NORTH AMERICAN DRÄGER

OPERATOR'S INSTRUCTION MANUAL

NARKOMED 4
ANESTHESIA SYSTEM

NARKOMED 4
OPERATOR'S INSTRUCTION MANUAL

TABLE OF CONTENTS

NARKOMED 4
OPERATOR'S INSTRUCTION MANUAL

TABLE OF CONTENTS

NARKOMED 4
OPERATOR'S INSTRUCTION MANUAL

TABLE OF CONTENTS

NARKOMED 4
OPERATOR'S INSTRUCTION MANUAL

TABLE OF CONTENTS

NARKOMED 4
OPERATOR'S INSTRUCTION MANUAL

TABLE OF CONTENTS

Appendices

Operator's Responsibility for Patient Safety

North American Dräger anesthesia products are designed to provide the greatest degree of patient safety that is practically and technologically feasible. The design of the equipment, the accompanying literature, and the labeling on the equipment take into consideration that the purchase and use of the equipment are restricted to trained professionals, and that certain inherent characteristics of the equipment are known to the trained operator. Instructions, warnings, and caution statements are limited, therefore, to the specifics of the North American Dräger design. This publication excludes references to hazards which are obvious to a medical professional, to the consequences of product misuse, and to potentially adverse effects in patients with abnormal conditions. Product modification or misuse can be dangerous. North American Dräger disclaims all liability for the consequences of product alterations or modifications, as well as for the consequences which might result from the combination of North American Dräger products with products supplied by other manufacturers if such a combination is not endorsed by North American Dräger.

The operator of the anesthesia system must recognize that the means of monitoring and discovering hazardous conditions are specific to the composition of the system and the various components of the system. It is the operator, and not the various manufacturers or suppliers of components, who has control over the final composition and arrangement of the anesthesia system used in the operating room. Therefore, the responsibility for choosing the appropriate safety monitoring devices rests with the operator and user of the equipment.

Patient safety may be achieved through a variety of different means depending on the institutional procedures, the preference of the operator, and the application of the system. These means range from electronic surveillance of equipment performance and patient condition to simple, direct contact between operator and patient (direct observation of clinical signs). The responsibility for the selection of the best level of patient monitoring belongs solely to the equipment operator. To this extent, the manufacturer, North American Dräger, disclaims responsibility for the adequacy of the monitoring package selected for use with the anesthesia system. However, North American Dräger is available for consultation to discuss monitoring options for different applications.

Limitation of Liability

North American Dräger's liability, whether arising from or related to manufacture and sale of the goods, their installation, demonstration, sales representation, use, performance, or otherwise, including any liability based upon North American Dräger's Product Warranty, is subject to and limited to the exclusive terms and conditions as set forth, whether based upon breach of warranty or any other cause of action whatsoever, regardless of any fault attributable to North American Dräger and regardless of the form of action (including, without limitation, breach of warranty, negligence, strict liability, or otherwise).

THE STATED EXPRESSED WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR NONINFRINGEMENT.

North American Dräger shall not be liable for, nor shall the buyer be entitled to recover, any special incidental or consequential damages or for any liability incurred by buyer to any third party in any way arising from or relating to the goods. North American Dräger disclaims any liability arising from a degraded system due to an improperly designed or malfunctioning third party interfaced product.

Restriction

Federal law restricts this device to sale by, or on the order of, a physician.

How This Manual Is Organized

All users of the NARKOMED 4 must read this manual completely before using the machine. In order to make this document more convenient for future reference, it has been divided into several independent sections. Each section deals specifically with one task.

Conventions Used in This Manual

This manual has been set up with several conventions to help organize the information contained in it. Please read about these conventions carefully so that you understand their significance in the manual.

Typefaces

Narrative information in this manual appears in this typeface.

Machine messages and labels appear in this typeface.

Warnings and Cautions

Warning messages give important information that, if ignored, could lead indirectly or directly to a patient's injury.

Caution messages give important information that, if ignored, could lead directly to equipment damage.

All parts of this manual contain special warnings and cautions about the NARKOMED 4. Each time a warning or caution appears in the text, it is accompanied by a symbol in the margin that looks like this:

⚠️

Use this symbol as a visual flag that reminds you to pay close attention to the message beside the symbol.

Section 1
Introduction

General Warnings and Cautions

The following list of warnings and cautions apply to general operation and maintenance of the NARKOMED 4. Warnings and cautions about installing and operating specific parts appear with those topics.

⚠ **WARNING:** Any person involved with the setup, operation, or maintenance of the NARKOMED 4 anesthesia system must be thoroughly familiar with this instruction manual.

⚠ **WARNING:** This anesthesia system will not respond automatically to certain changes in patient condition, operator error, or failure of components. The system is designed to be operated under the constant surveillance and control of a qualified operator.

⚠ **WARNING:** No third-party components shall be attached to the anesthesia machine, ventilator, or breathing system unless authorized by North American Dräger.

⚠ **WARNING:** This machine may be serviced only by an authorized representative of North American Dräger. Refer any servicing to qualified service personnel.

⚠ **CAUTION:** Although the NARKOMED 4 is designed to minimize the effects of ambient radio-frequency interference, machine functions may be adversely affected by the operation of electrosurgical equipment or short wave or microwave diathermy equipment in the vicinity.

⚠ **CAUTION:** Do not place more than 100 pounds on top of the NARKOMED 4 monitor housing.

Overview

The NARKOMED® 4 is a continuous flow anesthesia system. All NARKOMED 4 machines are equipped with a monitoring system and pneumatic circuitry for delivering medical gases and anesthetic vapor.

Gas Delivery System

Gases

The pneumatic system can simultaneously deliver up to four gases and one anesthetic agent (from a selection of up to three). Oxygen and nitrous oxide are standard on all NARKOMED 4 machines. Optional gases are air, carbon dioxide, and oxygen-helium. Gas is supplied to the system through pipelines and cylinders. Pipeline connections for oxygen and nitrous oxide are standard on all machines, and a pipeline connection for air is also available. Gas cylinder yokes are available for up to two oxygen cylinders and two nitrous oxide cylinders, plus one additional cylinder for a third gas.

Color Coding

Each connection, valve, gauge, and flowmeter is labeled and color coded for the appropriate gas, as shown in the table below.

GAS	LABEL	COLOR CODE	
		U.S.	CANADA (CSA)
Air	AIR	Yellow	Black/White Checkered
Carbon Dioxide	CO_2	Gray	Gray
Oxygen-Helium	O_2-He	Green/Brown Diagonal Stripes	White/Brown Diagonal Stripes
Nitrous Oxide	N_2O	Blue	Blue
Oxygen	O_2	Green	White

Gas Entry Via Pipeline

Gas from the hospital pipelines enters the NARKOMED 4 through hoses connected to diameter-indexed safety system (DISS) inlets. The indexed connector system reduces the risk of delivering the wrong gas to a patient by preventing incorrect connection of gas pipes. The inlets include check valves, which prevent back flow leakage into the atmosphere (when supply hoses are not connected) or into the attached supply hoses (when reserve cylinders are in use). Each pipeline connection is also equipped with a filter to prevent foreign material from entering the internal gas piping of the NARKOMED 4. Pipeline gases should be supplied at 50–55 psi.

Pipeline Pressure Gauges

Pipeline pressure gauges for oxygen and nitrous oxide are standard. If the anesthesia machine is equipped with air, a pipeline pressure gauge for air is also included. The gauges are located directly below the flowmeters and flow control valves for each gas and are labeled and color-coded for their respective gases. Concentric scales in psi and kPa indicate the pipeline supply pressure.

When the machine is connected to a functioning pipeline supply, each gauge should indicate 50–55 psi. Supply pressures outside of this range may adversely affect the operation of the NARKOMED 4. A fluctuating pipeline supply pressure, for example, would cause a corresponding fluctuation of the delivered flow of that gas. An excessively low pipeline pressure may activate the corresponding reserve cylinder and deplete its contents (if the reserve cylinder valve was left in the open position).

FINE FLOW TUBE (ml/min), O_2

COARSE FLOW TUBE (l/min), O_2

INDICATOR FLOATS, O_2

FLOWMETER KNOB GUARD

PRECISION FLOW CONTROL KNOB, O_2

PIPELINE PRESSURE GAUGE, O_2

CYLINDER PRESSURE GAUGE, O_2

COLOR-CODED GAS LABEL

OP10005

⚠
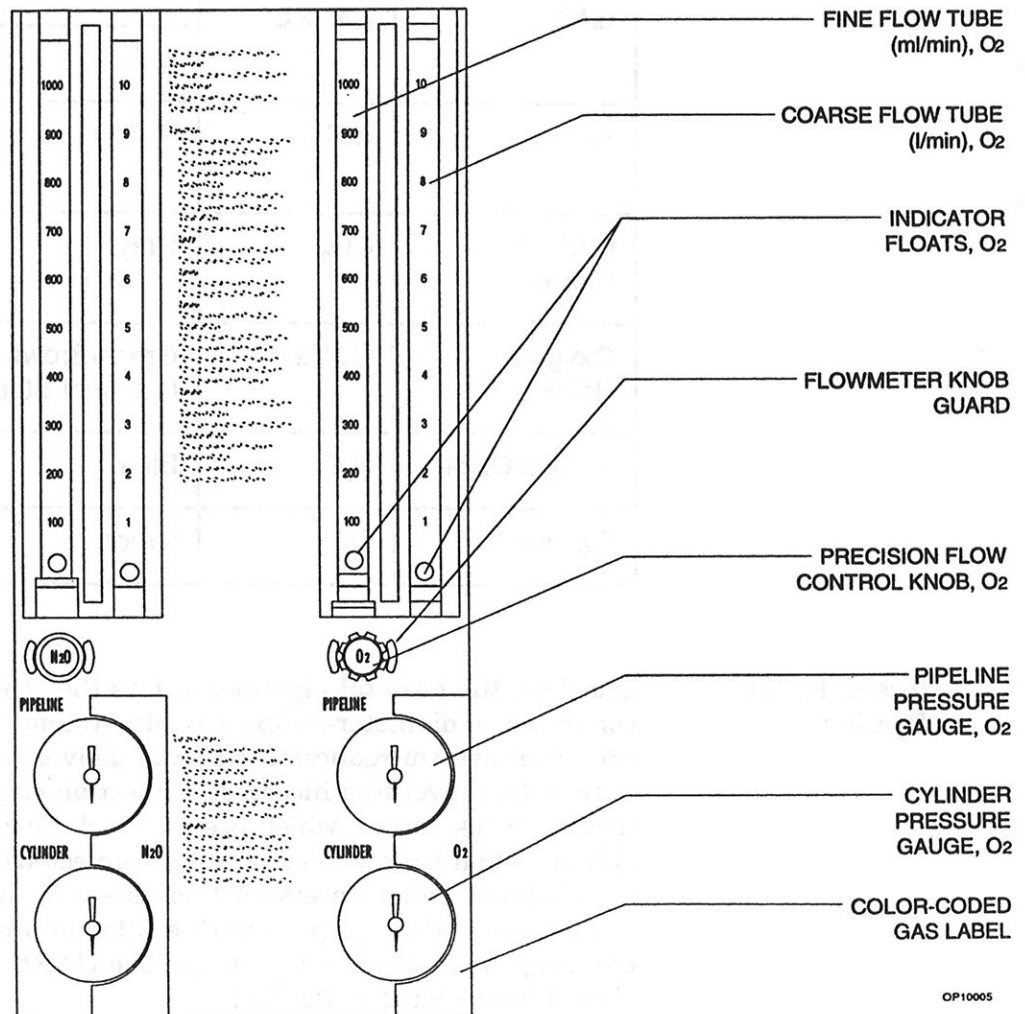
CAUTION: To ensure that gas supplies are at adequate pressure, pipeline pressure gauges should indicate steady pressures of 50–55 psi.

Gas Entry Via Cylinder Yokes

The NARKOMED 4 can be equipped with a maximum of two oxygen and two nitrous oxide cylinder hanger yokes. An additional yoke for an optional third gas is also available. To prevent a cylinder from being improperly connected, the yokes are labeled, color-coded, and keyed for gas-specific cylinders using the pin-indexed safety system.

COARSE FLOW TUBE
(l/min), N₂O

FINE FLOW TUBE
(ml/min), N₂O

INDICATOR
FLOATS, N₂O

FLOWMETER KNOB
GUARD

PRECISION FLOW
CONTROL VALVE, N₂O

PIPELINE PRESSURE
GAUGE, N₂O

CYLINDER PRESSURE
GAUGE, N₂O
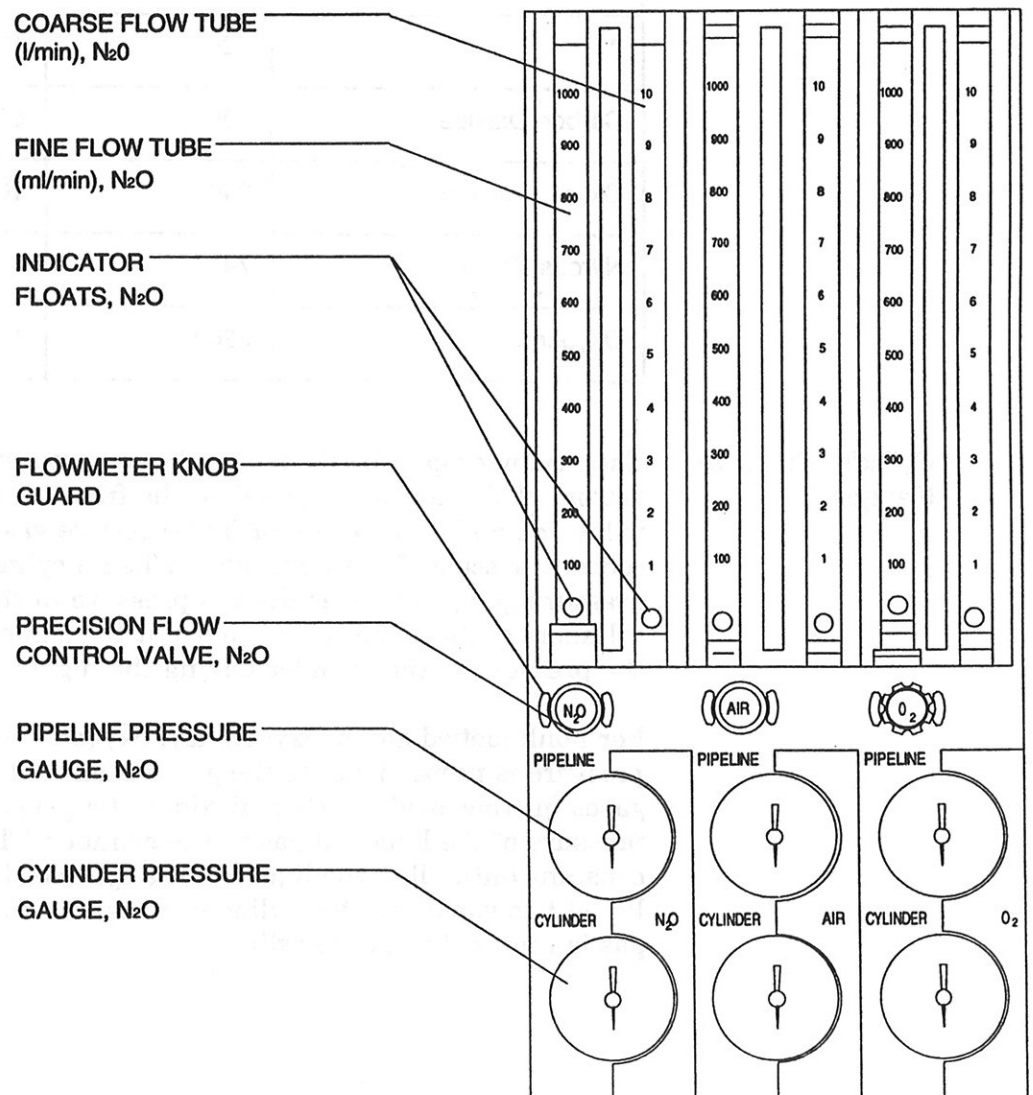
A filter in each yoke prevents foreign material from entering the internal gas piping of the NARKOMED 4. A check valve in each yoke prevents back flow into the cylinder or leakage into the atmosphere if the cylinder is not mounted on the yoke. When the machine is configured with two yokes for the same gas, the check valve prevents movement of gas from one cylinder to the other. If a cylinder is not mounted to a yoke, the attached yoke plug should be placed between the yoke handle's threaded bolt and the yoke's gas inlet.

Cylinders attached to the hanger yokes must contain gas at the pressures outlined in the table below. Any cylinders that contain less than the recommended minimum outlined in the table should be replaced with new, full cylinders.

GAS	MAX PSI	MIN PSI
Air	2200	1000
Carbon Dioxide	830	600
Oxygen-Helium	2400	1000
Nitrous Oxide	745	600
Oxygen	2200	1000

Cylinder Pressure Gauges

Each cylinder gas circuit has a cylinder pressure gauge, located at the bottom of the flowmeter panel on the front of the machine. Each gauge is labeled and color-coded for its respective gas. The dial is marked with concentric scales for psi and kPa. When a cylinder's valve is open, its pressure gauge indicates the gas pressure in the cylinder. If two reserve cylinders of the same gas are open at the same time, the gauge indicates the pressure in the cylinder having the higher pressure.

For nonliquefied gases (oxygen, air, oxygen-helium), the indicated pressure is proportional to the gas content of the cylinder. For liquefied gases (nitrous oxide, carbon dioxide), the gauge indicates the vapor pressure of the liquefied gas in the cylinder. This pressure remains constant until all of the liquid in the cylinder has vaporized. When the liquid has vaporized, the cylinder pressure decreases proportionally as gas is removed from the cylinder.

FINE FLOW TUBE (ml/min), O₂

COARSE FLOW TUBE (l/min), O₂

INDICATOR FLOATS, O₂

FLOWMETER KNOB GUARD

PRECISION FLOW CONTROL KNOB, O₂

PIPELINE PRESSURE GAUGE, O₂

CYLINDER PRESSURE GAUGE, O₂
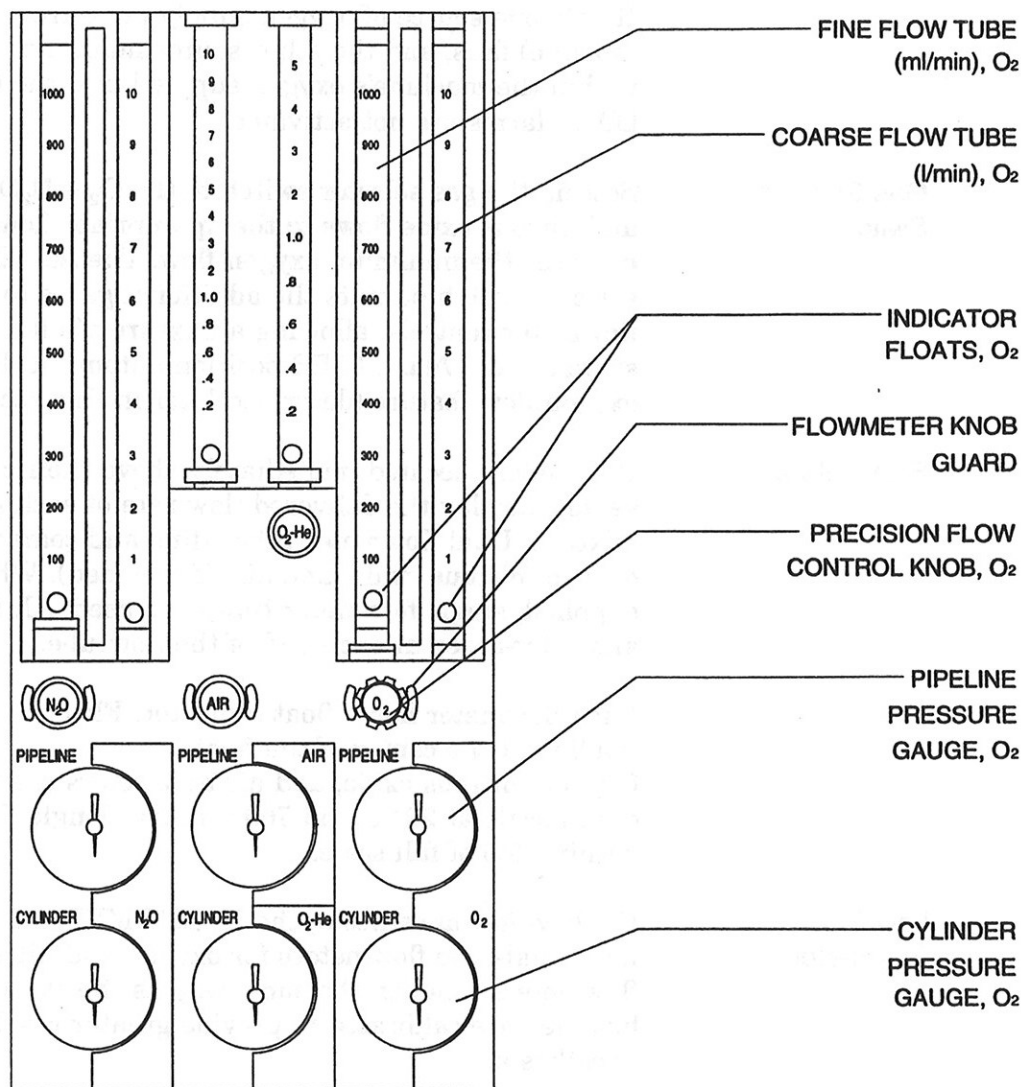
Oxygen Supply Pressure Failure Protection Device (OFPD)

The oxygen failure protection device (OFPD) is a pneumatically operated valve located in the anesthesia machine's internal supply lines for all gases except oxygen. The OFPD valve is controlled by the gas pressure in the oxygen supply line. Proper oxygen pressure keeps the valve open; a failure or reduction of pressure in the oxygen supply line proportionally reduces and eventually shuts off the supply of all other gases.

When the OFPD is activated, the flowmeters indicate a reduced gas flow proportional to the reduction of oxygen supply pressure. When the oxygen supply pressure (from either pipeline or reserve cylinders) drops below approximately 37 psi, an O2 SUPPLY LOW alarm message appears on the central alarm display. The red O₂ SUPPLY PRESSURE indicator light on the main switch panel lights up, and an intermittent audible alarm sounds.

If only one source of oxygen supply pressure (either reserve cylinders or pipeline) fails, and the other source maintains proper supply pressure within the machine's oxygen supply lines, the OFPD and O2 SUPPLY LOW alarms are not activated.

Gas Selector Switch

Setting the gas selector switch to the $O_2 + N_2O$ position permits oxygen and nitrous oxide flows to the appropriate flowmeter controls and **enables** the minimum oxygen flow. The ALL GASES position of the gas selector switch permits the additional gases to flow to their respective flowmeter controls, allowing a mixture of all gases. However, setting the switch to the ALL GASES position automatically **disables** the minimum oxygen flow feature (described later in this section).

Flowmeters

Flowmeters, located immediately above their corresponding flow control valves, display the delivered flow rate of each gas in the fresh gas mixture. Dual flowmeter tubes (fine and coarse) are used in tandem for oxygen, nitrous oxide, and air (if provided). When other gases are supplied, single flowmeter tubes are used. All flowmeters are labeled and color-coded at each end of the flowtube.

Each flowmeter has a float indicator. Flow rate is indicated by the scale reading at the center of the float.
Oxygen, nitrous oxide, and air flowmeters are certified to be within ±3% of full scale at 20° C and 760 mm Hg. Single flowtubes are certified to be within ±5% of full scale.

Low-Flow Flowmeters

For low-flow anesthesia, the NARKOMED 4 can be configured with low-flow, dual-tube flowmeters for oxygen and nitrous oxide. These flowmeters function the same way as the standard dual-tube flowmeters, but they are calibrated to provide greater resolution for low-flow anesthesia.

Minimum Oxygen Flow

The oxygen dispensing system incorporates a calibrated bypass flow of 150 ± 50 ml/min (at 50 psi pipeline pressure), which delivers this volume of oxygen even if the oxygen flow control valve is fully closed.

If the machine is equipped with an additional gas, the minimum oxygen flow is automatically disabled when the gas selector switch is set to the ALL GASES position.

If required for low-flow anesthesia, the NARKOMED 4 can be modified to eliminate the minimum oxygen flow feature. If this option is requested, a label is placed above the oxygen flowmeter to indicate that the anesthesia machine has been modified to eliminate minimum oxygen flow. Elimination of minimum flow also slightly changes the performance of the oxygen ratio controller. (See "Oxygen Ratio Controller" below.)

Flow Control
Valves

A needle valve located below the fine flowmeter tube for each gas is used to adjust the gas flow. A zero stop prevents damage to the flow control valve seats. If necessary, a North American Dräger authorized service representative can readjust the stop.

Each flow control knob is identified by its color code and chemical symbol. The oxygen flow control valve is also touch-coded with a deeply fluted knob.

⚠ **CAUTION:** Unless the anesthesia machine has been specifically modified to eliminate the minimum oxygen flow feature (see "Minimum Oxygen Flow" later in this section), the flow of oxygen cannot be completely shut off. Do not force the oxygen flow control knob past the zero stop in an effort to shut off the minimum flow; forcing the knob can damage the valve seat.

Oxygen Flush

A manually operated, self-closing oxygen flush valve is located on the front of the machine. A bezel is mounted around the pushbutton in order to prevent accidental engagement. The valve, when actuated, delivers an unmetered oxygen flow of approximately 55 l/min directly to the NARKOMED 4's fresh gas common outlet. The SYSTEM POWER switch does not have to be in the ON position to use the oxygen flush.

Oxygen Ratio
Controller (ORC)

The ORC is a pneumatic oxygen/nitrous oxide flow ratio controller designed to maintain a fresh gas oxygen concentration of approximately 25%. It permits independent control of the oxygen and nitrous oxide flows, but prevents a flow ratio that could result in a hypoxic fresh gas mixture by proportionally limiting the nitrous oxide flow.

The ORC works by limiting the nitrous oxide flow whenever the selected oxygen and nitrous oxide flow control valve settings would otherwise result in a hypoxic fresh gas mixture. For example, if you open the nitrous oxide flow control valve excessively without making a corresponding increase in the oxygen flow control valve setting, the flow of nitrous oxide will not increase even though its flow control valve setting has been greatly increased. Similarly, if you decreases the oxygen flow without also decreasing the nitrous oxide flow, the nitrous oxide flow will automatically drop in proportion to the oxygen flow.

100 —
90 —
80 —
70 —
60 —
50 —   DELIVERABLE OXYGEN CONCENTRATIONS
40 —
30 —
20 —
10 —   UNDELIVERABLE OXYGEN CONCENTRATIONS

FRESHGAS O₂ CONCENTRATION (%)

OP10008

0   2   4   6   8   10   12   14   16   18   20

FRESH GAS FLOW RATE (L/min)
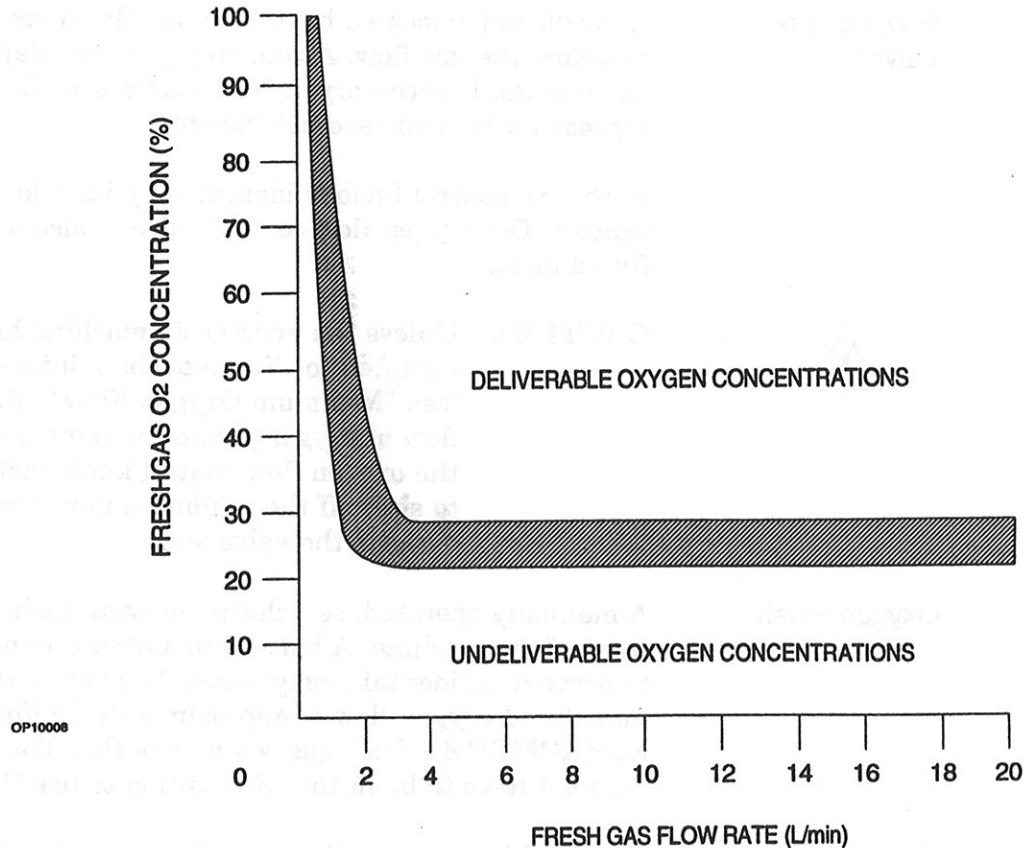
At low flows, patients use a greater percentage of the oxygen in
inspiratory gas (and therefore exhale less of it). Consequently, circle
systems (where the patient rebreathes previously exhaled gas) require a
higher oxygen concentration at low flows in order to maintain sufficient
inspiratory oxygen concentration. For that reason, the ORC is designed
to maintain higher levels of oxygen in the fresh gas at lower flow rates;
at lower fresh gas flow rates, the ORC maintains fresh gas oxygen
concentrations well above 25%.

Fresh Gas Outlet

The fresh gas outlet, located on the front of the anesthesia machine, delivers the fresh gas mixture (consisting of oxygen, nitrous oxide, optional gases, and anesthetic vapors) to the patient breathing system.

The outlet's 15 mm cylindrical female fitting is designed to accept the 15 mm male fitting on the absorber fresh gas hose. The male fitting slides into a retaining slot in the spring-loaded safety locking bar designed to prevent inadvertent disconnection of the fresh gas hose. The 15 mm male fitting on the fresh gas hose is unique to North American Dräger design, and cannot be replaced by a hose from any other manufacturer.

TABLETOP

FRESH GAS
OUTLET

FRESH GAS
LOCKING BAR
(EXTENDED
POSITION)

FRESH GAS
HOSE

RELEASE TO
LOCK
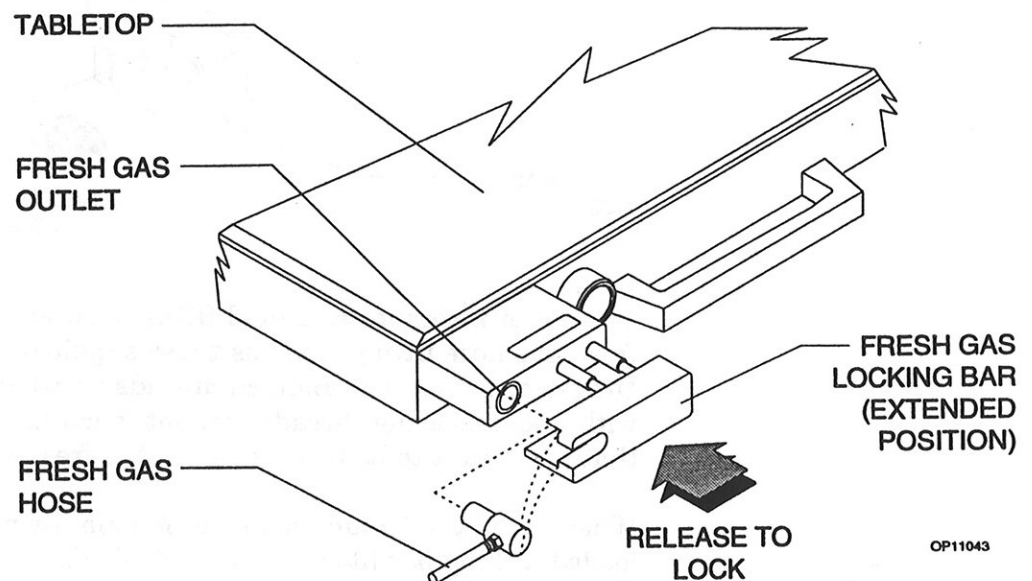
OP11043

Fresh Gas Outlet
(Canada)

The fresh gas outlet, located on the front of the anesthesia machine, delivers the fresh gas mixture (consisting of oxygen, nitrous oxide, optional gases, and anesthetic vapors) to the patient breathing system.

TABLETOP

OP10012

FRESH GAS
HOSE

RELEASE TO
LOCK

FRESH GAS
LOCKING BAR
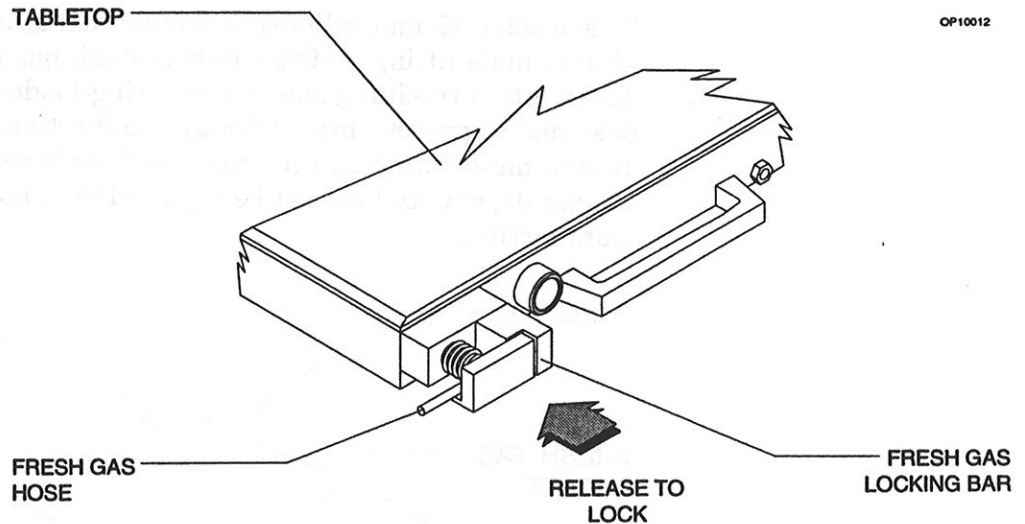
The outlet incorporates a dual fitting that accepts either a 15 mm male fresh gas hose fitting (such as those supplied with North American Dräger absorbers and Bain circuit adapters), or a 22 mm female fitting with a load-bearing threaded mount (such as the ones for Magill circuits that are meant to be threaded onto the fresh gas common outlet).

When using the 15 mm male and female fittings, verify that the spring-loaded locking bar fits over the male fresh gas hose fitting, securing it in the female fitting.

When using the Magill circuit fitting, swing the spring-loaded locking bar to the side to gain access to the threaded load-bearing fitting.

Fresh Gas
Adapter

The optional fresh gas adapter allows monitoring of the fresh gas oxygen concentration when using a nonrebreathing circuit (other than a Bain circuit). The fresh gas adapter fits securely into the fresh gas outlet of the anesthesia machine and provides a port for the oxygen sensor.

OXYGEN SENSOR

ANESTHESIA MACHINE'S FRESH GAS OUTLET

FRESH GAS LOCKING BAR (EXTENDED POSITION)

15MM MALE FITTING

OXYGEN SENSOR PORT

ADAPTER STEM

OXYGEN SENSOR PORT PLUG

FRESH GAS HOSE BARBED FITTING FOR NON-REBREATHING GAS CIRCUIT

OP10825
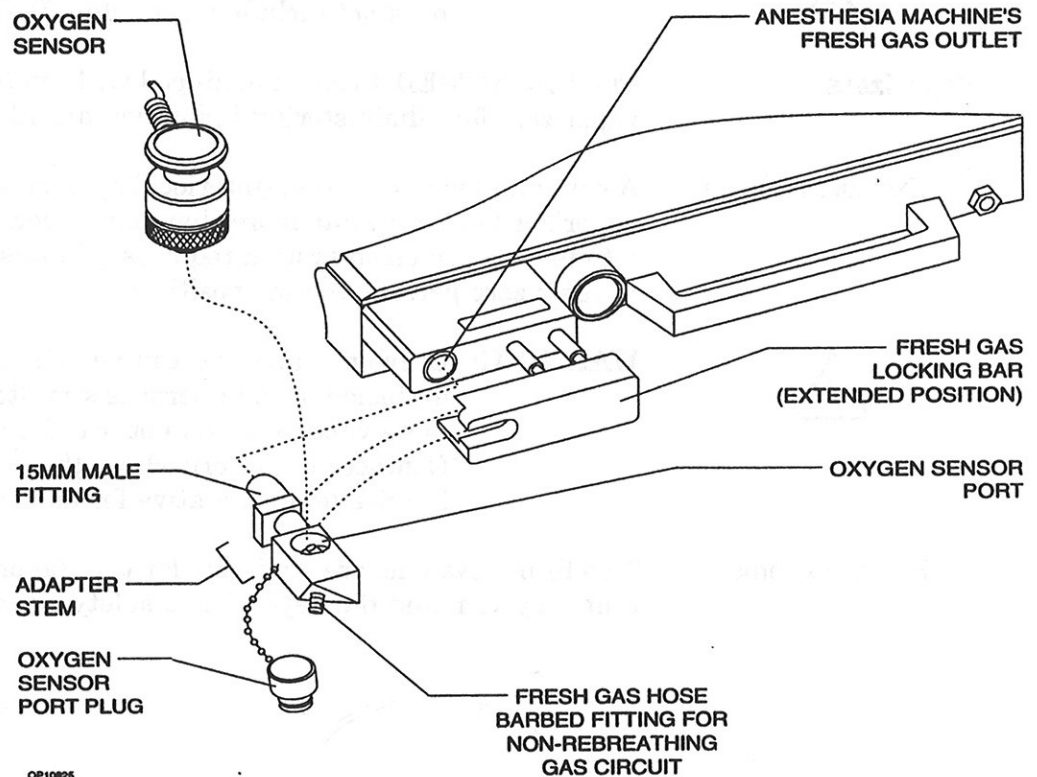
WARNING: The oxygen sensor port of the fresh gas adapter is designed allow the measurement of the fresh gas oxygen concentration, not the inspiratory oxygen concentration. Depending on the fresh gas flow and the respiratory minute volume, the inspiratory concentration oxygen may be lower than fresh gas oxygen concentration due to the rebreathing of previously exhaled gases. When used as part of a nonrebreathing circuit, the fresh gas adapter does not provide a means to measure the patient's breathing pressure and respiratory volume. Additionally, the fresh gas adapter does not provide a means to automatically detect a disconnect or obstruction in the breathing or fresh gas circuit. As a result, use of the fresh gas adapter requires constant observation of all breathing circuit components.

Auxiliary Oxygen Flowmeter

For the delivery of 0-10 l/min flow of pure oxygen (for example, delivery of oxygen through a nasal cannula), the optional auxiliary oxygen flowmeter is mounted on the left side of the flowmeter bank. This flowmeter can be used when the machine is turned off.

CAUTION: The flow control valve for the auxiliary oxygen flowmeter does not include a zero stop. Do not over tighten the knob.

Vaporizers

The NARKOMED 4 can be equipped with up to three Vapor 19.1 vaporizers for administering inhalation anesthetics.

Exclusion System

A cam and lever exclusion (interlock) system incorporated into the vaporizer bank prevents more than one vaporizer from being activated at a time. The exclusion system requires all unused vaporizers to be locked in their zero percent volume positions.

WARNING: Only one vaporizer can be activated at a time. If the exclusion system permits simultaneous activation of two or more vaporizers, do not use the anesthesia machine. Contact an authorized North American Dräger Technical Service Representative for adjustment.

Filling Systems

Two filling systems are available for the Vapor 19.1 vaporizer: the open funnel system and the key-indexed safety system.
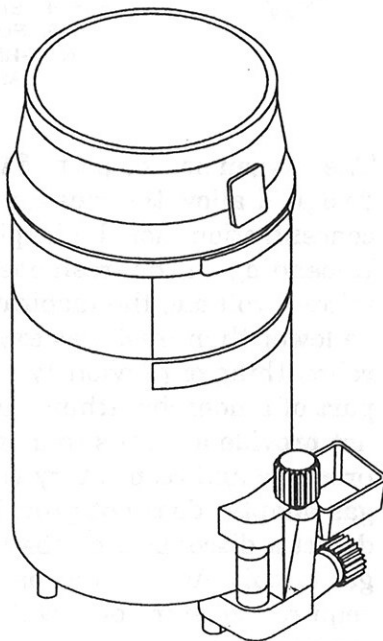
OPEN FUNNEL FILLER
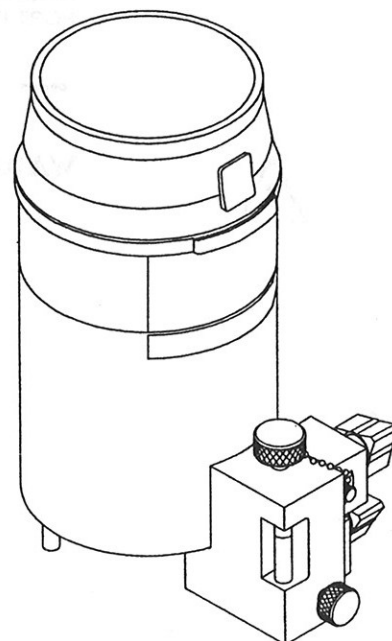
KEY INDEXED
SAFETY SYSTEM

Absorber

The absorber is a dual-canister system for absorbing exhaled carbon dioxide in the rebreathing circuit of the anesthesia machine. It incorporates an adjustable pressure limiter (APL) valve, a breathing system pressure gauge, a fresh gas line, and provides ports for attaching the sensors for breathing pressure, volume, frequency, and oxygen concentration.

The absorber system permits spontaneous, manually assisted, or automatic ventilation of the patient. The absorber incorporates a manual/automatic selector valve, which allows you to select either manual or automatic ventilation. An absorber with a positive end expiratory pressure (PEEP) valve is also available.

WARNING: Waste gas scavenging systems used with North American Dräger absorber systems must have safety features to ensure that excessive subatmospheric pressure (lower than -0.5 cmH$_2$O) and excessive positive pressure (higher than $+0.5$ cmH$_2$O) are not possible at the connection point.

Inspiratory and Expiratory Valves

The inspiratory and expiratory valves are unidirectional valves that permits gas flow in one direction only. The inspiratory valve allows gas to flow toward the patient only, without backflow; the expiratory valve allows gas to flow into the absorber, away from the patient, without backflow. Each valve consists of a gravity-loaded disk that seats horizontally over an annular valve seat within the valve body.

The inspiratory valve is attached by means of a knurled ring nut to the top of an external pipe which extends laterally and then vertically from the absorber bottom assembly. The expiratory valve attaches to the respiratory valve volume monitor sensor which mounts directly to the center of the absorber's top dome assembly by means of a knurled ring nut. Each valve can be removed as a unit for cleaning. A gasket between the valve and mount assures a tight gas seal.

The inspiratory valve dome incorporates a port for the oxygen analyzer sensor. The inspiratory valve is labeled INSPIRATION and the expiratory valve is labeled EXPIRATION. To prevent inadvertent interchanging of the inspiratory and expiratory valves, the mounting ring nuts are different sizes. A groove around the 22 mm hose terminal helps to firmly retain a 22 mm breathing hose.

WARNING: Do not use the inspiratory or expiratory valves if the pins in the plastic valve domes or in the valve bodies are bent, damage, contaminated, or missing. Also, do not use the valves if the valve disks or seats are damaged.

Canister Release Lever	The canister release lever provides the means to release the clamping force that seals the dust cap and canisters together when disassembly is required.
Canisters	Each absorber unit contains two interchangeable transparent plastic canisters, which house the absorbent. The absorbent (soda lime or barium hydroxide lime) can be bought in either loose granular or prepacked cartridge form.
	The ratio of canister diameter to screen opening area was carefully chosen to minimize a phenomenon known as channeling. In channeling, gas flows through the canister along the path of least resistance and depletes the efficiency of the absorbent along this route, bypassing efficient absorbent in other areas of the absorber.
Canister Gaskets	Several gaskets assure sealing between the components of the absorber unit.
Dust Cup	A removable, transparent plastic cup below the bottom assembly catches absorbent dust and excess moisture that could otherwise cause caking and increased flow resistance in the lower canister.
Breathing System Pressure Gauge	The absorber system is equipped with a removable pressure gauge that allows quick visual determination of breathing circuit pressure. The gauge is marked for measurements from -20 to +80 cmH$_2$O in increments of 2 cmH$_2$O.

⚠️ **WARNING:** Frequent observation of the breathing system pressure gauge is mandatory to ensure adequate pressure buildup and relief, regardless of the mode of operation.

Bain Circuit Adapters

The absorber mounted Bain circuit adapter mounts onto the manuals/automatic selector valve of the absorber system. The adapter includes an adjustable pressure limiter (APL) valve, a breathing pressure gauge, a quick-connect fitting for the breathing pressure pilot line, and a port for the oxygen sensor.

APL VALVE CONTROL KNOB

OXYGEN SENSOR

22MM M/15MM F EXPIRATION TERMINAL

BAIN CIRCUIT

BAIN CIRCUIT HOSE BARB FOR FRESH GAS HOSE

BREATHING BAG

FRESH GAS HOSE

BREATHING PRESSURE PILOT LINE QUICK-CONNECT FITTING

MANUAL/AUTOMATIC SELECTOR VALVE OF THE ABSORBER

OXYGEN SENSOR PORT CAP
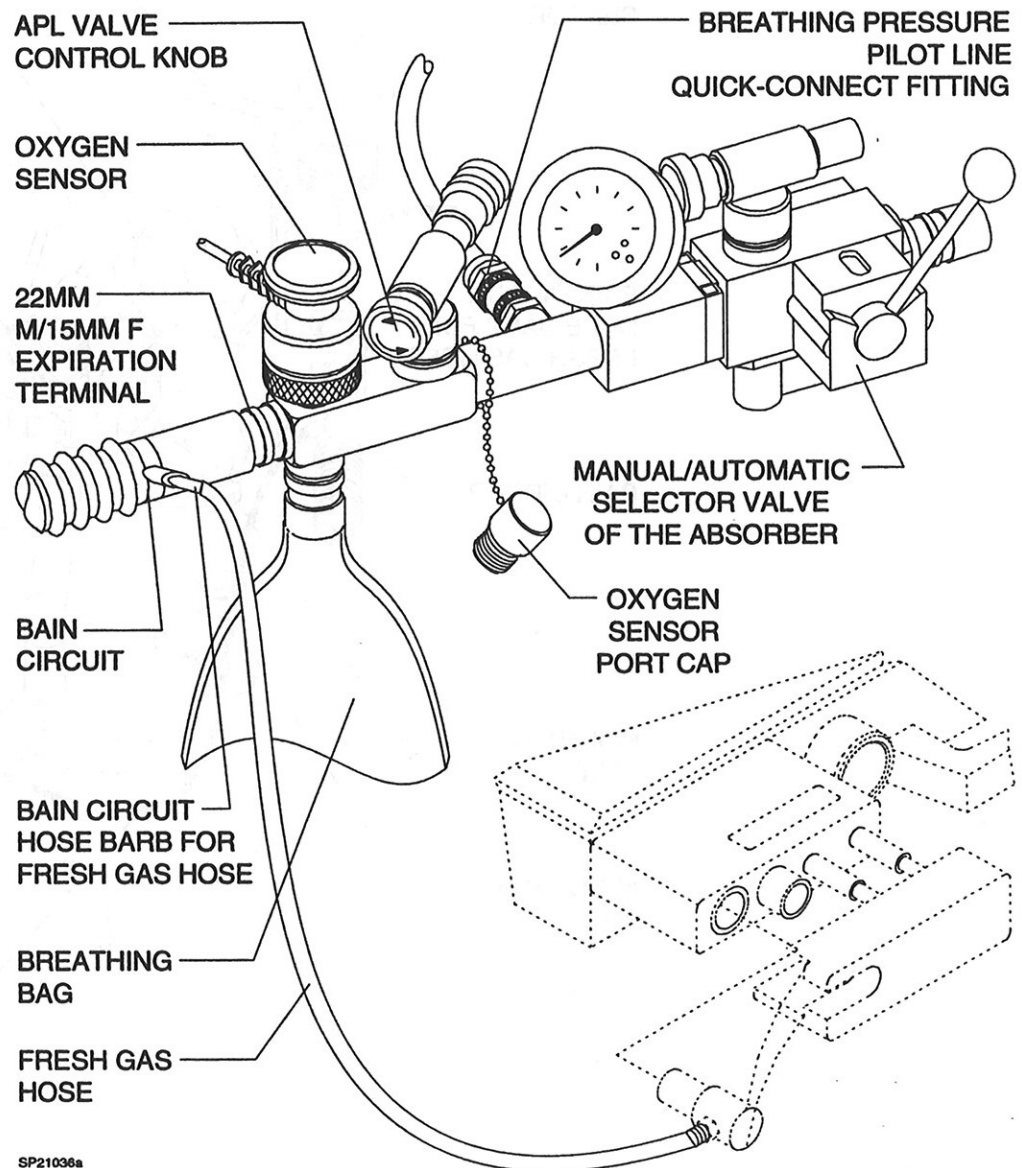
SP21036a

The pole mounted Bain Circuit adapter is also available with manual/automatic selector and with or without positive end-expiratory (PEEP) valves; these versions mount on the absorber pole.

OXYGEN SENSOR

PEEP BYPASS LEVER

BREATHING SYSTEM PRESSURE GAUGE

MANUAL/AUTOMATIC SELECTOR VALVE

BAIN CIRCUIT HOSE BARB FOR FRESH GAS HOSE

APL VALVE

PEEP CONTROL KNOB

BAIN CIRCUIT

MOUNTING STUD

ABSORBER POLE

BREATHING BAG MOUNT

OP21031

FRESH GAS HOSE
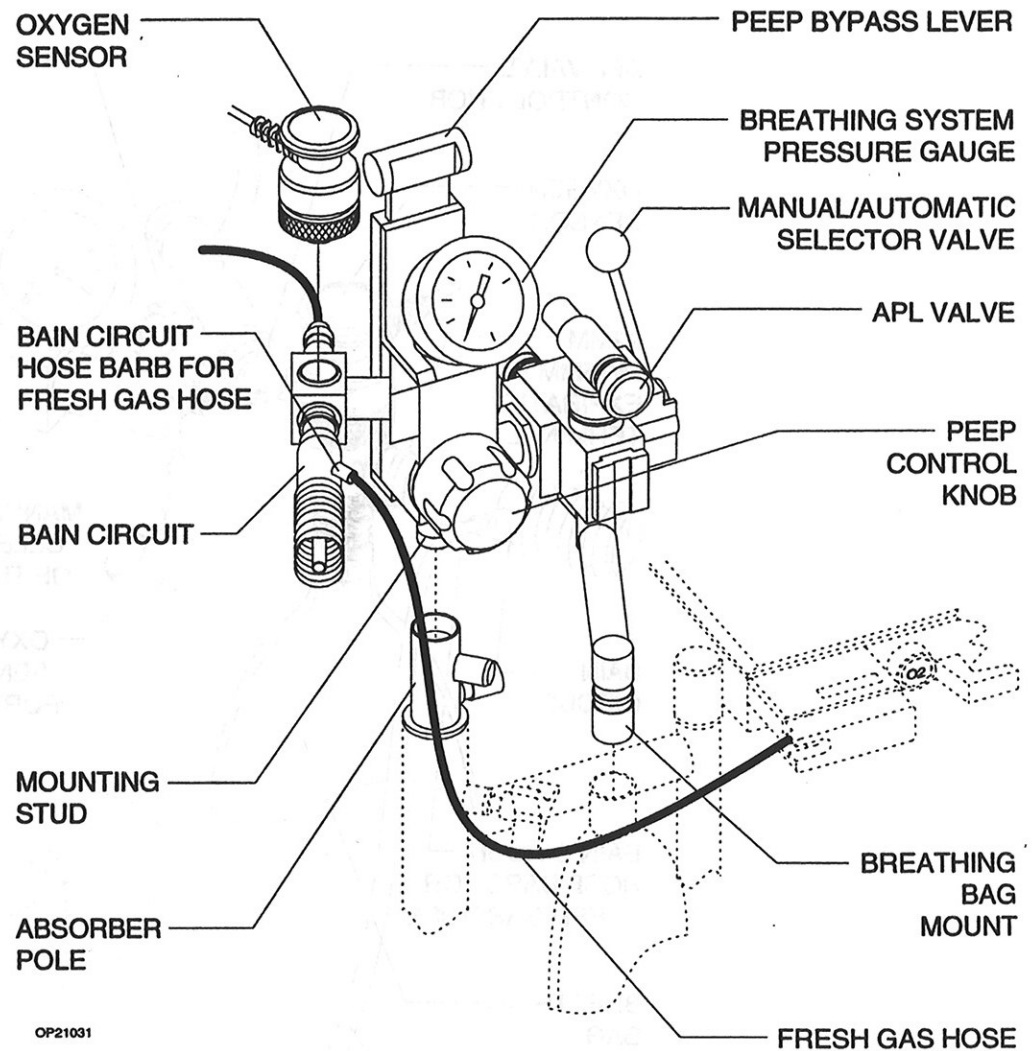
Scavenger Systems

The NARKOMED 4 can be equipped with two kinds of scavenger systems, permitting the best match with the hospital's waste gas disposal system.

Open Reservoir Scavenger

The open reservoir scavenger is used with suction (vacuum) waste gas disposal systems. This scavenger is an "open" system, using continually open relief ports to provide positive and negative pressure relief.

VACUUM
HOSE
TERMINAL

NEEDLE VALVE
ADJUSTMENT
WING NUT

INPUT
PORT CAP

19MM
SCAVENGER
HOSE TERMINAL

19MM
SCAVENGER
HOSE TERMINAL

FLOWMETER

RESERVOIR
CANISTER

RELIEF PORT

OP75121
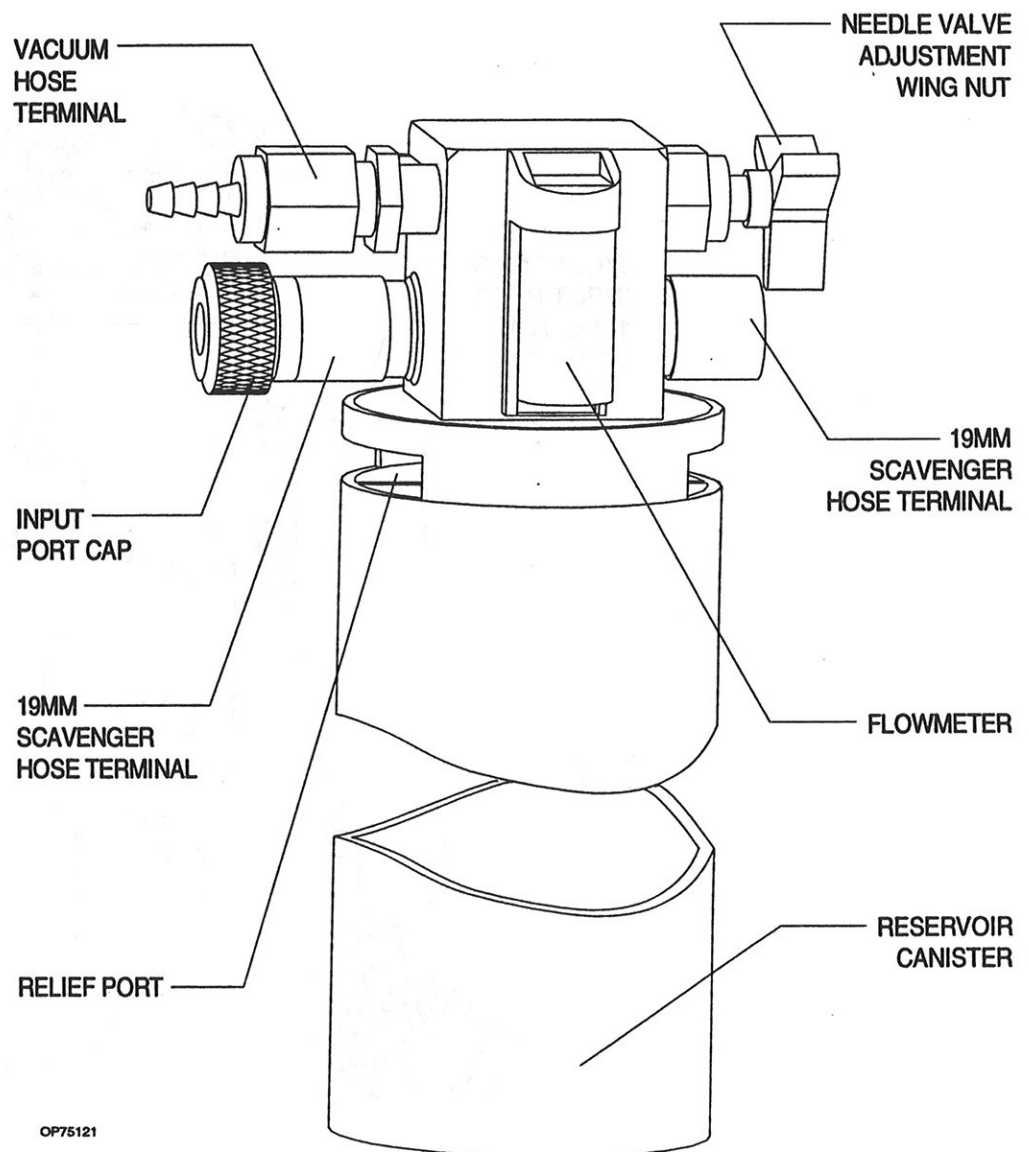
Scavenger
Interface for
Passive Systems

The scavenger interface for passive systems is used with nonrecirculating HVAC systems (also called exhaust systems). This scavenger is a "closed" system, using spring-loaded valves for positive and negative pressure relief.

