

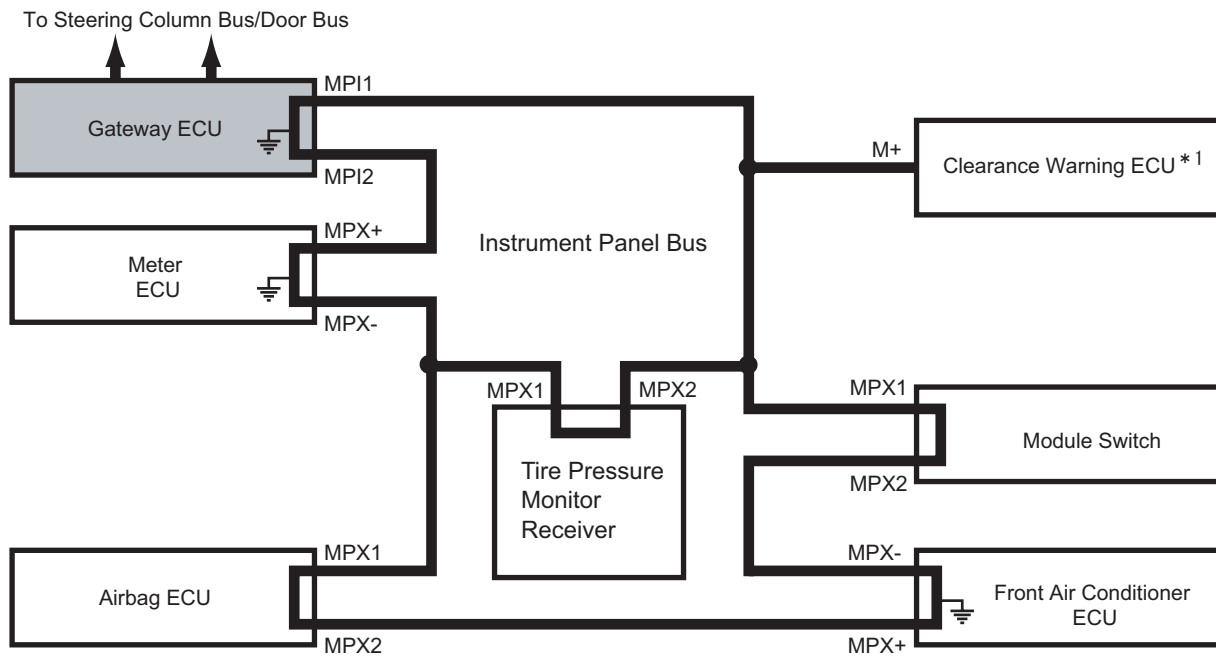
Body Multiplex Communication System[BEAN]

- The BEAN* increases the volume of control data by expanding and making more multifunctional the object of control. In addition, it is a multibus body electronics area network consisting of a network of three systems (instrument panel system, column system, door system). This reduces the number of wires in the wiring harness and reduces the thickness of the electronic control system.

❖REFERENCE❖

*BEAN = Body Electronics Area Network (Toyota Motor Corporation's proprietary bi-directional multiplex communication network used among the ECUs for body system control)

BEAN System Diagram (Instrument Panel Bus)

