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# Checking and Calibrating the Anesthetic Gas Module

This chapter explains how to check the Anesthetic Gas Module to ensure that it is operating within its specified limits. A list of the equipment required to carry out the checks is included, as well as step-by-step instructions for the calibrations.

If you receive fail indications while testing, refer to the troubleshooting section of this document for guidance. If you are instructed to remove or replace parts of the Anesthetic Gas Module refer to the respective section.

## Access Service Functions of the M1026B Anesthetic Gas Module

Service functions of the M1026B Anesthetic Gas module are accessed with the M1026B Service Software which is available on the Service Guide CD shipped with the product.

## When and how to check the Philips M1026B Anesthetic Gas Module

To ensure that the Philips M1026B Anesthetic Gas Module operates with the specified limits, it must be checked:

- 1 Every 12 months *or* if the measurements are in doubt.
- 2 After repairing the AGM

If you find values outside the tolerance limits while checking, the Philips M1026B Anesthetic Gas Module must be repaired.

The basic steps to check the Philips M1026B Anesthetic Gas Module are:

- 1 Connect a PC/Laptop running the M1026B Service Software to the Anesthetic Gas Module and wait for the first zero calibration after the startup period.
- 2 Perform:
  - a. a leakage check
  - b. a flowrate checkto ensure that there are no leaks in the gas system and that the flowrates are set correctly.
- 3 Perform Zero calibration.

- 4 Check that there are no reported errors.
- 5 Check the Span calibration of gases.

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**WARNING** Only perform Zero and Span calibration checks when the top cover is closed. Light and electro-magnetic interference can affect the measurements.

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## Equipment required for checking

The following equipment is required for checking the AGM. Part numbers are given in the Parts List section.

- 1 Electronic Flowmeter M1026-60144 (Instructions are provided with the flowmeter. See also Service Note M1026A-034).
- 2 Span Check Equipment.
  - Check Gas (M1662A).
  - Calibration Tubing (M1659A).
  - Luer lock plug available on the elbow airway adapter (13902A).
- 3 Flow Split Test Fixture (M1026-60136)

## Checks and adjustments

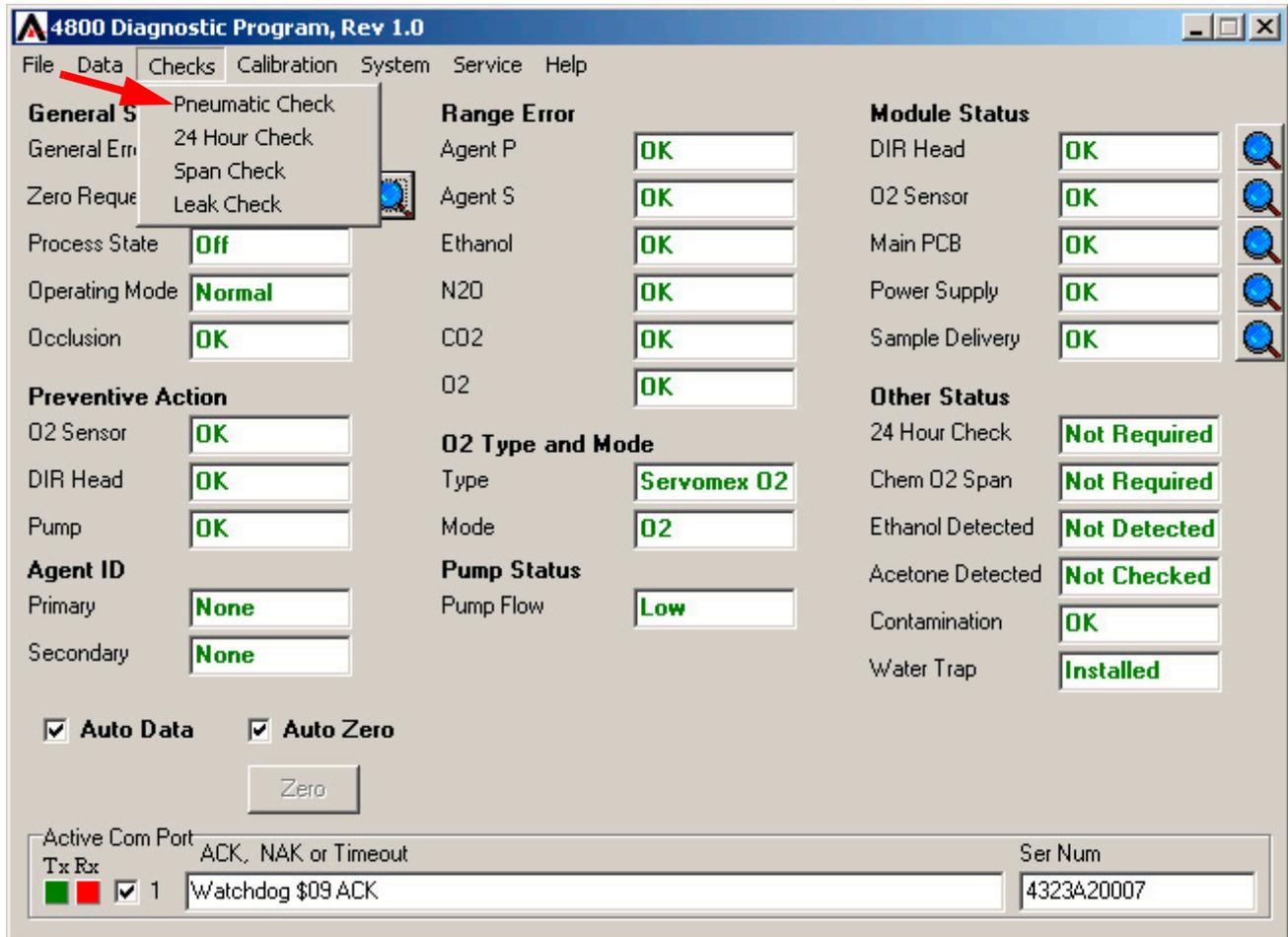
The following sections explain the steps needed to carry out the checks and adjustments. A complete check and calibration procedure requires approximately 30 minutes, including waiting time.

