



Better Lighting Clinic

Objective: Ideas that you can use to improve Lighting



Clinic Topics

- ❑ Look at the Lighting options
 - ❑ Light Bulbs vs. LED
 - ❑ Installation techniques
 - ❑ The Light bulb replacement
- ❑ The Resistor Issue – Non Technical
 - ❑ Resistors
 - ❑ Voltage regulators
 - ❑ Keep alive circuits
 - ❑ Circuit Boards
 - ❑ Testing
- ❑ Tools
- ❑ Sources for the Parts

Some Lighting Options



Tsunami AT-1000
Head Light, Rear Light – 603 LEDs, light
pipes and lens, neg. voltage regulator
Gyralight - 1.5v 30ma Bulbs, resistor



TCS A6X & Sound bug
Headlight – 1.5v 30ma Bulbs,
neg. voltage regulator
Ditch Lights – 603 LEDs, MV lens,
neg. voltage regulators
Beacon - 1.5v 30ma Bulb, resistor,
DA 229-2902 Beacon

Some Lighting Options



QSI Revolution & TCS FL2
Headlight - 1.5v 30ma Bulbs,
Neg. voltage regulator
Mars Light - 1.5v 30ma Bulbs,
resistor



TCS A4X
Headlight – model's light tube with
the model's T-1 LED filed and
glued to light tube
Strobe Light – 1.5v 30ma Bulb,
resistor, DA 229-2901 Flasher
with custom white lens

Some Lighting Options



Track Powered
Walther's Lighting Kit,
3 – T1 LED's, light bar and
Pos. voltage regulator modified
with a pot and a Keep Alive



TCS FL2
Marker Light - 603 Red LED
mounted on edge in casting,
Pos. voltage regulator with
keep alive

The Lights



T-1 LED



603 LED



805 LED



1206 LED

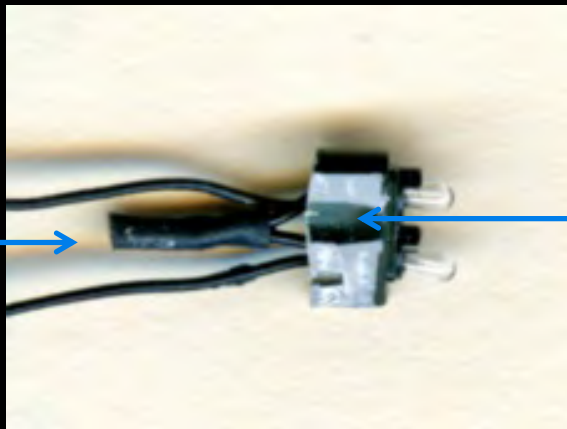


Miniatronics 1.5v 30ma Bulbs

Light Bulbs

Miniatronics 1.5v 30ma Bulbs

Twin Beam Pyle Headlights



Bulbs are wired in Series

Light Grey Plastic
See Note

Test the bulbs in series to match the brightness

Bulbs are run through the Pyle light holes

Use masking tape to make the bulbs fit better (Optional)

Glue in place with white glue

Note: paint the inside of the hole black with lighter color shell

Light Bulbs

Miniatronics 1.5v 30ma Bulbs
Large F7 type Headlight



Digitrax DH163IP

Headlight: 1.5v 30ma Bulb with custom
reflector, Neg. voltage regulator

Light Bulbs

Custom reflector for
Large F7 type Headlight



Drill 1/8" hole in 3/16
styrene tube



Glue 1/8" Styrene tube into
3/16" Tube, Trim off the excess

Light Bulbs

Custom reflector for Large F7 type Headlight



- ❑ Ream the combined tubes with “The Tool” to form the reflector.
- ❑ Paint the reflector surface with Model Master Chrome Paint.
- ❑ Glue the reflector in back of the headlight opening.
- ❑ Add a MV lens with foil removed or clear styrene.
- ❑ Insert the light bulb and move the bulb until the reflector is filled with light. Glue the bulb in place with white glue.

