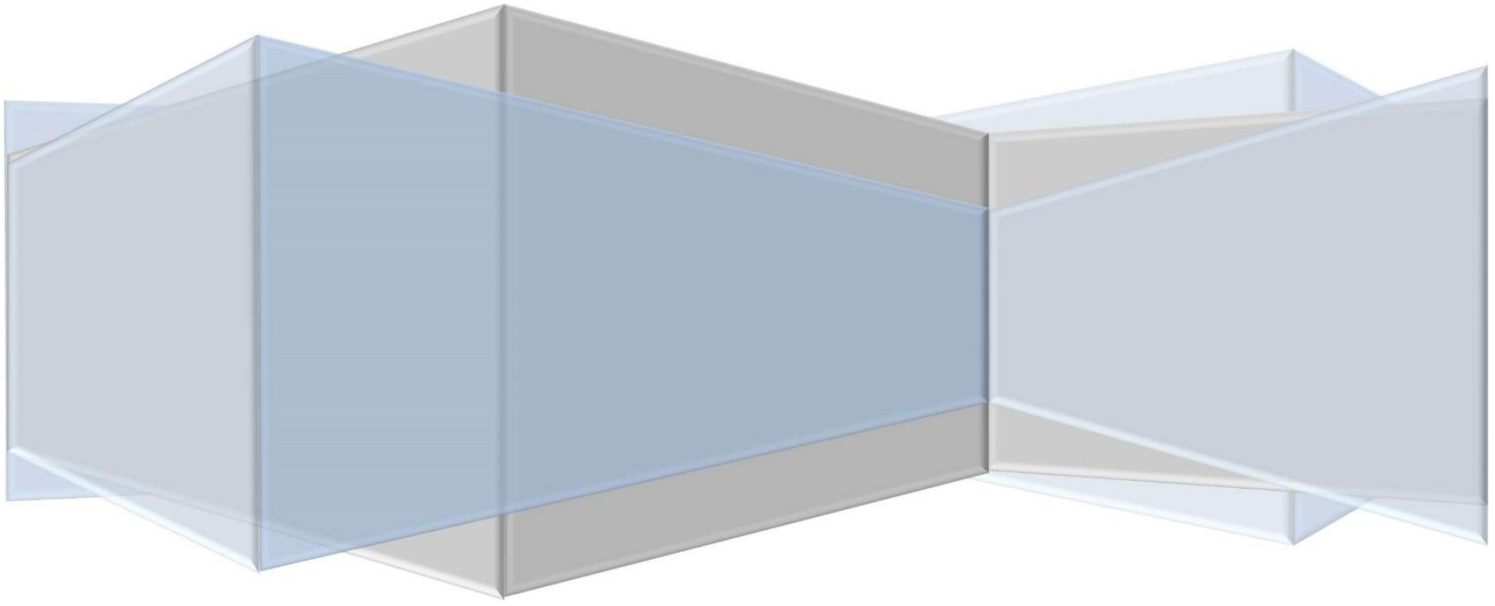
User manual for:

NumioVET-Monitor

Document reference: VET_IFU0008_InstructionForUsers



Numio Tecnologías S.L.

c/ Bellas Vistas 55

E-28411 Moralzarzal (Madrid) SPAIN

Phone: +34 677522042

www.numiotec.com numio@numiotec.com

CE

Abbreviations

CO2	Carbon dioxide
cm	Centimetre
e-CO2	Expiratory CO2
e-Flow	Expiratory Flow
F	Flow
mL	Millilitre
HR	Heart Rate
i-Flow	Inspiratory Flow
i-Vol	Inspiratory Volume
min	Minute
mm	Millimeter
P	Pressure
PEEP	Positive End Expiratory Pressure
PIP	Peak Inspiratory Pressure
RR	Respiratory Rate
sec	second
V	Volume

Contents

1. User responsibilities

NumioVET-Monitor will operate in accordance with the information contained in this User Manual, the device label and other documents that could be distributed to the device. The device must be set up, operated, maintained and repaired in accordance with the instructions provided by the manufacturer.

NumioVET-Monitor should be ONLY used in accordance with the Intended Use contained in this manual. Do not use this unit for other purposes not specified by the manufacturer.

NumioVET-Monitor should be checked periodically by qualified personnel. If the device is defective, broken or with mechanical deformations, turn it off and do not use it for clinical activities.

Do not use disposable different to those recommended by the manufacturer. If any part of the device, or a disposable, is damaged, contaminated or defective, replace it immediately.

Should the device need to be repaired or replaced, it must be reported to the technical service or to the qualified personnel authorized by Numio Tecnologías S.L.

The final user of this product is responsible for any malfunction resulting from improper use, defective maintenance, improper repair, damage or alteration by any person not authorized by Numio Tecnologías S.L.

2. Safety warnings

- Read and follow all cautions and warnings.
- Read this manual before using NumioVET-Monitor.
- NumioVET-Monitor is intended for using by Veterinary professionals only.
- Do not open the unit if you have not been trained previously for technical support by the manufacturer of the product. Never touch the internal electronic boards without proper electrostatic discharge (ESD) protection.

