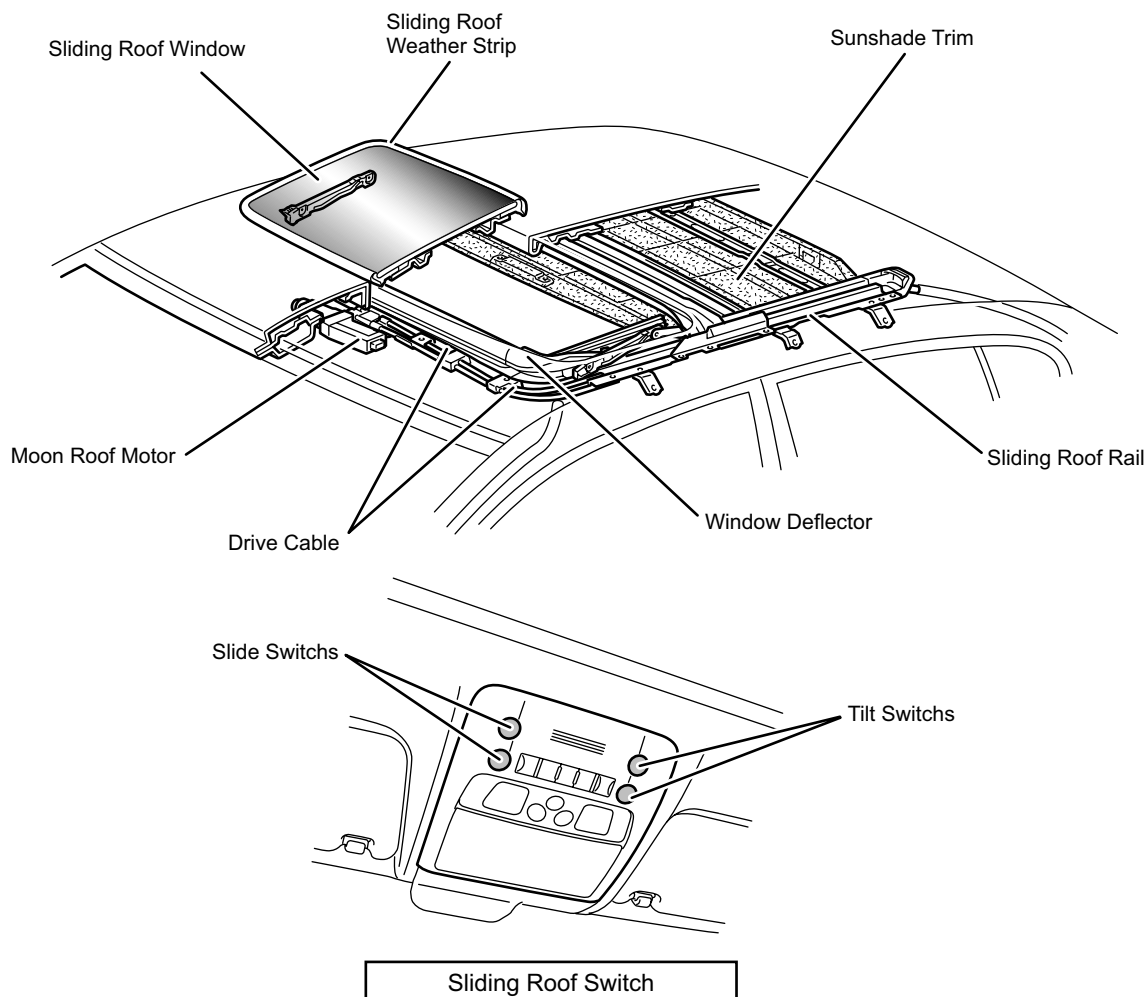


SLIDING ROOF

Moon Roof System

- A "tilt & slide power moon roof", which is provided with various functions such as a one-touch auto function and a jam protection function, is used and made available on all models as a manufacturer's option.
- In addition to a key-off operation function, the moon roof system is provided with a warning function to warn the user if the sliding roof is left open, as well as a door key-linked and a transmitter-linked open-close function for superior ease of use.
- Two switches are provided for the sliding roof: a dedicated tilt switch and a dedicated slide switch. They are located in the front personal light area.
- A pulse sensor (with Hall ICs) is used to detect the position and the movement direction of the sliding roof glass, which is needed for system control. After an inspection or maintenance service is performed, the system must be initialized.
- Privacy glass (dark gray) is used for the sliding roof glass.

