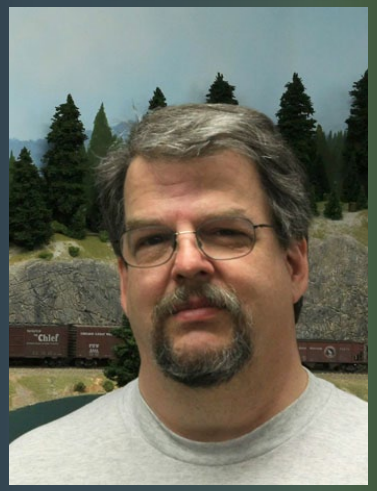
About our layouts columnist



Charlie Comstock is our layouts editor and columnist.

This column documents the 3rd version of his Bear Creek & South Jackson railroad.

Click here to learn more about Charlie.

Charlie Comstock is ...

UP THE CREEK: Night time - layout and structure lighting

A regular report on the construction of a 1950s-something layout

Reader Feedback (click here)

Simulating the night adds a exciting new feel to an existing layout. I explain the ways I achieve this type of ambiance on my BC&SJ layout ...

I'm a night-owl. If you're like me you're fascinated by street lights and the light spilling from windows and doors, all contrasted against the dark.

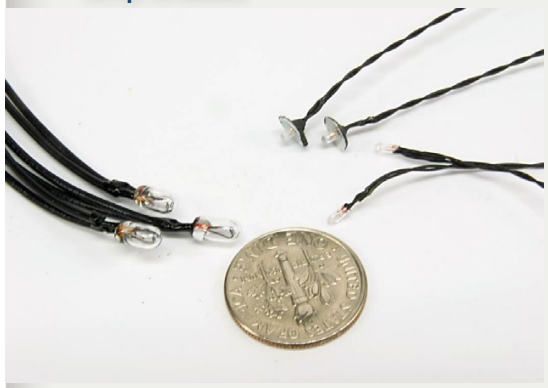
Moonlight

Poets have written about it, Beethoven wrote the Moonlight Sonata, and movie studios have struggled to simulate it. Real moonlight is too dim to shoot movie film - the result would be nearly black. Cinematographers long ago discovered that bluish lighting looks like moonlight and that's what I'm using on my Bear Creek and South Jackson.

Blue rope lights usually go on sale after Christmas at big-box stores (figure 2). I strung this stuff around the ceiling. It works fairly well - the room is definitely dark and the bluish light suggests moon light. Not quite the feeling that inspired poets to write endless verses, but good enough.

FIGURE 2 (above): blue rope lights.

FIGURE 3 (below): Miniature light bulbs - (left) grain of wheat (12V), (right) grain of rice bulbs (1.5V), (center) grain of rice bulbs with lamp shades.



Rope lights work well with standard incandescent light dimmers giving fine control of brightness.

If I get a budget that will permit it, someday I may replace all the fluorescent ballasts in my ceiling with 1% dimmable ballasts and dimmers (these special electronic ballasts allow dimming fluorescent lamps to 1% of full brightness) instead of using rope lights. But at around $80 or more *each* for ballasts, that day is not now!

Screw-in compact fluorescent lights can't be dimmed enough to create a good nighttime effect, and dimmed standard incandescent bulbs are too reddish, so I chose not to use them.

Structure lighting

Buildings with lights on (inside and outside) are nice during the day. At night, however these lights fill a scene with drama (see figure 19).

There are two major types of lights used in model buildings - LEDs and incandescent bulbs. I use mostly incandescent lights so they're what I'll write about here.

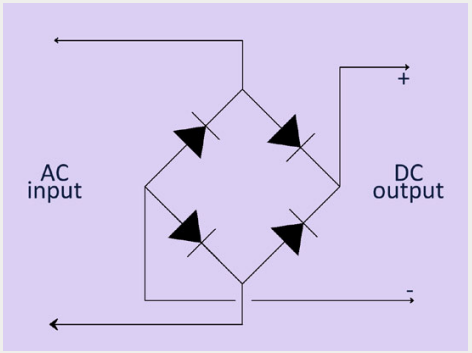
Nothing looks more like an incandescent lamp than an incandescent lamp. LEDs don't come close (though LEDs are good for emulating high intensity mercury and sodium vapor lights used in warehouses or gymnasiums).

