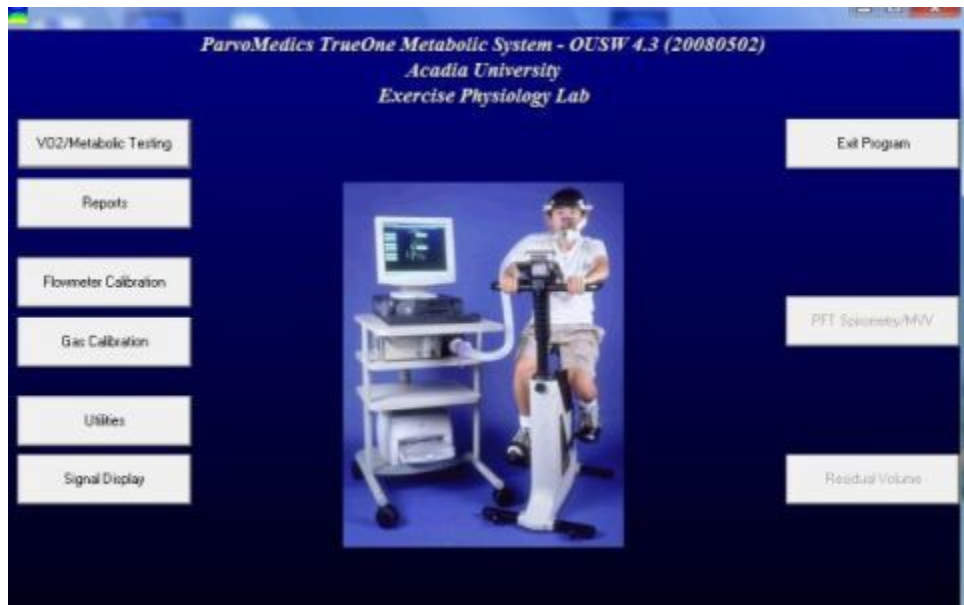


Directions for Setup, Calibration and Testing of the Parvo TrueOne Metabolic Cart

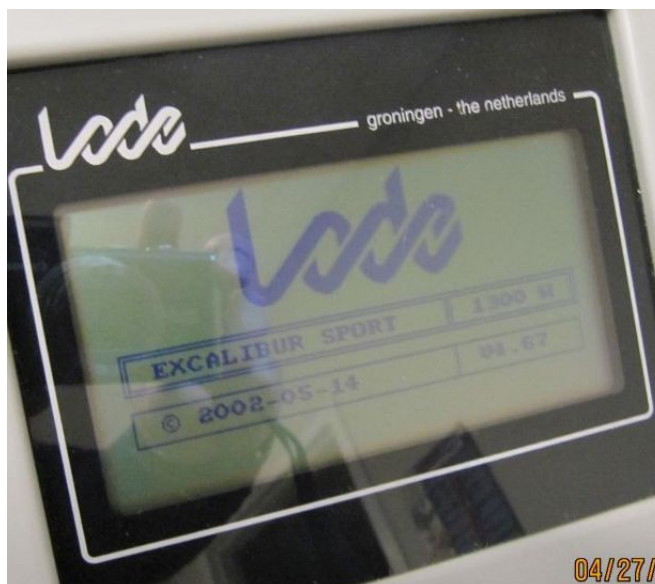
Setup:

- Turn on main power switch (green switch) on the back of the unit
- Turn on Pump/Heater switch on the front of the unit (circle with dot in the middle is the On position). This turns on the oven for the pneumotach. You must wait at least 20 minutes for this to come up to temperature before any testing is done
- Turn on computer. The TrueOne software should open. Click the Desktop icon if it does not open on boot up



- Turn on the device used for testing. The treadmill power switch is on the front. Treadmill is connected to COMM 1 on PC
- The Lode WLP programmer drives the Lode Excalibur ergometer. The Lode WLP programmer is connected to COMM 2 on PC. The power switch for the Lode WLP programmer is on the back

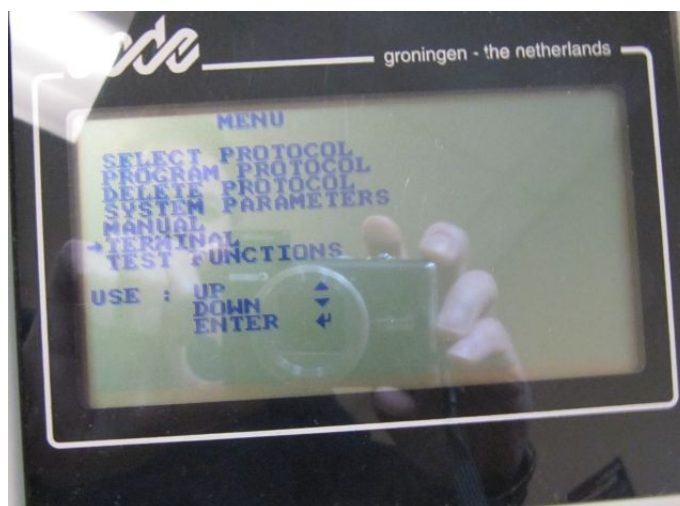
- You will see this when the programmer powers up



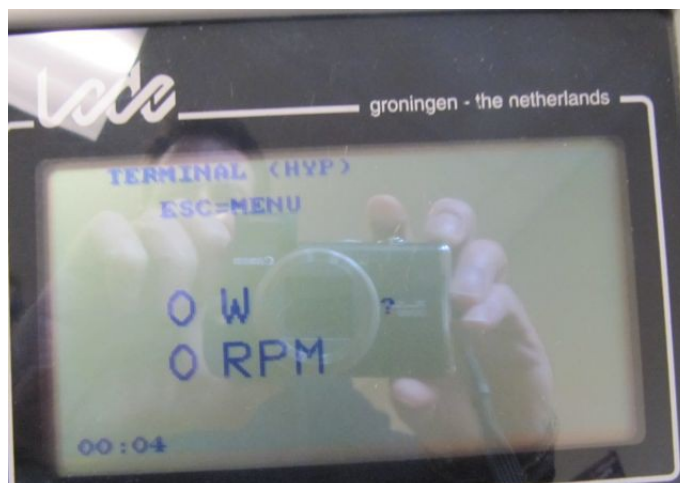
- Push Enter. You will see this Menu appear



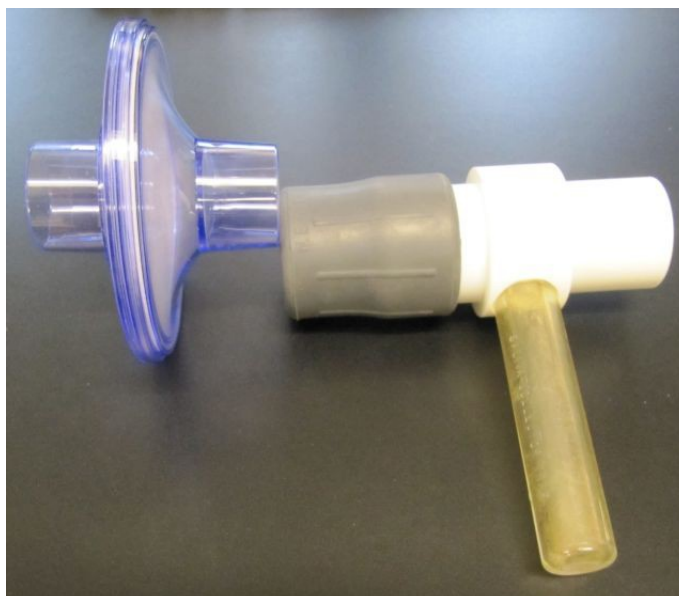
- Push the Down arrow and press Enter to choose Terminal



