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6 Respiration

Respiration measurement is conducted with the bio-impedance method. The method has the advantage of using the same electrodes that are used to monitor ECG. The respiration rate is calculated from the transthoracic impedance signals from either 2-wires or 4-wires. However, the method is sensitive to all movements and activities.

The running bio-impedance curve is presented in the waveform area of the monitor view together with the current respiration value in breaths per minute.

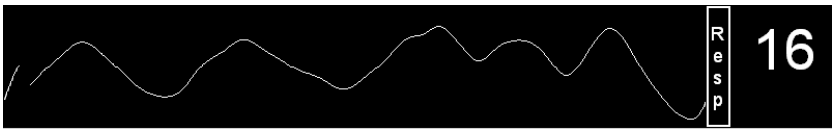

Figure 29. Respiration waveform

6.1 Measurement

The best alternative for respiration analysis is with 4-wire measurement. 4-wire measurement uses two separate pairs of electrodes in which one pair feeds and the other pair measures, whereas 2-wire measurement uses the same wires to feed and measure. 4-wire or 2-wire measurement can be selected in the respiration settings menu (see “Respiration settings” on page 47).

Important: *Respiration measurement by the impedance method must not be made on patients with pacemakers/ICDs that use impedance measurement to control rate-response function since it may affect the function of the pacemaker/ICD.*

The method is not reliable when the patient has obstructive apnoea or weak breathing.

For reliable measurement the method requires that the patient should remain still.

For respiration measurement with 5 lead cable and 4-wire method, the C (V)-electrode should be placed close to the C4 (V4)-position.

6.2 Electrodes for respiration measurement

The table below describes which sets of electrodes are used for respiration measurement. The correct placement for the electrodes is shown in “ECG measurement” on page 21.

	2-wire measurement	4-wire measurement	
	Feed current & measure	Feed current	Measure
10 lead cable	R-F (RA-LL)	R-F (RA-LL)	L-C4 (LA-V4)
8 lead cable	I-A	I-F	A-H
5 lead cable	R-F (RA-LL)	R-F (RA-LL)	L-C (LA-V)
3 lead cable	R-F (RA-LL)	N/A	

6.3 Respiration alarms

Clinical alarms

Indicate divergence from the following set limits for respiration:

Message	Priority
Respiration low <	**
Respiration high >	**

Technical alarms

Message	Priority
No resp analysis	#
Leadfail on resp electrode	#
Bad resp signal	#
No cable	#

6.4 Respiration settings

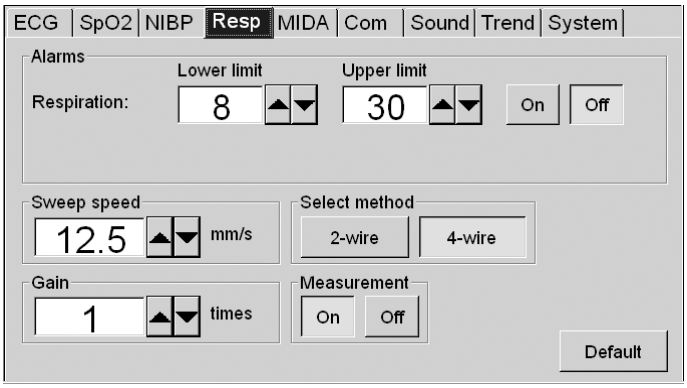

Figure 30. Respiration settings

The respiration settings view can be accessed by selecting **More:Settings:Resp** or by clicking on the **Resp** parameter data in the monitor view. In the respiration settings view the upper and lower alarm limits can be set for respiration and the measurement can be turned **Off** or **On**. The alarm can be activated/deactivated. The sweep speed and gain can be set. The measurement can be set for 2- or 4-wires. 4-wire measurements are not possible if a 3 lead ECG cable is used.

To return to the default settings select the **Default** button.

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7 Trends

Parameter trends are displayed in Trend view (Figure 31). The Trend view is accessed by selecting **More:Trends**. The Trend view presents an immediate overview of the parameters measured during the care period. The trended parameters are updated and saved every minute.

The Trends are displayed in two groups each with four parameters. The trend curves are named and colour coded on the trend bar. The trend bar also indicates the scale values for the displayed parameters. The value bar indicates the trend value at marker position.

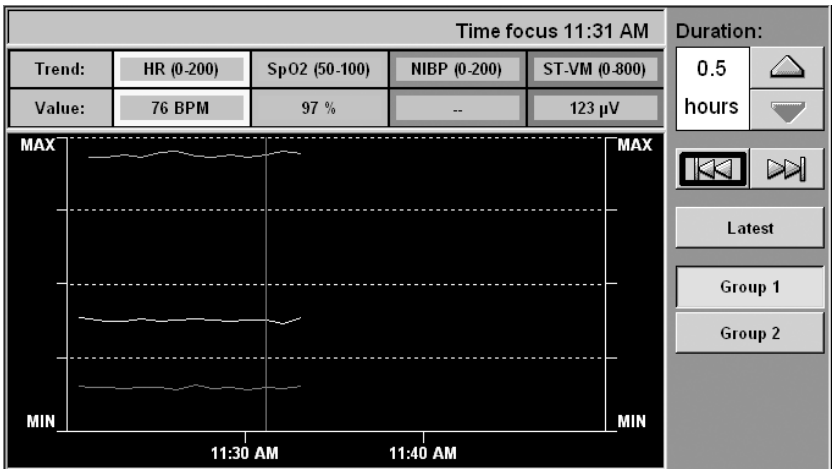

Figure 31. Trend view

Trend values that fall outside of the parameter limits or scale are marked with three asterisks (***) in the trend graph.

The Trend view displays data based on three types of values:

- Single value measurements. The NIBP values that are presented consist of a series of single measurements of systolic, diastolic and mean blood pressure values.
- Mean value measurements. Pulse, saturation, respiration and heart rate values are presented as the mean values of the parameters measured during the previous minute.

- ECG complex values. The values originate from the complex values recorded in the complexes (see “ECG view” on page 27) using the MIDA analysis. The following parameters are calculated from these complexes QRS-VD, ST-VM, STC-VM, ST-X, ST-Y, ST-Z, ST-I, ST-II, ST-III, ST-aVR, ST-aVL, ST-aVF, ST-V1, ST-V2, ST-V3, ST-V4, ST-V5 and ST-V6. For more information about MIDA analysis, see “MIDA” on page 83.

Important: *ECG diagnosis should not be based on ST values presented in trends before the underlying ECG data has been checked for artefacts.*

7.1 Time handling and navigation

The time scales of the displayed trends can be set with the arrows to the left of the time scale display. There are five possible time scale settings; 30 min, 1 h, 2 h, 4 h and 8 h. The selected duration is displayed to the left of this button. **Latest** function is used for viewing the latest trend values.

The time focus bar can be moved to examine trend values at a chosen time. To move the time focus bar, point on the time you wish to examine or use the navigation arrows to move the bar to left or right in the view. If the time focus bar is placed to the right of the latest trend value it is moved automatically to the latest trend value.

