Precise and powerful HFO piston technology
from Japan to the world.

Metran

Humming Vue

Piston HFO/IMV Ventilator for Neonatal and Pediatric Patients

HFO ventilation can reduce premature

Premature births
Key facts

15M premature babies/year

There is more than one premature birth in every 10 births [1,2]

Total of 5.3M deaths of under-5s in 2018

Of these approximately 47% were neonatal, so around 2.5M neonatal deaths per year [3]

Inequalities in survival rates around the world are stark

< 28 weeks mortality:
Low-income: 90%
High-income: <10% [2]

To reduce the inequality SDGs were set

One of the Sustainable Development Goals (SDGs) by 2030 is to reduce under-5 deaths to 25/1000 and reduce neonatal mortality to 12/1000 [4]

REFERENCES

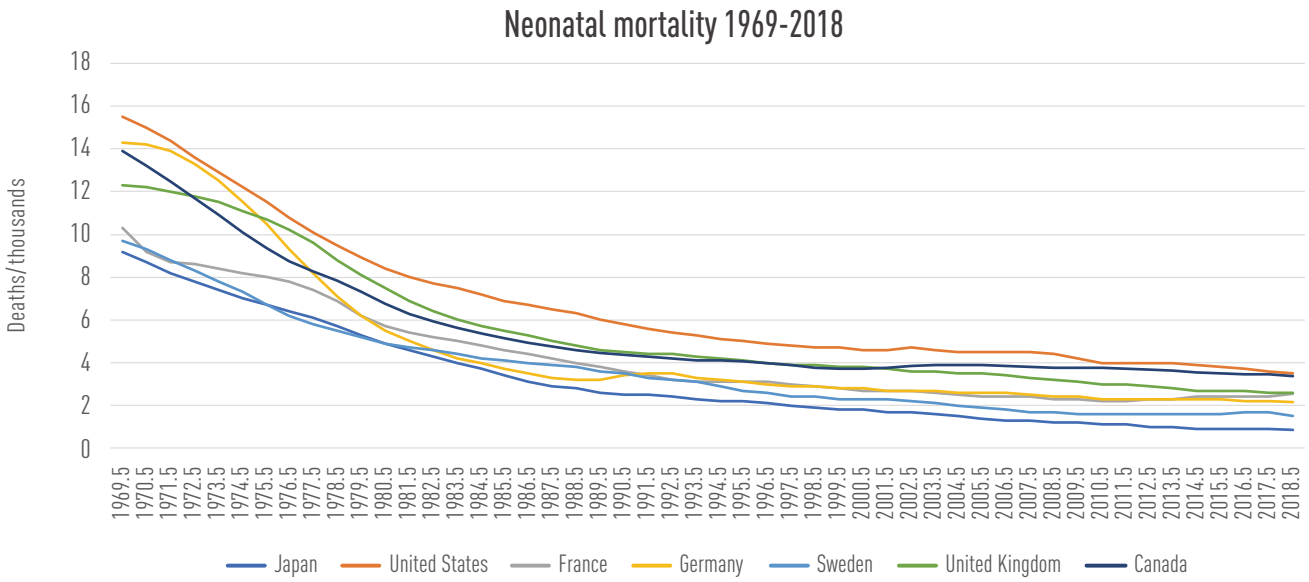
1) Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. Lancet. June 2012;379(9832):2162-72.
2) Liu L, Oza S, Hogan D, Chu Y, Perin J, Zhu J, et al. Global, regional, and national causes of under-5 mortality in 2000-15: an updated systematic analysis with implications for the Sustainable Development Goals. Lancet. November 2016;388 (10063):3027-35.
3) https://data.unicef.org/topic/child-survival/under-five-mortality/
4) https://data.unicef.org/topic/child-survival/child-survival-sdgs/

