VM-2000 Ventilator

Quick Start Guide

VENTIS Medical

VM-LP011-002

Indications for Use

The VM-2000 ventilator is intended to provide continuous or intermittent ventilatory support for the care of the individuals who require mechanical ventilation. The ventilator is a medical device intended for use by qualified, trained personnel under the direction of a physician. Specifically, the ventilator is applicable for adult patients, who require the following types of ventilatory support:

- Positive Pressure Ventilation, delivered invasively (via endotracheal tube or trach tube) or non-invasively (via mask).
- Assist/Control, SIMV, CPAP and NPPV modes of ventilation.

The ventilator is suitable for use in institutional or transport settings.

CAUTION

Federal law (U.S.A) restricts this device to sale by or on the order of a licensed medical practitioner. Outside the U.S.A., check local laws for any restrictions that may apply.

VM-2000 Specifications

General Notes

Please Note

- The *VM-2000* is for use with **adults only**, not pediatric patients
- The *VM-2000* is for use from **-10 to 40 degrees C**
- **Do not immerse the VM-2000 in liquid**
- Clean only with **bleach, alcohol, or hydrogen peroxide** based disinfecting agents
- Ventilation **alarms** are **not active while** ventilation is **paused** or **stopped**

VM-2000 Overview

General Overview: Front of Unit

VM-2000 Overview

General Overview: Back of Unit

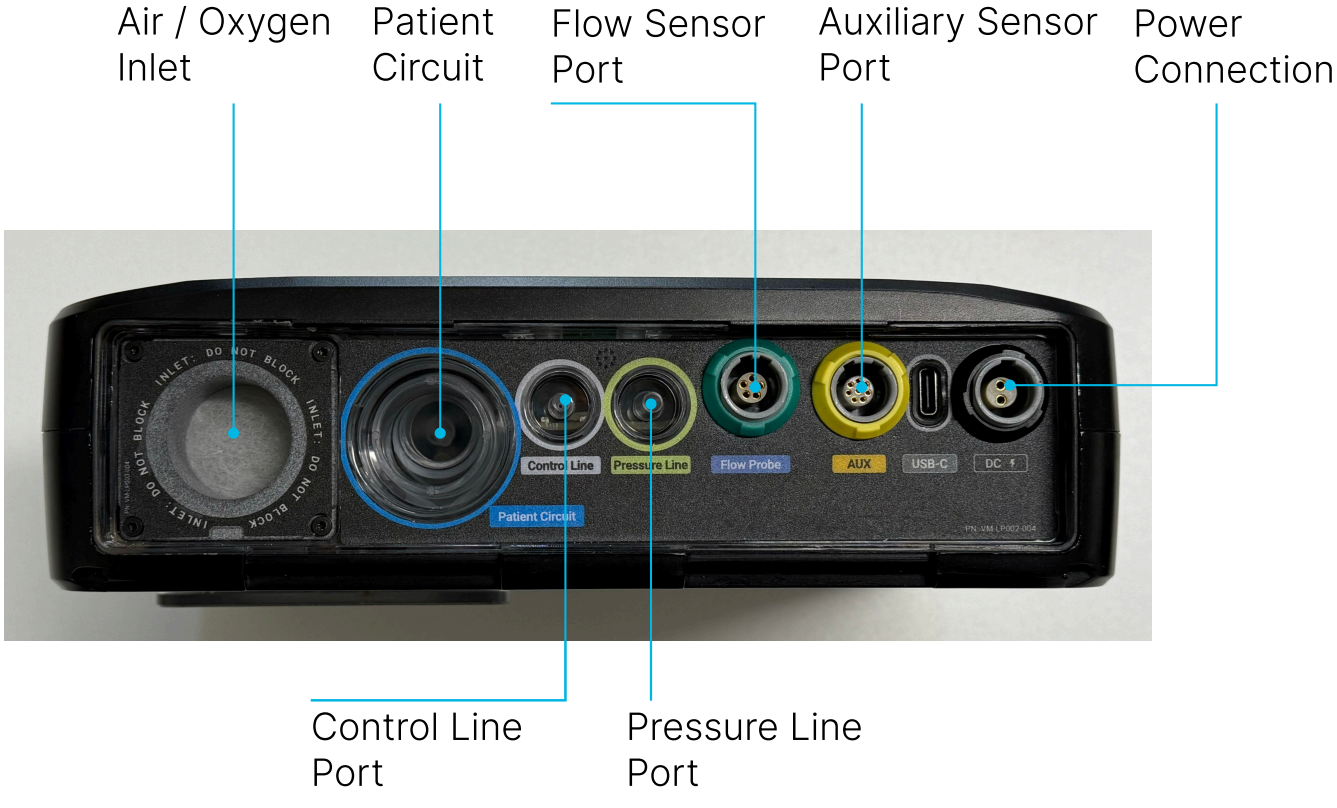
Back Panel Label

Battery Pack

Battery Latch

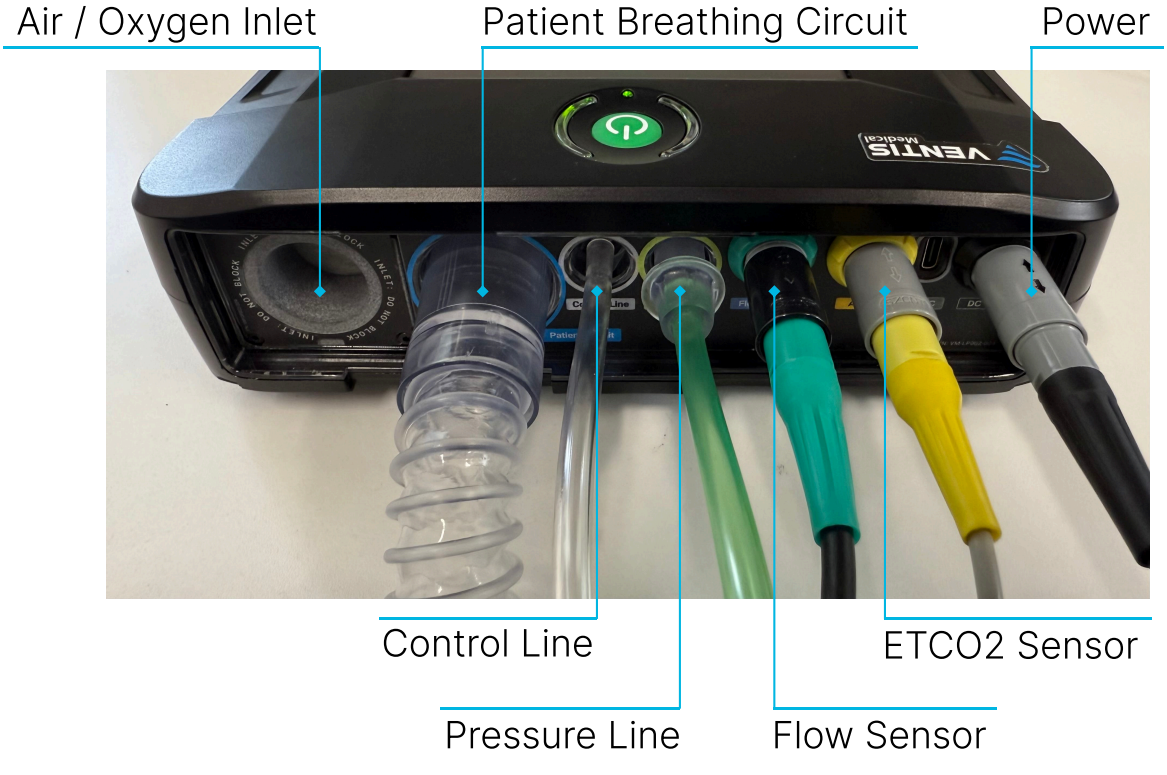
VM-2000 Overview

General Overview: Port Plate

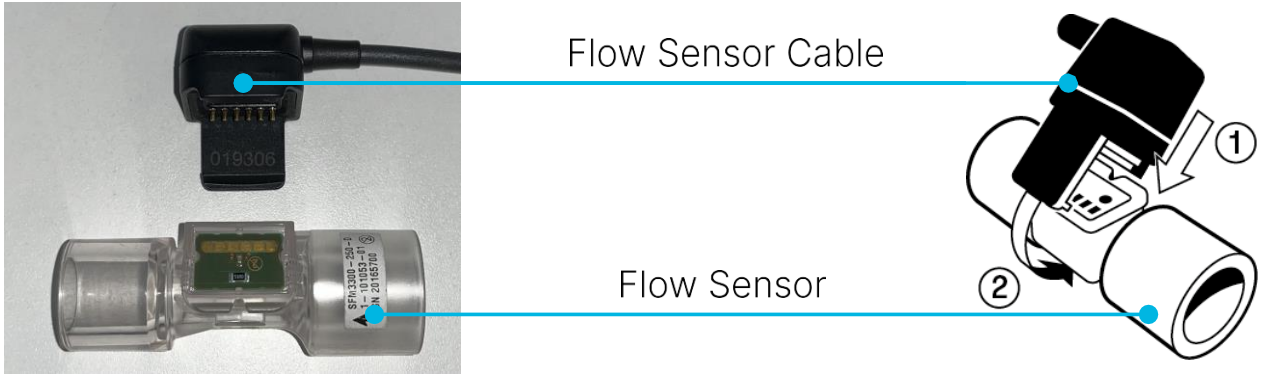


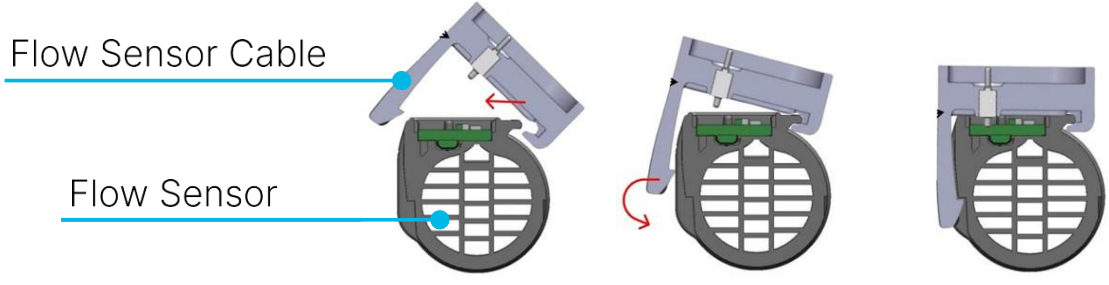
VM-2000 Overview

General Overview: Connections

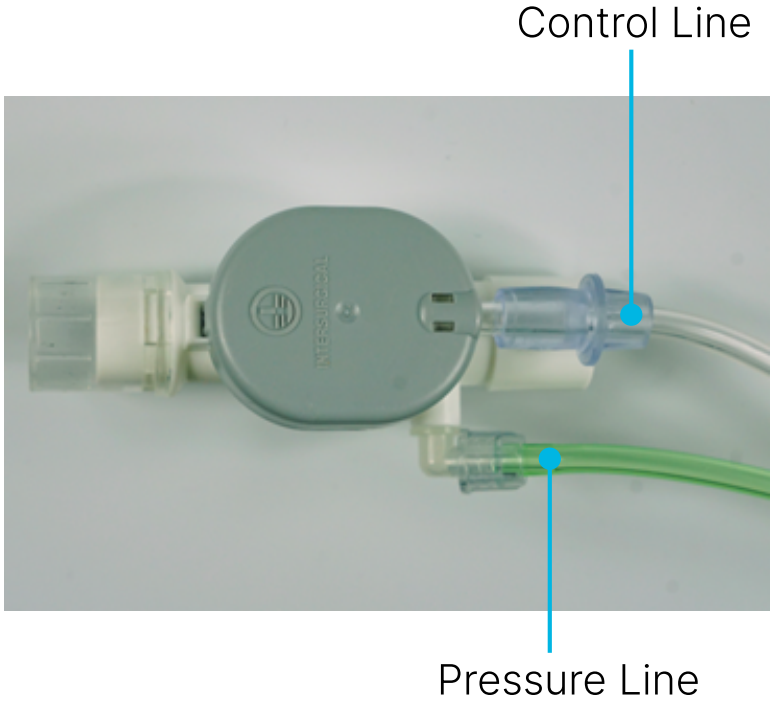


General Overview: Flow Sensor Connection

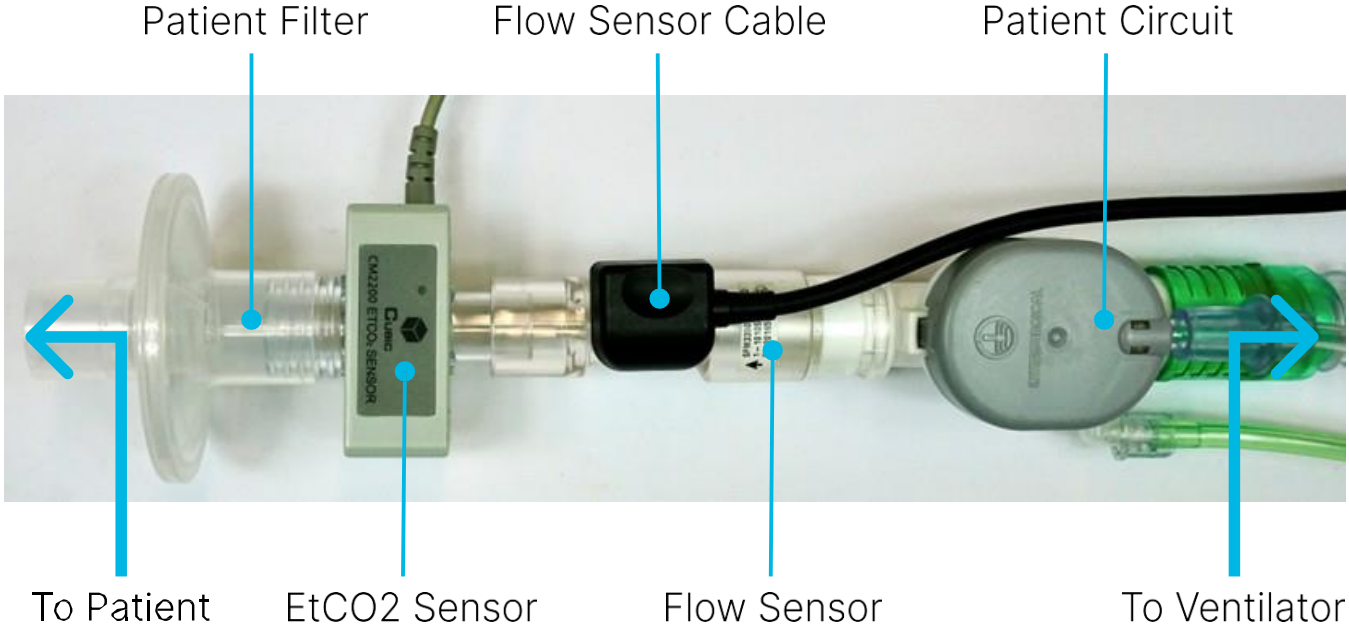




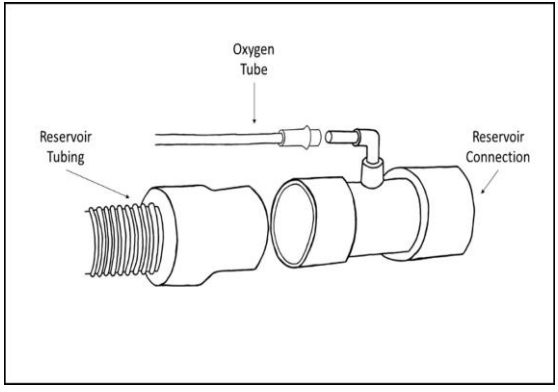
General Overview: Patient Circuit

