

Emfit DVM2007 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 standards, 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 Input for wired patient peer-button (nurse call -button) Nurse present -button Nurse requests for help -button Automatic presence/absence detection + alarm (IP-9150) Device and network error alarms
Main nurse call system features	Heart rate display Respiration rate display Movement activity display Trend displays for HR, RESP, ACT Raw curve displays for HR, RESP, ACT Fall detection + alarm Tonic-clonic epileptic seizure detection + alarm (IP-9190)
Main assisting features	All communications IP-based over standard data network 95 mm x 125 mm x 30 mm 130 g, white AC-adapter; 5 V 3.0 A DC Medical Grade, PoE (power-over ethernet 48 V) 5 V DC Bed sensor Floor sensor (optional, 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 Buttons: Nurse present, Nurse requests for help LEDs: Power on, Presence indicator, Device/sensor fault
Communications	Standard Ethernet or 802.11x WLAN
Dimensions (WxDxD)	
Weight, colour	
Power source	
Operating voltage	
Connections	Microsoft Windows XP, Microsoft Windows Vista, Microsoft Windows 2003 Server ® **
Inbuilt buttons and light indicators	
Network/software	
Compatibility	

SENSOR

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

PC SOFTWARE

	DVM2007 Main Software, Optional Remote Terminal Display Software Compatibility/platform Microsoft Windows XP, Microsoft Windows Vista, Microsoft Windows 2003 Server ® **
Safety standards, 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 Nurse requests for help Device/sensor error Network error Additional detailed documentation available on request.
Communications	DVM Unit, DVM2007 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 fall 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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IP-based Nurse Call System with Fall
Alarm and Assisting Non-Body-
Contact Vitals Monitoring

EMFIT[®]

Networked nurse call system with advanced assisting features

Emfit DVM 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 tonic-clonic epileptic seizures.





WHAT IS IT?

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 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?

DVM technology consists of Emfit's patented thin film dynamic sensor, installed under the mattress (or two mattress layers), a control unit utilizing advanced digital signal processing, a standard data network (LAN or WLAN) as the media for all communications, one or more monitoring computers with Emfit's sophisticated DVM software, and optional remote terminals showing all main status information and alarms in for example passageways. Conventional nurse call buttons and nurse-present as well as nurse-requests-for-help -buttons are also included.

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 several other types of alerts in the application software running on the monitoring computer(s), e.g. of a prolonged tachy- or bradycardia, 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)



DVM IP-9150

Emfit DVM System Description

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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 DVM system, or the existing office network.

The software displays all bed status data, calculated value trends, alarms, and raw measurement curves centrally from the beds.

The first official software release in 2008 will provide full support for epileptic seizure alarm and an advanced nurse call system.

A Windows® CE (mobile) version of the Remote Display software will be released within the second quarter of 2008. This will enable alarm data to be displayed and acknowledged in mobile devices. If the nurses have dedicated mobile terminals of their own, the alarm/acknowledgement system will also automatically log the acknowledging person's identifying information, with no need for any other kind of authentication (like a PIN code).



PASSAGEWAY DISPLAY

The passageway or lobby / nurses' office displays are terminals with either a touch panel user interface or a conventional keyboard + mouse combination. These displays will show main status information and alarm events. The staff can acknowledge any alarm from any bed simply and fast by clicking directly on the alarm notice showing on the screen. If required, the software will ask for an authentication (a PIN code) for the acknowledgment.



NURSE BUTTONS

There are two buttons on the unit itself; one for alarm acknowledgement and another for nurse's request for help.



OUTPUT FEATURES BESIDES PRESENCE/ABSENCE

HEART RATE

The bed sensor detects ballistocardiographic (BCG) movements caused by heart beat. The DVM 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 which is also available for observing on the monitoring computer display.

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 activity and general movements are recorded, too. The unit calculates several different activity indexes from this data. Raw movement signal curve, as measured, is also available for monitoring.

BED SENSOR

While the networked DVM unit with its IP-based communications is the heart of the whole concept, the bed sensor may be considered as the lungs. 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 DVM unit and the (end-user) application software running on the monitoring PC.

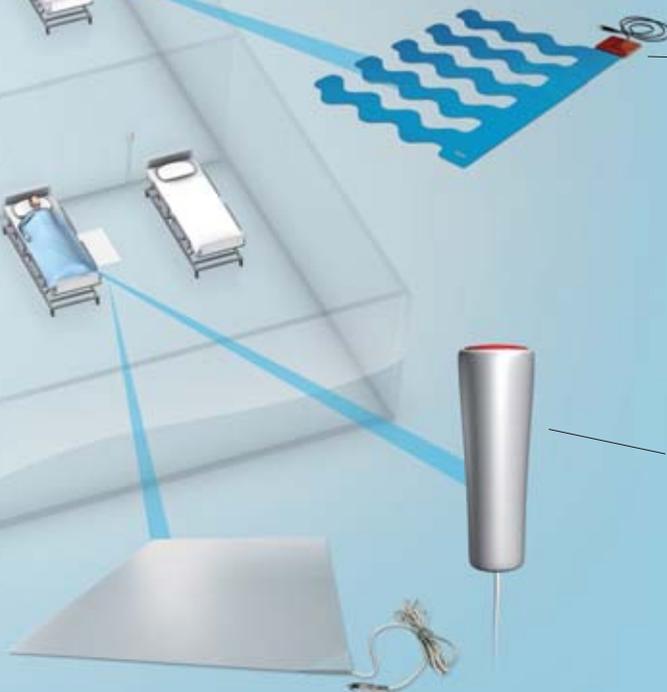
The sensor is placed in the bed under the mattress or between two mattress layers. It is very easy to use, being totally non-body-contact and almost invisible for the patient.