⚠ **WARNING:** Do not use this device with a waste gas disposal system capable of applying a negative pressure to the scavenger interface (a suction or vacuum waste gas disposal system).

SAFETY RELIEF
VALVE, SHOWN
CLOSED

WASTE GAS
INPUT PORT,
19MM HOSE
TERMINAL

WASTE GAS
INPUT PORT,
19MM HOSE
TERMINAL

INPUT
PORT CAP

OP76131

WASTE GAS EXHAUST PORT,
19MM HOSE TERMINAL
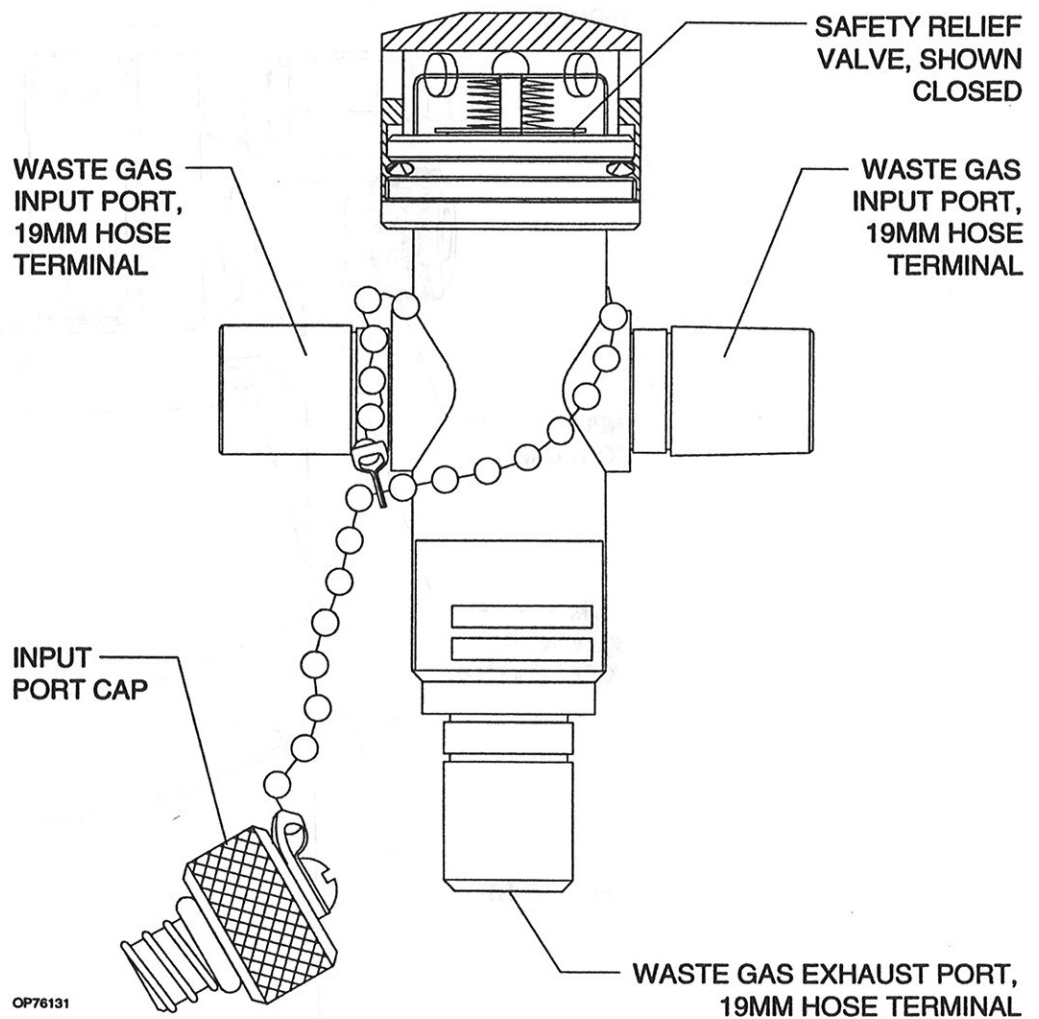
AV-E Ventilator

The electronic anesthesia ventilator is volume-preset and time-cycled. It has a solid-state timer and independent controls for frequency I:E ratio and flow.

Pneumatic power to the ventilator is supplied through the oxygen pipeline supply or, if the pipeline supply fails or is disconnected, through the oxygen cylinders. The pressure of the oxygen pipeline supply must be 50–55 psi; the ventilator will not function if this pressure drops below 32 psi. Electrical power is supplied by the NARKOMED 4's AC power source, or, in event of AC power failure, by the backup battery. A fully charged battery can power the ventilator for approximately 30 minutes.

During automatic ventilation, the manual/automatic selector valve isolates the absorber's adjustable pressure limiter (APL) valve from the breathing system. To compensate for the continuous introduction of fresh gas into the breathing system, the ventilator incorporates a relief valve mounted behind the bellows chamber.

The ventilator relief valve remains closed until the end of expiration so that the ascending bellows can refill. When the bellows is completely filled, any excess gas in the system is released to the scavenging system by the ventilator relief valve. As with any ascending bellows, the force needed to overcome gravity acting on the bellows causes a slight positive end-expiratory pressure (PEEP) within the breathing system of approximately 2 cmH$_2$O.

Pressure Limit Control

The optional pressure limit control (PLC) allows you to set the peak inspiratory pressure produced by the ventilator, in order to prevent barotrauma. The PLC can also improve ventilation for patients with reduced lung compliance (neonatal/pediatric patients and patients with adult respiratory distress syndrome) because it holds the ventilator in the inspiratory cycle for the preset inspiratory-to-expiratory time ratio without exceeding the preset peak inspiratory pressure.

Main Switch Panel

The main switch panel, located between the ventilator bellows and flowmeter bank.

System Power Switch

The SYSTEM POWER switch on the NARKOMED 4 has two positions: ON and STANDBY. In the ON position, the gas (pneumatic) and electric power circuits are actuated, and the green LED indicator adjacent to the switch comes on. In the STANDBY position, the switch shuts down the gas supplies, the monitoring system, and all electrical power to the machine except the convenience receptacles and battery charging circuit.

AC Power Failure
Indicator

The yellow AC POWER FAIL LED signals AC power disruption. The LED lights up whenever the battery supplies power to the monitoring system and the electronic ventilator. When AC power is first disrupted, a single tone also sounds. If the anesthesia machine's backup battery is completely discharged, the AC power failure indicator does not have power and does not function.

YELLOW ORMC O2/ N2O
FLOW RATIO INDICATOR

RED O2 SUPPLY
PRESSURE
LOW INDICATOR

O₂ SUPPLY PRESSURE

O₂/ N₂O FLOW RATIO
O₂ SUPPLY PRESSURE

GREEN FLOWMETER
LIGHT INDICATOR

FLOWMETER LIGHTS
PUSHBUTTON

AC POWER FAIL
BATTERY LOW
BATTERY TEST

AC POWER FAIL
BATTERY LOW
BATTERY TEST

YELLOW AC POWER
FAIL INDICATOR

BATTERY TEST
PUSH BUTTON

ON

YELLOW BATTERY
LOW INDICATOR

ON

GREEN BATTERY
TEST INDICATOR

STANDBY
SYSTEM POWER

STANDBY
SYSTEM POWER

SYSTEM POWER
SWITCH

OP20053

CURRENT MODELS

EARLY MODELS

Oxygen Supply
Pressure Alarm

The oxygen supply pressure alarm is activated if the oxygen supply pressure in the system (from both the pipeline supply and reserve cylinders) drops below approximately 32 psi. When this happens, the LED indicator marked O_2 SUPPLY PRESSURE lights red continuously, the caution message O_2 SUPPLY LOW appears on the central alarm display, and an intermittent audible alarm sounds. If only one source of oxygen supply pressure (either cylinders or pipeline) fails, and the other maintains proper supply pressure within the machine's oxygen supply lines, the oxygen supply pressure alarm does not activate.

O₂/N₂O Flow
Ratio (ORMC)
(early machines
only)

The oxygen flow ratio alarm indicator is activated whenever the ORMC limits the nitrous oxide flow in order to maintain a fresh gas oxygen concentration of approximately 25% of the combined oxygen and nitrous oxide flow. This alarm means that the oxygen and or nitrous flow control valves have been incorrectly set and the ORMC has responded by limiting nitrous oxide flow. This alarm *does not* mean that the fresh gas mixture itself has become hypoxic.

Whenever the ORMC is actively limiting the nitrous oxide flow to prevent a hypoxic fresh gas mixture, a FRESHGAS O2 LOW advisory message appears on the central alarm display, the O₂/N₂O FLOW RATIO yellow indicator light comes on and an audible alarms sounds.

For the following conditions the ORMC audible and visual alarms are automatically disabled, indicated by the advisory message O2/N2O ALARM OFF on the central display:

- the optional gas selector switch is set to the ALL GASES position.

- the nitrous oxide flow is below 150 ±50 ml/min (750 ±50 ml/min if the minimum oxygen flow feature has been disabled on the machine).

Flowmeter Lights
(early machines
only)

A push button on the main switch panel controls back lighting for the flowmeter panel.

Power Supply System

The NARKOMED 4 is equipped with a central power supply for the ventilator, alarm system, and monitoring system. The NARKOMED 4 must be plugged into an AC outlet when in use.

Convenience
Receptacles

The NARKOMED 4 is equipped with four convenience receptacles, mounted on the upper rear of the anesthesia machine. The receptacles are active whenever the NARKOMED 4 is plugged into an outlet whether or not the machine is turned on.

The total current for devices plugged into the receptacles must not exceed 5 amps; a 5-amp circuit breaker protects the convenience receptacle circuit. This circuit also incorporates an EMI filter, which minimizes interference to the anesthesia machine from devices plugged into the convenience receptacles.

NOTE: Devices plugged into the convenience receptacles contribute to the anesthesia system's total leakage current. This total leakage current must not exceed 100 microamps.

CONVENIENCE RECEPTACLES

OP11042

SYSTEM POWER SWITCH
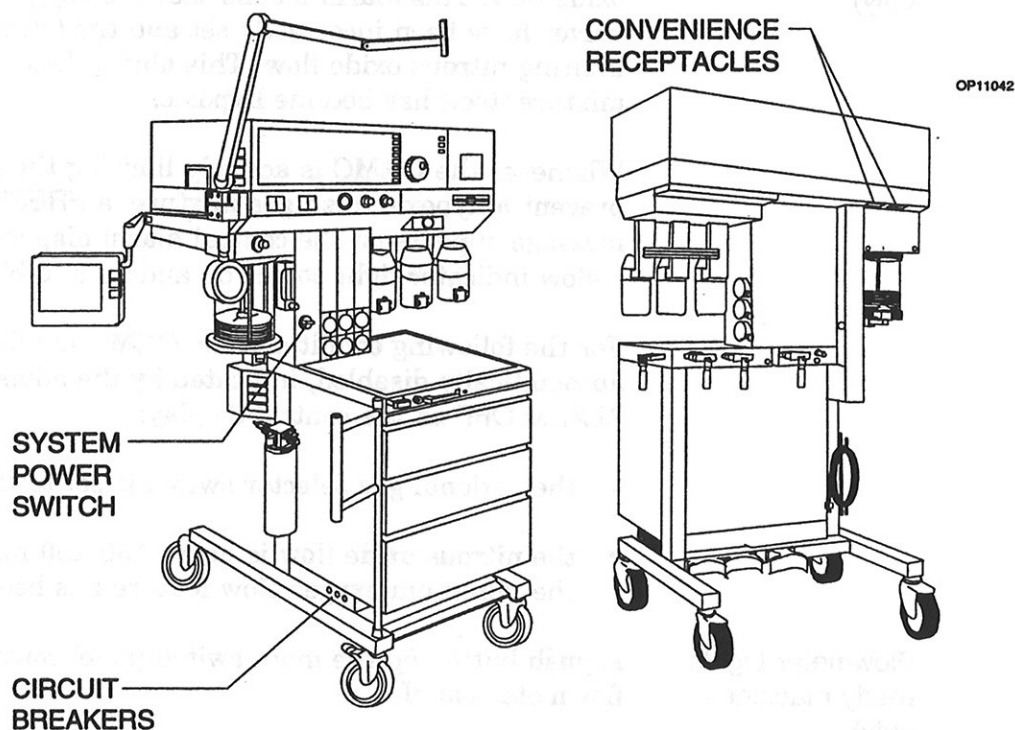
CIRCUIT BREAKERS

Circuit Breakers

The electrical system includes three circuit breakers to protect machine functions (primary AC power input, convenience receptacles and backup battery power). These circuit breakers located on the lower (absorber) side of the machine.

When the plunger is flush with the surface of its base, the circuit breaker is in its normal, closed position. A circuit breaker is open (tripped) when its plunger extends beyond its base. If a breaker is tripped, the cause must be found and corrected before using the anesthesia system.

Backup Battery System

The backup battery system consists of a rechargeable battery and a built-in battery charging system. Although most hospitals have emergency generators to provide AC power when line power fails, a delay may occur before generator power comes on line. The backup battery system automatically provides power for the interim between line power failure and the activation of the hospital's emergency generator. The backup battery also provides power if the anesthesia machine's power cord is accidentally unplugged during a case.

When the hospital's emergency generator comes on line (or when a disconnected power cord is reconnected), the NARKOMED 4 automatically switches back to AC power and recharges its battery. The battery charging system charges the battery any time the power cord is connected to an active AC power source. The charger can recharge a fully discharged battery in approximately 12 hours.

Machine Functions on Backup Battery Power

If the hospital's primary AC power fails, the backup battery system is activated. To alert the operator to this condition, the following events occur:

- the yellow AC POWER FAIL indicator on the anesthesia machine's alarm panel lights up
- the advisory message AC POWER FAIL appears on the central alarm display
- a single tone audio alarm sounds

All monitoring functions continue to operate using the battery for power. When the battery reserve approaches depletion, the yellow BATTERY LOW main switch panel indicator illuminates. In addition, if there is AC power, the advisory message RESERVE BATT LOW appears on the central alarm display, provided there is AC power; if there is no AC power, the advisory message AC/BATT FAIL appears. These alarms signify approximately 15 minutes of backup battery operation remain. After approximately 30 minutes, all electrical power to the anesthesia machine is automatically cut off to prevent damage to the battery.

The gas supply system remains operative even after electrical power is cut off. However, since the ventilator is inoperative when battery power has been cut off, any ventilation must be manual (by bag squeezing). The machine cannot provide monitoring or alarm functions until it is reconnected to an AC power source.

NOTE: If the NARKOMED 4's power cord is not plugged into an active AC outlet for a period of 7 days or more, the backup battery may become depleted.

Breathing System Sensor Interface Panel

The breathing system sensor interface panel, located on the left side of the NARKOMED 4 below the ventilator bellows, contains input ports for three monitor sensors: the oxygen analyzer, the respiratory volume sensor, and the breathing pressure pilot line.

The bottom port on the interface panel is for the gas analyzer exhaust.

Patient Sensor Interface Panel

The patient sensor interface panel, located on the upper left side of the NARKOMED 4 monitor housing, contains input ports for three monitor sensors: the manual sphygmomanometer blood pressure cuff and gauge, the pulse oximeter sensor, and the noninvasive blood pressure monitor pressure cuff. A data port is also provided for the remote display.

The two upper ports on the panel are data ports for Datagrip and the remote display.

Patient Cable Boom Arm

The patient cable boom arm, mounted on the left side of the machine, aids in routing patient sensor lines from the patient to the anesthesia machine in an organized manner. The arm can be adjusted to retain the lines in the most convenient position.

Monitoring System

The NARKOMED 4's monitoring system integrates the functions of the electronic monitors and organizes information on three screens. Two screens are integrated into the main monitor housing; these screens can be tilted to provide a convenient viewing angle. The third, or remote display is mounted on a movable boom arm.

The NARKOMED 4 monitors the following items:

- pulse oximetry
- respiratory gas (oxygen, carbon dioxide, nitrous oxide, and anesthetic agent)
- oxygen concentration
- breathing pressure
- respiratory volume

The anesthesia machine also monitors key anesthesia system functions such as oxygen supply pressure and backup battery status.

Main Display

Monitored items are shown on two screens. The main display, which is part of the monitor housing, is a "touch screen." On the touch screen, you make selections by touching a "key," a button-like box that contains a selection. The main display can be tilted up or down for optimal viewing.
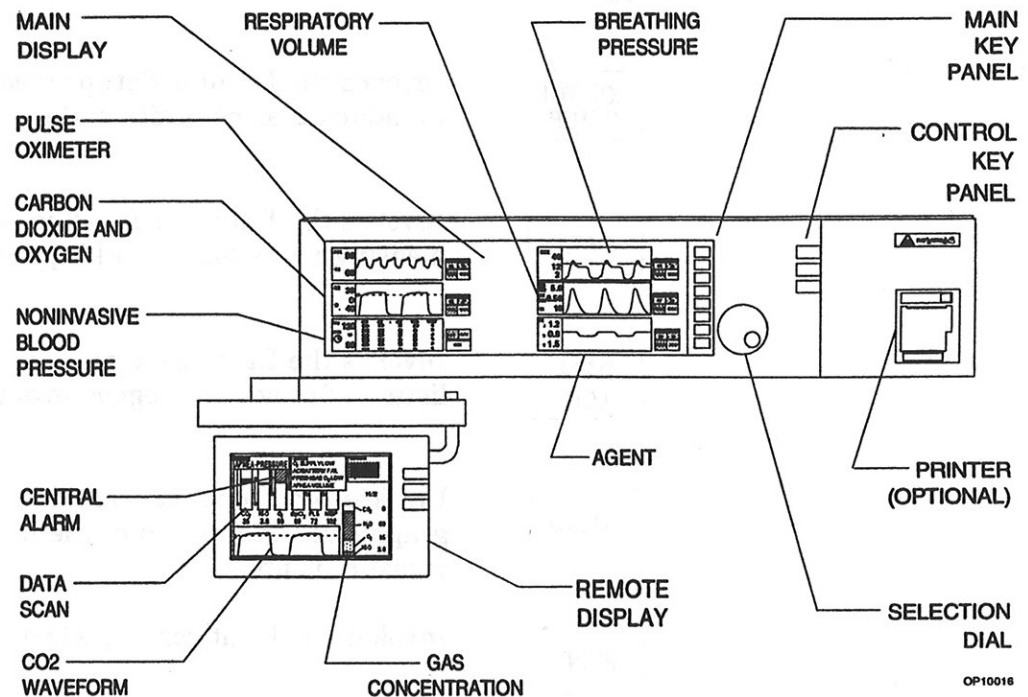
Pulse oximetry, carbon dioxide, and noninvasive blood pressure information appear on the left side of the main display. Airway pressure, respiratory flow and volume, and agent information appear on the right side of the main display.

Main Key Panel

The main key panel, located to the right of the main display, is used for selecting the NARKOMED 4's different screens. Below is a description of each key's function:

MONITOR — Invokes the Monitor screens, which is the main information display.

MONITOR SETUP — Invokes the Monitor Setup screen, which you must access to adjust alarms limits and specific monitor functions.

DATA — Invokes the Data screen, which displays additional measurements for recordkeeping or detailed analysis.

DATA LOG — Invokes the Data Log screen, which displays a tabular listing of previously logged events.

TREND — Invokes the Trend screen, which displays a detailed graphic representation of the history of selected measurements.

PRINT — Invokes the Print screen, which displays print options.

SYSTEM CONFIG — Displays the System Configuration screens, which let you customize the operation of the NARKOMED 4.

BACKUP — Toggles the NARKOMED 4 active processor between the primary and backup processors.

Control Key Panel

The control key panel, located on the upper right corner of the main and remote displays, perform system functions. Each time one of these keys is pressed, a tone sounds. Below is a description of each key's function:

Invokes an audio silence period on the NARKOMED 4 for 60 seconds, or 120 seconds if pressed twice. If the remaining silence period is 15 seconds or greater when you press the key, the audio silence period advances to 120 seconds.

LOG DATA — Logs a data entry (event) into the Data Log for future reference.

DATASCAN RESET — Normalizes current Datascan measurements to the center line.

Touch Keys

Touch keys are touch-sensitive areas of the screen. The touch keys are button-like boxes that contain selections. To activate one of theses keys, you touch it, and it becomes highlighted in the screen's amber color. Unselected keys are not highlighted.

Selection Dial

The selection dial is located under and to the right of the main key panel. You can use the selection dial to scroll through menus or change variables, such as alarm limits by turning the dial. Turning the dial clockwise increases a number, scrolls a log upward, and scrolls the cursor down through a menu. Turning the dial counterclockwise decreases a number, scrolls a log down, and scrolls the cursor up through a menu. Pressing the dial enters new values.

Backup Mode

The NARKOMED 4's monitoring system has two simultaneously running processor systems so that if one processor develops a fault, the other can continue analyzing monitor functions. The processors are identical and receive the same sensor information from the monitoring subsystems. However, only one processor sends monitoring information to the screens at a time. The remote display shows the processor which is functioning. (When the main processor is in use, MAIN appears on the display.)

To switch the NARKOMED 4's central monitoring display to the processor in reserve, press the BACKUP key on the main key panel. To return the central monitoring display to initial processor, press the key again. If the processor in use malfunctions, press this key. A North American Dräger technical service representative should also be notified immediately.

NOTE: If the alternate processor is selected, you may have to adjust alarm limits, audio volume, etc., in order to match the settings on the initial processor.

Central Alarms

A central alarm system categorizes and organizes alarm messages from all the electronic monitors and displays them on the central alarm display area. Audible alarms are organized into distinct sound patterns and are delivered by a central audio annunciator. There are three alarm classifications:

• *Warning* is the highest priority alarm. Warnings are annunciated with a continuously repeating sound pattern of three audio tones. After an initial sound pattern at full volume, when the alarm occurs, there is a 6-second pause. The initial sound pattern is followed by a pattern at one-third volume, a 5-second pause, a pattern at two-thirds volume, a 4-second pause, then another pattern at full volume. After a 3-second pause, a constant full volume sound pattern occurs until the alarm condition is removed.

Warnings are displayed in a drop-down box in the upper portion of the screen.

• *Caution* is the second priority alarm. Cautions are annunciated by a three-pulse sound pattern that is repeated every 30 seconds until the alarm condition is cleared.

Cautions are displayed in a drop-down box in the upper middle portion of the screen.

• *Advisory* is the lowest priority alarm. Some Advisories are annunciated with a single tone; other Advisory alarms are only displayed, not annunciated.

Advisories are displayed in a box in the upper right portion of the screen.

You can use the audible alarm silence key (labeled with a crossed-out speaker) to temporarily silence audible alarms. This key invokes an audio silence period on the NARKOMED 4 for 60 seconds, or 120 seconds if pressed twice. If the remaining silence period is 15 seconds or greater when you press the key, the audio silence period advances to 120 seconds.

While in the silence mode, time remaining in the silence period appears at the bottom of the advisory box. If a new alarm condition occurs during a silence period, a single tone pattern sounds corresponding to the priority level of the alarm.

Remote Display	The remote display shows the Datascan, central alarms, carbon dioxide waveform, and inspired gases stacked bar graph information. If the NARKOMED 4 is equipped with the optional O. R. Data Manager, its information appears on the remote display.
Datascan Display	The Datascan display shows, in graph form, the deviation of measurements from a nominal value. Datascan allows you to see at a glance if any measurement deviates from the preset value. The display shows the following six bar graphs, unless information for one or more graphs is not supplied (in which case the corresponding display area is blank).

- End-tidal carbon dioxide
- Inspiratory anesthetic agent
- Inspiratory oxygen concentration
- Oxygen saturation
- Pulse rate
- Systolic blood pressure

A baseline measurement setpoint appears at the midpoint of each bar graph, represented by a center line common to all six bar graphs. Pointers along the left side of each bar graph mark the high and low alarm limits. The current value for the measurement appears in numerical form under each bar graph.

Any increase in a patient measurement produces the corresponding bar to rise from the center line. If any patient measurement decreases, its bar descends below the center line. Therefore, any deviation from the set point, whether positive or negative, is immediately apparent.

To normalize the current measurements of the NARKOMED 4, press the DATASCAN RESET key on the control key panel. This presets the current measurements at the center line and resets the endpoints.

The endpoints of the bar graph boundaries represent values above and below the setpoint by an offset determined by the scaling factor that you can configure in the System Configure screen.

Carbon Dioxide Waveform	The bottom left area of the remote display contains the carbon dioxide waveform and a dotted reference line at 40 mmHg.
Inspired Gases Stacked Bar Chart	The bottom right area of the display shows the inspired gases stacked bar chart, which displays the relative concentrations inspired agent, inspired oxygen, inspired nitrous oxide, carbon dioxide, and balance gas. The current values for the four measurements monitored appear to the right of the bar. The values are displayed in their usual units of measure (carbon dioxide - mmHg, nitrous oxide - volume %, oxygen - volume %, anesthetic agent - volume %, and balance - volume %).

Printer

The NARKOMED 4 can be equipped with an internal thermal printer that prints both numerical (cardiovascular, temperature, ventilation, etc.) and graphical (traces, waveforms, etc.) information.

O.R. Data Manager

O.R. Data Manager, an electronic data management system consisting of keyboard and a central processing unit with disk drive, creates electronic anesthesia records from information automatically recorded by the monitoring system and input from the keyboard (such as patient data, events, drugs, and other case-related information), as well as externally interfaced monitors.

In addition to creating anesthesia records, O.R. Data Manager can display case information on the NARKOMED 4 in the form of a graph and can print anesthesia records to a disk or laser printer.

Manual Sphygmomanometer

Noninvasive blood pressure can be measured with the manual sphygmomanometer. Several cuff sizes are available to accommodate all types of patients.

Daily Checkout Procedure

Prior to operating the NARKOMED 4, the following checkout procedure must be performed to make sure the machine is ready for use. If the anesthesia system fails any procedures identified by an asterisk (*) do not use the machine. Contact an authorized North American Dräger Service Representative for inspection of the unit.

NOTE: Do not insert any additional components into or modify the anesthesia system after the checkout procedure has been started.

1. Enter the anesthesia machine serial number, located on the right rear leg, into the anesthesia record.

2. Verify the presence of a valid inspection sticker on the rear of the NARKOMED 4, indicating that the anesthesia machine has been serviced and inspected by an authorized North American Dräger service representative.

,3. Verify the presence of a cylinder wrench, tethered to the rear of the anesthesia machine, adjacent to one of the cylinders.

4. Connect the electrical power cable to a hospital grade live AC receptacle that accepts and properly grounds the NARKOMED 4's power cable. DO NOT use "cheater" plugs.

Emergency Ventilation Equipment

*5. Verify that backup ventilation equipment is available and functional.

High Pressure System

*6. Check the oxygen cylinder supplies.

A. Disconnect all pipeline gas supply hoses.

B. Close the oxygen cylinder valve and remove the cylinder from the yoke. Verify that there is only 1 cylinder gasket and that 2 index pins are present. Verify that the cylinder matches the yoke label.

C. Open an oxygen cylinder and check the cylinder pressure gauge. A full oxygen cylinder should indicate a pressure of about 2200 psi. Replace any cylinder with a pressure less than 1000 psi. To check for a high pressure leak, close the cylinder and observe the cylinder pressure gauge for a prominent decrease in the pressure. With the oxygen cylinder closed, actuate the oxygen flush button on the front of the anesthesia machine. Hold the button in until the pressure gauges indicate no pressure.

D.   If equipped with dual oxygen cylinder yokes, repeat these procedures for the other cylinder.

*7.   Check the nitrous oxide cylinder supplies.

A.   Close the nitrous oxide cylinder valve and remove the cylinder from the yoke. Verify that there is only 1 cylinder gasket and that 2 index pins are present. Verify that the cylinder matches the yoke label.

B.   Open the nitrous oxide flow control valve until the nitrous oxide pipeline and cylinder pressure gauges indicate zero pressure. Open an nitrous oxide cylinder and check the cylinder pressure gauge. A full nitrous oxide cylinder should indicate a pressure of about 745 psi. Replace any cylinder with a pressure less than 700 psi. To check for a high pressure leak, close the cylinder and observe the cylinder pressure gauge for a prominent decrease in the pressure.

C.   If equipped with dual nitrous oxide cylinder yokes, repeat these procedures for the other cylinder.

*8.   Check additional (optional) gas cylinder supplies.

A.   With the cylinder closed, open the flow control valve of the associated gas until the cylinder and pipeline pressure gauges (air only) indicate zero pressure.

B.   Close the cylinder valve and remove the cylinder from the yoke. Verify that there is only 1 cylinder gasket and that 2 index pins are present. Verify that the cylinder matches the associated yoke label.

C.   Open the associated flow control valve until the cylinder pressure gauges indicate zero pressure. Open the cylinder and check the cylinder pressure gauge. Replace the cylinder if its contents are insufficient for the intended procedure. To check for a high pressure leak, close the cylinder and observe the cylinder pressure gauge for a prominent decrease in the pressure.

D.   Replace any cylinder of when its contents is insufficient for the intended procedure.

*9. Pipeline Supply Verification

A. Inspect the supply hoses for cracks or wear.

B. Connect the appropriate hospital pipeline supply hoses from the wall outlet fittings to the anesthesia machine's DISS inlet connectors.

C. Check for sufficient pipeline pressure. The pressure for each gas, indicated on the pipeline pressure gauge below the flow control valves, should be between 50–55 psi. Open the flow control valve for each gas to a moderate value; the pressure indicated at the pipeline pressure gauge must not decrease more than 5 psi.

D. Verify that the correct gases are supplied to the anesthesia machine inlets.

Low Pressure System

*10. Vaporizer Verification

A. Check for sufficient supply of liquid anesthetic in the vaporizer(s). The liquid level, as indicated by the vaporizer sight glass, must be between the minimum and maximum markings.

B. Check each vaporizer for tightness of the fill and drain valves. Each vaporizer's fill and drain valves must be completely closed.

C. Check the vaporizer exclusion device, which prevents more than one vaporizer from being activated simultaneously. Make sure that when one vaporizer handwheel is turned to a setting greater than 0, the others remain locked in their 0 positions. Test the system for all three vaporizers. Then, turn all vaporizers to the 0 position.

*11. Turn the SYSTEM POWER switch of the NARKOMED 4 to the ON position. Wait for the machine to complete is diagnostic checks. Ensure that the machine is functional.

*12. System Gas Circuit Verification

A. Check the function of the flowmeters. Adjust the flow control knob for each gas and verify the proper operation of the corresponding flowmeters. The float must move freely over the full range of each flowmeter.

Breathing System   *13.   Calibrate the oxygen monitor by exposing the sensor to ambient air and activate the calibration key. (See *Oxygen Analysis, Calibrating the O₂ Sensor* in Section 5 for more information.)

A.   Place the oxygen sensor securely in the sensor mount.

B.   Verify that the correct gas concentrations are supplied to the anesthesia system from the supply cylinders.

C.   Close the cylinder supplies and deplete the pressure from the system.

*14.   Check the oxygen failure protection device. With all gases available on the machine set to a flow of about 1 l/min, discontinue the oxygen flow by disconnecting the oxygen pipeline supply hose and closing the oxygen cylinder(s). The flow of all other gases, as indicated by their flowmeters, must decrease in proportion to the decrease in oxygen flow and eventually shut off.

*15.   Check the function of the ORC. If the anesthesia machine includes an additional gas selector switch, set the switch to the $O_2 + N_2O$ position. With the nitrous oxide flow control valve open to a flow of 10 l/min, vary the oxygen flow with the oxygen flow control valve. The nitrous oxide flow, as indicated on the nitrous oxide flowmeter, must automatically vary in response to the adjustment of the oxygen flow control valve.

The ORC must maintain a fresh gas oxygen/nitrous oxide flow ratio of at least 25 ±4 % Oxygen. At low flows, the ORC must maintain a fresh gas oxygen concentration higher than 25% oxygen.

*16.   Oxygen Verification

A.   Test the oxygen flush. Pressing the oxygen flush button must result in an audible gas flow sound, accompanied by a marked increase in oxygen concentration in the breathing system.

B.   Verify the delivered oxygen concentration. Repeatedly flush the patient breathing system by pressing the oxygen flush button. Open the oxygen flow control valve to a flow of 8 l/min and close the other flow control valves. The oxygen measurement display area should indicate 97 to 100 % oxygen concentration.

C.   Open the oxygen flow control valve to an 8 l/min flow and close all other flow control valves. Sniff the gas coming from the fresh gas common outlet. There should be no noticeable odor.

*17.   Absorber System Verification

A.   Check the hose connections in the breathing system.

B.   The fresh gas hose of the breathing system intended for use must be securely connected to the fresh gas common outlet of the NARKOMED 4.

C.   A 22 mm breathing hose must be connected between the inspiratory valve on the absorber and the Y-piece.

D.   A 22 mm breathing hose must be connected between the expiratory valve on the absorber and the Y-piece.

E.   A 22 mm breathing hose must be connected between the ventilator hose terminal and the manual/ automatic selector valve breathing hose terminal.

F.   A breathing bag of proper capacity and appropriate construction must be connected to the breathing bag terminal of the breathing system.

G.   The respiratory gas analysis sample line must be connected to the 15 mm patient side of the Y-piece.

H.   The breathing pressure pilot line must be properly connected between the patient sensor interface panel and either the absorber quick-connect fitting or the appropriate fitting at or near the patient Y-piece.

*18.   Check the status of the absorbent in the absorber system. Make sure there is an adequate supply of carbon dioxide absorbent in the absorber system. Consult the absorbent manufacturer's literature and replace the absorbent when signs of exhausted absorbent are evident. Make sure that the color change represents the absorbent's true state of depletion and is not due to regeneration after a rest period.

Remove accumulated absorbent dust and water from the absorber dust cup.

WARNING: Absorbent is caustic and is a strong irritant to the eyes, skin, and respiratory tract. When emptying the absorber dust cup, take care not to spill its caustic contents.

19. Check for free gas passage in the patient breathing system. With a surgical mask over your mouth, inhale and exhale through the breathing system (each limb individually if possible). Verify the unidirectional flow in each limb and then reconnect the tubing.

20. Perform a breathing and fresh gas delivery system pressure test. This test detects leaks from the patient breathing system and fresh gas delivery system.

To perform the test:

A. Close all flow control valves on the anesthesia machine.

B. Turn the SYSTEM POWER switch of the NARKOMED 4 to the STANDBY position.

C. Turn the vaporizers to 0% concentration. Interconnect the 22 mm ports of the inspiratory and expiratory valves with a 22 mm breathing hose.

D. Set the manual/automatic selector valve to BAG.

E. Close the APL valve by turning the knob fully clockwise to its stop position.

F. Check that the breathing pressure gauge is on 0.

G. Attach the supplied test terminal to the breathing bag mount.

H. Connect a sphygmomanometer squeeze bulb (available from North American Dräger) to the hose barb on the test terminal.

I. Pump the squeeze bulb by hand until the breathing system pressure gauge indicates pressure of at least 50 cm H_2O (not to exceed 80 cm H_2O).

J. Observe the pressure drop at the breathing system pressure gauge. The pressure shall not drop more than 20 cm H_2O in 30 seconds.

*21. Check the function of the patient system relief valve (adjustable pressure limiter (APL) valve). The APL valve must be capable of relieving excess gas from the breathing system into the scavenger system.

To check the APL valve's flow resistance:

A. Set the manual/automatic selector valve to BAG.

B. Remove the bag from the swivel arm bag mount.

C. Interconnect the 22 mm ports of the inspiratory and expiratory valves with a 22 mm hose.

D. Completely open the APL valve by turning the control knob fully counterclockwise to its stop position.

E. Open the oxygen flow control valve to a flow of 8 l/min.

F. Occlude the bag mount opening, and watch for a pressure increase on the breathing system pressure gauge. This pressure increase, a reflection of the valve's flow resistance, must not exceed 3 cm H_2O.

Scavenging System

*22. Open Reservoir Scavenger System Verification

A. A 19 mm scavenger hose must be connected between the ventilator relief valve and the scavenger interface.

B. A 19 mm scavenger hose must be connected between the APL valve on the absorber and the 19 mm hose terminal on the rear of the absorber pole.

C. A 19 mm scavenger hose must be connected between the bottom of the absorber pole and the scavenger interface.

D. Check for moisture accumulation in the breathing and scavenger hoses. Remove any moisture found.

E. Verify the safe performance of the open reservoir scavenging system. With the scavenging system properly installed and operating, test for positive and negative pressure relief.

To test for negative pressure relief:

F.   Connect one end of a 19 mm hose to the 19 mm terminal on the bottom of the absorber pole; connect the other end to the 19 mm hose terminal labeled SCAVENGER HOSE on the right side of the scavenger body.

G.   Connect the short 19 mm scavenger hose between the absorber system APL ("pop-off") valve and the 19 mm hose terminal on the rear of the absorber pole. The 19 mm hose terminal on the left side of the scavenger may be capped for this test, or an appropriate 19 mm scavenger hose may be connected between this terminal and the ventilator relief valve.

H.   Connect a DISS vacuum hose to the threaded terminal on the left-hand side of the scavenger. Alternatively, the provided adapter can be used to attach a wall suction hose onto the adapter's hose-barb fitting.

I.   Short circuit the absorber's inspiratory and expiratory valves with a 22 mm breathing hose.

J.   Set the absorber's manual/automatic selector valve to BAG.

K.   Turn the APL valve control knob fully counterclockwise.

L.   Verify that the suction waste gas disposal system is active.

M.   Adjust the scavenger needle valve to a flowmeter indication between the two white lines.

N.   Close all flow control valves on the anesthesia system.

O.   Occlude the absorber breathing bag terminal and observe the breathing pressure gauge on the absorber. The gauge should indicate a pressure of 0 cm H_2O.

To test for positive pressure relief:

P.   Perform steps A through G above.

Q.   If the absorber system or ventilator bellows is equipped with a PEEP valve, turn the PEEP valve control knob fully counterclockwise to its lowest setting.

R.   Adjust the scavenger needle valve to a completely closed position by turning it fully clockwise.

S.   Open the oxygen flow control valve to a flow of 10 l/min and occlude the absorber breathing bag terminal.

T.   The flow of oxygen must now exit through the relief ports located on top of the canister. The absorber system's breathing pressure gauge must indicate a pressure less than 5 cm H_2O.

U.   After the test, adjust the scavenger needle valve to a flowmeter indication halfway between the two white lines.

NOTE: To test the Scavenger Interface for Air Conditioning Systems, refer to its instruction manual.

Manual and Automatic Ventilation Systems

*23.   Test the ventilator.

A.   Check for proper pressure and flow at the Y-piece during the inspiratory and expiratory phases. Turn the NARKOMED 4's SYSTEM POWER switch and ventilator power switch to their ON positions. Place the manual/automatic selector valve in the AUTO position. Adjust the oxygen flow control valve to a 3 l/min flow. Set the ventilator frequency to 3 BPM, the I:E ratio to 1:2, and the tidal volume to approximately one liter. (If testing the Pediatric Bellows or Adult/Pediatric Bellows, adjust the tidal volume to 200 ml.)

Adjust the ventilator flow control to the maximum of the "low" zone on the flow gauge. Occlude the patient side of the Y-piece. Fill the ventilator bellows by pressing the oxygen flush button. Observe the breathing system pressure gauge as the ventilator cycles.

The pressure gauge must indicate a pressure in excess of 30 cm H_2O when the bellows has completed its downward travel. At the end of the expiratory phase, when the bellows has completed its upward travel, the pressure should be about 2 cm H_2O.

B.   If the ventilator or absorber is equipped with a PEEP valve, verify the PEEP valve's performance. Attach a breathing bag to the patient Y-piece with an appropriate adapter such as an NAD combination mask elbow with a 22 mm male fitting for the breathing bag and 15 mm male fitting for the Y-piece. With the manual/automatic selector valve in the AUTO position, set the ventilator to the desired frequency.

Then adjust the PEEP valve to different values and observe the breathing system pressure gauge to verify performance. Turn the PEEP valve control knob fully counterclockwise to its lowest setting after the test has been completed.

24.   Inspect the respiratory gas analysis sample line for kinks or occlusions. Check the water trap's reservoir level; replace if filled to maximum capacity.

Monitors   25.   Check the alarm limit settings. The NARKOMED 4 automatically sets monitor alarm limits to a default configuration when the SYSTEM POWER switch is turned on. Check these settings and adjust them if necessary. Alarm limits may be adjusted at the beginning of or during a procedure. Also, make sure that external monitors (if present) are connected properly and that they annunciate alarms through the anesthesia machine's central audio annunciator.

*26.   Test the alarm functions of all monitors. Simulate alarm conditions and check for appropriate alarm signals.

27.   Flush the system with 100% oxygen by pressing the oxygen flush button.

NOTE: If a breathing system other than an absorber system is used, consult the checkout procedure for that system in the appropriate manual.

28.   If the optional fresh gas oxygen sensor adapter is installed, check to make sure that the fresh gas hose connection is intact and not occluded. Verify that the oxygen analyzer is properly calibrated. (See *Oxygen Analysis, Calibrating the O₂ Sensor* in Section 5 for more information.) When removing the oxygen sensor during calibration, insert the oxygen sensor port plug into the fresh gas adapter port.

Reserve Power

*29.   Reserve Power Verification

A.   Check the reserve battery power. With the machine's plug removed from the outlet, pressing the BATTERY TEST button on the NARKOMED 4's main switch panel must result in the illumination of the green LED indicator directly to the left of the test button. The yellow BATTERY LOW LED indicator must remain unlit. Place the plug back into its outlet.

Final Position

30.   At the completion of the Daily Checkout procedure, verify that the final status of the machine is as follows:

A.   All vaporizers off (handwheels set to zero)

B.   APL Valve open (fully counter-clockwise)

C.   Manual/Automatic switch set to BAG

D.   All flowmeters indicating zero (or minimum)

E.   Patient suction level adequate

F.   Breathing system ready to use (bag in place and all hoses connected properly)

Preuse Checkout Procedure

The following abbreviated checkout procedure applies to the NARKOMED 4 when used in successive cases. It may be performed only after the machine has undergone the initial Daily Checkout procedure given in Section 3. If the anesthesia system fails any procedures identified by an asterisk (*) do not use the machine. Contact an authorized North American Dräger Service Representative for inspection of the unit.

NOTE: Do not insert any additional components into or modify the anesthesia system after the checkout procedure has been started.

Breathing System

*1.   Absorber System Verification

A.   Check the hose connections in the breathing system.

B.   The fresh gas hose of the breathing system intended for use must be securely connected to the fresh gas common outlet of the NARKOMED 4.

C.   A 22 mm breathing hose must be connected between the inspiratory valve on the absorber and the Y-piece.

D.   A 22 mm breathing hose must be connected between the expiratory valve on the absorber and the Y-piece.

E.   A 22 mm breathing hose must be connected between the ventilator hose terminal and the manual/ automatic selector valve breathing hose terminal.

F.   A breathing bag of proper capacity and appropriate construction must be connected to the breathing bag terminal of the breathing system.

G.   The respiratory gas analysis sample line must be connected to the 15 mm patient side of the Y-piece.

H.   The breathing pressure pilot line must be properly connected between the patient sensor interface panel and either the absorber quick-connect fitting or the appropriate fitting at or near the patient Y-piece.

*2.   Check the status of the absorbent in the absorber system. Make sure there is an adequate supply of carbon dioxide absorbent in the absorber system. Consult the absorbent manufacturer's literature and replace the absorbent when signs of exhausted absorbent are evident. Make sure that the color change represents the absorbent's true state of depletion and is not due to regeneration after a rest period.

Remove accumulated absorbent dust and water from the absorber dust cup.

WARNING: Absorbent is caustic and is a strong irritant to the eyes, skin, and respiratory tract. When emptying the absorber dust cup, take care not to spill its caustic contents.

3.   Check for free gas passage in the patient breathing system. With a surgical mask over your mouth, inhale and exhale through the breathing system (each limb individually if possible). Verify the unidirectional flow in each limb and then reconnect the tubing.

4.   Perform a breathing and fresh gas delivery system pressure test. This test detects leaks from the patient breathing system and fresh gas delivery system.

To perform the test:

A.   Close all flow control valves on the anesthesia machine.

B.   Turn the SYSTEM POWER switch of the NARKOMED 4 to the STANDBY position.

C.   Turn the vaporizers to 0% concentration. Interconnect the 22 mm ports of the inspiratory and expiratory valves with a 22 mm breathing hose.

D.   Set the manual/automatic selector valve to BAG.

E.   Close the APL valve by turning the knob fully clockwise to its stop position.

F.   Check that the breathing pressure gauge is on 0.

G.   Attach the supplied test terminal to the breathing bag mount.

H.   Connect a sphygmomanometer squeeze bulb (available from North American Dräger) to the hose barb on the test terminal.

I.   Pump the squeeze bulb by hand until the breathing system pressure gauge indicates pressure of at least 50 cm H_2O (not to exceed 80 cm H_2O).

J.   Observe the pressure drop at the breathing system pressure gauge. The pressure shall not drop more than 20 cm H_2O in 30 seconds.

*5.   Check the function of the patient system relief valve (adjustable pressure limiter (APL) valve). The APL valve must be capable of relieving excess gas from the breathing system into the scavenger system.

To check the APL valve's flow resistance:

A.   Set the manual/automatic selector valve to BAG.

B.   Remove the bag from the swivel arm bag mount.

C.   Interconnect the 22 mm ports of the inspiratory and expiratory valves with a 22 mm hose.

D.   Completely open the APL valve by turning the control knob fully counterclockwise to its stop position.

E.   Open the oxygen flow control valve to a flow of 8 l/min.

F.   Occlude the bag mount opening, and watch for a pressure increase on the breathing system pressure gauge. This pressure increase, a reflection of the valve's flow resistance, must not exceed 3 cm H_2O.

Scavenging System   *6.   Open Reservoir Scavenger System Verification

A.   A 19 mm scavenger hose must be connected between the ventilator relief valve and the scavenger interface.

B.   A 19 mm scavenger hose must be connected between the APL valve on the absorber and the 19 mm hose terminal on the rear of the absorber pole.

C.   A 19 mm scavenger hose must be connected between the bottom of the absorber pole and the scavenger interface.

D.   Check for moisture accumulation in the breathing and scavenger hoses. Remove any moisture found.

E. Verify the safe performance of the open reservoir scavenging system. With the scavenging system properly installed and operating, test for positive and negative pressure relief.

To test for negative pressure relief:

F. Connect one end of a 19 mm hose to the 19 mm terminal on the bottom of the absorber pole; connect the other end to the 19 mm hose terminal labeled SCAVENGER HOSE on the right side of the scavenger body.

G. Connect the short 19 mm scavenger hose between the absorber system APL ("pop-off") valve and the 19 mm hose terminal on the rear of the absorber pole. The 19 mm hose terminal on the left side of the scavenger may be capped for this test, or an appropriate 19 mm scavenger hose may be connected between this terminal and the ventilator relief valve.

H. Connect a DISS vacuum hose to the threaded terminal on the left-hand side of the scavenger. Alternatively, the provided adapter can be used to attach a wall suction hose onto the adapter's hose-barb fitting.

I. Short circuit the absorber's inspiratory and expiratory valves with a 22 mm breathing hose.

J. Set the absorber's manual/automatic selector valve to BAG.

K. Turn the APL valve control knob fully counterclockwise.

L. Verify that the suction waste gas disposal system is active.

M. Adjust the scavenger needle valve to a flowmeter indication between the two white lines.

N. Close all flow control valves on the anesthesia system.

O. Occlude the absorber breathing bag terminal and observe the breathing pressure gauge on the absorber. The gauge should indicate a pressure of zero (0) cm H_2O.

To test for positive pressure relief:

P. Perform steps A through G above.

Q. If the absorber system or ventilator bellows is equipped with a PEEP valve, turn the PEEP valve control knob fully counterclockwise to its lowest setting.

R. Adjust the scavenger needle valve to a completely closed position by turning it fully clockwise.

S. Open the oxygen flow control valve to a flow of 10 l/min and occlude the absorber breathing bag terminal.

T. The flow of oxygen must now exit through the relief ports located on top of the canister. The absorber system's breathing pressure gauge must indicate a pressure less than 5 cm H_2O.

U. After the test, adjust the scavenger needle valve to a flowmeter indication halfway between the two white lines.

NOTE: To test the Scavenger Interface for Air Conditioning Systems, refer to its instruction manual.

Manual and Automatic Ventilation Systems

*7. Test the ventilator.

A. Check for proper pressure and flow at the Y-piece during the inspiratory and expiratory phases. Turn the NARKOMED 4's SYSTEM POWER switch and ventilator power switch to their ON positions. Place the manual/automatic selector valve in the AUTO position. Adjust the oxygen flow control valve to a 3 l/min flow. Set the ventilator frequency to 3 BPM, the I:E ratio to 1:2, and the tidal volume to approximately one liter. (If testing the Pediatric Bellows or Adult/Pediatric Bellows, adjust the tidal volume to 200 ml.)

Adjust the ventilator flow control to the maximum of the "low" zone on the flow gauge. Occlude the patient side of the Y-piece. Fill the ventilator bellows by pressing the oxygen flush button. Observe the breathing system pressure gauge as the ventilator cycles.

The pressure gauge must indicate a pressure in excess of 30 cm H_2O when the bellows has completed its downward travel. At the end of the expiratory phase, when the bellows has completed its upward travel, the pressure should be about 2 cm H_2O.

B.   If the ventilator or absorber is equipped with a PEEP valve, verify the PEEP valve's performance. Attach a breathing bag to the patient Y-piece with an appropriate adapter such as an NAD combination mask elbow with a 22 mm male fitting for the breathing bag and 15 mm male fitting for the Y-piece. With the manual/automatic selector valve in the AUTO position, set the ventilator to the desired frequency.

Then adjust the PEEP valve to different values and observe the breathing system pressure gauge to verify performance. Turn the PEEP valve control knob fully counterclockwise to its lowest setting after the test has been completed.

8.   Inspect the respiratory gas analysis sample line for kinks or occlusions. Check the water trap's reservoir level; replace if filled to maximum capacity.

Monitors

9.   Check the alarm limit settings. The NARKOMED 4 automatically sets monitor alarm limits to a default configuration when the SYSTEM POWER switch is turned on. Check these settings and adjust them if necessary. Alarm limits may be adjusted at the beginning of or during a procedure. Also, make sure that external monitors (if present) are connected properly and that they annunciate alarms through the anesthesia machine's central audio annunciator.

*10.   Test the alarm functions of all monitors. Simulate alarm conditions and check for appropriate alarm signals.

11.   Flush the system with 100% oxygen by pressing the oxygen flush button.

NOTE: If a breathing system other than an absorber system is used, consult the checkout procedure for that system in the appropriate manual.

12. If the optional fresh gas oxygen sensor adapter is installed, check to make sure that the fresh gas hose connection is intact and not occluded. Verify that the oxygen analyzer is properly calibrated. (See *Oxygen Analysis, Calibrating the O₂ Sensor* in Section 5 for more information.) When removing the oxygen sensor during calibration, insert the oxygen sensor port plug into the fresh gas adapter port.

Reserve Power

*13. Reserve Power Verification

A. Check the reserve battery power. With the machine's plug removed from the outlet, pressing the BATTERY TEST button on the NARKOMED 4's main switch panel must result in the illumination of the green LED indicator directly to the left of the test button. The yellow BATTERY LOW LED indicator must remain unlit. Place the plug back into its outlet.

Final Position

14. At the completion of the Daily Checkout procedure, verify that the final status of the machine is as follows:

A. All vaporizers off (handwheels set to zero)

B. APL Valve open (fully counter-clockwise)

C. Manual/Automatic switch set to BAG

D. All flowmeters indicating zero (or minimum)

E. Patient suction level adequate

F. Breathing system ready to use (bag in place and all hoses connected properly)

Overview

The NARKOMED 4 is a continuous flow anesthesia system with pneumatic circuitry for mixing and delivering gases and anesthetic agent vapor. The pneumatic system can deliver up to four gases and one anesthetic agent simultaneously. Oxygen and nitrous oxide are standard on all machines; available optional gases include air, carbon dioxide, and oxygen-helium (heliox). Up to three vaporizers can be mounted on the machine; available vaporizers are for halothane, enflurane, and isoflurane.

Connecting the Pipeline Gas Supply

Gas from the hospital pipelines enters the NARKOMED 4 through hoses connected to diameter-indexed safety system (DISS) inlets located on the side of the flowmeter housing.

To connect a pipeline supply to the NARKOMED 4:

1. Connect the gas fitting on the supply hose to the corresponding gas fitting on the side of the flowmeter housing Use a wrench to tighten the hex nut.

WARNING: Carefully check hoses each time you connect a machine to a wall or ceiling outlet to ensure that both ends of the hose are indexed for the same gas. Pipeline delivery hoses used between wall outlets and anesthesia machines have caused accidents when, during assembly, an oxygen fitting was placed on one end of the hose and a nitrous oxide fitting on the other end.

2. Connect the other end of the supply hose to the appropriate functioning hospital pipeline supplies.

3. Check the pipeline pressure gauge on the front of the NARKOMED 4 for sufficient pipeline pressure (50-55 psi).

YELLOW

BLACK & WHITE
CHECKERED

AIR DISS
GAS FITTING

AIR DISS
GAS FITTING

GREEN

WHITE

O2 DISS
GAS FITTING

O2 DISS
GAS FITTING

BLUE

BLUE

OP11021

N2O DISS
GAS FITTING

N2O DISS
GAS FITTING

CANADA
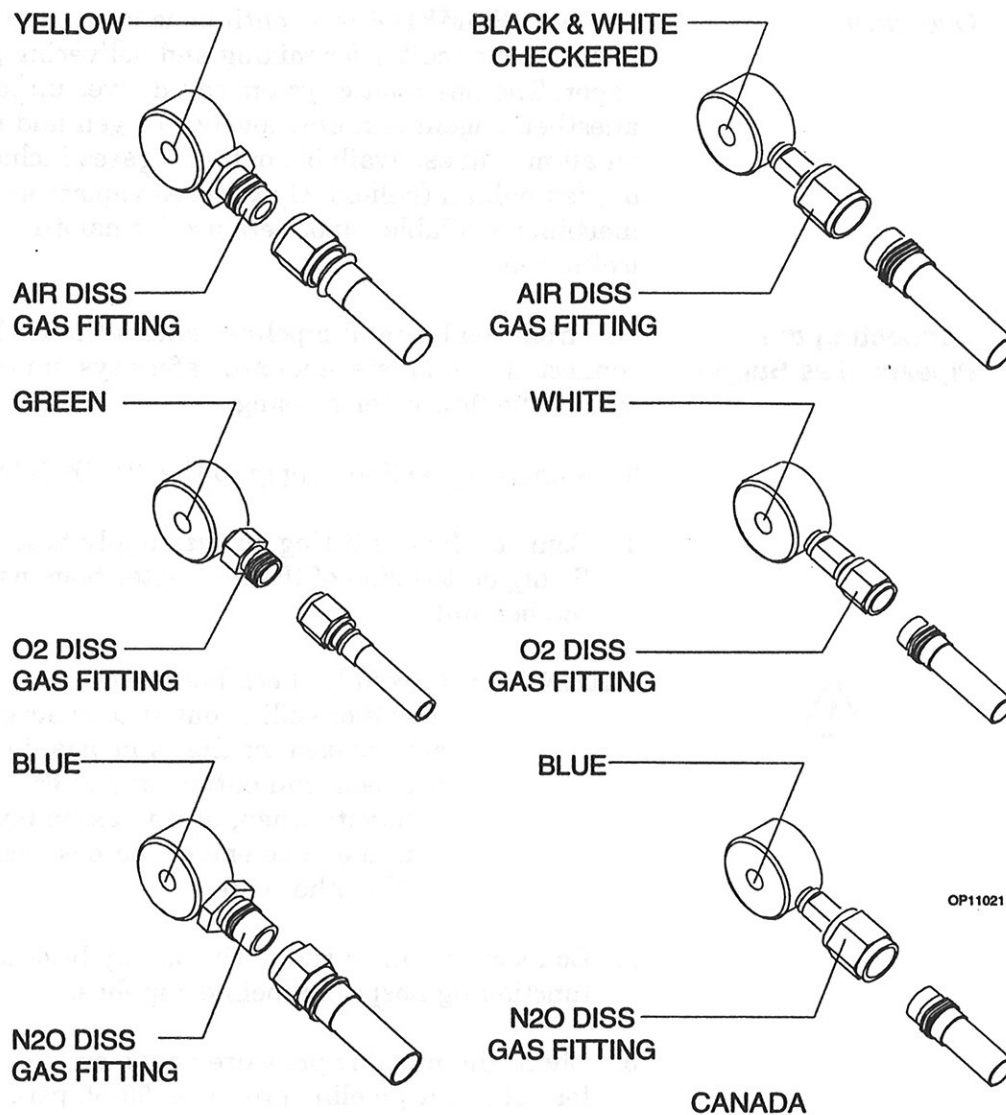
**Connecting the
Gas Cylinders**

When attaching a cylinder, make sure that only one washer is installed between the cylinder and the yoke gas inlet. Using multiple washers may compromise the pin-indexed safety system. Be sure to verify the integrity of both index pins whenever you install a new cylinder.

