

Bio Signal Total Solution

Total Health care for everyone



Bio Signal Total Solution



BT-500 INFANT INCUBATOR

Senior Research Engineer / J.W. KIM

Total solution of Bio-Medical System



bistos





The Use of Infant Incubator

❖ Main Purpose :

- Nursery
- NICU (neonatal intensive care unit)

❖ Object:

- Newborn Infant, Low birth-weight Infant (1000 g ~ 2500 g) , Very Low birth-weight Infant (Under 1000 g).
- Warmer feature in case Newborn Infant.

❖ Temp. :

▪ Normal working Temp. :

- Normal Temp. (32 °C ~ 35 °C) : Minimized BMR, and Oxygen Demand Temp. and Normal Body Temp.

▪ Very Low birth-weight Infant (Under 1000 g) :

- 36.5 °C ~ 37.0 °C skin mode
- 36.0 °C ~ 36.5 °C air mode

- ## ❖ Humidity : Even in case Very Low birth-weight Infant, the process of cornification involves after birth few days. And it allows decrease humidity of infant incubator. To accelerate the process of cornification, decrease humidity of the incubator.

	Under 750g	750-1000g	1001-1250g
After Birth 1~3days	80-100%(full)	80-100%	70%
4days		75%	
5~7days		70%	
8days	75%		40-60%
9~14days	70%		
After	40-60%	40-60%	



Introduction

- ❖ Infant Incubator for new born-baby.
- ❖ Helping new born-baby under 2Kg by controlling the Temp. and Humidity of the Infant Incubator.
- ❖ Only handled by well trained Medical Staff, and using in NICU (Neonatal Intensive Care Unit) and Nursery.



Features of BT-500

- ❖ Servo control of Incubator Air Temp.
- ❖ Servo control of Incubator Skin Temp.
- ❖ Servo control of Incubator Humidity.
 - Water boiling system.
- ❖ X-ray tray
- ❖ Dual Door & Doubled wall.
- ❖ Strong and efficient Mattress Tilting mechanism (Max. 12 °)
- ❖ Modular Major parts.
- ❖ Multi Microprocessor based control.
- ❖ Measuring Infant body weight. (Option)
- ❖ Monitoring Infant's SpO2 & pulse rate. (Option)
 - Masimo technology
- ❖ Lifting Stand (Option)
- ❖ CCD Camera & External Monitor providing real-time image inside Incubator. (Option)
- ❖ Monitoring, servo control Oxygen saturation inside Incubator. (Option)

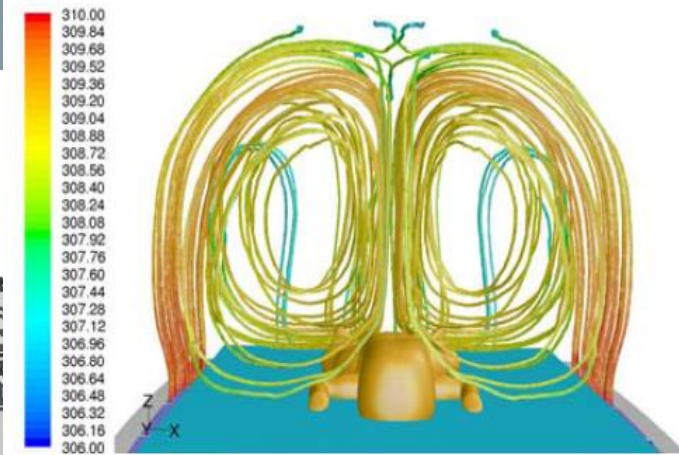
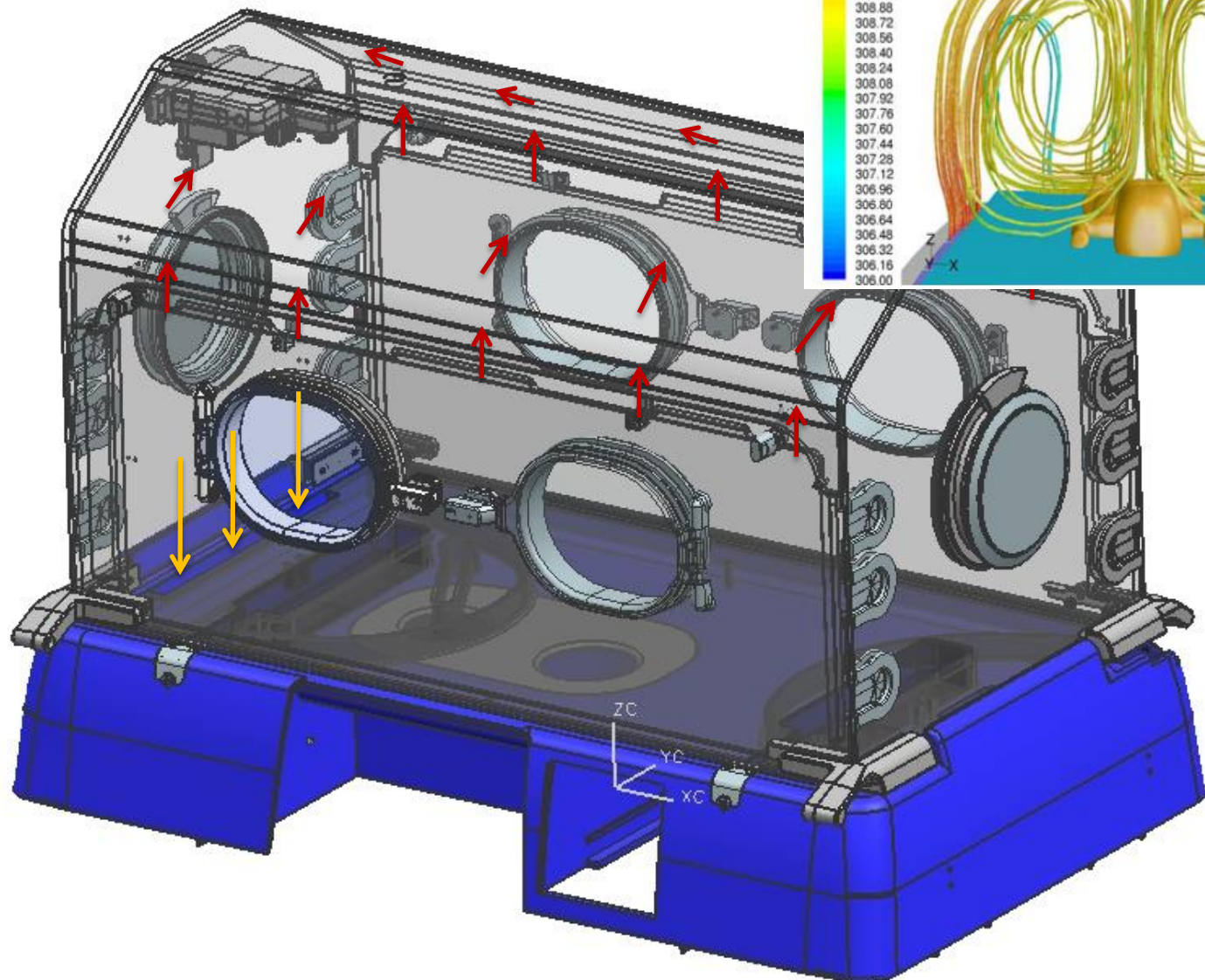


