Fitness Assessment - Aerobic Fitness Testing



Equipment Required

PC or Mac Computer and USB cable

IX-TA data acquisition unit and power supply

A-FH-1000 Flow head with flow head tubing

A-GAK-201 Reusable mask and non-rebreathing valve

6ft smooth bore tubing (35mm I.D.)

5 Liter Mixing Chamber

iWire-GA CO₂/O₂ Gas Analyzer with filter and Nafion gas sample tubing

A-CAL-150/A-CAL-200 Calibration kit

PHRM-220 Heart rate monitor or the ANT+ Heart rate monitor

Treadmill with adjustable speed and gradient or Fitness Bike

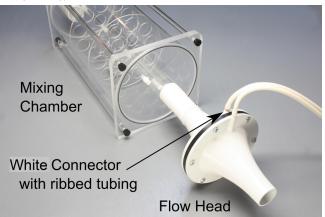
3 Liter Calibration syringe

Setup the IXTA and the iWireGA

- 1. Place the IXTA on the bench, close to the computer.
- 2. Use the USB cable to connect the computer to the USB port on the rear panel of the IXTA.
- 3. Connect the iWire-GA unit to the front of IXTA using the iWire-1 port.
- 4. Plug the power supply for the iWire-GA into the electric outlet. Insert the plug on the end of the power supply cable into the labeled socket on the rear. Use the power switch to turn on the unit. Confirm that the power light is on.
- 5. Plug the power supply for the IXTA into the electrical outlet. Insert the plug on the end of the power supply cable into the labeled socket on the rear of the IXTA. Use the power switch to turn on the unit. Confirm that the power light is on.

Setup the Metabolic Cart

- 1. Locate the A-FH-1000 flow head and tubing in the iWorx kit.
- 2. Plug the flow head tubing into channel A1 of the IX-TA, matching the colors.
- 3. Connect the other end of the flow head tubing to the flow head, making sure that the ribbed side of the tubing connects the red marked port on the flow head.
- 4. Locate the mixing chamber in the iWorx kit.
- 5. Connect end of the flow head to the flow head port of the mixing chamber, making sure that the white port faces the mixing chamber. Make sure the tubing is in an upright direction.



- 6. Locate the non-rebreathing valve, mask, and smooth bore tubing in the iWorx kit
- 7. Attach one end of the smooth bore tubing to the "**Tubing to Mask**" inlet of the mixing chamber.
- 8. Attach the other end of the smooth bore tubing to the calibration syringe.





- 9. Attach the mask to the side port of the non-rebreathing valve, using the provided adaptor, if needed.
- 10. Note: There are arrows on the valve that indicate the direction of air flow. The white port is the inlet and the clear port is the outlet. The Clean Bore tubing will be plugged into the clear port later when testing the subject.



- 11. Place the filter on the Sample In port of the iWire-GA in the lower right front corner of the gas analyzer. Attach the braided end of the Nafion sampling tube to the filter.
- 12. Connect the other end of the Nafion sampling tubing to the white "**To Gas Analyzer**" port on the mixing chamber near the Flow Head



- 13. Attach a Clear tubing to the outlet gas analyzer.
- 14. Attach the other end of the clear gas analyzer tubing to the "**From Gas Analyzer**" connector on the mixing chamber next to the smooth bore tubing



- 15. If using the Polar Heart Rate Monitor.
 - 1. Locate the PHRM-220 Polartm heart rate monitor transmitter, electrode belt and receiver.
 - 2. Plug the phono connector of the extension cable of the PHRMP-220 into the **HR** input on the iWire-GA. Plug the polar receiver into the other end of the extension cable.

Note: The polar receiver needs to be within 3 feet of the transmitter. It is helpful to attach the receiver to the clean bore tubing near the mask, with a twist tie during the test.



