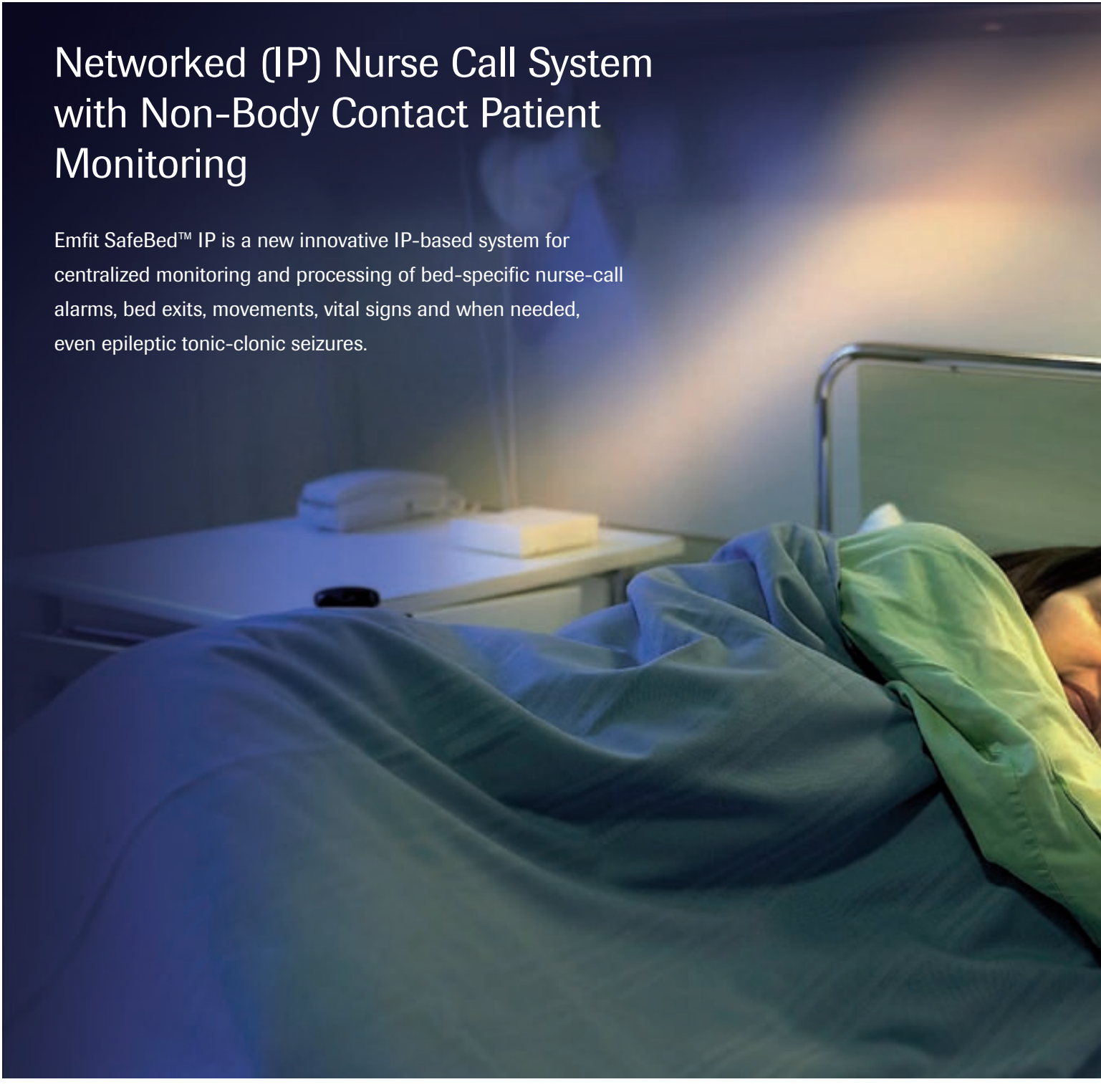
EMFIT®

Networked (IP) Nurse-Call System with Passive Patient Monitoring

Networked (IP) Nurse Call System with Non-Body Contact Patient Monitoring

Emfit SafeBed™ IP is a new innovative IP-based system for centralized monitoring and processing of bed-specific nurse-call alarms, bed exits, movements, vital signs and when needed, even epileptic tonic-clonic seizures.



