

TWO SERIAL DATA TO PULSE CODE MODULATION SYSTEM INTERFACES

Summary

Two pulse code modulation (PCM) system interfaces for asynchronous serial data are described. One interface is for global positioning system (GPS) data on the NASA Dryden Flight Research Center (DFRC) F-15B (McDonnell Douglas Corporation, St. Louis, Missouri) airplane, tail number 836 (F-15B/836). The other is for flight control computer data on the duPont Aerospace (La Jolla, California) DP-1, a 53-percent scale model of the duPont Aerospace DP-2.



Photo courtesy duPont Aerospace

Figure 1. The duPont Aerospace DP-1.



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Figure 2. The NASA F-15B airplane in flight.

Objective

Digital data from various aircraft computers are frequently required to be downlinked with other measurements obtained by flight research instrumentation systems. The RS-232 format is a standard format for communicating data between computers. Having an easily deployable and reconfigurable interface unit can address a wide range of needs.

Approach

For several years, the DFRC has had experience using Tattletale[®] (Onset Computer Corporation, Bourne, Massachusetts) data loggers for analog and digital data acquisition and control tasks. The Tattletale Models 7 and 8 are based on the 68332 microcontroller which has an onboard coprocessor called the time processing unit (TPU). The TPU is well suited for handling digital waveforms such as the RS-232. Data is passed to the PCM system as 8-bit parallel words under the control of the timing signals from the PCM system.

The Tattletale system on the F-15B/836 receives five blocks of data from the Ashtech Z-12 GPS receiver (Thales Navigation, Santa Clara, California), cross-checks two of the blocks for the correct time, extracts the desired parameters, converts most values from American Standard Code for Information Interchange (ASCII) characters to the Institute of Electrical and Electronics Engineers (IEEE) 754 floating-point numbers, and passes them to the PCM system.

Data conversions are not required for the DP-1 system. This frees processing time for the Tattletale to handle data at a higher transfer rate, as shown in table 1.

Table 1. Selected specifications for the two interfaces.

Item	F-15B/836 interface	DP-1 interface
Block data rate	2 blocks per second	20 blocks per second
Block length	345 bytes	500 bytes
Real-time data conversion	Yes	No
RS-232 Bd rate	19,200	115,200



Photo courtesy Phil Hamory

Figure 3. Photograph of the Tattletale system for the DP-1.

Status

The GPS interface has been flying on the F-15B/836 since 2001. The flight control computer interface for the DP-1 has been fully checked out at DFRC and is at duPont Aerospace waiting for aircraft installation. Lab tests have shown that the TPU can support RS-232 rates of at least 230,400 Bd. The RS-422 and Serial Peripheral Interfaces (SPI)[®] (Motorola, Incorporated, Schaumburg, Illinois) are available as well.

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