Technical Advantage

- ❖ Accurate Air/Skin Temp. data and Humidity.
 - Air/Skin Temp. & Humidity Auto Calibration network
 - Advanced Sensing Accurate.
 - User Friendly Operation.
- ❖ Modular Sensor module.
 - Improving stability by checking Sensor module position.

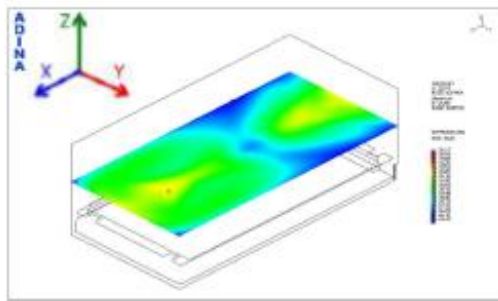


Technical Advantage

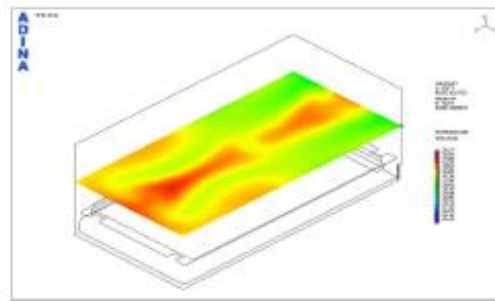


Technical Advantage

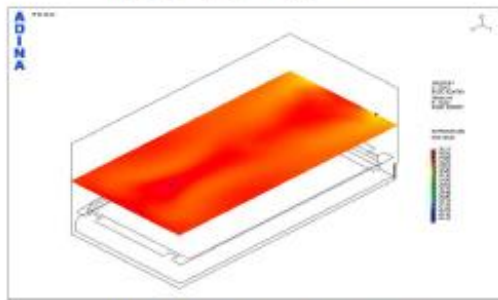
- ❖ **Efficient Heat Insulation by Doubled wall.**
 - Technology development Project 1st Year Report.
 - The stimulation of Air flow inside Incubator Hood. (Yonsei Univ.)
 - Analysis inside incubator Air flow and Temp distribution by Fluid



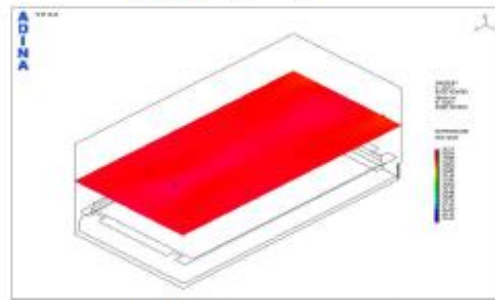
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<기준면의 온도 분포-30초>



