

SLE5000

Neonatal Ventilator with
High Frequency Oscillation



When the smallest thing matters

SLE5000 - The Total Solution for Infant Ventilation

The smallest thing does matter...

There are still some neonates who cannot be adequately ventilated with even the most sophisticated conventional ventilation.

Indeed, using conventional ventilation with higher rates and airway pressures has often led to an increased incidence of barotrauma and lung tissue damage.

High Frequency Oscillation (HFO) has been shown to overcome this problem whilst still allowing excellent gaseous exchange.

A proven technique

Developed in cooperation with nurses and doctors, the SLE5000 uses a unique valveless system that gives both a manageable range of HFO parameters plus the ability to have 'active exhalation'

Of course, the SLE5000 still has all of the conventional ventilation modes meaning that it can be used on virtually any baby in the NICU

User Interface

SLE has always worked hard to make our ventilators easier to use. Essential functions are never more than a couple of button pushes away. Our own research has shown that users find it much easier to use a ventilator if there are fewer sub-menus.

By reducing the number of menus and sub-menus the SLE5000 is even easier to use when time is critical.

The SLE5000 has a high resolution colour touch-screen that is your interface to all the ventilator controls and functions, but in addition allows you to access many new features including trends and dynamic loops.

The SLE5000 also features parameter presetting, meaning that you can choose a ventilation mode and set up all parameter values before accepting these and confirming the mode change.



Fully Featured

Modes include: CPAP, CMV+ TTV^{plus}, PTV, PSV, SIMV+ TTV^{plus} + PSV, HFO, HFO+CMV.

Plus, the SLE5000 gives you:

- The ability to preset parameters in all modes of operation
- Powerful HFO with active expiration to cover a wide range of patients
- Full colour, total touch-screen operation
- Integral flow monitoring measuring lung mechanics and displaying of loops and waveforms
- Trending of measured parameters
- Standard patient circuit for all modes including HFO
- Unique, patented valveless technology
- Integral battery with up to 60 minutes operating capability
- Software based, allowing for upgrading to versions with new or improved functions

Advanced Software

If you already use an SLE5000 or SLE4000 ventilator then you will know just how versatile the range of installed modes can be, particularly on the SLE5000 where HFO allows you to include a considerably larger patient demographic than with conventional ventilation.

SLE's Software Engineers are always working on new algorithms to ensure the ventilators keep up with new developments in medicine and user-feedback.

The latest software, standard on all new SLE5000 and SLE4000 ventilators includes:

- TTV^{plus}
- Leak compensation
- MAP in HFO (SLE5000)
- Battery indicator
- Mute all alarms
- CPAP mode alarms

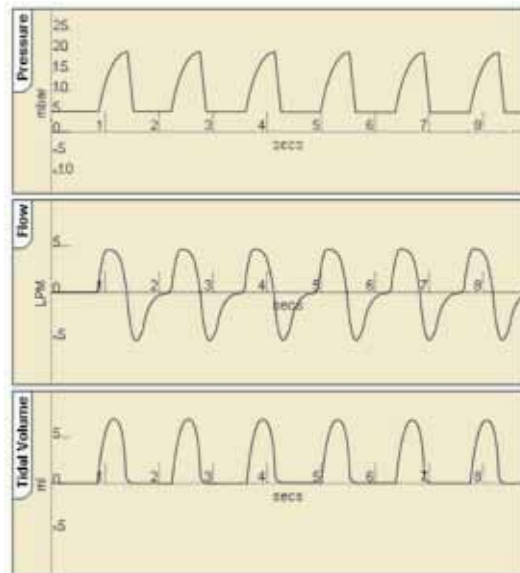
Comprehensive Ventilation Features

Targeted Tidal Volume *plus* (TTV^{plus})

The SLE5000 is our first production ventilator to feature TTV^{plus} - an entirely new way of managing the patient's tidal volume.

Lung protective ventilation strategies in neonates are now accepted as a marker for improved ventilation outcome. One such strategy is the use of a targeted tidal volume in pressure ventilation. The aim of TTV^{plus} is to deliver a stable tidal volume at the lowest possible pressure. All this has to occur in the presence of a changing lung environment, that also has potential for a variable leak around the ET tube.

