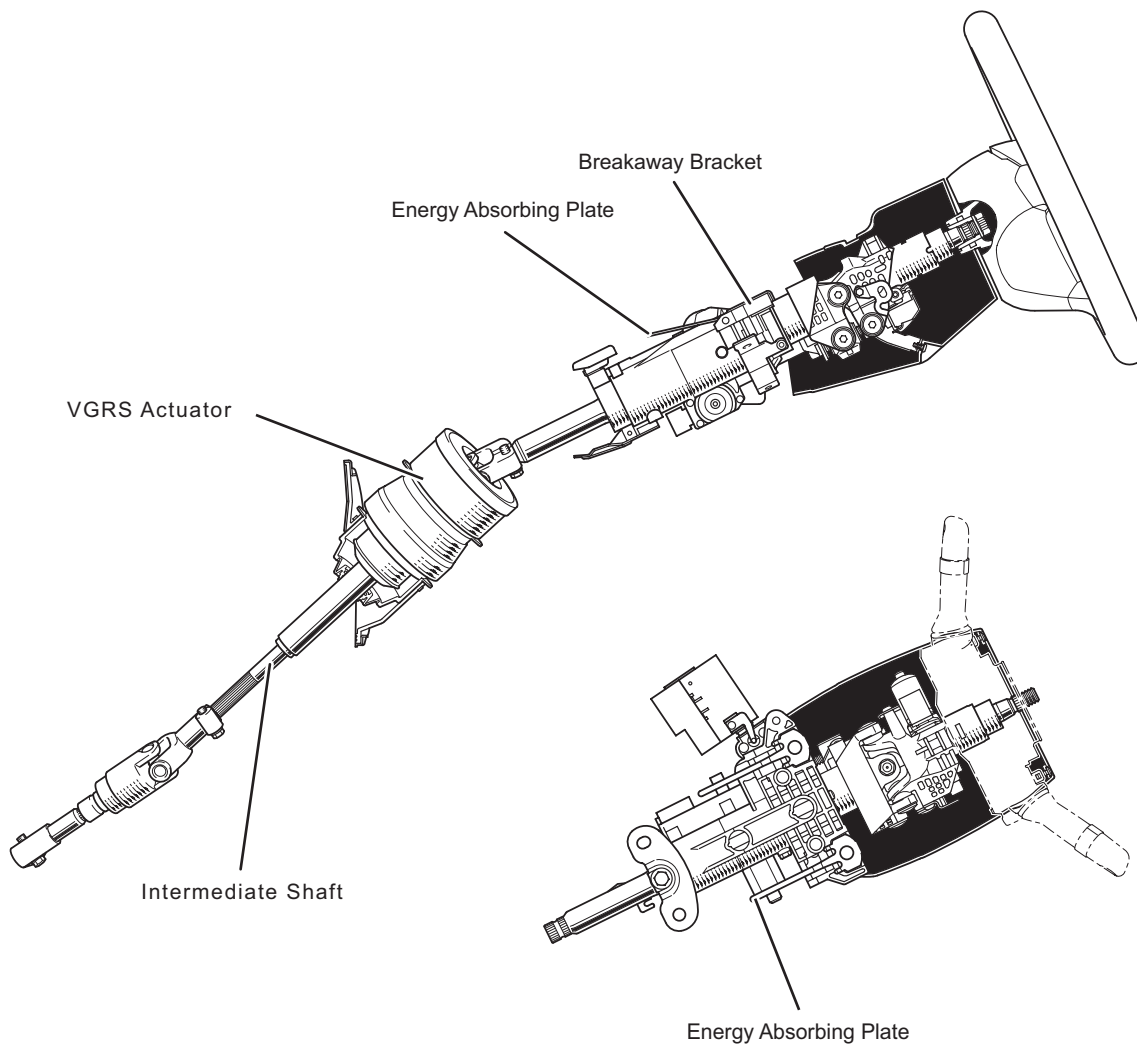


VGRS STEERING COLUMN

VGRS Outline

- The models with the 3UZ-FE engine uses a Variable Gear Ratio Steering (hereafter referred to as "VGRS") system. This system controls the turning angle of the wheels in accordance with the vehicle's driving speed, in order to achieve higher levels of steering maneuverability and vehicle stability from the low-speed to the high-speed driving range.
- The tilt & telescopic motor, tilt & telescopic ECU, and the steering wheel are the same as those used in the models without the VGRS.



