

ESD3500A

Accident Data Recorder System (ADRS)



■ *Combined data and voice recorder*

■ *Low-weight, low power*

■ *High reliability*

■ *Rapid on-board data extraction*

■ *Interface to aircraft digital data bus to
McDonnell Douglas MDC A5232 or
MIL-STD-1553B, DEF-STAN 00-18 part 2*

■ *Inputs from analogue and discrete aircraft
sources*

■ *Recorder crash survivability to TSO-C51A*

The Accident Data Recorder System (ADRS), type ESD3500A comprises 2 units, data acquisition unit type ESD3501A, and Penny and Giles Data Recorders Ltd, accident data recorder type D50330.

The equipment has been designed for use on agile military aircraft. The data acquisition unit receives inputs from a variety of aircraft sensors and converts the information into a digital format suitable for the recorder. The recorder accepts both digital data from the data acquisition unit and voice for a duration of 2 hours.

ESD3501A (DAU)

The data acquisition unit will accept an overall maximum of 18 analogue voltage inputs:

single wire, ratiometric type

(potentiometer) - up to 18 max.

twin wire, absolute differential type

(accelerometer) - up to 6 max.

All analogue inputs have input protection and low pass filtering. The DAU also provides 4 supply lines (+5, 0V) for powering potentiometer type transducers.

The analogue inputs are multiplexed and applied to an 11 bit A/D converter.

In addition to the above the DAU will accept up to 33 single wire discrete inputs (organised as 3 x 11 bit data words within the DAU)

All discrete inputs have input protection.

The remote terminal (RT), within the DAU, provides two-way communication with the aircraft multiplex data bus (MDB). The RT is capable of receiving data for recording from the bus controller. The RT is also capable of transmitting data in response to a request from the bus controller. The RT meets the requirements of MIL-STD-1553B (DEF-STAN 00-18 part 2), and offers the flexibility to meet the MDB specification McDonnell Douglas MDC A5232.

The DAU combines the analogue, discrete and bus input data into a form suitable for recording by the ADR. This consists of 2 channels of serial Harvard bi-phase data. Up to 128 words per second (each channel) can be transmitted simultaneously. Each word consists of 12 bits, 11 bits for data, 1 bit for odd parity check.

The DAU has comprehensive built-in test equipment (BITE) and provides a failure signal upon the failure of any one of the following monitored items:

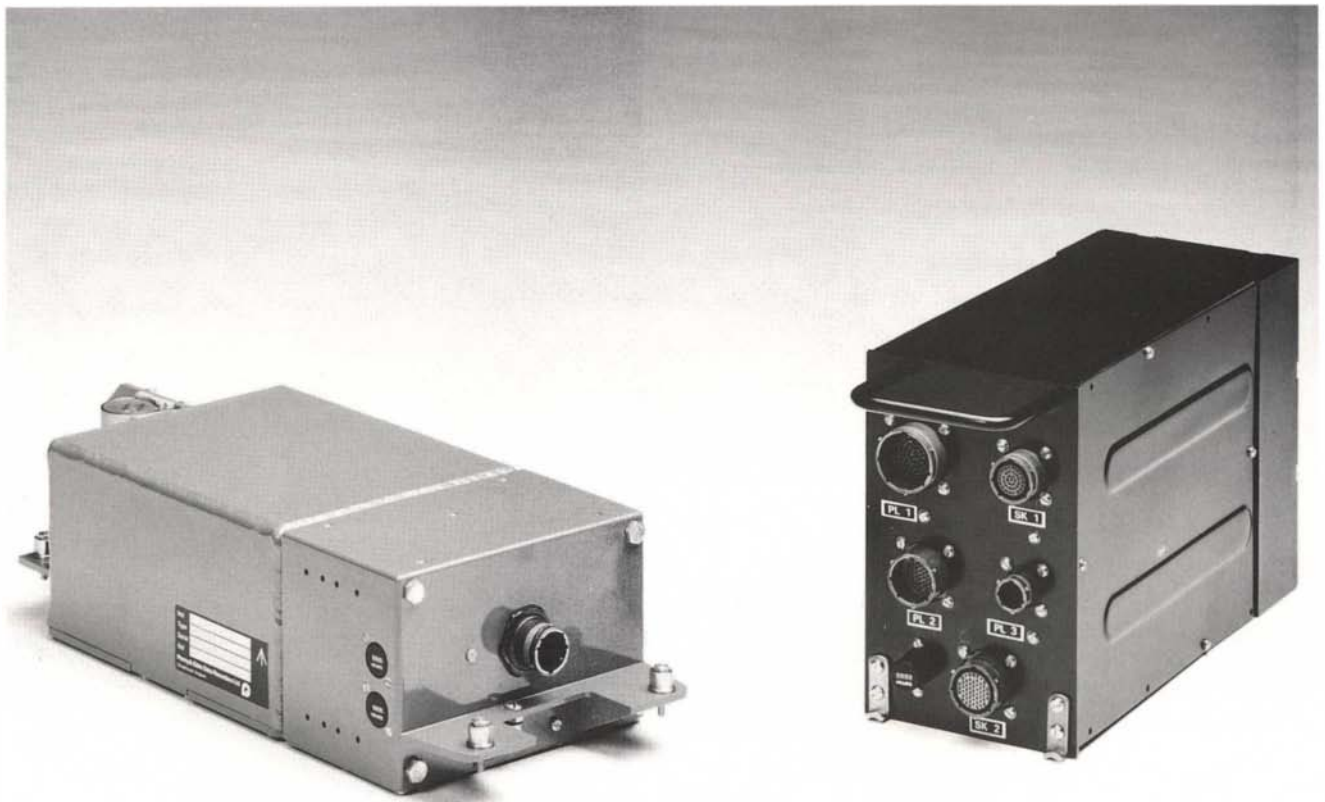
Internal timing of DAU, to ensure correct operation.