baby and neonate mortality

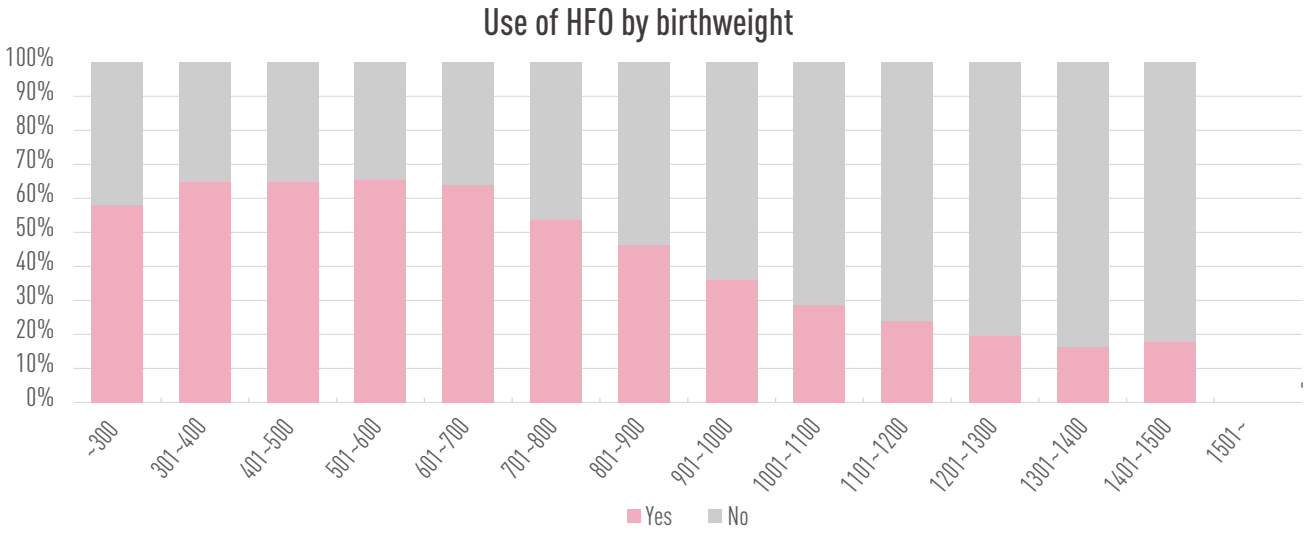
HFO ventilation is recognized worldwide as an effective treatment for neonates and premature babies

Perinatal mortality is influenced by many factors but ventilators play a major role in hospital treatment. HFO (high frequency ventilation) is a gentle ventilation method that is especially effective for neonates and premature babies.

Japan has one of the world's lowest perinatal mortality rates. One reason is adoption of the latest technology. Metran HFO ventilators are used in nearly 90% of NICUs in Japan and we are glad to be able to contribute to the high level of neonatal care in Japan.



UNICEF: Neonatal mortality rate September 2019
https://data.unicef.org/topic/child-survival/neonatal-mortality/



Kusuda et al., Special Report of the Neonatal Research Network of Japan, 2018 p.175

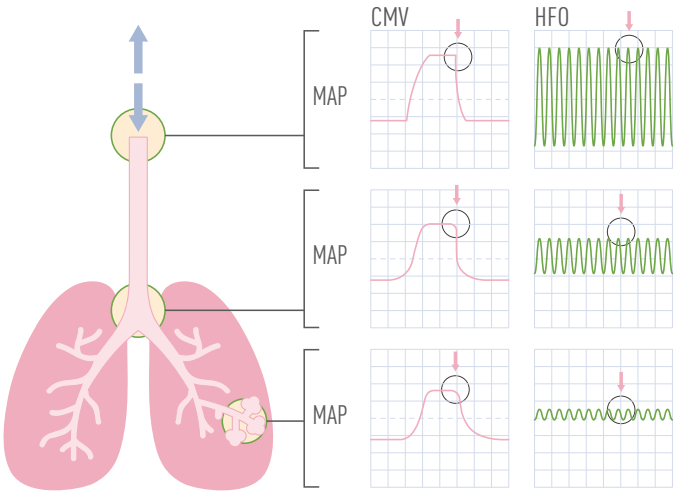
Powerful and precise piston generated oscillation

HFO ventilation is gentler to the lungs

HFO ventilation provides sufficient and sustained exchange of gas when the stroke volume is smaller than the anatomical dead space.

HFO pressure waves are sinusoidal and symmetrical with respect to the mean airway pressure (MAP) axis. After passing through the endotracheal tube, the amplitude of the HFO pressure wave falls drastically upon entering the trachea so pressure variation at the airway periphery near the pulmonary alveoli is minimal.

