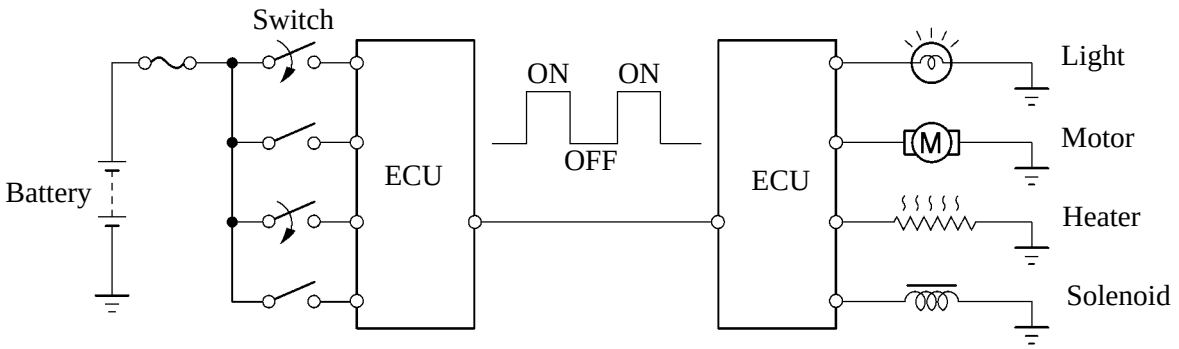
■BASIC OF MPX

1. General

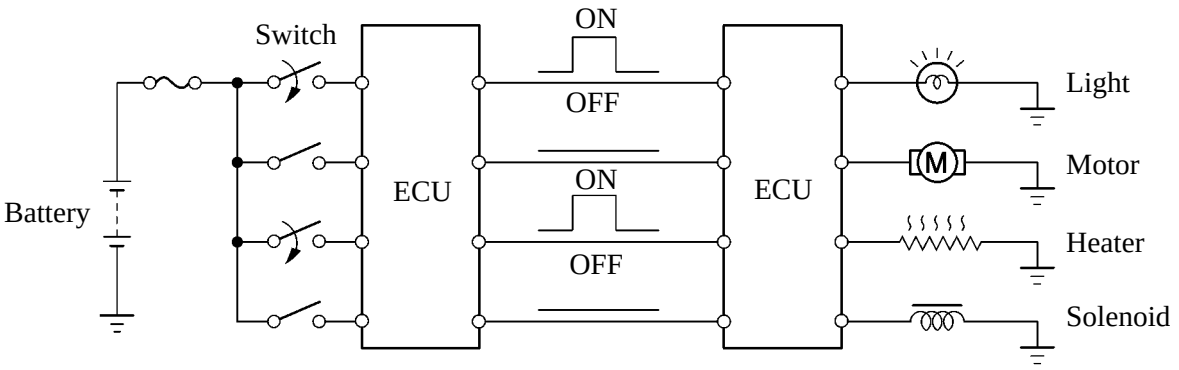
- In the conventional system, a parallel communication is used to exchange information between ECUs. To transmit four pieces of information, for example, the parallel communication requires four communication wires. In contrast, a multiplex communication is used on a serial communication, which converts multiple pieces of information into serial communication data. Thus, they can be transmitted through a single communication wire.

▶ Conceptual Drawing ◀



Serial Communication

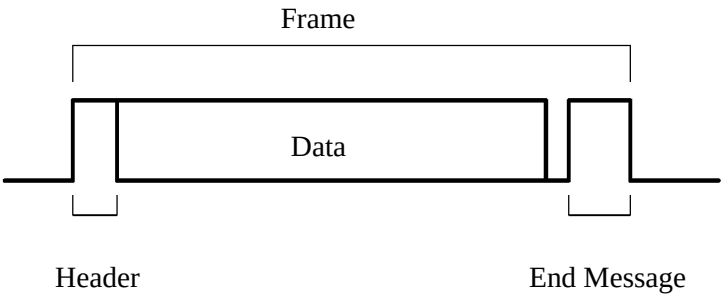
240BE03



Parallel Communication

240BE04

- Serial communication data consist of bits and frames. A bit is the basic unit that represents 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, and an end message that indicates the end.



