Power Seat Wiring Harness

Project goals, dimensions, parts list, cost breakdown, and wiring diagram.

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1 Overview

The goal of this project is to design a power seat harness for a hypothetical 8-way automotive power seat. It will not fit any particular car, and is constructed purely as a prototype. However it should highlight the issues that arise in the design of any wiring harness.

Power seats use electrical motors to control seat's relative positioning within the car, as well as its overall shape. Power controls are often combined with additional manual adjustment mechanisms. The type of a power seat is usually specified by quantifying the number of ways it can be adjusted using power controls. This number does not include the number of ways a seat can be adjusted using manual controls and does not alone specify which controls are manual and which are powered. Thus not all 8-way power seats are alike.

Our hypothetical power seat, will have power adjustable *bottom height*, *bottom angle*, *seat distance* from the steering wheel and *lumbar support*. That's total of 4 adjustable parameters. Since each one of the 4 parameters can be adjusted in 2 ways(increased or decreased) there are total of 8 ways in which seat can be adjusted. In addition to 4 power adjustments, there's going to be one more manual adjustment: *seatback recline*.

2 Requirements

The role of the power seat wiring harness is to conduct electrical current between *power source*, mechanical *switch assemblies* and electrical *motors*. Our power seat uses *4 electrical motors* and *2 switch assemblies*. The switch assemblies control which electrical motors receive electrical current as well as in which direction it is flowing for each motor.

The first switch assembly is used just for *lumbar support* and controls only one motor, while the second switch assembly controls the other 3 motors, for *height*, *angle* and *distance* adjustments.

The motors used are all *Direct Current(DC)* and each is a two-terminal device. Each motor is usually dedicated to adjusting a single parameter, with the exception of *angle* and *height*. Neither of those two parameters are controlled by any single motor, but by two motors working in tandem: one raises(or lowers) the front and the other raises(or lowers) the back of the seat.

The power is supplied from without by a lead-acid battery over two terminals, usually with 12V potential between them and hopefully with a fuse somewhere in series as the only current limiting device.

In order for motors to be able to turn in either direction they must be connected in such a way that the polarities of the potentials applied to their two terminals could be inversed. This could not be true, for example, if one of the terminals was always connected to ground! That means there will be two wires leading from each motor to the respective switch assembly.

Likewise, to be able to control direction of rotation of the motors, each switch assembly requires two power inputs, for both ground and positive potential, meaning a total of 4 power lines is needed. This is a problem, because the power terminal of the car supplies only 2. Additional 2 power lines will have to be spliced from the 2 existing ones in order to supply power for the second switch assembly.

3 Equivalent Circuit

In order to better understand operation of the mechanical switch assemblies it is helpful to consider an equivalent circuit using a commonplace Double-Pole, Double-Throw or DPDT On-Off switch as shown in Figure 1. The motor will change direction when the switch is flipped.

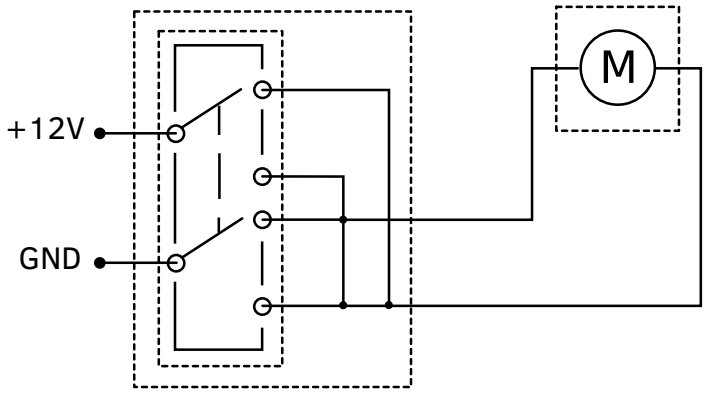


Figure 1: Equivalent circuit for a switch assembly using DPDT On-Off switch

4 Layout

Figure 2 on the next page outlines the general layout of the wiring harness as well as exact dimensions of different sections. Black lines indicate sections of wires protected by plastic loom, gray lines are unprotected wire sections.

