**STOP/CLEAR**" for 3 seconds, there will be a long "beep" denoting entering into the children-lock state and "🔒" indicator will light. LED will display current time or 0:00.

Unlock: In locked state, press "**STOP/CLEAR**" for 3 seconds, there will be a long "beep" denoting that the lock is released, and "🔒" indicator will disappear.

13. Food Detection Algorithm

In standby mode, open the door, and then close the door. If the cooking program is set within 5 minutes, the oven will start cooking normally; if more than 5 minutes, the oven cannot start cooking, the buzzer will sound once, and the screen will display "FOOD" repeatedly. Switching the door and then setting the cooking program within 5 minutes, the oven can start cooking.

14. State Inquiry

1). During cooking, press "**Convec**", "**Power**", "**Grill**" to check the responding power, and the power will be displayed for 2-3 seconds;

2) During cooking, press "**Clock**" to check the current time, and the time will be displayed for 2-3 seconds.

Pay Special Attention:

When cooking with "Microwave", "Convection", "Grill", "Roast" or "Time Defrost" function, the maximum cooking time is 99 minutes and 99 seconds.



CONVECTION MICROWAVE - HIGH POINTE

Auto menu Chart

Menu	Weight (Oz)	Display
Popcorn	1.75 OZ	1.75 OZ
	3.00 OZ	3.00 OZ
	3.50 OZ	3.50 OZ
Potato	1 portion	1
	2 portions	2
	3 portions	3
Beverage	about 8.80 OZ	1
	about 17.60 OZ	2
	about 26.40 OZ	3
Dinner Plate	8.00 OZ	8.00 OZ
	12.00 OZ	12.00 OZ
	16.00 OZ	16.00 OZ
Fresh Vegetable	4.00 OZ	4.00 OZ
	8.00 OZ	8.00 OZ
	16.00 OZ	16.00 OZ
Frozen Vegetable	4.00 OZ	4.00 OZ
	8.00 OZ	8.00 OZ
	16.00 OZ	16.00 OZ
Roast Chicken	16.00 OZ	16.00 OZ
	24.00 OZ	24.00 OZ
	32.00 OZ	32.00 OZ
	40.00 OZ	40.00 OZ
	48.00 OZ	48.00 OZ
Cake	16.00 OZ	16.00 OZ
Pizza	10.00 OZ	10.00 OZ
	22.00 OZ	22.00 OZ

Note: 1) Cake menu is under convection cooking with 325F-preheat function, and you should preheat first following the auto menu operation, when the oven reaches the temperature, it will stop working and sound to remind opening the door to put cake in, then press "**Start / +30 SEC.**" to start cooking.

2) You should use the grill rack when roasting chicken in order to have a better effect of cooking.



MAINTENANCE

Troubleshooting

Check your problem by using the chart below and try the solutions for each problem. If the microwave oven still does not work properly, contact the nearest authorized service center.

TROUBLE	POSSIBLE CAUSE	POSSIBLE REMEDY
Oven will not start	<ul style="list-style-type: none"> a. Electrical cord for oven is not plugged in. b. Door is open. c. Wrong operation is set. 	<ul style="list-style-type: none"> a. Plug into the outlet. b. Close the door and try again. c. Check instructions.
Arcing or sparking	<ul style="list-style-type: none"> a. Materials to be avoided in microwave oven were used. b. The oven is operated when empty. c. Spilled food remains in the cavity. 	<ul style="list-style-type: none"> a. Use microwave-safe cookware only. b. Do not operate with oven empty. c. Clean cavity with wet towel.
Unevenly cooked foods	<ul style="list-style-type: none"> a. Materials to be avoided in microwave oven were used. b. Food is not defrosted completely. c. Cooking time, power level is not suitable. d. Food is not turned or stirred. 	<ul style="list-style-type: none"> a. Use microwave-safe cookware only. b. Completely defrost food. c. Use correct cooking time, power level. d. Turn or stir food.
Overcooked foods	Cooking time, power level is not suitable.	Use correct cooking time, power level.
Undercooked foods	<ul style="list-style-type: none"> a. Materials to be avoided in microwave oven were used. b. Food is not defrosted completely. c. Oven ventilation ports are restricted. d. Cooking time, power level is not suitable. 	<ul style="list-style-type: none"> a. Use microwave-safe cookware only. b. Completely defrost food. c. Check to see that oven ventilation ports are not restricted. d. Use correct cooking time, power level.
Improper defrosting	<ul style="list-style-type: none"> a. Materials to be avoided in microwave oven were used. b. Cooking time, power level is not suitable. c. Food is not turned or stirred. 	<ul style="list-style-type: none"> a. Use microwave-safe cookware only. b. Use correct cooking time, power level. c. Turn or stir food.



RECORD THIS INFORMATION FOR FUTURE REFERENCE:

Model Number	_____
Serial Number	_____
Date Purchased	_____
Retailer / Qualified Installer	_____

**OPERATING
INSTRUCTIONS**

TYPE

9500E

**(120 VAC) POWER
CASE / CASSETTE AWNING**

MODEL

202(LL)(CC).003(#)



Read these instructions carefully. These instructions **MUST** stay with this product.

REVISION B
Form No. 3314490.000 09/16
(French 3314491.000_B)
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INTRODUCTION

This cassette awning (hereinafter referred to as “awning,” or “product”) is designed and intended for use on RVs with straight sides. It is especially well suited for RVs with an over cab extension where there is not sufficient surface for a bottom mounting bracket. Use these instructions to ensure correct operation of product.

Dometic Corporation reserves the right to modify appearances and specifications without notice.

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DOCUMENT SYMBOLS



Indicates additional information that is **NOT** related to physical injury.



Indicates step-by-step instructions.



IMPORTANT SAFETY INSTRUCTIONS

This manual has safety information and instructions to help you eliminate or reduce the risk of accidents and injuries.

A. Recognize Safety Information



This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

B. Understand Signal Words

A signal word will identify safety messages and property damage messages, and will indicate the degree or level of hazard seriousness.

WARNING indicates a hazardous situation that, if **NOT** avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation that, if **NOT** avoided, could result in minor or moderate injury.

NOTICE is used to address practices **NOT** related to physical injury.

C. Supplemental Directives



Read and follow all safety information and instructions to avoid possible injury or death.

Read and understand these instructions before [installing / using / servicing / performing maintenance on] this product.

Incorrect [installation / operation / servicing / maintaining] of this product can lead to serious injury. Follow all instructions.

The installation **MUST** comply with all applicable local and national codes, including the latest edition of the following standards:

U.S.A.

- ANSI/NFPA70, National Electrical Code (NEC)
- ANSI/NFPA 1192, Recreational Vehicles Code

CANADA

- CSA C22.1, Parts I & II, Canadian Electrical Code
- CSA Z240 RV Series, Recreational Vehicles

D. General Safety Messages

WARNING Failure to obey the following warnings could result in death or serious injury:

- This product **MUST** be [installed / serviced] by a qualified service technician.

- Do **NOT** modify this product in any way. Modification can be extremely hazardous.

- Frequently examine product for imbalance (uneven fit / sagging / loose parts); and signs of wear or damage to wiring (if applicable) and other critical parts. Do **NOT** use product if adjustments or repairs are necessary.



Critical parts may include awning fabric, cables, arm assemblies, etc.

- Disconnect product from power supply (if applicable), and do **NOT** operate product when maintenance (such as window cleaning) is being carried out in the vicinity.

- Do **NOT** allow anyone (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge to use this product, unless they have been given supervision or instruction (concerning use of this product) by a person responsible for their safety.

- Do **NOT** allow children to play with product or with fixed controls (if applicable).

- Keep remote controls (if applicable) away from children.

- Do **NOT** add any devices or accessories to this product except those specifically authorized in writing by Dometic Corporation.

- **IMPACT OR CRUSH HAZARD. NEVER** leave an open awning unattended. Keep awning stowed (closed) when snow, heavy rain, wind, and severe weather conditions are expected.

- **IMPACT OR CRUSH HAZARD.** Do **NOT** allow water to pool, snow to accumulate, or heavy debris on awning fabric. Do **NOT** hang or place anything on awning. The awning will become unstable, and could bend or collapse.

- **FIRE HAZARD.** Keep sources of heat and fire (barbecue grills, portable heater, etc.) away from awning.



Failure to obey the following cautions could result in injury:

- **PINCH HAZARD.** Maintain a horizontal distance of at least 16" between fully open awning and any permanent object.



Do **NOT** face awning toward permanent objects that may interfere with awning operation.

- **PINCH HAZARD.** Keep **CLEAR** of arm assemblies while awning is open. If awning is equipped with a wind sensor, arm assemblies will automatically [fold / close] against back rail during windy conditions.



OPERATION

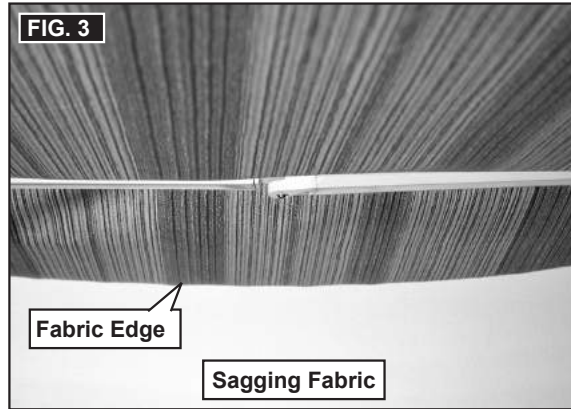
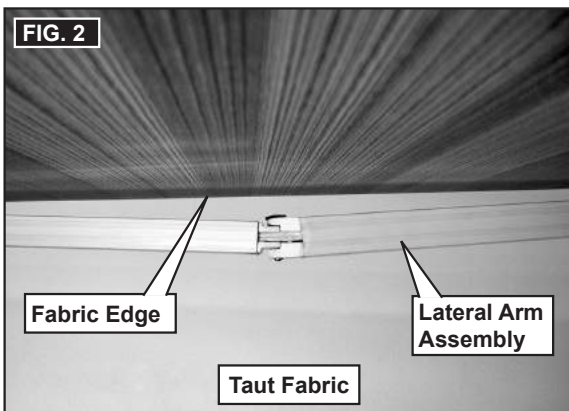
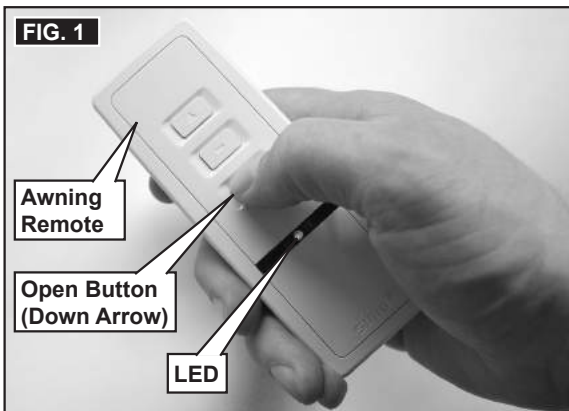
A. Open Awning

CAUTION PINCH HAZARD. Maintain a horizontal distance of at least 16" between fully open awning and any permanent object. Failure to obey this caution could result in injury.

NOTICE Do **NOT** allow awning fabric to rest on rafters. Wind will cause awning fabric to rub against arm assemblies which could result in premature wear and abrasions.

Press the open (down arrow) button briefly on awning remote. Awning will extend to its out limit. See (FIG. 1), (FIG. 2), & (FIG. 3).

i When awning is fully extended, the fabric edges **MUST** be taut. If awning fabric edges are sagging, the out limit will need to be reset. See "E. Reset Awning Out Limit" on page (9).



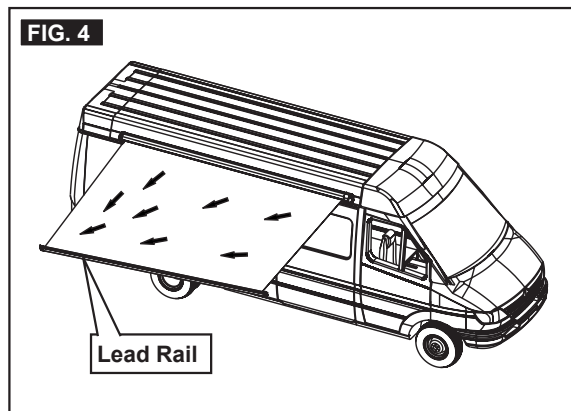
B. Water Shed Feature

WARNING Failure to obey the following warnings could result in death or serious injury:

- **IMPACT OR CRUSH HAZARD.** Do **NOT** allow water to pool or snow to accumulate on awning fabric. The awning will become unstable, and could bend or collapse. Whenever heavy rain or snow is expected, place awning in stowed (closed) position.
- **IMPACT OR CRUSH HAZARD.** Do **NOT** constrain or tie down lead rail as this could disable the water shed feature.

This awning is designed with a water shed feature that automatically lowers one side of awning during light rain to allow water run off.

i This water shed feature is meant for light rain only.



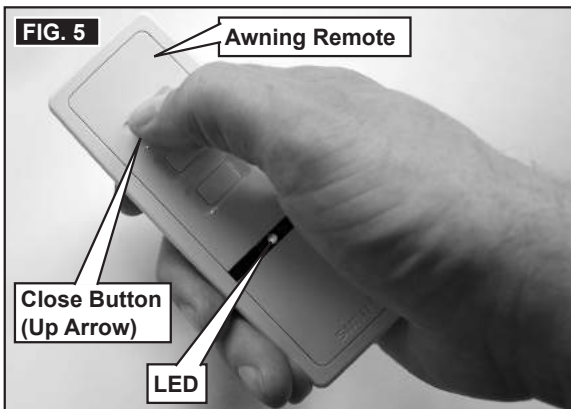


OPERATION

C. Close Awning

⚠ WARNING PINCH HAZARD. Keep **CLEAR** of arm assemblies while closing awning. Arm assemblies will [fold / close] against back rail. Failure to obey this warning could result in death or serious injury.

Press the close button (up arrow) briefly on awning remote. Awning will retract until it's closed. See (FIG. 5).

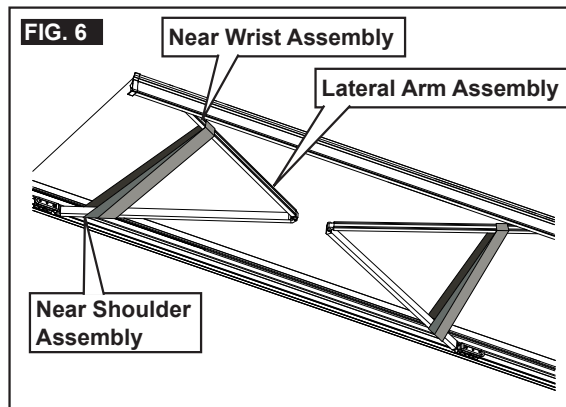


D. Prepare Awning For Travel

- ⚠ WARNING** IMPACT OR CRUSH HAZARD. Do **NOT** transport RV if awning fabric is torn / damaged, even if awning closes successfully. Damaged awning fabric could compromise awning's stability, and could allow awning to extend quickly and unexpectedly during transit. Failure to obey this warning could result in death or serious injury.

Inspect Awning for damage.

- i** If awning fabric is torn / damaged, tie all lateral arm assemblies securely (with fabric strapping or light rope) near shoulder and wrist to close awning as much as possible. Then contact a qualified Dometic service technician for on-site repair. See (FIG. 6).



- ⚠ WARNING** IMPACT OR CRUSH HAZARD. Verify ignition interlock is working correctly before traveling with RV. If awning responds to remote with ignition in **ON** position, accidental operation during transit could occur. The awning **MUST** be disabled, then serviced by a qualified service technician. Failure to obey this warning could result in death or serious injury. With awning fully closed, Test ignition interlock system:
 - With vehicle ignition in **ON** position, attempt to open awning.
 - If awning does **NOT** respond (remains closed), the ignition interlock is functioning. Skip to step (4).
 - If awning responds (awning opens), there is a problem with the ignition interlock system. Proceed to step (3).
- Disable awning for travel to service center:
 - Close awning and remove fuse for power source to awning.
 - Retest ignition interlock. See step (2).
 - If awning does **NOT** respond (remains closed), the awning is now disabled. Skip to step (f).
 - If an inverter is installed and awning still operates, disconnect awning motor wiring from inverter.
 - Repeat step (2) to verify motor is disabled.
 - Have awning repaired by a qualified service technician.
- Verify awning is secure for travel.
 - i** Look for loose parts, and any sign of instability.
- Store remote in a secure location.



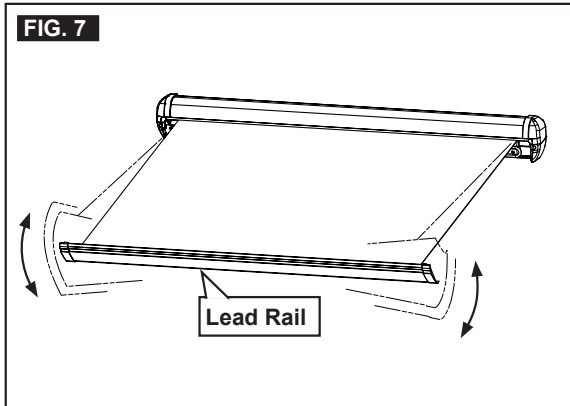
SETTINGS AND ADJUSTMENTS

A. Reset Wind Sensor

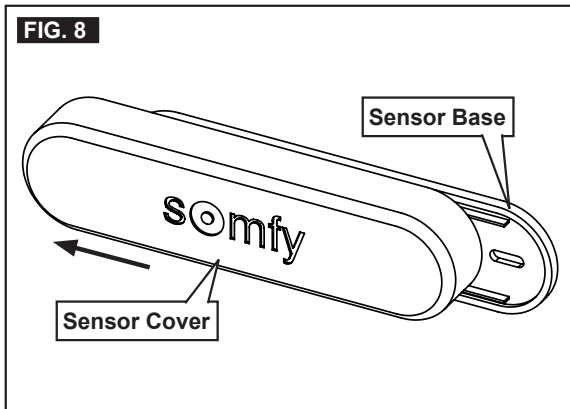
If awning is equipped with a wind sensor (located on inside surface of lead rail), awning will automatically close when windy conditions are present.

If wind sensor is not responding to windy conditions, it may need to be reset.

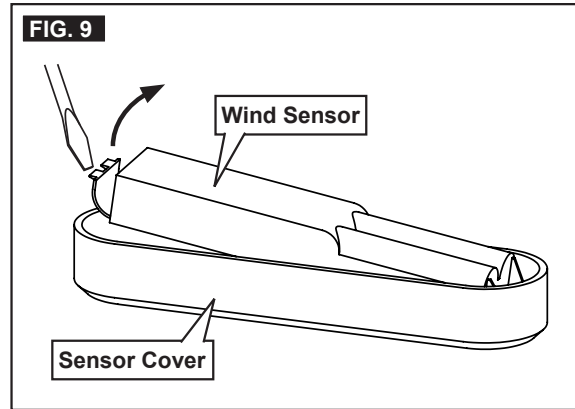
1. Verify wind sensor functionality.
 - a. With awning extended to its out limit, shake lead rail up and down 3" - 4" for approximately 8 seconds (to simulate wind vibration). Awning will retract until it's closed. See (FIG. 7).



- b. If awning does not close, slide sensor cover (with wind sensor) to the left, and remove from sensor base. See (FIG. 8).

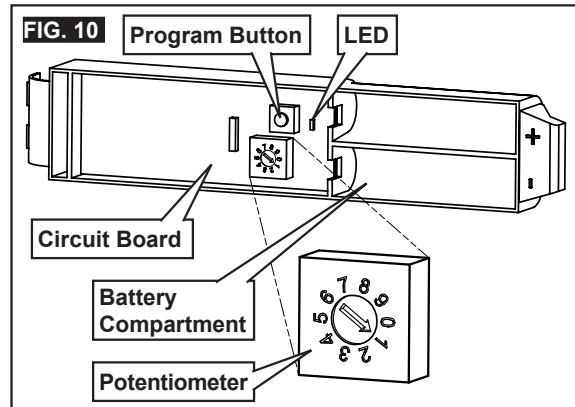


- c. With flat bladed screw driver, detach wind sensor from sensor cover. See (FIG. 9).



- d. Install new batteries (size AA) in wind sensor. See (FIG. 10).

See "Battery Replacement" on page (10).

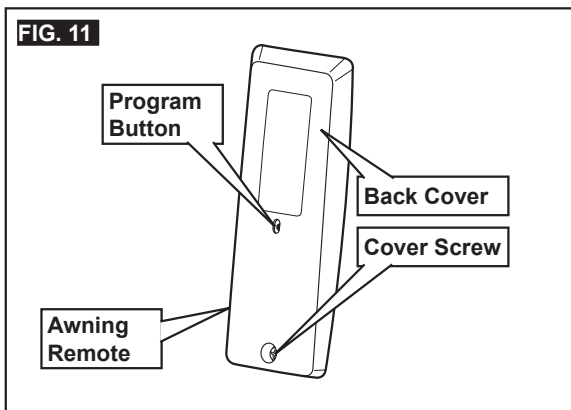


- e. Verify potentiometer sensitivity is set to desired predefined level (factory preset is "1"). Then reattach wind sensor to sensor cover, and install onto sensor base securely. See (FIG. 8), (FIG. 9), & (FIG. 10).
 - f. If awning still does not close when shaken, proceed to step (2).



SETTINGS AND ADJUSTMENTS

2. Press program button on back of awning remote. Awning motor will jog momentarily. See (FIG. 11).



3. With wind sensor removed from sensor base, press program button on inside of wind sensor. Awning motor will jog momentarily. See (FIG. 10).

i The awning motor will only recognize wind sensor if the awning remote is fully programmed. See "F. Reset Motor And Remote" on page (9) if necessary.

4. Reattach wind sensor to sensor cover, and install onto sensor base securely. See (FIG. 8) & (FIG. 9).
5. Shake the lead rail up and down 3" - 4" for approximately 8 seconds (to simulate wind vibration). Awning will retract until it's closed. See (FIG. 7).

i Awning motor will **NOT** operate for approximately 30 seconds after awning is closed by wind sensor.

6. If awning does not close when shaken, repeat steps (2) through (5) before contacting a qualified Dometic service technician.

B. Predefined Wind Sensor Adjustment

If wind sensor is not responding appropriately to windy conditions, or is closing awning during light breezes, it may need to be adjusted.

1. **⚠ WARNING** IMPACT OR CRUSH HAZARD. Make sure wind sensor sensitivity is set correctly to enable awning to close during windy conditions. Low sensitivity to high intensity wind will allow the awning to stay open during windy conditions, and could cause it to bend or collapse. Failure to obey this warning could result in death or serious injury.

Verify wind sensor functionality. See "A. Reset Wind Sensor" on page (6).

2. If wind sensor functions when shaken, but sensitivity needs adjustment, proceed with step (3).
3. Extend awning to its out limit.

4. **⚠ CAUTION** PINCH HAZARD. Do **NOT** remove wind sensor from sensor base until ready to complete procedure. Awning will close automatically 1 hour after wind sensor removal. Failure to obey this caution could result in injury.

Slide sensor cover from sensor base. Then detach sensor from sensor cover. See (FIG. 8) & (FIG. 9).

5. Using a small flat bladed screwdriver, set potentiometer sensitivity according to desired threshold. See (FIG. 10).

a. "1" is the highest predefined setting for wind sensitivity. Low intensity shaking will close the awning.

b. "9" is the lowest predefined setting for wind sensitivity. High intensity shaking is required to close the awning.

6. Once desired sensitivity is set, reattach wind sensor to sensor cover, and install onto sensor base securely. See (FIG. 8) & (FIG. 9).

7. With awning extended to its out limit, shake the lead rail for approximately 8 seconds (to simulate wind vibration) with the intensity desired to close awning. Awning will retract until it's closed. See (FIG. 7).

i Awning motor will **NOT** operate for approximately 30 seconds after awning is closed by wind sensor.

8. Repeat steps (3) through (7) if further adjustments are necessary.

i If predefined settings on potentiometer do **NOT** meet your desired wind sensitivity, a personalized setting may be necessary. See "C. Personalized Wind Sensor Adjustment" on page (8).



SETTINGS AND ADJUSTMENTS

C. Personalized Wind Sensor Adjustment

If wind sensor is not responding as desired to windy conditions (using the predefined settings), it may be adjusted to personalized preference.

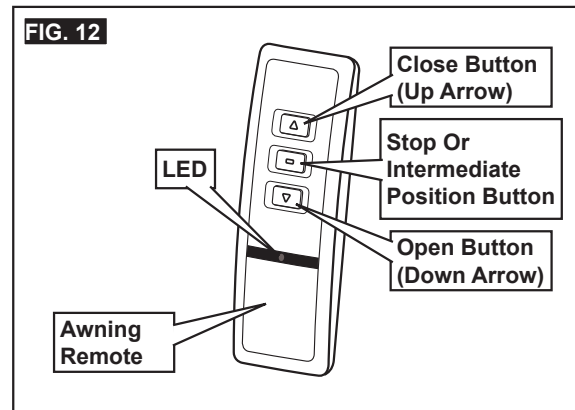
1. **⚠ WARNING** IMPACT OR CRUSH HAZARD. Make sure wind sensor sensitivity is set correctly to enable awning to close during windy conditions. Low sensitivity to high intensity wind will allow the awning to stay open during windy conditions, and could cause it to bend or collapse. Failure to obey this warning could result in death or serious injury.
Verify wind sensor functionality. See "A. Reset Wind Sensor" on page (6).
2. If wind sensor functions when shaken, but sensitivity needs adjustment beyond what the predefined (potentiometer) settings can provide, proceed with step (3).
3. Extend awning to its out limit.
4. **⚠ CAUTION** PINCH HAZARD. Do **NOT** remove wind sensor from sensor base until ready to complete procedure. Awning will close automatically 1 hour after wind sensor removal. Failure to obey this caution could result in injury.
Slide sensor cover from sensor base. Then detach sensor from sensor cover. See (FIG. 8) & (FIG. 9).
5. Using a small flat bladed screwdriver, set potentiometer to "0". See (FIG. 10).
6. Reattach wind sensor to sensor base, and install onto sensor base securely. See (FIG. 8) & (FIG. 9).
i Wind sensor is now in personalized detection mode.
7. With awning extended to its out limit, shake the lead rail for approximately 8 seconds (to simulate wind vibration) with the intensity desired to close awning. Awning will retract until it's closed. See (FIG. 7).
i Wind sensor recorded the intensity of vibration, and is now set to close when the wind intensity matches this personalized setting.
Awning motor will **NOT** operate for approximately 30 seconds after awning is closed by wind sensor.
8. Extend awning to its out limit.
9. Repeat step (7) to test setting. If awning does not retract satisfactorily, proceed to step (10).
10. Extend awning to its out limit (if applicable).
11. Slide sensor cover (with wind sensor) from sensor base, and wait for 2 seconds. See (FIG. 8).

12. Install sensor back onto sensor base securely. See (FIG. 8).
i If sensor is removed from sensor base for more than 4 seconds, reinstall sensor onto sensor base and repeat steps (11) through (12).
13. Repeat step (7) through (9) to record and test new setting.
i If awning still does **NOT** retract satisfactorily, repeat steps (10) through (13) for further adjustments.

D. Set / Reset Awning Intermediate Position

An intermediate limit may be programmed to open awning to a customized position (between the out limit and closed position).

1. Using awning remote, move lead rail to the desired position. See (FIG. 12).
 - a. Press the open or close button briefly on awning remote to move lead rail in desired direction.
 - b. When lead rail reaches desired position, press the stop button briefly to stop travel.



2. Press and hold stop button on awning remote for approximately 5 seconds. Awning motor will jog momentarily, indicating intermediate position is recognized. See (FIG. 12).
i If a different intermediate position is desired, repeat steps (1) through (2).
3. Press stop button briefly (from any position). Awning will extend to its intermediate position. See (FIG. 12).



SETTINGS AND ADJUSTMENTS

E. Reset Awning Out Limit

The awning limits are factory preset for optimal operation. However, if the awning does not fully extend, or awning over-extends causing the awning fabric to sag, the out limit may need to be reset. See (FIG. 3).

- 1. Press open (down arrow) button to extend awning to its current out limit. See (FIG. 12).

i If awning motor begins to back-wind (fabric wraps around roller tube backwards) after full extension, a full motor reset may be required. See "F. Reset Motor And Remote" on page (9).

- 2. Press and hold the close (up arrow) and open (down arrow) buttons simultaneously for approximately 6 seconds. Awning motor will jog momentarily. See (FIG. 12).
- 3. Press and hold the open (down arrow) or close (up arrow) button until lead rail is in desired out limit position, and awning fabric is taut. See (FIG. 2) & (FIG. 12).
- 4. Press and hold stop button for approximately 3 seconds. Awning motor will jog momentarily, indicating new limit is recognized. See (FIG. 12).

i If awning motor does **NOT** jog, a full motor reset may be required. See "F. Reset Motor And Remote" on page (9).

F. Reset Motor And Remote

The awning motor and remote is factory preset for optimal operation. However, if the awning does not respond correctly to the remote (after first reviewing, "Appendix A: Troubleshooting" on page (13)), the motor and remote may need to be reset.

- 1. Verify awning motor and remote functionality.
 - a. Press the open (down arrow) button briefly on awning remote. Awning will extend to its out limit. See (FIG. 12).

i If awning does **NOT** respond to remote, verify LED lights momentarily (on remote) when button is pressed. If LED does **NOT** light, install a new battery. See "Battery Replacement" on page (10).

If awning still does **NOT** respond, does **NOT** extend to its out limit, extends too far (fabric **NOT** taut), or stops when button is released proceed to step (2). See (FIG. 2) & (FIG. 3).

- 2. Turn power supply to awning motor off and on twice:
 - a. Turn OFF and wait 10 seconds.
 - b. Turn ON and wait 10 seconds.
 - c. Turn OFF and wait 10 seconds.
 - d. Turn ON and wait until awning extends or retracts momentarily, then stops.

- 3. Press and hold the program button on back of awning remote. See (FIG. 10).

While holding the program button, the awning motor will jog twice:

- a. Jogs momentarily.
- b. Wait 6 seconds, then jogs momentarily again.

- 4. If jog cycle is not successful, restart from step (2).

i If an earlier attempt to program the remote was aborted, the awning motor may **NOT** respond to remote's program button. If re-starting from step (2) fails, try continuing procedure starting with step (6).

- 5. If jog cycle is successful, release program button and proceed to next step.

i All prior controls will be cleared from motor memory at this point.

- 6. Press and hold the close (up arrow) and open (down arrow) buttons simultaneously until awning motor jogs. See (FIG. 12).

- 7. Press the close (up arrow) or open (down arrow) button briefly to verify awnings motor direction. See (FIG. 12).

- a. If awning travels in the wrong direction, press and hold the stop button for approximately 3 seconds. Awning motor will jog momentarily.
- b. Press the close (up arrow) or open (down arrow) button briefly again to verify direction has been corrected.

i Do **NOT** attempt other programming until the awning motor direction is correct. Otherwise, a full reset will be required again (restarting from step (2), after first completing this procedure through step (12)).

- 8. Press and hold the open (down arrow) button until lead rail is in correct out limit position, and awning fabric edges are taut. See (FIG. 2) & (FIG. 12).


i You may adjust position up or down using remote, to ensure there is clearance between awning fabric and outer arm assemblies. See (FIG. 3).

Remote will stop awning motor if button is held longer than 10 seconds. If this happens, release button and press again until desired position is reached.




SETTINGS AND ADJUSTMENTS


9. Press and hold the close (up arrow) and stop buttons simultaneously until awning motor begins to run. See (FIG. 12).

 This sets the awning out limit from step (8).

10. Press the stop button briefly to stop the awning motor's travel. See (FIG. 12).
11. With the awning motor stopped, press and hold the stop button until awning motor jogs. See (FIG. 12).

 This programs the awning out limit set in step (9).


12. Press the program button on back of awning remote. Awning motor will jog momentarily. See (FIG. 11).

 The Awning motor and remote will now be in "user mode". The close (up arrow) or open (down arrow) buttons on remote, no longer need to be held to move awning to closed or out limits.

13. Verify awning functionality. See "Operation" on page (4).
14. Reprogram wind sensor, and any additional awning controls and accessories (additional remotes, sensors, etc.). See "A. Reset Wind Sensor" on page (6) starting with step (2), and any applicable accessory instructions.

BATTERY REPLACEMENT


A. Remote


-  1. Remove cover screw and back cover from remote. See (FIG. 11).
2. Remove old Li-MnO₂ battery and discard. See FIG. 15.
3. Place and slide new Li-MnO₂ battery (type CR2430) into battery clip until fully engaged. See FIG. 15.

 Make sure battery's positive side is up.

4. Reinstall back cover onto remote, and replace and tighten cover screw securely. See (FIG. 11).


B. Wind Sensor

 If awning is equipped with a wind sensor, it is located on inside surface of lead rail.

-  1. Slide sensor cover from sensor base. Then detach sensor from sensor cover. See (FIG. 8) & (FIG. 9).

2. Remove old alkaline batteries and discard. See (FIG. 10).

3. **NOTICE** Do **NOT** use rechargeable batteries (NiMH, NiCD, etc.). Disposable Lithium or Alkaline type batteries are recommended. Install new batteries (size AA) in wind sensor. See (FIG. 10).

 Make sure battery polarity is matched correctly to battery compartment. An LED will light momentarily (on circuit board) when new batteries are installed. See (FIG. 10).

4. Reattach wind sensor to sensor cover, and install onto sensor base securely. See (FIG. 8) & (FIG. 9).



CLOSE AWNING MANUALLY (POWER FAILURE)

In case of power failure, it may be necessary to close awning manually.

i Rule out simple causes for power failure (RV disconnected from power, ignition/safety interlock, etc.), and review "Appendix A: Troubleshooting" on page (13) **BEFORE** attempting to close awning manually.

If faulty remote, power source failure, or connection issues are ruled out as the cause, then there may be an issue with the awning motor or motor wiring requiring service by a qualified service technician.

After awning is closed manually, it will require service by a qualified service technician.

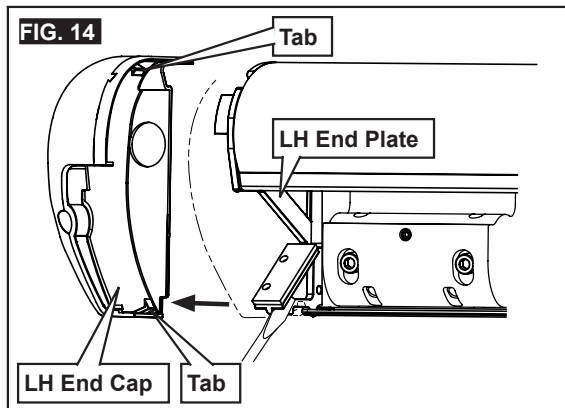
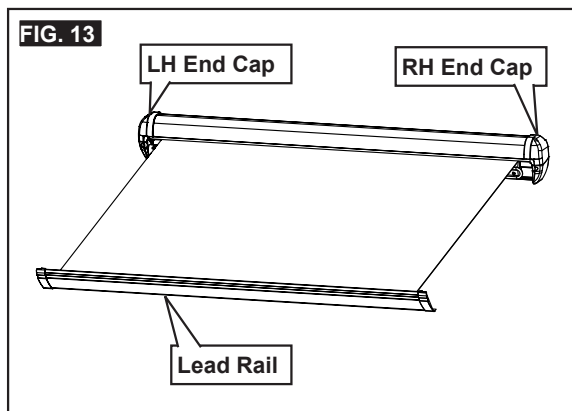
When awning is in open position and 120 Vac power has been lost, perform the following procedure to close awning.

i This procedure requires a 3/8" wrench (or electric/cordless drill), and a flat bladed screwdriver.

1. ⚠️ ELECTRICAL SHOCK HAZARD. Disconnect power from product before accessing wiring connections. There may be issues mimicking a power failure with electric current still present, or power may return unexpectedly. Failure to obey this warning could result in death or serious injury.

Disconnect 120 Vac power from RV.

2. Using a flat bladed screwdriver, disengage (2) tabs (starting with bottom tab) on LH end cap. Then remove from awning. See (FIG. 13) & (FIG. 14).

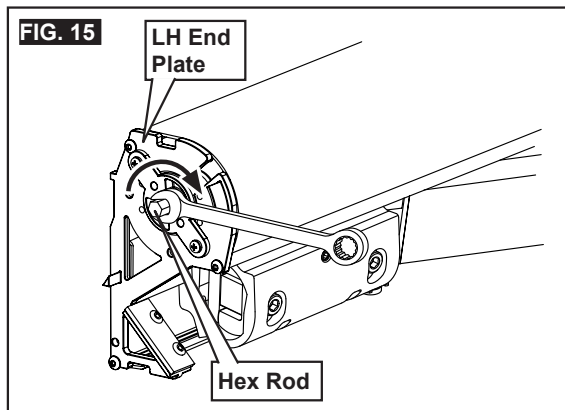


3. ⚠️ PINCH HAZARD. Keep **CLEAR** of arm assemblies while closing awning. Arm assemblies will [fold / close] against back rail. Failure to obey this warning could result in death or serious injury.

Turn the hex rod at LH end plate clockwise until awning is closed. See (FIG. 13) and (FIG. 15).

i Awning may **NOT** close completely. Up to a 4" gap between lead rail and awning case may be expected.

This step will confuse the set limits, requiring limit reset(s) once power issue is resolved. See "D. Set / Reset Awning Intermediate Position" on page (8) and "E. Reset Awning Out Limit" on page (9).




4. Reinstall LH end cap onto awning. See (FIG. 13).




GENERAL CARE AND USE

A. Precautions

NOTICE Failure to obey the following notices could damage product or property:


- Do **NOT** use insecticides or other sprays near awning fabric. These could cause stains, and could adversely affect fabric's ability to repel water.
- Do **NOT** expose awning to adverse environmental conditions, corrosive agents, or other harmful conditions.
- Do **NOT** allow corner of entry door to contact awning fabric. Otherwise, premature wear or tearing of awning fabric could occur.
- **NEVER** close awning (for storage) when wet. The combination of moisture and dirt could result in mildew, discoloration, and stains.
 -  If it is necessary to roll up awning (temporarily) while it's wet, make sure you roll it out and let it dry (as soon as conditions allow) before rolling it up again.
- Do **NOT** allow dirt, leaves, or other debris to accumulate on awning, which could cause abrasion and stains. Mildew could grow on dirt and organic debris causing permanent discoloration, stains, and odors to awning fabric.

B. Hardware Maintenance



-  1. **NOTICE** Do **NOT** use strong chemicals or abrasives to clean parts, as their protective surfaces will be damaged.
Clean awning hardware (as needed) with a mild surface cleaner (such as dish soap).
- 2. **NOTICE** Do **NOT** use silicone sprays near labels. Otherwise, the label's adhesive bond to product surfaces could weaken.
Apply silicone spray lubricant as needed to keep the fabric roller tube assembly's moving parts operating smoothly.
- 3. Lubricate all sliding surfaces of arm assemblies with silicone spray as needed.

C. Fabric Maintenance



Vinyl fabric offers the advantage of durability and water resistance.

-  Wrinkling is a normal characteristic of vinyl. Wrinkling may be more noticeable when retracted, and after prolonged periods of stowage (rolled up). Leave awning open during warm weather to minimize the wrinkling over a period of time.

1. To clean:


-  a. Mix 1/4 cup dish soap and 1/4 cup bleach to 5 gallons of fresh water to use as cleaning solution.
- b. **NOTICE** Do **NOT** use abrasive or corrosive cleaners, mildew removers, or hard bristle brushes on awning fabric.
Liberally drench open awning fabric with cleaning solution.
- c. Close awning, let it soak for 5 minutes, then open awning again.
- d. **NOTICE** Remove solution **COMPLETELY** from awning fabric. Bleach will degrade awning fabric if **NOT** completely rinsed off.
Thoroughly hose off top and bottom of fabric with clean water.
 -  Repeat as necessary to completely remove solution.
- e. **NOTICE** **NEVER** close awning (for storage) when wet. The combination of moisture and dirt could result in mildew, discoloration, and stains.
Allow awning to dry thoroughly before stowing (rolling up).

2. To repair a pinhole, or if a spot of coating flakes off from top layer of vinyl fabric:

-  a. Apply a very small dab of VLP (Vinyl Liquid Patch) on tip of cotton swab.
 -  VLP is available from Dometic Corporation. Reference part number 3314216.000 when ordering.
- b. Gently roll cotton swab around pinhole. The VLP will melt the coating (on fabric) and that will quickly fill in pinhole and blend with all colored vinyls.
- c. **NOTICE** **NEVER** close (roll up) awning when vinyl liquid patch is wet. Otherwise, damage to other parts of awning fabric (melting through layers) will occur.
Allow VLP to dry thoroughly before stowing (rolling up) awning.

D. When To Get More Help

If malfunctions occur (that cannot be corrected by reviewing these instructions), contact a qualified service technician.

-  A slight "travel line" may appear where door roller (if installed) contacts awning fabric. This is considered normal and does **NOT** affect the integrity of awning fabric.



APPENDIX A: TROUBLESHOOTING

Wind Sensor		
Problem	Cause	Solution
Awning does not automatically close when windy conditions are present.	Wind sensor batteries are spent.	Replace batteries. See "Battery Replacement" on page (10).
	Wind sensor is not programmed to awning motor.	Reset wind sensor. See "A. Reset Wind Sensor" on page (6).
	Sensitivity setting is too low.	Adjust to appropriate sensitivity level using one of the following methods: Set potentiometer sensitivity according to a predefined threshold. See "B. Predefined Wind Sensor Adjustment" on page (7).
Awning automatically closes during light breezes.	Sensitivity setting is too high.	Set sensitivity to personalized preference. See "C. Personalized Wind Sensor Adjustment" on page (8).
Awning automatically closes after 30 minutes without windy conditions.	Wind sensor batteries are low. -Indicated by LED staying lit (on sensor circuit board).	Replace batteries. See "Battery Replacement" on page (10).
Awning automatically closes after 1 hour without windy conditions.	Wind sensor is missing, or installed incorrectly on sensor base.	Install wind sensor onto sensor base correctly. See "A. Reset Wind Sensor" on page (6).
	Wind sensor batteries are dead.	Replace batteries. See "Battery Replacement" on page (10).
	Wind sensor is damaged or defective.	Replace wind sensor.
LED (on sensor circuit board) does not light when new batteries are installed.	Wind sensor batteries are installed incorrectly.	Install batteries to correct polarity (direction). See "Battery Replacement" on page (10).



APPENDIX A: TROUBLESHOOTING

Awning Motor And Remote		
Problem	Cause	Solution
Awning motor does not respond to awning remote.	Motor will not operate for approximately 30 seconds after awning is closed by wind sensor.	Power motor off then on to temporarily bypass delay.
	Remote batteries may be spent.	Press either the open or close button briefly to verify LED lights momentarily (on remote). If LED does not light, install new battery. See "Battery Replacement" on page (10).
	Remote is not activated (programmed to motor), or remote programming is corrupt.	If remote is added from a kit, see kit instructions to activate.
		Motor and remote may need to be reset. See "F. Reset Motor And Remote" on page (9).
	Awning is disconnected from power source.	Check all power connections.
	RV or power source breaker is tripped, or fuse is blown.	Reset breaker, or replace fuse as necessary. If this issue persists, contact a qualified service technician.
	A power line switch is off, or ignition disconnect switch is on.	Turn power line switch on, or ignition switch off.
	RV battery has discharged. (Applies only if inverter is installed.)	Recharge RV battery.
	Inverter has malfunctioned (if installed).	Connect to residential power source to verify awning functionality. Contact a qualified service technician.
Awning motor is damaged or defective.	Close awning manually, and contact a qualified Dometic service technician. See "Close Awning Manually (Power Failure)" on page (11).	
Awning motor travels in wrong direction when open (down) or close (up) button is pressed.	Remote programming for motor rotation is incorrect.	The motor and remote will need to be reprogrammed to change direction on remote. See "F. Reset Motor And Remote" on page (9).
Awning does not fully extend, or extends too far (fabric edge sags).	Awning out limit is set incorrectly.	Reset limit. See "E. Reset Awning Out Limit" on page (9).
Awning does not fully close, or lead rail moves out slightly after awning closes.	Awning back-release feature is enabled.	Disable back-release feature: Press and hold the open (down arrow) and stop buttons simultaneously until awning motor jogs.
		If back-release feature will not disable normally, a program reset may be necessary. See "F. Reset Motor And Remote" on page (9).



HYPERVENT CONDENSATION PREVENTION MATTING

HyperVent Marine

A DIVISION OF SLUMBER EASE MATTRESS FACTORY

1301 4TH STREET, MARYSVILLE, WA 98270

360 657 5503 FAX 360 651 1365

Thank you for your order. We believe you'll be very satisfied with the performance of HyperVent, its durability, and low maintenance. It is the only product known to us that addresses the **prevention of condensation** beneath mattresses and cushions.

Installing HyperVent

- 1) The grey, thin material goes **up**; the white, coarser material faces **down**.
- 2) The flap of grey material along one edge is for joining two pieces. Lay the pieces together, spread or spray an adhesive on the flap and proceed according to the directions for the adhesive. If you want to keep the pieces separate but still butted up to each other, let the flap overlay onto the other piece or trim to your desire.

NOTE: If you have a pattern that will need multiple pieces, place or join the pieces together, draw (trace) the pattern onto the grey side, then trim as necessary.

- 3) Usually, it is best to leave the HyperVent about ¼" to ½" **undersized** from the item that it will be under. For example; a mattress that is 60 x 80, cut between 59"-59 ½" by 79" – 79 ½". You may do the same for odd shapes/angles.

For mattresses that have a beveled edge against an outside bulkhead/hull, you may want to consider placing a strip of HyperVent or other insulation between the mattress and the bulkhead/hull. This is usually done when the condensation/sweating is extremely high in this area.

- 4) Tuck your bedding **under** the mattress, but **above** the HyperVent.

Cleaning

HyperVent is easily cleaned with a hose while the material is spread out on the dock or boat deck. Avoid high pressure spraying to prevent the de-lamination of the grey fabric from the thicker white material. Swishing HyperVent around in a tub with household cleaners is okay as well. Let HyperVent dry and reinstall.

How it Works

HyperVent works to prevent condensation by allowing air to circulate beneath mattresses/ cushions. This air warms the supporting surface and eliminates the cold surface and allows moisture to evaporate. There can be climatic conditions that develop inside a cabin so favorable to condensation that even HyperVent cannot completely solve the problem. HyperVent will reduce condensation under any circumstances. **If** moisture forms beneath the HyperVent, be sure the bedding is tucked in under the mattress but above the HyperVent and open the cabin as much as practical for ventilation.



Program Your Keypad

1. Write down your "new" code below
2. Hold down the "8" button, simultaneously press the "LOCK" button, then release both. A long confirmation beep signifies that you have entered the programming mode
3. Key in the existing code then press the "LOCK" button ("1234" is the default).
4. Key in your new code, then "LOCK" button.
5. Key in the same new code and again press "LOCK". A long confirmation beep confirms your new programming.
6. To ensure your new code is working, key in the new code and press the lock or unlock button. The Keypad should confirm the accepted code by actuating the deadbolt.

If programming is unsuccessful, simply press the "CODE RESET" button for 5 seconds on the back handle and repeat step #1.

* The keypad will time-out at 10 seconds. If you make a mistake, simply start over with step #1.

(We recommend 4 to 6 digits)



Program Your Fob/Remote

1. Turn switch to "ON" at the back of your handle. Then, press and release the "FOB LEARN" button located just above the ON/OFF switch. A short, quick beep will confirm that you have entered programming mode.
2. Press the "LOCK" button on your remote until the handle confirms a sync with a long beep. (May take 2 to 3 clicks).
3. Finally, press the "LOCK/UNLOCK" button to confirm the actuation of the deadbolt on your RVLock handle.

*If programming did not work, or if you have additional remotes to program, simply repeat steps #1, #2, and #3.

*Holding down the "LEARN" button for 10 seconds (or until you hear a beep) will remove all previously synced remotes from the handles memory.

NOTE:

Up to 10 remote fobs can operate the same Keyless Handle. Remote fobs also have the ability to control multiple Keyless Handles.



SEE VIDEO TUTORIALS
ONLINE AT RVLOCK.COM

Changing Handle Batteries



Remove the 2 screws on the back battery cover next to the "ON/OFF" switch and install 4 AA alkaline batteries.

- * Fast beeps before the lock actuates means the batteries are low.
- * Changing the batteries on your handle will not change the current code or remote fob programming.
- * To save battery life and avoid handle damage, remove the batteries in the handle when you are not in travel season.



NATURE'S HEAD COMPOSTING TOILET

NATURE'S HEAD[®]

Self-Contained Composting Toilet

Installation Manual and User's Guide



Saving Our Water for Tomorrow



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Sales
PO Box 250
Van Buren, OH 45889
Phone: 251-295-3043
Email: sales@NaturesHead.net

Corporate
535 Bayou Sara Avenue
Saraland, AL 36571



Made in the USA



Nature's Head® Composting Toilet

Congratulations on your acquisition of a NATURE'S HEAD® composting toilet! Although the concept of a composting head (toilet) is not a new one, the unit which you have purchased is the freshest of the new generation of this kind of product.

We saw a need for an improved design and more user-friendly product. The concept has been refined and reworked to provide you with a product that is easier to use, aesthetically pleasing, more space-efficient, and more affordable alternative to other products. While designed to withstand the rigors of the boating environment, the NATURE'S HEAD® toilet is well suited for many other applications.

Wherever you choose to install your new NATURE'S HEAD® toilet, it is sure to provide you with years of worry-free sanitation solutions without the hassles, inconvenience, expense, and odors of other sanitation systems.

WHAT'S IN THE BOX?

- 1) Your new NATURE'S HEAD® composting toilet
- 2) Liquids Bottle and Cap
- 3) Basic installation kit:
 - 5 feet of 1½ inch inside diameter hose with ends
 - inside vent flange
 - agitator handle
 - 2 mounting brackets and knobs
 - 4 mounting screws (for wood floor installations)
 - 6' single pin cable for 12 volt fan
 - fuse holder and fuse for direct battery attachment
 - Allen wrench for installation of spider handle
 - Spray bottle
- 4) Instruction manual
- 5) Warranty Card

Note: The exhaust fan for the head was installed before shipment.



INSTALLATION

ITEMS YOU MAY NEED TO COMPLETE YOUR INSTALLATION

Your NATURE'S HEAD® composting toilet comes with most of the items necessary for completion of your installation. The outside vent is not included because each application is different and many will require a different vent. Also the 12V to 110V Power Transformer (AC Adapter) is not included because all installations do not require this.

What might I need to install Nature's Head...

... for My Tiny House installation?

If you are using 110 volt house power, you will need our Power Transformer (AC Adapter). If using 12 volt, batteries and or solar, the toilet comes with the necessary parts. Our PVC vent assembly is an easy way to vent through the wall or floor.

... for My RV installation?

The toilet comes with the 12 volt parts needed. You will need our Power Transformer (AC Adapter) to plug into an outlet to power the fan ONLY if using 110 house power. The mushroom vent is an easy way to vent through the side or roof. The PVC vent is good for through the floor venting. You may already have an existing vent to connect to.

... for My Tiny House or Cabin installation?

The toilet comes with everything for a 12 volt system. If using 110, house power you will need our Power Transformer (AC Adapter) to plug into an outlet to power the fan. The PVC vent is a good way to vent through the wall or the floor on a raised cabin.

... for My Boat installation?

The toilet comes with the 12 volt parts needed. The venting, you can use the mushroom vent for cabin side or roof. It can also be used over an old pump out fitting hole.



INSTALLATION, continued

Hose Length

Some installations may require increased hose lengths which may be purchased on a per foot basis. PVC pipe, available at most home improvement or hardware stores, may also be substituted for longer hose sections.

Floor Construction

For floor construction other than wood, a different type of mounting bolt may be required. If the installation is on concrete floor, many customers have found it convenient to mount the toilet to a section of plywood rather than trying to drill masonry. The plywood can be placed on the concrete floor and painted or varnished for appearance.

Electrical Requirements

If regular household current is available (110 volts), the head can be powered by a 12 volt Power Transformer (AC Adapter). These may be purchased from Nature's Head, Inc.

Composting Medium

Some type of composting medium is required.

Sphagnum Peat Moss: The most commonly used material is sphagnum peat moss (organic) which is available at most garden stores or home improvement stores. It is usually available in a shrink-wrapped 3 ft cubic bale for \$8 to \$10. This quantity of sphagnum peat moss should sustain use of the head for a year or longer. The sphagnum peat moss should be organic, no additives. **DO NOT** use MIRACLE-GRO peat moss, as it is enriched with plant food.



Example



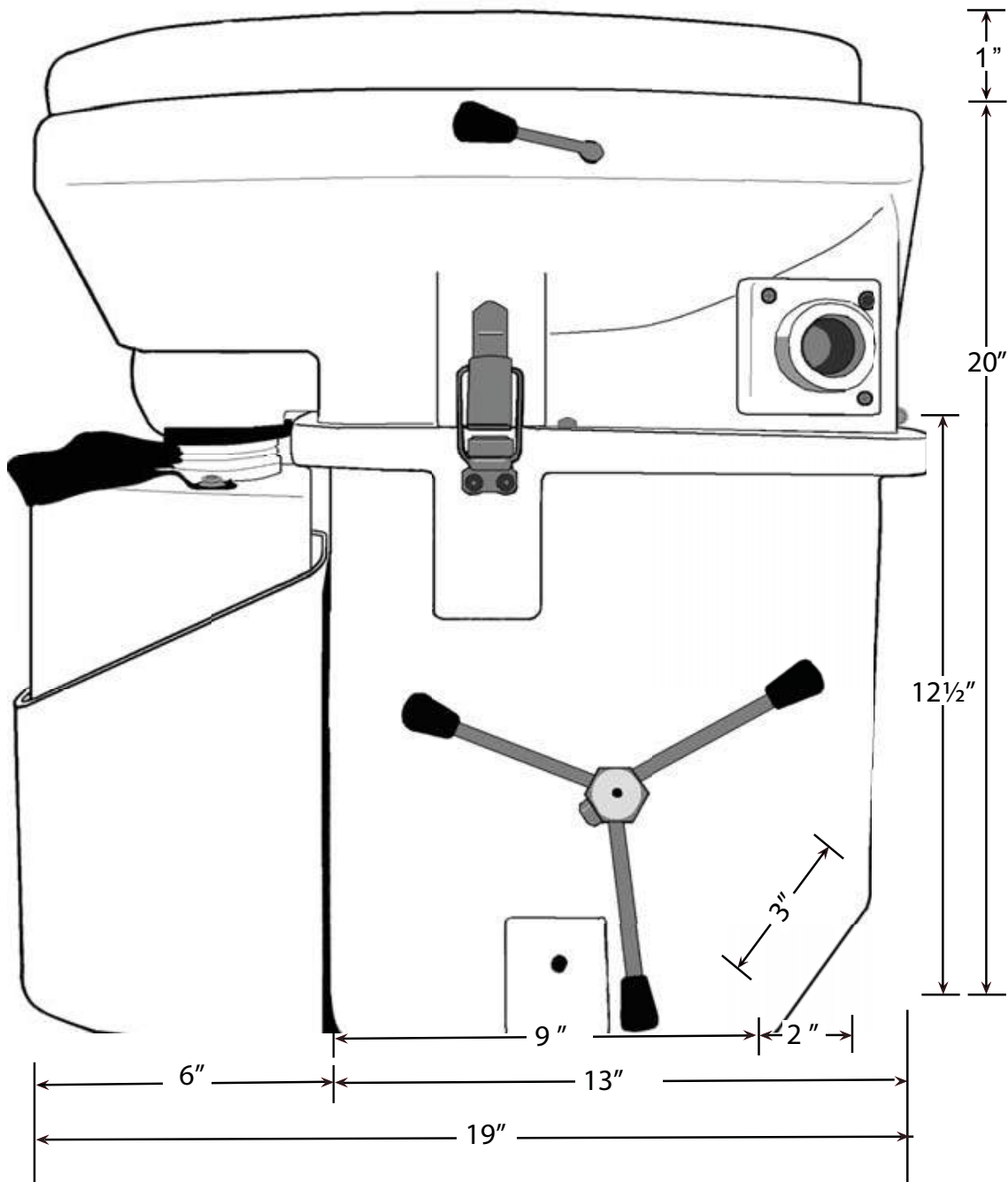
Example

Coconut Coir: Coconut fiber (also referred to as coir brick) is also an acceptable composting medium. However, it is more costly and less readily available. It may be obtained at hydroponic gardening outlets or online. The bricks on the left weigh 250 grams (a bit more

than 1/2 pound each). Coir bricks can be placed in a plastic bag: add 5 measuring cups of water per brick and let sit for 12 hours. This brick will expand to just a little more than 2 1/2 gallons.



INSTALLATION: Dimensions



Note:

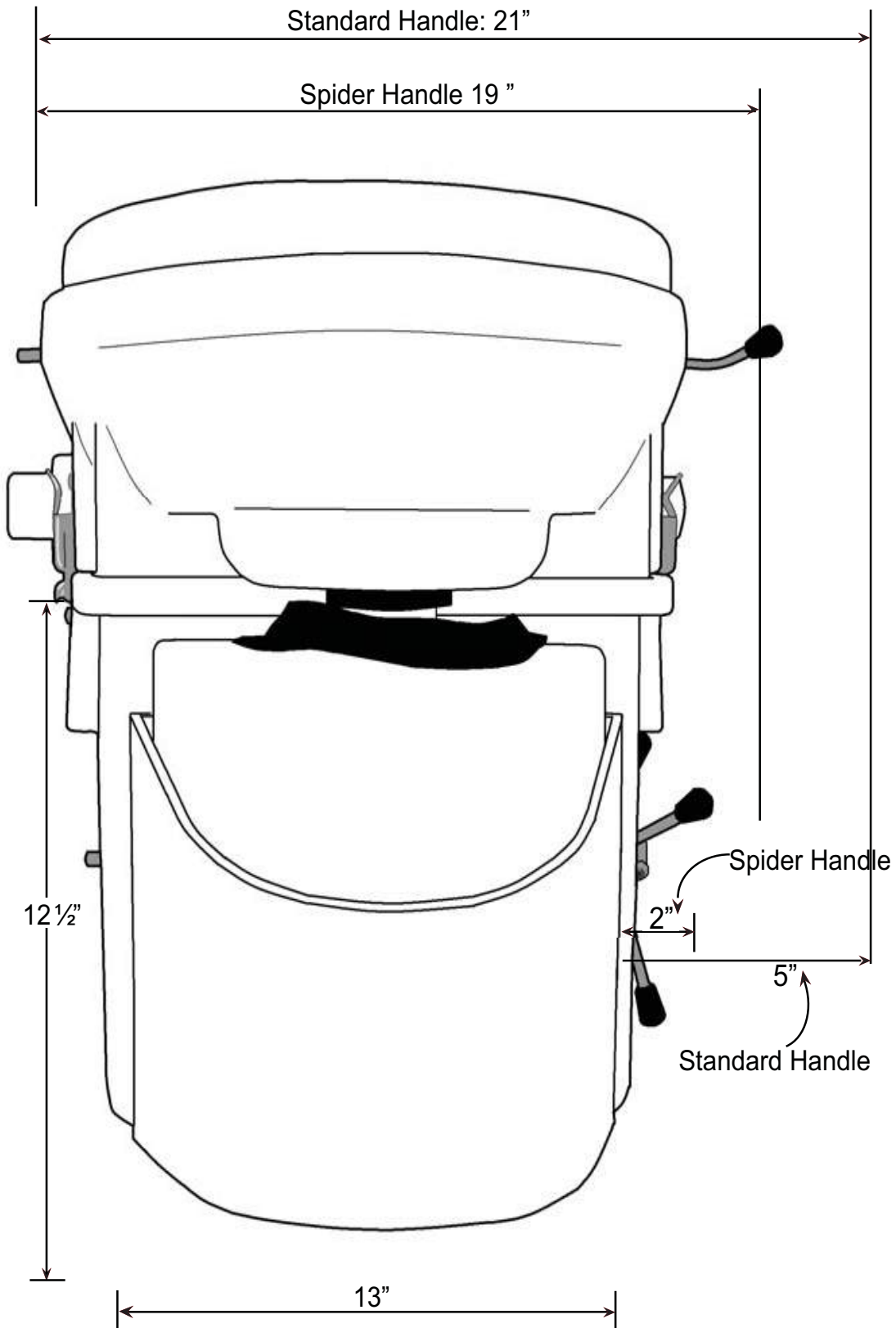
Dimensions can vary up to 4% due to the rotational moulding of polyethylene plastic.

Please note as stated in our instructions the following.

- Allow approximately 1.5 inches behind toilet if against a bulkhead or wall for the bowl to tilt for servicing.
- To disengage the bowl from the base, face the toilet. The bowl slides to the left 2 inches to disconnect from the slip hinge
- Handle and agitator, as well as the fan housing, can be switched to either side.



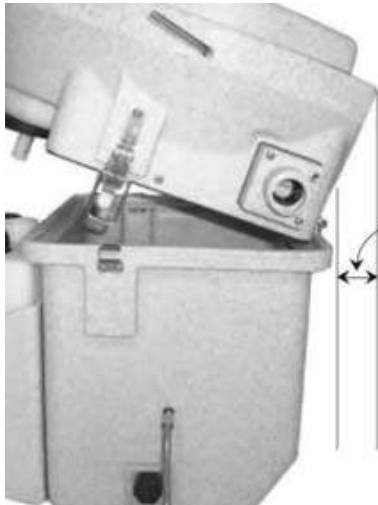
INSTALLATION: Dimensions





INSTALLATION: Location

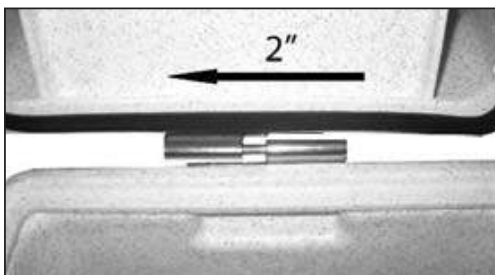
When selecting the location for your new Nature's Head®, be certain to allow enough space behind and on both sides for the toilet to function and be serviced.



Be sure that the lid will open fully. You must also be certain that the bowl has enough room to tilt rearward to allow for its removal and for the removal of the liquid tank.

If mounted against a wall or bulkhead, allow a minimum of 1½ inches between the toilet and the wall.

It is necessary to allow adequate room for the hose connection and agitator handle. Both of these may be relocated to the opposite side of the unit if needed. In some space-restricted areas it may be necessary to offset the toilet to one side or even turn the toilet slightly to one side to allow for extra clearance.

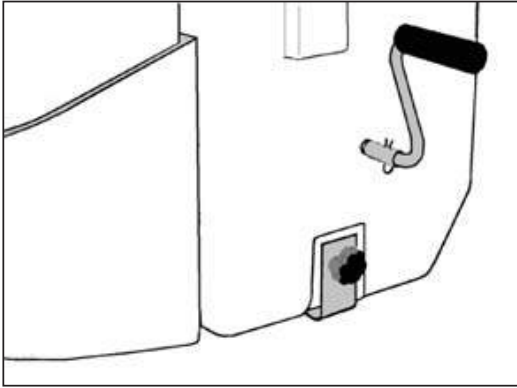


With the standard handle attached, the width of the unit is 21 inches. For more confined spaces, the optional spider handle decreases the width to 17 ¾ inches. Two inches, to the left side of the head (as you face it), is required to slide the bowl off the slip hinge for servicing the base.

In severely confined spaces, removing the mounting knobs and sliding the toilet away from the mounting location may be a more desirable method of servicing the unit.



INSTALLATION: Mounting



It is necessary to secure your toilet to the floor using the two L-brackets.

The normal mounting is to position the L-brackets under the base in the recesses in the toilet, as shown on the left. Counter sunk mounting screws are included for installing to a wood floor.

To mount the L-brackets to the floor, position the base of the toilet in the previously selected location. Attach the L-brackets to the toilet with the knobs provided. If you choose to mount the L-brackets facing out (not under the toilet) simply mark the holes of the brackets on the floor with a pencil for drill locations. If you choose to mount them under the toilet, carefully trace around as much of the outline of the bracket as possible. Measure the distance between the bracket and the lines you drew.

Now remove the brackets from the toilet and move the toilet out of the way. Carefully position the L-brackets inside of the lines that you drew and mark the holes for drilling. Before drilling any holes in your floor or walls, be sure you know what is behind them! The holes in the brackets are for #12 countersunk bolts or screws. If you are using the screws provided you will need to drill a 1/8 inch pilot hole in the drill marks you made on the floor.

If you are uncertain if your brackets are positioned correctly, drill and mount just one bracket. Then reposition the toilet and mount to the one attached bracket. Check the positioning of your other bracket and marks. If all looks good, proceed with drilling and mounting the other bracket. If your markings are off, adjust your lines and proceed with mounting the second bracket. If mounting the toilet to a floor that will get wet frequently, a small amount of sealant should be placed in the holes before installing your screws. Attach your toilet and check to be sure everything works and fits as you intended.

Do not over tighten the hold down knobs as you will damage the threads in the base!



INSTALLATION: Venting

The unit must be vented to the outside of your cabin whether it is a boat, RV, truck, or vacation property. This helps keep your bathroom smelling fresh, and allows for proper growth of beneficial bacteria which facilitates the composting process.

Installing the venting system will be the most difficult portion of the installation. The average do-it-yourselfer should be able to easily accomplish this if one is familiar with and has the proper tools. Depending on the type and placement of your vent, you may be required to cut holes in the wall, ceiling, or the floor. If you are unsure if you are qualified to complete this portion, it may be wise to hire a contractor or handyman to do this for you.



Due to the variety of ventilation choices available, the external vent has not been provided. Mushroom vents, solar vents, and our PVC Vent Assembly Kit are commonly used for venting to the exterior. All of these can be purchased from Nature's Head.

The unit may be vented vertically through the roof, or most common horizontally through the wall, or down through the floor. For installations in homes, cabins, and other permanent structures the venting can be placed horizontally through the wall with our PVC Vent Kit.

This vent flange, included with the toilet, is used beneath a mushroom vent or solar vent and connects directly to the hose.





INSTALLATION: Venting Airflow Assembly



Attaching the Handle

The toilet is shipped with the agitator handle unattached and must be installed before use. The standard handle is attached with a collar and hairpin clip, while the spider handle attaches with an allen set screw and locknut. In the event that the handle must be moved to the opposite site of the base, the agitator must be manually removed, reversed, and reinstalled. A Video showing how to reverse the agitators can be found on NaturesHead.net/Installation

Reversing the Fan and Filter Housing

If installation of the ventilating hose is more favorable on one side of the unit than the other, the fan/filter housing is interchangeable with the filter-only housing. This is accomplished by swapping sides with the components and their respective housings. A Video showing how to reverse the fan and filter housing can be found on NaturesHead.net/Installation.



INSTALLATION: Venting, continued

Attaching a mesh fabric or screen (not provided) over the opening is necessary to prevent the entry of insects into the system. Any mesh fabric such as window screen or nylon netting will provide an adequate insect barrier.



If a sharp 90 degree turn from the fan housing is needed, a 1¼ inch PVC street elbow (not provided) may be used to achieve a proper configuration.

Installations on boats and RV's are easily managed with the stainless steel mushroom vent with the built-in screen and adjustable top which is self-sealing.

In this case, the vent flange provided with the toilet would be placed on the inside wall around the opening to the vent with the flat side to the wall. On many boats, the pump-out fitting can be removed and the mushroom vent mounted over the existing hole. The venting hose provided with the unit will attach directly to the adapter.

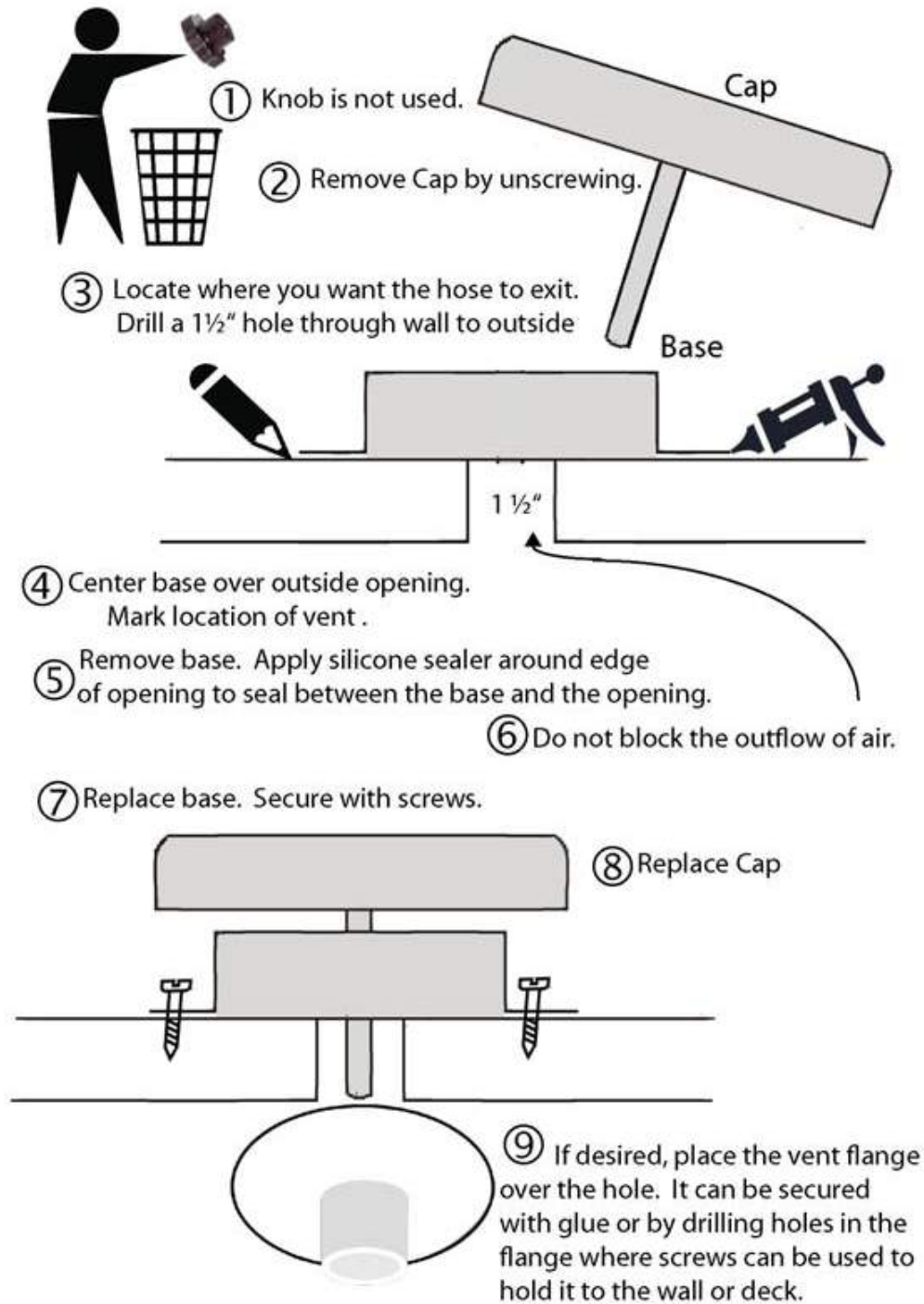
Clamping the hose to the fan housing is not necessary on the connection for the head, and normally not necessary on the exterior connector. With an overhead connection, you may find it necessary to clamp this end depending on the amount of support provided for the vent hose. If the hose is supported properly, you will probably not need a clamp. The vent hose must be attached to the housing which has the fan inside it. The unit is designed to pull fresh air through the head and ventilate it outside. If you disassemble the fan housing, always check to be certain that the fan is blowing out of the vent before re-attaching the vent hose.



INSTALLATION: Venting

NATURE'S HEAD®

Mushroom Vent Installation





INSTALLATION: POWER CONNECTION



As with all electrical connections, be sure your head is on a fused circuit. The fuse should be no less than 2 amps and no more than 5 amps (12V). A fuse holder and fuse are provided for use in a non-protected 12 volt system such as direct attachment to a battery.

The fan may also be powered by a 110 volt source with a Power Transformer (AC Adapter) that reduces the power to 12 volts. If the system is being powered by the 110 volt Power Transformer (AC Adapter) disregard the fuse, fuse holder and single pin cable as they are intended for use ONLY with a 12 volt power source. No fuse is required when using the Power Transformer (AC Adapter).

These Power Transformers (AC Adapter) are available through Nature's Head, Inc.



Assistance

If you are unsure about your wiring system or requirements, consult an electrician.

If you are unsure of a particular step in the installation of your Nature's Head, please check the FAQs for Installation on our website, www.natureshead.net. If you are unable to resolve the issue, send us an email giving your name, phone number, address, distributor name, and a brief description of how we may help.



USING YOUR NATURE'S HEAD

The waterless, urine separating design contributes the extraordinary holding capacity. The composting section holds approximately 60 to 80 uses.

The time frame to empty the solids bin varies with number of people and the time period. The toilet is designed for 1 to 4 people full-time. Generally, two people full-time people's usage will require emptying approximately every 3 weeks; additional people will shorten the time. If using just on weekends with 2 people, that can extend time to 2 months or more. Just a couple of days of non-use extends the period of time. Usually, the level of the compost will not increase; if it does it will be minimal.

The urine bottle holds 2.2 gallons and will require more frequent emptying; two people might need to empty after 3-4 days.

Before use, it is necessary to add compost material to the base of the unit. Gallon size "ZIPLOC®" type bags are an inexpensive manner for storing the medium. To fill your toilet or refill it after emptying, pour two one-gallon bags of pre-moistened sphagnum peat moss or coconut fiber into the base of the toilet. The sphagnum peat moss should rise to the level of, or cover, the agitator bar in a horizontal position.



The sphagnum peat moss should be damp and crumbly, never wet or soupy. If your sphagnum peat moss or coconut fiber is dry, add a small amount of water. When not in use, the lid of the toilet should be in the closed position, preventing the entry of insects and allowing proper ventilation. The peat moss must be regular/organic sphagnum peat moss, no additives. DO NOT use MIRACLE-GRO peat moss.

Do not add additional medium after solids usage. Doing this will result in too much sphagnum peat moss or coconut coir in the unit and will limit your time of usage before emptying.

The primary concept of our composting toilet is the separation of liquids and solid wastes! Be sure to inform your guests as to the proper use of your head. This will allow proper composting action and assist your guests in feeling comfortable with a new piece of equipment.

USAGE, continued

Allowing the overflow of urine into the composting chamber will cause unpleasant odor and prevent proper compost action.

Seated usage is recommended. While seated, the unit may be used with the trap door in the open or closed position. Whether male or female, the user's liquids and solids will be directed to the correct locations from this position. With any bowel movement, the trap door must be open. Male stand-up usage is less acceptable as splatter may result. In the event that the unit is used in a standing position, the trapdoor must remain closed in order to prevent mingling of liquid and solid wastes.

Toilet paper is typically placed in the toilet. Since paper products do not decompose as quickly as solid wastes, they will be visible long after the solid matter has broken down. Any type of toilet paper is acceptable; less substantial brands (such as marine or RV paper) will compost the quickest.

Diapers, wipes and tampons should not be placed in the solids bin. Many brands of these items are made from a mix of rayon and non-organic cotton, and are commonly chlorine-bleached. These will not decompose.

Most users keep a small spray bottle (included) filled with a mixture of water and 2 oz of white vinegar nearby to spray off the bowl in the event that some solid waste adheres to the bowl. Spritzing of the bowl also assists in cleansing the urine passages.

All urine has an odor. It will not be noticed with normal use. It will be present when the storage container is open to the air for emptying. For persistent urine odors in the container, add a few ounces of white vinegar, and/or a few drops of Dawn dishwashing soap to reduce this odor.

After solid waste addition, the sphagnum peat moss or coconut fiber must be agitated 2-3 revolutions slowly in order to mix the waste into the compost and promote the composting process. Contents of the solid waste container must be kept moist, not wet, and remain separated from the liquid waste.



USAGE, continued

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USAGE, continued

When the toilet is functioning correctly, the composted matter will have a musty or soil-like odor and the visual appearance will be very similar to that of the original sphagnum peat moss. It is not normal for the compost to be wet or for there to be odor problems

If the compost is staying wet and you have odor problems, the solids tank is becoming contaminated with urine and steps must be taken to prevent this. If this persists, and you are unable to determine how it is becoming contaminated, please contact us for help.

Vomiting and diarrhea, if not persistent, are unlikely to affect the head function. If increased wetness of the compost results, the situation may be corrected with the addition of a small amount of dry compost medium.

