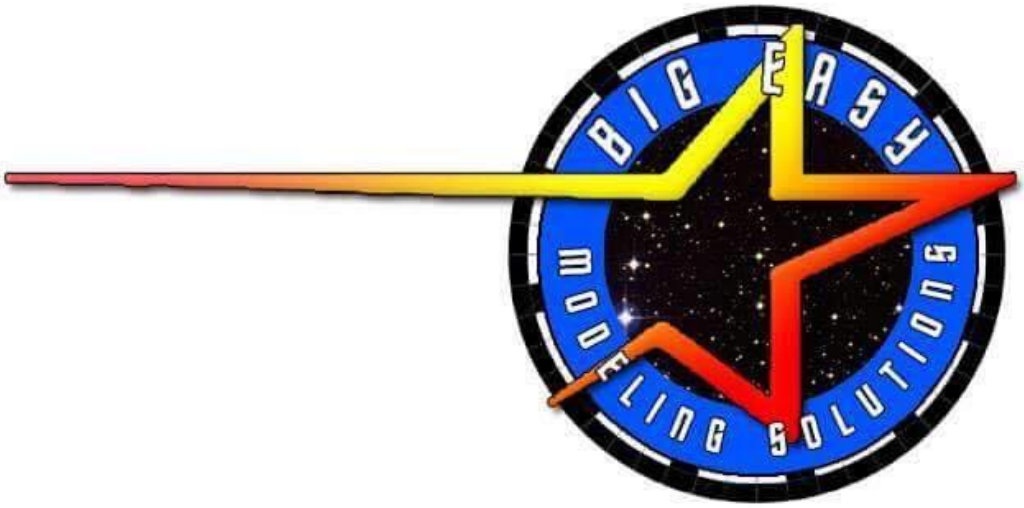
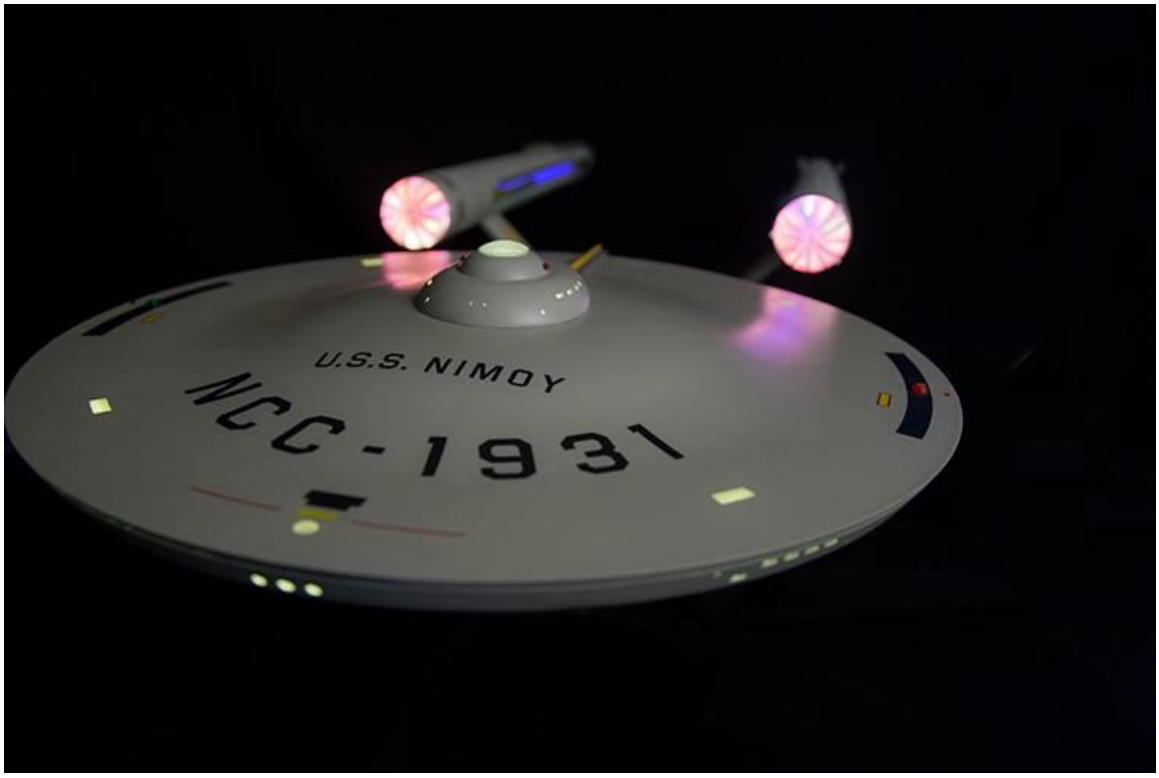



