VM-2160 SMARTsat and OEM Boards – Technical Training

What is pulse oximetry?

Pulse oximetry, also known as **SpO2**, is the peripheral capillary oxygen saturation, which is an estimate of the amount of oxygen in the blood.

It is a measure of how efficiently blood is carrying oxygen around the body and is one of the **vital signs** measured by clinicians.

Specifically, SpO2 is the percentage of oxygenated **haemoglobin** compared to the total amount of haemoglobin in the blood.

Haemoglobin is a molecule present in red blood cells that readily bonds with and releases oxygen, allowing it to transfer oxygen from the lungs around the body.
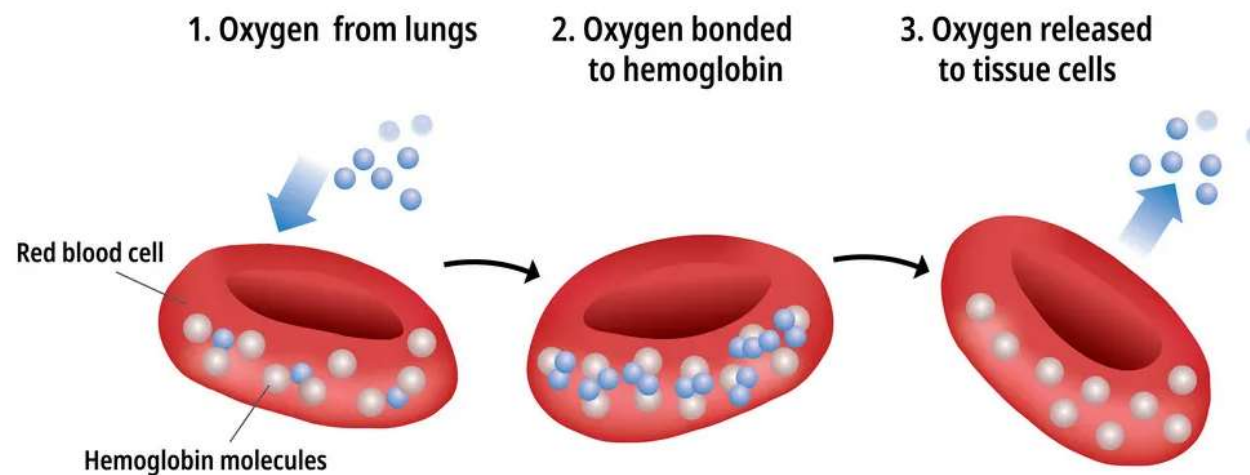
How do we measure SoO2?

We can measure SpO2 using a **pulse oximeter**, which measures the oxygen saturation using a sensor attached to the patient.

It is measured at the extremities, most commonly the index finger, but also on the ear lobe, the big toe or the whole foot of a newborn.

A pulse oximeter displays the percentage of haemoglobin saturated with oxygen, together with the heart rate. Some models display a graphical representation of the blood flow at the measurement site, known as a **plethysmograph** or **pleth waveform**.

