

Operator's Manual Addendum

Software Enhancements

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Introduction

This addendum describes enhancements to the 840 Ventilator System and changes to the *840 Ventilator System Operator's and Technical Reference Manual* part number 4-075609-00 up to and including Revision G, and part number 4-070088-00 up to and including Revision F.

NOTE:

If you have *840 Ventilator System Operator's and Technical Reference Manual* part number 4-075609-00 Revision F, your manual has been updated with the information contained in this addendum except for any references to PAV™*+ option, PA breath type, the Flow-Volume loop plot information starting on page 21, and the RS-232 command update starting on page 37. If your manual is Revision G, it has been updated with the information contained in this addendum except for the Flow-Volume loop plot information starting on page 21 and the RS-232 command update starting on page 37.


If you have *840 Ventilator System Operator's and Technical Reference Manual* part number 4-070088-00 Revision E or later, your manual has been updated with the information contained in this addendum except for the Flow-Volume loop plot information starting on page 21 and the RS-232 command update starting on page 37.

Updates to the manual include:

- The patient circuit type specified during short self test (SST) determines default settings and available ranges for ventilator operation.
- Certain recommended ranges can be overridden. Touching the **OK** button allows operation outside the recommended setting range.
- The humidification type can be changed after running SST without adversely affecting breath delivery or spirometry, and humidifier volume can be entered for non-HME humidifiers during or following SST.
- A prompt has been added at the start of the SST compliance test to allow the operator to check for the presence of water in the humidifier.
- A reminder arrow now flashes at the *Ventilator Startup* screen to prompt the operator to consider previous settings.
- Display of data on the upper GUI screen is larger for improved visibility at a distance.

- Alarm Silence in Progress and 100% O₂/CAL in Progress indicators (when active) and the **CANCEL** buttons for them are displayed on the lower GUI screen.
- The main settings (buttons displayed at the top of the lower screen) can be set individually or in a batch to allow quick setup.
- Drop-down menus of available selections have been added for mode, mandatory type, spontaneous type, trigger type, apnea mandatory type, and graphics plot setup.
- The lower screen displays monitored settings if you select or change the settings that affect them:
 - Selecting or changing the volume setting displays the current volume per weight ratio (V_T/IBW or $V_{T\ SUPP}/IBW$).
 - Selecting or changing the respiratory rate or volume setting displays the set minute volume ($V_{E\ SET}$).
- Expiratory sensitivity (E_{SENS}) is now a primary setting that appears at the top of the lower screen. E_{SENS} can be set as high as 80% for leak management.
- The alarm setting bars on the *Alarm Setup* screen display the recent range of the corresponding patient data.
- Circuit disconnect and patient data alarms no longer reset an active alarm silence.
- Oxygen sensor calibration (100% O₂ CAL) can be canceled.
- An automatic expiratory or inspiratory pause maneuver can be canceled by touching the **CANCEL** button on the lower GUI display.
- If the ventilator enters idle mode or an occlusion status cycling (OSC) state when NeoMode is active, the ventilator delivers 40% O₂ if available.
- *Peak Circuit Pressure* (P_{PEAK}) shows the peak inspiratory pressure, and is updated at the end of each inspiration. Previously, this number represented the peak pressure for the whole breath.
- *Mean Circuit Pressure* (P_{MEAN}) indicates the average circuit pressure over all breaths for the previous 1-minute interval.
- The O₂ sensor alarm is no longer a DEVICE ALERT alarm.
- Various alarm parameters have been changed to reduce the occurrence of nuisance alarms.

- The following have changed:

 P %	This symbol is now defined as <i>Rise Time Percent</i> (was <i>Flow Acceleration</i>). The symbol has not changed.
P_{MEAN}	New symbol for mean airway pressure (was \bar{P}_{CIRC}).
P_{PEAK}	New symbol for peak circuit pressure (monitored) (was $P_{\text{CIRC MAX}}$).
PEEP	New symbol for end expiratory pressure (monitored) (was $P_{\text{E END}}$).
$V_{\text{E SET}}$	New symbol, now defined as <i>set minute volume</i> (was V and defined as minute volume).
C_{STAT}	New symbol for <i>static compliance</i> (was C).
R_{STAT}	New symbol for <i>static resistance</i> (was R).

- The extended self test (EST) compressor leak test now takes approximately one minute (was five minutes).
- Several spontaneous data parameters (rapid shallow breathing index, spontaneous inspiratory time, and spontaneous percent inspiratory time) have been added to the *More Patient Data* screen.
- Graphics displays have been enhanced to show estimated carinal or lung pressure when the respective TC or PA spontaneous breath type is active.
- Frozen graphics can now be printed.
- Available waveform plots now include a Flow-Volume loop.
- The clinician must now select a Ventilation Type, either INVASIVE or NIV (Non-invasive Ventilation), during new patient set-up.
- The INSPIRATION TOO LONG alarm now applies only to INVASIVE Vent Type, and a High Spontaneous Inspiratory Time Limit ($2T_{\text{I SPONT}}$) ventilator setting is available for NIV Vent Type with SIMV and SPONT breath modes.
- A new RS-232 command, SNDF, has been added.

Update to patient circuit ranges

This section updates Operator’s Manual section 2.3.

Warning

When using a Fisher & Paykel™* humidifier with the 840 Ventilator, use the Fisher & Paykel™* model 210 or 250 humidifier chamber for adult patients and the model 220 or 290 humidifier chamber for pediatric patients. Other Fisher & Paykel™* humidifier chambers can cause water to splash into the patient circuit during circuit disconnects and high peak flow rate conditions.

Patient circuit type selection

Table 1 shows IBW values and patient circuit types. The “Allowed but not recommended” ranges require an override.

Table 1. Patient circuit and IBW values

Recommendation	Ideal body weight (IBW) in kg (lb)
Recommended	Neonatal: 0.5-7.0 kg (1.1-15 lb) Pediatric: 7.0-24 kg (15-53 lb) Adult: 25-150 kg (55-330 lb)
Allowed but not recommended	Neonatal: Not applicable. Pediatric: 3.5-6.5 kg (7.7-14.3 lb), and 25-35 kg (55-77 lb) Adult: 7-24 kg (15-53 lb)

Warning

Recommended ranges exist to ensure patient safety. Only those with expertise to judge the appropriate circumstances should override the recommended ranges.

Update to short self test (SST) and humidification type

This section updates Operator's Manual sections 3 and 4.8.

SST setup

For optimum inspiratory volume and spirometry accuracy, SST asks you to specify the humidification type: *Heated exp tube*, *Non-heated exp tube*, or *HME* (HME = heat-moisture exchanger). For non-HME humidifiers, you can touch the **HUMIDIFIER VOLUME** button, then turn the knob to select the dry humidifier volume (the humidifier's specified volume, *not* compressible volume). The **HUMIDIFIER VOLUME** button is not visible when *HME* is selected.

SST compliance calibration

For a humidification type of *Heated exp tube* or *Non-heated exp tube*, the ventilator prompts you to indicate if there is water (YES or NO) in the humidifier.

Changing humidification type after SST

For optimum spirometry accuracy, humidification type and volume (for non-HME humidifiers) can now be changed after running SST.

Follow these steps to select the humidification type and set its volume:

1. Touch the **OTHER SCREENS** button, then touch the **MORE SETTINGS** button.
2. Touch the **HUMIDIFICATION TYPE** button, then turn the knob to select the new value (*Heated exp tube*, *Non-heated exp tube*, or *HME*).
3. For non-HME humidifiers, touch the **HUMIDIFIER VOLUME** button, then turn the knob to select the dry humidifier volume. (The **HUMIDIFIER VOLUME** button is not visible when *HME* is selected.)
4. Review the proposed settings, then press ACCEPT to apply the new settings.

Update to Ventilator Startup screen

This section updates Operator's Manual section 4.1. The *Ventilator Startup* screen (Figure 1 below) has changed:

- Expiratory sensitivity (E_{SENS}) is now a primary setting and appears at the top of the lower GUI screen.
- The startup screen includes flashing reminder arrow (next to the **SAME PATIENT** button) that prompts the user to consider previous settings.
- During and after Ventilator Startup, drop-down menus of available selections are displayed for vent type, mode, mandatory type, spontaneous type, trigger type, and apnea mandatory type.
- Once Ventilator Startup is complete, the volume per weight ratio is displayed when the volume setting is selected or changed. Volume = tidal volume (V_T) when breath type is VC, target volume (V_T) when breath type is VC+, target support volume ($V_{T SUPP}$) when breath type is VS.
- V_E is no longer displayed in the *Ventilator Startup* screen.
- For additional changes to *Ventilator Startup* screen, see "Ventilation Type – INVASIVE/NIV" on page 26.