3. Introduction to this manual

This manual is the Instructions for Use of the models of NumioVET-Monitor. The essential performance, the intended use, the different modes of operation and the way of using NumiotVET in a safety condition are described in this manual. It is very important to read this manual before using NumioVET-Monitor.

This document is subject to periodic reviews.

For any query regarding this manual or about the use of NumioVET-Monitor, please contact us:

Numio Tecnologías S.L.
c/ Bellas Vistas 55,
E-28411 – Moralzarzal– Madrid (Spain)
Phone: +34 677522042
e-mail: numio@numiotec.com

4. General description of the device

NumioVET-Monitor (see Fig. 1) is a portable multiparameter monitoring system which can be used in veterinary applications for acquire physiological parameters. It helps clinicians to control the state of the animal during medical interventions and anaesthesia. Continuous monitoring of the animals minimizes the risks during the surgeries, ensures the proper use of the ventilation during interventions, assists clinicians to focus in animal surgery and, most importantly. gives valuable information regarding vital signs of the subject.

The device is intended for monitoring to medium and small size animals (cats, dogs, rabbits, etc) in veterinary clinics or in experimental labs and to be used by clinicians or other healthcare/veterinary experts. The advantages of continuous monitoring of the animal are mainly:

- Minimizing the risks during animal surgeries,
- Correct control of the animal during ventilation or other medical interventions,
- Reduction of hazard situations and better management of the animals, generating alarms when the measurements are out of limits,
- Permits the veterinary physician focusing in the animal intervention rather than in its control.

Figure 1. NumioVET-Monitor device.

Applications:

Some example of the field of applications of the device are summarised as follow:

- For small and medium size animals surgeries,
- For simple and more sophisticated veterinary procedures,
- For animals undergoing mechanical ventilation.

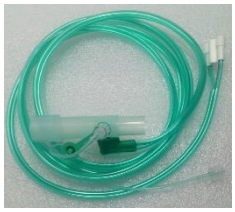
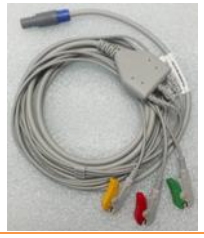
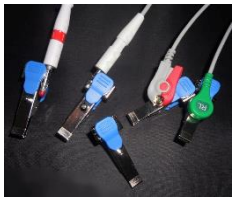
Measurements:

The device incorporates a combination of sensors for monitoring some of the physiological parameters of the animals. Note that not all measurements are implemented in all the devices but depend of the device model (see device models determination).

- Lung functional parameters: airway pressure during the respiratory cycle: pressure at the end of the inspiration (PIP), pressure in the inspiratory plateaux (PPlateau) and pressure at the end of the expiration (PEEP), inspiratory and expiratory flow, and inspiratory volume,
- Calculated lung compliance,
- Respiratory frequency,
- Digital capnography (exhale CO_2),
- Blood oxygen saturation,
- Electro cardiograph (ECG),
- Heart rate,
- Temperature,
- Fraction of inspiratory oxygen (FiO_2)

5. Parts and accessories

WARNING: Do not use or attach items not specified by the manufacturer.

VET 1001		Pneumotachograph sensor kit
VET 1002		Small volume pneumotachograph sensor
VET 1502		Temperature sensor
VET 1005		Water trapping
VET 1401		ECG cable
VET 1402		ECG crocodile
VET 1403		SPO_2 sensor kit

VET 1501		Oxygen sensor
VET 1006		Power supply *

- Only used in model 1000

6. Connection of the sensors

Pneumatic sensors and the water-trap are connected in the right side of the device. Electrical connectors are in the left size of the device. In the next figure, there are presented the standard connectors.

Note: The location and types of connectors could be different depending on the model and version of the equipment.

Figure 2. Sides of the device for the sensor and main power connection

7. Initial verifications

NumioVET-Monitor performs an initial automatic verification of all critical functionalities. If there is error, it will be displayed in the top of the screen (alarm area). Before using the device, it is necessary to deal with the possible errors (see troubleshooting and alarms section).

WARNING: User is the responsible to solve the problems detected before using the device in clinical application.

WARNING: If the errors found cannot be solved by restarting the system, contact a specialized technical service.

When the unit verification is completed successfully, the message to perform the offset correction procedure appears. The user must disconnect the Pneumotachography sensor kit from the animal's mouth and touch OK to perform the correction process.

If the correction process is performed incorrectly, the flow or pressure measurement will have a zero offset. To correct this, you must perform a zero calibration in the "Settings" menu of the equipment.

WARNING: The calibration of the offset of the equipment must be executed with the flow and pressure sensor disconnected from the animal's mouth.

8. General user interface

The main screen of the User Interface (see Fig. 3) allows the user to access to all functionalities during the use of the device by touch screen. The real-time charts and measurements as well as other measures required for the control of the unit are accessible through the user interface.

Figure 3. Main screen of the user interface.

The user interface is split in 3 areas: a) alarm and menu area in the top, b) charts area in the middle, and c) measurements area in the right and bottom.

Settings

The settings of the device are hidden in the User Interface. The "burger button" in the left size corner can be touched to access to that functionalities (see Fig. 4). The options are hidden after 5 seconds without using it.

Figure 4. Button to access to the settings (left) when hidden and (right) when options are accessible.

