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CSIRO DIVISION OF RADIOPHYSICS
THE AUSTRALIA TELESCOPE

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Maximum Data Rates between ACC and Data Sets
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n.b. This analysis assumes that the ACC serial ports are provided by a DHV11 asynchronous multiplexer, described by DEC document EK-DHV11-TM-001, and that the communication protocol is that implemented in data set software V1.0.

1) Signalling Limit
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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 DHV11). Hence there is an absolute limit of 3490 characters per second (chps) on any path.

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

2) Format Limit
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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 698 transactions per second for overlapped (5Tc) transmissions or 581 per second otherwise (6Tc).

3) Throughput Limits
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The DHV11 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
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The throughput limits in 3) are only approached by long messages, where long implies >>6 characters. Shorter messages are affected by interactions between IO requests issued by the ACC host processor and actual IO 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 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 how!

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.