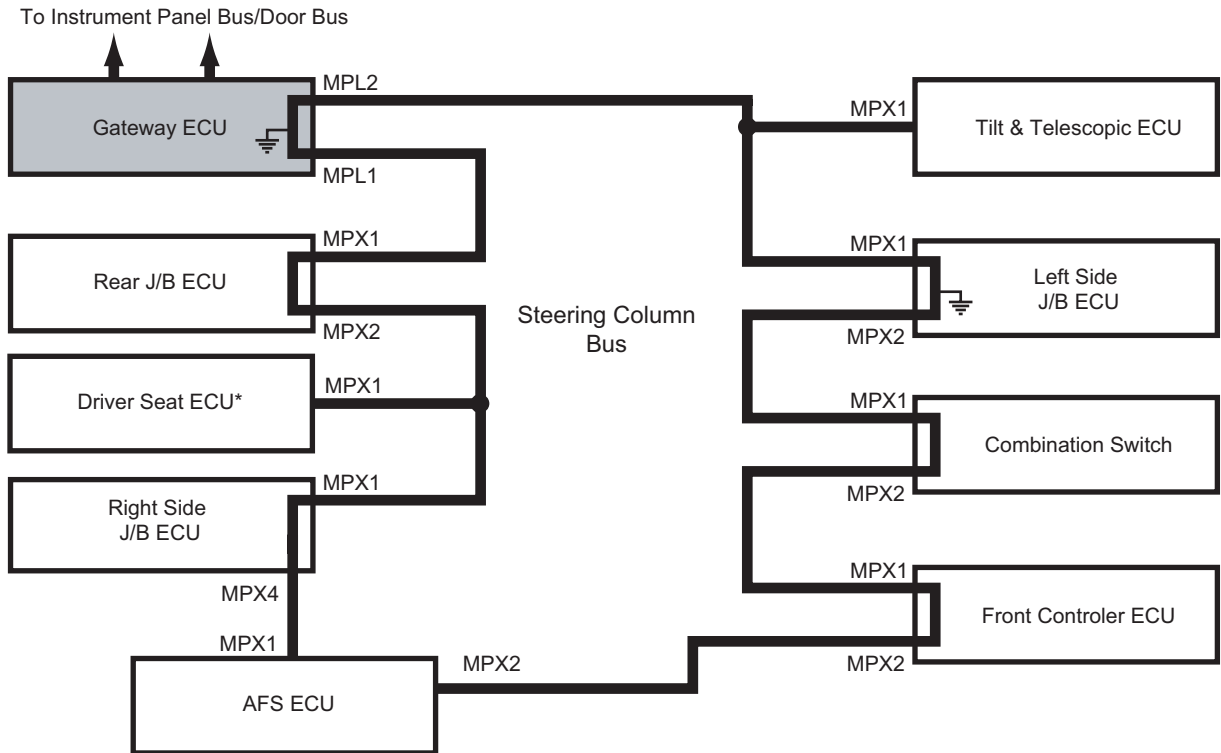


*1 :Option

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Multiplex communications control ECU list(Instrument Panel Bus)

ECU & Switch	Function
Airbag ECU	Supplies Airbag operation and other operation data
Clearance Warning ECU	Controls the Clearance sonar system
Meter ECU	Controls the Combination meter system
Front Air Conditioner ECU	Controls the Heater & Air Conditioner system-window defogger system
Tire Pressure Monitor Receiver	Monitors the tire air pressure
Module Switch	Centralized switch for combination meter, outer mirror, and other operation

BEAN System Diagram (Steering Column Bus)