- 16. If using the *ANT*+ *Heart Rate Sensors* such as Garmin HR monitor, Scosche Rhythm+ Heart Rate Monitor Armband, etc.
 - 1. Plug the ANT+ USB dongle into the computer. You should have entered the license number for the ANT+ device in LabScribe, using the External Devices menu, during the initial setup. Enable the ANT+ sensor from the External Devices Menu.
 - 2. Get the ANT+ heart rate sensor ready for use, according to the instructions provided with the sensor.

Software Setup :

1. Load the Fitness Assessment settings.

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- 2. Click the **Setup** button shown in the left side window. The Online Setup Dialog window will open
 - Enter your subject's information or Load a subject from a previously saved file.

Online Metabolic Setup Dia	alog 25
Subject Settings	
Load Subject	
Name	
Protocol	
Age	30
Sex	Male 🔻
Height(cm) 🔻	160
Weight(kg) 💌	80
Maximum Heart Rate	200
Blood Pressure	120 A / 70 A
	OK Cancel

- Click "Settings" to change any parameters you wish to view
- Click OK to save the changes.

Online Metabolic Setup Dialog	×
CO2 Channel CO2 Concentration (%) O2 Channel O2 Concentration (%) Volume Channel Expired Air Volume Average 20 Seconds O2 Conc. in Inhaled Air 20.9 CO2 Conc. in Inhaled Air 0.04 %	Calculations Sel Time Abs.VO2 Abs.VC02 Rel.VC02 Rel.VC02 RER REE METS %Fat %Carbs Calories Min O2 conc Max CO2 conc Expired Vol.
	OK Cancel

Calibrating the iWire-GA Gas Analyzer

Note: Warm up the iWire-GA for at least 15 minutes prior to use. Make sure the calibration gas tank is located close to the Fitness Assessment equipment.

This procedure will calibrate the O_2 and CO_2 channels.

- 1. Connect the gas sample tubing of the A-CAL-150 Calibration Kit to the output barbed connector of the gas regulator.
- 2. Click the **Calibrate Gas Analyzer** button. Click Perform Quick Software Gas Calibration.
- 3. Follow the directions as prompted. Room air will be sampled for 10 seconds. Calibration gas will be sampled for 20 seconds.
- 4. If necessary, move the cursors into correct position.
- 5. Click OK.



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Quick Flow Calibration :

A pre-saved .iwxfcd (file IXTA-longFlowHeadCalibration) is already loaded for you.

If you prefer, click "Load", to load the .iwxfcd file created when you performed the optional full flow head calibration.

Perform the Quick Flow Calibration by clicking the button and following the prompted directions as they pop up on the LabScribe Screen.

- After the calibration data has been collected, The Spirometer Calibration dialog window will pop-up.
- Position the two cursors on the flat line to either side of the recording shown.
- Click the 'Calibrate difference between cursors to' button.
- Click OK.

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Spirometer IX-TA 🔹	
Type of Flowhead Calibrated 💌	
Calibration Curve Data: Load May 18 FlowHeadCalibration	
Internal Barometric Sensor 💌	
Temp. of Mixing Chamber(typ. 25 degC)= 25.000000 deg C	
- MMMMM	
Baseline: Use first 10.000000 seconds as zero Calibrate difference between cursors to 3 Liters	
OK Cancel	

Prior to performing your test:

Determine the correct concentration of O2 in the mixing chamber:

- Click on the Preview button.
- Record room air by sampling air through the mixing chamber. Look at the value for O2 as you record for approximately 10 seconds. It should be reading between 20.7% and 21%.

NOTE – If the O2 channel is not reading between 20.7% and 21% - REPEAT the Quick Flow Calibration.

• Click on the Stop button.

Now you are ready to perform your test. Some sample protocols are provided on the CD and on the website.

