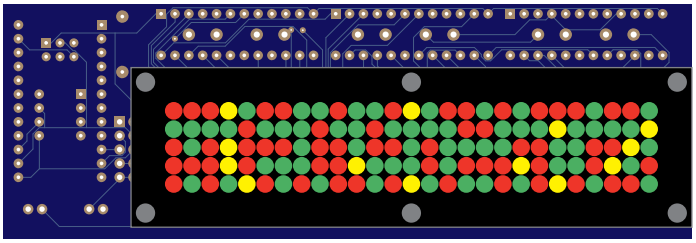
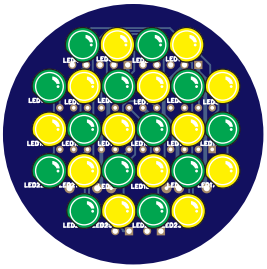
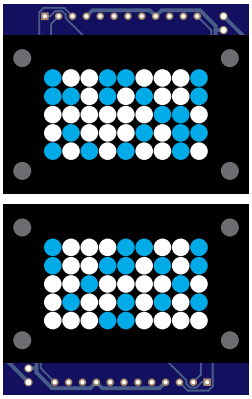
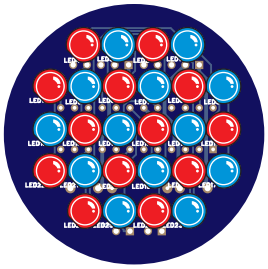
TEECES DOME LIGHTING SYSTEMS

This lighting system was designed by John V (Teeces) to be a simple, customizable, expandable and affordable solution for dome lighting. An Arduino micro-controller is used to tell LED driver chips which LEDs to turn on and off on several circuit boards that are daisy-chained together. Assembling the kits is easy, but can be time consuming and a little intimidating if you are unfamiliar with soldering electronics. Take your time and if you do make a mistake don't panic.

Almost any Arduino can be used, but the V3 was designed with an Arduino Pro Mini or Pro Micro in mind. A Pro Mini can be mounted directly to the back of the RLD. I offered pre-programmed Pro Micro's to complement the components kit runs.

For full details of V3 (and V2), see John's blog : **barrettandcarly.com/blog/elec**
For assembly tutorial videos, see my YouTube channel : **youtube.com/murphydigital**

PARTS LIST

(1) Arduino ProMicro/ProMini (5V 16Mhz)
(1) set of 5 PCBs
(7) MAX7219 LED Driver chips
(7) 24-pin narrow sockets (single-row DIP sockets can be used for PSI V3.2)
(2) 10K resistors (for PSI's)
(2) 24K resistors (for FLD)
(1) 28K resistor (for RLD)
(5) 0.1uF capacitors (1 per PCB)
(5) 10uF capacitors (1 per PCB)
(1) single-row long pin header
(1) single-row long pin header
(1) single-row female header (24-pin wide socket could alternatively be used)
(1) double-row pin header
(1) 2-position screw terminal
(1) toggle on/off switch
(1) piece of heatshrink tubing (for switch)
(1) 9V battery connector

REGULATOR PARTS (for RLD v3.1):
(1) LM7805 regulator
(1) 1uF capacitors
(1) 10uF capacitors

LEDs:
(64) 3mm flangeless red (4 extra)
(68) 3mm flangeless green (6 extra)
(14) 3mm flangeless yellow (1 extra)
(59) 3mm flangeless white (5 extra)
(41) 3mm flangeless blue (5 extra)
(14) each 5mm red, blue, green, yellow
(4) 5mm bright white or warm white

WIRES:
(2) 5-pin 8inch (RLD to rear PSI, FLD to front PSI)
(1) 5-pin 24inch (RLD to FLD)
(1) 5-pin 4inch (FLD to FLD)
(2) 2-pin 12inch (used for HP LEDs)
(2) 2-pin 8inch (used for HP LEDs)

CNC-CUT PARTS:
(1) set of black acrylic logic bezels
(1) set of non-glare clear acrylic logic screens
(1) set of white Lexan PSI diffusers
Note: PSI diffusers & boards fit standard 1 ½" PVC DWV Couplings, found at any US hardware store.