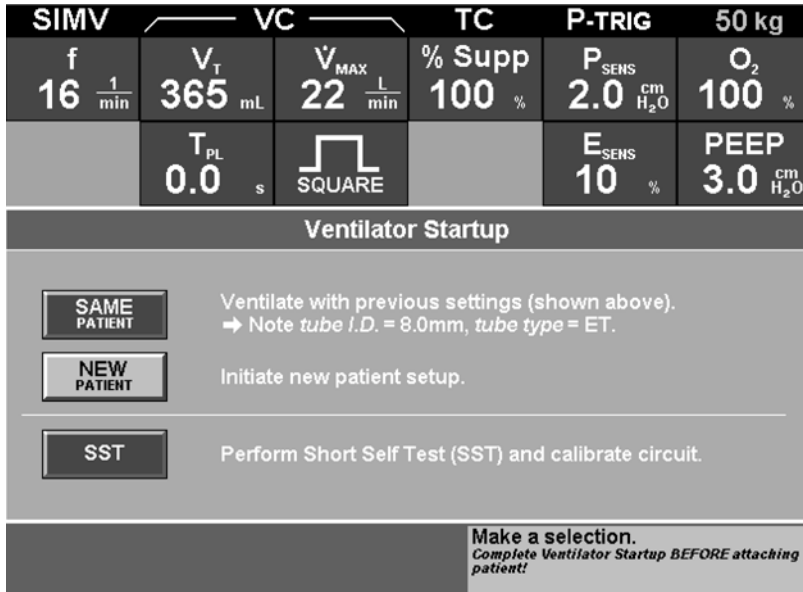


Figure 1. Ventilator Startup screen

Update to normal ventilation screens

This section updates Operator's Manual section 4.2.

The upper GUI screen (Figure 2 below) now displays patient data in large characters on a single line for improved distance visibility. Breath type is indicated in the upper left corner (C = control, S = spontaneous, A = assist).

To view units and symbol definitions at the bottom of the screen, touch the displayed symbol. Additional data is available on the *More Data* screen.

For additional changes to normal ventilation screens see "Ventilation Type – INVASIVE/NIV" on page 26.

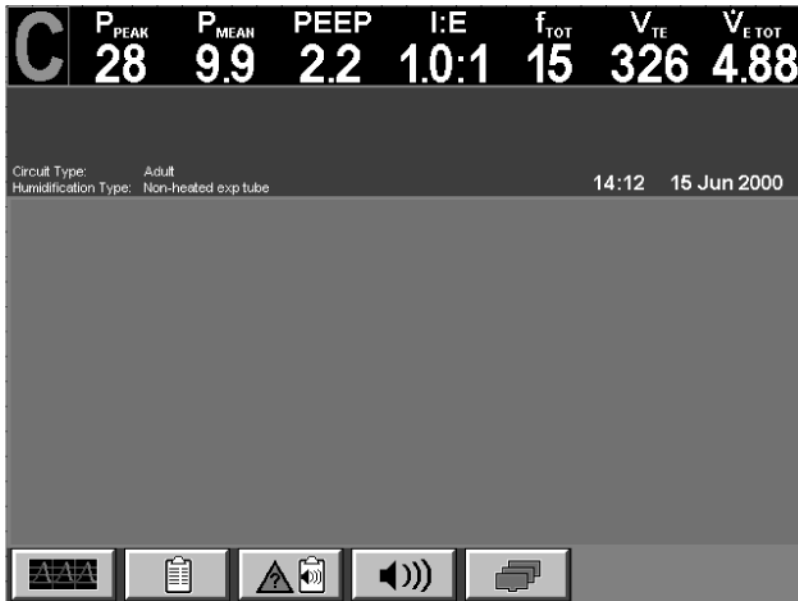


Figure 2. Upper GUI screen

The lower GUI screen (Figure 3) shows the Alarm Silence In Progress and the 100% O₂/CAL In Progress indicators if no higher-priority display is active. The lower screen automatically displays the In Progress indicators when you press the 100% O₂/CAL 2 min key.

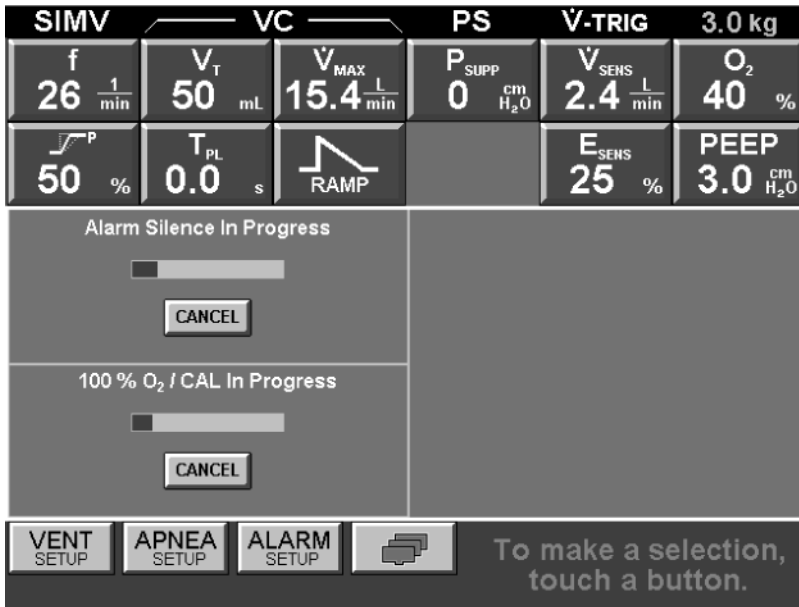


Figure 3. Lower GUI screen

Update to main settings changes

This section updates Operator's Manual section 4.3 to reflect that main settings can now be changed in a batch to allow quick setup. Main settings are the buttons displayed at the top of the lower screen. Follow these steps to change main settings:

1. Touch a setting you want to change. Turn the knob to set the desired value.
2. Repeat for each setting to be changed.
3. Touch CANCEL ALL to cancel the new input and leave the settings unchanged.
4. Touch ACCEPT to apply the new setting(s).

The lower screen displays monitored settings (Table 2) if you select or change the settings that affect them:

Table 2. Monitored settings

$V_{E\ SET}$	Set minute volume: displayed along with the breath timing bar whenever you select or change the respiratory rate (f) or volume setting.
$V_{T\ /IBW}$	Volume per weight ratio: displayed when you select or change the tidal volume (V_T , when breath type is VC) or target volume (V_T , when breath type is VC+) setting.
$V_{T\ SUPP/IBW}$	Volume per weight ratio: displayed when you select or change the target support volume ($V_{T\ SUPP}$ when breath type is VS) setting.

Update to mode, breath type, and batch (multiple) settings changes

This section updates Operator's Manual section 4.4 to reflect that V_E is no longer displayed in the *Current Vent Setup* screen.

Update to apnea ventilation settings changes

This section updates Operator's Manual section 4.6 to reflect that when the apnea mandatory type is selected in the *Apnea Setup* screen, a drop-down menu of all available selections is displayed with the current selection highlighted. Apnea set minute volume is no longer displayed in the *Apnea Setup* screen.

Update to setting alarms

This section updates Operator's Manual section 4.7 to reflect the updated *Alarm Setup* screen (Figure 4). Alarm setting bars now include a highlighted block that represents the recent range of the corresponding patient data.

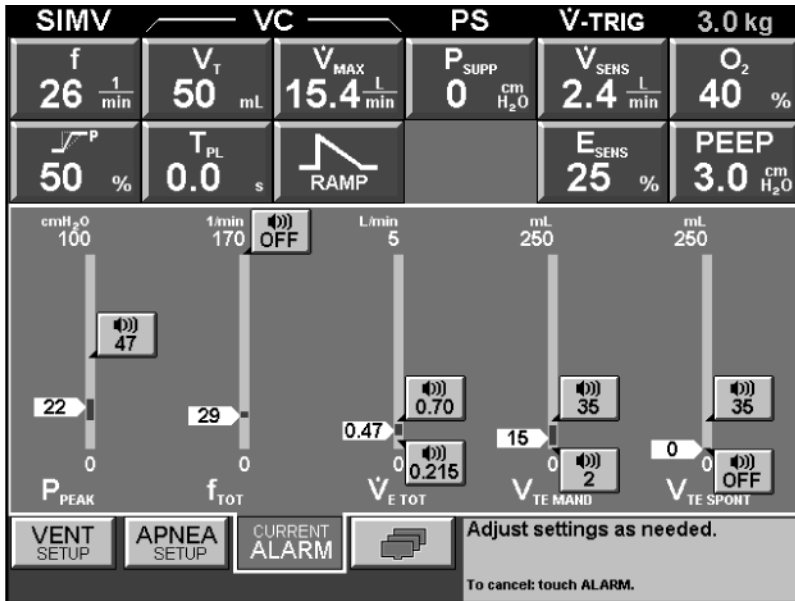


Figure 4. Alarm setup screen

Update to More Settings

This section updates Operator's Manual section 4.8. The *More Settings* screen has changed:

- E_{SENS} has been removed (and is now a primary setting).
- Humidifier Volume (for non-HME humidifiers) has been added.

The procedure for changing any setting on the *More Settings* screen is the same.

Updated ranges for settings, alarms, and data

This section updates Operator's Manual section 4.9 and Appendix A.6, and includes only changes to ventilator settings or alarms. Ventilators equipped with the NeoMode option can select all ranges (neonatal, pediatric, or adult). Only pediatric and adult ranges are available to ventilators without the NeoMode option.

Some settings have recommended limits that can be overridden. When a proposed setting exceeds the recommended limits, the ventilator sounds a tone and asks you to confirm that you want to override the recommended range.

Table 3 lists changes to ventilator settings. Table 4 lists changes to alarm settings. Table 5 lists additions to patient data.