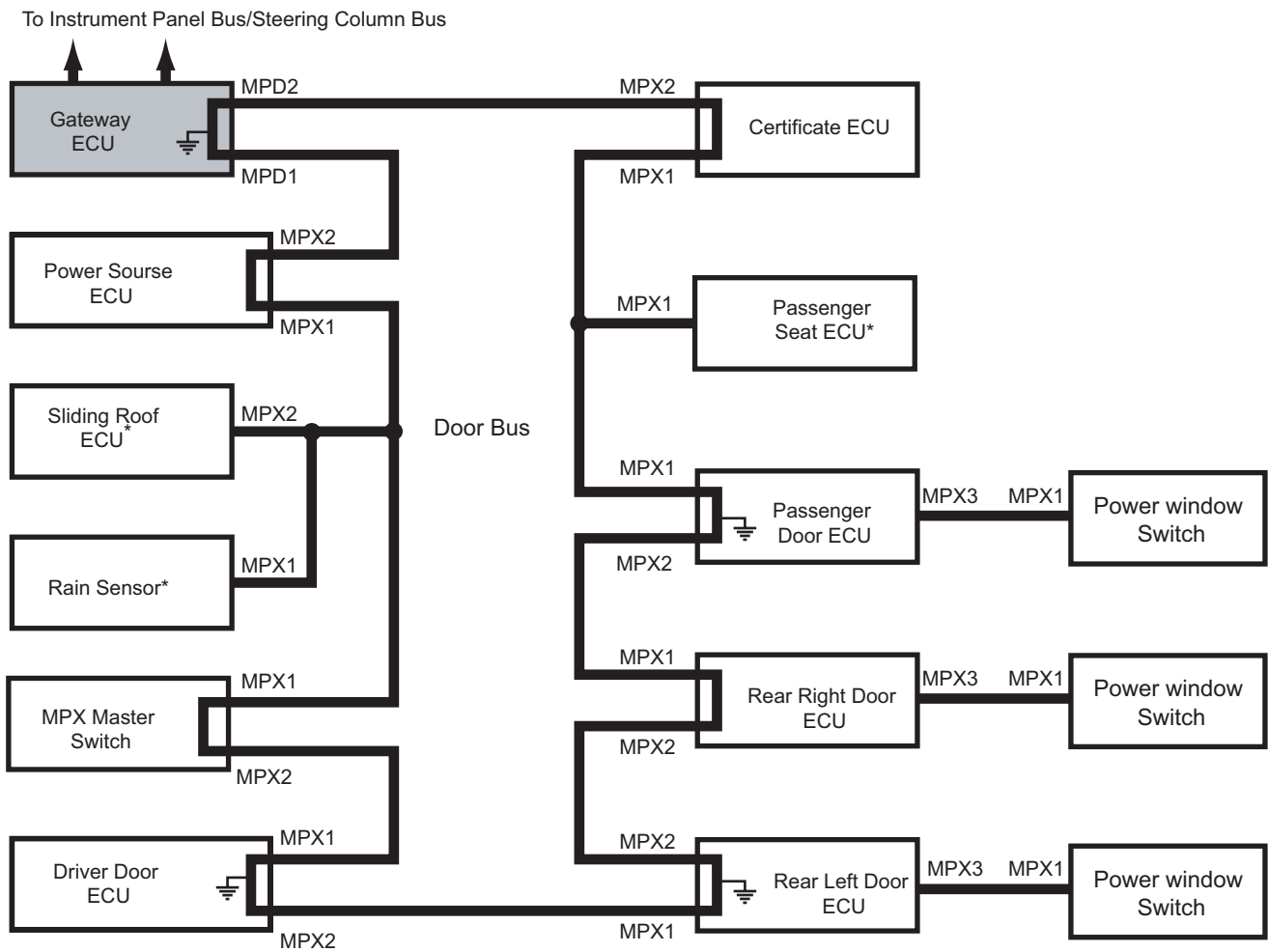
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Multiplex communications control ECU list(Steering Column Bus)

ECU & Switch	function
Right Side J/B ECU	Controls the Power window ·Electrical door lock ·Security system
Left Side J/B ECU	Controls the Wiper & Washer ·Illuminated entry system
Front Controller ECU	Controls the Lighting(Front circumference lamp)·Washer system·Horn
Rear J/B ECU	Controls the Lighting(Rear circumference lamp)
Driver Seat ECU	Controls the Microcomputer preset driving position system
AFS ECU	Controls the Intelligent AFS system
Combination Switch	Supplies lighting, wiper, and other switch operation data.
Tilt & Telescopic ECU	Controls the Microcomputer preset steering columns system

BEAN System Diagram (Door Bus)