240BE05

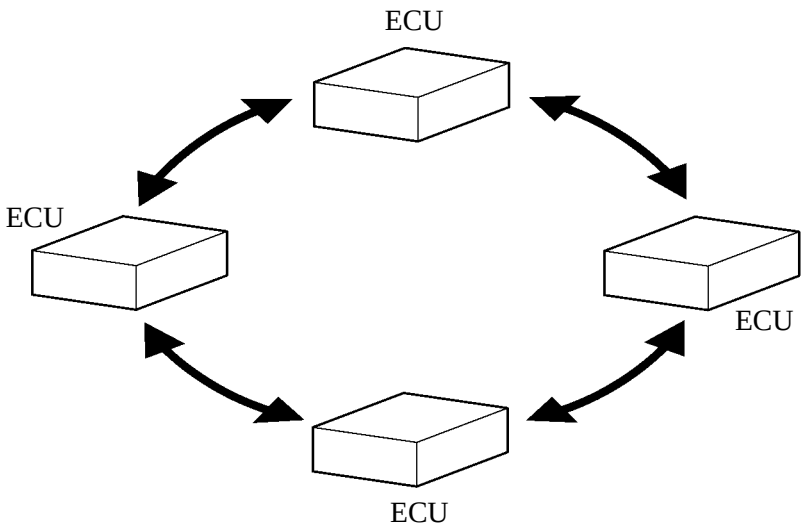
2. Network Style

General

Based on a serial communication, various ECUs are connected on a network to exchange various pieces of information. Such a system is called a “Multiplex Communication”. There are three styles of networks: ring, star, and bus.

Ring Style

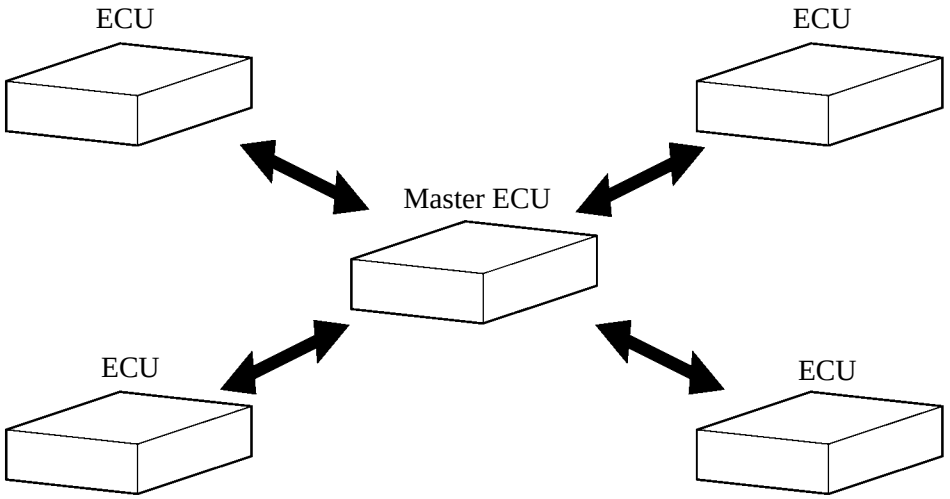
In this style of network, the ECUs are connected in a ring form. A feature of this style is that a signal that is output by a transmitting ECU circles the ring and returns to its original ECU.



