

Capnograph and Oximeter

CapOx

User Manual

VirtuOx VPOD CapOx

Instructions to User

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Please to read this manual carefully and then to operate by the instruction of this manual.

It is not allowed to open the monitor's cover without our permission.

Some changes on the product due to the technologies' promotion or due to the special demands of user which do not influence the monitor's work will not be informed further. Furthermore please pay attention to the difference between the parts or components and this manual. You may apply to our company for technical documents about the electric circuit diagram relevant batch and lists of parts or components and so on because the continuous promotion of the product. You may contact us by means of the following address.

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Chapter I Preface

I. Brief

The purpose of this manual is for quick understanding of characteristics, functions, operation of the monitor, preventing from mal-operation and mistakes.

This monitor can supervise four physical parameters of patient at the same time: concentration of EtCO₂, respiration rate, pulse and saturation of SPO₂.

II. Warranty and Maintenance Warranty

The CapOx comes with a standard 1 year warranty

The following is out of warranty:

The monitor is damaged due to bad-operation (without following the manual instruction)

The monitor is managed due to incorrect connection with other instruments.

The monitor is damaged due to accident.

The user changes the monitor on his own will without written authority of the company.

The serial number is torn off or unreadable.

Maintenance

If the monitor is broken beyond warranty period, the manufacturer or distributor will fix it with a charge.

Re-packing

To take out all the sensors and accessories, then to pack them in plastic bag.

It is recommended to use the original packing boxes and packing materials.

It is better to provide description for broken-down phenomenon.

III. Safety Demand

For the purpose of safety, please read the following and abide by the instruction of medical instrumental products.

Warning: Indicating the possible injury on patient or operator.

- This monitor is banned to supervise patient for suffocation, and also is banned to apply during the operation of MRI or CT.

- For the monitor's safely grounding, the hospital shall provide three-pole power socket.
- To use the designated accessories, which complying with standard of manufacturer...
- It is banned to remove the cover of the monitor.
- This monitor provides Concentration of EtCO₂, Respiration rate or Oximeter saturation and Pulse. These data only do auxiliary help for diagnosis but the real diagnosis shall be made by doctor through the clinical evaluation and symptoms.
- In order to keep the patient's skin intact, the SpO₂ 's sensor needs to repute on a new place at least every 24 hours.

Chapter II Technical specifications and characteristics

1. The normal working conditions:

Environment temperature: 10℃~40℃

Relative humidity: 30%~75%

Voltage: AC 100V~250V, Frequency: 50Hz/60 Hz

Air pressure: 86kPa~106 kPa

2. Concentration of EtCO₂ (see note 1)

Range: 0.0-19.7% (V/V), 0-150mmHg, or 0-20kPa

Accuracy: deviation ± 2 mmHg when EtCO₂ concentration in 0-40mmHg

deviation $\pm 5\%$ (reading) when EtCO₂ concentration in 41-70mmHg

deviation $\pm 8\%$ (reading) when EtCO₂ concentration in 71-100mmHg

deviation $\pm 10\%$ (reading) when EtCO₂ concentration in 101-150mmHg

Alarm accuracy: accuracy $\pm 0.2\%$

3. Total System response time

< 1second

4. Respiration rate

Range: 3 ~150 times/min.

Deviation: the bigger of $\pm 1\%$ or ± 1 bpm

5. Oximeter Saturation

Range: 0%~100%

Accuracy: when 50%~79%, $\pm 3\%$ (absolute value);
when 80%~100%, $\pm 2\%$ (absolute value)

6. Pulse

Range: 30 times/min~250times/min

Deviation: when 30times/min~40times/min, ± 2 times/min (absolute value);
when 41times/min~250times/min, $\pm 5\%$ (relative value)

7. Trend

Parameter: EtCO₂ concentration, respiration rate, SpO₂ and Pulse

Range: 24 hours

8. Power Demand:

Voltage: AC 100V-250V, Frequency 50Hz/60 Hz, DC5V

Unit Consume: "5VA

9. Battery

Battery pack 3.6Volt, 3AH

Battery fully charged time: 4 hours

10. The conditions of transportation and storage:

Transportation Demand: It is not allowed for striking, violent vibration and humidity.

Environment temperature range: -40℃~+55℃

Relative humidity range: <93%

Storage demand: In a dry and good ventilating room without corrosive gas and strong magnetic field.

11. Size and weight

Size: 72mm(W) x 155mm(H) x40mm(D)

Weight: about 600g

Note 1: The accuracy of CO₂ concentration measurement is influenced by interfering gas and vapour, for example the N₂O,agent can raise the CO₂ reading(2-10%), and He and O₂ can reduce the CO₂ reading(1-10%), so compensation should be set in the balance gas MENU to meet the accuracy requirement when interfering gases exist.

Chapter III Introduction of Monitor

I. Introduction



Figure 1

(1) Screen: It can display waves, menu, alarm and all measuring parameters.

(2) : Function button:

 a) When menu(except the TREND menu) is activated, to press this button to move cursor.

 b) When the TREND menu is activated, this button is to change-over switch of the trend graph and date table



On the main display, to press this button to silence in 2 minutes.

