Monitoring system for operating theatres

Magelis OptiPC touch screen panel
Operating theatre management system
Remote access for maintenance

User Guide
2012
A monitoring system...

Reliable information are needed to manage the satisfactory operation of operating theatres. The monitoring system informs in real time and allows taking the appropriate decisions in case of unexpected events. This guide allows different users: nurse, supervision personnel and maintenance personnel to understand and to use:

- the control panel in the operating theatre
- the medical supervision system inside the room of head nurse's or service responsible
- the remote access for maintenance (via Web) to each operating theatre with the Webstation

Monitoring system for the “Full Energy Efficiency” solution

This monitoring system makes it possible:
- with the Magelis OptIPC touch screen panel in the operating room, to have information concerning alarms generated by the electrical installation and concerning the operating room environment,
- with the monitoring system softwares, to have real-time access to all information concerning operation of the operating rooms and to ensure event traceability.

Monitoring system for the “Advanced” solution

The monitoring system makes it possible:
- with the Magelis OptIPC touch screen panel in the operating room, to have information concerning alarms generated by the electrical installation and concerning the operating room environment,
- with Internet Explorer, to have real-time access to all information concerning the operation of each operating room.
## Two levels of information

### Functions performed by the control and signalling panel in operating theatre

<table>
<thead>
<tr>
<th>Type of Control and signalling panel in operating room</th>
<th>Full EE</th>
<th>Advanced</th>
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</thead>
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<tr>
<td>Visual and audible alarms on electrical and insulation faults</td>
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<td>Audible alarm stoppage</td>
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<td>Tests of the insulation monitoring system</td>
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<td>Fault handling information</td>
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<tr>
<td>Time display, chronometer and timer</td>
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<td>•</td>
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<tr>
<td>Display of operating room temperature, relative humidity</td>
<td>•</td>
<td>•</td>
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<tr>
<td>Display of operating room differential pressure</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Display of medical gas states (O2, N2O, vacuum)</td>
<td>•</td>
<td>•</td>
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<tr>
<td>Generation of an event report</td>
<td>•</td>
<td>•</td>
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<td>UPS information</td>
<td>•</td>
<td>•</td>
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<tr>
<td>Ventilation control</td>
<td>•</td>
<td>•</td>
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<tr>
<td>Hardwired connection with BMS control modules</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

### Functions performed by the monitoring system

| Access to functions by supervision personnel                                             | •       | •        |
| Access to functions by maintenance personnel                                            | •       | •        |

### Simultaneous display of all operating rooms data

- Temperature, relative humidity
- Differential pressure
- Ventilation monitoring and control
- Medical gas states
- Electrical and insulation fault alarms

### Display of each room data

- Temperature, relative humidity
- Differential pressure
- Ventilation monitoring and control
- Medical gas states
- Electrical and insulation fault alarms
- List of events with dates
- Display of current alarms
- Min and max threshold alarms for temperature and relative humidity settings
- Display of temperature and relative humidity curves
- Event report edition (Excel file export can be possible)
- UPS information

### Remote access for maintenance

- Advanced Solution
- Full Energy Efficiency Solution

*Fault handling* information from the maintenance personnel

Sending of an SMS to maintenance personnel in the event of installation fault (operating room number + type of alarm)
The nurse

- Tests the insulation monitoring system at start-up of the operating room.
- Is warned of an electrical fault or insulation fault.
- Uses the Magelis OptiPC touch screen panel to monitor environmental parameters.
- Is notified of the time remaining power available for the battery power.
- Is notified of any work performed by maintenance personnel.
- Generates an insulation test.

The maintenance personnel

- Is notified by SMS message of the presence of an electrical fault in an operating room.
- Consults via its PC the electrical state of each operating room.
- Performs servicing on the cabinet indicated as at fault.
- Can indicate its handling of the fault and confirming its reparation.

The supervision personnel

- Views the states of each operating room on its PC.
- Generates event reports.
- Sets alarm thresholds for the temperature, hygrometry and ventilation of the operating rooms.
Control panel touch screen
Full Energy Efficiency solution
Advanced solution

The control panel (monitoring and signalling) is a touch screen which is located inside the operating room. At the beginning the main menu appears with information of Environment, Electrical status, medical gases and time.

