LabPod: A high precision system for controlling storage atmospheres and measuring respiration.

Presented by

David Bishop Storage Control Systems Ltd Kent UK

Co-Authors: Dr Deborah Rees[2], Dr Richard Colgan[2] , Andrew Duff[1], Karen Thurston[2]

[1] Storage Control Systems Ltd Kent UK [2]University of Greenwich Kent UK

LabPod.

- Self contained system for Controlled Atmospheres from 0.1% to 21% Oxygen and 0.1% to 20% CO2
- High precision CA control
- Automatic measurement of respiration rates
- 65kg Produce capacity

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LabPod.

- Multiple Pod’s in one cold room
- Controller with capacity for 32 Pods
- Simple connections with CAN network
- Liquid gas seal

LabPod mini

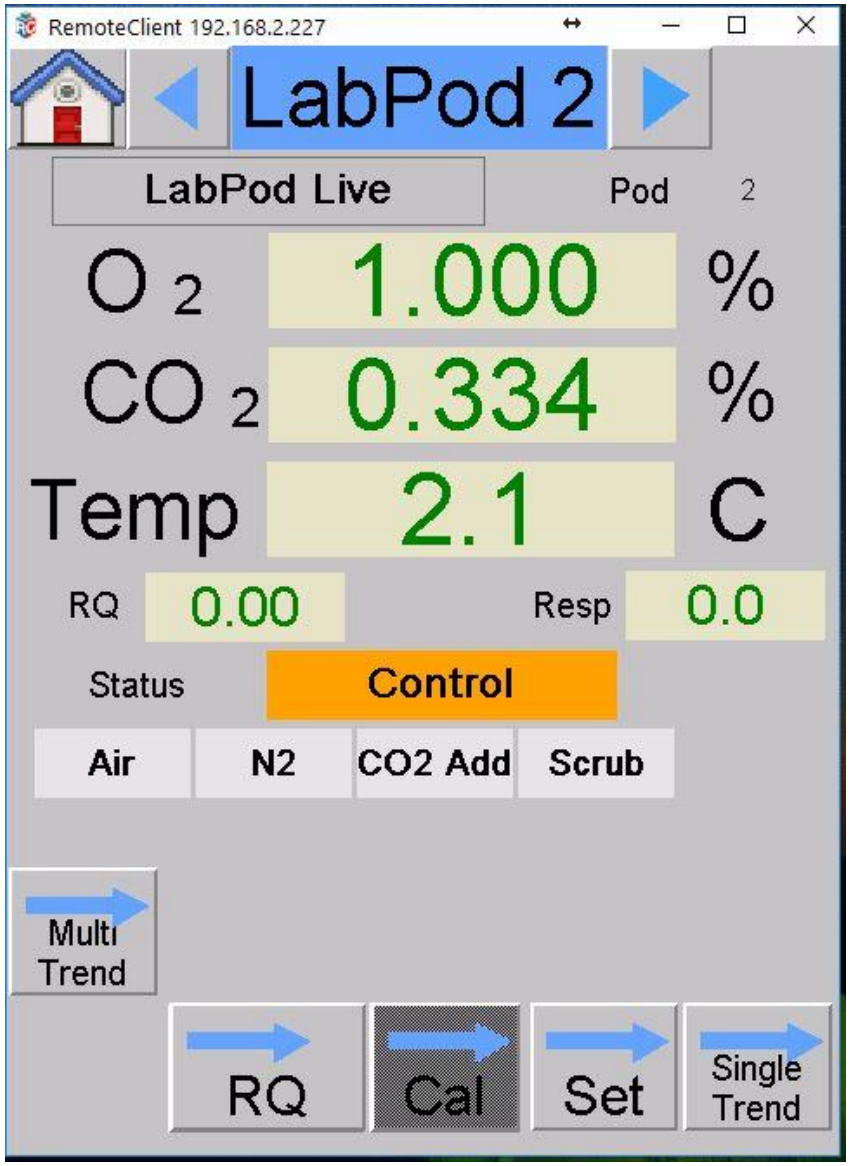
- Same features as LabPod
- 10 Kg Produce capacity
- Very high resolution built in gas analysers
- Internal circulation fans
- High accuracy temperature probe

Gas regulator

- Automatic atmosphere control
- Uses N2 ,Air and CO2 to maintain CA

Master controller

- Touch screen controller
- Up to 32 Pods with individual control
- Network based for many communication and data storage options



Temperature control

- Located in cold room of required temperature
- Built in probe for temperature recording
- Differential temperature between inside and cold room > 0.3 degC with respiring produce

