

# Operator's Manual

*Vital Signs Monitor*

*Pulse Oximeter*



**PulseSense™ Vet LS1P-10R**  
For veterinary use

CE

**medair**  
A NONIN MEDICAL, INC. COMPANY



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This manual reflects **PulseSense Vet** version **10R** (LS1P-10R).

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# CHAPTER 1

## Introduction

### ***Indications for Use***

The **PulseSense Vet** is a Pulse Oximeter monitor that measures and displays functional oxygen saturation of arterial hemoglobin (SpO<sub>2</sub>) and pulse rate of animals. It is intended for continuous, non-invasive monitoring of these parameters in where the need for an early warning system is required. These functions may be used separately or simultaneously.

## Safety messages

### ***Contraindications***

**Do not use PulseSense vet in an MR environment.**

**Do not use PulseSense vet during defibrillation.**

**Do not use PulseSense vet in an explosive atmosphere or in the presence of flammable anaesthetics or gases.**

### ***Warnings***

**PulseSense Vet** is intended for **VETERINARY USE ONLY**. It must be used in conjunction with other methods of assessing clinical signs and symptoms.

Never allow liquids to enter into or to be spilled onto the monitor. If liquid has penetrated into the monitor it must be checked by Medair Technical Service before it can be used again.

The use of accessories, sensors, and cables other than those specified in this manual may result in increased emission and/or decreased immunity of this device.

Use only NONIN-branded PureLight<sup>®</sup> veterinary pulse oximeter sensors. These sensors are manufactured to meet the accuracy specifications of the **PulseSense Vet**.

Inadequate perfusion, thick fur, improperly applied sensor, or foreign matter that blocks light can result in inconsistent or inaccurate oxygen saturation and/or pulse rate measurement. If proper operation cannot be verified, remove the sensor from the animal, and **DO NOT** use the pulse oximeter.

**Warnings, continued**

Do not use a damaged Sensor.

Misuse or improper handling of the pulse oximeter sensor could damage the sensor or the cable which may lead to inaccurate readings. Never alter or modify the sensor since this also may affect the performance or accuracy.

If the **PulseSense Vet** fails to respond as described, discontinue use and contact Medair Technical Service.

Use only Medair recommended accessories and replacement parts. See the Accessories List in Chapter 6.

Oximeter readings may be affected by the use of an electrosurgical unit (ESU).

This device should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the device should be observed carefully to verify normal operation.

When selecting a sensor application site use an extremity without a catheter, blood pressure cuff or intravascular infusion line.

**Cautions**

Before use, carefully read the Instructions for Use provided with the sensor.

**PulseSense Vet** monitor is a sensitive electronic instrument and must be repaired by authorized personnel only; contact Medair Technical Service.

Do not mount **PulseSense Vet** directly above the animal. If the monitor is mounted be sure to check that the adjustable mounting clamp is securely affixed.

Dispose or recycle all waste material in accordance with your local, state, or national regulations for waste management.

Always turn off and unplug the monitor prior to changing or cleaning the Nonin-branded PureLight<sup>®</sup> oximeter sensor.

Portable and mobile RF communications equipment may interfere with medical electrical equipment.

Do not sterilize, autoclave or use caustic or abrasive cleaning agents on the **PulseSense Vet** monitor or sensors. Do not immerse in liquids. Do not disassemble the moisture trap.

**Cautions, continued**

This equipment complies with IEC 60601-1-2:2001 for electromagnetic compatibility for medical electrical equipment and/or systems. This standard is designed to provide reasonable protection against harmful interference in a typical medical installation. However, because of the proliferation of radio-frequency transmitting equipment and other sources of electrical noise in healthcare and other environments, it is possible that high levels of such interference due to close proximity or strength of a source might disrupt the performance of this device. Medical electrical equipment needs special precautions regarding EMC, and all equipment must be installed and put into service according to the EMC information specified in this manual.

Do not cover or block speaker opening; this may significantly reduce the sound volume.

Set or adjust alarm parameters one at a time, not simultaneously.

Always store and ship the device in its case to avoid accidental damage.

Before each use, it is the operator's responsibility to verify that the alarm limits are appropriate for the **animal** being monitored.

Allow sufficient time for **PulseSense Vet** to adapt to normal room temperature before you start using it, if it has been stored in cold temperatures.

Never store or transport **PulseSense Vet** where condensation can occur. However if this has occurred, wait until all condensation has evaporated before using **PulseSense Vet**.

Prior to connecting **PulseSense Vet** to the battery charger and the power outlet, be sure to verify the voltage and frequency rating on the battery charger are compatible with the outlet. If this is not the case, do not connect the monitor and battery charger to the outlet.

Do not operate **PulseSense Vet** while charging a completely depleted battery. This may cause permanent damage to the monitor. Charge the battery prior to operating the monitor.

If **PulseSense Vet** is intended to be stored for longer periods of time, always charge the battery to full capacity before storing it in order to prevent damage to the equipment.

Never open the monitor housing/case. By opening the case you will invalidate the warranty.

 **Cautions, continued**

The **PulseSense Vet** pulse oximeter must be able to measure the pulse properly to obtain an accurate SpO<sub>2</sub> measurement. Verify that nothing is hindering the pulse measurement before relying on the SpO<sub>2</sub> measurement. If the pulse quality or pulse rate displays are inadequate, examine the animal for any signs of distress and then reexamine sensor placement.

The **PulseSense Vet** pulse oximeter may not work on all animals. If you are unable to achieve stable readings, discontinue use.

The **PulseSense Vet** pulse oximeter may misinterpret motion artifact of sufficient amplitude and regularity as good pulse quality.

Certain pharmacologic agents used to sedate or anesthetize animals may have cardiovascular effects that can adversely affect the performance of the pulse oximeter by reducing the perfusion to the sensor site. Examples of commonly used agents that may have this type of effect on certain animal species are Detomidine HCl and Xylazine HCl.

There is a wide range of variability between animal species and their respective differences in anatomy, physiology, and responses to veterinary pharmacological agents. Therefore, the qualified veterinary professional will need to use discretion when selecting sensors and / or sensor sites that are appropriate for the animal species and the monitoring conditions.

When attaching the pulse oximeter sensor, make sure to secure the sensor in a manner that will not restrict perfusion. An improperly applied sensor could inhibit proper function of the pulse oximeter and cause discomfort or localized ischemia to the animal.

The oximeter sensor might not work on cold extremities due to reduced circulation. Warm skin area to increase circulation, or reposition the sensor.