When the setting is visible, there are 3 options accessible: a) animal selection, b) device setting and c) help.

Animal Selection

Touching in top of the animal, it is possible to switch between different animal configurations. When the new animal is selected, the last configuration used for that animal is loaded into the interface and programmed into the device. The parameters included into the animal configuration are:

- Chart X and Y scales
- Limits of the system alarms
- Graph and alarms absolute limits

By default, the device is configured with 3 different settings for animals: small, medium and large size. The sequence of change is presented in the Figure5. More animal configurations can be added upon request. If during the operation of the device the user changes scales and/or alarm limit values through chart and measurements areas, the new values will be saved for that animal and will be used in the future loading of the device. Additionally, when the device is turn on, the configuration for the last animal used will be loaded.

WARNING: This functionality is intended to support to the veterinary doctor to use the device easily, but the user is the responsible of configuring the device properly before the intervention.

Figure 5. Different animal settings available for use in the software.

Pneumotachography sensor kit selection

NumioVET-Monitor is configured by default to use the low-flow pneumotachography sensor for small and medium-weight animals and the high-flow sensor for heavy-weight animals. The following table can be used as a reference for selecting the pneumotachography sensor:

Animal weight	Pneumotachography sensor
Less than 15 Kg	Low flow
Between 15-20 Kg	Low flow or High flow
More than 20 Kg	High flow

Either of the two pneumotachography sensors could be used In animals weighing between 15-20 kg, However, in this case the user must change to the high flow sensor in case of observing a saturation in the curve and flow values or to the low flow sensor in case of appreciating poor precision in the curve and flow values. The sensor change can be carried out in the device settings window without having to change the previously selected type of animal.

Device Settings

The device settings are used for adjusting the time scales of the charts and for sending commands to the device. In order to use this feature, touch on settings button when the menu options are not hidden. When the settings are accessed, the following functions appear:

Figure 6. Settings panel.

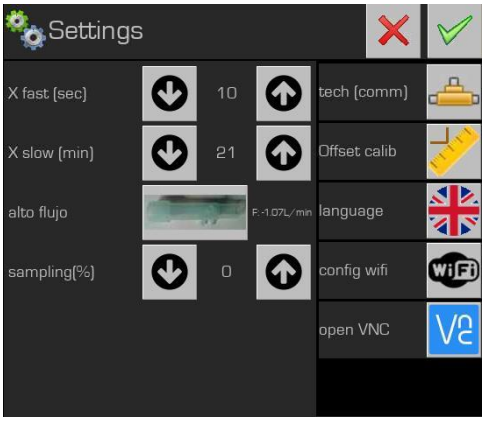


Figura 7. Setting devices options.

Parameter	Description	Low limit	High limit
X fast (sec)	Time of the lung measurements in real time in fast mode acquisition mode. Actual fast time scale value(sec) in fast mode acquisition mode.	10	60
X slow (min)	Time of the lung measurements in real time in slow mode acquisition mode. Actual fast time scale value(min) in slow mode acquisition mode.	1	30
Pneumotachography sensor	Allows you to change the pneumotachography sensor without having to change the type of animal. This change is carried out fundamentally in animals weighing between 15-20 kg when pulmonary flow measurements are not optimal.	NA	NA
Sampling (%)	Pump speed control. If the user wants higher acquisition speed, this value should be increased. Increasing/decreasing this value have an effect of increasing/decreasing noise level in acquisitions.	0	100
Offset calibration	To launch the command to correct the offset of the unit. Ensure the device is not connected to animal for calibration.	NA	NA
Comm	Implemented for technical service support only.	NA	NA
Language	To change the language of the software (English or Spanish).	NA	NA
Config wiffi	To connect the monitor to the client's wifi. Only for technical services actions	NA	NA

WARNING: When the device is turn on or when the flow sensor is changed, the offset calibration must be performed. Otherwise, the flow and the volume measurements can be incorrect.

Help section

General guidelines and troubleshooting issues could be obtained in Help tab. In order to access it, touch the button "Help" into the menu options (see Fig. 8).

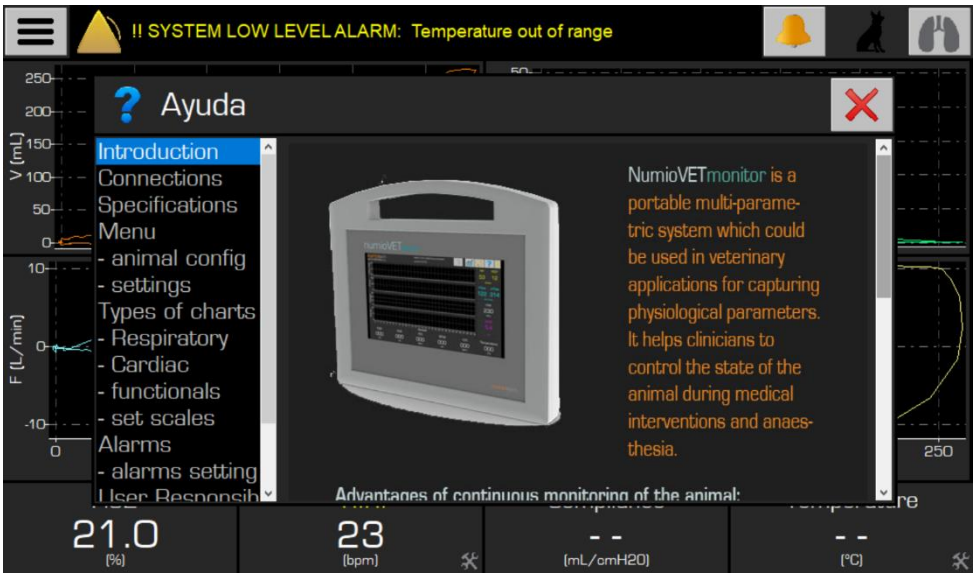


Figure 8. Help panel.