**NOTE** Make sure that the watertrap is attached.

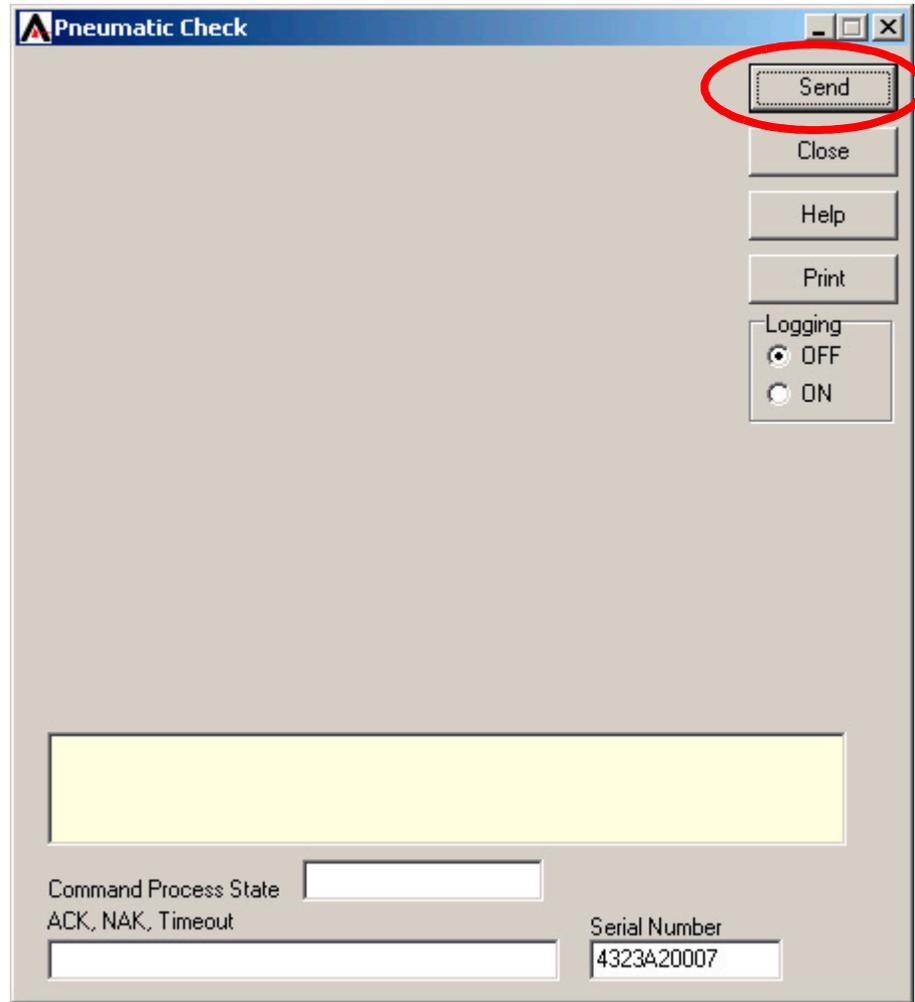
## Pneumatic Check

Always perform a pneumatic check before performing a leak check or before retrieving a temperature or ambient air pressure reading.

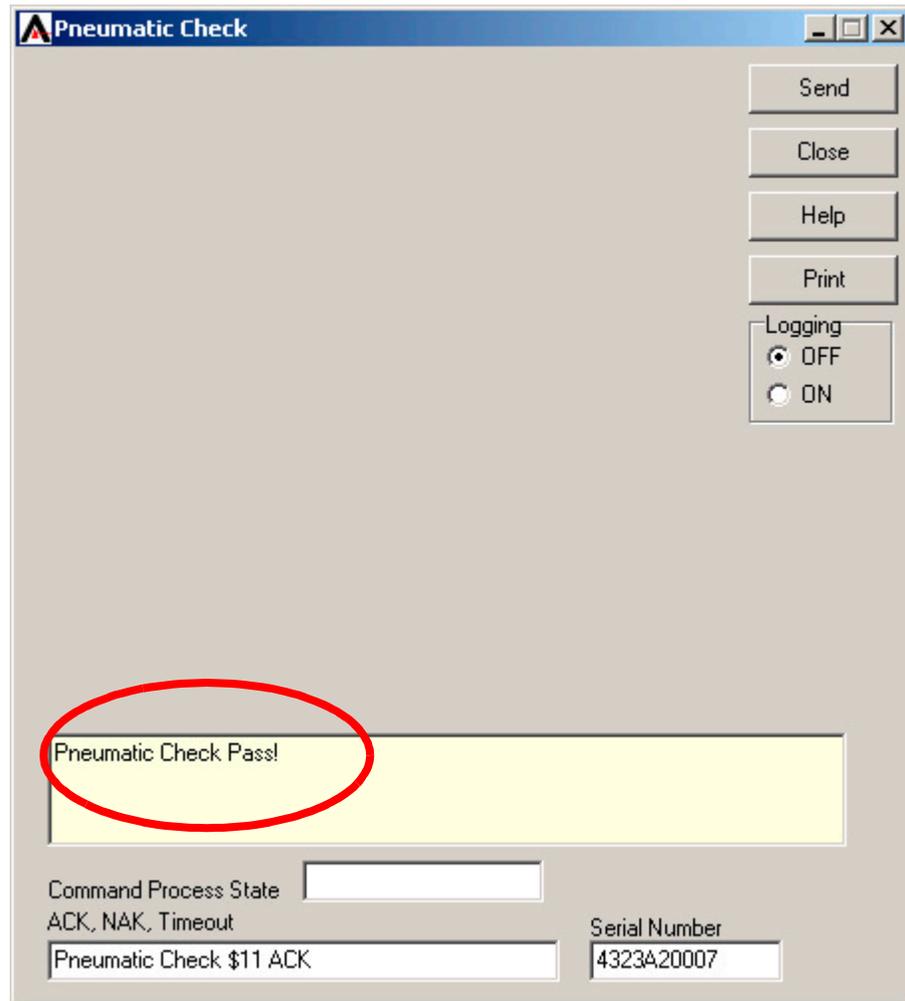
- 1 Select **Pneumatic Check** from the Checks pull-down menu.



- 2 Click on Send.



- 3 Wait for the “passed” message.

