Instructions for use

Infinity® Acute Care System

WARNING

To properly use this medical device, read and comply with these instructions for use.

Monitoring Applications Software VG7.1

Typographical conventions

1 Consecutive numbers indicate steps of action, with the numbering restarting with "1" for each new sequence of actions.

- Bullet points indicate individual actions or different options for action.

– Dashes indicate the listing of data, options, or objects.

(A) Letters in parentheses refer to elements in the related figure.

A Letters in figures denote elements referred to in the text.

> The greater-than symbol indicates the navigation path in a dialog.

Bold, italicized text indicates labelson the device and texts that are displayed on the screen.

Figures

Images of products and screen content in this document may differ from the actual products depending on configuration and design.

Trademarks

– Babylog®
– Evita®
– Infinity®
– Innovian®
– MCable®
– Medical Cockpit®
– MPod®
– PatientWatch®
– Monolead®
– Perseus®
– Apollo®
– Zeus®
– Primus®
– Tcore®

are trademarks of Dräger.

– Masimo®
– SET® (Signal Extraction Technology)
– Masimo® rainbow® SET®
– PVI®
– SpHb®
– SpMet®
– Pulse CO-Oximeter Signal Extraction®

are trademarks of Masimo Corporation.

– CapnoLine®
– Capnostream®
– FilterLine®
– Microcap®
– MicroPod®
– Microstream®
– Oridion®

are trademarks of Oridion Medical 1987 Ltd.

– Edwards®
– Vigilance®
– Vigileo®
– EV1000®

are trademarks of Edwards Lifesciences, LLC.

– BIS VISTA®
– Medtronic®
– Nellcor®
– OxiMax®
– SatSeconds®

are trademarks of a Medtronic company.

– Dismozon® pur

is a trademark of BODE Chemie GmbH.

– Buraton®
– Mikrozid®
– perform®
– acryl-des®

are trademarks of Schülke & Mayr.

– BruTab 6S®

is a trademark of Brulin.

– Descogen®

is a trademark of Antiseptica.

– Klorsept®

is a trademark of Medentech.

– Virkon®

is a trademark of DuPont.

– SERVO-i®

is a trademark of Maquet, Inc.

– Internet Explorer®

is either a registered trademark or trademark of Microsoft Corporation in the United States and/or other countries.

– Citrix XenApp®

is a trademark of Citrix Systems, Inc. and/or one or more of its subsidiaries, and may be registered in the United States Patent and Trademark Office and in other countries.

All devices referenced in these instructions for use may not be approved for sale in all countries. Please check with your local Dräger representative.

Microstream® MicroPod® External Capnography Module patents

The capnography component of this product is covered by one or more of the following US patents: 6,437,316; 6,428,483; 6,997,880; 7,488,229; 8,414,488; 8,412,655 and their foreign equivalents. Additional patent applications pending.

Open-source software

Dräger devices that use software may use open-source software, depending on their setup. Open-source software may be subject to different terms of license. Additional information regarding the open-source software used in this device is available at the following web page:

www.draeger.com/opensource

Safety information definitions

WARNING

A WARNING statement provides important information about a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

A CAUTION statement provides important information about a potentially hazardous situation which, if not avoided, may result in minor or moderate injury to the user or patient or in damage to the medical device or other property.

NOTE
A NOTE provides additional information intended to avoid inconvenience during operation.

Abbreviations and symbols

For explanations, refer to sections "Abbreviations" and "Device symbols" in chapter "System overview".

Target Groups

Duties of the operating organization

The tasks described in this document specify the requirements that have to be met by each respective target group.

The operating organization of this product must ensure the following:

The target group has the required qualifications (e.g., has undergone specialist training or acquired specialist knowledge through experience).

The target group has been trained to perform the task.

The target group has read and understood the chapters required to perform the task.

Description of target groups

The target groups may only perform the following tasks if they meet the corresponding requirements.

User

Task	Requirement
Use of the product in accordance with the intended use	Specialist medical knowledge in the use of the product

Reprocessing personnel

Task	Requirement
Reprocessing	Specialist knowledge in the reprocessing of medical devices

Service personnel

Task	Requirement
Installation	Specialist knowledge in electrical engineering and mechanics Experience in the servicing of medical devices
Basic service activities (inspection, maintenance according to "Maintenance" on page 579).	

Specialized service personnel

Task	Requirement
Installation	Specialist knowledge in electrical engineering and mechanics Experience in the servicing of medical devices Training in service activities on this product
Basic and complex service activities (inspection, maintenance, repair)	

A service contract with Dräger is recommended.

Contents

This page has been left blank intentionally.

For your safety and that of your patients

Mandatory reporting of adverse events

Serious adverse events with this product must be reported to Dräger and the responsible authorities.

Strictly follow these instructions for use

NOTE

The Infinity Acute Care System provides the following additional instructions for use:

– *Infinity Acute Care System – Infinity M540* patient monitor (describes the M540 user interface)

– Infinity Acute Care System – Medical Cockpit (describes the hardware of the Cockpit)

– Infinity Acute Care System – Monitoring accessories (describes all of the IACS accessories).

Please refer to these additional instructions for use for device-specific information.

WARNING

Risk of incorrect operation and use.

Any use of the medical device requires full understanding and strict observation of all sections of these instructions for use. The medical device must only be used for the purpose specified under "Application" and in conjunction with appropriate patient monitoring.

Strictly observe all WARNING and CAUTION statements throughout these instructions for use and all statements on medical device labels. Failure to observe these safety information statements constitutes a use of the medical device that is inconsistent with its intended use.

Storing the instructions for use

WARNING

Risk of incorrect use.

Instructions for use must be kept accessible for the user.

Training

Training for users is available from the responsible Dräger organization, see www.draeger.com.

Maintenance

WARNING

Risk of medical device failure and of patient injury.

The medical device must be inspected and serviced regularly by service personnel. Repair and complex maintenance carried out on the medical device must be performed by experts.

If the above is not complied with, medical device failure and patient injury may occur. Observe the chapter "Maintenance".

A service contract with Dräger is recommended. It is recommended that original Dräger parts are used for repairs and that Dräger performs these repairs.

Accessories

WARNING

Risk due to incompatible accessories.

Dräger has only tested the compatibility of accessories listed in the current list of accessories. If other accessories are used, there is a risk of patient injury due to medical device failure. Dräger recommends that the medical device is only used with accessories listed in the current list of accessories.

Installing accessories

CAUTION

Risk of device failure

Install accessories to the basic device in accordance with the instructions for use of the basic device. Make sure that there is a safe connection to the basic device.

Strictly observe instructions for use and assembly instructions.

Sterile accessories

CAUTION

Risk of medical device failure and of patient injury.

Do not use sterile-packaged accessories if the packaging has been opened, is damaged or if there are other signs of non-sterility. Single-use accessories must not be reused, reprocessed, or resterilized.

Restriction of distribution

Federal Law (U.S.) restricts this device to sale by or on the order of a physician.

Restrictions for use

CAUTION

Device for use in health care facilities only and exclusively by persons as defined in the target groups (see "Target Groups" on page 6).

Connected devices

WARNING

Risk of electric shock and of device malfunction.

Any connected devices or device combinations not complying with the requirements mentioned in these instructions for use can compromise the functional integrity of the medical device and lead to electric shock. Before operating the medical device, strictly comply with the instructions for use of all connected devices and device combinations.

WARNING

To avoid electric shock, the equipment should only be connected to a power source that is properly grounded (protective earth ground).

Safe connection with other electrical equipment

WARNING

Risk of patient injury.

Electrical connections to equipment which are not listed in these instructions for use should only be made following consultation with the respective manufacturers. Equipment malfunction may result with the risk of patient injury.

