Bulletin No. 8

ADS-2 INPUT AND OUTPUT SIGNAL INTERFACE DESCRIPTION

I. **Introduction**

This Bulletin gives concise descriptions of the various input and output interfaces available for users of the RAF Airborne Data System (ADS-II). Unless otherwise specified, they apply to all of the NSF/NCAR aircraft fleet. ADS-II was used from 1995 to 2005 on the C-130 and Electra. ADS-II was never used on the GV.

If you have questions or need more detailed information about the topics covered here, please contact the RAF Data Manager.

II. **Output Data Feeds**
- **Serial Data**
  The ADS-II data acquisition system aboard NSF/NCAR aircraft can distribute, in pseudo-real-time (about a 3-second lag), a single, ASCII data stream to properly-interfaced user equipment. Up to 16 devices (8 in the front cabin and 8 in the rear cabin) can receive this common data stream which consists of time and a subset of all the raw and derived measurements made aboard the aircraft. Measurement selections and their output order are controlled by a special file. Since all attached devices share these data, users should select and agree on which of the measurements will best satisfy their needs.
    - Equipment used:
      - Black Box DB-8 Data Broadcast Unit (1 input channel, 8 output channels) with RJ-11 modular jacks
      - A serial feed from ADS-II
    - Equipment furnished by RAF:
      - RJ-11 four-wire phone cable
      - RJ-11 adapters to DB-9 or DB-25 connectors (M or F): wired as DCE for connection to DTE (terminal equipment)
      - If you have a special need beyond the above descriptions, please contact us.
    - Protocol:
      - baud rate: 9600
      - data bits: 8
      - stop bits: 1
      - parity: none
    - Data output:
      - Rate: One record per second
      - Format: ASCII

- Measurements: selected from the project's master variable list and ordered via the project file "ascii_parms"
- Format: 10-character date (yyyy/mm/dd with leading zeros, if numbers are less than 10) followed by a [SPACE] followed by 8-character time (hh:mm:ss with leading zeros, if numbers are less than 10) followed by 14-character measurement fields (leading [SPACE] character, E format with leading sign, 6 significant digits and 2-digit exponent, e.g., +0.123456e+78), the return [CR] character and the End-of-line [LF] character (There will always be the same number of characters in each record.)
- Theoretical maximum number of variables (excluding date/time): 61
- Practical maximum number of variables (excluding date/time): 50

- **IRIG-B**
  For those user instruments able to accept it, IRIG-B signals are routed throughout the aircraft to provide timing information. It is referenced to the on-board GPS system (once per second) and synchronized with the ADS-II.
    - Cabling: RG-58/U
    - Connector: BNC
    - Signal description: IRIG-B
      An IRIG-B format description of can be found at the URL: http://www.jcte.jcs.mil/RCC/manuals/irig/2toc.htm.

III. Data Input

This section describes the various methods for having measurements recorded by the ADS-II. There may be occasions when a user only wants his/her data displayed on the ADS-II system (WINDS). The present configuration requires that the data must be recorded before they can be displayed.

- **Analog**
  The analog output(s) from a user's instrument can be sampled and recorded on the ADS-II. A wide range of signals can be used depending on level and instrument response speed. The analog input circuitry of the ADS-II has a sample rate of 10K sps (samples per second). Instrument output(s) are assumed to have no frequency components higher than 5K Hz. If this is not the case, anti-alias filters should be installed to assure that this condition is met.
    - Sample rates: 5, 25, 250 and 1000 sps only
    - Maximum signal level: ±10 Vdc
    - Available input voltage ranges: 0-1, 0-5, 0-10, 0-20, ±10 Vdc
    - Note: Full-scale signal levels less than 1 Vdc should be amplified to assure adequate resolution and to minimize external noise effects.
    - Analog connection: three-wire with full floating ground (shielded cable preferred)
    - Ground: single-ended or full floating; cable at source can be grounded or not.
    - Connectors: twinax (BNC adapters furnished, if needed)

- **Serial**
  The default serial input has the following characteristics:
    - RS-232, RS-422 interface
    - ASCII
    - [CR][LF] record termination
    - baud rate: Standard rates up to 38,400 baud
    - data bits: 7, 8
    - stop bits: 2, 1
    - parity: none, odd, even
  If your serial data have other characteristics, the ADS-II can handle a wide range of types and rates. Consult RAF for your special needs.

- **Pulses**
  RAF supports pulse counting with a multiple, 16-bit interface card that can be set up to sample (read and reset) a pulsed signal between 1 and 25 times per second. By properly setting the sample rate, pulses can be counted to a maximum of 1.6M pulses per second without overflowing the 16-bit register. If higher rates are needed, the channels can be cascaded to extend the overflow capacity.
  - Pulse width: 100 ns or greater (pulses shorter than 100 ns can be stretched to 100 ns with an input one-shot circuit, if necessary, but it obviously limits the maximum resolvable pulse-rate to something less than 10M pps.)
  - Pulse amplitude: 5-volt, TTL level (higher amplitude signals can be attenuated)
  - Input impedance: 50 ohms (BNC connector and RG-58/U cable preferred)

- **Ethernet**
  Consult RAF if you have any desire to send data to the ADS-II via an Ethernet connection.

- **Parallel**
  RAF supports parallel data input with the following characteristics: 8-bit or 16-bit with strobe.

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