USAGE: Emptying

The liquid waste vessel will contain approximately 2.2 gallons of urine. The translucent material of the container allows easy visualization of the liquid level.

To empty the liquid waste container:

- 1) Release the latches located at both front sides of the unit which secure the bowl to the base,
- 2) Raise the bowl to an angle of approximately 45 degrees, install the cap, and remove the bottle,
- 3) Dispose of the contents in an appropriate manner. The urine bottle may be emptied into a conventional toilet or other appropriate facility. Many books and articles have been written on the benefits of using diluted urine as a fertilizer. This may also be part of your environmental plan for disposing of wastes in a cabin situation.

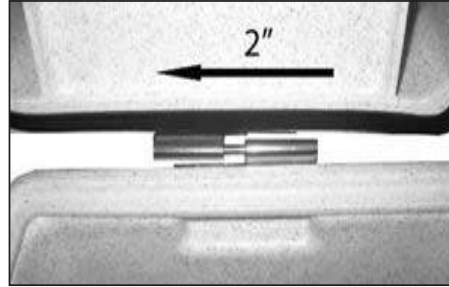


Should overflow of the liquid waste container occur, the liquid will remain confined to the container base so long as the overflow is not excessive. The liquid tank should be emptied frequently and rinsed with water with detergent or vinegar added. Allowing urine to remain in the storage container for extended periods is unwise as this will result in increased odor production. If the toilet is used in combined bathroom/shower, you may wish to drill a drain hole in the urine tank holder if water accumulation becomes a problem.



USAGE: Emptying

With the bottle assembly removed, lift the seat unit several inches and slide it to the left to disengage the slip hinge. (You may need to unhook your vent hose and power supply if it is necessary to move the bowl to the side.) Remove the knobs from the mounting brackets at each side of the base and the base is now ready to empty.



One of the simplest methods to empty is to place a 13 gallon kitchen bag over the opening of the base (NOTE: the bag does NOT go in the base.) The bag should fit tightly over the rim and allow you to invert the base and empty the contents into the bag without spillage. This is especially useful when the toilet is used for boats and other mobile units, as removing the toilet is unnecessary.

It is unnecessary to clean the interior of the solid waste container as composting will continue from the residual matter clinging to the sides.

Cleaning the base unit, especially with any chemicals, may inhibit its ability to generate the good bacteria that is breaking down the solid wastes. Simply empty, put in more sphagnum peat moss, and re-assemble your toilet.

It is best you do not leave the liquid wastes in the tank for extended periods. While everyone is different, some urine will smell bad if allowed to sit for extended periods.



USAGE: Disposal

The recommended procedure for disposing of the contents of the solid waste tank is placing it in a proper composting bin to allow it to fully decompose. When traveling in a boat or RV, this may not be practical. The contents of the solid waste tank may be safely placed into a conventional dumpster if it has been allowed to compost fully. When fully composted, the solid wastes may be used to fertilize non-ingestible plantings. Placing human waste compost on edible plants or vegetables is not recommended.

Full-time users have some special circumstances to deal with. Full-time use does not allow enough time for the solid wastes to compost. The most recent waste, although mixed with the already composted material, will not be decomposed. This also means that the fecal bacteria (present in fresh human wastes) may still be present. We recommend taking precautions such as the use of gloves if you may come into contact with waste material. It is advisable that you delay emptying the solid waste for 6-8 hours after the last use.

Another method for dealing with non-composted wastes (if space allows) is to purchase the “extra base” option and swap out the bases. The extra base comes complete with all the necessary hardware, agitator, and bottle holder. It also comes with a vented lid so the contents can be set aside and allowed to compost. A storage bin utilizing the trash bag method of emptying, placing the bag into a small plastic bucket, ventilating the lid, then allow it to finish composting may be constructed. In a cabin setting, contents could be emptied into a traditional compost bin and allowed to finish there. Solids that have not fully composted for at least a year are not suitable for use on ingestible plants.



CLEANSING & MAINTENANCE

A quick spray of water and white vinegar or a natural cleaner from the squirt bottle (included) is all that is needed to keep your NH fresh between uses. If necessary, a moistened paper towel (no synthetics) is excellent for cleansing the interior (as well as the exterior) of the head.

For more intensive cleansing or dried-on matter, a paper towel moistened with a 1:1 solution of vinegar and water may be used, and disposed of, in the same manner, after cleaning. Bleach, ammonia, and other commercial cleaning compounds should never be added to your composting head as they will interfere with the composting process and may lead to unpleasant odors. These cleaners maybe used to clean the exterior surfaces.

Maintenance requirements for the head are very minimal. All metal parts (bolts, hinges, latches, knobs, agitator, and trapdoor components) are either stainless steel or brass. Filters on each side of the base should be removed and cleaned yearly or when emptying the solid wastes. Each filter is secured to the housing with 2 Phillips-head bolts. Remove the bolts, clean and replace. Caution should be taken so that the fan is reinstalled with the airflow exiting the unit.

The full-size molded-in seat of the head is designed for safety and comfort and requires no special care.

CUSTOMER SERVICE

We are committed to providing our customers with outstanding service. If you need assistance please email us, giving us your name, address, telephone number. Approximate date of purchase and name of distributor would be helpful.

Contact Us.

Email: Sales@NaturesHead.net

Phone: 251-295-3043

We periodically send newsletters to our customers and friends in order to share ideas and solutions suggested by our customers, to alert you to new developments and to provide other relevant information. If you have never received one of our newsletters, we invite you to sign up by clicking the link in the footer of our webpage: www.natureshead.net



TROUBLESHOOTING

Find more troubleshooting and FAQ information online at natureshead.net/installation_use. Or email us at sales@natureshead.net.

Fan not working. If using 12 volt battery, check for voltage. Be sure the wire marked positive is attached to the positive from the battery. Check the fuse. Check to see if the single pin hookup is making contact. If using the 110 to the 12v Power Transformer (AC Adapter), check voltage at the outlet. Verify the single pin connection. Try unplugging and reconnecting. When the fan is running, make sure the fan is blowing outward. If the fan is still not working, contact Nature's Head or your distributor for a free replacement.

Compost seems too wet. If too wet due to prolonged diarrhea, add a small amount of sphagnum peat moss. If wet due to excessive condensation, also add a little sphagnum peat moss. Make sure excessive wetness is not due to someone urinating directly into the compost section. This can also contribute to an unpleasant odor. The compost area should have only a musty smell. If a sewage odor is present, please contact Nature's Head for consultation.

Compost seems too dry. If the compost is dry or hard, add some water and turn the agitator after the sphagnum peat moss has absorbed the moisture.

Cold Conditions. Composting works from 55 degrees and warmer. The warmer it is, the faster it composts. When the temperature drops to freezing, the compost will be dormant until heat is introduced to the area.

Fruit flies or gnats. If your toilet incurs flies or gnats, add five cups of natural Diatomaceous Earth to the compost. This can be purchased at swimming pool supply stores or hardware stores. You may also want to try Gnatrol, following packaging directions. If neither of these work, please call us.

Agitator handle turns with difficulty. If the compost gets dry, the handle may not turn easily. Adding used coffee grounds results in added moisture and keeps the compost loose so that it mixes better.

FAQs

We update our Frequently Asked Questions regularly on our website. Please visit NaturesHead.net/faq where you will find many tips, suggestions and solutions that will be helpful to you.



OPTIONS

For enhanced capacity and convenience, consider these options for your NATURE'S HEAD® Composting Toilet. All items are available for purchase on our website www.NaturesHead.net, from our distributors, or by phone at 251-295-3043.

EXTENDED CAPACITY

Extra Liquids Bottle

Bottle with cap.



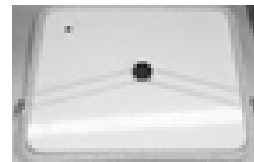
Extra Base, with Lid

Complete with lids for storage allow for further composting and to extend the use of the unit. Bases have the agitator and hinge pre-installed for rapid change out. Handle is included.



Lid for Solids Bin

Vented lid for use when transporting solids bin is necessary.



Power Transformer (AC Adapter)

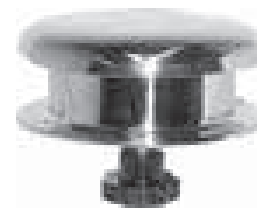
Optional 110 V adapter, used only when using 110V (house) power.



VENTS

Mushroom Ventilator

Polished 304 sheet stainless steel with a screw down knob to open and close the vent. Includes a stainless steel mesh mosquito screen.



PVC Vent Assembly for Structures

Screened vent assembly for through-the-wall installation in structures such as cabins, homes, workshops, barns. Fits 1 5/8 inch opening. 16" connector pipe can be shortened as required. Can be installed horizontally or vertically. Vent hose snugly fits end of connector pipe.





Nature's Head® Composting Toilet

LIMITED WARRANTY

This NATURE'S HEAD® composting toilet and its components are warranted against defects in materials and workmanship for five (5) years from the initial purchase date. During this period any NATURE'S HEAD® toilet, after inspection by Nature's Head, Inc., if deemed defective will be repaired or replaced without cost to the customer.

This warranty extends to the original purchaser only and is non-transferable. Only consumers who purchased the NATURE'S HEAD® toilet from Nature's Head, Inc., or an authorized dealer, and who install, operate, and maintain the toilet in conformance with the instructions in this manual may obtain coverage under this Limited Warranty.

This Warranty does not apply to any problem caused by any condition, malfunction, or damage: (1) caused by defects other than defects in material or workmanship; (2) resulting from normal wear and tear, improper installation, improper maintenance or repair, misuse, abuse, negligence, accident, alteration of a part or the product, or any external cause; or (3) to any accessories, materials, products, or parts not manufactured or supplied by Nature's Head, Inc.

Nature's Head, Inc. makes no other warranty, either express or implied, including but not limited to implied warranties of merchantability, fitness for a particular purpose, or conformity to any representation or description, with respect to the NATURE'S HEAD® product or any of its parts or accessories, other than as expressly set forth in this Warranty. Nature's Head, Inc. makes no warranty or representation, either express or implied, with respect to any other manufacturer's product or documentation, its quality, performance, merchantability, fitness for a particular purpose, or conformity to any representation or description. To the extent permitted by law, this warranty and remedies set forth below are exclusive and in lieu of all others, oral or written, expressed or implied. No dealer, distributor, reseller, agent or employee is authorized to make any modification, extension or addition to this Warranty. Some states do not allow the exclusion or limitation of incidental or consequential damages. If such exclusions or limitations are prohibited under the applicable law, the above limitation or exclusion may not apply. This Warranty gives you specific legal rights and you may have other rights, which vary from state to state.

LIMITATION OF LIABILITY

EXCEPT AS PROVIDED IN THIS WARRANTY AND TO THE MAXIMUM EXTENT PERMITTED BY LAW, NATURE'S HEAD INC. IS NOT RESPONSIBLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO DAMAGES TO PERSONAL OR REAL PROPERTY, RESULTING FROM ANY BREACH OF WARRANTY OR CONDITION, OR UNDER ANY OTHER LEGAL THEORY, INCLUDING BUT NOT LIMITED TO LOSS OF USE. THE FOREGOING LIMITATION SHALL NOT APPLY TO DEATH OR PERSONAL INJURY CLAIMS, OR ANY STATUTORY LIABILITY FOR INTENTIONAL AND GROSS NEGLIGENT ACTS AND/OR OMISSIONS.

Warranty claims should be addressed to Nature's Head, Inc. PO Box 250, Van Buren, OH, 45889 or by E-mail to Sales@NaturesHead.net. Include a copy of the sales receipt or other evidence of the date and place of purchase of the toilet and a description of the problem.

NATURE'S HEAD® is a registered trademark of Nature's Head, Inc. All other marks are the property of their respective owners.



SAVING OUR WATER FOR TOMORROW



NATURE'S HEAD, INC.

PO Box 250

Van Buren, OH 45889

251-295-3043

www.NaturesHead.net

LAGUN TABLE LEG



INSTALLATION INSTRUCTIONS	OPERATING INSTRUCTIONS
<p><u>PARTS INCLUDED</u></p> <ul style="list-style-type: none"> • Mounting Plate for Table Top • Arm (Horizontal piece) • Leg (Vertical piece) • Mounting Bracket Plate <p><u>INSTALLING THE LAGUN</u></p> <ul style="list-style-type: none"> • Decide where you want to install the mounting bracket plate, which can be installed on any solid vertical surface. NOTE: Make sure there is enough clearance to be able to adjust the leg up and down. Some RV dinette benches have the cushions sticking out, so you may have to shim to be able to clear them. • Flip your table top upside down and install the mounting plate for the table top to your table top. NOTE: Make sure that the screws you use to install bracket with are shorter than your table top, so you don't go through the table top. • Install the arm to your mounting plate for the table top by sliding it over the splined piece on the bracket. (You may have to move it back and forth to slide it on the splined piece) • Install the splined piece of the leg into the bushing on the other end of the arm. (You may have to move it back and forth to slide it on the splined piece) • Once it's all assembled lock all the handles and flip it upright and slide it on the mounting bracket plate and tighten the handle. 	<p><u>TOP LEFT HAND HANDLE</u></p> <ul style="list-style-type: none"> • Releases the table top to swivel 360 degrees <p><u>TOP RIGHT HAND HANDLE</u></p> <ul style="list-style-type: none"> • Releases the complete system to swivel 360 degrees <p><u>BOTTOM HANDLE</u></p> <ul style="list-style-type: none"> • Releases the vertical height adjustment • Be careful when releasing as gravity will pull it down <p><u>ALL HANDLES:</u></p> <ul style="list-style-type: none"> • ALL Handles <u>Untighten</u> counter clockwise • ALL Handles <u>Tighten</u> clockwise • Push the button on the handles to position the handles



TECHNICAL MANUAL

For Lifeline[®] Batteries

Manufactured by:

Concorde Battery Corporation
2009 San Bernardino Road
West Covina, CA 91790
Phone 626-813-1234
Fax 626-813-1235
www.lifelinebatteries.com

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February 2, 2017

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RECORD OF REVISIONS

Revision	Date
Initial Release	10/27/08
Rev. A	3/25/09
Rev. B	9/09/09
Rev. C	7/18/11
Rev. D	4/14/14
Rev. E	2/02/17



SAFETY SUMMARY

DANGER OF EXPLODING BATTERIES

Lead acid batteries can produce explosive mixtures of hydrogen and oxygen. Take the following precautions:

- Never install batteries in an airtight or sealed enclosure and make sure installation is adequately ventilated.
- Charge batteries in accordance with the instructions given in this manual.
- Keep all sparks, flames and cigarettes away from batteries.
- Connect cables tightly to the terminals to avoid sparks.
- Wear proper eye and face protection when installing and servicing batteries.

DANGER OF CHEMICAL BURNS

Lead acid batteries contain sulphuric acid electrolyte which can cause severe burns to body tissue. Take the following precautions:

- Avoid contact of the electrolyte with skin, eyes or clothing.
- Never remove or damage vent valves.
- In the event of an accident, flush with water and call a physician immediately.

DANGER OF BURNS IF TERMINALS ARE SHORTED

Lead acid batteries are capable of delivering high currents if the external terminals are short circuited. The resulting heat can cause severe burns and is a potential fire hazard. Take the following precautions:

- Do not place metal objects across battery terminals.
- Remove all metallic items such as belt buckles, watches, bracelets and rings when installing or servicing batteries.
- Wear insulating gloves when installing or servicing batteries.
- Use insulating tools when installing or servicing batteries.

DANGER OF THERMAL RUNAWAY

Thermal runaway is a condition in which the battery temperature increases rapidly resulting in extreme overheating of the battery. Under rare conditions, the battery can melt, catch on fire, or even explode. Thermal runaway can only occur if the battery is at high ambient temperature and/or the charging voltage is set too high. Take the following precautions:

- Charge batteries in accordance with the instructions given in this manual.
- Do not install batteries near heat sources or in direct sunlight that may artificially elevate their temperature.
- Provide adequate air circulation around the batteries to prevent heat build up.



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CHAPTER 1 - INTRODUCTION

1.1 Company Background

Concorde Battery Corporation was founded in 1977 and is a manufacturer of premium quality lead acid batteries. Originally, Concorde's main product emphasis was dry charged and gelled electrolyte lead acid batteries. In 1985, Concorde developed its valve regulated, absorbent glass mat [AGM] technology for use in aircraft applications. The success of this technology in the aviation market has been outstanding. Concorde is now the largest manufacturer of valve regulated lead acid batteries for both commercial and military aircraft.

In 1986, Concorde further developed the AGM technology for deep cycle applications. This development effort provided higher energy density (higher capacity) and better cycle life than its gelled electrolyte battery. Concorde soon discontinued the gel product line and concentrated all engineering developments on the AGM product line. In 1987, Concorde began supplying the marine and recreational vehicle market with our deep cycle AGM batteries. Over the years it has been our design expertise, quality and customer focus that has made Concorde a leader in providing the best battery available for this market segment. Concorde is committed to the proposition that the customer deserves the best performing and highest quality product. Our batteries are tailored to the application rather than make the designer/user settle for what is available. It is this commitment – to meet the needs of the customer – that sets Concorde apart.

1.2 Overview of Lifeline® AGM Technology

Lifeline® AGM batteries are valve-regulated, recombinant gas, absorbed electrolyte, lead acid batteries. The cells are sealed with a pressure relief valve that prevents gases within the battery from escaping. The positive and negative plates are sandwiched between layers of glass mat consisting of a blend of glass micro fibers of varying length and diameter. This blend features superior wicking characteristics and promotes maximum retention of the electrolyte. An envelope of micro porous polyethylene surrounds each wrap of glass mat to further protect the plates from shorting. Electrolyte is absorbed and held in place by the capillary action between the fluid and the glass mat fibers. The mat is over 90% saturated with the electrolyte. By design it is not totally saturated with electrolyte, a portion is filled with gas. This void space provides the channels by which oxygen travels from the positive to the negative plates during charging. When the oxygen gas reaches the negative plate, it reacts with lead to form lead oxide and water. This reaction at the negative plate suppresses the generation of hydrogen that otherwise would come off the negative plate. In this manner, virtually all of the gas is “recombined” inside the cell, eliminating the need to add water, resulting in “maintenance free” operation. Furthermore, since the acid electrolyte is fully absorbed in the AGM separator, the battery is nonspillable even when turned upside down.

1.3 About this Manual

This manual is intended to provide the customer with technical information for selecting, installing, operating, and servicing Lifeline® AGM batteries. The next Chapter provides a detailed description of the product, its design features and materials of construction. Concorde is very proud of this innovative product line and we think you will share our enthusiasm. Chapter 3 provides a comparison of Lifeline® with other lead acid technologies: flooded-electrolyte batteries, gelled-electrolyte batteries, and AGM batteries from other manufacturers. Chapter 4 presents an overview of the battery specifications for the Lifeline® product line; detailed specifications for each model are published separately. Chapter 5 provides instructions for storing, operating and servicing Lifeline® AGM batteries. Chapter 6 gives important safety information. Further technical information can be found in the Appendices. If you have additional questions beyond what is covered in this manual, please contact Concorde Battery Corporation or any of our distributors.



CHAPTER 2 - BATTERY CONSTRUCTION

2.1 Component Description

Refer to the battery pictorial in Section 2.2 showing a cut away view of the cell and a summary of the features and benefits. A more detailed description of the battery's construction is given below.

GRIDS - The negative grid is made of pure lead calcium alloy. The positive grid is extra thick and is made from a proprietary, pure lead-tin-calcium alloy with special grain refiners. These features improve corrosion resistance of the grid and gives the battery excellent cycling capability and float life.

PLATES – The grids are pasted on state-of-the-art pasting machines to give the highest quality plates with tightly controlled weight and thickness specifications. The lead oxide paste used to make the positive plates is our high density formula. With time and use, the active material tends to soften and give less discharge capacity. The high density paste formula retards the active material softening and extends battery life.

ABSORBENT GLASS MAT [AGM] SEPARATOR – The AGM is a premium blend of glass micro fibers having an optimum ratio of fine and extra fine fiber sizes. This blend features superior wicking characteristics and promotes maximum retention of the electrolyte. The AGM layer is squeezed to an optimum level of compression during assembly to provide sufficient contact with the surface of the plate over the life of the battery. This compression also promotes retention of the active material if the battery is exposed to shock or vibration conditions.

POLYETHYLENE ENVELOPE – Concorde is the only manufacturer that envelopes the AGM separator with a thin layer of microporous polyethylene. The microporous layer is wrapped around the glass-matted plate and then sealed along the sides to eliminate the possibility of shorts at the edges of the plate (a common failure mode). The microporous polyethylene is more durable and puncture resistant than the AGM material alone and significantly reduces the occurrence of plate to plate shorts.

INTERCELL CONNECTIONS - Massive “over the partition” fusion welds are used which increase the strength of the intercell connection. This minimizes the possibility of open welds and provides a low resistance connection between cells. Other manufacturers use “through the partition” spot welded construction that inserts a weak point into the assembly because of the small cross section area and the difficulty of making a reliable weld and leak proof construction.

HIGH IMPACT, REINFORCED CONTAINER & COVER – The battery container and cover are made of a thick walled polypropylene copolymer. This material provides excellent impact resistance at extreme low temperatures and minimizes bulging at high temperatures.

COVER-TO-CONTAINER SEAL - The batteries use an epoxy-filled tongue and groove seal between the cover and container. Most other manufacturers heat seal their cover to the container. The epoxy-filled tongue and groove seal is a far stronger than a heat seal and will not separate in high or low temperature extreme applications.



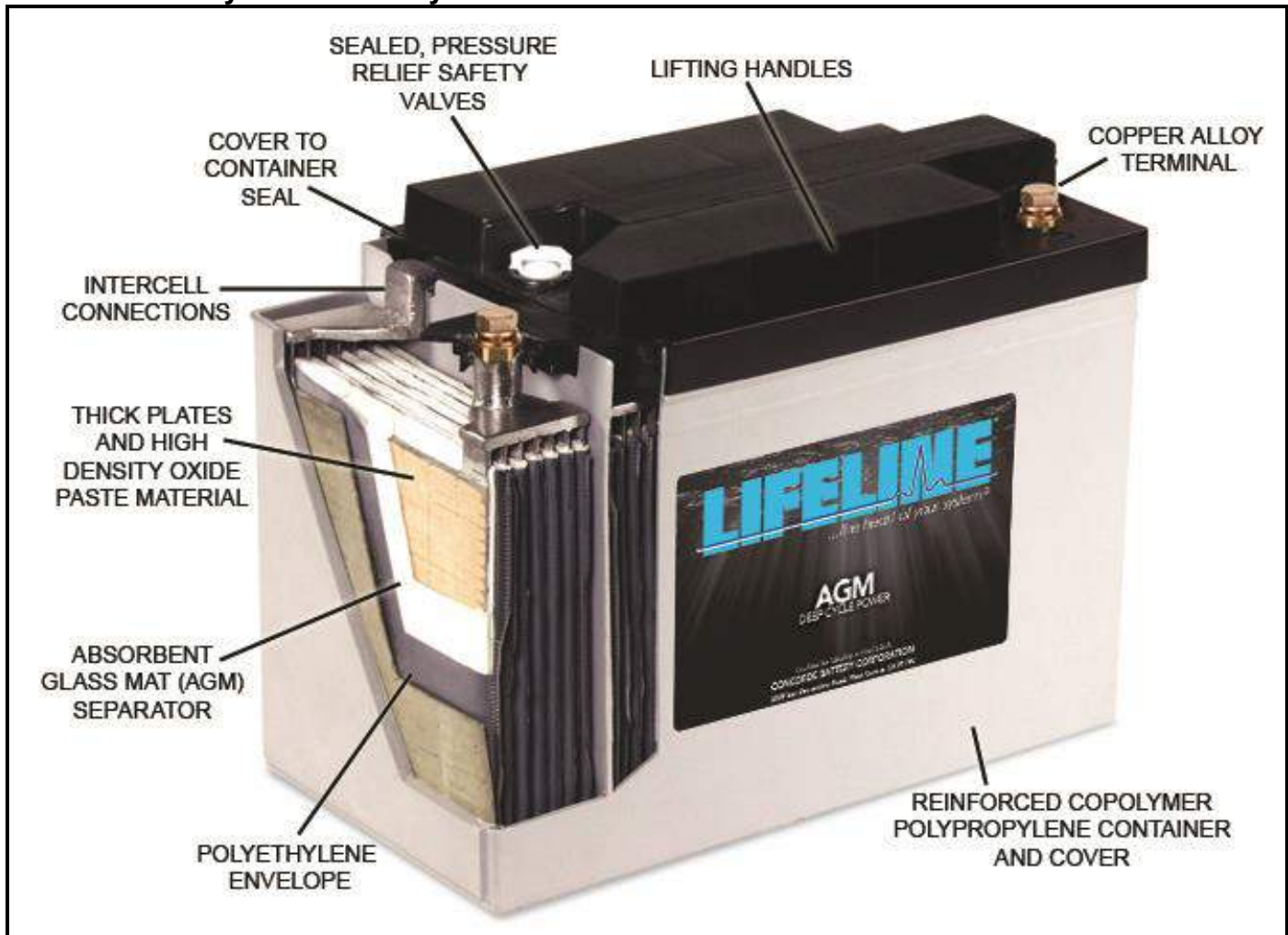
PRESSURE RELIEF SAFETY VALVE - Each cell in the battery employs a pressure relief safety valve. The valve is designed to release excess pressure that builds up over time to vent the small quantity of gasses that do not recombine inside of the battery. Once the pressure is released, the valve automatically re-seals. The gasses that escape are mainly oxygen and some hydrogen, and these gasses rapidly dissipate into the atmosphere.

TERMINALS - Lifeline® AGM batteries are available in a variety of terminal configurations. Most terminal types are made of copper alloy which provide a long lasting, low resistance electrical connection. The copper alloy terminals are non corrosive, unlike lead terminals. Additionally, the copper alloy terminals offer increased environmental protection and personal safety in comparison to commonly used lead terminals. Refer to the pictorial in Section 2.3 to see a detailed view of the various terminal types that are available.

HANDLES – Lifting handles are incorporated into all Lifeline® AGM batteries. This provides easier handling for lifting, carrying and installation.



2.2 Battery with Cut Away View





2.3 Terminal Types

Lifeline Battery Terminal Types



M8 Threaded Insert (Copper Alloy)
M6 Threaded Insert for GPL-U1T only



L-Blade Terminal (Solid Copper)
M8 Hardware



Marine Terminal (Copper Alloy)
Positive Terminal with M10 Hardware
Negative Terminal with M8 Hardware



A - SAE Post Automotive (Lead)



CHAPTER 3 - TECHNOLOGY COMPARISON

3.1 Lifeline® versus Flooded Batteries

Flooded-electrolyte lead acid batteries have been around since 1859 and tend to be less expensive than AGM or Gel batteries. However, they have major deficiencies compared to AGM or Gel batteries. For instance, deep cycle flooded lead acid batteries contain antimony in the grid alloy which causes a high rate of self discharge and rapid water loss due to gassing reactions. The escape of hydrogen and oxygen from the battery represents a serious safety hazard if the gasses are not ventilated properly. In flooded batteries, replacing the antimony lead alloy with calcium lead alloy reduces the amount of gassing and water loss, but the cycle life is much lower and they are no longer considered deep cycle batteries.

Electrolyte stratification can occur in all types of flooded batteries. As the battery is discharged and charged, the concentration of acid becomes higher at the bottom of the cell and becomes lower at the top of the cell. The low acid concentration reduces capacity at the top of the plates, and the high acid concentration accelerates corrosion at the bottom of the plates and shortens the battery life. Although stratification can be minimized by raising the charging voltage so that the increased gassing agitates the electrolyte, this will accelerate the water loss and watering frequency.

One other difference is that flooded batteries can not tolerate freezing temperatures when in the discharged state, whereas AGM batteries are resistant to damage by freezing temperatures. The following table provides a side by side comparison of Lifeline® AGM and flooded deep cycle batteries.

Table 3-1. Comparison of Lifeline® AGM Batteries with Flooded Deep Cycle Batteries

Characteristic	Lifeline® AGM Battery	Flooded Deep Cycle Battery
Self-discharge at room temperature	1 to 3% per month – remains stable over life.	5-10% per month when new – increases drastically with age due to antimony contamination of the negative plate.
Water addition	Never.	Frequent – increases dramatically with age due to antimony contamination of the negative plate.
Hydrogen gas emissions	Generally negligible unless severely overcharged.	Significant volume is generated and must be ventilated to prevent explosion.
Electrolyte spillage during storage, shipping and handling	Nonspillable in all orientations – electrolyte is retained in AGM separator.	Electrolyte spills when tilted, inverted, or cracked.
Electrolyte stratification during operation	No stratification occurs.	Stratification occurs when operated at low charging voltages or in taller batteries.
Tolerance to freezing temperatures	Resistant to damage when frozen.	Battery destroyed when frozen.



3.2 Lifeline® versus Gel Batteries

Gel batteries have been commercially available since the early 1970's and are still offered by some manufacturers. Concorde manufactured gel batteries for many years before developing the AGM technology and, therefore, is aware of inherent deficiencies associated with gel batteries.

The gel product employs a highly viscous, semisolid mixture of silica gel and dilute sulfuric acid in a colloidal suspension as an electrolyte. The electrolyte is difficult to keep homogeneous and the solid silica can separate from the acid, creating a "flooded" battery. Handling and vibration exposure are operational factors that can cause the silica and acid mixture to separate as there is no chemical bond. In high temperature environments, the semisolid electrolyte develops cracks and voids that reduce contact between the plates and causes the battery to lose capacity. This same effect gradually occurs even at normal room temperatures.

By contrast, AGM batteries employ a glass micro fiber mat separator that holds the liquid electrolyte like a sponge. Shrinkage of the separator does not occur as the battery ages and the electrolyte remains in direct contact with the plates. The electrolyte remains immobilized even when the battery is exposed to severe vibration, so electrolyte spillage or leakage is prevented.

Since it is easier to fill a container with a liquid than a semi-solid, AGM batteries require less space between battery plates. The closer plate spacing gives the AGM battery a lower internal resistance, making it more charge efficient and giving better power performance on discharge, especially at low temperatures.

Gel batteries are also more sensitive to charging voltage. If the charging voltage is not controlled within a very tight range relative to the battery's temperature, the life of the battery will be adversely affected. For example, one manufacturer of gel batteries claims that if the charging voltage is 0.7V higher than the recommended level, the cycle life will be reduced by 60 percent. The reason for this effect is the limited oxygen recombination capability of gelled batteries. Lifeline® AGM batteries are more forgiving in overcharge conditions and their ability to recombine the hydrogen and oxygen gases back into water is more efficient. With Lifeline® AGM batteries, tests have shown that increasing the charging voltage 1.0V above the recommended charging voltage results in only a 23% reduction in the cycle life.

The charge acceptance of gel batteries is also less than that of Lifeline® AGM batteries. This means it takes longer to recharge gel batteries. As an example, tests have shown that when discharged to 50% of rated capacity (fairly common in a deep cycle applications), gel batteries took twice as long to reach full charge as compared to Lifeline® AGM batteries.

The following table provides a side by side comparison of Lifeline® AGM and gel batteries:



Table 3-2. Comparison of Lifeline® AGM Batteries with Gel Batteries

Characteristic	Lifeline® AGM Battery	Gel Batteries
Electrolyte Stability	Excellent – AGM acts like a flexible sponge.	Prone to solid / liquid separation leading to spillage / spewage of acid and premature failure. Electrolyte loses contact with plates due to cracks and voids as the battery ages, especially at higher ambient temperatures.
High Rate Performance	Excellent due to low internal impedance.	Inferior. Plate spacing must be greater to allow for gel passage during filling. Gel adds to impedance, especially at low temperatures.
Sensitivity to Charging Voltage Levels	Moderately sensitive. Life is somewhat reduced if charged outside of recommended charge voltage levels.	Very Sensitive. Life is greatly reduced if charged outside of recommended charge voltage levels.
Charge Acceptance Rate	Excellent. Battery can be fully charged in 2 hours if high inrush current is available.	Inferior. Must limit inrush current and charge time is at least twice as long to reach full charge.

3.3 Lifeline® versus other AGM Batteries

Lifeline® AGM batteries have been specifically designed for true deep cycle, long service life capability in adverse temperature and handling conditions. Concorde uses extra thick positive plates, high density paste, thick AGM separator layers encased within a microporous polyethylene envelope, thick walled containers with epoxy-sealed covers. A side by side comparison of Lifeline® AGM batteries with typical AGM batteries from other manufacturers is provided in the following table:

Table 3-3. Comparison of Lifeline® AGM Batteries with Other AGM Batteries

Characteristic	Lifeline® AGM Battery	Other AGM Batteries
Positive Grids	Extra thick grids (typically 0.095" or greater) and extra thick plates (typically 0.105" or greater), for long cycle and float life.	Thinner grids, typically 0.045 to 0.060".
Pasted Plates	High density positive paste for long cycle life.	Lower density, resulting in lower cycle life.
AGM Separator	Extra thick for maximum electrolyte reserve. Premium grade of AGM with extra fine fibers for long life.	Thinner material used. Inferior grade of AGM without the extra fine fiber content.
Microporous polyethylene separators	Envelopes the positive plate to prevent shorting due to shock, vibration and dendrites	Not present, AGM is the only separator protecting the plates.
Intercell connections	Massive over the partition connectors provide a robust, leak proof connection with low voltage loss.	Inferior through the partition welds have less cross sectional area, provide weaker structural connection, and are leak prone.
Battery Terminals	Copper alloy – low electrical resistance and no exposed lead.	Lead alloy - higher in electrical resistance and user is exposed to lead contamination.
Container	Thick wall for rigid support of cell elements and high compression of AGM separator.	Thinner walls, less support of cell elements and lower compression of AGM separator.
Cover Seal	Cover is epoxied to container – high strength bond for reliable operation at temperature extremes.	Cover is heat sealed (melted) to container – prone to separation and leakage at temperature extremes.



CHAPTER 4 - BATTERY SPECIFICATIONS

4.1 Battery Models

The Lifeline® Series consists of deep cycle as well as engine starting batteries. Capacities of the deep cycle batteries range from 33 to 1200 ampere hours (rated at the 20 hour rate) and a variety of 2-volt, 6-volt and 12-volt models are available. Ratings of the starting batteries range from 550 amperes to 810 amperes (CCA at 0°F) and these are only available in 12 volt models. Refer to the battery specification sheet (published separately) for a complete listing of the mechanical and electrical specifications for each battery model.

4.2 Terminals

Standard Terminals: The following table shows the standard type of terminal used on each battery model:

Table 4-1. Battery Terminals

Battery Model	Standard Terminal Type
GPL-24T, GPL-2400T, GPL-27T, GPL-2700T, GPL-31T, GPL-3100T, GPL-31XT, GPL-31T-2V	Marine Terminal (Copper Alloy) Positive = M10 and Negative = M8
GPL-4DL, GPL-8DL GPL-4DA, GPL-8DA	L-Blade Terminal (Copper Alloy) with M8 Hardware SAE Automotive Post (Lead)
GPL-1400T, GPL-30HT, GPL-4CT, GPL-6CT, GPL-L16T, GPL-4CT-2V, GPL-6CT-2V, GPL-L16T-2V	M8 Threaded Insert (Copper Alloy)
GPL-U1T	M6 Threaded Insert (Copper Alloy)

Optional Terminals: The 2 and 6 volt models are available with marine terminals on a special order basis.

Terminal Hardware: When requested, batteries are supplied with silicon bronze bolts, nuts and washers as required for installation.

Terminal Torque Values: Use 35 in-lbs / 4.0 nm for M6. Use 70 in-lbs / 7.9 nm for M8 and M10.

4.3 Handles

All batteries include lifting handles, either built into the cover, dual ropes attached to the cover, or a single plastic handle attached to brackets on the sides of the container.

4.4 Definition of Ratings

Capacity ratings are after 15 cycles per BCI specifications and are stated at 77°F (25°C) to 1.75 volts per cell.

4.5 Temperature Range

Storage (when fully charged): -67°F (-55°C) to 122°F (50°C)

Operating: -40°F (-40°C) to 160°F (71°C).

4.6 UL Recognition

All Lifeline® AGM batteries meet the requirements of UL® 1989 (Standby Battery) and are UL recognized under UL File Number MH-17983.

4.7 Shipping Classification

Lifeline® AGM batteries have been tested and determined to be in compliance with the vibration and pressure differential tests in accordance with DOT 49 CFR 173.159(d) and Special Provision A67 of the International Air Transport Association (IATA) Dangerous Goods regulations. As such, they are classified as a “NONSPILLABLE BATTERY” and can be shipped as non-hazardous material by any means. To comply with DOT shipping regulations, the battery must be packaged to protect against short circuits and the battery and outer packaging must be plainly and durably marked “NONSPILLABLE” or “NONSPILLABLE BATTERY”.



CHAPTER 5 - COMMISSIONING AND SERVICING INSTRUCTIONS

5.1 Storage

Lifeline® Batteries are charged at the factory and are ready for installation when they are received. For warranty coverage, batteries need to be properly boost charged while in storage and installed within 12 months of the original factory ship date. Batteries should be stored in the coolest environment available, preferably not exceeding 68°F (20°C). The higher the temperature, the faster the battery will self-discharge and require boost charging. See Appendix C for data on storage time versus temperature.

While in storage, batteries should be boost charged every 90 days or when the open circuit voltage (OCV) drops to 12.5 volts for a 12 volt battery (6.25 volts for a 6 volt battery and 2.08 volts for a 2V battery). This OCV corresponds to approximately 75% state of charge. Boost charge batteries using a constant voltage charger set at 14.4 to 15.0 volts for a 12 volt battery (7.2 to 7.5 volts for a 6 volt battery and 2.40 to 2.50 for a 2 volt battery). The boost charge should be applied until the charging current falls below 0.5 percent of the battery's 20 hour rated capacity (0.5 amps for a 100 Ah battery).

5.2 Installation

Be sure there is adequate ventilation in the area where the batteries are to be installed. Refer to Section 6.1 for specific safety hazards associated with the emission of hydrogen gas. The space surrounding adjacent batteries should be at least 0.25 inch to permit airflow around each battery.

Batteries may be installed in any orientation except upside down (i.e., terminals facing the earth). When batteries are installed on their sides there is a remote risk that a small quantity of electrolyte will be expelled from the vents during charge. Therefore, suitable precautions should be taken to protect the surroundings from exposure to any drops that are expelled. For example, a plastic containment tray could be placed under the batteries.

Batteries may be connected in series (voltage adds, capacity stays the same), in parallel (capacity adds, voltage stays the same), or a combination of series and parallel (voltage and capacity adds). Each of these connection options are illustrated in Figures 5-1 through 5-3, respectively.

Always use batteries of the same size and condition in multi-battery installations. Connect batteries using cabling that is sized for the maximum load of the system. The voltage drop on the cables during charging should not exceed 0.2 volts at full output. Protect the battery terminals from shorting during installation. When replacing batteries, it is best to replace the entire set of batteries so they remain balanced.

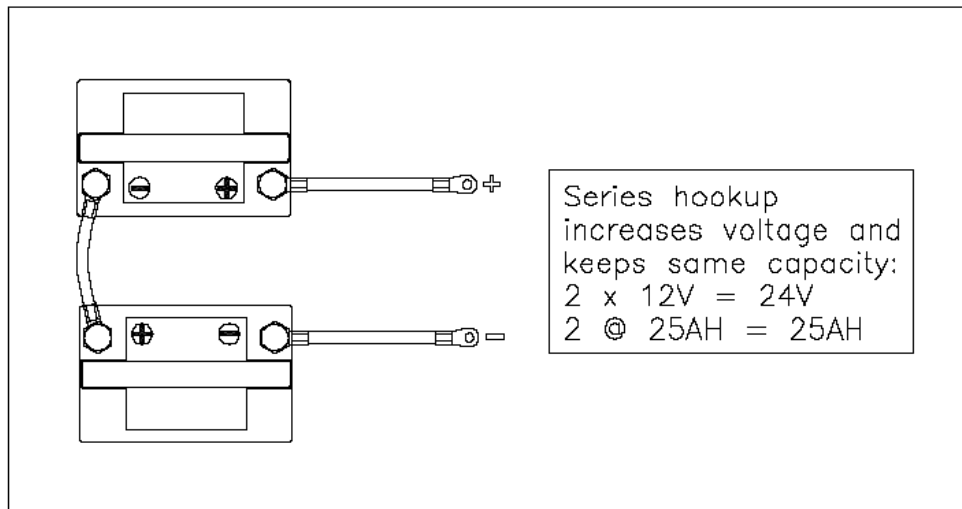


Figure 5-1. Series Connection

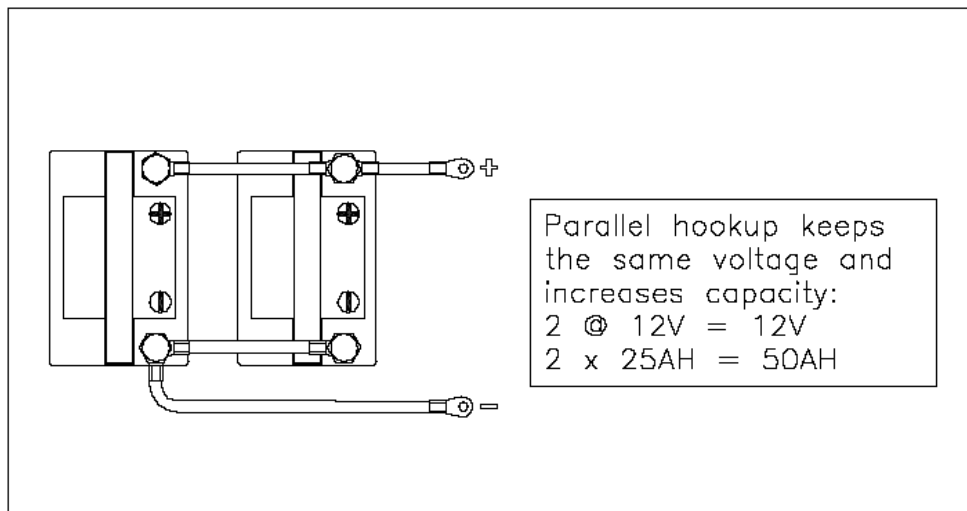


Figure 5-2. Parallel Connection

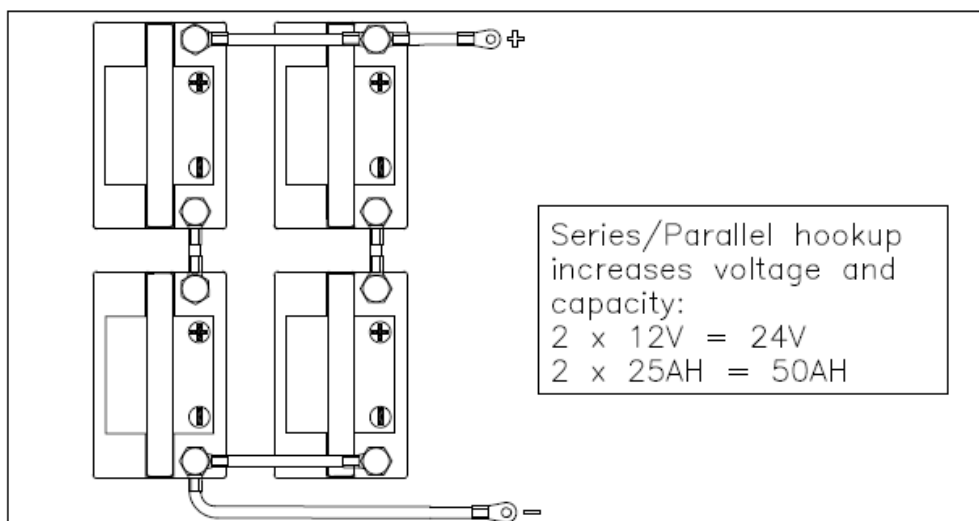


Figure 5-3. Series/Parallel Connection



Connection options for 4-terminal batteries are illustrated in Figures 5-4 through 5-8. For low rate applications (current levels less than 400 amperes), only two of the four terminals need to be connected, but it is still best to use all four terminals for redundancy. For high rate applications (current levels greater than 400 amperes), all four terminals should be connected.

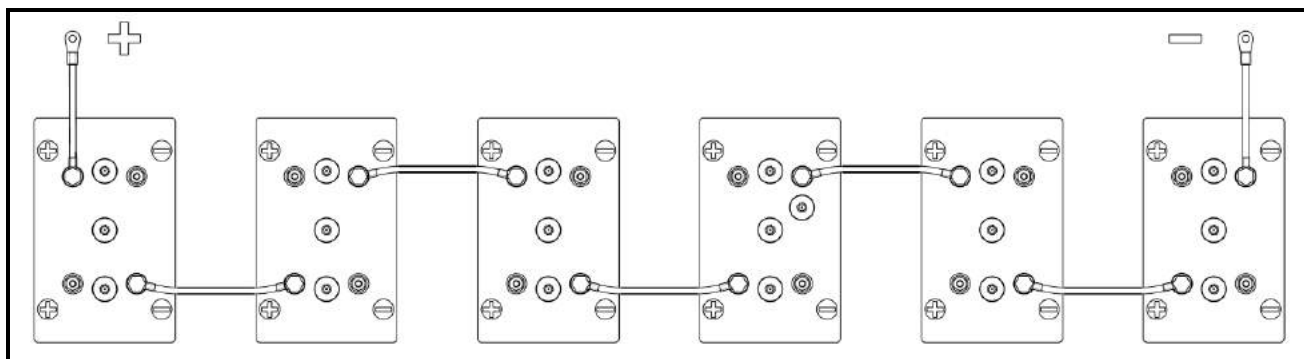


Figure 5-4. Series Connection for 4-Terminal Batteries (Low Rate Applications Only)

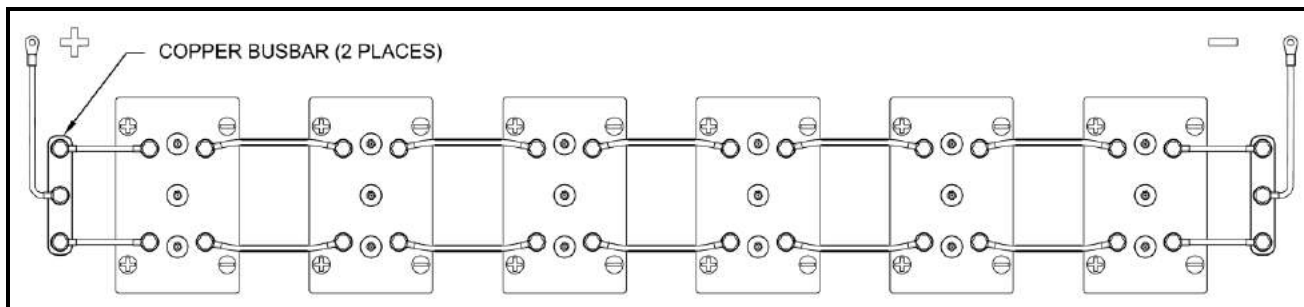


Figure 5-5. Series Connection for 4-Terminal Batteries (Low or High Rate Applications, Option A)

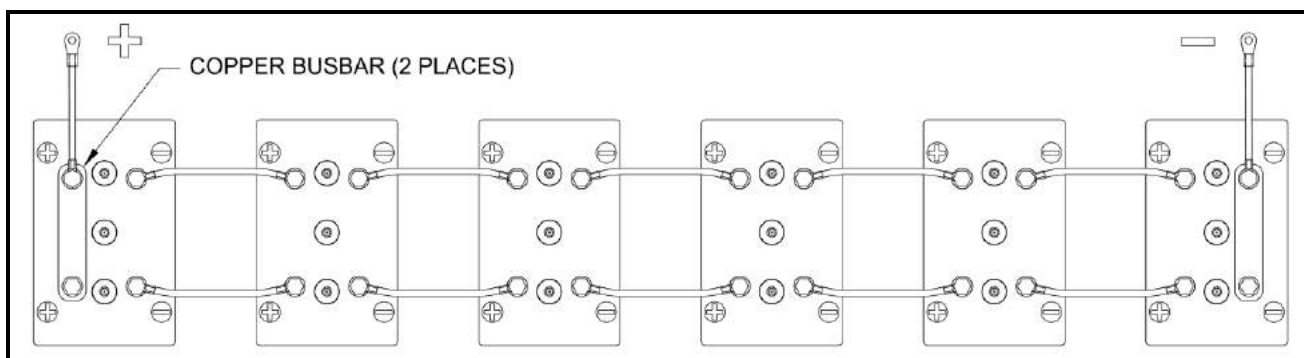


Figure 5-6. Series Connection for 4-Terminal Batteries (Low or High Rate Applications, Option B)

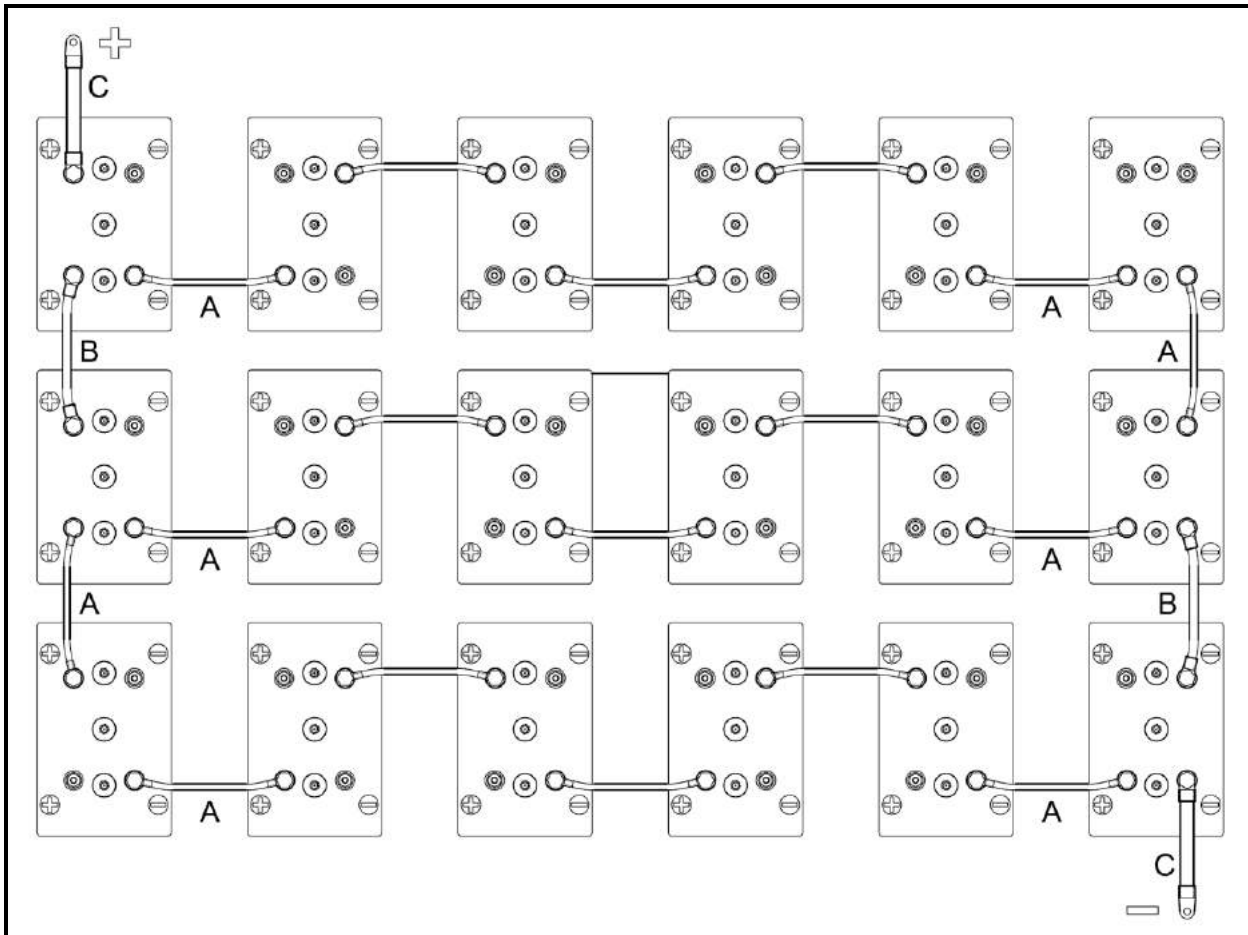


Figure 5-7. Series/Parallel Connection for 4-Terminal Batteries (Low Rate Applications Only)

NOTE: Cables A, B and C carry different current levels and should be sized accordingly. In this example, the current in Cable B is 2 times that of Cable A and the current in Cable C is three times that of Cable A.

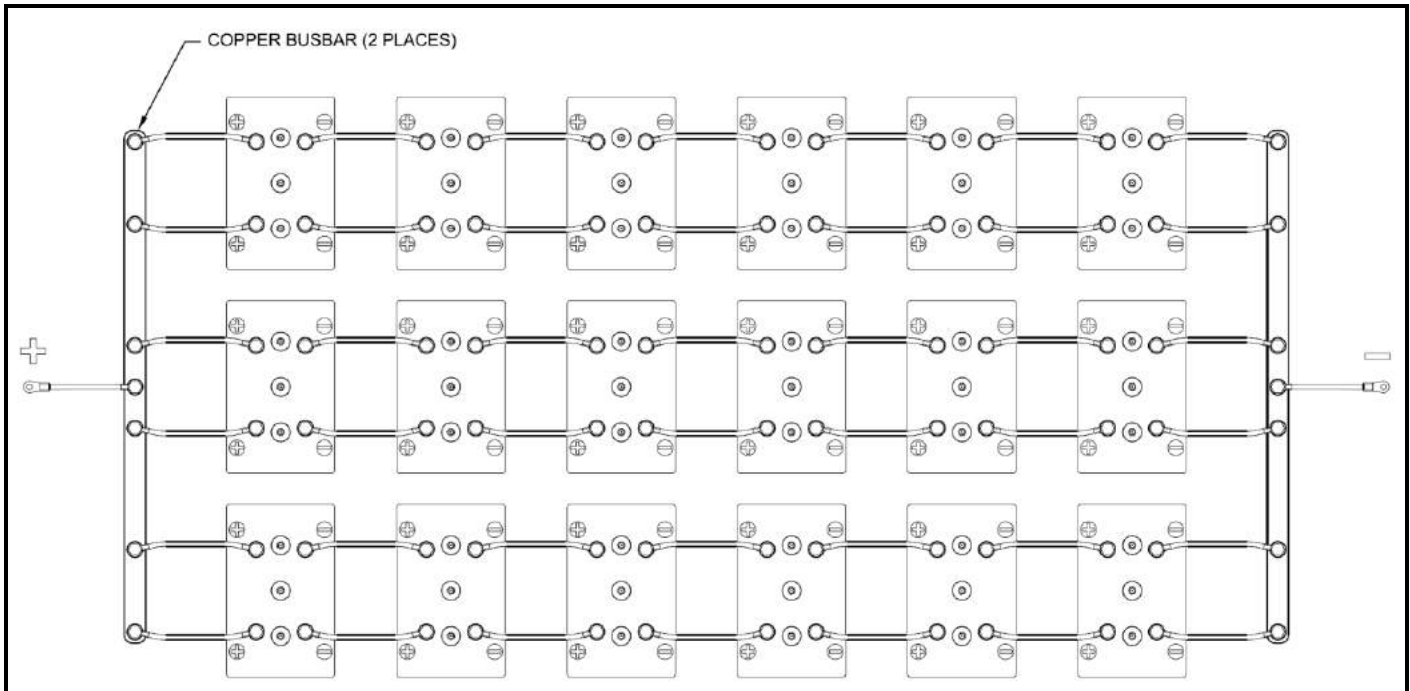


Figure 5-8. Series/Parallel Connection for 4-Terminal Batteries (Low or High Rate Applications)

5.3 Discharging

Discharge data for Lifeline® AGM batteries are given in Appendix C. The capacity delivered by the battery depends on the rate of discharge as well as the battery temperature. The battery will deliver less capacity as the discharge rate increases and less capacity as the temperature is lowered. Graphs are provided in Appendix C to quantify these effects. Peukert plots (Amps vs Time) are also included, along with formulas for calculating the current that can be removed or any discharge time from 0.5 hours to 120 hours. To calculate the discharge time for a specified amperage, these formulas can be inverted as follows:

$$A = C \times T^{-n}$$

$$T = C^{1/n} \times A^{-1/n}$$

(A = Amps, T = Time in hours, C & n are constants specific for each battery model)

In general, batteries should be sized such that the rated capacity is at least twice the capacity required by the load. For example, if 100 Ah is required on average, select at least a 200Ah battery. This approach will limit the average depth of discharge to 50% and will dramatically extend the life of the battery (see chart of Cycle Life versus Depth of Discharge in Appendix C).



5.4 Charging

Charging Lifeline® AGM batteries is a matter of replacing the ampere-hours removed during discharge plus a little extra to make up for charging inefficiency. The ampere-hour input necessary for a full recharge depends on the depth of discharge, rate of recharge, and temperature. Typically, between 102% and 110% of the discharged ampere-hours must be returned for full recharge. If the recharge is insufficient, the battery’s state of charge will gradually “walk down” as it is cycled, resulting in sulfation and premature failure.

The recommended method of charging Lifeline® AGM batteries is to use a 3 stage charging profile. In the first stage, a constant current is applied until the voltage reaches a pre-set limit. The first stage is often called the **Bulk** charging stage.

In the second stage, the voltage is held constant at the same pre-set limit until the charging current tapers to a very low value, at which point the battery is fully charged. The second stage is often called the **Absorption** charging stage. A voltage setting of 14.3 volts ± 0.1 volts (7.15 ± 0.05 volt for a 6 volt battery) should be used when the battery temperature is 77°F (25°C). The battery is considered to be fully charged when the current drops below 0.5% of the battery’s rated capacity (0.5A for a 100Ah battery). The absorption stage will typically last 2 – 4 hours before the current reaches this level.

In the third stage, the charging voltage is reduced to a lower value that minimizes the amount of overcharge, while maintaining the battery at 100% state of charge. This third stage is often called the **Float** charging stage. A float voltage of 13.3 ± 0.1 volts (6.65 ± 0.05 volts for a 6 volt battery) should be used when the battery temperature is 77°F (25°C). The charging voltages at other temperatures can be determined from the following table:

Table 5-1. Charging Voltage at Different Temperatures for a 12 Volt Battery*

Temp °F	Absorption Voltage	Float Voltage		Temp °F	Absorption Voltage	Float Voltage
-40	16.88	15.86		70	14.41	13.39
-30	16.58	15.56		77	14.30	13.30
-20	16.30	15.28		80	14.27	13.25
-10	16.03	15.01		90	14.15	13.13
0	15.78	14.76		100	14.04	13.02
10	15.54	14.52		110	13.95	13.00
20	15.31	14.29		120	13.87	13.00
30	15.10	14.08		130	13.81	13.00
40	14.90	13.88		140	13.76	13.00
50	14.72	13.70		150	13.73	13.00
60	14.56	13.54		160	13.71	13.00

* For a 6 volt battery, divide the voltage by 2. For a 2 volt battery, divide the voltage by 6.

See Appendix C for a chart of charging voltage versus temperature. Most chargers that have automatic temperature compensation use a simplified equation with a linear coefficient. The recommended linear coefficient for Lifeline® batteries is 0.0022V/cell per degree F (0.013V/degree F for a 12V battery).



The following table provides recommended absorption times for Lifeline® Batteries:

Table 5-2 Recommended Absorption Times

Average Depth of Discharge (DOD)	Absorption Time
Less than 30%	2 hours
30 – 50%	3 hours
More than 50%	4 hours

The absorption time may need to be fine-tuned from these values to assure the batteries consistently reach full charge per the criteria given above (charging current is less than 0.5% of battery’s rated capacity).

The charging current during the Bulk stage should be set as high as practical; higher current levels mean faster recharge time and less time for the plates to become sulfated. Due to the low impedance design, Lifeline® batteries can tolerate in-rush current levels as high as 5C (500A for a 100Ah battery). The time to reach full charge at temperatures in the range of 20-30°C (68 to 86°F) can be estimated from the following equation:

$$\text{Charge Time} = [(DOD/100) \times \text{Rated Capacity (Ah)} \div \text{Output of Charger (Amps)}] + \text{Absorb Time.}$$

For example, charging a 100Ah battery at 40% DOD with a 25A charger would take:
 $[(40/100) \times 100 \div 25] + 3 = 4.6$ hours to reach full charge.

If a 10A charger is used, it would take:
 $[(40/100) \times 100 \div 10] + 3 = 7$ hours to reach full charge.

Note that this formula is approximate and the full charge state should be verified using the criteria given above (current drops below 0.5% of rated capacity). If the recharge does not return 102 to 110% of the discharged capacity, the battery’s state of charge will gradually “walk down” as it is cycled leading to premature failure. Therefore, it is important to verify that the battery is not being undercharged.

For repetitive deep cycling applications (deeper than 50% DOD), chargers should have an output current of at least 0.2C (20 Amps for a 100 Ah battery). If the output current is less than this value, the cycle life of the battery may be negatively affected. If a charger with at least 0.2C output is not practical, an alternative charge profile using a low rate constant current stage at the end of the absorption stage will normally improve the cycle life. The constant current stage should be at 0.02C (2 Amps for a 100Ah battery) for no more than one hour.

Some types of battery chargers allow the user to input the Peukert constant to obtain an optimum charging profile. For Lifeline® batteries, the recommended value of the Peukert constant is $n = 1.12$.



5.5 Conditioning

Conditioning should only be done when the battery is showing symptoms of capacity loss due to extended time in a partial or low state of charge condition. This could be caused, for example, by low charging voltage for an extended number of charge cycles, or by repeatedly charging to only 90% state of charge.

NOTE: Some chargers use the term Equalizing Charge instead of Conditioning Charge. An Equalizing Charge is generally applied to flooded lead acid batteries that are susceptible to acid stratification. However, an Equalizing Charge may be used to provide a Conditioning Charge for Lifeline® batteries as described below.

To apply a conditioning charge, first go through the normal charge cycle to bring the battery to full charge. The conditioning charge should then be applied by charging for 8 hours. At 77°F (25°C), the conditioning voltage should be set at 2.58 VPC (15.5 volts for a 12 volt battery). The conditioning voltage at other temperatures is shown in Table 5-2. By using the temperature-compensated conditioning voltage, batteries that are not in controlled temperature environments may be conditioned without bringing them to room temperature. If temperature compensation is not available, it is best to bring the battery as close to room temperature as possible before applying the conditioning charge.

Table 5-2. Conditioning Voltage at Different Temperatures for a 12 Volt Battery*

Temperature °F	Conditioning Voltage	Temperature °F	Conditioning Voltage
-40	18.05	70	15.58
-30	17.75	77	15.48
-20	17.47	80	15.44
-10	17.20	90	15.32
0	16.95	100	15.21
10	16.71	110	15.12
20	16.48	120	15.04
30	16.27	130	14.98
40	16.07	140	14.93
50	15.89	150	14.90
60	15.73	160	14.88

* For a 6 volt battery, divide the voltage by 2. For a 2 volt battery, divide the voltage by 6.

In systems with limited charging output or long time periods between full charge, a routine conditioning charge may helpful in preventing capacity loss due to sulfation. If a routine conditioning charge is used, the time duration should be less than the 8 hours specified above. As a starting point, a routine conditioning charge may be applied every 3 weeks for 4 hours at the voltage levels given above. The frequency should be fine-tuned to assure the batteries are not being undercharged or over-charged. In most cases, the optimum frequency will be between 2 and 4 weeks.



5.6 Deep Discharge Recovery

Batteries having an OCV less than 1.93 volts/cell (11.6 volts for a 12V battery) are considered deeply discharged. This condition may occur when batteries are stored for long periods of time without boost charging, or when discharged below 100% and not recharged. Batteries in this condition may sometimes be recovered using a constant current charge instead of a constant voltage charge. The deep discharge recovery procedure is given below.

WARNING: This procedure should only be done by a trained technician. Refer to Chapter 6 for safety precautions.

WARNING: This procedure should only be done in a well ventilated area because a significant amount of hydrogen gases and fumes may be released from the battery.

CAUTION: If the battery becomes hot (above 55°C/130°F) during this charge, stop the current and allow the battery to cool to room temperature before continuing.

1. Stabilize the battery at 20-30°C (68-86°F) for at least 24 hours.
2. Charge at a constant current of 5% of rated (24 hour) capacity until the voltage reaches 2.58 VPC (15.5 volts for a 12 volt battery), then continue charging at this rate for an additional 4 hours. Note that the charging voltage may get as high as 3.0 volts/cell, so the power supply must be capable of outputting this level to maintain constant current. This constant current charge may take 16 to 20 hours.

NOTE (1): If the battery voltage exceeds 2.58 volts/cell at the beginning of charge and then drops below 2.58 volts/cell within 2 hours, continue charging at constant current until the voltage reaches 2.58 volts/cell a second time. Then continue charging for an additional 4 hours as specified above.

NOTE (2): If the battery voltage does not reach 2.58 volts/cell within 24 hours, the charge should be terminated.

5.7 Capacity Testing

To determine the actual capacity of a Lifeline® AGM battery relative to its rated capacity, a full discharge test should be performed. Although there are various battery testers available on the market, such as carbon pile testers, impedance meters, conductance meters, and others, these testers are not reliable in determining the battery's actual capacity. To determine the battery's actual capacity relative to its rated capacity, use the following procedure:

1. Stabilize the battery at 68-86°F (20-30°C) for at least 24 hours.
2. Bring the battery to full charge as described in Sections 5.4, 5.5 or 5.6 as applicable.
3. Discharge the battery at a constant current of 25 amperes until the voltage falls to 10.5 volts (5.25 volts for a 6 Volt battery). Record the discharge time in minutes.
4. Compare the measured discharge time to the published 25A rating (reserve capacity minutes) for the battery.
5. If the battery delivers less than 80% of the rated capacity the conditioning procedure given in Section 5.5 should be attempted and the battery capacity should be retested.
6. If the battery delivers less than 50% of its rated capacity, it should be replaced. However, the user should determine the amount of capacity needed for their particular application and adjust the pass/fail threshold accordingly.



5.8 Temperature Considerations

The temperature of the battery has a significant impact on its performance and life capability. Battery capacity is reduced significantly in cold temperatures. For example, a battery that operates continuously at -18°C (0° F.) will only provide about 60% of its normal room temperature capacity. Appendix C provides a chart of capacity versus temperature at various discharge rates.

Battery calendar and cycle life are also affected by temperature. As a rule of thumb, the battery life decreases by 50% for every 10°C rise in temperature. Thus, a battery that lasts 6 years at 25°C will last 3 years at 35°C, 1.5 years at 45°C, and 0.75 years at 55°C. Similarly, a battery that lasts 1000 cycles at 25°C will last 500 cycles at 35°C, 250 cycles at 45°C, and 125 cycles at 55°C.

It should be realized that the temperature of the battery itself and ambient temperature can be vastly different. While ambient temperatures can change very quickly, battery temperature change is much slower. This is due to the large thermal mass of the battery. It takes time for the battery to absorb temperature and it takes time for the battery to relinquish temperature.

If the battery is exposed to cold climates, the state of charge should be kept at a maximum to prevent freezing of the electrolyte. A fully charged battery will not freeze even under the coldest weather conditions, but a discharged battery will freeze even when moderately cold. Table 6-2 gives the freezing point of electrolyte at various states of charge.

Frozen batteries are not capable of charging or discharging except at very low rates, and may be permanently damaged by expansion of the electrolyte. If a battery becomes frozen, it should be thawed by placing it at room temperature for at least 24 hours, and then charged in accordance with Sections 5.4, 5.5 or 5.6 as applicable. However, if the battery container has any evidence of cracking, the battery is no longer serviceable and should not be used.

Table 6-2. Electrolyte Freezing Point at Various Battery States of Charge

Battery State of Charge (%)	Approximate Electrolyte Freezing Temperature
100%	-70°C (-94°F)
75%	-47°C (-53°F)
50%	-25°C (-13°F)
25%	-13°C (9°F)
0%	-6°C (21°F)



5.9 Servicing

Lifeline® AGM batteries do not need electrolyte adjustment as do flooded lead-acid batteries, but periodic servicing is essential to assure continued integrity of the battery system. Servicing should include good record keeping to document the life history of the battery system and to identify whether corrective action needs to be taken.

The following servicing schedule is recommended:

Installation

1. Within the first week of operation, put the battery system on a full charge cycle and record the following parameters (baseline readings):
 - a. Charger amperage output
 - b. Absorption voltage at battery system terminals
 - c. Float voltage at battery system terminals
 - d. Ripple voltage at battery system terminals (see Note 1)
 - e. Voltage of each battery when charger is in float mode (see Note 2)
 - f. Ambient temperature
2. Allow the battery system to discharge until it reaches the low voltage disconnect, and record the following parameters:
 - a. Run time
 - b. Capacity delivered (Ampere-hours)
 - c. Average DC load (amperes)
 - d. Endpoint voltage at battery system terminals
3. After discharging, return the battery to a fully charged condition as soon as possible.

Quarterly

1. Inspect each battery terminal for any corrosion deposits. If present, remove with a wire brush, neutralize with a baking soda solution, dry, and then apply NO-OX-ID grease.
2. Record the following parameters with the battery on float charge:
 - a. Float voltage at battery system terminals
 - b. Voltage of each battery (see Note 2)
 - c. Ambient temperature

Yearly

1. Put the battery on a full charge cycle and record the following parameters:
 - a. Charger amperage output
 - b. Absorption voltage at battery system terminals
 - c. Float voltage at battery system terminals
 - d. Ripple voltage at battery system terminals (see Note 1)
 - e. Voltage of each battery when charger is in float mode (see Note 2)
 - f. Ambient temperature
2. Allow the battery system to discharge until it reaches the low voltage disconnect, and record the following parameters:
 - a. Run time
 - b. Capacity delivered (Ampere-hours)
 - c. Average DC load (amperes)
 - d. Endpoint voltage at battery system terminals
3. After discharging, return the battery to a fully charged condition as soon as possible.

**NOTES:**

- (1) Excessive ripple voltage will negatively impact battery life. Maximum recommended ripple voltage (peak to peak) is 0.5% of the float voltage setting.
- (2) A large variation of individual float voltages in a new battery system is normal because of variations in oxygen recombination efficiency due to slight variations of acid saturation within the AGM. As the battery ages, the variation should drop to lower values. Excessive variation of float voltages after the first 1-2 months is an indication that the batteries may be out of balance. If individual battery voltage readings during float charge vary by more than 0.10 volt per cell (0.10 volt for 2V batteries, 0.30 volt for 6V batteries, and 0.6 volt for 12V batteries), then a conditioning charge per Section 5.5 is recommended.

5.10 Recycling

Batteries that have reached the end of their service life should be returned to a local or regional collection center for recycling. All local regulations and ordinances must be followed. Never discard Lifeline® AGM batteries in the trash or in a landfill. The recycle rate of lead acid batteries is close to 100% and this is very good for the environment!



CHAPTER 6 - SAFETY INFORMATION

There are four main safety hazards associated with the use of any valve regulated lead acid (VRLA) battery. These hazards are: a) Release of ignitable gas, b) Exposure to acid, c) Shorting of terminals, d) Thermal runaway. This chapter provides a description of each of these hazards and means to mitigate them.

6.1 Release of Ignitable Gasses

All lead acid batteries, including VRLA batteries, produce hydrogen and oxygen gases during normal charging. Even though VRLA batteries are designed to recombine these gases internally, the recombination efficiency is less than 100%. Small amounts of hydrogen and oxygen are released from the pressure relief valve during charging. Normally, the hydrogen gas dissipates very rapidly and never reaches a concentration level that is hazardous. However, if the battery is installed in an enclosure with minimal airflow, the concentration of hydrogen could build up to a high enough concentration to be of concern. Hydrogen can ignite at concentrations as low as 4% in air. **For this reason, never install a Lifeline® AGM battery in a sealed or an airtight container.**

6.2 Exposure to Acid

All lead acid batteries contain sulfuric acid in the electrolyte, which can cause chemical burns to body tissue. Although Lifeline® AGM batteries are classified as Nonspillable, exposure to the electrolyte is possible under extreme conditions (e.g., if the battery is cracked open or crushed). **In the event that electrolyte is displaced from the battery, avoid contact with the skin, eyes and clothing. In the event of an accident, flush with water and call a physician immediately.**

6.3 Shorting of Terminals

Lifeline® AGM batteries have very low internal impedance and therefore are capable of delivering high currents if the external terminals are short circuited. The resulting heat can cause severe burns and is a potential fire hazard. Accidentally placing metal objects across the terminals can result in severe skin burns. **It is a good practice to remove all metallic items such as belt buckles, watches, bracelets and rings when installing or servicing batteries. As a further precaution, insulating gloves should be worn and only insulated tools should be used when installing or servicing batteries.**

6.4 Thermal Runaway

Thermal runaway is a condition in which the battery temperature increases rapidly resulting in extreme overheating of the battery. Under rare conditions, the battery can melt, catch on fire, or even explode. Thermal runaway can only occur if the battery is at high ambient temperature and/or the charging voltage is set too high. As the battery accepts current, its internal temperature rises. The rise in temperature reduces the battery impedance, causing it to accept more current. The higher current further heats the battery, and so on, causing the battery temperature to “runaway”. An upper limit will eventually be reached when the electrolyte starts to boil, but once the electrolyte has boiled away, the temperature can climb even further to the point of plastic meltdown and possible fire.

As of this writing, Concorde does not know of any Lifeline® AGM batteries that have failed due to thermal runaway. **To preclude the possibility of thermal runaway, the charging instructions in Chapter 5 should be carefully followed, especially if the battery will be subjected to high ambient temperatures. Batteries should not be installed near heat sources or in direct sunlight that may artificially elevate their temperature. Also, there should be adequate air circulation around the batteries to prevent heat build-up.**



APPENDIX A – GLOSSARY OF BATTERY TERMS

- AGM** - Stands for Absorbed Glass Mat. This is the separator system used in all Lifeline® AGM batteries.
- Active Material** - Electrode material which produces electricity during its chemical conversion. In the positive plate it is lead dioxide. In the negative plate, it is sponge lead.
- Ampere** - Unit of electrical current abbreviated as amps or A.
Amps = Watts/Volts or $A = W/V$.
- Ampere Hour (Ah)** - The capacity of a storage battery is measured in ampere hours. One ampere hour is defined as a current flow of one ampere for a period of one hour. Five ampere hours means a current flow of one ampere for five hours, a current flow of 2 1/2 ampere for 2 hours, or any multiple of current and time that will result in five. This relationship can be expressed as follows:
Capacity (Ampere hours) = $I \times T$, where I is the current (in amperes) and T is the time (in hours). The capacity of a storage battery is based on a given discharge rate, since the capacity will vary with the rate of discharge.
- Boost Charge** - A charge applied to a battery which is already near a state of full charge, usually of short duration.
- Capacity** - The quantity of electricity delivered by a battery under specified conditions, usually expressed in ampere hours.
- Capacity, Rated** - A designation by the battery manufacturer which defines the performance of a new battery at a defined rate of discharge. For Lifeline® AGM batteries, the rated capacity is based on the 20 hour rate.
- Capacity, Residual** - Capacity remaining at particular point in time and set of operating conditions, usually at a partial state of charge condition.
- Cell Reversal** - Reversing of polarity within a cell in a multi cell battery due to over discharge.
- Charge** - The conversion of electrical energy from an external source, into chemical energy within a cell or battery.
- Charge Rate** - The rate at which current is applied to a cell or battery to restore its capacity.
- Charge Retention** - The ability of a charged cell or battery to resist self discharge.
- Charge, State of** - Ratio of the amount of capacity remaining in a battery to the capacity when fully charged. A battery at 25% state of charge has 25% capacity remaining versus what it could give if fully charged.
- Charger** - Device capable of supplying electrical energy to charge a battery.
- Charging** - The process of converting electrical energy to stored chemical energy. The opposite of discharging.
- Charging Efficiency** - Ratio of the Ampere hours delivered on discharge to the Ampere hours needed to fully charge a battery.
- Conditioning** - A special constant current charge process used to restore a battery's capacity after extended storage periods or deep discharge exposure. Also known as reconditioning.
- Constant Current (CC) Charge** - Charging technique where the output current of the charge source is held constant. Warning! This procedure may damage the battery if performed on a repetitive basis.
- Constant Voltage (CV) Charge** - Charging technique where the output voltage of the charge source is held constant and the current is limited only by the resistance of the battery and / or the capacity of the charge source. Also known as Constant Potential (CP) charge.



