MEKANT User Manual

Ventilator System

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Definitions

This operator's manual uses three special indicators to convey information of a specific nature. They include :

Warning

Indicates a condition that can endanger the patient or the ventilator operator.

Caution

Indicates a condition that can damage the equipment.

NOTE :

Indicates points of particular emphasis that make operation of the ventilator more efficient or convenient.

CONTENTS

Operator’s Guide

1 Introduction 9

1.1 Warnings and Cautions 9
1.1.1 Warning 9
1.1.2 Caution 11
1.2 General description 15
1.2.1 Front picture and the explanation 16
1.2.2 Back side picture and explanation 18
1.2.3 Left side picture and explanation 20
1.2.4 Right side picture and explanation 21
1.3 Specifications 22
1.3.1 Features 22
1.3.2 Electrical Specifications 22
1.3.3 Functional Specifications 23
1.3.4 Pneumatic Specifications 29
1.3.5 Physical data 29
1.3.6 Environmental data 30
1.4 Standards and safety requirements 30
1.4.1 Standards and safety requirements 30
1.5 Symbols 31
1.5.1 Description of Symbols 31
1.6 Maintenance 35

٢. Installation and set up 37

٢.١. Installation 37
٢.٢. External electrical supply 37
٢.٢.١ AC description 37
٢.٢.٢ External battery 38

٢.٣ Internal battery …… 40
٢.٣.١ Internal battery Indicator …… 41
٢.٣.٢ How to change internal battery …… 42
٢.٤ Oxygen and Air supply …….. 43
٢.٥ Filters …… 44
٢.٦ Transportation …… 45
٢.٧ Fuse replacement instruction …… 45

٣. Operating instructions …….. 47

٣.١. Front panel …… 47
٣.١.١ Rotational Control Knob …… 47
3.1.2 Alarm lamp …… 47
٣.١.3 Keypad …..…….. 48
٣.١.4 LED Indicator …….. 51
٣.٢ Operating……. 52
٣.٢.١ Operating procedure and how to use…….. 52
٣.٣ Display …… 54
٣.٣.١ Status information …….. 55
٣.٣.٢ Measurement information ……. 56
٣.٣.٣ Waveform and alarm status …….. 57
٣.٣.٤ Setting information …….. 58
٣.4 Menu ……. 59
٣.4.١. VENT Mode …….. 60
3.4.1.1 VACV ……. 62
3.4.1.2 VSIMV …… 65
3.4.1.3 SPONT …… 68
3.4.1.4 PACV ……. 71
3.4.1.5 PSIMV …… 74
3.4.1.6 TBILEVEL …… 77
3.4.1.7 NIV …….. 81
3.4.1.8 PRVC …….. 83
3.4.1.9 AUTO ……... 85

٣.4.٢ Alarm set 86
٣.4.٣ Trend Mode 88
٣.4.٤ SYSTEM SETUP 90
3.4.4.1 SOUND..... 91
3.4.4.2 NEBULIZER 92
3.4.4.3 Graph SETUP 93
3.4.4.4 User SETUP..... 95
3.4.4.5 SYSTEM SETUP..... 104

٤. Alarms 111

٤.١ General Information 111
٤.٢ Alarm Massage..... 112

Appendix 113

A. Operating theory 114
B. Communications 117
C. Parts accessories 120

Service Calls 122

Introduction

SECTION 1

This operator's manual explains the way of installation and usage for MEKANT. Notice for use explains general information to be careful while using the product and other notices are written with each function. Users are recommended to be aware of notice for use and all menus before using the product.

This operator's manual is allowed to use by doctors or authorized persons who are permitted to use, or designed to use by qualified and trained persons for using this products.

Service, test, correction and main continuous working will be written in service manual of MEKANT Ventilator. However, service manual is allowed to be possesed by authorized persons by MEKICS.

1.1 Warnings and Cautions

1.1.1 Warning ⚠

Please make sure to use MEKANT by authorized persons and read the manual before use. Check the setting figure of various sensors and devices before use. Users shall check out whether the environment is OK before use.

Please be aware of the manual provided by the manufacturer when it is used or kept.

Do not use it near inflammable anesthetic to avoid any possible explosion.

Do not disassemble or open the main body to avoid electrical impulse. Disassembly of the equipment shall be allowed by service staffs approved by MEKICS Co., Ltd.

Users shall be careful with circuit joint to be connected with patients.

Always shall be careful with leakage of electrical current and consult with hospital technical engineer if any doubt.

In case of abnormal working or any damage in the equipment, it shall not be used for patients.

Do not touch patient, table or the equipment if a defibrillator is used.

Disposable stuffs and disposable circuit for patients shall not be reused.

Reusable stuffs used for patients shall be sterilized or washed for reuse.

Check out the level before setting alarm. Alarm limitation shall be done for the current selected group. Alarm setting can be changed by level change.

Do not correct calibration while used for patient. Please correct it after disconnection from patient if any doubt.

Insulate power source in case that the equipment is wet and call a hospital technical engineer.

Please connect earth cable to earth connection port to protect patients and the product.

Do not disassemble the product in any case.

Do not install the various kinds of sensor to patients too strongly and not to be entangled.

Do not reuse it if you find this symbol ⊗ *on the accessory, which means disposable stuff.*

MEKANT shall be tested regularly if it is working in normal condition.

Accessories are aseptic products, so the package shall not be torn before use and products shall be free from any defects or cracks.

1.1.2 Caution ⚠

MEKANT as respiration assistant equipment for adult helps for normal breathing by setting breathing way, breathing volume, breathing times, oxygen density, breathing rate etc in order to solve hypoxia to be appeared from emphysema of the lungs patients or respiratory disease patients. It is a respiration assistant equipment with various alarm function and safety device for safe respiration management, but above all, should be used together with other clinical information for patients' safety and diagnosis.

Avoid the place where there is moisture.

Do not handle the equipment with wet hands.

Avoid the place under direct rays.

Use the equipment within the limits of temperature ١٠ ~ ٤٠ centigrade and humidity ٣٠ ~ ٧٥%

Do not place the equipment near electronic heater.

Do not place the equipment under high humidity and bad ventilation.

Do not place the equipment where it is possible to take vibration or sudden impulse.

Do not place the equipment where to be damaged by explosive gas or chemicals.

Protect the equipment from dust or metal scrap.

Pull out power code with plug grasped, instead of cable.

Check out the main equipment and sensor at the same time after cleaning the equipment. Do not use if there is any damage in the equipment.

Make the cable and sensor clean after use. Clean them by towel with alcohol soaked and do not use benzene or gasoline.

Do not use the equipment in dangerous place. Always be careful with the possibility of bad influence by environment.

It is possible to be flew more current than allowed when the assistant device is used. Consult with hospital engineer or authorized local dealer.

Check out the basic auxiliary device regularly. Do not use a damaged or electrical unstable device. Consult with hospital engineer if any doubt.

Do not use the goods beyond standard certified one. This product shall be used under standard certification. Manufacturer does not take responsibility for the problem occurred while using the product beyond standard certification.

The product can be disassembled by educated and authorized staffs. If a user violates this item, after sales service is not provided.

Do not install the various kinds of sensor to patients too strongly and not to be entangled.

Do not place the product where it is possible to fall to a patient.

Do not move the equipment when power code or high pressure hose cage is connected. It will be harmed for patient or the equipment has an error by itself

If a measured figure is turned out not to be correct, consult with hospital engineer or authorized local dealer.

Connect the equipment isolated from other devices electronically for patients' electrical safety.

Accessories of MEKANT shall be used with the ones provided by MEKICS or MEKICS's designated dealer or listed in the manual. MEKICS or MEKICS's designated dealer provide standard certified products only.

MEKANT shall be tested regularly if it is working well.

Turn off main switch located backside of the product after use.

Place the product in stable position.

Use the sensor and cable provided and designated by manufacturer, and consult with hospital engineer or authorized local dealer if you want to use other products.

Replace the disposable sensor after use.

Sep up the equipment when it is needed.

Minimize patient's move when it is used.

Make high pressure hose and cable clean after use. Clean them by towel with alcohol soaked and do not use benzene or gasoline.

The Oxygen Air pressure which is impressed pneumatic block should be between ٣٥PSI and ٩٠PSI. Otherwise, it would affect the equipment.

Move the equipment with fastened to avoid any possible damage to other products or people by the monitor or cable.

Basically, MEKANT is designed not to have functional disorder by surrounded electronic wave. But, it is possible to be occurred any disorder due to high frequency of surrounding. It may be possible to calculate wrong figure, lose present figure or show noisy wave. Please ask MEKICS technical service center or local distributor if you need help.

Please turn off the power to recharge the battery when it is not used.

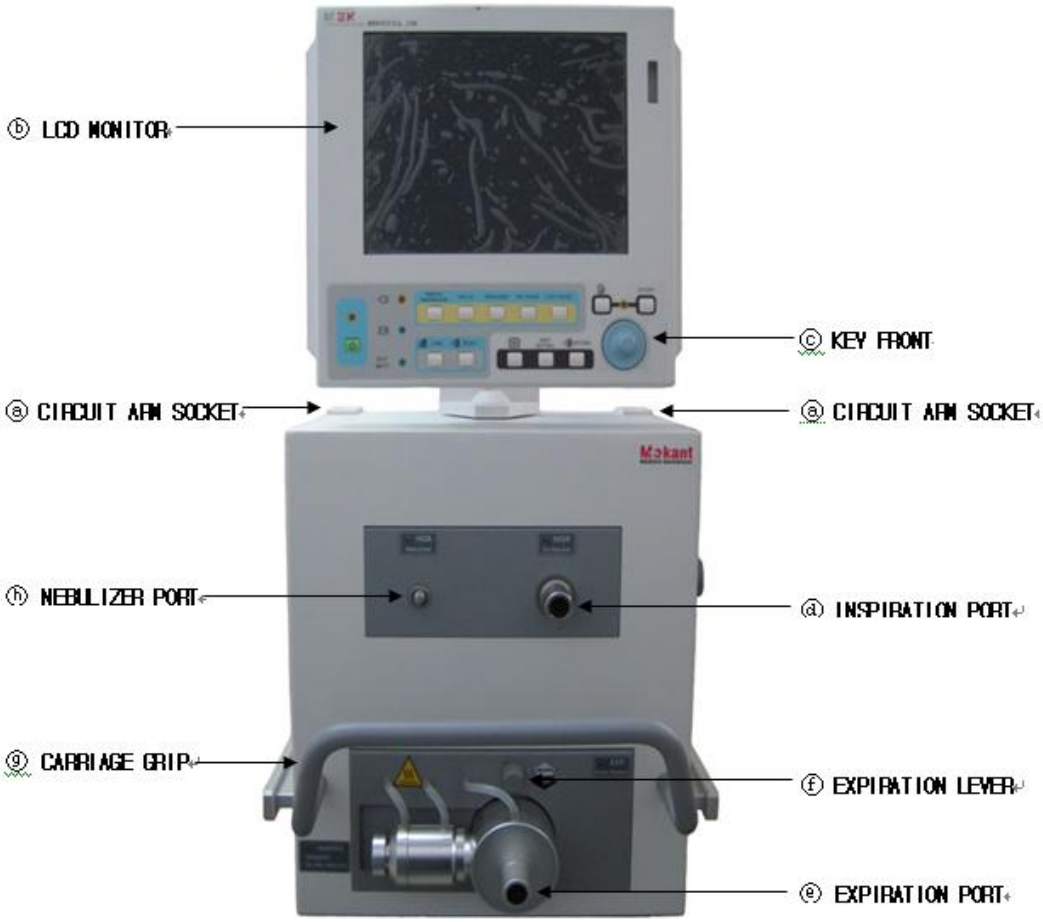
MEKANT ventilator system is a product conforming to Class II b.

1.2 General Description

MEKANT as respiration assistant equipment for adult helps for normal breathing by setting breathing way, breathing volume, breathing times, oxygen density, breathing rate etc in order to solve hypoxia to be appeared from emphysema of the lungs patients or respiratory disease patients.

It is a respiration assistant equipment with various alarm function and safety device for safe respiration management, but above all, should be used together with other clinical information for patients' safety and diagnosis

1.2.1 Front picture and the explanation



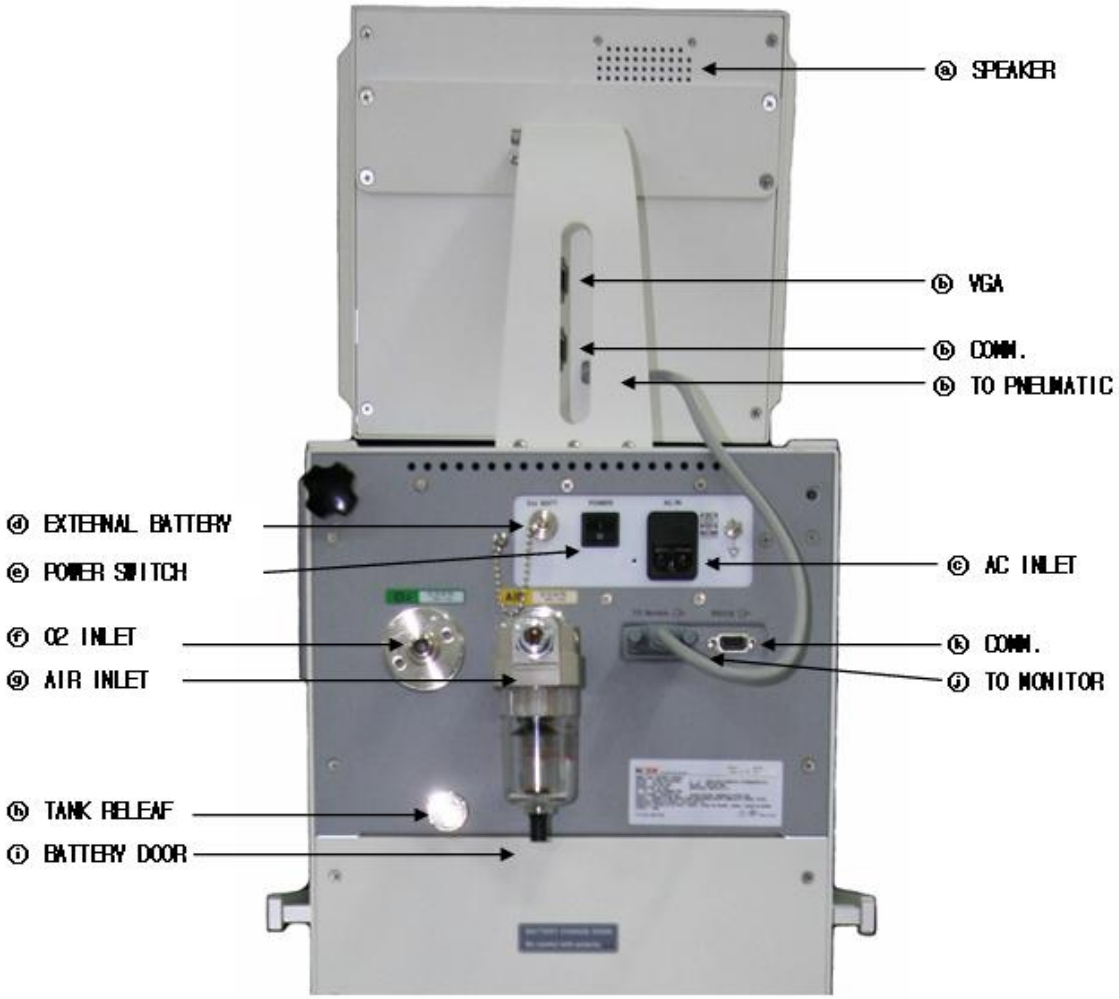
1 Instruction

No.	*Part*	*Description*
ⓐ	**Circuit Arm**	*Install Circuit Arm for patient.*
ⓑ	**LCD Monitor**	*Show the condition of various ventilators and patients.*
ⓒ	**Key Pad**	*Key button and encoder.*
ⓓ	**Inspiration Connector**	*Joint hole to connect to patient.*
ⓔ	**Expiration Connector**	*Joint hole to connect from patient.*
ⓕ	**Expiration Lever**	*Lock or unlock lever for Expiration Assembly.*
ⓖ	**Carriage Grip**	
ⓗ	**Nebulizer Port**	*Connection to spray medicines*

Warning

Be careful because heated exhalation assembly due to moisture during exhalation.

1.2.2 Back side picture and the explanation



No.	*Part*	*Description*
ⓐ	**Speaker**	*For alarm and sound.*
ⓑ	**VGA** **COMM** **To Pneumatic**	*VGA cable connection hole to show patient condition on the other Monitor.* *Cable connection hole to connect PC or central connection.* *Connection hole to connect to the main body.*
ⓒ	**AC Inlet**	*Connection hole for AC power input.*
ⓓ	**External Battery**	*Connection hole for external battery.*
ⓔ	**Power Switch**	*Power on/off switch for common use.*
ⓕ	**O2 Inlet**	*Connection hole to connect to main body using high pressure hose to approve O٢ gas.*
ⓖ	**Air Inlet**	*Connection hole to connect to the main body, using high pressure hose to approve air gas. Device to filter the moisture in the Air.*
ⓗ	**Tank Relief**	*Outlet to exhaust the over pressed air when the pressure of air tank is over than 40 PSI.*
ⓘ	**Battery Replacement Door**	*Door to replace the internal battery.*
ⓙ	**To Monitor**	*Connection for monitor.*
ⓚ	**COMM**	*Connection hole for pneumatic communication.*

Warning

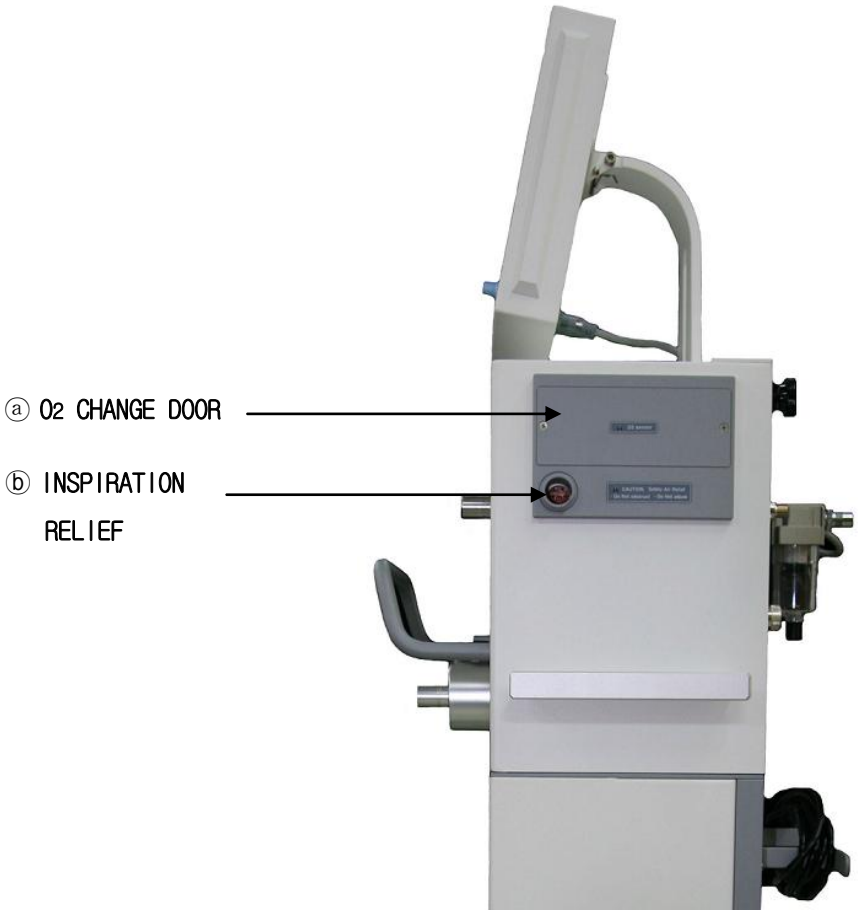
You should be careful with battery's polarity when it is exchanged. Products can be damaged when polarity is connected wrongly.

It should be careful of battery's terminal to be short on the metal part

1.2.3 Left side picture and the explanation

ⓐ **LOCKER** *Locker to disassemble main body with cart.*
Pull to unlock and push to lock.

1.2.4 Right side picture and the explanation



ⓐ **O٢ Exchange Door**	*Door to be used for exchanging O٢ Sensor.*
ⓑ **Inspiration Check Valve**	*Safety valve to exhaust by software, hardware and mechanically when the equipment is out of order.*

Warning

Do not stop up safety valve to exhaust by software, hardware and mechanically when the equipment is out of order.

1.3 Specifications

1.3.1 Features

User friendly POP-up Menu with rotary and push/pull Encoder.
١٠٠%O٢, Inspiration Pause, Expiration Pause, Key-Lock ,
Manual and/or Auto Nebulizer
Dual Alarm (Speaker / Buzzer) system
External battery (for Mobile application)

1.3.2 Electrical Specifications

AC input voltage	*١٠٠- ١٢٠VAC, ١٠A ٥٠/٦٠Hz*
	٢٠٠- ٢٤٠VAC, ٥A ٥٠/٦٠Hz
AC input FUSE Rating	*٢٥٠V/6.3A*
Power consumption	*٨٤W max*
External DC input voltage	*١٢V @ ١A Pb battery*
Internal battery	*Battery ; ١٢V / ١A Pb battery* *Operating time: 3 hours minimum .* *Recharge time; 4 Hours max.* *Please change it after ٢ years use.* *It can be used for 30 minutes normally. On the other hand, it will be more than 30 minutes if power consumption is small.*
Communication	*Central interface ; RS-٢٣٢ serial interface* *Baud rate 1 ١5, ٢٠٠bps,* *Upgrade (Main board, Pneumatic board)*
Display	*10.4" LCD monitor,* *640*480,*

1.3.3 Functional Specifications

MODE

V-ACV *Volume Assist Controlled Ventilation*
Controlling patient's mechanical artificial respiration based on air volume and adjusting inspiration and exhalation time by force.

V-SIMV *Volume based Synchronized Intermittent Mandatory Ventilation*
Controlling artificial respiration based on air volume in accordance with patient's voluntary respiration.

SPONT Spontaneous Ventilation
Giving pressure support centering around voluntary respiration.

P-ACV *Pressure based Assistance Controlled Ventilation*
Controlling patient's mechanical artificial respiration based on pressure.

P-SIMV *Pressure based Synchronized Intermittent Mandatory Ventilation*
Controlling artificial respiration based on pressure in accordance with patient's voluntary respiration.

T-BILEVEL *Same as SPONT and exist Upper PEEP (Refer to SPONT mode)*

NIV Non Invasive Ventilation
During artificial respiration by mask type, not tubing type, PACV working in allowance of air leakage. (Refer to PACV mode)

PRVC *Pressure Regulated Volume Controlled* Ventilation
Breaths are delivered mandatorily with a constant flow to assure present volumes.

