

# BLUEPRINT FOR BREATHING

*Introducing the A.D.S. 2000...*

**An Unprecedented Breakthrough in Anesthesia Delivery**



**MICROPROCESSOR ELECTRONICALLY VENTILATES THE PATIENT IF SPONTANEOUS RESPIRATION DOES NOT OCCUR**

- Eliminates need to monitor patients' breathing
- Frees technician for other duties

**AUTOMATICALLY SETS BREATHING PARAMETERS AFTER ENTERING PATIENT'S WEIGHT INTO SYSTEM**

- Delivers measured amounts of anesthesia at predetermined intervals
- May be used as a critical care ventilator or anesthesia delivery unit

**ELECTRONICALLY CALCULATES AND DISPLAYS MINUTE VOLUME PER KILOGRAM**

- Assures optimum oxygen and CO<sub>2</sub> levels
- Eliminates errors associated with conventional ventilation

**ANESTHESIA MADE SIMPLE**

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**1-800-445-8581**

1099 East 47th Street • Hialeah, Florida 33013 USA  
(305) 688-8581 • FAX (305) 685-7671

Web site: [www.englerUSA.com](http://www.englerUSA.com)  
E-Mail: [info@englerUSA.com](mailto:info@englerUSA.com)

## **COMPANY PROFILE**

**Engler Engineering Corporation has been in business since 1964 and occupies an 8000 square foot facility in Hialeah, Florida (USA). We manufacture ultrasonic dental scalers, polishers and combination units including electro surgery equipment and ultrasonic instruments for the veterinary market as well as a respiratory monitor for veterinary use only.**

**We also manufacture dental equipment for the human market. Please visit our website [www.englerusa.com](http://www.englerusa.com) for more detailed information or call us at the numbers shown below.**

**Engler Engineering Corp. acquired the exclusive manufacturing and marketing rights of Dynax products, including stretchers, animal restraint devices, comfort cots, and other products. We also acquired the Alpha-Sonic, Ora-Sonic, and Pro-Sonic line of piezo scalers.**

**Engler Engineering Corporation's brand name products proudly include: Scale-Aire High Speed Dental Air unit, Son-Mate II scaler / polisher, Sonus II dental scaler, Vet II dental scaler, Poli-x variable speed polisher, Tri-Mate scaler / polisher / electro surge, (for veterinary use only), A.D.S. 2000 Anesthesia delivery system / Ventilator, (for veterinary use only), and the Sentinel V.R.M. veterinary respiratory monitor.**

**We manufacture all of the inserts and tips used in the Engler products as well as others on the market today in the 18K, 25K, and 30K frequency range.**

**Our repair department has the technical knowledge to repair and maintain a number of dental devices manufactured by others including Shorline.**

**Engler Engineering Corporation's foreign sales are handled through a large and growing network of dental and veterinary distributors. At the present time we are represented throughout the Middle East, Europe, Central and South America, Canada, Asia, New Zealand, Australia, and most other countries.**

**Engler Engineering Corporation  
1099 East 47th Street Hialeah, Florida 33013-2194 USA  
305-688-8581 800-445-8581 Fax 305-685-7671 Website:  
[www.englerusa.com](http://www.englerusa.com) E-mail: [info@englerusa.com](mailto:info@englerusa.com)**

## INTRODUCTION

Thank you for selecting the A.D.S. 2000 Microprocessor controlled ventilator. We believe you have selected the best product available for ventilating and anesthetizing your veterinary patients. You can look forward to many years of service from your A.D.S.

The A.D.S. 2000 is a microprocessor controlled anesthetic ventilator. The microprocessor serves as a command and control base for a combination of flow controlling valves, exhale valves, safety valves and electronic sensors located within the A.D.S. 2000. The microprocessor simultaneously senses the proximal airway pressure, inspiratory time, breaths per minute, flow rate, and then calculates a minute volume per kg, based upon these parameters. The A.D.S. 2000 also senses any negative proximal pressure and depending on the amplitude of this pressure determines whether or not to give an assisted breath to the patient. The microprocessor is the brain of the A.D.S. 2000; it sends and receives all information within the unit. The microprocessor controls the following parameters;

- *Flow Rate*
- *Peak Inspiratory Pressure*
- *Positive End Expiratory Pressure*
- *Breaths per Minute*
- *Inspiratory Assist*

The A.D.S. 2000 has default settings for these parameters already programmed into it. The operator only needs to enter in the patients' weight and the A.D.S. 2000 will do the rest. However, if at any time the operator feels that the patient requires a different setting for a specific parameter then the preset value, they may change this value at any time. This feature allows the operator more options over the way the anesthetic is delivered to the patient. With these functions, the A.D.S. 2000 may be used to safely deliver anesthesia while avoiding the risk of anesthesia related respiratory depression.

The A.D.S. 2000 may be used *without* a vaporizer as a critical care ventilator, and has a number of built-in features designed for veterinary respiratory therapy.

This manual is not intended to teach veterinary medicine or veterinary anesthetics techniques. Its sole purpose is to instruct the veterinarian or qualified veterinary technician on the proper use of this device.

**TO OPERATE THIS DEVICE SAFELY AND PROPERLY, PLEASE READ THIS MANUAL AND REFER TO IT WHENEVER YOU HAVE ANY QUESTIONS OR PROBLEMS. IF YOU NEED FURTHER ASSISTANCE, PLEASE CONTACT ENGLER ENGINEERING CORPORATION AT 800-445-858.**

This Class A Device has been tested and certified to comply with FCC Part 15, ICES-003 and CE / EN61326-1:2006 (EMI-EMC).

**The A.D.S. 2000 is FOR VETERINARY USE ONLY.**

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## **PARTS LIST**

Upon opening the carton the A.D.S. 2000 was shipped in, you will find:

- { } A.D.S. 2000 Unit**
- { } A.D.S. instruction manual, which should be read prior to operating the unit**
- { } Instructional DVD**
- { } Breathing Circuit with gas sampling elbow**
- { } Oxygen Hose, Green**
- { } “To” Vaporizer Hose**
- { } “From” Vaporizer Hose**
- { } Scavenger Tubing, Blue**
- { } Power Adapter**
- { } Mask Adapter, For Masking Procedures**
- { } Test Lung**
- { } Gas sampling hose with Luer lock connectors**

### **PLEASE READ VERY CAREFULLY**

**Engler Engineering Corporation makes every effort to verify that all parts for this device and optional accessories ordered with it are included in this shipment. It is imperative that you inspect the package and if you find any pieces damaged or missing, you must notify us immediately. Claims for damaged or missing parts will only be accepted within five days of you receiving the product.**

**Engler Engineering Corporation makes every effort to verify that our devices are built and tested to approved standards. Any modification to the device, hoses or power supply initiated by others nullifies all warranty statements. Engler Engineering Corporation will not be held liable in any way, for any damage, injury or death due to non-authorized service, improper installation, or improper use of this device.**

**Engler Engineering Corporation  
1099 East 47th Street, Hialeah, Florida 33013  
800-445-8581 – 305-688-8581 – FAX 305-685-7671  
E-mail: [info@englerusa.com](mailto:info@englerusa.com)**

## **SPECIAL INFORMATION**

There are a few special areas of information that must be read and understood prior to operating the A.D.S. 2000.

1. **BATTERY BACKUP:** The A.D.S. 2000 has an internal battery backup system that allows you to continue your procedures in the event of loss of electrical power. It also protects the unit from electrical spikes that may occur during thunderstorms or brownouts. In addition, it allows you to use it as an emergency ventilator in the field if required. It is suggested that the power supply be plugged in, and connected to the device at all times so you will have full power in the event of an emergency. The battery backup should provide you with a minimum of ten to twelve hours of use when fully charged.
2. The red LED on the face of the A.D.S. 2000 will illuminate when the battery requires charging. It will also flash whenever the external gas sampling hose is disconnected from the circuit.
3. The A.D.S. 2000 can be damaged if any liquid or droplets of anesthesia enters it from the vaporizer. It is imperative that you do not overfill the vaporizer and that you have it inspected and certified at least every year. Anesthesia residue in the device may void the warranty.

**CAUTION:** It is important when connecting the vaporizer to ensure that The vaporizer is mounted lower than the A.D.S. 2000. This will prevent liquid anesthetic from possibly entering the A.D.S. 2000.

4. This device must be flushed between procedures to insure proper operation. Failure to flush the device may allow unwanted foreign particles to build up in the hoses and internal parts. This may cause incorrect readings on the display, and / or interfere with the proper flow of gases through the unit. Additionally, the unit may not be able to complete its self-test causing a default which will show as an error on the display. Please refer to page 20 of this manual for flushing procedures.
5. The breathing circuit hoses supplied with the A.D.S. 2000 are “disposable” type hoses and are easily replaceable. It is suggested that they be replaced periodically.
6. The A.D.S. 2000 will shut down the flow of oxygen, sound the alarm and flash the LED, whenever the gas sampling circuit is disconnected. This is an important safety feature for this device. On reconnecting the sampling hose, the device will continue to operate with the settings as established.

## INSTALLATION INSTRUCTIONS

1. Connecting the Oxygen Hose - On the back panel of the unit there is a port marked "OXYGEN IN", connect one end of the Green Oxygen Hose to this port and connect the other end of this hose to your 50 psi oxygen source. Since the oxygen fittings are universally standard, you may use your own oxygen hose if desired.