WARNING

The leakage current increases when multiple medical devices are connected to a patient. Make sure that the galvanic isolation of each device is suitable for the intended application. Connect only equipment that is set up and tested according to IEC standards to the analog and digital signal inputs and outputs. Connect only passive USB devices to the IACS (Infinity Acute Care System) Cockpit.

To protect the patient from possible injury due to electrical shock, peripheral devices should only be connected to a monitor within the same room. The installer or service provider should verify that the leakage current of the interconnected system meets the electrical safety requirements of IEC 60601-1.

Electrical safety

WARNING

Because of the risk of electric shock, never remove the cover of a device while it is in use or plugged into a power socket.

CAUTION

Connect the PS250 or the P2500 with an attached power cable only to hospital-grade electrical power sockets to make sure that it is properly grounded.

CAUTION

To avoid injuring the patient, do not touch any connector or mounting screw on the device when you are touching the patient. Do not allow the conductive parts of electrodes and cables to contact other conductive parts or the ground.

Connection to hospital network

Many medical devices manufactured by Dräger use networks to transmit patient data in real-time and to notify clinical users of alarm conditions. Hospitals should refer to IEC 80001-1 before attempting to connect such medical devices to their IT networks.

Patient safety

The design of the medical device, the accompanying documentation, and the labeling on the medical device are based on the assumption that the purchase and the use of the medical device are restricted to persons familiar with the most important inherent characteristics of the medical device. Instructions and WARNING and CAUTION statements are therefore largely limited to the specifics of the Dräger medical device.

These instructions for use do not contain any information on the following points:

– Risks that are obvious to users

– Consequences of obvious improper use of the medical device

– Potentially negative effects on patients with different underlying diseases

Medical device modification or misuse can be dangerous.

Patient monitoring

The user of the medical device is responsible for choosing a suitable patient monitoring system that provides appropriate information on medical device performance and patient condition.

Patient safety may be achieved by a wide variety of means ranging from electronic surveillance of medical device performance and patient condition to direct observation of clinical signs.

The responsibility for selecting the best level of patient monitoring lies solely with the user of the medical device.

General safety information

The following WARNING and CAUTION statements apply to general operation of the medical device.

WARNING and CAUTION statements specific to subsystems or particular features of the medical device appear in the respective sections of these instructions for use or in the instructions for use of another product being used with this medical device.

WARNING

Risk of explosion and of chemical burns.

Improper handling of batteries can result in explosions and chemical burns.

Do not throw batteries into fire. Do not force batteries open.

Observe the applicable laws and regulations for battery disposal.

WARNING

To avoid electric shock, inspect all cables before use. Never use cables that appear cracked, worn, or damaged in any way (doing so may compromise performance or put the patient at risk).

WARNING

Do not cover the device with blankets or bed sheets. To prevent burns to the patient, avoid direct contact between external surfaces and the patient.

CAUTION

To avoid injuring the patient, disconnect all sensors that will not be used during transport, before moving the patient.

CAUTION

Read all cleaning instructions (for example, originating from the disinfectant manufacturer and the hospital) carefully before cleaning the device. Refer to the chapter entitled "Reprocessing" on page 587 for device-specific cleaning instructions. Moisture may damage the circuits, compromise critical performance and present a safety risk.

WARNING

Dräger recommends using the Infinity Acute Care System or the M540 (if on wireless transport) for primary diagnosis and the (ICS) Infinity CentralStation for patient viewing only.

For countries subject to the EU directive 2002/96/EC

This device is subject to EU directive 2002/96/EC (WEEE). In order to comply with its registration according to this directive, this device may not be disposed of at municipal collection points for waste of electrical and electronic equipment. Dräger has authorized a company to collect and dispose of this device.

To initiate collection or for further information, visit Dräger on the Internet at www.draeger.com. Use the Search function with the keyword "WEEE" to find the relevant information. If access to the Dräger website is not possible, contact the local Dräger organization.

Not for use in areas of explosion hazard

WARNING

Risk of explosion

This medical device is neither approved nor certified for use in areas where oxygen concentrations greater than 25% (combustible or explosive gas mixtures) are likely to occur.

Information on electromagnetic compatibility

General information on electromagnetic compatibility (EMC) according to international EMC standard IEC 60601-1-2:

Medical electrical equipment is subject to special precautionary measures concerning electromagnetic compatibility (EMC) and must be installed and put into operation in accordance with the EMC information provided on page 606.

Portable and mobile radio frequency communications equipment can affect medical electrical equipment.

WARNING

Do not connect connectors with an ESD warning symbol and do not touch their pins without implementing ESD protective measures. Such protective measures may include antistatic clothing and shoes, touching a potential equalization pin before and during connection of the pins, or using electrically insulating and antistatic gloves. All users concerned must be instructed in these ESD protective measures.

Operating location

Only use devices (monitor, MPod, MCable, and accessories) in areas that meet the environmental requirements outlined in the technical data section.

WARNING

To avoid interfering with device operation, do not operate devices (monitor, MPod, MCable, and accessories) within equipment that emits microwave or other high-frequency emissions. For recommended separation distances, see page 609.

WARNING

Make sure that the device is properly mounted and secured to prevent injury. Make sure the requirements for maximum load and slope of floor are met. Consult the documentation of the mounting manufacturer for detailed information.

WARNING

To minimize the risk of patient strangulation, carefully position and secure sensor cables. Also position the sensor cables to minimize inductive loops.

WARNING

To avoid patient injury as the result of a falling monitor when using a rolling trolley, universal bed hook, or handle hook mount, do not apply excessive force to the monitor or mount when entering or exiting elevators or passing over thresholds and other uneven surfaces.

CAUTION

To prevent overheating, do not place the device in direct sunlight or near radiant warmers.

CAUTION

After extended exposure in a cold environment, acclimate the device carefully so that condensation does not form on the electronic parts and damage the device.

CAUTION
To avoid damaging the touch-sensitive screen, do not allow sharp instruments to touch the front of the devices.

CAUTION
To avoid short-circuiting and otherwise damaging the device, Dräger recommends that no fluids come in contact with the IACS devices when they are connected to a power socket. If fluids are accidentally spilled on the equipment, remove the affected device from service as soon as possible and have service personnel verify that patient safety is not compromised.

Defibrillator precautions

The IACS and the peripheral devices are protected against high-frequency interference from defibrillators and electrosurgical units and against 50-Hz and 60-Hz power line interference.

WARNING
To avoid electrical shock, always remove accessories that are not resistant to defibrillation before defibrillating a patient.

CAUTION
To prevent burns and electric shock due to rerouting of electrical current through electrodes, do not position the defibrillator pads near any electrodes or sensors.

CAUTION
Only defibrillate across the chest.

CAUTION
To protect the patient during defibrillation and to ensure accurate ECG information, use only ECG electrodes and cables specified by Dräger. Removal of applied parts that are not rated defibrillation-proof such as disposable SpO2 sensors may be required to prevent sensor breakdown and energy shunting.

Electrosurgery

Observe the following precautions during electrosurgery to reduce electrosurgical unit (ESU) interference and improve user safety and patient safety.

WARNING
For better performance and to reduce the hazard of burns during surgery, always use accessories designed for ESU environments.

WARNING
To reduce the hazard of burns during electrosurgery, keep the sensor or transducer (ECG, pressure, SpO2) and their associated cables away from the surgical site, the ESU return electrode, and earth ground.

NOTE
Cover internally placed reusable temperature sensors with temperature sensor sheaths.

Virus protection

CAUTION
The IACS does not have virus protection software and relies therefore on the firewall of your institution to prevent access to infected files. While setting up IT applications to access websites, evaluate each website with regard to possible virus infection.

Security recommendations

Dräger makes the following security recommendations:

– Physical security of the patient monitors is recommended and is the responsibility of the operating organization.

– Physical security of the telecommunications closet is recommended and is the responsibility of the operating organization.

– Dräger recommends that operating organizations restrict physical access to unused ethernet ports on the IACS.

