

# SAHAND & SAHAND PRO

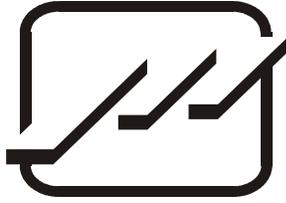
## Central Monitoring System

### User Manual



CE 2195

D00970-V10



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## **Preface**

### **Manual Purpose**

This manual provides the instructions necessary to operate the SAHAND & SAHAND PRO central monitoring system in accordance with its function and intended use. Observance of this manual is a prerequisite for proper performance and correct operation, and ensures patient and operator safety. If you have any question about the central, please contact our customer service. This manual is an integral part of the central system and should always be kept close to this system, so that it can be accessed whenever necessary.

### **Intended Audience**

This manual is provided for the clinical medical professionals. Clinical medical professionals are expected to have working knowledge of medical procedures, practices and terminology as required for monitoring of patients.

### **Version Information**

This manual has a version number. This version number changes whenever the manual is updated due to software or technical specification changes. The version of this manual is as follows:

Release date	Version number
October 2024	D00970-V10

### **Illustrations and Names**

The illustrations and names of this document may not necessarily accord with your central system.

## **General warnings**

- The Central Monitoring System is intended for use only as an adjunct in patient assessment.  
It must be used in conjunction with clinical signs and symptoms.
- Before using the CMS, please read all parts of this user manual.  
SAADAT Company is responsible for safety, reliability and performance of this product only if the product is used according to this user manual.
- All installation operations, developments, changes, modifications, repairs, transportation and disassembly of this product should be conducted by SAADAT trained and experienced personnel;
- All cleaning operations should be conducted by trained personnel.
- The CMS software has been designed so that probability of risks arising from the software errors is minimized.
- Compliance with maintenance and transportation requirements.
- Before monitoring, check all the system components in terms of mechanical damage during transport, installation, storage and use;
- Contact Customer service in case of any problem;
- Before monitoring, make sure that the CMS equipment is switched on and functions properly;
- During monitoring, the system time should be synchronized with the local time;
- Check the system time regularly;
- The CMS must be inspected every two years by trained personnel, but it is recommended that the system is inspected every year. In addition, the system lifetime is 10 years.
- The EMC information of the CMS are provided in the APPENDIX I.
- Keep the CMS components free from noise, vibration, pressure, dust, corrosion, fire and explosion. Leave a space in front and back of the device for convenient operation and maintenance. In order to have sufficient ventilation, the CMS should be kept at a distance of minimum 5 cm (2 inches) from the shelf.

# 1.The Basics

## 1.1 Product Overview

The Central Monitoring System, abbreviated to CMS afterward, is powerful software with high performance that constructs a monitoring network by connecting bedsides. By storing, processing, analyzing and displaying the bedsides information, the CMS is capable of providing a centralized monitoring for all patients that greatly promotes the efficiency and quality of the monitoring.

## 1.2 Intended Use

### Essential Performance

Some of CMS capabilities:

- Monitoring of 32 bedsides information.
- Review of 48 hours Disclosure data in 16-bed mode and 24 hours data in 32-bed mode for each patient.
- Review of 96 hours Trend data in 16-bed mode and 48 hours data in 32-bed mode for each patient.
- Review of 720 alarms for each patient
- Review of 1000 NIBP measurements for each patient
- Storage and review of all waveforms in the Disclosure page.
- Storage and retrieval of 2000 patients data
- Monitoring of a bed in enlarged mode on the first and second screens (Bed View).
- Monitoring of 12-lead ECG signal
- Recording/printing 12-lead ECG signal
- Patient information management
- HR alarm History
- Recording History
- Audible and visual alarms
- Recording/Printing
- Recording /printing one or two waveforms (based on user selection)
- Setting waveforms/parameters color
- User -friendly configuration
- Supporting two display screens with high resolution (1920× 1080 (Full HD))

- LAN network (wired /wireless)
- Connection to PACS server to create and display DICOM file
- Connection to HIS server to send data
- Sending NIBP measurement command to the bedside monitor
- Backing up data of each bed (Disclosure, Trend, NIBP List, Alarm List) and saving the data in the flash memory
- Inputting data via keyboard and barcode scanner
- Capturing an image of the screen data
- Reviewing and printing 100 images and storage of them on USB flash
- Supporting several languages
- Solar and Christian calendars
- Supporting Nurse Call
- Adjusting ST analysis
- Creating, saving and printing PDF files
- Setting and displaying measurement unit of each parameter
- Setting the bedside's modules
- Sending beds data to Cloud server
- Caliper measurement in Disclosure

#### **Indications For Use**

The CMS is intended to conduct centralized monitoring of vital signs information from multiple monitors in hospitals or medical institutions.

- Waveforms, parameters and alarms of the CMS are only a reference for physicians and cannot be used directly for clinical treatment.
- If any displayed value is unreasonable or ambiguous, first measure patient's vital signs by the other tools and then verify the CMS performance.
- The preferred distance for monitoring is 1 m from the display screen.

 **Patient Population**

The CSM is used to monitoring adults, pediatrics and neonates.

 **Intended User**

This CSM is intended for use by qualified clinical physicians or well-trained nurses.

## **1.3 Components**

The CMS consists of:

1. Main device
2. Second display screen
3. Input/Output devices
4. Recorder /Printer
5. Network Equipment

**NOTE:**

- ✓ The main device in the Sahand model consists of a display and a PC and in the Sahand Pro model all parts are integrated in just one PC.
- ✓ All the CMS components should be CE marked.

## **1.4 Network Connection**

The CMS communicates with bedsides via wired/wireless network and provides centralized monitoring. A typical network model of the CMS is as follows:

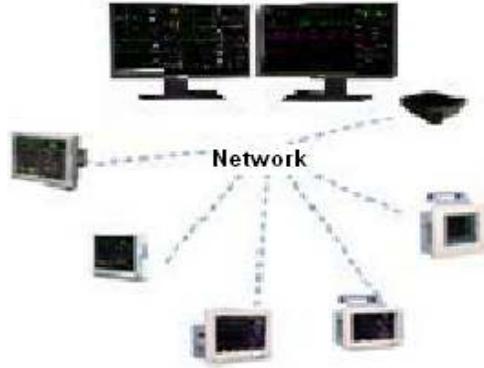


Figure 1-2 CMS network connection

## **2. Installation**

### **2.1 Unpacking and Inspection**

#### **⚠ WARNING ⚠**

- Disposal of the packaging materials shall comply with your local requirements.
- Components of the CMS may be contaminated by microbes during transportation, storage and use.

### **2.2 Installation**

#### **⚠ WARNING ⚠**

- The CMS should be installed by the manufacturer personnel. The copyright of SAHAND software is solely owned by POOYANDEGAN RAH SAADAT Company. No organization or individual shall resort to juggling, copying or exchanging it or to any other infringement on it in any form or by any means without due permission.

#### **⚠ WARNING ⚠**

- Do not place CMS near the strong noisy fields.
- Do not place devices that are sensitive to noise near the CMS.
- Using the CMS in the presence of flammable gases produces explosion risk.

### **2.3 Starting the system**

#### **NOTE:**

- Before using the CMS, make sure that the touch screens have been calibrated and network cable has been connected.
- Check connection of the CMS components before monitoring, otherwise some components may fail to function properly.
- After turning the system on, it plays a sound to ensure that the system sound functions correctly. In case of selecting manufacturer logo, it appears by starting the system.

The system checks the database whenever it is starting up.

In this time the message “SYSTEM IS CHECKING DATABASE PLEASE WAIT...” will appear.



Figure 2-1 Message of database checking

If the CMS turns off because of sudden power failure, there is a possibility of crash in the CMS database. Next time you turn on the CMS, it will take a few minutes that the CMS repairs crashed database. During this time, the following messages will appear in the taskbar:

SYSTEM IS REPAIRING DATABASE PLEASE WAIT...

### **⚠ WARNING ⚠**

- To prevent unexpected errors or consequences of a sudden power failure, it is essentially required that your CMS is equipped with an UPS.
- In lack of AC power and using the UPS, turn off the CMS manually before the UPS turns off.

### **NOTE:**

- If network connection is interrupted, the message “Network cable is unplugged” will appear on the taskbar.
- If the CMS is unable to establish network connection (e.g. fault of network card), the message “Network problem, system restarts in # s” will appear on the taskbar. The system will restart after 120 seconds.
- If software activation file is not available in the CMS or the file content is invalid, “Not Licensed” will be displayed on the taskbar.

## **2.4 Shutting down the system**

Press the power switch on the PC to shut down the system.

## 3. Display screen

### 3.1 Overview

The CMS displays up to 32 patient windows on two screens simultaneously. The number of patient windows depends on the view mode setting (See chapter 4). As shown in the following figure, each CMS screen is divided into maximum eight rows and two columns of patient windows.

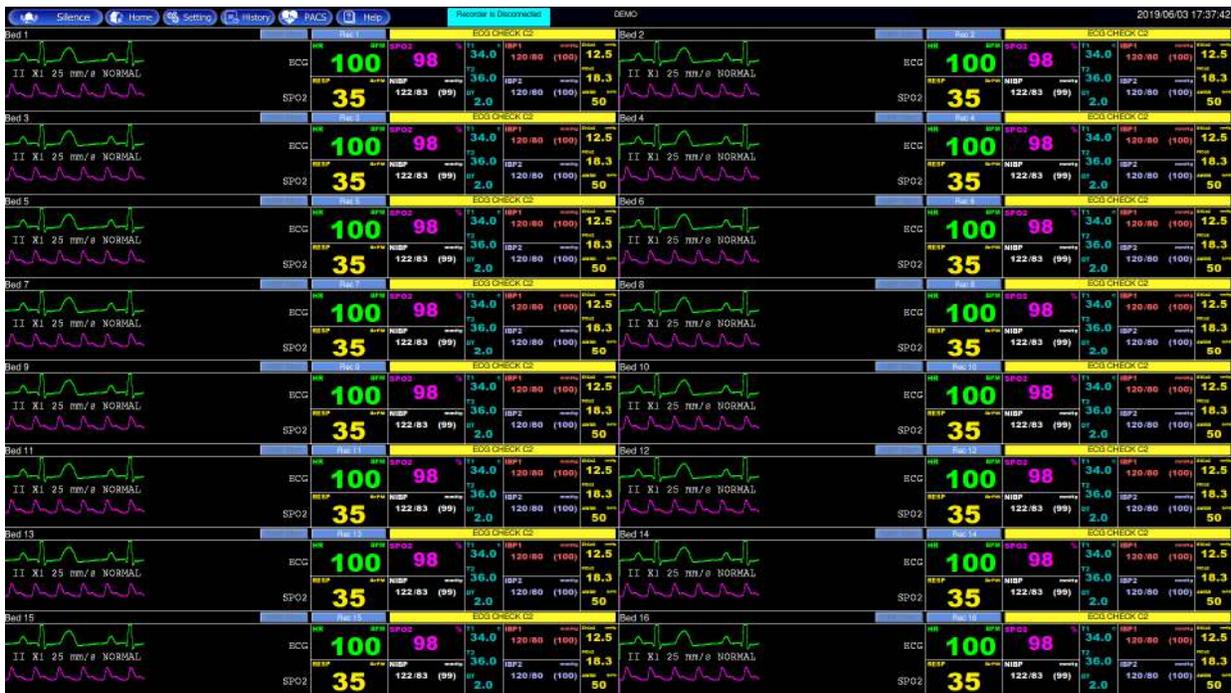


Figure 3-1 Display screen

### 3.2 Patient Window

Each patient window on the CMS represents one Bedside in which you can monitor patient information and vital signs.

#### 3.2.1 Patient Window in Disconnection Status

In the process of monitoring, the patient window may be on “offline” status that it means that Bedside either is switched off or disconnected from the CMS.

In case of disconnection between the CMS and Bedside, the alarm level 2 will occur. In addition to “offline” message, “Bed Disconnect” visual alarm will be displayed until

clicking SILENCE button or reconnecting the Bedside. (See chapter 5)



Figure 3-2 Disconnection status

### 3.2.2 Patient Window in Monitoring Status

In the monitoring status, a patient window displays real-time patient data transmitted from the Bedside. The following figure indicates that the Bedside is communicating with the CMS.

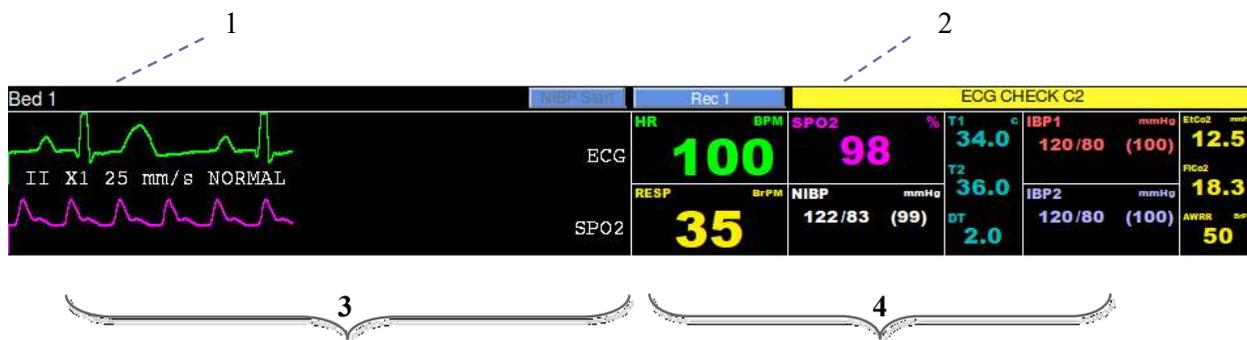


Figure 3-3 Patient window

#### 1. Patient Information Area

This area is to display bed number and patient name. You can measure noninvasive blood pressure by pressing NIBP Start button in this area (Refer to NIBP Start section, 3.3).

#### 2. Alarm Area

This area is to display visual alarms. You can record or print data by pressing Record/Print button in this area.

#### 3. Waveforms Area

This area is to display waveforms transmitted from the Bedsides. Click on this area to freeze the waveforms. By clicking on this area again, you can unfreeze the

waveforms.

Lead, gain, sweep speed and filter are displayed along with the ECG waveform and scale value is displayed along with the IBP waveform.

**NOTE:**

If the bedside can send scale and label of IBP waveform to the CMS, same scale value will be displayed on the bedside and the CMS. Otherwise, default scale (-30–250) value and the word “IBP” will be displayed along with the IBP waveform on the CMS.

### **4.Parameter Area**

This area is to display parameter values transmitted from the bedsides.

**NOTE:**

Unit of the parameters cannot be changed via the CMS. Numeric parameters and their unit are displayed on the CMS (See the figure 3-4). If the bedside can send parameters unit to the CMS, numeric parameters will be displayed based on the selected unit. If the bedside cannot send measurement unit to the CMS, parameters values will be only displayed in default units. If the unit is changed via the bedside, the CMS will display the parameters values in default units.

<b>Parameter</b>	<b>Default units</b>
HR	BPM
SPO2	%
Resp	BrPM
NIBP	mmHg
Temp	°C
IBP	mmHg
EtCo2/FiCo2	mmHg
AWRR	BrPM
BFI/BS/SQI/EMG	%

Figure 3-4 Default units of the CMS

By clicking on this area, you can call up Param Menu. If you click the "Return" button, the parameters will be displayed again.

### **3.3 NIBP Start**

Sending NIBP measurement request

#### **⚠ WARNING ⚠**

Before using this function, please study NIBP chapter of the bedside's user manual and observe safety precautions.

Press NIBP Start to send measurement request to the bedside and start pressure measurement. The button will change to "NIBP Stop" during measurement. If you click on "NIBP Stop", the measurement will be stopped.

RTCP value and relevant message (if any) are displayed beside this button.

#### **NOTE:**

- ✓ Clicking on NIBP Start button will disable this button for 5 seconds.
- ✓ You cannot close NIBP List menu during measurement.
- ✓ If a bedside does not support NIBP measurement, this button will be inactive.
- ✓ If the menu is opened (the main screen slides up), NIBP Start button will not be available.

### **3.4 Nurse Call**

If the Nurse Call button is pressed on the front panel of the bedside, "Nurse Call" item will appear at the top of the patient window on the CMS, and three warning beeps will sound at the same time. Press this item on the CMS screen to respond to the warning and remove the item.

#### **NOTE:**

- ✓ If the warning is responded by pressing the Nurse Call item on the CMS, "Nurse Call" button will be disabled for 40 seconds on the bedside.
- ✓ You can review Nurse Call data in the History menu.

