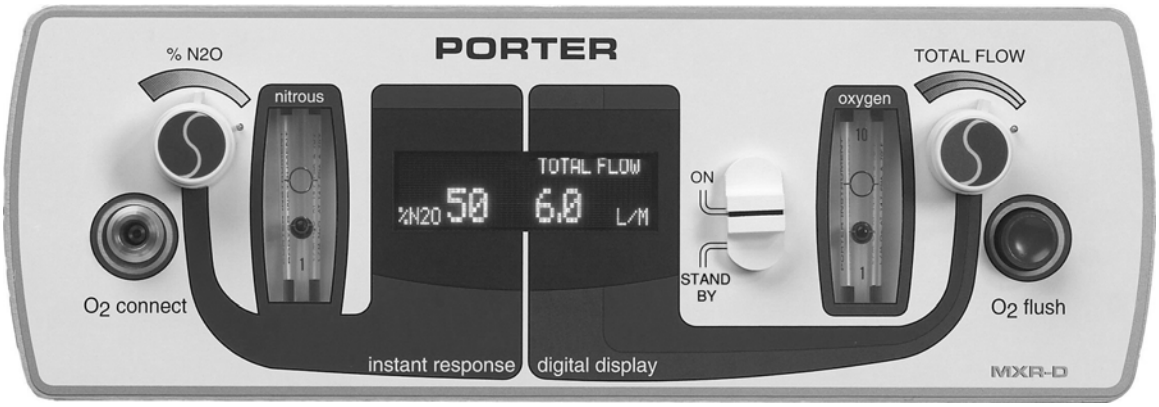
DIGITAL MXR-D

FLOWMETER USER'S MANUAL

Instructions and Safety Considerations
Cabinet Mount MXR-D

Porter Conscious Sedation Flowmeter
and Bag Tee (Accessory)



Parker Hannifin Corporation
Porter Instrument Division
245 Township Line Rd.
Hatfield, PA 19440 USA
(215) 723-4000 / fax (215) 723-5106

FM-1061 Rev. B 4/11

IMPORTANT:
READ MANUAL COMPLETELY BEFORE OPERATING THIS DEVICE

Basic delivery technique is described. Also, this manual contains instructions on periodically required checks to be performed by the user. These checks are necessary to insure the proper performance of this device and its safety features. Retain this manual for future reference.

CAUTION: Federal law U.S. restricts this device for use by or on the order of a physician, dentist or licensed practitioner.

Date Purchased: _____

MXR-D Model No.: 4065D **Serial Number:** _____

Dealer Name: _____ **Dealer Phone No.:** _____

UL Classified to 60601-1: Medical Equipment with respect to electric shock, fire and mechanical hazard only in accordance with UL 60601-1 and CAN/CSA C22.2 No. 601.1-M90.

Symbol	Description
	Protective Earth Ground, Class I Device
	Alternating Current
	Attention, consult the accompanying documents.
	Type B Equipment

- Distribution of Porter Model 4065D is limited and controlled to United States and Canada only.
- The Porter Model 4065D incorporates fusing only in the ungrounded phase conductor. **This product must not be used in countries other than the United States and Canada and must be used only in health care facilities on grounded systems where conditions of maintenance and supervision ensure that only qualified persons will service the electrical distribution system.**

For Technical Assistance, contact Dental Customer Service:
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WARNINGS AND PRECAUTIONS

These warnings and precautions are to help you to understand how to safely operate the MXR Flowmeter. A WARNING alerts you to a possible hazard to people. A CAUTION alerts you to the possibility of equipment damage.

WARNING: Do not use this device for the administration of general anesthesia or as a part of, or in conjunction with, a general anesthesia administration system.

WARNING: Dental workers are exposed to N_2O during administration of N_2O/O_2 conscious sedation analgesia. NIOSH has recommended that exposures should be minimized. Contact NIOSH (1-800-35-NIOSH) to receive NIOSH Publications on *Control of Nitrous Oxide in Dental Operatories.* Exposure can be minimized by effective controls. National Institute for Occupational Safety and Health (NIOSH) publications state that controls, including System Maintenance, Ventilation and Work Practices can effectively reduce N_2O concentrations in dental operations. Your flowmeter accessory Porter scavenger system is an important part of the system of controls.

WARNING: Porter Instrument equipment utilizes the **cross+protection** system. The flexible hose and connectors that connect to the flowmeter are diameter indexed; 3/8" O.D. for Nitrous Oxide and ½" for Oxygen. The **cross+protection** system is designed to prevent misconnection of Oxygen and Nitrous Oxide piping. **DO NOT ATTEMPT TO CHANGE THE DIAMETERS OR CONNECTORS OF THE FLOWMETER!** Tampering with the **cross+protection** system constitutes acceptance of liability by the installer. For your own protection, as well as that of the Doctor and the patients, use 3/8" O.D. tubing for all Nitrous Oxide lines and ½" O.D. tubing for all Oxygen lines.

To assure safe operation and conformation to local fire codes, all Porter Instrument flowmeter systems are designed to be used with sedation delivery systems mounted inside walls and they meet or exceed the guidelines established by the National Fire Protection Association for Nonflammable Medical Gas Systems, NFPA 99. Copies of NFPA 99 or portions thereof may be obtained by writing to: National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9904; or call 1-800-344-3555

WARNING: New or modified installations - **properly connected gas pipelines are absolutely essential to patient safety.** The dealer or contractor should provide written documentation that all gas pipelines are connected properly and that the system has been pressure tested prior to use. While this is a good business practice, it is important that the user verify by their own test, independent of the dealer or contractor, that all gas pipelines are connected correctly prior to using the system. **The ultimate responsibility of assuring that lines are not crossed rests with the user.**

WARNING: Do not use an electrical cord with nicks, cuts, or other damage.

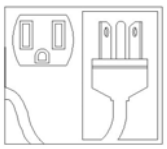
WARNING: During any extended power outage, remember to turn the On / Standby (Off) switch to the STANDBY position on the flowmeter and manually turn OFF the tank valves. With centralized, electrically powered gas systems, if gas was flowing when the power went out and the flowmeter is left ON, gas will be flowing when the power is restored.

CAUTION: Federal law (U.S.) restricts this device for use by or on the order of a physician, dentist or licensed practitioner.

CAUTION: Always use clean, dry medical grade gases. Introduction of moisture or other contaminants into this device may result in defective operation.

CAUTION: Do not attempt to repair, alter or calibrate this device. Unauthorized repair, alteration or misuse of this device is likely to adversely affect the performance and will void the warranty.

CAUTION: Never oil or grease any part of this system (minimize fire or explosion potential).



CAUTION: There are no user-serviceable parts inside this unit. A shock hazard exists if power is not disconnected prior to any internal servicing or maintenance. Always disconnect the power source before inspection or repair.

CAUTION: Do not change any internal factory set adjustments. The Porter Digital MXR is adjusted and calibrated for proper operation prior to shipment. Any change could alter the specified operation and accuracy.

CROSSED LINES WARNING
NEW OR MODIFIED INSTALLATIONS

ALWAYS ASSURE THAT LINES ARE NOT CROSSED!

WARNING: New or modified installations - **properly connected gas pipelines are absolutely essential to patient safety.** The dealer or contractor should provide written documentation that all gas pipelines are connected properly and that the system has been pressure tested prior to use. While this is a good business practice, it is important that the user verify by their own test, independent of the dealer or contractor, that all gas pipelines are connected correctly prior to using the system. **The ultimate responsibility of assuring that lines are not crossed rests with the user.**

Do not allow crossed lines to defeat the safety features of the dental flowmeter and / or central gas supply manifold systems. Crossed lines will create a dangerous and hazardous condition where 100% Nitrous Oxide will be delivered through the Oxygen dental flowmeter tube and subsequently to the patient. In addition, the resuscitator quick connect would deliver 100% Nitrous Oxide to an Oxygen demand valve.

Maintain patient observation during procedures. Prevent over sedation. If a patient becomes over sedated when being delivered 100% Oxygen, it is a definite indication of crossed lines. If crossed lines are suspected, remove the nasal mask immediately and encourage mouth breathing. Deliver pure Oxygen from an Oxygen demand valve only if the Oxygen source is independent from the suspected crossed lines area.

To check for crossed lines of an installed Porter Vanguard (or Sentinel) Manifold System:

1. At the manifold system (in the tank room), start the check from an operating system with 50 PSI showing on both gauges and the indicator lights turned on – electrical operation and alarms needed for the Vanguard test. Then, turn off both Oxygen tanks and leave both Nitrous Oxide tanks on. (For the Sentinel, only one tank of each gas is on at a time. Turn off the one open Oxygen tank, leave on the one Nitrous Oxide tank, turn off the indicator lights – eliminates alarms during the Sentinel test.)