- Current** - The rate of flow of electricity. The movement of electrons along a conductor. It is comparable to the flow of a stream of water. The unit of measurement is an ampere.
- Cut Off Voltage** - Battery voltage reached at the termination of a discharge. Also known as end point voltage or EPV.
- Cycle** - One sequence of discharge and charge.
- Cycle Life** - The total number of charge/discharge cycles before the battery reaches end of life (generally 80% of rated capacity).
- Deep Discharge** - Withdrawal of more than 80% of the rated capacity.
- Depth Of Discharge** - The portion of the capacity taken out during a discharge, expressed as a percent of rated capacity.
- Discharge** - The conversion of the chemical energy of a cell or battery into electrical energy and withdrawal of the electrical energy into a load.
- End Of Life** - The stage at which the battery fails to deliver acceptable capacity (typically 80% of nameplate rating).
- Float charge** - A method of maintaining a battery in a charged condition by continuous, long term, constant voltage charging at level sufficient to balance self-discharge.
- Gassing** - The evolution of gas from one or more of the electrode plates in a cell. Gassing commonly results from local action (self discharge) or from the electrolysis of water in the electrolyte during charging.
- Internal Impedance** - Same as Internal Resistance.
- Internal Resistance** - The opposition or resistance to the flow of a direct electric current within a cell or battery; the sum of the ionic and electronic resistance of the cell components. Its value varies with the current, state of charge, temperature, and age. With an extremely heavy load, such as an engine starter, the cell voltage may drop significantly. This voltage drop is due to the internal resistance of the cell. A cell that is partly discharged has a higher internal resistance than a fully charged cell, hence it will have a greater voltage drop under the same load. This change in internal resistance is due to the accumulation of lead sulfate in the plates.
- Open Circuit Voltage** - The voltage of a battery when it is not delivering or receiving power, and has been at rest long enough to reach a steady state (normally, at least 4 hours).
- Overcharge** - The forcing of current through a cell after all the active material has been converted to the charged state. In other words, charging continued after 100% state of charge is achieved. The result will be the decomposition of water in the electrolyte into hydrogen and oxygen gas, heat generation, and corrosion of the positive electrode.
- Self Discharge** - The decrease in the state of charge of a cell or a battery, over a period of time, due to internal electrochemical losses.
- Series Connection** - Voltage of the system is cumulative. Capacity stays the same.
- Shelf Life** - The period of time (measured from date of manufacture) at a specified storage temperature after which the cell or battery needs to be boost charged so it does not suffer permanent capacity loss.
- State Of Charge (SOC)** - The available ampere hours in a battery at any given time relative to its full charge capacity.
- State Of Health (SOH)** - The available ampere hours in a battery when fully charged relative to its rated capacity.
- Sulfation** - Refers to the formation of hard lead sulfate crystals in the plates that are difficult, if not impossible, to reconvert to active material.
- Temperature, Ambient** - The average temperature of the battery's surroundings.



- Temperature, Cell** - The average temperature of the battery's internal components.
- Trickle Charging** - Method of charging in which the battery is either continuously or intermittently connected to a constant current charging source to maintain the battery in a fully charged condition. Not recommended for use with Lifeline® AGM batteries.
- Vent Valve** - A normally closed check valve located in a cell which allows the controlled escape of gases when the internal pressure exceeds its rated value.
- Venting** - A release of gas either controlled (through a vent) or accidental from a battery cell.



APPENDIX B – FREQUENTLY ASKED QUESTIONS (FAQ'S)

1. What does AGM stand for?

It stands for Absorbed Glass Mat, the type of separator used in all Lifeline® AGM batteries.

2. What is the difference between AGM batteries and Gel batteries?

Both AGM and Gel batteries utilize oxygen recombination and pressure relief valves to minimize water loss and allow maintenance-free operation. That is where the similarities end. AGM batteries have the advantage of being mountable in any orientation without capacity loss, have lower internal impedance to support high load currents, and have better capacity at low temperatures. Gel batteries must be mounted upright to prevent air pockets from forming that will burn out the plates. They have inferior performance at high discharge rates and low temperatures. Refer to Chapter 3 for further details.

3. Why should I choose Lifeline® AGM batteries?

Concorde has been supplying Lifeline® AGM batteries to the marine and recreational vehicle marketplace for over 20 years, providing excellent performance, reliability and life. With this long history and wide variety of successful applications, prospective customers are assured that Lifeline® AGM batteries have proven themselves over and over again.

4. What depth of discharge should be used when sizing a battery?

To get the best cycle life, the average depth of discharge should be as low as possible. Concorde recommends the average depth of discharge be no greater than 50% of the battery's 20 hour rating.

5. What is the maximum number of batteries that can be connected in parallel?

There is no theoretical limit to the number of batteries that can be connected in parallel. As more batteries are paralleled together, the risk of one faulty battery affecting the entire battery bank increases. Depending on the criticality of the application, there may be a need to isolate each battery or battery string for fault protection or to allow servicing of individual batteries. This can be accomplished by incorporating additional circuitry in the battery system that includes fuses, circuit breakers, or diodes. For more details on this subject, contact Concorde Battery for technical assistance.

6. May Lifeline® AGM batteries be installed in sealed containers?

NO! Do not install Lifeline® AGM batteries in a sealed container or enclosure. During storage, charging, or discharging hydrogen gas can be released and must be ventilated to prevent the possibility of ignition and/or explosion.

7. What is the best way to charge my battery?

Charge with a 3 stage charger that compensates the voltage setting as the battery temperature changes. See Section 5.4 for further information.

8. What is the best charge voltage setting for outdoor applications if temperature sensing is not available?

NONE! Charging voltage varies widely depending on the battery's temperature and there is no single voltage that will work over a wide temperature range. Batteries will fail prematurely if this is attempted.

9. How can I tell if my battery is fully charged?

For a battery at room temperature, it can be considered fully charged when the charging current falls below 0.5A per 100Ah of rated capacity. The open circuit voltage (after at least 4 hours of rest) will be 2.17 volts per cell or higher (13.0 volts for a 12-volt battery), regardless of the battery temperature.

10. What causes some batteries to have convex or concave end walls?

Lifeline® AGM batteries contain a pressure relief valve (PRV) that prevents excessive pressure buildup when the battery is being charged, and automatically reseals once the pressure is released. A slight bulge in the battery container (convex end walls) can appear when the internal pressure is above the surrounding atmospheric pressure but not enough to open the PRV. Alternatively, the end walls can flex inward (concave end walls) when the internal pressure is less than surrounding atmospheric pressure. Both of these conditions are normal and do not affect the battery's operation



11. Do all the batteries in a series string have to be the same model/size?

Yes. Do not mix different models/sizes of batteries in the same string.

12. Are there any issues with having parallel strings of different battery models/sizes, as long as each string has the same model/size battery in series?

No, since the strings are in parallel they will operate at the same voltage level and will self-regulate. Refer to Section 5.2 for proper installation procedures for parallel strings. Make sure the batteries are all at 100% state of charge before connections are made.

13. Are there any issues with adding a new battery string in parallel with an old string?

No, since the strings are in parallel they will operate at the same voltage level and will self-regulate. Refer to Section 5.2 for proper installation procedures for parallel strings. Make sure the batteries are all at 100% state of charge before connections are made.

14. Is it better to use 2V, 6V or 12V batteries as building blocks to make a 24V or 48V battery bank?

As long as the total voltage and capacity of the bank is equivalent, it doesn't make a lot of difference which voltage is selected for the building block. To minimize the number of parallel connections in higher capacity banks, it is sometimes preferable to use 2V or 6V batteries instead of 12V batteries. However, having just one string of 2V or 6V batteries may not be the best choice because a single point failure in that string would take down the entire bank.

15. How do I know when it is time to replace my battery?

Replace the battery when it no longer is capable of supporting the discharge load for the minimum required run time. See Section 5.7 and/or Section 5.9 for capacity testing procedure. Note: short duration load tests and impedance/conductance measurements are not reliable to determine the actual capacity of a battery.

16. Can I replace one or several bad batteries in a series string without affecting the other batteries in that string?

Unless the string is fairly new (less than 12 months year old), replacing only the bad one(s) will cause the other batteries to be under-charged and/or over-discharged, which will negatively affect their performance and remaining life. Therefore, it is best to replace the entire string. However, if it is decided to replace only one or some of the batteries, make sure all the batteries are at 100% state of charge before connections are made.



APPENDIX C – CHARTS AND GRAPHS

Battery Load Voltage vs. DOD

Below are listed the one hour, 8 hour, 24 hour and 120 hour load voltages during a discharge cycle to 100% discharge (10.5V endpoint) for a 12V battery at 77°F (25°C).

DOD (%)	1 hr. Rate	8 hr. Rate	20 hr. Rate	120 hr. Rate
10	12.23	12.60	12.65	12.69
20	12.16	12.51	12.55	12.58
30	12.07	12.39	12.42	12.45
40	11.96	12.25	12.28	12.32
50	11.83	12.11	12.15	12.18
60	11.70	11.98	12.02	12.05
70	11.55	11.79	11.83	11.88
80	11.38	11.59	11.61	11.65
90	11.15	11.32	11.34	11.40
100	10.50	10.50	10.50	10.50

NOTE: Multiply by 2X for a 24V battery bank and 4X for a 48V battery bank.

Note that these voltages are approximate and will vary as the battery ages. They are, however, a fair indicator of state of charge and can be used when setting low voltage alarms or disconnects. For example, if the average load is 50A and the battery has a rated capacity of 400 AH at the 8 hr. rate, the minimum discharge voltage would be 12.11 volts for a 50% DOD.

SOC (%) vs. OCV

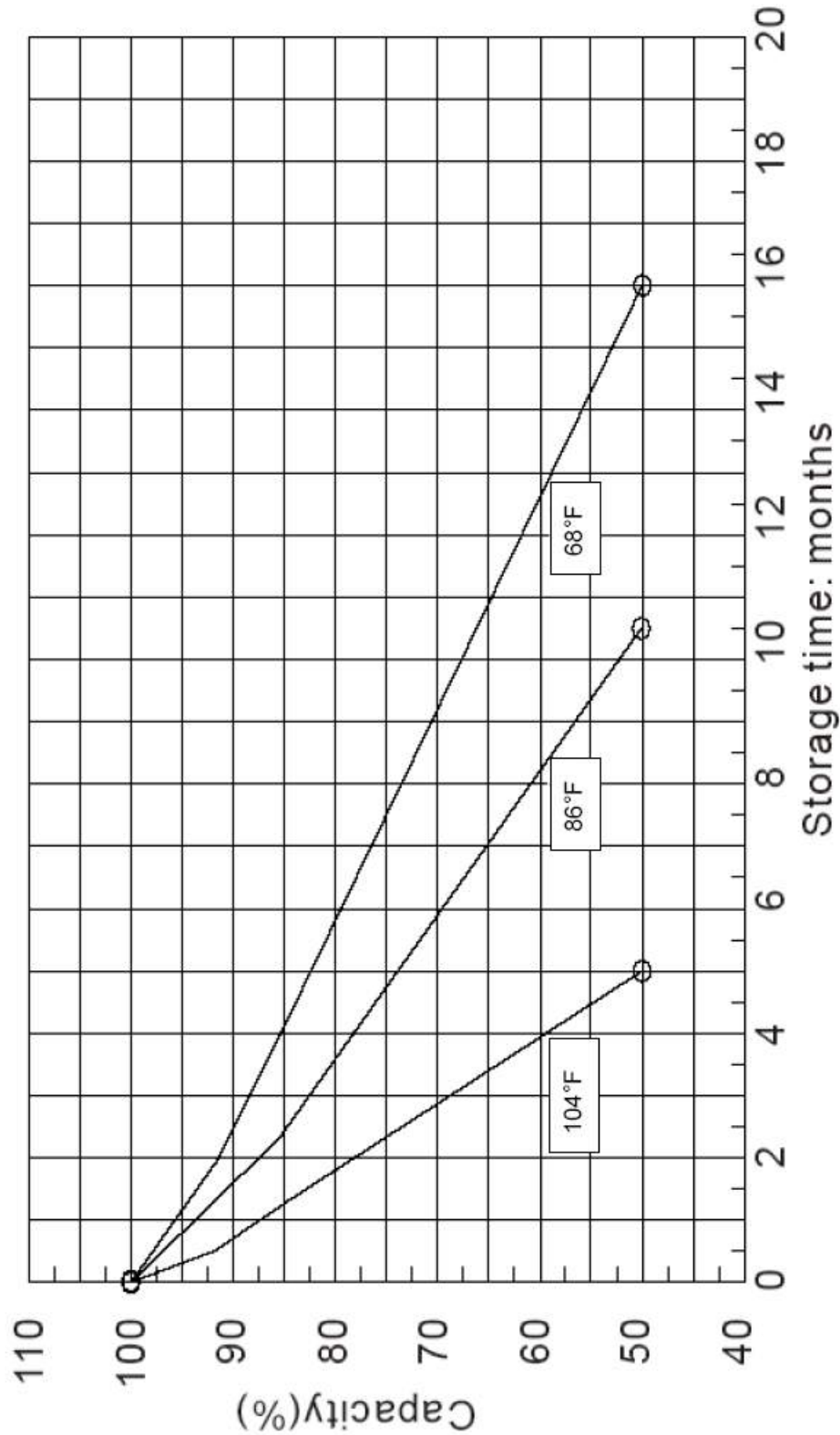
An easy method to estimate the State of Charge (SOC) of the battery is by measuring its Open Circuit Voltage (OCV). This measurement should be made after the battery has been at rest for a minimum of four hours with the battery shut off from its charging source and load. The reference temperature is 77°F (25°C), but the OCV does not change appreciably at other temperatures (temperature coefficient is 0.10 millivolts/cell per °F).

State of Charge (%)	OCV of 2V battery	OCV of 6V battery	OCV of 12V battery	OCV of 24V battery	OCV of 48V battery
100	>2.13	>6.39	>12.78	>25.56	>51.12
90	2.11	6.33	12.66	25.32	50.64
80	2.09	6.27	12.54	25.08	50.16
75	2.08	6.24	12.48	24.96	49.92
70	2.07	6.21	12.42	24.84	49.68
60	2.05	6.15	12.30	24.60	49.20
50	2.03	6.09	12.18	24.36	48.72
40	2.01	6.03	12.06	24.12	48.24
30	1.99	5.97	11.94	23.88	47.76
25	1.98	5.94	11.9	23.76	47.52
20	1.97	5.91	11.82	23.64	47.28
10	1.95	5.85	11.70	23.40	46.80
0	<1.93	<5.79	<11.58	<23.16	<46.32

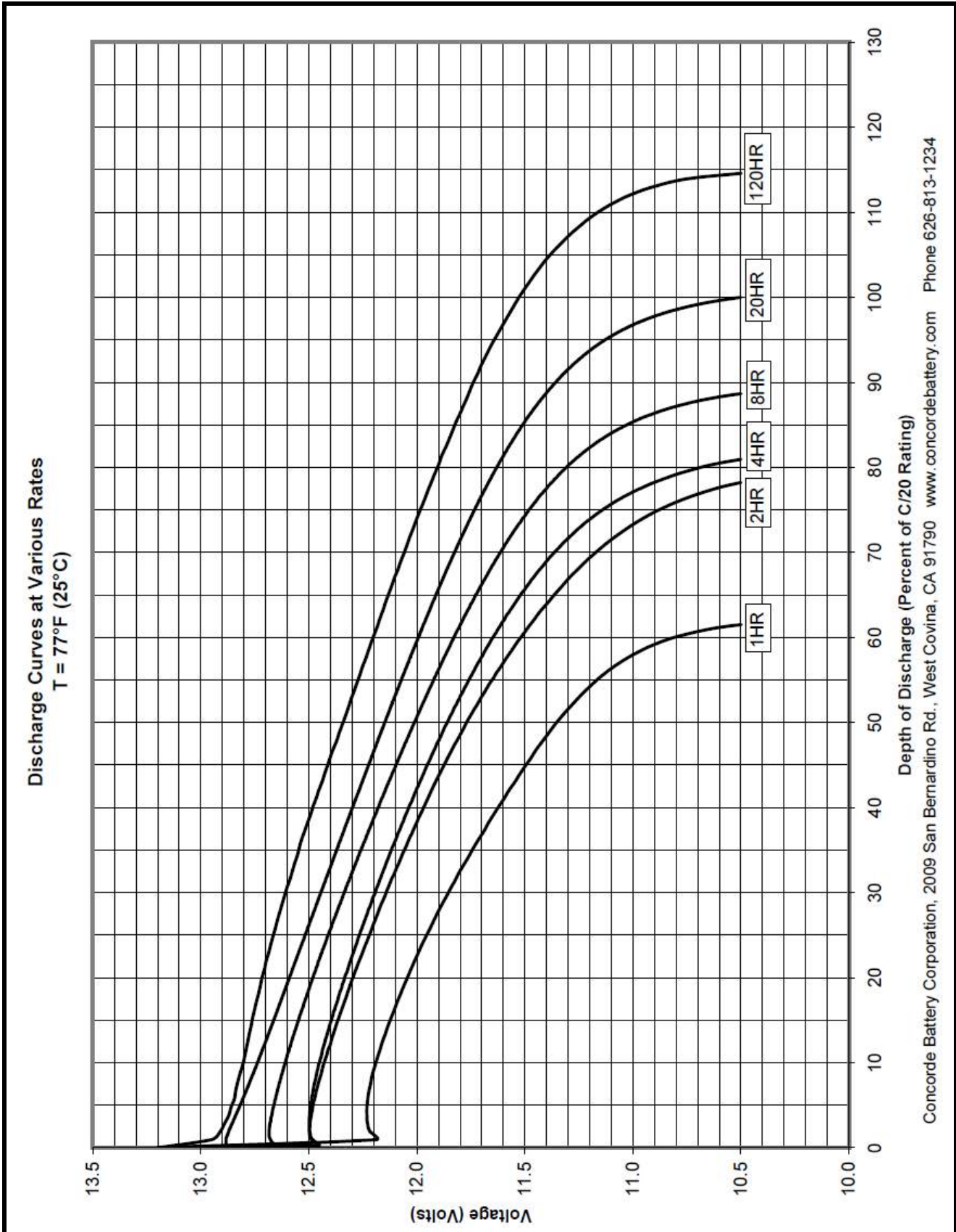
These voltage levels are applicable for aged batteries. The voltage levels for a new battery will be somewhat higher at a given state of charge. For example, a new battery typically has an OCV of 2.17 volts per cell (13.0 for a 12V battery) or higher at 100% SOC.



Self Discharge Characteristics



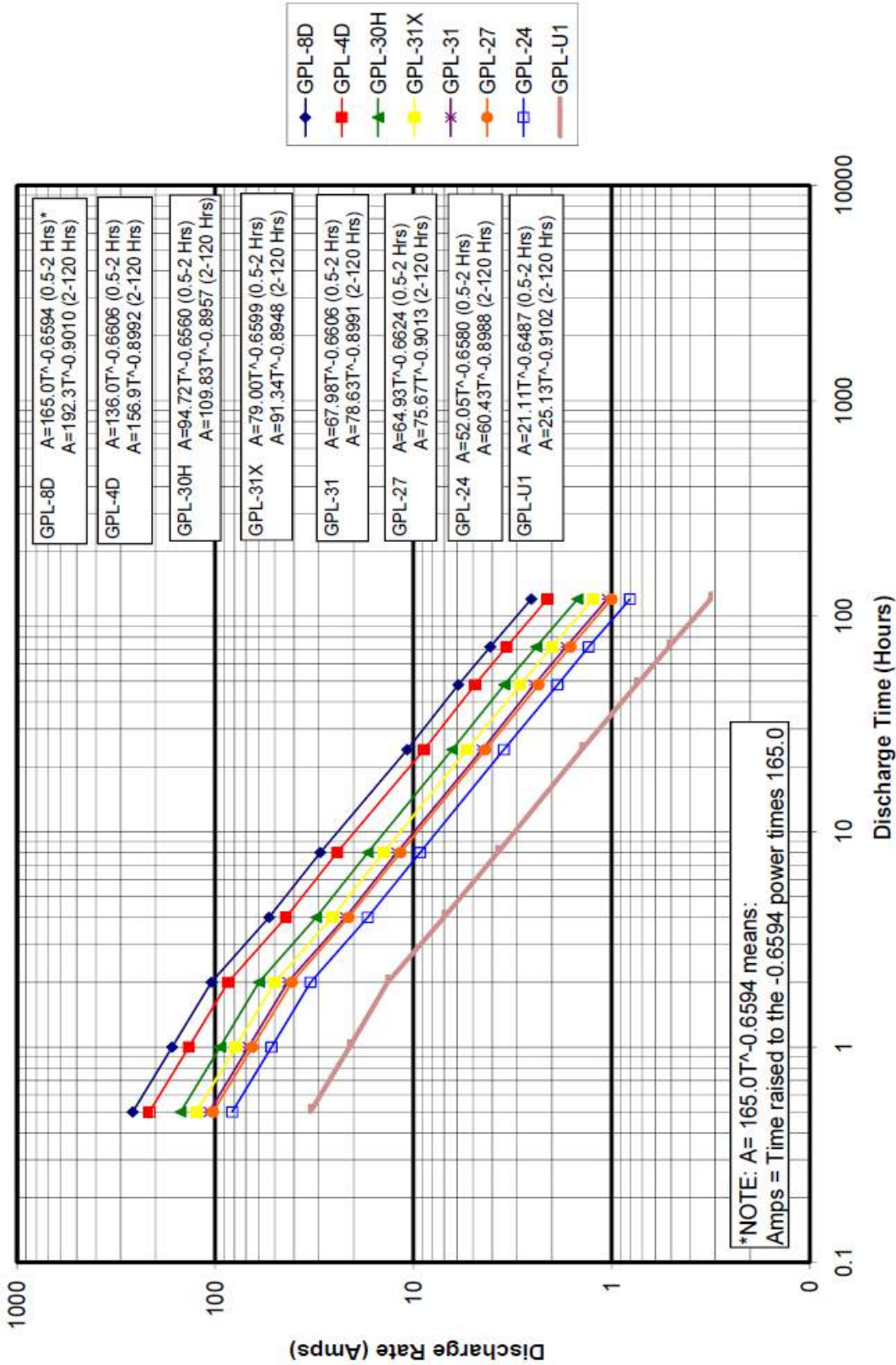
Concorde Battery Corporation, 2009 San Bernardino Rd., West Covina, CA 91790 www.concordebattery.com Phone 626-813-1234



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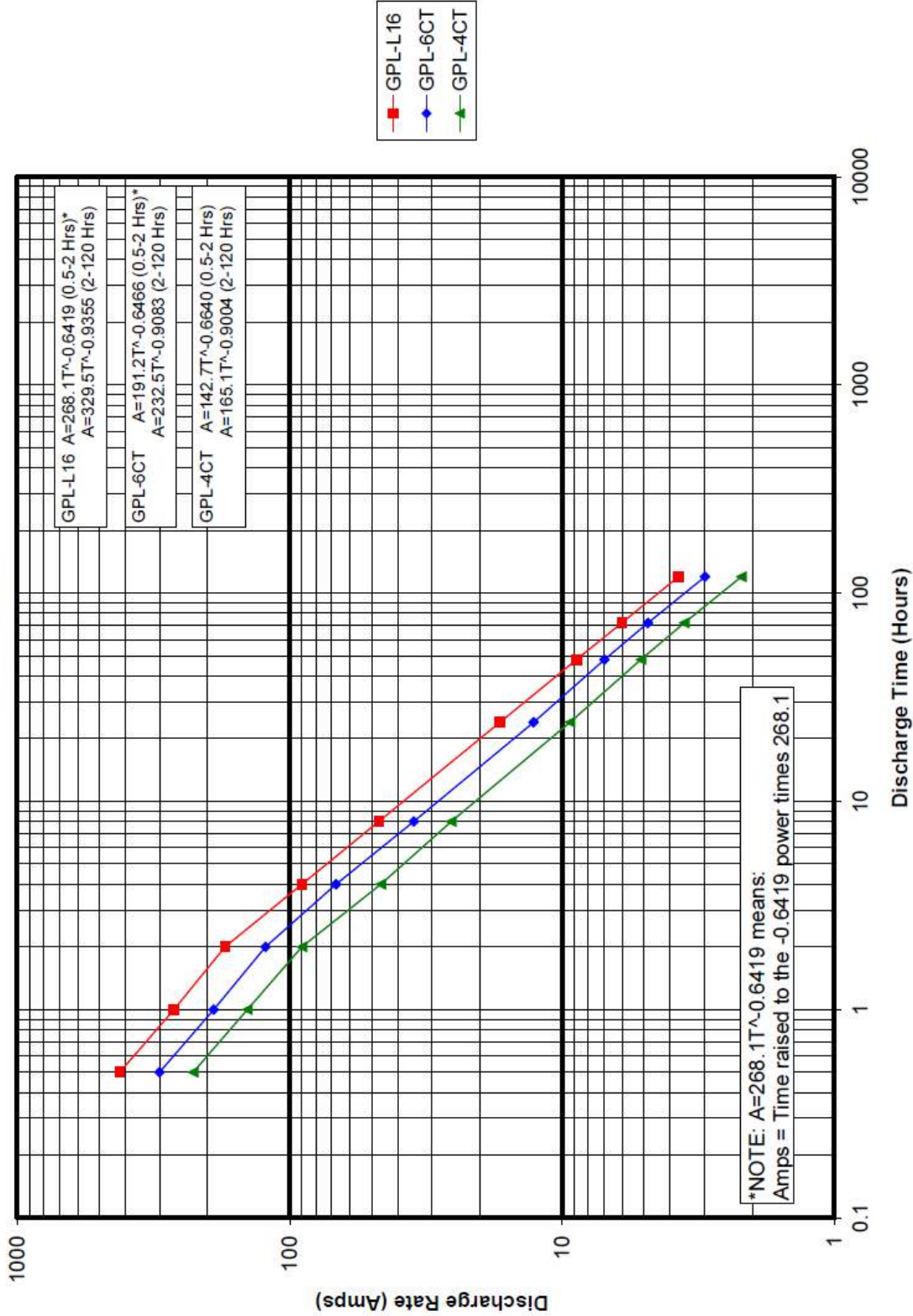
Peukert Plot for GPL Deep Cycle Batteries
12-Volt Models



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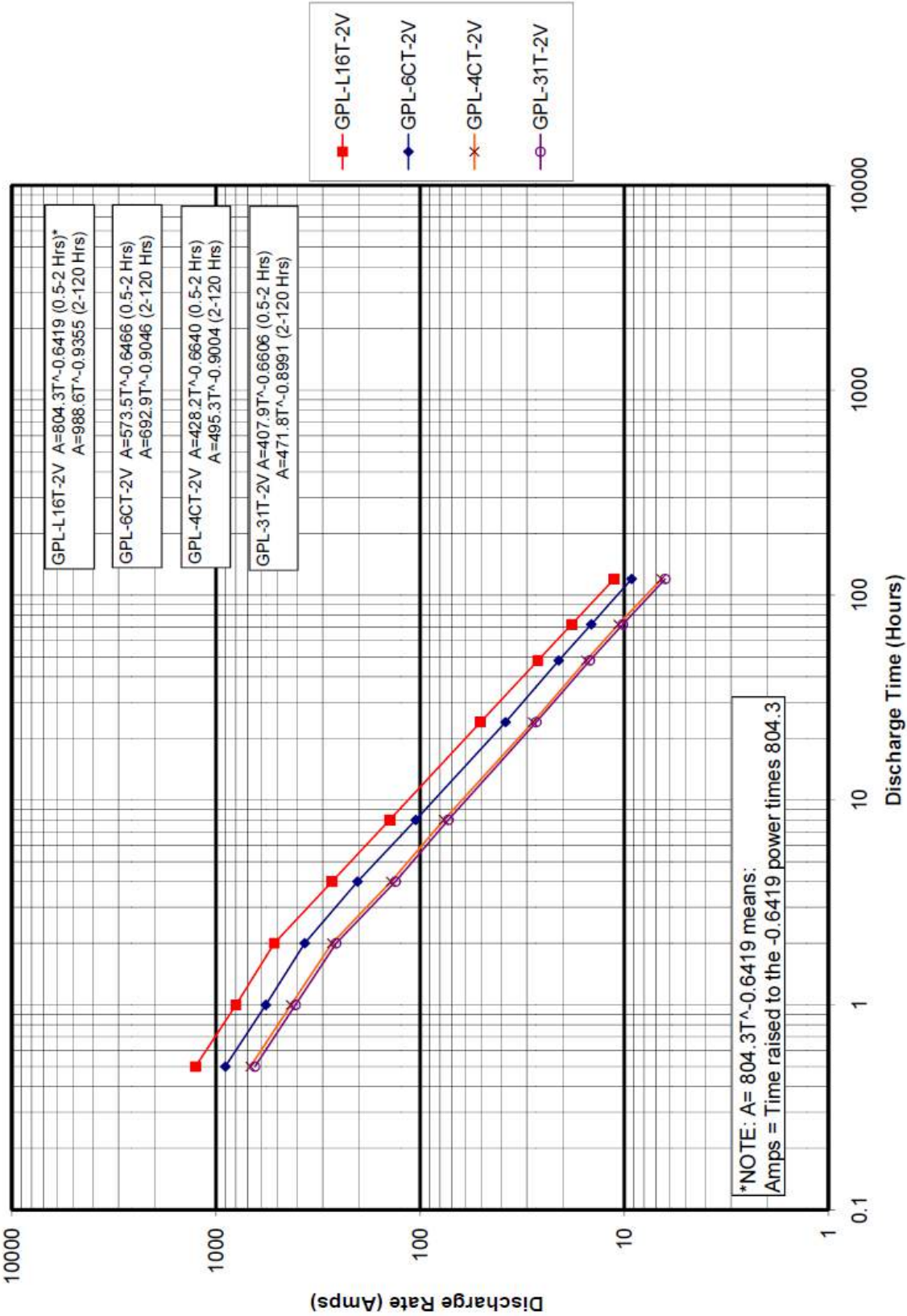
Peukert Plot for GPL Deep Cycle Batteries
6-Volt Models



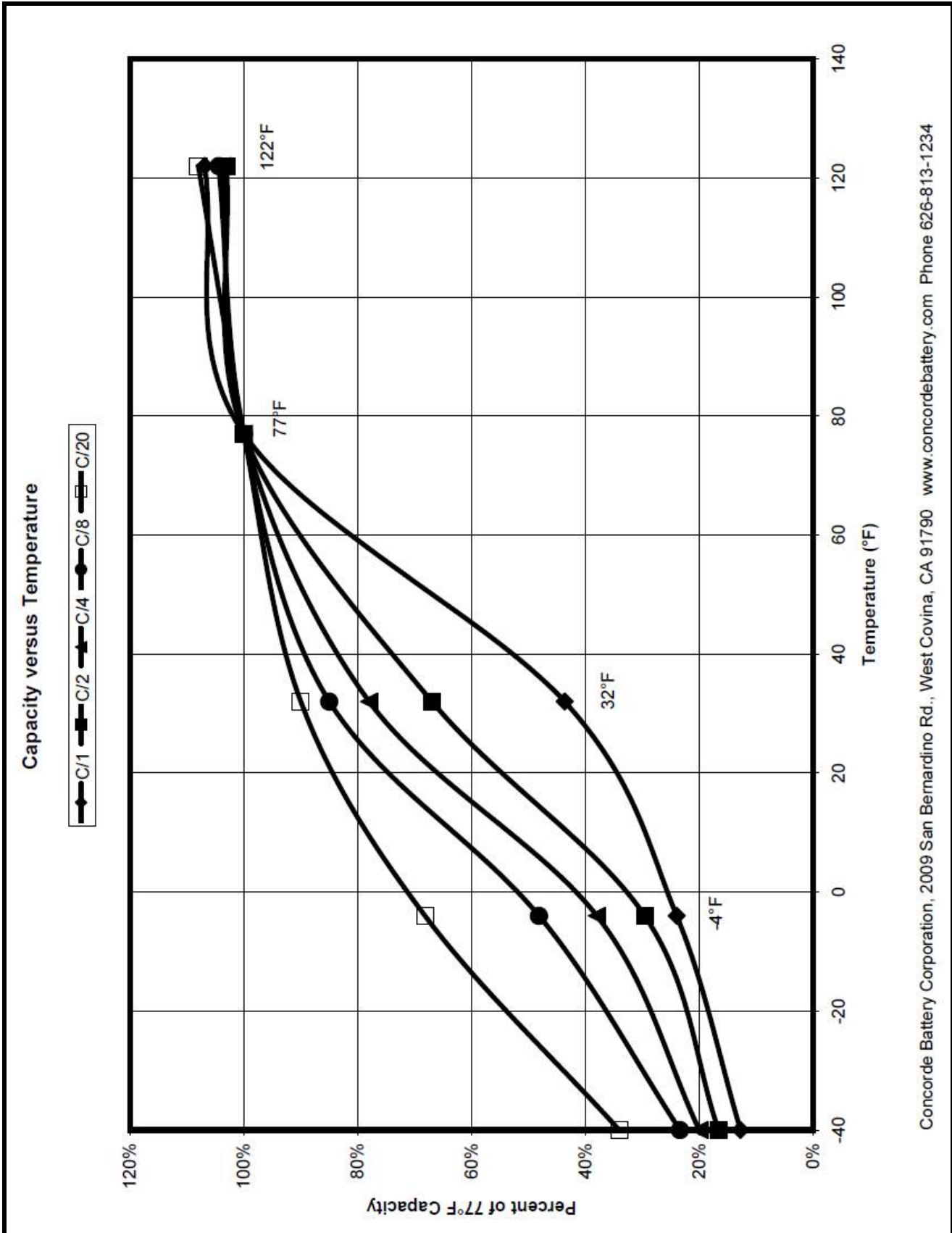
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Peukert Plot for GPL Series
2-Volt Models



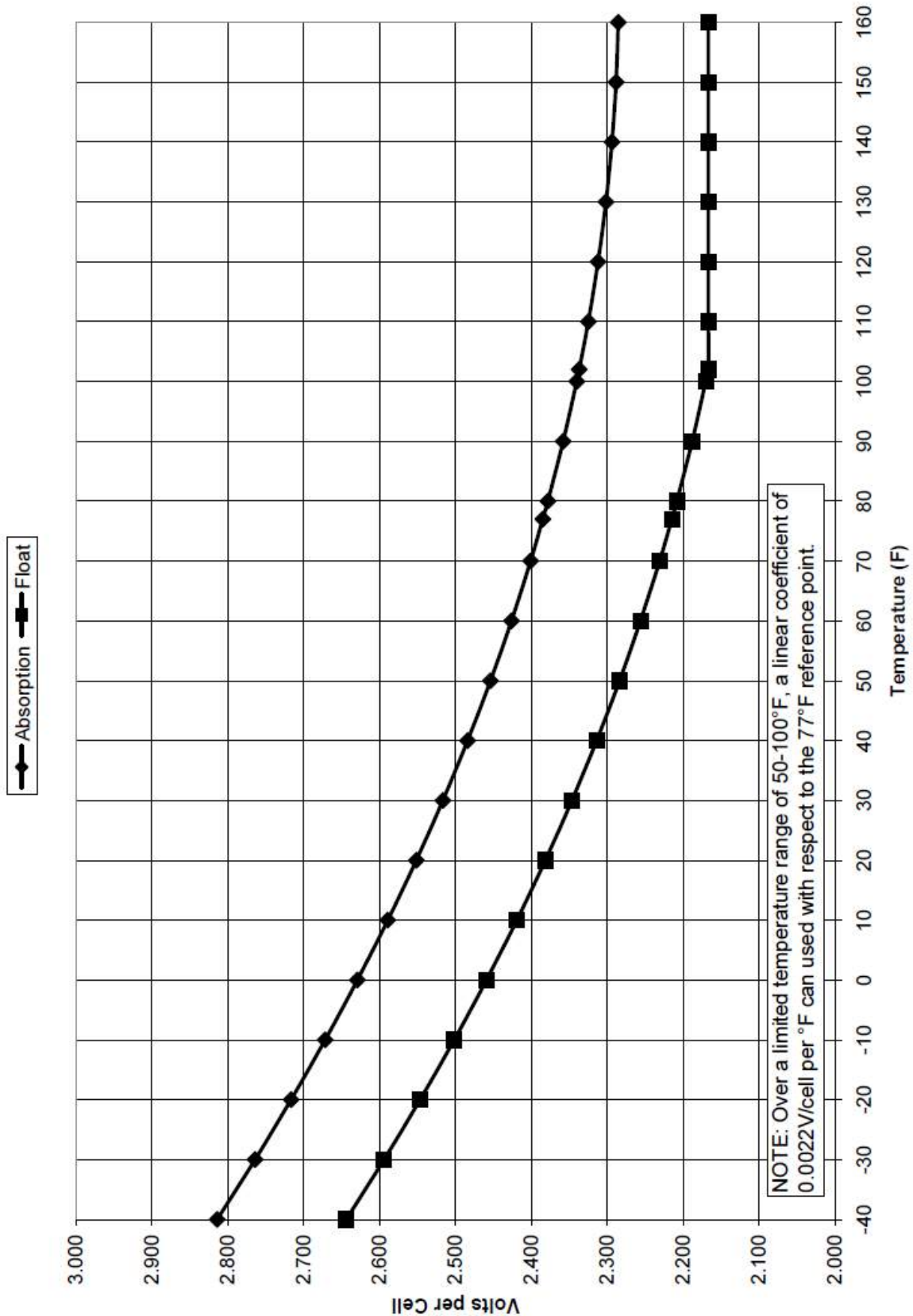
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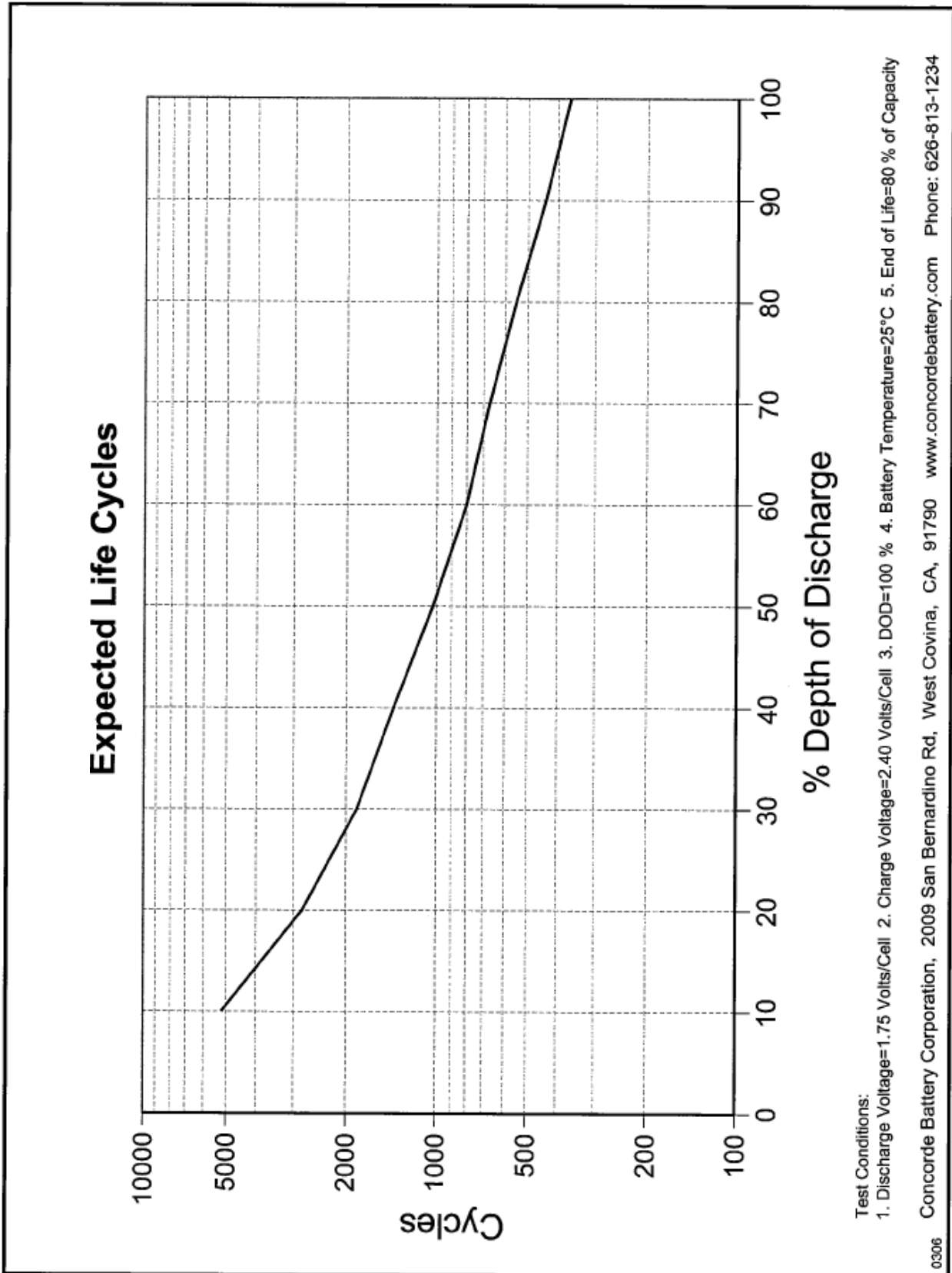
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Charge Voltage vs. Temperature



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Truma AquaGo® LP Gas Instant Water Heater

Model: Truma AquaGo® basic (DLE60B) *
 Truma AquaGo® comfort (DLE60C) *
 Truma AquaGo® comfort plus (DLE60CP) *

* Patent Pending

⚠ WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result, causing property damage, personal injury, or death.

– Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS

- Evacuate all persons from the vehicle.
- Shut off the gas supply at the gas container or source.
- Do not touch any electrical switch, or use any phone or radio in the vehicle.
- Do not start the vehicle's engine or electric generator.
- Contact the nearest gas supplier or certified service technician for repairs.
- If you cannot reach a gas supplier or certified service technician, contact the nearest fire department.
- Do not turn on the gas supply until gas leaks have been repaired.

Installation and service must be performed by a certified service technician, service agency, or the gas supplier.

US

Operating instructions
Installation instructions

Page 2
 Page 25

To be kept in the vehicle.
 This document is part of the water heater.



Conforms to ANSI Std. Z21.10.3
 Certified to CSA Std. 4.3

Sales and Service

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 825 East Jackson Blvd.
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 Fax 1-574-538-2426
 info@trumacorp.com
 www.truma.net





Truma AquaGo® instant water heater (appliance)

Overview / Designation of parts

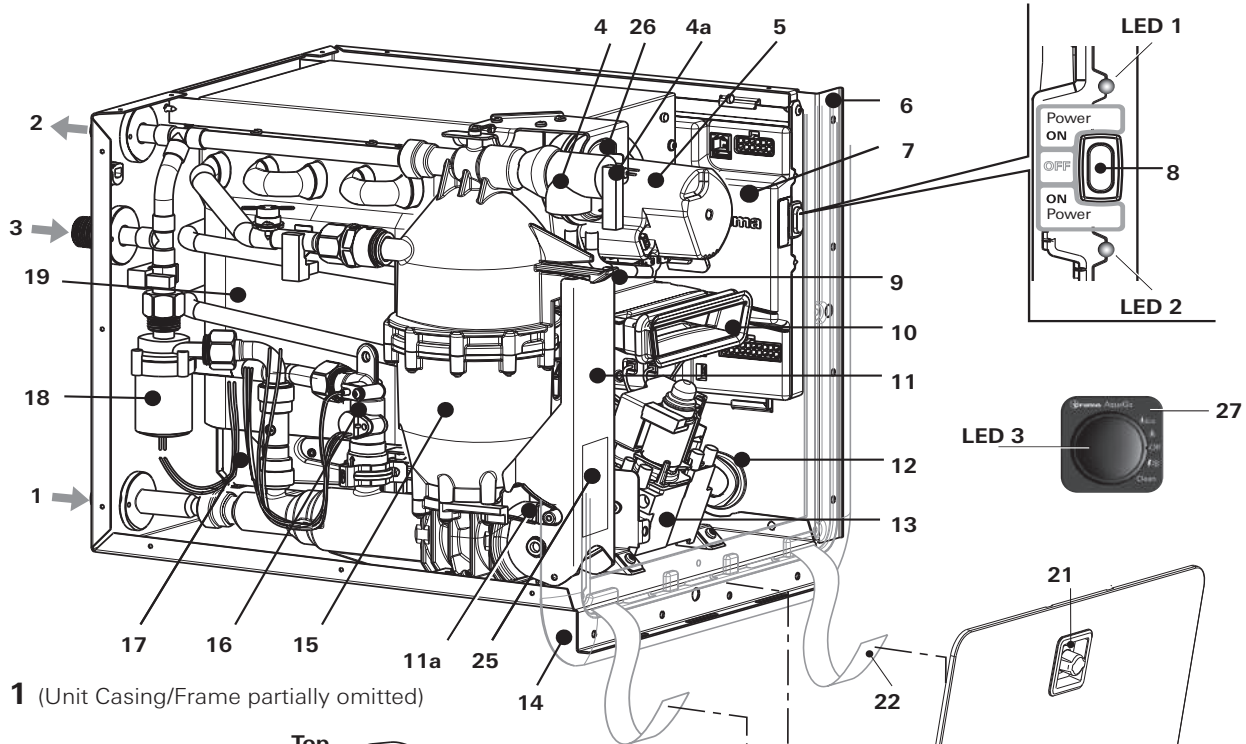


Fig. 1 (Unit Casing/Frame partially omitted)

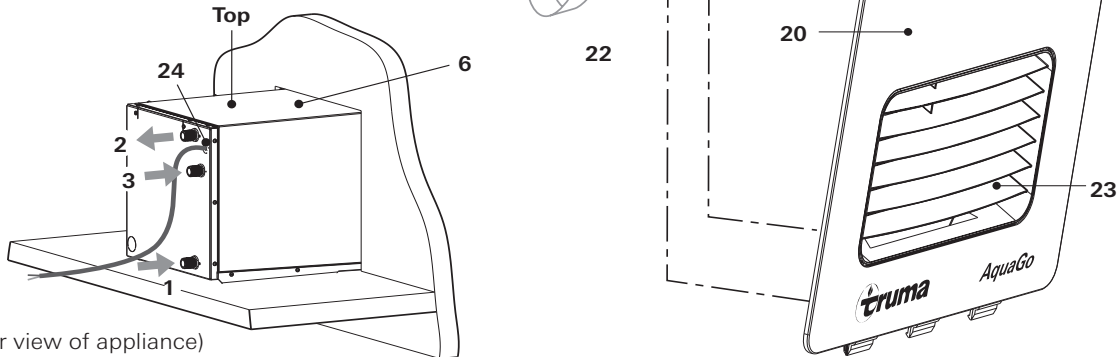


Fig. 2 (rear view of appliance)

Legend

- | | |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1 Cold water connection 1/2 in. NPT | 15 Temperature stabilizer |
| 2 Hot water connection 1/2 in. NPT | 16 Water flow sensor |
| 3 Circulation line connection 1/2 in. NPT (AquaGo® comfort plus model only) | 17 Burner |
| 4 Pressure relief valve | 18 Circulation pump (AquaGo® comfort and AquaGo® comfort plus models) |
| 4a Test lever | 19 Heat exchanger |
| 5 Flue fan | 20 Access door (assembly) |
| 6 Unit casing | 21 Turn lock |
| 7 Control unit | 22 Webbing |
| 8 POWER switch | 23 Venting grid (air inlet, exhaust) |
| 9 Latch | 24 Grommet for 12 V cable (power supply) |
| 10 Flue duct | 25 Type plate |
| 11 Easy Drain Lever | 26 Exhaust pressure switch |
| 11a Water inlet filter | LED 1 Power ON LED – green |
| 12 Gas pipe grommet (side) | LED 2 Error code LED – red |
| 13 Gas valve | LED 3 Status LED 3 – yellow |
| 14 Cover plate | |



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Intended use

The Truma AquaGo® instant water heater (appliance) may be used only to heat water in recreational vehicles (RVs) that are used for recreation, travel, or camping.

RVs are recreational vehicles designed as temporary living quarters for recreation, camping, or travel use. Such vehicles have their own power or are towed by another vehicle.

Prohibited use

Any use other than the intended use (see above) is prohibited.

Examples of prohibited use:

- Use in a marine environment.
- Use as part of a space heating system.
- Use in mobile homes.
- Use in food trucks or roadside food vending vehicles.
- Use in construction trailers.
- Use as a pool heater.

California Proposition 65 lists chemical substances known to the state to cause cancer, birth defects, death, serious illness, or other reproductive harm. This product may contain such substances or such substances may be formed from combustion of fuel (gas) or be components of the product itself.



Consumer Safety Information

Safety symbols and signal words

⚠ This is the safety alert symbol. This symbol alerts you to potential hazards that can kill or hurt you and others.

⚠ DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE is used to address practices not related to physical injury.

i Other important information or tips

Safety behavior and practices

Ensuring a safe operating environment

- **⚠ DANGER** Suffocation through exhaust gases. To ensure dissipation of exhaust gases, operate the appliance outdoors only.
 - Never use in enclosed spaces or tents or breathe in the exhaust gases.
 - If installing an awning, make sure that the exhaust system terminates to the outdoors.
 - If you park the RV in an enclosed space, such as a garage or repair shop:
 - You must block the fuel supply.
 - You must switch the appliance off at the control panel.
- Use the appliance only with a functioning LP gas and carbon monoxide detector installed in the RV. For installation, operation and function test follow the manufacturer's guidelines.

- Keep the air inlet and exhaust outlet free of obstructions in order to ensure clean combustion.
- **Do not** place articles on or against the appliance. Do not lean any objects against the water heater's access door or place any foreign objects within 2 feet (61 cm) of the access door.
- **Do not** use or store flammable materials near the appliance.
- **Do not** spray aerosols in the vicinity of the appliance while it is in operation.
- **Do not** modify the appliance.

Responsibilities of the operator

- Avoid possible serious health issues caused by electromagnetic radiation. All persons with a pacemaker are prohibited from opening the access door and maintaining the appliance during operation.
- The operator is responsible for the water filled into the appliance and its quality.
- The use of upright gas cylinders from which gas is taken in the gas phase is mandatory for the operation of gas regulators, gas equipment and gas systems. Gas cylinders from which gas is taken in the liquid phase (e. g. for forklifts) must not be used, since they would result in damage to the gas system.
- For your own safety it is absolutely necessary to have the complete gas installation regularly checked by an expert (at least every 2 years). The vehicle owner is always responsible for arranging the gas inspection.



Safe operation

- Use with LP gas (propane) only. Butane or any mixtures containing more than 10% butane must not be used.
- LP tanks must be filled by a qualified gas supplier only.
- The nominal gas system pressure must be 10.5 in. wc.
- Hot water can be dangerous, especially for infants, children, the elderly, or infirm. It can cause severe burns. Therefore:
 - Never actuate the pressure relief valve (Fig. 1 – 4) as long as the appliance is still hot.
 - Never actuate the Easy Drain Lever (Fig. 1 – 11) as long as the appliance is under water pressure and/or still hot.
 - Always check the water temperature before entering a shower or bath.
- How long before hot water causes skin damage?

Temperature °F (°C)	Time before skin becomes scalded
155 (68)	1 second
148 (64)	2 seconds
140 (60)	5 seconds
133 (56)	15 seconds
127 (52)	1 minute
124 (51)	3 minutes
120 (48)	5 minutes
100 (37)	safe bathing temperature

Source: Moritz, A.R. / HERRIGUES, F.C.: Studies of thermal injuries: the relative importance of time and surface temperature in causation of cutaneous burns A. J. Pathol 1947; 23: 695 – 720

- The water pressure on the inlet side must be limited to 65 psi (4.5 bar), otherwise internal components of the appliance will be damaged. On (city) water connections with a pressure higher than 65 psi (4.5 bar) a pressure regulator is strongly recommended.

While driving

- To avoid damage, make sure the access door (Fig. 1 – 20) to the appliance is closed before moving the RV, as follows:
 - Turn lock is engaged.
 - Access door is flush with the cover plate.

- Shut OFF gas and the LP tank when moving the RV. This disables all gas appliances and pilot lights. Gas appliances must never be operated while the vehicle is in motion.
- Shut OFF the appliance when refueling or pumping gas, in multi-storey car parks, in garages or on ferries.
- To avoid damage, make sure no spray water enters the appliance when cleaning the RV, e.g., do not spray directly into the openings/venting grid.

Safe handling of malfunctions

- Switch OFF the gas supply and the appliance:
 - if anything seems to be out of the ordinary.
 - if you smell gas.
- **⚠ DANGER** Fire / explosion if you attempt to use an appliance that has been damaged by flooding or if the vehicle has been involved in an accident. A damaged appliance must be repaired by an expert or be replaced.
- Only carry out repairs yourself if the solution is described in the troubleshooting guide of this manual.
- A damaged appliance may have to be replaced with a new one.

Safe maintenance and repair

- Repairs may only be carried out by an expert.
- Children must not carry out maintenance, repair or cleaning work.
- Before accessing terminals, please secure all supply circuits (i.e. 12 V) and ensure that the gas supply is securely turned off.
- Any work involving connection or interconnecting wiring must be carried out by a licensed electrician.



TRUMA AQUAGO COMFORT WATER HEATER

- Only use Truma AquaGo® decalcification tablets to decalcify the appliance to avoid damage and the voiding of your warranty. Never use vinegar. Call your local AquaGo® dealer or service provider or see www.truma.net for more information.
 - The use of non-Truma-approved substances for decalcification can cause chemical reactions and produce hazardous substances that could enter the drinking water.
- Any alteration to the appliance or its controls can cause unforeseen serious hazards and will void the warranty.
- After a long period of winterization: Flush all hot/cold water hoses and the appliance thoroughly with drinking water before using it.
- Keep the appliance free of foreign objects, e.g., leaves, animals, spiderwebs, and keep the area around free of snow and ice. The appliance will not function properly if the intake air or exhaust terminal is obstructed.

Safety features

The appliance is equipped with the following safety devices:

Flame monitoring

If the flame goes out, the gas supply to the burner is switched off (after 3 failed restarts).

Low-voltage (over-voltage) shutdown

If the voltage drops below 10 VDC (or rises above 16.4 VDC), the appliance shuts off.

Overcurrent protection

If there is a short circuit in the appliance (>10 A), a fuse on the control unit is activated and the appliance is switched off.

Monitoring of the flue fan

If there is a failure of the flue fan, the gas supply to the burner is switched off.

Monitoring of hot water temperature

A water over temperature switch avoids excessively high water temperatures in case of a fault.



Operating Instructions

Read and follow the “Consumer Safety Information” before operating the appliance.

▲ WARNING

Scalding injuries caused by hot water!

Water temperatures over 127°F (52°C) can cause severe burns or scalding and in extreme cases even death.

- Before using the hot water faucet or using the shower, allow the hot water to run until the water temperature no longer increases.
- Test the temperature of the water before placing a child in the bath or shower.
- Do not leave a child or an infirm person in the bath unsupervised.

How the appliance works

The appliance was developed exclusively for use in recreational vehicles (RVs).

The appliance is connected between the vehicle’s fresh water supply and its hot water plumbing system.

It is powered by propane and a 12 V power supply. The ventilation grid on the access door allows combustion air to flow into the appliance and exhaust gas to flow out.

When the appliance is switched on, the water will be warmed on demand:

- A volume-flow sensor in the appliance detects when the hot water faucet has been opened and the volume flow is greater than approximately 0.4 gallons/min (1.5 liter/min). The burner then starts automatically.
- The burner control continuously adjusts the heater output based on volume flow and inlet water temperature, so that the temperature at the hot water outlet is approximately 120 °F (49 °C). A temperature stabilizer is also installed in the appliance to minimize fluctuations of the outlet temperature.

- After some time the maximum temperature at the faucet or in the shower is reached. The length of time will depend on the model (AquaGo® basic, AquaGo® comfort and AquaGo® comfort plus) and variations in the water plumbing (length of pipes, insulation, circulation line, etc.). Like in a home shower, a comfortable water temperature at the shower head is reached by mixing in cold water.
- When the volume flow is less than approximately 0.4 gallons/min (1.5 liter/min) and the faucet is closed, the burner is automatically switched off.

The AquaGo® comfort and AquaGo® comfort plus models are equipped with a circulation pump. The circulation pump as well as the burner are switched on automatically by the control unit in order to keep the water temperature above 102 °F (39 °C) in “COMFORT” mode and 41 °F (5 °C) in “ECO” mode.

NOTICE

Risk of damage in frosty conditions.
Refer to “Winter operation” on page 12.



Pressure relief valve

⚠ WARNING

Scalding injury from hot water and/or tampering with the pressure relief valve!

- Never actuate the pressure relief valve as long as the Truma AquaGo® instant water heater is still hot.
- Do not place a plug or reducing coupling on the outlet part of the valve.



- The pressure relief valve is a safety component and must not be removed for any reason other than replacement.
- The pressure relief valve is not serviceable; if defective, it must be replaced. It must be replaced by a certified service technician.
- Tampering with the pressure relief valve will void the warranty.

The appliance is equipped with a pressure relief valve (Fig. 3) that complies with the standard for Relief Valves for Hot Water Supply Systems, ANSI Z21.22

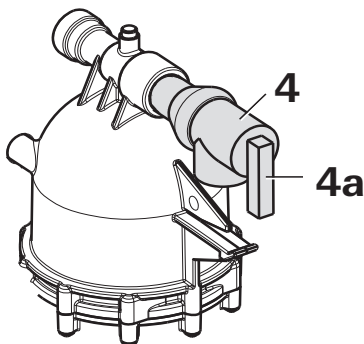


Fig. 3

- 4 Pressure relief valve
- 4a Test lever

Access door

Opening the access door

1. Turn the turn lock counterclockwise ↺ into the vertical position.

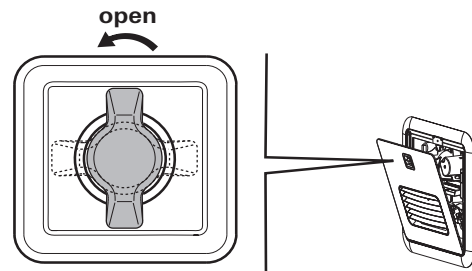


Fig. 4



- The access door can be opened in two different positions:
 - Position ① is the maximum opening width for switching the appliance on or off.
 - Position ② is the starting position for removing the access door.

NOTICE

Damage to the hinge!

- Do not try to remove the access door in Position ①. Position ① is the maximum opening width of the access door.
- Only remove the access door in Position ②.

2. Open the access door to Position ①.

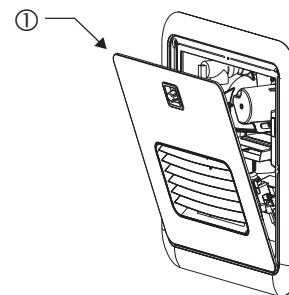


Fig. 5



Removing the access door

1. Open the access door to Position ②.
2. Move the access door upwards to remove it.

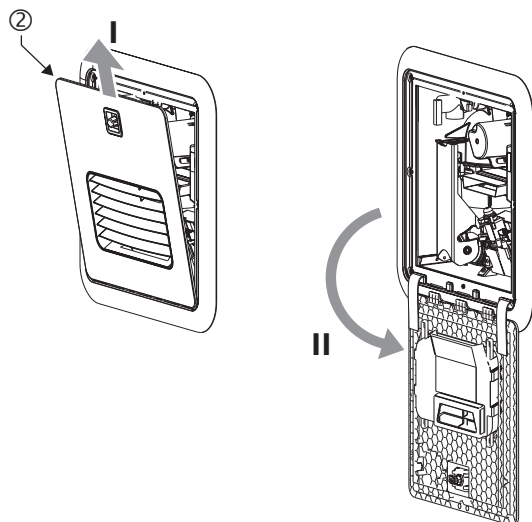


Fig. 6

Closing the access door

NOTICE

Damage to the access door and the RV if the access door is not closed properly!

- Make sure that the access door is flush with the cover plate when closed.

1. If removed, insert the access door into the cover plate.
2. Make sure that the webbing is not pinched between the access door and the cover plate.
3. Press the access door against the cover plate.
4. Turn the turn lock clockwise into the horizontal position.

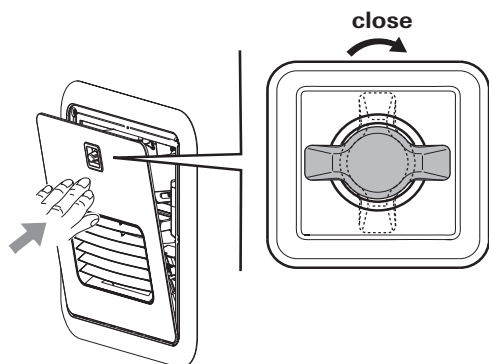


Fig. 7

Starting the appliance

▲ WARNING

Danger of over-temperature and toxic exhaust gases!

- Use with LP gas (propane) only. Butane or any mixtures containing more than 10 % butane must not be used.
- Keep the air inlet and exhaust gas outlet free of obstructions. Do not lean any objects against the water heater's access door or place any foreign objects within 2 feet (61 cm) of the access door.

▲ WARNING

Danger of combustion, personal injury and damage to RV!

- Keep the area around the appliance free from combustible materials, gasoline, and other flammable vapors or liquids.
- Switch the gas supply and the appliance off:
 - if anything seems to be out of the ordinary.
 - if you smell gas.
 - if you move the RV.
 - before entering a gas station.
 - before entering a tunnel.

Inspections before each use

Check the appliance for the following points before each use. In case of damage, contact an authorized Truma service provider and do not operate the appliance.

1. Check for visible damage, e.g., on the cover plate or access door.
2. Provide adequate quantities of propane gas and fresh water.
3. Switch ON and check 12 V power supply of your RV.
4. Check that the access door of the appliance is closed.
5. Keep the appliance free of foreign objects, e.g., leaves, animals, spiderwebs, and keep the area around free of snow and ice. The appliance will not function properly if the intake air or exhaust terminal is obstructed.



Operating procedures

NOTICE


Risk of damage in frosty conditions.

In frosty conditions there is a risk that water in pipes, faucets and appliances could freeze. This can cause considerable damage.

- Before you fill water into appliances and parts that transport water, you must heat the installation area sufficiently so that the water cannot freeze.

Proceed as follows to fill the appliance with water:

1. Close open bypass lines (if present).
2. Turn on fresh water supply or switch on water pump.
3. Fill the plumbing system.
 - Open all water-release points, e.g., cold and hot water faucets, showers, toilets.

 It is important that you bleed the water system before starting the appliance.

- Once water flows, the plumbing system is vented. Close the water-release points.

4. Start the appliance as follows:
 - Make sure that the LP gas supply is turned on.
 - Switch on the 12 V power supply (RV).
 - Open the access door (refer to "Opening the access door" on page 8).
 - Switch on the appliance at the POWER switch. Refer to "Switching ON the appliance" on page 11.

5. AquaGo® comfort / AquaGo® comfort plus:


- Select the desired operating mode (refer to "Operating modes (control panel)" on page 11).
- Close the access door (refer to "Opening the access door" on page 8).

▲ WARNING

Scalding injuries caused by hot water!

Water temperatures over 127°F (52°C) can cause severe burns or scalding and in extreme cases even death.

- Before using hot water faucet or using the shower, allow the hot water to run until the water temperature no longer increases.
- Test the temperature of the water before placing a child in the bath or shower.
- Do not leave a child or an infirm person in the bath unsupervised.

-  • There may be a variation between the temperature delivered from the appliance and the temperature at the faucet due to water conditions or the length of pipe from the appliance.
- The presence of a flow restrictor in the hot water line may limit the water flow.

How to use hot water:

- To obtain the desired water temperature at the faucet or in the shower, mix cold and hot water.
- Particularly when showering, wait until the water temperature has stabilized before entering or allowing other people or animals to enter the shower.



Switching ON the appliance

1. Open the access door (refer to “Opening the access door” on page 8).
2. To switch on the appliance, switch the POWER switch (Fig. 8 – 8) to one of the two “ON” positions.

i Both ON positions on the POWER switch have the same function. Choose your preferred position.

- When the green power ON LED 1 (Fig. 8 – LED 1) is lit, the appliance is switched on.
- If the red error code LED 2 (Fig. 8 – LED 2) is lit / flashes, there is a fault or warning. Refer to “APPENDIX A – Error Codes” on page 37).

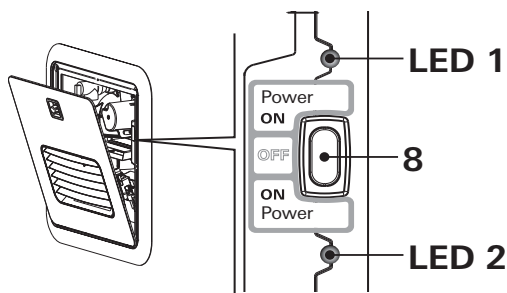


Fig. 8

AquaGo® basic

- The operating mode is set automatically to “BASIC”.
- The appliance is now ready for use.
- Water temperature at the outlet is approximately 120 °F (49 °C).

AquaGo® comfort / AquaGo® comfort plus

- The appliance is now ready for using the control panel inside your vehicle. Refer to “Operating modes (control panel)” on page 11.

Operating modes (control panel)

AquaGo® comfort / AquaGo® comfort plus

A control panel to select the operating mode (included with the delivery from serial number DLE60X(X)27100000).

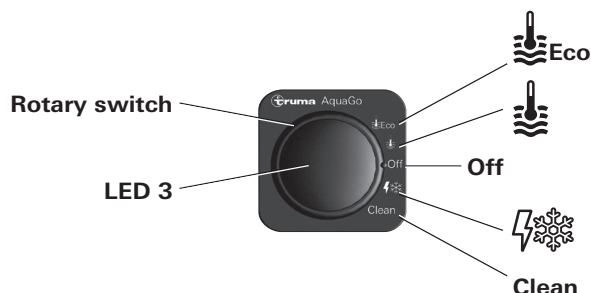


Fig. 9

With the rotary switch (Fig. 9) you can choose between the following operating modes:

Sign	Operating mode / Description
	<p>ECO</p> <p>The appliance is now running in energy-saving mode.</p> <ul style="list-style-type: none"> • Water temperature at outlet is approximately 120 °F (49 °C). • Prevention of freezing by using propane gas. The temperature in the appliance is automatically kept above 41 °F (5 °C) . • During operation, the yellow status LED 3 is lit.
	<p>COMFORT</p> <p>The appliance is now running in a mode that provides rapid availability of hot water.</p> <ul style="list-style-type: none"> • Water temperature at the outlet is approximately 120 °F (49 °C). • Stand-by heat. The temperature in the appliance is automatically kept above 102 °F (39 °C). • During operation, the yellow status LED 3 is lit.
Off	<p>Stand-by. The appliance is not running in any operating mode.</p> <ul style="list-style-type: none"> • The yellow status LED 3 is off. <p>i To switch off the POWER and gas supply (refer to “Switching OFF the appliance” on page 12).</p>



Sign	Operating mode / Description
	<p>ANTIFREEZE</p> <p>Prevention of freezing using 12 VDC electricity:</p> <p>i Operating mode with installed electric antifreeze kit (available as an accessory) and appliance switched on. The temperature in the appliance is automatically held above 41 °F (5 °C).</p> <ul style="list-style-type: none"> • During operation, the yellow status LED 3 is lit.
Clean	<p>DECALCIFICATION</p> <p>Only AquaGo® comfort / AquaGo® comfort plus. See Section “Decalcification” on page 16.</p> <p>i For safety reasons, after 30 seconds the decalcification process cannot be stopped until the system has been rinsed in accordance with the instructions. See “Interrupting decalcification” on page 20.</p>

Switching OFF the appliance

- 1. AquaGo® comfort / AquaGo® comfort plus**
 - Set the control panel to “Off”.
2. Open the access door (refer to “Opening the access door” on page 8).
3. Switch off the appliance at the POWER switch (Fig. 8).
 - The green Power-ON LED 1 (Fig. 8) extinguishes.
4. Close the access door (refer to “Closing the access door” on page 9).
5. If the appliance is not needed, turn off the gas supply to the appliance.

i If you intend to place the RV into storage or turn off the appliance during freezing temperatures, refer to “Winterizing” on page 13.

Description of the yellow status LED 3 (see Fig. 9 – LED 3)

Signal	Meaning
LED 3 lit	Appliance is switched ON
LED 3 is off	Appliance is switched OFF. Refer to “Switching OFF the appliance” on page 12.
Every 7 s, LED 3 is interrupted for 1 s	The appliance must be decalcified
LED 3 flashes slowly 1 s on, 1 s off	Decalcification mode has been activated
LED 3 flashes quickly	Before you use the water system you must rinse it (refer to step f) “Rinsing the water system” on page 19).
LED 3 flashes 2 x briefly after a break.	There is a fault in the appliance. The exact fault diagnosis must be determined via error LED 2. Refer to “APPENDIX A – Error Codes” on page 37. Risk of freezing if the temperature in the appliance is below 37.4 °F (3 °C).

Winter operation

NOTICE

Risk of damage in frosty conditions.

In frosty conditions there is a risk that water in pipes, faucets and appliances could freeze. This can cause considerable damage.

- **Never operate the AquaGo® basic in frosty conditions, this model must be winterized (refer to “Winterizing” on page 13).**
- Winter operation will not protect the RV’s entire water system. Water lines, faucets, water tanks and the external water valves and the vehicle must be heated separately.
- The RV must be designed for winter use/ freezing conditions.
- The water pipes in the RV must be ice-free to operate the AquaGo® comfort / AquaGo® comfort plus in winter. Otherwise, there is no water flow and the appliance does not start.



Only AquaGo® comfort / AquaGo® comfort plus

When the vehicle is standing, to -4 °F (-20 °C)

- The appliance has a built-in thermostat that will start the burner and the circulation pump whenever the temperature in the appliance falls below 41 °F (+5 °C). The burner will automatically shut off when it senses a temperature above 111 °F (44 °C). You must leave the mode switch in the "ECO" or "COMFORT" position.
- **NOTICE** For the appliance to operate properly, you must ensure a constant supply of power (12 V), propane gas, sufficient water in the system, and you must leave the appliance powered "ON". The water system must be bled so that the circulation pump works.
- **NOTICE** If the vehicle is standing and ambient temperatures are below -4 °F (-20 °C), the appliance must not be operated and must be winterized. To winterize the appliance (refer to "Winterizing" on page 13).

While driving (or if there is no gas supply), to -4 °F (-20 °C)

- **NOTICE** Gas must not be used for heating while the vehicle is in motion. Ask your dealer / vehicle manufacturer about options for heating your RV while driving.
- An electric antifreeze kit is available as an accessory (ask your dealer). With this kit, the appliance can be kept frost-free while you are driving or if there is no gas supply (to ambient temperatures of -4 °F (-20 °C)). The electric antifreeze kit includes detailed instructions.
- **NOTICE** While the vehicle is in motion and at ambient temperatures below -4 °F (-20 °C) the appliance must not be operated and must be winterized. To winterize the appliance (refer to "Winterizing" on page 13).

Winterizing

NOTICE

Severe damage to the water system components and the appliance!

Any damage caused by freezing or an unsuitable winterizing fluid will not be covered by warranty.

- Follow the recommendations below if the appliance will be stored under freezing conditions or for an extended period of time.
- Winterize the appliance at the start of the winter season or before travelling to a location where freezing conditions are likely.

If your RV is equipped with a bypass around the appliance, separate the appliance from the water system with the bypass.

Winterizing the appliance

To winterize the appliance, drain all water from the appliance ("Draining the water and cleaning the water inlet filter" on page 15).

Once the water has been drained, the appliance is protected against freezing conditions.



Winterizing the RV with a winterizing fluid

- i** Winterizing the RV with a winterizing fluid is only possible with an installed bypass kit (not in scope of delivery)
- Refer to the connection diagram “Winter operation” on page 12 for all letters referred to in the following description.

Winterizing AquaGo® basic / AquaGo® comfort

1. Close valves A and B.
2. Open valve C.
3. Drain the appliance (“Draining the water and cleaning the water inlet filter” on page 15).
4. Flush the RV’s water system with a suitable winterizing fluid according to the supplier’s or RV manufacturer’s guidelines.

Winterizing AquaGo® comfort plus

1. Close valves A, B and E.
2. Make sure that valve D remains in the closed position.
3. Open valve C.
4. Drain the appliance (“Draining the water and cleaning the water inlet filter” on page 15).
5. Flush the RV’s water system with a suitable winterizing fluid according to the supplier’s or RV manufacturer’s guidelines.
6. Close all faucets (if open).
7. Open valve D.
8. Wait until winterizing fluid has drained. Collect escaping fluid in a suitable vessel.
9. Close valve D.

AquaGo® technical data

BTU/h (Nominal input rate)	20,000 – 60,000		
Fuel	LP gas (propane only)		
Fuel inlet pressure	10.5 – 14 in. wc (26.2 – 34.9 mbar)		
Fuel manifold pressure	1.3 – 10 in wc (3.2 – 24.9 mbar)		
Nominal voltage	12 V DC (< 1 V _{pp})		
Power input			
AquaGo® basic	< 1.5 A		
AquaGo® comfort	< 2.5 A		
AquaGo® comfort plus	< 2.5 A		
Water operating pressure	65 psi (4.5 bar) max.		
Standard water outlet temperature	120 °F (49 °C)		
Water volume	0.35 gallons (1.3 liter)		
Ambient temperature			
AquaGo® basic	+32 °F...+104 °F (+5 °C...+40 °C)		
AquaGo® comfort	-4 °F...+104 °F		
AquaGo® comfort plus	(-20 °C...+40 °C)		
Dimensions (without flange and frame)			
	Width	Height	Depth
in.	12.5	12.5	15.5
mm	318	318	394
Dimensions of frame			
Size XS			
in.	15.1	15.5	0.8
mm	384	394	20.2
Standard			
in.	17.7	17.7	0.8
mm	450	450	20.2
Adapter			
in.	20.1	20.1	0.8
mm	510	510	20.2
Installation cutout and depth			
	Width	Height	Depth*
in.	12.8	12.8	17.7 >19.7**
mm	324	324	450 >500**
Weight unit without access door	(approx.) 34.2 lbs (15.5 kg)		
Weight access door standard and access door XS	(approx.) 2.9 lbs (1.3 kg)		
Weight access door adapter kit	(approx.) 5.5 lbs (2.5 kg)		

* Depending on application

** Recommended



Maintenance

Repairs must be performed by a certified service technician. Truma recommends that the appliance be serviced annually by a certified service technician. Verify proper operation after servicing.

⚠ WARNING

High temperatures or repair attempts while the gas supply is turned on may result in scalding injuries!

- Turn OFF the electrical power supply and the LP gas supply before starting maintenance and repair work.
- Allow the appliance to cool down.
- Never actuate the pressure relief valve as long as the appliance is still hot.

⚠ CAUTION

Injuries caused by the Easy Drain Lever!

- Never actuate the Easy Drain Lever as long as the appliance is under water pressure and/or is still hot.

⚠ CAUTION

Sharp edges can cause cuts and injury!

- Always wear protective gloves to avoid injuries from sharp edges during maintenance work.

Draining the water and cleaning the water inlet filter

i To keep the appliance fully functional, clean the water inlet filter at least once a year.

1. AquaGo® comfort / AquaGo® comfort plus
Set the control panel to "Off".

2. Remove the access door (refer to "Removing the access door" on page 9).
3. Switch OFF the appliance at the POWER switch.
4. Open a hot water faucet and wait for cold water.
5. Turn OFF the water supply or switch OFF the water pump.

6. Leave the hot water faucet open in order to depressurize and vent the water system.

⚠ CAUTION

Injuries caused by the Easy Drain Lever!

When the Easy Drain Lever is folded out, it protrudes beyond the side wall of the vehicle.

- When walking past or stooping down, make sure that you and others have sufficient distance.

7. Open the latch with your thumb while pulling the Easy Drain Lever down as far as it will go.
8. Remove the water inlet filter (or heating cartridge) as shown in Fig. 10 and rinse it with clean water.
9. Inspect the O-rings on the water inlet filter (or heating cartridge) for cracks. Change the filter assembly (spare part, refer to "APPENDIX C – Spare Parts (all models)" on page 39) if there are cracks.

⚠ CAUTION

Danger of crushing/pinching of fingers when the Easy Drain Lever is closed!