### **3.5 Freeze /Unfreeze waveforms**

By clicking on the waveform area, you can freeze all dynamic waveforms in the

waveforms area. In this status, the red message, “Frozen”, is displayed on the waveform area, and by clicking on this area again, it becomes unfrozen, and the message disappears.



Figure 3-5 Frozen message

You can also freeze/unfreeze Bed View waveforms by clicking on the second display.

**NOTE:** Freezing Bed View waveforms has no effect on patient window waveforms, and vice versa.

### 3.6 Taskbar

There are six buttons on the taskbar as shown in figure 3-6.



Figure 3-6 Taskbar items

#### 3.6.1 SILENCE

At the left side of the taskbar, there is “SILENCE” button. Normally audio alarm is on. By clicking this button, you can set the audio alarm on or off. (Refer to alarm control, chapter 5).

#### 3.6.2 HOME

This button is used to display main screen. You can close the auxiliary screen and return to the main screen by clicking the "HOME" button.

#### 3.6.3 SETTING

You can perform the CMS settings by clicking “SETTING” button.

#### 3.6.4 HISTORY

By clicking this button, you can call up a page including these two tabs:

- History-Patient List
- History-Alarm Setting List
- History-Nurse Call List

### **3.6.5 PACS View**

If the software does not support PACS server, click on PACS View button to open a browser page for connection to the PACS server and displaying DICOM files on the second screen.

**NOTE:** The View button is inactive in the view modes with structure **A×B Beds + A×B Beds**.

## 4. Bed view

### 4.1 Overview

The CMS enables you to view one bed in enlarged mode on the second display (Bed View screen). In fact, the patient data can be monitored more closely.



Figure 4-1 Bed View on the second screen

Click on the “Bed View” in menu of a certain patient window.

#### NOTE:

- ✓ The Bed View button is inactive in the view modes with structure **A×B Beds + A×B Beds**.
- ✓ The Bed View button will turn to green if it is enabled in the Bed Setup menu.

## 4.2 Bed view screen

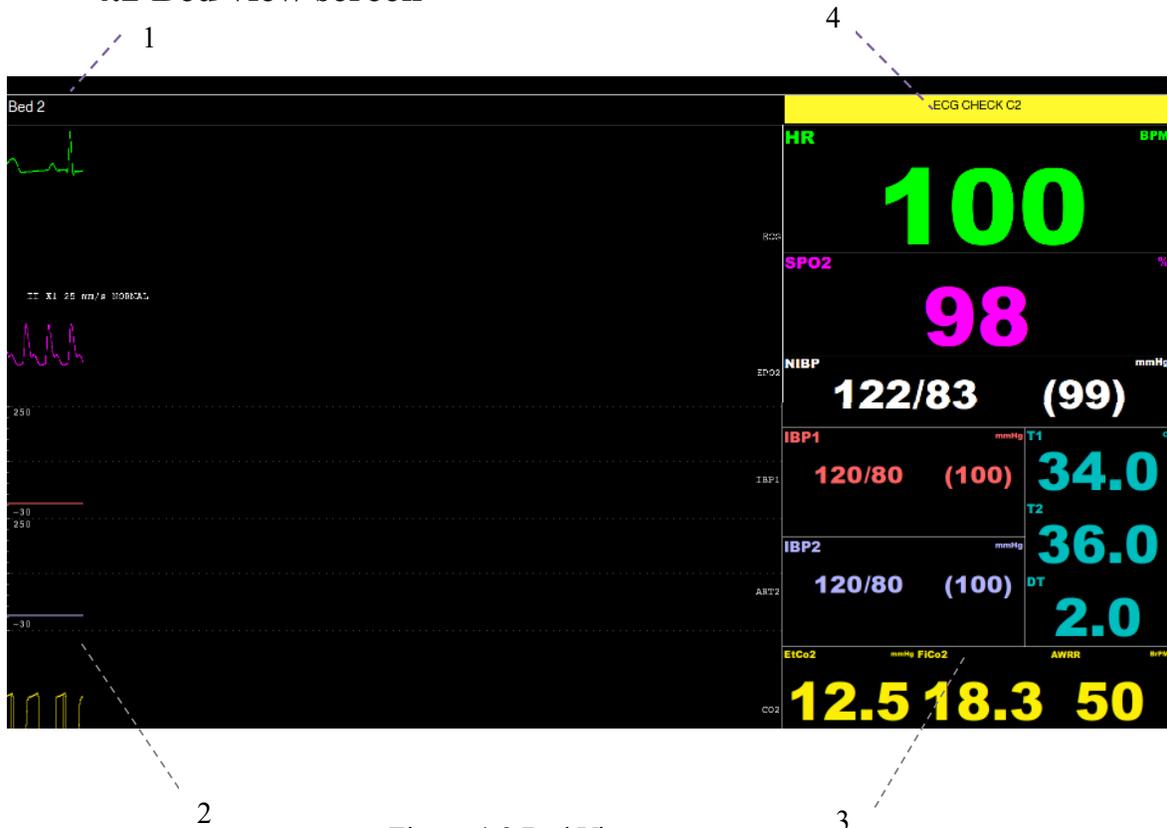


Figure 4-2 Bed View screen

### 1. Patient Information Area

This area is to display bed number and patient name.

### 2. Waveforms Area

This area is to display waveforms transmitted from the Bedsides.

### 3. Parameter Area

This area is to display parameter values transmitted from the Bedsides.

### 4. Alarm Area

This area is to display visual alarms.

## 5. Alarm Control

### 5.1 Alarm Structure

The alarms are triggered by abnormal vital signs (Physiological alarm), by technical problems of the bedside (Technical alarm) or by the CMS software (Systemic alarm) that the first two types of alarm will be transmitted to the CMS. The systemic alarms are intended to inform user about current status of the CMS. Visual and audio alarms are designed according to the standard IEC 60601-1-8.

■ As mentioned, the alarms are classified into the following categories:

1. Physiological alarms
2. Technical alarms
3. Systemic alarms

■ By severity, the alarms are classified into:

- level 1: High priority alarms
- level 2: Moderate priority alarms
- level 3: Low priority alarms

#### 5.1.1 Audible alarms

The system will use different Alarm tones to indicate different alarm levels:

- High priority alarms: “DO-DO-DO—Do-Do---DO-DO-DO--Do-Do”, every 10 s.
- Medium priority alarms: “DO-DO-DO”, every 25 s.
- Low priority alarms: “DO”, every 50 s.

**NOTE:** When multiple alarms with different priorities occur at the same time, the system will select the alarm of highest priority and give alarm tone accordingly.

**NOTE:** Visual alarms can be seen from 2 m and audio alarms can be heard from 10 m.

**NOTE:** if alarm sound is silenced in bedsidess with version 12 or later, all messages will be displayed in gray background.

### 5.1.2 SILENCE button

By clicking the "SILENCE" button, you can silence the alarm. If a new alarm occurs, alarm sound will be activated automatically. You can also activate alarm sound manually.



Figure 5-1 Alarm area

If you click the “SILENCE” button in normal situation, the color of the button will change, “AUDIO OFF” will appear and alarm sound will be silenced. Click again the button to return to normal status.

If you click on the “SILENCE” button in critical condition (e.g. RESP Apnea, Asystole, HR out of limit), the color of the button will change, the button text will change to “ALARM SILENCED” and the alarm sound will be silenced for 2 minutes (120s). If a new alarm occurs in this condition, the alarm sound will be activated automatically.

When alarm is silent in critical condition, icon  appears on the taskbar. You can return to normal status by clicking the button again and then icon will disappear.

### 5.1.3 Visual alarms

If an alarm condition occurs for a patient, its corresponding patient window will give a visual alarm with colors indicating different alarm levels.

Priority of alarm	Background color	Font color
High (1)	“red”	“black”
Medium (2)	“yellow”	“black”
Low (3)	“cyan”	“black”

Visual physiological alarms, technical alarms of the Bedside and "Bed Disconnect" which is systemic alarm are displayed at the top of the patient window. Other systemic alarms of the CMS and the recorder error messages are displayed on the taskbar (Refer to chapter 21 for details).

**NOTE:** When multiple alarms occur in one window, if a level 1 alarm occurs, a message is displayed until the cause of the alarm disappears. Otherwise, level 2 and 3 alarms are displayed alternately.

### 5.1.4 Parameter blinking

If any physiological parameter of the patient generates an alarm, the parameter value will blink in the parameter area. When parameter value exceeds the alarm limits and alarm status is “on” in the bedside, the parameter value blinks in the CMS.

When the CMS starts up, HR alarm limits cannot be set in this system and the adjusted alarm limits in the bedside are transmitted to the CMS.

**NOTE:** The bedside alarms are stored in the CMS and are not lost as a result of sudden power failure, turning off the CMS or disabling alarm.

**NOTE:** Alarm is transmitted from the bedside to the CMS with 1 sec delay (average time).

 **WARNING** 

- If you select specific parameters to monitor, only alarms of those parameters will be enabled.
- Alarm sound should be set with regard to the patient and environment conditions in a way that the patient life is not threatened.

When an alarm occurs:

1. Check the patient condition.
2. Recognize related alarms to each module.
3. Identify the alarm cause.
4. Click “SILENCE” button, if necessary.
5. After removing the alarm cause, enable the alarm sound.

## 6. CMS Menu

### 6.1 General

Click on the Parameter area of each bed, a menu will appear (See the figure 6-1). This menu consists of several tabs. If settings of a tab is exclusively related to a bed, the items patient name, bed number and ID will be displayed above the menu. Click on the bed number, a list of connected beds to the CMS or beds which have data will appear.

- ✓ You can set the first bed number of the CMS by selecting “Bed Offset”.
- ✓ The main screen slides up when the CMS menu is opened. In this condition, only HR parameter and ECG waveform are displayed.
- ✓ If you enter this menu via clicking on History or Setting buttons in the taskbar and then select tabs which are exclusively related to a bed, a pull-down list will pop up. You should select a bed number from the list and press OK. You can close the pop up menu by clicking outside of the menu.

If you change the bed number, data of the current menu and other menus will be changed. Click on Home button to close the menu.

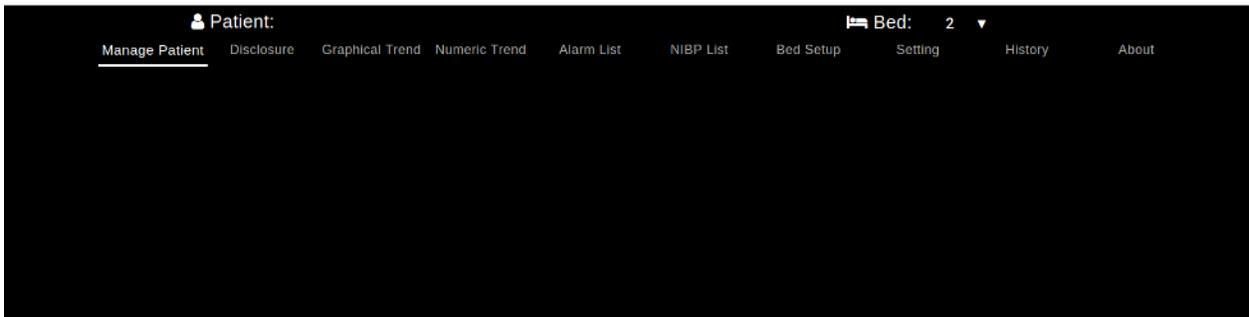


Figure 6-1 CMS Menu

## 6.2 Controls

### 6.2.1 Tooltip

Hover the cursor over an icon, image and etc., a "hover box" with information about the item may appear.

### 6.2.2 High-level accessibility

Some capabilities of the Admin tab are intended only for trained and authorized personnel of the manufacturing company.

The icon  means high-level accessibility of the settings. Clicking on this icon will call up an **Authentication** page in which you should enter the correct password and press  button to access your intended settings for 300 seconds. Press **Log out** or leave the page to disable accessibility. If you select **Cancel** or click outside of the page, the page will be closed and no change will be made in the settings.

#### NOTE:

- ✓ Only trained and authorized personnel have access to the password.
- ✓ Accessibility will be disabled if you leave the page.
- ✓ Press  icon and **Log out** button to disable high-level accessibility.

### 6.2.3 On-screen keyboard

By clicking on text fields, an on-screen keyboard will pop up to enter data. To close the keyboard, click outside of the keyboard or press Close icon ▼.The keyboard includes the alphanumeric keys (letters and numbers) or numeric keys.

### 6.2.4 Date & time

This item is used to set time and date. Click on date above the screen and set year, month and day. You can set time (Hour and minute) below the screen. Click outside of the menu or select **Cancel** to close the menu.

### 6.2.5 Save

A disk icon  is available in some menus toolbar to save settings. Click on this icon to save settings and leave the menu.

**NOTE:**

- ✓ To save settings, click on Save icon before leaving the menu, otherwise new settings will not be applied.
- ✓ Click on  in **Bedsetup-Module Setting** menu. The new settings will be applied , but the menu will not be closed.

### **6.2.6 Help**

The icon  is available in the toolbar of all menus. Click on this icon to access Help page of the menu. You can access other Help pages via sidebar navigation menu. Select your intended menu from above tabs to leave the Help page. You can also press Home button on the taskbar to close the menu.

### **6.2.7 Capture**

The icon  is available in some menus. Click on this icon to capture an image from the screen data. You can review the captured images in the Event Recall menu.

## **7.Manage Patient menu**

### **7.1 General**

The CMS enables you to modify patient information and discharge a patient.

**NOTE:** After connection between the CMS and Bedside, vital signs of a new patient that transmitted from the Bedside will be saved and displayed automatically.

#### **7.1.1 Modifying patient information**

In this page, you can modify patient information, such as name, gender, height, blood type and etc. Click on your desired field and enter data into the field. You can change gender by clicking on image.

#### **7.1.2 Saving patient information**

Click on  icon in toolbar of the Manage Patient menu to save data and leave the menu.

### **7.1.3 Discharging a patient**

Discharging a patient means to terminate monitoring of that patient. To discharge a patient:

1. Select  icon in the menu toolbar.
2. Set date and time of discharging in the current menu and press **Set** button.
3. Confirm the pop-up message for discharging the patient.

#### **WARNING**

- After discharging the patient, if the CMS is not disconnected from the Bedside completely, data storage will be continued.

### **7.2 Barcode Scanner**

Connect barcode scanner to the CMS and click on your intended text field in **Patient Info** page. Data is read via the barcode scanner and entered into the text field.

## **8. Disclosure**

### **8.1 General**

You can review up to 48 hours of ECG waveform and numeric parameters in this page.

**NOTE:** After saving 48 hours of Disclosure data in 16-bed mode or 24 hours of data in 32-bed mode if new data is saved, the earliest data will be deleted.

### **8.2 Function**

The below functions are available in the Disclosure page:

- Review ECG, SPO2, IBP1, IBP2 and RESP waveforms
- Review parameters values
- Options (selecting waveform and parameters)
- Scroll through pages
- Capture an image of the screen data
- Search
- Record/print
- Caliper

#### **8.2.1 Review ECG Waveform**

You can review one selected waveform for 1 minute (in three rows of 20 seconds) or two selected waveforms for 20 sec. Move the mouse along the waveform, the cursor points to specific date and time.

Click on **Option** icon to change waveform. Available waveforms are:  
ECG, SPO2, IBP1, IBP2, RESP

**NOTE:** You cannot select some waveforms, because they are not sent via the bedside monitor.

#### **8.2.2 Review Parameters Values**

Momentary parameters values are displayed above the waveform based on location of the cursor. The parameters displayed in this section can be selected via **Option**

menu.

### 8.2.3 Options (Selecting waveform and parameters)

Click on  icon at the left side of the toolbar. A page will appear that consists of two sections: **Signal** and **Parameter**. In the Parameter section, you can select that numeric values and waveform of which parameters are displayed above the Disclosure page. Up to 12 parameters can be selected in this section. Available parameters are:

HR, ST, PVCs, PR, SPO2, PI, PVI, SPCO, SPHB, SPMET, SPOC, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2, AWRR, BFI, BS, SQI, EMG, Multi ST

**NOTE:** Selecting **Multi ST** parameter will disable all other options and **ST-I, ST-II, ST-III, ST-V1, ST-V2, ST-V3, ST-V4, ST-V5, ST-V6, ST-AVR, ST-AVF** and **ST-AVF** values will be displayed. In addition to these parameters, HR value will be displayed (if you have selected HR).

In the Signal section, you can select which signals are displayed in the Disclosure page. Up to 2 signals can be displayed at the same time. Available signals are:

**ECG, SPO2, IBP1, IBP2, RESP**

Click outside of the page or select **OK** to leave this page.