Details of visualization and commands
Main screen
The following information is provided:
- **electrical state**, with 3 exclusive states (normal, minor fault, major fault) + Alarm label (ex: fault in socket number XX).

<table>
<thead>
<tr>
<th>Electrical State</th>
<th>OK</th>
<th>Minor alarm</th>
<th>Audible alarm = buzzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB Socket 15-16</td>
<td></td>
<td>Major alarm</td>
<td>Audible alarm = buzzer</td>
</tr>
<tr>
<td>Power supply</td>
<td></td>
<td>Major alarm</td>
<td>Audible alarm = buzzer</td>
</tr>
</tbody>
</table>

- **Insulation state** indicator: signal lamps with 2 exclusive states.

<table>
<thead>
<tr>
<th>Insulation State</th>
<th>OK</th>
<th>Insulation default</th>
<th>Audible alarm = buzzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation OK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation Fault</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On the left, the picture of the screen when an electrical and insulation defaults occur.
- **Time display**: continuous HH/MM/SS

- **Fault acknowledgement** by maintenance personnel, the picture has 3 different states:

<table>
<thead>
<tr>
<th>Fault Acknowledgement</th>
<th>There is no fault in theatre X</th>
<th>Default in theatre X sent to maintenance operator but not yet acknowledged</th>
<th>Default in theatre X addressed by the maintenance operator and being resolved. Acknowledge done.</th>
</tr>
</thead>
</table>

(*) Optional in case of local UPS.
## Control panel touch screen

Full Energy Efficiency solution  
Advanced solution

- **Temperature:** Digital display with 2 decimals + fault

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td>Temperature OK</td>
</tr>
<tr>
<td></td>
<td>Default Temperature high</td>
</tr>
<tr>
<td></td>
<td>Default Temperature low</td>
</tr>
<tr>
<td></td>
<td>Temperature Sensor default</td>
</tr>
</tbody>
</table>

- **Digital display Hygrometry**

<table>
<thead>
<tr>
<th>Hygrometry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td>Hygrometry OK</td>
</tr>
<tr>
<td></td>
<td>Default Hygrometry high</td>
</tr>
<tr>
<td></td>
<td>Default Hygrometry low</td>
</tr>
<tr>
<td></td>
<td>Hygrometry Sensor default</td>
</tr>
</tbody>
</table>
### Control panel touch screen

**Full Energy Efficiency solution**

**Advanced solution**
- **Differential pressure**: Digital display with 2 decimals + fault

<table>
<thead>
<tr>
<th>Differential pressure</th>
<th>Display + fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure OK</td>
<td></td>
</tr>
<tr>
<td>Default Pressure high</td>
<td></td>
</tr>
<tr>
<td>Default Pressure low</td>
<td></td>
</tr>
<tr>
<td>Pressure Sensor default</td>
<td></td>
</tr>
</tbody>
</table>

**Full energy efficiency solution**
- **Differential ventilation degrees**: Display + fault

<table>
<thead>
<tr>
<th>Differential ventilation degrees</th>
<th>Display + fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation reinforced state</td>
<td></td>
</tr>
<tr>
<td>Normal state</td>
<td>Running normal state when there is someone in the operating room.</td>
</tr>
<tr>
<td>Reduced ventilation state</td>
<td>Works when there is no one exits in the operating room.</td>
</tr>
<tr>
<td>Reduced low volume</td>
<td>Fault case with the reduced state</td>
</tr>
</tbody>
</table>

(*) Optional in case of local UPS.
**Control panel touch screen**
**Full Energy Efficiency solution**
**Advanced solution**

- **Oxygen Operation gas (O₂):** indicator with 2 states
- **Nitrous oxide Operation gas (N₂O):** indicator with 2 states
- **Vacuum Operation gas (VAC):** indicator with 2 states