– Dräger recommends that operating organizations restrict physical access to unused USB and serial ports on the IACS.

– Dräger relies on the medical device isolation mechanism of the VLANs and the proper configuration, implementation, and use of the operating organization's security measures to prevent the introduction of malware onto the Infinity network.

CAUTION
Dräger recommends that all documents opened for viewing from the hospital LAN are from a secure source.

Application

Intended use

The IACS is intended for multi-parameter, physiologic patient monitoring of adult, pediatric, and neonatal patients in environments where patient care is provided by trained health care professionals.

The IACS obtains the physiologic, multi-parameter data from the connection to the M540 monitor and optional medical devices and displays. The transfer of this data is accomplished by the Infinity network.

The IACS and any connected optional hardware are not intended for use in the following hospital environments:

– Hyperbaric chambers

– Environments containing MRI equipment

Indications for use

The M540 monitors the following parameters:

– Heart rate

– Arrhythmia (adult and pediatric patients only)

– 12-lead analysis

– ST segment analysis including TruST® (adult and pediatric patients only)

– Apnea

– Impedance respiratory rate (***RRi***)

– Invasive pressure (***IP***)

– Non-invasive blood pressure (***NIBP***)

– Temperature

– Cardiac output, only available when the M540 is docked in an IACS configuration (adult and pediatric patients only)

– Arterial oxygen saturation (***SpO2***)

– Pulse rate

– Perfusion index (***PI***)

– Total arterial hemoglobin (***SpHb***) (adult and pediatric patients only)

– Total oxygen content (***SpOC***) (adult and pediatric patients only)

– Carboxyhemoglobin saturation (***SpCO***) (adult and pediatric patients only)

– Methemoglobin saturation (***SpMet***)

– Pleth variability index (***PVI***)

– Carbon dioxide (***CO2***)

– Oxygen (***O2***) (adult and pediatric patients only)

– Nitrous oxide (***N2O***) (adult and pediatric patients only)

– Anesthetic agents (Sevoflurane, Desflurane, Isoflurane, Halothane, Enflurane) (adult and pediatric patients only)

– xMAC (adult and pediatric patients only)

– The IACS is also capable of connecting to third party devices to display physiologic, multi-parameter data, store trends, and send data across a network.

System overview

Overview

These instructions for use describe the Cockpit (Medical Cockpit), the primary display and user interface of the Infinity Acute Care System – Monitoring Applications – M540 patient monitor (IACS). Specifically, these instructions for use describe the setup tasks and features available on the Cockpit. For detailed information on the M540 patient monitor, refer to the Instructions for use *Infinity Acute Care System – Infinity M540*.

Some terms used in these instructions for use:

– Cockpit – refers to the Infinity C700 Medical Cockpit or the Infinity C500 Medical Cockpit.

– M540 – refers to the Infinity M540 transport component and patient connection point of the IACS.

– M500 – refers to the Infinity M500 docking station that secures the M540, provides communication between the M540 and the Cockpit, and charges the battery in the M540.

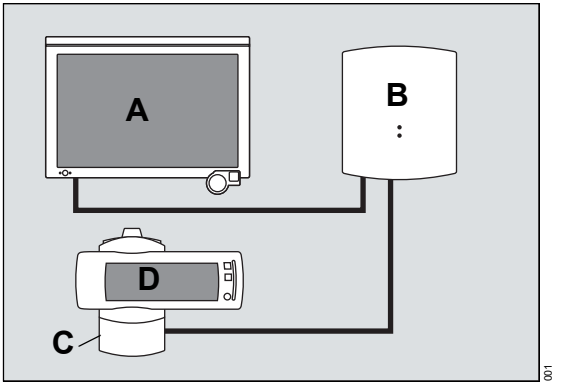
– PS250 – refers to the Infinity PS250 power supply Com Hub (power supply unit).

– P2500 – refers to the Infinity P2500.

– Docking the M540 – refers to placing the M540 on the M500.

– Undocking the M540 – refers to removing the M540 from the M500 for patient transport.

The following diagram shows the basic components of the IACS. In addition, you can connect various hardware to expand the viewing and monitoring capabilities (see "Additional hardware" on page 27).



A C500 / C700

B PS250 or P2500

C M500

D M540

Infinity Medical Cockpit

The Infinity **Medical Cockpit** *(referred to in this IFU as Cockpit)* is the primary display and user interface for the IACS and is available in the sizes listed in "Overview" on page 45.

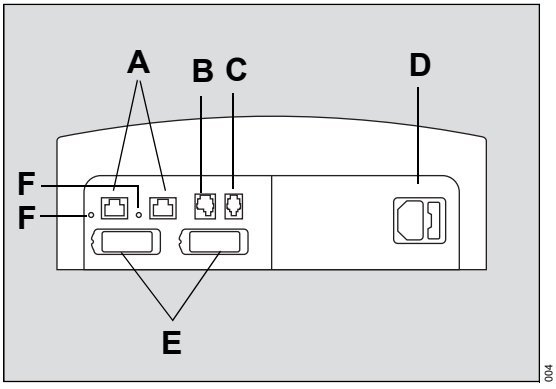
For detailed description regarding the front and back panel of the Cockpit, refer to the Instructions for use *Infinity Acute Care System – Infinity Medical Cockpit*.

NOTE

On the second-generation Cockpit, the yellow key on the front Audio paused has changed to .

Infinity PS250 power supply unit (PS250)

The following diagram shows the bottom of the PS250.



A Infinity network connectors

B Nurse call connector

C Export protocol connector

D Power cable connection

E Two interchangeable system cable connectors – one for the M540, one for the Cockpit

F Network connection LEDs

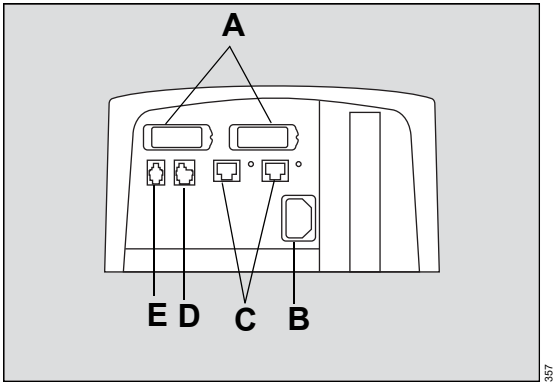
The front of the PS250 has the following two LEDs:

– Power mains – lights up green when the device is connected to AC power.

– Battery indicator – yellow LED that lights up briefly during startup or fault conditions such as a faulty battery.

Infinity P2500 power supply unit (P2500)

The following diagram shows the bottom of the P2500.



A Two interchangeable system cable connectors – one for the M540, one for the Cockpit

B Power cable connection

C Infinity network connector

D Nurse call connector

E Export protocol connector

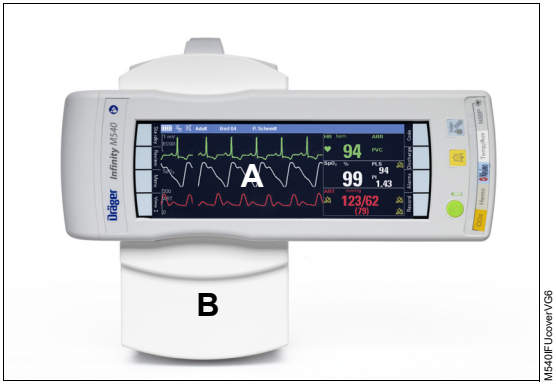
The front of the P2500 has the following two LEDs:

– Power mains – lights up green when the device is connected to AC power.

– Battery indicator – yellow LED that lights up briefly during startup or fault conditions such as a faulty battery.

Infinity M540 patient monitor (M540)

The following diagram shows the M540 when it is docked in the M500 docking station.



