

(CUSTOMER SUBMITTED FIXTURE SPECIFIC INSTRUCTIONS)

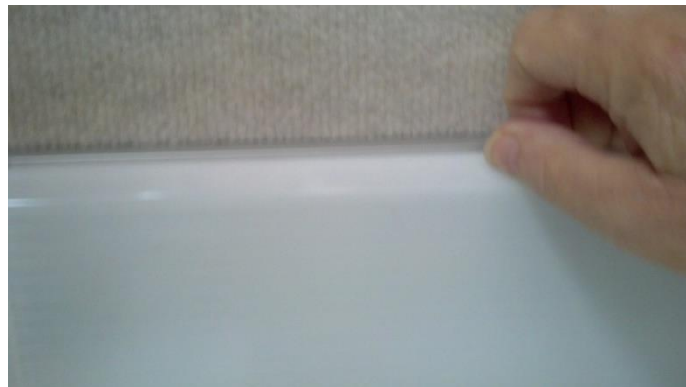
Instructions for replacing RV fluorescent bulbs with LED bulbs

The procedure is the same for 12" or 18" light bulbs. There may be differences between the fixtures pictured in these instructions and your fixtures or between the RV wiring pictured in these instructions and your RV wiring. These instructions were prepared as an example and the author assumes no liability if you are not satisfied with the results.



The first step is to remove the cover from the fixture. The cover has a narrow edge that fits in a groove in the light fixture base.

Place your fingers on the edge of the cover as shown and press toward the center of the fixture, squeezing the cover.



When the edge of the cover clears the groove, pull the cover gently away from the fixture base.



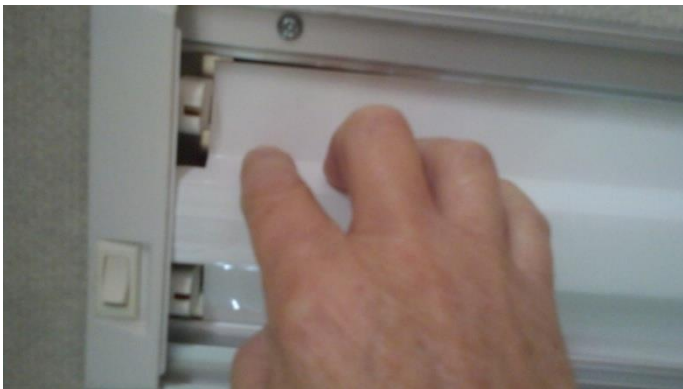
This will expose the bulbs and in ballast cover. Remove the bulbs by grasping them and rotating them $\frac{1}{4}$ turn in either direction. The bulbs then may be gently pulled down out of the lamp socket.

The light fixtures in the RV are attached to the mounting surface with 4 screws, 2 of which are shown here. Some fixtures may require that you remove them to do all this.

If you tried replacing the bulbs and the lamp still did not work, the problem is likely the ballast and these bulbs may still be good, in case you wish to save them for use elsewhere. We will discuss repairing the ballast further on in this document.



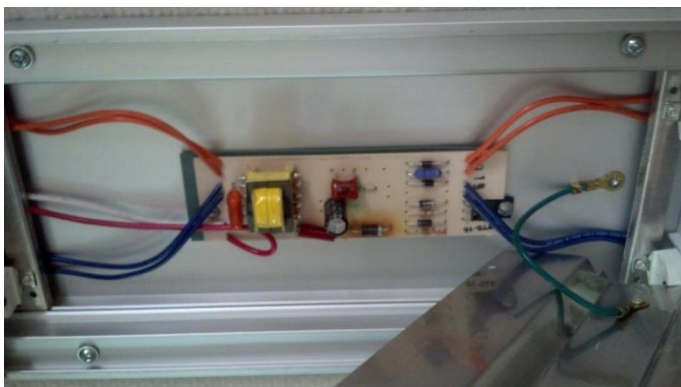
Like the cover that was removed earlier, the edge of the ballast cover is captured in a groove on each side of the fixture base. Press your fingers against the center part of the cover and squeeze to pull the edge away from the fixture base.



