Supplement Paper
Inhalation Anesthesia Machine
Apollo, Software 3.2n, Software 4.n


For the combination of the anesthesia machine Apollo with a module which can supply a controlled flow of carbon dioxide (CO2) as a fourth gas into the fresh-gas flow from the anesthesia machine’s mixer.

Anesthesia machines running Software 3.2 or higher may be combined with this module.

Such anesthesia machines will differ from previous models and their respective Instructions for Use as follows.

Supplement Paper Apollo SW 3.2n, SW 4.n
Chapter – Introduction

Intended Use

The Apollo is an inhalation anesthesia machine for use in operating, induction, and recovery rooms. It can be used with rebreathing systems, semi-closed to virtually closed systems with low flow and minimal flow techniques, and non-rebreathing systems (with the Auxiliary Common Gas Outlet). It may be used with O2, N2O, CO2 (in combination with the CO2 module), and Air supplied by a medical gas pipeline system (not available for CO2) or by externally mounted gas cylinders. Anesthetic agent can be delivered by vaporizers mounted to the machine.

Chapter 2 – System Components

The CO2 Module

1 Flow meter
2 CO2 Flow Control
3 CO2 cylinder connection
Chapter 3 – User Interface

CO2 Flow Control

The CO2 flow control is located on the right side on the Apollo, not adjacent to the other flow controls for O2, N2O, and Air. The module can only be operated by the flow meter and the flow control knob depicted in “The CO2 Module” on page 2. Turn the control knob counterclockwise to increase the CO2 flow and clockwise to decrease the flow. The current flow is shown on the CO2 flow tube and as part of the total flow on the total flow meter.

Connecting the Gas Cylinders for O2, N2O, CO2, and Air

The Apollo is equipped with ANSI standard pin-indexed hanger yokes for E-size cylinders to connect backup gas cylinders to the anesthesia machine. The yoke for O2 is standard, the yokes for N2O and Air are optional. All cylinder yokes are located on the back of the machine as shown in Figure 25 of the Instructions for Use. The CO2 module requires an externally mounted fourth gas cylinder. As shown in Figure 25a, the position for the CO2 cylinder is on the right hand side of the machine (as you face the machine). The CO2 cylinder mount is compatible with pin-indexed E-size cylinders and the gas inlet is equipped with a NIST gas-specific connection for the cylinder.

NOTE

The user must position the gas cylinder and the pressure regulator in such a way that the gauge of the pressure regulator can be read from the front of the anesthesia machine.

CAUTION

Risk of device failure.
Compressed gas supply (central supply or cylinder): To avoid damaging the device(s) attached to a gas supply, use only medical gases. Pay particular attention to national and international standards regulating the use of medical gases.
Chapter 5 – Pre-use Checkout

Checking the Workstation According to the Check List

Check the cylinder gas supply:

WARNING
Risk of patient injury.
When initializing operation, the pressure indicated on the pressure regulator may be residual pressure from the cylinder supply of a previous case.
To avoid injuring the patient, make sure the cylinder valve is open before delivering CO2.

3.1 Checking the cylinder gas supply of the CO2 gas cylinder
   a. Using the provided cylinder wrench, slowly open the cylinder valve of the CO2 cylinder.
   b. Open the control valves for O2 to activate SORC and CO2.
   c. Check if the cylinder pressure is sufficient for the operation planned.

Adjust the flow control knob for CO2 and verify that the float moves freely on the flow meter.
   d. Close the CO2 control valve.
   e. Close the control valve for O2 and push the O2+ button to flush the breathing system in order to remove CO2.
Chapter 6 – Operation Summary

Setting Fresh-gas Flow

**WARNING**
Risk of patient injury.
Because of high inspiratory CO2 levels, derived numerical expiratory CO2 measurement values will fluctuate greatly (up to 1 or 2 Vol.%) as compared to "normal" values when the CO2 Module is not in use. The user must exercise increased attentiveness by monitoring the CO2 waveform.

**CAUTION**
Risk of elevated levels of CO2 doses.
If a fully filled absorber or a CLIC absorber is used, the inspiratory CO2 concentration may automatically rise during a case as increasingly more soda lime becomes inactive in the upper area of the absorber canister. Inactive soda lime will remove less CO2 from the fresh-gas flow. When administering CO2, Dräger recommends using a refillable absorber (not a CLIC absorber) only filled halfway. In this way:
- The inspiratory CO2 concentration can more easily be kept constant;
- CO2 gas will be saved;
- Soda lime will be saved.

