Test Report
Peak flow measurements
Comparison between SE400 flow meter and external flow meter.
B.Daniel 26th April 2001

Attachments:
Bruce tests 26Apr01.xls Comparative graphs of EDL vs filter flowmeter
Bruce tests 26Apr01.dat EDL log file

Introduction
Calibration was done using the IPZ breathing pump.
Filter flow meter consisted of a DP filter with pressure connection to measure pressure drop across the filter. Connected to logging hardware and software.
Filter pressure drop was calibrated against reference rotameter flow meter (in cal).
Comparative tests were done with the filter flow meter fitted to each of the two filter positions of the SE400. There was no discernable difference.
Breathing pump calibration was checked and found to be within calibration.
SE400AT s/n F012286, which has the higher accuracy flow meter fitted (as used in ADF trials). Fitted with DP filters, Chloroprene full face mask RF1, demand valve DV2.

IPZ tests
Tests were done at two breathing rates: 25 x 2.5 litres (62.5 l/min) and 40 x 2.5 litres (100 l/min).
Initial testing was to determine the accuracy of the filter flow meter against the breathing pump volume, by testing the SE400 in power-off mode:

Breathing rate	Expected peak	Measured Minute flow	Error	Measured Peak flow	Error
25 x 2.5 (62.5 lpm)	196	55.0	-12%	183	-7%
40 x 2.5 (100 lpm)	314	90.4	-10%	286	-9%

This test was repeated using a filter mounted directly on the breathing head, with the same results.
The indications are that the filter flow meter was reading low by approximately 10% to the nominal breathing rate.
The cause of this error is not known without further investigation.
It was decided to apply a correction to the filter flow meter results of +10%.

A series of tests were performed to compare the filter flow meter with the output of SE-Win in real-time mode (identical data used by extended data logger).
Minute flow and peak flow results were recorded as follows:
- SE400 Power-on, filter flow meter
- SE400 power-on, via SE-Win real-time mode
- SE400 power-off

The results were as follows:

Breathing rate		Measured Minute flow	Error	Measured Peak flow	Error
25 x 2.5 (62.5 lpm)	P/on filter	92.9		197	
25 x 2.5 (62.5 lpm)	P/on filter corrected	103.2		219	
25 x 2.5 (62.5 lpm)	P/on SE-Win	116.1	+12.5%	245	+12%
40 x 2.5 (100 lpm)	P/on filter	130.8		307	
40 x 2.5 (100 lpm)	P/on filter corrected	145.3		341	
40 x 2.5 (100 lpm)	P/on SE-Win	157.6	+8%	370	+8%

The results indicate that the flow meter built into this SE400 has an error of approximately +10%. This is consistent with minute flows and peaks.

Practical test
Bruce wore the SE400 fitted with EDL and connection to the filter flow meter, and performed general exercise over 3.8 minutes duration, including speech.
The results are graphed in the abovementioned spreadsheet. See also the EDL data log.

The first curve is raw filter flow meter data.
The second curve is filter flow meter data corrected by 1/0.9
The third curve is EDL data.