TTV^{plus} approaches this challenge by assuring a stable expired volume, with a leak adjustment capability within safe limits. TTV^{plus} can be used in all conventional ventilation modes and provides a stable tidal volume control according to your requirements.

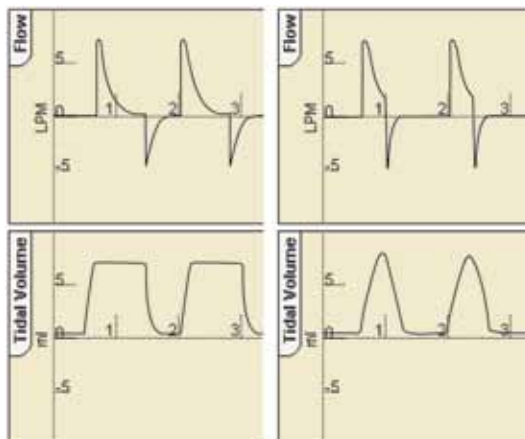


Pressure Support Ventilation (PSV)

PSV was developed on the SLE5000 as a method to decrease the work of breathing in-between ventilator mandated breaths by providing an elevated pressure triggered by spontaneous breathing that supports ventilation during inspiration. Thus, SIMV might be combined with PSV so that additional breaths beyond the SIMV programmed breaths are supported.

Whilst the SIMV mandated breaths have a preset volume or peak pressure, the PSV breaths are designed to cut short when the inspiratory flow reaches a percentage of the peak inspiratory flow (e.g. 0 - 50%). It includes automatic leak compensation thereby ensuring the flow termination of inspiration even in the presence of a leak.

All of this means that breathing on the SLE5000 ventilator is even easier for the smallest of babies, allowing them more energy to grow.



Without flow termination

With flow termination

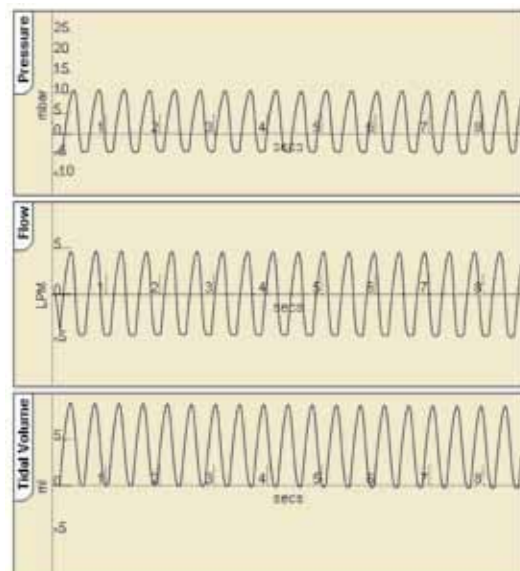
High Frequency Oscillation (HFO)

In the SLE5000, HFO is powerful enough to cater for a wide range of patients from 300 g to 20 kg, dependant on lung mechanics.

The SLE5000 provides sinusoidal ventilation with *active* expiration.

The main benefits of HFO include:

- Improves ventilation at lower pressures
- Higher levels of PEEP can be used without having to use high peak airway pressures to maintain appropriate levels of CO₂
- Produces more uniform lung recruitment
- Reduces airleaks
- Improved oxygenation in infants with severe RDS (Respiratory Distress Syndrome)



Features and Functions

User Interface

Colour-coded user touch screen. Easy-to-use, logical sequence allowing quick, smooth adjustments.

The SLE5000's 12.1 inch screen means that all the data you need can be easily seen.

Mode Panel

The mode panel is the user's interface to all mode related functions.

