



Product Overview

BedMasterEx Data Acquisition Systems

The BedMasterEx System is, for all intensive purposes, an electronic filing system designed to provide a means to automatically acquire all of a patient's clinical information as processed by any GE/Marquette patient monitor/s. and store the acquired patient data in a database for review, analysis and where desired, distribution to another Hospital system. This includes all patient vital signs, clinical waveforms, alarm data and the operational statistics of the patient monitor. Patient data acquisition automatically starts when the patient is admitted to the GE/Marquette patient monitor and continues until they are discharged from the patient monitor with no operator intervention required.

All patient data is stored in a BedMasterEx / MS SQL database to document a patient's entire clinical encounter while connected to a GE/Marquette patient monitor. All patient data acquired is maintained in the database whether it was for hours, days, weeks or in some cases months. Patient data is never automatically deleted by the BedMasterEx system.

The BedMasterEx System is a data acquisition system. It is not intended to replace a central monitoring station. It is designed specifically to acquire patient data and provide a clinician or researcher with the ability to easily access, review, analyze and manage large amounts of physiologic information for clinical review, research, quality control and risk management purposes.

The BedMasterEx Data Acquisition System operates exclusively with GE/Marquette Patient Monitors

The BedMasterEx System is the second generation of the BedMaster Data Acquisition Technology. The original BedMaster system, first introduced in 1999, was developed to assist individual clinicians by automatically acquiring a patient's vital signs from a GE/Marquette patient monitor and exporting them to a MS Excel spreadsheet to provide the documentation necessary to support their research projects.

The on-going development and evolution of the original BedMaster technology has taken us to the BedMasterEx system, first introduced in January 2006. The BedMasterEx development is driven by a close working relationship with our existing, and prospective, clients to create the tools they need to easily acquire, analyze and manage large amounts of patient data in a "cost effect" manner.

BedMasterEx System pricing starts at \$6,950.00. Options can be added to configure a system to meet the specific data acquisition and on-line data storage requirements of the individual user or clinical Department

BedMasterEx Systems are HIPPA compliant. All patient data acquired is protected by proprietary data compression and encryption algorithms. Patient information is NOT accessible unless viewed on a BedMasterEx System, or a hospital approved workstation with BedMasterEx Client software installed

The BedMasterEx is a Microsoft .NET application that functions with the Windows XP or Vista operating system. The application is scalable so that it can run in a Laptop, Desktop and Client Server configuration to address the specific data acquisition and on-line storage requirements of an individual researcher, a clinical department at a regional or university medical center, or a dedicated clinical research facility.

The BedMasterEx system can automatically acquire and store all physiologic data processed by a GE/Marquette patient monitor/s. The patient data is acquired either by a direct connection to an individual monitor using a crossover cable or by a “single point” connection to the GEMS Unity network where it can acquire patient data from up to forty-five (45) patient monitors at the same time.

DATA ACQUISITION FROM OTHER DEVICES OR 2ND TIER MONITORS

Patient data derived from other medical devices or 2nd tier monitors interfaced to the GE/Marquette patient monitor or GEMS Unity network is automatically acquired by the BedMasterEx System.

Excel Medical Electronics (EME) also provides custom serial interfaces to the BedMasterEx database for medical devices or 2nd tier monitors that are currently not interfaced with the GE/Marquette patient monitors or GEMS Unity network. The Excel Device Interface uses Avocent serial interface switches connected to the hospitals standard network, not the Unity Network for the patient data acquisition. The patient data acquired from the other medical devices is time-aligned and merged into the master patient file in BedMasterEx MS SQL database created when the patient was admitted to the patient monitor.

DATA STORAGE

The BedmasterEX can store an enormous amount of data related to the patient and the GE/Marquette patient monitor. Currently, with our proprietary data compression and encryption technology, we estimate average storage requirements at 130MB per patient monitor / per day.

These calculations are formed using a “heavy use scenario”, collecting and storing of all data from a “fully loaded” patient monitor, which includes all continuous clinical waveforms and all tabular vital signs data sampled at a five (5) second resolution.

