



MULTICAP®

CNO-103

OPERATOR'S MANUAL

MULTICAP^R

CNO-103

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This manual is updated with the newest features
of software revision No. 15.

All specifications subject to change without prior notice.

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WARNINGS

A WARNING INDICATES A POTENTIALLY HARMFUL SITUATION.

EXPLOSION HAZARD:

* Do not use the Datex Multicap^R in the presence of flammable anesthetics.

ELECTRICAL SHOCK HAZARD:

* Connect power cord to a properly grounded 3-wire outlet. Unplug before servicing, cleaning or disinfection.

* Do not open the covers of the unit. No user-serviceable parts inside. Service should be performed by a qualified service technician.

FIRE HAZARD:

* After washing the measuring chamber with flammable fluids like ethanol, isopropanol or alcohol, careful rinsing with distilled water is needed.

PATIENT SAFETY:

* Ensure that all the connections are secure and check for proper operation of the monitor and anesthesia circuit before use. In particular, the reusable airway adapters should be checked to ensure that the sampling connectors are not loose and that the sealing faces are not damaged.

* Disposable airway adapters and sampling tubes are for single patient use only. Reusable adapters and sampling tubes should be changed for a new patient.

* Constant attention by a qualified individual is required whenever a patient is under anesthesia or connected to a ventilator. Some equipment malfunctions require immediate action. A malfunction may pass unnoticed in spite of equipment or Multicap^R alarms.

* The internal sampling system of the monitor cannot be sterilized. If the return gas kit is used, gas will pass through the internal sampling system before being delivered back to the patient. If heavy contamination is suspected, the monitor should be serviced by a qualified technician.

* After monitoring a patient with hepatitis B virus or tuberculosis, a 2 % glutaraldehyde solution should be left in the wash circuit for 30 minutes to disinfect the internal sampling system of the monitor. After monitoring a HIV positive patient, use 70 - 80 % alcohol; the time needed for disinfection is 15 minutes. After disinfection, the measuring chamber should be washed with Datex measuring chamber cleaning fluid and rinsed thoroughly.

DATA VALIDITY:

* The oxygen sensor uses room air as a reference gas, with a zero-volt output level corresponding to 21 % O₂. The inspired O₂ display may continue to read 21 % in the event of a malfunction. Calibration checks the function of the O₂ sensor; a quick check can also be made by breathing into the sampling tube and noting a change in the INSP-EXP O₂ display. Always check the function of the O₂ sensor in connection with any service.

CAUTIONS

A CAUTION INDICATES A CONDITION THAT MAY LEAD TO EQUIPMENT DAMAGE OR MALFUNCTION.

- * Do not autoclave with steam or ethylene oxide. Do not immerse in liquids or allow liquids to enter the cabinet interior.
- * Always check the level of fluid in the water trap container prior to use and intermittently during operation. Empty the container whenever it is more than half full.
- * Disconnect the sampling tube connector from the airway if nebulized medications are being used.
- * Do not use other than specified cleaning agents. Cleaning agents such as blood gas electrode cleaners may damage the unit. Carefully rinse the system with distilled water after washing.
- * Use a Luer syringe without lock when cleaning or rinsing the measuring chambers. (If a non-Luer-lock syringe is not available, a short piece of intravenous extension tubing without a Luer-lock may be attached to the cleaning syringe.) Do not apply excessive pressure on the syringe, or serious damage to the monitor may result.
- * After cleaning the measuring chambers, it is essential to remove all the water from the measuring chambers before starting the unit. Even small amounts of residual water may impair the function of the oxygen sensor. Allow the monitor to run overnight to ensure that the measuring chambers are thoroughly dry.
- * When feeding in calibration gas, the diameter of the tube from the bottle must be several times larger than the diameter of the sampling tube to avoid overpressurization and consequent inaccurate calibration or internal damage.

NOTES

A NOTE INDICATES A POINT OF INTEREST FOR MORE EFFICIENT AND CONVENIENT OPERATION

- * Use only original Datex sampling tubes and accessories. Other sample tubes may cause inaccurate readings and malfunctions.
- * Note any error messages or deviations from normal operation.
- * All other Notes are clearly indicated in the appropriate section.

1.0 UNPACKING AND INSPECTION

Upon receipt of your Datex Multicap[®] Gas Monitor, check the shipping carton for damage. Check the electrical performance before use. If the carton has been damaged, or if damage to the Gas Monitor may have occurred, immediately notify the carrier.

The Multicap[®] is delivered in one carton containing the following items:

PART NO.	QTY.	DESCRIPTION
CNO-103	1	Multicap [®] Gas Monitor with short instructions underneath
54563 (Eur)	1	Mains Cable
86236 (USA)		
85584	5	Disposable Sampling Set
870832	1	Water Trap Container
872529	1	Multicap [®] Operator's Manual

2.0 MULTICAP^R GAS MONITORING SYSTEM

The Datex Multicap^R Multigas Monitor is a compact, microprocessor controlled monitoring instrument for use in surgical operation rooms or special care units where the monitoring of respiratory gases is critical.

It features CO₂ and N₂O concentration measurements using infrared absorption techniques. Oxygen concentration is measured using a fast-response paramagnetic oxygen analyzer.

Clear digital display of the gases and a comprehensive alarm system make the Multicap^R easy to use, accurate and reliable.

3.0 SWITCHES, DISPLAYS, AND SETTINGS

3.1 Front Panel

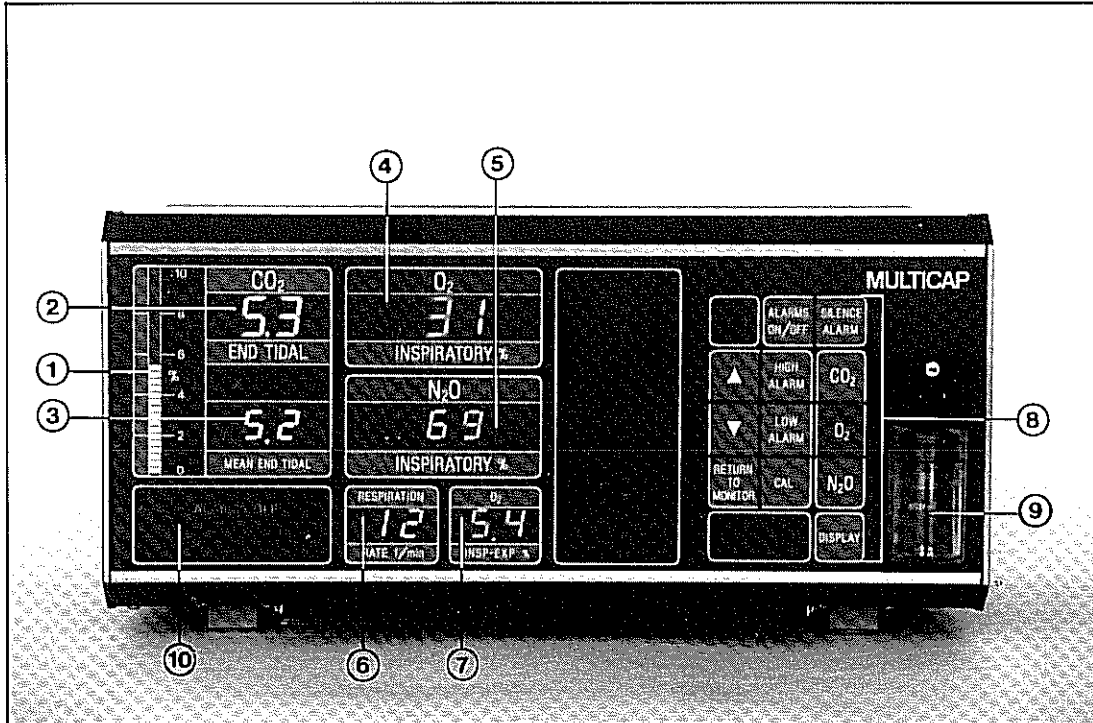


Figure 1 Multicap^R Front Panel

The Multicap^R front panel consists of:

- (1) An LED (Light Emitting Diode) bar graph that shows the instantaneous CO₂ concentration. When the alarms are activated, the high ETCO₂, low ETCO₂ and CO₂ rebreathing alarm limits are displayed as lit LEDs on the breathing indicator bar graph.
- (2) End-tidal CO₂ calculated from each breath. This value can be displayed as a percentage or as a partial pressure in mmHg, at the user's option.
- (3) Mean end-tidal CO₂ is the average ETCO₂ value over the last 15 minutes.

- (4) Inspiratory O₂ percentage.
- (5) Inspiratory or expiratory N₂O percentage.
- (6) Respiration Rate, breaths per minute. Counting is activated when four or more breaths per minute are detected.
- (7) Difference between inspired and expired O₂ concentrations, calculated after each breath.
- (8) The keyboard controls are used for calibration, setting alarm limits and other functions. See Section 3.2 for detailed description of all the functions.
- (9) Water trap for effective water drop separation from the sampled gas. The water trap bottle is removed for emptying.
- (10) Message field for the visible 'APNEA' and 'OCCLUSION' alarm indicators and the 'ALARMS OFF' warning.