To connect a gas cylinder to its yoke:

1. Place a new washer on the seat of the yoke gas inlet connection.

⚠

WARNING: Use only one cylinder washer per yoke. Using more than one washer could cause leakage of the cylinder gas and compromise the pin indexing system.

2. Verify the presence and integrity of the two index pins below the gas inlet.

⚠ **WARNING:** Check cylinder yokes for the presence of two index pins each time you attach a cylinder to the machine.

3. Insert the head of a gas cylinder with matching gas into the yoke from below, so that the gas outlet and indexing holes on the cylinder head are facing the gas inlet and indexing pins on the yoke assembly.

4. Engage the indexing holes with the index pins. Screw the yoke handle clockwise against the cylinder head, so that the point of the yoke handle bolt is aligned with the countersunk recess on the back of the cylinder head.

5. Verify that the sealing washer is in place, that the index pins are engaged, and that the cylinder hangs vertically. Tighten the handle securely.

YOKE HANDLE BOLT — YOKE ASSEMBLY — INDEX PINS — GAS INLET

YOKE PLUG

CYLINDER VALVE

YOKE HANDLE

SEALING WASHER

CYLINDER HEAD

GAS CYLINDER (COLOR CODED)

CYLINDER WRENCH

OP20035
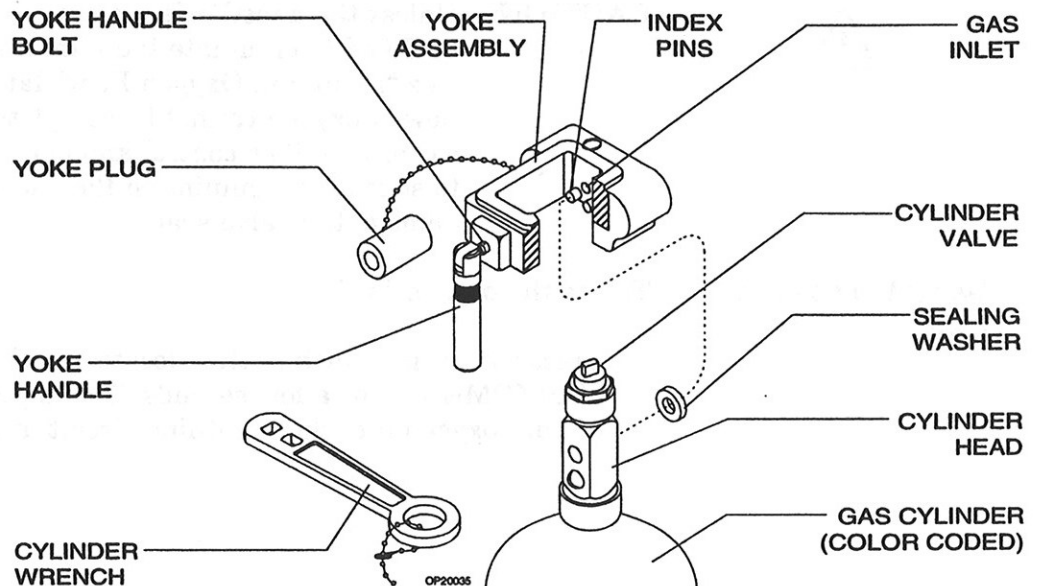
**Connecting the
Fresh Gas Hose**

To connect the fresh gas hose:

1. Pull out the fresh gas locking bar located on the front of the
   NARKOMED 4 to its extended position. Insert the 15 mm male
   fitting on the fresh gas hose into the 15 mm female terminal. Release
   the spring-loaded locking bar over the fitting, allowing it to "lock" the
   fitting into place.

WARNING: Do not pinch or kink the fresh gas hose leading from the
fresh gas outlet to the absorber.

**Adjusting the
Gas Flow**

To adjust the gas flow:

1. Turn the flow control knob located below the fine flowmeter tube for
   the gas you want to adjust. Turning the valve knob counterclockwise
   increases flow; turning the knob clockwise decreases flow.

2. As you adjust the flow control knob, observe the flow rate. Flow rate
   is indicated by the flowmeter scale reading at the center of the float.

CAUTION: Unless the anesthesia machine has been specifically
modified to eliminate the minimum oxygen flow feature
(see "Minimum Oxygen Flow" later in this section), the
flow of oxygen cannot be completely shut off. Do not force
the oxygen flow control knob past the zero stop in an effort
to shut off the minimum flow; forcing the knob can
damage the valve seat.

**Using the Oxygen
Flush**

To use the oxygen flush:

1. Press the oxygen flush button, located on the front of the
   NARKOMED 4, for a few seconds. This introduces an unmetered flow
   of pure oxygen into the breathing circuit at a rate of about 55 l/min.

Setting the Gas Selector Switch

Machines with at least one optional gas (three gases total) have a gas selector switch, which controls active gas circuits. The gas selector switch has two positions: O2 + N2O and ALL GASES.

1. To operate the machine in the O2 + N2O mode, turn the gas selector switch to O2 + N2O.

    NOTE: In this position, the gas selector switch permits oxygen and nitrous oxide flows to the appropriate flowmeter controls and **enables** the minimum oxygen flow.

2. To operate the machine in the ALL GASES mode, turn the gas selector switch to ALL GASES.

    NOTE: In this position, the gas selector switch permits the additional gases to flow to their respective flowmeter controls, allowing a mixture of all gases. However, setting the switch to the ALL GASES position automatically **disables** the minimum oxygen flow feature.

REFER TO SEPARATE MANUAL

REFER TO SEPARATE MANUAL

REFER TO SEPARATE MANUAL

REFER TO SEPARATE MANUAL

REFER TO SEPARATE MANUAL

Overview

The main switch panel, located between the ventilator bellows and flowmeter bank, incorporates the SYSTEM POWER switch and indicator lights for low O_2 supply pressure, AC power failure, and battery low alarms. These alarms are annunciated and displayed on the central alarm display.
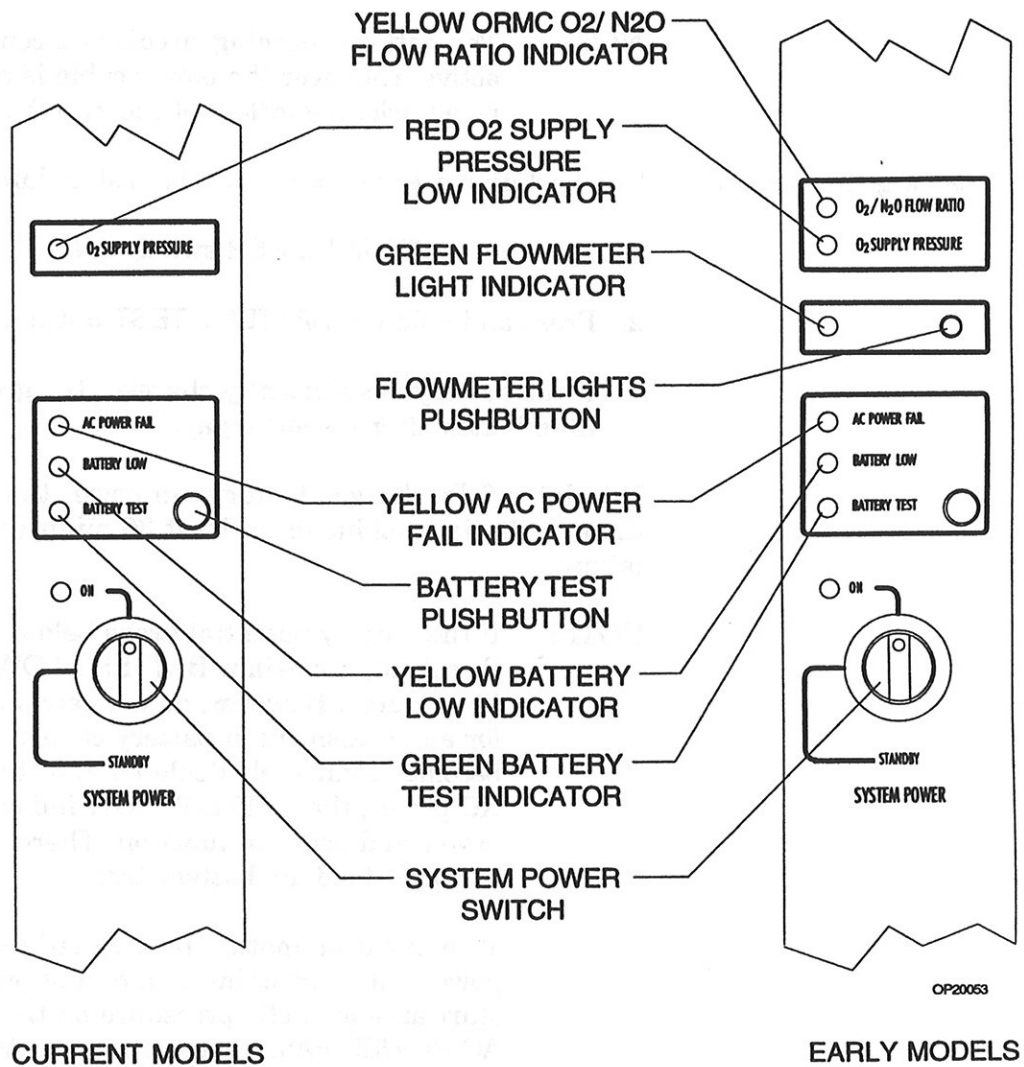
YELLOW ORMC O2/ N2O
FLOW RATIO INDICATOR

RED O2 SUPPLY
PRESSURE
LOW INDICATOR

O2/ N2O FLOW RATIO

O2 SUPPLY PRESSURE

GREEN FLOWMETER
LIGHT INDICATOR

FLOWMETER LIGHTS
PUSHBUTTON

AC POWER FAIL

BATTERY LOW

BATTERY TEST

YELLOW AC POWER
FAIL INDICATOR

BATTERY TEST
PUSH BUTTON

YELLOW BATTERY
LOW INDICATOR

ON

GREEN BATTERY
TEST INDICATOR

STANDBY

SYSTEM POWER
SWITCH

SYSTEM POWER

OP20053

CURRENT MODELS

EARLY MODELS

System Power Switch

The SYSTEM POWER switch on the NARKOMED 4 has two positions: ON and STANDBY. In the ON position the gas (pneumatic) and electric power circuits are activated and the green LED indicator adjacent to the switch is illuminated. In the STANDBY position the gas supplies, the monitoring system, and all electrical power to the machine except the convenience receptacles and battery charging circuit are deactivated.

NOTE: The battery charging circuit and convenience receptacles are active whenever the power cable is attached to an active wall receptacle, regardless of the switch setting.

Testing the Battery

The backup battery system shall be tested daily. To test the battery:

1. Turn the SYSTEM POWER switch ON.

2. Press and hold the BATTERY TEST button.

3. If the battery is sufficiently charged, the green BATTERY TEST light illuminates after a short delay.

Usually, a fully charged battery can power the electrical components of the anesthesia machine for at least 30 minutes in the event of a power failure.

NOTE: If the battery potential drops below the normal operating threshold, the yellow BATTERY LOW indicator light is illuminated. However, do not rely only on the this indicator for an assessment of battery capacity; if the backup battery becomes completely depleted and the machine does not have AC power, the BATTERY LOW indicator light has no source of power and does not function. Therefore, always remember to perform the daily battery test.

To prevent premature battery failure, use backup battery power only during interruption of primary AC power. Do not start an anesthetic procedure on the anesthesia machine if the AC POWER FAIL indicator light or the BATTERY LOW indicator light is illuminated.

Overview

The anesthesia ventilator is volume-preset and time-cycled. It has a solid-state timer and independent controls for frequency I:E ratio and flow. Pneumatic power to the ventilator is supplied through the pipeline supply or, if the pipeline supply fails or is disconnected, through cylinders. The pressure of the supply gas must be between 50 and 55 psi. The ventilator will not function if this pressure drops below 32 psi. Electrical power is supplied by the NARKOMED 4's AC power source, or, in event of AC power failure, by the backup battery. A fully charged battery can power the ventilator for approximately 30 minutes.

The monitoring system's breathing pressure and expiratory flow waveform displays can be used as an aid in adjusting the ventilator.

NOTE: The anesthesia ventilator is designed for use with a North American Dräger absorber system, which incorporates a manual/automatic selector valve. This valve allows you to select either the breathing bag and pop-off valve for manual ventilation, or the ventilator bellows for automatic ventilation.

During automatic ventilation, the manual/automatic selector valve isolates the absorber's adjustable pressure limiter (APL) valve from the breathing system. To compensate for the continuous introduction of fresh gas into the breathing system, the ventilator incorporates a relief valve mounted behind the bellows chamber.

The ventilator relief valve remains closed until the end of expiration so that the ascending bellows can expand upward and refill. When the bellows is completely filled, any excess gas in the system is released to the scavenging system by the ventilator relief valve. As in any ascending bellows, the force needed to overcome gravity acting on the bellows causes a positive-end expiratory pressure (PEEP) within the breathing system. For the NARKOMED 4, the PEEP is approximately 2 cm H_2O.

Activating the Ventilator

The ventilator power switch controls both pneumatic and electrical power to the ventilator. Place the switch to the ON position, to actuate the ventilator; it cycles according to the settings of the other controls. The ventilator power switch is placed to the ON postion it automatically enables the monitoring system's volume and pressure alarms. Place the switch to the OFF position to shut down the ventilator. The Advisory message VENTILATOR OFF appears on the anesthesia machine's central alarm display when the ventilator is turned off.

Adjusting the Tidal Volume

The tidal volume can be adjusted between 50 and 1500 ml. A self-locking knob, located above the bellows assembly, adjusts the bellows stop within the canister. To adjust the tidal volume, press the self-locking knob so that it can turn, then set the desired tidal volume as indicated by the pointer on the bellows chamber scale (marked 200–1400 ml). Smaller tidal volumes can be adjusted by setting the pointer below the

200 ml marking on the bellows chamber; larger tidal volumes can be selected by setting the pointer above the 1400 ml calibration.

As in any volume-preset anesthesia ventilator, the actual tidal volume delivered to the patient's lungs may differ from the preset volume at the bellows due to the compliance of the breathing system and fresh gas flow. To accurately set the tidal volume, refer to the tidal and minute volume measurements.

The position of the tidal volume indicator can be calibrated for a specific combination of fresh gas flow and equipment compliance by a North American Dräger authorized service representative.

FREQUENCY CONTROL — I:E RATIO CONTROL — FLOW GAUGE — FLOW CONTROL — VENTILATOR POWER SWITCH

TIDAL VOLUME ADJUSTMENT KNOB

TIDAL VOLUME POINTER

VENTILATOR RELIEF VALVE (W/19MM SCAVENGER HOSE TERMINAL)

22MM BREATHING HOSE TERMINAL

OP11041
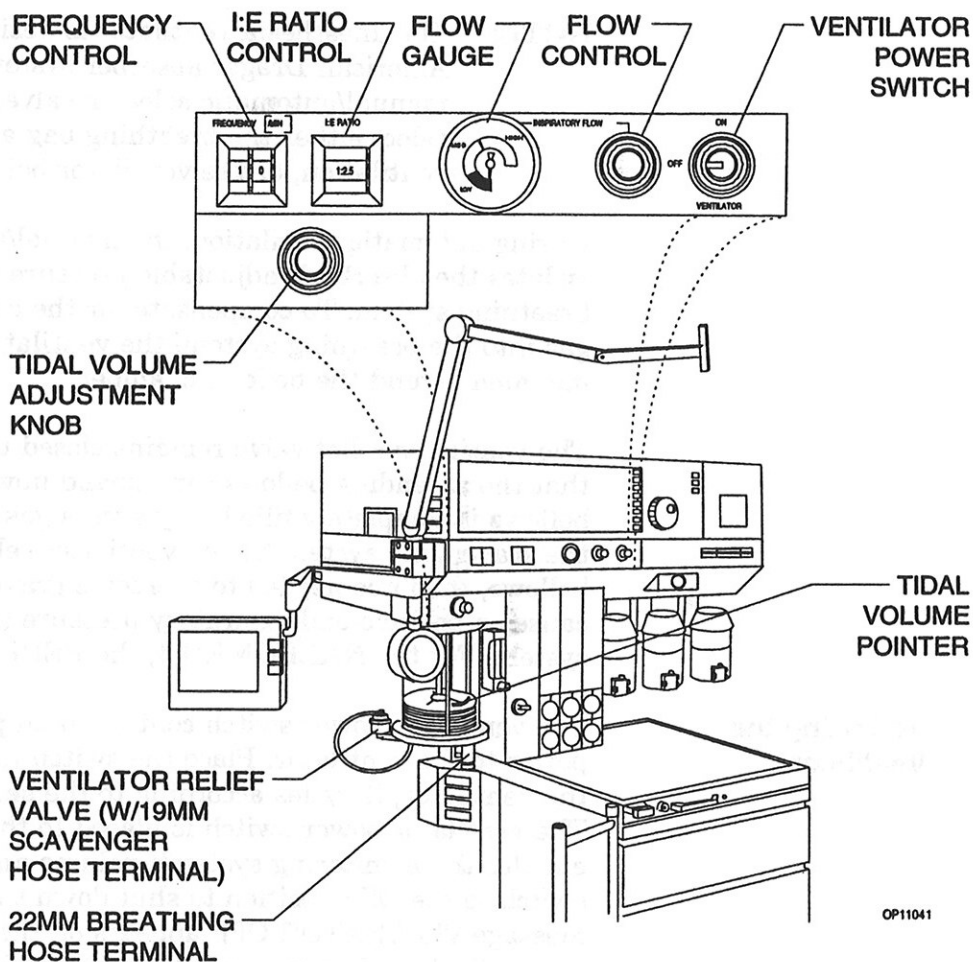
Setting the Frequency Control

You can set the respiratory frequency from 1 to 99 beats per minute (BPM) in 1 BPM increments using the two-digit thumbwheel labeled FREQUENCY. A setting of 00 BPM causes the ventilator to remain indefinitely in the expiratory phase.

Setting the Inspiratory/ Expiratory (I:E) Phase Time Ratio Control

You can vary the inspiratory/expiratory (I:E) phase time ratio in calibrated steps from 1:1 through 1:4.5. Calibrations are marked on the I:E controller-indicator thumbwheel in 0.5 increments. The I:E ratio thumbwheel is labeled I:E RATIO, and is located to the right of the frequency thumbwheel.

Setting the Inspiratory Flow Rate

The rotary knob marked INSPIRATORY FLOW controls the flow rate of gas into the bellows chamber and the inspiratory flow rate of gas into the patient's lungs. The inspiratory flow control cannot be calibrated with numerical values, however, due to such variables as total lung compliance, equipment compliance, and airway resistance. Therefore, the gauge to the left of the control knob is labeled with three zones: LOW, MEDIUM, and HIGH.

You should adjust the flow setting so that the bellows is fully compressed at the end of the inspiratory phase. In order to deliver the desired preset tidal volume, adjust the inspiratory flow control so that the bellows corrugations make contact with each other, but are not deformed, at the end of the inspiratory phase.

You can also use the inspiratory flow control to create an inspiratory plateau at the end of the inspiratory cycle and to affect the potential peak inspiratory pressure within the patient breathing system. Always check the pressure indicated by the breathing system pressure gauge and waveform when adjusting the inspiratory flow control.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Excessive PEEP	Improperly adjusted ventilator relief valve	Contact NAD service representative.
	Insufficient suction scavenger flow setting	Increase suction scavenger flow valve.
	PEEP valve active	Decrease PEEP valve setting.
Excessive NEEP	Excessive suction scavenger flow	Reduce suction scavenger flow rate.
Bellows won't reach tidal volume setting during expiration	Frequency too high for selected tidal volume	Decrease frequency.
		Increase expiratory phase time.
	Improperly adjusted ventilator relief valve	Contact NAD service representative.
Ventilator won't cycle	Frequency set to 00	Select correct frequency.
	Low O_2 supply pressure	Provide sufficient O_2 supply pressure.
Bellows won't compress during inspiration	Absorber manual/automatic selector valve in BAG position	Place manual/automatic selector valve in AUTO position.
	Inspiratory flow control setting on ventilator too low	Increase inspiratory flow control setting.
	Frequency too high	Decrease frequency.

Overview

In addition to monitoring several clinical parameters, the NARKOMED 4 monitoring system checks itself out every time the machine is turned on. After the initial power-on screen, the machine can display preuse checkout screens, which list the items you should check before starting a case.

After power-on, the NARKOMED 4's screens can display many different kinds of information. Each of the buttons in the main key panel (along the right side of the main display) puts a particular screen on the main display. This section describes how to display and use the following screens:

- Monitor screen - displays standard monitoring information

- Monitor Setup screen - lets you change alarm limits, begin calibrations, and set up other important selections

- Data screen - displays additional measurements for recordkeeping or detailed analysis.

- Data Log screen - displays a tabular listing of previously logged events

- Trend screen - displays a detailed graphic representation of the history of selected measurements

- Print screen - displays print options

- System Configuration screens - displays a series of screens that let you customize operation of the NARKOMED 4

Power-On Screen

When you turn the SYSTEM POWER switch to the ON position, the NARKOMED 4 performs extensive self-diagnostics on its internal hardware. During the diagnostics, each test and its result (PASS or FAIL) appears on all main screens, showing the status of various components of the monitoring system. The last test reports the status of the backup processor. If the backup processor fails, press the BACKUP key to obtain a more detailed display of what is nonfunctional on the NARKOMED 4.

```
DIAGNOSTICS                        NARKOMED 4 SYSTEM SOFTWARE
                                   (C) COPYRIGHT 1988-199x, NAD INC.
                                   VERSION: x.xx

  VIDEO TEST                PASS
  FIRMWARE TEST             PASS
  MEMORY TEST BLANK1        PASS
  MEMORY TEST BLANK2        PASS
  TIMER/INTERRUPT TEST      PASS
  ANALOG TEST               PASS
  AUDIO TEST -PRIMARY       PASS
           -BACKUP          PASS
           -SpO2            PASS
  SERIAL I/O TEST           PASS
  CLOCK TEST                PASS
  NON-VOLATILE MEMORY TEST  PASS
  ALTERNATE PROCESSOR TEST  PASS
                                      ┌─────────┬─────────┐
                                      │ MONITOR │ CHECKOUT│
FUNCTIONAL                            └─────────┴─────────┘
```

NOTE: If the machine is equipped with the optional O.R. Data Manager its self-diagnostics messages also appear briefly on the remote display.

At the end of the self-diagnostics, the NARKOMED 4's status is posted in the lower left corner of the Power-On screen as of the three following classifications:

- FUNCTIONAL - Every component of the machine is in satisfactory operational order.

- CONDITIONALLY FUNCTIONAL - A nonessential component of the machine is not functioning properly. You can use the machine, but a North American Dräger service representative should be notified to correct the problem.

- NON-FUNCTIONAL - An essential component of the machine is malfunctioning that precludes operation of the monitoring system. Do not use the machine. Notify a North American Dräger service representative immediately to correct the problem.

If the NARKOMED 4 is functional or conditionally functional, two keys appear on the screen — MONITOR and CHECKOUT.

- To invoke the Monitor screen, touch the MONITOR key.

- To invoke the Preuse Checkout screen, touch the CHECKOUT key.

If you do not touch one of these keys within a set time-out period, the Monitor screen appears.

After turning on the NARKOMED 4, the low minute volume, apnea volume, and breathing pressure apnea alarms are automatically disabled for three minutes to prevent nuisance alarms. To cancel the automatic disable period for these alarms, touch the ALARM ON keys in the respiratory volume and the breathing pressure areas of the Monitor screen, or turn the ventilator power switch to ON.

In addition, the carbon dioxide and agent alarms are disabled until the second carbon dioxide calibration is complete (a period of about three minutes). During the calibration period, only the ALARM OFF keys for carbon dioxide and agent appear on the screen. The agent ALARM ON key is enabled (highlighted) as soon as the second calibration is completed; the carbon dioxide ALARM ON key is enabled (highlighted) after the second calibration is completed and an end-tidal carbon dioxide reading of 5 mmHg or greater is detected.

Preuse Checkout Screen

To view the Preuse Checkout screen:

1. Touch the CHECKOUT key on the Power-On screen after the power-up diagnostics are complete. A condensed list of tests to be performed prior to the start of a case appears on the main display.

PRE-USE CHECKLIST   PAGE 1
CONSULT PRE-USE CHECKOUT PROCEDURE IN OPERATOR MANUAL FOR

DETAILED PROCEDURES.
- VERIFY CONNECTION OF PROPER PIPELINE SUPPLIED GASES.
- CHECK PIPELINE SUPPLY PRESSURES: 50 - 55 PSI
- VERIFY CONNECTION OF PROPER CYLINDER SUPPLIED GASES.
- CHECK CYLINDER PRESSURE: O2 - 2200 PSI N2O - 745 PSI
- CHECK FOR SUFFICIENT SUPPLY OF LIQUID ANESTHETIC: MUST BE
   BETWEEN MIN AND MAX FULL MARKING.
- VERIFY TIGHTNESS OF VAPORIZER FILLER AND DRAIN VALVES.
- VERIFY FUNCTION OF FLOWMETERS: FLOAT MUST MOVE FREELY
   OVER FULL RANGE.
- CHECK OXYGEN ANALYZER:EXPOSE SENSOR TO AMBIENT AIR
   AND PRESS O2 CAL.
- VERIFY FUNCTION OF ORMC:
   ORMC LIMIT N2O FLOW AT APPROXIMATLY 25% OXYGEN.
- TEST OXYGEN FLUSH: OXYGEN ANALYZER READING SHALL INCREASE.
- VERIFY OXYGEN DELIVERY: OXYGEN ANALYZER SHALL RESPOND TO
   INCREASE IN OXYGEN FLOW.
- TEST RESERVE BATTERY POWER: BATTERY TEST INDICATOR SHALL
   ILLUMINATE GREEN FOR FULLY CHARGED RESERVE BATTERY.

$$\boxed{O_2 \; CAL}$$

CP1108

Calibrating Oxygen Sensor

To be calibrated correctly, the sensor must be exposed to room air. Calibration for the oxygen sensor should be performed as part of the daily, preoperative setup of the anesthesia equipment.

To calibrate the oxygen sensor:

1. Remove the sensor assembly from the inspiratory valve dome and plug the dome with the inspiratory valve dome plug. (Do not disassemble the sensor assembly further.)

2. With the sensor cap off the sensor assembly, hold the sensor assembly away from any open part of the patient breathing system and away from any gas fittings to ensure that the sensor avoids the influence of breathing system gases and is exposed only to the 21% oxygen concentration normally found in ambient air.

3. Touch the O2 CAL key.

The length of time that the sensor takes to calibrate depends on the gas mixture which the sensor was exposed to before calibration. If the sensor was exposed to 21% oxygen for longer than one minute, calibration can take as little as 10 seconds. If the sensor was exposed to higher concentrations of oxygen, calibration may last up to 50 seconds. Typically, calibration lasts less than 30 seconds.

4. When the calibration is completed, pull the inspiratory valve dome plug and reinsert the sensor assembly.

If during or at the end of the calibration period, the calibration was not successful the condition is also indicated by one of the advisory messages O2 SENS DISC, SERVICE O2, REPL O2 CELL, or CAL O2 SENS. Refer to Section 5 - Operation *Oxygen Analysis* for additional information.

5. To clear the Preuse Checkout screen and enter the Monitor screen, touch the END CHECKOUT key.

Monitor Screen

To display the monitor screen:

1. Touch the MONITOR key that appears on the Power-On screen after diagnostics are complete. (The display automatically switches to this screen after a timed delay, once the functional checkout is complete.)

OR

2. Press the MONITOR key on the main key panel.

The left side of the screen displays information for pulse oximetry, carbon dioxide and inspired oxygen, and noninvasive blood pressure.

OP10018A

| SpO$_2$ | **98** |
| PLS | **69** |

ALARM OFF | ALARM ON
TRACE | TREND

CO$_2$	**43**
	0
O$_2$	**40**

ALARM OFF | ALARM ON
TRACE | TREND

NIBP 118	**120**
ADULT	100
04:20	
	80

TIME	SYS / DIAS		MEAN	PULSE
8:30	145	75	95	68
8:35	127	70	90	65
8:40	117	60	90	68
8:45	115	60	87	67
8:50	120	80	100	69

START | STOP
STAT
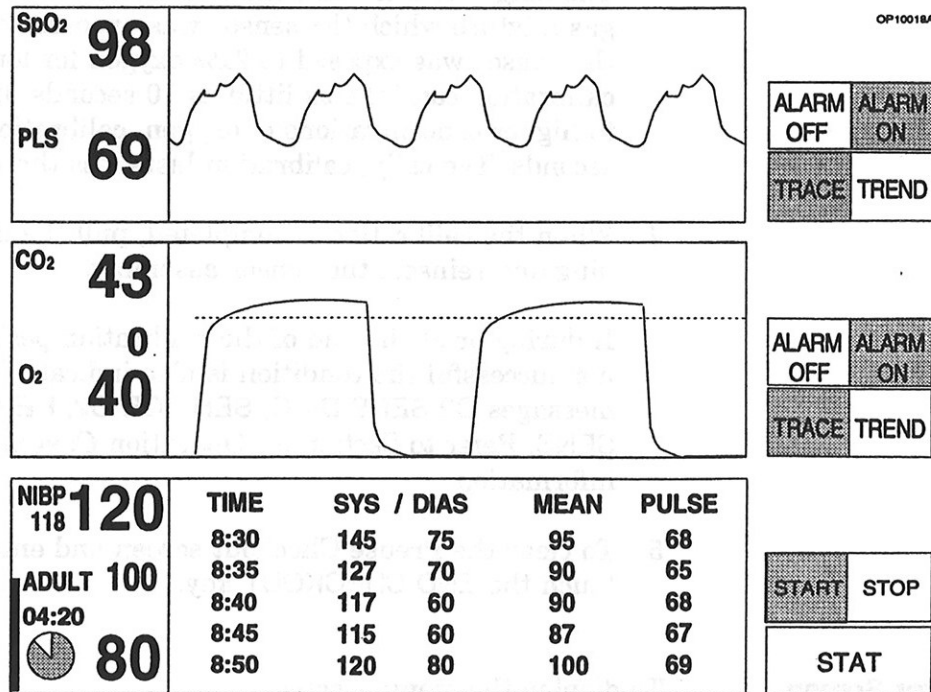
The right side of the screen displays information for breathing pressure, respiratory flow and volume, and anesthetic agent.

OP10019

PEAK	**40**
MEAN	12
PEEP	**2**

ALARM OFF | ALARM ON
TRACE | TREND

MIN VOL	**5.6**
TID VOL	**0.58**
RR	**10**

ALARM OFF | ALARM ON
TRACE | TREND

ISO	
I	**1.2**
E	**0.8**
FG	

ALARM OFF | ALARM ON
TRACE | TREND
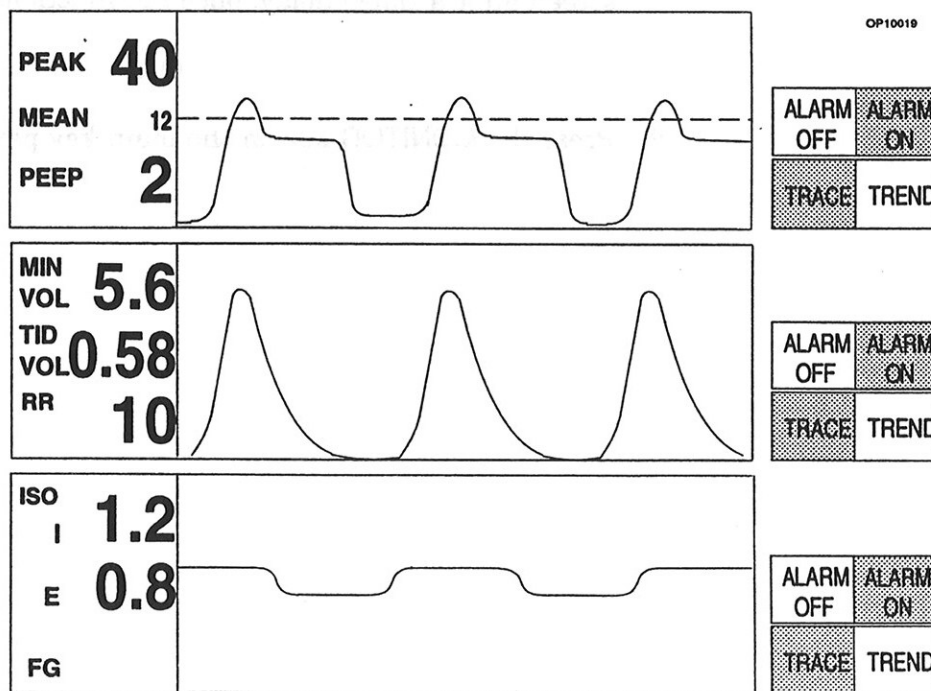
Each area monitor screen is divided horizontally into three sections:

- numerical values for the current measurement

- graphical trace or trend of the measurement. In the trace mode, the center section may display a message window containing operational information.

- keys associated with the measurement (e.g. ALARM OFF/STBY, ALARM ON, TRACE, TREND).

The area above th keys is reserved for displaying up to two alarm messages.

Monitor Setup Screen

To display the Monitor Setup screen:

1. Press the MONITOR SETUP key on the main key panel.

The Monitor Setup screen lets you change alarm limits, perform calibrations, and set other selections. Like the Monitor screen, the Monitor Setup screen has an area for each of the NARKOMED 4's monitored items. The left section of each of the monitor areas (which contains numerical values for current measurements) appears on this screen.

SpO2 98	SpO2 ALARMS		INTERLOCK	OP10020
	LO **80**	HI **100**	OFF ON	ALARM OFF / ALARM ON
PLS 69	PULSE ALARMS		TONE VOL	
	LO **50**	HI **120**		TRACE / TREND
CO2 **36** 0	EtCO2 ALARMS		CO₂ CAL	ALARM OFF / ALARM ON
	LO **10**	HI **50**		
O2 **40**	O2 ALARMS		O₂ CAL	TRACE / TREND
	LO **30**	HI **100**		
NIBP 118 **120**	SYSTOLIC ALARMS		MODE	START / STOP
ADULT 100	LO **60**	HI **150**	ADULT NEO	
04:20 **80**	INFLATION PRESSURE		INTERVAL	STAT
	AD **180**	NE **110**	5 MIN	

Data Screen

To display the Data screen:

1. Press the DATA key on the main key panel

The Data screen, which is displayed on the right side of the main display, shows two kinds of information:

- breathing pressure measurements
- respiratory gas analysis or cardiovascular data

To select the information shown on the bottom portion of the screen:

1. Touch the key for the data you want to display. (Touch GAS ANALYSIS to display the gas analysis; touch CARDIOVASCULAR to display cardiovascular data.)

Gas Analysis Screen

The Gas Analysis screen shows both numerical values and bar charts of the respiratory gas concentrations. The bars are divided into five sections, each with a distinct pattern. The patterns represent inspired amounts of the following gases, from top to bottom:

- balance gas
- carbon dioxide
- nitrous oxide
- oxygen
- agent
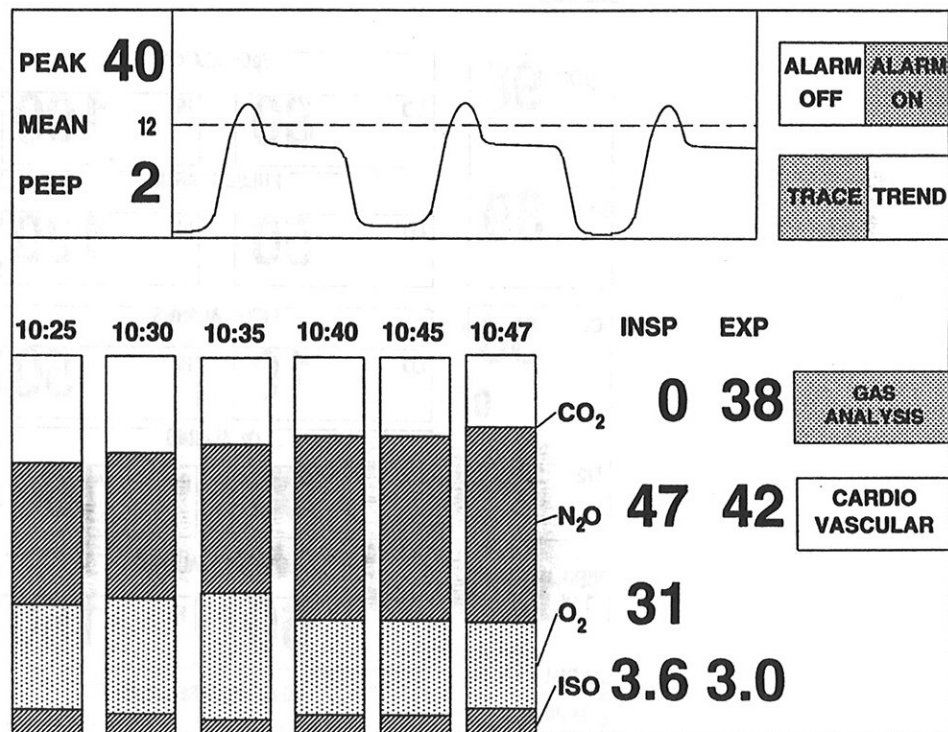
OP10022

There are six stacked bar charts. The left five bars display a history, in five minute intervals, of the inspired gases' relative concentrations. The sixth bar gives the current concentrations.

Current inspiratory and expiratory values for the four monitored gases appear to the right of the bars. The values displayed are the usual units of measurement for that gas.

- carbon dioxide - mmHg
- nitrous oxide - volume %
- oxygen - volume %
- anesthetic agent - volume %

Cardiovascular Data Screen

The Cardiovascular Data screen displays cardiovascular data from a vital signs monitor (for example, the VITALERT 2000) interfaced to the NARKOMED 4.

The screen has three display areas:

- The P1 box displays systolic, diastolic, and mean arterial blood pressure measurements.

- The P2 box displays blood pressure measurements for central venous pressure, pulmonary artery pressure, or a second arterial blood pressure.

- The HR box displays the heart rate.

PEAK **40**

MEAN   12

PEEP **2**

ALARM OFF | ALARM ON

TRACE | TREND

P₁ **130**
100
78

P₂ **60**
40
10

GAS ANALYSIS

CARDIO VASCULAR

HR **65**
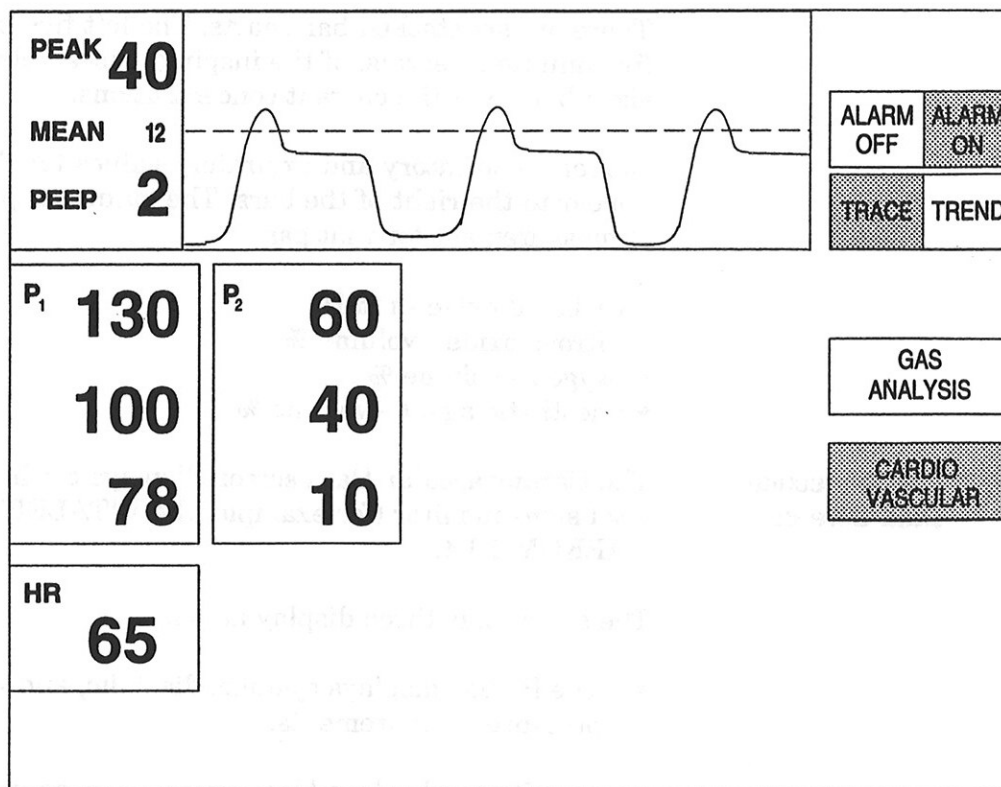
OP10023

Data Log Screen

To display the Data Log screen:

1. Press the DATA LOG key on the main key panel.

The NARKOMED 4 has an electronic data log that lets you save a set of measurements (called an "event") for future reference. (Events are logged by pressing the LOG DATA key on the control key panel or on the remote display.) The Data Log screen, which appears on the right side of the main display, is a tabular listing of these logged events.

The NARKOMED 4 can store up to 199 events in memory. The events can be manually logged with the Log Data key or automatically logged by setting in the Auto Log Configuration screen. (For more information, see "System Configuration Screens" later in this section.) Logged data can be received from either the NARKOMED 4 or external monitor(s). If P1 and P2 reading are being received from an external monitor, they will be logged instead of the measurements taken by the NARKOMED 4's noninvasive blood pressure monitor.

11:02	140/85	108	70	35.3	99	35	2.9	39
TIME	SYS/DIAS	MEAN	PULSE	TEMP	SpO_2	CO_2	AGENT	O_2
10:21	160/85	111	77	34.8	98	38	3.2	40
10:24	158/79	108	79	34.3	98	35	2.9	39
10:27	159/83	104	76	35.1	99	36	3.4	40
10:30	160/85	107	80	34.8	97	34	3.2	40
10:34	164/87	105	81	34.6	98	38	3.3	40
10:37	162/78	110	79	34.9	97	39	3.0	39
10:43	161/80	111	76	34.5	96	36	3.1	39
10:48	156/79	108	78	34.6	99	35	3.4	39
10:54	158/83	109	74	34.8	98	37	3.2	40

CLEAR
LOG/TREND

OP10024

In the Data Log screen, the top line of the screen shows current values for the following measurements:

- systolic blood pressure
- diastolic blood pressure
- mean blood pressure
- pulse rate
- temperature
- oxygen saturation
- end-tidal carbon dioxide
- anesthetic agent
- oxygen concentration

Logged events are sequentially listed below the current values with their time of occurrence. You can scroll through the list of events on the Data Log screen with the selection dial.

Clearing the
Log/Trend

You can clear the logs (the data log and the NIBP log) and trend, which erases all the previous data stored in the NARKOMED 4's memory. Typically, you clear the trend and logs at the beginning of a procedure before connecting the patient to the monitors. This clears the buffer of old data accumulated during the setup and checkout of the equipment.

To clear the data log, NIBP log, and trend information:

1. Touch the CLEAR LOG/TREND key at the bottom of the screen.

2. The message CLEAR LOG/TREND? appears at the bottom of the screen with YES and NO keys.

3. To erase all information in the data log, NIBP log, and trend, touch the YES key.

   To return to the Data Log screen without clearing any information, touch the NO key.

Trend Screen

To display the Trend screen:

1. Press the TREND key on the main key panel.

The Trend screen displays up to 10 hours and 40 minutes of trend history, showing two trends at a time. You can select from six sets of trend pairs:

- carbon dioxide concentration and respiratory minute volume
- oxygen saturation and pulse rate
- noninvasive blood pressure and anesthetic agent concentration
- invasive blood pressure measurements P1 and P2
- temperature measurements T1 and T2
- oxygen and nitrous oxide concentration

Labels for the selected measurements appear at the top of the corresponding trend graph. The horizontal axis is calibrated in units of time. The vertical axes are calibrated in the appropriate units for the selected measurement. Graphs, representing the historical variations of the trend measurements, travel from left to right as new trend data accumulates. The trend graph initially displays up to 1 hour and 20 minutes of trend information. When that time is exceeded, the NARKOMED 4 automatically rescales the display by compressing the entire data display into the left half of the screen.

Generally, trend information appears as a single trace plotted against time. The carbon dioxide and agent trends, however, show the inspiratory/expiratory envelope. Similarly, the breathing pressure trend shows the systolic/diastolic envelope, with the mean blood pressure.
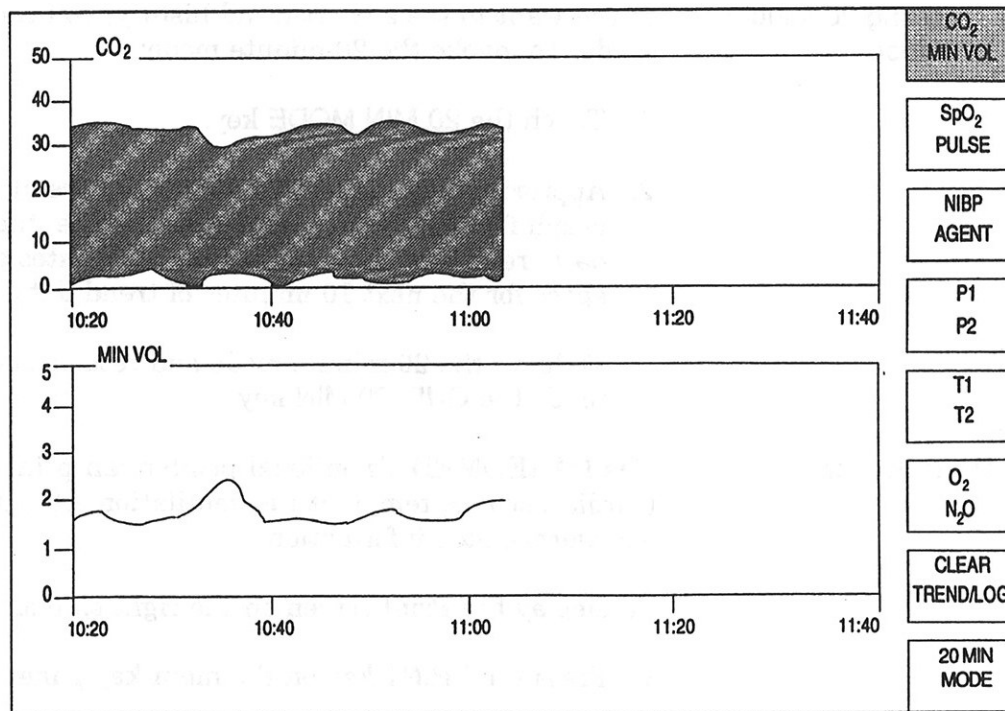
Clearing the Trend/Log

You can clear the trend and logs (the data log and the NIBP log), which erases all the previous data in the NARKOMED 4's memory. Typically, you clear the trend and logs at the beginning of a procedure before connecting the patient to the monitors. This clears the buffer of old data accumulated during the setup and checkout of the equipment. After the data has been cleared, the current system time is used as the time base. The display returns to the previous time scale.

To clear the trend and logs (data log and NIBP log):

1. Touch the CLEAR TREND/LOG key at the bottom of the screen.

2. The message CLEAR TREND/LOG? appears at the bottom of the screen with YES and NO keys.

3. To erase all information in the trend, data log, and NIBP log, touch the YES key.

   To return to the Trend screen without clearing any information, touch the NO key.

Using 20-Minute Mode

If you want to see a short trend history, you can use the 20-minute mode. To invoke the 20-minute mode:

1. Touch the 20 MIN MODE key.

2. Approximately the last 20 minutes of trend data appears. When the graph fills the twenty minute time scale, the time scale shifts the data, retaining the most recent 10 minutes of trend date and leaving space for the next 10 minutes of trend data.

    To leave the 20-minute mode and return to the previous time scale, touch the QUIT 20 MIN key.

Print Screen

The NARKOMED 4's optional printer can print both numerical (cardiovascular, temperature, ventilation, etc.) and graphical (traces, waveforms, etc.) information.

To display the Print screen on the right side of the main display:

1. Press the PRINT key on the main key panel.

The print selections (DATA, DATALOG, and TRACE, appear on the left side of the screen.

To print current data values, such as pulse rate, SpO_2, noninvasive blood pressure, temperature, etc., in tabular form, touch the PRINT key next to the DATA selection.

To print a hard copy of the data log, touch the PRINT key next to the DATALOG selection.

To print a hard copy of a specific trace:

1. Touch the SELECT key next to the TRACE selection.

2. A second set of keys appear on the screen, showing which traces can be printed (SPO2, CO2, PRES, FLOW, and AGENT/HAL/ENF/ISO.
3. Touch one or more of the trace keys to select them for printing.

4. To print the trace(s), touch the PRINT key next to the DATA selection.

To stop the printer during the print process, touch the STOP PRINT key below the TRACE/PRINT keys.

```
┌─────────────────────────────────────────────────┐
│  INTERNAL PRINTER                                 │
│  DATA      ┌─────────┐                            │
│            │  PRINT  │                            │
│            └─────────┘                            │
│  DATALOG   ┌─────────┐  ┌─────────┐              │
│            │  PRINT  │  │  SPO2   │              │
│            └─────────┘  └─────────┘              │
│          ┌─────────────┐┌─────────┐              │
│          │   SELECT    ││  CO2    │              │
│  TRACE   ├─────────────┤└─────────┘              │
│          │    PRINT    │┌─────────┐              │
│          ├─────────────┤│  PRES   │              │
│          │   STOP      │└─────────┘              │
│          │   PRINT     │┌─────────┐              │
│          └─────────────┘│  FLOW   │              │
│                         └─────────┘              │
│                         ┌─────────┐              │
│                         │  AGENT  │              │
│                         └─────────┘              │
│                                                   │
│  PRINTER READY                                    │
└─────────────────────────────────────────────────┘
```

OP10026
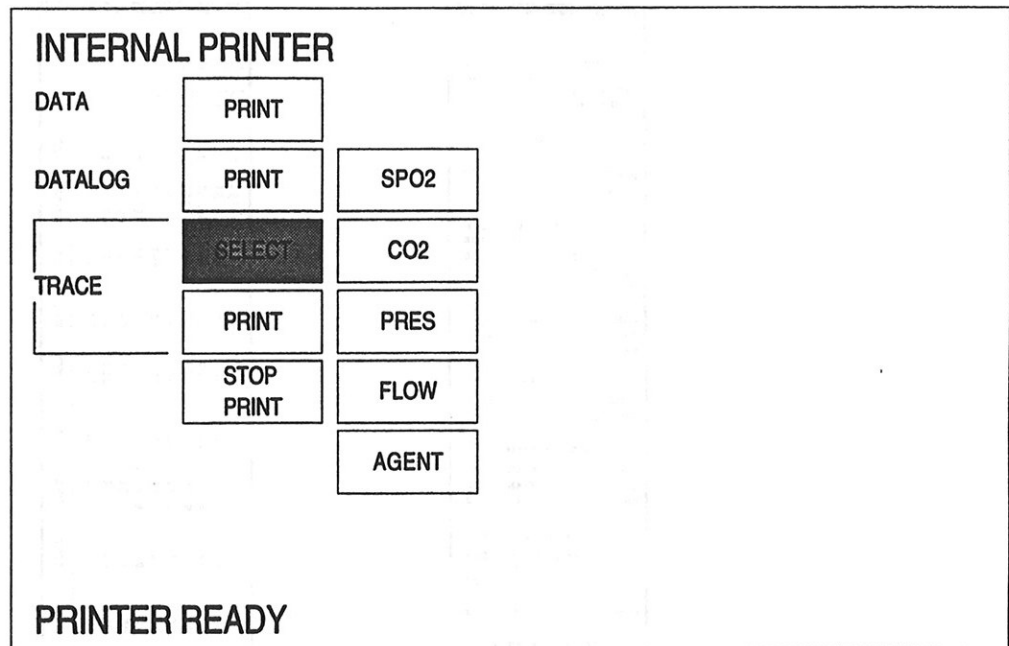
The printer's status is displayed in the lower left portion of the screen. The following printer status messages may appear:

- **NO PRINTER** - The optional printer is not installed.

- **PRINTER READY** - The printer is online and ready to print.

- **DATA PRINT** - Numerical information is being sent to the printer.

- **DATALOG PRINT** -Data log information is being sent to the printer.

- **WAVEFORM PRINT** - Waveform information is being sent to the printer.

- **PAPER OUT** - The printer is out of paper.

- **DOOR OPEN** - The printer door is not properly latched.

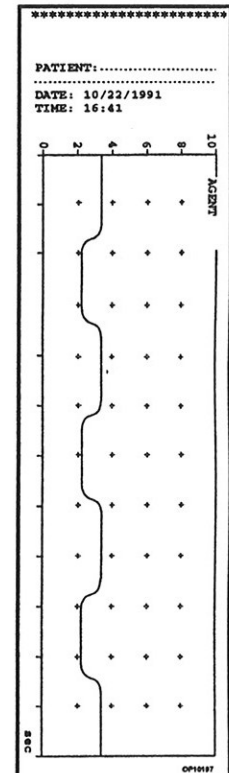- **PRINTER ERROR** - There is an internal problem with the printer.

DATA PRINTOUT

```
***********************
PATIENT:.................
.........................
DATE: 10/22/1991
TIME: 16:41

        CARDIOVASCULAR

PULSE RATE            69
SpO2                  95
CARDIAC OUTPUT     .......
        SYST   DIAS   MEAN
NIBP    157    80     108
P1 ART  105    74     86
P2 ART  .....  .....  .....
CVP     .....  .....  .....
PA      .....  .....  .....
LAP     .....  .....  .....
RV      .....  .....  .....
RA      .....  .....  .....

        TEMPERATURE
TEMP 1               98.6
TEMP 2               99.2

        VENTILATION
MINVOL  5.6   PEAK    40
TIDVOL  0.58  MEAN    12
RATE    10    PEEP    2

     GAS CONCENTRATION
      FRESH  INSP   EXP
O2           24
CO2                 27
AGT          1.2    0.8
N2O          3.1    2.8

     BLOOD CHEMISTRY
O2SAT  .....  Cl-   .....
pH     .....  NA+   .....
pCO2   .....  K+    .....
pO2    .....  CA++  .....
HcT    .....  GLU   .....
ABG TIME .....................
                      OP10106
```

DATALOG PRINTOUT

```
***********************
PATIENT:.................
.........................
DATE: 10/22/1991
TIME: 16:41
```

EV#	TIME	SYS	DIAS	MEAN	PULSE	TEMP	SpO2	CO2	AGENT	O2
1	15:48	160	85	111	77	34.8	98	38	3.2	40
2	15:49	158	79	108	79	34.3	99	35	3.1	40
3	15:50	159	83	104	76	35.1	98	36	2.9	40
4	15:51	160	85	107	80	34.8	97	34	3.4	40
5	15:52	164	87	105	81	34.6	98	36	3.2	36
6	15:53	162	78	110	79	34.9	98	39	3.3	40
7	15:54	161	80	111	78	34.5	97	36	3.1	40
8	15:55	156	79	108	76	34.6	98	37	3.4	39
9	15:56	158	83	109	74	34.8	98	36	3.1	39
10	15:57	157	80	108	76	38.6	99		3.2	39

```
                      OP10108
```

TRACE PRINTOUT

```
***********************
PATIENT:.................
.........................
DATE: 10/22/1991
TIME: 16:41
```

```
                      OP10107
```

System Configuration Screens

There is a series of six configuration screens you can use to customize operation of the NARKOMED 4.

