

“1802 Badge” Holder instructions

Designed by Paul Schmidt, October 1, 2024

OK, you are not a mind reader. So, these instructions are detailed and explicit.

The “Holder” is intended to support Lee Hart’s “1802 Badge” (kit available from www.sunrise-ev.com) for programming, and optionally for display. It is made from pieces that are fabricated using a 3D Printer, from “STL” files included in the ZIP file that also includes these instructions.

The STL files are:

- 1802 Badge Holder.stl
- 1802 Badge Blank Panel.stl
- 1802 Badge Switch Panel.stl
- 1802 Badge Switch Panel w_Text.stl
- 1802 Badge Switch Spacer.stl

The main part is the HOLDER, and the other parts fit into it. If you wish to have a toggle switch for easier programming of the Badge, it mounts through a hole in the SWITCH PANEL w_TEXT, which is super-glued into the recess on the left side of the HOLDER; this panel includes two words of text, “RUN” and “PROG”, that are associated with the switch. If you wish the switch panel to NOT have the text, then use the alternate SWITCH PANEL; it still has the switch mounting hole, but omits the text. If you do NOT wish to have a toggle switch, and just want a ‘filler’ for the unused part of the holder, then make the BLANK PANEL which does not have the hole for the switch (you can optionally drill holes or cut openings in this panel to fit other hardware or devices you may wish to use with the Badge. Finally, the SWITCH SPACER is simply a 4mm thick ring that you can optionally slip over the bushing of a toggle switch so that it does not protrude too far past the front of the panel. You should not need to print more than three of these STL files, depending on which options you prefer.

To print these STL files, you will need to import them into the “slicer” program that goes with your 3D printer; e.g. for a Prusa brand printer, you might be using their “PrusaSlicer” program.

- The HOLDER should be printed in its default orientation.
- The BLANK PANEL should be printed in its default orientation.
- The two versions of the SWITCH PANEL may be printed in their default orientation, OR printed flipped over on their back, face down; depending on your printer, and its printing surface, the best (smoothest) finish might be the one that is directly on the printing surface, so use your experience printing other things to determine the best printing orientation. The Holder’s designer printed the PANEL face-down.
- The SWITCH SPACER should be printed in its default orientation.

In your slicer program, make sure that at least some percentage of “infill” is selected, otherwise the print time will be excessive and lots of filament will be used up with the large size and thick walls of the holder. The Holder designer’s own print time ran towards 7 hours, with the Holder

and all three versions of panel, and the spacer, all part of that print job. Print time for a panel might be 30 minutes, and the spacer only five minutes, but the Holder itself will certainly take several hours.

Once printed, take note of the following features:

- The Holder has a definite top and bottom. On the bottom corners are two slightly enlarged areas. On the top there is a recessed area inboard of the outer edge, into which the Badge circuit board and the Panel of your choice fit down into, with their top sides flush with the raised outer edge of the Holder.
- The Holder has a definite left and right orientation. It has a partition/divider between its front and its rear sides, and the partition is closer to the left than to the right. The Badge circuit board will recess into the top of the Holder on the right, and the Panel will recess into the top of the Holder on the left. The right edge of the Panel and the left edge of the Badge will rest on the partition.
- There is a 9mm diameter hole in the partition; this is for getting the toggle switch wiring through to the underside of the Badge.
- To provide the Holder with a firm, grippy friction with whatever surface it rests on, it is designed with enlarged areas on the bottom edge at all four corners. These are intended to be bases for self-adhesive plastic “rubber” feet, of a common kind that is either black or clear/translucent and has a diameter of $\frac{3}{8}$ ” (0.375” or 9.5mm). *See photo on last page.*
- The holes in the Panel and Spacer are 6mm diameter. This will fit certain toggle switch mounting bushings. But for the common (standard) bushing size of $\frac{1}{4}$ ” (0.25” or 6.35mm), you will need to use a drill to open these holes up slightly (a ‘step drill’ bit will drill the plastic more smoothly than a normal ‘twist drill’ bit). Use a fairly slow drill speed to avoid melting the plastic.

The reason for the external toggle switch is that, when programming a message into the Badge using its own resources, the user needs to press and hold down the SET pushbutton for long periods of time, and this can be quite painful. This Holder was designed to accommodate the notion that a larger, external SET switch will be more comfortable, and a ‘maintained’ type switch will be more convenient. Thus, a common “Miniature” SPDT toggle switch (2-position, maintained) with a $\frac{1}{4}$ ” bushing is an appropriate choice. The designer of the Holder used a C&K brand, model number 7101P3YZBE (DigiKey CKN1018-ND), or alternately 7101SYZGE); the “B” in the part number means gold-plated contacts, perfect for this application, or the “G” means gold-over-silver-plated contacts, which is also OK, but don’t use the “Q” option, which is silver-plated contacts, not suitable for low power logic circuits. C&K is a premium brand, so if you want to save money there are less expensive brands with direct substitutions to the C&K products, e.g. ATEM and E-Switch.

