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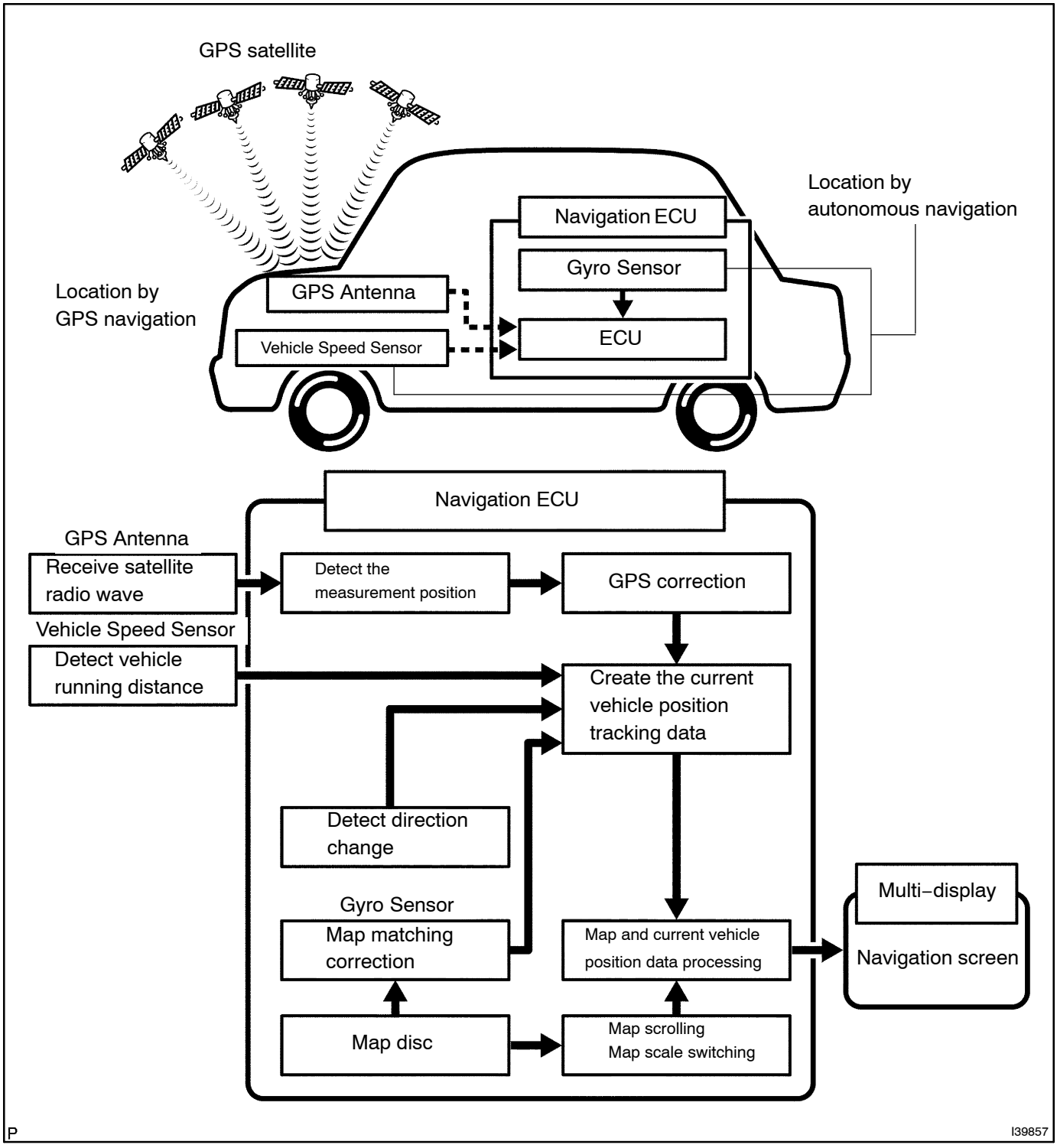
SYSTEM DESCRIPTION

1. Navigation system outline

(a) Vehicle position tracking methods

It is essential that the navigation system correctly tracks the current vehicle position and displays it on the map. There are 2 methods to track the current vehicle position: autonomous (dead reckoning) and GPS* (satellite) navigation. Both navigation methods are used in conjunction with each other.

