S/5™ FM

User's Guide

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Datex-Ohmeda S/5 FM

User's Guide

Related to software licenses L-FICU03 and L-FICU03A

CE 0537

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 are 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 S/5 FM. Descriptions refer to S/5 software licenses L-FICU03 and L-FICU03A.

If you are a new user of the monitor, we suggest you begin with sections "Safety precautions", "System introduction" and "Monitoring basics." 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: ***ECG Setup.***
- Menu access is described from top to bottom. For example, the selection of the ***Screen 1 Setup*** menu item and the ***Waveform Fields*** menu item would be shown as ***Screen 1 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 FM User's Reference Manual
Installation, technical solutions and servicing: S/5 FM Technical Reference Manual
Options and selections of the software: S/5 FM Default Configuration Worksheet
Compatible supplies and accessories: S/5 FM Supplies and Accessories
Other devices closely related to the S/5 FM: S/5 iCentral User's Reference Manual S/5 Network Wireless LAN Installation Guide

Intended purpose (Indications for use)

The Datex-Ohmeda S/5 FM is intended for multiparameter patient monitoring. The S/5 FM with L-FICU03 or L-FICU03A software is indicated for monitoring of hemodynamics (including arrhythmia and ST-segment analysis) and respiratory status of all hospital patients. Impedance respiration measurement is indicated for patients three years old and up. NIBP and CO_2 (using option N-FCREC or N-FC) measurements are indicated for patients weighing over 5 kg (11 lb). The S/5 FM is indicated for use by qualified medical personnel only.

Classifications

In accordance with IEC 60601-1:

- Class I and internally 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

In accordance with CISPR 11: Group 1 Class B; see page 4 of this User's Guide

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

Trademarks

Safety precautions

These precautions refer to the entire system. Warnings and cautions specific to parts of the system can be found in the relevant section.

Warnings

A WARNING indicates a situation in which the user or the patient may be in danger of injury or death.

- Connect only one patient to the monitor at a time.
- Do not use the monitor without manufacturer approved mounting attached.
- Vibrations during intrahospital transport may disturb SpO_2, ECG, impedance respiration, NIBP and InvBP measurements.
- Use only hospital-grade grounded power outlets and power cord.
- Some equipment malfunctions may not generate a monitor alarm. Always keep the patient under close surveillance.
- To avoid explosion hazard, do not use the monitor in presence of flammable anesthetics.
- Do not use the monitor in high electromagnetic fields (for example, during MRI.)
- Do not connect any external devices to the system other than those specified.
- Do not touch the patient, table, instruments, modules or the monitor during defibrillation.
- If the integrity of the external protective earth conductor arrangement is in doubt, use the monitor with battery operation.
- After transferring or reinstalling the monitor, always check that it is properly connected and securely attached.
- When detaching modules, be careful not to drop them. Always support with one hand while pulling out with the other.
- Use only accessories, including mounts and batteries, and defibrillator-proof cables and invasive pressure transducers approved by Datex-Ohmeda. For a list of approved supplies and accessories, see the “Supplies and Accessories” catalog delivered with the monitor. Other cables, batteries, transducers and accessories may cause a safety hazard, damage the equipment or the system, result in increased emissions or decreased immunity of the equipment or system or interfere with the measurement. Protection against cardiac defibrillator discharge is due in part to the accessories for pulse oximetry (SpO_2), temperature (T) and invasive pressure (P) measurement.
- Single-use accessories are not designed to be re-used. Re-use may cause a risk of contamination and affect the measurement accuracy.
- Do not incinerate a battery or store at high temperatures, as it will explode.
- The monitor or its components should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor and its components should be observed to verify normal operation in the configuration in which it will be used.
- Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. See the "User’s Reference Manual" for details.
- The system may be interfered with by other equipment, even if that other equipment complies with CISPR emission requirements.
- If liquid has accidentally entered the equipment, disconnect the power cord from the power supply and have the equipment serviced by authorized service personnel.
- If the unit fails to respond as described, do not use the monitor until tested and repaired by authorized service personnel.

Cautions

A CAUTION indicates a situation in which the unit or devices connected to it may be damaged.

- Leave space for circulation of air to prevent the monitor from overheating.
- Do not store or use the monitor outside the temperature and humidity ranges specified in the "Performance" section of this manual.
- After replacing a battery, always make sure to close the battery compartment by sliding the lid back to the right until it clicks.
- Other transmitting radio devices using the same radio frequency band (Industrial Scientific and Medical 2.45 GHz band) may degrade or disturb the wireless network communication.

Disposal

- Dispose of the whole device or parts of it in accordance with local environmental and waste disposal regulations.

Points to note

- Medical electrical equipment needs special precautions regarding electromagnetic compatibility and needs to be installed and put into service according to the electromagnetic compatibility information provided in the "Technical Reference Manual" by qualified personnel.
- Portable and mobile RF communications equipment can affect the medical electrical equipment.
- The allowed cables, transducers and accessories for the system are listed in the “Supplies and Accessories” catalog delivered with the monitor.
- The equipment is suitable for use in the presence of electrosurgery. Please notice the possible limitations in the parameter sections and in the "Safety precautions” section.
- Service and reparations are allowed for authorized service personnel only.
- CISPR classifications:
  - Group 1 contains all ISM (Industrial, scientific and medical) equipment in which there is intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.
  - Class B equipment is suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Symbols

Attention, consult accompanying documents.

When displayed next to the HR value, indicates that the pacer is set on R or a wide QRS is selected.

On the E-PSM(P) module indicates that protection against cardiac defibrillator discharge is due in part to the accessories for pulse oximetry (SpO_2), temperature (T) and invasive pressure (P) measurement.

On the rear panel this symbol indicates the following warnings and cautions:

- Electric shock hazard. Do not open the cover or the back. Refer servicing to qualified personnel.
- For continued protection against fire hazard, replace the fuse only with one of the same type and rating.
- Disconnect from the power supply before servicing.
- Do not touch the monitor during defibrillation procedure.
- Do not use the monitor without manufacturer approved mounting attached.
- Lithium battery on CPU board: follow the regional regulations for disposal.

Type BF (IEC 60601-1) protection against electric shock.

Type BF (IEC 60601-1) defibrillator-proof protection against electric shock.

Type CF (IEC 60601-1) protection against electric shock.

Type CF (IEC 60601-1) defibrillator-proof protection against electric shock.

When displayed in the upper left corner of the screen, indicates that the alarms are silenced. When displayed in the menu or digit fields, indicates that the alarm source has been turned off or alarm does not meet the alarm-specific activation criteria.

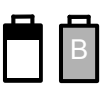
Equipotentiality. Monitor can be connected to potential equalization conductor.

Alternating current

Fuse. Replace the fuse only with one of the same type and rating.

In the front panel: battery.

Battery operation and remaining capacity. The height of the green bar indicates the charging level.



Battery (A) charging (white bar).

Battery (A) failure.

Both batteries failed.

Battery (A) missing.

In the front panel: mains/external DC power.

Wireless LAN signal strength. The number of segments corresponds to the signal strength: four segments indicate strong signal, one segment weak signal. When connection to access point is being searched, the segments scroll from zero to four and back.

ESD warning symbol for electrostatic sensitive devices. Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. See "Safety precautions: ESD precautionary procedures" in the "User's Reference Manual" for details.

Symbol for non-ionizing electromagnetic radiation. Interference may occur in the vicinity of equipment marked with this symbol.

SN, S/N Serial number

Submenu. Selecting a menu item with this symbol opens a new menu.

The monitor is connected to the Datex-Ohmeda S/5 Network (Local Area Network).

The monitor is connected to the Datex-Ohmeda S/5 Network (Wireless Local Area Network).

Data Card (green) or Menu Card (white) is inserted

A blinking heart next to the heart rate or pulse rate value indicates the beats detected.

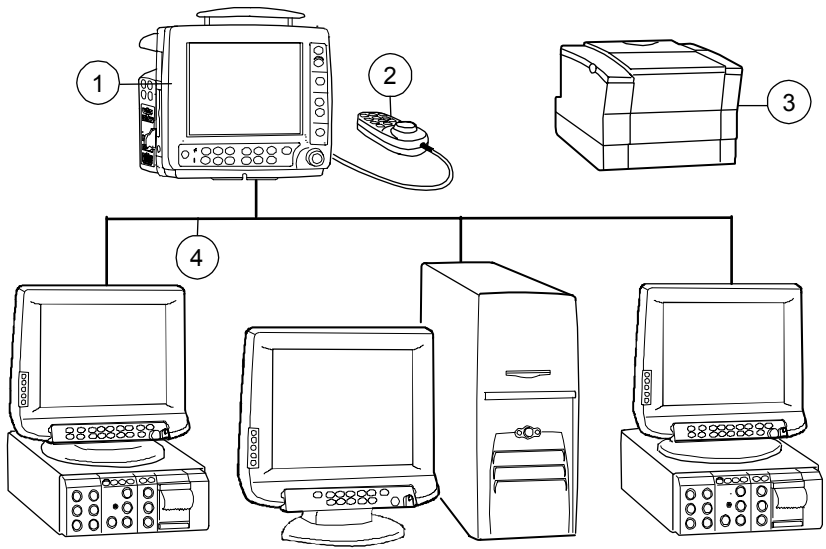
A lung next to the respiration rate value indicates that respiration rate is calculated from the impedance respiration measurement.

System introduction

(1) S/5 FM with module(s)
(2) S/5 Remote Controller, K-CREMCO
(3) Printer
(4) Other monitors in the Network

NOTE: The monitor display is fragile. Ensure that it is not placed near a heat source or exposed to mechanical shocks, pressure, moisture, or direct sunlight.

NOTE: Your system may not include all these components.



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

WARNING: After transferring or reinstalling the monitor, always check that it is properly connected and securely attached.

Optional components

Optional components for the S/5 FM are:

- Patient Side Modules E-PSM and E-PSMP
- Extension Modules N-FREC, N-FCREC and N-FC
- S/5 Wireless Network Option, N-FMW
- S/5 Remote Controller, K-CREMCO

For details regarding modules, see section “Measurement modules.” The monitor provides places for one E-PSM(P) and/or one N-Fx module. The S/5 Network Option is always included.

Attaching and mounting the monitor

The S/5 FM has various mounting accessories like a roll-stand, pole mount, wall mount and so on. It also has the slide for a GCX mounting system. For details, please, refer to the “Supplies and Accessories” catalog delivered with the monitor.

WARNING: Never install the monitor so that it is above the patient.

WARNING: Do not use the monitor without manufacturer approved mounting attached.

Communication between monitors

You can use the S/5 FM as a stand-alone monitor or for:

- Viewing and receiving data (alarms, vital signs) from other patient monitors
- Gathering and storing data during intrahospital transport.

To view other patient monitors, the monitor needs to be connected to the Datex-Ohmeda S/5 Network. The Network Option is always included in the monitor. However, you can also choose the optional wireless network option, N-FMW. To gather, store and transfer data between different Datex-Ohmeda monitors, use the Data Card or network communication. NOTE: You cannot transfer data to an S/5 FM using the Data Card. Use network for this purpose.

The Data Card is used for storing and transferring patient data from the S/5 FM. The Menu Card is used for loading and storing hospital-specific user modes.

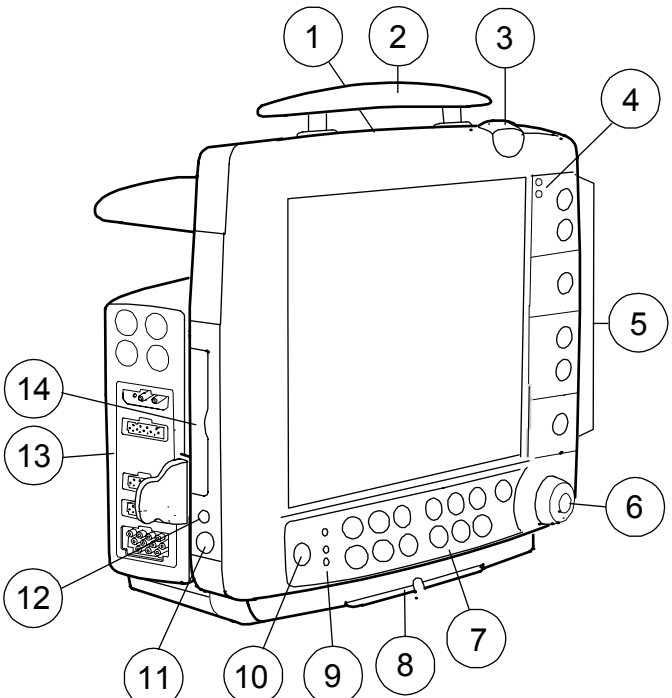
Interfacing other devices

External devices can be connected to the S/5 FM, and the data they measure can be seen on the monitor screen. For more information, see section "Interfacing external devices."

WARNING: A printer must be supplied from an additional transformer providing at least basic isolation (isolating or separating transformer).

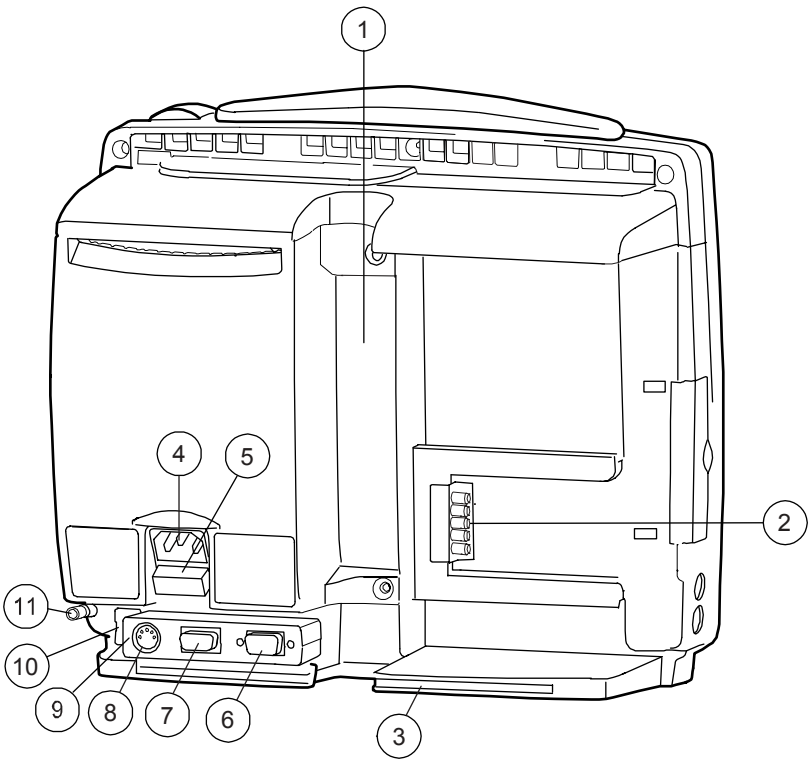
WARNING: Before starting to use the system, ensure that the whole combination complies with the international standard IEC 60601-1-1 and the requirements of the local authorities. Do not connect any external devices to the system other than those specified by Datex-Ohmeda.