Charts

This is the area dedicated for showing the acquisition data in format of x-y charts. There are 4 types of graph accessible in this area: a) real-time pneumological data, b) real-time cardiological data, c) functional pneumological loops, and d) trend graphs. By default, real-time pneumological data is display when the software is started. The modes can be changed using the button in the top right side of the user interface (see Fig. 9).

Figure 9. For changing mode of the acquisition use the symbol on top right section.

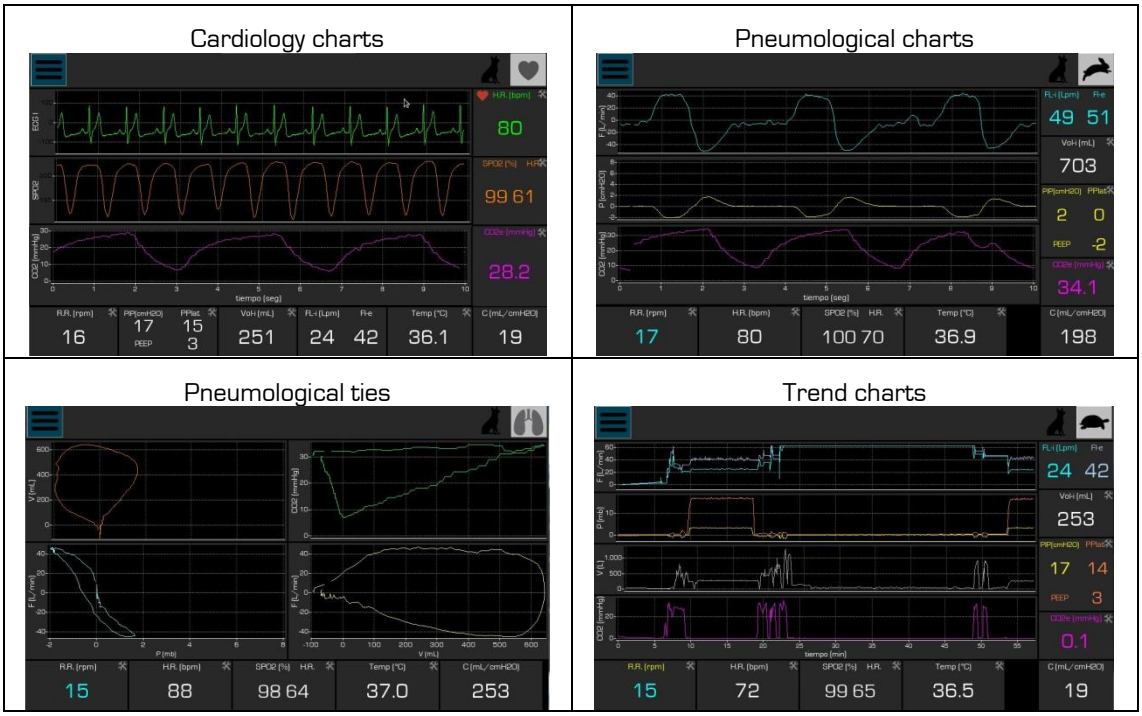


Figure 10. Types of graphs of the numioVET-Monitor.

A brief description of the waveforms in each mode is presented in the Table below.

Chart	Mode	Description
Flow vs Time		Shows flow (L/min) versus time (sec) in **fast mode acquisition**.
Pressure vs Time		Shows pressure (cmH2O) versus time (sec) in **fast mode acquisition**.
CO2 vs Time		Shows CO_2 (mmHg) versus time(sec) in **fast mode acquisition**.
Electrocardiography		Displays EKG signals (lead II) versus time (sec) in real-time, **fast mode acquisition**
Pulse oximetry signal		Pulse oximetry signal corresponding to the red LED versus time (sec) in real-time, **fast mode acquisition**
CO_2 vs Time		Displays exhaled CO2 (mmHg) versus time (sec) in real-time, **fast mode acquisition**
Volume vs Pressure		Shows volume (mL) versus pressure (cmH2O) in **slow mode acquisition**.
Flow vs Pressure		Shows flow (L/min) versus pressure (cmH2O) in **slow mode acquisition**.
CO_2 vs Volume		Shows CO_2 (mmHg) versus volume (mL) in **slow mode acquisition**.
Flow vs Volume		Shows flow (L/min) versus volume (mL) in **slow mode acquisition**.