The analogue to digital conversion of a pre-set calibration signal is correct. Bi-phase data is present at outputs to ADR.

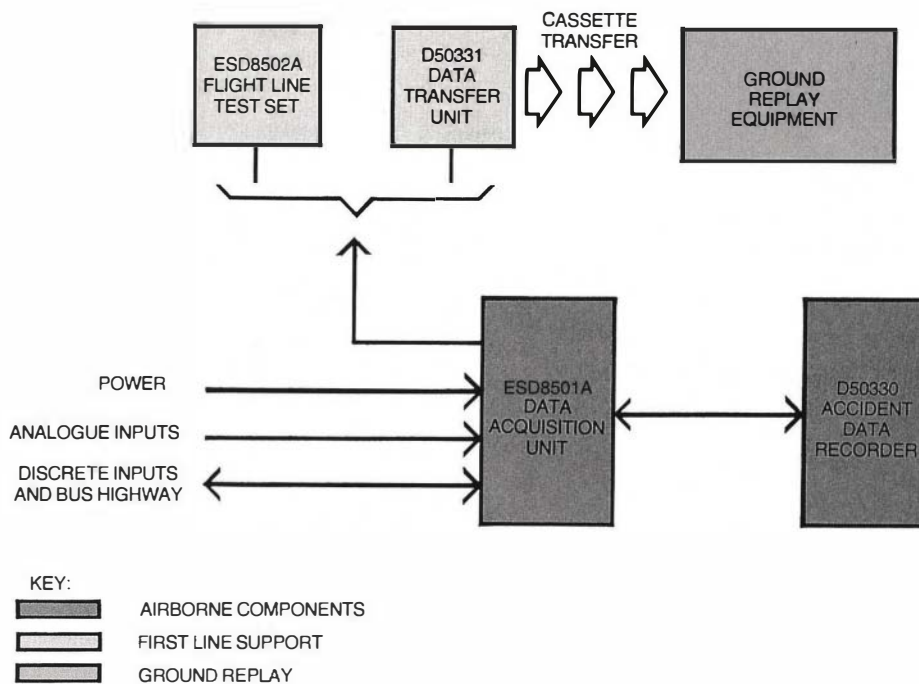
Serial data is present prior to bi-phase conversion.

Internal power supply rails are within correct limits.

The DAU also has an elapsed time indicator showing the accumulated number of hours that the unit has been "powered up".



ACCIDENT DATA RECORDING SYSTEM - ESD8500A



D50330 (ADR)

The accident data recorder consists of a miniature crash protected tape mechanism and an electronic interface. The tape mechanism is protected by an outer, high strength, titanium alloy case. Inside this case is a layer of high efficiency heat insulation material and then an inner aluminium alloy case. The electronics compartment is secured to the crash protected case and houses all the control, record and replay electronic modules. The unit is fitted with two elapsed time indicators; one indicator shows the total accumulated hours during "power on" and the other indicator shows total hours run during data retrieval (x 10 operation).

