Christmas
Countdown
Timer

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Project Description

This document describes the project that my 8-year-old daughter, Faith, and I undertook to build a huge Christmas Countdown timer for our light show for 2012.

The prop, along with some batch programming, executed from within a Light-O-Rama show, counts down the days ‘til Christmas, beginning on Nov 16 and ending on Jan 13. Though I don’t anticipate using it for that duration, the real requirement I established was to run from Thanksgiving through the second weekend of the New Year.

Much of the construction is wood (of various types, as shown in the parts list below). It also includes a sheet of Plexiglas and operates using a single, slightly augmented 16-channel Light-O-Rama controller. The controller is used to turn on various circuits of lights that show through the Plexiglas to indicate the days remaining as well as highlight the appropriate text on the sign. On Christmas day and after, only the “Merry Christmas” portions of the sign are lit.

The overall layout of the sign is showed below. Its actual size is about 3’ x 3’. In order to keep the sign as compact as possible, I laid out the “’til” and the Merry on the same line, knowing that only one would be turned on at any given time. This also allowed me to “reuse” the word “Christmas” both before and after the holiday. The font used is called “Hayseed”. I chose it for its thick line width and availability from the place where I bought the vinyl lettering from. Choose whichever one you’d like to use.

![Figure 1 Overall Sign Layout](image-url)
Materials List

Here are the materials used in the construction of this prop. Note that the sizes of the materials will be dependent upon your application.

- 1 – 4’ x 4’ sheet, ½” particle board
- 1 – 4’ x 4’ sheet, ½” plywood
- 1 – 4’ x 4’ sheet, ¼” hardboard
- 1 – 3’ x 6’ sheet, 1/8” Plexiglas (it’s what was available at my local Menard’s)
- 2 – 8’ 4x4 green treat post
- 2 – 8’ 2x6 green treat board
- 1 – 3” hinge
- 1 – window sash latch
- SPT2 cord
- 2 – ¼” electrical strain relief
- 2 – ¼” female thread conduit coupler
- 1 – 16-channel LOR controller board
- 1 – DPDT relay
- 100 – C7 sockets
- 100 – C7 LED retrofit light bulbs
  - [https://1000bulbs.com/product/7903/SSL-C7E12RED.html](https://1000bulbs.com/product/7903/SSL-C7E12RED.html)
  - [https://1000bulbs.com/product/817/SSL-C7E12GRN.html](https://1000bulbs.com/product/817/SSL-C7E12GRN.html)
- Vinyl lettering
- Black paint
- Silver metallic paint
- Glass frosting paint
- Wood glue, screws, etc.
Overall Construction Technique

There are lots of ways to put this together, but I decided to create a frame out of 2x6 lumber and cut dados into the frame to accept the various pieces of plywood, Plexiglas, etc. At 36”, the Plexiglas was my limiting factor, as it was the largest width available to me locally. What I was attempting was a 3’ x 3’ visible sign area, but due to my dado-style construction, that was reduced in one dimension to 34-1/2” viewable, as the dados were cut ¾” deep on each of the frame pieces. Since I had more flexibility in the vertical dimension, I decided that the viewable area would be 34-12” high and 36” wide.

The concept was to drill holes in the particle board, insert the C7 light sockets through the front side, and wire them from the back side. I wanted to give the C7 lights about 2-1/2” of space and I wanted about an inch of space to house the back of the sockets and the wiring. I’ve included a rough drawing below showing the layout of the dados on the 2x6 frame.

![Dado Layout for 2x6 frame](http://www.facebook.com/bluecreekchristmas)

Each dado is cut ¾” deep into the 2x6. The bottom 2x6 on the frame is cut at 39” wide with a 45-degree mitre on both ends. The sides are cut at 36-1/4” with a 45-degree mitre on the bottom end and a straight cut at the top. The upper 2x6 is cut straight on both ends, 46” side. Once the dados are cut into the frame, most of the construction occurs on the particle board “slice” in the build.
Particle Board “Slice” Construction

The concept for this portion of the build is to create little “boxes” to house the light bulbs. To build these boxes, I cut the hardboard to the appropriate sizes (all at 2-1/2” height) and then used Elmer’s Wood Glue Max (waterproof wood glue) to glue the individual pieces to the particle board.

