

# Controller Area Network (CAN)

## Functionality

The Controller Area Network (CAN) was developed by Bosch in 1980, and it has become a standard in automotive and industrial systems. CAN is a multi-master broadcast system where all the nodes in the system share a communication bus, on which they can send and receive data. In CAN, messages are organized as frames, and each frame consists of: a unique ID, control field indicating the length of the data, CRC for error-detection, acknowledgement bit to identify that the message has been received correctly by the other nodes, and finally the data. CAN also supports data rates up to 1 Mbps for short distances, while for long distances the speed decreases to maintain signal integrity.

## Common Use Cases

CAN is heavily used in fields where reliability and real-time communication are important. It's used for example in automotive systems to connect various control units seamlessly like the airbags, and the engine management system. It's also used in medical equipments to ensure reliable data exchange between critical components. Another use case for CAN is in aircraft systems for communication between flight control systems and sensors.

## Advantages & Disadvantages

- Advantages:
  - CAN's error-detection mechanisms ensure stable communication in noisy environments
  - CAN is a cost-effective protocol for applications requiring reliable communication between multiple nodes
  - CAN is preferred in systems that may require scalability, and the addition of new nodes without major changes to the existing network
- Disadvantages:
  - The data field is limited to 8 bytes, which may require segmentation larger data transfers
  - CAN imposes a speed constraint of 1 Mbps. Although, this may be sufficient for many applications, it may be inadequate for long-distance communication