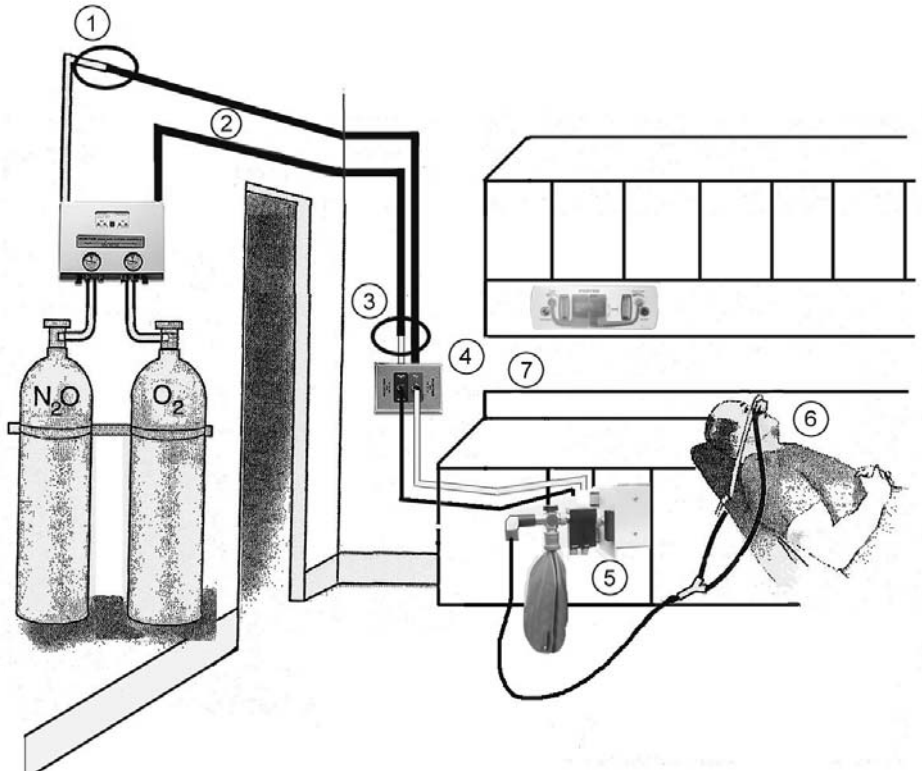
2. In the operatory, where the flowmeter is installed, flow 5 to 6 liters per minute of O_2 only. Verify that the N_2O flowmeter valve is in the off position and that there is no indicated flow of N_2O - by observing the ball float resting at the bottom of the glass N_2O flow tube.

   This action will bleed the Oxygen copper tubing lines (1/2" OD) from the manifold, through the office walls, to the flowmeter. Note: this action does not cause a quick bleed down, as there is a fair sized volume in the lines. O_2 flow would be observed by the position of the ball float in the O_2 flow tube for several minutes.

3. Rather than waiting for the O_2 flow to decrease, go back to the manifold tank room and observe the O_2 pressure gauge on the manifold (normally showing approximately 50 PSIG pressure). The line pressure should start to decrease, indicating bleeding of the O_2 that is no longer being replenished by the tanks. On Vanguard systems, the alarm will beep at 40 PSIG, a switch will occur from one tank to the second tank at a timed interval (increasing the gauge back to 50 PSIG). The gauge then should eventually go down to zero.

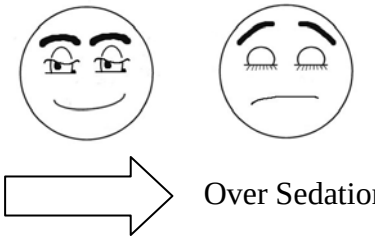
   If the O_2 pressure does not go down as described above, and remains at about 50 PSIG, it indicates a crossed lines condition.

4. If O_2 pressure does not go down, proceed to the next crossed line determination check. Turn N_2O tanks off in the manifold tank room and watch the N_2O gauge. Given a crossed line condition, the N_2O gauge will now go down (the Vanguard system will show a switching similar to step 2 above) — this shows the O_2 valve of the flowmeter is bleeding the crossed N_2O lines. The N_2O gauge will go down to zero.



Do Not Allow Crossed Lines to Defeat Equipment Safety Features

Crossed lines in wall structure piping creates hazard of 100% Nitrous Oxide delivery to nasal mask and Oxygen demand valve when Flowmeter is set for 100% Oxygen resulting in over sedation.



The initial installation potential problem:

1 DISS (Diameter Index Safety System) is modified at tank room wall when 3/8 inch Nitrous Oxide pipe is increased to 1/2 inch pipe size. Oxygen pipe remains at the normal 1/2 inch size.

2 Both Nitrous Oxide and Oxygen piping is maintained at a common 1/2 inch size throughout the building walls leading to operatories.

3 At gas outlet station, the Oxygen 1/2 inch pipe is incorrectly decreased down to the DISS 3/8 inch size reserved for Nitrous Oxide lines. Oxygen is fed into the Nitrous Oxide lines.

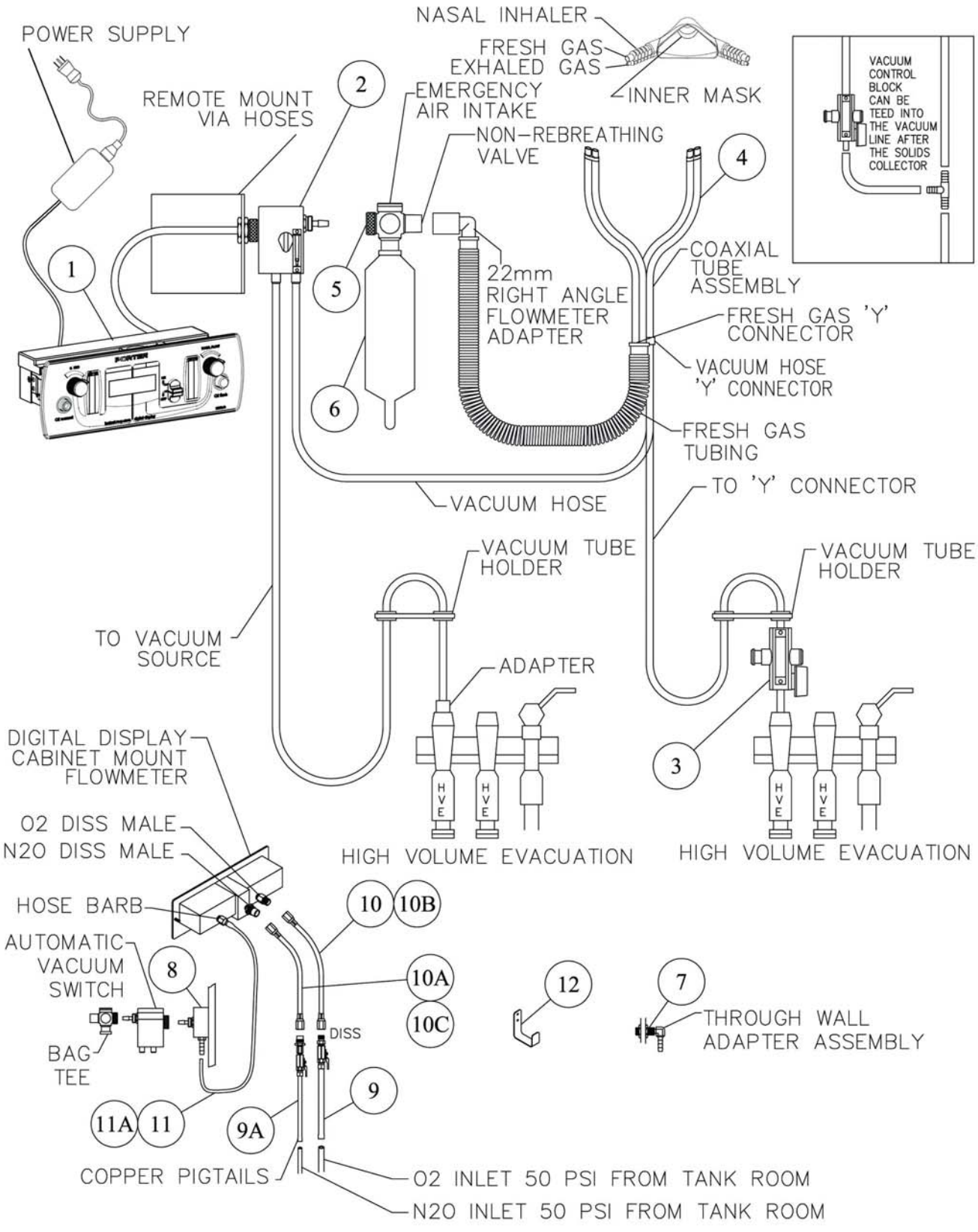
4 At gas outlet station, the common run of 1/2 inch pipe for Nitrous Oxide is incorrectly allowed to remain at the 1/2 inch size and is then falsely connected to the DISS 1/2 inch outlet station. Nitrous Oxide is fed into the Oxygen lines.

5 Dental flowmeter valve is set for 100% Oxygen only, but will deliver 100% Nitrous Oxide because of the crossed lines.

6 A patient will become over sedated and may appear to fall asleep when the flowmeter is set for 100% Oxygen.

7 An Oxygen demand valve connected to the resuscitator quick connect of the Flowmeter will also deliver 100% Nitrous Oxide because of the crossed lines.

