

# Tesla Roadster GPS Firmware Update Cable

The idea of making a special cable for updating the firmware of the Roadster's GPS sensor is to allow connecting to the GPS through the cable that plugs into the VMS box in the passenger footwell rather than needing to take off the front wheel and inner fender. The cable needs to provide two functions:

- RS232 serial interface to a computer that can run Windows
- +5V power supply for the GPS sensor

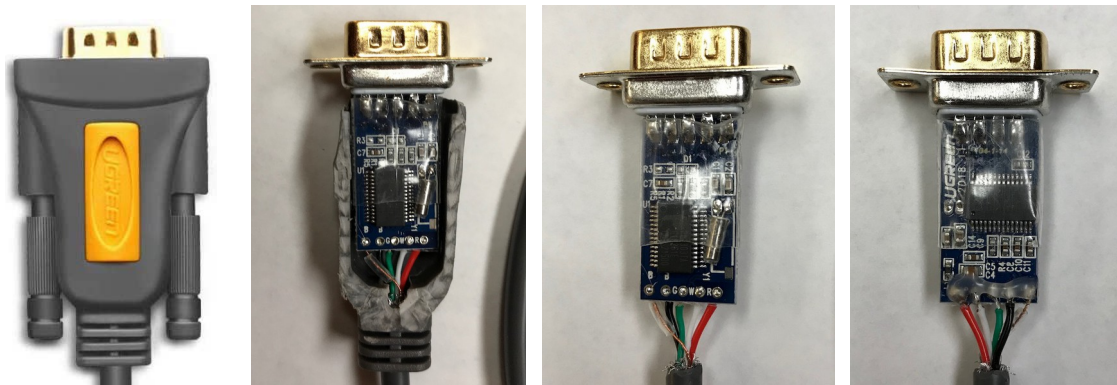
We can provide both functions by hacking a USB to RS232 serial adapter that plugs into a USB-A port on a laptop to access the +5V that comes from the USB port to power the chips in the serial adapter.

## Parts List

1. [UGREEN USB 2.0 to RS232 DB9 Serial Cable Male Adapter \(6ft\)](#) from Amazon.
2. [Zulkit Waterproof Plastic Project Box ABS IP65 Electronic Junction box Enclosure Black 3.94 x 2.68 x 1.97 inch \(100x68x50mm\) \(Pack of 1\)](#) from Amazon.
3. 23-pin AMPSEAL connector [1-776200-1](#) from TE Connectivity, available from DigiKey as part number [A128214-ND](#); or the [776200-1](#) variant with tin rather than gold plating was available through Amazon when I made my cable. This mates with the Roadster's cable at the VMS.
4. Four TE Connectivity [770854-1](#) crimp-on socket contacts to mate with the pins on the back side of the AMPSEAL connector. Available from DigiKey as part number [A107002-ND](#). The 770854-1 (tin) or 770854-3 (gold) parts may be available from Amazon in quantity.
5. Four pieces of wire 4-6 inches (100-150mm) long, preferably one each black, red, green and white. The socket contacts specify AWG 20, but smaller wire works with manual crimping.
6. Strain-relief bushing like Essentra [23MP04L40](#) (DigiKey [145-23MP04L40-ND](#)) or rubber grommet and cable clamp; six 2.5 mm or #4 self-tapping screws; and heat shrink tubing.

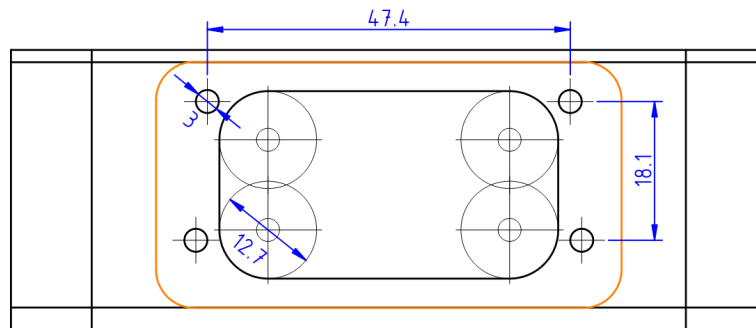
## Construction

The tricky part of making this cable is the surgical removal of the moulded plastic encapsulation containing the circuit board and DE-9M connector (DB-9 is a misnomer) of the USB to RS232 serial adapter in order to get access to the +5V supply. The result is shown in the following photos.