Content	Temperature deg C
empty pod with cover removed	4.8
empty pod	4.9
Lettuce in CA	5.1
Lettuce in CA	5.0

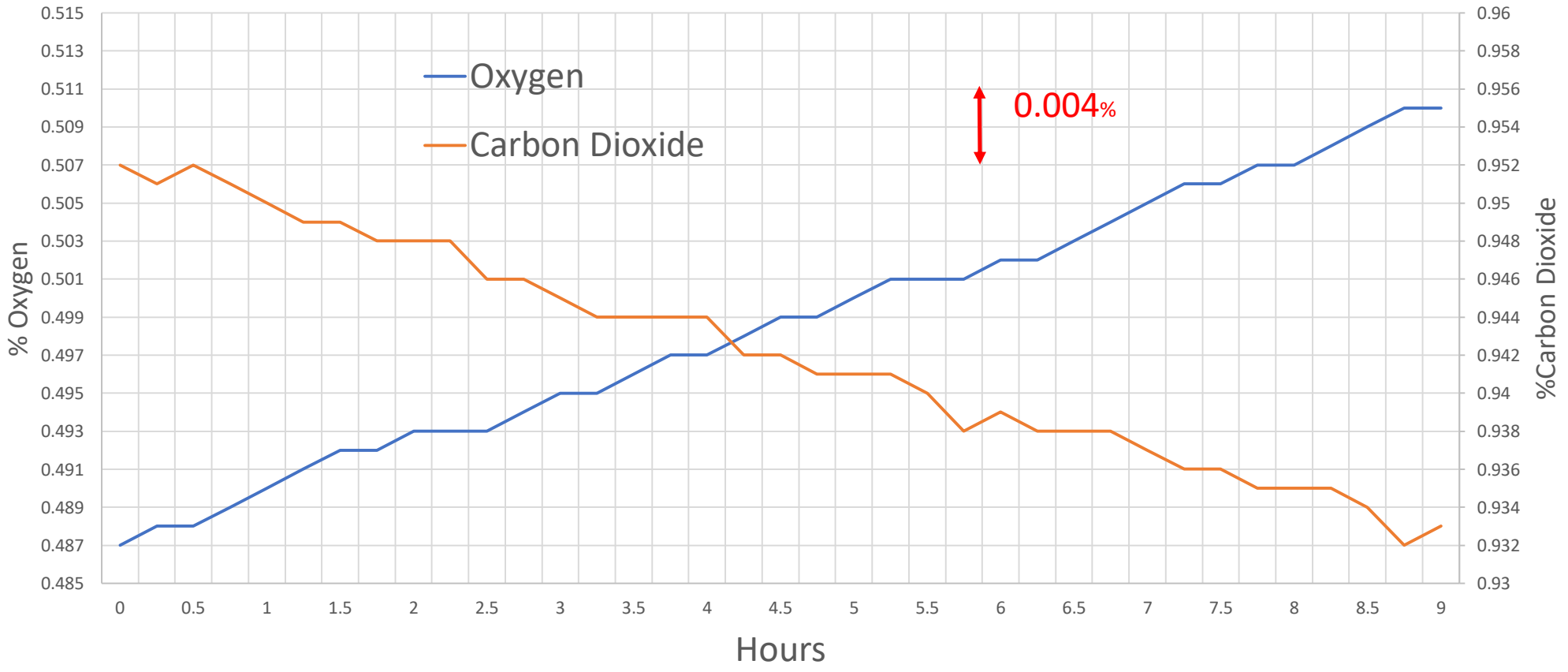
4 Pods in one cold room recorded at the same time

Gas leakage and measurement stability

For accurate respiration measurements it is important that no air leaks into the enclosure and the measuring gas analysers have a high stability and good resolution.

To verify, tests were carried out in an empty Pod with no respiring produce and with a static atmosphere of a nominal 0.5% Oxygen and 0.8% CO_2