A video option is available. If selected, real-time patient images are embedded in the ECG signal for time alignment purposes then displayed and stored along with the patient data. The video resolution is selectable from up to 20 frames per second, resulting in approximately 300MB to 1.7GB per day of additional storage requirements. Approximately twenty (20) Video cameras can be processed per server

The BedMasterEx, when configured for a Laptop or Desktop Computer uses the MSDE SQL database with 2GB of memory. This configuration is not designed for long-term on-line data storage. Periodic database maintenance is necessary to discard un-needed patient files, or to archive patient files to a CD, DVD, USB medium, or to a designated archive server on the hospital network.

The BedMasterEx, in a client server configuration, is designed to provide the most flexibility. The BMEX system uses a full featured MS SQL database to support data mining objectives, use with other data analysis tools, and to meet the longer-term "On-Line" storage requirements of most clinical departments. We currently specify a 2.5TB (Terabyte) disk drive to provide for extended on-line storage. Additional disk drives can be added as needed or, patient data files can be off-loaded onto a hospital SAM's server.

System Operational Design Structure and Configuration

The BedMasterEx Data acquisition process runs as a service on the Windows XP or Windows Vista operating system. This separates the data acquisition and database operations of the BedMasterEx system into two isolated and separate processes. Data acquisition and Database servers can be combined into a single server or they can be separated so that multiple acquisition servers can function with one, or multiple database servers. In medical facilities where there are multiple BedMasterEx systems the servers can operate separately or they can be linked together. BedMasterEx client applications can be configured to point to and provide access to a specific or multiple servers.

The only proprietary component of the BedMasterEx system is the software application itself. We utilize commercially available hardware components which can be purchased from Excel Medical Electronics or from the medical facilities hardware vendor of choice based on the specifications provided

The BedMasterEx is designed to function and adhere to the established guidelines, operations, policies and IT structures that are found in most hospitals. We work with your IT departments to insure the BedMasterEx System adheres to established requirements, security, archiving and IT operational policies

MODES OF OPERATION

A clinician can select a specific patient from the Main “Device Screen” to review near real-time and historical data related to a patient currently admitted to a patient monitor. Access to clinical data on patients discharged from the patient monitor is accessed from the “Master Patient Directory Listing”.

Near Real-Time Display

The BedMasterEx Client application communicates with the BedMasterEx database server to access patient data. For security purposes, data can be viewed as it is being written to the disk drive after it has been compressed and encrypted. This provides the clinician with the ability to view from a remote location, near real-time clinical information including all tabular vital signs, near real-time display of clinical waveforms and patient alarm information as processes by and presented on the patient monitor.

While viewing near real-time patient data, a clinician can, without interrupting the data acquisition process, switch to review mode to access all historical patient data, inclusive of all patient vital signs, clinical waveforms and patient alarm data acquired since the patient was admitted to the patient monitor.

If the video option is selected, a real-time video image of the patient is displayed on the BedMasterEx display along with the clinical waveforms allowing the clinician to see the patient at that point in time.

Historical Data Review

Acquired patient data is never automatically deleted from the BedMasterEx System. A clinician can access historical data for any patient that was at one time admitted to a GE/Marquette monitor and has since been discharged. All data related to the patient’s entire clinical encounter is available for review. This includes all patient vital signs, all continuous clinical waveforms and all patient alarms acquired while the patient was admitted to the patient monitor.

If the video option is selected, a video image of the patient is displayed along with the clinical waveforms so the clinician can see what was going on with the patient at any point in time.

DATA ACQUISITION AND REMOTE DATA REVIEW

DATA ACQUISITION

One Data Acquisition License (DAL) is included in the basic BedMasterEx Application. Additional “Concurrent” data acquisition licenses can be added to acquire patient data from multiple GE/Marquette patient monitors at the same time to meet data acquisition requirements of each user or clinical department.