### 8.2.4 Scroll through pages

 Displays the most recent disclosure data and refreshes data.

 Displays the next page (if any).

 Displays disclosure data stored 60 seconds after current page (for 1 signal) or 20 seconds after current page (for 2 signals).

 Displays disclosure data stored 60 seconds before current page (for 1 signal) or 20 seconds before current page (for 2 signals).

 Displays the previous page (if any).

 Displays the earliest disclosure data.

### **8.2.5 Capture**

Click on icon  to capture an image from the screen data. You can review the captured images in the Event Recall page.

### **8.2.6 Search**

Click on Search icon  at the right side of the toolbar to call up Search page. Select your desired interval and press **Goto** button, respective Disclosure page will appear. Click outside of the page or select **Cancel** to close the page.

#### **NOTE:**

If no data is available for an interval, you cannot select that interval.

### **8.2.7 Record/print/ PDF**

There are two types of recording:

- a) Normal recording/printing
- b) Recording/printing the marked area

- a) Normal recording/ printing

- 1- Click on  icon, a page will appear to select time of recording/printing.
  - 2- Three intervals of 20 sec are available in this page for three rows of ECG signal in the Disclosure page.
  - 3- Click on  icon, the recording/printing will be carried out according to the selected interval.
- If there are two waveforms in the current page, you can record/print/save both waveforms by clicking on the icon.

- b) Recording/printing the marked area

- 1- Mark start point of the recording/printing by clicking on the signal. The start point is marked by a vertical red line.
- 2- Select end point of the recording/printing by clicking again on the signal (in the disclosure page).

3- Click on the icon to start recording/printing . Click again to stop recording/printing.

**NOTE:**

- ✓ The recording/printing starts from the start time and continues to the end time.
- ✓ You can not mark the signal in the Print mode.
- ✓ You can review PDF files in the Event Recall menu.

The ECG signal, patient information including date and time of recording, bedside Number, type of recording, patient ID, patient name, date of birth, gender, weight and height, Trace 1, Trace 2, recording speed, ECG filter of bedside, hospital name, ward, physician name and parameters values are recorded in this section. The message “Recording Disclosure Bed#” is displayed on the taskbar during the recording.

**NOTE:**

Lead, gain and filter values of the recording time are printed on the header of the paper.

### **8.2.8 Caliper**

You can select two points on the tracing waveform in the Disclosure window to view measured tracing interval (in millisecond) above the screen.

## 9. Graphical Trend

### 9.1 General

You can review up to 96 hours of trend data in this page.

**NOTE:** After saving 96 hours of Graphical Trend data in 16-bed mode or 48 hours of data in 32-bed mode if new data is saved, the earliest data will be deleted.

### 9.2 Function

The below functions are available in the Graphical Trend page:

- Review Trend graph and numeric parameters
- Options (selecting graph, parameter and time width)
- Scale setting
- Scroll through pages
- Capture an image of the screen
- Search
- Record/print/PDF

#### 9.2.1 Review Trend graph and numeric parameters

You can review graph of the selected parameters for one hour or 10 minutes in this page. The parameters values corresponding to the time of the cursor position are displayed above the graph. The parameters displayed in this section can be selected via Options menu.

#### 9.2.2 Options (Selecting waveform, parameter and time width)

Click on  icon at the left side of the toolbar. A page will appear that consists of three sections: Graph, Parameter and Time Width

- Numeric values of the selected parameters in Parameter section are displayed above the Trend page. Available parameters in this section are (you can select up to 12 parameters):

HR, ST, PVCs, PR, SPO2, PI, PVI, SPCO, SPHB, SPMET, SPOC, IBP1, IBP2, T1,

T2, RESP, EtCo2, FiCo2, AWRR, BFI, BS, SQI, EMG, Multi ST

**NOTE:** Selecting **Multi ST** parameter will disable all other options and **ST-I, ST-II, ST-III, ST-V1, ST-V2, ST-V3, ST-V4, ST-V5, ST-V6, ST-AVR, ST-AVF** and **ST-AVF** values will be displayed. In addition to these parameters, HR value will be displayed (if you have selected HR).

- The graphs of the selected parameters in Graph section are displayed in the Graphical Trend page. The maximum five parameters can be selected in this section. Available parameters are:

HR, SPO2, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2

Click outside of the page or select **OK** to leave this page.

**NOTE:**

If more than one scale is available for a parameter, you can change its scale.

- You can select time interval of the graph (1 h or 10 min) via “Time Width” option.

### **9.2.3 Scale setting**

Select a parameter in the Graph section. The scale value is displayed at the right side of the toolbar. Click on the scale and select a scale from list of available scales, the graph will be changed corresponding to your selected scale.

**NOTE:**

The selected scale will be saved for each parameter and bed.

### **9.2.4 Scroll through pages**

 Displays the most recent Graphical Trend data and refreshes data.

 Displays the next page (if any).

 Displays the previous page (if any).

 Displays the earliest Graphical Trend data.

### **9.2.5 Capture**

Click on icon  to capture an image from the screen data. You can review the captured

images in the Event Recall page.

### **9.2.6 Search**

Click on Search icon  at the right side of the toolbar to call up Search page. Select your desired interval and press **Goto** button, respective Graphical Trend page will appear. Click outside of the page or select **Cancel** to close the page.

#### **NOTE:**

If no data is available for an interval, you cannot select that interval.

### **9.2.7 Record/print/PDF**

1- Click on  icon , a page will appear to select parameter.

2- Select your desired parameter to record/print its graph.

Available parameters are:

HR, SPO2, RR, IBP1, IBP2, T1, T2, EtCo2, FiCo2

3- Click on **Print** button to record/print/ save the graph of the current page.

The ECG signal, patient information including date and time of recording, bedside Number, type of recording, patient ID, patient name, date of birth, gender, weight and height, time interval, hospital name, physician name and parameters values are recorded in this section. The message “Recording Trend Bed#” is displayed on the taskbar during the recording.

## 10. Numeric Trend

### 10.1 General

You can review up to 96 hours of the below parameters values in this page.

Date, Time, HR, SPO2, RR, Dual IBP (S D M), ETCO2, FICO2

**NOTE:** After saving 96 hours of Numeric Trend data in 16-bed mode or 48 hours of data in 32-bed mode if new data is saved, the earliest data will be deleted.

### 10.2 Function

The below functions are available in the Numeric Trend page:

- Options
- Scroll through pages
- Search
- Capture an image of the screen data

#### 10.2.1 Options (Selecting waveform, parameter and time width)

Click on  icon at the left side of the toolbar. A page will appear to select parameter. Available parameters in this section are:

HR, ST, PVCs, PR, SPO2, PI, PVI, SPCO, SPHB, SPMET, SPOC, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2, AWRR, BFI, BS, SQI, EMG, Multi ST

**NOTE:** Selecting **Multi ST** parameter will disable all other options and **ST-I, ST-II, ST-III, ST-V1, ST-V2, ST-V3, ST-V4, ST-V5, ST-V6, ST-AVR** and **ST-AVF** values will be displayed.

#### 10.2.2 Scroll through pages

 Displays the most recent Numeric Trend data and refreshes data.

 Displays the next page (if any).

 Displays the previous page (if any).

 Displays the earliest Numeric Trend data.

### **10.2.3 Search**

Click on Search icon  at the right side of the toolbar to call up Search page. Select your desired interval and press **Goto** button, respective Numeric Trend page will appear. Click outside of the page or select **Cancel** to close the page.

#### **NOTE:**

If no data is available for an interval, you cannot select that interval.

### **10.2.4 Capture**

Click on icon  to capture an image from the screen data. You can review the captured images in the Event Recall page.

## 11. Alarm list

### 11.1 General

By clicking the “Alarm List” button, you can review up to 720 alarm events for each patient. Date, time, message, type and level of alarms are displayed in this window.

#### NOTE:

- ✓ After storage of 720 alarm events, if you save a new event, the earliest alarm event will be deleted.
- ✓ In case of ECG alarm occurrence, it is possible to view HR alarm limits.
- ✓ In addition to storage of 720 alarm records, the CMS can save 700 Arrhythmia alarm records (in case of customization).

### 11.2 Function

The below functions are available in the Graphical Trend page:

- Filter alarm events
- Scroll through pages
- Search
- Capture an image of the screen data
- View alarm details via the Disclosure page
- Record

#### 11.2.1 Filter alarm events

Click on  icon in the Alarm List toolbar. A page will be displayed to filter alarm events based on type, level or time of occurrence. Select **OK** to filter alarm events and select **Clear** to remove filtering. Click outside of this page to leave the page.

Available options for Alarm Type are:

ALL ALARMS, ECG, SPO2, IBP1, IBP2, RESP, NIBP, Co2, TEMP,BFA, ARR  
(ARRHYTHMIA)

Available options for Alarm Level are:

ALL LEVELS, LEVEL 1, LEVEL 2, LEVEL 3, SILENCED

- ✓ If a filtering is applied in the alarm List page , the filter icon will change to 

- ✓ The selected filtering will be applied for all beds until user remove or change it. The filtering will remain if you leave the menu and enter it again.
- ✓ To remove time of filtering, click on  icon beside the time field.

### **11.2.2 Scroll through pages**

The following navigation keys and page number are displayed above the Alarm List window.

-  Displays the most recent Alarm List data and refreshes data.
-  Displays the next page (if any).
-  Displays the previous page (if any).
-  Displays the earliest Alarm List data.

### **11.2.3 Search**

Click on **Search Records** in toolbar of the Alarm List window. An on-screen keyboard will pop up that you can type and search your intended data. Only data containing your keywords will be shown in the list.

### **11.2.4 Capture**

Click on icon  to capture an image from the screen data. You can review the captured images in the Event Recall page.

### **11.2.5 View alarm details via the Disclosure page**

Double click on an alarm to view ECG waveform and related parameters values in the disclosure page.

### **11.2.6 Record**

The icon  is only available for ECG or Arrhythmia alarm. Click on this icon to record/print/PDF ECG waveform in time of the alarm occurrence. Click the icon again to stop the recording.

The ECG signal, patient information including date and time of recording, bedside number, type of recording, patient ID, patient name, date of birth, gender, weight and height, Trace 1, Trace 2, recording speed, ECG filter of bedside, hospital name, ward, physician name, parameters values are recorded in this section. The message “Recording Manual Alarm Bed#” is displayed on the taskbar during the recording.

## 12. NIBP list

### 12.1 General

You can review NIBP measurements of a patient in **NIBP List** page. The below information are displayed in this page.

Row, Date Time, NIBP SYS, NIBPDIA, NIBPMAP, Pulse, Message

#### NOTE:

After storage of 1000 NIBP records, by saving a new record the earliest record will be deleted.

### 12.2 Function

The below functions are available in the Graphical Trend page:

- Filter NIBP records
- Scroll through pages
- Search
- Capture an image of the screen data
- Record

#### 12.2.1 Filter NIBP records

Click on  icon in the NIBP List toolbar. A page will be displayed to filter records based on type (SYS, DIA and MAP) or time of the measurement. Each time the filter page is opened, the maximum and minimum pressure values are updated and you can select your desired interval.

Select **OK** to filter NIBP records. Click outside of this page to leave the page.

- ✓ If a filtering is applied in the alarm List page, the filter icon will change to 
- ✓ The selected filtering will be applied for all beds until user remove or change it .
- ✓ To remove time of filtering, click on  icon beside the time field. The filtering will be removed if you leave the menu.
- ✓ Select **Clear** to remove all filters.

**NOTE:**

Select a correct range before filtering. If the maximum value is lower than the minimum value, the message “Please select value correctly” will appear.

**12.2.2 Scroll through pages**

The following navigation keys and page number are displayed above the NIBP List window.

 Displays the most recent NIBP List data and refreshes data.

 Displays the next page (if any).

 Displays the previous page (if any).

 Displays the earliest NIBP List data.

**12.2.3 Search**

Click on **Search Records** in toolbar of the NIBP List window. An on-screen keyboard will pop up that you can type and search your intended data. Only data containing your keywords will be shown in the list.

**12.2.4 Capture**

Click on icon  to capture an image from the screen data. You can review the captured images in the Event Recall page.

**12.2.5 Record**

Click on  icon in toolbar of the NIBP List window to record/print/save the current page.

The current page of the NIBP List, patient information including date and time of recording, bedside Number, type of recording, patient ID, patient name, date of birth, gender, weight and height, hospital name, ward and physician name are recorded in this section. The message “Recording NIBP List Bed#” is displayed on the taskbar during the recording.

## 13. Event Recall

### 13.1 General

You can review captured images and PDF files in this section. The files (image or PDF) are named based on initial letter of menu and date and time of capturing. The newer images are shown at the top of the list.

#### **NOTE:**

Up to 100 images or PDF files are saved for each patient. If a new file or image is saved after this quantity, the oldest file/image will be deleted.

### 13.2 Function

The below functions are available in the Event Recall page:

- Review images
- Review PDF files
- Save or print
- Delete

#### 13.2.1 Review images/PDF files

There is a button at the left side of the toolbar. Click on the button to select Image or PDF. A list of images or PDF files can be reviewed in the Event Recall page. The files and images are organized based on their name and you can also see their quantity. Press > to see available images in each group. Click on a file to open it.

#### **NOTE:**

- ✓ You can open/close the list by clicking on the icon .
- ✓ When you click on an image, the cursor pointer will change to a magnifier. Move the cursor outside of the image to restore it to the initial state.
- ✓ You can change size of PDF files in this page.

### **13.2.2 Save and Print**

Click on  icon in toolbar of the Event Recall menu and select your intended printer to print the current file. Select “Print to File” to save the current file into PDF file.

**NOTE:**

- ✓ If no file (image or PDF) is available, a message will appear to notify you.
- ✓ You can change storage location of images.

### **13.2.3 Delete**

Mark an image (s) and press  to delete the selected image (s).

**NOTE:**

If you select a group, all files (image or PDF) of that group will be deleted.

## 14. Bed Setup

### 14.1 General

You can perform bed settings and export patient data via this menu. There are three tabs **Setting**, **Extract Data** and **Module Setting** at the left side of this menu. The icons **Save** and **Save All Beds** are available in top toolbar of this page. Click on

Save icon  to save new settings for a bed. Clicking on “Save All Beds” icon



will save settings of the current page for all beds.

#### **NOTE:**

Click on Save icon after settings, otherwise new settings will not be applied.

### 14.2 Setting tab

**Bed Setting** and **View Setting** are available in the **Setting** tab.

#### 14.2.1 Bed Setting

The following items can be set in this section:

- Periodic Record
- Alarm Record
- Freeze Record
- Arrhythmia to PACS
- ST Default Point
- Bedview
- PACS
- ECG Lead
- ECG Gain
- CMS Signals Speed
- HR Alarm

#### **NOTE:**

HR Alarm, ECG Lead, ECG Gain and CMS Signals Speed will not be available in this section if the bedside is able to send/receive parameters settings to/from the CMS. In this condition, you can set these items in the Parameter Settings tab.

## ■ **Periodic Record/Print**

ECG signal can be recorded by recorder for 10 seconds and can be printed by printer for 40 seconds in different intervals. Available intervals are:

(OFF, 15Min, 30Min, 1H, 2H, 4H, 8H, 12H, 24H)

In addition to ECG signal, patient information including date and time of recording, bedside number, type of recording, patient ID, patient name, date of birth, gender, weight and height, Trace1 and Trace2, recording speed and ECG filter of bedside, hospital name, ward, doctor name and parameters value are recorded on the paper.

The message “Recording Periodic Bed #” is displayed on the taskbar during the recording.

## ■ **Alarm Record**

Select this item to start recording upon an alarm occurrence. The recording is initiated when HR value violates the adjusted alarm limits or ECG ASYSTOLE occurs. When ECG alarm occurs, the system records ECG waveform for 20 s.

In addition to ECG signal, information including date and time of recording, bedside number, type of recording, patient ID, patient name, date of birth, gender, weight and height, Trace1 and Trace2, recording speed and ECG filter of bedside, hospital name, ward, physician name and parameters value are recorded on the paper.

The message “Recording Automatic Alarm Bed #” is displayed on the taskbar during the recording.

## ■ **Freeze Record**

When you select “Freeze Record” in a bed, the system records frozen ECG signal for 20 s. In this condition, you can freeze an abnormal ECG signal and record it.

In addition to ECG signal, information including date and time of recording, bedside number, type of recording, patient ID, patient name, date of birth, gender, weight and height, Trace1 and Trace2, recording speed and ECG filter of bedside, hospital name, ward, physician name and parameters value are recorded on the paper.

The message “Recording Freeze Bed #” is displayed on the taskbar during the recording.