3.2 Keyboard

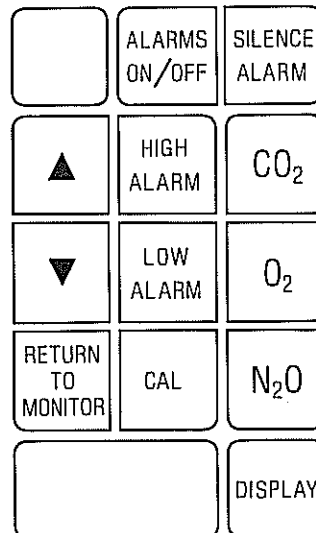


Figure 2 Multicap^R Keyboard

The keyboard on the Multicap^R Gas Monitor is used to:

- a) Set the desired high and low alarm limits for each of the gases used and set the CO₂ rebreathing alarm level.
- b) Activate or deactivate the alarms or silence the alarms for two (2) minutes.
- c) Calibrate the unit.
- d) Select display mode.

The functions of each key on the keyboard are as follows:

1) DISPLAY

Activates the remaining displays after switching the power on.

Changes the units of measurement for the ETCO₂ digital displays (end-tidal CO₂) from percentage to partial pressure in mmHg and vice-versa, if the user presses the CO₂ key and then the DISPLAY key.

Changes the N₂O display to expiratory N₂O, if the user presses the N₂O key and then the DISPLAY key. Repeating the sequence returns the display to inspired N₂O. After selection of expiratory N₂O, 'Et' will be displayed on the N₂O display once every 10 seconds. When the display is returned to inspiratory N₂O, the message 'Fi' will be displayed once only.

2) ALARMS ON/OFF

Activates or deactivates all alarms except the apnea and low inspiratory O₂ alarms. When the alarms are switched off, the 'ALARMS OFF' warning is lit in the message field.

3) SILENCE ALARM

Silences all current alarms for two (2) minutes (except the alarm for inspiratory O₂ below 18 %, which is only silenced for 20 seconds).

If no alarm has been triggered, pressing SILENCE ALARM for two seconds will disable the audible alarms for the next two minutes (inspiratory O₂ < 18 % alarm for only 20 sec). This situation is indicated by the flashing 'ALARMS OFF' warning.

The apnea alarm is not activated until the Multicap^R detects five breaths with an intervening period of less than 20 seconds between two successive breaths.

4) HIGH ALARM

When used in conjunction with one of the gas selection keys (6), pressing this key activates the high alarm limit display. The alarm limit is shown on the selected gas display. The high alarm limit may now be raised or lowered by pressing the appropriate arrow key (7).

5) LOW ALARM

When used in conjunction with one of the gas selection keys (6), pressing this key activates the low alarm limit display. The alarm limit is shown on the selected gas display. The low alarm limit may now be raised or lowered by pressing the appropriate arrow key (7).

6) CO₂, O₂, N₂O

These keys allow you to select a gas for setting alarm limits. These keys also allow gas selection when calibrating (calibration is accepted only after a five-minute warm-up period) or gas selection for the analog signal output.

7) ARROW KEYS

These keys are used to raise or lower the alarm limits for each gas. During the calibration procedure, these keys raise or lower the displayed gas percentages to match the gas percentages in the calibration gas.

8) CAL

This key sets up the monitor for calibration of the gases. After selecting the calibration mode, sample the calibration gas and use the arrow keys (7) to adjust the displayed percentages to match those in the calibration gas.

If one of the gas selection keys (6) is pressed first, the CAL key enables individual gas calibration. See Section 5.2 for complete calibration instructions.

9) RETURN TO MONITOR

This key returns the monitor from calibration mode or from alarm limit setting mode back to the monitoring mode.

If the RETURN TO MONITOR key is pressed for 5 seconds, (1) the trend memory will be cleared, (2) the alarm limits will be reset to their factory preset levels, and (3) the initial self check will be performed.

<p>NOTE: The monitor will automatically return to the monitoring mode 60 seconds after the last key has been pressed.</p>
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3.3 Rear Panel

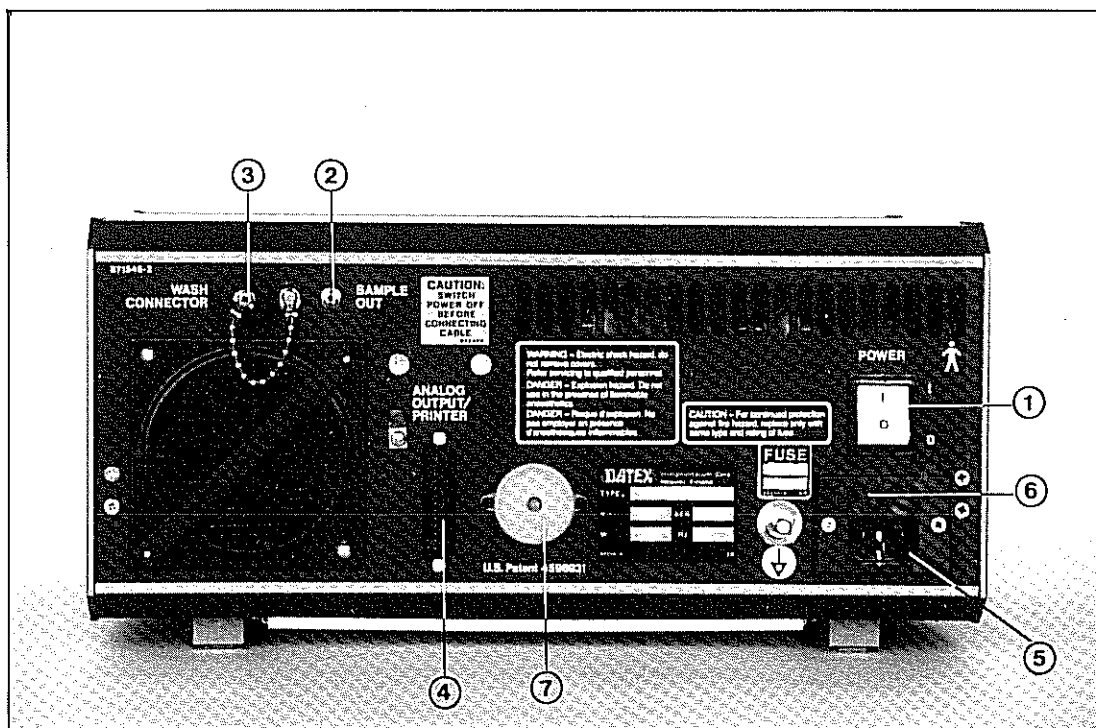


Figure 3 Multicap^R Rear Panel

The Multicap^R rear panel consists of:

- (1) Power switch to turn the unit on or off (I = ON).
- (2) Sample Out - This is the sample gas outlet. Nominal flow rate is 150 ml/min.
- (3) Wash Connector - This is the connector to the measuring chamber wash circuit. Make sure that the cap is screwed on tightly during normal use of the unit.

NOTE: Cleaning of the measuring chamber should be performed only by a qualified service technician.

- (4) Connector - D type, 25 pin. This connector has both digital and analog signal input/output. The digital input/output can be used to drive the Multicap^R DP-103 Graphic Printer. See Appendix 10.3 for pin designations.
- (5) Receptacle for line cord.

CAUTION: Connecting an improper cable may result in damage to the monitor.

- (6) Fuse holder.
- (7) Alarm buzzer.

4.0 ABBREVIATED INSTRUCTIONS

- a) Check that the unit is turned "off". Connect the special sampling tube with Luer connector to the Luer connector on the water trap. Check that the water trap is empty.
- b) Connect the monitor power cord to a power outlet socket and turn the power on with the rear panel switch.
- c) Only the CO₂ and O₂ displays are initially active. To activate the remaining parameter displays, press the DISPLAY key.
- d) Check the sampling tube by breathing through the distal end of the sampling tube yourself (through a surgical mask, if possible). The ET_{CO}₂ display should show a value within the normal range of 4.5 - 6 % CO₂ (34 - 46 mmHg CO₂).
- e) Check the calibration of each gas when necessary.

For complete calibration instructions, see Section 5.2.
- f) Adjust the alarm limits for the monitored gases, as desired.
- g) Connect the sampling tube to the airway connector in the patient circuit.
- h) Turn the alarms on by pressing the ALARMS ON/OFF key.

5.0 OPERATION

5.1 Turn-on Sequence

- (1) Connect a Multicap^R sampling tube or a disposable sampling set to the connector on the water trap.

NOTE: Use of other types of tubing may cause problems with the water separation system or auto-zeroing and may increase the response time of the measurements.

- (2) Turn the power on.

NOTE: The sampling tube must be connected before the power is switched on. Otherwise the 'OCCLUSION' alarm may be triggered. In this case, connect the sampling tube and press the RETURN TO MONITOR key for 5 seconds to reset the instrument.

NOTE: If the unit detects water in the internal tubing system, internal reverse flow will be activated for 20 seconds or more, immediately after start-up, in order to eject the liquid. Flow is not reversed in the sampling tube to the patient, however.

The monitor now performs a self test that checks all electrical signals and measures the atmospheric pressure.

Message 'Pr xx' indicating program code and program revision number is shown. Abbreviation 'Pr' for program appears on the ETCO₂ display and the program code (6 digits) and the program revision number (2 digits) are shown on the O₂ display in sequence.

The 'ALARMS OFF' warning will remain on the message field until the alarms are turned on.

NOTE: 'ALARMS ON' status is retained over a short power failure.

NOTE: Selection of analog waveform output: CO₂, O₂ or N₂O:
The monitor is factory preset to give CO₂ as the analog output signal. To select O₂ as the analog output, press the O₂ key down while the power switch is turned from off to on during the start-up routine, until the message 'O2' appears in the MEAN ETCO₂ display. To select N₂O as the analog output, press the N₂O key down during the start-up routine until the message 'n2' appears.

