

# POWER WINDOW SYSTEMS

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## DESCRIPTION AND OPERATION

### POWER WINDOW SYSTEM

#### DESCRIPTION

Power operated driver side and passenger side front and rear door windows are standard factory-installed equipment on this model. The power window system allows each of the door windows to be raised or lowered electrically by operating a switch on the trim panel for that door. Additionally, the master switches on the driver side front door trim panel allow of the windows to be operated from the driver seat position. A power window lockout switch on the driver side front door trim panel will allow the driver to disable all of the passenger door window switches.

The power window system operates on ignition switched battery current supplied through a fuse in the junction block, only when the ignition switch is in the On position. However, a unique feature of this system will allow the power windows to be operated for up to forty-five seconds after the ignition switch is turned to the Off position, or until a front door is opened, whichever occurs first.

An auto-down feature allows the driver side front door window to be lowered all the way, even if the window switch is released. The driver side front door window switch must be depressed in the down direction to a second detent to begin an auto-down event. Depressing the switch again in any direction will stop the window movement and cancel the auto-down event.

This group covers the following components of the power window system:

- Power window switches
- Power window motors.

Certain functions and features of the power window system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network.

The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect power window system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.

- **Driver Door Module (DDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.

- **Passenger Door Module (PDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.

This group covers diagnosis and service of only the electrical components in the power window system. For service of mechanical components, such as the regulator, lift plate, window tracks, or glass refer to Group 23 - Body. Refer to **Power Windows** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the power window system.

#### OPERATION

The power window system includes the Driver Door Module (DDM) and Passenger Door Module (PDM), which are mounted in their respective front door, the rear door power window switches mounted on the rear doors, and the power window motors mounted to the window regulator in each door. The DDM houses four master power window switches, the

## DESCRIPTION AND OPERATION (Continued)

power window lockout switch and the control logic for the driver side front and rear door power windows. The PDM houses the passenger side front door power window switch and the control logic for the passenger side front and rear door power windows.

When a master power window switch on the DDM is used to operate a passenger side power window, the DDM sends the window positioning messages to the PDM over the Programmable Communications Interface (PCI) data bus. The PDM responds to these messages by sending control outputs to move the passenger side power window motors. In addition, when the power window lockout switch in the DDM is actuated to disable power window operation, this is accomplished through a lockout message sent to the PDM over the PCI data bus.

The Body Control Module (BCM) also supports and controls certain features of the power window system. The BCM receives a hard wired input from the ignition switch. The programming in the BCM allows it to process the information from this input and send ignition switch status messages to the DDM and the PDM over the PCI data bus. The DDM and PDM use this information and hard wired inputs from the front door ajar switches to control the lighting of the power window switch lamps, and to control the operation of the power window after ignition-off feature.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power window system.

## POWER WINDOW SWITCH

### DESCRIPTION

The power window motors are controlled by a two-way momentary switch mounted on the trim panel of each passenger door, and four two-way momentary switches on the driver side front door trim panel. The driver side front door trim panel also has a two-position power window lockout switch. Each power window switch, except the lockout switch, is illuminated by a Light-Emitting Diode (LED) that is integral to the switch paddle.

The front door power window switches and the power window lockout switch are integral to the Driver Door Module (DDM) or Passenger Door Module (PDM), respectively. The front door power window switches and their lamps cannot be adjusted or repaired and, if faulty or damaged, the entire DDM or PDM unit must be replaced. The rear door power window switches and their lamps cannot be adjusted or repaired but, if faulty or damaged, only the affected rear door power window switch must be replaced. Refer to **Door Module** in the Power Lock

System section of Group 8P - Power Lock Systems for the DDM and PDM service procedures.

### OPERATION

The front door power window switches provide an up or down (or lock and unlock signal in the case of the lockout switch) to the door module circuitry. The Driver Door Module (DDM) circuitry controls the output to the driver side front and rear door power window motors, and supplies electrical current as required for the stand-alone operation of the driver side rear door power window switch. The Passenger Door Module (PDM) circuitry controls the output to the passenger side front and rear door power window motors, and supplies electrical current as required for the stand-alone operation of the passenger side rear door power window switch.