The Holder's designer connected the toggle switch to the Badge in the following manner:

- Obtain some male pin headers, such as can be used for shunts/jumpers on circuit boards, and cut off a 2-pin section. There will be short pins on one side of the plastic frame, and those need to be bent 90 degrees outwards to the ends. Find the S4 "SET" switch on the Badge circuit board, and find its two circuit board pads on the 'solder side' of the board. Compare the bent header pins to the spacing of the pads, and trim the pins' lengths so that they will fit down over the pads without extending past them.
- Melt some solder onto the bent header pins.
- Use a pliers to hold the header such that its two bent pins are laying flat across the two circuit board pads (on the 'solder side' of the board), adjacent to where the pins of S4 come through the board. Make sure that the header's long pins extend directly away from the circuit board, perpendicular to it (NOT at an angle).
- Heat the pads so that the solder on the bent header pins flows into the solder already on the pads. Be careful to NOT dislodge S4's pins in the process.
- Carefully inspect the two solder joints to make sure that the original pins of S4 are still part of the joints, that the solder makes good contact with the two bent header pins, and that there is no shorting to adjacent circuit board pads, traces or components.
- Obtain a 2-pin section of a female pin header, suitable for plugging onto the two male header pins that have been soldered to the Badge circuit board (see above). Solder two small gauge wires to the solder pins on the new header; the wire length should be about 3" (76mm). Solder the other ends of the wires to the center toggle switch pin and to either of the other two switch pins.
- Use an Ohmmeter or continuity checker to measure across the two wires, and move the toggle switch until continuity is detected. Note the toggle lever position and mark its end of the switch to denote which should be closest to the inside surface of the Holder when mounted to the SWITCH PANEL. The goal is for the switch to short the two wires together then the switch toggle lever is angled towards the front/bottom of the Holder ("PROG" position).

If used, mount the toggle switch to its panel (with or without the text), making sure to orient it so that the end you marked in the above procedure is adjacent to the nearest end of the panel. If you obtained the kind of switch specified above, you should remove all the washers, lockwashers, etc; from the switch bushing, slide the 3D printed SPACER over the bushing, pass the end of the bushing through the hole on the inner side of the SWITCH PANEL, and screw on the decorative nut that came with the switch. Make sure the nut is tightened snugly, so the switch will not rotate easily. Discard the remaining switch hardware. Note that some other models or brands of otherwise comparable toggle switch may have just a plain hex nut rather than the decorative nut of the specified switch. Push the switch's toggle lever towards the bottom/front edge of the SWITCH PANEL (where the text "PROG" is located, if you are using that version of the panel), and re-verify that there is continuity between the two switch wires in this position (if NOT, loosen the nut and turn the switch 180 degrees in the mounting hole, and re-tighten the nut).

Verify that the SWITCH PANEL (or just the BLANK PANEL) will fit into the recessed area on the left-top of the Holder while the Badge is also in position inside the recessed area next to the panel. They should fit closely, with essentially no wiggle room, but without needing to be forced into place. If necessary, use careful sanding or filing to make everything fit into the Holder. In particular, the small area on the bottom (solder side) of the Badge circuit board, where the two wires from the battery holder are soldered to the board, is just a little too close to the edge of the Holder's recessed area to allow it to fit properly. Use a tool (small file, Dremel tool with milling bit, Dremel tool with a small sanding drum) to carefully remove a small amount of plastic from the edge of the recessed ledge where that 'battery wiring' area of the Badge circuit board is in conflict. Verify that the Badge now fits down evenly into the Badge's recessed area.

Remove the Badge from the Holder. Remove the SWITCH PANEL and apply four small drops of "super glue" (CA glue) to the four corners of the PANEL, where the glue will contact the top edge of the Holder's recessed surface. Also put two more drops of glue along the two long edges of the PANEL. Place the PANEL back into the left side of the Holder, making sure it is tightly up against the left edge, and press down firmly against the Holder until the glue has set.

Route the switch wires through the hole in the Holder's partition, pulling as much wire as possible through to the other side of the partition.

Affix the "rubber" feet to the bottom corners of the Holder.

Plug the female connector of the wires onto the two pins of the male header on the bottom of the Badge's SET pushbutton S4. Rest the Badge down into place in the Holder's recessed area.

The Badge is now nicely displayed, or at least well supported for being programmed with new message(s). Use the toggle switch instead of the normal Badge SET button S4. Pushing the toggle lever to the top/rear ("RUN") position will allow the Badge to display and scroll through the programmed message. Pulling the toggle lever to the bottom/front ("PROG") position will be just like pushing and holding the Badge's SET button. Briefly moving the toggle lever from "PROG" to "RUN" and promptly back to "PROG" will allow the message to scroll one position to the left before stopping again. Whichever message character is in the right-most display position can be edited by using the Badge's UP and DOWN buttons (S3 & S2). When programming is complete, return the switch to its "RUN" position.



Photo of intended kind of adhesive-backed "rubber" feet