ReVel® user guide
Critical care ventilation
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ReVel ventilator

Front
A. Alarm sounder ports
B. LED front panel
C. Lower interface panel
D. Pulse oximeter panel *(optional)*
ReVel ventilator

Left side

A. Cooling fan filter
B. Battery eject latch
C. Air inlet filter
D. O₂ connection
E. Battery pack
ReVel ventilator

Back

A. Docking station interface connector
B. Battery release button
C. Battery pack
D. Docking station mounting recesses (2)
ReVel ventilator

Right side

A. Safety valve openings
B. Inspiratory port
C. Exhalation drive line port
D. Sense line ports
E. Oximetry port ($SpO_2$)
F. FiO$_2$ port
G. Exhaust port
H. Power port
Operational set-up

To connect the circuit:

**1.** Connect the inspiratory limb of the patient circuit to the inspiratory port.

**2.** Connect the exhalation valve drive line of the patient circuit to the exhalation drive line port (*hose barb)*.

**3.** Connect the patient circuit wye sense lines (2, *each with non-interchangeable luer fittings*) to the sense line ports.
Operational set-up

A. Safety valve openings *(do not cover)*
B. Inspiratory port
C. Exhalation valve drive line port
D. Sense line ports
E. Right side of ReVel ventilator
F. Low side sense line *(upper connection)*
G. High side sense line *(lower connection)*
H. Exhalation valve drive line
I. Inspiratory limb of patient circuit
Operational set-up

Example of ReVel patient circuit

A. Luer fittings
B. Inspiratory limb
C. High and low pressure sense lines
D. Wye
E. Patient connection port
F. Sense line connections (do not remove)
G. Expiratory limb
H. Expiratory valve
I. Exhalation drive line
High pressure O₂ connection

To attach a high pressure O₂ source, connect an O₂ hose (B) to the O₂ inlet (D) fitting labeled “O₂.”

A. Left side of ReVel ventilator

B. O₂ inlet

C. O₂ inlet cap

D. High pressure O₂ hose/fitting
Low pressure $O_2$ connection

To attach a low pressure (less than 10 psig) $O_2$ source such as a flowmeter:

1. Attach a low pressure adapter ($D$) to the $O_2$ inlet.
2. Attach the $O_2$ supply hose ($E$) to the hose barb on the adapter.
3. Set the $O_2$ control on the front panel to LPS.

A. Left side of ReVel ventilator
B. $O_2$ inlet
C. $O_2$ inlet cap
D. Low pressure DISS adapter
E. Low pressure $O_2$ hose
Power up

The connector is keyed to fit in only one direction and snaps (*locks*) into place when properly inserted. To connect to external power:

1. Align the external power connector with the red dot oriented as shown on page 11.

2. Insert the connector directly into the power port. The DC power port is labeled with 11–16V and a red triangle.

3. Connect the external power cable to a valid external power source.

A. Red triangle  
B. DC power port  
C. Right side of ReVel ventilator  
D. Red dot  
E. Power cable  
F. Knurled sleeve
External power disconnection

To disconnect external power:

1. Grasp the knurled sleeve of the connector (B).
2. Pull it away from the ventilator (B).

A. Red dot
B. Knurled sleeve
Battery pack installation

To install the battery pack:

1. Position and orient the battery pack (C).

2. Insert it directly into the battery pack slot. The battery snaps (locks) into place when fully inserted. An audible signal sounds when the ventilator acknowledges the battery.

A. Left side of ReVel ventilator

B. Eject latch

C. Battery pack

D. Release button (bottom side of battery)
Battery pack removal

To remove the battery pack:

1. Push the eject latch up to partially eject the battery.

2. Press the release latch.

3. Pull the battery completely out of the battery slot.

**WARNING:** When changing power sources, the ventilator runs off the internal transition battery. This is a short-duration power source, intended to power the ventilator for up to ONE MINUTE ONLY.
Low pressure O$_2$ blending flow set-up

Use one of the three following charts and the accompanying instructions to determine the required low pressure O$_2$ flow setting to deliver the desired FiO$_2$:

- **Bias Flow = 10 lpm**
- **Bias Flow = 5 lpm**
- **Bias Flow = 3 lpm**
To determine the required O$_2$ input flow:

1. Select the appropriate chart based on the Bias Flow setting. When Leak Compensation is on, the patient leak should be added to the Bias Flow value.