As the edge of the ballast cover clears the groove in the light fixture base, pull it gently away from the base.



Grasp the ballast cover at the other end, squeezing so the cover edge will clear the fixture base groove and the whole ballast cover may be pulled away from the fixture. **Caution: There will be a ground wire riveted to the cover and attached to the fixture base. Be careful not to pull the cover so far away that the wire is broken.**



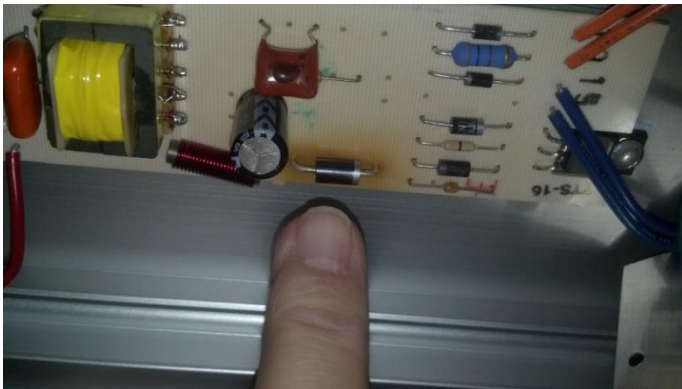
The cover is light weight and may hang from the ground wire riveted to it.



This is the ground wire mentioned in the previous paragraph. It should remain attached to the base and to the cover.



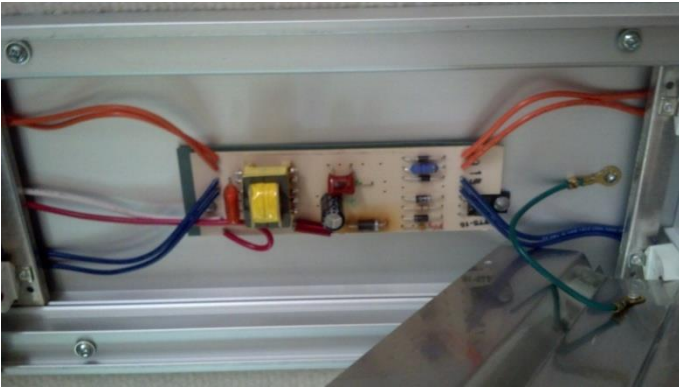
The ground wire from the RV will be attached to the ballast printed wiring board. In this case the white wire. The +12 volt RV wire will go to the switch on the left end of the light fixture. The switched +12 volts is (in this case) the red wire attached to the ballast printed wiring board.



If new bulbs did not work in your fixture, the ballast has likely failed. The usual culprit is the power diode shown here. When the bulbs begin to fail, they draw much more current, overheating the diode and eventually causing it to fail. The lesson is: when the bulbs begin to fail and you can see the ends of the bulb getting dark – replace the \$1 bulb at that time, instead of waiting for it to overload the ballast.

Should you decide to just replace the diode, here is an example that will work in most light fixtures. \$0.47 I believe.

<http://www.digikey.com/product-detail/en/on-semiconductor/MUR460RLG/MUR460RLGOSCT-ND/1139948>



The ballast board does not have to be removed to install the LED bulbs. Cut **(as close to the board as possible)** the 2 wires from each socket, on each end of the fixture. Total of 8 wires in this case. In this picture 2 orange at each end of the board and 2 blue at each end of the board. Be sure to leave as much wire as possible connected to the sockets. These wires are what we will connect to.

Cut the electrical ground and +12v wires **(as close to the board as possible)**. Depending on the fixture, it may be easy

to slide the socket mounting strips out of the fixture and remove them from the fixture for easy connecting.

The LED bulbs in this example came from M4 and come with their instructions (sort of) for installing the bulbs. A copy of these instructions are shown on the next 2 pages.