*GPS (Global Positioning System)



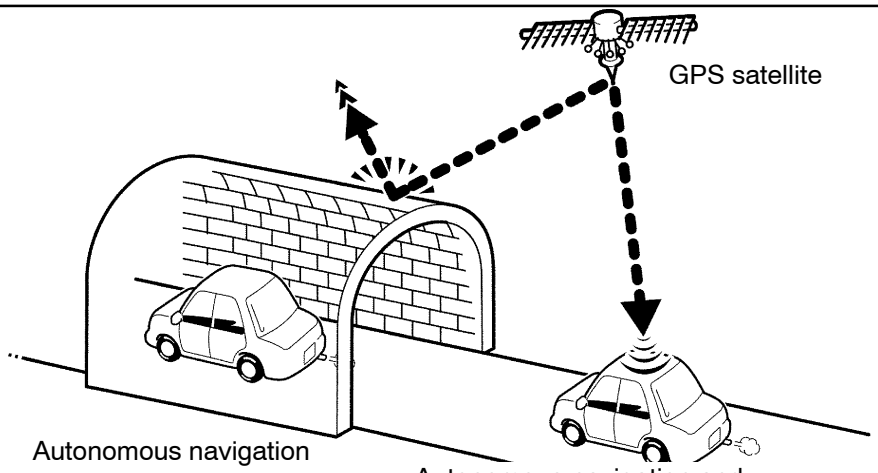
Operation	Description
Vehicle Position Calculation	The navigation ECU calculates the current vehicle position (direction and current position) using the direction deviation signal from the gyro sensor and the running distance signal from the vehicle speed sensor and creates the driving route.
Map Display processing	The navigation ECU displays the vehicle track on the map by processing the vehicle position data, vehicle running track, and map data from the map disc.
Map Matching	The map data from the map disc is compared to the vehicle position and running track data. Then, the vehicle position is matched with the nearest road.
GPS Correction	The vehicle position is matched to the position measured by GPS. Then, the measurement position data from the GPS unit is compared with the vehicle position and running track data. If the position is widely different, the GPS measurement position is used.
Distance Correction	The running distance signal from the vehicle speed sensor includes the error caused by tire wear and slippage between the tires and road surface. Distance correction is performed to account for this. The navigation ECU automatically offsets the running distance signal to make up for the difference between it and the distance data of the map. The offset is automatically updated.

HINT:

The combination of autonomous and GPS navigation makes it possible to display the vehicle position even when the vehicle is in places where the GPS radio wave cannot receive a signal. When only autonomous navigation is used, however, the mapping accuracy may slightly decline.

Navigation performed even where the GPS radio wave does not reach.

- In a tunnel
- In an indoor parking lot
- Between tall buildings
- Under an overpass
- On a forest or tree–lined path

