# RGB MegaBall Assembly Instructions

## RGB MegaBall Overview

RGB MegaBalls were intended to replicate the reflective, colored glass balls traditionally found on Christmas trees.   While RGB MegaBalls make an excellent addition to a MegaTree, they can also be used in a variety of other ways:

- Hanging from eves and soffits
- Hanging from "real" trees
- Draped along fences, sidewalks and driveways
- Hanging from the inside of arches
- Any other place where they will be hanging

The RGB MegaBall basically consists of two parts – a power injector and the MegaBall which contains a 3 Channel DMX controller and three RGB modules.  The diagram below shows three MegaBalls and a power supply:
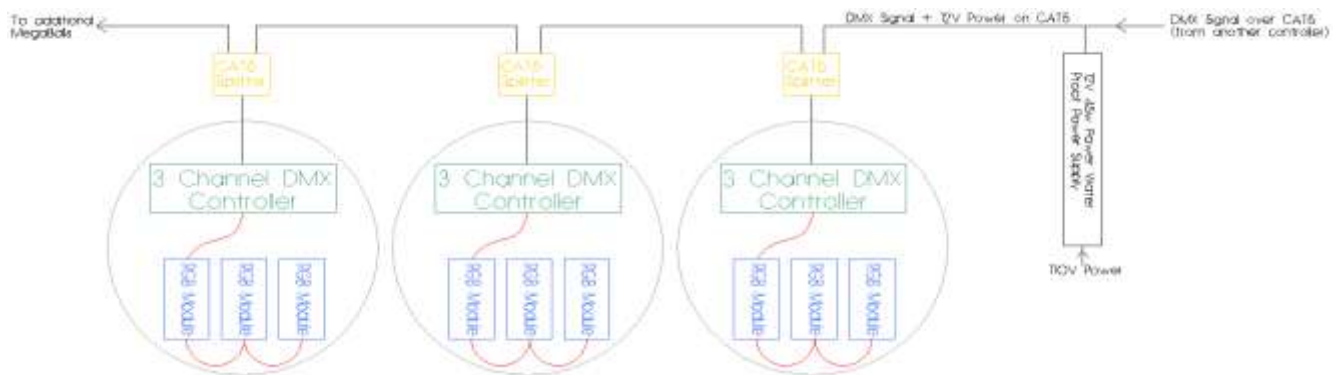


On the far right, a standard DMX signal comes in (typically on pins 1 & 2 of a CAT5 cable) and along that same line, 12 volts is injected on the remaining 6 wires (numbers 3 through 8) along with the DMX signal.  The power and DMX signal go from the power supply over a plug-n-play CAT5 cable of any length you choose to the first MegaBall – this allows you to customize the exact spacing you need between the balls.  At the end of each MegaBall is a three-way CAT5 splitter.  This splitter allows the signal and the power to continue down the cable but also split off power and signal to the first MegaBall.  This splitter is connected to the MegaBall via a small length of CAT5 with a male plug on the end that plugs into the splitter.  This small length of CAT5 cable then goes inside the MegaBall (though a waterproof cap) where it is connected to an inexpensive 3 channel DMX controller.  The power and signal are then soldered to

the DMX controller and the wires of three RGB, 5050 style modules is attached to the DMX controller. The cap, which contains the DMX controller and RGB modules, is then inserted into a 6" frosted acrylic dome.  Screws are then used to attach the cap to the lip of the acrylic dome.  Additional MegaBalls simply daisy chain onto prior MegaBalls.  Up to 10 MegaBalls can be connected in series at which time another power injector is added and the signal continues on to the additional section of MegaBalls.