Audible and Visual Alarms

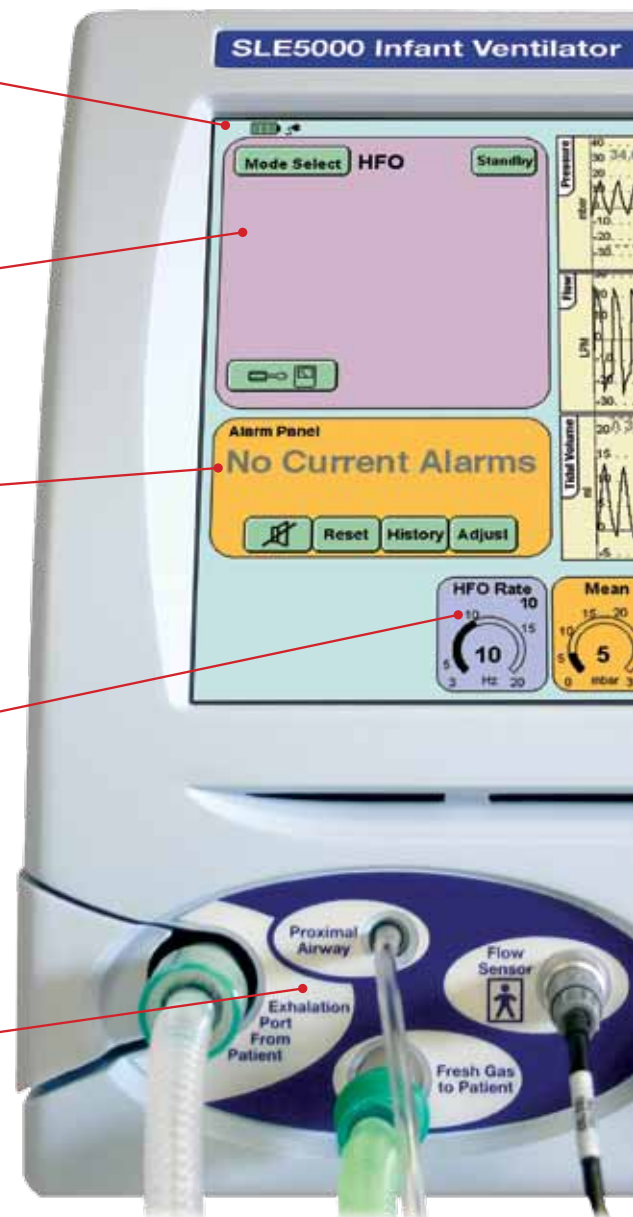
The alarm panel provides an immediate audible and pictorial view of the alarm condition, thus allowing easy monitoring, plus an alarm history of the last 100 conditions.

Pre-Setting Facility

Parameters can be preselected for the next mode whilst continuing to ventilate the patient in the current mode of ventilation.

Patient Circuit Connections

Front panel mounted patient circuit connections with (autoclavable) exhalation block.



Principles of operation of the SLE5000 valveless system

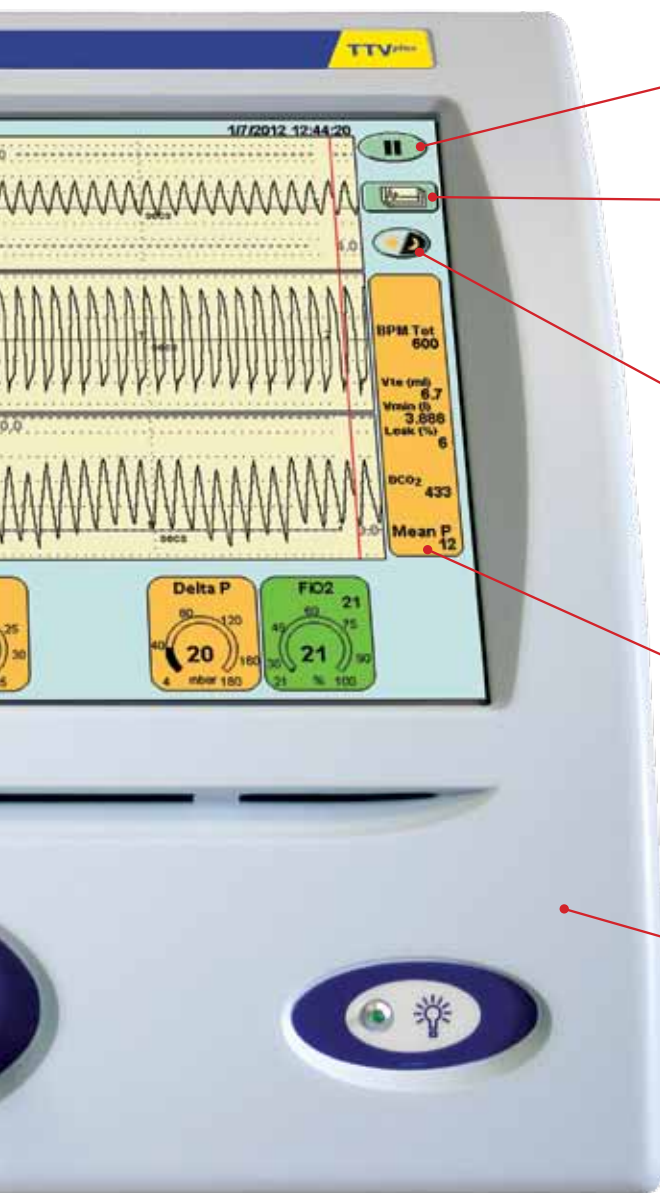
A constant flow of fresh gas is supplied to the patient circuit at 8 l/min. The expiratory manifold has three jets (❶, ❷ and ❸). The front jet (❶) is used to generate an opposing flow to the fresh gas in the exhalation manifold and thereby creates CPAP/PEEP.