## Big Easy Modeling Solutions Presents:

# 1:350 TOS MICRO SERIES BOARD™



# INTRODUCTION

Welcome to Big Easy Modeling's lighting kit for the TOS Starship model kit! In purchasing this kit and the effects board it is designed for, it can be assumed you're building a very serious model requiring countless hours of work and planning and building and, most of all, FUN! And you're likely looking for a very accurate representation of the beautiful Enterprise as she appeared on the original television show or, in some cases, your own version of the Grand Lady! We're here to help you in the process so you can hopefully have less aggravation and more "WOW!" as you assemble this wonderful model.

This model kit is one of the most challenging and involved kits a modeler can face, especially when it comes to lighting, so make sure to follow all steps carefully and test all connections as you go.

The manual that follows is designed to help you easily install and connect all the lighting you need to make your model stand out. We've taken great consideration to make this kit as easy to install as possible, though some soldering will be necessary to get the results you want. Basic soldering skills are assumed with this kit, but if you need help or are not as experienced, feel free to contact us at Big Easy and we'll do our best to assist you! We are confident that anyone can learn the skills necessary to make this lighting kit work for your build and we'll help you in any way we can!

This manual is intended to be a usable reference for how the lighting kit is designed to work with the JAZZ MICRO TOS Series effects board. It is not the ONLY way to do things and you, as the builder, are perfectly welcome to deviate and experiment with your own version of lighting the Big E. (ONLY recommended for experienced builders) However, we do caution against using other materials (such as LED's, wires, resistors, etc) not included with this kit as you may damage the lights you're using or, worse, the board itself. Big Easy Modeling Solutions claims NO RESPONSIBILITY for any damage caused by incorrectly using the supplied products or any damage caused by using materials other than those included in this kit.

*Note: using materials or components other than those included in this kit may void your warranty on your product!

# HOW TO USE THIS GUIDE

This guide is presented in a format intended to be easy to decipher for the intermediate to advanced model builder who is passably familiar, at least, with lighting diagrams and electrical current flow. For the beginner, this kit is certainly usable! But you might want to take some time to gather some information and familiarize yourself with basic terminology and knowledge on electrical diagrams and current. This is especially true if you intend to deviate at all from the instructions for this kit.

The guide is presented in an "easy-to-read" format where the builder can simply solder the string of lights, as marked, and connect them to the color-coded terminal points, as marked. However, to ensure better connections, it is HIGHLY RECOMMENDED that the model builder solder the connecting wires together whenever possible! Terminal connections may not always be absolutely secure. Twisting the ends of wires together may also create some issues getting good connections. It is much more preferable to solder the end connections together whenever possible before inserting the wires into the corresponding terminal points. If connecting only a single wire, particularly wire wrapping wire (thin shielded wire) or magnet wire (thin coated wire), we recommend making a tiny "hook" by carefully curving the end of the wire back on itself to fit into the terminal. This helps to hold the wire in place so it doesn't slip out of the screw lock.

Ultimately, it's up to you, the builder, to choose how best to secure your wiring. We've made every possible attempt to make this process as simple as possible for builders of all levels. But you must choose the most secure method you prefer for your building style to ensure the best, lasting connection. We will make suggestions in the guide to help whenever possible/necessary.

There may be some times when a group of wires do not easily fit into a terminal, particularly on the main board. You may choose to make a "ponytail" by bringing together all the wires for that terminal and soldering them together or using a wire nut with a single short additional wire leading out which will connect to the terminal and supply current to all the connected wires. Instead of, say, 4 wires going into one terminal, you now have only the one.