# Parts List

The RGB MegaBall is a "do-it-yourself" project and the cap you purchased from HolidayCoro.com is only one part of the required items to complete this project.  The following items are needed to complete the assembly:

- **CAT5 Cable** – CAT5 cable is used to both deliver the signal and to carry the power.  This reduces the number of cables required, speeds assembly time (both on the build and during your display assembly) and reduces costs.  You will need the following CAT5 cables:
    - o **MegaBall lead in/Hanging cable -** Each MegaBall will require one black CAT5 cable.  Black cable is recommended to prevent it from lighting up or reflecting light – you want the MegaBall to appear to be hanging in mid-air.  In general, it is best to have it as short as possible but the length depends on how you will be mounting it.  So, if you will be mounting these in a MegaTree, a length of 1.5 to 2 feet would be ideal.  If you were hanging them from "real" trees, you may need, say, 3 or 4 feet of cable.  Black CAT5 cables can be ordered from Monoprice.com here: http://www.monoprice.com/products/subdepartment.asp?c_id=102&cp_id=10208 We recommend that once you determine your length of cable from the top of the MegaBall to the splitter that you double this length and then purchase that length of cable instead of individual cables.  The reason for this is that only one end of the CAT5 cable with the plug will be used, the other end would be discarded.  By purchasing a cable double the length, you will be able to purchase longer cables but half as many which are generally cheaper.  So if you need 2ft, purchase a 5ft cable and cut out 1ft in the middle of the cable.
    - o **Daisy chain –** You can vary the distance between each MegaBall to suit your needs.  Just select a CAT5 cable with a color (black is recommended) and length that meets your needs.  The distance between each splitter does not need to be equal.  CAT5 cable can be ordered from Monoprice.com here: http://www.monoprice.com/products/subdepartment.asp?c_id=102&cp_id=10208
- **Frosted Acrylic Globe** – The custom machined caps you purchased from HolidayCoro are designed to work with one type of Acrylic Frosted 6" Globe from Superior Lighting.  That item is 02017-06WASPL with the description of "*6 Inch Plastic Globe Plain Lip Opening White Opal Acrylic*".  They can be purchased from this link: http://www.superiorlighting.com/Plastic_Globe_Plain_Lip_Opening_p/02017-06waspl.htm Please be aware that this company has a $50 minimum order, which at the current price of $3.60 (July 2011), means you will need to purchase a minimum of 14 globes.  Shipping is a flat

rate $8.  I recommend ordering one or two extra globes in the case one gets crushed or otherwise damaged in storage.  It is possible that other globes, such as those from hardware stores, may work - the globe would need to have the following specifications to be compatible with our custom cap:

- o Outside neck diameter of just under 3.16"
- o Neck height of .5" or greater
- o Ideally it would also have a slight groove around the neck where the screws attach but that is not absolutely required

- **RGB MegaBall Package** – We offer a complete package that includes 10 caps, 30 LED modules (see below), 10 DMX controllers (see below), 30 screws and one power supply (see below).  You may find this easier and less expensive than ordering items individually.  You can find the package on our website at http://www.holidaycoro.com/Hardware.asp, item #30.

- **RGB Light Modules** – Our testing has found that three RGB modules, each containing three 5050 RGB LEDs (a total of nine 5050 LEDs) works ideal at lighting the 6" globe.  In general, any basic RGB module less than 4" in length will work.  You can purchase LED modules from the following websites:

  http://www.holidaycoro.com/Hardware.asp (item #56)

  or

  http://cheapdmx.com/products-page/leds

  or

  http://www.aliexpress.com/fm-store/701799/209889132-291745854/Waterproof-RGB-LED-LED-Module-3-pcs-5050-SMD-RGB-LED.html

- **3 Channel DMX Controller** – The ideal DMX controller we selected for the MegaBall is very small, doesn't require you to open the ball to program the DMX address, is inexpensive and extremely robust.  You will require one controller per MegaBall.  You can purchase this controller from the following websites:

  http://www.holidaycoro.com/Hardware.asp (item #26)

  or

  http://cheapdmx.com/products-page/dmx

  or

  http://www.aliexpress.com/fm-store/701799/209915969-307297826/DMX-512-Module-decoder-DC12V-input-P-N-LN-DMXMODEL-3CH-12V.html

