

# AS/3™ Compact Anesthesia Monitor upgraded with U-LIFE2

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User's Guide  
Part II: For Daily Use



**Datex·Ohmeda**

*Devoted to caring for life*

# **Datex-Ohmeda AS/3 Compact Anesthesia Monitor upgraded with U-LIFE2**

## **User's Guide**

### **Part II: For Daily Use**

#### **Related to software licenses L-ANE03 and L-ANE03A**



Conformity according to the Council Directive 93/42/EEC concerning Medical Devices

CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.  
Outside the USA, check local laws for any restriction that may apply.

All specifications subject to change without notice.

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## About this guide

This User's Guide describes the most common features and functions offered by the Datex-Ohmeda AS/3 Compact Anesthesia Monitor. Descriptions refer to S/5 software licenses L-ANE03 and L-ANE03A.

If you are a new user of the monitor, we suggest you begin with the section "Starting and ending." Also read Part I of this User's Guide. The following conventions are used:

- Names of the hard keys on the Command Board, Remote Controller and modules are written in the following way: **ECG**.
- Menu items are written in bold italic typeface, for example ***ECG Setup***
- Menu access is described from top to bottom. For example, the selection of the ***Screen Setup*** menu item and the ***Waveform Fields*** menu item would be shown as ***Screen Setup - Waveform Fields***.
- Messages (alarm messages, informative messages) displayed on the screen are written inside single quotes: 'Learning'.
- When referring to different sections in this manual, section names are enclosed in double quotes: "Cleaning and Care."
- In this manual, the word "select" means choosing and confirming.

## Related documentation

Clinical aspects, basic methods of measurement and technical background:  
S/5 Compact Anesthesia Monitor, User's Reference Manual

Monitor setup instructions: AS/3 Compact Anesthesia Monitor upgraded with U-LIFE2, User's Guide Part I

Installation, technical solutions and servicing: AS/3 and CS/3 Compact Monitors upgraded with U-LIFE2 and S/5 Modules, Technical Reference Manuals

Options and selections of the software: Default Configuration Worksheet

Supplies and accessories: CS/3 Compact Critical Care Monitor upgraded with U-LIFE2, User's Guide Part I

Other devices closely related to the AS/3 Compact Anesthesia Monitor:  
S/5 Central and S/5 Arrhythmia Workstation User's Reference Manuals

## Intended purpose (Indications for use)

The Datex-Ohmeda AS/3 Compact Anesthesia Monitor upgraded with L-ANE03 or L-ANE03A software is intended for multiparameter patient monitoring with optional patient care documentation.

The AS/3 Compact Anesthesia Monitor upgraded with L-ANE03 or L-ANE03A software is indicated for monitoring of hemodynamic (including arrhythmia and ST-segment analysis), respiratory, ventilatory, gastrointestinal/regional perfusion, Bispectral index (BIS), Entropy (State Entropy and Response Entropy) and neurophysiological status of all hospital patients.

The AS/3 Compact Anesthesia Monitor with L-ANE03 and L-ANE03A software when using BIS is for monitoring the state of the brain by data acquisition and processing of electroencephalograph signals and may be used as an aid in monitoring the effects of certain anesthetic agents.

The AS/3 Compact Anesthesia Monitor with L-ANE03 or L-ANE03A software is also indicated for documenting patient care related information.

The AS/3 Compact Anesthesia Monitor with L-ANE03 or L-ANE03A software is indicated for use by qualified medical personnel only.

## Classifications

### In accordance with IEC 60601-1:

- Class I and internal powered equipment - the type of protection against electric shock.
- Type BF or CF equipment. The degree of protection against electric shock is indicated by a symbol on each parameter module.
- Equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
- Continuous operation according to the mode of operation.

### In accordance with IEC 60529:

- IPX1 - degree of protection against harmful ingress of water

### In accordance with EU Medical Device Directive: IIb

## Responsibility of the manufacturer

Datex-Ohmeda Division, Instrumentarium Corp. is responsible for the safety, reliability and performance of the equipment only if:

- assembly, extensions, readjustments, modifications, service and repairs are carried out by personnel authorized by Datex-Ohmeda.
- electrical installation complies with appropriate requirements.
- the equipment is used in accordance with this User's Guide.

## Contents

<b>Starting and ending (Start/End).....</b>	<b>3</b>	<b>Pulse oximetry (SpO<sub>2</sub>) .....</b>	<b>47</b>
<b>Entering and loading patient data (Start/End) .....</b>	<b>4</b>	<b>Non-invasive blood pressure (NIBP) .....</b>	<b>49</b>
<b>Screen setup (Start/End) .....</b>	<b>5</b>	<b>Invasive blood pressure (InvBP/PCWP) .....</b>	<b>51</b>
<b>Alarms.....</b>	<b>7</b>	<b>Cardiac output (C.O.) .....</b>	<b>55</b>
<b>Anesthesia record keeping (Report).....</b>	<b>9</b>	<b>Mixed venous oxygen saturation (SvO<sub>2</sub>).....</b>	<b>57</b>
<b>Laboratory data and calculations (Calcs) .....</b>	<b>11</b>	<b>Airway gases (Gases).....</b>	<b>59</b>
<b>Trends and snapshots (Trends) .....</b>	<b>13</b>	<b>Patient Spirometry (Spirom.).....</b>	<b>61</b>
<b>Recording and printing (Print).....</b>	<b>15</b>	<b>Gas exchange (Gas exch.) .....</b>	<b>63</b>
<b>Troubleshooting (What if?).....</b>	<b>19</b>	<b>Tonometry (Tono).....</b>	<b>65</b>
<b>Messages (What if?) .....</b>	<b>25</b>	<b>Neuromuscular transmission (NMT) .....</b>	<b>67</b>
<b>ECG/ST .....</b>	<b>35</b>	<b>EEG and evoked potentials (EEG).....</b>	<b>69</b>
<b>Impedance respiration (Resp./Temp.) .....</b>	<b>45</b>	<b>Bispectral Index (BIS).....</b>	<b>73</b>
<b>Temperature (Resp./Temp.).....</b>	<b>46</b>	<b>Entropy.....</b>	<b>75</b>

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A portion of the entropy software is derived from the RSA Data Security, Inc. MD5 Message-Digest Algorithm.

## Starting and ending

### Preparations

NOTE: Before using the AS/3 Compact Anesthesia Monitor for the first time, charge the batteries to their full capacity (charging time 10 hours).

1. Plug in the measurement modules.
2. Turn on the monitor from the power switch.
3. If necessary, change the user mode:

Press the **Monitor Setup** key and select **Select Mode**.

NOTE: Changing the mode also changes settings such as the alarm limits. For details, see the "User's Reference Manual."

### Starting monitoring

1. Prepare patient connections according to the setup picture in the measurement section. Use only Datex-Ohmeda approved supplies and accessories. The alarms and parameter default settings become active.
2. If necessary, adjust the waveform and digit fields; see section "Screen setup."
3. Zero invasive pressure lines, see section "Invasive blood pressure."
4. Check the alarm limits; press the **Alarms Setup** key. Change them, if necessary. See section "Alarms."
5. Start the measurement according to the instructions in the measurement section.
6. Enter or load patient data by pressing the **Patient Data** key; see section "Entering and loading patient data" below.

A case starts automatically when the monitor receives a patient's vital signs, or patient data is entered by the user.

Always observe the monitor and the patient carefully during start-up periods.

### Automatic case reset

The monitor resets a case automatically after a predefined time when vital signs for some parameters (ECG, Art, NIBP, SpO<sub>2</sub>, CO<sub>2</sub>, Resp, tonometry, EEG, BIS, entropy) or events are not available. When a case is reset, all trend data will be cleared and alarm limits set to default values. The predefined reset time depends on the software license and availability of the network and MemCard option as follows: L-ANExx software license with network and/or MemCard option: after 15 minutes.

L-ANExx software license without network or MemCard option: after 60 minutes.

NOTE: This does not apply to user mode CPB in software license L-ANE03(A).

### Ending monitoring

1. Print necessary data. Press the **Record/Print** key.
2. Wait until the printing is finished. Then clear the patient data and return the settings to their defaults: **Reset Case - Reset ALL - YES**.
3. Turn the monitor to standby by pressing the power switch if the monitor will not be used.
4. Clean the monitor according to the instructions.

**WARNING: Connect only one patient to the monitor at a time.**

**WARNING: Always make sure that necessary alarm limits are active and set according to the patient's clinical condition when you start monitoring a patient.**

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## Entering and loading patient data

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### Entering patient data

When you start a new case, you must enter all relevant patient data:

1. Press the **Patient Data** key.
  2. Enter patient data by pushing and turning the ComWheel.
- 

### Loading patient data

To load a case that has already been started on the same or another monitor, press the **Patient Data** key and select one of the following:

- **Load Prev. Case**

Select this when neither memory cards nor network are in use. This loads the most recent case from the monitor memory when less than 15 minutes has elapsed from the turn-off. If the monitor has been on but reset, the last case from the previous 24 hours can be retrieved.

- **Patient from Net.**

Select this when the monitor is connected to the network. This loads a case from the network. Note that the case must have been closed less than 24 hours ago.

- **Other Networks**

Select this to load a case from another network.

- **Patient from Card**

Select this when the memory cards are in use. This loads a case from the Data Card. Note that the case must have been closed less than 24 hours ago.

NOTE: You can load a case from a Critical Care Monitor to an Anesthesia Monitor only if the total length of the case is less than 24 hours (the max. case length for the L-ANE03 and L-ANE03A software licenses).

When loading trends of patient data without patient's name or ID, select the data according to time indicated in the message field.

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### Receiving data from other sites

Once the monitor is connected to the Datex-Ohmeda network, you can view and receive data from other monitors in the network.

1. Press the **Patient Data** key.
2. Select **Other Patients**.
  - To receive alarms from other patient sites, select **Receive Alarms** (and the correct network if there are several available).
  - To view other patients' vital signs, select **Show Vital Signs** (and the correct network if there are several available).

NOTE: The heart rate is always calculated from ECG, independently from the selection made at the other site.

---

### Saving data

The AS/3 Compact Anesthesia Monitor continuously saves patient data, for example trends. Saving is activated once the case is started. The monitor saves automatically:

- in the monitor memory the most recent case if neither memory module nor network is in use.
- in the network cases from 2 to 90 days depending on the configuration.
- on the Data Card up to 48 hours of information (depends on the data load). The green Data Card stores and transfers information.

## Screen setup

### Selecting a user mode

Modes determine, for example, what is displayed on the screen and in trends and what the alarm limits are. The monitor starts in startup mode. The startup mode is one of the user modes chosen during configuration. To select a user mode:

1. Press the **Monitor Setup** key.
2. Select **Select Mode** and choose one of the options.

Changing the modes is described briefly in the User's Guide Part I, section "Setting up the monitor before use." For more information, please refer to the "User's Reference Manual."

### Modifying the screen temporarily

- Press the **Monitor Setup** key and select **Screen Setup**.

Change the waveform and digit field measurements, split screen option, minitrend length, and sweep speeds.

- To make other setup changes such as scale changes, press a parameter key and select its **Setup** menu. For example, press the **ECG** key and select **ECG Setup**.

Changes are valid until the monitor is turned off (+15 minutes) or until the case is reset. Only time and date settings are stored permanently.

### Modifying the screen permanently

You can also make permanent changes in the screen setup. This is described briefly in the User's Guide Part I, section "Setting up the monitor before use." For information on default configuration, refer to

the "User's Reference Manual" and "Default Configuration Worksheet."

### Selecting an appropriate page

In addition to Normal Screen, you can define up to five more pages for looking at the information on the screen. Pages are preconfigured but if desired, can also be changed.

#### To move between different pages:

1. Close all menus.
2. Push the ComWheel to open the **Select Page** menu.
3. Select the page.

For more information, please refer to the User's Guide Part I, section "Setting up the monitor before use" or the "User's Reference Manual."

### Changing the split screen contents

You can split the Normal Screen page into two parts. The other half of the split screen shows trend, ST, spirometry, EEG or EP data.

1. Press the **Monitor Setup** key.
2. Select **Screen Setup**.
3. Select **Split Screen** and choose from the options:

**ST** shows current and reference QRS complexes and ST trends.

**Spiro1** is a basic view of spirometry data.

**Spiro2** is an enhanced view of spirometry with additional values.

**EEG** shows EEG compressed spectral array.

**EP** shows current evoked potential waveforms.

**Trend** shows minitrends beside waveforms.

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## Changing waveform and digit fields

Up to eight waveforms and four digit fields can be displayed simultaneously.

- Press the **Monitor Setup** key.
- Select **Screen Setup - Waveform Fields** or **Digit Fields**.

Note that:

- Waveforms are always evenly spread to fill the entire waveform area. The height of the waveforms depends on the number of waveforms configured to be displayed: When 2 or 3 waveforms are displayed, the waveforms are at least double the normal height, and when only 1 waveform is displayed, it fills the entire waveform area.
- When less than four digit fields contain data, the remaining fields are automatically enlarged.
- Any digit field having an empty digit field (= "OFF") on the right is automatically enlarged.
- When you select **4 invP**, four invasive pressure waveforms are displayed together, using an area of two normal waveforms. The **4 invP** choice removes the waveform under it.
- Selecting **Combine Pressures** displays invasive pressures in the same waveform field with the same zero line, but with individual scales.
- If 5- or 12-lead ECG is measured, up to three different ECG leads can be displayed simultaneously in different fields.



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## Alarms

To enable the alarms, connect the patient cables. When an alarm becomes active, messages appear in the order of priority. See also section "Alarm basics" in User's Guide Part I.

NOTE: If the monitor is connected to the network, the alarms can be heard and seen on the S/5 Central as well. Please consult the "Datex-Ohmeda S/5 Central User's Reference Manual :Alarms" for details.

---

**WARNING: Always make sure that necessary alarm limits are active and set according to the patient's clinical condition when you start monitoring.**

**WARNING: When the alarms are silenced, observe the patient frequently.**

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### Adjusting limits

- Press the **Alarms Setup** key and select **Adjust Limits**.
- Highlight the measurement or select **Next Page** if it is not displayed.
- Push the ComWheel to open an adjustment window.
- Turn the ComWheel to change limits and accept them by pushing it. Move between selections by turning the ComWheel.

NOTE: If the monitor is connected to the network, the alarm limits can also be changed using the S/5 Central if this feature is available and has been enabled in the Central configuration.

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### Adjusting volume

- Press the **Alarms Setup** key.
- Select **Alarm Volume** and adjust.

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### Changing source

For NIBP, P1, P2, P3, P4, P5, P6, O<sub>2</sub> and Temp, you can select which measured values trigger the alarm. Only the most recently modified source is active.

1. Press the **Alarms Setup** key and select **Adjust Limits**.
2. Select the measurement.
3. If the highlight is in the adjustment window, push the ComWheel until you get to the menu selections.
4. Select the desired alarm source ON.

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### Receiving alarms from other sites

NOTE: The monitor needs to be connected to a network.

1. Press the **Patient Data** key and select **Other Patients - Receive Alarms**.
2. Select the correct network and one of the other sites.

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### Showing alarm history

Press the **Alarms Setup** key and select **Alarm History**. A list of the last 20 alarms is displayed.

---

### Silencing audible alarms temporarily

To silence alarms for two minutes, press the **Silence Alarms** key. To silence them for five minutes, press the key for more than three seconds.

If the alarms are not active when you press the **Silence Alarms** key, they are pre-silenced for two or five minutes.

**Exception:**  $\text{FiO}_2 < 18\%$ ,  $\text{EtO}_2 < 10\%$  and Ppeak High alarms are silenced for 20 seconds.

During silencing, all new alarms for the same reason and all alarms for a different reason are indicated visually.

To silence the individual alarm that is currently active, press **Silence Alarms** key twice. This does not pre-silence the upcoming alarms.

### Reactivating silenced alarms

- Press the **Silence Alarms** key during the silencing period. The alarm sounds of new alarms are activated. Silenced alarms are active after two minute period. Apnea alarm is activated after five breaths.

---

### Silencing audible alarms permanently

1. Press the **Alarms Setup** key and select **Audio ON/OFF**.
2. Select **Silence Apnea**, **Silence ECG**, **Silence Apn&ECG** or **Silence ALL**.

If an active alarm is silenced, the monitor gives a reminder beep every two minutes. By default, silencing alarms is set unselectable and can only be activated through the **Installation** menu. For more information, see the "Setting up the monitor before use: Alarm options " in User's Guide Part I and "User's Reference Manual."

### Reactivating alarms

- In **Alarms Setup**, select **Audio ON/OFF** and select **Activate Alarms**.

NOTE: If the monitor is connected to the network, the bedside alarms can also be silenced using the S/5 Central if this feature is available and has been enabled in the Central configuration.

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## Anesthesia record keeping

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### Overview

You can keep automatic anesthesia records with the optional anesthesia record keeping solution.

The following describes the most frequently used functions. For more detailed information, see the anesthesia record keeping solution user documentation.

The network is used for storing patient data and for providing the menu configurations. You can use the Memory Module with memory cards as a backup device.

The green Data Card stores and transfers patient data. The white Menu Card is used for storing the record keeping menus and configurations, and for loading patient data and user modes from the Data Card.

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### Getting started

Before starting, check that:

- The memory cards are properly inserted in the memory module.
  - The keyboard is connected.
  - The monitor is connected to the network.
1. Turn on the power. The green LED on the keyboard lights up. The MemCard symbol and the network symbol are displayed on the screen.
  2. Press the **Reset Case** key and select **Reset Trends** to erase any previously recorded data.
  3. Connect the patient to the monitor.
  4. If the monitor prompts for user ID and password before allowing access to the menus, enter them and push the ComWheel to confirm.

## Entering data

1. Press the **Patient** key to enter patient data.
2. Press the **Personnel** key and select the names of the personnel.
3. Press the menu keys to access the corresponding menus and enter the desired information (gases and ventilation data, laboratory data, fluids, drugs, events, comments and postoperative instructions.)

## Modifying data

1. If you have incorrect entries in the anesthesia record, press the **Modify** key to open the menu and modify or delete data.
2. Select **Select Event** and highlight the data by turning the ComWheel, or using the **Events** arrow keys on the keyboard.
  - To correct data, select **Modify Event**.
  - To delete data, select **Delete Event**.

NOTE: If you try to correct data through any other menu than **Modify**, you will simply add new data. All the previous data remains in the record as well.

## Printing data and closing the record

1. Press the **Print** key.
2. Select **Print and Close** to print the record, to close and end it, and to log out.

The anesthesia record has two pages by default. If you wish to use the 3-page printout with ventilatory data on the third page, press **Special** and select the 3-page record.

You can also close the record by pressing the **End of Case** key and selecting **Close Record**.

## Laboratory data and calculations

For more information, please refer to the “*User’s Reference Manual.*”

### Entering laboratory values

1. Press the **Patient Data** key.
2. Select **Lab Data - Enter Values.**
3. Enter the values by turning and pushing the ComWheel.