Diffusion through the Water seal



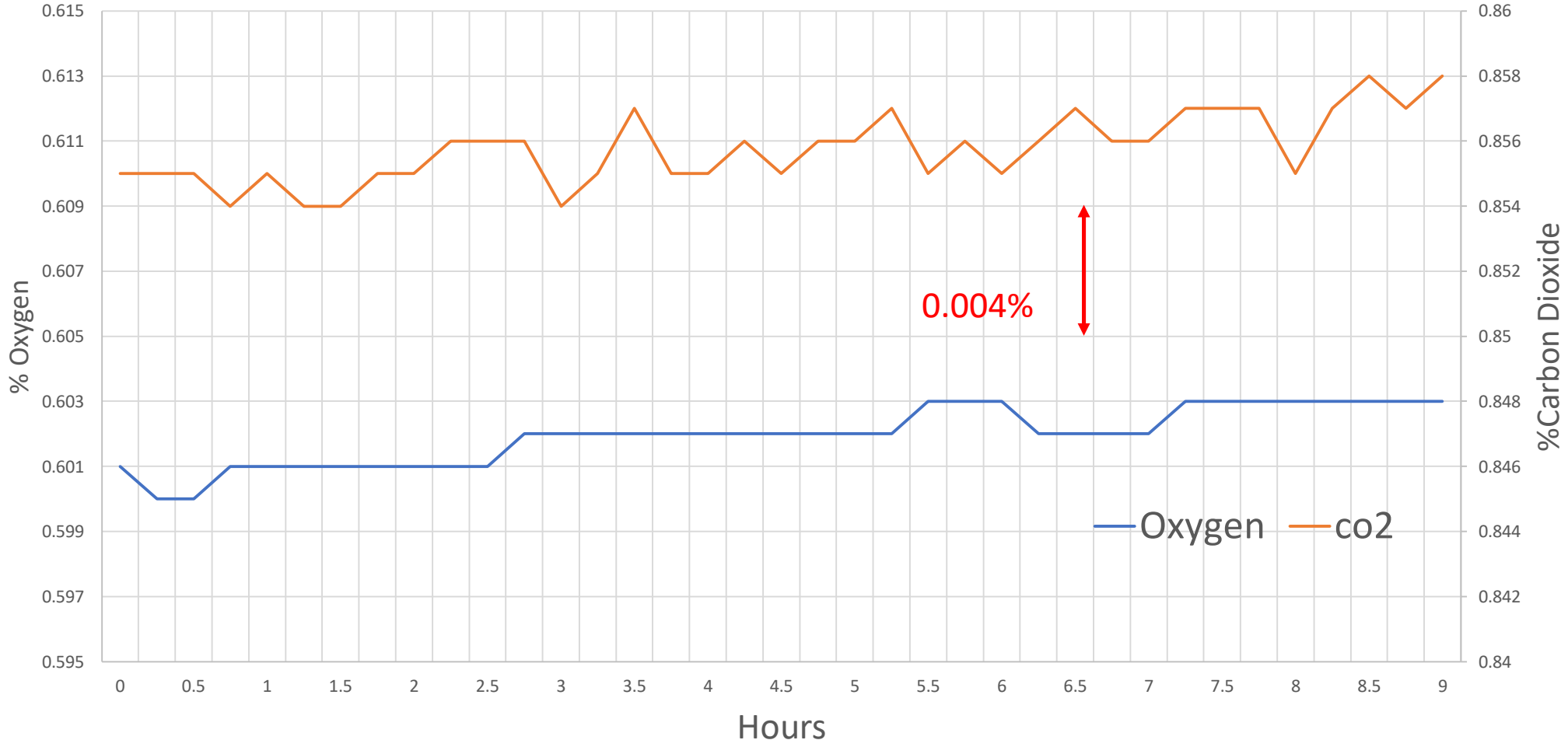
Gas leakage and measurement stability

These tests indicated that despite there being no measurable leak in the Pod the Oxygen and the CO2 were still not stable.