The rear jet (❷) is used to generate the Peak Inspired Pressure (PIP) in the same way.

A third (reverse) jet (❸) is used during High Frequency Oscillation (to produce an *active* negative pressure) in addition to helping eliminate excess circuit pressure.

To avoid gas dilution these jets are supplied with the same oxygen concentration as the fresh gas supply. Sophisticated software controls the rate and duration of the flow of driving gas into the exhalation manifold in opposition to the fresh gas flow. The opposing flow acts as a pneumatic piston and creates a pressure wave at the ET manifold.

Since the opposing flow pressure is set by pressure regulators it automatically compensates for patient and circuit compliance changes.



Screen Pause

Freezes waveforms for review.

Graphic Select

Allows display of real-time or trends of flow, pressure and volume.

Loops depicting flow/volume, flow/pressure and volume/pressure may also be shown.

Night Mode and Screen Lock

A low-level light mode for night time environments with automatic screen locking.

Auto activation on an alarm condition.

Real-time Data Display

Real-time lung mechanics measurements and ventilatory data.

This allows for continuous feedback for making crucial clinical decisions.

Compact Unit

The SLE5000 ventilator is housed in a single compact box, making it easier to clean and use.

The integrated touch screen is angled for perfect visibility and easy to read from a distance.

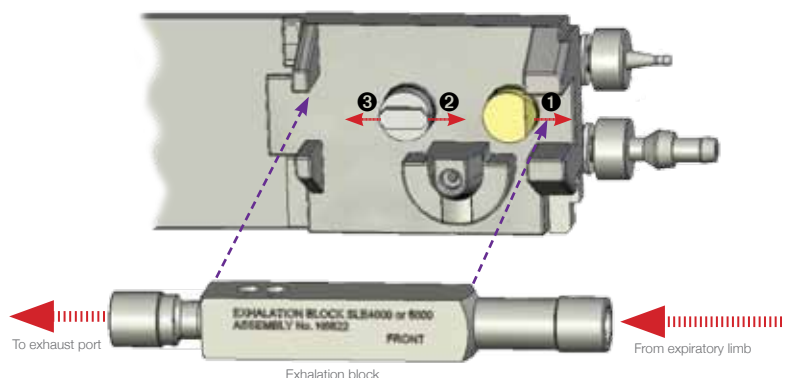
How does it work...?

The illustration shows the exhalation block removed from its mountings in the ventilator. When replaced, the jets (1 and 2) can create a positive pressure on flow from the patient circuits's expiratory limb.

Jet 3 is used to create a negative pressure and gives *true* active expiration.

Since there are no valves or other blockages in the system, there is minimal resistance to the patient.

Fewer moving parts means there is less to clean and less risk in terms of wrong assembly or infection.