The time focus in the Trend view is linked to the time focus in the ECG view. Therefore, changing the time focus in Trend view automatically changes the time focus in the ECG view.

The **Group 1** and **Group 2** buttons are used to select the trend groups in the Trend view.

7.2 Trend settings

The trend settings can be accessed by selecting **More:Settings:Trend**. The four parameters and their intervals in the first and second trend groups respectively can be selected in this view. It is also possible to choose no parameters at all. To return to the default settings select the **Default** button.

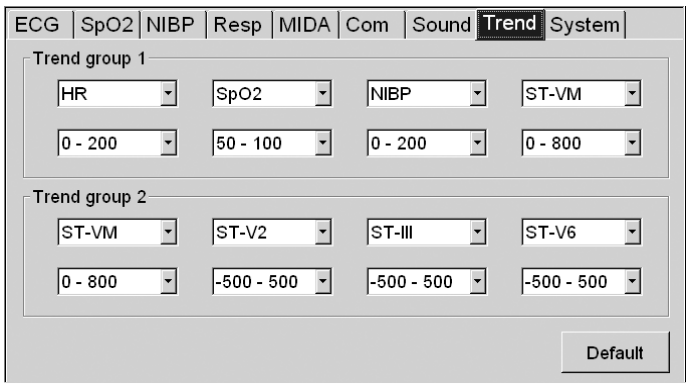

Figure 32. Trend settings

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8 Messages and forms

8.1 Messages

By selecting **Message** all messages are displayed in the message log in chronological order (Figure 33). The latest (sent/received) message is always visible.

Messages sent from a MobiMed 300m are displayed with an “ambulance” icon and messages sent from an HWS are displayed with a “hospital” icon. The sender or receiver is displayed in the log together with the date and time for each message.

Incoming messages are indicated by a beep and dialogue box on the screen. When a message arrives you can choose to **Close** the message or **Reply** in the dialogue box. Selecting **Reply** opens the message view.

Messages sent from MobiMed 300m are displayed in *italics* until the receiver HWS has confirmed the message, at which point it is displayed in normal letters.

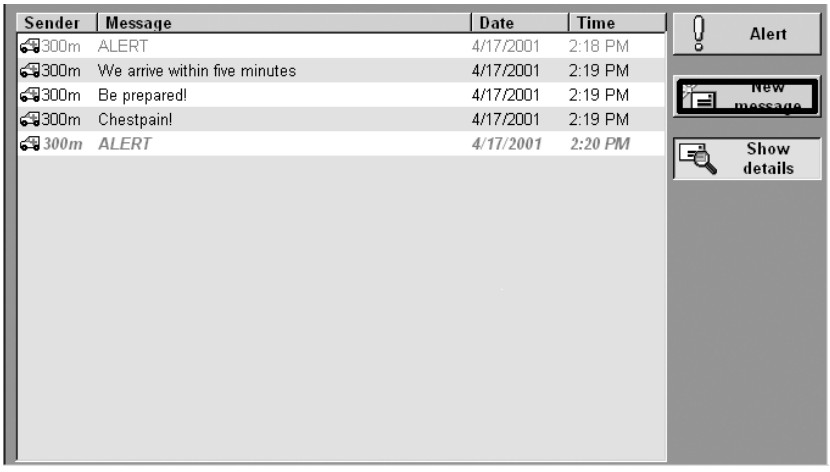

Figure 33. First message view

Alert
The **Alert** button allows the possibility to choose which HWS reviewer to alert from the list presented in the pop-up dialogue box.

Important: *The Alert function is disabled until communication is established with the chosen HWS.*

Show details
Select **Show details** to display the whole length of the message in the messages log.

New message
Messages can be selected or written by pressing the **New message** button make the Second message view visible (Figure 34). Below the message log is an area for writing messages with a maximum length of 255 characters. Predefined messages are listed below the edit area.

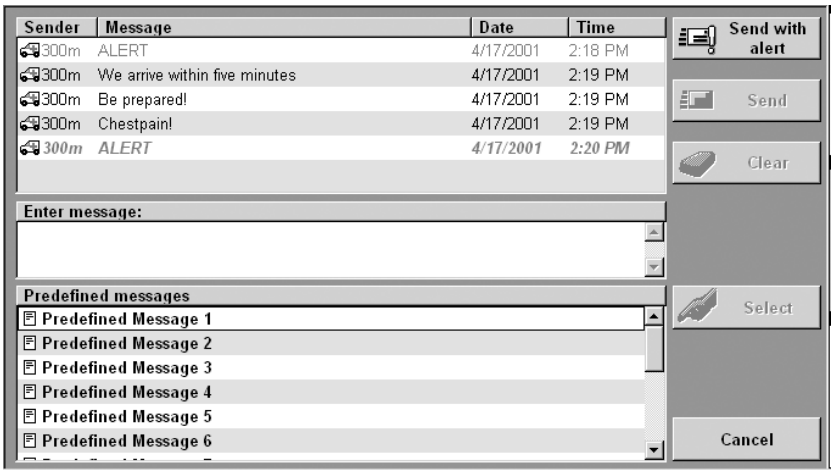

Figure 34. Second message view

Sending messages

Select **Send** to transmit the message in the edit area without an alert.

By selecting **Send with alert** the message in the edit area is sent with an alert. The Alert is sent after a reviewer has been selected from the dialogue box.

Important: *The Send buttons are disabled and messages cannot be sent until communication is established.*

Select
Press **Select** to choose a marked predefined message.

Clear
Press **Clear** to clear the edit area.

Cancel
Cancel closes the Second message view and returns the screen to the First message view.

8.2 Forms

Patient information, medical information, ambulance data, alarm data and status times are recorded in the forms.

The number of forms varies depending on the installation. Forms can also be designed so that they are compliant with the customer's specific requirements.

All information recorded in forms is saved and automatically sent to HWS unit once per minute.

The ambulance station and ambulance number can be specified in the system settings so that this information is automatically filled in to the form.

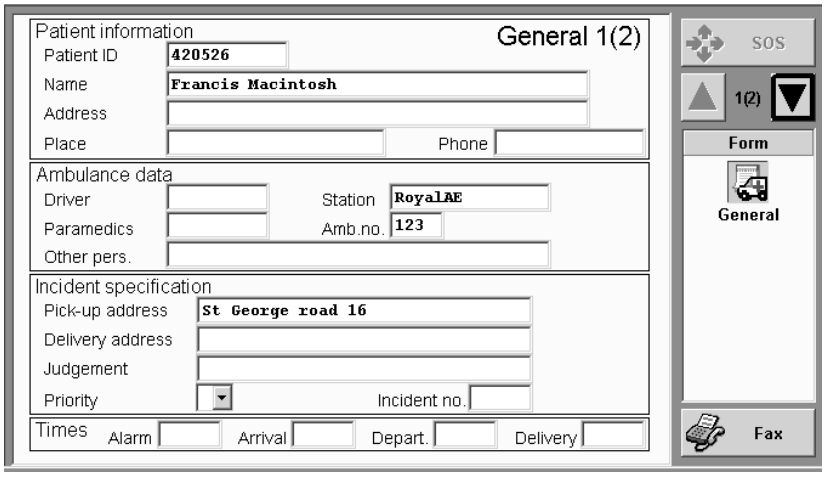

Figure 35. Forms

Changing forms

Predefined forms are selected by selecting the buttons or icons on the right side of the view. The navigation arrows in the upper right side of the forms view are used to scroll through the pages in a form. Data can be written with a conventional keyboard or with an on-screen keyboard.