The ADR is also fitted with an underwater acoustics locator beacon.

The tape mechanism features a motor with optical tacho feedback for speed control.

Recording takes place over 2 passes of an endless tape loop. Each pass utilizes 3 tracks- 2 tracks for digital data and the other for voice. The ADR receives 2 serial, Harvard bi-phase data channels; each data stream from the DAU

contains synchronization words thus eliminating sensitivity to tape skew during retrieval. The ADR has facilities for in- situ data retrieval at x 1 and x 10 recording speed. During retrieval all digital tracks are outputted simultaneously so that a fast data dump can be achieved in under 10 minutes.

The ADR also has a comprehensive B.I.T.E. giving a failure signal upon the failure of any of the following monitored items:

The motor servo, to ensure correct tape speed.

The replay of an audio pilot tone, to ensure that the audio channel is fully operational.

The digital record heads, to ensure that they are operating and not open or short circuit.

The digital replay waveform, to ensure correct tape contact and alignment.

Support equipments

First line test equipment:-

ESD3502A - Flight Line Test Set (FLTS)

Used for routine maintenance checks of ESD3500A system and isolation of any fault down to a line replaceable unit.

D50331 - Data Transfer Unit (DTU)

Can perform data retrieval ADR onto cassette tape.

Data summary

ESD3501A Data acquisition unit

Input signal types

Analogue:

Ratiometric voltage

Absolute differential voltage

All analogue inputs have low pass filtering

Discrete:

DC-AC(400Hz) voltage levels (or pulsed levels)

Open circuit/DC voltage level

Open circuit/ground

Multiplex data bus:

Two-way communication with digital multiplex data bus to MIL-STD-1553B or McDonnell Douglas MDC A5232

Output signal types

Serial data: (for recording)

Differential line drivers producing 2 Harvard bi-phase channels, signal levels as RS-422-A

Capable of transmitting up to total of 256 words per second

12 bits per word - 11 bits data plus odd parity bit (LSB)

LSB of each word transmitted first

B.I.T.E.:

Open collector output giving ESD3501A general fail status

Recorder control:

Open collector output giving on/off control of recorder

Transducers supplies:

+5V, 50mA supply for external potentiometers

Environmental

Temperature, humidity, altitude:

Mainly MIL-STD-810B

Operating temp range -40°C to +85°C

Vibration, mechanical shock:

Mainly MIL-STD-810B and to McDonnell Douglas MDC A3780.

Electromagnetic interference & compatibility:

To requirements of MIL-STD-461A

Reliability

MTBF: 5000 hours

Power requirements

Supply :

28V DC conforming to MIL-STD-704C emergency limits

Consumption: 28W max

Dimensions

1/2 ATR short case

Height: 193.5mm (7.62in)

Width: 124.7mm (4.91in)

Depth: 384mm (15.12in)

Weight: 4.55Kg (10lb)

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D50330 Accident data recorder

Input signal types

Accepts 2 Harvard bi-phase data channels from ESD3501A

Accepts Audio (voice) channel providing input transformer isolation

Recording

Tape speed:

up to 15/16 inches per second

Recording density:

up to 2000 bits per inch

Recording speed accuracy:

(a) Long term $\pm 1\%$ peak

(b) Short term $\pm 8\%$ peak

Records over 2 passes of endless magnetic tape loop; each pass utilizes 3 tracks - 2 tracks for digital data, 1 track for audio

Retrieval

Facilities for data retrieval at x 1 and x 10 recording speed

During retrieval all digital channels are outputted simultaneously

Output signal types

Serial data (replay):

Differential line drivers producing 4 data channel outputs (2 from each tape pass), signal levels to RS-422-A

Audio replay:

Unbalanced audio output

Track status:

Open collector output indicating current tape pass (1 or 2)

B.I.T.E.:

Open collector output giving D50330 general fail status

Environmental

Primarily same as ESD3501A apart from TSO-C51A testing

Crash survivability

TSO-C51A

Reliability

MTBF: 5000 hours

Power requirements

Supply:

28V DC conforming to MIL-STD-704C emergency limits

Consumption: 14W max

Dimensions:

Height: 115mm (4.53in)

Width: 172mm (6.77in)

Depth: 440mm (17.32in)

Weight: 8.3 Kg (18.3lb)

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