**CAUTION:** IT IS EXTREMELY IMPORTANT THAT THE OXYGEN BE REGULATED TO A PRESSURE OF 50 POUNDS PER SQUARE INCH (psi), FOR THE MINUTE VOLUME PER KILOGRAM DISPLAY TO READ ACCURATELY. PRESSURE OVER 50 psi MAY DAMAGE INTERNAL PARTS VOIDING THE WARRANTY.

2. Connecting the Vaporizer Hose - On the back panel of the unit there is a port marked "TO VAPORIZER", connect one end of the non marked silicon hose to this port and connect the other end to your vaporizer inlet port.

3. Connecting the Vaporizer Hose - On the back panel of the unit there is a port marked "FROM VAPORIZER", connect one end of the blue striped silicon hose to this port and connect the other end to your vaporizer outlet port.

**NOTE:** The A.D.S. 2000 must be used with a *precision* vaporizer.

4. Connecting the Scavenger Tubing - Connect one end of the Blue Scavenger tubing to the "SCAVENGER OUT" port on the back of the unit. Connect the other end to either a "passive" or "active" scavenging system. This will help to eliminate all traces of anesthetic gases used in the operating room that could pose a possible hazard to personnel. The use of a f/air anesthesia gas filter unit or active anesthesia scavenger system is highly recommended. Care must be taken to ensure that the scavenger port is not blocked by improper use of these devices as the animal's ease of expiration depends on the resistance of the scavenger line.

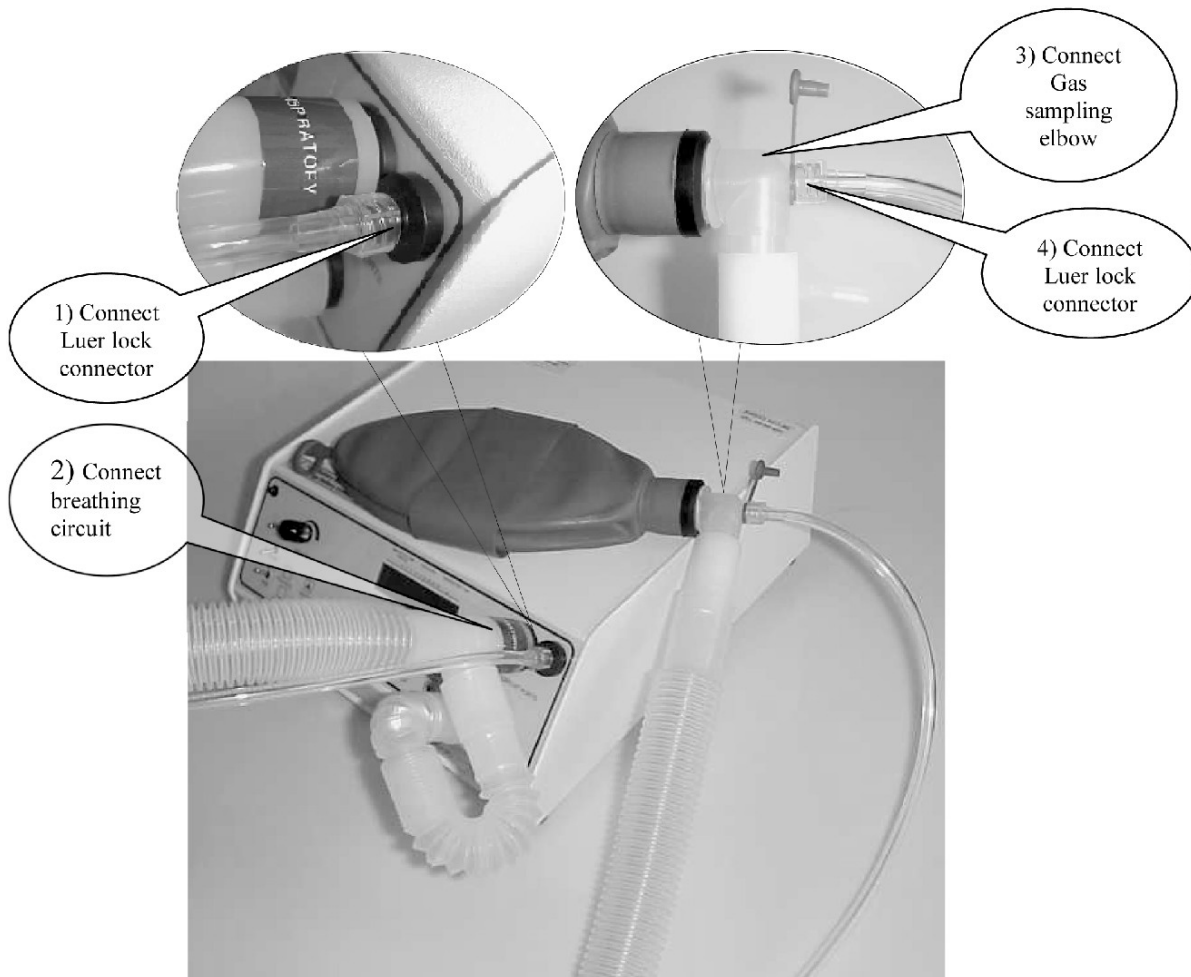
5. Connecting the Power Adapter - Connect the small male plug of the power adapter into the back of the A.D.S. 2000 at the 15 VDC @ 1.2 A outlet. Then plug the adapter into an electrical outlet. The supplied power adapter continuously charges the internal battery backup when plugged in properly.

**NOTE:** On a full charge the A.D.S. 2000 has up to 12 hours of battery backup for uninterrupted operation during power failure. Complete battery recharging is accomplished in approximately 8 hours.

6. Connecting the Breathing Circuit - Connect the two large ends of the breathing circuit to the "BREATHING CIRCUIT" ports on the front panel of the A.D.S. 2000. You may use your own breathing circuit if you desire. The top port (inspiratory) of the A.D.S. 2000 feeds oxygen / anesthesia into the animal's lungs. The bottom port (expiratory) is the exhaust. After the lungs have been inflated the internal exhale valve allows the natural elasticity of the animal's lungs to exhale oxygen / anesthesia through this port.

sampling system perform the following steps:

- 1) Insert the Luer lock connector to the gas sampling input and rotate it clockwise one half turn.
- 2) Connect the two breathing circuits ends to the breathing circuit ports.
- 3) Now insert the gas-sampling elbow into the end of the breathing circuit as shown.
- 4) Insert the Luer lock connector to the gas-sampling elbow and rotate it clockwise one half turn.



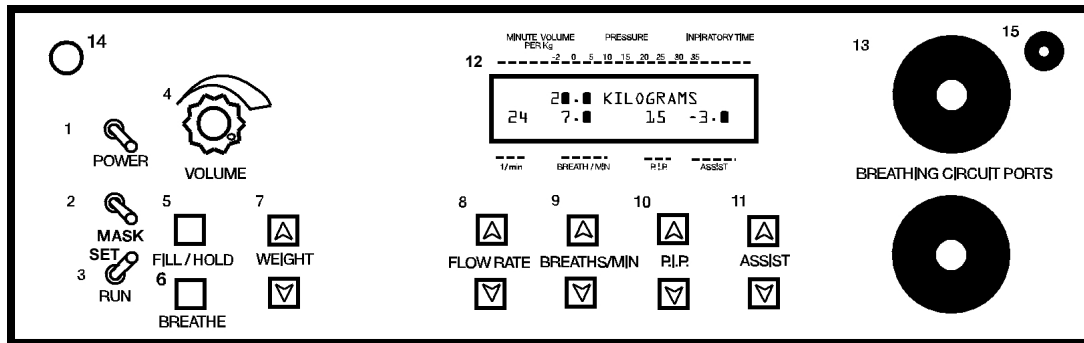
**Note: You're A.D.S. 2000 unit is fitted with a hose disconnect safety system. In the event that the external sampling hose becomes disconnected the system will disconnect the gas input to the patient, sound an alarm and flash the red LED on the front left corner of the unit.**

Once the external sampling hose is reconnected, the unit will continue to work at its previous setting.



## GETTING FAMILIAR WITH THE A.D.S. 2000

In order to operate the A.D.S. 2000 properly, you need know its controls.  
**Front View:**