* :option

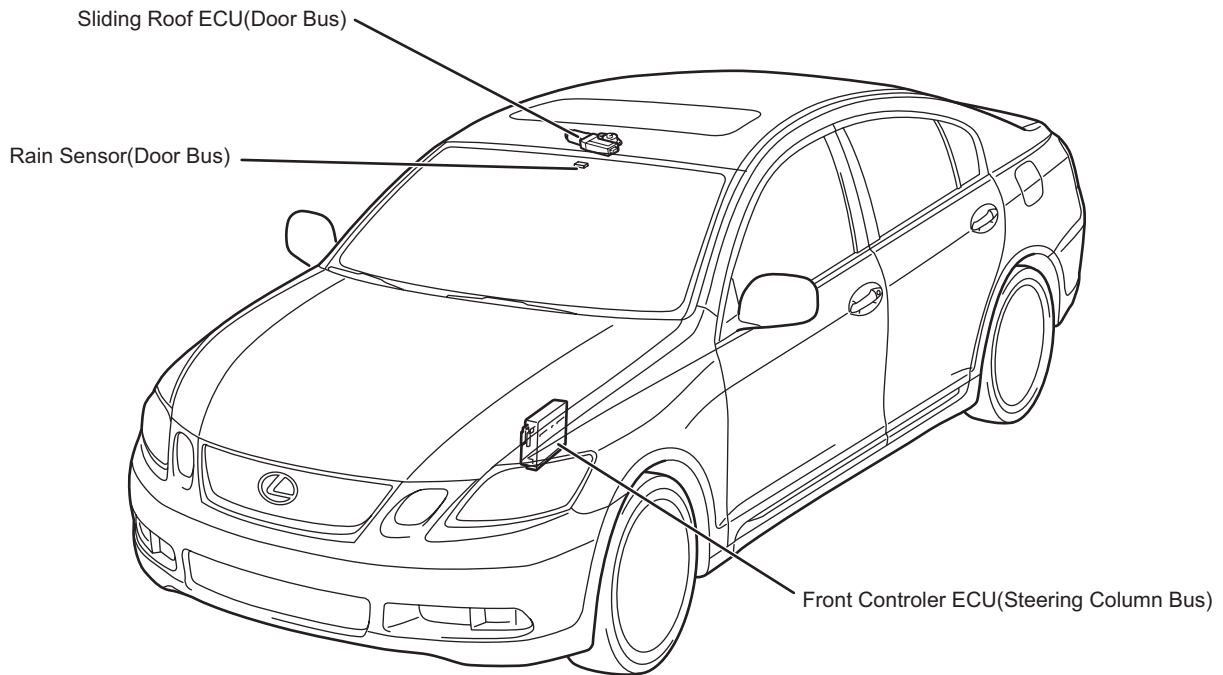
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Multiplex communications control ECU list(Door Bus)

ECU	Function
Driver Door ECU	Controls the corresponding seat's window regulator and door lock assembly.
Passenger Door ECU	
Rear Right Door ECU	
Rear left door ECU	
MPX Master Switch	Controls the Power window system
Passengers Seat ECU	Controls the Microcomputer preset driving position system
Rain Sensor	Detects rain on the windshield
Certificate ECU	Controls the Smart entry & start system
Sliding Roof ECU	Controls the Sliding roof system
Power Source ECU	Controls the Push button start system