## ■ Arrhythmia to PACS

If the system can connect to PACS server, upon occurrence of an arrhythmia event ECG data as well as Trend data in time of arrhythmia occurrence and other arrhythmia events (if any) will be sent to PACS server for 10 seconds.

## ■ HR Alarm

Select ON to enable all alarm functions such as parameter blinking and audio alarm. If you select OFF, the icon  will be displayed in HR parameter area to indicate the alarm silence. Enable HR alarm again, the icon will disappear.

### NOTE:

This section can only be set by admin user.

## ■ Alarm Limits

Set ON HR Alarm to set the alarm limits.

### NOTE:

This section can only be set by admin user.

## ■ ECG LEAD

Available options for ECG Lead are:

I: To measure the heart rate and monitor RA – LA waveform.

II: To measure the heart rate and monitor RA – LL waveform.

III: To measure the heart rate and monitor LA – LL waveform.

aVR: To measure the heart rate and monitor  $RA - (LA + LL)/2$  waveform.

aVL: To measure the heart rate and monitor  $LA - (RA - LL)/2$  waveform.

aVF: To measure the heart rate and monitor  $LL - (RA - LA)/2$  waveform.

V: To measure the heart rate and monitor  $C - (RA + LL + LA)/3$  waveform.

### NOTE:

- ✓ You can only select V, aVF, aVL and aVR in 5-lead ECG mode.
- ✓ You can only select V1 to V6 leads in 10-lead ECG mode.

## ■ ECG Gain

To adjust the size of ECG waveform, select gain value for each lead from X0.25, X0.5, X1, X2, X4 and AUTO. In "AUTO" mode, the monitor chooses an appropriate gain automatically.

## ■ ECG Sweep Speed

Available options for Sweep speed are 12.5 mm/s, 25 mm/s and 50 mm/s.

### NOTE:

- ✓ Changing sweep speed setting in the CMS does not have effect on the sweep speed setting of the bedside and vice versa.

## ■ ST Default Point

Select this item to view adjusted ST and ISO points (red and green lines) on normal ECG waveform. ST and ISO values are displayed below the graph. You can change position of these points using navigation keys or by clicking on the waveform. Upon clicking on **OK**, new settings will be sent to the bedside. If the settings are changed via the bedside, the appropriate message will be displayed.

### NOTE:

- ✓ If the bedside is able to send 12-lead ECG signal, all 12 signals are displayed to set ST and ISO points.
- ✓ The lead of each signal is shown beside it.
- ✓ Clicking on  icon will refresh the signal.
- ✓ This time can only be set by authorized user.

## ■ Bedview

This item is only enabled in the view modes with structure of mxn Beds + Bedview. Click on this item to view the current bed in enlarged mode on the second display (Bedview). This item will turn to green if it is activated for a bed.

## ■ PACS

This item will only be active if a Patient ID is defined for the patient. Click on this button to send ECG data and corresponding Trend data to PACS server for 10 seconds.

- ✓ Pay attention when entering patient ID. This ID is used to create and view DICOM file, so it should be unique for each patient.
- ✓ When a patient is discharged, you should record it in patient menu with “Discharge”. If not DICOM file of new patient is not recognizable of the file of previous patient.

### 14.2.2 View Setting

The following items can be set in this page:

- Waveforms
- Parameters

## ■ Waveforms

The following waveforms can be selected and monitored on the main screen:  
ECG, SPO2, IBP1, IBP2, CO2, RESP

### NOTE:

- ✓ With regard to the height of bed window, 2 to 5 waveforms can be selected for monitoring.
- ✓ It is not possible to select Co2 and RESP at the same time. ECG signal has been selected by default and cannot be unselected.

## ■ Parameters

The following parameters can be selected and monitored on the main screen:

- Selectable parameters:  
HR, SPO2, RESP, IBP1, IBP2, NIBP, TEMP, CO2, BFA
- Full parameter

### NOTE:

If “Full Parameter” is not selected:

- ✓ Up to 4 parameters can be selected.

- ✓ Only alarms of the selected parameters will be activated.
- ✓ If the menu is open, HR value and its relevant parameters and alarms as well as alarms of the selected parameters will be displayed.

If “Full Parameter” is selected:

- ✓ BFA parameter is not displayed.

**NOTE:**

- ✓ If HR Source is set to SPO2 or IBP, HR will change to PR on the main screen.

■ **Waveforms/parameters color**

At first select parameter/waveform and then choose your desired color. Click the OK or Cancel button to confirm or cancel the setting. To view default color of all parameters/waveforms in a bed, click on **Reset**.

## **14.3 Extract data**

This tab consists of two sections: **HIS Setting** and **Export**

### **14.3.1 HIS Setting**

The following items can be set in this section:

- **Event to send data**
- **Parameters to save**

**NOTE:**

This section can only be set by admin user.

■ **Event to send data**

**1. ALL Alarms, ECG, SPO2, RESP, IBP1, IBP2, NIBP, TEMP, CO2, ARR**

Upon occurrence of an alarm for each of above parameters or their relevant parameters, numeric values of parameters which are selected in the section “Parameter to save” (except NIBP) will be sent to HIS server.

## **2. Record**

Select this item and take a record to send numeric values of the marked parameters in “Parameter to save” to HIS server.

## **3. NIBP Measurement**

Select this item and measure NIBP to send Diastolic, Systolic and Mean pressure values to HIS server.

## **4. Periodic**

Enable this item and set time interval to send numeric values of the marked parameters in “Parameter to save” to HIS server at the specified interval. Clicking on **Minute** button will change it to **Hour**. You can change your selected interval using + and – buttons.

Available intervals are 5, 10 ,15, .... and 55 min and 1, 2, 3, ... , 24 h.

## **■ Parameters to save**

Available options for this section are NIBP, TEMP, CO2, Full Parameter, HR, SPO2, RESP, IBP1 and IBP2. Upon occurrence of an alarm event for the marked parameter(s), numeric values of the parameter will be sent to HIS server.

### **NOTE:**

- ✓ Numeric values of pertinent parameter(s) to a parameter will also be sent to HIS server, for example if HR is selected, numeric values of ST and PVCs will also be sent to HIS server.
- ✓ Data of a bed will be sent to HIS server only if Patient ID is defined for that bed in PatientInfo page.
- ✓ Patient ID of each patient who accepted in the hospital must be entered carefully in the PatientInfo page. If this ID is entered incorrectly, information of a patient will be saved for other patient.
- ✓ If information of a patient is not used any more, Select Discharge from PatientInfo page and press Save button. If the previous patient is not discharged, information of new patient will be saved for the previous patient.
- ✓ NIBP values will be sent to HIS server only if :
  - 1- “NIBP Measurement” is marked.
  - 2- NIBP parameter is selected in “Parameters to save” section.
  - 3- NIBP is measured.

If each of above actions is not taken, NIBP values will not be sent to the server.

### **14.3.2 Export**

Click on Export button to export patient data and save data on an external memory (USB flash or hard disk). The Export page consists of the below sections:

#### 1. Information

You can select type of information for exporting in this section. Available options are:

- **Alarm List:** To export alarm data saved in the Alarm List.
- **Disclosure:** To export vital signs signals saved in the Disclosure.
- **Trend:** To export parameters values saved in the Trend.
- **NIBP List:** To export NIBP data saved in the NIBP List.

2. With regard to the type of information you have selected in above section, one of the below items will be available:

- **NIBP List:** If you set Information to the Alarm List, no option will be available for the NIBP List.
- **Alarm List:** By setting “Information” to the Alarm List, you can select the alarm which parameters is exported. Available options are:  
All Types, ECG, ST, SPO2, RESP, NIBP, IBP, CO2, Arrhythmia, TEMP, BFA
- **Disclosure:** By setting “Information” to the Disclosure, you can select signal of which parameter is exported. Available signals are:  
ECG, SPO2, RESP, IBP1, IBP2,Co2
- **Trend:** By setting “Information” to the Trend, you can select data of which parameter is exported. Available parameters are:  
HR, SPO2, RESP, IBP1, IBP2, CO2, T1, T2, BFA

#### 3. Time

You can set interval of data export in this section.

#### 4. File Format

The information are exported in two formats: TEXT and PDF. You can select your desired format in this section.

After the settings have been made, press Export button and select path of data storage from pop-up dialog box. Default location is the desktop, but you can select path of data

storage (Flash) via the dialog box. Press “Create Folder” to make a new folder in the current path. Default name for the folder is displayed above the page and you cannot rename the folder.

There are two buttons below the dialog box.

**Cancel:** Press this button to cancel data saving and to close the dialog box.

**Save:** Press this button to save data and to close the dialog box.

## **14.4 Bed Setup-Bedside Setting**

You can perform parameters setting for each bed via this menu. There is a list of different parameters including **ECG, ARRHYTHMIA, ST, TEMP, NIBP, IBP,SPO2, CAPNO** and **RESP**. Click on a parameter to access its setting.

Click on  icon (Save) to save new settings for a bed. Clicking on  icon (Save All Beds) will save settings of the current page for all beds.

### **NOTE:**

Click on Save icon after setting, otherwise new settings will not be applied.

### **14.4.1 ECG**

Available settings for ECG parameter are **Lead, Gain, Speed, Filter, Source, Average, Pace Detect, Alarm Record, Alarm On/Off** and **Alarm Limit**.

#### **• Lead**

Available options for ECG Lead are:

I: To measure the heart rate and monitor RA – LA waveform.

II: To measure the heart rate and monitor RA – LL waveform.

III: To measure the heart rate and monitor LA – LL waveform.

aVR: To measure the heart rate and monitor  $RA - (LA + LL)/2$  waveform.

aVL: To measure the heart rate and monitor  $LA - (RA - LL)/2$  waveform.

aVF: To measure the heart rate and monitor  $LL - (RA - LA)/2$  waveform.

V: To measure the heart rate and monitor  $C - (RA + LL + LA)/3$  waveform.

**NOTE:**

- ✓ You can only select V, aVF, aVL and aVR in 5-lead ECG mode.
- ✓ You can only select V1 to V6 leads in 10-lead ECG mode.
- ✓ Changing sweep speed setting in the CMS does not have any effect on the sweep speed setting of the bedside and vice versa.
- ✓ **Extended** is applicable in diagnostic condition, but the ECG waveform might have some noises.
- ✓ **Monitor** mode may reduce interference from Electrosurgery equipment or can be used when the system has high noises or doesn't have equipotential earth.
- ✓ If all modules are being monitored and Auto mode is selected, the heart rate calculation will be done based on the signals priority, i.e. ECG, SPO2, IBP1 and IBP2.
- ✓ If the heart rate is calculated from any signal except ECG, PR parameter will be displayed instead of HR in the same label and color.

• **Gain**

To adjust the size of ECG waveform, select gain value for each lead from X0.25, X0.5, X1, X2, X4 and AUTO. In "AUTO" mode, the monitor chooses an appropriate gain automatically.

• **Speed**

Available options for Sweep speed are 12.5 mm/s, 25 mm/s and 50 mm/s.

**NOTE:** Changing sweep speed setting in the CMS does not have effect on the sweep speed setting of the bedside and vice versa.

• **Filter**

Available Options for filter are **Normal**, **Extended** and **Monitor**.

**NOTE:**

- ✓ **Extended** is applicable in diagnostic condition, but the ECG waveform might have some noises.
- ✓ **Monitor** mode may reduce interference from Electrosurgery equipment or can be used when the system has high noises or doesn't have equipotential earth.

• **Source**

The heart rate may be derived from “ECG”, “SpO2”, “IBP1”and “IBP2” signals. Default setting for this item is AUTO.

**NOTE:**

- ✓ If all modules are being monitored and Auto mode is selected, the heart rate calculation will be done based on the signals priority, i.e. ECG, SPO2, IBP1 and IBP2.
- ✓ If the heart rate is calculated from any signal except ECG, PR parameter will be displayed instead of HR in the same label and color.

• **Average**

Available options for **Average** are 4, 8 and 16 sec.

Select one option to monitor HR changes with a delay based on your selection.

• **Pace Detect**

This item is "ON" for patient with pacemaker and " OFF" for patient without pacemaker. For more information, please refer to User Manual of Bedside Monitor.

• **Alarm Record**

Set On **Alarm Record** in the CMS to enable this item in the bedside.

• **Alarm**

Select "ON" to enable alarm functions such as parameters blinking, audio alarm and light indicator. Select "OFF" to disable the alarm functions, and there will be a  symbol beside ECG parameter.

Available options are 1 and 2. Level 1 represents the most serious case.

• **Limit**

Alarm limit ranges from 30 to 250 . ECG alarm is activated when the heart rate exceeds ALARM HIGH limit or falls below ALARM LOW limit.

## **14.4.2 Arrhythmia**

The system can detect up to 17 types of arrhythmias.

These arrhythmias include:

- VTAC
- RUN
- AIVR
- TACHY
- BRADY
- FREQUENT PVCs
- ASYSTOLE
- VFIB
- AFIB
- COUPLET
- TRAGEMINY
- BIGEMINY
- R on T
- PAUSE
- MULTIFORM
- PNC
- PNP
- ARR MONITOR
- ALL ALARM LEVEL
- ALL ARCHIVE
- ARR RELEARN

### **NOTE:**

- ✓ ALARM LEVEL for **ASYSTOLE**, **VFIB** and **VTAC** cannot be set and always is **1**.
- ✓ Count and Rate determine the point at which an arrhythmia event is triggered.
- ✓ RUN, AIVR, TACHY, BRADY, FREQUENT PVCs, AFIB, COUPLET, TRIGEMINY, BIGEMINY, R on T, PAUSE, MULTIFORM, PNC and PNP arrhythmias have alarm levels of 1, 2 and OFF. Select level 1 to change background color to red. The background color in level 2 and OFF is yellow and gray respectively.
- ✓ Rate setting is available for VTAC, RUN, AIVR, TACHY and BRADY arrhythmias.
- ✓ RUN and AIVR derive their rate settings from VTAC and cannot be modified.
- ✓ Count setting is available for RUN, AIVR and VTAC arrhythmias.
- ✓ Select ARCHIVE to determine whether the selected event and its information are stored or recorded or both.

- **ARR MONITOR**

This item is used to enable or disable arrhythmia monitoring.

- **ALL ALARM LEVEL**

Select this item to set the level of all arrhythmia alarms.

- **ALL ARCHIVE**

Press to set all arrhythmia ARCHIVE condition to the same state.

- **ARR RELEARN**

Select to start a learning procedure. The message “RELEARN” is displayed in the message area.

### **14.4.3 ST**

ST segment deviation is defined as the displacement above or below the isoelectric level.

ST settings include Analysis, Event Duration, Alarm Record , Alarm and Limit.

- **Analysis**

Select this item to enable or disable ST monitoring.

- **Event Duration**

Select this item to determine the time that a potential ST alarm condition must persist on ECG waveform before the monitor classifies it as a valid alarm condition.

Available options are OFF, 15s, 30s, 45s and 60s.

### **14.4.4 TEMP**

TEMP settings include Unit, Alarm Record, Alarm and Limit.

- **Unit**

Select this item to set measurement unit. Available options are °C and °F.

### **14.4.5 NIBP**

NIBP settings include Unit, Manual/Auto, Alarm Record, Alarm and Limit.

- **Unit**

Select this item to set measurement unit. Available options are mmHg and KPa.

- **Manual/Auto**

In the MANUAL mode, only one measurement is performed by pressing Start key. In the AUTO mode, measurement is repeated over a specified period of time; available intervals are 1,2,3,5,10,15,20,30,45, 60, 90 minutes and 2, 4, 8, 12,16,20,24 hours.

### **14.4.6 IBP**

IBP1/IBP2 settings include Unit, Label, Alarm Record, Alarm ,Limit, Sweep, Filter and Autoscale .

LOW limit.

### **14.4.7 SPO2**

SPO2 settings include Average Time, Speed, Sensitivity Mode, Alarm Record, Alarm and Limit.

### **14.4.8 CAPNO**

Capno module is used to measure respiratory rates. Available Capno settings are CO2 Unit, Signal Speed, Signal Scale, Work Mode, Fill Signal, Compensate, Waveform, Gas Unit and Limit.

- **CO2 Unit**

Select this item to set measurement unit. Available options are mmHg, KPa and %V.

### **14.4.9 RESP**

Available RESP settings are Lead, Gain, Speed, Apnea Limit, Alarm and Limit.

**NOTE:**

- ✓ Any change in parameters settings will be sent from the CMS to the bedside.
- ✓ Enabling Alarm Record in Bedsetup-Module Parameters menu will enable this item in both bedside and CMS.
- ✓ If you enable Alarm Record through “Bedsetup-Module Parameters” menu, this item will be enabled in both CMS and bedside.