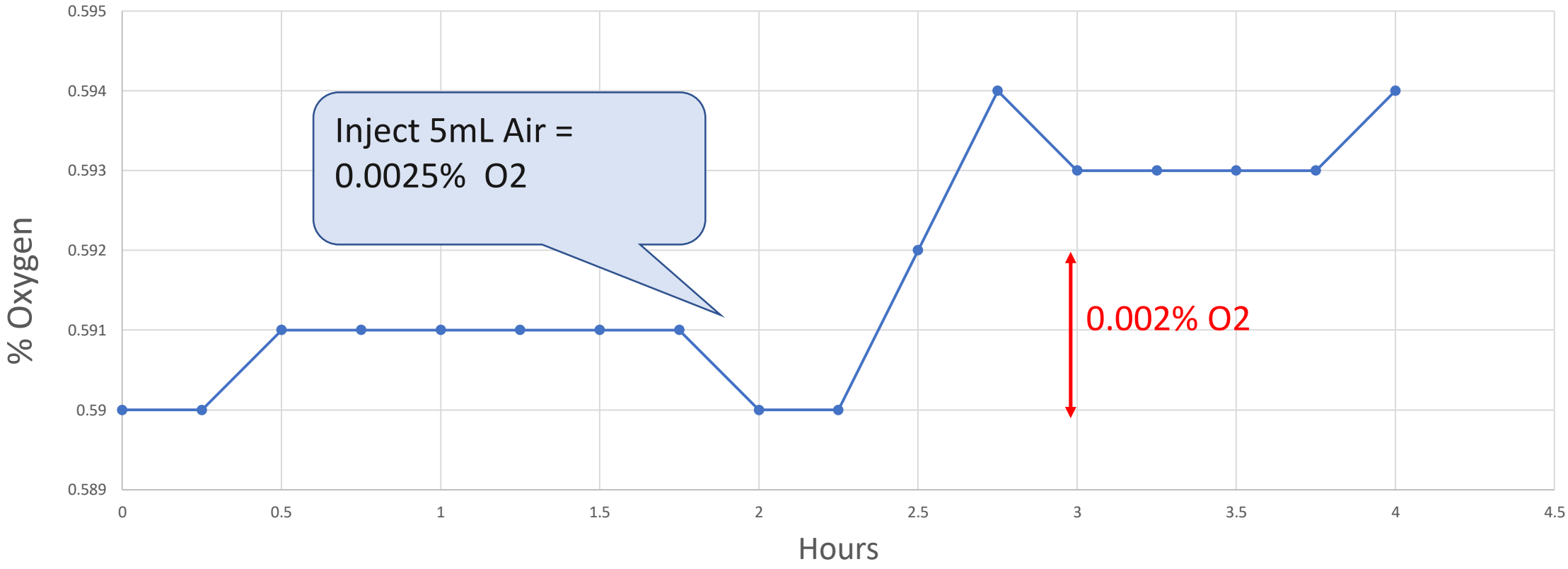
Interestingly the leakage rate for O2 and CO2 were similar. An air leak has a much greater influence on the O2.

The addition of 3mm of vegetable oil floating on the top of the water seal solved the problem.