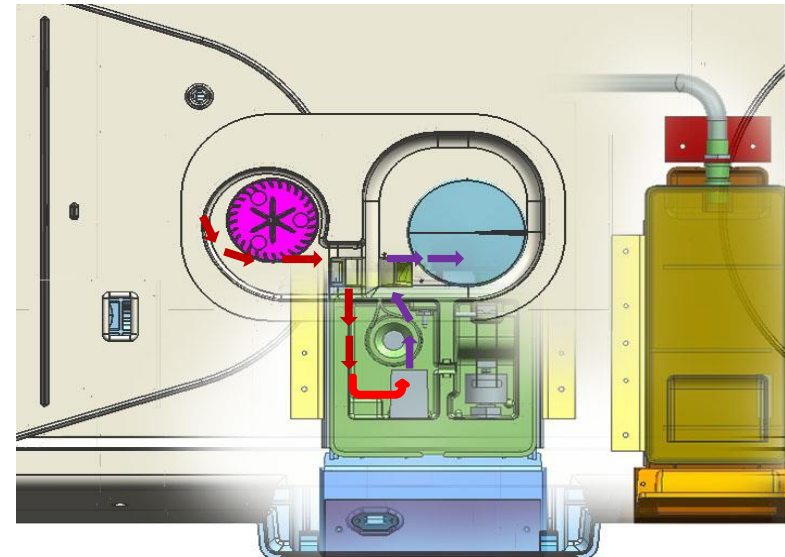
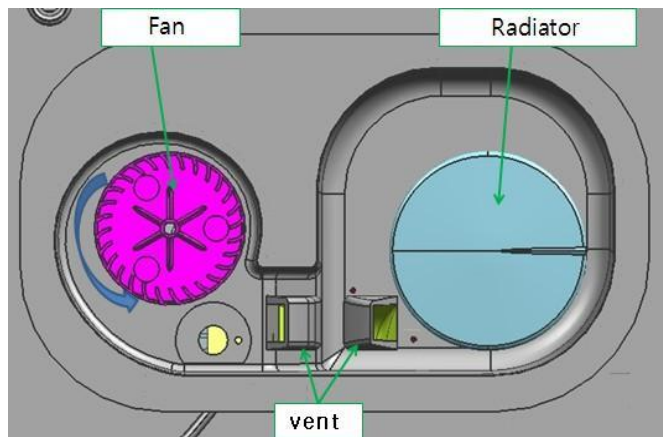
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< 시간 경과에 따른 내부 온도 변화 >



Technical Advantage

- ❖ Quick Humidity Control.
- Quick Humidity Control by the Composition of Humidity control Network in the Air circulation.
- Uniformly Humidity distribution in the Air circulation.
- Field test in various Children Hospital in Korea.





Technical Advantage

- ❖ Repress the propagation of germs by the Water Heating Humidity control system.
 - Disinfection by the water heater.
 - Complement disadvantages of Ultrasound Humidification.
 - Even spray water particle, and Germ increases.
- ❖ Easy assemble and disassemble modules.
 - Main control Module (Masimo module include)
 - Sensor module
 - Scale module
 - O2 module

Structure & name of BT-500

Overview

IV pole
(Option)



MASIMO SpO2 & CCD
Camera & External Monitor
(Option)

O2 Monitoring
(Option)



Built-in x-ray tray



Air / Skin temperature
Humidity Servo control

Lifting Stand
(Option)

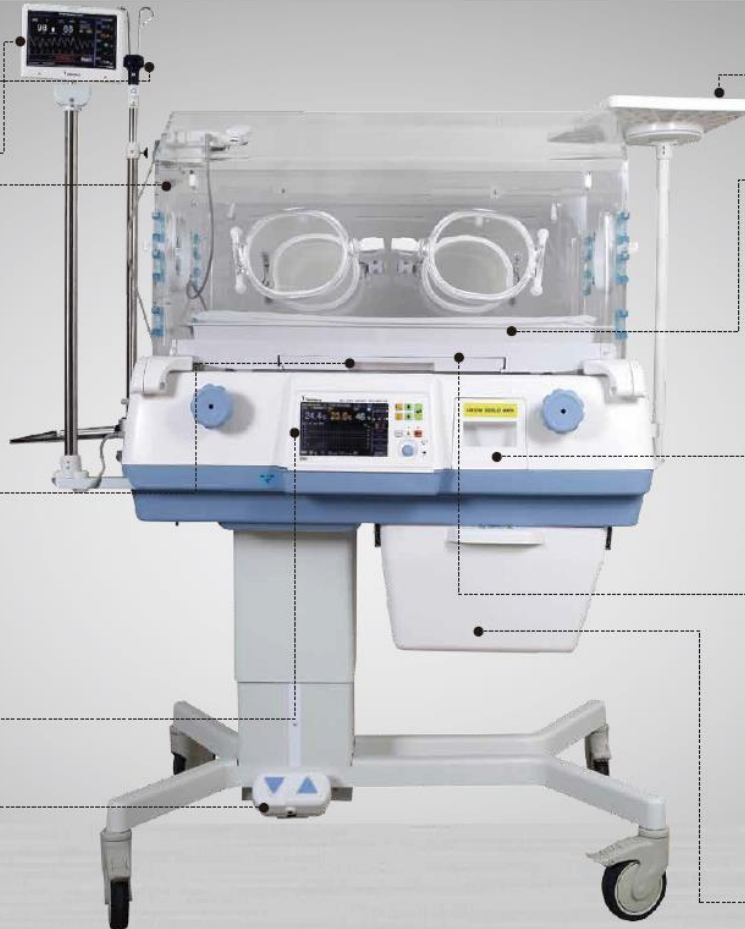


plate
(Option)

Weighing Scale
(Option)