<table>
<thead>
<tr>
<th>GAZ</th>
<th>O₂</th>
<th>O₂ OK</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₂</td>
<td>O₂</td>
<td>O₂ Defaults</td>
</tr>
<tr>
<td>N₂O</td>
<td>N₂O OK</td>
<td></td>
</tr>
<tr>
<td>VAC</td>
<td>N₂O Default</td>
<td></td>
</tr>
<tr>
<td>VAC</td>
<td>Vacuum OK</td>
<td></td>
</tr>
<tr>
<td>VAC</td>
<td>Vacuum</td>
<td></td>
</tr>
</tbody>
</table>

When a default occurs, there is an audible alarm and the buzzer picture becomes red. To stop the buzzer, you have to push on this picture on the top left of the main screen.
Control panel touch screen
Full Energy Efficiency solution
Advanced solution

Control
The following controls will be accessible:

- **Lock on**: 2-state button
  - Command from Control panel
  - Screen is locked when you press this button and the unlock button appears

- **Mode**: button to access to the timer menu
  - Command from Control panel
  - Access to the timer menu

- **Prepare**: button to access to an other configuration screen
  - Command from Control panel
  - Access to an other menu

- **Report**: allows the event report generation (for full energy efficiency solution)
  - Command from Control panel
  - Generate a report

Prepare
By pushing the prepare button, a new panel with several options appears. The system test menu makes an insulation system checking of the solution. The Timer menu allows setting time options like countdown, timer or clock time. The comfort menu is to set environment options such as temperature, control panel light brightness, air conditioning rate...

To go back to the main screen you have to click on **Exit**.

System test
Before starting an operation, the test button needs to be pushed that allows the user to be sure that there is any insulation fault of the system:

- Command from Control panel
- Check the insulation alarm system

An insulation fault is generated, and identified.
If everything is ok, the sentence “system test was successful” appears.

**Timer Menu**
By choosing the timer menu, the operator can set time options.
To choose the right mode you have to click on it.

- **Timer:**
  - **Time:** 13:00:19
  - **Countdown:**

By using the + and – button it is possible to set hour, minute and seconds.
Once these settings done, the countdown or the timer appears on the main screen.
To launch it the operator has to push on the start button.

- **Start**
  - Command from Control panel
  - Start the countdown

When the countdown/Timer is launched, the operator can stop it by pushing on the stop button.
At any time you can choose the time mode (Time, Timer, Countdown) by pushing on the mode button.

- **Mode**
  - Command from Control panel
  - Change time mode
Comfort Menu

By choosing the comfort menu you can set environmental parameters to improve the comfort of the Operation Theatre such as temperature, hygrometry and screen brightness.

<table>
<thead>
<tr>
<th>Command from Control panel</th>
<th>Environmental setting menu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If the system is interfaced with the air conditioning system (HVAC), the operator can raise or reduce the temperature and hygrometry of the operation theatre. All the environment settings are controlled like that (hygrometry).

Through the screen brightness mode, you can choose the day or night mode by pushing on the switch to day/night button.

<table>
<thead>
<tr>
<th>Command from Control panel</th>
<th>Screen iday mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch to Day</td>
<td></td>
</tr>
<tr>
<td>Command from Control panel</td>
<td>Screen night mode</td>
</tr>
<tr>
<td>Switch to Night</td>
<td></td>
</tr>
</tbody>
</table>

This is a view of the night mode.

And on the left, a view of the main screen in night mode.
Report
At any time, the operator can generate an event report by pushing the report button on the main screen.

This report is a document that shows the later 200 events that occur in the operating room. There is a report for each room. After that, there is a pop up message which asks if you really want to generate a Report then click on yes.

And then, there is another pop up to indicate the location of the report on the head nurse monitoring PC (OTMS).

At any time, if the communication is interrupted, this screen appears which gives a message about a disconnection between the Magelis Optipc and the controllers.
The monitoring system can be installed on the operating block head nurse’s PC or technical hub manager PC or else. This is a specific application of TAC VISTA. This offer is only in the full solution. A specific password will be required. By default the name is system and the password system. The function of this PC is to supervise all the utilities of the operating block, and to ensure operating traceability (recording of data from the different rooms and the infrastructure).