NITROUS OXIDE CONSCIOUS SEDATION SYSTEM ILLUSTRATION



NITROUS OXIDE CONSCIOUS SEDATION SYSTEM COMPONENTS & ACCESSORIES

Item No.	Part Number	Description
1	4065D	MXR Flowmeter with Power Supply and Cable
2	AVS-5000	AVS
3	5501-RK	Vacuum Block Kit
4	5155-1	Adult Rubber Gds (w/ Vacuum Block)
4A	5155-3	Adult Rubber Gds (no Vacuum Block)
5	P1407A	Bag Tee
6	4100	3L Bag
7	A-2633-000	Adapter for Bag Tee
8	A-1679	Remote Bag Tee Adapter
9	B-2460-001	O2 Check Valve
9A	B-2461-001	N2O Check Valve
10	8005	O2 Hose, Diss / Diss, 5 Ft
10A	8505	N2O Hose, Diss / Diss, 5 Ft
10B	80012	O2 Hose, Diss / Diss, 12 Ft
10C	85012	N2O Hose, Diss / Diss, 12 Ft
11	PA-450-1-002	O2 Hose, 12 Ft
11A	PA-450-1-001	O2 Hose, 20 Ft
12	A-2508-000	Kit, Rubber Gds Hook
	Mounting Options for Bag Tee and AVS	
13	2036-4	3 1/2" Wide Slide (not shown)
14	2036-2	5" Wide Slide (not shown)
15	2037-1	7" Wide Under Cabinet Mt (not shown)

SAFETY:

ADA Guidelines

In addition to the fail-safe and other safety features found on most sedation machines, effective August 1976, the following specifications were added to those required for acceptance by the ADA Council on Dental Materials and Devices: 1. Emergency Air Valve; 2. Non-rebreathing Check Valve; and 3. Resuscitator Quick Connect.

In addition, the ADA Council requires that: 1. The gas storage and delivery system meet the recommendations of the National Fire Protection Association (NFPA).; 2. The system be installed by a competent supplier of gases and equipment.

NFPA Codes

To assure safe operation and conformation to local fire codes, Porter Instrument Nitrous Oxide Sedation Systems meet or exceed the guidelines established by the National Fire Protection Association for Nonflammable Medical Gas Systems, NFPA 99. Copies of NFPA 99 or portions thereof may be obtained by writing to *National Fire Protection Association, Batterymarch Park, Quincy, MA 02269-9904 USA* or call: 1-800-344-3555

GAS SUPPLY CONNECTION

After installation of the flowmeter, connect the Nitrous Oxide and Oxygen supply lines to the Diameter Indexed Safety System (DISS) fittings located on the back of the flowmeter unit. It is important that the regulators for both gases be set to give pressures in the range of 50 PSIG ±2 PSIG.

Confirm the absence of leaks at pressure connections on the unit. Bubbles will appear at leaking locations when a soap / water solution is used. This procedure is recommended each time a cylinder is changed.

TANK REGULATOR SPECIFICATIONS

Oxygen Regulator

Use Porter O_2 Regulator part number 7000-2 or the Oxygen tank regulator should have the following specifications:

- Regulator should be pre-set at 50 PSIG ± 2 PSIG (static)
- Inlet fitting per CGA 540
- Outlet fitting per O_2 DISS
- I0 micron filter on inlet
- Self-resetting safety relief valve pre-set to 100 ± 10 PSIG
- 0-4000 PSIG color coded pressure gage
- Maximum flow capacity of no less than 150 LPM
- Droop shall be a maximum change in regulated pressure of 8% from 0-150 LPM when supply is 2000 PSIG.
- Regulation of the supply pressure should not change by more than 4% of set pressure at a flow of 75 LPM.
- UL Listed
- Installation shall conform to local codes with respect to pressure relief.

Nitrous Oxide Regulator

Use Porter N_2O Regulator part number 7500-2 or the Nitrous Oxide tank regulator should have the following specifications:

- Regulator should be pre-set at 50 PSIG ± 2 PSIG (static)
- Inlet fitting per CGA 326
- Outlet fitting per N_2O DISS
- I0 micron filter on inlet
- Self-resetting safety relief valve pre-set to 100 ± 10 PSIG
- 0-1500 PSIG color coded pressure gage
- Maximum flow capacity of no less than 100 LPM
- Droop shall be a maximum change in regulated pressure of 8% from 0-150 LPM when supply is 800 PSIG.
- Regulation of the supply pressure should not change by more than 4% of set pressure at a flow of 75 LPM.
- UL Listed
- Installation shall conform to local codes with respect to pressure relief.

INTENDED USE—Flowmeter for Analgesia Delivery System

This device is intended for patient (adult and pediatric) use by an attending physician or dentist properly trained in its use. Porter Instrument recommends the user be thoroughly familiar with the use of Nitrous Oxide - Oxygen Conscious Sedation for patient analgesia and be properly trained in its administration prior to using this product. For training requirements on the administration of Nitrous Oxide - Oxygen Conscious Sedation, contact the appropriate regulatory authority in your country, state, or province. Training is recommended to provide a practical, hands-on capability and an understanding of the behavioral aspects of Nitrous Oxide Sedation and will complement the safety features of this device.

USE SCAVENGING

Monitor for N_2O in the operatory to insure that controls are effective in achieving low levels of ppm (parts per million) exposure. Contact your Porter dealer for details on monitors and testing.

MONTHLY LEAK CHECK

Monthly leak check (or if connections to flowmeter are disconnected and then reconnected, such as after a flowmeter service at the factory or if the DISS / DISS hose is replaced): Leak test the flowmeter system for working pressure leaks. After all hose connections are tightened, turn the %N2O and Total Flow control knobs clockwise to the off position, and the On / Standby (Off) switch to the STANDBY position. Confirm that the DISS Shut-Off Valves are in the open position. Pressurize the sedation gas supply lines with 50 PSIG. Observe any pressure decay after an overnight time period (5 PSIG drop allowed).

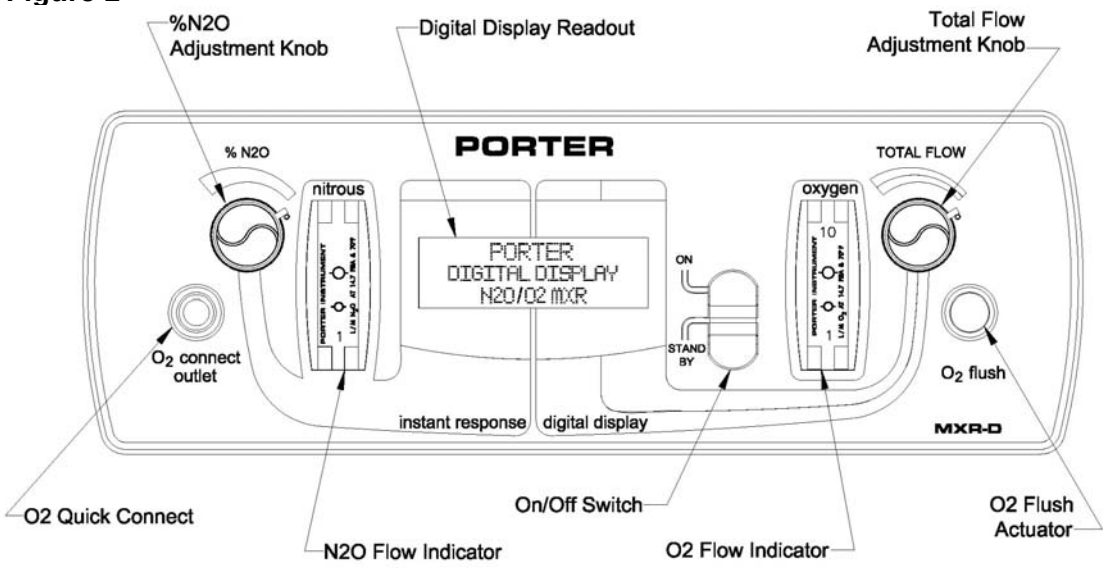
Monitor O_2 gas pressures at the beginning of each procedure to assure sufficient gas remains in the tank to complete the procedure.

SWITCHABLE CONNECTORS

The MXR-D has Universal connectors that are easily switched in the field from back to bottom or bottom to back position to suit the installation. If the connectors are switched, the flowmeter should be completely function tested after installation to the user instructions contained in this manual.

CAUTION: The position of the connectors may be switched by an authorized Porter representative only. Unauthorized repair, alteration or misuse of this device is likely to adversely affect the performance and will void the warranty.

Figure 1



DIGITAL MXR-D FLOWMETER FEATURES

% N2O Adjustment Knob: Controls the % concentration of N_2O but does not change the O_2 flowrate. (70% Maximum N_2O delivery). Turn the knob counter-clockwise to increase N_2O concentration.

Digital Display Readout: Displays the % N_2O on the left side and Total Flow in L/min on the right side. The display reads % N_2O in increments of 5%. The display will read in words for user conditions such as: "Low O2 Flow / Increase O2 Flow / Check O2 Source", "N2O % Outside Tolerances / Turn Knob to Reduce N2O" and "Failsafe / Service is Required / Turn Off N2O Source /."

Total Flow Adjustment Knob: Controls the combined flow of O_2 and N_2O (or O_2 flow only when the % N_2O knob is turned clockwise until it hits the stop). Turn the Total Flow knob counter-clockwise to increase flow and clockwise to decrease.

O_2 Connect: Oxygen quick connect facilitates connection of positive pressure / demand valve resuscitation equipment to the central system for emergency oxygen.

ON / STANDBY Switch: Dual function: Selecting ON will turn on the flowmeter, gas to the meter and the digital display. Select STANDBY to turn OFF the gas to the meter and the digital display (and perform auto-zero). Note: The flowmeter still has power in the STANDBY position.