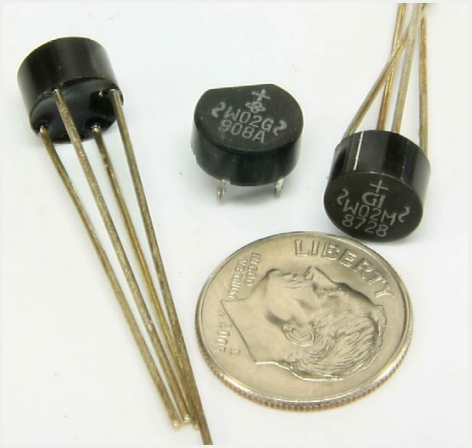
Incandescent lights are categorized by size, voltage, and current draw. It's usually (but not always) the case that the smaller lamps run on 1.5V while the larger ones use 12V or even 16V (figure 3). Bulbs last much longer if they are operated at less than their rated voltages.

Getting the right voltages

If all the lamps in a building are 12V, life (and the building wiring) is easy. When I'm mixing 12V and 1.5V lamps it's trickier, but there is a relatively simple solution I use.

It tuns out that silicon diodes require about 0.7V before they'll start conducting. Once they're conducting, that voltage barely increases no matter how much current is pushed through the diode (until too much power is applied and they fry). Two diodes in series have a voltage drop of about 1.4V across them. That's a good voltage for 1.5V lamps - it's high enough to light





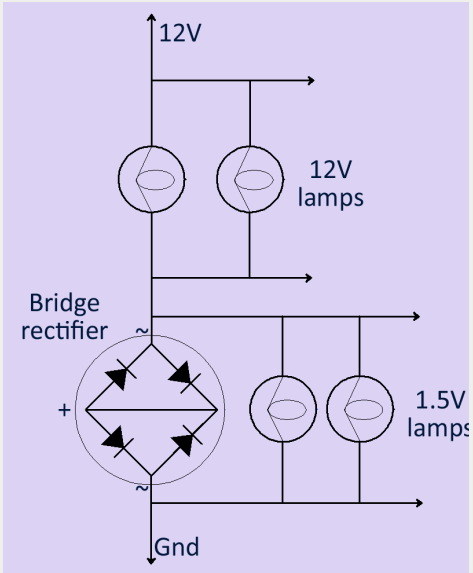


FIGURE 4: (right/top) Diodes configured as a bridge rectifier

FIGURE 5: (right/middle) 1 amp bridge rectifiers. Note the ~ and + markings on their cases!

FIGURE 6: (right/bottom) Wiring for a building with both 12V and 1.5V lamps. Note the connection between the + and - terminals of the rectifier.

Things to watch out for...

- Always verify that you have the correct voltage before connecting any lights or a power supply for the first time.
- Verify polarity is correct. Plus and minus can be important. I've blown out a building full of 1.5V lights by reversing polarity on a regulator circuit...
- Set up a color code for wiring and stick to it. This will help avoid confusion about whether a building should be hooked up to 12V or 1.5V.
- Don't glue lamps in place. If they fail and need replacement, you'll be sorry.
- Don't make the room too dark or people will bump into things or trip. Both the layout and crewmen are likely to suffer.