Steering Column with VGRS System

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VGRS Aims

- At very low speeds, this system reduces the amount of steering effort of the driver. At high speeds, it gradually varies the amount of steering effort. Thus, it realizes maneuverability and stability at high levels, while supporting the driver with the proper driving feel.

List of VGRS Objectives

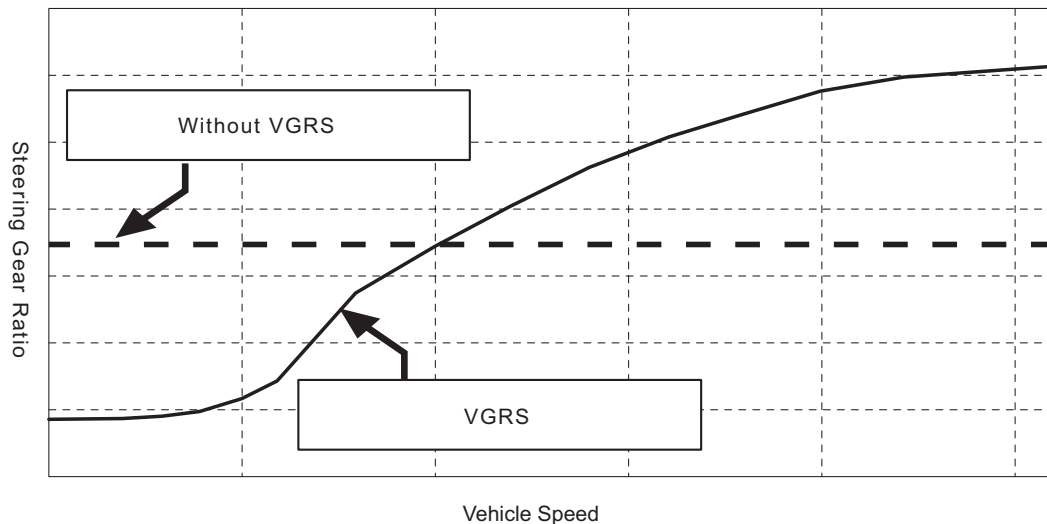
Driving Condition	Effectiveness
Very low speeds, steering at a standstill, and U-turns	Reduces the turning angle of the steering
Low to medium speeds	Continuously changes the steering gear ratio to suit the vehicle speed
High-speed driving	Provides a gentle steering feel

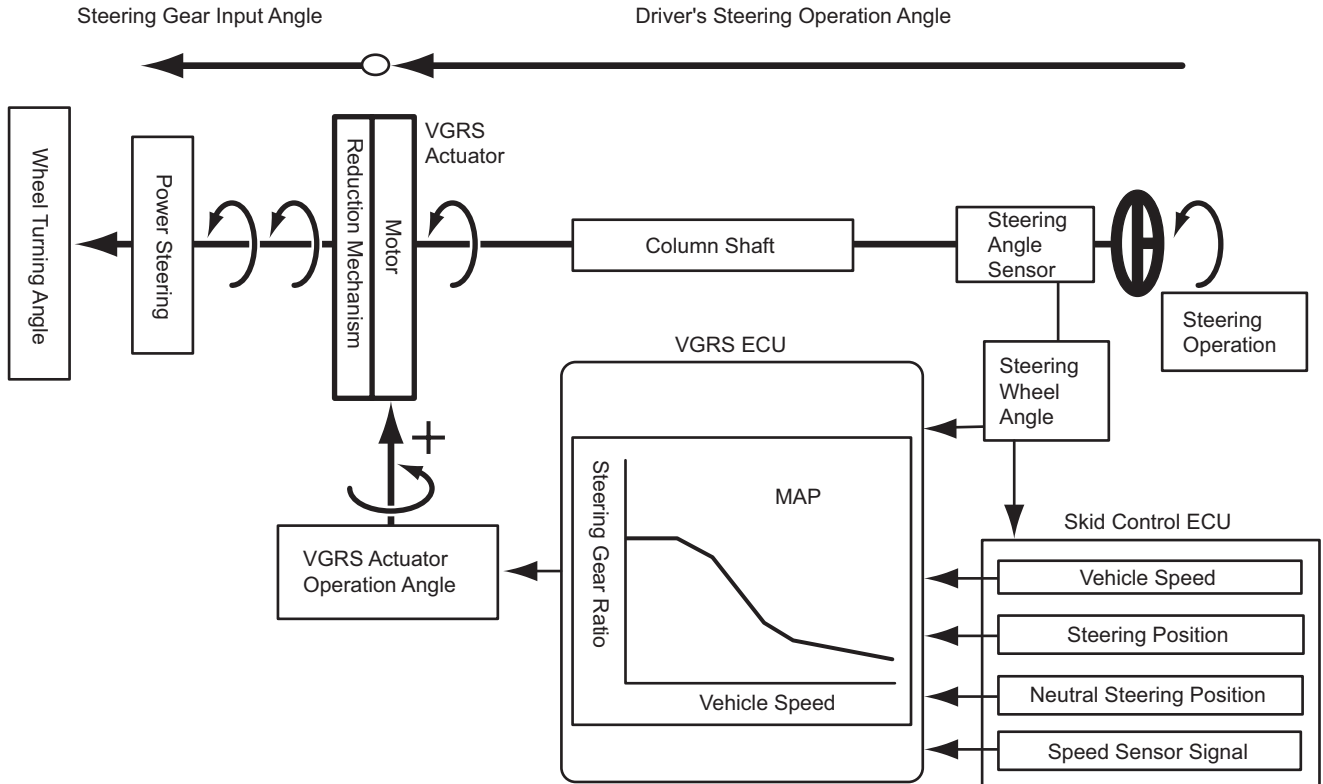
Steering Gear Ratio Changed to Suit Vehicle Speed