Water Tank (1,000ml)

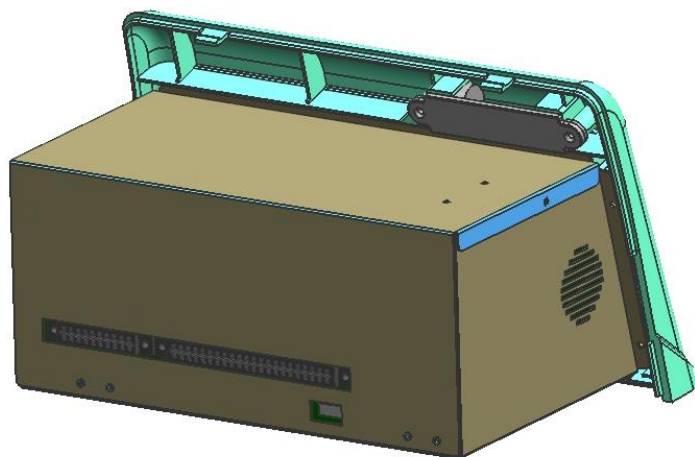










Mattress tilt

Basket
(Option)



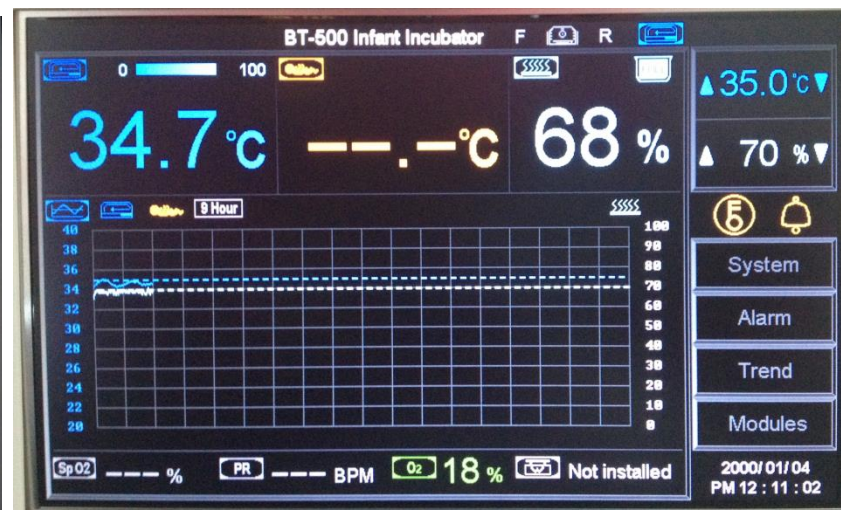
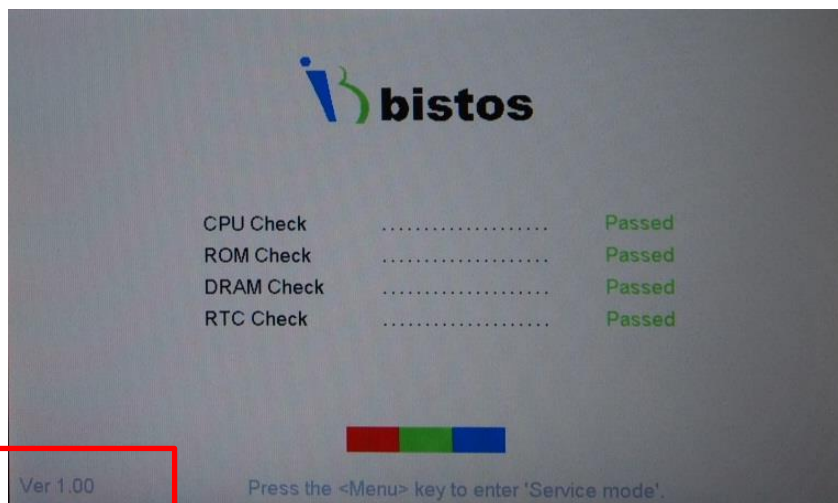
Main Console Box



Symbol	Name	Description
	Parameter Key	Select the parameters which can be set using up and down keys. - Temperature, Humidity selection
	Mode Key	Use this key to select control mode.
	Up Key	Use this key to raise the parameter's value.
	Down Key	Use this key to lower the parameter's value.
	Enter Key	Use this key to enter the parameter's value to the control mode.
	Menu Key	Use for changing "knob" function to menu.
	Mute Key	Use for Alarm sound mute or silence.
	Keylock Key	Use for unlocking key and knob functions.