- (3) **↵**: To press this button to move the cursor when menu is activated.
- (4) **↑**: To press this button to increase figures.
- (5) **↓**: To press this button to decrease figures.
- (6) **ENTER**: Confirmation button: To press this button to enter menu. In the main menu, to press this button to turn on the pump directly when it is off.
- (7)  To press this button to enter or quit menu.
- (8)  Power button
- (9) Indicator **POWER**: If yellow LED is bright, the AC/DC is connected, If blue LED brightening showing the machine is working.
- (10) **CO2**: The faucet of filter
- (11) **SpO2**: The socket of SpO2 .
- (12) DC5V and data interface. Note: this interface is connected to device which meet safety standards (13) Exhaust outlet
- (14) Speaker location
- (15) Battery cabin
- (16) The hanging rope bayonet

Chapter IV Patient connection

I .CO2 measurement

The measurement value will be more accurate if the monitor has 2 minutes' warming-up. To connect the CO2 filter with 3-way joint of the loop of anesthetic machine by sampling tube, or to directly connect patient's nose by the hose.

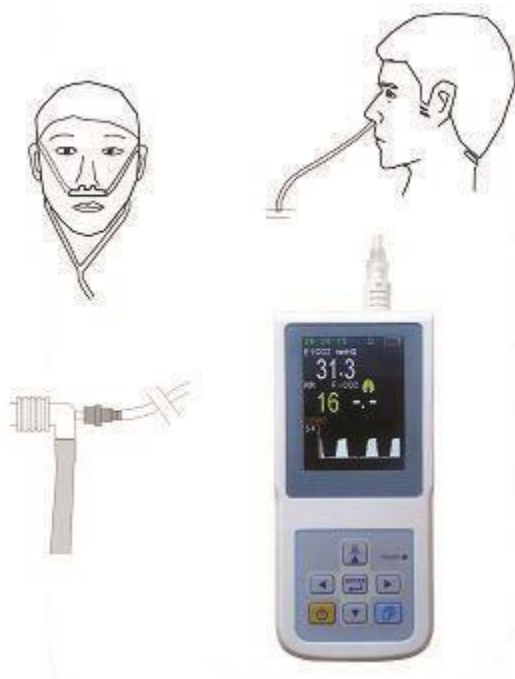


Figure 2

Installation of filter:

⚠ alarm ⚠.

Do not use the capnograph when filter is not installed, so as to avoid pollution of the monitor

In order to avoid breathing vapor and respiratory mucus into the module, the machine must be used with the filter T3.

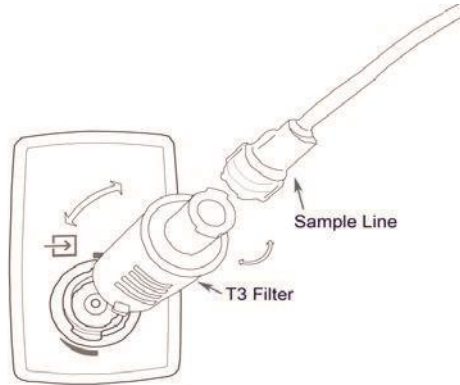


Figure 3

.Instruction for use of the water filterT3:

- 1.) To put the convex cleat of Water Filter T3 into the notch of the inlet port of device and clockwise to turn it to 45°.
- 2.) Attach sample line to Water Filter T3
- 3.) To connect the other end of the sample line with breathing loop of ventilator, anesthetic machine or nasal breathing tube.
- 4.) Change the Water Filter T3 as needed alarm

. If there is leakage, measured values are likely to distortion



alarm



.Use only original sample tube, the other line measurement results may change

II. Respiration rate measurement

The calculation of respiration rate derives from monitoring the wave of CO₂.

III. Theory introduction

1 The measure principle:

The device working theory is NON-DISPERSIVE INFRA GAS ANALIZER.

The device has an AUTO ZERO ADJUSTMENT SYSTEM and GAIN CONTROL

2 Automatic Offset Calibrations

The device was designed to automatically perform calibrations in order to correct for changes in temperature, altitude and electronic component drift. At this moment, respiration wave becomes one straight line.

The air surrounding the device may have elevated concentrations of CO₂ present (such as in an enclosed compartment or room with poor ventilation), we recommend cleaning the CO₂ from the ambient air with a ventilator, otherwise, the device will cause deviation.

3 The Moisture Separation System:

This instrument uses patented filter which can filter a large number of moisture meanwhile maintain minimum dead space without affecting the waveform. But beware: too much moisture can cause congestion; The screen will show "OCCLUSION ", The operator needs to change the filter, the old filter can be reused after natural drying in ventilated and dry environment.

IV. Oximeter density measurement

1. The finger oximeter sensor is recommended to use. The measurement will begin when your finger is put into the sensor clip, meanwhile, the PLETH wave will appear on the screen, after several seconds the saturation and pulse rate appear also. The monitor will utter a sound of "Di" when the each measurement happens. The tone will vary if the values of SpO₂ and Pulse Rate surpass the alarm scope. The more values of SpO₂ and Pulse Rate surpass the sharper the tone will do.

The volume of pulse beep can be modulated and closed down by the item of **BEEP VOLUME** in the SOUND SET menu. The pulse beep will disappear under the silent condition.