*A note on magnet wire and/or wire wrapping wire: Many of the solutions used for wiring LED's in this kit involve the use of magnet wire or wire wrapping wire, both a form a thin, highly conductive wire used to reduce the visible profile of standard 24-28 gauge wire inside the model. Magnet wire is wonderful stuff! But, it's also thin and potentially fragile. Pieces prewired with magnet wire (red and green in this kit) should be handled delicately so as not to damage the connections. Also note that, while all magnet wire pieces included have been prepared for connection, magnet wire can be a bit challenging to "strip" to prepare for proper connection. If your prewired LED's with magnet wire don't seem to be functioning, please double check to make sure the colored wire shielding has been stripped away at its connecting point and, if not, carefully use a #11 hobby blade to scrape away any shielding to expose wires as necessary.*

# Getting Started

So you're ready to embark on your mission? Ok, the first step is to check the contents of the kit to make sure you have all included parts. There may be some modifications necessary to the model kit to accommodate lighting and wires you will need to make before completing installation. If so, you will need different tools to complete the various modifications. We recommend using a rotary tool such as a Dremel for the majority of them, but you should also need a drill or pin vise and a jeweler's file.

Here is a useful chart for non-metric drill bit sizes to accommodate standard size LED's if you need to change any mounting hole sizes:

**1.8mm/2mm LED = 3/32" Drill bit**
**3mm LED = 1/8" Drill bit**
**5mm LED = 13/64" Drill bit**

***WE ALSO RECOMMEND MARKING THE INSIDE OF THE MODEL DESIGNATING WHERE YOU WILL BE INSTALLING LED'S.***

## Tools Needed:

- Jeweler's standard (flat head) screwdriver.
- Low Temp hot glue gun. (optional to secure wires
- Wire snips and wire stripper
- Soldering iron with 60/40 rosin core solder

# Soldering an LED

We realize not everyone has experience with electronics and, in particular, using a soldering iron. So the Big Easy team thought it would be a good idea to include a little basic tutorial here to make this process simple for you. With just a little bit of practice, you can solder an LED like the pros! Let's check it out… (if you're familiar with this technique, feel free to skip to the next section)


Obviously, the first thing you'll need is an LED and a resistor. For this example, we're using a 5mm Cool White LED and a standard 470 ohm resistor, like most of the resistors included in your kit. These resistors are designed for a 9V or 9V power source. Use a resistor calculator (or "Ohm's Law") for help in finding out which ohm rating you need for your power source if using something different. Your kit comes with appropriate resistors for the included power source. (Deflector/Impulse resistors may be different as those effects connect to a 5V terminal instead of the higher 9V or 9V)

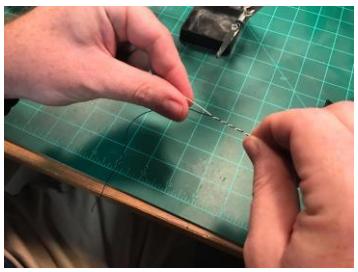
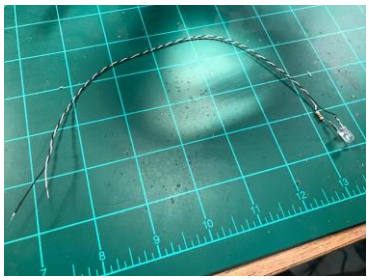
Notice on your LED that each has a long metal lead and a shorter one. In almost all cases, the longer leg is positive and the shorter leg is negative. Also, on 3mm and 5mm LED's, there is a noticeable indentation on the very low ring around the base of the bulb on the negative side. These will help you know which lead is which.

The first step is to wrap one metal lead (leg) of the resistor around one lead (leg) of the LED. NOTE: It does not matter which leg of the resistor goes on the LED leg as resistors are not polarized. Also NOTE: The resistor can be put onto EITHER leg of the LED. However, we strongly recommend always choosing the same one. (we tend to choose positive, as shown, because that's how we were each taught, but it doesn't matter) The reason to always use the same leg is so that, once you clip off any excess metal on the leg of the LED, you'll still know positive from negative.