NOTE: When entering laboratory values, make sure that the units you are using are the same as the ones on the screen. If not, convert the values or change the units on the screen through **Monitor Setup - Install/Service - Installation - Units.**

### Loading laboratory values from an external device

1. Press the **Patient Data** key.
2. Select **Lab Data - Load Art.** or **Load Ven.** NOTE: These selections are available when there are unconfirmed values in the monitor memory.
3. Confirm the values with the ComWheel. The message ‘Lab Data available’ remains in the message field until the values are confirmed.

### Temperature correction

In the laboratory, blood gas values are measured and calibrated at +37°C. These values may need to be adjusted to the actual patient temperature since an increase or decrease in temperature changes the volume of dissolved gas (PO<sub>2</sub>, PCO<sub>2</sub>, pH).

The monitor has three options for temperature correction. To choose:

1. Press the **Patient Data** key and select **Lab Data.**
2. Select **Correct.** and one of the following:
  - **Lab** = Temperature correction has been done in the laboratory and the values have already been adjusted to patient temperature. The entered blood gas values are stored without adjustments.
  - **Yes** = The monitor will perform correction calculations. Select **Source** to tell the monitor how the actual patient temperature is entered for the calculations (**Manual, Eso, Naso, Tymp, Rect, Blad, Core, T1-T4, Tblood**). The monitor corrects the entered blood gas values to patient temperature, and displays both corrected and uncorrected values.
  - **No** = No temperature correction is needed. The entered blood gas values are stored as such.

NOTE: The monitor marks corrected values with the letter ‘c.’

---

## Hemodynamic, oxygenation or ventilation calculations

1. Press the **Others** key.
2. Select **Calculations - Hemodynamic/Oxygenation/Ventilation Calcs.**
3. Enter or edit the measurement data using the ComWheel.
4. Save data by selecting **Save Calcs.**

NOTE: The monitor marks the edited values with an asterisk (\*).

NOTE: The monitor uses the last measured and confirmed C.O. value as source data for hemodynamic and oxygenation calculations.

## Estimated values in oxygenation calculations

Only a couple of percent of the total oxygen content is dissolved in the blood. The monitor measures SvO<sub>2</sub> and also SpO<sub>2</sub>, which is used for estimating the SaO<sub>2</sub>. The oxygen content can be estimated by using monitored saturations only and disregarding the dissolved amount of oxygen. The monitor marks these estimated values and all the values derived from them with the letter 'e.'

---

## Viewing calculations

To view values of the three most recent calculations:

1. Press the **Others** key and select **Calculations.**
2. Select **Hemodynamic/ Oxygenation/Ventilation Calcs - Calc. Trends -**

If the patient demographics have been entered, the monitor displays indexed values. You can select the non-indexed values with the ComWheel.

---

## Recording calculations

To record the current calculation page to a strip chart recorder:

1. Press the **Others** key.
2. Select **Calculations - Hemodynamic/ Oxygenation/Ventilation Calcs.**
3. Select **Record Calcs.**

---

## Printing calculations

To print hemodynamic or oxygenation or ventilation calculations:

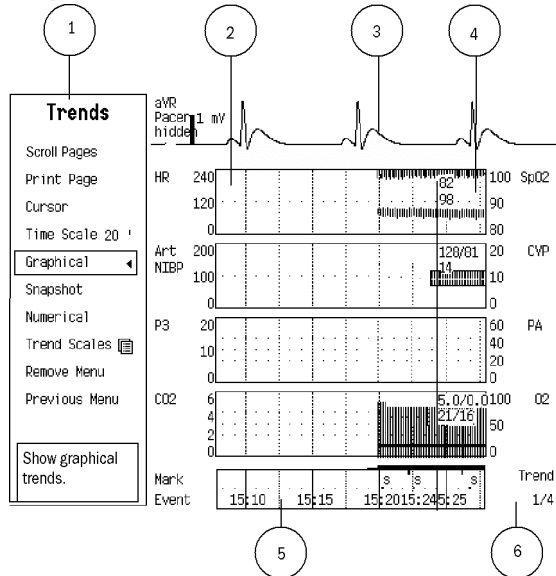
1. Press the **Others** key.
2. Select **Calculations - Hemodynamic/ Oxygenation/Ventilation Calcs.**
3. Select **Calc. Trends - Print Page.**

To print all calculations:

1. Press the **Record/Print** key.
2. Select **Print Calcs.**

## Trends and snapshots

### Graphical trend view



### Trends view

- (1) Trends menu
- (2) Measurement trend field
- (3) Real time ECG
- (4) Numeric value of a measurement at the trend cursor point
- (5) Time and marker field
- (6) Trend page number

### Viewing graphical trends

- Press the **Trends** key and select **Graphical**.
- To see more parameters, select **Scroll Pages**.
- To see more data, select **Cursor** and scroll with the ComWheel.

Graphical trends contain four trend pages each having up to six preconfigured fields with different parameters. Real-time ECG waveform is displayed at the top of each page.

The graphical trend time scale varies from 20 minutes to 24 hours and the resolution from 10 seconds to one minute. With the 20 minute trend length, the displayed time period is 30 minutes and the resolution 10 seconds. With trend lengths from one to 24 hours, the displayed time period is 24 hours and the resolution one minute. For HR, ST, PVC, PCWP, C.O., SpO<sub>2</sub>, PgCO<sub>2</sub>, VO<sub>2</sub>, VCO<sub>2</sub> and temperature measurements you can select the scale in the **Trend Scales** menu.

### Symbols



**Trend bar:** the gap shows the mean value.



**NIBP trend bar**



**Indicator of change** -for example, ST relearning or zeroing of an invasive blood pressure channel

---

## Viewing numerical trends

- Press the **Trends** key and select **Numerical**.
- To see more pages, select **Scroll Pages** and scroll with the ComWheel.
- To see more data, select **Cursor** and scroll with the ComWheel.

Numerical trends contain eight pages with the maximum of 24 hours of trend data. Real-time ECG waveform is displayed at the top of each page.

---

## Creating snapshots manually

A snapshot is a frozen frame of preconfigured waveforms or trends saved in the monitor memory. For configuration, see Part I section "Setting up the monitor before use."

To create a snapshot:

- Press the **Take Snapshot** key.

The monitor saves an image of preconfigured waveforms or trends. You can take up to 100 snapshots, depending on the data load. When a snapshot is taken by pressing the **Take Snapshot** key, it is automatically numbered. This number also appears in the column 'Mark' in the numerical trends.

---

## Automatic snapshots

Automatic snapshot creation can be defined separately for each arrhythmia alarm. For more details, see section "ECG" and Part I, section "Setting up the monitor before use."

Snapshots are always taken automatically on Brady, Tachy and Art sys/dia/mean high/low alarms when they reach the red level if automatic snapshot creation is enabled, see Part I section "Monitor setup." Invasive pressure alarms reach the red level only when there is a simultaneous yellow HR alarm.

---

## Viewing snapshots

- Press the **Trends** key.
- Select **Snapshot - Next Snapshot**.

Turn the ComWheel to move to the next snapshot. In the upper right-hand corner, you can see the time the snapshot was created. Five fields can be displayed on the snapshot page, and six fields can be printed.

---

## Erasing trends and snapshots

- Press the **Reset Case** key and select **Reset Trends**.

If the power switch has been turned to stand-by position but the case has not been reset, the trend data will be stored in the memory for 15 minutes.

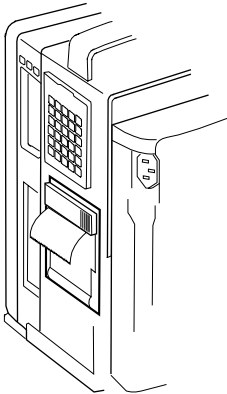


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## Recording and printing

### You need

- Laser printer for printouts (serial or parallel printer)
- Optional built-in recorder for recording (or M-REC module)
- Thermal paper for the recorder



---

Recorder

**Record  
Wave**

**Stop**

NOTE: Recordings on thermal paper may be destroyed when exposed to light, heat, alcohol, etc. Take a photocopy for your archives.

---

### Side panel keys

**Record Wave** Records up to three real-time waveforms  
**Stop** Stops recording

---

### Starting and stopping the recording

Use side panel keys to start and stop recording immediately.

---

## Recording with the recorder

### Recording numerical trends

NOTE: Recording is possible with the optional internal recorder only.

You can record the current values of up to 11 preconfigured parameters.

1. Press the **Record/Print** key.
2. Select **Record Trends - Record Numerical**.
3. Stop recording by selecting **Stop Trend**.

Alternatively, you can start recording with the **Record Trends** module key and stop recording with the **Stop** key.

### Selecting the format for the recorded numerical trends

You can select the format for the recorded numerical trend to be either **Num.** (vertical, 11 parameters) or **Tab.** (horizontal, four parameters):

1. Press the **Record/Print** key.
2. Select **Record Trends - Num. Trend Type - Num.** or **Tab.**

### Selecting the default trend format

You can select which trend format is recorded when recording is started with the module key:

1. Press the **Record/Print** key.
2. Select **Record Trends - Default Trend** and **Num., Graph.** or **Tab.**

## Recording graphical trends

1. Press the **Record/Print** key.
2. Select **Record Trends**.
3. Select **Record Graphical**.
4. Stop recording by selecting **Stop Trend**.

Alternatively, you can start recording with the **Record Trends** module key and stop recording with the **Stop** key.

Trends are recorded for the time period that corresponds to the time scale of the graphical trends.

To choose the time scale:

1. Press the **Trends** key.
2. Select **Time Scale - 20'/1h/2h/4h/6h/8h/10h/12h/24h**.

To select the parameters for the graphical trends:

1. Press the **Record/Print** key.
2. Select **Record Trends**.
3. Select **Graphic Trend 1** or **Graphic Trend 2**.

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### Recording on alarms

1. Press the **Record/Print** key.
2. Select **Record Waveforms**.
3. Select **Start on Alarms - YES**.

Recording is activated when the following alarms reach the red level: Asystole, Tachy/Brady, Art High/Low, V Fib, V Tachy; V Run >3 with Extended arrhythmia analysis or Arrhythmia Workstation only and Rapid VT, X Brady and X Tachy with Arrhythmia Workstation only.

Art and ECG1 waveforms are recorded. Selections are preconfigured.

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### Recording calculations

1. Press the **Others** key.
2. Select **Calculations -Hemodynamic/Oxygenation/Ventilation Calcs - Record Calcs**.

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### Recording waveforms

You can record three waveforms to a local recorder, and two to four waveforms to a network recorder:

1. Press the **Record Wave** side panel key or module key, or press the **Record/Print** monitor key and select **Record Waveforms - Record Wave**.
2. If the monitor is connected to the network, you can also use the network recorder by selecting **Record to Net**. The network recorder uses the settings of the S/5 Central.
3. Stop recording by pressing the **Stop** side panel key or module key, or by selecting **Stop Wave**.

### Changing the waveform appearance

To see the waveforms more clearly or more generally, change the paper speed.

1. Press the **Record/Print** key.
2. Select **Record Waveforms - Paper Speed**.

To select other waveforms for recording, press the **Record/Print** key and select **Record Waveforms - Waveform 1, 2, or 3**.

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## Printing with a laser printer

### Selecting a printer

1. Press the **Record/Print** key.
2. Select **Printer Connection**.
3. Select **Serial** or **Parallel** (local printer) or **Net** (network printer).

### Printing everything

To print all the graphical trends, all calculations or all the saved loops:

1. Press the **Record/Print** key.
2. Select **Print Graphical**, **Print QRS/ST**, **Print Calcs**, **Print Loops**, or **Print EP's**.

### Printing patient record

1. Press the **Record/Print** key.
2. Select **Print Record**.

## Printing currently displayed screen contents

You can print currently displayed trend data, calculation trends, ECG waveforms, EEG data, spirometry loop, and calculations.

To print trend data:

- Press the **Trends** key and select:  
**Graphical/Snapshot/Numerical - Print Page**

To print calculations trends:

- Press the **Others** key and select:
  - **Calculations - Hemodynamic/Oxygenation/Ventilation Calcs - Calc Trends - Print Page**

To print ECG and ST data:

- Press the **ECG** key and select:
  - **ECG View - Print Page**
  - **ST View - ST Trends - Print Page**
  - **ST View - Print QRS/ST**

To print Spirometry loops:

- Press the **Airway Gas** key and select:
  - **Spirometry Loops - Print Loop**

To print EEG data:

- Press the **Others** key and select:
  - **EEG & EP - Print Page**

## Troubleshooting

NOTE: Always check the patient's condition first in problematic situations or if an alarm is triggered.

PROBLEM RELATED TO:	SYMPTOM	POSSIBLE CAUSE AND SOLUTION
<b>AEP</b>	AEP signal is unstable	<ul style="list-style-type: none"> <li>Noisy signal.</li> <li>Check headphone connections.</li> <li>Check stimulation intensity.</li> </ul>
	AEP signal is poor	<ul style="list-style-type: none"> <li>Make sure that the headphones/earphones are working and the sound intensity is high enough.</li> </ul>
<b>Airway gases</b>	Airway gas values are too low	<ul style="list-style-type: none"> <li>Check the sampling line and connectors for leakage.</li> </ul>
<b>Arrhythmia</b>	Extra arrhythmia are detected	Patient's medical condition. <ul style="list-style-type: none"> <li>Check the patient.</li> </ul> The morphology of the ECG signal has changed. <ul style="list-style-type: none"> <li>Start relearning manually through <b>ECG - Relearn</b>.</li> </ul>
	Extra Ventricular Fibrillations are detected	Low amplitude signal in some ECG leads. <ul style="list-style-type: none"> <li>Leads I and II: Select the one with the largest amplitude to ECG1.</li> <li>Leads C1-C6 (V1-V6): Select the one with the largest amplitude to ECG2.</li> <li>After selecting the leads, start relearning manually.</li> </ul>
<b>Battery</b>	Battery operation time is markedly shortened.	<ul style="list-style-type: none"> <li>Charge and discharge the batteries entirely once a month (see Part I section "Cleaning and care").</li> </ul>

PROBLEM RELATED TO:	SYMPTOM	POSSIBLE CAUSE AND SOLUTION
<b>Bispectral index</b>	Measurement does not start	<ul style="list-style-type: none"> <li>• Check sensor attachment and placement. Check sensor type.</li> <li>• Check the digital signal converter: <b>Others – BIS – BIS Setup – Test DSC.</b></li> <li>• Check all connections and the PIC Plus cable.</li> </ul>
	BIS signal is poor	<p>Artifacts or too much EMG activity interfere with the measurement. Some external devices may also disturb the measurement.</p> <ul style="list-style-type: none"> <li>• Check the sensor.</li> <li>• Ensure that the DSC is not close to other electrical radiating equipment.</li> </ul>
<b>Cardiac output</b>	C.O. measurement fails	<p>The amount of injectate is too small or injectate is too warm.</p> <ul style="list-style-type: none"> <li>• Inject smoothly and within less than four seconds.</li> </ul>
<b>ECG</b>	ECG signal is noisy or no QRS is detected	<ul style="list-style-type: none"> <li>• Ensure that the patient is not shivering.</li> <li>• Select the correct filter by pressing <b>ECG</b> and selecting <b>ECG Setup - Filter.</b></li> <li>• Check the electrode quality and positioning. Do not place them on body hair, bones close to skin, layers of fat and major muscles. Pre-gelled electrodes are recommended.</li> <li>• Change the lead.</li> <li>• Remove the ECG cable from the module and reinsert it.</li> </ul>
<b>EEG</b>	EEG signal is noisy	<ul style="list-style-type: none"> <li>• Check that the electrodes are properly connected, not dried out and their impedance is not too high.</li> <li>• Calm the patient since frontal muscle activity can cause artifacts.</li> <li>• Remove sources of external electrical noise (for example, some lamps) from the vicinity of the patient's head.</li> <li>• EEG may cause artifacts; change electrode positioning.</li> </ul>

<b>PROBLEM RELATED TO:</b>	<b>SYMPTOM</b>	<b>POSSIBLE CAUSE AND SOLUTION</b>
<b>Entropy</b>	Entropy values seem unstable	<ul style="list-style-type: none"> <li>• Check that the sensor is not dried out, and that it is properly connected and correctly positioned.</li> <li>• Check the patient status.</li> </ul>
	Entropy EEG signal is noisy	Electrosurgery and other high frequency noise may cause artifacts. <ul style="list-style-type: none"> <li>• Check sensor attachment.</li> </ul>
	Entropy EEG signal is poor	Some external devices may disturb the measurement. <ul style="list-style-type: none"> <li>• Remove disturbing equipment from the proximity of entropy module or sensor.</li> </ul>
<b>Impedance respiration</b>	Respiration measurement fails	<ul style="list-style-type: none"> <li>• Check electrode quality and positioning.</li> <li>• Adjust the detection limits. During ventilator-supported breathing, the respiration calculation may count only ventilator-produced inspirations and expirations.</li> <li>• Other electrical devices may interfere with the measurement.</li> </ul>
<b>Invasive pressures</b>	InvBP readings seem unstable	<ul style="list-style-type: none"> <li>• Make sure there are no air bubbles in the transducer system. Flush and zero.</li> <li>• Place the transducer on the patient's mid-heart level and zero.</li> </ul>
<b>Mixed venous oxygen saturation</b>	SvO <sub>2</sub> values are too high	The catheter is wedged and measures partially arterial blood. <ul style="list-style-type: none"> <li>• Position the catheter properly.</li> <li>• Calibrate In Vivo.</li> </ul>

PROBLEM RELATED TO:	SYMPTOM	POSSIBLE CAUSE AND SOLUTION
<p style="text-align: center;"><b>Monitor, measurements, printing</b></p>	The monitor does not start	<ul style="list-style-type: none"> <li>• Check that the power cord is properly connected.</li> <li>• Check the fuses and replace them if necessary (see Part I section “Cleaning and care” ).</li> </ul>
	The measured values are not displayed	<ul style="list-style-type: none"> <li>• Check that you have selected the parameter to a waveform or digit field; see section “Screen setup.”</li> </ul>
	You cannot perform a measurement or a function	<ul style="list-style-type: none"> <li>• Check that the measurement module is properly installed.</li> <li>• Remove the module and reinstall it.</li> </ul>
	Printing is not possible.	<ul style="list-style-type: none"> <li>• Printer selection is <b>None</b>; change it through <b>Record/Print - Printer connection</b>.</li> <li>• Printer is not connected to the network. Check the cable.</li> </ul>
<p style="text-align: center;"><b>Neuromuscular transmission</b></p>	NMT calibration and measurement fail	<ul style="list-style-type: none"> <li>• Check the electrode quality and positioning.</li> <li>• Replace stimulating electrodes.</li> </ul>
	Measurement is disturbed	<ul style="list-style-type: none"> <li>• Check the black ground electrode.</li> </ul>
	Difficulty in getting the response when locating the nerve for plexus stimulation	<p>You may try using the local muscle response as an indication of current in the needle. If there is no response, the needle may be broken.</p> <ul style="list-style-type: none"> <li>• Change the needle if necessary.</li> </ul>



PROBLEM RELATED TO:	SYMPTOM	POSSIBLE CAUSE AND SOLUTION
<b>Non-invasive blood pressure</b>	NIBP measurement does not work or values seem unstable	<ul style="list-style-type: none"> <li>• Check that cuff tubings are not bent, stretched, compressed or loose.</li> <li>• Prevent motion artifacts.</li> <li>• Use cuffs of correct size.</li> </ul>
<b>Patient Spirometry</b>	Patient Spirometry values seem unreliable	<ul style="list-style-type: none"> <li>• Check the sensor type selection.</li> <li>• Remove the D-lite and shake drops away.</li> <li>• Check that the connectors on the D-lite are intact and connections tight.</li> </ul>
<b>Pulse oximetry</b>	SpO <sub>2</sub> signal is poor	<ul style="list-style-type: none"> <li>• Check the sensor and sensor positioning.</li> <li>• Change the averaging time from slow to normal.</li> <li>• Note that skin pigment causes differences.</li> <li>• Make sure that the patient is not shivering.</li> </ul>
	SpO <sub>2</sub> measurement results do not appear on the screen	<p>The M-OSAT or M-NSAT module overrides other modules' SpO<sub>2</sub> measurement.</p> <ul style="list-style-type: none"> <li>• Check modules and connections.</li> </ul>

<b>PROBLEM RELATED TO:</b>	<b>SYMPTOM</b>	<b>POSSIBLE CAUSE AND SOLUTION</b>
<b>Temperature</b>	Temperature measurement fails	<ul style="list-style-type: none"> <li>• Check that you are using a correct probe.</li> <li>• Try another probe.</li> </ul>
<b>Tonometry</b>	PgCO <sub>2</sub> values seem too high	<ul style="list-style-type: none"> <li>• Check that intraluminal acid or feeding is not interfering with measurement.</li> <li>• Check calibration.</li> </ul>
	PgCO <sub>2</sub> values seem too low	<ul style="list-style-type: none"> <li>• Check the catheter and connector for leakages and distortions and check the catheter position.</li> <li>• Check that active suctioning is not interfering with the measurement.</li> <li>• Check calibration.</li> </ul>
	P(g-Et)CO <sub>2</sub> /P(g-a)CO <sub>2</sub> values seem too low (below zero)	<ul style="list-style-type: none"> <li>• Check the catheter and connector for leakages and distortions.</li> <li>• Check the catheter position.</li> <li>• Check that active suctioning is not interfering with the measurement.</li> <li>• Check calibration.</li> </ul>
	P(g-Et)CO <sub>2</sub> /P(g-a)CO <sub>2</sub> values seem too high	<ul style="list-style-type: none"> <li>• Check that intraluminal acid or feeding is not interfering with the measurement.</li> <li>• Check calibration.</li> </ul>

## Messages

Always check the patient first. If any problem or message persists, contact qualified service personnel. Messages are listed here in alphabetical order.

