LIT PANEL INSTALLATION
**WARNING: ELECTRIC SHOCK**

Pinball machines use high voltages which can cause serious harm. Always turn the power off and unplug the pinball machine prior to installation. Failure to follow this guideline can cause serious electric shock. *(We know from experience!)*

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Before you begin

-For safety, we recommend the use of safety glasses when installing

-To avoid damage to your machine or existing speaker panel:

- Never use metal tools for any reason on plastic speaker covers
- Your package includes plastic razor blades specifically intended for removing the black paper on the speaker cover

Materials You Will Need

- Phillips head Screwdriver
- Red plastic razor blades (these should be included as part of your package) – DO NOT use metal blades; they will scratch
- Bottle of Goo-Gone or similar adhesive remover
- If your game was made after approximately 1993, you will need an auxiliary outlet adapter cable. These are available from your standard pinball parts retailers such as Pinball Life (link) and from Marco’s (link)
included in the package

Your kit will include the following items:

- Four (4) plastic or rubber spacers
- Four (4) short screws - for standard DMD installation
- Four (4) long screws - for color DMD installation
- Four (4) long screws for mounting the PCB
- Four (4) cable ties
- One (1) Power Adapter
- One (1) Power Adapter extension cable
- Two (2) Remote Controls - for controlling the main Speaker Panel and Speaker LEDs (*note that either remote will work for both sets of lights*)
- Two (2) flat batteries - one for each remote control
- One (1) custom PCB board – this is a relay used to activate the panel when the game is turned on*
- Two (2) white LED Power/Infrared interface cables
- One (1) long custom Power cable
- One (1) Wood block
- Two (2) 4-pin male-male connectors
- Two (2) 2-pin white Molex connectors
- Two (2) red plastic razor blades for removing the panel masking
Speaker Panel Installation Instructions

This section describes the full process of preparing your machine and installing your Lit Speaker Panel mod.

Workspace and Pinball Machine Preparation

1. Lay down a towel or a bathroom mat on the game glass.
   a. This will be used as a surface on which to lay the speaker panel down, and to avoid scratching the panel and your siderails.
   b. Lighted Pinball Mods recommends using a bathmat, because the rubber on the underside helps to keep the mat from moving around while you work.

2. Remove the glass and translite, and store these safely away from your work area.
3. Remove the four screws that secure the H Channel at the top of the speaker panel

4. Fully remove the H Channel and store safely nearby

5. Next, gently remove the speaker plastic from the wood backing panel. The plastic will most likely stick in place, so peel gently. Use a flat plastic spade (or a spatula from the kitchen) to assist in working the plastic loose.

   DO NOT use anything metal whatsoever, as it will damage the plastic.
Removing the double-stick blackout mask

Flip over the plastic panel. The back of the panel is completely covered black masking paper, which is fully glued down. This black masking will need to be removed.

Lighted Pinball Mods also has brand new plastic panels made for almost every B/W game, which you can use instead of modifying your stock panel. Contact Lighted Pinball Mods to purchase one if you run into trouble, or if you simply wish to simplify this step.

**IMPORTANT:** This process must be done slowly in order to remove the paper in the most efficient manner. Read this again: to spend the least amount of time on this step, go SLOWLY. If removed properly, the process will take 30 minutes. If not done properly, it can take 2 hours or more.

1. Find the red plastic razor blades supplied in your package.

   If you do not find these blades, IMMEDIATELY STOP. Contact Lighted Pinball Mods, or find these blades at your local hardware store. Using metal blades will immediately and irreversibly scratch your panel forever. To remove double-stick black paper from plastic, use only these type of plastic razor blades.

2. Keep the razor fully engaged with edge of the masking which is still stuck. Peel the paper slowly and continuously. Use two thumbs for the best results.

Pull about a quarter of an inch each time, and keep your fingers as close to the stuck edge as possible. Pulling from the top of the paper will make it more likely to rip.

While it’s almost impossible for the masking not to rip, you can use the plastic blade to help pull up small sections of the masking if it does begin to rip. As soon as you notice it tearing, use the blade to gently scrape up the ripped portion and then try to pull up the ripped section joined along together with the main section aligned as if it wasn’t ripped. The sections should pull up together as one piece again as you continue.
Try to avoid tearing the black masking as much as possible. Once it tears too much, it is very difficult to start pulling up the masking again. Use the blade to start again at the nearest corner if possible.