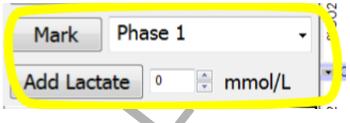
Performing the Test:

- 1. Attach the head gear to the mask.
- 2. Instruct the subject to try on the assembly. Adjust the straps so that the mask fits the subject comfortably. Make sure there are no leaks around the mask.
- 3. Connect the smooth-bore tubing to the clear outlet of the non-rebreathing valve. There are arrows on the valve that indicate the direction of air flow.
- 4. Make sure the flaps on the non-rebreathing valve are facing the right way.
- 5. Remove the smooth-bore tubing from the mixing chamber to record baseline.

6. Click the **Record** Button to start recording data



- 7. Wait at least 10 seconds for the system to zero, then reconnect the smooth-bore tubing to the mixing chamber
- 8. The test has now started
- 9. Mark the data for each stage of the exercise protocol you have chosen to use. You can enter text in the text area next to the **Mark** button and click on the **Mark** button, or



choose one of the preset marks from the dropdown list.

- 10. If lactate values are measured during the test, you may enter them in the record using the Add Lactate button.
- 11. Click **Stop** and then Click Save As to save your data

Analyze your data

- 1. Click Analyze to pull up the automated metabolic calculations and chart generator.
- 2. Make sure channels are set correctly.
- 3. Click Settings: Your subject information should be automatically populated into the settings.
- 4. Click Calculate to generate the table as seen below.
- 5. To generate a Report, click on the Report Tab. Reports can be customized as well.
- 6. Refer to the metabolic module manual in the LabScribe manual for more information.