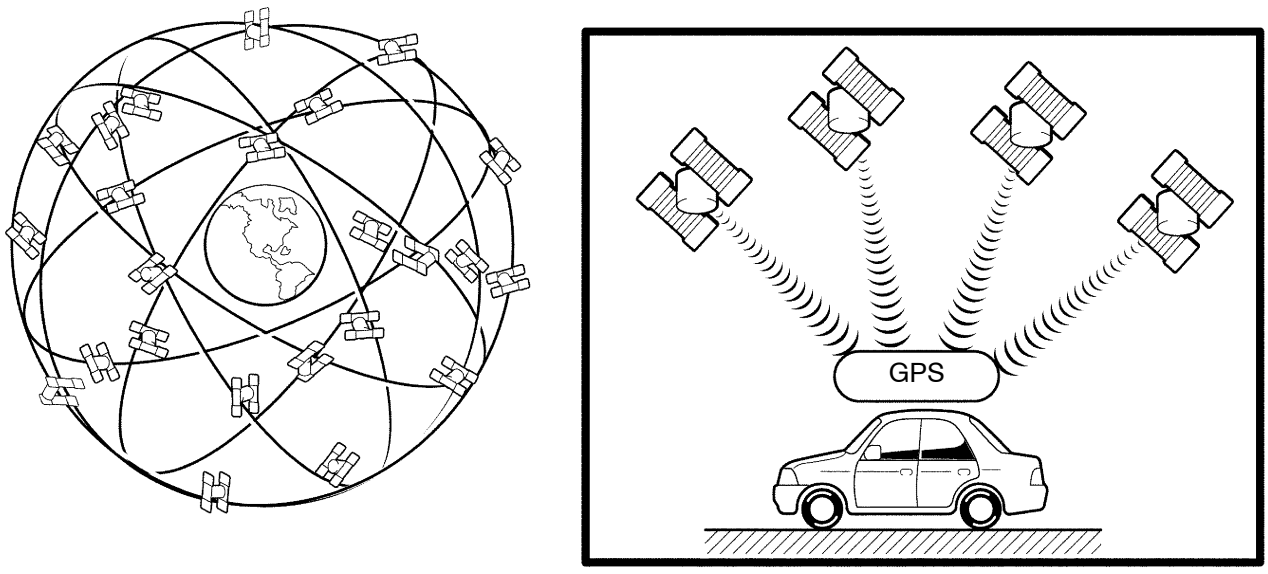


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(b) Autonomous navigation
This method determines the relative vehicle position based on the running track determined by the gyro and vehicle speed sensors located in the navigation ECU.
(1) Gyro sensor
Calculates the direction by detecting angular velocity. It is located in the radio and navigation assy.
(2) Vehicle speed sensor
Used to calculate the vehicle running distance.

(c) GPS navigation (Satellite navigation)
This method detects the absolute vehicle position using radio wave from a GPS satellite.
* GPS satellites were launched by the U.S. Department of Defence for military purposes.

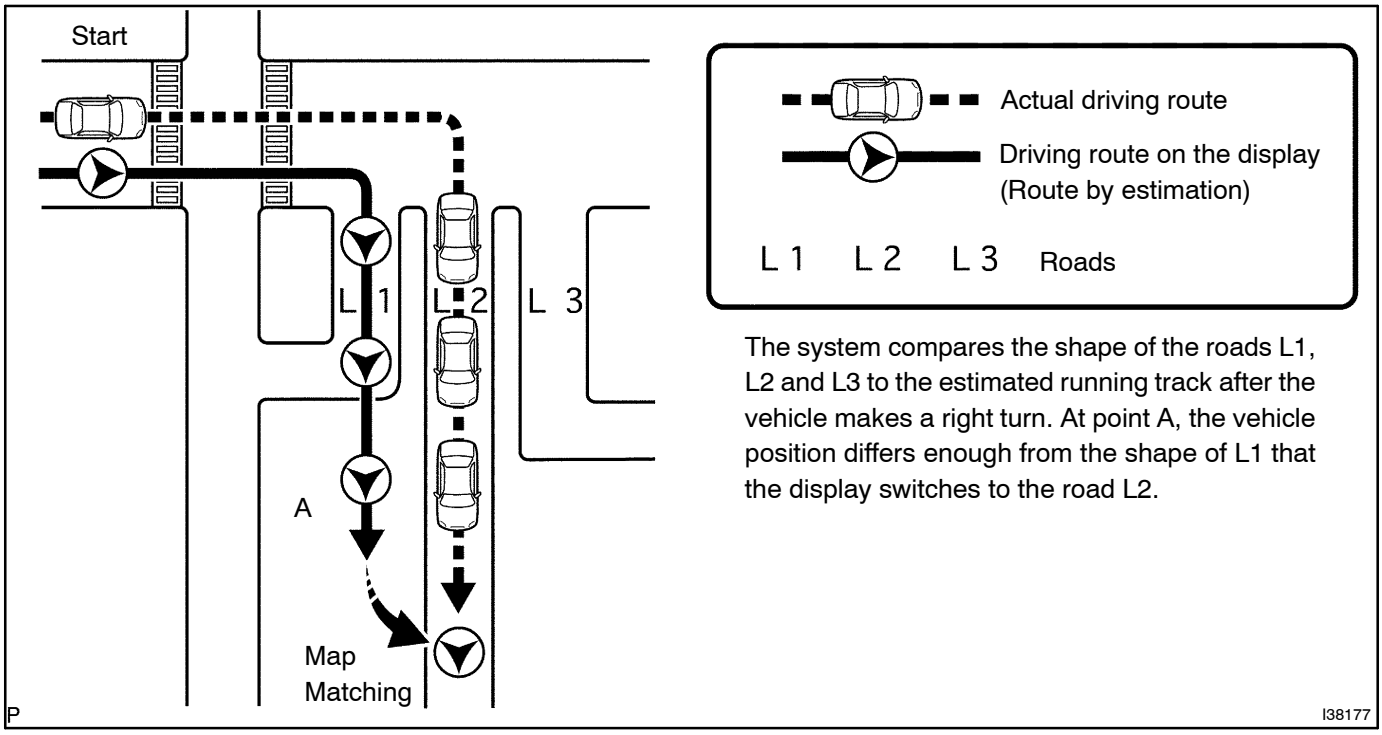
Current longitude/latitude/altitude is determined using the radio wave arrival time from four satellites.