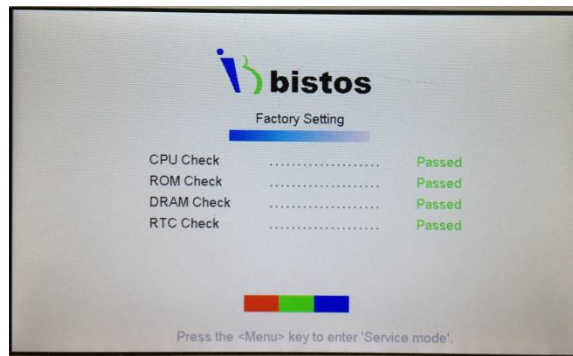
Startup and operation



Factory setting & Service mode

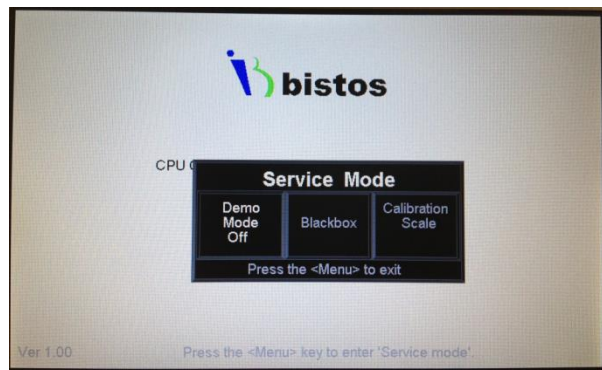
❖ Factory setting

- Power on while keep pressing control Knob.



❖ Service mode

- Press Menu key during Self test.

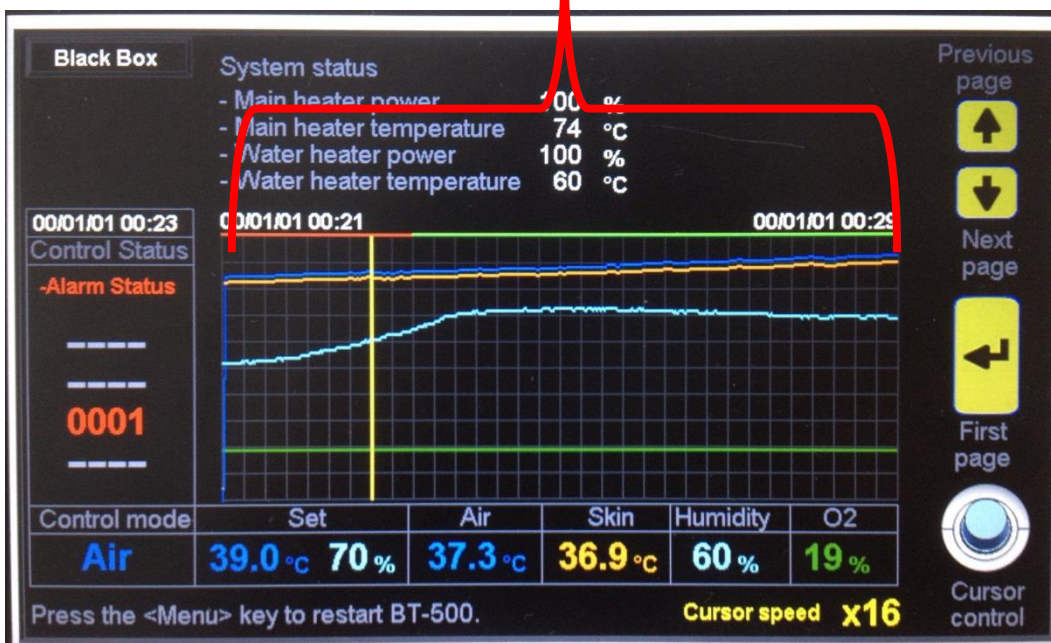




Black box

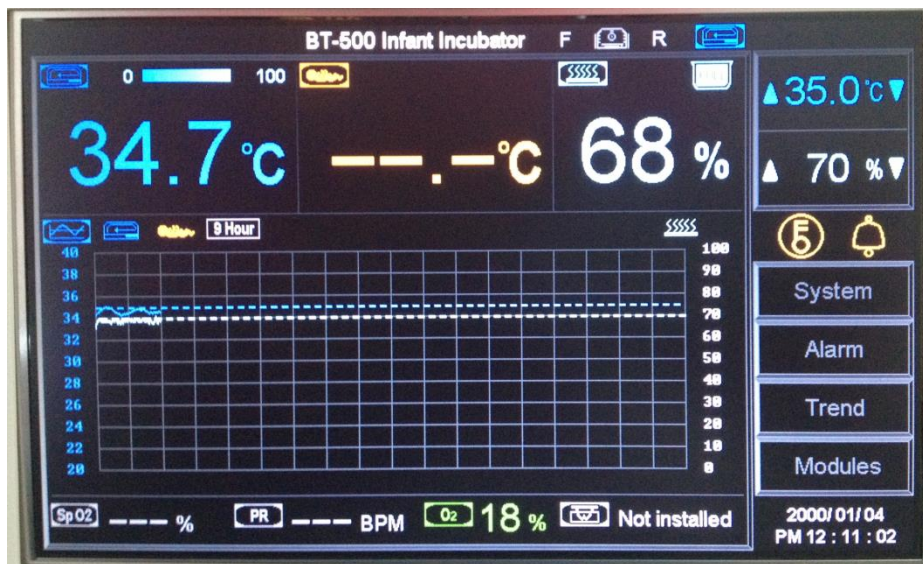
- ❖ Continuously data saving 1Min. Interval.
- ❖ Total saving capability: 728 Days