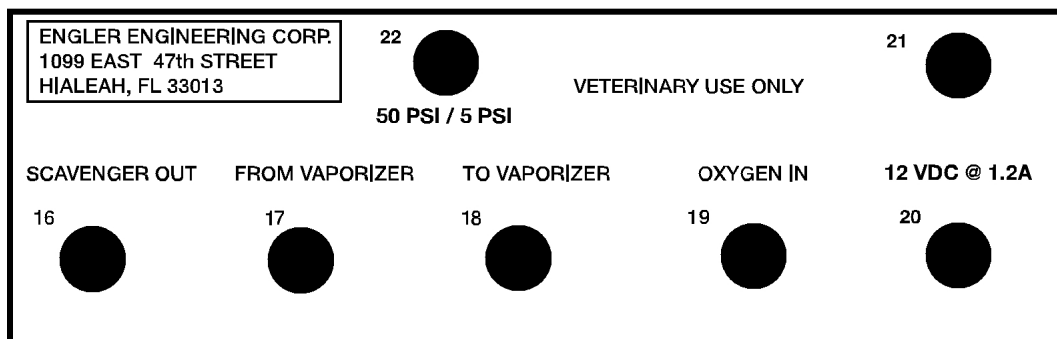
- [1] **POWER Switch** - This switch turns the power to the A.D.S. 2000 ON and OFF.
- [2] **MASK Switch** - This switch is used for enabling and disabling the mask mode
- [3] **SET / RUN Switch** - When in the SET position this switch allows the operator to enter in the patients' weight. When switched to RUN the A.D.S. 2000 begins ventilating the patient.
- [4] **VOLUME Knob** - This knob controls the volume of the audible warning alarm. We suggest that you start with it turned fully clockwise, i.e. full volume and adjust it as necessary.
- [5] **FILL / HOLD Button** - When this button is pressed, the A.D.S. 2000 will fill the lungs of the patient to the indicated peak inspiratory pressure and hold it until the button is released.
- [6] **BREATHE Button** - When this button is pressed, the A.D.S. 2000 will initiate a breath to the indicated peak inspiratory pressure to the patient.
- [7] **WEIGHT UP / DOWN Buttons** - When the A.D.S. 2000 is in the SET mode these buttons allow the operator to enter the weight of the patient, from below 1.0 Kg. to 68 Kg.
- [8] **FLOW RATE UP / DOWN Buttons** - Depressing these buttons cause the flow rate to increase or decrease, from 0.2 LPM to 60 LPM
- [9] **BREATHS PER MINUTE UP / DOWN Buttons** - These buttons control the minimum number of times that the A.D.S. 2000 will breathe per minute, from 1 to 95 B.P.M.
- [10] **P.I.P. UP / DOWN Buttons** - These buttons control the Peak Inspiratory Pressure in cm of H<sub>2</sub>O, that the A.D.S. 2000 will deliver to the patient, from 5.0 to 35 cm./ H<sub>2</sub>O
- [11] **ASSIST UP / DOWN Buttons** - These buttons set the sensitivity of inspiratory effort necessary for the A.D.S. 2000 to facilitate an assisted breath, from -0.3 to 6.0 cm. / H<sub>2</sub>O They also allow the assist feature to be turned off.
- [12] **LCD DISPLAY** - Displays minute volume, inspiratory time, proximal airway pressure, flow rate, breaths per minute, peek inspiratory pressure, and assist pressure.

- [13] **BREATHING CIRCUIT PORTS** - Connect the breathing circuit to these ports.
- [14] **BATTERY LOW INDICATOR / SAFETY ALARM** - The red led on the front panel of the A.D.S. 2000 is a warning indicator that the battery power is low, and that the unit should be placed on charge immediately. When the unit is first powered up the led will self test by flashing on and then should remain off.  
The LED will flash if the external sampling hose is disconnected.
- [15] **GAS SAMPLING INPUT** - To connect the gas sampling system, insert the Luer lock connector to the gas sampling input and rotate it clockwise one half turn. The Luer lock connector is located at the end of the 1/8" clear tube. Locate the other Luer lock connector at the other end of the 1/8" clear tube. Connect it to the gas-sampling elbow on the breathing circuit.

**Note:** It is imperative that the gas sampling hose stay connected during use.

**Rear View:**

- [16] **SCAVENGER OUT** - Connect one end of the blue "Scavenger" tubing to this port and connect the other end to a scavenging filter canister or other scavenging device, either active or passive.
- [17] **FROM VAPORIZER** - Connect one end of the "From Vaporizer" hose to this port and connect the other end to the outlet port of your precision vaporizer.
- [18] **TO VAPORIZER** - Connect one end of the "To Vaporizer" hose to this port and connect the other end to the inlet port of your precision vaporizer.
- [19] **OXYGEN IN** - Connect one end of the green "Oxygen" hose to this port and connect the other end to an oxygen source that is set to a pressure of 50 psi (pounds per square inch).
- [20] **POWER INLET** - Connect your power cord to this port.
- [21] **ALARM** - This is the alarm speaker.
- [22] **50 psi / 5 psi** - This is the manual control to alternate between the 50 psi normal operating mode and the 5 psi for lab mode.



In order for the A.D.S. 2000 to operate properly you must enter in the correct patient weight. The A.D.S. 2000 requires that the patients weight be entered in kilograms, therefore if the patients weight in pounds is known then the following formula will help in determining the patients weight in kilograms.

$$\text{Kg} = \text{P} \times 0.454$$

Where:

Kg = patients' weight in kilograms

P = patients' weight in pounds

Example: You have a 40 pound patient and need to find out its' weight in kilograms.

$$\text{Kg} = 40 \times 0.454$$

Kg = 18.2 Kilograms or just 18 Kilograms

Conversion from kilograms to pounds			
Kilograms	Pounds	Kilograms	Pounds
1	2.205	35	77.160
2	4.409	36	79.365
3	6.614	37	81.570
4	8.818	38	83.774
5	11.023	39	85.979
6	13.228	40	88.183
7	15.432	41	90.388
8	17.637	42	92.593
9	19.841	43	94.797
10	22.046	44	97.002
11	24.250	45	99.206
12	26.455	46	101.411
13	28.660	47	103.616
14	30.864	48	105.820
15	33.069	49	108.025
16	35.273	50	110.229
17	37.478	51	112.434
18	39.683	52	114.638
19	41.887	53	116.843
20	44.092	54	119.048
21	46.296	55	121.252
22	48.501	56	123.457
23	50.705	57	125.661
24	52.910	58	127.866
25	55.115	59	130.071
26	57.319	60	132.275
27	59.524	61	134.480
28	61.728	62	136.684
29	63.933	63	138.889
30	66.128	64	141.093
31	68.342	65	143.298
32	70.547	66	145.503
33	72.751	67	147.707
34	74.956	68	149.912

## TURNING ON THE A.D.S. 2000

1. Verify that the oxygen supply hose is connected properly. Open the valve to begin oxygen supply to the A.D.S. 2000. The oxygen supply must be regulated to 50 psi. Make sure that the vaporizer (if in circuit) is in the "OFF" position.
2. Place the "POWER" and "MASK" switches into the "O" position. Place the "SET / RUN" switch into the "SET" position. Check that the normal 50 psi / Lab 5 psi switch located at the rear of the unit is set to normal 50 psi position.
3. Place your thumb over the open end of the gas-sampling elbow that is connected to the end of the breathing circuit.

**Note:** By placing your thumb over the gas-sampling elbow you are creating a closed circuit for the A.D.S. 2000's built in self-test feature.

**Note:** The gas sampling system hose must be properly connected before the A.D.S. 2000 self-test is initiated.

4. While still holding your thumb over the sampling elbow, place the Power switch into the "I" or "On" position. The A.D.S. 2000 will now perform a self-test. This will be indicated by the LCD display as shown in Figure 1. Continue to hold your thumb over the end of the sampling elbow until this test is complete.

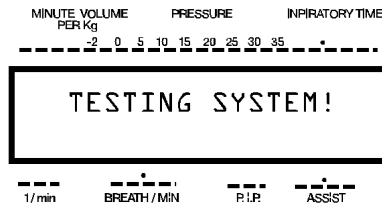


Fig.1

5. As shown in Figure 2, at the end of the self-test you will be prompted by one of the following messages in the LCD display.

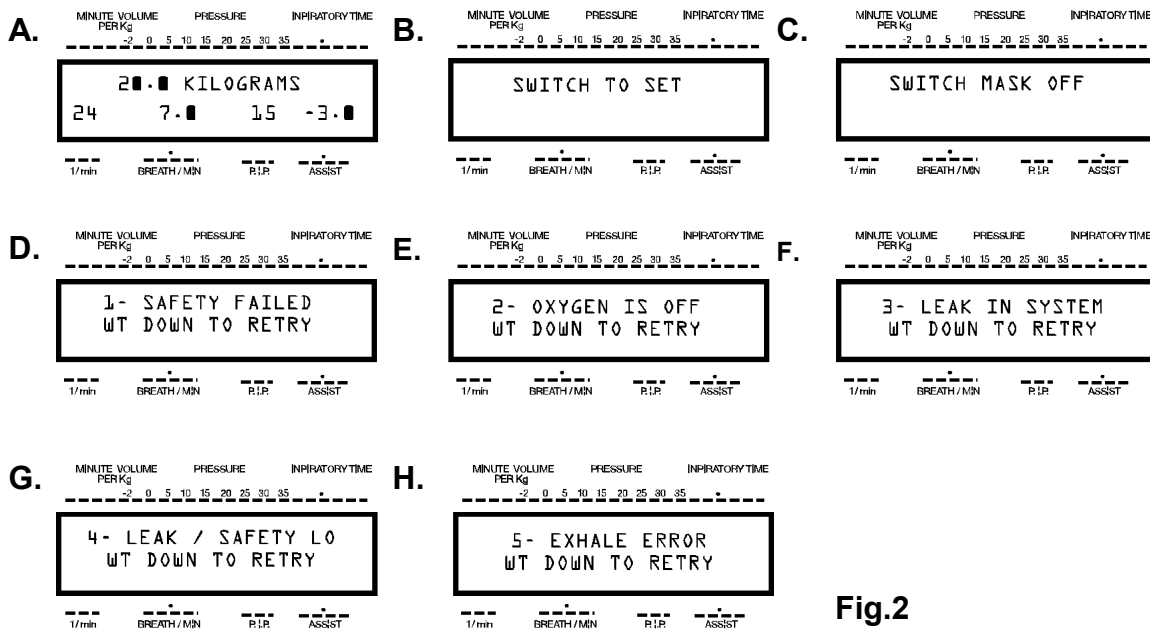
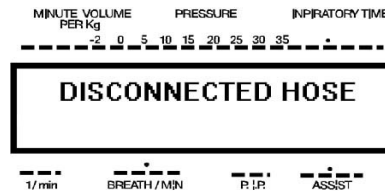


Fig.2



**Fig.3**

6. When the unit passes self test, the LCD Display will show (fig 2 A), its automatic default – 20 kilograms. The A.D.S. 2000 has just passed the self-test.