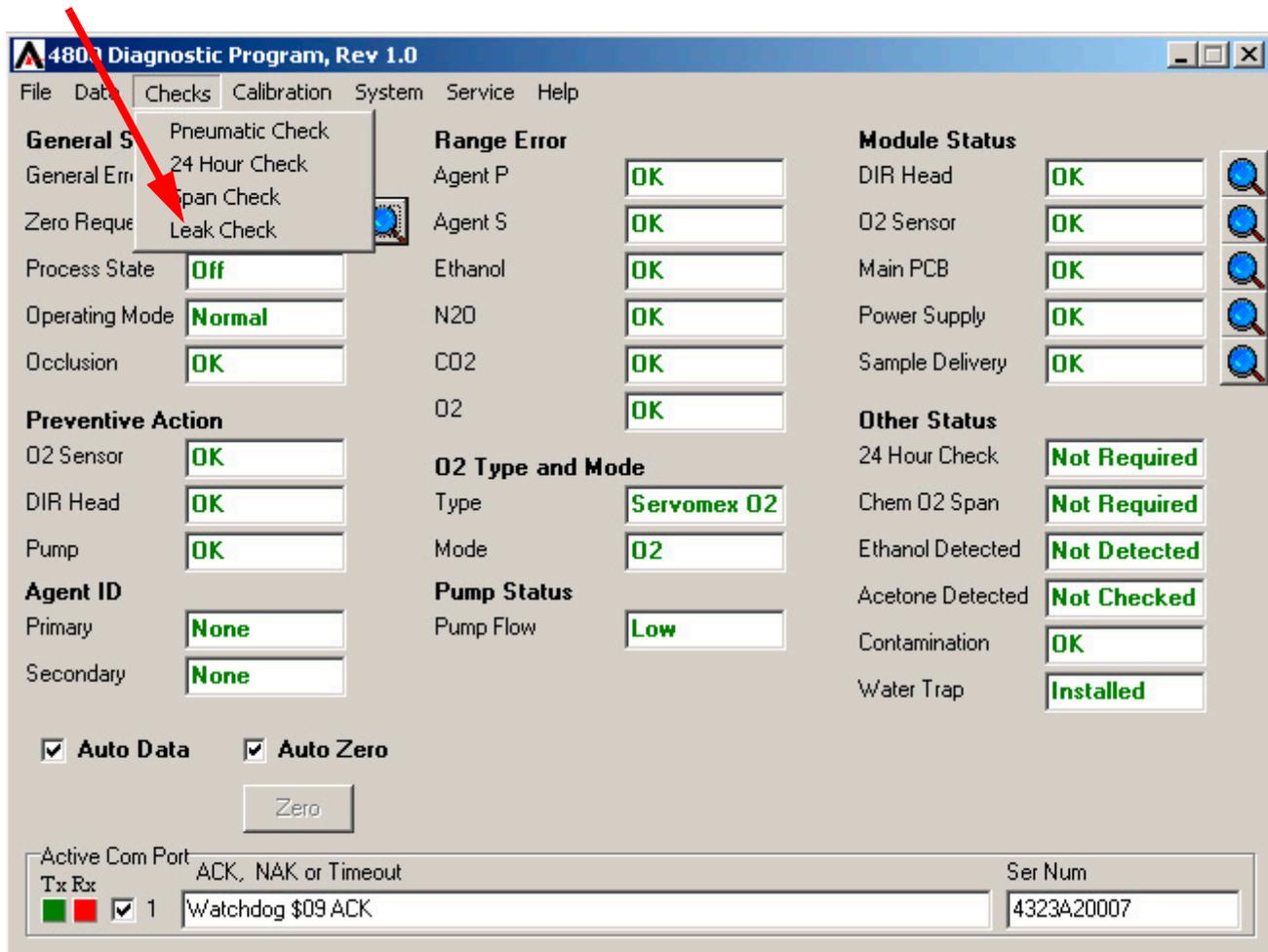


## Leak Check

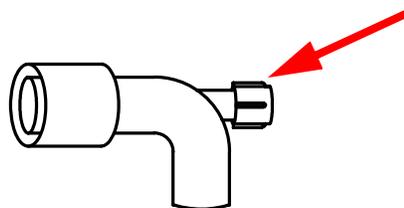
Complete the following steps to do a leak check:

**NOTE** Do not perform the leak check while a Zero calibration is running.

- 1 Select **Leak Check** from the Checks pull down menu.



- 2 Block the watertrap inlet using for example the cap of the airway adapter.



- 3 Click **Send** in the Leak Check window.

Leak Check

Vacuum Time, Seconds: 15

Wait Time, Seconds: 15

Leak Rate, Torr/Minutes: 12

Buttons: Send, Close, Help, Print

Logging:  OFF,  ON

Block the Water Trap Inlet port prior to sending this command!

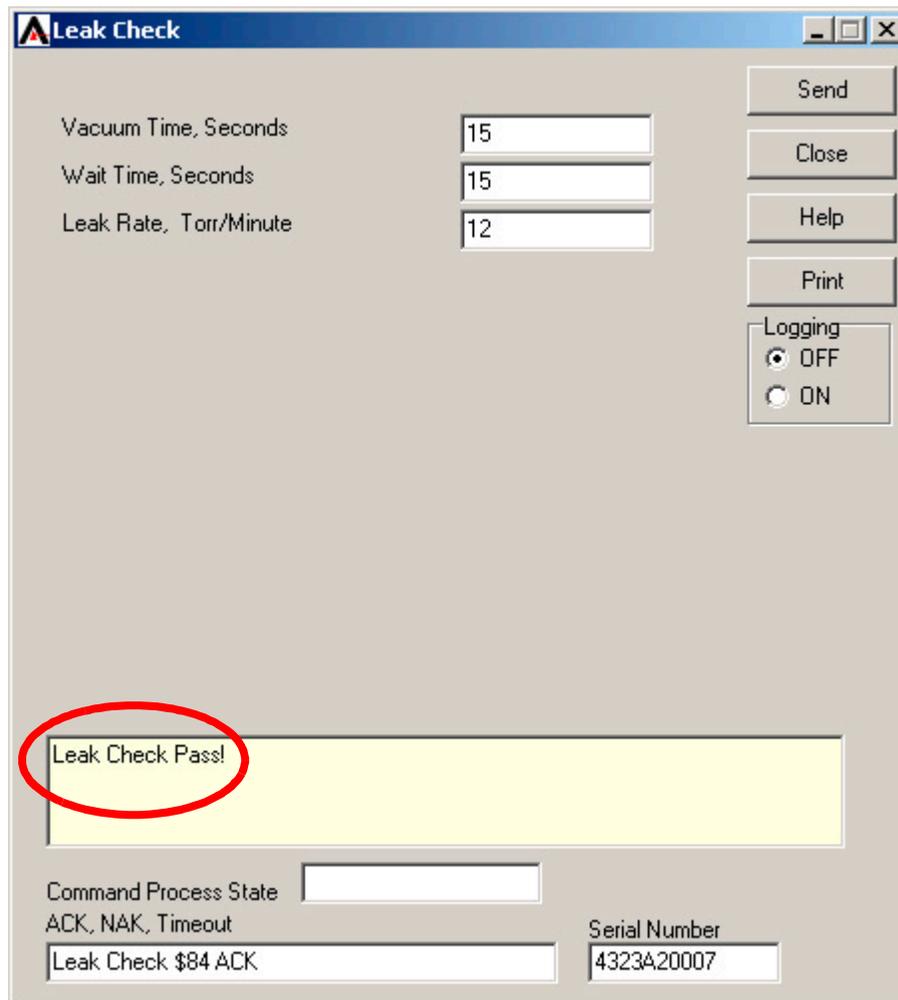
Process State: [ ]

