

NB350

Ventilator

Operator's Manual



© 2021 Shenzhen Mindray Bio-Medical Electronics Co., Ltd. All rights Reserved. For this Operator's Manual, the issue date is January, 2021.

Intellectual Property Statement

SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD. (hereinafter called Mindray) owns the intellectual property rights to this Mindray product and this manual. This manual may refer to information protected by copyright or patents and does not convey any license under the patent rights or copyright of Mindray, or of others.

Mindray intends to maintain the contents of this manual as confidential information. Disclosure of the information in this manual in any manner whatsoever without the written permission of Mindray is strictly forbidden. Release, amendment, reproduction, distribution, rental, adaptation, translation or any other derivative work of this manual in any manner whatsoever without the written permission of Mindray is strictly forbidden.



MINDRAY are the trademarks, registered or otherwise, of Mindray in China and other countries. All other trademarks that appear in this manual are used only for informational or editorial purposes. They are the property of their respective owners.

Responsibility on the Manufacturer Party

Contents of this manual are subject to change without prior notice.

All information contained in this manual is believed to be correct. Mindray shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this manual.

Mindray is responsible for the effects on safety, reliability and performance of this product, only if:

- all installation operations, expansions, changes, modifications and repairs of this product are conducted by Mindray authorized personnel;
- the electrical installation of the relevant room complies with the applicable national and local requirements; and
- the product is used in accordance with the instructions for use.

WARNING: **It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or personal injury.**

NOTE: **This equipment must be operated by skilled/trained clinical professionals.**

ALARM MESSAGE	P	CAUSE AND RESPONSE ACTION
O₂ Sensor Unconnected	L	The O ₂ sensor is not connected. Connect the O ₂ sensor.
Please perform flow calibration.	H	Please calibrate the flow sensor. Please calibrate the flow sensor.
Please perform pressure calibration.	H	Please calibrate the pressure sensor. Contact your service personnel.
Please calibrate O₂ sensor.	L	The O ₂ sensor is not calibrated or the calibration data is lost, and requires re-calibration. Contact your service personnel.
Please reset O₂ sensor.	M	The paramagnetic oxygen sensor needs a reset. Contact your service personnel.
Technical Error 05	M	Atmospheric Pressure Sensor Failure. Contact your service personnel.
Technical Error 04	L	Buzzer failure. Contact your service personnel.
Technical Error 07	M	3-way Valve Failure. Contact your service personnel.
Device Failure 12	H	Air Insp. Limb Failure. Contact your service personnel.
Device Failure 13	H	O ₂ Limb Failure. Contact your service personnel.
Device Failure 09	H	Pressure sensor failure. Contact your service personnel.
Device Failure 21	H	Error in pressure sensor zero point. Contact your service personnel.
Device Failure 10	H	Safety valve failure. Contact your service personnel.
Device Failure 06	H	Ctrl Module Selftest Error. Contact your service personnel.
Device Failure 01	H	Power Supply Voltage Error. Contact your service personnel.
Device Failure 02	H	Memory Error. Contact your service personnel.
Device Failure 22	H	Communication of the VPM stops. Contact your service personnel.
Breath Sensor Not Connected	M	The respiratory sensor is not connected. Check the connection of the respiratory sensor.

Table D-2 Technical alarms

ALARM MESSAGE	P	CAUSE AND RESPONSE ACTION
IOC Paused	H	Intelligent Oxygen Control paused. 1. The tube is disconnected for at least 10 seconds. 2. Air supply or oxygen supply is in short supply. 3. SpO ₂ module failure, sensor disconnected or SpO ₂ signal disturbed. 4. Air inspiratory limb failure or oxygen limb failure.
		1. Re-connect the breathing tube and the proximal pressure sampling line. 2. Check the pressure and connection of the air supply and oxygen supply. 3. Replace the SpO ₂ sensor or check the connection of the SpO ₂ sensor. 4. Contact your service personnel.
Low IOC O₂% Limit	M	The SpO ₂ value is greater than the target SpO ₂ range when O ₂ % value is adjusted to the low limit of the O ₂ regulation range (low limit of the O ₂ regulation range is greater than 21%). 1. Check the patient's condition. 2. Check the low limit setting of the O ₂ regulation range.
High IOC O₂% Limit	H	The SpO ₂ value is less than the target SpO ₂ range when O ₂ % value is adjusted to the high limit of the O ₂ regulation range. 1. Check the patient's condition. 2. Check the high limit setting of the O ₂ regulation range.
Device Failure 23	H	Error in self-check of the VPM. Contact your service personnel.
Device Failure 05	H	Control Module Communication Stop. Contact your service personnel.
Battery 1 Failure 02	H	Failure in battery charging. Contact your service personnel.
Battery 1 Failure 03	H	Battery aging. Contact your service personnel.
Battery 1 Failure 04	H	Battery communication exception. Contact your service personnel.
Battery 1 Failure 05	H	Battery failure. Contact your service personnel.
Battery 2 Failure 02	H	Failure in battery charging. Contact your service personnel.
Battery 2 Failure 03	H	Battery aging. Contact your service personnel.
Battery 2 Failure 04	H	Battery communication exception. Contact your service personnel.
Battery 2 Failure 05	H	Battery failure. Contact your service personnel.
Battery Temp. High. Connect Ext. Pwr.	M	Battery temperature is high during discharge. Connect external power supply.
Battery Temp High. Syst maybe Down.	H	Battery temperature is too high during discharge and the system may shut down. Connect external power supply.