The Light Bulb Replacement

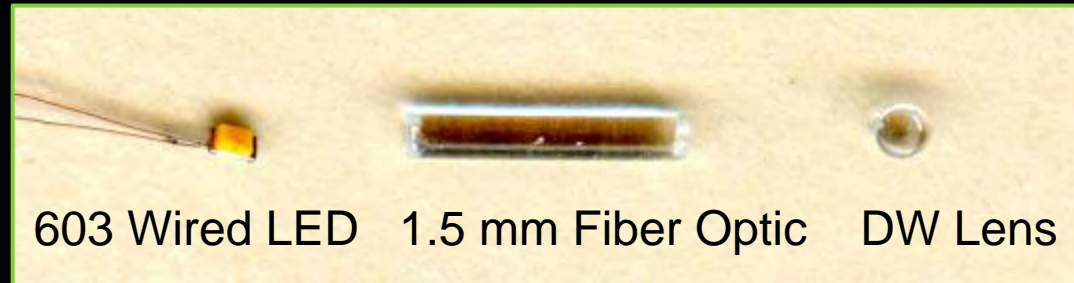


Ulrich Models - LED Light with Fiber Optic and Light Shield
SKU: 4-5002 - \$7.50

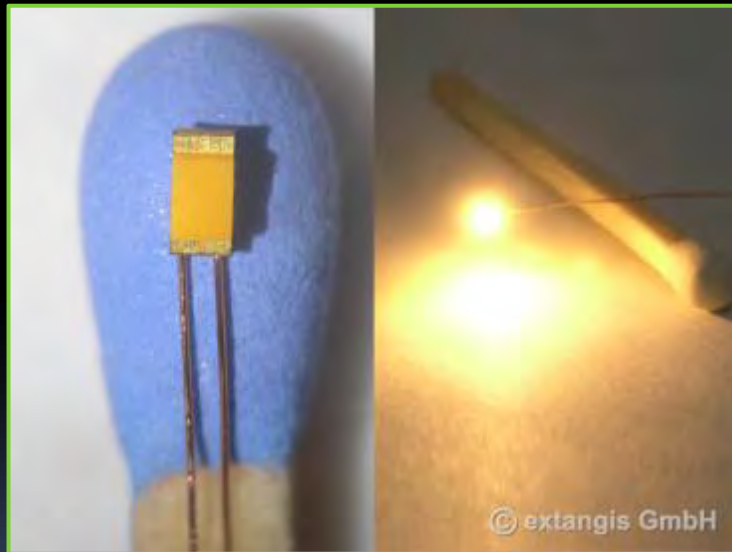


Details West - Headlight Lens 6" HO Scale
SKU: W-235-341

The Light Bulb Replacement



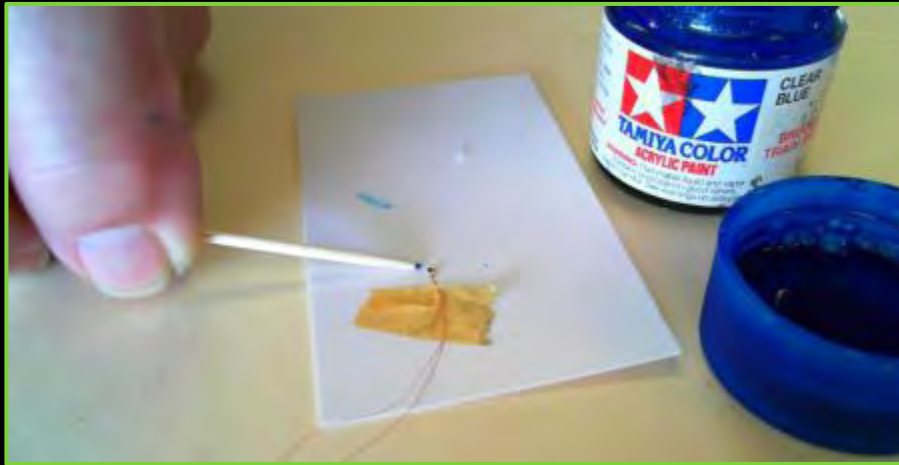
Homemade product – About \$1.00



WWW.LEDBARON.DE
LED 0603 super golden white
with copper magnet Wire #2400111

Use 1.5 mm fiber optic not plastic rod

The Light Bulb Replacement



Color balance the LED with Tamiya Transparent Blue

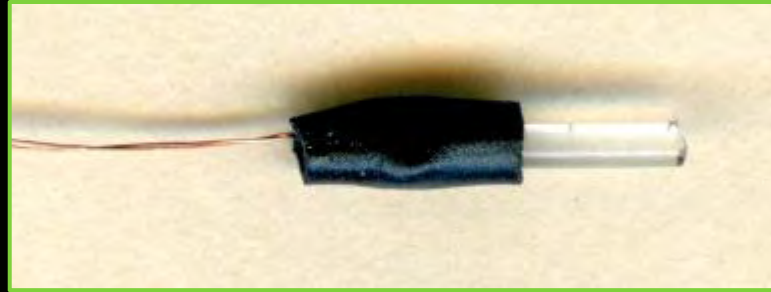


Tack the Fiber optic the Micro Bond ACC – Set with kicker spray

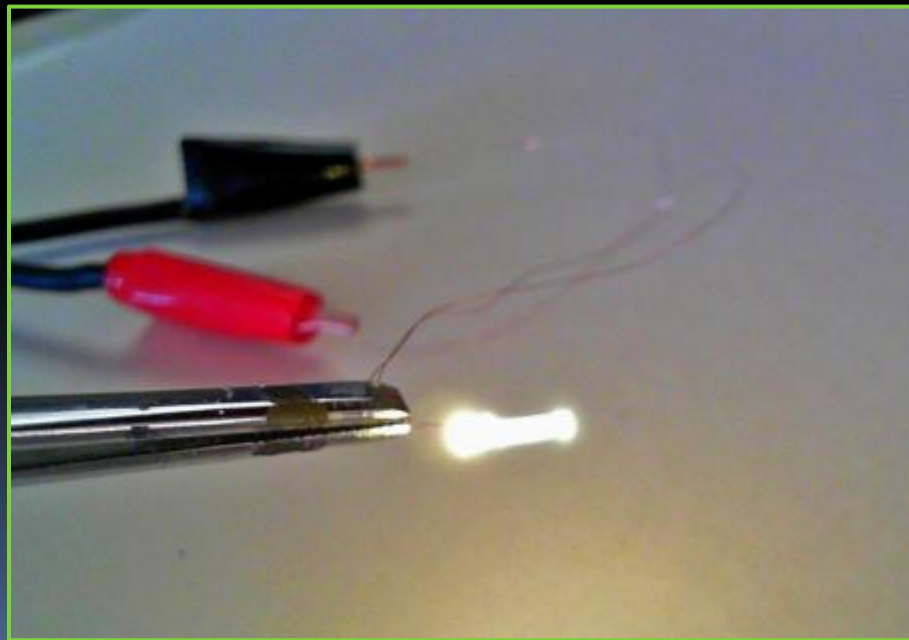


Put a bead of ACC around the LED to secure the LED – Use Micro Bond or Cool Chem and the Kicker

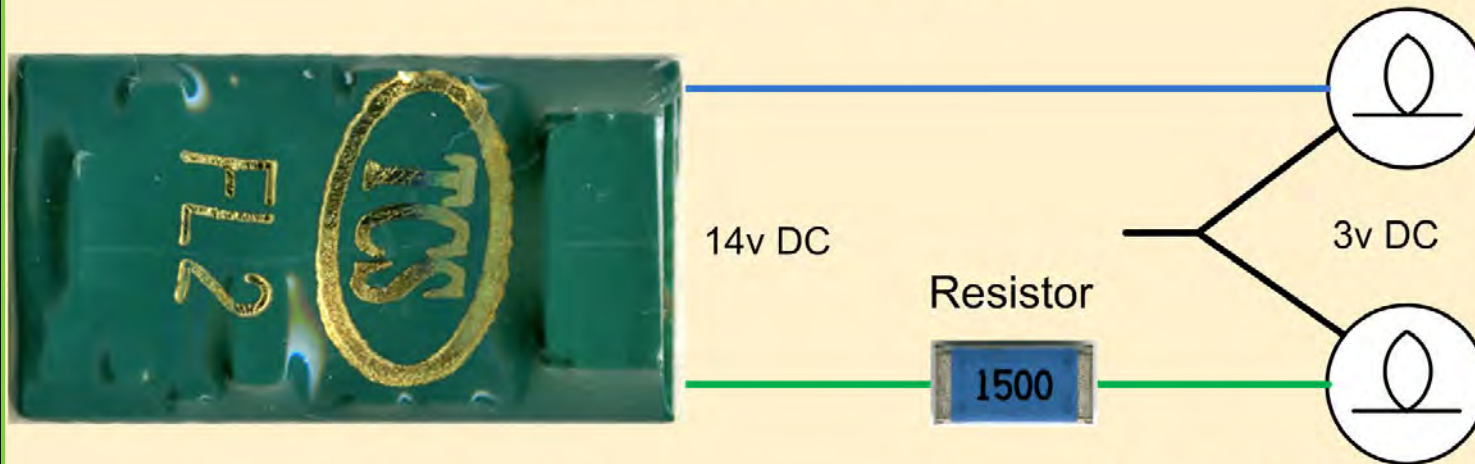
The Light Bulb Replacement



With Shrink Tube – Be Careful not to melt the pipe



The Problem



TCS FL2 Lights Only Decoder

* Two 1.5v 30ma Light Bulbs
Series Wiring

* Series wiring requires that the light bulbs be matched for brightness

What is the Value of the Resistor?

Use Ohms Law to Calculate

$$I = V/R$$

Na!

We will use the cheat sheets

Values are a starting point

Recommend dropping resistors if using 1.5 volt bulbs

Track Voltage (14 volts is typical for HO scale)

Bulb Current	12.5	13	13.5	14	14.5	15	15.5	16	Wattage
15ma	680	680	720	750	820	820	910	910	¼ watt
30ma	330	360	360	390	390	430	430	470	½ watt
40ma	240	270	270	300	300	300	330	330	1 watt
50ma	200	200	220	220	240	240	270	270	1 watt
60ma	160	180	180	200	200	200	220	220	1 watt
80ma	120	130	130	150	150	160	160	160	2 watt

The cheat sheets and other references are available at:
<http://smrhs.com/Documents/documents.htm>

The TCS (Train Control Systems) Cheat Sheet

When using bulbs rated less than the track voltage, you must use a resistor in series with the bulb.