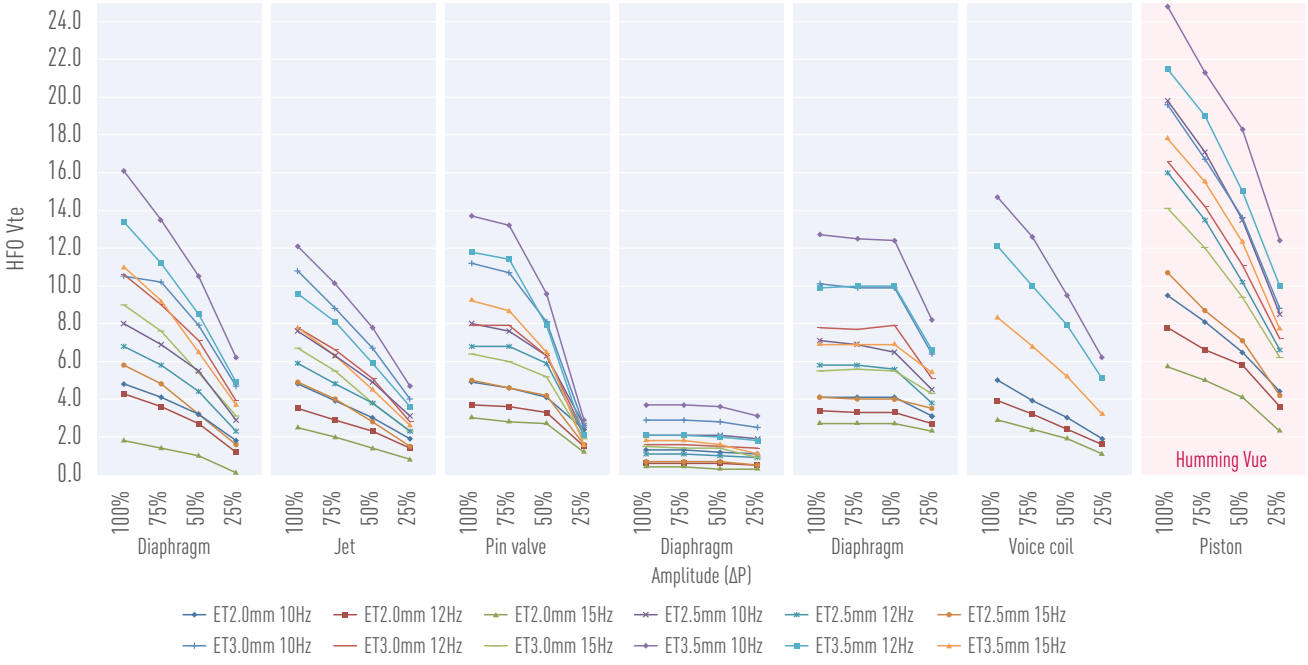
Compared with continuous mandatory ventilation (CMV), HFO ventilation has much less pressure swing at any MAP and this greatly reduces physical injury to the pulmonary alveoli.



MAP:Mean Airway Pressure

Power is needed for effective HFO ventilation

The tidal volume which is delivered by the stroke volume of other ventilators becomes flat after the ventilator reaches a certain power or is used with very thin endotracheal tubes.

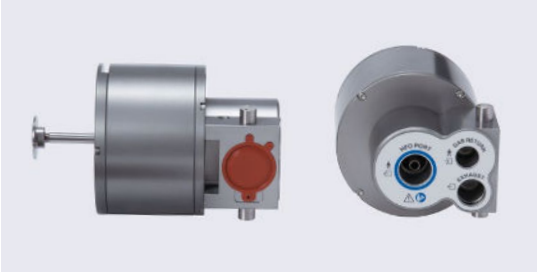


HFO tidal volume with increase in amplitude

Vertical axis
HFO Vte: HFO tidal volume
Horizontal axis
Amplitude (ΔP): Stroke volume

- This graph shows the change of HFO tidal volume (HFO Vte) for various types of ventilator with MAP fixed at 10cmH_2O and amplitude (stroke volume) at 100%, 75%, 50% and 25% of each device's maximum power during HFO
- Test lung compliance = 2.0mL/cmH_2O