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8	Yes Yes Yes Yes Yes Yes Yes Yes	09.12 09.44 04.14 05.14 05.14 05.14 05.14 05.14 05.14 05.14 07.14	2.898534 3.130925 3.044063 2.600774 4.059415 3.725900 3.515753 3.562942 4.423079	2.647034 2.643132 2.878090 2.849945 2.797895 2.344130 3.531133 3.496970 3.730129 3.922347 4.345452	28.121478 28.197392 81.645155 29.04018 29.04173 25.560034 39.798188 16.479503 31.345738 16.852779 41.855279	25.951.317 25.91.3055 28.196900 27.940638 27.038189 21.981964 34.638947 34.284023 36.546888 84.454386 42.562867	0.916312 0.912515 0.91907 0.936047 0.936047 0.932057 0.996212 0.959955 0.952595 0.952595 0.965757 0.962957	20405.107723 20440.555738 227328.01.5541 21621.251540 21031.646024 16251.595440 28342.869045 25425.96,707 27967.738019 28001.768996 11.751.0530.28	8 091851 8 111540 8 3770302 8 528462 8 311752 7 310290 11 370911 10 422715 10 968497 11 100677 12 388577	27.899038 29.161557 27.171706 21.317759 23.567665 13.929655 43.379291 25.060.337 15.871538 3.414492 6.000842	72.104072 70.838443 72.464602 78.682247 76.402335 66.070545 56.620799 79.538666 84.198462 96.385508 93.998158	14.443954 14.442670 15.654637 15.6254637 15.223304 14.640046 11.040672 20.297036 18.004547 19.538707 19.538707 39.814708 22.115395	15.575469 15.40698 15.442038 15.74591 15.79591 15.390459 15.305459 15.405459 15.417.307 15.305171 15.446421 15.251371	4.11/0617 4.229135 4.209129 4.209129 4.209129 4.124433 4.167939 4.309129 4.309129 4.405278 4.405299	69.316016 87.366397 73.585366 76.32116 71.975272 60.241128 87.812966 87.84082 89.901364 94.889475 101.256387	0.00000 0.000000 0.000000 0.000000 0.000000	124.651430 125.42008 125.920572 124.613096 125.00008 129.447223 136.066247 139.757441 141.864807 147.009523 149.671795	175		
3 4 5 4 7	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	0314 07.44 0414 0514 0544 0544 0544 0544 0744 0744	2.898534 3.1.30825 3.044661 2.869039 2.669774 4.059435 3.729809 3.943953 3.943953 3.943942 4.420079 4.386730	2.647034 2.643132 2.838060 2.848945 2.33886 2.348130 2.538133 3.448370 3.739129 3.822347 4.343852 4.508053	28.121478 28.397392 39.849635 29.549635 29.549635 29.598139 25.580034 39.798138 34.479503 38.385738 34.852376 41.8635376 43.007153	25.951.317 25.91.3055 28.196960 27.940636 27.038189 22.981564 34.638947 34.284023 36.546888 18.454386 42.562867 44.250477	0.306312 0.302515 0.915807 0.935047 0.935047 0.952027 0.35595 0.35595 0.355295 0.365257 0.365257 0.365257	20405.107723 20446.555738 225.28.21.25148 225.28.21.251566 22031.646024 10551.205449 28435.305449 28435.305409 28435.305409 28435.305409 28051.765956 11.751.2511.28 31.841.685379	8.001851 8.113540 8.770302 8.528462 8.313752 7.310290 11.370811 10.422715 10.966407 11.100877 12.388577 12.287758	27.899038 29.163557 27.171108 21.37753 23.597965 31.929455 43.376291 20.061337 15.802538 3.614692 6.000862 0.000000	72.304072 70.838443 72.868823 78.662247 76.402335 66.070545 56.620799 79.538668 54.196462 54.196462 56.385508 53.385158 30.988158 30.988158	14.443954 14.442870 15.654637 15.223344 14.840645 11.048672 20.297036 18.064547 19.578787 39.3244708 27.115395 23.393648	15.575469 15.40698 15.442038 15.74591 15.79591 15.390459 15.305459 15.405499 15.445421 15.251571 15.351649	4.11/0617 4.229135 4.229135 4.229139 4.229139 4.229439 4.329439 4.329439 4.329535 4.309739 4.429739 4.429139 4.429129	69.316016 87.366397 73.588366 76.32116 71.975272 60.241128 87.84082 89.901564 94.869475 101.256287 108.408607	0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000	124.651430 121.429081 125.938572 124.613096 125.000081 129.447223 136.066247 139.367441 141.884897 141.009523 149.671295 153.794877	175		