- This will appear on the screen. The Excalibur ergometer is now ready to be used for testing

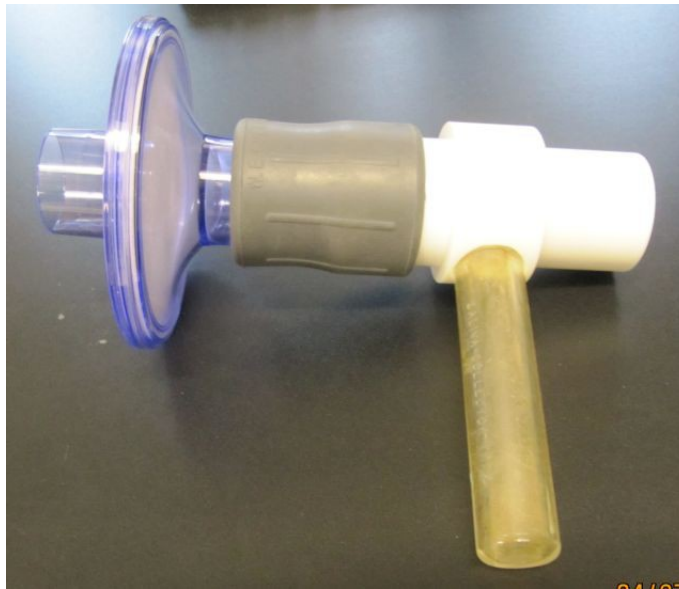


- Get the grey connector, the T-connector, a purple filter and the calibration mouthpiece (this has a metal bracket attached) from the cabinet assembled and ready to calibrate the cart. The grey connector is ribbed on the inside



- The grey connector for the T-connector, the T-connector and the grey connector to interface the 3-Litre syringe and the calibration mouthpiece are to be kept in the Ziploc bag when not in use (cabinet)

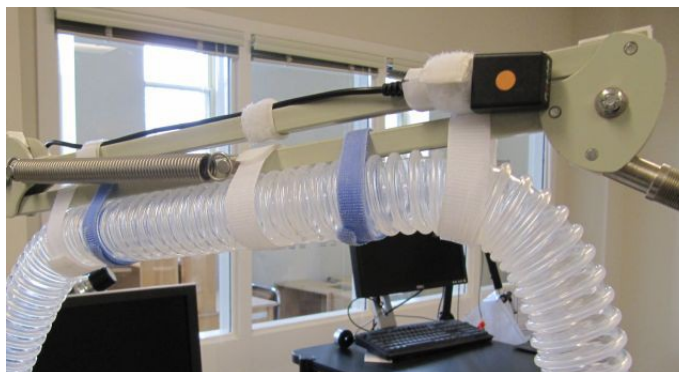
- Connect the purple filter to the T-connector using the grey connector. Gently push the grey connector on to the T-connector. Then gently push the purple filter into the grey connector. Ensure the tapered side of the purple filter is the side being attached



- Attach this assembly to the pneumotach. Again all that is needed is slight pressure to make the following attachment. Ensure that the mixing chamber (tinted rectangular box) does not fall to the floor. Grab the white connector (not the round over) of the pneumotach and gently push the assembly (purple filter end) together to make the connection



- The hose can be attached to the reticulated arm using Velcro straps. The black device (with the orange dot) is the heart rate monitor receiver (the chest strap on the subject is the transmitter). Take the far end (from the cart) and attach to the T-connector/pneumotach assembly. Ensure the hose is parallel to the floor.



- The hose can be attached to the T-connector assembly.



- The result will be something like this. The weak point is the hose mating with the T-connector. Ensure a good connection. If this separates during testing, continue testing and re-attach as quickly as possible



- If you feel the pneumotach, it should be getting very warm to the touch. Ensure at least 20 minutes has elapsed to allow proper temperature to be achieved
- All of the mouthpieces/full masks have arrows indicating input and output airflow. The calibration mouthpiece has a metal bracket attached to the backside of it. You do not have to disassemble this mouthpiece for disinfecting like we do with testing mouthpieces/full masks used on subjects

- The smaller grey connector, that is smooth on the inside with a ridge halfway down the middle, is used to interface the calibration mouthpiece and the 3 liter syringe



- Attach the grey connector to the syringe



- Attach the other end of the hose to the calibration mouthpiece. Ensure you are on the output valve when making this connection



- The three similar mouthpieces have arrows on the top (beside the black cap) indicating input/output. The full face masks have the same indicators. The output is the clear end, the input is the white end

- We want to keep a tight seal. Using the cart, we can lay the 3 liter syringe flat on the cart while interfacing it with the calibration mouthpiece that is attached to the hose . We will keep the setup like this for the calibration process



- Turn on the calibration gas cylinder. Turn the metal knob on top of the cylinder counterclockwise 1 and 1/2 turns. Do not adjust the Praxair black plastic knob. This is for the Fine indicator and has been preset.
- The Fine and Coarse indicators will deflect to values seen below. The Coarse will deflect to the total O₂ and CO₂ in the cylinder, the Fine will deflect to a range between 10 – 15 psi. The cal gas hose can be left connected to the unit right up to testing (and during testing). The gas mixture for this cylinder is 16% O₂ and 4.05% CO₂



- As you can see, the Fine indicator is showing 10-12 psi. This is too high to input to the Cal Gas port on the metabolic cart. We need to bleed off the excess until the needle drops to the preset level of 3 psi. (I have preset this level already).
- Find the end of the calibration gas hose and gently push on the plastic connector/opening at the end. You should get air escaping and the Fine indicator needle should fall to 3 psi.
- **Ensure this excess has been bled off before attaching the cylinder hose to the Cal Gas port on the metabolic cart.** The internal circuitry will be damaged if the cylinder hose attached to the Cal Gas port of the metabolic cart exceeds 3 psi
- **The Cal Gas calibration is key to accurate testing results.** You can run the gas calibration as many times as needed during calibration. It is recommended to run the cal gas calibration one last time just before (gets on the treadmill or ergometer) testing the subject. We need to ensure the CO₂ levels the Parvo cart is reading for room air have not floated above 3-4%. If this happens, the RER value in the test window will be inflated when the test starts

- Here is what you need to see on the Fine dial after bleeding off the excess. The coarse indicator will not change



- Now you can attach the calibration gas hose/white connector from the cylinder to the Cal Gas Port on the metabolic cart. This is located on the back of the unit. It is to the left of the Room Air port and just above the O2 Range switch. You must hold the front of the unit, so it does not fall to the floor, while bringing the calibration gas hose/white connector to the Cal Gas port. Stay parallel to the floor and push the connector straight in the port connector. To remove, push down lightly on the metal clasp and pull the calibration gas hose/white connector away