Table 3. Ventilator settings updates

Setting	Function/Details
Apnea mandatory type	New patient value: Neonatal: Same as non-apnea mandatory type when non-apnea mandatory type is PC or VC. PC when non-apnea mandatory type is VC+. Pediatric: Same as non-apnea mandatory type when non-apnea mandatory type is PC or VC. VC when non-apnea mandatory type is VC+. Adult: Same as non-apnea mandatory type when non-apnea mandatory type is PC or VC. VC when non-apnea mandatory type is VC+.
Apnea interval (T_A)	New patient value: Neonatal: 10 s Pediatric: 15 s Adult: 20 s
Apnea respiratory rate (f)	New patient value: Neonatal: 20/min Pediatric: 14/min Adult: 10/min
Expiratory sensitivity (E_{SENS})	Range: 1% to 80%; 1 to 10 L/min for PAV TM *+ option New patient value: 25%; 3 L/min for PAV TM *+ option

Table 3. Ventilator settings updates (continued)

Setting	Function/Details
Flow pattern	Range: Flow pattern not selectable when mandatory type is PC or VC+. New patient value: Neonatal: Descending ramp Pediatric: Square Adult: Square
Flow sensitivity (V_{SENS})	Range: Neonatal: 0.1 L/min to 10 L/min Pediatric/Adult: 0.2 L/min to 20 L/min New patient value: Neonatal: 1.0 L/min Pediatric: 2.0 L/min Adult: 3.0 L/min
High spontaneous inspiratory time limit ($2T_{I\ SPONT}$) (Available when Vent Type is NIV, only)	Range: Neonatal: 0.4 sec to $(1 + (0.1 \times IBW))$ sec Pediatric/Adult: 0.4 sec to $(1.99 + (0.02 \times IBW))$ sec New patient value: Neonatal: $(1 + (0.1 \times IBW))$ sec Pediatric/Adult: $(1.99 + (0.02 \times IBW))$ sec
Humidifier volume	Function: The empty volume of the currently-installed humidifier. Range: 100 mL to 1000 mL Default: 480 mL Resolution: 10 mL

Table 3. Ventilator settings updates (continued)

Setting	Function/Details
Ideal body weight (IBW)	Range: Neonatal: ≥ 0.5 kg (1.1 lb), ≤ 7.0 kg (15 lb) Pediatric: ≥ 3.5 kg (7.7 lb), ≤ 35 kg (77 lb) Adult: ≥ 7.0 kg (15 lb), ≤ 150 kg (330 lb) New patient value: Neonatal: 3.0 kg Pediatric: 15.0 kg Adult: 50 kg Resolution: 0.1 kg for 0.5 kg to 3.5 kg 0.5 kg for 3.5 kg to 10 kg 1.0 kg for 10 kg to 50 kg 5 kg for 50 kg to 100 kg 10 kg for 100 kg to 150 kg
Inspiratory time (T_I)	New patient value: Based on circuit type, IBW, and VC settings Resolution: 0.01 s when mandatory type is PC or VC+, 0.02 s when mandatory type is VC.
Mandatory type	Function: Sets the type of mandatory breath: volume control (VC), pressure control (PC), or volume control plus (VC+). VC+ is only available with the <i>Volume Ventilation Plus</i> option when the mode is A/C or SIMV. Range: VC, PC, or VC+ New patient value: Neonatal: PC Pediatric/Adult: VC
Mode	New patient value: Neonatal: SIMV Pediatric/Adult: A/C
$O_2\%$	New patient value: Neonatal: 40% Pediatric/Adult: 100%
Patient circuit type	Range: Neonatal, Pediatric, or Adult. Neonatal is only available with the NeoMode option.

Table 3. Ventilator settings updates (continued)

Setting	Function/Details
Peak flow (V_{MAX})	Range: Neonatal: ≥ 1.0 L/min, ≤ 30 L/min Pediatric: ≥ 3.0 L/min, ≤ 60 L/min Adult: ≥ 3.0 L/min, ≤ 150 L/min New patient value: Based on IBW Resolution: 0.1 L/min for flows of 1 L/min to 20 L/min 1 L/min for flows of 20 L/min and above
Respiratory rate (f)	Function: Sets the minimum number of mandatory breaths the patient receives per minute. Active in <i>A/C</i> , <i>SIMV</i> , and <i>BiLevel</i> . Range: Neonatal: 1.0 /min to 150 /min Pediatric/Adult: 1.0 /min to 100 /min New patient value: Neonatal: 20 /min Pediatric: 14 /min Adult: 10/min Resolution: 0.1/min for 1.0 /min to 10 /min 1/min for 10 /min to 150 /min Accuracy: ± 0.1 (+0.6% of setting) 1 /min averaged over 60 s or 5 breaths, whichever occurs last.
Spontaneous type	Function: Sets the type of spontaneous breath: pressure supported (PS), not pressure supported (NONE), Tube Compensated (TC), volume support (VS), or proportional assist (PA). TC is only available with the <i>TC</i> option when the patient circuit type is pediatric or adult. VS is only available with the <i>Volume Ventilation Plus</i> option when the mode is SPONT. PA is only available with the PAV TM *+ option when the IBW ≥ 25.0 kg (patient type is Adult), tube I.D. ≥ 6.0 mm, and the mode is SPONT Range: Neonatal: PS, NONE, VS Pediatric: PS, NONE, TC, VS Adult: PS, NONE, TC, VS, PA

Table 3. Ventilator settings updates (continued)

Setting	Function/Details
Target volume (V_T) or Tidal volume (V_T)	Range: Neonatal: 5 mL to 315 mL Pediatric/Adult: 25 mL to 2500 mL (IBW-based range is $1.16 \times$ IBW minimum; $45.7 \times$ IBW maximum) New patient value: Neonatal: The greater of 5 mL or $(7.25 \times$ IBW) Pediatric/Adult: The greater of 25 mL or $(7.25 \times$ IBW) Resolution: 1 mL for 5 mL to 100 mL 5 mL for 100 mL to 400 mL 10 mL for 400 mL to 2500 mL
Trigger type	Range: Neonatal: Flow (V -TRIG) Pediatric/Adult: Pressure (P-TRIG) or V -TRIG New patient value: V -TRIG
Vent type	Range: INVASIVE or NIV (non-invasive) New patient value: INVASIVE

Table 4. Alarm settings updates

Alarm	Range
High circuit pressure ($2P_{PEAK}$)	New patient value: Neonatal: 30 cmH ₂ O Pediatric/Adult: 40 cmH ₂ O
High exhaled minute volume ($2V_{E\ TOT}$)	Range: OFF <i>or</i> ≥ 0.10 L/min <i>or</i> > low exhaled minute volume limit and Neonatal: ≤ 10 L/min Pediatric: ≤ 30 L/min Adult: ≤ 100 L/min New patient value: Based on IBW
High exhaled tidal volume limit ($2V_{TE}$)	Range: OFF <i>or</i> > low exhaled spontaneous tidal volume limit > low exhaled mandatory tidal volume limit and Neonatal: 5 mL to 500 mL Pediatric: 25 mL to 1500 mL Adult: 25 mL to 3000 mL New patient value: Based on IBW Resolution: 1 mL for 5 mL to 100 mL 5 mL for 100 mL to 400 mL 10 mL for 400 mL to 3000 mL
High respiratory rate ($2f_{TOT}$)	Range: OFF <i>or</i> Neonatal: 10 /min to 170 /min Pediatric/Adult: 10 /min to 110 /min New patient value: OFF Resolution: 1 /min

Table 4. Alarm settings updates (continued)

Alarm	Range
Low exhaled mandatory tidal volume ($4V_{TE\ MAND}$)	Range: OFF <i>or</i> ≥ 1 mL $<$ high exhaled tidal volume limit <i>and</i> Neonatal: ≤ 300 mL Pediatric: ≤ 1000 mL Adult: ≤ 2500 mL New patient value (INVASIVE Vent Type): Based on IBW New patient value (NIV Vent Type): OFF Resolution: 1 mL for 1 mL to 100 mL 5 mL for 100 mL to 400 mL 10 mL for 400 mL to 2500 mL
Low exhaled minute volume ($4V_{E\ TOT}$)	Range: OFF <i>or</i> $<$ high exhaled minute volume limit, <i>and</i> Neonatal: OFF <i>or</i> 0.01 L/min to 10 L/min Pediatric: 0.05 L/min to 30 L/min Adult: 0.05 L/min to 60 L/min New patient value (INVASIVE Vent Type): Based on IBW New patient value (NIV Vent Type): OFF Resolution: 0.005 L/min for 0.01 L/min to 0.50 L/min 0.05 L/min for 0.05 L/min to 5.0 L/min 0.5 L/min for 5.0 L/min to 60.0 L/min

Table 4. Alarm settings updates (continued)

Alarm	Range
Low exhaled spontaneous tidal volume ($4V_{TE\ SPONT}$)	Range: OFF <i>or</i> ≥ 1 mL < high exhaled tidal volume limit and Neonatal: ≤ 300 mL Pediatric: ≤ 1000 mL Adult: ≤ 2500 mL New patient value (INVASIVE Vent Type): Based on IBW New patient value (NIV Vent Type): OFF Resolution: 1 mL for 1 mL to 100 mL 5 mL for 100 mL to 400 mL 10 mL for 400 mL to 2500 mL
Low circuit pressure ($4P_{PEAK}$)	Available only during NIV <i>or</i> when VC+ is selected as Mandatory Type during INVASIVE ventilation. Range: NIV: OFF to $2P_{PEAK} - 1$ cmH ₂ O VC+: PEEP to $2P_{PEAK} - 1$ cmH ₂ O <hr/> <p>NOTE:</p> When VC+ is selected, $4P_{PEAK}$ can be set to OFF if PEEP is set to 0. <hr/> New patient value: PEEP + 6 cmH ₂ O Resolution: 0.5 cmH ₂ O for pressures < 20 cmH ₂ O 1 cmH ₂ O for pressures ≥ 20 cmH ₂ O

