

# TAFONIUS JUNIOR



J2

## A USERS GUIDE

v01Jun2017

# TAFONIUS JUNIOR – A User Guide

**Notes:**

## Table of Contents

An Overview .....	5
Junior sans gas.....	5
Junior with gas.....	7
Turning Junior On.....	8
Controller Start Up Sequence.....	8
Pressure sensor setup.....	9
Initialising the Piston.....	9
Leak Testing.....	9
The Control Screen.....	10
1) Status and message information.....	10
2) Piston Graphic and Settings Information.....	10
BV.....	10
MWPL.....	10
ASST.....	11
CPAP / PEEP.....	11
3) Resultant Ventilation values.....	11
4) Patient Ventilator settings & Measured values.....	11
Ventilator Controls.....	12
Setting Values using the control knobs – Change & Commit.....	12
Control setting validation.....	12
THE CONTROL KNOBS.....	12
LIMITS IMPOSED ON SETTINGS.....	12
OTHER CONTROLS.....	12
Assist: .....	12
CPAP/PEEP .....	13
Dump Valve Button.....	13
Buffer Volume Setting.....	14
Controls on the Anesthesia Machine Side.....	14
Oxygen Flowmeter.....	14
Air Flowmeter.....	14
N2O Flowmeter.....	14
Oxygen Flush Button.....	14
Scavenging Flowmeter.....	14
Pressure Gauges.....	15
Junior and Spontaneous Breathing.....	15
Thinking of the Piston as a “Virtual bag”.....	15
Dictating the size of the “Virtual Bag”.....	15
Add-a-Litre feature.....	15
Ventilation measurements during Standby Mode.....	16
Junior and IPPV.....	16
Junior’s Built-in Scavenging Options.....	16
The Passive Scavenging System.....	17
The Blower-in-a-Box Active System.....	17
The Surgical Suction Type Active Scavenging System .....	17
Warning Messages – Alerts and Alarms.....	18
Alerts.....	18
BATTERY1 LOW VOLTAGE and/or .....	18
BATTERY2 LOW VOLTAGE .....	18
MAX PRESSURE EXCEEDED LIMIT.....	18
LOW SYSTEM RESERVE VOLUME.....	18
CYLINDER EMPTY/OUT OF RESERVE.....	18

# TAFONIUS JUNIOR – A User Guide

SYSTEM FULL.....	18
PISTON POSITION INFO ERROR .....	18
Alarms.....	19
* OXYGEN SUPPLY PRESSURE LOW * .....	19
* OXYGEN SUPPLY PRESSURE LOW * .....	19
* LOW BREATHING SYSTEM PRESSURE * .....	19
* BATTERY 1 CRITICALLY LOW * and/or.....	19
* BATTERY 2 CRITICALLY LOW * .....	19
* NO RESPONSE TO INPUT KNOBS * .....	19
* RD VACUUM FAILURE * .....	19
Technical Specifications:.....	20
PHYSICAL .....	20
ELECTRICAL.....	20
CLINICAL.....	20

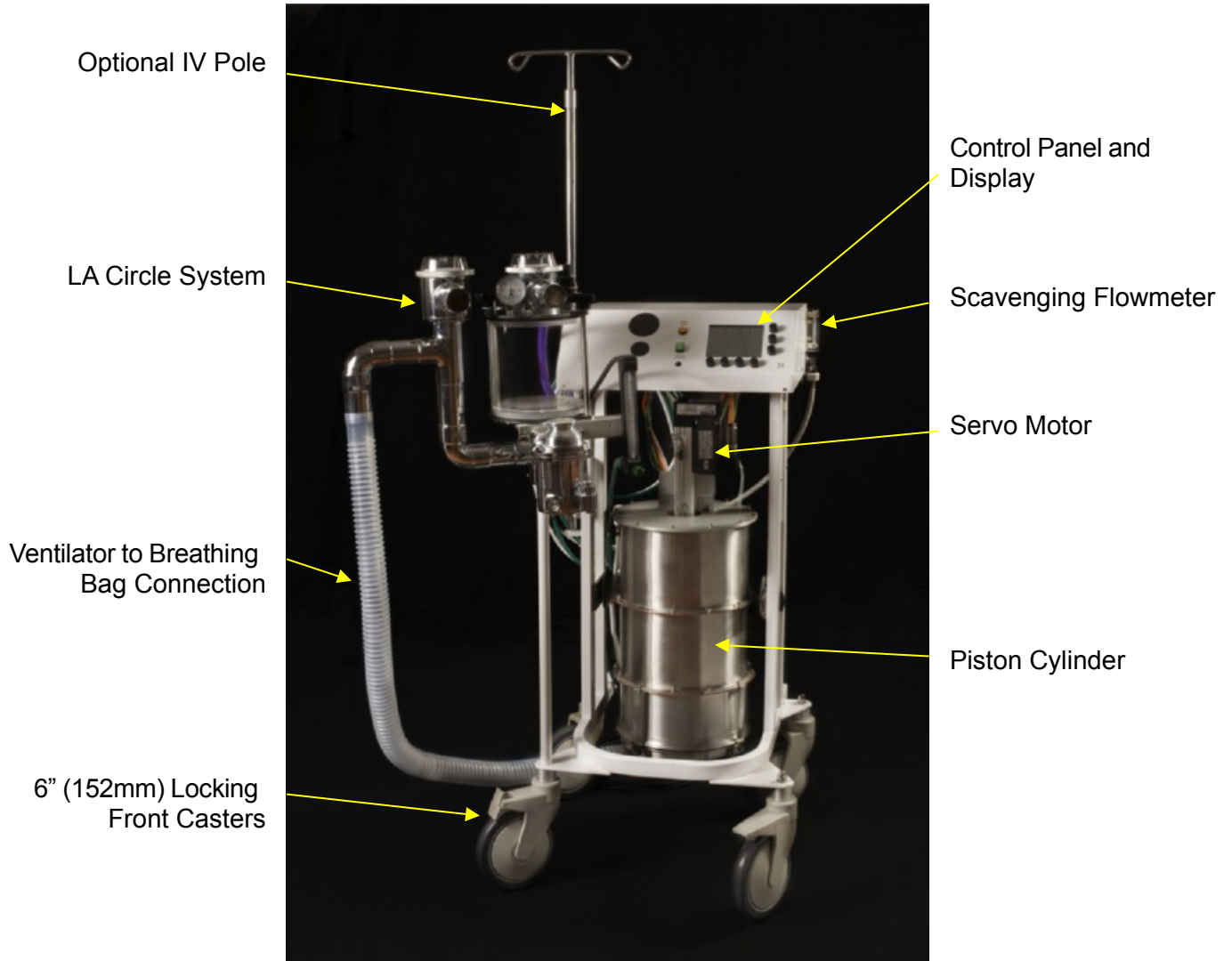
# TAFONIUS JUNIOR – A User Guide

## An Overview

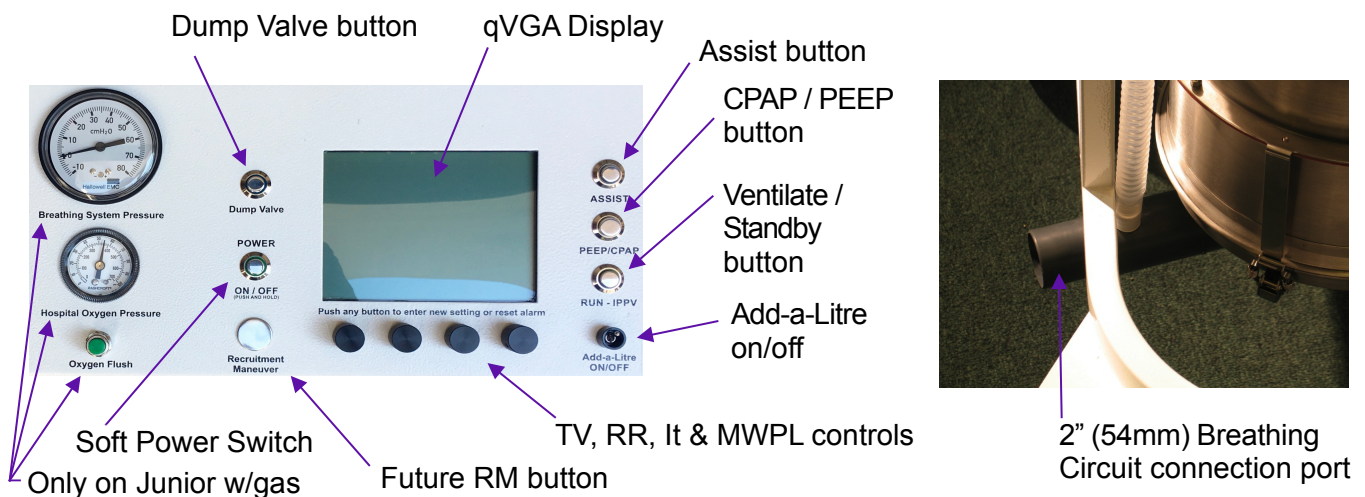
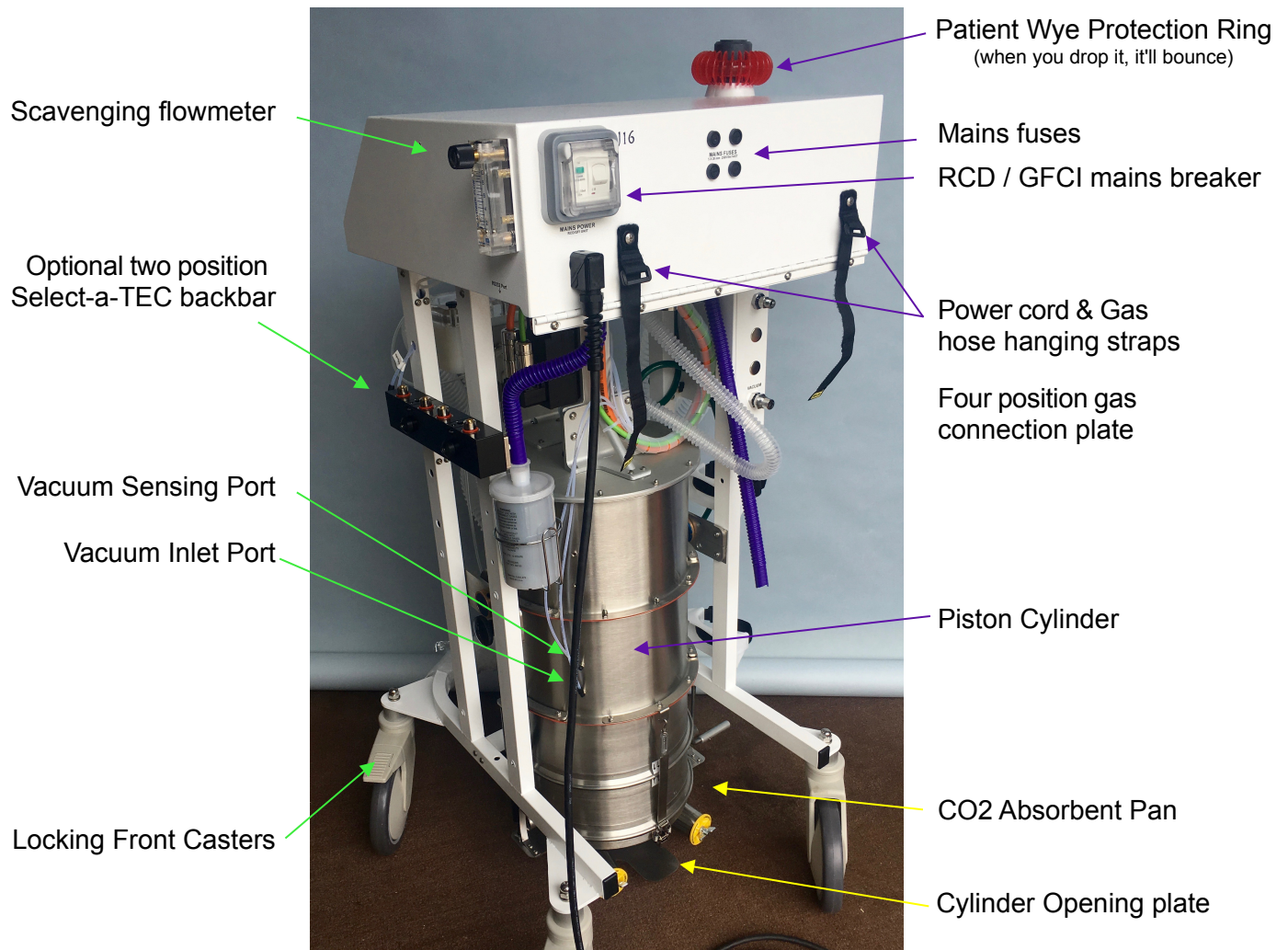
There are two versions of JUNIOR. Junior w/gas has a circle system and gas controls the other is a ventilator only, JUNIOR sans gas, for use with an existing gas machine.