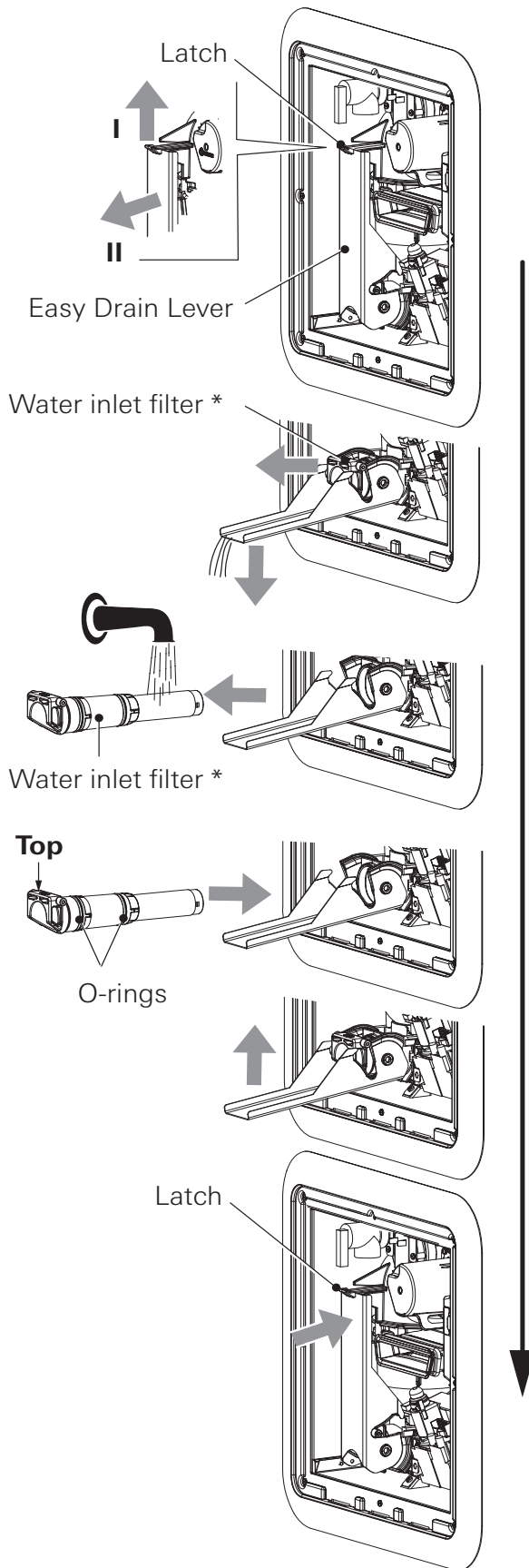
- Never put fingers between Easy Drain Lever and water inlet filter or latch.

i If, during installation, it is difficult to install the filter cartridge, use a small amount of soap on the O-rings. Never use grease because the O-rings are not resistant to grease.

10. Install the water inlet filter as shown in Fig. 10. Observe the correct installation position and close the Easy Drain Lever until it is locked by the latch.

You can hear a "clicking" sound as the Easy Drain Lever engages.

11. Insert and close the access door (refer to "Closing the access door" on page 9).



* or heating cartridge

Fig. 10

Decalcification

NOTICE

Risk of damage in frosty conditions.

In frosty conditions there is a risk that water in pipes, faucets and appliances could freeze. This can cause considerable damage.

- Do not decalcify the appliance in frosty conditions.

Decalcification frequency

Lime scale occurs especially as a result of precipitation from "hard" water. The appliance must be decalcified regularly depending on water hardness and hot water consumption.

Recommended decalcification frequency per year

Water hardness mg/l CaCO ₃	Very hard >180	1	2	4
	Hard 121 – 180	1	1	3
	Moderately hard 61 – 120	1	1	2
	Soft 0 – 60	1	1	1
	Use*	few	normal	frequent

* Hot water consumption (approximately)

low	635 gallon/year	2400 l/year
normal	1585 gallon/year	6000 l/year
high	6350 gallon/year	24000 l/year




Decalcification (models **without** control panel)

Models AquaGo® basic without control panel:

You can have these models decalcified by a Truma service partner. Please contact the following address:

Truma Corp.
 825 East Jackson Blvd.
 Elkhart, IN 46516
 USA
 Toll Free 1-855-558-7862
 Fax 1-574-538-2426
 info@trumacorp.com
 www.truma.net

 Refer to “Decalcification frequency” on page 16 for the decalcification frequency.

Decalcification (models **with** control panel)

AquaGo® comfort / AquaGo® comfort plus with control panel (included with delivery).

An integrated water consumption meter recognizes (after hot water consumption of approx. 1585 gallons / 6000 l) that decalcification is necessary. The assumed water hardness is “hard” and cannot be changed. The yellow status LED 3 (Fig. 9) indicates that decalcification is necessary (goes off briefly about every 7 seconds).

▲ WARNING

The use of non original Truma AquaGo® decalcification tablets (e.g. vinegar) for decalcification can cause chemical reactions and produce hazardous substances that could enter the drinking water supply.

- **Do not** mix Truma AquaGo® decalcification tablets with other substances to avoid chemical reactions and production of hazardous substances.
- Only use Truma AquaGo® decalcification tablets to decalcify the appliance to avoid:
 - chemical reactions and production of hazardous substances,
 - damage to your appliance,
 - and the voiding of your warranty.
 - Call your local AquaGo dealer or service provider or see www.truma.com for more information to obtain Truma AquaGo® decalcification tablets.

Irritation of skin and eyes in case of contact with decalcification agent

Wear protective gloves, eye protection and face protection to avoid contact.

- Never use the water supply in the RV during decalcification
- In case of skin contact with the decalcification agent, immediately rinse the affected area with plenty of water.
- In case of eye contact, hold eyelid open and rinse with running water for 10 – 15 min. Remove contact lenses, if present and easy to do. Continue rinsing. Consult an eye specialist.
- If you swallow the decalcification agent, immediately rinse your mouth and drink plenty of water in small sips. Do not vomit. Consult a doctor.



TRUMA AQUAGO COMFORT WATER HEATER

During decalcification, you must also observe the following

- Damage to the appliance if decalcification is interrupted.
 - You must complete the decalcification process and then rinse thoroughly with clean water.
 - Allow about 3 hours for decalcification. The appliance works on its own for most of this time.
- Sensitive surfaces (e. g. marble) may be damaged through contact with the decalcification agent.
 - Immediately remove splashes of decalcification agent on these surfaces.

a) Preparing for decalcification

i For safety reasons, once the decalcification process has started it must not be stopped until the system has been rinsed (see process f). All operating modes of the appliance are blocked until decalcification has been completed.

Tasks within the RV

- Set the control panel to "Off".
- Turn OFF the water supply or switch OFF the water pump.
- Open a hot water faucet to relieve pressure in the system.
- On all water faucets attach the warning sign "Caution decalcification in progress" in a clearly visible position. Warning signs are enclosed with the decalcification tablets.

b) Draining the water system

Tasks outside the RV

- Remove the access door (refer to "Removing the access door" on page 9).
- Switch OFF the appliance at the POWER switch.
- Drain the water system and remove the water inlet filter. Do do this, refer to "Draining the water and cleaning the water inlet filter" on page 15, Steps 4 to 8.

NOTICE You must use the water inlet filter for decalcification (included with the delivery Fig. 1 – 11a). If you are using an electric anti-freeze kit, it must be removed and be unplugged from the power supply before decalcification (see Fig. 11).

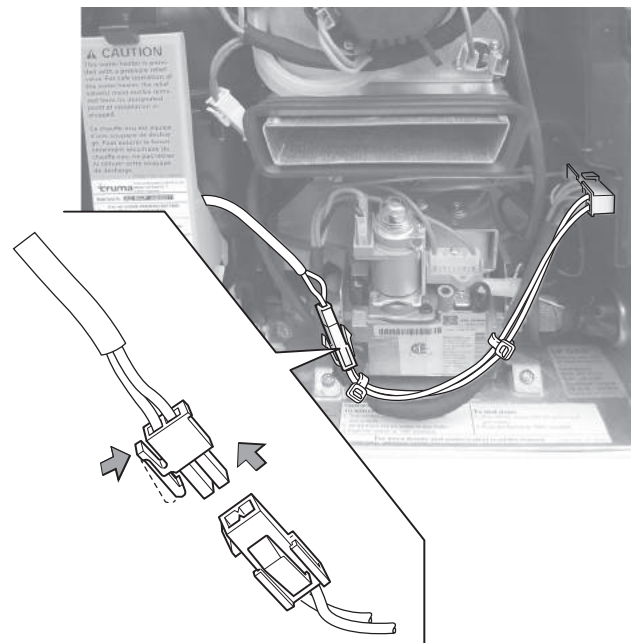


Fig. 11



c) Introducing the decalcification agent

Tasks outside the RV

- **⚠ WARNING** Irritation of skin and eyes in case of contact with decalcification agent. Wear protective gloves, eye protection and face protection to avoid contact.
- Fill the water inlet filter with 6 Truma AquaGo® decalcification tablets (content of one blister pack).

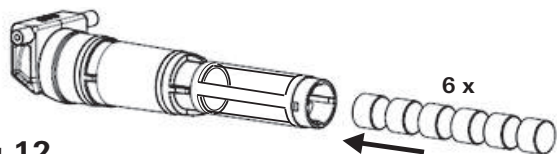


Fig.12

- Re-insert the water inlet filter. See Step 9 in "Draining the water and cleaning the water inlet filter" on page 15.
- Switch ON the appliance at the POWER switch.

d) Filling the water system

Tasks within the RV

- Turn on fresh water supply or switch on water pump
- **i** The decalcification tablets dissolve in water quickly (approx. 10 minutes). So that the decalcification agent is not rinsed out, when filling, run the water only as long as necessary. The Truma decalcification tablets color the water slightly red.
- Fill the water system.
 - Open all water-release points, e.g., hot water faucets, showers, toilets.
 - Once water flows uniformly, the water system is vented.
 - Close the water-release points.

i You must bleed the water system thoroughly otherwise the circulation pump cannot circulate the decalcification solution.

e) Starting decalcification

Tasks within the RV

- Set the control panel to "Clean".
 - If decalcification does not start, switch the appliance on at the POWER switch.

f) Rinsing the water system

- **i** You will need about 8 gallons of water to rinse the water system.
- Dispose of (used) decalcification solution in accordance with local laws and regulations.

Tasks within the RV

- Open all water-release points, e.g., hot water faucets, showers, toilets.
- Run the water until the status LED 3 (Fig. 9) on the control panel goes out.
- Set the control panel to "Off".
- Close all water-release points.
- Turn OFF the water supply or switch OFF the water pump.
- Open a hot water faucet to relieve pressure in the system.
- **i** To make sure that the appliance and the water pipes contain no decalcification agent, empty the water system again and refill it.



Tasks outside the RV

- Switch the appliance OFF at the POWER switch (red error code LED 2 (Fig 8) flashes before it switches off).
- Drain the water System (refer to “Draining the water and cleaning the water inlet filter” on page 15, steps 4. to 8.).
- Install the water inlet filter* referring to step 9.
* or antifreeze cartridge if electric antifreeze kit is installed.
- Switch ON the appliance at the POWER switch.
- Insert and close the access door (refer to “Closing the access door” on page 9).

i You have to switch the appliance off and on to unblock decalcification and enable further operation.

g) Filling the water system

Tasks within the RV

- Turn on fresh water supply or switch on water pump.
- Fill the water system.
 - Open all water-release points, e.g., hot water faucets, showers, toilets .
 - Once water flows uniformly, the water system is vented.
 - Close the water-release points.
- Before you use the water system and the appliance, check the color of the water at all faucets:
 - Slightly red -> rinse again.
 - Clear -> decalcification is finished.
- Remove the warning signs “Caution decalcification in progress”.

Interrupting decalcification

i Decalcification is indicated through slow flashing (1 s on, 1 s off) of the status LED 3 (Fig. 9) on the control panel.

- Decalcification can be interrupted by switching the control panel to “Off”.
 - Decalcification is interrupted after about 2 s.
 - The status LED 3 (Fig. 9) on the control panel flashes quickly.
- **⚠ WARNING** Irritation of skin and eyes in case of contact with decalcification agent. Wear protective gloves, eye protection and face protection to avoid contact.
- First you must take out the water inlet filter and remove any Truma AquaGo® decalcification tablets that it may contain.
 - To take out the water inlet filter, see “Draining the water and cleaning the water inlet filter” on page 15.
 - Dispose of Truma AquaGo® decalcification tablets in accordance with local laws and regulations.
- Before you use the water system again, you must rinse it (see step f) “Rinsing the water system” on page 19) and fill it with water (see step g) “Filling the water system” on page 20).



Accessories

Electric antifreeze kit *

Truma offers an electric antifreeze kit (part no. 77400-01) that keeps the appliance frost-free to -4 °F (-20 °C) while you are driving or if there is no gas supply. To operate the kit, you need a 12 VDC (120 W) power supply from the vehicle's on-board system. Ask your dealer.

* For AquaGo® comfort / AquaGo® comfort plus.

Truma AquaGo® decalcification tablets

Truma offers decalcification tablets (part no. 77300-01) to decalcify AquaGo® comfort / AquaGo® comfort plus.

Truma rear installation gas connection kit

Truma offers a rear installation gas connection kit (part no. 77000-37500) if installation from the back of the appliance is required.

Truma AquaGo® Comfort upgrade kit

Truma offers a kit (part. no. 77000-00005) to upgrade from AquaGo® basic to AquaGo® comfort.



Troubleshooting

Problem	Potential cause	Resolution
No hot water at the faucet	Gas supply is turned off or interrupted.	Check and/or turn on gas supply.
	Gas tank is empty.	Refill/replace the gas tank.
	The appliance is switched off.	Switch on the appliance according to instructions (refer to "Operating procedures" on page 10).
	Fresh water supply is turned off.	Open the fresh water supply.
	Power supply to the appliance is switched off.	Switch on power supply to the appliance.
	Defect in the appliance.	LED 2 blinks red (refer to "APPENDIX A – Error Codes" on page 37) and contact a certified service technician if necessary.
Boiling noises	Too much lime scale in the Truma AquaGo® instant water heater.	The appliance must be decalcified (refer to "Decalcification" on page 16).
Hot water temperature too low.	Gas flow to the appliance is too low (gas inlet pressure < 10.5 in. wc).	Consult vehicle documentation to determine if gas supply is capable of providing the necessary volume of gas for the appliance. Contact a service technician to verify a suitable gas installation.
	Volume flow of hot water is too high and/or the temperature of cold water reaching the appliance is too low.	Turn down hot water at the faucet or in the shower in order to reduce volume flow. Potentially retrofit a volume flow throttle into the water system. This must be performed only by a certified service technician.
	Too much lime scale in the appliance.	The appliance must be decalcified (refer to "Decalcification" on page 16).



Problem	Potential cause	Resolution
Water escaping at pressure relief valve.	Water pressure in water system too high.	Adjust the water pump pressure to a maximum of 65 psi (4.5 bar). If the water system is connected to a central water supply higher than 65 psi (4.5 bar) (rural or urban connection), a pressure reducer must be used. Install a pressure reducer (e.g. Truma pressure reducer) at the fresh water supply.
	Water cannot expand in the water system.	Contact the vehicle manufacturer about retrofitting a pressure compensation element.
	Lime or dirt under the pressure relief valve seat.	Allow the appliance to cool and then slowly raise the test lever (Fig. 3 – 4a) to flush the water system and attempt to force dirt or foreign matter out of the pressure relief valve seat. Replace pressure relief valve. This must be performed only by a certified service technician.
Water escaping at the water inlet filter	Lime or dirt under the O-ring seats.	Clean the O-rings and their corresponding sealing surfaces with clean water.
AquaGo® comfort / AquaGo® comfort plus		
The yellow status LED 3 is off although an operating mode was selected.	Power switch is OFF.	Switch ON the appliance at the POWER switch.
	Power supply to the appliance is switched off.	Switch on the power supply to the appliance.
	Power supply was interrupted.	Reset by switching OFF at the control panel, waiting 2 seconds and then switching on again.



TRUMA Gerätetechnik GmbH & Co. KG
("TRUMA")

"AquaGo" MANUFACTURER LIMITED WARRANTY

(September 2014)

This limited warranty pertains solely to the "AquaGo" (the "Product") manufactured by TRUMA and sold through its affiliates and dealers in North America.

TRUMA warrants subject to the below stated conditions that the Product will be free from defects in material and workmanship, and will perform in accordance with the technical specifications set forth in the description of the Product for a period of twelve (12) months for newly manufactured parts from the original date of purchase. The original purchaser is advised to register the Product within two (2) months of purchase with **www.truma.net** in order to receive an extended warranty of an additional twelve (12) months. This limited warranty shall only apply if the Product was properly installed according to the installation instructions provided and in compliance with applicable codes.

During the warranty period, TRUMA will repair or replace, at its own discretion and costs, the defective Product or parts or components of such Product reported to TRUMA and which TRUMA determines was defective due to a warranty defect. Costs of diagnosis for a warranty defect are borne by TRUMA. Other costs of diagnosis are not included in this warranty. At the discretion of TRUMA, the replacement of the Product or parts or components thereof (i) may be newly manufactured, (ii) may be assembled from new or serviceable used parts that are equivalent to new parts in performance, or (iii) may have been previously installed.

The customer shall not attempt to repair the Product or resolve the problem without the prior consent of TRUMA. Any attempt by the customer to repair the Product or resolve the problem without the prior consent of TRUMA will void this warranty.

This limited warranty does not cover any defects attributable in whole or in part to (i) non-TRUMA products and services and / or alterations of out-of-specification supplies, (ii) accidents, misuse, negligence or failure of the customer to follow instructions for the proper use, care and cleaning of the Product, (iii) damages caused in gas pressure regulation systems due to foreign substances in the gas (i.e. oil, plasticizers), (iv) external factors (e.g., fire, flood, severe weather), (v) failure of proper transport packaging, or (vi) failure by the purchaser to comply with TRUMA's installation and user manual regarding the Product.

All warranty claims must be reported to TRUMA's authorized warranty service center in the United States: Truma Corp Service Center, **825 East Jackson Blvd., Elkhart, IN 46516, toll free: (855) 558-7862, fax: (574) 538-2426, service@trumacorp.com, www.truma.net**

The purchaser shall provide the following information regarding the potential warranty claim (i) serial number of the defective device, (ii) proof of purchase, (iii) purchaser's contact information.

EXCEPT AS EXPRESSLY STATED AND SET FORTH HEREIN, THERE ARE NO WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT AND NO SUCH WARRANTIES OR REPRESENTATIONS SHALL BE IMPLIED UNDER ANY APPLICABLE LAW, IN EQUITY OR OTHERWISE, INCLUDING WITHOUT LIMITATION, A WARRANTY OF MERCHANTABILITY, A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER WARRANTY WHICH MAY BE IMPLIED UNDER COMMON LAW OR UNDER THE UNIFORM COMMERCIAL CODE OF ANY STATE OR OTHER JURISDICTION OF THE UNITED STATES OF AMERICA.

Unless further limited herein, the entire liability of TRUMA and the customer's exclusive remedy for damages from any cause related to or arising out of a warranty defect, regardless of the form of action, whether in contract or in tort, will not exceed the amount of the purchase



price for each purchase order for the Product which is the subject matter or directly related to the causes of action asserted.

Unless prohibited under applicable state law, in no event will TRUMA, its agents, subcontractors, affiliates, suppliers and employees be liable for (a) any incidental, indirect, special or consequential damages, including, but not limited to, loss of use, revenue, profits or savings, substitute rental or for any other reason, even if TRUMA knew or should have known of the possibility of such losses or damages, (b) claims, demands or actions against the customer by any person, except as provided by applicable law.

Installation Instructions

Read, observe, and follow these safety instructions to avoid injuries during installation or operation.

Safety behavior and practices

- Installation and service must be performed by an authorized Truma recommended installer, service agency, or OEM. Improper installation, alteration, service, or maintenance can cause property damage, personal injury, or loss of life.
 - Do not attempt installation as a Do-it-Yourself project.
- Install in recreational vehicles (RVs) only.
 - Install the appliance on an exterior wall, with the access door opening to the outside.
 - Install the appliance in the shown orientation.
- Switch off the vehicle's on-board power supply during installation and when connecting the appliance.
- Close the vehicle's gas supply during installation and when connecting the appliance.
- Always wear protective gloves to avoid injuries from sharp edges during installation and maintenance work.
- Handle the appliance only by lifting or grabbing the metal casing or cover plate. Never lift or grab the appliance by any of its delicate interior components.
- Make sure that all combustion air is supplied from outside the RV. DO NOT draw air for combustion from occupied spaces.



TRUMA AQUAGO COMFORT WATER HEATER

- Make sure that all exhaust gases are directed outside of the RV.
 - Protect building materials from exhaust gases.
 - Never direct the exhaust gases to any outdoor enclosed spaces, such as a porch.
- Any alteration to the appliance or its controls can cause unforeseen serious hazards and will void the warranty.
- DO NOT alter the appliance for a positive grounding battery system.
- DO NOT shorten the power cable or remove the sticker that indicates polarity.
- DO NOT perform a hi-pot test on the appliance unless the electronic ignition system (circuit board) has been disconnected. A hi-pot test applies a very high voltage between two conductors.
- DO NOT use a battery charger to supply power to the appliance, even when testing.
- If the vehicle requires welding, DO NOT connect the 12 V DC power to the appliance. Electrical welding will cause serious damage to the appliance controller.


United States and CANADA

This appliance must be installed in accordance with local codes or, in the absence of local codes, the Standard for Recreational Vehicles, ANSI A119.2/NFPA 501C or CAN/CSA-Z240 RV.

Selecting a suitable location

The appliance is designed to be installed on a floor or a fixed platform with access to water. Electrical connections are established at the back. Gas access is from the side or from the rear.

The appliance is designed exclusively for installation on an outside wall of a RV.

 Installation of the water heater on the back of a trailer is not advised because of high pollution caused, e.g., by dirty and wet roads.

WARNING

Risk of poisonous exhaust gases due to improper installation!

- Make sure that the appliance is installed as described below.
- DO NOT install the appliance in any location where the vent may be covered or obstructed when any door on the RV is opened or due to the design of the RV or due to special features of the RV such as slide-out, pop-up, etc.
- DO NOT install on a swing door.
- DO NOT install the appliance under any window, slide-out or opening into the RV in order to prevent exhaust gases from entering the RV.
- DO NOT install the appliance in such a way that the cover plate is less than
 - 1 foot (30 cm) from each side and top of any window, slide-out or opening into the RV,
 - 6 feet (1.8 m) from any mechanical air supply inlet or
 - 3 feet (91 cm) from any gas tank connection or ventilation.
- Maintain a minimum clearance from combustible materials on sides, top, floor and rear (0 in.).
- Provide room for access to rear of appliance for servicing.



Preparing for installation

⚠ CAUTION

Sharp edges can cause cuts and injury!

- Always wear protective gloves to avoid injuries from sharp edges during installation work and while handling the appliance.

Preparing the installation site

1. Make sure that the appliance is in contact with the vehicle floor or a platform with adequate weight-bearing capacity when installed.
2. To install on a carpeted area, install a metal or wood panel under the appliance that extends at least 3 in. (7.6 cm) beyond the width and depth of the appliance.
3. If escaping water may damage components or the vehicle, install a collection pan below the appliance. Direct the flow of water from the pan to outside the vehicle.
4. Make sure that the front edge of the opening is surrounded by a solid frame to firmly anchor the appliance. If needed, build an appropriate frame (Fig. 13) with the following dimensions:

Width	a =	12.75 in. (324 mm)
Height	b =	12.75 in. (324 mm)
Depth	c =	>17.7 in. (450 mm)

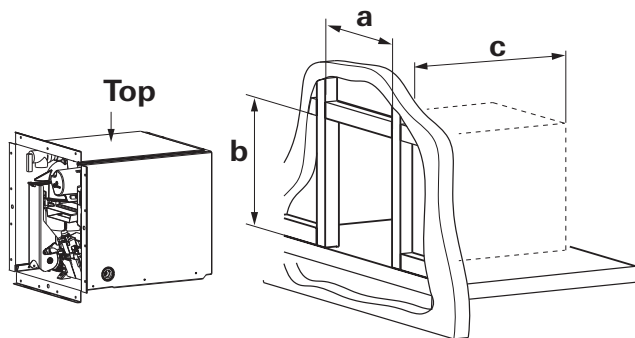


Fig. 13



- The required depth “c” depends on how the water hoses, electrical connection cable, and gas line are installed. The depth “c” must be determined for the particular situation before installation.
- The corners of the rough opening must be at right angles. The exterior wall opening must be the same dimensions with no rounded corners.
- An access door adapter kit is available for replacing existing water heaters, with a large cut-out in the outer wall of the RV. The adapter plate must be installed before the appliance is installed. The access door adapter kit includes detailed installation instructions.

5. Make sure you have suitable screws ready:

- Without access door adapter kit

In order to securely fasten the appliance and the cover plate, the screws must be suitable for the chosen frame material and have a diameter of 0.138 in. (#6) to 0.164 in. (#8).

- **NOTICE** Never use countersunk screws to secure the cover plate, as it will be damaged (tear). Use pan head screws.
- For the length of the screws follow the screw manufacturer’s guidelines.

- With access door adapter kit

You must use the 22 screws 0.164 (#8) x 0.51 in. (4.2 x 13 mm) that are included with the access door adapter kit.

- 14 x for fixing: appliance with adapter plate.
- 8 x for fixing: cover plate with adapter plate.



Preparing the gas connection

⚠ WARNING

Risk of explosion due to improper installation of the gas connection!

- Make sure that the operating pressure of the gas supply corresponds to the operating pressure of the appliance 10.5 – 14 in. wc (26.2 – 34.9 mbar).

For correct installation, you must also observe the following:

- The gas connection (SAE 45° Flare Male – SAE J512, 5/8 in. – 18) is located inside the appliance.
- Make sure that the gas line to the appliance is able to supply the maximum required quantity of gas ($\geq 60,000$ BTU/h), without the gas pressure on the gas connector of the appliance falling below 10.5 in. wc (26.2 mbar).
- Consider the space needed to lay the gas line and integrate the appliance when planning the installation space.
- Guide the gas line into the installation space so that the appliance may be removed and reinstalled if service or repairs are needed.
- Allow sufficient length and flexibility in the gas line for connection or disconnection of the gas line.
- Reduce the number of separation points in the gas line to the technically required number.
- Avoid separation points in the gas line in spaces used by people.
- Ensure that the gas connection from the vehicle is in place before installing the appliance.

– Gas side connection

⚠ DANGER

Risk of explosion due to improper installation of the gas side connection!

- Use rigid metal 3/8 in. pipes (complies to 1/2 in. (12.7 mm) outside diameter) for the side gas connector of the appliance to the gas system of the RV.
- In exceptions, flexible gas hoses may be used for the side gas connector. The following 4 conditions must be met:
 1. Guidelines, laws or regulations allow the use of flexible gas hoses in this application.
 2. The flexible gas hoses are **certified** for this type of application.
 3. The flexible gas hoses can be inspected easily over their entire length.
 4. New flexible gas hoses are used for the installation.

The gas line is guided into the appliance from the side. A hole with a gas pipe grommet (side) is provided in the unit casing for this purpose.

- Slide the appliance carefully into the installation space until the installation frame makes contact.
- Make sure that the gas line connects vertically with the appliance's gas connection and without tension.
- If the connection is OK, push the gas line back. It will be connected in a later step.

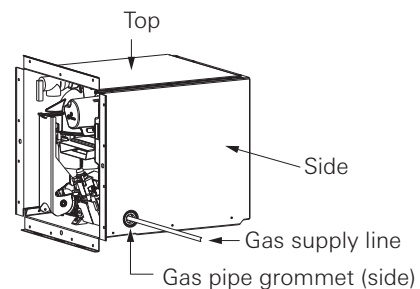


Fig. 14



– Gas rear connection

⚠ DANGER

Risk of explosion when using flexible gas hoses with a gas rear connection.

- Flexible gas hoses can leak due to the high temperatures in the appliance.
- You must use rigid metal 3/8 in. pipes (complies to 1/2 in. (12.7 mm) outside diameter) for a gas rear connection.

Truma offers a rear installation gas connection kit (part no. 77000-37500) if installation from the back of the appliance is required.

Scope of delivery:

- A brass elbow with a 45° SAE flare style fitting,
- a plug,
- a gas pipe grommet (rear) and
- a cable tie are included.

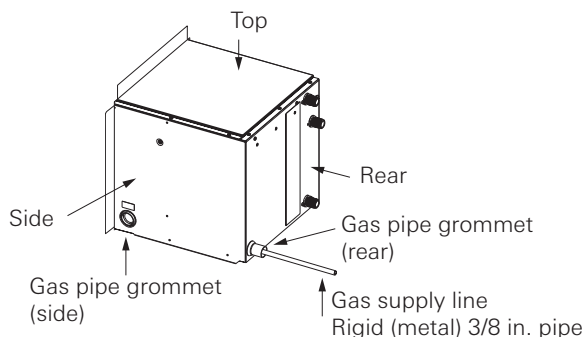


Fig. 15

- Open the pre-punched hole on the rear side of the appliance.
- Insert the gas pipe grommet (rear) in this hole (pay attention to the direction).

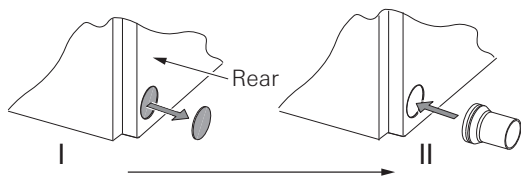


Fig. 16

Preparing the water connection

All water connections on the appliance are 1/2 in. NPT male connections.



- Use only pressure pumps in the water system, not immersion pumps, as air in the water system could cause malfunctions.
- The network of lines must be planned before installation (refer to “Connection diagrams” on page 31).
- Keep the length of the water pipes as short as possible.
- Because of the risk of frost, install water pipes only in adequately heated areas of the RV.
- Avoid thermal bridges.
- Install water pipes in a rising direction so that air in the pipes can escape.
- For AquaGo® comfort plus Protect the circulation line against heat loss with sufficient insulation material.

- Use a suitable connector with a seal for establishing the water connection to the appliance.
- Use of flexible water hoses of at least 1/2 in. diameter is preferred.
- Make sure that all water hoses are installed without kinks.
- Make sure that the water connections from the vehicle are in place before installing the appliance.



TRUMA AQUAGO COMFORT WATER HEATER

Preparing the 12 V DC electrical connection

All electrical connections must be made in compliance with all national, regional or local electrical codes.

▲ WARNING

Risk of a short circuit and hazardous situations due to improper installation of the electrical connection!

- Use only insulated terminals for all electrical connections.
- The positive line must be fused with a 7.5 A fuse near the battery's positive terminal.
- The power supply cable must have a diameter of at least:
 - 16 AWG (1.5 mm² MWG) for up to 40 ft (12 m) length (bidirectional)
 - 14 AWG (2.0 mm² MWG) for up to 66 ft (20 m) length (bidirectional)
- Establish the 12 V DC electrical connections according to the connection diagram see "Electrical connection for all models" on page 31.
- To ensure reliable operation:
 - Provide a constant voltage supply.
 - Filter any AC spikes or voltage surges.
 - The AC voltage ripple must not exceed 1 Vpp.
- Make sure that the electrical connections from the vehicle are in place before installing the appliance.

Mounting the control panel

Only AquaGo® comfort / AquaGo® comfort plus

- **NOTICE** **Damage to the control panel from wetness and moisture.** You must install the control panel at a place inside the RV that is protected against moisture and wetness.
- Install the control panel (Fig. 17- 27) where it can be seen easily.
 - A 9 m control panel cable (27a) is included with the delivery.
- Drill a 2 1/8 in. (54 mm) diameter hole.
- Insert the plug (27b) on the control panel (27) until it clicks into place.
- Clamp the control panel cable (27a) in the cable duct of the control panel.
- **NOTICE** **Damage to the control panel cable at temperatures above +60 °C.** Do not install the control panel cable on or fix it to hot components.
- Slide the control panel cable to the back and lay it to the appliance.
- Fix the control panel with 4 screws (27d).
- Install the cover frame (27e).

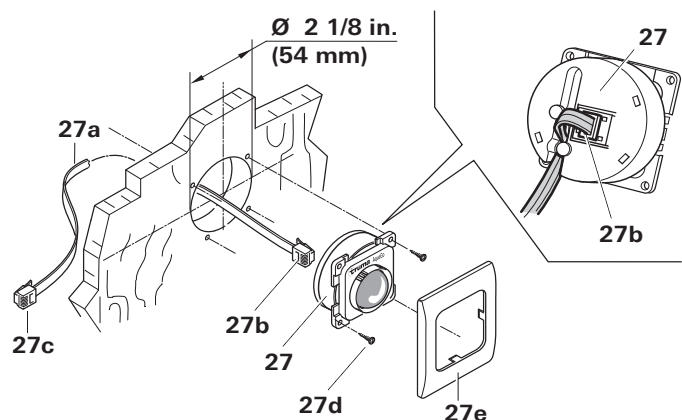


Fig. 17



Connection diagrams

- i** The drawings are not intended to describe a complete system. It is up to the certified service technician to determine the necessary components for and configuration of the particular system being installed (for example an additional surge protector).
- The drawings do not imply compliance with state or local code requirements or regulations. It is the certified service technician's responsibility to make sure that the installation is in full compliance with all state or local code requirements or regulations.

Model AquaGo® basic / AquaGo® comfort

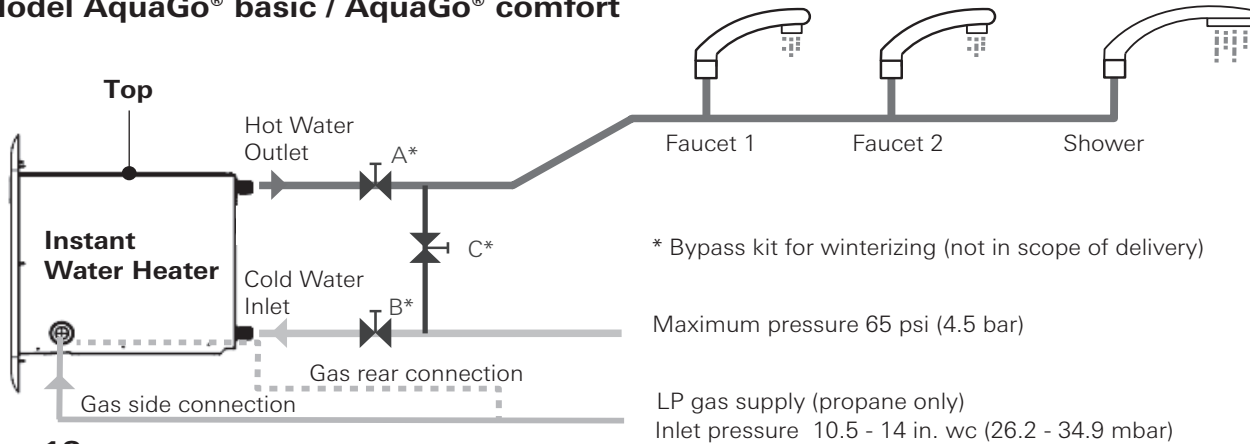


Fig. 18

Model AquaGo® comfort plus

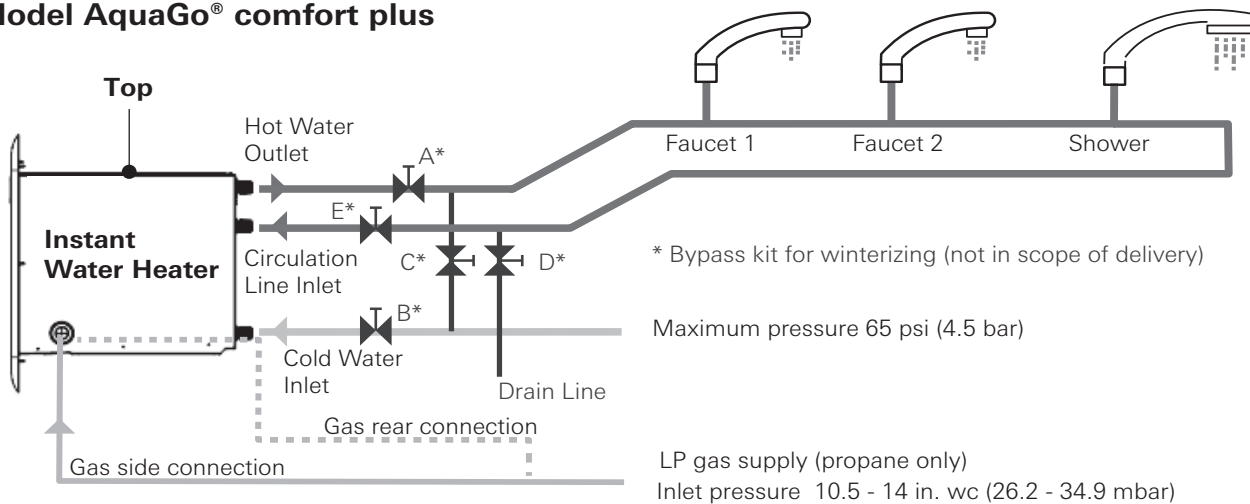


Fig. 19

Electrical connection for all models

Maximum length of the power supply cable (including cables for the optional switch):

- for 16 AWG or 1.5 mm² MWG: max. 40 ft (12 m) (bidirectional)
- for 14 AWG or 2.0 mm² MWG: max. 66 ft (20 m) (bidirectional)

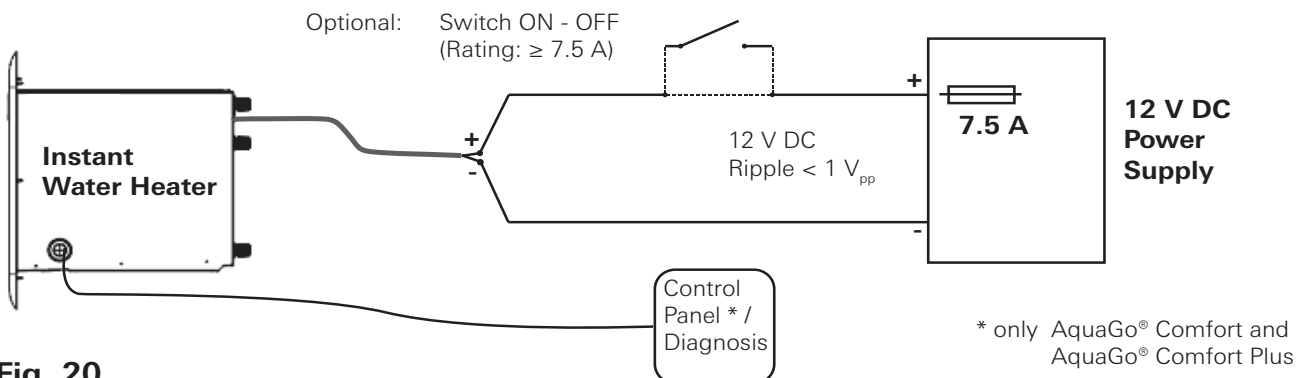


Fig. 20



Installing the appliance

Before installation, read "Preparing for installation" on page 27 and the following.

⚠ CAUTION

Sharp edges can cause cuts and injury!

- Always wear protective gloves to avoid injuries from sharp edges during installation work and while handling the appliance.

- Slide the appliance carefully into the installation space until the installation frame makes contact.

- **NOTICE** **Damage to the appliance and/or the RV!** Do not use adhesive sealing material (e.g. silicone) for the watertight seal. Otherwise damage may occur when the appliance is moved during servicing.

- The appliance must be installed with a watertight seal with the outer skin of the vehicle.

To achieve the watertight seal:

- Pull the appliance out \approx 2 in. (5 cm).
- Apply an adequate amount of watertight sealing material to the entire flange area of the installation frame and at the corners, see gray marking in Fig. 21.
- Slide the appliance carefully into the installation space until the installation frame makes contact.

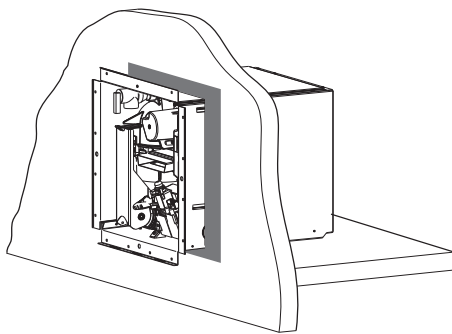


Fig. 21

- Screw the appliance into the vehicle's frame with the prepared 14 screws. See 5. "Make sure you have suitable screws ready:" on page 27.

- Make sure that the unit casing corners are 90 degrees square so that the cover plate/access door fits properly.

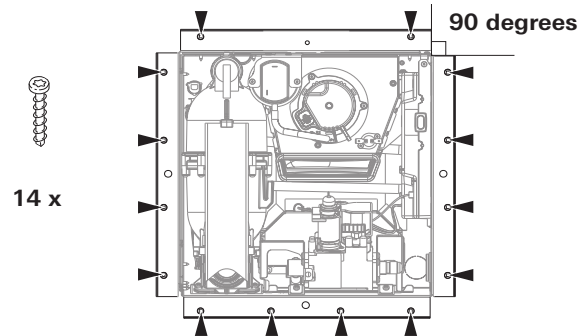


Fig. 22

- Immediately remove all excess sealing material.

- **⚠ WARNING** **Risk of death from poisoning and significant damage to the RV due to exhaust gas and leaking water!**

- Make sure that there is a tight seal and that no exhaust gas or water can enter the RV.

- Check and make sure that there is a tight seal.

- Fasten the cover plate to the appliance (see Fig. 23):

- Position the cover plate.
- Screw the cover plate only loosely. Start with screw 1.
- Align the cover plate.
- Uniformly tighten all 8 screws.

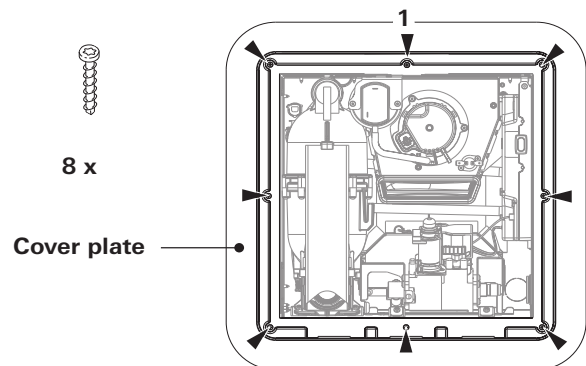


Fig. 23

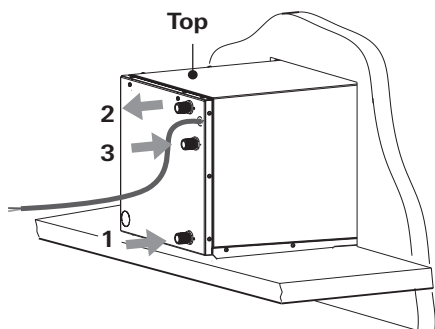


Fig. 24

- **NOTICE** **Damage to the appliance and the connections!**
 - Make sure that no gas lines, water hoses or electrical lines are kinked or pinched.
 - When establishing the water connections, observe the installation instructions and torques specified by the manufacturer.
- Connect the hose for cold water (1) at the bottom of the appliance.
- Connect the hose for hot water (2) at the top of the appliance.
- **Model AquaGo® comfort plus only:**
Connect the hose for the circulation line (3).
- Check all connections for water leaks.
 - Repair leaks as needed.
 - Repeat check for water leaks and take any necessary steps to repair the leaks at all water connections.
- Connect the electrical lines with the proper polarity to the 12 V DC power supply. Refer to “Electrical connection for all models” on page 31). Install a 7.5 A fuse (see Fig. 20).

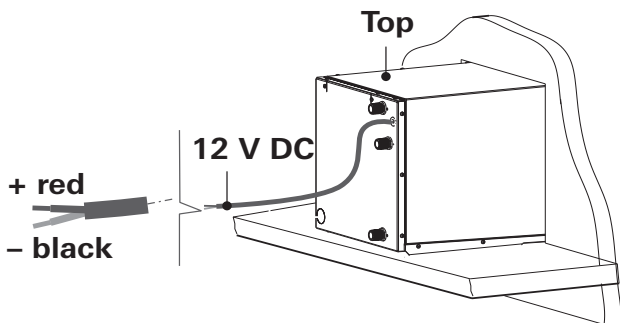


Fig. 25

Gas connection

▲ WARNING

Risk of explosion or poisoning due to improper installation!

- Permit only a certified service technician to perform installation.
- Make sure that the manual shut-off valve in the gas line of the appliance is closed.
- Make sure that the gas line is centered and tension-free when it enters the grommet so that the gas line will not abrade the grommet.
- Make sure that the gas line has an SAE 45° Flare Female connector.

Additional rules for the appliance gas connector.

- Make sure that the gas line is free of dirt, chips, etc.
- Never use pipe dope on a flare fitting. The flare fitting is a dry seal.

Connecting the gas line (gas side connection)

- **Only AquaGo® comfort / AquaGo® comfort plus (with control panel)**
 - Feed the control panel cable (approx. 10 in. (25 cm)) from outside through the gas pipe grommet (side).
 - Attach the control panel cable to the control unit.
 - Hook the control panel cable on to the clip.
- Guide the prepared gas line through the gas pipe grommet (side).
- Screw the gas line’s union nut (wrench size 3/4 in. (19 mm)) onto the appliance’s gas connection so it is finger-tight.



TRUMA AQUAGO COMFORT WATER HEATER

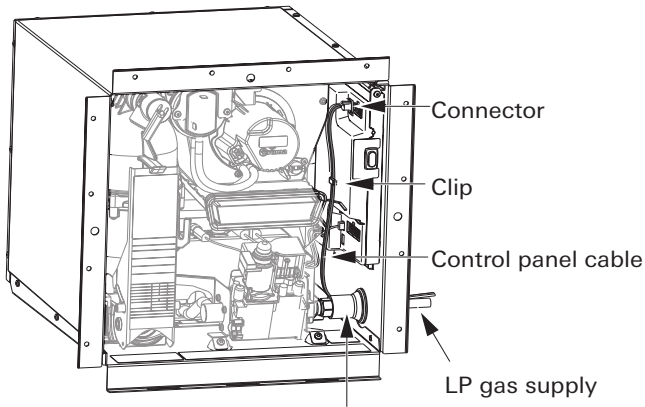
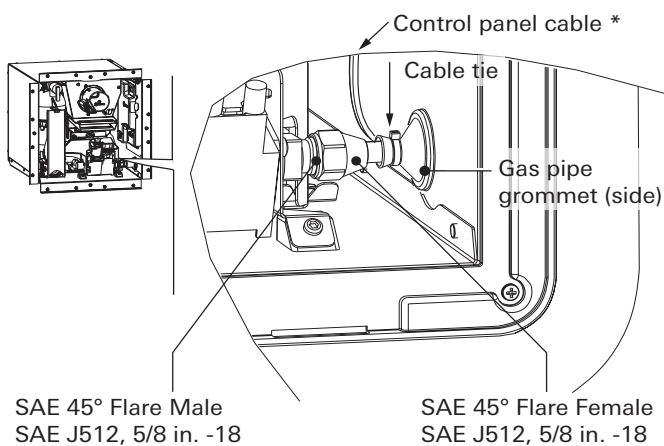


Fig. 26

- **NOTICE** Gas valve may be damaged during tightening! Use a second wrench to counterhold at the square end (wrench size 11/16 in. (18 mm)).
- Use a torque wrench to tighten the union nut (nominal torque 15 lb-ft (20 Nm)).
- **⚠ WARNING** Risk of poisoning and/or explosion! Improper tightening of the cable tie could result in gas/exhaust entering the RV.
- Close the cable tie so that the gas pipe grommet (side) tightens the gas pipe passage (see Fig. 27).

i A cable tie is provided with the appliance. You will find it fixed to the gas valve.



* AquaGo® comfort / AquaGo® comfort plus

Fig. 27

Connecting the gas line (gas rear connection)

- Remove the gas pipe grommet (side).
- Slide the prepared gas pipe through the gas pipe grommet (rear) from behind so that the elbow fitting can be mounted.

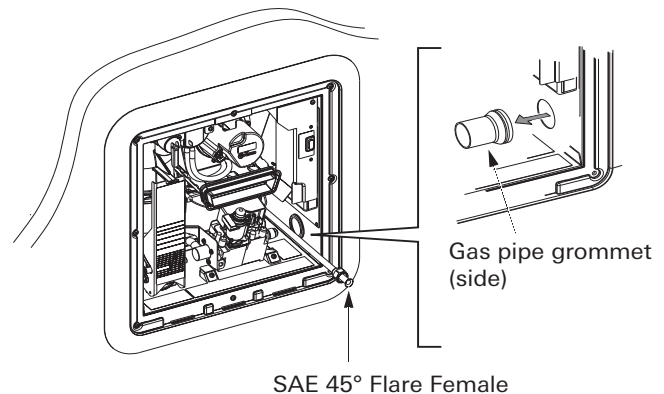


Fig. 28

- **NOTICE** Gas line may be damaged during tightening! Use a second wrench to counterhold at the square end (wrench size 9/16 in. (14 mm)).
- Mount the elbow union (45° SAE flare style) on the gas pipe in the direction shown (see Fig. 29).
- Use a torque wrench to tighten the union nut (nominal torque 15 lb-ft (20 Nm)) (brace against the elbow union with wrench size 9/16 in. (14 mm)).

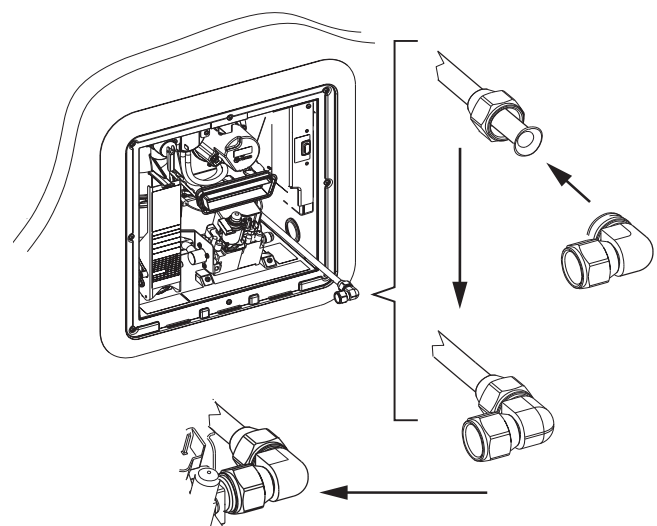


Fig. 29



- Screw the gas line's union nut (wrench size 3/4 in. (19 mm)) onto the appliance's gas connection so it is finger-tight.
- **NOTICE** Gas valve may be damaged during tightening! Use a second wrench to counterhold at the square end (wrench size 11/16 in. (18 mm)).
- Use a torque wrench to tighten the union nut (nominal torque 15 lb-ft (20 Nm)).
- **Only AquaGo® basic (without control panel):**
 - Close the side hole with the plug.

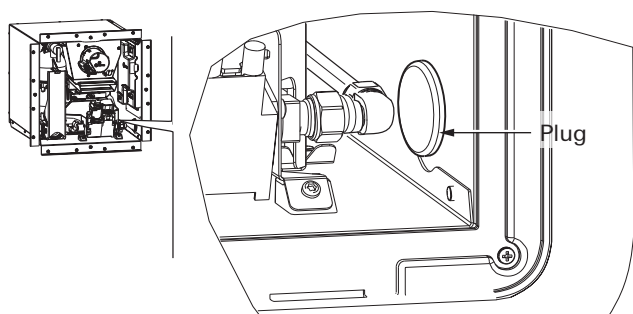


Fig. 30

- **Only AquaGo® comfort / AquaGo® comfort plus (with control panel)**
 - **NOTICE** Damage to the control panel cable at temperatures above +60 °C. Do not install the control panel cable through the rear gas pipe connection. You must feed the control panel cable through the hole on the side.
 - Slide the side gas pipe grommet on to the control panel cable (bush points towards hole). The control panel cable must protrude by about 25 cm.
 - **⚠ WARNING** Risk of poisoning and/or explosion! Improper tightening of the cable tie could result in gas/exhaust entering the RV. Close the cable tie so that the side gas pipe grommet tightens the control panel cable passage.

- Fix the side gas pipe grommet to the control panel cable with a cable tie.
 - A cable tie is provided with the appliance. You will find it fixed to the gas valve
- Attach the control panel cable to the control panel.
- Hook the control panel cable on to the clip.

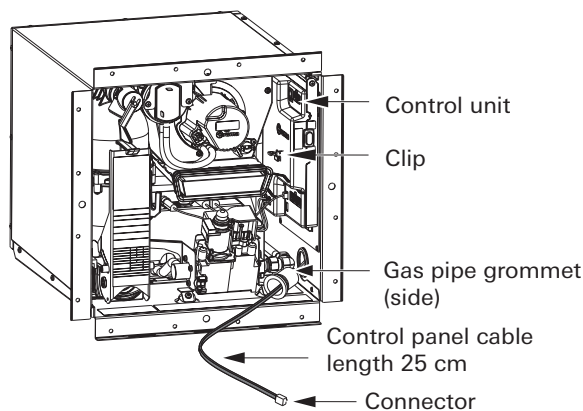


Fig. 31

- Install the side gas pipe grommet with the control panel cable in the side hole.

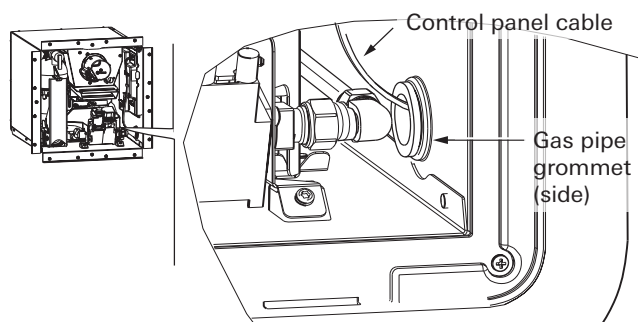


Fig. 32



Checking for gas leaks

▲ WARNING

Risk of death and personal injury through fire and/or explosion!

- DO NOT use matches, candles or other sources of ignition when checking for gas leaks.
- After the gas supply is connected, check for gas leaks at all gas connections. Use a gas leak detection liquid.

1. Turn OFF the electrical power supply
2. **NOTICE** **Damage to the appliance from test pressure higher than 60 in. wc (150 mbar). Ensure that the test pressure is lower than 60 in. wc (150 mbar).**
3. Turn on the gas.
4. Check the appliance and all gas connections for gas leaks with leak detection liquid.
 - Bubbles indicate a gas leak that must be repaired.
5. Repair gas leaks as needed.
6. Repeat check for gas leaks at all gas connections.

Functional check

1. Bring the appliance into operation (refer to “Starting the appliance” on page 9).
2. Check the appliance for proper functionality.



If faults occur during operation of the appliance, refer to “Troubleshooting” on page 22.

3. Provide operating and installation instructions to the vehicle owner.

The appliance is now ready for normal operation and use.



APPENDIX A – Error Codes

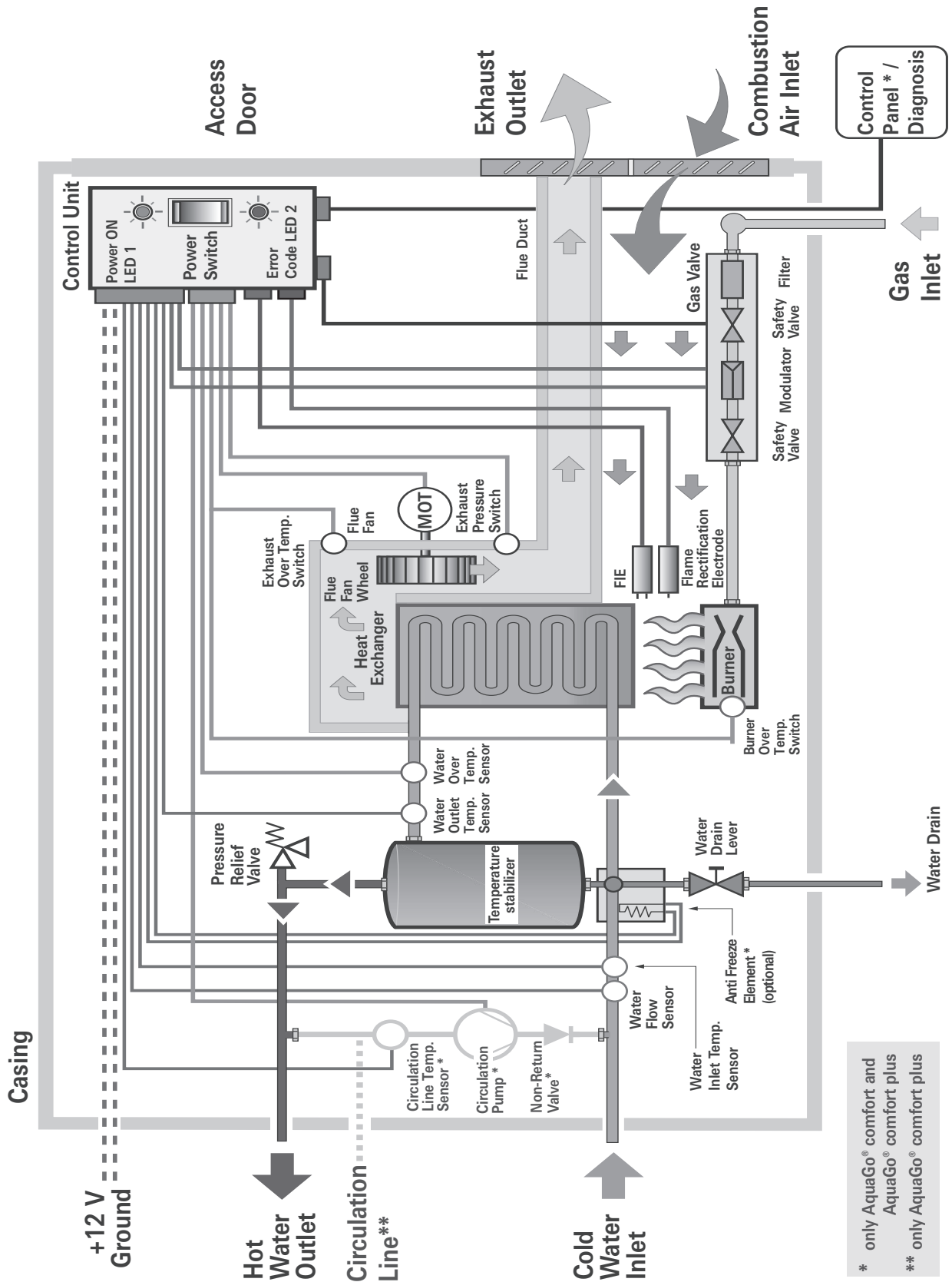
If the appliance malfunctions, LED 2 (refer to “Overview / Designation of parts” on page 2) will blink to indicate the malfunction. There are short and long intervals of blinking. The blinking will repeat every 3 seconds.

1. Write down the blinking intervals and check the list below.
2. Reset the appliance:
 - Switch off the appliance. / – Wait 5 seconds / – Switch the appliance on again.
3. If an error code is still displayed, contact an authorized Truma service center.

Error code	Blink code s = short = 0 l = long = 1	Error	Description
1	s,s,s,s,s,s,l	Flame not detected	There is a flame-detection error at the burner because the flame was not detected after release of gas and ignition. Important: The system indicates this error only after three attempts at intervals of approximately 30 seconds.
2	s,s,s,s,s,l,s	Error at over temperature switches (EOS, BOS)	The exhaust over temperature switch (EOS) or burner over temperature switch (BOS) is open/unplugged.
3	s,s,s,s,s,s,l,l	Error at exhaust pressure switch (EPS)	The EPS did not close when the flue fan was actuated because the fan did not push enough air through the exhaust channel. A cause could be, e.g., blocking of the exhaust channel or a faulty switch. OR The EPS is closed even though the flue fan is not running. Cause is a defective EPS or flue fan.
4	s,s,s,s,s,l,s,s	Error at water over temperature switch (WOS)	The WOS opened at a water temperature of over 185 °F (85 °C).
5	s,s,s,s,s,l,s,l	Flame detected at incorrect time	There is an error in flame detection of the burner because the flame was detected – before ignition or – before the release of gas or – after the gas was switched off.
6	s,s,s,s,s,l,l,s	Error in the safety circuit for gas valve	There is a heating request but gas cannot be released. One of the switches WOS, EOS, BOS, EPS is open/unplugged.
7	s,s,s,s,s,l,l,l	Error of burner MCU internal RAM	Error detected in the burner MCU's internal safety monitoring feature (safety variables are no longer correct or RAM/STACK was overwritten by mistake).
9	s,s,s,s,l,s,s,l	Malfunction of water outlet temperature sensor WOT	Water outlet temperature sensor WOT – has a short circuit or – is open/unplugged.
10	s,s,s,s,l,s,l,s	Error in the safety circuit	There is a heating request but gas is not released because a valve-actuation signal was not activated.
11	s,s,s,s,l,s,l,l	Error of MCU watchdog gas release	There is a heating request but the MCU watchdog does not release the gas path.
12	s,s,s,s,l,l,s,s	Internal error	
13	s,s,s,s,l,l,s,l	Short circuit shut-off valve	Short circuit detection in the gas valve (shut-off part) detected a current > 1000 mA and shut off.
16	s,s,s,l,s,s,s,s	Malfunction of the MCU	Internal error of the control unit.
20	s,s,s,l,s,l,s,s	Malfunction of water inlet temperature sensor WIT	Water inlet temperature sensor WIT – has a short circuit or – is open/unplugged or – the temperature of the sensor is colder than 14 °F (-10 °C).
21	s,s,s,l,s,l,s,l	Malfunction of circulation line temperature sensor WCT	Circulation line temperature sensor WCT – has a short circuit or – is open/unplugged or – the temperature of the sensor is colder than 14 °F (-10 °C).
22	s,s,s,l,s,l,l,s	Malfunction of gas valve, modulation section	Error at gas valve, modulation level, because - the modulator has a short circuit or - is open/unplugged.
23	s,s,s,l,s,l,l,l	Voltage is too high	The main power supply's voltage detector measured a voltage level of >16.4 V.
24	s,s,s,l,l,s,s,s	Voltage is too low	The main power supply's voltage detector measured a voltage level of <10 V.
25	s,s,s,l,l,s,s,l	Flue fan current consumption error	The current detector for the flue fan has measured a current outside the permitted limits.
26	s,s,s,l,l,s,l,s	Circulation pump current consumption error	The current detector at the circulation pump has measured a current outside the permitted limits.
27	s,s,s,l,l,s,l,l	Water circulation pump is running dry.	The circulation pump does not generate water flow. The water system may not be filled or not sufficiently vented. The circulation pump tries (20 times) to generate a water flow every 30 s (if successful, the error is reset).
28	s,s,s,l,l,l,s,s	Too low gas pressure.	Gas supply (in vehicle) to the appliance insufficient.
29	s,s,s,l,l,l,s,l	Too high heat power required.	You are trying to use more hot water than the appliance can supply.
30	s,s,s,l,l,l,l,s	Risk of freezing.	Temperature in the appliance below 27 °F (3 °C).
31	s,s,s,l,l,l,l,l	Decalcification finished.	–
32	s,s,l,s,s,s,s	Current too low.	Current in the antifreeze kit too low (e.g. cable break).
33	s,s,l,s,s,s,s,l	Current too high.	Current in the antifreeze kit too high (e.g. short circuit).



APPENDIX B – Functional Diagram



* only AquaGo® comfort and AquaGo® comfort plus
 ** only AquaGo® comfort plus

Fig. 33



APPENDIX C – Spare Parts (all models)

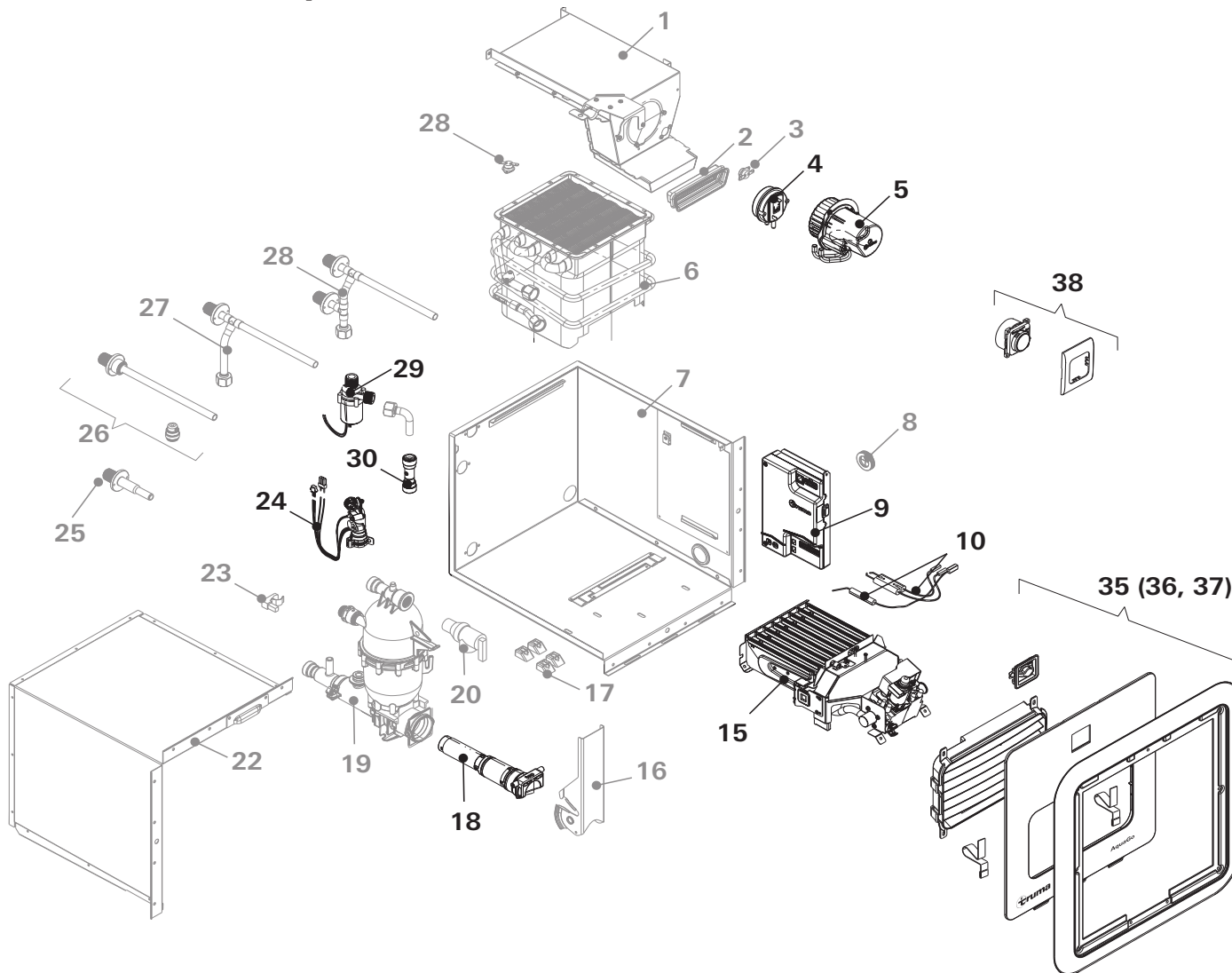


Fig. 34

Item Ref.	Part no.	Component
1	NYA	
2	NYA	
3	NYA	
4	77000-90100	Exhaust Pressure Switch
5	77000-90200	Flue Fan Assembly
6	NYA	
7	NYA	
8	NYA	
9	77000-00113	Control Unit Assembly
10	77000-91300	Electrodes
11	NYA	
12	NYA	
13	NYA	
14	NYA	
15	77000-90400	Burner Assembly
16	NYA	
17	NYA	
18	77000-90800	Filter Assembly
19	NYA	
20	NYA	

Item Ref.	Part no.	Component
21	-	-
22	NYA	
23	NYA	
24	77000-90500	Flow Sensor Assembly
25	NYA	
26	NYA	
27	NYA	
28	NYA	
29	77000-90600	Circulation Pump
30	77020-03500	Non-Return Valve Assembly
31	NYA	
32	NYA	
33	NYA	
34	NYA	
35	77001-01	Access Door Standard
36	77101-01	Access Door Adapter (not shown)
37	77201-01	Access Door XS (not shown)
38	77000-00089	Control panel
39	77000-00114	Sticker set (not shown)



APPENDIX D – Electrical Connection Diagram

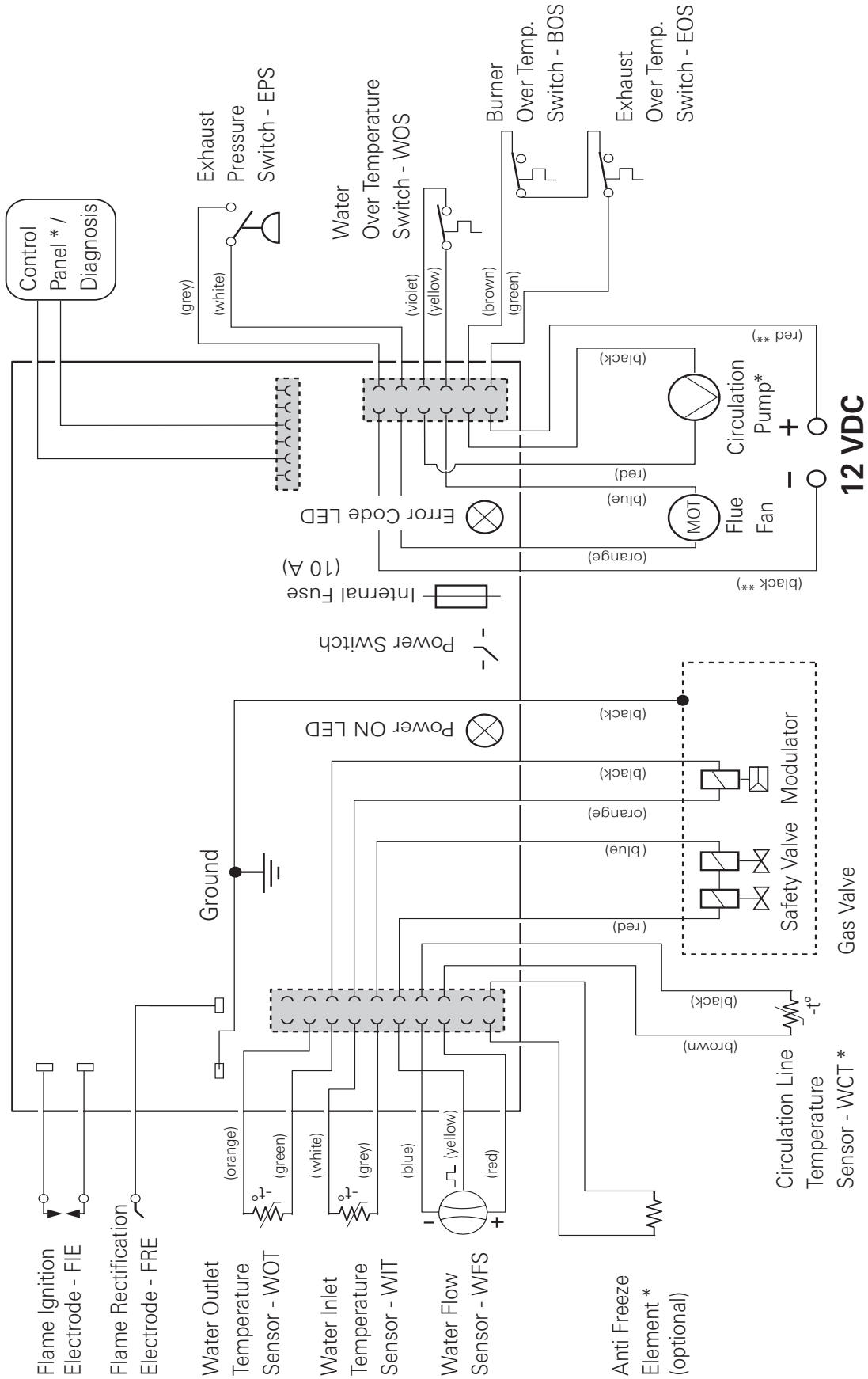


Fig. 35

* only AquaGo™ Comfort and AquaGo™ Comfort Plus

If any of the original wire as supplied with the water heater must be replaced, it must be replaced with wire 18 AWG (** 16 AWG) - 105 °C - UL1015, or its equivalent

18 AWG or 1 mm² MWG (** 16 AWG or 1.5 mm² MWG)



APPENDIX E – Notes for painting the access door and cover plate

Important Information

▲ Observe all safety notes/instructions for painting the access door and cover plate.

The following parts (see Fig. 37) may be painted:

- The white cover plate
- The white outer surfaces of the access door

Material of the parts:

- The parts are made from a polycarbonate material.
- Check whether the paint to be used is suitable for polycarbonate.
- For optimum adhesion of the paint it may be necessary to apply a primer to the surfaces that will be painted.
- **NOTICE** Use of unsuitable paints may damage the parts. Follow the recommendations of the paint manufacturer.

The following parts (see Fig. 36) must not be painted:

- The black venting grid
- The turn lock
- The webbings

Work before painting

i In order to simplify painting and reduce the work for masking, the turn lock and the venting grid can be removed/disassembled.

Please follow the steps below to remove the venting grid and the turn lock:

1. Open the access door.
2. Remove the venting grid:

- Using a Torx T-15 remove the 4 screws securing the venting grid to the access door.
- After removing the screws, depress the four (4) clips on the side of the venting grid and remove it as shown in Fig. 36.

3. Remove the turn lock:
To remove the turn lock, depress the four (4) clips and remove it as shown in Fig. 36.
4. Mask the venting grid opening from the back side (side with waffle pattern).
5. Close the access door and fix it in the closed position for painting.
 - This can be done with help of tape that joins the flue fan and the edge of the turn lock opening (see Fig. 37 for this detail).
 - Remove any tape that hangs over the edge by more than 0.12 in. (3 mm).
 - Finally mask the turn lock opening with tape (hatched area). Take care not to exceed 0.12 in. (3 mm) from the edge (this is the area that will be covered by the turn lock).
6. Paint the access door and the cover plate.

Work after painting

7. Remove all masking.
8. Assemble the venting grid and the turn lock in the reverse order. Make sure that they are installed in the right direction.
9. Ensure turn lock operates correctly (if unsure: see "Closing the access door" on page 9).



TRUMA AQUAGO COMFORT WATER HEATER

Painting a detached access door

i If necessary for masking or painting, the access door can be detached temporarily.

- Remove the four (4) screws that fix the webbings.
- Fix the webbings again after painting.

⚠ WARNING

Danger of personal injury or damage to the recreational vehicle.

Unsecured webbings cause the access door to become loose and it may fall off when you are driving the RV.

- After painting, the webbings must be fixed firmly to the access door with the original screws.