MESSAGE	EXPLANATION	WHAT TO DO
<b>AEP stimulation ON</b>	AEP measurement is being performed and clicks are being delivered to the headphones.	Wait until the stimulation has been completed.
<b>Air leakage</b>	NIBP: There is an air leak in the cuff or hose.	Check all connections and test tightness using venous stasis.
<b>Alarms acknowledged (from Central)</b>	Silenced alarms remain silent. New alarms will have an audible sound. (Can also be done using the Central.)	If required, turn on the alarms through <b>Alarms Setup – Audio ON/OFF – Activate Alarms.</b>
<b>Alarms setup changed from Central</b>	Alarm limits or arrhythmia alarm priorities have been changed using the Central.	Check the alarm limits and the arrhythmia alarm priorities – see sections "Alarms" and "ECG/ST."
<b>Alarms silenced from Central</b>	Alarms have been silenced using the Central.	If required, turn on the bedside alarms through <b>Alarms Setup – Audio ON/OFF – Activate Alarms</b>
<b>Apnea</b>	No breath detected for 20 seconds (respiration or CO <sub>2</sub> measurement).	Check the ventilator and breathing circuit. Check the patient status.
<b>Apnea deactivated</b>	Apnea alarm is silenced but will activate after five breaths.	If required, turn on the alarm through <b>Alarms Setup – Audio ON/OFF – Activate Alarms.</b>
<b>ARRWS arrh analysis off</b>	Arrhythmia Workstation is on stand-by or the monitor is not connected to the ARRWS.	Turn off the ARRWS stand-by. Check the connection to the ARRWS.
<b>Artifact(s)</b>	Patient movements, eye blinks, shivering, deep breathing, arrhythmia or irregular beats may cause some measurements to fail.	Calm the patient and start a new measurement, if applicable. If gas exchange is measured, check the sample line.
<b>Asystole</b>	No QRS detected in ECG.	Check the electrodes. Check the patient status.
<b>Automatic check off</b>	BIS or entropy sensor's automatic impedance check has been turned off.	If required, activate the check through <b>Others – BIS – BIS Setup</b> or <b>Others – Entropy.</b>
<b>Battery empty</b>	The monitor does not work.	Connect the monitor to power outlet.

<b>MESSAGE</b>	<b>EXPLANATION</b>	<b>WHAT TO DO</b>
<b>Battery low</b>	About 10 minutes of battery operating time left.	Connect the monitor to power outlet.
<b>Big contact difference</b>	EEG: Differences in electrode impedances may disturb measurement.	Check individual impedances of the EEG electrodes and try to make them similar.
<b>Brady</b>	HR equal or below lower alarm limit.	Check the patient status.
<b>Cable off</b>	NMT or regional block cable is not connected. The digital signal converter is not connected to the BIS module. The entropy sensor cable is not connected to the entropy module.	Connect the cable. Connect the DSC to the module.  Connect the entropy cable to the entropy module.
<b>Calibr. error</b>	Gases: Unsuccessful gas calibration.	Perform a new calibration.
<b>Check cath. position</b>	SvO <sub>2</sub> : Low blood flow at catheter tip, or the tip is against vessel wall.	Reposition or flush the catheter.
<b>Check D-fend</b>	Gases: D-fend water trap connection is wrong.	Check that the water trap is properly attached to the gas module.
<b>Check ground electrode</b>	EEG: The ground electrode impedance is over <5kΩ.	Press the ground electrode to improve connection. If necessary, change it. Check impedance.
<b>Checking electrodes</b>	EEG: Electrode impedance is being measured and EEG analysis is stopped for a few seconds.	Wait until the check is completed.
<b>Checking sensor</b>	BIS or entropy sensor check is in progress.	Wait until the check is over. Check results are displayed.
<b>Check NIBP</b>	NIBP: Measurement affected by low blood pressure and pulsation, or a change in patient's condition.	Check patient status, measurement setup and cuff.
<b>Check probe</b>	SpO <sub>2</sub> : There is no detectable SpO <sub>2</sub> signal, the sensor is faulty or it is detached from the patient.	Check the sensor and connections.
<b>Check sample gas outlet</b>	Gases: Sample gas outlet is blocked.	Remove blockage.

MESSAGE	EXPLANATION	WHAT TO DO
<b>Check stim electrodes</b>	NMT: Broken connection of the stimulating electrode or cable.	Check the white and brown stimulating electrodes.
<b>C.O. out of range</b>	C.O. value is less than 0.1 l/min or more than 20 l/min.	Perform a new measurement. Check the patient status.
<b>Cuff loose</b>	NIBP: Cuff is not attached to patient, it is too loose or the hose is not connected to module.	Check cuff and hose.
<b>Cuff occlusion</b>	NIBP: Tubes or hose kinked.	Check tubes and hose.
<b>Cuff overpressure</b>	NIBP: Cuff is squeezed during measurement.	Check NIBP cuff hose and tubes. Restart.
<b>Curve over range</b>	C.O.: Too large a temperature difference for C.O. calculation.	Check that right injectate port is used. Use smaller injectate.
<b>Curve under range</b>	C.O.: Too small a temperature changes for C.O. calculation.	Check that right injectate port is used. Use colder injectate or larger volume.
<b>DSC error</b>	BIS: The digital signal converter is not communicating or operating properly.	Test the DSC: <b>Others–BIS–BIS Setup–Test DSC</b> . If the problem persists, call service.
<b>EEG measurement off</b>	EEG: Leads have been disconnected for impedance check or have just been connected (< 15 seconds ago).	Reconnect the leads to continue the measurement, or wait a few seconds.
<b>EEPROM Error or EPROM Error</b>	Memory checking failed.	Contact authorized service personnel.
<b>Electrodes OK</b>	EEG: Electrode impedance is below 5 k $\Omega$ .	Continue the measurement.
<b>EMG electrodes off</b>	EMG recording electrodes are off.	Attach the electrodes to continue/start the measurement.

<b>MESSAGE</b>	<b>EXPLANATION</b>	<b>WHAT TO DO</b>
<b>Failure in Agent ID</b>	An unknown agent or three or more agents detected.  Vaporizer may contain a mixture of agents.	Flush the breathing circuit with O <sub>2</sub> flush (O <sub>2</sub> +, 100% O <sub>2</sub> ).  Empty the vaporizer and refill from an unopened container.
<b>Faulty cable</b>	SvO <sub>2</sub> cable is defected.	Replace Edwards Lifesciences Corp. optical module.
<b>Headbox off</b>	EEG headbox is not connected.	Connect the EEG headbox.
<b>High EMG</b>	EEG: High frontal muscle activity may disturb the measurement.	Calm the patient.
<b>HR limit changed</b>	HR alarm limits are changed on the ARRWS.	Check the limits.
<b>Identical 'X' modules</b>	There is another similar module in the system.	Remove the other module. See Part I section "Monitoring Basics " for identical modules.
<b>Incompatible DSC</b>	BIS: The hardware/software is not compatible with the digital signal converter type used.	Check and change the digital signal converter.
<b>Incompatible sensor</b>	BIS: The sensor used is not a BIS sensor.	Check and change the sensor.
<b>Infl. Limits! Check setup</b>	NIBP: Adult or child cuff is used but infant inflation limit is selected.	Check cuff and inflation limits.
<b>Insufficient signal</b>	SvO <sub>2</sub> signal is not sufficient for performing the measurement.	Check SvO <sub>2</sub> connections. Replace optical module. Calibrate In Vivo or replace catheter.
<b>Intensity shift</b>	SvO <sub>2</sub> catheter is kinked, there is a blood clot or Hb has changed.	Update Hb. Check and recalibrate catheter or replace it.

<b>MESSAGE</b>	<b>EXPLANATION</b>	<b>WHAT TO DO</b>
<b>InvBPs not zeroed</b>	InvBP: One or more channels have not been zeroed.	Zero all channels.
<b>In Vitro failed</b>	SvO <sub>2</sub> : In Vitro calibration was not successful.	Check SvO <sub>2</sub> connections. Perform In Vitro calibration again. Straighten catheter and perform In Vivo calibration. Replace optical module.
<b>In Vivo poor signal</b>	SvO <sub>2</sub> : The signal during In Vivo calibration is not sufficient.	Reposition SvO <sub>2</sub> catheter and recalibrate.
<b>Irregular curve</b>	C.O.: Patient's breathing or arrhythmia may interfere with the curve.	Inject the injectate smoothly.
<b>Irregular HR</b>	C.O.: Irregular QRS synchronization for REF measurement.	Check the patient status. Check the electrodes.
<b>Leads off</b>	ECG trunk cable, all leadwires, or neutral electrode (RL/N) are disconnected. Offset voltage between two electrodes is too high. EEG leads are not connected.	Reconnect the disconnected electrode or leadwire.
<b>Low perfusion</b>	SpO <sub>2</sub> : Pulse signal is weak possibly because of low perfusion.	Change measuring site.
<b>Low signal</b>	Entropy: Measured EEG signal is too low for reliable entropy calculation.	Check the sensor positioning. The patient may be in total suppression; check the patient status.
<b>Low volumes</b>	C.O.: Measured volumes are too small for reliable calculation.	Check the volumes.

<b>MESSAGE</b>	<b>EXPLANATION</b>	<b>WHAT TO DO</b>
<b>MVexp &lt;&lt; MVinsp</b>	Exhaled volume is markedly smaller than inhaled.	Check the whole system for leakages.
<b>Module error</b>	M-BIS module is not working properly.	Check the module. Change if necessary.
<b>Network down: xxx (xxx= network name)</b>	Network cable is not connected. S/5 Central is shut down.	Check the cable. Check the Central.
<b>NIBP manual</b>	NIBP: Air leakage or loose cuff have interrupted the autocycling mode.	Check setup and restart autocycling.
<b>No ARRWS arrhythmia available</b>	Arrhythmia Workstation is connected but there is no arrhythmia signal available.	Discharge the previous patient on the Arrhythmia Workstation and admit the new patient.
<b>No C.C. Check C.O. Setup</b>	C.O.: No computation constant can be found.	Check the information given in the <b>C.O. Setup</b> .
<b>No cable</b>	SvO <sub>2</sub> : The cable is not connected.	Connect the Edwards Lifesciences Corp. optical module.
<b>No catheter</b>	C.O.: The catheter is not connected, or it is defective.	Check C.O. connections. Run the C.O. self test to check the cable. If it is OK, the catheter is faulty.
<b>No HR for REF</b>	C.O.: No QRS synchronisation available for REF measurement.	Check the patient status. Check the electrodes.



<b>MESSAGE</b>	<b>EXPLANATION</b>	<b>WHAT TO DO</b>
<b>No sensor</b>	BIS: The sensor is not connected to the digital signal converter. Entropy: The sensor is not connected to the cable.	Check the sensor connection to the DSC and PIC. Check connection between sensor and cable.
<b>No SpO<sub>2</sub> probe</b>	SpO <sub>2</sub> : The probe is not properly connected.	Check connection between sensor and module.
<b>No SpO<sub>2</sub> pulse</b>	SpO <sub>2</sub> : Pulse signal is poor.	Try other measuring sites.
<b>Noise</b>	ECG: Unreliable HR calculation or distorted waveform, possible during defibrillation.	Check the patient status. Check the electrodes.
<b>Noisy baseline</b>	C.O.: Changes in patient's blood temperature affect C.O. measuring.	Check the patient status. Check the blood temperature connector.
<b>Not an entropy sensor</b>	Entropy: The sensor used is not an entropy sensor.	Make sure that you are using a Datex-Ohmeda entropy sensor.
<b>Not calibrated</b>	SvO <sub>2</sub> : The sensor needs to be calibrated.	Calibrate In Vivo or accept old calibration values.
<b>Poor electrode contact</b>	EEG electrode impedance is over 5 kΩ.	Improve EEG electrode connection by pressing it. Change the electrode. Check the impedance.
<b>Poor signal</b>	BIS: Too much EMG activity or artifact for BIS measurement. Some external devices may also disturb the measurement. SpO <sub>2</sub> : Pulse signal is poor possibly because of low perfusion.	Check the sensor, then the PIC Plus cable. Press each electrode in the sensor. Change measuring site.

<b>MESSAGE</b>	<b>EXPLANATION</b>	<b>WHAT TO DO</b>
<b>Press sensor electrode n</b>	Entropy: One of the sensor electrodes has poor contact.	Press sensor electrode 1, 2 or 3 as indicated in the message (n= electrode number).
<b>Press sensor electrodes</b>	Entropy: More than one of the sensor electrodes have poor contact.	Press all sensor electrodes to ensure proper contact.
<b>PVC rate limit changed</b>	PVC rate limit is changed on the Arrhythmia Workstation.	Check the limit.
<b>Px no transducer connected</b>	InvBP: Transducer or channel x cable disconnected.	Connect the transducer or the cable.
<b>RAM Error</b>	Memory checking failed.	Contact authorized service personnel.
<b>Re-calibrate</b>	SvO <sub>2</sub> : Calibration was last performed more than 24 h ago.	Calibrate In Vivo.
<b>Replace D-fend</b>	Gases: D-fend water trap is partially blocked.	Replace the D-fend.
<b>Replace sensor</b>	Entropy: The sensor is defective, too old or it has been used for more than 24 hours.	Replace the sensor.
<b>Response too weak</b>	NMT measurement cannot be performed because the response is too weak.	Check NMT electrode placement and connections. If electrodes are dry, replace them. Check that the stimulus current is not too weak.
<b>Sample line blocked</b>	Gas: The sampling line is blocked.	Change sampling line and water trap.
<b>Sensor check failed</b>	The BIS or entropy sensor has not passed the impedance check.	Check sensor placement and attachment.
<b>Sensor INOP</b>	Gases: The gas measuring sensor is inoperative or the temperature in the module has increased.	Contact authorized service personnel.
<b>Sensor off</b>	Entropy: The sensor is connected to the cable but not attached to the patient.	Apply the sensor to the patient.

<b>MESSAGE</b>	<b>EXPLANATION</b>	<b>WHAT TO DO</b>
<b>SpO<sub>2</sub> probe off</b>	SpO <sub>2</sub> : The finger or ear lobe may be too thin or sensor halves are not aligned. Sensor may be defective.	Check connection between sensor and patient. Replace the sensor.
<b>SRAM Error</b>	Memory checking failed.	Contact authorized service personnel.
<b>Starting</b>	Entropy: The monitor is collecting data to start the measurement.	Wait for about one minute. Entropy values appear automatically.
<b>Supramax not found</b>	NMT supramaximal stimulus current was not found. 70 mA is used as stimulus current.	Stop measurement, reposition the stimulating or recording electrodes, and start the measurement.
<b>Supramax search</b>	NMT search in progress.	Wait.
<b>SvO<sub>2</sub> out of range</b>	Calculated SvO <sub>2</sub> is not within the range 1-98%.	Recalibrate In Vivo.
<b>Tachy</b>	HR equal or above higher alarm limit.	Check the patient.
<b>Tblood under/ over range</b>	C.O.: The blood temperature is too cold or too warm.	Wait until message disappears before starting a new C.O. measurement. Perform a new measurement.
<b>Temperature error</b>	Temp: The self-check has found an error in the temperature measurement.	Contact authorized service personnel
<b>Testing DSC</b>	BIS: The digital signal converter test has been activated.	Wait until the check is over.
<b>Tinj high</b>	C.O.: The injectate temperature is too close to blood temperature or too warm (over 27°C).	Use colder injectate.
<b>Tonometry catheter empty</b>	There is no gas in the tonometry catheter. It is filled automatically during the next measurement.	Wait for the automatic filling during the next measurement.
<b>Tonometry catheter leakage</b>	The tonometry catheter is disconnected, or the sampling line is leaking inside the module.	Ensure proper catheter connection and have the internal leak repaired.
<b>Tonometry module HW error</b>	Memory checking failed.	Contact authorized service personnel.