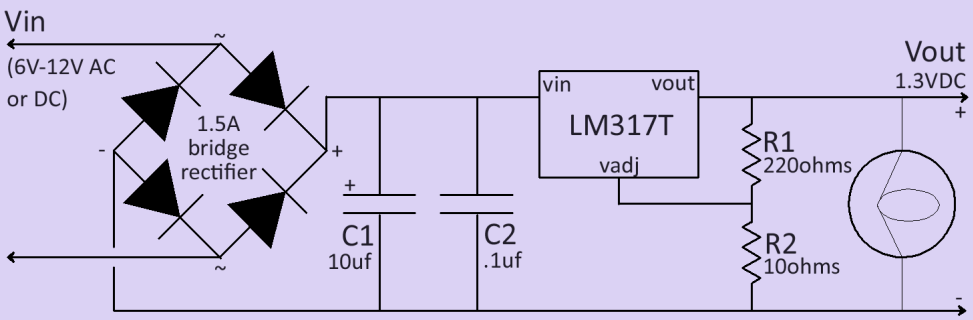


FIGURE 7: Circuit for a 1.3V power regulator. It will function with an input voltage from 6V to 16V either AC or DC (inputs are polarity independent).

Capacitor C1 is only needed if AC input voltage is used. C2 suppresses ringing on the output if the wires from the input power source are longer than 6 inches.

Output voltage is set by resistors R1 and R2 as follows:

$$V_{out} = 1.25 (1 + R2/R1).$$

A LM317T in a TO-220 package with a suitable heat sink will regulate up to 1.5 amps at 1.3V (with the proper power input).

Figures 18b and c show the Mill Bend cold storage building with 1.5V lamps powered by such a regulator.

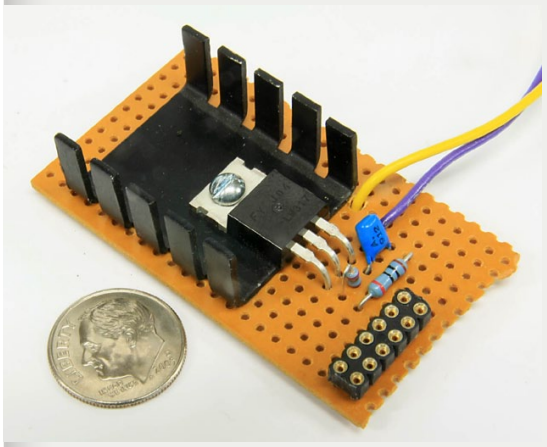


FIGURE 8: My prototype 1.3V power regulator. It is connected to a 6-12 VDC or VAC power source (via the yellow and violet wires). Up to 75 30ma 1.5V lamps can be connected to this device in 6 circuits (plugged into the 12 pin connector). The heat sink on the TO-220 chip allows this circuit to handle up to 1.5 amp.

them up, but low enough that they last a long time. Model Railroaders have been taking advantage of this phenomena for decades to get constant intensity lighting circuits in DC locomotives.

There is a special configuration of 4 diodes called a bridge rectifier (Figures 3 and 4). That's a fancy name for a way to convert AC to DC power. We can use the diodes in a bridge rectifier for our lighting circuit by connecting the + and - outputs together (see Figure 5). Since there are two conducting diodes in series (whether current is top to bottom or bottom to top) there will never be more than 1.4V across the bridge rectifier and the 1.5V lamps across it.

By connecting our 1.5V lamps across the diodes we guarantee they'll never get too much voltage (an important consideration with those 1.5V lamps!).

There is a potential problem with the circuit in Figure 3 though - it will only work if the total current through the 12V lamps is greater than the total current needed by the 1.5V lamps.

If there are four 30mA 1.5V lamps and two 50mA lamps that's 120mA in the 1.5V lamps, but only 100mA in the 12V lamps (mA stands for milliamp or $^1/_{1000}$th of an Amp). There won't be enough current flowing through the diodes to bring them up to 1.4V and the 1.5V lamps will be very dim. The answer is to add some more 12V lamps or remove some 1.5V lamps. Or the 1.5V and 12V lamps could be powered separately.

A 1.5 volt power source

A D-cell battery makes an excellent 1.5V power source. It will never generate too high a voltage and burn out all those tricky-to-install-bulbs. However batteries go dead and need replacement so a power supply connected to grid power is generally needed.