Monitor introduction



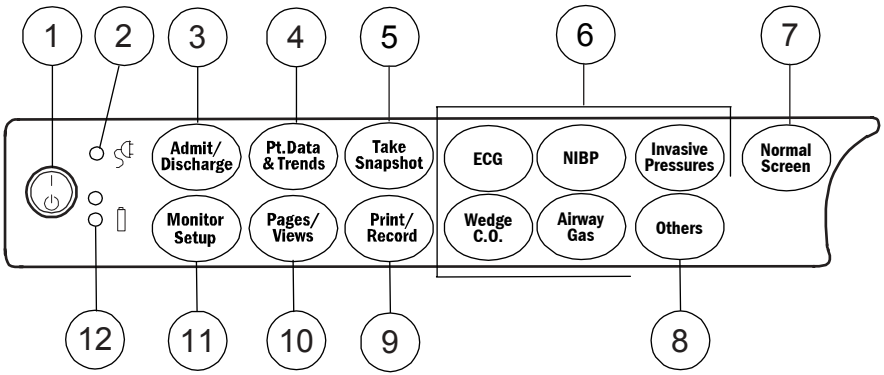
(1) Battery compartment, see page 13
(2) Transportation handle
(3) Alarm light, see page 33
(4) Alarm LEDs, see page 33
(5) Side panel keys, see page 12
(6) The ComWheel
(7) Command Board keys, see page 10
(8) Guide rail for GCX mounting
(9) Mains power and battery LEDs, see page 13
(10) ON/standby key
(11) Connector for the Device Interfacing Solution (marked with X6)
(12) Connector for defibrillator synchronization (marked with X5)
(13) Measurement modules, see page 15
(14) Slot for Data Card or Menu Card

Rear panel connections



(1) Slot for infusion pole mount
(2) Module connector (marked with X4)
(3) Guide rail for GCX mounting
(4) Receptacle for power cord
(5) Fuse holder
(6) Serial port (marked with X9)
(7) Network ID connector (marked with X8)
(8) Connector for K-CREMCO (marked with X7)
(9) Accessory: multi I/O adapter (with connectors 6 - 8 above)
(10) Network connector
(11) Equipotential connector

Command Board keys



(1) ON/standby key

(2) Mains power ON (lit) or OFF (dark): indicates mains or external DC power

(3) For admitting or discharging a patient; for selecting user modes; for viewing data from other monitors; for activating standby

(4) For viewing trends, alarm history and other patients, and for activating the ***Lab Data*** and the ***Drug Calculator*** menu

(5) For creating snapshots

(6) For activating parameter specific menus. NOTE: All modules do not measure all of these parameters. For more information, see page 15.

(7) For returning the Normal Screen view to the screen

(8) For activating pulse oximetry, impedance respiration and temperature setup menus

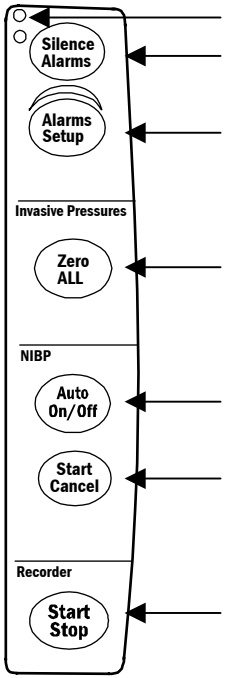
(9) For printing and recording different trends and views

(10) For selecting pages and for activating the ***ECG View*** or the ***ST View***

(11) For setting up the monitor and for activating the HELP menu

(12) Battery operation LEDs, see page 13

Side panel keys



Alarm LED indicators: see page 34

For silencing the alarms, see page 36

For activating the ***Alarms Setup*** menu, see page 33

For zeroing the invasive pressure channels, see page 69
NOTE: Functional with the E-PSMP module only.

For starting the NIBP autocycling, see page 67

For starting or stopping the NIBP manual cycling, see page 67

For starting or stopping local recording, see page 39
NOTE: Functional with the N-FREC and N-FCREC modules only.

Batteries

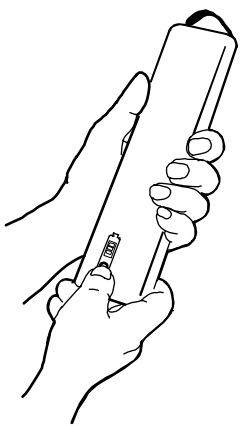
The S/5 FM has two lithium-ion batteries, located in the battery compartment. They can be charged separately, and screen symbols and monitor frame LEDs indicate their charging level and possible failure, see table below. You can also check the battery status through **Monitor Setup** – ***Battery Setup***.

Battery indicators

Screen symbol	Explanation	Front panel battery LED indicators
	Monitor is battery powered. Batteries are fully charged; the size of the green bar indicates the charging level.	Green lit ● Orange dark ○
	Monitor is battery powered. Battery A is empty, battery B is ok.	Green lit ● Orange dark ○
	Monitor is battery powered. Battery A failure, battery B is ok. NOTE: If both batteries fail, the green battery LED is dark.	Green lit ● Orange flashing ☼
	Monitor is battery powered. Battery A missing, battery B is ok.	Green lit ● Orange flashing ☼
	Monitor is mains powered. Battery A is being charged (white bar), battery B is already charged.	Green dark ○ Orange lit ●
(No symbol)	Monitor is mains powered. 'No battery backup' message on screen. Batteries have failed or they are not inserted.	Green dark ○ Orange flashing ☼

NOTE: Always use the S/5 FM with batteries inserted. Otherwise all trend data, snapshots and temporary settings are lost if the power cable is detached from the mains. NOTE: When the monitor is battery powered, the green battery LED is on. When the monitor is mains powered, the green mains LED is on. See also sections "Conditioning the batteries" and "Messages."

Checking the battery charge when the monitor is turned off



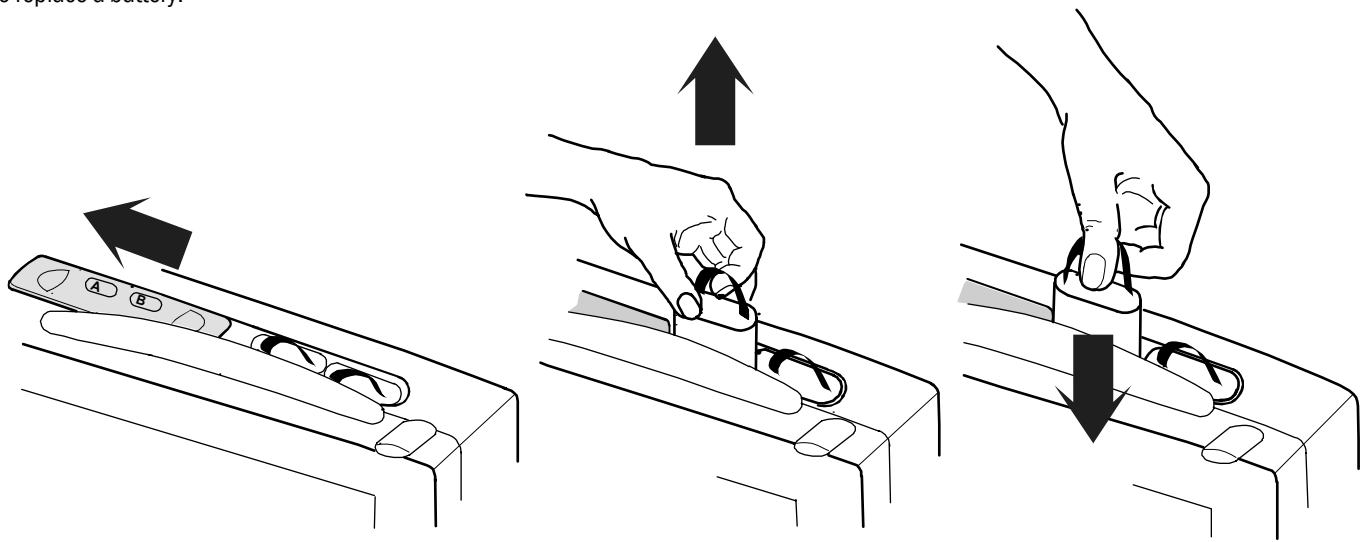
When the monitor is turned off, you can check the battery charging level by pressing the test button on the battery as indicated in the drawing on the left. The green bar lights up and the number of lit segments indicates the charging level.

WARNING: Do not incinerate a battery or store at high temperatures, as it will explode.

Replacing the batteries

Battery capacity indicators in the upper right corner of the screen tell you when you should replace a battery, and which one is out of charge, missing or not working, see above. You can replace one battery at a time.

To replace a battery:



1. Open the lid of the battery compartment located behind the transportation handle by sliding it to the left.
2. Lift up the battery you want to change. Check the indicators and messages on screen to make sure that you change the battery with lower charge.
3. Push in the new battery. Make sure that the charging indicator is facing forward and push the battery down all the way. Check the monitor indicators, see above.

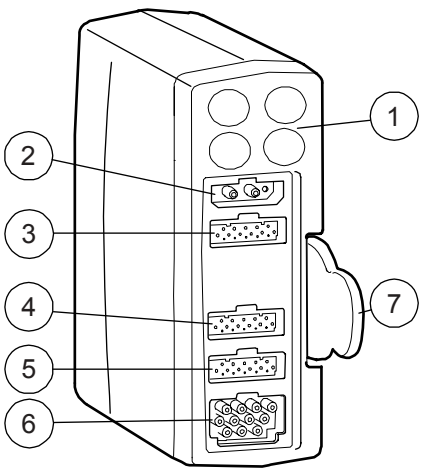
CAUTION: After replacing a battery, always make sure to close the battery compartment by sliding the lid back to the right until it clicks.

Measurement modules

There are five modules for the S/5 FM: hemodynamic Patient Side Modules E-PSM and E-PSMP, and the S/5 FM specific Extension Modules N-FREC, N-FCREC and N-FC.

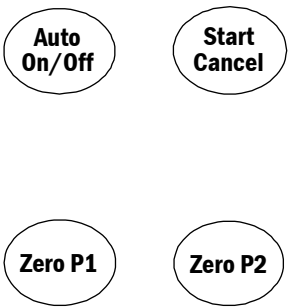
You can use simultaneously either one E-PSM(P) module or one N-Fx module or one of each. See the following pictures and explanations for module features.

Patient Side Modules E-PSM and E-PSMP (in the drawing)



(1) Module keys, see below
(2) NIBP connector
(3) InvBP connector in E-PSMP only: 2-channel measurement
(4) Temperature connector: 2-channel measurement
(5) SpO_2connector
(6) ECG (3/5/12 lead) and impedance respiration connector
(7) Tab for removing the module

Module keys



Auto On/Off: for starting or stopping the NIBP automatic cycling, see page 67

Start Cancel: for starting or stopping the NIBP manual cycling, see page 67

In E-PSMP only:

Zero P1: for zeroing pressure channel P1

Zero P2: for zeroing pressure channel P2

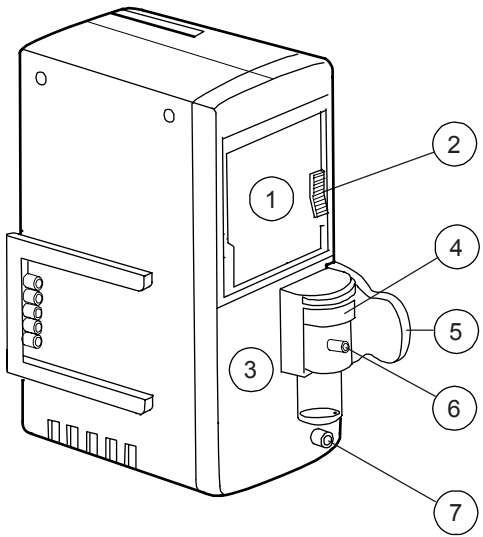
Module versions

The Patient Side Modules have the following measurement capabilities:

E-PSM:
- Non-invasive blood pressure
- Temperatures
- Pulse oximetry
- ECG and impedance respiration

E-PSMP (in the drawing above):
- Non-invasive blood pressure
- Invasive blood pressures
- Temperatures
- Pulse oximetry
- ECG and impedance respiration

Extension Modules N-FREC, N-FCREC (in the drawing) and N-FC



(1) Recorder, in N-FREC and N-FCREC
(2) Paper compartment lever
(3) CO_2 measurement, in N-FCREC and N-FC
(4) Water trap
(5) Tab for removing the module
(6) Sample gas inlet
(7) Gas outlet

Module versions

The Extension Modules have the following measurement capabilities and features:

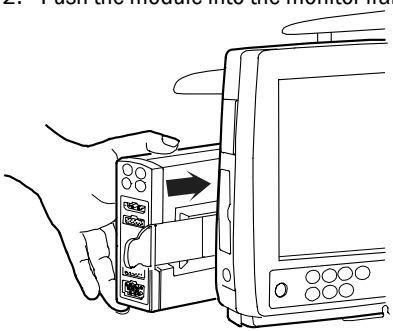
N-FREC:
- Built-in strip chart recorder for local recording

N-FCREC (in the drawing):
- Built-in strip chart recorder
- CO_2 measurement

N-FC:
- CO_2 measurement

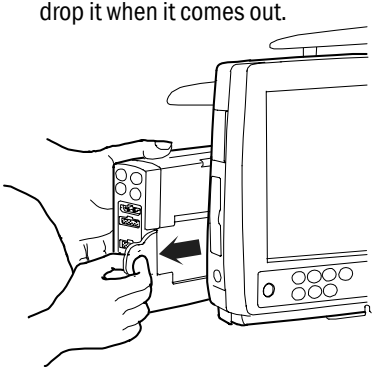
Inserting a module

1. Align the module with the insertion guides. E-PSM(P) and N-Fx modules are all inserted the same way.
2. Push the module into the monitor frame until it clicks:



Removing a module

1. Pull the module outwards using the tab. Make sure not to drop it when it comes out.

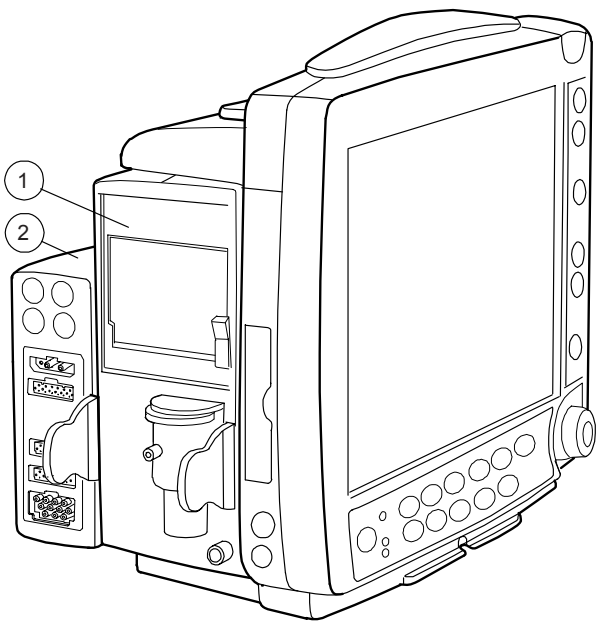


Using two modules

To install an E-PSM(P) and an N-Fx module:

(1) Insert the N-Fx module first as explained in section “Inserting a module.”

(2) Attach the E-PSM(P) to the N-Fx.



WARNING: When detaching modules, be careful not to drop them. Always support with one hand while pulling out with the other.

Monitoring basics

Navigating in menus

A menu is a list of functions or commands. To display a menu, press one of the hard keys. Selections in the menus are made with the ComWheel. For example, to change the ECG display:

- **Press the ECG key** to open the function menu.
- **Turn the ComWheel** to select the desired function in the menu.
- **Push the ComWheel** to open a submenu or an adjustment window.
- **Push the ComWheel** to confirm the selection.

Using modes

The S/5 FM has six user modes. These user modes are predefined sets of parameters. They determine, for example, what is displayed on the screen and in trends and what the alarm limits are. In other words, by choosing a specific mode you get suitable settings on the screen without having to choose all features one by one.

Modes can be hospital specific. The monitor starts in start-up mode, which is one of the user modes chosen during configuration. The default modes are ***STEP-DOWN***, ***ED***, ***PACU***, ***CCU***, ***NEURO*** and ***PEDIATRIC***. For more information about the default user modes, see the "Default Configuration Worksheet" delivered with the monitor. For more information about the installation settings and user modes, see the "User's Reference Manual."

Using pages

Each user mode has six configurable pages. Also pages contain different sets of parameters. In addition to the Normal Screen page, some modes have factory defaults for one or more other pages.

For more information, see the "Default Configuration Worksheet" or the "User's Reference Manual."

Selecting an appropriate page

In addition to the Normal Screen, you can define up to five more pages for each mode. Pages are preconfigured but if desired, can also be changed. To select a page:

1. Press the **Pages/Views** key or push the ComWheel once in the Normal Screen view.
2. Select the page with the ComWheel.

For more information, please refer to section "Setting up the monitor before use."

For your notes:

Setting up the monitor before use

Before starting to use the monitor, check the monitor installation settings and what is configured in different user modes, and make the necessary changes. The user modes can be hospital-specific. For more information about the default user modes, see the “Default Configuration Worksheet.” For more information about the installation settings and user modes, see the “User’s Reference Manual.”