ACK, NAK, Timeout: [ ]

Serial Number: 4323A20007

- 4 While the leak check is running, the **Process State** field will read *In Process*.
- 5 Wait until the **Process State** field goes blank again, indicating that the check is finished. Then remove the blockage from the watertrap inlet.

- 6 Check whether the leak check reports pass or fail. If the leak check fails make sure all internal tubing connections are tight.



The screenshot shows a software window titled "Leak Check". It contains several input fields and buttons. The input fields are:

- Vacuum Time, Seconds: 15
- Wait Time, Seconds: 15
- Leak Rate, Torr/Minute: 12

Buttons on the right side include: Send, Close, Help, Print, and a Logging section with radio buttons for OFF (selected) and ON.

A yellow message box at the bottom left contains the text "Leak Check Pass!", which is circled in red.

At the bottom, there are two more input fields:

- Command Process State: ACK, NAK, Timeout (with "Leak Check \$84 ACK" entered)
- Serial Number: 4323A20007

## Zero Calibration

**NOTE** Only perform a zero calibration with the top cover closed. Light and electro-magnetic interference may affect the measurements. Zero calibration is not possible during warm-up.

A zero calibration will be performed automatically when required if **Auto Zero** is selected in the Service Tool main screen.

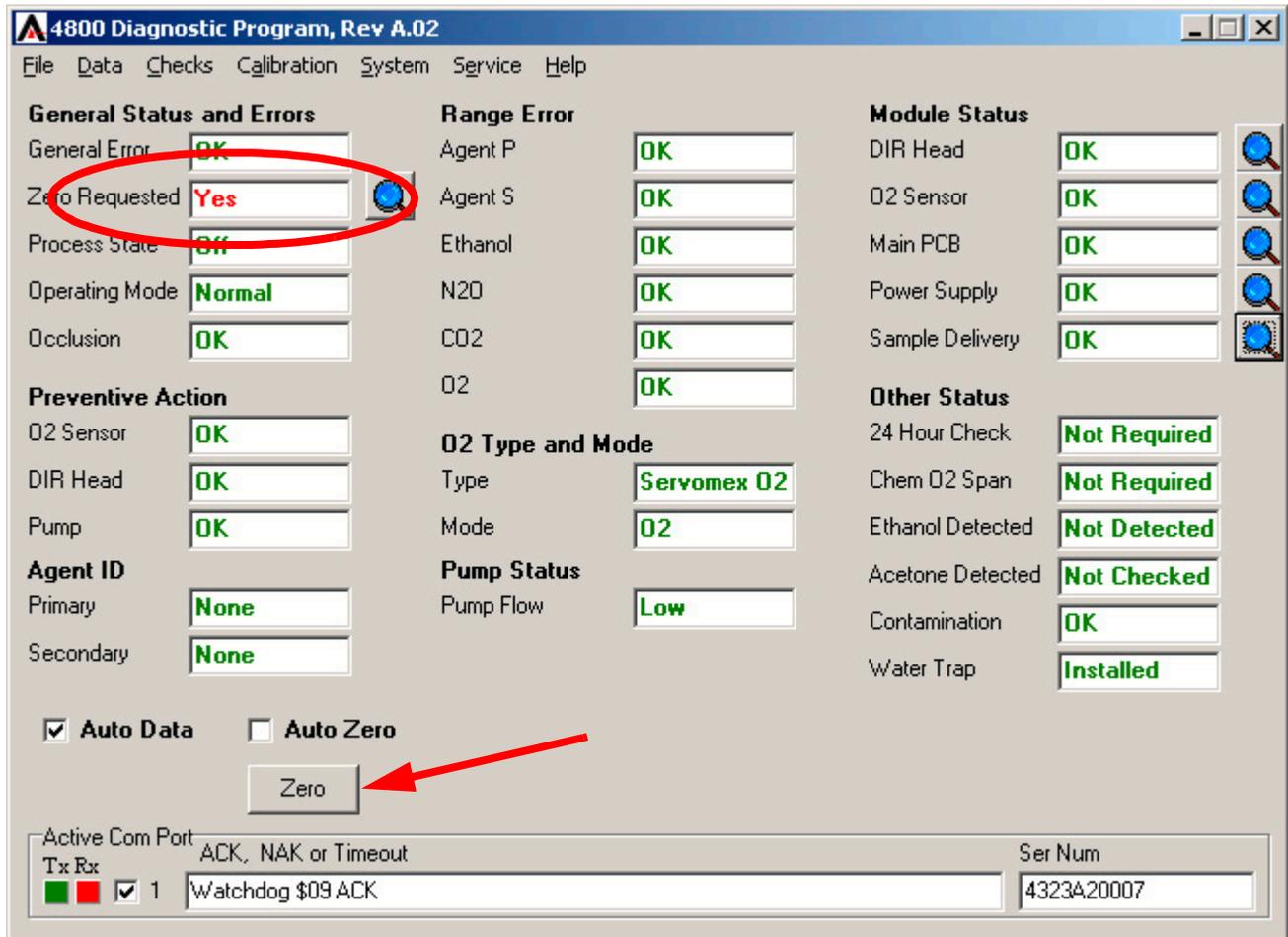
The screenshot displays the '4800 Diagnostic Program, Rev 1.0' interface. The 'Auto Zero' checkbox is highlighted with a red circle. Below it is a 'Zero' button. The interface is organized into several sections:

- General Status and Errors:** General Error (OK), Zero Requested (No), Process State (Off), Operating Mode (Normal), Occlusion (OK).
- Preventive Action:** O2 Sensor (OK), DIR Head (OK), Pump (OK).
- Agent ID:** Primary (None), Secondary (None).
- Range Error:** Agent P (OK), Agent S (OK), Ethanol (OK), N2O (OK), CO2 (OK), O2 (OK).
- O2 Type and Mode:** Type (Servomex O2), Mode (O2).
- Pump Status:** Pump Flow (Low).
- Module Status:** DIR Head (OK), O2 Sensor (OK), Main PCB (OK), Power Supply (OK), Sample Delivery (OK).
- Other Status:** 24 Hour Check (Not Required), Chem O2 Span (Not Required), Ethanol Detected (Not Detected), Acetone Detected (Not Checked), Contamination (OK), Water Trap (Installed).