2. Identify the desired FiO$_2$ (*bottom of chart*).

3. Calculate the patient’s Minute Volume (Ve) rate by using the formula: Tidal Volume x (as a multiplier) Breath Rate. Locate the Minute Volume reading (*right side of chart*).

4. Follow the vertical FiO$_2$ line up to the applicable slanted Ve line.

5. From where #3 and #4 intersect, read across horizontally to the left side of the chart to the required Input O$_2$ Flow (*L/min*).
Delivered $O_2$ concentration determination

To determine the delivered $O_2$ concentration:

1. Select the appropriate chart based on the Bias Flow setting. When Leak Compensation is on, the patient leak should be added to the Bias Flow value.

2. Find the Input $O_2$ Flow (left side of the chart).

3. Follow the Input $O_2$ Flow across horizontally to the right side of the chart to the applicable slanted $V_e$ line.

4. Read down to the $FiO_2$ (bottom of chart).
Testing

Ventilator testing

Operating a ventilator that does not appear to be functioning properly may be hazardous to both the patient and operator. Perform the following tests between patients to verify the functional operation of the ReVel ventilator:

<table>
<thead>
<tr>
<th>Test</th>
<th>Type of test</th>
<th>Operating mode</th>
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<td>Extended Systems Test (EST)</td>
<td>Start-up</td>
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Preparation required for all tests:
- Starting with the ventilator off, connect the ventilator to a valid, external source of power
- Insert a fully charged battery pack

Additional preparation required for circuit test:
- Assemble the patient circuit to be used/tested. Do not include a nebulizer in the circuit.
- Connect the patient circuit to the ventilator:
  - Do not attach an oxygen supply to the ventilator at this time
  - Do not connect the patient circuit to a patient
Testing

Perform circuit test (*pass or fail*):

1. When the Patient ID displays, rotate the Scroll knob until *Circuit Test* displays.

2. Press *Select* to confirm.

3. When *Remove Ptnt* displays, press *Select* to confirm.

4. As the ventilator increases, view the flow (*Flow XX.X lpm*) through the patient circuit.

5. Follow the on-screen instructions to complete the circuit test.

**WARNING:** If the ventilator or any attached accessory is damaged, fails any tests or malfunctions in any way, immediately discontinue use and contact CareFusion or a service technician certified by CareFusion.
Normal ventilation mode tests

Use a test lung while testing the ReVel ventilator:

- Display/Alarm check
- All LED indicators and displays light up
- High-priority audible alarm sounds

The following Battery/Power check messages display:

<table>
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<th>Battery pack</th>
<th>External DC power</th>
<th>Docking station</th>
<th>Transition battery</th>
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<tr>
<td>Batt xxx%</td>
<td>Ext OK</td>
<td>Dock OK</td>
<td>T-Bat OK</td>
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<tr>
<td>Batt Removed</td>
<td>Ext Low</td>
<td>Dock Low</td>
<td>T-Bat Low</td>
</tr>
<tr>
<td>Batt Fault</td>
<td>Ext Removed</td>
<td>Dock Removed</td>
<td>T-Bat Remove</td>
</tr>
<tr>
<td>–</td>
<td>Ext Fault</td>
<td>Dock Fault</td>
<td>T-Bat Charge</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>T-Bat Fault</td>
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Ventilator use

Power the ventilator on by pressing, then releasing the ON/STANDBY button.

The ReVel ventilator performs a POST, and an audible alarm sounds.

Same patient

The message bar displays Same Patient. If OK, press Select.

Then, select Intubated or NPPV. The ventilator begins operating using the stored control settings.
Ventilator use

New patient

If a new patient is desired, scroll to change the message bar to read **New Patient**. Press **Select**.

The **Patient Size** menu appears.