Quest for perfection



Power

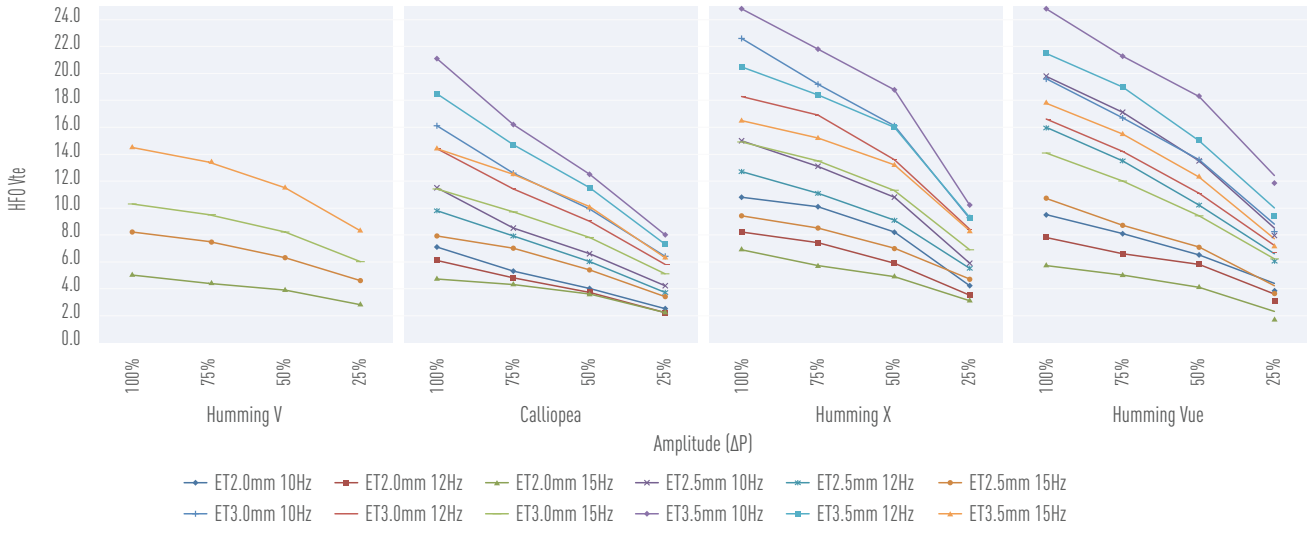
Humming Vue is a volume generating ventilator which produces a precise stroke volume (SV) to obtain a specified amplitude pressure (ΔP). SV is similar to tidal volume in conventional ventilation. A fixed SV is guaranteed no matter how the lung compliance changes.

Precision

Our piston is precisely controlled to within 13 microns on each stroke, allowing you to set stroke volume with resolution of 0.2ml. This fine control of amplitude enables effective $PaCO_2$ management, which is critical when treating very small babies.

Our system maintains the same HFO Vte even after changing an oxygenation setting such as MAP. Users do not need to readjust other parameters after making a change in one setting. MAP remains stable even when the patient is breathing spontaneously.

So stable MAP and ability to manage PaO_2 independently from $PaCO_2$ are key features of Humming Vue.



MAP10 stroke volume per amplitude (ΔP) of previous models

Vertical axis
HFO Vte: HFO tidal volume

Horizontal axis
Amplitude (ΔP): Stroke volume

- This graph shows the change of HFO tidal volume (HFO Vte) for various Metran Humming Series ventilators with MAP fixed at 10cmH_2O and amplitude (stroke volume) at 100%, 75%, 50% and 25% of each device's maximum power during HFO
- Test lung compliance = 2.0mL/cmH_2O

Caring for neonates from birth through

Humming Series ventilators are used at top hospitals to enable treatment of the patients throughout their early development. A typical protocol for a low-weight premature baby may include stages such as initial use of SIMV for stabilization and application of surfactant, then HFO to support ventilation with the fragile lungs, then return to SIMV once the lungs gain more compliance, and finally a phase of NIV to prepare the baby for weaning*. All of these ventilation modes are provided by Humming Vue, so there is no need to detube or switch to a different ventilator midway through treatment.

Enhanced conventional modes

In addition to HFO, some of the Humming Vue models have enhanced conventional ventilation modes such as APRV and NIV. All modes support treatment of any case.