Different types of pulse oximeter

There are varying levels of pulse oximeter, from high-performance table-top devices, through hand-held devices, compact finger oximeters, and for consumer use, watches and smart phones that can measure SpO2.
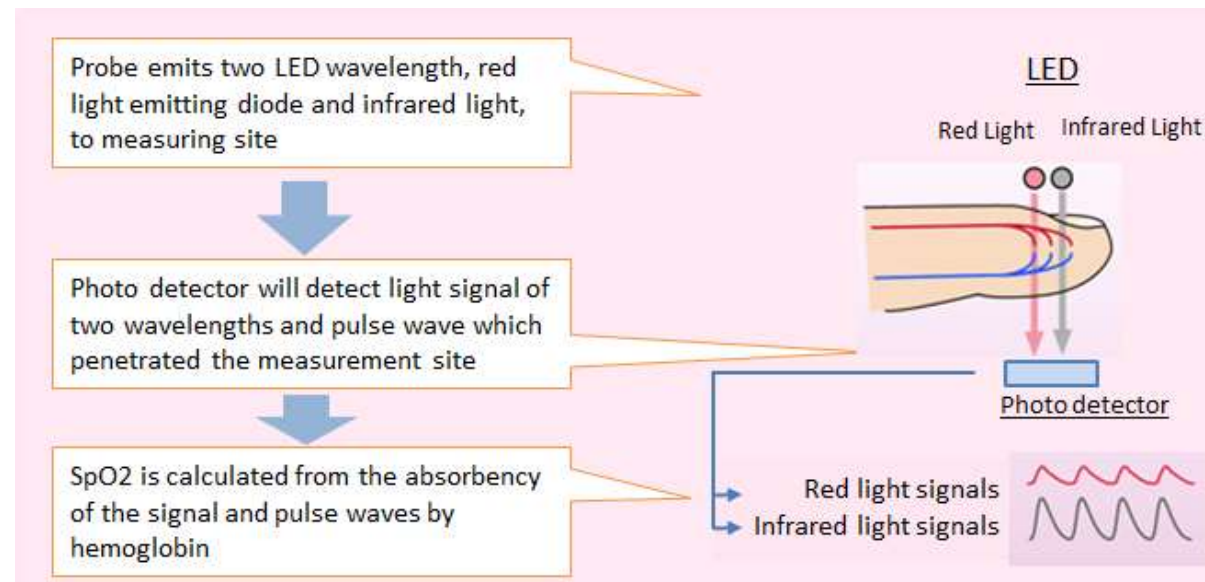
How does pulse oximetry work?

With each heartbeat, a pulse of oxygenated arterial blood flows to the sensor site. Oxygenated haemoglobin differs from deoxygenated haemoglobin in the way that it absorbs red and infra-red light.

A pulse oximetry sensor uses an LED emitter to shine red and infra red light through the measurement site and a detector on the opposite side measures the intensity of light that comes through at each wavelength.

Using known ratio curves of red to infra-red and their relationship to oxygen levels (**r-curves**), the pulse oximeter is able to determine how much of each wavelength of light has been absorbed, and hence the amount of oxygen in the blood.

Probe emits two LED wavelength, red light emitting diode and infrared light, to measuring site

Photo detector will detect light signal of two wavelengths and pulse wave which penetrated the measurement site

SpO2 is calculated from the absorbency of the signal and pulse waves by hemoglobin

LED

Red Light   Infrared Light

Photo detector

Red light signals
Infrared light signals

In simple terms: **oxygenated blood appears redder.**

Viamed VM-2160 SMARTsat pulse oximeter

Hand-held pulse oximeter that can be used for spot checking or constant monitoring of SpO2 and pulse rate.

VM-2160 SMARTsat

Features

- Colour OLED display.

- A range of different sensors can be connected to the device:

  Adult Silicone Finger Sensor
  Medium (Small Adult) Silicone Finger Sensor
  Paediatric Silicone Finger Sensor
  Silicone Wrap Sensor
  Ear Sensor
  Hard Shell Finger Sensor
  Disposable plaster sensors

- Includes a SMARTsat adult soft silicone sensor, a different reusable sensor can be specified at the point of purchase.

- Adjustable high and low alarms on SpO2 and pulse rate.

- The SMARTsat algorithm offers excellent motion tolerance for better accuracy.

- Can be mounted on a range of V-mounts, e.g. pole clamp, rail clamp or wall mount. This requires a mounting kit, p/n 0022171, which is supplied separately.

- Stores and restores up to 560 hours of trend data, which can be uploaded to a PC using the software provided.
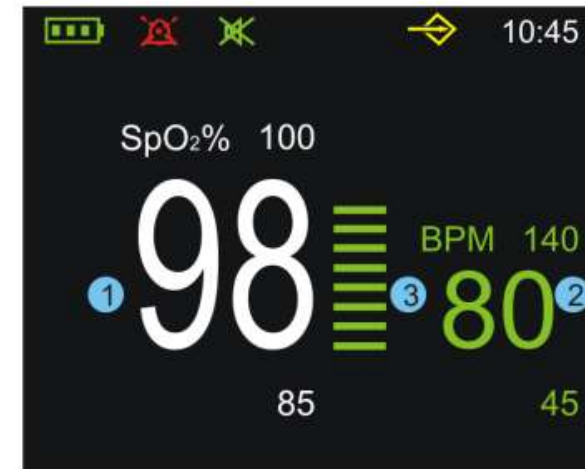
- Includes:

  1 x Reusable Sensor
  1 x Windows PC Software
  1 x USB Data Cable
  1 x Silicone Protective Cover
  3 x AA batteries

Display modes

The operator can toggle between various display modes by pressing the display button.