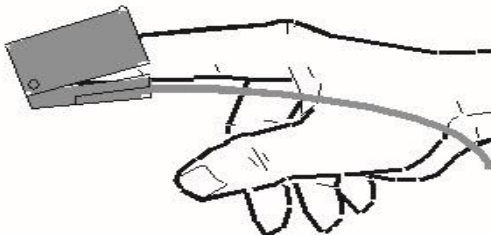


Figure 4

2. The use of SpO₂ sensor for neonate

The SpO₂ sensor of neonate has two parts: Y-shape sensor and fixing wrapping and binding part. When it is being used, Y-shape sensor must be inset into wrapping and binding part. It should be wrapped and bound on the palm or foot of neonate. Pay attention: the two windows of Y-shape sensor should be paralleled and face to face, only in this way can the light signal emitted by light-emitting window, through the body, irradiates on the receiving window. If the two windows are not paralleled and face to face, the monitoring result may be not accurate.

In addition, when SpO₂ is not being monitored the probe should be taken off the monitor or the two windows of sensor should be kept face to face, otherwise the light window will keep shining and PLETH wave will be disordered and the screen will appear **“FAIL SEARCH”**

V. Notice 1 Caution:

Showing clearly possible mis-operation to the device

Under the conditions of electromagnetic influence, for example: electrosurgical devices, MRI, CT etc. will cause negative impact.

The filter should be taken off and replaced when it approaches full of water, otherwise too much moisture will bring irreversible damage for inner components. Be sure that the collection tube is open otherwise it will make inner sampling pump overwork and reduce pump life.

2. Attention: indicating other important information.

1). CO₂:

The readings will be wrong if the monitor does not warm up.

The sampling tube provided by the manufacturer, shall be used, otherwise the readings may be inaccurate.

Under the environment of roughly changed temperature, data measured may not be accurate. Therefore the screen will show **“TEMP IMBALANCE”** when quickly changed temperature overruns a certain range. It is better to use the monitor under the environment stable temperature.

The measured data may be influenced a little bit if the patient is inflicted by kinds of anesthetic gases. To calibrate some interferential gases if necessary.

Please refer to Appendix 2.

Any circumstances of blocking sampling gas, such as bending, folding, contaminations blocking sampling tube and filter or water trap etc. will lead to inaccurate measurement.

2). Oximeter:

The monitor's measurement to SpO₂ may be influenced under outside strong light therefore to cover the probe (e.g. to use surgical tape etc.) if necessary.

Accuracy of oximeter readings will be influenced if there is some radioactive dye in blood.

Please use SpO₂ probe attached with the unit or the one specially designated to this unit.

It may be the problem of SpO₂ probe if the SpO₂ readings or the wave of plethysmogram are obviously abnormal. Therefore to check if the finger has been put into probe enough deep, if the direction is right, if there are some contaminations inside, if the probe is somehow broken or if the two ends of prolonged cable of SpO₂ fall off.

Warning:

It shall not be used if the sensor has some electrical wires and broken interfaces.

The test of high inside pressure of thorax and blood pressure or some other continuous negative influence to venal circle will lead to vein vibration. The signal of pulse will disappear.

If shock, low blood pressure, serious blood vessel shrinking, serious anemia, over low temperature, artery block near sensor and incomplete heart shrinking appear, pulse signal will disappear

Chapter V Screen display and Operation

I. Screen main display menu

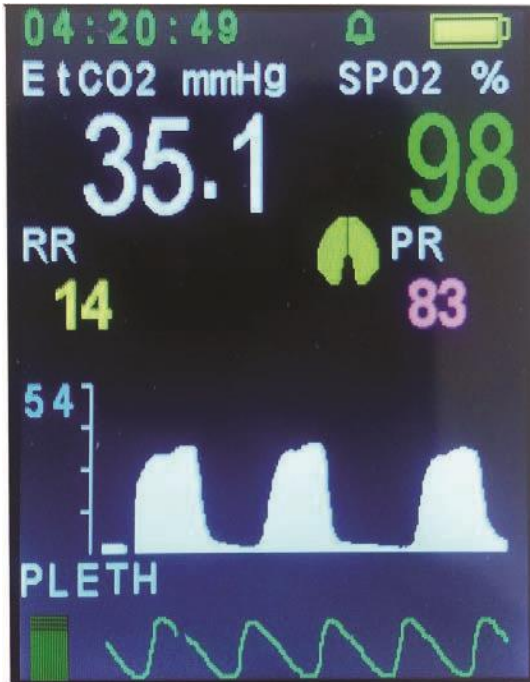


Figure 5

The first line of data shows time(hour, minute)/patient ID,patient type: adult

(ADU) or neonate (NEO), the memory area full indicator  or a bell icon  for alarm sound closing (!), silence () or non silence () and battery indicator .

Attention: When the full indicator for memory area displays, the data of same ID of patient can not be stored. If you want to store the new data, you need to delete the data from the memory area in the menu NEW PATIENT or to change patient's ID.

The second area shows result data:

EtCO₂ concentration, respiratory rate, inhaling CO₂ concentration, oxygen PLETH, exhaling or inhaling state (during exhaling,  becomes blue color).