N_2O and O_2 Indicator Tubes: Visual flow tubes indicating flowrates in L/min of Nitrous Oxide and Oxygen. Nitrous tube with 1 L/min marking. Oxygen tube with a 1 and 10 L/min marking. Each tube has a small Circle Flow Guide which indicates 3 L/min of flow when the float is set at the center and a larger Circle Flow Guide which indicates 6 L/min of flow when the float is set at the center. Ball float height (flow) of the Oxygen tube is 1:1 proportional to the ball float height (flow) of the Nitrous tube. Thus, given any line-of-sight reference on the digital display front, when the ball floats are at the same height, the percent nitrous oxide is 50%.

Oxygen Flush Button: Provides extra delivery of O_2. Button is accessible to add O2 flow to all other gas flows. Color-coded for Oxygen.

Failsafe: Dual-seal oxygen-piloted valve system that automatically maintains the %N2O concentration setting with any change in the O2 flow or pressure. N_2O flow is proportionately reduced if O_2 is shut off or pressure is reduced.

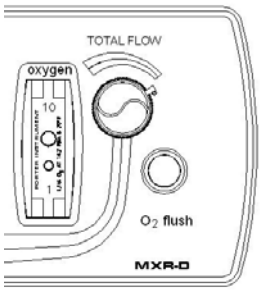
Gas Scavenging & Bag Tee (Not Shown) Emergency Air Valve: Automatically provides patient with ambient Air if gas flow is interrupted for any reason. **Non-rebreathing Check Valve**: Prevents rebreathing of used gases and guards against CO_2 build-up.

DIRECTIONS FOR USE

Note: These directions detail a basic delivery technique. *However, this is not a comprehensive description and not a substitute for a training course that emphasizes a practical, hands-on approach together with instruction on safe administration techniques.* Topics covered in such a course will include experiences of practitioners in specific dental clinical settings, the pharmacokinetic properties of Nitrous Oxide, strategies to avoid over sedation and allow for biological variability, and strategies to maximize patient satisfaction. Refer to "Basic Delivery Technique" on the following page.

IMPORTANT: Before using the Digital MXR-D Flowmeter, check the operation of the unit by performing the Safety Feature Checks to ensure that your analgesia unit is performing correctly. Refer to Flowmeter Features in Figure 1.

1. Maintain patient observation during procedure.
2. Move the On / Standby Switch to the ON position.
3. Open N_2O / O_2 tank valves.
4. Using Total Flow knob, set flow rate of O_2 to desired rate, keep bag about ¾'s full. Rotate flow knob counter-clockwise to increase flow.
5. Set % N_2O concentration to desired level by turning the % N_2O knob counter-clockwise to increase concentration, as read by percentages shown on the digital display. Turn knob slowly until desired level is achieved. Practice titration with 10% nitrous upward movements every 60 seconds until endpoint achieved. Patients may typically experience relief of anxiety, tingling in extremities, and euphoria. Patients typically require less than 50% Nitrous.
6. Watching primary digital display, Flow Control knob may be re-adjusted to bring the total flow of gases back to desired level, when concentration is increased or decreased. Note also: Total flow is equal to the sum of right and left tube readings.



7. When the procedure is nearing completion, amounts of N_2O should be decreased. Terminate the flow of N_2O and deliver 100% O_2 to begin a minimum postoxygenation period of 3 to 5 minutes. Assess the patient for appropriate recovery. Administer additional O_2 if necessary. Titration and post-procedure 100% O_2 will minimize Nitrous exposure to the operatory, potential patient side effects of lethargy, headache, or nausea, and any potential adverse effects of Nitrous diffusion into air filled cavities.
8. When procedure is finally completed, turn off **both** control knob valves for gas shut off.
9. Place the On / Standby (off) switch (primary shut-off mechanism) in the STANDBY position. **Note:** If control valves are still open, gas flows should stop at this point. In STANDBY, the MXR-D will perform an auto-zero of the unit.

   Best Practices: Recommend placing the unit in STANDBY mode at the end of a procedure or when the unit is not in use. Place the switch in the Standby position. This will auto–zero the unit for optimum performance.
10. Turn OFF the gas supply at the tank at the end of the day.

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Basic Delivery Technique

"Practice titration. Titration is a method of administering a substance by adding definitive amounts of a drug until an endpoint is reached. For Nitrous Oxide / Oxygen (N_2O) / O_2) sedation, N_2O is given in incremental doses until a patient has reached a comfortable relaxed state of sedation. The ability to titrate N_2O is a significant advantage because it limits the amount of drug to that which is required by the patient. If titration is done properly, the patient does not receive any more of the drug than is necessary. The amount of N_2O required by a patient on any given day or time varies."[1] [Clark, Brunick]

For information on titration, a most valuable resource for the practitioner is the [1]Handbook of Nitrous Oxide and Oxygen Sedation, written by Clark and Brunick and published by Mosby (www.mosby.com). This text is a concise and contemporary guide for Nitrous Oxide / Oxygen administration.

IMPORTANT NOTE:

When the % N_2O concentration knob is open, the Total Flow knob is closed, and there is no N_2O flow indicated in the flow tube, the Nitrous Oxide Failsafe System will stop the flow of N_2O. However, this safety feature should not be used as the primary shut off mechanism. The % N_2O and Total Flow control knobs are for primary shut-off. After primary shut-off, the On / Standby Switch should be placed in the STANDBY (off) position for final shut-off of the unit (an auto-zero of the unit will be performed).

NOTE: If your unit does not operate as described in Steps 1 through 10 under Directions for Use, please contact your Dental Dealer or Porter Instrument.

MAINTENANCE AND SERVICE

It is advisable, on a two (2) year cycle, to have the MXR Flowmeter factory checked and serviced. The Nitrous Oxide Failsafe System is made of moving parts. Between servicing intervals, it is advisable to safeguard against potential malfunctions by performing the failsafe check before each and every use of the unit. Safe operating techniques, learned during your N_2O - O_2 Conscious Sedation training, should always be used.

Inspect and maintain the analgesia delivery system to prevent N_2O leaks in all hoses, connections and fittings. Repair all leaks immediately.

CLEANING METHODS

We recommend the use of an approved disinfectant for the dental environment for cleaning the outside of the flowmeter and accessories. Do not spray disinfectant directly onto meter. Spray disinfectant into disposable towel and wipe unit thoroughly removing excess disinfectant to eliminate buildup.

DIGITAL DISPLAY READOUTS

The digital display shows a primary and precise digital number readout for the % N_2O concentration setting on the left side and the Total Flow in L/min on the right side.

- To increase the Nitrous concentration, turn the % N_2O knob counter-clockwise. The display will change in increments of 5%. To decrease the Nitrous concentration, turn the % N_2O knob clockwise.
- To increase Oxygen / total flow, turn the Total Flow knob counter-clockwise. The display will change in increments of 0.5 L/min. To decrease the oxygen / total flow, turn the knob clockwise.

The following table defines the various display conditions and their meanings.

Display / Condition	Meaning	User Action
Display is Blank	1) Unit's switch is in the STANDBY (Off) position. 2) Power outage / interrupted. **Note:** The restart from the power outage restores the display of % N_2O and Total Flow to the same as before the outage.	1) Turn On / Standby Switch to the ON position. 2) Flowmeter will continue to deliver the same mixture during a power outage but will not display the digital readout for % N_2O and Total Flow during the outage. Refer to **Usage During Power Outage**.
PORTER **Digital Display** **N2O / O2 MXR** **Model No.** **SN-(Serial No. of Unit)** **Ed Mixer Version** **Check Sum**	Initial sequence upon a power up of power supply. (On / Standby Switch turned ON is not a power up.)	To see initial sequence: Power down (unplug); wait 1 minute; power up. **Note:** The serial number of the unit will display when the unit is powered up.
Self-Check Error, **Service is Required**	Self-checks are performed at start up and during operation. Unit is not useable possibly due to a bad checksum or a failed voltage reference test.	If this continues to display, contact your Porter dealer. Turn On / Standby switch to STANDBY (Off) and remove flowmeter for servicing.
%N2O **L/M**	There is no Oxygen flowing. There is no Nitrous flowing. %N2O and Total Flow valves are shut tightly.	Normal display condition for no flows.
High Flow Mode *Display will also flash* 50(60)% N2O Max. *Audible alarm will sound.*	The unit is flowing Total Flow above 14 L/min.	Turn the Total Flow knob clockwise to reduce flowrate until below 14 L/min.
O2 Flow **%N2O** [is blank] **6 L/M**	Oxygen is flowing 6 L/min only. There is no Nitrous flowing.	Normal display condition for Oxygen only flows.