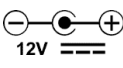







Inspect the pulse oximeter sensor application site periodically to ensure correct sensor alignment and skin integrity.

In compliance with the European Directive on Waste Electrical and Electronic Equipment (WEEE) 2002/96/EC, do not dispose of this product as unsorted municipal waste. This device contains WEEE materials; please contact your distributor regarding take-back or recycling of the device. If you are unsure how to reach your distributor, please call Medair for your distributor's contact information.

Fluctuating or very bright light, moisture, blood pressure cuffs, infusion lines, venous pulsations, insufficient pulse signals, anemia, arterial catheters, may degrade the SpO<sub>2</sub> device's performance.

## Equipment Symbols and Definitions

This table describes the symbols that are found on the **PulseSense Vet** monitor.

Symbol	Meaning
	Consult Instructions for Use.
	Type BF applied part.
	CE mark.
	Indicates separate collection for electrical and electronic equipment (WEEE).
	Device Input voltage. 12 Volts Direct Current (VDC), positive (+) in center of plug.
A41208G (230 VAC 50Hz) A41209 (120 VAC 60Hz)	Approved battery chargers for use with this device.
For veterinary use only!	Indicates that this device may only be used on animals. This device may not be used on human beings.
	Model number. This manual reflects model <b>LS1P-10R</b> .
	A unique serial number for the model. For identification.
	Date of manufacture.
	Indicates the ON/OFF switch on the device.
	Audible alarm pause button.
CHARGE 	Charging indicator. When the monitor is connected to the power outlet the charge indicator will be green. This also means that the internal battery is charging.
	DC input. Connection of battery charger.
<b>I O I O I</b>	Serial port for use with accessories specified by Medair only.
<b>NONIN SpO<sub>2</sub></b>	Connection for NONIN-branded veterinary SpO <sub>2</sub> sensor.

## ***About PulseSense Vet***

**PulseSense Vet** offers the veterinarian the ability to non-invasively monitor pulse oximetry on animals.

Pulse rate and SpO<sub>2</sub> are measured by a NONIN-branded PureLight<sup>®</sup> lingual clip sensor, provided with the system. It is essential to only use the accessories and replacement parts recommended by Medair. Refer to the Accessories List in Chapter 6 for further information.

**PulseSense Vet** alarms both audibly and visually when set limits are exceeded. Limits can easily be adjusted using the touch panel display. The operator can pause or resume the alarm by activating the audible alarm pause button.

**PulseSense Vet** is equipped with a touch panel display where all settings and adjustments are made. The touch panel display also shows battery status and fault messages. The only buttons on the monitor are placed on the right hand side of the front panel and are the On/Off button and the audible alarm pause button. Next to these buttons there is a small charging indicator that will turn green as soon as the monitor is connected to the power outlet. **PulseSense Vet** can be operated on battery for approximately 15 – 18 hours without being plugged into a power outlet.

## ***About Pulse Oximetry***

Pulse Oximetry is a non-invasive method that passes red and infrared light through perfused tissue and detects the fluctuating signals caused by arterial pulses. Well-oxygenated blood is bright red, while poorly oxygenated blood is dark red. The pulse oximeter determines functional oxygen saturation of arterial hemoglobin (SpO<sub>2</sub>) from this color difference by measuring the ratio of absorbed red and infrared light as the volume fluctuates with each pulse.

## ***Operator Requirements***

The concept of **PulseSense Vet** is simplicity in combination with accurate measurements. Even though the **PulseSense Vet** monitor is easy to operate it is necessary for each operator to read this manual before using the monitor. **PulseSense Vet** should only be operated by a qualified professional.

# Chapter 2

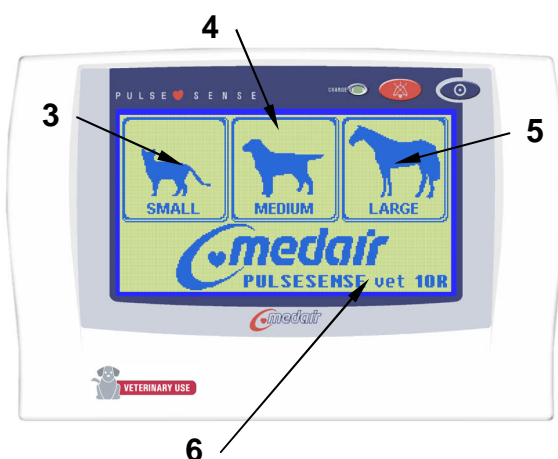
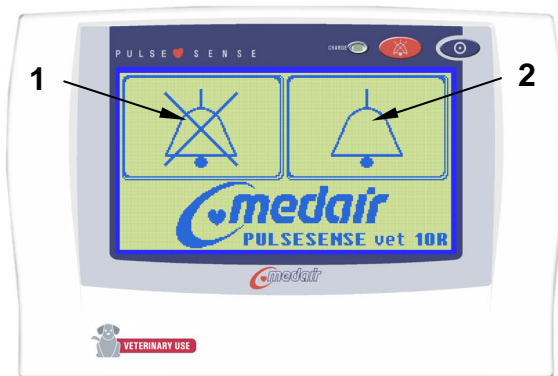
## Description of Components

A standard **PulseSense Vet** set-up consists of a monitor, a NONIN-branded PureLight® Lingual clip sensor (2000SL), a 1 meter extension cable (UNI-EXT-1) and a battery charger (A41208G 230V). It is shipped in a specially designed case. See the Accessories list in Chapter 6 for information on optional accessories.