Passwords

The default password for entering the ***Install/Service*** menu is `16 4 34`.

The default password for entering the ***Save Modes*** menu is `13 20 31`.

Interfacing

1. Press **Monitor Setup** and select ***Interfacing***.
2. Select the desired interfaced external devices.

Battery setup

Through this menu, you can check the battery status:

1. Press the **Monitor Setup** key.
2. Select ***Battery Setup***. Battery information is now available.

Setting time and date

NOTE: If the monitor is connected to the S/5 iCentral, it follows the iCentral’s time settings and the ***Time and Date*** menu is not available.
NOTE: You cannot change the monitor’s time settings after the patient has been admitted.

1. Press **Monitor Setup** and select ***Time and Date***.
2. Turn and push the ComWheel to set the time and date.

Changing the monitor installation settings

The monitor installation settings are the same in all user modes. The changes are preserved until changed again. Press **Monitor Setup**, enter the password and select ***Install/Service*** - ***Installation***.

Units

1. Change units for height, weight, laboratory values and calculations.

You can change temperature units through **Others** - ***Temp Setup*** and CO_2 units through **Airway Gas** - ***CO2 Setup***. The changes are permanent.

Alarm options

Show Limits: Select ***YES*** to show alarm limits in digit fields.
Show Audio ON/OFF: Select ***YES*** to enable alarm silencing. Selecting ***NO*** (default) hides silencing options in the ***Audio ON/OFF*** menu in ***Alarms Setup***.
Alarm Light: Select ***NO*** to disable the alarm light.
Latching Alarms: Select ***YES*** to keep alarm messages on screen until **Silence Alarms** key is pressed.
Reminder Volume: Adjust volume of audible alarm reminder tone.
Alarm Tones: Select ISO 9703-2 standard tones or general tones.

Printer

ECG Printout Type: Select ***2x6-25***, ***2x6-50*** or ***3x4-25***.
Snapshot Printout: Select ***12.5*** or ***25 mm***.
Printer Connection: Select printer connection (default: ***None***).
Paper Size: Select ***A4*** or ***Letter***.

Monitor settings

Parameter Settings: Set tidal volume calculation conditions, CO_2 humidity compensation and inspired flow drawing direction.

Display setup

LCD Colors: Change the number of colors on the LCD display.

Standby-sites

Give names to the standby sites shown in the ***Admit/Discharge*** menu. Enter the names by pushing and turning the ComWheel. You can also reload the default names through ***Default Sites***.

Drug list

Edit Drug List: Select the available drugs and the drugs to be displayed in the drug calculator.
Defaults: Return the default drug list.

Changing the user modes

NOTE: If you want to make changes in user modes, we recommend you contact the person responsible for the configuration. When new settings are saved, they should be marked in the "Default Configuration Worksheet." See below for instructions on how to change the modes permanently.

1. Select the user mode you wish to change through **Monitor Setup** - ***Select Mode***.
2. Make necessary changes (sweep speeds, parameter colors, report contents, Normal Screen layout, trends or snapshots etc.). To change a parameter setup, press a parameter key and go to the setup menu. For instructions, see relevant parameter sections. To change alarm limits and volume, press the **Alarms Setup** side panel key. For instructions, see section "Alarms."
3. Confirm changes through **Monitor Setup** - ***Install/Service*** - ***Save Modes*** - ***Save***. You can save the changes also in other modes. If you do not save the changes in the modes, they are temporary and valid only until you discharge a patient or change the mode or until more than 15 minutes has elapsed from the turn-off of the monitor. Entering ***Save Modes*** requires a password, see "Passwords" above.

Changing the start-up mode

1. Select **Monitor Setup** - ***Install/Service*** - ***Save Modes***.
2. Select ***Startup Mode*** - ***1***, ***2***, ***3***, ***4***, ***5*** or ***6***.

Renaming a mode

1. Select **Monitor Setup** - ***Install/Service*** - ***Save Modes***.
2. Select the mode, select ***Name*** and give a new name.

Loading modes

1. Select **Monitor Setup** - ***Install/Service*** - ***Save Modes***.
2. Select ***Load Modes*** and load to/from Menu Card or network.

Changing the waveform sweep speeds

1. Select **Monitor Setup** - ***Sweep Speeds***.
2. Select the parameters and adjust the values. Slow waveforms show the amplitude changes better.

Configuring report contents

1. Select **Monitor Setup** - ***Install/Service***.
2. Select ***Report Setup***.
3. Select what you want to include in the report.

Changing the parameter colors

To change colors for parameter waveforms, digits and trends:

1. Select **Monitor Setup**- ***Install/Service*** - ***Colors***.
2. Select colors for parameters.

Changing the recorder settings

1. Press **Print/Record**.
2. Select ***Record Waveforms*** and select the recorded waveforms, delay, paper speed and length, and select if you wish to record waveforms on alarms.
3. Select ***Record Trends*** and set the numerical trend resolution and trend type, and select the graphical trend recorded in upper and lower field.

Changing the printer settings

1. Select **Print/Record** - ***Print Graphical***.
2. Select the pages to print and how many hours to print on one page.

Changing the Normal Screen layout

1. Press **Monitor Setup** and select ***Screen 1 Setup***:
   - ***Waveform Fields***: Select the displayed waveforms.
   - ***Digit Fields***: Change the contents of a field or turn it off.
   - ***Split Screen***: Select what you wish to display with the waveforms (***ST***, ***Trend*** or ***None***).
   - ***Minitrend Length***: Select the length of the minitrend.

Changing the layout of other pages

You can check the contents of the pages by pressing the **Pages/Views** key. To change the layout of the pages:

1. Press **Monitor Setup**.
2. Select ***Install/Service*** - ***Pages Setup.***
3. Select the page and make the changes.

Changing the display brightness

1. Press **Monitor Setup** and select ***Display brightness***.
2. Select from 10 to 100 %.

Setting the default trend

You can select graphical or numerical trends to be displayed by default.

1. Press **Monitor Setup** and select ***Install/Service*** - ***Trends & Snapshot***.
2. Select ***Default Trend*** and ***Graph*** or ***Num***.

Configuring trend pages

To select the parameters that are displayed on the graphical trend pages:

1. Press **Monitor Setup** and select ***Install/Service*** - ***Trends & Snapshot*** - ***Graphical Trends***.
2. Select the graphical trend page you want to change.
3. Select parameters for fields.

Setting trend length and time scale

1. Press **Pt.Data & Trends**:
   - Select ***Trends*** – ***Graphical*** - ***Time Scale*** and the value.
   - Select ***Trends*** - ***Graphical*** - ***Trend Scales*** and adjust the scales.

Configuring snapshots

To change the snapshot settings, press **Monitor Setup** and select ***Install/Service*** - ***Trends & Snapshot*** - ***Snapshot***:

- ***Field 1 – Field 6***: Select to display waveform, graphical trend or numerical trend. Five fields can be displayed on screen and six fields can be printed.
- ***Create on Alarms***: Select ***YES*** (default) to create automatic snapshots for Tachy, Brady, Art High and Art Low alarms. You can select other arrhythmia alarms to create snapshots through the ***Arrhythmia*** menu, see section “ECG/ST.”
- ***Automatic Print***: Select ***ALL*** to print all the snapshots immediately after creation, ***ALARMS*** to print snapshots created on alarms or ***NO*** to print only on request.

Starting and ending

Preparations

NOTE: Before using the monitor for the first time with batteries, charge the batteries to their full capacity (charging time 3 hours per battery pack).

1. Plug in the measurement modules.
2. Turn on the monitor from the ON/standby key. The monitor performs a self-test to ensure correct functioning.
3. If necessary, change the user mode: Press the **Admit/Discharge** key and select ***Select Mode***.

Modes are preconfigured but if desired, can be changed. Changing the modes is described briefly in section "Setting up the monitor before use." NOTE: Changing the mode also changes settings, such as the alarm limits. For details, see the "Default Configuration Worksheet."

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.

Starting monitoring

1. Prepare the patient connections according to the setup picture in the measurement section. Use only Datex-Ohmeda approved supplies and accessories, see the “Supplies and Accessories” catalog delivered with the monitor. 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** side panel key. Change them, if necessary; see section "Alarms."
5. Start the measurement according to instructions in the measurement section.
6. Enter or load patient data by pressing the **Admit/Discharge** key; see section "Entering and loading patient data.”

The patient admission happens through ***Admit Patient*** selection or automatically when the monitor receives a patient's vital signs. Always observe the monitor and the patient carefully during start-up periods.

During monitoring

To remove a patient temporarily from the monitor, use standby:

1. Disconnect patient cables or the measurement module and ensure that the monitor receives no vital signs and that the NIBP autocycling is turned off.
2. Press the **Admit/Discharge** key.
3. Select ***Standby*** and one of the options.
4. Accept with ***YES***. Alarms are silenced and all the gathered data is saved. New data is not collected.

Retrieving information after standby

If the monitor has been in the standby state:

1. Reconnect patient cables or the measurement module.
2. Press any key or push the ComWheel.
3. Select ***YES*** in the opened ***Contin. Previous*** window.

Alarms are activated. The previous data is retrieved and the monitor starts collecting new data. NOTE: Zero invasive pressure lines.

Ending monitoring

1. Print necessary data: press the **Print/Record** key.
2. Wait until the printing is finished. Then clear the patient data and return the settings, including alarm limits, to their defaults through **Admit/Discharge** - ***Discharge*** - ***YES.***
3. Turn off the monitor from the ON/standby key if the monitor will not be used.
4. Clean the monitor according to the instructions.

Automatic discharge of the patient

The monitor discharges a patient automatically after 24 hours when vital signs for some parameters (ECG, Art, NIBP, SpO_2, Resp and CO_2 (with N-FCREC and N-FC)) are not available. When this happens, all trend data will be cleared and alarm limits set to default values.

Entering and loading patient data

Entering patient data

When you admit a patient, you must enter all relevant data:

1. Press the **Admit/Discharge** key and select ***Admit Patient***.
2. Enter patient data by pushing and turning the ComWheel.

Loading patient data

If the patient has already been admitted on the same or on another monitor, press **Admit/Discharge** and select one of the following:

- ***Contin. Previous***

Select this when the monitor is not connected to the network. This loads the most recent patient trends from the monitor memory when less than 15 minutes has elapsed from the turn-off.

- ***Admit Patient - Patient from Net.***

Select this when the monitor is connected to the network. This loads patient trends from the network. Note that the patient must have been discharged from the monitor less than 72 hours ago.

- ***Admit Patient - Other Networks***

Select this to load patient trends from another network.
When loading trends of patient data without the patient's name or ID, select the data according to time indicated in the message field.

Receiving data from other sites

Once the monitor is connected to the Datex-Ohmeda S/5 Network, you can view and receive data from other monitors in the network.

1. Press the **Pt.Data & Trends** key.

- To receive alarms from other patient sites, select ***Other Patients*** - ***Receive Alarms*** (and the correct network if there are several available).
- To view other patients' vital signs, select ***Other Patients*** - ***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 S/5 FM continuously saves patient data, such as trends. Saving is activated once the patient is admitted. The monitor saves automatically:

- In the monitor memory the most recent patient data up to 72 hours if neither the Data Card nor network is in use.
- In the network the most recent patient data up to 72 hours.
- On the Data Card up to 48 hours of information depending on the data load.

For your notes:

Screen setup

Modifying the screen temporarily

- Press the **Monitor Setup** key and select ***Screen 1 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 you discharge the patient from the monitor. Only time and date settings are stored permanently.

Modifying the screen permanently

You can make permanent changes in the screen setup. This is described briefly in the section “Setting up the monitor before use.” For information on default configuration, refer to the “Default Configuration Worksheet.”

Changing the split screen contents

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

1. Press the **Monitor Setup** key.
2. Select ***Screen 1 Setup***.
3. Select ***Split Screen*** and choose from the options.
   - ***ST*** shows current and reference QRS complexes and ST trends.
   - ***Trend*** shows minitrends beside waveforms.
   - ***None*** shows no split screen.

Changing waveform and digit fields

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

- Press the **Monitor Setup** key.
- Select ***Screen 1 Setup - Waveform Fields*** or ***Digit Fields.***

Note that:

- Waveforms are always evenly spread to fill the entire waveform area. When 3 or fewer waveforms are displayed, the waveforms are displayed in an enlarged format.

– 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.

Alarms

Enabling the alarms

To enable the alarms, connect patient cables. If the alarm source is selected, the alarms are operative also when the measurement is not displayed (except the respiration measurement alarms).

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

Alarm indications

When the monitor is turned on, you will hear a beep: this tells you that the alarm audio signal is working. Also, the alarm LED indicators light up for a few seconds. To check them, see “Cleaning and care:Functioning of the alarms.” You can also check the functioning of the audio signal and alarm light through **Alarms Setup** - ***Alarm Volume*** or ***Alarm Light***.

When an alarm becomes active, messages appear in the order of priority. The alarming measurement value flashes and its background color indicates the alarm category; see the table below. In some cases, there may be a message on the screen giving more detailed information. An audible alarm is also triggered, and the alarm LEDs on the monitor side panel indicate the alarm level. If enabled, also the alarm light flashes red or yellow according to alarm levels, see below.

Alarm categories

The priority depends primarily on the cause and alarm duration.

Visual	Meaning	Tone pattern (selected when the system is configured)	Side panel LED indicators	Alarm light (if enabled)
Red	For life threatening situations	Triple + double beep every 5 seconds or continuous beep --- -- 5 --- --/ -----	red LED lit	flashing red
Yellow	For serious but not life threatening problems	Triple beep every 19 seconds or double beep every 5 seconds --- 19 --- / -- 5 -- 5 --	yellow LED blinking	flashing yellow
White	Advisory	Single beep -	yellow LED lit	dark

Adjusting limits

1. Press the **Alarms Setup** side panel key and select ***Adjust Limits***.
2. Highlight the measurement.
3. Push the ComWheel to open an adjustment window.
4. 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 iCentral if this feature has been enabled in the iCentral configuration.

Adjusting volume

1. Press the **Alarms Setup** side panel key.
2. Select ***Alarm Volume*** and adjust.

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

Alarm light

The S/5 FM has an alarm light, located in the upper right corner of the monitor frame, see page 9. The alarm light can be enabled (default) or disabled through **Monitor Setup** - ***Install/Service*** - ***Installation***– ***Alarm Options***- ***Alarm Light***. When enabled, it flashes red or yellow according to the currently active highest priority alarm.

To adjust the brightness of the light:

1. Press the **Alarms Setup** key.
2. Select ***Alarm Light*** and adjust with the ComWheel. During adjustment the light is on to help you determine a suitable brightness level.

Changing source

For NIBP, P1 and P2 (with E-PSMP) and Temp, you can select which measured values trigger the alarm. One or several alarm sources may be active at a time.

1. Press the **Alarms Setup** side panel 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.

Receiving alarms from other sites

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

1. Press the **Pt.Data & Trends** key.
2. Select ***Other Patients***.
3. Select ***Receive Alarms***.
4. Select the correct network and one of the other sites.

Showing alarm history

- Press the **Pt.Data & Trends** key.
- 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** side panel 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** side panel key, they are pre-silenced for two or five minutes.

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 the **Silence Alarms** side panel key twice. This does not pre-silence the upcoming alarms.

NOTE: If the monitor is connected to the network and the network connection is lost, the silenced alarms are reactivated and the volume level is automatically set to 7.

Reactivating silenced alarms

- Press the **Silence Alarms** side panel key during the silencing period.

The alarm sounds of new alarms are activated. Silenced alarms are active after a two-minute period. Apnea alarm is activated after five breaths.

Silencing audible alarms permanently

1. Press the **Alarms Setup** side panel 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 "Setting up the monitor before use" or the "User's Reference Manual."