240BE06

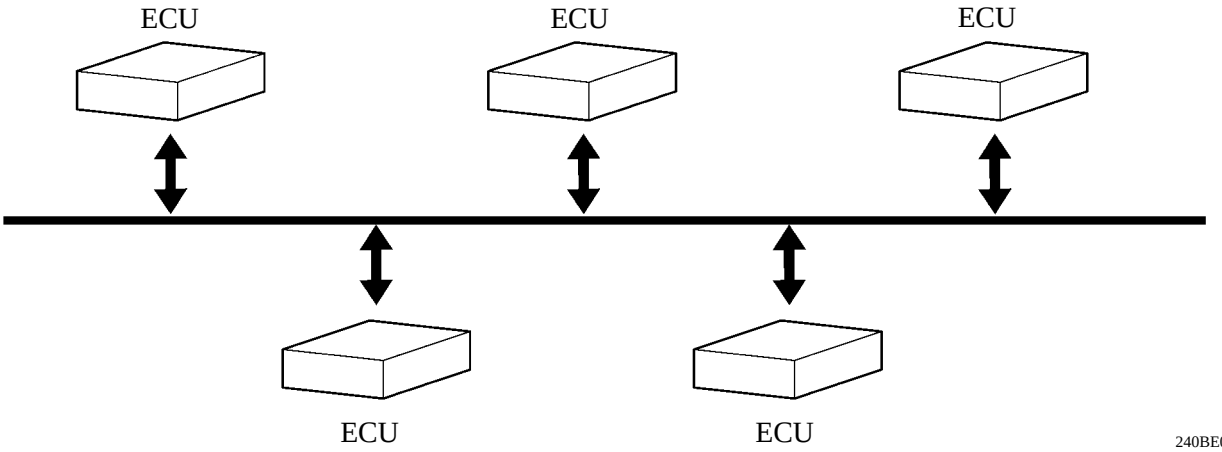
Star Style

This style is centered on a master ECU, which holds a central control function. The ECUs are connected in a star shape. The ECUs cannot establish a communication with other ECUs without passing through the master ECU.



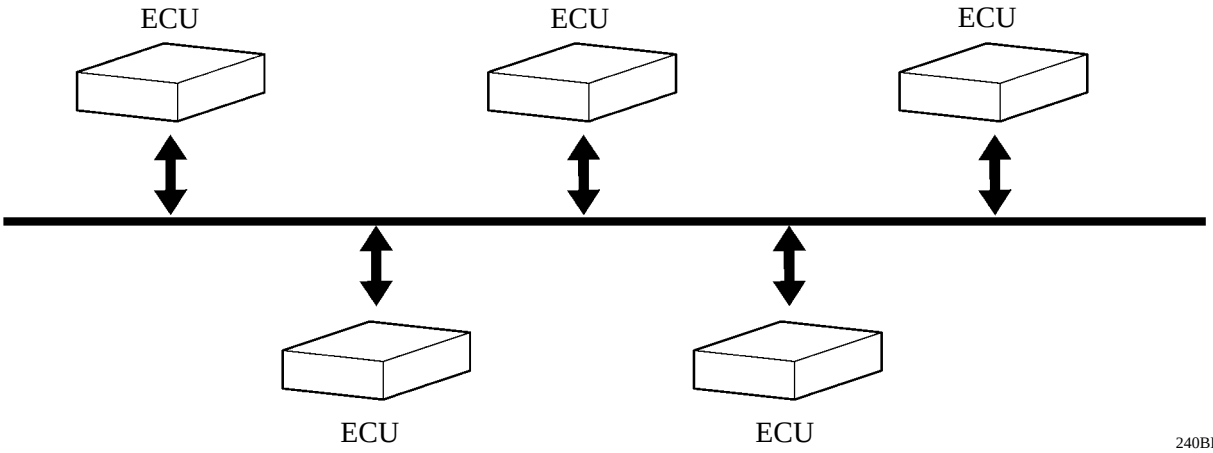
Bus Style

In this style of network, all ECUs are connected to a single common communication wire. The transmitting ECUs output signals through the common communication wire and the receiving ECUs input data through the common communication wire.