SUGGESTED ASSEMBLY ORDER

1. Rear Logic Display : the RLD is usually first in our chain, so start by placing and soldering all components (sockets, capacitors, 28K resistor & 5-pin double header). Once components are soldered, place the MAX7219 chips and Arduino Pro Mini into the sockets. Test the RLD by placing a few LEDs and applying power. v3.1 includes a regulator on the RLD; this means you can power everything by connecting 7v-14v to the RAW input on the RLD. Or you can connect 5v to the +5V header.

2. Rear PSI : this will be next in the chain. Start by soldering the row of LEDs located behind the socket location. Once they're soldered the socket and other components can be soldered. Place the remaining LEDs and test PSI by connecting it to the RLD. If all looks correct, solder the LEDs.

3. Front FLD 1 & 2 : assembly is identical to RLD but 24K resistors are used. Place all LEDs and test before soldering all LEDs.

4. Front PSI : assembly is identical to the Rear PSI.

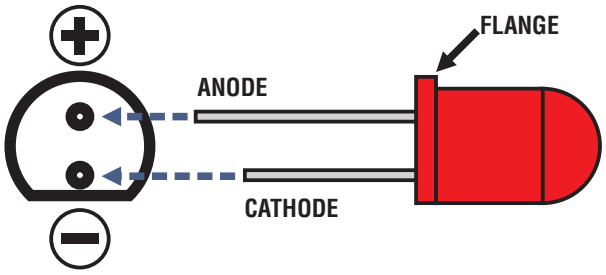
5. RLD LEDs : With the FLD's under your belt, go back to the RLD and finish it off.

Kits were provided by Paul Murphy (JoyMonkey) to the R2 Builders Club : joymonkey@gmail.com

TEECES DOME LIGHTING SYSTEMS

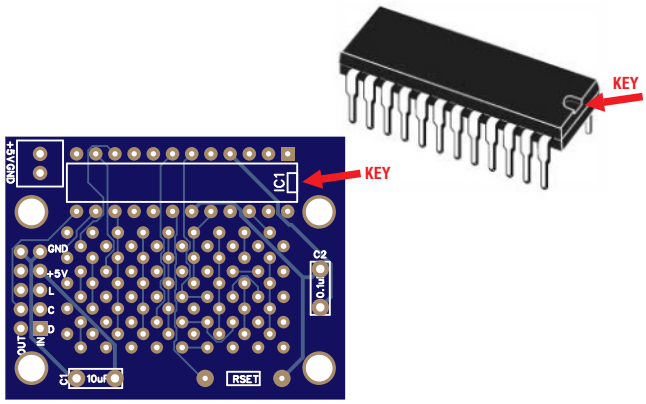
LED POLARITY

LEDs have a long positive leg (the anode) and short negative leg (the cathode), and need to be correctly placed on the PCBs. Examine each LED and the symbol printed on the PCB as shown. If LEDs are placed incorrectly the circuits will behave unexpectedly.



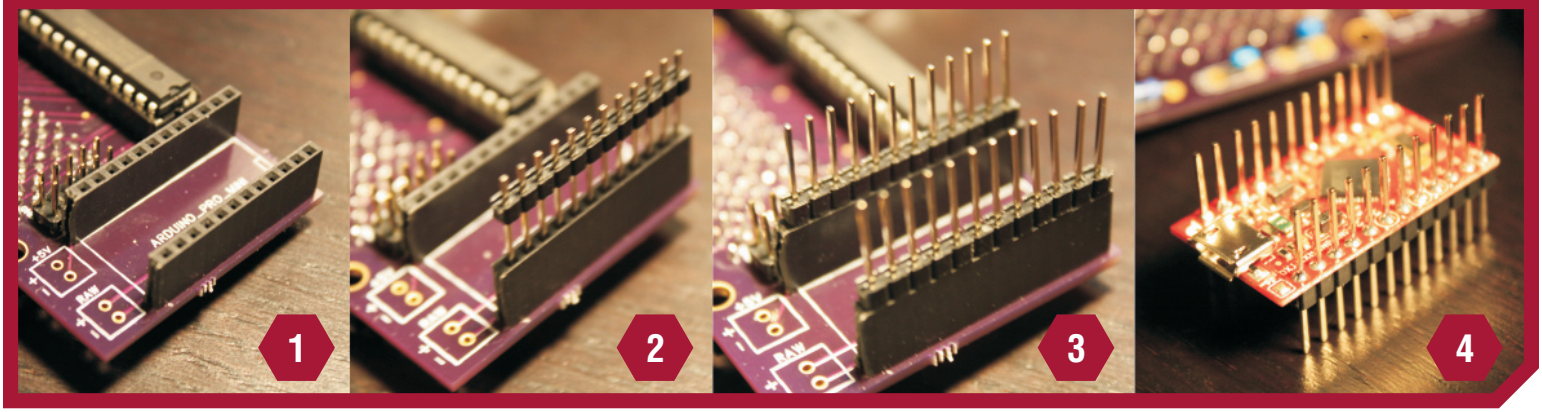
IC CHIP ORIENTATION

IC chips must also be placed in the correct orientation, and may cause damage if placed the wrong way around. Each chip's location on the PCB shows a 'key' on one side. Similarly, each chip has one keyed end. These keys must be aligned together.