Table D-2 Technical alarms

ALARM MESSAGE	P	CAUSE AND RESPONSE ACTION
Battery in Use	L	The current system is powered by a battery. Please connect external power supply. Connect external power supply.
Low Battery. Connect Ext. Power.	M	The remaining battery power is lower than a threshold. Connect external power supply.
System DOWN. Connect Ext. Power.	H	Battery runs up and the system will shut down in a few minutes. Connect external power supply immediately.
Battery Undetected	H	The current system has no battery. Contact your service personnel.
Device Failure 03	H	Power Board Selftest Error. Contact your service personnel.
SpO₂ Sensor Off	L	The SpO ₂ sensor on the patient's end turns from the connected status to the disconnected status (such as disconnection or short circuit in the lead). Check the connection of the SpO ₂ sensor.
Please Replace SpO₂ Sensor	M	Failure in the SpO ₂ sensor (such as disconnection or short circuit in the lead). 1. Replace the SpO ₂ sensor. 2. Contact your service personnel.
SpO₂ No Sensor	L	The main cable and the module turn from the connected status to the disconnected status; the sensor and the main cable turn from the connected status to the disconnected status. Check the connection of the SpO ₂ module cable.
SpO₂ Too Much Light	L	The ambient light of the sensor is too strong that the sensor's photodetector absorbs the surrounding light. Put the SpO ₂ sensor in a place with a lower ambient light level.
SpO₂ No Pulse	L	The SpO ₂ sensor cannot detect pulse signals (or the signals are not complete). 1. Check the patient's condition. 2. Check the connection of the SpO ₂ sensor. 3. Replace the SpO ₂ sensor.
SpO₂ Module Error	M	Error in SpO ₂ module or SpO ₂ module initialization. 1. Replace the SpO ₂ sensor. 2. Contact your service personnel.
SpO₂ Overrange	L	The measured value of the SpO ₂ parameter exceeds the applicable measurement range. 1. Replace the SpO ₂ sensor. 2. Contact your service personnel.
PR Overrange	L	The measured value of the PR parameter exceeds the applicable measurement range. 1. Replace the SpO ₂ sensor. 2. Contact your service personnel.
Device Failure 20	H	The SpO ₂ module communication stops. Contact your service personnel.

Table D-2 Technical alarms

Factory Defaults

Ventilation Parameters	E-2
Setup	E-2
Alarms	E-3
History	E-3
Others.....	E-3

E.1 Ventilation Parameters

ITEM	DEFAULTS
CPAP	4.0 cmH ₂ O
PEEP	4.0 cmH ₂ O
Pinsp	8.0 cmH ₂ O
Pwakeup	8.0 cmH ₂ O
Flow	1.0 L/min
O ₂ %	21 vol.%
Tinsp	0.4 s
f	40/min
fBackup	30/min
Tapnea	10 s
I:E	1:2.5
SNIPPV Trigger	5
Wakeup	On
Wake-up cycles	1

Table E-1 Ventilation parameters

E.2 Setup

ITEM	DEFAULTS
Menu:Menu:Setup:Ventilation:Tinsp/I:E of NIPPV	Tinsp
Menu:Setup:Ventilation:Increase O ₂ % during O ₂ ↑	10 vol.%
Menu:Setup:O ₂ Sensor:Monitoring	On
Menu:Setup:Respiration Sensor:Monitoring	On
Menu:Setup:SpO ₂ :Monitoring	On
Menu:Setup:SpO ₂ :Sensitivity	Med
Menu:Setup:SpO ₂ :Sweep-Speed	25 mm/s
Menu:Screen:Brightness/Volume	Daytime
Menu:Screen:Waveform Type	Curve
Menu:System:Setup:Language/Unit:Language	CHINESE
Menu:System:Setup:Language/Unit:Pressure Unit	cmH ₂ O
Menu:System:Interface:Nurse Call:Switch	Off
Menu:System:Interface:Nurse Call:Signal Type	Continuous
Menu:System:Interface:Nurse Call:Contact Type	Normally Closed
Menu:System:Interface:Nurse Call:Alarm level	High Alarms, Med Alarms
Menu:System:Interface:Nurse Call:Alarm Type	Phys. Alarm, Tech. Alarm