— REFERENCE —

The CAN uses the bus style bus connection. The sensors and ECUs are connected to a single common communication wire.



3. Differences of CAN and Other Communication Systems

- Currently, Toyota vehicles use three types of multiplex communication systems: the CAN (Controller Area Network), BEAN (Body Electronics Area Network), and AVC-LAN (Audio Visual Communication-Local Area Network).
- The protocols, which are the rules for establishing a data communication, differ between the CAN, BEAN and AVC-LAN. If the ECUs use different types of data such as a communication speed, communication wire, and signals, they will be unable to understand each other. Therefore, protocols (rules) must be established among them.

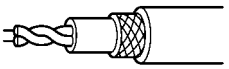
Protocol	CAN (ISO Standard)	BEAN (TOYOTA Original)	AVC-LAN (TOYOTA Original)
Communication Speed	500 k bps* (Max. 1 M bps)	Max. 10 k bps*	Max. 17.8 k bps*
Communication Wire	Twisted-pair Wire	AV Single Wire	Twisted-pair Wire
Drive Type	Differential Voltage Drive	Single Wire Voltage Drive	Differential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

*: bps: abbreviation for “Bits Per Second”, indicating the number of bits that can be transmitted per second.

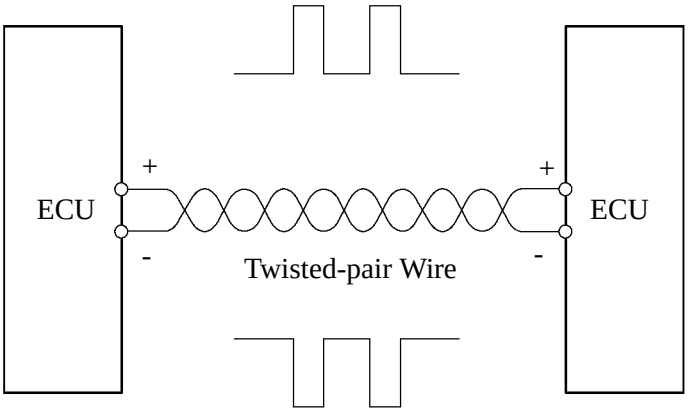
- Although the BEAN and AVC-LAN have almost the same communication speed, the communication speed of the CAN is much faster than the BEAN and AVC-LAN.
- When the chassis control system uses the BEAN with a slower communication speed than the CAN, the slower communication speed means that system control could possibly be delayed.
- For this reason, the power train and chassis control system uses the CAN which has a fast communication speed and can send and receive a large quantity of data at one time.

4. Communication Wire

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

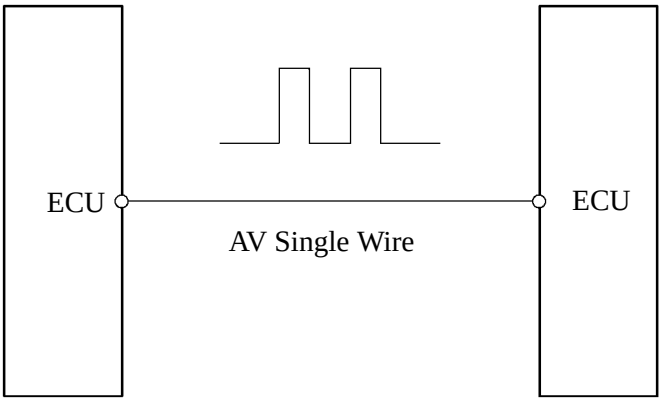
Communication Wire	Outline
Twisted-pair Wire for CAN  241BE168	In this communication wire, a pair of lines are twisted together and covered with insulation. The communication is driven by applying positive (+) and negative (-) voltage to the two lines in order to send a single signal. This system, which is called a “Differential Voltage Drive”, can reduce noise.
Twisted-pair Wire for AVC-LAN  240BE10	
AV Single Wire 240BE09	This is a lightweight single communication wire that consists of a single core line surrounded by insulation. Voltage is applied to this line in order to drive the communication, and this system is called a “Single Wire Voltage Drive”.