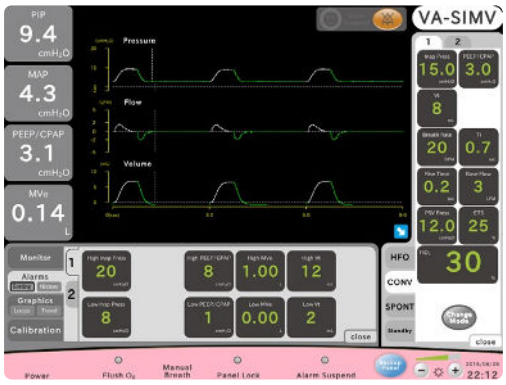
A new feature VA (Volume Assured) can support respiration control by prioritizing ventilation volume.

Modes and breath types

SIMV: PC, VC, VA
A/C: PC, VC, VA
APRV

VA (Volume Assured)

In addition to VC or PC, Humming Vue also has VA mode which is volume control ventilation with pressure correction. VA supports respiration control especially when CO_2 control is prioritized.



Safety with a variety of settings

Appropriate amplitude and SV

If amplitude is set, the SV is automatically adjusted to maintain that amplitude.

If SV is set, the amplitude changes according to the SV setting. You can confirm the lung condition by changing the amplitude or flow.

Even if ventilation is started or after changing the circuit, safe ventilation is assured with appropriate amplitude and SV.

Auto SI

Lung recruitment can be performed periodically from 0.5-10 s (1 to 120 times/hour).

* There are many factors influencing selection of ventilation mode and settings, and the clinician will choose these based on the condition of the patient. The protocol mentioned here is for illustrative purposes only and is not a recommendation for application in a clinical setting.

to weaning

Sync+ (Sync Plus)

Sync+ is available for PC-SIMV. When the patient has spontaneous breathing, Sync+ uses PS to support those efforts.

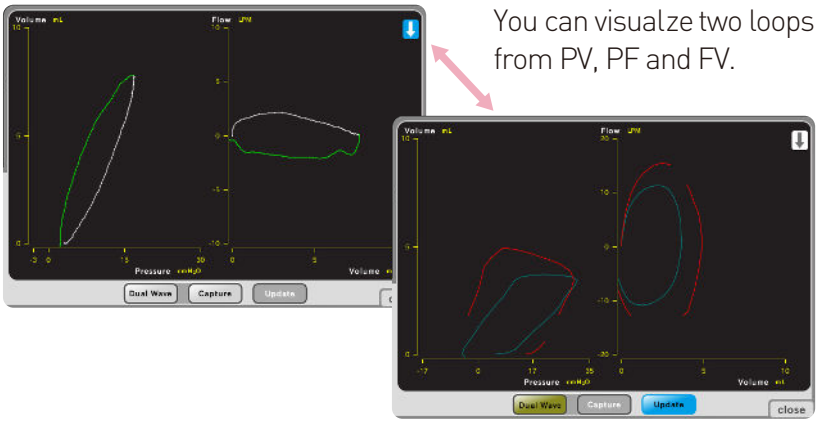
When the patient experiences apnea, mandatory ventilation automatically starts after the respiration rate falls below the setting. Sync+ gives you flexible respiration control, especially in neonatal patients with sudden apnea.

Enhanced non-invasive modes

Humming Vue has improved non-invasive modes to support optimum ventilation, like CPAP, NIV and N-CPAP. High-flow therapy is available with cannulas. Humming Vue provides a variety of respiration control for optimal support of each individual patient.

Other useful features

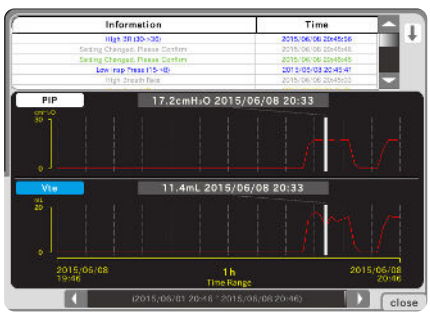
PV, PF and FV loops



You can visualze two loops from PV, PF and FV.