NOTE: After complete self checking the monitor performs automatic zeroing for all gases, except O₂, five minutes after the power has been turned on. After 30 minutes and then every 60 minutes thereafter the automatic zeroing is repeated. (This automatic zeroing is performed by sampling room air from the internal circuit; it does not require disconnecting the sample tubing.)

NOTE: The oxygen measurement is zeroed only during calibration. After the five minute warm-up time, check the O₂ display while the monitor is sampling room air. If the reading does not show 21 % \pm 1 %, calibration of the oxygen measurement should be performed. See Section 5.2.

After the five-minute warm-up time, calibration of the gas measurements can be checked. For maximum accuracy, a warm-up time of 30 minutes is recommended prior to calibration.

As an indication that the monitor is not ready for calibration, the message 'no C' is shown on the ETCO₂ and O₂ displays.

5.2 Calibration

The gas calibration is recommended to be done half-yearly or when ever there are indications of errors in the readings. Calibration should always be performed after rinsing or washing the measuring chamber or if the atmospheric pressure has changed more than \pm 50 mmHg since last calibration.

Calibration may be checked after the auto-zero, which is made five minutes after power-up. For maximum accuracy, a warm-up time of 30 minutes is recommended prior to calibration.

When performing the calibration procedure, the monitor draws in gas only via the sampling tube. It is thus essential to have the sampling tube aspirate room air, with no vapors or other

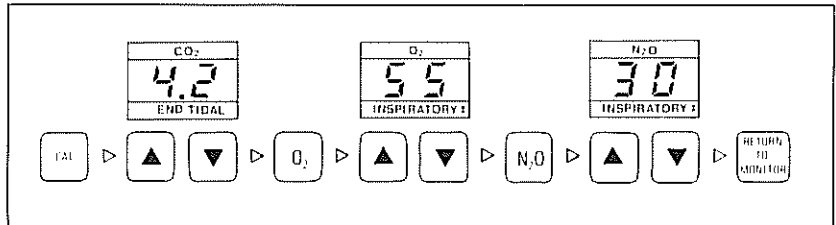


Figure 4 Key Strokes for Calibration

If another gas source is used to check the calibration of the gas measurements, the gas source should contain the concentrations listed below.

$$\text{CO}_2 \geq 3 \%$$

$$\text{O}_2 \geq 50 \%$$

$$\text{N}_2\text{O} \geq 30 \%$$

NOTE: Maximum accuracy is provided when the O₂ and N₂O measurements are calibrated with 100 % gas concentrations. However, the N₂O gas used in hospitals is not 100 % pure, but usually 97 % or 98 %. Please check the purity of the gas used.

CAUTION: To prevent overpressurization of the measuring chamber, the flow rate of the calibration gas must not exceed 1 l/min and the inside diameter of the tubing from the calibration gas cylinder must be at least 2 or 3 times the outside diameter of the sample tube. Overpressurization will result in inaccurate calibration and may damage the internal tubing.

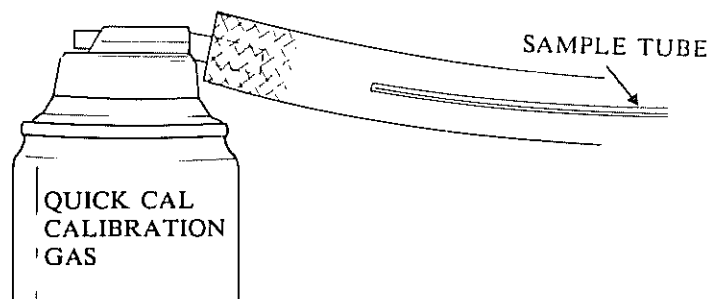


Figure 5 Tubing Connection for Feeding Calibration Gas

While the monitor is being calibrated, the analog connector (rear panel connector PIN 22) gives a square wave output.

NOTE: During calibration, the 'no C' message also indicates that the gas concentrations percentage in the calibration gas is too low for calibration.

5.2.1 Simultaneous Calibration Check of All Gases

- a) Attach the sampling tube to the sample-in connector on the water trap. Turn the power on and wait at least five minutes for the monitor to warm-up. See Section 5.1 Turn-on Sequence for full details of the start-up process.

Ensure that the sampling tube is drawing in room air.

- b) Press the CAL key for five seconds.

The message 'Air' on the displays is to remind the user to be sure that the monitor is sampling room air. The zero points for each gas are automatically established.

CO ₂	0.0 %
O ₂	21 %
N ₂ O	0 %

If the message 'no C' is displayed, it indicates that the warm-up period is still less than 5 minutes. Allow the monitor to continue to warm-up.

- c) The message 'in' on the mean end tidal CO₂ display, indicates that the monitor is ready to accept the calibration gas.

Insert the sample tube half-way up the large tube of the Quick Cal Calibration Gas Bottle.

- d) Start the gas flow.

Allow the monitor to draw in the calibration gas via the sampling tube until an audible beep is heard. The ETCO₂ display will flash.

- e) Stop the gas flow. The monitor has analyzed the contents of the calibration gas and now displays the concentrations.

The gas values are now ready for adjustment, if necessary.

- f) Check the displayed ETCO₂ value against the CO₂ concentration marked on the calibration gas bottle.

If necessary, press the arrow keys to adjust the ETCO₂ display to match the CO₂ concentration in the calibration gas bottle.

NOTE: During calibration CO₂ will be measured in %, even if it is normally measured in mmHg.

- g) Check the other displayed values against the gas concentrations marked on the calibration gas bottle.

- h) If calibration of another gas measurement is necessary, press the corresponding gas key. The display will begin to flash. Adjust the display with the arrow keys to match the gas concentration marked on the calibration gas bottle.

- i) If necessary, adjust the calibration of the other gases.

- j) Press the RETURN TO MONITOR key to complete the calibration procedure.

- k) Check the calibration by feeding in a 1 second shot of the calibration gas. If the difference to the set value is more than 0.1 % CO₂ or 1 % O₂/N₂O, repeat the calibration.

5.2.2 Calibration Check of One Gas Measurement at a Time

- a) Attach the sampling tube to the sample-in connector on the water trap. Turn the power on and wait at least five minutes for the monitor to warm-up. For complete instructions, see Section 5.1 Turn-on Sequence.

Ensure that the sampling tube is drawing in room air.
- b) Press the appropriate gas key to select the gas for calibration check.
- c) Press the CAL key for five seconds.
- d) The message 'Air' on the displays is to remind the user to check that the monitor is sampling room air. The zero point for the gas will be calibrated automatically.
- e) When 'in' appears on the mean end tidal CO₂ display, the monitor is ready for the calibration gas. Feed the calibration gas into the sampling tube until an audible beep is heard and the gas display flashes.
- f) Check the display against the gas concentration marked on the calibration gas bottle.
- g) If necessary, adjust the display with the arrow keys to match the displayed value to the calibration gas concentration.
- h) Complete the calibration by pressing RETURN TO MONITOR.
- i) Check the calibration by feeding in a 1 second hot of the calibration gas. If the difference to the set value is more than 0.1 % CO₂ or 1 % O₂/N₂O, repeat the calibration.

5.3 Procedures during Monitoring

Alarms for apnea and occlusion will be activated automatically. If desired, individual alarm limits can be set for each gas. (See Section 5.4.) In addition to automatically zeroing all the gases (except oxygen) 5 and 30 minutes after start-up, this zeroing will be automatically repeated every hour thereafter. During automatic zeroing the unit samples air through an internal vent; no operator action is required.

WARNING: If 'oF' is suddenly displayed and the respiratory bar graph is at full scale (10 %), the measuring chamber has probably become contaminated. The measuring chamber should be cleaned as described in Section 7.3 by a qualified service technician.

CAUTION: Always check the level of fluid in the water trap container prior to use and intermittently during operation. Empty the container whenever it is more than half full.

NOTE: The sampling tube should temporarily be removed from the patient's airway whenever nebulized medications are being used.

NOTE: The oxygen measurement is not automatically zeroed. To check the zero point for oxygen: after a 30 minute warm-up period, note the O₂ reading while the monitor is aspirating through the sampling tube room air. If the O₂ measurement is not 21 % ± 1 %, manual zeroing should be performed by pressing the CAL key.

5.4 Alarms and Warnings

5.4.1 Setting Alarm Limits

After turning power on, the ALARMS OFF warning message indicates that all the alarms are inactive except apnea and low inspiratory O₂.

Alarm limits can be set individually for each gas monitored. The only restriction is that the low O₂ limit cannot be set below 18 %. The apnea alarm cannot be adjusted.

The Multicap^R Gas Monitor arrives from the factory with the alarm limits set as follows:

The Multicap[®] Gas Monitor arrives from the factory with the alarm limits set as follows:

High End-Tidal CO ₂	7 %
Low End-Tidal CO ₂	3 %
High N ₂ O	85 %
Low N ₂ O	0 %
High O ₂	OFF
Low O ₂	18 %
CO ₂ Rebreathing	1 %

NOTE: When the unit has been turned off for over 15 minutes, the alarm limits revert to the preset levels shown above.

NOTE: The low inspiratory oxygen alarm limit is preset to 18 %, and cannot be adjusted below 18 %. An alarm is always triggered when O₂ falls below this limit.

During operation the alarm limits may be returned to the factory preset limits by pressing the RETURN TO MONITOR key for 5 seconds.