## **14.5 Bed Setup-Drug Calculation**

The CALCULATION tab from BedSetup menu contains two submenus **Drug**, **Hemodynamic, Renal, Ventilation and Oxygenation**. The Drug menu is used to calculate rate and dosage of drug and the Hemodynamic menu is used to display numeric parameters.

### **14.5.1 Drug Calculation**

This item is used to calculate rate, dosage, amount or volume, capacity and time of drug infusion. Infusion rate based on Drop Size is defined as Drip Rate.

- **Input data**

Three of parameters **AMOUNT**, **VOLUME**, **DOSE** and **RATE** are entered by user as input, and output values are automatically calculated and displayed in yellow color.

- Measurement unit of AMOUNT and DOSE can be selected by user.
- Available units for AMOUNT are **mg** and **mcg**.
- Available units for DOSE are mg/min, mg/kg//min ,mcg/min and mcg/kg/min

- **Weight**

Weight is adjustable by user, but weight value adjusted in PATIENT INFORMATION menu is displayed in this window by default.

- **RESET VALUE**

User can select << RESET VALUE >> to delete all input values and calculations for new input data and calculations.

The calculation is automatically done as user changes inputs.

- **DRIP RATE**

DRIP RATE is automatically calculated as user defines DROP SIZE.

- **TITRATION TABLE**

Choose TITRATION TABLE >> to access the following window in which you can review the relation between rate and dosage of drug infusion.



The screenshot displays a window titled "Titration Table : Aminophylline". It contains four side-by-side tables, each with two columns: "Dose" and "Inf Rate". The data is as follows:

Dose	Inf Rate
0.50	1.50
1.00	3.00
1.50	4.50
2.00	6.00
2.50	7.50
3.00	9.00
3.50	10.50
4.00	12.00
4.50	13.50
5.00	15.00

Dose	Inf Rate
5.50	16.50
6.00	18.00
6.50	19.50
7.00	21.00
7.50	22.50
8.00	24.00
8.50	25.50
9.00	27.00
9.50	28.50
10.00	30.00

Dose	Inf Rate
10.50	31.50
11.00	33.00
11.50	34.50
12.00	36.00
12.50	37.50
13.00	39.00
13.50	40.50
14.00	42.00
14.50	43.50
15.00	45.00

Dose	Inf Rate
15.50	46.50
16.00	48.00
16.50	49.50
17.00	51.00
17.50	52.50
18.00	54.00
18.50	55.50
19.00	57.00
19.50	58.50
20.00	60.00

- **INFUSION TABLE**

Choose INFUSION TABLE to open the following window in which you can observe the relation between amount and volume of infused drug and infusion time.

Amount	Volume	Infusion Time
10.00	5.00	00:01:00
120.00	10.00	00:12:00
230.00	15.00	00:23:00
340.00	20.00	00:34:00
450.00	25.00	00:45:00
560.00	30.00	00:56:00
670.00	35.00	01:07:00
780.00	40.00	01:18:00
890.00	45.00	01:29:00
1000.00	50.00	01:40:00

### 14.5.2 Hemodynamic Calculation

Hemodynamic is analysis of dynamics of blood and adequacy of oxygenation and perfusion in body's tissues.

Hemodynamic Instability can be defined as failure of oxygen delivery to tissues which can cause abnormal function of body's organs. One of the most important hemodynamic parameters is Cardiac Output (C.O) which can be measured by SAADAT monitor.

In addition to CO parameter, other hemodynamic parameters can be measured through Hemodynamic Calculator and inputting data by user or the system. The hemodynamic parameters include SVR, SVI, SV, CI, BSA, LCWI, LCW, RCWI, RCW, LVSWI, LVSW, RVSWI, RVSW, PVRI, PVR and SVRI.

#### **WARNING**

Calculation Safety Information

#### **WARNING**

- Decisions on the choice and dosage of drugs administered to patients must always be made by the physician in charge. The drug calculations are based on the values input; it does not check the plausibility of the calculation performed.
- Check that the entered values are correct and the calculated values are appropriate. Mindray assumes no responsibility for any consequences caused by wrong entries and improper operations.

**NOTE:**

If available, the patient weight and height from the Manage Patient menu are automatically entered when you first access calculation menu, otherwise you can enter the patient weight and height. These numbers just use in calculation menu and will not save as the patient information.

### 14.5.3 Ventilation Calculation

On the left side of the page, enter the Ventilation Calculation page from the Bed Setup menu and by entering the input values, the calculation is done and the result is displayed in the output section.

- By the select SAVE key  for save records
- By the Select Clear key  for clear value
- By the Select History key  enter the saved record page

Ventilation Calculation History:

- By the select keys ,  displays the previous and next saved records
- By the select Delete key  the record is deleted.
- 100 records are stored in the History section.
- By the select  (Print, Record, PDF) the requested operation is performed.
- The number of saved records along with the date and time are displayed in yellow at the top of the screen.
- A calculated value greater than the normal upper limit is indicated by an up arrow “↑”. A calculated value lower than the normal lower limit is indicated by a down arrow “↓”.
- The units related to Pressure Unit are mmHg and kPa options.
- By selecting each parameter, the selectable range will be displayed. If a numerical value outside the range is selected, the message Invalid Value must be between... is displayed.

**- Input parameters for ventilation calculations**

Input Parameter	Label	Unit
percentage fraction of inspired oxygen	FiO2	%
respiration rate	RR	rpm
partial pressure of mixed expiratory CO2	PeCO2	mmHg, kPa
partial pressure of carbon dioxide in the arteries	PaCO2	mmHg, kPa
partial pressure of oxygen in the arteries	PaO2	mmHg, kPa
tidal volume	TV	ml
respiratory quotient	RQ	None
atmospheric pressure	ATMP	mmHg, kPa

**- Calculated parameters and formulas for ventilation calculations**

Calculated Parameters	Label	Unit	Formula
partial pressure of oxygen in the alveoli	PAO2	mmHg, kPa	$PAO_2 \text{ (mmHg)} = [ATMP \text{ (mmHg)} - 47 \text{ mmHg}] \times FiO_2 \text{ (\%)/100} - PaCO_2 \text{ (mmHg)} \times [FiO_2 \text{ (\%)/100} + (1 - FiO_2 \text{ (\%)/100})/RQ]$
alveolar-arterial oxygen difference	AaDO2	mmHg, kPa	$AaDO_2 \text{ (mmHg)} = PAO_2 \text{ (mmHg)} - PaO_2 \text{ (mmHg)}$
oxygenation ratio	Pa/FiO2	mmHg, kPa	$Pa/FiO_2 \text{ (mmHg)} = 100 \times PaO_2 \text{ (mmHg)}/FiO_2 \text{ (\%)}$
arterial to alveolar oxygen ratio	a/AO2	%	$a/AO_2 \text{ (\%)} = 100 \times PaO_2 \text{ (mmHg)}/PAO_2 \text{ (mmHg)}$
minute volume	MV	L/min	$MV \text{ (L/min)} = [TV \text{ (ml)} \times RR \text{ (rpm)}]/1000$
volume of physiological dead space	Vd	ml	$V_d \text{ (ml)} = TV \text{ (ml)} \times [1 - PeCO_2 \text{ (mmHg)}/PaCO_2 \text{ (mmHg)}]$
physiologic dead space in percent of tidal volume	Vd/Vt	%	$V_d/V_t \text{ (\%)} = 100 \times V_d \text{ (ml)}/TV \text{ (ml)}$
alveolar volume	VA	L/min	$VA \text{ (L/min)} = [TV \text{ (ml)} - V_d \text{ (ml)}] \times RR \text{ (rpm)}/1000$

### 14.5.4 Renal Calculation

On the left side of the page, enter the Renal Calculation page from the Bed Setup menu and by entering the input values, the calculation is done and the result is displayed in the output section.

- By the select SAVE key  for save records
- By the Select Clear key  for clear value
- By the Select History key  enter the saved record page

#### Renal Calculation History:

- By the select keys ,  displays the previous and next saved records
  - By the select Delete key  the record is deleted.
- 100 records are stored in the History section.
  - By the select  (Print, Record, PDF) the requested operation is performed.
  - The number of saved records along with the date and time are displayed in yellow at the top of the screen.
  - A calculated value greater than the normal upper limit is indicated by an up arrow “↑”. A calculated value lower than the normal lower limit is indicated by a down arrow “↓”.
  - The units related to Pressure Unit are mmHg and kPa options.
  - By selecting each parameter, the selectable range will be displayed. If a numerical value outside the range is selected, the message Invalid Value must be between... is displayed.

#### - Input parameters for Renal calculations

Input Parameter	Label	Unit
urine potassium	URK	mmol/L
urinary sodium	URNa	mmol/L
urine	Urine	ml/24 hrs
plasma osmolality	Posm	mOsm/kgH <sub>2</sub> O
urine osmolality	Uosm	mOsm/kgH <sub>2</sub> O
serum sodium	SerNa	mmol/L
creatinine	Cr	μmol/L

urine creatinine	UCr	μmol/L
blood urea nitrogen	BUN	mmol/L
height	Height	cm
weight	Weight	kg

**- Calculated parameters and formulas for Renal calculations**

Calculated Parameters	Label	Unit	Formula
urine sodium excretion	URNaEx	mmol/24 hrs	$URNaEx \text{ (mmol/24 hrs)} = \text{Urine (ml/24 hrs)} \times URNa \text{ (mmol/L)}/1000$
urine potassium excretion	URKEx	mmol/24 hrs	$URKEx \text{ (mmol/24 hrs)} = \text{Urine (ml/24 hrs)} \times URK \text{ (mmol/L)}/1000$
sodium potassium ratio	Na/K	%	$Na/K \text{ (\%)} = 100 \times URNa \text{ (mmol/L)}/URK \text{ (mmol/L)}$
clearance of sodium	CNa	ml/24 hrs	$CNa \text{ (ml/24 hrs)} = URNa \text{ (mmol/L)} \times \text{Urine (ml/24 hrs)}/SerNa \text{ (mmol/L)}$
creatinine clearance rate	Clcr	ml/min	$Clcr \text{ (ml/min)} = Ucr \text{ (}\mu\text{mol/L)} \times \text{Urine (ml/24 hrs)}/[Cr \text{ (}\mu\text{mol/L)} \times (BSA \text{ (m}^2\text{)}/1.73) \times 1440]$
fractional excretion of sodium	FENa	%	$FENa \text{ (\%)} = 100 \times URNa \text{ (mmol/L)} \times Cr \text{ (}\mu\text{mol/L)}/[SerNa \text{ (mmol/L)} \times Ucr \text{ (}\mu\text{mol/L)}]$
osmolar clearance	Cosm	ml/min	$Cosm \text{ (ml/min)} = Uosm \text{ (mOsm/kgH}_2\text{O)} \times \text{Urine (ml/24 hrs)}/(Posm \text{ (mOsm/kgH}_2\text{O)} \times 1440)$
free water clearance	CH <sub>2</sub> O	ml/hr	$CH_2O \text{ (ml/hr)} = \text{Urine (ml/24 hrs)} \times [1 - Uosm \text{ (mOsm/kgH}_2\text{O)}/Posm \text{ (mOsm/kgH}_2\text{O)}]/24$
urine to plasma osmolality ratio	U/P osm	None	$U/P \text{ osm} = Uosm \text{ (mOsm/kgH}_2\text{O)}/Posm \text{ (mOsm/kgH}_2\text{O)}$
blood urea nitrogen creatinine ratio	BUN/Cr*	Mmol/L	$BUN/Cr = 1000 \times BUN \text{ (mmol/L)}/Cr \text{ (}\mu\text{mol/L)}$

urine-serum creatinine ratio	U/Cr	None	$U/Cr \text{ (mmol/L)} = U_{cr} \text{ (}\mu\text{mol/L)}/Cr \text{ (}\mu\text{mol/L)}$
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\*: BUN/Cr is a ratio under the unit of mol.

### 14.5.5 Oxygenation Calculation

On the left side of the page, enter the Oxygenation Calculation page from the Bed Setup menu and by entering the input values, the calculation is done and the result is displayed in the output section.

- By the select SAVE key  for save records
- By the Select Clear key  for clear value
- By the Select History key  enter the saved record page

#### Oxygenation Calculation History:

- By the select keys ,  displays the previous and next saved records
- By the select Delete key  the record is deleted.
- 100 records are stored in the History section.
- By the select  (Print, Record, PDF) the requested operation is performed.
- The number of saved records along with the date and time are displayed in yellow at the top of the screen.
- A calculated value greater than the normal upper limit is indicated by an up arrow “↑”. A calculated value lower than the normal lower limit is indicated by a down arrow “↓”.
- The units related to Pressure Unit are mmHg and kPa options.
- By selecting each parameter, the selectable range will be displayed. If a numerical value outside the range is selected, the message Invalid Value must be between... is displayed.

#### - Input parameters for Oxygenation calculations

<b>Input Parameter</b>	<b>Label</b>	<b>Unit</b>
cardiac output	C.O.	L/min
percentage fraction of inspired oxygen	FiO2	%
partial pressure of oxygen in the arteries	PaO2	mmHg, kPa
partial pressure of carbon dioxide in the arteries	PaCO2	mmHg, kPa
arterial oxygen saturation	SaO2	%
partial pressure of oxygen in venous blood	PvO2	mmHg, kPa
venous oxygen saturation	SvO2	%
hemoglobin	Hb	g/L, g/dl, mmol/L
respiratory quotient	RQ	None
atmospheric pressure	ATMP	mmHg, kPa
height	Height	cm, inch
weight	Weight	kg, lb

**- Calculated parameters and formulas for Oxygenation calculations**

<b>Calculated Parameters</b>	<b>Label</b>	<b>Unit</b>	<b>Formula</b>
body surface area	BSA	m <sup>2</sup>	$BSA(m^2) = Wt^{0.425}(kg) \times Ht^{0.725}(cm) \times 0.007184$
oxygen consumption	VO2	ml/min	$VO2 (ml/min) = C(a-v)O2 (ml/L) \times C.O. (L/min)$
arterial oxygen content	CaO2	ml/L, ml/dL	$CaO2 (ml/L) = 10 \times (0.0134 \times Hb (g/dl) \times SaO2 (\%) + 0.031 \times PaO2 (mmHg))$
venous oxygen content	CvO2	ml/L, ml/dL	$CvO2 (ml/L) = 10 \times (0.0134 \times Hb (g/dl) \times SvO2 (\%) + 0.031 \times PvO2 (mmHg))$
arteriovenous oxygen content difference	C(a-v)O2	ml/L, ml/dL	$C(a-v)O2 (ml/L) = CaO2 (ml/L) - CvO2 (ml/L)$
oxygen extraction ratio	O2ER	%	$O2ER (\%) = 100 \times C(a-v)O2 (ml/L) / CaO2 (ml/L)$

oxygen transport	DO <sub>2</sub>	ml/min	$DO_2(\text{ml/min}) = C.O. (\text{L/min}) \times CaO_2(\text{ml/L})$
partial pressure of oxygen in the alveoli	PAO <sub>2</sub>	mmHg, kPa	$PAO_2 (\text{mmHg}) = [ATMP (\text{mmHg}) - 47 \text{ mmHg}] \times FiO_2 (\%)/100 - PaCO_2 (\text{mmHg}) \times [FiO_2 (\%)/100 + (1 - FiO_2 (\%)/100)/RQ]$
alveolar-arterial oxygen difference	AaDO <sub>2</sub>	mmHg, kPa	$AaDO_2 (\text{mmHg}) = PAO_2 (\text{mmHg}) - PaO_2 (\text{mmHg})$
capillary oxygen content	CcO <sub>2</sub>	ml/L, ml/dl	$CcO_2 (\text{ml/L}) = Hb (\text{g/L}) \times 1.34 + 0.031 \times PAO_2 (\text{mmHg})$
venous admixture	QS/Q <sub>T</sub>	%	$QS/QT (\%) = 100 \times [1.34 \times Hb (\text{g/L}) \times (1 - SaO_2 (\%)/100) + 0.031 \times (PAO_2 (\text{mmHg}) - PaO_2 (\text{mmHg}))] / [1.34 \times Hb (\text{g/L}) \times (1 - SvO_2 (\%)/100) + 0.031 \times (PAO_2 (\text{mmHg}) - PvO_2 (\text{mmHg}))]$
oxygen transport index	DO <sub>2</sub> I <sub>m</sub>	l ml/min/m <sup>2</sup>	$DO_2I (\text{ml/min/m}^2) = CaO_2(\text{ml/L}) \times (C.O. (\text{L/min}) / BSA (\text{m}^2))$
oxygen consumption	VO <sub>2</sub> I <sub>m</sub>	l ml/min/m <sup>2</sup>	$VO_2I (\text{ml/min/m}^2) = C(a-v) O_2 (\text{ml/L}) \times (C.O. (\text{L/min}) / BSA (\text{m}^2))$

## 15. Multi Lead

### 15.1 General

You can monitor 12-lead ECG signal in this page. The signals features such as

Sweep speed and Gain are displayed in the menu's toolbar.