Reactivating alarms

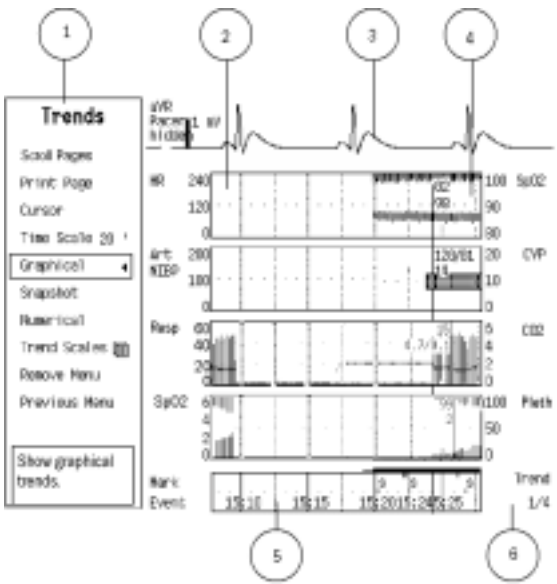
- In ***Alarms Setup*** menu, select ***Audio ON/OFF*** and select ***Activate Alarms***.

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

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

Trends and snapshots

Graphical trend view



Trends view

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

Viewing graphical trends

- Press the **Pt.Data & Trends** key and select ***Trends*** -***Graphical***.
- To see more parameters, select ***Scroll Pages*** and scroll with the ComWheel.
- 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. Five fields can be displayed, and six fields can be printed. Real-time ECG waveform is always displayed at the top of each page.

The graphical trend time scale varies from 20 minutes to 72 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 72 hours, the displayed time period is 72 hours and the resolution is one minute. For HR, ST, PVC, PCWP, SpO_2 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

1. Press the **Pt.Data & Trends** key.
2. Select ***Trends*** - ***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 four pages with the maximum of 72 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 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 400 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/ST" and 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 section "Setting up the monitor before use"). Invasive pressure alarms reach the red level only when there is a simultaneous yellow HR alarm.

Viewing and printing snapshots

To view snapshots:

1. Press the **Pt.Data & Trends** key.
2. Select ***Trends***.
3. 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.
To print snapshots:

1. Press the **Pt.Data & Trends** key.
2. Select ***Trends*** - ***Snapshot***.
3. Select ***Print Page***.

Erasing trends and snapshots

1. Press the **Admit/Discharge** key.
2. Select ***Discharge***.

If the monitor has been turned off from the ON/standby key but the patient has not been discharged, the trend and snapshot data will be stored in the memory for 15 minutes.

Printing and recording

You need

- Laser printer for printouts (PCL5 compatible, min. 2Mb memory, serial or parallel printer; for parallel port printer accessories, see below)
- Optional N-FREC or N-FCREC module for recording
- Thermal paper for the recorder

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

NOTE: A vertical line in the printed trends means that the standby function of the monitor has been activated through menu selections.

Side panel key

Starts and stops recording

Starting and stopping the recording

Use the side panel key to start and stop recording immediately.

Printing with a laser printer

Selecting a printer

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

NOTE: To print directly from the monitor to a parallel port printer, you need the Serial to Parallel Converter, the Converter Interface Cable, the Gender Changer and a parallel printer cable. For detailed information, see the "Supplies and Accessories" catalog delivered with the monitor.

Printing graphical trends

To print graphical trends:

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

Printing patient report

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

Printing currently displayed screen contents

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

To print trend data:

- Press the **Pt.Data & Trends** key and select:
  - ***Trends - Graphical/Snapshot/Numerical - Print Page***

To print calculation trends:

- Press the **Pt.Data & Trends** key and select:
  - ***Calc. Trends - Hemodynamic/Oxygenation - Print Page***

To print ECG and ST data:

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

Recording with the recorder

NOTE: You need the N-FREC or N-FCREC module with the built-in recorder.

Recording numerical trends

You can record the current values of measured parameters.

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

Selecting the format for the recorded numerical trends

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

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

Recording graphical trends

1. Press the **Print/Record** key.
2. Select ***Record Trends*** - ***Record Graphical***.
3. You can stop recording by selecting ***Stop Graphical***.

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 **Pt.Data & Trends** key.
2. Select ***Trends.***
3. Select ***Time Scale*** – ***20 '/1 h/2 h/4 h/6 h/8 h/10 h/12 h/ 24 h/ 36 h/48 h/72 h***.

To select the parameters for the graphical trends:

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

Recording on alarms

1. Press the **Print/Record** 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/Art Low, V Fib, V Tachy; V Run >3 with Extended arrhythmia analysis.

Art and ECG1 waveforms are recorded. Selections are preconfigured.

Recording calculations

1. Press the **Wedge C.O.** key.
2. Select ***Calculations***.
3. Select ***Hemodynamic Calcs*** or ***Oxygenation Calcs.***
4. Select ***Record Calcs***.

Recording waveforms

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

1. Press the **Print/Record** monitor key.
2. Select ***Record Waveforms - Record Wave***.
3. 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 iCentral.
4. Stop recording by selecting ***Stop Wave***.

Changing the paper speed

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

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

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

Laboratory data and calculations

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

Entering laboratory values

1. Press the **Pt.Data & Trends** 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 **Pt.Data & Trends** key.
2. Select ***Lab Data - Load Art Values*** or ***Load Ven Values***.
   NOTE: These selections are available when there are unconfirmed values in the monitor memory.
3. Mark the sampling time.
4. 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_2, PCO_2, pH).

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

1. Press the **Pt.Data & Trends** 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, T1-T2, Eso, Naso, Tymp, Rect, Blad, Core, 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 or oxygenation calculations

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

NOTE: Monitor marks the edited values with an asterisk (*).

Estimated values in oxygenation calculations

Only a couple percent of the total oxygen content is dissolved in the blood. Mixed venous oxygen saturation, SvO_2, can be interfaced from an external SvO_2 monitor. Together with SpO_2 it is used for estimating the SaO_2. 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 **Wedge C.O.** key.
2. Select ***Calculations*** - ***Hemodynamic Calcs*** or ***Oxygenation Calcs***.
3. Select ***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 the recorder:

1. Press the **Wedge C.O.** key.
2. Select ***Calculations*** - ***Hemodynamic Calcs*** or ***Oxygenation Calcs***.
3. Select ***Record Calcs.***

Printing calculations

To print hemodynamic or oxygenation calculations:

1. Press the **Pt.Data & Trends** key.
2. Select ***Calc. Trends*** - ***Hemodynamic*** or ***Oxygenation*** - ***Print Page***.

NOTE: You can also print the calculations through **Wedge C.O.** – ***Calculations – Hemodynamic Calcs*** or ***Oxygenation Calcs – Calc. Trends – Print Page***.

To print all calculations:

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

Drug calculator

The S/5 FM also includes a drug calculator and a titration table, which can be used for determining the correct infusion or drip rates. These values and tables can also be recorded on a bedside recorder or printed on a laser printer.

The drug list used by the calculator can include up to 18 drugs, one of which is always defined ***generic*** and cannot be deleted or renamed. This list is configured through the ***Installation*** menu (for more information, see the "User's Reference Manual").

NOTE: The drug list can be saved to and loaded from the network or Menu Card with the modes. However, it is not mode dependent.

NOTE: Infusion rate calculations may require the patient weight. Enter it by selecting ***Demographics*** in the ***Drug Calcs*** menu.

Performing drug calculations

1. Press the **Pt.Data & Trends** key.
2. Select ***Drug Calculator***.
3. Select ***Calculator - Edit Values***.
4. Enter the data you have available, for example, select the drug, and enter the dose and the infusion time. Make selections with the ComWheel.
5. The monitor calculates all other values.

Titration table

The titration table gives 50 titration values for the selected drug. The monitor displays both infusion rates and drip rates. If required, both the starting dose and the increment steps can be edited through the ***Installation*** menu; for more information, see the "User's Reference Manual."

To have a titration table for a given drug:

1. Press the **Pt.Data & Trends** key.
2. Select ***Drug Calculator***.
3. Select ***Table*** - ***Edit Values***.
4. Enter the data you have available, for example the drug name and concentration, by turning and pushing the ComWheel.
5. The monitor calculates the infusion rate and the drip rate.

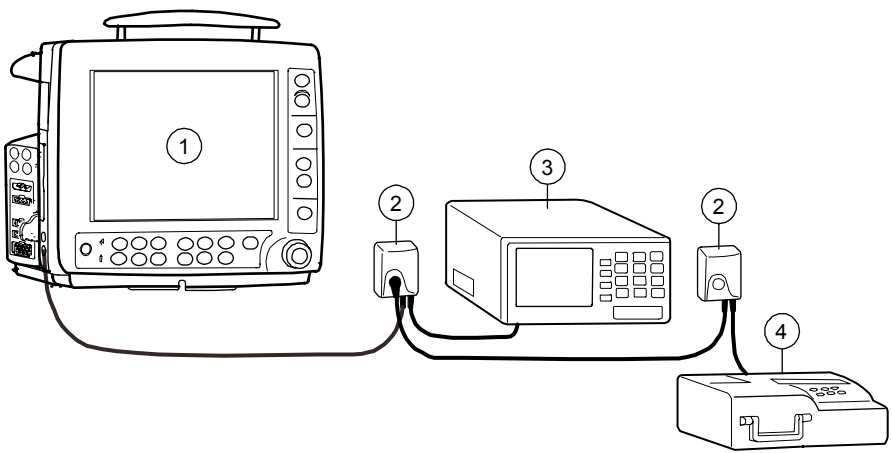
Printing or recording the titration table

In some cases, the titration table may be required near the patient. You can print the table on the recorder in modules N-FREC and N-FCREC, or on a laser printer. The ***Calculator*** and ***Table*** values are both printed at the same time.

1. Press the **Pt.Data & Trends** key.
2. Select ***Drug Calculator***.
   - Select ***Record Calcs*** to print them on the recorder.
   - Select ***Print Calcs*** to print them on a laser printer.

Interfacing external devices

With the Datex-Ohmeda S/5 Device Interfacing Solution, DIS, you can interface simultaneously up to four devices, like monitors and blood gas analyzers, to the Datex-Ohmeda monitoring system. The real-time and trended parameter data can be displayed on the monitor screen and used for calculations. An example of interfacing external devices with the S/5 Device Interfacing Solution:



(1) Datex-Ohmeda S/5 FM

(2) Device specific interfacing module. NOTE: Only version 01 or later is compatible with the S/5 FM

(3) Abbott Laboratories Q-Vue monitor

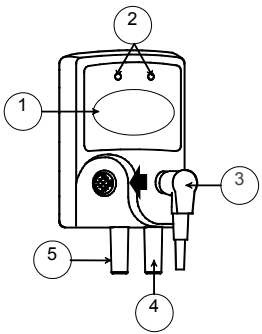
(4) AVL Opti CCA blood gas analyzer

WARNING: Connecting electrical equipment together or using the same extension cord for more than one device may cause their leakage currents to exceed the limits specified in relevant safety standards. Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.

WARNING: The monitor, interfacing modules and interfaced devices must be situated in the same patient environment (as defined in IEC 60601-1-1).

NOTE: For more detailed instructions regarding installation, cables and settings, and supported versions of the interfaced device, please refer to the “User’s Reference Manual” and the "Installation Guide" provided with the interfacing module.

Connecting external devices



(1) Label specifying the external device
(2) LED indicators
(3) Black bus cable to/from another interfacing module if needed
(4) Gray device specific cable: connect to the communication port of the external device
(5) Black bus cable to the monitor's connector for DIS (or to another interfacing module)

WARNING: Make sure that you are connecting the interfacing module to the device specified in the label.

- Turn off the external device you want to interface.
- Connect the gray device specific cable to the external device and the black bus cable to the monitor's connector for the S/5 Device Interfacing Solution, see page 9, or to another interfacing module.
- Turn on the external device.

NOTE: The status message 'Connected' appears on the ***Status Page*** of the ***Interfacing*** menu after you have connected the external device to the interfacing module and turned it on. Note also that the monitor and the interfacing module must be operational.

CAUTION: Make sure that the interfacing module is always used in vertical position to prevent water from entering the module.

Checking the functioning of the S/5 DIS

You can check the functioning of the S/5 DIS in two ways:

1. Press the **Monitor Setup** key and select ***Interfacing*** - ***Status Page***. The ***Status Page*** shows you the current communication status of the interfacing modules connected to the bus (1 - 4 pcs).
2. Check the LED indicators on the interfacing module:

GREEN	YELLOW	INDICATION
lit ●	dark ○	Physical connections between the monitor, interfacing module and external device are in order. The device has been selected in the menu.
dark ○	lit ●	There is something wrong with the physical connections between the monitor, interfacing module and external device. The external device has not been selected in the menu, see the "User's Reference Manual."
lit ●	lit ●	Physical connections between the monitor, interfacing module and external device are in order but the external device has not been selected in the menu; see the "User's Reference Manual."
dark ○	dark ○	The interfacing module is not connected to the monitor

Selecting the external device

- Press the **Monitor Setup** key and select ***Interfacing.***
- Select the desired measurement parameter group (like SvO_2).
- Select the connected external device by its name.

NOTE: The device appears on the list only if it is correctly connected.

Cleaning and care

Daily and between patients	Every two months	Every six months
• Wipe the monitor and module surfaces. • Wipe the ECG trunk cable, NIBP cuff and cables and SpO_2 sensors. • Change or sterilize all airway and invasive patient accessories. • Clean, disinfect or sterilize reusable temperature probes. • Check that the accessories, cables and monitor parts are clean and intact.	• Refresh the batteries, see below.	• Perform gas calibration, see below.
Permitted detergents	**Permitted disinfectants**	**DO NOT!**
– Datex-Ohmeda Cleaning Fluid – Other mild detergents	– Ethanol – Isopropyl alcohol – Chlorite compounds – Glutaraldehyde	• Do not use hypochlorite, acetone-, phenol- or ammonia based cleaners. • Do not autoclave the device or its parts. • Do not immerse any part of the device in liquids or allow liquid to enter the interior. • Do not apply pressurized air to any outlet or tubing connected to the monitor.
NOTE: For details about cleaning, disinfecting and sterilizing the accessories, see the instructions for use in the accessory package or the “Supplies and Accessories” catalog.		

Before cleaning

1. Turn off the monitor from the ON/standby key.
2. Disconnect the power cord.

After cleaning

1. Let dry completely.
2. Reconnect the power cord and turn on the monitor.

More comprehensive checking

See the “Technical Reference Manual.”

WARNING: After cleaning or if liquid has accidentally entered the monitor, ensure that every part of the monitor is dry before reconnecting it to the power supply.

Water trap in the N-FCREC and N-FC modules

- Empty the container whenever half full.
- Change the water trap every two months and when the text ‘Replace D-Fend’ appears.
- The water trap cartridge is disposable. Do not wash or reuse the cartridge.

Other accessories

For information on how to clean and check reusable accessories, see the accessory package or the “Supplies and Accessories” catalog. Do not reuse single-use disposable accessories.

Conditioning the batteries

Condition batteries regularly to maintain their useful life. Condition a battery every six months or when the message ‘Replace Battery A’ appears on the screen. Always observe the messages and symbols on the screen to see the battery status. You can also check the status through **Monitor Setup** – ***Battery Setup***. For more information, see sections "Replacing the batteries", "Symbols" and "Messages."

Conditioning a battery is best done on an external charger. To do this, please, refer to the "User’s Reference Manual."

Power interruption

NOTE: Always use the S/5 FM with batteries inserted. Otherwise all trend data, snapshots and temporary settings are lost if the power cable is detached from the mains.

If the monitor is in standby or turned off, trend data and the latest user-made settings remain in the monitor memory for 15 minutes even if the mains power is interrupted. After 15 minutes, trend data is lost and the monitor returns to the user default settings (start-up mode).

Changing fuses

1. Remove the power cord if used.
2. Remove the fuse holder by pushing the locking pin and pulling the holder gently out, see also page 10.
3. If a fuse is blown, replace it with a fuse of the correct type and rating.

Regular checks

ECG

- Check that the ECG waveforms are displayed when the cable is connected to the patient. When the cable is disconnected from the patient, the message '**Leads off**' is displayed.

Impedance respiration

- Check that the impedance respiration waveform is displayed when the cable is connected to the patient. When the cable is disconnected from the patient, the message '**Leads off**' is displayed.

