05I97–01

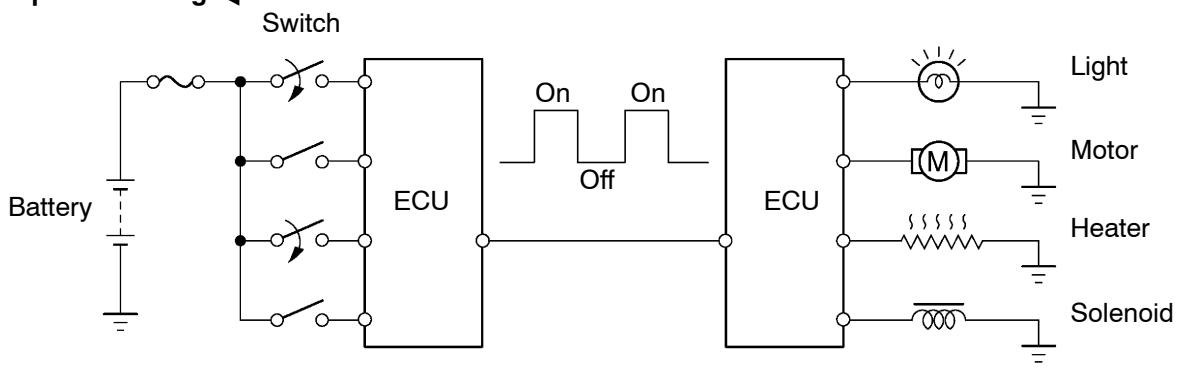
SYSTEM DESCRIPTION

1. BASIC OF MPX

General

The LEXUS LS430 multiplex communication system uses serial communication, which converts multiple pieces of information into serial communication data. As a result, they can be transmitted through a single communication wire.

▶ **Conceptual Drawing** ◀



Serial Communication

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Serial communication data consists of bits and frames. A bit is the basic unit that represent the amount of information. A bit is represented by binary values ”0” or ”1”. A frame is a body of data that is transmitted together. A frame contains a ”header” that indicates the beginning of the data and an ”end” message that indicates the end of the data.