Light Type and Power Source		Resistor Values in Ohms					
Quantity and Type of Light	Power Wire	12 V. Track	14 V. Track	16 V. Track			
12 V	(1) 30mA Bulb	Full Power	Blue	0 to 100	47 to 150	100 to 220	
	(2) 30mA Bulbs in Parallel		Blue	0 to 68	33 to 82	56 to 100	
	(3) 30mA Bulbs in Parallel		Blue	0 to 68	10 to 68	22 to 68	
1.5 Volt	(1) 15mA Bulb		Blue				
	(2) 15mA Bulbs in Series		Blue				
	(4) 15mA Bulbs in Series		Blue				
	(1) 30mA Bulb		Blue	270 to 390	330 to 390	470 to 560	
	(2) 30mA Bulbs in Series		Blue	220 to 330	270 to 330	470 to 560	
	(4) 30mA Bulbs in Series		Blue	180 to 270	270 to 390	330 to 470	
LED	(1) 30mA Bulb		Half Power	Red or Black	180 to 270	220 to 330	270 to 390
	(2) 30mA Bulbs in Series			Red or Black	100 to 180	150 to 220	220 to 330
	(4) 30mA Bulbs in Series			Red or Black	10 to 100	47 to 150	82 to 180
	(1) White LED	Red or Black		180 to 1200	220 to 1500	270 to 1800	
	(2) White LEDs in Series	Red or Black		82 to 680	150 to 820	180 to 1200	
	(1) Color LED	Red or Black		220 to 1200	270 to 1800	330 to 2200	
(2) Color LEDs in Series	Red or Black	150 to 1000		220 to 1500	270 to 1800		
(3) Color LEDs in Series	Red or Black	0 to 560		100 to 1000	220 to 1200		
(4) Color LEDs in Series	Red or Black			82 to 820	180 to 1000		
Constant Lighting Wired Across Rails				12 V. Track	14 V. Track	16 V. Track	
12 V	(1) 30ma Bulb	Full Power AC		Red to Black	0 to 100	82 to 150	150 to 330
	(2) 30ma Bulbs in Parallel			Red to Black	0 to 68	47 to 82	82 to 150
	(3) 30ma Bulbs in Parallel		Red to Black	0 to 33	33 to 56	56 to 100	
	(4) 30ma Bulbs in Parallel		Red to Black	0 to 22	22 to 47	39 to 82	
LED	(1) White LED		Red to Black	180 to 1200	270 to 1500	330 to 1800	
	(2) White LEDs in Series		Red to Black	100 to 680	180 to 1000	220 to 1200	
	(2) Color LEDs in Series		Red to Black	180 to 1000	220 to 1200	270 to 1500	

NOTE: If you are powering features with the red or black wires, make sure to make those features inactive on DC power because the voltage will be higher. See table 16.

Resistors



1/8 w
805

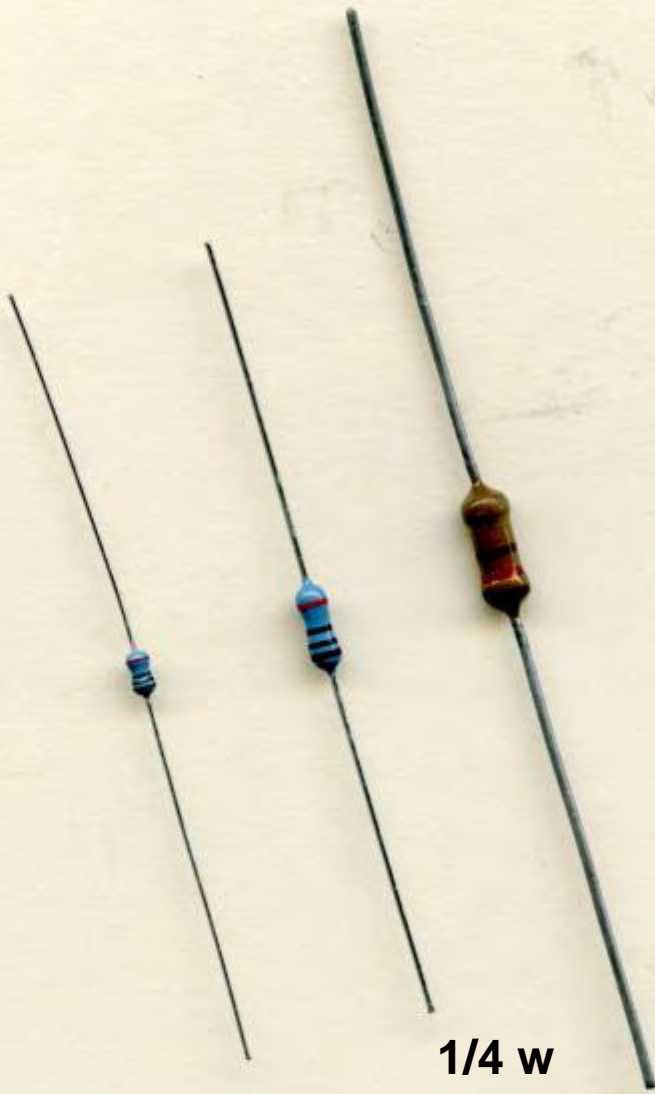
1/4 w
1206

1/2 w
1210

1/8 w

1/4 w

1/2 w



Use Surface Mount Resistors

- ❑ SMF resistors are smaller
- ❑ Easier to mount
- ❑ Use a 1/32" PC Board to mount



Use a Dremel Tool to make the PC board from 1/32" Material



Solder Chip resistor to the board.
Note the soldering pads

The Better Solution

Voltage Regulators

- ❑ Just dial in the Brightness
No trial and error selecting resistors
- ❑ Voltage Output is constant regardless of Input
- ❑ Cuts down on the wiring
- ❑ Negative: cost more – about \$3.00