<b>MESSAGE</b>	<b>EXPLANATION</b>	<b>WHAT TO DO</b>
<b>Unable to fill tonometry catheter</b>	Occlusion in the catheter or sampling line, or the balloon is squeezed.	Check the catheter, sampling line and balloon positioning.
<b>Unable to measure Dia</b>	NIBP: Accurate diastolic pressure is difficult to measure because of artifacts, weak pulsation etc.	Check the patient status and the cuff placement. Perform a new measurement.
<b>Unable to measure Sys</b>	NIBP: Systolic pressure probably higher than maximum inflation pressure, or artifacts interfere in the systolic area.	Check the patient status and inflation limits. Perform a new measurement.
<b>Unstable blood temperature</b>	Blood temperature does not return to baseline after C.O. measurement.	Check the patient status. Check the connectors.
<b>Unstable zero pressure</b>	NIBP: Pressure is unstable at start of the measurement.	Calm the patient and retry.
<b>Warming up</b>	The module/monitor is warming up.	Wait until message disappears. After 20 minutes, replace optical module or M-COPsv module.
<b>Weak pulsation</b>	NIBP: Difficult to measure NIBP because: cuff position or attachment is not correct; blood circulation is weak or abnormal; heart rate is slow and it is associated with artifacts; patient is moving; there is an air leakage.	Check the patient status. Check the cuff position and attachment. Check that the cuff is not damaged.
<b>'X' measurement removed</b>	Measurement module has been removed.	Reconnect the module if you want to restart the measurement.
<b>'X' module removed</b>	Measurement module has been removed.	Reconnect the module if you want to restart the measurement.
<b>x-lead off</b>	One of the ECG leadwires is off.	Check the leadwires and their connections.
<b>xxx high/low</b>	Measured value exceeds the alarm limit.	Check the patient's condition. Adjust alarm limits.
<b>Zero error</b>	Zeroing during gas calibration failed.	Repeat the procedure.

'X' is the name of the interfaced device, measurement module or measurement parameter.

## ECG/ST

### Hemodynamic modules M-NE(12)STPR, M-NE(12)TPR, M-NE(12)STR, M-ESTPR, M-ETPR, M-ESTR

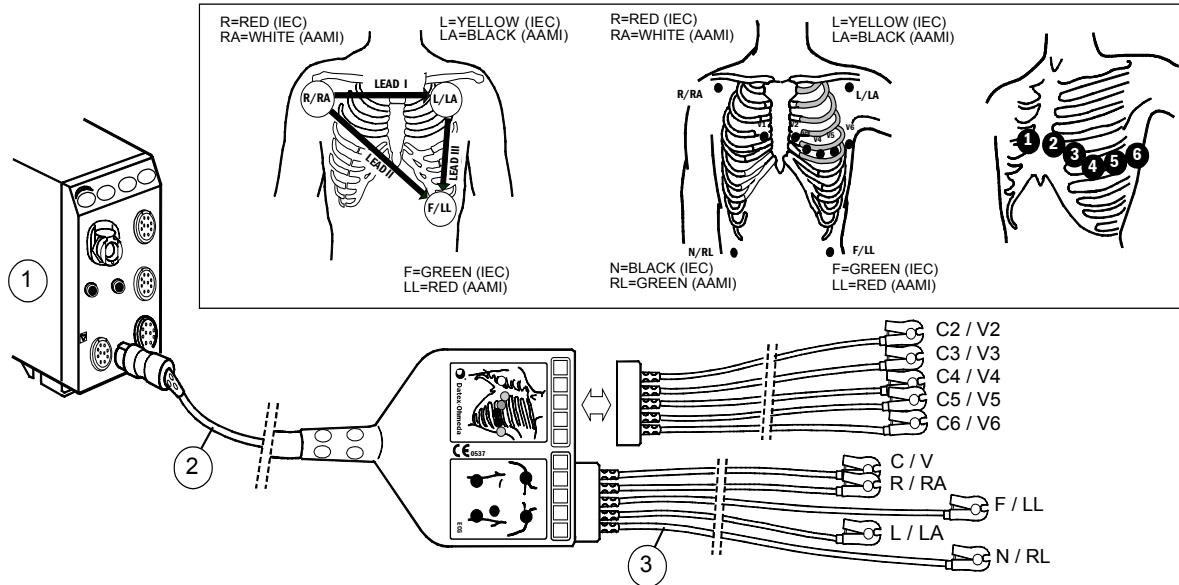
#### You need

- (1) Module with ECG measurement capability
- (2) 3, 5 or 10 leadwire ECG trunk cable
- (3) 3 or 5 leadwire ECG set, or a combination of 5 and V leadwire ECG sets.

ECG electrodes (pre-gelled electrodes are recommended).  
Check the expiration date.

NOTE: In 5-lead ECG, place the 5th electrode (C/V) in one of the six places indicated, and select the corresponding V lead label.  
In 12-lead ECG, C/V is the same as C1/V1.

NOTE: For 5-lead ECG with a 10 leadwire ECG trunk cable, disconnect the V leadwire ECG set.



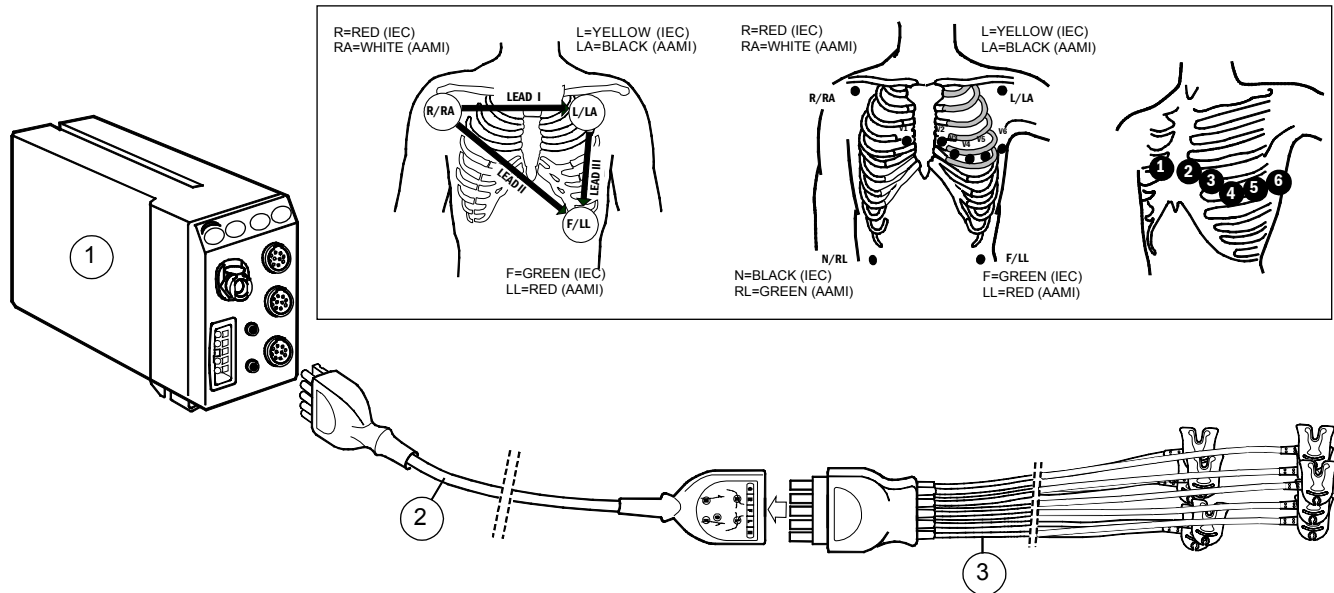
## Hemodynamic modules M-PRESTN, M-RESTN, M-PRETN

### You need

- (1) Module with ECG measurement capability
- (2) Extension cable
- (3) 3 or 5/10 leadwire ECG trunk cable and 3, 5 or 10 leadwire ECG set  
ECG electrodes (pre-gelled electrodes are recommended).  
Check the expiration date.

NOTE: In 5-lead ECG, place the 5th electrode (C/V) in one of the six places indicated, and select the corresponding V lead label.  
In 12-lead ECG, C/V is the same as C1/V1.

NOTE: Do not use multiparameter cable with M-PRESTN, M-PRETN or M-RESTN.



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## Connecting ECG leadwire sets to ECG trunk cables

### Hemodynamic modules M-NE(12)STPR, M-NE(12)TPR, M-NE(12)STR, M-ESTPR, M-ETPR, M-ESTR

- For 3-lead ECG, connect the 3 leadwire ECG set to the 3 or 5 leadwire ECG trunk cable (blue color indicator).
- For 5-lead ECG, connect the 5 leadwire ECG set to the 5 or 10 leadwire ECG trunk cable (5= blue color indicator, 10= green color indicator).
- For 12-lead ECG, connect the 5 leadwire ECG set and the additional V leadwire ECG set to the 10 leadwire ECG trunk cable.

NOTE: Connect a 3 or 5 leadwire ECG trunk cable to the blue connector on the module. Connect a 5 or 10 leadwire ECG trunk cable to the green connector.

### Hemodynamic modules M-PRESTN, M-RESTN, M-PRETN

- For 3-lead ECG, connect the 3 leadwire ECG set to the 3 or 5/10 leadwire ECG trunk cable.

NOTE: To use the 5/10 leadwire trunk cable for 3-lead ECG, connect the 3 leadwire set to the following leads:

IEC: R, F, L

AAMI: RA, LL, LA

- For 5-lead ECG, connect the 5 leadwire ECG set to the 5/10 leadwire ECG trunk cable.
- For 12-lead ECG, connect the 10 leadwire ECG set to the 5/10 leadwire ECG trunk cable.

---

## 12-lead placement according to Mason-Likar

- The arm leads are located just below the clavicles in the infraclavicular fossae.
- The lower limb leads are located just above the iliac crests.
- The six precordial leads (chest leads) are positioned as follows:
  - $V_1$  is placed in the fourth intercostal space to the right of the sternum.
  - $V_2$  is placed in the fourth intercostal space to the left of the sternum.
  - $V_3$  is placed between  $V_2$  and  $V_4$ .
  - $V_4$  is placed in the fifth intercostal space in the midclavicular <sup>(1)</sup> line.
  - $V_5$  is placed between  $V_4$  and  $V_6$  same horizontal level as  $V_4$ .
  - $V_6$  is placed in the fifth intercostal space in the midaxillary <sup>(2)</sup> line, same horizontal level as  $V_4$  and  $V_5$ .

<sup>(1)</sup> Midclavicular line = A line that runs vertically downward from the midpoint of the clavicle.

<sup>(2)</sup> Midaxillary line = A line that runs vertically downward from a point situated midway between the dorsal and ventral boundaries of the axilla.

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**WARNING: Make sure that the leadwire set clips or snaps do not touch any electrically conductive material including earth.**

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**WARNING: The 800 mV offset voltage range may be insufficient for handling the offset potentials when using ECG electrodes of dissimilar metals.**

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## Preparing the patient and applying the electrodes

1. Prepare the skin properly to ensure optimal signal quality:
  - Shave any hair from the electrode sites.
  - Gently rub the skin surface to increase capillary blood flow and remove dead skin cells and oil.
  - Clean the skin using a mild soap and water solution.
  - Dry the skin completely before applying the electrodes.
2. Apply the electrodes (see figures and instructions above). Avoid bones close to the skin, obvious layers of fat and major muscles.

---

## Selecting the ECG filter

1. Press the **ECG** key.
2. Select **ECG Setup - Filter**:

**STfilt** filters high-frequency artifacts but catches slow ST changes.

**Monit.** filters high-frequency artifacts and slow ST changes.

NOTE: No ST analysis.

**Diagn.** catches high-frequency changes and slow ST changes.

---

## Selecting the number of electrodes

1. Press the **ECG** key.
2. Select **ECG Setup**.
3. Select **3** or **5** for 5 leadwire cable.

With the 12-lead module (green ECG connector and cable), electrode selection is automatic.

---

## Selecting the user leads

1. Press the **ECG** key.
2. Select a lead for **ECG1-3 Lead**.

With 3-lead ECG, you can select only one user lead (**ECG1 Lead**).

With 5- and 12-lead ECG, you can select three user leads.

---

## Selecting a label for V Lead

With 5-lead ECG, one V lead is measured according to the placement of the V lead electrode. To select a label for the lead:

1. Press the **ECG** key.
2. Select **ECG Setup - V Lead**.



---

## Selecting how to view ECG waveforms

- To set the number of ECG waveforms in Normal Screen, press **Monitor Setup** and select **Screen Setup - Waveform Fields**. With 3-lead ECG, one lead, and with 5- or 12-lead ECG, up to three leads can be viewed at the same time.
- To cascade a lead, press **ECG** and select **ECG2/ECG3 Lead - Casc.**
- To increase ECG amplitude, press **ECG** and select **ECG Size**.
- To change the waveform sweep speed, **Monitor Setup - Sweep Speeds**. Select **Hemodynamics** and adjust the value.
- To view ECG waveforms from all 5 or 12 leads, press **ECG** and select **ECG View** (available only with 5- and 12-lead ECG).

NOTE: The module input circuits are protected against the effects of electro-surgery and defibrillation. However, the ECG trace on the monitor screen may be disturbed during electro-surgery.

---

## Displaying ECG grid

To view the ECG waveforms over gridlines on the screen:

- Press the **ECG** key and select **ECG Setup - Grid - ON**. To view without gridlines, select **OFF**.

---

## Changing the HR source

- Press the **ECG** key and select **ECG Setup - HR Source**. **AUTO** selects the first available of **ECG**, **Art**, **ABP** and **Pleth**.

---

## Beat sound volume

To adjust the beat sound volume of the monitor:

1. Press the **ECG** key.
2. Select **ECG Setup**.
3. Select **Beat Sound Volume**.
4. Adjust the volume between **0** and **10**.

If you select **0**, there is no audible sound.

---

## Selecting what to display with HR

To select what is displayed with heart rate:

1. Press the **ECG** key.
2. Select **ECG Setup**.
3. Select **Display with HR - PR/PVC/None**.

---

## Printing ECG

To print all ECG waveforms on a laser printer:

1. Press the **ECG** key.
2. Select **ECG View**.
3. Select **Print Page**.

---

## Monitoring pacemaker patients

1. Press the **ECG** key.
2. Select **ECG Setup - Pacemaker** and select one of the following:
  - **Show** = Pacemaker spike is displayed on ECG.
  - **Sensit** = Sensitive pacemaker detection; spike displayed on ECG
  - **ON R** = Pacemaker suppression weakened; asystole alarm may not be reliable with active pacemakers.
  - **Hide** = Pacemaker spike is not displayed on ECG.

NOTE: If the patient has an atrial pacer, ST calculations can be performed if the pacer does not coincide with the ISO point's adjustment range.

NOTE: Pacemaker detector may not operate correctly during the use of high-frequency (HF) surgical equipment. The disturbance of HF surgical equipment typically cause false positive pacer detection.

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**WARNING: The impedance respiration measurement may cause rate changes in Minute Ventilation Rate Responsive Pacemakers. Set the pacemaker rate responsive mode off or turn off the impedance respiration measurement on the monitor.**

**WARNING: When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites.**

**WARNING: Do not rely entirely upon rate meter alarms when monitoring patients with pacemakers. The monitor may count the pacemaker pulses as heartbeats. In this case, asystole and ventricular fibrillation may go undetected. Always keep these patients under close surveillance and monitor their vital signs carefully.**

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## Arrhythmia monitoring

NOTE: For optimal results, select **STfilt** as the ECG filter.

### Selecting arrhythmia analysis

NOTE: With L-ANE03 software license only severe analysis is available.

1. Press the **ECG** key.
2. Select **ECG Alarms - Arrh. Alarms - Analys.:**  
**SEVERE** detects asystole, bradycardia, tachycardia, ventricular fibrillation and ventricular tachycardia.  
**EXTENDED** detects (in addition to the types mentioned above), ventricular run, ventricular couplet, R-on-T PVC, ventricular bigeminy, ventricular trigeminy, multifocal PVCs, frequent PVCs and missing beats.

### Setting arrhythmia alarm priority and snapshot creation

1. Press the **ECG** key.
2. Select **ECG Alarms - Arrh. Alarms - Adjust.**
3. Select the desired alarm by turning and pushing the ComWheel.
4. Select **Red, Yellow, White** or **OFF** with the ComWheel. Asystole and ventricular fibrillation alarms are always **Red** and VTachy alarms cannot be selected **OFF**.
5. To create a snapshot on the alarm, select **Yes**.
6. Select **Exit** to confirm the changes and return to menu.

NOTE: Alarm priorities can also be set using the S/5 Central if the Central configuration allows that.

NOTE: If the Arrhythmia Workstation is used, priorities cannot be changed from the monitor.

### Starting relearning manually

When the patient's ECG pattern changes considerably, the monitor should start relearning a new ECG pattern.

You can start relearning manually through **ECG - Relearn - Start**.

### Selecting leads for the arrhythmia analysis

When measuring 5- or 12-lead ECG, you can affect the selection of the two ECG leads used for detecting beats and ventricular fibrillation. The selection of user leads (ECG1, ECG2, ECG3) on the monitor affects the leads used for detection. The first lead used for detection is lead I or II. The algorithm uses the lead appearing first in user leads. The second lead used for detection is one of the precordial leads (V1 - V6). The algorithm uses the precordial lead appearing first in the user leads.

To change the user lead:

1. Press the **ECG** key.
2. Select a lead for **ECG1-3 Lead**.
3. Start the relearning manually by selecting **Relearn - Start**.

NOTE: With a 3 leadwire trunk cable, the algorithm uses the only one available lead **ECG1 Lead**, which is I, II or III, depending on the selected user lead.

## Detecting arrhythmia alarms

For details about detection performance and test results of the arrhythmia algorithm testing, please refer to “User’s Reference Manual: ECG.”

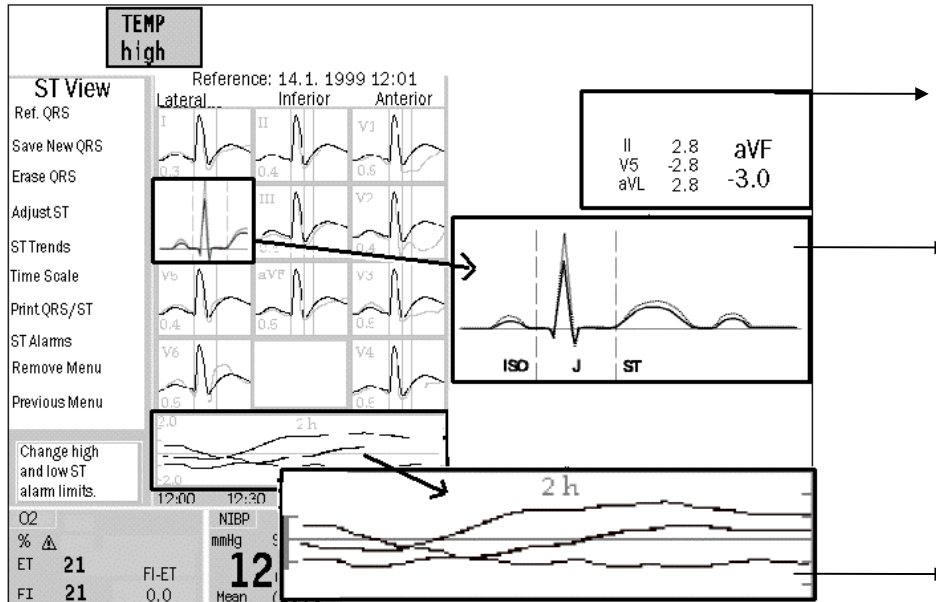
<b>Alarm</b>	<b>Criteria</b>
<b>Asystole</b>	Cardiac arrest, no QRS complexes for five seconds.
<b>Bradycardia</b>	HR below the HR alarm limit.
<b>Frequent PVCs</b>	PVCs per minute above the alarm limit.
<b>Missing beat</b>	Actual RR rate interval more than 1.8 times the average RR interval.
<b>Multifocal PVCs</b>	Over the last 15 beats two or more premature ventricular beats with different morphologies are detected.
<b>R on T PVC</b>	Early PVC, beat detected as a PVC and previous beat as not a PVC; current RR interval is less than half of the previous RR interval.
<b>Tachycardia</b>	HR over the HR alarm limit.
<b>Ventricular bigeminy</b>	The following pattern is detected: N, V, N, V, N, V where N = normal, V = PVC (every other beat is a PVC).
<b>Ventricular couplet</b>	Two consecutive ventricular beats, preceded and followed by a normal beat.
<b>Ventricular fibrillation</b>	Fibrillatory waveform caused by ventricular fibrillation.
<b>Ventricular run</b>	Three or more consecutive PVCs and rate of successive beats over 120 bpm.
<b>Ventricular tachycardia</b>	Six or more consecutive PVCs and rate of successive beats over 120 bpm.
<b>Ventricular trigeminy</b>	The following pattern is detected: N, N, V, N, N, V, N, N, V where N= normal, V= PVC (i.e., every third beat is a PVC).

