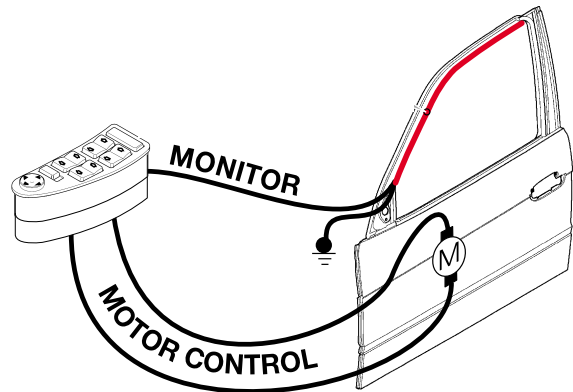


Power Windows/Sunroof

Purpose of the System

The features of the power windows and sunroof system include:

- One-touch operation in both directions (up/down) on all four windows.
- The cable design window regulator is used for all windows.
- Anti-trap detection is through the use of the pressure sensitive finger guard.
- The control of the front window motors is carried out in the respective door modules.
- The control of the rear windows is carried out in the GM III.
- The switch block/module on the driver's door panel controls all four windows and the rear window lock out feature.



System Components - with the Principle of Operation

The signals from the switch block pass through the driver's door via the P-Bus and on to the GM III and passengers door module.

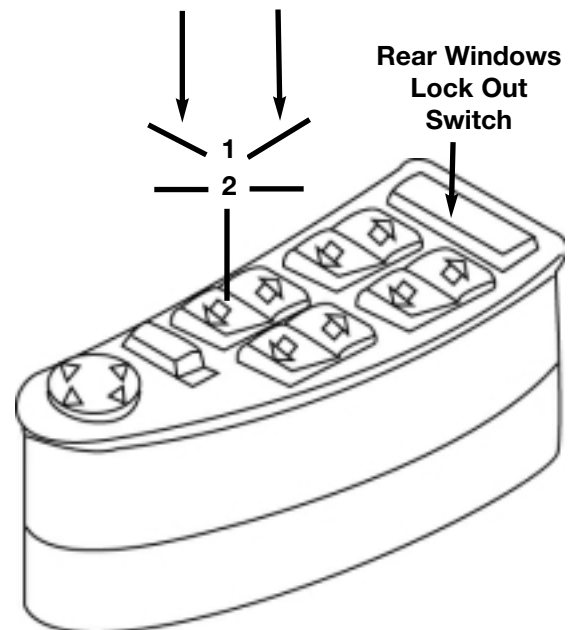
Each window switch has four positions.

Two for the standard mode of operation:

- Push to first detent and hold to raise/lower the window (1).

Two for the one-touch mode:

- Push to second detent and quickly release (quick strike) to automatically raise/lower the window (2).



All window operations signals are digital inputs to the door module and GM III.

- Comfort closing/opening of the windows from the driver's lock cylinder. The remote key provides opening only.
- When the ignition key is in accessory or "on" position press the switch to open or close the windows. Window operation is possible with the ignition switched off until a front door is opened or 16 minutes (maximum) has elapsed.
- Window load switching is through relays. The front window control relays are located in the door modules, the rear window relays are in the GM III. The GM III monitors the current draw for end limit position. The maximum run time for the window motors is limited to 6 seconds in the one-touch mode. This allows the motors to be switched off if the end limit load sensing fails.

E53 Style Window Switches: The E53 power window switch design is a push - pull type switch. Each switch provides the GM with the coded ground signaling strategy as previous two wire switches.

Pushing a switch to the first detent and holding provides a single ground signal on one wire requesting the GM to operate the window motor in the down direction.

When released, the ground signal is removed and the window motor stops.

Momentarily pushing the switch to the second detent and releasing provides an additional ground signal on the second wire requesting the "one touch mode", operating the window motor automatically.

The motor runs the window down until it reaches the end stop.

The switch functions in the same manner for the upward run of the window motor but the ground signal sequencing is reversed.