A M540 patient monitor

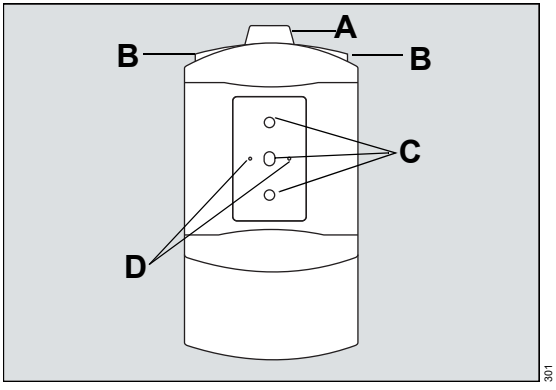
B M500 docking station

The M540 acquires patient signals, processes them, and relays them to the Cockpit for display. The M540 also provides patient monitoring when it is undocked during patient transport. For more detailed information on the M540, refer to the Instructions for use *Infinity Acute Care System – Infinity M540*.

Infinity M500 docking station (M500)

The M500 is the mechanical device that secures and powers the M540. It also charges the battery and controls the communication between the M540 and the Cockpit through an optical Ethernet link.

Front view of the M500



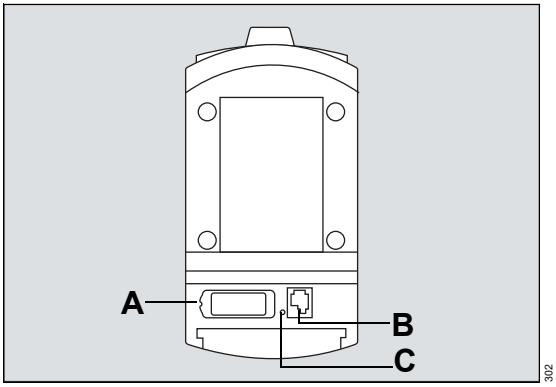
A Locking mechanism – secures the M540 (for more detailed information, see "Locking/unlocking the M540" on page 108)

B Release buttons for undocking the M540 (you only have to press one button to release the M540)

C Optical Ethernet links

D Pins for charging the battery of the M540 and for providing power to the M540 when it is docked

Rear view of the M500



A System cable connector

B Nurse call connector

C LED – lights up green when connected to the network

Additional hardware

The following table lists the additional devices that can be connected to the IACS.

Device	Description	Connection
Infinity MCable – Masimo SET	Measures the percentage of functional hemoglobin saturated with oxygen (%SpO2) and reports the perfusion index (PI) and the pulse rate (PLS*).	Connects directly to the SpO2 connector of the M540 (see page 268 and page 286).
Infinity MCable – Masimo SET rainbow	Measures the percentage of functional hemoglobin saturated with oxygen (%SpO2) and reports the perfusion index (PI) and the pulse rate (PLS*). In addition, it measures total arterial hemoglobin (SpHb), total oxygen content (SpOC), pleth variability index (PVI), Carboxyhemoglobin saturation (SpCO), methemoglobin saturation (SpMet).	
Infinity MCable – Nellcor OxiMax	Measures the percentage of functional hemoglobin saturated with oxygen (%SpO2) and the pulse rate (PLS*).	

Device	Description	Connection
Hemo4 pod Infinity MPod – QuadHemo	Measures up to 4 pressures, cardiac output, core and body temperature.	Connects directly to the Hemo connector of the M540.
Hemo2 pod	Measures up to 2 pressures, cardiac output, core and body temperature.	
Infinity MCable – Dual Hemo	Measures up to 2 pressures.	
Infinity MCable – Mainstream CO_2	Measures mainstream CO2.	Connects directly to the CO2 connector of the M540 (see page 348).
Infinity MCable – Microstream CO2	Measures Microstream CO_2.	Connects directly to the CO_2 connector of the M540 patient monitor (see page 358).
Scio Four	Measures the concentration of CO_2, N_2O, and anesthetic agents (Sevoflurane, Desflurane, Isoflurane, Halothane, and Enflurane) in the breathing gas.	Connects directly to the CO2 connector of the M540 or the M500 docking station (see the instructions for use *Infinity Acute Care System – Infinity M540*).
Scio Four Oxi	Measures the concentration of CO_2, N_2O, O_2, and anesthetic agents (Sevoflurane, Desflurane, Isoflurane, Halothane, and Enflurane) in the breathing gas.	
Scio Four plus	Measures the concentration of CO_2, N_2O, and anesthetic agents (Sevoflurane, Desflurane, Isoflurane, Halothane, and Enflurane) in the breathing gas.	
Scio Four Oxi plus	Measures the concentration of CO_2, N_2O, O_2, and anesthetic agents (Sevoflurane, Desflurane, Isoflurane, Halothane, and Enflurane) in the breathing gas.	
Infinity MCable – Nurse call	Provides remote notification of medium and high-priority alarm conditions.	Connects to the PS250 / P2500 (see page 25) or to the M500 (see page 26).

Device	Description	Connection
Infinity MCable – Analog/Sync	Provides a sync pulse to synchronize defibrillators to the heart beat of the patient during cardioversion. The cable's analog out function provides an ECG and arterial blood pressure signal to a device such as intra-aortic balloon pump.	Connects to the Temp/Aux connector of the M540 or to the CO2 connector with a Y-cable.
Secondary video display	Extends the viewing capabilities of a Cockpit to an additional video display. Secondary displays mirror the content of the Cockpit.	Connects to a Cockpit using the DVI 1 connector located on the back panel (see the instructions for use *Infinity Acute Care System – Medical Cockpit*).
R50N recorder	Produces timed and continuous recordings.	Connects to the Infinity network or the PS250 / P2500.
Laser printer	Prints various reports and Cockpit print screens.	Connects to the Infinity network.

Device interface kits

The following device interface cables are available for the Infinity Acute Care System and are used to connect to the corresponding devices.

Device	Part No. (cable)
Edwards EV1000/Vigi.II/Vigileo	MS34114
Dräger Evita 2D/4/XL ventilator	
Dräger Savina 300 ventilator	
Dräger Carina ventilator	
Bis Vista monitor	MS34115
Dräger Primus/IE/Apollo	
Dräger Fabius Family	
Masimo SpO_2	
Nellcor SpO_2	MS34239

Device	Part No. (cable)
Dräger V500 ventilator	MS34116
Dräger Babylog VN500	
Dräger V300 ventilator	
Dräger Perseus A500	
Dräger Zeus IE	
Maquet Servo-I ventilator	MS34117
TOFscan monitor	MS34118
Dräger Oxylog 3000+ ventilator	N/A

Additional devices that can display physiologic, multi-parameter data, provide trends and transmit information across a network, are listed below. (Availability is subject to in-country approval.)