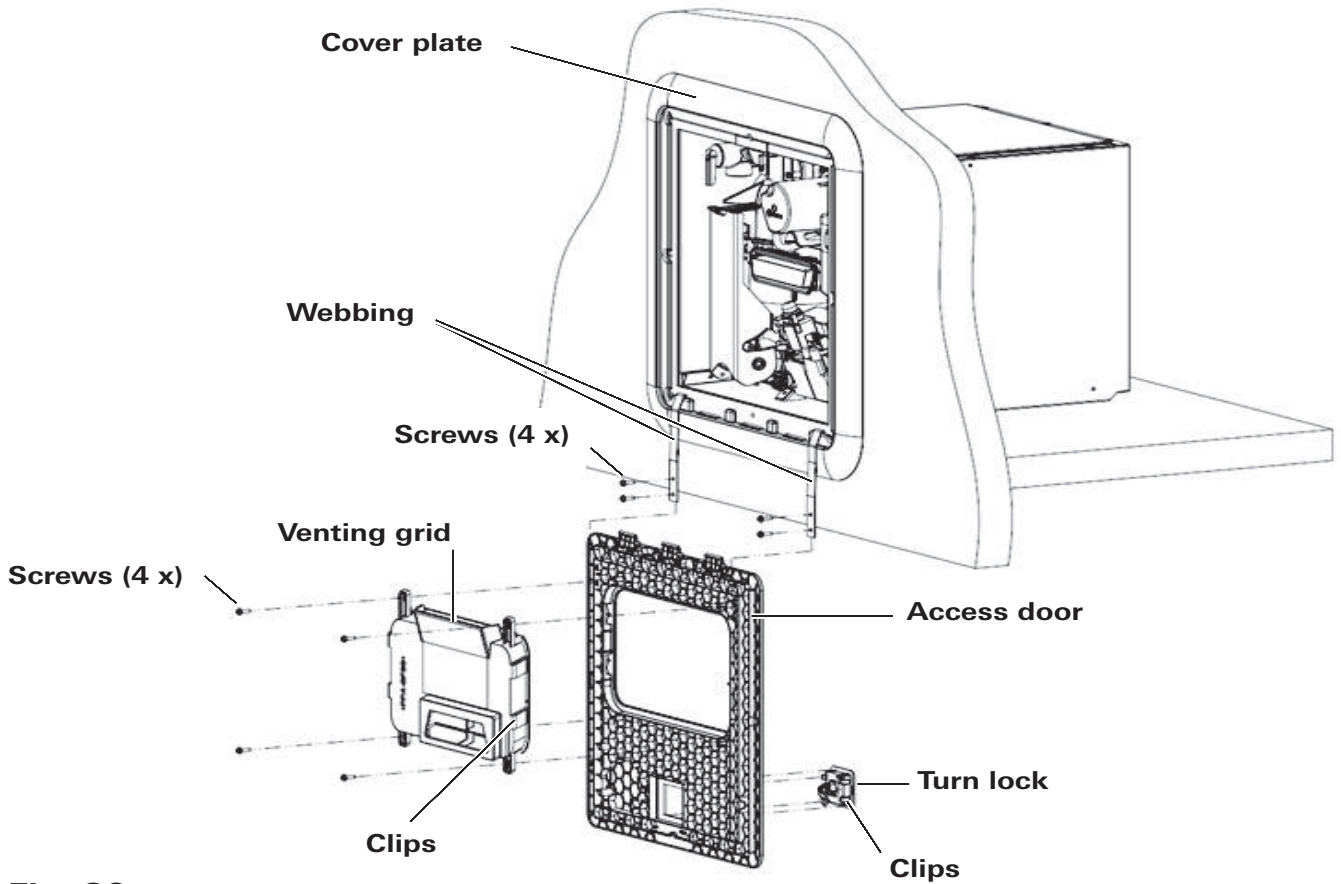


Fig. 36

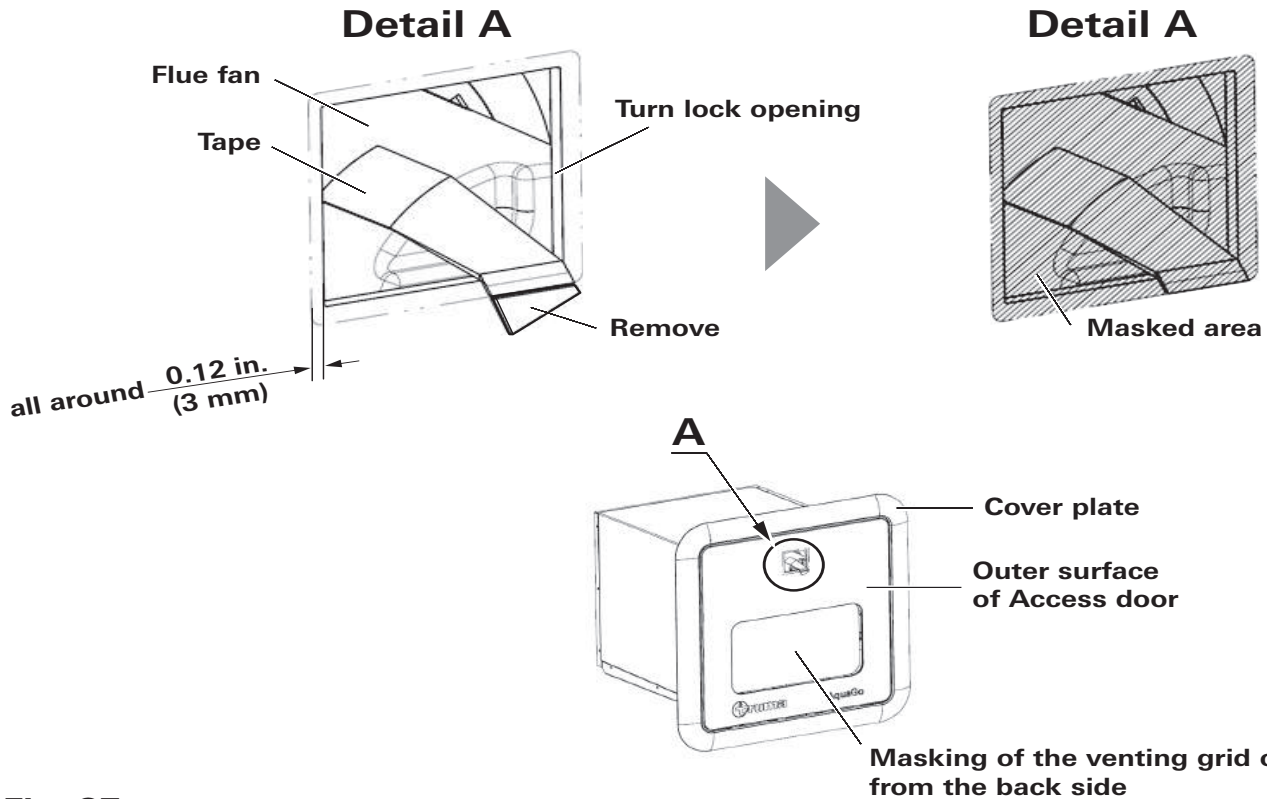


Fig. 37



TRUMA AQUAGO COMFORT WATER HEATER

USA In case you encounter any problems, please contact the Truma Service Center at 855-558-7862 or one of our authorized service partners. For details see www.truma.net.

Please have the model number and serial number (on water heater's type plate) handy when you call.

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Manufacturing

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Fax 1-574-538-2426
service@trumacorp.com
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Electric antifreeze kit

AquaGo™

US

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CA, MX ▶






Intended use

The Truma electric antifreeze kit* keeps the Truma AquaGo™ instant water heater frost-free to -4 °F (-20 °C) while you are driving or if there is no gas supply. To operate the Truma antifreeze kit you need a 12 V (minimum 120 W recommended) power supply from the RV's on-board system.

* For AquaGo™ comfort / AquaGo™ comfort plus


 The Truma electric antifreeze kit protects only the water in the Truma AquaGo instant water heater against freezing. The Truma electric antifreeze kit will not protect the RV's entire water system. Water lines, faucets, water tanks and the external water valves and the vehicle must be heated separately.


Safety Information


The operating instructions supplied with the Truma AquaGo™ instant water heater are part of these installation and operating instructions for the Truma electric antifreeze kit.

Read and follow all of this information to avoid injuries during installation and operation.

Safety symbols and signal words

 This is the safety alert symbol. This symbol alerts you to potential hazards that can kill or hurt you and others.

 **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

 **NOTICE** is used to address practices not related to physical injury.



i Other important information or tips

Installation and service must be performed by an expert. Improper installation, alteration, service or maintenance can cause property damage, personal injury or loss of life.

California Proposition 65 lists chemical substances known to the state to cause cancer, birth defects, death, serious illness or other reproductive harm. This product may consist of such substances or such substances may be formed from components of the product.

3

Scope of delivery

Quantity	Component
1	Electric antifreeze kit cartridge (heating cartridge)
1	Adapter cable
1	Plug
1	Holder
2	Cable ties (not shown)
1	Installation/Operating instructions for the Truma electric antifreeze kit

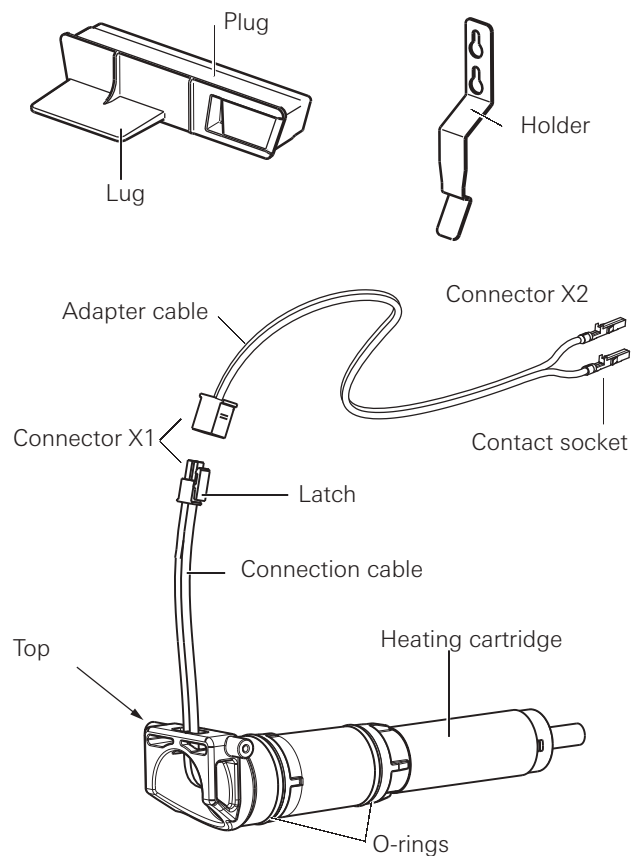


Fig. 1



Installation instructions



You will find more information about the following in the operating instructions for the Truma AquaGo™ instant water heater:

- Operation
- Access door
- Draining the water

Preparing for installation

1. Remove the access door.
2. Switch OFF the Truma AquaGo™ instant water heater at the POWER switch and at the control panel (set Operating mode to OFF).

Installing the holder

3. Attach the holder to the rear side of the access door, as shown in Figure 2.

4. Clamp the plug beneath the holder, as shown in Figure 3.

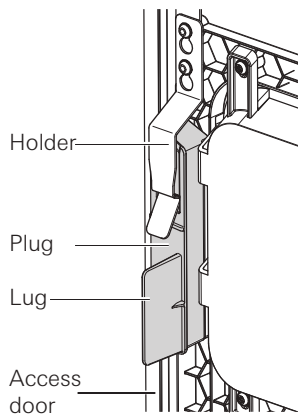


Fig. 3

Installing the heating cartridge

1. Turn OFF the water supply or switch OFF the water pump.
2. Open a hot water faucet and leave it open in order to depressurize and vent the water system.

- Undo the two screws of the webbing about 1/10 inch (2.5 mm).
- Position the holder below the screws.
- Tighten the screws.

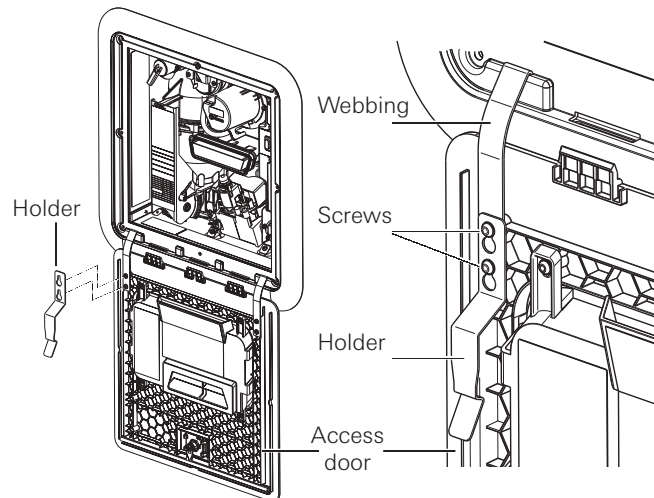


Fig. 2

3. **CAUTION** **Injuries caused by the Easy Drain Lever!** When the Easy Drain Lever is folded out, it protrudes beyond the side wall of the vehicle.
 - When walking past or bending over, make sure that you and others have sufficient distance.
4. Open the latch with your thumb while pulling the Easy Drain Lever down as far as it will go.
5. Remove the water inlet filter as shown in Fig. 4a and rinse it with clean water.



Keep the water inlet filter in a safe place. When you decalcify the Truma AquaGo™ instant water heater, you will need it for the Truma AquaGo™ decalcification tablets.

6. Inspect the O-rings on the heating cartridge for cracks. Replace the heating cartridge if there are cracks.



7. **⚠ CAUTION** Danger of crushing/pinching of fingers when the Easy Drain Lever is closed!

- Never put fingers between Easy Drain Lever and water inlet filter or latch.

i If during installation, it is difficult to install the heating cartridge, use a small amount of soap on the O-rings. Never use grease, because the O-rings are not resistant to grease.

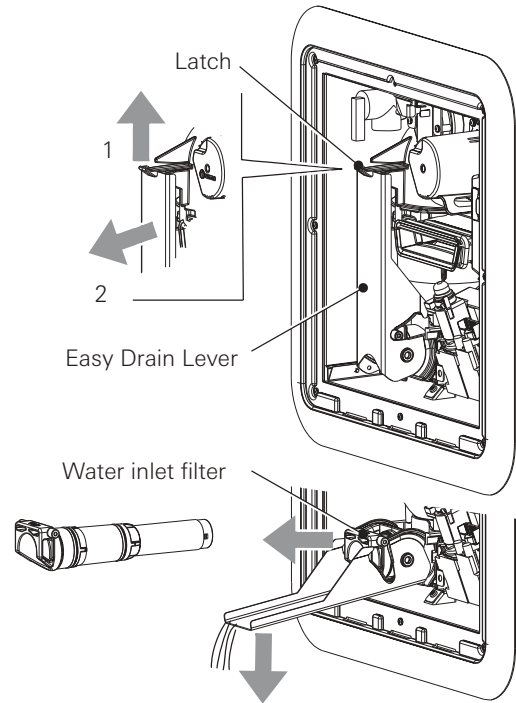


Fig. 4a

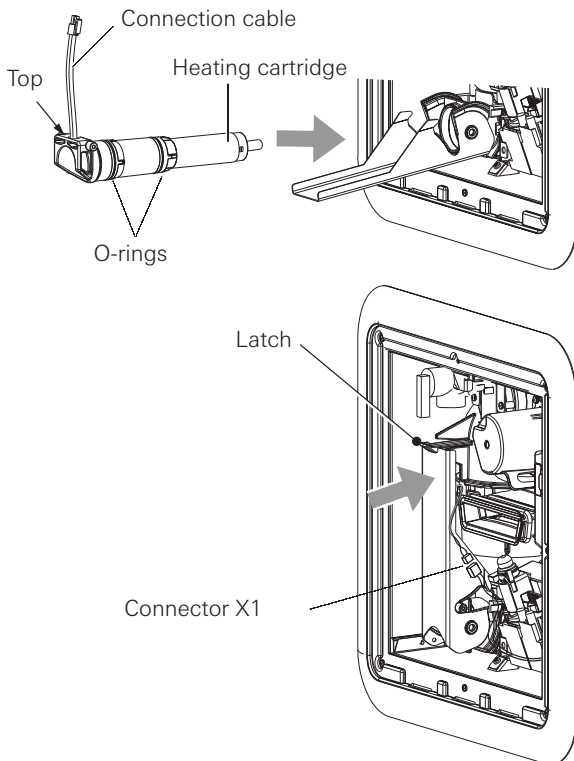


Fig. 4b

7

8. **⚠ CAUTION** Risk of a short circuit!

- Lay the connection cable upward so that it is not jammed when the Easy Drain Lever is closed.

9. Install the heating cartridge as shown in Fig. 4b. Observe the correct installation position and close the Easy Drain Lever until it is locked by the latch. You can hear a “clicking” sound as the Easy Drain Lever engages.

Electrical installation (“adapter cable”)

1. **NOTICE** Damage to the contact sockets resulting from incorrect installation.
 - During installation, you must align the contact sockets as shown in Figure 5.
 - Remove the socket housing from the control unit (press the lock).

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TRUMA ELECTRIC ANTIFREEZE KIT

2. Slide the contact sockets (see Figure 5) into the socket housing (openings 1 and 11) until they lock in place. You do not have to bother about the plus and minus poles.
3. After installation, lightly pull the adapter cable to make sure that the contact sockets are locked in place.
4. You must attach the socket housing to the control unit again when you have removed it. It must lock in place.
5. Lay the adapter cable and fix it in place with the 2 cable ties, as shown in Figure 5.
6. Connect the connection cable to the adapter cable (see Figure 5).

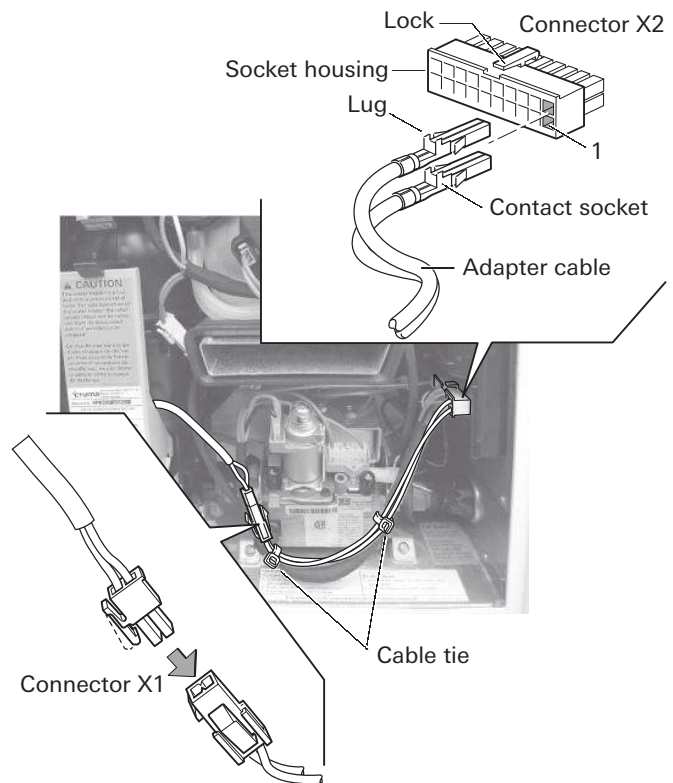


Fig. 5

7. Installation is complete.

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Operating instructions

For proper operation, you must observe the following:

- **Gas must not be used for heating while the RV is in motion.**
- With this electric antifreeze kit, the Truma AquaGo™ instant water heater can be kept frost-free while you are driving or if there is no gas supply (to ambient temperatures of -4 °F (-20 °C)).
- At ambient temperatures below -4 °F (-20 °C) the Truma AquaGo™ instant water heater must not be operated and must be winterized.



You will find more information about the following in the operating instructions for the Truma AquaGo™ instant water heater:

- Operation
- Operating modes
- Winter operation / winterizing
- Troubleshooting
- Access door
- Draining the water

Start-up

1. Remove the access door.
2. Switch OFF the Truma AquaGo™ instant water heater at the POWER switch and at the control panel (set Operating mode to OFF).
3. Allow the Truma AquaGo™ instant water heater to cool down
4. **NOTICE** Risk of damage in frosty conditions without plug!



- Never operate the electric antifreeze kit without an installed plug in the flue duct. (The plug prevents cold air from flowing through the heat exchanger).
5. Remove the plug from the holder and close the flue duct with it (see Figure 6).
 6. You may have to connect the connection cable to the adapter cable (see Figure 5).

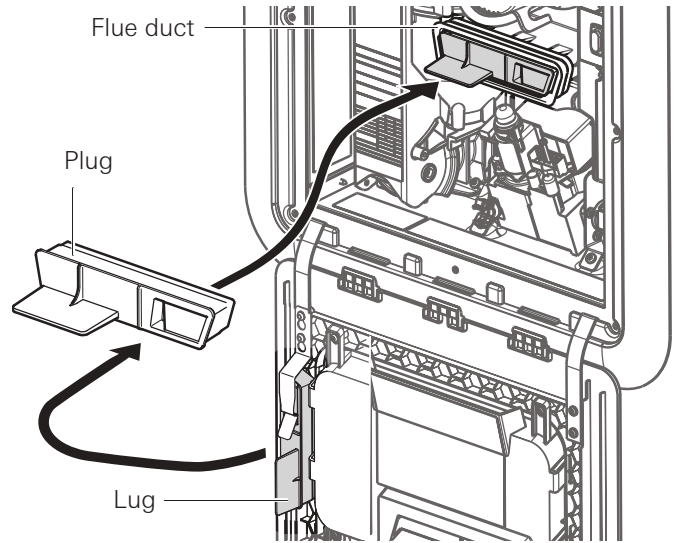


Fig. 6

7. To operate the antifreeze kit, fill the Truma AquaGo™ instant water heater with water and switch it on. (See “Winter operation” in the operating instructions for the Truma AquaGo™ instant water heater.)
 - Close open bypass lines (if present).

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- Turn on fresh water supply or switch on water pump.
 - Fill the water system.
 - **NOTICE Malfunction of the electric antifreeze kit due to air in the water system**
 - Vent the water system so that the circulation pump in the Truma AquaGo™ instant water heater works.
 - Open all water-release points, e.g., cold and hot water faucets, showers, toilets.
 - Once water flows uniformly, the water system is vented. Close the water-release points.
8. Switch ON the Truma AquaGo™ instant water heater at the POWER switch.
 9. Insert and close the access door.

10. Check the position of the plug. You must be able to see the lug through the venting grid – as shown in Figure 7.

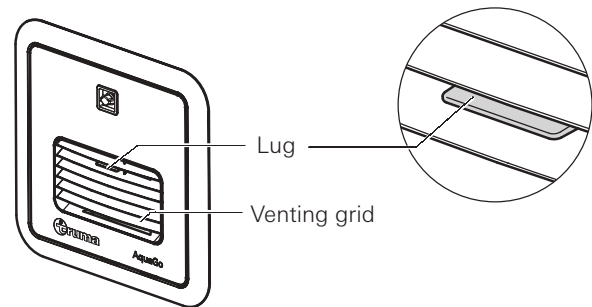


Fig. 7

11. Select operating mode ANTIFREEZE (see Figure 8).



Fig. 8

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TRUMA ELECTRIC ANTIFREEZE KIT

- During operation, the yellow status LED 3 (see Fig. 8 - LED 3) is lit.

Troubleshooting

Problem

The Truma AquaGo™ instant water heater does not start in gas mode.

Remove the plug from the flue duct and clamp it beneath the holder (see Figure 9).

The yellow status LED 3 is not lit.

Check the connection on connector X1. You may have to disconnect it and connect it again.

The yellow status LED 3 is flashing.

See "Description of the yellow status LED 3" in operating modes (control panel) in the operating instructions for the Truma AquaGo™ instant water heater.

Potential cause

– The plug is blocking the flue duct.

– The heating cartridge is not attached or is defective.

– There is a malfunction.

If none of the measures in the troubleshooting chart proves successful, please contact your dealer, the Truma Service Center on 1-855-558-7862 or one of our authorized service partners.

Change over to gas mode

i If you change the Truma AquaGo™ instant water heater back to gas mode, the heating cartridge can remain in the Truma AquaGo™ instant water heater.

1. Remove the access door.
2. Switch OFF the Truma AquaGo™ instant water heater at the POWER switch and at the control panel (set Operating mode to OFF).
3. Remove the plug from the flue duct and clamp it beneath the holder (see Figure 9).

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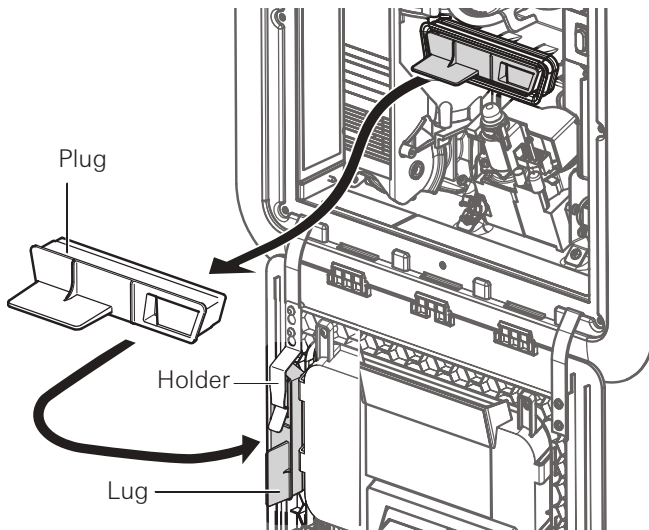


Fig. 9

4. Switch ON the Truma AquaGo™ instant water heater at the POWER switch.
5. Insert and close the access door.

6. The Truma AquaGo™ instant water heater is now ready for using the control panel inside your vehicle.

Dismantling the electric antifreeze kit

For decalcification you must use the water inlet filter (included with the delivery of the Truma AquaGo™ instant water heater).

1. Remove the access door.
2. Switch OFF the Truma AquaGo™ instant water heater at the POWER switch and at the control panel (set Operating mode to OFF).
3. Turn OFF the water supply or switch OFF the water pump.
4. Open a hot water faucet and leave it open in order to depressurize and vent the water system.

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5. Remove the plug from the flue duct and clamp it beneath the holder (see Figure 9).
6. Unplug the connector X1 (see Fig. 10).

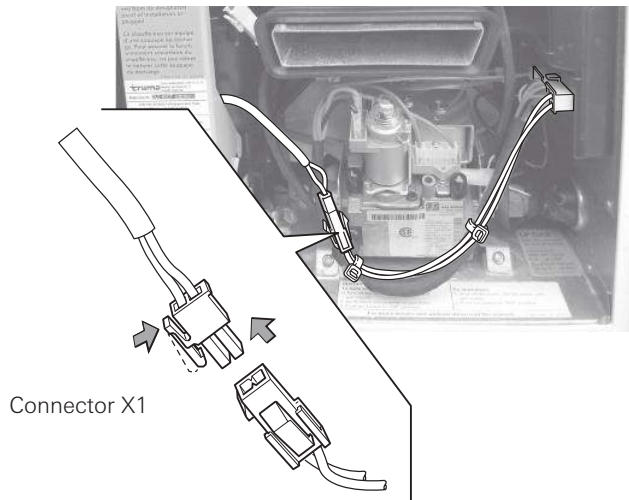


Fig. 10

7. **⚠ CAUTION Injuries caused by the Easy Drain Lever!** When the Easy Drain Lever is folded out, it protrudes beyond the side wall of the vehicle.
 - When walking past or bending over, make sure that you and others have sufficient distance.
8. Open the latch with your thumb while pulling the Easy Drain Lever down as far as it will go.
9. Remove the heating cartridge as shown in Fig. 11a and rinse it with clean water.

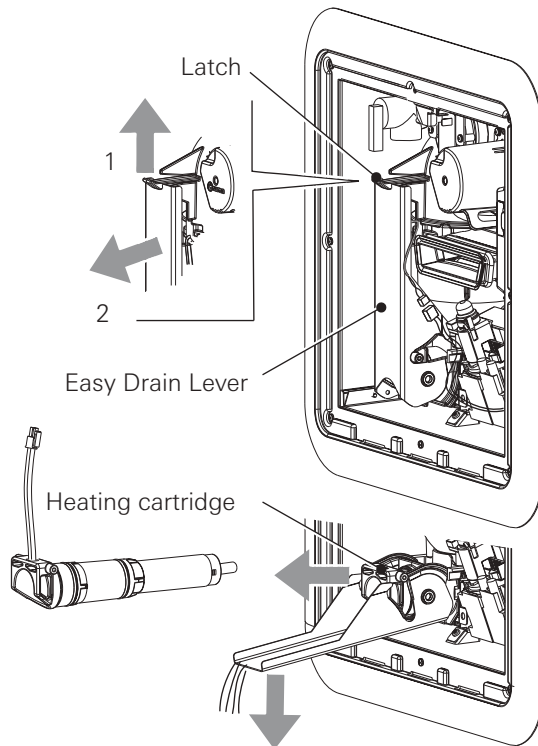


Fig. 11a

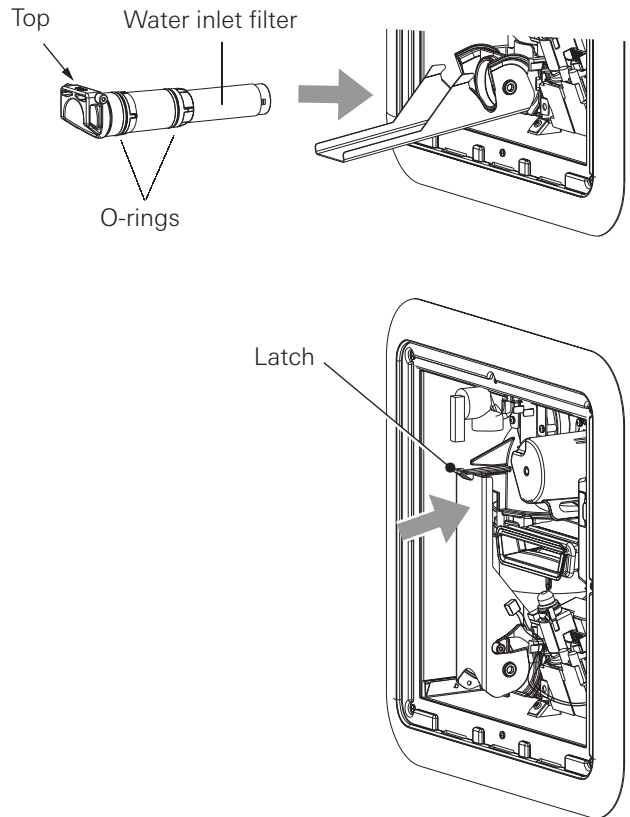


Fig. 11b



TRUMA ELECTRIC ANTIFREEZE KIT

10. If you now want to decalcify the Truma AquaGo™ instant water heater, the removal of the electric antifreeze kit is complete.

i You can find more information about decalcification in the operating instructions for the Truma AquaGo™ instant water heater in “Decalcification (models with control panel)”.

11. Inspect the O-rings on the water inlet filter for cracks. Replace the water inlet filter if there are cracks.

12. **⚠ CAUTION** **Danger of crushing/pinching of fingers when the Easy Drain Lever is closed!**

- Never put fingers between Easy Drain Lever and water inlet filter or latch.

i If during installation, it is difficult to install the heating cartridge, use a small amount of soap on the O-rings. Never use grease, because the O-rings are not resistant to grease.

13. Install the water inlet filter as shown in Fig. 11b. Observe the correct installation position and close the Easy Drain Lever until it is locked by the latch.

You can hear a “clicking” sound as the Easy Drain Lever engages.

14. Insert and close the access door.

15. Removal of the electric antifreeze kit is complete. You can find information about operation of the Truma AquaGo™ instant water heater in “Operating procedures” in the operating instructions for the Truma AquaGo™ instant water heater.

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Technical data

Nominal voltage	12 VDC
Nominal current	5 A
Ambient temperature	-4 °F...+104 °F (-20 °C...+40 °C)
Dimensions	
Width	2.8 inch (72 mm)
Height	2.0 inch (50 mm)
Depth	9.1 inch (230 mm)
Weight (approx.)	0.5 lbs (220 g)

TRUMA Gerätetechnik GmbH & Co. KG
("TRUMA")

“Electric antifreeze kit” MANUFACTURER LIMITED WARRANTY

(September 2014)

This limited warranty pertains solely to the “electric antifreeze kit” (the “Product”) manufactured by TRUMA and sold through its affiliates and dealers in North America.

TRUMA warrants subject to the below stated conditions that the Product will be free from defects in material and workmanship, and will perform in accordance with the technical specifications set forth in the description of the Product for a period of twelve (12) months for newly manufactured parts from the original date of purchase. This limited warranty shall only apply



if the Product was properly installed according to the installation instructions provided and in compliance with applicable codes.

During the warranty period, TRUMA will repair or replace, at its own discretion and costs, the defective Product or parts or components of such Product reported to TRUMA and which TRUMA determines was defective due to a warranty defect. Costs of diagnosis for a warranty defect are borne by TRUMA. Other costs of diagnosis are not included in this warranty. At the discretion of TRUMA, the replacement of the Product or parts or components thereof (i) may be newly manufactured, (ii) may be assembled from new or serviceable used parts that are equivalent to new parts in performance, or (iii) may have been previously installed.

The customer shall not attempt to repair the Product or resolve the problem without the prior consent of TRUMA. Any attempt by the customer to repair the Product or

resolve the problem without the prior consent of TRUMA will void this warranty.

This limited warranty does not cover any defects attributable in whole or in part to (i) non-TRUMA products and services and / or alterations of out-of-specification supplies, (ii) accidents, misuse, negligence or failure of the customer to follow instructions for the proper use, care and cleaning of the Product, (iii) damages caused in gas pressure regulation systems due to foreign substances in the gas (i.e. oil, plasticizers), (iv) external factors (e.g., fire, flood, severe weather), (v) failure of proper transport packaging, or (vi) failure by the purchaser to comply with TRUMA's installation and user manual regarding the Product.

All warranty claims must be reported to TRUMA's authorized warranty service center in the United States: Truma Corp Service Center, **825 East Jackson Blvd., Elkhart, IN 46516, toll free: (855) 558-7862, fax. (574) 538-2426, service@trumacorp.com, www.truma.net**

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The purchaser shall provide the following information regarding the potential warranty claim (i) serial number of the defective device, (ii) proof of purchase, (iii) purchaser's contact information.

EXCEPT AS EXPRESSLY STATED AND SET FORTH HEREIN, THERE ARE NO WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT AND NO SUCH WARRANTIES OR REPRESENTATIONS SHALL BE IMPLIED UNDER ANY APPLICABLE LAW, IN EQUITY OR OTHERWISE, INCLUDING WITHOUT LIMITATION, A WARRANTY OF MERCHANTABILITY, A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER WARRANTY WHICH MAY BE IMPLIED UNDER COMMON LAW OR UNDER THE UNIFORM COMMERCIAL CODE OF ANY STATE OR OTHER JURISDICTION OF THE UNITED STATES OF AMERICA.

Unless further limited herein, the entire liability of TRUMA and the customer's exclusive remedy for damages from any cause related to or arising out of a warranty defect, regardless of the form of action, whether in contract or in tort, will not exceed the amount of the purchase price for each purchase order for the Product which is the subject matter or directly related to the causes of action asserted.

Unless prohibited under applicable state law, in no event will TRUMA, its agents, subcontractors, affiliates, suppliers and employees be liable for (a) any incidental, indirect, special or consequential damages, including, but not limited to, loss of use, revenue, profits or savings, substitute rental or for any other reason, even if TRUMA knew or should have known of the possibility of such losses or damages, (b) claims, demands or actions against the customer by any person, except as provided by applicable law.



TRUMA ELECTRIC ANTIFREEZE KIT

US In case you encounter any problems, please contact the Truma Service Center at 855-558-7862 or one of our authorized service partners. For details see www.truma.net.

CA En cas de problème, veuillez communiquer avec le Service après-vente (SAV) Truma au 855-558-7862 ou avec l'un de nos partenaires de service autorisés. Pour plus de détails, visitez www.truma.net.

MX En caso de que se presente algún problema, rogamos se comuniquen con el Centro de Servicio postventa Truma en el 855-558-7862 o con uno de nuestros distribuidores de servicio autorizados. Para más información, visite www.truma.net.

Manufacturing / Fabrication / Producción

Truma Gerätetechnik GmbH & Co. KG
Wernher-von-Braun-Straße 12
85640 Putzbrunn
Germany / Allemagne / Alemania
www.truma.com

Please have the model number and serial number (on water heater's type plate) handy when you call.

Ayez à portée de la main les numéros de modèle et de série (indiqués sur la plaque signalétique du chauffe-eau) au moment de votre appel.

Tenga a mano el número de modelo y el número de serie (en la placa de características del calentador de agua) cuando se comuniquen con nosotros.

Service / service / servicio

Truma Corp
825 East Jackson Blvd.
Elkhart, IN 46516
USA / États-Unis / EE.UU.
Toll Free / Sans frais / Sin coste
1-855-558-7862
Fax / Télécopieur / Fax
1-574-538-2426
service@trumacorp.com / www.truma.net

77000-00127 - 00 - 03/2016



Voyager®
Digital Wireless
Auto-Pairing
 FEATURING
WiSight® technology

WVOS43
Digital Wireless
Observation System



YOU WILL NEED:

- Voltage Meter
- Water proof sealant
- Drill with 1/8" drill bit
- Phillips head screwdriver

KEY FEATURES:

- Easy installation, fits most applications
- 4.3" monitor comes with suction cup mount and 12 Volt DC plug for easy portability
- Camera connects to rear clearance light or 12V circuit
- WiSight® technology- no cable or wiring necessary
- No interference
- Signal transmits through and around objects up to 60+ feet away
- Sharp, clear, uninterrupted picture
- Expandable up to four wireless cameras (WVCMS130AP) and one Voyager wired camera
- Mirror or Normal View selectable

Package includes a 4.3" LCD color monitor, one 12 Volt DC accessory plug, one wired camera cable input, a suction cup monitor mount, one rear color camera, stainless steel hardware, and non-corrosive camera mounting bracket.

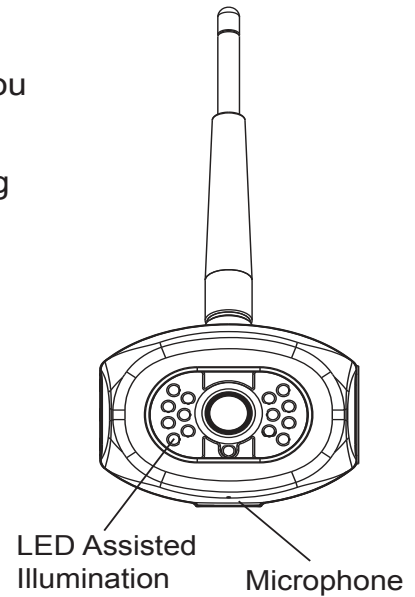
PATENT PENDING

English



INSTALLING THE CAMERA

1. Choose a location close to the rear clearance lights so you can easily splice the power and ground connections.
2. Using a voltage meter, measure the clearance light wiring to determine positive/negative polarity.
3. Connect the red wire from the camera to the positive wire in the rear clearance lights.
4. Connect the black wire from the camera to the negative wire in the rear clearance lights.
5. Pre-drill the screw holes for the mounting bracket with an 1/8" drill bit.
6. Apply a weather proof sealant to the pre-drilled holes.
7. Align the bracket to the holes.
8. Install the bracket with the supplied Tapping P/H screws with washers.
9. Apply additional sealant to the screw heads and bracket to ensure a weather proof seal.
10. Align the camera in the bracket (Figure 1).
11. Install with the supplied Hex Socket Head stainless screws and larger washers in the corresponding holes(Figure 2).
12. Camera should be adjusted for optimum view before these screws are fully tightened.



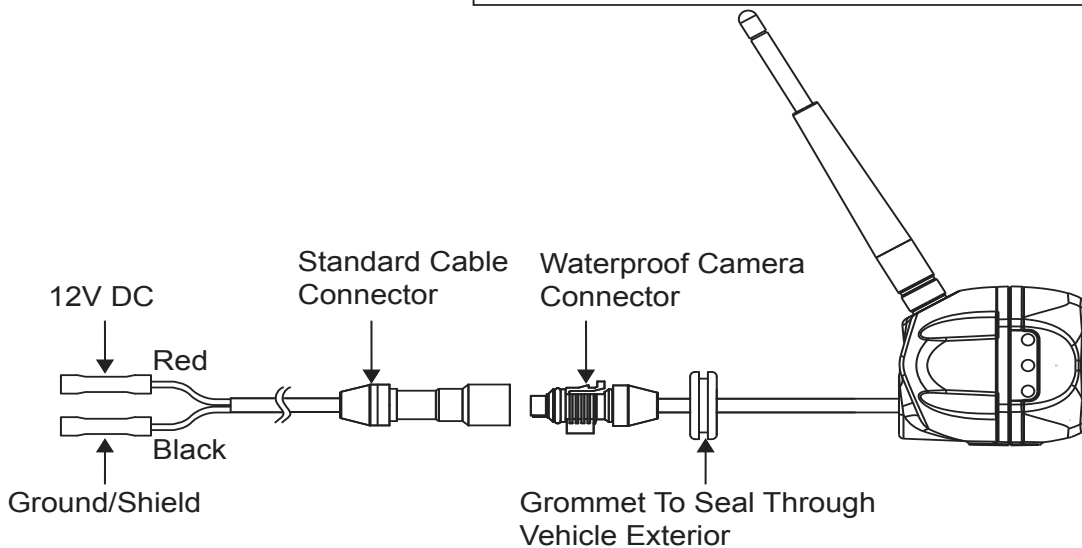
Installation

Screw For Use

- Hex socket Head M4xM6L stainless screw
- Flat washers 4.5x9.5x1mm
- Stainless Allen wrench

Figure 1

Figure 2

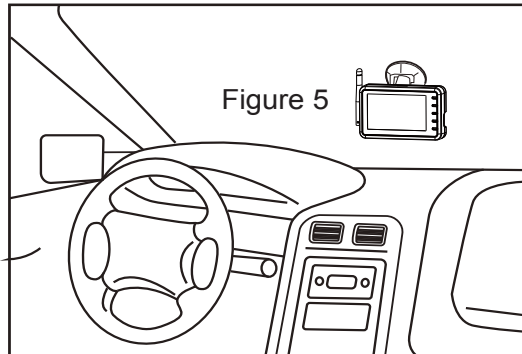


EN-01



INSTALLING THE MONITOR

1. Plug power cable into the back of the monitor.
2. Attach the suction cup mount to the rear of the monitor with the supplied bracket.
3. Locate flat section of glass on your windshield (that does not block your vision) and apply suction cup. Snap the lever into the locked position (Figure 5).
4. Connect the power cord to a 12 Volt DC outlet.
5. Align the antenna to its upright position, parallel to the monitor.



OPERATION

1. Press the power button on the monitor and turn on your vehicle's parking lights.
2. In the top left corner of the monitor, you will see the signal strength meter.
3. Adjust the suction cup bracket to provide the best viewing angle.

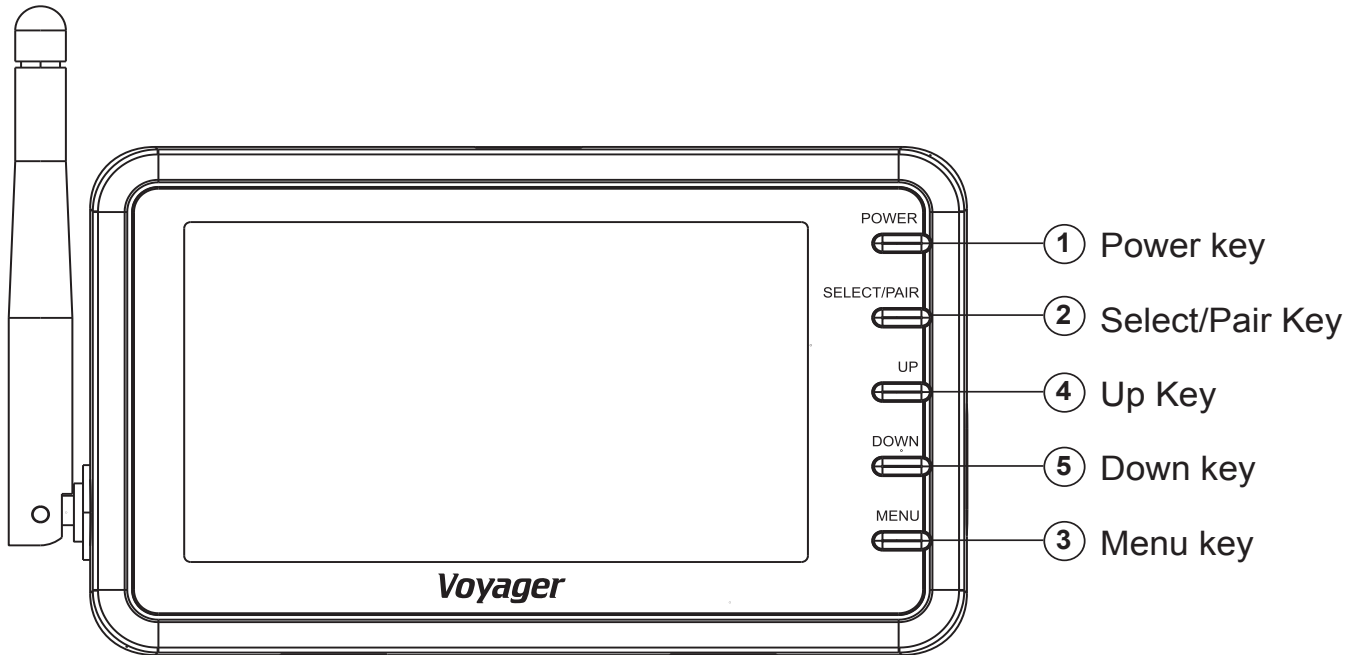
PAIRING PROCESS

This system has Auto-Pairing function. If your monitor is not receiving a signal from the camera; the two may not be paired correctly.

1. Monitor must be connected to 12 Volt DC power supply.
2. Press the SELECT/PAIR button on the front of the monitor expected mode & select the appropriate AV source (AV1-AV4)
3. Press and hold the "SELECT/PAIR" button on the front of the monitor for 5 seconds and release. (Monitor will display "PAIRING START")
4. Apply 12 Volt DC power to the camera.(Camera 1 - Camera 4 corresponding to Monitor's AV1 - AV4)

If done correctly, monitor will display "SAVE DATA". If pairing is not successful, the monitor will display "PAIRING FAIL". If you receive this message, repeat steps 3-4.

KEY FUNCTION



1. POWER KEY

- Press once to turn on the monitor.
- Press again to turn off the monitor.

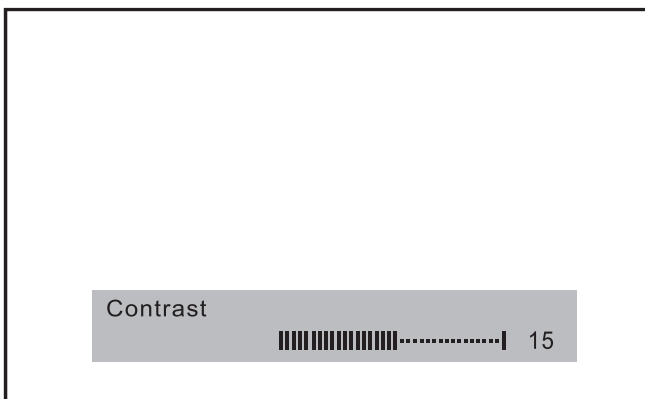
2. SELECT/PAIR KEY

- Press the SELECT/PAIR key less 1 second, the channel will be changed.
- Press the SELECT/PAIR key over 5 seconds, the pairing mode is enabling.

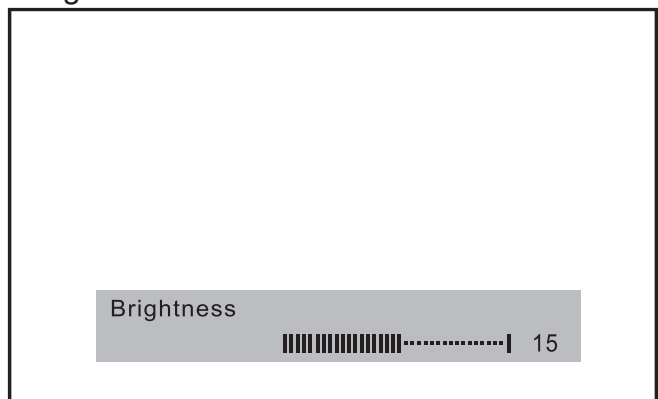
3. MENU KEY

- Press less than 1 second enters the Contrast, Brightness, Color, Tint, Mirror, AutoPower, Dimming, Screen Saver and Scale Marker adjustment mode.
- Press the up or down key to adjust the level of menu.

Contrast

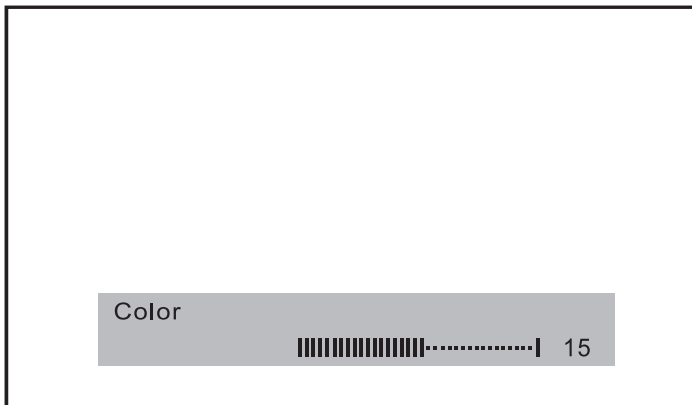


Brightness

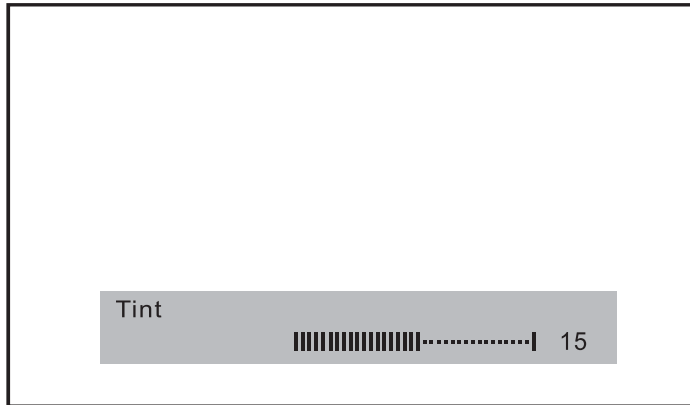




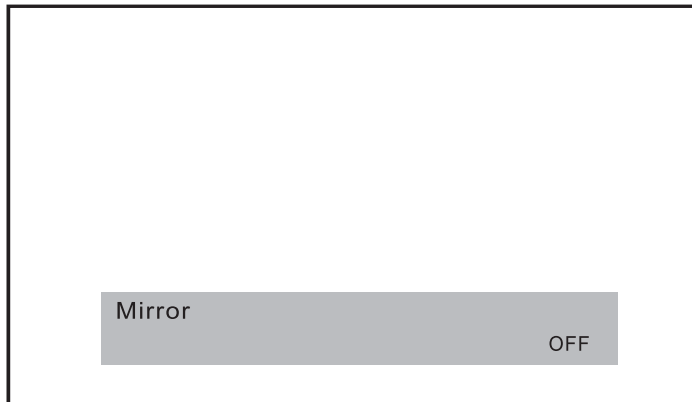
Color



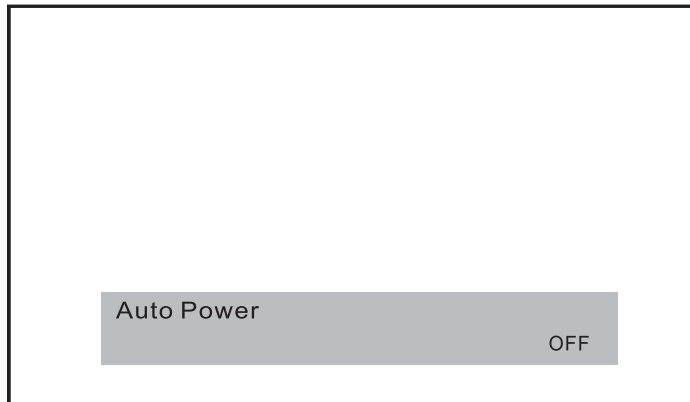
Tint



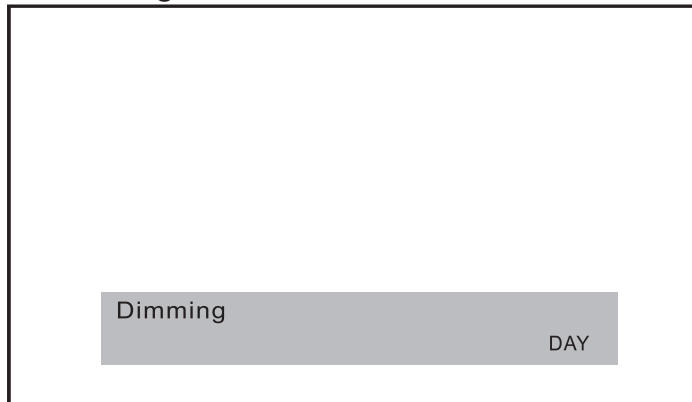
Mirror



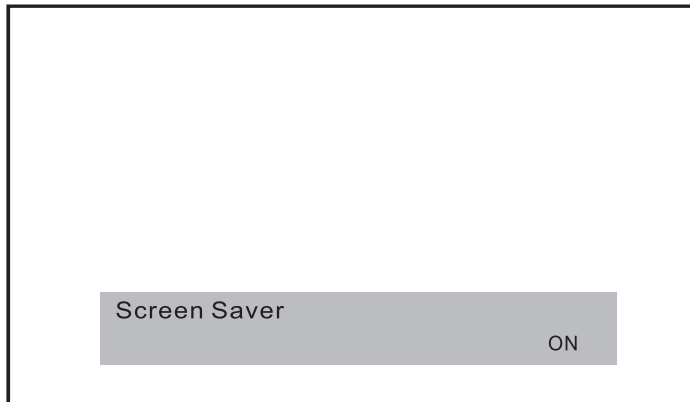
AutoPower



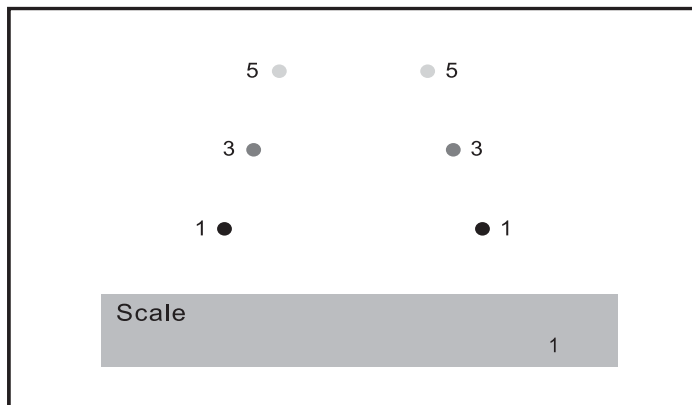
Dimming



Screen Saver



Scale Marker





VOYAGER REAR/BACKUP CAMERA

4.UP AND 5.Down KEYS

Function for Brightness, Contrast, Color, and Tint Control

- Pressing “UP” key to increases brightness, contrast, color, or tint level when accessed menu adjust mode.
- Pressing “DOWN” key to decreases brightness, contrast, color, or tint level when accessed menu adjust mode.

Function for Mirror Control

- Pressing “UP” key to change the mirror setting to ON or OFF when accessed menu adjust mode.
- Pressing “DOWN” key to change the mirror setting to OFF or ON when accessed menu adjust mode.

Function for AutoPower

- Pressing “UP” key to change the Autopower setting to ON or OFF when accessed menu adjust mode.
- Pressing “DOWN” key to change the Autopower setting to OFF or ON when accessed menu adjust mode.

Note:

Auto power on - The system automatically returns to a power on state when switch on.

Auto power off - The system automatically returns to a power off state when switch on.

Function for Dimming

- Pressing “UP” key to change the Dimming setting to DAY or NIGHT when accessed menu adjust mode.
- Pressing “DOWN” key to change the Dimming setting to DAY or NIGHT when accessed menu adjust mode.

Note:

The luminance is 100% when DAY mode.

The luminance is 50% when NIGHT mode.

Function for Screen Saver

- Pressing “UP” key to change the Screen Saver setting to ON or OFF when accessed menu adjust mode
- Pressing “DOWN” key to change the Screen Saver setting to OFF or ON when accessed menu adjust mode.

Note:

The luminance is 10% when Screen Saver ON.

The screen saver will run when no any key is presses within 1 minute.

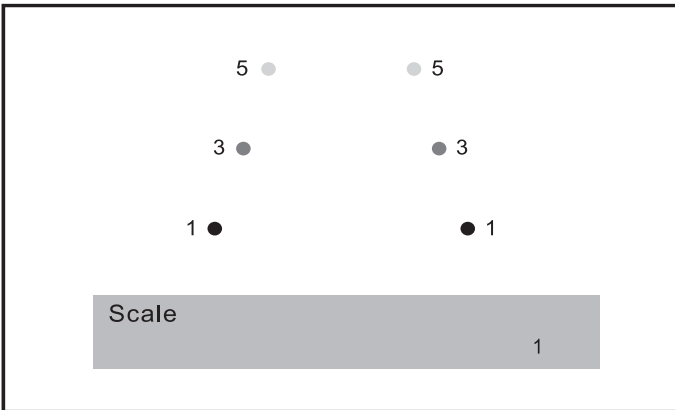
The luminance will back to DAY or NIGHT when press any key.

Function for Scale Marker

- Press "UP" or "DOWN" to change the Scale Marker mode.

1.OFF mode

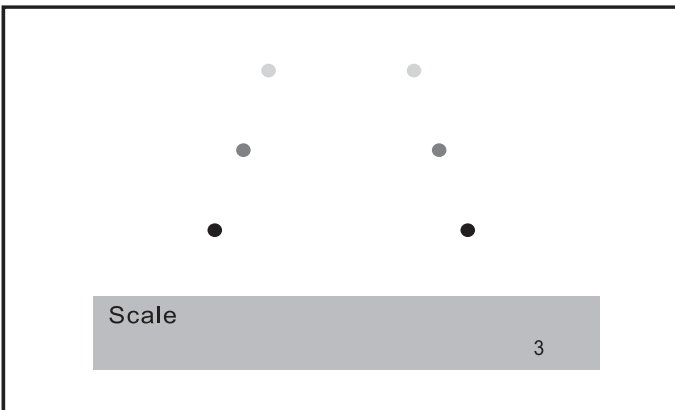
2. Mode1



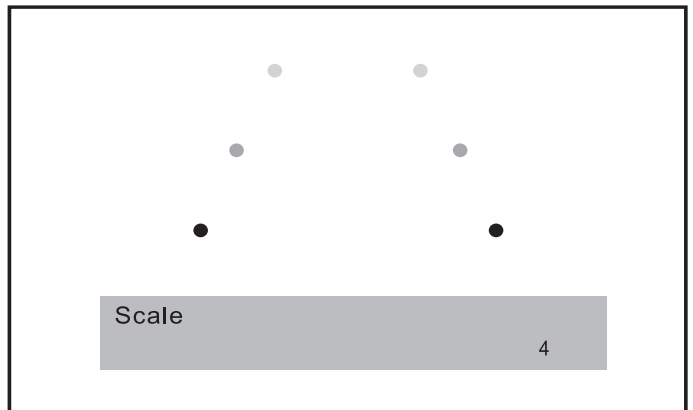
3. Mode 2



4. Mode 3



5. Mode 4

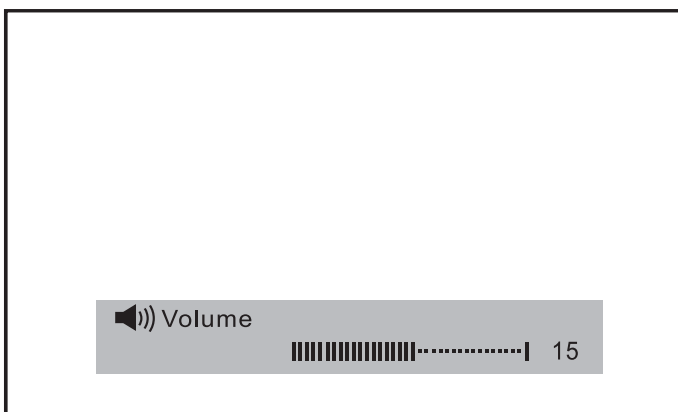


Function for Speaker Volume Control

- Pressing "UP" key to increases volume level.

- Pressing "DOWN" key to decreases volume level.

Volume





FCC IMPORTANT NOTE:

15.105(b)

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 in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

To comply with the FCC RF exposure compliance requirements, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. No change to the antenna or the device is permitted.

Any change to the antenna or the device could result in the device exceeding the RF exposure requirements and void user's authority to operate the device.

CAMERA-MONITOR WARNINGS!

1. Camera/Monitor system aids in the use of, but does not replace vehicle side/rear-view mirrors.
2. Objects in Camera/Monitor view are closer than they appear.
When backing up, processed cautiously and be prepared to stop.

NOTICE 1 :

The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTICE 2:

Our WiSight wireless technology operates at nearly the same performance level as a wired system. However, slight delays and signal reductions are possible due to application or environmental factors.

It is recommended to maintain at least three feet in between any RF transmitting/receiving devices including the WiSight components. This can include, but not limited to, in-vehicle Wi-Fi systems, personal Wi-Fi hotspots, Bluetooth devices or additional wireless monitors & cameras.

If you have a Voyager WiSight Digital Wireless Observation System along with any other



device that transmits or receives and you are experiencing difficulty in operating the system, the device(s) may be too close to either the WiSight Monitor or Camera.

Change the placement to at least three feet between devices and re-test for proper operation.

TROUBLE SHOOTING

Monitor will not turn on.

- Check power cord connection at monitor and 12VDC socket.
- Check fuse in cigarette socket adapter.

Monitor displays "No Signal".

- Check 12VDC power at camera.
- Make sure antenna is tight and pointed correctly.
- Make sure monitor is set to AV1.
- Try manually pairing the system. see pairing Process for instructions.

Intermittent reception.

- Make sure antenna is tight and installed vertically.
-

Features and specifications subject to change with out notice
For further technical support call: 1-877-305-0445



Fusion2Go™ 3.0

Vehicle Voice and 4G Data Signal Booster

User Guide



07.12.2018



Table of Contents

Thank you for purchasing SureCall's Fusion2Go 3.0 cell phone signal booster kit. Fusion2Go 3.0 provides enhanced voice, text and 4G data signal for any vehicle.

If you have any questions during setup, please reach out to our US-based experienced support technicians:

- Call: 1-888-365-6283
- Email: support@surecall.com

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How It Works

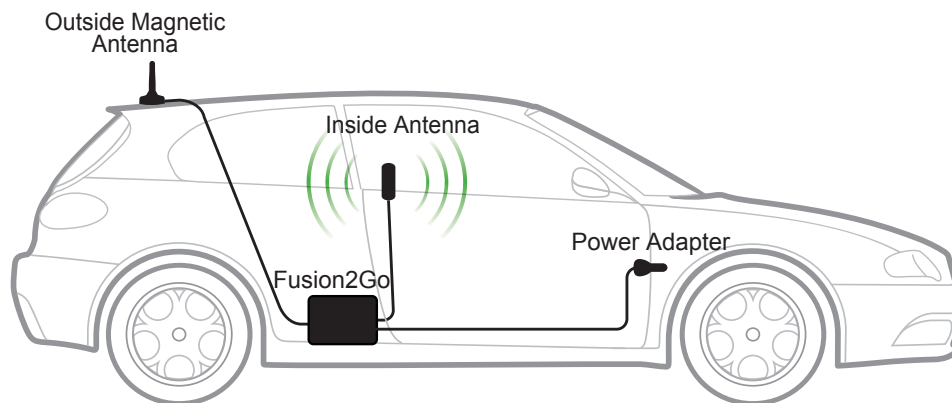
How It Works

The SureCall Fusion2Go 3.0 is a high-quality bidirectional booster that enhances cellular signals for vehicles.

The Fusion2Go 3.0 works with two antennas:

- An inside antenna that communicates with your cell phone.
- An outside antenna that communicates with the cell tower.

Signals sent from a cell tower are received by the outside antenna, amplified by the booster and then sent to your cell phone via the inside antenna. When your phone transmits, the signal is sent to the inside antenna, and then sent to the cell tower via the outside antenna.





Package Contents

Package Contents

1. Unpack all package contents. For missing or damaged items, contact your reseller.
2. Turn over the signal booster and record the model and serial number for reference:

Serial #: _____

Purchase Date: _____

3. Keep the carton and packing material to store the product in case you need to return it.

Your Fusion2Go 3.0 signal booster package includes the following items:

- One SureCall Fusion2Go 3.0 signal booster
- DC power adapter
- One inside patch antenna
- One outside magnetic mount antenna



Fusion2Go 3.0 Amplifier



Power Adapter



Inside Patch Antenna



Outside Magnetic-Mount Antenna and optional adhesive mount



Installation

Step 1: Mount Outside Antenna

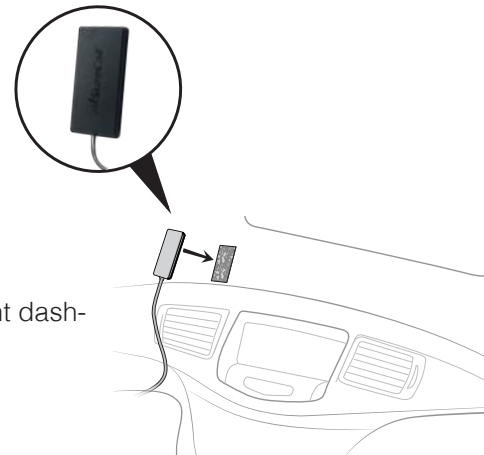
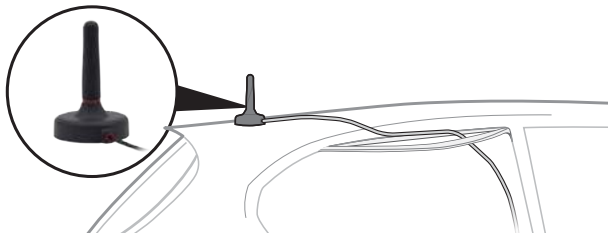
Place the magnetic-mount antenna on the top of your vehicle, preferably toward the back, maximizing the distance from planned location of the inside patch antenna. Ensure that the antenna has at least a 12-inch radius clear of obstructions and other radiating elements, such as a radio antenna.

Note, For applications that require a more secure mount or where mounting surface is not metal, an optional adhesive mount has also been included with your kit. Follow these guidelines for use of adhesive mount:

- Always clean the surface properly. Apply the tape as soon as possible after cleaning to avoid contaminants
- Use an adequate amount of tape
- Ensure that all materials meet the required minimum tape application temperature of 15°C
- Roll down tape firmly both after tape application and then again after parts are bonded together

Next, run the cable from the outside antenna across the car's roof and into the car. To hide and protect the antenna cable, carefully pull down the door seal, run cable underneath it and push the seal back into place. Run the cable to the inside of the vehicle near the planned location of the booster (under the seat of the vehicle, or in the front or middle console).

Note: The outside antenna must not be collocated or operating with any other antenna or booster.



Step 2. Install the Inside Patch Antenna

Identify a location for the inside antenna on or near your front dashboard that is

1. Within 2-3 feet of the typical cell phone location
2. At least 8 inches (20cm) from cellular devices and
3. At least 4 inches (10cm) from metal



Installation

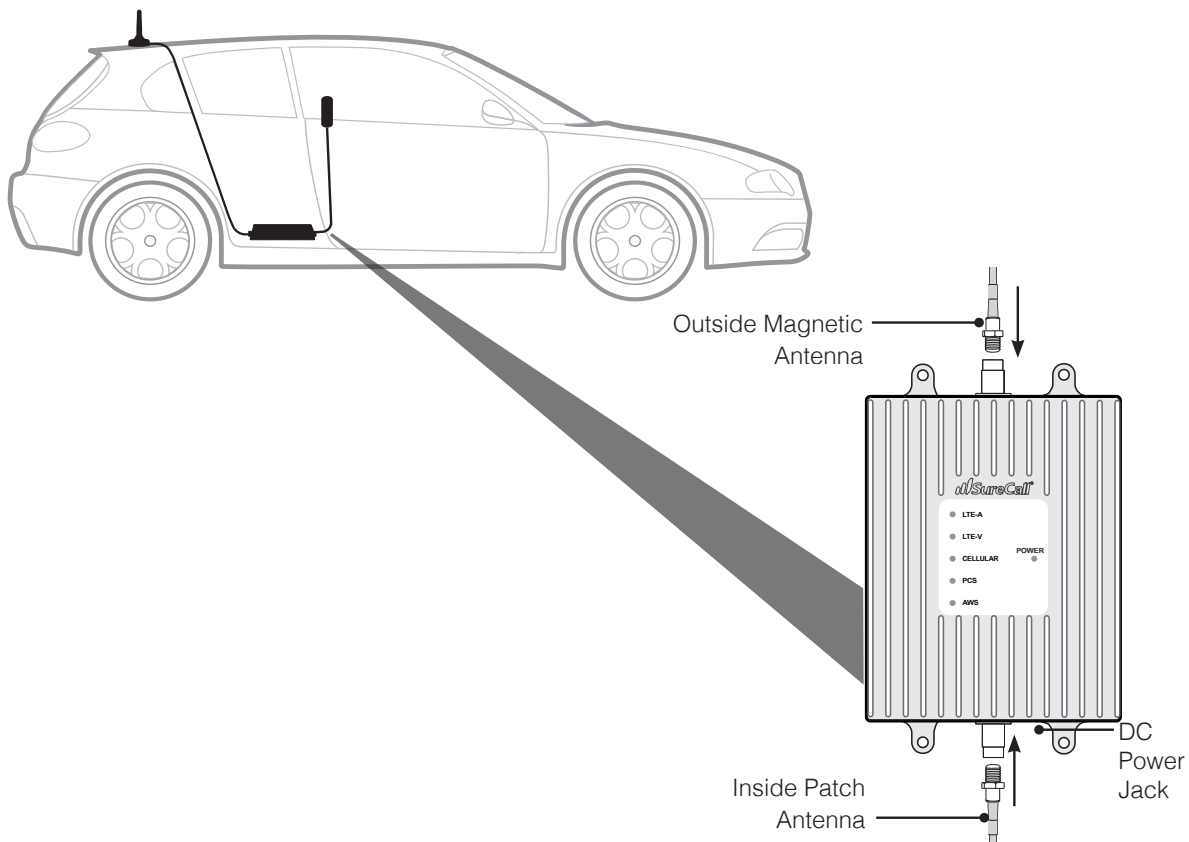
Next, peel Velcro backing and apply to a clean dry surface in your chosen location.

Or try this - Use the free vent clip provided with your product as a mounting surface then simply clip to an air vent.

Step 3. Place Booster and Connect Cables

Select a well-ventilated location for the booster that is away from excessive heat, direct sunlight, and moisture. We often suggest installing beneath a seat or within the front console.

Connect the cable from the outside antenna to the connection marked OUTSIDE and connect the cable from inside patch antenna to the connection marked INSIDE. Tighten the connections and wrap up any loose cable.





Installation

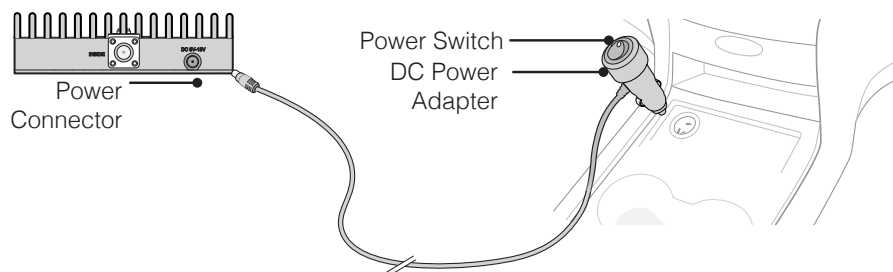
Step 4. Connect Power

Connect the power cord connector to the signal booster and insert the other end into your cigarette lighter adapter¹. The Power LED illuminates to show that the signal booster is ready for use. The Alert LEDs flash 5 times to show the frequency band is operational.

Place a call in a location you have previously experienced poor signal and confirm that your phone is receiving a boosted signal.

Note: When your car is off, turn the power switch to OFF to keep the booster from continuing to draw power from your vehicle.

[1] WARNING: The booster is rated for 5-15V input voltage. DO NOT use the booster with a higher voltage power supply. This can damage the booster and/or cause personal injury.





Troubleshooting

LED Indicators

Place a call in a location you have previously experienced poor signal and confirm that your phone is receiving a boosted signal. Normal operation is indicated by Green LEDs (both flashing and solid). In the event Red LEDs appear, antenna adjustments may be needed.

Color	Condition	Indication
Green	Solid	Indicates normal operation.
Green	Flashing	Normal operation. Indicates that Automatic Gain Control (AGC) is self-adjusting due to over-signal or antenna proximity.
Red	Flashing	Indicates issues caused by overpowering or oscillation. Adjustment of your outside antenna placement is likely needed. Verify that it has sufficient separation from the inside antenna, as well as, any potentially interfering objects or antennas

Note that the booster case may become warm during operation. This is normal.

Troubleshooting

Problem	Resolution
Signal booster has no power	Verify that the Power LED is ON. Connect the power supply to an alternate power source. Verify that the power source is operational and the fuse is intact. If it remains OFF, contact tech support at: 1-888-365-6283 or support@surecall.com
After completing installation, signal has not Improved	Verify that cable connections are tightly fitted to the booster. Try further separating the antennas. Note: Bars are not always a reliable measure of signal. The best way to confirm signal coverage is the ability to place and hold a call.



Specifications

Specifications

Product	Fusion2Go 3.0 (US)	Fusion2Go 3.0 CA (Canada)
Uplink Frequency Range (MHz):	698-716 / 776-787 / 824-849 / 1850-1915 / 1710-1755 (G Block Included)	
Downlink Frequency Range (MHz):	728-746 / 746-757 / 869-894 / 1930-1995 / 2110-2155 (G Block Included)	
Input / Output Impedance:	50 Ω	
Maximum Gain:	50 dB	
Noise Figure:	≤ 5 dB	
VWSR:	≤ 2.0	
Gain Adjustment:	20 dB (Automatic)	
Supported Standards:	CDMA, WCDMA, GSM, EDGE, HSPA+, EVDO, LTE and all cellular standards	
DC Power:	6-15V	
Maximum Output Power:	1 Watt EIRP	
Cable:	SC-174	
RF Connectors:	FME Male (both ends)	
Power Consumption:	≤ 10W	
Operation Temperature:	-4° to +158° F	
Dimensions:	5.625 x 4 x 1.125 inches	
Weight:	1.43 lbs	
Certification:	FCC ID: RSNF2GO3	IC: 7784A-F2GO3

Note: The term "IC" before the radio certification number only signifies that Industry Canada technical specifications were met.



Kitting Information

Antenna Kitting Information

Component	Prod No. Description	Gain				
		LTE-A	LTE-V	800 MHz	1900 MHz	1700 MHz / 2100 MHz
Vehicle						
Outdoor Antenna and Cable	SC-202W and SC174-12.5 ft (12.5 ft)	-3.16 dB	-5.15 dB	-5.65 dB	-2.85 dB	-3.34 dB / NG
Outdoor Antenna and Cable	SC200W and SC174-10 ft (10 ft)	-2.3 dB	-2.3 dB	-2.3 dB	-5.8 dB	-3.98 / -5.96 dB
Indoor Antenna and Cable	SC110W and SC174-10 ft (10 ft)	-2.7 dB	-2.7 dB	-3.2 dB	-5.8 dB	-3.98 / -5.96 dB

*All equivalent antennas and cables are suitable for use with the Fusion2Go 3.0

Component	Prod No. Description	Gain				
		LTE-A	LTE-V	800 MHz	1900 MHz	1700 MHz / 2100 MHz
Marine						
Outdoor Antenna and Cable	SC288W or Galaxy 5412-P and SC240-40FN (40 ft)	-0.52 dB	-0.52 dB	-0.98 dB	-2.52 dB	-2.12 / -2.92 dB
Indoor Antenna and Cable	SC248W Panel and SC240-20FN (20 ft)	4.94 dB	4.94 dB	4.71 dB	6.44 dB	6.64 / 6.24 dB
Indoor Antenna and Cable	SC302W and SC240-20FN (20 ft)	0.44 dB	0.44 dB	0.71 dB	1.44 dB	0.64 / 1.24 dB
Desktop / RV						
Outdoor Antenna and Cable	SC288W and SC240-40FN (40 ft)	-0.52 dB	-0.52 dB	-0.98 dB	-2.52 dB	-2.12 / -2.92 dB
Indoor Antenna	SC120W whip	1.2 dB	1.2 dB	1.2 dB	3 dB	3 / 3 dB
Indoor Antenna and Cable	SC302W and SC240-20FN (20 ft)	0.44 dB	0.44 dB	0.71 dB	1.44 dB	0.64 / 1.24 dB

*All equivalent antennas and cables are suitable for use with the Fusion2Go 3.0

* **Warning:** Unauthorized antennas, cables, and/or coupling devices are prohibited by FCC new rules. Changes or modifications not expressly approved by SureCall could void the user's authority to operate the equipment.

* **FCC 27.50(d)(4) Statement:** Fixed, mobile and portable (hand-held) stations operating in the 1720-1755 MHz band are limited 1 Watt EIRP. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in this band must employ a means for limiting power to the minimum necessary for successful communications.



Kitting Information

Frequency (MHz)	PreAGC			PreAGC		
	Pulse GSM			4.1 MHz AWGN		
	Input (dBm)	Output (dBm)	Gain (dB)	Input (dBm)	Output (dBm)	Gain (dB)
Uplink: 1710-1755	-17.9	27.0	44.9	-22.0	23.2	45.2
Uplink: 1850-1915	-21.0	25.1	46.1	-24.9	21.9	46.8
Uplink: 824-849	-18.6	29.0	47.6	-21.2	26.0	47.2
Uplink: 698-716	-18.9	28.3	47.2	-22.8	25.6	48.4
Uplink: 777-787	-22.4	26.6	49.0	-23.0	25.0	48.0
Downlink: 2110-2155	-46.6	-0.8	45.8	-51.5	-4.5	47.0
Downlink: 1930-1995	-43.7	-2.2	45.9	-47.9	-0.6	47.3
Downlink: 869-894	-47.9	-2.0	45.9	-50.4	-4.9	45.5
Downlink: 728-746	-48.0	-1.4	46.6	-50.2	-3.5	46.7
Downlink: 746-757	-47.0	-2.0	45.0	-50.3	-4.3	46.0



Safety Information

Safety Information

This is a CONSUMER device.