Voltage Regulators

SOT-223



Adj In Out

TO-92



Adj Out In

TO-220



Adj In Out



SOT-223



Adj Out In

TO-92



Adj Out In

TO-220



Adj Out In

LM337 Negative Regulator

LM317 Positive Regulator

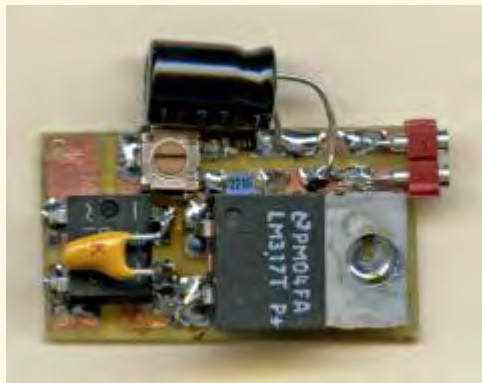
The Voltage Regulator Circuits



Keep Alive Car Lighting
on Prototype Board



Locomotive Lighting
on Prototype Board



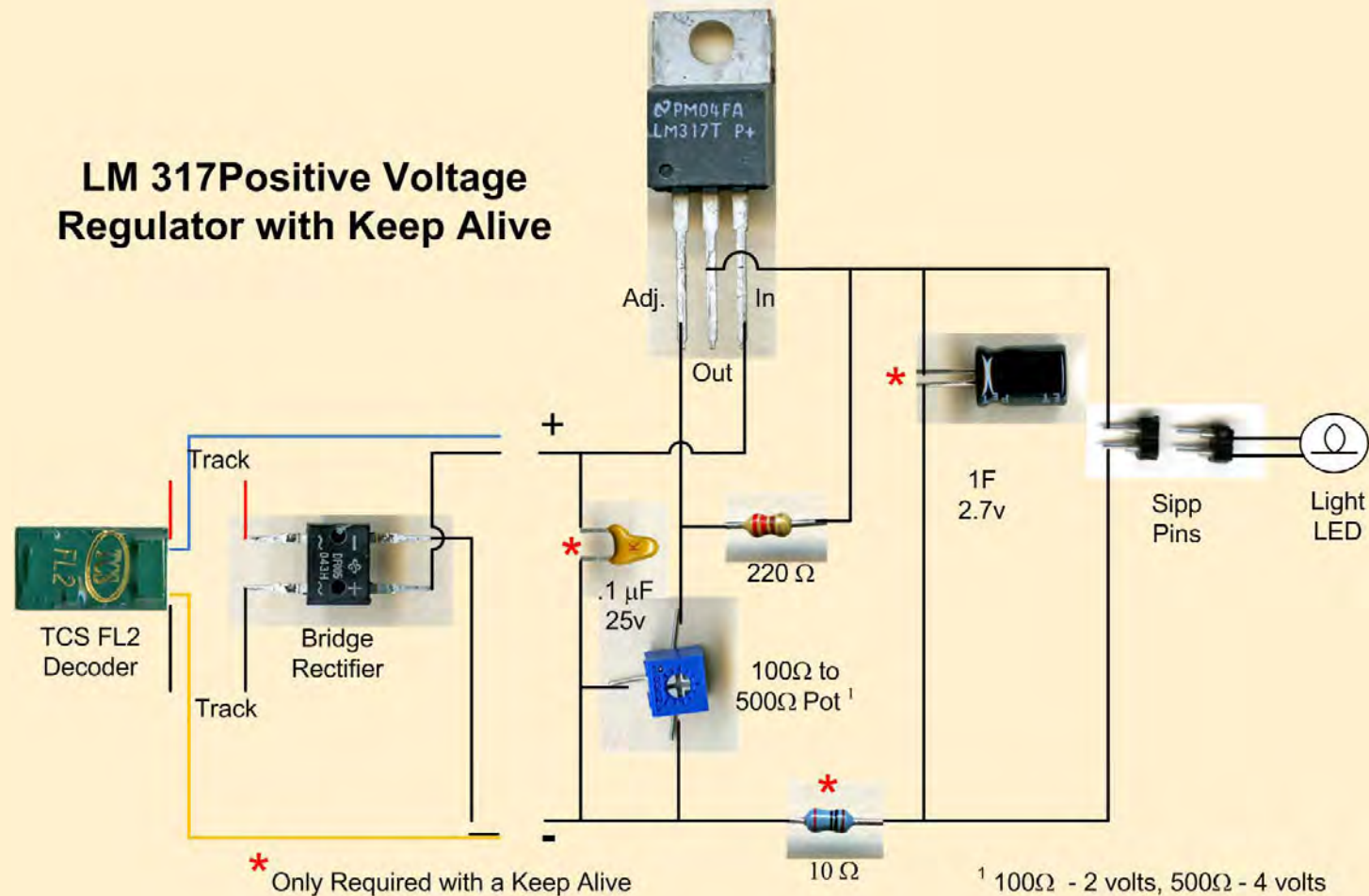