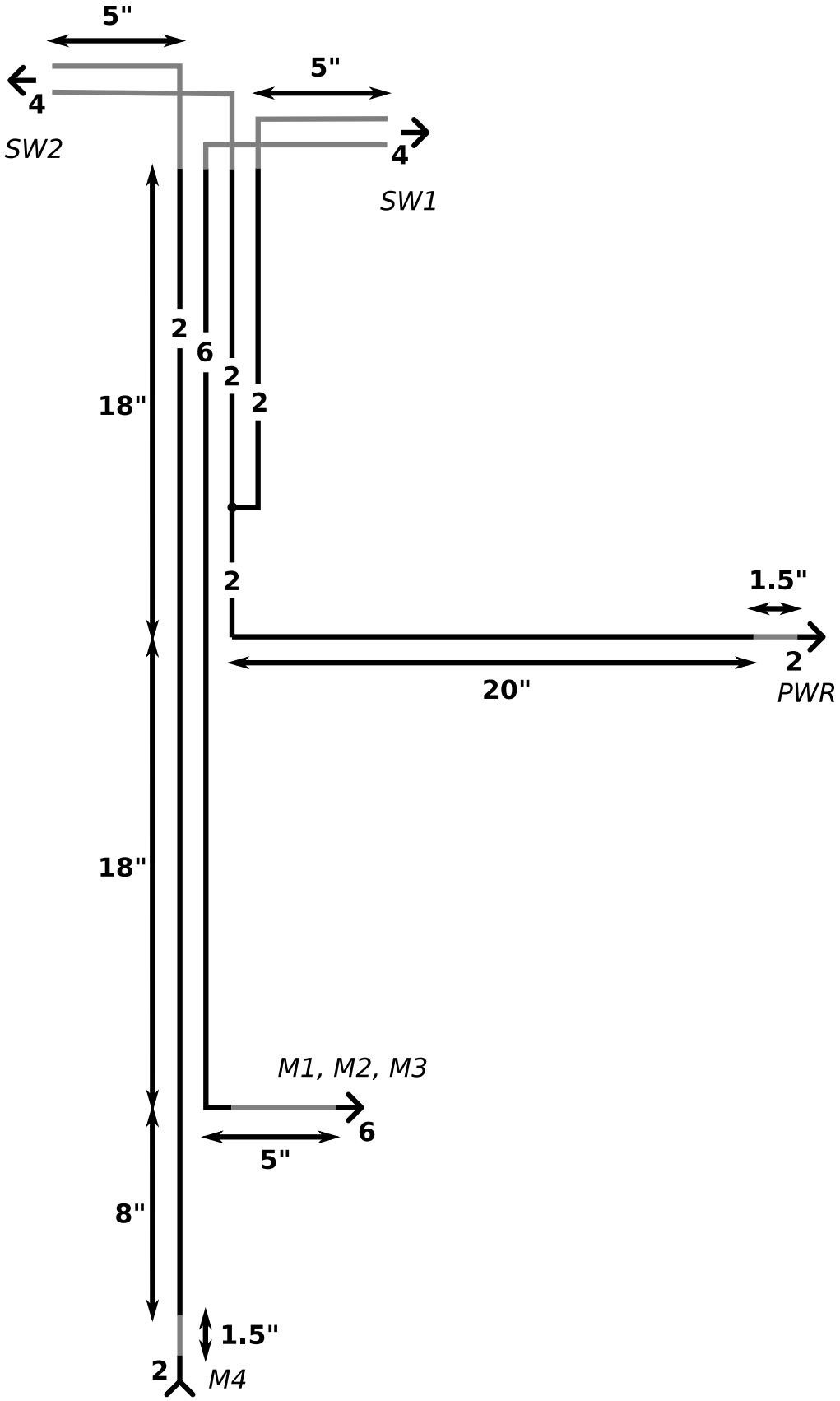


Figure 2: Layout of the wiring harness

5 Materials

This section lists all the parts required to assemble the harness. Where materials need to be cut to specific lengths(such as wires and plastic tubes), all cut lengths are specified.