At the bottom, there are checkboxes for 'Auto Data' and 'Auto Zero', both of which are checked. A 'Zero' button is located below the 'Auto Zero' checkbox. The bottom status bar shows 'Active Com Port' with 'Tx Rx' indicators and a 'Ser Num' field containing '4323A20007'.

If **Auto Zero** is not selected the **Zero Requested** field will read *Yes* everytime a zero calibration is required. To perform a zero calibration manually:

- 1 Click Zero in the Service Tool main screen.



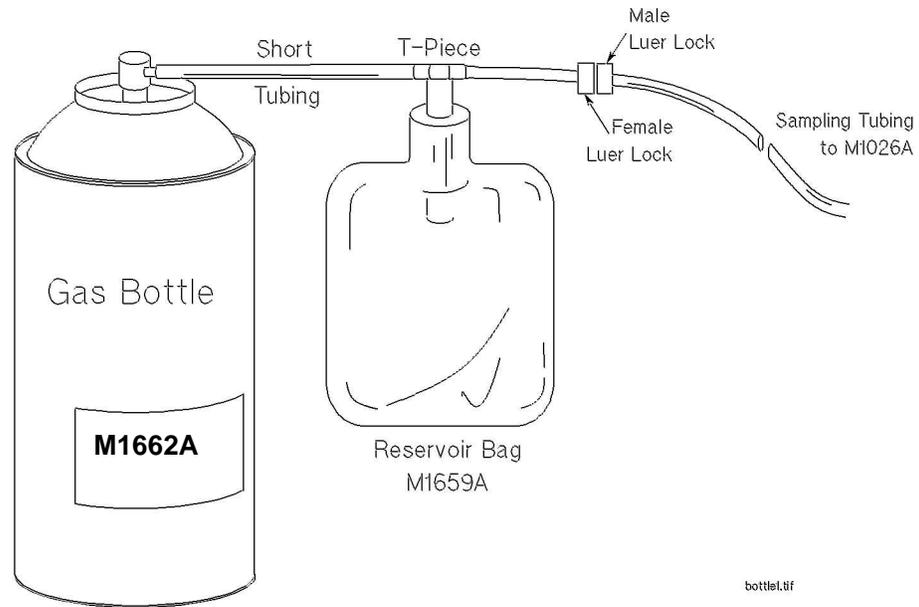
## Span Check

**NOTE** The Philips M1026B Anesthetic Gas Module should run for 2 minutes until the operating mode in the service tool reads *Normal* before continuing with the following calibration procedures. This is to allow the module to reach a stable measurement condition.

Only perform Span checks when the top cover is closed. Light and electro-magnetic interference can affect the measurements.

Before performing a Span check, you *must* first:

- perform a Leak Check.
- perform a Zero Calibration.
- Ensure that there is enough gas in the check gas bottle.
- Check tubing assembly.



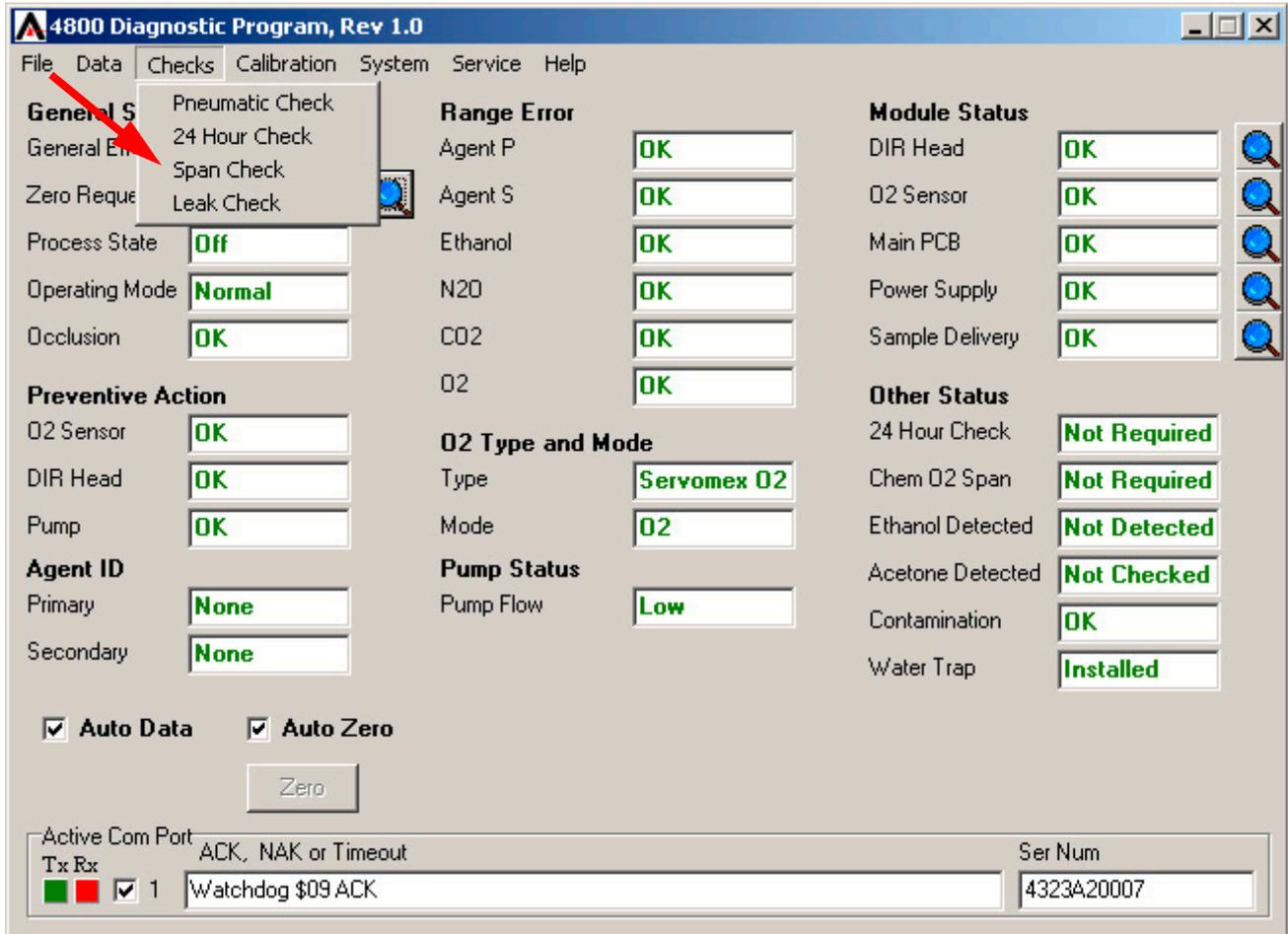
**Figure 7** Span Checking Equipment including Gas Canister and Spray Valve