## Monitoring ST

The monitor analyzes ST for all measured leads and gives ST trends separately for each lead. The ST analysis starts automatically after the leads have been connected, the QRS detection has started and the ECG filter selection is either **STfilt** or **Diagn**. ST can be viewed as digits, average and reference complexes and trends.

For details about detection performance and test results of ST segment measurement algorithm testing, see the "User's Reference Manual: ECG."

NOTE: ST segment changes may also be affected by such factors as some drugs or metabolic and conduction disturbances.



### ST View

**ST number field** with four ST values: three from the user leads and one from the lead with the largest absolute ST value.

The **current average complex** (indicated here with black) for each lead with **lead ID** and **ST value**, together with the **reference complex** (indicated here with gray) and markers of the three measurement points **ISO point**, **J point** and **ST point**.

The first reference complex is saved automatically and displayed by default. You can save manually up to six reference complexes. (See below.)

**Minitrends** for the three user leads. You can select the scale:

- 2...+2 mm
- 5...+5 mm
- 9...+9 mm

NOTE: For optimal results, select **STfilt** as the ECG filter. With **Monit** filter the ST analysis is not available.

**ISO point** is on the isoelectric line.

**J point** is the point on the ECG trace where the S wave transitions to the ST segment.

**ST segment** is the component of the ECG trace between the end of the QRS complex and the T wave.

---

## Viewing ST in split screen

- Press **Monitor Setup** and select **Screen Setup - Split Screen - ST**. The split screen shows current QRS complexes, reference QRS complexes and ST trends.

---

## Viewing current and reference ST complexes in ST View

- Press **ECG** and select **ST View**.
- To show only the data area, select **Remove Menu**.

## Selecting a reference complex from memory

- In ST View, select **Ref. QRS**, scroll to the time of the desired reference complex saved in the memory and push the ComWheel.

## Saving the current complex as the new reference complex

- In ST View, select **Save New QRS**. The current QRS is saved and displayed as the reference complex. You can save up to six reference complexes.  
NOTE: If the memory is full and you do not erase a complex before saving a new one, the oldest manually saved complex is deleted.
- To erase a saved reference complex, select **Erase QRS**, scroll to the time of the reference complex to be erased and push the ComWheel. You cannot erase the first automatically saved reference complex.

---

## Adjusting measurement points

- In ST View, select **Adjust ST**.
- Adjust the points by selecting **Set ISO Point**, **Set J Point** or **ST Point** (where the value is the delay between J-point and ST-point in milliseconds).

---

## Studying ST Trends

- Press **ECG** and select **ST View - ST Trends**. QRS complexes and trends for the three user leads are displayed by default. HR trend is also displayed.
- To see complexes and trends for other leads, select **Leads** and then **User, Lat., Inf.** or **Ant**.
- To check the saved average complex for the displayed leads, select **Cursor** and move the trend cursor with the ComWheel to the desired time point indicated in the time scale. When you stop, the ST value of the moment indicated by the trend cursor is displayed next to it, and the saved average complex is drawn behind the current QRS complex.

---

## Changing the time scale

NOTE: The time scale setting affects the ST Trends window, ST split screen trends, ST View trends and the length of the printed reports.

- Press **ECG**, and select **ST View - ST Trends - Time Scale**.

---

## Displaying ischemic burden in ST Trends

NOTE: Available only if the ischemic burden has been selected ON.

- Press **ECG** and select **ECG Setup - Ischemic Burden - ON**. In an ischemic episode, the ST value falls outside the threshold limits. The area between the threshold limit and the ST trend is yellow.
- To change the limits, press **ECG** and select **ST View - ST Trends** and adjust **Elev. Limit** or **Depr. Limit**.

---

## Printing ST reports

In ST View, select **Print QRS/ST**. The length of the report is the same as the time scale selected in ST Trends.

## Impedance respiration

### You need

- The same setup as in the ECG measurement, see section "ECG/ST."

### Starting

1. Select respiration to a waveform or digit field, otherwise the respiration data is not included in the trends and no alarms are activated.
2. Turn on the measurement:
  - Press the **Others** key.
  - Select **Resp&Temp Setup - Resp Setup**.
  - Select **Measurement** and **ON**.

NOTE: Impedance respiration measurement is intended for patients over three years old.

### Improving waveform readability

1. Press the **Others** key.
2. Select **Resp&Temp Setup - Resp Setup**.
3. Select **Size** and adjust the waveform size.

### Correcting the respiration number

Normally, the AUTO detection limit is recommended. However, if the respirations are particularly weak or affected by artifacts, they may not be included in the respiration rate. To ensure the correct respiration number, adjust detection limits closer to each other.

1. Press the **Others** key.
2. Select **Resp&Temp Setup - Resp Setup - Detection limit**.
3. Adjust the limits.

---

**WARNING: Respiration movements and impedance variations may continue in obstructive apnea.**

**WARNING: Make sure that the leadwire set clips or snaps do not touch any electrically conductive material including earth.**

**WARNING: When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites.**

**WARNING: The impedance respiration measurement may cause rate changes in Minute Ventilation Rate Responsive Pacemakers. Set the pacemaker rate responsive mode off or turn off the impedance respiration measurement on the monitor**

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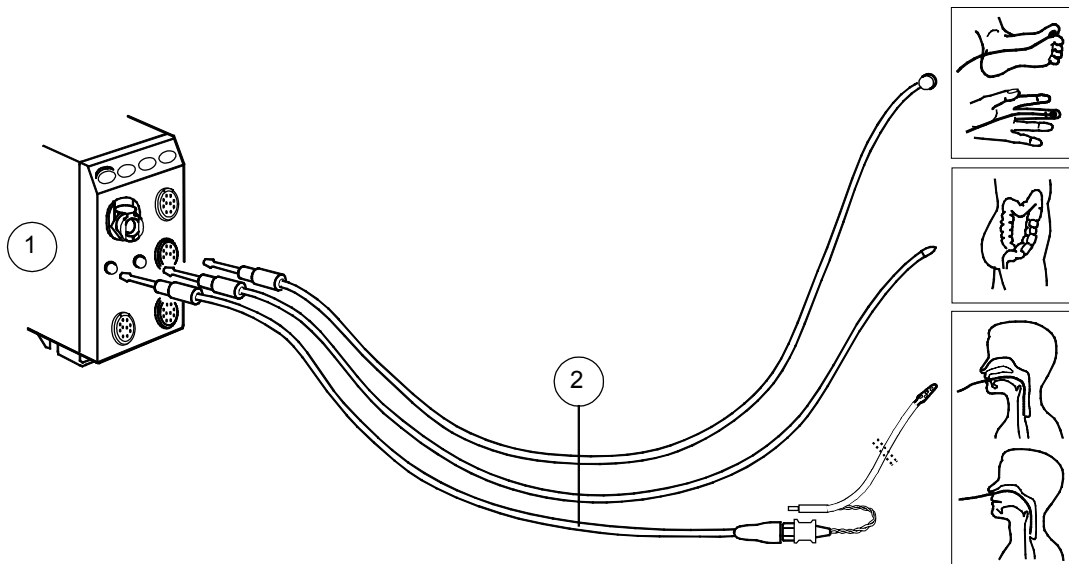
# Temperature

## You need

- (1) Module with temperature measurement capability
- (2) Temperature probe

NOTE: Use only Datex-Ohmeda temperature probes or defibrillator-proof YSI 400 series probes.

NOTE: Do not use multiparameter cable with M-PRESTN, M-PRETN or M-RESTN.



## Changing temperature label

1. Press the **Others** key.
2. Select **Resp&Temp Setup - Temp Setup - X Label**.

## Changing temperature units

You can select the temperature units to be either degrees Celsius or degrees Fahrenheit:

1. Press the **Others** key and select **Resp&Temp Setup -Temp Setup**.
2. Select **Units** and then **°C** or **°F** with the ComWheel.

## Combining different temperatures

The monitor displays the difference between different temperatures if they are displayed in the same digit field.

For example, to display Tblood - T1:

1. Press the **Monitor Setup** key.
2. Select **Screen Setup**.
3. Select **Digit Fields**.
4. Select **T1+ Tbl** in one of the lower fields.



## Pulse oximetry (SpO<sub>2</sub>)

### You need

- (1) Module with SpO<sub>2</sub> measurement capability
- (2) OxyTip+ integrated SpO<sub>2</sub> sensor
- (3) Interconnect cable for OxyTip+ sensors, or
- (4) Interconnect cable for OxyTip+ sensors, or
- (5) Adapter cable for OxyTip+ sensors

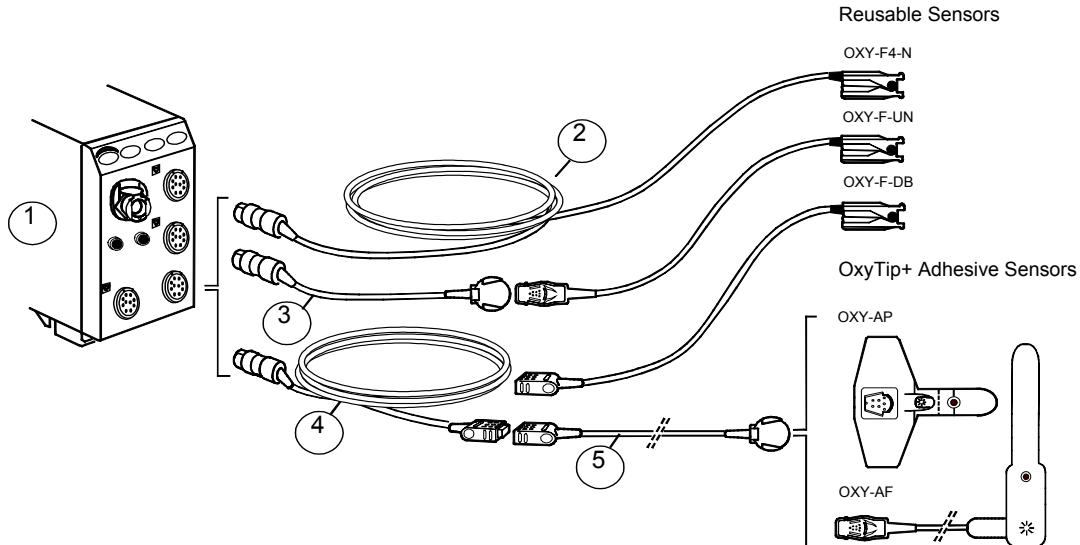
NOTE: This is not a comprehensive list of cables and sensors.

NOTE: Pulse oximetry measurement is intended for patients weighing over 3 kg (6.6 lb).

NOTE: Do not use multiparameter cables with the M-PRESTN, M-PRETN and M-RESTN modules.

**WARNING: Vibrations during transport may disturb SpO<sub>2</sub> measurement.**

**WARNING: Allow sensor and cable to dry completely after cleaning. Moisture and dirt on the connector can affect the measurement accuracy.**



---

## Applying sensors

- Use dry and clean sensors only.
- Clean the application site. Remove nail polish, artificial fingernails, earrings etc.
- Clip long fingernails.
- Attach the sensor cable to the wrist or bed clothes to prevent the cable and sensor from moving.

NOTE: Datex-Ohmeda sensors are latex-free.

---

**WARNING: Change measuring site frequently. Change sensor site and check skin and circulatory status every 2 to 4 hours with adults and every hour with small children.**

**WARNING: To prevent erroneous readings, do not use physically damaged sensors. Discard a damaged sensor immediately. Never repair a damaged sensor or cable; never use a sensor or cable repaired by others. A damaged sensor or a sensor soaked in liquid may cause burns during electrosurgery.**

**WARNING: Inaccurate SpO<sub>2</sub> data can result if a sensor is past its useful life. Therefore, re-evaluate the measurement periodically by performing additional assessment of the patient and equipment, including consideration of use of alternate monitoring methods such as direct measurement of arterial oxyhemoglobin saturation (SaO<sub>2</sub>).**

---

## Displaying pulse rate

The heart rate can originate from various sources. Displaying the pulse rate measured with pulse oximetry:

1. Press the **Pulse Oximetry** key and select **HR Source - Pleth**.

---

## Measurement limitations

- The pulse oximeter cannot distinguish between oxyhemoglobin and dyshemoglobins, for example, met- or carboxyhemoglobins.
- Poor perfusion may affect the accuracy of measurement when using the ear probe.
- If possible, do not attach the SpO<sub>2</sub> sensor to a limb that is used for non-invasive blood pressure measurement or for administering cold infusions.

---

**WARNING: Conditions that may cause inaccurate readings and impact alarms include interfering substances, excessive ambient light, electrical interference, ventricular septal defects (VSD), excessive motion, low perfusion, low signal strength, incorrect sensor placement, poor sensor fit, and/or movement of the sensor on the patient.**

---

## Adjusting SpO<sub>2</sub> settings

You can adjust the volume of the beat sound, the waveform scaling, and response averaging time:

1. Press the **Pulse Oximetry** key.
2. Select **Beat Sound Volume**, **Pleth Scale** or **SpO<sub>2</sub> Response**.

NOTE: The **Pleth Scale** and **SpO<sub>2</sub> Response** are not selectable if the M-NSAT or M-OSAT module is used for SpO<sub>2</sub> measurement.

---

## Using the M-NSAT or M-OSAT modules

You cannot use the M-NSAT and M-OSAT modules simultaneously in the monitor.

The SpO<sub>2</sub> measurement with the M-NSAT or M-OSAT module overrides the other installed modules' SpO<sub>2</sub> measurement.

You can use only Nellcor sensors with the M-NSAT module. Use only approved accessories for the M-OSAT module as defined in the M-OSAT instruction sheet.

## Non-invasive blood pressure (NIBP)

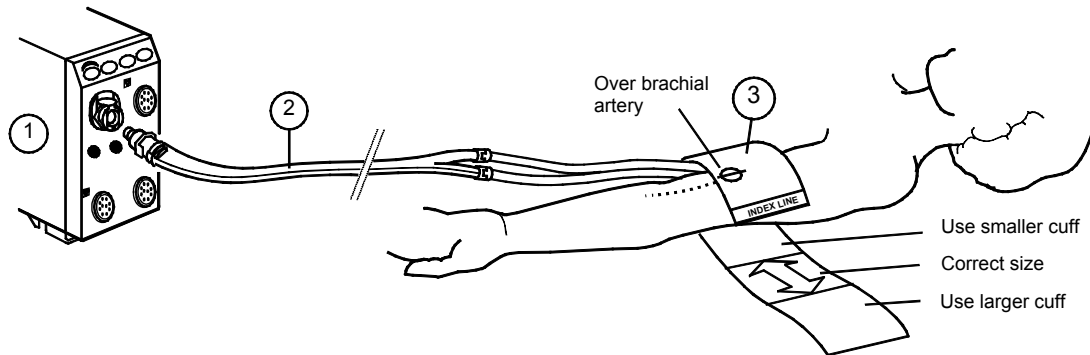
### You need

- (1) Module with NIBP measurement capability
- (2) Cuff hose
- (3) Cuff of correct size

	Cuff	Width		Limb circumference		Hose
		cm	inch	cm	inch	
<b>Reusable cuffs</b>	Thigh cuff	20.5	8.1	44 - 57	17.3 - 22.4	Black
	Long large adult	16	6.3	33 - 47	13 - 18.5	Black
	Large adult	16	6.3	33 - 47	13 - 18.5	Black
	Long standard adult	12.5	4.9	25 - 35	9.8 - 13.8	Black
	Standard adult	12.5	4.9	25 - 35	9.8 - 13.8	Black
	Small adult	9.5	3.7	18 - 26	7 - 10.2	Black
	Child	7	2.8	13 - 19	5.1 - 7.5	Black
<b>Disposable cuffs</b>	Infant	5	2	9 - 14	3.5 - 5.5	White
	Long large adult	16	6.3	33 - 47	13.0 - 18.5	Black
	Large adult	16	6.3	33 - 47	13.0 - 18.5	Black
	Long standard adult	12.5	4.9	25 - 35	9.8 - 13.8	Black
	Standard adult	12.5	4.9	25 - 35	9.8 - 13.8	Black
	Small adult	9.5	3.7	18 - 26	7.1 - 10.2	Black
	Child	7.0	2.7	13 - 19	5.1 - 7.5	Black
	Infant cuff #3	4.0	1.5	7.2 - 10.7	2.8 - 4.2	White
Infant cuff #4	4.8	1.8	8.5 - 12.7	3.3 - 5	White	
Infant cuff #5	5.5	2.2	9.6 - 14.3	3.7 - 5.6	White	

NOTE: These Datex-Ohmeda NIBP cuffs are latex-free.

**WARNING: Non-invasive blood pressure measurement is intended for patients weighing over 5 kg (11 lb).**



---

## Starting

The monitor sets inflation limits automatically for adults and infants according to the hose used. For children, the inflation limit must be set manually. To do this:

- Press the **NIBP** key and select **NIBP Setup - Inflation Limits - Child**.

To produce a single measurement:

- Press the **Start/Cancel** side panel or module key, or press the **NIBP** key and select **Start Manual**.

To measure automatically after set intervals:

- Press the **Auto On/Off** side panel or module key, or press the **NIBP** key and select **Start Cycling**.

To measure continuously for five minutes:

- Press the **STAT On/Off** module key, or press the **NIBP** key and select **Start STAT**.

---

## During measurement

- Observe the cuffed limb frequently. Measurement may impair blood circulation.
- Make sure that tubes are not bent, pressed or stretched. Measurement may be impaired.
- Blood pressure values may be affected by a change in the patient's position.