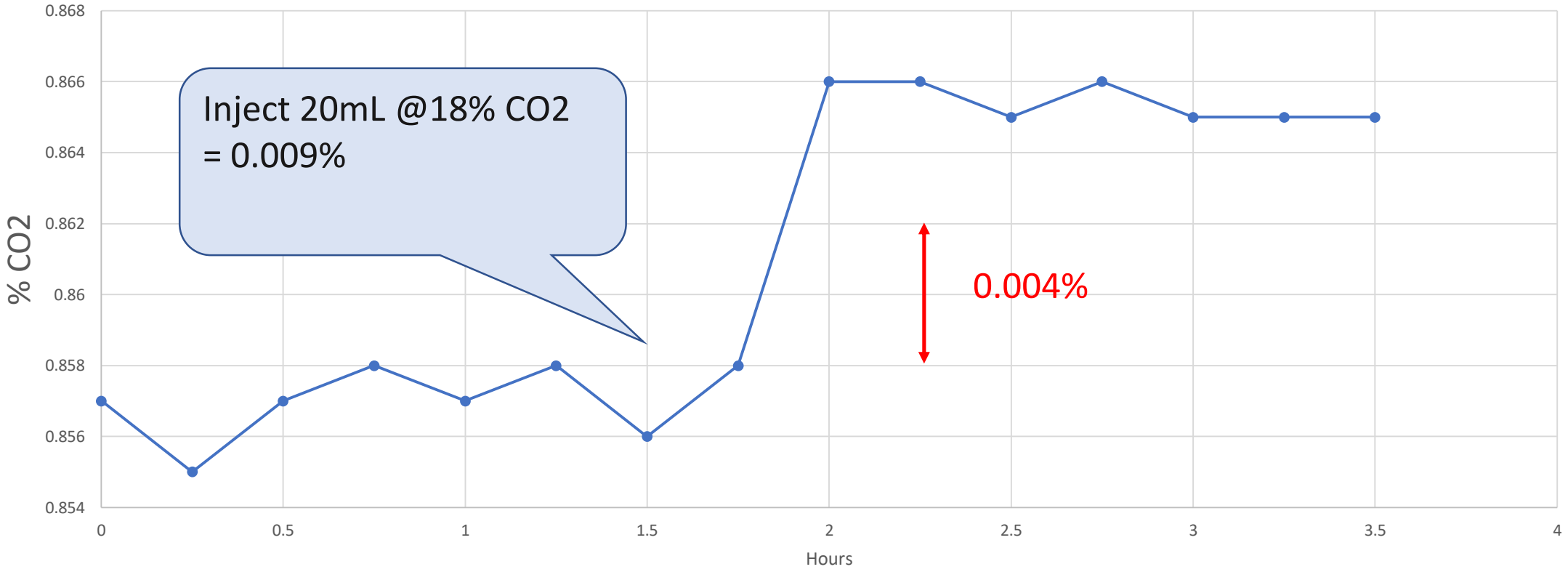
Gas leakage and measurement stability



Oxygen Analyser Resolution in Pod



Carbon Dioxide Analyser Resolution in Pod



Sensitivity and Stability

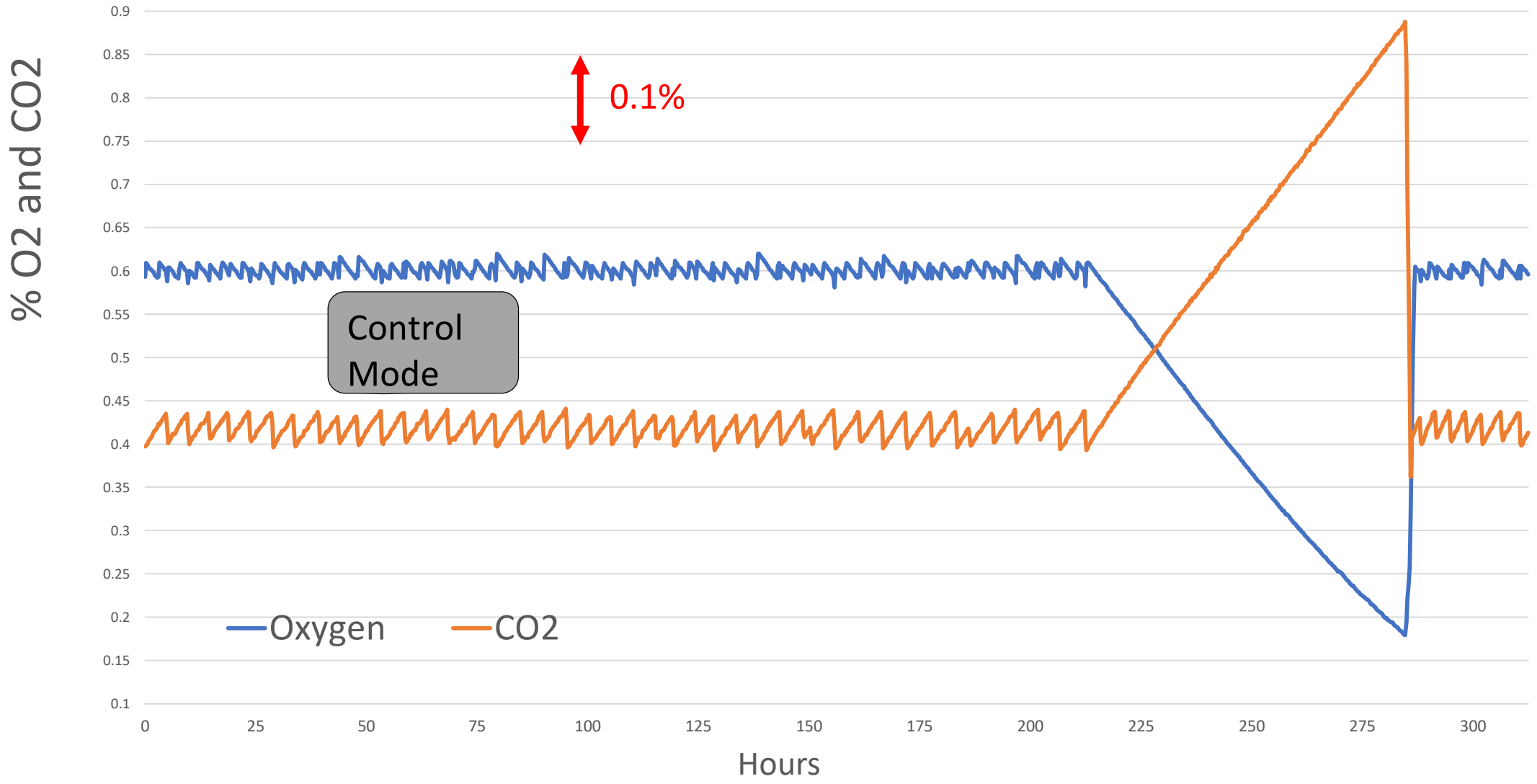
Fruit in very low Oxygen can have respiration rates as low as 0.3 mL/kg/hr which produce gas level changes in the order of 0.005%/hour.
This illustrates the need for the very high sensitivity and stability offered by the LabPod.