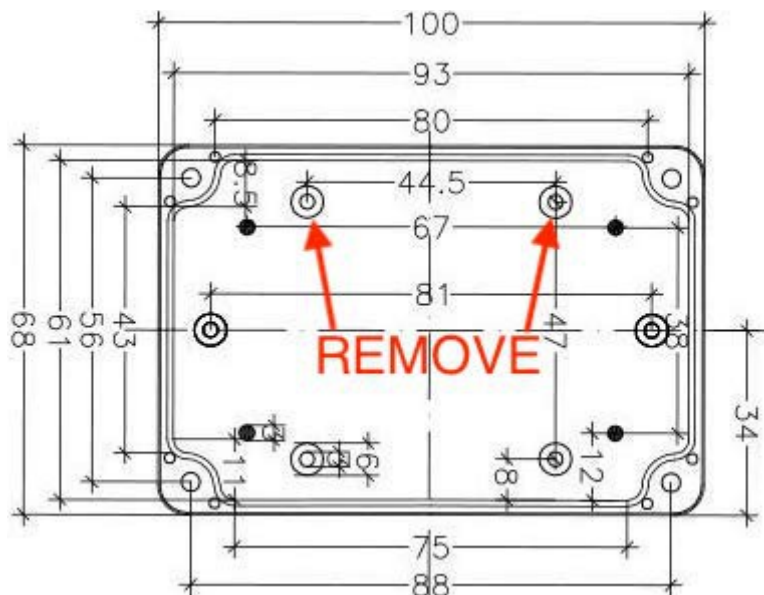


I selected the UGREEN serial adapter from among those available on Amazon based on the cable length and having confirmed with UGREEN support that the encapsulation left air space around the circuit board. I used a utility knife and diagonal cutters to perform the surgery being very careful not to damage the components inside. This will be easier with photos of the insides. It is also necessary to remove the clear plastic sheath around the circuit board that was still present in these photos.

The plastic box also requires modification for this project. Use the following template to position the cutout for the connector to fit through and to drill four holes for mounting screws. The cutout can be formed by drilling four corners with a 13 mm or ½ inch drill and then making straight cuts between them. The black outline corresponds to the overall size of the bottom half of the box. Note that there is just enough height to fit the outline of the connector, shown in orange, so the template must be centered carefully. Use the dimensions shown in the template to set the scale when printing this page so that it prints actual size (47.4 mm = 1.87 inch, 18.1 mm = 0.71 inch).

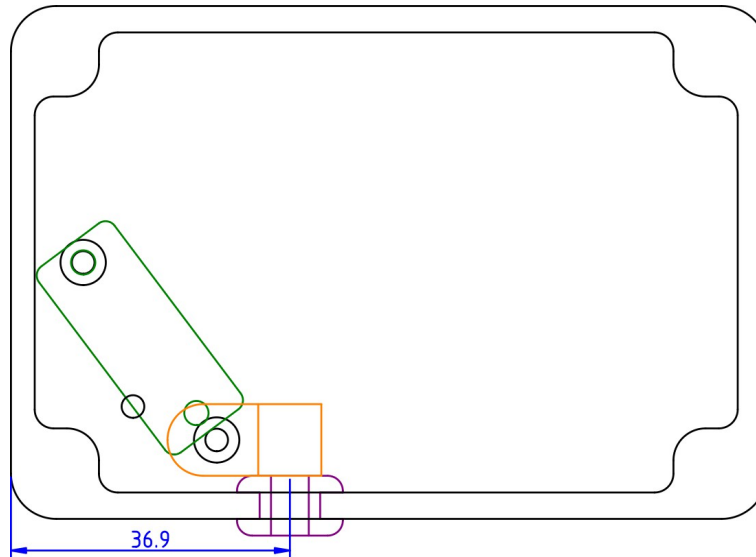


Additionally, two of the six mounting posts inside the box on the bottom need to be removed by drilling them away because they would interfere with the AMPSEAL connector. Keep the others for mounting the serial adapter circuit board.



I used countersunk flat-head screws to mount the connector, but the connector extends out far enough that there should be enough room for pan-head screws without hitting the car's mating connector. Use 2.5 mm self-tapping screws to go into the plastic sockets that are part of the AMPSEAL connector.

The last modification to the box is to provide a means for the cable to enter. For the cable I made, I drilled a hole and used a rubber grommet and a cable clamp to hold the cable from pulling out, as shown in the following diagram. Note that the cable clamp also secures the DE-9M connector since the mounting posts are slightly farther apart than the hole spacing of the connector.