- In the conventional steering system, the steering gear ratio is set to enable the vehicle to respond gently to the amount of steering effort, with high-speed driving in mind. This requires the driver to increase the amount of steering effort while driving at low speeds. Because the VGRS can change the steering gear ratio at will, it is able to optimize the steering gear ratio in accordance with the driving conditions.

VGRS Functions

Reducing the steering angle in the very low speed range, steering at a standstill, and U-turns	- This is the quickest gear ratio setting. It takes 2.7 turns (or 3.2 turns on non-VGRS models) of the steering wheel for lock-to-lock. Thus, it significantly reduces the amount of effort to turn the steering wheel back and forth at a standstill. - At very low speeds, the gear ratio is close to the quick gear ratio setting, which reduces the number of back-and-forth turns.
Lightening the handling in the low-to medium-speed range	This function adjusts the gear setting between quick and slow to suit the vehicle speed. Thus, it provides a steering feel that is comfortable and easy to handle in urban areas or on mountain roads that require frequent turns.
Handling at high speeds	This is the slowest gear ratio setting. It provides a gentle and stable steering feel in the same way as the conventional steering mechanism.

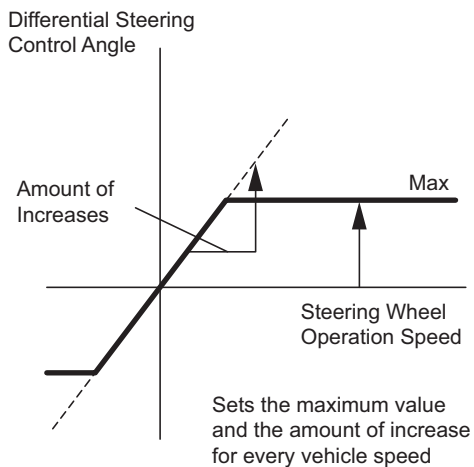




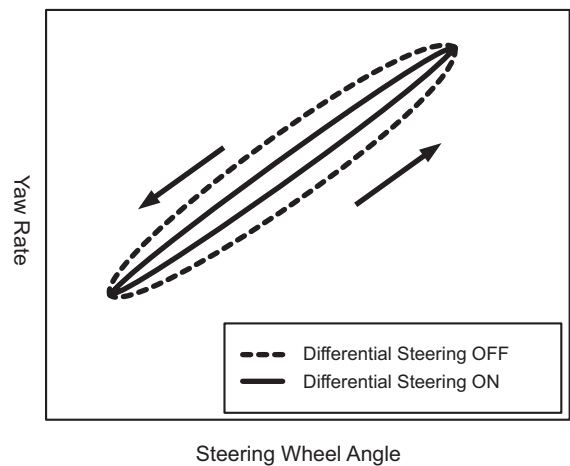
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Driving Feel Through Differential Steering Control

- The system controls the VGRS actuator with very small angles in accordance with the speed of the driver's steering maneuver (differential of the steering turning angle), in order to correct the response delay of the vehicle. Thus, it supports the vehicle with the proper driving feel during lane changes or while driving on a winding road.