Moon Roof System Components



Necessity of Initializing Moon Roof Glass Position

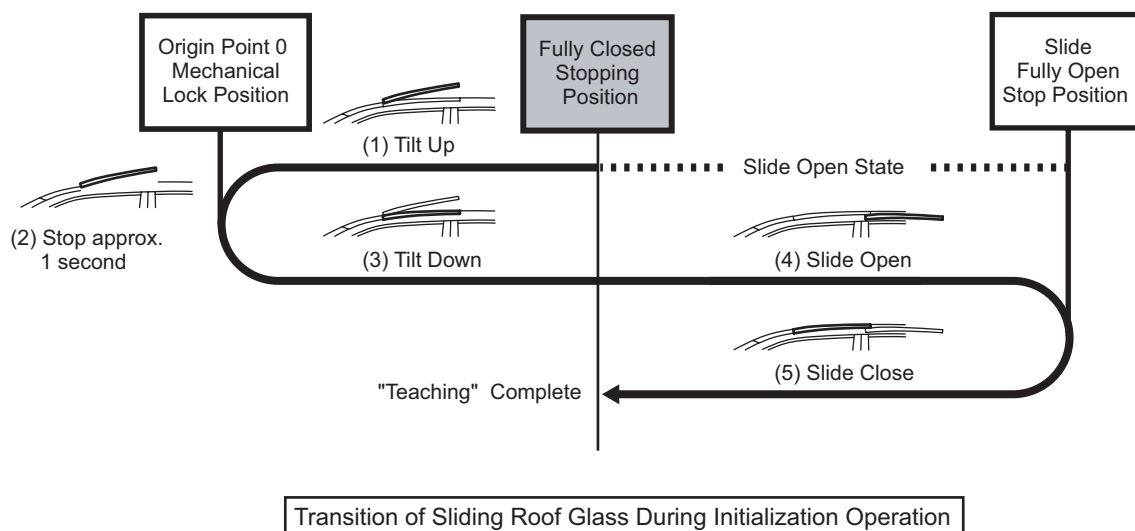
- This system uses a pulse sensor to electrically fetch information pertaining to the current position of the sliding roof glass by way of the rotational movement of the motor. Based on this position information, this system controls various types of functions.
- If the battery is reconnected (initial application of the +B power supply) after an inspection or maintenance service, or the connector of the sliding roof control ECU is disconnected and reconnected, the sliding roof glass position information that is presently stored in the system memory becomes lost. For this reason, the system must be initialized to "teach" the sliding roof glass position to the system.
- Beware that some functions, such as the jam protection function, do not operate if the system has not been properly "taught" the present sliding roof glass position.

Precautions in case the system has not been properly "taught" the sliding roof glass position

- The jam protection function will not function. (If a foreign object gets jammed between the sliding roof glass and the roof opening, causing a load exceeding a predetermined value to act on the sliding roof glass, the sliding roof glass will stop but it will not operate in reverse.)
- The one-touch auto function, key-off operation, and the door key-linked function will not operate.
- The user can operate the sliding roof glass while pressing the sliding roof switch. However, the sliding roof glass will not stop automatically when it reaches the fully closed position.

Initialization Operation

- If the sliding roof glass is open, first operate the sliding roof glass to the vicinity of the fully closed position.
- Turn the ignition ON, and press and hold the slide-close or tilt-up side of the sliding roof switch.
- While the switch is held pressed, the sliding roof glass operates in the following sequence: tilt up (stopping approximately 1 second), tilt down, slide open, and slide close.
- Thereafter, the sliding roof glass comes to stop at the fully closed position, thus completing the initialization operation.
- If you release the switch during the initialization operation, start the operation from the beginning. After completing the initialization operation, make sure to inspect the functions of the sliding roof system. For details on the initialization operation and the inspection of functions, refer to the repair manual.



One-Touch Tilt Up-and-Down Function

- When the up <or down> side of the tilt switch is pressed for more than approximately 0.3 seconds while the ignition is ON, the sliding roof glass will automatically perform a tilt-up operation <or tilt-down operation> until it reaches the fully open <or fully closed> position.
- The auto tilt operation can be interrupted by pressing the tilt switch while the sliding roof glass is undergoing an auto tilt operation.