AUTO Quick start according to body weight. (Working in PACV mode)

SETTING PARAMETER

	Setting range	**Condition**	**Default**
BW	3 kg ~ ١٥٠ kg		١٠ml/kg
Pressure	٥ ~ ٨٠ cmH_2O	±(١.٧ + ٤% of the actual reading) cmH_2O	٣٠ cmH_2O
Plateau time (pause)	٠ ~ ٢ sec		٠.١ sec
PEEP	٠ ~ ٤٥ cmH_2O	±(١.٧ + ٤% of the actual reading) cmH_2O	٣ cmH_2O
High PEEP	٥ ~ ٤٥ cmH_2O	±(١.٧ + ٤% of the actual reading) cmH_2O	+١٥ cmH_2O
Low PEEP	٠ ~ ٤٥ cmH_2O	±(١.٧ + ٤% of the actual reading) cmH_2O	+٣ cmH_2O
High PEEP time	٠.٢ ~ ٢٤ sec	±١٠%	١ sec
Low PEEP time	Infinite		

	Setting range	**Condition**	**Default**
Inspiration time	٠.٢ ~ ٩.٩ sec	±١٠%	١ sec
Fend	٢٥ ~ ١٠٠ %		١٠٠ %
Rise	SLOW,MID,FAST		MID
E-sense %	١٠ ~ ٦٠ %		٣٠ %
Pressure Support	٠ ~ ٤٥ cmH_2O	±(١.٧ + ٤% of the actual reading) cmH_2O	٠ cmH_2O
Trigger sensitivity Pressure	٠.٥ ~ ٢٠ cmH_2O	±(١.٧ + ٤% of the actual reading) cmH_2O	٥ cmH_2O
Trigger sensitivity Flow	٠.٥ ~ ٢٠ L/min	±١٥% (V_{MIN}> ٦lpm) ±٠.٥lpm (V_{IMIN}≤ ٦lpm	٥ lpm
Volume	5 ml ~ ٢٥٠٠ ml	±١٥% (V_{TIDAL}> ١٠٠ml) ±٢٠ml (V_{TIDAL}≤ ١٠٠ml)	١٠ ml/kg
Rate	٢ ~ ١٢٠ bpm	±٢bpm	٢٠ bpm
O_2 %	٢١ ~ ١٠٠ %	±٣%	٣٠ %

	Setting range	**Default**
Nebulizer	١٠ ~ ١٨٠ min	off
	Limited ٢٠٠ml	
	Flow trigger	
	base flow can not use	
Inspiration pause	Resistance measurement	off
Expiration pause	Compliance measurement	off
Manual Inspiration	Setting tidal volume	off
١٠٠% $O_٢$	٢ minutes	off
Key lock	Function key lock	off

QUICK RUN (Emergency Start Ventilation)

	Setting range
I : E	١ : ٢
$O_٢$	٤٠ %
Mode	*PACV*
Inspiration Pressure	٢٥ $cmH_٢O$
Inspiration time	١ *sec*
Expiration time	٢ *sec*
Respiration rate	٢٠ *bpm*
PEEP	٣ $cmH_٢O$
Trigger type	*Pressure type*
Trigger sensitivity	٣ $cmH_٢O$
Rise %	٥٠ %
E-sense	٣٠ %

Alarms

	Setting range
High pressure	*٥ cmH٢O ~ ١٢٠ cmH٢O*
Low pressure	*٠ cmH٢O ~ ٥٠ cmH٢O*
High tidal volume	*20 ml ~ ٢٥٠٠ ml ,OFF*
Low tidal volume	*٠ ml ~ ٢٥٠٠ ml*
High minute volume	*1 ~ 99L*
Low minute volume	*0 ~ 98L*
High respiration rate	*2 ~ 120 bpm*
Leak volume	*10 ~ 500 ml*
Apnea	*OFF, 10 ~60 sec*
O٢% high	*21~100%,OFF*
Power loss	*AC/DC power loss*
Low Air/O2 pressure	
Obstructed tube	
Airway leak	
Vent in-operation	
Open Circuit	

DISPLAY PARAMETER

● V_{ACV} MODE, V_{SIMV} MODE

No.	Item	Range	Unit	Condition
ⓐ	VTIDAL	٠~٢٠٠٠	ml	±١٥% (VTIDAL>١٠٠ml), ±٢٠ml (VTIDAL≤١٠٠ml)
ⓑ	ViTIDAL	٠~٢٥٠٠	ml	±١٥% (ViTIDAL>١٠٠ml), ±٢٠ml (ViTIDAL≤١٠٠ml)
ⓒ	VMIN	٠~١٨٠	LPM	±١٥% (VMIN>٦LPM), ±٠.٥LPM (VMIN≤٦LPM)
ⓓ	RRESP	٠~١٥٠	BPM	±١.٠%
ⓔ	PPEAK	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓕ	PMEAN	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓖ	PPAUSE	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓗ	PEEP	٠~٥٠	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓘ	O_2	٢١~ ١٠٠	%	±٢.٠%
ⓙ	I:E RATIO	٤:١ ~ ١:٩٩		±٢.٠%
ⓚ	sVmin	٠~١٨٠	LPM	±١٥% (VMIN>٦LPM), ±٠.٥LPM (VMIN≤٦LPM)
ⓛ	sRR	٠~١٥٠	BPM	±١.٠%

● SPONT MODE

No.	Item	Range	Unit	Condition
ⓐ	VTIDAL	٠~٢٠٠٠	ml	±١٥% (VTIDAL>١٠٠ml), ±٢٠ml (VTIDAL≤١٠٠ml)
ⓑ	VMIN	٠~١٨٠	LPM	±١٥% (VMIN>٦LPM), ±٠.٥LPM (VMIN≤٦LPM)
ⓒ	RRESP	٠~١٥٠	BPM	±١.٠%
ⓓ	PPEAK	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓔ	PMEAN	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓕ	FPEAK	٠~١٨٠	LPM	±١٥% (VMIN>٦LPM), ±٠.٥LPM (VMIN≤٦LPM)
ⓖ	PEEP	٠~٥٠	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓗ	O_2	٢١~ ١٠٠	%	±٢.٠%
ⓘ	sVmin	٠~١٨٠	LPM	±١٥% (VMIN>٦LPM), ±٠.٥LPM (VMIN≤٦LPM)
ⓘ	sRR	٠~١٥٠	BPM	±١.٠%

● **P_{ACV} , P_{SIMV}, NIV, PRVC, Auto Mode**

No.	Item	Range	Unit	Condition
ⓐ	VTIDAL	٠~٢٠٠٠	ml	±١٥% (VTIDAL> ١٠٠ml),±٢٠ml (VTIDAL≤ ١٠٠ml)
ⓑ	VMIN	٠~١٨٠	LPM	±١٥% (VMIN> ٣LPM), ±٠.٥LPM (VMIN≤ ٣LPM)
ⓒ	RRESP	٠~١٥٠	BPM	±١.٠%
ⓓ	PPEAK	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓔ	PMEAN	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓕ	FPEAK	٠~١٨٠	LPM	±١٥% (VMIN> ٣LPM), ±٠.٥LPM (VMIN≤ ٣LPM)
ⓖ	PEEP	٠~٥٠	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓗ	O_2	٢١~ ١٠٠	%	±٢.٠%
ⓘ	I:E RATIO	٤:١ ~ ١:٩٩		±٢.٠%
ⓙ	sVmin	٠~١٨٠	LPM	±١٥% (VMIN> ٣LPM), ±٠.٥LPM (VMIN≤ ٣LPM)
ⓚ	sRR	٠~١٥٠	BPM	±١.٠%

● **$T_{BILEVEL}$ MODE**

No.	Item	Range	Unit	Condition
ⓐ	VTIDAL	٠~٢٠٠٠	ml	±١٥% (VTIDAL> ١٠٠ml),±٢٠ml(VTIDAL≤ ١٠٠ml)
ⓑ	VMIN	٠~١٨٠	LPM	±١٥% (VMIN> ٣LPM), ±٠.٥LPM (VMIN≤ ٣LPM)
ⓒ	RRESP	٠~١٥٠	BPM	±١.٠%
ⓓ	PPEAK	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓔ	PMEAN	٠~٨٥	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓕ	FPEAK	٠~١٨٠	LPM	±١٥% (VMIN> ٣LPM), ±٠.٥LPM (VMIN≤ ٣LPM)
ⓖ	PEEPH	٠~٥٠	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓗ	PEEPL	٠~٥٠	cmH_2O	±(١.٧+ ٤% of the actual reading) cmH_2O
ⓘ	O_2	٢١~ ١٠٠	%	±٢.٠%
ⓙ	sVmin	٠~١٨٠	LPM	±١٥% (VMIN> ٣LPM), ±٠.٥LPM (VMIN≤ ٣LPM)
ⓚ	sRR	٠~١٥٠	BPM	±١.٠%

1.3.4 Pneumatic Specifications

$O_٢$and air supply Pressure range	*٢.٥٦~ 6.5 Kgf/㎠ or ٢.٤~ ٦.2 bar or ٣٥~ 90 psi*
	Flow ١٥٠ L/min (STPD, dry required)
	١٠٠% $O_٢$ Suction button – auto calibration
Oxygen sensor life	*١٠,٠٠٠hours or ١ Years of use, normal*
Safety pressure Pneumatic	*٣٠ psi +/- ١٠%*
Internal pressure Limit	
Inspiration Pressure Limit	*٨٥ $cmH_٢O$ +/- ١٠% ; mechanical release valve*
Double safety mechanism	
for over pressure	

1.3.5 Physical Data

Dimensions of device	*38 W x 43 D x 69 H cm*
	(Width x depth x height of device)
Weight of device	*٣٥Kg (with Battery)*
Dimensions of Cart	*49 W x 56 D x 77 H cm*
	(Width x depth x height of device)
Weight of Cart	*28 kg*
Connectors	
Inspiratory limb connector	*ISO ٢٢mm conical male*
Expiratory limb connector	*ISO ٢٢mm conical male*
Air and Oxygen inlets	*DISS male / female*

1.3.6 Environmental Data

Operating environment	*Temperature : ١٠ to ٤٠ °C (٥٠ ~ ١٠٤ F)*
Atmosphere	*٧٠٠ to ١٠٦٠ mbar (١٠.٢ ~ ١٥.٤ psi)*
Altitude	*-٤٤٣ ~ ٣٢٨٠ m (-١٣٥٠ ~ ١٠,٠٠٠ ft)*
Storage environment	
Temperature	*-١٠ to ٦٠ °C*
Relative humidity	*١٠ to ٨٥ %*
Atmosphere	*٥٠٠ to ١٠٦٠ mbar (٧.٣ ~ ١٥.٤ psi)*
Altitude	*up to ٦٥٦٠ m (٢٠,٠٠٠ ft)*
Oxygen/Air inlet supply pressure	*٢.٥٦ ~ ٧.٣ Kgf/㎠ / ٢.٤ ~ ٦.٩ bar / ٣٥ ~ ١٠٠ psi*

1.4 Standard and Safety requirements

MEKANT is in conformity with the following tables. Obtainment of license and required testing has been completed.

1.4.1 Standards and Safety requirements

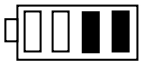
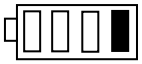
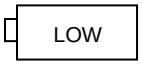
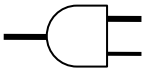
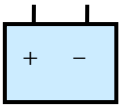
EN60601-1:1990	*General requirements for Safety*
EN60601-1-1:2001	*Electromechanical Safety*
EN60601-1-2:2001	*Electromagnetic Compatibility Requirement and tests*
IEC ٦٠٦٠١-٢-١٢:2001	*Particular requirements for the safety of lung ventilators for medical use*

1.5 Symbols and Labels

Descriptions for marking on MEKANT ventilator and its operational manuals.

1.5.1 Description of Symbol

No	Name	Symbol	Explanation
١	POWER ON/OFF		Provision of power by switching on and off the system. IEC ٦٠١-١
٢	Equipotential-ity		It is indicated terminal which do not need ground electric potential to make equipotentiality by connecting with each part of system or equipment. IEC٦٠١-١, IEC ٤١٧-٥٠٢١
٣	Attention, Consult accompanying documents		Indicates the necessity to refer to the operational manual prior to equipment operation. IEC ٦٠١-١
٤	stand-by		Indicates the stand-by mode of the system. IEC٤١٧-٥٠٠٩
٥	Start (of action)		Indicate the activation of the equipment. IEC ٤١٧-٥١٠٤
٦	Direct current		Indicates appropriateness for the equipment against direct current and designate the connecting part. IEC ٦٠١-١, IEC ٤١٧-٥٠٣١

No	Name	Symbol	Explanation
٧	Battery check		Battery capacity indicator  FULL Charging  ٢/٣ Charging  ١/٢ Charging  Low Charging  Discharging
٨	AC Power plag		Indicates the AC plug without ground earth. IEC ٤١٧-٥٥٣٤Pr
٩	Battery		It should be indicated rating sticker that equipment is suitable for only direct current (D.C). Also, indicate it is related connecting part. IEC ٦٠١-١, IEC ٤١٧-٥٠٣١
١٠	EXT. BATT	EXT. BATT	Indicates external battery for vehicle use.
١١	KEY LOCK		Locks KEY BUTTON
١٢	Manual control		Indicates manual operation of the apparatus. ISO٧٠٠٠-٠٠٩٦
١٣	CLEAR		Clears the menu tree from the display.

No	Name	Symbol	Explanation
۱۴	Dangerous voltage		Warns the high voltage. IEC۶۰۱-۱, IEC۴۱۷-۵۰۳۶, ISO ۳۸۶۴
۱۵	Respiration Mode		Indicate a respiration mode in VENT Mode. (VACV. VSIMV. SPONT. PACV. PSIMV. TBILEVEL. NIPPV. AUTO)
۱۶	۱۰۰% $O_۲$ MODE		Indicate ۱۰۰% $O_۲$ MODE. This mode can by ON / OFF by $O_۲$ ۱۰۰% KEY
۱۷	FREEZE MODE		Indicate FREEZE MODE. This mode can be ON / OFF by FREEZE KEY
۱۹	NEBULIZER MODE		Indicate NEBULIZER MODE. This mode can be ON / OFF by NEBULIZER KEY, and the operating time is set from 10 to 180 minutes.
۲0	CALIBRATION MODE		Indicate CALIBRATION MODE. This mode is displayed when activating CALIBRATION in SET UP menu.
۲1	MANUAL INSPIRATION KEY		Supply the respiration to the patient when pressing the MANUAL INSPIRATION KEY.
22	INSPIRATION TIME		Increase INSPIRATION TIME to 1 second.
23	EXPIRATION TIME		Increase EXPIRATION TIME to 1 second.

No	Name	Symbol	Explanation
٢4	ALARM SOUND OFF Or MUTE		Indicate ALARM SOUND OFF or MUTE. This function can be ON / OFF by pressing ٢ MIN KEY.
٢5	TREND MODE		Indicate TREND MODE.

Table 1-1. Description of Symbols

1.6 Maintenance

The following table shows the periodic check point and maintenance method for MEKANT ventilator system and the circuit system.

Period	Subject	Check point
Daily	Bacteria Filters - Inspiratory Filter - Expiratory Filter	Check if all filters are in good position.
	Patient Circuit System	Check the connection, leakage, Blockage and moisture.
	Collector Vial, Gas Supply Water Traps	Check if there is moisture and remove it if necessary.
Minimum Every half month or when changed the patient	Patient Circuit System, all Bacteria Filters and Humidification Chamber	Exchange everything, and cleaning and sterilizing used one.
Every Half year	All system	Conduct EST
Every year or After ١٠٠ times autoclaving	All Bacteria Filters	Exchange to new filter and scrap used one
Between ١ year and ٢ year	Oxygen Sensor	Exchange to new one
When necessary	Oxygen Sensor	Conduct Oxygen sensor calibration by pressing ١٠٠% O٢/CAL.
Every ١٠,٠٠٠ hours	Various components	Exchange appropriate components using ١٠,٠٠٠ hours PM kit.

Table 1-2. Check and Maintenance Period

Caution

User should check the installation status and problem of the filters and patient circuit system with naked eyes every day. In case of any problem, replace or exchange the parts in problem right away.

When patient is changed or one patient uses it for a long period, exchange the patient circuit system including bacteria filter in every ١٥ days, and clean and sterilize the used one.

All the components of patient circuit system excluding bacteria filter can be sterilized by any way among ETO(Ethylene Oxide) gas sterilization, Steam Autoclave and Chemical sterilization. But, only Steam Autoclave is available for bacteria filter.

Sterilization shall be done for about ٢٠ minutes at ١٣٢ degree centigrade. Exchange to new bacteria filter after one year use or ١٠٠ times of Autoclave use.

Oxygen sensor is valid for ٢ years, but it can be shortened in case of using at the condition of high FiO٢ or high temperature.

Installation and Set up

SECTION 2

2.1 Installation

When installing and moving the equipment, it is required to stay shock free.

2.2 External electrical supply

MEKANT is capable to receive both AC and DC power supply.

2.2.1 AC description

External AC connector is located on the rear side of the apparatus. Refer to Figure ٢-١.

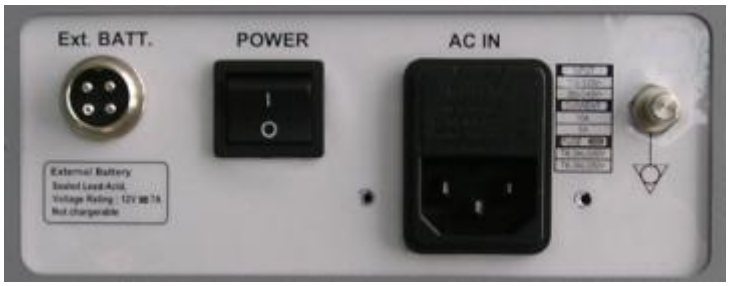


Figure ٢-١. External AC and DC Power Supply Sockets

Warning

Prior to applying AC or DC to the ventilator, the line frequency has to be adjusted to the local standard otherwise it might cause damages to the apparatus.

Power Cord has to be plugged in to the concentric plug on the ground.

Replace covered wire in case of wear and tear.

Please apply the ground cable in order to protect the patient and the apparatus.

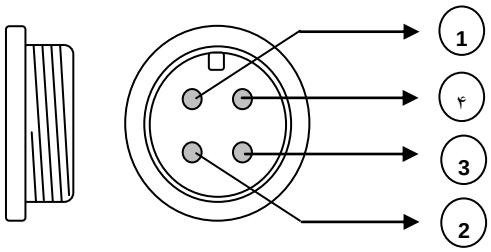
Maintain the same level of input & output voltage.

Caution

Cable Clips are used in order to affix the AC code and also to prevent disconnection.

When connected to DC or AC, LED display will be turned on to indicate the connection.

2.2.2 External battery



Pin	Name	Direction	Explanation
①	Not connected		Not used
②	GND	▬▬	Pins for the ground.
③	+VCC	◀▬▬	Pins to connect external battery
④	Not connected		Not used

Figure ٢-٢. Pin Setting of MV٢٠٠0 Ventilator External Battery

Warning

Watch for polarity when connecting the battery.

Note that when external battery is used, internal battery will not be charged.

It should be used for rating voltage, ١٢V⎓ 7A and Electric current should be more than ١A.

Caution

Cover the Port Pin by putting the cap when the external battery is not in use.

Do not make pin to be shorted because internal Battery is damaged when EXT. BATT is opened, or each pin is shorted.

Please put a cap next to terminal when EXT. BATT is not used.

NOTE :

Fuse is built in the machine.

ATO® Fuse (Fast-Acting Type), Catalog Number ٢٥٧ ٠١٥, Ampere Rating (A) ١٥A, Body color code : blue

Vehicle outlet power supply is used.

2.3 Internal battery

Internal battery for MV٢٠٠0 is used for the provision of power when moving the patients. Recharge of the battery is done while AC power connected as the apparatus simultaneously utilizes the power from the same source of AC. In case of power failure, the operation will be done by internal battery.

Warning

When replacing the battery, watch for polarity. Red for +, Black for -. Inappropriate connection might cause damages to the apparatus.

Short-circuit might cause explosion of the battery or harm human body due to high voltage.

It should be used for rating voltage, ١٢V ⎓ 7A and Electric current should be more than ١A.

We recommend that you should contact the distributor or CS team if you find any problems in the internal battery.

Caution

When difficulties of power supply arise or when transferring the patients, the battery needs to be charged. Replace the battery if it is in deficiency.

In case of the lowest battery voltage, there may be an error in the measured value.

In case of low battery, use the machine after connection to AC common electric power.

NOTE :

Fuse is built in the machine.

ATO® Fuse (Fast-Acting Type), Catalog Number ٢٥٧ ٠١٥, Ampere Rating (A) ١٥A, Body color code : blue

Internal Battery may be affected by the number of times for discharge, surrounding temperature, charging voltage. Generally it can be used more than ٢ years.

2.3.1 Internal battery indicator

It displays battery capability. This is displayed on the upper right hand corner of the LCD display. The battery capacity will be displayed in 5 main statuses.

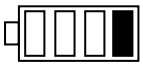
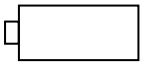
Battery Indicator	Level Status	Explanation
	Full Charging	
	٢/٣ Charging	
	١/٢ Charging	
	Low Charging	
	Discharging	In case of discharging status, the system will be automatically turn off to protect the battery ٥ minutes later.

Table ٢-١. Internal battery Indicator

2.3.2 How to change internal battery

Loose 4 screws on the lower rear cover that is for Battery.

You can see the internal battery. After changing battery, assemble the battery cover.

Warning

When replacing the battery, watch for polarity.

Red for +. Black for −.

Inappropriate connection might cause damages to the apparatus. Short-circuit might cause explosion of the battery or harm human body due to high voltage.

NOTE :

All of bolt is locked when turned clockwise. All of bolt is loosed when turned counter clockwise.

2.4 Oxygen and Air supply

MEKANT is the system to provide oxygen and air to patients. Oxygen and Air are provided through the adaptor end at the rear by pressure (٢.٥٦~ ٧.٣Kgf/cm٢ / ٢.٤~ ٦.٩bar / ٣٥~ 90 PSI) and get mixed to have appropriate concentration .

Warning

Check the oxygen and air connector to be free from oil to prevent from explosion.

When you supply or stop oxygen and air, be careful when it's assembled and disassembled because high pressure hose can harm to human body due to inside pressure.

Caution

Check and see if the Oxygen and Air pressure is set at exact pressure range prior to ventilator application.

When high pressure hose is used or moved, pay attention to wiring not to be tripped over persons.

Connection way of high pressure hose

O٢ consists of green adaptor and green high pressure hose.

Air input consists of a yellow color.

2.5 Filters

Use ۲ filters between MEKANT Product and patient for the safety of patients. Before supplying for patient INS. Filter is used, and exhalation filter is used at the place for exhaled air from patient's body in order not to supply polluted air to patient.

Warning

Contaminated gas might be in exposure to patients if the air was provided without applying filter.

Do not reuse the accessories when ⊗ symbol is found since it represents its category as disposable.

Replace the disposable sensor with the new one after single use.

Reusable materials which are used for patients shall be sterilized and washed for reuse.

Caution

Filters must be MEKICS genuine or designated products. If you wish to use other makes, please consult biomedical engineers at the hospitals, or local authorized dealer.

Please use quality certified product, otherwise manufacturer will not be responsible for any problems caused by this.

All accessories are aseptic, therefore the wrapping has to be intact before opening and use.

2.6 Transportation

Warning

When moving the apparatus, please make sure that the LCD Monitor is fixed properly since this might cause damage to the Device.

Please move the product when components and power cords are in order.

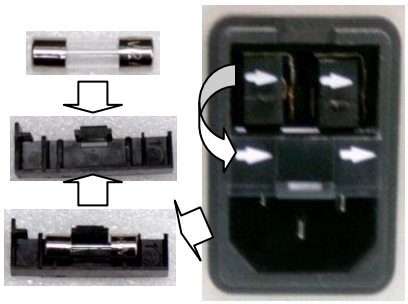
Caution

Before moving the system, unlock the locker on the caster.

Move the product by handle.

2.7 Fuse replacement instruction

Inlet Fuse



Pull the upper part of inlet toward you.

Fuses are located where two upper arrows are and those are and those lower ٢ arrows indicate the direction when inserted.

Remove the existing fuse and insert the new fuse as shown in the picture after checking the rating.

Close the inlet by doing the steps backward.

Operating instructions SECTION 3

3.1 Front panel

3.1.1 Rotational control knob

Rotating and Pressing the Encoder allows a user to navigate through and make changes to the display element.

Left Rotating
- Menu Down - Left Value

Right Rotating
- Menu Up - Right Value

Click
- Menu Screen - Menu confirmation & storing

3.1.2 Alarm lamp

STATUS	COLOR	DESCRIPTION
NORMAL	GREEN	No alarm and Ventilator is working within Setting limits.
WARNING	RED	Ventilator does not work or alarm is occurred.

Figure ۳-1. Alarm lamp

Warning

Red lamp is on in case of emergency such as Ventilator does not work. Though emergency is clear, it will be still on before pressing RESET.