Table 5. Patient data updates

Data	Range
Rapid shallow breathing index (f/V_T)	<p>Function: Displays the ratio of respiratory rate to inspired volume measurements on the <i>More Patient Data</i> screen. Available for spontaneous breaths only. Accessible during normal ventilation by pressing the More Patient Data button on the upper GUI screen.</p> <p>Range: 0.0 1/min-L to 600 1/min-L</p> <p>Resolution: 0.1 for $f/V_T < 10$ 1/min-L 1 for $f/V_T \geq 10$ 1/min-L</p>
Spontaneous inspiratory time ($T_{I\text{ SPONT}}$)	<p>Function: Displays the measured patient inspiratory time on the <i>More Patient Data</i> screen. Available for spontaneous breaths only. Accessible during normal ventilation by pressing the More Patient Data button on the upper GUI screen.</p> <p>Range: 0.00 s to 10.00 s</p> <p>Resolution: 0.01 s</p>
Spontaneous percent inspiratory time (T_I/T_{TOT})	<p>Function: Displays the ratio of the inspiratory time to total breath cycle time measurements on the <i>More Patient Data</i> screen. Available for spontaneous breaths only. Accessible during normal ventilation by pressing the More Patient Data button on the upper GUI screen.</p> <p>Range: 0.00 to 0.80</p> <p>Resolution: 0.01</p>

Update to alarm silence

This section updates Operator's Manual section 5.1.

- Patient data and patient circuit disconnect alarms do not cancel an alarm silence. Other high-urgency alarms still cancel an alarm silence.
- *Alarm Silence in Progress* indicator: if no higher-priority screens are displayed on the lower GUI screen, a bar graph representing the alarm silence period appears.

Update to graphics

This section updates Operator's Manual section 6 to reflect these enhancements to graphics displays:

- The **PLOT 1** and **PLOT 2** buttons now display drop-down menus of available selections with the current selection highlighted.
- If a pressure-time waveform is selected and the spontaneous type is TC or PA, a new **SHADOW TRACE** button is displayed. The **SHADOW TRACE** button allows you to enable or disable the graphic display of carinal pressure or lung pressure when TC or PA is active.
- The pressure-time curve now shows an estimate of carinal pressure (P_{CARI}) or lung pressure (P_{LUNG}) as a shaded area within the waveform when the spontaneous breath type is TC or PA, respectively.

NOTE:

The graphic display of carinal or lung pressure is an estimate, *not* an actual measurement.

Printing graphics

Frozen graphics can now be printed. When graphics are frozen on the screen and the selected device for RS-232 serial port 1 is a printer, a **PRINT** button now appears in the upper left corner of the screen. Follow these steps to print frozen graphics:

1. Touch the **PRINT** button. The flashing message *PRINTING* replaces the **PLOT SETUP**, **UNFREEZE**, and **PRINT** buttons. You may stop printing by touching the **CANCEL** button.
2. Once all graphics data has been sent to the printer, the **PLOT SETUP**, **UNFREEZE**, and **PRINT** buttons reappear.

NOTE:

To print graphics, RS-232 serial port 1 must be configured with *PRINTER* as the selected device.

Flow volume (F-V) loop

A Flow-Volume loop is available for use with or without the Respiratory Mechanics option (Figure 5).

Scaling is selectable by the user, from -2000 to 6000 mL for volume (x-axis), and up to 200 L/min for flow (y-axis). The plot begins at the start of inspiration with the inspiratory flow curve plotted above the x-axis, and the expiratory flow curve plotted below the x-axis.

NOTE:

Traditionally, Flow-Volume loops are presented with inspired flow plotted below the horizontal axis, and exhaled flow plotted above, with the plot beginning at the start of exhalation.

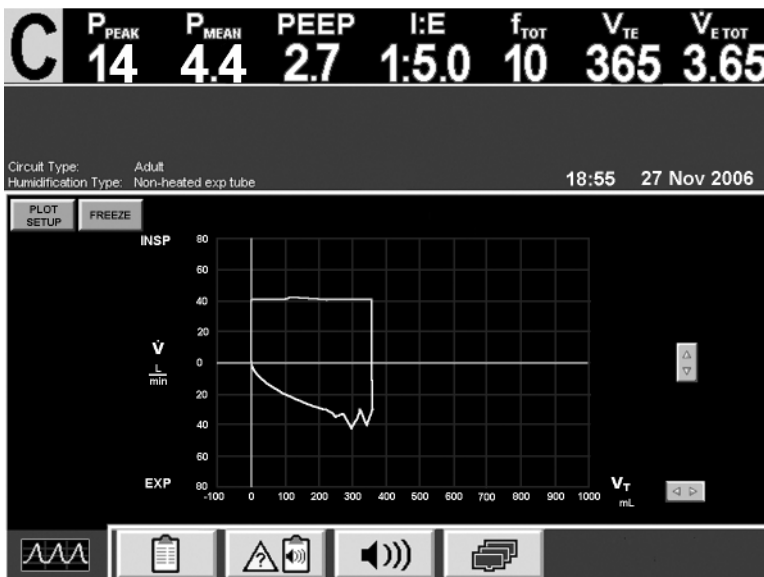


Figure 5. Flow-Volume loop

Update to RS-232 port information

This section updates Operator's Manual section E.2 to reflect that the RS-232 port can now be configured to select the attached device, baud rate, data bits, and parity. Follow these steps to configure the RS-232 port:

1. From the *Ventilator Settings* screen, press the **MORE SCREENS** button.
2. Press the **COMMUNICATIONS SETUP** button.
3. Touch the serial port 1 button, then turn the knob to select the attached device (**DCI** or **PRINTER**). Choose **DCI** if the attached device is an external host/monitor, or **PRINTER** for a printer. (Only Port 1 may be configured as a printer port.)
4. Touch the **BAUD RATE** button, then turn the knob to select the baud rate (1200, 2400, 4800, 9600, 19200, or 38400).
5. Touch the **DATA BITS** button, and turn the knob to select either 7 or 8 data bits.
6. Touch the **PARITY MODE** button, then turn the knob to select parity (None, Even, or Odd). Even or Odd parity may only be selected if the number of data bits is set to 7.
7. Press **ACCEPT** to apply these changes.

Updated alarm summary

This section updates Technical Reference Manual section 13.1.2. Table 6 lists changes to the alarm summary.

Table 6. Alarm summary updates

Base message	Urgency	Analysis message	Remedy message	Comments
APNEA	Medium	Apnea ventilation. Breath interval > apnea interval.	Unchanged.	Unchanged.
	High	Extended apnea duration or multiple apnea events.		
INSPIRATION TOO LONG	Low	Last 2 spont breaths = IBW based T ₁ limit.	Unchanged.	INSPIRATION TOO LONG alarm only functions when Vent Type is INVASIVE.
	Medium	Last 4 spont breaths = IBW based T ₁ limit.		
	High	Last 10 or more spont breaths = IBW based T ₁ limit.		
O ₂ SENSOR	Low	Ventilation unaffected.	O ₂ sensor out of calibration/failure. Press 100% O ₂ CAL, replace or disable.	Background checks have detected a problem. Resets when operator successfully calibrates oxygen sensor, or disables oxygen sensor.

Table 6. Alarm summary updates (continued)

Base message	Urgency	Analysis message	Remedy message	Comments
1P _{PEAK}	Low	Last breath ≥ set limit.	Check patient circuit & ET tube.	Measured airway pressure ≥ set limit. Ventilator truncates current breath unless already in exhalation. Possible dependent alarms: 3V _{TE MAND} 3V _{E TOT} 1f _{TOT}
	Medium	Last 3 breaths ≥ set limit.		
	High	Last 4 or more breaths ≥ set limit.		
1V _{TE}	Low	Last 2 breaths ≥ set limit.	Unchanged.	Unchanged.
	Medium	Last 4 breaths ≥ set limit.		
	High	Last 10 or more breaths ≥ set limit.		
1V _{E TOT}	Low	V _{E TOT} ≥ set limit.t for ≤ 30s.	Unchanged.	Unchanged.
	Medium	V _{E TOT} ≥ set limit for > 30s.		
	High	V _{E TOT} ≥ set limit for > 120s.		
1f _{TOT}	Low	f _{TOT} ≥ set limit for ≤ 30s.	Unchanged.	Unchanged.
	Medium	f _{TOT} ≥ set limit for > 30s.		
	High	f _{TOT} ≥ set limit for > 120s.		