**NOTE:**

- ✓ The bedside monitor cannot send some signals to the CMS, thus the CMS extracts these signals from other received signals. These signals are specified by adding suffix **d-** to their name.
- ✓ This menu will be disabled if a bedside does not support it and a message is displayed in the respective bed to notify user.
- ✓ By clicking on the waveform area, you can freeze all waveforms. In this condition, the red message "Frozen" appears in the toolbar. Reclick on the waveforms to unfreeze them.

## **15.2 Function**

The below functions are available in the Multi Lead page:

- Options (Signal settings)
- Capture an image of the screen data
- Record/print

### **15.2.1 Options (Signal Settings)**

Click on  icon at the left side of the toolbar. A page will appear to set Speed, Gain, Notch Filter, Drift Filter and Print Time of signal. Available options are:

Gain: X0.25, X0.5, X1, X2, X4

Speed: 12.5, 25, 50 mm/s

Drift Filter: 0.5, 0.05

Notch Filter: Off, 50, 60HZ

Print Time: 3s, 10s

**NOTE:**

- ✓ If a filtered signal with specific speed and gain is sent to the CMS, this item (**Options**) will not be displayed.
- ✓ Only **3s** is available for **Print Time** in the recording mode (thermal recorder).

### **15.2.2 Capture**

Click on icon  to capture an image from the screen data. You can review the captured images in the Event Recall page.

#### **NOTE:**

If there is not any signal sweeping, this item will be disabled.

### **15.2.3 Record/Print**

Click on  icon in toolbar of the menu to record/print/save data from 3 or 10 seconds before the the current time.

12-lead ECG waveform, patient information including date and time of recording, bedside Number, type of recording, patient ID, patient name, date of birth, gender, weight and height, recording speed, type of ECG filter, hospital name, ward and physician name are recorded in this section. The message “Recording Multi Lead ECG Bed#” is displayed on the taskbar during the recording.

#### **NOTE:**

- ✓ 3 or 10 seconds after that the signal sweeping starts (regarding Print Time setting), Print function will be enabled.
- ✓ Speed of 12-lead ECG printing/recording is 25mm/s.

## **16. Bed View**

### **16.1 General**

You can monitor two waveforms, numeric parameters and alarms in this page.

- ✓ If ECG waveform is selected, the waveform and its relevant data (Gain, speed and filter) will be displayed.
- ✓ If IBP1 or IBP2 waveform is selected, Scale values will be displayed. If the bedside supports this function, the CMS will display Scale values and label sent via the bedside monitor, otherwise it will display default scale values (-30 to 250) and “IBP” label.
- ✓ If a Wearable device is connected to the CMS, IBP1 and IBP2 waveforms will not be displayed.
- ✓ By clicking on the waveform area, you can freeze all waveforms. In this condition, the red message “Frozen” appears in the toolbar. Reclick on the waveforms to unfreeze them.

## **16.2 Function**

The below functions are available in the Bed View page:

- Options (Signal settings)
- Capture an image of the screen data

### **16.2.1 Options (Signal Settings)**

Click on  icon at the left side of the toolbar. A page will appear to select your desired waveforms (Two waveforms are selectable). Available options are:  
ECG, SPO2, IBP1, IBP2, RESP

#### **NOTE:**

You are not allowed to select same waveforms.

### **16.2.2 Capture**

Click on icon  to capture an image from the screen data. You can review the captured images in the Event Recall page.

## **17. Setting**

### **17.1 General**

Select this item to perform General settings of the system.

There are two tabs **System Setting** and **Admin Setting** at the left side of this page.

The Save icon () is available in the toolbar of this page. Click on this icon to save the settings.

**NOTE:**

Click on Save icon after settings, otherwise new settings will not be applied.

## **17.2 System Setting**

**System** and **Recorder/Printer Setting** are available in the **System Setting** tab.

### **17.2.1 Recorder/Printer Setting**

The following items can be set in this section:

- Printing Mode
- Speed
- Time
- Delay
- Trace1
- Trace 2
- Grid
- Reset

#### **■ Printing Mode**

You can select Recorder, Printer or PDF in this page. Default setting is Recorder and you can see related settings to the recorder.

**NOTE:**

- ✓ Delay time of the printer and the PDF is **40** sec and **5** sec respectively.
- ✓ The speed values of **12.5**, **25** and **50** mm/s are available for all modes.
- ✓ Touch /click **Reset Printer** to empty print list and reset the printer.

#### **■ Reset**

Touch /click Reset to empty print list and reset the printer.

#### **■ Speed**

To set recording speed. Available options are 12.5, 25 and 50 mm/s.

## ■ Time

To set recording time. Available options are 5,10, 15, 20, 25, 30 and Continuous.

In Continuous mode, the recording will continue until you stop it.

### NOTE:

- ✓ If you start a continuous recording via the bedside, it will be stopped after maximum one minute.
- ✓ This time for the printer and PDF is 40 seconds.

## ■ Delay

To set recording delay time. Available options for the recorder are 5, 6, 7,... and 15 sec. Available delay time for the printer and PDF is 40 sec.

### NOTE:

The start time of recording depends on delay time. For example, if delay time is set to 5 s, it means that recording is done from 5 seconds before time of pressing “Rec” button.

## ■ Trace 1

To display the first waveform of recording. Available options are IBP1, SPO2, ECG, RESP and IBP2.

## ■ Trace 2

To display the second waveform of recording. Available options are IBP1, SPO2, ECG, RESP, IBP2 and OFF.

## ■ Grid

Mark **Grid** to record/print in grid format.

## **17.2.2 System**

The below items can be set in this section:

- Mode
- Screen Size
- Signal Thickness
- Language
- Calendar
- Brightness
- Volume
- Date/Time

### **■ Mode**

Select your favorite view mode and click on OK or outside of this page to leave the page. When the mode is changing, the message “Loading..., Please wait!” is displayed. General structure of view mode is A×B. “A” represents the number of beds in one column and “B” represents the number of columns in the screen. You can monitor BedView or A×B on the second display with regard to view mode.

### **■ Screen Size**

Select your desired screen size and click on OK. Click outside of the page to leave it.

The below sizes of screen are available:

17", 18.5", 19", 19" wide , 22", 23", 24", 25", 26", 27", 28", 29", 30", 31", 32", 34", 39", 42", 46", 48", 50", 55", 58", 60", 64", 70", 80", 84", 99", 102", 108", 111" and 152" .

### **⚠ WARNING ⚠**

- ✓ Select this item with regard to actual size of the screen, otherwise ECG waveform may be displayed incorrectly.
- ✓ To change the screen size during the monitoring, you shall turn the device off and on.
- ✓ This item can only be set by authorized user.

### **■ Signal Thickness**

Available options are “Normal” and “Thick”.

## ■ Language

Available options are English, Persian, Spanish , Polski and Russian.

## ■ Calendar

Available options are “Solar” and “Christian”.

## ■ Volume

The system sound can be set to 4 different volumes. If you change the volume, the alarm sound will be played corresponding to the adjusted volume to ensure that new setting has been applied. (See chapter 5 for more information).

The sound pressure range is indicated on the back case label.

### NOTE:

The start time of recording depends on delay time. For example, if delay time is set to 5 s, it means that recording is done from 5 seconds before time of pressing “Rec” button.

## ■ Brightness

The system brightness ranges from 1 to 7. Default setting for this item is 4.

## ■ Date/Time

Select date and time and click on **Set** button. Click outside this page or select **Cancel** to leave the page.

### **WARNING**

- ✓ If you set the CMS time or date during monitoring, the following message will appear and you should turn off and on the system to apply settings.
- ✓ The time can only be set by authorized user (See chapter 3, Admin tab).
- ✓ If you set back the time or date of the CMS, some data may be missed.

**Please turn off and on the system**

Figure 14-1 Turn off and on message

## **17.3 Admin tab**

### **17.3.1 General**

The capabilities of the Admin tab are intended only for trained and authorized personnel of the manufacturing company.

You can set the first bed number of the CMS by selecting “Bed Offset”.

## 18. History

### 18.1 General

There are three tabs **Patients List**, **Alarm Setting List** and **Nurse Call History** at the left side of this page.

### 18.2 Patient List

You can review data of 2000 patients in this tab. The patient data include:

Bed, First Name, Last Name, Birth Date, Physician Name, Patient Category, Ward, Phone, Admit Date, Discharge Date

#### **NOTE:**

- ✓ When connection between the bedside and the CMS is established, bed number and time of connection establishment are saved and displayed in the Patient List as the admit date. Data of the Patient List will change corresponding to the patient data in the Manage Patient menu.
- ✓ If a patient is discharged, time of discharging will be saved and displayed in the Patient List. As the connection is made to the bedside, data of new patient will be saved and displayed in the Patient List.
- ✓ After storage of 2000 patients data, if you save data of a new patient, the data of the earliest patient will be deleted.

#### 18.2.1 Function

The below functions are available in this page:

- Scroll through pages
- Search ]

##### 18.2.1.1 Search

Click on **Search Records** in toolbar of the Patient List window. An on-screen keyboard will pop up that you can type and search your intended data. Only data containing your keywords will be shown in the list.

### **18.2.1.2 Scroll through Patient List**

The following navigation keys and page number are displayed above the Patient List window.

 Displays the most recent Patient List data.

 Displays the next page (if any).

 Displays the previous page (if any).

 Displays the earliest Patient List data.

## **18.3 Alarm Setting List**

You can review HR alarm setting data in this page. Each record includes row, date and time, HR alarm on/off status, alarm limits and alarm Silence.

### **NOTE:**

✓ After storage of 100 HR alarm setting records (on/off status and silence status), if you save a new record, the earliest record will be deleted.

### **18.3.1 Function**

The below functions are available in this page:

- Scroll through pages
- Filter

#### **18.3.1.1 Scroll through Alarm Setting List**

The following navigation keys and page number are displayed above the Alarm Setting List.

 Displays the most recent Alarm Setting List data .

 Displays the next page (if any).

 Displays the previous page (if any).

 Displays the earliest Alarm Setting List data.

#### **18.3.1.2 Filter**

You can filter data based on bed number in the toolbar.

## **18.4 Nurse Call List**

You can review Nurse Call history including time and date of Nurse Call (via the bedside) and Response time (via the CMS) for each bed.

### **NOTE:**

- ✓ If multiple requests are sent from the bedside, these requests will be saved with interval of minimum one minute.
- ✓ After storage of 100 Nurse Call events, if you save a new event, the earliest event will be deleted.

### **18.4.1 Function**

The below functions are available in this page:

- Scroll through pages
- Search
- Filter

#### **18.4.1.1 Search**

Click on **Search Records** in toolbar of the Patient List window. An on-screen keyboard will pop up that you can type and search your intended data. Only data containing your keywords will be shown in the list.

#### **18.4.1.2 Scroll through Nurse Call List**

The following navigation keys and page number are displayed above the Nurse Call List.

-  Displays the most recent Nurse Call List data .
-  Displays the next page (if any).
-  Displays the previous page (if any).
-  Displays the earliest Nurse Call List data.

#### **18.4.1.3 Filter**

You can filter data based on bed number in the toolbar.

## **19. About**

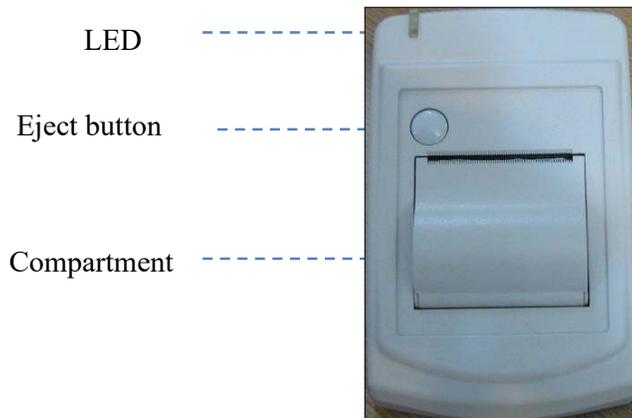
### **19.1 General**

Software information such as name and version are shown in About menu.

## 20. Recorder/Printer

### 20.1 General

SAADAT thermal recorder can be installed on the CMS.



16-1 Recorder front panel



16-2 Recorder rear panel

### Recorder function

- Adjusting recording speed (12.5, 25 and 50 mm/s)
- Setting delay time (5,6, ..., 14, 15 sec)
- Recording two waveforms simultaneously
- Recording ECG, SPO2, IBP1, IBP2 and RESP waveforms
- Recording Pace pulse
- Recording via bedside
- Recording frozen ECG signal
- Automatic alarm recording

### **20.1.1 Recorder/Printer/PDF tab**

The Recorder tab was explained briefly in 3.4.3.2, more information about this tab are provided in this section.

You can select the Recorder or Printer in this tab.

- ✓ The scale of the ECG waveform is recorded/printed before the waveform.
- ✓ The CMS only supports laser printer.
- ✓ The size of the printer paper should be A4.
- ✓ You can print/ record one or two waveforms(ECG, SPO2, IBP1/2, RESP).

## **20.2 Recording/Printing types**

The recording is possible through the bedside and the CMS. The CMS provides two recording modes:

- Continuous recording

In this mode, the recording will continue until you stop it.

- ✓ This mode is not available in the printer.

- Normal recording/printing/PDF

In this mode, the recording will continue until the end of the adjusted interval. Available intervals are 5s, 10 s, 15 s, 20 s, 25 s, and 30 s which are set in the Recorder tab.

- ✓ Delay time of the printer and PDF is 40 secs and cannot be changed.

### **Other recording/printing types:**

- Trend recording/printing/PDF
- NIBP List recording/printing/PDF
- Disclosure recording/printing/PDF
- Alarm List recording/printing/PDF
- Periodic recording/printing/PDF
- Auto alarm recording/printing/PDF
- Freeze recording/printing/PDF

## **20.3 Functional and status messages of recorder**

The following data is printed in header of normal and continuous recordings:

- Recording mode (Normal/Continuous)
- Date and time of recording
- Bedside number, patient ID, patient name, date of birth, gender, weight, height
- Trace 1 and Trace 2
- ECG lead and gain
- Sweep Speed and type of ECG filter in bedside
- Hospital, ward and physician name
- Parameters values

The message “Recording Bed #” is displayed on the taskbar during the recording.

If you touch/click the Rec button, text of the button will change to “Stop” or “In Queue #” according to the current status. The “Stop” indicates that the recording is in progress and “In Queue #” indicates that the recording is in queue. Click “Stop” button to stop recording and return the button to the initial status.

### **NOTE:**

- ✓ Make sure that the recorder is ON and the connections are made properly.
- ✓ Pay attention to the adjusted interval in “Recorder tab”.

### **Recording via bedside**

You can change “Network” message on the bedside to “In Queue” by clicking Rec button. If no recording request from another bedside is in progress, this message will change to “Recording” at once. “Network” message will appear again on the bedside as recording finishes. In normal recording like continuous recording, you can click/touch “Stop” button to stop recording.

### **NOTE:**

- ✓ In order to record via the bedside, set “INTERNAL RECORDER” to “OFF” in the bedside.
- ✓ If you do not stop continuous recording in the bedside, it will be stopped by the CMS after maximum 60 seconds.

## **20.4 Recorder Paper**

57 mm width paper should be used for SAADAT recorder.

### **NOTE:**

- ✓ Use only manufacturer recommended white thermo sensitive record papers, otherwise the recording quality may be poor and the thermal printhead may be damaged.
- ✓ Do not use grid paper.

It is recommended to use the paper with colored marks intended to indicate paper finish; otherwise the operator should ensure that there is sufficient paper for recording.

### **NOTE:**

- ✓ Do not use paper with edges that are pasted at the end of the roll. If they need to be used inevitably, replace them with a new paper roll as soon as possible before entire roll is used up.

### **WARNING**

Do not touch the recorder head during recording and immediately after that because it is so hot and may result in physical injury.

### **WARNING**

The recorder will be damaged by pulling its paper during recording.

### **NOTE:**

If the paper is jammed, open the recorder door and remove the paper. Do not pull the paper by force.

### **Loading the paper:**

- Push the button on the recorder case to open its door.
- Insert a new roll of paper into the paper compartment.
- Close the recorder door

**NOTE:**

Thermo sensitive side of paper should be placed facing the head. Make sure to load the paper correctly.