# Soldering an LED (pg2)


Next, slide the coiled resistor up the LED leg a bit and apply the solder by touching the iron and the tip of the solder coil to the wrapped resistor. For most LED's, you should keep your soldering iron from 335˚C to 400˚C. Leave just enough solder to secure the two wire leads together. Then trim the excess wire from the LED leg and the resistor leg, making sure not to cut into the solder itself and separate the two again.

Next, repeat the same process with the wire by coiling about a cm of exposed (stripped) wire around the other end of the resistor and adding solder the same way. Then repeat this step for the negative wire and LED leg. (NOTE: you only need a resistor on one LED leg) Again, trim off any excess LED leg metal.

Finally, twist your attached wires tightly for a tidy finish, strip off a little shielding at the end of the wire, and you should be done! Test your LED by connecting the negative wire to negative on your power source and positive to the positive. (in this case, 9V-9V) If you see light, you've got it right!

# Soldering an LED Strip

LED strips are convenient for several lighting needs! They are prewired with resistors to operate at 9V – 9V and may be cut every third LED into smaller strips. However, when cutting the LED strip, you must add solder to the connection points on the strip. This process is actually fairly simple and, since you don't need a resistor for the strips themselves, it is a fast and easy process.

Notice that at the connection points, there is a positive side and a negative side. This is where we will add some solder before attaching the wire. (called "tinning" the solder point) Again, touch the solder coil and soldering tip together to the copper solder points, not just the iron tip with solder on it. "Drag" the melting solder from the solder coil onto the copper pads. You should have a small bead of solder at the point when finished.

Next, strip off only about a half a millimeter of wire to attach to the points. Simply touch the iron tip to the solder point to re-melt the solder and slip the exposed wire into it and remove the iron, holding the wire still a second or two until the solder hardens. Repeat the process for both positive and negative contact points. That's it! It's wired!

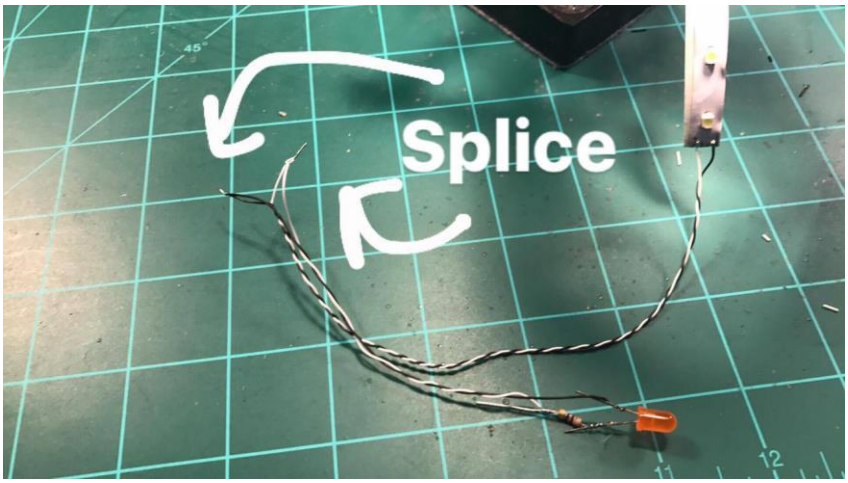
NOTE: If your kit included waterproof LED strips with the protective coating, simply use a razor and cut the coating right past the solder points and peel it off, revealing the solder points underneath. There is no need to completely remove the coating.

# Wiring tips and tricks

"How do those pro and advanced builders get such tidy wires without a rat's nest?" We hear this question a lot. The trick is learning to be efficient with your wiring. It's also important to understand current, voltage, and terms such as "common ground," "common positive (hot)," and other terms and concepts such as voltage drop. For our purposes, we'll focus on "common" connections. This concept basically uses the idea that you can connect either a positive or negative leg of one LED (with proper resistors) to another one on the same wire and terminal and they'll share the terminal's function. For the Tier2V2/TOS kit, most of the effects terminals are negative. (you'll connect the negative wire of the LED's to this terminal to get the effect and the positive to the 9V terminal) This means that, while different LED's in one section may all be on separate effects, they can share one common 9V positive wire. This means, if you plan out your wiring carefully, almost all the LED's in, say, your saucer section can have one positive wire spliced from each LED and strip to the next with only a single positive wire having to go back into the 9V terminal instead of all of the positive wires from each LED. Talk about a space saver!

