

Helix Light Controller

# Helix Daughter Board v2

Assembly and Setup Manual



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## Overview

This is the basic assembly and setup instructions for the Helix Daughter Board v2.

It is not the purpose of this document to teach soldering techniques or basic electronics. If you need assistance in this area there are several other sources on the internet for this type of information.

The Helix Daughter Board assembly is fairly simple, especially in comparison to the Helix Main Board. **For those with limited board assembly and soldering experience, it might be beneficial to begin assembly of the Helix System with the Daughter Boards.**

If you have any suggestions or problems with this manual or assembly of the Helix Daughter Board please email the developer at: [Greg@helixlightcontroller.com](mailto:Greg@helixlightcontroller.com)

## Helix Daughter Board Bill Of Materials (BOM)

Part	Description	Part#	Supplier	Qty	Notes
C1, C2, C3, C4, C5	0.1 uF Bypass Cap	594-K104Z15Y5VF53L2	Mouser	5	
C6	4700uF Filter Cap	647-UVR1C472MHD	Mouser	1	
C7	100 uF Filter Cap	647-UVR1E101MED1TD	Mouser	1	
D1	1N5817	821-1N5817	Mouser	1	
D2, D3	RED LED	859-LTL1CHKEKNN	Mouser	2	
F1	FUSE Horizontal	534-3517	Mouser	2	
H1	0.1" Pin Strip Header 4 Pin	517-929834-01-04-RK	Mouser	1	
IC1, IC2, IC3, IC4	8 bit SIPO Shift Register	511-M74HC4094	Mouser	4	
IC5	Quad RS485 Receiver	595-SN75LBC175N	Mouser	1	
J1, J2, J3, J4, J5, J6, J7, J8, J9	RJ45	571-5556416-1	Mouser	9	
NE1	NE-2 Neon Lamp	606-A9A	Mouser	1	
R1, R2, R3	100 ohm Resistor	291-100-RC	Mouser	3	
R4	100K ohm Resistor	291-100K-RC	Mouser	1	
R5, R6	560 ohm Resistor	291-560-RC	Mouser	2	
T1	6.3V .4A Transformer	838-3FD-312	Mouser	1	
TB1	2 POS 5mm Terminal Block	651-1935161	Mouser	1	
U1	DB101	583-DB101C	Mouser	1	
U2	5V 800ma Voltage Regulator	511-LD1117V50-DG	Mouser	1	

### Misc Other Parts

	Description	Part #	Supplier	Qty	Notes
	250V 0.5A Fuse	576-0217.500HXP	Mouser	1	
	Fuse Cover	534-3527C	Mouser	1	
	0.1" Shunt 1A	151-8010-E	Mouser	2	
	16p DIP Socket	571-1-390261-4	Mouser	5	
	TO-220 Heatsink	532-579302B00	Mouser	1	
	Recommended Enclosure	CG-500	WLC Ventures	1	
	¼" Luan Board			1	
	Recommended Spacers	561-KSP117	Mouser	4	
	#6 x 1" Pan Head Sheet Metal or Wood Screws			4	
	#6 x ¾" Pan Head Sheet Metal Screws			4	

## Assembly of the Daughter Board

The initial assembly of the daughter board will consist of soldering all of the major components to the PCB, starting with the components that have the lowest profile and finishing with the ones with the highest profile. Two methods of assembly are presented in this manual. This first is a table with the step-by-step instructions and associated notes. The second is a series of pictures of the daughter board's silk screen with arrows and notes pointing to each step. Each method shares the same notes and pictures. Use whichever method works best for you.