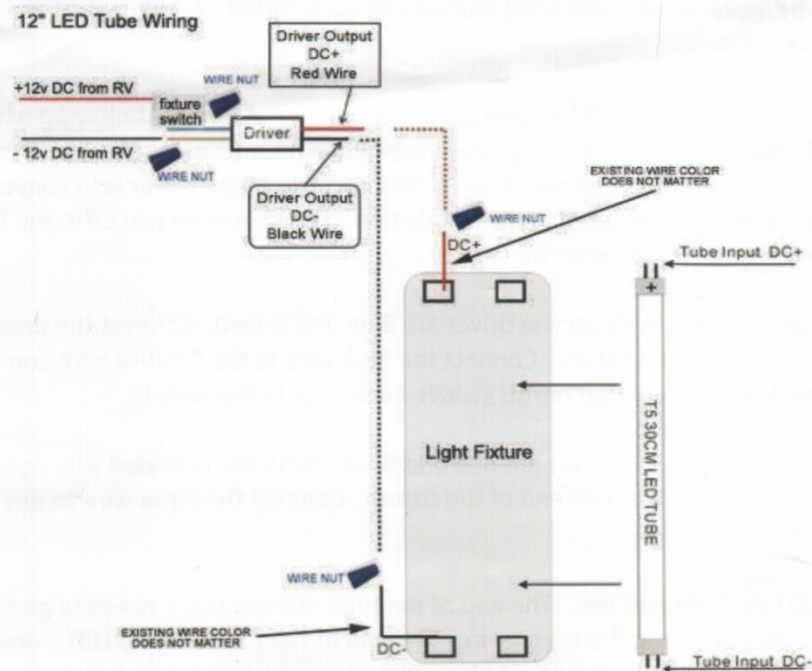
Installation Instructions T5 12" Tube Lights

M4LED.com

PRODUCT NOTES: The tube lights we sell are different than other 12v LED retrofit lights on the market because ours use the natural pins on the bulb and fixture to supply power to the LED light. This gives a cleaner appearance since there are no wires protruding from the side of the tube light that can be seen dangling from the fixture. Our tube lights also have frosted cover so you cannot see the individual LED lights when looking at the fixture. At one end of the tube, the two pins are internally jumped together. At the other end of the tube, those two pins are jumped together, so you only need to connect a wire to one pin on each end of the tube.

CAUTION: THESE ARE FOR 12 VOLT DC APPLICATIONS ONLY. Serious Injury and Damage may occur if you try to install these into 110-120v AC Household Current.

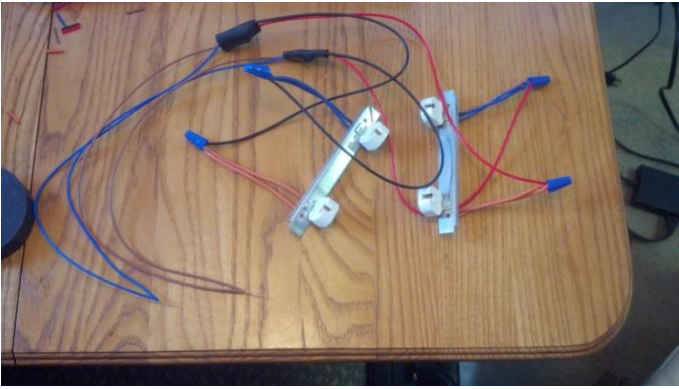
DISCLAIMER: To install these retrofit lights, you will be altering the wiring in your fixture to bypass or remove the Florescent Ballast as it is no longer necessary. You will be cutting and splicing wires that will void your warranty on your original light fixture. Though this is an easy rewire, if you are not comfortable with basic wiring, please seek a professional's assistance. M4 shall not be accountable for any damage to the existing light fixture or damage caused by shorts, loose wires, or mis-wiring. If you do not want to alter your light fixture, **STOP NOW.**



1. T5 Tubes use an external driver (black with 4 wires). If you have two tubes in one fixture, each must be wired to its own driver separately. Do not interconnect the red and black wires from the driver.
2. Confirm the light to be retrofit is 12v DC. This product is only to be used on 12v DC systems, attempt to use on 120v AC system will damage the bulb and may result in serious injury.
3. A limited number of fixtures have rivet in ballast covers, you can still retrofit these fixtures but you will be required to work around or remove and replace the rivets to convert these fixtures.