Pulse oximetry

- Check that the sensor is functioning when connected to the measurement site.
- Check that the SpO_2 value is displayed. When the sensor is disconnected from the patient, the message 'SpO2 probe off' is displayed.

Temperature

- Check that the temperature value is displayed when the probe is connected to the patient.

InvBP

- Check that the monitor recognizes cable connections (activates the display) for all the pressure channels used and the pressure values are shown.
- Make sure that the zeroing of all the transducers is working correctly. The message '**No P1 transducer**' or '**No P2 transducer**' is displayed when the invasive pressure transducer or channel P1 – P2 cable is disconnected.

NIBP

- Ensure that you are using correct cuff size and have selected correct inflation limits.
- Check that the cuff hose detection (Adult/Infant) works properly.
- Check that the pump is not restarting in Venous Stasis mode. If it does, there may be a leakage in the cuff.
- Check that the pressure values are displayed.

Airway gases

- Check that the 'Sample line blocked' message appears within 30 seconds after you have occluded the airway adapter, and gas waveforms are showing zero at the same time.
- Check that the water trap is empty.

Functioning of the alarms

- Set a parameter value outside the alarm limits. For example, connect the SpO_2 sensor and adjust the SpO_2 High limit under the measured SpO_2values. The alarms go from white to red according to sequence given in the "Alarm categories" table on page 34.
- Check that the yellow and red LEDs function as indicated in the table.
- Check that the alarm light functions if it is enabled, see page 35.

You can also use the same method for checking other parameters, such as ECG and CO_2.

Calibrating

Calibration check of temperature, NIBP and invasive blood pressures

Calibration check of temperature, NIBP and invasive blood pressures should be performed at least once a year by qualified service personnel as a part of the Planned Maintenance, see the “Technical Reference Manual."

Calibrating airway gases

Follow the recommended calibration intervals (every six months in normal use and every two months in continuous use) to ensure that the measurement accuracy remains within specifications.

NOTE: % is used for CO_2 regardless of selected units.

NOTE: See the “Supplies and Accessories” catalog delivered with the monitor for correct regulator and gas.

NOTE: Ensure that the calibration gas and regulator are functioning properly before calibration. Perform annual maintenance on the regulator as required.

NOTE: Calibrate the N-FCREC or N-FC module with calibration gas 755580 only and set the O_2 concentration to 20%.

1. Turn on the power. Let the monitor warm up for 30 minutes.
2. Attach a regulator to the calibration gas container.
3. Attach a new sampling line to the water trap. Connect the other end of the sampling line to the regulator on the gas container.
4. Press the **Airway Gas** key and select ***Gas Calibration***.
5. Wait until the texts ‘Zero OK’ and then ‘Feed gas’ appear on the screen, open the regulator and start feeding gas. Push the ComWheel and continue feeding gas until the text ‘Adjust’ is displayed.
6. Check that the displayed gas values match the values on the calibration gas container. Adjust with the ComWheel, if necessary.

ECG/ST

You need

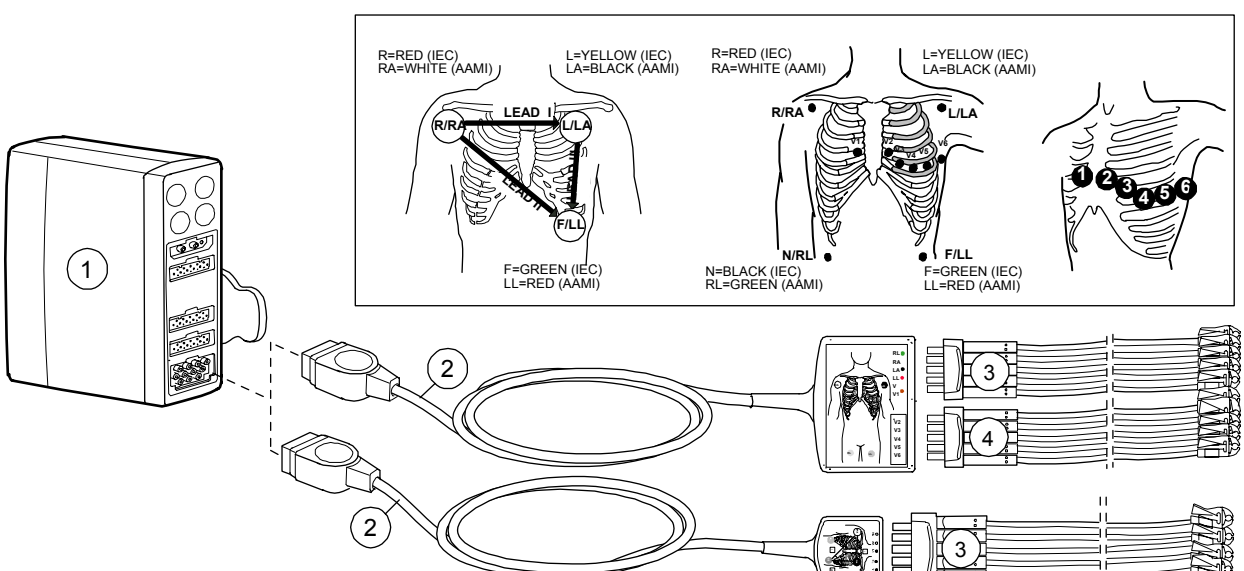
(1) E-PSM or E-PSMP module
(2) Multi-Link 5-lead or 12-lead standard cable
(3) Multi-Link leadwire set (3 or 5 leads)
(4) Multi-Link leadwire set (C2-C6 IEC, V2-V6 AHA)

NOTE: For 3-lead ECG, you can also use the Multi-Link 3-lead ECG cable with integrated leadwires.
ECG electrodes (pre-gelled electrodes are recommended).
Check the expiration date.

NOTE: For a comprehensive list of accessories, see the “Supplies and Accessories” catalog delivered with the monitor.

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.

WARNING: Vibrations during intrahospital transport may disturb ECG measurement.



Connecting ECG leadwire sets to ECG trunk cables

- For 3-lead ECG, connect the Multi-Link 3 leadwire set to the 5- or 12-lead standard cable. You can also use the Multi-Link 3-lead ECG cable with integrated leadwires.
- For 5-lead ECG, connect the 5 leadwire set to the 5- or 12-lead standard cable.
- For 12-lead ECG, connect the 5 leadwire set together with the C2 – C6 or V2 – V6 leadwire set to the 12-lead standard cable.

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

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[(1)] 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[(2)] line, same horizontal level as V_4 and V_5.

[(1)] Midclavicular line = A line that runs vertically downward from the midpoint of the clavicle.

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

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 ***5-lead Cable*** - ***3elect*** or ***5elect***.

With 12-lead ECG, the electrode selection is automatic.

Selecting the user leads

1. Press the **ECG** key.
2. Select a lead for ***ECG1 Lead***, ***ECG2 Lead*** or ***ECG3 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 1 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 Lead/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** or **Pages/Views** and select ***ECG View*** (available only with 5- and 12-lead ECG).

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

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 from ***0*** *to* ***10***.

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

Selecting what to display with HR

You can 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** or **Pages/Views** 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 causes false positive pacer detection.

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 possible 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.

For your notes:

Arrhythmia monitoring

NOTE: For optimal results, select ***STfilt*** as the ECG filter. For details, see page 55.

Selecting arrhythmia analysis mode

NOTE: With the L-FICU03 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.
   Extend 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 V Tachy alarm 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 iCentral if the iCentral configuration allows it.

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 Lead, ECG2 Lead, ECG3 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

NOTE: A clinician must analyze the arrhythmia information in conjunction with other clinical findings.
For details about detection performance and test results of the arrhythmia algorithm testing, please refer to “User’s Reference Manual: ECG.”

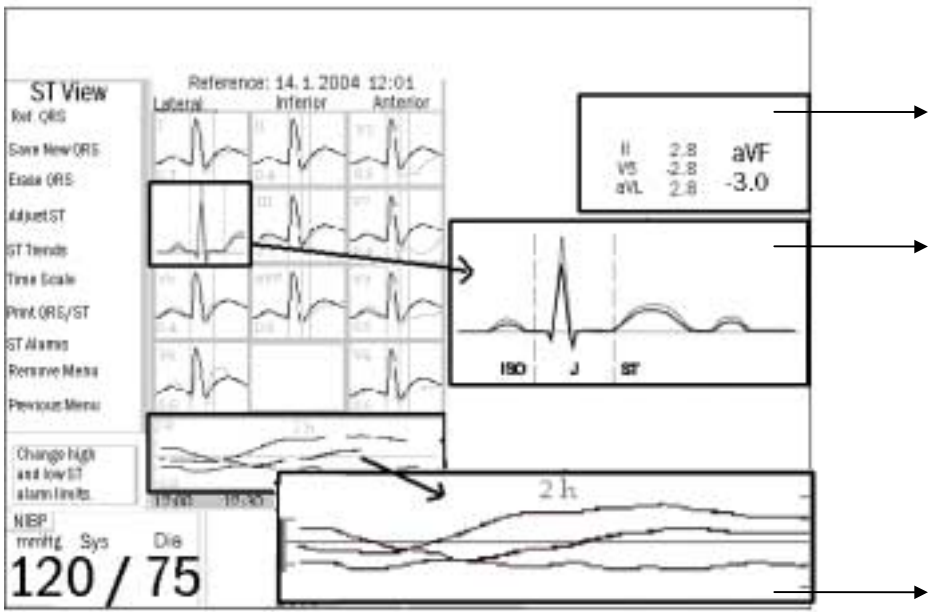
Alarm	Criteria
Asystole	Cardiac arrest, no QRS complexes for five seconds
Bradycardia	HR below the HR alarm limit
Frequent PVCs	PVCs per minute above the alarm limit
Missing Beat	Actual RR rate interval more than 1.8 times the average RR interval
Multif. PVCs	Over the last 15 beats two or more premature ventricular beats with different morphologies are detected
R on T PVC	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
Tachycardia	HR over the HR alarm limit
Ventricular bigeminy	The following pattern is detected: N, V, N, V, N, V where N = normal, V = PVC (every other beat is a PVC)
Ventricular couplet	Two consecutive ventricular beats, preceded and followed by a normal beat
Ventricular fibrillation	Fibrillatory waveform caused by ventricular fibrillation
Ventricular run	Three or more consecutive PVCs and rate of successive beats over 120 bpm
Ventricular tachycardia	Six or more consecutive PVCs and rate of successive beats over 120 bpm
Ventricular trigeminy	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.

NOTE: The significance of the ST segment changes needs to be determined by a clinician.



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.

ST View

To get the ST View on screen:

1. Press the **ECG** or **Pages/Views** key.
2. Select ***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

Viewing ST in split screen

- Press **Monitor Setup** and select ***Screen 1 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** or **Pages/Views** 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** or **Pages/Views** 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** or **Pages/Views**, and select ***ST View - ST Trends - Time Scale***.

Displaying ischemic burden in ST Trends

NOTE: Available only if the ***Isch. 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 in a waveform or a 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 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 Setup***.
3. Select ***Size*** and adjust the waveform size.

For more information, see the “User’s Reference Manual.”

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 Setup - Detection Limit***.
3. Adjust the limits.

WARNING: This device is not an apnea monitor system intended to alarm primarily upon the cessation of breathing. In central apnea it indicates an alarm after a pre-determined time since the last breath detection. Do not attempt to use it for detecting obstructive or mixed apneas, since respiration movements and impedance variations may continue in these cases.

WARNING: Vibrations during intrahospital transport may disturb impedance respiration measurement.

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.

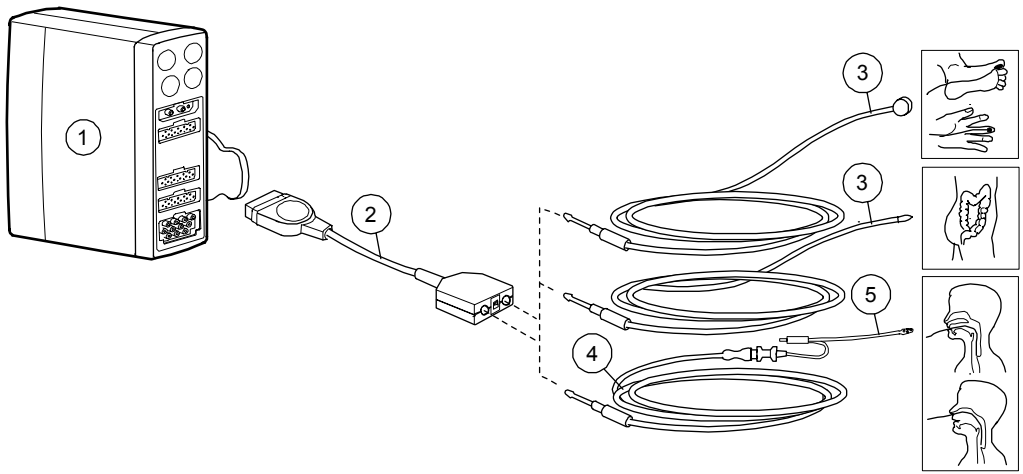
WARNING: The impedance respiration measurement may cause rate changes in Minute Ventilation Rate Responsive Pacemakers. Set the pacemaker rate responsive mode off or turn off the impedance respiration measurement on the monitor.

Temperature

(1) E-PSM or E-PSMP module
(2) Adapter cable for temperature probes
(3) Reusable temperature probe
(4) Adapter cable for disposable temperature probes
(5) Disposable temperature probe

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

NOTE: For a comprehensive list of accessories, see the “Supplies and Accessories” catalog delivered with the monitor.



Changing temperature label

1. Press the **Others** key.
2. Select ***Temp Setup*** - ***T1 Label*** or ***T2 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 ***Temp Setup***.
2. Select ***Unit*** and then ***°C*** or ***°F*** with the ComWheel.

Combining different temperatures

The monitor displays the difference between different temperatures if you display them in the same digit field.

For example, to display ***Tblood*** - ***T1***:

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

Pulse oximetry

You need

(1) E-PSM or E-PSMP module

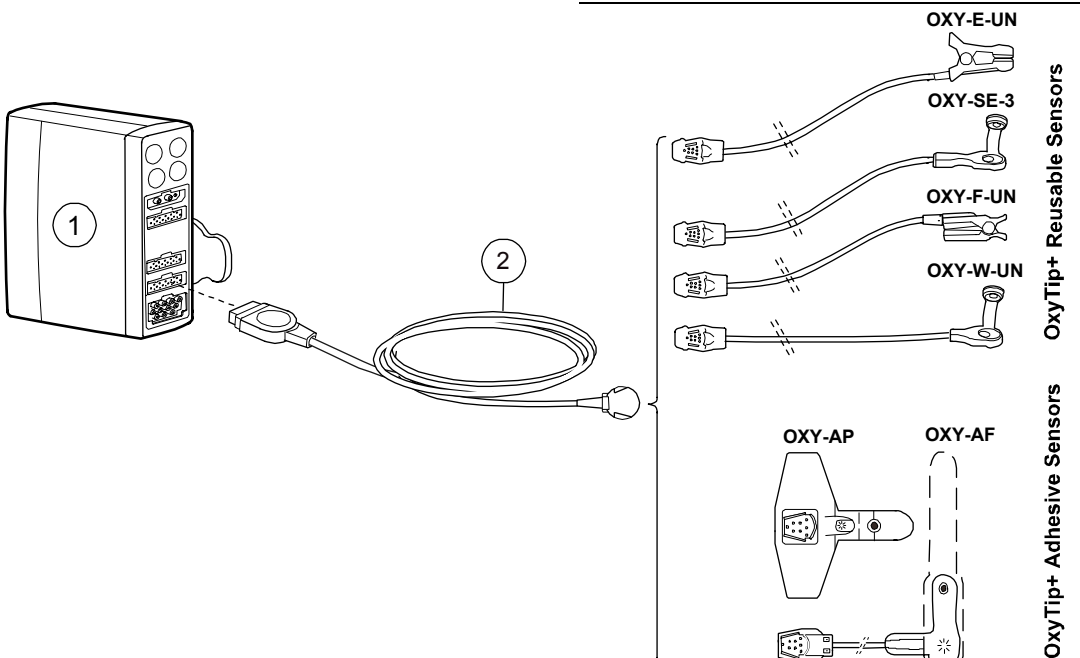
(2) OxyTip+ interconnect cable

NOTE: For a comprehensive list of accessories, see the “Supplies and Accessories” catalog delivered with the monitor.