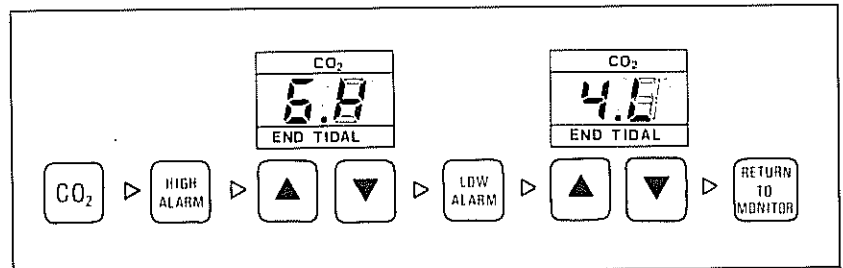


Figure 6 Key Strokes for Setting Alarm Limits

The alarm limits for all the gases may be checked simultaneously by pressing the HIGH ALARM key or the LOW ALARM key.

To adjust a high alarm limit press the HIGH ALARM key and the key of the desired parameter in sequence either one first. The letter H will be displayed, followed by the current alarm limit. To raise or lower the alarm limit press the up or down arrow key. Select another parameter by pressing the corresponding key and repeat the above procedure.

The procedure to set the low alarm limits is similar to the one of the high alarm, except that the LOW ALARM key must be pressed instead of the HIGH ALARM key. The letter 'L' will be displayed, followed by the current low alarm limit. Adjust the alarm limit by pressing the appropriate arrow key.

After all the desired limits have been set, press the RETURN TO MONITOR key.

To turn the alarms on, press the ALARMS ON/OFF key.

Whenever the alarms are turned on, the end-tidal CO₂ alarm limits and the CO₂ rebreathing limit, when different from default rebreathing limit 1 %, are indicated by illuminated LED's on the respiratory bar graph.

5.4.2 Apnea Alarm

When the unit is first turned on, the 'ALARMS OFF' warning and the visible 'APNEA' alarm indicator will appear in the message field.

A breath is defined as a 1% variation in the end-tidal CO₂ concentration.

The apnea alarm sequence is:

- * If no breaths are detected during 20 seconds, the APNEA alarm indicator will light and a single audible alarm beep will be given.
- * If the apnea continues for another 20 seconds two audible alarm beeps will be given.
- * If the apnea continues still another 20 seconds (60 seconds total), a continuous audible alarm will be triggered.

The audible alarm may be silenced by pressing the SILENCE ALARM key. The audible alarm can also be kept silent for a two-minute period (in anticipation of a period of apnea) by pressing the SILENCE ALARM key two (2) seconds, until the ALARM OFF message starts flashing. The apnea alarm cannot otherwise be adjusted or disabled. The two (2) minutes audible alarm silence period can be interrupted by setting alarms on with 'ALARMS ON/OFF' -key.

5.4.3 Rebreathing Alarm

The rebreathing alarm is triggered when the inspiratory CO₂ value does not drop below the set rebreathing alarm limit

within 20 seconds. When the alarm is triggered, an audible beep sounds and the lowest LEDs of the CO₂ bar graph start to flash. The factory set limit is 1 %. To adjust the rebreathing alarm limit, complete the following procedure:

- a) Press the CO₂ key.
- b) Press the LOW ALARM key for two seconds. One of the Rebreathing percent indicators, r1, r2 or r3 (corresponding to 1 %, 2 % or 3 %), will be displayed in the ETCO₂ display, indicating the current alarm limit.
- c) Press the up or down arrow keys to raise or lower the alarm limit in 1 % steps.
- d) Press the RETURN TO MONITOR key to complete the procedure.

5.4.4 Low Inspiratory O₂ Alarm

If both the inspired and expired O₂ values drop below 18 %, an audible alarm will be triggered.

The audible alarm may be silenced by pressing the SILENCE ALARM key. The low inspiratory O₂ alarm at 18 % is automatically activated when the monitor is turned on and cannot be disabled. Even if the O₂ low alarm limit is set to a higher value, a non-defeatable alarm is given whenever O₂ drops below 18 %.

5.4.5 Occlusion Alarm

The 'OCCLUSION' alarm is triggered if the sampling tube becomes kinked, pinched, or blocked with mucus. An occlusion in the sampling tube will cause a partial vacuum inside the sampling system which can be detected by the monitor. The monitor will then try to increase the flow through the sampling tube, via the trap bottle to the monitor, to try to eliminate the obstruction.

The occlusion alarm sequence is:

If the monitor detects an occlusion, the 'OCCLUSION' message will light in the message field and the gas readings will be frozen until the occlusion is cleared.

If the occlusion persists for 20 seconds, the gas readings will be replaced by dashes.

If the occlusion persists for another 20 seconds the audible alarm will be triggered.

WARNING: The sample tube should be changed if occlusion due to blood or mucus cannot be cleared.

NOTE: The OCCLUSION message may also be given when the sampling tube is connected, if the monitor was switched on before the sampling tube was connected. This event occurs because the monitor cannot tell if the increased flow resistance is due to connecting the sampling tube or an occlusion.

5.5 Displayed Messages

MESSAGE	DISPLAY FIELD	INDICATION
After start up: Pr xx O ₂ n ₂	 END TIDAL CO ₂ INSPIRATORY O ₂ MEAN END TIDAL MEAN END TIDAL	 Program code and revision number (during self check). O ₂ selected for analog output. N ₂ O selected for analog output.
During calibration: Air in nO C	 END TIDAL CO ₂ INSPIRATORY O ₂ MEAN END TIDAL END TIDAL CO ₂ INSPIRATORY O ₂	 Reminder to ensure the monitor is sampling room air. Monitor is ready to receive calibration gas. a) Monitor not ready for calibration. Allow at least 5 min warm-up time. b) Indication that the gas concentration is not sufficient for calibration
During operation: APNEA OCCLUSION ALARMS OFF Et (every 10 s) Fi	 message field message field message field INSPIRATORY INSPIRATORY	 Apnea alarm, indicating that a 1% variation in ETCO ₂ has not been measured within a 20 sec period. Sampling tube occluded or kinked. See Section 5.5.5. Alarms 'off', except low O ₂ and apnea. Expiratory N ₂ O displayed. Returned to inspired N ₂ O display.

<p>oF up to full reading 10 %</p>	<p>END TIDAL CO₂ LED bar graph</p>	<p>ETCO₂ over 10 %. Measuring chamber contaminated and requires drying or cleaning. See Section 7.3.</p>
<p>nO oP</p>	<p>END TIDAL CO₂ INSPIRATORY O₂</p>	<p>CO₂ measurement chamber contaminated and requires cleaning. See Section 7.3.</p>
<p>Er 40</p>	<p>INSPIRATORY O₂</p>	<p>Oxygen measurement failure.</p>
<p>Er 41</p>	<p>END TIDAL CO₂ INSPIRATORY O₂</p>	<p>Flow error: a) Wash connector cap may be loose. If so, tighten the cap. b) Sample outlet may be blocked. Examine external outlet tubing for obstruction (e.g Return Gas Kit). Contact a qualified service technician to check the operation of the unit. c) There may be a fault in the internal valves or pressure sensors. Contact a qualified service technician to check the monitor.</p>
<p>Er 42</p>	<p>END TIDAL CO₂ INSPIRATORY O₂</p>	<p>Failure of the pressure transducer.</p>
<p>Er 43</p>	<p>END TIDAL CO₂ INSPIRATORY O₂</p>	<p>Leak in the gas sampling circuit.</p>
<p>Er 00 .. 08</p>	<p>END TIDAL CO₂ INSPIRATORY O₂</p>	<p>Error in the monitor's internal electronics. Contact a qualified service technician to check the unit.</p>
<p>Gas measurement failures (Zeroing failures): Er/ Er 09</p>	<p>END TIDAL CO₂ INSPIRATORY O₂ INSPIRATORY N₂O</p>	<p>'Er' flashing alone at a fast rate on the displays of failed gas(es) warns that some zero-drift has occurred and cleaning of the measuring chamber will soon be necessary. 'Er' flashing alternately with '09' on the displays of failed gas(es) indicates zeroing failure. (See Section 7.3)</p>

6.0 OPERATING PRINCIPLES

6.1 CO₂ and N₂O Measuring Principle

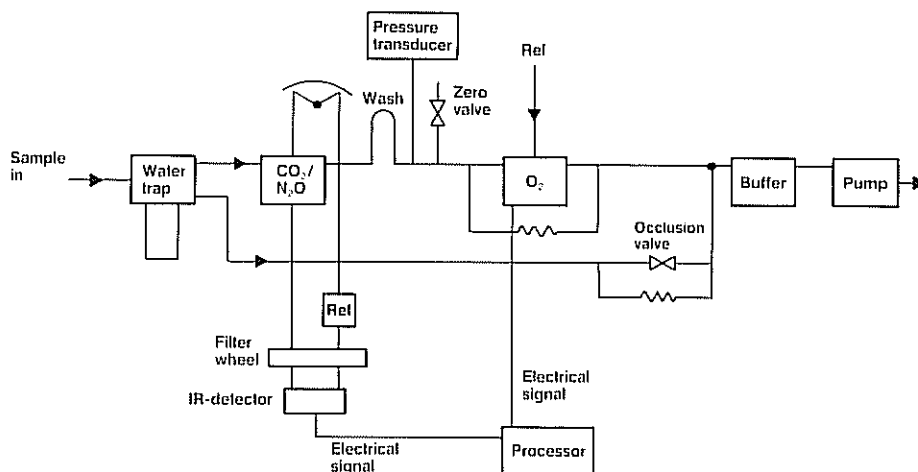


Figure 7 CO₂ and N₂O Measuring Principle

The measurement of carbon dioxide (CO₂) and nitrous oxide (N₂O) concentrations is based on an infrared absorption technique.