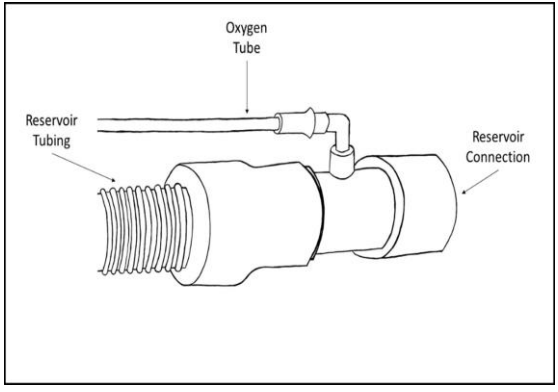


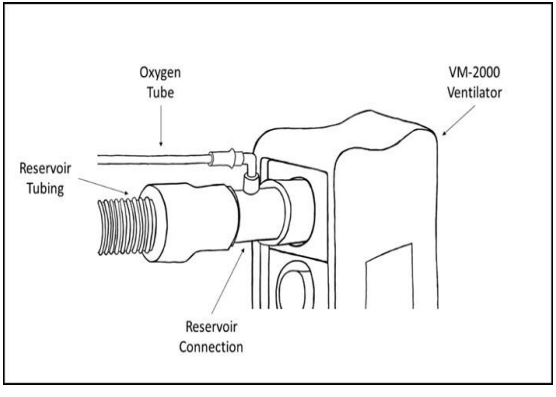
General Overview: Patient Circuit Assembly



General Overview: Oxygen Enrichment







VM-2000 Specifications

Ventilation Controls

Tidal Volume	200 to 2000 ml
Respiratory Rate (RR)	0 to 40 BPM
Peak Inspiratory Pressure (PIP)	15 to 90 cmH2O
Positive End Expiratory Pressure (PEEP)	0 to 20 cmH2O
Trigger Sensitivity (flow)	OFF, 1 to 9 LPM
Inspiratory Time	0.3 to 5.0 seconds

VM-2000 Specifications

Alarm Limit Settings

Tidal Volume	170 to 2300 ml
Respiratory Rate (RR)	0 to 41 BPM
Peak Inspiratory Pressure (PIP)	0 to 90 cmH2O
FiO2	14% to 100%
EtCO2 *Note: To convert EtCO2 to mmHg, multiply kPa by ~7.5*	0 to 10 kPa
Minute Ventilation	0 to 30 LPM
Apnea Interval	10 to 60 seconds

VM-2000 Specifications

Measured and Displayed Patient Parameters

Tidal Volume	0 to 2000 ml
Respiratory Rate (RR)	0 to 100 BPM
Peak Inspiratory Pressure (PIP)	0 to 90 cmH2O
FiO2	14% to 100%