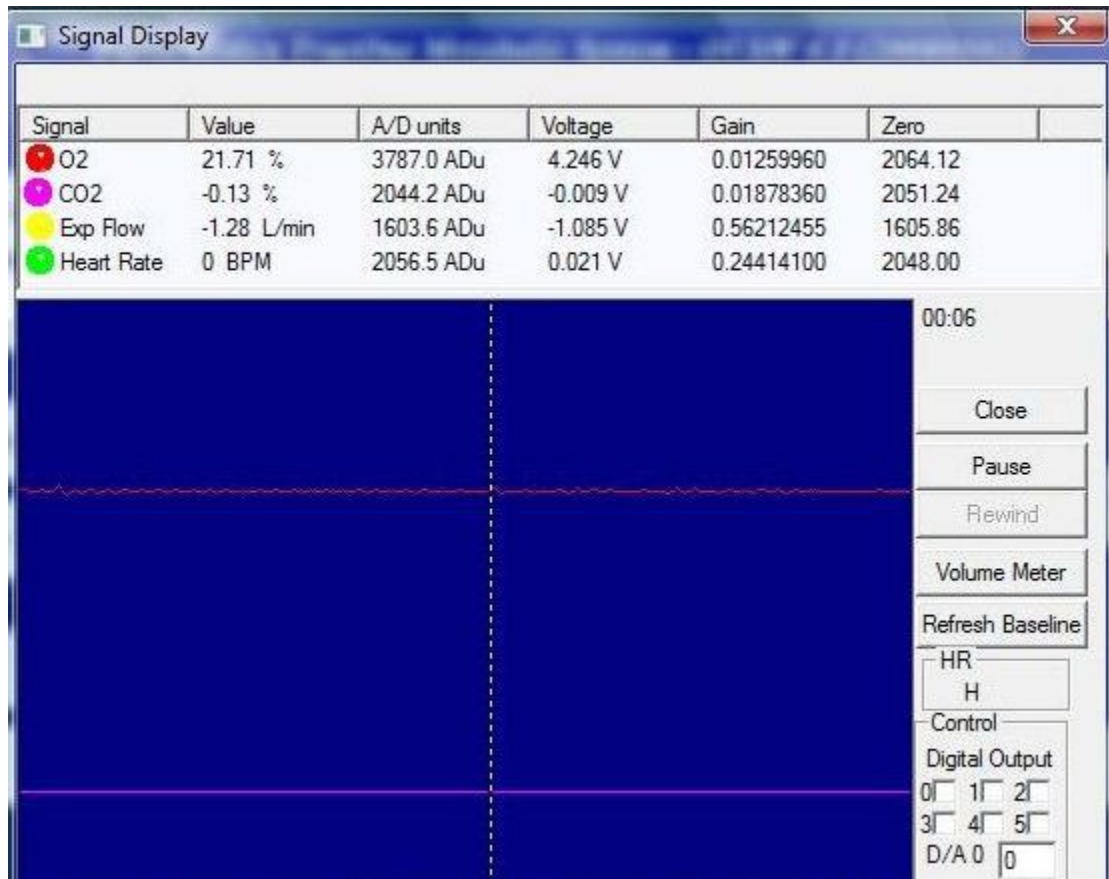
- This is what you want to see. This connection can be left intact up to and including testing. Remove when you are finished. Turn off the calibration gas cylinder by turning clockwise hand tight. Then bleed of the excess left in the regulator and the calibration gas hose/white connector by gently pushing on the plastic connector/opening at the end. Bleed off until both indicators read zero



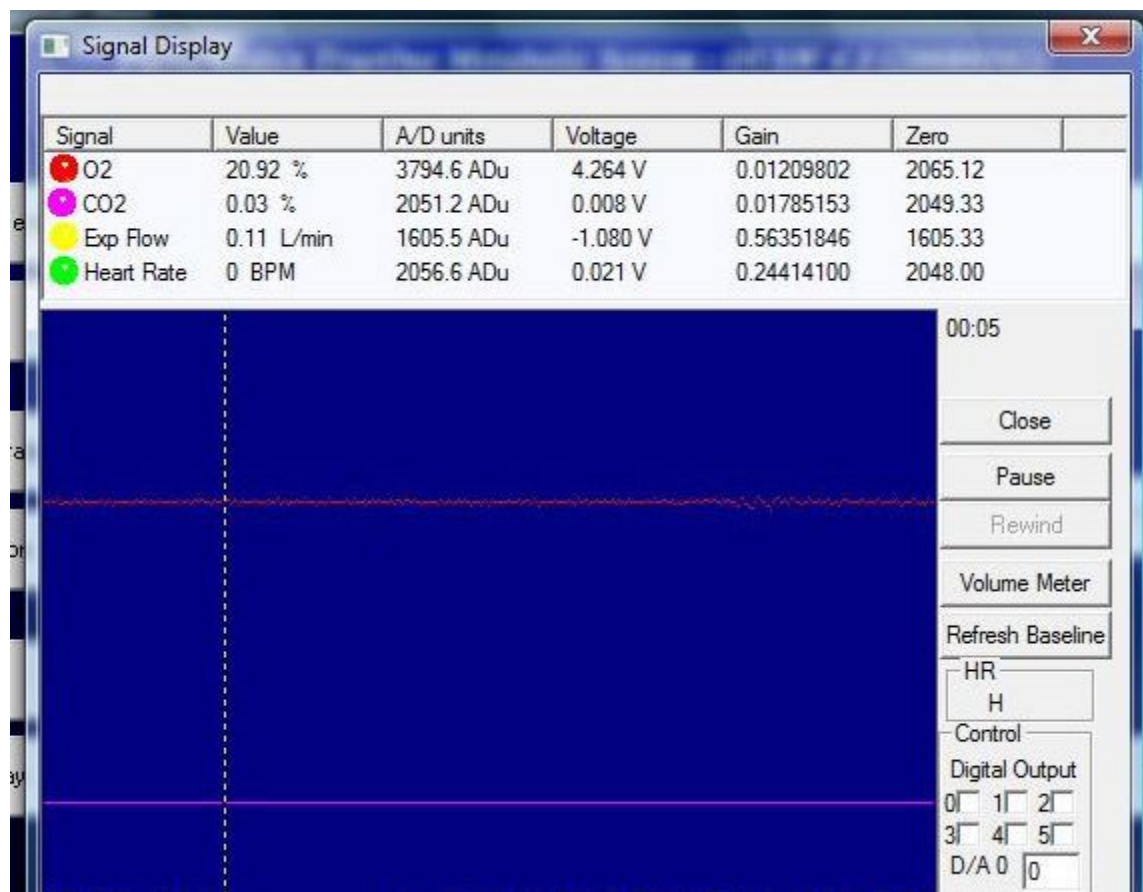
- The system is now ready for the three step calibration. Once the system has been setup, the calibration process is very quick and easy. The system should be calibrated again in between multiple subjects or if it has been sitting turned on but not used for a long period of time. The only calibration step theoretically needed after initial calibration is to apply the calibration gas again. However, the enemy of the pneumotach is moisture. Excess moisture will electrically distort what the pneumotach is sensing; this will be reflected in erroneous reading of the 3 liter syringe as 9, 12, 15 liters etc... The screen inside the round oven needs to be as dry as possible, so you may have to use the syringe to input room air across the sensor and into the mixing chamber if you are testing multiple subjects. The pneumotach is very sensitive to subtle changes in CO2. This is the reason why we need to let the pneumotach heat up to operating temperature. Doing a test with a cold pneumotach will have distorted CO2 results – the RER and VO2 kg readings will be way off.

Calibrate System:

- When the metabolic is initially turned on, the pneumotach sensor is reading low levels of CO₂ and more or less accurate O₂ levels of the room air. The pneumotach is not up to temperature. You can see this by clicking Signal Display (then Start) in the splash screen