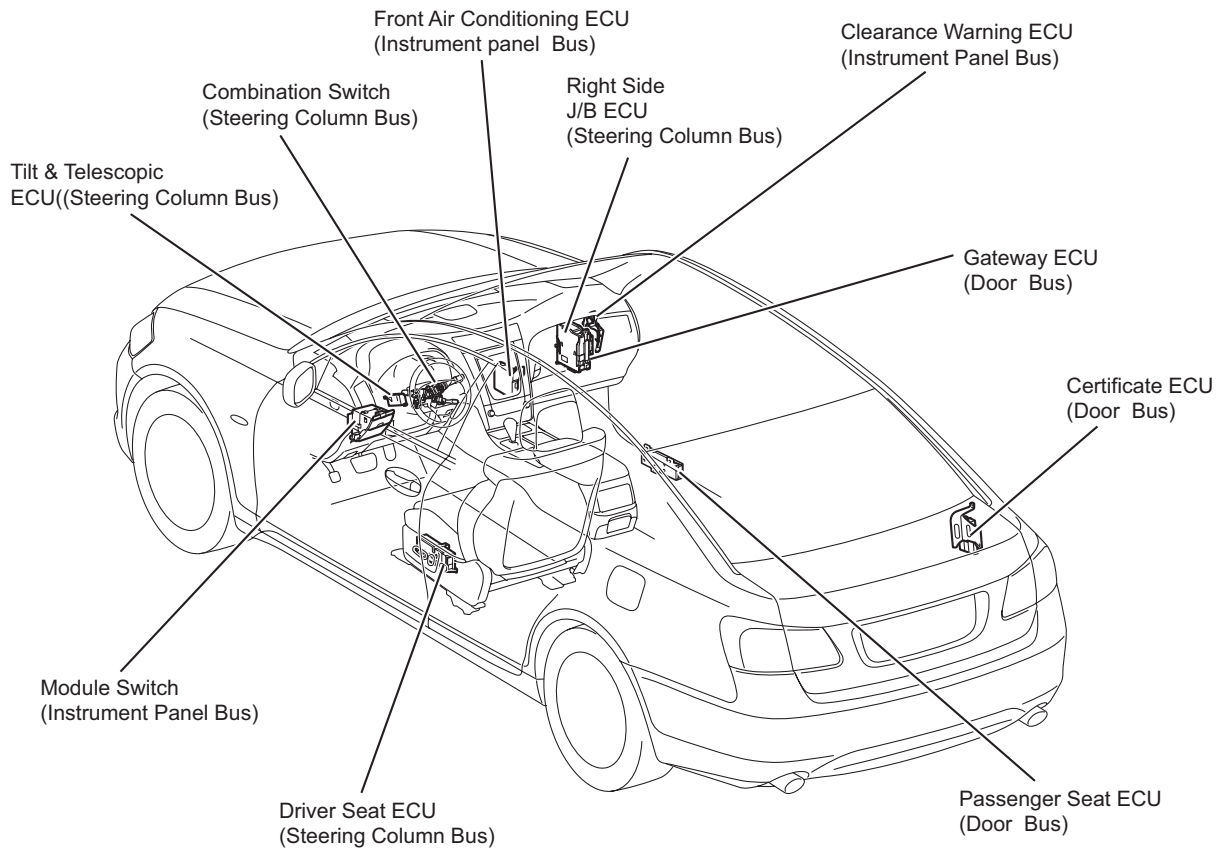
Layout of Component

Layout of BEAN component 1



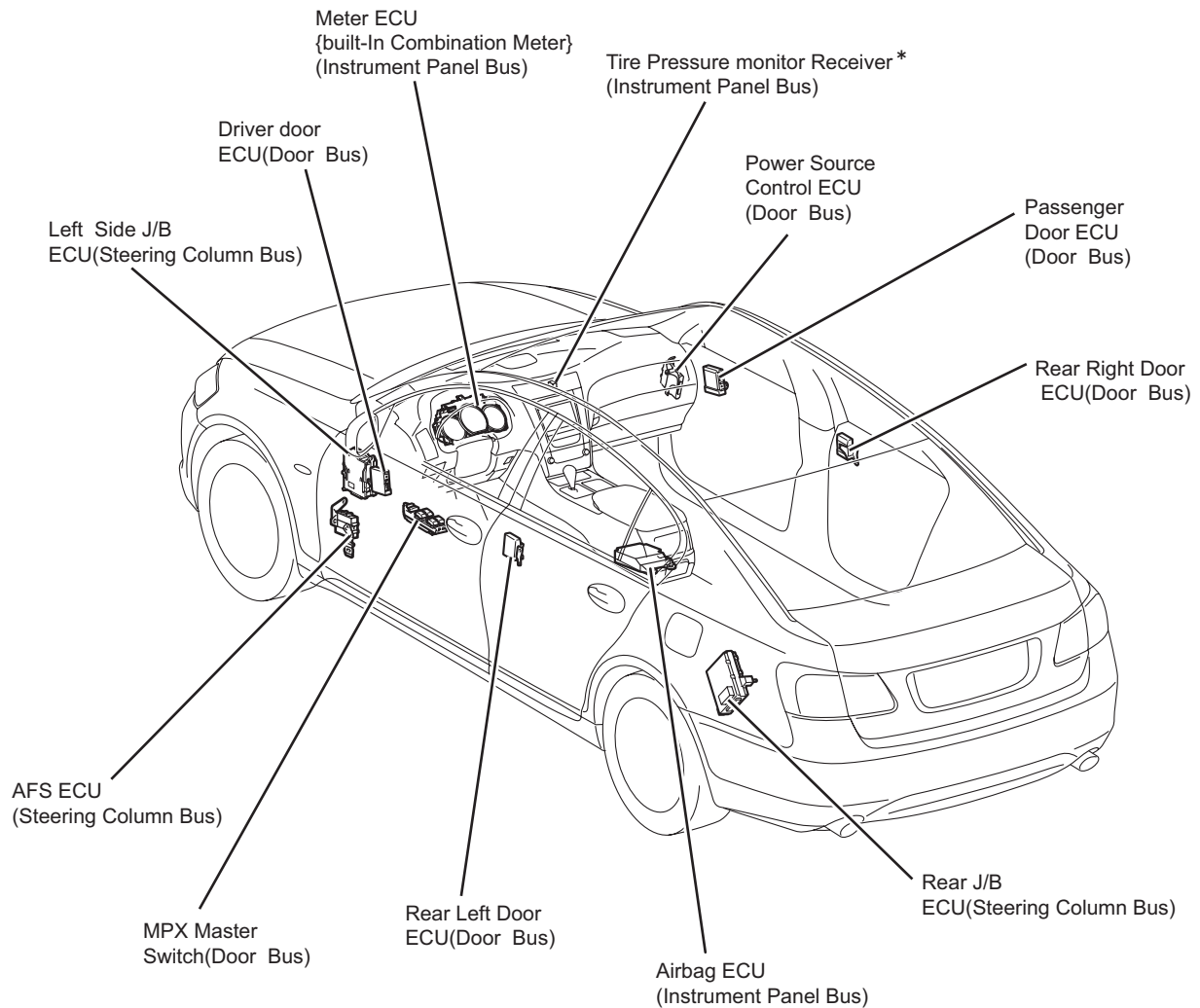
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Layout of BEAN component 2



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Layout of BEAN component 3



* : Except General Countries

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Communication Frame

- The Body Electronics Area Network [BEAN] system is a time division multiplex bi-directional communication system that enables all the ECUs that comprise the network to transmit or receive data by staggering their time, using a single communication line (bus). Therefore, the ECUs operate in accordance with a common communication protocol to ensure smooth and reliable communication.
- The data used in the Body Electronics Area Network system consists of digital signals containing information such as priority (PRI), destination (DST-ID), data type (MES-ID), etc. The BEAN communication circuits that are built into the ECUs transmit these signals at a speed of 10 kbps*.