Keep Alive Car Lighting
on Etched Board



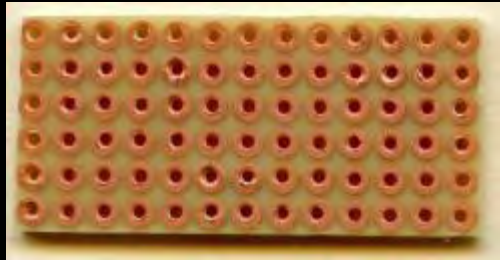
Locomotive Lighting
on Etched Board

Voltage Regulator Circuit with Keep Alive

LM 317 Positive Voltage Regulator with Keep Alive



Let's build a Voltage Regulator with Keep Alive for a Car

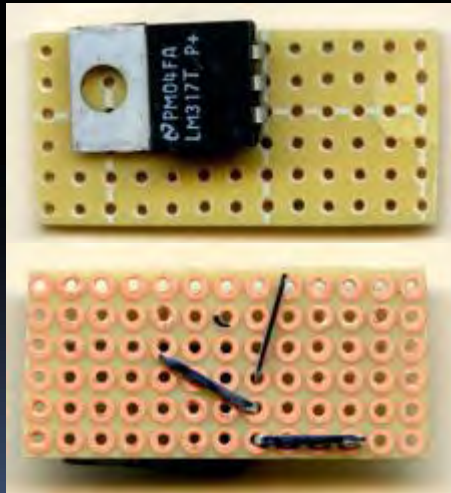


6 x 13 piece of Prototype Board



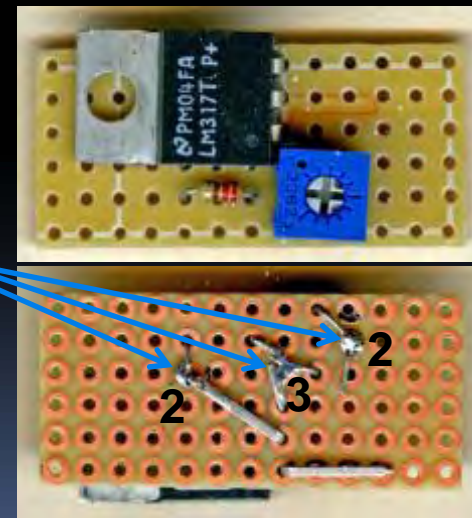