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9 Communication

MobiMed 300m can use a range of communication networks to transmit and receive information from an HWS. Radio networks such as **Mobitex 1200** and **Mobitex 8k**, have widespread coverage in Sweden, Europe, USA, Australia, Korea and China. Mobitex 8k is the faster of the two Mobitex systems. Mobitex 1200 communication can only be used when the computer is docked and has a slower communication rate than Mobitex 8k. The **GSM** radio network is available in a number of versions worldwide and is faster than the Mobitex system. **CDPD** networks can be used in the USA. The general telecommunications network (**PSTN**) can be used when available.

9.1 Communication during a care session

MobiMed 300 monitors a patient during a care session and exchanges information with one specific **receiver** hospital workstation (HWS). The receiver HWS can in turn be linked to a network of **reviewer** HWSs. Note that several MobiMed 300m units and earlier products such as patient workstations (PWS) can communicate with a receiver HWS.

When the communication is established the name of the receiver HWS is displayed on the information bar. The following information is sent automatically or manually according to the system configuration:

- Averaged ECG complexes and rhythm strips.
- Trends.
- Any changes to Forms.

The following information is sent to the receiver HWS when initiated by the user:

- Messages are sent by pressing **Send** or **Send with alert** buttons in message view.
- Alerts are sent by pressing **Alert** or **Send with alert** buttons in message view or **Alert** in ECG view.
- ECG complexes and rhythm are sent by pressing **Send ECG** in the ECG view.

Important: *Pressing the Send ECG button to update the ECG information is recommended only when the user has an important observation to report.*

9.2 Connecting to a receiver

While MobiMed 300 is connecting to the receiver HWS, ***Receiver: Connecting***, is displayed in italics on the information bar. When communication is established, the receiver name is displayed with normal lettering.

MobiMed 300m can receive following information **from an HWS**:

- A list of active reviewers (in consultation mode).
- A list of inactive reviewers (not in consultation mode).
- Messages.
- Acknowledgement of alerts.

Consultation

In consultation mode, direct communication takes place between a MobiMed 300m user and an HWS user. At the HWS unit, the user can study all information transferred from MobiMed 300.

The reviewers name is presented next to the name of the receiver as they enter consultation mode.

“Receiver: Reviewer 1, Reviewer 2”

Communication status

The communication status icon is available only for systems using Mobitex 8k. The icon indicates the quality of the communication that is shown by the number of filled bars on the communication status icon, which is found on the information bar.

If the user clicks on the communication status icon or HWS name in the information bar, the communication settings view is opened.

Figure 36. Communication status icon

9.3 Communication settings

The Communication settings view can be accessed by selecting **More:Settings:Com** or by clicking on the communication information on the Information bar. Transfer of information is only possible once a connection with a receiving hospital workstation (HWS Communication node) has been established.

In the Communication settings view (see Figure 37) it is possible to select the HWS receiver in the **Select receiver list**. Communication can be switched **On, Off** or be transferred to a **Reserve** channel that can vary depending on whether the computer is docked or not. Therefore, MobiMed has four possible choices of modem configuration for active communication:

Computer position	Communication channel	
Docked	ON	Modem configuration 1
Undocked	ON	Modem configuration 2
Docked	Reserve	Modem configuration 3
Undocked	Reserve	Modem configuration 4

Communication should be switched off in places where mobile radio communication is not allowed, e.g. in a hospital, by selecting **Off** in Communication settings. When communication is switched off the text message **Communication off** is shown on the information bar.

Important: *Switch off radio communication if there is a risk of interference with medical apparatus. Remember to reconnect when the risk for interference is over.*

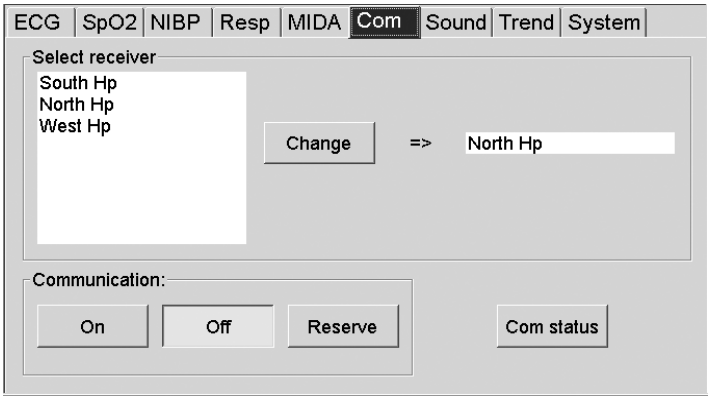

Figure 37. Communication settings

9.4 Communication status and alarms

When one of the following system alarms is displayed, *"No communication with hospital unit"* or *"Slow transmission rate - data build up. All data could not be sent to hospital unit"* this may indicate that radio coverage is poor in an area and that a reserve channel might be chosen. For more information the user can check the current communication status by pressing **Com status** button in the communication settings view.

The communication status view displays information about:

- The type of data sent.
- How much space there is in the buffer send queue.
- The current network being used.
- Whether the unit is connected, connecting or busy etc.
- The names of the reviewers.
- The names of consulting reviewers.

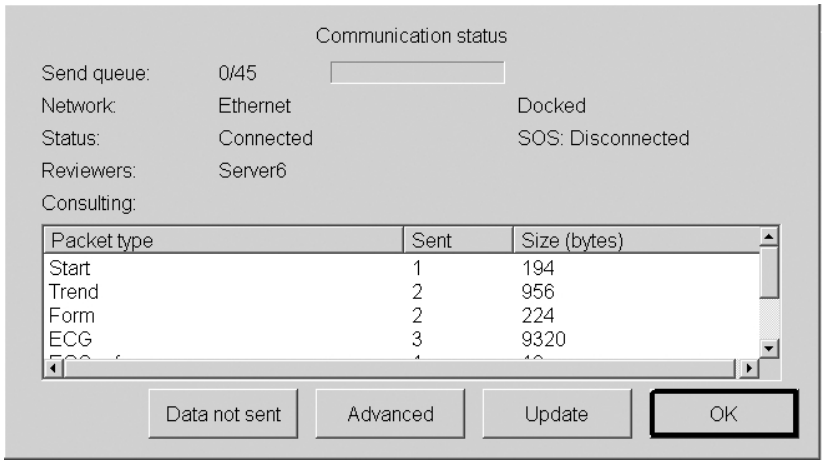

Figure 38. Communication status view

Selecting **Data not sent** presents a list of data that has not been sent and allows you to judge whether or not to retransmit data after the patient care session when MobiMed 300 is in standby mode, see "Discharge and Pause" on page 18 and "Retransmit" on page 61.