For the segments of the simulated LED digits on the sign, I came up with an easy construction method. What I did was to cut 3” x 2-1/2” pieces of hardboard (4” x 2-1/2” as shown in Figure 4, but I changed it as I was actually cutting them), cut a ½” dado at 1-1/4” depth (half the height of the piece), and then insert one into the other to make an “X”. This formed four perfect (or at least close enough) 90-degree angles. See the figure below. The left portion of the picture shows the individual pieces and how they go together. The right portion shows a top view of the “X” once it’s put together.

![Diagram of hardboard layout for “X”]

Once the above were constructed, I used some tracing paper and a layout diagram that I’d printed to scale (included in this zip file) and traced the layout onto the particle board. I then glued an “X” in each position, according to the diagram. A representative layout is shown below (not to scale) in Figure 4.
See Figure 5 for a photo of a completed digit of “X’s” to see what they look like after they’re glued to the particle board. You’ll note that there are 6 of them that are glued down to form the intersections of each LED segment. Also visible in the photo are the layout lines that I traced onto the particle board. You can see that I traced the location of each “X” as well as the lines between them which define the inside edge of the other parts of the segment, as indicated by the red arrows.

Next was to construct the sides of each LED segment. They’re 2-1/2” high and 3-3/4” in length with a 45-degree mitre on both ends. To complete each segment, I glued two of the mitred pieces to the particle board complete the segment. Figure 6 below depicts both digits with all hardboard pieces glued to the particle board. On my board, I decided to place them approx. 1-1/4” apart, the same distance as the width of each LED segment.
Figure 6 Final Layout of Both Digits
Building the “Boxes” for the Text

To build the boxes for the text, I started with the vinyl lettering that I ordered from UppercaseLiving.com. There are other options, but we’ve used them before for other projects, with great satisfaction. Again using tracing paper, I placed the vinyl lettering (with all paper backing intact) on the particle board and traced a rough outline of the letters into their correct locations. Using those outlines as a guide, I drew some rough lines around the text where I intended to glue the hardboard such that it would create a “box” around each portion of the text that I wanted to light separately. There is a box around each of the following:

- day
- s
- ‘til
- Merry
- Christmas

I then measured each side of each box and cut hardboard at 2-1/2” high and at the appropriate length for that particular side. With all the pieces cut, I glued them into place. You can see a photo of the final particle board and all of the “boxes” and the LED segments below in Figure 7. If you look closely, you can see where I traced the text onto the particle board.

![Figure 7 Digit and “Box” Layout on Particle Board](image)

Once you’re finished with this, the hard part’s done.
Working with the Plexiglas

To begin this step, I first cut the Plexi to size and painted one side of it with three coats of glass frosting spray paint. At the end state, what I wanted was for the lighted portions of the sign to show through the Plexi. And only the lighted portions. That meant masking off those portions and then spray painting the rest black.

I then dry fit the completed particle board into the 2x6 frame and slid the frosted Plexi into place. From there, I performed 2 steps.

1. I used blue painters tape to mask off the areas inside the LED segments. I applied the painters tape to the frosted side of the Plexi.
2. Looking through the Plexi, I used the “boxes” that had been glued to the particle board to decide where to place the vinyl lettering. Once I knew where to place the lettering, I removed the paper backing from the lettering and adhered it the text to the frosted side of the Plexi.

Figure 8 below shows the completed Plexiglas masking while it’s still dry fitted into the sign’s frame. You can see the text “boxes” through the Plexi.

Figure 8 Masked Plexiglas

Once these steps were complete, I used two coats of flat black spray paint to cover the entire sheet of Plexi. Once dry, I removed the masking tape and the vinyl lettering to expose the areas of the sign where I wanted the light to shine through. I was sure to allow the paint to dry completely before removing the vinyl lettering to avoid ruining the nice clean edge on the letters. Figure 9 below provides
a depiction of the Plexiglas after all masking has been removed. This process was surprisingly effective with both the tape and the vinyl lettering and all lines were very crisp. Removing the vinyl lettering was very easy with a household utility knife. If you go this route, you'll want to be sure to get the standard vinyl lettering. Not the stuff meant for use on windows or Plexiglas, as the adhesive on those is much stronger and likely more difficult to remove.