Table E-2 Setup

E.3 Alarms

ITEM	DEFAULTS
Alarms:Vent Limits:Paw High Limit	18.0 cmH ₂ O
Alarms:Vent Limits:Paw Low Limit	0.5 cmH ₂ O
Alarms:Vent Limits:Tapnea	10 s
Alarms:Module Limits:SpO ₂ Higher Alarm Limit	100%
Alarms:Module Limits:SpO ₂ Lower Alarm Limit	90%
Alarms:Module Limits:PR Higher Alarm Limit	200 1/min
Alarms:Module Limits:PR Lower Alarm Limit	100 1/min
Alarms:Module Limits:Desat	80%

Table E-3 Alarms

E.4 History

ITEM	DEFAULTS
History:Graphic:Zoom	10 min
History:Graphic:Display Group	All
History:Tabular Trend:Resolution	1 min
History:Tabular Trend:Display Group	All
History:Event Logbook:Filter	All Events

Table E-4 History

E.5 Others

ITEM	DEFAULTS
Menu:System:Setup:Date/Time:Date Format	YYYY-MM-DD
Menu:System:Setup:Date/Time:Time Format	24 h

Table E-5 Others

This page intentionally left blank.

Abbreviations, Symbols and Measuring Units

Abbreviations.....	F-2
Symbols	F-2
Measuring Unit.....	F-3

F.1 Abbreviations

ABBREVIATIONS	DESCRIPTION
BTPS	Body temperature and pressure, saturated
CPAP	Continuous positive airway pressure
Desat	Desaturation limit
NIPPV	Nasal intermittent positive pressure ventilation
f	Respiration rate
fBackup	Backup frequency
FiO ₂	Fraction of inspired oxygen
Flow	Flow rate
HFNC	High-flow nasal cannula oxygen ventilation
I:E	Inspiratory time to expiratory time ratio
IOC	Intelligent Oxygen Control
Leak%	Leakage rate
NCPAP	Nasal continuous positive airway pressure ventilation
O ₂	Oxygen
OSI	Oxygenation saturation index
Δ P	Pressurization pressure
Paw	Airway pressure
PEEP	Positive end-expiratory pressure
PI	Perfusion index
Pinsp	Inspiratory pressure
Pleth	PPG waveform
PR	Pulse rate
RSS	Respiratory severity score
SNIPPV	Synchronized nasal intermittent positive pressure ventilation
SpO ₂	Pulse oxygen saturation
Tinsp	Inspiratory time
Trigger	Trigger sensitivity
Wakeup	Ventilation wake-up
Wakeup Cycles	Number of wakeup cycles

Table F-1 Abbreviations

F.2 Symbols

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
-	minus, negative	>	greater than
%	percentage	≤	smaller than or equal to
/	per, divided by, or	≥	greater than or equal to
≈	approximately	±	plus or minus
^	power	×	multiplied by
+	plus, positive	©	copyright

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
=	equal to	™	trademark
<	smaller than	®	registered trademark

Table F-2 Symbols

F.3 Measuring Unit

MEASURING UNIT	DESCRIPTION	MEASURING UNIT	DESCRIPTION
A	ampere	m	meter
Ah	ampere-hour	mAh	milliampere-hour
bpm	breaths per minute	mbar	millibar
°C	degree centigrade	mg	milligram
cc	cubic centimeter	min	minute
cm	centimeter	ml, mL	milliliter
cmH ₂ O	centimeter water-column	mm	millimeter
dB	decibel	mmHg	millimeter mercury
°F	Fahrenheit degree	ms	millisecond
g	gram	mV	millivolt
hr	hour	mW	milliwatt
Hz	hertz	ppm	parts per million
hPa	hectopascal	s, sec	second
inch	inch	V	voltage
k	thousand	VA	volt-ampere
kg	kilogram	VAC	alternating current volt
kPa	kilopascal	Ω	Ohm
psi	pound per square inch	μA	microamp
L, l	litre	μV	microvolt
lb	pound	W	watt
nm	nanometer		

Table F-3 Measuring unit

This page intentionally left blank.