### Monitor Front View

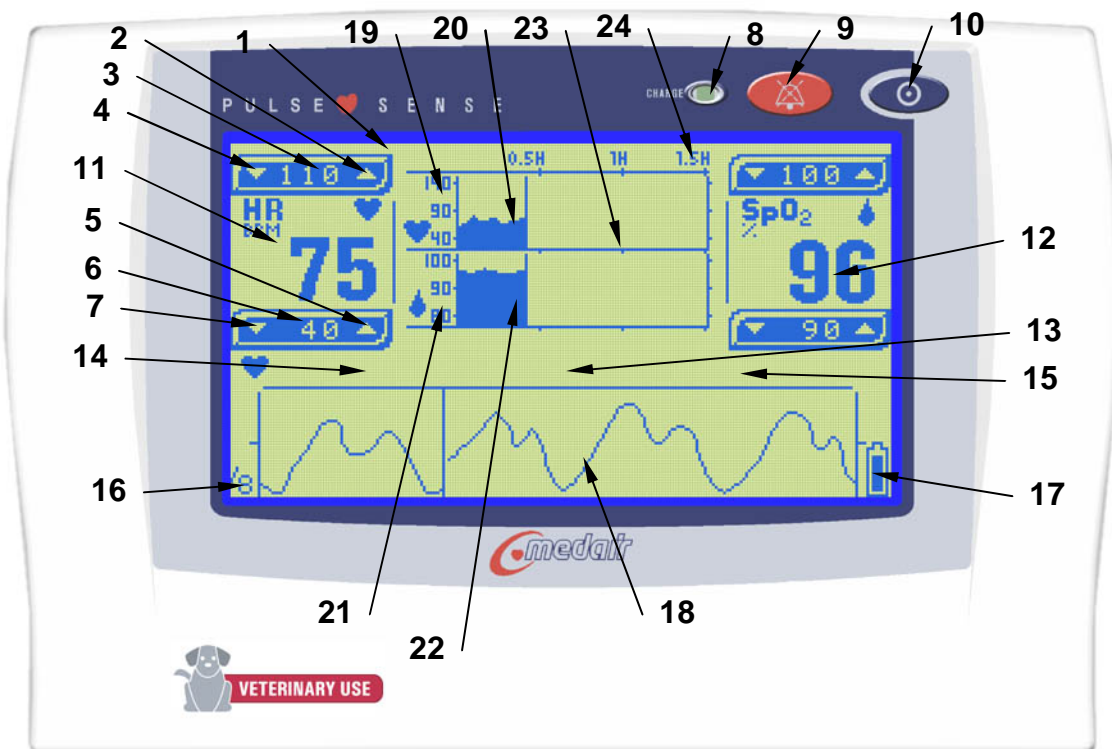
All operator settings are made using the touch panel display on the monitor. The components and functions used and displayed on the front panel of the monitor are shown in the figures below. Names and descriptions of each component are listed in the tables below.

#### 1) Start-up Screens






No	Name	Description
1.	Audible Alarm Silence Icon	Icon for selecting alarms off (disables audible alarms by setting all lower limits to 0)
2.	Alarms on Icon	Icon for selecting alarms on. Default if no icon is chosen.
3.	Small Animal Icon	Icon for selecting alarm limits for a small animal, like a cat. See factory settings under Chapter 5, Settings for more information.
4.	Medium Animal Icon	Icon for selecting alarm limits for a medium sized animal, like a dog. See factory settings under Chapter 5, Settings for more information. Default if no icon is chosen.
5.	Large Animal Icon	Icon for selecting alarm limits for a large animal, like a horse. See factory settings under Chapter 5, Settings for more information.
6.	<b>PulseSense Vet</b> version	Shows PulseSense Vet version. If error occurs during start-up, an error number will be shown here and the monitor will alarm.

## 2) Operating Screen




No	Name	Description
1.	LCD Display	The LCD monitor displays parameters, graphs, menus and other information. It also functions as a touch panel from which all the operator defined settings are made.
2.	Button Increase Upper Alarm Limit	Button for increasing the upper alarm limit. There are 2 buttons for increasing the upper alarm limits. These are always above the parameter that the alarm limit is for. By pressing this button, the upper limit increases by 1 point until it reaches its predefined maximum value.
3.	Upper Alarm Limit	Upper alarm limit. There are 2 upper alarm limits. When the parameters are below the upper alarm limit settings they are treated as normal values. Values exceeding these limits activate alarm function, which is both audible and visual. The exceeded limit is also displayed as inverted blue and white figures if the alarm is silenced.
4.	Button Decrease Upper Alarm Limit	Button for decreasing the upper alarm limit. There are 2 buttons for decreasing the upper alarm limits. These are always above the parameter that the alarm limit is for. By pressing this button, the upper limit decreases by 1 point until it reaches its lower alarm limit value.

**Operating Screen, continued**

No	Name	Description
5.	Button Increase Lower Alarm Limit	Button for increasing the lower alarm limit. There are 2 buttons for increasing the lower alarm limits. These are always below the parameter that the alarm limit is for. By pressing this button, the lower limit increases by 1 point until it reaches the upper alarm limit value.
6.	Lower Alarm Limit	Lower alarm limit. There are 2 lower alarm limits. When the parameters are above the lower alarm limit settings they are treated as normal values. Values exceeding these limits activate alarm function, which is both audible and visual. The exceeded limit is also displayed as inverted blue and white figures if the alarm is silenced.
7.	Button Decrease Lower Alarm Limit	Button for decreasing the lower alarm limit. There are 2 buttons for decreasing the lower alarm limits. These are always below the parameter that the alarm limit is for. By pressing this button, the lower limit decreases by 1 point until it reaches 0.
8.	 Charge Indicator	The charge indicator is green whenever the battery charger is connected between the power outlet and <b>PulseSense Vet</b> . When there is no outlet power connected the indicator will remain off.
9.	 Audible Alarm Pause Button	Audible alarm function alerts the operator when preset limits are exceeded. The operator can temporarily disable the audible alarm by pushing the audible alarm pause button. Alarms are still indicated visually on the display when limits are exceeded, and on the status texts. If the alarm is paused it will remain inactive for approximately 2 minutes before it will reactivate again. The current alarm status is indicated visually on the LCD (See No 15; Alarm symbols in this table).
10.	 ON/OFF Button	This button turns the monitor ON or OFF. This button will also enable or disable the audible pulse beep function by depressing the ON/OFF button briefly. <b>Note:</b> depressing this button > 1 second will turn the monitor off. When enabled the audible pulse beep (tone) increases as the SpO <sub>2</sub> rate increases or decreases as the SpO <sub>2</sub> rate decreases. The default setting is OFF.
11.	HR	Displays the pulse rate parameter as beats per minute. The pulse rate is updated on the display after every pulse.
12.	SpO <sub>2</sub>	Displays oxygen saturation parameter (% SpO <sub>2</sub> ). The SpO <sub>2</sub> value is updated on the display after every pulse.