Overview

The overview provides a graphical representation of all the rooms in the technical support centre, and of the state of the electrical power supply chain.

To access a room you have to click on its appellation Op. Theatre 1.

The main screen is the following one.

The information that is displayed is the same as on the control panel in the Operating theatre.

The additional functions are:

- **Overview**: this is a copy of the MMI of the operating theatre.
- **Event view**: Dated list of operating theatre events.
- **Alarm view**: list of current alarms, with status (active, acknowledged but not solved, solved by not acknowledged).
- **Configuration view**: The user sets the MIN and MAX thresholds for temperature, ventilation and hygrometry UPS remaining time alarm.
- **Logs view**: Here are the charts of the evolution of environment conditions (temperature, ventilation and hygrometry).

Alarms view

When an alarm is detected, it has to appear in red. When the alarm is acknowledged, it has to appear in green. To acknowledge an alarm you have to select it and then right-click->acknowledgement (the alarms acknowledgement is done by the maintenance team). When the alarm is corrected it has to disappear if it has been acknowledged or it remains in red with OK at the end of its text.
Operating theatre management system (OTMS)
Full Energy Efficiency solution

Events view

Configuration view
By accessing to this view, the supervisor can set the MIN and the MAX of the following environmental Variables: pressure, temperature and hygrometry. Those values are used to set the limits under or over which there is a fault. For example if the temperature $T$ is under the $T_{\text{min}}$, there is an alarm “temperature low”.

Remaining time: below this value, the system sends an alarm if no voltage is detected on the emergency inomer.
Logs view
In this view, the user can access to the graphics of all environment parameters that allows seeing the evolution of those parameters. This may be helpful to detect the air conditioning default for example.

Here are some logs:

- Temperature log.
- Resistance.
- Hygrometry log.
- Log-Load Current.
Remote access for maintenance
Advanced solution
Full Energy Efficiency solution

Remote access
In this package, the remote access is configured according to the solution version

Advanced Solution
The remote access is ensured by:
■ A simple PC or laptop with internet.
The maintenance operator can access to the supervision webpage. To access to the webpage, the operator has to launch Internet explorer with the ip address of the Xenta communication module i.e. http://ip_address. A specific password is necessary.

The general view is the same as on the touchscreen in the operating room. The maintenance operator can also access to:
■ the alarm list located in the Navigation folder where he can acknowledge the defaults and have information to correct them
■ the configuration menu where he can sets the MIN and MAX thresholds for temperature, ventilation, hygrometry.

Full Energy Efficiency Solution
In the full energy efficiency solution, the remote access is handled by a software included in the TAC package.
■ RAM software
The TAC Remote Alarm Manager is software which monitors Building Management Systems and networks. It takes or generates alarms and sends them, interactively, as messages to a variety of remote locations. In the application, it sends an SMS(1) to the maintenance once an alarm is detected by the TAC Vista.
The SMS sent must include the alarm number, the alarm text with the operating room number. The maintenance operator can acknowledge the fault by responding to the short message. The operator should respond to the SMS received only with the number of the alarm. The alarm is automatically acknowledged and appears in green on the OTMS and a confirmation is sent to it. At the same time in the operating room, the picture “on progress” appears on the Control touchscreen to inform the operating team that the maintenance is going to solve the problem.

■ Webstation
Before launching webstation, ensure that the OTMS computer is on and that the application is launched.

The maintenance operator can also have details of the problem by accessing to the webpage. At any time the maintenance can log on the web station system with any computer. To access to the webstation, the operator has to launch Internet Explorer with the OTMS computer ip address i.e http://otmsIp/webstation, and to login by using a specified login and password. By default, the login is: system and the password is: system. The password can be changed by the user.

In the main screen appears a menu where the maintenance can access to the alarm list, the event list with the main toolbar.
In the home page of the web station, the maintenance operator has an overview of all operating rooms, and he can select the room where there is alarm. All functions are the same as on the OTMS.