Figure 9 Final Plexiglas View
Installing the Light Sockets

This was not an exact science for me, so I eyeballed the locations where I wanted to place lights and marked them on the front side of the particle board. You can see these locations marked with a black marker in Figure 7 above. I used 2 bulbs for each of the LED segments. For the text “boxes”, I placed them roughly 3” – 3-1/2” apart. Very roughly. That meant 12, 2, 10, 20, and 30 bulbs in the “day”, “s”, “’til”, “Merry”, and “Christmas” boxes, respectively. From the front side, I used a 9/16” spade bit to drill the holes. Then, I flipped the particle board over and cut a small “notch” into each hole. This was to accommodate the particular sockets that I chose. It actually worked out nicely. The protrusion from the edge of the socket fit into the notch and kept it from turning during the rest of the build. It worked great. See Figure 10 below for a photo of a couple of light socket holes.

![Light Socket Holes](image)

**Figure 10 Light Socket Holes**

Before installing the sockets into the newly cut holes, I painted the particle board. First a coat of black for all the areas I was not intending to light. This was mostly for weather protection. Then, I applied 2 coats of silver metallic paint to the insides of all the areas that were going to be lighted. I think white paint on the insides would also have worked well. Figure 11 below shows what the particle board looks like, fully painted and with all light socket holes drilled.
Once the paint was dry, I inserted the sockets from the front side of the board, then turned it over to expose the back side, where I connected all the SPT2 wire to each individual circuit, and then ran each individual cord to the bottom of the board, leaving about 18” of length to make the electrical connection to the controller. To do this, with the back side of the particle board facing upward, I placed a piece of lumber (2x4, small piece of plywood, whatever) between the socket and the floor, placed the SPT2 across the socket, installed the cap on the back of the socket, and tapped it into place with a hammer. This provided resistance to keep the socket from pushing back through the hole while I was tapping it with the hammer. Worked great. Figure 12 below shows the view of the back of the particle board with all wiring completed. Once the sockets were wired, they were ready for the C7 LED retrofits. A note about the sockets: the metal tab at the bottom of the inside of the socket was a little too vertical in some of the sockets and needed to be bent downward. I didn’t realize it until it was too late, but I had one that bent the wrong direction when I screwed in the light bulb. It created a short between the bottom of the bulb and the threads. When I plugged it in to test it, I burned up the socket.
Figure 12  Rear View of Particle Board with Completed Socket Wiring
**Putting it All Together**

To begin, I cut the 4x4 lumber into 4 pieces, each 48” in length. Two would serve as the base. Two would serve as the vertical posts. I then cut a dado into the bases at a depth of 1-3/4” to accept the posts.

I painted all the remaining pieces (including the ½” plywood) flat black on all sides to protect it from the weather and to help it “disappear” into the night during the show.

To accommodate the SPT2 cords from the individual light circuits, I drilled two large holes in the 2x6 that is the bottom part of the frame. I inserted the female threaded PVC conduit adapters into the two holes. To attach them to the frame, I pre-drilled a couple holes in each one and screwed them to the 2x6. Then, from the inside side of the frame, I screwed in the ¾” electric wire strain reliefs. Through these, I fed the SPT2 cords and used the strain reliefs to clamp them tight. Depending upon your implementation, you may have to make a couple of cuts in the bottom of the particle board to accommodate the strain reliefs. I did. If you look closely at Figure 12 above, you can see the cords feeding through the bottom of the frame as well as the small cut-outs in the particle board to accommodate the strain reliefs.

I glued the particle board into its slots in the bottom and side2x6s. Once the glue was dry, I attached the vertical posts to the sides of the 2x6 frame. With the posts attached, I set them into the dados that I’d previously cut into the base 4x4s. Once in place, I was able to slide the Plexi as well as the rear ½” plywood into the dados in the frame. I did not glue them, so as to be able to remove them later for trouble-shooting or replacing light bulbs.

To one of the posts and to the top 2x6, I attached a hinge so that I could later open the sign from the top and remove the Plexiglas or rear plywood for repairs or to replace burnt out bulbs. To the other post and the other end of the 2x6, I attached a latch that you usually see on a window in order to be able to keep it closed. Note that the dados that were cut into the top piece of the sign (to accept the plywood, particle board, and Plexi) were not cut all the way to the right and left edges of the 2x6 as they were with the bottom and sides of the frame. This was for better weather-proofing and for aesthetics, as the top 2x6 covers the vertical posts as well as the frame and sign (thus the need to be 46” in length, when the bottom is only 39”). Figure 13 below show how it looked when it was all assembled.
Figure 13 Assembled Countdown Sign

Figure 14 shows a few elements of the top 2x6 used in constructing the frame. Beginning from the left picture, and moving to the right, you see the hinge, the latch, the end of the 2x6 showing the dados stopping before they reach the edge of the board, and a view of the various “layers” of the sign installed into their dados.