**Operating Screen, continued**

No	Name	Description
13.	Alarm Symbols 	Space for alarm symbols. No symbol means audible alarms are active. A bell with a cross of broken lines indicates that the audible alarm is paused. A bell with a cross of solid lines indicates that the audible alarm is disabled.
14.	Status Text	Shows alarm messages for the pulse oximeter. See alarms under Chapter 5 for more information.
15.	Status Text	Shows alarm messages for the battery. See alarms under Chapter 5 for more information.
16.	Plethysmograph Scale Factor	Displays a scale factor for the plethysmogram. Scale factor can be either /1, /2, /4 or /8.
17.	Battery Indicator	Displays the battery status. See Chapter 6 for more information.
18.	Pulse Oximetry Plethysmograph	Displays a graph giving information on the oximetry signal (plethysmograph). The signal displays 25 samples/second.
19.	Scale HR	Scale for pulse rate. The scale is fixed, and values are shown in beats per minute.
20.	Trend HR	Displays a trend graph of the pulse rate.
21.	Scale SpO <sub>2</sub>	Scale for SpO <sub>2</sub> . The scale is fixed, and values are shown in percent.
22.	Trend SpO <sub>2</sub>	Displays a trend graph of the SpO <sub>2</sub> values.
23.	Trend Time Scale	Timescale is presented in half hour segments.
24.	Trend Time	The total trend time is approximately 4 hours of volatile internal memory.

## Monitor Rear View

The equipment label is located on the rear side of **PulseSense Vet**. The items on the rear side of the monitor are shown in the figure below. Names and descriptions of each component are listed in the table below.



No	Name	Description
1.	Speaker	Output hole for internal speaker.
3.	Attachment Holes	Dedicated holes for attachment of a mounting bracket. See the accessories list in Chapter 6 for part number if a mounting fitting is required. 2 mm screws can be used if there is a need to attach the monitor in a fixed position.
4.	Equipment Label	The label contains model number, serial number, manufacturing date, manufacturer, CE-mark, "Read operator's manual" symbol and the Applied Part symbol. Every <b>PulseSense Vet</b> device has a unique serial number for identification. See Chapter 1, Equipment Symbols for description of the different symbols.

### Monitor Right Side View

Outputs and connections are located on the right hand side of the monitor as shown in the figure below. Names and descriptions of each component are listed in the table below.



No	Name	Description
1.	Serial Interface Output	For data transfer from <b>PulseSense Vet</b> to external devices. Use only by Medair specified accessories along with the <b>PulseSense Vet</b> .
2.	Power Inlet	Power inlet for the battery charger that is connected to the power outlet. Only use Medair specified chargers.
3.	SpO <sub>2</sub> Connector	Nonin-branded PureLight <sup>®</sup> veterinary pulse oximeter sensor connection for measuring oxygen saturation. Pulse oximeter sensors to be used with the device are specified under “Accessories” in Chapter 6. No other sensors may be used.

<b>Warning</b>	Use only NONIN-branded PureLight <sup>®</sup> veterinary pulse oximeter sensors. These sensors are manufactured to meet the accuracy specifications of the <b>PulseSense Vet</b> . Using other manufacturer’s sensors can result in improper pulse oximeter performance.
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# Chapter 3

## Installation

### Unpacking

**PulseSense Vet** is shipped in a shockproof case designed to protect the equipment. It is recommended that the equipment be stored in its case whenever it is not in use.

### Standard Kit



If you have ordered a standard kit your delivery should contain the following:

- 1 **PulseSense Vet** monitor
- 1 NONIN-branded Lingual clip sensor
- 1 NONIN-branded 1 meter Extension cable
- 1 AC/DC battery charger
- 1 Operator's Manual
- 1 Hard case

Unpack all accessories and check that everything is included in your shipment. Read the individual instructions for use provided with each accessory prior to use. Contact Medair or your Medair distributor if anything is missing or seems to be defective. Dispose of all waste material in accordance with the local, state, or national environmental regulations that apply.


After unpacking the monitor and accessories the **PulseSense Vet** is ready for use. Ensure the **PulseSense Vet** battery is fully charged by viewing the status of the battery indicator on the display panel after the battery charger is connected to the monitor and the power outlet.

### Stationary Use

- Place the monitor in a position so that you can see the display clearly.
- Connect the battery charger to the monitor by putting the small plug into the power inlet marked with  on the right hand side of the monitor. Plug in the other end of the power cable into a power outlet. The green charging indicator **CHARGE**  located on the front panel will light up as soon as the monitor is connected to the power outlet.




**Caution:** Prior to connecting **PulseSense Vet** to the battery charger and the power outlet be sure to check that the voltage and frequency rating on the battery charger are the same as the power outlet. If this is not the case, do not connect the monitor and battery charger to the power outlet.

Turn on **PulseSense Vet** by pressing the ON/OFF  button on the monitor and keep it pressed until you hear a beep.

## **Battery Operation**

Whenever there is a need for the monitor to be used portably, or if it is needed in environments where there is no power, the monitor can operate on battery; this will only be possible if the battery has been charged. Always plug in the battery charger as soon as possible for the monitor to be connected to a power outlet.

- Turn on **PulseSense Vet** by pressing the ON/OFF  button on the monitor and keep it pressed until you hear a beep. The battery symbol on the touch panel display shows the remaining battery capacity. Also, the charging indicator on the top right hand side of the monitor will not light up if the battery charger is not connected.
- Plug the **PulseSense Vet** battery charger into the power outlet as soon as there is no need for battery operation.

## **Mounting**

**PulseSense Vet** can be equipped with a mounting bracket and adjustable mounting clamp, intended to fit most poles and table edges. The mounting bracket is screwed onto the back side of the **PulseSense Vet** monitor. Contact Medair Technical Service to order a mounting bracket and adjustable mounting clamp. Order number can be found in the accessories list in Chapter 6.



**CAUTION:** Do not mount **PulseSense Vet** directly above the animal. If the monitor is mounted be sure to check that the adjustable mounting clamp is securely affixed.

# Chapter 4

## Pulse Oximeter Sensor

### **Indications for Use**

The NONIN-branded PureLight<sup>®</sup> veterinary oximeter sensors are designed to non-invasively measure oxygen saturation (%SpO<sub>2</sub>), pulse rate and plethysmographic pulse waves. Connect the veterinary pulse oximeter sensor (with the NONIN logo facing toward you) to the port located on the side of the monitor with the SpO<sub>2</sub> symbol. Ensure that the sensor is firmly plugged in. Position the appropriate sensor on the animal.

<b>Note:</b>	NONIN veterinary pulse oximeter sensors do not contain natural rubber latex.
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### **Applying the Sensor**

Choose the appropriate sensor for the animal that will be monitored.

#### **Lingual Sensor**




The easiest site for this sensor is the tongue. This sensor can be placed on the right side, left side, or the end of the tongue. After a few seconds verify a wave form is displayed; if the waveform is not displayed move the sensor to another site on the tongue and wait a few seconds until the waveform is displayed. Once the waveform is displayed, secure the sensor cable to ensure proper sensor placement.