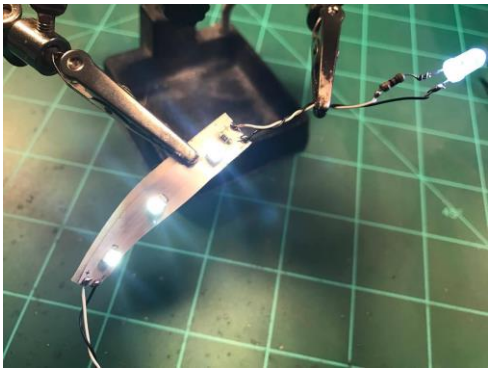
The negative wires will each go to their respective effects terminal. But you can share the wires from each effect as well if multiple LED's have the same effect. (for example, each NAV light can share one negative wire) Then you can do the same for shared strobe (STR) lights, for instance.

To achieve this "common" wiring, you will need to learn how to make a "splice" and a "pigtail" with your wires. A splice is simply twisting two exposed sections of wire together and soldering them together. You can also twist the two wires together, then around an LED or resistor leg to have two wires attached to that leg, one that can go back to the terminal and the other to the next LED or strip. (NOTE: Each LED will still get its own resistor!) That basically makes it where the two wires are joined together to become one common wire. You'd simply connect the positives of each splice to the next LED positive leg and splice another there to go to the next.



A “pigtail” is similar to a splice except, in this case, we’ll twist multiple (common positive, for example) wires together from several LED’s with one additional wire attached to go back to the terminal. That way, instead of trying to fit 10 wires into one terminal, you can simply have one. You will likely want to cover up the splice point of the pigtail with electrical tape or shrink tubing to avoid any possibility of crossing other wires and causing a short.

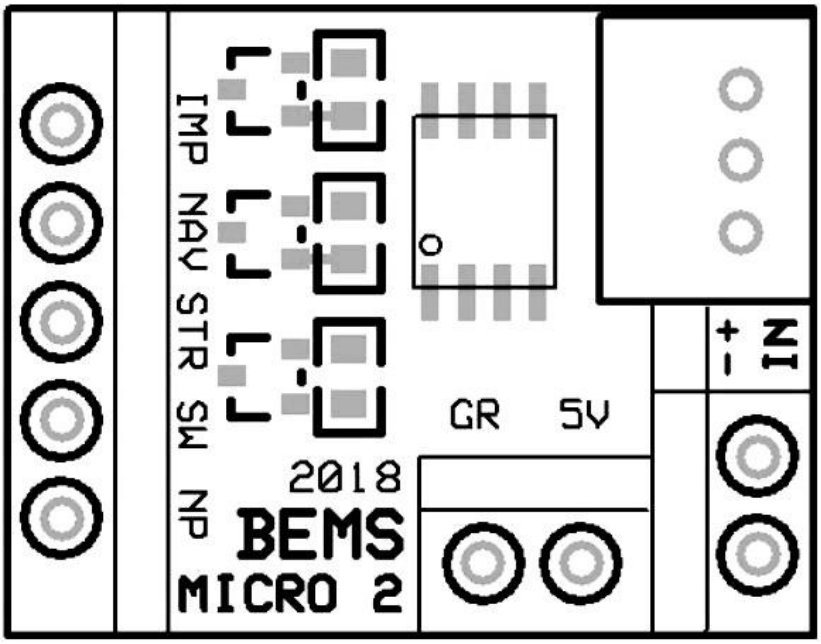

One more trick is using LED strips as a contact point for other LED’s. (as long as either the positive or negative wires or both connect to the same voltage and effects terminal) In the picture below, you can see where an LED has been attached to the LED strip on the contact points opposite of the wire end. The attached LED will behave with the same effect and button functions as the LED strip it’s attached to.