WHAT IS IT?

Networked SafeBed IP devices and DVM2008 software is new innovative nurse-call system with integrated non-body contact vitals monitoring. Emfit's DVM (discreet vitals monitoring) technology measures basic physiology (e.g. heart rate, respiration rate, movement activity) passively, from below the patient's mattress, without any electrodes, leads, cuffs or cannula. It is a versatile system that can be used for delivering various alarms and notifications, monitoring, and trend tracking in establishments such as hospitals, elderly care, retarded people's care, mental care etc. The main use is, however, to provide an easy-to-use yet advanced system for delivering nurse call alarms and automatic presence/absence (fall) alarms from bedside to personnel, and acknowledgements for such alarms.

WHY IS IT NEEDED?

The DVM™ technology is a developed to enhance the caring environment for both the patients and personnel. There are always patients who need nurse's special attention, like those who should not leave the bed without a helping hand, but who often are not able to use a nurse-call button. Also, nurses need to check patients' condition often while in sleep, and wake them unnecessarily. The DVM technology lowers the workload of nurses, decreases patients' falls and wanderings, and lowers costs associated with patient monitoring in general. It brings better rest for patients. Additional applications can be found for example in sleep studies.

HOW DOES IT WORK?

System consists of Emfit's patented sensor installed under the mattress and a bed-side control unit utilizing advanced digital signal processing connecting to a standard data network (LAN or WLAN) as the media for all communications. Conventional nurse call buttons are included at the bed-side device. DVM2008 sofware installed at one or more monitoring computers commmunicates with bed-side devices and integrates with DECT phone or pager system for messaging alarms to nurses. Networked thin-client displays can be used for visual messaging at corridors.

The sensor responds to small pressure changes caused by patient's ballistocardiographic (BCG) and respiration movements, and generates a respective output voltage signal. Digital data acquisition and signal processing unit uses special algorithms developed by Emfit (patents pending) to calculate heart and respiration rates and movement activity from the sensor signal.

The system transmits all alerts, events, and monitoring data over a standard data network, using standard IP protocol. In the future it is also possible to generate other types of alerts in the application software e.g. of a prolonged tachy- or bradycardia or overall movement activity being below a preset threshold for more than preset time (mentioning these as examples only).

WHO IS IT FOR?

DVM technology can be used for low risk adults and children in various care environments. The intended use, however, is not monitoring of vital physiological parameters, where the nature of variations is such that it could result in immediate danger to the patient.

FEATURES AND BENEFITS

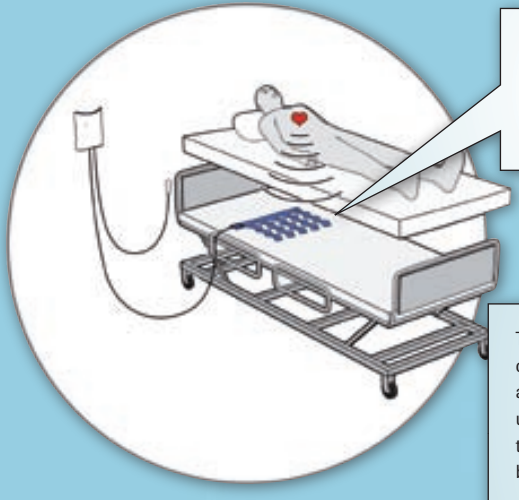
- Low purchase and use cost
- Easy to install and use
- Interfaces to existing data networks (LAN or WLAN)
- Comfortable for the patient, being almost invisible
- Generates bed-exit (fall) alarms automatically
- Provides acknowledgement of alarms and requests for help
- Assisting vitals monitoring data is available from every bed
- Optionally with epileptic tonic-clonic seizure alarm
- Works with adults and children
- Medical device, Class1 (MDD 93/42/EEC, IEC 60601-1)