Table 6. Alarm summary updates (continued)

Base message	Urgency	Analysis message	Remedy message	Comments
3V _{TE MAND}	Low	Last 2 mand breaths ≤ set limit.	Unchanged.	Unchanged.
	Medium	Last 4 mand breaths ≤ set limit.		
	High	Last 10 or more mand breaths ≤ set limit.		
3V _{TE SPONT}	Low	Last 2 spont breaths ≤ set limit.	Unchanged.	Unchanged.
	Medium	Last 4 spont breaths ≤ set limit.		
	High	Last 10 or more spont breaths ≤ set limit.		
3V _{E TOT}	Low	V _{E TOT} ≤ set limit for ≤ 30s.	Unchanged.	Unchanged.
	Medium	V _{E TOT} ≤ set limit for > 30s.		
	High	V _{E TOT} ≤ set limit for > 120s.		
3P _{PEAK}	Low	Last 2 breaths, pressure ≤ set limit.	Check for leaks.	Peak inspiratory pressure ≤ set limit. (Available only when Vent Type is NIV or during INVASIVE ventilation when Mandatory Type is VC+.)
	Medium	Last 4 breaths, pressure ≤ set limit.		
	High	Last 10 or more breaths, pressure ≤ set limit.		

Ventilation Type – INVASIVE/NIV

This section updates Operator's Manual Section 4. The clinician must now select either INVASIVE or NIV (non-invasive ventilation) using the **VENT TYPE** button that appears on the *New Patient Setup* or *Current Setup* screens.

Choosing INVASIVE allows conventional ventilation with either endotracheal or tracheostomy tubes. During invasive ventilation, the 840 ventilator operates in the same way as the previous software version with no changes to the appearance of the main ventilator screens.

When VC+ is selected for Mandatory Type during New Patient Setup or when changing the current setup, a Low Circuit Pressure alarm ($3P_{PEAK}$) is now available that replaces the previously non-settable Low Inspiratory Pressure alarm. Refer to Table 4 and Table 6 for more information on the $3P_{PEAK}$ alarm.

Warning

Because the VC+ pressure control algorithm does not allow the target inspiratory pressure to fall below PEEP + 5 cmH₂O, setting the $4P_{PEAK}$ alarm limit at or below this level, in effect, disables the alarm.

Choosing NIV allows ventilation with various non-invasive interfaces and with uncuffed endotracheal tubes in NeoMode. NIV improves the 840 ventilator's ability to handle large system leaks associated with these interfaces by providing pressure-based disconnect alarms, minimizing false disconnect alarms, and replacing the INSPIRATION TOO LONG alarm with a High Spontaneous Inspiratory Time limit ($2T_{I\ SPONT}$) setting and visual indicator.

The remaining Ventilation Type discussion focuses on the changes associated with the addition of NIV.

Intended Use

NIV is intended for use by neonate, pediatric, and adult patients possessing adequate neural-ventilatory coupling and stable, sustainable, respiratory drive.

Breathing Interfaces

Covidien has successfully tested the following non-vented interfaces with NIV:

Full-face Mask: Puritan Bennett™ Benefit Non-vented Full Face Mask (large, part number 4-005253-00), ResMed Mirage™* Non-vented Full Face Mask (medium)

Nasal Mask: ResMed Mirage™* Non-vented Mask (medium)

Infant Nasal Prongs: Sherwood Davis & Geck Argyle CPAP Nasal Cannula (small), Hudson RCI™*, Infant Nasal CPAP System (No. 3)

Uncuffed neonatal ET tube: Mallinckrodt™ Uncuffed Tracheal Tube, Murphy (3.0 mm)

Warning

- Use only non-vented patient interfaces with NIV.
 - Full-faced masks used for non-invasive ventilation should provide visibility of the patient's nose and mouth to reduce the risk of emesis aspiration.
 - Do not ventilate patients intubated with cuffed endotracheal or tracheostomy tubes using NIV Vent Type.
-

Changes to ventilator GUI screens

The following changes have been introduced to the GUI touch screens that allow the clinician to set up the ventilator and readily identify that it is operating using NIV:

- **VENT TYPE** button added to the *New Patient* and *Current Setup* screens to select either INVASIVE or NIV ventilation types.
- Breath modes and breath type choices are limited to a subset of the settings available in INVASIVE ventilation.
- A new ventilator setting, High Spontaneous Inspiratory Time Limit ($2T_{I\text{SPONT}}$), is available when either SIMV or SPONT breath mode is selected.
- Indicators for NIV appear on both upper and lower GUI screens. Figure 6 and Figure 7 show the lower GUI screen during New Patient Setup for NIV.
- A new alarm setting, Low Circuit Pressure ($4P_{\text{PEAK}}$), is available.

New Patient Setup

IBW = 50 kg

1. Vent Type: **NIV**

2. Mode: **SIMV**
A/C
SIMV
SPONT

3. Mandatory Type: **VC**

4. Spontaneous Type: **PS**

5. Trigger Type: **V-TRIG**

CONTINUE

RESTART

Mode of Ventilation

Use knob to adjust.
When done: touch CONTINUE.
To cancel: touch RESTART.

- Vent Type Button:** New button used to select between INVASIVE or NIV.
- Breath Mode:** Only A/C, SIMV, and SPONT modes are allowed with NIV.
- Mandatory Type:** Only VC and PC are available with NIV.
- Spontaneous Type:** Only PS or NONE are available with NIV when SIMV or SPONT breath mode is selected.
- Trigger Type:** Only Flow Triggering is available with NIV.

Figure 6. New patient set up screen – NIV

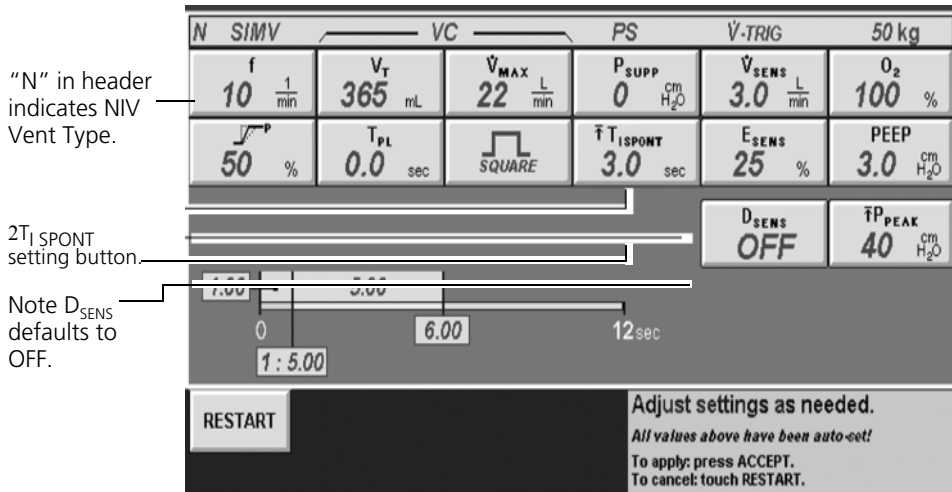


Figure 7. New patient ventilator settings screen – NIV

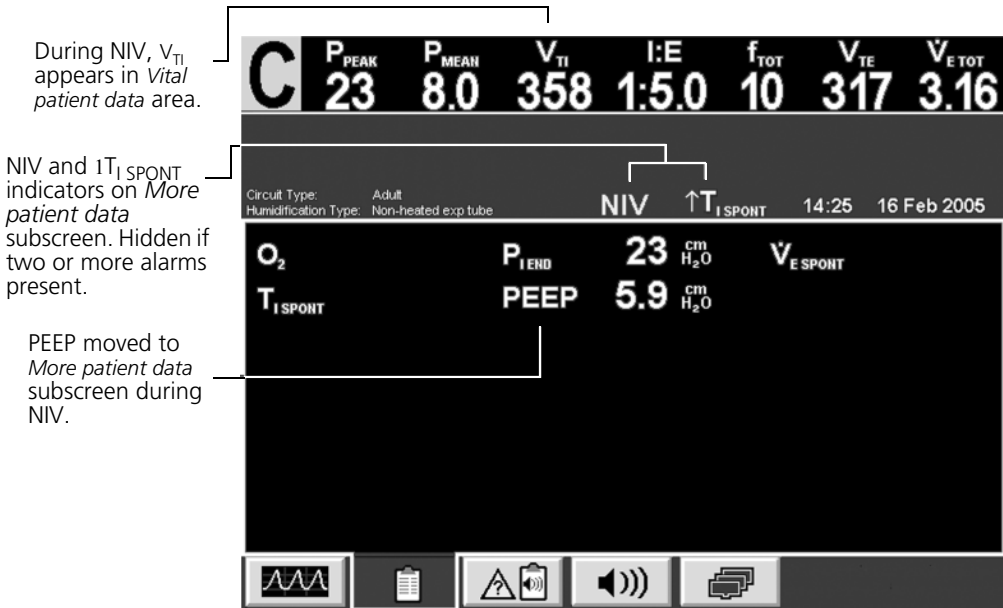


Figure 8. More patient data screen – NIV

Table 7 summarizes the differences in upper and lower GUI screens between NIV and INVASIVE ventilation types.