Display 1

Display 2

1. The SpO2 value shows the blood oxygen saturation level expressed as a percentage. The small numbers shown immediately above and below the measured value on the right side indicate the upper and lower alarm limits.

2. Pulse rate in beats per minute. The small numbers immediately above and below the measured value on the right side indicate the upper and lower alarm limits.

3. Bar graph for pulse amplitude. Indicates the dynamic pulse amplitude and rate. As the detected pulse becomes stronger, more bars light with each pulse. The colour of the bar graph is an indicator for signal quality going from green (good signal quality) to yellow (average signal quality) and red (poor signal quality).

4. Pulse waveform (plethysmogram). The reading is automatically adjusted to the pulse strength; therefore, a waveform of good amplitude should be visible at all times.

Display 3 to 5: Trend
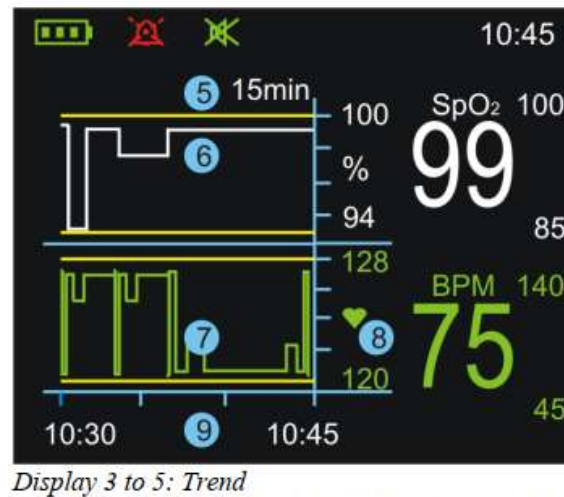
5. Time-interval of trends. Can be viewed as 15, 30 or 240 minutes.

6. Trend waveform for SpO2 with continuous upper and lower alarm limits in yellow

7. Trend waveform for pulse rate with continuous upper and lower alarm limits in yellow

8. Pulse indicator

9. Start and end times

Alarms

The alarm limits for SpO2 and pulse rate can be set individually. The current alarm limits are shown as small numbers above and below the measured values on the right side. If a measured value either exceeds the upper limit or falls below the lower limit, visual and audible alarms will be triggered immediately.

When an alarm has been triggered, the critical value will turn yellow together with the violated alarm limit and the critical value flashes.

An alarm will also be triggered if the sensor is removed from the application site, if the signal remains poor over a long period of time or if the sensor is disconnected from the device, provided that valid measurement data has been recorded beforehand.

Alarm Settings

The upper and lower alarm limits of the SpO2 and pulse rate can be set by the user. They can also be deactivated but after restarting the device, the default alarm limits will be reset.

Recording Data

The VM-2160 SMARTsat can store more than 560 hours of monitoring data in up to 50 data sets.

Each individual data set, regardless of its actual length, uses at least 15 minutes of memory space.

A new data set is generated automatically each time the device is turned on. All of the measurements that were taken are automatically stored in the devices memory, together with the respective alarm limits, date and time.

The device warns the user when the memory is almost full by displaying the ⬦ symbol.

A maximum of 50 data sets can be stored in the memory. After this maximum has been reached the oldest data set is overwritten upon confirmation by the user.

Stored data sets can be retrieved and erased under 'Data Management' in the menu. The data sets can be stored and processed with the VM-2160 PC-Software.
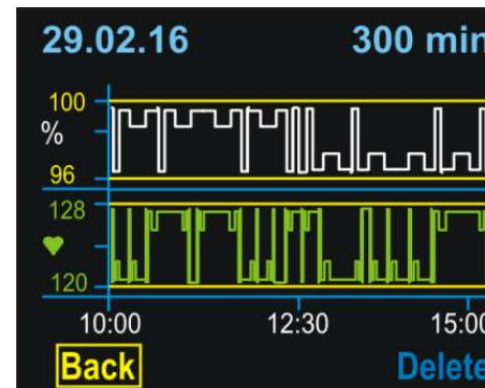
Stored data will not be erased when the batteries are removed temporarily.