To display the first of the six configuration screens on the right side of the main display:

1. Press the SYSTEM CONFIG key on the main key panel

The six screens contain different types of options that you can configure:

- Alarms - alarm limits

- System functions - time, date, audio alarm volume, NIBP annunciator volume, and sweep speed.

- Auto log - criteria that determines when events are automatically logged

- Datascan - bar graph boundaries for the six measurements shown on the Datascan display.

- Checkout - preuse checkout (view only)

- Serial ports - baud rate, parity, stop bits, data bits, and device type

To display a particular configuration screen:

1. Touch the key on the right side of the screen for the configuration screen you want to enter.

Alarms Configuration Screen

The Alarms Configuration screen shows all current measurements and the current alarm limits for the following parameters:

- oxygen saturation
- pulse rate
- oxygen concentration
- end-tidal carbon dioxide
- anesthetic agent concentration
- systolic pressure
- peak breathing pressure
- minute volume

Changing Alarm Limits

To change an alarm limit:

1. Use the selection dial to scroll to the desired alarm limit. (A box surrounds the selected limit as you scroll through the settings.)

2. When the alarm limit you want to set is selected (boxed), press the selection dial. This highlights the selected alarm limit value.

3. Turn the selection dial to change the value as desired.

4. Press the selection dial to enter the value.

Using the
Autoset

To automatically set all alarm limits around their current measurements, you can use the autoset function. Typically, the autoset function should be used after induction, during the maintenance phase of the anesthetic procedure, when the patient measurements have stabilized.

Touching the AUTOSET WIDE key sets the alarm limits to the following values:

Alarm	Value
SpO$_2$	Current measurement ± 5%
Pulse	Current measurement ± 20/min
EtCO$_2$	Current measurement ± 10 mmHg
Systolic	Current measurement ± 50 mmHg

Touching the AUTOSET NARROW key adjusts the alarm limits to the following values:

Alarm	Value
SpO$_2$	Current measurement ± 3%
Pulse	Current measurement ± 10/min
EtCO$_2$	Current measurement ± 5 mmHg
Systolic	Current measurement ± 25 mmHg

Using and
Saving
Defaults

You can also set alarm limits to the preset default values. To set all the alarm limits the default limits, touch the DEFAULT key.

To save the current alarm limits as the new default limits (at power-on), touch the SAVE DEFAULTS key.

Turning
Alarms On/Off

In the Alarms Configuration screen, you can also enable or disable alarms. To enable or disable alarms:

1. Touch the ON or OFF key to the right of the alarm you want to enable/disable.

   Touching the ALL ON key enables all alarms on the NARKOMED 4's monitoring system.

   Touching the ALL STBY key puts all alarms in the standby mode.

SpO2 **98**	100 / 90	OFF / ON			ALARMS
PULSE **64**	100 / 70				SYSTEM FUNCTIONS
O2 **40**	100 / 30		ALL STBY		AUTO LOG
ETCO2 **33**	40 / 30	OFF / ON	ALL ON		
ISO **2.6**	4.0 / 0	OFF / ON	DEFAULT		DATA SCAN
NIBP SYS **124**	180 / 100		AUTOSET WIDE		
PRES **28**	50 / 12	OFF / ON	AUTOSET NARROW		CHECK OUT
MIN VOL **8.1**	3.0	OFF / ON	SAVE DEFAULTS		SERIAL PORTS

OP10027

System Functions Configuration Screen

In the System Functions Configuration screen, you can set the time and date, the audio alarm volume, the NIBP annunciator volume, and the sweep speed.

Setting Time and Date

To set the time or date:

1. Touch the key for the item you want to change.

2. Turn the selection dial to change the value as desired.

		ALARMS
TIME	10 : 26	SYSTEM FUNCTIONS
DATE	SEP - 12 - 1989	AUTO LOG
ALARM VOLUME		
		DATA SCAN
SWEEP SPEED	FAST SLOW	
NIBP VOLUME		CHECK OUT
		SERIAL PORTS

OP10028

Setting the Alarm Volume

To adjust the audio alarm volume:

1. Touch the ALARM VOLUME key. A sample tone is generated to assit in setting the volume level.

2. Turn the selection dial to the desired volume.

3. Press the selection dial, or select another function or screen, to set the volume level.

Setting the Sweep Speed

The sweep speed selects the sweep rate of the monitor traces. To adjust the sweep speed, touch the FAST or SLOW key.

Setting the
NIBP Volume

To adjust the NIBP volume:

1. Touch the NIBP VOLUME key. A sample tone is generated to assit in setting the volume level.

2. Turn the selection dial to the desired volume.

3. Press the selection dial, or select another function or screen, to set the volume level.

Auto Log
Configuration
Screen

The Auto Log Configuration screen lets you set the criteria that determine when an event is automatically entered in the data log. You can configure the settings to log an event when one or more of the following occur:

- a warning alarm
- a caution alarm
- an NIBP measurement
- a preselected time interval passes (1, 2, 5 or 10 minutes)

OP10029

To enable the auto log function for any of these criteria, touch the ON key for one or more options by which you want to automatically log data.

Setting the Time Interval

To adjust the time interval function:

1. Touch the interval setting.

2. Turn the selection dial to change the value.

3. Press the selection dial to enter the new value.

Datascan Configuration Screen

In the Datascan Configuration screen, you can set bar graph boundaries for the six measurements shown on the Datascan display.

Below each measurement are four keys; each is labeled with a different range limit for the range selections. To select a range, touch the key for the desired limit. You can select a range for each measurement (bar graph).

							ALARMS
TOUCH DESIRED MAXIMUM DEVIATION							SYSTEM FUNCTIONS
FOR EACH DATASCAN MEASUREMENT							
MMHG	%	%	%	/MIN	MMHG		AUTO LOG
CO_2	AGENT	O_2	SpO_2	PULSE	NIBP		
+ 5 −	+ 1 −	+ 10 −	+ 2 −	+ 10 −	+ 10 −		
+ 10 −	+ 2 −	+ 20 −	+ 5 −	+ 20 −	+ 20 −		DATA SCAN
+ 15 −	+ 3 −	+ 30 −	+ 10 −	+ 50 −	+ 50 −		
+ 20 −	+ 4 −	+ 40 −	+ 15 −	+ 75 −	+ 75 −		CHECK OUT
							SERIAL PORTS

OP10030

Checkout Screen

The Checkout screen displays the preuse checklist. This is the same screen available from the Power-On screen (after system diagnostics are complete).

To page through the checklist, touch the NEXT key.

```
PRE-USE CHECKLIST                                    PAGE 1        │ ALARMS │

CONSULT PRE-USE CHECKOUT PROCEDURE IN OPERATOR MANUAL
FOR DETAILED PROCEDURES.                                           │ SYSTEM │
                                                                   │.FUNCTIONS│
  - VERIFY CONNECTION OF PROPER PIPELINE SUPPLIED GASES.

  - CHECK PIPELINE SUPPLY PRESSURES: 50 - 55 PSI                   │ AUTO │
                                                                   │ LOG  │
  - VERIFY CONNECTION OF PROPER CYLINDER SUPPLIED GASES.

  - CHECK CYLINDER SUPPLY PRESSURE:
        02-2200 PSI N2O-745 PSI

  - CHECK FOR SUFFICIENT SUPPLY OF LIQUID ANESTHETIC:
        MUST BE BETWEEN MIN AND MAX FULL MARKING.                  │DATA SCAN│

  - VERIFY TIGHTNESS OF VAPORIZER FILLER
        AND DRAIN VALVES.

  - VERIFY FUNCTION OF FLOWMETERS:
        FLOAT MUST MOVE FREELY OVER FULL RANGE.

                                                                   │CHECK OUT│

                                           │ NEXT │                │ SERIAL │
                                                                   │ PORTS  │
```

OP10013

Serial Ports Configuration Screen

In the Serial Ports Configuration screen, you can configure the serial ports (A, B, C, and D) on the back of the NARKOMED 4.

To adjust a port's configuration:

1. Touch the key for the port and variable setting you want to configure (for example, PORT C BAUD RATE).

2. Rotate the selection dial to select the desired setting.

You can configure the serial ports with the following values:

Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19.2 K, or 38.4 K
Parity	ODD, EVEN, or NONE
Stop Bits	1 or 2
Data Bits	7 or 8
Device Type	NONE, VITALINK, OR/LINK, MECIF, or SPACELAB LOGGER

PORT	A	B		C	D	
						ALARMS
						SYSTEM FUNCTIONS
BAUD RATE	300	9600		2400	9600	AUTO LOG
PARITY	EVEN	NONE		NONE	NONE	
STOP BITS	1	1		1	1	DATA SCAN
DATA BITS	7	8		8	8	
DEVICE TYPE	VITA LINK	SPACELAB LOGGER		OR/ LINK	MECIF	CHECK OUT
						SERIAL PORTS

OP10031

Overview

The NARKOMED 4's pulse oximetry monitoring allows noninvasive monitoring of both arterial oxygen saturation (SpO$_2$) and pulse rate via a spectrophotometric transmission sensor applied to the patient's finger (optional sensors may be applied at different sites). The sensor incorporates two low-power LED light sources and a photodetector.

Two wavelengths of transmitted light illuminate the tissue under the probe. They are absorbed differently by the oxyhemoglobin and deoxyhemoglobin; these light transmissions are read by the photoreceptor and converted to electrical pulses that represent absorbance. From these electrical pulses, the monitor calculates both the percentage of available hemoglobin that is saturated with oxygen and the pulse rate.

NOTE: The NARKOMED 4 calculates the arterial hemoglobin oxygen saturation as a percentage of total functional hemoglobin, (that is, hemoglobin available to transport oxygen). Significant levels of dysfunctional hemoglobin (for example, carboxyhemoglobin, methemoglobin) may cause an inaccurate measurement.

The pulse oximetry display area shows numerical and graphical data for oxygen saturation and pulse rate. The pulse oximetry real-time values for oxygen saturation (SpO$_2$) and pulse rate (PLS) appear on the left side of measurement display area. The display range for SpO$_2$ is 0–100% with a resolution of 1%, and the display range for pulse rate is 35–250 beats per minute with a resolution of 1 beat per minute.

An audible tone is generated with each pulse beat. The pitch of the of the tone depends on the oxygen saturation value at the time: the higher the satuartion value, the higher the pitch. When no pulse oximetry data is available, the trace/trend area is blank. If the NIBP cuff is placed on the same arm as the pulse oximeter, no trace appears during cuff inflation.

The ALARM STBY key is highlighted when the machine is turned on, indicating that the visual and audible SpO$_2$ related alarms are disabled. When an SpO$_2$ pulse is first read, the ALARM STBY key changes to ALARM OFF and the ALARM ON key is highlighted. Once the alarms are turned on, they can be set to standby only by selecting the ALL STANDBY key in the Alarms Configuration Screen (see *System Configuration Screens* for details). The area above the alarm touch keys is reserved for displaying up to two alarm messages. If the sensor is removed or disconnected or an oximeter hardware error occurs, numerical data is removed from the screen, the ALARM ON key is removed from the screen, and the ALARM OFF key is enabled (highlighted). When the error condition is corrected, the alarms are enabled again.

**Connecting the
Pulse Oximeter
Sensor**

When preparing for a case that includes pulse oximetry monitoring, be sure to choose a sensor that is proper for the application and location and to apply the sensor correctly.

A reuseable finger sensor is provided with the NARKOMED 4. The sensor is supplied in an individual nonsterile package. Other sensors are available (see *Spare and Replacement Parts*) that have limited reuse capability and can be applied to different sites. For more information on other sensors, consult the detailed instructions provided with each sensor.

The supplied finger sensor is recommended for relatively immobile patients who weigh more than 40 kg. This sensor is not recommended for active patients or for prolonged cases (for example, nonanesthesia applications, such as monitoring of long-term respiratory support).

The preferred site for the sensor is the index finger. If you cannot use the index finger, use another digit; however, avoid large or very small digits. (If the patient is large or obese, use a small finger.)

NOTE: Do not place the sensor on a thumb or any toe. Do not place the sensor distal to an inflated pneumatic tourniquet or on any extremity with an arterial catheter in place. Avoid placing the sensor on any extremity with a blood pressure cuff or intravascular venous line. If you must place the sensor distal to the blood pressure cuff used with the NARKOMED 4's noninvasive blood pressure monitor, you can automatically disable pulse oximetry alarms during blood pressure cuff inflation with the NIBP/SpO$_2$ Interlock.

Apply the sensor so that the cable is on the back side of the hand. This places the light source on the nail side of the finger and the detector on the underside, allowing the sensor light source to shine down through the top side of the finger. The fingertip should lightly touch the stop at the end of the soft pad on the sensor. Make sure that the sensor's side walls are not pinching the finger or causing a pressure point anywhere on the finger. If the patient has long fingernails, the fingernail tip must extend over the stop to ensure that the fingertip lightly touches the stop. Do not tape the sensor shut. For best results, the patient's hand should be at the same elevation as the patient's heart.

NOTE: Check the sensor placement frequently. The sensor must be reapplied to a different appropriate digit at least once every 4 hours, or more often if clinical conditions indicate that the site should be changed.

Regardless of clinical conditions, the sensor should not remain in the same location for more than 4 hours. Inspect the sensor site routinely to check circulatory status and skin integrity of the finger.

NOTE: Although the sensor is designed to minimize interference from ambient light, bright light sources (for example, surgical lamps and direct sunlight) may interfere with the accuracy of the measurement. If bright ambient light proves to be a problem, cover the sensor site with an opaque material, such as a towel or blanket.

SENSOR CABLE

FINGER SENSOR
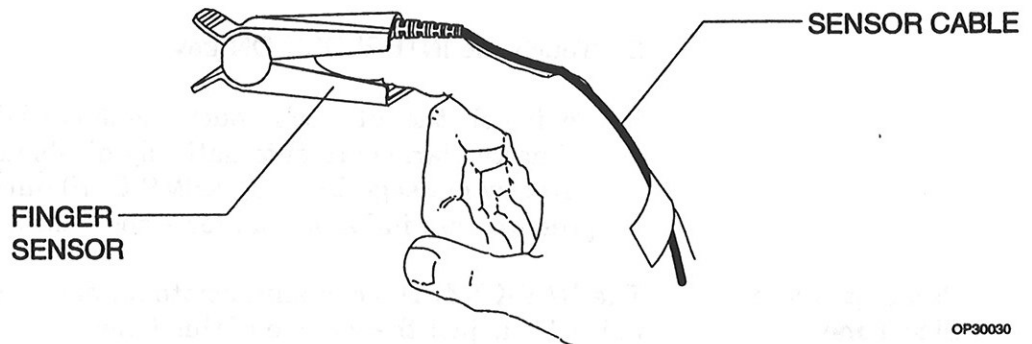
OP30030

Setting Alarms

Press the MONITOR SETUP key on the main key panel to invoke the Monitor Setup screen. Use the onscreen touch keys and selection dial to set the high and low alarm limits for oxygen saturation and pulse rate, to enable the SpO$_2$/NIBP Interlock, and to adjust the volume of the audio tone for each heartbeat.

To set pulse oximetry alarm limits:

1. Invoke the Monitor Setup screen.

2. Touch the key for the specific alarm limit which is to be adjusted. That key becomes highlighted.

3. Turn the selection dial to adjust the value.

4. Press the selection dial to set the value or select another function on the screen.

Setting SpO₂ Interlock

If you must place the finger sensor distal to the noninvasive blood pressure cuff, you can automatically disable the pulse oximetry alarms during blood pressure cuff inflation to prevent false pulse alarms.

To enable or disable the SpO₂ interlock:

1. Invoke the Monitor Setup screen.

2. Touch the INTERLOCK ON key.

3. To disable the interlock, touch the INTERLOCK OFF key. The pulse oximetry alarms are automatically disabled (indicated by the advisory message SPO2 ALARMS OFF) during noninvasive blood pressure cuff inflation and for a short duration after cuff deflation.

Adjusting Audio Pulse Tone

The NARKOMED 4 can annunciate an audio tone for each detected pulse. To adjust the volume of this tone:

1. Invoke the Monitor Setup screen.

2. Touch the TONE VOL key. A sample tone is generated to assit in setting the volume level.

3. Turn the selection dial to the desired volume.

4. Press the selection dial, or select another function or screen, to set the volume level.

Dispalying the Waveform (Trace)

To invoke the plethysmography waveform display, touch the TRACE key. The NARKOMED 4 continuously transmits a real-time trace of the pulse seen by the sensor to the pulse oximetry measurement display area. The plethysmography waveform does not represent the SpO₂ value plotted against time, but rather the changes in light absorption seen by the sensor plotted against time.

OP10032

SpO2 **98**

PLS **69**

| ALARM OFF	ALARM ON
TRACE	TREND
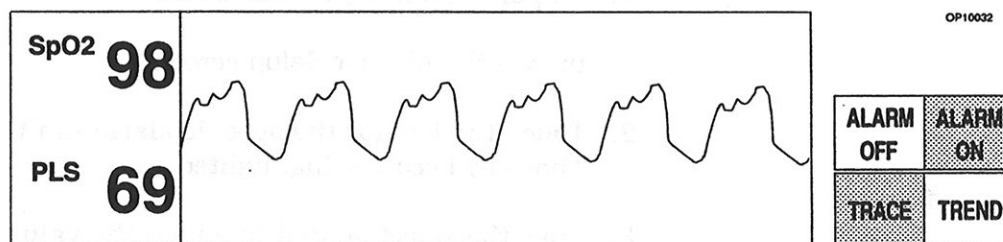
The plethysmography waveform provides a means of quickly assessing the regularity of the pulse. The pulse waveform may also be used to check the credibility of unusual SpO₂ or pulse rate measurements.

Displaying the Trend Display

To invoke the pulse oximetry trend display, touch the TREND key. This display provides up to 1 hour of the most recent readings for oxygen saturation.
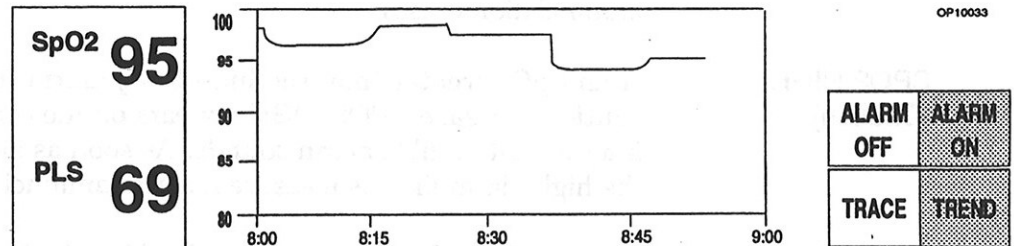
Pulse Oximetry Alarm Messages

The following list describes all warning, caution, and advisory alarms associated with pulse oximetry monitoring.

NO OXI PULSE (Warning)

If a pulse is not sensed for a period of ten seconds, the warning message NO OXI PULSE appears on the central alarm display, and a continuous audible alarm sounds. The condition is cleared as soon as a pulse is sensed. During the 10 second period in which the monitor searches for a pulse, the last valid reading obtained before beginning the pulse search is displayed.

OXI PULSE LOW (Warning)

If a pulse rate lower than the low alarm limit is measured, the warning message OXI PULSE LOW appears on the central alarm display, and a continuous audible alarm sounds. As soon as a pulse rate equal to or greater than the low pulse rate alarm limit is measured, the alarm annunciation ceases.

SPO2 LOW (Warning)

If a SpO_2 less than the low SpO_2 alarm limit is measured, the warning message SPO2 LOW appears on the central alarm display, and a continuous audible alarm sounds. As soon as a SpO_2 equal to or greater than the low alarm limit is measured, alarm annunciation ceases.

OXI PULSE HIGH (Caution)	If a pulse rate greater than the high pulse rate alarm limit is detected, the caution message OXI PULSE HIGH appears on the central alarm display, and a intermittent audible alarm sounds. As soon as a pulse rate equal to or less than the high pulse rate alarm limit is measured, the alarm annunciation ceases.
SPO2 HIGH (Caution)	If an SpO_2 greater than the high SpO_2 alarm limit is measured, the caution message SPO2 HIGH appears on the central alarm display, and an intermittent audible alarm sounds. As soon as an SpO_2 equal to or less than the high alarm limit is measured, alarm annunciation ceases.
ALARMS OFF (Advisory)	Any time the alarms have been disabled, including during sensor disconnection and the SpO_2/NIBP interlock, the advisory message SPO2 ALARMS OFF appears on the central alarm display.
SPO2 DISC (Advisory)	If a disconnection occurs at either the interface panel or between the sensor cable and interface cable, the advisory messages SPO2 SENSOR DISC and SPO2 ALARMS OFF appear on the central alarm display, and a single tone alarm sounds.
SERVICE SPO2 MON (Advisory)	If an internal electronics failure that may prevent proper operation is detected, the advisory message SERVICE SPO2 MON and SPO2 ALARMS OFF appears on the central alarm display. If this happens, contact an authorized North American Dräger service representative.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Blank display area, and SPO2 SENR DISC and ALARMS OFF alarm messages	Sensor disconnection	Check connections at interface panel cable and between sensor cable and interface panel.
SERVICE SPO2 MON alarm message on central alarm display	Internal electronics failure	Contact NAD service representative.
SpO_2 measurement does not agree with laboratory blood gas determination	Lab instrument used is multiwavelength type and reports "fractional" saturation	Monitor measures SpO_2 as a percentage of functional hemoglobin. Convert fractional measurement to functional measurement.
SpO_2 pulse rate measurements are erratic	Excessive patient motion	Make sure sensor is securely applied.
	Interference from Electrostatic Unit activation	Move Electrostatic Unit leads away from interface cable and sensor cables.
	Damaged sensor	Replace sensor.
	Patient has poor peripheral perfusion	Use different type of sensor if possible.
	Interference from ambient light sources	Shield sensor from ambient light sources.
Pulse rate measurement does not correlate with other monitors	Excessive patient motion	Make sure sensor is securely applied.

Overview   Inspiratory oxygen concentration is measured using a dual galvanic cell sensor, which is attached to the inspiratory valve dome.

The oxygen analysis display area is located in the central part of the left side of the main display.

Setting Alarms   To set alarms, you must enter the Monitor Setup screen. To go to the Monitor Setup screen, press the MONITOR SETUP key on the main key panel. In this screen, you can use the on screen keys and the selection dial to set the high and low alarm limits for oxygen concentration and to initiate an oxygen sensor calibration.

To adjust oxygen concentration alarm limits:

1. Invoke the Monitor Setup screen

2. Touch the key for the specific alarm limit which is to be adjusted. That key becomes highlighted.

3. Turn the selection dial to adjust the value.

4. Press the selection dial to set the value or select another function on the screen.

Calibrating Oxygen Sensor

To be calibrated correctly, the sensor must be exposed to room air. Calibration for the oxygen sensor should be performed as part of the daily, preoperative setup of the anesthesia equipment.

To calibrate the oxygen sensor:

1. Remove the sensor assembly from the inspiratory valve dome and plug the dome with the inspiratory valve dome plug. (Do not disassemble the sensor assembly further.)

2. With the sensor cap off the sensor assembly, hold the sensor assembly away from any open part of the patient breathing system and away from any gas fittings to ensure that the sensor avoids the influence of breathing system gases and is exposed only to the 21% oxygen concentration normally found in ambient air.

3. When the sensor is exposed to room air only, press the MONITOR SETUP key on the main key panel.

4. Touch the O2 CAL key on the carbon dioxide and oxygen display area. The oxygen value on the display disappear.

   The length of time that the sensor takes to calibrate depends on the gas mixture which the sensor was exposed to before calibration. If the sensor was exposed to 21% oxygen for longer than one minute, calibration can take as little as 10 seconds. If the sensor was exposed to higher concentrations of oxygen, calibration may last up to 50 seconds. Typically, calibration lasts less than 30 seconds.

5. When the NARKOMED 4 has completed calibration, the oxygen value (21) reappears on the display. Pull the inspiratory valve dome plug and reinsert the sensor assembly.

If, at the end of the calibration period, the display area remains blank, the calibration was not successful. (This condition is also indicated by the advisory messages O2 SENSOR ERROR, O2 NOT CALIBR, and O2 ALARMS OFF.)

An unsuccessful calibration can be caused by any of the following conditions:

- *A sensor exposed to an excessively lean or excessively rich oxygen calibration mixture.* Make sure that the sensor is exposed only to room air for the entire calibration period.

- *A sensor exposed to a constantly changing calibration mixture.* As above, make sure that the sensor is exposed only to room air for the entire calibration period.

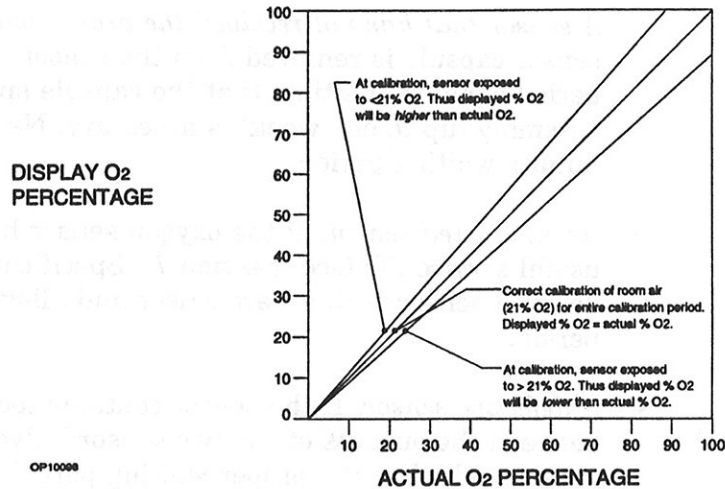**NOTE:** In this instance, the O2 SENS ERR message is replaced by O2 CAL ERR.

- *A sensor that has not received the proper waiting period.* When the sensor capsule is removed from the sensor assembly, a waiting period equal to the time that the capsule spent outside the sensor assembly (up to one week) is necessary. New sensors require a 15-minute waiting period.

- *An exhausted sensor.* If the oxygen sensor has decayed beyond its useful service life (see "Section 7 - Specifications"), replace the decayed sensor with a new sensor and allow the proper waiting period.

- *A defective sensor.* If the sensor contains too great a difference between the outputs of the two sensor halves, replace it with a new sensor and allow the proper waiting period.

- *A disconnected sensor.* If the sensor is disconnected, the display area is blank and the messages O2 SENSOR DISC, O2 NOT CALIBR, and O2 ALARMS OFF appear on the alarm display. When this happens, reconnect the sensor cord to the interface panel on the NARKOMED 4 and recalibrate the sensor.

During normal operation, the NARKOMED 4 may sense that a calibration procedure is required and advise the you to calibrate the oxygen sensor as soon as it is convenient.

If the oxygen sensor is improperly calibrated, its measurements may not be accurate. When a calibration gas mixture is excessively rich or lean in oxygen, the NARKOMED 4 will not complete an attempted calibration; however, if the calibration gas is rich or lean but is within certain limits, the NARKOMED 4 will complete the calibration. As a result, when displaying sensor measurements, the NARKOMED 4 displays an oxygen percentage either greater or less than the actual oxygen percentage. Therefore, make sure the sensor is exposed only to room air during the entire calibration period.

The following illustration illustrates the relationship between the calibration mixture and the accuracy of oxygen measurement.

Figure labels:
- DISPLAY O2 PERCENTAGE (vertical axis)
- ACTUAL O2 PERCENTAGE (horizontal axis)
- At calibration, sensor exposed to <21% O2. Thus displayed % O2 will be *higher* than actual O2.
- Correct calibration of room air (21% O2) for entire calibration period. Displayed % O2 = actual % O2.
- At calibration, sensor exposed to > 21% O2. Thus displayed % O2 will be *lower* than actual % O2.
- OP10098

Displaying Oxygen and Carbon Dioxide Concentration

Inspiratory oxygen concentration (O2) is displayed on the left side of the measurement display area, along with carbon dioxide concentration. The display range for oxygen is 0–100% with a resolution of 1%.

The upper right area of the measurement display is reserved for displaying up to two alarm messages. Only one oxygen alarm message is displayed at a time.

Display showing:
- CO2 43
- 2
- O2 40
- ALARM OFF
- ALARM ON
- TRACE
- TREND
- OP10035
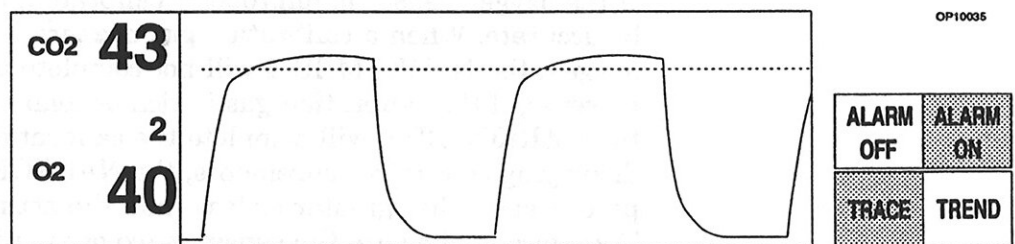
Oxygen Alarm Messages

The following list describes all warning, caution, and advisory alarms associated with oxygen monitoring.

INSP O2 LOW (Warning)

The NARKOMED 4 continuously compares the current inspiratory oxygen percentage with the preset low oxygen alarm limit. If the measured oxygen concentration falls below the low alarm limit, the warning message INSP O2 LOW appears on the central alarm display, and a continuous audible alarm sounds.

INSP O2 HIGH (Advisory)

If the measured inspiratory oxygen concentration exceeds the preset high alarm limit, the advisory message INSP O2 HIGH appears on the central alarm display and a single-tone audible alarm sounds.

CAL O2 SENSOR (Advisory)

When the oxygen sensor enters a noncalibrated state or the NARKOMED 4 is unable to calibrate the oxygen sensor or more than 18 hours have elapsed since the last calibration, the advisory message CAL O2 SENSOR appears on the central alarm display.

O2 SENSOR DISC (Advisory)

If the oxygen sensor cord becomes disconnected (or is damaged enough to cause an open circuit), the advisory message O2 SENSOR DISC appears on the central alarm display and a single-tone audible alarm sounds.

SERVICE O2 MON (Advisory)

If the NARKOMED 4 detects an internal electronic failure that would prevent proper operation, the advisory message SERVICE O2 MON appears on the central alarm display. If this happens, contact an authorized North American Dräger service representative.

REPLACE O2 CELL (Advisory)

During oxygen sensor calibration and monitoring, the NARKOMED 4 checks for a difference between the outputs of the two sensor channels. If the difference exceeds a predetermined percentage, the advisory message REPLACE O2 CELL appears on the central alarm display.

During oxygen sensor calibration, the NARKOMED 4 also checks the sensor's output against a range of acceptable output voltages. There are three possible causes for deviation from within this range:

- *Exhausted sensor* - If the sensor's capacity is exhausted, its output voltage will not meet the required minimum.

- *Incorrect environment* - If the operator exposes the Calibration sensor to an excessively rich or lean oxygen mixture during calibration, the sensor's output will either exceed or fall below the acceptable output range.

- *Improper waiting period* - If the operator doesn't allow for a proper waiting period for a new sensor or for a sensor removed from the sensor housing, the sensor's output can either exceed or fall below the acceptable output range.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Display area remains blank when a reading is expected. O_2 NOT CAL and O_2 ALRM OFF message on central alarm display.	Needs calibration	Perform proper calibration. Remove sensor from breathing circuit. Make sure sensor is exposed to room air only.
O_2 analyzer fails to retain calibration. Alarm message O_2 NOT CAL appears on central alarm. Monitor continues to function but no data is reported.	Backup memory power not available	Allow backup battery to recharge and recalibrate the analyzer.
	Hardware malfunction	Contact NAD service representative.
Pressing O_2 CAL key does not initiate calibration.	Sensor is disconnected	Reconnect sensor cord to input receptacle on anesthesia machine.
	Sensor cord is damaged	Replace housing/cord assembly.

| PROBLEM	POSSIBLE CAUSE	REMEDY
Pressing O2 CAL key initiates calibration, but display window remains blank at end of calibration period	Sensor is exposed to incorrect oxygen concentration	Expose sensor to room air for 21% calibration.
	Sensor exposed to constantly changing calibration mixture	
	Sensor capsule was removed from housing for a prolonged period	Allow a waiting period equal to duration of capsule removal.
	New capsule not given proper waiting period	Allow a 15 minute waiting period.
	Exhausted or defective sensor capsule	Replace sensor capsule. Allow a 15 minute waiting period.
O2 SENSOR DISC, and CAL O2 SENSOR messages appear on central alarm display during monitoring	Defective sensor housing and cable	Replace housing/cable assembly.
	Sensor cord is disconnected	Reconnect sensor cord to input receptacle on anesthesia machine.

Overview

The NARKOMED 4 measures carbon dioxide concentrations with a nondispersive infrared analyzer, using a side-stream sample withdrawn at the Y-piece. The sample flow rate is set at 200 ml/min; it is not adjustable.

The carbon dioxide display area is located in the central part of the left side of the main display. It shows numerical and graphical carbon dioxide data.

Real-time values for inspiratory and end-tidal carbon dioxide along with the inspiratory oxygen concentration appear on the left side of the carbon dioxide display area. End-tidal carbon dioxide is displayed in large numerals; inspiratory carbon dioxide is displayed in small numerals. The end-tidal display range is 0–80 mmHg with a resolution of 1 mmHg. The carbon dioxide numerical inspiratory data measurement range is 0–76 mmHg with a resolution of 1 mmHg. For reference, a dashed line is displayed on the graphical waveform data screen at 40 mmHg.

NOTE: When the sample line is connected to the fresh gas outlet, the message FRESH GAS CIRCUIT ENABLED appears in the carbon dioxide and agent trace windows.
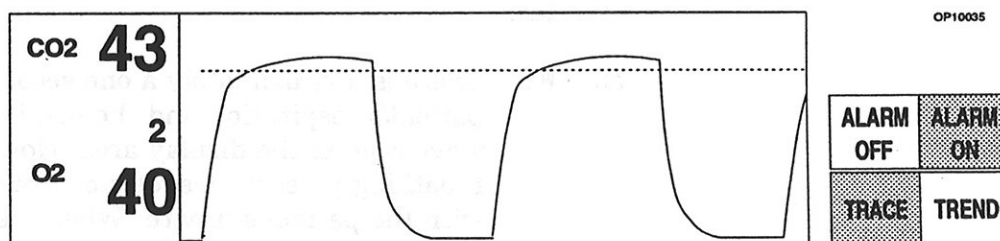
To enable the carbon dioxide alarms, touch the ALARM ON key on the right side of the display area. To disable the carbon dioxide alarms, touch the ALARM OFF key. You can adjust alarm limits in the Monitor Setup screen or in the Alarms Configuration screen (see "Section 5 - Operation, Monitoring System" for more details).The area above the alarm touch keys is reserved for displaying up to two alarm messages, one of which may be an oxygen alarm message.

For the first 3 minutes after power-up, the message CO2 TRACE WILL BE AVAILABLE AT HH:MM appears in the carbon dioxide trace/trend window. (HH = hour; MM = minute. This time is derived by adding 4 minutes to the system clock setting on power-up.) Because the alarms are disabled during this period, the ALARM ON key does not appear on the screen, and the ALARM OFF key is highlighted.

After the initial delay time has elapsed, the carbon dioxide waveform appears in the window, but no numerical data is displayed. The word WAVEFORM appears to the right of the CO2 label. When the first calibration is complete, the word WAVEFORM is replaced with the applicable numerical data. If no carbon dioxide is detected while the monitor is in the WAVEFORM mode, the ALARM OFF/STBY key is set to ALARM STBY, and the ALARM ON key is displayed. As soon as the monitor detects an end-tidal reading of at least 5 mmHg, the ALARM ON key is enabled (highlighted), and the ALARM STBY key changes to ALARM OFF. After the alarms are turned on, they can be set to standby only by selecting the ALL STANDBY key in the Alarms Configuration screen (see "Section 5 - Operation, Monitoring System" for details).

If a carbon dioxide or agent error is detected, the ALARM ON key and carbon dioxide waveform are removed, and the message DATA WILL BE AVAILABLE IN HH:MM is displayed (HH = hour; MM = minute). The ALARM ON key is also removed from the screen every time a carbon dioxide calibration is performed.
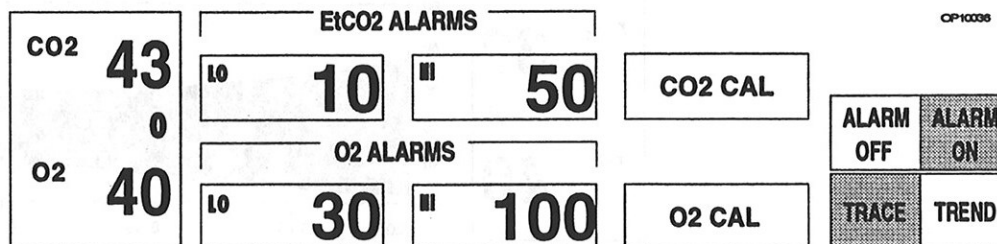
The monitor calibrates itself 8 minutes after the system is turned on. Another calibration occurs 7 minutes later (15 minutes after the system is turned on), and then again 15 minutes later (30 minutes after the system is turned on). Thereafter, a calibration is performed every 60 minutes.

NOTE: There is approximately a one-second delay between the patient's respiration and the display of the carbon dioxide waveform on the display area. However, expiratory flow and breathing pressure waveforms are displayed simultaneously with the patient's breath. When displaying the carbon dioxide waveform with either the expiratory flow or breathing pressure waveform, there will be a misalignment on the time scale (the display's X axis), even though both waveforms provide information about the same breath.

Setting Alarms

Press the MONITOR SETUP key on the main key panel to display the Monitor Setup screen. Use the on screen keys and the selection dial to set the high and low alarm limits for end-tidal carbon dioxide and sample flow.

OP10036

| CO2 **43**	EtCO2 ALARMS		CO2 CAL	ALARM OFF	ALARM ON
0	LO **10**	‖ **50**			
O2 **40**	O2 ALARMS		O2 CAL	TRACE	TREND
	LO **30**	‖ **100**			

To set carbon dioxide alarm limits:

1. Touch the key for the specific alarm limit.

2. Turn the selection dial to adjust the value.

3. Press the selection dial to enter the new value.

Carbon Dioxide Calibration

To perform a zero calibration of the gas analyzer, touch the CO2 CAL key. During calibration, message CO2 CALIBRATION IN PROGRESS appears in the carbon dioxide and agent trace/trend windows and all numeric values are removed from the display. Upon completion of the calibration numeric data returns, and the analyzer will not calibrate again for at least 5 minutes (2 minutes, if halothane is being used).

**Displaying the Waveform (Trace)**

To invoke the carbon dioxide waveform display, touch the TRACE key. A carbon dioxide waveform trace provides a means for a visual check of the patient's ventilation and of the patency of the patient breathing system. The study of the shape of the trace (capnography) can also provide diagnostic information about the patient's circulation and metabolism.

OP10035
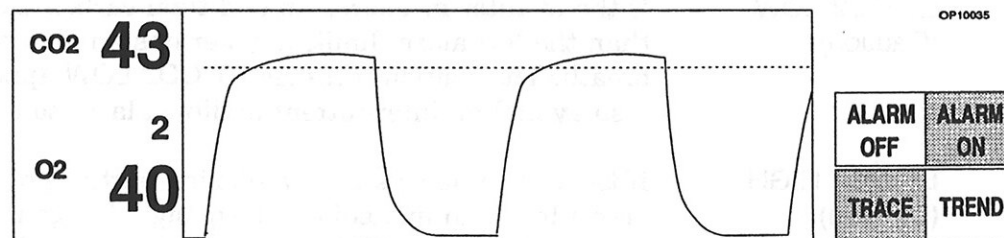
The resolution for the carbon dioxide waveform is 1 mmHg through its 0–50 and 80 mmHg range. When no carbon dioxide trace data is available, the trace/trend display shows a moving cursor at the baseline of the display area.
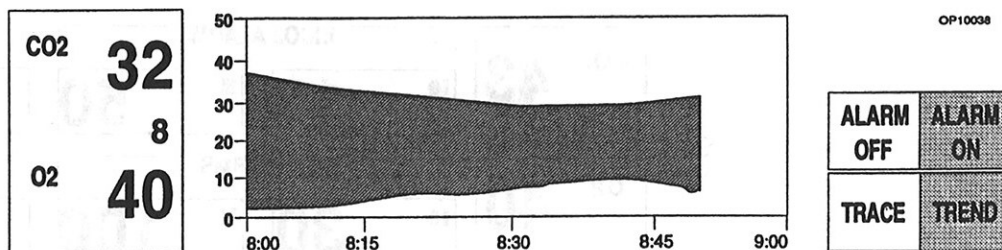
Displaying the Trend

To display the carbon dioxide trend, touch the TREND key. The carbon dioxide trend display provides up to one hour of the latest information for inspiratory and end-tidal carbon dioxide. The trend appears as a shaded area with end-tidal values at the top and inspiratory values at the bottom.

Carbon Dioxide Alarms Messages

The following list describes all warning, caution, and advisory alarms associated with carbon dioxide monitoring.

APNEA - CO2 (Warning & Caution)

If the instantaneous carbon dioxide partial pressure does not cross an internally computed threshold for a period of 15 seconds, the caution message APNEA - CO2 appears on the central alarm display and an intermittent audible alarm sounds.

If the condition persists for an additional 15 seconds (30 seconds total), a continuously repeating audible alarm sounds, the end-tidal carbon dioxide value is blanked, and the caution message APNEA - CO2 is upgraded to a warning on the central alarm display.

Note: If an apnea condition exists and the alarms are on, the analyzer will stay in the warmup mode.

ET CO2 LOW (Caution)

If the monitor measures an end-tidal carbon dioxide partial pressure less than the low alarm limit, it generates an alarm signal at the end of the breath. The caution message ET CO2 LOW appears on the central alarm display and an intermittent audible alarm sounds.

ET CO2 HIGH (Caution)

If the instantaneous carbon dioxide partial pressure exceeds the high alarm limit, an immediate alarm signal is generated. The caution message ET CO2 HIGH appears on the central alarm display and an intermittent audible alarm sounds.

INSP CO2 HIGH
(Advisory)

If the inspiratory carbon dioxide partial pressure exceeds 5 mmHg, the advisory message INSP CO2 HIGH appears on the central alarm display.

LINE BLOCK
(Advisory)

If the sample line becomes blocked, the NARKOMED 4 disables CO_2 alarms after 15 seconds, as noted by the highlighted ALARM OFF key. The advisory message LINE BLOCK appears on the central alarm display and the carbon dioxide display area is blanked.

Occlusion can be caused by a full water trap reservoir, water in the sample line, or a kinked sample line.

CO2 ALARMS
OFF (Advisory)

Any time the carbon dioxide alarm is disabled with the ALARM OFF key, and during the automatic three-minute disable period, the advisory message CO2 ALARMS OFF appears on the central alarm display.

CO2/AGENT
ERROR
(Advisory)

If the NARKOMED 4 detects an internal electronics failure that precludes proper carbon dioxide and agent monitoring, the advisory message CO2/AGENT ERROR appears on the central alarm display and all numeric data and waveforms for carbon dioxide and agent are removed from the display. There is a delay of approximately 6 minutes before the information is redisplayed while and the monitor attempts to clear the error and resume normal operation.

If the error is not cleared, refer to "Troubleshooting" later in this section.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Unusually low End-tidal and Inspiratory CO_2 readings	Leak in sample line, between line connections, or between water trap and mounting bracket (room air dilutes sample)	Make sure all connections are tight and sample line is intact.
	Multiple Gas Analyzer needs to be zero calibrated	Perform zero calibration.
Slow response	Occlusion in adapter, sample line, or water trap reservoir	Replace occluded component.
Dashes during patient monitoring	Sample line disconnected	Reconnect sample line.
	Zero calibration in progress	Wait until calibration procedure is over.
CO2/AGT ERR message on central alarm display	Internal fault	Contact NAD service representative.
	Wrong agent selected	Select correct agent.
	Span calibration required	Perform span calibration.

PROBLEM	POSSIBLE CAUSE	REMEDY
Periodic pump noise	Occlusion in adapter, sample line, or water trap	Replace occluded component.
	Zero calibration in progress	Wait until calibration procedure is over.
LINE BLOCK message on central alarm display	Sample flow is less than 75 ml/min	Increase the sample flow setting in the Monitor Setup screen.
	Blocked filter, full water trap reservoir, water in the sample line, kinked sample line, blocked exhaust, and/or missing sample line	Check for each condition. Replace occluded component(s) and unkink lines.

Overview

The NARKOMED 4 uses oscillometric means to noninvasively measure the patient's systolic, diastolic, and mean arterial blood pressure, as well as the pulse rate. The oscillometric method employs a pressure cuff without transducers and microphones. Instead, a pressure transducer and microprocessor within the monitor translate cuff pressure oscillations into blood pressure readings. A full range of blood pressure cuffs, from neonatal through large adult is supported. To ensure proper readings, only North American Dräger cuffs should be used.

The NIBP display area, located at the bottom left side of the main display, shows numerical and graphical information from periodic blood pressure measurements.

The left side of the NIBP measurement display area contains the following information. Display ranges are noted where they apply. Resolution for pressure readings is 1 mmHg.

- Systolic blood pressure (adult: 60–260 mmHg; neonatal: 40–260 mmHg)

- Diastolic blood pressure (adult: 25–260 mmHg; neonatal: 15–260 mmHg)

- Mean blood pressure (adult: 35–260 mmHg; neonatal: 25–260 mmHg)

- Instantaneous cuff pressure, shown as a bar graph

- Numeric value for instantaneous cuff pressure (during inflation only)

- Sample age (elapsed time since last measurement), shown numerically and as a pie graph

- Pressure mode selection (adult or neonatal)

OP10040A

NIBP **112**	TIME	SYS / DIAS	MEAN	PULSE		
108	8:30	145 / 75	95	68		
	8:35	127 / 70	90	65		
ADULT 100	8:40	117 / 60	90	68	START	STOP
04:58	8:45	115 / 60	87	67		
60	8:50	112 / 60	100	69	STAT	

When a measurement is in progress, the instantaneous cuff pressure is shown as a vertical bar. The numeric value of the cuff pressure is displayed directly below the NIBP label.

The sample age both is given numerically and depicted as a pie graph with respect to the preset sample interval at the bottom left corner of the display area. For example, if it has been 10 minutes since the last measurement and the sample interval has been set to 15 minutes, the sample age display will indicate an age of 10 minutes and two-thirds of the pie graph will be filled, indicating a relatively old sample. The NIBP mode, ADULT or NEO, appears directly above the numerical value.

The middle portion of the display area shows the NIBP log display. The NIBP log display consists of a tabular listing of NIBP measurements, including the time at which the measurement occurred, the systolic, diastolic, and mean blood pressure, and NIBP pulse (range: 40-250 BPM with a resolution of 1 BPM). Each time the monitor completes a reading, it sounds a single tone. The NIBP log can store up to 50 events (readings), which you can scroll through by turning the selection dial.

Selecting the Noninvasive Blood Pressure Cuff

When preparing for a case that includes noninvasive blood pressure monitoring, be sure to choose the correct cuff size and mode and to place the cuff correctly. Use the following table to select the appropriate cuff size and NIBP measurement mode. If you don't have a tape measure, use the INDEX and RANGE lines marked on the cuff as described in "Placing the Cuff," later in this section.

Cir. (cm) 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 25 30 35 40 45 50 55 60 65 70

Disposable Cuff:
- Neonatal#10 3-6cm
- Neonatal#11 6-9.5cm
- Neonatal#12 8-12cm
- Neonatal#13 9-14cm

Nondisposable Cuff:
- Newborn 6-11cm
- Infant 10-19cm
- Pediatric 18-26cm
- Adult 25-35cm
- Large Adult 33-47cm
- Thigh 46-66cm

Mode: Neonatal | Adult

When using the neonatal, newborn, or infant cuff size, you must select the neonatal NIBP measurement mode in the Monitor Setup screen (see "Selecting the Measurement Mode" later in this section).

The neonatal mode should be used only for patients with a limb circumference of less than 14 centimeters; using the neonatal mode with larger cuffs for larger patients may produce unreliable measurements. When using the pediatric, adult, large adult, or thigh cuff, you must select the adult mode. You must also select the adult mode for infants who have a limb circumference greater than 14 cm, even if they require an infant cuff.

Placing the Cuff

To apply the pressure cuff:

1. Place the center of the cuff inflation bag over the artery (for the brachial artery, place the bag on the inside of arm, above the elbow).

2. Make sure the cuff fits securely on the limb and that the INDEX line falls between the two RANGE lines. If the INDEX line does not fall between the RANGE lines, select a smaller or larger cuff. The cuff can be used on either a left or right extremity, but the left is preferred.

   NOTE: Do not place the cuff on a limb being used for infusion.

The cuff should be positioned at the same level as the patient's heart for an accurate measurement. Placing the cuff above the heart causes the reading to be falsely low; placing the cuff below the heart causes the reading to be falsely high. In instances when you cannot place the cuff at the same level as the heart, use the following general rule:

- For every inch above the heart, add 1.8 mmHg to the reading.

- For every inch below the heart, subtract 1.8 mmHg from the reading.
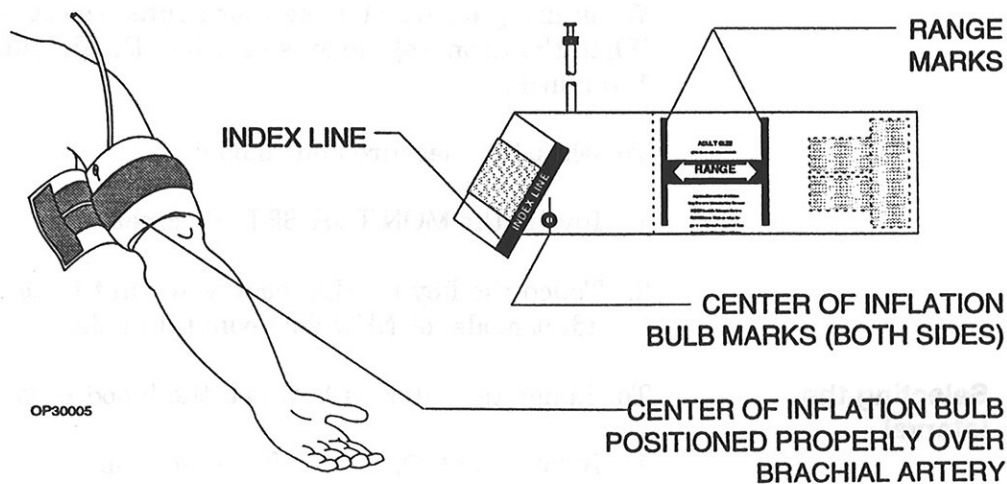
OP30005

INDEX LINE

RANGE MARKS

CENTER OF INFLATION BULB MARKS (BOTH SIDES)

CENTER OF INFLATION BULB POSITIONED PROPERLY OVER BRACHIAL ARTERY

Setting Alarms

Press the MONITOR SETUP key on the main key panel to invoke the Monitor Setup screen. Using the onscreen touch keys and selection dial, you can set high and low alarm limits for systolic pressure, select the measurement mode (adult or neonatal), select initial inflation pressure, and configure the time interval between measurements.

NIBP 112	**SYSTOLIC ALARMS** LO **60** HI **150**	**MODE** ADULT NEO	OP10041
ADULT 100 02:50 ⏲ **60**	**INFLATION PRESSURE** AD **180** NE **110**	**INTERVAL** 10 MIN	START STOP STAT

To set NIBP alarm limits:

1. Invoke the MONITOR SETUP screen.

2. Touch the key for the specific alarm limit which is to be adjusted. That key becomes highlighted.

3. Turn the selection dial to change the value.

4. Press the selection dial to set the value or select another function on the screen.

Selecting Measurement Mode

The adult mode (ADULT) is the default selection and should be used with pediatric, adult, and thigh cuffs. In the adult mode, the default cuff inflation pressure is 180 mmHg. When using an infant cuff, select the adult mode and set the inflation pressure to 110 mmHg.

When using neonatal or newborn cuffs, select the neonatal mode (NEO). When the neonatal mode is selected, the default cuff inflation pressure is 120 mmHg.

To select the measurement mode:

1. Invoke the MONITOR SETUP screen.

2. Touch the key for the mode you want to select. Chose ADULT for adult mode, or NEO for neonatal mode.

Selecting the Interval

To change the interval between the blood pressure measurements:

1. Invoke the MONITOR SETUP screen.

2. Touch the INTERVAL key.

3. Turn the selection dial to choose either a larger or smaller interval time period. You can select 1–30 minutes (in 1-minute increments) for the interval. The default interval is 5 minutes.

4. Press the selection dial to set the value or select another function on the screen.

Invoking Measuring Mode

The measurement for a period equal to the selected interval is displayed. For example, if you take a measurement while the interval is set to 5 minutes, and, after 2 minutes of operation, press the STOP key to place NIBP monitoring in the standby mode, the previous reading remains in the display area for approximately 3 more minutes. After the time interval has elapsed, the previous reading is automatically cleared and the display area is blanked.

Automatic Mode

To invoke the automatic mode of operation:

1. Touch the START key.

2. A measurement is started the alarms are enabled. All subsequent measurements occur at the preset interval. (For more information, see "Selecting the Interval" in this section.)

Standby Mode

To invoke the standby mode:

1. Touch the STOP key.

2. The cuff is immediately deflated, measurements are suspended, and NIBP alarms are disabled.

Stat Mode

Compared to the automatic mode, the sample duration time in the stat mode is slightly reduced, and the time between samples is minimized to approximately 3 seconds. The STAT mode is automatically existed after 5 minutes. The automatic mode with the previously selected sample interval is resumed.

To invoke a maximum rate measurement mode:

1. Touch the STAT key.

2. The advisory message NIBP STAT MODE appears on the central alarm display.

To disable the stat mode, touch either the START or STOP keys.

NIBP Alarm Messages

The following list describes all warning, caution, and advisory alarms associated with noninvasive blood pressure monitoring.

NIBP SYSTOLIC LO (Caution)

If the measured systolic blood pressure falls below the low systolic alarm limit, the caution message NIBP SYSTOLIC LO appears on the central alarm display and an intermittent audible alarm sounds. You can manually disable the low systolic blood pressure alarm by touching the STOP key to enter the standby mode.

NIBP SYSTOLIC HI (Caution)

If the measured systolic blood pressure exceeds the high systolic alarm limit, the caution message NIBP SYSTOLIC HI appears on the central alarm display and an intermittent audible alarm sounds. You can manually disable the high systolic blood pressure alarm by touching the STOP key to enter the Standby mode.

CHECK BP CUFF (Advisory)

If the monitor cannot take a measurement because the cuff is improperly positioned, the advisory message CHECK BP CUFF appears on the central alarm display, and the monitor reattempts the reading. If after three tries no reading can be obtained, the monitor will wait until the sample time interval has elapsed and try again. The message is cleared when the next interval starts, when you touch the START or STAT key between intervals, or when a valid measurement is taken.

BP CUFF MOTION (Advisory)

If the monitor cannot take a measurement because the cuff is moving, the advisory message BP CUFF MOTION appears on the central alarm display, and the monitor reattempts the reading. If after three tries no reading can be obtained, the monitor will wait until the sample time interval has elapsed and try again. The message is cleared when the next interval starts, when you touch the START or STAT key between intervals, or when a valid measurement is taken.

BP CUFF LEAK (Advisory)

If the NARKOMED 4 starts to inflate a completely disconnected or leaky cuff, the advisory message BP CUFF LEAK appears on the central alarm display and STOP is highlighted. The message is cleared as soon as you touch the START or STAT key.

IRREG NIBP PULSE (Advisory)

If the monitor cannot take a measurement because the pulse is erratic, the advisory message IRREG NIBP PULSE appears on the central alarm display, and the monitor reattempts the reading. If after three tries no reading can be obtained, the monitor will wait until the sample time interval has elapsed and try again. The message is cleared when the next interval starts, when you touch the START or STAT key between intervals, or when a valid measurement is taken.

WEAK NIBP PULSE (Advisory)

If the monitor cannot take a measurement because the pulse is weak or absent, the advisory message WEAK NIBP PULSE appears on the central alarm display, and the monitor reattempts the reading. If after three tries no reading can be obtained, the monitor will wait until the sample time interval has elapsed and try again. The message is cleared when the next interval starts, when you touch the START or STAT key between intervals, or when a valid measurement is taken.

CUFF PRES LOW (Advisory)

If the monitor cannot take a measurement due to an initial cuff inflation pressure that is too low, the message CUFF PRES LOW appears on the central alarm display, and the monitor reattempts the reading using a higher inflation pressure. (The inflation pressure is increased by 40 mmHg in the adult mode and 20 mmHg in the neonatal mode.) If after three tries no reading can be obtained, the monitor will wait until the sample time interval has elapsed and try again. The message is cleared when the next interval starts, when you touch the START or STAT key between intervals, or when a valid measurement is taken.