EtCO2 *Note: To convert EtCO2 to mmHg, multiply kPa by ~7.5*	0 to 10 kPa

Pre-Use Checks

Occlusion Alarm Pre-Use Check

To perform a functional test of the circuit occlusion alarm:

1. Connect Patient Breathing Circuit
2. Place cap on end of circuit
3. Turn device on and start ventilation
4. Confirm that the unit reports **Patient Circuit Occlusion Detected** and produces correct visual and audio alarm response

Functional Test of Circuit Disconnect

To perform a functional test of the circuit disconnect alarm:

1. Connect Patient Breathing Circuit
2. Remove cap on end of circuit
3. Turn device on and start ventilation
4. Confirm that the unit reports **Patient Circuit Disconnect Detected** and produces correct visual and audio alarm response

Pre-Use Checks (Optional)

Apnea Backup Mode Check
To perform a functional test of the Apnea backup mode alarm prior to patient use:

1. Connect Patient Breathing Circuit
2. Attach a test lung to the patient end of the Patient Breathing Circuit
3. Select SIMV mode
4. Set Respiratory Rate = 1
5. Start ventilation
6. Confirm that an **Apnea Detected: In Backup Mode** alarm is activated and that the device initiates backup ventilation after 10 seconds with audio and visual alarm response

PIP Limit / High Pressure Alarm Check
To perform a functional test of PIP Limit / High pressure alarm:

1. Connect Patient Breathing Circuit
2. Attach a test lung to the patient end of the Patient Breathing Circuit
3. Start ventilation in AC mode with: P INSP = 20, TV = 500, PEEP = 5, RR = 12, T INSP = 1
4. confirm that the **High Inspiratory Pressure** alarm is activated. Note that other alarms such as Low Tidal Volume may also occur

VM-2000 Specifications

Default Settings

Mode	AC Mode
Tidal Volume	500 ml
Respiratory Rate (RR)	12 BPM
Peak Inspiratory Pressure (PIP)	30 cmH2O
Positive End Expiratory Pressure (PEEP)	5 cmH2O
Trigger Sensitivity (flow)	3 LPM
Inspiratory Time	1 second