The third area shows CO₂ respiratory wave.

It shows SpO₂, pulse oxygen PLETH and histogram.

When the pump is closed, "PUMP OFF" will appear on the screen.

When the filter is not inserted into the inlet port, the screen will show 'LINE OFF';, the pump will also be automatically closed

Alarm indication:

- 1) If the EtCO₂'s value exceeds the limit of high or low alarm level, the word 'EtCO₂' will flash and alert with 'Di Di' .The same situation will happen too to respiration rate,SpO₂ and pulse.
- 2) If the battery level is so low that the battery  indicates completely empty, and monitor will utter sound continuously. At this time the monitor will be closed down automatically.
- 3) When the apnea alarm is turned on and the apnea happens and alerts, the screen center will appear with 'APNEA' (It means to stop breathing) flashing, and if the sound alarm is turned on \, it will alert 'DI DI'.
- 4) When the SpO₂ sensor is disconnected or off from finger, the screen will flash the word '**SENSOR OFF**'. If the saturation could not be detected for long time, the screen will flash the word '**FAIL SEARCH**'.
- 5) The volume of continuous or interval sound mentioned above can be modulated and closed down by the item of **ALARM_VOLUME**. The sound will disappear under the silent condition. If the alarm volume is 0, the silence indicator in the main menu will show 'I'
- 6) All the parameters ' alarm for over limits and apnea alarm, will lead to flashing of red alarm indicator on the panel

II. The main menu



Figure 6

When the main menu is open, to press the MENU button to enter the setting menu as FIGURE 6 shows.

In this menu, to press $\uparrow$ or $\downarrow$ button to move the cursor up or down, To press ENTER button to enter the next son menu.

This menu includes the following son menu:

The setting menu for CO2: **CO2_SETUP** The

setting menu for SpO2: **SPO2_SETUP**

The trend menu: **TREND**

The time menu: **TIME_SETUP**

The sound menu: **SOUND_SETUP**

The renew set: **NEW PATIENT** .To renew the new patient, Pay attention, this operation trend will be refreshed meantime so it is needed to reconfirm again.

III. CO2 setting menu

CO2 SET		
EtCO2	ALARM_H	50.0
	ALARM_L	19.0
RESP	ALARM_H	30
	ALARM_L	08
	FLOW SET	100 ml/Min
	APNEA TIME	30 S
	UNIT	mmHg
	CO2 PUMP	ON
	AUTO OFF TIME	10 M
	SWEEP SPEED	FAST
	WAVE SCALE	54mmHg
	EtCO2 AVERAGEING	10 S
	LOAD DEFAULTS	
	EXIT	

Figure 7

In this menu, to press $\uparrow$ or $\downarrow$ button to move the cursor up or down, to press $\rightarrow$ button or $\leftarrow$ button to change the data highlighted by the cursor. Regarding some items in this menu, if not to change the data but just to operate them such as LOAD DEFAULTS or EXIT, then to press **ENTER** button.

In this menu, to press MENU button, then to exit this menu and enter the main menu.

This menu includes the following setups:

- 1).The high alarm limits of EtCO2: **EtCO2 ALARM_H**: 22-99mmHg, off
- 2).The low alarm limits of EtCO2: **EtCO2 ALARM_L**: off, 10-60mmHg
- 3).The high alarm limits of respiration rate: **RESP ALARM_H**:5-60t/m, off
- 4).The low alarm limits of respiration rate: **RESP ALARM_L**: off, 4-40t/m
- 5).Pump flux setup: **FLOW-SET**: 50cc/min-250cc/min
- 6).The setup of apnea time: **APNEA TIME**: 15s-44s, off
- 7).The unit of CO2:**CO2 UNIT**. %, mmHg or kPA
- 8).Pump switch: ON or Off

9). Pump auto-closing time: **AUTO-OFF-TIME**: 10-30min

10). Screen speed of capnograph: SWEEP SPEED: SLOW, NORMAL or FAST

11). CO2 Wave scale: **WAVE SCALE**: 54mmHG or 76mmHG

12). EtCO2 average computation time: **EtCO2 Averaging**: every breath, 10sec, 20sec, 30sec

13). Default reload: **LOAD-DEFAULTS** 14).

Exit: **EXIT**

Attention:

Pump auto-closing time means that the pump will automatically be closed down when in that long time no respiration occurs.

The wave range means the maximum value of waveform amplitude display but it does not mean data on full-scale. Data on full-scale still means 99mmHg.