Part Number: 776427-1
Manufacturer: TE Connectivity
Number of Positions: 2
Product Series: AMPSEAL 16
Description: Connector Housing
Connector Style: Male
Unit Price: $0.85
Quantity: 1
Color: Red

Part Number: 776531-3
Manufacturer: TE Connectivity
Number of Positions: 6
Product Series: AMPSEAL 16
Description: Connector Housing
Connector Style: Male
Unit Price: $1.46
Quantity: 1
Color: Yellow

Part Number: 776534-3
Manufacturer: TE Connectivity
Number of Positions: 2
Product Series: AMPSEAL 16
Description: Connector Housing
Connector Style: Female
Unit Price: $1.06
Quantity: 1
Color: Yellow

Part Number: 776524-2
Manufacturer: TE Connectivity
Number of Positions: 4
Product Series: AMPSEAL 16
Description: Connector Housing
Connector Style: Male
Unit Price: $1.50
Quantity: 1
Color: Grey

Part Number: 776532-2
Manufacturer: TE Connectivity
Number of Positions: 8
Product Series: AMPSEAL 16
Description: Connector Housing
Connector Style: Male
Unit Price: $2.06
Quantity: 1
Color: Grey

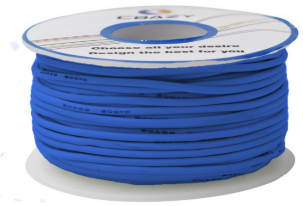
Part Number: 776492-1
Manufacturer: TE Connectivity
Terminal Style: Socket
Product Series: AMPSEAL 16
Description: Socket Terminal
Wire Size(AWG): 18-14
Unit Price: $0.46
Quantity: 20
Current Rating (A): 13
Pin Diameter: 1.588mm

Part Number: 2098250-1
Manufacturer: TE Connectivity
Terminal Style: Pin
Product Series: AMPSEAL 16
Description: Pin Terminal
Wire Size(AWG): 18-14
Unit Price: $0.27
Quantity: 2
Current Rating (A): 13
Pin Diameter: 1.588mm

Manufacturer: Electriduct Inc
Diameter: 3/4"
Description: Split Wire Loom Tubing
Price per Inch: $0.12
Cut Lengths: 44", 20", 1"
Total Lengths: 65"

Manufacturer: CBAZY
Size: 18AWG
Color: Red
Description: Stranded Hook-up Wire
Price per Inch: $0.02
Cut Lengths: 46"x2
Total Length: 92"

Manufacturer: CBAZY
Size: 18AWG
Color: Green
Description: Stranded Hook-up Wire
Price per Inch: $0.02
Cut Lengths: 46"x2
Total Length: 92"



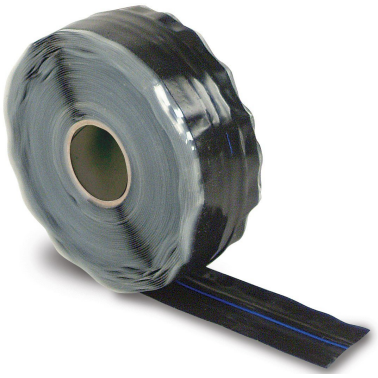
Manufacturer: CBAZY
Size: 18AWG
Color: Blue
Description: Stranded Hook-up Wire
Price per Inch: $0.02
Cut Lengths: 46"x2
Total Length: 92"

Manufacturer: CBAZY **Price per Inch:** $0.02
Size: 18AWG **Cut Lengths:** 50.5"x2
Color: White **Total Length:** 101"
Description: Stranded Hook-up Wire

Manufacturer: CBAZY **Price per Inch:** $0.02
Size: 18AWG **Cut Lengths:** 14"x2, 30.5x2"
Color: Yellow **Total Length:** 89"
Description: Stranded Hook-up Wire

Manufacturer: CBAZY **Price per Inch:** $0.02
Size: 18AWG **Cut Lengths:** 13"x2, 31.5x2"
Color: Black **Total Length:** 89"
Description: Stranded Hook-up Wire

Manufacturer: Ginsco **Unit Price:** $0.05
Size: 14-16AWG **Material:** Tinned Copper
Description: Splice terminal **Quantity:** 2



Manufacturer: DEI
Unit Price: $30.63
Price Per Inch: $0.07
Total Length: 20"
Marketing Name: Fire Tape
Quantity: 1
Width: 1"
Length: 36’
Description: Self-Vulcanizing Silicone Rubber Tape

Manufacturer: SES
Price per Inch: $0.03
Diameter: 3/8"
Cut Lengths: 1"x2
Color: Black
Total Length: 2"
Description: Dual-Wall Adhesive Heat Shrink Tube

Manufacturer: Temco
Price per Inch: $0.13
Diameter: 3/4"
Cut Lengths: 1.5"x4
Color: Black
Total Length: 6"
Description: Dual-Wall Adhesive Heat Shrink Tube

Total Cost Of Materials: $37.95

6 Wiring Diagram

The wiring diagram in Figure 3 on the next page specifies the exact connections that need to exist between different connector housings for the wiring harness to function.