3. When the vast majority of the black masking is removed, you can use the plastic blade to help scrape up any small sections or bits of masking; it will not damage the panel.

4. After removing the masking, there will be glue residue left on the plastic. Lightly Spray Goo-Gone (or another similar non-toxic adhesive remover) on the entire panel. Use your fingers to spread the adhesive remover so that it covers the entire panel evenly. Let sit undisturbed for 5 to 7 minutes.
After the adhesive remover has had time to work, go back and gently scrape up what is left with the razor. There should be quite a bit of residue which just comes right off. Some areas may need a bit of additional work; spray a very small bit more adhesive remover if necessary.

5. Wipe off the remaining residue with a paper towel, or lint-free cloth or clean rag. You may need to wipe several times. Ensure no paper or cloth fibers remain on the panel.

6. Finish by spraying area with glass cleaner and wiping clean, making sure to remove any streaking.

7. Your old panel should be removed from the game, laying down on your mat.

Transfer speaker and DMD to new panel.

8. Use a quarter inch driver to remove hex nuts around the speakers. You can keep track of the screws by letting them stick to the magnet on each speaker.

You may need to remove a ground braid from one of the speakers. Carefully remove this, and remember to re-connect it when installing the new panel.
9. Now remove the nuts and washers from the DMD.

   Carefully remove the black spacers from the screws – keep track of these; you will need them again!

10. Remove the DMD and speakers fully away from the old wood panel. Be very aware of the wires for each piece and ensure they do not get tangled on anything.

11. Unscrew the two metal brackets from the old wood panel, and keep the screws handy.

12. Pull the old wood panel slightly away from the speakers and DMD, so you can set the speakers and DMD down directly on your mat.

13. Remove the old wood panel completely away from the area and set down away from your workspace. You may want to keep this, but you will no longer need it for this mod.

14. Lay the new panel down directly in front of where the old panel was

   Picture shown gives a general idea of where to place everything; note that you should have already disconnected the speakers, DMD and removed the old panel
15. Reattach the small speaker on the right side. Be gentle. Do not push screws in, let them screw down into the panel as you turn the screwdriver. Do not push.

16. In your package, find the two new metal brackets. These will be used to hold the new panel in the machine.

17. On the right (small speaker) side, re-use a screw from your original bracket to secure the new bracket in.

18. On the left-hand side, place one of the brackets on the topmost screw hole. Place the large speaker on top of the bracket, and insert a screw through the speaker and bracket. Screw into the panel gently.
19. Place the DMD or Color DMD onto the new panel. Contrary to the old board’s mounting, you will use the screws top down and just screw the DMD directly to the new panel. The DMD should be snug, but does not have to be overtightened. Overtightening can bend or break the DMD bracket.

   a. **STANDARD DMD**: If you have a Standard DMD, use one inch #6/32’s and the original DMD spacers
   b. **COLOR DMD**: IF you have a Color DMD, use the shorter ¼” 6/32 screws and the included black spacers

20. Find the 4-pin connector and connect it to the black (shorter wire) LED controller on the new panel. Line up the tiny arrows on each side of the plug. There is a small male-to-male 4 pin connector already inserted to the connector. If this falls out, just re-insert it (does not matter which direction)

   [Image of 4-pin connector]

Use electrical tape to wrap around plug and secure it.

21. To power the panel, you will plug the power adapter into the game’s Service Outlet. In a stock WPC game, the Service Outlet has power at all times – even if the game is off. You can either mod your service outlet to

   [Image of Service Outlet]
turn off after the game is powered off (see link on LightedPinballMods website), or you can use the included LightedPinballMods Relay (See Appendix C).

Note: Some game owners may have already performed a Service Outlet Mod for powering other pinball mods such as under-cabinet lighting. If this case, you can add a power strip plugged into the Service Outlet so that both mods have power. If you have performed the Service Outlet mod, you do not need the LightedPinballMods Relay and this can be stored away.

22. Drop wiring harness with two circular plugs down the hole of the black box.

20. Connect black extension card to power on LED controller.
21. Find the long white cable attached to the panel, and drop both this and the black extension cord from the previous step down through the backbox. You may want to zip tie these together first.

22. This will be the wiring you see under the playfield after inserting through backbox correctly.

23. Find the DC power supply and small controller board that was supplied in your accessory kit.
24. Connect DC power supply and the 6-pin white connector into the board. The 6-pin connector should only fit in one direction.