When a DDM-integrated master power window switch for a passenger side window is actuated, or when the power window lockout switch is actuated to disable the passenger door power windows, the DDM circuitry sends a message to the PDM over the Programmable Communications Interface (PCI) data bus to control the output to that power window motor(s).

The power window switch for the driver side front door power window has two detent positions in the Down direction. The first detent provides normal power window down operation. If this switch is depressed to the second detent, the Auto Down circuitry of the DDM is activated. The Auto-Down circuitry will automatically move the driver side front door window to its fully lowered position, even if the power window switch is released. The Auto-Down event will be automatically cancelled and the window movement will be stopped if the DDM circuitry detects a second input from the driver side front door power window switch, in either direction.

Each power window switch, except the lockout switch, is illuminated by a Light-Emitting Diode (LED) when the ignition switch is turned to the On position. However, when the lockout switch is placed in the Lock position, the LED for the locked-out front and rear passenger door power window switches is turned off.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power window switches.

## POWER WINDOW MOTOR

### DESCRIPTION

Power operated front and rear door windows are standard equipment on this model. Each door has a permanent magnet reversible electric motor with an integral right angle gearbox mechanism that operates the window regulator. In addition, each power

## DESCRIPTION AND OPERATION (Continued)

window motor is equipped with an integral self-resetting circuit breaker to protect the motor from overloads.

(1) The power window motor gearbox housing is secured to the window regulator drum housing with screws. The window regulators used in all four doors are single vertical post cable-and-drum type. A molded plastic slider guided by the post is driven by the regulator cables. The slider raises and lowers the window glass through a steel lift plate attachment. Front and rear glass channels within each door guide and stabilize each end of the glass.

The power window motor and gearbox assembly cannot be repaired and, if faulty or damaged, the entire power window motor and gearbox unit must be replaced. The window regulators are available for service. Refer to **Front Door Window Regulator** or **Rear Door Window Regulator** in the Removal and Installation section of Group 23 - Body for the regulator service procedures.

### OPERATION

A positive and negative battery connection to the two motor terminals will cause the power window motor to rotate in one direction. Reversing the current through these same two connections will cause the motor to rotate in the opposite direction.

When the power window motor operates, it rotates the regulator cable drum through its gearbox. The window regulator cable drum is connected through two cables to the plastic slider on the vertical post. As the cable drum rotates, it lets cable out on one side of the drum, and takes cable in on the other side of the drum. The changes in cable length move the slider up or down the vertical post, raising or lowering the window glass.

If the window regulator or window glass bind, encounter obstructions, or reach their travel limits it overloads the power window motor. The overloading condition causes the power window motor self-resetting circuit breaker to open, which stops the motor from running.

## DIAGNOSIS AND TESTING

### POWER WINDOW SYSTEM

Following are tests that will help to diagnose the hard wired components and circuits of the power window system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power window system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the power window system components must be checked.

The most reliable, efficient, and accurate means to diagnose the power window system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the power window motors are being sent the proper hard wired outputs by the door modules for them to perform their power window system functions.

For complete circuit diagrams, refer to **Power Windows** in the Contents of Group 8W - Wiring Diagrams.

### ALL WINDOWS INOPERATIVE

(1) Check the operation of the power lock switch on the driver side front door. If all of the doors lock and unlock, but none of the power windows operate, use a DRB scan tool and the proper Diagnostic Procedures manual to check the Body Control Module (BCM), the Driver Door Module (DDM) and the PCI data bus for proper operation. If not OK, go to Step 2.

(2) Check the operation of the power lock switch on the passenger side front door. If the passenger doors lock and unlock, but the driver side front door does not, go to Step 5. If all of the power locks and power windows are inoperative from both front doors, go to Step 3.