Table 7. Visual differences between NIV and INVASIVE Vent Types

Display	NIV	INVASIVE	Comments
Upper GUI: Vital patient data area (top of upper GUI screen)	P_{PEAK} , P_{MEAN} , V_{TI} , $I:E$, f_{TOT} , V_{TE} , $V_{E\ TOT}$	P_{PEAK} , P_{MEAN} , PEEP, $I:E$, f_{TOT} , V_{TE} , $V_{E\ TOT}$	When Vent Type is NIV, PEEP is displayed on <i>More Patient Data</i> subscreen.
Upper GUI: <i>More Patient Data</i> subscreen	Displays current PEEP value in addition to same data displayed in INVASIVE Vent Type.	Data displayed according to selected breath mode.	Patient data varies according to selected breath mode.
Upper GUI: Alarm area	NIV and $1T_{I\ SPONT}$ (if set limit is reached) displayed in yellow letters.	N/A	If 2 alarms are simultaneously active, "NIV" and " $1T_{I\ SPONT}$ " are hidden from view until one alarm is no longer active.
Lower GUI: Upper left of settings area	N A/C N SIMV N SPONT displayed as black letters in yellow highlight	Breath mode displayed in white letters.	Indicator for NIV always present on lower GUI screen regardless of alarm conditions.

Table 7. Visual differences between NIV and INVASIVE Vent Types (continued)

Display	NIV	INVASIVE	Comments
Lower GUI: <i>New Patient</i> and <i>Current Setup</i> screens	“N” appears in New Patient and Current Setup header. D_{SENS} button available during patient setup. New patient value set to OFF. After settings have been accepted, D_{SENS} can also be accessed in the same manner as for INVASIVE.	D_{SENS} button only accessed by touching OTHER SCREENS and MORE SETTINGS buttons. New patient value set to 75%.	N/A
Lower GUI: Ventilator settings	$2T_{I\ SPONT}$ setting available	N/A	$2T_{I\ SPONT}$ setting available only in SIMV or SPONT modes during NIV.
Lower GUI: Alarm settings	$4P_{PEAK}$ alarm setting available	$4P_{PEAK}$ alarm setting available only with VC+ selected as Mandatory Type.	$4P_{PEAK}$ setting replaces Low Insp Pressure alarm (previously not settable) in VC+.

NIV setup

NIV can be initiated from either the *New Patient Setup* screen during Vent start-up or while the patient is being ventilated invasively. Refer to the sections “Changing patient from INVASIVE to NIV Vent Type” on page 35 and “Changing patient from NIV to INVASIVE Vent Type” on page 36 for information on automatic settings changes that occur when switching between Vent Types.

Follow these steps to set up the ventilator for NIV:

To set up a new patient:	To set up a patient currently being ventilated:
1. Turn the ventilator on.	1. Press the VENT SETUP button. Proceed to step 4.
2. Select NEW PATIENT.	
3. Enter the patient's Ideal Body Weight (IBW) and press CONTINUE.	
4. Touch the VENT TYPE button and turn the rotary knob to change to NIV.	
5. Touch the MODE button and turn the knob to select AC, SIMV, or SPONT. (BILEVEL mode is not available with NIV).	
6. Touch the MANDATORY TYPE button and turn the knob to choose pressure control (PC) or volume control (VC). (VC+ is not available with NIV.)	
7. If either SIMV or SPONT was selected in step 5, touch the SPONTANEOUS TYPE button and turn the knob to select PS or NONE. (TC and VS are not available with NIV.)	
<p>NOTE:</p> <p>With NIV selected as Vent Type, the only allowable trigger type is flow triggering (V -TRIG).</p>	
8. Press CONTINUE and adjust settings as needed. See the section, "High Spontaneous Inspiratory Time limit setting," below, for information on this ventilator setting.	
<p>NOTE:</p> <p>With NIV selected as Vent Type, the DISCONNECT SENSITIVITY (D_{SENS}) button appears on the <i>Settings</i> screen set to OFF. If desired, touch the button and turn the knob to set a value. To change the disconnect sensitivity after you have applied the ventilator settings, touch the OTHER SCREENS button, then the MORE SETTINGS button and make your changes.</p>	
9. Press ACCEPT to apply the settings. Review the apnea and alarm settings as described below.	

High Spontaneous Inspiratory Time limit setting

NIV includes a setting in SIMV or SPONT modes for High Spontaneous Inspiratory Time limit ($2T_{I\text{ SPONT}}$). When a patient's inspiratory time reaches or exceeds the set limit, the ventilator transitions from inspiration to exhalation, and the $1T_{I\text{ SPONT}}$ symbol appears on the upper GUI screen, indicating that the ventilator has truncated the breath (see Figure 8).

Warning

No audible alarm sounds in conjunction with the visual $1T_{I\text{ SPONT}}$ indicator, nor does the indicator appear in any alarm log or alarm message.

The $1T_{I\text{ SPONT}}$ indicator appears at the beginning of a ventilator-initiated exhalation and remains visible for as long as the ventilator truncates breaths in response to the $2T_{I\text{ SPONT}}$ setting. The $1T_{I\text{ SPONT}}$ indicator disappears when the patient's inspiratory time returns to less than the $2T_{I\text{ SPONT}}$ setting, or after 15 seconds has elapsed after the beginning of exhalation of the last truncated breath.

It is possible that the target inspiratory pressure may not be reached if the $2T_{I\text{ SPONT}}$ setting is not long enough, or if system leaks are so large as to cause the ventilator to truncate the breath at the maximum allowable $2T_{I\text{ SPONT}}$ setting.

NOTE:

To reduce the potential for not reaching the target pressure, minimize the leaks in the system and increase the Rise time % and/or decrease the E_{SENS} setting, if appropriate.

Apnea setup

Set the patient's apnea parameters as usual. NIV does not change the way that apnea parameters are set.

Alarm setup

Touch the **ALARM SETUP** button to display the current alarm settings and change the alarm settings as needed. A low circuit pressure ($3P_{PEAK}$) alarm is now available during NIV to detect potential circuit disconnects or large system leaks based upon pressure measurements in the patient circuit. Refer to Table 4 and Table 6 for more information regarding this alarm. The $3P_{PEAK}$ alarm may be turned OFF, if desired. Figure 9 shows the NIV alarm screen with new patient default settings.

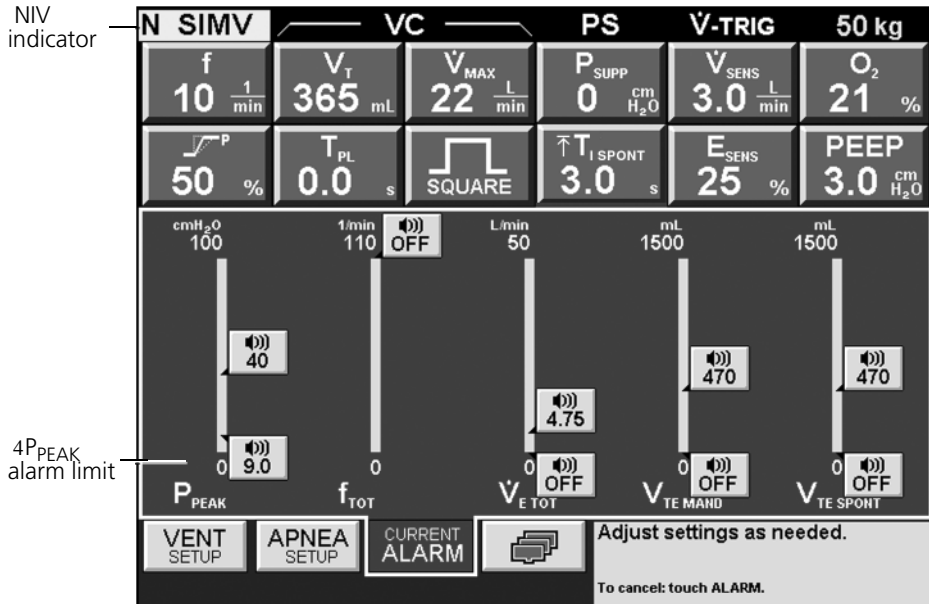


Figure 9. New patient alarm settings

Warning

With NIV selected as the Vent Type, the new patient value for each of the following alarm limits is OFF:

$$2f_{TOT} \quad 4V_{E\ TOT} \quad 4V_{TE\ MAND} \quad 4V_{TE\ SPONT}$$

Additionally, the $4P_{PEAK}$ alarm can be set to OFF.

Ensure that you have set these alarms appropriately before connecting the patient to the ventilator.

Changing patient from INVASIVE to NIV Vent Type

Some ventilator settings available during INVASIVE ventilation are not available during NIV. Table 8 shows the settings changes that occur automatically when changing the Vent Type from INVASIVE to NIV on the same patient.

Table 8. Automatic settings changes – INVASIVE to NIV

Current INVASIVE setting	New NIV setting
Breath Mode: BILEVEL	Breath mode: A/C
Breath Mode: SIMV or SPONT	High $T_{I\ SPONT}$ ($2T_{I\ SPONT}$) limit setting available
Mandatory Type: VC+	Mandatory type: Adult/pediatric: VC Neonatal: PC
Spontaneous Type: Any type except NONE or PS	Spontaneous type: PS If Spontaneous Type set to NONE or PS during INVASIVE ventilation, NIV Spontaneous Type does not change.
NOTE: In any delivered spontaneous breath, either INVASIVE or NIV, if Pressure Support is set to NONE or 0, there is always a target inspiratory pressure of 1.5 cmH ₂ O applied.	