25. Connect your two power plugs.
26. Ultimate panel owners only: Pull the long white cable with the small black tip (this is the receiver for the remote control) through the backbox and fasten it somewhere near your coin door.
   You can now open the coin door to change the colors without disrupting the other receiver. This allows you to have different colors on the main panel and the speakers.

27. Games made after approximately 1993 may require this auxiliary outlet adapter. This is not included in your accessory kit, but you can order it from Pinball Life or Marco’s, or wherever fine pinball accessories are sold.
28. Plug the adapter into your game’s service port either directly, or using the above adapter.

29. Place the plastic panel with the artwork flat against the lit panel, and align it so that the speakers holes are centered around the speakers themselves.

30. Replace the H Channel. You do not need to screw the H channel back in (it will hold via friction) but you can replace the screws if desired. Alternately, you can use double-stick tape to fix the artwork to the lit panel.

31. In the backbox, begin closing the game up by inserting the DMD/speaker panel. Tightly grip the panel and the plastic overlay together so that they stay aligned. Once inserted, push the H channel slightly to the left so that there is a gap on the rightmost side.

32. Grab the small, white cable with the black tip that is coming out of the back of the panel. This can be inserted to the extreme right of the H channel, so that it can still be controlled when the backbox is closed. This allows you to change colors without opening the game.

33. Use the remote to select your color palette (see next section), and enjoy your newly installed panel!
Appendix A: Using the remote

Note: The original instructions which come with the third-party remote are reprinted in Appendix D for reference.

Fine color adjustments

You can dial in a very specific mix of Red, Green and Blue for your “White” setting. If you wish to have for example a “Warm White” hue, or a touch of red – or any other variation when in “White” mode, try the following:

Reset the white to full RGB

- a. Click the top red button; the panel will turn full red, then click brightness up a number of times,
- b. Click the top green button; the panel will turn full green, then click brightness up a number of times,
- c. Click the top blue button; the panel will turn full blue. Then click brightness up a number of times
- d. Now click on White. All of the colors are now at full brightness.

Dial in a specific hue

- e. Reset your white to full brightness if you have not yet performed this step
- f. In this example, we will dial in a white with slightly less red:
  - i. click on red,
  - ii. click on brightness down one or more times
  - iii. then click on white.
  - iv. The white setting will now have a little less red in it
- g. Note that the other colors variations are preset when you push the color, but you can raise or lower the individual R/G/B brightness with those top buttons.

Save your custom color mix

- h. There are 6 “DIY” buttons on the remote. These are like save ‘slots’ for 6 corresponding custom color mixes.
- i. First click on a DIY button, then follow the steps above to dial in your specific color hue
- j. When you find a color mix that works best for your gameroom, click the same DIY button again, and it will lock in that color. Clicking a different DIY at this point button will start the process over in that new slot, so be careful!
## Appendix B: Trouble Shooting

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<th>Issue</th>
<th>Description</th>
<th>Fix</th>
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<tr>
<td><strong>Panel Sizing and Light Bleed / Shadows</strong></td>
<td><strong>Note</strong></td>
<td>There is a slight variation in size from panel to panel, as many different batches were made through the years. This may cause some bleed-through of light.</td>
</tr>
<tr>
<td>Light is bleeding through different areas of the panel, or around the speakers</td>
<td></td>
<td>The lit panel is intentionally made slightly smaller than your original panel, so you can move your panel around to be best centered on the speakers</td>
</tr>
<tr>
<td>I can’t center my panel precisely enough</td>
<td></td>
<td>You can use a small shim under or above the board to help with centering</td>
</tr>
<tr>
<td>I have a bit of light coming into the DMD area</td>
<td></td>
<td>You can add masking (““black out””) to a part of the lighted speaker panel with a paint pen or really any black paint. Be sure to mask off everything but the area to be painted! If you get any paint on the plastic, it will block light and be very obvious when the panel is lit</td>
</tr>
<tr>
<td>Light is bleeding too much into the speaker area</td>
<td></td>
<td>This light bleed can be removed by similarly painting that area black</td>
</tr>
<tr>
<td>I added paint masking to my DMD or Speaker areas, but now I need to remove it</td>
<td></td>
<td>To remove the black paint, this can be done with acetone (finger nail polish remover) without any damage to your lit speaker panel</td>
</tr>
<tr>
<td><strong>Removing paint masking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My game has the switched power outlet mod. Do I still need the additional PCB board and the activation wire into J-116?</td>
<td></td>
<td>If you have performed the switched power outlet mod (i.e. if your game’s auxiliary power outlet turns on and off with the game, you can avoid using the PCB entirely, and plug your DC power supply directly into the outlet.</td>
</tr>
<tr>
<td><strong>Power Switching</strong></td>
<td></td>
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<tr>
<td>I have a panel with both the speaker LED mod and the full lit panel. Do I need both remotes? Or can I use one for both the speaker and panel LEDs?</td>
<td></td>
<td>If you have the “ultimate” Lit Speaker Panel with both speaker and panel LEDs, one remote can control both the lighted colored panel and the lighted colored speakers.</td>
</tr>
<tr>
<td><strong>Using the Remote Control</strong></td>
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### Power issues / Switching problems