NOTE: For each SpO_2 accessory, refer to the instructions for use in the accessory package for patient weight limits.

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

WARNING: Vibrations during intrahospital transport may disturb SpO_2 measurement.



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 bedclothes 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, sensor cables or modules. Discard a damaged sensor or sensor cable 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_2 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_2).

Displaying pulse rate

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

1. Press the **Others** key and select ***SpO2 Setup***.
2. 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_2 sensor to a limb that is used for non-invasive blood pressure measurement or for administrating 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_2 settings

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

1. Press the **Others** key.
2. Select ***SpO2 Setup*** and ***Beat Sound Volume, Pleth Scale*** or ***SpO2 Response***.

NIBP

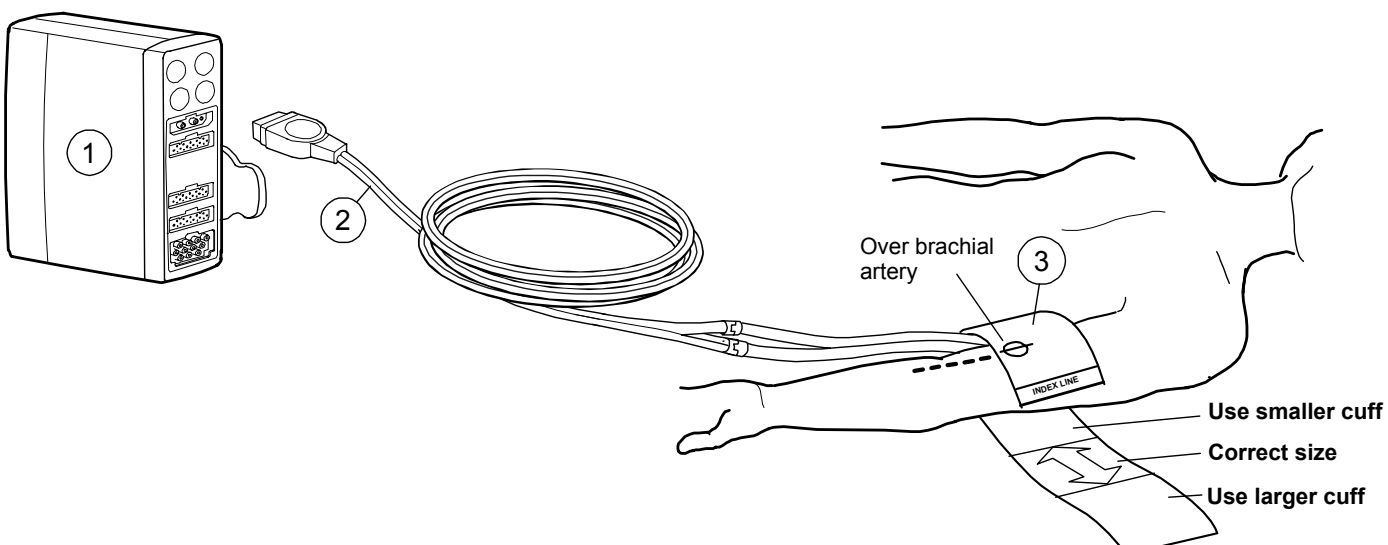
You need

(1) E-PSM or E-PSMP module
(2) Cuff hose
(3) Cuff of correct size

NOTE: For a comprehensive list of accessories, see the “Supplies and Accessories” catalog delivered with the monitor.

WARNING: Vibrations during intrahospital transport may disturb NIBP measurement.

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 and when using hoses without identification, the inflation limit must be set manually. To do this:

1. Press the **NIBP** key and select ***NIBP Setup*** - ***Inflation Limits***.
   NOTE: When using hoses without identification, the monitor goes to this selection automatically when you press the **NIBP** key. With these hoses, ***AUTO*** option is not available.
2. Select the limit according to the hose with the ComWheel.

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 **NIBP** key and select ***Start STAT***.

During measurement

- Observe the cuffed limb frequently. Measurement may impair blood circulation. Intervals below 10 minutes and STAT measurements are not recommended for extended periods of time.
- 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: When 30 minutes has passed from the latest NIBP measurement, the numeric value turns gray.

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 the "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

1. Press the **NIBP** key.
2. Select ***Start Ven.Stasis***.

Inflation limit		Venous stasis pressure	Venous stasis time
Infant	145 ±5 mmHg	30 ±5 mmHg	1 min
Child	200 ±10 mmHg	40 ±5 mmHg	2 min
Adult	280 ±10 mmHg	40 ±5 mmHg	2 min

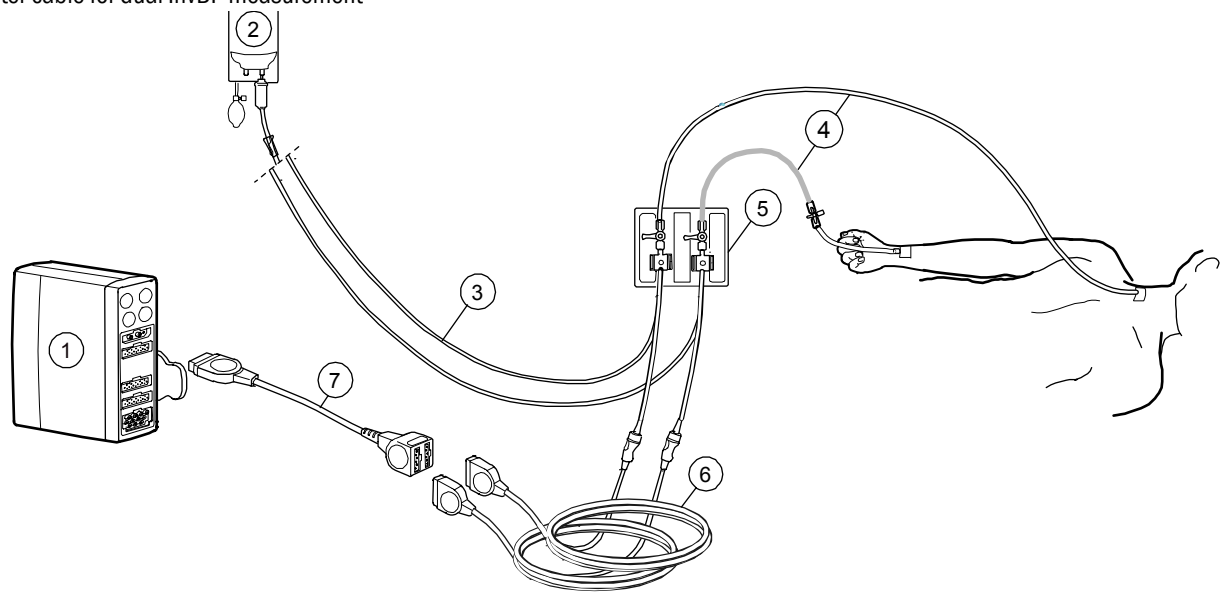
WARNING: The monitor sets the inflation pressure automatically according to the previous measurement. Discharge the patient from the monitor to reset the inflation limit before measuring a new patient.

Invasive blood pressure

You need

(1) E-PSMP module with InvBP measurement capability
(2) Heparinized fluid bag with pressure infusor
(3) Flushing set
(4) Line from arterial or central vein to the transducer
(5) Transducer
(6) Adapter cable for the InvBP transducer
(7) Adapter cable for dual InvBP measurement

You can monitor up to two pressure channels with the E-PSMP module by using a dual cable.
NOTE: For a comprehensive list of sensors and accessories, see the “Supplies and Accessories” catalog delivered with the monitor.
NOTE: Invasive pressures need to be zeroed after reconnecting the pressure transducer or cable, and whenever patient’s position is changed. If all channels have not been zeroed, the message ‘InvBP's not zeroed’ appears. The invasive pressure alarms advance to yellow and red levels regardless of the zeroing.



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, or zero one channel at a time with the module keys **Zero P1** and **Zero P2**. Zero each channel. NOTE: The transducer is always leveled to the mid right atrium. Zero the transducer and pressures whenever the patient's position is changed.
- Open the line to the patient.

Labeling channels

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

To change the label:

1. Press the **Invasive Pressures** key.
2. Select ***P1 Setup - Label***.

Factory default descriptions

The channels have the following factory default descriptions:

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

Combining pressures

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

1. Press the **Monitor Setup** key and select ***Screen 1 Setup***.
2. Select ***Waveform Fields***.

- To combine all pressure waveforms in one field, select ***Combine Pressures*** and ***YES***.

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. The cursor is not available for pressures shown with a combined scale.

1. Press the **Invasive Pressures** key.
2. Select ***P1 Setup*** - ***P1 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 values appear on the screen. This way, you can keep track of the changes made.
4. You can remove the cursor by selecting ***Remove Cursor***. Note that if the cursor is not removed, it remains visible on the Normal Screen.

Pulmonary Capillary Wedge Pressure (PCWP)

Starting

1. Prepare the pulmonary artery catheter 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 – Contrl*** (controlled ventilation) or ***Spont*** (spontaneous breathing).
4. Press the **Invasive Pressures** key and select ***Wedge Pressure***.
5. Select ***Measurement***.
6. When 'Inflate the balloon' is displayed, inflate the catheter balloon. The monitor automatically freezes the waveform for 20 seconds.
7. 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: Vibrations during intrahospital transport may disturb InvBP measurement.

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.

Airway gas

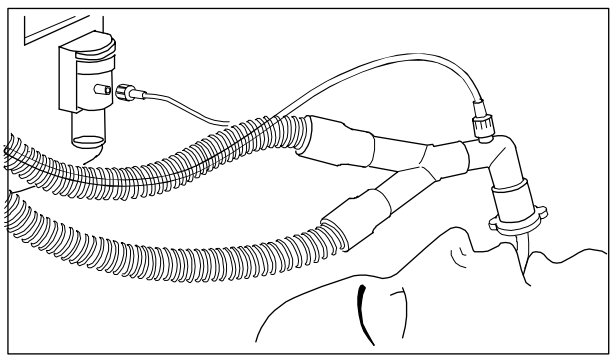
You need

- N-FCREC or N-FC module with CO_2 measurement capability
- Gas sampling line
- Airway adapter with sampling line connector
- Water trap

You get

Carbon dioxide measurement: $EtCO_2$, $FiCO_2$, capnogram.
Respiratory rate

NOTE: For a comprehensive list of accessories, see the “Supplies and Accessories” catalog delivered with the monitor.



Starting

- Connect the gas sampling line to the airway adapter and to the module.
- Before connecting the patient, check that the message 'Calibrating gas sensor' is no longer on the screen.
- Position the adapter with the sampling port upwards. This prevents any condensed water from entering the sampling line.
- If N-FCREC or N-FC is used with O_2 and/or N_2O contents higher than 40%, make sure that ***FiO2 Level*** and ***N2O Level*** is set accordingly in **Airway Gas** – ***CO2 Setup*** to enable O_2 and/or N_2O compensation.

During monitoring

- Empty the water trap container when half full.
- Disconnect the airway adapter during nebulization of medications.

NOTE: When the measured CO_2 value is outside the specified measurement range, the numeric value is gray.

Waveform scaling

If $EtCO_2$ is above 6% or the difference between FiO_2 and EtO_2 is above 6%, change the scale for capnogram:

1. Press the **Airway Gas** key.
2. Select ***CO2 Setup***.
3. Select ***Scale.***

Changing the units

You can use %, kPa or mmHg as the CO_2 measurement units. The units can be changed in the CO_2 setup menu:

1. Press the **Airway Gas** key.
2. Select ***CO2 Setup*** - ***Unit*** and choose the option.

Points to note

- Do not return the sample gas to the patient circuit.
- All accessories including the water trap are for single use only.
- Calibrate the airway gas module every sixth months, see section "Cleaning and care."

Troubleshooting

NOTE: Always check the patient's condition first in problematic situations or if an alarm is triggered. See also section "Messages." Also note that if the measurement or function does not appear on the screen, check module connections.

PROBLEM RELATED TO:	CAUSE	WHAT TO DO
Airway gases	Airway gas values are too low	• Check the sampling line and connectors for leakage.
Arrhythmia	Extra arrhythmia are detected	The morphology of the ECG signal has changed. • Start relearning manually through **ECG** - ***Relearn***.
	Extra Ventricular Fibrillations are detected	Patient's medical condition. • Check the patient. Low amplitude signal in some ECG leads. • Leads I and II: Select the one with the largest amplitude to ECG1. • Leads C1-C6 (V1-V6): Select the one with the largest amplitude to ECG2. • After selecting the leads, start relearning manually.
Batteries	Battery operation time is markedly shortened	• Condition batteries (see section "Conditioning the batteries").
ECG	ECG signal is noisy or no QRS is detected	• Ensure that the patient is not shivering. • Select the correct filter by pressing **ECG** and selecting ***ECG Setup - Filter.*** • 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. • Change the lead. • Remove the ECG cable from the module and reinsert it.
Impedance respiration	Respiration measurement fails	• Check electrode quality and positioning. • Adjust the detection limits. During ventilator-supported breathing, the respiration calculation may count only ventilator-produced inspirations and expirations. • Other electrical devices may interfere with the measurement.

PROBLEM RELATED TO:	CAUSE	WHAT TO DO
Invasive pressures	InvBP readings seem unstable	• Make sure there are no air bubbles in the transducer system. Flush and zero. • Place the transducer on the patient's mid-heart level and zero.
Monitor, measurements, printing, recording	The monitor does not start	• For battery operation, check that the batteries are inserted and charged, see page 13. • Check that the power cord is properly connected. • Check the fuses and replace them if necessary (see section "Cleaning and care.")
	The measured values are not displayed	• Check that you have selected the desired parameter to a waveform or digit field; see section "Screen setup."
	You cannot perform a measurement or a function	• Check that the measurement module is properly installed. • Remove the module and reinstall it.
	Printing is not possible	• Printer selection is ***None***; change it through **Print/Record** – ***Printer Connection***. • Printer is not connected to the network. Check printer cable.
	Recording is not possible	There is no N-FREC or N-FCREC module connected. • Connect an N-FREC or N-FCREC module.
Non-invasive blood pressure	NIBP measurement does not work or values seem unstable	• Check that cuff tubings are not bent, stretched, compressed or loose. • When using hoses without identification, make sure that you have selected the inflation limits in the ***NIBP Setup*** menu, see section "NIBP." • Prevent motion artifacts. • Use cuffs of correct size.
Pulse oximetry	SpO_2 signal is poor	• Check the sensor position. • Change the averaging time from slow to normal. • Note that skin pigment causes differences. • Make sure that the patient is not shivering.
Temperature	Temperature measurement fails	• Check that you are using a correct probe. • Try another probe.

Messages

MESSAGE	CAUSE	WHAT TO DO
Air leakage	NIBP: There is an air leak in the cuff or hose.	Check all connections and test tightness using venous stasis.
Alarms acknowledged from Central	Silenced alarms remain silent. New alarms will have an audible sound. (Can also be done using the iCentral).	If required, turn on the alarms through **Alarms Setup** – ***Audio ON/OFF – Activate Alarms***.
Alarm setup changed from Central	Alarm limits or arrhythmia alarm priorities have been changed using the iCentral.	Check the alarm limits and the arrhythmia alarm priorities – see sections "Alarms" and "ECG."
Alarms silenced from Central	Alarms have been silenced using the iCentral.	If required, turn on the alarms through **Alarms Setup** – ***Audio ON/OFF – Activate Alarms***.
Apnea	No breath detected for 20 seconds (respiration or CO_2 measurement).	Check the patient status. Check the ventilator and breathing circuit.
Apnea deactivated	Apnea alarm is silenced but will activate after five breaths.	If required, turn on the alarms through **Alarms Setup** – ***Audio ON/OFF – Activate Alarms***.
Artifacts	Patient movements, shivering, deep breathing, arrhythmia or irregular beats may cause some measurements to fail.	Calm the patient. Start a new measurement, if applicable.
Asystole	No QRS detected in ECG.	Check the patient status. Check the electrodes.
Batt. low	About 20 minutes of battery operating time left.	Replace the battery, see section “Replacing the batteries”, or connect the monitor to the mains.
Brady	HR is equal to or below the lower alarm limit.	Check the patient status.
Calibr.error	Gases: Unsuccessful gas calibration.	Perform a new calibration.
Check D-Fend	Gases: The water trap connection is wrong.	Check that the water trap is properly attached to the module.

