ePROPELLED
The Future of Electric Propulsion

Application Note

Controller Area Networks in UAVs

As UAVs become more prevalent in a wide range of industries, Mission profiles and the associated payloads are becoming more diverse and complex. Power systems are essential to ensure the success of these missions. It is critical to mission success that operators have complete information about the performance of the aircraft including the power system.

UAVs designers should utilize a standards-based approach to monitor and report on the status of on-board systems. This enables diverse systems to utilize a common infrastructure. Moreover, designers should be concerned about the weight especially of the wring used to connect these systems.

Using a Controller Area Network (CAN) for electric systems

A Controller Area Network (CAN) is a serial network technology that was originally designed for the automotive industry but has also become a popular bus in industrial automation as well as other applications. The CAN is a bus-based system that can be used in embedded systems to provide fast communication among microcontrollers in intelligent devices without the help of a hosting device.

CAN is an International Standardization Organization (ISO) defined serial communications bus. It is a message-based protocol allowing individual systems, devices and controllers within a network to communicate.

A key motivation in the automotive industry was to replace the complex and heavier wiring harness and the developers selected a two-wire (parallel) bus. The specification calls for high immunity to electrical interference and the ability to self-diagnose and repair data errors. The greatest advantage of CAN lies in the reduced amount of wiring combined with an ingenious prevention of message collision (meaning no data will be lost during message transmission).

Devices and controllers connected to the CAN Bus can transmit data to the bus and receive data from the bus. A message transmitted by one unit is received by all the units connected to the bus**.** A data message is transmitted as a frame. In each frame, the message is labelled by an identifier that is unique throughout the network. Each unit will have a filter to accept the message relevant to it.

CAN Standards

CAN is an open standard so it can be used without a license. The current version is CAN 2.0B and can be obtained online. CAN was standardized in 1993 by the International Organization for Standardization (ISO) released the CAN standard ISO 11898 which was later restructured into two parts; ISO 11898-1 which covers the data link layer, and ISO 11898-2 which covers the CAN physical layer for high-speed CAN. ISO 11898-3 was released later and covers the CAN physical layer for low-speed, fault-tolerant CAN.

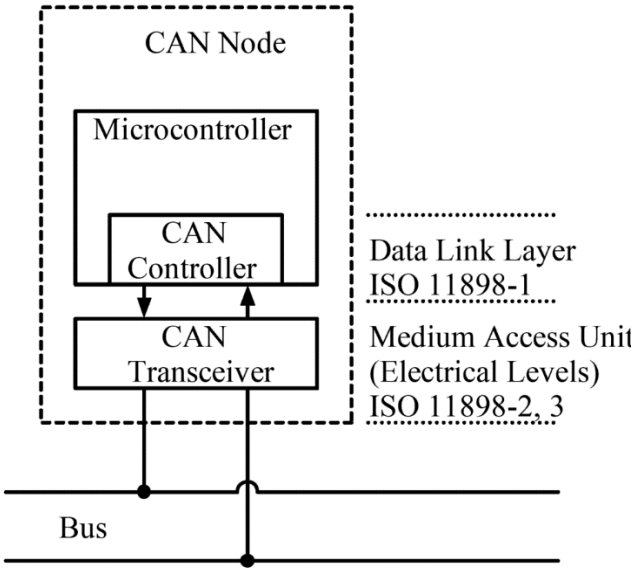

Figure 1. Visual diagram of CAN standard.

CAN Messages

CAN status messages are generated by the power management unit (PMU) which converts the AC power from the starter-generator and converts it to DC at the appropriate voltage level(s). An intelligent PMU has a CAN chip so it can connect to a CAN bus.

The PMU can generate a range of CAN messages covering:

- Device Information
- Input & Output Connection Status
- Event Based Alerts
- Real Time Data Monitoring (RTDM) Functionality
- Electric Engine Starter (EES) Functionality
- Acknowledgement of Transmitted Messages

ePropelled Intelligent Power Systems (iPS)

The ePropelled family of PMUs, the iPS, uses “Alert User” Message to communicate to the user that an event has occurred. The message contains an “Alert Indicator” to encode the event. The user can set alerts based on user configurable thresholds.

Real Time Data Monitoring (RTDM) Functionality

The iPS allows the user to receive Real Time Data from via the “RTDM Data” Message. The iPS750 Features the capability to monitor data in real time over the CAN Bus, this is referred to as RTDM. The user can enable or disable this feature and change the frequency at which the data is reported. All output Voltage and Current measurements are taken via the iPS on board sensors and communicated to the user over the CAN Bus with the “RTDM Data” message.

The message contains Measured Values for the following test points:

- Time Delta (from Power-On T=0)
- 28V Output Voltage
- 28V Output Current
- 12V Output Voltage
- 12V Output Current
- 5V Output Voltage
- 5V Output Current

The CAN driver we use is compatible with ISO 11898-2 and the processor is compatible with ISO 11898-1. The processor complies with ISO11898-1 (Bosch® CAN protocol specification 2.0 A and B). Our products support CAN 2.0A. CAN 2.0B defines extended IDs that are not used in our protocol.

For more information about ePropelled, please visit the ePropelled webpage.

ePropelled Inc
116 John Street, Suite 205
Lowell, MA 01852 USA
Tel. +1-978-703-1350
Email info@ePropelled.com