▶ Differential Voltage Drive ◀



240BE12

▶ Single Wire Voltage Drive ◀

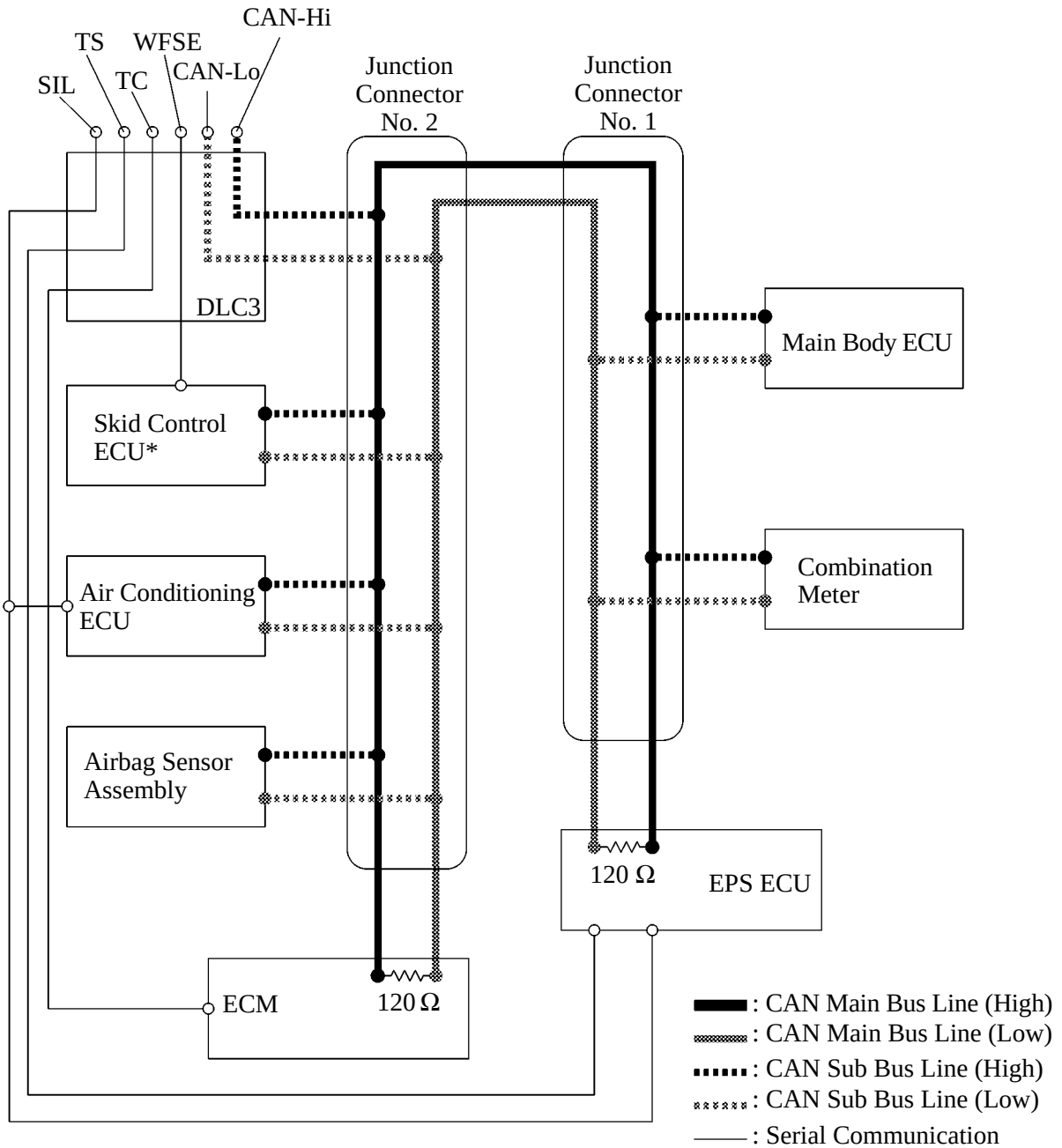


240BE11

■CAN (CONTROLLER AREA NETWORK)