Display / Condition	Meaning	User Action
%N2O 50 Total Flow 6 L/M	Normal display condition for 50% N_2O setting	Adjust % N_2O and Total Flow knobs to desired concentration. The display will change by every 0.5 Liter increments when the Total Flow knob is turned, and the % N_2O will change by every 5% increments as you turn the knob.
Failsafe / Service Is Required, Turn Off N2O Source *Audible alarm will sound. Display will Flash.*	1) Possible failsafe failure: Nitrous Oxide is flowing without Oxygen or Nitrous Oxide is flowing more than 70% 2) This display ***may*** appear after a power interruption or power outage.	1) End procedure. Confirm failsafe operation by performing safety check on Nitrous Oxide failsafe system. If failsafe failure is confirmed, flowmeter should be removed for servicing. 2) Follow Initialization Procedure below. If display continues to show Failsafe message, follow Step 1 above.
Low O2 Flow, Turn Knob to Increase O2 Flow, Check O2 Source (Tanks) *Audible alarm will sound. Display will Flash.*	1) Oxygen flowrate is below 1 L/min. 2) Oxygen regulator is varying pipeline pressure. 3) Empty Oxygen cylinders. 4) O_2 Connect feature is in use.	1) Increase Oxygen flowrate by turning the Total Flow Knob counter-clockwise. Unit will stop beeping. 2) Check Oxygen regulator, manifold pressure setting should be 50 PSIG ±2 PSIG. 3) Replace with full cylinder. 4) Remove quick connect from O_2 Connect port to return display to normal.
O2 Flush Condition *Display will not indicate accurate flow settings.*	When the O_2 Flush button is activated / pushed in, extra delivery of Oxygen (about 35 L/min) is provided to the breathing bag. However, the reading displayed by the digital display will not display the actual flow and percent.	Remove finger from O_2 Flush button to deactivate. Releasing button returns unit to flowrate and mixture ratio before flush activation.
Low O2 Flush Service is Required	The unit is flowing less than 25 L/min of Oxygen when the O_2 Flush button is pushed in.	
N2O % Outside Tolerances, Turn Knob To Reduce N2O%	% N_2O measurement is above 70.0% concentration.	Turn % N_2O knob clockwise to reduce / decrease % N2O flowrate.

INITIALIZATION PROCEDURE

These steps are required for new installations or ***may be required*** when a power interruption / outage occurs and the flowmeter's switch is in the STANDBY position and the unit is off for 15 minutes or longer (and Failsafe message appears).

1. Confirm power supply is plugged into the power source and the back of flowmeter.
2. Turn On / Standby switch to the ON position and wait 20 seconds.
3. Then, turn On / Standby switch to the STANDBY (Off) position and wait 20 seconds (auto-zero).
4. Turn On / Standby switch to the ON position and the unit will display initial sequence startup. If display continues to show a Failsafe message, flowmeter should be removed for service.

NITROUS AND OXYGEN FLOW TUBE INDICATORS

The Nitrous and Oxygen flow tube indicators are factory calibrated separately and indicate the lowest to highest flow of Oxygen with tube markings at 1 and 10 L/min, and lowest to highest flow of Nitrous Oxide with a tube marking at 1 L/min. The glass tubes are secondary indications of flow (digital display is primary) and the Total Flow is the addition of the two indicated ball float positions in the tubes.

Each tube has a small Circle Flow Guide which indicates 3 L/min of flow when the center of the float is set at the center of the circle and a larger Circle Flow Guide which indicates 6 L/min of flow when the center of the float is set at the center of the circle.

Ball float height (flow) of the Oxygen tube has 1:1 proportionality to the ball float height (flow) of the Nitrous tube. Thus, given any line-of-sight reference on the front panel, when the ball floats are at the same height, the percent Nitrous Oxide is 50%. Similarly, when the Nitrous ball float is lower than the Oxygen ball float, the percent Nitrous Oxide is less than 50%. When the Nitrous ball float is roughly one-half the height of the Oxygen ball float, the percent Nitrous Oxide is roughly 33%. The chart below may be used as a guide.

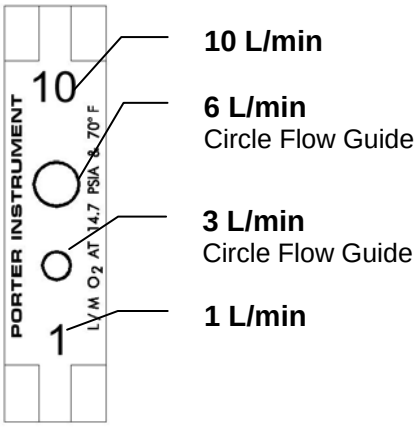
USAGE DURING POWER OUTAGE

Note: If the power is interrupted to the unit, the unit will continue to deliver the same mixture setting during the power outage but the device will not display the digital readouts for the % N_2O and Total Flow. The knobs may be adjusted to move the ball float to the desired positions. When safely possible, discontinue the procedure using normal delivery techniques as described below. Refer to Monthly Calibration Check which describes the use of the Circle Flow Guides and how to read the ball float position using these guides.

1. Rotate knobs to appropriate positions using the chart and figure below as a guide.
2. Place the center of the ball float at the desired setting for the % N_2O and the desired setting for O_2 / Total Flow to achieve the %N_2O Setting. Refer to sections on “Directions for Use” and “Basic Delivery Technique”.
3. When the procedure is nearing completion, decrease the amounts of N_2O by turning the % N_2O (left knob) and then terminate the flow of N_2O and deliver 100% O_2 to oxygenate the patient.
4. When the procedure is completed, turn the On / Standby switch to the STANDBY (Off) position until power is restored.

Flow Tube Indicators (Note: Read Center of Ball Float)

% N_2O Setting	Ball Float Position for % N_2O	Ball Float Position for O_2 / Total Flow
50%	3 L/min	3 L/min
50%	6 L/min	6 L/min
33%	3 L/min	6 L/min
67%	6 L/min	3 L/min



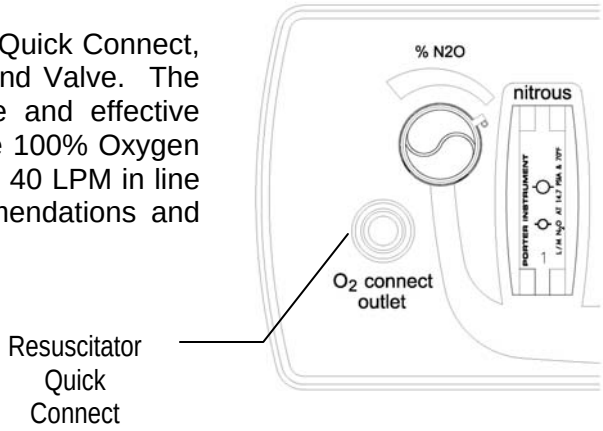
FLOWMETER ACCESSORIES

Three or Two Liter Reservoir Bag

Install the reservoir bag by sliding the opening over the outside of the bag tee downspout. The bag moves in and out with each inhalation and exhalation and becomes a visual barometer for monitoring the patient's respiration rate. Refer to FM-809 for User Instructions, Assembly, Installation and Cleaning.

Positive Pressure / Demand Valve

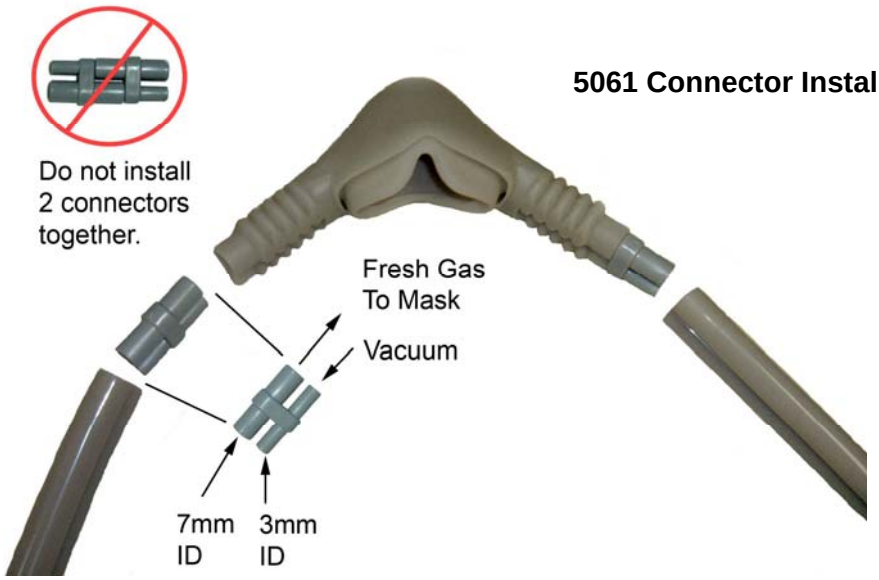
The Porter flowmeter is equipped with a Resuscitator Quick Connect, which allows for the attachment of an Oxygen Demand Valve. The Demand Valve Resuscitator provides a fast, simple and effective means to ventilate non-breathing patients and provide 100% Oxygen on demand. The resuscitator flow rate is limited up to 40 LPM in line with the 1992 American Heart Association "Recommendations and Guidelines for Resuscitation." Refer to the User Instructions supplied with this product for complete details.



Gas Scavenger Breathing Circuit

Gas scavenger system is used to remove exhaled gases during a dental analgesia conscious sedation procedure in a dental operatory. The breathing circuit consists of a 22mm 90° elbow connector, fresh gas / coaxial tubing, a corrugated hose and hood assembly. Attach the nasal inhaler to the coaxial tubing assembly using the diameter-indexed connectors. Attach one end of the fresh gas corrugated tubing to the coaxial tubing assembly at the fresh gas "Y" connector and the other end to the 22mm right angle adapter. Press fit the 22mm right angle adapter onto the bag tee. Attach a 2L or 3L reservoir bag to the bottom / downspout of the bag tee. Attach the vacuum hoses to the vacuum control source (AVS or In-line Vacuum Control Block). Refer to FM-809 for User Instructions, Assembly, Installation and Cleaning.