Previously available CA laboratory systems typically measured and controlled with a resolution of 0.1%

Control mode

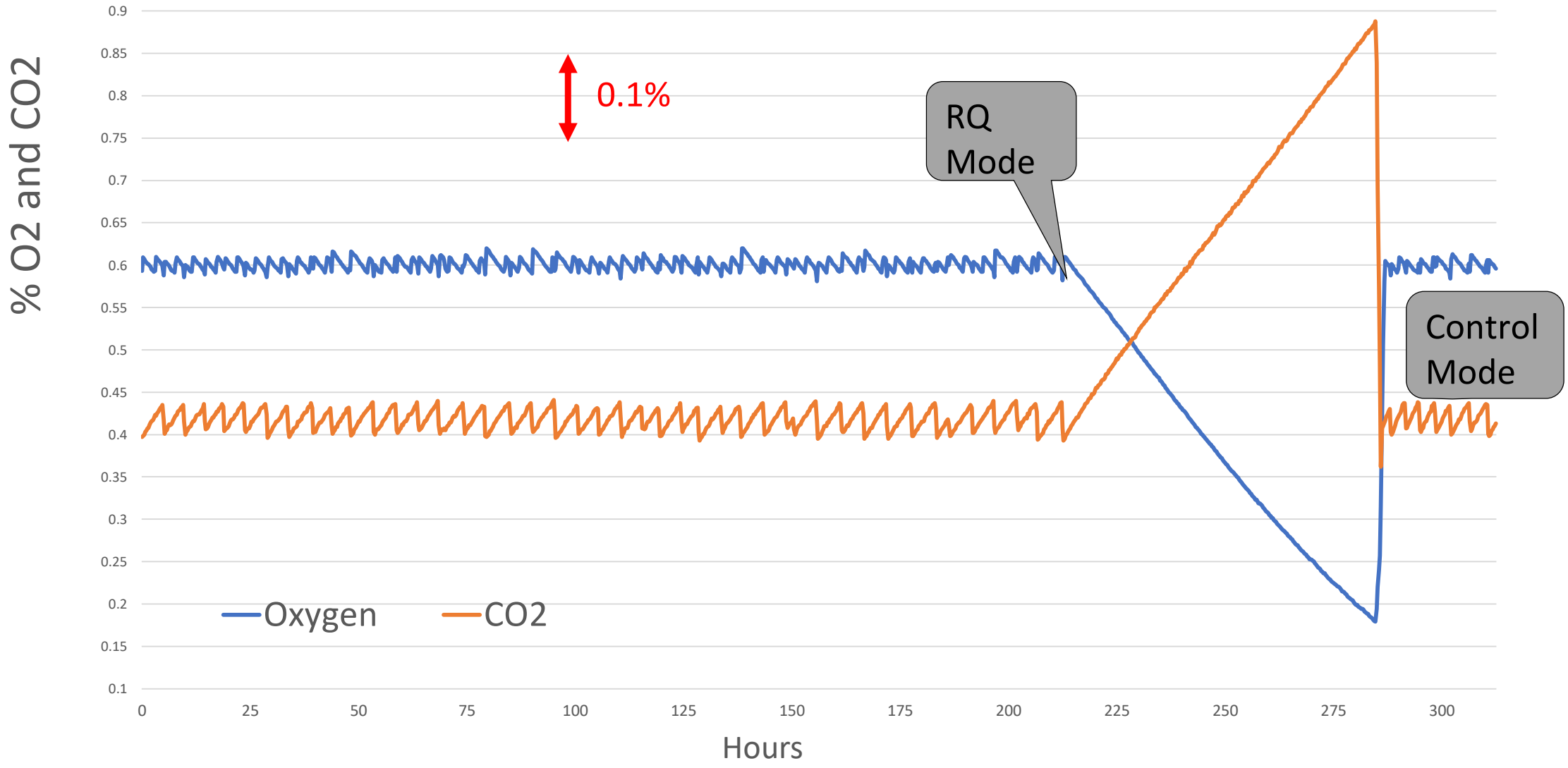
To initially establish the required CA conditions within the Pod and then maintain the levels required against the background of the respiring produce the system runs in control mode.