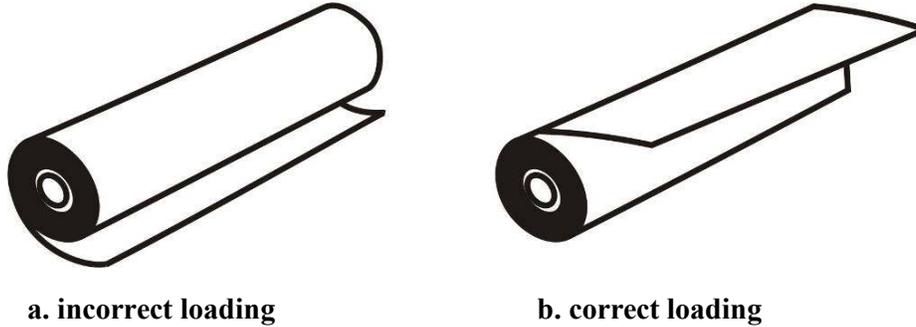


Figure 16-3 Recorder paper loading

**NOTE:**

The paper detector may not operate properly if covered with a foreign matter. Therefore, if you find any foreign matter on the sensor, remove it and clean the sensor.

**⚠ WARNING ⚠**

Be careful not to damage thermal printhead while inserting paper. Avoid touching thermal printhead.

## 20.5 Recorder Error Messages

If the following problems occur during monitoring, corresponding error message will be displayed.

<b>Message</b>	<b>Cause</b>	<b>Solution</b>
<b>Software Error</b>	Failure of the recorder software	Turn the recorder off and on. If the problem still exists, contact manufacturer Customer service.
<b>Hardware Error</b>	Failure of the recorder hardware	Turn the recorder off and on. If the problem still exists, contact manufacturer Customer service.
<b>Door Open</b>	The recorder door is open.	Close the recorder door.
<b>Out of Paper</b>	The recorder paper has been finished.	Load new roll of paper.
<b>Printhead High Temp</b>	The thermal head is too hot.	Stop recording for few minutes.
<b>Printhead High Volt</b>	Printhead voltage is high.	Turn the recorder off and on. If the problem still exists, contact manufacturer Customer service.
<b>Printhead Low Volt</b>	Printhead voltage is low.	Turn the recorder off and on. If the problem still exists, contact manufacturer Customer service.

## **21. Care & Cleaning**

### **21.1 General Inspection**

The CMS should be serviced every two years by trained personnel.

In the case of any damage, do not use the CMS. Contact the hospital biomedical equipment group or manufacturer service personnel immediately.

#### **⚠ WARNING ⚠**

- Failure on the part of the responsible hospital or institution to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazard.
- The safety checks or servicing involving any disassembly or decomposition of devices should be performed by professional service personnel; otherwise it may lead to undue equipment failure and possible health hazard.
- Turn off the CMS if no patient is to be monitored

## 21.2 Cleaning and Disinfection

### • General

Use only the substances approved by us and methods listed in this chapter to clean your equipment.

Manufacturer makes no claims regarding the efficacy of the listed chemicals or methods as a means for controlling infection. For the method to control infection, consult your hospital's Infection Control Officer or Epidemiologist. See also any local policies that apply within your hospital.

### **WARNING**

- 1) Before cleaning the system, make sure that the equipment is switched off and disconnected from the power line.
- 2) Disinfection & Sterilization may cause damage to the device and is therefore not recommended for this device otherwise indicated in the instructions delivered with accessories or your hospital's servicing schedule.
- 3) If you see any signs of damage or deterioration in the device and its accessories, do not use it, and if necessary, contact the after-sales service company.
- 4) Allow the system to dry completely before making connections. And please make sure all connectors tightly connected to the system before using the system.
- 5) To prevent environmental pollution, the disposal of equipment shall be done in accordance with the policies of the hospital.

To avoid damage to the equipment, follow these instructions:

- **ALWAYS** wipe up the cleaning solution with a dry and soft cloth after cleaning.
- **NEVER** immerse the system or its peripheral into water or any cleaning solution.
- **NEVER** pour or spray cleaning agents directly on equipment surfaces.
- **NEVER** allow fluids drip into the casing, switches, connectors, or any ventilation openings in the equipment.
- **NEVER** use abrasive materials and erosive or acetone-based cleaners.
- **NEVER** use rough or sharp material or your fingernail to remove stubborn stains.

### **WARNING**

Do not use ETO for disinfection.

The equipment surfaces shall be cleaned regularly. Cleaning frequency depends on the environment. If you are in an area that is heavily polluted or dusty, the equipment should be cleaned more frequently.

The equipment to be cleaned includes the host (or computer), and its peripheral devices (if applicable any I/O devices) such as display(s), printer, recorder, keyboard, mouse, network equipment, and so forth.

**The following are permitted cleaning and disinfection agents:**

- Mild soapy water
- Screen cleaner (for Display screen if needed)
- Low level disinfectant such as Alcohol 70% (if needed)

● **External Surfaces**

As required, the external surfaces of the system and its peripheral devices may be cleaned with a clean and soft cloth, sponge or cotton ball dampened with above cleaning and disinfection agents.

**NOTE:**

- 1) For cleaning of peripheral devices you may refer to the original manufacturer's Instructions For Use or hospital protocol for computer equipment and peripherals.
- 2) Take extra care when cleaning the screen of the display because it is more sensitive to rough cleaning methods than the housing.

● **Internal Surfaces**

**\_Recorder (printer head part)**

Accumulation of paper powder or foreign matter between the thermal head and platen roller deteriorates the print quality. Clean the head elements and platen roller surface using alcohol and a cotton swab. Wait until the alcohol dries then close the recorder door.

**⚠ WARNING ⚠**

Do not clean the recorder immediately after recording because thermal head and its surrounding area are hot during and after recording.

**- Host (computer)**

If needed, internal cleaning of host is recommended by a vacuum cleaner or similar device.

## 22. Troubleshooting

All repair operations should be carried out by the manufacturer authorized personnel, otherwise the manufacturer will not take any responsibility against eventual hazards to users and patients.

The purpose of this part is to resolve minor problems due to improper use of the CMS. Please follow audio-visual alarms and troubleshooting guide before calling Customer service.

Fault Symptoms	Possible Cause	Solution
Patient's vital signs is not displayed on the CMS	<ul style="list-style-type: none"> <li>- The following items may have been switched off:                             <ul style="list-style-type: none"> <li>• Bedside monitor</li> <li>• Network equipment</li> <li>• The CMS screen</li> <li>• The CMS</li> </ul> </li> <li>- Network disconnection</li> </ul>	<ul style="list-style-type: none"> <li>- Check the power cable.</li> <li>- Make sure that the CMS equipment is switched on and connected securely.</li> <li>- Pay attention to the CMS messages.</li> <li>- Check the contrast and brightness of the CMS screen.</li> </ul>
The system time and dynamic waveforms pause.	The system crashes due to power failure or switching off UPS	- Pay attention to the CMS messages
The system resets continuously .		- Call Customer service department.
Incorrect and abnormal vital signs	Incorrect information is displayed by the bedside.	<ul style="list-style-type: none"> <li>- Measure clinical signs and symptoms by the other means and compare them with the displayed information by the bedside. If there is noticeable difference, refer to user manual (troubleshooting chapter) of S1600 and S1800 bed sides.</li> <li>- Do not use the system and call Customer service immediately.</li> </ul>
Touch screen malfunction	<ul style="list-style-type: none"> <li>- Touch screen cable is not connected.</li> <li>- Touch screen is out of calibration</li> </ul>	- Connect touch screen cable to the back of the CMS case.
No alarm sound	Alarm silence	- Make sure that the alarm has not been silenced.
Incorrect display of information	Disconnection between the CMS and the bedside	- If the CMS equipment has been switched on and connected securely, call Customer service.
A flat line waveform is displayed and parameter value disappears.	<ul style="list-style-type: none"> <li>- The module may be switched off or disconnected.</li> <li>- No module exists.</li> </ul>	- Make sure that relevant module exists, is switched on and connected.

Fault Symptoms	Possible Cause	Solution
The recorder does not work	<ul style="list-style-type: none"> <li>- The recorder is off</li> <li>- The recorder is disconnected.</li> <li>- Hardware or software error</li> <li>- The recorder is out of paper</li> <li>- The recorder door is open</li> </ul>	<ul style="list-style-type: none"> <li>- Pay attention to error messages.</li> <li>- Make sure that the recorder is switched on and functions correctly (the green LED of the recorder should light up).</li> <li>- Check that the recorder is connected to the CMS securely.</li> </ul>
The recording stops before the adjusted time	<ul style="list-style-type: none"> <li>- The recorder is out of paper</li> <li>- The recorder door is open</li> <li>- Network disconnection</li> </ul>	<ul style="list-style-type: none"> <li>- Pay attention to the recorder messages on the taskbar.</li> <li>- If the recorder equipment has been connected correctly, call Customer service.</li> </ul>
Low quality of recording	<ul style="list-style-type: none"> <li>- Inappropriate recorder paper</li> </ul>	<ul style="list-style-type: none"> <li>- Use standard and approved papers by the manufacturer.</li> </ul>
No record can be taken by the bedside during the Central monitoring	<ul style="list-style-type: none"> <li>- “INTERNAL RECORDER” is not set to OFF.</li> <li>- Network disconnection</li> </ul>	<ul style="list-style-type: none"> <li>- Set off “INTERNAL RECORDER” in the bedside.</li> </ul>
No system sound	<ul style="list-style-type: none"> <li>- Incorrect connection of HDMI cable</li> </ul>	<ul style="list-style-type: none"> <li>- If one monitor is used, turn off the system and connect HDMI cable to relevant socket, then turn on the system.</li> <li>- Call Customer service department.</li> </ul>
Patient data is not displayed on the CMS menu	<ul style="list-style-type: none"> <li>- There is no link between menu and the main program</li> </ul>	<ul style="list-style-type: none"> <li>- Call Customer service department.</li> </ul>

## 23. Technical Specification

SAHAND		SAHAND Pro
<b>Minimum Hardware Specification</b>		
CPU	1.1GHz or above	
RAM	DDR3 1600 2 GB or above	
Graphic card	Two outputs and compatible with Linux	
Hard disk	SSD/SD card 64 GB or above	
Power supply	Varies by configuration selected	
UPS	At least 3 hours stability	
Interface connection	Network, Serial port, USB 2.0	
Input/Output Devices (Optional)	Mouse, Touch, Keyboard, Barcode Scanner	
<b>OS</b>		
Operating system	Linux UBUNTU 14.04	
<b>Display</b>		
Screen size	Full HD color TFT (17" - 50")	Full HD color TFT (24")
Resolution	1920/3840× 1080	
Number of displays	One or two (optional)	
Waveforms	ECG (I, II, III, aVR, aVL, aVF, V), SpO <sub>2</sub> , Dual IBP, Resp/Co2 (All freezable)	
12-Lead ECG	ECG (I, II, III, V1, V2, V3, V4, V5, V6, AVR, AVF, AVL) on the menu	
Signal sweep	12.5 ,25 ,50mm/s	
Numeric Parameters	HR, SpO <sub>2</sub> , Dual Temp, DT, NIBP, Dual IBP, RESP /CO2 (EtCo2, FiCo2, AWRr), BFA, Multi ST	
User guide	Onscreen Help	
<b>Network</b>		
Protocol	TCP/IP	
Connection	LAN with RJ45 interface, Ethernet 802.3 WLAN IEEE 802.11a/b/g/n, Wireless	
<b>Bed Communication</b>		
Number of beds	Supports up to 32 Saadat patient care monitors	
Bidirectional control	The following settings of each bedside can be changed via central monitoring system: ECG Lead, ECG Gain, HR Alarm	
<b>Alarm</b>		
Alarm types	Physiological, Technical, Systemic	
Alarm levels	High, Moderate, Low	
Alert	Audible-Visual alarm	
<b>Data Review</b>		
Trend	Review of up to 96 hours Trend, Graphic and Tabular	
Disclosure	Up to 48 hours store and review of waveforms ( ECG, SPO <sub>2</sub> , IBP1, IBP2, RESP)	
NIBP List	Review of 1000 NIBP measurements, NIBP measurement via central monitoring system	
Alarm List	Review of 720 Alarm events	
Patient info	Managing Patient information	
Patient History	Review of 2000 Patient Information	
Alarm History	Storing 100 HR alarm setting and silence status	
Nurse Call History	Review of 100 Nurse Call events	
Export	Retrieving selected information and store them on external memory	
Event Recall	Review of 100 captures of events, Review of 100 PDFs of events	
<b>Communication with Hospital systems (Optional)</b>		
PACS	Making files based on DICOM protocol and sending them on PACS server Viewing DICOM files via web browser	
HIS	Sending vital signs and alarms to HIS server based on HL7 protocol	
<b>Recorder (Optional)</b>		
Model	Saadat external thermal recorder	
Size	120× 96 × 165 mm (W × H × D)	
Weight	425g (approximately)	
Printing speed	12.5 ,25 ,50mm/s	
Paper width	57mm	
Trace	1 or 2 waveform(s) ( ECG, SPO <sub>2</sub> , IBP1, IBP2, RESP )	
Recording type	Fixed time/Continuous recording, Automatic / Manual Alarm recording, NIBP List recording, Trend recording, Disclosure recording, Freeze recording, Periodic recording, Bedside Arrhythmia list recording, 12-Lead ECG recording.	
Power supply	DC 12V, 3A	
Data interface	RS232 interface	
<b>Printer (Optional)</b>		
Model	Laser printer	
Paper size	A4	
Printing speed	12.5 ,25 ,50mm/s	
Trace	ECG waveform	
Printing type	Fixed time printing , Automatic / Manual Alarm printing , NIBP List printing, Trend printing, Disclosure printing, Freeze printing, Periodic printing.	
<b>ENVIRONMENTAL CONDITION</b>		
Temperature	Operating : 0°C to +40°C Storage & Transport: -25 to 60 °C	

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Humidity	Operating :	20-90 % (Noncondensing)
	Storage & Transport:	10-100 % (Noncondensing)
<b>Size &amp; Weight</b>		
Net Dimensions	Varies by configuration selected	573mm×52mm ×400mm
Net Weight	Varies by configuration selected	7.5Kg

## 24. Alarms and Messages

The alarms are categorized into Technical, Physiological and Systemic. Error messages of the recorder have been described in the section 8.5. All physiological alarms are received from the bedside. Systemic alarms and messages are as follows:

### 24.1 The CMS Alarms and Message

Systemic Alarm Message	Cause	Description
Bed Disconnect	Bedside monitor is disconnected from the CMS.	Level 2 alarm. The yellow message is displayed above the patient window.
Recorder is disconnected	The recorder is off or disconnected from the CMS.	Level 3 alarm. The cyan message is displayed on the taskbar.
Printer is disconnected	The printer is off or disconnected from the CMS.	Level 3 alarm. The cyan message is displayed on the taskbar.

Systemic Message	Cause	Description
SYSTEM IS CHECKING DATABASE PLEASE WAIT...	Database is checked in time of the system booting	The message is displayed in form of progress bar when the system is starting up.
SYSTEM IS REPAIRING DATABASE PLEASE WAIT...	The system crashes due to sudden power failure or switching off UPS	The message is displayed in form of progress bar when the system is starting up.
LOADING ..., PLEASE WAIT!	User changes View mode	The red message on the taskbar.
Recording Bed #	The system is recording.	The red message blinks on the taskbar.
Network problem, system restarts in # s	No network connection (failure of network module)	The red message is displayed on the taskbar and the system resets after 120 sec.
Temperature is too high; the system is shutting down after #second. Please call after sale service	The CMS temperature exceeds the upper limit.	The red message is displayed in the middle of the screen.
Network cable is unplugged	No network connection (cable disconnection)	The red message on the taskbar.
Not Licensed	There is not software activation file in the system or its content is invalid.	The red message on the taskbar.
Delete software problem	Delete software does not run or has bug.	The red message on the taskbar.