The selected computer configuration and intended data acquisition resolution determines the actual total number of concurrent data acquisition process that can take place

REMOTE ACCESS AND VIEWING OF NEAR REAL-TIME AND HISTORICAL PATIENT DATA

The Remote View capability of the BedMasterEx System provides a valuable tool by offering a clinician the ability to access near real-time and historical patient data from locations remote to the patient monitor or clinical department for clinical review, data analysis, and research purposes.

Access to the BedMasterEx database is controlled by BedMasterEx Client application Licenses (CAL's). One client application license is included with the Basic BedMasterEx Application.

The laptop and desktop configurations are delivered with one (1) BedMasterEx Client to access the patient data acquired. The Laptop and Desktop configurations do not support remote viewing.

The Client Server configuration of the BedMasterEx System supports the Remote Viewing of Patient data acquired by the BedMasterEx system. Once the patient data is acquired and written to the BedMasterEx database it is fully routable over an intranet, internet, VPN connection or dedicated line.

A BedMasterEx client workstation can reside basically anywhere there is a network connection to provide a clinician with remote access and review capabilities of Near Real-time and/or historical patient data.

Clinicians can access the BedMasterEx database to review patient information or to provide consulting services to other clinical departments within the hospital or to remote medical facilities supported by the hospital from any standard PC that has the BedMasterEx Client software installed via a connection to the hospital network such as a work area, their office, or even from a home PC via hospital VPN connection

The On-line Remote BedMasterEx Client application can be configured to access a designated BedMasterEx server or any BedMasterEx server connected to the hospital network.

Installation of the BedMasterEx Client application is non-restrictive. It can be installed on as many PC's running on Windows XP or Windows Vista as designated by the medical facility. Access to the BedMasterEx Database is controlled by the number of "concurrent client licenses" (CAL's) purchased by the hospital. For example, a hospital may install the BMEX client software on thirty (30) PC's, but only have five (5) client licenses; meaning up to five (5) authorized users can access the BedMasterEx database server at the same time. Additional Client licenses can be added as needed

STANDARD SYSTEM FEATURES

AUTOMATIC VITAL SIGN COLLECTION

The BedMasterEx system automatically collects and plots all of the patient's vital signs as processed by a GE/Marquette Patient monitor in a tabular format. The resolution of the data acquisition is user selectable from once every five (5) seconds to once an hour. All vital sign data can be selectively exported to a Microsoft Excel spreadsheet, or in XML and HL7 formats to other hospital systems.

VITAL SIGN TRENDING

The BedMasterEx provides the ability to display and print all acquired tabular vital sign data in user defined trend displays for the entire time patient data was collected. The resolution and configuration of the trend displays is user defined.

CRG TRENDING

CRG trending is a specific trending function added at the request of our Neonatal clients. The CRG trend presents a correlated beat - to - beat linear trend of a neonate's heart rate, respiration and SPO2 to assist a clinician in determining which physiologic parameter initiated or preceded the sequence of events that leading to a patient alarm condition as processed by the GE/Marquette patient monitor.

All patient alarm conditions are linked to the time display of the CRG trend. This format provides the clinician with the ability to rapidly review monitor determined alarm conditions and to validate their accuracy. Comments or notes can be added and artifacts and false alarms conditions can be deleted.

If the video option is selected, a time aligned image of the patient is displayed along with the CRG. The clinician can select points in time on the CRG graph to display the image of the patient and then zoom to a display of all the clinical waveforms acquired at that point in time.

CONTINUOUS CLINICAL WAVEFORM ACQUISITION AND DISPLAYS

All patient clinical waveforms acquired from the GE/Marquette patient monitor or other devices interfaced to the BedMasterEx database can be displayed in a variety of user selected formats and display sweep speeds. Waveforms can be printed and/or exported to a Microsoft Excel spreadsheet or to a hospital CIS system in a XML, HL7 format. Waveforms can also be exported in a Binary format for structural analysis.