3.1.3 Keypad

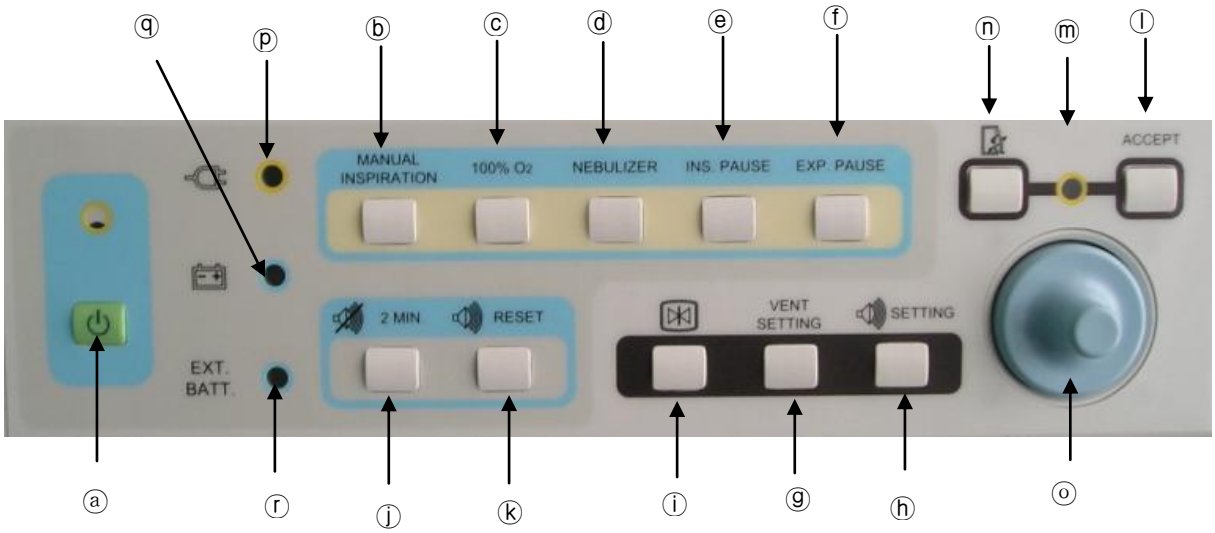
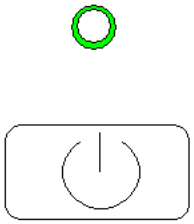


Figure ۳-2. Keypad

No	Picture	Description
ⓐ		**START SWITCH** – If you press START switch for 0.5 sec, power would be on. In case of STOP OFF you want , switch should be pressed for longer than 10 seconds in Vent operating or switch should be pressed for longer than ۲ seconds in Vent Ready status.
ⓑ	**MANUAL INSPIRATION**	**MANUAL INSPIRATION** : This function which is for a respiration according to Ventilator's default is operated once by pressing the key.
ⓒ	**100% O_2**	۱۰۰% O_2: If you press this button, ۱۰۰% O_2 is provided for ۲ minutes.

No	Picture	Description
ⓓ	NEBULIZER	**NEBULIZER** : It is acted once as setting value. This allows to nebulize during only inspiration and is stopped by pressing once again.
ⓔ	INS. PAUSE	**INS. PAUSE** : Operating of Ventilator is stopped for a regular second after Inspiration Time.
ⓕ	EXP. PAUSE	**EXP. PAUSE** : Operating of Ventilator is stopped for a regular second after Expiration Time
ⓖ	VENT SETTING	**VENT SETTING** : This changes Respiration mode & each parameter. But if RUN key or button is not pressed, modified value would be canceled.
ⓗ	SETTING	**ALARM SETTING** : It is set alarm limit of each parameter.
ⓘ		**FREEZE** : This is for stop of graph on the display. Stop graph is measured after its FREEZE
ⓙ	2MIN	**ALARM ٢MIN** : This makes ALARM remove for ٢ minutes.
ⓚ	RESET	**ALARM RESET** : This actives when alarm is reset. And previous alarm lamp is removed and the status of NORMAL will be.

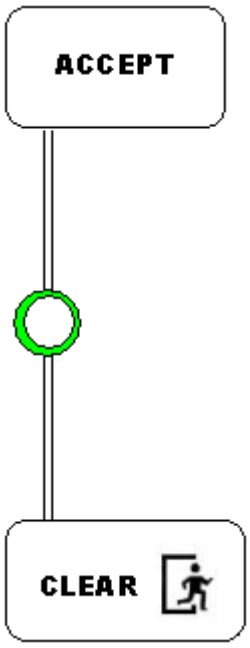
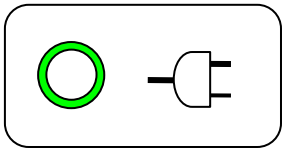
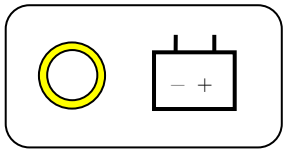
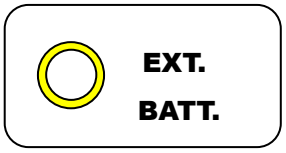
No	Picture	Description
ⓛ ⓜ ⓝ		**ACCEPT RUN** : It is used when Ventilator is working as its final value. If ACCEPT key is not pressed, setting value would not be accepted on the change of MODE and VENT SETTING. This is for the safe. **KEY LOCK** : It is limit key of all operations. It can be set and removed in case of only pressing ACCEPT and CLEAR at the same time. Green LED is lighted when it sets. **CLEAR** : It is used for clearance of menu when menu is controlled by Knob
ⓞ		**Encoder** : Rotary switch for selecting function on the pop-up menu.

Table ٣-١. Keypad

3.1.4 LED Indicator

No	Picture	Description
ⓠ		**AC POWER ON LED** : LED is on when machine is connected to AC, otherwise, LED is OFF.
ⓡ		**BATTERY ON LED** : Battery is charged as the machine is working when it is connected AC If it is not, battery ON LED is lighted because the machine is operating by internal battery. If both AC POWER ON LED and BATTERY ON LED are OFF, battery should be charged.
ⓢ		**EXT. BATT** : LED is on when the machine is connected to external battery, otherwise, LED is OFF.

3.2 Operating

NOTE :

Buzzer will be sounded when main power is on normally. Otherwise, check something wrong on the main power. (power, battery, fuse)

ALARM LAMP (Warning or INOP) is on and buzzer is sounded if ventilator has defect on working .

Connect the ventilator to the power is earthed.

3.2.1 Operating procedure and how to use

No	Picture	Description
1		Connect high pressure hose and accessories.
2		Connect earthed cable to equipotential port and earthed AC power. Connect power cord to an electric outlet and AC inlet. Switch on POWER on the back side.

No	Picture	Description
3		Switch on START on the Front Panel. System Fail sound will be disappeared in case power is on normally. Wait for the calibration of each sensor. It is presented normal INITIAL, and then normal ventilator READY is appeared.
4		Set the present time and date. (SYSTEM SET - USER SETUP - DATE/TIME) Enter patient's bed number etc. (SYSTEM SET – USER SETUP – BED NUMBER) Select patient's weight. (VENT MODE – B/W) Set up alarm limit. (ALARM SET) Choose mode suitable for the patient. (VENT MODE) Input other value as prescription. Adjust value by pressing and rotating. Select RUN. Check the wave form and figure on the monitor normally.

Figure ٣-٣. Operating procedure and how to use

3.3 Display

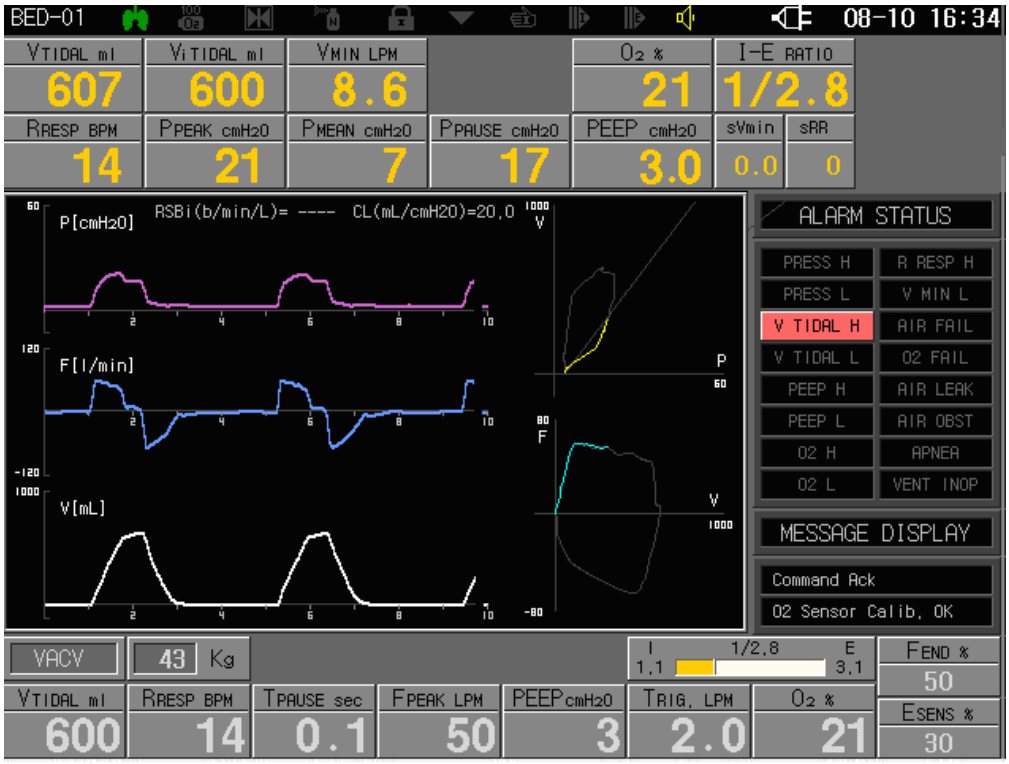


Figure ٣-٤. LCD Display

Explanation		Reference
Status information	ICONs of working status, BED NO and Date/Time.	٣. ٣. ١
Measurement information	Measurement of ventilator or patient factor.	٣. ٣. ٢
Waveform and alarm status	Graph and alarm statue of ventilator or patient factor.	٣. ٣. ٣
Setting information	Setting value according to respiratory mode.	٣. ٣. ٤

Table ٣-2. Description of display

3.3.1 Status information

ICONs of working status, BED NO, Date/Time.

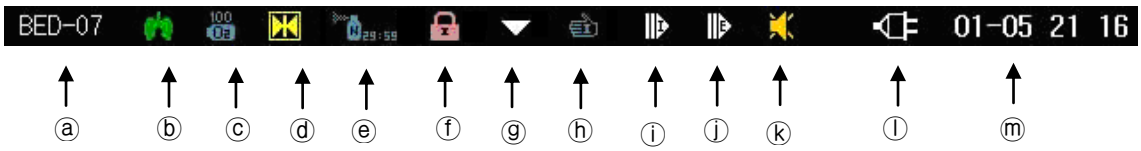


Figure ٣-5. Explanation of status information

No	Icon	Explanation
ⓐ	BED-07	BED Number. You can change at SETUP MENU.
ⓑ		It displays respiratory mode of VENT Mode. (VACV, VSIMV, SPONT, PACV, PSIMV, TBILEVEL, NIV, PRVC, AUTO)
ⓒ		It display O٢ ١٠٠% Mode. You can ON/OFF to O٢ ١٠٠% KEY.
ⓓ		It displays FREEZE MODE (Display Paused). You can ON/OFF to FREEZE KEY.
ⓔ		It displays NEBULIZER MODE. You can ON/OFF to NEBULIZER KEY. Setting time is ٣٠ minute.
ⓕ		It displays KEY LOCK MODE. You cannot use another key. If you use another Key, push the ACCEPT KEY. If not, push the EXIT KEY.
ⓖ		It displays CALIBRATION MODE. When it work Calibration to SETUP MENU it will be displayed.
ⓗ		When you push the MANUAL INSPIRATION KEY, Ventilator supplies breathing to patient at the same time.

No	Icon	Explanation
ⓘ		It makes longer to “INSPIRATION TIME“ a regular second.
ⓙ		It makes longer to “EXSPIRATION TIME“ a regular second.
ⓚ		It displays ALARM SOUND OFF or MUTE. You can ON/OFF to ٢ MIN KEY.
ⓛ		It displays AC Power. (It maybe changed Battery Status)
ⓜ		It displays month-day-hour-minute. You can choose setting value to DATE/TIME of SYSTEM SET menu.

3.3.2 Measurement information

It displays measurement information of ventilator or patient factor. It shows different tables of measurement information to each Mode.

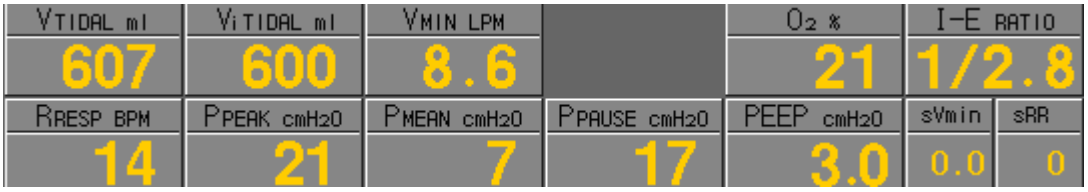


Figure ٣-6. Measurement information explanation (VACV)

3.3.3 Waveform and alarm status

It displays WAVE, ALARM STATUS and MESSAGE to ventilator or patient factor. Refer to Section ۴ for alarm information.

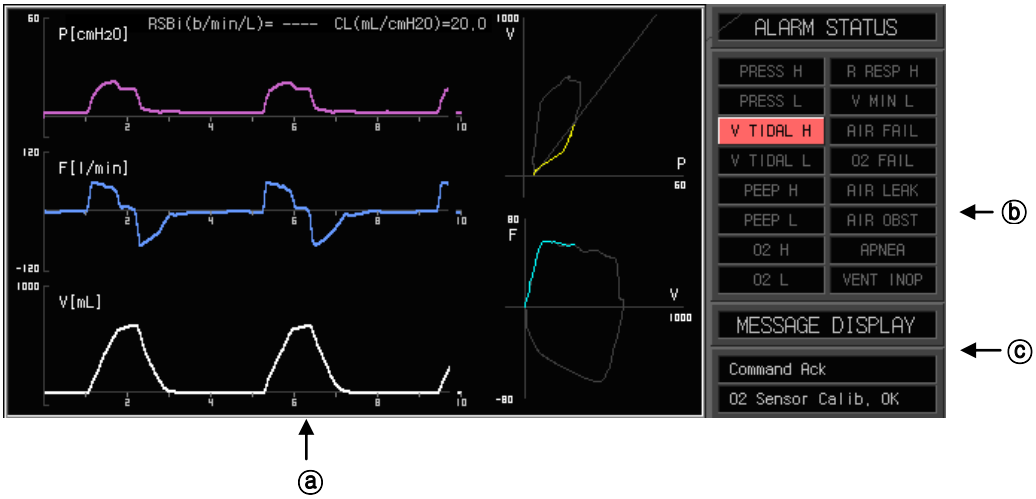


Figure ۳-7. Waveform and alarm status

No	Display	Explanation
ⓐ	WAVE	It displays waveforms of Pressure, Flow, Volume, V/P and F/V.
ⓑ	ALARM STATUS	It displays alarm message. When alarm is working, it displays orange color.
ⓒ	MESSAGE DISPLAY	It displays Software Version and Message.

Table ۳-۳. Waveform and alarm status explanation

3.3.4 Setting information

It displays respiratory mode of VENT Mode. It shows different table of setting table to each Mode.

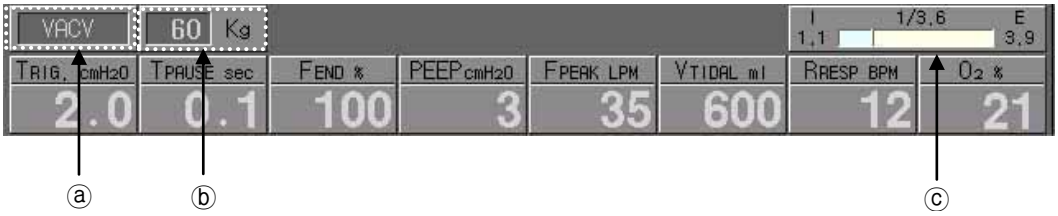


Figure ٣-8. Setting information Display explanation

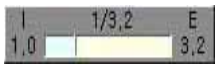
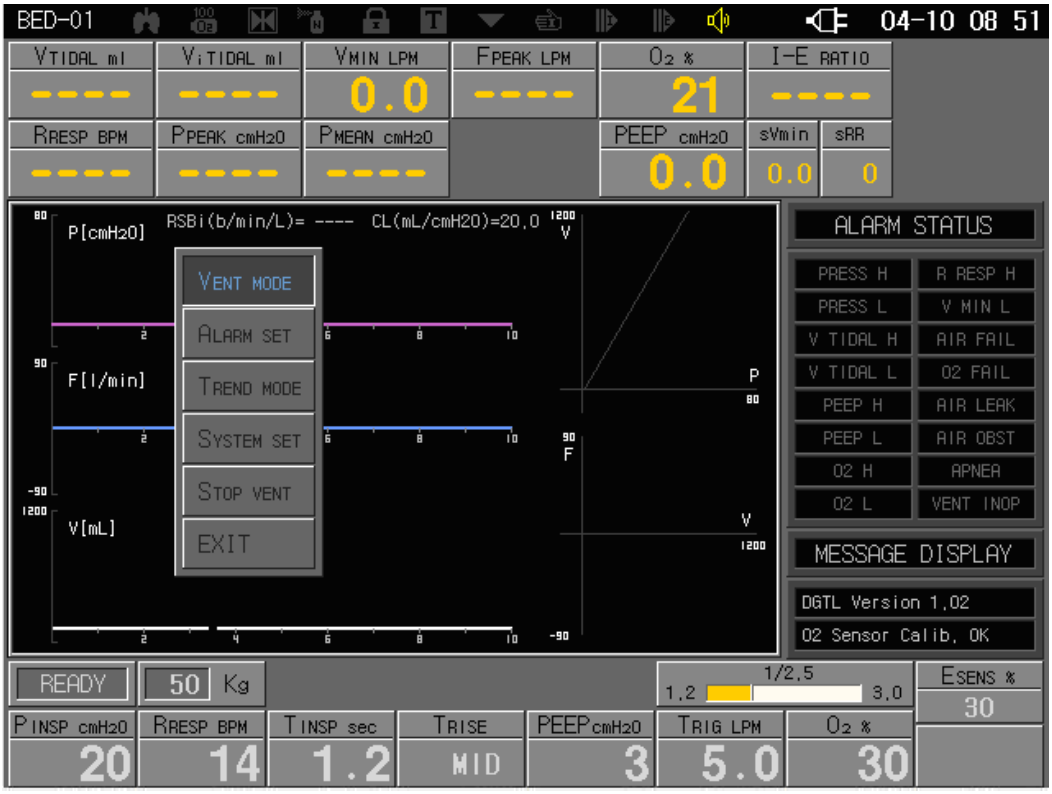
No	Display	Explanation
ⓐ		It displays Setting Mode.
ⓑ		It displays Weight of setting information. (Unit : Kg)
ⓒ		It displays ratio of I:E

Table ٣-4. Setting information Display explanation

3.4 Menu

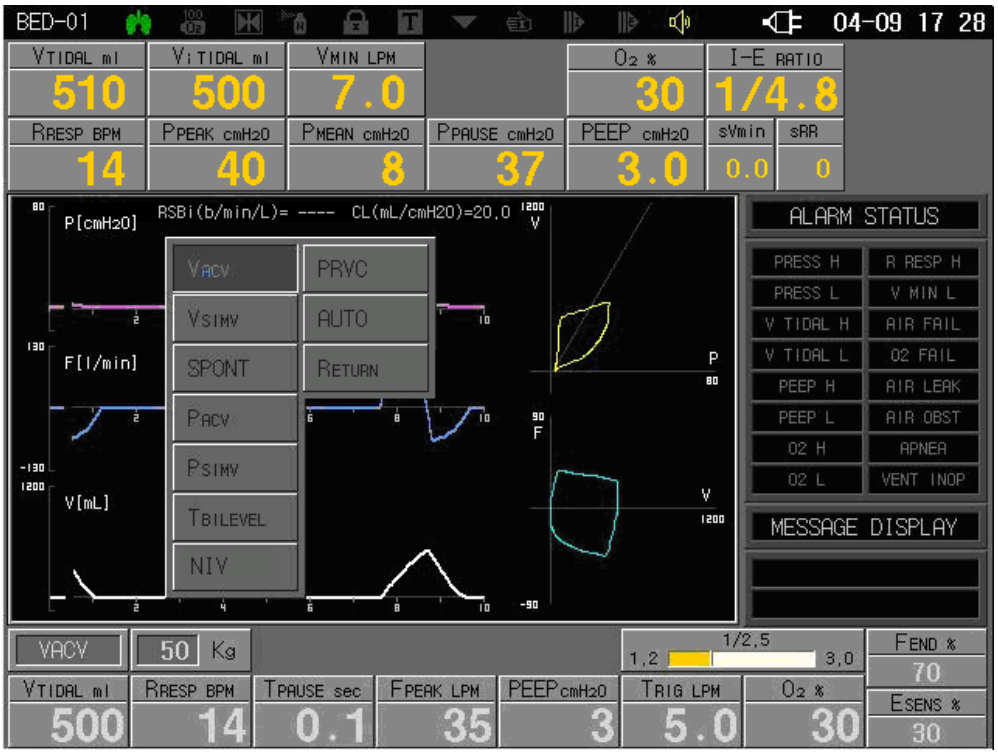
If you press the encoder, the Menu screen is shown up at the center left side of main menu as shown below. If you choose menu on the menu tree and press the encoder, menu is closed. Below Figure shows menu tree.



DESCRIPTION		Reference
VENT MODE	You can choose respiratory mode according to respiratory status of patient respiratory.	٣.٤.١
ALARM SET	Choosing alarm mode	٣.٤.٢
TREND MODE	This is function which presents each value of parameter as table and graphic. It is available for ٧٢ hours.	٣.٤.٣
SYSTEM SET	Choosing System set	٣.٤.٤
EXIT	Remove menu on the front screen	٣.٤.٥

3.4.1 VENT Mode

MV۲۰۰0 has the ventilation mode which are SIMV(VSIMV,PSIMV), ACV(VACV, PACV, other company calls CMV to Mandatory Mode), Spontaneous Mode, tBi-Level, NIV, PRVC and AUTO Mode.



No.	Item	Mode	Explanation	Refer.
ⓐ	V_{ACV}	V_{ACV}	Volume based Assistance Controlled Ventilation. It controls Patient Ventilation by force from air volume. And it controls expiration time and inspiration time by force.	٣.٤.١.٢
ⓑ	V_{SIMV}	V_{SIMV}	Volume based Synchronized Intermittent Mandatory Ventilation. It controls Patient Ventilation to air volume from Synchronized Intermittent Mandatory Ventilation	٣.٤.١.٣
ⓒ	SPONT	SPONT	Spontaneous Ventilation. It supports spontaneous breathing.	٣.٤.١.٤
ⓓ	P_{ACV}	P_{ACV}	Pressure based Assistance Controlled Ventilation. It controls Patient Ventilation by force from air pressure.	٣.٤.١.٥
ⓔ	P_{SIMV}	P_{SIMV}	Pressure based Synchronized Intermittent Mandatory Ventilation. It controls Patient Ventilation to air pressure from Synchronized Intermittent Mandatory Ventilation.	٣.٤.١.٦
ⓕ	$T_{BILEVEL}$	$T_{BILEVEL}$	It is same to SPONT. And it has Upper PEEP. (Refer to SPONT)	٣.٤.١.٧
ⓖ	NIV	NIV	It is mask type, not tubing type. It work PACV allow to leakage. (Refer to PACV)	٣.٤.١.٨
ⓗ	PRVC	PRVC	Breath are delivered mandatorily with a constant flow to assure present volumes.	٣.٤.١.9
ⓘ	AUTO	PACV	Quick Start according to the weight of patient. (PACV Controlled)	٣.٤.١.10
ⓙ	EXIT	-	Remove menu on the front screen.	-

Table ٣-5. $V_{ENT\ MODE}$ Menu tree explanation

3.4.1.1 V_{ACV}

V_{ACV} *(Volume based Assistance Controlled Ventilation) : It controls Patient Ventilation by force from tidal volume. And it controls expiration time and inspiration time by force. VITIDAL means inspiration volume to supply patient.*

A/C (Volume Control) - VACV

If MEKANT perceives spontaneous breathing it works the Assisted Mandatory Breath. If not it works Controlled Mandatory Breath.

When MEKANT works in Volume Control Ventilation it decides inspiratory time for setting of tidal volume and peak flow. Also inspiratory time is influenced by flow pattern and plateau.