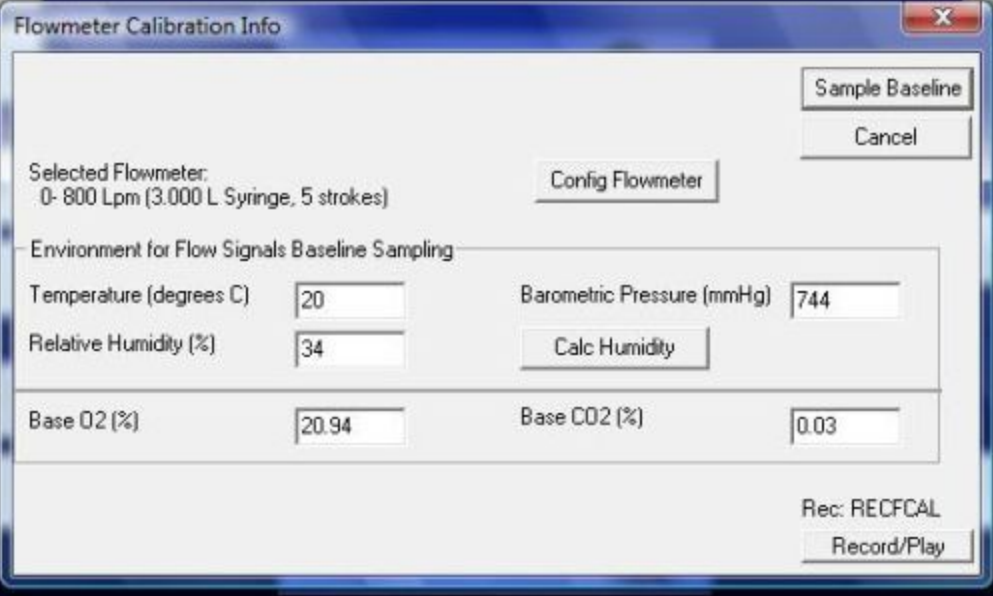


- You want to have the values for O₂ and CO₂ seen below after a 20 minute warm up and calibration



Flowmeter Calibration

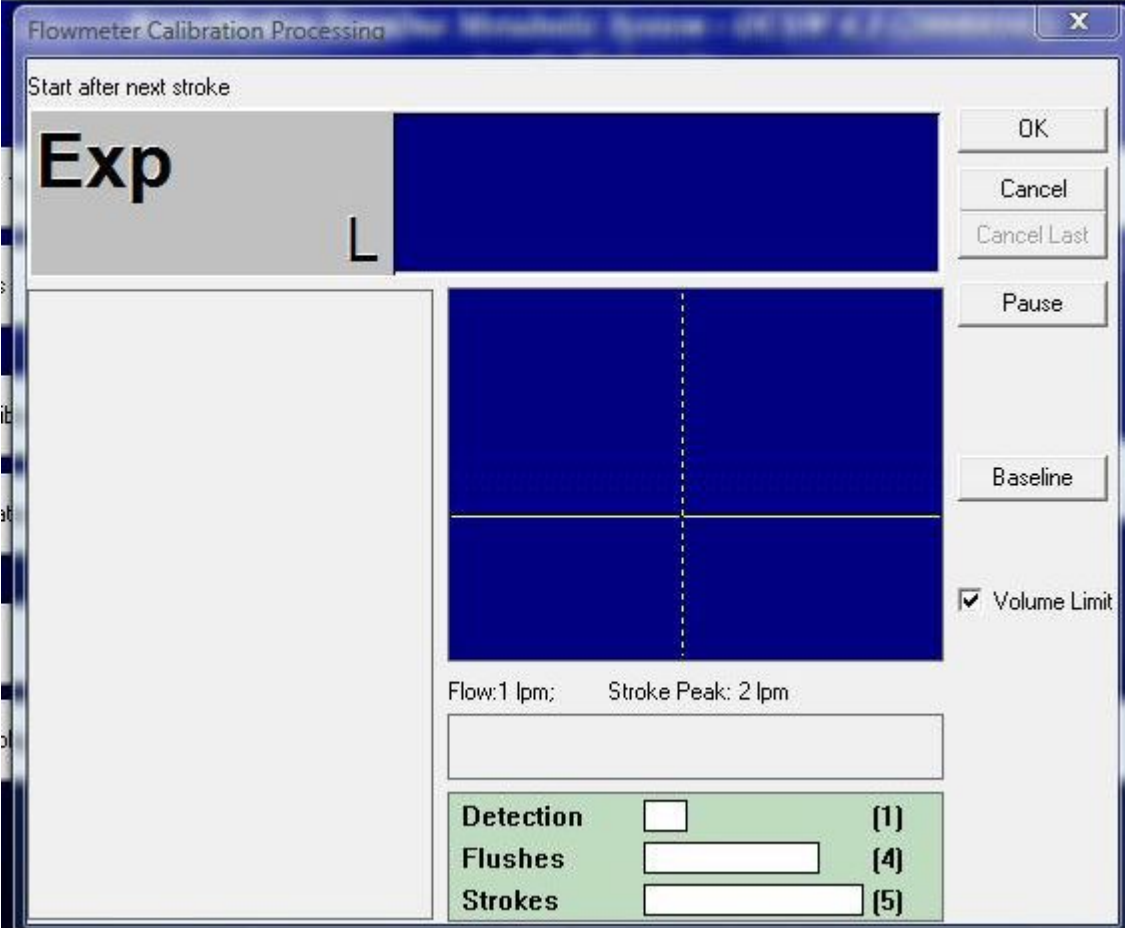
- In main splash screen click and open Flowmeter Calibration



The image shows a software interface with a sidebar on the left containing buttons: "VO2/Metabolic Testing", "Reports", "Flowmeter Calibration", "Gas Calibration", "Utilities", and "Signal Display". The "Flowmeter Calibration" button is highlighted. A "Flowmeter Calibration Info" dialog box is open in the center. It contains the following fields and buttons:

- Selected Flowmeter:** 0- 800 Lpm (3.000 L Syringe, 5 strokes) with a "Config Flowmeter" button.
- Environment for Flow Signals Baseline Sampling:**
 - Temperature (degrees C): 20
 - Barometric Pressure (mmHg): 744
 - Relative Humidity (%): 34 with a "Calc Humidity" button.
 - Base O2 (%): 20.94
 - Base CO2 (%): 0.03
- Buttons: "Sample Baseline", "Cancel", "Record/Play".
- Text: "Rec: RECFCAL".

- Enter room temperature, barometric pressure and relative humidity
- Click and open Sample Baseline (upper right corner of Flowmeter Calibration Info window)
- Flowmeter Calibration Processing window will open. All input strokes are done using the syringe



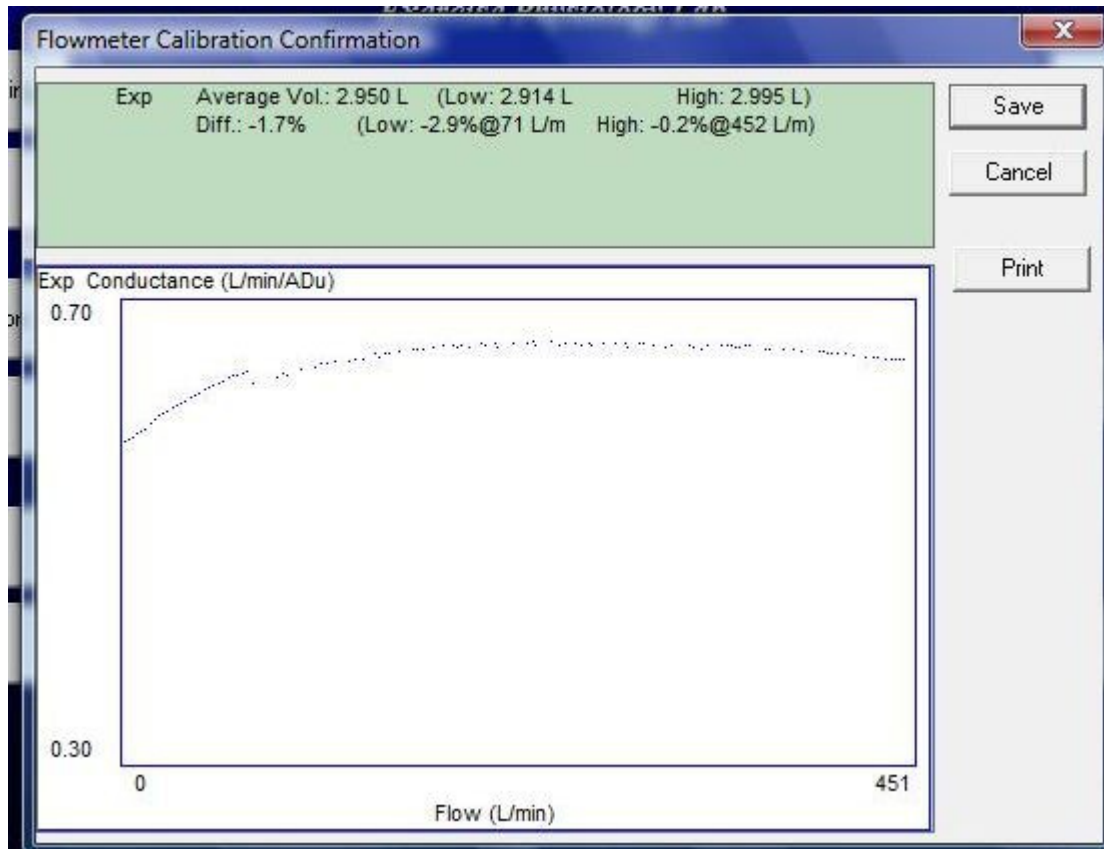
The image shows the "Flowmeter Calibration Processing" window. It has a title bar with the text "Flowmeter Calibration Processing" and a close button. The window contains the following elements:

- Start after next stroke** (text label).
- Exp** (large text label) and **L** (small text label).
- Flow:** 1 lpm; **Stroke Peak:** 2 lpm.
- Detection** (checkbox), **Flushes** (checkbox), and **Strokes** (checkbox) with corresponding numerical values in parentheses: (1), (4), and (5).
- Buttons:** "OK", "Cancel", "Cancel Last", "Pause", "Baseline", and "Volume Limit" (checked).

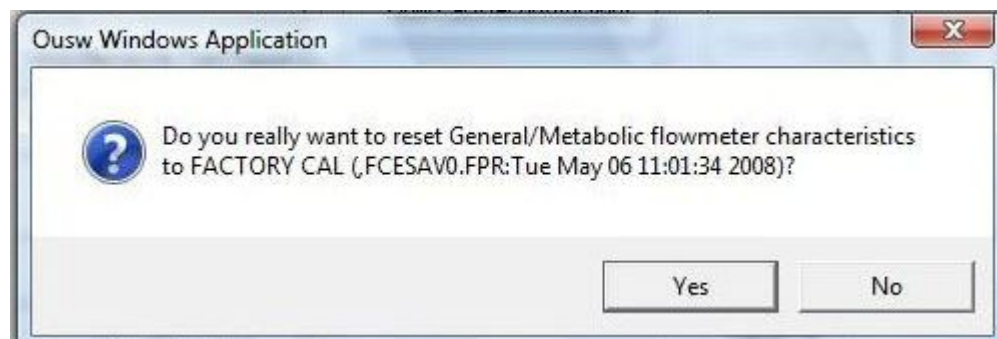
- Detection stroke** - one input stroke indicates air is flowing into the system (mouthpiece and all assemblies are properly configured).
*Notice the Flow indicator will show the real time input velocity, Stroke Peak will show the peak in real time and in the blank blue field beside the Cancel button, the volume of the syringe will be displayed at the end of any stroke. This value should be around 3

liters. If it reads high – 9, 12, 15 liters etc.. the pneumotach has a moisture issue (if testing multiple subjects over a short period of time) and must be allowed to dry. You can use the syringe setup to do the Flowmeter calibration, but don't open the software. You are just physically driving air across the pneumotach, through the mixing chamber and into the system

- **Flush Stroke** – four input strokes to push fresh air into the system
- The pneumotach can sense 800 lpm. Of the five calibration strokes input next, two must be less than 80 lpm. The number will fluctuate beside the Flow numerical indicator (to the left of Stroke Peak)
- **For Exercise Stroke** velocity is very very slow, very slow, slow, fast, faster.
- Stroke 1 → approximately 50 -80 lpm (very, very slow)
- Stroke 2 → approximately 100+ lpm (very slow)
- Stroke 3 → approximately 200+ lpm (slow)
- Stroke 4 → approximately 300+ lpm (fast)
- Stroke 5 → approximately 400+ lpm (faster)
- For Resting Stroke velocity can stay at 50 -80 lpm
- The result is something like this curve



- If you feel the need, the Flowmeter calibration can be reset to the factory levels. In the main splash screen, click and open Utilities, then halfway down the middle column, click Flowmeter Calibration Reset



2). Gas Calibration

- In the splash screen click and open Gas Calibration.
- Gas Analyzer window will open

Gas Analyzer Calibration

Environment

Room Temp (deg C)

Baro. Pressure (mmHg) mmHg

Relative Humidity (%)

Auto Cal

☒ Auto

☐ Manual

☐ SemiAuto

(Line diff 2.4 applied to room air.)

Sampling Line Calibration

Cal Gas Concentration

	O2 (%)	CO2 (%)
Room Air	<input type="text" value="20.94"/>	<input type="text" value="0.03"/>
Standard Gas	<input type="text" value="16"/>	<input type="text" value="4.05"/>

☒ Save Values

OK Cancel

Rec: RECGCAL Record/Play

- Enter room temperature, barometric pressure and relative humidity. Click OK
- Ousw Windows Application window opens. The Cal gas tube should already be connected so click OK. The program will process data in about 15 seconds. Click Save to close window

Confirm Updating Gas Calibration Parameters

2014/04/29 08:38:42 20 deg C, 773 mmHg, 22 %

Gas #	O2 (%)	CO2 (%)	Reading	O2 (%)	CO2 (%)
Gas #1	20.94	0.03	21.78	20.94	0.03
Gas #2	16.00	4.050	16.65	16.00	4.050

	Gain Factor	Zero Offset
	O2	CO2
New	0.000121165	0.000178699
Original	0.000125996	0.000187836
Change	-3.8%	-4.9%

(Sample Line Diff Correction: O2 gain by 0.999. CO2 gain by 0.998)

Save Cancel Print

- The pop-up will prompt you to turn off the calibration gas. It is recommended to do the Cal Gas calibration until you get the exact numbers on the cylinder. Also, you may do this step just before your subject is ready for testing

Confirm Updating Gas Calibration Parameters

2014/04/29 08:41:31 20 deg C, 773 mmHg, 22 %

Gas #	O2 (%)	CO2 (%)	Reading	O2 (%)	CO2 (%)
Gas #1	20.94	0.03	20.95	20.94	0.03
Gas #2	16.00	4.050	16.00	16.00	4.050

	Gain Factor	Zero Offset
	O2	CO2
New	0.000120980	0.000178515
Original	0.000121067	0.000178647
Change	-0.1%	-0.1%

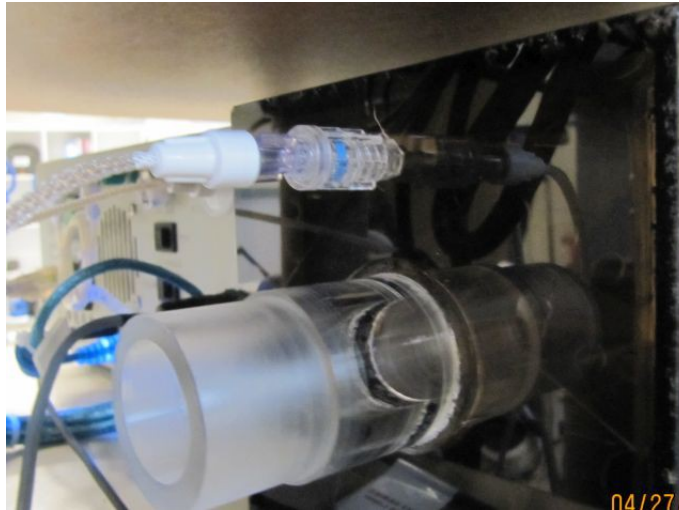
(Sample Line Diff Correction: O2 gain by 0.999. CO2 gain by 0.998)