Figure 14 Elements of 2x6 Frame Top
Lighting it Up

As stated above, I was able to use a single 16-channel controller to animate the Countdown Sign. This allows it to be entirely self-contained. Just a single power cord and a network cable attached to it. The challenge I had, however, is that I needed 17 channels in order to have control of one small feature that would have bothered me if I hadn’t figured it out. I wanted a channel to be able to turn the “s” off in the “days ‘til” text when there was only 1 day left ‘til Christmas. Otherwise, the sign would have read “1 days ‘til Christmas”. I could also have used an X10 controller to replicate this capability, but I can’t get the X10 signal to work reliably at my house (even with a booster and phase coupler).

Thanks to some smart guys on the LOR Forum, I came up with this solution to my problem... What I was able to do is add a double pole, double throw (DPDT) relay to the mix to enable this behavior. Since the word “Christmas” is always intended to be turned on, and since either “day ‘til” or “Merry” is always turned on, I used the latter two as inputs to the DPDT relay to drive the circuit that turns on “Christmas.” I took the controller output that turns on “day ‘til” and also connected it to the normally open (NO) position of the . Then, I took the controller output that turns on “Merry” and also connected it to the normally closed (NC) position of the relay and the relay coil. The relay output was then connected to the circuit for the word “Christmas.” Thus, before Christmas, the power comes through the NO connection and passes through the relay to turn on the lights for the word “Christmas.” Then, on Christmas day and after, the power energizes the coil of the relay and closes it, allowing the power to come through the NC connection and pass through to turn on the lights for “Christmas.” Voila. 17 channels.

The channel layout is as follows below. For reference, the digit segments begin with the letter A at the top, and follow clockwise around the digit to segment F in the upper left. The segment in the very middle is segment G. See http://en.wikipedia.org/wiki/Seven-segment_display for more details. Note that I only operate 6 of the seven segments in the tens digit. This allowed me to stay within the 16-channel limitation of the controller. Since I only needed to be able to display a 3, 2, or 1 in the tens digit, I didn’t need segment F.

<table>
<thead>
<tr>
<th>Channel #</th>
<th>Connection</th>
<th>Channel #</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>tens digit, segment A</td>
<td>2</td>
<td>tens digit, segment B</td>
</tr>
<tr>
<td>3</td>
<td>tens digit, segment C</td>
<td>4</td>
<td>tens digit, segment D</td>
</tr>
<tr>
<td>5</td>
<td>tens digit, segment E</td>
<td>6</td>
<td>tens digit, segment G</td>
</tr>
<tr>
<td>7</td>
<td>ones digit, segment A</td>
<td>8</td>
<td>ones digit, segment B</td>
</tr>
<tr>
<td>9</td>
<td>ones digit, segment C</td>
<td>10</td>
<td>ones digit, segment D</td>
</tr>
<tr>
<td>11</td>
<td>ones digit, segment E</td>
<td>12</td>
<td>ones digit, segment F</td>
</tr>
<tr>
<td>13</td>
<td>ones digit, segment G</td>
<td>14</td>
<td>day ‘til</td>
</tr>
<tr>
<td>15</td>
<td>Merry</td>
<td>16</td>
<td>s</td>
</tr>
<tr>
<td>17* - from relay output</td>
<td>Christmas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I placed the controller as well as the relay in a single weatherproof box and then screwed it to the back side of the sign (to the ½” plywood). In my original design, I actually planned to wire directly from the

Christmas Countdown Sign Instructions http://www.facebook.com/bluecreekchristmas
controller to the C7 sockets to eliminate the male and female vampire plugs, but quickly realized that if I ever needed to do any kind of repairs, I’d want a disconnect of some sort. So, I added the vampires.

**That’s it!** Once you connect the controller outputs to the sign inputs and plug it in, you’re ready to turn it on.
Making it Work

To enable this sign to work, there are a number of sequences that are required. I’ve included a list here, along with their purpose. Note that my sign will operate as Unit 07, so you’ll need to change that, as appropriate. I have included all files in the attached zip file for your use.