iFlujo y eFlujo vs Time		Shows the trend of inspiratory and expiratory flow for each respiratory cycle (L / min) versus time (min) in **slow mode acquisition** (1 point per respiratory cycle)
PIP, PEEP y PPlato vs Time		Displays pressure at the end of inspiration (PIP), pressure at the end of expiration (PEEP) and platea pressure (PPlat) versus time (min) in **slow mode acquisition** (1 point per respiratory cycle)
eCO_2 vs Time		Shows exhaled CO2 concentration (mmHg) versus time (min) in **slow mode acquisition** (1 point per respiratory cycle)

In order to adjust the scale of each chart, touch somewhere inside that chart (see Fig. 11) and then a form for setting the new scale will appear. Maximum and minimum of the graph can be increased or decreased using the arrows if manual option is selected. The scale can also be set to Automatic instead of manual. This means the maximum and minimum will be set using the maximum and minimum of the measurements.

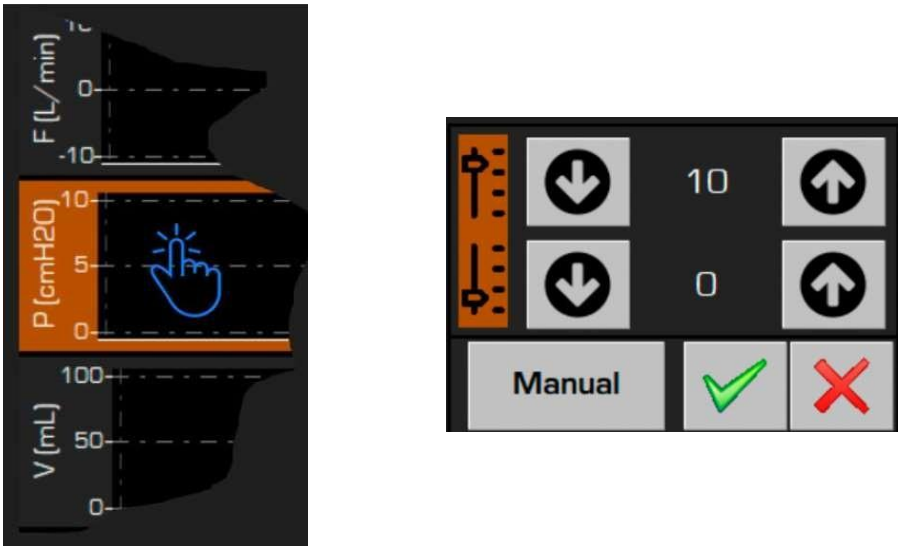


Figure 11. Example of changing scale for a chart; (left) how to touch on the graph for displaying the axis change form (right).

Measurements

The calculated values from the respiratory cycles are shown in the right-side of the user interface, just in the right of the chart area. Other measurements and calculated values are shown in the bottom of the main screen (see Fig. 12). These measurements are displayed in real-time and in trend chart modes, but they are hidden in the functional loop chart presentation.

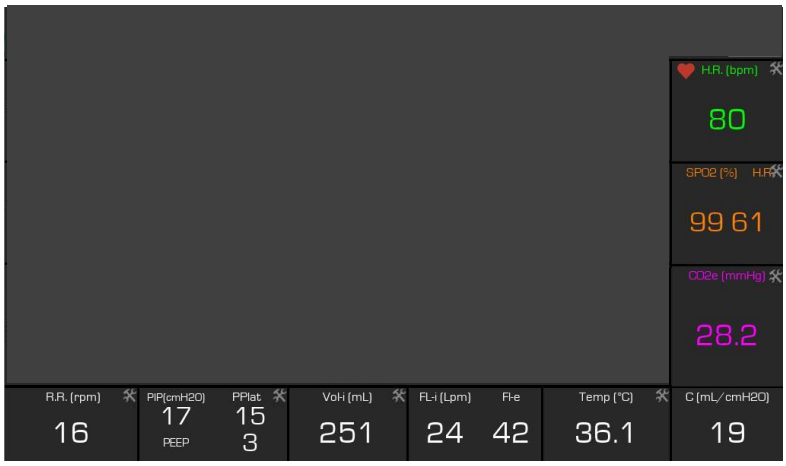


Figure 12. Measurements area.

The available measurements are presented in the following table.

Measurement	Description
i-Flow	Inspiratory flow in L/min
e-Flow	Expiratory flow in L/min
PIP	Peak Inspiratory Pressure in cm of H_2O
PEEP	Positive End Expiratory Pressure In cm of H_2O
i-Vol	Inspiratory volume in ml
eCO_2	Expiratory CO_2 in mmHg
Temperature	Temperature in Celsius
Compliance	Lung compliance in mL/cm of H_2O
H.R.	Heart rate in bpm
R.R.	Respiratory rate in bpm
SpO_2	Peripheral capillary oxygen saturation in %
FiO_2	Fraction of inspired oxygen in %

Alarms

In order to protect the animals and facilitate the animal vital signs and measurements handling, it is possible to set different alarms in the system. Alarms are presented visually and audible according to the normative ISO 60601-1-8. The measurement threshold to activate the alarms (minimum and maximum) are configurable through the User Interface.

Setting the alarm of the system is accessible on the corresponding measurements. Note the setting icon that appears in the right button border of some measurements  , that means that an alarm can be set to the corresponding measurement.