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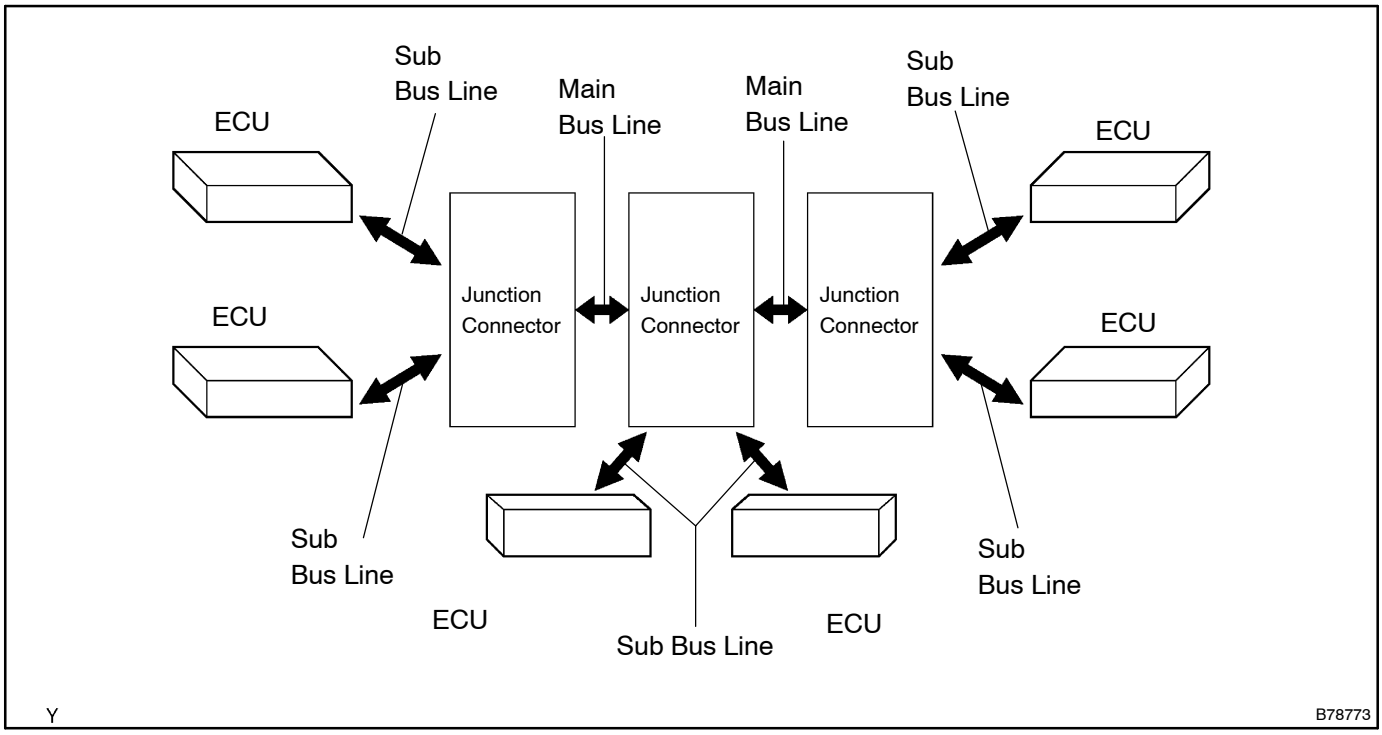
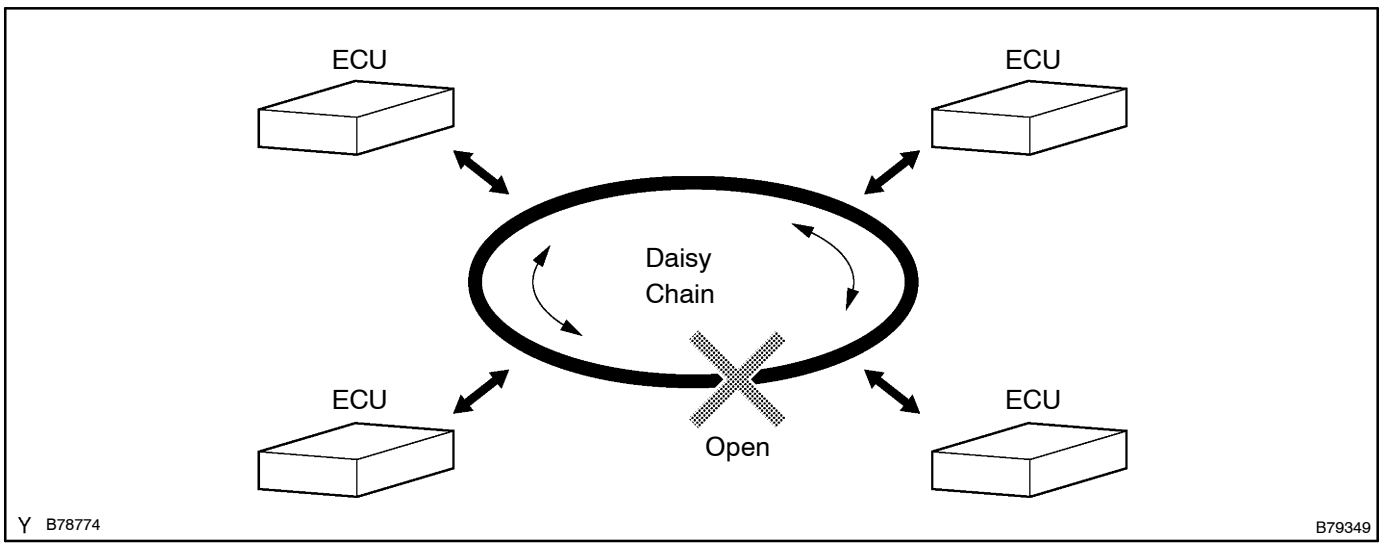
Network Style

Based on serial communication, various ECUs are connected on a network to exchange various pieces of information. Such a system is called a multiplex communication system.