7. If you get readout "B. SWITCH TO SET", then place the SET / RUN switch into the "SET" position. The display will now give readout "A" or "C", if you get readout "A." then proceed to Step 6.

8. If you get readout "C. SWITCH MASK OFF" then place the "MASK" switch into the "O" or "OFF" position. The display will now give readout "A", if it does, then proceed to Step 6.

9. If you get any one of the error messages "D" through "H" please refer to the TROUBLESHOOTING THE A.D.S. 2000, section of this manual, beginning on page 24.

10. If a message as in figure 3 is displayed, a hose from the breathing circuit or the sampling circuit is not connected properly.

The A.D.S. 2000 is ready for operation!

**Note: Do not connect test lung until unit has passed self-test.**

## SET MODE

In this section you will learn how to understand and set up the parameters of the A.D.S. 2000 in the "SET MODE". The "SET MODE" is the resting or static mode for the A.D.S. 2000. The "SET MODE" is the mode in which you will enter the patients' weight in kilograms and from that input the A.D.S. 2000 will select all of the other parameters for you. Of course, the A.D.S. 2000 will only select values based on an average, if at any time you wish to change any parameter, you may do so.

**THE LCD DISPLAY in SET MODE.** Figure 2 A shows the default 20 kilograms display once the self test process is completed.

1. Make sure that the switch is in the "SET MODE" position.

2. As shown on figure 2A we can see the following:

- a. Patient weight is preselected at 20 Kilograms.
- b. The flow rate for this patient has been preselected to a value of 24 liters per minute.

- c. The patient will be ventilated at a preselected minimum of breaths per minute.
- d. The peak inspiratory pressure for this patient has been preselected to a value of 15 cm. of H<sub>2</sub>O.
- e. The ASSIST feature is on, at a preselected value of -3.0 cm. of H<sub>2</sub>O.

Every time you turn on the A.D.S. 2000, the LCD display should show the default values as shown on page 10, indicating a successful self-test.

3. To enter a different weight, simply press either the WEIGHT UP or WEIGHT DOWN buttons on the front of the A.D.S. 2000 until the upper line of the LCD displays the desired weight.

**NOTE:** Weight values under 10 Kilograms are set to the nearest 0.5 Kilograms, while weights over 10 Kilograms are set to the nearest 1 Kilogram.

**NOTE:** It is important to set the unit for the correct weight for each patient so that the MINUTE VOLUME PER KILOGRAM value will be calculated correctly.

4. As you select different weight values the A.D.S. 2000 automatically provides default ventilation parameters. At any time before or during a procedure, you can change any of following parameters:

- a. LITERS PER MINUTE - To adjust the flow rate to the patient, simply press the FLOW RATE UP or FLOW RATE DOWN buttons on the front of the A.D.S. 2000.
- b. BREATHS PER MINUTE - To adjust the number of breaths per minute delivered to the patient, simply press the BREATHS PER MINUTE UP or BREATHS PER MINUTE DOWN buttons on the front of the A.D.S. 2000.
- c. PEAK INSPIRATORY PRESSURE - To adjust the peak inspiratory pressure delivered to the patient, press either the P.I.P. UP or P.I.P. DOWN buttons on the front of the A.D.S. 2000.
- d. ASSIST - To adjust the amount of inspiratory effort needed to initiate a breath by the patient, press either the ASSIST UP or ASSIST DOWN buttons on the front of the A.D.S. 2000.

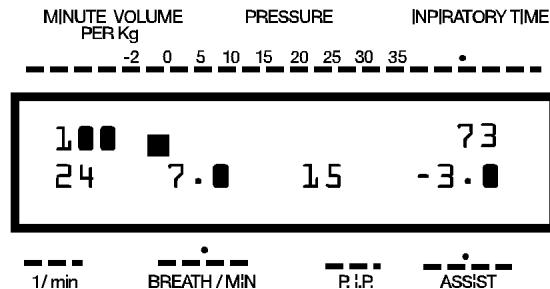
**NOTE:** To turn the ASSIST feature off, press and hold the ASSIST DOWN button until the LCD displays "OFF" where the Assist value was located.

## THE LCD DISPLAY in RUN MODE

**NOTE:** We suggest that you practice with the provided test lung, until you feel confident that you fully understand the proper operation of the A.D.S. 2000. Throughout the manual whenever the word "patient(s)" is used, you will also see the words (TEST LUNG), this means that you should first familiarize yourself with this function by using the "TEST LUNG".

**NOTE:** When using the TEST LUNG you should always keep the vaporizer in the OFF position.

1. Now that you have entered in the patients' weight (the TEST LUNG simulates a 20 Kilogram patient), you are ready to begin delivering anesthesia or ventilating your patient (TEST LUNG).
2. If you haven't done so already, connect the end of the Breathing Circuit to your patient (TEST LUNG).
3. Place the SET / RUN switch into the "RUN" position. The patients' (TEST LUNG) chest should begin to fill up to the preset P.I.P.
4. After the patient (TEST LUNG) has reached the preset P.I.P. the exhale valve will open and the patients' (TEST LUNG) chest will exhale. The LCD display should look similar to the display below.



**NOTE:** Numbers used in section 5 and 6 of pages 11 and 12 are examples only.

5. The upper line of the LCD readout is now displaying, from left to right, the following information:

- a. Minute Volume Per Kilogram, (100 in this case). This number will be updated with each breath.
- b. Peak Inspiratory Pressure Graph, (A square black cursor moving across a white background).

**NOTE:** The cursor starts at 0 cm. of H<sub>2</sub>O and moves up to the selected Peak Inspiratory Pressure (15 cm. of H<sub>2</sub>O in this case).

**NOTE: A square BLACK cursor moving across a WHITE background indicates that the breath was initiated by the A.D.S. 2000. Whereas a square WHITE cursor moving across a BLACK background indicates that the patient initiated the breath.**

c. **Inspiratory Time, (.73 seconds in this case)**

**6. The bottom line of the LCD readout shows the following parameters:**

a. **Flow Rate, (24 Liters Per Minute in this case).**

b. **Breaths Per Minute, (7 Breaths per minute in this case).**

c. **Peak Inspiratory Pressure, (15 cm. of H<sub>2</sub>O in this case).**

d. **Assist (Inspiratory Effort), (-3.0 cm. of H<sub>2</sub>O in this case).**

**7. The A.D.S. 2000 will now wait until either the patient initiates a breath, either by giving an inspiratory effort of equal or greater to the ASSIST value (-3.0 in this case), or until it is time for the A.D.S 2000 to give the next breath (computed by the microprocessor), it will then repeat the cycle.**

**NOTE: If pressure in the system increases between breaths, a built in safety feature will cause the A.D.S. 2000 to allow an "exhale", i.e. the exhale valve opens to allow pressure to escape. This would happen, for instance, if the surgeon leaned on the patient's chest. It can also happen if the patient tries to exhale after he has already exhaled a tidal volume. You will hear the exhale valve open and close rapidly. *This is normal.***

**8. To temporarily stop the A.D.S. during a procedure, place the SET / RUN switch into the "SET" position. By doing so the current parameters will be held, the current breath will be completed and the machine will stop. To continue ventilation, switch back to the "RUN" position.**

## **UNDERSTANDING THE MINUTE VOLUME NUMBER**

**1. Since a blood gas analysis is not always available, we provide a minute volume number as a guide, to know if you are properly ventilating the patient. A properly ventilated patient should require from 150 to 250 ml. / minute / Kg. The 150 ml. / minute / Kg. number is appropriate for larger patients and the 250 ml. / minute / Kg. number for smaller patients. In general, it is better to over ventilate rather than under ventilate a patient.**

**NOTE: The Minute Volume per Kilogram number becomes useful after the patient has stabilized. It will require a few breaths for this stabilization to take place, and then you will see the Minute Volume per Kilogram number fluctuate between breaths.**



## 2. There are two ways to change the Minute Volume per Kilogram number:

- a. Since the Minute Volume number is directly proportional to Breaths Per Minute, the most direct way to change the Minute Volume number is to change the number of Breaths Per Minute.
- b. Changing the Peak Inspiratory Pressure (P.I.P.) will change the Tidal Volume and therefore change Minute Volume number as well. Obese patients with low thoracic compliance and patients with restrictive lung conditions will often need a higher Peak Inspiratory Pressure. The best method is to observe the chest and adjust the Peak Inspiratory Pressure for a "reasonable" amount of filling.

## THE PEAK INSPIRATORY PRESSURE GRAPH

1. The Peak Inspiratory Pressure of the patient is indicated by a cursor moving across the middle of the LCD display.
2. The cursor starts at 0 cm. of H<sub>2</sub>O and moves up to the selected Peak Inspiratory Pressure.
3. A square BLACK cursor moving across a WHITE background indicates that the breath was initiated by the A.D.S. 2000. Whereas a square WHITE cursor moving across a BLACK background indicates that the patient initiated the breath. (ASSIST MODE)

## THE INSPIRATORY TIME

1. The information in the upper right hand corner of the display shows the Inspiratory Time in seconds, e.g., 1.20 and is updated with each breath. The exact length of inspiration is not critical, but it should allow an INSPIRATORY: EXPIRATORY RATIO of at least 1:2. This means at 10 breaths per minute, the inspiratory time should be no longer than two seconds. Generally, intervals of 0.75 to 2 seconds are suggested, the shorter time intervals being best for smaller patients.
2. The easiest way to adjust the Inspiratory Time is to adjust the Flow Rate, i.e. the higher the flow rate the quicker the lungs will be brought up to the preset Peak Inspiratory Pressure, thus a quicker Inspiratory Time. Generally set the FLOW RATE so that the patient's chest rises in a reasonable time.