Default values as follow:

EtCO2 alarm high limit: 50 mmHg

EtCO2 alarm low limit: 19 mmHg

RESP alarm high limit: 30 times/min

RESP alarm low limit: 08 times/min

FiCO2 alarm high limit: OFF FLOW_SET:

100 CC/Min

Apnea time: 30S

CO2 unit: %

CO2_PUMP: ON

AUTO_OFF_TIME: 10 Min

SWEEP SPEED: NORMAL

EtCO2 Averaging: 1 Breath WAVE

SCALE: 54mmHg

IV. SpO2 setting menu

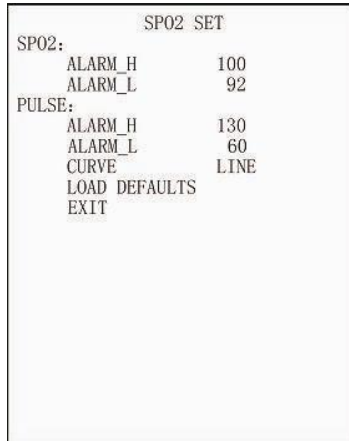


Figure 8 In this menu, to press $\uparrow$ or $\downarrow$ button to move the cursor up or down, to press $\rightarrow$ button or $\leftarrow$ button to change the data highlighted by the cursor. Regarding some items in this menu, if not to change the data but just to operate them such as LOAD DEFAULTS or EXIT, then to press **ENTER** button.

In this menu, to press MENU button, then to exit this menu and enter the main menu.

This menu includes the following setups:

- 1).The high alarm limits of SpO2: **SPO2 ALARM_H**: 50%-100%, off
- 2).The low alarm limits of SpO2: **SPO2 ALARM_L**: off, 50%-99%
- 3).The high alarm limits of pulse rate: **P_RATE ALARM_H**: 70-250t/m, off
- 4).The low alarm limits of pulse rate: **P_RATE ALARM_L**: off, 40-100t/m
- 5).Wave selection: **WAVE**: FILL or LINE
- 6).Renewing of defaults. **LOAD DEFAULTS**

The wave selection means that: FILL indicates the wave of plethysmogram is solid. LINE indicates the wave of plethysmogram is linear.

Default values as follow:

Saturation of SPO2 alarm high limit: 100%

Saturation of SPO2 alarm low limit: 92% Pulse

alarm high limit: 130 t/min.

Pulse alarm low limit: 50 t/min.

Wave: Line

V. The time setting menu

TIME SET	
YEAR	13
MONTH	01
DATE	10
HOUR	21
MINUTE	18
SAVE	
EXIT	

Figure 9

In this menu, to press $\ddot{Y}$ or $\dot{z}$ button to move the cursor up or down, to press $\dot{Z}$ button or $\ddot{Z}$ button to change the data highlighted by the cursor.

Attention: Any time adjustment will renew the trend, so time adjustment shall be careful.

The procedure is as follow:

- 1) Changing time;
- 2) To move the cursor to SAVE & EXIT, then to press the ENTER button to enter the following menu FIGURE 9.1;
- 3) To move the cursor to YES, then to press ENTER button. Only in this way can the time adjustment work.

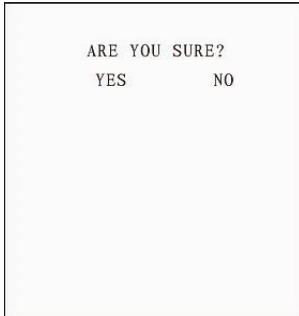


Figure 10

VI. Sound setting menu

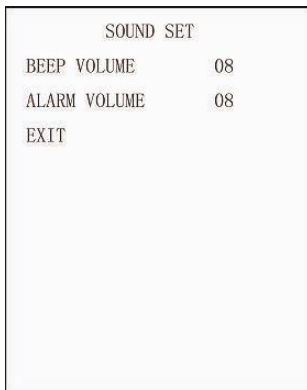


Figure 11 In this menu, to press $\uparrow$ or $\downarrow$ button to move the cursor up or down, to press $\rightarrow$ button or $\leftarrow$ button to change the data highlighted by the cursor. This menu includes following setups:

Pulse sound volume: **BEEP_VOLUME**: 0(OFF)-8

Alarm sound volume: **ALARM_VOLUME**: 0(OFF)-8

If the alarm volume is 0, the top line in the main menu will show '!'

VII. Trend

- 1) The graph trend

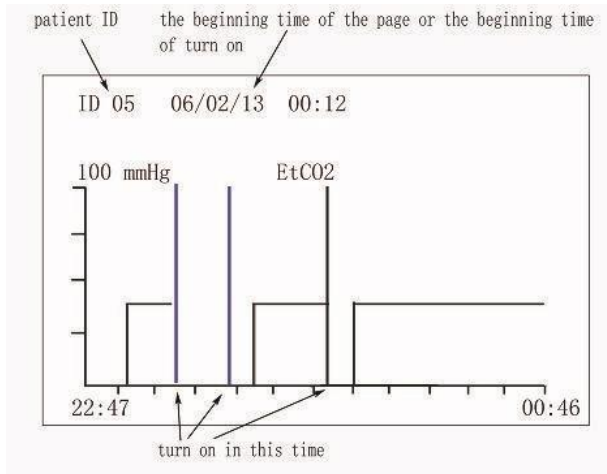


Figure 12

This monitor stores one group data every 12 seconds and keeps them even after power off. This monitor can circularly accumulate trend data for 24 hours.

. When datum are stored and accumulated up to 24 hours, full memory indicator ☐ will display on the top line in the home screen, then the user should change the patient's ID in the menu of NEW PATIENT or delete the existing datum and now the new datum can be stored.

As Figure 12 showing, the time for trend's every page is for 1 hours and every point indicates the result of every 12 second. The top line of this page indicates patient's ID number, the beginning time of this page (date/month/year hour: minute).