Setting Alarm Limits

Example: Maximum FIO2 Alarm Limit

1) On the main screen, select either the:

   a) Set Alarms icon 

   or

   b) Settings icon  then in the settings pane, enter the **alarm settings** tab by tapping the right arrow 

2) In the alarm settings pane, select the relevant alarm **parameter** by tapping the right arrow

3) Then, in the alarm parameter settings pane, select the relevant alarm **limit** by tapping the right arrow

Setting Alarm Limits

Example: Maximum FIO2 Alarm Limit

4) Utilize the standard VM-2000 keyboard to enter the new alarm limit.
NOTE: The settable range can be viewed above the Keyboard

5) Press "CONFIRM" to set the new alarm limit, or "CANCEL" to abort
NOTE: cancelling will revert the alarm setting to the previous set value

Setting Alarm Limits

User-settable alarm		Range	Default setting
Respiratory Rate			
	Low	0 to 40 BPM	0 BPM
	High	(Respiratory Rate setting +1) to 41 BPM	40 BPM
Tidal Volume			
	Low	170 mL to (Tidal Volume setting -1)	425 mL
	High	(Tidal Volume setting +1) to 2300 mL	575 mL
FIO2			
	Low	12 to 95%	19%
	High	27 to 100%	100%
ETCO2			
	Low	0 to 14%	0%
	High	0 to 14%	6%

Setting Alarm Limits

User-settable alarm	Range	Default setting
Pinsp		
Low	1 to 89 cmH2O	6 cmH2O
Minute Ventilation		
Low	0 to 29 L/min	0 L/min
High	1 to 30 L/min	30 L/min
Apnea Interval		
Settable Range	5 to 60 seconds	10 seconds

Resolving Alarms

Alarm	Probable Cause	What To Do
AC Power Disconnected Modal: "Wall supply unplugged; connect to a wall supply if possible"	AC power loss or outage, AC power disconnected, damage at connection to external power, power source not plugged in	Confirm operation on internal battery is intended or restore external power: • Check unit connection to power source If battery power intended, check the external battery charge level and charge /replace if depleted, only while connected to AC • Prepare to ventilate by alternative means if power supply is unavailable
Apnea Detected: In Backup Mode Modal: "In Backup Mode. Apnea No breath within apnea interval"	Patient does not take breath within apnea interval	• Give manual breath or increase Resp. Rate to a higher value • Check the patient's status and airway • Evaluate and adjust the ventilation settings *e.g., Increase RR > 8*
Audio Failure: Switch to Backup Modal: "Audio System Error – Backup in use"	Technical fault	• If the fault persists, ventilate by alternative means and service unit *e.g., Obtain another ventilator or BVM*

Resolving Alarms

Alarm	Probable Cause	What To Do
Battery Critical (0%) – No AC Modal: "CONNECT AC IMMEDIATELY!; Battery Critical; Do not change battery until AC connected"	Battery at 0% of capacity	• Connect device to external power source If battery power intended, check the external battery charge level and charge /replace if depleted, only while connected to AC • Prepare to ventilate by alternative means if power supply is unavailable *e.g., Plug in to AC power and change battery*
Battery Almost Out (<5%) – No AC Modal: "CONNECT AC IMMEDIATELY!; Battery Almost Out; Do not change battery until AC connected"	Battery at 5% of capacity	
Battery Very Low (<10%) – No AC Modal: "CONNECT AC IMMEDIATELY!; Battery Very Low; Do not change battery until AC connected"	Battery at 10% of capacity	
Battery Low (<15%) – No AC Modal: "CONNECT AC IMMEDIATELY!; Battery Low; Do not change battery until AC connected"	Battery at 15% of capacity	

Resolving Alarms

Alarm	Probable Cause	What To Do
Battery Status Unknown Modal: "Battery Status Unknown"	Faulty battery	• Connect device to external power source and replace battery, only while connected to AC • Prepare to ventilate by alternative means if power supply is unavailable *e.g., Plug in to AC power and change battery*
Check Control Line or Inlet Filter	Control line disconnected	• Check control line is properly connected • Check that inlet filter is not blocked *e.g., Check connections*
Check Circuit for Leak	Leak in patient breathing circuit	• Check the breathing circuit and proximal lines for disconnection • If NIV, check mask position • Check for circuit leaks *e.g., Check for disconnect*
Check Pressure Line Connection	Pressure line disconnected	• Check pressure line is properly connected *e.g., Check connections*