**Remember** the sensor application site must be well perfused and not pigmented. On light colored animals (gray or lighter), try the Achilles tendon; shave the sensor application site and make sure the skin is not pigmented.

<b>Warning</b>	When selecting a sensor application site use an extremity without a catheter, blood pressure cuff or intravascular infusion line.
<b>Warning</b>	Use only NONIN-branded PureLight <sup>®</sup> veterinary pulse oximeter sensors. These sensors are manufactured to meet the accuracy specifications of the <b>PulseSense Vet</b> . Using other manufacturer's sensors can result in improper pulse oximeter performance.
<b>Warning</b>	Do not use a damaged sensor.

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<b>Warning</b>	Misuse or improper handling of the pulse oximeter sensor could damage the sensor or the cable which may lead to inaccurate readings. Never alter or modify the sensor since this also may affect the performance or accuracy.
	<b>Caution:</b> Inspect the pulse oximeter sensor application site periodically to ensure correct sensor alignment and skin integrity.
	<b>Caution:</b> Fluctuating or very bright light, moisture, blood pressure cuffs, infusion lines, venous pulsations, insufficient pulse signals, anemia, arterial catheters, may degrade the SpO <sub>2</sub> device's performance.
	<b>Caution:</b> The oximeter sensor might not work on cold extremities due to reduced circulation. Warm skin area to increase circulation, or reposition the sensor.


# Getting Started

## ***Preparations***

Visually inspect the monitor and make sure it has no visual signs of damage; examine the SpO<sub>2</sub> sensor for obvious defects. Ensure the sensor is clean if it has been previously used.

Connect the pulse oximeter sensor to the port located on the side of the monitor with the SpO<sub>2</sub> symbol. Use only NONIN-branded PureLight<sup>®</sup> pulse oximeter sensors. These sensors are manufactured to meet the accuracy specifications of the **PulseSense Vet**. Using other manufacturer's sensors can result in improper pulse oximeter performance. See the Accessories List in Chapter 6.

## ***Turn on the Monitor***

Turn on the monitor by pressing the ON/OFF  button and keep it pressed until you hear a beep.

The monitor starts by running a self-test (this only takes a few seconds) before the graphs and settings are displayed. Verify that the graphs and settings are displayed on the touch panel screen.

## ***Check the Alarm Limits***

Adjust alarm limits for each animal. If appropriate, use the factory default settings that are programmed at start-up. All settings are adjusted directly on the touch panel display. Refer to Chapter 5 for instructions on how to change alarm limits.

<b>Note</b>	The audible alarm is paused for approximately 2 minutes unless activated by the operator. This gives the operator a chance to verify and adjust the connections and alarm limits.
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***Up and Running***

The audible alarm function activates approximately 2 minutes after start up, which means that the monitor is now ready for use. The animal can stay connected to the monitor for as long as needed.

<b>Contraindication</b>	Do not use <b>PulseSense Vet</b> during defibrillation.
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<b>Warning</b>	<b>PulseSense Vet</b> is intended for <b>VETERINARY USE ONLY</b> . It must be used in conjunction with other methods of assessing clinical signs and symptoms.
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## End of procedure

***Disconnect the animal***


Turn off the monitor using the ON/OFF  button and disconnect the animal.

<b>Note</b>	If the monitor is ON and there is no animal connected, the alarm will be activated.
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# Chapter 5

## Settings

### *Touch Panel Display*

All adjustments and settings are made using the touch panel display on the **PulseSense Vet**. Each specific parameter is adjusted by using the up/down arrows  on the display bar.

### *Factory Default Settings*

**PulseSense Vet** always recalls and displays the factory default settings upon start-up. At the start-up screen the operator can select from 3 different default settings (only if alarms are activated on first start-up screen). Adjust settings according to each animal's needs. The factory settings are:

Parameter	Small animal selected	Medium animal selected (default)	Large animal selected
HR upper limit	200 beats per minute (BPM)	180 beats per minute (BPM)	150 beats per minute (BPM)
HR lower limit	60 beats per minute (BPM)	50 beats per minute (BPM)	40 beats per minute (BPM)
SpO <sub>2</sub> upper limit	100 %	100 %	100 %
SpO <sub>2</sub> lower limit	85 %	90 %	90 %



**Caution:** Before each use, it is the operator's responsibility to verify that the alarm limits are appropriate for the animal being monitored.

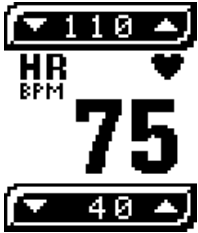
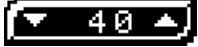


**Caution:** Do not cover or block speaker opening; this may significantly reduce the sound volume.



## Alarm Limits

All parameters have built in limits that cannot be exceeded.



### Pulse limits

	← Upper limit range: 450 (beats per minute)
	← Lower limit range: 0 (beats per minute)

### SpO<sub>2</sub> limits

	← Upper limit range: 100 (%)
	← Lower limit range: 0 (%)

## Changing Settings

All settings follow the same procedure to increase or decrease an alarm limit. The arrow  located on the right side of a displayed parameter bar allows the alarm limits to be increased and the arrow  on the left side of the displayed parameter bar allows the alarm limit to be decreased. The upper alarm limit is always located above the displayed value, and the lower limit is displayed below.

### Procedure for changing upper/lower alarm limits

Push to decrease upper limit →		← Push to increase upper limit
Push to decrease lower limit →		← Push to increase lower limit

Each time an arrow is pushed it will increase or decrease the alarm limit in single digits until reaching the limit range.

<b>Note</b>	The monitor will always reset the alarm limits to the factory default settings once it is turned off and turned on again.
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# Alarms

## Alarm Function

The alarm is activated under certain conditions, such as if an alarm limit is exceeded, if there is no animal connected or if an equipment fault has occurred.

The alarm is both visual (a blinking parameter, digit, or a message) and audible (beeper tones at different intervals).

## Alarm Silence

The operator can silence the audible alarm by pressing the audible alarm pause button . The audible alarms will stay deactivated for approximately 2 minutes but the visual alarms will remain active until the condition is corrected. The operator can always decrease  or increase  the alarm limit settings for individual animals. If alarm limits are set to zero for the pulse oximeter, alarms will be disabled until alarm limits are set higher. The alarm off icon  will appear on the touch panel display.