One-Touch Sliding Open-and-Close Function

- When the user presses the open <or close> side of the slide switch for more than approximately 0.3 seconds while the ignition is ON, the sliding roof glass will automatically perform a slide open <or slide close> operation until it reaches the fully open <or fully closed> position.
- The auto slide operation can be interrupted by pressing the slide switch while the sliding roof glass is undergoing an auto slide operation.

Manual Adjustment Function

- The user can manually operate the sliding roof glass to either direction by pressing an individual sliding roof switch for less than approximately 0.3 seconds while the ignition is ON.
- During an automatic operation, the user can press a sliding roof switch to momentarily stop the automatic operation. Then, the user can manually operate the sliding roof glass to either direction by pressing a sliding roof switch for less than approximately 0.3 seconds, in order to adjust the amount of roof opening.

Jam Protection Function

- If the system detects the jamming of a foreign object between the sliding roof and the roof opening during a tilt-down or slide-close operation, the sliding roof will automatically operate in reverse (tilt-up or slide-open). The jam protection function detects jamming through the changes in the rotational speed of the motor (or the locking of the motor). Therefore, if the rotational speed of the motor is unaffected, such as when a thin object is jammed along the side of the sliding roof, the system might not recognize it as being jammed.
- If the system does not detect jamming for some reason, such as in the event of a failure in a sensor, the one-touch auto function will not operate.

Jam Protection During Tilt-Down

The system will perform a tilt-up operation until the sliding roof reaches the fully open (full tilt-up) position, regardless of the position in which the system has detected jamming.

Jam Protection During Slide-Close

The system will perform a slide-open operation until the sliding roof reaches approximately 218mm from the position in which the system has detected jamming or until the sliding roof reaches the fully open (full slide-open) position.

Key-OFF Operation Function

- For approximately 45 seconds after the ignition is turned from ON to OFF, or until the driver's door is operated from open to close, this function enables the operation of the sliding roof in the same way as when the ignition is ON. If approximately 45 seconds have elapsed during a roof glass operation, or if the driver's door is operated from open to close, the post-key OFF function will continue until this operation is completed.

Key-Linked Open and Close Function

- If the user inserts a key plate into the driver's door key cylinder, turns it in the locking direction, and holds it in that position for more than approximately 2.5 seconds, the sliding roof will perform a 'close' operation (and the jam protection function will also function). While the user keeps the key plate turned in the unlocking direction, the sliding roof will perform an 'open' operation.
- The door key-linked function is a type of manual operation that maintains an operation while the user holds the key plate in the locking or unlocking direction. Therefore, this function stops the operation when the user returns the key plate to the neutral position.
- The door key-linked open and close function of the sliding roof system is linked to the door key-linked door glass window up and down function of the power window system.

Transmitter-Linked Open and Close Function

- If the user holds the lock button of the transmitter pressed for more than approximately 2.5 seconds, the sliding roof will perform a 'close' operation (and the jam protection function will also function). If the user holds the unlock button pressed, the sliding roof will perform an 'open' operation. The wireless buzzer will sound (an answerback function) at the start of this operation.
- The transmitter-linked function is a type of manual operation that maintains an operation while the user keeps the button pressed and stops the operation when the user releases the button.
- The transmitter-linked open and close function of the sliding roof system is linked to the transmitter-linked door glass window up & down function of the power window system.

Moon Roof Closing Reminder Warning Function

- When the driver turns the ignition from ON to OFF and opens the driver's door while the sliding roof glass is open, the multi-buzzer in the combination meter emits an attenuated sound once to warn the driver that the sliding roof glass has been left open.