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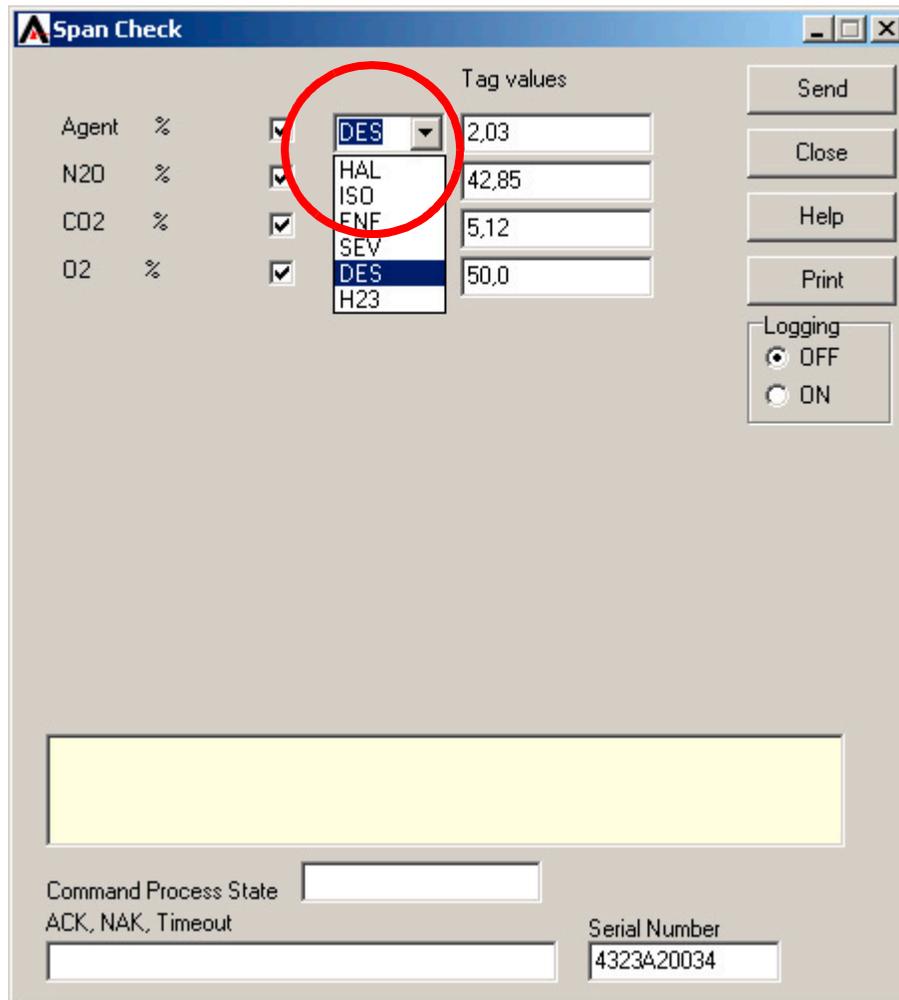
**CAUTION** Ensure that the room you are working in is well-ventilated, and that the Philips M1026B Anesthetic Gas Module exhaust is properly connected to the gas scavenging system.

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- 1 Select **Span Check** in the Checks pull down menu.



- 2 Select the agent you are checking and enter the corresponding gas values as given on the check gas bottle.



Agent	%	Tag values
<input checked="" type="checkbox"/>	DES	2,03
<input checked="" type="checkbox"/>	N2O	42,85
<input checked="" type="checkbox"/>	CO2	5,12
<input checked="" type="checkbox"/>	O2	50,0

Logging  
 OFF  
 ON

Command Process State  
ACK, NAK, Timeout  
Serial Number  
4323A20034

- 3 Connect the calibration gas bottle, the reservoir bag and the sample line as shown in Figure 7, "Span Checking Equipment including Gas Canister and Spray Valve".
- 4 Wait until the **Sample Delivery** field in the **Module Status** section of the service software reads *Error*, indicating that the reservoir bag is empty. Now wait for another 10 seconds to let the Anesthetic Gas Module completely evacuate the reservoir bag.
- 5 Now fill the reservoir bag with gas.