Visual alarms are appearing in the top section of the User Interface (see Fig. 13). Audible alarms are in accordance with the normative IEE 60601-1-8 and could also be muted using the bell button seen in top right section of the interface.

Figure 13. Alarm panel.

The device implements 3 level of alarm, depending of the potential hazard to the animal: **high-level** is use when the situation is critical to the animal, **low-level** when a critical situation could appear soon or **warning** when system could be optimised for better performance.

The alarms implemented in the system are summarised in the following table.

Alarm	Description	Level	Alarm detection
PIP	Maximum lung pressure is too high	High	Pressure is higher than upper limit
PEEP	Pressure after the expiration is too low	Low	Pressure is lower than lower limit
Insp. volume	The inspiratory volume is too high	High	Volume is higher than upper limit
Exhale CO_2	Level of CO_2 exhale by the animal is out of range	High	CO_2 measurement if out of range (either upper or lower limit)
Resp. rate	The respiratory rate is out of range	High	Calculated respiratory rate if out of range (either upper or lower limit)
Heart rate	The heart rate is out of range	High	Calculated heart rate if out of range (either upper or lower limit)
Temper.	Temperature is out of range	Low	Temperature measurement if out of range (either upper or lower limit)

In order to change the threshold of the alarms, touch on the measurement area (measurement must have the symbol  if the option is available) for accessing to the alarm limit form. (see Fig. 14). In the form, minimum and/or maximum values could be modified.

Figure 14. Alarm panel.

Oxygen saturation

In the models that include the blood oxygen saturation measurement, the numioVET-MONITOR will show the user this measurement and the heart rate computed with the blood saturation signal, both in the fast mode window  and in the cardiac measurements window  . In the latter case, you can also view the graph of oxygen saturation vs time, as shown in figure 15.

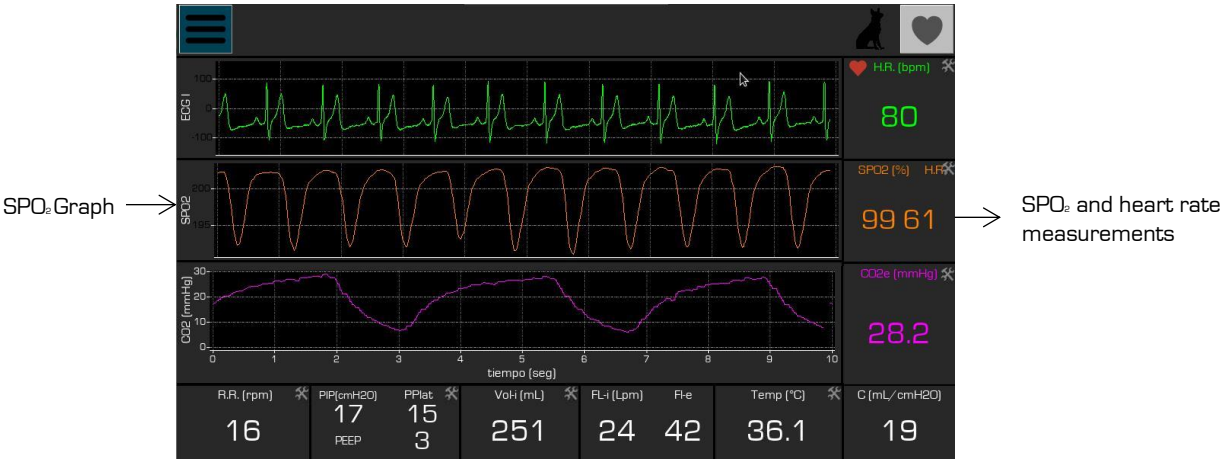


Figure15. SPO2 signal in the cardiac measurements window

To ensure better SPO_2 measurements, the sensor should be placed primarily on the animal's ear or tongue. In the latter case, the measurement will often be affected after a long time, so for long-term surgeries it is recommended to place it on the ear. The user should reposition the sensor until a suitable and stable signal is shown on the monitor.

EKG

In the models that include the electrocardiography measurement, the numioVET-MONITOR will show the user the heart rate calculated with the ECG signal, both in the fast mode window  and in the cardiac measurements window  . In the latter case, you can also view the graph of lead II Vs time, as shown in figure 16.

Figure 16. EKG signal (lead II) in cardiac measurements window

Figure 17 shows the correct way to connect the 3 contacts of the EKG cable to obtain lead II. The use of this lead is recommended as it has the best amplitude and signal-to-noise ratio compared to leads I and III.

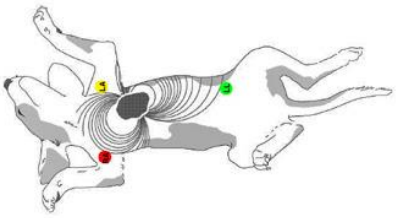


Figure 17. Correct electrode placement to obtain EKG Lead II

To ensure proper measurements of the EKG signal, the following guidelines are recommended:

- If possible, place the animal in the right lateral decubitus position with the limbs perpendicular to the body and slightly apart.
- Separate the hairs of the animal as much as possible in the area where the clips will be placed and clean with alcohol.
- Apply conductive gel in the area where the clips will be placed.
- Avoid that the cables touch each other or make contact with any metal part.
- To reduce interference, place the EKG cable avoiding contact with power cables (220V), other equipment or the ground.