NURSE CALL BUTTON

The DVM unit 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.

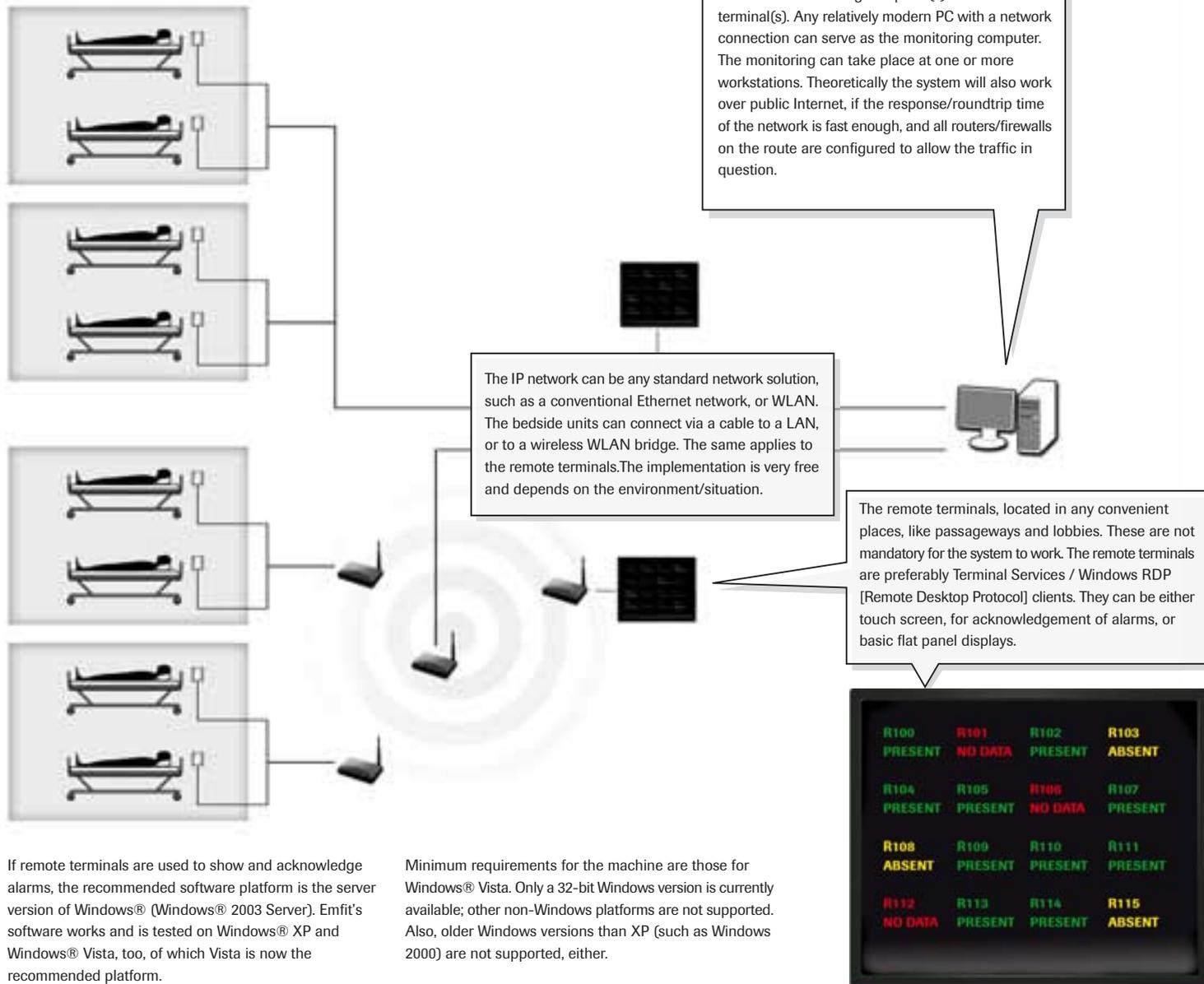
FLOOR SENSOR

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.



EMFIT DVM SYSTEM – BLOCK DIAGRAM

Emfit DVM is a networked IP-based system for centralized monitoring and processing of bed-specific nurse-call alarms, bed exits, movements, vital signs, and tonic-clonic epileptic seizures. The system provides alarms of detected events and status changes in the bed. All the alarms are shown on the screen of a monitoring computer and remote terminals located in passageways, lobbies, or any convenient location. The system also includes a more conventional nurse call subsystem, with a patient button and nurse's acknowledgement buttons, the signalling of which is also IP-based. Alarms can be acknowledged from the remote terminals, too.



If remote terminals are used to show and acknowledge alarms, the recommended software platform is the server version of Windows® (Windows® 2003 Server). Emfit's software works and is tested on Windows® XP and Windows® Vista, too, of which Vista is now the recommended platform.

Minimum requirements for the machine are those for Windows® Vista. Only a 32-bit Windows version is currently available; other non-Windows platforms are not supported. Also, older Windows versions than XP (such as Windows 2000) are not supported, either.