- **3 Channel DMX Controller Programmer –** There are two methods to program the address on the 3 channel – PC based and a standalone programmer.  The standalone programmer is useful if you don't have a Windows or Mac PC or you would like to program the MegaBalls when they are in your display.  The software based programmer runs on the Windows PC and Mac (not supported) platforms.  You can program the modules with either our USB programmer or if you have an LOR USB adapter, you may be able to use that also.  For additional information on the software programmer, see our documentation here:

  http://www.holidaycoro.com/docs/DMXProgrammer.pdf

  The based software programmer cable can be purchased here:

http://www.holidaycoro.com/Hardware.asp (item #54)

You can purchase the standalone programmer from the following website:
http://www.aliexpress.com/fm-store/701799/209915969-307319323/DMX512-Dditor-for-setting-DMX-address-P-N-LN-DMXID-EDTIOR.html
As this programmer contains DMX standard XLR jacks, you will need to build a XLR to CAT5 adapter cable.  You can purchase a standard CAT5 cable and this XLR plug:
http://www.monoprice.com/products/product.asp?c_id=104&cp_id=10424&cs_id=1042405&p_id=6210&seq=1&format=2
The wiring diagram for the adapter is as follows:
- o   RJ45 Orange to XLR Pin 2 (this is the blue wire on the DMX controller)
- o   RJ45 Orange/White to XLR Pin 3 (this is the red wire on the DMX controller)
- o   XLR Pin 1 (ground) not used (this is the black wire on the DMX controller)

- **Power Supply** – While you can use any 12v power supply that can provide 45 watts of power, we recommend the following  12v 45watt power supplies.  They have short circuit, over current and thermal overload protection all in a small waterproof sealed package at a very economical price.  Due to limits in the current carrying capicity of CAT5 cable, we only recommend connecting 10 MegaBalls in series which equals about 40watts of power.  You can purchase these power supplies from the following websites:
http://www.holidaycoro.com/Hardware.asp (item #55)
or
http://cheapdmx.com/products-page/power
or
http://www.aliexpress.com/fm-store/701799/209855560-301813985/waterproof-switch-mode-power-supply-90-250VAC-input-12V-45W-output-P-N-NV1245C.html
- **Splitter** – Connecting each MegaBall from one to another you will be bringing two CAT5 cables from each of the ajecent MegaBalls to the input of a MegaBall.  You will need one spitter per MegaBall.  We recommend ordering one extra as a spare.  Spiltters can be ordered from MonoPrice here:
http://www.monoprice.com/products/product.asp?c_id=105&cp_id=10513&cs_id=1051304&p_id=1112&seq=1&format=2
- **Cap/Topper** – In order to form a waterproof connection around the lip of the Acrylic Globe and to provide a mounting location for the controller, you will require one cap per MegaBall.  You can purchased them from HolidayCoro here:
http://www.holidaycoro.com/MegaBall.asp (item #27)
- **Zip Ties** – You will need standard zip ties to provide a strain relief for the cables attached to the power supply.  Any 4" or greater length zip tie will work fine.  A black color is recommended.  8" Zip-Ties can be purchased from MonoPrice here:
http://www.monoprice.com/products/product.asp?c_id=105&cp_id=10520&cs_id=1052001&p_id=5761&seq=1&format=2

- **Old 110v AC power cable** – Used to provide power to the power supply.  Any old left over cable from a computer or lamp will work fine.
- **Plastic bag** – A zip-lock or similar type bag used for sealing the CAT5 tee connection.
- **Shrink wrap tube (optional)** – When splicing the power cable onto the power supply, the ideal solution is heat shrink tubing but electrical tape or lots of hot glue can also be used.

# Tools Required

The following is a list of tools necessary to build the MegaBall using the parts listed in the above section.

- **Soldering iron/gun and solder** – Any basic soldering iron will be sufficient.  The soldering iron will be used to attach the CAT5 cables and RGB modules to the controller.
- **Glue gun and glue sticks** – Most any glue gun and glue sticks will work for this project.  Glue guns can be found at Wal-Mart or big box hardware stores and usually are less than $10.
- **Knife or CAT5 cable stripper** – This will be used to remove the sheath covering over the CAT5 cables.  We HIGHLY recommend he MonoPrice cable stripper, product #3354 which perfectly removes and cuts CAT5 cable sheath.
- **Nippers/Dikes/Wire Cutters** – Used to cut and strip theCAT5 and RGB module wire.
- **Small Phillips screw driver** – Used to remove the controller from the plastic box and screw in the provided screws for attaching the cap to the globe.
- **1/8" Drill bit and Drill** – Used to drill the pilot holes for attaching the cap to the acrylic dome.