## High Priority Alarm

A high priority alarm calls for immediate action from the operator. The alarm will occur if any of the parameters exceed operator defined or default alarm limits. High priority alarms are both audible and visually indicated. The audible alarm beeps faster in high priority situation than in low priority situation. The visual alarm is indicated by the flashing of the value and the exceeded alarm parameter setting.

The following table shows the high priority alarm parameter and their causes.

Parameter	Cause of alarm
Pulse	Exceeds the high limit setting
Pulse	Outside the low limit setting
SpO <sub>2</sub>	Exceeds the high limit setting
SpO <sub>2</sub>	Outside the low limit setting



### Low Priority Alarm

A low priority alarm indicates that an equipment fault has occurred and is unable to provide a reliable measurement value. See the table below for parameters, fault messages and possible cause.

Low priority alarms are also both audible and visible with a slower beep frequency and the monitor will display a fault message. The table below shows possible fault messages and possible causes. See Chapter 6 – Trouble Shooting for further information of possible causes and remedies.

Parameter	Message	Possible Cause
Pulse oximetry	NO PROBE	The sensor is not connected to the monitor.
Pulse oximetry	CHECK SITE	The sensor is not connected to the tongue.
Pulse oximetry	ARTIFACT	A questionable pulse was detected
Pulse oximetry	NO OXIMET	No communication from the pulse oximetry unit. Possibly due to a sensor error.
Pulse oximetry	SIGNAL LOW	Hard to detect a pulse. Verify perfusion status at the sensor application site, minimize motion, and verify that there is not excessive ambient light.
System	BATT LOW	Battery is almost depleted.
System	DISP ERROR	The touch panel display is not working properly.

### Disable Alarm

It is possible to disable the audible alarms either by selecting the alarm off icon  on the start-up screen or by decreasing all lower limit settings to 0. When audible alarms are disabled, this will be visually indicated on the display screen by the alarm off icon .


# Chapter 6

## Maintenance and Inspection


### **Battery Operation**

**PulseSense Vet** is designed to operate continuously using a power outlet or on battery for approximately 15 – 18 hours. As soon as **PulseSense Vet** is disconnected from the outlet, and is ON, it automatically runs on battery.

### **Charging the Battery**

The battery is rechargeable and charges itself whenever the monitor is connected to a power outlet, even when the monitor is turned off. The green charge indicator **CHARGE**  on the front panel of the monitor indicates the monitor is connected to a power outlet. Always connect **PulseSense Vet** to an outlet whenever it is not in use. Recharging a depleted battery takes approximately 17 hours. To maximize battery capacity for monitoring you can use this rule: one hour of monitoring needs approximately one hour of charging time.

### **Checking Battery Capacity**

The touch panel display shows a battery symbol  indicating battery capacity. Approximate battery capacity is defined by the battery symbols below:



A filled battery symbol indicates that the monitor can be used for approximately 15 – 18 hours.



A depleted symbol indicates that the battery has run out of power and needs recharging immediately.

### **Battery Message**

**PulseSense Vet** displays a **LOW BATTERY** message when the battery is almost depleted. This gives the operator approximately 15 minutes of use or time to plug in the monitor before it switches itself off.

### **Battery Care**

The battery is made of Lithium Ion (Lion) rechargeable cells and requires no maintenance. The battery is integral to the device and cannot be replaced by anyone other than Medair Technical Service. Check the remaining capacity of the battery by running a fully charged battery down to depletion.


<b>Note</b>	When a fully charged battery allows for only 3 to 5 hours of operation it needs to be replaced. Contact Medair Technical Service for battery replacement.
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# Maintenance

## ***Ensuring Optimal Performance***

In order to ensure safety and optimal performance of **PulseSense Vet** it is necessary to carry out recommended maintenance and inspections. See the section on recommended inspections in this chapter.

	<b>CAUTION:</b> Always turn off and unplug the monitor prior to changing or cleaning the Nonin-branded PureLight <sup>®</sup> lingual sensor.
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	<b>CAUTION:</b> Always store or ship the device in its case to avoid accidental damage.
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## ***Cleaning the Sensor***

Clean the NONIN-branded PureLight<sup>®</sup> veterinary reusable sensor with a soft cloth moistened with isopropyl alcohol. Allow the sensor to dry completely after cleaning. Refer to individual sensor Instructions for Use for details.

## ***Cleaning the Monitor***


Clean the Medair **PulseSense Vet** monitor with a soft cloth moistened with isopropyl alcohol. Allow the monitor to dry completely after cleaning.

	<b>CAUTION:</b> Do not sterilize, autoclave or use caustic or abrasive cleaning agents on the <b>PulseSense Vet</b> monitor or sensors. Do not immerse in liquids. Do not disassemble the moisture trap.
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## Recommended Inspections

### Functional Check


Before each use verify the equipment is clean and in optimal operating condition, if needed, wipe the surface of the monitor with isopropyl alcohol.

	<b>Caution:</b> Always turn off and unplug the monitor prior to changing or cleaning the Nonin-branded PureLight <sup>®</sup> lingual sensor.
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Verify battery capacity by turning on the monitor.

	<b>Caution:</b> Do not operate <b>PulseSense Vet</b> while charging a depleted battery. This may cause permanent damage to the monitor. Charge the battery prior to operating the monitor.
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Always verify the reusable lingual clip sensor is clean, if previously used. Visually examine the reusable accessories for defects prior to use.

Turn on the monitor by pressing the ON/OFF  button and keep it pressed until you hear a beep.


Verify that all parameters are displayed correctly and adjust any alarm limits according to the animal.

Verify alarm function/status by simulating alarm situations for all parameters.

<b>Warning</b>	If the <b>PulseSense Vet</b> fails to respond as described, discontinue use and contact Medair Technical Service.
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<b>Warning</b>	Never allow liquids to enter into or be spilled onto the monitor. If liquid has penetrated the monitor it must be checked by Medair Technical Service.
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<b>Warning</b>	<b>PulseSense Vet</b> is intended for <b>VETERINARY USE ONLY</b> . It must be used in conjunction with other methods of assessing clinical signs and symptoms.
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	<b>Caution:</b> Always store and ship the device in its case to avoid accidental damage.
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***Yearly Inspection***

A comprehensive inspection should be carried out annually by Medair Technical Service to ensure optimal performance of **PulseSense Vet**. Contact Medair Technical Service for return authorization instructions.



**Caution:** Never open the monitor housing/case. By opening the case you will invalidate the warranty.

## Trouble Shooting

### ***Fault Messages***

**PulseSense Vet** has built-in self-diagnostics for detection of fault conditions. Detected fault conditions are presented as messages on the touch panel display. The fault conditions are either operator or system generated. The table below lists common messages, descriptions and advice on actions to take; if the problem persists contact Medair Technical Service.