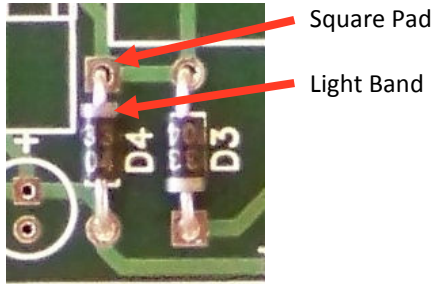
### Table of Step-by-Step Instructions

Step	Done	Ref Number	Value	Note
1		R1	100 Ω	Brn, Blk, Brn
2		R2	100 Ω	Brn, Blk, Brn
3		R3	100 Ω	Brn, Blk, Brn
4		R4	100 KΩ	Brn, Blk, Yel
5		R5	560 Ω	Grn, Blu, Brn
6		R6	560 Ω	Grn, Blu, Brn
7		D1	1N5817	See Note 1
8		U1	DB101	See Note 2
9		IC1 Socket	16p DIP Socket	See Note 4
10		IC2 Socket	16p DIP Socket	See Note 4
11		IC3 Socket	16p DIP Socket	See Note 4
12		IC4 Socket	16p DIP Socket	See Note 4
13		IC5 Socket	16p DIP Socket	See Note 4
14		C1	0.1 μF	
15		C2	0.1 μF	
16		C3	0.1 μF	
17		C4	0.1 μF	
18		C5	0.1 μF	
19		D2	Red T-1 (3mm) LED	See Note 3
20		D3	Red T-1 (3mm) LED	See Note 3
21		H1	4p Header	See Note 5
22		F1A	Fuse Clip	See Note 6
23		F1B	Fuse Clip	See Note 6
24		TB1	2p Terminal Block	AC Input; 0.2" Pitch
25		C7	100 μF	See Note 7
26		J1	RJ45 Jack	Cat 5 Jack
27		J2	RJ45 Jack	Cat 5 Jack
28		J3	RJ45 Jack	Cat 5 Jack
29		J4	RJ45 Jack	Cat 5 Jack
30		J5	RJ45 Jack	Cat 5 Jack
31		J6	RJ45 Jack	Cat 5 Jack
32		J7	RJ45 Jack	Cat 5 Jack
33		J8	RJ45 Jack	Cat 5 Jack
34		J9	RJ45 Jack	Cat 5 Jack
36		U2	LD1117V50-DG	See Note 8, 5V Regulator
37		C6	4700 μF	See Note 7
38		T1	3FD-312	See Note 9; 6.3V Center Tap 1/2A Transformer
35		NE1	Neon Bulb	

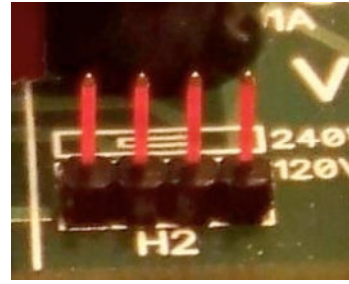
## Assembly Notes:

1. Orientation matters with diodes. The diode has a light band marked on one end; this is the cathode. The diode needs to be inserted in the PCB with this light band oriented with the band mark on the PCB (the square pad). See Picture 1 for an example of a correctly installed diode.
2. This is a full wave bridge rectifier, orientation matters. Align the markings on top of the chip with the markings on the PCB. I.e. the pin with "+" inserted in the hole marked "+". Solder on the bottom side of the PCB.
3. Orientation matters with LEDs. The LED has one pin longer than the other; this is the anode. The LED needs to be inserted in the PCB with the anode lead in the round pad.
4. When installing DIP sockets ensure that the notch in the socket is aligned with the notch on the silkscreen, and flush with the circuit board. All five sockets can be placed in the board at once, then using a piece of cardboard to hold the sockets, turned the board over and place on your work surface. Then you can slide the cardboard out from under the board, leaving all five sockets in place. Solder two of the pins on each socket, holding the socket in place. Check to make sure the socket is flush to the PCB, reheat the pins and reposition as necessary. After verifying that the sockets are installed correctly, solder all of the other pins.
5. Solder the header on to the PCB with the longer leads facing up. Make sure the header is perpendicular to the PCB. See Picture 2 for an example of a correctly installed header.
6. Orientation matters with the fuse clips. Make sure to install them in the correct orientation so they will hold the fuse.
7. This is an electrolytic capacitor, orientation matters. One side of the capacitor is marked with as negative. The pin on this side needs to be inserted in the round pad. Make sure the capacitor is flush with the PCB.
8. This is a TO-220 package voltage regulator, orientation matters. Install this component so that it matches the silkscreen layout, i.e. the tab is aligned with the right side of the silkscreen. The large silkscreen box around this component is the outline for the heat sink. Do not install the heat sink at this time.
9. Insert the transformer such that the pin numbers on top of the transformer are aligned with the pad numbers on the PCB. The transformer has small standoff pins. Make sure these standoff pins are flush with the PCB.