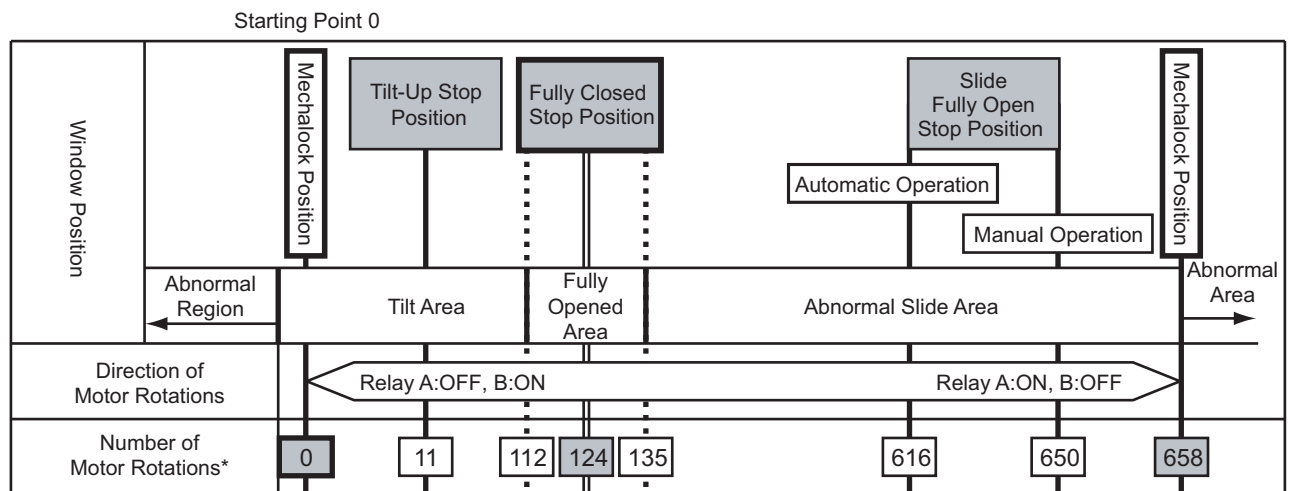
SMART ENTRY & START SYSTEM-Linked Close Function

- After door lock operation is effected by the SMART ENTRY & START SYSTEM, if the user continues to press the lock switch for more than approximately 3 seconds, the sliding roof will start a tilt-down or a slide-close operation that is linked to the power window up operation.
- The door lock by the SMART ENTRY & START SYSTEM-linked close function is a type of manual operation that maintains an operation while the user keeps the lock switch pressed and stops the operation when the user releases the switch.

The Overload Stop Function

- If the system detects a load that exceeds a predetermined amount as a result of an obstacle coming in contact with the sliding roof glass during a tilt-up or slide-open operation, this function automatically stops the operation.
- The overload stopping function operates during a tilt-down or slide-close operation as well, if the system is not initialized.