Third party devices

- BIS Vista (Medtronic)
- Lifescience EV1000 (Edwards)
- Vigilance II (Edwards)
- Vigileo (Edwards)
- ToFScan (IDMed)
- Servo-i (Marquet)

Dräger devices

Dräger Ventilators

- Evita 2D
- Evita 4
- Evita XL
- Evita V500
- Babylog VN500
- Evita V300
- Savina 300
- Carina
- Oxylog 3000 plus

Dräger Anethesia devices

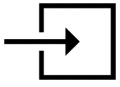
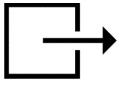
- Perseus A500
- Fabius OS
- Fabius Tiro Military
- Fabius MRI
- Zeus IE
- Primus
- Primus IE
- Primus US (Apollo)
- Fabius GS / Fabius Ti ro
- Fabius GS Premium
- Fabius plus
- Fabius plus XL

Device symbols

	Warning! Strictly follow these instructions for use		Lower alarm limits
	Consult instructions for use		Upper alarm limits
	Caution! Observe the accompanying documentation!		Autoset alarm limits
	Medical Device		Alarm monitoring deactivated temporarily
	Access to trend pages		Alarm monitoring deactivated permanently
	The button next to this symbol accesses special procedure pages		Acoustic alarm signal paused temporarily
	Access to alarm functions		Acoustic alarm signal turned off permanently
	Access to the standby and privacy modes, and access to patient discharge		Change clinical password Change biomed password

	Access to pre-configured views and layouts		Lung symbol that pulsates with each detected breath
	Access to parameter pages		Heart blip that flashes with each detected pulse
	Adult patient category		Pediatric patient category
	Neonatal patient category		Pacer detection is activated; the heart symbol flashes with each detected paced pulse
	Battery status LED	>>	Scrolls to additional tabs and pages
	Battery charging error		Power on/off
	AC power mains		WEEE - dispose electrical-electronic equipment properly
	Function/setting is unlocked	REF	Component number and revision

	Function/setting is locked		Device serial number
	Data entry with numeric keypad		Date of manufacture
	Trend configuration		Complete screen calibration procedure
	Keyboard access		Repeat screen calibration procedure
	Nurse call		Display filter. When selected, only the connected parameters and associated setup pages are displayed. When deselected, all parameters and associated setup pages are displayed.
	Manufacturer		Zeroing all pressures
	Parameter is excluded from display		Parameter is represented as a parameter field only
	Parameter is represented as a waveform and a parameter field		Import functions (for example, importing profiles)

	Save modifications (for example, changes to a view)		ESD warning
	Save as symbol	IPXx	Degree of protection against solid particle and liquid ingress, e.g., IPX1, IPX4, etc.
	Navigates forward on a web page		Refreshes a web screen
	Displays the main screen		Navigates backward on a web page
	Defibrillation-proof Type CF equipment		Stops loading the web page
	Gas in		Defibrillation-proof Type BF equipment
	Gas out	Rx only	Caution: Federal law restricts this device to sale by or on the order of a physician.
	Not made with natural rubber latex		Not made with natural rubber latex

 Do not re-use	Do not re-use, single patient use		Keep away from sunlight
	China RoHs marking for Control of pollution caused by Electronic Information Products.	Use by:  yyyy-mm-dd	Symbol indicates shelf life. YYYY-mm-dd indicates date by which device needs to be used to remain safe.
	Caution: This product contains natural rubber latex which may cause an allergic reaction		Contains DEHP

Abbreviations

The following table lists the abbreviations used in these instructions for use and those that are displayed on the Cockpit. For any abbreviations of parameters originating from external devices, refer to the corresponding instructions for use.

Abbreviation	Description
% leak	Relative leakage
% MVspon	Spontaneous minute volume, fractional
%PACED	Percentage of paced beats
AAMI	Association for the Advancement of Medical Instrumentation
ABD	Abdominal pressure
AHA	American Heart Association
Air cons	Cumulated air consumption

Abbreviation	Description
AIVR	Accelerated idioventricular rhythm
alv	Alveolar
AOR	Aortic arterial blood pressure
APP	Abdominal perfusion pressure
APR	Arterial pulse rate
ARR	Arrhythmia
ART	Arterial blood pressure
ART D	ART diastolic value
ART M	ART mean value
ART S	ART systolic value
ARTF	Artifact
ASY	Asystole

Abbreviation	Description
aVF	ECG lead aVF
aVL	ECG lead aVL
aVR	ECG lead aVR
AW-Temp	Gas temperature (airway)
AXL	Axillary arterial blood pressure
BCT	Burst count
BDP	Bladder pressure
BGM	Bigeminy
BIS	Bispectral index
BPP	Bladder perfusion pressure
BRA	Brachial arterial blood pressure
BRADY	Bradycardia
BSA	Body surface area
BSR	Suppression ratio
C.O.	Cardiac output
C20/Cdyn	Ratio of compliance during last 20% of inspiration over dynamic compliance
CaO2	Arterial oxygen content
CCI	Continuous cardiac index
CCO	Continuous cardiac output
Cdyn	Dynamic lung compliance
CI	Cardiac index
CISPR	International special committee on radio interference
CO2	Carbon dioxide
CPP	Cerebral perfusion pressure
CPP2	Cerebral perfusion pressure 2
CPP3	Cerebral perfusion pressure 3
CPP4	Cerebral perfusion pressure 4
CPT	Ventricular couplet
Cs	Static lung compliance
Cstat	Static lung compliance
CvO2	Venous oxygen content
CVP	Central venous blood pressure

Abbreviation	Description
DCO2	CO2 elimination coefficient during HFO
Des	Desflurane
Des cons	Cumulated desflurane consumption
DHCP	Dynamic host configuration protocol
DNS	Domain name system
DO2	Oxygen delivery
DO2I	Oxygen delivery index
dV1 to dV6	Derived chest leads
DVI	Digital visual interface
E	Lung elastance
E (I:E)	Inspiratory:expiratory ratio, expiratory component
E (I:Espon)	Inspiratory:expiratory ratio, spontaneous, expiratory component
ECG	Electrocardiogram
EDV	End-diastolic volume
EDVI	End-diastolic volume index
EF	Ejection fraction
EIP	End inspiratory pressure
Enf	Enflurane
Enf cons	Cumulated enflurane consumption
ESO	Esophageal pressure
ESV	End-systolic volume
ESVI	End-systolic volume index
et	End-tidal (in combination with gas values)
etDes	End-tidal desflurane concentration
etEnf	End-tidal enflurane concentration
etHal	End-tidal halothane concentration
etIso	End-tidal isoflurane concentration

Abbreviation	Description
etN2O	End-tidal N2O concentration
etO2	End-tidal oxygen concentration
etSev	End-tidal sevoflurane concentration
FEM	Femoral arterial blood pressure
FEMV	Femoral venous blood pressure
FiO2	Fractional inspired O2
FV	Flow-Volume loop
GP1 D to GP4 D	General pressure 1-4 diastolic value
GP1 M to GP4 M	GP 1 to 4 mean value
GP1 S to GP4 S	GP 1 to 4 systolic value
GP5 to GP8	General pressure 5 to 8
GPM	Mean general pressure
Hal	Halothane
Hal cons	Cumulated halothane consumption
HFO	High-frequency oscillation
Hgb	Hemoglobin
HR	Heart rate
Ht	Height
I	ECG lead I
I (I:E)	Inspiratory:expiratory ratio (inspiratory component)
I (I:Espon)	Inspiratory:expiratory ratio, spontaneous, inspiratory component
I:E	Inspiratory to expiratory ratio
IACS	Infinity Acute Care System – Monitoring Applications
IP	Invasive pressure
ICI	Intermittent cardiac index
ICO	Intermittent cardiac output
ICP	Intracranial pressure

Abbreviation	Description
ICP2	Intracranial pressure 2
ICP3	Intracranial pressure 3
ICP4	Intracranial pressure 4
ICS	Infinity CentralStation
IEC	International Electrotechnical Commission
II	ECG lead II
III	ECG lead III
in	Inspiratory (in combination with gas values)
inCO2	Inspiratory CO2 concentration
inDes	Inspiratory desflurane concentration
inEnf	Inspiratory enflurane concentration
inHal	Inspiratory halothane concentration
inIso	Inspiratory isoflurane concentration
inj	Injectate temperature
inN2O	Inspiratory N2O concentration
inSev	inspiratory sevoflurane concentration
Insp. term.	Inspiratory termination criterion based on peak inspiratory flow
inxMAC	MAC factor
iO2	Inspired O2
ISO	Isoelectric point
Iso	Isoflurane
Iso cons	Cumulated Isoflurane consumption
LA	Left arm (ECG)
LA	Left atrial blood pressure
LHCPP	Left heart coronary perfusion pressure
LV	Left ventricular blood pressure
LV D	LV diastolic value