9.5 Retransmit

Retransmit is used when information is sent to another hospital (receiver HWS) or if the following communication problems arise because:

- Radio shadows hindered communication.
- A network has a low transfer rate.
- Communication was switched off.
- Modems were switched off.

After the system alarm *"Slow transmission rate - data build up. All data could not be sent to hospital unit",* retransmit should be initiated. Retransmission is initiated by selecting **Retransmit** when MobiMed is in standby mode. Standby mode is only accessible when a patient has been discharged, see "Discharge and Pause" on page 18.

After selecting **Retransmit** in standby mode, a list of the last 10 recorded sessions is presented. Choose from the list which session to retransmit, and the name of the receiver HWS. Select either **Normal** or **Reserve** communication mode. The selection of communication network depends on whether the computer is docked or undocked. Press **OK** to start the retransmission, see Figure 39.

During retransmission a new view displays a progress bar and the communication status for all the recorded data for the chosen patient session. The retransmission can be stopped at any time by pressing **Cancel**.

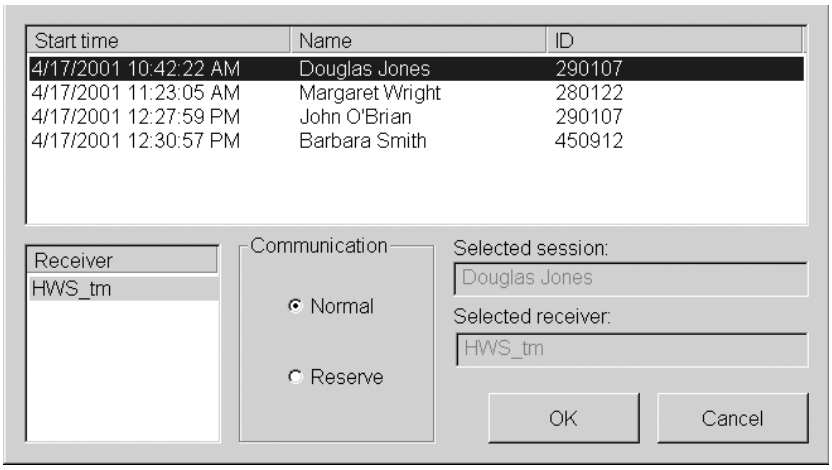

Figure 39. Retransmit view

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10 Appendix

10.1 Settings

The settings described in this manual can be changed by the user. Moreover, there are settings that require an administrator password. Settings for the four parameters (ECG, SpO_2, NIBP and Respiration), MIDA, Trend and Communication are described in the respective parameter chapters.

10.1.1 Sound settings

Sound settings are accessed by pressing **More:Settings:Sound**.

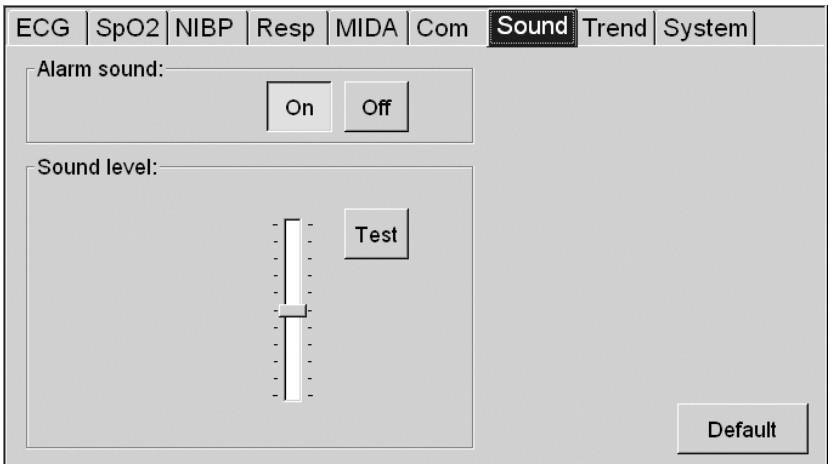


Figure 40. Sound settings

In this setting it is possible to turn alarm sound on or off and adjust the sound level by clicking on the sound control (see Figure 40.). A test sound is played when **Test** is selected. To return to the default settings select the **Default** button.

10.1.2 Unit connection settings

The unit connection settings are accessed from the standby view by pressing **300c connection**. In this view it is possible to see which MobiMed 300c is connected to the 300m. In the unit field the *Bluetooth*

address of the selected MobiMed 300c is displayed. Status shows if the selected 300c is connected to the 300m.

Unit connection can be established in one of two ways:

- Press **Scan**, select the preferred address and then press **Connect**.
- Type the *Bluetooth* address of the preferred 300c in the unit field and then press **Connect**.

To confirm the *Bluetooth* connection, press the **ID button** on the 300c. When a connection is established, MobiMed 300m responds to the signal by displaying a pop-up dialogue with the *Bluetooth* address of MobiMed 300c.

When the settings dialogue is closed, **Close** button, MobiMed 300m tries to establish connection with the selected MobiMed 300c if status was disconnected.

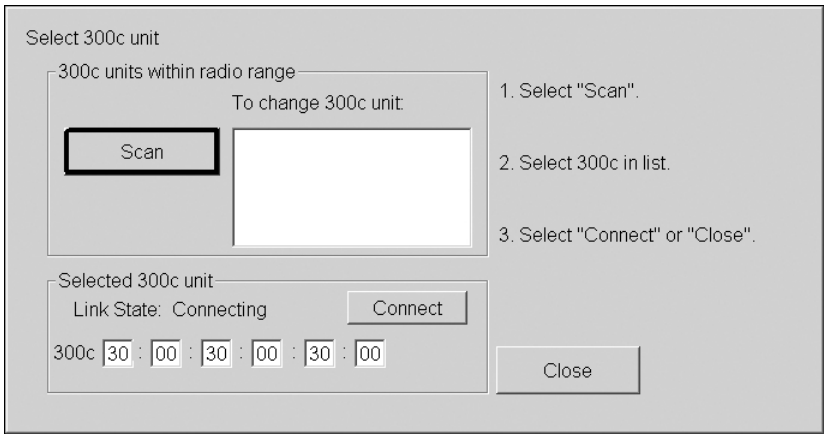


Figure 41. Unit connection settings

10.1.3 System settings

The System settings (see Figure 42.) are accessible only via password. These settings are described in more detail in the MobiMed 300 Technical Manual.

- Selecting **Com status** makes the communication status view visible.
- Selecting **Version** makes a new view with system information such as program version and system configuration visible.
- Selecting **Event viewer** makes the event viewer visible.

- Selecting **Read only** makes the system configuration visible in read only mode.