Rotate the knob until the desired patient size displays. Press **Select** when the appropriate size selection displays. Once selected, the operator selects **Intubated** vs. **NPPV**.
Using NPPV

NPPV set-up

1. Use the ReVel dual limb circuit and a well-fitting Non-Vented mask.

2. Once the patient size is selected, an option for INTUBATED or NPPV appears. Select NPPV.

3. Once selected, the IPAP setting displays. To adjust, push the SELECT button. To change the IPAP setting, push the SELECT button and use the Scroll knob to select the desired setting.

4. Once IPAP has been set, use the Scroll knob to select the desired EPAP setting. To change the EPAP setting, push the SELECT button and use the Scroll knob to select the desired setting.

5. Once the EPAP has been set, use the Scroll knob until the default RATE value displays. To change the RATE setting, push the SELECT button and use the Scroll knob to select the desired setting. If only spontaneous rate with apnea back up is desired, set the rate to 0.
Helpful hints for using NPPV

1. Set NPPV at vent start up with test lung first.


3. Set initial settings as follows:
   - Flow term to 35–40%
   - If in AC mode, set i-Time to 0.7 - 1.0 seconds
   - If in CPAP + PS mode, set time term between 0.7 and 1.0 seconds

4. Place circuit on patient who has been fitted with a **Non-Vented mask**

5. Adjust rise time as needed for patient comfort

6. Once patient is comfortably breathing at set-up, set Low Min Vol and Low Pk. Pres. alarms to appropriate settings
Front panel

A. Airway pressure manometer: Airway pressure tracking breath by breath. Range -6 to +90 cmH₂O

B. Display window: Notifications, alarm messages, configuration menus

C. Controls: Select, change, confirm

D. Alarms: Select, change, confirm LPP, HP, LFiO₂, LVE

E. Pulse oximeter: Select, change, confirm

F. Lower interface panel controls: Power, Scroll knob, power status, control lock, maneuvers, manual breath, alarm silence/rest
Displays and indicators

Display characteristics (LED)

Normal intensity
• Active in the current mode.
• The control is selected for a change. All other displays dim.

Dimmed
• Not active in the current mode.
• Another control is selected for a change.

Flashing
• The upper or lower limit for a control or a special condition has occurred.
• An alarm is occurring or has occurred.
• An attempt to change the control settings has occurred while the controls are locked.

Blank
• The power is conserving when the ventilator is operating on the transition battery (to turn displays back on, press any button or turn the control knob).
• The control feature is not available.
• The sensor for an installed option is not connected or communicating with the ReVel ventilator.

Dashes
• This control is turned off.
Airway pressure manometer

The airway pressure manometer tracks breath-to-breath airway pressure, displaying:

- Low pressure limit as a single yellow LED at the current low Ppeak pressure alarm limit value.
- High pressure limit as a single yellow LED at the current high pressure alarm limit value.
- PEEP as a continuous bar of green LEDs that remain lit at the end of the expiratory phase of each breath when a PEEP value is set.
- Peak pressure (PIP) as a single green LED that remains lit at the peak pressure value until the start of the next breath.

A. Airway pressure  
B. Low pressure limit  
C. PEEP  
D. Peak pressure  
E. High pressure limit
LED display window

Select button

The **Select** button is used to select a menu item or control scrolling monitored data on the alphanumeric LED display window.

To use:

1. Press the **Select** button to pause scrolling.

2. Use the Scroll knob to manually increment the values you wish to view.

3. Press **Exit** to start the automatic scroll again.

Exit button

The **Exit** button is used to restart paused monitored data scrolling and exit Advanced Features menus.
LED display window

A. Dot matrix LED display window
B. Select button
C. Exit button

Monitored patient data display
Controls

Monitored patient data display
Alarms

The following alarm limits can be set from the front panel:

- Low Ppeak
- High pressure
- Low FiO₂
- Low Ve
- High/Low pulse rate (option)
- High/Low SpO₂ (option)

1. Select the alarm by pressing the associated button.
2. Change the alarm limit setting by turning the Scroll knob.
3. Confirm the alarm by pressing the associated button again.
Ensure the apnea alarm is set appropriately.
Lower interface panel

On/Off

Power status LEDs Silence/Reset button

To use:

1. Press the button once while an alarm is sounding to silence the audible alarm for 60 seconds. The Silence/Reset LED lights up.