5061 Connector Installation



Automatic Vacuum Switch [AVS] (Option)

The AVS is used to control the vacuum flow in the gas scavenger breathing circuit and assure that the scavenging system is activated as soon as N_2O / O_2 is turned ON. Adjust the vacuum flow using the control knob. Vacuum flow is most effective when the ball float is set within the green bar area. Installation of AVS to Flowmeter: Screw AVS 5000 knurled seal nut down tight onto flowmeter making sure the rubber washer is inside the seal nut. When tight, the AVS should not rotate. Then, screw the bag tee seal nut onto the AVS. Bag tee should not rotate. Connecting AVS to Vacuum Hoses: Attach one end of the vacuum hose to the vacuum hose "Y" connector and the other end to the MASK port of the AVS. Attach a second vacuum hose to the VAC port of the AVS and the other end to the vacuum source. Refer to FM-809 for User Instructions, Assembly, Installation and Cleaning.

Porter recommends that effective scavenging can be achieved with the ball float in the green bar area of the acrylic sight glass, however NIOSH publications conclude that higher vacuum flows of up to 45 L/min are most effective. To meet the NIOSH recommendation of 45 L/min adjust the ball above the green bar area.

CAUTION: DO NOT PROCESS ANY LIQUIDS OR DEBRIS THROUGH THE AVS. This contamination can cause damage and affect the function of the unit. The AVS is designed to regulate the vacuum flow level for scavenging of Nitrous Oxide / Oxygen gas only.

CAUTION: The vacuum system should be equipped with a back flow shutoff device to prevent carryover of fluids into equipment attached to the piping systems. It is recommended that a separate vacuum trap be used between the piping system and the vacuum station inlet or any equipment that is attached to the system.

In-line Vacuum Control Kit (Option)

The kit includes a vacuum control block with sight glass, vacuum tube holder, adapter "T" and straight fitting. The vacuum control block can be inserted directly into the High Volume Evacuation (HVE) line or may be placed "in-line" by cutting the vacuum hose and attaching the cut ends of the tubing to both ends of the vacuum control block. Adjust the vacuum flow using the control knob. Vacuum flow is most effective when the ball float is set within the green bar area. Refer to FM-809 for User Instructions, Assembly, Installation and Cleaning.

BAG TEE

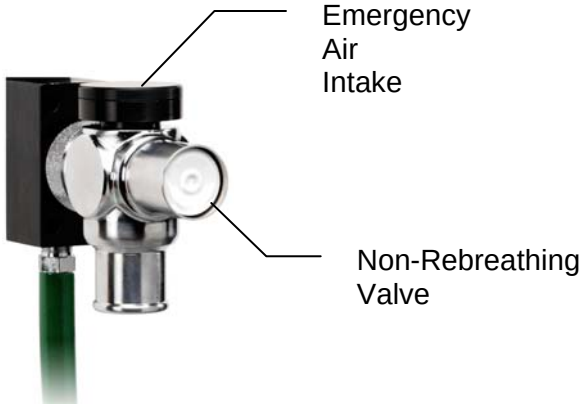
The Bag Tee assembly features a Non-rebreathing Valve and an Emergency Air Intake located on the Bag Tee, which comply with American Dental Association guidelines. The non-rebreathing valve has a back flow check valve, which prevents exhaled gases from entering the breathing bag (no carbon dioxide buildup). The emergency air intake has a valve that allows room air to be inhaled into the breathing circuit by the patient. A breathing bag is attached to the metal portion of the Bag Tee and is a reservoir bag for the delivered analgesia gases, which when taken together with the two valves above, becomes the visual barometer for monitoring the patient's respiration rate. The bag moves in and out with each inhalation and exhalation.

Bag Tee Installation to Flowmeter: Screw knurled seal down tight onto flowmeter making sure the rubber washer is inside the seal nut. When tight, the bag tee should not rotate.

Note: Fit mask to patient so inner mask is pulled down tight secure to the face. Outer mask should not be against the face. Vacuum needs to be drawn into outer mask during inhalation.

Non-Rebreathing Valve—Check Monthly

Place the On / Standby switch in the STANDBY (Off) position. Disconnect the corrugated rubber tubing from the Rubber Goods and breathe into the corrugated tubing connected to the bag tee. You should not be able to fill the bag with exhalation gas. If the bag fills, the system's Non-Rebreathing Valve is not functioning properly and should be replaced.



Emergency Air Valve—Check Monthly

Place the On / Standby switch in the STANDBY (Off) position. Disconnect the corrugated rubber tubing from the gas scavenging apparatus and draw air with your mouth through the corrugated tubing connected to the bag tee. You should be able to draw ambient air through the Emergency Air Valve (the gas bag may have to fully collapse first). Air going through the valve sounds different than normal gas flow.

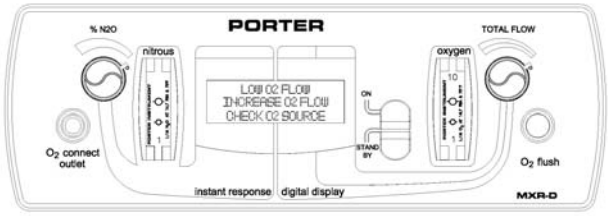
SAFETY FEATURE CHECKS

IMPORTANT: These are safety features, which you should routinely check to assure proper function. If any of these safety features are not functioning properly, contact your Dental Dealer or Porter Instrument and arrange for the necessary repairs. Porter Instrument recommends the repairs be made before reusing the device.

Low Oxygen Detection

The MXR-D Flowmeter has a mechanical failsafe feature. If there is an Oxygen failure, caused by the loss of Oxygen pressure or flow, this safety feature will cause the Nitrous Oxide to be mechanically shut off. Reflecting this status the digital display will show the normal "blank, no numbers" no flow display (observe indicator tube float positions as well).

1. If the Oxygen flow is below 1 L/min the display will flash and read "LOW O2 FLOW, TURN KNOB TO INCREASE O2 FLOW, CHECK O2 SOURCE (TANKS). **Note:** An audible alarm will sound if some nitrous is still flowing. No alarm will sound if nitrous is not flowing.

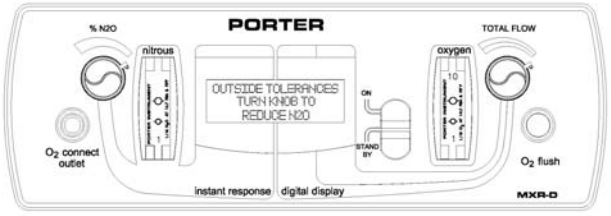


2. With total loss of oxygen, the Nitrous Oxide delivery is automatically shut off. The digital display will reflect status with blank Total Flow and % numbers.
3. When Oxygen flow is restored to above 1 L/min, the display will return to normal.

High Nitrous Percentage Detection

The MXR-D Flowmeter has a feature to detect a **High N_2O Percentage** (above 70% concentration, which is outside of the tolerances). If the % N_2O concentration knob is turned to the highest mechanical stop (full counter-clockwise), the MXR-D may detect and then read "OUTSIDE TOLERANCES / TURN KNOB TO REDUCE N2O".

1. To reduce the percentage of Nitrous Oxide, simply adjust the % N_2O and Total Flow knobs by turning clockwise until the percentage of Nitrous Oxide reduces to 70% or below concentration. The digital display will then return to normal.



2. If any serious failsafe fault condition results in a significantly high N_2O percentage, and the unit has detected the percent Nitrous is above 73%, the display will revert to "FAILSAFE / SERVICE IS REQUIRED / TURN OFF N2O SOURCE," and an alarm will sound. Again, turn the knobs to reduce the high percentage or turn off N2O source.

Nitrous Oxide Failsafe System—Check Before Each Use

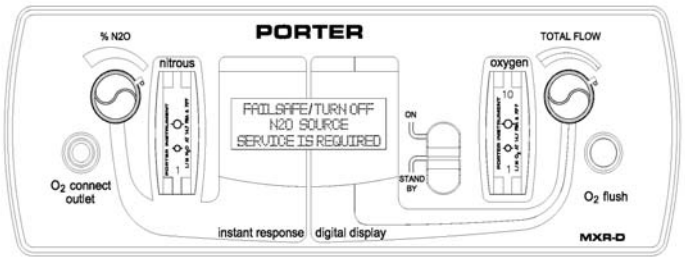
Note: Be sure O_2 and N_2O are connected to your MXR and the line pressure for both gases is 50 PSIG (which is standard).

1. Turn the Total Flow knob to the right (clockwise) until the pointer on the knob hits the stop and then turn the % N_2O Concentration knob to the right (clockwise) until the pointer on the knob hits the stop.
2. Turn the % N_2O concentration knob counter-clockwise until the pointer is at the left edge of the "eyebrow" above the knob. **There should be no flow of N_2O indicated by the digital display or the flow tube indicator.** This is a check of the static position of the Nitrous Oxide Failsafe System valve.