(3) Check the fused B(+) fuse in the Power Distribution Center (PDC). If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Check for battery voltage at the fused B(+) fuse in the PDC. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the battery as required.

(5) Disconnect and isolate the battery negative cable. Remove the trim panel from the driver side front door. Disconnect the 15-way door wire harness connector from the DDM connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the DDM and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the DDM. If OK, replace the faulty DDM. If not OK, repair the open fused B(+) circuit to the fuse in the PDC as required.

### PASSENGER SIDE FRONT AND REAR WINDOWS INOPERATIVE

If the driver side front and rear power windows operate, but the passenger side front and rear do not,

## DIAGNOSIS AND TESTING (Continued)

use a DRB scan tool and the proper Diagnostic Procedures manual to check the PCI data bus for proper operation.

**ONE WINDOW INOPERATIVE**

The window glass and regulator mechanism must be free to slide up and down for the power window motor to function properly. If the window glass and regulator is not free to move up and down, the motor will overload and trip the integral circuit breaker. To determine if the window glass and regulator are free, disconnect the regulator plate from the glass. Then slide the window up and down by hand.

There is an alternate method to check if the window glass and regulator mechanism is free. Position the glass between the up and down stops. Then, shake the glass in the door. Check that the glass can be moved slightly from side to side, front to rear, and up and down. Then check that the glass is not bound tight in the tracks.

If the window glass and regulator mechanism is free, refer to **Door Module** in the Diagnosis and Testing section of this group. If the glass is not free, inspect the window glass mounting and operating hardware for damage or improperly installed components. Refer to **Group 23 - Body** to check for proper installation or damage of the window glass mounting and operating hardware.

**DOOR MODULE**

**NOTE:** The following tests may not prove conclusive in the diagnosis of this component. The most reliable, efficient, and accurate means to diagnose this component requires the use of a DRB scan tool and the proper Diagnostic Procedures manual.

If the problem being diagnosed is a rear door window that does not operate from the rear door switch, but does operate from the master switch on the driver side front door, refer to **Rear Door Power Window Switch** in the Diagnosis and Testing section of this group. If the problem is a passenger side front or rear window that operates from the switch on that door, but does not operate from the master switch on the driver side front door, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the circuitry of both door modules and the PCI data bus. For complete circuit diagrams, refer to **Power Windows** in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Remove the trim panel from the front door, but do not disconnect the door wire harness connectors from the door module. Go to Step 2.

(2) Check the 15-way door wire harness connector for the door module to see that it is fully seated in the door module connector receptacle. If OK, go to

Step 3. If not OK, properly connect the 15-way door wire harness connector for the door module to the door module connector receptacle.

(3) Disconnect the 15-way door wire harness connector from the door module connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the door module and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the door module. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center (PDC) as required.

(5) If the inoperative window is on a front door, go to Step 6. If the inoperative window is on a rear door go to Step 9.

(6) Disconnect and isolate the battery negative cable. Disconnect the door wire harness connector from the inoperative power window motor wire harness connector. Check for continuity between the front window driver up circuit cavity of the 15-way door wire harness connector for the door module and a good ground. Repeat the check for the front window driver down circuit. In each case there should be no continuity. If OK, go to Step 7. If not OK, repair the shorted front window driver up or down circuit as required.

(7) Check for continuity between the front window driver up circuit cavities of the 15-way door wire harness connector for the door module and the door wire harness connector for the power window motor. Repeat the check for the front window driver down circuit. In each case there should be continuity. If OK, go to Step 8. If not OK, repair the open front window driver up or down circuit as required.

(8) Reconnect the 15-way door wire harness connector back into the door module connector receptacle. Connect the battery negative cable. Connect the probes of a reversible DC digital voltmeter to the door wire harness connector for the power window motor. Observe the voltmeter while actuating the switch for that window in the up and down directions. There should be battery voltage for as long as the switch is held in both the up and down positions, and no voltage in the neutral position. If OK, refer to **Power Window Motor** in the Diagnosis and Testing section of this group. If not OK, replace the faulty door module.