NEAR REAL-TIME WAVEFORM DISPLAY

The BedMasterEx system displays all acquired patient waveforms in near real-time at 250Hz, just as they are displayed on the patient monitor at 2.5mm, 5mm and 25mm sweep speeds in both the real-time and

historical review modes. The clinician can navigate through the patient waveforms either on a page-by-page or beat-to-beat mode. All patient alarms are listed for rapid access for review and verification

If the Video option is selected, a real-time image of the subject is displayed along with the patient's clinical waveforms

FULL DISCLOSURE WAVEFORM DISPLAY

The BedMasterEx also provides a "Full Disclosure Display mode for all clinical waveforms" acquired from the GE/Marquette patient monitor or other medical devices from the time the patient was admitted to the monitor until they were discharged. The full disclosure waveform data is displayed in a compressed one-hour per page format to support the easy navigation, review and analysis. Clinicians can select specific areas of interest from within the "Full Disclosure" view to zoom into a near real-time view containing all the clinical waveforms for the selected point in time.

All clinical waveforms collected by the BedmasterEX system can be presented in a full disclosure format. For example, if bradycardic or apnea events are of special interest, a clinician can view a full disclosure display of just the acquired respiratory waveforms.

ALARM MASTER

The Alarm Master tracks all patient and systems alarms as determined by the GE/Marquette patient monitor. The clinicians are presented with one (1) minute of all patient clinical waveforms preceding an alarm condition, the alarm condition itself, and one minute of data following the alarm condition.

A histogram of all alarm activity illustrating alarm frequency by alarm type and duration is presented along with a listing of every alarm condition determined by the patient monitor. Each alarm listing is linked to the actual clinical waveform for rapid access, review, verification and or printing. Based on user privileges, notations and comments can be added and false alarms can be deleted. While all alarms are always automatically collected, clinicians can use filters to control which alarms are displayed, allowing them to focus on alarms of particular interest. Alarms can also be sorted the alarm category or type.

The BedmasterEX system does not determine the alarm condition; this is a function of the individual GE/Marquette patient monitor and its settings.

Manual Event Marker

Clinicians can manually enter event markers to note clinical areas of interest not detected by the patient monitor or to indicate a specific point in time an event of some sort has taken place such as a drug start time or a clinical procedure. This can be done in real time using a LineMaster foot or thumb switch at the

bedside connected the Excel Device interface or during the review of patient data at a later time. All events can be edited to indicate what occurred at that specific point in time

MASTER PATIENT DIRECTORY

The master patient directory provides a listing of, and access to, all patient data files in the BedMasterEx database.

The Master Patient Directory also displays and provides access to additional patient data files from either a patients previous clinical encounter or if the patient was transferred from another department within the medical facility where the their data was acquired by another BedMasterEx System. For example, if a patient entered the medial facility via the emergency department and was later transferred to the CCU, the clinicians in the CCU would have full access to all of the patient data processed by the GE/Marquette patient monitor while the patient was in the emergency room.

UNITY TIME

The Unity Time is a feature that can automatically correct the time drifting that is found in the patient monitors time clocks due to the natural degradation of the patient monitor time clock, daylight savings time, or incorrect adjustments made by the clinical staff. Unity time insures the accuracy of the time clocks on all GEMS devices connected to the Unity Network

Unity time functions in conjunction with an NTP (Network Time Protocol) server, as specified by the medical facility. All time-clocks on all GEMS patient monitors connected to the unity network are automatically reset to the NTP server at a time interval selected by the hospital. A system generated audit trail verifies / documents all time changes made to specific monitors.

CLINICAL ENGINEERING MAINTENANCE MODULE

The BedMasterEx system includes a Clinical Engineering support feature that monitors all GE/Marquette patient monitors connected to the GEMS Unity Network in the Clinical Department. The CE Support feature display screen identifies all devices by name, type, location, serial number, IP address, MAC address and the software revisions of all circuit boards in each patient monitor. External Serial numbers can be entered to link them to a specific MAC Address to locate and track any changes in the location of the patient monitor. Any changes that have occur in the monitors configuration since the last time it was accessed are highlighted in red for easy identification

The BedMasterEx CE support feature also locates and identifies where the TRAM modules are and their software revision. Actual serial numbers of TRAM Modules can be acquired from versions of Tram Modules that broadcast their MAC ID Address.