72 hours





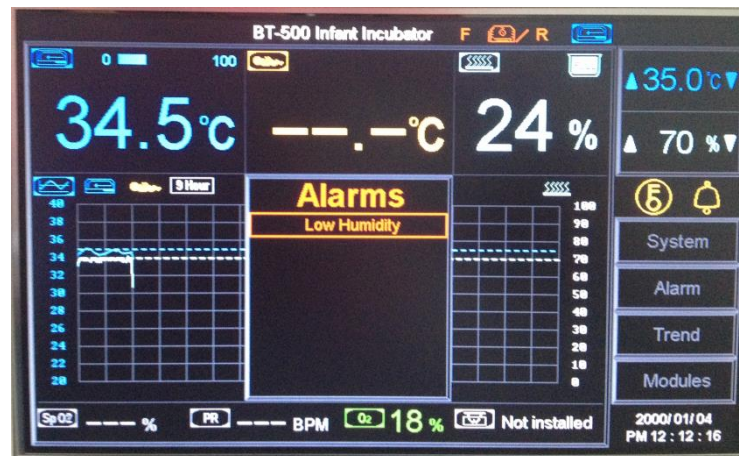
Main window



Icon	Name	Description
	Air mode icon	Control mode status : Air mode
	Skin mode icon	Control mode status : Skin mode
	Override mode icon	Override mode On.
	Key lock icon	Key is locking.
	Key unlock icon	Key input is enable..
	Sound on icon	Sound on.
	Sound off icon	Sound off.



Door status



Alarms

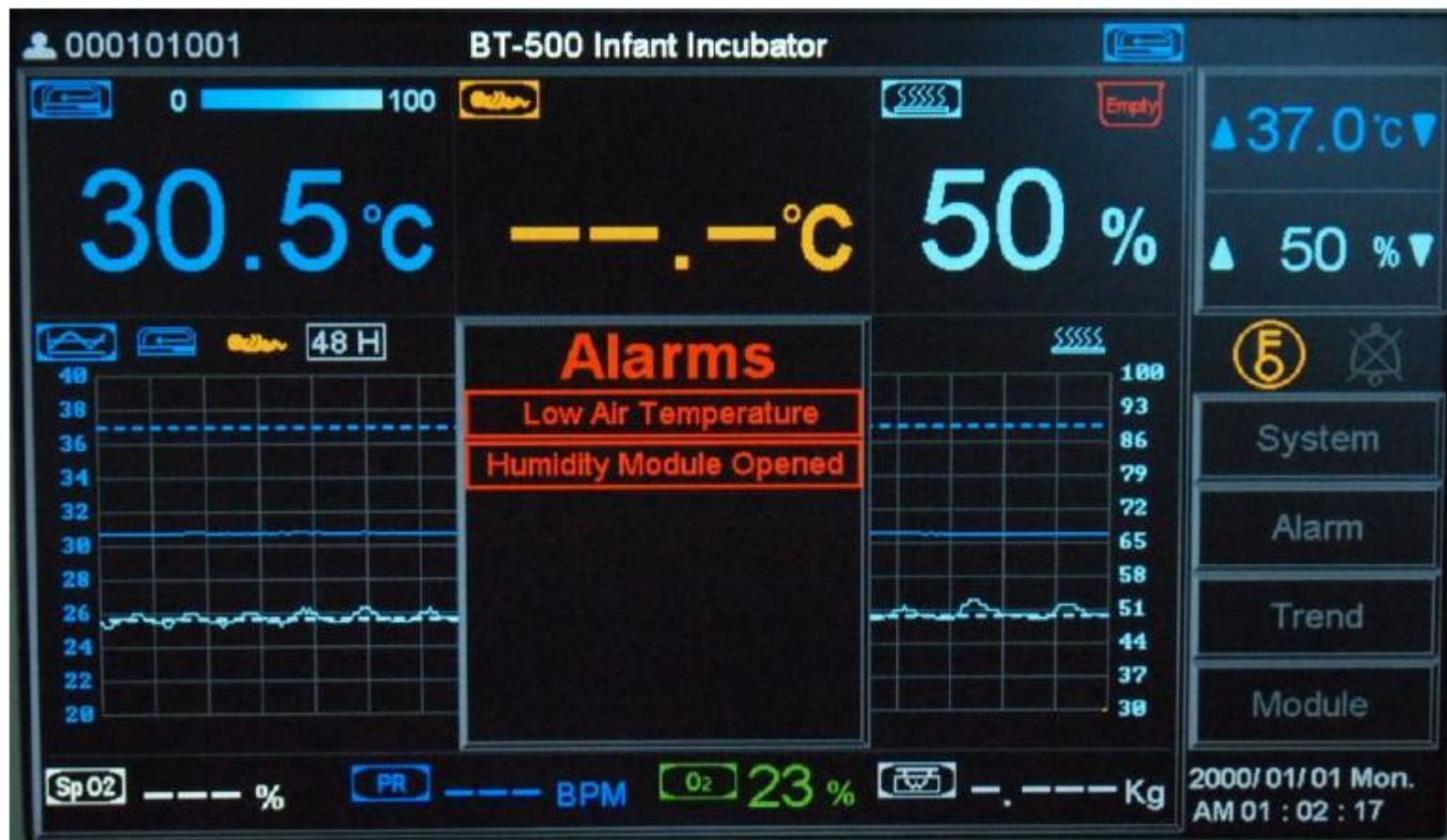


Figure 5-1. 알람 팝업창의 활성화

System alarms

System alarms				
Messages	display	Sound	LED flash	Descriptions
Motor Failed	O	O	O	Main motor failed.
Overburned Heater	O	O	O	Heater is <u>overburned</u> .
Humidity Heater Failed	O	O	O	Water heater failed.
Stuck key	O	O	O	Key is pushed over 1 minute.
Air sensors failure	O	O	O	Air temperature measurement sensor in hood is failed.
Sensor mod disconnected	O	O	O	Sensor module is disconnected.
Sensor module not in position	O	O	O	Sensor module is not in proper position.
Skin Probe Disconnect	O	O	O	Skin temperature probe is disconnected during skin mode operation.
Skin Probe Fail	O	O	O	Skin temperature probe is failed.
Air Probe Failed	O	O	O	Air temperature probe is failed.
Air sensors failure	O	O	O	Air temperature sensor is failed.