NOTE: The presence of some arrhythmias during NIBP measurement may increase the time required for the measurement. For details about the test results of the functioning of the NIBP measurement in the presence of arrhythmias, see "User's Reference Manual: NIBP."

---

## Stopping

To release the cuff pressure before the measurement is finished:

- Press the **Start/Cancel** side panel or module key, or press the **NIBP** key and select **Stop xx**.

---

## Setting cycling intervals

1. Press the **NIBP** key.
2. Select **Cycle Time**.
3. Select the interval time of the list with the ComWheel.

---

## Using NIBP cuff for venous stasis

- Press the **NIBP** key.
- Select **Start Ven. Stasis**.

Values for M-PRESTN, M-PRETN and M-RESTN given in parenthesis ().

	<b>Inflation limit</b>	<b>Venous stasis pressure</b>	<b>Venous stasis time</b>
Infant	150 (145 $\pm$ 5) mmHg	40 (30 $\pm$ 5) mmHg	1 min
Child	200 (200 $\pm$ 10) mmHg	60 (40 $\pm$ 5) mmHg	2 min
Adult	280 (280 $\pm$ 10) mmHg	80 (40 $\pm$ 5) mmHg	2 min

---

---

**WARNING: The monitor sets the inflation pressure automatically according to the first measurement. Reset the case to reset the inflation limit before measuring a new patient.**

---

---

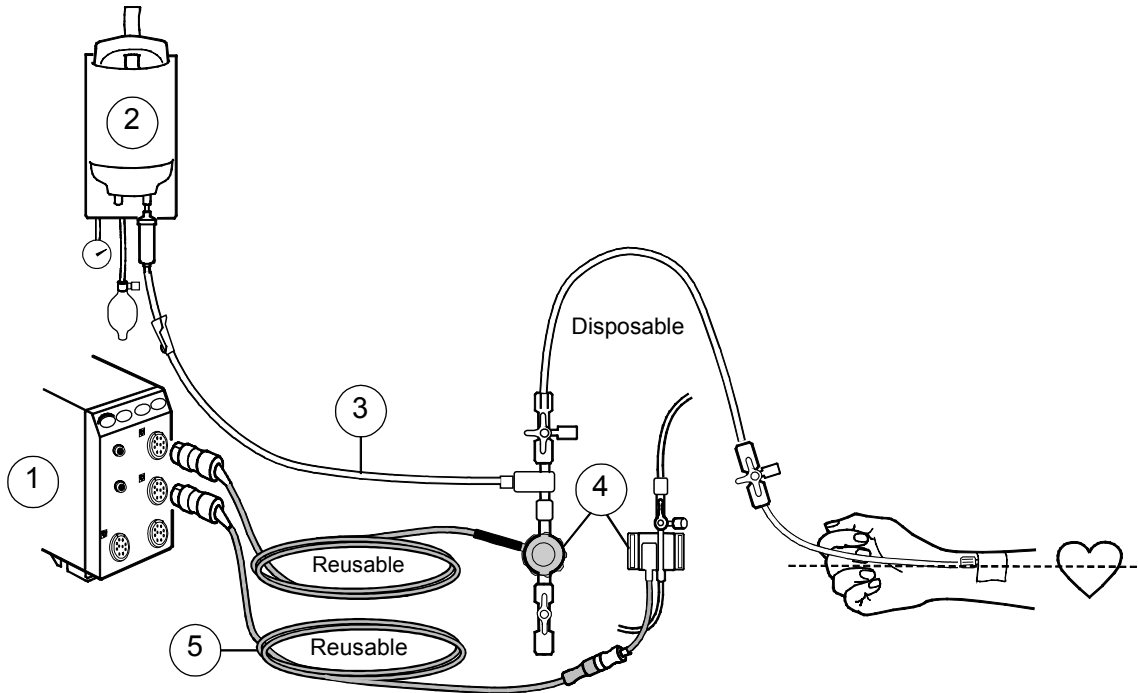
## Invasive blood pressure

### You need

- (1) Module with invasive blood pressure measurement capability
- (2) Heparinized fluid bag with pressure infusor
- (3) Flushing set
- (4) Transducer
- (5) Adapter cable for using disposable transducers

You can monitor up to six pressure channels.

NOTE: Invasive pressures need to be zeroed after reconnecting the pressure transducer or cable. If all channels have not been zeroed, the message 'InvBPs not zeroed' appears and the invasive pressure alarms will reach the white level only.



---

## Starting

- For the setup, prepare the transducer kit according to the manufacturer's instructions.
- Ensure that there is no air in the line.
- Zero the transducer by opening it to air, pressing the **Zero ALL** side panel key or the **Invasive Pressures** monitor key and selecting **Zero Pressures - Zero ALL**. You can also use the **Zero ALL Pressures** Remote Controller key. Zero each channel.
- Open the line to the patient.

## Factory default descriptions

The channels have the following factory default descriptions:

<b>LABEL</b>	<b>P1, Art, ABP</b>	<b>P2, CVP</b>	<b>P3, RAP, LAP</b>	<b>ICP</b>	<b>P4, PA</b>	<b>P5</b>	<b>P6, RVP</b>
Scale	200	20	20	20	60	20	60
Color	Red	Blue	White	White	Yellow	White	White
Alarm source	Sys	off	off	off	off	off	off
Digit format	S/D	Mean	Mean	CPP	S/D	S/D	S/D
Filter	22	9	9	9	9	9	9
Response	Normal	Normal	Normal	Normal	Normal	Normal	Normal

---

## Labeling channels

The label of the pressure channel sets its display scale, color, filter, alarm source and alarm limits. Label descriptions are preconfigured.

To change the label:

1. Press the **Invasive Pressures** key.
2. Select **Px Setup - Label**.

---

## Combining pressures

Four invasive pressure waveforms can be displayed together so that they use an area of two normal waveforms, or so that all four are combined in the same field with the same zero line.

1. Press the **Monitor Setup** key and select **Screen X Setup**.
  2. Select **Waveform Fields**.
- To combine all pressure waveforms in one field, select **Combine Pressures** and **Yes**.
  - To combine four waveforms, select one waveform area to be **4invP**. The **4invP** choice removes a waveform below it on the screen.

---

## Determining pressure values visually

By moving the horizontal cursor across the pressure waveform, you can get accurate pressure values at selected points. This may be useful, for example, if the patient's breathing pattern is irregular.

1. Press the **Invasive Pressures** key.
2. Select **Px Setup - Px Cursor**.
3. Move the cursor up or down by turning the ComWheel. Every time the cursor is moved, the time (hours and minutes) and pressure value appear on the screen. This way, you can keep track of the changes made.

You can remove the cursor by selecting **Remove cursor**.

---

## Pulmonary Capillary Wedge Pressure (PCWP)

### Starting

1. Prepare the same setup as in the C.O. measurement and use the distal lumen for the pressure line.
2. Label the wedge pressure channel 'PA'.
3. Check that the monitor has correct information about the patient's ventilation: **Invasive Pressures - Ventilation Mode - Control** (controlled ventilation) or **Spont** (spontaneous breathing).
4. Press the **Start Wedge** module key or press the **Invasive Pressures** key and select **Wedge Pressure - Measurement**.
5. When 'Inflate the balloon' is displayed, inflate the catheter balloon. The monitor automatically freezes the waveform for 20 seconds.
6. When 'Deflate the balloon' is displayed, deflate the catheter balloon.

NOTE: During the wedge pressure measurement, PA values are not trended and PA alarms are disabled.

### Adjusting PCWP

To manually adjust the wedge pressure level:

1. In the **Wedge** menu, turn the ComWheel to move the cursor to a point that represents the true PCWP level.
2. Push the ComWheel and select **Confirm**.

### Canceling the PCWP measurement

- In the **Wedge** menu, select **Cancel**.

---

**WARNING: All invasive procedures involve risks to the patient. Use aseptic technique. Follow catheter manufacturer's instructions.**

**WARNING: Make sure that no part of the patient connections touches any electrically conductive material including earth.**

**WARNING: When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites.**

**WARNING: Use only defibrillator proof transducers and cables.**

**WARNING: Mechanical shock to the invasive blood pressure transducer may cause severe shifts in zero balance and calibration, and cause erroneous readings.**

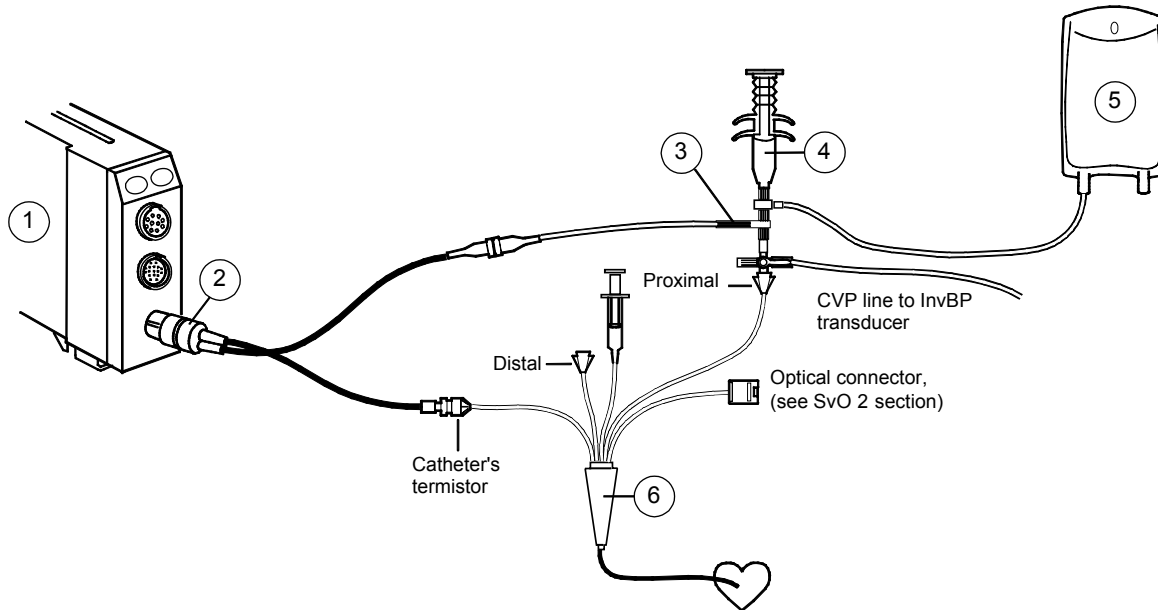
---



## Cardiac output (C.O.)

### You need

- (1) Module with C.O. measurement capability
- (2) Catheter connecting cable
- (3) Injectate temperature probe
- (4) Injectate syringe
- (5) Injectate: 5% dextrose or physiological saline at 0 - 27 °C (32 - 77 °F)
- (6) Thermodilution catheter (Edwards Lifesciences Corp. compatible)



NOTE: All invasive procedures involve risks to the patient. Use aseptic technique. Follow the catheter manufacturer's instructions.

---

## Starting

1. Press the **Others** key and select **C. O - C.O. Setup**.
2. Check the catheter type and injectate volume. If they are not correct, change the values with ComWheel.
  - If your catheter type is not on the list, select **Catheter Type - User** and enter the computation constant according to the catheter package.

## Calculating Body Surface Area (BSA)

To produce for example a cardiac index, C.I.:

1. Press the **Others** key and select **C.O. - Demographics**.
2. Enter patient's weight and height for body surface area (BSA) calculation.

---

## Measuring C.O.

1. Fill syringe with injectate.
2. Press the **Start C.O.** module key.
3. Inject smoothly within less than four seconds.
4. Observe the curve displayed on the screen.
5. If necessary, reject the measurement by selecting **Cancel Meas.**
6. Repeat measurement at least three times. Wait at least one minute between measurements to warm up the catheter. You can save up to six curves for calculating averages.

---

## Editing and calculating

After measuring C.O. values:

1. Press the **Others** key.
2. Select **C.O. - Edit Average**.

To reject unacceptable curves:

1. Select Exclude Curves.
2. Select the curve to be eliminated.

To calculate the average value:

- Select **Confirm**. The **Hemo Calcs** menu appears on the screen.
- To measure more curves, select **Previous Menu**.

To edit the values in the **Hemo Calcs** menu:

1. Select **Edit values** and change the value(s).
2. Exit the editing mode by selecting **Exit**.
3. To return to the C.O. menu, select **Previous Menu**.

You can also save the calculations in the **Hemo Calcs** menu by selecting **Save Calcs**, or record them by selecting **Record Calcs**.

NOTE: For recording, you need the optional internal recorder.

---

## Viewing other cardiac parameters

1. Press the **Others** key.
2. Select **Calculations - Hemodynamic** or **Oxygenation Calcs**.

See also section "Laboratory data and calculations."

---

## Measuring REF

You can measure the right ventricular ejection fraction (REF) with some C.O. catheters:

1. Use a catheter that allows REF measurement (see catheter package).
2. Press the **Others** key and select **C.O. - C.O. Setup**.
3. Select **REF measurement ON**.

---

**WARNING: The cardiac output measurement results may be erroneous during electrosurgery.**

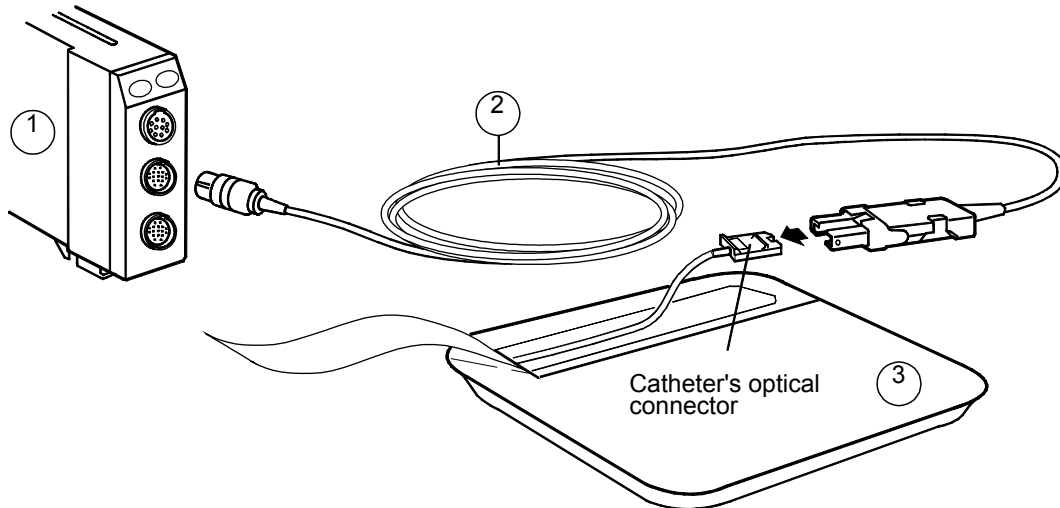
**WARNING: When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites.**

---

## Mixed venous oxygen saturation (SvO<sub>2</sub>)

### You need

- (1) Module with SvO<sub>2</sub> measurement capability
  - (2) Edwards Lifesciences Corp. Optical module, OM-2E
  - (3) Edwards Lifesciences Corp. Swan-Ganz oximetry thermodilution catheter
- See also the section “Cardiac output (C.O.)” for thermodilution catheter setup.



NOTE: All invasive procedures involve risks to the patient. Use aseptic technique. Follow the catheter manufacturer's instructions.

---

## Starting

Always perform In Vitro calibration with a new catheter before removing the catheter from its package:

1. Plug the Edwards Lifesciences Corp. optical module in the SvO<sub>2</sub> module and let it warm up for 20 minutes.
2. Aseptically expose the catheter's optical connector.
3. Connect the catheter to the optical module.
4. Press the **Others** key.
5. Select **SvO<sub>2</sub>- Calibrate In Vitro**.

---

## Calibrating In Vivo

In Vivo calibration is recommended at least every 24 hours.

1. Insert the catheter.
2. Press the **Others** key.
3. Select **SvO<sub>2</sub> - Start SvO<sub>2</sub>**.
4. Select **Calibrate In Vivo**.
5. Wait until the highlight moves to **Draw Blood Sample**.
6. Take blood samples from distal lumen of the catheter and push the ComWheel.

---

## Entering laboratory results

1. Press the **Others** key.
2. Select **SvO<sub>2</sub>**.
3. Select **Give lab SvO<sub>2</sub>**.
4. Select **Give lab Hb**.
5. Enter laboratory results with the ComWheel.

---

## Maintaining the SvO<sub>2</sub> measurement

For optimal accuracy, calibrate In Vivo at least every 24 hours. If Hb values change significantly, enter the new Hb value:

1. Press the **Others** key and select **SvO<sub>2</sub>**.
2. Select **Update Hb**.

---

---

**WARNING: When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites.**

---

---

## Airway gases

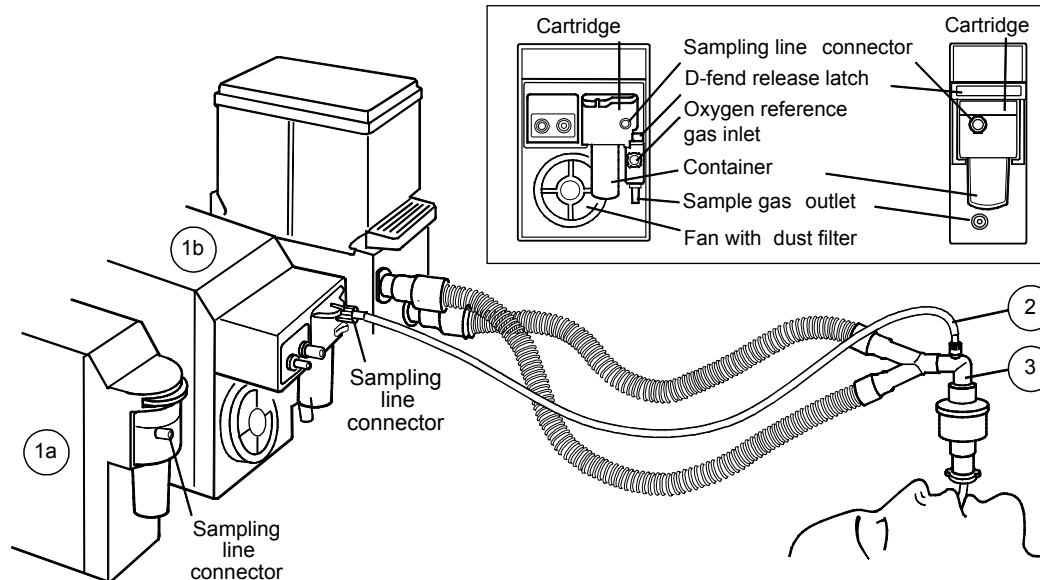
### You need

- (1) Module with airway gases measurement capability: M-CO, M-COV, M-CAiOV, M-CAiOVX (**1b** in the drawing), or a single-width module for measuring CO<sub>2</sub>, M-miniC (**1a** in the drawing)
- (2) Anesthesia gas sampling line
- (3) Airway adapter with sampling line connector

### You get

Depending on the module in use, you can monitor measured inspiratory and expiratory concentrations of O<sub>2</sub>, N<sub>2</sub>O, CO<sub>2</sub>, and anesthetic agents, and calculated minimum alveolar concentration (MAC) and balanced gas.