- The CAN (Controller Area Network) is a serial data communication for a real time application. It is a multiplex communication to be equipped for a vehicle and has the communication speed (500 kbps) and function to detect malfunction.
- The communication wire uses a twisted-pair wire. The bus line has a high line (2.5 V to 3.5 V of voltage is applied) and a low line (1.5 V to 2.5 V of voltage is applied).
- The CAN system in the ’06 models is used to connect the following ECUs and parts via junction connector No. 1 and No. 2.

▶ System Diagram ◀



*: Only for ABS Models

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■DIAGNOSIS

If a malfunction occurs on the CAN communication line, the ECU that is connected to the CAN communication line stores the DTCs (Diagnostic Trouble Codes) in its memory.

- There are 2-digit DTCs and 5-digit DTCs for the CAN communication.
  - The 5-digit DTCs can be read by connecting a hand-held tester to the DLC3.
  - The 2-digit DTCs can be read from the warning light on the combination meter by connecting the SST (09843-18040) to TC and CG terminals of the DLC3.

For details, see the 2006 Yaris Repair Manual (Pub. No. RM00R0U).

■CUSTOMIZED BODY ELECTRONICS SYSTEM

A hand-held tester can be changed the specification of the systems or functions.

System	Hand-Held Tester Display Content	Contents	Default	Selection
Wireless Door Lock Remote Control System*1	WIRELESS OPER (Wireless door lock control function)	Function to turn on or off of the wireless door lock.	ON	ON/OFF
	HAZARD ANS BACK (Hazard answer back of the wireless)	Function to turn on or off of the hazard answer back of the wireless door lock.	ON	ON/OFF
	AUTO LOCK DELAY (Auto lock time)	Function to change the time until re-locking after unlocking with the wireless door lock.	30 sec.	30 sec./ 60 sec.
	UNLOCK/2 OPER (2 times operation wireless unlock)	Function to unlock the driver's door by pressing the unlock button of the transmitter once and to unlock all the doors by pressing it twice. In the OFF setting, pressing one time makes all the doors unlocked.	ON	ON/OFF
	ALARM FUNCTION (Panic function)	Function to operate the theft deterrent system by keeping pressing the lock button of the transmitter for 1.5 seconds. If there is the panic button, press the panic button instead of the lock button.	ON	ON/OFF
Door Lock Control System*2	UNLK/KEY TWICE (Unlock w/2 times D key operation)	Function to unlock only the driver's door by operating the key once and to unlock all the doors by operating the key twice. In the OFF setting, operating the key "UNLOCK" once makes all the doors unlocked.	ON	ON/OFF
Illuminated Entry System	LIGHTING TIME	To change the lighting time after closing the door. (It will quickly fade out in case of turning the ignition on.)	15 s	7.5 s/ 15 s/30s
	I/L ON/UNLOCK (Interior light on w/door key unlock)	Function to light the interior light, etc. when the door is unlocked with a transmitter, door key or door lock control switch.	ON	ON/OFF
	I/L ON/ACC OFF (Light the I/L when ACC OFF)	Function to light the interior light when the ignition switch is operated from "ACC" to "LOCK".	ON	ON/OFF
Warning	KEY REMND SOUND	To change the frequency of the key reminder buzzer.	NORMAL	NORMAL/ FAST/ SLOW/0 s
	SEAT BELT WARN	Function to change the seat-belt warning buzzer.	D/P ON	D/P ON/ D ON/ P ON/ D/P OFF

*1: Only for Models with Wireless Door Lock Remote Control System

*2: Only for Models with Door Lock Control System