HIGH NIBP PULSE (Advisory)

If the monitor cannot take a measurement because of an artifact, such as movement of the arm with the cuff or a high pulse rate, the advisory message HIGH NIBP PULSE appears on the central alarm display, and the monitor reattempts the reading. If after three tries no reading can be obtained, the monitor will wait until the sample time interval has elapsed and try again. The message is cleared when the next interval starts, when you touch the START or STAT key between intervals, or when a valid measurement is taken.

LOW NIBP PULSE (Advisory)

If the monitor cannot take a measurement because the cuff is improperly positioned or pulse is low, the message LOW NIBP PULSE appears on the central alarm display, and the monitor reattempts the reading. If after three tries no reading can be obtained, the monitor will wait until the sample time interval has elapsed and try again. The message is cleared when the next interval starts, when you touch the START or STAT key between intervals, or when a valid measurement is taken.

SERVICE NIBP (Advisory)

If the NARKOMED 4 detects an internal electronic or pneumatic failure that would prevent proper operation, the advisory message SERVICE NIBP appears on the central alarm display. If this happens, contact an authorized North American Dräger service representative.

NIBP STAT MODE (Advisory)

When STAT key is touched the NIBP maximum rate measurement mode is invoked and the advisory message NIBP STAT MODE appears on the central alarm display.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
BP CUFF LEAK message on central alarm display.	Cuff hose or extension hose disconnected	Reconnect hoses.
	Excessive cuff leak	Replace cuff.
CHECK BP CUFF message on the central alarm display.	Center of inflation bag not positioned over artery	Position cuff according to instructions.
BP CUFF MOTION message on the central alarm display.	Outside "noise" interfering with measurement	Take care not to tap or squeeze cuff during measurement.
	Patient movement	Allow monitor to retry.
IRREG NIBP PULSE message on the central alarm display.	Erratic pulse	Allow monitor to retry.
WEAK NIBP PULSE message on the central alarm display.	Weak or absent pulse	Check patient condition.
CUFF PRES LOW message on the central alarm display.	Initial cuff inflation pressure selected is too low	Adjust initial cuff inflation pressure.
	Sudden change in blood pressure	Allow monitor to retry until measurement is obtained.
HIGH NIBP PULSE message on the central alarm display.	Artifact (e.g. movement of the arm with the cuff) or high pulse rate	Check patient condition if no artifacts occurred.

| PROBLEM	POSSIBLE CAUSE	REMEDY
LOW PULSE RATE message on the central alarm display.	Cuff not properly positioned or low pulse rate	Check cuff position and patient condition.
SERVICE NIBP message on the central alarm display.	Internal electronic or pneumatic failure	Contact NAD service representative.

Overview

The NARKOMED 4 monitors breathing pressure with a solid-state pressure transducer that measures and displays mean, peak, and positive end-expiratory pressure (PEEP). The display range is from -10 to at least 125 cmH_2O, with a 1 cmH_2O resolution. Pressure can be sensed at either the absorber or patient Y-piece, depending on which pilot line is used.

NOTE: The apnea alarm is automatically enabled when the ventilator power switch is turned on.

The breathing pressure display area, located in the top right area of the main display, shows numerical and graphical data for peak, mean and PEEP breathing pressure.

Real-time values for peak, mean, and positive end expiratory pressure (PEEP) appear on the left side of the breathing pressure display area. The peak pressure is the highest instantaneous pressure value for each breath. The mean pressure represents the average of all of the instantaneous pressure values recorded during each breath. The PEEP pressure is the pressure at the end of exhalation. These breathing pressure values are displayed if the data is available (that is, when the ventilator is on). If the data is not available (ventilator is off), the values do not appear.
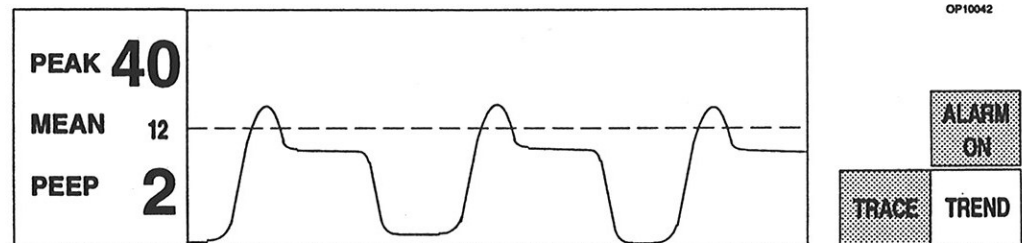
To enable the breathing pressure alarms, touch the ALARMS ON key. To disable the breathing pressure alarms, touch the ALARMS OFF key. Alarm limits can be adjusted in the Monitor Setup screen. They can also be adjusted in the Alarms Configuration screen (see Section 5 - Operation/Monitoring System "System Configuration Screens" for more information). The area above the keys is reserved for displaying up to two alarm messages.

Note: The breathing pressure alarms cannot be turned off when the ventilator is on.

The power-up default with the ventilator off is ALARM STBY (key is highlighted), which disables the visual and audible apnea pressure alarms. If the ventilator is turned on, the apnea alarms are automatically enabled; the ALARM ON key is highlighted, and the

4. Press the selection dial to enter the new value or select another function on the screen.

Selecting Auto Set

The AUTO SET key automatically adjusts the threshold pressure alarm limit to 4 cmH$_2$O below the current peak pressure within 5–30 cmH$_2$O.

Threshold Pressure Limit

If a breathing system leak or partial disconnection occurs while the threshold pressure alarm limit is set significantly lower than the peak pressure, continued positive pressure ventilation can produce a pressure fluctuation large enough to exceed the threshold (and thus satisfy the monitor's alarm), yet too small to provide adequate ventilation.

To address this problem, the breathing pressure monitor displays the advisory message THRESHOLD LO under the following circumstances:

1. If the sensed peak pressure exceeds the set threshold by more than 6 cmH$_2$O at threshold pressure alarm limit settings of 5–20 cmH$_2$O.

Displaying the Trend

To invoke the breathing pressure trend display, touch the TREND key. The breathing pressure trend display provides up to 1 hour of the latest trend information for peak, mean and PEEP pressure. The trend appears as a shaded area with the peak pressure at the top, the PEEP pressure at the bottom, and the mean pressure a clear line through the shaded area. The trend scale at power-up is 0–50 cmH$_2$O. If the pressure exceeds 50 cmH$_2$O, the scale will be automatically rescaled to 0–100 cmH$_2$O.
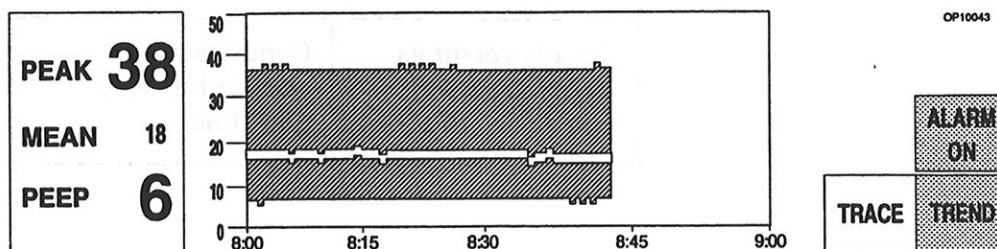
Breathing Pressure Alarm Messages

The following list describes all warning, caution, and advisory alarms associated with breathing pressure monitoring.

APNEA - PRESSURE (Warning & Caution)

If the measured breathing pressure remains below the threshold pressure alarm limit for more than 15 seconds, the caution message APNEA - PRESSURE appears on the central alarm display and an intermittent audible alarm sounds.

If the measured breathing pressure continues to remain below the threshold pressure alarm limit for an additional 15 seconds (30 seconds total), the breathing pressure display area is blanked, the caution message APNEA - PRESSURE is upgraded to a warning on the central alarm display, and a continuously repeating audible alarm sounds.

Adjust the threshold pressure alarm limit as close as possible to the patient's peak inspiratory pressure without exceeding the peak. The breathing pressure monitor advises you if the threshold pressure alarm limit is improperly set.

THRESHOLD LOW (Advisory)

The advisory message THRESHOLD LOW appears on the central alarm display if the sensed peak pressure exceeds the threshold pressure alarm limit by more than 6 cmH$_2$O at threshold pressure alarm limit settings of 5–20 cmH$_2$O, or by more than 8 cmH$_2$O at threshold pressure alarm limit settings of 21–29 cmH$_2$O. Setting the threshold pressure alarm limit at 30 cmH$_2$O disables the THRESHOLD LOW advisory.

Troubleshooting

| PROBLEM	POSSIBLE CAUSE	REMEDY
No pressure readout in display area during ventilation	Pilot line not connected	Make sure pilot line is properly connected.
	Pilot line blocked or kinked	Make sure that lumen of pilot line is free of obstructions.
Erratic readings	Condensation accumulation in pilot line	Drain and reconnect pilot line.

Overview

The NARKOMED 4 monitors respiratory volume using a positive displacement rotating-lobe impeller that generates electronic pulses in response to the patient's expiratory flow. The NARKOMED 4 converts these pulse patterns into readings for minute volume, tidal volume, and respiratory rate displays.

The respiratory volume display area, located in the middle right area of the main display, shows numerical and graphical spirometry data.

Numerical values for minute volume, tidal volume, and respiratory rate appear on the left side of the respiratory volume display. These respiratory flow and volume values are displayed if the data is available (i.e. ventilator is on). If the data is not available (i.e. ventilator is off), the values are removed from the screen.
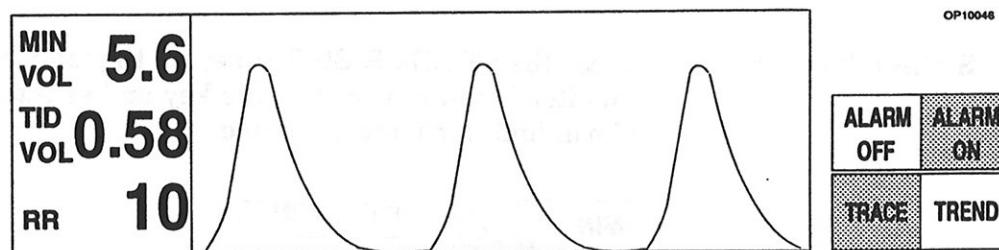
The minute volume display continuously indicates the total volume of exhaled gas accumulated during the previous minute of respiration. It represents a true measurement of the minute volume, not the result of a calculation. If a full one-minute history of exhaled volume is not available, the MIN VOL display area is blank.

The respiratory rate (RR) display indicates the total number of breaths registered by the monitor during the previous minute of respiratory activity. As with the minute volume display, if a full minute of respiration has not occurred, the RR display area is blank.

The tidal volume display indicates the tidal volume for each breath. If no breath has been registered for 30 seconds, the TID VOL display area is blank.

To enable the tidal volume, minute volume, and apnea-volume alarms, touch the ALARMS ON key. To disable the alarms, touch the ALARMS OFF key. You can adjust the low minute volume alarm limit in the Monitor Setup screen or in Alarms Configuration screen.

The power-up default with the ventilator off is ALARM STBY (key highlighted), which disables the visual and audible respiratory volume alarms. If the ventilator is turned on, the volume alarms are automatically enabled (the ALARM ON key is highlighted). After the

Displaying the Trend

To display the minute volume trend, touch the TREND key. This display provides up to one hour of trend for the minute volume. The trend scale at power-up is 0-5 liters. If the minute volume exceeds 5 liters, the scale is automatically rescaled to 0-10, and then 0-20.

MIN VOL	5.0
TID VOL	0.50
RR	10

OP10047

ALARM OFF	ALARM OFF
TRACE	TREND
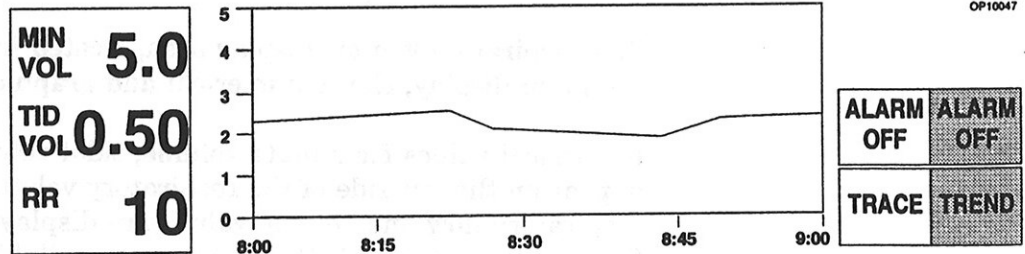
Setting the Alarm

Press the MONITOR SETUP key on the main key panel to invoke the Monitor Setup screen. Use the key and selection dial to set the low alarm limit for minute volume.

MIN VOL	5.0
TID VOL	0.50
RR	10

VOL ALARM
LO 1.0

OP10048

ALARM OFF	ALARM ON
TRACE	TREND
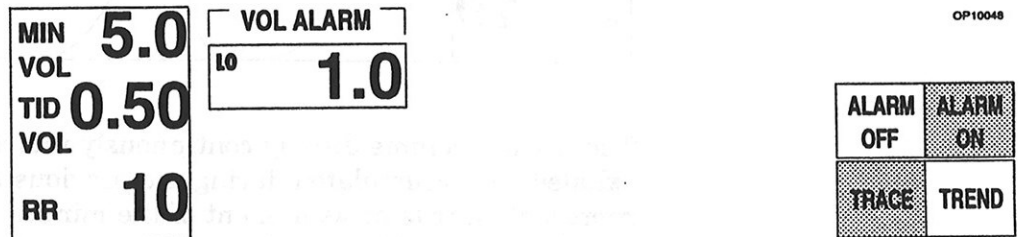
To set the low minute volume alarm limit:

1. Invoke the Monitor Setup screen.

2. Touch the key labeled VOL ALARM.

3. Turn the selection dial to adjust the value.

4. Press the selection dial to enter the new value.

Respiratory Volume Alarm Messages

The following list describes all warning, caution, and advisory alarms associated with respiratory volume monitoring.

APNEA-VOLUME (Warning and Caution)

The NARKOMED 4 continuously monitors the expiratory flow in the patient breathing system. By processing the expiratory flow pattern, the monitor can determine if a "valid" breath has occurred. A "valid" breath has a tidal volume of 80 ml or greater.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Blank display area	One full minute has not elapsed (for Minute Volume and Respiratory Rate) since respiration began	Wait one minute to read display.
	Apnea condition	Correct apnea condition.
Blank display area, VOL SENSOR DISC and VOL ALARMS OFF alarm messages on central alarm display	Sensor cord disconnected	Reconnect sensor cord plug to interface panel on anesthesia machine.
	Sensor cord damaged	Repair sensor cord.
REVERSE FLOW alarm message on central alarm display	Leak between sensor and expiratory valve	Check gasket; make sure it is in good condition and is seated properly.
	Expiratory valve not closing completely during inspiration	Check expiratory valve disc and pins. Clean, repair, or replace expiratory valve.
	Defective sensor	Repair or replace sensor.
Tidal volume readings obtained are consistently low and sensor is noisy during operation	Excessive friction in sensor	Lubricate, repair, or replace sensor.

Overview

The NARKOMED 4 measures anesthetic agent and nitrous oxide concentrations with a nondispersive infrared analyzer, using a side-stream sample withdrawn at the Y-piece.

The agent display area, located at the bottom right side of the main display, shows numerical and graphical data for agent concentration.

The left side of the agent display area contains real-time values for the anesthetic concentrations during the inspiratory and expiratory phases. The anesthetic display range is 0–10 volume % with a resolution of 0.1 volume %.

NOTE: When the sample line is connected to the fresh gas outlet, the message FRESH GAS CIRCUIT IS ENABLED appears in the trace area of the display.
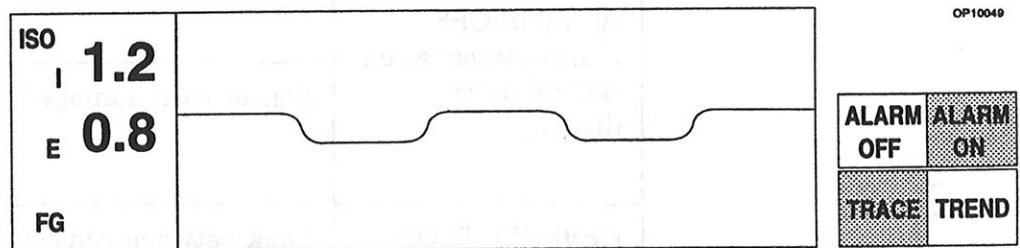
To enable the agent alarms, touch the ALARM ON key. To disable the agent alarms, touch the ALARM OFF key. You can adjust alarm limits in the Monitor Setup screen or Alarms Configuration screen (see Section 5 - Operation/Monitoring System, "System Configuration Screens" for more information). The area above the keys is reserved for displaying up to two alarm messages.

There is a delay after the NARKOMED 4 is initially powered up during which agent data and waveform are not displayed, the ALARM ON key does not appear on the screen, and the ALARM OFF key is highlighted. When the initial delay period is over, agent data and waveform appear on the display along with the ALARM ON key, and the ALARM OFF/STBY key is set to ALARM STBY.

As soon as agent is detected, the ALARM ON key is enabled (highlighted) and the ALARM STBY key is changed to ALARM OFF. After the alarms are turned on, they can be set to standby only by selecting the ALARM STBY key in the Alarms Configuration screen.

If no agent is selected for analysis, alarms are disabled and the advisory message AGENT NOT SELECT appears on the central alarm display.

NOTE: An activated vaporizer takes priority over any agent selected through the Monitor Setup mode.

Sample Line

To select the sample line:

1. Invoke the Monitor Setup screen.

2. Touch the key for the sample line you want.

   Touch PAT to sample gas through the patient sample line and display inspiratory and expiratory data.

   Touch FGAS to enable the fresh gas circuit. The message FRESHGAS CIRCUIT IS ENABLED appears in the carbon dioxide and agent trace windows.

Displaying the Waveform (Trace)

To display the agent waveform, touch the TRACE key. The agent waveform provides an indication of the patient's uptake of agent and depth of anesthesia.
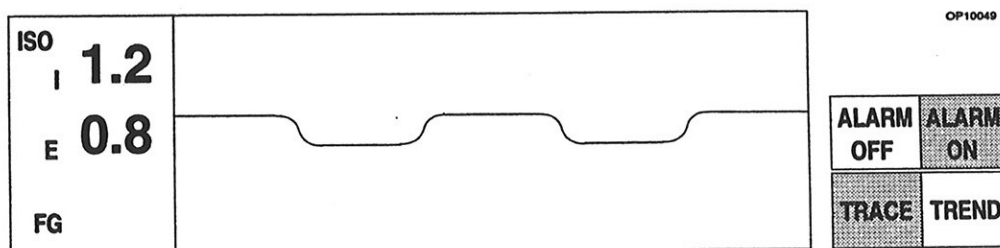
When no agent trace data is available, the agent trace/trend display shows a moving cursor at the baseline of the display area. During agent calibrations, the message AGT CALIBRATION IN PROGRESS appears in the trace/trend display area.

NOTES: There is approximately a one second delay between the patient's respiration and the display of the anesthetic waveforms on the monitoring system's display screen. Expiratory flow and breathing pressure waveforms, however, are displayed simultaneously with the patient's breath. When displaying the anesthetic waveform with either the expiratory flow or breathing pressure waveform, there will be a misalignment on the time scale, even though both waveforms provide information about the same breath.

AGENT NOT
SELECT
(Advisory)

The agent monitor cannot identify the agent being measured. The agent to be analyzed must be selected (see "Selecting the Agent" earlier in this section) before anesthetic concentrations can be measured; otherwise, the advisory message AGENT NOT SELECT appears on the central alarm display.

ANALYZER
WARMUP
(Advisory)

While the agent monitor is in its warm-up period, the advisory message ANALYZER WARMUP appears on the central alarm display. After the agent analyzer warms up and enters its full accuracy mode, the advisory message is cleared. Although agent analysis can be used during the warm-up period, the measurements obtained during this period may not be as accurate as those obtained in the full accuracy mode, and zero calibrations occur more frequently.

AGENT ALARMS
OFF (Advisory)

When the agent alarms are disabled by touching the ALARM OFF key, or during the automatic 3-minute disable period, or during calibration, the advisory message AGENT ALARMS OFF appears on the central alarm display.

CO2/AGENT
ERROR
(Advisory)

If the NARKOMED 4 detects an internal electronics failure that would prevent the agent analyzer from functioning correctly, the advisory message CO2/AGENT ERROR appears on the central alarm display.

Overview

The O.R. Data Manager is an electronic data management information storage/retrieval system. It creates an electronic patient record from information automatically recorded by the monitoring system, and from information that is entered through the keyboard such as patient/case data, events, drugs and other case-related information. This information can be viewed on the remote display. A record of the information may be printed using the optional printer.

The O.R. Data Manager consists of a central processor unit with an integral floppy disk drive, a QWERTY keyboard with function keys for data entry and editing and a remote display shared with the NARKOMED 4 for conveniently viewing the data. The O.R. Data Manager enhances the NARKOMED 4 anesthesia machine by giving it a means of recording patient information, drug administration, events and other case-related information.

Information That Can Be Recorded and Viewed

The O.R. Data Manager allows the user to enter, edit and view information such as —

- patient/case information

- drug administration by name, amount and time

- events that occur during the case

- graphical displays and numerical information based on data received from the monitoring system

- CO_2 waveform and gas analysis

- graphical history of the recorded information

This information is automatically stored electronically on a floppy disk, providing a means of accessing the information later.

Central Processing Unit with Floppy Disk Drive

The central processing unit (CPU) for the O.R. Data Manager is mounted inside the ventilator box. It is a small self-contained computer. It records and processes data received from the anesthesia machine and entered through the keyboard and touch switches on the remote display.

Accessible through the front, is a 3.5" (1.44 megabyte) floppy disk drive. The data entered and received from the host machine is automatically written to the floppy disk inserted in this drive. The disk is written to at regular intervals. The data is recorded in ASCII file format. This makes information stored on the disk compatible with PC/MS–DOS application programs, such as database and spreadsheet programs and North American Dräger's PC Prep/View, that can import ASCII data files.

The light on the front of the disk drive comes on whenever the drive is reading or writing information.

CAUTION: To avoid losing data, never remove the floppy disk from the O.R. Data Manager when the disk drive light is on or while an anesthesia record is being printed.

How to Handle Floppy Disks

Floppy disks are a durable and reliable means of electronic data storage. However, certain precautions must be taken to ensure that the disk is not damaged or the data corrupted during use or storage.

- Always keep disks away from dust and dirt. Small particles of dust or dirt may scratch the magnetic surface and destroy data.

- Always keep disks away from magnetic fields.

- Always store disks in a moderate environment (such as normal room temperature and humidity).

- Never touch the disk's magnetic surface.

- Always store disks in a diskette container when not in use.

- Never wipe, brush or try to clean the magnetic surface in any way.

- Be sure to label all disks for proper identification.

- Do not use an eraser on a label affixed to a disk.

- Remove the disk before removing power from the NARKOMED 4.

How to Prepare the Floppy Disk for Use

A separate disk must be used for each patient case file. Insert a pre-formatted disk into the disk drive at the beginning of the case.

All disks must be formatted before they can be used. Disks purchased from North American Dräger have been pre-formatted.

NOTE: If the disk is not formatted, it may be formatted in any PC/MS-DOS compatible computer with a 3.5 inch, 1.44 megabyte disk drive. Refer to the computer's PC/MS-DOS manual for instructions on how to format a disk.

Inserting the Disk into the Floppy Drive

1) Press the eject button on the disk drive to ensure that the disk drive is empty.

2) Hold the disk so that the metal media cover is facing toward the NARKOMED 4 and the round metal hub is facing down toward the eject button and indicator light.

3) Insert the disk into the drive and ensure that it locks into place.

DISK
SLOT

WRITE-PROTECT
TAB

INDICATOR LIGHT ——————
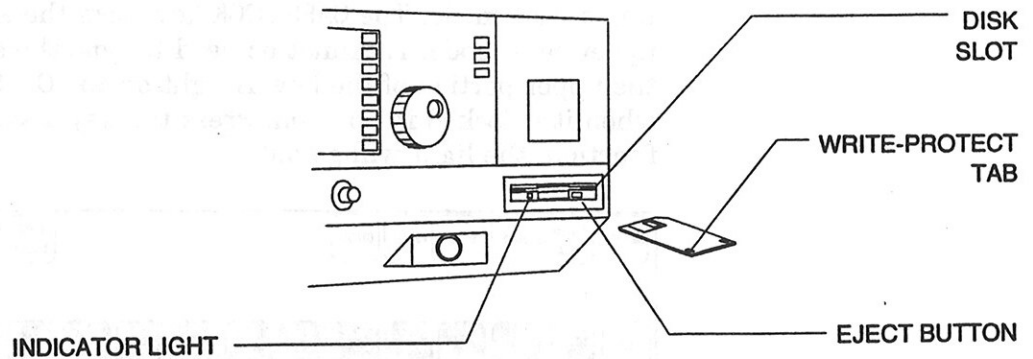
EJECT BUTTON

**Removing the
Disk from the
Floppy Drive**

1) Press the eject button on the drive. The floppy disk will partially self-eject from the drive.

2) Take the floppy disk out of the drive.

NOTE: To ensure that the data on the disk in not overwritten, place the write-protect shutter to the protect position (window is **open**).

Keyboard

The keyboard is an integral part of the NARKOMED 4 anesthesia system. Use the keyboard to enter and edit patient data, drug, flows, fluids and event information into the patient record, or to switch between the NARKOMED 4 and any of the various O.R. Data Manager screens for viewing on the remote display. A polyurethane shield protects the keyboard. This shield should always be in place. It is user replaceable and must be replaced when it becomes contaminated or damaged to ensure that no foreign material enters the keyboard.

Standard Keys

The alphanumeric keys on the keyboard are used for data entry. The SHIFT keys switches the letter keys and symbol keys from lower case to upper case mode. The CAPS LOCK key locks the A through Z keys in the upper case mode. It cannot be used to type the symbols that appear on the upper portion of the key. A light on the CAPS LOCK key will come on when it is locked in position. Press the key a second time to release the function; the light will go out.
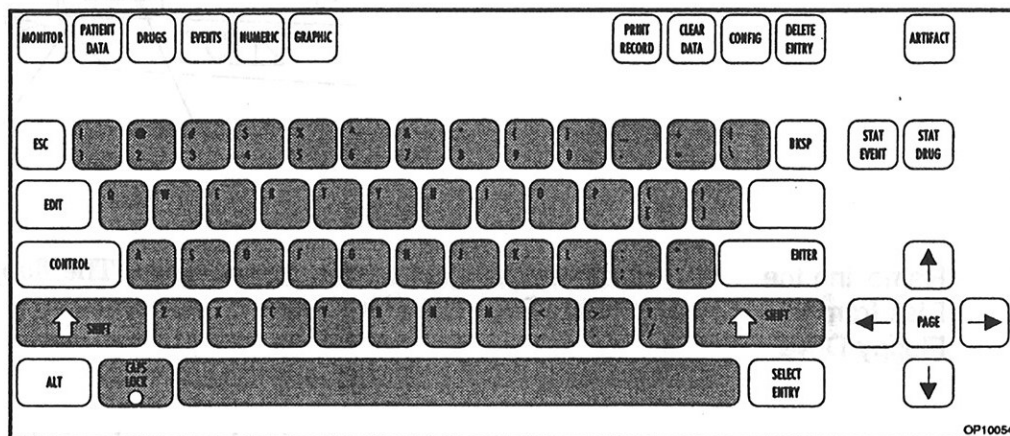
Screen Keys

The keys on the upper left of the keyboard invoke display screens which are used to view and enter various aspects of the patient record.
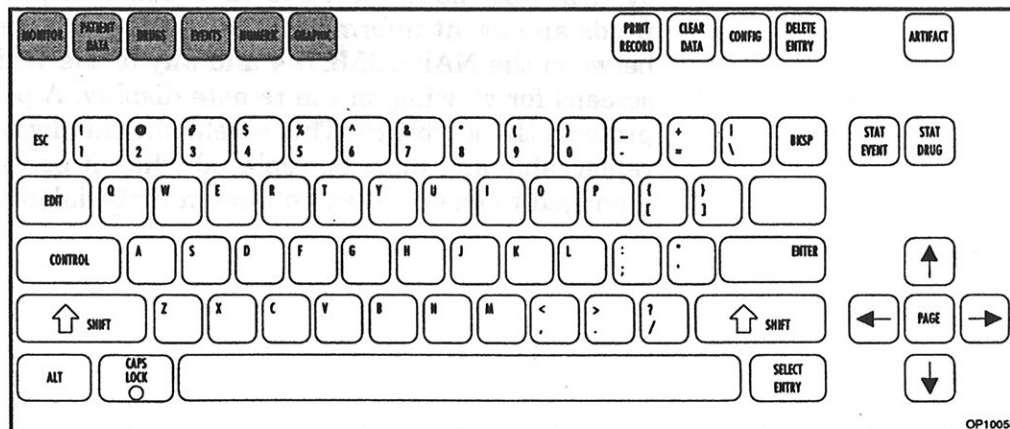
Function Keys

The keys at the right portion of the keyboard perform specific O.R. Data Manager functions. The other function keys perform distinct functions depending on which screen is currently invoked.

The function keys are discussed in detail where applicable throughout this section.

OP10058
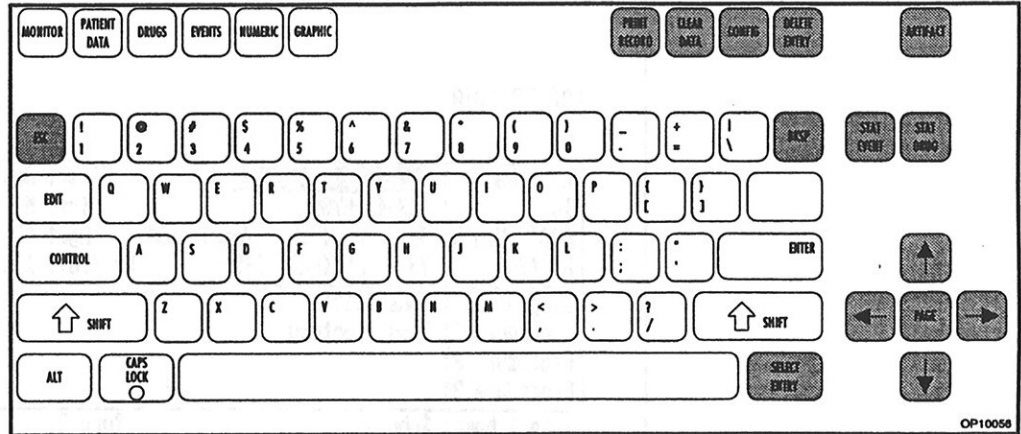
Remote Display

The remote display is the focal point for observing all information. Graphical and numeric data, events that have been entered, drugs administered, CO_2 waveform and alarms appear on the remote display.

Screens

The following screens can be invoked through the keyboard –

* Narkomed 4 Monitor (MONITOR)
* Patient Data (PATIENT DATA)
* Drug Administration (DRUGS)
* O.R. Event Record (EVENTS)
* Numeric Data (NUMERIC)
* Graphic History (GRAPHIC)
* System Configuration (CONFIG)

The Narkomed 4 Monitor screen is described in the *Monitoring System* section. The following paragraphs provide a brief description of each of the remaining screens.

Patient Data Screen

The Patient Data screen displays the following specific patient/case information: Name, ID, Sex, Date of Birth, Age, Height, Weight, Diagnosis, Diagnosis Code, Procedure(s), Procedure Code(s), Surgeon(s), Anesthesiologist(s), Anesthesia Type, O.R. Number, Level of Supervision, ASA Number and any other remarks. This data is entered through the

keyboard or off-line using a personal computer and the PC Prep/View software program available from North American Dräger.

```
PATIENT DATA

┌──────────────────────────────────────────────────────────────────┐
│ Last Name : Jackson              First: James         MI: A        │
│ ID        : 123-45-6789          Sex: M                            │
│ DOB   Month: Jul   Day: 13   Year: 1951   Age: 40                  │
│ Ht (in)   : 73   Ht (cm): 185    Wt (lb): 198      Wt (kg): 90     │
├──────────────────────────────────────────────────────────────────┤
│ Diagnosis : Tonsillitis                   Diag Code:               │
│ Procedure 1: Tonsillectomy                Proc Code: 42826         │
│ Procedure 2:                              Proc Code:               │
│ Procedure 3:                              Proc Code:               │
├──────────────────────────────────────────────────────────────────┤
│ Surg 1 Name: Schuler             Surg 2:                           │
│ Anes 1 Name: Johnstone           Anes 2:                           │
│ Anest Type : General             OR No: 10   Supvn:   ASA No: 233  │
├──────────────────────────────────────────────────────────────────┤
│ Remarks   : Allergic to penicillin.                                │
│ Remarks   :                                                        │
├──────────────────────────────────────────────────────────────────┤
│ Delete Entry: Clear all patient data                               │
└──────────────────────────────────────────────────────────────────┘
```

Drug Administration Screen

The Drug Administration screen displays a record of patient drug intake. This screen displays a tabular list that gives the sequence number, time, drug, dosage and units of measure for each drug entered. This data is entered through the keyboard.

```
DRUG ADMINISTRATION

NO.  TIME   DRUG NAME        DOSE   UNITS
12   07:04  Labetalol        10     mg
13   08:47  Protamine        20     mg
14   09:15  Protamine        20     mg
15   09:31  Pancuronium      2      mg
16   09:42  Sufentanil       100    mcg
17   09:47  Morphine         12     mg
18   09:51  Sufentanil       60     mcg
19   09:53  Morphine         12     mg
20   09:54  Pancuronium      2      mg
21   09:59  Morphine         12     mg
22   10:12  Midazolam        2      mg
23   10:17  Midazolam        2      mg
24   10:22  Morphine         6      mg
25   10:26  Morphine         12     mg
26   10:31  Midazolam        4      mg
27   15:15
```

O.R. Event
Record Screen

The O.R. Event Record screen displays a record of events that have been entered through the keyboard.

This screen displays a tabular list that includes the sequence number, time and event entered.

```
O.R. EVENT RECORD


NO.  TIME   EVENT
 10  08:52  Arms padded, positioned + checked
 11  08:53  NGT PSR, head wrapped; Bair Hugger on
 12  08:54  Incision to remove LaVeen shunt
 13  08:55  Incision for liver transplant
 14  09:12  Surgeons repair diaphragmatic tear
 15  09:18  hepatic artery clamp
 16  09:19  ANHEPATIC START
 17  09:34  Flush
 18  09:35  PORTAL/CAVAL REPERFUSION
 19  09:36  Labs sent for analysis
 20  09:38  Cholangiogram taken
 21  09:39  TAH   started by Dr Laros
 22  09:49  Abdomen closed
 23  09:53  End Of Surgery
 24  09:55  Transport to ICU, hand vent w/ monitor
 25  15:26
```

Numeric Data
Screen

The top portion of the Numeric Data Screen displays the following numeric data: fresh inspiratory oxygen concentration (Fi O2), fresh inspiratory nitrous oxide concentration (Fi N2O), inspiratory anesthetic agent concentration (ISOFLURANE, ENFLURANE, HALOTHANE or AGENT), end-tidal carbon dioxide (ET-CO2), peak inspiratory pressure (P.I.P.) and mean central venous pressure (CVP) data.

This information is automatically recorded by the host monitoring system. No keyboard entries or editing can be made to this portion of the screen.

A record of patient flows and fluids, (e.g., blood, urine, etc.) appears on the lower portion on the screen. This data is entered through the keyboard.

```
                                                                    16:00

NUMERIC DATA


NAME             UNITS   14:30 14:45 15:00 15:15 15:30 15:45 16:00 16:15
Fi O2              %       64    49    48    48    48    48    48    48
Fi N2O             %       1     1     1     1     0     0     0     1
ISOFLURANE         %       2.9   0.4   0.4   0.4   0.4   0.4   0.4   0.4
ET-CO2           mm Hg     31    25    28    27    27    27    31    27
P.I.P.           cm H2O    25    23    24    22    22    22    19    19
CVP Mean         mm Hg  ————————————————————————————————— 50 ————      TOTAL
Cryoprecipitate  cc    ——————————————————————————————————————————      0.0
Ringers          cc    ——————————————————————————————————————————      0.0
Est blood loss   cc    ——————————————————————— 350 ————————— 500     2550.0
Urine output     cc    ——————————————————————— 150 ————————— 100     1250.0
Ascites Removed  cc    ——————————— 400 ——————————————————————         400.0
Insensible loss  cc    ——————————————————————— 500 —————————————     2500.0
Lasix            mg      10    10    10    10    10    10    10    10   200.0
```
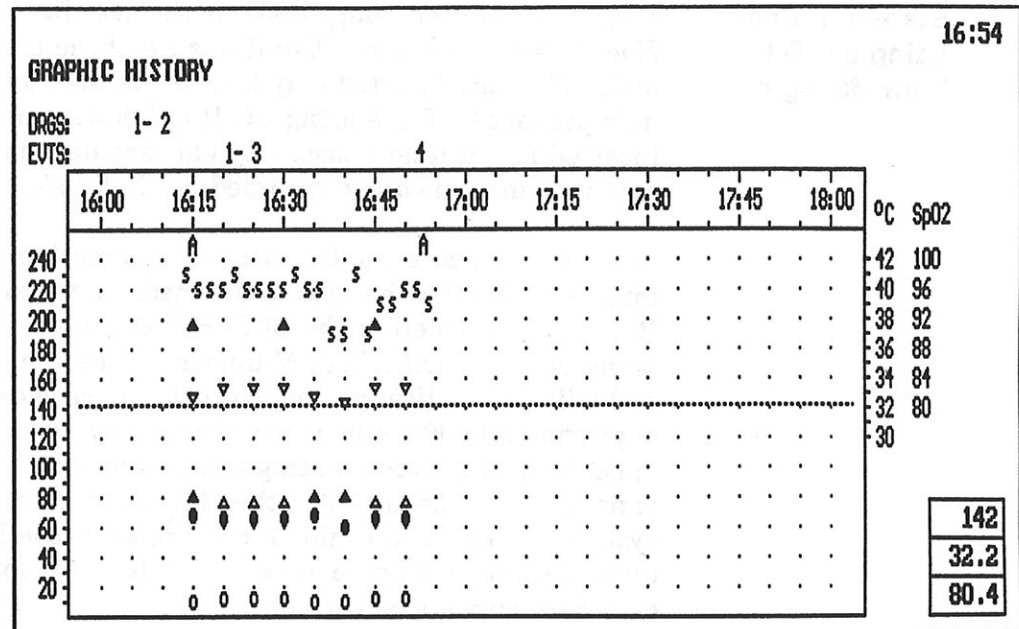
Graphic History Screen

The Graphic History screen displays a graphical history for the following:

- Oxygen saturation
- Pulse rate
- Systolic and diastolic non-invasive blood pressure
- Systolic and diastolic arterial blood pressure
- Temperature
- Respiratory rate

In addition, the screen provides references for:

- Artifacts
- Drug reference numbers
- Event reference numbers

```
                                                              16:54
GRAPHIC HISTORY

DRGS:    1- 2
EVTS:            1- 3              4

      16:00  16:15  16:30  16:45  17:00  17:15  17:30  17:45  18:00  °C  SpO2
                  A                       A
240    .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   . 42  100
          S  S   S S S S S   S S  S  . S    . S S . .
220    .   S .S SS S. S. S.S  . . SS. SS S . . .   .   .   .   .   .   . 40  96
200    .   .  ▲ .   . ▲ .   . SS ▲  .   .   .   .   .   .   .   .   .   . 38  92
180    .   .   .   .   .   .   . SS S.   .   .   .   .   .   .   .   .   . 36  88
160    .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   . 34  84
       ▽      ▽  ▽  ▽  ▽    ▽    ▽  ▽
140 ······································································ 32  80
120    .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   . 30
100    .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
 80    .   . ▲ △ △ ▲ △ ▲ ▲ △ △ .   .   .   .   .   .   .             ┌─────┐
 60    .   . ● ● ● ● ● ● ● ● ● .   .   .   .   .   .   .             │ 142 │
 40    .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   ├─────┤
 20    .   . ○ ○ ○ ○ ○ ○ ○ ○ ○ .   .   .   .   .   .   .             │32.2 │
                                                                    ├─────┤
                                                                    │80.4 │
                                                                    └─────┘
```

The System Configuration Screen permits the user to configure the O.R. Data Manager for specific needs. This screen is used to select one of the sub-screens.

System Configuration Screen

The user must enter one of these sub-screens to create case-specific templates for drugs, events and fluids (numeric items). The user can also use these sub-screens to enter the hospital name.

```
SYSTEM CONFIGURATION



  (D) Drug template edit
  (E) Event template edit
  (N) Numeric template edit
  (H) enter Hospital name







  Use arrow keys or alpha keys to select option...
```

Starting a Case using the O.R. Data Manager

Insert a formatted floppy disk for the case into the disk drive. (Refer to *How to Insert a Floppy Disk* if unsure of the proper way to insert the disk.) The disk inserted may be a blank disk for a new case or may be a disk prepared off-line using PC Prep/View. A new disk should be inserted for each new case. Any old case data must be erased before new case information can be recorded on that disk.

The start of a case can be initiated by pressing the CLEAR DATA key immediately after the disk is inserted. (Refer to *Editing Data*). Regardless of whether the CLEAR DATA key is pressed, when a new disk is inserted, the O.R. Data Manager will assume the start of a new case and will automatically check for existing case data. Within approximately 30 seconds after the floppy disk is inserted, a message appears on the screen stating that a new disk has been detected. If there is no case data on the disk, the O.R. Data Manager clears data in system memory and begins recording new case information onto the disk. If there is old case data on the disk, the following prompt to clear case data appears on the screen:

1) To clear all case data contained on the floppy disk, press the Y key.

2) To cancel the request to clear existing case data, press the N key or any key other than Y.

```
A NEW DISK HAS BEEN DETECTED !
There is an existing case on the disk...


   ┌─────────────────────────────────────────────────┐
   │ OK to clear the previous case from disk ? (Y/N) _ │
   └─────────────────────────────────────────────────┘
```

If no input is detected within 5 seconds, the case data is not cleared and the prompt is removed from the screen.

A Y response to the delete prompt will be followed by a second prompt to confirm the deletion.

1) To clear the case data from the disk, press the Y key.

2) To cancel the request to clear case data, press the N key or any key other than Y.

If no input is detected within 5 seconds, the case data is not cleared and the prompt is removed from the screen.

A Y response to the confirmation prompt initiates the clearing of case data. Any Patient Data, Fluid Names, Drug Template, Event Template and Numeric Template information contained on the floppy disk will then be loaded into system memory.

```
A NEW DISK HAS BEEN DETECTED !
There is an existing case on the disk...

    ┌──────────────────────────────────────────┐
    │ Are you sure ? (Y/N) _                    │
    └──────────────────────────────────────────┘
```

A "disk error" message will appear on a O.R. Data Manager screen if there is a problem reading or writing the disk. Messages only appear when an O.R. Data Manager screen appears on the remote display. They do not appear on the Monitor screen. The Monitor screen will appear on the remote display once both the NARKOMED 4 and O.R. Data Manager are operational.

```
┌─────────────────────────────────────────────┐
│                                               │
│                                               │
│                                               │
│                                               │
│              ┌──────────────────┐             │
│              │ Disk Error !!    │             │
│              └──────────────────┘             │
│                                               │
│                                               │
│                                               │
│                                               │
│                                               │
└─────────────────────────────────────────────┘
```

Possible error messages are —

ERROR MESSAGE	CORRECTIVE ACTION
Disk Not Inserted!!	• Insert a formatted disk.
Disk Not Formatted!!	• Insert a formatted disk.
Disk Full!!	• Insert a new formatted disk.
Disk Write Protected!!	• Remove disk, close the write protect tab on the disk and retry. • Use a different formatted disk and retry.
Disk Error!!	• Ensure that the disk is 1.44MB, formatted and the write protect tab is closed and retry. • Insert a new formatted disk. • If the disk error persists, contact an authorized NAD service technician.

Selecting a Screen

To select a screen for entering or viewing information, press the respective key on the keyboard.

MONITOR   — Invokes the NARKOMED 4 Monitor screen.

PATIENT   — Invokes the Patient Data
DATA   screen.

DRUGS — Invokes the Drug Administration screen.

EVENTS — Invokes the O.R. Event Record screen.

NUMERIC — Invokes the Numeric Data screen.

GRAPHIC — Invokes the Graphic History screen.

CONFIG — Invokes the O.R. Data Manager System Configuration

Moving the Cursor

The cursor can be placed in any cell on the screen which accepts keyboard-entered data.

- Press the arrow keys (→, ←, ↑, and ↓) to move the cursor from cell to cell in the direction indicated.

- When there are multiple screens of data, press and hold one of the arrow keys along with the PAGE key to scroll one screen at a time in the direction indicated by the arrow key.

Entering Data

To enter data into the O.R. Data Manager the user must first select one of the O.R. Data Manager screens. Data may be entered in the Patient Data, Drug Administration, O.R. Event, Numeric and System Configuration screens. Move the cursor to the desired cell using the arrow keys. Enter the information using the alphanumeric keys or the SELECT ENTRY key. Refer to the specific screen's operating instructions for more information on the SELECT ENTRY key. When viewing any screen, the ARTIFACT key may be pressed to make a *note* on the O.R. Event and Graphic History screens to indicate that an invalid reading occurred. An entry is reserved on the O.R. Event screen at the time the key was pressed, and the word ARTIFACT is automatically entered in the name column. On the Graphic History screen the letter A will appear at the time of the occurrence. The O.R. Event screen may be edited later to describe what occurred.

Similarly, the STAT DRUG key may be pressed at any time to make a *note* on the Drug Administration screen that a drug was administered at that time. An entry is reserved on the Drug Administration screen at the time the key was pressed, and the phrase STAT DRUG is automatically entered in the name column. The Drug Administration screen may be edited later to enter the actual drug and dose.

Likewise, the STAT EVENT key may be pressed at any time to make a *note* on the O.R. Event screen to indicate that an event took place. This will reserve an entry on the O.R. Event screen at the time the key was pressed, and the phrase STAT EVENT is automatically entered in the name column. The O.R. Event screen may be edited later to describe the event.

Editing Data

Any screen that can receive keyboard-entered information may be edited. Generally, the BKSP, DELETE ENTRY, and ESC keys are used to edit data that has been entered. These keys perform somewhat different functions in each screen; refer to each screen's operating instructions for the specific function.

The CLEAR DATA key performs the same function regardless of which screen is selected. This key is to be used at the start of a case to delete all data on the floppy disk and in memory **except** Patient Data, Fluid Names and Templates on the disk. After the data is cleared, the Patient Data, Fluid Names and Templates are loaded from the disk into system memory. Before the information is cleared, a query appears on the screen to confirm the deletion.

1) To clear the data press the Y key. A second prompt "Are you sure ? (Y/N)" appears on the screen; respond accordingly.

2) To cancel the CLEAR DATA request, press the N or any key other than Y.

If no input is detected within 5 seconds, nothing is deleted and the message is removed from the screen.

NOTE: A maximum of 14 hours of data may be recorded on a disk. If a case will last more than 14 hours, two disks should be prepared prior to the start of the case. Each disk should include the required templates and patient/case identification and fluid names information. These disks can be prepared using PC Prep/View™ before the case begins. Before the 14 hours has elapsed, it is recommended that an anesthesia record is printed if the optional laser printer is connected; do not remove the disk from the disk drive while the anesthesia record is being printed. When the print process is completed, remove the floppy disk from the drive. Then, insert the second disk into the disk drive and repeat the procedure to start a new case. (For more information about printing a record, refer to the *Printing Anesthesia Records* section).

Edit Mode

The O.R. Data Manager has an edit mode which allows the operator to edit characters in a selected cell. The edit mode can be invoked in the following screens: Patient Data, Drug Administration, O.R. Event Record, Numeric, and the Drug Template Edit, Event Template Edit, Numeric Template Edit, and Hospital Name Configuration screens.

To invoke the edit mode, highlight the cell to be edited using the →, ←, ↑ or ↓ keys, and press the EDIT key. The Edit Mode window will appear. The window displays the selected cell along with editing instructions. For specific information on the use of the edit mode, refer to the operating instructions for each screen.

```
WARNING: This will clear all data from memory and disk !!!

┌─────────────────────────────────────────────┐
│ Do you wish to clear all data ? (Y/N) _      │
└─────────────────────────────────────────────┘
```

Patient Data Screen   The Patient Data screen is used to enter, edit and view specific
patient/case information such as name, age, procedure, etc.

Selecting the   Press the PATIENT DATA key to view the Patient Data screen.
screen

```
┌─────────────────────────────────────────────────────────────┐
│                                                               │
│  PATIENT DATA                                                 │
│                                                               │
│  ┌──────────────────────────────────────────────────────┐    │
│  │ Last Name : ▊Jackson▊            First: James   MI: A │    │
│  │ ID         : 123-45-6789          Sex: M              │    │
│  │ DOB   Month: Jul   Day: 13   Year: 1951   Age: 40     │    │
│  │ Ht (in)   : 73   Ht (cm): 185   Wt (lb): 198   Wt (kg): 90 │
│  ├──────────────────────────────────────────────────────┤    │
│  │ Diagnosis  : Tonsillitis          Diag Code:          │    │
│  │ Procedure 1: Tonsillectomy        Proc Code: 42826    │    │
│  │ Procedure 2:                      Proc Code:          │    │
│  │ Procedure 3:                      Proc Code:          │    │
│  ├──────────────────────────────────────────────────────┤    │
│  │ Surg 1 Name: Schuler          Surg 2:                 │    │
│  │ Anes 1 Name: Johnstone        Anes 2:                 │    │
│  │ Anest Type : General          OR No: 10   Supvn:   ASA No: 233 │
│  ├──────────────────────────────────────────────────────┤    │
│  │ Remarks    : Allergic to penicillin.                  │    │
│  │ Remarks    :                                          │    │
│  ├──────────────────────────────────────────────────────┤    │
│  │ Delete Entry: Clear all patient data                  │    │
│  └──────────────────────────────────────────────────────┘    │
└─────────────────────────────────────────────────────────────┘
```

Moving the cursor   When the Patient Data screen appears on the remote display, the cursor
will appear in the first data cell, titled Last Name. Press the →, ←, ↑ or
↓ key to move the cursor to other cells on the screen.

Entering/Editing   Use the alphanumeric keys to type and edit data. To delete the last
Data   character entered, press the BKSP key.

If the ENTER key has not be pressed, pressing the ESC key clears newly
entered data from a cell and restores the previous entry, if any. The ESC
key can also be used to exit from a pop-up menu.

To complete an entry and advance the cursor to the next cell, type the
desired data and press the ENTER key or the →, ←, ↑ or ↓ keys.
The date of birth (DOB) row accepts three letters for the month, two
digits for the day and four digits for the year. When the date of birth is
entered, the age is automatically calculated and placed into the AGE cell.
If the age calculated is less than 5 years, the age entered will appear in
years and tenths.

The Height and Weight cells accept only numeric entries. The Sex cell
accepts only upper case or lower case letters F or M.

The O.R. Data Manager has an auto-conversion feature for the height and weight entries. When the patient's height in inches is entered in the Ht (in) cell, the patient's height in centimeters is automatically calculated and entered in the Ht (cm) cell (and vice versa). The same type of conversion is performed for the Wt (lb) and (kg) cells. The anesthesia type can be typed in from the keyboard or entered from a pop-up menu. To select the anesthesia type from the pop-up menu, move the cursor to the cell labeled Anest. Type, and press the SELECT ENTRY key. This invokes the anesthesia type pop-up menu.

To select an anesthesia type, press the key letter next to the desired selection (e.g., press "b" to enter Local), or use the ↑ or ↓ keys to highlight the desired entry and press the ENTER key.

The SUPVN cell refers to the anesthesiologist's level of supervision. It specifies the number of operating rooms supervised by the anesthesiologist and accepts one digit.

```
PATIENT DATA

 Last Name  : Jackson          First: Ja a. General
 ID         : 123-45-6789       Sex: M  b. Local
 DOB  Month: Jul   Day: 13   Year: 1951   Age: 40  c. Intravenous
 Ht (in)    : 73   Ht (cm): 185      Wt (lb): 19 d. Regional Intravenous
                                              e. Regional Nerve Block
 Diagnosis  : Tonsillitis               f. Caudal
 Procedure 1: Tonsillectomy             g. Epidural
 Procedure 2:                           h. Spinal
 Procedure 3:                           i. MAC

 Surg 1 Name: Schuler          Surg 2:
 Anes 1 Name: Johnstone        Anes 2:
 Anest Type : General          OR No: 10

 Remarks    : Allergic to penicillin.
 Remarks    :

 Delete Entry: Clear all patient data
```

To clear **all** the entries in the Patient Data screen, press the DELETE ENTRY key while in any cell. A prompt appears on the screen to confirm the deletion.

1) To cancel the clear request, press N or any key other than Y. 2) To clear all patient data, press Y. A confirmation prompt "Are you sure? (Y/N)" will appear; respond accordingly.

If no response is detected within 5 seconds, no data is cleared, and the prompt is removed from the screen.

```
PATIENT DATA

 ┌────────────────────────────────────────────────────────────────────┐
 │ Last Name  : Jackson                    First: James      MI: A      │
 │ ID         : 123-45-6789                Sex: M                       │
 │ DOB  Month: Jul   Day: 13   Year: 1951  Age: 40                      │
 │ Ht (in)    : 73   Ht (cm): 185      Wt (lb): 198    Wt (kg): 90      │
 ├──────────────────────────────────────────────────────────────────── │
 │ Diagnosis  ┌─────────────────────────────────────────┐              │
 │ Procedure  │ Clear all patient data ? (Y/N) _        │              │
 │ Procedure  └─────────────────────────────────────────┘              │
 │ Procedure 3:                                      Proc Code:         │
 ├──────────────────────────────────────────────────────────────────── │
 │ Surg 1 Name: Schuler              Surg 2:                            │
 │ Anes 1 Name: Johnstone            Anes 2:                            │
 │ Anest Type : ▒General▒            OR No: 10   Supvn:    ASA No: 233   │
 ├──────────────────────────────────────────────────────────────────── │
 │ Remarks    : Allergic to penicillin.                                │
 │ Remarks    :                                                         │
 ├──────────────────────────────────────────────────────────────────── │
 │ Delete Entry: Clear all patient data                                │
 └────────────────────────────────────────────────────────────────────┘
```

Edit Mode

The O.R. Data Manager edit mode is used to edit characters in a selected cell. The operator can edit any cell except the Sex field, the DOB field, or a blank field.To invoke the edit mode, highlight the cell to edit using the ←, →, ↑ or ↓ keys, and press the EDIT key. The Edit Mode window appears.

```
PATIENT DATA

 ┌────────────────────────────────────────────────────────────────────┐
 │ Last Name  : Jackson                    First: ▒James▒    MI: A      │
 │ ID         : 123-45-6789                Sex: M                       │
 │ DOB  Month: Jul   Day: 13   Year: 1951  Age: 40                      │
 │ Ht (in)    : 73   Ht (cm): 185      Wt (lb): 198    Wt (kg): 90      │
 │ D ┌────────────────────────────────────────────────────────────┐    │
 │ P │ EDIT MODE   [ First ]                                       │    │
 │ P │                                                             │    │
 │ P │                        ┌──────────┐                         │    │
 │ S │                        │ James█   │                         │    │
 │ A │                        └──────────┘                         │    │
 │ A │ Key legend:    (Insert characters by typing)                │    │
 │ R │ ->  : Move cursor to right    PAGE ->  : Move cursor to end of cell │
 │ R │ <-  : Move cursor to left     PAGE <-  : Move cursor to start of cell │
 │ R │ ESC : Exit edit without save  DELETE ENTRY: Delete char. at cursor │
 │ D │ ENTER: Exit edit with save    BKSP     : Delete char. to left of cursor │
 │   └────────────────────────────────────────────────────────────┘    │
 └────────────────────────────────────────────────────────────────────┘
```

The Edit Mode window displays the selected cell along with editing instructions. To position the cursor at the character to be changed, use the ← and → keys. Hold down the PAGE key and press the ← or → keys to position the cursor at the beginning or end of the line. Use the DELETE ENTRY or BKSP keys to delete characters. Insert new characters by typing them in. Press the ENTER key to save your changes and exit Edit Mode. Press the ESC key to exit Edit Mode without saving the changes.

Exiting the Screen

To exit the Patient Data screen, press any of the other Screen keys.

Drug Administration Screen

The Drug Administration screen is used to enter, edit and view the record of the drugs administered to the patient.

The Drug Administration screen displays a list that shows the sequence number, time, drug, dosage and units of measure for each drug entered.

Selecting the Screen

Press the DRUGS key to enter the Drug Administration screen.

Moving the cursor

When the screen is selected, the cursor appears under the DRUG NAME column in the blank cell below the last entry, unless the last entry is "STAT DRUG". If the last entry is "STAT DRUG" the cursor will appear on that line. Press the ←, →, ↑ or ↓ keys to move the cursor between cells. When there are multiple screens of data, hold down the PAGE key and press the ↑ and ↓ keys to scroll information one screen forward or backward.