4. Turn the Master Power of the RV Off
5. Remove the fixture lens and florescent tube light. The tube may pull straight out, or may turn 90 degrees and pull out depending on the design.
6. Test fit your LED Tubes in the sockets. Do not turn on the power during the test fit. Remove the tubes.
7. Refer to the retrofit LED wiring diagram. If you do not understand the diagram, request more information or have a professional continue installation.
8. Locate the wiring and fixture ballast. You will need to remove the ballast from the fixture as it is not necessary with LED tube light and your LED tube light will not work with the ballast in place. The ballast and wiring may be under a tin shroud, or in the end of the fixture. You may have to remove the fixture from the RV in order to disassemble it. Due to the many different fixture designs, we cannot provide specific instruction on finding and removing the ballast.
9. Identify which wires to cut or remove from the fixture and ballast. You should end up with a positive and negative wire coming into the fixture from the RV (through the fixture on/off switch if applicable), and one wire extending from each tube socket. The two pins at each end of the LED tube are wired together internally, so you only need one wire to each socket. Additional wires from each socket may be removed.
10. The LED tube light comes with an external driver covered in black shrink wrap with 4 wires extending from it. Do not remove the covering. Each tube must have its own driver, so if you are retrofitting a two light fixture, you will need two drivers. The purpose of the driver is to convert 10-30v power to clean 12v power and is required in the installation. This should be placed in the fixture in the same area the ballast was removed from.
11. The input wires from the RV for the driver are Blue and Brown. Connect the Brown wire to the RV ground wire entering the fixture. Connect the Blue wire to the Positive wire coming into the fixture, or if the fixture has an integrated on/off switch, connect it to the switch.
12. The output wires from the Driver are Red and Black. With the provided wire nuts, connect the red wire to one wire on one base at one end of the fixture. Connect the black wire to one base at the other end of the fixture.
13. Install a LED tube light and test. The end of the tube marked LED + needs to go to the socket base which is connected to the driver red wire. The end of the tube marked LED – needs to go to the socket base which is connected to the driver black wire. Turn the RV Master Power on.
14. After testing, remove the tubes, reinstall any removed shields, and place the included LED Retrofit sticker inside the fixture behind the LED Tube light. Reinstall the LED Tube lights, and Fixture Cover.

Enjoy your new LED tube lights, and let everybody know about M4LED.com



Once you attached the wiring kit with the driver that came with each bulb to the lamp sockets it should look like this. Note that each socket is attached one of the drivers. i.e., the black wire from one kit goes to one socket, the matching socket at the other end of the fixture goes to the red wire from this same driver. So one driver is connected to one bulb and the other driver is connected to the other bulb. The red and black wires from a driver must be connected to the same bulb and the red and black wires from the other driver, connected to the other bulb.



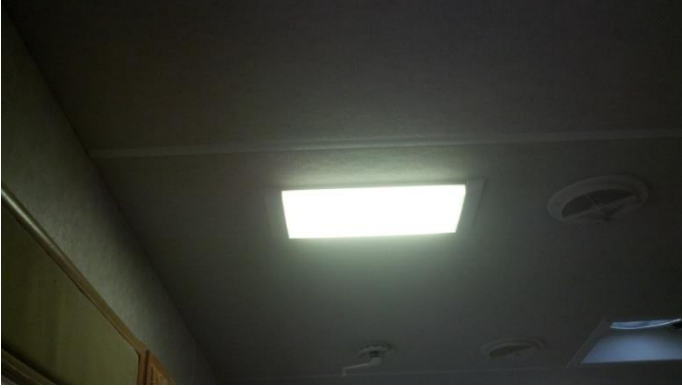
On the other end of the drivers, there is a blue and brown wire. These go to the switched +12 volts and electrical ground.



Lay the wires in the center of the ballast cover and reinstall it.



Push each end of each bulb into the socket and then rotate it $\frac{1}{4}$ turn to click it into place. Be sure to orient it the bulb so the aluminum heat sink side is toward the fixture base and the frosted side of the bulb is facing away from the base.



Replace the light fixture cover to complete the project.