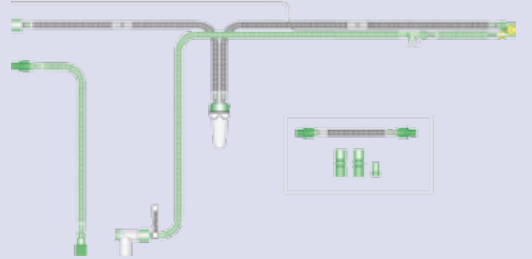


SLE5000 Patient Circuits

BC5188/100/15

Single use breathing circuit for use with SLE4000 and SLE5000 infant ventilators. Temperature port 100 mm from ET manifold (single use). Circuit comes complete with filter connection kit and adaptors.

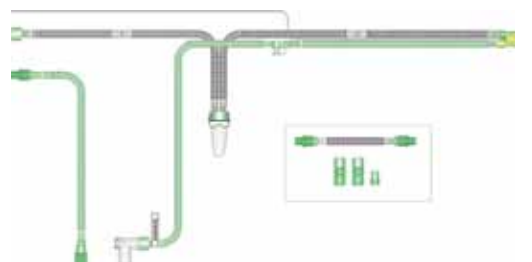
Box of 15



BC5188/400/15

Single use breathing circuit for use with SLE4000 and SLE5000 infant ventilators. Temperature port 400 mm from ET manifold (single use). Circuit comes complete with filter connection kit and adaptors.

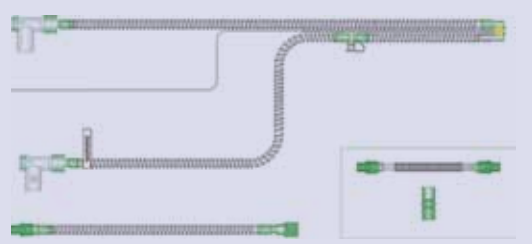
Box of 15



BC5488/DHW/15

Dual heated wire smooth bore breathing circuit for use with SLE4000 and SLE5000 infant ventilators. Temperature port 170 mm from ET manifold (single use). Circuit comes complete with filter connection kit and adaptors.

Box of 15



BC6216

Nitric Oxide delivery kit. Set of connectors.

BC2506/25

Nebuliser Kit suitable for 15 mm diameter patient circuits. For use with the BC5188, BC2188, BC5198 & BC2198 circuits.

Box of 25

BC2508/15

Nebuliser Kit suitable for 10 mm diameter patient circuits. For use with the BC5488 Circuit.

Box of 15

BC4110/KIT

Nitric Oxide adaptor kit for BC5188/100 and BC5188/400 breathing circuits (SLE4000 and SLE5000 infant ventilators).

Box of 5

BC4110/ASY

Nitric Oxide dual hose scavenging filter assembly for SLE4000 and SLE5000 infant ventilators.

Box of 1

Technical Specification

Ventilation Modes: Conventional

CPAP / PTV / PSV

Inspiratory Time:	0.1 to 3.0 sec
CPAP Pressure:	0 to 20 mbar
Inspiratory Pressure:	0 to 65 mbar
Volume Targeting:	2 to 200 ml
FI _O ₂ :	21% to 100%

CMV / SIMV

BPM:	1 to 150
I:E Ratio:	(11.2:1 to 1:600)
Inspiratory Time:	0.1 to 3.0 sec
PEEP Pressure:	0 to 20 mbar
Inspiratory Pressure:	0 to 65 mbar
Volume Targeting:	2 to 200 ml
FI _O ₂ :	21% to 100%

Ventilation Modes: HFO Ventilation

HFO Only

Frequency Range:	3-20 Hz
I:E Ratio:	1:1
Delta Pressure range:	4 to 180 mbar
Mean airway range:	0 to 35 mbar
FI _O ₂ :	21% to 100%

HFO+CMV

BPM:	1 to 150
Inspiratory Time:	0.1 to 3.0
Frequency Range:	3-20 Hz
I:E :	(11.2:1 to 1:600)
Inspiratory Pressure:	0 to 65 mbar
Delta Pressure range:	4 to 180 mbar
Mean airway range:	0 to 35 mbar
FI _O ₂ :	21% to 100%