# Building the Power Injector

The MegaBall design used here allows a single CAT5 cable to not only carry the signal (orange wires) but also for the remaining three cables (brown, blue, green) to carry the power for up to 10 MegaBalls on a single sequential run.  To provide the power for the MegaBalls, you will need to make a power injector. This puts power on the three pairs of power wires within the CAT5 but also at the same time it passes the DMX signal through the cable.

1. First solder a standard 120v plug and cable to the end of the sealed power supply.   Just apply a little solder to each bare wire, put on the shrink wrap tubing and then solder the wires together.  Using shrink wrap tubing helps to ensure a safe connection (see photo to right) though you could use electrical tape over the solder joint.



2. Take a CAT5 cable (length depends on your needs, we recommend about 8-10ft) and about 2ft from one end of the cable, remove about 2 inches of the sheath.  This can be accomplished using either a knife or CAT5 cable stripped.  See to the right for the removed section of sheath:
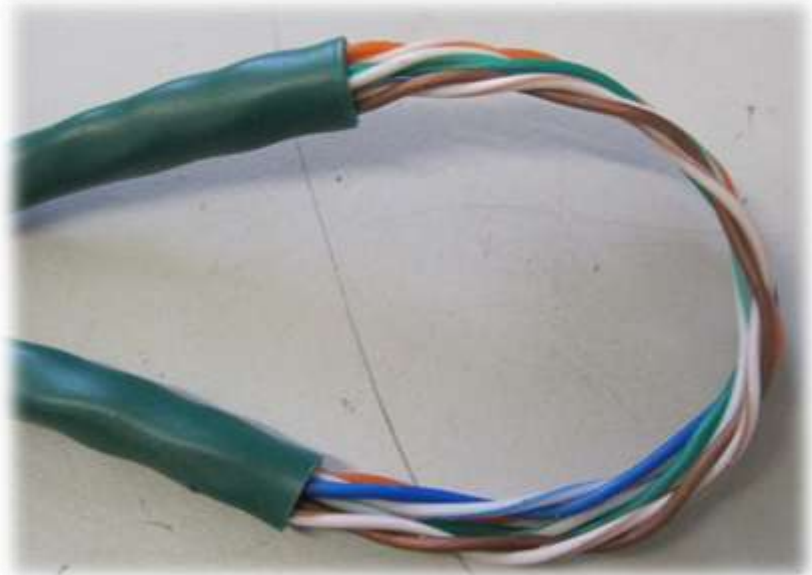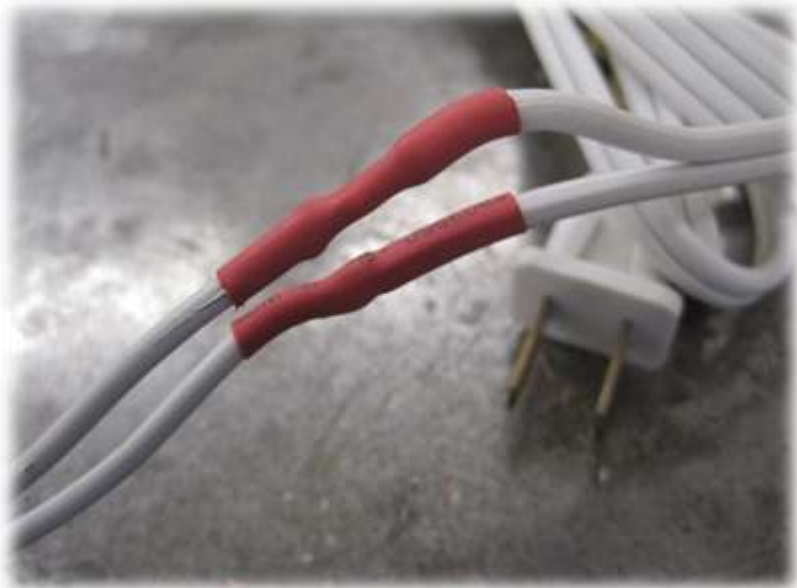
3. Next, **without** cutting the orange and orange/white wires – cut the remaining other pairs (green, brown, blue) in the middle of the section of cable with the removed sheath as shown in the photo to the right.