The addition of N2, Air and the occasional CO2 is carefully and intelligently controlled by the LabPod to maintain the desired Oxygen and CO2 to within better than 0.05%


% O2 and CO2
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.1%
Control Mode
Oxygen
CO2
0
25
50
75
100
125
150
175
200
225
250
275
300
Hours

RQ mode

To measure the respiration and determine the RQ the control mode is halted and the increase of CO2 and the reduction in Oxygen is tracked and recorded.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Hours

RQ mode

This RQ mode is left to run for a pre-set period of time equivalent to a change of approximately 0.1% Oxygen.

The data during this time is entered into a table and at the end of the test the data is examined and the best line fit calculated using the “least squares” method (LINEST in Excel) to give a result in % change/hour

RQ mode

Using the calculated O2 and CO2 change/hour and from the previously determined free air volume and the weight of the produce the respiration calculations can be made, displayed and recorded.

Oxygen Respiration = mL/kg/hr

CO2 Respiration = mL/kg/hr

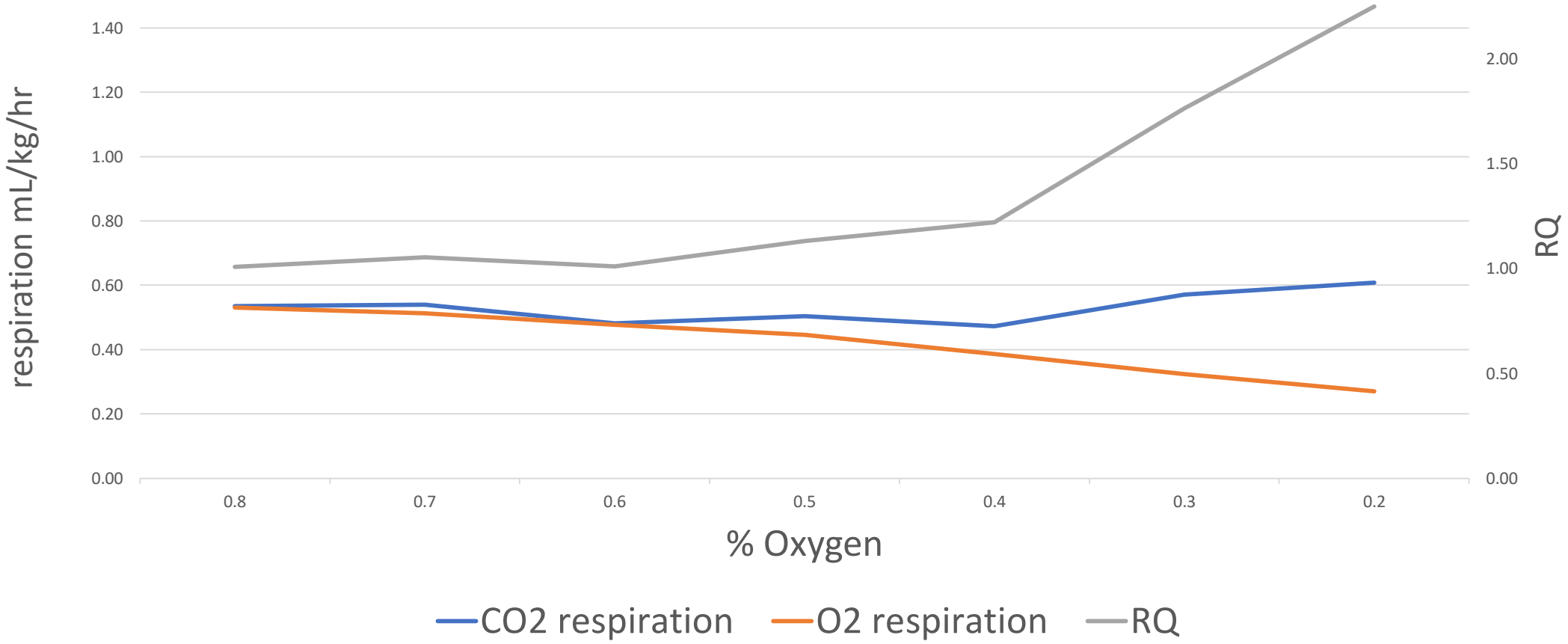