Abbreviation	Description
LV M	LV mean value
LV S	LV systolic value
LVSW	Left ventricular stroke work
LVSWI	Left ventricular stroke work index
MV	Total minute volume
MV ds	Minute volume, dead space
MValv	Alveolar minute volume
MVe	Minute volume, total expiratory
MVe s	Minute volume, spontaneous expiratory
MVi	Minute volume, total inspiratory
MVi s	Minute volume, spontaneous inspiratory
MVleak	Minute volume leakage
MVmand	Minute volume, mandatory
MVspon	Minute volume, expired spontaneous
N2O	Nitrous oxide
N2O cons	Cumulated N2O consumption
NIBP	Non-invasive blood pressure
NIBP D	NIBP diastolic value
NIBP M	NIBP mean value
NIBP S	NIBP systolic value
NIF	Negative inspiratory force
NMT	Neuromuscular transmission
O_2 cons	Cumulated O_2 consumption
OR	Operating room
P0.1	Occlusion pressure
P2500	Power supply unit
PA	Pulmonary arterial blood pressure
PA D	PA diastolic value
PA M	PA mean value
PA S	PA systolic value
PaCO2	Arterial CO2 pressure
PaO2	Arterial O_2 pressure

Abbreviation	Description
Pause	Pause pressure
Paw	Airway pressure
PAW min	Minimum airway pressure
Pb	Ambient pressure
PeCO2	Mixed expired CO2 pressure
PEEP	Positive end expiratory pressure
PEEPi	Intrinsic positive-end expiratory pressure
Phigh	Upper pressure level during APRV
PI	Perfusion index (SpO2)
Pinsp	Inspiratory pressure
PIP	Peak inspiratory pressure
Plow	Lower pressure level during APRV
PLS	Pulse rate from SpO2 or arterial pressure
PLS*	Pulse rate from external SpO2* device
APR	Arterial blood pressure – pulse rate
Pmax	Maximum inspired pressure
Pmean	Mean airway pressure
Pmin	Minimum airway pressure
Pplat	Plateau pressure
PS250	Power supply unit
PTC	Post tetanic count
PV	Pressure-Volume loop
PVC/min	Rate of PVC (pre-ventricular contractions) per minute
PVI	Pleth variability index
PVR	Pulmonary vascular resistance
PVRI	Pulmonary vascular resistance index
PWP	Pulmonary wedge pressure
PWR	Total signal power

Abbreviation	Description
Qs/Qt	Intrapulmonary right-left shunt
R	Resistance (airway)
r2	Parameter correlation factor
R50N	Strip recorder
RA	Right arm (ECG)
RA	Right atrial blood pressure
RAD	Radial arterial blood pressure
Raw	Resistance (airway)
Raw exp	Expiratory resistance (airway)
Raw insp	Inspiratory resistance (airway)
Resp.	Respiration
RPP	Rate pressure product
RR	Respiratory rate, ventilation
RRapn	Rate for apnea ventilation
RRc	Respiratory rate (CO_2)
RRi	Respiratory rate (impedance)
RRmand	Mandatory respiratory rate
RRs	Respiratory rate, spontaneous
RRspon	Respiratory rate, spontaneous
RSB	Rapid shallow breathing index
RUN	Ventricular run
RV	Right ventricular blood pressure
RV D	RV diastolic value
RV M	RV mean value
RV S	RV systolic value
RVSW	Right ventricular stroke work
RVSWI	Right ventricular stroke work index
SaO2	Arterial oxygen saturation
SC-duration	Duration of patient session (SmartCare)
SC-etCO_2	etCO_2 (SmartCare)
SC-RRspon	Spontaneous frequency (SmartCare)
SC-VT	Tidal volume (SmartCare)

Abbreviation	Description
SC-ΔPsupp goal	Pressure support goal (SmartCare)
SC-ΔPsupp rated	Pressure support by internal controller (SmartCare)
SEF	Spectral edge frequency
Sev cons	Cumulative sevoflurane consumption
SpCO	Carboxyhemoglobin saturation
SpHb	Total arterial hemoglobin
SpHbv	Total venous hemoglobin
SpMet	Methemoglobin saturation
SpO2	Oxygen saturation measured by pulse oximetry
SpO2/CO-Ox	CO-oximetry
SpO2*	SpO2 from external device
SpOC	Total oxygen content
SQI	Signal quality index
ST(x)	ST deviation of lead (x)
STdV1 STdV3 STdV4 STdV6	ST-segment deviations of derived leads
SV	Stroke volume
SVI	Stroke volume index
SvO2	Venous oxygen saturation
SVR	Systemic vascular resistance
SVRI	Systemic vascular resistance index
SVT	Supraventricular tachycardia
SVV	Stroke volume variation
T1a	Temperature 1A
T1b	Temperature 1B
Ta	Temperature A
TACH	Tachycardia
Tb	Temperature B

Abbreviation	Description
TBlad	Bladder temperature
TBld1	Blood temperature
TBlnkt	Blanket temperature
Tblood	Blood temperature
TC	Time constant
Tcase	Therapy case duration
Tcore	Body core temperature
TEso	Esophageal temperature
Thigh	Time of upper pressure level in APRV
Ti	Inspired time
Ti set	Inspired time setting
Tinj	Injectate temperature
Tispon	Spontaneous inspiratory time
TL	Left temperature
Tlow	Time of low pressure level in APRV
TNasal	Nasal temperature
TOF Cnt	Train of four (NMT)
TOral	Oral temperature
TPR	Total pulmonary resistance
TR	Right temperature
Trapped VOL	Trapped volume
TRect	Rectal temperature
TruST	Algorithm that provides a TruST 12-lead-ECG (including derived chest leads dV1, dV3, dV4, dV6) using a 6-wire lead set that provides leads I, II, III, aVL, aVR, aVF, V2, V5.
TSkin	Skin temperature
TVd aw	Tidal volume, dead space
TVR	Total vascular resistance
UAP	Umbilical arterial blood pressure
UVP	Umbilical venous pressure

Abbreviation	Description
V	Chest lead from a 5- or 6-wire lead set.
V'CO2	CO2 production
V+	Second chest lead from a 6-wire lead set
V1 - V6	ECG chest leads V1 to V6
VCO2	CO2 production
Vds	Dead space
Vds/VTe	Tidal volume, relative dead space
VESA	Video Electronics Standard Association
VF	Ventricular fibrillation
VO2	Oxygen consumption
VO2I	Oxygen consumption index
VT	Tidal volume
VT/Wt	Tidal volume per kg body weight
VTACH	Ventricular tachycardia
VTe	Tidal volume, expired
VTemand	Mandatory expiratory tidal volume
VTespon	Spontaneous expired total volume
VTespon mean	Spontaneous expired mean total volume
VThf	Tidal volume for HFO
VTi	Tidal volume, inspired
VTimand	Mandatory inspired tidal volume
VTispon	Spontaneous inspired tidal volume
VTispon mean	Spontaneous inspired mean total volume
VTmand	Tidal volume, mandatory
Vtrap	Trapped volume
VTspon	Spontaneous tidal volume, leakage-corrected
VTspon mean	Spontaneous mean tidal volume
ΔO_2	Inspiratory/expiratory oxygen concentration difference

Abbreviation	Description
∆Phf	∆ pressure amplitude during HFO
∆Psupp	Pressure amplitude above PEEP in pressure support
ΔT	Temperature difference
ΔT1	Temperature difference 1

This page has been left blank intentionally.

Operating concept

Overview

The IACS is a fully networked solution that offers patient monitoring, therapy, and IT applications at the point of care.

Dräger developed the IACS to solve problems common in the acute care environment. As a result, the IACS provides standardized user interfaces, improves workplace ergonomics and flexibility, and centralizes patient data at the point of care. The IACS also provides the ability to backfill information automatically after patient transport. An M540 on wireless transport transmits the data to the ICS (Infinity CentralStation) during transport.