I worry about my 1.5V lamps. If a power supply fails and somehow puts 12V on them they'll become flash bulbs. Big oops! I chose to use a LM317T voltage regulator chip to produce a 1.3V output. This voltage will light the bulbs but is low enough to give them long life. The circuit is shown in Figures 6 and 7. To change the voltage output select appropriate values for R1 and R2.

$$V_{out} = 1.25 (1 + R2/R1)$$

Changing R2 to 26 ohms yields:

FIGURE 9: Lamp shades cut from .010" styrene. I twist the wires together to approximate the conduit that would support these lights.

$$V_{out} = 1.25 (1 + 26/220) = 1.4V$$

I strongly advise checking the output of each regulator circuit BEFORE connecting it to your structures.

Adding the optional diode bridge will protect the output from overvoltage, but it will draw current, reducing what's available for the lamps. I chose not to use it.

The cost of an LM317T is under $.50 at Allied Electronics or Digi-Key. The total parts cost for a 1.5 amp regulator is under $2 including the perf-board and connectors.

Interior vs Exterior lights

I often use 12V bulbs inside my structures and use the 1.5V bulbs outside where their smaller size is more suitable for HO scale (sometimes I use 1.5V bulbs inside, too). If you model in a larger scale the bigger bulbs may be a good choice for you.

FIGURE 10: Mounting ceiling lights in the BCSJ office at Oakhill. Note the wiring closet in the lower right.

FIGURE 11: An operating desk lamp. I had to drill a hole through the desk to mount this guy!

Exterior lights

Exterior lighting often has a lamp shade. If I'm using 'shaded' lights I prepare the bulbs by twisting their leads together. I use a punch for a 3-ring binder to cut out lamp shade blanks from 0.010" styrene. I use a jig to give the lamp shades a conical shape.

I made my jig by drilling a very shallow hole in a scrap of wood with a $^{5}/_{16}$" bit. The hole is not even $^{1}/_{8}$" deep. I press the lamp shade blank into hole and burnish it. Then I drill a hole in the center of the shade big enough for the leads of the 1.5V bulb to pass through. I thread the leads through the hole and ACC the shade in place. When the ACC dries, I paint the top of the lamp shade a dark color (so light won't show through the thin styrene). See Figure 9.

I drill a small hole in the side of a building where the light will be installed, thread the lamp's wires through the hole, and tape the wires inside to hold them in place (don't glue the wires, it will be a problem if you ever need to replace the light!). See figure

Mounting interior lights

I mount interior lights in different ways. For ceiling lights I'll put strips of styrene across a ceiling and thread the bulbs' wires through them, leading to a wiring closet (figure 10)

I make desk lamps by drilling holes in bits of $^{1}/_{8}$" round stock. I file the top piece to look like a lamp shade and paint it tan.

FIGURE 12: With the lights on at night it's obvious there's nothing inside the South Jackson Mill and Feed if someone looks through the windows...

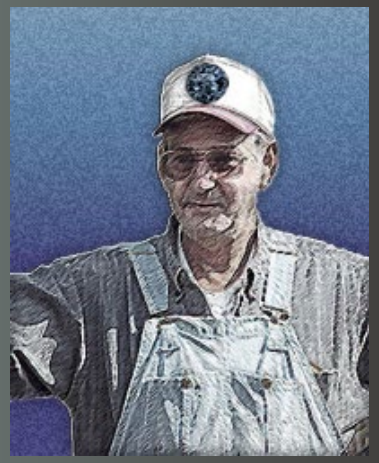
The Junior Hoghead says ...

I really like the way night time lighting looks. I love seeing all the lights and getting a good look inside the buildings I made with detailed interiors.

I love to run trains at night too because it looks so cool and I want to start having some night-lighting time during my op sessions. I can't wait to show my pals the new night lighting!

Someday I plan to install a system to automatically go from day to night and back to day again with sunrises and sunsets all under computer control. ■

FIGURE 13: Interior details are clearly visible at night. Each story in this building has its own floor and interior wall assembly complete with wiring.