Table 8. Automatic settings changes – INVASIVE to NIV (continued)

Current INVASIVE setting	New NIV setting
Trigger type: Pressure	Trigger type: Flow (Flow triggering is only allowable trigger type in NIV)
Alarm settings: $4P_{PEAK}$ (if applicable), $4V_{E\ TOT}$, $4V_{TE\ MAND}$, $4V_{TE\ SPONT}$, INSPIRATION TOO LONG (alarm limit based on IBW)	Alarm settings: $4P_{PEAK}$, $4V_{E\ TOT}$, $4V_{TE\ MAND}$, $4V_{TE\ SPONT}$ default to NIV new patient values (see Table 4). INSPIRATION TOO LONG alarm not available.
D_{SENS}	D_{SENS} setting defaults to OFF.

Changing patient from NIV to INVASIVE Vent Type

Table 9 shows automatic settings changes that occur when changing the same patient from NIV to INVASIVE Vent Type.

Table 9. Automatic settings changes – NIV to INVASIVE

Current NIV setting	New INVASIVE setting
Ventilator settings: $2T_{I\ SPONT}$	N/A
Alarm settings: $4P_{PEAK}$, $4V_{E\ TOT}$, $4V_{TE\ MAND}$, $4V_{TE\ SPONT}$	Alarm settings: Default to new patient values dependent upon selected INVASIVE ventilator settings. INSPIRATION TOO LONG alarm becomes available.
D_{SENS}	D_{SENS} setting defaults to INVASIVE new patient value.

Warning

When changing the Vent Type on the same patient, review the automatic settings changes described in Tables 8 and 9 and adjust appropriately.

Update to RS-232 commands

SNDF command

This section updates Chapter 19 in the Technical Reference section of the *840 Ventilator Operator's and Technical Reference Manual*.

SNDF is a command sent from an external host device to the 840 ventilator instructing it to transmit all ventilator settings data, monitored patient data, and alarm settings and occurrences.

Enter the SNDF command exactly as shown:

```
SNDF<CR>
```

When the ventilator receives the command SNDF<CR>, it responds with the code MISCF, followed by ventilator settings, monitored data, and alarm information.

The MISCF response follows this format:

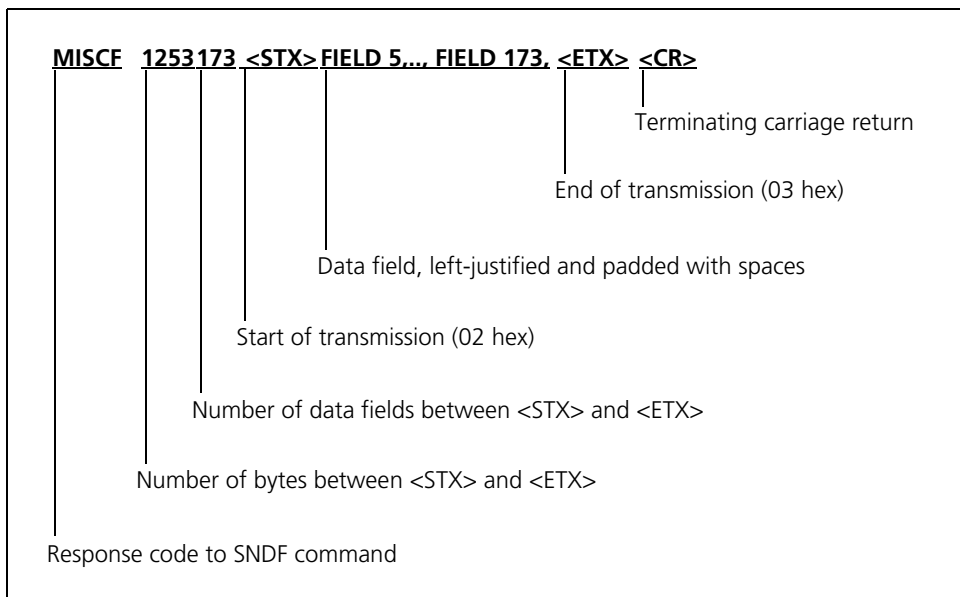


Table 10 lists the SNDF message components and their descriptions.

NOTE:

Non-applicable fields will either contain zero or be blank.

Table 10. SNDF response

Component	Description
MISCF	Response to SNDF command (5 characters)
1253	Number of bytes between <STX> and <ETX> (4 characters)
173	Number of fields between <STX> and <ETX> (3 characters)
<STX>	Start of transmission character (02 hex)
Field 5	Ventilator time (HH:MM_) (6 characters)
Field 6	Ventilator ID to allow external hosts to uniquely identify each 840 ventilator (18 characters)
Field 7	Date (MMM_DD_YYYY_) (12 characters)
Field 8	Vent Type (NIV_____ or INVASIVE_) (9 characters)
Field 9	Mode (A/C____, SIMV__, SPONT_ or BILEVL) (6 characters)
Field 10	Mandatory Type (PC____, VC____, VC+____) (6 characters)
Field 11	Spontaneous Type (NONE__, PS____, TC____, VS____, PA____) (6 characters)
Field 12	Trigger Type setting (V-Trig or P-Trig) (6 characters)
Field 13	Respiratory rate setting in bpm (6 characters)
Field 14	Tidal volume setting in L (6 characters)
Field 15	Peak flow setting in L/min (6 characters)
Field 16	O ₂ % setting (6 characters)
Field 17	Pressure sensitivity setting in cmH ₂ O (6 characters)
Field 18	PEEP/CPAP in cmH ₂ O (6 characters)
Field 19	Plateau setting in seconds (6 characters)
Field 20	Apnea interval setting in seconds (6 characters)
Field 21	Apnea tidal volume setting in L (6 characters)

Table 10. SNDF response (continued)

Component	Description
Field 22	Apnea respiratory rate setting in bpm (6 characters)
Field 23	Apnea peak flow setting in L/min (6 characters)
Field 24	Apnea O ₂ % setting (6 characters)
Field 25	PCV apnea inspiratory pressure setting in cmH ₂ O (6 characters)
Field 26	PCV Apnea Inspiratory Time setting in seconds (6 characters)
Field 27	Apnea flow pattern setting (SQUARE or RAMP) (6 characters)
Field 28	Apnea mandatory type setting (PC or VC) (6 characters)
Field 29	Inspiratory component of Apnea I:E ratio (if apnea mandatory type is PC) (6 characters)
Field 30	Expiratory component of Apnea I:E ratio (if apnea mandatory type is PC) (6 characters)
Field 31	Support pressure setting (cmH ₂ O)
Field 32	Flow pattern setting (SQUARE or RAMP) (6 characters)
Field 33	100% O ₂ Suction (ON or OFF) (6 characters)
Field 34	High inspiratory pressure alarm setting ($2P_{PEAK}$) in cmH ₂ O (6 characters)
Field 35	Low inspiratory pressure alarm setting ($4P_{PEAK}$) in cmH ₂ O or OFF (6 characters)
Field 36	High exhaled minute volume ($2V_{E\ TOI}$) alarm setting in L/min or OFF (6 characters)
Field 37	Low exhaled minute volume ($4V_{E\ TOI}$) alarm setting in L/min or OFF (6 characters)
Field 38	High exhaled mandatory tidal volume ($2V_{TE\ MAND}$) alarm setting in mL or OFF (6 characters)
Field 39	Low exhaled mandatory tidal volume ($4V_{TE\ MAND}$) alarm setting in mL or OFF (6 characters)
Field 40	High exhaled spontaneous tidal volume ($2V_{TE\ SPONT}$) alarm setting in mL or OFF (6 characters)
Field 41	Low exhaled spontaneous tidal volume ($4V_{TE\ SPONT}$) alarm setting in mL or OFF (6 characters)
Field 42	High respiratory rate ($2f_{TOI}$) alarm setting in bpm or OFF (6 characters)
Field 43	High inspired tidal volume ($2V_{TI}$) alarm setting in mL (6 characters)

Table 10. SNDF response (continued)

Component	Description
Field 44	Base flow setting in L/min (6 characters)
Field 45	Flow sensitivity setting in L/min (6 characters)
Field 46	PCV inspiratory pressure (P _i) setting in cmH ₂ O (6 characters)
Field 47	PCV inspiratory time (T _i) setting in seconds (6 characters)
Field 48	Inspiratory component of I:E ratio setting or High component of H:L ratio setting (6 characters)
Field 49	Expiratory component of I:E ratio setting or Low component of H:L ratio setting (6 characters)
Field 50	Constant during rate change setting (I-time, I/E, or E-time) (6 characters)
Field 51	Tube I.D. setting in mm (6 characters)
Field 52	Tube type setting (ET or TRACH) (6 characters)
Field 53	Humidification type setting (Non-Heated Exp, Heated Exp, or HME) (18 characters)
Field 54	Humidifier volume setting in L (6 characters)
Field 55	O ₂ sensor setting (Enabled or Disabled) (9 characters)
Field 56	Disconnect sensitivity setting in % or OFF (6 characters)
Field 57	Rise time % setting (6 characters)
Field 58	PAV TM *+ percent support setting (6 characters)
Field 59	Expiratory sensitivity (E _{SENS}) setting in % or L/min for PA breath type (6 characters)
Field 60	IBW setting in kg (6 characters)
Field 61	Target support volume (V _{T SUPP}) setting in L (6 characters)
Field 62	High PEEP (PEEP _H) setting in cmH ₂ O (6 characters)
Field 63	Low PEEP (PEEP _L) setting in cmH ₂ O (6 characters)
Field 64	High PEEP time (T _H) setting in seconds (6 characters)
Field 65	High spontaneous inspiratory time limit (2T _{I SPONT}) setting in seconds (6 characters)
Field 66	Circuit type setting (ADULT, PEDIATRIC, or NEONATAL) (9 characters)
Field 67	Low PEEP time (T _L) setting in seconds (6 characters)