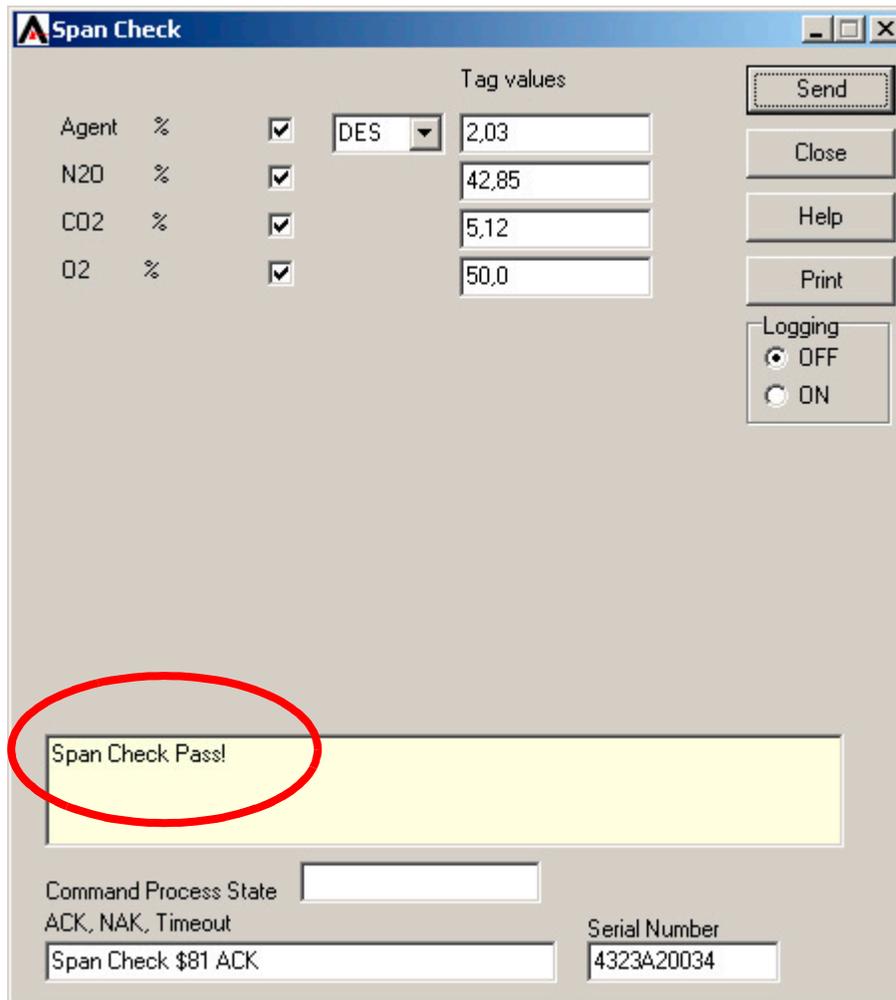
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**CAUTION** Do not pressurize the reservoir bag.  
Do not attempt the span check process if there are any visible leaks in the bag or tubing.  
Prevent the bag from emptying before the span check procedure is complete.

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- 6 Click Send in the Span Check window.

- 7 Check whether the check has been passed.



The screenshot shows the Span Check software interface. The window title is "Span Check". It features a table of gas agents with checkboxes and tag values. A red circle highlights the message "Span Check Pass!" in a yellow box. Below the table, there are fields for "Command Process State" and "Serial Number".

Agent	%	Tag values
DES	<input checked="" type="checkbox"/>	2,03
N2O	<input checked="" type="checkbox"/>	42,85
CO2	<input checked="" type="checkbox"/>	5,12
O2	<input checked="" type="checkbox"/>	50,0

Span Check Pass!

Command Process State:

ACK, NAK, Timeout:

Serial Number: 4323A20034

- 8 If the check has not passed, check for any errors in the module status windows of the service software and proceed to the troubleshooting section of this manual.

## Disposal of Empty Gas Cylinder

- 1 Empty cylinder completely by pushing in the pin of the valve.
- 2 Once the cylinder is empty, drill a hole in the cylinder

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**CAUTION** Be careful to assure that the cylinder is completely empty before you try to drill the cylinder.

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- 3 Write "Empty" on the cylinder and place it with your scrap metal or, if you do not collect scrap metal for recycling, dispose of the cylinder.

## Flowrate Check

- 1 Before starting a flowrate check, get an ambient pressure reading by:
  - a. performing a zero calibration
  - b. performing a pneumatic check to update temperature and pressure data
  - c. selecting the **Temperature and Pressure Data** from the Data pull down menu and clicking on send.

The **Ambient Pressure (mmHg)** field in that window provides the ambient pressure that should be used for correcting the electronic mass flowmeter reading.

- 2 Connect a flowmeter to the flow split test fixture.
- 3 Check the measurement path flowrate at low flow and high flow.
- 4 If you are using the electronic flowmeter M1026-60144, correct the reading for each step according to the following formula:

$$\text{Actual Flow} = \frac{\text{Flow Reading} \times 760 \text{ mmHg}}{\text{Actual Ambient Air Pressure}}$$

or: in order to get the actual reading for a desired flowrate:

$$\text{Flow Reading} = \text{Desired Flowrate} \times \frac{\text{Actual Ambient Air Pressure}}{760 \text{ mmHg}}$$

	Flowrate in each mode	Tolerance
Low flow	96 ml/min	+/- 5ml/min
High flow	160 ml/min	+/- 8ml/min

If the flowrate is out of tolerance, perform a flow calibration.

## Total Flowrate Check

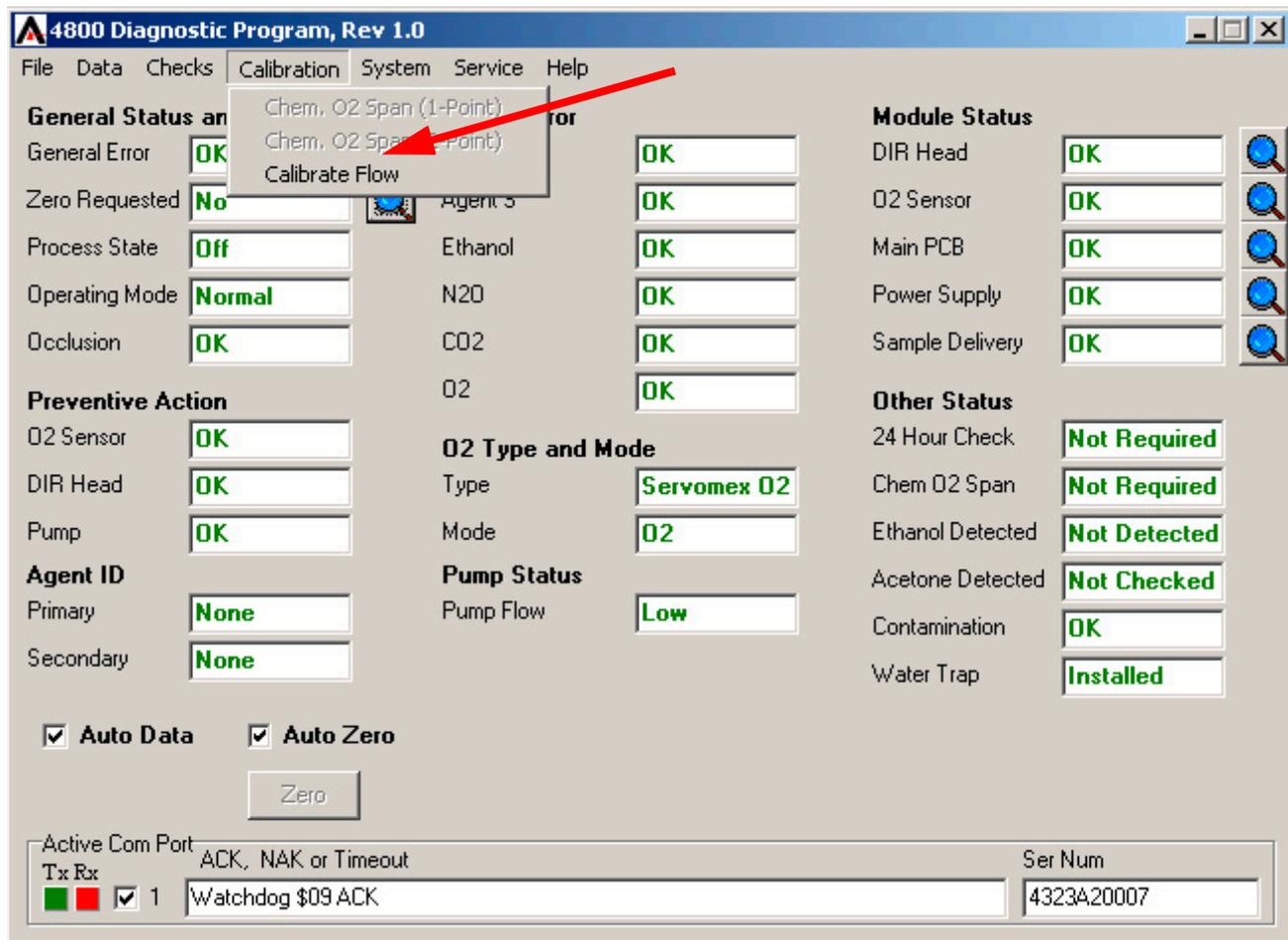
- 1 Restart the M1026B Anesthetic Gas Module.
- 2 Connect the Anesthetic Gas Module to the patient monitor.
- 3 Measure the total flowrate at the watertrap. It should be 150 +/- 15 ml/min. If it is out of tolerance, troubleshoot the pneumatics assembly.