A pump in the monitor draws the gas sample through the sampling tube at a flow rate of 150 ml/min, into measuring chambers where the gases absorb infrared light emitted by an incandescent lamp. Adjacent to each measuring chamber is a reference chamber which contains air. The infrared light passes through narrow-band infrared filters, which filter out all radiation except that which is within the absorption bands of interest. This radiation is then converted to electrical signals by solid-state infrared detectors.

From the detector signals, the ratio of radiation through the measuring chambers to the radiation through the reference chambers is computed. The detector signals are functions of the gas contents of the sample.

The pump exhausts the sample through an outlet at the rear panel of the unit. The infrared absorption measurement is so fast that the response time depends only on the properties of the sample flow. For this reason, the volumes of the measuring chambers and tubing have been minimized.

The absorbed light is measured at different wavelengths. The wavelength for maximum absorption of infrared light for CO₂ is 4.3 μm and for N₂O it is 3.9 μm .

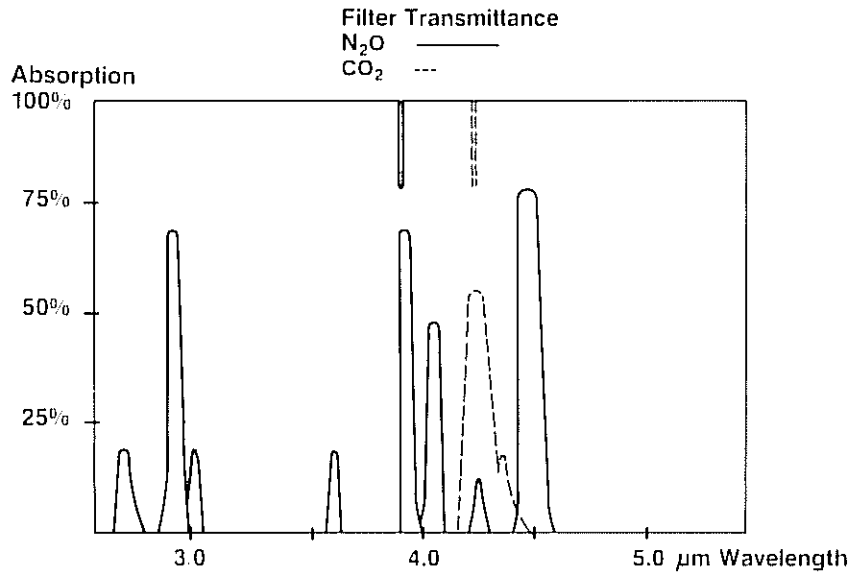


Figure 8 Absorption Spectra for CO₂ and N₂O

6.1.1 Calculation of ETCO₂ and Mean ETCO₂ Values

The ETCO₂ concentration is calculated from the end-expiratory CO₂ plateau. The ETCO₂ value is calculated and updated on the display breath-by-breath.

The mean ETCO₂ value displayed is the average end-tidal ETCO₂ value over the last 15 minutes, with periods of apnea disregarded. The mean ETCO₂ value is updated once a minute. During the first 15 minutes after start up, the display will show the average value since CO₂ monitoring was started, i.e., after two minutes the mean of the first two minutes, after three minutes, the mean of the first three minutes etc.

6.1.2 Calculation of Respiration Rate

The calculation of respiration rate is based on breath detection from the CO₂ measurement. A 1 % variation in the CO₂ level is required to be counted as a breath. The displayed respiration rate is calculated from the mean of the present breath-to-breath interval and that previously displayed.

The respiration rate is updated whenever a new breath is detected. If no breaths are detected for 20 seconds, the respiration rate will be replaced by dashes. The respiration rate can be calculated in the range of 4 to 60 breaths per minute. If the respiration rate exceeds 60 breaths per minute, the monitor display will remain at 60 breaths per minute but will flash on and off as an indication that the measurement is out of range.

6.2 O₂ Measurement Principle

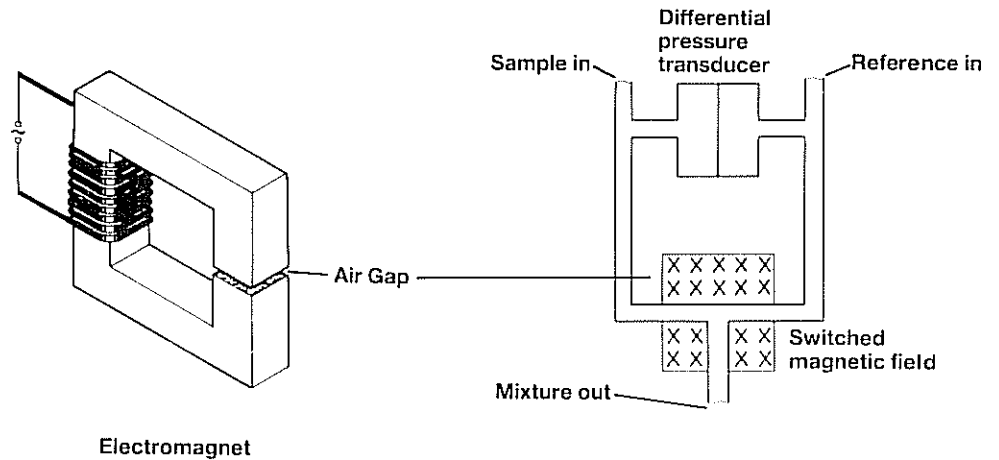


Figure 9 O₂ Measurement Principle

The operation of the oxygen analyzer is based upon the strong paramagnetic response of oxygen molecules as compared to that of other gases. The sample gas and the reference gas (room air) are conducted into a gap in a strong electromagnetic field that is rapidly switched on and off. An alternating pressure difference is generated between the two tubes due to forces which act on the oxygen molecules in the magnetic field. The pressure difference is measured with a sensitive differential pressure transducer and detected and amplified to produce a DC-voltage signal directly proportional to the partial pressure difference of the oxygen in the two tubes.

7.0 MAINTENANCE

7.1 Emptying the Water Trap

The water trap container should be emptied whenever half full, or at least at 24-hour intervals.

Pull the container down to remove it. After emptying, push the container back and check that it sits straight. To check the tightness of the sampling system, occlude the distal end of the sampling tube and see that the occlusion message appears.

7.2 Troubleshooting

The following troubleshooting guide should help the operator find a possible cause of malfunction.

TROUBLE	CAUSE
Prolonged internal reverse flow when starting the monitor. Dashes shown on all the displays. After 3 min. a 'no oP' message will be given.	Water in the internal tubing. Let the monitor dry itself by the internal reverse flow. The measuring chamber may require cleaning. See Section 7.3.
Sudden increase in CO ₂ display (full reading, message 'oF').	Measuring chamber contamination. Dry measuring chamber by running the unit so that it draws in room air. If it is impossible to zero, clean the measuring chamber. See Section 7.3.
No response to breathing.	Fuse blown, unit off (no displays). Sample tube or water trap blocked. Water bottle or wash circuit cap loose.
Impossible to zero (Error message 'Er 09').	Condensation or residue is affecting one or more of the gas measurements. First try drying the measuring system by leaving the monitor running, drawing room air. Wait for the error message to disappear following the regular auto-zeroing. If the error message remains, the measuring chamber should be rinsed or washed. See Section 7.3.

7.3 Cleaning and Disinfection

7.3.1 General Cleaning

Datex Measuring Chamber Cleaning fluid (85969) has been specially developed for cleaning sensitive surfaces. It is suitable for cleaning the external surfaces of the monitor as well as the measuring chamber of the Multicap^R monitor.

NOTE: Use only original Datex sampling tubes and disposable airway adapters or stainless steel adapters. Use of other tubes may affect operation of the occlusion warning system and cause contamination of the measuring chamber. Changing the diameter and the length of the tubing may affect the accuracy of the measurements.

NOTE: Always change the gas sampling tube and adapter for each new patient.

7.3.2 Cleaning the Measuring Chamber

The measuring chamber should be cleaned only when necessary. The monitor indicates the error message 'Er 09' and the gas measurement(s) affected, if there is excessive condensation or residue build-up in the measuring chamber.

CAUTION: Cleaning of the measuring chamber should be performed only by a qualified service technician.

Before attempting to clean the measuring chamber, consider the following possible causes of malfunction:

a) Sample tube occlusion

Since the inner diameter of the sampling tube is small, viscous fluids such as blood or mucus may occlude the tubing. In this case, change the sample tubing and recheck the function of the monitor.

b) Full water trap bottle

Condensed water vapor is separated at the water trap and collected in the trap bottle. If the bottle has been allowed to fill up, empty the bottle and recheck the function of the monitor. The water trap bottle should be emptied at least every 24 hours or whenever it is more than half full.

c) Condensation in the measuring chamber

Dry the measuring chambers by disconnecting the sampling tube from the water trap. Allow the unit to run while sampling room air.

