# SAE D102 Display Module Clone

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Thank you for supporting my efforts. I have always been a fan of SAE gear and this project was started out of pure admiration for the brand. The project was also driven out of necessity for the sake of my own SAE equipment. I am happy to pass along some of my work and make your sick D102 great once again.

# SAE D102 LED Module Installation instructions

Please make note of the following safety concerns and read this document in its entirety before commencing with any repairs. This device install is to be performed by qualified personnel. Installation of this device requires removing protective covers. **Removing covers can expose the installer to areas of the equipment that may have dangerous or lethal voltages present. The installer must be qualified to identify and work on circuits that handle high voltage.** The installer should never work on equipment while it is attached to an AC power circuit. The installer shall proceed at his/her own risk. If the purchaser is not qualified to perform this install then return the un-opened / uninstalled device for a refund of the purchase price.

There are three failure modes of the original SAE D102 display:

- ***Failure mode 1***: Some segments of the 7 segment LED's do not light up. The characters seem alien.

- ***Failure mode 2:*** The display is completely blank. Other standalone LED's such as PAUSE, INDEX & ERROR do not light at any time.
- ***Failure mode 3:*** The displays is completely blank similar to failure mode 2. Other LED's on the control panel cease to function as well. This failure occurs for a different reason.

With failure mode 1, it is apparent that the LED driver controller is still communicating with the CD player motherboard. This failure may be caused by bad led segments ***OR*** bad output bits on the LED controller chip. The good news is this is repairable by replacing the LED display module.

With failure mode 2, there is a possibility that the LED driver chip has completely failed. The motherboard is still sending serial data but there is no driver chip alive to process it. This can be fixed by replacing the LED display module which contains a new, healthy LED driver chip.

With failure mode 3, the display is completely blank because it is not receiving serial data from the main board. In this scenario the replacement display will not resolve the problem. In this case the electronics upstream of the display module has a fault. The only way to identify this failure mode is via test gear such as an oscilloscope or data analyzer. If you suspect you are dealing with this failure mode then DO NOT attempt to install the replacement display. I cannot accept returns on any device that has been installed.

The D102 replacement displays are tested twice. They are tested when they are manufactured and tested a second time just before shipping. You will receive a fully functional unit. However I cannot be responsible if the replacement unit produces no visual output. In that scenario you may be dealing with failure mode 3. To be totally clear, I cannot accept returns on any device that has been installed in equipment.

**Aging D102 PCB's**

The printed circuit board that you will be mounting the new display module on is over 30 years old. The traces on old circuit boards do not like to be disturbed and they really hate a lot of heat. You must use the correct tools and techniques to remove components from old PCB's without damaging them. Proceed at your own risk. If in doubt seek the help of someone who has some skill with de-soldering & soldering. A bad soldering job will most certainly lead to a future failure or damage. Before you solder in the new LED module ensure you have fitted the LED module to the bezel first. See **Modding Bezel** section below.

**Document, Document, Document!**

Take detailed high resolution photos of all wiring harnesses BEFORE you start to remove the control panel. Some revisions of the SAE D102 skip header positions, meaning that a ribbon cable could have 10 conductors and the header may have 12 positions. If you plug the harness in the wrong position you may destroy something or possibly damage the unit beyond repair. Closely inspect and count the positions on all the headers. Make note of empty positions, if any.

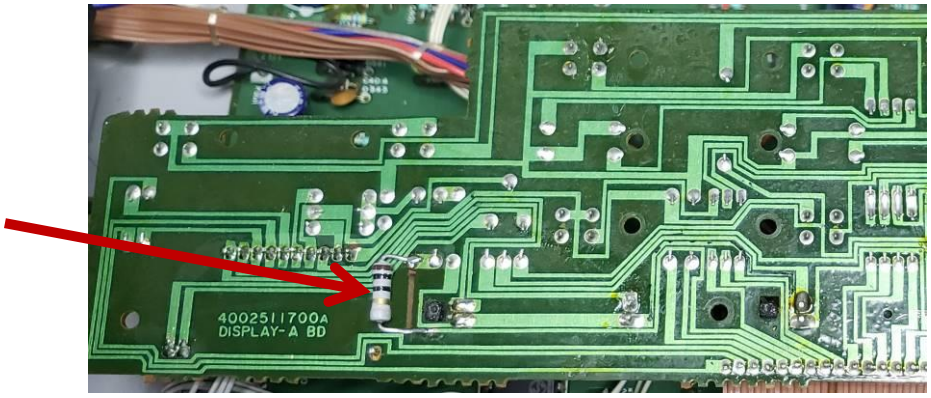
Mark ribbon cable with a marker to designate a side that should be facing UP. Installing ribbon cables upside down will certainly lead to disaster.