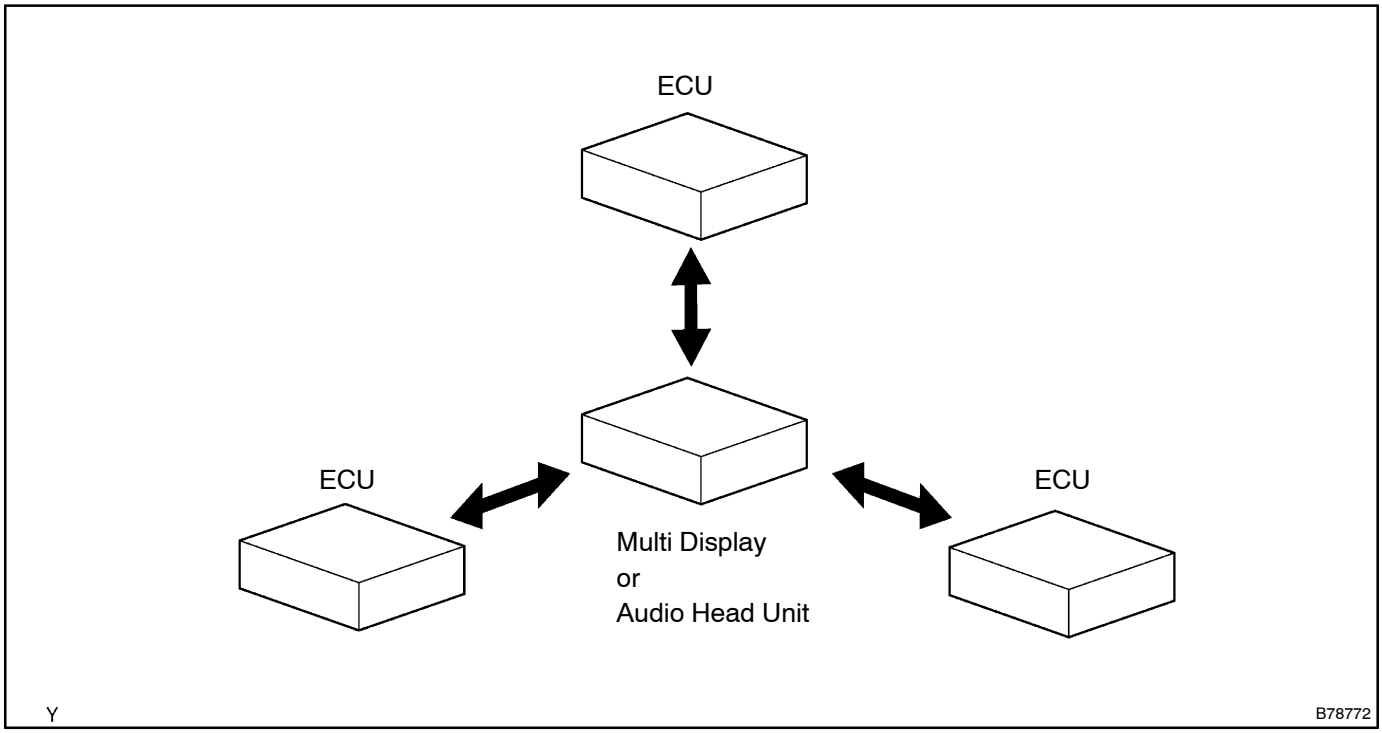
- The CAN uses the multi star style bus connection. The three junction connectors are connected with a main bus line. The junction connector extends a sub bus line and enables communication between all the connected ECUs.



- The BEAN uses the ring and bus styles of networks to connect ECUs. This style of connection method is called a daisy chain. In a daisy chain, communication can be maintained even if there is an area that has an open circuit.



- The AVC–LAN uses a star style, which is centered on the multi display or audio head unit.



Difference of CAN, BEAN and AVC–LAN

(1) General

The protocols, which are the rules for establishing data communication, differ between the CAN, BEAN and the AVC–LAN. If ECUs use different types of data such as communication speed, communication wire, and signals, they will be unable to understand each other. Therefore, protocols (rules) must be established among them.