### Assembly Pictures



**Picture 1**  
Diodes



**Picture 2**  
4 Pin Header

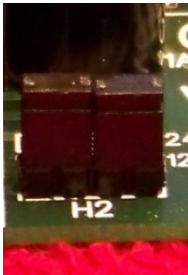
## Initial Power Up of the Helix Daughter Board

Before powering up the Helix Daughter Board for the first time, perform these checks:

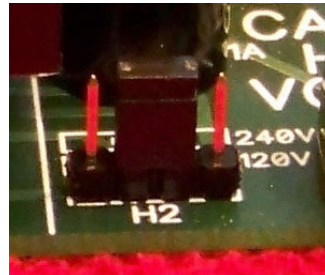
- Do **NOT** install any of the ICs at this time
- Do **NOT** install the heat sinks on the voltage regulator at this time
- Verify that all diodes, LEDs, electrolytic capacitors, voltage regulator, IC sockets are aligned properly
- Verify that all components are properly soldered and there are no solder bridges or cold joints

Next perform these steps

1. Install a 0.5A fuse in the fuse holder F1
2. Install the shunts (jumpers), Mouser part #151-8010-E, on Header 1 in the correct configuration for your line voltage. See Picture 3 for 120 VAC and Picture 4 for 240 VAC.
3. Install a power cord on TB1, being careful to properly align the Hot and Neutral leads. The Neutral wire is the one connected to the wide blade on the plug and is usually white or has ribs or dashes on the wire.
4. Place the Helix Daughter Board on a non-conductive surface
5. Plug in the power cord
6. The Power LED (D33) should be illuminated, if not then unplug the power cord and troubleshoot the power supply section of the board. The Power LED is powered by the 5VDC regulator which is connected to the transformer via the full wave rectifier and filter capacitors.
7. With the main board plugged in, carefully touch the heat sink tabs on the voltage regulator. It should be cool to the touch or slightly warm at most. If it is hot then you have a short circuit somewhere on the board. Unplug the board, find the short circuit and repair.
8. With the main board plugged in, use a voltage meter to check the voltage between +5V and GND on the test points. This voltage should be a solid 5VDC. If it seems to be excessively low or high then unplug the main board and troubleshoot the 5VDC section of the power supply
9. Once the board passes all of these tests then you are finished with the initial testing.



**Picture 3**  
120 VAC



**Picture 4**  
240 VAC



## Final Assembly of the SSR Daughter Board

Before final assembly, inspect the board to ensure there are no solder bridges, cold joints or unsoldered pads. After that is completed it is time to install all of the ICs. Make sure they are installed in the correct orientation and that all of the pins are firmly seated in the sockets. There is a dot next to pin 1 or an indentation at the top of the IC chip that identifies orientation. This dot or indentation needs to be aligned with the indentation on the socket. It often helps to lay the chip on its side on a table and carefully bend all of the pins in toward the center of the chip before trying to insert it into the socket.