**IMPORTANT:** Very short inspiratory times may indicate a very high FLOW RATE into a very small patient. Under these circumstances, the narrowness of the tube and the resistance of the trachea and other air passageways will cause the pressure to build up without inflating the lungs. It is usually very obvious when this occurs because the pressure will rise extremely rapidly, but the chest will not fill. **DO NOT LET THIS CONDITION GO UNCORRECTED.** Lower the flow rate to 2 or 4 LPM and let the chest fill slowly.

Once the chest is filling normally, raise the flow rate up to a reasonable inspiratory time.

3. If the Inspiratory Time exceeds 3 seconds, the ALARM will sound. This may be due to a too low FLOW RATE, but is usually caused by a leak in the system. Most of the time the problem will be a leaking endotracheal tube cuff. This can almost always be detected by carefully listening for a leak during inhalation.

## DISPLAYING TIDAL VOLUME

1. Tidal Volume can be displayed instead of Minute Volume Per Kilogram. This option can be initiated upon start-up or while set / run switch is on run. In order to have the A.D.S. 2000 display the Tidal Volume, depress the FLOW RATE up button and hold it down while turning the ON A.D.S. 2000. You can also press WEIGHT UP during run mode. To exit this mode, you can turn the A.D.S. 2000 OFF and restart the unit or press WEIGHT DOWN while set / run switch is on run.

## UNDERSTANDING FLOW RATE

1. The Flow Rate displayed on the A.D.S. 2000 is an instantaneous value, i.e. if the A.D.S. 2000 was set to 24 LPM then if the unit were to have an inspiratory time of 1 minute then 24 liters of gas would have been used. In reality, the A.D.S. 2000 only allows gas to flow when a breath is being delivered. In order to determine the "Actual Flow Rate" a simple calculation can be performed. This calculation is as follows:

$$F_{ave.} = (F_{ins} \times T_{on} \times B) / 60$$

Where:

$F_{ave.}$  = Actual Flow Rate

$F_{ins.}$  = Flow Rate on LCD Display

$T_{on}$  = Inspiratory Time

$B$  = Actual Breaths Per Minute

## **UNDERSTANDING BREATHS PER MINUTE**

1. The Breaths Per Minute displayed is the exact Breaths Per Minute only when the ASSIST is in the OFF setting. If the ASSIST is ON, the displayed value is the minimum Breaths Per Minute, i.e. the A.D.S. will initiate a breath only if the patient does not do so in the allotted time. The A.D.S. 2000 correctly updates and displays the Minute Volume per Kilogram after each breath, whether the patient or the machine initiated the breath.

**NOTE:** If the ASSIST is in the OFF position and the Breaths Per Minute is set at 6.0, then the patient (TEST LUNG) will only have six inspiratory / expiratory cycles each minute.

**NOTE:** If in the above case, the ASSIST was in the -2.0 setting and the Breaths Per Minute remained at 6.0, and the patient gave a single inspiratory effort of -2.0 cm. of H<sub>2</sub>O, then the patient will have seven inspiratory / expiratory cycles for that minute.

## **HOW TO SET P.I.P.**

1. To adjust the Peak Inspiratory Pressure, simply depress either the P.I.P. UP or P.I.P. DOWN buttons on the front of the A.D.S. 2000.

**NOTE:** To see how the P.I.P. setting works using the TEST LUNG, press the P.I.P. DOWN button until it displays 5.0, place the SET / RUN switch into the "RUN" position. The TEST LUNG will begin to fill up to 5.0 cm. H<sub>2</sub>O shown on the display. Notice that the TEST LUNG does not inflate as much as it did when the P.I.P. was set at 15.

## **UNDERSTANDING ASSIST**

1. The default setting for ASSIST, i.e. assisted respiration is set at -3.0 cm. of H<sub>2</sub>O. This setting allows for a breath to be initiated by the patient. If you wish to allow the patient to initiate its own breath, use the ASSIST buttons on the far right to set the amount of NEGATIVE PRESSURE, i.e. VACUUM the patient has to produce in order to initiate a breath.

2. You would usually select the lowest possible number that does not cause false breaths. When in ASSIST mode the A.D.S. 2000 will wait for the patient to initiate a breath. If the patient does not spontaneously INITIATE a breath, the A.D.S. 2000 will automatically begin the breathing cycle for the patient at the set parameters.

3. If you prefer not to allow the patient to initiate its own breath, you may do so by pressing the ASSIST DOWN button until the display reads "OFF". This is not recommended.

## USING THE FILL / HOLD FEATURE

1. FILL / HOLD fills the chest to the selected pressure and then maintains that pressure, i.e., it does not allow exhalation until the button is released. FILL and HOLD can be used to induce a patient as described below in the section BUCKING THE A.D.S.
2. FILL / HOLD can also help during closure of thoracotomy incisions. Simply press the FILL and HOLD and hold it until the lungs are filled. The lungs will fill to the preset parameter and will remain inflated AT THAT PRESSURE until the button is released. There is some hysteresis, i.e. the pressure is allowed to fall 3 cm. H<sub>2</sub>O before the chest is refilled. Overzealous hyperinflation of previously collapsed areas of the lungs can cause pulmonary damage.

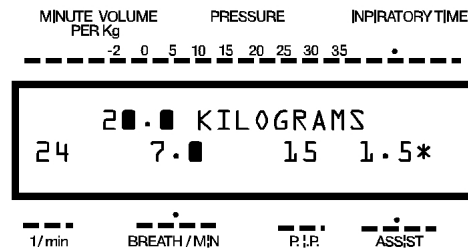
For this reason it is best to inflate the lungs at the lowest possible P.I.P. value, (around 10 cm. of H<sub>2</sub>O) and for the shortest time necessary (a few seconds) when the chest is open.

## RESISTING (BUCKING) THE A.D.S.

1. If the patient is not in a deep enough plane of anesthesia it may attempt to buck the A.D.S. 2000. You will see very short inspiration times and violent attempts to inhale and exhale. There are several practical solutions to this problem.
  - a. Patient may require additional medication, on Doctors orders. (For example intravenous drugs).
  - b. Set the vaporizer to 4 or 5 percent. Then press FILL & HOLD and keep the button depressed for a second or two. Release, then repeat. Do this until the patient relaxes, then reset the vaporizer and allow the A.D.S. 2000 to take over.
  - c. Set the ASSIST value to a more sensitive value (i.e. a smaller negative number, -2.0 is more sensitive than -4.0), turn the vaporizer to 3 or 4 percent. The patient will usually ventilate himself down. The Minute Volume number may go up for a few breaths.
3. Once the patient is stabilized, the settings can be adjusted (if necessary).

## UNDERSTANDING PEEP MODE

1. The A.D.S. 2000 has a built in PEEP (Positive End Expiratory Pressure) mode. To activate the PEEP mode perform the following:
  - a. Press the ASSIST UP button until the unit displays “Entering the PEEP mode” and the alarm beeps.
  - b. As shown below, the LCD display will now show a PEEP value instead of an ASSIST number



**NOTE:** An " \* " is displayed as an indication that the A.D.S. 2000 is in the PEEP mode.

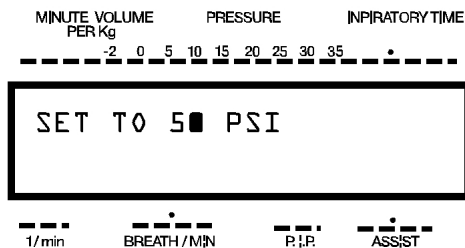
**NOTE:** The ASSIST mode will not function when the A.D.S. 2000 is in PEEP mode.

**NOTE:** PEEP pressures range from 0 to 9 cm. of H<sub>2</sub>O. Adjust the PEEP pressure by using the ASSIST UP and ASSIST DOWN buttons.

- c. To exit the PEEP mode Press the ASSIST DOWN button until the unit displays “Entering the ASSIST mode” and the alarm beeps.

## UNDERSTANDING THE FLUSH MODE

1. To avoid failure of the A.D.S. 2000 it must be flushed after each surgery. This will assist to remove any debris or condensation that may build up.
2. To enter the FLUSH mode perform the following:
  - a. Turn OFF the A.D.S. 2000, turn the vaporizer to the off position, and ensure the 5 psi / 50 psi switch is set to 50 psi
  - b. Seal the end of the breathing circuit i.e. by placing your thumb over it. Maintain the seal over the end of the breathing circuit until the end of this procedure.
  - c. Press the FILL & HOLD button and continue holding it down while turning ON the A.D.S. 2000. Continue to hold FILL & HOLD button down for 20 seconds.
  - d. The LCD will now look like the display below. The A.D.S. 2000 is now in the FLUSH mode and a full 60 LPM flow of oxygen is passing through the A.D.S. 2000.



- 
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- 
- 
- e. To exit this mode, simply release the FILL & HOLD button and the unit will go through the usual self-test.