BEFORE USE, you MUST REGISTER THIS DEVICE with your wireless provider and have your provider's consent. Most wireless providers consent to the use of signal boosters. Some providers may not consent to the use of this device on their network. If you are unsure, contact your provider.

In Canada, BEFORE USE you must meet all requirements set out in ISED CPC-2-1-05¹.

You MUST operate this device with approved antennas and cables as specified by the manufacturer. Antennas MUST be installed at least 20 cm (8 inches) from (i.e., MUST NOT be installed within 20 cm of) any person.

You MUST cease operating this device immediately if requested by the FCC (or ISED in Canada) or licensed wireless service provider.

WARNING: E911 location information may not be provided or may be inaccurate for calls served by using this device.

Ceci est un dispositif GRAND PUBLIC.

AVANT DE L'UTILISER, vous DEVEZ ENREGISTRER CE DISPOSITIF auprès de votre fournisseur de services cellulaires et obtenir son consentement. La plupart des fournisseurs de services cellulaires autorisent l'utilisation d'amplificateurs de signal. Il se peut que certains fournisseurs n'autorisent pas l'utilisation de ce dispositif sur leur réseau. Si vous n'êtes pas sûr, contactez-le.

Au Canada, AVANT DE L'UTILISER vous devez répondre à toutes les exigences ISED CPC-2-1-05².

Vous DEVEZ utiliser ce dispositif avec les antennes et les câbles autorisés, tel que le spécifie le fabricant. Les antennes DOIVENT être installées à au moins 20 cm (8 po) (NE DOIVENT PAS être installées à moins de 20 cm) de toute personne avoisinante.

Vous DEVEZ arrêter cet appareil immédiatement à la demande de la FCC (ISED au Canada) ou de tout fournisseur de services cellulaires autorisé.

AVERTISSEMENT: Il se peut que les informations relatives à la localisation E911 ne soient pas disponibles ou soient inexactes pour les appels qui utilisent cet appareil.

Register your cellular booster with your wireless carrier at the following urls:

Verizon: <http://www.verizonwireless.com/wcms/consumer/register-signal-booster.html>

AT&T: <https://securec45.securewebsession.com/attsignalbooster.com/>

T-Mobile: <https://support.t-mobile.com/docs/DOC-9827>

Sprint: https://www.sprint.com/legal/fcc_boosters.html

U.S. Cellular: <http://www.uscellular.com/uscellular/support/fcc-booster-registration.jsp>

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

[1] For details on the requirements specified in ISED CPC-2-1-05, visit: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08942.html>

[2] Pour plus de détails sur les exigences ISED CPC-2-1-05, reportez-vous au site: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08942.html>



Warranty

Three-Year Product Warranty

Register at www.SureCall.com

SureCall warrants its products for three years from the date of purchase against defects in workmanship and/or materials. Specifications are subject to change. The three-year warranty only applies to products meeting the latest FCC Certification Guidelines stated on 2/20/2013 and going into effect April 30, 2014. A two-year warranty applies to any products manufactured before May 1, 2014.

Products returned by customers must be in their original, un-modified condition, shipped in the original or protective packaging with proof-of-purchase documentation enclosed, and a Return Merchandise Authorization (RMA) number printed clearly on the outside of the shipping container.

Buyers may obtain an RMA number for warranty returns by calling the SureCall Return Department toll-free at 1-888-365-6283. Any returns received by SureCall without an RMA number clearly printed on the outside of the shipping container will be returned to sender. In order to receive full credit for signal boosters, all accessories originally included in the signal booster box must be returned with the signal booster. (The Buyer does not need to include accessories sold in addition to the signal booster, such as antennas or cables.)

This warranty does not apply to any product determined by SureCall to have been subjected to misuse, abuse, neglect, or mishandling that alters or damages the product's physical or electronic properties.

SureCall warrants to the Buyer that each of its products, when shipped, will be free from defects in material and workmanship, and will perform in full accordance with applicable specifications. The limit of liability under this warranty is, at SureCall's option, to repair or replace any product or part thereof which was purchased up to THREE YEARS after May 1, 2014 or TWO YEARS for products purchased before May 1, 2014, as determined by examination by SureCall, prove defective in material and/or workmanship. Warranty returns must first be authorized in writing by SureCall. Disassembly of any SureCall product by anyone other than an authorized representative of SureCall voids this warranty in its entirety. SureCall reserves the right to make changes in any of its products without incurring any obligation to make the same changes on previously delivered products.

As a condition to the warranties provided for herein, the Buyer will prepay the shipping charges for all products returned to SureCall for repair, and SureCall will pay the return shipping with the exception of products returned from outside the United States, in which case the Buyer will pay the shipping charges.

The Buyer will pay the cost of inspecting and testing any goods returned under the warranty or otherwise, which are found to meet the applicable specifications or which are not defective or not covered by this warranty.

Products sold by SureCall shall not be considered defective or non-conforming to the Buyer's order if they satisfactorily fulfill the performance requirements that were published in the product specification literature, or in accordance with samples provided by SureCall. This warranty shall not apply to any products or parts thereof which have been subject to accident, negligence, alteration, abuse, or misuse. SureCall makes no warranty whatsoever in respect to accessories or parts not supplied by it.

Limitations of Warranty, Damages and Liability:

EXCEPT AS EXPRESSLY SET FORTH HEREIN, THERE ARE NO WARRANTIES, CONDITIONS, GUARANTEES, OR REPRESENTATIONS AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHER WARRANTIES, CONDITIONS, GUARANTEES, OR REPRESENTATIONS, WHETHER EXPRESSED OR IMPLIED, IN LAW OR IN FACT, ORAL OR IN WRITING.

SURECALL AGGREGATE LIABILITY IN DAMAGES OR OTHERWISE SHALL NOT EXCEED THE PAYMENT, IF ANY, RECEIVED BY CELLPHONE-MATE, INC. FOR THE UNIT OF PRODUCT OR SERVICE FURNISHED OR TO BE FURNISHED, AS THE CASE MAY BE, WHICH IS THE SUBJECT OF CLAIM OR DISPUTE. IN NO EVENT SHALL SURECALL BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES, HOWSOEVER CAUSED.

All matters regarding this warranty shall be interpreted in accordance with the laws of the State of California, and any controversy that cannot be settled directly shall be settled by arbitration in California in accordance with the rules then prevailing of the American Arbitration Association, and judgment upon the award rendered may be entered in any court having jurisdiction thereof. If one or more provisions provided herein are held to be invalid or unenforceable under applicable law, then such provision shall be ineffective and excluded to the extent of such invalidity or unenforceability without affecting in any way the remaining provisions hereof.

SureCall has made a good faith effort to ensure the accuracy of the information in this document and disclaims the implied warranties of merchantability and fitness for a particular purpose and makes no express warranties, except as may be stated in its written agreement with and for its customers. SureCall shall not be held liable to anyone for any indirect, special or consequential damages due to omissions or errors. The information and specifications in this document are subject to change without notice.

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www.surecall.com

W I F I R A N G E R

CONNECTING MOBILE LIFESTYLES™

USER MANUAL

Revision 11



Written For
7.0.5 Phantom Firmware

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WiFiRANGER

CONTROL PANEL

The interface used to setup and control a WiFiRanger router. Each WiFiRanger has its own Control Panel that is embedded within the router and accessed in a web browser of a *connected* device. Computers, smartphones, tablets, and other devices with web browsers can be used to setup and control a WiFiRanger.

By default, advanced features are hidden on the Control Panel. Turn Hide Advanced Features to Off on the Setup tab to view the full Control Panel. Most users only need the simple mode.

- ◆ **Web Browser Based**
- ◆ **Accessible by All Devices**
- ◆ **Simple and Clean Design**



Quick Start

1) Power WiFiRanger

USE INCLUDED POWER SUPPLY OR FOLLOW INSTALLATION GUIDE

2) Wait a couple minutes

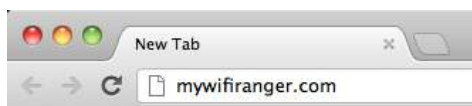
WiFiRANGERS AUTOMATICALLY SEARCH FOR INTERNET AFTER POWERING UP

3) Wirelessly connect a device to **NETWORK** using **PASSWORD**

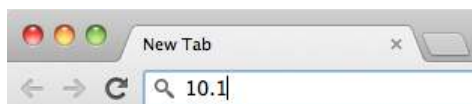
YOU CAN ALSO CONNECT VIA HARDWIRE FOR WiFiRANGERS WITH LAN PORTS

4) Open device's web browser and go to Control Panel

OPEN INTERNET EXPLORER, CHROME, FIREFOX, SAFARI, ETC.



mywifiranger.com




CONTROL PANEL ADDRESS

5) See if WiFiRanger is online or connect

JOIN A WiFi NETWORK OR CONNECT TO ETHERNET WAN OR CELLULAR IF NOT YET ONLINE

Newer 2.4 / 5.8GHz products will also broadcast a separate 5G signal that can be used by your 5.8GHz-capable computers / devices

DETERMINE **XX** AND **YY** FROM NETWORK BROADCAST OF YOUR WFR 

NETWORK Pvt.WiFiRanger.XXYY
PASSWORD changemenowXXYY
CONTROL PANEL ADDRESS
10.1XX.YY.1:8080

FOR EXAMPLE

Pvt.WiFiRanger.4067 
changemenow4067
10.140.67.1:8080



BASICS

Bookmark

Upon accessing the Control Panel, it is highly recommended to create a bookmark using the Make Bookmark link located at the bottom left of the Control Panel. This makes accessing the WiFiRanger easy in the future while alleviating the need to remember the direct IP address.

Bookmark Hotkeys: Command+D (Mac) / Control+D (Windows)

Scan & Connect to WiFi Signals

1) Get on Main tab of Control Panel

EVERYTHING NECESSARY IS LOCATED ON THE LEFTHAND SIDE

2) Select desired wireless radio

ONLY WFRBOOST & WFRCONTROL USERS HAVE MULTIPLE CHOICES AS SHOWN (**Go²** / **MOBILE** IN THIS CASE)

3) Click Scan

REFRESHES THE LIST OF WiFi NETWORKS WHICH THE SELECTED RADIO CAN CURRENTLY SEE



4) Click Connect on desired WiFi Network once Scan is complete

YOU WILL BE PROMPTED FOR THE PASSWORD IF THE WiFi NETWORK WAS SECURED USING WEP OR WPA

	14 WiFi Networks	Signal	Type	Speed	Tag
CONNECT	BlueMeshNetworks	n	WPA		<input type="checkbox"/>
CONNECT	Pub.WiFiRanger.7226	n	OPEN		<input type="checkbox"/>

The Scan button performs a one-time refresh of the wireless signals in range. When moving locations, for instance, the list of WiFi Networks may look like you are still at the old location, but clicking the Scan button will list what is currently available. Keep in mind that you must first select the desired model to the left of the Scan button prior to scanning or connecting. Generally, it is best to select the outdoor unit which will be positioned to the right of the indoor unit’s radial button. With 2.4 / 5.8GHz capable products released starting in 2016, you will also have the option to switch between the 2G or 5G receiver. It is likely that the 5G receiver will not see as many networks as the 2G because 2.4GHz is currently the most popular frequency use for WiFi Hotspots.

The Connect button simply attempts to connect to the selected WiFi Network. If the signal is secured, you may be prompted to enter the password of the WiFi Network. The WiFi status will update with the steps the WiFiRanger is taking during the connection attempt.



Perform Range

REQUIRES HIDE ADVANCED FEATURES OFF ON SETUP TAB

1) Get on Main tab of Control Panel

THE RANGE OPTIONS ARE HIDDEN INITIALLY

2) Click arrow-button to right of WiFi header

THIS EXPANDS TO SHOW THE RANGE OPTIONS BELOW



3) Click desired Perform Range choice

EACH OPTION IS BASED ON INTELLIGENT PRIORITIZATION TO PROVIDE CONVENIENT CONNECTIVITY

Perform Range



First Available

Tries to establish a connection with the first available WiFi Network that provides an internet connection regardless of its speed, security, or signal quality

First Tagged

Tries to establish a connection with the first available WiFi Network that is tagged as Prefer or Last Try, sorted by signal quality from best to poorest

Strongest Signal

Tries to establish a connection with an available WiFi Network that provides the strongest wireless signal quality

Fastest Tagged

Tries to establish a connection with the fastest available WiFi Network that is tagged as Prefer or Last Try, sorted by internet speed from best to poorest

Fastest Available

Tries to establish a connection with the WiFi Network that has the fastest internet speed available, regardless of any Prefer tokens

NOTE THAT RANGE OPTIONS WILL ATTEMPT ALL WiFi NETWORKS IN RANGE, BUT NOT ALL SIGNALS ARE NECESSARILY AVAILABLE. SUCCESS IS BASED ON HAVING AVAILABLE NETWORKS IN RANGE FOR WHICH YOU HAVE ALREADY STORED THE PASSWORD OR THAT ARE OPEN OR FILTERED.




















WiFi Networks

On the Main tab, the list of available WiFi Networks provides useful information and sorting of wireless signals. The number of networks is displayed, as are the signal details. All networks are sorted top to bottom in order of signal strength (strongest to weakest) from the time of the Scan.

The letter to the left of the signal strength bars denotes the type of network whether 802.11**b**, **g**, **n**, **a**, or **ac** (oldest and slowest technology to newest and fastest from left to right). The signal bars are color coded to help emphasize their strength (red is weakest and green is strongest). Only 2.4 / 5.8GHz product models released starting in 2016 will see 802.11**a** or **ac** in the list of available networks.

Speedtest results are also displayed once the network has successfully been connected to and Speedtested. Creating a network Tag is also possible for each WiFi Network by clicking the Tag checkbox. A prompt window will appear so that you can select the type of Tag that you would like to create for this WiFi Network.

14 WiFi Networks		Signal	Type	Speed	Tag
CONNECT	BlueMeshNetworks	n 	WPA		<input type="checkbox"/>
CONNECT	Pub.WiFiRanger.7226	n 	OPEN		<input type="checkbox"/>
CONNECT	Pvt.WiFiRanger_Go6879 	n 	WPA		<input type="checkbox"/>
CONNECT	Pvt.WiFiRanger.1036 	n 	WPA		<input type="checkbox"/>
CONNECT	Public.1036	n 	OPEN		<input type="checkbox"/>
CONNECT	OpenWRT.BadBandwidth	n 	WPA		<input type="checkbox"/>
CONNECT	Pvt.Tactical	n 	WPA		<input type="checkbox"/>
CONNECT	Pvt.WiFiRanger_X.5747 	n 	WPA		<input type="checkbox"/>
CONNECT	Pubnet5747	n 	OPEN		<input type="checkbox"/>
CONNECT	CSS	n 	WPA		<input type="checkbox"/>
CONNECT	BN Guest Network	n 	WPA		<input type="checkbox"/>
CONNECT	Boyle Network	n 	WPA		<input type="checkbox"/>
CONNECT	Pvt.WiFiRanger_Sky.1925	n 	WPA		<input type="checkbox"/>
CONNECT	FBI-NSA-CIA Van	n 	WPA		<input type="checkbox"/>

Type (encryption)

OPEN

No password required for connecting and common for free public WiFi Hotspots

FILTERED

No password required yet a *passcode* or terms acceptance on a web page is required

WEP

Password is required for connecting and this is an older and weaker form of security

WPA

Password is required for connecting and this is the latest and strongest form of security



Private Wireless Network

On the WiFi tab, customize the WiFiRanger's private wireless signal.

Private Wireless Network

<input checked="" type="checkbox"/> Broadcast <input type="checkbox"/> Same Name (SSID) 2GHz <input type="checkbox"/> Hidden Network <input type="text" value="Name (SSID)"/> <input type="text" value="Password (WPA Key)"/> <input type="text" value="Encryption"/> <input type="checkbox"/> Sync WiFi Broadcast with WFRControl	<input checked="" type="checkbox"/> 2GHz <input checked="" type="checkbox"/> 5GHz <input type="radio"/> On <input checked="" type="radio"/> Off <input type="radio"/> On <input checked="" type="radio"/> Off <input type="text" value="Pvt.WiFiRanger_GoAC.8153"/> <input type="text" value="changemenow8153"/> <input type="text" value="WPA2 AES"/>	5GHz <input type="radio"/> Hidden Network <input type="radio"/> On <input checked="" type="radio"/> Off <input type="text" value="Pvt.WiFiRanger_GoAC5G.8153"/> <input type="text" value="changemenow8153"/> <input type="text" value="WPA2 AES"/>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Broadcast*

In general, it is not recommended to turn the Broadcast to Off. In cases of paired WFRControl systems, it may be preferable to turn the Broadcast of the Slave to Off, minimizing wireless noise. Only 2.4 / 5.8GHz models will have the option of a 5GHz broadcast as shown.

Same Name (SSID)* (for 5.8GHz capable models only)

Makes both 2 and 5GHz broadcasts the exact same name. Not recommended to have On if desiring to manually distinguish between the two frequencies when connecting to the WiFiRanger on your device, as best performance would be achieved if connecting to 5GHz.

Hidden Network*

This hides the signal, preventing the WiFiRanger's broadcast from showing up in a standard scan of a computer or device. Hiding the signal is not recommended. This setting is for limited purposes. Prior to hiding the signal, take the same precaution listed above for when turning the WiFi Broadcast Off.

Name (SSID)

Personalize your signal by changing the Name. It is recommended to change the Name at the same time of making a Password change, as your computers and devices may get confused and have mismatched passwords stored for the WiFiRanger.

Password (WPA Key)

When setting up the WiFiRanger for the first time, it is highly recommended to change the Password from the default. Once the new Password is Saved, your device's connection will be knocked off, as the WiFiRanger is resetting its broadcast to use the new password. Once disconnected, reconnect your computer or device to the WiFiRanger and enter the new Password. It is recommended to personalize the Name along with the Password.

Encryption*

Modify the type of security if some older devices do not support the default WPA2 AES encryption which is the latest and most secure type.

Sync WiFi Broadcast with WFRControl*

Match broadcast name of indoor and outdoor WiFiRangers so that computers and devices see both broadcasts as one signal name. This also enables wireless roaming so that computers and devices seamlessly switch between both broadcasts depending on whichever one is in range.

*REQUIRES HIDE ADVANCED FEATURES OFF ON SETUP TAB
User Manual



Updating

It is highly recommended to keep the WiFiRanger updated and on the current firmware version. This ensures best performance and highest security possible.

1) [Connect WiFiRanger to stable Internet](#)

RELIABLE INTERNET AND POWER IS CRUCIAL FOR MINIMIZING POTENTIAL UPGRADE FAILURE

2) [Click Check for Updates on Control Panel](#)

THIS MAY HAVE ALREADY OCCURRED UPON GETTING THE WIFIRANGER ONLINE

3) [Click Update Firmware link if available](#)

THE CHECK FOR UPDATES BUTTON WILL ONLY CHANGE TO THE FIRMWARE LINK IF AN UPDATE IS AVAILABLE

4) [Follow instructions shown on screen](#)

GENERALLY WAIT FOR THE WIFIRANGER TO COMPLETE THE UPDATE ON ITS OWN AND LEAVE IT POWERED UP

Cautions & Risks

Leaving the WiFiRanger alone for several minutes will allow the update to complete. If the WiFiRanger loses either power or internet during the update process, the router may become inaccessible and unresponsive. In the unfortunate and infrequent event of an upgrade failure, contact WiFiRanger support to receive the appropriate troubleshooting and solution.

Upgrading Multiple WiFiRangers

For owners of multiple WiFiRanger routers, we have simplified the update process so that it is all done automatically if WFRControl is properly setup. Just get on the Control Panel of your Go/Go2 (master) and follow the update procedure as outlined above.

(()) WIFIRANGER

CONNECTIONS

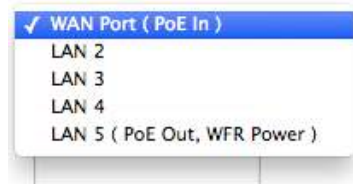
To access the more advanced configuration details of each Internet Connector, ensure that it is Active and then click the Settings gear icon on the Setup tab.



Ethernet WAN

Use Ethernet WAN for internet via a hardwired connection from a Cable or DSL modem. By default Ethernet WAN is Active on the Setup tab. This connection type is very simple, as it only requires an ethernet cable be plugged into the designated Ethernet WAN port of the WiFiRanger.

On the Setup tab, by clicking the gear Settings icon of Ethernet WAN, the Ethernet Port selection is exposed. Here the port can actually be changed to the desired one. It is recommended to leave it on the default WAN port, but the option to modify the port designation is available.



A second Ethernet WAN port can be assigned in order to have two Ethernet WAN internet sources. This allows for improved internet stability and redundancy. Simply check Ethernet WAN 2 as Active, then expand its Settings to select which port to assign for the secondary Ethernet WAN.



Toggle POE's 2nd Port

For WiFiRanger Mobile, Marine, Sky, or Elite products that are using a POE power supply, it is possible to toggle the secondary ethernet port (labeled **LAN**) of the adapter to act as either a WAN or LAN port. Having Ethernet WAN Active allows you to hardwire the WiFiRanger to an internet source as outlined above. Making Ethernet WAN inactive causes the WiFiRanger to use the secondary port of the POE as a LAN connection for hardwiring one computer, device, or switch.

Secondary Port as WAN

Check Ethernet WAN as Active on the Setup tab then click Save Changes

Order	Internet Connector	Description	Multi-WAN ?	Active	Settings
1	Ethernet WAN	WAN PORT FOR HARDWIRED CONNECTION TO MODEM OR LAN NETWORK	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Secondary Port as LAN

Uncheck Ethernet WAN making it inactive on the Setup tab then click Save Changes

	Ethernet WAN	WAN PORT FOR HARDWIRED CONNECTION TO MODEM OR LAN NETWORK	<input type="checkbox"/>	
--	--------------	-----------------------------------------------------------	--------------------------	--



Internal WiFi

The primary purpose of WiFiRangers has been to connect to the internet through other wireless signals. This is a very unique feature, and is one that was pioneered by the makers of WiFiRanger.

WiFi For WAN is a term used for this functionality, which denotes the WiFiRanger’s ability to use other WiFi Networks in a similar way to a hardwired WAN connection.

To use Internal WiFi, simply Scan & Connect or setup Auto Connect as desired. Internal WiFi is capable of connecting to any standard wireless signal that provides internet, including Public Hotspots, Home Networks, Hotel Networks, MiFi Signals, Smartphone Signals, etc.

Cellular

Indoor WiFiRanger routers that are equipped with a USB port which supports plug-n-play use of particular Aircards, Smartphones, and MiFi devices. Ensure that the device is activated and has service before attempting to use with the WiFiRanger. For a list of supported devices, go to wifiranger.com

In general, no settings need to be changed on the WiFiRanger in order for a supported Aircard or MiFi device to tether. If unable to connect to a support device after verifying that all of its settings are correct, then contact WiFiRanger support for assistance. Additional settings are available to troubleshoot Cellular by turning Hide Advanced Features Off on the Setup tab. Now on the Setup tab, click the gear Settings icon to reveal additional settings. By default, Automatic is selected for Carrier which is the recommended option. Any supported device should work with Automatic selected.



3 **Cellular** USB PORT FOR CONNECTION TO 3G/4G AIRCARD OR MIFI...

- Carrier
- Username
- Password
- APN
- USB Mode
- Speedtest
- Slowest Usable Speed On Off
- Reboot Cellular

FOR TETHERING THE NOVATEL 4620L/LE MIFI DEVICE, FOLLOW THE SEPARATE GUIDE AVAILABLE AT WIFIRANGER.COM

WHEN PLUGGING USB AIRCARDS IN, IT IS RECOMMENDED TO USE A USB EXTENSION CABLE BETWEEN THE WIFIRANGER AND AIRCARD. THIS ENSURES PROPER SEATING OF THE USB CONNECTION, AND ALLOWS THE AIRCARD TO BE PLACED IN AN OPTIMAL LOCATION FOR CELLULAR RECEPTION.

(()) WIFIRANGER

WFRBoost

NO LONGER SUPPORTED OR RECOMMENDED

The WFRBoost systems were discontinued in July of 2012. These were the predecessors of the current WiFiRanger Mobile. It is critical to determine which product is in use as the WFRBoost feature will not work for paired systems which require WFRControl setup instead and vice versa.

To distinguish between a WFRBoost and the similar looking original Mobile (non-Titanium version), simply look at the hardware.



Activating WFRBoost

1) Check WFRBoost as Active on Setup tab

WFRBOOST MUST BE POWERED UP AND PLUGGED INTO WiFiRANGER

2) Expand settings by clicking gear icon

GENERALLY THE DEFAULT SETTINGS WILL WORK TO CONFIGURE

3) Select WFRBoost Model and verify other settings

RESET THE WFRBOOST TO FACTORY DEFAULTS IF THE PROVIDED SETTINGS FAIL (GUIDE AT WIFIRANGER.COM)

4) Click Save Changes

IF SUCCESSFUL, WFRBOOST WILL BE READY TO USE AND LISTED ON THE MAIN TAB AS AN AVAILABLE MODEL

Model	Ubiquiti Bullet
Test	Test WFRBoost Connection
Ethernet Port	LAN 5 (PoE Out, WFR Power)
IP Address	192.168.1.20
Username	ubnt
Password	ubnt



WFRControl

This feature allows a master WiFiRanger to manage and control a secondary WiFiRanger. This is used in packs that generally include both indoor and outdoor routers. It is preferable to Scan and Join using the outdoor router which is generally the slave. This can be done conveniently from the master's Control Panel once WFRControl is properly setup.

WFRControl also unites the private network so that devices connected to either WiFiRanger can communicate on the same Local Area Network. This ensures that the network is one, even though two routers are in play. Generally, the master router is used for Control Panel functions while WFRControl is in use.

Initiating WFRControl

- 1) [Check WFRControl as Active on Setup tab](#)
- 2) [Expand settings by clicking gear icon](#)
- 3) [Select appropriate Control Over method](#)

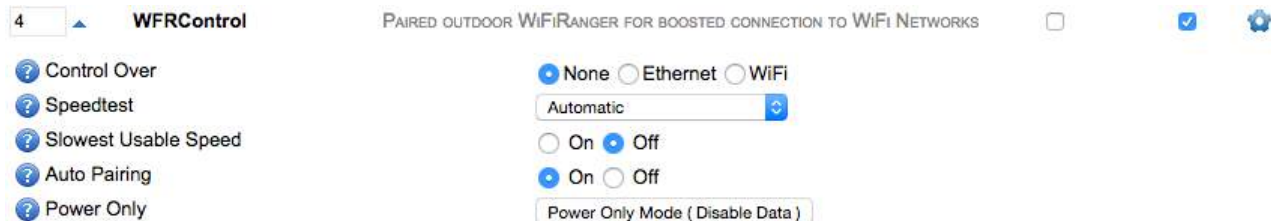
Ethernet

No additional information needed (automatically senses ports)

WiFi

Select client WiFiRanger's SSID and enter WPA key

- 4) [Click Save Changes](#)
- 5) [Select WFRControl then Scan and Connect on Main tab](#)

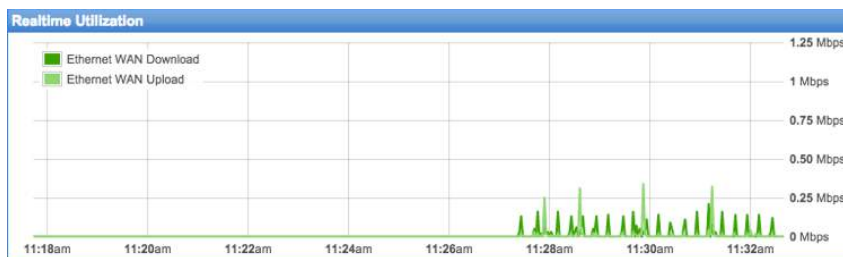


Power Only Mode is used only in troubleshooting situations which require the outdoor unit to be powered up by the indoor router, but not to have data interconnectivity. This mode is helpful when encountering trouble pairing WFRControl, allowing direct access to the outdoor unit's wireless network and Control Panel so that it can be reset to factory defaults before attempting pairing again.



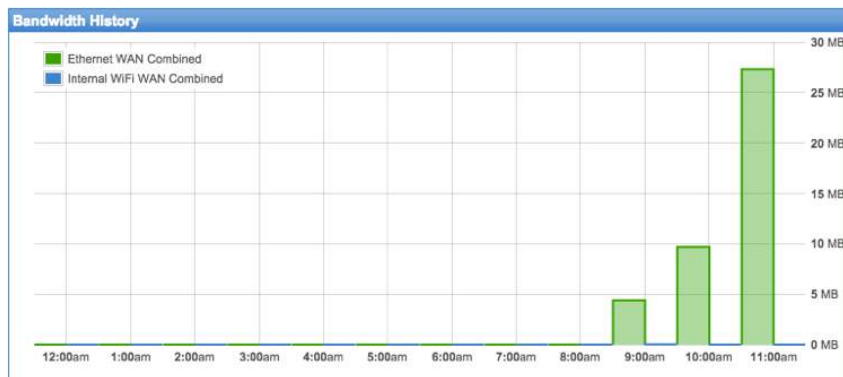
USAGE

Realtime Utilization



Monitor the past 15 minutes of bandwidth activity on the Usage tab of the Control Panel. Speeds will be indicated on the graph, and each individual Internet Connector will be color coded with Download and Upload separated by shade of color.

Bandwidth History



Analyze past consumption of data on the Usage tab of the Control Panel. History is broken out by Internet Connector using color coding. The desired history to display can be changed using various drop-down options below the graph. A table of usage will display by clicking the Show History button on the right. This table can also be downloaded as a CSV export.

WAN Combined	Ethernet	Internal WIFI	Total
1:00 pm	0.60 MB	0 MB	0.60 MB
12:00 pm	8.81 MB	0 MB	8.81 MB
11:00 am	33.08 MB	0 MB	33.08 MB
10:00 am	9.67 MB	0 MB	9.67 MB
9:00 am	4.38 MB	0.03 MB	4.41 MB
8:00 am	0 MB	0.01 MB	0.01 MB
7:00 am	0 MB	0 MB	0 MB
6:00 am	0 MB	0 MB	0 MB
5:00 am	0 MB	0 MB	0 MB
4:00 am	0 MB	0 MB	0 MB
3:00 am	0 MB	0 MB	0 MB
2:00 am	0 MB	0 MB	0 MB
Total	56.54 MB	0.04 MB	56.58 MB
	Reset	Reset	Reset All

[Export CSV](#)

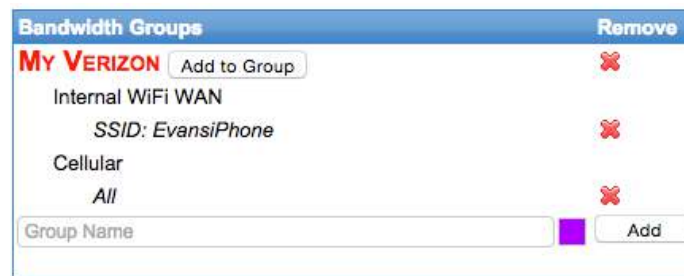


Bandwidth Groups

Create custom groups of internet sources to combine the total data usage into one viewable and trackable statistic. This helps with keeping track of overall usage of a shared 4G plan that may include a MiFi and multiple smart phones. Instead of only having visibility for each individual device on the shared 4G plan, you can lump the sum of their usage together to accurately avoid overages.

Configuring Bandwidth Group

- 1) Go to Usage tab on Control Panel
- 2) Ensure that Usage Tracking is On
- 3) Enter new Group Name under Bandwidth Groups section
- 4) Select desired color from palate (used for group title and graph bars)
- 5) Click Add
- 6) Follow on-screen options to combine desired internet sources into Group
- 7) Click Add to Group to put another device in the Group
- 8) Click Save Changes

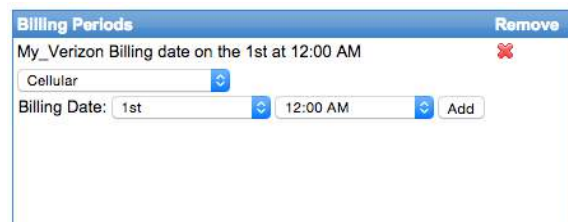


Billing Periods

Set a Billing Period to break-out data usage totals into monthly timeframes. This feature is useful for keeping better track of how much Cellular data is used within a monthly billing period. Use this feature in conjunction with a Bandwidth Group created for your Cellular devices to keep tabs on how much data is used within the group during the billing period.

Configuring Billing Period

- 1) Go to Usage tab on Control Panel
- 2) Ensure that Usage Tracking is On
- 3) Select Internet Connector or Bandwidth Group
- 4) Select Billing Date upon which usage is reset
- 5) Click Add
- 6) Click Save Changes





Device Restrictions

Make rules to manage internet speeds or access for particular devices and Internet Connectors. This gives you control over bandwidth usage for optimizing performance, limiting individuals, and avoiding overages on data plans. Device Restrictions can be used creatively to schedule when children have internet access, cutoff 4G service when approaching monthly limits, and limiting internet speeds or downloads on particular devices. The applications are as diverse as you can imagine.

Configuring Device Restriction

- 1) Go to Usage tab on Control Panel
- 2) Ensure that Usage Tracking is On
- 3) Select all or a particular Internet Connector or network interface
- 4) Select all Devices or a particular one (check Exclude if effect should apply to all other Devices)
- 5) Select desired Effect when restriction engages
- 6) Set Schedule for when restriction applies
- 7) Set Threshold for amount of bandwidth consumed that triggers Effect
- 8) Set Reset Interval for timetable that the bandwidth Threshold will be reset on
- 9) Click Add

A limit speed restriction will be highlighted in yellow when active and a disable internet access restriction will be highlighted in orange when active. A message will also display on the Control Panel that indicates that the restrictions is in effect. Any restrictions that are not highlighted in yellow or orange are not currently being applied.

Active Color Codes

Limit Speed: **Yellow**

Disable Internet Access: **Orange**

Device Restriction	Effect	Schedule	Limit Type	Activation	Usage	Reset Interval	Remove
ETHERNET WAN	STOP INTERNET BLOCKS TRAFFIC WHEN LIMIT IS REACHED	10:00PM TO 8:00AM EVERY DAY	NONE	ALWAYS ACTIVE	0 KB	Reset MONTHLY On 1st at 12:00 AM	
ALL INTERNET CONNECTOR	LIMIT SPEED Download: 25Mbps Upload: 25Mbps	ALL DAY EVERY DAY	NONE	ALWAYS ACTIVE	5.45 KB	Reset MONTHLY On 1st at 12:00 AM	
ALL INTERNET CONNECTOR	LIMIT SPEED Download: 10Mbps Upload: 10Mbps	ALL DAY EVERY DAY	COMBINED (Download and Upload)	5 GB	139.27 MB	Reset DAILY 12:00 AM	
ETHERNET WAN 10.167.80.162	STOP INTERNET BLOCKS TRAFFIC WHEN LIMIT IS REACHED	ALL DAY EVERY DAY	NONE	ALWAYS ACTIVE	22.58 KB	Reset MONTHLY On 1st at 12:00 AM	

Add Restriction
CREATE RULES TO THROTTLE SPEEDS OR STOP INTERNET CONNECTIVITY TO OPTIMIZE USAGE

SELECT INTERNET CONNECTOR
CHOOSE ALL OR A PARTICULAR INTERNET CONNECTOR THAT THIS RESTRICTION WILL APPLY UNDER

Select Internet Connector ▼



OPTIONS

Guest Wireless Network

Share internet with guests and friends without needing to share your private password. The Guest Wireless Network is an optional broadcast that is totally independent of your Private Wireless Network. Because the access can be time-limited, it could also be ideal for use with children whose internet access you wish to schedule.

Configuring Guest Wireless Network

- 1) Go to WiFi tab on Control Panel
- 2) Check Broadcast to On
- 3) Enter desired Name (SSID) and Passcode
- 4) Select Duration guests have access per use
- 5) Select Interval which guests can access internet again
- 6) Enter Title, Sub Title, and Redirect URL for guest login page (optional)
- 7) Upload Header Image for guest login page if desired (100kb max file size)
- 8) Enter Message for guest login page
- 9) Click Save Changes

The Guest Wireless Network will now broadcast an OPEN wireless signal based on the Name (SSID) given. Once guests connect to the network, they must open a web browser where they will be redirected to the guest login page. Then guests must enter the Passcode in order to gain internet access.

Guest Wireless Network

Broadcast On Off

Name (SSID)

Passcode

Duration

Interval


Title

Sub Title

Redirect URL

Header image No file chosen

Preview:



[Remove image](#)

Message



Social Info

Display your social profile to other WiFiRanger owners that are in the same vicinity. If a WiFiRanger owner has activated his Social Info feature, you will see a "person" icon displayed next to his WiFi Network on the Main tab of the Control Panel. Hover over the icon to view the Social Info. You do not need to connect to the WiFi in order to see the Social Info, as a simple Scan will display the icon.

Connect	23 WiFi Networks	Signal	Type	Channel	Speed	Mac Address	Tag
Connect	BlueMeshNetworks	n [signal]	WPA	7	1.06 Mbps	DC:9F:DB:38:08:BA	<input type="checkbox"/>
Connect	Pvt.WiFiRanger_Go6879	n [signal]	WPA	5		02:5E:0C:31:12:F9	<input type="checkbox"/>
Connect	Pvt.WiFiRanger_Sky.1925	n [signal]	WPA	4		02:27:22:B3:F8:A5	<input type="checkbox"/>
Reconnect Disconnect	test	n [signal]	OPEN	4		04:27:22:B3:F8:A5	<input type="checkbox"/>
Connect	Pvt.WiFiRanger.1036	n [signal]	WPA	7		02:15:6D:4C:AC:16	<input type="checkbox"/>
Connect	Public.1036	n [signal]	OPEN	7		04:15:6D:4C:AC:16	<input type="checkbox"/>
Connect	ZyXEL-03CD57	n [signal]	WPA	2		FC:8F:C4:03:CD:56	<input type="checkbox"/>
Connect	CSS	n [signal]	WPA	1		6C:B0:CE:25:E3:3E	<input type="checkbox"/>
Connect	Boyle Network	n [signal]	WPA	11		00:26:BB:78:66:1B	<input type="checkbox"/>
Connect	Pvt.WiFiRanger_X.5747	n [signal]	WPA	7		02:27:22:EE:02:2B	<input type="checkbox"/>
Connect	Pvt.Tactical	n [signal]	WPA	7		02:27:22:00:07:BC	<input type="checkbox"/>
Connect	BN Guest Network	n [signal]	WPA	7		06:26:BB:78:66:1B	<input type="checkbox"/>
Connect	DIRECT-JU-VIZIOTV	n [signal]	WPA	7		02:6B:9E:A6:85:F1	<input type="checkbox"/>
Connect	Pubnet5747	n [signal]	OPEN	7		04:27:22:EE:02:2B	<input type="checkbox"/>
Connect	FieldSync	n [signal]	WPA	11		00:27:22:F3:35:69	<input type="checkbox"/>
Connect	CSR Idaho	n [signal]	WPA	8		DC:95:DB:02:DB:63	<input type="checkbox"/>

Social Info
Interests: Flea markets,Live music,kicking things,living awesomely,Playing music
Website: <http://wifiranger.com/>
About Me: past the Shire, over the rainbow, around Tamriel, and just before Albion.

Configuring Social Info

- 1) Go to WiFi tab on Control Panel
- 2) Enter desired info (Interests, Website address, Find Me directions)
- 3) Click Save Changes

Social Info

Interests

BBQ,Photography,Biking,Guns,Hiking,Motorcycles,Skiing

Web Site

Find Me

Entering info into any of these fields is optional. For example, you could fill out only the Website field with a link to your Facebook profile or blog, leaving Interests and Find Me blank. This means that only the Website info will be displayed to others on your own social icon. Find Me directions are used to give others a way to find your campsite or location so that you can easily make new friends.



System Preferences

Numerous settings are managed on the Setup tab under System Preferences.

Failover

RECOMMENDED ON

Automatically searches for internet connectivity after going offline. By default, Failover is turned off to ensure that the user does not experience a reconnect loop in case internet is unavailable out of box. For most users, it is recommended to turn Failover On once familiarized with the product and able to get online via at least one connection device.

Failover Interval

RECOMMENDED 5 MINUTES

Checks for internet connectivity based on set time interval. High frequency is recommended for users needing immediate internet recovery while less frequent checks are recommended for situations where there are limited internet sources that are all slow or unstable.

Multi-WAN Mode

Select mode for Multi-WAN based on desired operation. Read more under Optimizations > Multi-WAN

Safe Surf

RECOMMENDED OFF DURING GENERAL USE

Encrypts all data through secure servers to eliminate dangers from man-in-middle attacks at public networks. Increase security by turning this feature on when doing sensitive web activity. It is recommended to turn Safe Surf off for general use as performance is slightly decreased when encrypted.

Control Panel Redirect

RECOMMENDED ON

Automatically force your web browser to bring up the Control Panel if offline. This feature alerts the user that the WiFiRanger is offline, prompting them to attempt to get back online.

Initial Auto Connect

RECOMMENDED ON

Automatically attempts to get online after booting up. Having Initial Auto Connect set to On may require that you wait a minute or two after powering the WiFiRanger up, but it makes the internet experience seamless. Most of the time, the router will automatically get online after powering up.

Attempt Auto Login

RECOMMENDED ON

Automatically attempts to bypass login/agreement page at Filtered WiFi Networks. Public networks that require a username and password cannot be bypassed, but Filtered networks that simply have a one-click access button may be automatically bypassed with this feature on.



FEEDBACK

Network Reviews

Submit reviews of WiFi Networks by clicking the stars to the right of the status and signal bars on the Main tab.



Fill out the information in the review popup and then submit it. The Venue Name automatically populates if the location or business is recognized by Google Maps. These reviews are collected in an effort to improve the WiFi Hotspot experience for all. Accurate network reviews provide valuable insight to travelers and businesses alike.

Venue Name:	<input type="text" value="BlueMesh Networks"/>	Rating:	★★★★★
City:	<input type="text" value="Meridian"/>	SSID:	BlueMeshNetworks
State / Province:	<input type="text" value="ID"/>	BSSID:	DC:9F:DB:38:08:BA
Site Number / Area:	<input type="text" value="Build Room"/>	Signal:	
Comments:	<input type="text" value="Very nice WiFi service and excellent staff. They even give out free candy!"/>	Speed:	12.28 Mbps
		Global IP:	10.128.41.86

((i)) WIFIRANGER

Registration

On the Register tab, you may register a mywifiranger.com account that has many new and powerful features being developed.

Owner Information

? First Name

? Last Name

? E-mail

? Phone Number

MyWiFiRanger.com

? User Name

? Password

Install Information

? Type

? Make

? Model

? Length

? Serial Number

Registration

? Remind me to Register On Off



OPTIMIZATIONS

Multi-WAN

Unify All Internet Sources

Multi-WAN has three modes to ensure maximum reliability and speed. Combine your 3G/4G Cellular device, WiFi Networks, and up to two Ethernet WAN connections from hardwired internet sources. Nothing compares to this easy-to-use and dependable way to blend multiple internet sources together.

Order	Internet Connector	Description	Multi-WAN ?	Active	Settings
1	▼ Ethernet WAN	WAN PORT FOR HARDWIRED CONNECTION TO MODEM OR LAN NETWORK	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
2	▲▼ Internal WiFi WAN	BUILT-IN WIRELESS RADIO FOR CONNECTION TO NEARBY WiFi NETWORKS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3	▲ Cellular	USB PORT FOR CONNECTION TO 3G/4G AIRCARD OR MiFi DEVICE	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	WFRBoost	EXTERNAL UBIQUITI RADIO FOR BOOSTED CONNECTION TO WiFi NETWORKS	<input type="checkbox"/>	<input type="checkbox"/>	
	WFRControl	PAIRED OUTDOOR WIFIRANGER FOR BOOSTED CONNECTION TO WiFi NETWORKS	<input type="checkbox"/>	<input type="checkbox"/>	

Check Multi-WAN for each Internet Connector that you would like configured to function jointly using the below modes. Once selected, choose the desired Multi-WAN Mode under System Preferences then click Save Changes. Learn more about each mode and its intended uses on the following pages.

MULTI-WAN MODES

Hot Standby

Prepare backup internet sources for immediate changeover following internet failure

- Exclusively utilize primary connection unless it fails
- Back up primary connection with a Cellular device or other source
- Prepare backup connection in background for instantaneous swap over

Load Balance

Combine multiple internet sources for stacked speed and fail-safe reliability

- Evenly disperse usage over multiple sources
- Maximize stability by actively using multiple sources
- Stack speeds of multiple sources for improved video streaming and downloading

Dynamic

Prefer primary internet source with temporary speed boosts from secondary sources

- Mainly use primary connection until additional speed is needed
- Conserve data usage of secondary connection and use only when needed
- Set speed threshold which triggers secondary source to supplement primary source



HOT STANDBY

The Multi-WAN Hot Standby mode makes it possible to set up multiple internet connections which serve as instant backups to your primary connection if it goes offline or if its speed drops below the Slowest Usable Speed. This mode can be very useful if your primary source is local WiFi while your Cellular Aircard/MiFi is serving as a secondary backup connection. Cellular data will not be used unless the local WiFi fails.

When using an RV Pack (indoor Go/Go2 and outdoor Mobile/Sky), Multi-WAN is even more useful, as your indoor WiFiranger can be connected to a separate local WiFi source than your outdoor Mobile/Sky, giving you two WiFi Networks. This means you could have one WiFi Network as your primary, while having up to two backup connections-- one WiFi and one Cellular.

Configuring Hot Standby

- 1) Select Hot Standby for Multi-WAN Mode drop-down on Setup tab
- 2) Check Multi-WAN for each desired Internet Connector
- 3) Order Internet Connectors in preferred order (primary at top in 1st position with secondary following)
- 4) Click Save Changes
- 5) Connect Internet Connectors to internet on Main tab or await automatic connections



On the Main tab, any backup connections will be highlighted in orange or have an orange flame icon next to them, indicating that they are ready for immediate switchover in case the primary internet source fails.



LOAD BALANCE

The Multi-WAN Load Balance mode makes it possible to spread your data usage across multiple internet connections simultaneously. This feature is very useful for combining the speed and dependability from both WiFi and Cellular. In many cases, the speed of local WiFi networks is slow but the dependability is good. On the other hand, Cellular can often be less stable but much faster. With Load Balancing, the best of both WiFi and Cellular are combined for solid reliability and fast speed.

When using an RV Pack (indoor Go/Go2 and outdoor Mobile/Sky), Multi-WAN is even more useful, as your indoor WiFi Ranger can be connected to a separate local WiFi source than your outdoor Mobile/Sky, giving you two WiFi Networks. This means you could have one WiFi Network as your primary, while having up to two more combined connections-- one WiFi and one Cellular.

Configuring Load Balance

- 1) Select Load Balance for Multi-WAN Mode drop-down on Setup tab
- 2) Check Multi-WAN for each desired Internet Connector
- 3) Click Save Changes
- 4) Connect Internet Connectors to internet on Main tab or await automatic connections

WiFi	Internet	Cellular					
CONNECTED .lll ***** BlueMeshNetworks Go2 Scan	ONLINE Using WiFi+Cellular Auto Connect	Tether Active .lll AC341U Disconnect					
Connect 22 WiFi Networks	Signal	Type	Channel	Speed	Mac Address	Tag	
Reconnect Disconnect	BlueMeshNetworks	n .lll	WPA	7	22.01 Mbps	DC:9F:DB:38:08:BA	■

On the Main tab, all active internet sources will display under the Internet Status which indicates that these sources are Load Balancing.

NOTE

Performing speedtests on some websites may not work when using Load Balancing as these speedtests are not designed to support multiple internet sources at once.



DYNAMIC

The Multi-WAN Dynamic mode makes it possible to boost the speed of your primary internet source using a secondary source only when needed. For example, this feature would help save Cellular data by using local WiFi as the primary internet source, with a 4G Aircard/MiFi used only when needing extra speed. Conserve data usage on your secondary source but utilize its speed when exceeding a set threshold, such as for streaming video or downloading files.

Configuring Dynamic

- 1) Select Dynamic for Multi-WAN Mode drop-down on Setup tab
- 2) Set Dynamic Threshold at speed which triggers secondary boost
- 3) Set Dynamic Threshold Time at time period for average speed to be based on
- 4) Check Multi-WAN for each desired Internet Connector
- 5) Order Internet Connectors in preferred order (primary at top in 1st position with secondary following)
- 6) Click Save Changes
- 7) Connect Internet Connectors to internet on Main tab or await automatic connections

It is recommended to set the Dynamic Threshold at a speed which the primary internet source would normally achieve. For instance, if your primary internet source is local WiFi normally at 3Mbps, then set the Dynamic Threshold just under that speed at 2.5Mbps. This means that when you sustain an average of 2.5Mbps+ for the Dynamic Threshold Time specified, your secondary internet source will step in and boost your speeds. The average is rolling, so once the heavy usage is done, and the average speed is less than 2.5Mbps, your secondary connection will no longer be used to boost the speed.



NOTE

If watching brief videos online or performing small downloads is taking too long, and only the primary internet source is being used, then you should set the Dynamic Threshold Time to just 1 minute. This means that it will take less time for the average speed to be calculated, therefore using the secondary internet source to boost your speeds sooner. To use your secondary internet source less frequently, conserving its data plan, simply increase the Dynamic Threshold Time to 3 minutes and perhaps increase the Dynamic Threshold slightly.

Be sure to not increase the Dynamic Threshold higher than what your primary source can sustain, otherwise your secondary source will never boost the speed. The Dynamic Threshold speed must be exceeded for a sustained period of time before the secondary internet source steps in to boost your speed.

WiFi RANGER

Profiles

REQUIRES HIDE ADVANCED FEATURES OFF ON SETUP TAB

On the Setup tab, the Profiles feature allows for saving a particular configuration which can be loaded to easily setup the WiFiRanger without requiring manually changing settings all over the Control Panel. Save your desired default configuration to easily allow for reverting back to your favorite settings. Create multiple Profiles to switch between configurations that are designed for particular circumstances or locations.

Profiles make saving and loading your customized preferences convenient.

Using Profiles

1) Configure WiFiRanger as desired

ALL CURRENT SETTINGS WILL BE PUT INTO A NEW PROFILE

2) Type in a Profile Name and click Save Profile

BEING DESCRIPTIVE WITH THE PROFILE NAME IS HELPFUL

3) Load or Delete Profiles as desired

THE TWO DEFAULT PROFILES SHOWN (ETHERNET ONLY & WIFI ONLY) CANNOT BE DELETED

Profiles	Load Profile	Delete
Ethernet Only	<input type="button" value="Load"/>	
WiFi Only	<input type="button" value="Load"/>	
<input type="text" value="Profile Name"/>	<input type="button" value="Save Profile"/>	



Internet Connectors

On the Setup tab, customize how the WiFiRanger prioritizes connections and acts automatically behind the scenes to keep you online through the best source. On the Main tab, an Auto Connect can be initiated to have the WiFiRanger attempt to get online according to the Auto Connect Order.

Order	Internet Connector	Description	Multi-WAN ?	Active	Settings
1	Ethernet WAN	WAN PORT FOR HARDWIRED CONNECTION TO MODEM OR LAN NETWORK	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
2	Internal WiFi WAN	BUILT-IN WIRELESS RADIO FOR CONNECTION TO NEARBY WiFi NETWORKS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3	Cellular	USB PORT FOR CONNECTION TO 3G/4G AIRCARD OR MIFI DEVICE	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	WFRBoost	EXTERNAL UBIQUITI RADIO FOR BOOSTED CONNECTION TO WiFi NETWORKS	<input type="checkbox"/>	<input type="checkbox"/>	
	WFRControl	PAIRED OUTDOOR WiFiRANGER FOR BOOSTED CONNECTION TO WiFi NETWORKS	<input type="checkbox"/>	<input type="checkbox"/>	

Order

Adjust the priority of connection Internet Connectors (1 is highest priority). The Internet Connector in 1st position will be the first attempted during any automatic connections, and will also be the primary internet source if Multi-WAN is enabled. It is recommended to sort Internet Connectors based on which sources you prefer to use. For instance, if you usually have free WiFi available, then move Internal WiFi WAN, WFRBoost, or WFRControl to the top and then have your Cellular in a secondary position in order to save your data plan.

Multi-WAN

Multi-WAN has three modes to ensure maximum reliability and speed. Combine your 3G/4G Cellular device, WiFi Networks, and up to two Ethernet WAN connections from hardwired internet sources. Nothing compares to this easy-to-use and dependable way to blend multiple internet sources together. Check each Internet Connector that you wish to have use this feature then select the desired Multi-WAN Mode under System Preferences.

Active

Make Internet Connectors active or inactive using the Active checkbox. If inactive, the Internet Connector will not function during automatic connections and will not display on the Main tab.

Settings

Expand the advanced Settings of an Internet Connector by clicking its blue gear icon. The Internet Connector must be Active prior to expanding the advanced Settings.



Tags

Tags provide a way to change how the WiFiRanger interacts with certain WiFi Networks. Add Tags on the WiFi (create all types) or Main (prefer checkbox only) tabs to make your WiFiRanger treat networks in a variety of ways.

Tags can be partial (multiple networks) rather than explicit (particular network), meaning that just part of a network name could be used to create a tag that will effect multiple similarly named networks. For example, creating a Prefer Tag for “Tengo” would mean that any networks that contain that case sensitive phrase would be preferred. This comes in handy when prioritizing or ignoring common public networks that share a similar naming scheme.

Prefer

Create a Prefer Tag for any WiFi Networks you want the WiFiRanger to automatically prioritize and favor during an Auto Connect.

Ignore

Create an Ignore Tag to have the WiFiRanger skip WiFi Networks which for whatever reason are not desirable during an Auto Connect.

Last Try

Create a Last Try Tag for a WiFi Network is to be resorted to after exhausting all other wireless signals. This type of Tag is useful for WiFi Networks from MiFi devices or Hotspot Phones in order to conserve bandwidth when possible yet use the 3G/4G data when absolutely necessary.

Auto Login

Create an Auto Login Tag for Filtered WiFi Networks that require membership and periodic login credentials. This feature makes keeping logged in to the supported service providers automatic. Enter the partial network name and click add to be prompted for the service provider and your username/ password.

Slowest Usable Speed

REQUIRES HIDE ADVANCED FEATURES OFF ON SETUP TAB

On the Setup tab, expand the Settings of a particular Device by clicking its gear icon where you can enable the Slowest Usable Speed feature. This feature will disconnect the WiFiRanger from an internet source if the speed drops below the defined threshold.

Slowest Usable Speed is helpful to ensure that sluggish or overloaded internet connections are avoided to automatically favor faster connections. The caution is to realize that placing a higher speed threshold will limit the connections available to the WiFiRanger. Higher thresholds equal less options.





Wireless Radio

REQUIRES HIDE ADVANCED FEATURES OFF ON SETUP TAB

Several options for the wireless radio can be changed on the WiFi tab. 5GHz appears only for newer models that have 2.4 / 5.8GHz capabilities.



Channel

RECOMMENDED AUTOMATIC

Hardcode the wireless channel as desired. This channel will not always be the one used, as the connection method Internal WiFi will override the hardcoded channel when connected to a WiFi Network. The hardcoded channel will be broadcasted when Internal WiFi is not connecting to another signal on a different channel. Automatic is recommended as the WiFi Ranger intelligently selects the least noisy channel to use when booting up.

Power

RECOMMENDED LOW FOR INDOOR & MEDIUM FOR OUTDOOR

Adjust the power of the wireless radio to the optimal level which varies by circumstance. In some cases, less is more. Wireless noise is a key factor for wireless performance. To put it in perspective, when there are many people talking in the same room, it gets more difficult to hear as more people talk, or as they talk *louder*. This principle helps to improve WiFi performance and reliability by selecting the appropriate power.

Some users of multiple WiFi Rangers (RV Packs) can benefit from setting the Radio Power appropriately. In the case of a WFRControl installation, setting the Power of the indoor router to Low with the outdoor router set to High will give best performance. This reduces wireless noise inside while maintaining the needed power outside to reach distant WiFi Networks.

Mode

RECOMMENDED 802.11N/G FOR 2GHZ & 802.11AC FOR 5GHZ

Change the wireless mode that your WiFi Ranger broadcasts to an older 802.11 wireless standard to allow old devices to connect. In most cases, having the mode to 802.11n/g for 2.4GHz and 802.11ac for 5GHz is preferred, as this is the fastest and most current wireless operating mode, which translates to more speed. Change the Mode only when old devices do not support connecting to the newer standards.



WiFi RANGER

Range Options

REQUIRES HIDE ADVANCED FEATURES OFF ON SETUP TAB

When using Range automatic connections in an area that has numerous available WiFi Networks, it may be helpful to limit how many networks are attempted. This will reduce the amount of time taken for the WiFiRanger to establish an internet connection. Configure Range Options on the WiFi tab.

Configuring Range Options

- 1) Go to WiFi tab of Control Panel
- 2) Select desired number of Attempted Networks
- 3) Select desired level of Signal Strength
- 4) Select desired Wireless Standard
- 5) Click Save Changes

Range Options

- ? Attempted Networks
- ? Signal Strength
- ? Wireless Standard
- ? Restrict Networks

By requiring higher Signal Strength and Wireless Standards, your connection possibilities are reduced. The same applies to lowering the amount of Attempted Networks or Restricting Networks to tagged-only. Increasing standards reduces the time taken to establish an automatic connection, but also reduces the likelihood of establishing a connection at all. Therefore, it is not recommended to limit Range Options too severely.

To attempt a Range, go to the Main tab and click the arrow icon to the right of the WiFi box header. This will drop-down the Perform Range options. Simply click the desired option which will process a Range which is limited by your Range Options configured on the WiFi tab.

Perform Range

FIRST AVAILABLE

FIRST TAGGED

STRONGEST SIGNAL

FASTEST AVAILABLE

FASTEST TAGGED



ADVANCED

Fusion

Fusion Networking™ interconnects all of the WiFiRanger routers together that are online and a part of the same fuse. This creates an interconnected private network (LAN) that can span the world, allowing for easy remote desktop access, quick file sharing, global NAS hosting, and much more. Fusion Networking™ is the most simple and intuitive internet cloud Global Local Area Network.

The ideal scenario involves a dedicated and stationary indoor router that has a static Global IP on reliable internet. Fusion Networking™ now interconnects your mobile clients through the fixed host.

Configuring Fusion Networking™

1 Setup a Fusion on the Fusion tab

Host a Fusion Network (requires Global IP)

Add a Fusion Host (requires ID, IP, and Key)

2 Add a Fusion Client (requires ID and Key)



Port Forwarding

On the Advanced tab, create a port forward using the standard method with the IP Address of the destination device/computer, the starting/ending ports, and the protocol in use.

Port Forwarding	Starting Port	Ending Port	Protocol	Delete
No ports are being forwarded				
<input type="text" value="IP Address"/>	<input type="text" value="Start Port"/>	<input type="text" value="End Port"/>	TCP ▾	<input type="button" value="Add"/>

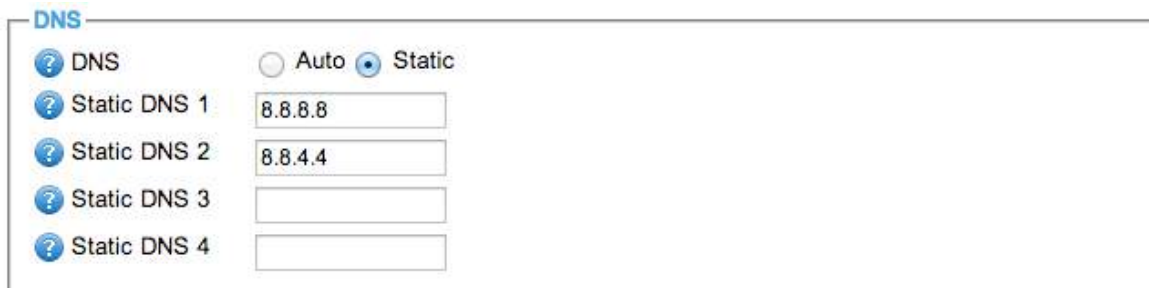
WiFi RANGER

DNS

On the Advanced tab, configure the appropriate DNS settings to determine what domains are used for assessing online statuses. This setting is generally fine to leave on Auto.

In some cases, setting the DNS statically is necessary. For WFRControl installations, it is recommended to have the outdoor slave set to Auto while the indoor master is statically assigned to Google's DNS servers. However, in firmware 7.0.5rc2 or later, Auto is recommended as it will try using the DNS server of the internet source it is connected through first, but then fall back to Google's name servers if the internet source's name servers fail.

Static Recommendations (Google)



DNS

Auto Static

Static DNS 1

Static DNS 2

Static DNS 3

Static DNS 4

DMZ

On the Advanced tab, set a DMZ IP Address of a server behind the WiFiRanger. DMZ stands for Demilitarized Zone, which in computer security terms means that this server is exposed through the router's firewall so that access is granted to the DMZ server from the internet.

Hosting a DMZ server behind a WiFiRanger does not compromise other devices or computers on the LAN. Only the specified server will be exposed to the internet.



DMZ

DMZ IP Address



Static IP

On the Setup tab, each Device can be set to a static IP by expanding the Settings after clicking the gear icon. This allows for manually assigning the WiFiRanger with a static IP by Device.

This feature is useful if connecting to an internet source that does not issue DHCP addresses. In these cases, assign a Static IP Address within the source’s IP scheme and enter the corresponding Subnet Mask and Gateway IP.

Once a Static IP is configured for the appropriate Device, connect to the non-DHCP internet source.

 Static IP Address	<input type="text"/>
 Static Subnet Mask	<input type="text"/>
 Static Gateway	<input type="text"/>

Private LAN IP Alias

On the Advanced tab, create Private LAN IP Aliases that bridge up to two IP subnets with the WiFiRanger’s unique DHCP subnet. This feature allows for easily placing a WiFiRanger into an existing network that was on a different subnet with statically assigned devices. By creating a Private LAN IP Alias, devices issued a DHCP address will also see anything statically assigned in the IP Alias range.

To make an IP alias, enter the desired Gateway IP and Subnet separated by a comma (no spaces). In this example, anything statically assigned with 10.100.254.**2-254** will be able to communicate with all other devices connected to the WiFiRanger which are receiving the regular DHCP addresses.

IP Alias Format

xxx.xxx.xxx.1 (*Gateway IP*)

Private LAN IP Alias

 IP Alias 1	<input type="text" value="10.100.254.1"/>
 IP Alias 2	<input type="text"/>



TERMS GLOSSARY

General Networking Terms

LAN	Local Area Networks refers to a wired/wireless network of directly interlinked devices
WAN	Wide Area Network commonly refers to internet networking or an ethernet port for internet
SSID	Name of a wireless broadcast which is seen when scanning for signals

WIFIRANGER TERMS

Ranging	Process of analyzing and connecting to available wireless broadcasts
First	Connects WiFiRanger to first available wireless broadcast
Best	Analyzes all wireless broadcasts in range and connects with best
Swap Connection	Connection method to change to once available
Standby	Being ready for an immediate swap after current connection fails
IP Alias	Bridges static devices on a separate IP subnet from DHCP subnet
Uptime	Length of time that a WiFiRanger has been operating since last boot
WiFiRanger ID	Unique six digit identification number for WiFiRangers
Firmware	Operating platform of router which supports all features and functions

WIFI NETWORK TYPES

Filtered	Networks that require user authentication done through a web browser
Open	Unencrypted network that anyone in range can connect with
WEP	Encrypted network which requires a HEX key or passphrase
WPA	Encrypted network which requires a key that is much stronger than WEP

WiFi Ranger Guide

- 1) Power on WiFi Ranger
- 2) Wait a couple minutes (roughly 2 minutes for boot process)
- 3) Wirelessly connect a device to NETWORK using PASSWORD

NETWORK: Pvt.WiFiRanger ._____

PASSWORD: changemenow_____

- 4) Open device's web browser and go to Control Panel

myWiFiRanger .com

***If using a phone or tablet, you will need to scroll down and click "Take me to the full site"**

- 5) Register Tab

You will want to register by providing at least the required fields.

- 6) WiFi Tab

You will want to change your password on this tab. Be sure to save the changes.

- Once saved you will need to log back into the WiFi Ranger using the new password.

- 7) Once you have your WiFi Ranger setup, you can simply click on any available wireless network from the main control panel screen. If the WiFi network is password protected you will need to enter the password in order to connect to the WiFi.

* The WiFi Ranger is an amplifier, not a WiFi network. Your WiFi Ranger password will be used only to connect to the ranger. WiFi(Wireless Networks) can be setup several different ways and you may need information to connect to the WiFi network. This information needs to be gotten from the network owner. Example (Password to connect to the network).

WiFi Ranger IP Address

10.1____.____.1

*Your system should automatically redirect to the control panel just by going to myWiFiRanger .com. However, if it does not you can use the IP address above to gain access to the control panel.

WiFiRANGER™

CONNECT & CONTROL. COMPLETELY.™

ADDITIONAL INFORMATION & SUPPORT AT
WiFiRanger.com



Quick Start Guide

1. Power On WiFiRanger Sky™

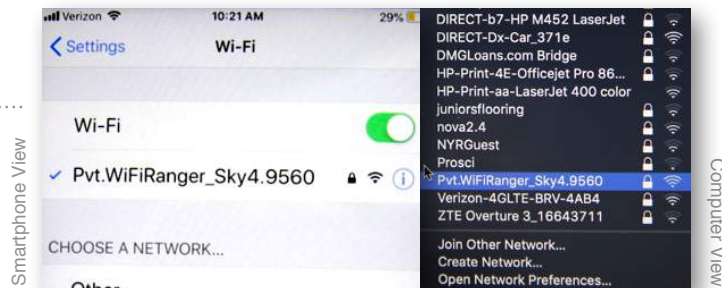
Look for a toggle switch in RV labeled as WiFiRanger Sky. After switching on, the unit will search for an internet signal (2-3 minutes).



Power switches vary in style & location depending on RV manufacturer.

2. Wirelessly connect your smartphone, tablet, or computer to Network: Pvt.WiFiRanger_Sky...

9560 is for example purposes only. Your Network name will have their own unique 4 digits. Do not look for 9560.



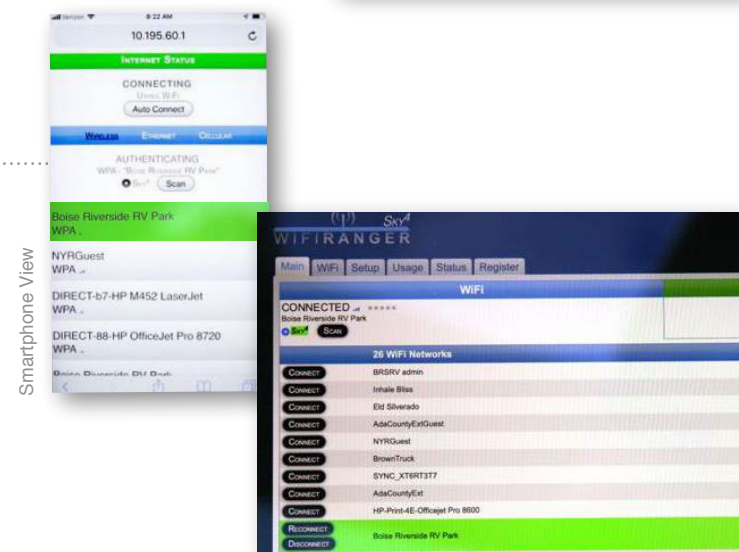
3. Enter Password: changemenowXXYY

For XXYY values, use the last 4 digits from your unique Network name in Step 2. Remember, your Network name will have their own unique 4 digits. Do not try to use 9560.



4. Visit 10.1XX.YY.1:8080

XXYY values are the same as described in Step 3 above. If the above numeric web address does not load in your browser, visit MyWiFiRanger.com.



5. Click Scan, then connect to desired network.

The network you select may require a password from network host (e.g. RV Park office, coffee shop employees, etc.)

IMPORTANT!
 Keep this Guide for RV Owners

W I F I R A N G E R
CONNECTING MOBILE LIFESTYLES™

WFRCONTROL PAIRING

WFRControl is the feature that allows a master indoor WiFiRanger to manage and control a secondary outdoor WiFiRanger. Any of our Packs which include both an indoor and outdoor router use this feature. It is preferable to setup WFRControl so that it is easy to Scan and Connect using the outdoor router from the Control Panel of the indoor router. The networks of both units are also bridged together so that a computer connected the indoor unit could communicate with a device connected to the outdoor unit, and vice versa.

Packs Utilizing WFRControl		
	Indoor Controller	Outdoor Controlled
Mini Pack	WiFiRanger Mini	WiFiRanger Sky2
Sky2 Pack	WiFiRanger Core	WiFiRanger Sky2
Sky3 Pack	WiFiRanger Core	WiFiRanger Sky3
SkyPro Pack	WiFiRanger Core	WiFiRanger SkyPro
Elite Pack	WiFiRanger Go2	WiFiRanger Elite
Elite Pack FM	WiFiRanger Go2	WiFiRanger Elite FM
EliteAC Pack	WiFiRanger GoAC	WiFiRanger EliteAC
EliteAC Pack FM	WiFiRanger GoAC	WiFiRanger EliteAC FM
RV Pack	WiFiRanger Go	WiFiRanger Mobile
RV Pack2	WiFiRanger Go2	WiFiRanger Sky
RV PackTi	WiFiRanger Go2	WiFiRanger MobileTi
IR Pack	WiFiRanger IR	WiFiRanger Sky
IR Pack2	WiFiRanger IR2	WiFiRanger Sky
Marine Pack	WiFiRanger Go	WiFiRanger Marine
Marine Pack2	WiFiRanger Go2	WiFiRanger Marine2



W I F I R A N G E R

CONNECTING MOBILE LIFESTYLES™

WFRCONTROL PAIRING STEPS

- 1) Plug outdoor unit's ethernet cable into appropriate port on indoor unit
 - a) **Port 5** for Core, Go2, IR2, or GoAC (marked yellow-to-yellow)
 - b) **Port 5** for Go or IR (marked blue-to-blue)
 - c) **ETH2** for Mini (marked yellow-to-yellow)
- 2) Plug power into indoor unit (powers up outdoor unit from appropriate port)
- 3) Wait 3-5 minutes for both units to boot up
- 4) Connect computer / device to indoor unit via LAN or WiFi
- 5) Access indoor unit's Control Panel in web browser by going to 10.1**XX.YY**.1:8080
 - a) **XX** and **YY** are determined from the middle and last pairs of your WiFiRanger's 6-digit ID number. For example, unit 77**4265** would have the Control Panel address of 10.1**42.65**.1:8080
- 6) Get on Setup tab of indoor unit's Control Panel
- 7) Check WFRControl to make it Active
- 8) Click blue gear icon to expand WFRControl settings
- 9) Select Ethernet for Control Over option
- 10) Click Save Changes at bottom left of page
- 11) Wait 30 seconds for WFRControl to pair both indoor and outdoor units together
- 12) Use Up arrow button to move WFRControl to desired priority of Order
 - a) Recommended to prioritize WFRControl above Internal WiFi WAN
 - b) Think of WFRControl as outdoor unit and Internal WiFi WAN as indoor unit
- 13) Click Save Changes at bottom left of page
- 14) Get on Main tab of indoor unit's Control Panel
- 15) Select outdoor unit to left of Scan button instead of indoor unit
- 16) Click Scan and then Connect on desired WiFi Network (connects using outdoor unit)

CONCLUSION

Now you have the simple, unified control of two WiFiRangers from the Control Panel of the indoor unit. WFRControl also combines the networks of both WiFiRangers, meaning devices connected via LAN or WiFi to *either* unit will be interconnected at all times. WFRControl makes the most of both indoor and outdoor unit capabilities.

WFRControl Pairing Guide

W I F I R A N G E R

CONNECTING MOBILE LIFESTYLES™

TROUBLESHOOTING APPENDIX

Follow these instructions if the above Steps did not work

TROUBLESHOOT 1

Verify both WiFiRangers are on matching firmware (required to work)

FIRMWARE VERSION IS FOUND ON TOP RIGHTHAND CORNER OF CONTROL PANEL AND UPDATE LINK IS FOUND IN THE SAME AREA SHOULD THE UNITS REQUIRE AN UPDATE FOR WFRCONTROL TO FUNCTION PROPERLY

TROUBLESHOOT 2

Reset both WiFiRangers to Factory Default Settings on Setup tab

CONNECT TO INDOOR UNIT AND RESET THEN CONNECT TO OUTDOOR UNIT AND ALSO RESET THEM INDIVIDUALLY, REBOOTING BOTH UNITS ONCE RESET IS PERFORMED

TROUBLESHOOT 3

Ensure there is no confusion between indoor and outdoor units

IN SOME CASES, JUST TAKE SOME TIME TO THINK THROUGH A STEP, KEEPING IN MIND WHICH UNIT YOU'RE CURRENTLY CONNECTED TO AND FOLLOW EACH STEP WHILE CLOSELY DISTINGUISHING BETWEEN INDOOR AND OUTDOOR UNIT

TROUBLESHOOT 4

Contact a WiFiRanger support representative

QUESTIONS@WIFIRANGER.COM OR WWW.WIFIRANGER.COM



MAGNADYNE OMNI-DIRECTIONAL ANTENNA

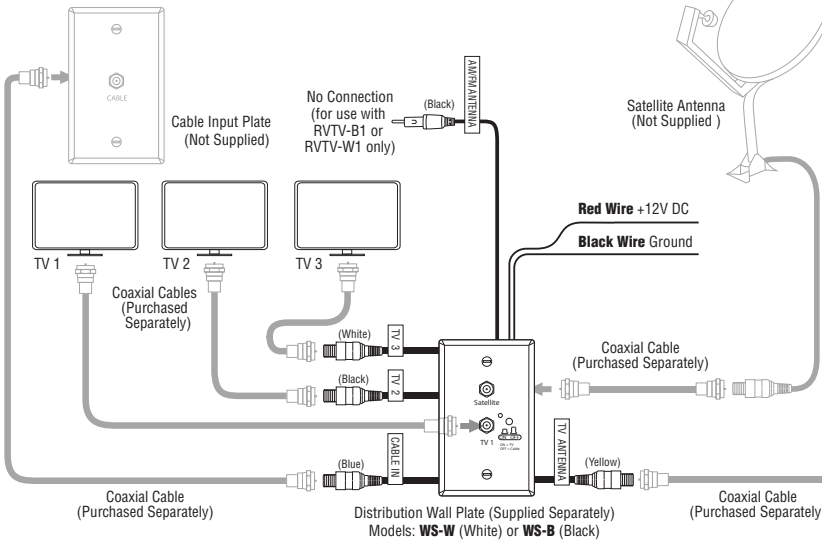
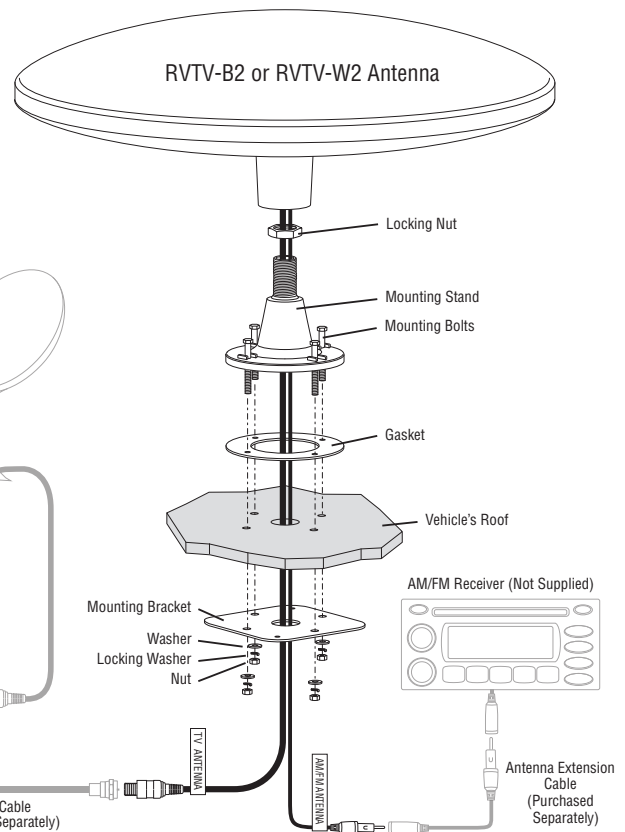
Models: RVTV-B2 (Black)
RVTV-W2 (White)

Installation Instructions

Installation

- Step 1: Choosing a Location:** Make sure the mounting location has a sufficient flat area so the antenna's mounting stand can be mounted flat.
- Step 2: Drilling Holes:** Use the mounting bracket as a template to determine where to drill the holes.
- Step 3: Assembling the Antenna:** Rotate the antenna's locking nut all the way down on the base. Gently pull the antenna's cables thru the mounting stand. Screw the antenna onto the mounting stand then rotate up the locking nut to lock the antenna into place.
- Step 4: Attaching the Antenna:** Feed the cables thru the gasket then thru the hole in the roof. Put the mounting bolts thru the holes in the mounting stand. On the interior, place the mounting bracket then use the washers and nuts to secure the antenna.
- Caution:** Do not over-tighten the mounting bolts, damage to the mounting stand or roof may occur.
- Step 5: Wiring:** Connect the cables from the antenna to distribution wall plate and to the radio. Connect the power cables from the distribution wall plate according to the diagram below.