Resolving Alarms

Alarm	Probable Cause	What To Do
Circuit Disconnect or Inlet Blocked	Disconnected patient circuit, blocked ventilator inlet	• Check breathing circuit for disconnection • Check ventilator inlet for blockage *e.g., Check for disconnect*
$ETCO_2$ Below Minimum	Low CO_2	• Check the patient's status and airway • Evaluate and adjust the ventilator settings • Evaluate and adjust the alarm settings
$ETCO_2$ Exceeds Maximum	CO_2 too high	*e.g., for "Below Minimum," Decrease the ETCO2 Alarm: Minimum ETCO2% below the displayed value* *e.g., for "Exceeds Maximum," Increase the ECTO2 Alarm: Maximum ETCO2% above the displayed value*
ETCO2 Sensor Disconnect Modal: "ETCO2 sensor disconnected"	ETCO2 sensor disconnected	• Check ETCO2 sensor cable is properly connected *e.g., Check connections*

Resolving Alarms

Alarm	Probable Cause	What To Do
Exhaled Volume Exceeds Limit	Low inspiratory effort followed by larger expiratory effort	• Check the patient's status and airway • Evaluate and adjust the ventilator settings *e.g., Increase TV*
FIO_2 Below Minimum	Low oxygen	• Check supplemental oxygen supply • Evaluate and adjust the alarm settings *e.g., for "Below Minimum," Decrease FIO2 Alarm: Minimum O2% or increase FIO2 supply*
FIO_2 Exceeds Maximum	Oxygen too high	*e.g., for "Exceeds Maximum," Increase FIO2 Alarm: Maximum O2%*
Patient FIO2 Sensor Error Modal: "Patient FIO2 Sensor Error"	FIO2 sensor problem	• Provide an alternate method of ventilation then contact customer service *e.g., Obtain another ventilator or BVM*

Resolving Alarms

Alarm	Probable Cause	What To Do
Flow Sensor Disconnected Modal: "Flow sensor not functioning properly; check flow cable connections; Ventilator in Safety Mode"	Flow sensor disconnected	• Check flow sensor cable is properly connected *e.g., Check connections*
Flow Sensor Problem: Safety Mode Modal: "Flow sensor not functioning properly; check flow cable connections; ventilator in Safety Mode."	Flow sensor disconnected	• Check flow sensor is properly connected *e.g., Check connections*

Resolving Alarms

Alarm	Probable Cause	What To Do
High Inspiratory Pressure	Kinked breathing circuit, blocked airway, low patient lung compliance, high patient airway resistance, vomitus in airway, tension pneumothorax, patient is actively exhaling during the inspiratory phase of the device (may be accompanied by HIGH PEEP alarm)	• Check the patient's status and airway • Check the breathing circuit • Evaluate and adjust the ventilation settings if necessary *e.g., Increase Pinsp*

Resolving Alarms

Alarm	Probable Cause	What To Do
High Minute Ventilation	Patient hyperventilation	• Check the patient's status and airway • Evaluate and adjust the ventilator settings • Evaluate and adjust the alarm settings *e.g., Increase Minute Ventilation Alarm: Maximum Minute Vent*
High Respiratory Rate	Patient respiratory rate high	• Check the patient's status and airway • Evaluate and adjust the ventilation settings *e.g., Increase Respiratory Rate Alarm: Maximum RR*
High Temperature: Cool Unit Now	Extreme temperature environment, or extreme operating conditions	• Remove unit from excessive temperature environment • Cool unit If high temperature persists, ventilate by alternative means and service unit *e.g., Remove from high temperature environment and/or obtain another ventilator or BVM*