The central component of the IACS is the Cockpit. This medical-grade workstation provides centralized viewing and control of Infinity monitoring systems and IT applications at the point of care. The Cockpit is available in the following sizes:

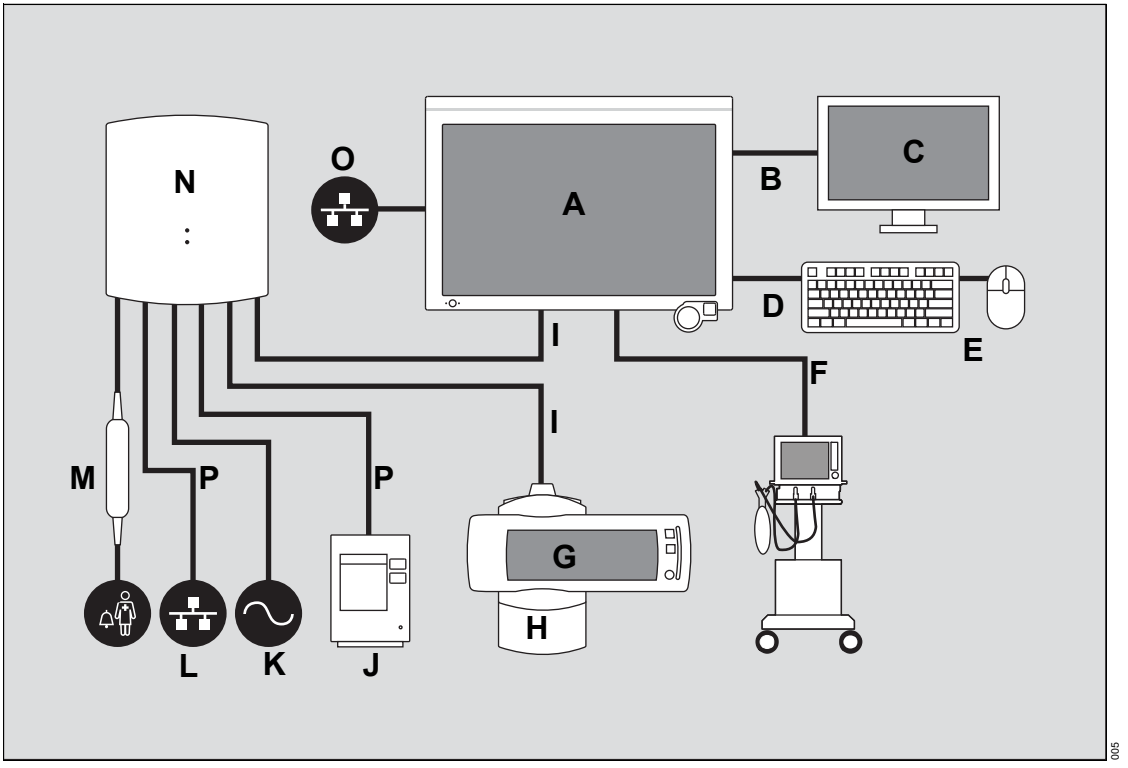
Display	**Screen width**
C500 (2nd generation)	17-inch (43.2 cm)
C500 (3rd generation)	17.3-inch (43.9 cm)
C700 (2nd generation)	20-inch (50.8 cm)
C700 (3rd generation)	21.5-inch (54.6 cm)

Both offer a large viewing angle, extended screen layout capabilities, and a fan-less design.

The common Dräger-standardized user interface offers intuitive operation via a touchscreen and a rotary knob. A 360-degree alarm bar alerts the user to the alarm conditions of a patient.

The IACS components

The following diagram shows a possible IACS configuration.



A C500/C700

B DVI cable / DisplayPort cable

C Secondary display (option)

D USB cable

E Keyboard and mouse (option)

F Device connectivity cable (option)

G M540 patient monitor

H M500 docking station

I System cables

J *R50N recorder (option)
*Not available in the EU

K AC power

L Infinity network

M Infinity MCable – Nurse call (option)

N P2500 / PS250

O Hospital network

P Ethernet cable

M540 and Cockpit communication

Communication between the M540 and the Cockpit starts as soon as the M540 is docked in the M500 (see page 107). The M540 acquires physiological signals from the patient and relays them to the Cockpit for display. The Cockpit then makes the patient data available to the Infinity network.

When the M540 is docked, the Cockpit assumes the annunciation of all acoustic alarm signals. However, alarms are always reported optically at the Cockpit *and* at the M540. When the M540 is undocked for transport, it provides acoustic alarm signals. In addition, the ICS can assume the annunciation of acoustic alarm signals for an M540 on wireless transport.

NOTE

For alarms to also sound at the M540 when it is docked, select the alarm volume at the M540 manually. For information, refer to the M540 instructions for use.

The only exceptions are Cockpit-specific alarm messages such as ***External device disconnected*** for which the M540 does not report any acoustic and optical alarm signals.

When the M540 is docked, any changes to the patient setup such as alarm limits made on the Cockpit are automatically transferred to the M540 (and vice versa).

NOTE

If the M540 cannot communicate with the Cockpit, the Cockpit sounds an alarm. In addition, an alarm indicating a loss of communication is broadcast over the network to the Infinity CentralStation (ICS) provided the patient is admitted there. The M540 continues to monitor the patient.

Docking the M540

As soon as the user docks the M540 in the M500, the following happens at the Cockpit:

– The message ***Connecting to M540*** appears in the center of the Cockpit screen.

– The Cockpit makes the data of the M540 available to the Infinity network.

NOTE

If the user docks an M540 with a patient category that differs from the one selected on the Cockpit, the patient category setting of the Cockpit changes to match the one of the M540.

Docking to the same Cockpit

If the user undocks an M540 from a Cockpit and later docks the M540 to the same Cockpit, the data collection continues seamlessly. The Cockpit automatically retrieves any data the M540 collected while on patient transport and merges it with the data set for that patient.

Docking to a different Cockpit

CAUTION
Before connecting the M540 to a different Cockpit, make sure that the units of measure align between the two devices. Differing units of measure could result in loss of data or a patient discharge.

If the user undocks an M540 from a Cockpit and later docks the M540 to a different Cockpit, the original data are automatically retrieved over the network by the new Cockpit. The new Cockpit then automatically merges this data with any data the M540 collected while on patient transport. The original Cockpit automatically discharges the patient once all patient data are transferred.

When moving the M540 between Cockpits in different monitoring units, the time stamps may differ occasionally between the Cockpit and the M540.

If not all patient data was transferred, the message ***Transfer of Data Incomplete*** appears in the header bar of the new Cockpit. In this case, the original Cockpit does not discharge the patient.

Undocking the M540

When the user undocks the M540, the following happens:

– The message ***Disconnected from M540*** appears in the center of the Cockpit screen.

– When the M540 is not in wireless mode, a message appears at the ICS that the bed is disconnected. When the wireless option for an M540 is activated and configured properly, the ICS displays the wireless symbol.

– Data are no longer trended at the Cockpit.

– With each docking or undocking of an M540, there is a short transition period. One minute of trend data collected during this transition period may not be displayed at an ICS equipped with software version VG1. However, this trend data can be reviewed at the Cockpit.

– Several buttons remain active on the main menu bar of the Cockpit:

  – ***Alarms...*** for accessing the alarm history.

  – ***Trends/ Data...*** for accessing the trend data.

  – ***Start/Standby...*** for accessing the ***Start*** tab from where the user can initiate a patient discharge.

– The current patient data from the Cockpit are no longer available to the Infinity network. However, when the wireless option for an M540 is activated and configured properly, it continues to make the data available to the Infinity network.

– Parameter values acquired using the device connectivity option are no longer available to the Infinity network.