**NOTE:** As a method of preventative maintenance the Flush mode should be done after every procedure. This will insure that the internal hoses and valves are kept clean and dry.

## USING THE BREATHE FEATURE

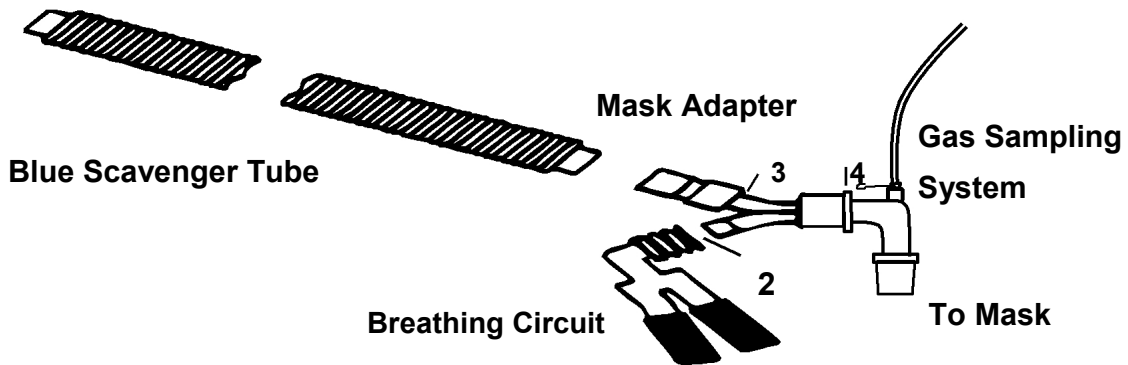
1. The BREATHE button can be pressed at any time between cycles to initiate a breath, overriding both timed and assisted respiration.

**NOTE:** To test the BREATHE function, turn ON the A.D.S. 2000, (see page 10) install the TEST LUNG onto the end of the Breathing Circuit, place the SET / RUN switch into the "RUN" position. In between a machine controlled breath press the BREATHE button, the TEST LUNG should inflate and deflate.

## USING THE MASK MODE

**NOTE:** Unit must be turned ON while in normal mode, then the tubing configuration changed to mask mode.

1. The mask adapter consists of the Y piece and the adapter. Masking a patient down requires an adapter, which is supplied with the unit.
2. As shown below, connect the Breathing Circuit to the end of the "Y" piece.
3. Attach the "Blue Scavenger Tubing" to the adapter that is connected to the "Y" piece.
4. Connect the Gas Sampling Elbow to the large port of the "Y" piece as shown.



5. Set the vaporizer to the desired concentration.

6. Place the "MASK" switch into the ON or "I" position. The LCD display will look like Figure 6, and a continual flow of oxygen with anesthetic gas will flow through the mask at your preselected flow rate.

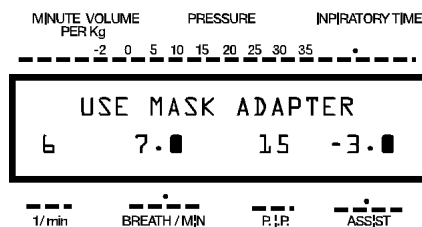


Figure 6

## 7. USING A MASK WHILE IN LAB MODE

When using a mask in lab mode (low flow) do not use the mask adapter. Instead, connect the mask directly to the breathing circuit. The blue scavenger tube should be connected to the scavenger port at the back of the unit.

**NOTE:** An adequate MASK flow is calculated as in the formula below:

$$F_{\text{MASK}} = 3 \times M_V$$

Where:  $F_{\text{MASK}}$  = Mask Flow Rate

$M_V$  = Minute Volume per Kilogram

The A.D.S. 2000 automatically selects a Mask Flow Rate of at least 3 times Minute Volume based on the patients' weight entered.

**NOTE:** The scavenger system must be able to hold at least one Tidal Volume for the mask function to work properly.

**NOTE:** In the MASK mode there is a built in pressure safety that stops the flow to the patient and causes an audible alarm if the pressure exceeds 35 cm. of H<sub>2</sub>O. This pressure can build up if the MASK ADAPTER is not used, i.e. the mask is connected directly to the Breathing Circuit.

8. To end a MASK procedure, simply place the "MASK" switch into the OFF or "O" position. The A.D.S. 2000 then reverts back to normal operation.



## **ENDOTRACHEAL TUBES and the A.D.S. 2000**

- 1. The proper function of any ventilator depends on a good seal between the trachea and the tube cuff. Small leaks will cause the Minute Volume Per Kilogram to be inaccurate, while larger leaks will not allow the peak inspiratory pressure to be reached in a reasonable time if at all.**
- 2. Small tubes should have the adapter on the OUTSIDE, rather than the inside of the tube. When they are on the inside, the adapter narrows the opening significantly and can seriously interfere with respiration. This is, of course, true whether positive pressure ventilation is used or not. In fact, it is even more important for "regular" anesthesia systems.**
- 3. The cuff should be tested to be sure there are no leaks. Fill and cap the cuff, then submerge in water to check for leaks.**
- 4. A good seal must be made to the patient, but care should be used not to put too much pressure on the trachea since excessive pressure can cause damage to the tissue.**

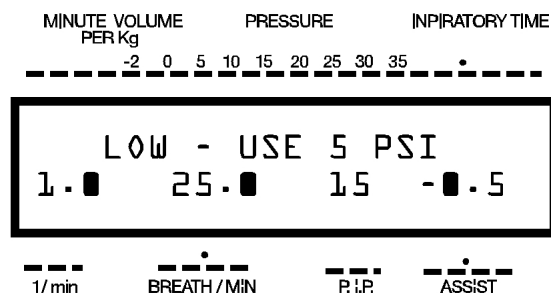
## USING THE A.D.S. 2000 in LAB MODE

In order to facilitate the ventilation of very small patients the A.D.S. 2000 has a low pressure LAB mode. This mode does not have any preset default parameters by weight; therefore it is advised that you have experience operating the A.D.S. 2000 before using this mode. To enter this mode perform the following:

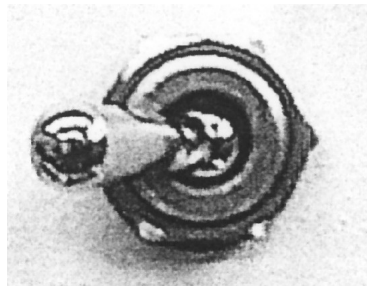
1. Turn ON the A.D.S. 2000 as usual and allow it to go through the self-test procedure. The LCD should display the initial default 20 Kilograms readout.

**NOTE:** The start-up self-test may show an error if you attempt to start the A.D.S. 2000 with the input pressure set at 5 psi, therefore, always start the A.D.S. 2000 in the NORMAL mode at 50 psi then set the 50 psi / 5 psi switch to the 5 psi setting, (to the right).

2. Now press the WEIGHT DOWN button until the LCD displays looks like the one below.



3. On the back panel of the A.D.S. 2000 you will find a toggle switch to select the pressure - 50 psi for normal operation (and to start up self test) and 5 psi for lab mode. Set switch to 5 psi



This A.D.S has an internal regulator for Lab Mode.

Always begin operation with an input pressure of 50 psi

50 psi / 5 psi

4. In LAB mode the Tidal Volume, rather than the Minute Volume per Kilogram, is displayed.

**5. In LAB mode the Flow Rates are adjustable between 0.2 to 6.0 Liters per Minute.**

**6. The Breaths per Minute in LAB mode are adjustable between 1 and 95.**

**NOTE: The Breaths per Minute are in increments of**

**0.5 for 1 - 12 B.P.M.**

**1.0 for 13 - 50 B.P.M**

**2.0 for 50 - 70 B.P.M**

**5.0 for 70 - 95 B.P.M**

**7. The MASK function in LAB mode does not require the use of a Mask Adapter.**

## **USE OF EXTERNAL EQUIPMENT WITH THE A.D.S. 2000**

**Connecting any external apparatus to the A.D.S. 2000 may adversely affect the operation of the unit. Engler Engineering Corporation will not be held liable for any damage to the unit, injury or death to the patient if any non-approved equipment is used.**

**Always test for correct operation on the test lung prior to using it on a patient.**

## **TROUBLESHOOTING CHECK LIST.**

### **1. Check the unit's calibration:**

To enter the calibration mode perform the following:

- a. Turn OFF the A.D.S. 2000, turn the vaporizer to the off position.
- b. Disconnect the breathing circuit and the gas sampling system (if available).
- c. Disconnect the scavenger port.
- d. Press the P.I.P. buttons up and down at the same time and hold them down while turning ON the A.D.S. 2000.
- e. A single number will be displayed in the LCD screen; this number must be between 25 and 27 for the unit to function properly. If the calibration number is not between 25 and 27, the unit is out of calibration. To have the unit calibrated, fill the repair form in the back of this manual and send it with the unit to Engler Engineering Corporation for recalibration.

### **2. Make sure that the unit has been flushed at the end of each procedure:**

To enter the FLUSH mode perform the following:

- a. Turn OFF the A.D.S. 2000, turn the vaporizer to the off position, and ensure the 5 psi / 50 psi switch is set to 50 psi
- b. Place and hold your thumb over the end of the breathing circuit.
- c. Press the FILL & HOLD button and continue holding it down while turning ON the A.D.S. 2000. Continue to hold FILL & HOLD button down for 20 seconds.
- d. The LCD will display "SET TO 50 psi". The A.D.S. 2000 is now in the FLUSH mode and a full 60 LPM flow of oxygen is passing through the A.D.S. 2000.