(9) Check the rear door power window switch continuity. Refer to **Rear Door Power Window Switch** in the Diagnosis and Testing section of this group. If OK, go to Step 10. If not OK, replace the faulty rear door power window switch.

DIAGNOSIS AND TESTING (Continued)

(10) Disconnect and isolate the battery negative cable. Reconnect the door wire harness connector to the rear door power window switch. Disconnect the door wire harness connector from the inoperative power window motor wire harness connector. Check for continuity between the rear window driver up circuit cavity of the 15-way door wire harness connector for the door module and a good ground. Repeat the check for the rear window driver down circuit. In each case there should be no continuity. If OK, go to Step 11. If not OK, repair the shorted rear window driver up or down circuit as required.

(11) Check for continuity between the rear window driver up circuit cavities of the 15-way door wire harness connector for the door module and the power window motor wire harness connector. Repeat the check for the rear window driver down circuit. In each case there should be continuity. If OK, go to Step 12. If not OK, repair the open rear window driver up or down circuit as required.

**NOTE:** The door module feeds battery current to both terminals of the rear door power window motors when the power window lockout switch is in the Unlock position, until the master window switch on the driver side front door is actuated. The door module feeds ground to both terminals of the rear door power window motor when the power window lockout switch is in the Lock position, until the master window switch on the driver side front door is actuated.

(12) Reconnect the 15-way door wire harness connector for the door module to the door module connector receptacle. Connect the battery negative cable. Check for battery voltage at each cavity in the door wire harness connector for the power window motor. Each cavity should have battery voltage when the power window switch is in the neutral position. Each cavity should also have battery voltage in one other switch position, either up or down, and zero volts with the switch in the opposite position. If OK, refer to **Power Window Motor** in the Diagnosis and Testing section of this group. If not OK, replace the faulty door module.

REAR DOOR POWER WINDOW SWITCH

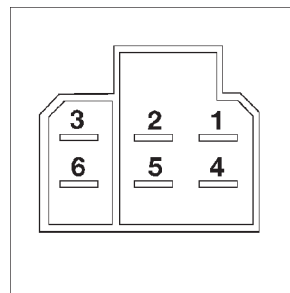
The diagnosis found here applies only to the rear door power window switches. For diagnosis of the front door power window switches, refer to **Power Window System - Door Module** in the Diagnosis and Testing section of this group. If the problem being diagnosed is an inoperative power window switch illumination lamp, but the power window switch operates as designed, replace the faulty rear door power window switch. For complete circuit dia-

grams, refer to **Power Windows** in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the power window switch from the rear door trim panel. Refer to **Rear Door Power Window Switch** in the Removal and Installation section of this group.

(3) Check the rear door power window switch continuity as shown in the Rear Door Power Window Switch Continuity chart (Fig. 1). If OK, refer to **Power Window Motor** in the Diagnosis and Testing section of this group. If not OK, replace the faulty rear door power window switch.



| SWITCH POSITION | CONTINUITY BETWEEN |
|-----------------|--------------------|
| LED             | 3 AND 6            |
| OFF             | 1 AND 2            |
| OFF             | 4 AND 5            |
| FORWARD         | 1 AND 2            |
| FORWARD         | 5 AND 6            |
| REARWARD        | 2 AND 6            |
| REARWARD        | 4 AND 5            |

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Fig. 1 Rear Door Power Window Switch Continuity

POWER WINDOW MOTOR

Before you proceed with this diagnosis, confirm proper switch operation. Refer to **Power Window System - Door Module or Rear Door Power Window Switch** in the Diagnosis and Testing section of this group. For complete circuit diagrams, refer to **Power Windows** in Group 8W - Wiring Diagrams.