2. Press the button again to remove the visible *(highest-priority)* flashing alarm message. The next highest-priority alarm message becomes visible. Continue to press the button to subsequently remove the alarms in order of priority.

3. Once the lowest-priority alarm has been removed, press the Alarm/Reset button to reinstate all active alarm messages and visual alarm indicator, and reactivate the audible alarm. If not manually reactivated, the audible alarm sounds 60 seconds after the silencing button is first pressed.

*(See lower interface panel on page 31)*
Lower interface panel
Patient settings

Breath type and mode set-up

To change modes or breath types on the LED interface:

1. Press the button on the LED panel to select the breath mode (the LED for the current mode or breath type flashes).

2. Turn the Scroll knob on the lower interface panel to change the breath type or mode.

3. Press the button again while the new mode LED is flashing to confirm the change. The ventilator begins operating with the new setting.
Set applicable Advanced Features

To enter the Advanced Features menu:

While in normal ventilation mode, press and hold the Select button for three seconds. Patient ID displays.

LED display window
Set applicable Advanced Features

To enter the Advanced Features menu *(continued)*:

1. Turn the Scroll knob to the desired displayed menu heading.
2. Turn the Scroll knob clockwise to view the next menu heading.
3. Turn the Scroll knob counter-clockwise to view the previous menu heading.
4. Press the Select button again to confirm the menu selection.

To access a menu item:

1. Turn the Scroll knob to change the displayed menu item.
2. Press the Select button to confirm the menu item selection.
Set applicable Advanced Features

To change and set a value:

1. Turn the Scroll knob to change the value of a selected menu item. Turn clockwise to increase or counter-clockwise to decrease the value.

2. Press the Select button to confirm the new value. The value is accepted, and the previous menu item displays.

To exit the Advanced Features menu:

3. Press the Exit button (repeatedly, as necessary) until the scrolling monitored data displays. The ventilator is now back in normal ventilation mode.
Advanced Features menus

V**ent Check** menus are only displayed and/or accessed in Vent Check mode.

**Alarm Config**
- Alarm Volume
- Batt Tone
- Apnea Int
- HP Delay
- MV/BR Delay
- PEEP Delay
- LPP Alarm
- High PEEP
- Low PEEP
- High f

**Vent Config**
- Query
- Dim After
- Local Time
- Local Date
- Date Format
- O₂ Flush %
- O₂ Flush Dur
- Ctrl Lock
- Safety Valve
- O₂ Cyl Dur

**Vent Check**
- Language
- Units
- Button
- Circuit Test
- Reset
- Presets

**Patient ID**

**SBT**
- SBT Start
- SBT Cancel
- SBT Pres. Sup
- SBT PEEP
- SBT O₂
- SBT Time
- SBT Hi f/Vt
- SBT Low f/Vt
- SBT High f
- SBT Low f
- Display f/Vt

**Vent Ctrl**
- Rise Time
- Flow Term
- Time Term
- PC Flow Term
- Bias Flow
- Leak Comp
- NPPV Mode

**Option Config**
- Pulse Ox
- FiO₂

**Service**
- Event Trace
- Data
- Usage
- About

**Service**

Patient ID
Advanced Features menus

Transitioning from invasive to noninvasive ventilation

To transition from invasive (intubated) to NPPV without restarting the ReVel ventilator:

1. Enter the Advanced Features menu from a normal mode of ventilation.

2. Rotate the Scroll knob until Standby? displays.


4. Push the Confirm? button to suspend patient ventilation and initiate Standby mode.

   Note: Selecting Confirm? ceases ventilation. Controls and alarms lock.

Patient ventilation is now suspended, and the message Stopping momentarily displays. This is followed by the flashing message IN STANDBY! in the front panel window.

5. Push the Select button a third time. Intubated displays.

6. Rotate the Scroll knob until NPPV shows, and then press Select.

The ventilator resumes ventilation in the latest intubated settings. The mode is CPAP+PS, and the breath type is Pressure.
Advanced Features menus

Fraction of Inspired Oxygen option

When installed and enabled, Inspired Oxygen (FiO₂) is measured by an O₂ sensor attached to the beginning of the inspiratory limb of the patient circuit.

FiO₂ sensor connection

Align the FiO₂ sensor connector with the red dot oriented as shown below, and insert it directly into the FiO₂ port on the right side of the ventilator.