We hope some of these tricks make sense and help you with your wiring to keep things neat and tidy! Feel free to practice with spare LED’s and strips, if you have some. The more you do these steps, the easier it gets!

# Board Layout

To begin, let's have a look at the board layout. The diagram below should line up with your BEMS MICRO Series TOS Effects Board. The terminals each have an effect assigned to them and your LED's will and switches will connect using the screw terminals by simply inserting the stripped wire into the terminal and then tightening the screw down in place to secure the wire in the terminal. You may find it best to make a hook with the end of the wire when inserting it into the terminal so that it's "double thick." That will help the terminal have more to secure to. Also note that the polarity of the output terminal will be different for some effects.




## 1:350 TOS MICRO Series Terminals

| TERMINAL | EFFECT | POLARITY/CONNECTION |
|---|---|---|
| IMP | IMPULSE ENGINES | NEGATIVE to LED'S |
| NAV | SAUCER NAVIGATION | NEGATIVE to LED'S |
| STR | STROBE LIGHTS | NEGATIVE to LED'S |
| SW | SWITCH – BUSSARD NEOPIXEL SPEED CONTROL | SWITCH WIRE 1 HERE SWITCH WIRE 2 to GR |
| NP | BUSSARD PROGRAM | YELLOW WIRE FROM BUSSARD RINGS HERE |
| GR | GROUND IN/OUT | GROUND (-) FOR INTERIORS AND NEOPIXEL RINGS |
| 5V | 5V VCC OUT | 5V (+) FOR NEOPIXEL RINGS |
| -IN/GR | GROUND IN/OUT | MAIN GROUND (-) INPUT |
| +IN/9V | 9V IN | MAIN 9V (+) INPUT |

# Board Layout Description

**IMP - IMPULSE ENGINE** –) This terminal controls the basic impulse engine effect. Connect the NEGATIVE leg of your impulse LED's (with proper resistor) to this terminal using ORANGE WIRE. The POSITIVE leg (WHITE WIRE) of the impulse LED's will connect to 9V.

**NAV – NAVIGATION** - This terminal controls the starboard and port navigation lights on the sauce. Connect the NEGATIVE leg of your strobe LED's to this terminal using GREEN WIRE. The POSITIVE (with proper resistor) leg (WHITE WIRE) of the LED's will connect to 9V. These are timed to the classic TOS studio model.

**STR – STROBE LIGHT** - This terminal controls the faster strobe lights on the saucer behind the bridge and on the rear of the nacelles. Connect the NEGATIVE leg of your strobe LED's to this terminal. The POSITIVE (with proper resistor) leg of the LED's will connect to 9V.

**SW – BUSSARD SPEED CONTROL SWITCH** – This terminal controls the switch for the bussard speed control. In connecting this switch, you can choose the speed of the rotation of the LED's in the bussard caps. There are 5 speeds. The default speed is middle speed (3) and is the speed that automatically comes on when the board is powered up. If you do not want to change the speeds, you can simply leave the switch disconnected and the speed will always come on at the default speed. To connect this switch, connect one pole on the switch to this terminal and the other to GR.

**NP – BUSSARD NEOPIXEL PROGRAM** – This terminal controls the program for the bussard NeoPixel Rings. There are four wires from the bussard rings. The YELLOW wire will connect to this terminal. More information on the bussard NeoPixel ring connection follows in a later section.

## TOS Bussard NeoPixel Rings

To connect the bussard NeoPixel Rings, find the wires coming off the rings. Note that the starboard ring has 4 wires and the port ring has only 3. Begin by running all of the wires to the central point in the secondary hull. You can then twist and solder the wires together by color. (except the single YELLOW wire) The RED wires will connect to the board's 5V terminal. DO NOT connect it to 9V or you will damage the rings! Connect the BLACK wires to GR on the main board. Connect the YELLOW wire (only one of these) to NP on the main board as shown above. Finally, leave the BLUE wires twisted and soldered together, but cap them off with electrical tape or a small wire nut or other shielding method that will keep them connected, but protected from shorts or connections with other wires or lights. The BLUE wires DO NOT connect to the board at all, only to one another.