## JUNIOR sans gas

Shown here with a Matrix VML by Midmark gas machine head.



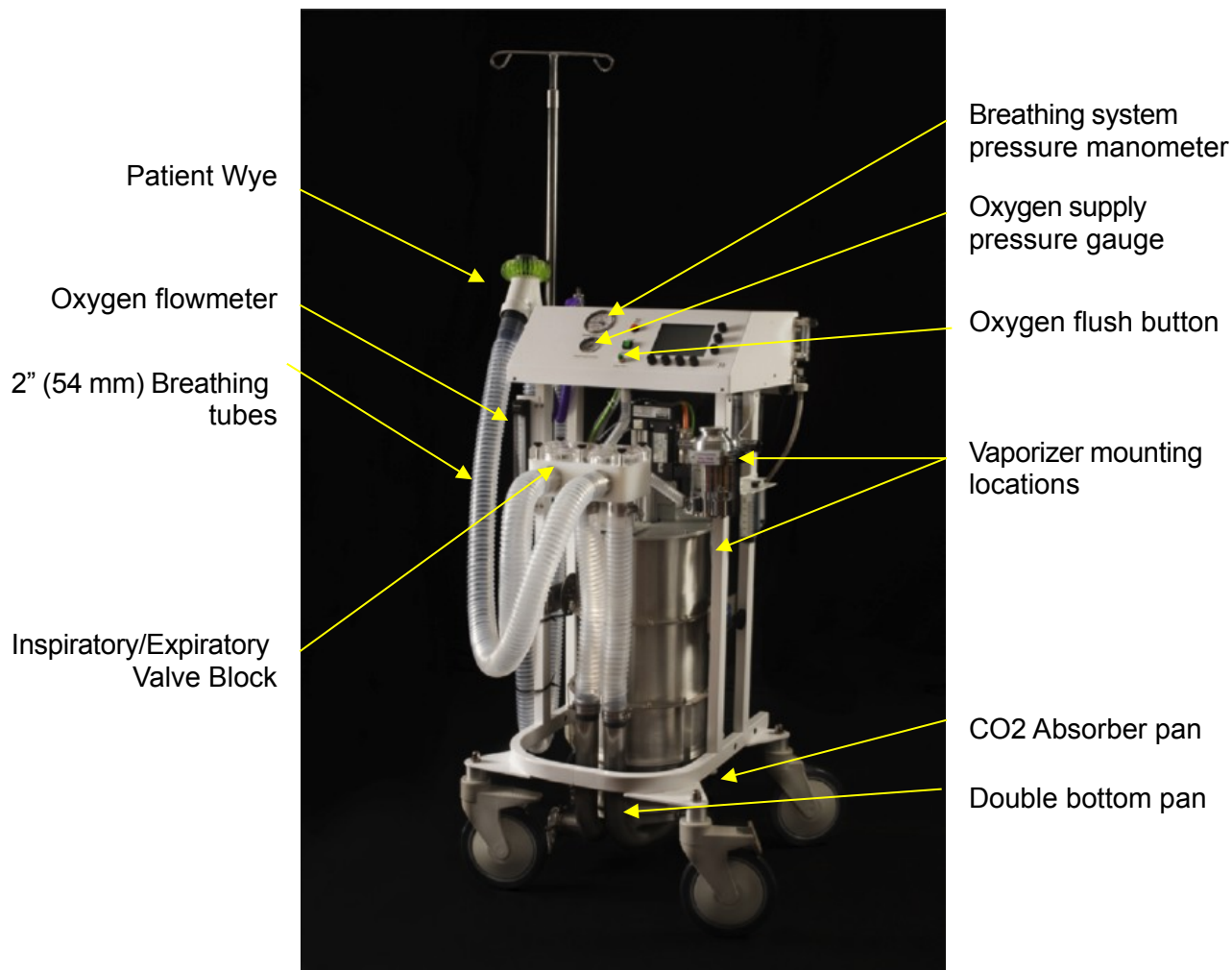
# TAFONIUS JUNIOR – A User Guide



# TAFONIUS JUNIOR – A User Guide

## JUNIOR with gas

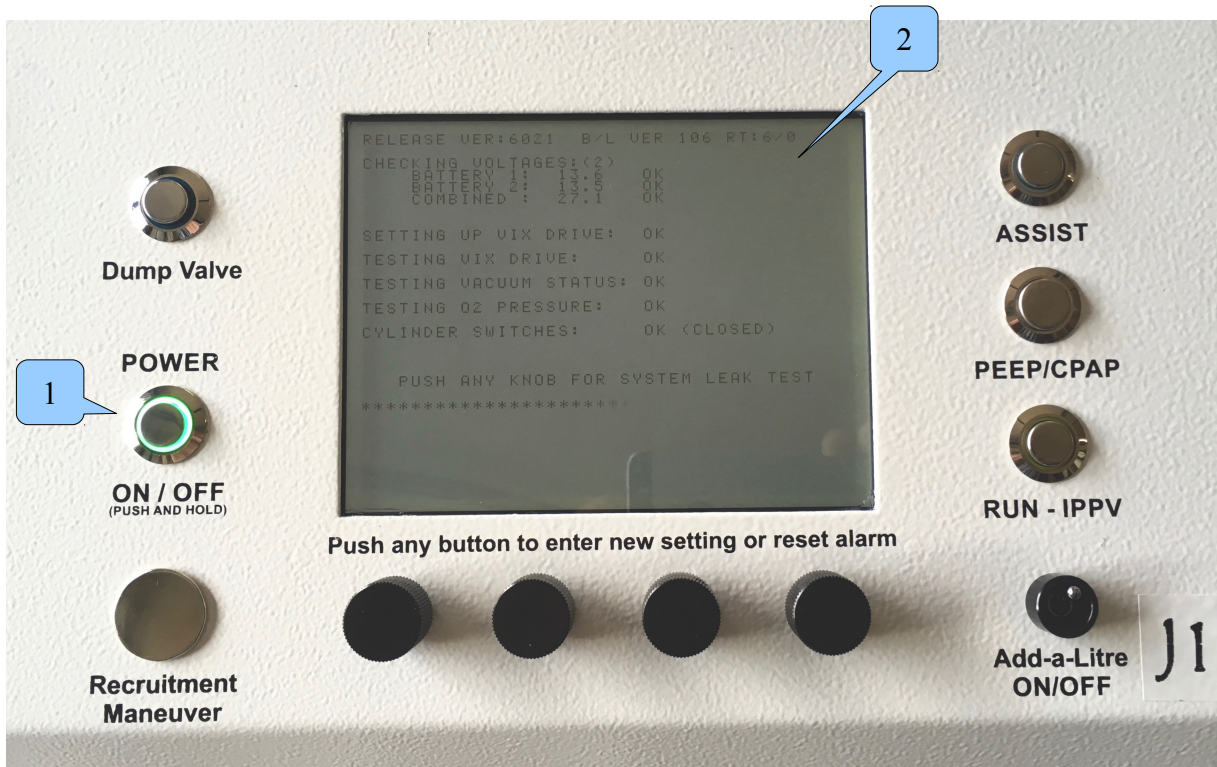
This version has the same circle system as the full TAFONIUS s well as mounting space for two vaporizers and two flowmeters, oxygen and air. Only features additional to those in the ventilator only version above are labeled below.



# TAFONIUS JUNIOR – A User Guide

This version of the Users Guide contains information for machines running software version 6021.

## Turning JUNIOR On



Press the soft ON/OFF control button (1). The Control screen (2) and the soft ON/OFF control button immediately illuminate. The vacuum pump will be heard as the control screen begins to display the power on sequence seen above.

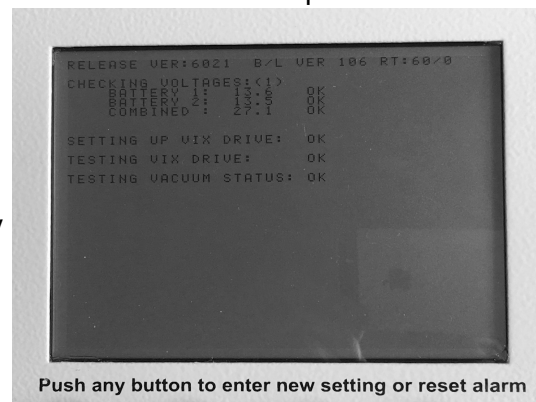
## Controller Start Up Sequence

The first line tells you what versions of software running. In this case it is version 6021 with Boot Loader ver. 106 followed buy the Runtime in the format <hours on / hours ventilating>

Next the battery voltages are checked. The result of this and each subsequent test is displayed on the screen. Each successful test is accompanied by a double-beep and a triple-beep when all tests have passed. Should a test fail the cause and instructions for a resolution will be displayed.