The Old-Timer says ...

I like to see what I've put all my hard work into creating and night scenes look neat, but the darkness hides my work except building interiors, and it just gets real old real fast.

Having operations in the dark is a real pain. I don't like needing a flash light to see what's going on - not to mention it's harder than heck to re-rail a car when you can't see where the wheels are!

As far as lighting automation goes, the equipment for that is pretty spendy. I'd rather use my hard earned $$ to build more railroad. ■

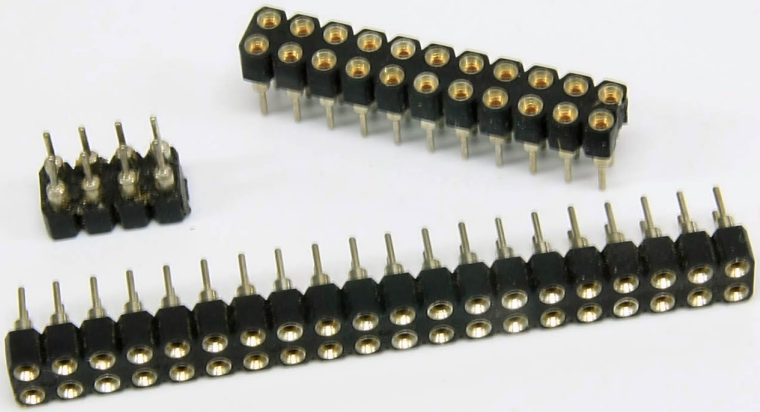


FIGURE 14 (left): Socket strips with pins on 1/10" centers. These strips are a bit flexible. I cut them with an X-acto blade to get the number of circuits I need - two for a single building light circuit.

FIGURE 15 (right): Building wiring with a homemade connector.

FIGURE 16 (below) The depot and plywood mill lit up in Mill Bend at night.

The lower piece is filed to look like a lamp base (figure 11). I thread a bulb's wires through the bottom piece and set the shade on top of the bulb.

Building Interiors

Interior illumination in buildings looks pretty cool when the train room is darkened and lit by 'moonlight'. I love the look of light spilling out a window across the ground below.

However, if light can get out, visitors or crewmen can see in, and notice the building is merely an empty shell (figure 12).

Buildings at eye level with interior lighting are especially prone to 'empty building syndrome' - either frost their windows so onlookers can't see what's missing inside, or add some interior details (or a facsimile of detail!). I detailed the BC&SJ office in Oakhill using components from SS Ltd. They look great but are a bit expensive. In the smaller scales (N and HO) visibility through windows is pretty restricted,

FIGURE 17: The Mill Bend depot and plywood mill at night

so it's OK to approximate interiors instead of going nuts with details (if you do add a bunch of details consider entering a modeling contest!)

Wiring

Wiring is crucial. I want to keep my buildings removable for maintenance (or if they move to a new layout - again).

That implies making the wiring unpluggable. There are lots of different connectors available but most of them are too big or too expensive.

I found some socket strips at a local electronics retailer (figure 14). I sawed them apart and made mini connectors (figures 15 and 18a). They're relatively economical and are small enough to