Emfit SafeBed IP / DVM2008
System Description

MONITORING COMPUTER

The main monitoring software runs on this networked computer. The software receives all its data as IP packets; hence the only connection needed for the system to work is standard Ethernet or WLAN network connection to the Local Area Network - either dedicated for the SafeBed system, or the existing office network.

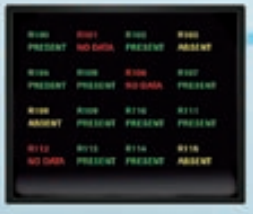
The DVM software displays all bed status data and alarms. Alarms are forwarded to DECT-phone or pager system. Raw measurement curves are also possibly to display. SQL database is used for all data storage for various reports useage. Integration to other softwares is easy.



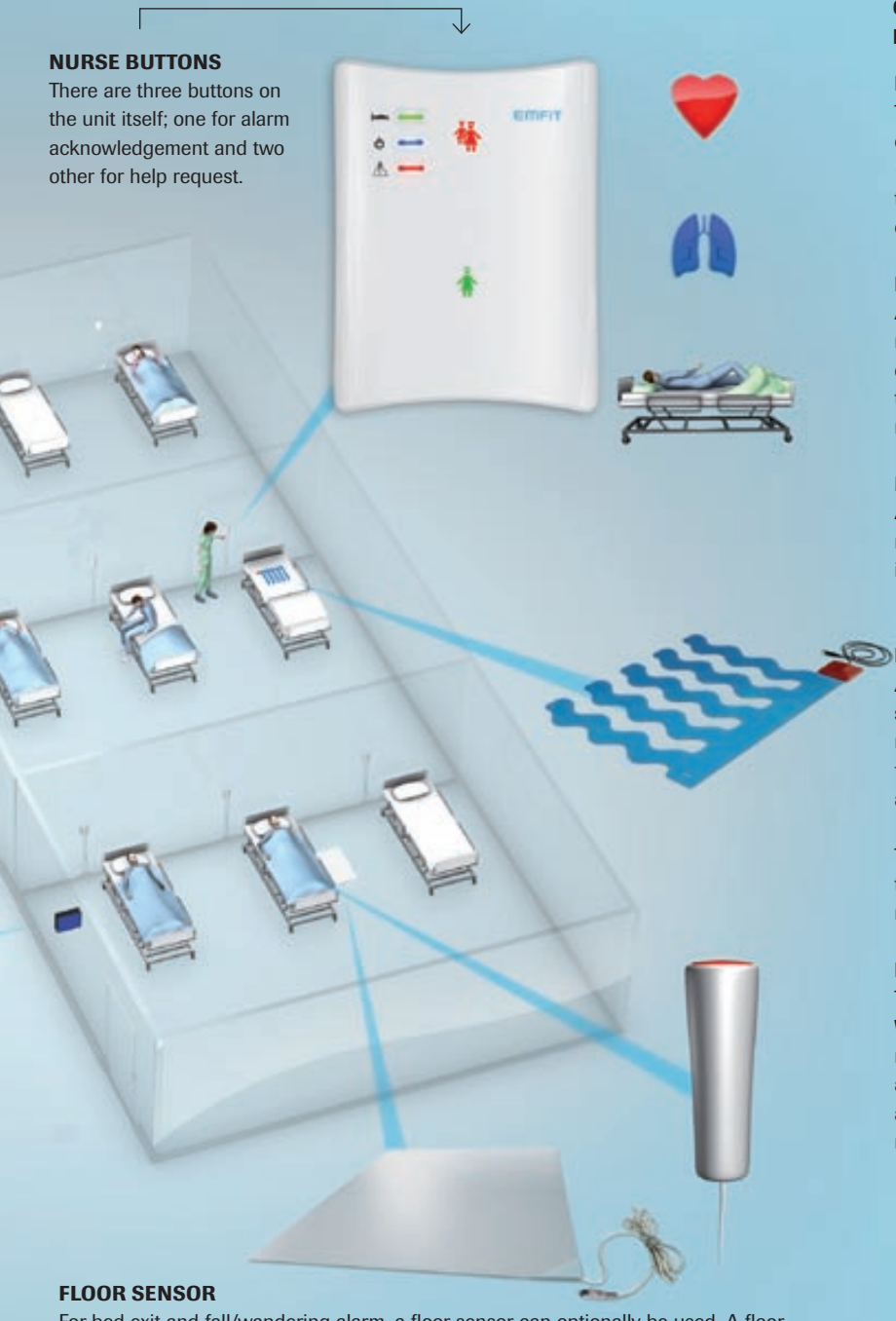
The Emfit bed sensor is located in bed under the mattress. All measured data is taken from the signal of the same one-and-only sensor; nothing is connected directly to the patient.