Entering/Editing Data

The sequence number is automatically placed in the NO. column. Sequence numbers cannot be edited.

The current time is automatically placed in the TIME column. The time in the blank set of cells at the bottom is updated every minute with the current time. When a new entry is made, the current time automatically becomes the time of the entry. The time can be changed for any entry by moving the cursor into the hour and minute columns and typing the new time.

```
┌─────────────────────────────────────────────────────┐
│                                                       │
│  DRUG ADMINISTRATION                                  │
│                                                       │
│                                                       │
│  NO.  TIME   DRUG NAME           DOSE   UNITS          │
│  12   07:04  Labetalol           10     mg             │
│  13   08:47  Protamine           20     mg             │
│  14   09:15  Protamine           20     mg             │
│  15   09:31  Pancuronium         2      mg             │
│  16   09:42  Sufentanil          100    mcg            │
│  17   09:47  Morphine            12     mg             │
│  18   09:51  Sufentanil          60     mcg            │
│  19   09:53  Morphine            12     mg             │
│  20   09:54  Pancuronium         2      mg             │
│  21   09:59  Morphine            12     mg             │
│  22   10:12  Midazolam           2      mg             │
│  23   10:17  Midazolam           2      mg             │
│  24   10:22  Morphine            6      mg             │
│  25   10:26  Morphine            12     mg             │
│  26   10:31  Midazolam           4      mg             │
│  27   15:15  ████████████████████                     │
│                                                       │
└─────────────────────────────────────────────────────┘
```

Use the alphanumeric keys to type and edit data. To delete the last character entered, press the BKSP key.

If the ENTER key or the ←, →, ↑ or ↓ keys have not been pressed, pressing the ESC key clears newly entered data from a cell and restores the previous entry, if any.

The ESC key can also be used to exit from a pop-up menu without making a selection.

After entering or editing data in a cell, press the ENTER key or the ←, →, ↑ or ↓ keys. This completes the current cell entry and advances the cursor to the next cell.

The phrase STAT DRUG may appear in the DRUG NAME column. It indicates that the STAT DRUG key was pressed at that time during the case. The STAT DRUG entry can be edited to show the actual drug and dose administered at that time. If any edited data alters the time sequence, the entries will initially appear to be out of sequence. To display the entries in proper time sequence, exit the Drug Administration screen and then re-enter it.

A maximum of 96 entries can be made in the Drug Administration Screen.

To delete an entry, move the cursor to the cell to be deleted, and press DELETE ENTRY. A prompt appears on the screen to confirm the deletion.

1) To delete the data from the screen and the disk, press the Y key.

2) To cancel the DELETE ENTRY request, press the N key or any key other than Y.

```
┌─────────────────────────────────────────────────────────────┐
│                                                              │
│  DRUG ADMINISTRATION                                         │
│                                                              │
│                                                              │
│  NO.  TIME   DRUG NAME          DOSE   UNITS                 │
│  12   07:04  Labetalol          10     mg                   │
│  13   08:47  Protamine          20     mg                   │
│  14   09:15  Protamine          20     mg                   │
│  15   09:31  Pancuronium        2      mg                   │
│  16   09:42  Sufentanil         100    mcg                  │
│  17   09:47 ┌─────────────────────────────────────────────┐│
│  18   09:51 │ Delete 10:26  Morphine  12  mg ? (Y/N) _     ││
│  19   09:53 └─────────────────────────────────────────────┘│
│  20   09:54  Pancuronium        2      mg                   │
│  21   09:59  Morphine           12     mg                   │
│  22   10:12  Midazolam          2      mg                   │
│  23   10:17  Midazolam          2      mg                   │
│  24   10:22  Morphine           6      mg                   │
│  25   10:26  Morphine           12     mg                   │
│  26   10:31  Midazolam          4      mg                   │
│  27   15:16                                                  │
│                                                              │
└─────────────────────────────────────────────────────────────┘
```

If no input is detected within 5 seconds, nothing is deleted and the message is removed from the screen.

Drug Template

As an alternative to typing drug names, drugs can also be selected from the Drug Template. The O.R. Data Manager will load the Drug Template found on the floppy disk. If no Drug Template file is found on the disk, the O.R. Data Manager will automatically load a default drug template from non-volatile memory.

To select a drug from the drug template, move the cursor to the desired cell in the DRUG NAME column. Then press the SELECT ENTRY key to invoke the pop-up menu which contains the list of drug names stored in the template.Press the key letter next to the desired selection or use the ↑ or ↓ key to highlight the name and then press ENTER. When the drug is selected, the UNITS column is automatically updated with the most commonly used units of measure for that drug. Refer to *System Configuration Screen - Drug Template Edit Screen* for instructions on creating and editing a case-specific template using the O.R. Data Manager.

The last entry in the Drug Template is the Drug Dictionary, which is a built-in, memory-resident list of commonly used drugs and fluids. When the Drug Dictionary option is selected, a pop-up window appears listing all the drug names in the Drug Dictionary.

```
DRUG ADMINISTRATION

NO.  TIME   DRUG NAME        DOSE   UNITS
12   07:04  Labetalol        10     mg          ┌──────────────────────┐
13   08:47  Protamine        20     mg          │ a. Anectine          │
14   09:15  Protamine        20     mg          │ b. Demerol           │
15   09:31  Pancuronium      2      mg          │ c. Ketamine          │
16   09:42  Sufentanil       100    mcg         │ d. Lidocaine         │
17   09:47  Morphine         12     mg          │ t. DRUG DICTIONARY   │
18   09:51  Sufentanil       60     mcg         │                      │
19   09:53  Morphine         12     mg          │                      │
20   09:54  Pancuronium      2      mg          │                      │
21   09:59  Morphine         12     mg          │                      │
22   10:12  Midazolam        2      mg          │                      │
23   10:17  Midazolam        2      mg          │                      │
24   10:22  Morphine         6      mg          │                      │
25   10:26  Morphine         12     mg          │                      │
26   10:31  Midazolam        4      mg          │                      │
27   15:16  Anectine                            └──────────────────────┘
```

```
DRUG ADMINISTRATION

NO.  TIME   DRUG NAME        DOSE   UNITS

Select Drug:
adenaline      alfentanil      alfentanyl       alphaprodine
amidate        aminophylline   anectine         ativan
atracurium     atropine        benadryl         brevibloc
brevital       bupivacaine     butorphanol      calcium chloride
cefazolin      chloroprocaine  cimetidine       curare
d-tubocurarine demerol         dexamethasone    diazepam
dilaudid       dimethylcurare  diphenhydramine  diprivan
dobutamine     dopamine        droperidol       DTC
edrophonium    enlon           ephedrine        epinephrine
esmolol        etidocaine      etomidate        fentanyl
flaxedil       gallamine       glycopyrrolate   heparin
hydralazine    hydrocortisone  hydromorphone    inderal
isoproterenol  keflin          ketamine         labetalol
```

To select a drug, use the →, ←, ↑ and ↓ keys to highlight the selection and press ENTER. To see information in previous or subsequent pages, press the PAGE key while holding down either the ↑ or ↓ key. After the

drug name is selected, the Drug Dictionary automatically fills in the UNITS column with the most commonly used units for that drug.

Units of Measure

Units of measure may be entered directly from the keyboard or from a pop-up menu. To select units of measure from the pop-up menu, move the cursor to the desired cell in the UNITS column. Press the SELECT ENTRY key to invoke the pop-up menu which contains the list of units of measure.To make a selection, press the key letter next to the desired selection (e.g., press "a" to enter mg), or use the ↑ or ↓ key to highlight the selection and press ENTER.

Edit Mode

The O.R. Data Manager edit mode is used to edit characters in a selected cell. Any cell except the time field and blank may be edited. To invoke the edit mode, highlight the cell to be edited using the ←, →, ↑ or ↓ keys, and press the EDIT key. The Edit Mode window appears. The Edit Mode window displays the selected cell along with editing instructions. To position the cursor at the character to changed, use the ← and → keys.

```
DRUG ADMINISTRATION

NO.  TIME   DRUG NAME         DOSE   UNITS
 12  08:47  Protamine          50    mg         ┌──────────────┐
 13  09:15  Protamine          20    mg         │ a. Mg        │
 14  09:31  Protamine          20    mg         │ b. ug        │
 15  09:42  Pancuronium         2    mg         │ c. cc        │
 16  09:47  Sufentanil        100    mcg        │ d. ml        │
 17  09:51  Morphine           12    mg         │ e. %         │
 18  09:53  Sufentanil         60    mcg        │              │
 19  09:54  Morphine           12    mg         │              │
 20  09:59  Pancuronium         2    mg         │              │
 21  10:12  Morphine           12    mg         │              │
 22  10:17  Midazolam           2    mg         │              │
 23  10:31  Midazolam           2    mg         │              │
 24  10:38  Morphine            6    mg         │              │
 25  10:52  Morphine           12    mg         │              │
 26  11:06  Midazolam           4    Mg         │              │
 27  11:10                                      └──────────────┘
```

Hold down the PAGE key and press the ← or → keys to position the cursor at the beginning or end of the line. Use the DELETE ENTRY or BKSP keys to delete characters. Insert new characters by typing them in. Press the ENTER key to save changes and exit Edit Mode. Press the ESC key to exit Edit Mode without saving the changes.

Exiting the Screen

To exit the Drug Administration screen, press any one of the other Screen keys.

O.R. Event Record Screen

```
DRUG ADMINISTRATION

NO.   TIME   DRUG NAME              DOSE   UNITS
12    07:04  Labetalol              10     mg
13    08:47  Protamine              20     mg
14    09:15  Protamine              20     mg
15    09:31  Pancuronium            2      mg
16
17   EDIT MODE   [ Drug name at 09:31 ]
18
19
20                         Pancuronium
21
22
23   Key legend:    (Insert characters by typing)
24   ->  : Move cursor to right    PAGE ->  : Move cursor to end of cell
25   <-  : Move cursor to left     PAGE <-  : Move cursor to start of cell
26   ESC : Exit edit without save  DELETE ENTRY: Delete char. at cursor
27   ENTER: Exit edit with save    BKSP     : Delete char. to left of cursor
```

The O.R. Event Record screen is used to enter, edit and view the record of events. Each entry shows the sequence number, the time of the event and a description of the event.

Selecting the Screen

Press the EVENTS key to enter the O.R. Event Record screen.

Moving the cursor

When the screen is selected, the cursor appears under the EVENT column in the blank cell below the last entry, unless the last entry is STAT EVENT or ARTIFACT. If the last entry is STAT EVENT or ARTIFACT, the cursor will appear on that line. Press the ←, →, ↑ and ↓ keys to move the cursor between cells. When there are multiple screens of data, hold down the PAGE key and press the ↑ or ↓ key to scroll information one screen forward or backward.

Entering/Editing Data

The sequence number is automatically placed in the NO. column. Sequence numbers cannot be edited.

The current time is automatically placed in the TIME column. The time in the blank set of cells at the bottom is updated every minute with the current time. When a new entry is made, the current time automatically becomes the time of the entry. The time can be changed for any entry by moving the cursor into the hour and minute columns and typing the new time.

Use the alphanumeric keys to enter and edit data. To delete the last character entered, press the BKSP key.

```
O.R. EVENT RECORD


NO.  TIME   EVENT
 10  08:52  Arms padded, positioned + checked
 11  08:53  NGT PSR, head wrapped; Bair Hugger on
 12  08:54  Incision to remove LaVeen shunt
 13  08:55  Incision for liver transplant
 14  09:12  Surgeons repair diaphragmatic tear
 15  09:18  hepatic artery clamp
 16  09:19  ANHEPATIC START
 17  09:34  Flush
 18  09:35  PORTAL/CAVAL REPERFUSION
 19  09:36  Labs sent for analysis
 20  09:38  Cholangiogram taken
 21  09:39  TAH   started by Dr Laros
 22  09:49  Abdomen closed
 23  09:53  End Of Surgery
 24  09:55  Transport to ICU, hand vent w/ monitor
 25  15:26
```

If the ENTER key or the ←, →, ↑ or ↓ keys have not been pressed, pressing the ESC key clears newly entered data from a cell and restores the previous entry, if any. The ESC key can also be used to exit from a pop-up menu without making a selection.

After entering or editing data in a cell press the ENTER key or the →, ←, ↑ or ↓ keys. This completes the current cell entry and advances the cursor to the next cell. The phrase STAT EVENT may appear in the EVENT column. It indicates that the STAT EVENT key was pressed at that time during the case. The STAT EVENT entry can be edited to show the actual event that occurred at that time. The word ARTIFACT may also appear in the EVENT column.It indicates that the ARTIFACT key was pressed at that time during the case. The ARTIFACT entry can be edited to describe the event that occurred at that time. If the time of the ARTIFACT is altered, the change is reflected on both the O.R. Event Record Screen and the Graphic History Screen.If any edited data alters the time sequence, the entries will initially appear to be out of sequence. To display the entries in proper time sequence, exit the O.R. Event Record screen and then re-enter it.

A maximum of 96 entries can be made in the O.R. Event Record Screen.

To delete an entry, move the cursor to the cell to be deleted, and press DELETE ENTRY. A prompt appears on the screen to confirm the deletion.

1) To delete the data from the screen and the disk, press the Y key.

```
O.R. EVENT RECORD

NO.  TIME   EVENT
10   08:52  Arms padded, positioned + checked
11   08:53  NGT PSR, head wrapped; Bair Hugger on
12   08:54  Incision to remove LaVeen shunt
13   08:55  Incision for liver transplant
14   09:12  Surgeons repair diaphragmatic tear
15   09:18
16   09:19  Delete 09:49  Abdomen closed ? (Y/N) _
17   09:34
18   09:35  PORTAL/CAVAL REPERFUSION
19   09:36  Labs sent for analysis
20   09:38  Cholangiogram taken
21   09:39  TAH    started by Dr Laros
22   09:49  Abdomen closed
23   09:53  End Of Surgery
24   09:55  Transport to ICU, hand vent w/ monitor
25   15:27
```

2) To cancel the DELETE ENTRY request, press the N key or any key other than Y.

If no input is detected within 5 seconds, nothing is deleted and the message is removed from the screen.

O.R. Event Pop-Up Menu

As an alternative to typing events, events can also be selected from an Event Pop-Up Menu. To select an event from this pop-up menu, move the cursor to the desired cell in the EVENT column, and press the SELECT ENTRY key. This invokes the main Event Pop-Up Menu which contains a list of standard events. To select an event, press the key letter next to the desired selection (e.g., press "h" for Patient Position), or use the ↑ or ↓ keys to highlight the event and press ENTER. Refer to *System Configuration Screen - Event Template Screen* for instructions on creating and editing a template using the O.R. Data Manager.

Pop-Up menu selections that appear in upper case letters have sub-menus which list several options for that selection. To invoke a sub-menu, select an option shown in upper case letters from the main Event Pop-Up Menu. There are three ways to select the option: press the key letter; highlight the option and press ENTER; or highlight the option and press SELECT ENTRY.

```
┌────────────────────────────────────────────────────────────┐
│ O.R. EVENT RECORD                                          │
│                                                            │
│ NO.  TIME   EVENT                                          │
│ 10   08:52  Arms padded, positioned + checked   ┌────────────────────────┐
│ 11   08:53  NGT PSR, head wrapped; Bair Hugger on│a. Pre-use checkout     │
│ 12   08:54  Incision to remove LaVeen shunt     │b. Patient Enters O.R.  │
│ 13   08:55  Incision for liver transplant       │c. Start Of Anesthesia  │
│ 14   09:12  Surgeons repair diaphragmatic tear  │d. Start Of Surgery     │
│ 15   09:18  hepatic artery clamp                │e. End Of Anesthesia    │
│ 16   09:19  ANHEPATIC START                     │f. End Of Surgery       │
│ 17   09:34  Flush                               │g. Patient Exits O.R.   │
│ 18   09:35  PORTAL/CAVAL REPERFUSION            │h. PATIENT POSITION     │
│ 19   09:36  Labs sent for analysis             │i. INTUBATION           │
│ 20   09:38  Cholangiogram taken                │j. BILLABLE ITEM        │
│ 21   09:39  TAH   started by Dr Laros          │t. EVENT TEMPLATE       │
│ 22   09:49  Abdomen closed                      └────────────────────────┘
│ 23   09:53  End Of Surgery                                 │
│ 24   09:55  Transport to ICU, hand vent w/ monitor         │
│ 25   15:28  Pre-use checkout                               │
└────────────────────────────────────────────────────────────┘
```

To invoke the PATIENT POSITION sub-menu, choose the "**h**" option;
the PATIENT POSITION sub-menu will overlay the main Event Pop-Up
Menu. To choose an event from the sub-menu, press the key letter (for
example, press "**c**" for Pat. pos. Supine), or use the ↑ and ↓ keys to
highlight the event and press ENTER.

```
┌────────────────────────────────────────────────────────────┐
│ O.R. EVENT RECORD                                          │
│                                                            │
│ NO. TIME   EVENT                                           │
│┌──────────────────────────────────────────────────────────┐│
││a. Patient positioned                                     ││
│ b. Patient positioned Prone                                │
│ c. Patient positioned Supine                               │
│ d. Patient positioned Trendelenburg                        │
│ e. Patient positioned Reverse Trendelenburg                │
│ f. Patient positioned Jack Knife                           │
│                                                            │
└────────────────────────────────────────────────────────────┘
```

To invoke the INTUBATION sub-menu, choose the "**i**" option; the INTUBATION sub-menu will overlay the main Event Pop-Up Menu. To choose an event from the sub-menu, press the key letter (for example, press "**i**" for Smooth Intubation) or use the ↑ and ↓ keys to highlight the event and press ENTER.

```
O.R. EVENT RECORD


NO. TIME  EVENT
a. Intubation
b. Intubation: Oral       Blade #N  Tube #M, Type XXX  Smooth
c. Intubation: Nasal Right Blade #N  Tube #M, Type XXX  Smooth
d. Intubation: Nasal Left  Blade #N  Tube #M, Type XXX  Smooth
e. Intubation: Oral       Blade #N  Tube #M, Type XXX  Difficult
f. Intubation: Nasal Right Blade #N  Tube #M, Type XXX  Difficult
g. Intubation: Nasal Left  Blade #N  Tube #M, Type XXX  Difficult
h. Difficult intubation
i. Smooth intubation
j. Atraumatic intubation
k. Traumatic intubation
l. Intubation: Breath sounds equivalent bilateral
```

To invoke the BILLABLE ITEM sub-menu, choose the "**j**" option; the BILLABLE ITEM sub-menu will overlay the main Event Pop-Up Menu. To choose an event from the sub-menu, press the key letter (for example, press "**b**" for CVP) or use the ↑ and ↓ keys to highlight the event and press ENTER.

The last entry in the main Event Pop-Up Menu is the Event Template.
The O.R. Data Manager will load the Event Template found on the
floppy disk. If no Event Template file is found on the disk, the O.R. Data
Manager will automatically load a default event template from non-
volatile memory.

```
O.R. EVENT RECORD


NO. TIME  EVENT
a. Arterial Line
b. CVP
c. Swan-Ganz
d. Fluid Warmer
```

To invoke the EVENT TEMPLATE sub-menu, choose the "**t**" option; the
EVENT TEMPLATE sub-menu will overlay the main Event Pop-Up
Menu. To choose an event from the sub-menu, press the key letter or use
the ↑ and ↓ keys to highlight the event and press ENTER.(For
instructions on creating and editing an event template, refer to *System
Configuration Screen - Event Template Screen* or the *PC Prep/View
Operator's Instruction Manual.*)

```
O.R. EVENT RECORD


NO.  TIME   EVENT
a. Eyes taped
b. Limbs Padded
c. Aorta clamped
d. Aorta unclamped
e. Aorta unclamped right side
f. Left side unclamped
```

Edit Mode

The O.R. Data Manager edit mode is used to edit characters in a selected
cell. Any cell except time field and blank one's may be edited. To invoke
the edit mode, highlight the cell to be edited using the ←, →, ↑ or ↓
keys, and press the EDIT key. The Edit Mode window appears. The Edit
Mode window displays the selected cell along with editing instructions.
To position the cursor at the character to be changed, use the ← and →
keys. Hold down the PAGE key and press the ← or → keys to position
the cursor at the beginning or end of the line.Use the DELETE ENTRY or
BKSP keys to delete characters. Insert new characters by typing them
in.

```
O.R. EVENT RECORD


NO.  TIME   EVENT
10   08:52  Arms padded, positioned + checked
11   08:53  NGT PSR, head wrapped; Bair Hugger on
12   08:54  Incision to remove LaVeen shunt
13   08:55  Incision for liver transplant
14
15   EDIT MODE   [ Event at 08:53 ]
16
17
18     NGT PSR, head wrapped; Bair Hugger on█
19
20
21   Key legend:    (Insert characters by typing)
22   ->  : Move cursor to right    PAGE ->  : Move cursor to end of cell
23   <-  : Move cursor to left     PAGE <-  : Move cursor to start of cell
24   ESC : Exit edit without save  DELETE ENTRY: Delete char. at cursor
25   ENTER: Exit edit with save    BKSP     : Delete char. to left of cursor
```

Press the ENTER key to save your changes and exit Edit Mode. Press the ESC key to exit Edit Mode without saving the changes.

Exiting the Screen

To exit the O.R. Event Record screen, press any one of the other Screen keys.

Numeric Screen

The numeric screen is divided into two sections. The upper portion of the screen contains information automatically detected by the host anesthesia system, and it cannot be edited. This part of the screen displays the following items:

- Inspiratory oxygen concentration (Fi O2)

- Inspiratory nitrous-oxide concentration (Fi N2O)

- Inspiratory anesthetic agent concentration (Agent, Enflurane, Isoflurane, Halothane)

- End-tidal carbon dioxide (ET-CO2)

- Peak inspiratory pressure (P.I.P)

- Mean central venous pressure (CVP)

The lower portion of the screen contains a record of patient flows and fluids. This information, which has been entered through the keyboard, can be edited.

Both portions of the screen share a common time line, which appears along the top of the screen. The time line is displayed in 15 minute intervals. A maximum of 1 hour and 45 minutes of information can be displayed on the screen at one time. The current time is displayed in the upper right corner of the screen.

Selecting the Screen

Press the NUMERIC key to enter the Numeric screen.

```
                                                                    16:00

NUMERIC DATA


NAME              UNITS   14:30 14:45 15:00 15:15 15:30 15:45 16:00 16:15
Fi O2              %       64    49    48    48    48    48    48    48
Fi N2O             %        1     1     1     1     0     0     0     1
ISOFLURANE         %       2.9   0.4   0.4   0.4   0.4   0.4   0.4   0.4
ET-CO2            MM Hg    31    25    28    27    27    27    31    27
P.I.P.            CM H2O   25    23    24    22    22    22    19    19
CVP Mean          MM Hg    ───────────────────────────────── 50  ──
                                                                    TOTAL
Cryoprecipitate   cc      ─────────────────────────────────────     0.0
Ringers           cc      ─────────────────────────────────────     0.0
Est blood loss    cc      ──────────────────── 350 ─────── 500    2550.0
Urine output      cc      ──────────────────── 150 ─────── 100    1250.0
Ascites Removed   cc      ──────────── 400 ─────────────────       400.0
Insensible loss   cc      ──────────────────── 500 ────────       2500.0
Lasix             mg      10    10    10    10    10    10    10    10  200.0
                          ─────────────────────────────────────
```

Moving the cursor

When the screen is selected, the cursor will appear under the NAME column in the blank cell below the last entry.

Press the ←, →, ↑ and ↓ keys to move the cursor between cells. When there are multiple screens of data, hold down the PAGE key and press the ←, →, ↑ and ↓ keys to page left, right, up, and down to see entries not currently shown on the screen. It is not possible to scroll back past the beginning of the procedure, nor ahead of the current time.

Entering/Editing Data

Use the alphanumeric keys to type and edit data. To delete the last character entered, press the BKSP key.

If the ENTER key or the →, ←, ↑ and ↓ keys have not been pressed, pressing the ESC key clears newly entered data from a cell and restores the previous entry, if any. The ESC key can also be used to exit from a pop-up menu without making a selection.

To complete an entry and advance the cursor to the next cell, type the desired data and press the ENTER key or the →, ←, ↑ and ↓ keys. A maximum of 15 numeric names can be entered, with a maximum of 30

entries for each numeric name. With the exception of the NAME and UNITS columns, most of the data entered on this screen is numeric. It is possible to also enter non-numeric information (such as **"NSR"** for Normal Sinus Rhythm under the NAME **"ECG"**).

However, because the entries are usually numbers, a screen prompt appears on the screen to make sure that non-numeric information is to be entered in that row:

```
                                                                    11:40


NUMERIC DATA


NAME             UNITS    15:15  15:30  15:45  16:00  16:15  16:30  16:45  17:00
Fi O2            %        48     48     48     48     48     84     85     56
Fi N2O           %        1      0      0      0      1      43     0      1
ISOFLURANE       %        0.4    0.4    0.4    0.4    0.4    0.0    0.4    0.4
ET-CO2           mm Hg    27     27     27     31     27     35     31     31
P.I.P.          ┌─────────────────────────────────────────────────┐
CVP Mean        │  Non-numeric value OK for this item ? (Y/N) _     │        TOTAL
                └─────────────────────────────────────────────────┘
Cryoprecipitate cc    ───    ───    ───    ───    ───    ───    ───    ───     0.0
Ringers         cc    ───    ───    ───    ───    ───    ───    ───    ───     0.0
Est blood loss  cc    ───    350    ───    ───    500    500    ───    300  2550.0
Urine output    cc    ───    150    ───    ───    100    ───    50     ───  1250.0
Ascites Removed cc    ───    ───    ───    ───    ───    ───    ───    ───   400.0
Insensible loss cc    ───    500    ───    ───    ───    500    ───    ───  2500.0
Lasix           mg    10     10     10     10     10     10     10     10    200.0
ECG                   ▬▬▬    ───    ───    ───    ───    ───    ───    ───     0.0
```

1) Press the Y key to enter the non-numeric information. If non-numeric information is entered, the TOTAL function will be disabled for that row.

2) Press N or any key other than Y if non-numeric information is not to be entered.

If no input is detected within 5 seconds, non-numeric information is not accepted for that row, and the message disappears.

To erase a single entry in a line, move to the cell and press DELETE ENTRY. A query appears on screen to confirm the deletion:

1) To delete the data from the screen and disk, press Y.

2) To cancel the DELETE ENTRY request, press N or any key other than Y.

If no input is detected within 5 seconds, nothing is deleted and the message is removed from the screen.

```
                                                                    16:09

 NUMERIC DATA


 NAME          UNITS   15:15  15:30  15:45  16:00  16:15  16:30  16:45  17:00
 Fi 02           %      48     48     48     48     48     84     85     56
 Fi N20          %      1      0      0      0      1     ----    0      1
 ISOFLURANE      %      0.4    0.4    0.4    0.4    0.4   ----   0.4    0.4
 ET-CO2        mm Hg    27     27     27     31     27    ----    31     31
 P.I.P.
 CVP Mean      | Delete  Est blood loss  500 cc  at 16:15 ? (Y/N) _ |
                                                                      TOTAL
 Rapid transfusi cc   300    300    100   ----   ----   700    ----   ----   2700.0
 Cryoprecipitate cc   ----   ----   ----  ----   ----   ----   ----   ----      0.0
 Ringers lactate cc   ----   ----   ----  ----   ----   ----   ----   ----      0.0
 Est blood loss  cc   ----   350    ----  ----   500    500    ----   300    2550.0
 Urine output    cc   ----   150    ----  ----   100    ----    50   ----    1250.0
 Insensible loss cc   ----   500    ----  ----   ----   500    ----   ----   2500.0
```

To erase all entries in a line, move to the NAME or UNITS column in that line and press DELETE ENTRY.

A query appears on screen to confirm the deletion.

1) To delete the data from the screen and disk, press Y.

2) To cancel the DELETE ENTRY request, press N or any key other than Y.If no input is detected within 5 seconds, nothing is deleted, and the message is removed from the screen.

Another prompt appears on the screen to make sure the information is to be deleted. Press Y or N accordingly.

```
                                                                    16:05

 NUMERIC DATA


 NAME              UNITS   15:30  15:45  16:00  16:15  16:30  16:45  17:00  17:15
 Fi O2             %        48     48     48     48     84     85     56    ____
 Fi N2O            %         0      0      0      1     ____    0      1     ____
 ISOFLURANE        %        0.4    0.4    0.4    0.4    ____   0.4    0.4    ____
 ET-CO2            mm Hg     27     27     31     27     ____   31     31
 P.I.P.
 CVP Mean       Delete all entries for 'Ringers lactate' ? (Y/N) _
                                                                       TOTAL
 Rapid transfusi cc   300    100    ____   ____   700    ____   ____   ____  2700.0
 Cryoprecipitate cc   ____   ____   ____   ____   ____   ____   ____   ____     0.0
 Ringers lactate cc   ____   ____   ____   ____   ____   ____   ____   ____     0.0
 Est blood loss  cc   350    ____   ____   500    500    ____   300    ____  2550.0
 Urine output    cc   150    ____   ____   100    ____   50     ____   ____  1250.0
 Insensible loss cc   500    ____   ____   ____   500    ____   ____   ____  2500.0
```

Numeric Template

As an alternative to typing fluid names, they can also be selected from the Numeric Template. The O.R. Data Manager will load the Numeric Template found on the floppy disk. If no Numeric Template file is found on the disk, the O.R. Data Manager will automatically load a default numeric template from non-volatile memory. To select a fluid from the Numeric Template, move the cursor into the desired cell under the NAME column. Press the SELECT ENTRY key to invoke the pop-up menu that contains the list of drug and fluid names stored in the template. To make a selection, press the key letter, or use the ↑ and ↓ keys to highlight the selection, and press ENTER.

When the fluid is selected, the UNITS column is automatically updated with the most common units of measure for that fluid. (For instructions on creating and editing Numeric templates, refer to *System Configuration Screen - Numeric Template Screen* or the *PC Prep/View Operator's Instruction Manual*.)

```
                                                              10:00

NUMERIC DATA


NAME          UNITS    08:30  08:45  09:00  09:15  09:3  a. Ringers
Fi O2           %       ─────  ─────  ─────  ─────   37   b. Normal saline
Fi N2O          %       ─────  ─────  ─────  ─────   11   c. Prbc
ISOFLURANE      %       ─────  ─────  ─────  ─────  0.0   d. Ffp
ET-CO2        MM Hg     ─────  ─────  ─────  ─────   34   e. Platelets
P.I.P.        CM H2O    ─────  ─────  ─────  ─────   33   f. Cryoprecipitate
CVP Mean      MM Hg     ─────  ─────  ─────  ─────   50   g. Rapid transfus.
                                                          h. Albumin
Cryoprecipitate cc      ─────  ─────  ─────  ─────        i. Epidural lido
Ringers         cc      ─────  ─────  ─────  ─────        j. Saline
Est blood loss  cc      ─────  ─────  ─────  ─────        t. DRUG DICTIONARY
Urine output    cc      ─────  ─────  ─────  ─────
Ascites Removed cc      ─────  ─────  ─────  ─────
Insensible loss cc      ─────  ─────  ─────  ─────
Lasix           MG      ─────  ─────  ─────  ─────
Ringers                 ─────  ─────  ─────  ─────
```

The last entry in the Numeric Template is the Drug Dictionary, which is a built-in, memory-resident list of commonly used drugs and fluids. If the Drug Dictionary is selected, a pop-up window appears listing all the drug names in the Drug Dictionary.

To select a drug, use the ←, →, ↑ and ↓ keys to highlight your selection and press ENTER. Hold down the PAGE key and press the ↑ and ↓ keys to see information on previous or subsequent pages. After the drug or fluid name is selected, the Drug Dictionary automatically fills in the UNITS column with the most commonly used units for that drug. As an alternative to typing units of measure, they can also be selected from a pop-up menu. To select units of measure from the pop-up menu, move the cursor to the desired cell under the UNITS column. Press the SELECT ENTRY key to invoke the pop-up menu that contains the list of units of measure.

To make a selection, press the key letter (for example, press "h" for cc), or use the ↑ and ↓ keys to highlight the choice and press ENTER. The new unit of measure replaces any existing unit of measure.

```
                                                              10:03


  NUMERIC DATA


  ┌──────────────────────────────────────────────────────────┐
  │ Select Drug:                                               │
  │ ▐Adenaline▌     Alfentanil      Alfentanyl      Alphaprodine │
  │ Amidate         Aminophylline   Anectine        Ativan     │
  │ Atracurium      Atropine        Benadryl        Brevibloc  │
  │ Brevital        Bupivacaine     Butorphanol     Calcium chloride │
  │ Cefazolin       Chloroprocaine  Cimetidine      Curare     │
  │ D-tubocurarine  Demerol         Dexamethasone   Diazepam   │
  │ Dilaudid        Dimethylcurare  Diphenhydramine Diprivan   │
  │ Dobutamine      Dopamine        Droperidol      Dtc        │
  │ Edrophonium     Enlon           Ephedrine       Epinephrine │
  │ Esmolol         Etidocaine      Etomidate       Fentanyl   │
  │ Flaxedil        Gallamine       Glycopyrrolate  Heparin    │
  │ Hydralazine     Hydrocortisone  Hydromorphone   Inderal    │
  │ Isoproterenol   Keflin          Ketamine        Labetalol  │
  │                                                            │
  └──────────────────────────────────────────────────────────┘
```

Disabling/Enabling Totals

The TOTAL function in the Numeric screen can be disabled. This is helpful when entering information that is numeric, but not cumulative (for example, cardiac output). To disable the function, highlight the TOTAL cell for the desired entry and press the SELECT ENTRY key. When the pop-up menu appears, select Total OFF by typing "b," or by using the ↑ and ↓ keys to highlight the choice and press ENTER.

```
                                                                  16:12

   NUMERIC DATA


   NAME             UNITS   15:15  15:30  15:45  16:00  16:1  a.  %
   Fi O2            %       48     48     48     48     48    b.  L/min
   Fi N2O           %       1      0      0      0      1     c.  cc/min
   ISOFLURANE       %       0.4    0.4    0.4    0.4    0.4   d.  ug/kg/m
   ET-CO2           mm Hg   27     27     27     31     27    e.  units
   P.I.P.           cm H2O  22     22     22     19     19    f.  mg
   CVP Mean         mm Hg   ─      ─      ─      50           g.  ug
                                                             h.  cc
   Rapid transfusi  cc      300    300    100    ─            i.  ml
   Cryoprecipitate  cc      ─      ─      ─      ─
   Ringers lactate  cc      ─      ─      ─      ─
   Est blood loss   cc      ─      350    ─      ─      500
   Urine output     cc      ─      150    ─      ─      100
   Insensible loss  cc      ─      500    ─      ─
```

The total can be re-enabled by selecting Total ON. (The default setting for all totals is Total ON.)

```
                                                                  10:03

   NUMERIC DATA


   NAME             UNITS   08:30  08:45  09:00  09:15  09:3  a.  Total ON
   Fi O2            %                                         b.  Total OFF
   Fi N2O           %       ─      ─      ─      ─      ─
   ISOFLURANE       %       ─      ─      ─      ─      ─
   ET-CO2           mm Hg   ─      ─      ─      ─      ─
   P.I.P.           cm H2O  ─      ─      ─      ─      ─
   CVP Mean         mm Hg   ─      ─      ─      ─      ─

   Normal saline    cc      ─      ─      ─      ─      ─
   Prbc             cc      ─      ─      ─      ─      ─
   Ffp              cc      ─      ─      ─      ─      ─
   Platelets        cc      ─      ─      ─      ─      ─
   Albumin          cc      ─      ─      ─      ─      ─
   Rapid transfusi  cc      ─      ─      ─      ─      ─
   Cryoprecipitate  cc      ─      ─      ─      ─      ─
   Cardiac Output   l/m     ─      ─      ─      ─      ─
```

Edit Mode

The O.R. Data Manager edit mode is used to edit characters in a selected cell. Any cell except time field and blank one's may be edited. To invoke the edit mode, highlight the cell to be edited using the ←, →, ↑ or ↓ keys, and press the EDIT key. The Edit Mode window appears.

The Edit Mode window displays the selected cell along with editing instructions. To position the cursor at the character to changed, use the ← and → keys. Hold down the PAGE key and press the ← or → keys to position the cursor at the beginning or end of the line.

Use the DELETE ENTRY or BKSP keys to delete characters. Insert new characters simply by them in.

Press the ENTER key to save changes and exit Edit Mode. Press the ESC key to exit Edit Mode without saving the changes.

```
O.R. EVENT RECORD

NO.  TIME   EVENT
 10  08:52  Arms padded, positioned + checked
 11  08:53  NGT PSR, head wrapped; Bair Hugger on
 12  08:54  Incision to remove LaVeen shunt
 13  08:55  Incision for liver transplant
 14
 15  EDIT MODE    [ Event at 08:53 ]
 16
 17
 18     NGT PSR, head wrapped; Bair Hugger on█
 19
 20
 21  Key legend:    (Insert characters by typing)
 22  -)  : Move cursor to right    PAGE -)      : Move cursor to end of cell
 23  (-  : Move cursor to left     PAGE (-      : Move cursor to start of cell
 24  ESC : Exit edit without save  DELETE ENTRY: Delete char. at cursor
 25  ENTER: Exit edit with save    BKSP         : Delete char. to left of cursor
```

Exiting the Screen

To exit the Numeric screen, press any of the other Screen keys.

Graphic History Screen

The Graphic History screen provides up to 14 hours of history for the following items:

- Oxygen saturation

- Pulse rate

- Arterial systolic and diastolic blood pressure

- Non-invasive systolic and diastolic blood pressure

- Temperature

- Respiratory rate

A time line, displayed in 5 minute intervals, appears at the top of the screen. A maximum of 2 hours of information can be displayed on the screen at one time.

Sequence numbers for the drugs and events, indicating the 15-minute time period during which the drug was administered or the event took place, appear above the time line.

The graph displays three scales:

- 0-240 scale (left side of the graph) - for blood pressure, pulse and respiration measurements.

- 30-42 scale (right side of the graph) - for temperature in degrees Celsius.

- 80-100 scale (far right side of the graph) - for oxygen saturation in percentage.The frequency of recording variables is as follows:

- SpO_2 2 minutes
- Pulse   5 minutes
- Arterial Blood Pressures   5 minutes
- Respiratory Rate   5 minutes
- Temperature   15 minutes
- Noninvasive Blood Pressures   on demand

Selecting the Screen

Press the GRAPHIC key to enter the Graphic History screen.

Moving the Cursor

Press the ← and → keys to move the cursor through the data. When there are multiple screens of data, hold down the PAGE key and press the ← and → keys to page left and right to see entries not currently shown on the screen. It is not possible to scroll back past the beginning of the procedure or ahead in time.
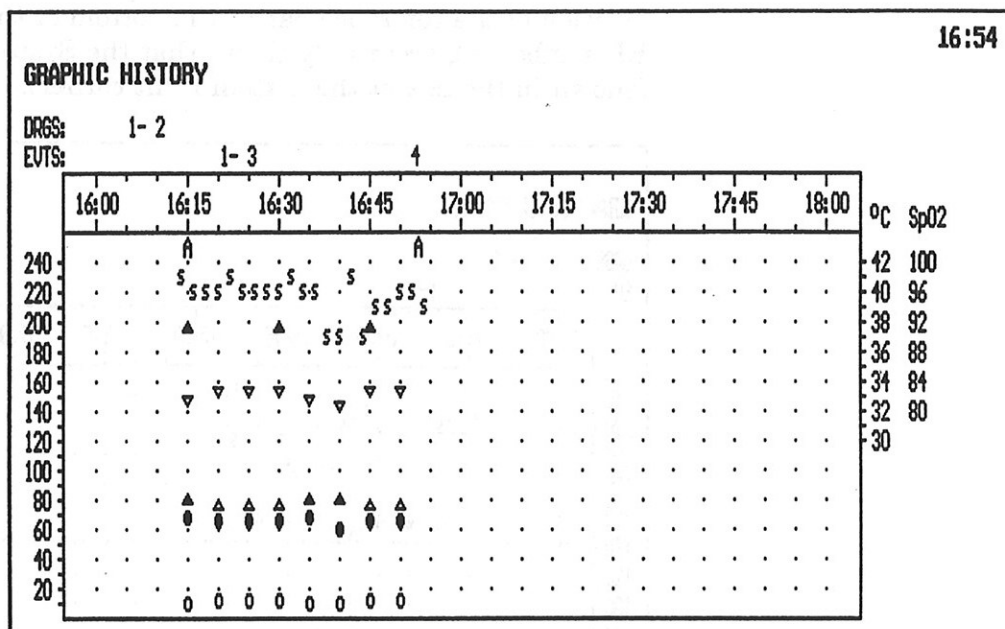
Screen Symbol Legend

o	Respiration
∧	Diastolic NIBP
△	Arterial Diastolic BP
▲	Temperature
S	Oxygen Saturation
●	Pulse
∨	Systolic NIBP
▽	Arterial Systolic BP
A	Artifact

The measured value lies at the top/bottom points of symbols ∧, ∨, △, ▽ and ▲, and at the center of symbols o, ● and S. Using the Reference Bar

The Graphic History screen contains a reference bar that can be moved up and down on the graph to help pinpoint the exact value for a measurement. When the screen appears, the reference bar is not shown. To use the reference bar, press the ↑ key; the bar appears and moves toward the top of the screen. A three-tier box also appears in the lower right corner of the screen, displaying the current location of the bar on all three scales; the top tier of the box displays blood pressure, pulse and respiration measurements, the middle tier displays temperature in degrees Celsius and the bottom tier displays oxygen saturation in percent. The reference bar can be moved up or down at any time by pressing the ↑ and ↓ keys. To move the reference bar in bigger increments, hold down the PAGE key and press the ↑ or ↓ key. To "put away" the reference bar and scale box, press the ↑ or ↓ key until the reference line moves off the top or bottom of the screen, or exit and re-enter the screen. As an example from the illustration below, the

position of the reference bar at the bottom of the first Arterial Systolic BP symbol (▽), accurately shows that the Systolic IBP at 16:15 was 142 (shown in the box at the bottom right corner).
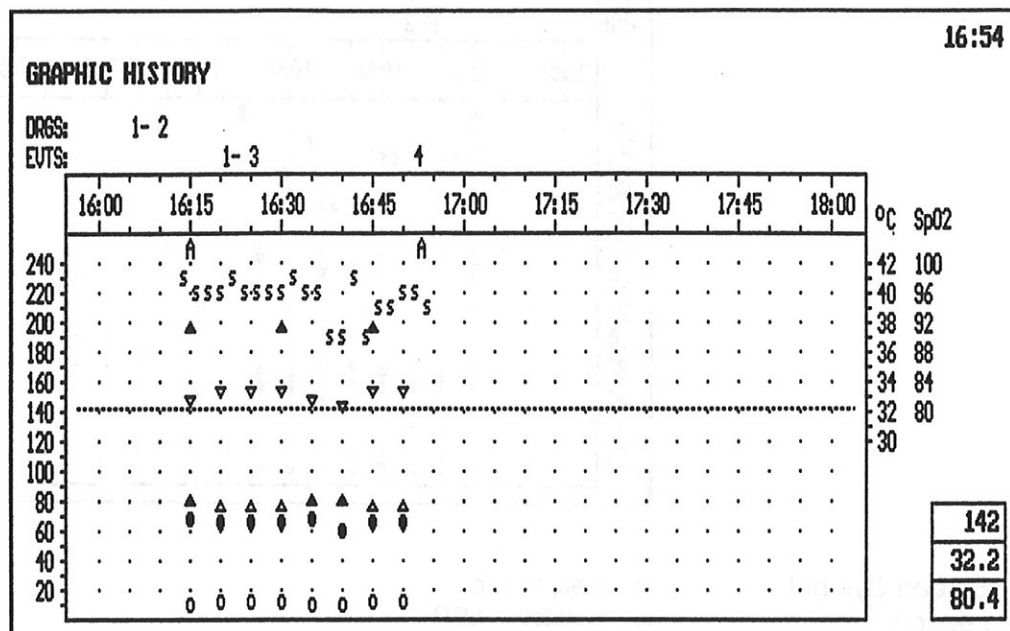
Exiting the Screen

To exit the Graphic History screen, press any of the other Screen keys.

Printing Anesthesia Records

If the optional printer is installed, an anesthesia record can be printed. A printed record contains data recorded by O.R. Data Manager during a case. The record also contains labeled boxes for Anesthesia Start time, Anesthesia End time, Surgery Start time and Surgery End time, as well as a check-off box for a Pre-Use Checkout of the anesthesia machine. This information will be automatically filled in only if these events were selected from the main Event Pop-Up Menu (refer to *Selecting from the Event Pop-Up Menu*). The duration of anesthesia and surgery (ANES TIME and SURG TIME) are calculated by the O.R. Data Manager by subtracting Start times from End times.

The print function can be performed at any time, from any screen. To print the anesthesia record, press PRINT RECORD. A screen prompt asks for the number of copies to print.

Enter a number of copies between 1 and 5. When a valid number of
copies is entered, the print request is initiated. Only numbers 1 through
5 are accepted. If a response is not made within 5 seconds, the print
request is cancelled. Do not remove the floppy disk from the disk drive
while the anesthesia record is being printed.

```
ORDM PRINT SCREEN




                     ┌──────────────────────────────────────────────┐
                     │ Enter number of copies of record to print... _ │
                     └──────────────────────────────────────────────┘
```

Cancelling a Print
Request

To stop the printer before it has completed printing, press PRINT
RECORD again, the ESC key or any Screen key. A screen prompt will
appear to confirm the print request.

- To cancel the print request, press Y.

- To continue printing, press N or any key other than Y.

```
ORDM PRINT SCREEN




                        ┌──────────────────────┐
                        │    ·                  │
              ┌─────────┴──────────────────────┴─────────┐
              │ Print in process... Abort print ? (Y/N) _ │
              │                                           │
              └───────────────────────────────────────────┘
```

The following is an example of an anesthesia record produced and printed by the O.R. Data Manager.

ANESTHESIA RECORD							PAGE: 01 of 02	
Medical Center: Liver Transplant Svc								

ANESTHETIST(S) Dr. Smith   **SURGEON(S)** Dr. Jones

DIAGNOSIS Alcoholic Liver Disease   **CODE**

PROCEDURE(S) Ortho Liver Transplant   **CODE(S)** 47135

REMARKS

ANES START 13:10	ANES END 19:35	ANES TIME 06:25	ANESTHESIA TYPE General		HT 68 in (173 cm)	PAT NAME: Smith, Joe I PAT ID: 111 222 8976	
SURG START 13:17	SURG END 19:15	SURG TIME 05:58	DATE 23-Jan-91	ASA# 3	OR# 11	WT 121 lb (55 kg)	PAT DOB: 1/30/1940 PAT AGE: 50 SEX: M SUPVN: 2

DRUGS

1	13:15	Midazolam	2 mg
2	13:15	Sufentanil	20 mcg
3	13:15	Thiopental	175 mg
4	13:17	Succinylcholine	100 mg
5	13:17	Pancuronium	5 mg
6	14:47	Sufentanil	530 mcg
7	14:50	Phenylephrine	180 mcg
8	15:49	Dexamethasone	10 mg
9	15:55	Sufentanil	40 mcg
10	16:03	mannitol	12.5 g

EVENTS

1	13:03	Pre-use Checkout
2	13:10	Start of Anesthesia
3	13:15	ID/NPO/NKDA/Consent/PIV20gL-checked
4	13:15	OR11, Transferred, Monitors, PreO2x3min
5	13:17	IV RSI, DLMAC3, 7.5 UDV, BBS, +ETCO2
6	13:17	16g R PIV, 20g LRA sline, 9FrL,RIJ-PA
7	13:17	Start of Surgery
8	13:47	Baseline Labs sent
9	13:47	Ceftzox 1 gr IV +Prednisolone 55 mg
10	13:47	Arms padded, positioned + checked
11	14:01	NGT PSR, head wrapped; Bair Hugger on
12	14:01	Incision to remove LeVeen shunt
13	14:30	Labs sent for analysis
14	14:35	Incision for liver transplant
15	15:00	Labs sent for analysis
16	15:30	Labs sent for analysis
17	15:38	Surgeons repair diaphragmatic tear
18	16:15	Labs sent for analysis
20	16:18	hepatic artery clamp

System Configuration Screen

The System Configuration screen is used to select a template or hospital name sub-screen in order to customize the operation of the O.R. Data Manager. The items that may be customized are Drug, Event and Numeric templates and the name of the hospital.

A Drug template is a custom list of drugs and units of measure that are commonly administered during a specific type of case. An Event template is a custom list of events that commonly occur during a specific type of case. A Numeric Template is a custom list of fluids and units of measure commonly administered during a specific type of case. Templates are always stored on the disk as case-specific templates, but they can also be saved to non-volatile memory to be used as the default templates. The hospital name is saved both to disk and to non-volatile memory.

If the O.R. Data Manager and the NARKOMED 4 are not communicating, a Configure Serial Port option will also appear on the System Configuration Screen.

Selecting the Screen

Press the CONFIG key to enter the System Configuration screen.

```
┌──────────────────────────────────────────────────────────┐
│                                                            │
│  SYSTEM CONFIGURATION                                      │
│                                                            │
│                                                            │
│  ▐(D) Drug template edit                      ▌            │
│   (E) Event template edit                                  │
│   (N) Numeric template edit                                │
│   (H) enter Hospital name                                  │
│                                                            │
│                                                            │
│                                                            │
│                                                            │
│                                                            │
│                                                            │
│  Use arrow keys or alpha keys to select option...          │
│                                                            │
└──────────────────────────────────────────────────────────┘
```

Moving the Cursor

When the screen is selected, the cursor appears in the first row. Press the ↑ and ↓ keys to move the cursor through the selections.Selecting a Sub-Screen

To select a sub-screen, press the key letter (for example, press "D" for Drug template edit), or use the ↑ and ↓ keys to highlight the choice and press ENTER. The requested screen appears.

Drug Template Edit Screen

The Drug Template Edit screen is used to create and edit a Drug Template, which is a custom list of drugs and units of measure commonly administered during a case. Using a Drug Template permits the user to quickly enter information into the Drug Administration screen without having to type all the information. A Drug Template can contain up to 14 entries.

When a template has been created or edited, it is saved to disk to be used as a case-specific template. It can also be saved to non-volatile (permanent) memory to be used as the default template.

Selecting the Screen

At the System Configuration menu, press "**D**," or use the ↑ and ↓ keys to highlight Drug template edit and press ENTER.

```
DRUG TEMPLATE EDIT SCREEN

KEY  DRUG NAME            UNITS
a.   Thiopental           mg
b.   Succinylcholine      mg
c.   Vecuronium           mg
d.   Dtubocurare          mg
e.   Morphine             mg
f.   Sufentanil           mcg
g.   Fentanyl             mcg
h.   Phenylephrine        mcg
i.   Lidocaine            mg
j.   Nahco3               mEq
k.   █████████████████
```

Moving the Cursor

When the screen is selected, the cursor appears under the DRUG NAME column in the blank cell below the last entry. Press the ↑ and ↓ keys to move the cursor through the selections.

Entering/Editing Data

Use the alphanumeric keys to enter new drugs and units of measure or to edit previous information. To delete the last character entered, press the BKSP key. If the ENTER key or the →, ←, ↑ and ↓ keys have not been pressed, the ESC key can be used to clear newly entered data from a cell and restore the previous entry, if any. The ESC key is also used to exit from a pop-up menu without making a selection.

To complete an entry and advance the cursor to the next cell, type the desired data and press the ENTER key or the →, ←, ↑ and ↓ keys. To

erase a drug entry, highlight the item and press DELETE ENTRY. A query appears on the screen to confirm the deletion.

1) To delete the data from the screen and disk, press Y.

2) To cancel the DELETE ENTRY request, press N or any key other than Y.

If no input is detected within 5 seconds, nothing is deleted, and the message is removed from the screen.

```
DRUG TEMPLATE EDIT SCREEN

KEY  DRUG NAME           UNITS
a.   Thiopental          mg
b.   Succinylcholine     mg
c.   Vecuronium          mg
d.   Dtubocurare         mg
e.   Midazolam           mg
f.   Morph┌──────────────────────────────────────┐
g.   Sufer│ Delete Lidocaine  in  mg ? (Y/N) _    │
h.   Fenta└──────────────────────────────────────┘
i.   Phenylephrine       mcg
j.   Lidocaine           mg
k.   Nahco3              mEq
l.
```

Drug Dictionary

O.R. Data Manager has a built-in, memory-resident Drug Dictionary containing commonly used drugs and fluids. Drug names can be selected from the drug dictionary by pressing SELECT ENTRY while the cursor is in the DRUG NAME cell. This invokes a pop-up window listing all the drug names in the Drug Dictionary. To select a drug, use the ←, →, ↑ and ↓ keys to highlight the selection and press ENTER. Hold down the PAGE key and press the ↑ and ↓ keys to see information on previous or subsequent pages. After the drug name is selected, the Drug Dictionary automatically fills in the UNITS column with the most commonly used units for that drug.

```
DRUG TEMPLATE EDIT SCREEN


KEY  DRUG NAME            UNITS
  a
  b ┌──────────────────────────────────────────────────────────┐
  c │ Select Drug:                                              │
  d │ ▌adenaline     alfentanil     alfentanyl    alphaprodine  │
  e │ amidate        aminophylline  anectine      ativan        │
    │ atracurium     atropine       benadryl      brevibloc     │
    │ brevital       bupivacaine    butorphanol   calcium chloride│
    │ cefazolin      chloroprocaine cimetidine    curare        │
    │ d-tubocurarine demerol        dexamethasone diazepam      │
    │ dilaudid       dimethylcurare diphenhydramine diprivan    │
    │ dobutamine     dopamine       droperidol    DTC           │
    │ edrophonium    enlon          ephedrine     epinephrine   │
    │ esmolol        etidocaine     etomidate     fentanyl      │
    │ flaxedil       gallamine      glycopyrrolate heparin      │
    │ hydralazine    hydrocortisone hydromorphone inderal       │
    │ isoproterenol  keflin         ketamine      labetalol     │
    └──────────────────────────────────────────────────────────┘
```

Edit Mode

The O.R. Data Manager edit mode is used to edit characters in a selected cell. Any cell except a blank one can be edited. To invoke the edit mode, highlight the cell to edited using the ←, →, ↑ or ↓ keys, and press the EDIT key. The Edit Mode window appears.

The Edit Mode window displays the selected cell along with editing instructions. To position the cursor at the character to be changed, use the ← and → keys. Hold down the PAGE key and press the ← or → keys to position the cursor at the beginning or end of the line.Use the DELETE ENTRY or BKSP keys to delete characters. Insert new characters by typing them in.

Press the ENTER key to save changes and exit Edit Mode. Press the ESC key to exit Edit Mode without saving the changes.

```
DRUG TEMPLATE EDIT SCREEN

KEY  DRUG NAME              UNITS
a.   Anectine               mg
b.   Demerol                mg
c.   Ketamine               mg
d.   Lidocaine              mg
e.
       EDIT MODE    [ Drug Name For Template ]

                        Ketamine█


       Key legend:     (Insert characters by typing)
       -)  : Move cursor to right    PAGE -)    : Move cursor to end of cell
       <-  : Move cursor to left     PAGE <-    : Move cursor to start of cell
       ESC : Exit edit without save  DELETE ENTRY: Delete char. at cursor
       ENTER: Exit edit with save    BKSP       : Delete char. to left of cursor
```

Saving the Template

To save the Drug Template, the user must exit the Drug Template Edit screen. To exit the screen, press any of the other Screen keys or the CONFIG key. If any changes were made to the template, they are saved when the screen is exited. A screen message appears stating that the changes are being saved to disk.

After the changes have been saved on the disk, a screen prompt asks if the current default drug template in non-volatile memory is to be replaced with the template just created.

```
DRUG TEMPLATE EDIT SCREEN

KEY   DRUG NAME            UNITS
a.    Thiopental           mg
b.    Succinylcholine      mg
c.    Vecuronium           mg
d.    Dtubocurare          mg
e.    Morphine             mg
f.    Sufe┌─────────────────────────────────────────┐
g.    Fent│ Store template as system default template ? (Y/N) _ │
h.    Phen└─────────────────────────────────────────┘
i.    Lidocaine            mg
j.    Nahco3               mEq
k.    ████████████████
```

The default drug template will be the one used if no drug template is found on the floppy disk.

1) To save the template as the new default template, press Y.

2) If the default template is not to be replaced, press N or any key other than Y. If no input is detected within 5 seconds, the previous default template remains, and the message is removed from the screen.

Event Template Edit Screen

The Event Template Edit screen allows the user to create and edit an Event Template. An Event Template is a custom list of events that occur commonly during a particular kind of case. Using an Event Template permits the user to quickly enter information into the O.R. Event Record without having to type all the information. An Event Template can contain up to 15 entries.

When a template has been created or edited, it is saved to disk to be used as a case-specific template. It can also be saved to non-volatile (permanent) memory to be used as the default template.