F  R	Door open/close icon	Front and rear doors are open.
F  R		Front and rear doors are close open.
F  R		Front door is open.
F  R		Rear door is open.

Table 5-1. Door Open/Close Icon



Temperature alarms

Temperature alarms				
Messages	display	Sound	LED flash	Descriptions
Low Air Temperature	O	O	O	Measured value is lower than setting value over 2.5°C.
High Air Temperature	O	O	O	Measured value is higher than setting value over 2.5°C.
Low Skin Temperature	O	O	O	Measured value is lower than setting value over 2.5°C.
High Skin Temperature	O	O	O	Measured value is higher than setting value over 2.5°C.
High Temperature cutout	O	O	O	① In setting of less than 37.0°C, measured temperature is reached 37.5°C±0.5°C. ② In setting of more than 37.0°C, measured temperature is different 39.5°C±0.5°C or more.
Over Skin Temperature	O	O	O	



Humidity alarms

Humidity alarms				
Messages	display	Sound	LED flash	Descriptions
Low Humidity	O	O	O	Measured value is lower than setting value over 5%.
Water Empty	O	O	O	There is no water in the internal water tank.



Scale alarms

Weighting Scale alarms				
Messages	display	Sound	LED flash	Descriptions
Too much weight	O	X	X	Weigh in excess of 10kg is on the mattress.