### Final Assembly Steps

Step	Done	Ref #	Value	Orientation
1		IC1	74HC4094 8bit SIPO Shift Register	Notch Up
2		IC2	74HC4094 8bit SIPO Shift Register	Notch Up
3		IC3	74HC4094 8bit SIPO Shift Register	Notch Down
4		IC4	74HC4094 8bit SIPO Shift Register	Notch Down
5		IC5	SN75LBC175N	Notch Down
6			Heat Sink for 5V Regulator	Apply a little heat sink compound to the back side of the TO-220. The heat sink slips on the TO-220 package very snugly. Should be inside of the outline on the silkscreen

## Setup of the Daughter Board

After the Helix Daughter Board is assembled it needs to be mounted in a weather proof enclosure such as the CG-500 from <http://wlcventures.com>. It is recommended that a wooden back panel, made out of 1/4" Luan plywood or other suitable material, be installed in the enclosure using #6 x 3/4" pan head sheet metal screws. The Daughter Board can then be mounted to it using #6 x 1" pan head sheet metal screws and nylon spacers such as Mouser Part# 561-KSP117.

The final connections all require standard Cat5 jumper cables. Connect the Channel Bank In, J9, to one of the Channel Banks on a Helix Main Board. Next connect a standard 4-Channel SSR board to each of the Channel Output Jacks, J1-J8, as necessary. Plug everything in and your Helix Daughter Board is ready to use.

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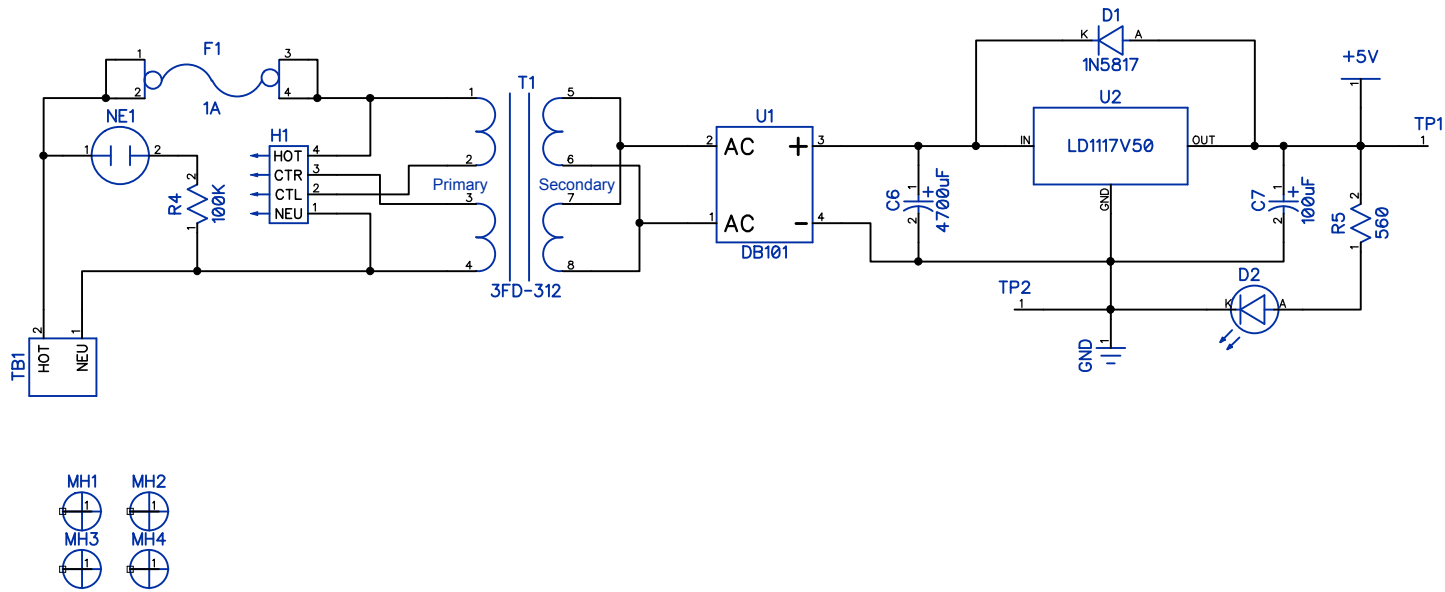
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REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
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Helix Light Controller Daughter Board

Daughter Board

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SIZE

FSCM NO.

DWG NO.