Selecting the
Screen

At the System Configuration menu, press "E," or use the ↑ and ↓ keys to highlight Event template edit and press ENTER.

EVENT TEMPLATE EDIT SCREEN

KEY	EVENT
a.	Labs sent for analysis
b.	Anhepatic start
c.	Liver off ice
d.	Portal/caval reperfusion
e.	Hepatic artery opened
f.	Biliary anastomosis completed
g.	Abdomen closed
h.	Transport to ICU, hand vent w/ monitor
i.	

Moving the
Cursor

When the screen is selected, the cursor appears under the EVENT column in the blank cell below the last entry. Press the ↑ and ↓ keys to move the cursor through the selections.Entering/Editing Data

Use the alphanumeric keys to enter new events or to edit previous information. To delete the last character entered, press the BKSP key. If the ENTER key or the →, ←, ↑ and ↓ keys have not been pressed, the ESC key can be used to clear newly entered data from a cell and restore the previous entry, if any.

To complete an entry and advance the cursor to the next cell, type the desired data and press the ENTER key or the →, ←, ↑ and ↓ keys.
To erase an event, highlight the entry and press DELETE ENTRY. A query appears on the screen to confirm the deletion.

```
EVENT TEMPLATE EDIT SCREEN


KEY  EVENT
a.   Labs sent for analysis
b.   Anhepatic start
c.   Liver off ice
d.   Portal/caval reperfusion
e.   Hepatic artery opened
f.   BILI
g.   Abdon   Delete Biliary anastomosis completed ? (Y/N) _
h.   Tran
i.
```

1) To delete the data from the screen and disk, press Y.

2) To cancel the DELETE ENTRY request, press N or any key other than Y.

If no input is detected within 5 seconds, nothing is deleted, and the message is removed from the screen.

Edit Mode

The O.R. Data Manager edit mode is used to edit characters in a selected cell. Any cell except a blank one may be edited.

To invoke the edit mode, highlight the cell to be edited using the ←, →, ↑ or ↓ keys, and press the EDIT key. The Edit Mode window appears.

```
EVENT TEMPLATE EDIT SCREEN


KEY  EVENT
a.   Eyes taped
b.   Limbs Padded
c.   Aorta clamped
d.   Aorta unclamped
e.
f.   EDIT MODE   [ Event For Template ]
g.

       Aorta clamped█


     Key legend:    (Insert characters by typing)
     ->  : Move cursor to right    PAGE ->  : Move cursor to end of cell
     <-  : Move cursor to left     PAGE <-  : Move cursor to start of cell
     ESC : Exit edit without save  DELETE ENTRY: Delete char. at cursor
     ENTER: Exit edit with save    BKSP     : Delete char. to left of cursor
```

The Edit Mode window displays the selected cell along with editing instructions. Position the cursor at the character to be changed, using the ← and → keys. Hold down the PAGE key and press the ← or → keys to position the cursor at the beginning or end of the line. Use the DELETE ENTRY or BKSP keys to delete characters. Insert new characters by typing them in.

Press the ENTER key to save your changes and exit Edit Mode. Press the ESC key to exit Edit Mode without saving the changes.

Saving the
Template

To save the Event Template, the user must exit the Event Template Edit screen. To exit the screen, press any of the other Screen keys or the CONFIG key. If any changes were made to the template, they are saved when the screen is exited. A screen message appears stating that the changes are being saved to disk.

After the changes have been saved on the disk, a screen prompt asks if the current default event template in non-volatile memory is to be replaced with the template just created. The default event template will be the one used if no event template is found on the floppy disk.

```
EVENT TEMPLATE EDIT SCREEN

KEY   EVENT
a.    Labs sent for analysis
b.    Anhepatic start
c.    Liver off ice
d.    Portal/caval reperfusion
e.    Hepatic artery opened
f.    Abdo┌──────────────────────────────────────────────────┐
g.    Trans│ Store template as system default template ? (Y/N) _ │
h.       │                                                  │
         └──────────────────────────────────────────────────┘
```

1) To save the template as the new default template, press Y.

2) If the default template is not to be replaced, press N or any key other than Y.

If no input is detected within 5 seconds, the previous default template remains, and the message is removed from the screen.

Numeric Template Edit Screen

The Numeric Template Edit screen allows the user to create and edit a Numeric Template. A Numeric Template is a custom list of fluids and other numeric items that are commonly used during a particular kind of case. Using a Numeric Template permits the user to quickly enter information into the Numeric Data screen without having to type all the information. A Numeric Template can contain up to 14 entries.

When a template has been created or edited, it is saved to disk to be used as a case-specific template. It can also be saved to non-volatile (permanent) memory to be used as the default template.

Selecting the
Screen

At the System Configuration menu, press "N," or use the ↑ and ↓ keys to highlight Numeric template edit and press ENTER.

```
┌─────────────────────────────────────────────────────┐
│                                                       │
│  NUMERIC TEMPLATE EDIT SCREEN                          │
│                                                       │
│  KEY  NAME              UNITS                          │
│  a.   Ringers           cc                             │
│  b.   Normal saline     cc                             │
│  c.   Prbc              cc                             │
│  d.   Ffp               cc                             │
│  e.   Platelets         cc                             │
│  f.   Cryoprecipitate   cc                             │
│  g.   Rapid transfusi   cc                             │
│  h.   Albumin           cc                             │
│  i.   Epidural lido     cc                             │
│  j.   Saline            cc                             │
│  k.   ████████████                                     │
│                                                       │
│                                                       │
└─────────────────────────────────────────────────────┘
```

Moving the
Cursor

When the screen is selected, the cursor appears under the NAME column in the blank cell below the last entry. Press the ↑ and ↓ keys to move the cursor through the selections.Entering/Editing Data

Use the alphanumeric keys to enter new fluids or other numeric items or to edit previous information. To delete the last character entered, press the BKSP key. If the ENTER key or the →, ←, ↑ and ↓ keys have not been pressed, pressing the ESC key clears newly entered data from a cell and restores the previous entry, if any. The ESC key can also be used to exit from a pop-up menu without making a selection.

To complete an entry and advance the cursor to the next cell, type the desired data and press the ENTER key or the →, ←, ↑ and ↓ keys.To erase a flow, fluid, or agent entry, highlight the entry and press DELETE ENTRY. A query appears on the screen to confirm the deletion.

1) To delete the data from the screen and disk, press Y.

2) To cancel the DELETE ENTRY request, press N or any key other than Y.

If no input is detected within 5 seconds, nothing is deleted, and the message is removed from the screen.

```
NUMERIC TEMPLATE EDIT SCREEN

KEY  NAME              UNITS
a.   Ringers           cc
b.   Normal saline     cc
c.   Prbc              cc
d.   Ffp               cc
e.   Platelets         cc
f.   Cryo
g.   Rapid    Delete Normal saline  in  cc ? (Y/N) _
h.   Albu
i.   Epidural lido     cc
j.   Saline            cc
k.
```

Drug Dictionary

O.R. Data Manager has a built-in, memory-resident Drug Dictionary that contains commonly used drugs and fluids. Drugs or fluids can be selected from the drug dictionary by pressing SELECT ENTRY while the cursor is in NAME cell. This invokes a pop-up window listing all the drug names in the Drug Dictionary.

To select a drug, use the ←, →, ↑ and ↓ keys to highlight the selection and press ENTER. Hold down the PAGE key and press the ↑ and ↓ keys to see information on previous or subsequent pages. After the drug or fluid name is selected, the Drug Dictionary automatically fills in the UNITS column with the most commonly used units for that drug field.

```
NUMERIC TEMPLATE EDIT SCREEN


KEY  NAME              UNITS
  a
  b  Select Drug:
  c  adenaline     alfentanil    alfentanyl    alphaprodine
  d  amidate       aminophylline anectine      ativan
  e  atracurium    atropine      benadryl      brevibloc
  f  brevital      bupivacaine   butorphanol   calcium chloride
  g  cefazolin     chloroprocaine cimetidine   curare
  h  d-tubocurarine demerol      dexamethasone diazepam
  i  dilaudid      dimethylcurare diphenhydramine diprivan
  j  dobutamine    dopamine      droperidol    DTC
  k  edrophonium   enlon         ephedrine     epinephrine
  l  esmolol       etidocaine    etomidate     fentanyl
     flaxedil      gallamine     glycopyrrolate heparin
     hydralazine   hydrocortisone hydromorphone inderal
     isoproterenol keflin        ketamine      labetalol
```

Edit Mode

The O.R. Data Manager edit mode is used to edit characters in a selected cell. Any cell except a blank one may be edited. To invoke the edit mode, highlight the cell to be edited using the ←, →, ↑ or ↓ keys, and press the EDIT key. The Edit Mode window appears.

```
NUMERIC TEMPLATE EDIT SCREEN

KEY  NAME            UNITS
a.   Ringers lactate cc
b.   Nitroglycerin   mg
c.   Plasmalyte      mg
d.   Urine loss      cc
e.
f.  EDIT MODE   [ Numeric Item Name For Template ]
g.
h.
i.                   Pentothal█
j.
k.
l.  Key legend:    (Insert characters by typing)
    -)  : Move cursor to right   PAGE -)    : Move cursor to end of cell
    (-  : Move cursor to left    PAGE (-    : Move cursor to start of cell
    ESC : Exit edit without save DELETE ENTRY: Delete char. at cursor
    ENTER: Exit edit with save   BKSP       : Delete char. to left of cursor
```

The Edit Mode window displays the selected cell along with editing instructions. To position the cursor at the character to be changed, use the ← and → keys. Hold down the PAGE key and press the ← or → keys to position the cursor at the beginning or end of the line. Use the DELETE ENTRY or BKSP keys to delete characters. Insert new characters simply by typing them in.

Press the ENTER key to save your changes and exit Edit Mode. Press the ESC key to exit Edit Mode without saving the changes.

Saving the Template

To save the Numeric Template, the user must exit the Numeric Template Edit screen. To exit the screen, press any of the other Screen keys or the CONFIG key. If any changes were made to the template, they are saved when the screen is exited. A screen message appears stating that the changes are being saved to disk.

After the changes have been saved on the disk, a screen prompt asks if the current default numeric template in non-volatile memory is to be replaced with the template just created. The default numeric template will be the one used if no numeric template is found on the floppy disk.

```
NUMERIC TEMPLATE EDIT SCREEN

KEY  NAME             UNITS
a.   Ringers          cc
b.   Normal saline    cc
c.   Prbc             cc
d.   Ffp              cc
e.   Platelets        cc
f.   Cryo┌────────────────────────────────────────────────┐
g.   Rapi│ Store template as system default template ? (Y/N) _ │
h.   Albu└────────────────────────────────────────────────┘
i.   Epidural lido    cc
j.   Saline           cc
k.   Atracurium       mg
l.   ████████████
```

1) To save the template as the new default template, press Y.

2) If the default template is not to be replaced, press N or any key other than Y.

If no input is detected within 5 seconds, the previous default template remains, and the message is removed from the screen.

**Hospital Name
Screen**
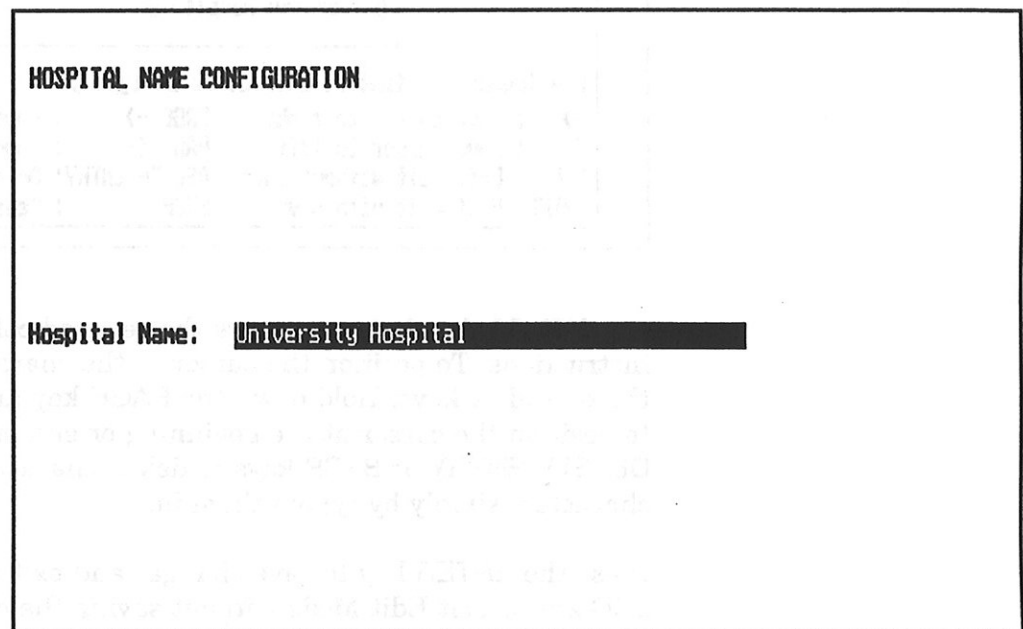
The Hospital Name screen allows the user to enter the hospital's name and save it on disk and in O.R. Data Manager's non-volatile (permanent) memory. The name appears on printed anesthesia records exactly the way it is entered in this screen.

**Selecting the
Screen**

At the System Configuration menu, press "H," or use the ↑ and ↓ keys to highlight enter Hospital name, and press ENTER.

**Moving the
Cursor**

When the screen is selected, the cursor appears in the line provided for this entry.

```
┌─────────────────────────────────────────────────────────┐
│                                                          │
│  HOSPITAL NAME CONFIGURATION                             │
│                                                          │
│                                                          │
│                                                          │
│                                                          │
│   Hospital Name:   University Hospital                   │
│                                                          │
│                                                          │
│                                                          │
│                                                          │
│                                                          │
└─────────────────────────────────────────────────────────┘
```

**Entering/Editing
Data**

Use the alphanumeric keys to enter a new hospital name or to edit previous information. To delete the last character entered, press the BKSP key.

If the ENTER key has not been pressed, pressing the ESC key clears newly entered data from a cell and restores the previous entry, if any.

To complete the entry, type the name and press the ENTER key.

Edit Mode

The O.R. Data Manager edit mode is used to edit characters in the hospital name cell. To invoke the edit mode press the EDIT key. The Edit Mode window appears.

```
HOSPITAL NAME CONFIGURATION




    Ho┌─EDIT MODE   [ Hospital Name ]─────────────────────────────┐
      │                                                           │
      │       ┌───────────────────────────────────────┐          │
      │       │ University Hospital█                   │          │
      │       └───────────────────────────────────────┘          │
      │                                                           │
      │  Key legend:    (Insert characters by typing)             │
      │  -)  : Move cursor to right    PAGE -)   : Move cursor to end of cell    │
      │  (-  : Move cursor to left     PAGE (-   : Move cursor to start of cell  │
      │  ESC : Exit edit without save  DELETE ENTRY: Delete char. at cursor      │
      │  ENTER: Exit edit with save    BKSP      : Delete char. to left of cursor│
      └───────────────────────────────────────────────────────────┘
```

The Edit Mode window displays the selected cell along with editing instructions. To position the cursor at the character to be changed, use the ← and → keys. Hold down the PAGE key and press the ← or → keys to position the cursor at the beginning or end of the line. Use the DELETE ENTRY or BKSP keys to delete characters. Insert new characters simply by typing them in.

Press the ENTER key to save changes and exit Edit Mode. Press the ESC key to exit Edit Mode without saving the changes.

Saving the Hospital Name

To save the hospital name, the user must exit the Hospital name screen. To exit the screen, press any of the other Screen keys or the CONFIG key. If any changes were made to the name, they are saved to disk and non-volatile memory when the screen is exited. A screen message appears stating that the new name is being stored.

Overview

An aneroid manual sphygmomanometer can be mounted on the NARKOMED 4. The sphygmomanometer gauge is positioned on the left side of the anesthesia machine, next to the ventilator bellows. The cuff inflation bulb is located to the right of the oxygen flush button on the front of the machine.

CUFF EXTENTION HOSE

TO BP CUFF INTERFACE PANEL

SPHYGMOMANOMETER GAUGE

INTERNAL PIPING CONNECTS BULB FITTING TO GAUGE AND CUFF FITTING

TO BP GAUGE INTERFACE PANEL

GAUGE HOSE

THREADED MOUNTING RING

FEMALE LUER FITTING (SLIP-FIT) FOR CUFF INFLATION BULB

OP20320A
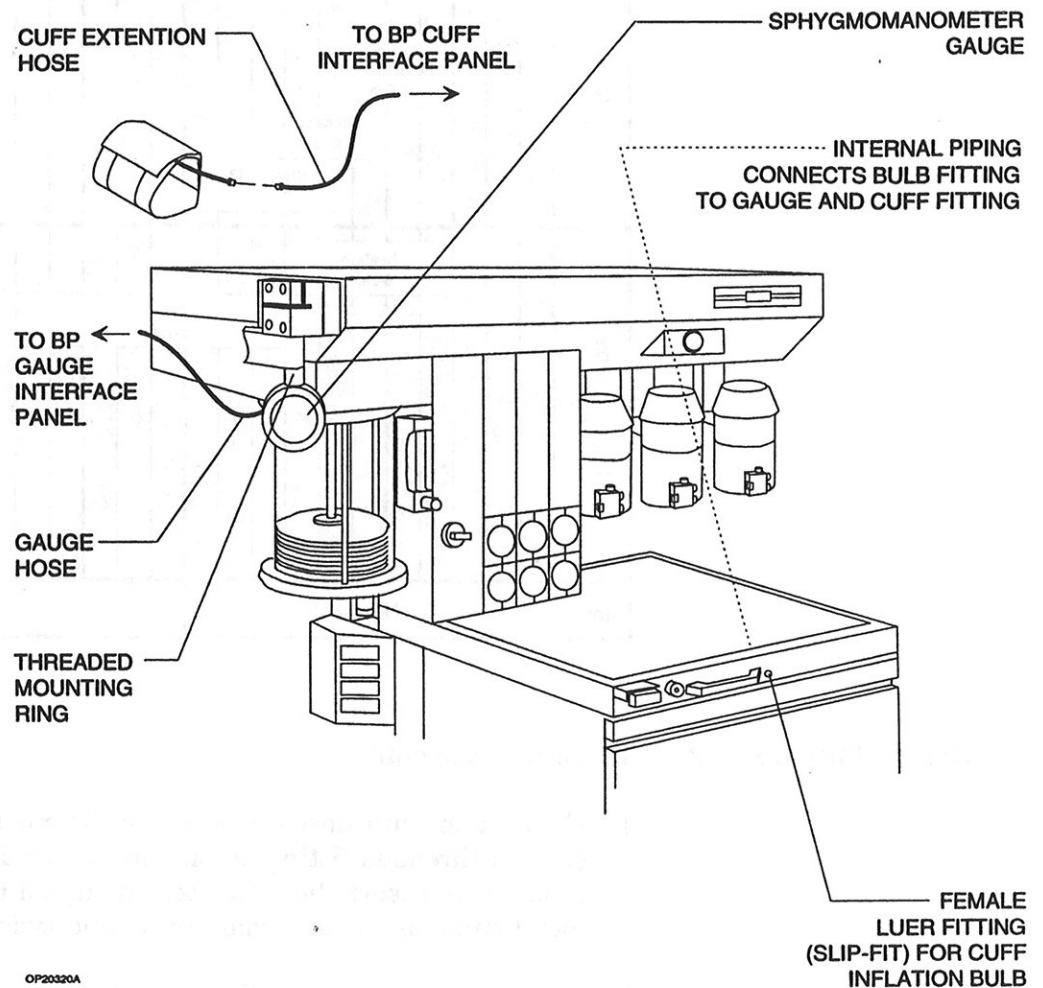
Selecting a Blood Pressure Cuff

When preparing for a case that includes noninvasive blood pressure monitoring, be sure to choose the correct cuff size and mode and to place the cuff correctly. Use the following table to select the appropriate cuff size and NIBP measurement mode. If you don't have a tape measure, use the INDEX and RANGE lines marked on the cuff as described in "Placing the Cuff," below.

| Cir. (cm) | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 |

Disposable Cuff											
Neonatal#10 3-6cm											
Neonatal#11 6-9.5cm											
Neonatal#12 8-12cm											
Neonatal#13 9-14cm											

Nondisposable Cuff											
Newborn 6-11cm											
Infant 10-19cm											
Pediatric 18-26cm											
Adult 25-35cm											
Large Adult 33-47cm											
Thigh 46-66cm											

Mode	Neonatal	Adult

Connecting the Cuff

To connect the cuff:

1. Connect the cuff hose (attached to the cuff) to the extension hose (with a threaded fitting on one end and a Luer lock fitting on the other end). Insert the Luer lock fitting on the cuff hose into the Luer lock fitting on the extension hose, and twist until they lock together.

2. Attach the other end of the extension hose to the fitting on the patient interface panel labeled BP CUFF. Hand-tighten the threaded hose fitting onto the threaded fitting of the interface panel.

3. Make sure that none of the hoses are pinched or kinked.

After connecting the manual sphygmomanometer, check the gauge's pressure indication. With zero pressure applied to the gauge and cuff, the gauge pointer should remain within the band marked on the face plate.

Placing the Cuff

When fitting the cuff, place the center of the cuff inflation bag over the artery (for the brachial artery, place over the inside of the arm above the elbow). Make sure that the cuff fits securely on the limb and that the INDEX line falls between the two RANGE lines. If the INDEX line does not fall between the RANGE lines, select a smaller or larger cuff.

The cuff can be used on either the right or left extremity, but the left is usually preferred.

NOTE: Do not place the cuff on a limb being used for infusion.

For accurate blood pressure measurements, position the cuff at the same level as the patient's heart. Placing the cuff above the heart causes the reading to be falsely low; placing the cuff below the heart causes the reading to be falsely high. In instances where you cannot place the cuff at the same level as the heart, use the following general rule.

- For every inch of elevation above the heart, add 1.8 mmHg to the reading.
- For every inch of elevation below the heart, subtract 1.8 mmHg from the reading.

INDEX LINE

RANGE MARKS

CENTER OF INFLATION BULB MARKS (BOTH SIDES)

CENTER OF INFLATION BULB POSITIONED PROPERLY OVER BRACHIAL ARTERY

OP30005
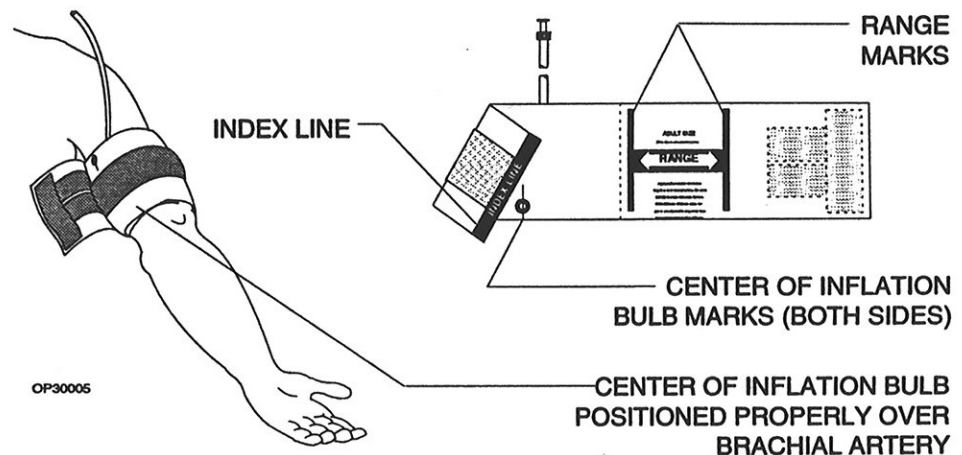
Cleaning and Sterilization

Clean and sterilize the NARKOMED 4 and its parts according to the guidelines below. Follow your institution's policies regarding specific methods and agents for cleaning and sterilization.

Surfaces

Clean painted, plated, and plastic surfaces of the NARKOMED 4 with a soft cloth moistened with an aqueous germicidal cleaner. Mix the germicidal cleanser in accordance with instructions provided by the manufacturer. Do not use solvent cleaners or abrasive cleaning agents on any surfaces of the NARKOMED 4.

Do not use anesthetic agents for cleaning purposes.

CAUTION: Do not allow liquid to enter the interior of the NARKOMED 4. Take extra precaution around the O.R. Data Manager disk drive opening.

Rubber Goods

Before disinfecting or sterilizing reusable rubber goods, thoroughly clean them with soap and water and thoroughly rinse them with water to remove all soap. To prevent water spots, use distilled or demineralized water. Avoid using hard-bristle brushes, which can damage the rubber goods.

Manufacturers of rubber goods have typically recommended that reusable rubber goods be soaked in a liquid disinfection agent. Always follow the agent manufacturer's instructions for use. After disinfection, thoroughly dry rubber goods before returning them to service.

CAUTION: Disinfectants containing phenol or phenyl compounds destroy rubber goods. Latex and rubber goods treated with disinfectants having a quaternary ammonium base will be damaged if subsequently autoclaved.

Reusable rubber goods may be autoclaved at 121°C. However, such temperatures accelerate the natural aging of rubber goods. Autoclaved rubber goods may also harden over time as a result of the less of softeners. Exposure to ozone or ultraviolet light also accelerates the natural aging of rubber goods. Reusable rubber goods may also be gas sterilized with ethylene oxide. After EtO sterilization, properly aerate rubber goods before returning them to service.

NOTE: Do not autoclave face masks. Autoclaving causes rapid deterioration of face mask cushions.

Ventilator Bellows Assembly

The bellows assembly and the ventilator relief valve are the only ventilator components that come in contact with the patient's breath. To clean and sterilize the ventilator bellows assembly:

1. Remove the ventilator bellows assembly from the machine by loosening the two wing nuts below the bellows canister.

2. Unscrew the knurled ring nut around the ventilator relief valve and pull the relief valve dome and pilot line away from the relief valve body.

3. Remove the ventilator bellows from the assembly by unscrewing it in a counterclockwise direction.

4. Clean the bellows assembly and all its parts with a mild detergent solution, followed by a distilled water rinse.

   NOTE: Take special care not to change the position of the adjustment lock ring on the ventilator relief valve dome. Do not attempt to loosen the knurled relief valve ring nut by twisting the pilot line hose barb.

5. Drip dry the assembly and all parts. If necessary, sterilize them in ethylene oxide gas (cold cycle), followed by shelf aeration for 24 hours or 8 hours aeration in an appropriate aeration cabinet.

6. After aeration, fit the relief valve dome onto the relief valve body, and tighten the knurled ring nut. Replace the ventilator bellows followed by the entire bellows assembly into the bellows canister. Verify that the ventilator relief valve pilot line is completely dry. If necessary, dry the line with compressed air or oxygen.

7. Perform a preuse checkout to verify proper reassembly.

Inspiratory and Expiratory Valves

Clean the inspiratory and expiratory valves frequently. Remove the valves by unscrewing the ring nut at the base of the valve. Before cleaning the valves, you may want to disassemble them. To disassemble the valves, unscrew and remove the ring nut around the plastic valve dome; then remove the dome, gasket, and valve disk.

The valve assemblies can be gas sterilized, immersed in a liquid disinfection agent, or autoclaved at a temperature not exceeding 121°C. The valve disks should be cleaned with a liquid disinfection agent. They may also be autoclaved in certain instances, but should not be autoclaved routinely.

Be careful with the valve disks; improper handling can damage them. After cleaning or sterilizing an inspiratory or expiratory valve assembly, verify that the valve disk and all internal pins are undamaged and that the valve disks are correctly reinstalled.

INSPIRATORY
VALVE DOME
PLUG

RING NUT

DOME PINS

INSPIRATORY
VALVE DOME

EXPIRATORY
VALVE DOME

DOME GASKET

VALVE DISK

VALVE PINS

EXPIRATORY
VALVE BODY

INSPIRATORY
VALVE BODY

CAPTIVE
RING NUT

VALVE MOUNT
GASKET

EXPIRATORY
VALVE MOUNT

INSPIRATORY
VALVE MOUNT
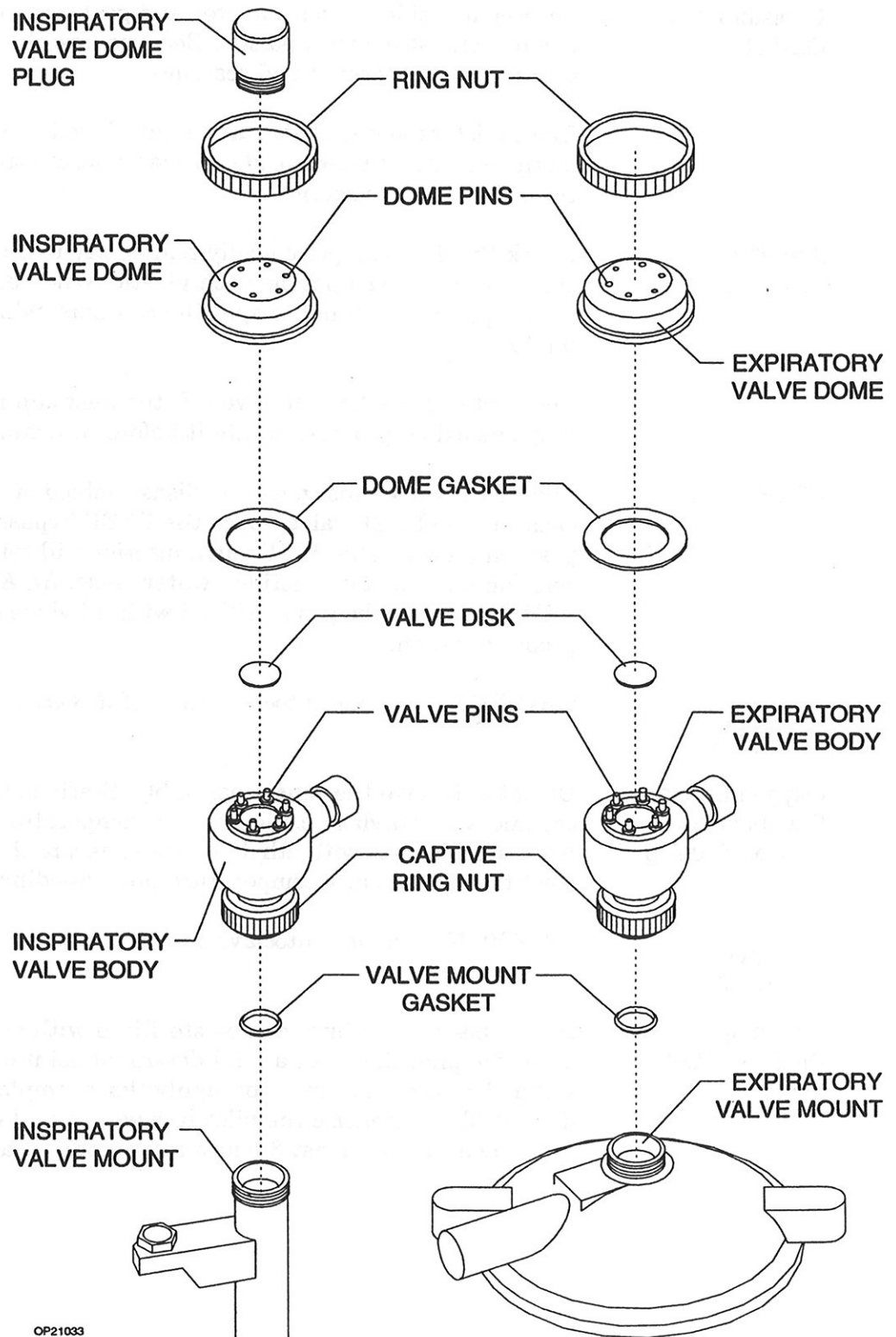
OP21033

Absorber Canisters and Gaskets	Clean the canisters frequently. Remove used absorbent and clean absorbent residues from canister and gasket surfaces. Use only cleaning agents compatible with plastic. Because absorbent is caustic, avoid contact with absorbent and residues.

The canisters and gaskets can be autoclaved. If the canisters are sterilized with ethylene oxide, properly aerate treated parts before returning them to service. |
| **Absorber Dust Cup** | Check the dust cup periodically and empty it when necessary. Use only cleaning agents compatible with plastic. When emptying the absorber dust cup, be careful not to spill the contents, which can be a caustic mixture.

The dust cup can be autoclaved. If the dust cup is sterilized with ethylene oxide, properly aerate it before returning it to service. |
| **PEEP Valve** | The PEEP valve must never be disassembled or autoclaved. Prior to cleaning the PEEP valve, place the PEEP bypass in the PEEP OFF position (down). The PEEP valve interior will tolerate a mild detergent solution followed by a distilled water rinse. An Absorber system with a PEEP valve may be gas sterilized with ethylene oxide, followed by proper aeration. |

CAUTION: Do not autoclave the PEEP valve.

Oxygen Sensor Capsule and Sensor Housing	Do not autoclave the sensor assembly. Sterilize the sensor housing and capsule with ethylene oxide gas at a temperature not exceeding 50° C. After sterilization with ethylene oxide, aerate the sensor assembly for at least three hours at a temperature not exceeding 45° C.

CAUTION: Do not autoclave the sensor assembly.

Breathing Pressure Pilot Line	Both types of pilot lines can be sterilized with ethylene oxide. First, clean the pilot line with a mild detergent solution and rinse it with water. Dry the pilot line thoroughly (for example, with a tube drying device). Then, sterilize the pilot line with a cold cycle and allow it to properly aerate (at least 8 hours in an appropriate aeration cabinet).

TOP
ABSORBER
GASKET

CANISTER

CANISTER
GASKET

CANISTER

CANISTER
GASKET

BOTTOM
ABSORBER
GASKET

BREATHING BAG
TERMINAL ADAPTER

DUST CUP
O-RING

DUST CUP

OP21035
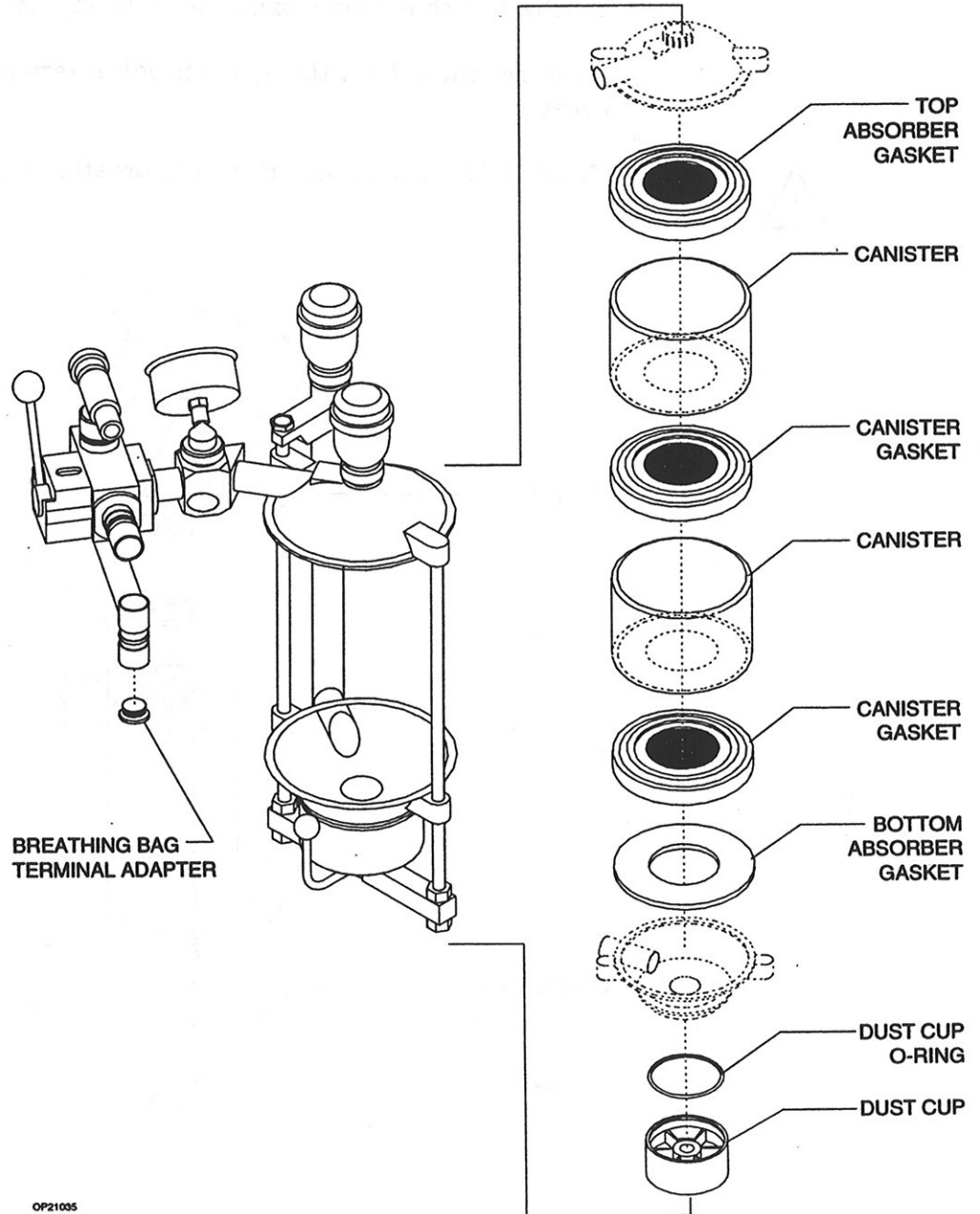
Breathing System
Pressure Gauge

The breathing system pressure gauge cannot withstand immersion or the heat and pressure of autoclaving. Therefore, it must be removed from the Absorber system prior to such a procedure. The gauge may be sterilized with ethylene oxide gas, followed by appropriate aeration.

After cleaning, check the gauge needle's zero position and adjust it if necessary.

CAUTION: Do not autoclave the breathing system pressure gauge.

BREATHING
PRESSURE
GAUGE

O-RING

GAUGE
MOUNT

O-RING

ABSORBER
MOUNTING STUD

OP21034
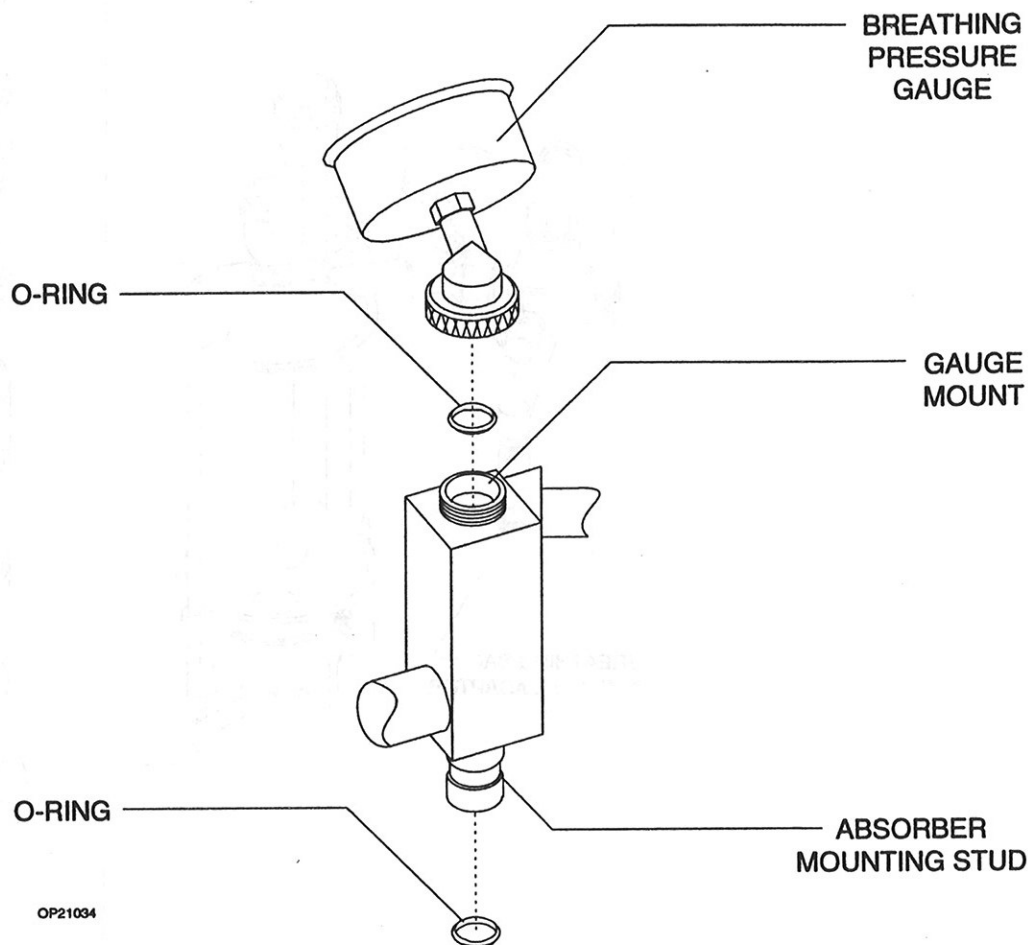
Pulse Oximeter
Sensor

Do not autoclave the sensor or interface cable. The sensor can be cleaned by wiping the patient contact areas with a liquid disinfection agent or alcohol. Do not use acetone or acetone/alcohol mixtures because they will damage the sensor. Do not immerse the sensor or interface cable. Do not allow liquid to enter the interior of the sensor.

Vaporizers

Disinfect external surfaces of the vaporizer by wiping with a damp cloth moistened with a liquid disinfectant, making sure that none of the disinfectant enters the filling funnel. Do not sterilize the vaporizer.

Do not immerse the vaporizer in water or other liquids, and do not allow water or any other liquid to enter the fill or drain ports or fresh gas inlet or outlet ports. Any vaporizer suspected of contamination with water or any other liquid must be returned to North American Dräger's Technical Service department for a complete overhaul. Water and other liquids (with the exception of the appropriate anesthetic) that enter the vaporizer chamber may cause injury to the patient or may form corrosive products that affect the function of the vaporizer.

Additional care must be taken with halothane vaporizers. Halothane contains a stabilization additive called thymol, which evaporates more slowly than halothane, and collects in the vaporizer. Over time, thymol may decompose into compounds that affect the wick material and turn the halothane yellow.

If you see particles in the sight glass of a halothane vaporizer, or if the halothane turns yellow, rinse the vaporizer chamber with fresh halothane as follows:

1. Drain the discolored halothane from the vaporizer.

2. Fill the vaporizer with fresh halothane up to the maximum level, then drain completely.

3. Dispose of the drained halothane in accordance with standard practices at your facility.

For information about filling and draining the vaporizer, see "Section 5 - Operation, Vaporizers."

Noninvasive Blood Pressure Cuff

Before cleaning or sterilizing the NIBP cuff, detach it from the extension hose by twisting the Luer-lock fitting at the juncture of the cuff hose and measurement hose. Clean the cuff with a liquid disinfection agent or mild detergent solution.

Do not autoclave the cuff. It can be sterilized with ethylene oxide gas, followed by at least 2 hours aeration in an appropriate aeration cabinet.

Do not autoclave the extension hose. It can be sterilized with ethylene oxide gas (cold cycle), followed by at least 8 hours aeration in an appropriate aeration cabinet.

Manual Sphygmo-manometer

Under typical conditions, the only cleaning the manual sphygmomanometer requires is a wiping down with a liquid disinfection agent. However, if further disinfection is required, remove the sphygmomanometer gauge assembly, hoses, and blood pressure cuff from the anesthesia machine and sterilize them with ethylene oxide gas (cold cycle), followed by appropriate aeration according to the sterilizer manufacturer's instructions.

NOTE: Do not autoclave the gauge assembly; it cannot withstand the heat of autoclaving.

Open Reservoir Scavenger

Clean the scavenger every 6 months with the following procedure.

1. Clean the outer surface of the scavenger with a moist cloth.

2. Inspect all scavenger hoses for deterioration. Replace any worn hoses.

3. Unscrew the wing nut until the needle valve assembly can be removed from its seat. Remove the nut and disassemble the valve. Inspect the needle valve and seat for lint or dust accumulation. Clean with compressed air, if necessary.

4. The flowmeter has a small port, located on its underside, that is open to the atmosphere. For the flowmeter to work properly, this port must remain open. Remove the flowmeter from the block and inspect this port. If it is blocked, clean it with compressed air.

5. Remove the reservoir canister from the scavenger body by unscrewing the four socket head cap screws located at the top of the canister.

6. Replace the cleaned needle valve assembly and reservoir canister; verify that all parts are completely dry before reassembly.

7. Perform the open reservoir scavenger portion of the preuse checkout.

The Open Reservoir Scavenger does not typically require sterilization. However, if it must be sterilized, use ethylene oxide gas followed by appropriate aeration.

⚠ **CAUTION:** Do not autoclave the Open Reservoir Scavenger. The scavenger's flowmeter cannot withstand the heat of autoclaving.

VACUUM
SOURCE
TERMINAL
ADAPTER

BLOCK

INPUT
PORT CAP

NEEDLE
VALVE
ASSEMBLY

FLOWMETER

TOP
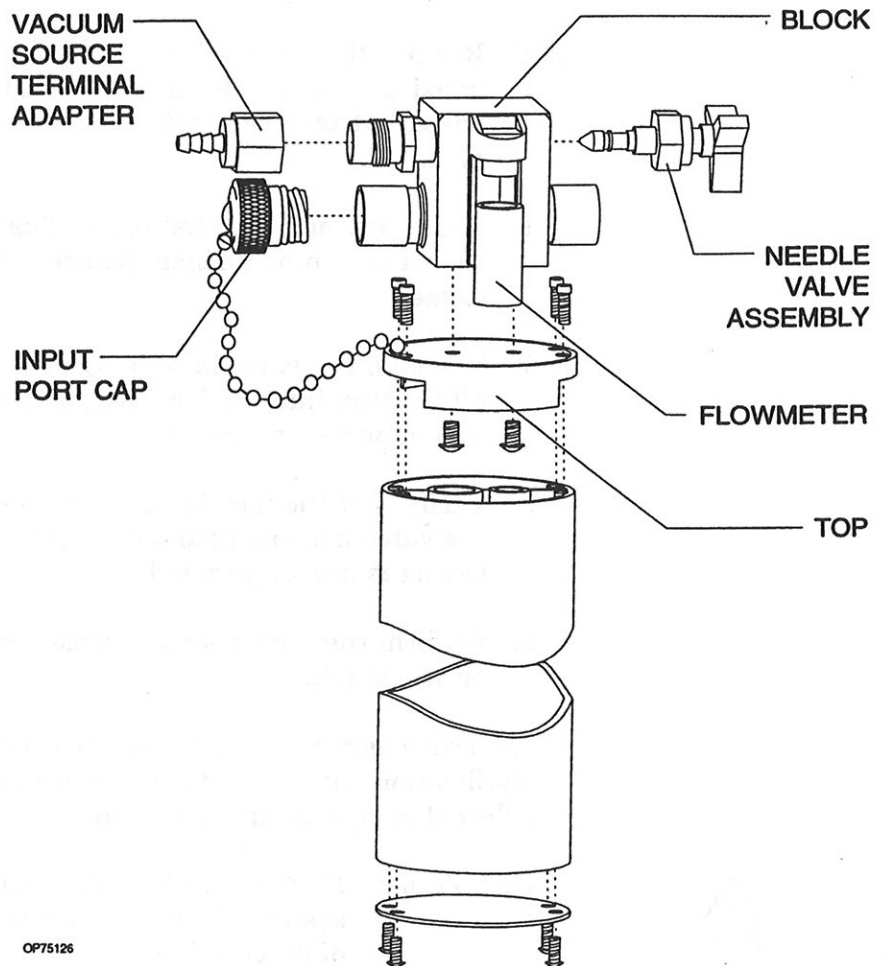
OP75126

Scavenger
Interface for
Passive Systems

Clean the scavenger every 6 months with the following procedure.

1. Clean the scavenger body with a moist cloth.

2. Inspect all scavenger hoses for deterioration. Replace any worn hoses.

3. Remove the relief valve housing by unscrewing it counterclockwise.

4. Inspect the rubber O-ring. If it is worn, replace it.

5. Remove the relief valve by twisting it counterclockwise out of the housing. You can use the tips of a needle-nose pliers to turn the valve, but take care not to damage the relief valve's fragile valve disk.

6. Brush any accumulated lint or dust off the valve with a soft brush. the valve can be further cleaned with a low flow of clean air or oxygen.

7. Reinstall the valve into the housing, making sure that it is threaded all the way into the housing and that the plastic washer is properly seated on its upper surface.

8. Verify that the interior of the valve body is completely dry. Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

9. Perform the scavenger interface for passive systems portion of the preuse checkout.

The scavenger interface for passive systems does not typically require sterilization. However, if it must be sterilized, use ethylene oxide gas followed by appropriate aeration.

⚠ **CAUTION:** Do not autoclave the scavenger interface for passive systems. The scavenger's disks cannot withstand the heat of autoclaving.

SAFETY RELIEF
VALVE HOUSING

PLASTIC
WASHER

SAFETY
RELIEF VALVE

O-RING

SECONDARY WASTE
GAS INPUT PORT

WASTE GAS
INPUT PORT

INPUT
PORT CAP

WASTE GAS
EXHAUST PORT
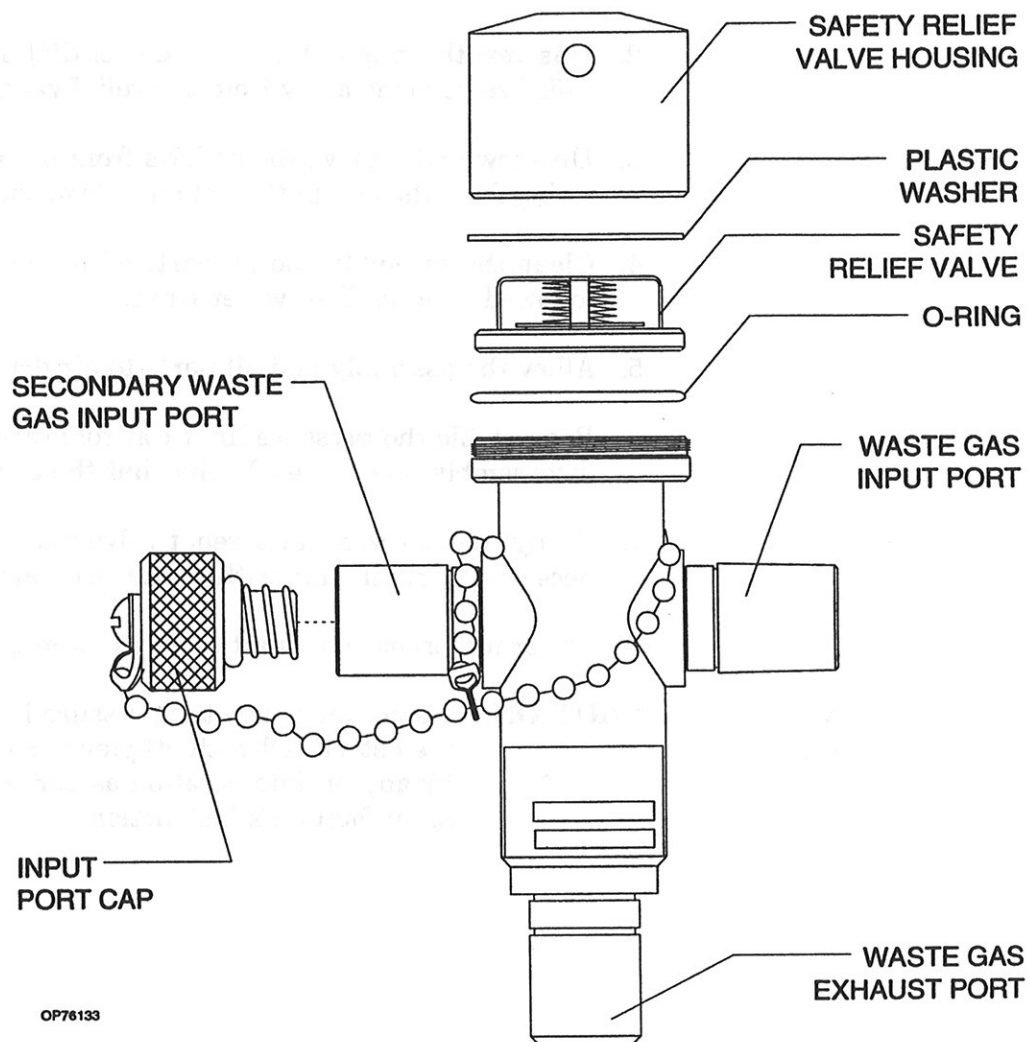
OP76133

Pressure Limit
Control

1. Remove the pressure limit control assembly from the anesthesia machine by loosening the two wing nuts at the base of the adult bellows canister.

2. Unscrew the ring nut around the ventilator relief valve and pull the relief valve dome away from the relief valve body.

3. Unscrew and remove the bellows from the assembly. Remove the o-ring from its seat in the bellows. Save the o-ring for reassembly.

4. Clean the assembly and all parts with a mild detergent solution followed by a distilled water rinse.

5. Allow the assembly and all parts to air dry.

6. Reassemble the pressure limit control assembly by reversing the disassembly procedures. Verify that the o-ring is properly reinstalled.

7. Verify that the ventilator relief valve pilot line is completely dry. If necessary, dry the line with compressed air or oxygen.

8. Perform a preuse checkout to verify proper reassembly.

⚠ **CAUTION:** Do not autoclave the pressure limit control assembly. It may sterilized with ethylene oxide gas (cold cycle), followed by appropriate aeration as per the sterilizer manufacturer's instructions.

Replacing the Water Trap Reservoir

The disposable water trap reservoir is held by a bracket mounted next to the patient interface panel on the left side of the monitor box. It is designed to collect excess water accumulation in the sample flow and must be replaced when it becomes full.

To replace a reservoir that is filled to capacity:

1. Detach the full reservoir's flexible hose fitting at the sample line connection by twisting counterclockwise.

2. Grasp the full reservoir at the base and gently pull it away from the mounting bracket, allowing the rubber port seals on top of the reservoir to disengage from the gas flow ports of the mounting bracket. Properly dispose of the full reservoir.

3. Insert the new reservoir by guiding its rubber port seals into the mounting bracket's gas flow ports; gently push at the reservoir's base until it rests flat against the mounting bracket.

4. Connect the new reservoir's flexible hose fitting to the male Luer-lock fitting on the sample line; twist clockwise until secure.

Replacing the Oxygen Sensor

When the electrolyte in oxygen sensor is depleted, the sensor cannot correctly analyze oxygen concentrations, and the sensor capsule must be replaced with a new one.

To replace the oxygen sensor capsule:

1. Set the System Power switch to STANDBY.

2. Pull the oxygen sensor housing from the inspiratory valve dome. (It is a press fit.)

3. Unscrew the cover from the sensor housing and remove the sensor capsule.

4. Install the replacement sensor capsule in the housing. Verify that the copper rings on the capsule mate with the electrical contacts in the sensor housing.

5. Wait 15 minutes to allow the sensor capsule to stabilize.

6. Restore power to the machine and calibrate the oxygen monitor.

**Replacing the
Keyboard Cover**

If the O.R. Data Manager keyboard cover becomes contaminated or damaged, it should be replaced.

To replace the keyboard cover:

1. Pull the keyboard tray out to its fully extended position.

2. Remove the contaminated or damaged keyboard cover from the keyboard faceplate by loosening the edges and pulling it away from the keyboard.

3. Clean any adhesive residue from the keyboard faceplate.

4. Remove the protective tape backing from the new shield to expose the adhesive surface.

5. Fit the new cover over the keys and press its adhesive perimeter firmly onto the keyboard faceplate. Verify that there are no gaps between the cover and the faceplate.