Technical Specifications
 Frequency range: VHF: 47-230MHz
 UHF: 470-862MHz
 Receiving range: FM/VHF/UHF
 Gain: 30dB
 Noise: 3dB
 Maximum output level: 110dBµV
 Impedance: 75Ω
 Power supply: DC 12V



MAGNADYNE® 1111 West Victoria Street
Compton, CA 90220

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For Technical Assistance, please call (800) 638-3600

RVTV-X2-IMUM Rev. A 1-7-13



Models: RVTV-B2 (Black)
RVTV-W2 (White)

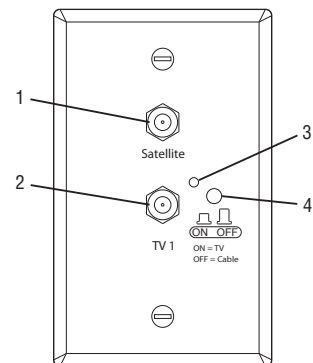
Operating Instructions

Distribution Wall Plate Features

Features:

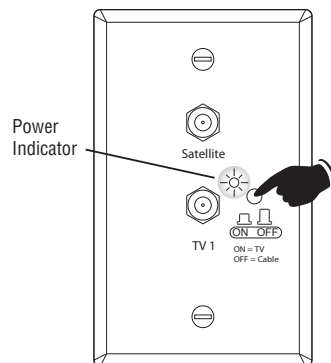
- Compatible with HDTV.
- Built-in high gain and low noise amplifier, shielded for minimum interference.
- Omnidirectional antenna receives VHF, UHF and AM/FM signal from every point regardless of the direction you are traveling.
- Amplifier with SMD technology and micro-electronics ensures excellent antenna performance.
- Waterproof antenna made of UV resistant ASA material.

- 1. Satellite Antenna Output Connector:** Use a cable to connect to a TV to receive a satellite signal.
Note: A satellite antenna must be connected to the vehicle.
- 2. TV 1 or Cable Output Connector.** Use a cable to connect to a TV to receive either TV antenna or cable reception.
- 3. TV Antenna Power Indicator.** When lit indicates TV reception. When off indicates cable reception.
- 4. TV Reception or Cable Selector Switch.** Press this button to choose from TV or cable reception.
Note: Every TV (TV 1, TV 2 and TV 3) connected to the wall distribution plate will be switch when a selection is made, either TV or cable.



Selecting TV Antenna Reception

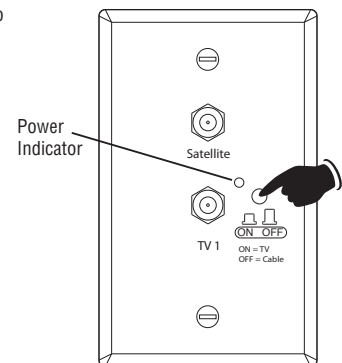
To receive TV antenna reception press the On/Off switch so the power indicator is lit.



Selecting Cable TV

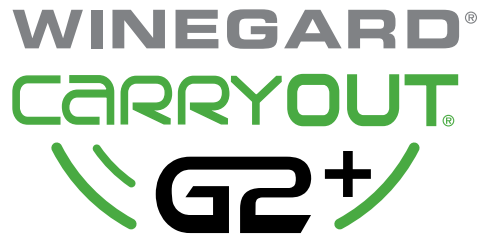
To receive cable TV press the On/Off switch so the power indicator is off.

Note: The vehicle must be connected to an external cable source.





WINEGARD CARRYOUT G2+ SATELLITE ANTENNA



Instruction Manual

www.winegard.com/carryout

For receivers and programming, call 1-866-609-9374



For up-to-date information on receiver compatibility and programming, visit www.winegard.com/receivers

For help, email help@winegard.com or call 1-800-788-4417

DO NOT RETURN ANTENNA TO PLACE OF PURCHASE



2452360



Specifications

Compatible with DIRECTV®, DISH®, & Bell TV™ programming
 Supports up to two receivers
 For stationary use only
 Includes 25' coaxial cable, 3' coaxial cable, and power inserter
 Unit weight: 10 lbs
 Unit height (no feet): 13.5'



Diameter: 14.3"
 Elevation range: 18–65°
 Azimuth: 0–416°
 UV-protected plastic dome

NOTE Operating temperature specifications: -25° to 70° C (-13° to 158°F)

Compatible Receivers

Receiver models change frequently. For an up-to-date list of compatible receivers, visit www.winegard.com/receivers.

DIRECTV Receiver Compatibility

The Carryout G2+ antenna is not compatible with DIRECTV SWM-only receivers (e.g. H25 or HR34). If you have a SWM-only technology receiver, Winegard Model SWM-840 kit is available. This SWM kit will allow for proper SWM technology operation with Winegard mobile satellite TV antennas.

DISH Receiver Compatibility

Operation may require an HD receiver. The antenna is not compatible with DISH Hopper™ or Joey™ receivers. Dual tuner receivers will require two coax connections from the antenna. In order to simultaneously watch or record two different programs, each program must be broadcast from the same satellite.

Compatible Satellites

DIRECTV: 101° or 119° (will not receive HD on 110° or any KA-band HD on 99° and 103°)

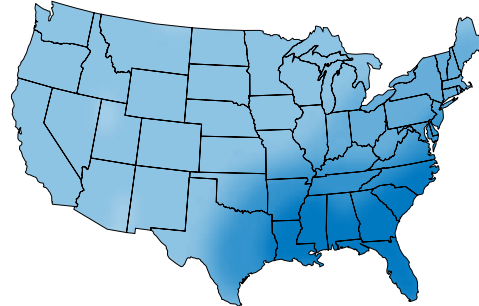
DISH (Western Arc): 110°, 119°, 129°

Bell TV: 91° or 82°

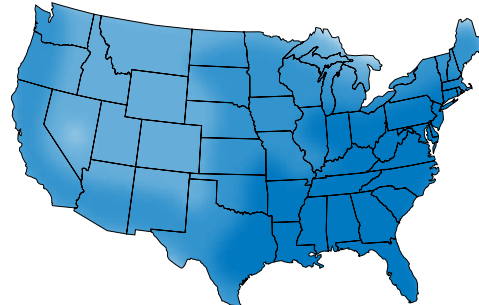
Refer to maps* to determine coverage in areas of the U.S.

Good **Signal Strength** Best

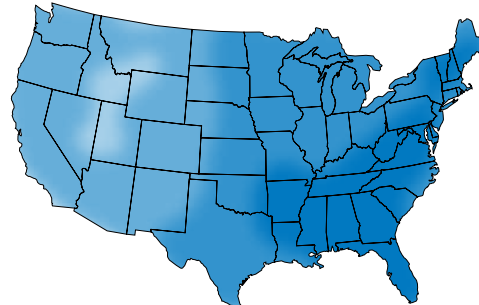
DIRECTV Sat. 119°



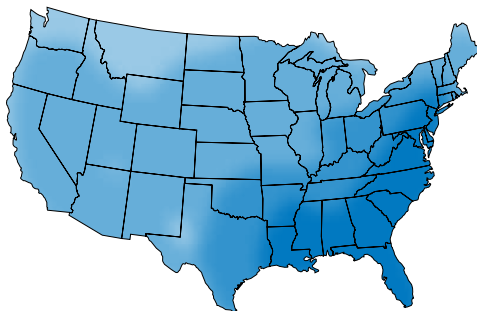
DISH Sat. 110°



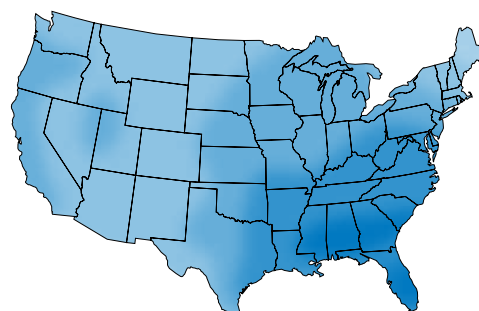
DISH Sat. 119°



DIRECTV Sat. 101°



DISH Sat. 129°



1 *Source: www.satbeams.com. Coverage maps are approximate and do not guarantee coverage.



WINEGARD CARRYOUT G2+ SATELLITE ANTENNA

Warnings

- ❗ Do not place the unit in water greater than one inch deep, or water may damage the electronics.
- ❗ Do not install or operate the antenna in winds of 35 mph or greater. The antenna will roll in winds ≥ 35 mph.
- ❗ Care should be taken when transporting and setting up the antenna. Do not toss or drop the antenna.
- ❗ Do not paint the antenna. Painting the antenna may cause signal degradation and will void your warranty.

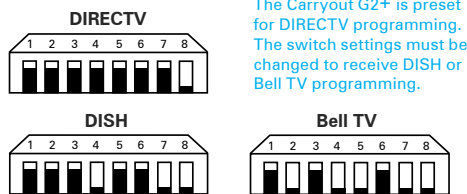
1. Switch Settings

The Carryout G2+ antenna switch settings are located on the Winegard Power Inserter and are preset for DIRECTV programming.



To set the antenna for any other programming provider, locate the switches on the Power Inserter and set according to the diagram below:

Switch Settings—Up () or Down ()



2. Installing the Handle

1. Locate the two screws for the handle in the base. Remove the screws from the base with a Phillips screwdriver.



NOTE The two holes for the handle are located between the cable connections and eyelet.

2. Locate the handle in the box. With "WINEGARD" on the handle facing upwards, align the two holes in the handle with the two holes in the base.
3. Thread two screws through the two aligned holes in the bottom of the handle.
4. Tighten the two screws using a Phillips screwdriver. Do not overtighten.

Carryout G2+ Antenna

3. Choosing a Location

1. Choose a location with a clear, unobstructed view of the southern sky. Avoid obstructions such as trees, hills, vehicles, or buildings—these can block the signal from the satellite.

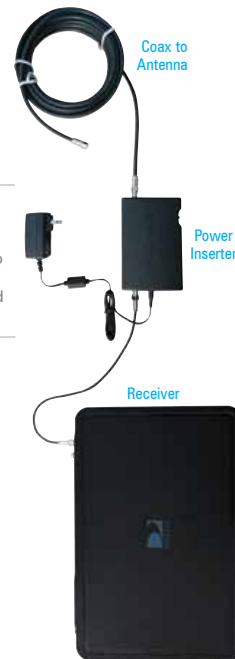
NOTE Satellite signal will not pass through solid objects. For this reason, it is vital to select a location with a clear, unobstructed view of the southern sky.

2. Make sure the antenna is not placed in the path of people or vehicles; otherwise, the antenna may be knocked off of the signal if run into, or cables may be disconnected from the unit.
3. Select a location that will enable the Carryout G2+ antenna to sit within three degrees of level. The antenna may take longer to lock onto signal if the antenna is not level.

4. Wiring the Antenna

TIP Run the coaxial cable directly from the satellite receiver to the Carryout G2+ antenna when searching for signal.

1. Ensure the power button on the Winegard Power Inserter is in the OFF position (not pressed in).
2. Connect the included 25' coaxial cable between the primary port of the Carryout G2+ and the ANTENNA port on the Power Inserter. Tighten coax connections until finger tight, and tighten a quarter turn more with a wrench. Do not overtighten.



NOTE A 25' coaxial cable is included with the antenna. To ensure proper operation, use only the included coaxial cable. Failure to use the included coax cable or use of the interior/exterior pre-wiring could hinder proper operation.

3. Connect the included 3' coaxial cable between the "SAT IN" port of your satellite receiver and the RECEIVER port of the Winegard Power Inserter. Tighten coax connections until finger tight, and tighten a quarter turn more with a wrench. Do not overtighten.
4. Plug power adapter into 110/120VAC outlet and connect to power port on Power Inserter (located next to RECEIVER coax port).
5. Once system is fully connected, press the power button on the Power Inserter.
6. Give the Carryout G2+ antenna approximately 3-5 minutes to complete the search sequence. Once the Carryout G2+ antenna has gone completely quiet, proceed to configure receiver for desired operation. For DIRECTV, see page 3. For DISH, see page 4.



5. Receiver Setup

Connect the receiver to a power source, and complete receiver setup. Receiver setup for the primary receiver follows; if your receiver differs from the options shown, you may need to consult your receiver manual. The wording and display used in your receiver may differ slightly.

Check out online receiver setup guides for your antenna at www.winegard.com/receivers/setupguide.php.

For more information on receiver compatibility and programming, visit www.winegard.com/receivers.

DIRECTV Receiver Setup



1. Press **Menu** on your remote. Select **Parental, Fav's & Setup**.



2. Select **System Setup**.



3. In your receiver menu, you will need to identify the Satellite menu. Once there, find the option for **Satellite Setup**.



4. You may be required to press the **DASH (-)** before proceeding (underneath #7 on the remote).

3 Receiver setup instructions are accurate at time of printing and may change without notice.

5. Select **3-LNB (18"x20")** or **3 Satellites**. If given the option of SWM or Multiswitch, select **Multiswitch**.

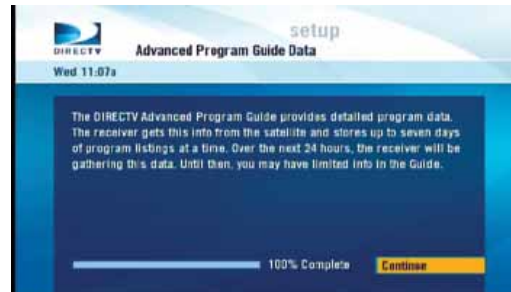


6. Power on the antenna, and allow the antenna a few minutes to acquire signal. Once the antenna has finished acquiring signal, the antenna will be silent.

7. After the antenna has acquired signal, press **Continue**; the receiver will automatically verify the setup.



8. Errors may be displayed on the screen. It is normal to see one or two boxes with an **X** instead of a **✓**. Select **Continue**.



9. Select **Continue** again. The program guide will download.
10. When the status bar reaches 100%, press **Continue**.
11. The receiver will run Data Feed and Guide Feed Tests for a few moments.
12. When prompted to set up the remote, select **Setup Remote Later** to do this at a later time.
13. Select **Watch DIRECTV**. Receiver setup is now complete.

Carryout G2+ Antenna



WINEGARD CARRYOUT G2+ SATELLITE ANTENNA

DISH Receiver Setup



If using two DISH receivers with the Carryout G2+ antenna, both receivers must be configured off of the primary port by following the steps below.

1. Disconnect coax cable from the Satellite In port on the back of the receiver.

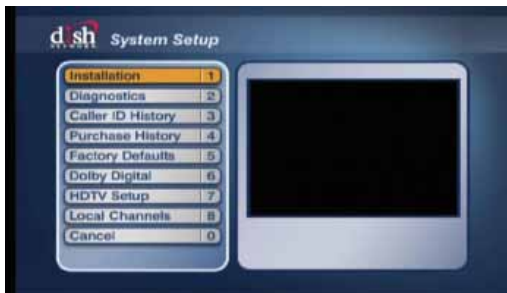


Back of 211z receiver shown

2. Press **Menu** on your remote. Select option 6, **System Setup**.



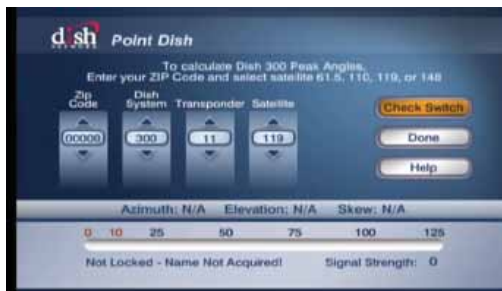
3. Select option 1, **Installation**.



4. Select option 1, **Point Dish**.



5. Select **Check Switch**.



6. Select **Test**. It will go through a number of steps, then return to the screen shown here with previous information cleared. If at any point it asks you to save, select **Save** or **Yes**.



7. Reconnect coax cable to "Sat In" port on back of receiver. Power on the antenna. Allow the antenna 3-4 minutes to acquire satellites.

8. Check that there are no check marks by SuperDISH or Alternate. If setting up a DISH 311, 301, or 500 series receiver, in some cases you may need to check the boxes next to SuperDish and Alternate before running the Check Switch test.

9. Next, select **Test** again to install the SW64 switch. This SW64 switch is a DISH receiver setting, not a physical part.



10. When you see the SW64 as the installed switch, the antenna is ready for use.



Troubleshooting

Issue	Possible Cause	Solution
Vin indicator unlit on power inserter	<ul style="list-style-type: none"> No DC power into power inserter 	<ul style="list-style-type: none"> Ensure power adapter is plugged into outlet and that outlet is providing AC power Ensure power adapter is connected to power inserter
Receiver indicator unlit on power inserter	<ul style="list-style-type: none"> No communication between receiver and power inserter 	<ul style="list-style-type: none"> Ensure 3' coaxial cable between receiver and power inserter's RECEIVER port is properly connected For DIRECTV users, ensure receiver is compatible and configured correctly. See page 3 for configuration instructions If cable is connected and receiver is properly configured, try different piece of RG6 coaxial cable
Receiver indicator faintly lit or flickering on power inserter	<ul style="list-style-type: none"> Intermittent communication between receiver and power inserter 	<ul style="list-style-type: none"> Replace 3' coaxial cable piece with a different piece RG6 coaxial cable
Antenna indicator unlit on power inserter	<ul style="list-style-type: none"> No communication between power inserter and Carryout G2+ antenna 	<ul style="list-style-type: none"> Ensure included 25' coaxial cable is being used and is properly connected between power inserter's ANTENNA port and Carryout G2+ PRIMARY port Ensure power button on power inserter pushed in ON position Replace 25' coaxial cable with different RG6 coaxial cable
Antenna indicator faintly lit or flickering on power inserter	<ul style="list-style-type: none"> Intermittent communication between power inserter and Carryout G2+ 	<ul style="list-style-type: none"> Ensure included 25' cable is being used and is properly connected between power inserter ANTENNA port and Carryout G2+ PRIMARY port Replace 25' coaxial cable with a different RG6 coaxial cable
The antenna continuously searches and eventually stops without ever acquiring any satellites.	<ul style="list-style-type: none"> Possible obstructions are blocking signal from the satellite 	<ul style="list-style-type: none"> Check to see if the southern sky is clear. Trees, buildings, large signs, or an overpass can block the signal Rain, snow, or excessive dew on the dome can interrupt the signal. Brush any snow or dew off of the dome. If heavy rain or snowfall is blocking the signal, it may be necessary to wait until the weather clears.
The antenna appears to lock onto signal, but my receiver does not show a picture or signal reading	<ul style="list-style-type: none"> Receiver improperly configured for the Carryout G2+ antenna 	<ul style="list-style-type: none"> Verify the switch settings are set correctly for the desired provider. See switch settings on page 2 Reconfigure the receiver according to steps on page 3 or 4
I have switched satellite service providers, and the antenna is no longer working properly	<ul style="list-style-type: none"> Switches are not set for the correct provider 	<ul style="list-style-type: none"> Set the switches to the correct programming provider. See switch settings on page 2

If a problem persists, contact Winegard Technical Services at help@winegard.com or 1-800-788-4417.

FCC Guidelines

Changes or modifications not expressly approved by Winegard could void your authority to operate the equipment.

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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.



WINEGARD CARRYOUT G2+ SATELLITE ANTENNA

Using Outside Receptacle

If your outside TV receptacle is wired for satellite, you'll need to locate where that receptacle leads and connect that directly to your satellite receiver.

If the outside TV receptacle is wired for cable, the wiring will have to be modified for use with satellite. The coaxial cable cannot run through any other devices or switches before the satellite receiver.

Typically, if wired for cable, the wiring will either run through a Winegard power supply or video switch. The easiest way to fix this is to disconnect the cable from that device, use a barrel connector, and connect a new cable that runs directly to the receiver, bypassing the power supply or video switch.



Transporting & Maintenance

Before transporting the antenna, disconnect all coaxial cabling from antenna and power inserter. Unplug power adapter from outlet.

The Carryout G2+ antenna is designed to be maintenance free. However, it is a good idea to periodically clean the dome with a soft cloth, water, and dish soap.

For more information or to purchase accessories contact your local RV dealer or winegard.com



Carryout G2+ Antenna

Optional Accessories

MT-4000 Ladder Mount

Permanent or temporary mount for RV with quick disconnect. Creates all the benefits of an ultra low profile roof mounted antenna plus quick and easy portability.



RK-2000 Roof Mount Kit

Permanently mount the Carryout G2+ antenna to your vehicle roof. No need to buy another antenna to replace your portable.



TR-1518 Tripod Mount

The tripod mount has adjustable height and leveling settings of 14.5"– 22" and quickly disassembles for compact storage.



MT-SM30 Window Mount

Temporary mount with maximum flexibility. Easy one time assembly. Includes 2 brackets for temporary side mount opt.





WINEGARD MOBILE PRODUCTS LIMITED WARRANTY (2 YEARS PARTS; 1 YEAR LABOR)

Winegard Company warrants this product against defects in materials or workmanship for a period of two (2) years from the date of original purchase. During year one (1) of such warranty, Winegard Company will also pay authorized labor costs to an authorized Winegard dealer to repair or replace defective products. No warranty claim will be honored unless at the time the claim is made, Customer presents proof of purchase to an authorized Winegard dealer (to locate the nearest authorized Winegard dealer, contact Winegard Company, 3000 Kirkwood Street, Burlington, Iowa 52601, Telephone 800-288-8094 or visit www.winegard.com). Customer must provide proof of purchase with a dated sales receipt for the Winegard product to verify the product is under warranty. If the date of purchase cannot be verified, the warranty period shall be considered to begin thirty (30) days after the date of manufacture.

If a defect in material or workmanship is discovered, Customer may take the product to an authorized Winegard dealer for service. Customer must provide proof of purchase to verify the product is under warranty. If the product is brought to an authorized Winegard dealer for service prior to expiration of year one (1) of the warranty period and a defect in material or workmanship is verified by Winegard Technical Services, Winegard Company will cover the Winegard dealer's labor charges for warranty service. The Winegard dealer must contact Winegard Technical Services in advance for pre-approval of the service. Approval of the service is at the sole discretion of Winegard Company.

Alternatively, Customer may ship the product prepaid to Winegard Technical Services (located at 2736 Mt. Pleasant Street, Burlington, Iowa 52601, Telephone 800-788-4417). Customer must return the product along with a brief description of the problem and provide Winegard Technical Services with Customer's name, address, and phone number. Customer must also provide proof of purchase to verify the product is under warranty. If the product is returned before the expiration of the warranty period, Winegard Company will (at its option) either repair or replace the product.

This Limited Warranty does not apply if the product has been damaged, deteriorates, malfunctions or fails from: improper installation, misuse, abuse, neglect, accident, tampering, modification of the product as originally manufactured by Winegard in any manner whatsoever, removing or defacing any serial number, usage not in accordance with product instructions or acts of nature such as damage caused by wind, lightning, ice or corrosive environments such as salt spray and acid rain. This Limited Warranty also does not apply if the product becomes unable to perform its intended function in any way as a result of the television signal provider making any changes in technology or service.

RETURN AUTHORIZATION POLICY

A Return Material Authorization (RMA) is required prior to returning any product to Winegard Company or Winegard Warranty Services under this warranty policy. Please call our Technical Services Department at 800-788-4417 or send an email to warranty@winegard.com to obtain the RMA number. Please furnish the date of purchase when requesting an RMA number. Enclose the product in a prepaid package and write the RMA number in large, clear letters on the outside of the package. To avoid confusion or misunderstanding, a shipment(s) without an RMA number(s) or an unauthorized return(s) will be refused and returned to Customer freight collect.

WINEGARD COMPANY DOES NOT ASSUME ANY LIABILITIES FOR ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, MADE BY ANY OTHER PERSON.

ALL OTHER WARRANTIES WHETHER EXPRESS, IMPLIED OR STATUTORY INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY ARE LIMITED TO THE TWO YEAR PERIOD OF THIS WARRANTY.

In states that do not allow limitations on implied warranties, or the exclusion of limitation of incidental or consequential damages, the above limitations or exclusions do not apply.

Some states do not allow limitations on how long an implied warranty lasts, or the exclusion of limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

This warranty gives Customer specific legal rights. Customer may also have other rights that may vary from state to state.

SATELLITE RECEIVER WARRANTY

See manufacturer's limited warranty policy.

WS-MOBWARREV3

Winegard and Carryout are registered trademarks of Winegard Company.

DISH is a registered trademark of DISH Network L.L.C. DIRECTV is a registered trademark of DIRECTV, LLC. Bell TV is a registered trademark of Bell Canada, Inc.

Disclaimer: Although every effort has been made to ensure that the information in this manual is correct and complete, no company shall be held liable for any errors or omissions in this manual. Information provided in this manual was accurate at time of printing. If the antenna does not function as expected, please contact Winegard Company at help@winegard.com or 1-800-788-4417, or visit our website at www.winegard.com.

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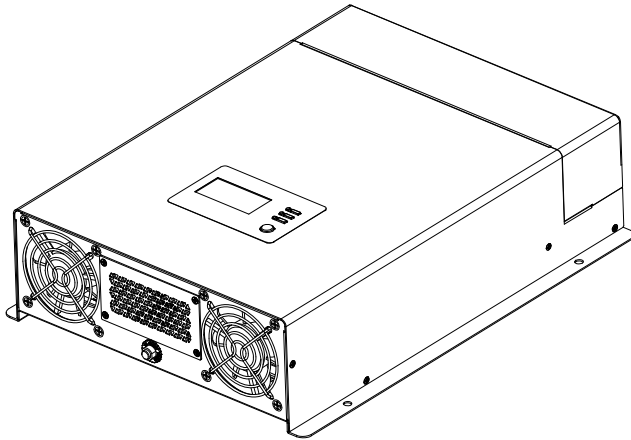
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Rev0 11/15 2452360



Smart choice for power™

xantrex™



Owner's Guide

Freedom XC Series Inverter Charger

Product Part Numbers
817-1050
817-2080



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 (C) REMINDS YOU THAT IF THIS MANUAL IS IN ANY LANGUAGE OTHER THAN ENGLISH, ALTHOUGH STEPS HAVE BEEN TAKEN TO MAINTAIN THE ACCURACY OF THE TRANSLATION, THE ACCURACY CANNOT BE GUARANTEED. APPROVED CONTENT IS CONTAINED WITH THE ENGLISH LANGUAGE VERSION WHICH IS POSTED AT [HTTP://WWW.XANTREX.COM](http://www.xantrex.com).

Document Part Number

975-0784-01-01

Date and Revision

June 2017 Rev A

Product Part Number

817-1050 (Freedom XC 1000 120VAC)
 817-2080 (Freedom XC 2000 120VAC)

Contact Information

Telephone: +1 800 670 0707
 +1 408 987 6030
 Email: customerservice@xantrex.com
 Web: <http://www.xantrex.com>

Information About Your System

As soon as you open your product, record the following information and be sure to keep your proof of purchase.

Serial Number _____
 Product Number _____
 Purchased From _____
 Purchase Date _____

To view, download, or print the latest revision, visit the website shown under Contact Information.

975-0784-01-01

About This Guide

Purpose

The purpose of this Owner's Guide is to provide explanations and procedures for operating, maintaining, and troubleshooting a Freedom XC Series Inverter Charger for Recreational, Fleet Vehicle, or Marine installations.

Scope

The Guide provides safety and operating guidelines as well as information on installing and configuring the Inverter. It also provides information about troubleshooting the unit. It does not provide details about particular brands of batteries. You need to consult individual battery manufacturers for this information.

Audience

The Guide is intended for users and operators as well as installers of the Freedom XC Series Inverter Charger.

Abbreviation or Acronym

A	Amps
AC	Alternating Current
DC	Direct Current
in-lbf	inch-pounds or pound-force (a unit of torque)
kW	Kilowatts (1000 watts)
LBCO	Low Battery Cutout (or Cutoff)
LED	Light Emitting Diode

N-m	Newton-meters (a unit of torque)
PV	Photovoltaic (Solar)
V	Volts
VAC	Volts AC
VDC	Volts DC
W	Watts

Related Information

You can find more information about Xantrex products and services at <http://www.xantrex.com>.

NOTE: The Installation section starting on page 9 is intended for qualified personnel. Qualified personnel have training, knowledge, and experience in:

- Installing electrical equipment (up to 1000 volts).
- Applying all applicable installation codes.
- Analyzing and reducing the hazards involved in performing electrical work.
- Selecting and using Personal Protective Equipment (PPE).



Important Safety Instructions

IMPORTANT: READ AND SAVE THIS OWNER'S GUIDE FOR FUTURE REFERENCE.

This guide contains important safety instructions for the Freedom XC Series Inverter Charger that must be followed during operation and troubleshooting. **Read and keep this Owner's Guide for future reference.**

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, can result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, can result in moderate or minor injury.

NOTICE

NOTICE indicates a potentially hazardous situation, which, if not avoided, can result in equipment damage.

Important: These notes describe things which are important for you to know, however, they are not as serious as a caution or warning.

975-0784-01-01

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Safety Information

1. **Before using the Inverter, read all instructions and cautionary markings on the unit, the batteries, and all appropriate sections of this manual.**
2. Use of accessories not recommended or sold by the manufacturer may result in a risk of fire, electric shock, or injury to persons.
3. The inverter is designed to be connected to your AC and DC electrical systems. The manufacturer recommends that all wiring be done by a certified technician or electrician to ensure adherence to the local and national electrical codes applicable in your jurisdiction.
4. To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the inverter with damaged or substandard wiring.
5. Do not operate the inverter if it has been damaged in any way.
6. This unit does not have any user-serviceable parts. Do not disassemble the inverter except where noted for connecting wiring and cabling. See your warranty for instructions on obtaining service. Attempting to service the unit yourself may result in a risk of electrical shock or fire. Internal capacitors remain charged after all power is disconnected.
7. To reduce the risk of electrical shock, disconnect both AC and DC power from the inverter before attempting any maintenance or cleaning or working on any components connected to the inverter. Turning off the Inverter using the Power button on the front panel will not reduce an electrical shock hazard.
8. The inverter must be provided with an equipment-grounding conductor connected to the AC input ground.
9. Do not expose this unit to rain, snow, or liquids of any type. This product is designed for indoor use only. Damp environments will significantly shorten the life of this product and corrosion caused by dampness will not be covered by the product warranty.
10. To reduce the chance of short-circuits, always use insulated tools when installing or working with this equipment.
11. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with electrical equipment.

DANGER

ELECTRICAL SHOCK AND FIRE HAZARD

Installation must be done by qualified personnel to ensure compliance with all applicable installation and electrical codes and regulations. Instructions for installing the Freedom XC Series Inverter Charger are provided here for use by qualified personnel only.

Failure to follow these instructions will result in death or serious injury.

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Freedom XC Owner's Guide



⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

⚠️ WARNING

FIRE AND EXPLOSION HAZARD

- Unit's components may produce arcs or sparks.
- Do not install near batteries, in machinery space, or in an area in which ignition-protected equipment is required.

Failure to follow these instructions can result in death or serious injury.

Areas include any space containing gasoline-powered machinery, fuel tanks, as well as joints, fittings, or other connections between components of the fuel system.

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⚠️ CAUTION

ELECTRICAL SHOCK AND FIRE HAZARD

- Do not open. No serviceable parts inside. Provided with integral protection against overloads. Bonding between conduit connections is not automatic and must be provided as part of the installation.
- Read manual before installing or using.
- Do not cover or obstruct ventilation openings.
- Do not mount in zero-clearance compartment – overheating may result.
- Do not expose to rain or spray. This inverter is designed for marine applications only when additional drip protection is installed in certain orientations. See “Approved Mounting Orientations” on the Installation Guide for more information.
- Install GFCIs only as specified in this manual. Other types may fail to operate.
- Do not connect AC OUT to any other source of power. Damage to unit may occur.
- For AC IN and AC OUT, use wires suitable for at least 75°C.

Failure to follow these instructions can result in minor or moderate injury.

NOTES:

1. Follow these instructions and those published by the battery manufacturer and the manufacturer of any equipment you intend to use in the vicinity of the battery. Review cautionary markings on these products and on the engine.

2. Freedom XC inverter products are designed for deep cycle lead-acid batteries. See warning below when connecting to lithium ion batteries.
3. Do not use transformerless battery chargers in conjunction with the inverter due to overheating.

⚠️ WARNING

LITHIUM_ION BATTERY TYPE HAZARD

Make sure to use a lithium ion battery pack that includes a Battery Management System (BMS) with built-in safety protocols. Follow the instructions published by the battery manufacturer.

Failure to follow these instructions can result in property damage, death or serious injury.

⚠️ CAUTION

PHYSICAL INJURY HAZARD

This Freedom XC Series Inverter Charger is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

Failure to follow these instructions can result in minor or moderate injury.



Precautions When Working With Batteries

Important: Battery work and maintenance must be done by qualified personnel knowledgeable about batteries to ensure compliance with battery handling and maintenance safety precautions.

⚠ WARNING
BURN FROM HIGH SHORT-CIRCUIT CURRENT, FIRE AND EXPLOSION FROM VENTED GASES HAZARDS
<ul style="list-style-type: none"> • Always wear proper, non-absorbent gloves, complete eye protection, and clothing protection. Avoid touching your eyes and wiping your forehead while working near batteries. See note #4. • Remove all personal metal items, like rings, bracelets, and watches when working with batteries. See notes #5 and #6 below. • Never smoke or allow a spark or flame near the engine or batteries.
Failure to follow these instructions can result in death or serious injury.

NOTES:

1. Mount and place the Freedom XC Series Inverter Charger unit away from batteries in a well ventilated compartment.
2. Always have someone within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
3. Always have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flood it with running cold water for at least twenty minutes and have someone within range of your voice or close enough to get medical attention immediately.

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Precautions When Placing the Inverter

⚠ WARNING
FIRE HAZARD
Do not install the inverter or any part of its supplied wiring in engine compartments.
Failure to follow these instructions can result in death or serious injury.

⚠ CAUTION
BURN HAZARD
Avoid touching the external surfaces - heatsink may be hot.
Failure to follow these instructions can result in minor or moderate injury.

NOTICE
RISK OF DAMAGE TO THE INVERTER
<ul style="list-style-type: none"> • Never allow battery acid to drip on the inverter when reading gravity, or filling battery. • Never place the Freedom XC Series Inverter Charger unit directly above batteries; gases from a battery will corrode and damage the inverter. • Do not place a battery on top of the inverter.
Failure to follow these instructions can damage the unit and/or equipment.

5. Use extra caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion. Use tools with insulated handles only.
6. Batteries can produce a short circuit current high enough to weld a ring or metal bracelet or the like to the battery terminal, causing a severe burn.
7. When removing a battery, always remove the negative terminal from the battery first for systems with grounded negative. If it is grounded positive, remove the positive terminal first. Make sure all loads connected to the battery and all accessories are off so you don't cause an arc.

Regulatory

The Freedom XC Series Inverter Charger is certified to appropriate US and Canadian standards. For more information see "Regulatory Approvals" on page 73.

The Freedom XC Series Inverter Charger is intended to be used for mobile or commercial applications. This Inverter is designed for marine applications only when additional drip protection is installed in certain orientations. See the section on Specifications for information.



FCC Information to the User

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 in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

⚠ CAUTION
Unauthorized changes or modifications to the equipment could void the user's authority to operate the equipment.



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Introduction

The Freedom XC Series Inverter Charger (Freedom XC) is designed with integrated inverting functions and power management features suitable for marine, recreational, and commercial vehicle installations.

Please read this chapter to familiarize yourself with the main performance and protection features of the Freedom XC.

Materials List

The Freedom XC base package includes the following items:

- one Freedom XC unit
- one Owner’s Guide and extra safety labels
- one pre-installed ground lug(not shown)
- one set of plastic bushings for large DC cables^a (not shown)

NOTE: If any of the items are missing, contact Xantrex or any authorized Xantrex dealer for replacement. See “Contact Information” on page i.

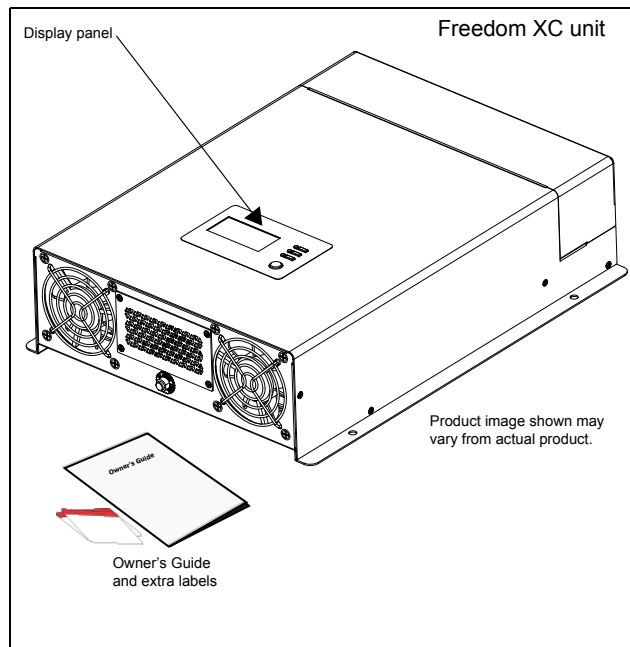


Figure 1 What's In The Box

^a.Available only to XC 2000 model.

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Introduction

Key Features

Power for Most Appliances The Freedom XC inverter/charger provides up to 1000 watts (Freedom XC 1000) or 2000 watts (Freedom XC 2000) of continuous utility grade, sine wave power derived from a battery bank. It is designed to handle loads such as microwave ovens, TVs, DVD/Blu-ray players, and power tools. In addition, the Freedom XC’s high-surge capability lets you handle many hard-to-start loads, including full size residential refrigerators.

The built-in transfer switch automatically transfers between inverter power and shore power from recreational facilities such as boat docks or campsites to ensure power is always available.

Back-up Capability If incoming shore power is interrupted by external events like brownouts, the Freedom XC automatically becomes an independent power source^a that supplies utility grade AC power to your loads.

Comprehensive Protection The Freedom XC’s built-in protection features safeguard your batteries (from unnecessary drain) such as the low battery voltage alarm and shutdown and protect equipment such as a configurable AC transfer speed.

- **Selectable Low Battery Shutdown:** The low battery shutdown for the inverter/charger can be manually selected by the user from 10.5 to 12.8 VDC.

- **Low Voltage Shutdown Delay Timer:** Configurable from 1 to 300 seconds to reduce an unnecessary shutdown of inverter operation such as during cranking or other brief but heavy discharge of battery.
- **Inverter Power Save:** The Freedom XC can be programmed to automatically turn off after 1 to 25 hours of continued operation of loads that are under 50 watts. It is designed, with LBCO (low battery cut off), to prevent the battery from deep discharge.

Configurable AC Transfer Speed The Freedom XC allows two speed settings for the AC transfer from Grid Mode to Battery Mode and vice versa which avoids nuisance resetting of appliances. The normal transfer rate is for common appliances and the faster transfer rate is designed for more sensitive digital equipment like a desktop computer.

Overload Alarm and Shutdown During Battery Mode (also called Inverter Mode), the Freedom XC automatically alerts you if the loads that are connected and drawing power from the unit are close to approaching the maximum operating limit. If so, the Freedom XC automatically shuts down when the maximum operating limit is exceeded. See page 66 for precautions.

^a.Assuming the inverter/charger is connected to a battery source with an adequate charge at the time of the power interruption.

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Over temperature Alarm and Shutdown During Battery Mode, the Freedom XC automatically alerts you if it is overheating and approaching the over-temperature shutdown limit. The Freedom XC automatically shuts down when the limit is exceeded. See page 66 for precautions.

Built-in Charge Formulas For the inverter to perform at the highest level, the batteries must be charged correctly. The Freedom XC has optimized algorithms for flooded, gel, and AGM batteries.

Manual Equalization Over a period of time, the cells in a flooded battery can develop uneven chemical states. This can result in a weak (undercharged) cell which, in turn, can reduce the overall capacity of the battery. To improve the life and performance of a non-sealed, flooded battery, the Freedom XC multi-stage charging cycle includes a manual equalize mode that can be used, if recommended by the battery manufacturer.

Dead Battery Charging Another feature of the Freedom XC is dead battery charging. This is the ability to recharge batteries, even if the battery voltage has reached zero volts.

Ignition Control The Freedom XC provides two user-selectable options for ignition control:

- **Ignition Auto-on:** The Freedom XC can automatically turn the inverter on and off in tandem with the vehicle's ignition circuit or a manually operated remote switch.

- **Ignition Lockout:** The Freedom XC features the ability to inhibit the inverter from operating in the absence of a voltage signal from a vehicle's ignition circuit. This is particularly useful if the inverter is required to operate only when a vehicle's engine is running.

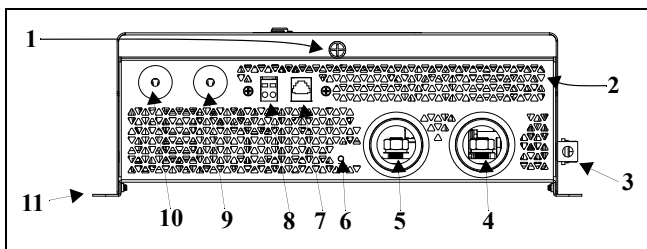
Configurable AC Output Frequency and Voltage The Freedom XC is factory set to 60 Hz AC output frequency. It can be configured to 50 Hz for use in regions outside the USA and Canada. The AC voltage setting can also be configured to either of three settings: 108, 110, or 120 volts.

Load Management The Freedom XC has a built-in 30A transfer relay that connects the inverter output or AC input from the AC generator to the loads. Because the usual AC power sources such as small generators often have limited current availability, having the capability to manage your AC loads is extremely valuable. The Freedom XC provides a number of features to facilitate this.

- The charger is power factor corrected to use AC current as efficiently as possible. Minimizing the AC current used by the charger means more current is available for your AC loads.
- The Freedom XC has a power share feature which prioritizes your AC loads by reducing the charge current and maintaining the total input current to less than the breaker setting.

Features

AC and DC Panel

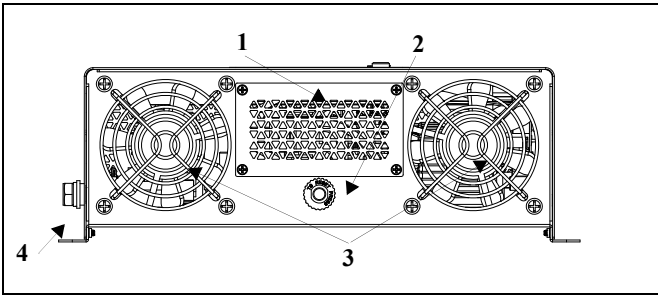


Feature	Description
1	Captive nut panel screw holds the AC compartment cover in place.
2	Ventilation grille (openings) must not be obstructed.
3	Grounding stud with attached nut provides a ground path for the Freedom XC chassis to the DC system ground.
4	DC output opening for routing (-) negative DC cable.
5	DC output opening for routing (+) positive DC cable.
6	LED indicator for reverse DC polarity.

Feature	Description
7	Remote port allows you to connect an accessory remote control device.
8	ACC input terminal for connecting ignition control wiring. Ignition Control Switch (ACC) for connecting [ON (I)] and disconnecting [OFF (O)] the ignition signal.
9	AC output knockout can be removed for routing AC output wiring.
10	AC input knockout can be removed for routing AC input wiring.
11	Mounting flanges on both sides allow you to mount the inverter/charger permanently on deck or on a wall.



GFCI Panel



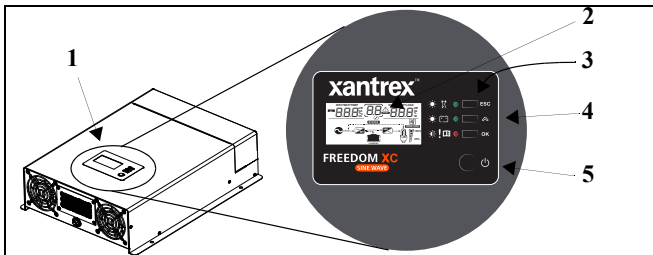
Feature	Description
1	GFCI cover is removed when installing a GFCI outlet. Location of GFCI receptacles.
2	20 A supplementary protector with reset button provides overload protection for the Freedom XC GFCI kit (PN: 808-9817). Press to recover from an overload condition. In a hard wired installation, the supplementary protector does not protect output wiring.
3	Ventilation grille (openings) must not be obstructed for the proper operation of the cooling fan and inverter/charger. When the inverter/charger is mounted, the ventilation grille must not point up or down. Cooling fans turn on when the internal temperature reaches a set point temperature.
4	Grounding lug provides a ground path for the Freedom XC chassis to the DC system ground.

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Features

Display Panel

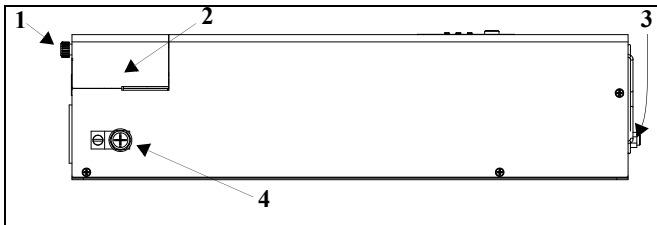


Feature	Description
1	Display panel displays status information on the screen. It is comprised of a display screen, LEDs, select and power buttons.
2	Multi-function LCD screen shows status information and error codes.
3	Status LEDs indicate the mode of operation.
4	Three function buttons change status information displayed on the screen. Also, changes inverter/charger settings.
5	Power button is pressed for turning on the unit. The inverter turns on for the loads and when applicable, the charger turns on automatically.
IMPORTANT: See “Freedom XC Display Panel” on page 39 for detailed information on the panel’s buttons.	

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Side Panel



Feature	Description
1	Captive nut panel screw holds the wiring compartment cover in place.
2	Wiring compartment cover protects the wiring compartment from debris and keeps the cables secure. Using the captive nut panel screw, the cover can be opened and lifted out during wiring.
3	20 A supplementary protector provides overload protection for the GFCI receptacles. In a hard wired installation, the supplementary protector does not protect output wiring.
4	Grounding lug provides a ground path for the Freedom XC chassis to the DC system ground.



Safety Instructions

Before You Begin the Installation

Before beginning your installation:

- Read this entire Installation section so you can plan the installation from beginning to end.
- Assemble all the tools and materials you require for the installation.
- Review the Important Safety Instructions on page iii.
- Be aware of all safety and electrical codes which must be met.

⚠ WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

- All wiring should be done by qualified personnel to ensure compliance with all applicable installation codes and regulations.
- Disconnect all AC and DC power sources.
- Disable and secure all AC and DC disconnect devices and automatic generator starting devices.

Failure to follow these instructions can result in death or serious injury.

Installation Codes

Governing installation codes vary depending on the specific location and application of the installation. Some examples include the following:

- The U.S. National Electrical Code (NEC)
- The Canadian Electrical Code (CEC)
- The U.S. Code of Federal Regulations (CFRs)
- Canadian Standards Association (CSA) and the RV Industry Association (RVIA) for installations in RVs
- The American Boat and Yacht Council (ABYC) for Marine installations in the U.S.

It is the installer's responsibility to ensure that all applicable installation requirements are met.

This section for use by qualified personnel only.

Installation Tools and Materials

You will need the following to install the Freedom XC:

- Wire stripper
- Mounting (#2) screws or bolts
- #2 Phillips screwdriver
- 3mm slot long neck screwdriver for spring clamp AC terminals
- Wrench for DC terminals (1/2" or 13mm socket wrench)
- AC cable (that is, two-conductor-plus-ground cable), sized appropriately for load and application
- 1/2" Strain relief clamps (for the AC knockouts)
- Wire nuts or crimp connectors for AC wire and appropriate tools
- DC cable, sized appropriately for load and application
- Lugs for DC cables to fit 5/16" DC stud terminals as well as appropriate tools (like a crimping tool)
- AC and DC disconnects and over-current protective devices

Basic Installation Procedures

This section provides sample installation information as a guide for your installation. For your convenience, the overall procedure is divided into these main steps:

- ❑ Step 1: Designing the Installation on page 12
- ❑ Step 2: Choosing a Location for the Unit on page 17
- ❑ Step 3: Mounting the Unit on page 18
- ❑ Step 4: Connecting the AC Input Wires on page 20
- ❑ Step 5: Connecting AC Output to an Existing AC Circuit on page 24
- ❑ Step 6: Connecting the DC Cables on page 26
- ❑ Step 7: Connecting to a Remote Panel on page 32
- ❑ Step 8: Testing Your Installation on page 33

This section for use by qualified personnel only.

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Basic Installation Procedures

Step 1: Designing the Installation

Most Freedom XC installations share common components, and some of these are briefly described in Figure 1.

Figure 1 shows some components and their relationship to each other in a typical recreational vehicle or fleet vehicle installation. Also, see “Marine Installation” on page 35.

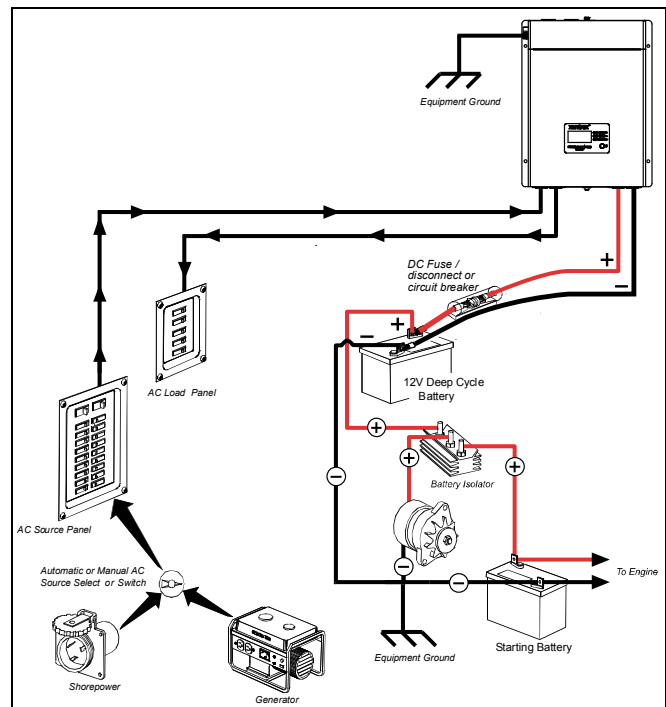


Figure 1 Typical Recreational Vehicle and Fleet Vehicle Installation

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Freedom XC Owner's Guide



AC Shore Power

A source of 120 volts AC 60Hz sine wave alternating current provides energy to pass power through to AC loads. This source is usually the utility grid (power company) or an AC generator. An automatic or manual AC source selector switch can be used to switch between the multiple sources of shore power to the Freedom XC system.

The AC source feeding the Freedom XC must have the neutral conductor bonded to ground. When the inverter passes shore power through, it will lift its internal bonding relay on the output and will rely on the input being bonded in order to ensure that the power delivered to a sub panel is properly bonded. See “AC Output Neutral Bonding” on page 15 for more information on bonding relay operation.

Important: Throughout this manual, the term “shore power” refers to AC input power from a utility grid, generator, or other AC source.

AC Disconnect and Over-Current Protection Device

Most safety requirements and electrical codes require the Freedom XC’s AC and DC inputs and outputs to be provided with over-current protection (such as circuit breakers or fuses) and disconnect devices.

AC Input: The circuit breaker or fuse (connected through hard wiring) that is used to supply the Freedom XC must be rated at no more than 30A and must be approved for use on 120 volts AC branch circuits. The wire used between the breaker and the Freedom

XC input must be sized adequately to carry current up to the rating of the input breaker and in accordance with the electrical codes or regulations applicable to your installation.

AC Output: The circuit breaker or fuse must be rated at no more than the rating of the input breaker in the installation and must be approved for use on 120 volts AC branch circuits. The wire used between the Freedom XC and the AC output breaker must be of adequate size to match the AC input circuit breaker’s rating. The wiring from each AC output breaker to each of the loads must be adequately sized to carry the current rating of the individual AC output breaker.

Disconnect Devices: Each system requires a method of disconnecting the AC circuits. If the over-current protection devices are circuit breakers, they will also serve as the disconnects. If fuses are used, separate AC disconnect switches will be needed ahead of the fuses. These will have to be a branch circuit rated for 120 volts AC and have an appropriate current rating.

This section for use by qualified personnel only.

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Basic Installation Procedures

AC Distribution Panels

Most systems incorporate distribution centers both ahead of the Freedom XC (the AC source panel) and between the Freedom XC and the loads (the AC load panel). An AC source panel includes a main circuit breaker, which serves as over-current protection and as a disconnect for the AC shore power supply line. Additional circuit breakers serve individual circuits, one of which serves the Freedom XC. The AC load panel can incorporate an AC output circuit breaker and breakers for individual load circuits.

NOTICE

RISK OF DAMAGE TO THE INVERTER

Do not connect the Freedom XC to a 120/240V, 3-pole, 4-wire circuit.
Failure to follow these instructions can damage the unit and/or equipment.

AC Cabling

AC cabling includes all the wires and connectors between the AC source and the Freedom XC, as well as all cabling between the Freedom XC and the AC output panels, circuit breakers, and loads. The type and size of the wiring varies with the installation and load. For example, in high vibration environments, such as marine or RV applications, wire nuts may not be acceptable, so crimp splices would be required. In other applications, flexible multiple-strand wire may be required. Installation codes usually specify solid or stranded, overall size of the conductors, and type and temperature rating of the insulation around the wire.

AC breakers and fuses must be sized to adequately protect the wiring that is installed on the input and output AC circuits of the Freedom XC. All breakers and wiring must be sized and connected in accordance with the electrical codes or regulations applicable to your installation. Table 1 gives some examples of wiring sizes based on the U.S. National Electrical Code and the Canadian Electrical Code. These examples are based on using a two-conductor-plus-ground cable rated at 75 °C, and assuming an ambient temperature of up to 30 °C. Ensure that your breakers and fuses have suitable temperature ratings for your wiring. Other codes and regulations may also be applicable to your installation.

Table 1 Required AC Wire Size vs Breaker Rating

Breaker Size (amps)	10A	15A	20A	30A
Minimum Wire Size	14AWG	14AWG	12AWG	10AWG



AC Output Neutral Bonding

The neutral conductor of the Freedom XC's AC output circuit (that is, AC Output Neutral) is automatically connected to the safety ground during inverter operation. When AC utility power is present this connection is not present, so that the utility neutral (that is, AC Input Neutral) is only connected to utility ground at your source. This conforms to the National Electrical Code (NEC), which requires that separately derived AC sources (such as inverters and generators) have their neutral conductors tied to ground in the same way that the neutral conductor from the utility is tied to ground in only one place. Check the regulations for your specific application to ensure that the installation will comply with the necessary requirements. In other words, the AC Input Neutral and Output Neutral must be isolated from each other.

AC Grounding

As per UL458 SA29.5, for all permanently connected marine inverters: The Freedom XC should be connected to a grounded, metal, permanent wiring system. Also, make sure that an AC ground wire is connected to the AC ground terminal on the unit. Do not just connect the line and neutral wires.

All connections to the unit should comply with all local codes and ordinances.

DC Cabling

This includes all the cables and connectors between the batteries, the DC disconnect and over-current protection device, and the Freedom XC. Most mobile installations require multi-strand insulated cables for flexibility and durability in high vibration environments and require disconnects and over-current devices. Electrical wiring sizes in North America are indicated by AWG notation. In other parts of the world, the metric system is used. Under the AWG standard, a larger gauge number indicates a smaller wire diameter. Wire size is usually marked on the larger sized cables. Table 2 specifies the minimum recommended DC cable size and maximum fuse size for the Freedom XC. **The DC cables must be copper and must be rated 75 °C minimum.** The cables should be terminated with lugs that fit the DC stud terminals snugly (⁵/₁₆" hole size).

Table 2 Recommended Cable and Fuse Sizes

Inverter	Cable Length: Battery to Inverter (one way)	Minimum Cable Size	Maximum battery Fuse Size
Freedom XC 1000 120VAC	Less than 5 feet (1.5 meters)	No. 2 AWG	150 A DC
Freedom XC 2000 120VAC	Less than 5 feet (1.5 meters)	No. 2/0 AWG	250 A DC

NOTE: It is not recommended using a cable longer than 5 feet (1.5 meters) in each direction. North American cable sizes above are based on the US National Electrical Code Table 310.17 - 75 °C cables, assuming an ambient temperature of 30 °C cables.

This section for use by qualified personnel only.

Basic Installation Procedures

Important: Using the correct cable size is critical to achieving the rated performance of the Freedom XC unit. When starting a heavy load the Freedom XC can draw current surges from the battery of up to 400A. If the DC wiring is too small the voltage drop from this surge will result in a voltage at the Freedom XC terminals that is too low for the Freedom XC to operate correctly. The Freedom XC may appear to operate correctly with smaller cables until a heavy load such as a microwave or refrigerator attempts to start - then the unit may work correctly sometimes and not work correctly other times.

DC Disconnects and Over-Current Devices

The DC circuit from the battery to the Freedom XC must be equipped with a disconnect and over-current device. This usually consists of a circuit breaker, a "fused-disconnect", or a separate fuse and DC disconnect. Do not confuse AC circuit breakers with DC circuit breakers. They are not interchangeable. The rating of the fuse or breaker must be matched to the size of cables used in accordance with the applicable installation codes. The breaker or disconnect and fuse should be located as close as possible to the battery, in the positive cable. Applicable codes may limit how far the protection can be from the battery.

Batteries

The Freedom XC uses 12-volt battery banks. Every Freedom XC system is recommended to have a deep-cycle battery or group of batteries with a total capacity of 100 Ah or more which provides the DC current that the Freedom XC converts to AC.

Ground Fault Circuit Interrupters (GFCIs)

A GFCI is a device that de-energizes a circuit when a current to ground exceeds a specified value that is less than that required to blow the circuit breaker. GFCIs are intended to protect people from electric shocks and are usually required in wet or damp locations.

Installations in marine and recreational vehicles require GFCI protection of branch circuits connected to the AC output of the Freedom XC.

The following GFCI will work correctly with the Freedom XC whether installed on the AC panel or in the inverter's AC output distribution wiring system.

Make	Model
Eaton/Cooper	SGF20W



Step 2: Choosing a Location for the Unit

⚠ WARNING

FIRE AND EXPLOSION HAZARDS

- Do not install the Freedom XC in compartments containing batteries or flammable materials, or in locations that require ignition-protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connections between components of the fuel system. This equipment contains components that tend to produce arcs or sparks.
- Do not cover or obstruct the ventilation openings. Do not install the Freedom XC in a zero-clearance compartment. Overheating may result.

Failure to follow these instructions can result in death or serious injury.

The Freedom XC should only be installed in locations that meet the following requirements:

- ❑ **Dry.** Do not allow water or other fluids to drip or splash on the Freedom XC. **Do not mount the Freedom XC in an area subject to splashing water or bilge water.**
- ❑ **Cool.** Normal air temperature should be between -4 °F and 104 °F (-20 °C and 40 °C)—the cooler the better.
- ❑ **Ventilated.** Allow at least 5 inches of clearance at the DC end of the Freedom XC for air flow, 1 inch on each side, and 2

inches at the AC end. The more clearance for ventilation around the unit, the better the performance. Do not allow the ventilation openings on the ends of the unit to become obstructed.

- ❑ **Safe.** Do not install the Freedom XC in the same compartment as batteries or in any compartment capable of storing flammable liquids like gasoline.
- ❑ **Close to the battery compartment and the AC source and load panels.** Avoid excessive cable lengths (which reduce input and output power due to wire resistance). Use the recommended cable lengths and sizes, especially between the battery banks and the Freedom XC.
- ❑ **Protected from battery acid and gases.** Never allow battery acid to drip on the Freedom XC or its wiring when reading specific gravity or filling the battery. Also do not mount the unit where it will be exposed to gases produced by the batteries. These gases are very corrosive, and prolonged exposure will damage the Freedom XC.

This section for use by qualified personnel only.

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Basic Installation Procedures

Step 3: Mounting the Unit

To mount the Freedom XC:

1. Remove the Freedom XC from its shipping container, verify that all components are present, and record relevant product information on “Information About Your System” in the Owner’s Guide.
2. Select an appropriate mounting location and orientation. (See Figure 2 below.) To meet regulatory requirements, for use in on-land applications, the Freedom XC must be mounted in one of the following orientations:
 - Under a horizontal surface (see A)
 - In a horizontal position on a vertical surface (see B)

NOTE: For marine installations, only this orientation is allowed, due to the probability of moisture finding access into the enclosure.

- On a horizontal surface (see C)

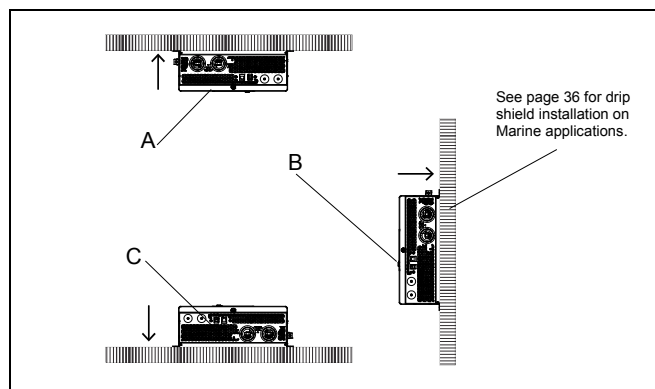


Figure 2 Approved Mounting Orientations

3. Mark the desired number of mounting holes on the wall by placing the unit on the wall.
4. Pilot-drill the mounting holes.
5. Fasten the Freedom XC to the mounting surface. If you are mounting the unit on a wall or bulkhead, use #12 or #14 pan-head wood or sheet metal screws to secure it to the framing behind the wall or bulkhead. Alternatively, use nut inserts and ¼"-20 machine screws.

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Freedom XC Owner's Guide



Connecting the Equipment Ground

⚠ WARNING

FIRE HAZARD

Never operate the Freedom XC without properly connecting the equipment ground. A fire hazard could result from improper grounding. **Failure to follow these instructions can result in death or serious injury.**

The Freedom XC has a ground lug on the side of the unit as shown in Figure 3. Follow the guidelines in “Grounding Locations” to connect the inverter’s chassis to the ground.

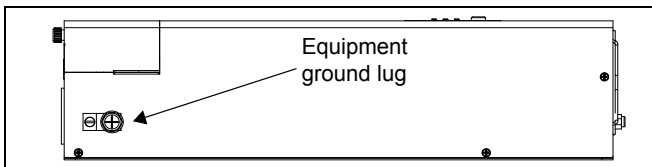


Figure 3 DC Panel Connections

Grounding Locations

You must connect the equipment ground lug to a grounding point—usually the vehicle’s chassis or DC negative bus ground—using recommended copper wire (if insulated then green insulation with or without one or more yellow stripes) or larger.

For recommended equipment ground cable size, see below.

Table 3 Recommended Equipment Ground Cable size

Application	Minimum equipment ground cable size (Stranded cable is recommended)
Recreational Vehicle ^a	No. 8 AWG
Marine ^b	No. 3 AWG (Freedom XC 1000) No. 1/0 AWG (Freedom XC 2000)

NOTE: There are no restrictions on length for the equipment ground cable.

- a. Based on US National Electrical Code NFPA70, Article 551, par. 551-20c.
- b. Based on ABYC E-11 11.18.

In general, the equipment ground cable size must not be smaller than one AWG size than the supply cable.

This section for use by qualified personnel only.

Step 4: Connecting the AC Input Wires

⚠ WARNING

FIRE, SHOCK, AND ENERGY HAZARDS

Make sure wiring is disconnected from all electrical sources before handling. All wiring must be done in accordance with local and national electrical wiring codes. Do not connect the output terminals of the Freedom XC to any incoming AC source.

Failure to follow these instructions can result in death or serious injury.

General AC Wiring Considerations

AC Wiring Connectors Where applicable, connect AC wires with crimp-on splice connectors. The amount of insulation you strip off individual wires will be specified by the connector manufacturer and is different for different types of connectors.

AC and DC Wiring Separation Do not mix AC and DC wiring in the same conduit or panel. Where DC and AC wires must cross, make sure they do so at 90° to one another. Consult applicable codes for details about DC and AC wiring in close proximity to each other.

AC wiring includes all the wires and connectors between the AC source and the Freedom XC and all wiring between the inverter, the AC panels, and circuit breakers. The type and size of the wiring varies with the installation and load. For some RV applications, flexible multiple-strand wire is required.

AC wiring must be sized appropriately to carry full load current on the input and output AC circuits in accordance with the electrical codes or regulations applicable to your installation. Table 4 is based on the U.S. National Electrical Code and the Canadian Electrical Code, assuming two-conductor-plus-ground cable, using 75 °C wiring, at an ambient temperature of 30 °C. Other codes and regulations may be applicable to your installation.



This section for use by qualified personnel only.

Table 4 Required AC wire size vs. required breaker rating

	Required Breaker Size (amps)	Required Wire Size
Freedom XC (both models)	30 A maximum 20 A maximum through a GFCI	10 AWG

The AC input terminal is located inside the unit through the front panel's knockout hole and is labeled properly as **AC IN** or **AC INPUT**. The unit comes with spring clamp-type terminals where individual wires can be attached securely.

NOTICE
<p>EQUIPMENT DAMAGE</p> <p>Make sure the wires are connected properly. The AC wiring terminal blocks are split into input and output sections.</p> <p>Failure to follow these instructions can damage the unit and/or equipment.</p>

When making the AC input and AC output connections, observe the correct color code for the appropriate AC wire, as described below in Table 5.

Table 5 Color codes for typical AC wiring

Color	AC Wire
Black/Red	Line
White/blue	Neutral

Table 5 Color codes for typical AC wiring

Color	AC Wire
Green/yellow or bare copper	Ground (Earth)

NOTICE
<p>REVERSE POLARITY DAMAGE</p> <p>Make sure the wires are connected properly. Improper connections (connecting a line conductor to a neutral conductor, for example) will cause the Freedom XC to malfunction and may permanently damage the inverter. Damage caused by a reverse polarity connection is not covered by your warranty.</p> <p>Failure to follow these instructions can damage the unit and/or equipment.</p>

Wiring Knockouts When installing wires to AC terminals, always remove the appropriate wiring knockouts (there are two on the AC panel) and install the proper strain-relief clamps or bushings.

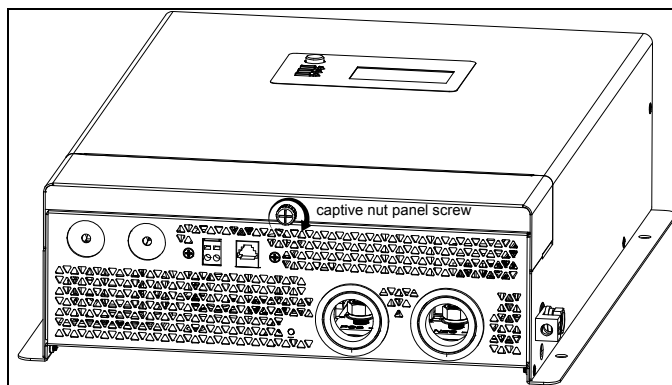
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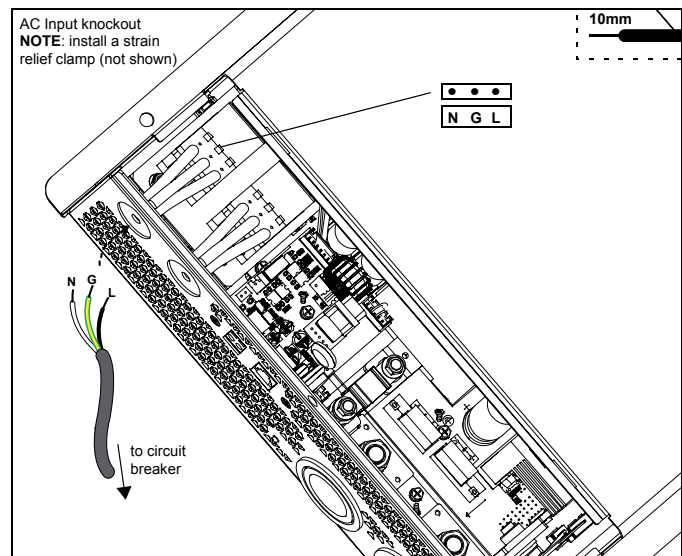
Basic Installation Procedures

AC Input Connections

1. Ensure AC and DC power sources are turned off.
2. Install the required circuit breaker in the AC distribution panel supplying AC power to the unit.
3. Remove the AC compartment cover by loosening the captive nut panel screw and lifting the cover up and out.



4. Strip a single AC input wire, as appropriate.
5. Remove the knockout and install a 1/2" strain relief clamp.
6. Route the wires through the strain relief clamp (not shown in the figure).



7. Locate the Neutral, Ground and Line terminals on the AC input terminal labeled as **N**, **G**, and **L** respectively.

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This section for use by qualified personnel only.

8. Using a 3mm slot long neck screwdriver, open the spring clamp by inserting the tool in the clamp slot and gently pulling the screwdriver handle forward, for Line terminal.
9. Insert Line AC wire into Line (L) terminal slot on the unit.
10. Release the spring clamp to secure the wire.
11. Repeat previous steps 8 through 10 for Ground (G) and Neutral (N) connections.
12. Tighten the strain relief clamp to secure the wires.
13. Replace the AC compartment cover onto the unit, if you are not connecting other wires such as for the AC Output. Otherwise, keep the AC compartment open and proceed to the next step.
14. Connect the other end of the wires to the circuit breaker in the AC distribution panel supplying AC power to the unit.

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Basic Installation Procedures

Step 5: Connecting AC Output to an Existing AC Circuit

⚠ WARNING

FIRE, SHOCK, AND ENERGY HAZARDS

Make sure wiring is disconnected from all electrical sources before handling. All wiring must be done in accordance with local and national electrical wiring codes.

Failure to follow these instructions can result in death or serious injury.

A manufacturer-tested and approved GFCI must be connected to the Freedom XC AC output, and GFCI protection must be provided on every receptacle connected to the AC hard wired installation. Other types may fail to operate properly when connected to the Freedom XC. See “Ground Fault Circuit Interrupters (GFCIs)” on page 16.

NOTICE

EQUIPMENT DAMAGE

Do not connect any AC source (such as a generator or utility power) to the AC output wiring of the Freedom XC.

The Freedom XC will not operate if its output is connected to AC voltage from another source, and potentially hazardous or damaging conditions may occur. These conditions can occur even if the inverter is off.

Failure to follow these instructions can damage the unit and/or equipment.

Do not connect the Freedom XC to an AC branch circuit that has high-power consumption loads.

The Freedom XC will not operate electric heaters, air conditioners, stoves, and other electrical appliances that consume more than its rated watts.

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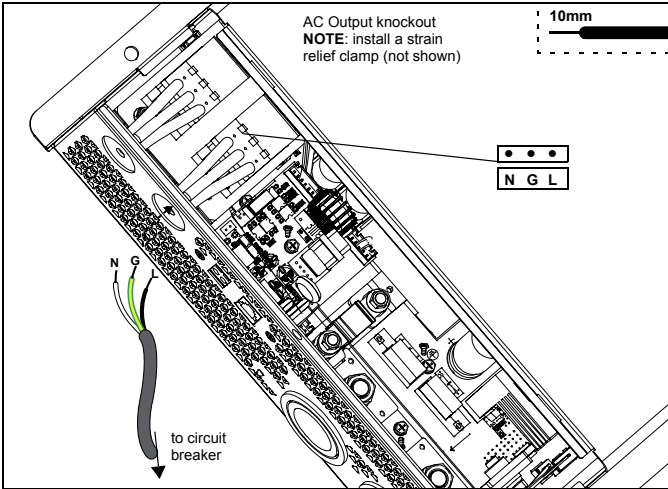
Freedom XC Owner's Guide



This section for use by qualified personnel only.

AC Output Connections

To make a permanent connection to existing AC wiring:



1. Ensure AC and DC power sources are turned off, if not already done from “Step 4: Connecting the AC Input Wires” on page 20.
2. Install the required circuit breaker in the inverter distribution panel receiving AC power from the inverter.
3. Remove the AC compartment cover, if not already done from “Step 4: Connecting the AC Input Wires” on page 20.
4. Strip a single AC output wire, as appropriate.
5. Remove the knockout and install a ½" strain relief clamp.
6. Route the wires through the strain relief clamp (not shown in the figure).
7. Locate the Neutral, Ground and Line terminals on the AC OUT terminal labeled as **N**, **G**, and **L** respectively.
8. Using a 3mm slot long neck screwdriver, open the spring clamp by inserting the tool in the clamp slot and gently pulling the screwdriver handle upward.
9. Insert Line AC wire into Line (**L**) terminal slot on the unit.
10. Release the spring clamp to secure the wire.
11. Repeat Step 8 through Step 10 for Ground (**G**) and Neutral (**N**) connections.
12. Tighten the strain relief clamp to secure the wires.
13. Replace the AC compartment cover, if you are finished with connecting all the AC wires in the unit.
14. Connect the other end of the wires to a circuit breaker in the inverter distribution panel.

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Basic Installation Procedures

Step 6: Connecting the DC Cables

NOTICE

REVERSE POLARITY DAMAGE

Check cable polarity at both the battery and the Freedom XC before making the final DC connection. Positive must be connected to positive; negative must be connected to negative.

Reversing the positive and negative battery cables will damage the Freedom XC and void your warranty.

Failure to follow these instructions can damage the unit and/or equipment.

WARNING

FIRE HAZARD

Use only copper wire rated 75 °C minimum. Make sure all DC connections are tight to a torque of 71–80 in-lbf (8–9Nm). Loose connections will overheat.

Failure to follow these instructions can result in death or serious injury.

If at all possible, minimize routing your DC cables through an electrical distribution panel, battery isolator, or other device that will cause additional voltage drops which can degrade the inverter’s ability to operate the loads.

Figure 4 shows the DC end for your reference.

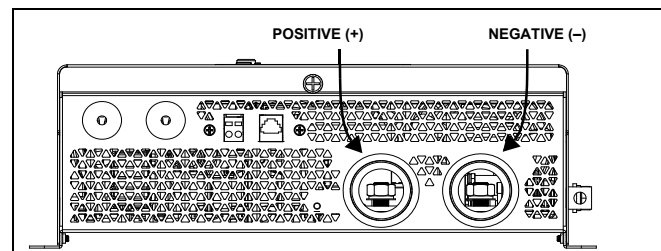


Figure 4 DC End

Follow the procedure given below to connect the battery leads to the terminals on the DC end. The cables should be as short as possible and large enough to handle the required current, in accordance with the electrical codes or regulations applicable to your installation. Table 2 on page 15 specifies the minimum DC cable size and maximum fuse size for the Freedom XC.

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Freedom XC Owner's Guide



This section for use by qualified personnel only.

To make the DC connections

Refer to Figure 5.

1. Make sure the inverter is off and no AC or DC is connected to the unit.
2. Remove the DC compartment cover by loosening the captive nut panel screw.
3. Loosen the DC terminal nuts from the terminal bolts and set them aside for later.
4. Strip 1/2" (13 mm) to 3/4" (19 mm) insulation from one end of each cable. The amount stripped off will depend on the terminals chosen.
5. Attach the connectors that will secure the cables to the battery, to the disconnect/battery selector switch, and the fuse block. The connectors you use must create a permanent, low-resistance connection. It is recommended to use approved and certified cable lugs. Use the tool recommended by the terminal manufacturer. Make sure no stray wires protrude from the lug or terminal.
NOTE: You may find it more convenient to have the cable lugs attached by the company that sells you the cable and/or connectors.
6. Strip 1/2" (13 mm) to 3/4" (19 mm) of insulation from each cable end that will be connected to the inverter cable. The amount stripped off will depend on the terminals chosen.