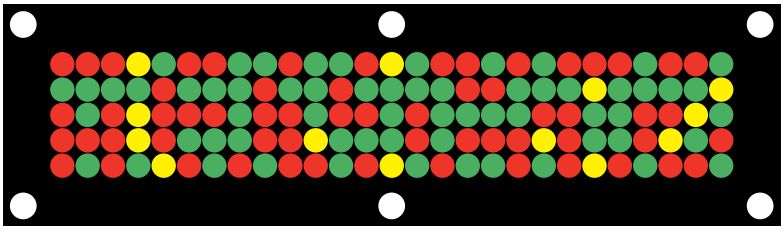
ARDUINO PRO MICRO & PRO MINI PIN HEADERS

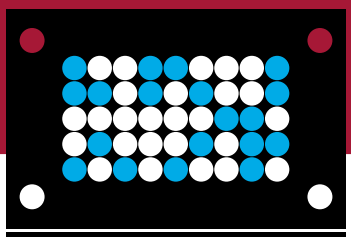
Long pin headers can be used with the Arduino so they can be accessed from either side. This is especially useful when using an older RLD (v3.0), where the front chain must be connected directly to Arduino pins 9, 8 and 7. Here's how they are soldered to the Pro Micro. (2) Use the female headers on the RLD to position the pin headers. (3) Slide the black plastic part of the pins down so they touch the female header. (4) With the pins still in the female headers, place the Pro Micro onto the pins and solder them to the top of the Pro Micro.

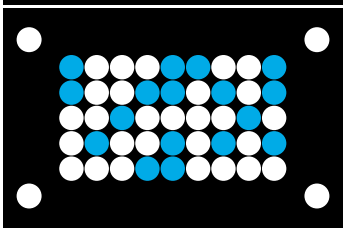


TYPICAL LOGIC DISPLAY PATTERNS

There are no 'correct' color patterns to use, but here are the patterns that builders have been using. These are believed to be a good representation of the screen-used logic displays, but please feel free to deviate from these as you see fit. These were originally suggested in Scott Gray's J.E.D.I Display manual. You can use my randomizer script (joymonkey.com/run/logics) to generate different patterns.







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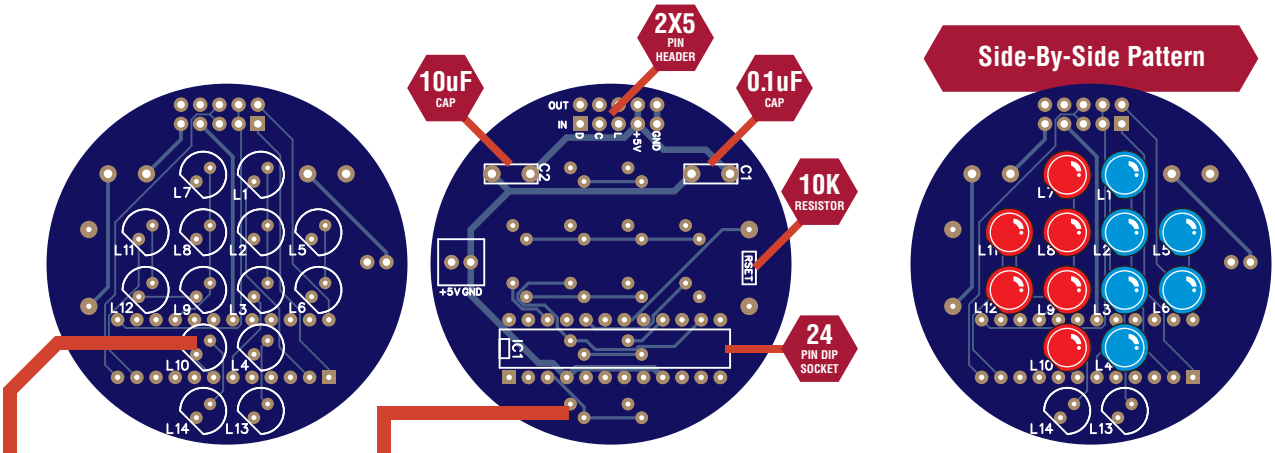
TEECES DOME LIGHTING SYSTEMS