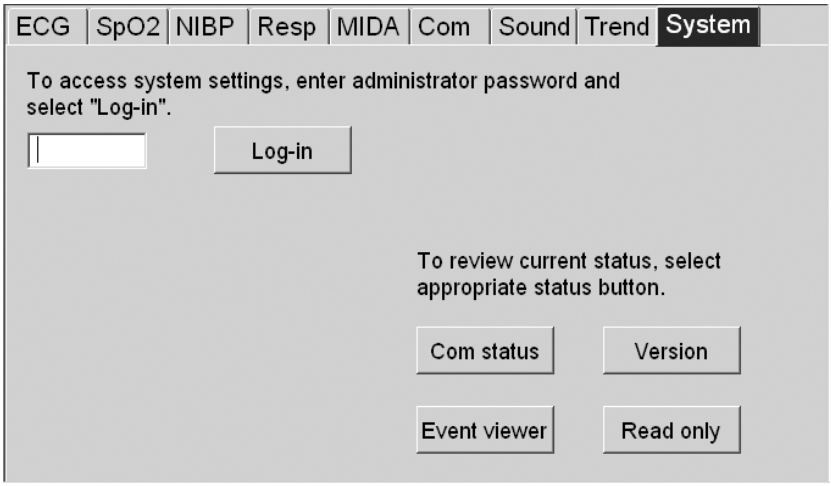


Figure 42. System settings

10.2 Care and maintenance

10.2.1 Preventive maintenance

- MobiMed 300c should be checked, recharged and receive preventative maintenance at least once a month.
- Inspect all cables and cuffs regularly. Beware of damage to contacts and cables and change the damaged equipment at once.
- If MobiMed 300m or MobiMed 300c is accidentally wetted, wipe it dry with a cloth.
- Clean the unit and patient cables as required, in accordance with the instructions below.

10.2.2 Cleaning

Before cleaning the rubber ends should be removed from MobiMed 300c. Wipe MobiMed 300c, the rubber ends and MobiMed 300m with a cleaning cloth moistened with water and ordinary washing-up liquid. Never use ether or petroleum.

Patient cables

All visible dirt should be removed using a lint-free cloth moistened with a solution of washing up liquid and water.

For disinfection, clean the patient cables with a cloth moistened with 70% alcohol solution and then dry.

Deposits of dirt and oxides should be regularly removed from the electrode clips by using a toothbrush and a solution of washing-up liquid and water.

Important: *Under no circumstances should the patient cable be immersed in any liquid cleaning agent. Nor should they be exposed to steam or hot air sterilisation, or chemical sterilisation using ethylene oxide.*

NIBP cuffs

Cleaning: wipe the cuff with a cleaning cloth moistened with water and ordinary hand detergent. Never use ether or petroleum products. The cuff may also be machine-washed. However, hand washing prolongs its life.

Disinfection: wipe the cuff with a cleaning cloth moistened with a 70% alcohol solution, mild bleaching agent or similar solvent. The cuff may be sterilised in an autoclave, or with ethylene oxide.

After washing, allow the cuff to dry, and then replace the rubber bladder.

Important: *Remove the rubber bladder from the cuff prior to cleaning and disinfection. Temperatures over 133 °C (271 °F) damages the cuff, as do strong solvents.*

SpO_2

Cleaning and disinfection: Saturate a clean, dry gauze pad with the cleaning solution. Wipe all surfaces of the sensor and cable with this gauze pad.

Saturate another clean, dry gauze pad with sterile or distilled water. Wipe all surfaces of the sensor and cable with this gauze pad.

Dry the sensor and cable by wiping all surfaces with a clean, dry gauze pad.

Important: *Caution: Do not sterilise by irradiation, steam, or ethylene oxide.*

10.3 Options

10.3.1 Fax

Faxes containing ECG data or Forms can only be sent if communication is established with a receiver HWS that supports the Fax function.

Faxes can be sent either from the ECG view or the Forms by pressing the **Fax** button in the respective view. Faxes sent from the 300m contain the data that is displayed at the time focus selected. The fax button is disabled if communication with a receiver HWS that supports the fax function is disabled.

When the **Fax** button has been selected a dialogue is displayed. Select a receiver from the fax list enter a message and press **Send Fax** (see Figure 43). This command tells the HWS to send a fax to the chosen receiver. After the fax is sent MobiMed 300m receives a message reporting whether the fax has or has not been received.

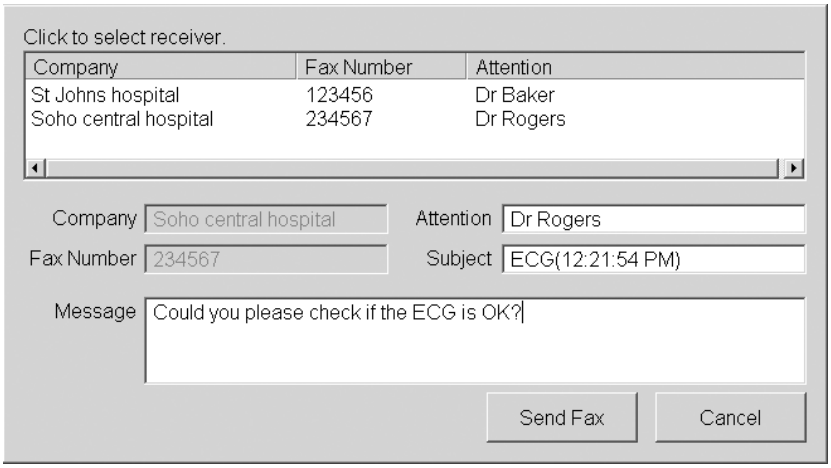


Figure 43. Fax view

Important: *ECG transmitted with Mobitex 1200 will only include the last seconds of the ECG rhythm strip when printed by the fax.*

If the communication situation is bad the fax could be lost in communication with the HWS. The system alarm "Slow transmission rate - data build up. All data could not be sent to hospital unit" indicates that data has not been sent and this data could include fax as well. If

facsimile failed, try again when better communication situation is established.

10.3.2 Communication with Emergency Centre

This function is only available in Sweden, and depends on the program version and equipment installed.

The MobiMed 300 system can be equipped to handle receipt of alarm data from an Emergency Centre, as well as status data from a status terminal (via a so-called UCD-97 Hogia).

Communication with an Emergency Centre may only take place via the Mobitex 1200 network and is taken care of automatically from a MobiMed 300m, both in MobiMed 300m standby mode and during patient care.

Important: *To be able to receive Emergency information and status information, MobiMed 300m must always be switched on. In addition, communication must not be switched off.*

For more information contact Ortivus.

10.4 Troubleshooting

Below are simple troubleshooting instructions. For more information in case of problems, contact authorised personnel.