LM317 Pos. Regulator
TO-220 Case

Step 1



Install 317T

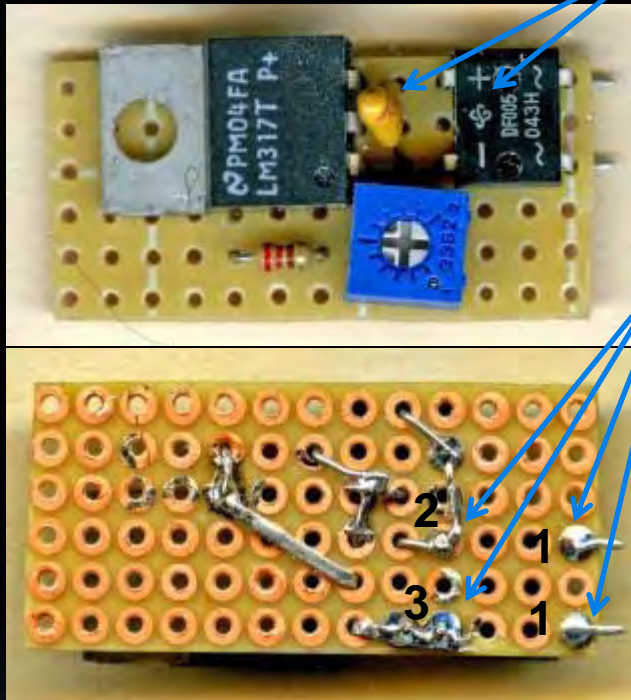
Step 2



Install Pot & 220Ω resistor

Let's build at Voltage Regulator with Keep Alive for a Car

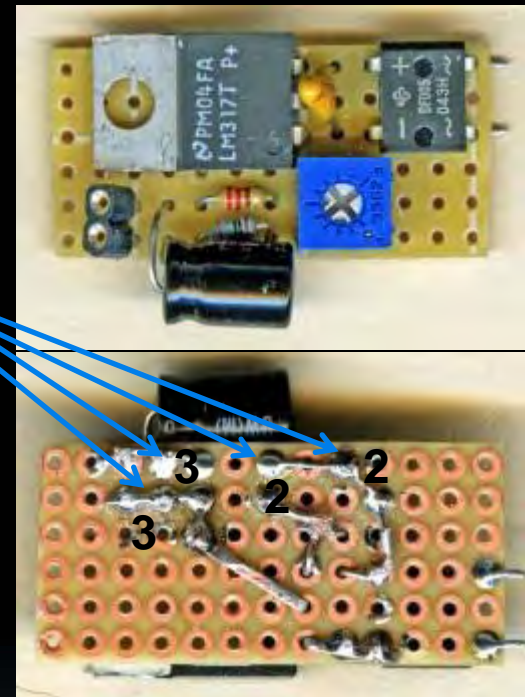
Step 3



+

Solder

Step 4

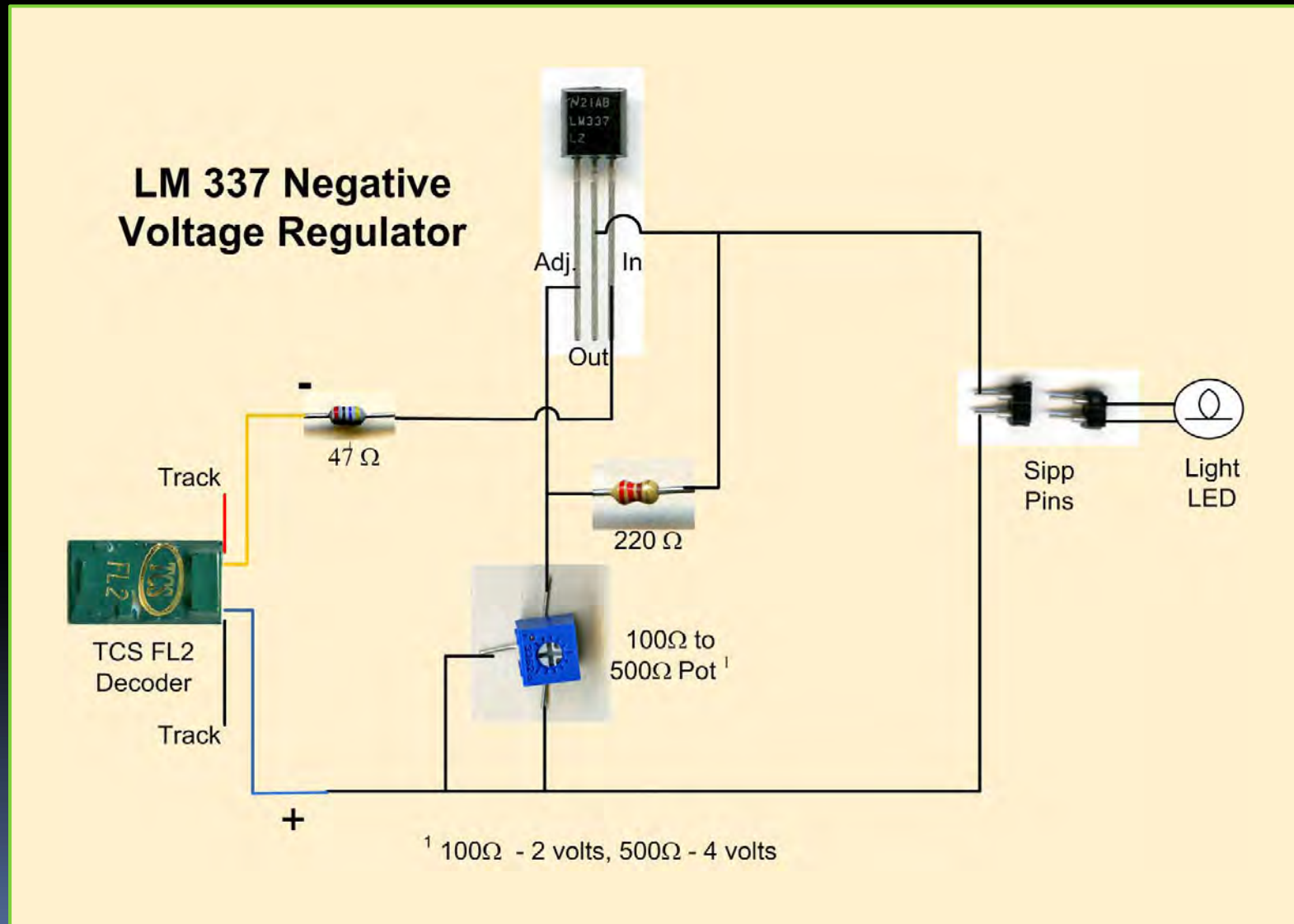


Install Bridge Rectifier & .1µf Cap.
Note the + on the Rectifier & Cap.