The ViX drive is the circuit component that actually runs the servomotor on the linear actuator that moves the piston. First it is setup and communications with it is established then it is tested.

Last the vacuum status is evaluated.

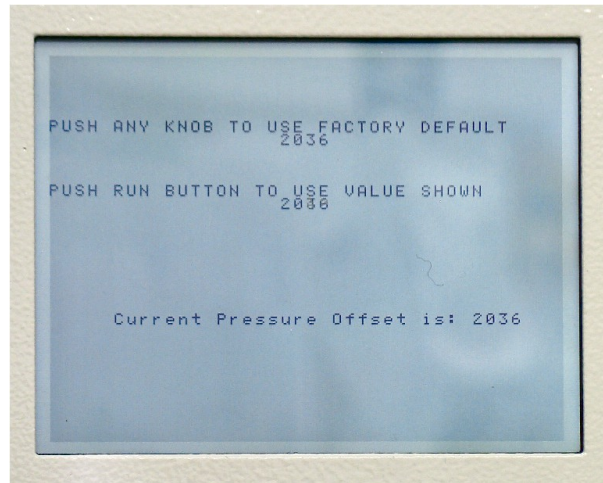


# TAFONIUS JUNIOR – A User Guide

## **Pressure sensor setup**

Following the vacuum test the option is provided for adjusting the zero offset of the pressure transducer. It will be the very rare occasion that this feature is used.

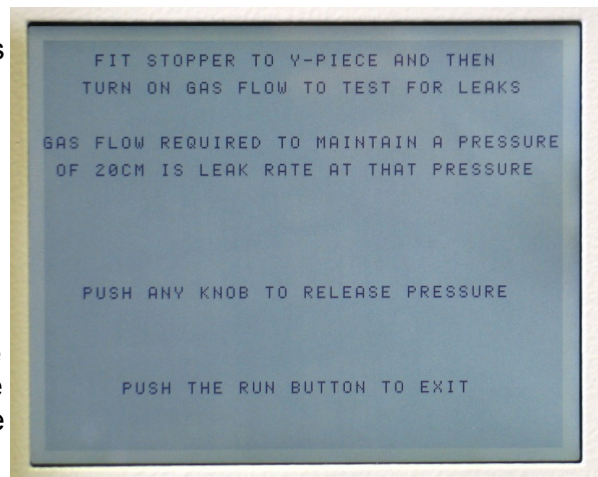
The user has 5 seconds to push any of the rotary knobs to enter the Pressure Sensor setup screen. If there is a discrepancy between the two offset values seen on the screen below, it usually indicates some problem other than pressure sensor drift. Most frequently you'll find water in the pressure sampling line. It is recommended that you blow out the pressure sensing line on a regular basis. To do this remove the sensing line from the underside of the main control box and flush the line out with air from a syringe.



## **Leak Testing**

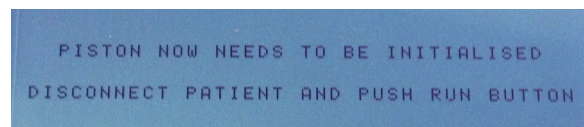
After the pressure sensor setup the operator is given the chance to leak test the system. Press any of the 4 knobs under the screen within 5 seconds and this screen to the right is displayed.

Follow the instructions on the screen. Fit a stopper to the patient wye piece, turn on the gas flow to bring the breathing system pressure up to 20 cmH<sub>2</sub>O. Adjust the flow rate to hold the pressure steady at 20 cmH<sub>2</sub>O. The flow observed on the flowmeter is the leak rate at that pressure. When satisfied press the RUN button to continue.



## **Initialising the Piston**

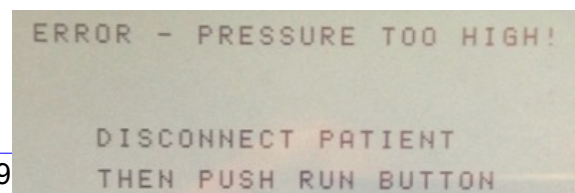
After the leak test has been completed or skipped this text to the right appears:



Before JUNIOR can be used the system needs to locate the zero position, the bottom of travel, of the piston.

The RUN button will be flashing, and the screen seen above will be waiting for the user to be sure there is nothing attached to the patient Y-piece before pushing the RUN button to instruct Junior to zero the piston. Once the button is pushed the screen shows the message **MOVING PISTON TO ZERO POINT**. During this piston movement the airway pressure is monitored. If there is a patient attached or an obstruction to airflow then the following message appears.

Clear the obstruction or remove the patient before continuing. Once the piston reaches the



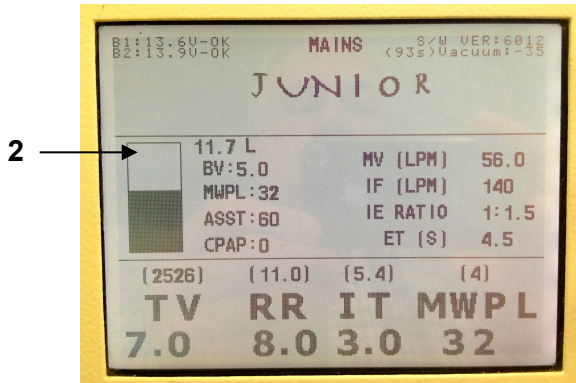
# TAFONIUS JUNIOR – A User Guide

bottom of its travel, a zero reading is taken and **ZEROING PISTON POSITON** is displayed briefly, a beep is heard.

The control screen below is displayed but the piston is left at the very bottom and the warning “CYLINDER EMPTY / OUT OF RESERVE” flashes in area 1 (see below) waiting for the user to pre-fill the system with oxygen and anaesthetic before induction.

JUNIOR is ready for use.

## The Control Screen



- 1) Status And Message Information
- 2) Piston Graphic And Settings Information
- 3) Resultant Ventilation Values
- 4) Ventilator Settings & Measured Values

The Control screen is divided into 4 main regions:

### 1) Status and message information

Area 1 shows status information on the system batteries, left. Displayed is the actual voltages of the two batteries used in JUNIOR and whether or not they are being charged. The centre area indicates whether the machine is running on MAINS or BATTERY power. The software version is displayed in the upper right and the vacuum level around the piston with the duration in seconds since the last vacuum cycle below that. When there are no warning or error messages, the name JUNIOR is displayed in this area as seen above. The display of warning and error messages will replace the machine name when they occur.

### 2) Piston Graphic and Settings Information

Area 2 shows a representation of the piston. The dark area represents the volume of gas under the piston and the numerical value at the top of the list to the right displays the amount in litres (L). The piston position and volume are constantly updated showing the position of the piston at all times. Two asterisks (\* \*) will appear at the top of the piston area whenever the Dump Valve, the electric pop-off valve, is open.

Below the volume display are four settings that are not otherwise always display on the screen.

#### **BV**

The **Buffer Volume** is displayed in litres. What the Buffer Volume is and how it is used is described below in the section [“Dictating the size of the “Virtual Bag”](#)

#### **MWPL**

The **Maximum Working Pressure Limit**, in cmH<sub>2</sub>O, is generally seen above the right most control knob used to set its value however it will not be displayed there when

# TAFONIUS JUNIOR – A User Guide

using the Assist Mode. The MWPL is set as a high-pressure safety limit the value of which is continuously compared to the breathing system pressure. JUNIOR is a volume or time cycled ventilator so the MWPL does NOT set how high the pressure will go but if the pressure should reach the set level the machine will alarm immediately, terminate the inspiration and switch to the expiratory phase of the breathing cycle.

## **ASST**

Assist is a mode of ventilation which compares the patient's effort to breathe with a set value of inspiratory flow. Should the patient reach or exceed that setting an assisted breath is delivered by the ventilator. Should the patient's breathing not be strong enough to reach or exceed that amount of inspiratory flow within a certain time the ventilator will give a controlled breath. The value next to the text **ASST** is the level of inspiratory flow, in liters per minute that must be generated by the patient to trigger an assisted breath.

## **CPAP / PEEP**

The set CPAP or PEEP pressure setting is displayed in cm H<sub>2</sub>O at the bottom of the list.

### **3) Resultant Ventilation values**

Area 3 shows the values that result from the settings of the independent variables Tidal Volume, Respiratory Rate and Inspiratory Time. The dependent variables displayed in this area are Minute Volume (MV) in liters per minute (lpm), Inspiratory Flow Rate (IF) in lpm, I:E Ratio and Expiratory Time (ET) in seconds. These are updated whenever a ventilation parameter is changed. This feature allows the user to see how other parameters are affected by the change being made. One can therefore “set” a dependent variable. For example you can set the MV by changing the TV and or the RR and watch the resulting affect on the MV display. Similarly one could “set” the I:E Ratio by changing the RR and or the I-time. The I:E ratio display will flash on and off when the settings result in an inverse I:E ratio, i.e. less than 1:1

### **4) Patient Ventilator settings & Measured values**

Area 4 shows the values set by the operator for Tidal Volume (**TV**), Respiratory Rate (**RR**), Inspiratory Time (**IT**) and Maximum Working Pressure Limit (**MWPL**) or Trigger sensitivity level (**SENS**) when assist mode is selected. The values in parentheses above these settings are the measured values taken during spontaneous breathing.

Tafonius Junior displays information that no other large animal ventilator is able to display. Take advantage of this information, get use to it, think about it. Especially the Minute Volume (MV) value. MV is the parameter to observe to quantitatively assess the change in gas delivery by the ventilator as you change settings. It is this number that must be changed to raise or lower the PaCO<sub>2</sub> all other things being constant. There are many ways to manipulate this setting. Depending on the pathophysiology of the patient there will be better ways than other ways to attain the MV delivery desired.

For example in colic cases already high abdominal pressure pose a unique challenge to the implementation of IPPV. If an increase in MV is required in an attempt to bring the PaCO<sub>2</sub> levels down it would be better to increase the RR than the TV. By watching the MV setting it is much easier to quantify the change you are making.

# TAFONIUS JUNIOR – A User Guide

## Ventilator Controls

JUNIOR'S ventilator is controlled via the 4 control knobs below the Control screen, the RUN/IPPV button, Assist button, CPAP/PEEP button, Oxygen Flush button, Dump Valve button and the soft power ON/OFF switch.

### **Setting Values using the control knobs – Change & Commit**

The process of setting any value uses the concept of "Change & Commit".

Turning the Tidal Volume knob for example will change the value displayed and an asterisk will appear next to the changed value. To commit this new value push in the Tidal Volume knob (or any of the 4 knobs) and hold it until a single beep is heard. The asterisk disappears and the new value is committed to memory. If the value is not committed by pressing a control knob then after 4 seconds the setting will revert to the original value. This process prevents accidental or inadvertent changing of ventilation parameters.