   Note: A momentary low flow of N_2O (about 1 L/min for about a second) may be seen if the % N_2O concentration knob is turned to zero before turning the Total Flow knob to zero. This is N_2O gas trapped between the Nitrous Oxide Failsafe System valve and the concentration knob valve and is a normal occurrence. **No other N_2O flow should be observed.**
3. With the % N_2O concentration knob still set to the left eyebrow position, turn the Total Flow knob until the display reads a flow of 6 L/min total flow. Turn the %N2O concentration knob until display reads %N2O 50. You should observe an equal amount of N_2O flowing, by equal height ball float positions, while gradually turning the Total Flow knob. The digital display will track 50% and changing total flow.
4. Interrupt the flow of O_2. This will check the dynamic status of the Nitrous Oxide Failsafe System valve. This can be done by either disconnecting the Oxygen hose from the wall or shutting off the Oxygen at the tank. **The Nitrous Oxide flow should drop as the Oxygen flow decreases, stopping completely before the Oxygen float drops to the bottom**.
5. If the unit detects a failsafe failure (high N2O percentage), the display will read "FAILSAFE / TURN OFF N2O SOURCE / SERVICE IS REQUIRED". The display will flash and an audible alarm will sound. This message will continue to be displayed in sequence unless the percent of Nitrous drops.

WARNING:

If the Nitrous Oxide Failsafe System fails to perform as indicated, do not use this product prior to repair. Improper function of this safety feature may permit Nitrous Oxide to flow independently of the flow control knob, potentially allowing Nitrous Oxide to flow to the patient without Oxygen.



Power Oxygen Flush—Check Monthly [Mechanical Check]

(O_2 Supply Pressure at 50 PSIG)

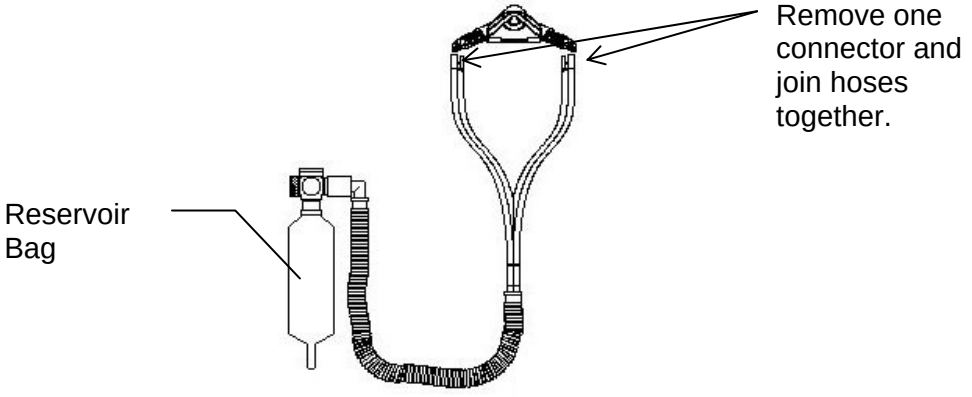
[Note: the O2 flush is monitored for minimum flow by the MXR-D during every flush button activation.]

Disconnect the corrugated rubber tubing from the bag tee outlet. With both knobs positioned so the pointer hits the stop, depress the power, **O_2 flush**, button while blocking the flow from the front of the bag tee. For proper operation, the gas reservoir bag should fill within about 5 seconds. Also Test to Check 3 L Bag / Rubber Goods for Leaks following Steps 1 through 6 in the following section.

Quick Test to Check Reservoir Bag / Rubber Goods for Leaks

1. With the flowmeter, bag tee and **Porter** rubber goods in place, remove the nosepiece and one of the two plastic connectors from the Porter rubber goods. Refer to Figure 2.
2. With the other plastic connector, join the two duplex hoses together making a closed system.
3. Taking care not to fill the bag too much (bag could burst), open the Oxygen control valve until the reservoir bag starts to over-inflate or “balloon”, then close the valve.
4. Observe the reservoir bag for <u>five</u> minutes.
5. The bag should stay inflated. If so, the test has been successful and there are no excessive leaks. If the bag does not stay inflated, the reservoir bag or rubber goods have an excessive leak. Replace any parts that leak and retest until results are successful.
6. Disconnect one of the duplex hoses from the plastic connector and re-install the nosepiece.

Figure 2

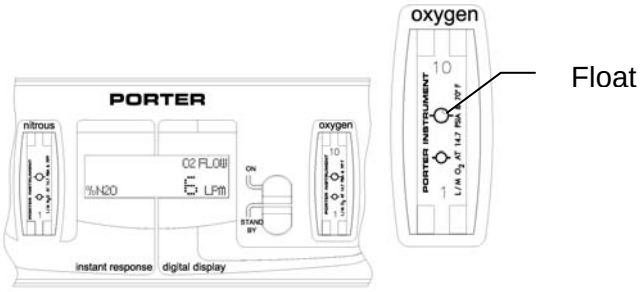


MONTHLY CALIBRATION CHECK

The MXR Flowmeter is designed to maintain its accuracy and performance without routine user maintenance being required. The display measurement is auto-zeroed at each STANDBY shut-down. The indicator tubes and ball floats are very resistant to accuracy changes over time such that the indicator tubes will maintain their accuracy. **Note:** Each indicator tube accuracy is ±5% at the markings.

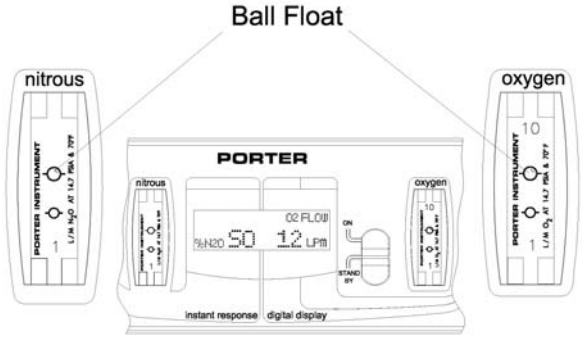
The user can check the relative accuracies of the % concentration and total flow display by performing a simple check. Servicing is indicated if the readings are out of tolerance.

1. With the Nitrous off, turn the Total Flow Knob until the display reads 6 L/min. Adjust the Total Flow knob so the ball float in the Oxygen tube is within the large circle flow guide. See figure below.

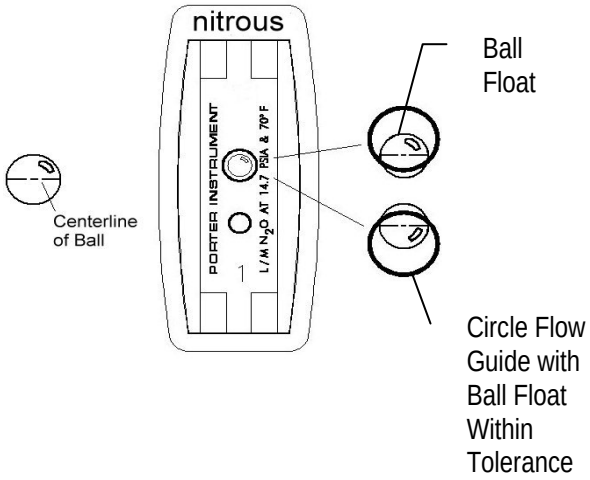


2. Turn % N2O knob until the display reads 50%.

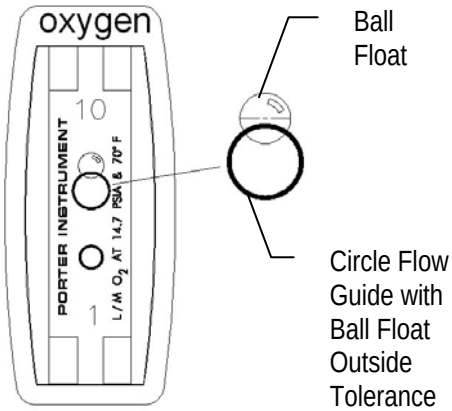
   The figure below shows the float within the circle flow guide of the Nitrous tube on the left, and the float within the circle flow guide of the Oxygen tube on the right.



3. The ball float in the Nitrous indicator tube should be within the large circle flow guide and no more than half of the ball float should be out of the large circle flow guide. The figure below shows the ball float position to be within tolerance.



Note: The figure below shows the ball float position to be out of tolerance.



TECHNICAL SPECIFICATIONS

Physical:
Dimensions: 12.6" W; 4.3" H; 3.9" D
Cut out hole: 11" x 3 5/8"
Weight: 8 lbs.

Fittings:
Fresh Gas Outlet: 15mm ID x 22mm OD (Diameter Index Safety System)
Nitrous Oxide Inlet: Male DISS (CGA # 1040A)
Oxygen Inlet: Male DISS (CGA # 1240) (Diameter Index Safety System)

Environmental:
Storage Temperature: -10°F to 150°F (Allow to stabilize to room temperature before operating.)
Operating Temperature: 60°F to 85°F
Humidity: Ambient, non-condensing

Gas Supply:

Oxygen Inlet
Pressure Requirements: 50 +/-10 PSIG
Flow Requirements: 30 L/min Minimum Flow
Note: A minimum Oxygen flow of 120 L/min is required when using the optional Demand Valve Resuscitator

Nitrous Oxide Inlet
Pressure Requirements: 50 +/-10 PSIG
Flow Requirements: 10 L/min Minimum Flow
Minimum Nitrous Oxide Concentration: 0%

Gas Delivery:
Oxygen Flush 35 L/min Minimum (50 PSIG input)
Maximum Nitrous Oxide Concentration: 70%
Minimum Oxygen Concentration: 30%
Maximum Oxygen Concentration: 100%
Flow Range at 100% Oxygen: 1 to 10 L/min
Total Flow Range at % Mixture: up to 12 L/min
(Low end flow limited by 1.0 L/min Oxygen limit.
Accuracy: ± 0.5 L/M Oxygen flow and ± 0.5 L/M Nitrous Oxide flow.