Time-linked

Trend graphs and logs are time-linked. This enables you to easily access any necessary information. When you switch screens, the same event is clearly displayed in both trend graphs.



Specifications

Ventilation modes	SIMV, A/C, APRV*, CPAP, N-CPAP*, NIV*, HFO, Standby
Breath types	PC, VC*, VA*, HFO

**Options of Humming Vue Plus and Humming Vue Advanced. APRV, VC and VA are available for Humming Vue Advanced only.*

Settings and Range

Inspiration pressure	5-80 cmH_2O
Inspiration time	0.1-3.0 s
Tidal volume	2-300 ml
Inspiration flow	3-30 Lpm
Flow pattern	⌐¬ Square, ⌐\ Decelerating
Plateau time	0-2.0 s
PEEP/CPAP	0-30 cmH_2O
Breath rate	1-150 bpm
Breath rate (NIV)	0-150 bpm
Backup rate	1-150 bpm
PSV (above PEEP)	0-50 cmH_2O
PSV (above P-high)	0-15 cmH_2O
Exhalation trigger	10-90 %
Trigger type	Pressure, Flow
Trigger sensitivity	Press: Off, -0.1 to -10.0 cmH_2O Flow: Off, 0.2-10.0 Lpm
P-high	1-80 cmH_2O
P-low	0-30 cmH_2O
T-high	0.1-30 s
T-low	0.1-2.0 s
Rise time	0.1-0.9 s

IMV base flow	3-20 Lpm
Sync+	On, Off
Tube diameter	2.0-8.0 mm
Tube length	30-300 mm
Tube compensation	Off, 0-100%
N-CPAP flow	3-30 Lpm
Amplitude	0-200 cmH_2O
Stroke volume	0-160 ml

Maximum stroke volume according to frequency

Freq (Hz):	<9	10	11	12	13	14	15	16	17
Max SV (ml):	160	154	148	130	120	112	106	99	89

MAP	3-40 cmH_2O
Frequency	5-17 Hz
SI pressure	3-50 cmH_2O
SI time	Off, 0.5-10s
SI cycles	1-120 cph
HFO base flow	10-30 Lpm
Amplitude control	On, Off
Auto SI	On, Off
Oxygen saturation	21-100%
Flush O_2	21-100%

Alarms

IMV	High inspiratory pressure, Extreme high inspiratory pressure, Low inspiratory pressure, High PEEP/CPAP, Extreme high PEEP/CPAP, Low PEEP/CPAP, High exhaled minute volume, Low exhaled minute volume, High breath rate, Apnea
HFO	High MAP, Extreme high MAP, Low MAP, Extreme low MAP, High amplitude, Low amplitude, High SI pressure, Extreme high SI pressure, Low SI pressure

Monitoring Data and Waveforms

Data	Peak inspiratory pressure, Mean airway pressure, PEEP/CPAP, Plateau, IE ratio, Overall breath rate, Spontaneous breath rate, Tidal volume, Minute volume, Proximal leak, Dynamic compliance, FiO_2, P-high*, P-low*, N-CPAP**, Amplitude***, MAP***, SI pressure***, HFO base flow***, Vhfo***, SI time***
Waveforms	Pressure, Flow, Volume (excluding HFO), Pressure-volume loop, Pressure-flow loop, Flow-volume loop

**APRV mode, **N-CPAP mode, ***HFO mode*

Operating Conditions

Gas supply input	Pressure: 0.3-0.5 MPa, Minimum flow: 100 Lpm
Protection level against electric shock	Class 1 equipment
Degree of protection against electric shock	Type B applied part
Water resistance	IPX0
Dimensions (W) x (D) x (H)	517 x 691 x 1,350 mm including stand 517 x 489 x 568 mm main unit only
Weight	Main unit: 38 kg, Main unit and stand: 55 kg
Power	AC 100-240 V 50/60 Hz, 200 VA
Environmental operating temperature	10-40 °C
Humidity	10-95% RH (non-condensing)
Altitude	-300–3,000 m

Metran

Metran Co., Ltd.

2-12-18 Kawaguchi, Kawaguchi City, Saitama 332-0015, JAPAN
Phone +81 (48) 242-0333 Fax +81 (48) 242-0550
www.metran.co.jp/en support_en@metran.co.jp

07/2020

Printed in Japan