Monitoring System with Masimo

❖ User selectable monitoring system display with Masimo

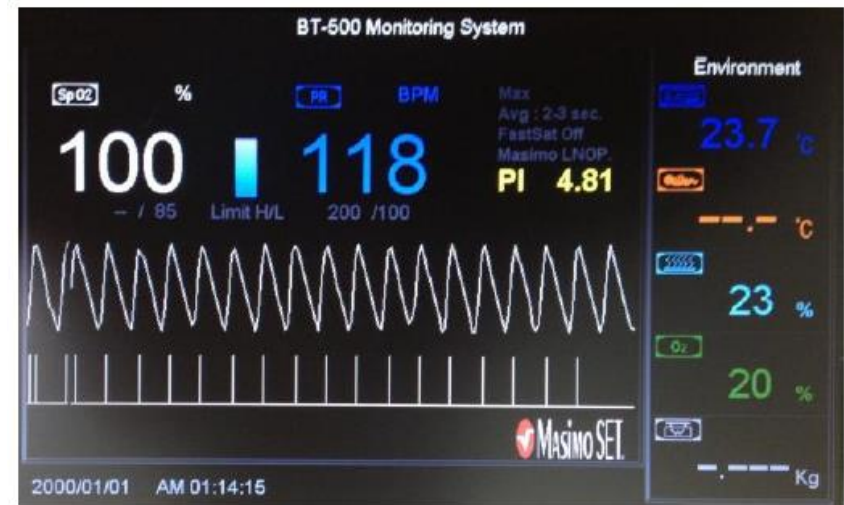
 **Masimo SET**®



(a) Cam Mode



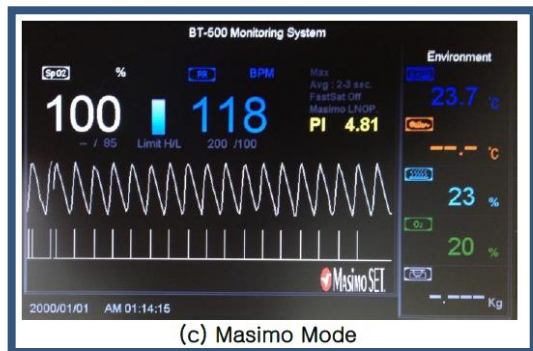
(b) Graph Mode



(c) Masimo Mode



Monitoring system

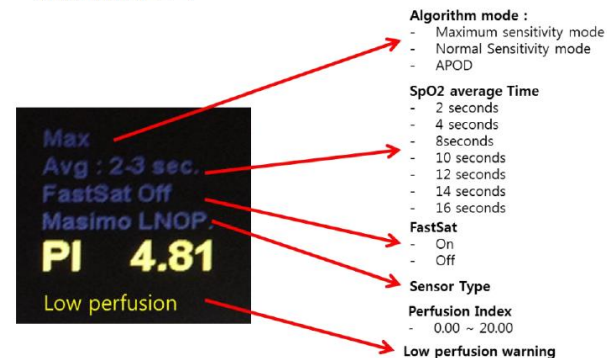


(c) Masimo Mode

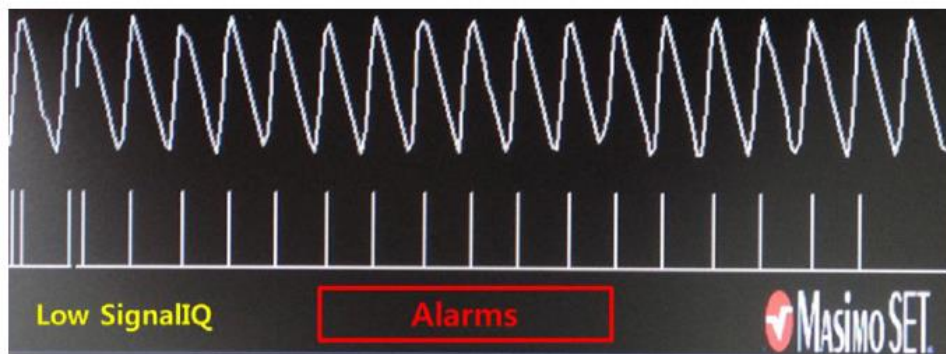
- Parameter 영역



- Information 영역



- PPG & SIQ 영역



Plethysmographic
- 8bit Autoscaled IR

Signal IQ
- 8bit Autoscaled



Masimo alarms

- Alarm messages on Alarm Region

Messages	display	Messages	display
Bad sensor ID offset	RED	No sensor connected	RED
Open LEDs	RED	Sensor off patient	YELLOW
Shorted detector	RED	Too much ambient light	RED
Interference detected	RED	Unrecognized sensor	RED
Shorted LEDs	RED	Low SpO2	RED
No adhesive sensor	RED	High pulse rate	RED
No cable	RED	Low pulse rate	RED

- Board failure & Diagnostic Failure code Region

Display when the event occurred. If no failure, it would be blanked. Each description about error codes is explained in Section 8.

2000/01/01 AM 01:14:15

Board failure code: 62

2000/01/01 AM 01:14:15

Diagnostic failure code: 00FF



Masimo failure code

Board Failure Codes↵	Meaning↵
32↵	DSP: Checksum failure↵
33↵	DSP: Program memory test failure↵
34↵	DSP: Data Memory test failure↵
35↵	DSP: Detector ADC Interrupt Test Failure↵
36↵	DSP: MCU Interrupt failure↵
37↵	DSP : <u>Diag</u> queue Overrun↵
38↵	DSP : Hardware Status Failure↵
39↵	DSP : Raw Queue Overrun↵
40↵	DSP: MCU Watch Dog Failure↵



Masimo failure code

Diagnostic failure Code↴	Meaning↴
0001↴	LED Ground↴
0002↴	Reference Voltage↴
0004↴	Digital Voltage↴
0008↴	DSP Voltage↴
0010↴	Positive LED Voltage↴
0020↴	Red current level↴
0040↴	IR Current level↴
0080↴	Digital ground↴
0100↴	Positive Preamp voltage↴
0200↴	Preamp↴
0400↴	Positive Detector voltage↴
0800↴	Negative Detector voltage↴
1000↴	LED current↴
2000↴	Analog ground↴
4000↴	LED drive voltage↴
8000↴	Sensor ID↴

Specification

Physical characteristics (with standard accessories)

Size	• 140 x 103 x 141 cm (H x L x D)
Weight	• 89 kg

Temperature Control

Air temperature control range	• 23.0 ~ 37.0 ± 0.3 °C (Override >39.0 °C)
Skin temperature control range	• 35.0 ~ 37.5 ± 0.3 °C (Override >39.0 °C)
Peripheral temperature	• YES (Option)

Humidity Control

Humidity control range	• 40 ~ 95% ± 5 % RH
Measurement range	• 15 ~ 99% ± 5 % RH
Control system	• Ultrasonic & steam
Water tank Capacity	• 1,000 ml

Display

Display panel	• 7" TFT COLOR LCD
Trend	• up to 7 days
Alarm	• 19 kinds of alarm
Multi-language support	• YES

Hood

Hood size	• 39 x 91 x 51 cm (H x L x D)
Matress size	• 38 x 73 cm
Matress tilt	• 12 °
Air Velocity	• < 10 cm/s (at 10cm above the center of mattress)
Warming-up time (from ambient 22 °C)	• < 35 min.
Noise level	• < 45 dBA
Micro air filter particle size	• 0.3 micron
Micro air filter efficiency	• 99.8 %

Options (Part id)

Lifting Stand (LS500)

Lifting Height	• 58 ~ 78 cm
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Basket (BK500)

Size	• 25 x 47 x 49 cm
Weight limit	• approx. 5Kg

Ringer Pole (RP500)

Size	• 25 x 47 x 49 cm
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IV Plate (IP500)

Size	• 76 x 48 x 40 cm
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O2 Monitoring (OT500)

Measurement range	• 18~100 % ± 5%
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Weighing Scale (WS500)

Measurement range	• 0~10.0 Kg ± 50g
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Shelf (SF500)

Size	• 3.6 x 22 x 34 cm
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MASIMO SpO2 & CCD

Camera & External Monitor (EM500)

Display panel	• 7" TFT COLOR LCD
SpO2 Measurement range	• 1~100 %
SpO2 accuracy	• 70~100 % : ± 3 digits
CCD Camera Resolution	• 510 x 492 pixel

Thank You !