The BedMasterEx system supports service maintenance scheduling, service notes and tracking for all patient monitors in the department. All data fields in the CE Support function are searchable to locate a specific item of interest.

The BedMasterEx is also available in a CE configuration designed specifically for the Clinical Engineering or Biomedical Department.

Patient Monitor Activity Reports

The BedMasterEx provides activity reports to track individual and department patient monitor utilization, admissions activity, length of stay and other operational and statistical information. The reports are available in tabular or graphical reports

OPTIONAL COMPONENTS

12 LEAD ECG ACQUISITION OPTION

The BedMasterEx can acquire and display for review from any BedMasterEx Client 12 Lead ECG's processed by any GE/Marquette patient monitor that has the 12 Lead ECG option installed. The 12 lead ECG is acquired in the standard 12 lead ECG resolution of 250 samples per second, or in the Network 12 lead ECG format of 500 samples per second. The 12 Lead ECG's can also be exported in XML, HL7 and/or Tab Delimited formats. The 12 lead ECG's can be automatically printed when received, at one or multiple printers connected to the hospital network. The patient ECG's are stored on the BedMasterEx database in the patient's master file along with the other clinical waveforms for review from any PC connected to the hospitals network with the BedMasterEx Client application installed.

VIDEO DISPLAY OPTION

The video display option provides a clinician with the ability to actually see the patient and what is/was actually going on with a patient at a specific point in time directly related to the physiologic data displayed on the patient monitor in both the Near Real-Time and historical review of patient information. The BedMasterEx Video software embeds the video signal in the ECG waveform acquired from the patient monitor for the proper time alignment. Wireless or hard-wired video cameras can be used acquire the video signal at a resolution of up to 20 frames per second.

CUSTOM INTERFACE OPTIONS

Serial Device Interface Option

Excel Medical Electronics (EME) also designs and provides custom serial interfaces for medical devices or 2nd tier monitors that are currently not interfaced with the GE/Marquette patient monitors or Unity network. This allows the user to acquire and store the patient data from other specified medical devices in the BedMasterEx Database for review and analysis. Patient information from these interfaces are stored and displayed on the BedMasterEx Display – Not the GE/Marquette patient monitor

The Excel Serial Device Interface design structure uses a commercially available serial interface switch (Avocent /Equinox), available in two, four, eight and sixteen ports, that connect to the hospitals network, (not the GEMS Unity Network) for the patient data acquisition pathway. The switch identifies the patient location, the device type and converts the devices RS232 serial data into a data stream that flows over the hospitals network to the BedMasterEx data acquisition server where it is processed by the BedMasterEx device interface application. The acquired patient data is time-aligned and merged into the identified patient's master file created when the patient was admitted to the GE/Marquette Patient monitor located in BedMasterEx MS SQL database. This allows all patient information acquired from all monitored devices, GE/Marquette & 3rd party devices, to be stored in a single time-aligned patient data file to support the cross correlation and analysis of all acquired patient data

Hospital & Clinical Information System Interface Option

A standard feature of the BedMasterEx system is its XML, Binary and HL7 Data export functions. This provides a cost effective solution for the automatic distribution of specified patient information (vital signs and/or clinical waveforms) acquired from GEMS patient monitors to other hospital, clinical, ADT or data management systems. Specified patient data or other information derived from the patient monitor can be distributed to the hospitals interface engine or directly to a clinical Information (CIS), Hospital Information (HIS), or Admissions / Discharge (ADT) system.

Custom Single or Bi-directional interfaces in HL7, XML, Binary and custom formats are designed to meet the specific data transfer requirements of each medical facility

SYSTEM CONFIGURATIONS

At this time, the BedmasterEX System is currently available in four (4) different configurations – Three (3) clinical documentation configurations and one (1) Clinical Engineering configuration.

Each clinical configuration includes all of the features and functions discussed in this document, unless specifically noted as an “Option”. The optional components can be added to any system configuration.