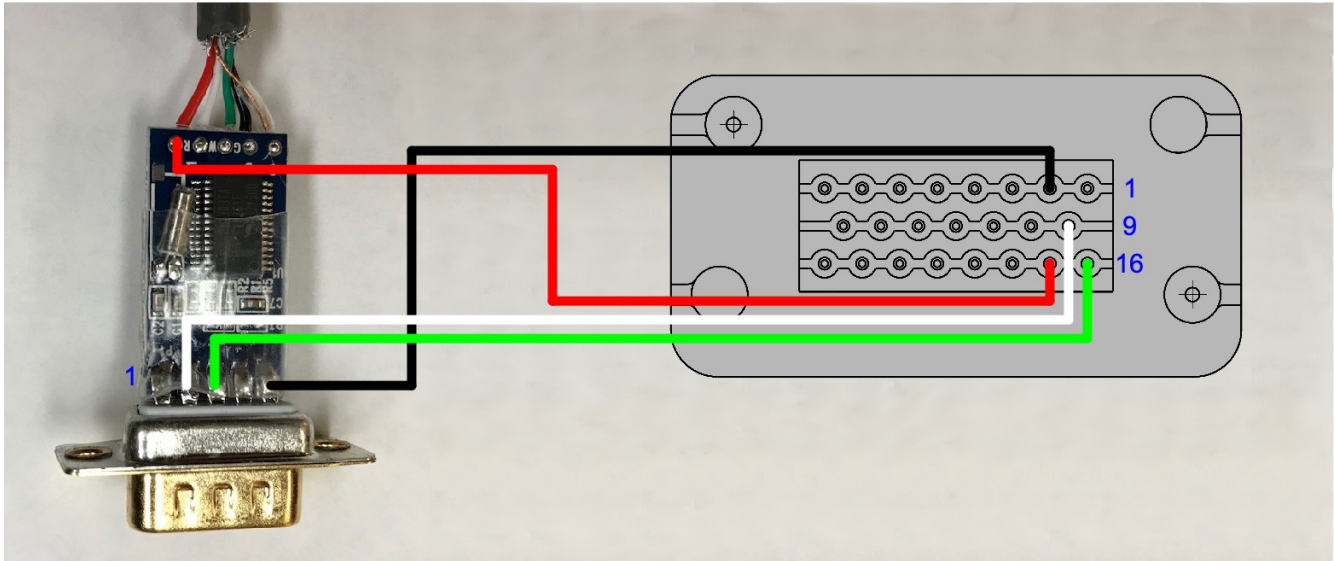
This was initially done for the first implementation of my cable that used a different USB to serial adapter. That adapter had only a header socket on the end of the cable so I was able to remove the contacts from the socket and feed the cable through the hole. For the present implementation with the UGREEN adapter it was necessary to unsolder the cable wires from the circuit board to feed the cable through the hole and then solder the wires back again. If you choose this same approach, the circuit board holes are labeled with the wire color codes BBGWR to help solder the wires in the correct order.

An alternative method that would not require unsoldering the adapter cable would be to cut a notch for the cable in the top edge of the box so the cable is held in place when the cover is attached. That notch could be fitted with a strain-relief bushing or a slit grommet to slip around the cable. It might be necessary to tie a knot in the cable on the inside of the box to keep it from pulling out.

The photo at the end of this document shows my completed cable, but I realized part way through building it that I should have rotated the AMPSEAL connector 180° to allow tilting the connector to get the catch through the cutout, so in these instructions I'm showing the circuit board mounted on the other side to leave room for attaching the wires to the AMPSEAL connector. Also, rather than using the small interconnect board with a header and socket between the circuit board and the AMPSEAL connector, I recommend buying the socket contacts that slide onto the backside pins of the connector so the interconnect wires can be soldered to the circuit board and route directly to the connector. After crimping the socket contacts onto the interconnect wires, insulate them with heat-shrink tubing.

The four wires connecting between the circuit board and the AMPSEAL connector are wired according to the following table and diagram. The reason for preferring the specified wire colors is to match the car's wiring as an aid in case someone needs to probe signals in the box to diagnose a hardware problem, as a few people have done with my cable.

Circuit Board	Wire Color	AMPSEAL Pin	Name	Description
DE-9M pin 5	Black	2	GND	Device ground
At USB cable red wire	Red	17	VCC	+5V from USB
DE-9M pin 3	Green	16	TXD	Data to GPS
DE-9M pin 2	White	9	RXD	Data from GPS



The red wire that carries +5V to the AMPSEAL connector to power the GPS sensor needs to be soldered into the same hole with the red wire from the USB cable. To do this I unsoldered the existing red wire, cleared the hole with a solder-sucker, and then inserted the original wire with as many strands of the new wire as would fit. The other strands were cut off. The three other wires go into solder cups on the DE-9M connector so those are easy to solder.

The suggested order of construction is as follows:

1. Remove the encapsulation from the serial adapter and make the modifications to the box.
2. Mount the AMPSEAL connector into the box.
3. Feed the USB cable through the grommet if using that method rather than the bushing.
4. Crimp the socket contacts onto the four wires and insulate with heat-shrink tubing.
5. Solder the wires to the circuit board and physically secure them and the incoming cable using a cable tie around the wires and the circuit board.
6. Slide the socket contacts onto the correct pins of the AMPSEAL connector.
7. Mount the DE-9M connector to the posts in the box. It would be good to support the four wires with a cable clamp on the mounting post on the other side of the box as well.

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