NOTE: Do not connect anything to the reference gas inlet.



---

## Starting

- Confirm that the D-fend container is empty and properly attached.
- Connect the gas sampling line to the D-fend and to the airway adapter. Check that the connections are tight.
- Before connecting the patient, wait until the message 'Calibrating gas sensor' disappears.
- Position the adapter upwards to prevent water from entering the sampling line.
- If M-miniC is used with O<sub>2</sub> and/or N<sub>2</sub>O contents higher than 40%, make sure that **FiO2 level** and **N2O level** are set accordingly in **Airway gas – CO2 Setup** to enable O<sub>2</sub> and/or N<sub>2</sub>O compensation.

---

## Anesthetic agent monitoring

Modules automatically identify the agent being used. When two agents are administered one after the other, both concentrations are displayed until the first one is less than 0.3 vol%. Minimum alveolar concentration (MAC) and balance gas are displayed on a common field.

---

## Preventing Operating Room pollution

When N<sub>2</sub>O and volatile anesthetics are used, prevent operating room pollution by connecting the sample gas outlet of the monitor to the scavenging system or by returning the sample gas to the patient circuit. With M-MiniC: Do not return the sample gas to the patient circuit.

---

## During monitoring

- Empty the D-fend container whenever it is more than half full.
- Disconnect the airway adapter during nebulization of medications.

NOTE: When the measured CO<sub>2</sub> value is outside the specified measurement range, the numeric value is gray.

---

## Points to note

- Use only Datex-Ohmeda anesthesia gas sampling lines (PVC/PE) for monitoring. Using other lines may cause inaccurate readings.
- Never connect the loose end of the gas sampling line to the Patient Spirometry connector because this may break the PVX unit. The Patient Spirometry connector is meant for the spirometry tube only.
- Calibrate the airway gas module every sixth month, see Part I of this guide, section "Cleaning and care."

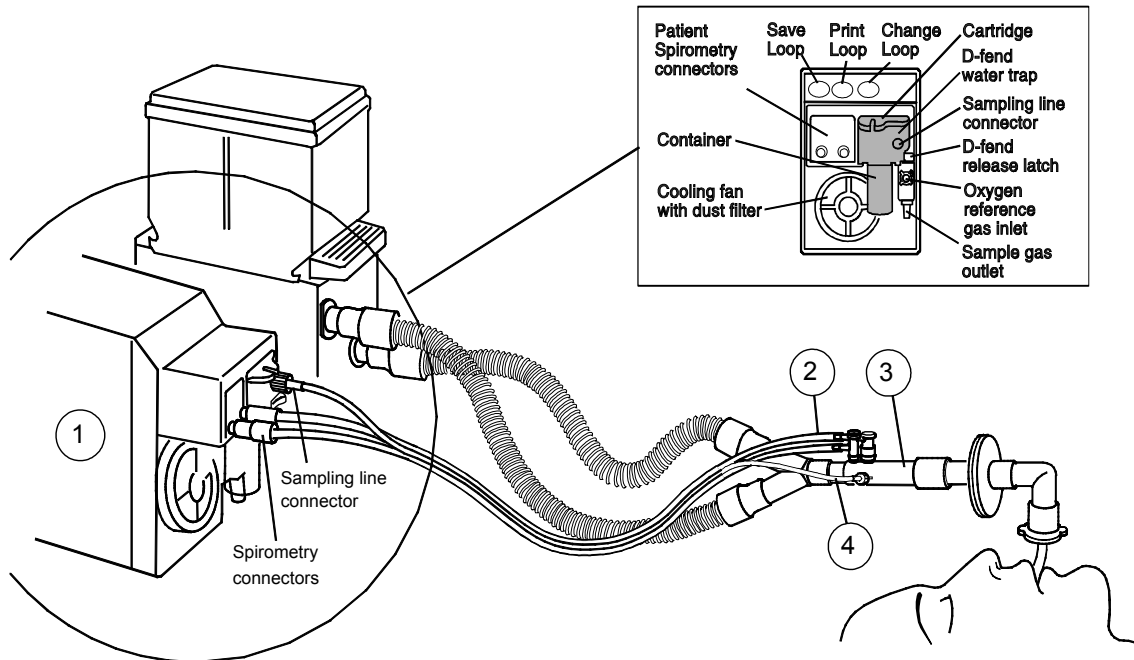
## Patient Spirometry

### You need

- (1) Module with Patient Spirometry measurement capability
- (2) Spirometry tube
- (3) D-lite/Pedi-lite sensor or D-lite+/Pedi-lite+ sensor for humid conditions
- (4) Anesthesia gas sampling line

### You get

In addition to airway gas concentration, you can monitor airway pressures, flow, volumes, compliance and resistance, breath-by-breath.



NOTE: Always place the HMEF between the D-lite sensor and the patient.

---

## Starting

Connect the spirometry tube and the gas sampling line to the D-fend water trap and D-lite sensor. Check that connections are tight.

To display Patient Spirometry values on the Normal Screen continuously:

1. Press the **Monitor Setup** key.
2. Select **Screen X Setup**.
3. Select the **Split Screen** alternative: **Spiro 1** is the basic view, **Spiro 2** shows all measured values (Ppeak, Pplat, Pmean, PEEPtot, Compl, Raw, TVinsp, TVexp, MVinsp, MVexp.)

---

## Changing the loop type

To change the displayed loop from a pressure/volume loop to a flow/volume loop or vice versa:

- Press the **Change Loop** module key, or press the **Airway Gas** key and select **Spirometry Loops - Paw-Vol Loop/Flow-Vol Loop**.

---

## Saving reference loops

Save a loop for reference after anesthesia induction and whenever major changes in the patient's lung mechanics occur.

1. Press the **Save Loop** module key, or press the **Airway Gas** key and select **Spirometry Loops**.
2. When the current loop is drawn, select **Save Loop**.

The monitor automatically displays the first saved loop as a reference loop. You can save up to six pairs of loops. If you save another pair of loops after the sixth one, the second oldest reference loop is erased automatically.

---

## Recalling a saved loop for reference

1. Press the **Airway Gas** key.
2. Select **Spirometry Loops**.
3. Select **Reference Loop** and select the number of the loop you want to recall.

---

## Printing the loops

- To print the currently displayed loop, press the **Print Loop** module key, or press the **Airway Gas** key and select **Spirometry Loops - Print Loop**.
- To print saved loops, press the **Record/Print** key and select **Print Loops**.

---

## Monitoring pediatric patients

- When monitoring pediatric patients with tidal volumes of 15 - 300 ml, use the Pedi-lite/Pedi-lite+ sensor and change the sensor type to **Pedi** through: **Airway Gas - Spirometry Setup - Sensor Type- Pedi**.

---

## Points to note

- Disconnect the HME and D-lite during nebulization of medications.
- Place all D-lite+/D-lite ports upwards with a 20to- 45° tilt to prevent condensed water from entering the sensor interior and the tubings.

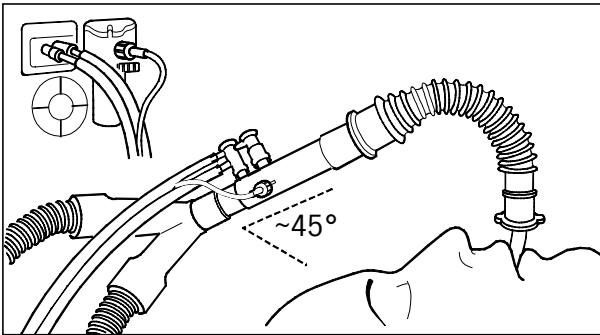


## Gas exchange

### You need

- M-CAiOVX module for measuring gas exchange
- Spirometry tube (2 meters, 7 feet)
- Anesthesia gas sampling line (2 meters, 7 feet)
- D-lite/Pedi-lite sensor or D-lite+/Pedi-lite+ for humid conditions

### Patient connections with flexible tube



NOTE: Place all D-lite ports upwards with a 20 to 45° tilt to prevent condensed water from entering the sensor interior and the tubings.

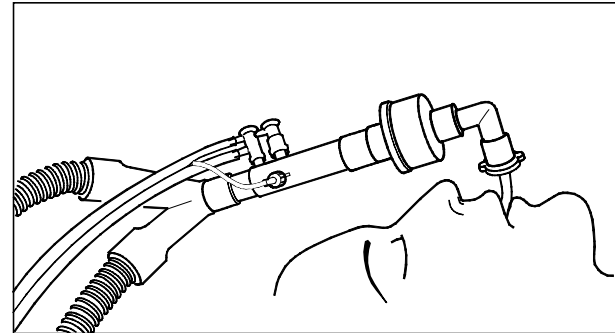
NOTE: When monitoring pediatric patients with tidal volumes of 15 - 300 ml, use the Pedi-lite/Pedi-lite+ sensor. Change the sensor type to **Pedi**:

1. Press the **Airway Gas** key.
2. Select **Spirometry Setup - Sensor Type- Pedi**.

### You get

In addition to airway gas concentrations and spirometry measurements, you can monitor oxygen consumption ( $\dot{V}O_2$ ), carbon dioxide production ( $\dot{V}CO_2$ ), energy expenditure (EE), respiratory quotient (RQ).

### With HMEF




NOTE: Always place the HMEF between the D-lite sensor and the patient.

---

## Starting

Use only 2-meter (7-ft) anesthesia gas sampling lines. Using other lines may cause inaccurate readings. There are four different digit fields for monitoring gas exchange data on the screen:

$\dot{V}O_2$ ml/min <b>244</b> $\dot{V}CO_2$ <b>195</b> RQ <b>0.80</b>	$\dot{V}O_2/m^2$ ml/min/m <sup>2</sup> <b>104</b> $\dot{V}CO_2$ <b>83</b> RQ <b>0.80</b>
$\dot{V}O_2/kg$ ml/min/kg <b>4.4</b> $\dot{V}CO_2$ <b>3.5</b> RQ <b>0.80</b>	EE average kcal/d RQ <b>1681 0.80</b> 2h 

For screen configuration, press the **Monitor Setup** key and select **Screen Setup - Digit fields**.

---

## Averaged EE and RQ

Average values of EE and RQ update every minute. You can select the averaging time from 2 to 24 hours. The bar in the lower part of the digit field indicates the amount of data that the monitor uses for performing the average calculations. The values on the screen are gray until there is enough data for reliable calculations.

To select the average time:

1. Press the **Airway Gas** key.
2. Select **Gas Exch. Setup**.
3. Select the desired averaging time.

If the RQ is out of the physiological range (<0.6 or >1.3), the monitor does not store the EE and RQ values in the trend history or use them for average calculations.

---

## Measurement principle

O<sub>2</sub> consumption is obtained by measuring the amount of inhaled O<sub>2</sub> subtracted from the exhaled amount. CO<sub>2</sub> production is obtained by subtracting the amount of inhaled CO<sub>2</sub> from the exhaled amount. Values are obtained by multiplying each measured volume sample by the corresponding gas concentration.

Gas exchange cannot be accurately measured when N<sub>2</sub>O is used because the measurement is based on the fact that the amount of nitrogen inhaled by the patient is equal to the amount of exhaled nitrogen.

---

## Points to note

- Adequate  $\dot{V}O_2$  /  $\dot{V}CO_2$  values cannot be measured with a leaking airway, with FiO<sub>2</sub> higher than 85%, or when N<sub>2</sub>O+O<sub>2</sub> mixtures are used in ventilation.
- Measurement results are valid only when the respiration rate is below 35/min.
- Unstable oxygen delivery may cause erroneous  $\dot{V}O_2$  readings.
- Disconnect the D-lite during nebulization of medications.

## Tonometry

### You need

- (1) Tonometrics catheter with
- (2) Built-in biofilter
- (3) Connector for the Tonometrics catheter
- (4) Module with gastrointestinal  $\text{PCO}_2$  ( $\text{PgCO}_2$ ) measurement capability

Optionally, an airway gas module measuring  $\text{EtCO}_2$  to facilitate the calculation of the difference between gastrointestinal and airway  $\text{CO}_2$ ,  $\text{P}(\text{g-Et})\text{CO}_2$ .

### You get

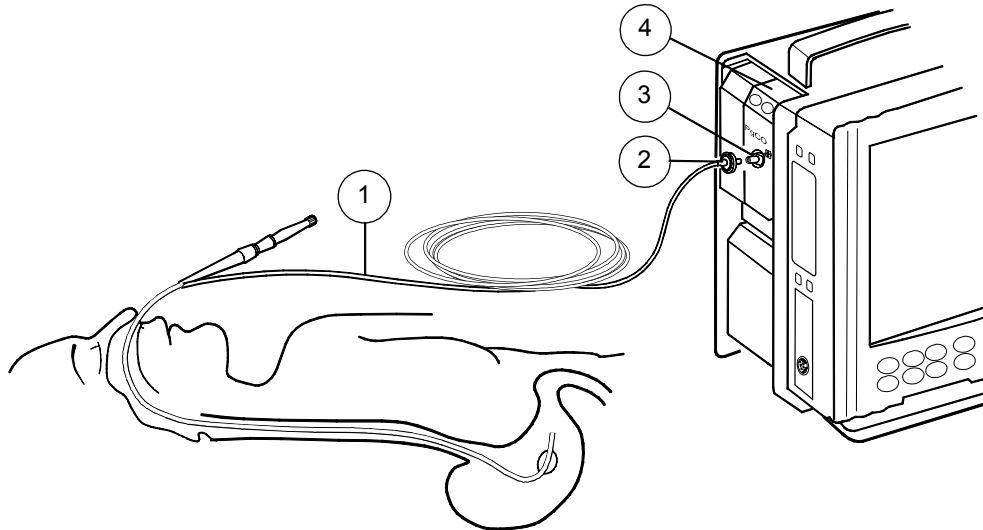
You can monitor gastrointestinal  $\text{PCO}_2$  ( $\text{PgCO}_2$ ) and, if a gas module is used, the difference between gastrointestinal and airway  $\text{CO}_2$  ( $\text{P}(\text{g-Et})\text{CO}_2$ ).

NOTE: Use tonometry module only with Tonometrics catheters.

---

**WARNING: Handle the Tonometrics catheter and its contents as you would any body fluid. Infectious hazard may be present.**

---



---

## Starting

1. Insert a new Tonometrics catheter into the patient's stomach (or intestine). See catheter instructions for more information.
2. Connect the catheter to the tonometry module and check visually that the connection is secure.
3. To start the tonometry measurement:  
press the **Start/Stop** key on the module , or  
press the **Others** key and select **Tonometry - Start Cycling**.

---

## During monitoring

The monitor measures and displays updated PgCO<sub>2</sub> every 10 minutes.

---

## Displaying P(g-a)CO<sub>2</sub>, P(g-Et)CO<sub>2</sub>, or pHi with PgCO<sub>2</sub>

You can choose which calculated value is shown with PgCO<sub>2</sub> in the digit field. The choices are P(g-a)CO<sub>2</sub>, P(g-Et)CO<sub>2</sub> or pHi.

1. Press the **Others** key.
2. Select **Tonometry - Display with PgCO<sub>2</sub> - Pg-Pa, Pg-ET or pHi**.

P(g-a)CO<sub>2</sub> is updated when PaCO<sub>2</sub> values are entered and PgCO<sub>2</sub> has been measured before PaCO<sub>2</sub> is entered.

If airway gases are monitored, P(g-Et)CO<sub>2</sub> can also be displayed. P(g-Et)CO<sub>2</sub> is updated every 10 minutes.

pHi is updated when PaCO<sub>2</sub> and pHa values are entered and PgCO<sub>2</sub> has been measured before PaCO<sub>2</sub> and pHa have been entered.

---

## Stopping

1. Press the **Start/Stop** module key, or  
press the **Others** key and select **Tonometry - Stop Cycling**.
2. When you stop measuring tonometry, remove and dispose of the catheter.

---

## Tonometry alarm settings

1. In the **Tonometry** menu, select **PgCO<sub>2</sub>/Pg-ET Alarms**.
2. Adjust the parameter upper limits or set the alarms **ON** or **OFF**.

---

## Calibrating

Calibration is recommended at least every six months. If airway gases are monitored, calibrate the airway module at the same time. For more information, see section "Cleaning and care" in Part I of this User's Guide.

NOTE: Calibrating tonometry interrupts the tonometry measurement.

---

**CAUTION:** Do not apply pressurized air to any outlet or tubing connected to the monitor. Pressure may destroy sensitive elements.

---

## Neuromuscular transmission (NMT)

### You need

- (1) Module with NMT measurement capability
- (2) NMT Sensor Cable
- (3) ElectroSensor, or
- (4) MechanoSensor (or Regional Block Adapter, not in the drawing)

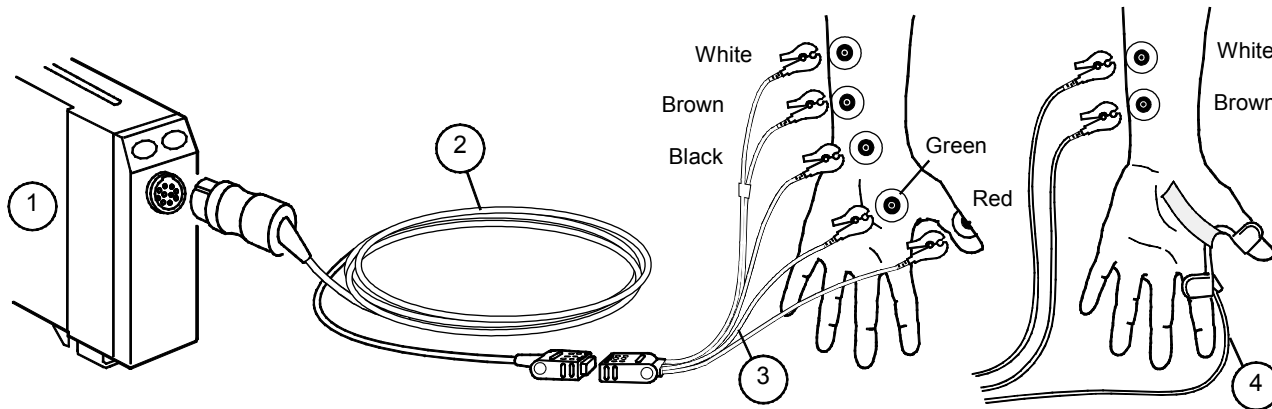
**WARNING: Make sure that the lead set clips do not touch any electrically conductive material including earth.**

**WARNING: Do not place the NMT stimulating electrodes on the patient's chest.**

**WARNING: Always stop the NMT measurement before handling the stimulating electrodes.**

### Starting

- Before connecting the electrodes, clean any grease and dirt from the application area.
- Place the stimulating electrodes (brown and white) along the ulnar nerve. Do not place electrodes on areas with excessive body hair or lesions. Do not let the electrodes touch each other.
- Place the piezoelectric probe or recording electrodes as indicated in the figure below. Fix the piezoelectric probe with tape.
- Press **Start-up** module key. Start monitoring after the induction of sleep but before the administration of a muscle relaxant drug.