RQ = CO2 Respiration/ O2 Respiration

Determining the RQ Threshold

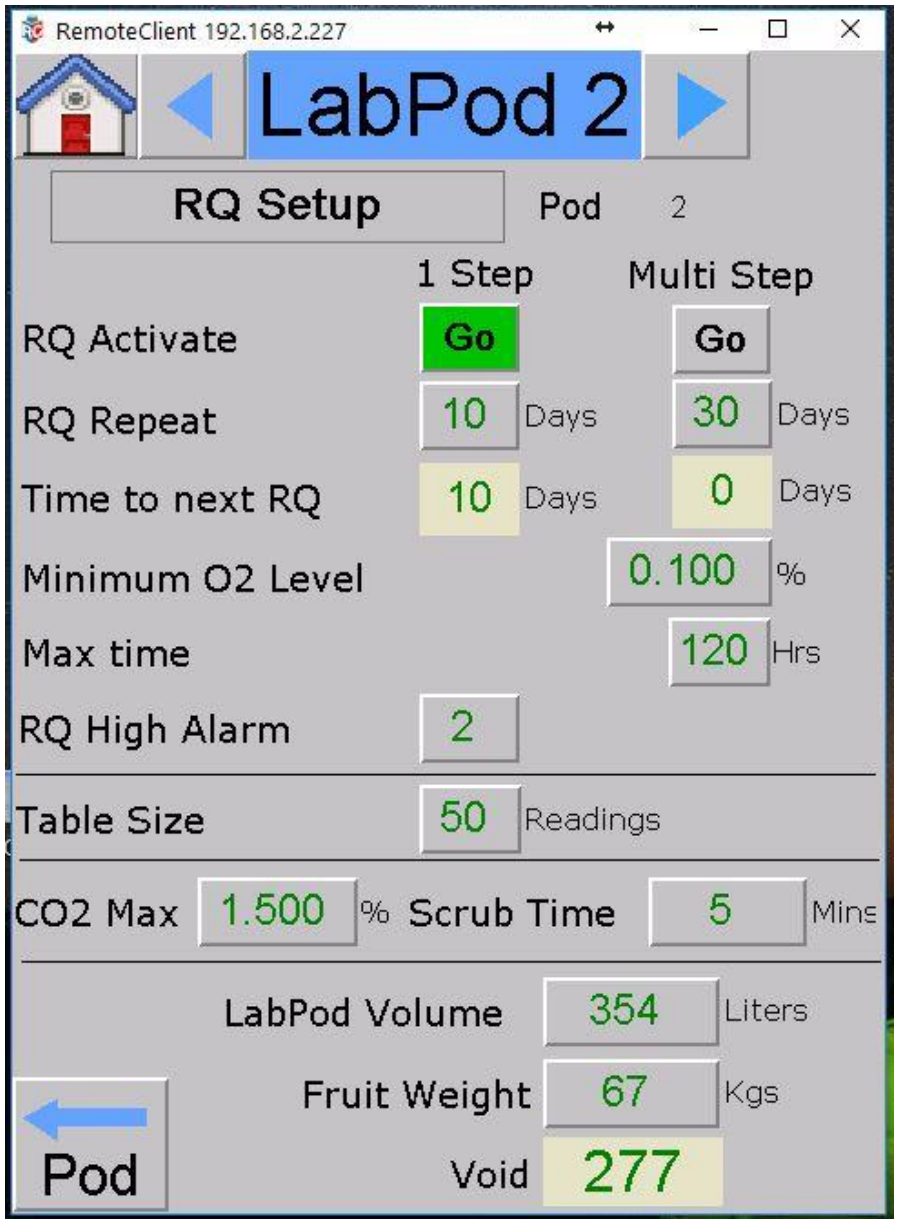
It has been shown by others that the Anaerobic Compensation point is indicated by an increase in the measured RQ as the Oxygen is reduced.

To measure this the LabPod can perform multistep RQ measurements so that the oxygen is reduced by about 0.1% for each step. This continues until a pre-set low oxygen is reached.

Determining the RQ Threshold 75kg Braeburn apples



RQ mode


RemoteClient 192.168.2.227
LabPod 2
RQ Setup
Pod 2
1 Step
Multi Step
RQ Activate
Go
Go
RQ Repeat
10 Days
30 Days
Time to next RQ
10 Days
0 Days
Minimum O2 Level
0.100 %
Max time
120 Hrs
RQ High Alarm
2
Table Size
50 Readings
CO2 Max
1.500 %
Scrub Time
5 Mins
LabPod Volume
354 Liters
Fruit Weight
67 Kgs
Void
277
Pod

LabPod

- Precise control of CA over long periods
- Accurate, simple and regular measurements of respiration
- Automatically determine RQ threshold
- Extensive data recording facilities

SafePod

- For Respiration and RQ testing in commercial CA rooms.
- Uses the Room CA as a baseline
- Does not expose the complete room to very low oxygen.
- 60kg capacity for a good sample size