# SAUCER TETHER UPGRADE

## TERMINAL CONNECTIONS

If you purchased the lighting harness upgrade, this section details how to connect and use the harness. Run the terminal umbilical cord marked "SAUCER" into the saucer through the neck and connect it to the MICRO board using the wire tags as a guide. Connect the JST connecter to the terminal block connector. Below is a list of color coded wires and functions for each and where they connect to the primary MICRO board.

- White Wire – 9V **(9V)** ***for strips and LED's only! Do not connect nacelle cap rings to 9V!*** use 9V Terminal
- Black Wire – Ground **(GR)** Use for all interior strips and static lighting negative
- Orange Wire - Impulse Engines **(IMP)** Impulse Engine Negative
- Green Wire – Navigation **(NAV)** Saucer Navigation Light Negative

Using the provided terminal umbilical cord marked "SAUCER," connect each light in the saucer section to the screw terminals by loosening the screw above each terminal, inserting the bare wire lead into the corresponding terminal, (wire colors should match unless otherwise marked) and then tightening down the screw to secure the wire into the terminal. Upon ***final*** connection, it is advisable to also hot glue the wires in place once secured into the terminals by placing a spot of glue at the point the wires go into the terminals. Also, you should hot glue the terminal block to the plastic on final assembly before sealing the saucer as well to ensure it doesn't move around inside the model causing damage or loose connections. Make sure all wires are connected correctly before securing with glue and closing the saucer section.

White Wire – 9V **(9V)** ***for strips and standard LED's only! Do not connect NeoPixels or rings to 9V!***
Black Wire – Ground (GR) Negative wire for all static lighting and interior strips.
Orange Wire – Impulse Engines **(IMP)** Negative wire for Impulse Engines
Green Wire – Navigation **(NAV)** Negative wire for Saucer Navigation Lights

## SAUCER TERMINAL BLOCK LAYOUT

| **9V** | **GR** | **IMP** | **NAV** |
|---|---|---|---|
| White | Black | Orange | Green |

# NACELLES

## LED RINGS

The forward nacelle caps (commonly referred to as “bussard collectors” or “bussard reactors”) are the focal point of the ship. We have designed special RGB LED rings using the latest technology. These rings run from a specific program from the main board and are linked together. The starboard ring will not work without the port ring also connected, though the port ring will work without the starboard. Placement of the rings in the housing should be done carefully. We recommend frosting the inner part of the front clear dome using your preferred method. If you’re using the inner dome with or without the fan motors, we recommend NOT frosting them, but painting the “spokes” either silver or a semi-transparent white or gray.

Whether using the inner domes or not, the distance from the front of the nacelle clear part will alter the effect somewhat, so try experimenting with how far into the housing the rings sit. If you’re using the motors, you may prefer them sitting a little farther back for both appearance and added clearance from the inner dome. If you’re not using the motors and/or inner dome, you might prefer them sitting farther forward for more clarity of motion and effects. The farther back they sit in the housing, the more diffused and “blended” the effects will appear. You may wish to add some bits of styrene behind the rings to seat them farther forward.

*NACELLE CAP – ring seating*

If you are using the fan motor upgrade, the motors we offer seat snugly, but perfectly into the center hole of the housing. It is best to install these before installing the rings. Some alterations to the clear inner dome piece may be necessary for fitting the dome to the motor mounting peg. To expand the motor connection stem on the clear dome, we HIGHLY recommend using a pin vise and gradually going up in bit size to find the right diameter. Using a Dremel here can cause the plastic to melt from friction, which can damage the part to where it won’t fit at all.

# NACELLE TETHER

The nacelles will actually be constructed around the terminal block harness as one of the final steps in assembly. Each nacelle has a slightly different terminal layout.

## PORT NACELLE TERMINAL CONNECTIONS

| GND | 9V | 5V | NPI | NPO |
|---|---|---|---|---|
| Black | White | Red | Yellow | Blue |

## STARBOARD NACELLE TERMINAL CONNECTIONS

| GND | 9V | 5V | NPO |
|---|---|---|---|
| Black | White | Red | Blue |

Connect the terminals from each component in the nacelles as marked.
**GND** – All negative/ground (-) **BLACK** wires will connect to this terminal.