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Number of satellites	Measurement	Description
2 or less	Measurement impossible	Vehicle position cannot be obtained because the number of satellites is not enough.
3	2–dimensional measurement is possible	Vehicle position is obtained based on the current longitude and latitude. (This is less precise than 3–dimensional measurement)
4	3–dimensional measurement is possible	Vehicle position is obtained based on the current longitude, latitude and altitude.

(d) Map matching
The current driving route is calculated by autonomous navigation (according to the gyro sensor and vehicle speed sensor) and GPS navigation. This information is then compared with possible road shapes from the map data in the map disc and the vehicle position is set onto the most appropriate road.



2. DVD (Digital Versatile Disc) player outline (for navigation map)

(a) The navigation ECU uses a laser pickup to read the digital signals recorded on a DVD.

HINT:

- Do not disassemble any part of the navigation ECU.
- Do not apply oil to the navigation ECU.
- Do not insert anything but a DVD into the navigation ECU.

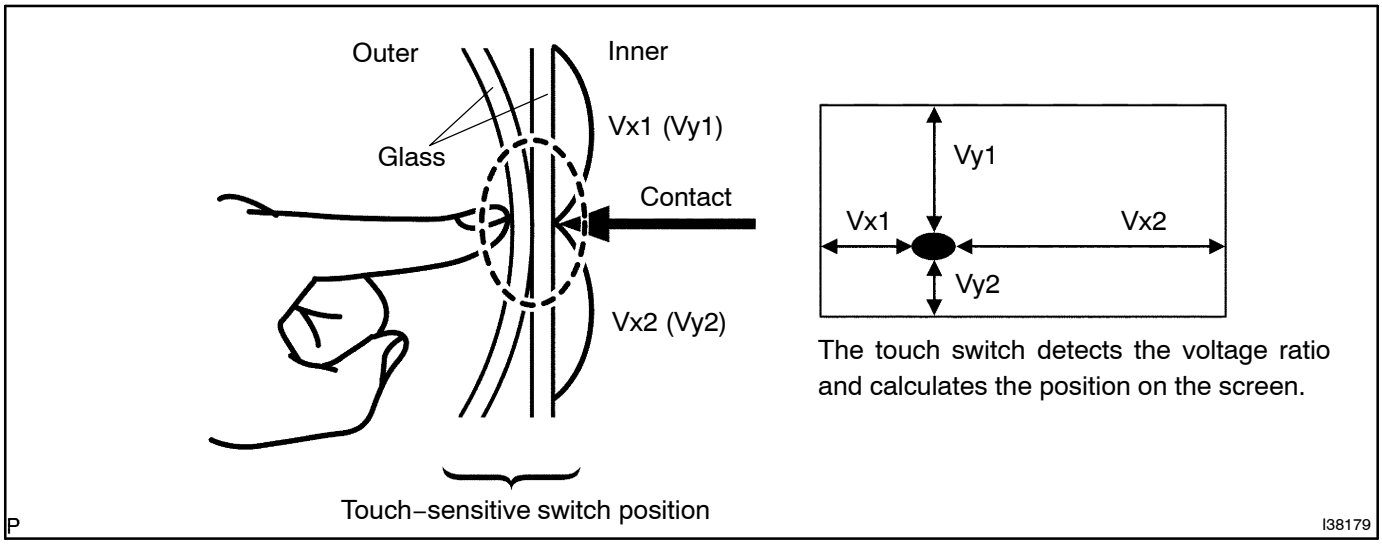
CAUTION:

Because the navigation ECU uses an invisible laser beam, do not look directly at the laser pickup. Be sure to only operate the navigation ECU as instructed.

3. Multi–display outline

(a) Touch switch

Touch switches are touch–sensitive (interactive) switches operated by touching the screen. When a switch is pressed, the outer glass bends in to contact the inner glass at the pressed position. By doing this, the voltage ratio is measured and the pressed position is detected.

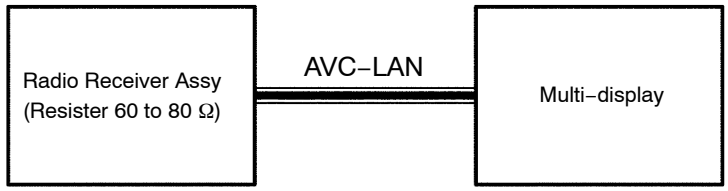


4. AVC–LAN Description

(a) What is AVC–LAN?

AVC–LAN, an abbreviation for ”Audio Visual Communication Local Area Network”, is a unified standard developed by the manufacturers in affiliation with Toyota Motor Corporation. This standard pertains to audio and visual signals as well as switch and communication signals.

Example:



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(b) Purpose:

Recently, car audio systems have rapidly developed and the functions vastly changed. The conventional car audio system is being integrated with multi–media interfaces similar to those in navigation systems. At the same time, customers are demanding higher quality from their audio systems. This is merely an overview of the standardization background. The specific purposes are as follows.

(1) To solve sound problems, etc. caused by using components of different manufacturers through signal standardization.

(2) To allow each manufacturer to concentrate on developing products they do best. From this, reasonably priced products can be produced.

HINT:

- If a +B or GND short is detected in the AVC–LAN circuit, communication is interrupted and the audio system will stop functioning.
- If an audio system is equipped with a navigation system, the multi–display unit acts as the master unit. If the navigation system is not equipped, the audio head unit acts as the master unit instead. If the radio and navigation assy is equipped, it is the master unit.
- The radio receiver assy provides resistance to make communication possible.
- The car audio system with an AVC–LAN circuit has a diagnostic function.
- Each component has a specified number (3–digit) called a physical address. Each function has a number (2–digit) called a logical address.

5. Communication system outline

(a) Components of the navigation system communicate with each other via the AVC–LAN.

(b) Radio receiver assy should have enough resistance (60 to 80 Ω) for communication. This is essential for communication.

(c) If a short circuit or open circuit occurs in the AVC–LAN circuit, communication is interrupted and the navigation system will stop functioning.

6. Diagnostic function outline

(a) The audio system has a diagnostic function (the result is indicated on the master unit).

(b) A 3–digit hexadecimal component code (physical address) is allocated to each component on the AVC–LAN. Using this code, the component in the diagnostic function can be displayed.