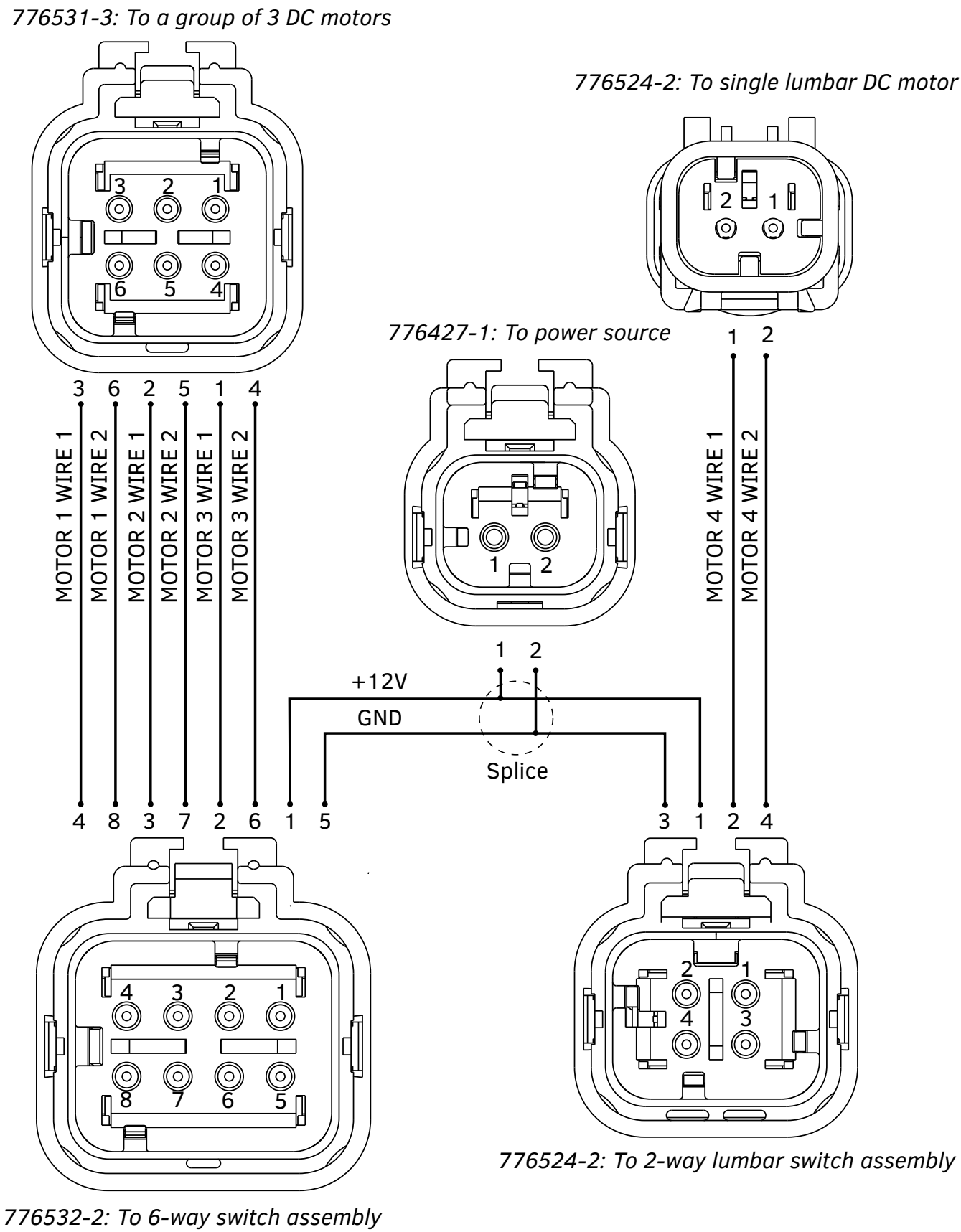


Figure 3: Wiring diagram