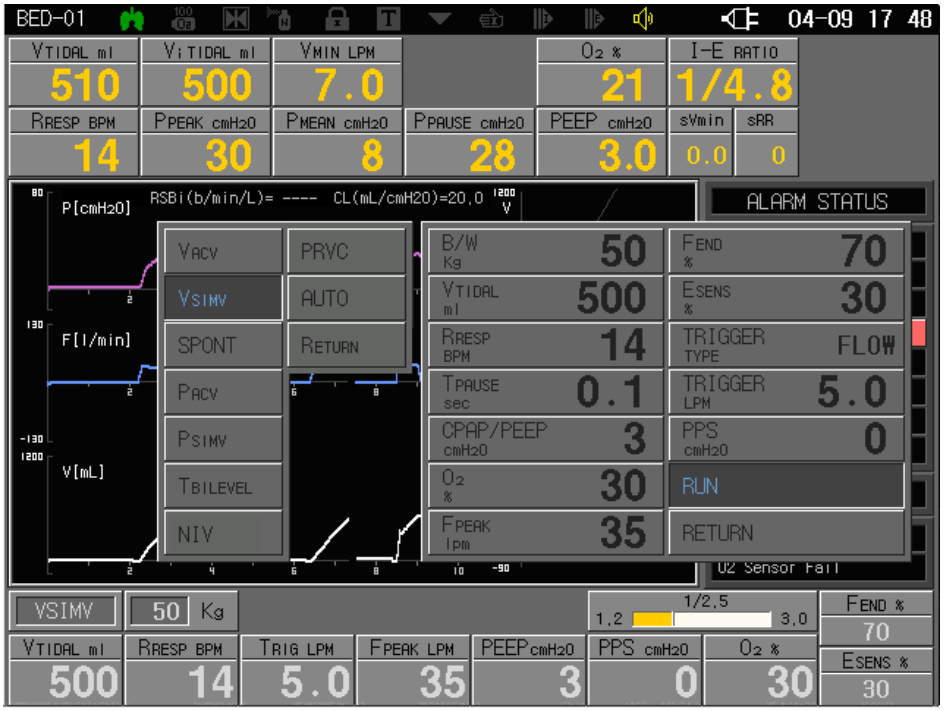
In the case of I:E ratio decides it for factor of inspiratory time and respiratory rate.
When you change the factor of I:E ratio and inspiratory time, you can know cycle time, inspiratory time, expiratory time and I:E ratio through breath timing bar.

No.	Item	Setting Range	Unit	Step	Explanation
ⓐ	V_{TIDAL}	15 ~ ٢٥٠٠	ml	١٠	It decides volume of ١ breath. **NOTE :** It set the volume of patient weight. It is ١٠ml per ١kg. (You can set the volume per ١kg in [SYSTEM SET - USER SETUP - B/W FACTOR] Menu.)
ⓑ	R_{RESP}	٢~ 120	BPM	١	It set the respiratory rate per ١ minute.
ⓒ	T_{PAUSE}	٠.٠ ~ ٢.٠	Sec	٠.١	Inspiration Pause Time. It set the inspiration pause time.
ⓓ	PEEP	٠ ~ ٤٥	cmH_2O	١	It set the PEEP pressure.(Base pressure of patient)
ⓔ	O_2	٢١ ~ ١٠٠	%	١	It set the percent of O_2 to patient.
ⓕ	F_{PEAK}	٥ ~ ١٨٠	LPM	١	It set the flow-peak (maximum velocity) to patient.
ⓖ	F_{END}	٢٥ ~ ١٠٠	%	٥	It set percent of Flow (supply velocity) / Fpeak (supply maximum velocity) to End-tidal.

No.	Item	Setting Range	Unit	Step	Explanation
ⓗ	E_{SENS}	١٠ ~ ۶٠	%	١٠	It set the sensitivity of one breath completion of patient during to setting of percent of patient expiration volume.
ⓘ	TRIGGER Type	Pressure /Flow	cmH_2O /LPM		It sets the type of trigger. It is Pressure or Flow type.
ⓙ	TRIGGER	٠.۵ ~ ٢٠	cmH_2O /LPM	٠.۵	Setting to detect spontaneous breathing signal, There are pressure and Flow type. User can select one.
ⓚ	SIGH MODE	OFF,30,60, 90,120	BPM	30	It sets breathing rate timing in sigh mode. Don't support over 1500ml volume.
ⓛ	RUN	-	-	-	It works VACV Mode.
ⓙ	RETURN	-	-	-	Go back to previous menu

3.4.1.3 V_{SIMV}

V_{SIMV} *(Volume based Synchronized Intermittent Mandatory Ventilation) :*
It controls Patient Ventilation to tidal volume from Synchronized Intermittent Mandatory Ventilation. VTIDAL means inspiration volume to supply patient.



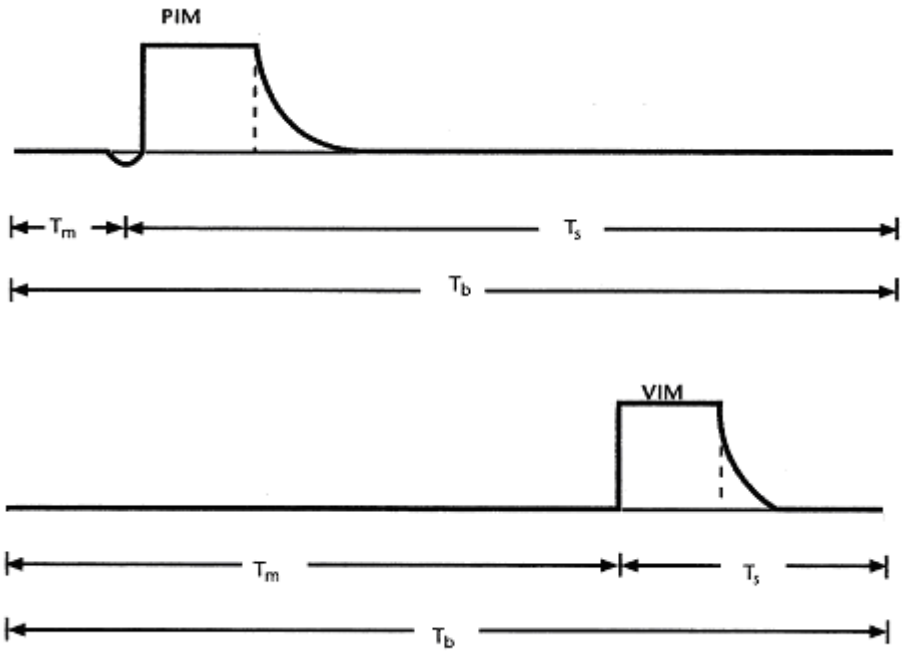
No.	Item	Setting Range	Unit	STEP	Explanation
ⓐ	V_{TIDAL}	15~۲۵۰۰	ml	۱۰	It decides volume of ۱ breath. **NOTE :** It sets the volume of patient weight. It is ۱۰ml per ۱kg. But you can set the volume per ۱kg.
ⓑ	R_{RESP}	۲ ~ 120	BPM	۱	It sets the respiratory rate per ۱ minute.
ⓒ	T_{PAUSE}	۰.۰~ ۲.۰	Sec	۰.۱	Inspiration Pause Time It set the inspiration time.
ⓓ	PEEP	۰ ~ ۴۵	cmH_2O	۱	It set the PEEP pressure. (Base pressure of patient)
ⓔ	O_2	۲۱~ ۱۰۰	%	۱	It sets the percent of O_2 to patient.
ⓕ	F_{PEAK}	۵ ~ ۱۸۰	LPM	۱	It sets the flow-peak (maximum velocity) to patient.
ⓖ	F_{END}	۲۵~ ۱۰۰	%	۵	It sets percent of Flow (supply velocity) / Fpeak (supply maximum velocity) to End-tidal.
ⓗ	E_{SENS}	۱۰ ~ ۶۰	%	۱۰	It sets the sensitivity of one breath completion of patient during to setting of percent of patient expiration volume.
ⓘ	TRIGGER Type	Pressure /Flow	cmH_2O /LPM		It sets the type of trigger. It is Pressure or Flow type.
ⓙ	TRIGGER	۰.۵ ~ ۲۰	cmH_2O /LPM	۰.۵	Setting to detect spontaneous breathing signal, There are pressure and Flow type. User can select one.
ⓚ	PPS	۰ ~ ۴۵	cmH_2O	۱	It sets the pressure to patient during spontaneous breathing.
ⓛ	RUN	-	-	-	It works V_{SIMV} Mode.
ⓜ	RETURN	-	-	-	Go back to previous menu

Table ۳-6. V_{SIMV} Menu Tree

SIMV (Volume Control or Pressure Control) only Mandatory Breath

SIMV is a mixed ventilator mode that allows both mandatory and spontaneous breaths. SIMV mode differs to other company. SIMV of MEKANT guarantees one of mandatory breath per SIMV cycle. This mandatory breath works by patient initiated mandatory (PIM or Assisted Mandatory) breath or ventilator initiated mandatory (VIM or Controlled Mandatory).

As the below figure shows, each SIMV breath cycle (Tb) has two parts. One is the mandatory interval (Tm) and the other is Spontaneous Interval (Ts). PIM is delivered, the Tm interval ends and the ventilator switches to the spontaneous interval (Ts). If a PIM is not delivered, the ventilator delivers a VIM at the end of the mandatory interval, and then switches to the spontaneous interval.



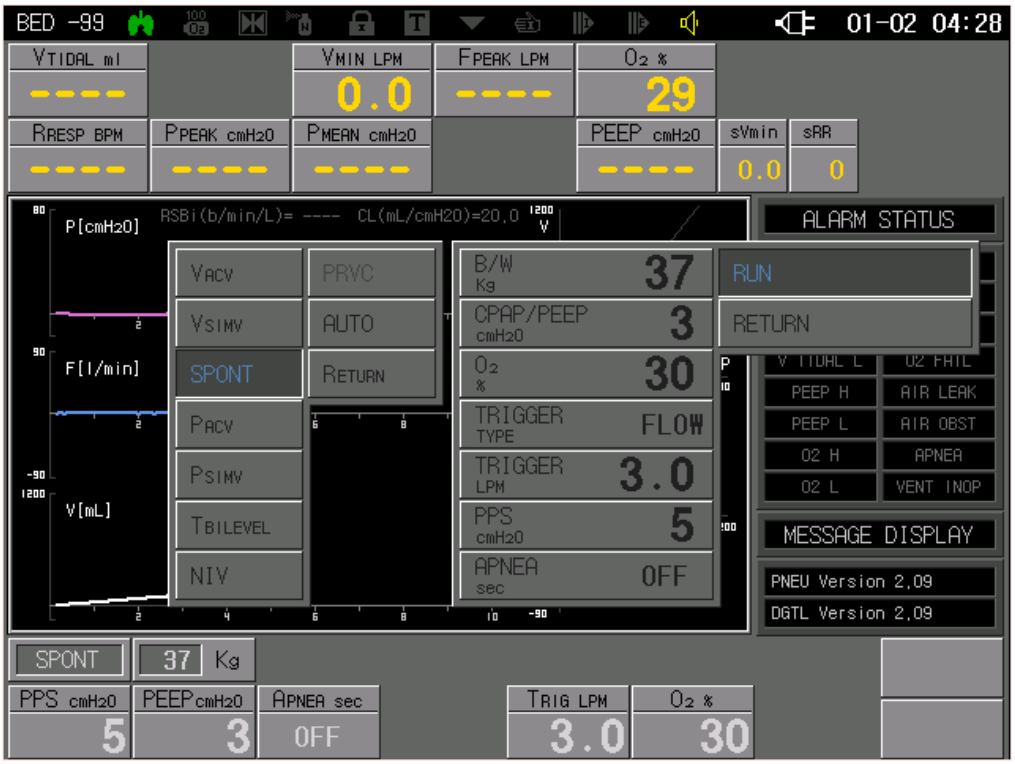
In the SIMV mode of MEKANT, SIMV Breath Cycle is decided by respiratory rate of setting. If respiratory rate is ١٢ times, SIMV Breath Cycle is ٥ seconds. Mandatory Interval is defined as whichever is less ٠.٦ x SIMV Breath Cycle, or ١٠ seconds. Mandatory interval can be shorter according to PIM breath.

3.4.1.4 SPONT

SPONT *(Spontaneous Ventilation) : It supports spontaneous breathing.*

Caution

When MEKANT is working SPONT mode to apnea status during setting time, it change mode(VACV) of Apnea Backup setting automatically. It does change back SPONT mode, when 3 times spontaneous breaths within 10seconds in apnea backup mode.



No	Item	Setting Range	Unit	STEP	Explanation
ⓐ	PEEP	۰ ~ ۴۵	cmH۲O	۱	It sets the PEEP pressure. (Base pressure of patient)
ⓑ	O۲	۲۱ ~ ۱۰۰	%	۱	It sets the percent of O۲ to patient.
ⓒ	TRIGGER Type	Pressure /Flow	cmH۲O /LPM		It sets the type of trigger. It is Pressure or Flow type.
ⓓ	TRIGGER	۰.۵ ~ ۲۰	cmH۲O /LPM	۰.۵	Setting to detect spontaneous breathing signal, There are pressure and Flow type. User can select one.
ⓔ	PPS	۰ ~ ۴۵	cmH۲O	۱	It sets the pressure to patient during spontaneous breathing.
ⓕ	APNEA	OFF ~ 6۰	sec	۱۰	If patient has not breath of setting time it works Apnea mode. It does not detect breath of patient during “OFF”
ⓖ	RUN	-	-	-	It works SPONT Mode.
ⓗ	RETURN	-	-	-	Go back to previous menu

Table ۳-7. SPONT Menu tree

SPONT mode only

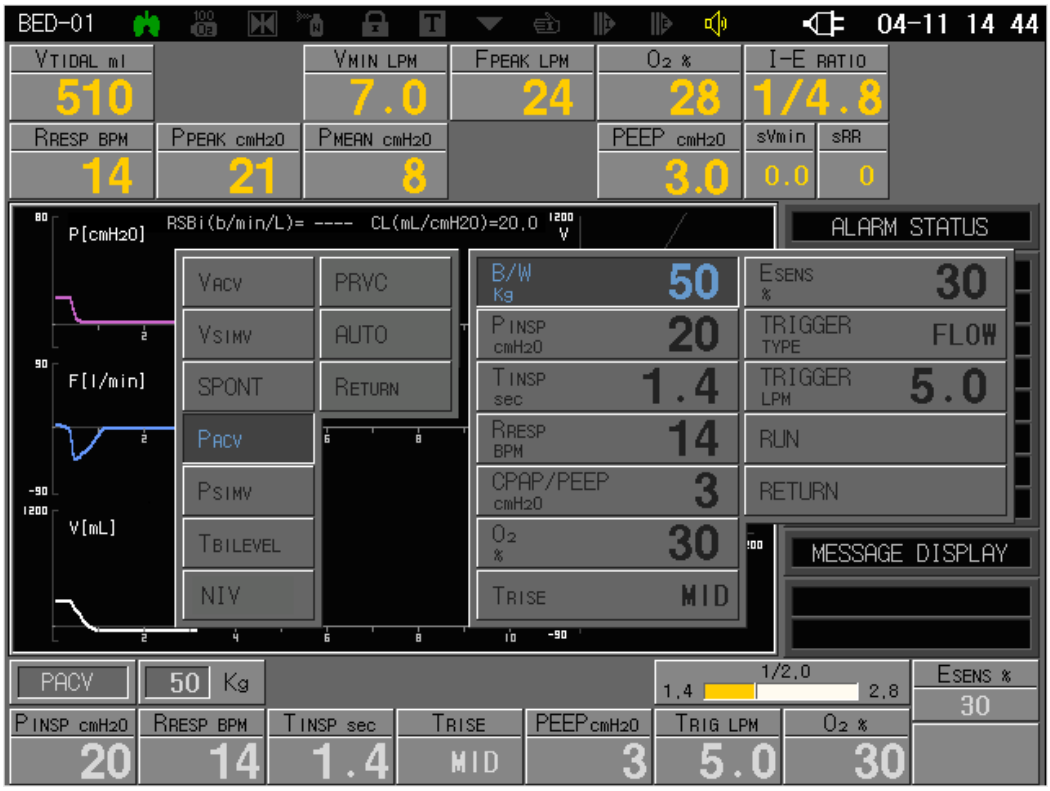
If spontaneous breath reach to sensitivity, it makes pressure between setting of sensitivity and ١ cmH٢٠ through flow supply according to patient flow demand. If Pressure is bigger than ١ cmH٢٠, it starts expiration to opening Exhalation valve. If patient has apnea breath, MEKANT occurs Apnea alarm and start Apnea ventilation(VACV Mode).

It works setting of Respiratory Rate, Tidal Volume, Inspiratory Pressure, Peak Flow, Inspiratory Time, FiO٢ and so on.

It works same as pressure support ventilation. Also if patient has apnea breath, MEKANT occur Apnea alarm and start Apnea ventilation. But it change previous spontaneous mode if patient has 3 times spontaneous breaths within 10seconds.

3.4.1.5 P_{ACV}

P_{ACV} *(Pressure based Assistance Controlled Ventilation) : It controls Patient Ventilation by force from air pressure.*



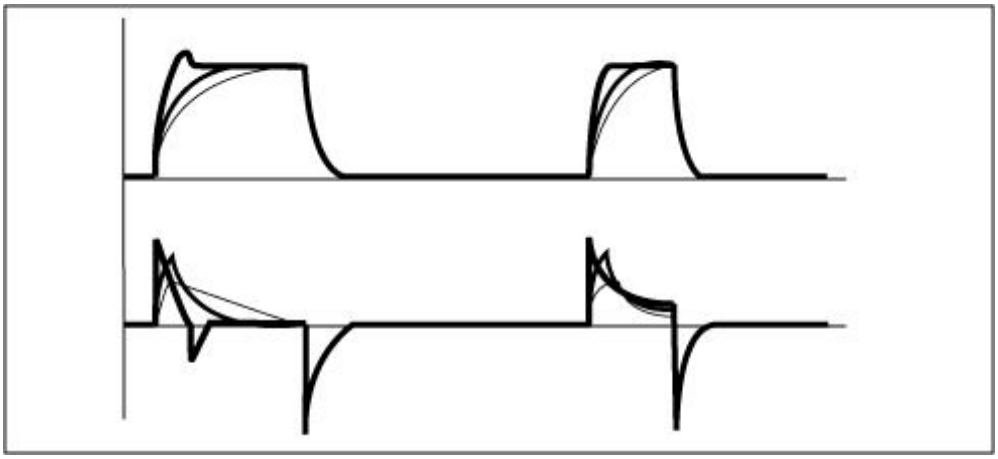
No	Item	Setting Range	Unit	STEP	Explanation
ⓐ	P_{INSP}	۵ ~ ۸۰	cmH_2O	۱	It sets the pressure to patient during inspiration.
ⓑ	T_{INSP}	۰.۲ ~ ۹.۹	sec	۰.۱	It sets the inspiration time.
ⓒ	R_{RESP}	۲ ~ ۱20	BPM	۱	It sets the respiratory rate per ۱ minute.
ⓓ	PEEP	۰ ~ ۴۵	cmH_2O	۱	It sets the PEEP pressure. (Base pressure of patient)
ⓔ	O_2	۲۱ ~ ۱۰۰	%	۱	It sets the percent of O_2 to patient.
ⓕ	TRISE	FAST,MID, SLOW	–	–	It sets the flow speed of gas to patient.
ⓖ	E_{SENS}	۱۰ ~ ۶۰	%	۱۰	It sets the sensitivity of one breath completion of patient during to setting of percent of patient expiration volume.
ⓗ	TRIGGER Type	Pressure /Flow	cmH_2O /LPM		It sets the type of trigger. It is Pressure or Flow type.
ⓘ	TRIGGER	۰.۵ ~ ۲۰	cmH_2O /LPM	۰.۵	Setting to detect spontaneous breathing signal, There are pressure and Flow type. User can select one.
ⓙ	RUN	-	-	-	It works PACV Mode
ⓚ	RETURN	-	-	-	Go back to previous menu

Table ۳-8. P_{ACV} Menu tree

A/C (Pressure Control) PACV

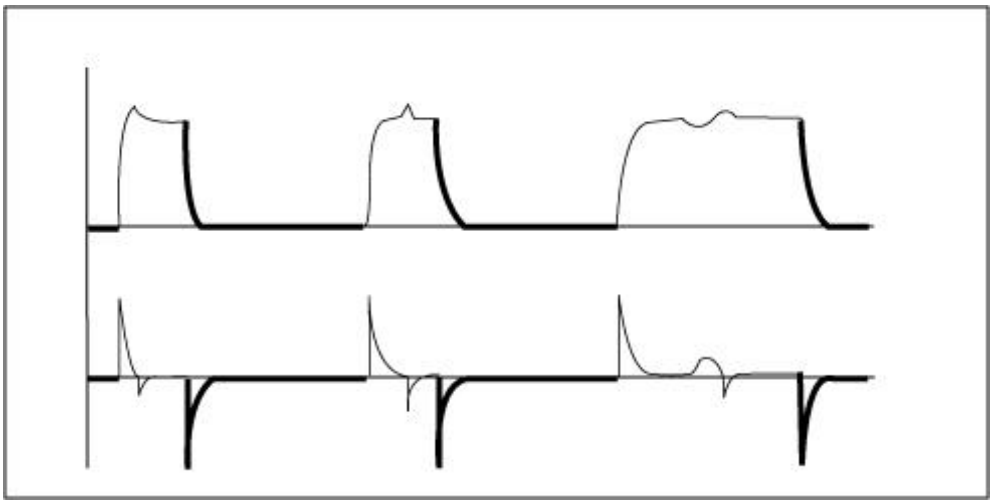
When MEKANT provide pressure control ventilation of mandatory breath, it draws inspiratory pressure instead of tidal volume and it sets I:E ratio or inspiratory time instead of peak flow same as other company.

But as the below figure shows, it is differ to slope of increase – baseline (PEEP) to Inspiratory pressure – according to setting of flow acceleration percent (FAP).
According to an increment of FAP setting value, slope of pressure is rapid. If not slope of pressure is gentle. If you show slope of flow, you know that FAP is the change of flow volume to patient. FAP sets PCV and PSV each other.



MEKANT keeps on pressure regularly during inspiration same as other company. So it has Ramp shape of flow pattern and cannot use plateau function.

MEKANT is more activity and elaborateness for control of airway pressure because it has exhalation valve and active exhalation valve. So it controls pressure to exhalation valve in patient's talk, cough. And it allows spontaneous breath. It is special function only MEKANT. It explain figure of next page.

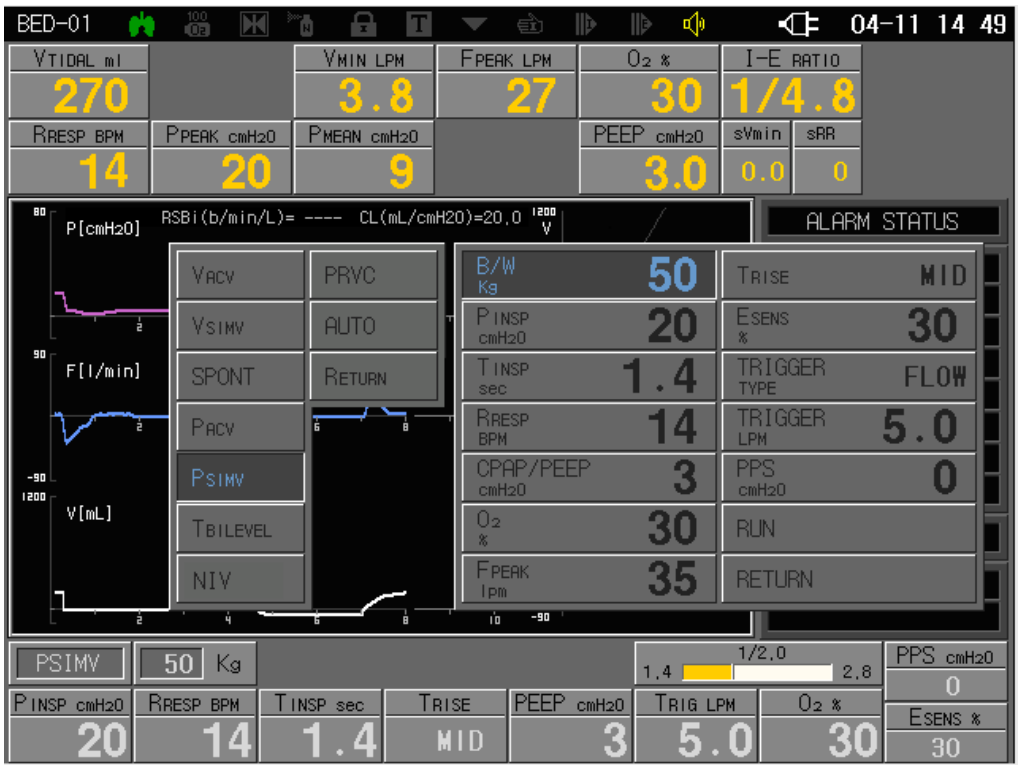


3.4.1.6 P_{SIMV}

P_{SIMV} *(Pressure based Synchronized Intermittent Mandatory Ventilation) : This mode is that MEKANT control artificial respiration by spontaneous breath and pressure.*

NOTE :

MEKANT synchronized spontaneous breathing or in case of without spontaneous breathing signal MEKANT ventilate by pressure.



