



## Service Troubleshooting Guide for: Body Box, SpiroAir and TransAir Instruments

### **1.0 Instrument Communication**

Go to the diagnostics and verify that the computer is receiving signals from the device.

- If the signals are all zeros or the gas calibration values are extremely low or high; exit CompPAS, power down the device, and unplug the computer cable (removes the 5 volts from the computer).
- Reverse the process, plug in the computer cable, power up the device, and reopen CompPAS. Retry the calibration.

### **2.0 Questions of Calibration for Flow Pneumotachs**

If either F/V or DLCO syringe calibrations do not pass ATS acceptability:

1. Check gas cylinder pressure (50 – 70 psi on the output)
2. If the values are high:
  - Replace or clean the pneumotach screen.
  - Perform a new span calibration if necessary
  - Check pneumotach red/blue hoses on the pneumotach
3. If the values are low:
  - Check syringe and hose for leaks
  - Remove the bags and repeat the calibration

When performing a new span factor always check the values in either the book or the calibration history screen.

- If they have deviated from the number 1.00 by more than (5%) then clean or replace the pneumotach screen.  
The span factors should be re-run and confirm the values once again
- If the span factors are still off then create a new linearity table

### **3.0 Questions of Gas Calibration**

If the gas calibration does not pass:

1. Check gas cylinder pressure (50 – 70 psi on the output)



2. Check that the gas cylinder values are the appropriate DLCO gas: Typically - 0.300% Carbon Monoxide, 10.0% Helium, 21.0 % Oxygen, and balance Nitrogen
3. Replace the inspiratory bag and re-try
4. Remove absorber container and clean the inside grooves of the red rubber caps and re-try. Be sure that there is space above the absorbers to allow the caps to seat properly. Also, make sure the lever is completely engaged, hitting the bottom plate on the absorber column

If gas calibration continues to fail, check the error messages to see if it indicates which analyzer is at fault.

Typical voltage values for the analyzers are as follows:

- Helium: 4 - 8 volt range, typical voltages are 5.5 - 6.5. Below 4 volts the software will generate an error message
- Oxygen: 1 - 8 volt range, below 1 volt will flag the software and indicates that the cell should be replaced
- CO: 4 - 8.5 volt range, below 4 volts the software will generate an error message

#### HELPFUL TIPS:

- Be sure that the Oxygen channel zero in the Configuration tab of Diagnostics is set. To do this: unplug the cell, Click [Set to current], and be sure to Click the [Apply] button
- If the Helium voltage is normal and the CO voltage is low, it indicates that the CO cell is showing signs of age. If CO voltage is not less than 4 volts run a master gas calibration
- If the CO cell is below 2 volts and appears slow in response, it needs replacement
- Whenever the Helium voltage is low, it is likely that there is a leak in absorber or inspirate bag or both
- If during calibration the Oxygen tracing is a flat line then the cell has failed

#### **4.0 Questions of Cabin Pressure Calibration**

If the box calibration fails:

1. Check gas cylinder pressure (50 – 70 psi on the output)
2. Make sure the door is properly closed
3. If possible, close all doors and windows in the room. Allow the box 2 minutes to equilibrate before running box calibration
4. In the device configuration, check the cabin pressure settings, Strokes can be set as high as 5% and Series can be set as low as 7



5. Very Important: If you change the box electronics module you must go to Diagnostics to change the Box Master Calibration

## **5.0 Questions of DLCO Results**

If Diffusion Results are being questioned:

1. Ask if the issue is common to all patients?
2. Is this recent or ongoing?
3. Are the chemicals fresh in the absorber? If the chemicals are exhausted, the helium gas values will be in error causing both lung volumes and DLCO to be erroneous
4. Has the gas cylinder recently been changed?
  - a. Important to check the oxygen values on the cylinder. Oxygen values higher than 21% will decrease diffusion
  - b. A good way to check the oxygen value is to go to diagnostics and click [Sample Room Air], the value displayed should be very close to 21%
5. Is there a leak in the system?
  - a. Check the Helium voltage history in Calibration
    - No change indicates no leak
    - If it has changed refer to section 3.0
6. Was enough gas collected in the Expiratory bag?
  - a. Check the gas analysis waveform, check that the gases reached a peak without any drop off.
    - Washout and sample volumes can be adjusted
7. Was there enough gas in the Inspiratory bag at the start of the test?
  - a. Check the gas analysis waveform, check that the gases reached a peak without any drop off.
    - Note: on ComPAS versions above 1628 the gas cylinder value will be used if insufficient gas is in the Inspiratory bag.
  - b. If the Inspiratory bag is consistently under filled, adjust the fill speed and percent of VC filled in Diagnostic Configuration. (Decrease the number in the Fill Speed to increase the volume in the Inspiratory bag.)
8. Is the expiratory bag holding a vacuum after being emptied and up to the point that the patient blows into the bag?
  - a. If not change the expiratory bag
  - b. If that does not solve the problem, check the patient expiratory valve is sealing