The mods do not always come on when the game comes on, or are intermittently lit.

We have found the most likely area of potential problems is the 6-pin wire harness. If you have a power or switching problem, first try unplugging and re-inserting this connection, then follow the below if necessary:

1. Check if the relay is clicking. The relay is the little box on the PCB. If the relay does NOT click when the game is turned on or off, most likely a problem on either the wire harness or the back box. Try wiggling the wiring harness; if this does not fix the problem, go into the back box and remove the plug in the game, and push the red wire down harder, it may not be making contact.

2. If still not clicking, double check your ground wire is hooked up securely to a ground in your game.

3. The DC power supply has a light on it. If this light is not on, check your power plug.

4. Red LED on the board. This will only turn on when your relay has clicked on, and the DC plug is plugged into a power supply. If your relay is clicking, and the RED LED is not on, verify the plug you plugged the DC power supply into is working properly.

5. RED LED is on, panels are not working. Wiggle the wiring harness then check all plugs.
<table>
<thead>
<tr>
<th>Heat</th>
<th>The relay PCB is very hot to the touch</th>
<th>The main box on the relay board can have an operating temperature up to 165 degrees. This is normal</th>
</tr>
</thead>
</table>

6. Also to troubleshoot. The DC power supply can be plugged into a wall outlet. The power supply can be plugged directly into the inverter. The inverter can be plugged directly to the panel plug (if you have an Ultimate board, either plug will work).
Appendix C: Universal Backbox Relay

This mod requires that 2 wires are hooked up in the back box. Below is a picture of a Bally/Williams/Midway WPC game backbox. If you are installing a Lit Speaker Panel, your game should be WPC89. This Universal Backbox Relay can also be installed in a System 11 or WPC95 game, but this is beyond the scope of this manual. The general Universal Backbox Relay manual can be found on the LightedPinballMods.com site.

Before you begin:

- **Turn your game off! This installation must be done with the game fully off, and unplugged.**
- You will not need to remove the power driver board from the backbox.
- Find the area of the power board we will be working with – it is in the circled area above.
- We will be hooking up to one of either plug J116, J117 or J118. These 4-slot wire harnesses are all wired exactly the same, so any can be used. Each WPC89 game is different in which slots are available, but most games should have at least one of the slots minimally wired.
- As you are looking at the board, the slot that is on the leftmost is the slot we need to work with. This is a 5V DC source for the game, and for our mod.
Installation

1. First, check which (if any) of the leftmost slots is open on either J116, J117, or J118. If no slot is open, skip to Step A on the following page.

2. Note in the photo at right, J118 (circled) has no wire inserted into the left slot.

3. If an open slot is found, remove the IDC plug in the slot.

4. Find the 6-wire Relay Connector that came in your install kit.

5. Push the red wire from the Relay Connector into that leftmost slot. Make sure the red wire is pushed down evenly into the connector, so that the red wire insulation is pierced by the small piece of metal in the connector. This metal should be touching the wire directly, and firmly. You may need to strip the wire and thicken it by doubling it up on itself in order to get a firm grip.
   a. It is best to use a proper IDC Punch Down Tool to push in – but if you are careful, you can use a tiny screwdriver. *LightedPinball Mods recommends the IDC Punch Down Tool – use a screwdriver at your own risk.*

6. Locate the screw to the left of J117

7. Locate the round terminal of the black wire from the 6-wire Relay Connector

8. Remove the screw, insert the round terminal and reinstall the screw

9. Carefully push the IDC plug back into its original position.

*Figure 12 - 6-wire Relay Connector

*Figure 13 - Installed Grounding wire with round connector*
Installation if No Left-hand slots are open