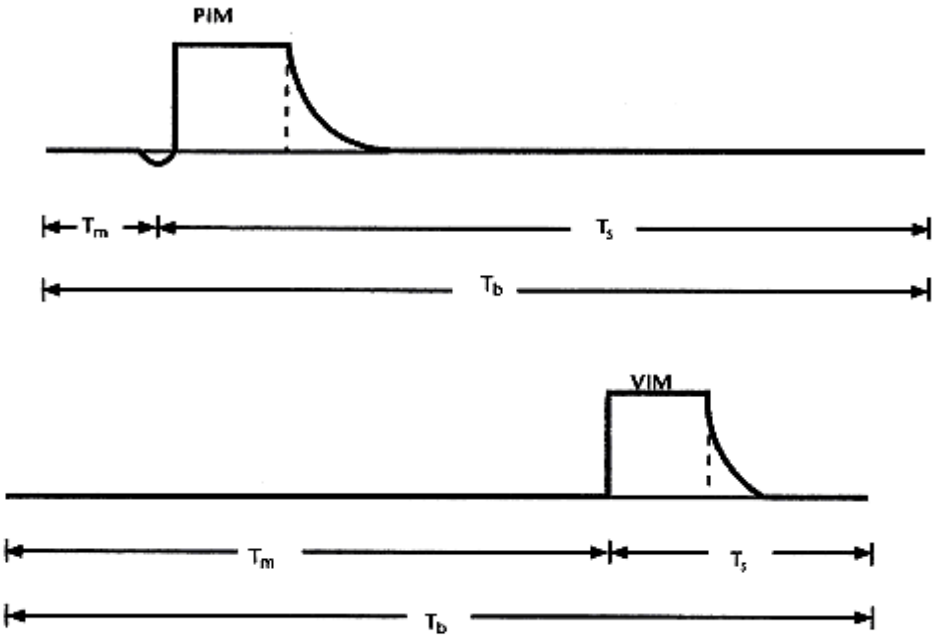
No	Item	Setting Range	Unit	STEP	Explanation
ⓐ	P_{INSP}	۵ ~ ۸۰	cmH۲O	۱	Setting the patient pressure to once breath.
ⓑ	T_{INSP}	۰.۲ ~ ۹.۹	sec	۰.۱	Setting the inspiration Time.
ⓒ	R_{RESP}	۲ ~ ۱20	BPM	۱	Setting number of breath per minute.
ⓓ	PEEP	۰ ~ ۴۵	cmH۲O	۱	Setting PEEP pressure. (Base Pressure)
ⓔ	$O_۲$	۲۱ ~ ۱۰۰	%	۱	Setting oxygen density.
ⓕ	T_{RISE}	FAST,MID, SLOW	–	–	It sets the flow speed of gas to patient
ⓖ	E_{SENS}	۱۰ ~ ۶۰	%	۱۰	Setting sensitivity of expiration by ratio of expiration capacity.
ⓗ	TRIGGER Type	Pressure /Flow	cmH۲O /LPM		It set the type of trigger. It is Pressure or Flow type.
ⓘ	TRIGGER	۰.۵ ~ ۲۰	cmH۲O /LPM	۰.۵	Setting to detect spontaneous breathing signal, There are pressure and Flow type. User can select one.
ⓙ	PPS	۰ ~ ۴۵	cmH۲O	۱	Setting pressure of patient when it is working spontaneous breathing.
ⓚ	RUN	-	-	-	Execute PSIMV Mode.
ⓛ	RETURN	-	-	-	Go back to previous menu

Table ۳-9. P_{SIMV} Menu tree

SIMV (Volume Control or Pressure Control) only Mandatory Breath

SIMV mode is able to work Mandatory Breath and Spontaneous Breath. MEKANT's SIMV mode is difference with other equipments. MEKANT's SIMV mode guarantees at least one Mandatory Breath per each cycle. This Mandatory Breath is one of the alternative Patient Initiated Mandatory (PIM or Assisted Mandatory) Breath or Ventilator Initiated Mandatory (VIM or Controlled Mandatory) Breath.

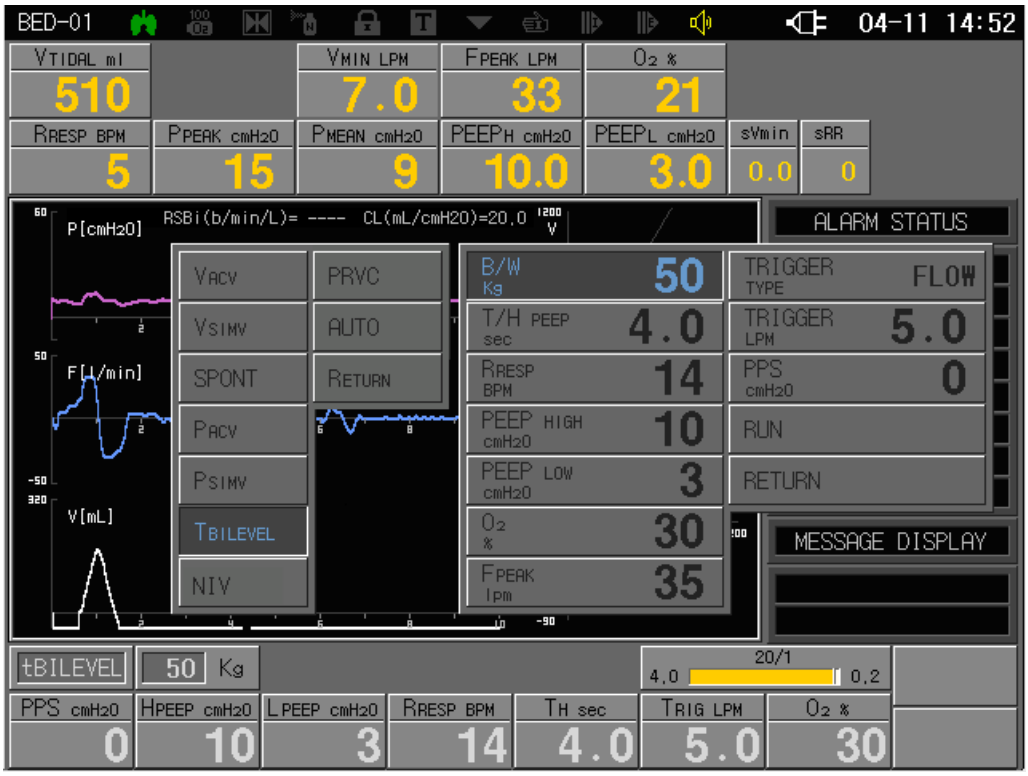
As bellow figure each SIMV Breath Cycle has two parts one is Mandatory Interval (Tm) and other one is Spontaneous Interval (Ts). After receive PIM Breath signal the Mandatory Interval was terminated and than to start Spontaneous Interval (Ts). If PIM Breath does not happen until Mandatory Interval terminate It will finish Mandatory Interval and than change to Spontaneous Interval with VIM Breath.



MEKANT SIMV mode's SIMV Breath Cycle depend on number of breath. For example if set Respiratory Rate is ١٢ SIMV Breath Cycle is ٥ sec. Mandatory Interval is taken smaller value maximum ١٠ sec or ٠.٦x SIMV Breath Cycle. Mandatory Interval will be shorter by PIM Breath.

3.4.1.7 $T_{BILEVEL}$

$T_{BILEVEL}$: It works same as SPONT mode and it has Upper PEEP.



No	Item	Setting Range	Unit	STEP	Explanation
ⓐ	T/H $_{PEEP}$	۰.۲ ~ ۲۴	sec	۰.۱	Setting High PEEP Time (Upper pressure holding time).
ⓑ	R_{RESP}	۲ ~ 120	BPM	۱	Setting patient's number of breath.
ⓒ	PEEP $_{HIGH}$	۵ ~ ۴۵	cmH$_۲$O	۱	Setting High PEEP (Upper pressure).
ⓓ	PEEP $_{LOW}$	۰ ~ ۴۵	cmH$_۲$O	۱	Setting PEEP (Base Pressure of patient).
ⓔ	O$_۲$	۲۱ ~ ۱۰۰	%	۱	Setting oxygen density of air
ⓕ	TRIGGER Type	Pressure /Flow	cmH$_۲$O /LPM		It sets the type of trigger. It is Pressure or Flow type.
ⓖ	TRIGGER	۰.۵ ~ ۲۰	cmH$_۲$O /LPM	۰.۵	Setting to detect spontaneous breathing signal, There are pressure and Flow type. User can select one.
ⓗ	PPS	۰ ~ ۴۵	cmH$_۲$O	۱	Setting pressure of patient when it is working spontaneous breathing.
ⓘ	RUN	-	-	-	Execute TBILEVEL Mode.
ⓙ	RETURN	-	-	-	Move to previous menu.

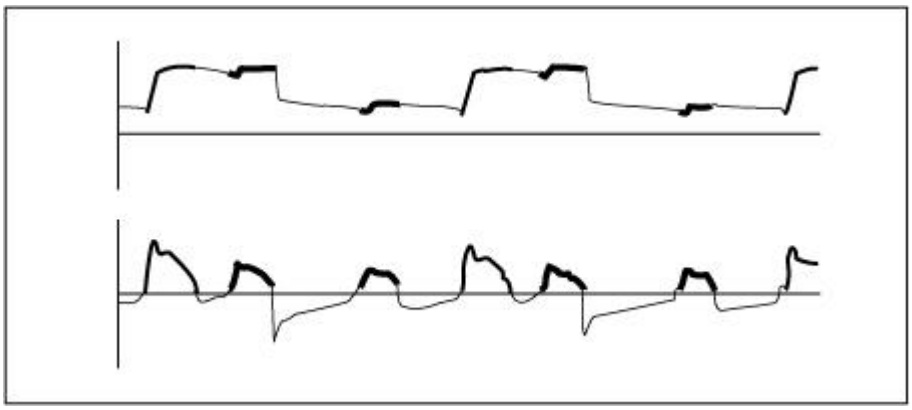
Table ۳-۱0. $T_{BILEVEL}$ Menu tree

T-BiLevel Mandatory Breath

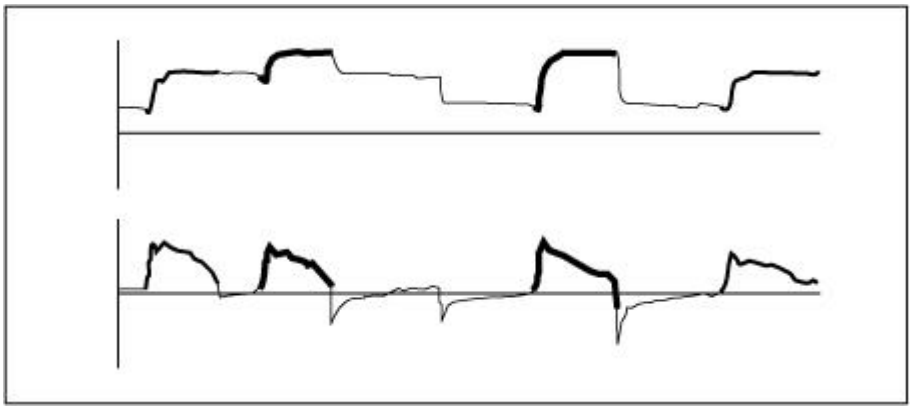
MEKANT's 'BiLevel mode is complex mode it may happened Mandatory Breath and Spontaneous Breath. Because it works as SIMV mode but it difference because Spontaneous range not fixed. So, anytime it is able to Spontaneous Breath.

'BiLevel has two level of PEEP to supply patient. The upper PEEP is $PEEP_H$ and lower PEEP is $PEEP_L$. Mandatory Breath's Inspiration is from $PEEP_L$ to $PEEP_H$ and Expiration is from $PEEP_H$ to $PEEP_L$. So 'BiLevel mode's Mandatory Breath is Pressure Control Ventilation. Each change time of before and after small zone is changing zone, this zone purpose is to detect patient breath if it detect patient breath it would adjust little early or late to start change inspiration and expiration for synchronizing with patient breathing.

Setting parameters are Respiratory Rate, PEEPH, PEEPL, PEEPH time (or I:E ratio , PEEPL time), FAP and so on, In case of Pressure Support Ventilation there is more add Support Pressure, FAP, Essens and so on.



MEKANT's 'BiLevel mode supplies ١.٥ cmH٢O Pressure in Spontaneous Breath. If user want to more high pressure support it will use Pressure Support Ventilation setting. If Support Pressure + $PEEP_L$ value is higher than $PEEP_H$ It will be working pressure support ventilation difference than Spontaneous breath works Pressure Support Ventilation. Refer to the figure below.

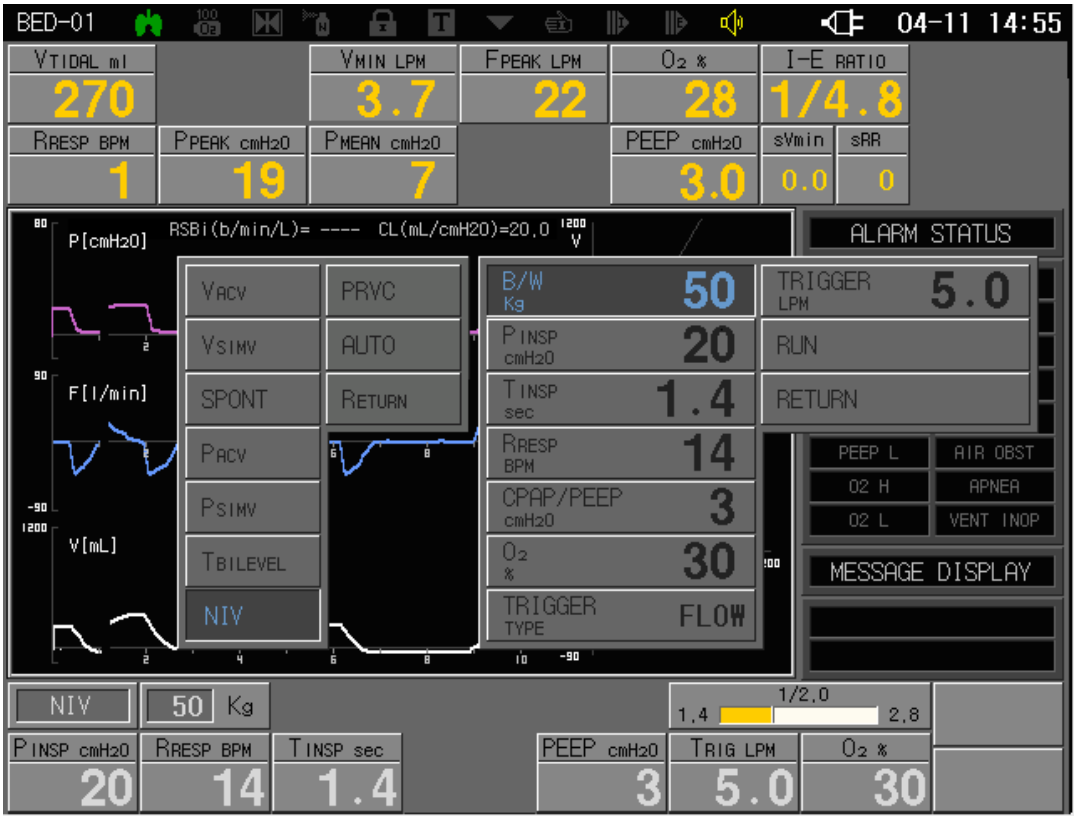


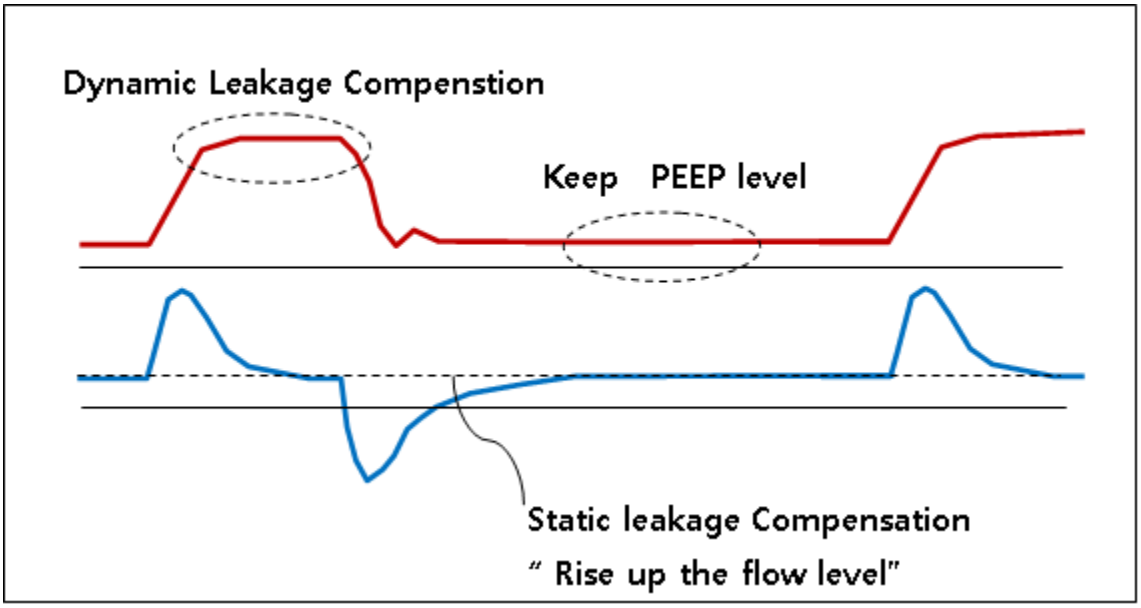
tBiLevel mode is able to work Spontaneous Breath any time it reduce fighting between ventilator and patient. It can reduce sedation so patient gets over more sort

All of Spontaneous Breath supplies Pressure Support Ventilation so patient feel more comfortable. If it using opposite I:E ratio it means very sort Expiratory Time it is Airway Pressure Release Ventilation(APRV) status. This APRV is one of best way to apply ARDS (Adult Respiratory Distress Syndrome).

3.4.1.8 NIV

NIV : *Mask type ventilation, it works similar PACV mode with air leakage.*



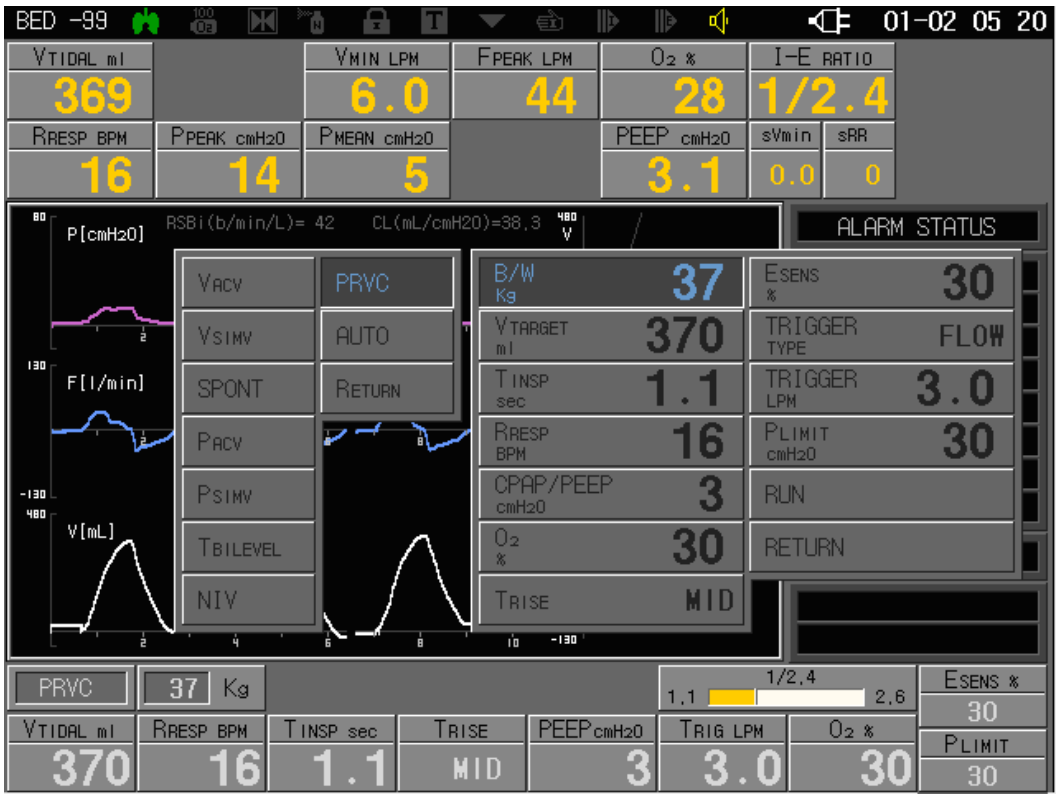


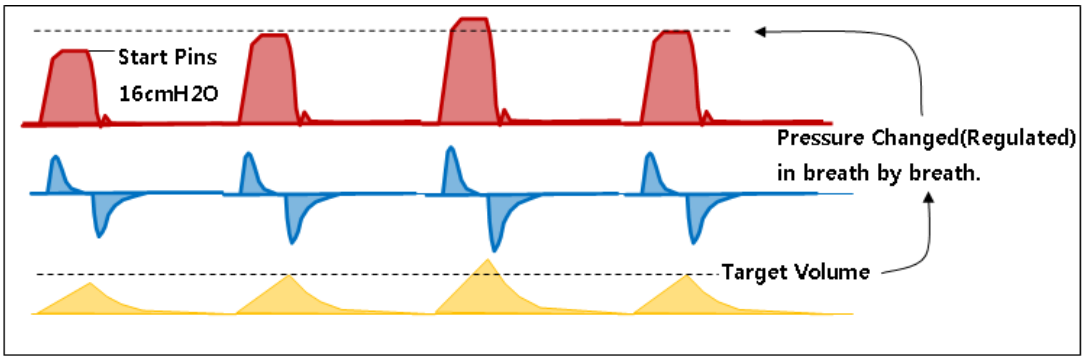
No	Item	Setting Range	Unit	STEP	Explanation
ⓐ	P_{INSP}	۵ ~ ۸۰	cmH_2O	۱	Setting the patient pressure to once breath.
ⓑ	T_{INSP}	۰.۲ ~ ۹.۹	sec	۰.۱	Setting the inspiration Time
ⓒ	R_{RESP}	۲ ~ ۱20	BPM	۱	Setting number of breath per minute.
ⓓ	PEEP	۰ ~ ۴۵	cmH_2O	۱	Setting PEEP pressure (Base Pressure)
ⓔ	O_2	۲۱ ~ ۱۰۰	%	۱	Setting oxygen density.
ⓕ	TRIGGER Type	Pressure /Flow	cmH_2O /LPM		It set the type of trigger. It is Pressure or Flow type.
ⓖ	TRIGGER	۰.۵ ~ ۲۰	cmH_2O /LPM	۰.۵	Setting to detect spontaneous breathing signal, There are pressure and Flow type. User can select one.
ⓗ	RUN	-	-	-	Execute NIV Mode.
ⓘ	RETURN	-	-	-	Move to previous menu.

Table ۳-۱1. NIV menu tree

3.4.1.1 PRVC

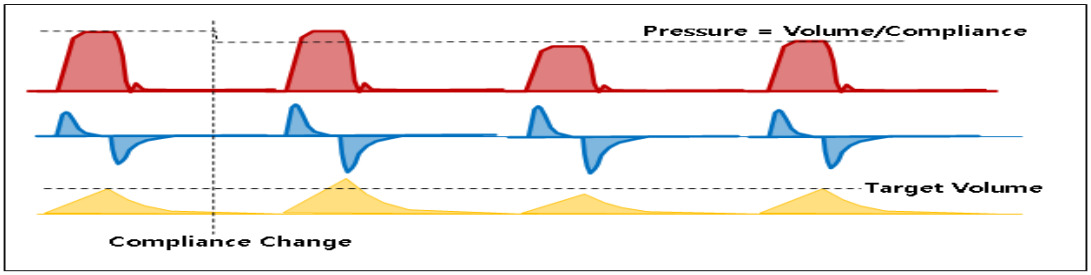
PRVC *(Pressure Regulated Volume Controlled Ventilation) : Breaths are delivered mandatorily to assure present volumes, with a constant inspiratory pressure continuously adapting to the patient's condition. The flow pattern is decelerating.*





Initial operation of PRVC (1st Breahing)

3 Operating Instructions



No.	Item	Setting Range	Unit	Step	Explanation
ⓐ	V_{TIDAL}	15 ~ ٢٥٠٠	ml	١٠	It decides volume of ١ breath. **NOTE :** It set the volume of patient weight. It is ١٠ml per ١kg. (You can set the volume per ١kg in [SYSTEM SET - USER SETUP - B/W FACTOR] Menu.)
ⓑ	T_{INSP}	٠.٢ ~ ٩.٩	sec	٠.١	Setting the inspiration Time
ⓒ	R_{RESP}	٢ ~ 120	BPM	١	It sets the respiratory rate per ١ minute.
ⓓ	PEEP	٠ ~ ٤٥	cmH_2O	١	It sets the PEEP pressure.(Base pressure of patient)
ⓔ	O_2	٢١ ~ ١٠٠	%	١	It sets the percent of O_2 to patient.
ⓕ	TRISE	FAST, MID, SLOW	–	–	It sets the flow speed of gas to patient
ⓖ	E_{SENS}	١٠ ~ ٦٠	%	١٠	It sets the sensitivity of one breath completion of patient during to setting of percent of patient expiration volume.
ⓗ	TRIGGER Type	Pressure /Flow	cmH_2O /LPM		It sets the type of trigger. It is Pressure or Flow type.
ⓘ	TRIGGER	٠.٥ ~ ٢٠	cmH_2O /LPM	٠.٥	Setting to detect spontaneous breathing signal, There are pressure and Flow type. User can select one.
ⓙ	PLIMIT	3 ~ 80	cmH_2O	30	It sets the patient pressure limit to set over pressure.
ⓚ	RUN	-	-	-	It works PRVC Mode.
ⓛ	RETURN	-	-	-	Go back to previous menu

Table ٣-١2. PRVC menu tree description

3.4.1.10 AUTO

AUTO *: Emergency Quick Start function it requirement patient body weight. It works PACV Mode. This menu purpose is that in case of emergency patient user have to start quickly so it has minimum stability. All parameters are setup default and user can execute with only body weight. But this mode can work one hour every one hour it displayed warning message. The warning message is that "CAUTION : AUTO MODE".*

No	Item	Setting Range	Unit	STEP	Explanation
ⓐ	RUN	-	-	-	Execute AUTO Mode.
ⓑ	RETURN	-	-	-	Move to previous menu.