(1) Remove the trim panel from the door with the inoperative power window. Refer to **Front Door Trim Panel** or **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(2) Disconnect the door wire harness connector from the power window motor wire harness connector. Apply battery current to one cavity of the power window motor wire harness connector, and apply ground to the other cavity of the connector. The power window motor should operate in one direction. Remember, if the window is in the full up or full

## DIAGNOSIS AND TESTING (Continued)

down position, the motor will not operate in that direction by design. If OK, go to Step 3. If not OK, replace the faulty power window motor.

(3) Reverse the battery and ground connections to the two cavities of the power window motor wire harness connector. The power window motor should now operate in the other direction. Remember, if the window is in the full up or full down position, the motor will not operate in that direction by design. If OK, go to Step 4. If not OK, replace the faulty power window motor.

(4) If the power window motor operates in both directions, check the operation of the window glass and regulator mechanism through its complete up and down travel. There should be no binding or sticking of the window glass or regulator mechanism through the entire travel range. If not OK, refer to **Group 23 - Body** to check for proper installation or damage of the window glass mounting and operating hardware.

## REMOVAL AND INSTALLATION

## REAR DOOR POWER WINDOW SWITCH

## REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the rear door. Refer to **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the sides of the switch receptacle on the back of the rear door trim panel away from the perimeter of the power window switch to release the switch from the receptacle (Fig. 2).

(4) Remove the power window switch from the rear door trim panel switch receptacle.

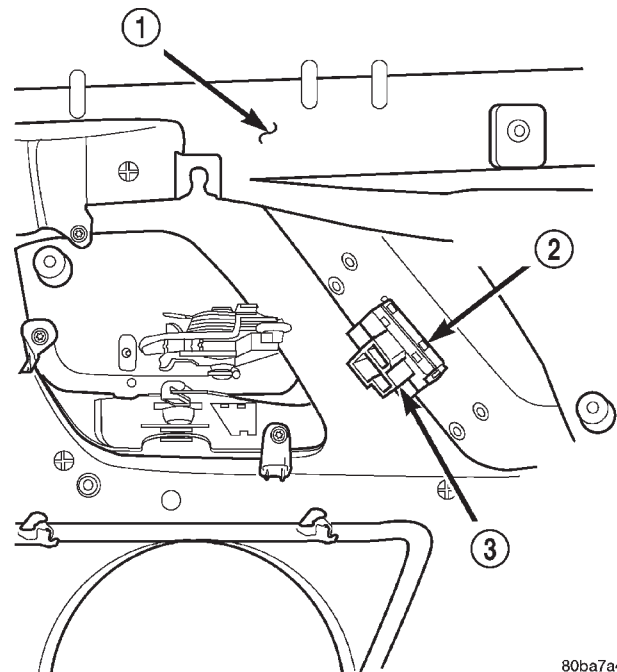
## INSTALLATION

(1) Position the power window switch to the rear door trim panel switch receptacle.

(2) Press firmly and evenly on the back of the power window switch until it snaps into rear door trim panel switch receptacle.

(3) Install the trim panel onto the rear door. Refer to **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Reconnect the battery negative cable.



**Fig. 2 Rear Door Power Window Switch Remove/Install**

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- 1 - REAR DOOR TRIM PANEL
- 2 - TRIM PANEL RECEPTACLE
- 3 - POWER WINDOW SWITCH

## POWER WINDOW MOTOR

## REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the window regulator from the door. Refer to **Front Door Window Regulator** or **Rear Door Window Regulator** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Place the window regulator on a suitable work surface and remove the screws that secure the power window motor to the window regulator.

(4) Remove the power window motor from the window regulator.

## INSTALLATION

(1) Position the power window motor onto the window regulator.

(2) Install and tighten the screws that secure the power window motor to the window regulator. Tighten the screws to 9 N·m (80 in. lbs.).

(3) Install the window regulator onto the door. Refer to **Front Door Window Regulator** or **Rear Door Window Regulator** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Reconnect the battery negative cable.