**9V** – Strip lighting for the (optional) warp chillers connect here. **WHITE** WIRES ONLY!!!

**5V** – This is for the nacelle cap rings main positive. **RED** wires will connect here. Also, fan motors may be connected here unless using a separate switched terminal. (see **AUX**)

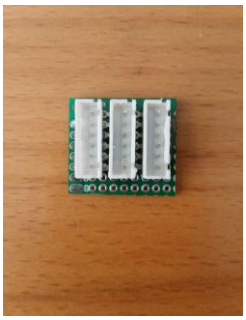
**RI** *(port side only)* – This terminal is for the ring input. **YELLOW** wire from the LED rings will connect here.

**RO**– This terminal for the ring output. **BLUE** wire from the LED rings will connect here.

If installing any optional static lighting, (for example, illuminating the nacelle end cap bubbles) connect positive to the **9V** terminal and negative to **GND**. Be sure you have proper resistors for any additional LED's you add.

# SECONDARY BOARD CONNECTIONS

For the secondary board, there are 3 white JST connection points. They may be used interchangeably. Each pylon terminal harness will connect. The other JST connector has loose wires which connect to the main board as marked and shown in the list below.



The two tethers with wire terminal blocks go into their corresponding nacelle pylons and to the nacelles. The third tether has loose wires which will connect to the board as follows:

**BLACK** wire will connect to the **GND** terminal.

**WHITE** wire to the **9V** terminal

**RED** wire to the **5V** terminal

**YELLOW** wire will connect to the **NP** terminal.

# MOTORS

## OPTIONAL BUSSARD MOTOR CONNECTIONS

If you're using the motor upgrades for the bussards, it's important to note a few things. First, the motors rotate from negative to positive with the flow of electricity. To get the motors to rotate in opposite directions (as seen in the show) wire one motor with the positive wire on the positive post and negative wire on the negative post on the motors and the other motor opposite, where the positive wire is on the negative post and the negative wire on the positive post. This will not damage the motor. But the motor wired backward should rotate the opposite direction. Motors should rotate inward from the top of the bussard. If facing the bussards from the front, the port side should rotate counter-clockwise and the starboard side clockwise. (note: occasionally, the motor manufacturer reverses the poles on the motor where you may have to connect both the same way to get them to rotate in opposite directions. Check your motor rotation before closing up the nacelles!)

To connect your motors, if you purchased the upgrade option, you have two options. One method is to simply use the existing nacelle tethers and connect the motors to 5V (positive, purple) and GR. (negative, black) This will give you about a 60 rpm rotation, which is a little faster than seen on the Smithsonian restoration, but is pretty close to the original studio model fan motor speed. If you're connecting the motors this way, note that you will not be able to vary the speed. If you find the motors to appear too fast, you can try adding a 100-360 ohm resistor to the positive leg of each motor to slow them down a little. (See what you like and use the same size resistor on both sides)

The second method is to use the motor speed control dial included with your motor upgrade. This method will give you much better control over the speed of your motors and allow you to adjust the speed anytime you wish. See the next section for connection instructions.

# MOTORS (CONT.)

## OPTIONAL MOTOR SPEED CONTROL DIAL CONNECTIONS

The speed control dial unit for the motors is separate from the Nacelle Tethers. To connect this unit, you will need to run two additional wires to each nacelle, one black GROUND wire (must be separate from the existing black GR wire on the tether) and one purple POSITIVE wire. (also must be separate from the 9V and 5V existing terminals on the tether) These will connect with your motors as marked. Pigtail these wires together in the secondary hull and splice them to purple and black wires run up through the mounting pole from the + (purple) and – (black) OUT on the speed control board. Then connect your + and – IN on the speed control board to your main 9V power in wire in your base stand. You can also connect to a 5V power source in the base if you have one for the sound. Be cautious if you use 9V as the motors are designed to run at 6V. You can turn the speed up on the control dial past a 6V setting, but it's not advisable to run the motors at a fast speed for extended periods of time.

For any questions, contact us anytime through our Facebook page or at:
www.bigeasymodelingsolutions.com
Thank you and happy modeling!!!