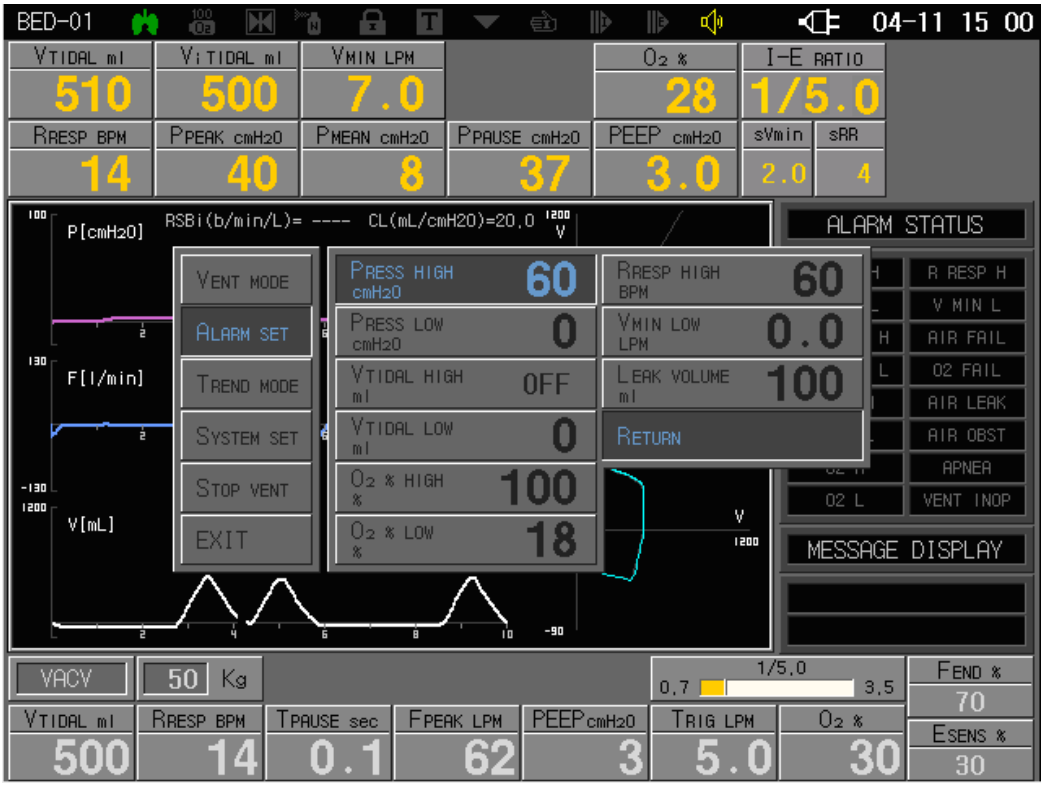
Table ٣-١3. AUTO menu tree description

3.4.2 Alarm Set

Each parameter has own alarm limit. User can set alarm limitation through moving the

encoder on the key front.

Leak volume setting value affect airway leakage checking. If you set 100(ml) leak volume, ventilation operates. If inspiratory volume is bigger than expiratory volume about 100ml, [AIR LEAK] alarm sounds and message displays.



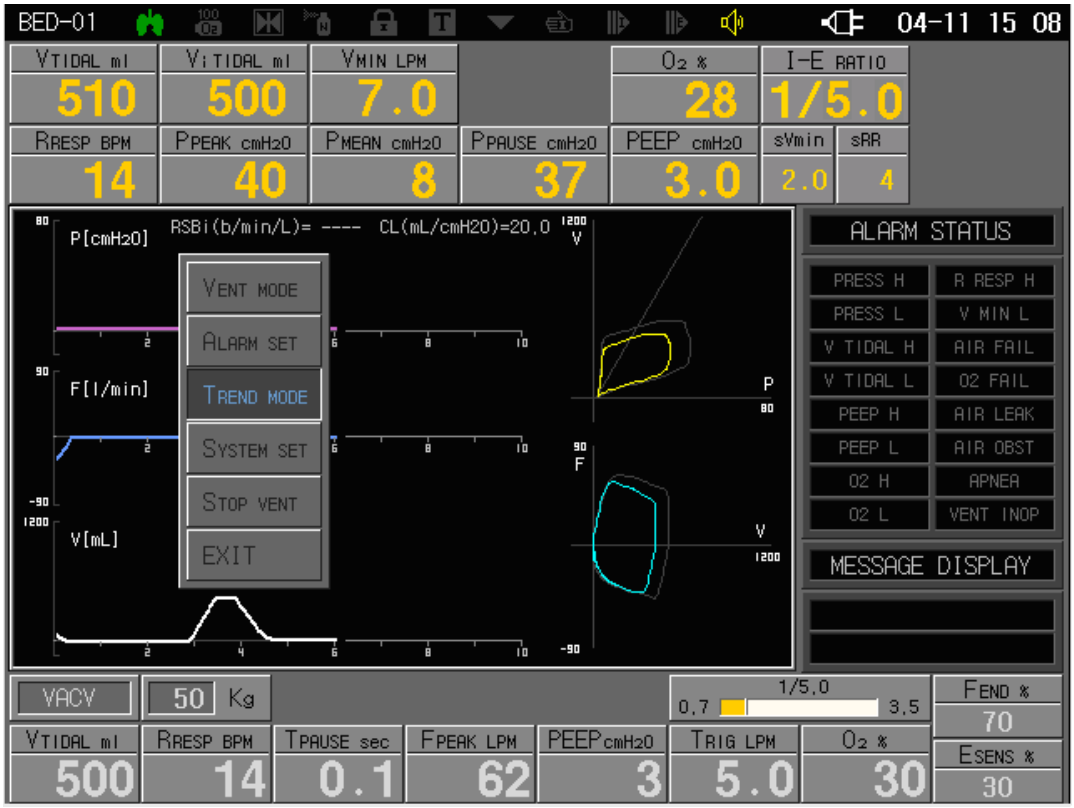
No	Item	Setting Range	Unit	STEP	Explanation
ⓐ	$P_{RESS\ HIGH}$	٥ ~ ١٢٠	$cmH_٢O$	١	Upper limit of patient's pressure.
ⓑ	$P_{RESS\ LOW}$	٠ ~ ٥٠	$cmH_٢O$	١	Lower limit of patient's pressure.
ⓒ	$V_{TIDAL\ HIGH}$	٢٠~ ٢٥٠٠,OFF	ml	١٠	Upper limit of patient's capacity.
ⓓ	$V_{TIDAL\ LOW}$	٠ ~ ٢٥٠٠	ml	١٠	Lower limit of patient's capacity.
ⓔ	$O_{٢\ HIGH}$	٢١ ~ ١٠٠	%	١	Upper limit of oxygen's density.
ⓕ	$O_{٢\ LOW}$	٠ ~ ٨٠	%	١	Lower limit of oxygen's density.
ⓖ	$R_{RESP\ HIGH}$	٢~ ١٢٠	BPM	٢	Upper limit of number of breath per minute.
ⓗ	$V_{MIN\ LOW}$	٠.٠ ~ 99	LPM	٠.١	Lower limit of patient's breathe of capacity.
ⓘ	$L_{EAK\ VOLUME}$	10 ~ 500	ml	10	Difference breathe of capacity between Ins. And Exp. Volume
ⓙ	RETURN	-	-	-	Move to previous menu.

Table ٣-١4. ALARM SET menu tree

3.4.3 Trend Mode

TREND MODE display vital sign from the patient last ٧٢ hours. As the following Figure, it displays table and graph, user can move indicator bar (white vertical line) and check each time patient vital sign. The data stored by one minute, it maximum ٧٢ hours can be stored, when ever user press "CLEAR" key user can be returned VENT MODE

In the TREND MODE user press encoder the trend interval will be change as ١ min, ٥ min, ١٠ min, ٣٠ min, ٦٠ min and ١٢٠ min.



3 Operating Instructions

NOTE :

When user goes from VENT MODE to TREND MODE the icon will be changed form to on the status bar.

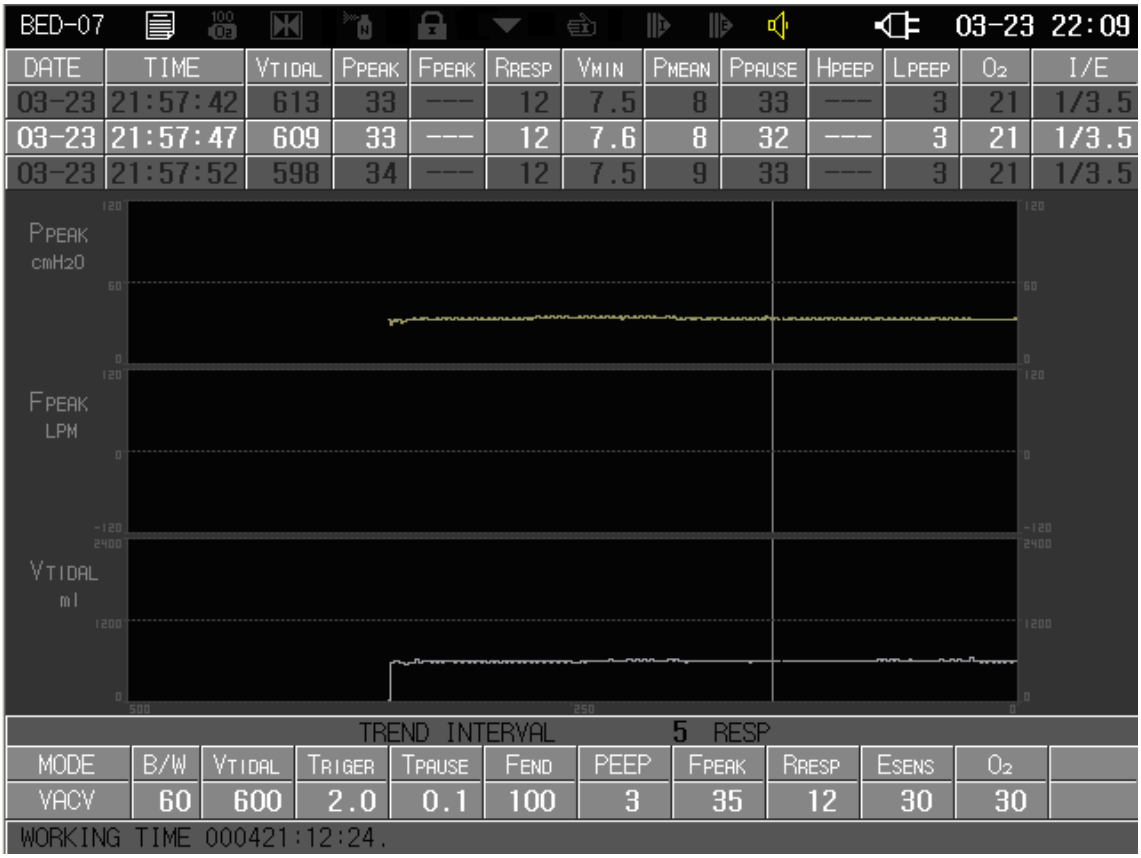


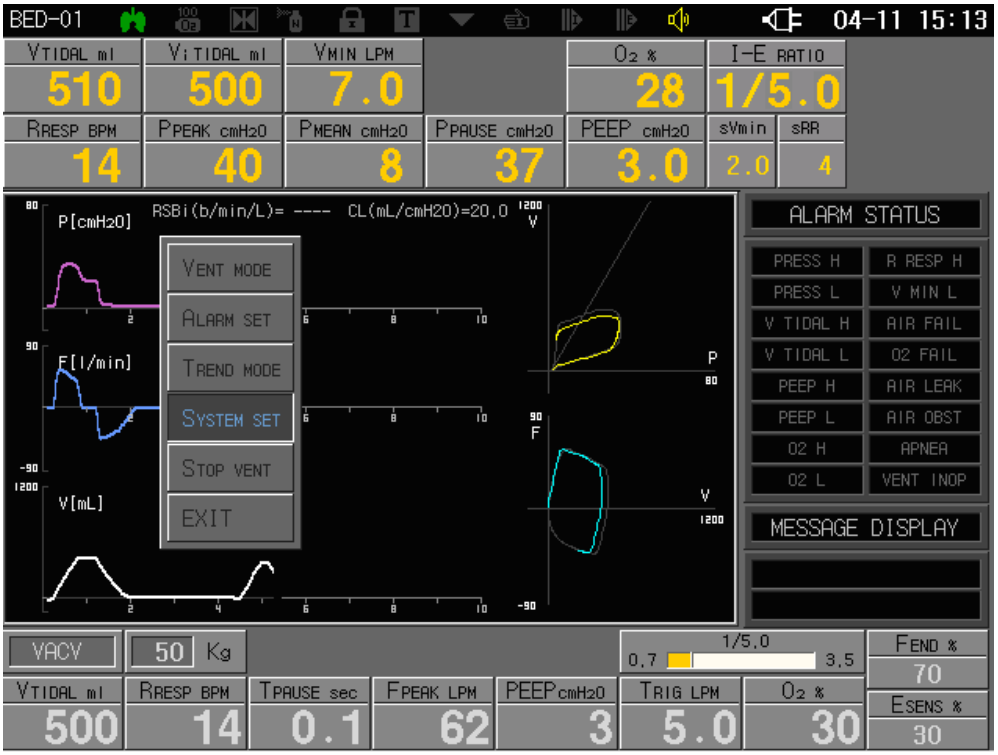
Figure ٣-9. TREND MODE screen

3.4.4 SYSTEM SET

SYSTEM SET menu has BED number, Date/Time, Sound volume, Graph Scale and CALIBRATION menu when you change parameter using encoder.

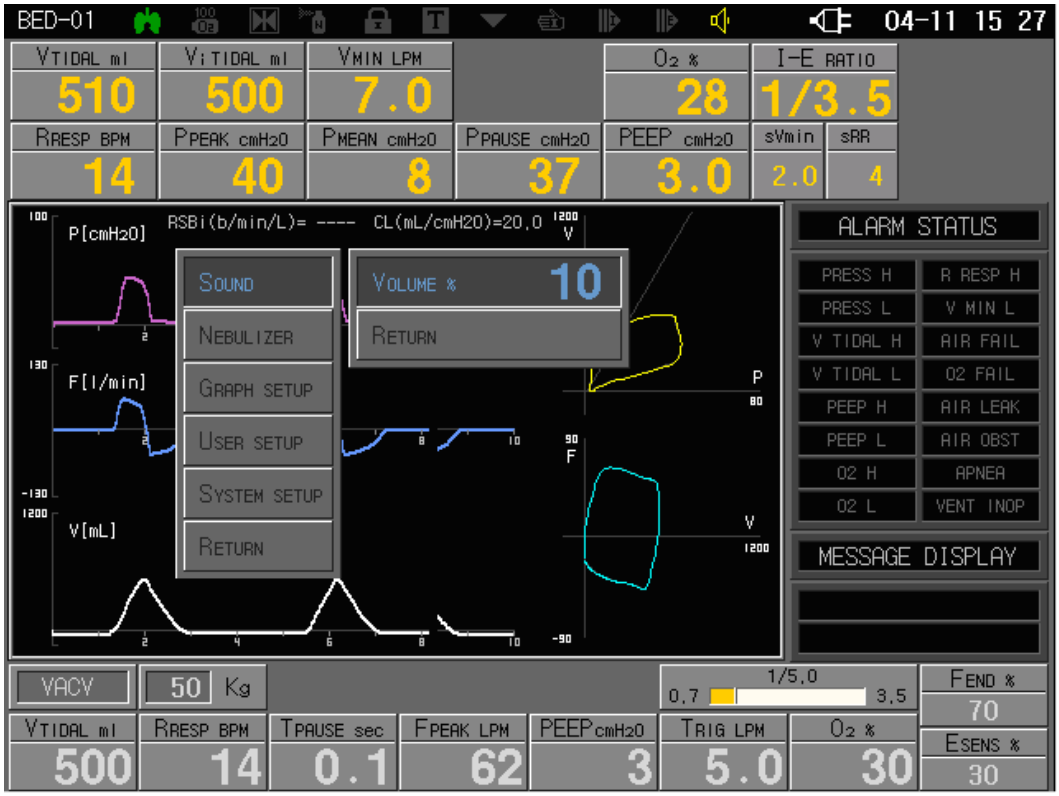
No.	Item	Mode	Explanation	Refer.
ⓐ	SOUND	-	Adjust sound volume.	٣.٤.4.١
ⓑ	NEBULIZER	-	Setting operating time of nebulizer(10 ~ 180 minute)	٣.٤.4.٢
ⓒ	GRAPH SETUP		Graph setup menu(Auto scale set, Pressure Limit, Flow Limit, Volume Limit, Trigger Display)	3.4.4.3
ⓓ	USER SETUP	-	User setup menu (B/W Factor, BED Number, O2 Sensor, and so on)	٣.٤.4.4
ⓔ	SYSTEM SETUP	-	System setup menu (System Information, System Self Calibration)	٣.٤.4.5
ⓕ	RETURN	-	Move to previous menu.	

Table ٣-١5. SYSTEM SET menu tree



3.4.4.1 SOUND

Adjust sound volume.

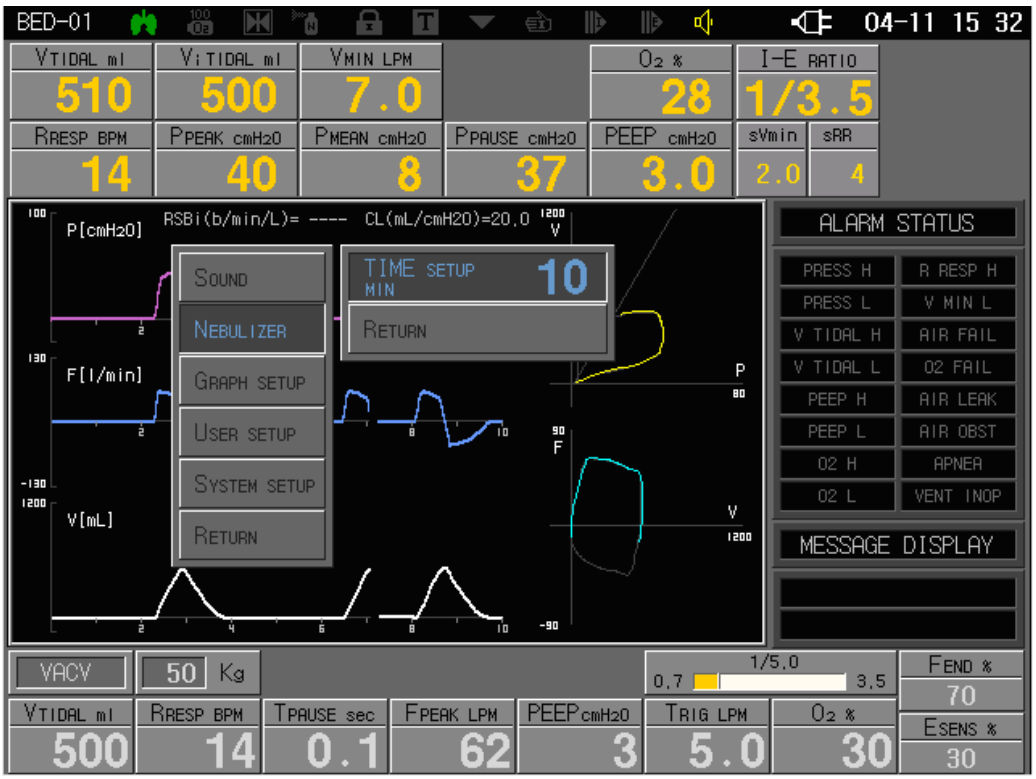


No	Menu	Range	Unit	STEP	Explanation
ⓐ	VOLUME	10 ~ 100	%	١0	Setting alarm sound volume
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-١6. VOLUME menu tree

3.4.4.2 NEBULIZER

Setting nebulizer operating time in minute.



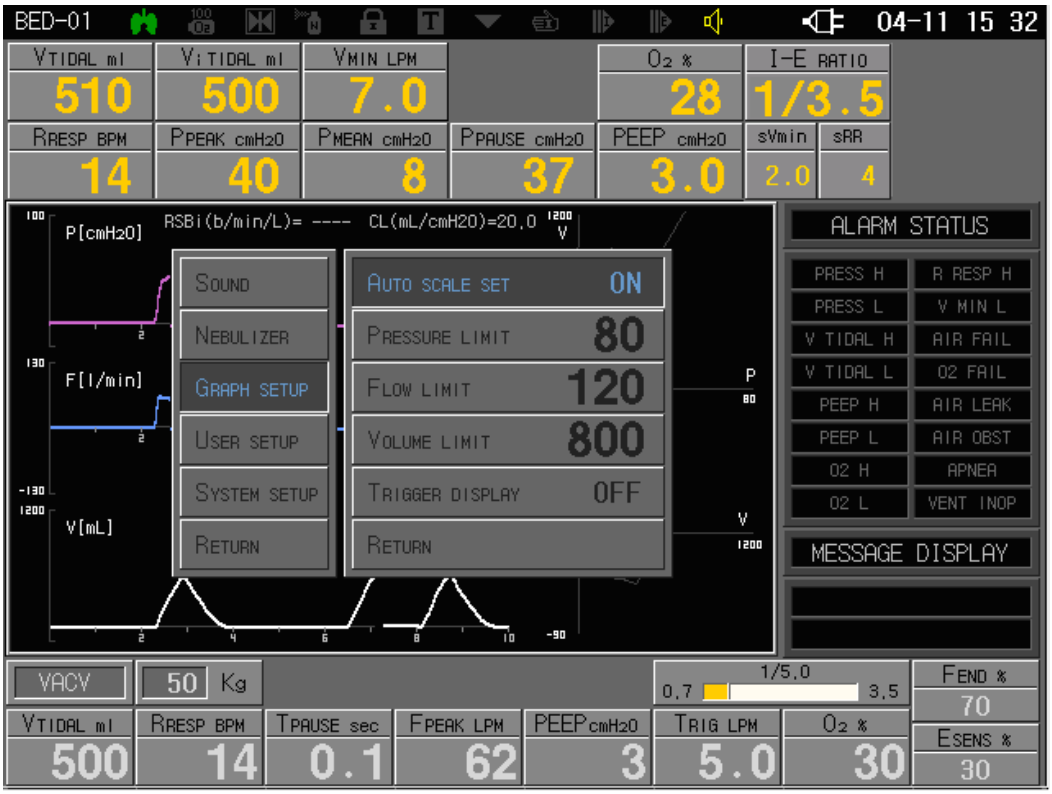
No	Menu	Range	Unit	STEP	Explanation
ⓐ	Nebulizer	10 ~ 180	min	10	Setting operating time of nebulizer.
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-١7. NEBULIZER menu tree

3.4.4.3 GRAPH SETUP

It is setting for graph. There are Auto Scale Set, Pressure Limit, Flow Limit, Volume

Limit and Trigger Display.