Save Cancel Print

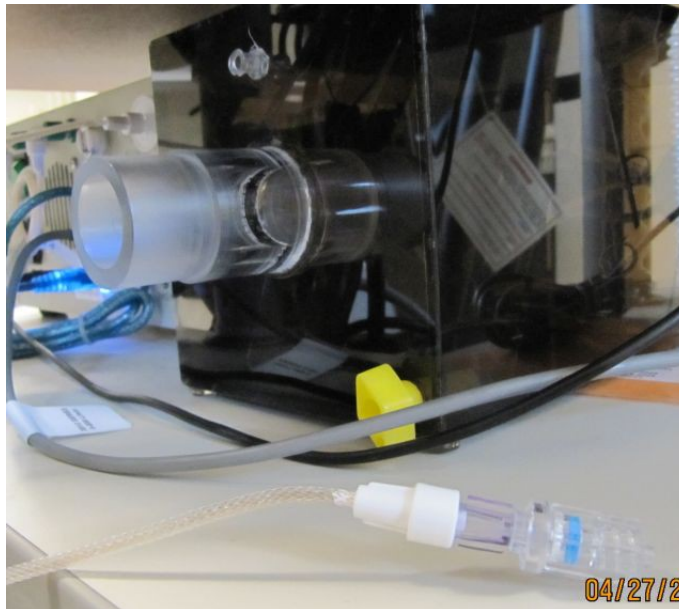
- Click OK then Save
- When done, turn off the calibration gas cylinder by turning clockwise hand tight. Then bleed of the excess left in the regulator and the calibration gas hose/white connector by gently pushing on the plastic connector/opening at the end. Bleed off until both indicators read zero

Sampling Line Calibration

- In main splash screen click and open Utilities
- In Utilities window, middle column below 3-Month Maintenance, click on Sampling Line Calibration
- Ousw Windows Application window opens
- Disconnect sampling line from the back of the mixing chamber. The connector is clear with a blue marking. All that is needed is about a ½ turn counterclockwise



- Click OK
- Ousw Application window opens
- Click OK
- Reconnect sampling line to the mixing chamber



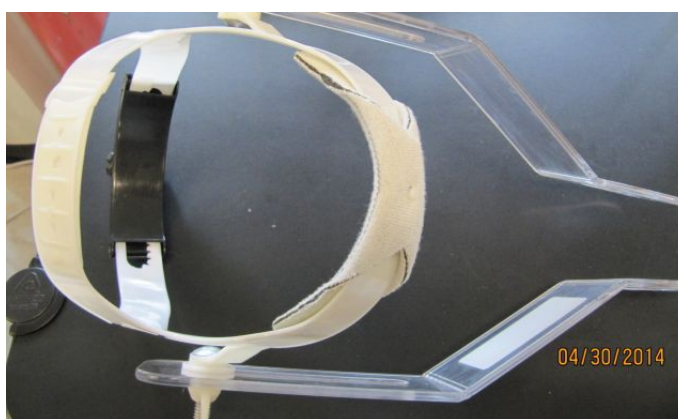
- All that is needed to reconnect is about a ½ turn clockwise – finger tight
- Click OK
- Close the Utilities window
- The system is now ready for testing

Testing Subjects:

- The subject must put on a heart rate monitor. The transmitter is worn by the subject. The receiver is on the reticulated arm. Ensure electrode gel is used on the transmitter strap for ideal electrical conductivity
- If you are using the head support system



- Attach sweat guard to the front of the system



- While subject is seated, fit the head support so the front portion is just above the eyebrows. Ensure a snug fit. Tighten the entire band around the head using the knob on the back. You will be using a mouthpiece and nose clip with this setup. Attach a rubber adaptor to the mouthpiece. The one shown works for most subjects. There are larger adaptors if needed. You want to avoid the subject breathing out of the corner of their mouth (when at maximal exertion). This will skew your test results. We want a tight seal regardless of what device is used - head support or full mask



- When using the head support, the subject must wear a nose clip. This cuts off any airflow through the nose. We want all the breathing down the hose to the pneumotach
- You must wear gloves during the test. Put on a pair of gloves. Fit the appropriate adaptor to the mouthpiece. One method is to jam your thumb down the adaptor and then fit it over the round fitting on the mouthpiece

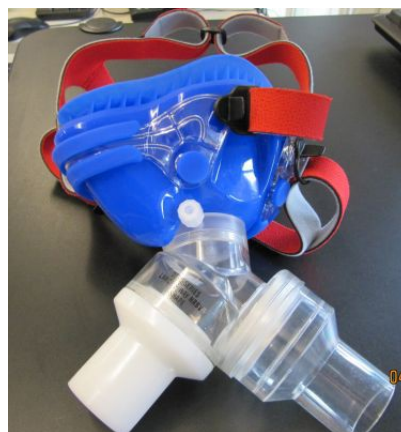
- The result must look like the image below



- Attach the assembled mouthpiece/adaptor to the head support while on the subject's head



- Give the subject a the nose clip to put on
- They are ready for the treadmill or ergometer. Attach the hose to the output end of the mouthpiece. Do not let the subject insert the adaptor yet. When it is time to start the test, the subject can just spin the adaptor toward their face, place the adaptor in their mouth and begin mouth breathing into the valves. We must wait until the appropriate test window opens for the subject to do this. They are not to breathe into the hose at this time
- The full face mask does not require a nose clip to be used. Facial hair may interfere with a tight seal. Do not hook up the hose to the full face mask until the test starts. The straps wrap around the head and then the black connectors lock into the clear brackets of the mask. The straps are adjustable by sliding the strap through the black connector the using Velcro to keep in place. The mask covers the mouth and nose – so the straps need to be tight to ensure a good seal



- In the splash screen click and open VO2/Metabolic Testing

Acadia University
Exercise Physiology Lab

Patient/Test Info

Patient Information

Last Name: BOUDREAU First Name: KAYLA

Med Rec #: 0

Age: 20 yrs Sex: ☒ Female ☐ Male

Height: 156 cm Weight: 125 lb

Test Protocol/Environment

Doctor: Tech: Samuel Robinson

Test Degree: Maximal Test Date / Time: 2014/ 4/28

Exercise Device: Treadmill

Heart Rate/ECG: Active

Insp. Temp.: 20 deg C Baro. Pressure: 744 mmHg

Insp. Rel. Humid.: 34 % Calc Humidity

Insp. O2: 20.94 % Insp. CO2: 0.03 %

Selected Flowmeter: (0) 800 Lpm

Base Values

Base O2 and CO2: Same as Insp. O2 and CO2.

OK Cancel

Rec: RECFP Record/Play

- Update temperature, humidity and barometric pressure if it has changed. Enter subject data. Choose which device you are using

Acadia University
Exercise Physiology Lab

Patient/Test Info

Patient Information

Last Name: BOUDREAU First Name: KAYLA

Med Rec #: 0

Age: 20 yrs Sex: ☒ Female ☐ Male

Height: 156 cm Weight: 125 lb

Test Protocol/Environment

Doctor: Tech: Samuel Robinson

Test Degree: Maximal Test Date / Time: 2014/ 4/28

Exercise Device: Treadmill

Heart Rate/ECG: Other

Insp. Temp.: 20 deg C Baro. Pressure: 744 mmHg

Insp. Rel. Humid.: 34 % Calc Humidity

Insp. O2: 20.94 % Insp. CO2: 0.03 %

Selected Flowmeter: (0) 800 Lpm

Base Values

Base O2 and CO2: Same as Insp. O2 and CO2.