MESSAGE	CAUSE	WHAT TO DO
Check NIBP	NIBP measurement affected by low blood pressure and pulsation, or a change in patient's condition.	Check patient status, measurement setup and cuff.
Check probe	SpO_2: There is no detectable SpO_2 signal, the sensor is faulty or it is detached from the patient.	Check the sensor and connections.
Check sample gas out	Gases: Sample gas outlet is blocked.	Remove blockage.
Condition Battery A Condition Battery B	Battery no longer holds its charge.	Condition the battery according to instructions of the external charger.
Cuff loose	NIBP cuff is not attached to patient, it is too loose or the hose is not connected to module.	Check cuff and hose.
Cuff occlusion	NIBP tubes or hose kinked.	Check tubes and hose.
Cuff overpressure	NIBP cuff is squeezed during measurement.	Check NIBP cuff, hose and tubes. Restart.
EEPROM error or EPROM error	Memory checking failed.	Contact authorized service personnel.
Gas measurements removed	Gases: The N-FREC or N-FCREC module has been removed.	Reconnect the module if you want to restart the CO_2 measurement.
Identical modules	Another module measuring the same parameter is already installed in the system.	Remove the other module. Note that you can only use one E-PSM(P) and/or one N-Fx module at a time.
Infl. limits! Check setup	NIBP: Adult or child cuff is used but infant inflation limit is selected.	Check cuff and inflation limits.
InvBP's not zeroed	InvBP: One or both channels have not been zeroed.	Zero the channel indicated or zero both channels.
Leads off	ECG trunk cable, all leadwires or neutral electrode (RL/N) are disconnected. Offset voltage between two electrodes is too high.	Reconnect the disconnected electrode or leadwire.
Low perfusion	SpO_2: Signal is weak possibly because of low perfusion.	Change measuring site.
MVexp << MVinsp	Exhaled volume is markedly smaller than inhaled.	Check the whole system for leakages.
Network down: xxx (XXX = network name)	Network cable is not connected. If the monitor is used with WLAN option, it is in shadow region and not connected to the network. S/5 iCentral is shut down.	Check the cable. Check signal strength. If it is ok, check the iCentral. Check the iCentral.

MESSAGE	CAUSE	WHAT TO DO
NIBP manual	NIBP: Air leak or loose cuff have interrupted the autocycling mode	Check setup and restart autocycling.
No battery backup	There are no batteries or they have both failed.	Replace the batteries; see section “Replacing the batteries.”
Noise	ECG: Unreliable HR calculation or distorted waveform, may occur during defibrillation or because of motion artifacts.	Check the patient status. Check the electrodes.
No SpO2 probe	SpO_2: The probe is not properly connected to the module.	Check connection between sensor and module.
No SpO2 pulse	SpO_2: Pulse signal is poor.	Try other measuring sites.
No P1 transducer	InvBP: Invasive blood pressure transducer or channel x cable disconnected.	Connect the transducer or the cable.
Poor signal	SpO_2: Pulse signal is poor possibly because of low perfusion.	Change measuring site.
'PSM' measurements removed	Measurement module has been removed.	Reconnect the module if you want to restart the measurement.
RAM error	Memory checking failed.	Contact authorized service personnel.
Recorder module removed	The N-FREC or N-FCREC module has been removed.	Reconnect the module if you need a recorder.
Replace Battery A Replace Battery B	There is hardly any charge left in one of the batteries. Also check the symbol on screen.	Replace the battery as soon as possible; see section “Replacing the batteries.”
Replace D-Fend	Gases: The water trap is partially blocked.	Replace the water trap.
Sample line blocked	Gases: The gas sampling line is blocked or the water trap is occluded.	Change sampling line and water trap.
Select inflation limits	NIBP: You are using a hose without an automatic identification. When you try to start the measurement, the monitor goes automatically to the selection ***NIBP Setup*** - ***Inflation Limits***.	Select appropriate inflation limits. NOTE: ***AUTO*** option is not available for these hoses.
Sensor INOP	Gases: The gas measuring sensor is inoperative or the temperature in the module has increased.	Contact authorized service personnel.

MESSAGE	CAUSE	WHAT TO DO
SpO2 probe off	SpO_2: 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.
SRAM error	Memory checking failed.	Contact authorized service personnel.
Tachy	HR is equal to or above the higher alarm limit.	Check the patient status.
Temperature error	The self-check has found an error in the temperature measurement.	Contact authorized service personnel.
Unable to measure Dia	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.
Unable to measure Sys	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.
Unstable zero pressure	NIBP: Pressure is unstable at start of the NIBP measurement.	Calm the patient and retry.
Weak pulsation	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 leak.	Check the patient status. Check the cuff position and attachment. Check that the cuff is not damaged.
'X' disconnected from module	DIS: External device is turned off or communication between the interfacing module and external device has failed.	Check connections.
'X' module removed	DIS: Communication between the interfacing module and monitor has failed.	Check connections.
x-Lead off	ECG: One of the ECG leadwires is off.	Check the leadwires and their connections.
xxx high/low	Measured value exceeds the alarm limit.	Check the patient's condition. Adjust alarm limits.
Zero error	Gases: Zeroing during gas calibration failed.	Repeat the procedure.
> 4 devices interfaced	DIS: There are more than four interfacing modules connected to the bus.	Reduce the number of modules.

'X' = the name of the interfaced device or measurement parameter.

Abbreviations

/min	beats per minute, breaths per minute
°C	Celsius degree
°F	Fahrenheit degree
µg	microgram
A	alveolar
A	arm (describing location)
a	arterial
a/AO_2	arterio-alveolar PO_2 ratio
AA	anesthetic agent
$AaDO_2$	alveolo-arterial oxygen difference
AAMI	Association for the Advancement of Medical Instrumentation
ABG	arterial blood gases
ABP	arterial pressure
ADU	Anesthesia Delivery Unit
AEP	auditory evoked potential
AirW	airway temperature
Alpha, Al	alpha frequency band
AM	Anesthesia Monitor
Amp	amplitude
Ant.	anterior
APN	apnea
Arrh.	arrhythmia
Art	arterial pressure
ASY	asystole
ATMP	atmospheric pressure
ATPD	atmospheric/ambient temperature and pressure, dry gas
ATPS	ambient temperature and pressure, saturated gas
aw	airway
AV	atrioventricular
aVF	left foot augmented lead
Avg.	average
aVL	left arm augmented lead
aVR	right arm augmented lead
Axil	axillatory temperature
BAEP	brainstem auditory evoked potential
Bal	balance gas
bar	1 atmosphere
Beta, BE	beta frequency band
Bigem.	bigeminy
BIS	bispectral index
Blad	bladder temperature
Blood	blood temperature (C.O. measurement)
Body	body temperature
BP	blood pressure
Brady	bradycardia
BSA	body surface area
BSR	burst suppression ratio
B-TO-B	beat-to-beat
BTPS	body temperature and pressure, saturated gas
c	calculated/derived value
C	chest
C(a-v)O_2	arteriovenous oxygen content difference
C.I.	cardiac index
C.O.	cardiac output
cal.	calibration
Calc	calculated/derived value
Calcs	calculations
CAM	Compact Anesthesia Monitor
CaO_2	arterial oxygen content
Casc.	cascaded (ECG)
cc	cubic centimeter
CCCM	Compact Critical Care Monitor
CCM	Critical Care Monitor
CCO	continuous cardiac output
CcO_2	capillary oxygen content
CCU	cardiac (coronary) care unit
CEL	Celsius degree
CISPR	International Special Committee on Radio Interference
cmH_2O	centimeter of water
CMRR	common mode rejection ratio
CO	carbon monoxide
CO_2	carbon dioxide
COHb	carboxyhemoglobin
Compl	compliance
Cont.	continuous
Contrl	controlled ventilation

Core	core temperature
Count	count of responses
CPB	cardiopulmonary bypass
CPP	cerebral perfusion pressure
CSA	compressed spectral array
CT	computer tomography
CvO_2	(mixed) venous oxygen content
CVP	central venous pressure
d	day
dB	decibel
DBS	double burst stimulation (NMT)
DEL	delete
Delta, De	delta frequency band
depr.	depression
Des	desflurane
Dia	diastolic pressure
Diagn	diagnostic (ECG filter)
DIFF	difference
DIS	S/5 Device Interfacing Solution
DO_2	oxygen delivery
DO_2I	oxygen delivery index
DSC	digital signal converter
Dyn.	dynamic
e	estimated
ECG	electrocardiogram
ECG1	first ECG waveform (top)
ECG1/r	real-time ECG
ECG2	second ECG waveform
ECG3	third ECG waveform
ED	emergency department
EDV	end-diastolic volume
EDVI	end-diastolic volume index
EE	energy expenditure (kcal/24h)
EEG	electroencephalogram
EEG1	first EEG waveform
EEG2	second EEG waveform
EEG3	third EEG waveform
EEG4	fourth EEG waveform
EEMG	evoked electromyogram
EEtot	total energy expenditure
elect	electrode
elev.	elevation
EMC	electromagnetic compatibility
EMG	electromyogram
Enf	enflurane
Entr	entropy
EP	evoked potential
ESD	electrostatic discharge
Eso	esophageal temperature
ESV	end-systolic volume
ESVI	end-systolic volume index
ET, Et	end-tidal concentration
EtAA	end-tidal anesthetic agent
EtBal	end-tidal balance gas
$EtCO_2$	end-tidal carbon dioxide
EtN_2O	end-tidal nitrous oxide
EtO_2	end-tidal oxygen
ET-tube, ETT	endotracheal tube
exp	expiratory
F	foot (describing location)
FAH	Fahrenheit degree
FEMG	frontal electromyogram
FFT	fast Fourier transform
FI, Fi	fraction of inspired gas
FiAA	fraction of inspired anesthetic agent
Fib	fibrillation
FiBal	fraction of inspired balance gas
$FiCO_2$	fraction of inspired carbon dioxide
FiN_2	fraction of inspired N_2
FiN_2O	fraction of inspired nitrous oxide
FiO_2	fraction of inspired oxygen
FLOW	airway gas flow
Freq.	frequent
ft	foot, feet
FVloop	flow volume loop
g	gram
Graph.	graphical
H	hand (describing location)
h	hour
Hal	halothane
Hb	hemoglobin
Hbtot	total hemoglobin
HCO3-	bicarbonate
Hemo Calcs	hemodynamic calculations
Hemo	hemodynamic
HHb	reduced hemoglobin

HME	heat and moisture exchanger
HMEF	heat and moisture exchanger with filter
hPa	hectopascal
HR dif	heart rate difference
HR	heart rate
ht	height
HW	hardware
Hz	hertz
I:E	inspiratory-expiratory ratio
IABP	intra-aortic balloon pump
IC	inspiratory capacity
ICP	intracranial pressure
ICU	intensive care unit
ID	identification
IEC	International Electrotechnical Comission
Imped.	impedance; impedance respiration
in	inch
Inf.	inferior
Infl.	inflation (limit)
insp	inspiratory
Inv.	invasive
InvBP	invasive blood pressure
Irreg.	irregular
ISO	International Standards Organisation
Iso	isoflurane
IVR	idioventricular rhythm
J	joule
K	kelvin
kcal	kilocalorie
kJ	kilojoule
kPa	kilopascal
L	left (describing location)
L	leg (describing location)
L, l	liter
l/min	liters/minute
Lab	laboratory
LAN	local area network
LAP	left atrial pressure
Lat.	lateral
lb	pound
LCD	liquid crystal display
LCW	left cardiac work
LED	light emitting diode
LVEDP	left ventricular end diastolic pressure
LVEDV	left ventricular end diastolic volume
LVSW	left ventricular stroke work
LVSWI	left ventricular stroke work index
MAC	minimum alveolar concentration
Max	maximum
mbar	millibar
mcg	microgram
mean	mean blood pressure
mEq	milliequivalent
MetHb	methemoglobin
MF	median frequency
mg	milligram
Min	minimum
min	minute
ml	milliliter
MLAEP	middle-latency auditory evoked potential
mmHg	millimeters of mercury
mol	mole
Monit	monitoring (ECG filter)
MRI	magnetic resonance imaging
Mult.	multiple
Multif. PVCs	multifocal PVCs
MV	minute volume
MVexp	expired minute volume (l/min)
MVexp(BTPS)	expired minute volume in BTPS conditions
MVexp(STPD)	expired minute volume in STPD conditions
MVinsp	inspired minute volume (l/min)
MVspont	spontaneous minute volume
Myo	myocardiac temperature

N	neutral
N_2	nitrogen
N_2O	nitrous oxide
Na	sodium
Naso	nasopharyngeal temperature
neo	neonate
Net	network
NIBP	non-invasive blood pressure
NMT	neuromuscular transmission
NO	nitric oxide
NTPD	normal temperature and pressure, dry gas
Num.	numerical
O_2	oxygen
O_2ER	oxygen extraction ratio
O_2Hb	oxygenated hemoglobin
OR	operation room
Oxy	oxygenation
Oxy. Calcs	oxygenation calculations
P	partial pressure
P	pressure
P(BTPS)	pressure in BTPS conditions
$P(g\text{-}a)CO_2$	difference between gastrointestinal carbon dioxide and arterial blood carbon dioxide concentration
$P(g\text{-}ET)CO_2$	difference between gastrointestinal carbon dioxide and end tidal carbon dioxide concentration
P(STPD)	pressure in STPD conditions
P1..6	invasive pressure channel identification on module
PA	pulmonary arterial pressure
PA	pulmonary artery
Pa	Pascal (unit of pressure)
Paced	paced beats
$PaCO_2$	partial pressure of carbon dioxide in the arteries
PAO_2	partial pressure of oxygen in the alveoli
PaO_2	partial pressure of oxygen in the arteries
PAOP	pulmonary artery occlusion pressure
Paw	airway pressure
Pbaro	barometric pressure
PCWP	pulmonary capillary wedge pressure
PE	polyethylene
Pedi	pediatric
PEEP	positive end-expiratory pressure
PEEPe	extrinsic positive end expiratory pressure
PEEPe+i	total positive end expiratory pressure (ICU)
PEEPe+PEEPi	total positive end expiratory pressure (ICU)
PEEPi	intrinsic positive end expiratory pressure
PEEPtot	total positive end expiratory pressure (anesthesia)
$PgCO_2$	gastrointestinal carbon dioxide concentration
pH	pH
pHa	arterial pH
pHi	intramucosal pH
pHv	(mixed) venous pH
PIC	patient interface cable
Pleth	plethysmographic pulse waveform
PM non-capt.	pacemaker non-capturing
PM non-funct.	pacemaker non-functioning
PM	pacemaker
Pmax	maximum pressure
Pmean	mean pressure
Pmin	minimum pressure
Ppeak	peak pressure
Pplat	plateau (pause) pressure
PR	pulse rate
Prev	previous
psi	pounds per square per inch
pt	patient
PTC	post tetanic count (NMT)
pts	patients