If in the corresponding time to the one page of trend table, the user turns off and turns on the device once or more times the trend table will show one or several blue vertical lines with full amplitude, at this time to press $\hat{z}$, then the top row will display the initial information in that turn on time: patient's ID number and initial time. The correspondingly initial blue vertical line will become white one. To press $\hat{z}$ again, the second initial time will display (if having several turning on or turning off).

The time at beginning and ending parts of abscissa in this picture respectively indicates the beginning and ending time for trend of this page.

Sometime the data is not complete, it shows the monitor is turned off although it has not completed 1 hours' record.

In this menu, to press ENTER button to change the trends of CO2 concentration, respiration rate, SpO2 and pulse (the latter 2 parameters are selectable).

In this menu, to press $\bar{Z}$ or $\bar{Z}$ button to change the page of trend.

In this menu, to press $\bar{Y}$ / $\bar{X}$ button to change graph trend to table trend (see Figure 13).

In this menu, to press MENU button to quit this menu and return to the main menu.

2) The table trend

ID	05	06/02/13	07:12	Et	PR	SP02	PR
00/29				00	00	00	00
07:28:12	00	00	00	00	00	00	00
07:28:24	00	00	00	00	00	00	00
07:28:36	00	00	00	00	00	00	00
07:28:48	36	12	99	78			
07:29:00	38	12	98	70			
07:29:12	36	12	98	76			
07:29:24	37	12	98	77			
07:29:36	39	12	98	77			
07:29:48	37	12	98	76			
07:29:00	36	12	98	79			

Figure 13

In this graph trend menu, to press $\bar{Y}$ / $\bar{X}$ button to change graph trend to table trend. To press $\bar{Y}$ / $\bar{X}$ button again, to return to graph trend (Figure 12).

Every trend table shows 10 groups of datum with each about 120 seconds, including time, EtCO2 (Et), respiration rate (RR), SpO2, pulse rate (PR).

Every hour covers 30 trend tables and to press $\bar{Z}$ successively to display next datum of 120 seconds (small page).

In this menu, to press $\bar{Z}$ or $\bar{Z}$ button to change the large page of trend table (to display the upper or lower hour trend table)

In order to check conveniently, if the four datum in every group are zero, the displaying data is blue

VIII. NEW PATIENT

PATIENT	
ERASE ALARM	
CLEAR MEMORY	
NEW PATIENT	
ID	02
TYPE	ADULT
SAVE	
EXIT	

Figure 14 In this menu, to press $\uparrow$ or $\downarrow$ button to move the cursor up or down, to press $\rightarrow$ button or $\leftarrow$ button to change the data highlighted by the cursor. In this menu, to press MENU button, then to exit this menu and enter the main menu.

This menu includes the following setups:

- 1). **ERASE ALARM:** to cancel the current alarm
- 2). **ERASE MEMORY:** to delete all the historical data so as to store the new data
- 3). **ID: patient's ID**, 00-99 optional
- 4). **TYPE:** patient type, adult or neonate optional
- 5). **SAVE:** to store the changed data (this needs to confirm by the new menu due to possibly substitution to the original data of the same ID of patient)
- 6). **EXIT:** to quit the current menu but not to store the changed setup

Chapter VI Charge, Maintenance, sterilization, cleanness

I. Charge

.After AC/DC power converter is connected and unit is turned on, this unit will charge the battery with power at the same time. The battery charge will end after battery is full.

The battery of this unit adopts reusable lithium battery group. In the case of only battery (without DC), the first column shows the battery's volume on the screen. When battery electricity is lack, red  will be flashing, and the DC power must be connected at once.

After plug in the DC power, the instrument can recharge the battery, and stop to charge after the battery is full of electricity

The replaced battery shall be made for environmental treatment.

The battery replacement method:

Note that the operation must be done after the AC/ DC power converter is pull up , otherwise easy to endanger personal safety.

To press and move down the battery cover, then the cover will be remove d, you can remove battery gently, and pull up the white plug, and insert the ne w battery's plug to the same location.

II. Maintenance

If the monitor appears abnormal (e.g. system halted), to press the switch the monitor at least more than 5 seconds, then it can be turned off compulsively.

Filter:

If the screen shows 'occlusion', we need to check if the filter and sampling pipe are blocked, otherwise the life of unit will be influenced.

If it is contaminated the filter should be replaced (If the sampling line and the loop are already known smooth).

It also should be replaced if its longest usage period is already overrun.

Please do not let alcohol, cleaning reagent or sterilizing reagent into filter.

To check the filter from the side of the fence whether internal membrane is dry clean before it is used. After each use, filters should be pulled out, the surface should be cleaned and placed in ventilated and dry environment to

let its internal moisture volatilizes nature. All this work is to make easy use for next time

Attention:

The sample line or water trap should be not sterilized and used repeatedly if the packing indication shows that it is disposable.

Attention: For the environment, disposable sample line or filter shall be treated suitably or recycled.

III. Sterilization, cleanness

Warning-Before to clean the monitor and probe, power shall be turned off and switched off form AC current.

1. The cleanness and sterilization of SpO₂ probe. Care:

Not to sterilize the probe by the high pressure.