### **Control setting validation**

There are 4 control knobs sitting directly beneath the display of the parameter they control. When adjusting any of the values calculations are made with the settings of the other parameters to ensure that the new combination of settings will not exceed the capabilities of the machine. For example if the Inspiratory Time is set to 1.0 seconds then it will be impossible to set the Tidal Volume to anything greater than 15.0L since this combination would exceed the machines maximum capacity of 900 lpm inspiratory flow. When a limit is reached the setting will not advance as the knob is turned.

## THE CONTROL KNOBS

Tidal Volume:	The range is 0.1L to 20.0L in 0.1L increments.
Respiratory Rate:	The range is 1 to 20 breaths per minute. 0.2 bpm increments between 1 and 2 bpm, 0.5 bpm increments between 2 and 5 bpm and 1 bpm increments between 5 and 20 bpm.
Inspiratory Time:	The range is 0.5 to 4.0 in 0.1 second increments.
MWPL:	The range is 10 to 80 cmH <sub>2</sub> O in 1 cmH <sub>2</sub> O increments.

## LIMITS IMPOSED ON SETTINGS

Inspiratory Flow	Maximum of 900 lpm
Expiratory time	Minimum of 0.5 seconds

## OTHER CONTROLS

### **Assist:**

When the Assist mode button is pressed you will notice the RR setting changes to 1/3 of its current value. This is the new RR that determines the period at which controlled breaths will be delivered if the patient does not trigger a breath before then. When the patient triggers an assisted breath the period till the next controlled breath is reset. Another way to put this is that during assist mode ventilation if the patient does not trigger a breath within 3 periods of the original RR setting (the RR displayed when the Assist mode was entered) the ventilator will deliver a controlled breath.

Changing the RR has effect on the dependent parameters MV, I:E and E-time, you will note that these displays change along with the RR when the assist button was pushed thereby entering the Assist mode. By observing these parameters you will know the minimum ventilation Junior will deliver should the patients breathing cease and

0	MV (LPM)	42.0
35	IF (LPM)	210
60	IE RATIO	1:4.0
2	ET (S)	8.0
(0.0)	(0.0)	(0)
<b>RR IT MWPL</b>		
<b>6.0 2.0 35</b>		
Before Pressing Assist		
0	MV (LPM)	14.0
35	IF (LPM)	210
60	IE RATIO	1:14.0
2	ET (S)	28.0
(0.0)	(0.0)	(0)
<b>RR IT SENS</b>		
<b>2.0 2.0 60 LPM</b>		
After Pressing Assist		

# TAFONIUS JUNIOR – A User Guide

never triggers a breath. **While in Assist Mode, you should verify that the settings as displayed will ALWAYS be enough to sustain the life of the patient.**

The trigger range settable is 1 lpm to 200 lpm inspiratory flow, 1 lpm increments. Junior behaves somewhat differently if you enter Assist Mode while in Standby or IPPV mode.

## **In STANDBY mode:**

In STANDBY mode, spontaneous breathing, the effort level can be set but is not active until the IPPV/RUN button is pushed. To enter the ASSIST mode, press the ASSIST button once, the ASSIST button will flash slowly and the MWPL legend on the Control screen will be replaced with the text “SENS” for SENSitivity followed by a value e.g. 60 LPM. This value of 60 litres per minute is the inspiratory flow rate that the patient must meet or exceed in order to trigger an assisted breath. This will not happen unless the ventilator is in IPPV mode. Pressing the RUN/IPPV button will cause the IPPV button to be lit, the ASSIST button will stop flashing, remain lit and the assist mode to become active.

## **In IPPV mode:**

ASSIST mode can also be chosen when the patient is receiving IPPV. In this case the ASSIST mode button will be lit continuously to show that the ASSIST mode is active. In this state the ventilator is waiting for an effort from the patient. If this effort level is not met within the time required a mandatory breath is given. If the patient triggers a breath then the timing of the mandatory breath is reset. In either case, the delivered breath will be based on the set TV and I-time. Pressing the RUN/IPPV button will return the ventilator to spontaneous mode and cancel the ASSIST function.

This is a new feature and we currently have no guidelines on sensitivity values to set. The software offers a range of between 1 LPM and 200 LPM as trigger values. We would welcome feedback on the settings found useful or normal in practice.

## **CPAP/PEEP**

The range is 0 to 50 cmH<sub>2</sub>O in 1 cmH<sub>2</sub>O increments.

### **In Standby Mode:**

CPAP or Continuous Positive Airway Pressure can be applied during spontaneous breathing. With CPAP applied patients inspire and expire normally with no added effort, the end expiratory pressure is held elevated to the CPAP setting. This aids in maintaining open alveolae. The airway pressure is held constant during all phases of spontaneous breathing. The same happens should the patient take a breath during IPPV when PEEP is applied as described below.

### **In Ventilator Mode:**

During IPPV the term PEEP or Positive End Expiratory Pressure applies and the display changes accordingly. Ventilating pressures rise during the Inspiratory phase as normal, but are allowed only to fall as far as the PEEP setting during expiration. Unlike traditional PEEP where the airway pressure would drop to zero or negative should the animal take a breath Junior maintains the PEEP level during the spontaneous breath.

## **Dump Valve Button**

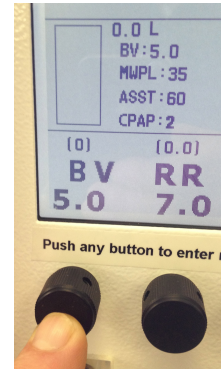
The dump valve button affords you manual control of the dump valve which is the electronic pop-off valve. This is useful when you want to empty the “bag” so to speak, actually dump the volume under the piston into the scavenging system at the end of a case or to quickly drop the anaesthetic concentration by replacing the gas under the piston with anaesthetic free oxygen. To do this press the DV button and hold it until the volume under the piston drops to the desired level. After the dump valve closes use the O<sub>2</sub> flush button to refill the

# TAFONIUS JUNIOR – A User Guide

cylinder. Our service technician can set the rate at which the volume under the piston is eliminated. If you would prefer it work faster or slower give us a call we can make the change for you over the internet.

## Buffer Volume Setting

To set the buffer volume depress the TV control and hold it for 3 seconds. The [TV display in section 4](#) of the screen will change to BV, release the knob. Turn the knob to the desired setting and depress it again to save the new setting. The BV value on the display will update with the new BV setting and the knob will revert to controlling the set TV. The default BV setting is 5.0 liters.



## Controls on the Anaesthesia Machine Side

These controls are on TAFONIUS JUNIOR w/gas and include the oxygen flowmeter, air and N<sub>2</sub>O flowmeters if fitted, the oxygen flush button and scavenging flowmeter. If you have the version of JUNIOR that is sans gas (the ventilator only) these controls would be found on your existing anaesthesia machine if fitted.

## Oxygen Flowmeter

The oxygen flowmeter has a 0 -10 lpm scale but considerably more flow can be delivered when the ball is off the top of the scale. Use this flowmeter as you would on any other anaesthesia machine.

## Air Flowmeter

An optional air flowmeter with either a yellow knob for the US or a black and white knob for most other countries may be installed on your machine. This allows the user to adjust the FiO<sub>2</sub> delivered to the breathing system.

The nomogram shown below can be used as a guide for setting the FiO<sub>2</sub> but it is easy to remember that:

- Equal flows of air and oxygen yields 60% O<sub>2</sub>
- 3 times as much air as oxygen yields 40% O<sub>2</sub>
- 3 times as much oxygen as air yields 80% O<sub>2</sub>

## N<sub>2</sub>O Flowmeter

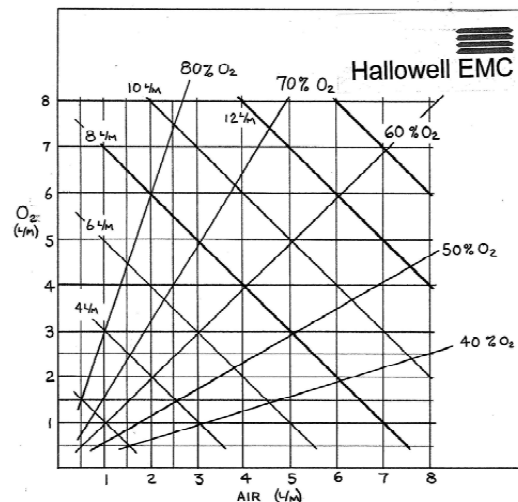
Although the use of N<sub>2</sub>O is much a thing of the past this option is still available but should never be used without a working oxygen analyzer in the breathing circuit.

## Oxygen Flush Button

The oxygen flush button delivers a high flow of pure oxygen to the breathing system without going through the vaporizer. It is generally used to fill the system quickly or to quickly dilute the anaesthetic concentration in the system.

## Scavenging Flowmeter

This flowmeter is located on the right side near the rear of the machine. It is used only when the machine is connected to a central vacuum system such as is used for surgical suction. Adjust the scavenging flow to the minimum flow possible to extend the life of your vacuum pump. The scavenging flow should be set enough to keep the reservoir bag flat at most times.



# TAFONIUS JUNIOR – A User Guide

## Pressure Gauges

Junior w/gas also has 2 pressure gauges on the front panel. One for Breathing System Pressure the range of which is -10 – +60 cmH<sub>2</sub>O and one for Oxygen Supply pressure with a full scale of 100psi (700kPa).

## JUNIOR and Spontaneous Breathing

### *Thinking of the Piston as a “Virtual bag*

When the ventilator is idle and a patient is connected, the system behaves like a ‘perfect’ bag. By a perfect bag we mean that when the patient breathes out there is no expiratory resistance and when the patient breathes in there is no inspiratory resistance. This action is possible because the airway pressure is sensed at the centre of the Y-piece. As soon as a pressure deviation in excess of 0.5 cmH<sub>2</sub>O from the ambient pressure is detected the piston is moved so as to negate this pressure change. If the patient breathes out then the piston withdraws, effectively filling. If the patient inspires then the piston moves down, effectively emptying. Because a motor drives the piston it is the motor that overcomes the resistances of any piping, valving or soda lime. To the patient it feels like breathing to room air with no resistance.

### *Dictating the size of the “Virtual Bag”*

The size bag you use on your anaesthesia machine depends on the size of the patient. The breathing bag must be large enough to hold the largest size breath the patient may take. But it should not be overly large because the excess volume increases the time constant of the breathing system making it take longer for changes in vaporizer settings or the FiO<sub>2</sub> setting equilibrate and take effect.

The tidal volume and the concept of a buffer volume are used to control the size of the “Virtual Bag”, the volume under the piston, in JUNIOR. The piston is not allowed to rise above the combined volumes of TV + BV. Whenever the piston volume reaches this upper limit, gas is allowed to flow out to the scavenging system.

In this manner JUNIOR is changing the Virtual bag size every time you change the TV.

### *Add-a-Litre feature*

In addition to continually managing the maximum volume is the system JUNIOR also works to keep a the minimum volume in the system at all times. JUNIOR considers the piston to be in the low volume zone whenever it dips below the 1.5 litre point. When this happens gas flows into the system during current and subsequent the inspiratory phase(s) until a liter has been added and the **LOW SYSTEM RESERVE VOLUME** alarm will sound.