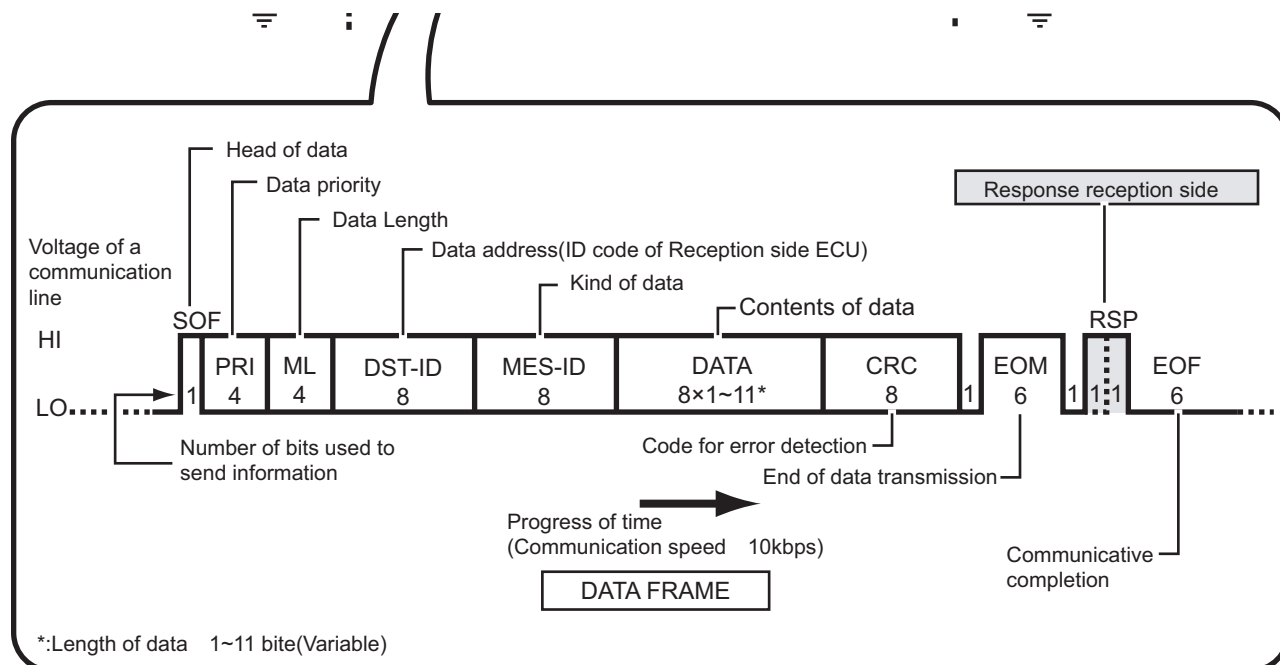
❖ REFERENCE ❖

*A unit that indicates the transmission speed of signals. The "10 kbps" indicates that 10,000 bits of data are transmitted per second.

- The BEAN communication uses the CSMA/CD (Carrier Sense Multiple Access with Collision Detection)* communication protocol for transmitting data to a communication line. This protocol enables all ECUs to share a single communication line while granting them the right to start transmitting data. Furthermore, this system determines their transmission priority in accordance with the priority (PRI) information contained in the respective transmitted data.

❖REFERENCE❖

*Carrier Sense Multiple Access with Collision Detection - Controls communication access by allowing the ECUs to constantly monitor the state (carrier waves) of the communication line, and start data transmission only when there is no other data present on the communication line. In addition, if an ECU detects a data collision (because another ECU has transmitted data simultaneously), this control allows the ECU to stand by for a predetermined length of time, and transmit the data again.



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Sleep & Wakeup Function

- When an ECU that does not stop its control with the ignition turned OFF (because it operates with the +B power supply) detects certain conditions indicating that the user has left the vehicle, it effects sleep control (by transferring to the low current consumption mode) in order to reduce dark current*.

❖REFERENCE❖

*When an ECU detects the conditions indicating that the user is near the vehicle in accordance with the signals from sensors and switches, it transmits a "sleep NG signal" to the ECUs that are related to the control. This prevents them from transferring to the sleep control and enables the BEAN (Body Electronics Area Network) to continue its control.

- When any one of the ECUs under sleep control detects a "control start condition" that is prescribed to the individual ECUs, that ECU will transmit a "wakeup signal" to other ECUs via the Body Electronics Area Network communication line, in order to start the entire Body Electronics Area Network system.

Fail-Safe

- The communication line forms a loop (except in a certain area) to prevent communication from being disrupted in case an open circuit occurs in one area.
- The ECUs are equipped with a backup control function that enables the ECUs to continue control in case of a disruption in communication with other ECUs related to control.