n.b. This analysis assumes that the ACC serial ports are provided by a DHV/11 asynchronous multiplexer, described by DEC document EH-DHV/11-7M-001, and that the communication protocol is that implemented in data set software V1.0.

1) Signalling Limit

Messages comprise a number of 11 bit characters (8 bits data, start, stop and parity) and the signalling rate is fixed at 38400 baud (maximum speed of the DHV/11). Hence there is an absolute limit of 3440 characters per second (cphs) on any path.

Operation is full duplex, and independent of the number of data sets on the line.

2) Format Limit

The ACC always transmits a message of five characters. A data set only transmits in response to a message addressed to it. The response begins immediately after receipt of the third character of the request, and in normal circumstances (no parity errors detected) has a duration of three characters, or slightly more. Although this implies a total of six character times (6Tc) for a complete transaction, the ACC may transmit continuously, beginning its next message as it receives the last character of a preceding response, resulting in an effective transaction length of five character times.

The maximum communication rate is therefore 598 transactions per second for overlapped (5Tc) transmissions or 581 per second otherwise (6Tc).

3) Throughput Limits

The DHV/11 has a maximum (average) transmit throughput of 2000 characters per second (DMA mode) on any one channel. At five characters per message this implies a maximum of 400 transactions per second.

The corresponding average response rate is 1200 char/sec (max), well within the maximum receive rate of 4000 char/sec.

A gross limit of 15000 char/sec applies over all channels, transmit and receive throughput together.

4) Synchronisation Limit

The throughput limits in 3) are only approached by long messages, where long implies >6 characters. Shorter messages are affected by interactions between 10 requests issued by the ACC host processor and actual 10 processes
running in the DHV11. The latter service requests to a particular port at intervals of 3.18ms, as determined by an independent clock. Thus, messages of 6 characters, or less, are dispatched at the rate of 314 per second.

5) **Protocol Induced Limit**

The data set protocol, by requiring the SYNC character be transmitted with a different format to the body of the message, results in each control/monitor request being treated as two separate short messages messages by the DHV11, and therefore requiring 6.28ms to dispatch. The corresponding maximum transaction rate is 157 per second.

6) **System Effect**

Difficulties experienced in driving the DHV11 from VAX/ELAN presently add a penalty of up to 20ms per message transmitted by the ACC. This unhappy event limits the guaranteed transaction rate to a miserable 50 per second.

To date this is the bottom line, and now!

7) **Summary**

An appropriate device driver installed under Micropower Pascal in the actual ACC software should achieve 157 transactions per second as per 5). If, in addition, the data set protocol is revised to a constant signalling format, double this rate is available as described in 4), subject to the gross limit described in 3). Such a revision would also remove ELAN's problem in 6).

+ **SYNC** is sent with even parity, the rest with odd parity.
+ All characters with odd parity.