### **Example 1:**

A 300kg patient breathing spontaneously. Rule of thumb would suggest setting the TV control to 3.0L in preparation for IPPV. The BV is set to its default of 5.0L. The upper limit of the piston volume is then 3.0 + 5.0 L = 8.0L, the patient is effectively breathing from an 8L bag.

Say the patient has just been induced, initial gas flow rates may be of the order of 5-10L per minute. This will tend to fill the system rather quickly.

When the piston volume reaches the 8.0L limit the piston stops rising and the excess gas will be discharged from the system through the electronically controlled Dump Valve. You will hear the dump valve opening and closing as a clunk... clunk. After induction you would turn the fresh-gas-flow down but let's say you turn it down a little too far. The piston volume falls a little breath by breath, the clunking sound will stop, until finally the piston dips below the 1.5L level towards the end of a cycle. At this point an extra 1.0L of gas will be added to

# TAFONIUS JUNIOR – A User Guide

the system through the vaporiser automatically and the **LOW SYSTEM RESERVE VOLUME** alarm will sound momentarily.

Then you decide to increase the tidal volume setting to 4.0L. This increases the upper limit to 9.0L. Doing so will also drive the piston down in to the low volume zone again causing another alarm. At this point it would be prudent to increase the fresh-gas-flow to avoid repeated alarms and allow the piston to rise to a higher level.

## **Example 2:**

Say the breathing of a spontaneously breathing patient is erratic and the piston repeatedly hits the upper limit and dips into the low volume zone it would be appropriate at this point to increase the tidal volume setting to increase the “Bag” size temporarily. If the tidal volume then seems to great for the animal check the buffer volume setting.

## ***Ventilation measurements during Standby Mode***

In Standby mode (during spontaneous breathing) the piston position is constantly monitored and will display patient breathing parameters when regular cyclic movements are detected. The values are updated at the beginning of each expiratory phase and show the values for the last breath cycle. The values in parentheses above the Tidal Volume, Respiratory Rate and Inspiratory Time legends are measurements of the respective parameter. The value above the MWPL legend is the maximum airway pressure measured during the last breath cycle. The dependant parameters such as minute volume, inspiratory flow etc are not affected by these measurements and reflect only their calculated values based on the settings for TV, RR and Itime.

## **JUNIOR and IPPV**

Changing between spontaneous breathing mode (standby) and ventilation mode is very simple and can be done at any time. As soon as the IPPV / RUN switch is pressed it will illuminate to indicate machine is in IPPV mode and immediately an inspiratory phase begins delivering the tidal volume as set by the TV and Itime controls. To stop IPPV at any time, simply press the IPPV / RUN switch again. The switch light will go out and the unit will return to standby mode.

In IPPV mode the tidal volume is delivered in the time set by the Inspiratory Time setting (see [Control Setting Validation](#) section for an explanation of how settings are restricted). After the tidal volume has been delivered the expiratory phase begins. In the expiratory phase the piston immediately behaves like a “Bag” and allows the patient to breathe out raising the piston as it does. The piston stays in this state until the end of the expiratory time when the inspiratory phase begins again and the piston is driven downwards delivering gas to the patient again.

At all times the piston image on the screen shows the position and actual volume under the piston.

## **JUNIOR'S Built-in Scavenging Options**

Tafonius junior has a unique scavenging interface that will accommodate a passive system, an active system such as the blower-in-box type and an active system such as a centrally plumbed surgical suction system.

# TAFONIUS JUNIOR – A User Guide

## ***The Passive Scavenging System***

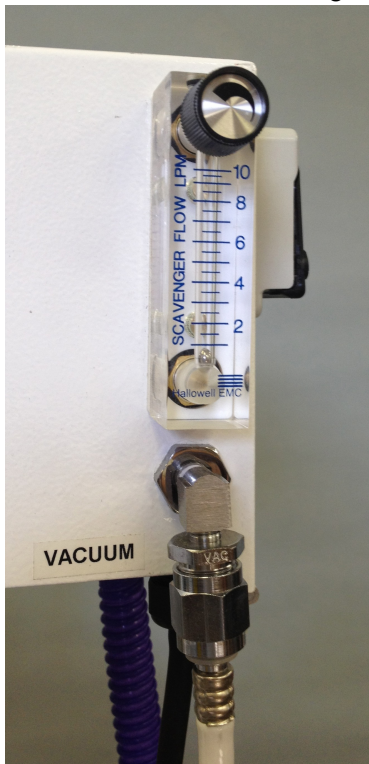
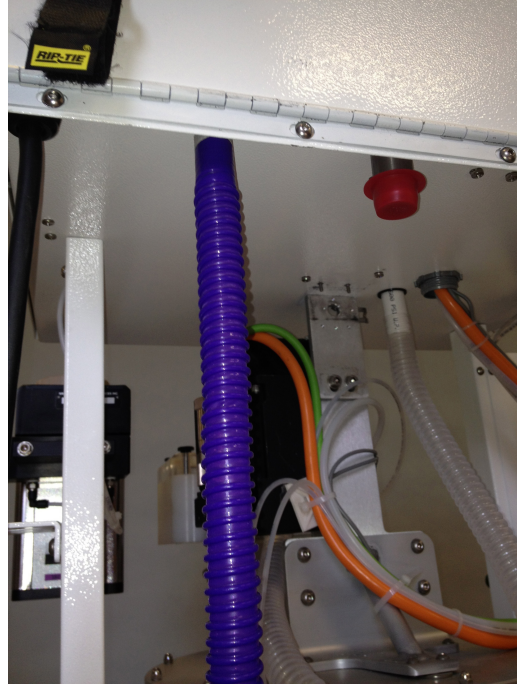
A passive interface is nothing more than a 19 or 22mm tube that is put through the wall to the outdoors. There is a scavenging port on Junior that will accept either a 19mm or 22mm hose for this purpose. The other port should then be occluded as shown here with the red cap.

## ***The Blower-in-a-Box Active System***

If the Blower-in-a-Box Active system is operating properly it should be connected in the same manner as the Passive system above.

## ***The Surgical Suction Type Active Scavenging System***

This type of scavenging system is supplied from a wall outlet or ceiling drop via a properly color-coded hose to the DISS or NIST Vacuum or EVAC connector below the scavenging flowmeter at the right rear side of the machine. In addition a 5 litre reservoir bag and f/air canister should be connected as in the picture below. Adjust the scavenging flowmeter to the minimum flow rate that will keep the reservoir bag flat most of the time. This will extend the life of your vacuum pump. For a more detail discussion of this scavenging interface visit <http://hallowell.com/media/DOCA3136.pdf>



The charcoal canister on the interface performs two duties. It acts as a pressure differential as room air is pulled through it when there is nothing to scavenge and it works as a backup scavenger when the vacuum fails or is disconnected.

## Warning Messages – Alerts and Alarms

There are two levels of warning messages alerts and alarms.

### **Alerts**

These messages are accompanied by an initial 2-second audible beep but are then silent. A flashing text message will appear on the screen in Area 1, where the JUNIOR logo is normally displayed. Alerts are non-critical events encountered during normal operation.

To clear an alert manually press and hold any of the 4 control knobs until two beeps are heard. Here is a list of the alerts.

### **BATTERY1 LOW VOLTAGE and/or BATTERY2 LOW VOLTAGE**

The indicated battery has a low voltage. This is normally because the machine is being operated without the mains connected or it has been left in storage without being connected to the mains. Connect the mains supply and make sure the RCD/GFCI switch at the back of the machine is on.

The alert will stay on screen until cleared. Unless the problem has been resolved the alert will return.

### **MAX PRESSURE EXCEEDED LIMIT**

The airway pressure exceeded the setting of the Maximum Working Pressure Limit. The Alert will stay on screen until cleared manually.

### **LOW SYSTEM RESERVE VOLUME**

The piston has entered the low volume zone at the 1.5L point. If this is during an active inspiratory phase then a litre of gas will automatically be added to the breathing system through the vaporiser. If the vaporiser is off then gas will still be added, but without agent. Continued occurrence of this warning is an indication that the fresh-gas-flow setting is too low and/or there may be a significant leak in the system or past the ET tube.

When the piston moves out of the low volume zone then the alert will self clear.

### **CYLINDER EMPTY/OUT OF RESERVE**

The piston is at the lower most position, i.e. zero volume. If this is during the inspiratory phase then the full tidal volume will not have been delivered.

When the piston moves away from the zero point the alert will self clear.

### **SYSTEM FULL**

The piston is at the most full position i.e. maximum volume. The Dump Valve will be opened to allow gas to escape and prevent pressure building up.

When the piston moves away from the top point the alert will self clear.

### **PISTON POSITION INFO ERROR**

The piston position reported from the motor is incorrect. This is usually transient and is self-correcting. Any permanent loss of position information will result in an alarm condition.

The alert will stay on screen until cleared manually.

# TAFONIUS JUNIOR – A User Guide

## Alarms

These messages are accompanied by a repeating intermittent beep of approximately one second duration. A flashing text message will appear on the screen in area 1, where the JUNIOR logo normally sits. Alarms are critical events that have serious implications for the efficient ventilation or support of the patient. Each alarm that is shown on the screen will have an asterisk at each end of the text, e.g.:

### **\* OXYGEN SUPPLY PRESSURE LOW \***

To clear an alarm manually press and hold any of the 4 control knobs until two beeps are heard. Here is a list of the alarms.

#### **\* OXYGEN SUPPLY PRESSURE LOW \***

The piped oxygen pressure, whether it is from the hospital supply Line, or from the E-cylinders has fallen below 40 psi. This alarm can only be cleared by connecting a source of oxygen with a pressure greater than 40psi.

#### **\* LOW BREATHING SYSTEM PRESSURE \***

This Alarm occurs when, at the end of an inspiratory phase during IPPV or Assist, a maximum pressure of 7 cmH<sub>2</sub>O has not been reached. This can occur when the patient has become disconnected from the system. It can also occur when the patient takes a breath at the same time as the ventilator delivers a breath.

The Alarm will continue until either a pressure in excess of 7cm H<sub>2</sub>O is registered during an inspiratory phase OR the alarm is cleared manually.