4. Un-twist all the wires and then strip off ½" of the insulation off each of the wires.  Twist all the solid



color wires (green, blue, brown) together and then twist all the striped wires together (green/white, blue/white, brown/white) so that all the ends of the wires are touching each other as shown to the left:

5. Apply solder to the ends of the CAT5 cable to "tin" them.  Take the output cable from the power supply (the end with the red and black wires) and slide shrink wrap over the bare wires and then slide it out of the way so that you can now solder the CAT5 cable to the power supply wires.   You should have four grouping of tinned

wires – take the pair from the longer cable and solder the black from the power supply to the solid color blue + green + brown wires and solder the red wire from the power supply to the blue/white + green/white + brown/white.  Put the shrink wrap over the



two soldered junctions and shrink as shown in the photo above.

**LONGER END OF THE CAT5 CABLE** = Power Injection Output / DMX Output Side (to MegaBalls). Mark this end of the cable (bright tape, label, etc) to indicate this is the power output side.

**SHORTER END OF THE CAT5 CABLE** = DMX Signal Input Side (from DMX Controller or other DMX Devices)

6.  Next, using some large wire ties (6" or more), attach the cables to the power supply to form a strain relief.  Using your hot glue gun, apply hot glue over the remaining, unconnected grouping of wires from the short end of the CAT5 cable, over the zip ties and over any exposed wire connection.  This will serve to seal up the exposed connections, making it water proof.



7.  Your power injector is complete.  We HIGHLY recommend that you apply a marker or some other indicator (we use fluorescent pink tape) to the long end of the CAT5 cable that has power output (the end that was wired to the power supply.)  The power output side will provide power to the entire chain of MegaBalls until it "hits" another power injector for another 10 balls.

**Make sure to NEVER plug the powered end of the CAT5 power injector into another type of controller, adapter or dongle as it could, in certain circumstances, damage the controller depending on it's internal wiring.**

# Building the RGB MegaBall

Building the power supply first will allow you to test each of your MegaBalls as you complete them.  So, now onto building the MegaBall:

1. First we will start by attaching the CAT5 cable that the MegaBall will hang from and get its DMX signal and power from.  Take one of the black CAT5 cables and measure out the length of cable you need from the top of the ball to where the "T" splitter will be.  Add about 4" to this length and then cut the cable leaving one end of the cable with the male CAT5 connector.
2. Thread the cut end of the CAT5 cable through the top of the cap from HolidayCoro – the top is the non-dished side.
3. About 2 to 3 inches from the end of the cable, tie a knot in the cable.
4. Using a knife or a CAT5 stripping tool, cut off about 1.5 inches of sheath from the CAT5 cable.
5. Un-ravel each of the CAT5 pairs (there are four of them) and then strip the insulation from all 8 wires so that about ¼ of an inch of exposed copper wire remains.  Your progress to this point should look about like the photo to the right.
6. Just like the power supply, twist all the solid color wires (green, blue, brown) together and then twist all the striped wires together (green/white, blue/white, brown/white) so that all the ends of the wires are touching each other and then solder them together.  Also apply a small amount of solder to the orange and orange/white wires.  Trim and excess length so that only about 1/8" of exposed wire that has been soldered remains.
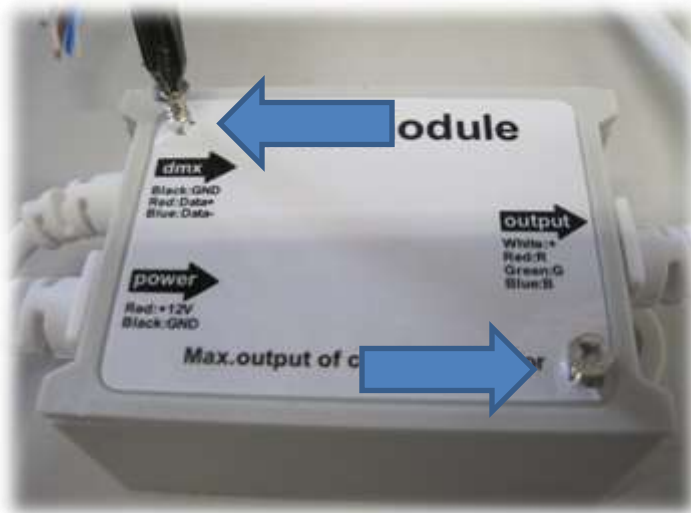
7.  Now we need to remove the DMX controller from its plastic box.  Using a small Phillips screw driver, remove the two screws from the top of the box.  They are located as shown in the photo to the left, under the label.  After the lid is removed from the box, just slide out the controller from the box.  You should now have just a controller with wires.  Throw out the box and lid as they will not be required.