The user should reposition the clips until an adequate and stable signal is observed on the monitor.

9. Warranty

The manufacturer warrants this product against any manufacturing defect or in materials for one year from the date of purchase.

The warranty includes repairing, replacing or changing the product and/or components free of charge to the customer, including labour and materials. Transport costs are not included.

This warranty does not include disposable, consumables or accessories such elements of the patient circuit, respiratory flow sensor, gases sensors or cylinder with calibration gases (included in maintenance contract, see conditions).

This warranty will not be valid under the following conditions:

- When the use and the care of the device have not been in accordance with the instructions contained in this manual.
- When the fault is caused by incorrect use of the unit.
- When the product has been opened or maintained by personnel not authorized and formed by Numio Tecnologías S.L. or companies authorized by this manufacturer.

10. Cleaning

WARNING: Before cleaning the device, turn it off and unplug it from the main.

Clean the device with a damp cloth impregnated with a mild detergent. It is important to dry the device after cleaning.

	Do not sterilize the device in a steam autoclave or with liquid.
	Do not use grease or oils for cleaning. Some of them may be incompatible with oxygen creating fire or explosion.

11. How to order

Follow the next table to proceed with the order of your product.

Item	CO2	Lung	ECG	SPO_2	FiO_2	Temp	Dispos.
VET 1000	Y	Y					
VET 1100	Y						
VET 1300			Y	Y			
VET 1400	Y	Y	Y	Y			
VET-ECG			Y				
VET-SpO2				Y			
VET-FiO2					Y		
VET-Temp						Y	
VET 1001	Pneumotachograph sensor kit						Y
VET 1002	Low flow pneumotachograph sensor						Y
VET 1003	High flow pneumotachograph sensor						Y
VET 1004	Capnography sensor						
VET 1005	Water trap						Y
VET 1006	External power supply (5V)						
VET 1401	EKG cable (1 lead, 3 contacts)						
VET 1402	EKG clip						Y
VET 1403	SPO_2 sensor kit						
VET 1501	Oxygen sensor						
VET 1502	Temperature sensor						

12. Technical specifications

Lung pressure measurements range	0 – 50	mbar
Volume measurement range*	Low flow sensor: 10 – 150 High flow: 80 - 1200	mL
Flow measurement range	Low flow sensor: 0.2 – 12 High flow sensor: 1 – 50	L/min
CO_2 measurement range	0 – 20, 0 – 150	%, mmHg
SpO_2 measurement range	80 – 100	%
FiO_2 measurement range	15 - 100	%
Temperature measurement range	25 - 45	˚C
Breathing frequency	6 – 100	Breaths per minute
Heart reate frequency	40 - 250	Beats per minute
Measurements accurate	< +/- 5	%
Sampling rate (fast mode)	20	Points per second
Alarms	Audible and visual	
Dimensions (l x w x h)	350 x 110 x 300	mm
Weight	3.5	kg

* The volume ranges depend on the inspiratory time used

Electrical specifications

Feeding	110 - 220VAC 5 VDC*	
	Device designed for continuous operation	
Consumption	Average power consumption (at 5V)	1.2A
	Maximum power consumption (at 5V)	2.4A
	Minumum power constumption (at 5V)	1A
Normative	EN 60601-1-2:2007 + CORR:2010 / IEC 60601-1-2:2007	
	EN 60601-1-8	
Classification	Class I, Type B	

Electromagnetic and RF specifications

Guidance and manufacturer's declaration - electromagnetic emissions		
The device is intended for use in an electromagnetic environment specified below. The customer or the user should ensure that it is used in said environment		
Emission test	Conformity	Electromagnetic environment - Guide
RF emissions CISPR 11	Group 1	The device uses RF energy only for its internal function. Therefore, their RF emissions are very low and are not likely to cause any interference to nearby electronic devices.
RF emissions CISPR 11	Class B	The device is suitable for use in all establishments, including domestic establishments and those directly connected to the public low voltage power supply network that feeds buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Fluctuations of voltage/flickers emission IEC 61000-3-3	Comply	

Guidance and manufacturer's declaration – electromagnetic immunity			
The device is intended for use in an electromagnetic environment specified below. The customer or the user should ensure that it is used in said environment			
Immunity test	Test level of Standard IEC 60601	Level of conformity	Electromagnetic environment - Guide
Electrostatic discharge (DES) IEC 61000-4-2	±6 kV by contact ±8 kV by air	±6 kV by contact ±8 kV by air	The floors should be made of wood, concrete or ceramic tile. If the floors are covered with synthetic material, the relative humidity should be at least 30%.
Transient/fast bursts IEC 61000-4-4	±2 kV for network power lines ±1 kV for input / output lines	±2 kV for network power lines Not applicable	The quality of the power supply network should be that of a typical commercial environment or that of a hospital.
Shock wave IEC 61000-4-5	±1 kV line to line ±2 kV line to ground	±1 kV line to line Not applicable	The quality of the power supply network should be that of a typical commercial environment or that of a hospital.