PROCESS STATE INDICATORS

PSI's are assembled similarly to the Logic Displays, however there are some points to note. Over time the PSI board design has evolved slightly to allow for more functionality. Please follow the instructions specific to whichever PSI board-type you have.

TEECES PSI V1



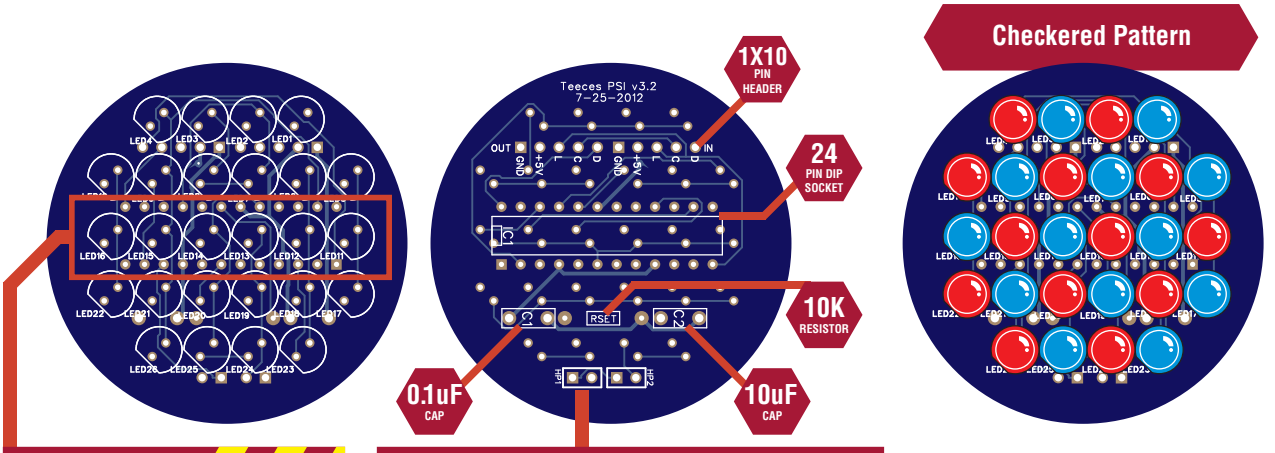
WARNING

L10 and L4 LEDs must be soldered BEFORE attaching the socket.

HOLOPROJECTORS

Solder a 2-pin header to the BACK of L14 and L13. HP LEDs can then be attached to each header using 2-pin jumper wires.

TEECES PSI V3.2



WARNING

LEDs 11 thru 16 must be soldered BEFORE attaching the socket.

HOLOPROJECTORS

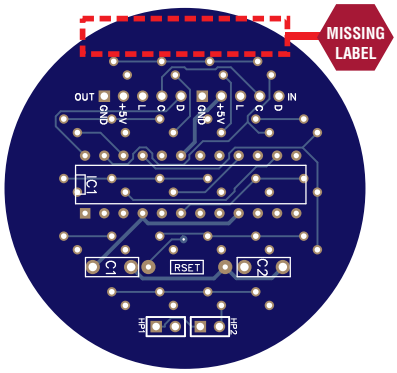
Solder two 2-pin headers here. HP LEDs can then be attached to each header using 2-pin jumper wires.

Note: Alternatively two single-row DIP sockets can be used instead of the 24-pin DIP socket. This will leave LEDs 11-16 accessible should they need to be removed.

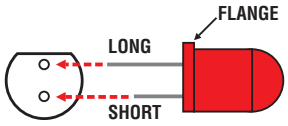
PROTOTYPE X

WARNING

While developing PSI V3.2, several prototypes were produced. One variety of these prototypes may have accidentally made it into the wild.
This PSI looks almost identical to V3.2, but LEDs need to be placed in the opposite orientation to that shown on the PCB. Once assembled this will work perfectly, but builders should be mindful of the LED orientation.
This PCB can be identified as having 26 LEDs, but lacking the 'Teeces PSI v3.2' label.