3. Make sure oxygen is on and the oxygen line pressure is 50 psi.
4. Check for cracks and leaks on the breathing circuit. If any damage is found replace breathing circuit.
5. Ensure that unit is connected to power and that the battery low LED is not on. If battery low LED is on the unit must be charged.

If battery low LED stays on after the unit has been powered you may have one of the following problems:

- a. There is no power in the wall socket that you are connecting the unit to.
  - b. The power adapter is damaged.
  - c. The battery has expired and needs to be replaced. To have the battery replaced, complete the repair form in the back of this manual and send it with the unit to Engler Engineering Corporation for repair.
  - d. The power socket in the back of the A.D.S.2000 has been damaged needs to be repaired. Complete the form in the back of this manual and send it with the unit to Engler Engineering Corporation for repair.
6. Make sure that the gas sampling system is connected.

To connect the external sensor input, insert the Luer lock connector to the gas sampling input and rotate it clockwise one half turn. Now insert the gas-sampling elbow into the end of the breathing circuit.

7. Observe the vaporizer hoses and make sure that they are properly connected, and not cracked or broken.

## TROUBLESHOOTING THE A.D.S. 2000

**NOTE:** The use of certain types of electrosurge cauterizing units can cause severe radio interference resulting in “locking up” the microprocessor. It is suggested to experiment with the supplied test lung to see which cauterizing units are compatible with the ADS 2000.

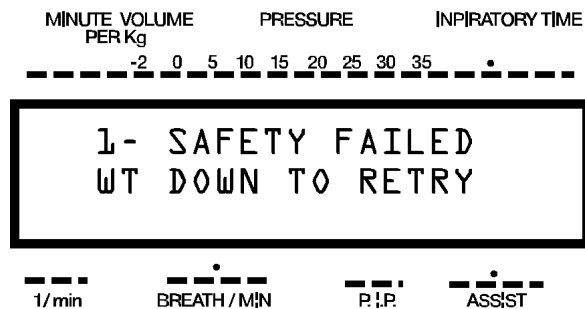
**NOTE:** The power supply that is supplied with the A.D.S. 2000 can sometimes act as an antenna for receiving interference from an electrosurge unit. Sometimes unplugging the power supply (running in battery mode) aids in isolating the A.D.S. 2000 from electrosurge interference.

**Note:** Your A.D.S. 2000 unit is fitted with a hose disconnect safety system. In the event that the external sampling hose becomes disconnected the system will disconnect the gas input to the patient, sound an alarm and flash the red light on the front left corner of the unit.

Once the external sampling hose is reconnected, the unit will continue to work properly.

If you encounter any unusual difficulties with the A.D.S. 2000 call Engler Engineering at 1-800-445-8581. Engler Engineering Corporation warrants the A.D.S. 2000 to be free from material or manufacturing defects for two years. Do not attempt to repair the A.D.S 2000 on your own. Doing so will invalidate your warranty.

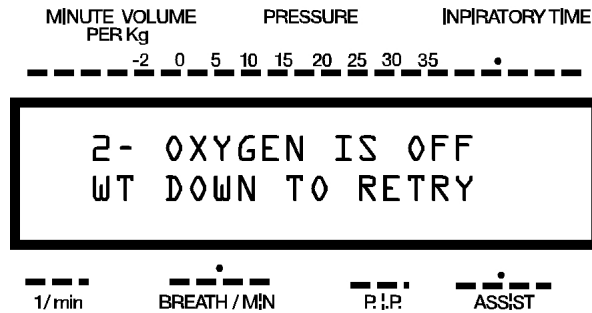
1. If upon Self-Test you get the following display:



- a. This indicates that the mechanical Safety pop-off valve inside the unit is dirty or it has failed.

- b. There is debris or condensation trapped inside the unit, perform a **FLUSH** of the unit by following the instructions in the **UNDERSTANDING THE FLUSH MODE** section of this manual. Then Press the **WEIGHT DOWN** button to retry.
- c. Call Engler's assistance hot line. 1-800-445-8581.

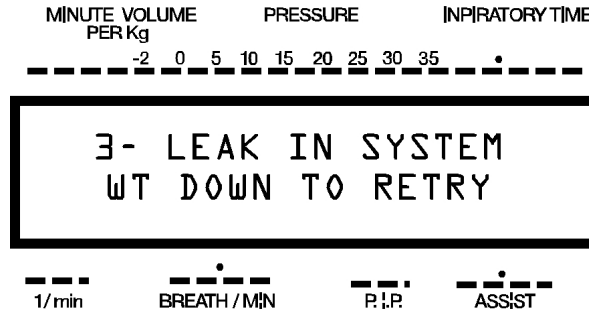
**2. If upon Self-Test you get the following display:**



This may indicate a number of problems. In order to test all internal lines and valves the A.D.S. 2000 attempts to pressurize and then checks for leaks. If it cannot pressurize then it will give the above readout. The causes for the error are as follows:

- a. No oxygen or very low oxygen pressure, check to insure that there is 50 psi of oxygen in the Green oxygen hose that runs to the back of the A.D.S. 2000. Press the **WEIGHT DOWN** button to retry.
- b. The "To Vaporizer" and / or "From Vaporizer" connectors are loose, check all vaporizer hoses and connectors, make sure they are secure and that they have no leaks. Press the **WEIGHT DOWN** button to retry.
- c. The vaporizer has a leak internally, to eliminate this problem connect the "To Vaporizer" hose directly to the "From Vaporizer" hose, and Press the **WEIGHT DOWN** button to retry.
- d. You are not placing you thumb over the gas-sampling elbow that is connected to the end of the breathing circuit during start-up. Place your thumb over the end of the gas-sampling elbow and press the **WEIGHT DOWN** button to retry.
- e. The gas sampling hose is disconnected or not installed properly.
- f. Low battery - recharge unit.
- g. If the problem persists call Engler's assistance hot line. 1-800-445-8581

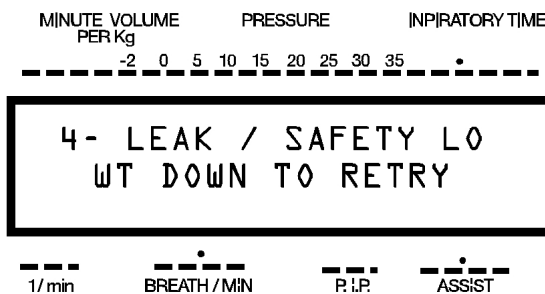
3. If upon Self-Test you get the following display:



This indicates that there is leak somewhere in the system.

- a. There is debris or condensation trapped inside the unit, perform a FLUSH of the unit by following the instructions in the UNDERSTANDING THE FLUSH MODE section of this manual. Then Press the WEIGHT DOWN button to retry.
- b. One of the tubes coming out of the back of the unit is loose, check all connections and Press the WEIGHT DOWN button to retry.
- c. The Breathing Circuit has a leak or cuff is loose, check the Breathing Circuit for leaks and check to see if it is securely connected to the Breathing Circuit Ports on the front of the unit. Press the WEIGHT DOWN button to retry.
- d. Vaporizer has a leak or improper hose connection to vaporizer.
- e. Pop off valve adjustment needed. This must be completed by Engler Engineering as specialized tools and test equipment is required.
- f. If the problem persists call Engler's assistance hot line. 1-800-445-8581

4. If upon Self-Test you get the following display:

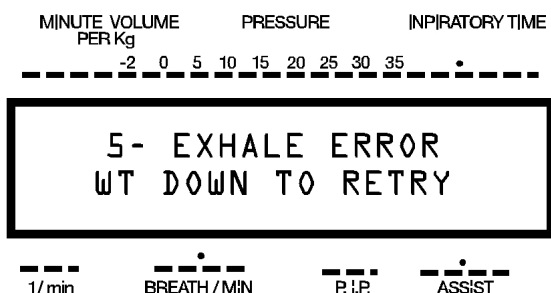


This display indicates that there is a minor leak or the Safety pop off is releasing at too low a pressure.



- a. There is a loose connection to the A.D.S. 2000 or to the vaporizer, check all of the connections and secure them if necessary. Press the WEIGHT DOWN button to retry.
- b. There is debris or condensation trapped inside the unit, perform a FLUSH of the unit by following the instructions in the UNDERSTANDING THE FLUSH MODE section of this manual. Then Press the WEIGHT DOWN button to retry.
- c. If the problem persists call Engler's assistance hot line.  
1-800-445-8581

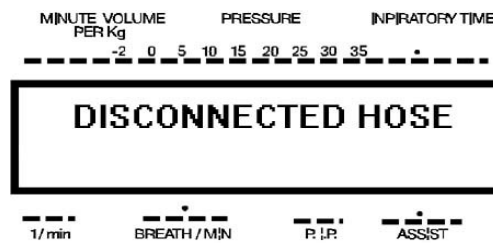
5. If upon Self-Test you get the following display:



This display indicates that there is an obstruction to the exhale valve or that the exhale valve did not open. The following can cause this error.

- a. There is an obstruction in the scavenging system, check to insure that a free flow of exhaust gas can pass through the scavenging system. Then Press WEIGHT DOWN button to retry.
- b. An active scavenging system is being used and the active scavenger valve is in the CLOSED or SHUT position. Open the active scavenger valve and then Press WEIGHT DOWN button to retry.
- c. Battery is too low – recharge unit
- d. If the problem persists call Engler's assistance hot line.  
1-800-445-8581

6. If at any point in time during the procedure you get the following display:



The display indicates that there is a hose disconnected. Typically the gas sampling hose.