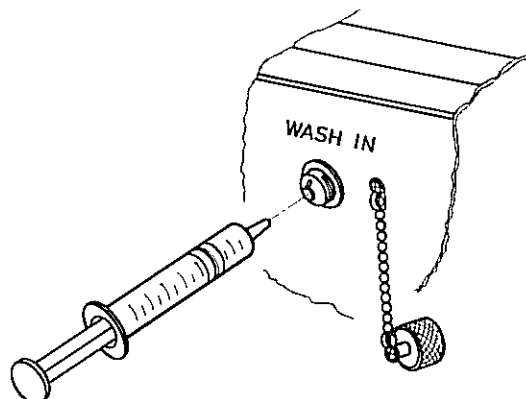


Figure 10 Cleaning the Measuring Chamber

After checking other possible causes of malfunction, first try rinsing the measuring chamber with distilled water only. Follow steps a), b), f), g), h) and i) below.

If rinsing alone is not sufficient, the measuring chamber should be cleaned following steps a) through j) below. Use only Datex Measuring Chamber Cleaning Fluid (85969).

CAUTION: Do not use other cleaning agents such as blood gas electrode cleaners. They may damage the unit. ALCOHOL SHOULD BE USED ONLY FOR DISINFECTION.

a) Turn off the monitor. Remove the sample tube and the water trap bottle.

OPERATOR'S MANUAL

- b) Open the wash circuit by unscrewing the WASH CONNECTOR cap. (See Figure 10.) The wash circuit is located in the rear of the unit.
- c) Fill a 5 ml syringe with the Datex Measuring Chamber Cleaning Fluid.

CAUTION: Do not use a Luer syringe with lock. Serious damage to the unit may result if liquid enters the O₂ sensor inlet (the small orifice located in the rim of the wash connector). Do not apply excessive pressure with the syringe.

- d) Place the syringe firmly into the wash inlet. Slowly inject the cleaning fluid into the wash circuit until a drop appears at the water trap. Leave for 15 minutes.

NOTE: Do not inject liquid into any other holes. You may damage the unit.

- e) Place an empty 5 ml syringe firmly into the wash inlet and aspirate the cleaning fluid from the circuit.
- f) Fill a 5 ml syringe with distilled water. Place the syringe firmly in the WASH CONNECTOR and slowly inject distilled water into the wash circuit. Repeat ten times to thoroughly rinse the measuring chamber.

CAUTION: Avoid applying high pressure during cleaning and rinsing to prevent damage to internal tubing.

- g) Place an empty 5 ml syringe firmly in the WASH CONNECTOR and slowly aspirate the distilled water out. Repeat ten times to remove all the water drops from the measuring chamber.

CAUTION: It is essential to remove all the water from the tubing system before starting the unit. Even small amounts of water may damage the O₂ sensor.

- h) Replace the cap on the WASH CONNECTOR and screw down tightly.

- i) Turn the power on and let the monitor run, sampling room air. If rinsing or cleaning was successful, the 'Er 09' error message will disappear at auto-zeroing when the monitor periodically checks the gas measurements. Auto-zeroing is performed 5 and 30 min after startup and thereafter every 60 min. The measuring system may take some time to dry sufficiently. Wait several hours if necessary.

If cleaning was not successful, repeat the procedure.

- j) Even after the 'Er 09' message has disappeared, leave the monitor running, sampling room air for several hours preferably overnight, to ensure that all moisture is removed from the measuring system.

These instructions are also provided on every bottle of Datex Measuring Chamber Cleaning Fluid (85969).

NOTE: Cleaning should be performed only when contamination of the measuring chamber is indicated by a gas zero error (Er 09). No regular or preventive cleaning is necessary.

7.3.3 Disinfection

Ethanol, isopropanol or glutaraldehyde can be used for disinfection of the measuring chamber.

WARNING: FIRE HAZARD: After washing the measuring chamber with flammable cleaning fluids like ethanol, isopropanol or alcohol, careful rinsing with distilled water is needed.

Recommendations for disinfection of the measuring chamber after monitoring a patient with the following diseases:

Hepatitis B virus and tuberculosis

- a) Use 2 % glutaraldehyde solution (3 ml).
- b) Inject into the wash inlet and leave in place for a half an hour.
- c) Aspirate the liquid with a syringe very slowly and carefully.
- d) Rinse twice with distilled water.
- e) Clean with Datex Measuring Chamber Cleaning Fluid according to the instructions on the bottle.

HI virus (AIDS virus)

- a) Use 70 - 80 % alcohol (2-3 ml).
- b) Inject into the wash inlet and leave in place for 15 minutes.
- c) Aspirate the liquid with a syringe very slowly and carefully.
- d) Rinse twice with distilled water.
- e) Clean with Datex Measuring Chamber Cleaning Fluid according to the instructions on the bottle.

NOTE: Disinfection of the measuring chamber is essential only if there is a known possibility of heavy contamination. No regular or preventive disinfection is needed. It is believed that HI virus (AIDS) needs blood or some other solution rich in proteins to survive.

The water trap bottle can be disinfected with cold chemicals.

7.3.4 Sterilization of Accessories

The stainless steel adapters can be sterilized by autoclaving or by using disinfect solutions. The water trap bottle can be sterilized using cold chemicals or ethylene oxide.

As the direction of the gas flow in the sampling tube is always away from the patient, sterilization of the internal sampling system is not necessary. Present sterilization methods using high temperatures, high pressure, saturated water vapor, or strong chemicals to destroy micro-organisms may damage the internal measuring system.

WARNING: The internal measuring system of the monitor cannot be sterilized. If the Return Gas Kit is used, gas from the internal measuring system will be delivered to the patient circuit.

NOTE: Datex stainless steel adapters are precision crafted components and they assure a reliable airway connection. With proper use, sterilization, and cleaning procedures, they will retain their properties for several years. If they are subjected to abuse, the adapters may become deformed and leaks or disconnections may result.

NOTE: If a patient with a known infection is monitored, the use of disposable airway adapters and sample tubes is recommended.

WARNING: The adapters must always be visually checked before use to ensure that the sampling connectors are not loose and that the sealing faces are not damaged.

8.0 ACCESSORIES

ITEM	PART NO.
CO ₂ Quick Check Calibration Gas Can	85086
Quick Cal Multigas Calibration Can (CO ₂ , O ₂ , N ₂ O)	872160
Water Trap Container	870832
PVC Sampling Tube in Package of 10 Tubes (1 x 2 mm 1.8)	85937
Disposable 15 mm Adapter with 1 x 2 mm x 1.8 m Sampling Tube	85584
15 mm Stainless Steel Adapter	84993
Pediatric Size (11.5 mm) Stainless Steel Adapter	84994
Stainless Steel Adapter with Rubber Sleeve Connection to Intubation Tube	85550
15/22 mm Plastic Adapter for Connection from Mask to Standard Adapter	874116
Neonatal/Infant Adapter Kit for 2.5 to 4.0 mm Endotracheal Tubes	86027
Measuring Chamber Cleaning Fluid 100 ml	85969
Disposable Nasal Adapter Sets for Monitoring Nonintubated Patients	
Adult Size 13/16 mm Adapter (package of 10 pcs)	872202
Adult Size 9/13 mm Adapter (package of 10 pcs)	872203
Pediatric Size 6/9 mm Adapter (package of 10 pcs)	872219
Pediatric Size 4/6 mm Adapter (package of 10 pcs)	872220
Return Gas Start-Up Kit)	86961
2 pcs Return Tube	
2 pcs Hydrophobic Bacteria Filter	
2 pcs Sample Out Connector	
22 mm Adapter for Return Connection to the Circuit	
Disposable Return Gas Set *)	86966
2 pcs Return Tube	
2 pcs Hydrophobic Bacteria Filter	
Disposable Dust Filter for Cooling Air Inlet	871558
Mains Cable (Standard)	54563
Handles	872516
Multicap ^R /Capnomac TM Graphics Printer	DP-103
Thermal Printer Paper (Package of 5 Rolls)	73021
Interface Cables	
Multicap ^R to DP-103	873973
Multicap ^R to Satlite	874622
Multicap ^R to CM-104	874569
Multicap ^R to ABM	873259
Multicap ^R to CR-102 Recorder	873260
Analog output option	873396
19 " Rack Mounting Option	874052
*)All parts with Luer connection	

9.0 TECHNICAL DATA

 CO₂, O₂ AND N₂O CHANNELS

Sampling Rate 150 ml/min.

 Automatic compensation for pressure (range ± 50 mmHg) and for CO₂ - N₂O and CO₂ - O₂ collision broadening effect.

CO ₂	Measurement range	0 to 10 % or 0 to 76 mmHg
	Measurement rise time	< 250 ms
	Gain drift	< 2% f.s./ 4 days
	Zero point drift	< 2% f.s./ 24 hours
	Zero temperature drift	< 0.2 f.s. / °C
	Gain temperature drift	< 0.2 f.s. / °C
	Nonlinearity error	< 2% f.s.
	N ₂ O compensation error	< 2% f.s.

O ₂	Measurement range	0 to 100 %
	Measurement rise time	< 450 ms
	21 % O ₂ drift	< 2 % / 24 hours
	21 % temperature drift	< 0.2 % / °C
	Gain drift	< 2 % / 24 hours
	Gain temperature drift	< 0.3 % / °C
	Nonlinearity error	< 2 %

N ₂ O	Measurement range	0 to 100 %
	Measurement rise time	< 500 ms
	Zero point drift	< 2 % / 24 hours
	Zero temperature drift	< 0.4 % / °C
	Gain temperature drift	< 0.3 % / °C
	Nonlinearity error	< 2 %

Measurement range of respiration rate	4 to 60 breaths/minute
---------------------------------------	------------------------

Detection criterion	1 % variation in CO ₂ baseline
---------------------	---

Display update rate	breath-by-breath
---------------------	------------------

NOTE: "f.s." denotes "full scale".