No	Menu	Range	Unit	STEP	Explanation
ⓐ	Auto Scale Set	On/Off	-	'	Setting graph auto scale.
ⓑ	Pressure Limit	10~ 100	cmH2O	5	Setting Pressure Graph Highlimit.
ⓒ	Flow Limit	10~100	L/min	5	Setting Flow Graph Highlimit.
ⓓ	Volume Limit	50~3000	ml	50	Setting Volume Graph Highlimit.
ⓔ	Trigger Display	On/Off	-	1	Setting Trigger Mark Display on graph.
ⓕ	RETURN	-	-	-	Move to previous menu.

Table ٣-18. GRAPH SETUP menu tree

3 Operating Instructions

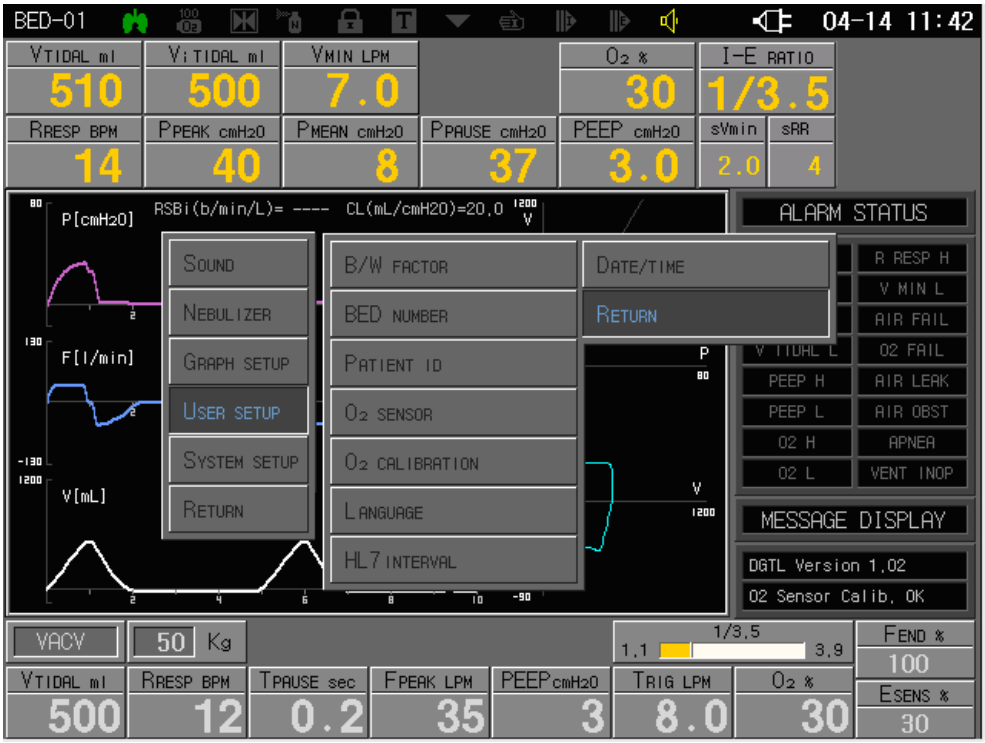
Auto Scale Set Menu sets highlimit value on graph. If Auto Scale Set is ON, the graph highlimit value will control automatically. If Auto Scale Set is OFF, user sets graph highlimit value.

Pressure, Flow and Volume limit Menu set highlimit value on each parameter.

Trigger Display Menu set trigger mark on graph. If Trigger Display is ON, trigger mark

displays on graph at occurring spontaneous breathing.

It is setting for user. There are B/W(Body weight) Factor, BED Number, PATIENT ID, O2 Sensor Enable/Disable, O2 Sensor Calibration, Language, HL7 INTERVAL and Date/Time Setting.

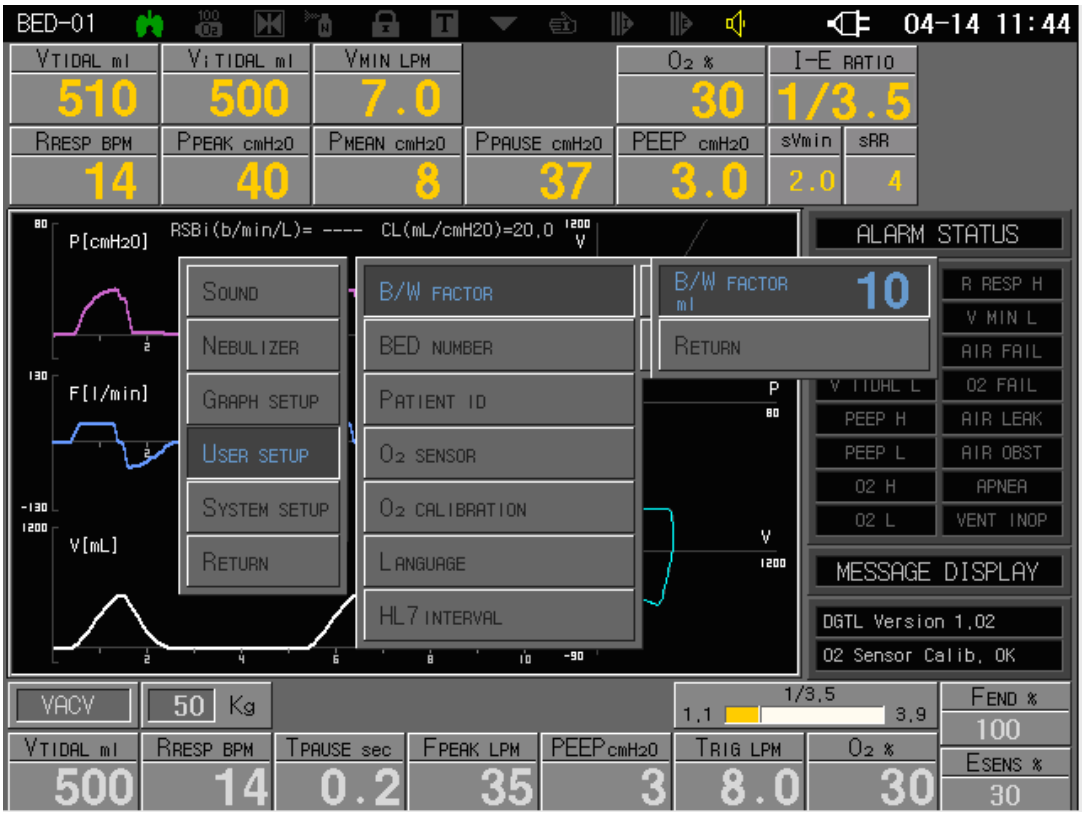


No	Menu	Range	Unit	STEP	Explanation
ⓐ	B/W Factor	5 ~ 15	Ml/Kg	١	Volume / Body weight
ⓑ	BED Number	1~99		1	Setting BED Number
ⓒ	PATIENT ID				Setting Patient ID.
ⓓ	O2 Sensor				Setting O2 Sensor. Enable/Disable
ⓔ	O2 Calibration				Calibrate O2 Sensor.
ⓕ	LANGUAGE				Setting Language(English,German,Spanish)
ⓖ	HL7 INTERVAL				Setting HL7 data sending interval.
ⓗ	Date/Time				Setting Date and time.
ⓘ	RETURN	-	-	-	Move to previous menu.

Table ٣-19. USER SETUP menu tree

3.4.4.4.1 B/W Factor

Setting body weight of patient in ml/kg.



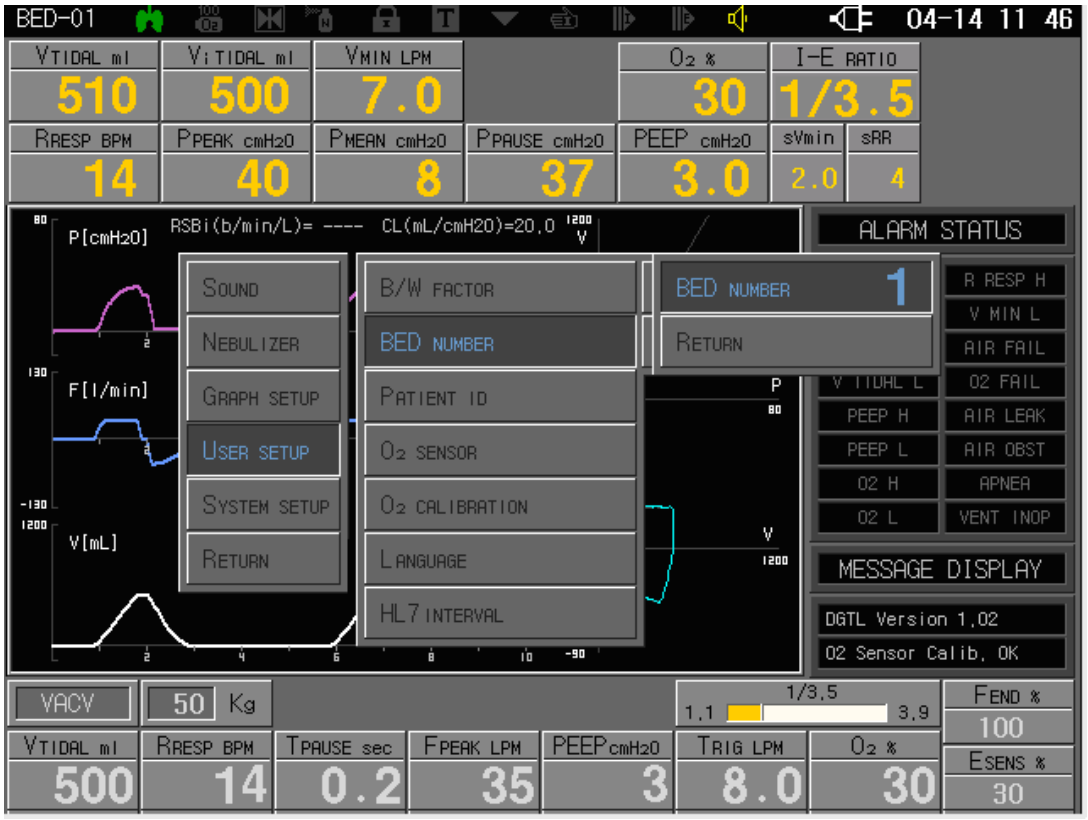
No	Menu	Range	STEP	Explanation
ⓐ	B/W Factor	5 ~ 15	1	Volume / Body weight
ⓘ	RETURN	-	-	Move to previous menu.

Table ٣-20. B/W Factor menu tree

3 Operating Instructions

3.4.4.4.2 BED Number

Setting Bed Number.



No	Menu	Range	Unit	STEP	Explanation
ⓐ	BED Number	1~99		1	Setting Bed number.
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-21. BED Number menu tree

3.4.4.4.3 PATIENT ID

Setting patient ID. The patient ID is used for HL7 data format.

No	Menu	Range	Unit	STEP	Explanation
ⓐ	PATIENT ID	0 ~ 99999999			Setting Patient ID.
ⓑ	RETURN	-	-	-	Move to previous menu.

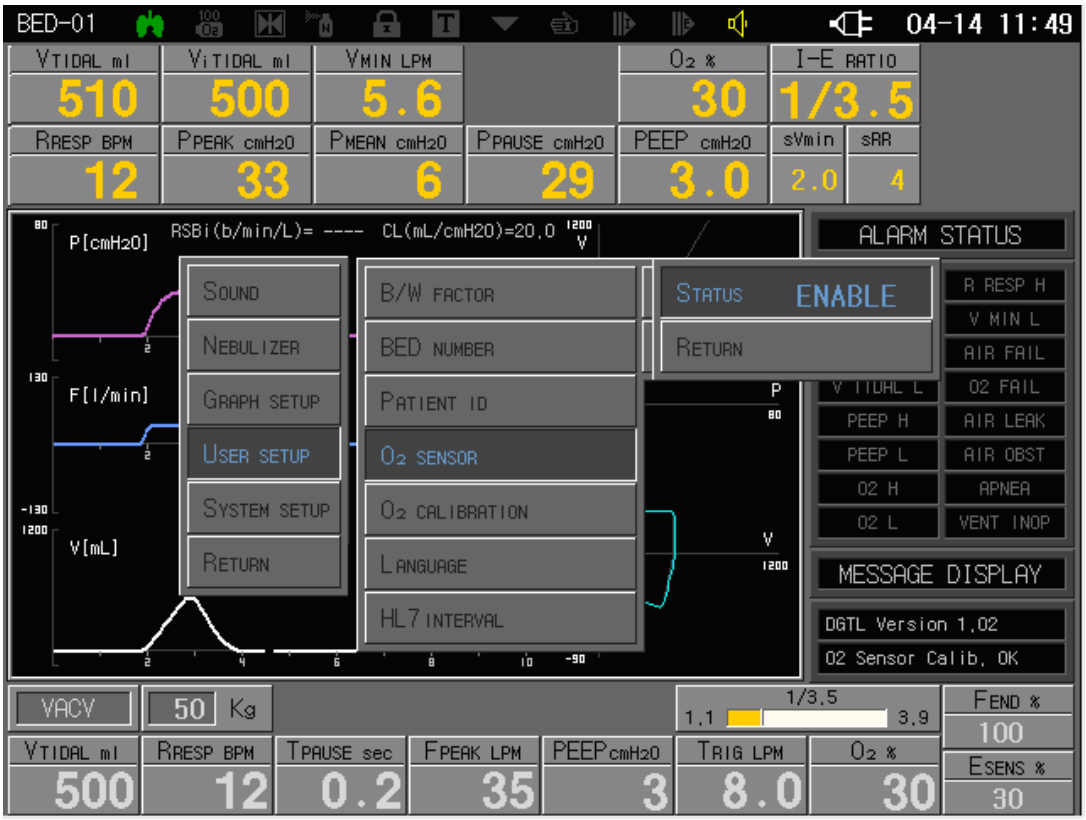
Table ٣-22. PATIENT ID menu tree

3.4.4.4.4 O_2 Sensor

Setting O_2 Sensor Enable / Disable.

O_2 Sensor Enable : It is default. It is setting O_2 sensor is normal.

O_2 Sensor Disable : Setting O_2 sensor is abnormal or O_2 Gas is empty.



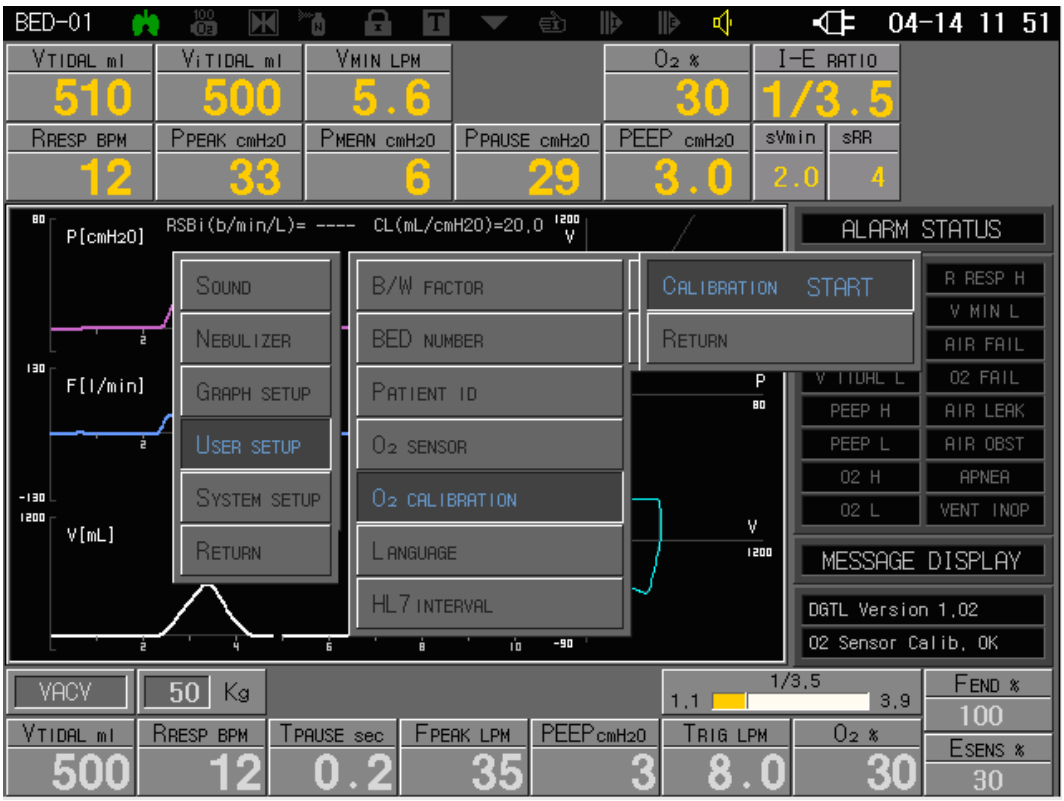
No	Menu	Range	Unit	STEP	Explanation
ⓐ	O_2 Sensor	ENABLE/ DISABLE			Setting O_2 Sensor.
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-23. O_2 Sensor menu tree

3.4.4.4.5 O_2 CALIBRATION

Calibrating O_2 Sensor. Push the encoder button and O_2 calibration start.

After few seconds O2 calibration is stopped.



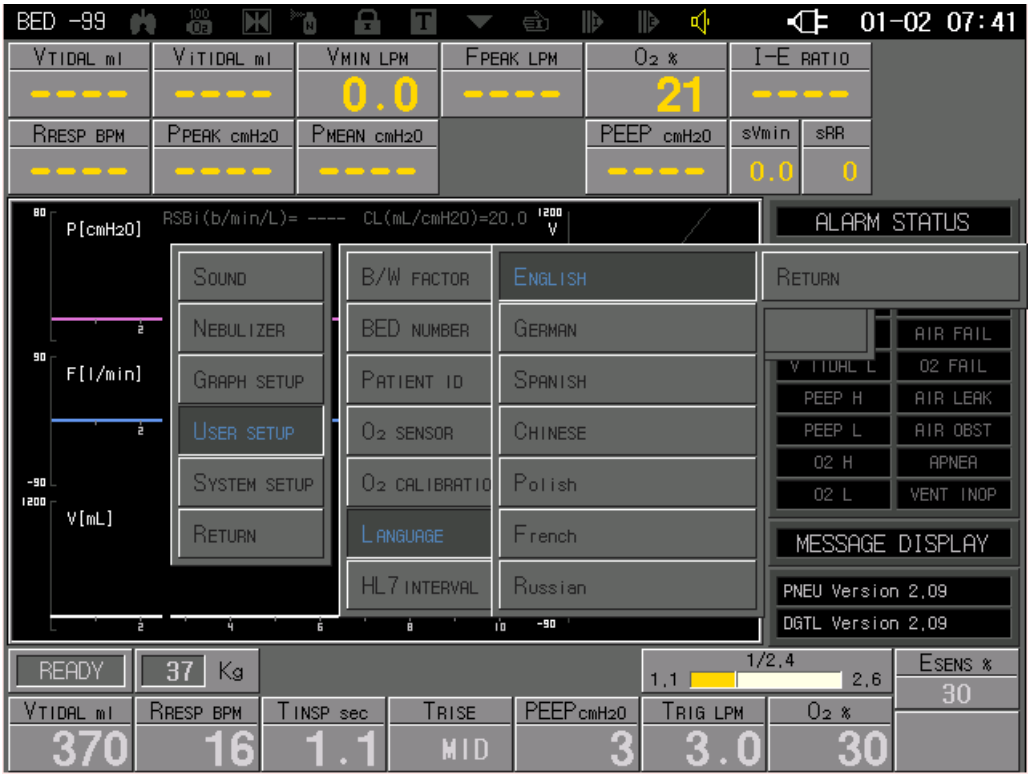
No	Menu	Range	Unit	STEP	Explanation
ⓐ	O2 Sensor Calibration	START			Calibration O2 Sensor
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-24. O2 Calibration menu tree

3.4.4.4.6 LANGUAGE

Setting the Language. Supported language is English, German, Spanish,

Chinese, Polish, French and Russian. Default language is English.



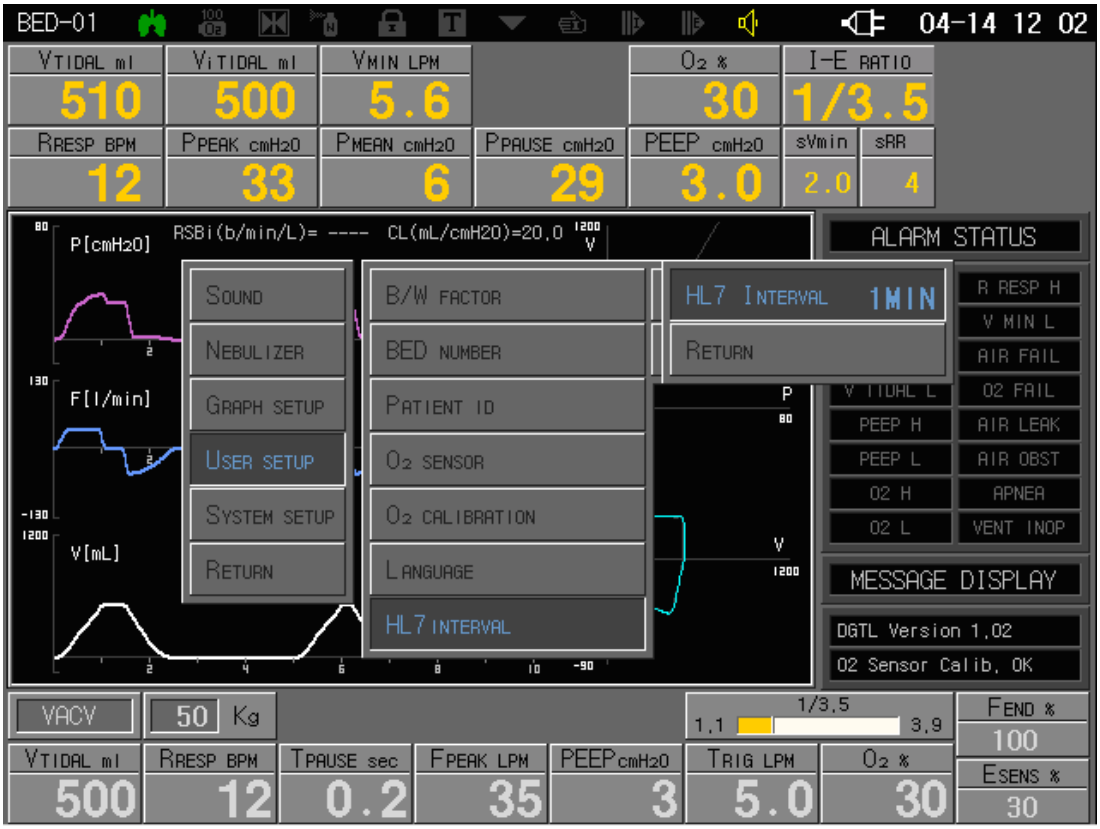
No	Menu	Range	STEP	Explanation
ⓐ	LANGUAGE	ENGLISH/GERMAN /SPANISH/CHINESE /POLISH/FRENCH/RUSSIAN		Setting the language.
ⓑ	RETURN	-	-	Move to previous menu.

Table ٣-25. Language menu tree

3.4.4.4.7 HL7 INTERVAL

Setting HL7 data sending period. The period is 30sec, 1,5,10,30 and 60min.

Default value is 1min.