Table 10. SNDF response (continued)

Component	Description
Field 68	Expiratory time (T_E) setting in seconds (6 characters)
Field 69	End inspiratory pressure ($P_{I\text{ END}}$) in cmH_2O (6 characters)
Field 70	Respiratory rate ($f_{T_{\text{TOT}}}$) in bpm (6 characters)
Field 71	Exhaled tidal volume (V_{T_E}) in L (6 characters)
Field 72	Patient exhaled minute volume ($V_{E\text{ TOT}}$) in L/min (6 characters)
Field 73	Peak airway pressure (P_{PEAK}) in cmH_2O (6 characters)
Field 74	Mean airway pressure (P_{MEAN}) in cmH_2O (6 characters)
Field 75	Expiratory component of monitored value of I:E ratio, assuming inspiratory component of 1 (6 characters)
Field 76	I:E ratio (6 characters)
Field 77	Delivered $\text{O}_2\%$ (6 characters)
Field 78	Inspired tidal volume (V_{T_I}) in L (6 characters)
Field 79	Intrinsic PEEP ($PEEP_I$) in cmH_2O (6 characters)
Field 80	Estimated total resistance ($R_{T_{\text{TOT}}}$) in $\text{cmH}_2\text{O/L/s}$ (6 characters)
Field 81	Estimated patient resistance (R_{PAV}) in $\text{cmH}_2\text{O/L/s}$ (6 characters)
Field 82	Estimated patient elastance (E_{PAV}) in $\text{cmH}_2\text{O/L}$ (6 characters)
Field 83	Estimated patient compliance (C_{PAV}) in $\text{mL/cmH}_2\text{O}$ (6 characters)
Field 84	Normalized rapid shallow breathing index ($f/V_{T_I}/\text{kg}$) (6 characters)
Field 85	Rapid shallow breathing index (f/V_{T_I}) (6 characters)
Field 86	Spontaneous percent inspiratory time (T_I/T_{TOT}) (6 characters)
Field 87	Monitored PEEP in cmH_2O (6 characters)
Field 88	Spontaneous inspiratory time ($T_{I\text{ SPONT}}$) in seconds (6 characters)
Field 89	Exhaled spontaneous minute volume ($V_{E\text{ SPONT}}$) in L/min (6 characters)
Field 90	Intrinsic PEEP ($PEEP_I$) from expiratory pause maneuver in cmH_2O (6 characters)
Field 91	Total PEEP ($PEEP_{T_{\text{TOT}}}$) from expiratory pause maneuver in cmH_2O (6 characters)
Field 92	Static compliance (C_{STAT}) from inspiratory pause maneuver in $\text{mL/cmH}_2\text{O}$ (6 characters)

Table 10. SNDF response (continued)

Component	Description
Field 93	Static resistance (R_{STAT}) from inspiratory pause maneuver in cmH ₂ O/L/s (6 characters)
Field 94	Plateau pressure (P_{PL}) from inspiratory pause maneuver in cmH ₂ O (6 characters)
Field 95	High spontaneous inspiratory time (ALERT_ or blank) (6 characters)
Field 96	Dynamic compliance (C_{DYN}) in mL/cmH ₂ O (6 characters)
Field 97	Dynamic resistance (R_{DYN}) in cmH ₂ O/L/s (6 characters)
Field 98	Peak spontaneous flow (PSF) in L/min (6 characters)
Field 99	Peak expiratory flow (PEF) in L/min (6 characters)
Field 100	End expiratory flow (EEF) in L/min (6 characters)
Field 101	Reserved
Field 102	Negative inspiratory force (NIF) in cmH ₂ O (6 characters)
Field 103	$P_{0.1}$ pressure change in cmH ₂ O (6 characters)
Field 104	Vital capacity (VC) in L (6 characters)
Field 105	Alarm Silence (ON or OFF) (6 characters)
Field 106	Apnea ventilation alarm* (6 characters)
Field 107	High exhaled minute volume alarm* ($1V_{E\ TOT}$) (6 characters)
Field 108	High exhaled tidal volume alarm* ($1V_{TE}$) (6 characters)
Field 109	High O ₂ % alarm* (6 characters)
Field 110	High inspiratory pressure alarm* ($1P_{PEAK}$) (6 characters)
Field 111	High ventilator pressure alarm* ($1P_{VENT}$) (6 characters)
Field 112	High respiratory rate alarm* ($1f_{TOT}$) (6 characters)
Field 113	AC power loss alarm* (6 characters)
Field 114	Inoperative battery alarm* (6 characters)
Field 115	Low battery alarm* (6 characters)
Field 116	Loss of power alarm* (6 characters)
Field 117	Low exhaled mandatory tidal volume alarm* ($3V_{TE\ MAND}$) (6 characters)

* Possible responses are: NORMAL, LOW, MEDIUM, HIGH, or RESET.

Table 10. SNDF response (continued)

Component	Description
Field 118	Low exhaled minute volume alarm* ($3V_{E\text{ TOT}}$) (6 characters)
Field 119	Low exhaled spontaneous tidal volume ($3V_{TE\text{ SPONT}}$) alarm* (6 characters)
Field 120	Low O ₂ % alarm* (6 characters)
Field 121	Low air supply pressure alarm* (6 characters)
Field 122	Low O ₂ supply pressure alarm* (6 characters)
Field 123	Compressor inoperative alarm* (6 characters)
Field 124	Disconnect alarm* (6 characters)
Field 125	Severe occlusion alarm* (6 characters)
Field 126	Inspiration too long alarm* (6 characters)
Field 127	Procedure error* (6 characters)
Field 128	Compliance limited tidal volume (V_T) alarm* (6 characters)
Field 129	High inspired spontaneous tidal volume* ($1V_{TI\text{ SPONT}}$) alarm (6 characters)
Field 130	High inspired mandatory tidal volume ($1V_{TI\text{ MAND}}$) alarm* (6 characters)
Field 131	High compensation limit ($1P_{\text{COMP}}$) alarm* (6 characters)
Field 132	PAV TM * startup too long alarm* (6 characters)
Field 133	PAV TM * R and C not assessed alarm* (6 characters)
Field 134	Volume not delivered (VC+) alarm* (6 characters)
Field 135	Volume not delivered (VS) alarm* (6 characters)
Field 136	Low inspiratory pressure ($3P_{\text{PEAK}}$) alarm* (6 characters)
Field 137	Technical malfunction A5* (6 characters)
Field 138	Technical malfunction A10* (6 characters)
Field 139	Technical malfunction A15* (6 characters)
Field 140	Technical malfunction A20* (6 characters)
Field 141	Technical malfunction A25* (6 characters)
Field 142	Technical malfunction A30* (6 characters)

* Possible responses are: NORMAL, LOW, MEDIUM, HIGH, or RESET.

Table 10. SNDF response (continued)

Component	Description
Field 143	Technical malfunction A35* (6 characters)
Field 144	Technical malfunction A40* (6 characters)
Field 145	Technical malfunction A45* (6 characters)
Field 146	Technical malfunction A50* (6 characters)
Field 147	Technical malfunction A55* (6 characters)
Field 148	Technical malfunction A60* (6 characters)
Field 149	Technical malfunction A65* (6 characters)
Field 150	Technical malfunction A70* (6 characters)
Field 151	Technical malfunction A75* (6 characters)
Field 152	Technical malfunction A80* (6 characters)
Field 153	Technical malfunction A85* (6 characters)
Field 154	Reserved
Field 155	Reserved
Field 156	Reserved
Field 157	Reserved
Field 158	Reserved
Field 159	Reserved
Field 160	Reserved
Field 161	Reserved
Field 162	Reserved
Field 163	Reserved
Field 164	Reserved
Field 165	Reserved
Field 166	Reserved
Field 167	Reserved
Field 168	Reserved
Field 169	Reserved

* Possible responses are: NORMAL, LOW, MEDIUM, HIGH, or RESET.

Table 10. SNDF response (continued)

Component	Description
Field 170	Reserved
Field 171	Reserved
Field 172	Reserved
Field 173	Reserved

SNDA command

When the SNDA command is sent to the 840 ventilator from an external host device, fields that were previously unused in the MISCA response now contain calculated values associated with Respiratory Mechanics. Refer to Chapter 19 of the Technical Reference portion of the *840 Ventilator Operator's and Technical Reference Manual* to see the complete MISCA response table. The following table lists the updated fields:

Table 11. Updated MISCA response

Component	Description
Field 63	Static compliance (C_{STAT}) from inspiratory pause maneuver in mL/cmH ₂ O (6 characters)
Field 64	Static resistance (R_{STAT}) from inspiratory pause maneuver in cmH ₂ O/L/s (6 characters)
Field 65	Dynamic compliance (C_{DYN}) in mL/cmH ₂ O* (6 characters)
Field 66	Dynamic resistance (R_{DYN}) in cmH ₂ O/L/s* (6 characters)
Field 67	Negative inspiratory force (NIF) in cmH ₂ O* (6 characters)
Field 68	Vital capacity (VC) in L* (6 characters)
Field 69	Peak spontaneous flow (PSF) in L/min* (6 characters)

* These fields will contain data only if the RM software option is installed.

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