REV

2

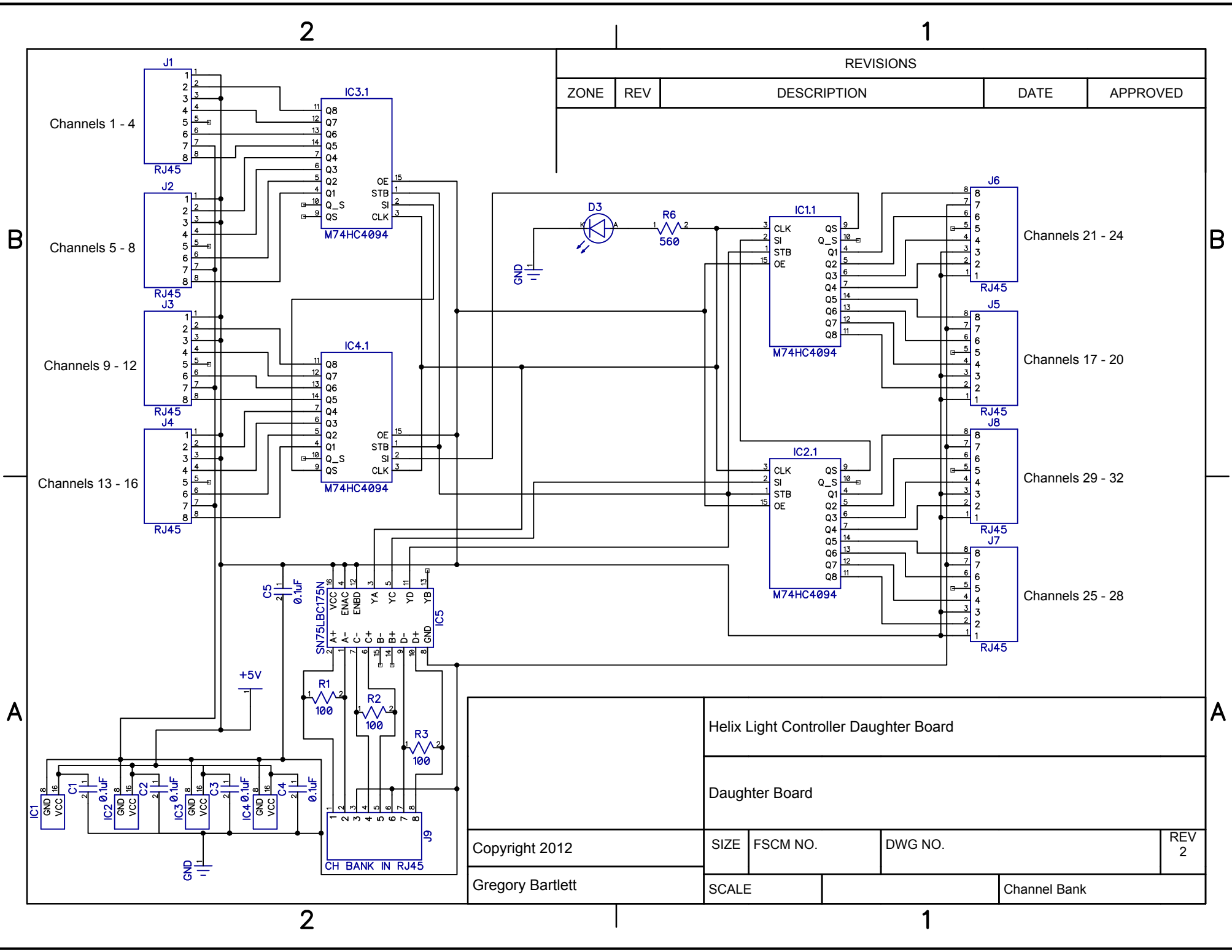
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SCALE

Power Supply

2

1



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Helix Light Controller Daughter Board					
Daughter Board					
Copyright 2012		SIZE	FSCM NO.	DWG NO.	REV 2
Gregory Bartlett		SCALE		Channel Bank	