**CAUTION**
Risk of patient injury.
If applying inspiratory CO2 concentrations, the soda lime will be exhausted more quickly; inspiratory CO2 concentrations may increase drastically. Pay special attention to the state of the soda lime when operating with inspiratory CO2 concentrations.
Operating the CO₂ Module

**WARNING**
Risk of inadequate monitoring.
When operating the CO₂ module within an inspiratory CO₂ concentration range higher than 3.5 Vol.%, situations may occur in which breathing phase-derived gas measurement values cannot be calculated. If this is the case, the related alarm monitoring will not be active. In order to guarantee gas monitoring, it is necessary to activate the bypass mode for inspiratory CO₂ concentration settings above 3.5 Vol.%.

**WARNING**
Risk of inadequate monitoring.
Apnea monitoring for CO₂ and pressure measuring is not active when the bypass mode is used (as described above). Flow apnea alarm monitoring is not active in the Man/Spont mode and therefore must be replaced by a continuously active lower minute volume (MV) limit.
To achieve this, activate the MV alarm limits for Man/Spont on the configuration screen by setting them to “on” and make sure that the MV lower alarm limit is active whenever ventilating the patient.

**WARNING**
Risk of inadequate monitoring.
CO₂ concentration monitoring alarms are not active when the bypass mode is used (as described above). The user must exercise increased attentiveness. The user must manually monitor measured CO₂ concentrations, which will not be based on breathing phases in the bypass mode, by observing the displayed CO₂ waveform. In addition, gas measurement availability must be constantly supervised because CO₂ apnea alarm monitoring is unavailable.
Standard operation is possible with the CO₂ module even if the inspiratory carbon dioxide values reach 3.5 Vol.%. If, however, the CO₂ concentration exceeds this level, breathing phase-derived gas measurement values may not be available. For this reason, inspiratory and expiratory gas measurement values and the respective alarm triggering (based on a breathing phase) can no longer be ascertained. In such cases, real-time values are displayed at a rate of 1/s. To monitor the CO₂ concentration, the user must correlate the displayed real-time values to the CO₂ waveform display.

To ensure adequate gas monitoring, the bypass mode is mandatory when the Apollo is intended for operation with inspiratory CO₂ levels above 3.5 Vol.%. When running in bypass mode, absolute inspiratory and expiratory CO₂ measurements, as well as apnea detection for CO₂ and pressure, are deactivated. The only apnea alarm function remaining is then based upon flow measurement; this is, however, deactivated in the Man/Spont mode. To provide adequate monitoring during Man/Spont, the lower minute volume limit must be appropriately set.

**WARNING**
Risk of patient injury.
To ensure proper CO₂ monitoring and prevent a risk to the patient, only set the CO₂ alarm default value to a higher limit if the device is being used solely for CO₂ applications.

The upper inspiratory CO₂ alarm limit is adjustable and can be disabled, to prevent nuisance alarms. The CO₂ module is equipped with an SORC. This safety feature limits the CO₂ concentration in the fresh gas so that the O₂ concentration does not fall below 21 Vol.%. When the CO₂ flow control is open and the O₂ flow control is closed (or the O₂ flow is less than 500 mL/min), the SORC prevents a CO₂ flow. If the CO₂ flow fails, oxygen can still be administered.
Chapter 9 - Alarms

Adjustment Range of the Alarm Limits during Operation

With Software 3.2n:

\[
\text{FiCO}_2 \quad [\text{Vol.%}] \quad 0.1 \text{ to } 1.4 \text{ Vol.%}, \quad --
\]

With Software 4.n:

\[
\text{FiCO}_2 \quad [\text{Vol.%}] \quad 0.1 \text{ to } 3.5 \quad 1), \quad --
\]

1) DrägerService can change the upper limit to 1.4.

Chapter 11 – Cleaning and Maintenance

Maintenance intervals

Refer to the Apollo Instructions for Use.

Chapter 13 – Specifications

CO2 Module

**WARNING**

Risk of patient injury.

To prevent the CO2 module from malfunctioning, only the Dräger pressure reducer CO2 Pin index (part no. 8607429) should be used. Only use a CO2 cylinder with this pressure reducer to supply the CO2 module.

Inlet connection: Pin-Index coded pressure regulator

Inlet pressure: 5 kPa x 100 ±20 % (72.5 psi ±20 %)

CO2 flow dosing: 0 to 0.6 L/min ±10 % with an inlet pressure of 5 kPa x 100 (72.5 psi)

CO2 flow meter: 100 to 1000 mL/min

Accuracy: ±50 mL/min

Resolution: 50 mL/min
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