This prototype PCB has LED symbols that are **backwards**! Place LED's in reverse polarity as shown here:



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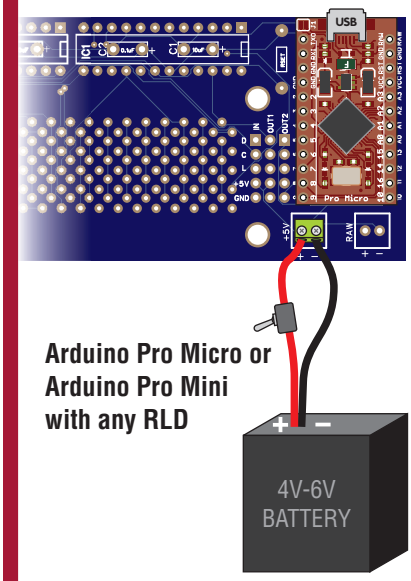
Teeces Dome Lighting Systems

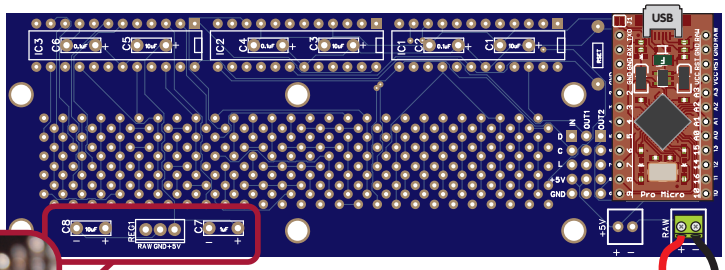
Power Options

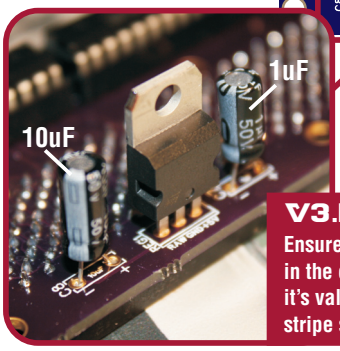
The system runs on 5V. Depending on which version of RLD you have, the lighting system can be powered in a number of ways. If you already have a good 5V source in your droid, you can connect that directly to any available +5V and GND terminals. If you have a V3.1 RLD then you can use its onboard power regulator to convert a higher voltage down to 5V by connecting to the RAW terminal.



Arduino Pro Micro or
Arduino Pro Mini
with any RLD

Arduino Pro Micro or
Arduino Pro Mini
with RLD V3.1

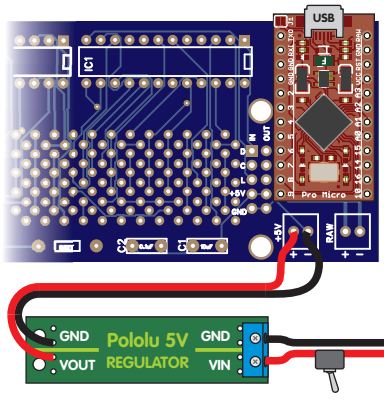




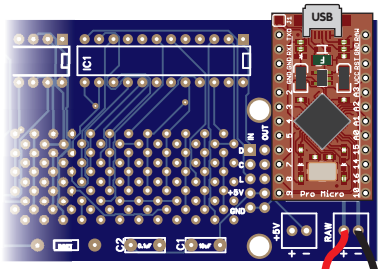
NOTE:
When powering with a power source over 5V, connect to the **RAW** header. This applies only to the V3.1 board, which has extra components to convert the voltage to a safe 5V.

V3.1 RLD Regulator

Ensure that the regulator components are soldered in place in the orientation shown in this photo. Each capacitor has it's value (10uF or 1uF) printed on it. The capactior's white stripe should line up with the "-" symbol on the board.