PASSAGEWAY DISPLAY

Optional passageway displays are so called thin-client terminals. These displays can show main status information and alarm events.



The SafeBed IP device filters, digitizes, separates and measures the sensor signals. A large amount of parameters is calculated from the signals in the device, including heart rate, respiration rate, and movement activity. There is also an input for a patient nurse call button and buttons for nurse use. The device transmits all calculated parameters, alarms and events, and also when requested the raw curve data of the measured signals, to an Ethernet network, or via an Ethernet-to- WLAN bridge to a wireless Local Area Network.



NURSE BUTTONS
There are three buttons on the unit itself; one for alarm acknowledgement and two other for help request.

FLOOR SENSOR
For bed exit and fall/wandering alarm, a floor sensor can optionally be used. A floor sensor is able to provide such alarms from the moment the patient feet touch the floor. The Emfit floor sensor utilizes the same unique sensor technology as the bed sensor.

OUTPUT FEATURES BESIDES PRESENCE/ABSENCE

HEART RATE
The bed sensor detects ballistocardiographic (BCG) movements caused by heart beat. The SafeBed IP unit calculates heart rate (BPM) from these movements and sends the calculated value to the monitoring software. The DVM also outputs filtered raw curve data of the measurement.

RESPIRATION RATE
Among other movements registered by the bed sensor, movements caused by breathing are also detected. Respiration rate is calculated and output from these movements. As for the BCG, the raw data of the respiration channel is also transmitted to the monitoring computer.