#### **\* BATTERY 1 CRITICALLY LOW \* and/or**

#### **\* BATTERY 2 CRITICALLY LOW \***

Either one of the batteries voltage has reached the critical level. Below this level ventilator function may be severely compromised, particularly with regard to piston movement and the action of the Dump Valve. **The ventilator must be connected to the mains supply immediately.**

#### **\* NO RESPONSE TO INPUT KNOBS \***

The circuit board for the front control knobs has failed to respond to the main controller. It will not be possible to change any of the ventilation settings. **This is a critical error and the patient should be changed to manual ventilation.**

#### **\* RD VACUUM FAILURE \***

The vacuum level in the double diaphragm has fallen below a critical level. Continued use of the ventilator will result in severe damage to the piston assembly. The vacuum level must be restored before ventilation is re-enabled. Check the connections of the hose at the vacuum port on the ventilator cylinder. **Until the vacuum has been restored the patient should be changed to manual ventilation.**

# TAFONIUS JUNIOR – A User Guide

## Technical Specifications:

### **PHYSICAL**

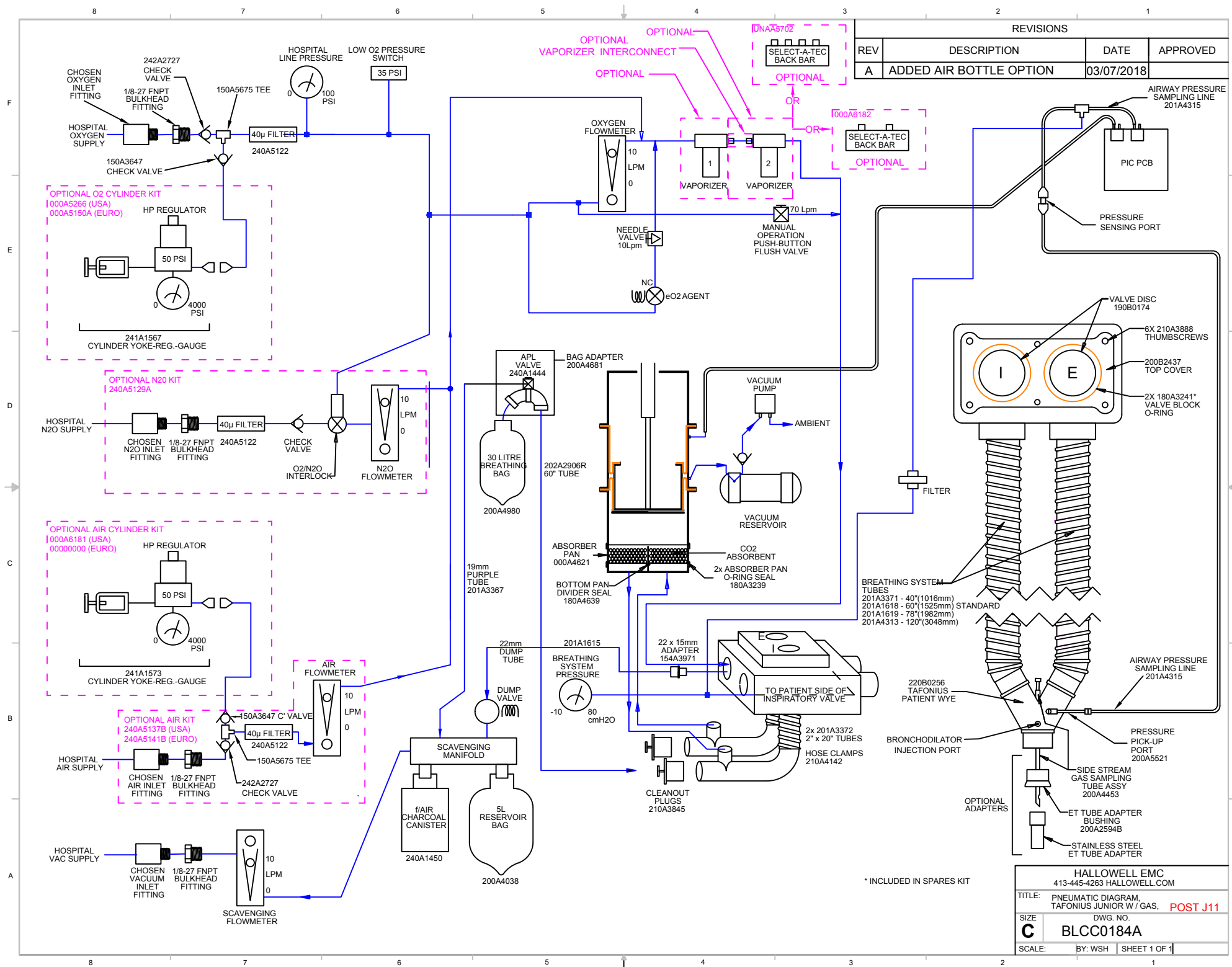
<b>Size:</b>	51" x 30" x 24" , Height x Depth x Width
<b>Weight:</b>	135 lbs (61kg) sans gas, ???kg with gas
<b>Construction:</b>	Powder-coated stainless steel and aluminum
<b>Top shelf dimensions</b>	20" W x 13" D; (50cm x 33cm)

### **ELECTRICAL**

<b>Power Input:</b>	90-240v AC 50/60Hz Universal Input
<b>Power consumption:</b>	400W max
<b>Operational voltage:</b>	12v/24v DC Sealed Lead Acid (SLA) Batteries
<b>Battery Charging:</b>	In-built lead-acid chargers @ max 5A charge

### **CLINICAL**

<b>Tidal Volume</b>	0.1 L to 20.0 L
<b>TV settings resolution</b>	100ml
<b>TV accuracy</b>	better than $\pm 25$ ml
<b>Buffer Volume (BV)</b>	2.0 L to 20 L
<b>Respiratory Rate</b>	1.0 to 30.0 bpm
<b>RR settings resolution</b>	@ 1.0 to 2.0 bpm – 0.2 bpm @ 2.0 to 5.0 bpm – 0.5 bpm @ 5.0 to 30.0 bpm – 1 bpm
<b>Inspiratory Time</b>	0.5 to 4.0 sec
<b>Itime setting resolution</b>	0.1 sec
<b>Maximum Inspiratory Flow Rate</b>	900 lpm
<b>Maximum Working Pressure Limit</b>	10 to 80 cmH <sub>2</sub> O
<b>MWPL settings resolution</b>	1 cmH <sub>2</sub> O
<b>Low breathing system pressure alarm threshold</b>	7 cmH <sub>2</sub> O
<b>CPAP/PEEP</b>	0 to 60 cmH <sub>2</sub> O
<b>CPAP/PEEP settings resolution</b>	1 cmH <sub>2</sub> O
<b>Assist Trigger Level</b>	1 to 200 lpm inspiratory flow
<b>Trigger setting resolution</b>	1 lpm
<b>Mounting space to accommodate</b>	2 cage mount vaporizers 2 gas flowmeters 2 e-cylinders 2 IV poles 2 syringe/ET tube holders



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADDED AIR BOTTLE OPTION	03/07/2018	

**HALLOWELL EMC**  
413-445-4263 HALLOWELL, IOWA

TITLE: PNEUMATIC DIAGRAM, TAFONIUS JUNIOR W / GAS, **POST J11**

SIZE: **C** DWG. NO. **BLCC0184A**

SCALE: BY: WSH | SHEET 1 OF 1

\* INCLUDED IN SPARES KIT

This Page Left Intentionally Blank - Section End

## USING THE MANUAL BREATHING BAG

- 1) If the ventilator is still powered, turn it OFF.
- 2) Remove the expandable drain clamp from either tube under the bottom pan.
- 3) Fit the manual breathing tube over the pipe .



- 4) Attach the bag to the connector on the side of the machine. The Oxygen Flowmeter, Vaporizer, Flush Button, Pop-off valve and Breathing Bag can now be used to run the machine.



## CLEANING PROCEDURE

Turn the Ventilator OFF. The piston will rise to the resting position, generally set to be at the top of the piston cylinder thereby exposing the orange silicone rolling diaphragm for cleaning.

Remove the Y- Piece and the patient tubing. Disconnect the pressure sensor line at the luer fitting.



Remove the pressure sensor tube from the patient tubing by undoing the 4 Velcro retainers.

Remove the Y- circuit from the ventilator. Flush & clean and hang to dry.

Undo and remove the 6 thumbscrews holding the valve block cover. Remove and clean the valve housing, disks and cover.



