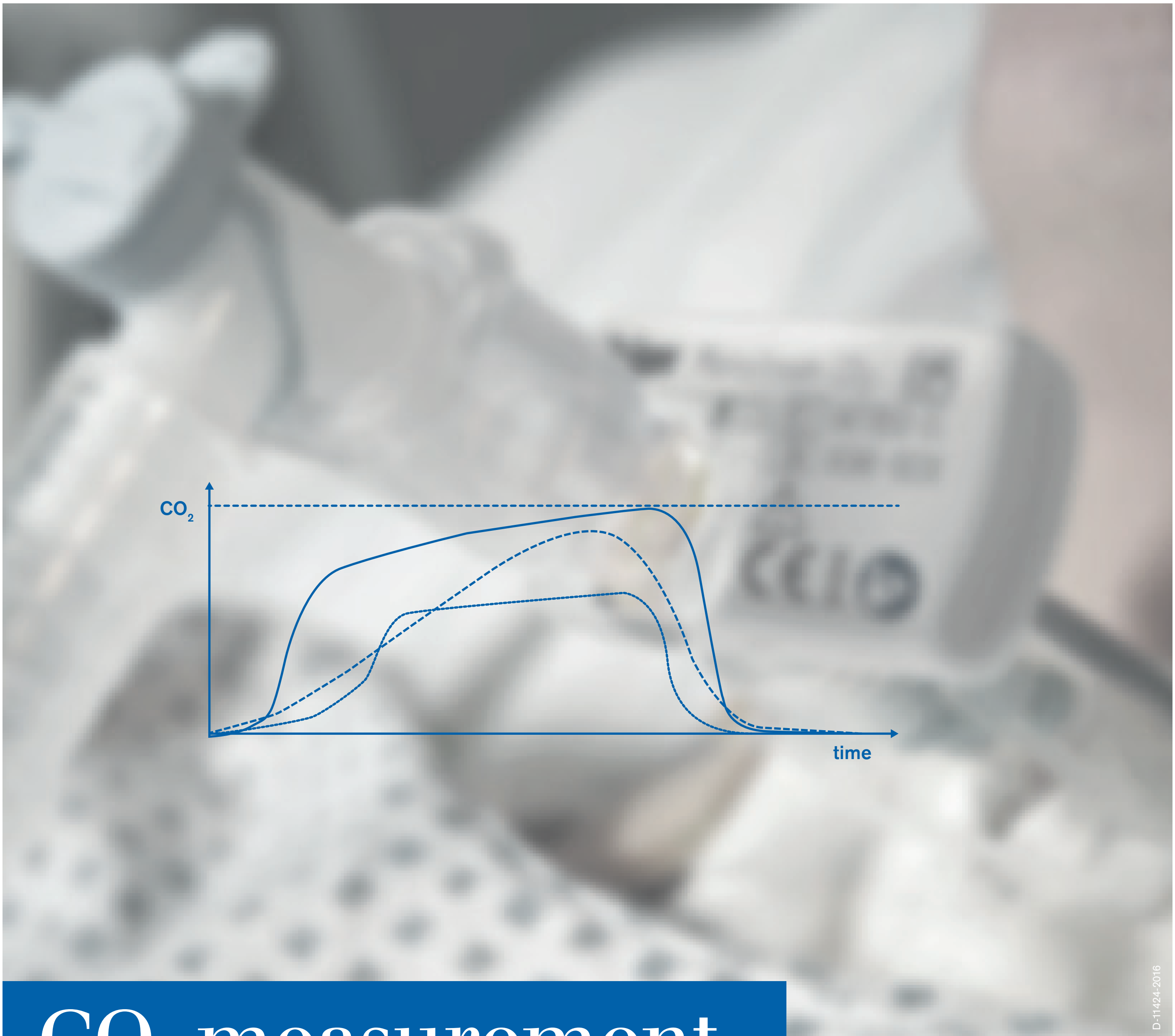
Dräger

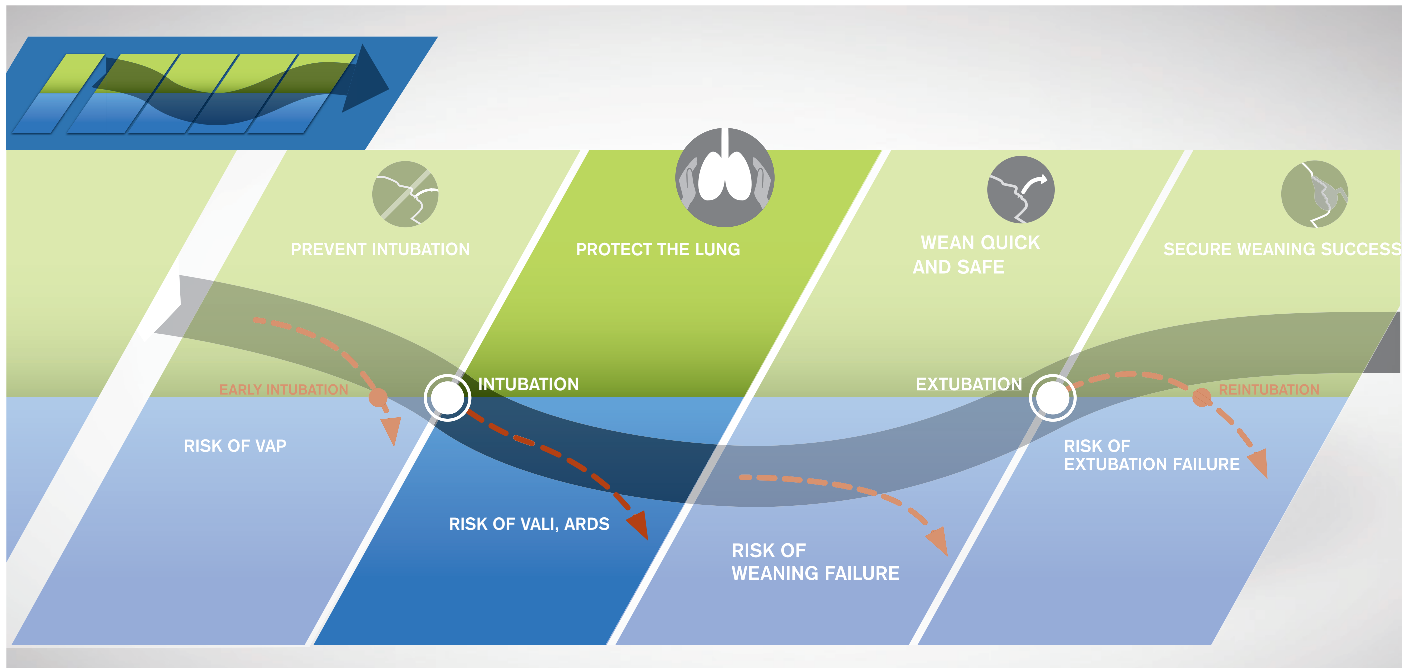


CO_2 measurement

During expiration, CO_2 is one of the most important parameter for analysing ventilation efficiency[1]. This is why precise and reliable monitoring of CO_2 concentrations of patients is so crucial.

> "Within the expiration phase, CO_2 is one of the most important parameters, providing valuable information on the efficacy of ventilation, gas exchange and metabolism."[2]

Stabilize the patient and protect the lung as second step of the Respiration Pathway



MECHANICAL VENTILATION

As non-invasive as possible, as invasive as necessary. Along the Respiration Pathway a variance and diversity of treatment tools clearly improve the clinical decision-making.

Continuous monitoring of CO_2 concentrations can serve as an early warning system with regard to changes in the acuity level of critically ill patients.[2] The mainstream infrared absorption measurement (real time method) of CO_2 directly at the Y-piece provides reliable data which are displayed in real time on the ventilator screen.

1 St. John RE.: End-tidal carbon dioxide monitoring Crit Care Nurs Vol 23, No. 4, August 2003; 83-88
2 St. John RE.: Exhaled gas analysis: technical and clinical aspects of capnography and oxygen con-sump-tion. Crit Care Nurs Clin N Am. 1989; 20:363-374

The CO_2 production VCO_2 is a measure of the physical stress on a patient.