Voltage drops, interruptions and voltage variations in the power input lines IEC 61000-4-11	<5% UT (drop >95% in UT) for 0,5 cycles 40% UT (drop 60% in UT) for 5 cycles 70% UT (drop 30% in UT) for 25 cycles >5% UT (drop >95% in UT) for 5 s	<5% UT (drop >95% in UT) for 0,5 cycles 40% UT (drop 60% in UT) for 5 cycles 70% UT (drop 30% in UT) for 25 cycles >5% UT (drop >95% in UT) for 5 s	The quality of the power supply network should be that of a typical commercial environment or that of a hospital. Device continues operating during the interruption of the power supply; this is because device is powered by a battery.
Magnetic field at network frequency (50/60 Hz) IEC 61000-4-8	3 A/m	3 A/m	Magnetic fields at network frequency should be at characteristic levels of a typical location of a typical commercial environment or hospital.
NOTE: UT is the AC voltage supply before the application of the test level.			

Guidance and manufacturer's declaration – electromagnetic immunity			
The device is intended for use in an electromagnetic environment specified below. The customer or the user should ensure that it is used in said environment			
Immunity test	Test level of Standard IEC 60601	Level of conformity	Electromagnetic environment - Guide
Conducted RF IEC 61000-4-6	3 Vrms of 150 kHz to 80 MHz	3 Vrms	Mobile and portable RF communications devices should not be used any closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the transmitter frequency. Recommended separation distance $d = 1.17\sqrt{P}$ 150 kHz to 80 MHz $d = 1.17\sqrt{P}$ 80 MHz to 800 MHz $d = 2.33\sqrt{P}$ 800 kHz to 2.5 GHz Where P is the maximum output power
Radiated RF IEC 61000-4-3	3 V/m of 80 MHz to 2.5 GHz	3 V/m of 80 MHz to 1 GHz (due to the limitations of the testing laboratory)	of the transmitter in watts (W) according to the manufacturer of the transmitter and d is the recommended separation distance in meters (m). The field strengths from the fixed RF transmitter, as determined by an electromagnetic site study[a], Should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of devices marked with the following symbol: 

NOTE 1: At 80 MHz and 800 MHz, the highest frequency range is applied.
NOTE 2: These guidelines cannot be applied in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

[a] Field strength of fixed transmitters, such as base stations for radio telephones (cellular / cordless) and land mobile radios, amateur stations, AM and FM radio broadcasts, and TV broadcasts cannot be predicted theoretically accurately. To assess the electromagnetic environment due to fixed RF transmitters, a study of the electromagnetic location should be considered. If the field strength measurement at the location where the device is used exceeds the applicable prior RF compliance level, the device should be observed to verify normal operation. If abnormal operation is observed, Additional measures may be necessary, such as reorientation or relocation it.

[b] Over the frequency range of 150 kHz to 80 MHz, the field strength should be less than 3 V/m.

Recommended separation distances between portable and mobile RF communications devices and NumioVET-Monitor

The device is intended for use in an electromagnetic environment in which RF radiations are controlled. Customer or user can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications devices (transmitters) and the device as recommended below, according to the maximum output power of the communications devices.

Maximum power output of the transmitter W	Separation distance according to the frequency of the transmitter m		
	150 kHz to 80 MHz $d = 1.17\sqrt{P}$	80 MHz to 800 MHz $d = 1.17\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.33\sqrt{P}$
0,01	0,12	0,12	0,23
0,1	0,38	0,38	0,74
1	1,2	1,2	2,3
10	3,8	3,8	7,3
100	12	12	23

For assigned transmitters with a maximum output power not listed above, the recommended separation distance d in meters (m) Can be determined using the equation applicable to the transmitter frequency, where P is the maximum power output in watts (W) according to the manufacturer of the transmitter.
NOTE 1: At 80 MHz and 800 MHz, the separation distance is applied for the highest frequency range.
NOTE 2: These guidelines cannot be applied in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

13. Troubleshooting

This section is in continue revision to add the feedback and main problems of the customer in the field. The manufacturer will update the manual to the user often.

Problem	Identification	Solution(s)
CO_2 too slow	CO2 graph is not following the respiratory pattern	• Review the sampling line. Use the one recommended by manufacturer. • Increase sample (%) in settings window
Flow saturation	Flow signal is out of scale	• Check the flow sensor. Use the correct one according to the animal size. You can see the one selected in settings window. • Calibrate the offset of the flow sensor before connecting to the animal's mouth.
EKG signal problems	Low quality in the EKG signal	• Check the connection of the electrodes or clamps on the animal. • Use gel to improve contact with the skin and select preferably hairless areas following the recommendations for this type of measure in animals. • Keep the EKG cables as far away as possible from the power supply cables (220V), from the ground and from metal surfaces.
SpO_2 problems	Signal of SpO_2 is not stable and the value disappear time to time	• Relocate the SpO2 sensor to the animal's ear or tongue. • Insert the clip as deeply as possible. • Make sure there are no elements between the sensor and the animal's skin.
Error in O_2 measurement	Measurement is fluctuating or not stable	• Replace the O_2 cell. The life of the cell is one year from the activation.