<table>
<thead>
<tr>
<th>Filename</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>days_til_sign_test.las</td>
<td>Use this file to test the operation of your sign. Not intended for use during actual show operation.</td>
</tr>
<tr>
<td>ones_digit.las</td>
<td>This sequence is included in the background section of the show. It includes the operation of the ones digit as well as the “day ‘til” and “Merry” text.</td>
</tr>
<tr>
<td>tens_digit.las</td>
<td>This sequence is included in the background section of the show. It includes the operation of the tens digit.</td>
</tr>
<tr>
<td>s_character.las</td>
<td>This sequence is included in the background section of the show. It includes the operation of the “s” character.</td>
</tr>
<tr>
<td>ZZ Ones_digit_X.las</td>
<td>X indicates the digit. There are 11 of these. One for each digit (0-9 and blank). Each one lights up the appropriate segments of the ones digit.</td>
</tr>
<tr>
<td>ZZ Tens_digit_X.las</td>
<td>X indicates the digit. There are 4 of these. One for each digit (1-3 and blank). Each one lights up the appropriate segments of the tens digit. Note that in my implementation, the 0 is not used.</td>
</tr>
<tr>
<td>ZZ S_character_XXX.las</td>
<td>There are 2 of these, where XXX indicates “off” or “on”.</td>
</tr>
</tbody>
</table>

The test sequence called out above includes all 16 channels in a single sequence and changes the appropriate channel once every second to cause the timer to countdown and to turn the appropriate text on and off as the time progresses. This is the sequence you see in my example video (linked at the end of this document).

When the sign is actually operating as part of the show, it’s a little more complicated, but here’s how it works... My plan is to run two “shows” each night. The first one will be a “dummy” show which will not do anything visible to our visitors. This show will run immediately prior to my real show, probably a couple minutes beforehand. It will load and execute one sequence that turns on no lights. The only thing it will do is to call the following command from the Windows command line. Then, the show will shut down. You’ll need to replace “C:\path” with the path to the showstart.bat batch file.

```
C:\path\showstart.bat" %DT_j%%DT_c%
```

When this command is executed, the batch file will run and will receive two variables from the system. The first is the day of the year (0 – 366). The second is today’s date, which will be in a format that could be different from system to system, so you may need to make some adjustments to the batch file to get it to work.

I have made an attempt to comment the batch file very well for two reasons. One is so that you can modify, as necessary, to fit your setup. The other is so that I can remember what the heck I did if I ever need to change it myself. A note... I’ve done some testing to try and make sure it’ll work, but I’m no
software programmer, so you may find some bugs and certainly will find things that could have been implemented better. I have included a bunch of debug lines, which are commented out in the included version of the batch file. Remove the “::” at the beginning of those lines to enable debugging, as appropriate. And it seems like a lot of lines, but there are only about 50 that actually do anything.

Essentially, the showstart.bat batch file uses the variables passed to it to determine how many days are left ‘til Christmas and then copies the appropriate files into the locations that will later be used by the “real” show. The batch file can handle leap year. And it is able to process all dates of the year without crashing, but will result in a “no action performed” sort of message to the user when it’s outside the bounds of the countdown timer (Nov 16 – Jan 13). It will not change the countdown in real time. So, if you’re running the show across a date change, overnight from Christmas Eve to Christmas, for example, it will not update the countdown. If you wish to do this and don’t want to modify my solution, I suggest you schedule the dummy show to run at midnight and then restart your normal show.

Note that the “ZZ” files listed in the table above need to be located in a folder called “countdown digit files” and that folder needs to be a sub-folder of the standard “Sequences” folder that LOR uses for the rest of the show sequences. For example:

C:\Light-O-Rama\Sequences\countdown digit files\ZZ_ones_digit_0.las

In order to get the batch file to look in the appropriate folders, you’ll need to modify it to match your setup. I believe my comments in the batch file should tell you how to do it.

In the background section of my show, I include the following animation sequences.

- ones_digit.las
- tens_digit.las
- s_character.las

These files are the ones that the batch file modifies each night to set up the show.

And that does it. Once those files are loaded into the background section, the show can just be run as normal. Here’s a link to the YouTube video if you want to see the sign in action. Also, take a look at Figure 15 below to see a photo of the sign once it’s lit up. Note that I did not have all segments lit.

http://youtu.be/b8hgfSytbD0
The End

This project has been very enjoyable for me. I’ve gotten to learn some new stuff – usage of the new variables provided in LOR S3, relays, and lots of batch commands I’ve never used before. But even better than that was getting to spend all the time with my daughter, Faith, working on it.

I hope you’re able to put it to use. Any part of it. And hopefully, you can make it even better. If you do improve it, please contact me via email (thelightguy@bluecreekchristmas.com). Enjoy.