7. Attach the cable lug that will join the cable to the inverter DC terminal. Cover the lug stem with heat shrink insulation (see Figure 5) to ensure that the lug does not touch the enclosure.
8. Install a fuse and fuse holder in the cable that will be used for the positive side of the DC circuit. The fuse must:
 - be as close to the battery positive terminal as possible
 - be rated for DC circuits
 - have an Ampere Interrupting Capacity (AIC) that exceeds the short-circuit current available from the battery (that is, Class T fuse)
9. To prevent sparking when making the connection, ensure the disconnect/battery selector switch is off.
10. Route the positive cable through the left side strain relief clamp and attach the cable lug on the positive cable to the positive DC terminal on the inverter.
11. Fasten the DC terminal nut (set aside earlier) to the terminal bolt. Tighten the nut to a torque of 71–80 in-lbf (8–9 N-m). Do not overtighten. Make the connection snug enough so the cable lug does not move around on the DC terminal. Center it through the DC knockout hole and do not let it touch the edge. See Figure 5, "DC Cable Connections" on page 28.

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Basic Installation Procedures

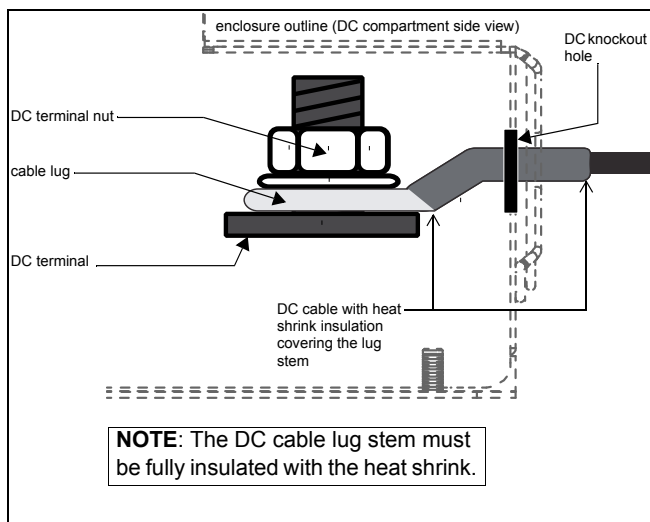


Figure 5 DC Cable Connections

NOTICE

EQUIPMENT DAMAGE

Tighten the nuts on terminals properly. Loose connections cause excessive voltage drop and may cause overheated wires and melted insulation. Do not over-tighten the nut on the DC input terminals. Damage to the DC input terminals may result. The maximum torque setting is **80 in-lbf (9 N-m)**. **Failure to follow these instructions can damage the unit and/or equipment.**

NOTICE

REVERSE POLARITY DAMAGE

Check cable polarity at both the battery and the Freedom XC before making the final DC connection. Positive must be connected to positive; negative must be connected to negative. Reversing the positive and negative battery cables will blow a fuse in the Freedom XC and void your warranty. **Failure to follow these instructions can damage the unit and/or equipment.**

12. Before proceeding, double check that the cable you have just installed connects the positive DC terminal of the inverter to the disconnect/battery selector switch, fuse holder, and that the other end of the fuse holder is connected to the positive terminal of the battery.



⚠ WARNING

FIRE HAZARD

Do not complete the next step if flammable fumes are present. Explosion or fire may result if the disconnect/battery selector switch is not in the off position. Thoroughly ventilate the battery compartment before making this connection.

Failure to follow these instructions can result in death or serious injury.

13. Route the negative cable through the right side strain relief clamp and connect the cable from the negative post of the battery to the negative DC terminal of the inverter.
14. Fasten the DC terminal nut (set aside earlier) to the terminal bolt. Tighten the nut to a torque of 71–80 in-lbf (8–9 N-m). Do not overtighten. Make the connection snug enough so the cable lug does not move around on the DC terminal. Center it through the DC knockout hole and do not let it touch the edge.
15. Replace the DC compartment cover.

DC Grounding

To connect the DC ground:

The equipment grounding lug on the DC end of the Freedom XC is used to connect the chassis of the Freedom XC to your system's DC negative connection or grounding bus point as required by electrical regulations. Use copper wire that is either bare or provided with green insulation. Do not use the DC Ground Lug for your AC grounding. See the AC wiring instructions in this section.

Follow the guidelines below that correspond to the specific type of installation. These guidelines assume you are using the DC supply cable and fuse sizes recommended in this manual. If you are using different sizes, refer to the applicable installation code for DC grounding details.

Recreational Vehicle Use 8AWG copper wire and connect it between the Chassis Ground lug and the vehicle's DC grounding point (usually the vehicle chassis or a dedicated DC ground bus).

Marine Use copper wire that is bare or has insulation rated minimum 105 °C, and connect it between the Chassis Ground lug and the boat's DC grounding bus or engine negative bus. For the Freedom XC 1000, use a wire of gauge 3AWG minimum. For the Freedom XC 2000, use a wire of gauge 1/0AWG minimum.

This section for use by qualified personnel only.

Basic Installation Procedures

Connecting to ACC Signal

The Freedom XC can be wired to inhibit inverter operation in the absence of a vehicle's (or vessel's) ignition control signal. This feature can avoid unnecessary battery drain that would otherwise occur if the inverter was operated without a charging source such as the vehicle alternator.

To enable ignition control:

1. Ensure that AC and DC power are both OFF.
2. Ensure the vehicle's ignition is turned to OFF position. It is highly recommended to remove battery power by disconnecting the vehicle's battery cables. Refer to the vehicle's user manual for proper instructions on how to disconnect the battery cables.
3. Locate the vehicle's ignition control wire from the vehicle's ignition circuit. This wire must be fused appropriately at no more than 5 amps. Refer to the vehicle's user manual for guidance.
4. Locate the ACC input (ignition signal input) terminal. See Figure 6.

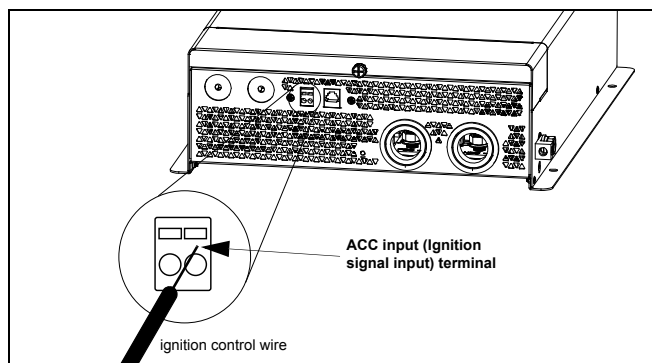


Figure 6 Ignition Signal (ACC) Input Terminal

5. Using a 3mm slot long neck screwdriver, push into the rectangular slot to release the spring clamp.
6. Insert the ignition control wire into the round ACC input terminal slot.
7. Pull the screwdriver out to engage the spring clamp and secure the wire to the terminal.



This section for use by qualified personnel only.

Description of Ignition Control Features

For information about the features and instructions on changing the ignition control features, see “Inverter and Charger Operation” on page 39.

Ignition Auto-on (AEO)	This setting allows the inverter to operate (Battery mode) automatically when an ignition control wire is connected to the ACC input and a valid ignition signal is constantly detected. The inverter works in tandem with the vehicle’s ignition circuit.
Ignition Lock-out (LOE)	This setting allows the inverter to operate (Battery mode) when an ignition control wire is connected to the ACC input terminal and a valid ignition signal is constantly detected. When enabled, you have to manually press the Power button on the display panel to operate the inverter.
Off (OFF)	To completely disable the ignition control features do the following: 1. Set Ignition Control to Off (OFF) using the Select buttons on the Display panel.

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Basic Installation Procedures

Step 7: Connecting to a Remote Panel

To connect the remote panel:

- ◆ Plug the Freedom X Remote panel (PN: 808-0817) to the RJ12 Remote port on the unit.

NOTE:

When the remote panel is connected, turn the inverter’s power button to the OFF position. This allows the remote panel to control the inverter’s power status.



Step 8: Testing Your Installation

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Pressing the Power button to turn OFF the Freedom XC inverter function on display panel does not disconnect DC or AC input power to the Freedom XC. If shore power is present at AC input terminals, it will pass through to the AC output.

Failure to follow these instructions can result in death or serious injury.

There are two tests to be performed. The first test verifies that the Freedom XC is inverting DC battery power and delivering AC power to its output.

The second test is intended for installations where AC input and output is hard wired to the Freedom XC. This test verifies that the Freedom XC transfers from inverter power to shore power when shore power is present.

NOTE: Shore power (pass-through) refers to the AC input power from a utility grid, generator or external AC source.

When you are ready to test your installation and operate the Freedom XC, close the DC fuse and Disconnect or the DC circuit breaker to supply DC power to the Freedom XC.

Testing in Battery Mode

To test the Freedom XC in invert mode:

1. For hard wired installations, ensure shore power is not present.
2. Press the Power button to turn the inverter on.
The green LED indicating Battery mode (Inverter mode) turns on and the LCD screen displays the **BATT. MODE** icon.
3. Plug a test load, such as a lamp within the power rating of the inverter into the Freedom XC GFCI or an AC outlet hard wired to the Freedom XC.
4. Turn the lamp on to verify that it operates.

If the lamp operates, your installation is successful. If your installation has AC input and output hard wired to the Freedom XC, proceed to “Testing in Grid Mode”.

If the status LED on the display panel glows red, see the Troubleshooting chapter.

This section for use by qualified personnel only.

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Basic Installation Procedures

Testing in Grid Mode

To test the Freedom XC in shore power mode:

- ◆ With the test load from the previous test still connected and operating, connect the shore power source.

The Freedom XC transfers the test load to shore power. The green LED indicating grid mode turns on and the LCD screen displays the **AC MODE** icon.

If the test load operates, your installation is successful.

NOTE: If the Power button on the Freedom XC is turned ON, the Freedom XC will automatically supply the appliances with inverter power if the shore power source fails or becomes disconnected.

If the Power button on the Freedom XC is turned ON and shore power voltage is too low (less than 90 volts AC), the unit will transfer to inverter power to continue running your appliances.

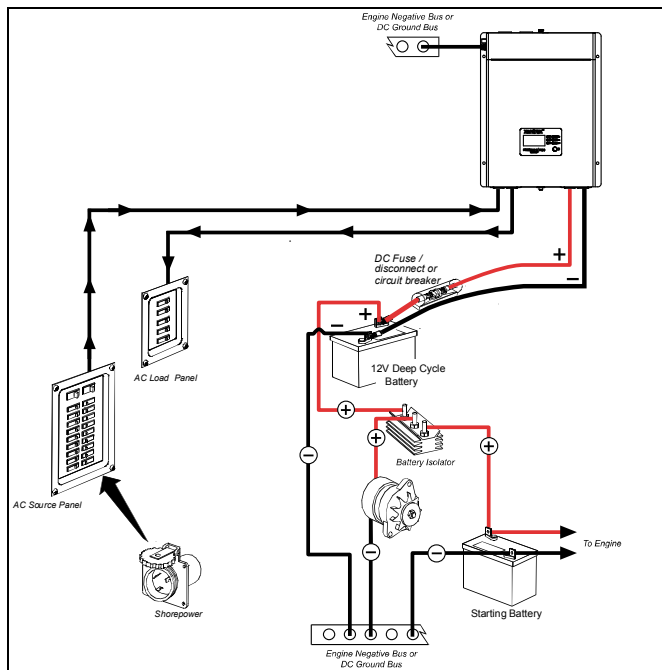
NOTE: In the event of low or no battery voltage, shore power will pass through the Freedom XC to the output even when shore power is outside the normal operating range.

NOTE: Whether or not the Power button is turned ON, shore power will pass through the Freedom XC to the output when shore power is within normal operating range. The unit also starts charging the battery after the transfer to grid mode.

Marine Installation

Figure 7 illustrates a typical marine installation with the following components:

1. AC power supplied from a shore power connector
2. An AC source panel that includes a max 30A (or a 15A if using a GFCI) circuit breaker that supplies the Freedom XC
3. An AC load panel with branch circuit breakers that supply only loads that run off the Freedom XC
4. Engine negative bus / DC ground bus
5. DC power supplied by a battery bank and protected by a DC fuse in the positive cable
6. Battery isolator
7. DC alternator
8. Starting battery
9. Drip shield (see next page)



This section for use by qualified personnel only.

Figure 7 Typical Marine Installation


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Marine Installation

Drip Shield Installation

The drip shields help to protect the unit from dripping or splashing liquids, which will cause a shock hazard when moisture comes in contact with electrical circuits in the unit. The drip shields are especially useful in marine installations where water from condensation, rain, or sea may come into contact with the Freedom XC.

 WARNING
<p>ELECTRICAL SHOCK HAZARD Place this unit in normally dry areas only. Operating the unit under wet conditions may expose you to a shock hazard. Installing drip shields may not entirely protect you from this hazard. Do not operate the unit when it is wet. Failure to follow these instructions can result in death or serious injury.</p>

You may purchase the drip shield set by contacting customer support. When ordering, mention part number 808-1050.

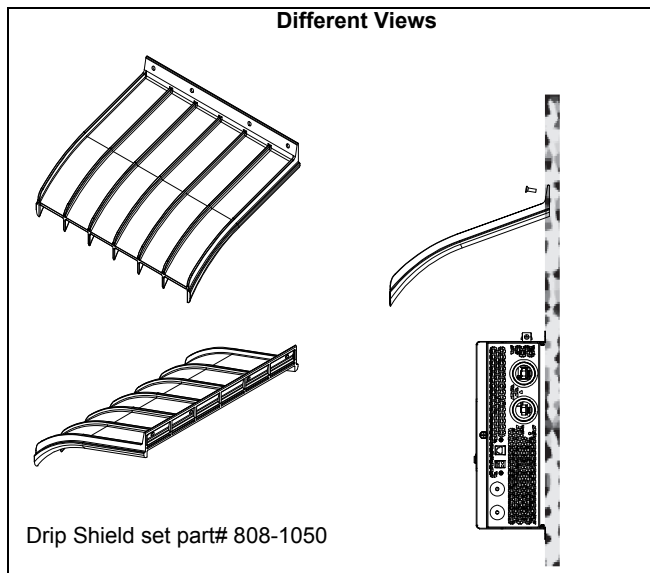


Figure 8 Drip Shields



To install the drip shields:

1. Gather the four screws needed to fasten a single drip shield to a wall.
2. Locate an appropriate setting for the drip shields above the Freedom XC making sure you cover the entire width of the unit.
You can overlay the shields as shown in Figure 9 below.
3. Fasten the screws through the holes in the drip shield into the wall. See Figure 8.

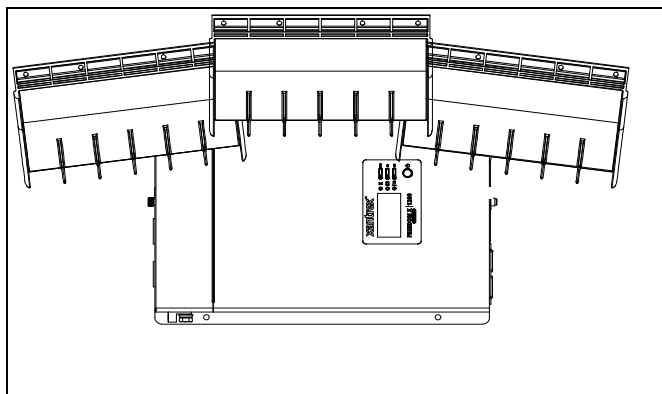


Figure 9 Typical Drip Shield Placement on a Freedom XC 1000

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Inverter and Charger Operation

Freedom XC Display Panel

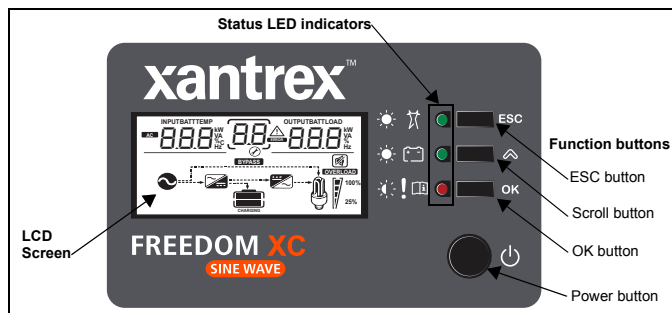










Figure 10 Display Panel

Status LED Indicators

Indicator	Definition
 ←	Indicates grid mode in which shore power is available and passing through to the loads and charging the battery.
 ←	Indicates Battery mode (Inverter mode) in which the inverter is running and supplying power to the loads from the battery.
 ←	Indicates error or fault mode and is accompanied by an error code displayed on the LCD screen. For a list of error codes, see “Warning Messages” on page 64.
 ←	Indicates a Warning condition and is accompanied by an error code and a sounding alarm. For a list of error codes, see “Warning Messages” on page 64.

Inverter and Charger Operation

Function Buttons

Button	Definition
	return to default screen or exit setting mode
	next screen or next selection
	to enter the setting mode or to confirm the setting
	turns the inverter on or off

LCD Screen

The LCD Screen changes depending on the operating mode of the inverter.

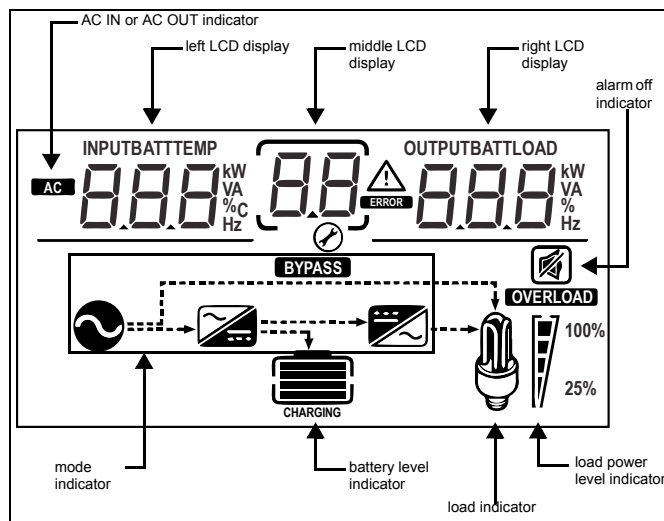


Figure 11 Parts of the LCD Screen



LCD Screen Icons

Icon	Definition
AC	AC input and output indicator.
	The wrench icon underneath a number is displayed during configuration mode.
	An error event with its corresponding number is displayed here.
	A warning event with its corresponding number is displayed here.
CHARGING	The charging indicator is displayed when the unit is in charger mode.
	The battery icon indicates remaining battery power. One bar = 1-25%, two bars = 25-50%, three bars = 50-75%, and four bars = 75-100%.
OVERLOAD	Shows an overload condition.

Icon	Definition
	The load icon is displayed if there is voltage available at the AC output.
	The bar represents load consumption levels. 100% is an indication of full capacity and 25% indicates low consumption. All the bars disappear at < 20 watts, and AC load indicates zero watt power.
	Shows up in grid mode when AC shore power is present. If the power is being qualified, then this icon will flash.
BYPASS	Shows that the unit is in grid mode and is bypassing shore power directly to the loads.
	This icon shows when there is power conversion from AC to DC - charging.
	This icon shows when there is power conversion from DC to AC - inverting.
	The alarm buzzer is muted.

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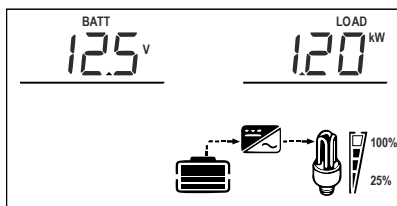
Viewing Information During Battery Mode

The LCD screen displays information related to battery mode operation.

◆ Press the Scroll button to move from screen to screen.

Info and Setting LCD Screen

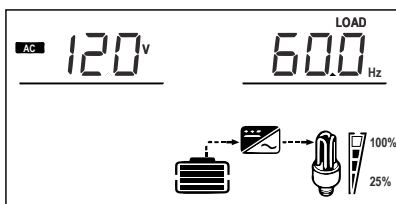
Screen 1 of 4 - Battery Voltage/ Load Wattage



This is the home screen.

battery voltage = 12.5V, AC load = 1.2kW

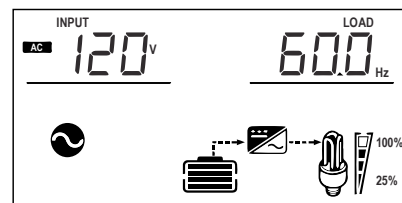
Screen 2 of 4 - AC Output Voltage/Frequency



output voltage = 120V, output frequency = 60Hz

Info and Setting LCD Screen

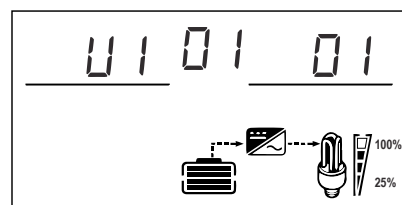
Screen 3 of 4 - AC Input Voltage/ Frequency



Screen shows up when utility AC is connected.

input voltage = 120V, input frequency = 60Hz

Screen 4 of 4 - Firmware version




Firmware version = U1 1.01

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Viewing Information During Grid Mode

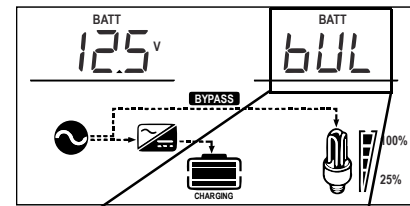
The LCD screen displays information related to AC bypass or charger operation.

1. Press the Scroll  button to move from screen to screen.
2. Press **ESC** to return to the home screen.

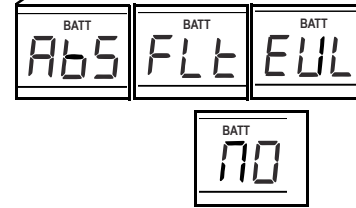
NOTE: After one minute of inactivity in the other screens, the LCD will go back to the home screen.

Info and Setting LCD Screen

Screen 1 of 5 - Battery Voltage/Charging Stage



This is the home screen.



battery voltage = 12.5V, charging stages = bulk, absorption, float, equalization, and no charging

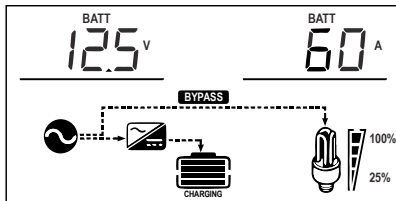
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Viewing Information During Grid Mode

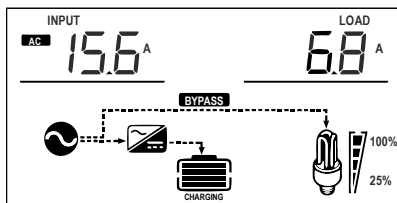
Info and Setting LCD Screen

Screen 2 of 5 - Battery Voltage/Charging Current



battery voltage = 12.5V, charging current = 60A

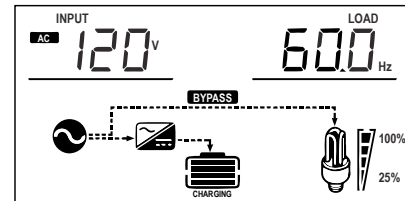
Screen 3 of 5 - AC input current/AC load current



input current = 15.6A, load current = 6.8A

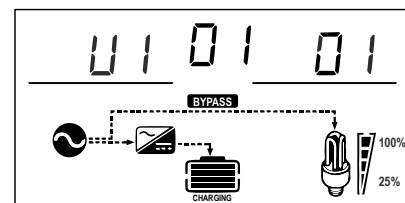
Info and Setting LCD Screen

Screen 4 of 5 - AC input voltage/AC input frequency



input voltage = 120V, input frequency = 60Hz

Screen 5 of 5 - Firmware version



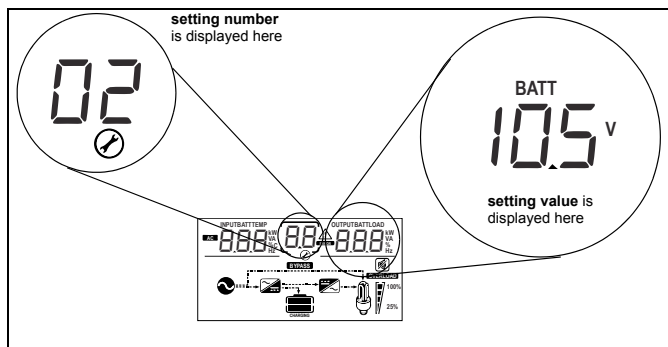
Firmware version = U1 1.01



Adjusting Feature Settings in Configuration Mode

The **OK**, Scroll **▲**, and **ESC** buttons can be used to cycle through the various feature settings:

1. Press and hold the **OK** button for three seconds to enter the feature settings mode.
2. Press the Scroll **▲** button to move through the different feature settings.



Adjusting Feature Settings in Configuration Mode

Settings

Setting Name	Setting Number	Default Value	Range of Values	Description
Inverter Ignition Control	01	OFF	OFF, L0t, Rt0	See “Description of Ignition Control Features” on page 31.
LBCO Voltage	02	10.5	10.1 to 12.8	The voltage setting value can be adjusted by 0.1 increments. The low battery warning is triggered at LBCO voltage + 0.5 volts. The low battery warning goes away at LBCO voltage + 1.0 volts.
LBCO Shutdown Delay Timer	03	300	1 to 300	When the range is from 1 to 20, the timer setting value can be adjusted by 1-second increments. When the range is from 20 to 300, the timer setting value can be adjusted by 10-second increments.
LBCO Recovery Voltage	04	13.1	12.0 to 16.0	The range is from LBCO voltage + 0.5 to 16, adjusted by 0.1 increments. Selecting a higher value than the battery’s actual fully-charged voltage level will not activate the auto-recovery feature. You may manually reset the inverter when the low battery cut off event occurs.
Power Save Time	05	25	OFF, 1 to 25	The range is from 1 to 25, adjusted by 1-hour increments. The next setting after 25 is OFF.
Power Save (Load Sensing) Mode	06	d1 5	EnA (enable), d1 5 (disable)	When enabled, the inverter’s “no load” loss can be reduced further when total load is less than 25 watts.
Output Frequency	07	60	60, 50	After changing the output frequency setting, turn the unit off and then on again, in order for the change to take effect.
Output Voltage	08	120	120, 110, 108	



Setting Name	Setting Number	Default Value	Range of Values	Description
Inverter Output Power Limit (Freedom XC 1000)	09	1.0	100 to 1.0	The wattage setting value can be adjusted by 100-watt increments. Use with Inverter Output Power Limit Timer especially when pairing with a lithium ion battery.
Inverter Output Power Limit (Freedom XC 2000)	09	2.0	100 to 2.0	
Inverter Output Power Limit Timer	10	300	1 to 300, OFF	When the range is from 1 to 20, the timer setting value can be adjusted by 1-second increments. When the range is from 20 to 300, the timer setting value can be adjusted by 10-second increments. Use with Inverter Output Power especially when pairing with a lithium ion battery. The timer is automatically disabled if the maximum Inverter Output Power limit is selected.
Transfer Mode	11	APL	APL (appliance), UPS (UPS)	Selecting <i>APL</i> - appliance sets the transfer time from line to battery to 20 ms. Selecting <i>UPS</i> (uninterruptible power supply) sets the transfer time from line to battery to 10 ms.
Utility AC Under Voltage Level	12	90	85 to 110	
Inverter Shutdown Recovery	13	RAE	RAE (auto-restart), RAE (manual restart)	The inverter shuts down when there is an over temperature, overload, and short circuit condition. Selecting <i>RAE</i> (auto-restart) will allow the inverter to recover automatically from a shutdown up to three times maximum. Selecting <i>RAE</i> (manual restart) allows the user to restart the inverter by performing a manual reset, that is, by acknowledging the restart via the display panel.
Audible Alarm	14	bOn	bOn (Audible), bOff (Mute)	The alarm beeps once every five seconds.

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Adjusting Feature Settings in Configuration Mode



Setting Name	Setting Number	Default Value	Range of Values	Description
Battery Type	20	FLd	FLd (Flooded), AGM (AGM), GEL (Gel), USE (Custom)	
Battery Temperature	21	HOt	CLd (Cold), wArM (Warm), HOt (Hot)	Selecting Cold from Warm will increase charger voltage by 0.4V. Selecting Cold from Hot will increase charger voltage by 0.8V.
Custom Absorption Voltage	22	14.6	12.0 to 18.0	The voltage setting value can be adjusted by 0.1 increments. Available only when custom battery type is selected.
Custom Float Voltage	23	13.5	12.0 to 18.0	
Charger Current (Freedom XC 2000)	24	80	5 to 80	The current setting value can be adjusted by 5A increments.
Charger Current (Freedom XC 1000)	24	50	5 to 50	
Charger Ignition Control	26	OFF	OFF (OFF), RAe (Auto-ON)	When set to <i>EnA</i> (Enabled), the charger operates only in tandem with the vehicle's ignition circuit.
Equalize Charging for Flooded Battery	27	d15	EnA (enable), d15 (disable)	This setting is only available when Flooded battery type is selected. It allows only one hour of equalize charging once.
AC Input Breaker for Load Share	28	30	5 to 30	The load share feature prioritizes the AC load by reducing the charge current in order to maintain the total input current to less than the load share setting.
Reset all settings to their default values	99	dEF	ndF (as is), dEF (default)	

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Freedom XC Owner's Guide


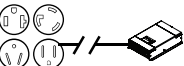


To change the default value to a different value:

1. Press and hold the **OK** button for three seconds to enter the feature settings mode.
2. Press the Scroll  button to move through the different feature settings.
3. Press the **OK** button to select a setting number and change its value.
4. Press the Scroll  button to change the value until you reach the desired value.
5. Press the **OK** button to confirm the change.
6. Repeat the previous steps to set other feature settings.
7. Press the **ESC** button to exit the feature settings mode.

Operating in Battery Mode

The Freedom XC is in Battery Mode (also called Inverter Mode) when all the following conditions exist:

- inverter power button is ON  (down position) or ignition auto-on is activated
- shore power is not presently available 
- battery has sufficient power

Inverter operation means that DC battery power is presently being converted to utility grade AC power, powering equipment and appliances connected to the AC output terminal of the unit.

The green status LED lights up to indicate the Freedom XC is using the battery to power the equipment and appliances.



Turning Inverter Operation ON and OFF

There are two ways to operate the Freedom XC's inverter.

- Press the Power button to a down position (it is Off in the up position).
- When the inverter's Ignition Control feature is set to Auto-on (**Auto**)^a, a +12VDC signal is present^b.

WARNING

ELECTRICAL SHOCK HAZARD

Turning the Power button off does not disconnect DC battery power from the Freedom XC. You must disconnect both AC and DC power before working on any circuits connected to the unit.

Failure to follow these instructions can result in death or serious injury.

To prevent unnecessary battery discharge, press the Power button to turn it off when you are not using the Freedom XC.

a. See "Adjusting Feature Settings in Configuration Mode" on page 45.

b. When the vehicle's ignition switch is On or the vehicle's engine is running.



Power Save Timer

The Power Save Timer is an adjustable countdown timer from 1 to 25 hours (25 hours is the default) that automatically shuts down inverter operation to reduce battery discharge and preserve battery life. During continuous inverter operation, the countdown is initiated when power from the AC load drops to less than approximately 50 watts and remains below this level. After reaching the end of the countdown timer the inverter automatically shuts down.

To change the countdown timer, see “To change the default value to a different value:” on page 49.

Power Save Mode: By enabling the power save mode, the inverter can automatically go to load sense mode by sending short pulses to further reduce the battery discharge. Power save mode ends when a load greater than 25 W is connected.

Checking Battery Status

During inverter operation (in battery mode), you can check the battery status by observing the battery capacity indicator on the LCD screen. The battery voltage appears in the left side of LCD screen.

The normal operating battery voltage range is between 11 and 15 volts.

Checking Output Power

When the inverter is in operation (in battery mode), you can check how much power (displayed in kW) the Freedom XC is supplying to the connected loads by observing the load capacity indicator on the LCD screen. The battery discharge amperage appears in the right side of the LCD screen.

Operating Several Loads at Once

If you are going to operate several loads from the Freedom XC, turn them on one at a time after you have turned the inverter on.

Turning loads on separately helps to ensure that the inverter does not have to deliver the starting current for all the loads at once, and will help prevent an overload shutdown.

Turning the Audible Alarm ON or OFF

The Freedom XC’s audible alarm can be muted. See “Adjusting Feature Settings in Configuration Mode” on page 45.

Any warnings such as error or fault conditions or imminent shutdown are both displayed on the LCD screen and sounded on the alarm speakers. See “To manually reset the alarm:” below.

Audible alarm for warning: The unit beeps once when a warning condition is detected.

Audible alarm for error: The unit beeps once every five seconds for one minute.

To mute the alarm:

- ◆ Press any one of the three function buttons.

The alarm is automatically muted after one minute. But the error code continues to be displayed until the error is cleared.

To manually reset the alarm:

1. Press the Power button to turn it Off (from a down position to up) and press again to turn it On to reset an active alarm and clear the error or error.
2. If the Inverter Ignition Control is set to auto-on, toggle the ignition signal to clear the alarm and error.
3. Toggle the AC input power to force the transition between grid mode and battery mode. This action clears the alarm and error.



Operating in Grid Mode

Battery Charger Functions

When AC power is available, the Freedom XC can operate as a 12-volt battery charger. Different battery types and chemistries require different charging voltage levels. Not charging batteries at the required levels can shorten battery life or damage the batteries. The Freedom XC is configured at the factory to work with the battery types recommended for inverter applications. If the default settings do not work for your specific installation, you can adjust the charge stage settings (as recommended by the battery manufacturer) on the Custom (Battery) Settings menu (see page 57).

NOTE: This information is provided for guidance only. Variations in battery chemistry and site-specific environmental considerations mean that you should consult your system designer or battery manufacturer for specific recommendations for appropriate battery voltage and current settings.

Battery Types

Freedom XC charges flooded (or wet) lead-acid, Gel, AGM (absorbed glass mat), and custom batteries.

- Flooded (or wet) batteries have removable battery caps for refilling with distilled water and testing the electrolyte.
- Gel batteries have the electrolyte in the form of a gel rather than a liquid and do not require topping up. Gel batteries are sealed and the battery caps are not removable.
- AGM (Absorbed Glass Mat) batteries are similar to gel batteries except that the electrolyte is absorbed into a fiberglass matting.
- Custom battery is configured by the dealer, factory, or service center for battery types other than those listed above.

NOTICE

RISK OF BATTERY DAMAGE
Do not mix battery types. The Freedom XC can only select one battery type setting for all batteries connected to its bank. All connected batteries should either be: Flooded (or wet) *or* Gel *or* AGM *or* Custom.

Failure to follow these instructions can damage the unit and/or damage other equipment.

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Operating in Grid Mode

3-Stage Charging Algorithm

When enabled, the Freedom XC will charge batteries in a sequence known as three-stage charging. Whenever qualified AC power is present at the inverter's input, it passes power through to the connected load and begins charging the batteries. The charging voltage delivered to the battery depends on the battery's:

- Type setting
- Temperature (by switch setting)
- State of charge

The three automatic stages are:

- Bulk
- Absorption
- Float

See Figure 12 for a graph of the three-stage charging profile.

There is a fourth stage, equalization, which is initialized manually as it is only performed occasionally and only on flooded (or wet) batteries.

The charging cycle is a multistage (three-stage) process. Whenever qualified AC power is present at the inverter's input, it passes power through to the connected load and begins charging the batteries.

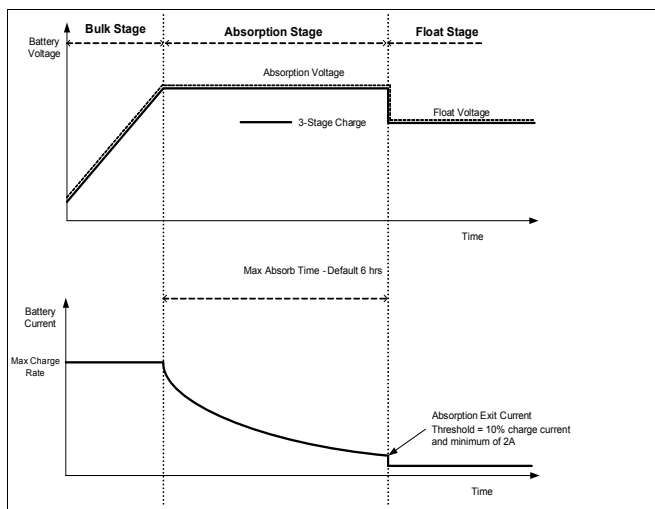


Figure 12 Three-Stage Battery Charging Cycle

NOTE:

When the charge cycle is interrupted, the charger will restart charging at the beginning of the multistage algorithm. Charge current during equalize state (optional state not shown here) is normally limited to 10A for 60 minutes.

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Freedom XC Owner's Guide



Bulk Stage

Bulk charge is the first stage in the charging process and provides the batteries with a controlled, constant current. Once the battery voltage rises to the absorption voltage threshold, the charger switches to the absorption stage.

Absorption Stage

During the absorption stage, the Freedom XC begins operating in constant voltage mode and the current falls gradually as the amp hours are returned to the battery.

Table 6 Preset Absorption Voltage Settings

Battery Type	Preset Absorption Voltage
Flooded	14.0V (Hot), 14.4V (Warm), 14.8V (Cold)
Gel	13.8V (Hot), 14.2V (Warm), 14.6V (Cold)
AGM	14.0V (Hot), 14.3V (Warm), 14.6V (Cold)
Custom Absorption	14.6 (default), changeable between 12.0 to 18.0

The Freedom XC transitions to the float stage if either one of the following two conditions are met:

1. The charge current allowed by the batteries falls below the exit current threshold, which is equal to 10% of the programmed charge current and a minimum of 2A.
2. The Freedom XC has been in absorption for the programmed maximum absorption time limit. The default is 6 hours.

NOTE: If there are DC loads on the batteries, the charger's current may never decrease to a level to initiate the next stage of charging. In this case, the charger would stay in absorption until the Absorb Time setting is reached.

Float Stage

Float charge maintains the batteries slightly above the self discharge voltage of the batteries. The charge current in float is the current necessary to maintain the batteries at the Float Voltage setting, limited only by the inverter's capability or other settings that limit the inverter's maximum charge rate. Float charging reduces battery gassing, minimizes watering requirements (for flooded batteries), and makes sure the batteries are in a constant state of readiness. The charger automatically switches to the float stage after the batteries have received a bulk and absorption charge (see Figure 12). The batteries are maintained at the default float voltage level for the selected battery type or the voltage selected under Float Voltage on the Custom Battery Settings menu.

Operating in Grid Mode

Table 7 Preset Float Voltage Settings

Battery Type	Preset Float Voltage
	Freedom XC 1000
Flooded	13.5
Gel	13.8
AGM	13.4
Custom Float	13.5 (default), changeable between 12.0 to 18.0

NOTE: The battery voltage can increase above the float voltage when using an external charging device such as PV arrays, wind turbines, and micro-hydro generators. Be sure to include appropriate charge management equipment with all external DC sources.

Equalize Charging

Many battery manufacturers recommend periodic equalize charging to counter cell charge imbalance and capacity-robbing electrolyte stratification. Equalizing helps to improve battery performance and lifespan by encouraging more of the battery material to become active.

Battery equalization is a controlled overcharging method that mixes up stratified electrolyte and reactivates unused areas of the plate material. Periodic equalizing can help to regularly restore batteries to a full and healthy state of charge.

Consult the battery manufacturer's recommendation for equalize charging settings. Sealed batteries should **never** be equalized. Consult the battery manufacturer for optimal charging procedures when using sealed batteries.

When Equalization is enabled, the battery is charged from bulk to absorption, and then to the equalize phase. The Freedom XC will transition from the absorption phase to equalize at an equalize current set to 10 amps.

After absorption, this constant current charge will continue until the voltage has increased to 16 volts DC.

Equalization duration is fixed at one hour.



Custom Battery Settings Menu

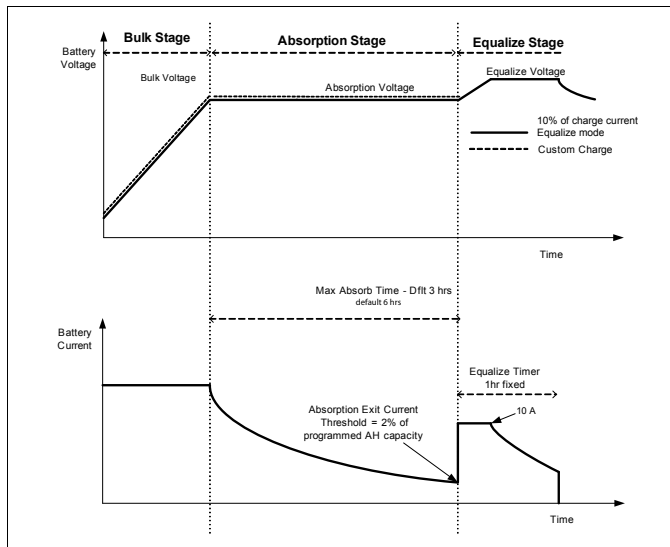


Figure 13 Equalize Charging

NOTICE

EQUIPMENT DAMAGE

To avoid damaging your batteries during charging or equalization, consult your battery manufacturer and associated documentation before setting a custom battery type.

Failure to follow these instructions can damage the unit and/or damage other equipment.

Custom battery type can be selected by the setting number 20 (see “Settings” on page 46). After the custom battery is selected, you can then adjust the value of custom absorption (setting number 22) and custom float (setting number 23) accordingly.

Operating During Transition Between Grid Mode and Battery Mode

The Freedom XC’s advanced power management is capable of transitioning power from an AC source to DC source within a fraction of a second and vice-versa.

The Freedom XC automatically detects when shore power is present and when it becomes unavailable or drops to less than 90 volts AC.

The transfer time can be set to two settings. For details see “Adjusting Feature Settings in Configuration Mode” on page 45.

NOTICE

EQUIPMENT DAMAGE

When the transfer mode is set to *UPS*, connect only sensitive digital equipment that requires fast AC transfer times.

Appliances with motors, compressors, and heating elements do not require a transfer mode of *UPS*. Set *RPL* for these devices to avoid damaging the transfer relay.

Failure to follow these instructions may cause equipment damage.

Transitioning from Grid Mode to Battery Mode

When the unit is operating in grid mode and shore power is lost, the Freedom XC has less than 20 milliseconds (default) to switch to operating in battery mode (if the Power button is pressed in the On position) and starts drawing power from the battery.

The operating mode indicator will change to Battery Mode and the green Status LED for Battery Mode will light up.

However, if the Power button is in the Off position, this transition does not happen and the display panel turns off.

Transitioning from Battery Mode to Grid Mode

When the unit is operating in Battery Mode and shore power becomes available, the Freedom XC begins a 20-second countdown to verify the stability of the shore power. If shore power remains stable for a 20-second countdown, at the end of the countdown, the Freedom XC will switch to shore power mode within 20 milliseconds and start drawing power from the AC source.

The operating mode indicator will change to grid mode and the green Status LED for grid mode will light up.



Operating Limits

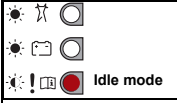
Power Output

The Freedom XC can deliver up to 1000 watts (Freedom XC 1000) and 2000 watts (Freedom XC 2000) of continuous utility grade sine wave AC power. The wattage rating applies to resistive loads such as incandescent lights.

Input Voltage

The allowable Freedom XC input battery voltage ranges are shown in the following table:

Operating Condition	Battery Voltage	Comment
Full Operating Range	LBCO – 18.0 volts	Assuming the battery is full, the inverter will operate until battery voltage goes past below LBCO ^a and LBCO Shutdown delay timer ^b .
Low Voltage Alarm	< LBCO+0.5 volts	A low battery warning shows error code E05 on the LCD screen.
Low Voltage Shutdown	< LBCO	The buzzer sounds a single one-second low battery alarm beep and the LCD screen shows error code E01. After LBCO Shutdown delay timer runs out, the unit shuts down inverter output. The buzzer stops beeping and the LCD screen shows error code E01.

Operating Condition	Battery Voltage	Comment
Instant Low Voltage Shutdown	< 10.2 volts	After two seconds below the limit, the unit shuts down inverter output completely. LCD screen turns off completely.
High Voltage Shutdown	18.0 volts	The display shows error code E02 alternating with the battery voltage. The red status LED turns on.  NOTE: Although the Freedom XC incorporates over-voltage protection, it can still be damaged if input voltage exceeds 18.0 volts.

a. To set LBCO, see “Adjusting Feature Settings in Configuration Mode” on page 45.
b. To set LBCO Shutdown Delay Timer, see “Adjusting Feature Settings in Configuration Mode” on page 45.

Operating During Transition Between Grid Mode and Battery Mode

Overload Conditions

There are two kinds of overload conditions:

- an overload warning
- an overload shutdown

Overload Warning When the Freedom XC’s AC load is approximately 100 W below the overload shutdown limit of rated watts, the audible alarm beeps once and the LCD screen shows a error code E06.

Overload Shutdown When the Freedom XC’s AC load increases to near ~1100 W (Freedom XC 1000) and ~2100 W (Freedom XC 2000), the audible alarm beeps every five seconds for one minute and the LCD screen shows a error code E03. The Status LED turns solid RED.

High Surge Loads

Some induction motors used in freezers, pumps, and other motor-operated equipment require high surge currents to start. The Freedom XC may not be able to start some of these motors even though their rated steady state current draw is within the inverter’s limits. The unit will shut down and indicate an overload shutdown.

Over-temperature Conditions

During inverter operation, when the Freedom XC’s internal temperature starts to approach its preset shutdown limit, the display will show error code E07. If the over-temperature condition persists, the display will show error code E04. The Status LED turns solid RED and the inverter will shut down to prevent damage to the inverter and protect the battery from being over-discharged.



Routine Maintenance

Freedom XC Unit

Minimal maintenance is required to keep your Freedom XC operating properly. Periodically you should:

- Clean the exterior of the unit with a damp cloth to prevent the accumulation of dust and dirt.
- Ensure that the DC cables are secure and fasteners are tight.
- Make sure the ventilation openings are not clogged.



Troubleshooting

⚠ WARNING

ELECTRICAL SHOCK HAZARD
Do not disassemble the Freedom XC. It does not contain any user-serviceable parts. Attempting to service the unit yourself could result in an electrical shock or burn.
Failure to follow these instructions can result in death or serious injury.

IMPORTANT: To obtain service go to “Contact Information” on page i.

This section will help you narrow down the source of any problem you encounter. Before contacting customer service, please work through the steps listed below:

1. Check for any error codes displayed on the LCD screen. If a message is displayed, record it before doing anything further.
2. As soon as possible, record the conditions at the time the problem occurred so you can provide details when you contact customer service for help. Include the following information:
 - What loads the Freedom XC was running or attempting to run
 - What the battery condition was at the time (voltage, etc.) if known
 - Recent sequence of events

- Any known unusual AC shore power factors such as low voltage, unstable generator output, etc.
 - Whether any extreme ambient conditions existed at the time (temperature, vibrations, moisture, etc.)
3. If your Freedom XC is not displaying an error code, check the following to make sure the present state of the installation allows proper operation:
 - Is the inverter located in a clean, dry, adequately ventilated place?
 - Are the battery cables adequately sized as recommended in the Installation guide?
 - Is the battery in good condition?
 - Are all DC connections tight?
 - Are the AC input and output connections and wiring in good condition?
 - Are the configuration settings correct for your particular installation?
 - Are all disconnects and AC breakers closed and operable?
 - Have any of the fuses blown in the installation?
 4. Contact customer support for further assistance. Please be prepared to describe details of your system installation and to provide the model and serial number of the unit.

Warning Messages

Warning messages in the form of audible alarms and error codes that appear on the LCD screen to alert you to an impending system change. Warnings do not affect operation.

With the exception of the error codes displayed on the screen, only the audible alarm can be turned ON or OFF. Follow the steps in “Turning the Audible Alarm ON or OFF” on page 52 to change the alarm settings.

The error codes are listed in Table 8 below. The text in the **Error Code** column appears on the LCD screen of the display panel.

Table 8 Error Codes Displayed on the LCD Screen

Error Code	Condition	Mode	Action
E01	Low battery voltage shutdown is imminent depending on the setting, see “Operating Limits” on page 59.	Battery mode (inverting)	<ul style="list-style-type: none"> • Check battery status and recharge if necessary. • Check for proper DC cable sizing. • Check for loose connections and tighten if necessary.
E02	High battery voltage shutdown > 18.0 volts DC	Battery mode (inverting)	<ul style="list-style-type: none"> • Check for external charging sources, such as a PV charger and an over voltage alternator. Disconnect, if necessary.
E03	AC output overload shutdown	Battery mode (inverting)	<ul style="list-style-type: none"> • Reduce the loads connected to the AC outlet of the unit. • Check appliances that have high-surge ratings and disconnect if necessary.
E04	Over-temperature shutdown	Battery mode (inverting)	<ul style="list-style-type: none"> • Reduce the loads connected to the AC outlet of the unit. • Check that the ventilation grille is not blocked. • Check for ambient temperature and move the unit to a cooler location whenever possible.



Table 8 Error Codes Displayed on the LCD Screen

Error Code	Condition	Mode	Action
E05	Low battery voltage detected depending on setting, see “Operating Limits” on page 59.	Battery mode (inverting)	<ul style="list-style-type: none"> Check battery status and recharge if necessary. Check for proper DC cable sizing. Check for loose connections and tighten if necessary.
E06	AC output overload warning	Battery mode (inverting)	<ul style="list-style-type: none"> Reduce the loads connected to the AC outlet of the unit.
E07	Over-temperature alarm and fan lock alarm	Battery mode (inverting)	<ul style="list-style-type: none"> Reduce the loads connected to the AC outlet of the unit. Check that the ventilation grille is not blocked. Check for ambient temperature and move the unit to a cooler location whenever possible. Check the fan for any obstruction and remove it.
E08	Fan lock error	Grid mode (bypass)	<ul style="list-style-type: none"> If there is no issue with the fan, disconnect the unit from its DC and AC power sources, then reconnect, and then restart the unit. Perform “Step 8: Testing Your Installation” on page 33. If error detection persists, contact customer service.
E09	Dead battery alarm	Grid mode (bypass)	<ul style="list-style-type: none"> Replace the battery.
E 10 to E 19	Internal hardware error	Battery and grid modes	<ul style="list-style-type: none"> If error detection persists, contact customer service.

For error code E01: after the LBCO shutdown delay, the unit will immediately stop inverting

For error codes E02 to E04: the unit will stop inverting

Troubleshooting Reference

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Do not disassemble the Freedom XC. It does not contain any user-serviceable parts. Attempting to service the unit yourself could result in an electrical shock or burn.

Failure to follow these instructions can result in death or serious injury.

NOTICE

INVERTER DAMAGE

Avoid continually overloading the inverter and subjecting it to over temperature conditions. Although provided with integral protection against overloads continual overloading can damage the circuitry.

Failure to follow these instructions can damage the inverter.

Table 9 Troubleshooting Reference

Problem	Possible Cause	Solution
Alarm does not sound when an error is encountered.	Alarm is turned OFF.	See “Turning the Audible Alarm ON or OFF” on page 52 and follow instructions to turn the alarm buzzer on again.



Table 9 Troubleshooting Reference

Problem	Possible Cause	Solution
No output voltage. The status LED is red.	AC shore power is not available or out of operating range and the inverter has shut down with the LCD screen showing one of the following error codes:	
	<ul style="list-style-type: none"> Low input voltage (error code E01) 	<ul style="list-style-type: none"> Check the DC connections and the cable. Recharge the battery.
	<ul style="list-style-type: none"> High input voltage (error code E02) 	<ul style="list-style-type: none"> Verify the unit is connected to a 12V battery. Check the voltage regulation of the external charging system (if any).
	<ul style="list-style-type: none"> Unit overload or AC output short circuit (error code E03) Thermal shutdown (error code E04) 	<ul style="list-style-type: none"> Reduce the load. Make sure the load does not exceed the output rating. Allow the unit to cool off. Reduce the load if continuous operation is required. Improve ventilation. Make sure the inverter's ventilation openings are not blocked.

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Troubleshooting Reference

Table 9 Troubleshooting Reference

Problem	Possible Cause	Solution
No output voltage is shown in the LCD screen but the green status LED for Battery mode is illuminated.	GFCI (when installed) has tripped or supplementary breaker has tripped.	Check load and reset the GFCI or supplementary breaker.
	Circuit breaker on the AC load panel or AC output disconnect has tripped.	Reset the circuit breaker or check the AC output disconnect circuits.
	Battery voltage is too low (depending on setting, see "Operating Limits" on page 59) to start inverting. LCD screen may show DC voltage as 000.	Check DC connections and cable. Recharge battery.
No output voltage is shown in the LCD screen and neither of the green status LEDs (for Grid mode and Battery mode) is illuminated.	AC shore power is not available or out of operating range and the inverter is OFF.	<ul style="list-style-type: none"> Check AC shore power. Turn the inverter ON.
	AC shore power is not available and the inverter is OFF due to a shutdown for more than 30 seconds.	<ul style="list-style-type: none"> Check AC shore power and battery voltage. Turn the inverter ON and look at the LCD screen for any error code. See Table 8, "Error Codes Displayed on the LCD Screen" on page 64.
No output voltage. The status LED is not lighting up.	Ignition lock (ACC) signal is not present.	If the ignition control feature is in use, ensure the vehicle's ignition is On and the ignition control switch on the front of the Freedom XC 1000 unit is On (I).

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Freedom XC Owner's Guide



Table 9 Troubleshooting Reference

Problem	Possible Cause	Solution
The fan turns on and off during AC shore power mode.	<ul style="list-style-type: none"> The battery is discharged. AC pass-through current is high. 	Do not be alarmed, the unit is performing normally.
The fan turns on and off during inverter mode.	The inverter is running continuously at high power.	Do not be alarmed, the unit is performing normally. The fan is activated automatically.

Inverter Applications

The Freedom XC performs differently depending on the AC loads connected to it. If you are having problems with any of your loads, read this section.

Resistive Loads

These are the loads that the inverter finds the simplest and most efficient to drive. Voltage and current are in phase (that is, in step with one another). Resistive loads usually generate heat in order to accomplish their tasks. Toasters, coffee pots, and incandescent lights are typical resistive loads. It is usually impractical to run larger resistive loads—such as electric stoves and water heaters—from an inverter due to their high current requirements. Even though the inverter can most likely accommodate the load, the size of battery bank required would be impractical if the load is to be run for long periods.

Motor Loads

Induction motors (that is, motors without brushes) require two to six times their running current on start up. The most demanding are those that start under load, for example, compressors and pumps. Of the capacitor start motors (typical in drill presses, band saws, etc.), the largest you can expect to run is ½ hp (the transfer relays are rated at 2 hp). Universal motors are generally easier to start. Since motor characteristics vary, only testing will determine whether a specific load can be started and how long it can be run.

If a motor fails to start within a few seconds or loses power after running for a time, it should be turned off. When the inverter attempts to start a load that is greater than it can handle, it will turn itself off after a few seconds.

Long Transfer Times The Freedom XC may take a long time (~ 0.1–0.2 seconds) to transfer to Battery Mode when shore power is cut off while powering a motor load. Motor loads typically “freewheel” when power is removed (for example, a grinder) and causes a longer transfer time. The longer transition from shore power to inverter power may cause connected computers or other sensitive equipment to operate incorrectly. To avoid this effect, do not connect motor loads together with sensitive equipment to the inverter for power.

Specifications

NOTE: Specifications are subject to change without prior notice.

Physical Specifications	Freedom XC 1000	Freedom XC 2000
L × W × H	14.2" (360mm) × 10.6" (270mm) × 3.7" (95mm)	15.4" (390mm) × 10.8" (275mm) × 4.0" (102mm)
Net Weight	13.4 lbs (6.1 kg)	16.3 lbs (7.4 kg)

Environmental Specifications	Freedom XC 1000	Freedom XC 2000
Ambient Temperature: Operating Temperature Range Storage Temperature Range	-4 –140 °F (-20 –60 °C), with output derated above 104 °F (40 °C) -40 –158 °F (-40 –70 °C)	-4 –140 °F (-20 –60 °C), with output derated above 104 °F (40 °C) -40 –158 °F (-40 –70 °C)
Humidity: Operation/Storage	5–95% RH, non-condensing	5–95% RH, non-condensing

System Specifications	Freedom XC 1000	Freedom XC 2000
Transfer relay rating	30A surge, 24A continuous	30A surge, 24A continuous
Transfer time (shore to inverter)	<20 milliseconds ^a	<20 milliseconds ^a
Transfer time (inverter to shore)	<20 milliseconds with a 20-second delay	<20 milliseconds with a 20-second delay
Transfer voltage (shore to inverter)	<85 V and >135 V	<85 V and >135 V
Transfer voltage (inverter to shore)	<130 V and >90 V	<130 V and >90 V
Cooling	Fan, activated by any of the following: •High internal temperature •High AC output power	Fan, activated by any of the following: •High internal temperature •High AC output power

a. To change the AC Transfer time (mode), see “Adjusting Feature Settings in Configuration Mode” on page 45.

Specifications

DC Input (For Inverting)	Freedom XC 1000	Freedom XC 2000
Operating voltage range	LBCO voltage ^a –18.0 VDC	LBCO voltage ^a –18.0 VDC
Maximum non-operating voltage	24 VDC	24 VDC
Nominal voltage	12.0 VDC	12.0 VDC
Nominal current at full load	100 ADC	192 ADC

AC Output (For Inverting)	Freedom XC 1000	Freedom XC 2000
Output voltage options	120, 110, 108 VAC	120, 110, 108 VAC
Continuous power	1000 W ^b @ 40 °C	2000 W ^b @ 40 °C
Continuous current	8.4 A	16.7 A
Surge power	2000 W	4000 W
Frequency	60 (or 50) Hz ^c	60 (or 50) Hz ^c
Wave shape	True Sine Wave	True Sine Wave
Peak efficiency	91%	91%
Full load efficiency	≥ 87.3%	≥ 87.5%

a. To set LBCO, see “Adjusting Feature Settings in Configuration Mode” on page 45.

b. Power derates to 85% when output voltage is set to 110/108 VAC.

c. To set the AC Frequency, see “Adjusting Feature Settings in Configuration Mode” on page 45.



AC Input (For Charging)	Freedom XC 1000	Freedom XC 2000
Operating voltage range	85–140 VAC	85–140 VAC
Safe non-operating voltage range	up to 240 VAC	up to 240 VAC
Full load maximum current	7 Arms	11 Arms
Nominal frequency	60 Hz	60 Hz
Power factor at full charge	> 98%	> 98%

DC Output (For Charging)	Freedom XC 1000	Freedom XC 2000
Nominal voltage	12.0 VDC	12.0 VDC
Min battery voltage for charging	0.0 VDC	0.0 VDC
Max output voltage	18.0 VDC (custom battery type)	18.0 VDC (custom battery type)
Nominal output current	User selectable: 5 to 50A ^a	User selectable: 5 to 80A ^a
Charger current derating	May reduce charger current depending on ambient temperature.	May reduce charger current depending on ambient temperature.
Efficiency at nominal output	≥90.1%	≥91%

a. Charger current is rated to 14.4 VDC output only. The charger derates if a high DC output voltage is selected.

Regulatory Approvals	Freedom XC 1000	Freedom XC 2000
EMC and Safety	ETL listed to CSA 107.1 UL458 and UL458 Marine Supplement (drip shield with product number 808-1050 required) ABYC E11, A20, A25, A31	ETL listed to CSA 107.1 UL458 and UL458 Marine Supplement (drip shield with product number 808-1050 required) ABYC E11, A20, A25, A31
EMI	FCC Class B	FCC Class B

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ZAMP CHARGE CONTROLLER



Solar Controller / Battery Charger

ZS-30A / ZS-40A

Input: DC12V Solar panel (Max. 25V)

Output: DC 12V 30A (ZS-30A)

DC 12V 40A (ZS-40A)

User's Manual



FEATURE

- Advanced MCU control pulse width modulated (PWM) technology, high efficiency operation.
- Target for LiFePO4, LTO (Lithium Titanium Oxide), Gel, AGM, Conventional lead-acid (WET) and Calcium Batteries.
- Built in regulator to prevent your battery from being overcharged. Overcharging occurs when the charge voltage is unregulated. This can result in premature battery failure.
- Come with regulator to prevent your battery from being under charged, in the solar energy field, battery undercharge always occurs, especially on some Conventional lead –acid or Calcium batteries; The unit provides an automatic Equalization feature for deeply drained Conventional lead acid battery or Calcium battery, as well as provides a cycling automatic Equalizing feature every 28 days.
- Can be connected to the battery permanently to keep the battery fully charged by using a process called “floating”. This means the controller will stop charging when the battery is full and will automatically start charging the battery as required. This process will also reduce water loss and help prevent the battery from ‘drying out’.
- Protects your battery from discharge at night. Under low light or no light conditions the solar panel voltage could be less than the battery voltage. The unit contains a special circuit which prevents current flowing back from the battery and into the solar panel.
- Colored LED’s to easily indicate the operational status and battery conditions.
- Digital LCD to directly display battery voltage, charging current, charging capacity (Amp hour), battery types and faulty codes.
- Provides plug-in remote digital display meter (Optional).
- Provides external battery temperature sensor (Optional).
- Multi charging protections against reverse polarity, short circuit, over temperature, over voltage, etc.
- Surface Mount or Flush Panel Mount options.
- Conformal-coating circuit boards and plated terminals apply to hostile environments.



For use with 12Volt Solar Panel Only
Suitable for Solar panels up to 510 Watts / ZS-30A; 680Watt / ZS-40A



WARNING – IMPORTANT PLEASE READ

- This charger is designed for indoor use only and should never be exposed to rain.
- Do not disassemble the controller. Take to a qualified person if the unit requires repairing.
- Lead acid, LiFePO₄, LTO batteries can be dangerous. Ensure no sparks or flames are present when working near batteries.
- Eye protection should always be used. Never short circuit the battery
- Given sufficient light solar panels always generate energy even when they are disconnected.
- Accidental 'shorting' of the terminals or wiring can result in sparks causing personal injury or a fire hazard. We recommend that you cover up the panel(s) with some sort of soft cloth so you can block all incoming light during the installation. This will ensure that no damage is caused to the Solar Panel or Battery if the wires are accidentally short circuited.
- Always install a battery fuse on each circuit including the solar controller
- Do not reverse connect the wires to the solar panel or battery

MOUNTING THE DEVICE

The Solar Controller has two mounting options.

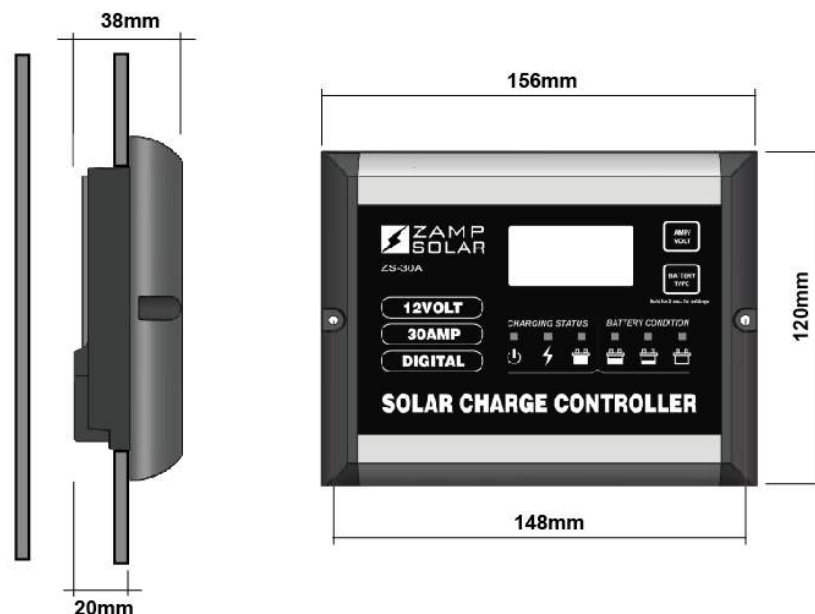
1. Surface mount:

The quickest and easiest way to mount the unit is to use the two plastic spacers and self tapping screws supplied and mount the unit to a flat surface,

2. Flush (panel) mount:

Before deciding to use this mounting method, please ensure there is sufficient depth behind the controller or in the cavity. (Refer to Diagram below)

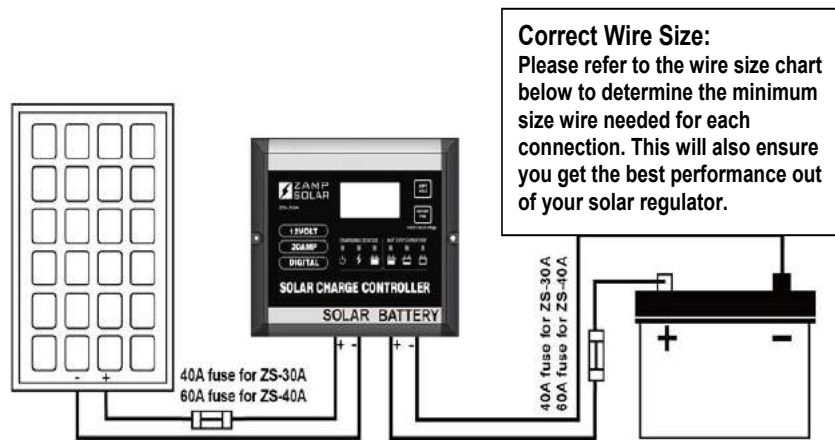
Using the dimensions shown in the following diagram, mark a 105mm x 130mm rectangle where you wish to mount the controller and cut-out the panel opening then use the two self- tapping screws supplied to secure the unit.





WIRING CONNECTIONS

To protect the Battery and the Solar Panel, we strongly recommend that you place a 40A inline fuse for ZS-30A (60A fuse for ZS-40A) on the positive wire on both the “Solar” and “Battery” Circuits. (As close to the Battery /Panel as possible)
 The Solar Controller has 4 terminals which are clearly marked ‘Solar’ and ‘Battery’.
 There is a (12V) and earth (GND) terminal for each circuit.
 Refer to the wiring diagram below.



	Battery Connection	Solar Array Connection		
Length of Wire	< 1m	6m	9m	12m
Size (AWG)	6	10	8	6

1. Using the Terminals supplied, crimp the terminals on your Solar Array wires and connect to the Solar Panel like shown.
2. Using the Terminals supplied, crimp the terminals on your Battery wires and connect to the Battery like shown.

When the connections are completed, the Solar Controller will start working automatically.

OPERATION - LCD DISPLAY

Please check your battery manufacturer’s specifications to select correct battery type. The unit provides 6 battery types for selections: LiFePO4, LTO, Gel, AGM, WET (conventional lead acid), and Calcium.






ZAMP CHARGE CONTROLLER

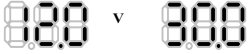
Press **BATTERY TYPE button** and hold for 3 seconds to go into your battery type selection mode, the battery type you select will be shown on the LCD meter, the default setting is AGM Battery; the controller will automatically memorize your battery type setting.

Caution: Incorrect battery type setting may damage your battery.

When the controller powers on, the unit will run self-qualify mode and automatically show below items on LCD before going into charging process

 Self-test starts, digital meter segments test

 Software version test

 Rated voltage and current test

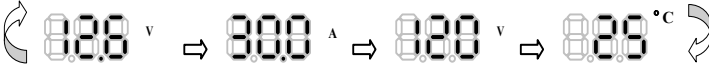
 External battery temperature sensor test (if connected)



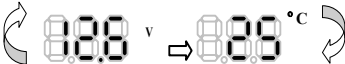
Indicates the solar panel connected.

After going into charging process, the LCD displays the charging statuses as below:
Press **VOLT / AMP button** in sequence, the LCD will display in turn with Battery Voltage, Charging Current, Charged capacity (Amp-hour) and Battery Temperature (if external temperature sensor connected)

Display in the day time-

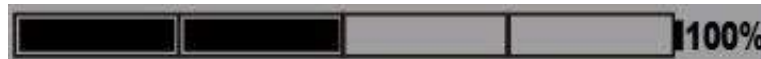


Display during the night-



The **VOLT / AMP button** can be changed at any time during charging process.

You also can visually monitor your battery charging condition for each battery; there is a LCD bar to show how many percentage capacities are charged, you can easily see the battery is charged around 25%, 50%, 75% or 100%.

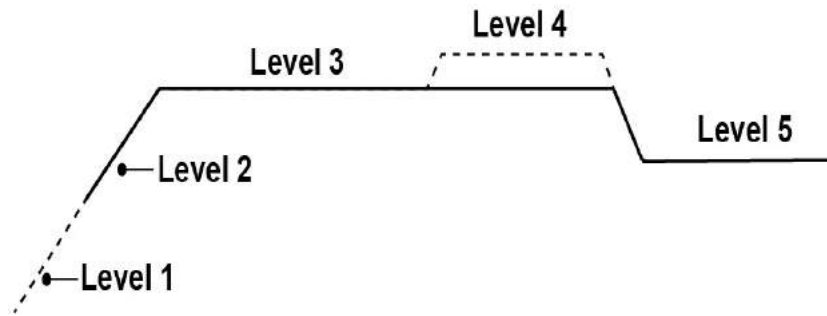


The LCD also can be treated as an independent voltage meter or thermometer. A voltage less than 11.5V Volts indicates that the battery is discharged and needs re-charging.

CHARGING STAGES

The unit has a 5 stage charging algorithm.

Soft Charge (Level 1) – Bulk Charge (Level 2) – Absorption charge (Level 3) – Equalizing Charge* (Level 4) – Float Mode (Level 5)



Soft Charge- When batteries suffer an over-discharge, the controller will softly ramp the battery voltage up to 10V.

Bulk Charge-Maximum current charging until batteries rise to Absorption level

Absorption Charge-Constant voltage charging and battery is over 85%.

Equalization Charge*-Only for WET battery or Calcium battery type, when the battery is deeply drained below 10V, it will automatically run this stage to bring the internal cells as an equal states and fully complement the loss of capacity.(LiFePO4, LTO,Gel and AGM battery do not run Equalization charge)

Float Charge-Battery is fully charged and maintained at a safe level.
A fully charged battery has a voltage of more than 13.6 Volts.

OPERATION - L.E.D. INDICATION

The 6 LED's indicate the charging status and the battery condition						
	Red	Blue	Green	Green	Yellow	Red
Solar Power Present-No battery connected	ON	OFF	OFF	OFF	OFF	Flash
Soft charging	ON	Flash	OFF	OFF	OFF	ON
Bulk charging	ON	ON	OFF	Subject to battery voltage		
Absorption charging	ON	ON	OFF	ON	OFF	OFF
Equalization charging	ON	ON	OFF	ON	OFF	OFF
Float charging	ON	OFF	ON	OFF	OFF	OFF
Solar panel weak	Flash	OFF	OFF	Subject to battery voltage		
At night no charge	OFF	OFF	OFF	Subject to battery voltage		
Battery Voltage below 11.5V (+/-0.2V)	ON	ON	OFF	OFF	OFF	ON
Battery Voltage between 11.5V - 12.5V(+/-0.2V)	ON	ON	OFF	OFF	ON	OFF
Battery Voltage above 12.5V (+/-0.2V)	ON	ON	OFF	ON	OFF	OFF

ABNORMAL OPERATION MODE



ZAMP CHARGE CONTROLLER

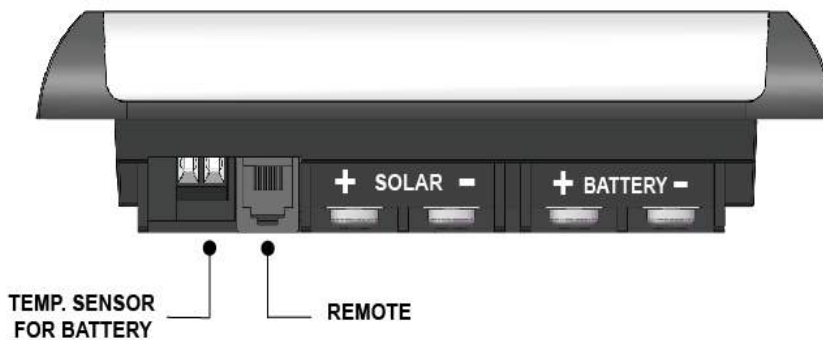
Solar panel abnormal mode	LCD display	LED indication	LCD backlight
Solar panel weak		Flash	ON
Solar panel reverse connection		Flash	Flash
Solar panel over voltage (> 26.5V)		Flash	Flash

Battery abnormal mode	LCD display	LED indication	LCD backlight
Battery disconnected or less than 3.0V		Flash Flash Flash	Flash
Battery reverse connection		Flash	Flash
Battery over voltage than > 17.5V		Flash	Flash
Battery temperature over 65C		Flash Flash Flash	Flash

The solar controller abnormal mode	LCD display	LED indication	LCD backlight
The controller over temperature protection			Flash

OPTIONAL EXTERNAL DEVICE

The controller provides two optional devices (excludes in the packaging box).



Optional external Battery temperature sensor:

As an option, the unit provides a port to connect the external battery temperature sensor; if the external battery temperature sensor is connected, the unit will optimize the charging performance subjected to the battery temperature detected and also provide the battery over temperature protection, in some cases, if battery over temperature occurs, the controller will automatically stop charging.

Optional external Remote display meter:

As an option, the unit also provides a port to connect the external Remote display meter



for some special location needed. The display content on the Remote meter is same as the display on the controller.

SPECIFICATIONS				
1	Electrical Parameters			
1-1	Rated solar panel amps ZS-30A /ZS-40A	30 / 40	Max.	AMP
1-2	Normal input Solar cell array voltage	15-22		VDC
1-3	Max. solar cell array voltage (output has no load)	25	Max.	VDC
1-4	The controller lowest operating voltage (solar or battery side)	8V	Min	VDC
1-5	Maximum voltage drop-Solar panel to battery	0.25	Max.	VDC
2	Charging characteristics			
2-1	Minimum battery start charging voltage	3	Min	VDC
2-2	Soft start charging voltage	3-10	+/-0.2	VDC
2-3	Soft start charging current ZS-30A / ZS-40A	Up to 15 / 20		AMP
2-4	Bulk charge voltage	10-14.0	+/-0.2	VDC
2-5	Absorption charging voltage at 25°C			
	--LTO type battery	14.0	+/-0.2	VDC
	--Gel type battery	14.1	+/-0.2	VDC
	--LiFePO4 battery	14.4	+/-0.2	VDC
	--AGM type battery (default setting)	14.4	+/-0.2	VDC
	--WET type battery	14.7	+/-0.2	VDC
	--Calcium type battery	14.9	+/-0.2	VDC
2-6	Absorption transits to Equalizing or Float condition:			
	--Charging current drops to ZS-30A / ZS-40A	0.5/1.0	+/-0.1	AMP
	-- or Absorption charging timer timed out	4		Hour
2-7	Equalization charging active			
	--Only for WET or Calcium battery			
	--Battery voltage discharged to less than	10	+/-0.2	VDC
	--Automatic equalizing charging periodical	28		Day
2-8	Equalization charging voltage at 25°C	15.5	+/-0.2	VDC
2-9	Equalization charging timer timed out	2		Hour
2-10	Float charging voltage at 25°C	13.6	+/-0.2	VDC
2-11	Voltage control accuracy	+/- 1%		
2-12	Battery temperature compensation coefficient	-24		mV/*C
2-13	Temperature compensation range	-20 ~ +50		*C
3	Protection			
3-1	Against reverse polarity or short circuit			
3-2	No reverse current from battery to solar at night			
3-3	Over temperature protection during charging	65		*C
3-4	Transient over voltage protection with TVS or varistor			
4	Electrical parts			
4-1	Input output terminal	M5 terminals		
4-2	Remote port	RJ-11 (6 pins)		
5	Physical Parameters			
5-1	Controller material	Plastic, Standard ABS		
5-2	Power terminal maximum stranded wire size	#6 AWG stranded-16 mm ²		
5-3	Power terminal torque	Up to 17 in-lb (0.2n-m)		
5-4	Mounting	Vertical wall mounting		
5-5	IP grade	IP22,		
5-6	Net weight	Approx. 300g		
6	Environmental characteristics			
6-1	Operating temperature	-25 ~ 50°C		
6-2	Storage temperature	-40 ~ 85°C		
6-3	Operating Humidity range	100% no condensation		



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