A. If neither J116, J117, nor J118 have an open left-hand slot, the installation kit includes two (2) IDC connectors and one (1) 2-pole Z connector in your installation kit.

   a. Take one of the IDC connectors, and insert the red wire from the Relay Connector into the right side of the IDC connector, leaving roughly 3 inches of wire hanging out of the end. This is called a pigtail.

   b. Push the red wire down into the right side of IDC connector all the way until the metal "V" slices through the red wire insulation and makes a firm connection, gripping the spliced wire.

      i. LightedPinballMods strongly recommends using an IDC Push Down Tool for this step, but you can use a very small flat head screwdriver to push the wire all the way in also.

   c. Slide the Z connector (item 8) in to the IDC connector with the red wire in it.

   d. Slide the second, empty IDC connector on the other side on the Z connector.

B. Remove the wire that was originally on the left position on either plug J116, J117, or J118. Remove only one (1) wire.

C. Place this wire in the slot on the second IDC plug so that electricity can flow from the red wire through the IDC plugs and Z connector to the wire you unplugged from the game.

D. Slide the pigtail end of the red wire into the slot left open when you removed the original wire from the left position.
Appendix D: Original Remote Instructions

Operation Instructions of Controller

I. Specifications:
- Working temperature: -20-60°C
- Product size: L62xW35xH23mm
- Net weight: 60g
- Output: Three CMOS drain-open output
- Max load current: 2A each color
- Supply voltage: DC12V
- Package size: L130xW60xH35mm
- Gross weight: 90g
- Connecting Node: Common anode

II. Control Method:
Adopt IR remote to control the led controller, which has 44 buttons, the function of each button as the table below:

<table>
<thead>
<tr>
<th>Brightness rise</th>
<th>Brightness fall</th>
<th>Pause/Run</th>
<th>On/Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static red</td>
<td>Static green</td>
<td>Static blue</td>
<td>Static white</td>
</tr>
<tr>
<td>Static orange</td>
<td>Static light green</td>
<td>Static dark blue</td>
<td>Static milk white</td>
</tr>
<tr>
<td>Static dark yellow</td>
<td>Static cyan</td>
<td>Static cyan blue</td>
<td>Static white pink</td>
</tr>
<tr>
<td>Static yellow</td>
<td>Static light blue</td>
<td>Static purple</td>
<td>Static green-white</td>
</tr>
<tr>
<td>Static light yellow</td>
<td>Static sky blue</td>
<td>Static brown</td>
<td>Static blue white</td>
</tr>
<tr>
<td>Increase red</td>
<td>Increase green</td>
<td>Increase blue</td>
<td>Speed up</td>
</tr>
<tr>
<td>Decrease red</td>
<td>Decrease green</td>
<td>Decrease blue</td>
<td>Speed-down</td>
</tr>
<tr>
<td>DIY key1</td>
<td>DIY key2</td>
<td>DIY key3</td>
<td>Automatic change</td>
</tr>
<tr>
<td>DIY key4</td>
<td>DIY key5</td>
<td>DIY key6</td>
<td>Flash on and off</td>
</tr>
<tr>
<td>3 color jump up change</td>
<td>7 color jump up change</td>
<td>3 color fade change</td>
<td>7 color fade change</td>
</tr>
</tbody>
</table>

About DIY key, when it's pressed first time, will enter the DIY color mode, you can adjust the color per the 6 keys above to increase or decrease the RGB color by yourself freely (if other key is pressed this time, will jump out from DIY color mode). And you can save the color which you have adjusted by pressing the DIY key once again. When next time this key is pressed, it will show the color you saved last time.

There are 6 DIY keys, so you can save 6 color you like. They are all independent, have no effect each other. For example: if you press DIY key1 first, then press DIY key2, DIY key1 will be invalid, until DIY key2 is pressed once again, current color will be saved.

III. Panel specification and connecting drawing as follows:

IV. Warning:
1. Supply voltage of this product is DC12V never connect to DC24V or AC220V.
2. Never connect two wires directly in case of short circuit.
3. Lead wire should be connected correctly according to colors that connecting diagram offers.
4. Warranty of this product is one year, in this period we guarantee replacement or repairing with no charge, but exclude the artificial situation of damaged or overload working.