POLYURETHANE
SHIELD

KEYBOARD
FACEPLATE

OP10057

General	Maximum dimensions (W x H x D) . . . . . 31 3/4 x 64 3/4 x 25 1/8 inches
	Weight (approximate) . . . . 500 lb

Environmental

Storage	Temperature . . . . -40-70° C
	Humidity . . . . 10-90% relative humidity (noncondensing)
Operating	Temperature . . . . 15-30° C
	Humidity . . . . 30-75% relative humidity (noncondensing)

Electrical	Leakage current . . . . ≤ 100 microamps
	Ground impedance . . . . ≤ 0.1 ohm (60 Hz source)
	Dielectric withstand . . . . ≥ 1500 VAC (per UL 544)
	Chassis resistance (between any metallic point
	and ground pin on power cord) . . . . ≤ 0.1 ohm

117 Volt Power Supply	Primary input voltage (acceptable range) . . . . 90-130 VAC @ 50/60 Hz
	Primary input current . . . . ≤ 8 amps (RMS total)
	≤ 3 amps (machine)
	≤ 5 amps (receptacles)
	Primary input power (includes receptacles) . . . . ≤ 920 watts

220/240 Volt Power Supply (Optional)	Primary input voltage (acceptable range) . . . . 180-265 VAC @ 50/60 Hz
	Primary input current . . . . ≤ 1.5 amp (RMS total)
	Primary input power . . . . ≤ 345 watts

Backup Battery	Charging time . . . . ≤ 12 hours
	Reserve power time (from full charge) . . . . ≥ 25 min

Gas Delivery System	Pipeline inlet connections . . . . DISS/male (ANSI B57.1-1977)
	Nut with nipple (Canada)
	Pipeline inlet pressure . . . . 50-55 psi (345-380 kPa) (O_2, N_2O, Air)
	Pipeline gauge accuracy . . . . ±3 psi (0-25 psi)
	±2 psi (25-75 psi)
	±3 psi (75-100 psi)
	Cylinder connections . . . . Pin-indexed hanger yokes (ANSI B57.1-1977)
	Over pressure relief valve . . . . 75 psi (520 kPa) (Canada: CSA Standard Z168.3-M84)
	Regulator safety relief valve . . . . 75 psi (520 kPa) (Canada: CSA Standard Z168.3-M84)
	Fresh gas common outlet . . . . 15 mm female (Canada: 15 mm female, 22 mm male)
	Oxygen flush flow rate . . . . 55 (±10) l/min

Cylinder gauge accuracy . . . . ±90 psi (0-750 psi)
±60 psi (750-2250 psi)
±90 psi (2250-3000 psi)

Cylinder Gas Pressures	Oxygen, Air	2200 psi (15150 kPa)
	Nitrous oxide	745 psi (5130 kPa)
	Carbon dioxide	830 psi (5700 kPa)
	Oxygen-Helium	2400 psi (16550 kPa)

Flowmeter
Accuracy
(at 20° C and
760 mm Hg)

Oxygen, Nitrous Oxide, Air
(Fine) . . . . 100-1000 ml/min ±2.5% FS
Oxygen, Nitrous Oxide, Air
(Coarse) . . . . 1-10 l/min ±2.5% FS
Air (Dual Tapered) . . . . 0.2-1 l/min ± 50 ml of reading
2-10 l/min ±5% FS
Carbon Dioxide . . . . 0.05-1.0 l/min ±5% FS
Oxygen-Helium . . . . 2-10 l/min ±5% FS
Oxygen, Nitrous Oxide (Fine)
(Optional, Low-Flow) . . . . 20-500 ml/min ±2.5% FS
Oxygen, Nitrous Oxide (Coarse)
(Optional, Low-Flow) . . . . 0.6-10 l/min ±2.5% FS @ >1 l/min
± 15% of reading @ <1 l/min
Oxygen (Auxiliary Oxygen) . . . . 0-10 l/min ±5% FS

Vaporizers
(Vapor 19.1)

Temperature Range . . . . +15-35° C
(at normal atmospheric
pressure of 760 mm Hg)
Flow Range . . . . 0.25-15 l/min
Maximum Pressure Load . . . . 150 mm Hg
(above atmospheric)
Maximum Angle of Inclination . . . . 45°
Weight . . . . Approximately 7.5 kg

The following values refer to individual concentration settings when operated with a continuous flow of air in the range 0.25-15 l/m, temperature at 22° C, and normal atmospheric pressure (760 mm Hg).

Halothane

Adjustment range . . . . 0.2-5 vol%
Accuracy . . . . ± 0.15% concentration (volume) **or**
± 15% (whichever is higher)

Enflurane

Adjustment range . . . . 0.3-7 vol%
Accuracy . . . . ± 0.2% concentration (volume) **or**
± 20% (whichever is higher) **or**
+ 20%/- 30% with flow settings
6.0-15 l/min and handwheel settings
higher than 5.0% volume concentration

Isoflurane	Adjustment range	0.2-5 vol%
	Accuracy	± 0.15% concentration (volume) **or** ± 15% (whichever is higher)

Ventilator	Frequency	1-99, ±1 BPM (in 1 BPM steps)
	I:E ratio	1:1–1:4.5, ±0.1 (in 0.5 steps)
	Inspiratory flow	10-33 l/min (uncalibrated)
	Tidal volume	50-1500 ml, ±100 ml
	PEEP (optional)	2-15 cm H$_2$O (continuously adjustable)

Absorber System

Inspiratory Valve	Mounting ring nut size	M35 x 1
	Hose terminal	22 mm male
Expiratory Valve	Mounting ring nut size	M33 x 1
	Hose terminal	22 mm male
Breathing System Pressure Gauge	Range	-20 to +80 cm H$_2$O
	Smallest scale division	2 cm H$_2$O
	Nominal accuracy	-20 to +5 cm H$_2$O: 3% FS
		+5 to +55 cm H$_2$O: 2% FS
		+55 to +80 cm H$_2$O: 3% FS
	Mounting ring nut size	1 1/8 x 18
APL Valve	Nominal low flow resistance	2 cm H$_2$O at 8 l/min
	Hose terminal	19 mm male
Breathing Bag Terminal	Bag terminal	22 mm male

Pulse Oximetry Monitoring

Monitor	SpO$_2$ display range	0 to 100%
	Accuracy	70 to 100%, ±2% full scale
	Pulse display range	35 to 250 BPM
Sensor	Power dissipation	< 50 milliwatts (typically <1° C temperature rise)
	Measurement wavelengths	Red--660 nM Infrared--925 nM
	Operating Temperature	28° to 42° C

Noninvasive Blood Pressure Monitoring

Monitor

Systolic blood pressure display range .... 60-260 mmHg (Adult)
40-260 mmHg (Neonatal)

Diastolic blood pressure display range ...... 25-260 mmHg (Adult)
15-260 mmHg (Neonatal)

Mean blood pressure display range .... 35-260 mmHg (Adult)
25-260 mmHg (Neonatal)

Resolution .... 1 mmHg
Minimum cuff deflated interval between measurements .... 3 sec
Pulse rate display range .... 40-250 BPM
Resolution .... 1 BPM

Cuff Inflation

Maximum cuff inflation pressure .... 325 mmHg (Adult)
220 mmHg (Neonatal)

Maximum cuff inflated time .... 2.5 minutes
Minimum cuff deflated interval between measurements .... 3 sec
Sample duration (automatic mode) .... 25-30 sec (Adult)
15-20 sec (Neonatal)

Sample duration (stat mode) .... 12-30 sec (Adult)
15-20 sec (Neonatal)

Breathing Pressure Monitoring

Range .... -10-125 cm H_2O
Resolution .... 1 cm H_2O
Accuracy .... ±3 cm H_2O or ±10% of reading,
whichever is greater

Waveform range - full .... 0-125 cm H_2O
Waveform resolution .... 1 cm H_2O
Waveform accuracy .... ±3 cm H_2O or ±10% of reading,
whichever is greater

Waveform display scales .... 0-20, 0-50, 0-125 cm H_2O

Respiratory Volume Monitoring

Minute Volume

Range .... 0.1-99.9 l
Resolution .... 0.1 l
Accuracy .... ≤ +10% or 0.1 l, whichever is greater

Tidal Volume

Range .... 0.05-9.99 l
Resolution .... 0.01 l
Accuracy .... ≤ ±10% or 0.01 l, whichever is greater
Minimum detectable volume .... 0.05 l

Respiratory Rate	Range	2-99 BPM
	Resolution	1 BPM
	Accuracy	$\leq \pm 10\%$ or ± 1 BPM, whichever is greater

Expiratory Flow	Waveform range - full	0-100 l/minute
	Waveform resolution	1 l/minute
	Waveform display scales	0-20, 0-50, 0-100 l/minute

Respiratory Gas Analysis

CO_2 Measurement	Numeric Display Range	0 to 80 mmHg
	Numeric Display Resolution	1 mmHg
	Measuring Range	0 to 76 mmHg
	Accuracy (full accuracy mode)	± 2.0 mmHg (0-40)
		± 2.5 mmHg (41-60)
		± 4.0 mmHg (61-80)
	Accuracy (warm up mode)	± 5 mmHg (0-60)
	Response	200 mS (@ 200 ml/minute flow)
	Noise (full accuracy mode)	0.5 mmHg (0-40)
		2.0 mmHg (41-60)
		3.0 mmHg (61-80)

Oxygen Analysis Monitoring	Range	0-100 volume % O_2
	Resolution	1 volume % O_2
	Accuracy	± 3 vol% O_2
		(When calibrated within 18 hours, and constant temperature and pressure)
	Response time	≤ 25 sec (T90)
	Zero drift	≤ 0.1 volume % O_2/month
	Span drift	≤ 1 volume % O_2/8 hours
	Temperature error	$\leq \pm 3\%$ of reading (15° to 40° C)
	Cross sensitivity	$\leq 1\%$ of full scale
		(using 70 volume % N_2O, 5 volume % CO_2, and 4 volume % Halothane, or 5 volume % Enflurane, or 5 volume % Isoflurane)
	Sensor service life	≥ 8 months at 25° C, 50% relative humidity, 50% O_2 gas mixture (or $\geq 5000\%$ hour CO_2)

N₂O

Measurement

Numeric Display Range	0 to 100 vol % N₂O
Numeric Display Resolution	1 vol %
Measuring Range	0 to 100 vol %
Accuracy (full accuracy mode)	±7.5 vol % N₂O
Accuracy (warm up mode)	± 10 vol % N₂O
Response	400 mS (@ 200 ml/minute flow)
Noise	3 vol % N₂O

Halothane

Numeric Display Range	0 to 8.5 vol %
Numeric Display Resolution	0.1 vol %
Measuring Range	0 to 7 vol %
Accuracy (full accuracy mode)	±0.2 vol % or 10% of reading, whichever is greater
Accuracy (warm up mode)	±0.5 vol % or 10% of reading, whichever is greater
Response	400 mS (@ 200 ml/minute flow)
Noise	0.2 vol %

Enflurane

Numeric Display Range	0 to 8.5 vol %
Numeric Display Resolution	0.1 vol %
Measuring Range	0 to 7.5 vol %
Accuracy (full accuracy mode)	±0.2 vol % or 10% of reading, whichever is greater
Accuracy (warm up mode)	±0.5 vol % or 10% of reading, whichever is greater
Response	400 mS (@ 200 ml/minute flow)
Noise	0.1 vol %

Serial Interface

Serial Ports

Type	RS-232C (ports C and D) (ports A and B for future expansion)
Baud Rate	300, 600, 1200, 2400 4800, 9600, 19.2K, or 38.4K
Parity	Odd, Even, None
Data Bits	7 or 8
Stop Bits	1 or 2
Protocols	NONE, VITALINK, OR/LINK, MECIF, or SPACELAB LOGGER

Manual Sphygmomanometer

Type	Aneroid
Range	0-300 mmHg
Accuracy	± 3% FS (0-75 mmHg) ± 1% FS (75-225 mmHg) ± 3% FS (225-300 mmHg)

Description	Part Number

Anesthesia System

Breathing Hoses

22 mm x 23" LG 9995123
22 mm x 32" LG 9995132
22 mm x 40" LG 9995140

Scavenging Hoses

19 mm x 10" LG 9995210
19 mm x 20" LG 9995220
19 mm x 30" LG 9995230

Breathing Bags

1.0 l 9995310
2.0 l 9995320
3.0 l 9995330
4.0 l 9995340
5.0 l 9995350
Kuhn w/vent(0.5 l) 2114638

Adult Bellows 4106930

Data Cables

DB9/DB25/2.5 ft (9 to 25 pin adapter) 4109882
DB9/DB9/2.5 ft for use with Vitalink 4110328

Narkomed 4 Operator's Instruction Manual S4111402
Narkomed 4 Technical Service Manual 4111556

Pulse Oximetry Accessories

Interface cable w/pre-amp 4108982
Interface cable extension 4110686

DURASENSOR 4108983

Disposable OXISENSORS
D-25 (Adult, adhesive, flexible) 4108984
D-20 (Older children & small adults, adhesive, flexible) 4108985
R-15 (Mounts on bridge of nose--ind. for severe vasoconstriction,
adhesive, flexible) 4108986
N-25 (Neonates up to 3 kg, adhesive, flexible) 4108987
I-20 (Infants between 3 & 15 kg, adhesive, flexible) 4108988

	Description	Part Number
Oxygen Analysis	O$_2$ Sensor Capsule	6803290
	Sensor Housing & Cable Assembly	4106363
	Inspiratory Valve Dome	4108329
	Inspiratory Valve Dome Plug	4106387
Noninvasive Blood Pressure Monitoring Accessories	Newborn cuff	4109596
	Infant cuff	4109595
	Pediatric cuff	4109094
	Adult cuff	4109095
	Large adult cuff	4109096
	Thigh cuff	4109597
	Extension hose	4108971
Breathing Pressure Monitoring Accessories	Breathing Pressure Pilot Line (to absorber)	4109368
	Breathing Pressure Pilot Line (w/Luer to Y-piece)	4108528
Respiratory Volume Monitoring Accessories	Volume Monitor Sensor Assembly	4106362
	Volume Sensor Lubrication Kit (supplied w/Sensor Assembly)	2218180
	Gasket (exp. valve mount & sensor inlet)	1101690
Respiratory Gas Analysis Accessories	15 mm Adapter/Filter	4108104
	Sample Line (96 in)	4108103
	Water Trap Reservoir	4110616
	Gas Analyzer Calibration Kit	4110683
O.R. Data Manager	Laser Printer	4111380
	Printer Cable (8 feet)	4110568
	Printer Cable (50 feet)	4111626
	Floppy Disk (3.5" pkg of 10)	4111462

Narkomed 4 Operator's Exam

The purpose of this exam is to promote North American Dräger's commitment to patient safety by familiarizing the operator with the Narkomed 4 anesthesia system.

This examination is divided into two parts. Part I is a matching examination where the operator must write the letter of the call out for a part or component next to its written description. Part II consists of 15 questions. Each question has multiple true or false answers that must be answered.

This examination is to be photo copied so that all operators may take this exam to ensure familiarity with the equipment.

Part I

A

B

BOOM ARM

C

MANUAL
SPHYGMOMANOMETER
(OPTIONAL)

D

E

F

G

H

I

J

PRINTER
(OPTIONAL)

O

K

L

VAPORIZERS
(OPTIONAL)

LEUR FITTING
(OPTIONAL)

M

N
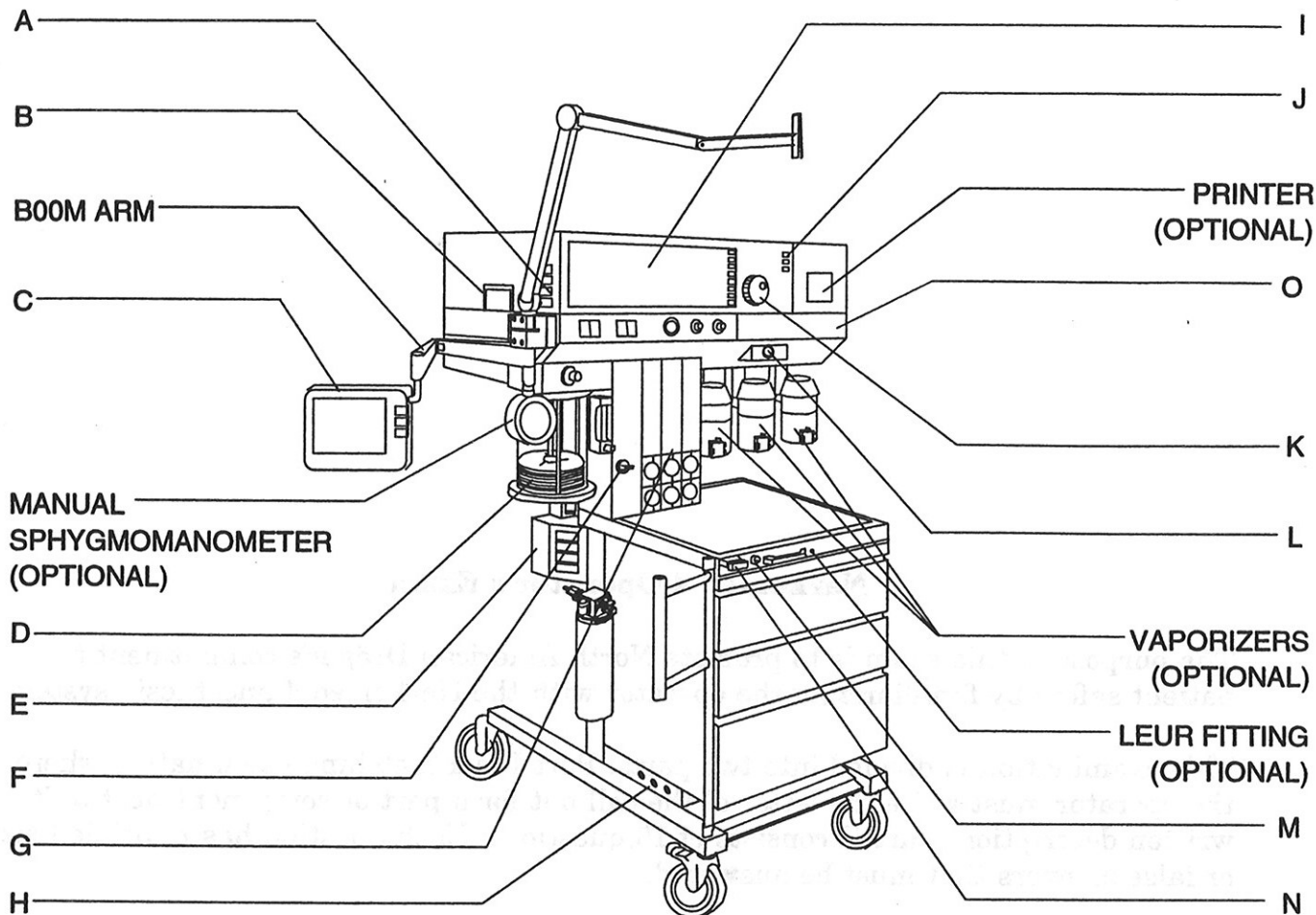
Figure 1   NARKOMED 4 Anesthesia System, Front View

Match the following controls or indicators with the correct letter.

_____ Selection Dial	_____ Fresh Gas Outlet
_____ Gas Selection Switch	_____ Main Display
_____ O$_2$ Flush	_____ SpO$_2$/N.I.B.P Interface
_____ Control Key Panel (Audio Silence)	_____ Volume/O$_2$/Pressure Interface
_____ Main Switch	_____ Ventilator Bellows
_____ Remote Display	_____ Ventilator
_____ Flow Meters	_____ Water Trap
_____ Circuit Breakers	
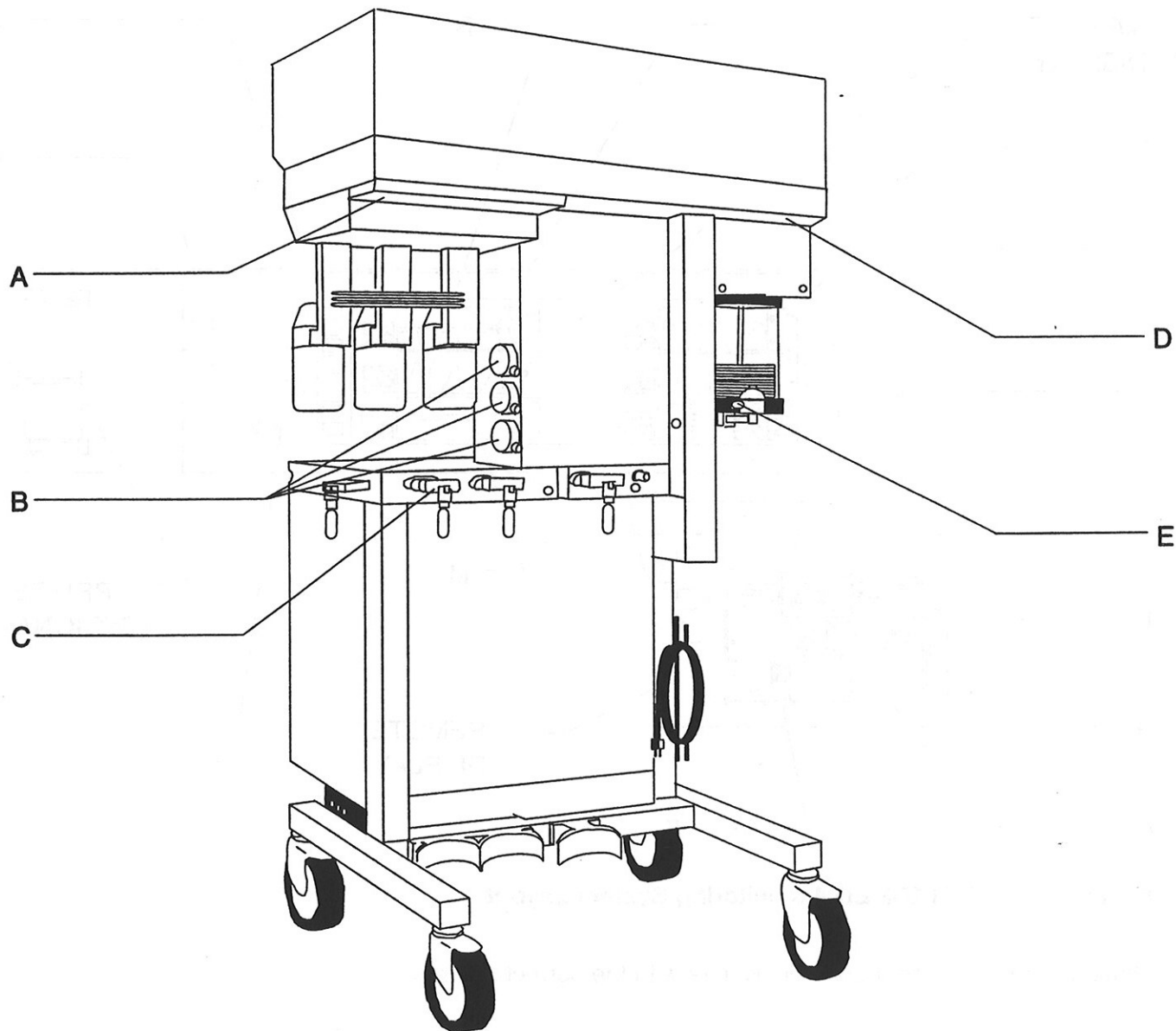
Figure 2   NARKOMED 4 Anesthesia System, Back View

Match the following components with the correct letter:

_____   External Communication Interface Panel

_____   D.I.S.S. Pipeline Inlets

_____   A.C. Convenience Receptacles

_____   Cylinder Yokes

_____   Ventilator Scavenger Connection
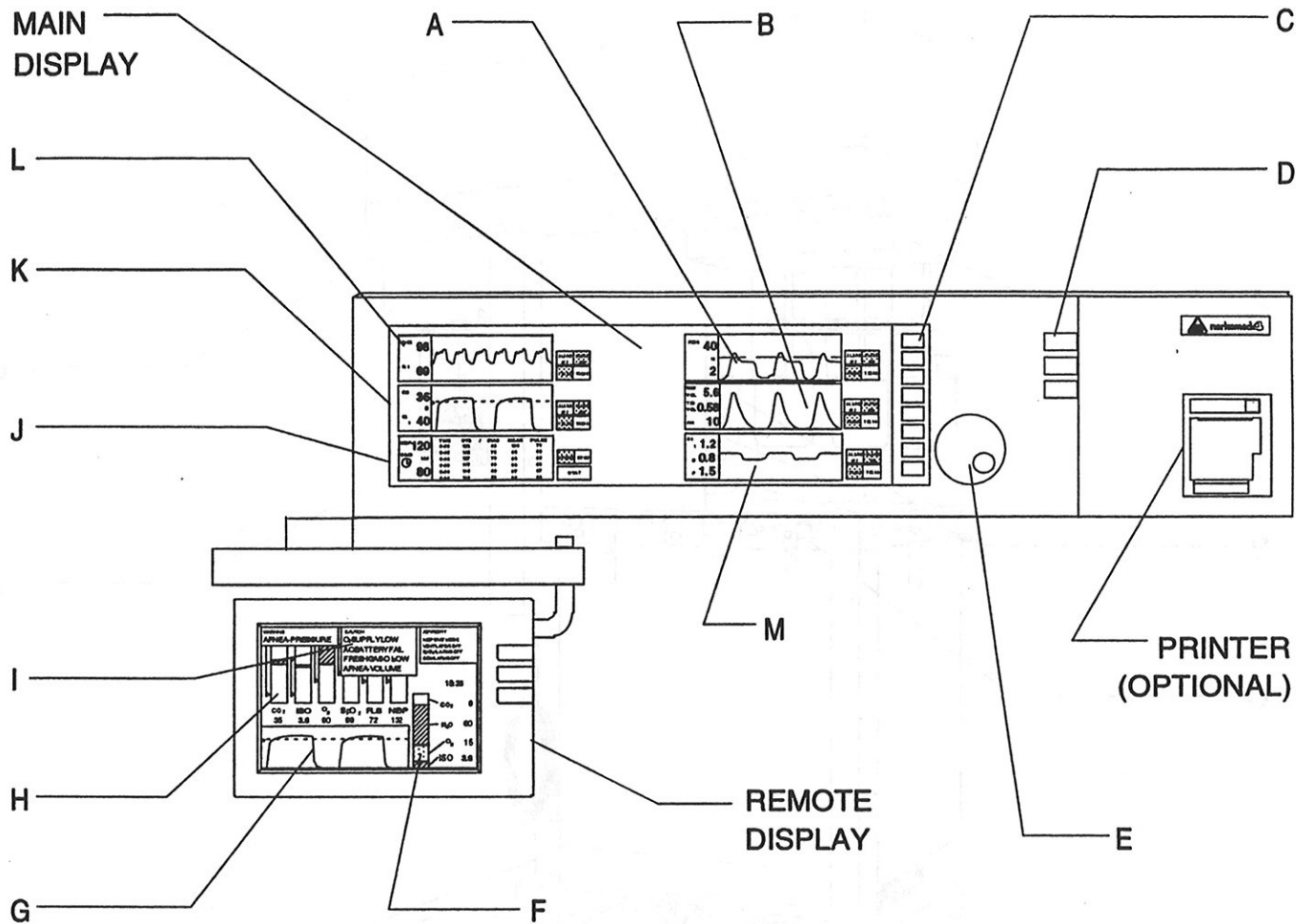
Figure 3   NARKOMED 4 Monitoring System Layout

Match the following controls or indicators with the correct letter.

_____	Breathing Pressure	_____	Silence Key
_____	Pulse Oximeter	_____	Respiratory Volume
_____	Selection Dial	_____	Data Scan
_____	Monitor Key	_____	Agent
_____	CO_2 and O_2	_____	Gas Composition Display
_____	Central Alarm	_____	Noninvasive Blood Pressure
_____	CO_2 Wave Form		
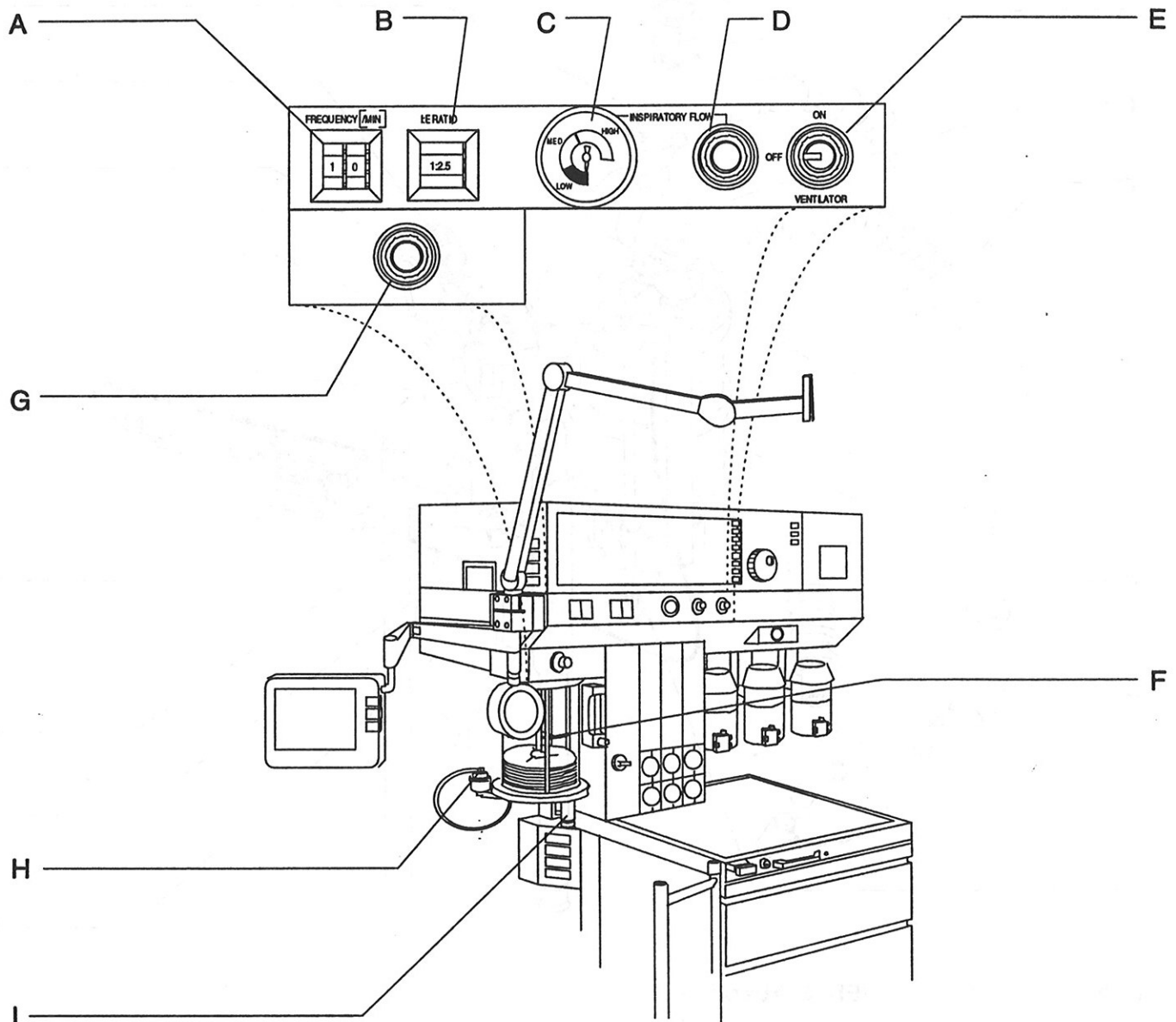
Figure 4   **NARKOMED 4 Ventilator**

Match the following controls or indicators with the correct letter.

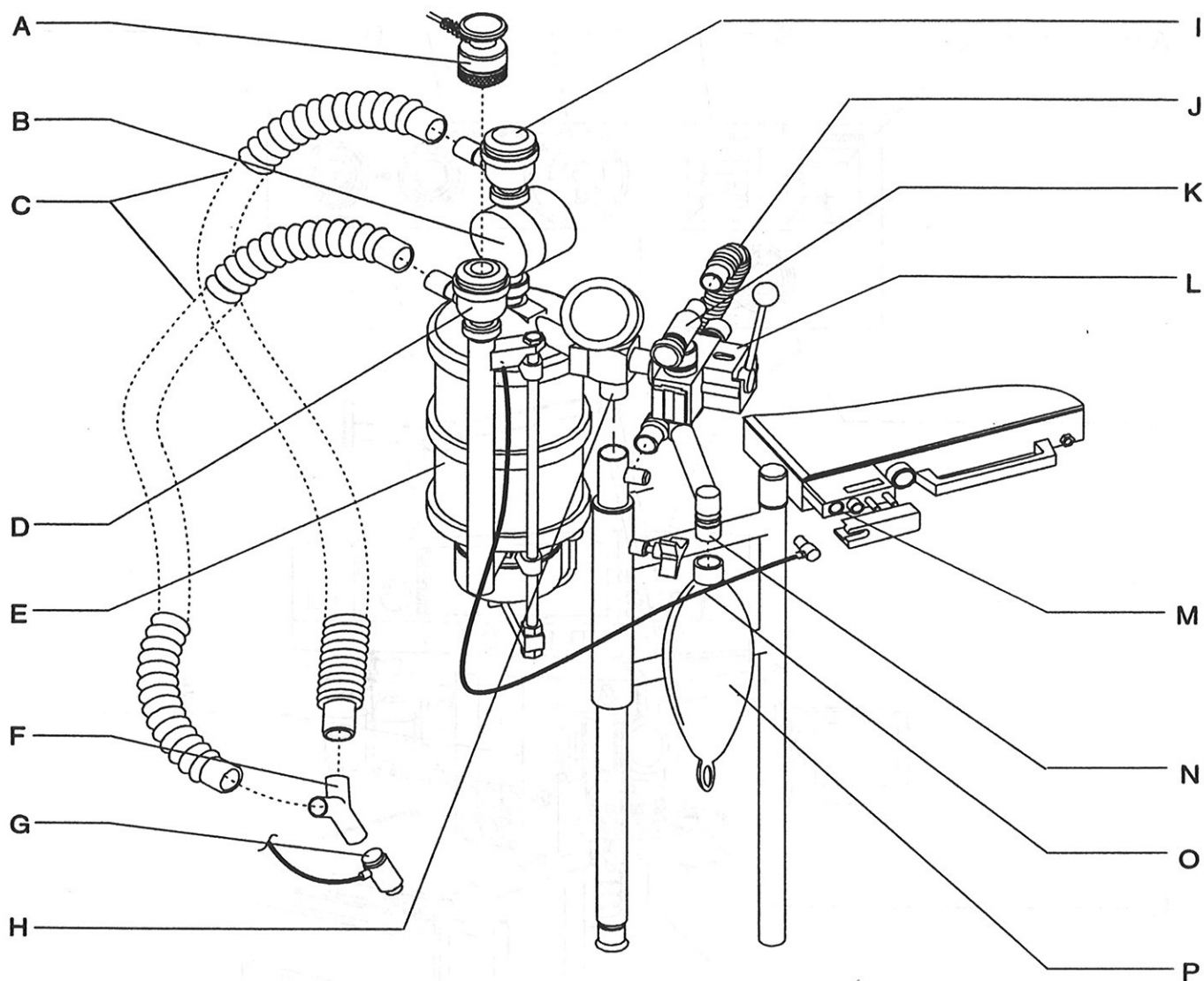|			
_____	Frequency Control	_____	Ventilator Power Switch
_____	Tidal Volume Adjustment Knob	_____	Tidal Volume Pointer
_____	Ventilator Hose Connection	_____	I:E Ratio Control
_____	Inspiratory Flow Gauge	_____	Inspiratory Flow Control
_____	Ventilator Relief Valve		

Figure 5   NARKOMED 4 Absorber

Match the following items with the correct letter.

___ APL Valve	___ Fresh Gas Hose	___ CO$_2$ Monitor Airway Adapter
___ Fresh Gas Outlet	___ O$_2$ Analyzer	
___ Breathing Bag	___ Volume Monitor Sensor	___ Swivel Bag Mount
___ MANUAL/AUTOMATIC Selector Valve	___ 22mm Breathing Hose	___ Absorber Mounting Stud
___ 19mm Scavenger Hose	___ Absorber	___ Y Piece
___ Expiratory Valve		___ Inspiratory Valve
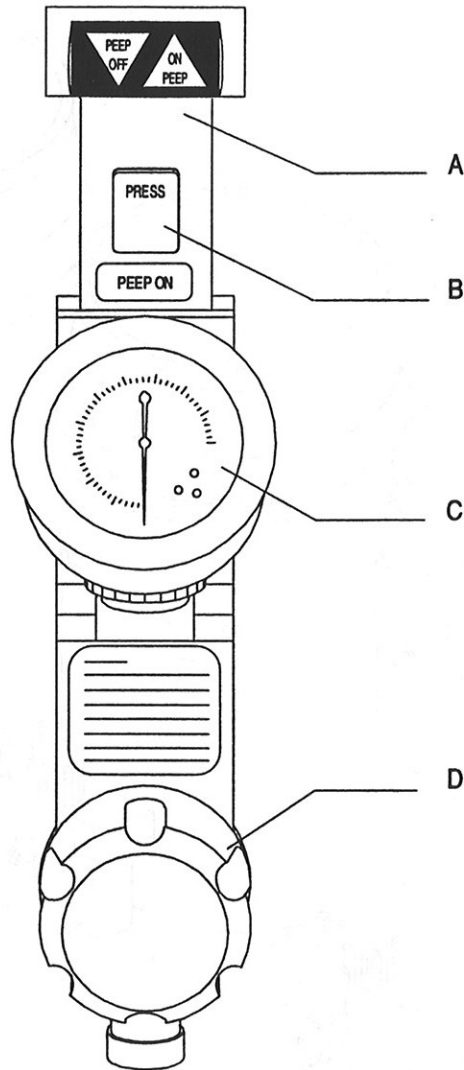
Figure 6   Optional PEEP Valve

Match the following items with the correct letter.

_____   Latch

_____   PEEP Control Valve

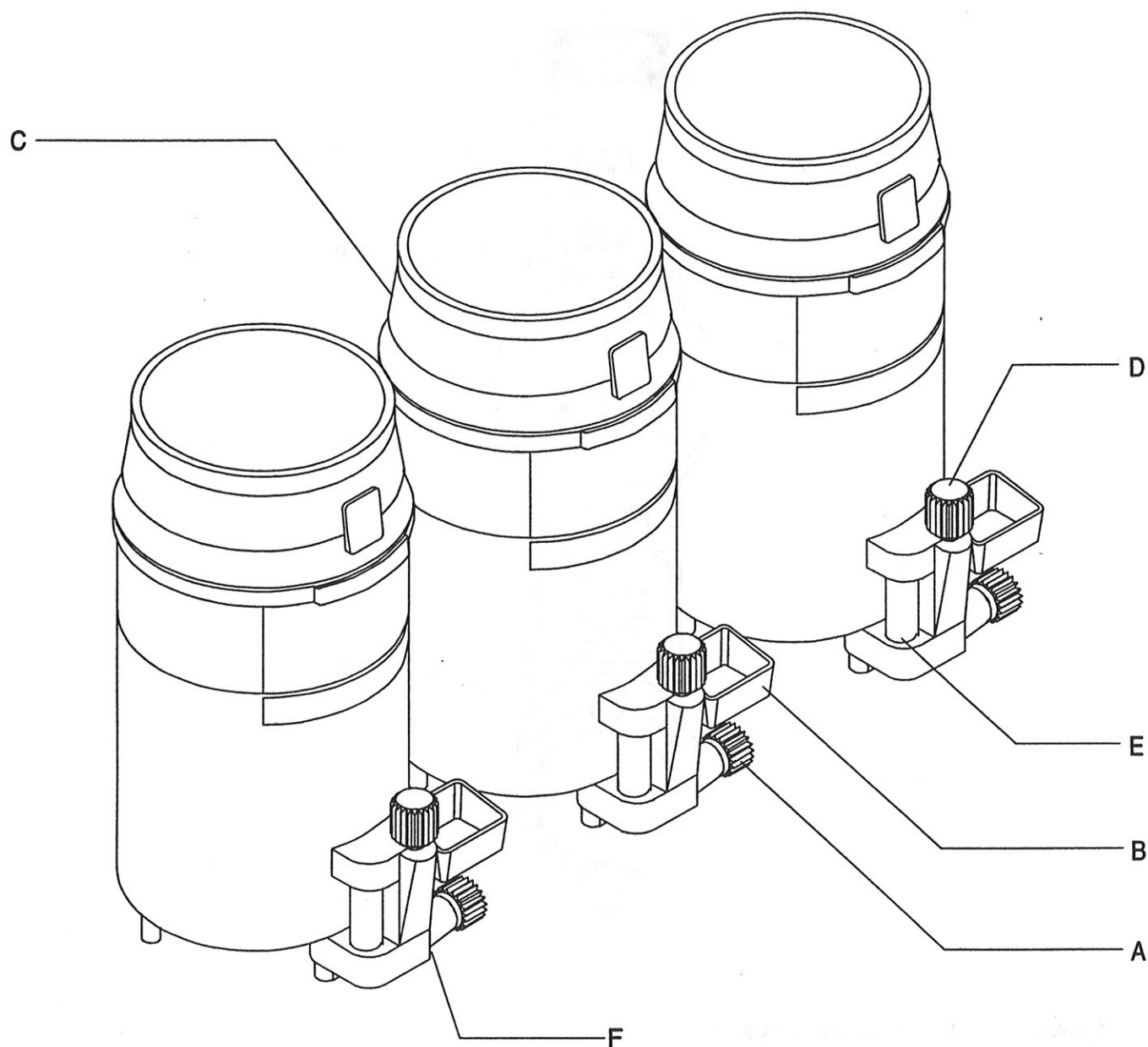_____   PEEP Bypass Control

_____   Breathing Pressure Gauge

Figure 7   Vaporizers (with Standard Filler/Drain Mechanisms)

Match the following controls or indicators with the correct letter.

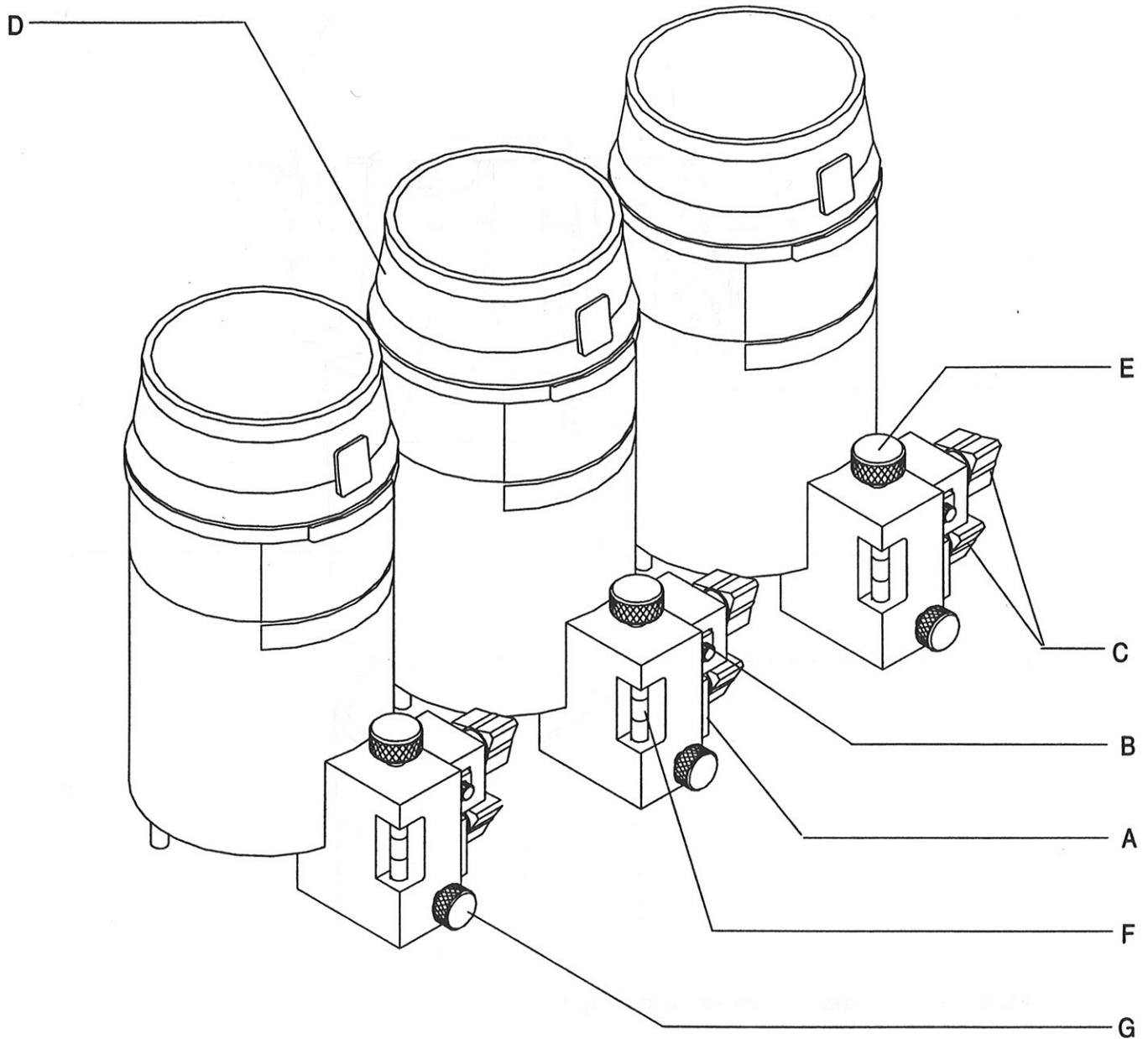|			
_____	Filler Valve	_____	Drain Valve
_____	Sight Glass	_____	Drain Port
_____	Filler Funnel	_____	Handwheel Adjustment

Figure 8   **Vaporizers (with optional Pin-Indexed Filler/Drain Mechanisms)**

Match the following controls or indicators with the correct letter.

_____ Filler Valve

_____ Sight Glass

_____ Wing Screws

_____ Drain Port

_____ Handwheel Adjustment
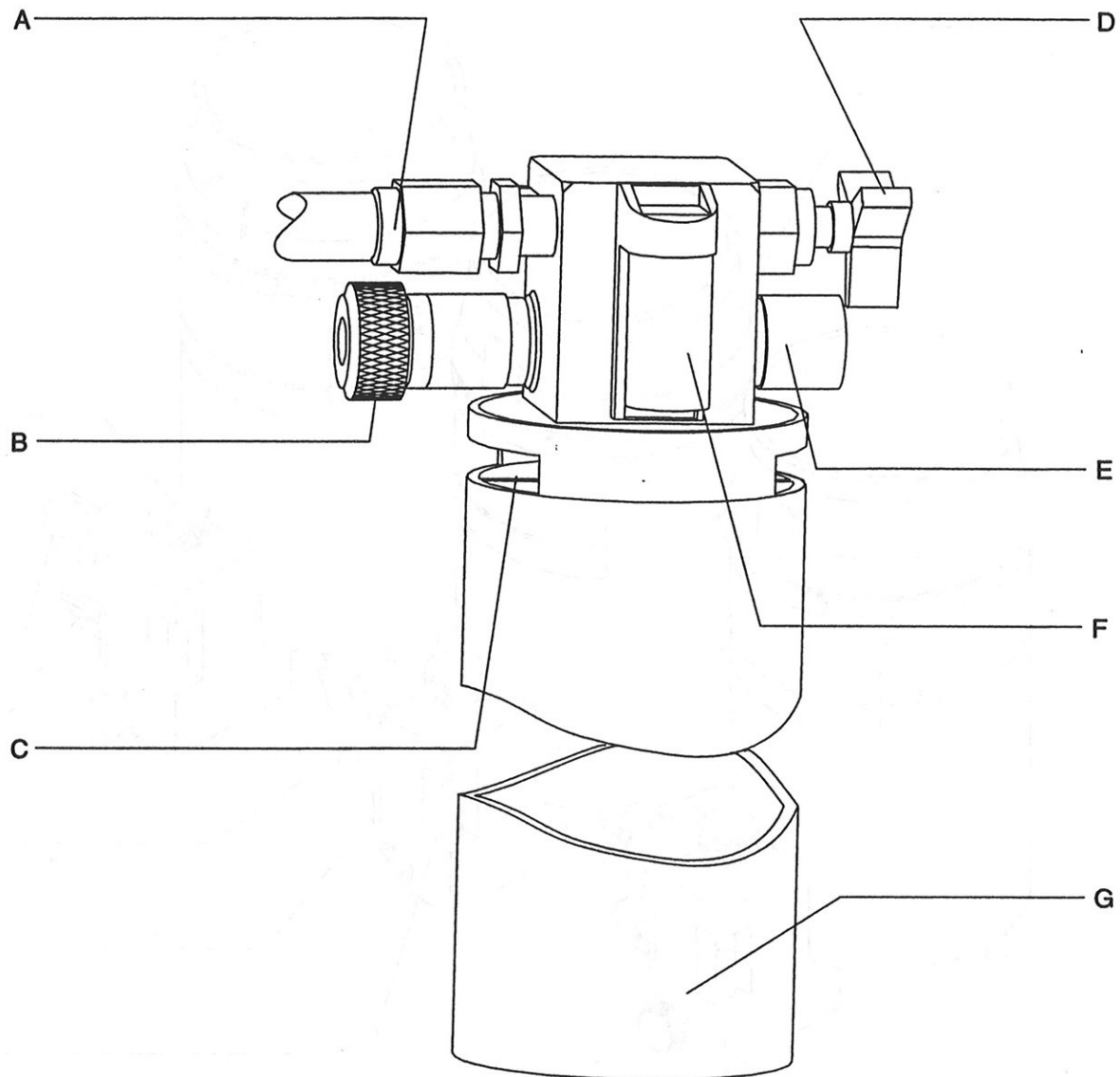
_____ Drain Valve

_____ Filler Port

A ●——

D ●——

B ●——

E ●——

F ●——

C ●——

G ●——

Figure 9   Open Reservoir Scavenger

Match the following items with the correct letter.

————— Input Port Cap

————— 19mm Scavenger Hose Connection

————— D.I.S.S. Vacuum Hose

————— Reservoir Canister

————— Flowmeter

————— Relief Port

————— Suction Flow Adjustment

PART II

Answer YES or NO to the following questions.

1.   The gas selector switch on the three gas version of the Narkomed 4 is turned to the "ALL GASES" position, resulting in which of the following changes in the gas delivery system:

        _____ A.   The audible/visual ORMC alarms are disabled.
        _____ B.   The minimum flow feature is disabled.
        _____ C.   The controller function of the ORMC is disabled.
        _____ D. O_2, N2O, Air, CO_2, and O_2He.
                (depending on gases present) can be delivered.

2.   During AC line power failure, the following changes occur in a Narkomed 4:

        _____ A.   Power supply automatically switches to battery back-up.
        _____ B.   AC power fail indicator light goes on.
        _____ C.   The AC convenience receptacles lose power.
        _____ D.   A single tone audio alarm sounds.

3.   What information is displayed on the left screen of the main display?

        _____ A.   Pulse oximeter.
        _____ B.   Airway pressure.
        _____ C.   Noninvasive blood pressure.
        _____ D.   Oxygen concentration.

4.   The monitor set up screens allows the operator to set which of the following?

        _____ A.   Interlock between SPO_2 and NIBP.
        _____ B.   Adult/neonatal mode on NIBP.
        _____ C.   Adjust pulse tone volume.
        _____ D O_2 and CO_2 calibration.

5.   In order to calibrate the O_2 monitor in a Narkomed 4 the operator you must, expose the sensor to 21% O_2 and:

        _____ A.   Press the "MONITOR SETUP" key.
        _____ B.   Set the LO O_2 alarm limit.
        _____ C.   Set up the HI O_2 alarm limit.
        _____ D.   Press the "O_2 CAL" soft key.

6.   The Narkomed 4 display breathing pressure information in which of the following ways:

      _____ A.   Mean pressure.
      _____ B.   PEEP.
      _____ C.   Peak pressure.
      _____ D.   Pressure wave form.

7.   To change the audio tone volume on the pulse oximeter one must:

      _____ A.   Press the monitor setup key.
      _____ B.   Set the high alarm limit for oxygen saturation.
      _____ C.   Touch the "TONE VOLUME" bar graph.
      _____ D.   Rotate the selection dial in the desired direction (up or down in volume).

8.   The message "AGENT DETECTED" appears as a caution when:

      _____ A.   No agent has been selected.
      _____ B.   Any agent is detected at greater than 0.5% Vol.
      _____ C.   Agent contamination in the O.R. exceeds 100 ppm.
      _____ D.   More than one vapor is turned "on".

9.   To set the threshold pressure alarm limit on the breathing pressure monitor, one must:

      _____ A.   Press the "MONITOR SETUP" key.
      _____ B.   Rotate the selection dial in the desired direction.
      _____ C.   Touch the "TRACE" soft key.
      _____ D.   Touch the "AUTOSET" soft key.

10.   To adjust the audio volume for the alarms on the Narkomed 4 one must:

      _____ A.   Press the "SYSTEM CONFIG" key on the main panel.
      _____ B.   Touch the "SYSTEM FUNCTIONS" soft key.
      _____ C.   Touch "AUDIO VOLUME" soft key.
      _____ D.   Rotate selection dial to change the value to desired setting.

11.   Which of the following can result in erratic SpO_2 measurements:

      _____ A.   Excessive patient motion.
      _____ B.   Defective O_2 sensor.
      _____ C.   Interference from electrostatic unit.
      _____ D.   Patient has poor peripheral perfusion.

12.   To adjust the oxygen concentration alarms on the Narkomed 4 the operator must:

_____   A.   Press "MONITOR SETUP" key.
_____   B.   Touch soft key for specific alarm limits.
_____   C.   Touch "SAVE" soft key.
_____   D.   Rotate selection dial to desired value.

13.   To adjust the CO_2 alarm limits on the Narkomed 4, the operator must:

_____   A.   Touch soft key for specific alarm limits.
_____   B.   Press "MONITOR SETUP" key.
_____   C.   Rotate selection dial to desired value.
_____   D.   Touch "SAVE" soft key.

14.   When the AV-E ventilator is turned on, which of the following occurs?

_____   A.   The volume alarms are enabled.
_____   B.   The apnea pressure alarms are enabled.
_____   C.   The CO_2 alarms are enabled.
_____   D.   The pulse oximeter alarms are enabled.

15.   The bellows on the AV-E ventilator will not collapse during inspiration. Some possible causes for this problem are:

_____   A.   Manual/Automatic selector valve in "BAG" position.
_____   B.   Inspiratory flow control setting on ventilator too low.
_____   C.   Excessive suction applied to the scavenger system.
_____   D.   PEEP valve value set too "high".

Narkomed 4 Operator's Examination Answers

Part I

Figure 1

K	Selection Dial	N	Fresh Gas Outlet
L	Gas Selection Switch	I	Main Display
M	O$_2$ Flush	A	SpO$_2$/N.I.B.P Interface
J	Control Key Panel (Audio Silence)	E	Volume/O$_2$/Pressure Interface
F	Main Switch	D	Ventilator Bellows
C	Remote Display	O	Ventilator
G	Flow Meters	B	Water Trap
H	Circuit Breakers		

Figure 2

A	External Communication Interface Panel
B	D.I.S.S. Pipeline Inlets
D	A.C. Convenience Receptacles
C	Cylinder Yokes
E	Ventilator Scavenger Connection

Figure 3

A	Breathing Pressure	D	Silence Key
L	Pulse Oximeter	B	Respiratory Volume
E	Selection Dial	H	Data Scan
C	Monitor Key	M	Agent
K	CO$_2$ and O$_2$	F	Gas Composition Display
I	Central Alarm	J	Noninvasive Blood Pressure
G	CO$_2$ Wave Form		

Figure 4

A	Frequency Control	E	Ventilator Power Switch
G	Tidal Volume Adjustment Knob	F	Tidal Volume Pointer
I	Ventilator Hose Connection	B	I:E Ratio Control
C	Inspiratory Flow Gauge	D	Inspiratory Flow Control
H	Ventilator Relief Valve		

Figure 5

K	APL Valve	O	Fresh Gas Hose	G	CO₂ Monitor Airway Adapter
M	Fresh Gas Outlet	A	O₂ Analyzer		
P	Breathing Bag	B	Volume Monitor Sensor	N	Swivel Bag Mount
L	Manual/Automatic Selector Valve	C	22mm Breathing Hose	H	Absorber Mounting Stud
J	19mm Scavenger Hose	E	Absorber	F	Y Piece
I	Expiratory Valve			D	Inspiratory Valve

Figure 6

B	Latch
D	PEEP Control Valve
A	PEEP Bypass Control
C	Breathing Pressure Gauge

Figure 7

D	Filler Valve	A	Drain Valve
E	Sight Glass	F	Drain Port
B	Filler Funnel	C	Handwheel Adjustment

Figure 8

E	Filler Valve	D	Handwheel Adjustment
F	Sight Glass	G	Drain Valve
C	Wing Screws	B	Filler Port
A	Drain Port		

Figure 9

B	Input Port Cap Connection	E	19mm Scavenger Hose
A	D.I.S.S. Vacuum Hose	G	Reservoir Canister
F	Flowmeter	C	Relief Port
D	Suction Flow Adjustment		

PART II

1.
N A.
Y B.
N C.
Y D.

2.
Y A.
Y B.
Y C.
Y D.

3.
Y A.
N B.
Y C.
Y D.

4.
Y A.
Y B.
Y C.
Y D.

5.
Y A.
N B.
N C.
Y D.

6.
Y A.
Y B.
Y C.
Y D.

7.
Y A.
N B.
Y C.
Y D.

8.
Y A.
Y B.
N C.
N D.

9.
Y A.
N B.
N C.
Y D.

10.
Y A.
Y B.
Y C.
Y D.

11.
Y A.
Y B.
Y C.
Y D.

12.
Y A.
Y B.
N C.
Y D.

13.
Y A.
Y B.
Y C.
N D.

14.
Y A.
Y B.
N C.
N D.

15.
Y A.
Y B.
N C.
N D.

NORTH
AMERICAN
DRÄGER