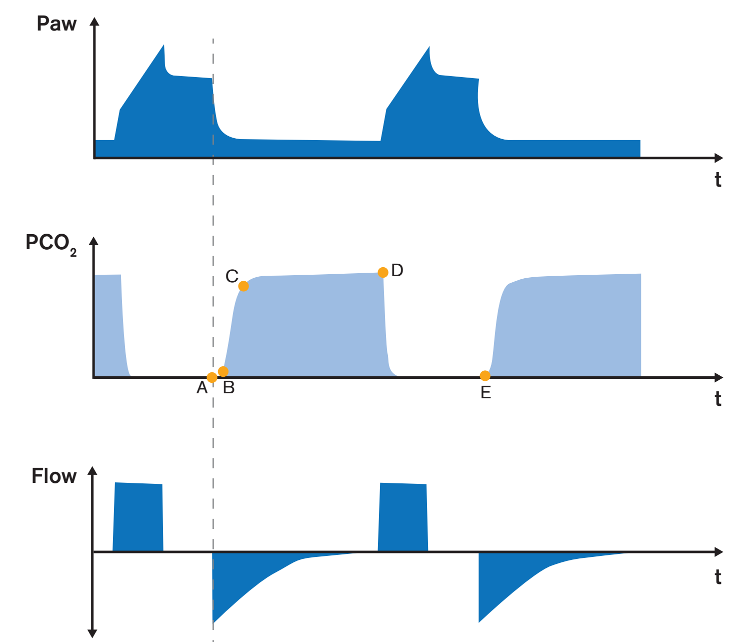
WHY CO_2 MEASUREMENT?

The CO_2 option offers more than just CO_2 measurement.

- Display capnometry and capnography simultaneously, together with other patient parameters such as flow, volume/pressure curves and data[6, 7]
- Enhance patient care with individually adjustable CO_2 alarm settings and optimized ventilation management
- Obtain accurate measurements even under challenging conditions, such as during active humidification
- Avoid gas leakage and resulting misrepresentation of ventilation settings
- Rapidly verify patient CO_2 values with direct sensor control via the reference filter
- Perform zero calibration without disconnecting the patient from the ventilator
- Combine the CO_2 option with optional mask ventilation (NIV/NIVplus) for real time CO_2 monitoring even during NIV
- Take full advantage of the automated weaning protocol SmartCare®/PS

THE PHYSIOLOGICAL CAPNOGRAM

A – B: Emptying of the upper dead space of the airways
The CO_2 concentration in this section of the curve equals zero, as this is the first phase of expiration during which air from the upper airways, which has not been involved in the process of gas exchange, is analysed.



B – C: Gas from the lower dead space and alveoli
The CO_2 concentration increases continuously, as the air being analysed comes partly from the upper airways and partly from the alveoli which are rich in CO_2.

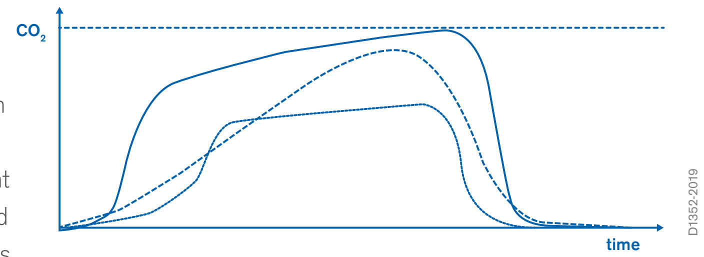
C – D: Alveolar gas
This phase is described as the "alveolar plateau". The curve rises very slowly. The air being analysed comes mainly from the alveolar area.

D: End-tidal CO_2 partial pressure
Represents the highest possible concentration of exhaled CO_2 and is reached at the end of expiration. This point is described as end-tidal CO_2 ($etCO_2$) and represents the final portion of air which was involved in the exchange of gases in the alveolar area. It thus represents under certain conditions a reliable index of CO_2 partial pressure in the arterial blood.

D – E: Inspiration
The CO_2 concentration falls rapidly, as fresh gas not containing CO_2 forces its way into the airways at the beginning of inspiration.

Monitoring the dead space Vds reflects the current patient situation and indicates respiratory insufficiency.

- In intensive care, capnography is applied as a non-invasive way for evaluating a patient's ventilator status[3].
- It can be used to assess changes in ventilation, pulmonary perfusion and metabolism to support optimization of ventilation settings[2].
- Observing the arterial and $etCO_2$ difference respective gradient over a period of time can provide important information, related to either improved or worsening patient clinical status[1] and thus support increased patient safety.
- Capnography monitoring has been increasingly used in operating rooms, intensive care units and emergency departments to indicate incorrect intubation and to monitor coardiopulmonary resuscitation effectiveness[4,5].
- CO_2 measurement can provide also ongoing measurement of dead space values and CO_2 production.



normal trace
shunt perfusion, poor ventilation / alveolar emptying
dead space, decreased perfusion, normal ventilation

CO_2 curve and value (Evita V800)

Display of alarm limits (Evita V800): $etCO_2$ high, $etCO_2$ low

Positioning of CO_2 cuvette and CO_2 sensor

YOUR BENEFITS WITH CO_2 MAINSTREAM MEASUREMENT:

- quick and easy non-invasive CO_2 measurement
- display of CO_2 values as end tidal CO_2 concentration and continuous CO_2 curves
- values such as VCO_2, Vds, Vds/Vte, $VTCO_2$ and Slope phase III are also available*

Evita V800/V600	Babylog VN800/VN600	Evita V500/V300	Babylog VN500	Savina 300 Select/Classic	Oxylog 3000 plus	Oxylog VE300
$etCO_2$ numeric	$etCO_2$ numeric	$etCO_2$ numeric	$etCO_2$ numeric	$etCO_2$ numeric	$etCO_2$ numeric	$etCO_2$ numeric
$etCO_2$ curve	$etCO_2$ curve	$etCO_2$ curve	$etCO_2$ curve	$etCO_2$ curve	$etCO_2$ curve	$etCO_2$ curve
VCO_2	VCO_2	VCO_2	VCO_2			
$VTCO_2$	$VTCO_2$	$VTCO_2$	$VTCO_2$			
Vds/VTe	Vds/VTe	Vds/VTe	Vds/VTe	VTe	VTe	VTe
Slope phase III	Slope phase III	Slope phase III	Slope phase III			

*depending on the device used
1 St. John RE.: End-tidal carbon dioxide monitoring Crit Care Nurs Vol 23, No. 4, August 2003; 83-88
2 St. John RE.: Exhaled gas analysis: technical and clinical aspects of capnography and oxygen consumption. Crit Care Nurs Clin N Am. 1989; 20:363-374
3 Bongard F, Sue D.: Pulse oximetry and capnography in intensive and transitional care units. West J. Med. 1992 Jan; 156(1); 57-64
4 AARC Guideline: Capnography/Capnometry during Mechanical Ventilation-2003 revision and update: Respiratory Care, May 2003 Vol. 48 No. 5
5 Behende et al.: Validity of a disposable and end-tidal CO_2 detection in verifying endotracheal tube placement in infants and children. Ann Erg Med 1992 31:142-5

"A volumetric capnogram contains extensive physiological information about metabolic production, circulatory transport and CO_2 elimination within the lungs. VCap* is also the best clinical tool to measure dead spaces allowing a detailed analysis of the functional components of each tidal volume, thereby providing clinically useful hints about the lung's efficiency of gas exchange.

Recent advances in VCap and our improved understanding of its clinical implications may help in overcoming the known limitations and reluctances to include expired CO_2 kinetics and dead space analysis in routine bedside monitoring. It is about time to start using this powerful monitoring tool to support decision making in the intensive care environment".

Suarez-Sipmann F, et al; Volumetric capnography: the time has come., 2014 Jun;20(3):333-9

*Vcap: Volumetric capnography

ACCESSORIES

- Mainstream CO_2 sensor that measures continuously
- Reusable and disposable CO_2 cuvettes for adult and pediatric patients
- The patented design of the disposable CO_2 cuvette delivers the same performance as the re-usable type, but without the additional cost of time consuming sterilization procedures and protocolls

D-14954-2010

Mainstream CO_2 sensor for Evita Infinity V500, Evita V300, Savina 300

adult **pediatric**

disposable


MT-1994-2008


MT-1995-2008

reusable


D-584-2009


D-583-2009

Mainstream CO_2 measurement	
End-tidal CO_2 concentration	$etCO_2$
Range	0 to 100 mmHg or 0 to 13.2 Vol% (at 1013 mbar (or cmH_2O)) or 0 to 13.3 kPa
Accuracy	According to ISO 80601-2-55 ±(3.3 mmHg +8 % of the measured value) ±(0.44 kPa +8 % of the measured value) ±(0.43 Vol% +8 % of the measured value)
Measurement conditions	Respiratory rate: 6 to 100 /min Inspiratory time: >250 ms Expiratory time: >250 ms
Drift of measurement accuracy	According to ISO 80601-2-55 <0.2 kPa (at 5.00 kPa) over 6 h
The measured values of the CO_2 measurement are barometrically pressure-compensated.	
T10...90	<35 ms
Response time, total	<200 ms
Time until specified accuracy is reached	<120 s (at 23 ±2 °C)
With reference to the displayed measured values the following dead spaces must be taken into account:	
CO_2 cuvette, adults (6870279, MP01062)	4.3 mL
CO_2 cuvette, pediatric patients (6870280, MP01063)	1.9 mL
Neonatal flow sensor ISO 15 (8411130)	0.9 mL
Neonatal flow sensor Y-piece (8410185)	1.7 mL

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