Arduino Pro Micro or
Arduino Pro Mini
with any RLD

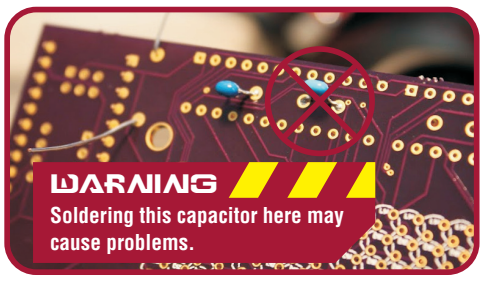


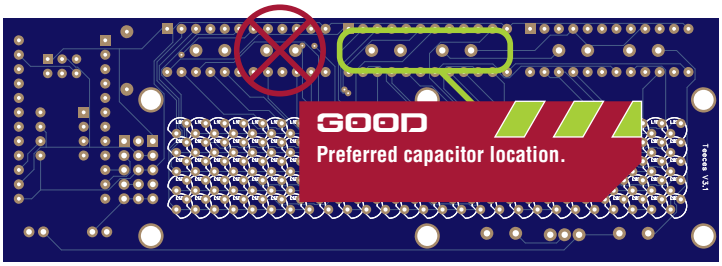
Arduino Pro Micro with
RLD V3.0 (single OUT)

NOTE:
The Arduino Pro Micro has its own built-in 5V regulator. You can supply power to this by hooking up to the **RAW** header on the V3.0 RLD. This regulator should only be used with power sources below 9V. Going over 9V with a full chain of logic displays and PSI's will cause the Pro Micro to overheat and reset.

RLD V3.1 Additional Notes

Each board requires two capacitors for the LED drivers. These are small blue ceramic capacitors and are valued 0.1uF and 10uF. On the new v3.1 RLD there are three different locations that these could be placed. These are directly under the LED driver chips and are best soldered on the opposite side of the PCB (the same side as the LEDs). It is recommended that the capacitors be soldered under the center LED driver.





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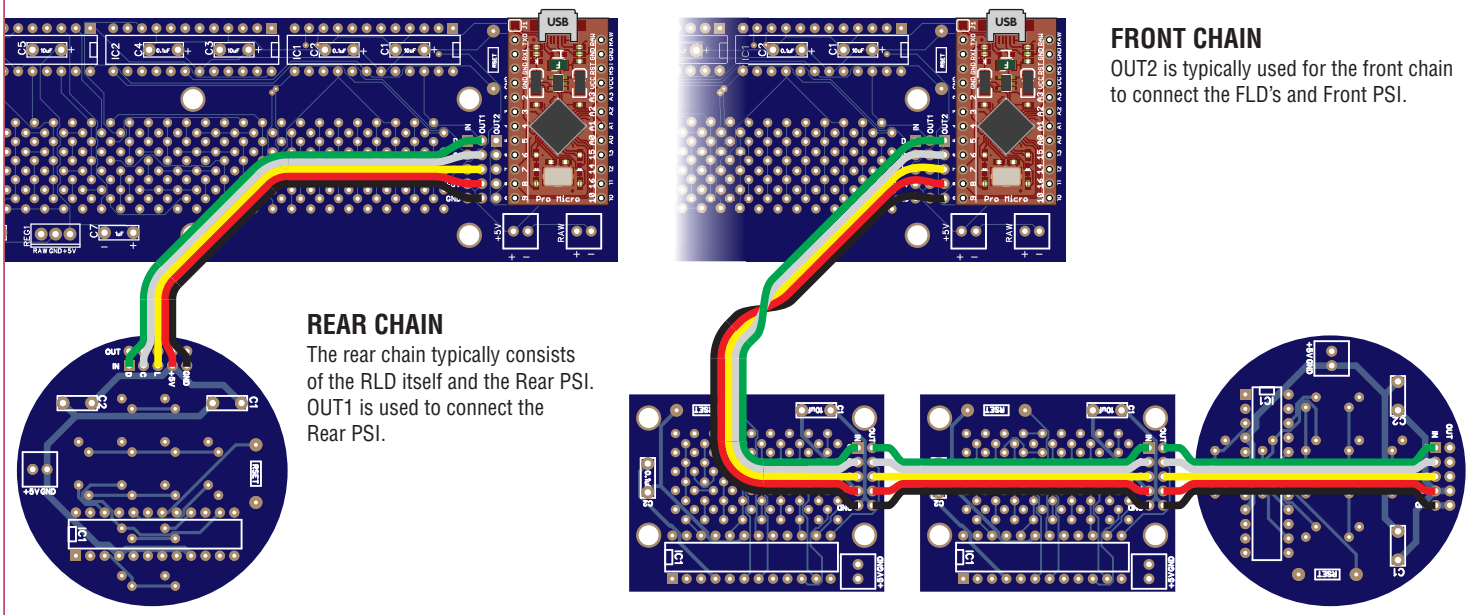
TEECES DOME LIGHTING SYSTEMS

HOOKING IT ALL UP

It is recommended to connect the boards together in two separate chains, as shown below. As each board is completed, hook it up to the previous board using 5-pin jumper wires as shown and test it out. Ensure that the wires are correctly connected - GND OUT must always go to GND IN on the next board. Try to use the shortest jumper wires possible to keep the signal from the Arduino as strong as possible.