10.4.1 System alarms

Alarm message	Cause	Action
MobiMed 300c battery low.	300c battery low.	Connect external power to charge the batteries in 300c. Make sure that the two indicators for external power supply connected and battery charging are lit. See “Units in the system” on page 5.
Batteries in MobiMed 300c do not charge. It is too cold.	300c is too cold to charge.	Warm the 300c in order to charge 300c battery.
Batteries in MobiMed 300c do not charge. It is too hot.	300c is too hot to charge.	Cool the 300c in order to charge 300c battery.
No connection with MobiMed 300c.	The 300c is not switched on.	Check that the 300c is turned on (green diode is lit).
	Bluetooth connection is not working.	Check that the 300c is within radio range of 300m (approx. 5 metres).
		Check that right *Bluetooth* address is stated in *Bluetooth* settings, “Unit connection settings” on page 63. Compare with *Bluetooth* address on the 300c label. Otherwise connect to appropriate 300c.
Monitor battery low.	Battery low in 300m.	Connect external power to charge the batteries in the 300m.
Monitor will shut down.	No remaining battery power in 300m.	Connect external power to charge the batteries in the 300m. A new patient care session needs to be started in order to proceed monitoring patient.
No communication with hospital unit.	Communication has not been established.	Check if name of receiver is written in italics or in normal font in information bar, see “Information bar” on page 12. If communication (shown in italics) has not been established. Wait a while and see if changed.
	Poor coverage of communication network.	If there is an antenna/coverage icon in information bar, check communication network coverage. If bad either move or change to other communication network if possible (docked/undocked and reserve channel), see “Communication settings” on page 59.
	Antenna on the 300m damaged or not properly attached.	Check if antenna is damaged and replace the damaged part.
Slow transmission rate - data build up. All data could not be sent to hospital unit.	Poor coverage of communication network.	If there is an antenna/coverage icon in information bar, check communication network coverage. If bad either move or change to other communication network if possible (docked/undocked and reserve channel) see “Communication settings” on page 59.
	NOTE! Do not forget to perform Retransmit after patient care session in order to update information at hospital unit for archiving.	

Database full. No new data will be saved for this patient.	The limit of 4 hours storage of patient data has been exceeded.	Monitoring of real time data is still possible, however no new data will be stored and thus cannot be sent to an HWS. A new care session could be started in order to store and transmit new data.
MIDA relearn failed.	Poor electrode contact.	Check ECG signal quality in Electrode test view. Check electrode contact, check if old electrodes, check that ECG cable is not damaged. Then try MIDA Relearn again.
No communication with hospital unit due to program error. Please contact support for more information.	Program error.	Contact authorised personnel.
Monitor mode only due to program error. Please contact support for more information.	Program error.	Contact authorised personnel.
Facsimile failed.	Fax request did not reach hospital unit.	Check communication status and try again.

10.4.2 Start up

Problem	Cause	Action
MobiMed 300c does not start (green diode is not lit).	300c has not been turned on properly.	Hold On/Off button on 300c pressed for at least 2 seconds.
	Battery low in 300c	Connect external power to charge the batteries in 300c. Make sure that the two indicators for external power supply connected and battery charging are lit. See “Units in the system” on page 5. Try pressing start button after a few minutes of charging.
MobiMed 300m does not start.	300m has not been started properly.	Press the Monitor on button on the 300m.
	Battery low in 300m.	Connect external power to charge the batteries in the 300m. Make sure that the 300m receives external power. Try pressing start button after a few minutes of charging.
MobiMed 300m can not establish contact with 300c.	The 300c is not turned on.	Check that the 300c is turned on (green diode is lit).
	Bluetooth connection is not working.	Check that the 300c is within radio range of 300m (approx. 5 metres).
		Press ID button on 300c to display a pop-up menu with the *Bluetooth* address. If it does, it means that the 300m has contact with the 300c.
		Check that right *Bluetooth* address is stated in Unit connection settings, see “Unit connection settings” on page 63. Compare with *Bluetooth* address on product label. Otherwise connect to appropriate 300c.

10.4.3 Batteries

Problem	Cause	Action
The 300c batteries can not charge.	The 300c does not receive external power.	Make sure that the two indicators for external power supply connected and battery charging are lit, see “Units in the system” on page 5.
	300c is too cold or hot to charge.	Warm or cool 300c in order to charge 300c battery.
The operating time of the 300c batteries is low.	Batteries are getting old.	Leave to authorised personnel for replacing batteries.
The 300m batteries do not charge.	The 300m does not receive external power.	Make sure that the 300m receives external power.
		Make sure that the 300m is correctly docked.
The operating time of the 300m is short.	Batteries are getting old.	Leave to authorised personnel for replacing batteries.

10.4.4 ECG

Problem	Cause	Action
No ECG waveform is displayed in monitor view.	The 300c is not turned on or the 300m can not establish contact with the 300c	Check that the 300c is turned on and that contact is established.
	ECG cable not connected.	Check that the ECG label is visible in monitor view, see “Monitor and workspace view” on page 12, otherwise ECG cable is not connected properly.
Disturbances and alarms on ECG in monitor view.	Poor ECG signal quality.	Check ECG signal quality in Electrode test view, see “Electrode test” on page 26. Check electrode contact, check if old electrodes, check that ECG cable is not damaged.
ECG alarms “ECG Learning” or “Selecting reference complex” wont go away.	Poor ECG signal quality.	Check ECG signal quality in Electrode test view. Check electrode contact; check if the electrodes are old, check that ECG cable is not damaged.
Pacemaker spikes are not shown in ECG waveforms.	Pacemaker option is not chosen.	Choose pacemaker option in ECG settings, see “ECG settings” on page 31.
No ECG complexes in ECG view.	Wrong ECG cable used.	For 3 lead cable no complexes can be calculated. Change ECG cable.
	MIDA analysis not working.	Press Relearn MIDA in MIDA settings, see “MIDA settings” on page 32.
MIDA relearn failed.	Poor electrode contact.	Check ECG signal quality in Electrode test view. Check electrode contact, check if old electrodes, check that ECG cable is not damaged. Then try MIDA Relearn again.
Too few ECG complexes in ECG view.	Wrong ECG cable used.	For 5 lead cable all complexes cannot be calculated. Change ECG cable.

10.4.5 SpO_2

Problem	Cause	Action
No SpO_2 waveform is visible in monitor view.	SpO_2 probe not connected.	Check that the SpO_2 label is visible in monitor view see “Monitor and workspace view” on page 12, otherwise SpO_2 cable is not connected properly.
	SpO_2 probe not working.	Check that the SpO_2 probe emits red light.
Disturbances and alarms on SpO_2 in monitor view.	Bad SpO_2 signal quality.	Disturbances can be caused by movement or if patient has poor circulation in finger.

10.4.6 NIBP

Problem	Cause	Action
No NIBP table is visible on monitor.	NIBP hose not properly connected.	Check that the hose is properly connected.
	NIBP measurement is not started.	Start NIBP measurement, see “Start an NIBP measurement” on page 41.
	Wrong NIBP cuff used.	Make sure that right size of NIBP cuff is used. See “Selection and placement of the cuff” on page 40.
	NIBP cuff not properly placed.	Make sure that NIBP cuff is properly placed. See “Selection and placement of the cuff” on page 40.

10.4.7 Respiration

Problem	Cause	Action
No respiration waveform is visible in monitor view.	Respiration measurement is not started.	Check that the Respiration label is visible in monitor view, otherwise start Respiration measurement in Respiration settings, see “Respiration settings” on page 47.
	ECG cable not connected.	Check that the ECG label is visible in monitor view, otherwise ECG cable is not connected properly.
	ECG electrodes poor contact.	Check the signal quality in Electrode test view (see “Electrode test” on page 26) of the ECG electrodes used for Respiration measurement, see “Electrodes for respiration measurement” on page 46. Adjust electrodes if necessary.
Disturbances and alarms on Respiration in monitor view.	Bad measurement environment.	The bioimpedance method is sensitive to movement by the patient, try using the 4-wire measurement, see “Electrodes for respiration measurement” on page 46.