8.  Next, using your soldering iron, you will remove all the soldered wires on the controller, leaving a bare board as shown to the right.

9.  Now you will need to solder the LED modules onto the DMX controller board.  One word of caution – there is no "standard" wiring color for RGB modules.  You will need to look closely at the RGB module where the wires come into the circuit board to determine the wiring colors.   In the example below, we lucked
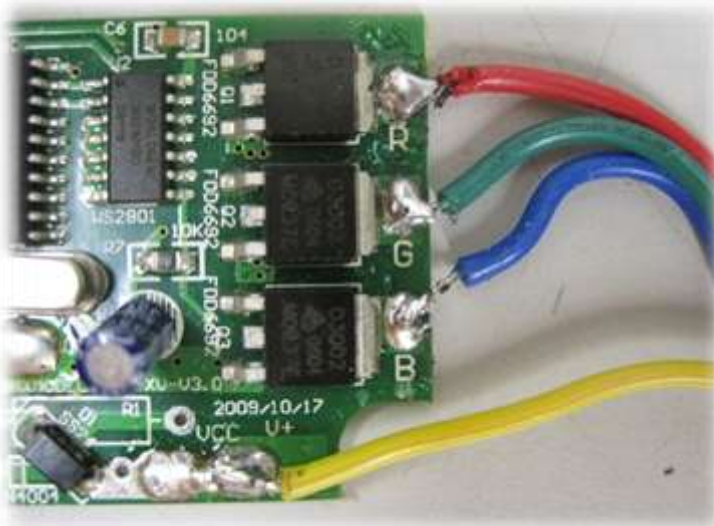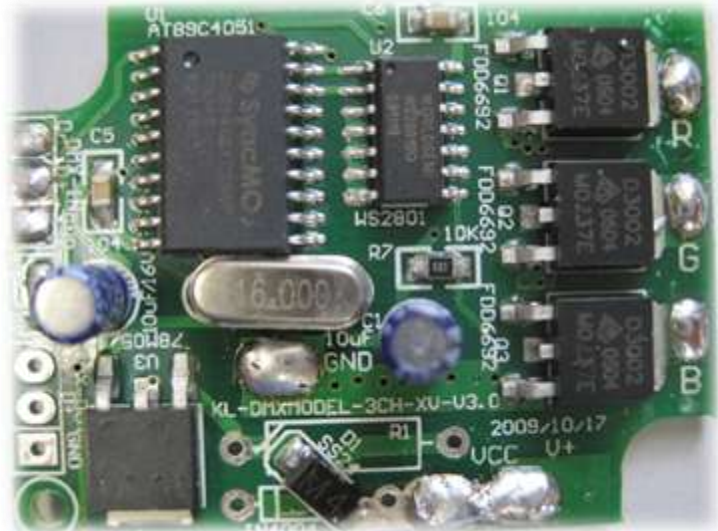




out and have the V0 which is common positive/anode, R0 which is red, G0 which is green and B0 which is blue.   Match up each of the Red, Green and Blue wires to the "R", "G" and "B" wires on the edge of the DMX controller.  Then wire the common anode/positive to the "V+ / VCC" on the bottom right corner of the board.  The completed controller board with the RGB modules should look like the photo to the left.