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Reset software problem	Reset software does not run or has bug.	The red message on the taskbar.
Printer software problem	Printer software does not run or has bug.	The red message on the taskbar.
Transmit software problem	Transmit software does not run or has bug.	The red message on the taskbar.
PACS viewer software problem	PACS viewer software does not run or has bug.	The red message on the taskbar.
Invalid connection to PACS server	Interruption in PACS Server/Gateway connection	The red message on the taskbar.
Please turn off and on the system	Network, date or time settings are changed.	The red message in the middle of the screen.
Recording Trend Bed#	Trend recording is in progress.	The red message on the taskbar.
Recording Disclosure Bed#	Disclosure recording is in progress.	The red message on the taskbar.
Recording NIBPList Bed#	NIBP List recording is in progress.	The red message on the taskbar.
Manual Alarm Record	Alarm recording is in progress.	The red message on the taskbar.
Recording Periodic Bed#	Periodic recording is in progress.	The red message on the taskbar.
Recording Freeze Bed#	Freeze recording is in progress.	The red message on the taskbar.
Recording Automatic Alarm Bed #	Automatic alarm recording is in progress.	The red message on the taskbar.
Printer paper out	The printer paper is finished.	The red message on the taskbar.
Backup Software Problem	Backup software does not run or has bug.	The red message on the taskbar.
Save Software Problem	Save software does not run or has bug.	The red message in the taskbar.
Please Wait...	The software is creating file.	The message in the Bedsetup-Extract menu.
YOU CAN CHOOSE A MAXIMUM OF TWO DAYS	The selected interval for data export exceeds 2 days.	The message in the Bedsetup-Extract menu.
WARNING:THERE IS NOT ANY INFORMATION FOR THIS BED		The message in the Bedsetup-Extract menu.
THERE IS NOT DATA IN TIME YOU SELECT		The message in the Bedsetup-Extract menu.

Please select time correctly.	The time interval has been selected incorrectly.	The message is displayed in the CMS menu.
You are trying to set time backward you will lose data, are you sure?	The time has been set backward.	The message is displayed in the Setting menu.
All vital data recorder for this patient will be deleted. Are you sure to discharge this patient at YYYY/MM/DD HH:mm	The system warns before discharging the patient	The warning is displayed in the Manage Patient menu.
Please select values correctly.	Incorrect NIBP range has been selected (The minimum value is more than the maximum value)	The message is displayed in the NIBP List window.
Interface Software Problem	Interface software (between the CMS and the bedside) does not run or has bug.	The red message on the taskbar.
Internet Connection Problem	Connection failure of the network cable or connector.	The red message on the taskbar.

## 24.2 Physiological and Technical Alarms of Bedside

If the bedside has the ability to send alarm message and level to the CMS, alarm messages and their level will be shown by the CMS. Otherwise, the alarm messages and their levels will be according to the below table. You can see Alarm chapter of the bedside's user manual for more information.

<b>Alarm Message</b>	<b>Alarm Level</b>
<b>ECG</b>	
ECG NO CABLE	3
ECG SIGNAL WEAK	3
ECG ASYSTOLE	1
ECG CHECK LL OR ALL	3
ECG CHECK LA OR ALL	3
ECG CHECK RA OR ALL	3
ECG CHECK RL OR All	3
ECG CHECK RA	3
ECG CHECK LL	3
ECG CHECK LA	3
ECG CHECK C	3
HR OUT OF LIMIT	1
<b>TEMP</b>	
T2 OUT OF LIMIT	1
T1 OUT OF LIMIT	1
<b>RESP</b>	
RR OUT OF LIMIT	1
RESP CHECK LEADS	3
RESP APNEA	1

<b>Alarm Message</b>	<b>Alarm Level</b>
<b>IBP1</b>	
IBP1MAP OUT OF LIMIT	1
IBP1DIA OUT OF LIMIT	1
IBP1SYS OUT OF LIMIT	1
IBP2MAP OUT OF LIMIT	1
IBP1 NO SENSOR	3
IBP1 ADJUST SCALE	3
IBP1 STATIC PRESSURE	3
IBP1 SEARCH	3
IBP1 DEFECT	3
<b>IBP2</b>	
IBP2DIA OUT OF LIMIT	1
IBP2SYS OUT OF LIMIT	1
IBP2 NO SENSOR	3
IBP2 ADJUST SCALE	3
IBP2 STATIC PRESSURE	3
IBP2 SEARCH	3
IBP2 DEFECT	3
<b>ETCO2</b>	
ETCO2 OUT OF LIMIT	1
<b>FICO2</b>	
FICO2 OUT OF LIMIT	1
<b>AWRR</b>	
AWRR OUT OF LIMIT	1
<b>SPO2</b>	
SPO2 PROBE DEFECT	2
SPO2 NO PROBE	3
SPO2 PROBE OFF	2
SPO2 CHECK PROBE	2
SPO2 HIGH AMBIENT LIGHT	2
SPO2 SIGNAL WEAK	3
SPO2 ASYSTOLE	1
SPO2 OUT OF LIMIT	1
<b>NIBP</b>	
NIBPMAP OUT OF LIMIT	1
NIBPDIA OUT OF LIMIT	1
NIBPSYS OUT OF LIMIT	1
NIBP MODE ERROR	2
NIBP SELF TEST FAILED	2
NIBP LOOSE CUFF	2
NIBP AIR LEAK	2
NIBP AIR PRESSURE ERROR	2
NIBP SIGNAL WEAK	2
NIBP RANGE EXCEED	2
NIBP EXCESSIVE MOTION	2
NIBP OVER PRESSURE SENSED	2
NIBP SIGNAL SATURATED	2
NIBP PNEUMATIC LEAK	2
NIBP SYSTEM FAILURE	2
NIBP TIME OUT	2
NIBP MODULE ERROR	2
NIBP MODULE DEFECT	2
NIBP STOP ERROR	2
NIBP STOP PRESSED	2
NIBP LEAKAGE OK	2
NIBP NO MODULE	2
NIBP LOW BATTERY	2

Alarm Message	Alarm Level
<b>CO2</b>	
CO2 SYSTEM FAULT#	2
CO2 SENSOR STANDBY MODE	2
CO2 NO WATER TRAP	3
CO2 NO MODULE	2
CO2 NO SENSOR	3
CO2 CHECK SAMPLE LINE	2
CO2 NO ADAPTER	2
CO2 INVALID	2
CO2 INVALID AMBIENT PRESSURE	2
CO2           INVALID            AMBIENT	2
TEMPERATURE	
CO2 ROOM AIR CALIB REQUIRED	2
CO2 ACCURANCY INVALID,PLEASE	2
ZERO	
CO2 INLET OCCLUDE	2
CO2 EXHUST OCCLUDE	2
CO2 UNEXPECTED REVERSE FLOW	2
CO2 UNEXPECTED FORWARD FLOW	2
CO2 CULATION ERROR	2
CO2 RESP APNEA	1
CO2 REPLACE ADAPTOR	2
CO2 SAMPLING LINE CLOGGED	2
<b>ARRHYTHMIA</b>	
VFIB ARRHYTHMIA	1
VTAC ARRHYTHMIA	1
RUN ARRHYTHMIA	1
AIVR ARRHYTHMIA	1
COUPLET ARRHYTHMIA	1
BIGEMINY ARRHYTHMIA	1
TRIGEMINY ARRHYTHMIA	1
TACHY ARRHYTHMIA	1
BRADY ARRHYTHMIA	1
AFIB ARRHYTHMIA	1
PAUS ARRHYTHMIA	1
FREQUENT PVCs	1
RELEARN	2
CAN NOT LEARN	2
ECG NOISE	2

## 25. System Defaults

Menu item	Selection	Default
<b>Manage Patient menu</b>		
Gender	Male, Female	Female
Patient Category	Adult, Neonate, Pediatric	
Blood Type	AB+, AB-, A+, A-, B+, B-, O+, O-	
<b>Disclosure menu</b>		
<b>Options</b>		
Parameter	HR, ST, PVCs, PR, SPO2, PI, PVI, SPCO, SPHB, SPMET, SPOC, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2, AWRR, BFI, BS, SQI, EMG, Multi ST	HR, ST, PVCs, PR, SPO2, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2
Waveforms	ECG, SPO2, IBP1, IBP2, RESP	ECG
<b>Graphical Trend menu</b>		
<b>Options</b>		
Parameter	HR, ST, PVCs, PR, SPO2, PI, PVI, SPCO, SPHB, SPMET, SPOC, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2, AWRR, BFI, BS, SQI, EMG, Multi ST	HR, ST, PVCs, PR, SPO2, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2
Signal	HR, SPO2, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2	HR, SPO2, IBP1, T1
Time Width	1 Hour, 10 minute	1 Hour
<b>Print</b>		
Signal	HR, SPO2, IBP1, IBP2, T1, T2, RESP, EtCo2, FiCo2	
<b>Numeric Trend menu</b>		
<b>Options</b>		
Parameter	HR, PR, Multi ST, PVC, SPO2, RESP, IBP1, IBP2, T1, T2, FICO2, ETCO2, AWRR, PI, PVI, SPCO, SPHB, SPMET, SPOC, BFI, BS, SQI, EMG	HR, PR, ST, SPO2, RESP, IBP1, IBP2, T1, T2, FICO2, ETCO2
<b>Alarm List menu</b>		
Alarm Type Filter	ALL ALARMS, ECG, SPO2, IBP1, IBP2, RESP, NIBP, Co2, TEMP, BFA, ARR (ARRHYTHMIA)	All Alarms
Alarm Level Filter	ALL LEVELS, LEVEL 1, LEVEL 2, LEVEL 3, SILENCED	ALL LEVELS
<b>Bed Setup menu</b>		
<b>Bed Setting</b>		
Predic Record	OFF, 15 Min, 30 Min, 1H, 2H, 4H, 8H, 12H, 24H	OFF
Alarm Record	OFF, ON	OFF
Freeze Record	OFF, ON	OFF
Arr. To PACS	OFF, ON	OFF
HR Alarm	OFF, ON	OFF
HR Alarm Limit	30-250	
ECG Lead	I, II, III, aVR, aVL, aVF, V	II
ECG Gain	AUTO, X0.25, X0.5, X1, X2, X4	AUTO
ECG Speed	12.5, 25, 50 mm/s	25 mm/s
<b>View Setting</b>		
Signal	ECG, SPO2, IBP1, IBP2, CO2, RESP	ECG, SPO2
Parameters	Full Parameters, HR, SPO2, IBP1, IBP2, NIBP, CO2, TEMP, BFA	Full Parameters
<b>Color of Signal/Parameters</b>		
HR		Green
SPO2		Violet
IBP1		Orange
IBP2		Purple
CO2		Yellow
RESP		Yellow
NIBP		White
TEMP		Sea Green
BFA		Blue

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Menu item	Selection	Default
<b>HIS Setting</b>		
Event to send data	All Alarms, ECG, SPO2, RESP, IBP1, IBP2, NIBP, TEMP, CO2, ARR, Record, Periodic NIBP Measurement	
Periodic	5,10,15, ... ,55 Minute, OFF 1,2,3,...,24 Hour, OFF	OFF OFF
Parameters to save	Full Parameter, HR, SPO2, RESP, IBP1, IBP2, NIBP, TEMP, CO2, BFA	
<b>Export menu</b>		
Inforamation	NIBP List, Alarm List, Disclosure, Trend	Disclosure
Trend Parameters	HR, SPO2, RESP, IBP1, IBP2, CO2, T1, T2, BFA	HR
Disclosure Waveforms	ECG, SPO2, IBP1, IBP2, RESP	ECG
Alarm List Settings	ALL TYPES, ARRHYTHMIA, ECG, ST, SPO2, RESP, NIBP, IBP, Co2 , TEMP, BFA	ALL TYPES
<b>Multi Lead menu</b>		
Gain	X0.25, X0.5, X1, X2, X4	X1
Speed	12.5, 25, 50 mm/s	25 mm/s
Notch Filter	0.5, 0.05	0.5
Drift Filter	OFF, 50Hz, 60Hz	
Print Time	3s, 10s	3s
<b>Bed View</b>		
Trace1	ECG, SPO2, IBP1, IBP2, CO2, RESP	ECG
Trace2	ECG, SPO2, IBP1, IBP2, CO2, RESP	SOP2
<b>Setting menu</b>		
<b>Recorder/Printer</b>		
Mode	Reorder, Printer, PDF	Recorder
Speed	12.5, 25, 50 mm/s	25 mm/s
Recorder Time Printer or PDF Time	5,10,15,20,25,30s,continuous 40s	10s 40s
Recorder Delay Printer or PDF Delay	5-15s 40s	5s 40s
Trace1	ECG, SPO2, IBP1, IBP2, RESP	ECG
Trace2	ECG, SPO2, IBP1, IBP2, RESP	OFF
Grid	OFF, ON	ON
<b>System</b>		
Mode	2×2 Beds + BedView, 2×2 Beds + 2×2 Beds, 3×2 Beds + BedView , 3×2 Beds + 3×2Beds, 4×1 Beds + BedView, 4×1 Beds + 4×1 Beds, 4×2 Beds + BedView, 4×2 Beds + 4×2 Beds, 5×1 Beds + BedView, 5×1 Beds + 5×1 Beds, 5×2 Beds + BedView, 5×2 Beds + 5×2 Beds , 6×1 Beds + BedView, 6×1 Beds + 6×1 Beds, 6×2 Beds + BedView, 6×2 Beds + 6×2 Beds, 7×1 Beds + BedView, 7×1 Beds + 7×1 Beds, 8×1 Beds + BedView, 8×1 Beds + 8×1Beds, 8×2 Beds + BedView, 8×2 Beds + 8×2 Beds, 9×1 Beds + BedView, 9×1 Beds + 9×1Beds, 10×1 Beds + BedView, 10×1 Beds + 10×1Beds	8x2 Beds + 8x2 Beds
Language	English, Persian, Spanish, Polski	English
Calendar	Christian, Solar	Christian
Set Thick	Thick, Normal	Normal
ScreenSize	17, 18.5, 19, 19W, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 39, 42, 46, 48, 50, 55, 58, 60, 64, 70, 80, 84, 99, 102, 108, 111, 152 (inch)	19"
Brightnss	1-7	4
SoundVolume	1-4	2

## 26. Patient Safety



This symbol means that consult user manual of the CMS and pay attention to the warnings and cautions.



This symbol indicates that the equipment shall be disposed of in an environmentally-friendly manner.

## 27. Preventive Maintenance (PM) Checklist

The preventive maintenance (PM) checklist #PL-F-25 should be completed by healthcare personnel. It should be noted that PM checklist only is used to perform systematic inspection of the equipment and will not guarantee their correct function.

<b>SAADAT Co.</b>				
Form No. : PL-F-25/2		PM Form (CMS)		
State:	City:	Medical center:	Ward:	
Device model:	Serial number:	Installation date:	Inspection date:	
No.	Test and Inspection Item	OK	NOK	N/A
<b>Visual inspection</b>				
1	No rip and fraying in power cables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	No rip and fraying in network cables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	No damage in RJ45 plug (for network cable)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	No damage or breakage in monitors, casing, internal parts, hub switch and recorder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Touch screen</b>				
5	Calibration and responsiveness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Recorder</b>				
6	Function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Paper quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Printer function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Functional test</b>				
9	Quality of the system sound (Alarm sound)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Data storage (Trend and Disclosure)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	No display of systemic error messages on the task bar (Delete software problem, Reset software problem and etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Final decision:</b> Pass <input type="checkbox"/> Fail <input type="checkbox"/>				

<b>Expert comments:</b>
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**Name & signature of healthcare specialist:**

**Name & signature of expert:**

## APPENDIX I) Electromagnetic Compatibility

The CMS is considered as part of a medical electrical system. The Saadat provided system has been evaluated for electromagnetic compatibility (EMC) according to relevant standards.

All components of the CMS including the main device, displays, touch, hub switch and printer carry CE-marking according to the European Low Voltage and EMC Directives.

### CAUTION

- The CMS is not suitable for installation in the Patient Care Environment.

### WARNING

- Do not use cellular phone in the vicinity of the CMS. High level of electromagnetic radiation emitted from such devices may result in strong interference with the system performance.
- To prevent EMC effect on the CMS, it should not be used adjacent to or stacked with other equipment and if adjacent or stacked use is necessary, the system should be checked for normal operation in the configuration in which it will be used.

<b>Manufacturer's declaration – electromagnetic emissions</b>					
Component	Main PC	Display	Hub Switch	Printer	Touch
<p><b>EN 60601-1-2, Clause 4.1.2</b></p> <p>a) The equipment that is not ME EQUIPMENT complies with applicable international EMC standards</p> <p>b) Both the EMISSION and IMMUNITY of the electrical equipment that is not ME EQUIPMENT have been determined not to adversely affect the BASIC SAFETY or ESSENTIAL PERFORMANCE of the ME SYSTEM; and</p> <p>c) The EMISSION of the electrical equipment that is not ME EQUIPMENT have been determined not to cause the EMISSION of the ME SYSTEM to exceed applicable limits.</p>	<p>This sub-clause is met with its own international standards which are ITE standards in this case and have been specified in related certificate.</p> <p>The CMS is installed outside the patient environment and the only connection between central unit and the bedside monitors is a TCP/IP cable for data transmission therefore the EMC properties of the CMS would not have any effect on EMC properties of patient monitors.</p>				