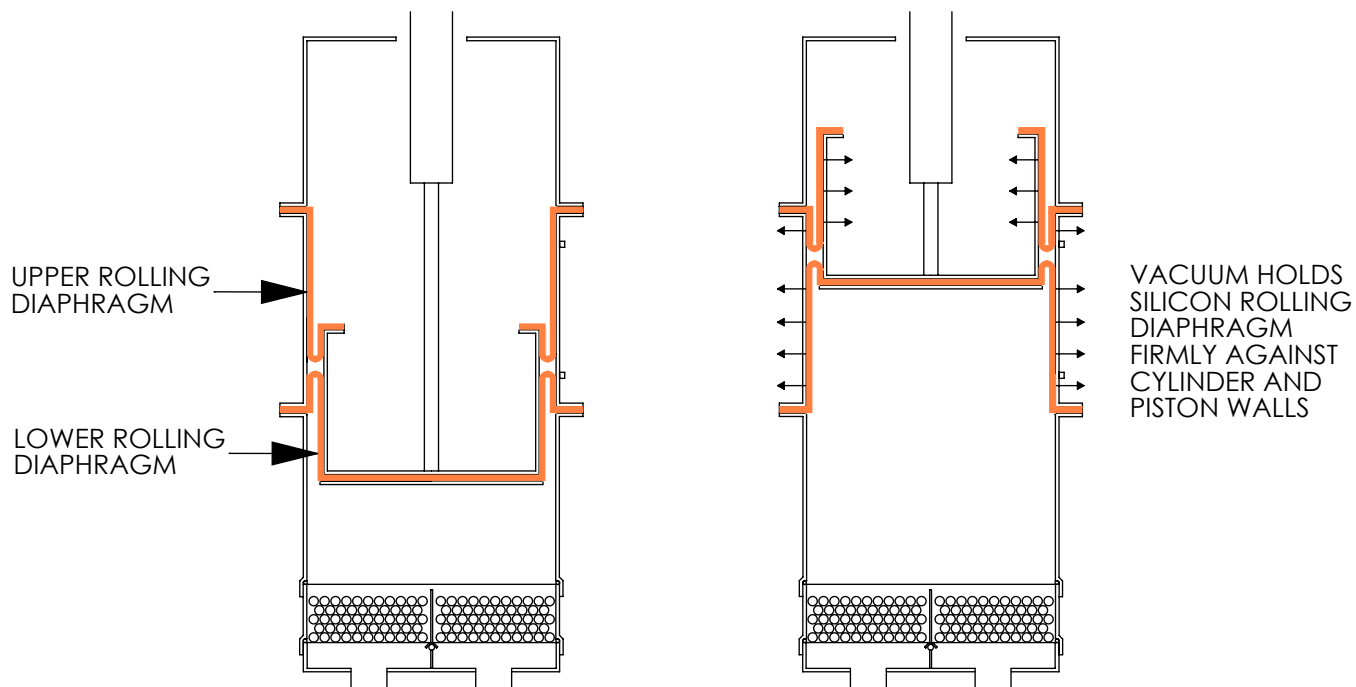
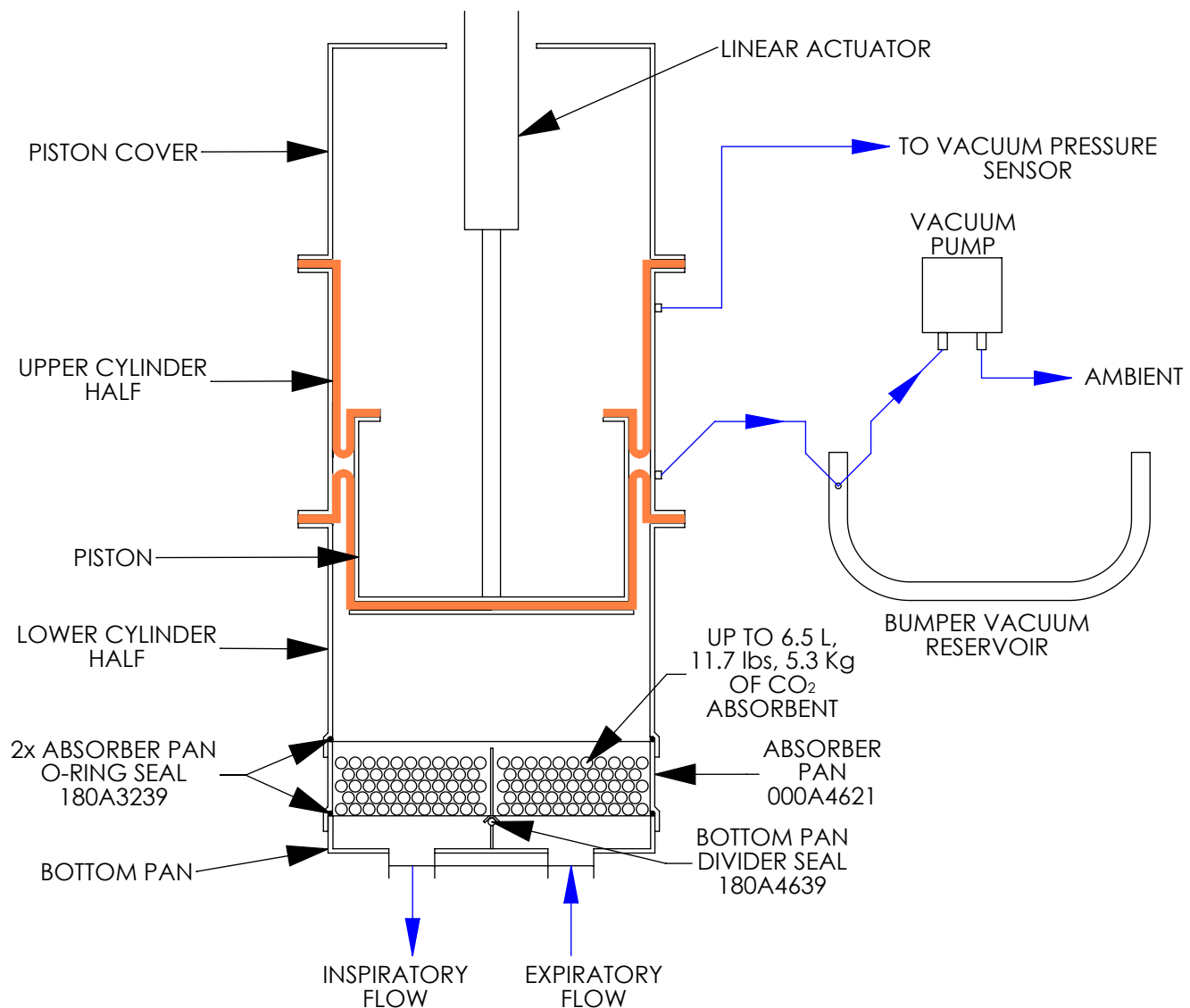
Remove the absorber pan. Place somewhere dry. Undo and remove the stoppers at the end of the two back drains.



Clean the lower pan area and up inside the piston cylinder. Leave to dry.

After cleaning and drying, re-assembly is the reverse of the above.

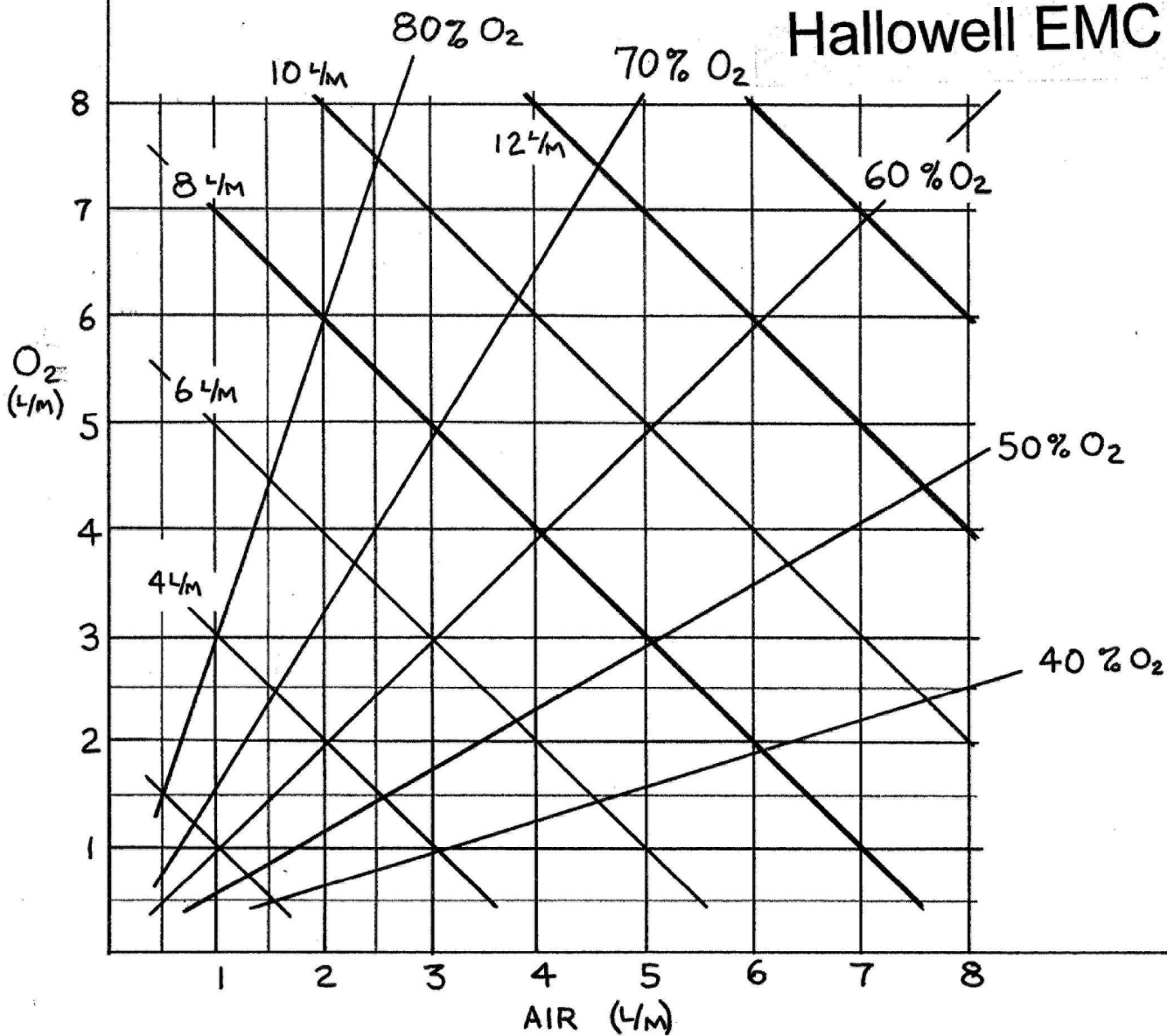
**MAKE SURE THE PRESSURE SENSOR IS FITTED TO THE Y-PIECE BEFORE TURNING THE VENTILATOR BACK ON**



Rolling Diaphragm System of Tafonius



Hallowell EMC





## **TAFONIUS Large Animal Anesthesia Machines**

*Service Options, Agreements and Warranties*

### **TAFONIUS and TAFONIUS JUNIOR Repair Visit Time & Materials Plus Travel, Lodging & Meals**

PN 000A5755

A repair visit is generated on an on-call basis and covers a technician's on-site visit for the work specifically requested. It will be calculated as the sum of:

- Travel time driving (round trip) @ \$70/hour or flying @ \$500/day plus ticket, car rental & fuel
- Lodging and meals if required
- Cost of materials
- Time for repair @ \$90/hour

Parts and Labor will be warrantied for 90 days.

### **TAFONIUS and TAFONIUS JUNIOR Annual Service Fee \$1,750 Plus Discounted Materials & Travel, Lodging & Meals**

PN 000A5756

The annual service fee will cover an on-site visit for a strip-down, tolerance checks, adjustments, re-assembly and a full system test as described below. Any worn/broken/missing parts will be replaced and charged at a discount rate of 20%. (e.g. split hoses, damaged sampling/pressure lines/seals and gaskets, rolling diaphragms, etc.)

*The service strip-down and re-assembly will include but is not limited to:*

Visual assessment

Check the battery integrity & power cord

Verify the performance of the Monitoring System

Lubricate the linear actuator

Update the PIC firmware if required/requested

Update the TAFONIUS software if required/requested

Piston disassembly & service:

- Check forward and reverse position sensors
- Lubricate the rolling diaphragms
- Check the alignment and tightness of the cylinder closed sensors
- Check the integrity of the cylinder seals, replace if required

Reassemble Piston assembly and test the following:

- Vacuum system and pump
- Dump valve performance
- System Leak Test

Check the caster tightness

Check the alignment and tightness of the Black Knob releasing brackets

Check manual breathing circuit

Check Auxiliary System performance

Check the tightness of the O2/Air flow meters - tighten as necessary

Check the seals on the Select-a-Tec vaporizer back-bar - replace as necessary

Check the operation of the TAFONIUS software and the Touch Computer

DOCA5737D



**Extended TAFONIUS and TAFONIUS JUNIOR Warranty Agreement  
\$2,750 Plus Discounted Materials, Travel, Lodging & Meals**

PN 000A5757

An Extended Warranty agreement may only be purchased as described below under "**Terms and Conditions for the Extended Warranty**".

The Extended Warranty agreement will cover the cost of the annual service as described above with a 20% discount for parts requiring replacement except as indicated below under "**Manufacturers' Warranty**" and extends the manufacturer's warranty for a further year.

***Terms & Conditions for the Extended Warranty***

The Extended Warranty must be purchased prior to the lapse of the Standard Manufacturer's warranty. The Standard Manufacturer's warranty is valid for one year from the original date of delivery. Should the Standard Manufacturer's or Extended Warranty lapse, an Annual Service Plan must be purchased in addition to the Extended Warranty to ensure the machine to be covered is in good working order prior to the reinstatement of Warranty.