---

## Stopping

- Press the **Stop/Continue** module key,  
or press the **Others** key and select **NMT - Stop**.

---

## Continuing monitoring in OR after induction

To move the module over to another Datex-Ohmeda system along with the patient and to continue with the already determined current and reference values, use the recall function:

1. Press the **Others** key and select **NMT - Start-up - Recall**.

---

## TOF and other stimulation modes

**TOF** (train of four) is the most common stimulation mode. In TOF, four impulses are generated at 0.5 second intervals. The ratio of the fourth to the first response is calculated resulting in TOF%. For safe extubation, TOF% should be higher than 90.

In TOF mode you can also see the number of responses, the Count. When there are less than four responses, the TOF% is no longer available and you can only see the Count. You can also use **DBS** (double burst) and **ST** (single twitch) stimulation modes.

---

## NMT in graphical trends

Different NMT values have their own specific colors in the graphical trends. The bar colors indicate the following:

- **white** = ratio% (TOF)
- **green** = T1%
- **blue** = PTC
- **purple** = Count

For more information on trends, see also section "*Trends and snapshots*."

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## Selecting recovery note

The NMT note alarms you with a single beep and the 'Block recovery' message if the Count reaches the set value.

1. Press the **Others** key and select **NMT**.
2. Select **Recovery Note** and the Count limit for activating the note.

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## Measuring deep relaxation

When the neuromuscular block deepens, there is no stimulus response. To monitor the relaxation level, start a five second tetanic stimulation.

- Select **NMT - Tetanic/PTC - Start**.

After tetanic stimulation, single impulses are generated and the number of responses is counted, resulting in Post Tetanic Count (PTC). After PTC, NMT measurements are stopped for one minute after which the previous measurement cycle continues.

### Relaxation meter:

100 TOF% 20	4 Count 0	10 PTC 0
Light  Deep		

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## Locating nerve for regional block with plexus stimulation

1. Connect the Datex-Ohmeda M-NMT Regional Block Adapter to the sensor cable.
  2. Connect a disposable needle and syringe set to the adapter.
  3. Press the **Start-up** module key.
  4. Adjust the current. If you have problems with getting a response, see section "Troubleshooting."
- To start the stimulation, press the **Continue** module key.
  - To stop stimulation, press the **Stop** module key.

## EEG and evoked potentials

### You need

- (1) Module with EEG, EP and FEMG measurement capability, M-EEG
- (2) EEG headbox and cable, N-EEG
- (3) EEG leadset: preconfigured or your own montage
  - EEG electrodes (cup, needle or stick-on)
- For AEP, earphones (4) are required.

NOTE: When measuring both AEP and BIS, see also section "*Bispectral Index (BIS)*."

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**CAUTION:** Do not cover the EEG headbox as it may overheat.

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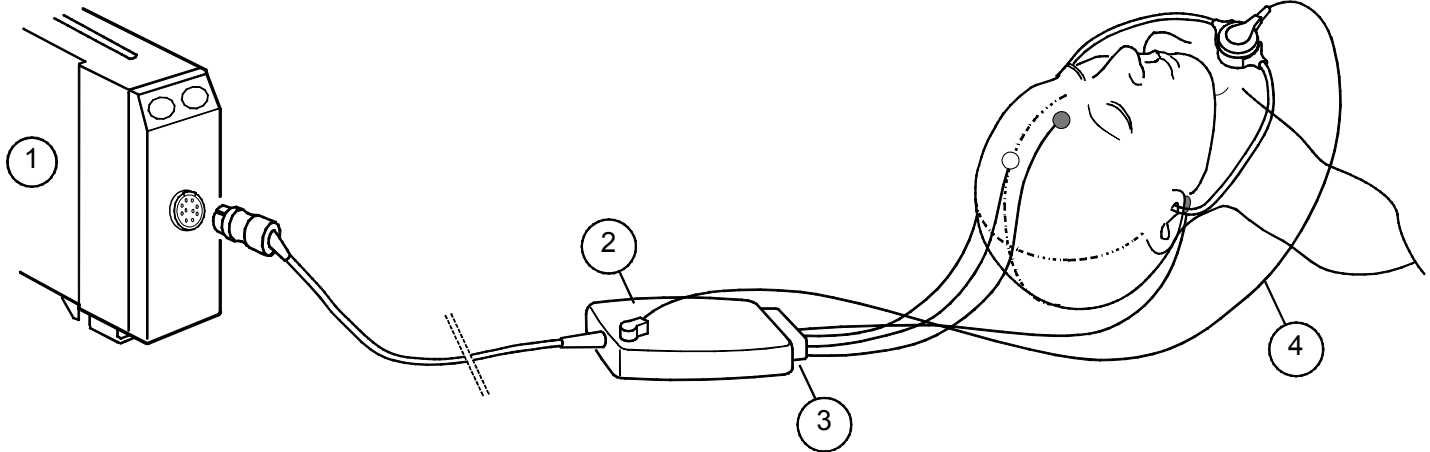


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**WARNING:** Make sure that the electrodes do not touch any electrically conductive material including earth.

**WARNING:** When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites. Also ensure that the ESU return electrode is near the operating area.

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## Starting

1. Select a preconfigured leadset or your own montage (see instructions later in this section) according to the application, and connect it to the headbox.
2. Clean and dry the patient's skin in electrode locations.
3. Attach the electrodes to the patient's head as indicated in the leadset or your own montage.
4. For AEP measurement, connect earphones to the headbox and place them on the patient's ear/s. NOTE: Make sure that the earphones do not press the patient's head in any position (for example, when the patient is lying on one side).
5. EEG measurement starts automatically. To start AEP, press the **EP Start/Stop** key on the headbox or on the module.
6. Observe the results of the electrode check and reconnect the electrodes if the impedance is too high.

NOTE: If you are using other than Datex-Ohmeda supplied headphones/earphones, verify the sound intensity. Too high an intensity may damage the ear and too low an intensity causes a poor response.

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## Changing electrodes

- Change the electrodes at least once a day.
- Check the electrode attachment by pressing the **Imp. Check** key.

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## Using a preconfigured leadset

A preconfigured leadset tells the monitor which montage (electrode position) is used. In other words, no menu selections are necessary. The three preconfigured montages, Basic, General and AEP, can be used in most applications. For more information, see the "User's Reference Manual."

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## Modifying a montage

If none of the preconfigured leadsets suits your application, you can define your own montage. You can either plug the leadwires directly to the headbox, or build your own leadset.

To define a montage:

1. Press the **Others** key.
2. Select **EEG & EP- Montage**. Go through the different menu items and select the options to suit the application. You can also name and save the montage for later use through **Save Montage**.
3. When a montage has been defined once, it can be used as any of the preconfigured leadsets.

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## Stopping measurement

EEG measurement continues as long as the electrodes are connected.

- To stop the AEP measurement, press the **EP Start/Stop** key on the headbox or on the module.



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## Displaying EEG

You can select EEG data to up to four waveform fields, or to digit fields as numeric or graphic data (**EEGgra** or **EEGnum**). You can also select EEG to the Split Screen and to snapshots.

See Part I, section "Setting up the monitor before use" for details on how to configure snapshots.

To display compressed spectral array or numerical EEG related calculated parameters:

1. Press the **Others** key.
2. Select **EEG & EP - CSA** or **Numerical**.

## EEG spectrum and frequency bands

EEG is divided in four frequency bands: delta, theta, alpha and beta. To characterize the spectral content of the signal, the following parameters are calculated:

- **Spectral Edge Frequency, SEF**: the frequency below which nearly all of the power is present.
- **Median Frequency, MF**: divides the spectrum in half: 50% of the power is below and 50% above this frequency.
- **Frequency band ratios** (Delta%, Theta%, Alpha%, Beta%): define what portion of the power is in a certain frequency band.

The spectrum is displayed graphically as a single, continuously updating curve, **Compressed Spectral Array (CSA)**.

**Burst Suppression Ratio (BSR)** is the ratio of suppressed EEG in a time period of 60 seconds.

---

## Displaying FEMG

The FEMG value is displayed on the first waveform field whenever the patient is connected for EEG monitoring and EEG is selected to be displayed in the waveform fields.

To display the FEMG value among other numerical values:

1. Press the **Others** key.
2. Select **EEG & EP - Numerical**.

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## Displaying Evoked Potentials

- Press the **Others** key and select **EEG & EP - EP**, or select the split screen: **Monitor Setup - Screen Setup - Split Screen - EP**.

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## Saving Evoked Potentials

1. Press the **Others** key.
2. Select **EEG & EP - EP - Save EP**.
3. Set markers on the response by turning the ComWheel.

To select a saved response to be displayed simultaneously with the real time response:

- Select **Ref. EP** and choose among the saved responses.

To change the stimulus frequency or volume or other AEP related settings:

1. Press the **Others** key.
- Select **EEG & EP - AEP Setup**.

## Bispectral Index (BIS)

### You need:

- (1) Module with BIS measurement capability, M-BIS
- (2) Digital Signal Converter, DSC-XP
- (3) Patient Interface Cable, PIC Plus
- (4) BIS Sensor Quatro (in the drawing), or BIS Sensor Pediatric

The M-BIS module is indicated for monitoring the state of the brain by data acquisition of EEG signals. BIS may be used as an aid in monitoring the effects of certain anesthetic agents.

BIS measurement is suitable for adult and pediatric patients. BIS values should be interpreted cautiously in children less than one year old.

NOTE: Make sure that the sensor connectors of the patient interface cable are not in contact with fluids.

NOTE: High EMG activity (like shivering or frequent eye movements) causes artifact and may interfere with the measurement.

NOTE: BIS sensors are latex-free, disposable and for single-patient use only. Do not use a sensor for more than 24 hours. Do not use dry sensors.

NOTE: Use only Aspect BIS sensors.

NOTE: Check the sensor expiry date on the sensor package.

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**CAUTION:** Continuous impedance check may need to be disabled if the 1 nA 128 Hz impedance check signal interferes with other equipment, such as EEG module with evoked potentials measurement.

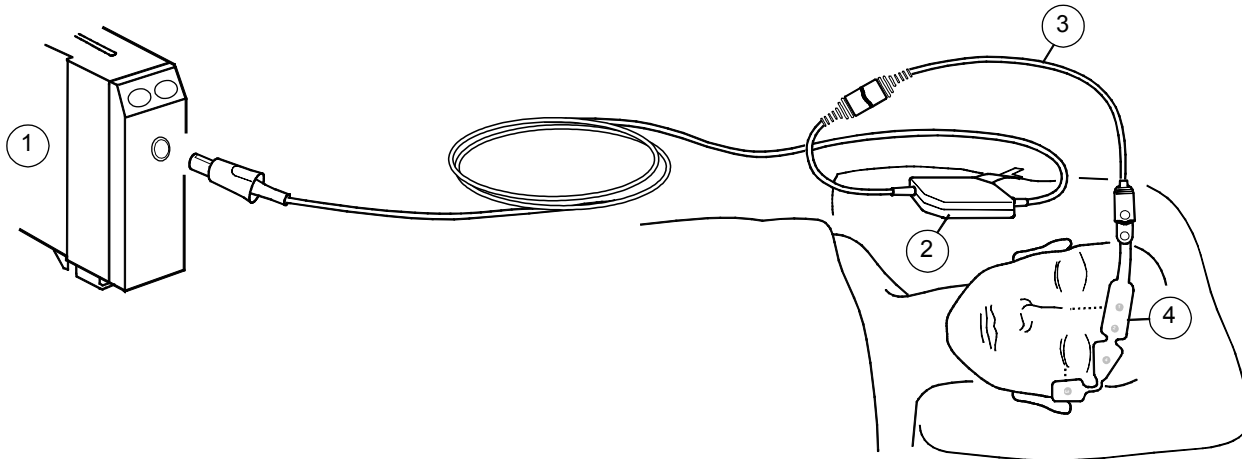
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**WARNING: Make sure that the electrodes, sensor and connectors do not touch any electrically conductive material, including earth.**

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## Digital signal converter (DSC)

Place the DSC close to the patient's head where the EEG signal is less subject to interference from other medical equipment.

NOTE: Degree of protection against harmful ingress of water as detailed in the IEC 60529: IPX4.

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**CAUTION:** Do not autoclave the DSC. Do not open it for any reason.

---

## Starting

1. Connect the DSC cable to the M-BIS module.
2. Prepare the patient. Clean the application site with alcohol and let dry.
3. Connect the patient interface cable to the digital signal converter.
4. Place the BIS sensor on the patient; see the sensor package.
5. Secure the DSC to a convenient location with the attachment clip.
6. Connect the sensor to the patient interface cable.
7. Observe the results of the automatic sensor check beside the waveform or in the digit field. The measurement starts automatically after the sensor has passed the check.

NOTE: You can turn off the automatic impedance check through **Others - BIS - BIS Setup - Automatic Check - OFF**.

---

**WARNING: When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites. Also ensure that the ESU return electrode is near the operating area.**

**WARNING: Radiated field strengths above 1V/m may cause erroneous measurements at various frequencies. Do not use electrical radiating equipment close to the DSC-XP.**

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## BIS measurement on the monitor screen

The waveform field shows the BIS EEG waveform. The following BIS related data appears in digit fields and graphical trends:

- **BIS** number indicates the patient's bispectral index, ranging from 100 for wide awake to 0 in the absence of brain activity.
- **Signal Quality Index (SQI)** bar graph indicates the quality of the EEG signal in the range of 0 to 100%.
- **Electromyograph (EMG)** bar graph represents the absolute power in the 70 to 110 Hz frequency band and ranges from 30 to 55 dB. This frequency band contains power from muscle activity as well as power from high frequency artifacts.
- **Suppression ratio (SR)** number indicates the percentage of suppressed (flatline) EEG detected over the last 63 seconds. It ranges from 0 to 100%.

## Selecting the smoothing rate

The smoothing rate is the time period over which artifact-free data is analyzed to calculate the BIS value. It determines how often the BIS data is updated on the screen and affects the appearance of waveforms and trends. Factory default is 15 seconds.

1. Press the **Others** key.
2. Select **BIS - Smoothing rate**.
3. Select **30** or **15** seconds (default).

---

## Manual sensor check

Whenever required, the sensor check can be done manually:

1. Press the **Check Sensor** key on the module, or press the **Others** key and select **BIS - Check Sensor**.
2. Observe the results on the screen. The measurement continues automatically after the sensor has passed the check.

## Entropy

### You need:

- (1) Module with entropy measurement capability, M-ENTROPY
- (2) Entropy sensor cable
- (3) Entropy sensor

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**CAUTION:** Automatic sensor check may need to be disabled if the 70 Hz impedance check signal interferes with other equipment, such as EEG module with evoked potentials measurement.

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**WARNING:** Make sure that the electrodes, sensor and connectors do not touch any electrically conductive material, including earth.

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### You get:

One channel of raw EEG, with two calculated entropy parameters and Burst Suppression Ratio.

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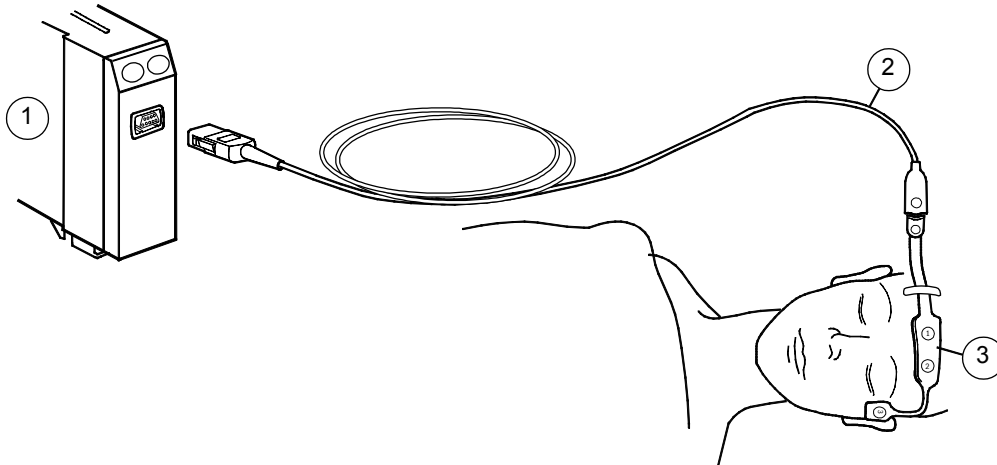
**WARNING:** When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites. Also ensure that the ESU return electrode is near the operating area.

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**WARNING:** Strong 30-40 Hz magnetic fields may cause erroneous entropy measurement. Do not use devices with such a field close to the module or sensor.

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### Entropy measurement on the monitor screen

The waveform field shows the entropy EEG waveform. The digit field shows the Response Entropy, RE, and State Entropy, SE, numbers and a small trend. You can also configure the Burst Suppression Ratio, BSR, to appear in the digit field. Entropy display format is chosen through **Others – Entropy – Display Format**. Different screen configurations are: RE, SE, RE+SE, and All (= RE, SE, and BSR).

- **RE** is a fast reacting parameter, which may be used to detect the activation of facial muscles
- **SE** is a more stable parameter, which may be used to assess the hypnotic effect of anesthetic drugs on the brain
- **BSR** number gives an indication when a burst suppression pattern appears. This may be a signal of an unnecessarily deep anesthetic state.

---

### Starting

1. Connect the entropy sensor cable to the M-ENTROPY module.
2. Prepare the patient. Clean the application site with alcohol and let it dry before attaching the sensor.
3. Place the entropy sensor on the patient's forehead according to instructions on the sensor package.
4. Connect the sensor to the entropy sensor cable.
5. Observe the results of the automatic sensor check beside the waveform or in the digit field. The measurement starts automatically after the sensor has passed the check.

NOTE: You can also turn off the automatic sensor check through **Others – Entropy - Automatic Check - OFF**.

NOTE: Always ensure that the sensor is properly attached and connected.

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### Manual sensor check

Whenever required, the sensor check can be started manually:

1. Press the **Check Sensor** key on the module, or press the **Others** key and select **Entropy – Check Sensor**.

Observe the results on the screen. The measurement continues automatically after the sensor has passed the check.

### Points to note

- Frequent eye movements, coughing and patient movement cause artifacts and may interfere with the measurement.
- Entropy readings may be inconsistent when monitoring patients with neurological disorders, traumas or their sequelae.
- Psychoactive medication may cause inconsistent entropy readings.
- Entropy measurement has not been validated with pediatric patients.
- Entropy sensors are latex- and PVC-free, disposable and for single-patient use only.
- Do not use a sensor for more than 24 hours. Do not use expired sensors.
- Make sure that the sensor connectors of the sensor cable are not in contact with fluids
- Check the expiry date on the sensor package.

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**CAUTION:** The entropy measurement is to be used as an adjunct to other physiological parameters in assessing the effects of certain anesthetic agents.

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