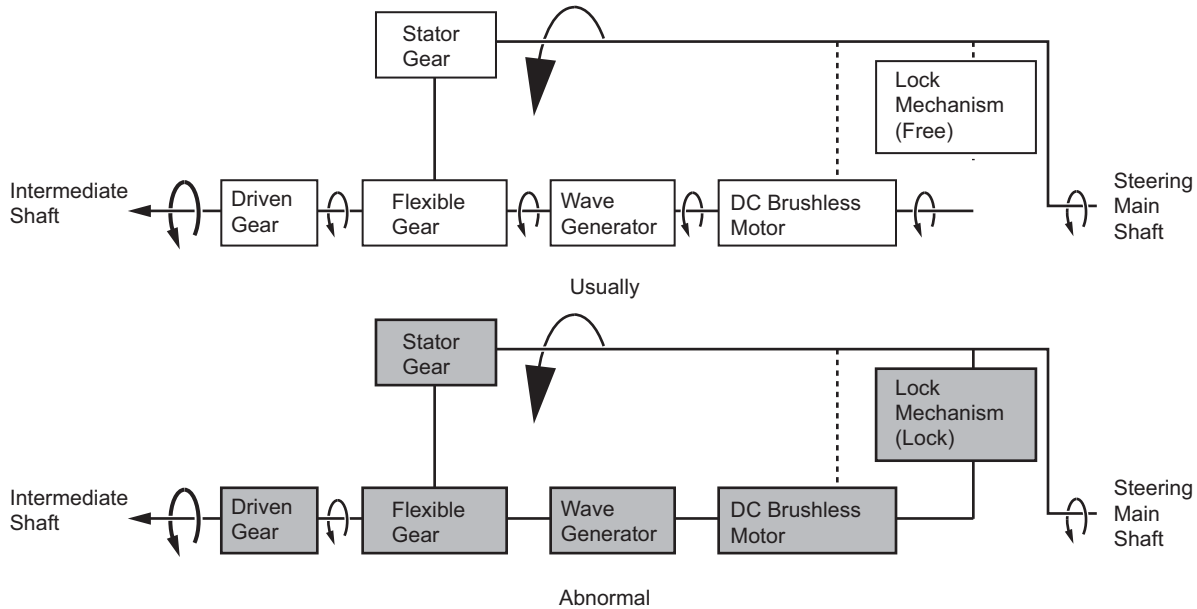
Differential Steering Control Outline

Conceptual Image of
Vehicle Response During Lane Change

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Fail Safe

- In case of a failure in the VGRS system or actuator, the actuator function stops and the lock mechanism renders the internal workings of the actuator in the directly coupled state, thus reverting to the same state as the conventional intermediate shaft. Thus, the proper steering function is ensured.

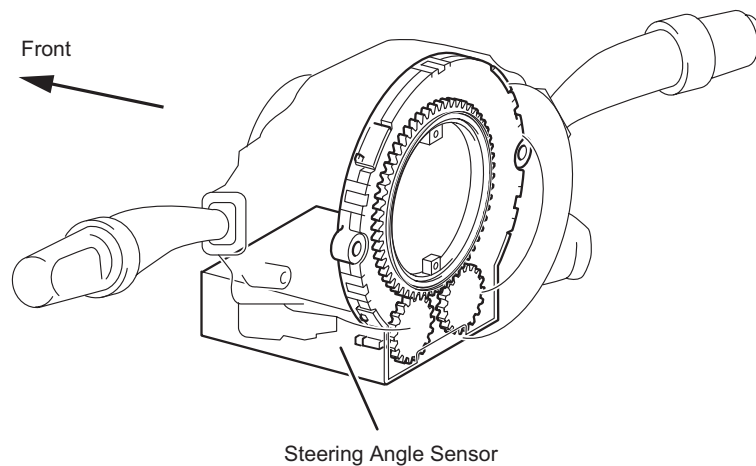


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Steering Angle Sensor

- A steering angle sensor is provided in the combination switch area. This sensor detects the amount of steering effort and the direction of steering and inputs them in the skid control ECU.
- The sensor assembly contains two sets of magnetic reluctance elements that detect the rotational movement of a magnet that is built into the detection gear. Thus, the sensor detects the changes that occur in the magnetic reluctance along with the rotational movement of the detection gear, in order to detect the rotational movement of the steering wheel.



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