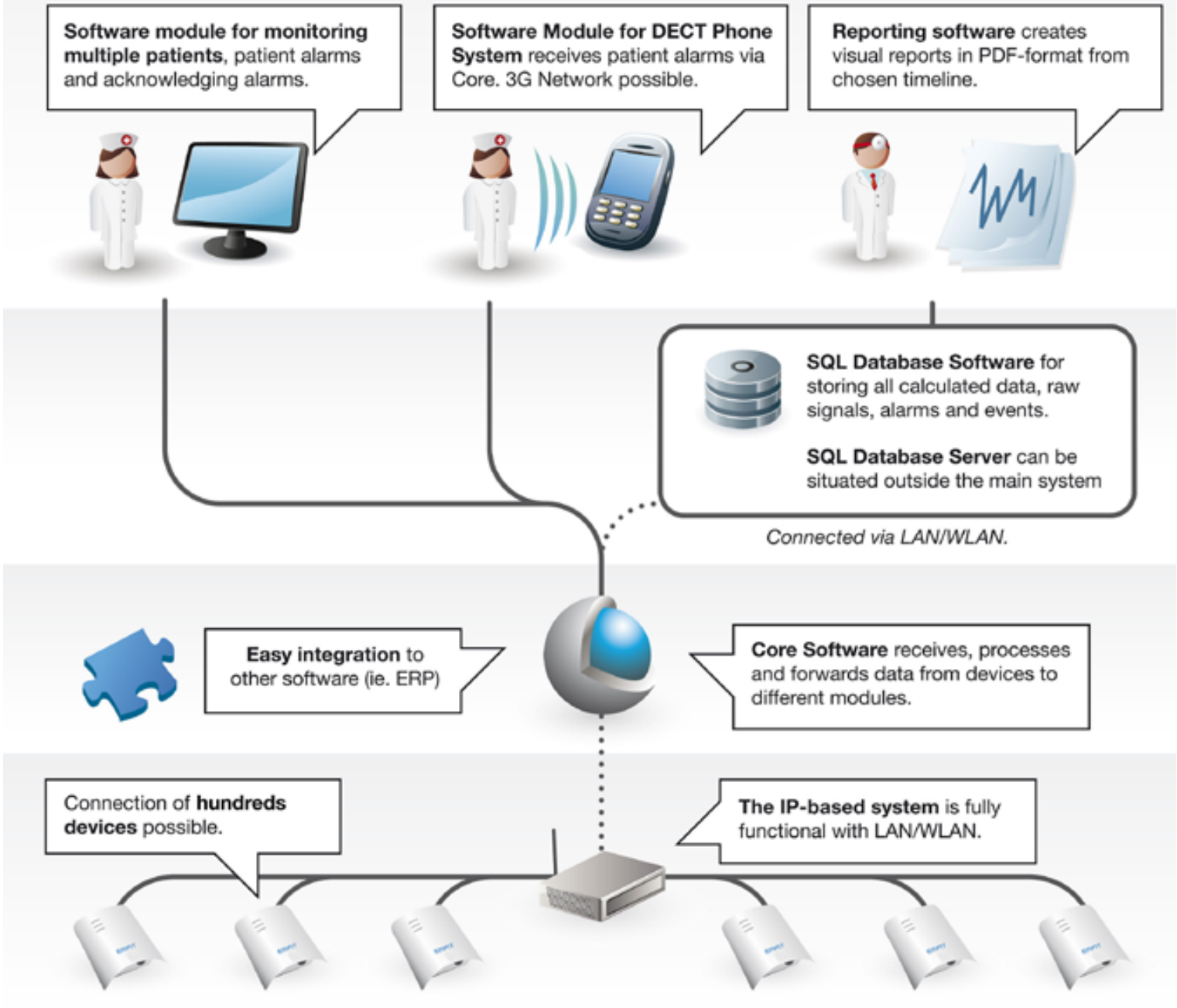
MOVEMENTS AND ACTIVITY
As the bed sensor senses all movements on the bed, overall movement activity is recorded too. Raw movement signal curve is also available for monitoring.

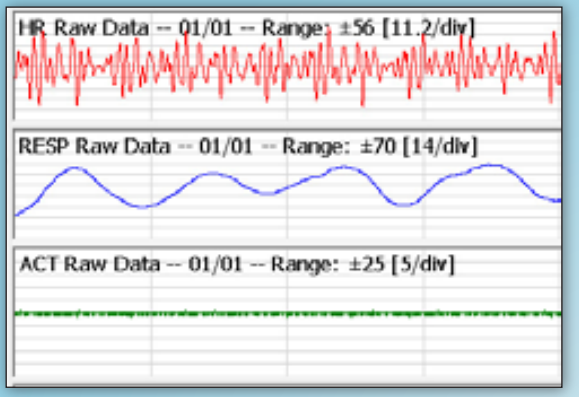
BED SENSOR
All measurements and recognitions from the patient/bed are sensed with this thin-film sensor, which converts every movement to an electrical signal, to be converted to digital data and further processed by the SafeBed IP unit and the {end-user} application software running on the monitoring PC.

The sensor is placed in the bed under the mattress or between two mattress layers. It lasts years and easy to use being totally non-body-contact and almost invisible for the patient.