<b>Fault</b>	<b>Description</b>	<b>Remedy</b>
NO PROBE	<p>The sensor is not connected to the monitor.</p> <p>The sensor is damaged.</p>	<p><b>Check</b> all sensor connections between animal and the monitor.</p> <p><b>Check</b> sensor for damage. <b>Replace</b> if necessary.</p>
CHECK SITE	<p>The sensor is not connected to the animal, or</p> <p>The sensor is damaged.</p>	<p><b>Check</b> sensor application site.</p> <p><b>Check</b> sensor for damage. <b>Replace</b> if necessary.</p>
ARTIFACT	A detected pulse beat did not match the detected pulse interval.	<b>Check</b> the sensor application site; reapply sensor to another site, if necessary.
BATT LOW	The monitor will run for approximately 15 minutes.	<p>Plug the power cable into a power outlet and charge the batteries for 17 hours. If the monitor continues to show BATT LOW message after recharging, contact Medair Technical Service, as the battery may need replacement. The battery is integral to the device and cannot be replaced by the operator itself.</p>





Fault	Description	Remedy
Continuous beeping sound	<p>The alarm beeps continuously.</p> <p>The monitor is non-functioning in this state. This indicates that a problem has occurred, possibly due to interference or loss of power.</p>	<p><b>Turn off</b> the monitor and then <b>turn on</b> again.</p> <p><b>Recharge</b> the monitor with the battery charger.</p> <p>If the problem persists, <b>contact</b> Medair Technical Service.</p>
NO OXIMET	<p>The sensor is damaged.</p> <p>An internal pulseoximetry fault has occurred.</p>	<p><b>Check</b> sensor for damage. <b>Replace</b> if necessary.</p> <p><b>Turn off</b> the monitor and then <b>turn on</b> again.</p> <p>If the problem persists, <b>contact</b> Medair Technical Service.</p>
FLASH CHECKSUM ERROR on the display screen	<p>An internal memory fault has occurred.</p>	<p><b>Turn off</b> the monitor and then <b>turn on</b> again.</p> <p>If the problem persists, <b>contact</b> Medair Technical Service.</p>

## Accessories





### List of Accessories

**PulseSense Vet** is designed to be used with Medair recommended accessories only. Use of other brands will compromise the function and performance. The following list of accessories can be ordered from Medair or your distributor. Medair may update the accessories list at any time. It is the purchaser's responsibility to always ask for the current list, by model number, when ordering accessories.

### Pulse Oximeter Accessories

Item	Description	Order no
	<b>Small Lingual Sensor, Vet</b> Lightweight, ultra-sensitive clip-on sensor for tongue application or paw pad, and well-vascularized areas, as appropriate. 1 meter cable length.	<b>2000SL</b>
	<b>Small Animal Sensor, Vet</b> Flexible wrap sensor for placement on the toe (dog, large animal) or base of tail, or foot (small animal). 1 meter cable length.	<b>2000SA</b>
	<b>Animal Transflectance Sensor, Vet</b> Convenient sensor of placement on the underside, base of the tail or other well-vascularized surfaces. 1 meter cable length.	<b>2000T</b>
	<b>Sensor extension cable</b> 1 meter sensor extension cable.	<b>UNI-EXT-1</b>

## Monitor Accessories

Item	Description	Order no
	<p><b>Battery charger</b> 230 VAC, 50 Hz (Europe)</p> <p><b>Battery charger</b> Approximately 120 VAC, 60 Hz (USA)</p>	<p><b>A41208G</b></p> <p><b>A41209G</b></p>
	<p><b>Emergency Bag</b> Protective emergency bag in which the monitor still can be fully connected without removing the bag. Perfect for field- and portable use where the monitor might be needed instantly.</p>	<p><b>LS1-020</b></p>
	<p><b>Monitor Mounting Bracket</b> Connector that enables adjustable mounting and hospital standard mounting. Delivered with 6 screws for connection on the backside of the monitor.</p>	<p><b>LS1-013</b></p>
	<p><b>Adjustable Mounting Clamp</b> Mounting for hospital rails, 10 – 30 mm diameter poles (as beds, IV-poles and ambulance) and table edges.</p>	<p><b>LS1-018</b></p>

# Chapter 7




## Technical Information

### **Working Environment**

The equipment must only be used in situations which fulfil the specified environmental conditions. Refer to device specification in this chapter.

### **Storage Environment**

When **PulseSense Vet** is stored or not used for a long period of time it can be stored safely in its original shipping case. The same applies if it needs to be shipped or sent for service. Refer to device specification in this chapter.

	<b>Caution:</b> Allow sufficient time for <b>PulseSense Vet</b> to adapt to normal room temperature before you start using it, if it has been stored in cold temperatures.
	<b>Caution:</b> Never store or transport <b>PulseSense Vet</b> where condensation can occur. However if this has been done, wait until all condensation has evaporated before using <b>PulseSense Vet</b> .
	<b>Caution:</b> If <b>PulseSense Vet</b> is intended to be stored for longer periods of time always charge the battery to full capacity before storing it in order to prevent damage to the equipment.

### **Power Requirements**

Power ratings	Unit
Rated supply voltages or voltage ranges for the battery charger	
- Europe	230 VAC / 50 Hz
- US	120 VAC / 60 Hz
Input voltage to <b>PulseSense Vet</b> from the battery charger	12 VDC, 800mA

<b>Warning</b>	The use of accessories, sensors and cables other than those specified in this manual may result in increased emission and/or decreased immunity of this device. See the Accessories List in Chapter 6.
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## Specifications

<b>Power Data</b>	Battery charger:	230 VAC, 50 Hz for Europe 120 VAC, 60 Hz for USA
	Power consumption:	3.6 W at battery operation 12 W with battery charger
	Input:	12 VDC, 800mA
<b>Battery Data</b>	Type:	Lithium ion (Lilon) internal battery, non-replaceable, rechargeable
	Battery capacity:	15 – 18 hours approximately
	Charging time:	17 hours approximately, or 2 hours for each hour of use
	Expected lifetime:	1 Year minimum
<b>Physical Data</b>	Dimensions:	200 x 135 x 50 mm (7.9 x 5.3 x 2 inches)
	Weight:	800 gram (1.8 lbs)
<b>Operation</b>	Working temperature:	20° – 50°C (-4° – 122°F)
	Humidity:	10 – 90% (non-condensing)
	Atmospheric pressure:	860 – 1060 hPa
<b>Storage</b>	Storage temperature:	-20° – 50°C (-22° – 122°F)
	Humidity:	10 – 90% (non-condensing)
	Atmospheric pressure:	Up to 4 atmosphere (110-4050 hPa)
<b>Alarms</b>	Sound pressure level:	65 dBa maximum at 1m in front of monitor
<b>Classification per IEC 60601-1</b>	Type of Protection:	Internally powered class II (with battery charger)
	Degree of Protection:	Type BF-Applied Part
	Mode of Operation:	Continuous
	Enclosure Degree of Ingress Protection:	IPX1