Not to dip the probe into liquid.

Not to use the probe if they have the sign of brokenness or degeneration.

Cleanness and sterilization:

To clean it with the soft cloth moistened with medical alcohol, then to wipe with dry cloth.

2. Cleanness and sterilization of filter

Attention:

To use clear and sterilized filter.

Cleaning:

Only the filter surface may be cleaned and/or disinfected Sterilization:

To use 70% of alcohol or isopropyl alcohol, glutaraldehyde and Chlorhexidine and ethanol etc. to sterilize.

Chapter VII Analysis of problems

Simple analysis of problems

No.	Phenomena	Causes	Solution
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1	The values of CO2 is lower	1. Leaking of filter or sampling tube 2. Occlusion of filter or sampling line 3. Parts overused or excursed.	1. To check and replace filter or sample line 2. To clean the gas loop. 3. To calibrate by standard gas.
2	The values of CO2 is zero 1. Screen indicating PUMP ERR and big noise. 2. Screen indicating IR-LAMP-BAD 3. Screen indicating CO2 SENSOR ERR	1. Heavy leaking inside the gas loop 2. The lamp resource of sensor damaged 3. Sensor broken	To contact the manufacturer.
3	Screen indicating CAL-ERR	The last calibration is failed.	To recalibrate by the standard gas.
4	Screen indicating POWER-ERR	Wrong power supply.	To contact manufacturer.
5	The CO2 wave is not normal. 1. Screen indicating TEMP-HIGH 2. Screen indicating TEMP-LOW 3. Screen indicating TEMP-IMBALANCE	1. Temperature too high. 2. Temperature too low. 3. Temperature sharp change	To provide normal environmental temperature.

6	No values of SPO2 or no wave	1.Finger too cold 2.Interference of strong light	1.Warm up finger 2. Avoiding strong light.
		3. The measurement test of SpO2 and blood pressure are done on the same arm. 4. Red light in the sensor no flashing. 5. Infrared and collector of sensor is not clean	3 .Avoiding such phenomenon. 4.Renew sensor of SPO2 5.Cleaning
7	Flashing 'LOW BATTERY' and closed down automatically.	1. Battery lack of power.	1. To connect AC power.
8	Still flashing 'LOW BATTERY' after the power is supplied and AC indicator no light.	AC power working abnormally.	1. To check AC electric current and cable.

Attention: Please to contact the client' service center if some problems occurred repeatedly.

Appendix 1. Explications for the appreciated terms

MENU	Menu
EtCO ₂	The co ₂ concentration of expiration end phase
INCO ₂	The co ₂ concentration of inspiration phase
SPO ₂	Oximeter saturation
RR or R-RATE	Respiration rate
PR or P-RATE	Pulse rate
mmHg	Millimeter hydrargyrum
KPA	Kilopascal
ALARM-H	Alarm high limit
ALARM-L	Alarm low limit
LINE	Linear
FILL	Filled or solid
BEEP_VOLUME	Pulse volume
ALARM_VOLUME	Alarm volume
LOW BATTERY	Lack of power
APNEA	Apnea or breath stop
T/Min	Times/ minute
CAL	Offset Calibration
SET	Setup
N ₂ O:	Nitrous oxide
HELIUM	Helium gas
O ₂ CONCENTRATION	O ₂ concentration compensation
ANESTHETIC GAS	Anesthetic gas
ZERO GAS	Base point or Zero point
BTPS	Temperature and deep lung air pressure compensation
CALIBRATE	Calibration
CANCEL:	cancellation
OCCLUSION	Block

Appendix 2. Changing compensation of balance gas

Attention! Only the trained person can do the following the procedures.

First to enter the engineer menu, the method as follows:

To press **Ź** and **▼** two buttons simultaneously, then to enter the following menu.

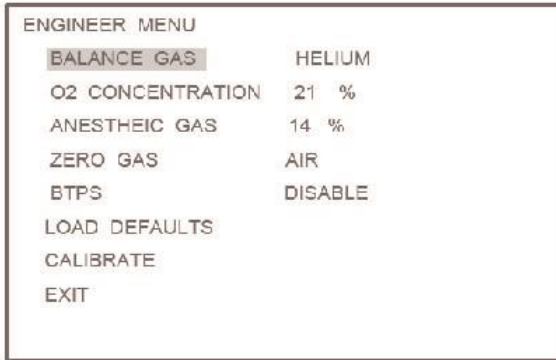


Figure 15

In this menu, to press **Ÿ** or **Ź** button to move the cursor up or down, to press **Ź** button or **Ź** button to change the data highlighted by the cursor.

The some items of this menu can be directly operated, such as LOAD-DEFAULT or EXIT: to press ENTER button, then to be executed without through changing data. In this menu, to press MENU button, then being able to exit this menu and to enter the main menu.

This menu including the following setups

BALANCE GAS: AIR, N2O, and HELIUM

O2 CONCENTRATION: 20%-99%

ANESTHEIC GAS: 0-20% **ZERO**

GAS: AIR, N2

BTPS: ENABLE, DISABLE

LOAD DEFAULTS

CALIBRATE

Default values as follows

BALANCE GAS: AIR

O2 CONCENTRATION: 20 %

ANESTHEIC GAS: 0 %

ZERO GAS:AIR

BTPS: DISABLE

Appendix 3. Calibrating of EtCO₂ precision

Attention: Only the trained person can do the following the procedures.