Monitoring Parameters

Measurement of Flow and Volume

Flow Sensor Type:	10 mm dual-hot-wire anemometer (autoclavable or single use)
Flow Rate:	0.2 to 32 l/min (Accuracy ±8%)
Expiratory Tidal Volume:	0 to 999 ml
Expiratory Minute Volume:	0 to 18 litres
Deadspace:	1 ml
Weight:	10 g

Conventional Ventilation and combined modes only:

Tube Leakage:	0 to 50% (Resolution: 5%, averaged over 5 breaths)
Breath Rate (total):	0 to 150 BPM
Dynamic Compliance:	0 to 100 ml/mbar (Resolution: 1 ml/mbar)
C20/C:	Resolution 0.1
Sampling Time:	2 ms
Resistance:	0 to 1000 mbar /l/second
Triggering:	Inspiratory flow (0.2 to 10 l/min)

The above values are measured under ATPD (ambient temperature and pressure, dry) conditions.

Oxygen Concentration

Range:	21 to 100% (Resolution 1%)
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Pressure

Real-time Pressure measurement:	Resolution 1 mbar
Sampling time:	2 ms
Peak Pressure:	0 to 175 mbar (resolution 1 mbar)
PEEP Pressure:	0 to 175 mbar (resolution 1 mbar)
Mean Pressure:	-175 to 175 mbar (resolution 1 mbar)

In HFO combined mode, Delta P is measured during expiration only

User Settable Alarms:

High Pressure

Autoset when patient pressure controls are adjusted or can be manually adjustable	
Range:	10 to 110 mbar
Resolution:	0.5 mbar

Cycle Fail

Autoset when patient pressure controls are adjusted or may be manually adjusted

Low Pressure

Autoset when patient pressure controls are adjusted or can be manually adjustable	
Range:	-10 mbar (Conventional) -70 mbar (HFO modes) to 10 mbar below high pressure threshold

Low Tidal Volume

Range:	0 to 200 ml
Resolution:	0.2 ml

Low Minute Volume

Range:	0 to 0.02 litres below High Minute Volume threshold
Resolution:	0.1 litre

High Minute Volume

Range:	0.02 to 18 litres
Resolution:	0.1 litre

Apnoea time

Settable only in CPAP or when Backup rate is less than 20 BPM

Range:	3 to 60 sec
Resolution:	1 second

Power, Dimensions, Standards etc.

Power Requirements

Voltage :	100-250 V 50-60 Hz
Power :	115 VA
Battery back up:	45-60 minutes (dependant on mode of operation)
Battery charging:	Full charge 24 hours, 80% charge after 8 hours

Outputs

RS-232C

Air and O₂ input

Pressures: 2.8 - 6 bar

Fresh Gas Flow: 8 litres/min

Maximum gas flow: 60 litres/min

Operating Environment

Temp:	10-40 °C
Humidity:	0-90% (non-condensing)

Dimensions

Size, ventilator only: 330mm W x
330mm H x
470mm D

Height on trolley: 131 cm

Weight, ventilator only: 22.4 kg

Constructed to conform to:

BS EN 60601-1: 1990 +A1:93, A11:93,
A12:93, A2:95, A13:96, Corrigendum: 94
BS EN 60101-2-12: 2006
Medical Devices Directive (93/42/EEC)

EMC

BS EN 60601-1-2: 2001+A1
BS EN 61000-3-2: 2006
BS EN 61000-3-3: 1995 +A1

European conformity mark: CE 0120

Environmental storage conditions

When packed for transport or storage:

Ambient Temperature:	-40 °C to +70 °C
Relative Humidity :	10% to 90% (non-condensing)
Atmospheric Pressure:	500 hPa to 1060 hPa

SLE is a world leader in the design and manufacture of neonatal ventilators.

Years of ventilation experience have given the company an understanding of the challenges facing nurses and clinicians when caring for the tiniest and most critical babies.

From being the pioneers of neonatal Patient Triggered Ventilation (PTV) in the 1980's, to the introduction of combined HFO (High Frequency Oscillation) in the 1990's, SLE has maintained a position of strength in neonatal ventilation.

The company's guiding principle is to support clinical and nursing staff in their everyday work.

The knowledge and experience gained during years of development is evident in the SLE5000 ventilator: the result of SLE's ongoing commitments to innovation, competency and care.



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