Make note of how some cables are routed differently. Some go over metal frames, some go under. Route a harness the wrong way and a screw will go through it!


The style of ribbon cables in the D102 are far from ideal. Pay close attention to the individual conductors. The flimsy wires can jump positions, can bend and not fully seat or 2 wires could inadvertently occupy one slot in the header. Again, this can have disastrous results. You must inspect closely! Two wires occupying the same slot is very easy to miss!

**Beware Of Previous Mods**

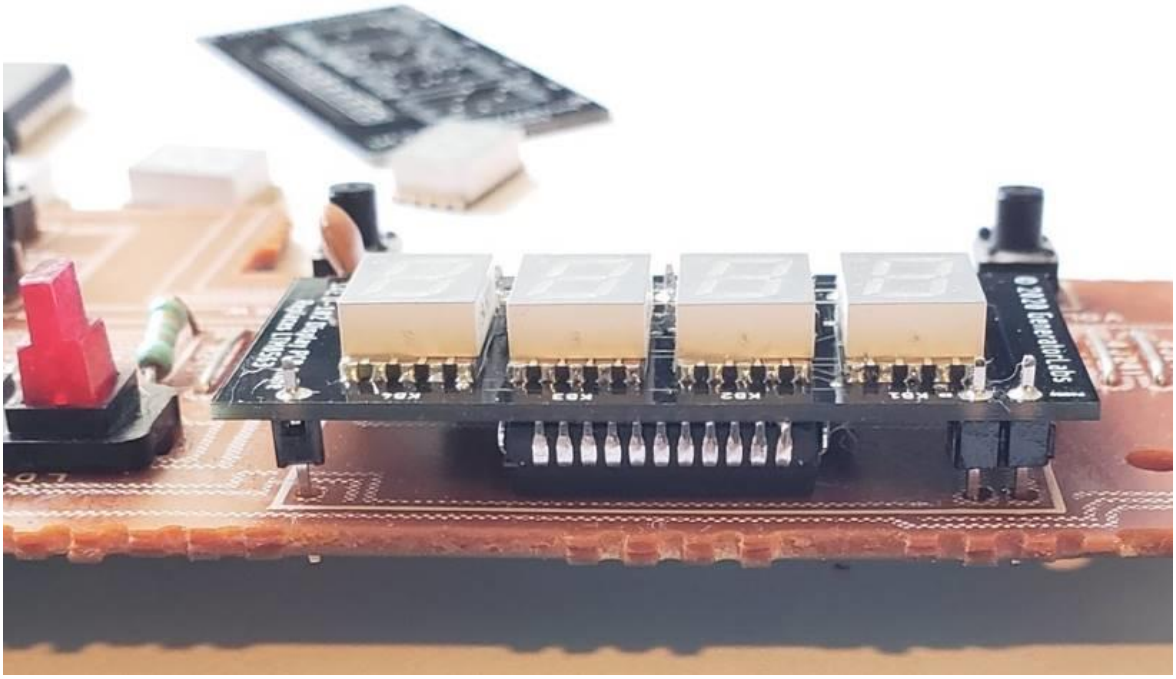
I cannot be certain if SAE authorized the following mod but I have seen it twice. If you see a resistor that seems out of place near the solder joints of the LED assembly then you may have a modified board. I am not sure if this was factory performed or done in repair shops after a failure. My best guess is the D102 displays were failing at an unusually high rate and someone noticed that the module was operating near the theoretical maximum input voltage. In order to extend the life of the display a resistor was put in place on the V+ line to form a voltage drop and cause the display module to operate in a more comfortable region. This mod will impede the proper operation of my newer circuit, which prefers to operate near 5 volts. If you see something like this on the foil side of your board, it will need to be removed and jumpered. This mod involved cutting a trace so it should be easy to identify. You may be able to reconnect the trace with a bit of solder. Here is an example of a board that was modded:



**Modding Bezel**

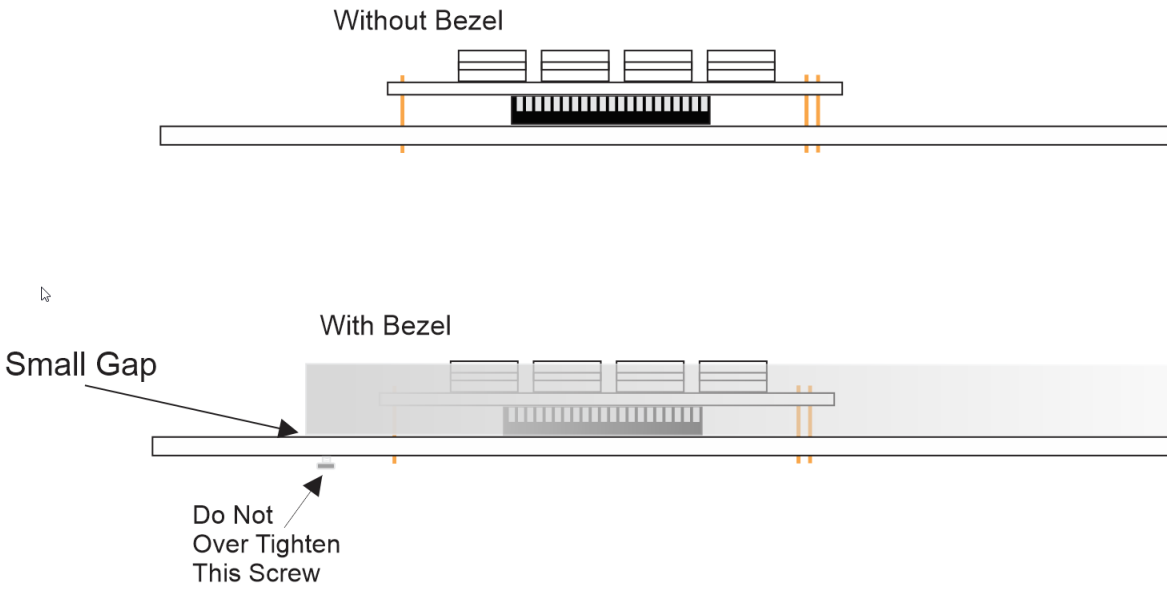
The internal plastic bezel in the control panel must be slightly enlarged to accept the new 7 segment LED's. Here is the method I use to make the opening slightly larger. Do not try to cut the opening larger. You will take off too much plastic and you may not end up with a perfect rectangular opening. You only need to remove a little bit of material. Use a scraping motion with the edge of an X-Acto knife. Make equal passes on both the top and bottom of the rectangular opening. Take a few scrapes and test fit the LED module. It should not fit tight. As you scrape you will end up with little curly shavings. Keep the knife edge perpendicular to the edge of the rectangular opening. If you tilt the blade it will cut instead of scrape. Start deep in the corners to ensure you get an even scrape across the opening. Remember this plastic is old and brittle. Take your time and be gentle.

If you look at the rear of the new LED module you will notice a large black chip there. That is the driver chip. That chip is only available in two sizes. You are looking at the smaller version. Because the chip is much thicker than the original 80's era chip, this module will sit slightly higher from the board to which it is attached. When soldering the replacement unit in, make sure this chip is flush with the board behind it. This chip does not get warm so there is no need to leave a gap behind it. Solder only one pin on the top row and one on the bottom row to verify the device is sitting square and flush. Once you are satisfied, solder the rest of the pins.



Also notice the 4 seven segment LED's. Those are surface mount devices and they also add to the thickness of the entire device. Be very careful when placing the internal bezel over the newly installed assembly. It is very old plastic and tends to get brittle. If you force the bezel to do something it does not like it may crack. Do not say I didn't warn you!