1. Attentive items and preparative work

All the devices have been calibrated before they are out of manufacturer and during every turning on they will do excursion control and gain adjustment according to working environmental temperature, pressure and balance gas etc. so generally the user does not need to calibrate himself or herself. If the unit has been used over one year and clinic readings' deviation is big, the following procedure shall be obeyed.

1.1 Necessary instruments:

CO₂ standard gas (Concentration is about 5%, or 5.0-7.0%)

Three- pass connector: inner diameter 1-3 mm, connecting with gas bottle, the water trap and open air, is used for connection and protection. This is because the device can not bear 1.1 air pressures and it is strictly forbidden to connect the gas bottle directly with the device. The one end of three-pass connector directly opens to the air so as to release the more gas and pressure into the air even the standard bottle flows out larger gas.

The two tubes whose length can extend outside room: The standard gas flows into the air continuously through the three-pass connector and the module pump vents also standard gas, in the meantime CO₂ gas of higher concentration accumulates easily and quickly around the device. If the two parts of these standard gases can not be vented outside room, the device will pick up the value with higher concentration as Zero, thus this will influence calibration accuracy.

1.2 To connect as following:

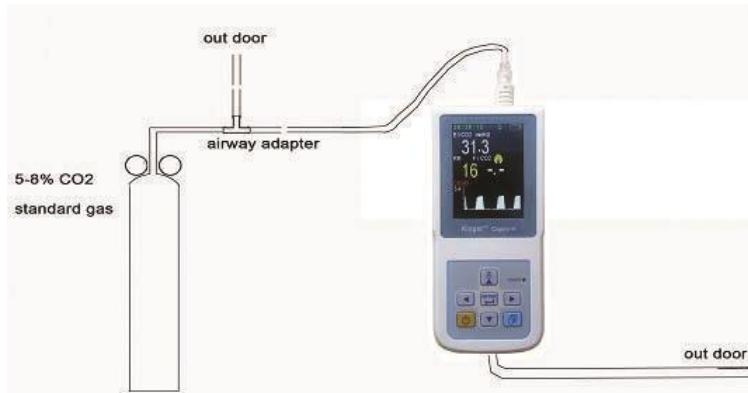


Figure 16

2. Warm-up: to turn on power and run the unit for 20-30 minutes and adjust the pump flux over 120cc/min. To check if there is a leakage, the method is as following: To squeeze the sampling tube by hands, the accelerating turning sound of sampling pump increases obviously. If the sampling pump does not accelerate and its turning sound also does not change under hands' squeezing, then there must be a leakage in loop somewhere. At this time, it is not good for demarcation. It's better to find out leakage point and solve it, otherwise, it will leads to short value measured. After warming-up, to open standard gas, to listen if the sound of pump is as same as original one. If the pump's turning is slow and its turning sound is weak, that means the standard gas export is too large, at this time its export flux needs to turn down until the sound of sampling pump resumes its original volume.
3. To enter the engineer menu again (procedure is same as Appendix 2, Figure 15), to move highlight onto CALIBRATE, then to press ENTER button to enter the next menu.

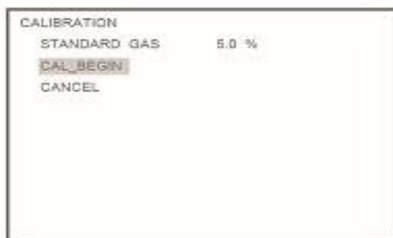


Figure 17

To move highlight onto STANDARD GAS, to adjust the value as same as the concentration of CO2 standard gas, if your standard gas concentration is precise enough to behind decimal two numbers, you can adopt a round method.

To move the highlight onto CAL-BEGIN and to press ENTER button, in the same time, to open the standard gas as the demand of Figure17 and attention items, the device begins to calibrate. Meanwhile, in the middle of FIGURE 18 appears 'ADJUSTING!'

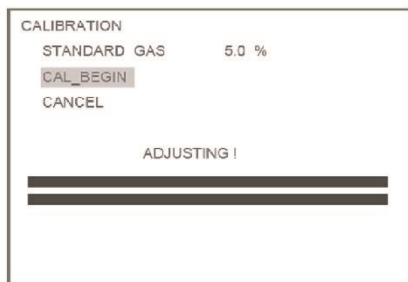


Figure 18

The cross thick bar in this menu will be erased as time passes and the calibration will be ended when it is completely erased. If the calibration is successful, the menu will show ADJUST OK and subsequently exit into the main menu. If the calibration is unsuccessful, this menu will show ADJUST ERR, at this time, the loop needs to be checked if there is a leakage or running out of standard gas (the pressure indicator of gas bottle shows 0). This menu still stays here if the calibration is unsuccessful.

If hoping to exit this menu during the calibration, just to press MENU button or to move the highlight onto CANCEL, then to press ENTER button.

Do not forget to close down the switch of the standard gas bottle and depressurized valve lest the standard gas should be wasted.



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