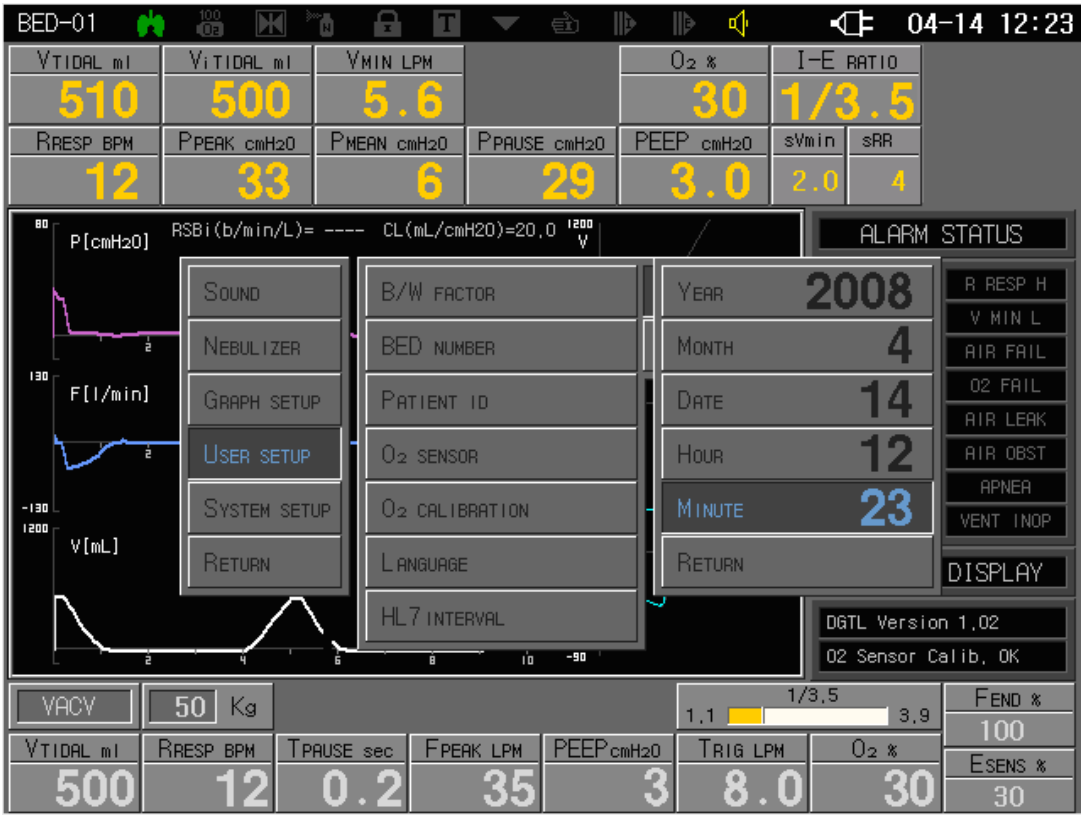
No	Menu	Range	Unit	STEP	Explanation
ⓐ	HL7 INTERVAL	30Sec, 1,5,10,30, 60 Min			Setting sending data interval.
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-26. HL7 Interval menu tree

3 Operating Instructions

3.4.4.4.8 DATE/TIME

Setting date and time.



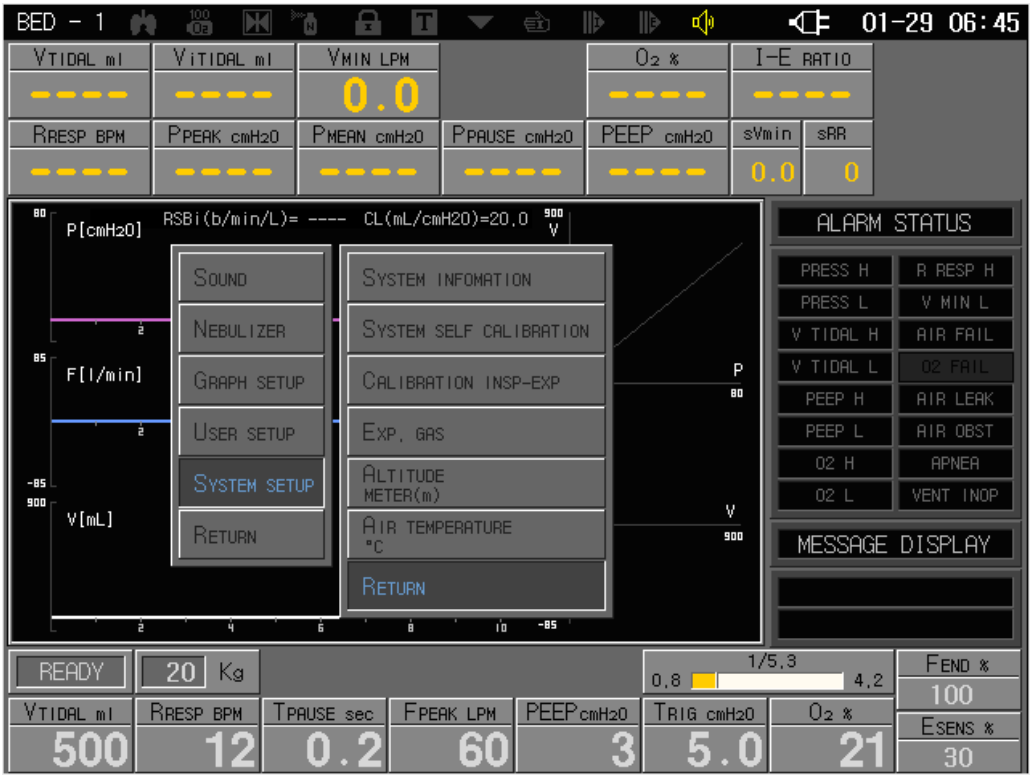
No	Menu	Range	Unit	STEP	Explanation
ⓐ	YEAR	2000~2099			
ⓑ	MONTH	1 ~ 12			
ⓒ	DATE	1 ~ 31			
ⓓ	HOUR	0 ~23			
ⓔ	MINUTE	0 ~ 59			
ⓕ	RETURN	-	-	-	Move to previous menu.

Table ٣-27. DATE/TIME menu tree

3.4.4.5 SYSTEM SETUP

Setting system setup menu. There are system information, system

calibration and expiratory gas kind



No	Menu	Range	Unit	STEP	Explanation
ⓐ	SYSTEM INFORMATION				Main S/W Version, Module S/W Version, Working Time
ⓑ	SYSTEM SELF CALIBRATION	-	-	-	Calibration Flow Sensor.
ⓒ	CALIBRATION INS-EXP				Calibration Inspiration-Expiration Sensor Balance
ⓓ	EXP. GAS				Setting expiratory gas kind.(Dry or Humid)
ⓔ	RETURN	-	-	-	Move to previous menu.

Table ٣-28. SYSTEM SETUP menu tree

3.4.4.5.1 SYSTEM INFORMATION

There are S/W version information and working time information.

No	Menu	Range	Unit	STEP	Explanation
ⓐ	MAIN S/W VERSION				
ⓑ	MODULE S/W VERSION	-	-	-	
ⓒ	WORKING TIME				Total working time
ⓓ	RETURN	-	-	-	Move to previous menu.

Table ٣-29. SYSTEM INFORMATION menu tree

3.4.4.5.2 SYSTEM SELF CALIBRATION

It is calibration mode for flow sensors. It has 2 flow sensor calibrations. One is offset calibration of Inspiration flow sensor and the other is offset

calibration of expiration flow sensor.

CAUTION : Before calibration, MV2000 must be separated from patient.

No	Menu	Range	Unit	STEP	Explanation
ⓐ	CALIBRATION				Inspiration and expiration flow sensor offset calibration.
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-30. CALIBRATION menu tree

3.4.4.5.3 CALIBRATION INSP-EXP

It is calibration mode for striking balance between inspiration flow sensor and expiration flow sensor. In F-V graph, when the start point of wave falls in with the end point of wave, the calibration meets the case. BF means Base Flow.

BF is the difference of inspiratory flow and Expiratory flow. It set that [Exp. Gas] is [DRY] status.

CAUTION : Before calibration, the test lung must be connected to ventilator.

3.4.4.5.4 EXP. GAS

You select the expiratory gas kind of dry gas or humid gas.

If you use humidifier. you select the humid. Default set is dry.

No	Menu	Range	Unit	STEP	Explanation
ⓐ	EXP. GAS				Select the respiratory gas kind of dry or humid.
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-31. EXP. GAS menu tree

3.4.4.5.5 ALTITUDE

Setting altitude height in meter.

No	Menu	Range	Unit	STEP	Explanation
ⓐ	ALTITUDE	-100 ~ 5000	meter	20	Setting height of altitude
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-32. ALTITUDE menu tree

Setting air temperature in centigrade.

No	Menu	Range	Unit	STEP	Explanation
ⓐ	TEMPERATURE	0 ~ 50	centigrade	1	Setting air temperature of centigrade
ⓑ	RETURN	-	-	-	Move to previous menu.

Table ٣-33. AIR TEMPERATURE menu tree

Alarms

SECTION 4

4.1 General Information

All alarm indicates condition of each situation on LED display window. LCD monitor shows their warning message.

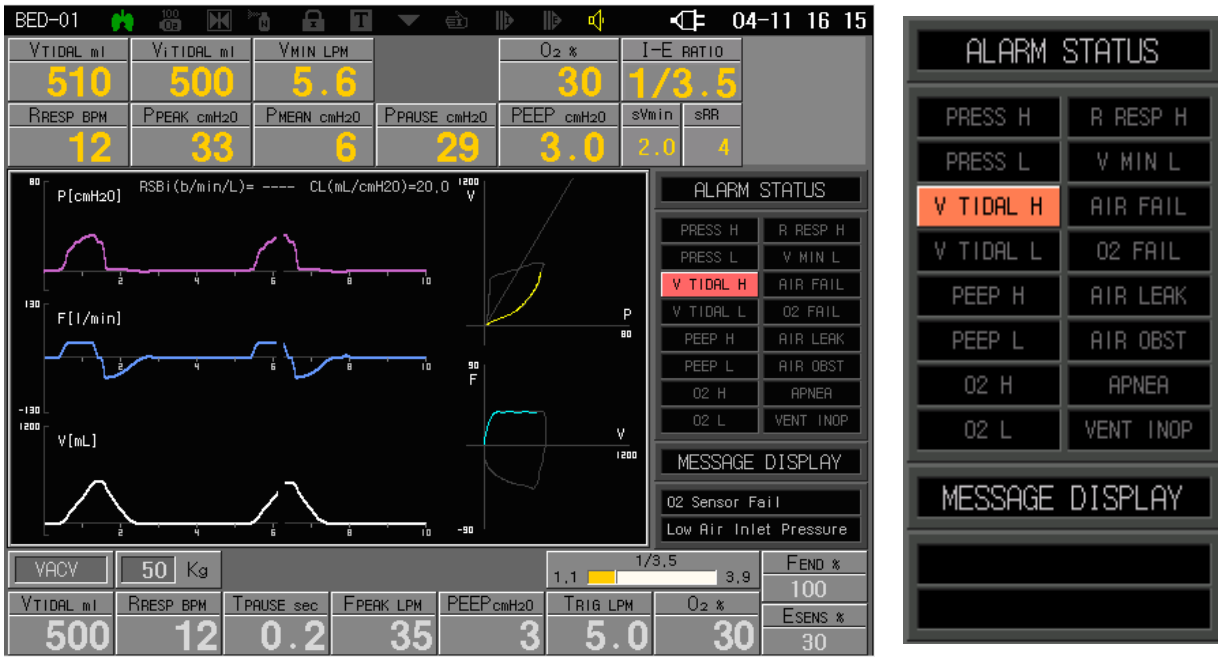


Figure 4-1. LCD Display Window

4 Alarms

4.2 Alarm Message

If alarm message is indicated, check the current mode and solve the problem

according to it.

Item	Alarm range
High pressure	*۵ cmH۲O ~ ۱۲۰ cmH۲O*
Low pressure	*۰ cmH۲O ~ ۵۰ cmH۲O*
High tidal volume	*20 ml ~ ۲۵۰۰ ml ,OFF*
Low tidal volume	*۰ ml ~ ۲۵۰۰ ml*
High minute volume	*1 ~ 99L*
Low minute volume	*0 ~ 98L*
High respiration rate	*2 ~ 120 bpm*
Leak Volume	*10 ~ 500 ml*
Apnea	*OFF, 10 ~60 sec*
O۲% high	*21~100%,OFF*
Power loss	*AC/DC power loss*
Low Air/O2 pressure	
Obstructed tube	
Airway leak	
Vent in-operation	
Open Circuit	

Table 4-1. Manual alarm description

۱	Low Battery	Discharge the internal battery. Connect the AC power.
۲	Low Air/O ۲ Pressure	Supplied pressure of Air and O2 is low. Check the Air and O2 line.
۳	Obstructed tube	It is problem between breathing circuit and patient. Check the breathing circuit.
۴	Airway leak	In breathing circuit airway leaks. Check the breathing circuit.
۵	Vent in- operation	The ventilator is abnormal status. Check the all ventilator system.
6	Leak volume	Difference volume between inspiration and expiration volume. Affected to airway leakage checking.
7	Open Circuit	It is problem between breathing circuit and patient. Check the breathing circuit.

Operating theory

APPENDIX A

Pneumatic System of MEKANT is composed of ۲ pcs of gas circuit. One is for Oxygen,

the other is for Air. Proportional solenoid Valve (PSOLs) is the core of Pneumatic System. The PSOLs is controlled accurately by Flow sensor and Microprocessor so that provide accuracy respiration to patient.

MEKANT's Pneumatic System is divided into inspiratory module, expiratory module and patient circuit system. inspiratory module is subdivided into Gas supply, Flow control, Safety Valve and Inspiration monitoring system.

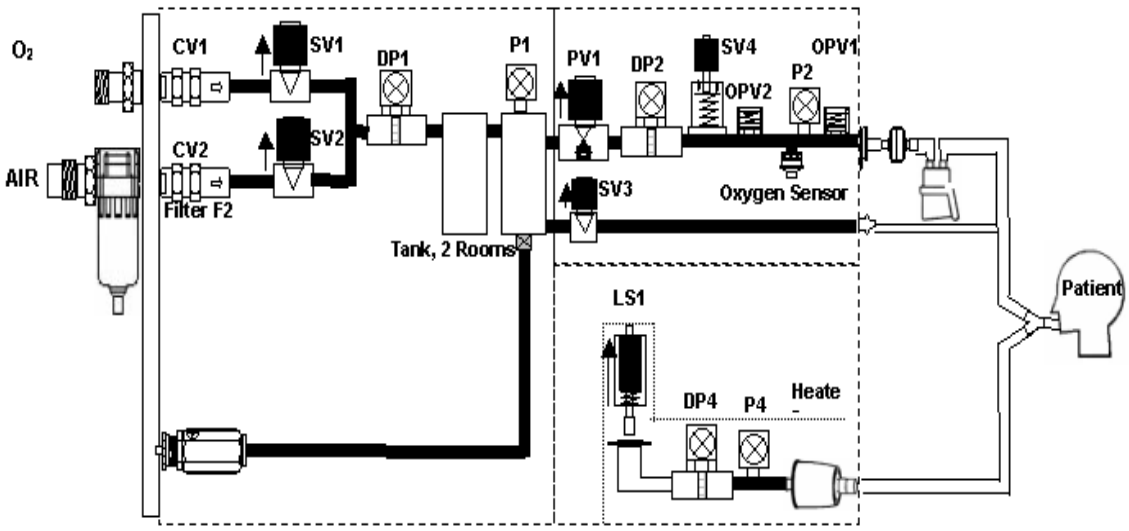


Figure A-١. PNEUMATIC Block Diagram

Blending Part

Gas supply system provides the equipment high pressure air (٣٥~١٠٠ psi) and Oxygen from external source of supply, and sense that supplying pressure is not adequate. The high supplied pressure air and Oxygen is decompressed into ١٠ psi through each regulator. Adjustment pressure of Regulator should be measured by pressure valve (SV١, SV٢).

Appendix A Operating theory

Moisture which may be occurred in the high supplied pressure is removed by water

trap in Air Inlet. Two peaces of Check Valve (CV٢, CV٣) prevent backflow between air and oxygen.

Inspiration Part

Flow control system is the most important part in Pneumatic System. This is composed of Flow sensor (DP2) and PSOLs (PV١). This system adjusts Tidal volume, Peak Flow, Flow pattern, Respiratory Rate, Oxygen Percentage. Control of PSOLs is done on measured value by Microprocessor. Flow sensor is Differential Pressure type.

Safety System

This is divided in Safety Valve section and Inspiration monitoring section. Safety valve section release excess pressure in the equipment and make a patient breathe with room air as a passageway.

Safety valve open and release pressure in case interior pressure reach to ١١٥ cmH٢O. And it is a role of passageway to connect to room air in case equipment is defect or no power, patient's expiratory limb is closed.

Inspiration monitoring section monitor gas pressure and oxygen concentration provided the patient. Monitor is measured by Absolute Pressure Transducer (PA) which is attached inspiratory Pressure Transducer (P2). Oxygen is done by Oxygen sensor.

Appendix A Operating theory

Expiration Part

This section is for Exhalation. PEEP/CPAP is controlled by Exhalation Valve during exhalation. Exhalation Valve of MEKANT is Active type and is similar with PSOL. This active exhalation valve makes BiLevel mode possible and prevent pressure increasing suddenly.

Flow sensor (DP4) measure Flow and Volume of patient's expiration gas, and Expiratory pressure Transducer(P4) measure pressure.

Patient Circuit System

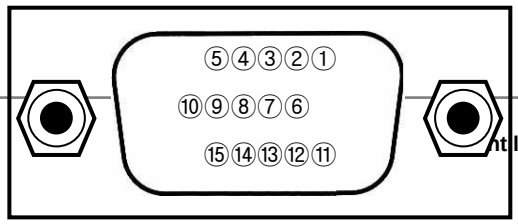
Patient circuit system transits gas which is adjusted in Flow control system to patient, and makes patient's exhalation gas to exhalation system.

There is each Bacteria Filter on the connecting part of patient circuit system and equipment. So they make patient circuit system separate from the ventilator. It makes gas to be provided the patient heat and humidify in case humidifier is used.

Communications

APPENDIX B

VGA

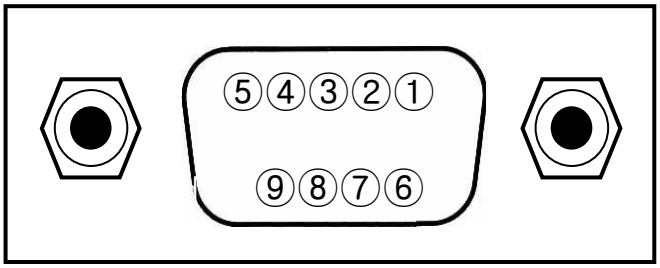


Pin	Name	Direction	Description
①	RED	→	Red Video (٧٥ohm, ٠.٧p-p)
②	GREEN	→	Green Video((٧٥ohm, ٠.٧p-p)
③	BLUE	→	Blue Video(٧٥ohm, ٠.٧p-p)
④	ID٢	←	Not connected
⑤	GND	—	Ground
⑥	RGND	—	Red Ground
⑦	GGND	—	Green Ground
⑧	BGND	—	Blue Ground
⑨	KEY		Not connected
⑩	SGND	—	Sync Ground
⑪	ID٠	←	Not connected
⑫	ID١ or SDA	←	Not connected
⑬	T HSYNC or CSYNC	→ →	Horizontal Sync (or Composite Sync)
⑭	VSYNC	←	Vertical Sync
⑮	ID٣ or SCL		Not connected

Table B-١. VGA serial port pin out

RS-232 (serial) port

A ۹-pin male connector configured as data terminal equipment (DTE). Allowable current is ۰.۱A at ۱۰V DC (maximum).



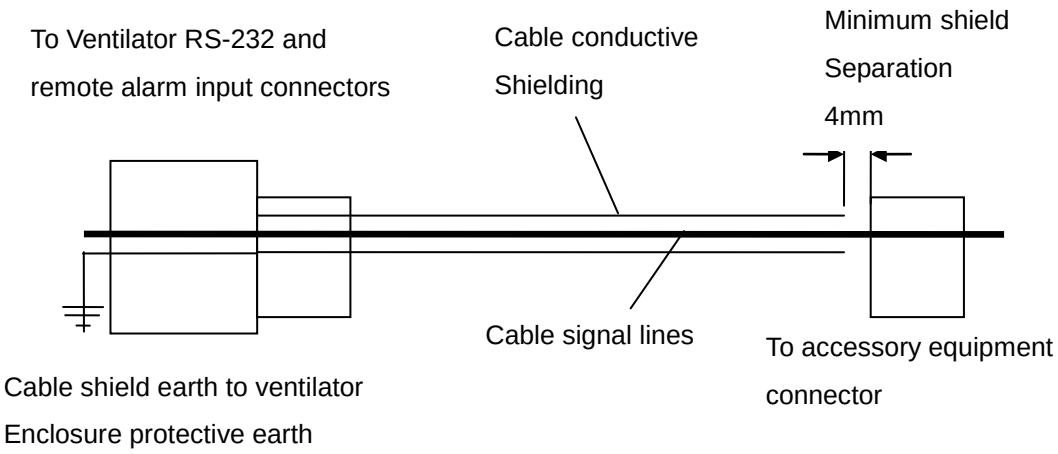
Pin	Name	Direction	Description
①	CD (Data Carrier Detect)		Not connected
②	RxD (Receive Data)	←	Receive data (RxD)
③	TxD (Transmit Data)	→	Transmit data (TxD)
④	DTR (Data Terminal Ready)		Not connected
⑤	SG(Signal Ground)	—	Ground(GND)
⑥	DSR(Data Set Ready)		Not connected
⑦	RTS(Request to Send)		Not connected
⑧	CTS(Clear to Send)		Not connected
⑨	RI(Ring Indicate)		Not connected

Table B-۲. RS-۲۳۲ serial port pin out

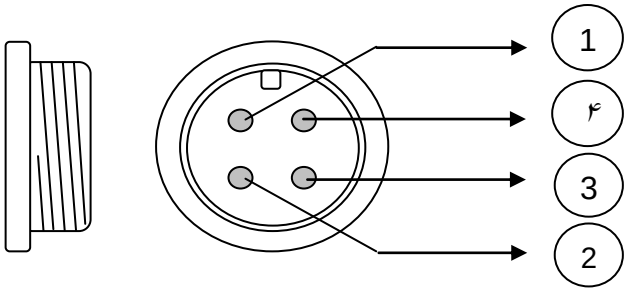
Communication capabilities (cont)

NOTE :

The connection of accessories or equipment to the ventilator's RS-٢٣٢ and remote alarm ports requires electrical separation of conductive earth (ground) connections between different items of equipment of a system. The system cable assembly shielding can interconnect the ventilator and other equipment, increasing the risk of excessive enclosure leakage current from external equipment. For safe connection, the shield conductor must have separation of ٤mm between the equipment and ventilator conductors, as show below:



LCD MONITOR POWER SUPPLY Connector



Pin	Name	Direction	Description
①	NC		Not connected
②	GND		GND
③	+VCC(+۱۲V/۵A)		۱۲V/ Max ۵A, OUTPUT LCD MONITOR POWER SUPPLY
④	NC		Not connected

Table B-۳. LCD Monitor Power Connector port pin out

Parts accessories

APPENDIX C

Standard

Item	Photo	Part Number	Q'ty	Description
Circuit Arm		١٤٠٤٠٣٥٢٠	١	
High Pressure Hose		١٤١٤٠٠٠٢٠	١	Air Gas / Yellow
		١٤١٤٠٠٠٣٠	١	O٢ Gas / Green
Display Panel Cable		١٤٢٢٤٠١٦٦٠	١	
O٢ Sensor		١٤٠٥٠٠١٠٠	١	
PEEP Silicone Plate		١٤٠٦٠١٦٣٠	٢	
Test Lung		١٤٠٦٠١٤٢٠	١	
Operation Manual		١٤١٧٠٠٣٨٠	١	
Power Cord		١٤٠٦٠٠٥٣٠	١	٣m, ٢٢٠VAC
Ground Cable		١٤١٣٠٠٢٠٠	١	

Fuse		١۴١٣٠٠١٧٠	٢	INLET ٥٠T ۶.٣A ٢٥٠V ٢٠mm
Wrench Driver		١۴٠٨٠٠٧٢٠	2	
Battery		١۴٠٨٠٠٧٢٠	1	
Circuit Arm Fix Knob		١۴٠۴٠١٠٠٠	1	
53010(O-Ring)		١۴٢١٠٠۴٠٠	12	O-Ring for Peep Module
53030(O-Ring)		١۴٢١٠٠۴١٠	3	O-Ring for Peep Module
Monitor Fix Bolt		١۴٠٨٠٠٣٣٠	3	M5x10mm Wrench Bolt(For Monitor)
Spring Washer		١۴٠٨٠٠٧٠٠	3	M5 Bolt Spring Washer
Body Cover		١٥٠٠٠٠١۶٠	1	

Contact Us

Service calls

Followings are telephone numbers and addresses for contacting various service, product supplies and sales personnel.
Reaching open a service call with MEKICS Co., Ltd., contact the numbers listed below.

MEKICS Co., Ltd.
5F, A-BLDG,WooLimLion, #144-3, Sangdaewon-dong,
Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea 462-725
Tel : + 82-70-7119-2500 Fax : + 82-31-735-2761
URL : www.mek-ics.com
e-mail : service@mek-ics.com

※ In the event of a malfunction or failure, contact Service Dept. of MEKICS Co., Ltd. along with the model name, serial number, date of purchase and explanation of failure.

Authorized Representative

Pedro Pestana, Lda
Nif : 507662407
Fax : +351214414138
Telef. : +351914881444
Adress: Rua Bernardo Marques, nº 3, 2º Dtº
2770-199 Paco de Arcos