10.4.8 Communication

Problem	Cause	Action
No contact with a hospital unit.	Communication is turned off.	Check if "Communication off" is stated in the information bar. Turn on communication in settings, see "Communication settings" on page 59.
	Communication has not been established.	Check if receiver name is in *italics* or in normal font in information bar, see "Information bar" on page 12. If in italics, then communication has not been established. Wait a while and see if changed. Check coverage of communication network.
	Poor coverage of communication network.	If there is an antenna/coverage icon in information bar, check communication network coverage. If bad either move or change to other communication network if possible (docked/undocked and reserve channel) see "Communication" on page 57.
	Antenna on the 300m damaged or not properly attached.	Check if antenna is damaged or incorrectly attached.
Data not sent to HWS.	Poor coverage of communication network.	If there is an antenna/coverage icon in information bar, check communication network coverage. If bad either move or change to other communication network if possible (docked/undocked and reserve channel), see "Communication" on page 57.
	NOTE! Do not forget to do Retransmit after patient care session in order to update information at hospital unit for archiving.	

10.4.9 Fax

Problem	Cause	Action
Facsimile failed.	Different causes stated in message.	Read message in message log to determine action.
System alarm "Data not sent"	Indicates that data has not been sent due to bad communication.	If possible, move for better network coverage, or change to other networks (docked/undocked/reserve) see "Connecting to a receiver" on page 58. Send the fax again.

10.4.10 SOS

Problem	Cause	Action
No SOS alarm is received.	Communication is turned off.	Check if "Communication off" is stated in the information bar. Turn on communication in settings, see "Communication settings" on page 59.

10.5 Technical specification

10.5.1 Classification of medical device

MobiMed 300 is classified as:

- Class IIb according to the Medical Device Directive (MDD).
- Class II according to the Food and Drug Administration (FDA).
- Class III according to Health Canada.

10.5.2 ECG specifications

Input signal range	±5 mV
Input DC range	±300 mV
Sensitivity	2.5 µV/LSB (referred to input)
Sampling frequency	500 Hz
Band width	0.05 - 170 Hz
Heart rate range	15 - 300 bpm (beats/minute)
Resolution, heart rate	1 bpm
Accuracy, heart rate	±1 bpm
Update, heart rate value	Value based on last 10 seconds of analysed ECG, not including beats occurring during bad signal quality. If less than 5 seconds since fatal lead failure, invalid value is presented.
Mains interference	Filter for suppression of 50 or 60 Hz mains interference.

The following electrodes have been tested and approved:

- Niko medical products, 4060 / 4420 / 4610.
- 3M, Red dot 2237 / 2249 / 2255.
- ConMed, Cleartrace 1700 - 030.
- Medicotest Blue sensor P-00-S / R-00-S / VL-00-S / M-00-S / L-00-S.
- MSB Monitab (List No. 1414).

The following ECG cables may be used with MobiMed 300c:

- 10 lead ECG cable.
- 8 lead (Frank vector) ECG cable.
- 5 lead ECG cable.
- 3 lead ECG cable.

10.5.3 SpO_2 specifications

The pulse oximeter is calibrated to show functional saturation and pulse.

Oxygen saturation range	70 - 100%
Pulse rate range	18 - 300 bpm
Measurement wavelengths	
Red	660 nm
Infrared	910 nm
Accuracy SpO_2	Saturation accuracy: ±2 digits for 70-100% (with adult finger clip sensor), specified at ±1 standard deviation. Accuracy is not specified for sensors <70% saturation.
Update, saturation and pulse value	Update period 0.3 s
Pulse rate accuracy	±3%, ±1 digit

The following sensor has been tested and approved:

- Nonin 8000AA Articulated Finger Clip.

10.5.4 NIBP specifications

NIBP measurement range	60 - 300 mmHg
Ambient pressure (atmospheric pressure)	355 to 807 mmHg (-500 to 6000 metres)
NIBP accuracy	±2 mmHg or ±2% depending on whichever is the greater
Measurement time	Maximum of 2 minutes. On average, less than 40 seconds
Maximum cuff pressure	330 mmHg

The following cuffs can be used with MobiMed 300c:

- CritiCare, Small adult size, circumference 10 to 26 cm.
- CritiCare, Adult size, circumference 25 to 35 cm.
- CritiCare, Large adult size, circumference 33 to 47 cm.

The following extension hoses can be used with MobiMed 300c:

- CritiCare, 3.1 metres (10 ft).
- CritiCare, 1.2 metres (4 ft).

10.5.5 Respiration specifications

Method	Respiration rate based on impedance waveform, either from 2- or 4-lead measurement. Respiration value is based on the last 30 seconds of impedance waveform, not including poor quality signals.
Current (peak)	100 µA, 150 kHz
Range	6 - 60 breaths per minute
Resolution	±1 breath per minute

Electrodes for respiration measurement with IEC and ANSI/AAMI labelling:

Cable	2-wire measurement	4-wire measurement	
	Feed current & measure	Feed current	Measure
10 lead cable	R-F (RA-LL)	R-F (RA-LL)	L-C4 (LA-V4)
8 lead cable	I-A	I-F	A-H
5 lead cable	R-F (RA-LL)	R-F (RA-LL)	L-C (LA-V)
3 lead cable	R-F (RA-LL)	N/A	

10.5.6 Storage capacity

It is possible to store up to 4 hours of data for each patient and up to 10 patients (ECG, trends and forms).

10.5.7 Connections on MobiMed 300c

Connections front:

- ECG: 12-pole, electrically isolated circular contact.
- SpO_2: 5-pole, electrically isolated circular contact.
- NIBP: Circular air nipple.
- Not used: Circular contact for fibre-optic cable.

Connections back:

- Power: 2-pole, circular connector for +12 V DC.

10.5.8 Power supply for MobiMed 300c

Internal battery (Lilon +7.4 V DC; 1.2 Ah) or from an Ortivus-approved external power unit. The internal battery is charged when power is supplied from the external power unit.

Charging time, internal battery	Up to 4 hours
Running time with internal battery	At least 2 hours with NIBP every 5 minutes
External supply voltage	12 V DC
Power consumption	Continuous 4 W, max 11 W (when NIBP is activating)

10.5.9 Power supply for MobiMed 300m

Internal battery or external power via docking station.

Charging time, internal battery	Maximum 4 hours
Running time with internal battery	Minimum 2 hours
External supply voltage via docking station	12 V DC
Power consumption	Refer to the manufacturer's manual

10.5.10 *Bluetooth*

Signal strength	1 mW
Frequency range	2.4 GHz ISM band, frequency hopping, 79 channels, 1 MHz spacing

10.5.11 Communication options

GSM, Mobitex 1200, Mobitex 8k, PSTN and CDPD.

