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TITLE: V100 Async Compression and Error-correction		

V100 Async Compression and Error-correction

1: Overview

This Application Note describes the configuration and operation of the error-correction and data compression features now available for Asynchronous channels on the V100 multiplexer. It should be read in conjunction with the V100 Technical Manual version 2.00 and later.

This feature allows individual async channels to operate error-free over a satellite link. It does not affect or relate in any way to bulk error-correction that may be taking place within the satellite modem or aggregate link.

Asynchronous channels have now been enhanced with the addition of a new configuration item on the DATA CHANNELS menu. A single-character field is now displayed to the right of the "FORMAT" field when the channel is configured into an async mode.

The new field allows three selections as follows:

"R" – Raw	Data is passed without error-correction or compression.
"E" – Error-correction only	Data is error-corrected.
"C" – Compression	Data is error-corrected AND compressed.

In Raw mode, async data is transferred normally as in all previous software releases. The compression mode intrinsically uses error-correction, since the compression tables cannot work reliably otherwise.

2: Theory of Operation

2.1 Error-correction

The error-correction function is based on 100mS time periods. Data received by the tributary port is buffered into a 100mS superframe irrespective of channel rate, which is then split into a number of smaller sub-packets according to Dynamic Bandwidth Allocation (DBA) requirements. For example, if the channel is configured with a baud rate of 115,200bps then there will be approximately 800 characters per superframe buffer, which is then sent as a number of small HDLC frames depending on the internal DBA rate, or the size of the logical connection on the aggregate which is allocated to the channel. The underlying rule here is that no subframe or packet on the aggregate occupy more than 20mS.

The error-correction has a window size of 128, so it can correct up to 128 100mS buffers of **continuous** data, representing roughly 128Kbytes of data at 115,200bps. For surfing/browsing this would improve, since the data is much more sporadic.

In practice, only 75% of this buffer is used for safety reasons, before flow control is asserted at the port. This means that at worst case, the error-correction can survive up to 9 seconds without receiving a good frame.

The principle used for error-correction uses a NACK-only protocol. This means that a negative acknowledgement packet is sent back whenever a good frame is received out of sequence, since at least one frame in the middle must be missing. This NACK asks for the retransmission of frames starting with the first missing one.

Errors experienced on the link affect the whole 100mS superframe, which has to be retransmitted. When the error rate approaches 1 in 10e4 to 1 in 10e5, the error-correction will start to fail since every superframe will be received in error. The technique therefore starts to reach a useful limit at error rates of around 1 in 10e5.

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When the channel input buffer reaches 75%, as caused by a poor link, insufficient bandwidth or loss of carrier, the CTS signal on the port is dropped by the multiplexer. **This signal must be connected to the DTE for the error-correction to work.** Loss of carrier is then handled by asserting flow control to stop the input data. Realistically, this means that a channel should continue without data loss through carrier losses of up to at least 5 seconds PROVIDED it is configured so that it does not lose any data. **NOTE: “The Data Channel Flag” parameter on the SYSTEM menu must be set to “Follows Alarms” for the error-correction to work properly.** If the connection is lost for more than 30 seconds then the channel dumps all data, deletes the compression and restarts.

2.2 Compression

The data compression feature uses a derivative of the Lempel-Ziv algorithm with a code size of 12 bits. The algorithm runs above the error-correction layer, which is always enabled when data compression is selected.

The 100mS data buffers are compressed and fed into the error-corrector, which builds up a table of 11-bit codes according to the data coming in. If the code table ever fills up completely (i.e. all 2^{12} Code entries are used) then the table is reset and begins to accumulate all over again. Similarly, the compression is turned off whenever the throughput reaches 100%, in which case there is no gain achievable and the data is passed transparently.

The compressor also stops operating when the channel goes idle for more than 0.5 seconds and drops into transparent mode. This is to optimize the transfer of single characters or sequences of data less than four characters – the compression will only start again when a block of at least four characters are present in a buffer. If for any reason, the compressor turns off, perhaps during a sequence of incompressible data, then it will retry after 5 seconds. This allows it to pick up again to optimize transmission automatically.

2.3 General characteristics

Error-correction or compression cannot be enabled on channels below 4800bps to avoid excessive delays. This will be enforced when the rate is changed by operating in RAW mode.

The operation of the error-correction facility imposes a processing burden upon the host. Testing has indicated that a safe performance limit of up to four channels per chassis running at 57600bps should be observed to prevent any adverse effects on the normal functioning of the unit. Performance degradation may be indicated by a slowing of the supervisor update speed.