***Service Dates***

The first service date shall be scheduled within one year of the original delivery date. Extended warranties must be purchased no later than 14 days following a service date. All subsequent services shall be within thirteen months of the previous service date. It is the customer's responsibility to schedule service dates within the Extended Warranty (or Annual Service) timeframe.

***Manufacturers' Warranty – Please see our Tefonius Limited Warranty Statement for Full Details***

Hallowell EMC warrants **TAFONIUS** and **TAFONIUS JUNIOR** to be in good working order and fit for the purpose intended for a period of one year from the date of delivery. In the event that the product is found to be defective within the warranty period the manufacturer will repair or replace, at its discretion, via an on-site visit or common carrier shipment, at its discretion, the item or items free of charge subject to the following conditions:

- 1) The failed item(s) are
  - a. Either returned to the Hallowell EMC for inspection prior to replacement and or repair, OR
  - b. Retained by the customer for inspection by a Hallowell EMC appointed technician via a return shipment or on-site visit at the discretion of Hallowell EMC.
- 2) Failure to perform or function correctly is a direct result of a component fault or fault in manufacture and does not arise from damage sustained in transit, from misuse, from direct physical abuse or an "act of God".
- 3) Where failed items can be shipped (< 50 lbs weight), the customer bears the return cost of secure transportation of the item to either the manufacturer or supplier.

**The manufacturer's warranty does not cover:**

- 1) Repair or replacement of parts due to normal wear and tear
- 2) Any consumables
- 3) Replacement product to cover period of repair

DOCA5737D



## Summary of TAFONIUS and TAFONIUS JUNIOR Warranty and Service Costs and Benefits

Plan	Prerequisite	Work Performed	Cost Plus →	Time <sup>1</sup>	Materials	Travel <sup>2</sup> , Lodging & Meals	Warranty Detail	Eligibility
<i>P/N 000A5755</i> <b>Repair Visit</b>	Arrange for an appointment	Only work specifically requested	Zero	See Footnote <sup>1</sup>	List Price	TBD	90 days on parts and work performed	None
<i>P/N 000A5756</i> <b>Annual Service</b>	Arrange for an appointment	Complete service and PM	\$1,750	No Charge	20% Discount	TBD	90 days on entire machine <sup>4</sup>	Eligibility for Extended Warranty for 12 months
<i>P/N 000A5757</i> <b>Extended Warranty</b>	An active new machine warranty or extended warranty and arrange for an appointment	Annual Service	\$2,750	No Charge	20% Discount	TBD	12 months on entire machine <sup>4</sup>	Eligibility for Extended Warranty for 12 months
<b>Purchase of Extended Warranty after expiration of Manufacturers' Warranty or lapse of Extended Warranty<sup>3</sup></b>								
Extended Warranty with required Annual Service	Call for an appointment	Annual Service	\$4,500	No Charge	20% Discount	TBD	12 months on entire machine <sup>4</sup>	Eligibility for Extended Warranty for 12 months

1-Time: Travel time billed at \$70/hour for driving, \$500/day plus cost of ticket for flying. Repair time billed at \$90/hour.

2-Travel: Mileage is billed at the current standard reimbursement rate as set by the United States Internal Revenue Service if driving. For travel by air, cost of airline ticket, car rental and fuel expenses are included. Additional travel expenses may apply.

3-Purchase of Extended Warranty after expiration of Manufacturer's Warranty: Should the standard Manufacturers' Warranty expire, customer must purchase an Annual Service Plan prior to Extended Warranty and Annual Service must be performed. Customer is responsible for scheduling service and ordering or renewing Plans prior to expiration.

4-Excluding the ELO Touchcomputer. Tyco provides a 3-year warranty on the Touchcomputer used, no other warranty is hereby provided.

TBD – To be determined. Based upon actual cost

Effective date: 01 Jan 2019

DOCA5737D

## Features Comparison of Junior and Tafonius Large Animal Machines

Junior sans gas	Junior w/gas	Tafonius (full boat)	
000A5241	000A5242	000A4630	
Ventilator only	Gas machine and ventilator	Gas machine, ventilator, monitoring and advanced features	<i>Features as of 1 JUN 2019</i>
✓	✓	✓	• Stainless and Aluminum construction with white powder coated finish
15 seconds	30 seconds	2 seconds	• Quick access to internal cleaning of the "bellows"
✓	✓	✓	• 8" wheels, front wheel locks
✓	✓	✓	• Accommodates a wide range of patients 100 lbs – 2000 lbs (more or less!)
✓	✓	✓	• Future, <b>new modes of ventilation</b> as features are <b>software upgradeable</b>
✓	✓	✓	• Always powered by two 12v rechargeable batteries, AC keeps them topped off
✓	✓	✓	• Servo driven piston, <b>NO bellows</b>
✓	✓	✓	• Control Settings for Tidal Volume, Respiratory Rate, Insp-time, MWPL, CPAP/PEEP, Displays the Resulting MV, I-flow, E-time and I:E ratio
✓	✓	✓	• Displays above parameters when patient is spontaneously breathing; <b>Respiratory monitoring</b>
✓	✓	✓	• Tidal volumes up to 20 liters in 100ml increments with 25 ml resolution
Future	Future	✓	• Delivers <b>compliance compensated TVs</b> insures the patient actually receives the set TV
✓	✓	✓	• Respiratory Rate 1 – 30 breaths per minute
✓	✓	✓	• Maximum Working Pressure Limit adjustable from 10 – 80 cmH2O
✓	✓	✓	• Implementation of <b>PEEP</b> and <b>CPAP</b> up to 50cmH2O
✓	✓	✓	• Implementation of <b>Assist Mode</b> Ventilation
✓	✓	✓	• Inspiratory flow rates up to 900 lpm
✓	✓	✓	• Facilitates the implementation of <b>Closed Circuit Anesthesia</b> with add-a-liter feature
✓	✓	✓	• Scavenging flowmeter
✓	✓	✓	• Backup scavenging system
✓	✓	✓	• Uses <b>NO driving gas</b> to compress the "bellows"; a major ongoing cost savings
✓	✓	✓	• Oxygen is used only for patient uptake
Optional	✓	✓	• Airway pressure gauge
Additional	Additional	Additional	• IV pole
	✓	✓	• 22mm Foal Breathing Circuit included
	✓	✓	• Lightweight, kink free clear breathing tubes
	✓	✓	• Accommodates both funnel fit and Bivona/Drager style ET tube adapters
	✓	✓	• Absorber pan holds 6.5 liters, 11.7 lbs, 5.3 kg of absorbent
	✓	✓	• Oxygen flowmeter for manual use
	✓	✓	• Oxygen flush button for manual use
	Additional	✓	• Hospital line pressure gauge
	✓	✓	• Low oxygen supply pressure alarm
	Additional	Additional	• Optional N2O and/or Air flowmeters
	✓	✓	• Bronchodilator injection port
	n*	✓	• Pullout swiveling keyboard tray
	n	✓	• Dual mount Select-a-Tec™ vaporizer back bar
	n	✓	• Swivel valve block permits the breathing tubes to exit to the right or the left
	n	✓	• Stainless hoop handle and bumpers
	n	✓	• GFI protected with 3 auxiliary AC power outlets
	n	✓	• Panel mount e-cylinder pressure gauge
	n	✓	• "Crash cart" drug drawer below work surface
	n	✓	• Absorbent can be changed in seconds
	n	✓	• Two work lights and a built in maintenance tool kit
	n	✓	• Accommodates two oxygen e-cylinders for backup, temporary disconnect or field use
Additional	Additional	Included	• Optional oxygen e-cylinder mount for backup, temporary disconnect or field use
		✓	• Footprint 30"wide x 36"deep, height is 72"
		✓	• Redundant computer systems
		Main Control	• 15" 1028x768 <b>touchscreen computer</b> w/GUI interface and 160 Gigabyte HD
Main Control	Main Control	Backup Control	• Microprocessor with TV, RR, Itime, MWPL, CPAP/PEEP and Assist mode controls
		✓	• Settable Ip, inspiratory pause, 0-40% of the Itime
		✓	• Settable FiO2, 30% – 100 % (requires Air Option above)
		✓	• Choice of automatic or manual modes for FiO2 and anesthetic delivery
		✓	• <b>Fully integrated monitoring</b> of ECG, IBP, SpO2, Temp, Insp/Expired CO2, O2, Agent, N2O
		✓	• Sidestream Gas Analyzer standard
		✓	• Paramagnetic oxygen sensor w/ above, no galvanic cells to worry about or replace!
		✓	• High and low alarms for all parameters
		✓	• <b>Anesthesia record printout</b> for clinical use
		✓	• <b>Data collection</b> to Excel™ for research
		Future	• User programmability for the researcher
		✓	• Unlimited presets for recalling all settings and alarms for different doctors or types of cases
		✓	• Trend display of all measured parameters
		✓	• User configurable display of traces and trends
		✓	• Freeze traces function
		✓	• Alarm silence/locked/disabled function
✓	✓		• Alarm silence function only
✓	✓		• Footprint 24"wide x 28"deep, height is 50"
Additional	Additional		• <b>ZOO PACKAGE</b> includes collapsable lifting arms & mayo trays for ease of use in the field
Optional			• VML by MidMark (Matrx) gas machine head and mounting pole
Additional			• VML by MidMark (Matrx) mounting pole only
Optional	Optional	Depends on location	• Up to 2 Days in-service and training at installation

\* Note: It is possible to upgrade Junior with gas to have many of the feature of Tafonius. The features that would not be available are indicated by the symbol "n" in the table above. Pricing for features indicated as "Optional" has not been determined. **DOCA4958A**

## TAFONIUS

**Large Animal Machines** with TV deliveries from a full 20L all the way down to 0.5L for the smallest foal



### TAFONIUS

*Our premier large animal anesthesia machine with the first new approach in the industry in over 50 years*

### TAFONIUS JUNIOR TAFONIUS JUNIOR

*Complete gas machine incorporating the same robust piston servo system*

*Sans gas  
For use with your current gas machine (Pictured with Matrx VML by Midmark)*

## Small Animal Machines

### Model 2002<sup>PRO</sup>

*One Machine, three interchangeable bellows and housings*

### Anesthesia Workstation

*A complete heated circle system for animals from the size of rats to cats, small dogs, and now reptiles*



300–1600 ml TV

20–350 ml TV

1500–3000 ml TV

5–200 ml TV

#### We also provide:

Cleaning/Calibration  
Unit Upgrades  
Breathing System  
Tubing  
Gas Supply Hoses &  
Fittings  
Vacuum Scavenging  
Parts & Accessories

#### For More Information:

[www.hallowell.com](http://www.hallowell.com)  
[info@hallowell.com](mailto:info@hallowell.com)

(413) 445-4263