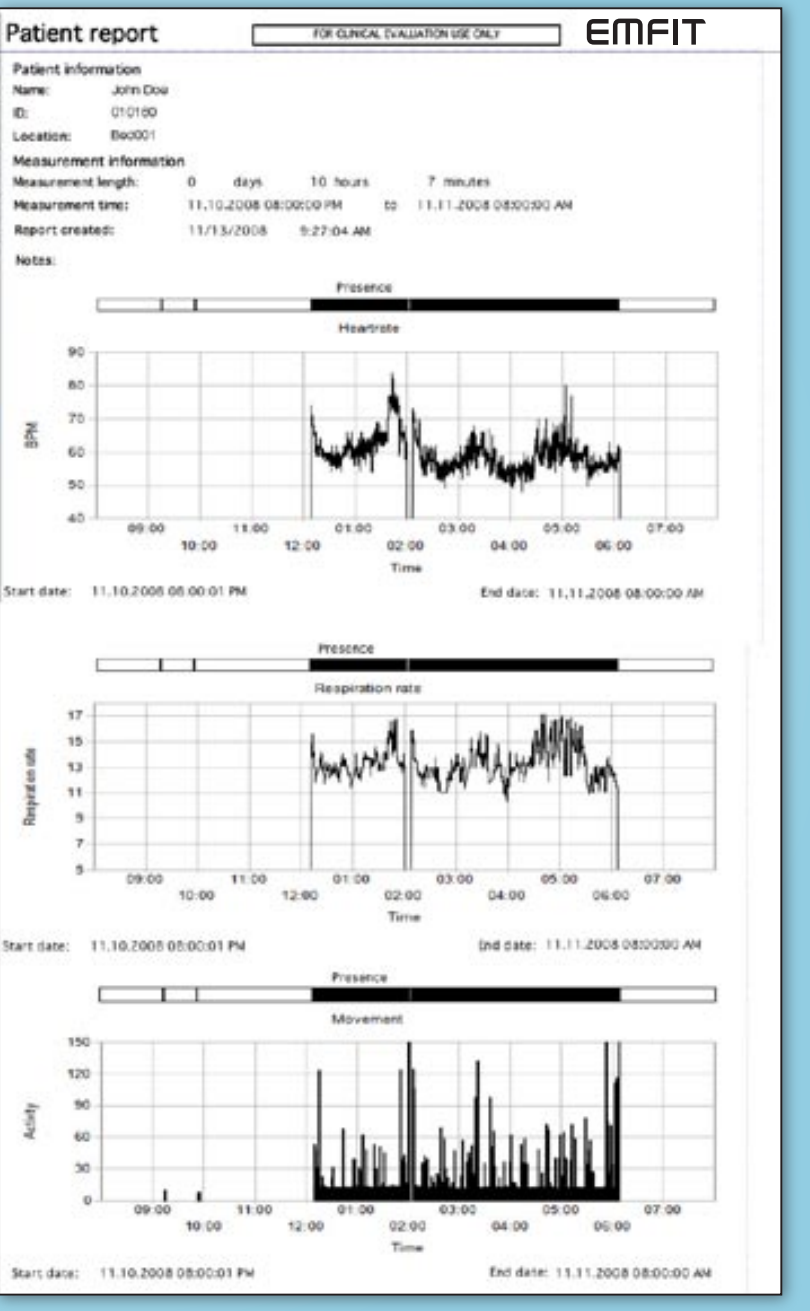
NURSE CALL BUTTON
The device has an input for a conventional nurse call button. When the patient/customer presses it, the system generates a nurse call alarm to be delivered to the personnel. It is transmitted as an IP packet among other events and parameters generated and sent by the device - via Ethernet or WLAN network - to monitoring computer(s) and passageway displays.

SafeBed IP / DVM2008 – System Overview





Raw Measured Curve Data can be visualised when necessary from one bed and stored to SQL database from multiple beds simultaneously.