PVC	polyvinylchloride
PVC	premature ventricular contraction
PVloop	pressure volume loop
PvO_2	partial pressure of oxygen in (mixed) venous blood
PVR	pulmonary vascular resistance
PVRI	pulmonary vascular resistance index
Px	standard pressure label, x being 1, 2, 3, 4, 5, or 6
QRS	QRS complex
Qs/Qt	venous admixture
R	right (describing location)
RAP	right atrial pressure
Raw	airway resistance
RCW	right cardiac work
RCWI	right cardiac work index
RE	response entropy
Rect	rectal temperature
REF	right ventricular ejection fraction
ref.	reference
Resp Rate	respiration rate (total) (measured)
Resp	respiration rate (total) (set)
RF	radio frequency
RMS	average (root mean square) power
Room	room temperature
RQ	respiratory quotient
RR	respiration rate (total) (measured)
rtm	rhythm
RV	residual volume
RVEDV	right ventricular end-diastolic volume
RVESV	right ventricular end-systolic volume
RVP	right ventricular pressure
RVSW	right ventricular stroke work
RVSWI	right ventricular stroke work index
s	second
SA	sinoatrial
SaO_2	arterial oxygen saturation
SD	standard deviation
SE	state entropy
SEF	spectral edge frequency
SEMG	spontaneous electromyogram
Sev	sevoflurane
SI	stroke index
Skin	skin temperature
SN, S/N	serial number
Spiro	patient spirometry
SpO_2	oxygen saturation
Spont	spontaneous breathing
SQI	signal quality index
SR	sinus rhythm
SR	suppression ratio
SSEP	somatosensory evoked potentials
ST	single twitch (NMT)
ST	ST segment of electrocardiograph
STAT	continuous NIBP cuff inflation for five minutes
stat	static
STBY	standby
STfilt	ST filter (ECG)
STPD	standard temperature and pressure, dry gas
Surf	surface temperature
SW	software
SV	stroke volume
SVC	supraventricular contraction
SVI	stroke volume index
SvO_2	(mixed) venous oxygen saturation
SVR	systemic vascular resistance
SVRI	systemic vascular resistance index
Sys	systolic pressure
T corr.	temperature correction
T inj.	injectate temperature
T	temperature
t	time (min)
T(BTPS)	temperature in BTPS conditions
T1%	first stimulus as % of the reference value (NMT)
T1..4	temperature channel identification on module
Tab.	tabular
Tachy	tachycardia
Tbl, Tblood	blood temperature
Temp	temperature
Theta, Th	theta frequency band
TOF	train of four (NMT)

TOF%	ratio of the 4th to the 1st response (NMT)
Trigem.	trigeminy
TV	tidal volume
TVexp	expired tidal volume (ml)
TVinsp	inspired tidal volume (ml)
Tx	temperature label, x being 1, 2, 3, r 4 or one of the other label choices
Tymp	tympanic temperature
V Fib	ventricular fibrillation
V Run	ventricular run
V Tachy	ventricular tachycardia
v	venous
V	ventricular
V	volume
V/Q	ventilation/perfusion ratio
V0.5	volume expired during the first 0.5 seconds
V1.0	volume expired during the first second
VA	alveolar ventilation
VC	vital capacity
VCO2	carbon dioxide production
Vd	dead space
Vd/Vt	dead space ventilation
Vent. Calcs	ventilation calculations
WLAN	wireless local area network
VO_2	oxygen consumption
VO_2calc	calculated oxygen consumption*
VO_2I	oxygen consumption index
VO_2Icalc	calculated oxygen consumption index*
Vol	volume
wt	weight
X	extreme
yr	year
yrs	years

* with Fick equation

Performance

WARNING: Operation of the monitor outside the specified values may cause inaccurate results.

Datex-Ohmeda S/5 FM

Power supply

Rated voltages and frequencies: 100 to 240V 50/60 Hz
Allowed voltage fluctuations: ±10%
Max. power consumption: 150 VA

Battery operation

Batteries: Exchangeable lithium-ion, 2 pcs
Charging time: 3 hours per battery pack
Operation time: Up to 5 hours

Environmental conditions

Operating temperature:
normal operation: +10 to +40°C (50 to 104°F)
with CO_2 measurement +10 to +40°C (50 to 104°F)
while charging batteries: +10 to +35°C (50 to 95°F)
Storage and transport temperature: -20 to +60°C (-4 to 140°F)
Relative humidity: 10 to 90% noncondensing, in airway 0 to 100% condensing
Atmospheric pressure: 660 to 1060 mbar (500 to 800 mmHg)

Alarm behavior

The maximum alarm delay of the alarm at the monitor signal output to network: 1.1 seconds

If the alarm mode is latched, the technical alarms are latched as well. This does not comply with the NIBP (IEC 60601-2-30) and invasive pressure (IEC 60601-2-34) standard requirements.
Silencing alarms for 5 minutes does not comply with the SpO_2 (ISO 9919) standard requirements.

Wireless Network Option, N-FMW

Type: Built-in transceiver and antenna
Frequency range:
Worldwide product covering 2.4 to 2.5 GHz, programmable for different country regulations
Data rate: 11 Mbps per channel (max.)
Output power: 100 mW
Data transmission: IEEE 802.11b compliant, Direct Sequence Spread Spectrum (DSSS)
Security: Wired Equivalent Privacy (WEP) 40 and 128 bit encryption
Certificates: Wi-Fi-certified

N-FREC, N-FCREC

Power consumption: 3 W
Recorder type: Thermal array
Print resolution:
Vertical 8 dots/mm (200 dots/inch)
Horizontal 32 dots/mm (800 dots/inch) at a speed of 25 mm/s and slower
Paper width: 50 mm, printing width 48 mm
Traces: Selectable 1, 2, or 3 traces
Print speed: 1, 6.25, 12.5, 25 mm/s

Hemodynamic modules E-PSM, E-PSMP

ECG [1)]

Filter modes:
monitoring filter 0.5 to 30 Hz
ST filter 0.05 to 30Hz
diagnostic filter 0.05 to 150 Hz
With 60 Hz power supply frequency:
monitoring filter 0.5 to 40 Hz
ST filter 0.05 to 40 Hz
diagnostic filter 0.05 to 150 Hz
QRS minimum detection level:
Minimum level 0.5 mV with duration between 40 and 120 ms fulfils ANSI/AAMI EC13 standard.
Defibrillation protection: 5000 V, 360 J
Recovery time: 5 seconds

1) The isolation barrier capacitance in the module has been minimized to reduce the hazard of burns in the event of a defect in the ESU return electrode connection.

ECG (cont.)

Heart rate:
Measurement range: 30 to 250 bpm
Measurement accuracy: ±5 % or ±5 bpm
Display averaging time: 5 seconds
Display update time: 5 seconds
Average heart rate response time and time range of response time (according to ANSI/AAMI EC13 4.1.2.1):
Response time 80 to 120 bpm: 6.6 s (4.7 to 9.1 s)
Response time 80 to 40 bpm:
10.2 s (8.7 to 12.8 s)
Maximum Tall T wave amplitude that does not disturb the heart rate calculation time (according to ANSI/AAMI EC13 4.1.2.1): 2.2 mV
The heart rate calculation operates with irregular rhythms of ANSI/AAMI EC13 4.1.2.1 as follows:
a): 85 bpm
b): 64 bpm
c): 125 bpm
d): 95 bpm
Pacemaker pulse detection:
detection level: 2 to 700 mV
pulse duration: 0.5 to 2 ms
The monitor is specified for both of the methods A and B required in AANSI/AAMI EC13 section 4.1.4.2.
Offset voltage range: ±1.0 V
CMRR: ≥95 dB
Pacer pulse rejection of fast ECG signals:
2.0 V/s according to the test defined in ANSI/AAMI EC13 section 4.1.4.3.
Pacemaker detector may not operate correctly during the use of high-frequency (HF) surgical equipment. The disturbances of HF surgical equipment typically cause false positive pacer detection.
Direct current for leads-off detection through an active patient electrode: ≤30 nA
Direct current for leads-off detection through a reference electrode: ≤300 nA
The normalized respiration sensing current between RA (R) and LL (F) or RA (R) and LA (L) or LA (L) and LL (L): ≤5.0 µA
Frequency of respiration sensing current: 31.25 kHz
Minimizing the effects of the line isolation monitor transients:
Crystal controlled oscillator used as the operating frequency source of the patient isolation power supply.
The average time and time range ( ) to alarm for tachycardia are as follows (ANSI/AAMI EC13 4.1.2.1.g):
Figure 4a halved amplitude: 6.3 s (5.7 to 7.1 s)
Figure 4a normal amplitude:6.1 s (5.0 to 8.6 s)
Figure 4a doubled amplitude:4.8 s (4.7 to 5.1 s)
Figure 4b halved amplitude: 5.7 s (5.2 to 6.4 s)
Figure 4b normal amplitude:6.6 s (5.1 to 8.7 s)
Figure 4b doubled amplitude:5.6 s (5.4 to 6.2 s)

The ECG measurement fulfils the requirements of the ANSI/AAMI EC11 3.2.7.2 by using the test methods a, b, c and e.

Direct cardiac application:
The display area reserved for the ECG measurement in the S/5 monitoring system screen may not be adequate for displaying the complete ECG amplitude when measuring ECG direct from the surface of the heart. Clipping of the signal can be reduced by adjusting the size of the signal on the display (for example, from the default 1.0 to 0.2) in the ECG menu.

ECG analog output (X5):
Bandwidth of auxiliary output: 0.05 to 100Hz
Gain: 1mV ECG signal is 1V ±10% at the analog output.
Propagation delay: < 35ms.

The pacemaker pulses have been replaced with 2ms fixed digital pulses at the ECG output for IABP or defibrillator equipment.
A device that fulfils the requirements of the IEC 60601-1 standard can be connected to the ECG analog output. There are no other limitations, because the ECG analog output of the monitor is galvanically isolated from patient applied part of the ECG measurement.

Impedance respiration

Respiration range: 4 to 120 resp/min
Accuracy: ± 5% or ± 5 resp/min

The EMC immunity of the respiration measurement has been tested with 1 Vrms and 1 V/m. This level has been used for optimizing the immunity of the respiration measurement to damp the operating frequency of the electrosurgery equipment.

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

Invasive blood pressure (E-PSMP)[2)]

Measurement range:-40 to 320 mmHg
Measurement accuracy: ±5 % or ±2 mmHg

Pulse rate:

Measurement range: 30 to 250 bpm
Accuracy: ±5% or ±5 bpm
Transducer sensitivity: 5 µV/V/mmHg

Temperature [2)]

Measurement range: 10 to 45°C (50 to 113°F)
Measurement accuracy:
±0.1°C (25 to 45.0°C)
±0.2°C (10 to 24.9°C)
Measurement accuracy with single-use probes:
±0.2°C (25 to 45°C)
±0.3°C (10 to 24.9°C)
Probe type: Use only Datex-Ohmeda temperature probes or defibrillator-proof YSI 400 series probes.
Temperature self-check: at start-up and then every 10 minutes

Time constant of temperature probes:

Reusable skin temperature probe: 3 s
Reusable adult central temperature probe: 6 s
Reusable pediatric central temperature probe: 4 s
Disposable skin temperature probe: 3 to 6s
Disposable central temperature probe, 12F: 5 to 8 s
Disposable central temperature probe, 9F: 5 to 8 s
Esophageal stethoscope with temperature probe, 9F: 15 s
Esophageal stethoscope with temperature probe, 12F : 16 s
Esophageal stethoscope with temperature probe, 18F[3)]: 23 s
Esophageal stethoscope with temperature probe, 24F[3)]: 32 s

NIBP

Blood pressure measurement range[4)]:
adult 25 to 260 mmHg
child 25 to 195 mmHg
infant 15 to 145 mmHg
Pulse rate range accepted: 30 to 250 bpm
Cuff pressure measurement range:
-15 to + 350 mmHg.
Typical measuring time: adult 23 s, infant 20 s
Overall system accuracy:
Meets or exceeds SP10-2002 AAMI standards

The ESU does not cause a burn hazard through the NIBP cuff, because there is no electrical connection between the cuff and the NIBP measuring electronics.

NOTE: NIBP measurement is intended for patients weighing over 5 kg (11 lb).

SpO_2 [2)]

Measurement and display range: 0 to 100%
Calibration range: 70 to 100%

Calibrated against functional oxygen saturation.
Measurement accuracy [5)] (% SpO_2 ±1SD):
100 to 70%, ±2 digits,
±3 digits during clinical patient motion;
69 to 0%, unspecified
Display update time:
5 seconds continuous, defined by the main software of the monitor
Display resolution: 1 digit (1% of SpO_2)

Wavelength of SpO_2 probe LEDs:

Infrared LED 940 nm
Red LED 660 nm

Maximum energy of SpO_2 probe LEDs:

Infrared LED 42 µJ/pulse
Red LED 62 µJ/pulse

Pulse rate:

Measurement and display range: 30 to 250 bpm
Measurement accuracy: ±5% or ±5 bpm

Default alarm limits [6)]:

SpO_2 high Off, low 90%
PR high 160, low 40

NOTE: For each SpO_2 accessory, refer to the instructions for use in the accessory package for patient weight limits.

[2)] The isolation barrier capacitance in the module has been minimized to reduce the hazard of burns in the event of a defect in the ESU return electrode connection.

[3)] Response time of the probe exceeds 150 s.

[4)] Cuff pressure measurement range is equal to cuff nominal and cuff indication ranges

[5)] Accuracy is based on deep hypoxia studies with volunteered subjects during motion and non-motion conditions over a wide range of arterial blood oxygen saturations as compared to arterial blood CO-Oximetry.

[6)] Limits are adjustable: OFF to 51% for SpO_2 high
50 to 100% for SpO_2 low
250 to 35 bpm for PR high
30 to 245 bpm for PR low

Airway gases, N-FCREC and N-FC

Sampling rate: 150±25 ml/min (sampling line 2 to 3 m, normal conditions)
Maximum sampling line length: 6 m
Sampling delay: 2.1 s typical with a 3-m sampling line
Total system response time: 2.4 seconds typical with a 3-m sampling line, including sampling delay and rise time (typically 3.7 seconds with a 6-m sampling line)
Warm-up time: 1 min for operation
30 min for full specification
Autozeroing interval: 4, 15, 30 and 60 minutes after start-up, then every 60 minutes

Non-disturbing gases are those with a maximum effect on the CO_2 reading at 5.0 vol% < 0.2 vol%. The effect is valid for specific concentrations shown in parentheses of the non-disturbing gas:

Ethanol C_2H_5OH (<0.3%)
Acetone (<0.1%)
Methane CH_4(<0.2%)
Nitrogen N_2 (0 to 100%)
water vapor (0 to 100%)
Trichloromonofluoromethane (<1%)
Dichlorotetrafluoroethane (<1%)
Dichlorofluoromethane (<1%)

Disturbing gases and their effect on the CO_2 reading at 5.0 vol% CO_2 are shown below. Errors listed reflect the effect of specific concentrations (shown in parentheses) of an individual disturbing gas and should be combined when estimating the effect of gas mixtures:

Halothane (4%) increases < 0.3 vol%
Isoflurane(5%) increases < 0.4 vol%
Enflurane(5%) increases < 0.4 vol%
Desflurane(24%) increases < 1.2 vol%
Sevoflurane(6%) increases < 0.4 vol%
Helium (50%) decreases < 0.3 vol%

If O_2 compensation is not activated:
O_2 (40 to 95%) decreases < 0.3 vol%
If O_2 compensation is activated:
O_2 (40 to 95%) error < 0.15 vol%
If N_2O compensation is not activated:
N_2O (40%) decreases < 0.4 vol%
If N_2O compensation is activated:
N_2O (40 to 80%) error < 0.3 vol%

Default alarm limits [7]:
$EtCO_2$ high 8%, low 3%
$FiCO_2$ high 3%, low Off

Carbon dioxide (CO_2)

Measurement range: 0 to 20 vol%
Resolution: 0.01%
Measurement rise time: < 300 ms with nominal flow
Accuracy:
0 to 15 vol% ± (0.2 vol% + 2% of reading)
15 to 20 vol% ± (0.7 vol% + 2% of reading)

Valid for respiration rate < 40 1/min at I:E ratio of 1:1. (Relative error is typically 10% for respiration rate 80 1/min at I:E ratio of 1:1.) The accuracy is specified in simulated ventilation. With higher respiration rates and with varying ventilation methods the specifications may not be met.

Respiration rate

Breath detection: 1% change in CO_2 level
Measurement range: 4 to 80 breaths/min
Accuracy: ±1 1/min in the range 4 to 20 1/min
±5% in the range 20 to 80 1/min
Resolution: 1/min

NOTE: CO_2 measurement is intended for patients weighing over 5 kg (11 lb).

7) Alarm limits and their adjustment range may vary depending on the mode used.

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