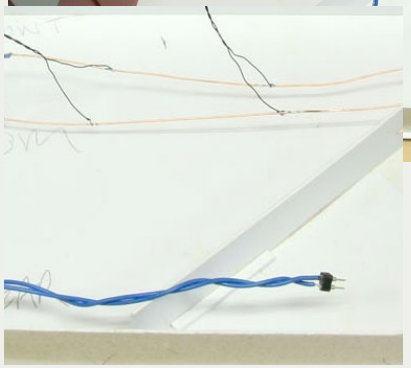
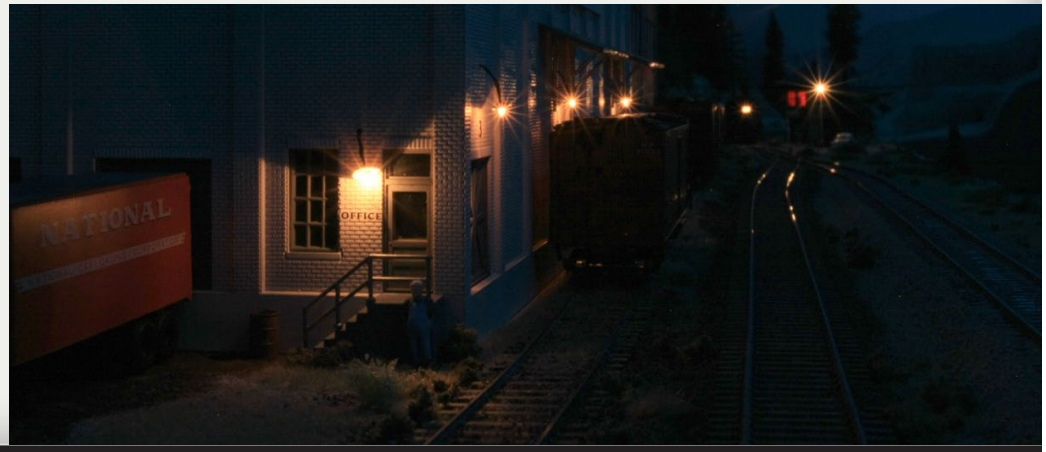


FIGURE 18a (top): Pouhler Bayer cold storage is wired with 4 1.5V external lamps. Note the bare copper 1.5V buss wires inside (where they can't be seen).

FIGURE 18b,c (below): The cold storage company lit up at night.



A clipping from the

South Jackson Gazette

Burglaries Baffle Railroad Police!

Railroad police in Mill Bend are baffled by a series of burglaries. In each case thieves made off with furniture, plumbing, carpets, stoves, fixtures and wall paper.

Said Horace Fithers, a local of neighboring Oakhill, "Heck, all them dadgum thieves left were the paint on the walls and the ceiling lights!"

Indeed the burglarized buildings look almost as though there was never any furniture present at all!

"Ya know", sighed Abe Euhnett, engineer on the BC&SJ. "Us railroad personnel were really looking forward to finally using these buildings once the electricians got the lights installed in them. Used to be so dark in 'em, there wasn't any point going inside. Then just when it got so we could see something ,this happened. Heck, I'd never even been in the Mill Bend depot before."

Meanwhile, an ugly rumor is circulating that the railroad never bothered to install any furniture or fixtures at all in some of their buildings! Certainly no one in their right senses would believe such a wild story?

Burglarized building in South Jackson

All this reporter knows is that the area is quite unsettled and is likely to remain that way until the crime is solved and the culprits are brought to justice.

* If you like the South Jackson Gazette, you can read more at bcsjrr.com.

FIGURE 19: The railroad never sleeps - SP&S 79 passing Deschutes Jct. after sun down.

easily fit through a 3/8" hole drilled in the subroadbed under a building.

Figure 18a shows how I wire buildings where the interior can't be seen. I strip the insulation from 2 pieces of solid 22 ga wire and use them as buss wires. I solder the lamp's leads to the buss wires and attach a length of feeder wiring terminating in one of my home-made connectors. I use blue for 1.5V and orange for 12V feeder wires.

For buildings where lots of windows show off their detailed interiors, bus wires are not practical. Instead I build a wiring closet (figure 10) and keep as much of the wiring as possible hidden away in it.

For multi-story buildings with detailed interiors, I find it easiest to make the floor and interior walls for each story as a separate assembly with its own wiring. Each floor assembly has a wiring closet stacked above the closet on the lower floors. I use my home-made connectors to plug the floors together. This way if any bulbs burn out I can disassemble the building for repairs.

Summary

With moon glow from above and buildings lit up below, the drama of nighttime railroading has come to the Bear Creek and South Jackson Railway Co. It may not be the lighting you'd choose for an op session, but I highly recommend you give it a try, even in a small area - the results can really make your eyes pop! ☑