10. The final soldering will be the DMX signal and power wires from the CAT5 cable to the DMX controller.  Starting with the upper left corner, you want to solder on the Orange wire to the circuit board pad "D-" and then the Orange/White wire to the circuit board pad "D+".  The circuit board pad "GND" does not have a wire.  Next, Solder the solid colored wire budles (brown, green, blue) to the blob of solder toward the center of the circuit board right below the silver oscillator that has "16.000" printed on top and "GND" to the right.  Solder the remaining
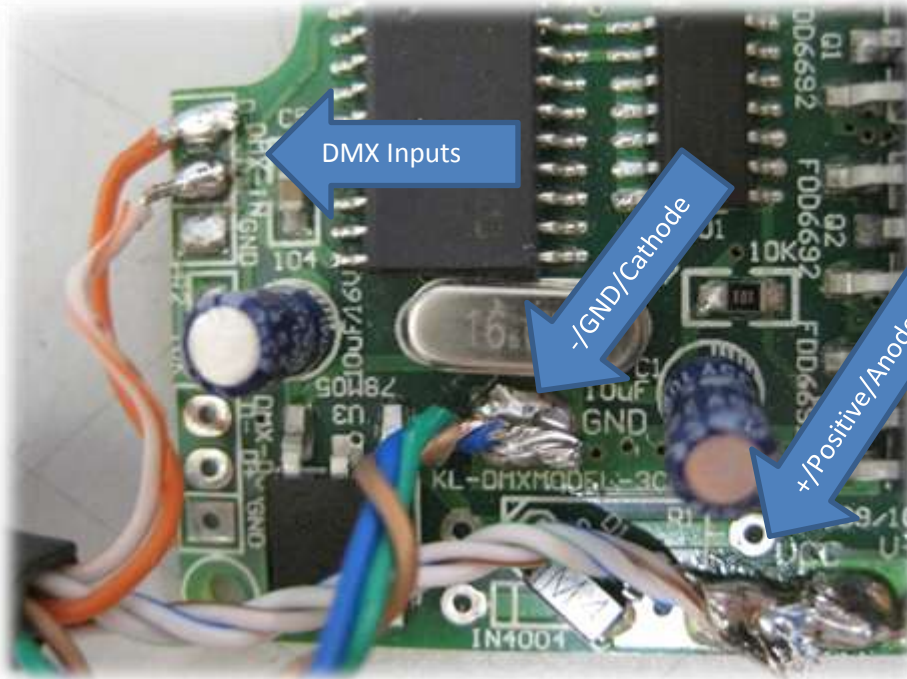


bundle of wires right next to the RGB module positive/anode wire, right below the "VCC" label as shown in the photo to the left.  You have now completed the soldering and wiring on this controller.

11. Warm up your hot-glue gun.  Flip over the cap and apply a liberal amount of hot-glue around the base of the knot and hole and then the bottom of the hole in the cap. Fill the slot in the bottom of the cap with hot-glue until it is filled to the level of the bottom of the cap. Before the hot glue hardens, insert the circuit in the slot as shown in the photo to the left – making sure not to block the edges of the cap. You may need to hold the circuit board in place for 30-45 seconds until the hot-glue sets up.
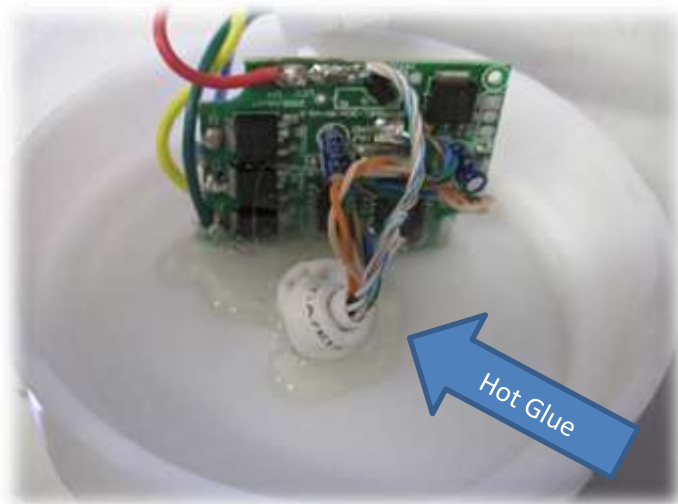
12. Put a moderate amount of hot glue around the top of the cap where the CAT5 cable enters the cap. Hold it there for about 30 seconds or until the hot-glue has setup. It should look like the photo to the left.