***Pulse Oximeter Specifications***


<b>Displayed Oxygen Saturation Range (SpO<sub>2</sub>)</b>	0 to 100%
<b>Displayed Pulse Rate Range</b>	18 to 450 beats per minute
<b>Measurement Wavelengths using NONIN-branded PureLight<sup>®</sup> Sensors</b>	Red: 660 nanometers, 1.2mW max average Infrared: 910 nanometers, 0.8 mW max average
<b>Saturation Accuracy (A<sub>rms</sub>)</b>	70-100% ± 2% of full scale using Nonin clip sensor.

### Manufacturer's Declaration

The following tables provide information regarding the device's compliance to IEC 60601-1-2:2001.

Table 1: Electromagnetic Emissions		
Emissions Test	Compliance	Electromagnetic Environment—Guidance
<i>This device is intended for use in the electromagnetic environment specified below; the user of this device should ensure that it is used in such an environment.</i>		
RF Emissions CISPR 11	Group 1	This device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11	Class B	This device is suitable for use in all establishments, including domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions IEC 61000-3-2	Pass	
Voltage Fluctuations/ Flicker Emissions IEC 61000-3-3	Pass	

Table 2: Electromagnetic Immunity			
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment—Guidance
<i>This device is intended for use in the electromagnetic environment specified below; the user of this device should ensure that it is used in such an environment.</i>			
Electrostatic Discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical Fast Transient/Burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV for common mode	± 1 kV differential mode ± 2 kV for common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	± 5% $U_T$ (>95% dip in $U_T$ ) for 0.5 cycle ± 40% $U_T$ (60% dip in $U_T$ ) for 5 cycles ± 70% $U_T$ (30% dip in $U_T$ ) for 25 cycles ± 5% $U_T$ (>95% dip in $U_T$ ) for 5 cycles	± 5% $U_T$ (>95% dip in $U_T$ ) for 0.5 cycle ± 40% $U_T$ (60% dip in $U_T$ ) for 5 cycles ± 70% $U_T$ (30% dip in $U_T$ ) for 25 cycles ± 5% $U_T$ (>95% dip in $U_T$ ) for 5 cycles	Mains power quality should be that of a typical commercial or hospital environment. If the user of the device requires continued operation during power mains interruptions, it is recommended that the device be powered from an uninterruptible power supply or battery pack.
Power Frequency (50/60 Hz) Magnetic Field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
<b>Note:</b> $U_T$ is the AC mains voltage before application of the test level.			

Table 3: Guidance and Manufacturer's Declaration—Electromagnetic Immunity			
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment—Guidance
<p><i>This device is intended for use in the electromagnetic environment specified below; the user of this device should ensure that it is used in such an environment.</i></p>			
<p>Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p>			
<p>Conducted RF IEC 61000-4-6</p> <p>Radiated RF IEC 61000-4-3</p>	<p>3 Vrms 150 kHz to 80 MHz</p> <p>3 V/m 80 MHz to 2.5 GHz</p>	<p>[3] V</p> <p>[3] V/m</p>	<p><b>Recommended Separation Distance</b></p> <p><math>d = 1.17 \sqrt{P}</math></p> <p><math>d = 1.17 \sqrt{P}</math> 80 MHz to 800MHz</p> <p><math>d = 2.33 \sqrt{P}</math> 800MHz to 2.5 GHz</p> <p>where <math>P</math> is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and <math>d</math> is the recommended separation distance in meters (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,<sup>a</sup> should be less than the compliance level in each frequency range.<sup>b</sup></p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 
<p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>At 80 MHz and 800MHz, the higher frequency range applies.</li> <li>These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.</li> </ul>			

- a) Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the device is used exceeds the applicable RF compliance level above, the device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the device.
- b) Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [3] V/m.

**Table 4: Recommended Separation Distances**

*This device is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. Users of this device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication equipment (transmitters) and the device as recommended below, according to maximum output power of the communications equipment.*

Rated Maximum Output Power of Transmitter W	Separation Distance According to Frequency of Transmitter		
	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	0.37	0.37	0.74
1	1.2	1.2	2.3
10	3.7	3.7	7.4
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance  $d$  in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where  $P$  is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

**Notes:**

- At 80 MHz and 800MHz, the separation distance for the higher frequency range applies.
- These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

## Manufacturer

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Your distributor:

## QUICK STEP with PulseSense Vet LS1P-10R



### To start

1. Visually inspect the monitor and pulse oximeter sensor to make sure it has no visual signs of damage. Make sure that the NONIN-branded PureLight<sup>®</sup> reusable lingual clip sensor is clean, if previously used.
2. For AC power, plug the **PulseSense Vet** battery charger into a power outlet.
3. Connect the pulse oximeter sensor to the connector on the monitor's side with the SpO<sub>2</sub> symbol.
4. Place the animal in a resting position; apply the NONIN-branded PureLight<sup>®</sup> lingual clip sensor.
5. Turn on the monitor with the ON/OFF  button. Keep it pressed until you hear a beep.
6. Verify that all parameters are displayed. Adjust alarm limits according to the animal.


### Alarm

-  Change Settings - Increase alarm limits with . Decrease with .
- High priority alarm - Check the animal status and take necessary medical action.
-  Audible alarm pause button – Pause/activate the audible alarm. It will stay turned off for approximately 2 minutes.

### Battery

-  Indicates remaining battery capacity.
- **PulseSense Vet** can run on battery for approximately 15 – 18 hours, when fully charged.
- The green light indicator CHARGE  comes on as soon as the monitor is connected to the power outlet and also indicates that the battery is being charged.

### When finished

1. Turn off the monitor with the ON/OFF  button.
2. Disconnect the pulse oximeter sensor from the animal.
3. Plug the **PulseSense Vet** into a power outlet to charge the battery.



Prior to using **PulseSense Vet** it is necessary for each user to read the Operator's Manual.