ALARMS**High and low alarm limits**

Adjustable over measurement range to OFF, except high/low
ETCO₂: 0 - 9,9 %, OFF (1 - 75 mmHg) and O₂: 18 % - 100 %,
OFF.

Preset limits

ETCO ₂	HIGH	7 %, 53 mmHg
	LOW	3 %, 23 mmHg
CO ₂ rebreathing level		1 %, 8 mmHg
Inspired O ₂	HIGH	OFF
	LOW	18 %
Inspired (or expired) N ₂ O	HIGH	85 %
	LOW	0 %

Non-adjustable alarms (cannot be disabled)

Apnea: 20 s and 40 s indicators; after 60 s continuous alarm.

Low oxygen: < 18 % (additional O₂ alarm)

Warning for sample tube occlusion.

DISPLAY

Digital displays of:

breath-by-breath ETCO₂
mean ETCO₂,
inspiratory O₂,
inspiratory - expiratory O₂ difference,
inspiratory or expiratory N₂O,
respiration rate,
LED bargraph for instantaneous CO₂ concentration.

EXTERNAL CONNECTIONS

Parallel output for optional printer
Serial RS 232C data output
Selectable Analog Output for CO₂, O₂ or N₂O.

PHYSICAL CHARACTERISTICS

Dimensions: D x W x H: 340 x 330 x 165 mm (13.3 x 12.9 x 6.4 inches)

Weight: 11.0 kg (24 lbs)

Operating Temperature: 10 to 35 degrees C (50 to 95 degrees F)

Storage Temperature: -5 to +50 degrees C (23 to 122 degrees F)

Power Requirements: 110/115/220/240 V; 50/60 Hz; 120 watts

Water trap volume: 9 cc

10.0 APPENDICES

10.1 Connection to an Anesthetic Gas Scavenging System

Regulations against pollution of operating room air by anesthetic gases have often made it necessary to connect the sample gas output to a scavenging system for disposal. If the scavenging system is connected directly to the SAMPLE OUT connector, however, excessively strong suction may cause a large change in the sample flow rate. Connecting the suction tube according to the picture below will prevent this problem.

CAUTION: The scavenging system should incorporate an inlet tube with a diameter sufficiently larger than sample out tubing to prevent a vacuum from being formed.

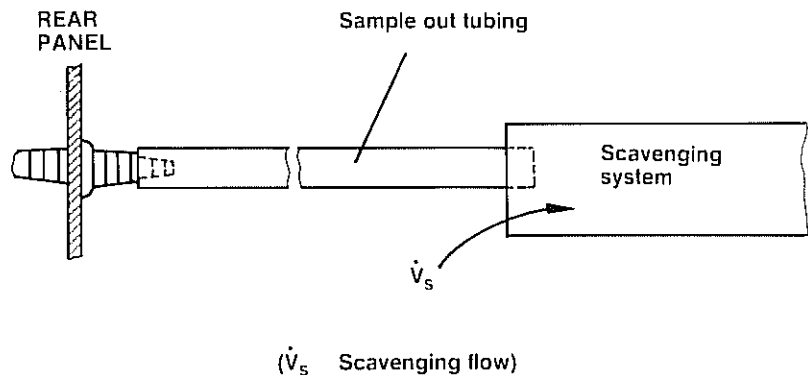


Figure 11 Scavenging System Circuit Flow

10.2 Gas Return Circuit

The gas flow can be returned to the respiratory circuit through a special Datex Return Gas Start-Up Kit, which consists of a sterilized return tube (1), bacteria filter (hydrophobic) (2), and return adapter (3). See Figure 12.

All parts are provided with a Luer lock connection.

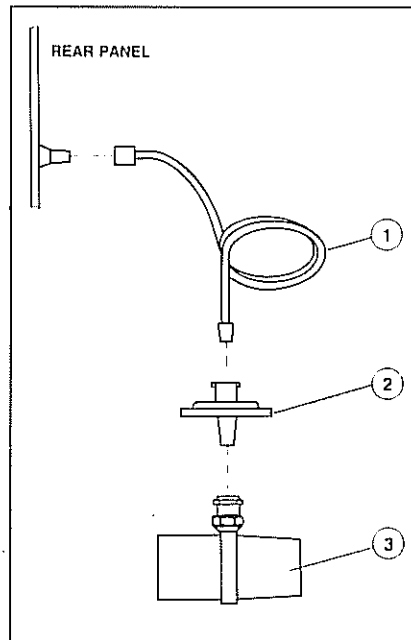


Figure 12 Gas Return Circuit

10.3 Data Connector Pin

25 pin D connector with following outputs and inputs

PIN	FUNCTION	PIN	FUNCTION
1	analog ground	14	D1
2	serial out	15	D0
3	serial in	16	STROBE
4	RTS	17	ACK
5	CTS	18	SW1
6	do not connect	19	L-SW
7	digital ground	20	BUSY
8	D7	21	RESET
9	D6	22	analog out (CO ₂ , O ₂ , N ₂ O), 0 - 10 V full scale
10	D5	23	SW2
11	D4	24	15 VAC out
12	D3	25	15 VAC out
13	D2		

RS232C Data Output

- transmission rate 1200 Baud
- 8 data bits, no parity
- 1 start bit and 1 stop bit
- each parameter has 3 digits. Parameters are separated by commas.

Every 10 seconds, the following string is transmitted:

A00,000,059,060,000,033,037,063,066,013,730,C02,000	Instrument and string type code
A00,000,059,060,000,033,037,063,066,013,732,C02,000	Hours (elapsed time)
A00,000,059,060,000,033,037,063,066,013,729,C02,000	Minutes
A00,000,059,059,000,033,037,063,066,011,728,C02,000	End Tidal CO ₂ (% x 10)
A00,001,000,054,000,033,037,063,066,007,729,C02,000	Inspired CO ₂ (% x 10)
A00,001,000,054,000,033,037,064,066,006,727,C02,000	Expired O ₂ (0 - 100 %)
A00,001,000,066,001,033,037,063,066,006,736,C02,000	Inspired O ₂ (0 - 100 %)
A00,001,000,059,000,030,037,063,066,005,733,C02,000	Expired N ₂ O (0 - 100 %)
A00,001,000,059,000,030,037,064,066,005,729,C02,000	Inspired N ₂ O (0 - 100 %)
A00,001,000,059,000,033,037,064,066,005,729,C02,000	Respiration rate (l/min)
A00,001,001,058,000,033,037,064,066,005,728,C02,000	Gas pressure (mmHg)
A00,001,001,057,000,033,037,063,066,005,730,C02,000	Analog output selection ⁽¹⁾
	Status
	Carriage Return
	Linefeed

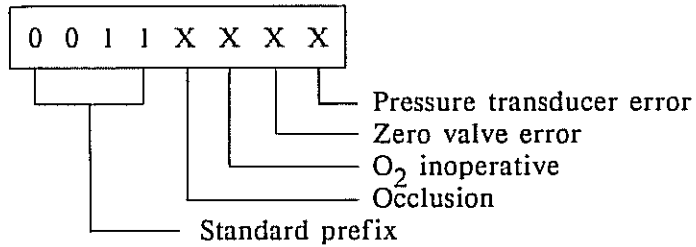
1 CO₂, O₂ or N₂O. If the multi-channel analog output option is installed, ALL, see Appendix 10.5.

Interpretation of three-digit status code:

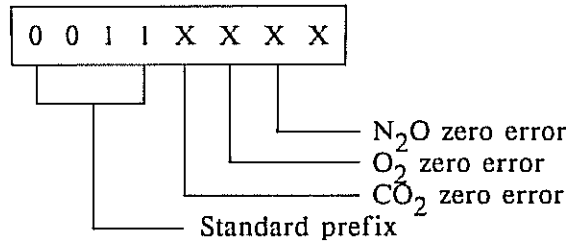
First character 0: no status change, no information.

First character 1:

Second character:

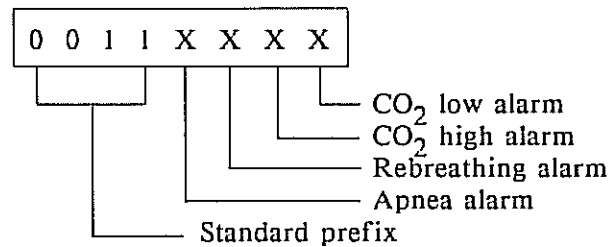


Third character:

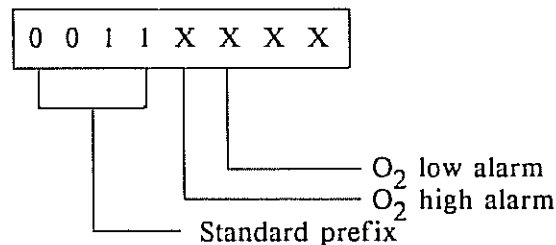


First character 2:

Second character:



Third character:



The standard prefix (0011) is added to make the codes printable characters.

On a printer the codes are shown as follows:

LAST FOUR BITS PRINTED OF CODE	CHARACTER
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	:
1011	:
1100	<
1101	=
1110	>
1111	?