10.5.12 Surroundings/environment

Temperature range	0 – 40 °C (32 – 104 °F), operation -20 – 60 °C (-4 – 140 °F), storage
Air humidity	30 – 95% non-condensing, operation 30 – 95% condensing, storage
Ambient pressure	See “NIBP specifications” on page 77
Degree of enclosure protection MobiMed 300c	IP X4 (according to standard IEC 60529, Degrees of protection provided enclosures.)
Vibration/Shock/Bump	MobiMed 300 meets requirements in accordance with EN 1789 (Medical vehicles and their equipment – Ambulances.)
Drop/Free fall	Fall test in accordance with EN 1789 (MobiMed 300c only.)
EMC/ESD	MobiMed 300 meets requirements in accordance with: IEC 60601-1-2 (Medical electrical equipment - Part 1: General requirements for safety - 2. Collateral Standard: Electromagnetic compatibility – Requirements and tests.) ISO 7637-1 (Road vehicles – Electrical disturbance by conduction and coupling – Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage - Electrical transient conduction along supply lines only.)

10.5.13 Electronic emission notices

Federal Communications Commission (FCC) statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These

limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful inference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Industry Canada Class B emission compliance statement

This Class B digital apparatus complies with Canadian ICES-003.

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. Ortivus cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-Ortivus accessories.

This product has been tested and found to comply with the limits for Class B Information Technology Equipment according to CISPR 22/ European Standard EN 55022. The limits for Class B equipment were derived for typical residential environments to provide reasonable protection against interference with licensed communication devices.

10.5.14 Mechanical dimensions of MobiMed 300c

Weight: approx. 1.9 kg (4.2 lbs)

Dimensions: 180 x 195 x 70 mm (7.1 x 7.7 x 2.8 inches)

10.5.15 Safety standards

MobiMed 300 is type-approved in accordance with the following safety standards:

- UL 2601-1 General requirements for safety, Medical Electrical Equipment.
- CAN/CSA-C22.2 No 601.1-M90 General requirements for safety, Medical Electrical Equipment.
- IEC 60601-1 Medical electrical equipment - Part 1: General requirements for safety.
- IEC 60601-1-1 Medical electrical equipment - Part 1: General requirements for safety – Section 1: Collateral standard: Safety requirements for medical electrical systems.
- IEC 60601-2-27 Medical electrical equipment - Part 2: Particular requirements for the safety of electrocardiographic monitoring equipment.
- IEC 60601-2-30 Medical electrical equipment - Part 2: Particular requirements for the safety of automatic cycling indirect blood pressure monitoring equipment.
- EN 865 Pulse oximeters for medical use – Requirements.
- EN 60950 Safety of information technology equipment including electrical business equipment. (Applies to MobiMed 300m only.)

10.6 MIDA

MIDA is an abbreviation for Myocardial Ischemia Dynamic Analysis. MIDA trends are used in Coronary Care Units, Intensive Care Units, Chest Pain Units, Cathlabs and in peri-hospital care to monitor the degree of myocardial ischemia, success or fail of thrombolytic therapy, Unstable Angina Pectoris, Angioplasty and other situations when ischemia monitoring is desirable.

Briefly the MIDA method in MobiMed includes four steps:

1. Every minute a noise-free QRS-complex representing the normal beat of the patient is formed from the last minute of ECG signal.
2. The QRS-complex is displayed in the ECG view as a 12-lead or derived 12-lead (Frank cable) representation.
3. From the QRS-complex a set of trend parameters are calculated and displayed in the trend view.
4. Trend curves and 12-lead ECG are automatically stored on MobiMed 300m and transmitted to a HWS.

The trend parameters are calculated either from the 12-lead presentation or from the vector representation of the ECG.

If a 10-lead cable is used, the three orthogonal vector leads are derived according to Edenbrandt L, Pahlm O: Vectorcardiogram synthesized from a 12-lead ECG: Superiority of the inverse Dower matrix. *J Electrocardiology 21 (1988); 361-367.*

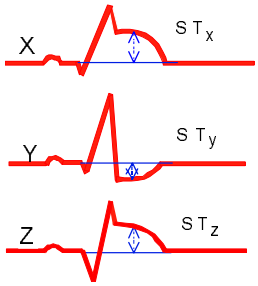
If Frank cable is used, the 12-lead ECG is derived according to Dower GE. The ECGD: a derivation of the ECG from VCG leads. *J Electrocardiology 17 (1984); 189-91.*

All trend parameters except for QRS-VD, ST-VM and STC-VM reflect the ST-deviation in the lead where it is measured. Depending on system setup the ST-deviation is measured 20, 60 or 80 ms after the end of the QRS-complex, the so-called J-point.

The QRS-VD, ST-VM and STC-VM include information from the three orthogonal vector leads and subsequently condensed information from the entire heart.

ST-Vector magnitude (ST-VM)

By measuring the ST-deviation in X-, Y- and Z-leads the ST-vector can be calculated.



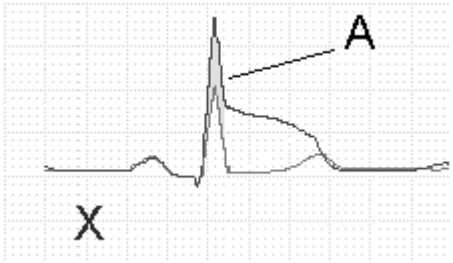
ST-VM is calculated by Pythagorean thesis:

$$ST - VM = \sqrt{ST_X^2 + ST_Y^2 + ST_Z^2}$$

ST-VM is always a positive value and shows if an ST-alteration is present; it will not show if there is an ST-depression or an ST-elevation, only if there is an alteration in one or more leads. ST-VM will show the occurrence of ischemia/ST-change, but not the location.

QRS-Vector difference (QRS-VD)

With QRS-VD changes of the QRS-complex are measured. If the QRS-complex is changed, e.g. during infarction or ischemia, this is displayed as an increase of the QRS-VD on the trend curve. QRS-VD is measured by comparing the reference complex with present complex. The difference between them can be described as an area, which is proportional to the change. If the patient has an ongoing infarction the amplitude of the QRS-complex will gradually be reduced, a Q-wave or a QS-complex can arise as a result from the infarction. This change is displayed by QRS-VD as an increasing value.



A is the area of difference between the reference complex and the present complex.

QRS-VD is calculated by the formula:

$$QRS-VD = \sqrt{A_X^2 + A_Y^2 + A_Z^2}$$

ST-Change Vector magnitude (STC-VM)

The ST-vector does not only consist of a length; it also has a direction. Changes of the ST-vector can concern the length as well as the direction. With the parameter STC-VM these changes are measured compared with the initial ST-vector, i.e. the ST-vector on the initial averaged complex. With STC-VM both changes in the length and direction of the ST-vector are measured. This means that if the patient only has a change in the ST-direction but not in the magnitude this will be seen in STC-VM but not in ST-VM.

More information regarding MIDA is available on Ortivus' website: www.ortivus.com

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