Reporting software can generate various reports from stored calculated vital signs and movements data.

Emfit SafeBed IP / DVM2008 SW System Main Technical Details

CONTROL UNIT

Model	IP-9150 (IP-9140 for floor sensor, IP-9190 with epileptic seizure alarm)
Classification	Class I medical device
Safety standard, CE-mark	IEC-60601-1, CE marking according to Directive 93/42/EEC (pending)
Description / intended use*	Networked multi-bed nurse call system with integrated non-body-contact vitals and movements monitoring
Main nurse call system features	
	Input for wired patient peer-button (nurse call -button)
	Nurse present -button
	Nurse requests for help -button
	CodeBlue button
	Automatic presence/absence detection + alarm (IP-9150)
	Device and network error alarms
	Alarm delivery to DECT phones
Main patient monitoring features	
	Heart rate
	Respiration rate
	Movement activity
	Raw curves for HR, RESP, ACT
	Absence (fall) detection and alarm
	Tonic-clonic epileptic seizure detection and alarm (IP-9190)
	Data storage to an SQL database
Communications	All communications IP-based over standard data network
Dimensions (W x L x D)	95 mm x 125 mm x 30 mm
Weight, colour	130 g, white
Power source	AC-adapter; 5 V 3.0 A DC Medical Grade, PoE (Power-Over-Ethernet 48 V)
Operating voltage	5 V DC
Connections	Bed sensor (IP-9150, IP-9190)
	Floor sensor (IP-9140 only)
	Nurse call peer-button
	Auxiliary input for 1 external device with dry-contact output Ethernet RJ-45
	Power input 5 V DC
Inbuilt buttons and light indicators	Buttons: Nurse present, Help requested, CodeBlue LEDs: Power on, Presence indicator, Device/sensor fault
Network/software Compatibility	Standard Ethernet or 802.11x WLAN Microsoft Windows XP, Microsoft Windows Vista, Microsoft Windows 2003 Server ®

SENSOR

Type	Dynamic response thin-film ferroelectret sensor
Model	L-4060SL
Classification	Class I medical device (in conjunction with device)
Safety standard, CE-mark	IEC-60601-1, CE marking according to Directive 93/42/EEC
Placing	Under mattress (floor-sensor on the floor or under flooring)
Dimensions, thickness	400 x 580 mm, 0,5 mm
Wire length	3 m
Surface material, colour	Polyester, blue

PC SOFTWARE

	DVM2008 Main Software Optional Remote Terminal Display Software
Compatibility/platform	Microsoft Windows XP, Microsoft Windows Vista, Microsoft Windows 2003 Server ®
Safety standard, CE-mark	IEC-60601-1, CE marking according to Directive 93/42/EEC along with device (pending)
Main measurements, calculations and alarms	Heart rate, Respiration rate, BCG and RESP signal qualities and signal levels. Movement activity. Raw signal curves for HR (BCG), RESP, and ACT. Presence/absence detection. Tonic-clonic epileptic seizure detection (with IP-9190 only). Nurse call, Nurse present, Help requested, CodeBlue Device/sensor error Network error Additional detailed documentation available on request.
Data storage	Microsoft SQL database (MS SQL Server sw not included.)

COMMUNICATIONS

	DVM Unit, DVM2008 Main Software, Optional Remote Terminal Display Software
Compatibility/platform	Microsoft Windows XP, Microsoft Windows Vista, Microsoft Windows 2003 Server ®
Used protocols	TCP/IP, UDP, HTTP {All over IP}
Used ports	Software-configurable
DVM unit network connection	Standard Ethernet RJ-45 Optional external Ethernet-to-WLAN bridge
Computer network connection	Any standard connection to LAN or WLAN

* Intended use: Nurse call system with presence/absence monitoring and alarm and non-diagnostic, non-body-contact assisting monitoring of vital signs. Product is not intended for monitoring of vital physiological parameters, where the nature of variations is such, that it could result in immediate danger to the patient.

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