Default Start Settings

Changed settings are in effect only as long as the monitor remains on. Once the monitor has been turned off, at the next start up the default settings will be in effect.

The start-up defaults can be changed in the PIN protected Service Menu. Only authorized service personnel are given access to PIN.

Power-Save Mode

The display can be turned off to save power and extend battery life.

This can be accomplished by holding the down arrow button. A countdown will start, after 3 seconds the display will be switched off.
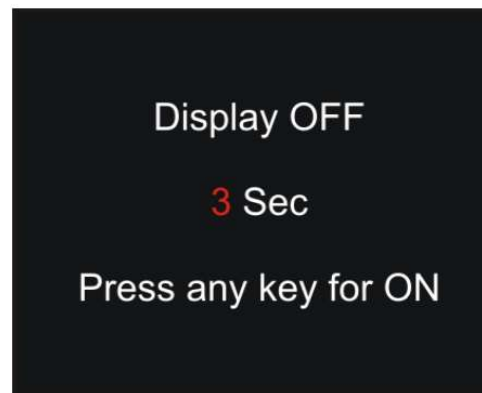
The device is now in economy power mode. Pressing any button will reactivate the display.

If an alarm is triggered, the display will be turned on automatically.

Can the oximeter be calibrated?

The VM-2160 SMARTsat cannot be calibrated by medical or technical personnel.

The calibration R-curve within the firmware is fixed and has been verified by the clinical validation against blood gas samples of functional oxygen saturation of arterial haemoglobin (SpO2).

Older VM-2160 devices

Earlier versions of VM-2160 did not feature SMARTsat technology.

SMARTsat sensors are backwards compatible with older VM-2160s, but older sensors cannot be used on SMARTsat devices.

SMARTsat sensors can be identified by a blue connector.
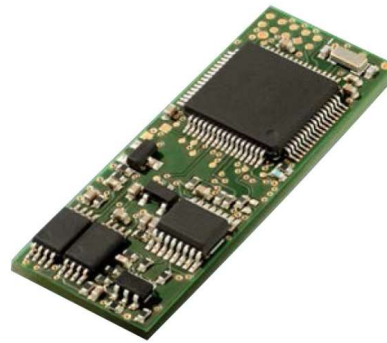

SMARTsat connector

OEM Boards

OEM Boards are PCBs that contain the SMARTsat hardware and algorithms, they are mounted internally inside pulse oximeters.

Viamed makes these boards available to OEMs (**O**riginal **E**quipment **M**anufacturers) for use in their own equipment.

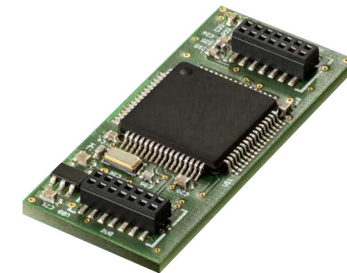There are 3 OEM Boards available: OEM I, OEM II and OEM III.

OEM I   OEM II   OEM III

OEM I – Older, larger board, being phased out unless specifically requested by a manufacturer.

OEM II – Higher performance with better motion artefact rejection and low perfusion performance.

OEM III – General SMARTsat board as used in the VM-2160.

In addition, we have the SMARTsat EB, which is an OEM board housed in a cable assembly that plugs into a monitor, and also development kits for the OEM I, II and III to help manufacturers test and integrate the technology into their own devices.

All OEM Board enquiries should be directed to Steve Nixon.

Warranty

The customer warranty is 24 months from the date of invoice for the VM-2160 SMARTsat and reusable sensors.

Batteries

The VM-2160 SMARTsat uses 3x AA batteries.

Maintenance/Service

These devices do not contain user serviceable components. Viamed can offer a functional check if required.

Latex

All devices and all accessories are latex-free.

Where to find additional information

- Viamed website
- Product leaflets – linked to stock pages
- FAQs on the stock page
- Memos on the stock page
- Instructions For Use