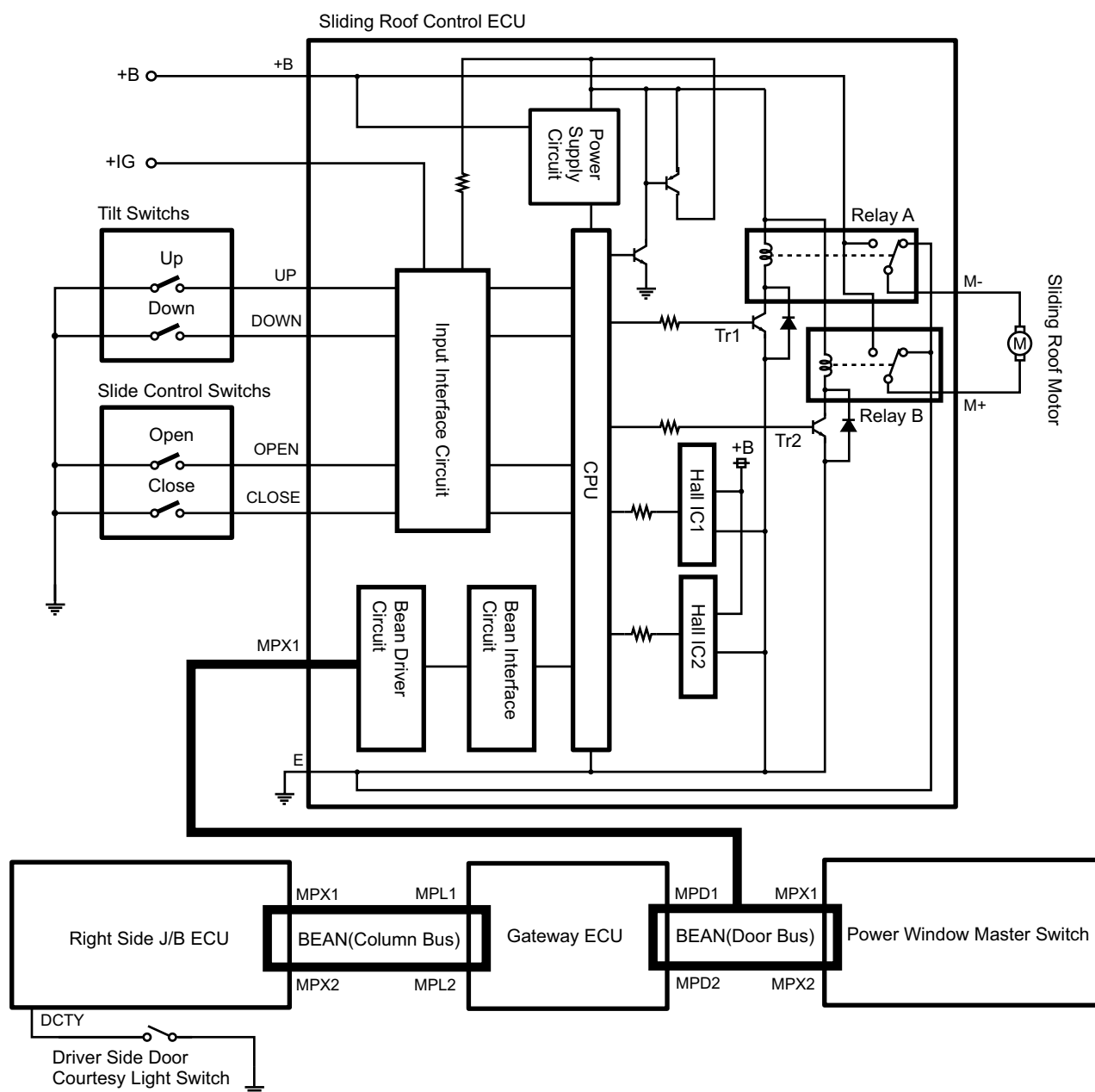
- The sliding roof control ECU recognizes the position of the sliding roof glass as illustrated in the diagram below. It uses the mechanical lock position of the tilt-up side as the origin point, in accordance with the input pulse signals received from Hall IC1 and Hall IC2. The sliding roof control ECU compares this positional information against the operation signal from the sliding roof switch in order to control the sliding roof control motor.



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With respect to the sliding roof glass position information recognized by the sliding roof control ECU, the full tilt-up position (mechanical lock position) is stored in memory as the origin point 0. If this position information is lost, it is necessary to initialize the system by "teaching" the system the sliding roof glass position information. To do so, the system must be made to recognize the origin point by performing a tilt-up operation. : BO-102

System Diagram



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Operation of One-Touch Tilt Up-and-Down Function

- While the sliding roof control ECU detects the fully closed region (tilt region), if the ECU receives the input of an UP-ON <or DOWN-ON> signal from the tilt switch for more than approximately 0.3 seconds, the ECU causes relay A <or relay B> to turn ON, and rotates the sliding roof motor in the close/up direction <or open/down direction>.
- The sliding roof control ECU counts the pulse signals from the Hall ICs. When the sliding roof control ECU detects that the sliding roof glass has reached the full tilt-up stop position <or fully closed stop position> based on the motor speed, it turns relay A <or relay B> OFF to stop the sliding roof motor. If the sliding roof control ECU receives the input of either ON signal from the tilt switch during an automatic operation, it will turn relay A <or relay B> OFF in the same way.

Operation of One-Touch Sliding Open-and-Close Function

- While the sliding roof control ECU detects the fully closed region (slide region), if the ECU receives the input of an OPEN-ON <or CLOSE-ON> signal from the slide switch for more than approximately 0.3 seconds, the ECU causes relay B <or relay A> to turn ON, and rotates the sliding roof motor in the open/down direction <or close/up direction>.
- The sliding roof control ECU counts the pulse signals from the Hall ICs. When the sliding roof control ECU detects that the sliding roof glass has reached the full slide open stop position <or fully closed stop position> based on the motor speed, it turns relay B <or relay A> OFF to stop the sliding roof motor. If the sliding roof control ECU receives the input of either ON signal from the slide switch during an automatic operation, it will turn relay B <or relay A> OFF in the same way.