CONFIGURATION DESCRIPTIONS

BMEX LAPTOP CONFIGURATION

The BedMasterEx in the Laptop configuration is designed as a portable stand-alone system to address the specific data acquisition requirements of an **individual clinician** wanting to acquire data for personal records or individual research purposes.

Data collection is accomplished via a direct connection to a GE/Marquette patient monitor using a cross-over cable or by a “single point connection” to the Unity network where the clinician can select up to **Three (3)** GEMS patient monitors from which they wish to simultaneously acquire patient data.

The BMEX in the Laptop configuration does not support long-term on-line storage. At some point in time the user can delete unneeded patient files, or archive patient files to a DVD, CD, flash memory device or a hospital network server for off-line storage

The BMEX in the Laptop configuration does not support on-line remote access to the patient data. A BMEX Off-line Client application is available to support the remote Off-Line review of patient data archived to a DVD, CD or USB Flash memory device from other PC's

BMEX DESKTOP CONFIGURATION

The BedMasterEx System in the Desktop PC configuration is designed as a stand-alone “Department” system where remote viewing of patient data and long-term on-line data storage is not a requirement.

Data collection is via a “single point connection” to the Unity network. The BMEX Desktop configuration can collect patient data from up to **Twenty-Five (25)** GEMS patient monitors at the same time.

The BMEX desktop configuration does not support long-term on-line storage. At some point in time the user needs to delete unneeded patient files, or archive selected patient data files to a DVD, CD or flash memory device for off-line storage

The BMEX in the desktop configuration does not support on-line remote access to the patient data. Review of patient data acquired takes place on the PC where the BedMasterEx application is installed.

A BMEX Off-line Client application is available to support the off-line review patient data archived to a DVD, CD or Flash memory device from other PC's

BMEX CLIENT-SERVER CONFIGURATION

The BedMasterEx System in the Client-Server configuration is “**department oriented**” and designed to offer the most flexibility and meet the data acquisition and long-term on-line storage requirements of most clinical departments.

The BMEX Client-Server configuration utilizes a full function MS SQL Database to support data mining objectives, other data analysis applications. Data collection is accomplished via a “single point connection” to the Unity network. The BMEX in the Client Server configuration can simultaneously collect patient data from up to **Forty-five (45)** GEMS patient monitors

The BMEX Client-Server configuration via the MS Server Software supports the Remote On-line access to near real-time and historical patient data acquired by the BedmasterEX system.

BMEX CE CONFIGURATION

The BedMasterEx CE is a Desktop PC configuration designed specifically for a Clinical Engineering Department to assist in their of GE/Marquette patient monitors. It support the acquisition, display, review, and on-line storage of the operational, statistical and maintenance information related to all of the GE/Marquette patient monitors via a single point connection to the Unity Network.

The BMEX CE configuration identifies all devices connected to the GEMS Unity Network by Device Name, Device Type, location, serial number, IP address, MAC Address and software revision. The BMEX CE also locates and identifies all TRAM modules and their software revision. Serial numbers of TRAM Modules can be acquired when/where available.

The BedMasterEx CE system configuration supports service maintenance scheduling and tracking for all patient monitors along with the remote view of any GEMS patient monitor connected to the hospital’s Unity network for initial remote trouble shooting determinations.

The BMEX CE configuration includes the “Unity Time”, a function that monitors and automatically resets the time clock errors for all of the patient monitors attached to the Unity network

SOFTWARE SUPPORT AND PROGRAM UPDATES

All licensed applications from EME are delivered with a six (6) month software support and update program. Extended and Annual software support services are available which includes all software updates and on-line support via a controlled VPN connection. This service can be included at the time of initial purchase or added at the conclusion of the initial six month software support program.

Excel Medical Electronics (EME) makes a concerted effort to work with and "rapidly implement" the ideas and suggestions put forth from our clients to support their data acquisition objectives. Our mission is to provide the best solution possible to document a patient's clinical encounter at the medical center and assist the clinician and/or researcher with their ability to acquire, review, analyze and manage patient physiologic information.

For additional information, system configurations and system current pricing contact:

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