General message string

← Blank
← Text
operative
A00,001,005,056,000,
A00,001,005,056,000,
A00,001,005,056,000,

Alarm activation/deactivation string

```
A99, O2, O2, 061, > , 053
A98, O2
A99, OCC
A99, REB
A98, REB
A99, APN
A99, APN
```

Instrument and string type code (1)

Alarm parameter (2)

Present value (4)

Type of limit violation (3) (4)

Alarm limit (4)

- | | | |
|---|-----------------------------------|---------|
| 1 | A99 alarm activation | |
| | A98 alarm deactivation | |
| 2 | Codes defined for parameters are: | |
| | gases | CO2, O2 |
| | apnea | APN |
| | rebreathing | REB |
| | occlusion | OCC |
| | O ₂ transducer error | O2? |
| 3 | high limit | > |
| | low limit | < |
| 4 | Sent only when applicable | |

10.4 Multicap^R Graphics Printer DP-103

The Multicap^R Graphics Printer DP-103 is an optional add-on module which provides hardcopy documentation of the parameters monitored by Multicap^R. The printer is a thermal dot-matrix printer, for printing waveforms and trends with alphanumeric annotation. There is no power line cord, since the printer derives its power from the Multicap^R monitor.

10.4.1 Connection to the Multicap^R Monitor

CAUTION: Switch power off before connecting the printer to the monitor.

- a) Attach the thumb wheels on the side of the printer to the threaded holes on the side of the monitor. Turn the thumb wheels until they are tight.
- b) Connect the interface cable (873973) from the ANALOG OUTPUT/ PRINTER connector on Multicap^R to the INPUT PRINTER connector on the printer.
- c) Turn the Multicap^R monitor on.

10.4.2 Initiating Printouts

Starting the continuous trend printout

Press the START/STOP key on the printer to initiate the continuous trend printout.

Continuous printing of the trend can be interrupted with the following functions, activated from the printer:

- 1 Printing 30 minute trend history from memory

Press the START/STOP key for 5 seconds. After the trend history has been printed, the printer will revert to the continuous trend mode.
- 2 Printing 10 second capnogram

Press the PRINT CAPNOGRAM key. After printing the capnogram, the printer will revert to the continuous trend mode.
- 3 Continuous capnogram printing

Press the PRINT CAPNOGRAM key for five seconds. To stop printing, press the PRINT CAPNOGRAM key.

Stopping the continuous trend printout

To stop the continuous trend printing, press the START/STOP key.

10.4.3 Changing the Paper Roll

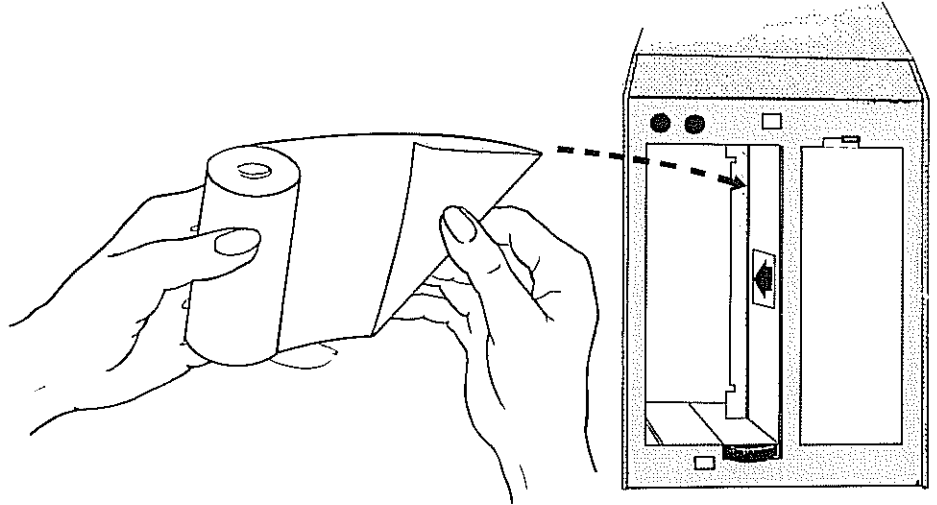


Figure 13 Changing the Paper Roll

To insert a new paper roll, follow the procedure below:

- a) Remove the cover from the paper roll enclosure.
Press the cover to the left and then pull the cover out.
- b) Draw 3 to 4 inches of paper off the new roll and fold the end of the paper at an angle to form an arrow, as shown in Figure 10-3, to facilitate entry into the uptake slot in the paper drive.
- c) Release the paper drive rollers by keeping the lever (1) pressed to the right. Manually insert the paper into the uptake slot at the right rear of the paper roll enclosure. Release the paper drive lever (1).
- d) Manually feed the paper through the printer by turning the thumbwheel (2).
- e) Replace the cover. Locate the two cover hinges into the holes on the left side of the paper roll enclosure. Press the cover to the left until it locks into place.

NOTE: Use only Datex printer paper (73021). The use of other paper may result in poor printing quality or damage to the printing mechanism.

CAUTION: Heat-sensitive paper may fade with time. Documents for long-term storage should be photocopied.

10.5 Multi-channel Analog Recording

The Multicap^R monitor with the analog output option can be connected to 3-channel analog recorder for a simultaneous real time waveform recording of CO₂, O₂ and N₂O.

NOTE: DP-103 printer can not be used with monitors, which have the analog output option.

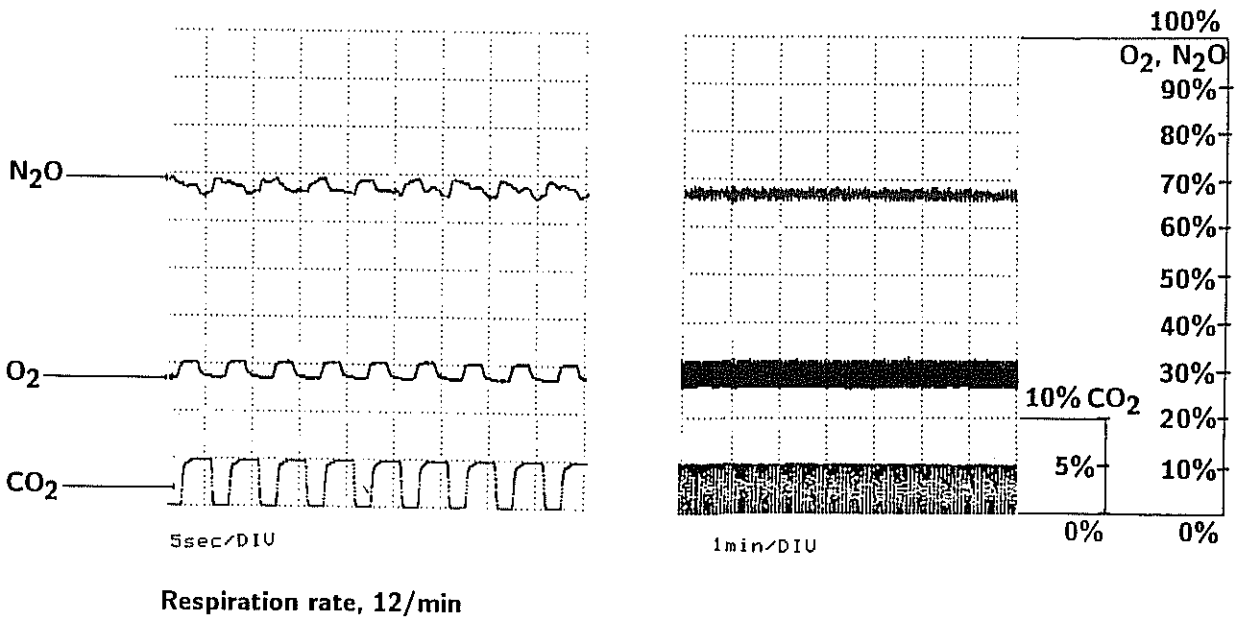


Figure 14 A 3-channel Analog Recording of the Gas Waveforms and Trends

Data connector pin layout of Multicap[®] with optional 3-channel analog output

PIN	FUNCTION	PIN	FUNCTION
1	analog ground	15	+5 V
2	serial out	16	N ₂ O analog out, 0...10V = 0...100% N ₂ O
3	serial in	17	not connected
4	RTS	18	not connected
5	CTS	19	not connected
6	not connected	20	CO ₂ analog out, 0...10V = 0...10% CO ₂
7	digital ground	21	not connected
8	not connected	22	CO ₂ analog out, see pin 20
9	not connected	23	not connected
10	not connected	24	18 VAC out
11	+15 V	25	18 VAC out
12	-15 V		
13	not connected		
14	O ₂ analog out, 0...10 V = 0...100 % O ₂		



MULTICAP^R SOFTWARE REVISION NO. 15

The following new features published in this Operator's Manual do not apply to MULTICAP^R-monitors with software revision 14 or earlier ones:

PAGE	NEW FEATURE	EXPLANATION (compared with the software version 8)
17	'Alarms on' -status is remembered over a short power fail.	Added feature.
24	The factory set alarm limit for high end-tidal CO ₂ is 7 % and for low end-tidal CO ₂ 3 %.	The corresponding values in earlier software versions are 6 % and 4 %.
25	The two-minute audible alarm silence can be interrupted by turning alarms on with ALARMS ON/OFF key	Added feature.
29	Display Message Er 40: 'Er' flashes alternately with '40' on the INSPO ₂ display.	Er flashes on the ETCO ₂ display and 40 on the INSPO ₂ display.
29	Display Message 'Er' flashing alone at a fast rate on the displays of failed gases is a zero-drift warning.	Added feature.
29	Display Message Er 09: 'Er' flashes alternately with '09' on the displays of failed gas(es)	'Er' flashes on the ETCO ₂ display, '09' on the INSPO ₂ display and the failed gas(es), 'CO ₂ ', 'O ₂ ' and 'n ₂ ', on the Mean ETCO ₂ display.

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