Electrical Power Supplies:
Wall Plug-in:
Input: 115 Vac, 60 Hz, 0.1A Max
(Unit is for 115 Vac use only.)
Output: 12Vdc / 0.3A Max.
The Branch Circuit breaker is the main disconnect.
In Wall Junction Box:
Input: 115 Vac, 60 Hz, 0.1A Max.
Output: 12 Vdc / 0.4A Max.

The main 110 Vac Branch connection is to be wired per NEC and local electrical codes. The branch circuit breaker is the main disconnect.
Porter recommends the following:
15A UL circuit breaker two-wire with ground.

UL CLASSIFICATION

The Porter Digital MXR-D is UL Classified to 60601-1: Medical Equipment with respect to electric shock, fire and mechanical hazard only in accordance with UL 60601-1 and CAN/CSA C22.2 No. 601.1-M90. The system consists of the Digital MXR-D and Power Supply.

The following are UL classifications for the Porter Digital MXR-D:

1. Is not intended to be used with or in the presence of flammable anesthetic mixtures.
2. Is classified as ordinary equipment and is designed for continuous operation.
3. Has safety protection provided in the equipment. If the equipment is tampered with or used in a manner not specified in this manual the safety protection provided by the equipment might be impaired.

The Porter Digital MXR-D is designed to be used in normal environmental conditions:

1. Indoor use;
2. Altitude up to 8000 feet (2,438 meters);
3. Temperature from 5°C to 40°C;
4. Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C;
5. Mains supply voltage fluctuations up to +/- 10% of the nominal voltage;
6. Transient over voltages typically present on mains supply;
7. Normal pollution degree.

The Porter Digital MXR-D controls both Oxygen (O_2) and Nitrous Oxide (N_2O). Both gases could be present in an over pressure event that requires the manifold system to have a safety relief valve to function.

Maximum system pressure is not to exceed 60 PSIG.

Product was tested for Electromagnetic Immunity per IEC 61000-4-3

Performance and Accuracy

Digital Flow Display: Indicates flow in L/M with accuracy of ± 0.5 L/M Oxygen flow and ± 0.5 L/M Nitrous Oxide flow.

Maximum N_2O Concentration: 70%

Nitrous Oxide Failsafe System: Dual-seal oxygen-piloted valve system that automatically maintains the %N_2O concentration setting with any change in the O_2 flow or pressure. N_2O flow is proportionately reduced if O_2 is shut off or pressure is reduced.

% N_2O Concentration and Total Flow Control Knobs: Total Flow adjustment knob which controls flow of both N_2O and O_2 at any desired concentration. Total Flow can be adjusted at a chosen concentration. Includes posi-stop needle valves for adjustment of all flows – prevents damage to valves and seats. Flow is increased by rotating the knobs counter-clockwise.

% N_2O Metering: ± 5%

Knob Adjustment and Display Resolution: % N_2O 5% from 0 to 70%; Total Flow by 0.5 L/min from 1 to 16 L/min.

Operation of Total Flow Knob and Oxygen Flush Button: The O_2 Flush Button on the flowmeter is used to add a high rate of Oxygen flow at any time. The button may be pushed (continuously) by a user's hand, the action operates independently from the Total Flow Knob. Oxygen can be added to delivery, approximately 35 L/min, and used to oxygenate the patient at the end of the procedure or at any other time. The Total Flow Knob is able to operate through the complete flow range of normal 100% Oxygen flow and normal (0 to 70%) Nitrous Oxide / Oxygen mixture, and the Oxygen flush adds flow.

Pressure Transducer: To minimize the effect of drift, the pressure transducer signals are auto-zeroed at each STANDBY shut-down initiated by the mechanical On / Standby slide switch when the switch in placed in the STANDBY (Off) position.

Dual Function On / Standby (Off) Switch: Will turn On and Off electronic display as well as gas flow. Provides positive mechanical gas pressure shut-off that reduces the possibility of accidentally leaving the machine ON and also provides electrical On and Off for the digital display.

O_2 Quick Connect – Used for resuscitation and ventilation of non-rebreathing patients and for delivery of 100% Oxygen to patients with respiratory difficulties. Oxygen Resuscitation Systems are separate devices that are not part of the dental flowmeter. When resuscitation device is inserted into the O2 Connect Outlet, high flow 100% Oxygen flows through the connected path. By contrast, the flowmeter output path will experience a significant <u>reduction</u> in flow, the Nitrous Oxide and Oxygen ball floats will drop in the indicator tube and the digital display will read lower total flow or "Low O2 Flow / Increase O2 Flow / Check O2 Source". Note: the digital display <u>does not</u> reflect the flow in the quick connected path; it reflects the reduced flow in the flowmeter.

Indicator Flow Tubes – Indicates flow for Oxygen and Nitrous Oxide in L/min with accuracy of ± 5% at Circle Flow Guides. If the power is interrupted to the unit, the unit will continue to deliver the same mixture setting during the power outage but the device will not display the digital readouts for the % N_2O and Total Flow. The knobs may be adjusted to move the ball float to the desired Circle Flow Guide positions to continue the procedure.

TROUBLESHOOTING CHART FOR MXR FLOWMETERS

SYMPTOM	POSSIBLE CAUSE	REMEDY
No flow of O_2 or N_2O when ON /STANDBY switch is ON and left knob is set at a concentration of N_2O or O_2 the right knob is rotated to give flow.	1. O_2 supply not turned ON. 2. Machine not connected to pipeline system. 3. Empty O_2 cylinders.	1. Turn O_2 regulator in tank room ON. 2. Connect to wall outlet. 3. Replace with full cylinder.
Can get O_2 flow but cannot get N_2O flow.	1. N_2O supply not turned ON. 2. N_2O cylinder empty.	1. Turn ON N_2O cylinder. 2. Replace with full cylinder. .
With N2O concentration set, display total flow varies and/or both tube flows vary proportionally with no change in % setting.	O_2 regulator is varying pipeline pressure.	Check O_2 regulator. Be sure O_2 manifold pressure is 50 PSIG ±2 PSIG. If not, call Dealer for service.
Meter will flow N_2O without any O_2 flow in the O_2 tube.	Failsafe failure.	Take out of service and return to Porter.
Cannot get 9 ½ L/min O_2 flow with %N2O concentration knob OFF and flow control knob full ON.	Low O_2 pressure setting.	Check O_2 regulator. Be sure O_2 manifold pressure is 50 PSIG ±2 PSIG. If not, call Dealer for service.
Ballooning of the gas bag.	90° Elbow connected onto bag tee is pushed on too far, blocking movement of the non-rebreathing valve.	Remove rubber goods and 90° elbow from bag tee. Reconnect elbow and rubber goods.
Patient not feeling effects of gases.	1. Outer mask is not fit properly to patient's face. 2. Gas flows do not meet patient's requirement. 3. Inner mask's exhalation valve is missing. 4. Inner mask is missing (must have inner and outer mask together).	1. Fit so inner mask is secure to face but outer mask is just off face. 2. Re-adjust gas flows to obtain acceptable bag action. 3. Replace valve. 4. Replace inner mask.
Bag is going flat during procedure.	1. Gas flows do not meet patient's requirement. 2. Outer mask is not fit properly to patient's face.	1. Re-adjust gas flows to obtain acceptable bag action. 2. Fit so inner mask is secure to face but outer mask is just off face.

PARTIAL LISTING OF REFERENCE MATERIAL

[1]Handbook of Nitrous Oxide and Oxygen Sedation – Morris Clark • Ann Brunick

Dentists' Desk Reference: Materials, Instruments & Equipment - American Dental Association

Relative Analgesia in Dental: Inhalation Analgesia and Sedation with Nitrous Oxide - Harry Langa, D.D.S.

Conscious - Sedation in Dental Practice - C. Richard Bennett

Sedation - A Guide to Patient Management - Stanley F. Malamed

The Practical Use Nitrous Oxide - Oxygen Conscious Sedation - Robert E. Hamric, D.M.D

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REVISION HISTORY

REV.	DATE	ECN #	DESCRIPTION OF CHANGES	DR	CH	APPR
0	3/8/07	07-0135	Formal Release.	ALE	WHK	SDL
A	5/30/07	07-0322	Tech Specs: Wall plug-in 0.3A was 1000 ma; Wall junction box 0.4A was 300 ma; p. 7 update power supply in System Illustration; p. 11; delete O2 Flush display readout option; p. 15 O2 Flush Condition was O2 Flush, Display will not indicate accurate flow settings was Display will flash, However….will not display the actual flow and percent was Low O2 flush is detected by the unit to Meaning column.; p. 22 remove O2 Flush figure and reformat layout for Power Oxygen Flush section.	ALE	WAK	TGT
B	4/27/11	11-0094	Updated logo and address	ANB		