3 4 5 4 7	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	0314 0544 0414 0548 0548 0548 0548 0548 0548 0548 054	2,898534 3,139825 1,044661 2,966039 2,669774 4,0596435 1,720509 3,355753 3,365759 4,386739 4,386739	2.647034 2.6473132 2.839090 2.849945 2.757895 2.357895 2.354130 2.531133 3.496979 3.730129 3.922547 4.345455 4.50053 4.600572	26.321478 28.387392 36.585357 29.5844035 29.596137 25.586034 39.598188 36.479503 38.389738 36.855279 41.95559 41.95559 41.95559	25.901.117 25.90.3055 28.196960 27.940636 27.9381864 34.638947 34.638947 34.638947 34.638947 34.544088 88.454386 88.454386 42.562867 44.250477 46.142839	0.916312 0.912515 0.91807 0.92807 0.92807 0.92807 0.98902 0.95295 0.95295 0.95295 0.95295 1.952794 1.045676	20405.107723 20446.555738 225.28.21.25148 225.28.21.25148 225.28.29449 254425.49449 254425.495449 254425.495449 254425.495449 254425.495449 254425.495449 254425.495449 254425.495428 21041.485379 24224.067786	8.001051 8.113540 8.770032 8.528462 8.213752 7.310290 11.370911 10.422735 10.965497 11.309677 12.389577 12.287758 13.154270	27.8990.38 29.161557 27.171106 21.317753 23.59365 31.929455 43.378291 20.061337 15.872536 3.612652 0.00000 0.000000	72.104072 70.838443 72.86802 78.662247 76.462335 56.626799 79.538666 54.196462 96.385508 53.368138 100.000000 100.000000	14.443054 14.482070 15.054637 15.223304 14.542046 11.540672 20.257026 18.508547 19.578767 19.578767 19.578767 19.578767 19.578767 19.578767 19.578767 19.578767 19.578767 19.578767 19.578767 19.578767 19.578767	15.575469 25.40698 15.442038 15.794592 15.794592 15.390459 16.417387 15.305498 18.417387 15.30571 15.345421 15.345421 16.351771 16.361649 15.635177	4.100617 4.22933 4.209139 4.209409 4.329409 4.329409 4.329545 4.309525 4.309525 4.465229 4.465229 4.455259 4.455455	60.310016 87.366307 73.588306 76.32116 71.975272 60.241228 87.842986 87.84402 86.901364 94.609425 101.256387 108.408607 118.579547	0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000	124,451,430 125,42005 125,920572 124,81,298 125,00000 129,447223 136,060247 139,347441 141,864937 147,09523 148,471795 153,756437 156,365963	175		
3	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	0312 07.44 0414 0444 0514 0514 0544 0544 0714 0544 0514 0514	2.898534 3.130825 1.044661 2.968039 2.669774 4.059435 1.720503 3.353753 3.345753 3.345753 4.386739 4.386739 4.386755 4.549527	2.647034 2.6473132 2.839090 2.849945 2.3573965 2.344130 2.331133 3.496970 3.730129 3.922547 4.345653 4.900532 4.829740	26.221478 28.387362 30.645355 29.64635 29.64635 29.64635 39.58188 39.58188 39.59138 39.59139 39.59513 41.55550 41.55550 41.55550 41.55550 41.55550	25.951.017 25.951.0055 20.396960 27.940636 27.981664 24.6518947 34.6518947 34.6518947 34.5545186 44.552367 44.252367 44.252367 44.252367	0.916312 0.912515 0.918007 0.936047 0.935057 0.959052 0.959955 0.965557 0.961557 1.027794 1.045582	20405.107723 20445.555738 22128.01.5548 21031.446234 10251.255366 25425.365307 29967.738659 28043.369346 28043.369346 10251.25536 2007.738659 2007.738659 2007.738659 2007.73866 2007.73866 2007.73866 2007.73866 2007.7386 2007.73866 2007.	8.001051 8.113540 8.770912 8.528462 8.431752 7.310291 10.402913 10.402913 10.402913 10.406977 11.2.080577 11.2.080577 11.2.080577 11.2.080577 11.2.080577	27.899338 29.161557 27.171106 21.317753 23.597865 13.929455 43.378291 20.061337 15.871538 3.414482 6.00080 0.00000 0.000000 0.000000	72.104072 70.838443 72.868032 76.682247 76.402375 66.071545 56.627590 79.538066 64.196452 96.385506 95.385508 33.988138 100.000000 100.000000	14.442054 14.482070 15.654632 15.222304 14.640646 11.540672 20.257076 18.654547 19.578763 19.578763 19.578763 19.578763 12.115395 12.939648 22.440373 12.247637	16.525409 15.400698 18.442028 18.794592 18.596557 18.300557 18.300557 18.300557 18.300599 18.4173071 18.401277 18.301649 18.409177 18.409177	4.110617 4.12230 4.208129 4.208129 4.124433 4.147209 4.308729 4.308729 4.405729 4.45278 4.45278 4.45219 4.45249 4.45249 4.45249 4.45249	60.316036 87.366307 73.588306 76.32116 77.975272 80.345128 87.365402 89.903364 74.488402 101.256387 103.456367 118.575547 116.843684	0.000000 0.000000 0.000000 0.000000 0.000000	124.451.430 125.520512 125.520512 124.61.5306 125.500000 126.447223 126.96547 129.97441 141.964897 144.96497 144.96497 144.96497 154.3654817 154.3654817 154.365943	175 200 225		
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Metabolic parameters and plots of VO₂, VCO₂, and RER vs. Time, displayed in the Offline Metabolic Calculations window used to analyze data collected during an aerobic fitness test.

Notice that the VO₂ and VCO₂ values increase quickly as the subject performs more strenuous segments of the test.