A. Red triangle
B. FiO₂ port
C. Right side of ventilator
D. Red dot
E. FiO₂ sensor or cable connector
F. Knurled sleeve
Advanced Features menus

Configuration

Once FiO₂ is set up, enabled and calibrated during Vent Check, communication with the FiO₂ sensor may be enabled/disabled during normal ventilation modes under the Advanced Features menu.

Enable (Enbl)/Disable (Dsbl) menu

1. Enter the Advanced Features menu, and scroll to Option cnfg.

2. Press Select. PULSE OX displays.

3. Scroll until FiO₂ displays and press Select. ENBL/DSBL displays.

4. Scroll until the desired ENBL/DSBL status displays, and press Select. The new ENBL/DSBL sets and displays. This function can be performed while the patient is on the ventilator.

*See vent check tips on page 49.
PalmTop™ docking station

For stationary applications, the ventilator can be docked to a PalmTop™ docking station that provides power to the ventilator, accommodates the PTM™ Graphics Monitor and expands the ventilator interface capabilities to include:

• Patient monitor system interface
• Nurse call interface
• AC power
• PTM™ Graphics Monitor mounting and communication (option)
• Memory card interface
• Wall rail mounting (option)
• Rolling floor stand mounting (option)
Docking station placement

1. Seat the alignment recesses on the ventilator over the alignment posts of the DC, as shown.

A. Alignment recess (2)
B. Alignment post (2)
Docking station placement

2. Seat the alignment recesses on the ventilator over the alignment posts of the DC, as shown.
Docking station placement

3. Press the ventilator case firmly until it clicks and the positive lock engages.
Docking station placement

Power connection verification
The external power LED on the ventilator lights up and stays green.

Communication verification
A confirmation accessory-attached audible alert sounds, and the LED on the front of the AC Power lights up and remains green.
Docking station release

1. Press the PTV Release button at the bottom/center of the front panel.
Docking station release

2. Lift the ventilator clear of the alignment posts on the cradle.
Ventilator (*communication status*)

The docked indicator LED on the front panel visually indicates the status of communication between the docking station and the docked ventilator with:

- **Flashing red twice a second**: The ventilator is not docked, or the ventilator is docked and the communication link is not connected
- **Continuous green**: The ventilator is docked and transferring data
FiO₂ sensor calibration

Accurate monitored FiO₂ readings cannot be obtained unless the O₂ sensor has been enabled and properly calibrated to the ventilator.

To perform a two-point (0.21 and 1.0 FiO₂) calibration of an attached FiO₂ sensor:

- Enable FiO₂ is set
- Ensure an external supply of 100% O₂ is available
- Make sure the ventilator is off the patient
- Calibrate the sensor every 12 hours

To calibrate:

1. While in the FiO₂ option, press Select. ENBL/DSBL displays. Select Enabled.
2. Scroll until Calibrate displays, and press Select. The date of the most recent successful FiO₂ sensor calibration displays. Press Select again. The calibration process begins, and Apply 21% O₂ displays.
3. Expose the FiO₂ sensor to ambient air for a minimum of 10 seconds, and press Select. Apply 100% O₂ displays.
4. Expose the FiO₂ sensor to 100% O₂ for one minute.
5. Press Select. Complete or Failed displays.
6. Exiting Enable/Disable menu: Press the Exit button until the ventilator displays scrolling monitored data.
FiO₂ monitoring alarms

FiO₂ monitoring alarms

• FiO₂ sensor fault
  – Generated when FiO₂ has been enabled in startup mode
  – Generated when the ventilator detects an FiO₂ sensor failure

• Low FiO₂
  – Generated when the monitored FiO₂ is equal to or less than the Low FiO₂ alarm setting
  – The Low FiO₂ alarm is only available when an FiO₂ sensor is installed in the patient circuit, connected to the ventilator and enabled
FiO₂ sensor disconnection

To disconnect the safety locking mechanism, grasp the knurled sleeve of the connector and pull it away from the ventilator.

A. Red dot

B. Knurled sleeve
⚠️ Caution—Federal (USA) law restricts this device to sale by or on the order of a physician.

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