13. Using the hot-glue gun, glue the modules in a "T" fashion to each other so that they appear as shown in the photo below.



14. You are now ready to assemble the globe to the cap. Using a 1/8" drill bit and a drill, place the cap over the globe and while holding the two parts in place, drill a hole in the cap rim at the bottom about 1/8" from the very bottom of the cap. **BE CAREFUL to not over-drill into the circuit board on the inside.** To make spacing out the 3 required holes, we have placed little "notches" along the edge of the cap which are each exactly 1/3 of the way around the base. We recommend drilling the hole just to the right of the notch. **Complete only ONE hole** first and then insert one of the self-drilling Phillips screws into the hole and using a hand screw driver, screw in the screw until it is flush with the edge of the cap – be sure not to over

tighten the screw. Putting in only one screw will index it so that the other holes will line up later.

Complete drilling the remaining two holes and then install the screws in the two holes. Your globe portion is now complete – see the photo to the right for an example of a screw prior to being completely screwed in.

15. Using one of the CAT5 female tee connectors, plug the globe into the single end of the tee.  Take one of the plastic bags and cut off the corner edge, leaving a hole about ½" wide. Insert the two globe-to-globe cables (length varies depending on your globe-to-globe spacing needs) into the bag so that the ends are inside the bag. Now plug the two cables into the CAT5 tee on the end of the globe CAT5 cable plugged into the tee in the prior step. Using a tip tie, close off the top of the plastic bag around the cable and then again using another zip-tie below the globe CAT5 cable.  The bag provides waterproofing for the CAT 5 cable but still allows it to be disassembled and the length changed if needed.  The final completed connection should then look like the photo to the right.



16. You can now connect the power output side of the power transformer (the end with the marking/tape) to another CAT5 tee and then plug in the cable coming from the first globe in the string.  Alternatively you can directly plug in the output of the power transformer into the first globe.

17. Your completed globe should look like the sample to the right.

18. When you apply power to the controller without a DMX (or DMX keep-alive) signal present, it will fade thorough the different colors.

# Hints, Suggestions & Alternatives

The following are a variety of hints, suggestions and alternatives:

- When we designed the interconnection system for the RGB MegaBalls, we made an effort to make it as simple as possible and with as little soldering as possible.  We also wanted a system that could be versatile enough to meet each individual's needs, such as the spacing between globes.  As such, we felt the CAT5 Tee connections were the best and most affordable solution.  They do have a draw back in that they add about a dollar to each tee connection and they require waterproofing.  If you have the necessary skills and you do not require the ability to disassemble the globes from a single string, you can also splice the globe cables directly into the CAT5 cable, saving about $1.50 to $2 per globe at the expense of time and flexibility.  Be sure to program the start address of the DMX controller prior to permanently attaching all the MegBalls.
- If you have sections of RGB strip instead of RGB modules, you can use these instead of the modules.
- As of July 2011, Light-O-Rama has announced that they will be offering an inexpensive DMX controller for use with their new LOR S3 software in the 3$^{rd}$ quarter of 2011.  This allows is a much cheaper solution than using the iDMX-1000 converter box.  When this product is released we will be updating our instructions to reflect connections with the RGB MegaBalls.