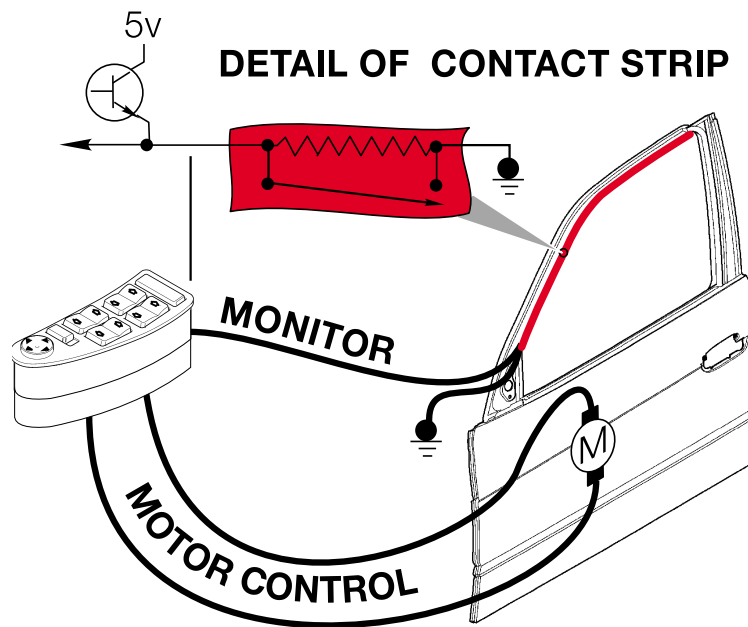
Rear Window Child Lockout Switch: The rear window child lockout switch is incorporated in the driver's side window switch block. It provides a constant ground signal to the GM preventing the windows from being operated from the rear door switches.

The lockout switch ground signal is overridden by the GM if the MRS crash signal is activated (MRS III equipped vehicles).

Window Anti-Trap Detection: Each pressure guard at the top edge of each door frame consists of two contact strips that close when subjected to pressure. This provides anti-trap for the full travel of the window.

When the contact strips close, the window will reverse direction. The contact strip does not require that the anti-trap feature be initialized prior to operation.

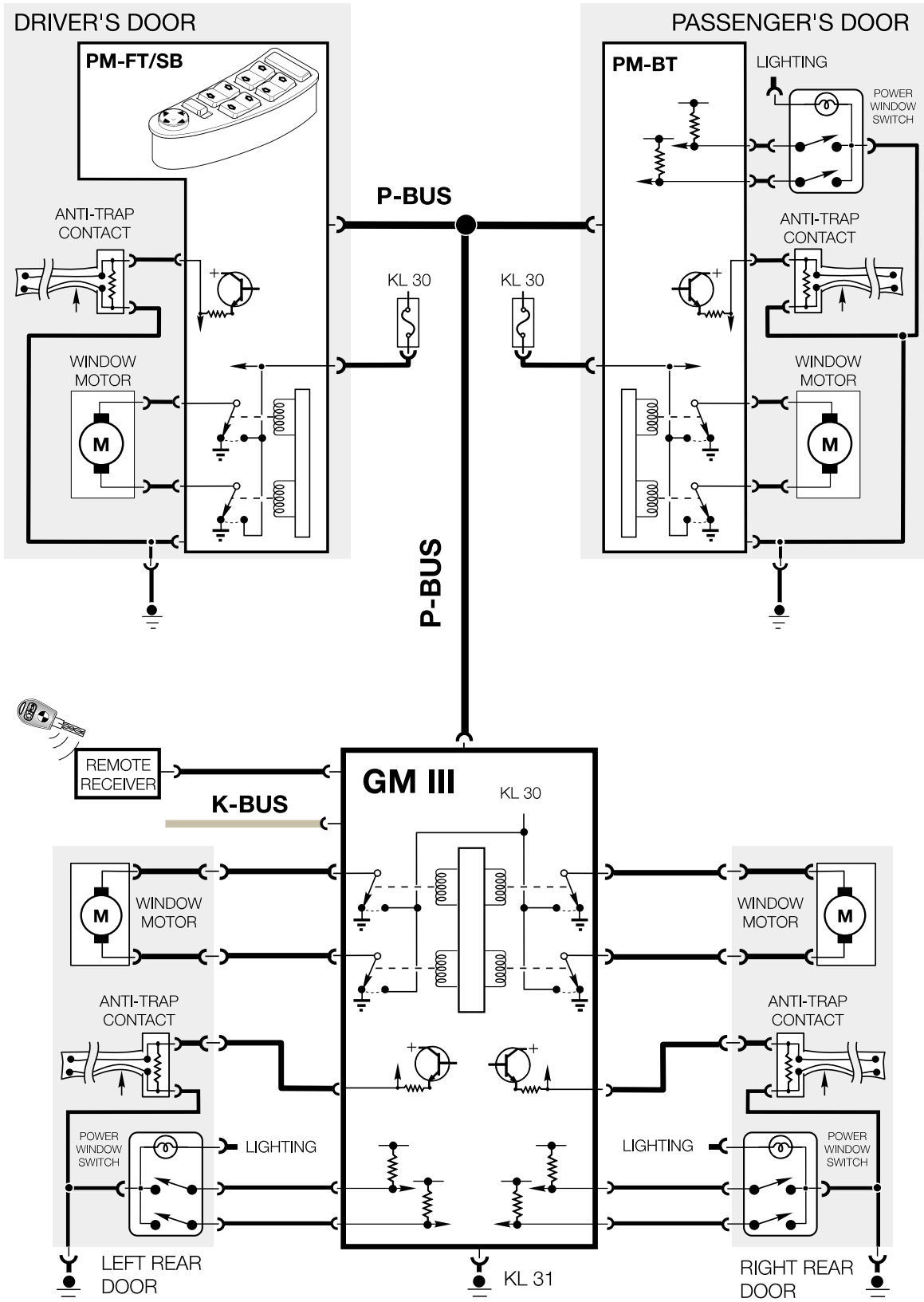
The finger guard has a resistance of 1.2 KOhm and it is monitored for open circuits. Faults with the anti-trap system require that the window switch be held to close the window.