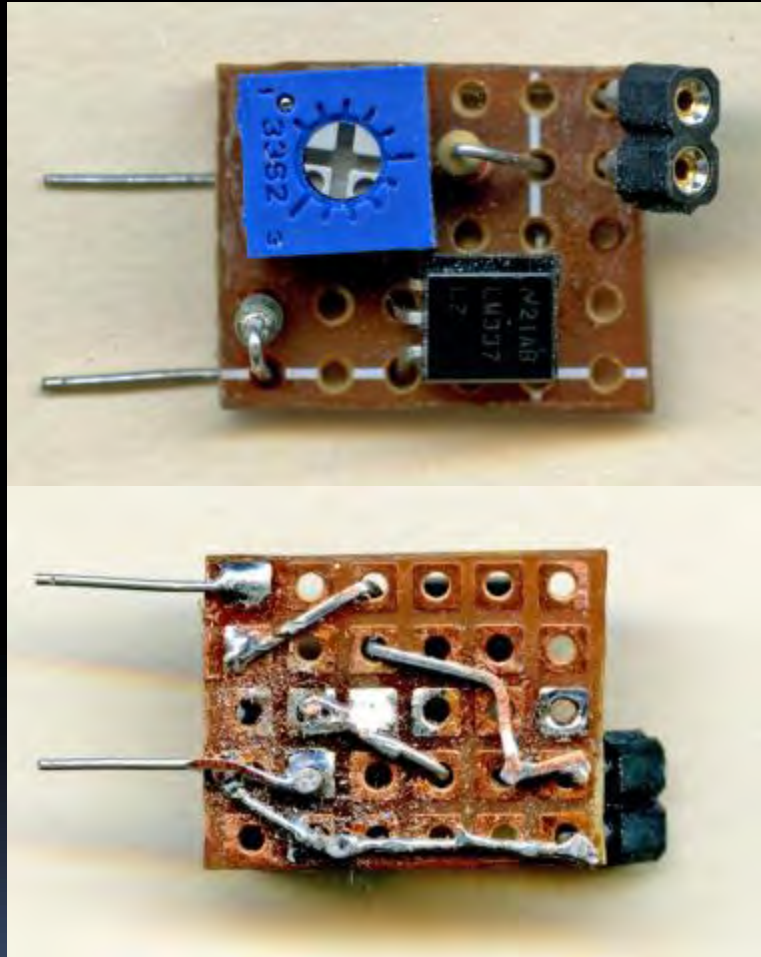
Install 10Ω resistor, 1f Cap. & SIPP
Note: the – on the 1f Cap. Goes in the
holes on the outside edge of the board

We are Finished !

Voltage Regulator Circuit for Locomotive



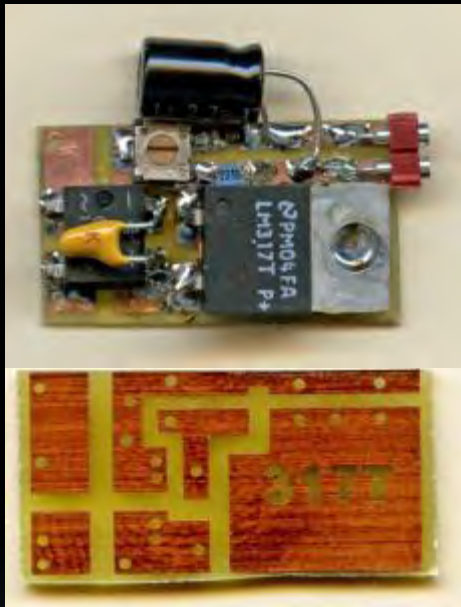
Voltage Regulator Circuit for Locomotive



Just like the Keep Alive circuit but smaller

Voltage Regulators

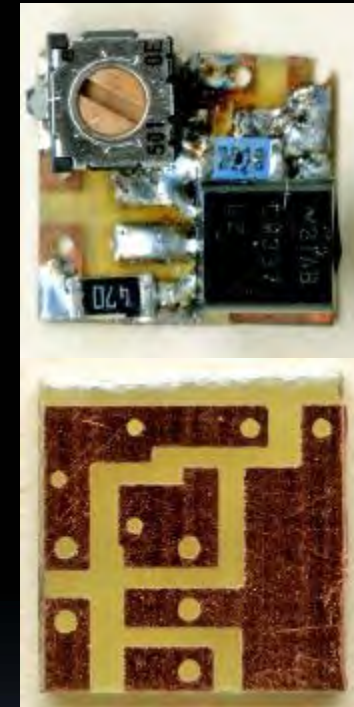
Surface Mount (SMF) on Etched Boards



Pos. Voltage Regulator
for Cars 1 3/16" x 5/8"
LM317 TO-220 case



Neg. Voltage Regulator
for Engines 7/16" x 5/8"
LM337 SOT-223 Case



Neg. Voltage Regulator
for Engines 3/8" x 3/8"
LM337 TO-92 Case

Testing



215Ω to 561Ω Test Board



581Ω to 1000Ω Test Board

- ❑ Use Alligator clip test leads with a sipp pin soldered on one end
- ❑ Connect to the light outputs on the decoder to the test board
- ❑ Determine a slightly higher value from the cheat sheets to start
- ❑ Move the test lead from one resistor to the next until the light brightness is correct.

Testing



9v Battery Throttle

- ❑ It is just like Keep alive circuit with out the Keep alive parts. Use a $5k\Omega$ Pot for the adjustment. Note the $.1\mu f$ Cap.
- ❑ Use a 12v test light bulb in the new circuit. Turn the pot on full.
- ❑ Connect the 9v Battery. The light should be dim.
- ❑ Turn the new circuit's pot down slowly. If the test light bulb dims further the circuit is wired correctly.

Tools



Hakko 936 (Discontinued)



Hakko FW888- \$90



MPJA 15846 TL - \$46



EXTECH MN35 Meter - \$20

Also Buy a fine point tip for your Soldering Station



Thanks for Watching