Results and discussion

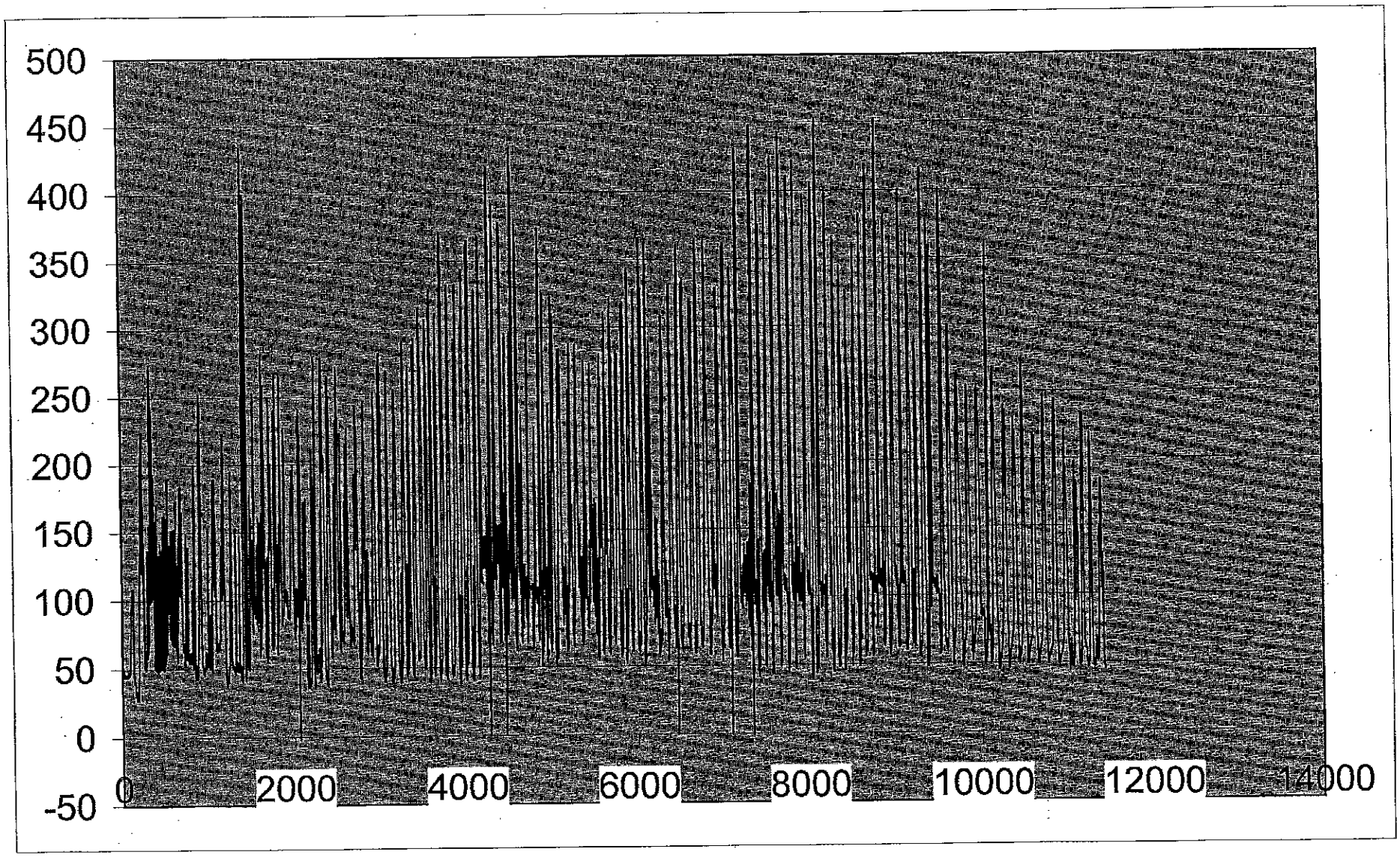
By comparing the corrected filter flow curve with the EDL curve it can be seen that the EDL curve siplays generally higher peaks, typically 10-30 l/min greater. This is generally consistent with the breathing machine results discussed above.

Minute flows.
Were calculated in Excel from the corrected filter flow meter data, by determining the total area under the curve, to be 123.5 litres.
The minute flow for the EDL data was 136.0 litres, which is 10% greater than the filter flows, consistent with earlier tests.

Because the error of approx +10% is evident throughout the above results, for minute flows and peak flow rates, it can be concluded from these results that the error is a general calibration error, and there is no evidence of an error specific to peak flows. The error of +10% is within tolerance for the SE400 flowmeter.

Note that the filter flowmeter, which measures simply the pressure drop across a filter/cartridge, is not susceptible to transient errors. I am therefore confident that these curves are a good approximation of the actual flow rates through the filters.

Note that there are some spikes evident on the EDL trace which are not eveident on the filter flow meter trace, visible in the first few seconds of data. We have not identified the cause of these. Further investigation is required. While the EDL trace is certainly "noisier" than the filter flow meter, the minute flows appear to be unaffected.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