- a. Inspect all the hoses and reinstall any disconnected hoses. After a few seconds the system will automatically go back to normal operation.
- b. If the problem persists call Engler's assistance hot line. 1-800-445-8581

## FREQUENTLY ASKED QUESTIONS:

**Q. The Flow Rate indicated on my LCD readout seems to be a very high number, in my rebreathing system I never used flow rates like 32 or 44 liters per minute, is this normal?**

**A. Absolutely, the LCD readout on the A.D.S. 2000 gives the Flow Rate if the unit were left on for an inspiratory time of 60 seconds (1 minute). An example would be as follows; say the A.D.S. 2000 was set to 24 LPM and we let the unit have an inspiratory time of 1 minute, then 24 liters of gas would have been used. In reality, the A.D.S. 2000 only allows gas to flow for whatever the Inspiratory Time is. In order to determine the "Actual Flow Rate" a simple calculation can be performed. This calculation is as follows:**

$$F_{ave.} = (F_{ins} \times T_{on} \times B) / 60$$

**Where:**

**F<sub>ave.</sub>** = Actual Flow Rate

**F<sub>ins.</sub>** = Flow Rate on LCD Display

**T<sub>on</sub>** = Inspiratory Time

**B** = Actual Breaths Per Minute

**Q. How does the A.D.S. 2000 calculate the Minute Volume per Kilogram?**

**A. The formula for calculating minute volume is:**

$$M_V = (T_V \times B) / W$$

**Where: M<sub>V</sub>** = Minute Volume per Kilogram

**T<sub>V</sub>** = Tidal Volume

**B** = Breaths Per Minute

**W** = Weight in Kilograms

The A.D.S. has a built in computer, which determines this number and updates the display after each inspiration has ended.

**Q. What is proper value for the Minute Volume per Kilogram number?**

**A. A properly ventilated patient should require from 150 to 250 ml. / minute / Kg. The 150 ml. / minute / Kg. number is appropriate for larger patients and the 250 ml. / minute / Kg. number for smaller patients.**

**Q. How do I add additional anesthesia liquid to my vaporizer during a procedure?**

To fill the vaporizer during a procedure, place the SET/RUN switch into the "SET" position, wait for the A.D.S. 2000 to complete the last breath cycle. Fill the vaporizer as usual, then switch back to "RUN" and continue.

**Q. How do I change my oxygen tank when it is low?**

**A. As with any anesthesia system, be sure to check your oxygen supply before starting any procedure. To replace the tank, shut off the valve on the top of the oxygen tank, then depressurize the GREEN, "Oxygen In" line running to the A.D.S. 2000. The pressure may be released in the line by slightly loosening the GREEN, hose for a few seconds to bleed the line.**

**Q. I have just successfully completed several procedures, but when I turn the A.D.S. 2000 back ON and it goes through the SELF-TEST, the LCD display gives me Error 4 - LEAK / SAFETY LO, is this normal?**

**A. Yes, this Error is usually caused by a build up of condensation in the exhale valve of the A.D.S. 2000. To remove this condensation simply perform the following procedure:**

- a. Turn OFF the A.D.S. 2000.**
- b. Place and hold your thumb over the end of the gas-sampling elbow that is connected at the end of the breathing circuit.**
- c. Press the FILL & HOLD button and hold it down while turning ON the A.D.S. 2000.**
- d. The unit is now in the FLUSH mode and a full 60 LPM flow of oxygen is passing through the A.D.S. 2000.**
- e. To exit this mode, simply release the FILL & HOLD button and the unit will go through the self-test.**

**Q. Can I use the A.D.S. 2000 with my induction chamber?**

**A. Of course, if you put the A.D.S. 2000 into the MASK mode it will allow a continuous flow of anesthetic gas to exit through the breathing circuit. All you have to do is connect the mask adapter to the unit as described in the section USING THE MASK MODE, but instead of connecting the output to a mask, connect it to your induction chamber.**

**Q. Can I use my vaporizer at the same settings that I am used to using on my rebreathing system?**

**A. Since the A.D.S. 2000 always delivers a consistent breath, using a measured amount of anesthesia, you may find that you can actually turn your vaporizer settings to about one- half of what you had been using with your rebreathing system.**

**Q. Why doesn't the A.D.S. 2000 use a Lime Canister or Breathing Bag?**

**A. Since the A.D.S. 2000 is a positive pressure type of ventilator it only allows the oxygen and or anesthetic to flow during the inspiration phase of the respiratory cycle i.e. only for the inspiratory time. Since the A.D.S. 2000 fills up the lungs for each breath there is no need for a breathing bag. The A.D.S. 2000 does not recycle the exhaled gas; it delivers the waste gas to the scavenger system.**

**Q. What happens if the electronic safety fails?**

**A. To prevent the over-inflation of the lungs, the A.D.S. 2000 incorporates both an electronic and mechanical safety mechanism.**

**Q. Does the gas sampling system need to be connected for the unit to work properly?**

**A. Yes, the gas sampling system must be connected for the unit to work properly.**

**Q. How often does my A.D.S. need to be sent back to the manufacturer for service?**

**A. We recommend sending your A.D.S. with the supplied hoses and power supply in for servicing every two years.**

**Service includes:**

- **Checking the power adapter and socket.**
- **Check the battery for voltage retention and leaks.**
- **Check ports for proper fit, debris and cleaning.**
- **Check operation of all switches.**
- **Check operation and calibration pressure sensor.**
- **Check operation of pressure sensor.**
- **Check oxygen manifold for leaks, proper flow and calibration.**
- **Check pop off for leaks and calibration.**
- **Check hose integrity**
- **Provide software upgrade as available.**

**It is also highly recommended that you send your vaporizer to an authorized center at least once a year for calibration and certification as per OSHA recommendations.**

**RETURN FOR EVALUATION / REPAIR FORM**

**PLEASE PHOTOCOPY AND INCLUDE A COMPLETED COPY WHENEVER SENDING UNITS IN TO US FOR EVALUATION AND / OR REPAIR.**

CONTACT PERSON \_\_\_\_\_

CLINIC PHONE NUMBER: \_\_\_\_\_ FAX # \_\_\_\_\_

CLINIC NAME: \_\_\_\_\_

SHIPPING ADDRESS: \_\_\_\_\_

CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP: \_\_\_\_\_

ITEM BEING SENT: \_\_\_\_\_

Please describe what is happening or why you are sending in this unit:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**PLEASE NOTE:**

**Whenever returning any products for evaluation and / or repair, we strongly suggest you send in the complete unit with all attachments so that a correct evaluation can be made.**

It is suggested that you ship all returns to us by Federal Express or UPS. If using US Mail, it is suggested that you track and insure all packages sent to us.

Address all returns as follows:

**ENGLER ENGINEERING CORP.  
REPAIR DEPARTMENT  
1099 EAST 47 STREET  
HIALEAH, FL 33013**

# LOANER REQUEST FORM - A.D.S. 2000

Loaners will only be sent to locations within the Continental United States.

Please review and complete this form and FAX it back to us at 305-688-0018 so we can ship a unit out to you.

CONDITIONS of the Engler Engineering Corporation loaner program:

1. We must receive this completed and signed form before a loaner is shipped out.
2. A Credit Card is required – the information must be shown on the form below.
3. It is understood that if Engler Engineering does not receive our unit for repair within five (5) business days of receiving the loaner, our credit card will automatically be charged \$50.00 per week for rental of the loaner.
4. We have five (5) business days after we receive your estimate of repairs to send our reply; otherwise a weekly rental charge of \$50.00 will be applied to our credit card.
5. Federal Express or UPS must ship the loaner back to Engler Engineering (NOT GROUND), to be received within five (5) days of the date we receive our unit. We need to insure it and keep record of the tracking number for reference if needed. If the loaner is not received, Engler Engineering will automatically charge our card for the full value of the loaner.
6. We are responsible for all shipping charges.
7. All parts are double checked at shipping to verify that they are included with the loaner. It is our responsibility to notify Engler Engineering at 800-445-8581 on the day the loaner is received if any items are missing.
8. All loaner items must be returned in good working condition. A copy of our check list is sent with the loaner to verify all parts are being returned. Missing and / or damaged items will be charged to our credit card.

NOTE: Loaner requests received after 11:30 AM Eastern time will be shipped out the next day. Unless specified, all loaners will be shipped Federal Express - Express Saver with a 3 to 4 business day delivery time.

Mark box with X if Next Day  or Second Day  service is requested.

Additional charges will be applied for these services.

Please fill in the information below authorizing the transaction to accommodate your request.

Clinic Name: \_\_\_\_\_ Phone \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip \_\_\_\_\_

The serial number(s) of the device being sent in is \_\_\_\_\_

Credit card number (Amex) (Visa) (MC) \_\_\_\_\_

Expiration: \_\_\_\_\_ Code: \_\_\_\_\_ Zip Code of billing address: \_\_\_\_\_

I understand and agree to the terms and conditions stated above. Date: \_\_\_\_\_

Signature

Print Name

E03-08-01 C

**NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:**

- o Reorient or relocate the receiving antenna**
- o Increase the separation between the equipment and receiver**
- o Connect the equipment into an outlet on a circuit different from that to which the receiver is connected**
- o Consult the dealer or an experienced radio / TV technician for help**

**This Class A digital apparatus complies with Canadian ICES-003.  
Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada.**