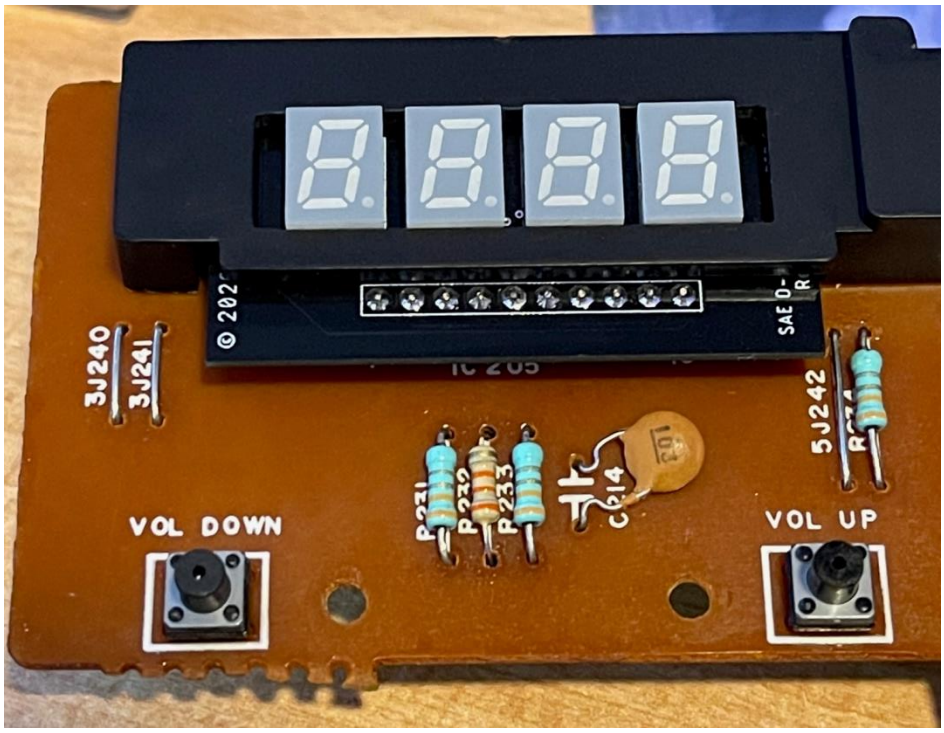
There are 3 silver screws that hold the bezel in place. **They are short**. Do not mistakenly use the longer black screws that are used to secure the various button assembles. The 2 silver bezel screws on the right (if looking at the control panel from the front) should hold the plastic bezel completely flush with the button PCB. There is a possibility that the bezel will not sit completely flush on the side with the LED module. This gap is very tiny and is not detectable from the outside of the unit. Do be tempted to use the last (3rd) silver screw to pull the bezel flush with the button PCB! You will only crack your bezel. Just gently tighten the screw enough to keep the bezel from wiggling and leave it alone. In many installs the bezel will sit flush so this will not be a concern.




**IMPORTANT! The screws that hold the metal top cover on are different lengths!!!!** Make sure the screw that is in the middle of the cover, just above the LED display is the shortest screw. If you put a long screw in that position it will push the LED digits downward, making them appear misaligned. It could also cause permanent damage or a short-circuit. All of the cover screws may appear short but some are purposely shorter than others.

**An optional mod:**

This is totally optional and does not affect performance. The modern chemistry of these LED's makes them brighter than their 80's counterpart. You can optionally dim these LED's. The brightness of the LED's can be adjusted by changing resistor P232 on the "button" board. This resistor connects to the drive level pin on the LED controller. Increasing the resistance decreases LED intensity. Typically the OEM value is 12k ohms. In this photo you can see I have installed a 33k ohm resistor to dim the display a little (beige color resistor). The value is a matter of personal choice. Do not try to make the LED's even brighter by putting a lower value resistor in there. Also bear in mind that dimming the display will also dim other standalone LED's. Perform this mod at your own risk. Before changing brightness values, make sure the display is functional first so can be sure you did not introduce a new problem.



I hope this repair kit grants you many years of trouble free service.


**Thank you for supporting my projects!**