OK Cancel

Rec: RECFP Record/Play

- Click OK

- If we use the treadmill we need to choose a protocol. You can create a new one and name it whatever you want. Modify an existing one and save it. Use what is there already from the pull down menu. Or modify a protocol and not save it by just clicking OK

The screenshot shows the 'Treadmill Protocol' window. On the left is a sidebar with buttons: 'VO2/Metabolic Test', 'Reports', 'Flowmeter Calibration', 'Gas Calibration', 'Utilities', and 'Signal Display'. The main window has a 'Protocol Selection' dropdown set to 'Modified Astrand 7.0'. Below it are 'Pattern' options: 'Ramp' (unselected) and 'Staged' (selected). There is a checked 'Auto Start Protocol' box. The 'Resting Phase' has a 'Duration (sec)' of 0. The 'Warm Up Phase' has 'Speed (MPH)' of 5.5, 'Grade (%)' of 0, and 'Duration (sec)' of 180. The 'Exercise Phase' is a table with 10 stages. The 'Cool Down Phase' has 'Speed (MPH)' of 3.5 and 'Grade (%)' of 0. On the right are buttons: 'OK', 'Cancel Test', 'Save', 'Save As', and 'Delete'.

Exercise Phase			
# Stages	Speed (MPH)	Grade (%)	Duration (sec)
1	7	0	120
2	7	2.5	120
3	7	5	120
4	7	7.5	120
5	7	10	120
6	7	12.5	120
7	7	15	120
8	7	17.5	120
9	7	19	120
10	7	21.5	120

- Treadmill protocols can have a resting, warm up, exercise and cool down phase. If you do not want resting or warm up phases, make the duration = 0
- The protocol window is showing us treadmill protocols. We chose the treadmill as the test device when we entered subject data

This screenshot shows the 'Treadmill Protocol' window with the 'Protocol Selection' dropdown menu open, displaying a list of protocols. The 'Modified Astrand 7.0' protocol is highlighted. The rest of the window, including the 'Exercise Phase' table and 'Cool Down Phase' settings, remains the same as in the previous screenshot.

Exercise Phase			
# Stages	Speed (MPH)	Grade (%)	Duration (sec)
1	7	0	120
2	7	2.5	120
3	7	5	120
4	7	7.5	120
5	7	10	120
6	7	12.5	120
7	7	15	120
8	7	17.5	120
9	7	19	120
10	7	21.5	120

- Click OK

- If we use the ergometer we need to choose a protocol. You can create a new one and name it whatever you want. Modify an existing one and save it. Use what is there already from the pull down menu. Or modify a protocol and not save it by just clicking OK

Bike Protocol

Protocol Selection: mod astrand 25W/min

Pattern: ☐ Ramp ☒ Staged

☒ Auto Start Protocol

Resting Phase: Duration (sec) 30

Warm Up Phase: Load (Watt) 75, Duration (sec) 180

☐ Workload Per Kg Body Weight

Exercise Phase # Stages: 12

#	Load (Watt)	Duration (sec)
1	100	60
2	125	60
3	150	60
4	175	60
5	200	60
6	225	60
7	250	60
8	275	60
9	300	60
10	325	60
11	350	60
12	375	60

Exercise Phase

Cool Down Phase: Load (Watt) 50

Buttons: OK, Cancel Test, Save, Save As, Delete

- Ergometer protocols can have a resting, warm up, exercise and cool down phase. If you do not want resting or warm up phases, make the duration = 0
- The protocol window is showing us ergometer protocols. We chose the ergometer as the test device when we entered subject data

Bike Protocol

Protocol Selection: mod astrand 25W/min

Pattern: ☐ Ramp ☒ Staged

☒ Auto Start Protocol

Resting Phase: Duration (sec) 30

Warm Up Phase: Load (Watt) 75, Duration (sec) 180

☐ Workload Per Kg Body Weight

Exercise Phase # Stages: 12

#	Load (Watt)	Duration (sec)
1	100	60
2	125	60
3	150	60
4	175	60
5	200	60
6	225	60
7	250	60
8	275	60
9	300	60
10	325	60
11	350	60
12	375	60

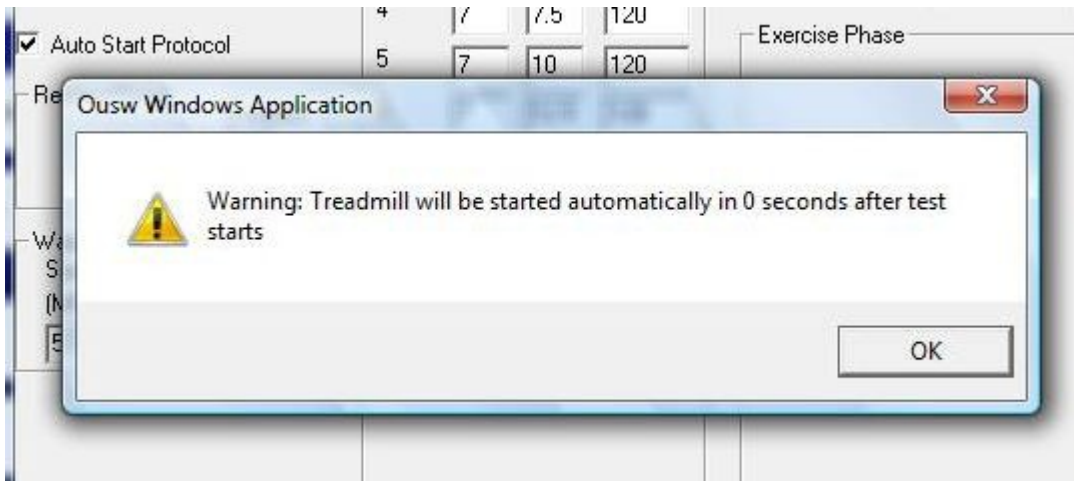
Exercise Phase

Cool Down Phase: Load (Watt) 50

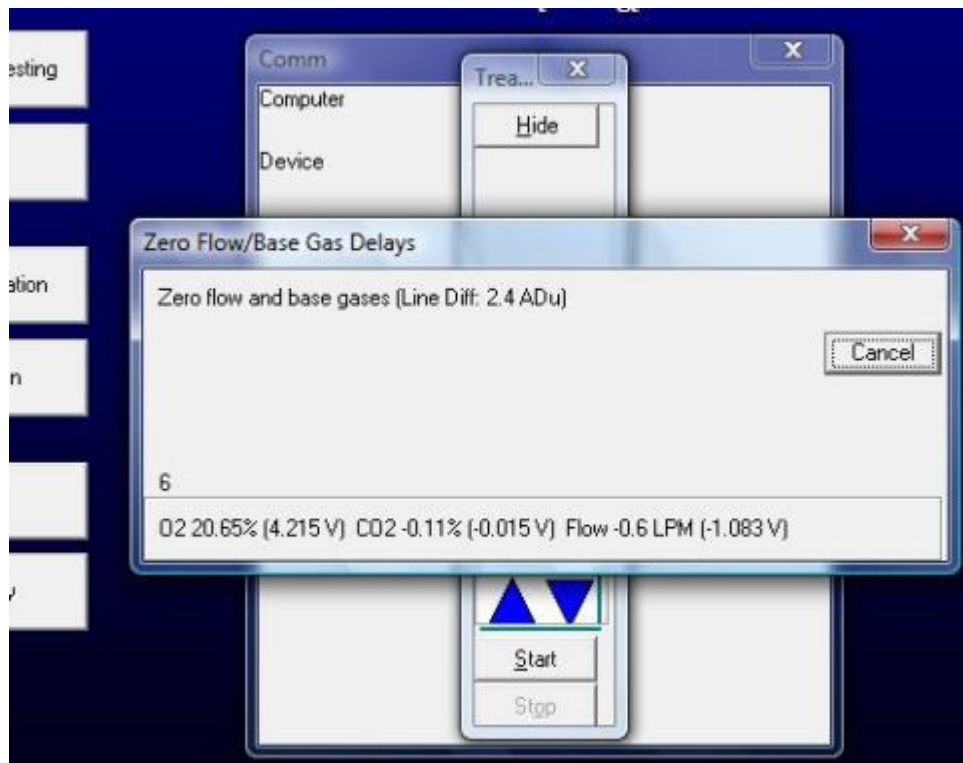
Buttons: OK, Cancel Test, Save, Save As, Delete