9. Check the volume inspired.
  - a. If the DLCO is elevated check to see if volume inspired is above 100%. Some labs use bronchodilators ignoring the fact that it can increase the inspired volume
  - b. If less than 85% the test is suboptimal
  - c. Be sure that the patient is truly empty before hitting the spacebar
  
10. Consider Alveolar Volume
  - a. If Alveolar Volumes are repeatedly normal but the DLCO is still low, check the function of the CO cell as noted in section 3.0. (Check the gas calibration history for consistency of the CO voltage)

### **Questions of N2 Recovery Lung Volume Results**

If the lung volumes by Nitrogen Recovery (DLCO) are questioned:

Note: Nitrogen recovery demands very accurate Oxygen and Helium measurement. The N2 values come from  $100 - \text{He} + \text{O}_2 + \text{CO}$ . With CO being such a small component (0.300%) it has no bearing on N2 lung volume results!

1. Review the DLCO test variables in the spreadsheet. The difference between the measured Inspired and Expired values for Oxygen should be greater than 1%. (Inspired - 21% and Expired 18 – 12%). If less than 1% differential it is almost certain that the O2 cell has failed
2. Leaks should always be considered and all conditions described in section 5.0 need to be checked
3. Are the chemicals fresh in the absorber? If the chemicals are exhausted, the helium gas values will be in error causing both lung volumes and DLCO to be erroneous
4. It is important to understand that this method of lung volume measurement can be compromised in severe cases of COPD. Alveolar CO2 has to be assumed in this method and therefore patients likely retaining CO2 are not candidates for this method of lung volume measurement. The preferred methods for lung volume measurement are plethysmography and helium dilution
5. Was the patient using supplemental O2? Patients should be removed from supplemental Oxygen a minimum of 10 minutes prior to any DLCO testing



### **Questions of Spirometer Set-up for Helium Dilution**

If the spirometer volume continues to climb beyond 6L during the set-up for helium FRC:

1. Most likely helium or oxygen are leaking into the system. To determine which one:
  - a. Run the set-up and then turn off the helium pressure and REMOVE the blue helium high-pressure hose. If the volume ceases to climb then the leak is on the helium solenoid.
  - b. Run the set-up and then turn off the oxygen pressure and REMOVE the green oxygen high-pressure hose. If the volume ceases to climb then the leak is on the oxygen solenoid.
  - c. Sometimes the output pressure of the cylinder regulator is inaccurate. Set the helium and oxygen pressures to 20psi and see if that corrects the problem. Note: The DLCO gas pressure **must be** left at 50psi because that is used to drive the piston valves.

### **Questions of Helium Dilution Lung Volume Results**

If the lung volumes by Helium dilution are questioned:

1. If CompAS detects a leak then check the following:
  - a. Patient hoses
  - b. Large CO<sub>2</sub> absorber o'ring
  - c. Chemical absorber (Soda Lime and Drierite)
  - d. Springs in the patient valve
  - e. Cylinder pressure
2. System Dead Space
  - a. Check the System Dead Space (typically between 3.0 and 5.0 liters)
  - b. Run a leak test and system dead space to see if the value reproduces. If not see possible leak causes above
3. FRC quality Control
  - a. Run and FRC Quality Control in Diagnostics to see if the error reported is less than 5% and is reproduced on subsequent checks
4. Turbine Absorber Unit
  - a. Disconnect the hoses and use the Diagnostics to confirm that both turbines are functioning
  - b. Confirm that the CO<sub>2</sub> scrubber chemical is fresh. No more than 5 FRC studies should be run without changing the chemical
5. Oxygen Compensation
  - a. If the oxygen compensation has been appropriate, the FRC tidal volume tracing should be more or less parallel
    - If the tracing is always climbing, check to see if the O<sub>2</sub> solenoid is sealing