Resolving Alarms

Alarm	Probable Cause	What To Do
High Tidal Volume	Large patient-initiated breath	• Evaluate the patient's status • Evaluate and adjust the ventilation settings • Evaluate and adjust the alarm settings *e.g., Increase Tidal Volume Alarm: Maximum Tidal Volume*
High Internal O_2: Switch to Backup	Oxygen enriched environment or internal leak	• Remove unit from enriched oxygen environment • Stop flow of O_2 Ventilate by alternative means • Turn device off • Service unit *e.g., Obtain another ventilator or BVM*
Low Minute Ventilation	Shallow breaths	• Check the patient's status and airway • Evaluate and adjust the ventilator settings • Evaluate and adjust the alarm settings *e.g., Increase Tidal Volume and/or RR and/or decrease Minute Ventilation Alarm: Minimum Minute Vent*

Resolving Alarms

Alarm	Probable Cause	What To Do
Low Respiratory Rate	Patient respiratory rate low	• Check the patient's status and airway • Evaluate and adjust the ventilation settings • Check the circuit connections *e.g., Decrease Respiratory Rate Alarm: Minimum RR below set RR*
Low Inspiratory Pressure	System or pulmonary leak	• Check the patient's status and airway • Check breathing circuit connection is not leaking • Evaluate and adjust the ventilation settings • Evaluate and adjust the alarm settings *e.g., Decrease P INSP Minimum Alarm*
Low Temperature: Warm Unit Now	Extreme temperature environment	• Remove unit from low temperature environment • Warm unit • If low temperature persists, ventilate by alternative means and service unit *e.g., Allow unit to warm while turned on*

Resolving Alarms

Alarm	Probable Cause	What To Do
Low Tidal Volume	Patient-initiated breaths inadequate	• Check the patient's status and airway • Evaluate and adjust the ventilation settings • Evaluate and adjust the alarm setting • Check for disconnections in breathing circuit or pressure sensor tubing *e.g., Lower TV and/or increase P INSP*
N/A (Screen is not functioning, 10 beep alarm audible)	Technical fault	• Ventilate by alternative means Service unit immediately *e.g., Obtain another ventilator or BVM*
Patient Circuit Disconnect Detected	Disconnected patient circuit, leaking airway, or leak in breathing circuit	• Check patient's status and airway • Check that circuit is connected to the patient and ventilator • Check circuit for a leak *e.g., Check connections*

Resolving Alarms

Alarm	Probable Cause	What To Do
Patient Circuit Occlusion Detected	Breathing circuit blockage	• Check the patient's status and airway • Verify breathing circuit tubing is not kinked or obstructed • Verify correct placement of airway and that it is clear of obstructions *e.g., Check for kinks or obstructions*
Patient FIO2 Sensor Calibration Required Modal: "FIO2 Sensor Calibration Required."	Issue with patient FIO2 sensor calibration	• Calibrate sensor when possible If problems calibrating, service unit *e.g., Calibrate FIO2 sensor*
Pause Expired	Device has been paused and no breath has been delivered	• Ventilation will resume automatically *e.g., No action necessary*

Resolving Alarms

Alarm	Probable Cause	What To Do
PEEP Below Minimum	Kinked or disconnected breathing circuit, system leak	• Check the patient's status • Evaluate and adjust the ventilation settings • Verify Breathing Circuit tubing is not kinked, obstructed, or leaking *e.g., Check circuit for leaks*
PEEP Exceeds Maximum	Kinked breathing circuit, blocked airway, increased patient Resp Rate, breath stacking	• Check the patient's status and airway • Evaluate and adjust the ventilation settings • Verify Breathing Circuit tubing is not kinked or obstructed *e.g., Check circuit for kinks and/or obstructions and evaluate for auto-PEEP and consider increasing expiratory time*
Technical Fault: Restart	Technical fault	• Restart unit and if fault persists, ventilate by alternative means and service unit *e.g., If necessary, obtain another ventilator or BVM*

Resolving Alarms

Alarm	Probable Cause	What To Do
Technical Fault: Switch to Backup	Technical fault	• If fault persists, ventilate by alternative means and service unit *e.g., Obtain another ventilator or BVM*
Unexpected Power Down Modal: “Unexpected Power down”	Loss of power source or technical problem	• Restore power supply • If fault persists, ventilate by alternative means and service unit *e.g., Check power connections*

VENTIS
Medical

Ventis Medical Inc.
515 Executive Dr
Princeton, NJ 08540 USA

REF VM-LP011-002
ZL 5/1/2025