Operation of Jam Protection Function

- During a tilt-down/slide-close operation (excluding manual control effected through the operation of the sliding roof switch), if the sliding roof control ECU detects changes in the pulse signals from the Hall ICs (detecting that the motor rotational speed has decreased or the motor has locked), the sliding roof control ECU determines that a foreign object is jammed in the sliding roof glass. Therefore, the sliding roof control ECU turns OFF the relay that is currently ON and turns ON the relay that is currently OFF, in order to operate the sliding roof motor in the reverse direction.
- The sliding roof control ECU will turn the relay OFF to stop the sliding roof motor if it detects any of the following: the full tilt-up position (jamming during tilt-down), the position in which approximately 218mm of reverse operation is detected by way of pulse signals from the Hall ICs, or the full slide-open position (jamming during slide-close).

Key-Off Operation

- Approximately 45 seconds after the ignition is turned from ON to OFF, or during the time the driver's door courtesy light switch changes from ON to OFF, the right side junctionblock ECU transmits a "post key-OFF operation authorization" signal to the sliding roof control ECU via the BEAN (Body Electronics Area Network).
- While receiving the "post key-OFF operation authorization" signal, the sliding roof control ECU effects the same control as when the ignition is ON. However, if the sliding roof is undergoing an automatic operation or a jamming reverse operation when the reception of the signal is completed, the sliding roof control ECU will continue this control until the operation is completed.

Operation of Key-Linked Open and Close Function

- When the power window master switch receives the input of a signal indicating the UNLOCK-ON <or LOCK-ON> state of the door lock control switch (for key-linked operation) for more than approximately 2.5 seconds, the power window master switch will transmit a "door key-linked open <or close> operation" signal to the sliding roof control ECU via the BEAN (Body Electronics Area Network).
- While receiving the "door key-linked open <or close> operation" signal, the sliding roof control ECU implements open control <or close control> by turning ON the corresponding relay.

Operation of Transmitter-Linked Open and Close Function

- When the power window master switch receives a door unlock signal <or door lock signal> from the right side junctionblock ECU for more than 2.5 seconds, the power window master switch transmits a "sliding roof open <or close> operation" signal to the sliding roof control ECU via the BEAN (Body Electronics Area Network).
- While receiving the open signal <or close signal>, the sliding roof control ECU implements open control <or close control> by turning ON the corresponding relay.

Failsafe Pertaining to Setting Moon Roof Glass Position Data

Abnormal Moon Roof Glass Position Information

If the sliding roof control ECU determines that an error exceeding a predetermined value exists between the mechanical lock position of the sliding roof glass or the motor lock detection position and the position information that is memorized based on the pulse count provided by the Hall ICs (thus detecting that the sliding roof glass is in the abnormal region), the ECU will delete the memorized position information and transfers the control to the state in which it is not "taught" any position information.

Sensor (Hall IC) Failure Judgment

If a failure occurs in one of the two Hall ICs that are used for detecting the position, speed, and direction of the sliding roof glass, the sliding roof control ECU transfers the control to be the same as in the state in which it is not "taught" any position information. If a failure occurs in both Hall ICs, the sliding roof control ECU will effect control by changing the overload detection function that operates by way of a motor lock judgment.

Failsafe Pertaining to Moon Roof Motor Actuation

Continuous Operation Restriction Function

If the motor actuation time (relay ON time) provided by the sliding roof control ECU is too long, this function automatically turns OFF the relay after approximately 20 seconds (during slide operation) or approximately 3.5 seconds (during tilt operation) have elapsed. Thus, it protects the motor and the circuit.

Forced Teaching Operation (jam protection function Cancel Operation)

A failure in the jam protection function may create the problem of preventing the sliding roof glass from closing fully (by preventing it from stopping at the fully closed position). If this occurs, the driver can press the tilt switch UP or the slide switch CLOSE for more than approximately 10 continuous seconds in order to force the control to transfer into a state in which it is not "taught" any position information. Then, the driver can correct the position information by performing an initialization operation.

Moon Roof Glass and Side Garnish

- The offset between the sliding roof glass and the weatherstrip has been reduced to enhance the appearance from the vehicle exterior.
- A side deflector and a side screen (side garnish) are provided along the sides of the sliding roof glass to reduce wind noise during a tilt-up and to enhance the appearance from the vehicle interior.