WHEN USING A V3.1 RLD…

To simplify connections the V3.1 RLD has two sets of Output pins - 1 for the rear PSI and 1 for the front chain.



REAR CHAIN

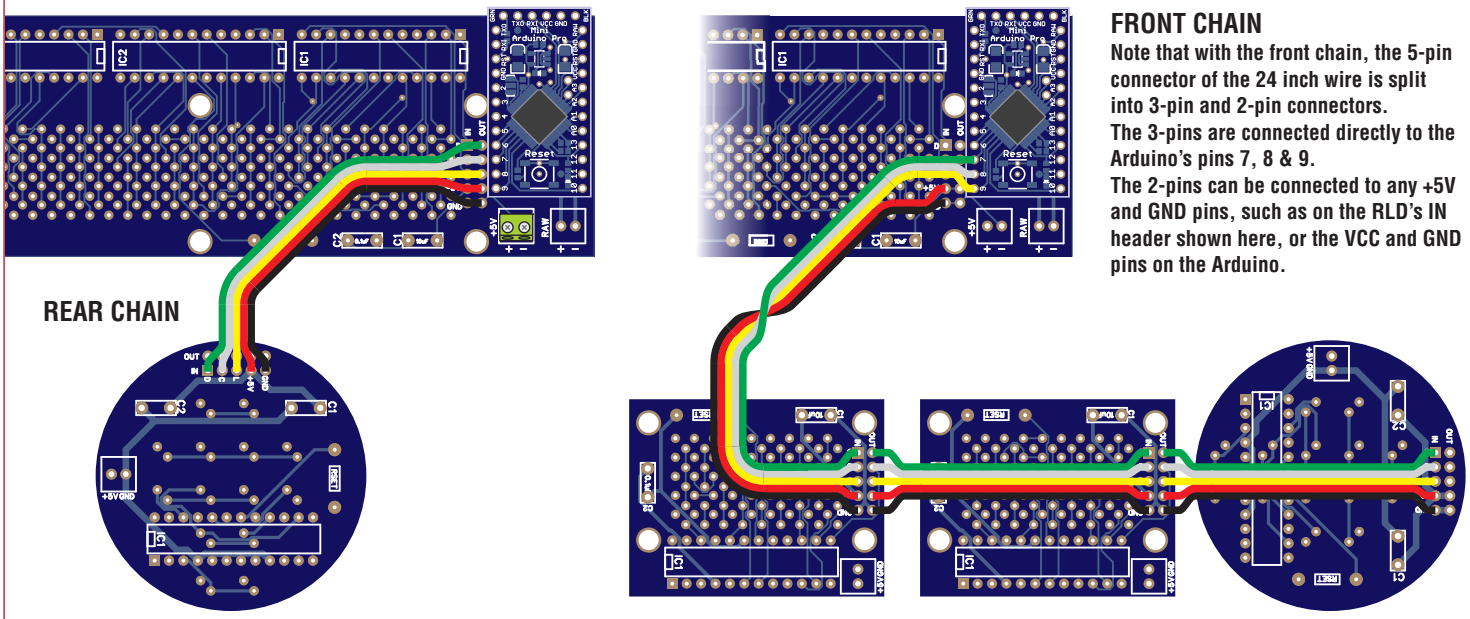
The rear chain typically consists of the RLD itself and the Rear PSI. OUT1 is used to connect the Rear PSI.

FRONT CHAIN

OUT2 is typically used for the front chain to connect the FLD's and Front PSI.

WHEN USING AN OLDER RLD…

Previous RLD's had 1 set of OUT pins. We can still connect in 2 chains, by connecting the Front Chain directly to pins on the Arduino.



REAR CHAIN

FRONT CHAIN

Note that with the front chain, the 5-pin connector of the 24 inch wire is split into 3-pin and 2-pin connectors.
The 3-pins are connected directly to the Arduino's pins 7, 8 & 9.
The 2-pins can be connected to any +5V and GND pins, such as on the RLD's IN header shown here, or the VCC and GND pins on the Arduino.

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