# Flow Calibration

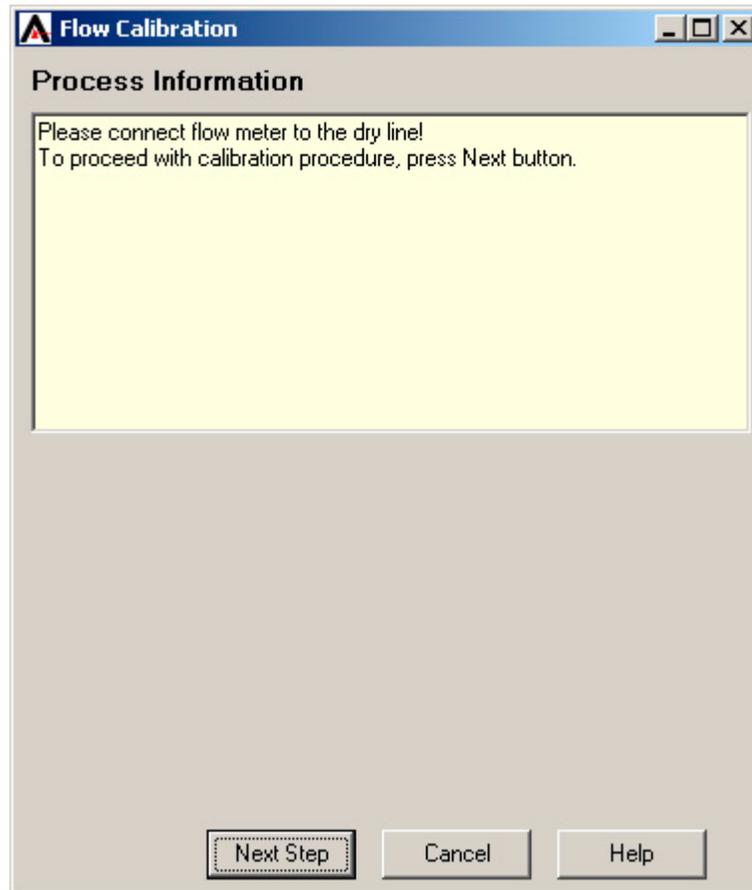
- 1 Before starting a flow calibration, get an ambient pressure reading by:
  - a. performing a zero calibration
  - b. selecting the **Temperature and Pressure Data** from the Data pull down menu and clicking on send.

The **Ambient Pressure (mmHg)** field in that window provides the ambient pressure that should be used for correcting the electronic mass flowmeter reading.

- 2 Select **Calibrate Flow** from the Calibration pull down menu.



- 3 Connect the Flowmeter to the dry line of the flow split test fixture and then click **Next Step**.



- 4 If you are using the electronic flowmeter M1026-60144, correct the reading for each step according to the following formula:

$$\text{Actual Flow} = \frac{\text{Flow Reading} \times 760 \text{ mmHg}}{\text{Actual Ambient Air Pressure}}$$

or: in order to get the actual reading for a desired flowrate:

$$\text{Flow Reading} = \text{Desired Flowrate} \times \frac{\text{Actual Ambient Air Pressure}}{760 \text{ mmHg}}$$

- 5 Calibrate:
- Low Flow,
  - High Flow and
  - Purge Flow

always following the instructions on the screen while making sure to correct the reading as described in step 3 above.

**Low Flow Calibration**

**Process Information**

Repeat steps 1 and 2 until you achieve 96 ml/min flow rate on the flow meter.

1. If flow rate on the flow meter is not equal to 96 ml/min, change Pump Output value by using <- and -> arrows.
2. Monitor Process Status for any possible problems.
3. Enter flow meter reading into Flow Value edit box.
4. Press Calibrate Low Flow button. Monitor Process Status for any possible problems. Press Next button.

**Process Status**

**In Progress**

Pump Output: 1190

<--- [-10]    [+10] --->

<--- [-100]    [+100] --->

Flow Value: 96    Calibrate Low Flow

Previous Step    Next Step    Cancel    Help

Always click the **Calibrate Low/High/Purge Flow** button before proceeding with **Next Step** and allow the instrument to stabilize before calibrating on a certain flowrate.

If the desired flowrate cannot be reached exactly, take the actual flow reading and (after coorrecting it for ambient air pressure influences if using the M1026-60144) enter this value into the field **Flow Value**.

**NOTE** During the flow calibration procedure (especially at the purge flowrate) a **Sample delivery** error flag and a yellow correctable error may appear on the main screen of the M1026B Service Software. These should disappear after the calibration procedure is completed.

- 6 Save the calibration and click **Next Step** to complete the flow calibration process.