- Click OK
- Now the testing windows will appear. If using the head support, you can attach the hose from the reticulated arm/T - connector to the output connector on the mouthpiece. The nose clip can be worn. Do not let the subject breath into the mouthpiece yet. If using the full face mask, **do not** attach the hose from the reticulated arm/T - connector to the mask yet

- This window will open to warn you that the treadmill will start automatically



- Click OK. This warning does not appear when using the ergometer
- A series of software windows will open and close



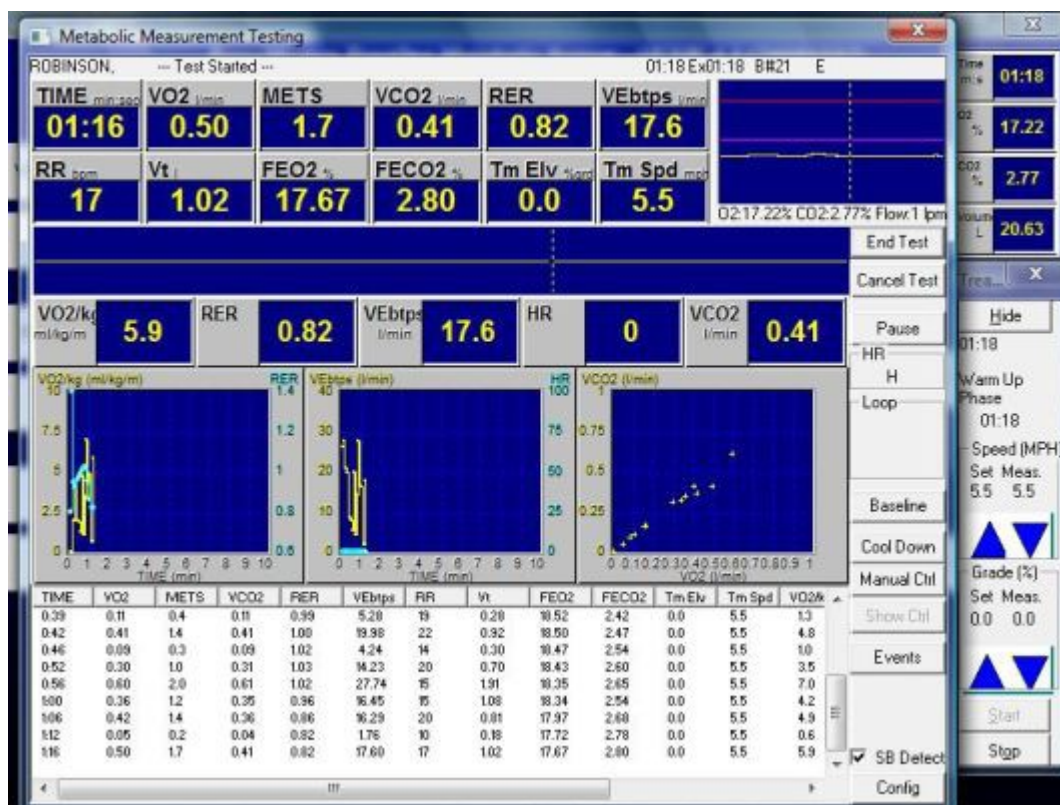
- Then this window will open. You will see the blank test results window open as well. The fields will be blank because the subject is not breathing into the system yet



- Wait until the CO2 levels exceeds 0.03%, then click OK
- If using the headgear, the subject can spin the mouthpiece toward their face. The adaptor can be placed in the mouth while the nose

clip is on. If using the full face mask, the hose from the reticulated arm/T can now be attached to the input connector on the full face mask

- There will be a delay of approximately 15 – 20 seconds before the Metabolic Measurement Testing window updates with data. The white space below will be filled with data every 5 seconds (this resolution level can be changed)



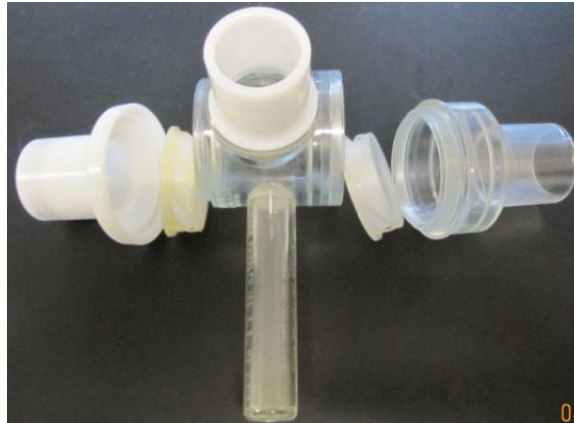
- The Events button to the right can be used to enter RPE values, blood pressure, etc...a pop-up window will appear. Simply enter the RPE value to the empty data field in the pop-up. This new event will be added to the data lines in the white space below

- Well documented reports are available after testing. To the right of the Cancel button is a set of timers. This will show overall test time, rest phase time left, warm-up phase time, and exercise phase time left as you go through the stages of the protocol you are using. When the subject cannot continue due to maximal exertion, hit the Cool Down button. This will cause the treadmill/ergometer to go to

this new workload level. The treadmill may take a few seconds to reduce incline/speed. If the workload is not adequate, you can use the up/down arrows (to the right) to increase/decrease speed, incline etc...

Clean Up:

- While wearing gloves, remove headgear or the full face mask from the subject. Remember to keep the subject attached to the cart for about 20 seconds after the test has finished. This allows software delay to fill in the remaining data
- Take all used parts over to the black lined sink
- Detach the mouthpiece from the headgear.
- Rinse the sweat guard under water. The heart rate strap and transmitter can be rinsed as well. Let these parts air dry
- Disassemble the mouthpiece if used in the sink



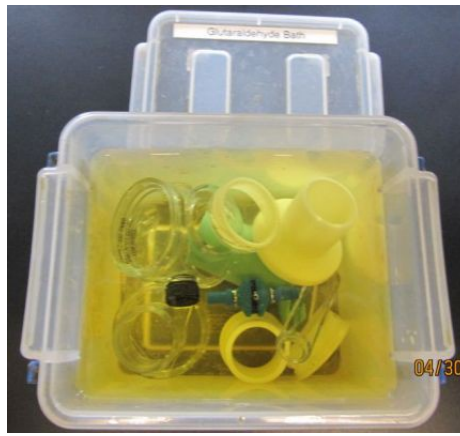
- Disassemble the full face mask if used in the sink



- Rinse off all parts with cold water



- The cold sterilisation system is an immersion bath in Glutaraldehyde
- After rinsing the parts thoroughly in the sink, you need to immerse everything in a Glutaraldehyde bath for **at least two hours**



- The container will hold two disassembled mouthpieces or one full face mask
- Close the cover and place this under the fume hood



- Disinfect for at **least two hours**. While wearing gloves, bring the container to the sink. Remove all parts and rinse in the sink. Fill the water bath container and immerse all parts in this container. Glutaraldehyde will dry the mouth if not rinsed properly. So these parts can be left in the water bath for an extended period. 24 hours is ideal. Over a weekend is fine
- Remove all parts from the water bath and let air dry on paper towel on the counter by the sink. The sweat guard, heart rate monitor strap and transmitter can be left to air dry here as well