The example shown represents the driver's door window control and monitoring carried out by the Driver's Door Switchblock Module (PM- FT/ SB).

The passenger door window is controlled and monitored by the Passenger door module (PM-BT) and the rear door windows are both controlled and monitored by the General Module.

System Components: Inputs - Processing - Outputs

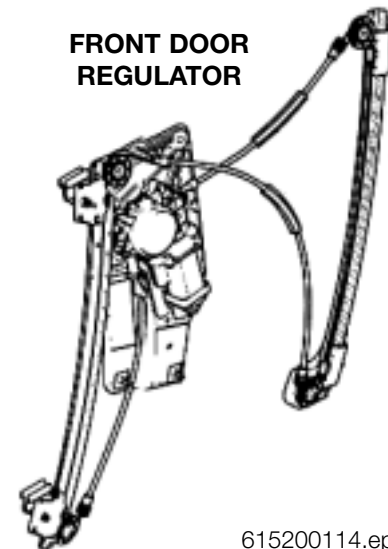


Power Window Motors: The window motors are mounted on the cable regulators. The window motor control circuit consists of two wires for operating the motor in both directions.

The motors are activated by relays in the GM of door modules (front doors). The relays provide either power or ground depending on the direction of window travel.

The GM controls the polarity of the motor based on a request to run the window (window switch, Convenience Opening/ Closing).

The windows are run to the limit stops which is detected by an amperage increase in the control circuit. Additionally, the window run cycle is limited to a 6-8 second duration if in case the amperage increase is not detected or there is a malfunction with the regulator.



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Window Motor Limit Stop Function: If the windows are run up and down continuously a limit stop function is activated to prevent the window motors from overheating. The GM monitors the number of times the window motors are activated. Each cycle is counted and stored in memory.

If the repetitive window activation (up/down) exceeds one minute, the GM deactivates the internal relays and disregards any further input requests. The GM provides motor activation after a short duration but not for the full one minute monitoring cycle. Over time, the GM slowly reverses the stored count of activation until the stored number equals 0.

Convenience Opening/Closing: The GM provides the convenience open/close feature providing control of the power windows (and sunroof) from outside the vehicle with the key in the driver's door lock cylinder. The FZV provides the same function for the opening only.

- The anti-trap feature is active during convenience closing from the driver's door lock.
- The convenience open feature provides outside activation of the windows and sunroof in the same manner.
- If the GM receives a request to operate convenience close or open for more than 110 seconds, the function is deactivated and a fault code is stored.
- The Car Memory Feature can activate and deactivate the Convenience Open Feature from the FZV's control.