Control	Driving Control System	Body Electrical Control System	Body Electrical Control System
Protocol	CAN (ISO Standard)	BEAN (TOYOTA Original)	AVC–LAN (TOYOTA Original)
Communication Speed	500 k bps* (Max. 1M bps)	Max. 10 k bps*	Max. 17.8 k bps*
Communication Wire	Twisted–pair Wire	AV Single Wire	Twisted–pair Wire
Drive Type	Differential Voltage Drive	Single Wire Voltage Drive	Differential Voltage Drive
Data Length	1 – 8 Byte (Variable)	1 – 11 Byte (Variable)	0 – 32 Byte (Variable)

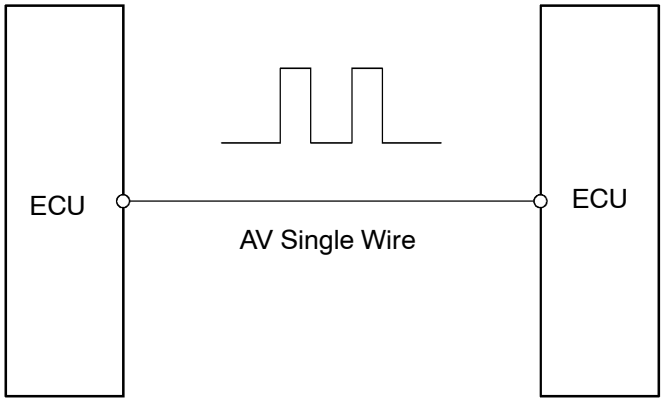
*:The abbreviation ”bps” stands for ”bits per second”, the number of bits that can be transmitted per second.

(1) Communication Wire

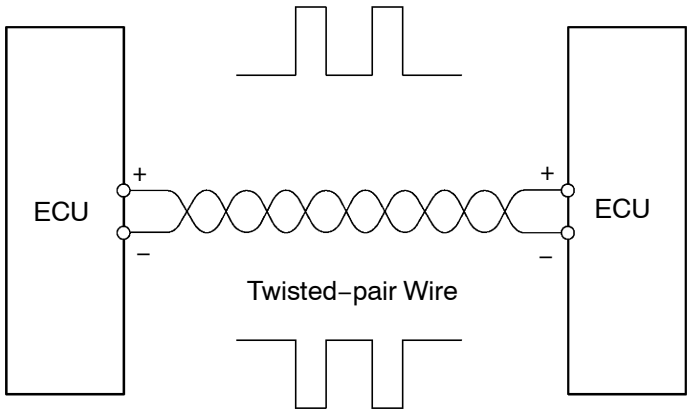
A single, Automobile Vinyl (AV) wire is used for BEAN communication. A twisted–pair wire is used for CAN and AVC–LAN communication.

Communication Wire	Outline
AV Single Wire	Lightweight single communication wire that consists of single core line surrounded by insulation. Voltage is applied to this line in order to drive communication. This system is called "Single Wire Voltage Drive".
• Twisted–pair Wire for AVC–LAN • Twisted–pair Wire for CAN	Pair of lines is twisted together and covered with insulation. Communication is driven by applying positive (+) and negative (–) voltage to 2 lines in order to send single signal. This system, which is called "Differential Voltage Drive", can reduce noise.

▶ Single Wire Voltage Drive ◀



▶ Differential Voltage Drive ◀



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2. GATEWAY ECU

General

The gateway ECU of the LEXUS LS430 has the following functions.

Function	Outline
Gateway	Data for respective protocols (CAN, BEAN and AVC–LAN) are arranged differently. Therefore, it is not possible to exchange data between different protocols. For this reason. data arrangement must be converted before transferring data to communication bus (CAN, BEAN and AVC–LAN). This conversion is called gateway function, which is performed by gateway ECU.
Diagnosis (only for BEAN)	By connecting intelligent tester II to DLC3 and operating tester, technicians can access ECUs via gateway ECU and BEAN communication bus. In this manner, DTCs can be output from BEAN, DATA LIST (for checking ECU data) and ACTIVE TEST (to actuate desired actuator) can be performed.
Customize (only for BEAN)	Customized body electronics system enables control function settings of ECUs to be changed through use of intelligent tester II. However, this system can change settings of only ECUs that belong to bus in which communication is centered on gateway ECU.