Communicating with the Infinity network

When the M540 is docked on the M500 and the IACS is connected to the network, the patient data are available on the Infinity network. When the setting, ***Enable Central Station*** is activated, the Cockpit provides additional messages and alarm tones for central monitoring. For more information, see page 47.

Communicating with the Infinity network has the following benefits:

– Patient data are sent across the Infinity network to connected devices.

– The alarm status of the patient is reported to the Infinity network and its connected devices. If multiple alarm conditions are present, the alarm with the highest alarm priority is reported.

– The patient can be admitted at the ICS for central monitoring. The IACS is fully compatible with ICS software VGx (not compatible with ICS software VFx).

– You can view the Cockpit from other Infinity monitors within the same monitoring unit using the remote view function (see page 54).

– From the Cockpit you can view other bedside monitors (including other Cockpits) in the same monitoring unit using the remote view function (see page 52).

NOTE

Two IACS monitoring devices in the same monitoring unit on the network, may result in a perceived time drift of a maximum of 80 seconds between each other.

Loss of connection to the network

When the Cockpit loses connection to the Infinity network and the feature ***Offline detection*** is activated (see page 490), the following happens:

– A single notification alarm of low alarm priority sounds once within 25 seconds of the offline condition until the communication with the network is restored or the alarm is acknowledged. The alarm tone sounds even if alarms are paused or the alarm volume has been deactivated.

– The alarm volume is automatically adjusted to 100% until the network connection is restored. Once the Cockpit re-establishes communication with the network, the previous alarm volume is restored.

– The message ***Offline*** appears on cyan background in the network message area of the Cockpit until the connection to the network is restored.

When the wireless option is activated and configured properly, the M540 switches to wireless transport mode automatically within ten seconds of being undocked from the M500 (see "Undocking the M540" on page 48). For detailed information on how an M540 behaves on wireless transport, refer to the instructions for use *Infinity Acute Care System – Infinity M540.*

M540 in standalone mode

When the wireless option is activated and configured, a standalone M540 communicates wirelessly with the Infinity network when undocked. When docked, a wireless M540 transitions back to a wired connection, and the wireless symbol is replaced by the network symbol  .

For detailed information on how the M540 behaves in standalone mode, see the Instructions for use entitled *Infinity Acute Care System – Infinity M540*.

Network data transfer

The IACS supports the transfer of patient data to and from the following devices assigned to the same monitoring unit:

– Infinity Delta/Delta XL/Kappa (software version VF7 to VF9.x)

– Other IACS monitoring Cockpits

CAUTION
A loss of network connectivity during a network transfer could result in the loss of patient data on both the source monitor and the target monitor.

NOTE
If the M540 is undocked during a network transfer, the transfer will fail, and the M540 does not exit the transferring data screen. Press the touch screen to resume data transfer.

NOTE
You can also transfer patient data by undocking and redocking an M540.

The following data are included in a patient data transfer:

– Demographic data (see page 99 for information of what demographic data is included)

– Trends (up to 60 trended parameters)

NOTE
The amount of data being transferred over the network depends on how much data is available at the source device. A maximum of 60 trend parameters can be transferred over the network based on the parameter priority of the Cockpit.

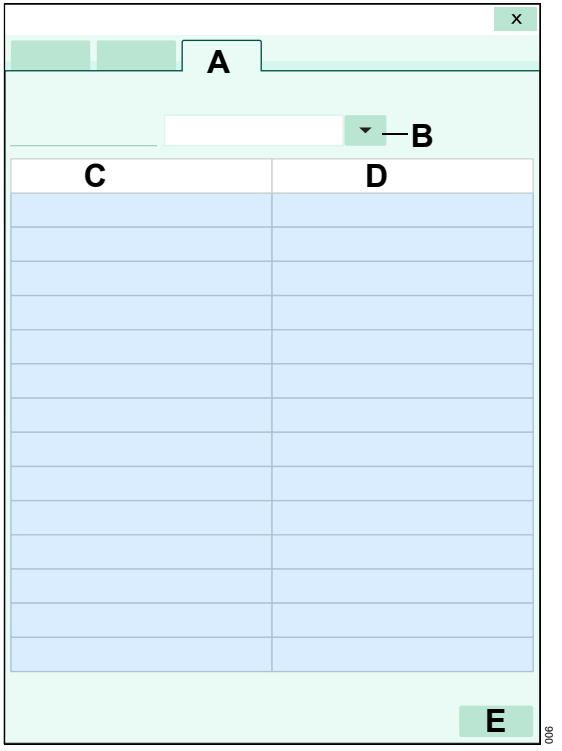
For Delta series monitors, the maximum amount of data is 24 hours. For a network transfer between IACS Cockpits, the maximum of data is 96 hours.

– Events containing up to 32 parameters for (C500) or up to 40 parameters for (C700)

– Hemodynamic, oxygenation, and ventilation calculation results

– Laboratory data values are not transferred during a network transfer. The following diagram shows the ***Transfer*** page which is used for patient data transfers.

NOTE
Due to a possible time variation between cockpits, the trend time stamp may vary by one minute after a network transfer.



A ***Transfer*** tab

B ***Care area*** selection arrow

C ***Current patient*** column

D ***Device name*** column

E ***Start transfer*** button

To transfer data over the network

The IACS network supports the transfer of patient data from a source device, such as an Infinity Delta, Delta XL/Kappa or an IACS Cockpit, to another Cockpit.

1 Place the source device in standby mode.

2 Go to the Cockpit to which you wish to transfer data.

CAUTION

To prevent mixing the data of two patients, first discharge the patient admitted at the destination Cockpit. If the patient is not discharged, the new data is appended to the existing data stored at the destination Cockpit.

3 Select the ***Start/Standby...*** button on the main menu bar.

4 Select the ***Transfer*** tab (if not already selected). The ***Transfer*** page (see page 55) lists all of the devices in the currently selected care area who are in standby mode.

5 Use the care area selection arrow (B) on the ***Transfer*** page to select the care area from the list in which the source device is located.

6 Select the source device in the ***Device name*** column (D).

7 Select the ***Start transfer*** button (E).

8 Press the rotary knob. A ***Confirm transfer*** dialog appears with the following message: ***The network transfer will delete existing patient data on this device.***

9 Select one of the following buttons:

- ***Cancel –*** to prevent the data transfer and return to the ***Transfer*** page.
- ***Transfer –*** to discharge the patient from the Cockpit and initiate the data transfer. During the transfer, the Cockpit and M540 display the message ***Transferring data....***

CAUTION

During a network transfer, do not touch either device until the transfer is completed.

A successful transfer results in the following:

– The Cockpit returns to the main screen.

– The message ***Transfer Complete*** appears in the Cockpit header.

A failed transfer results in the following:

– The Cockpit returns to the ***Transfer*** page.

– The message***Transfer of data incomplete*** displays in the network message header of the Cockpit.

– The M540 returns to the last monitoring screen before the transfer started.

Remote control and remote view

When a Cockpit is connected to the Infinity network, data can be shared among Infinity devices that are connected to the network. From the Cockpit, the user can view other Infinity devices and perform several remote functions. The user can also allow other Infinity devices to view a Cockpit and perform remote functions by activating the remote control function (see page 489).

Remote view from the Cockpit

The remote view function of the Cockpit allows the user to view patient data from other Infinity monitors within the same monitoring unit. If the user is viewing another Cockpit, the remote view window shows the ***Auto view*** (see page 73) of the remote Cockpit.

NOTE

For the Cockpit and M540, when viewing the patient monitor in Remote View, the HR label displays instead of the PLS label when the HR source is set to anything other than ECG. The value reported is the PLS label.

The remote view function also allows the user to pause acoustic alarm signals and request timed and continuous recordings of the remote device from the Cockpit.

To access the remote view

1. Select the ***Views...*** button on the main menu bar to access the ***Views*** dialog.
2. Select the ***Remote view*** tab. This dialog lists all of the beds in the monitoring unit of the Cockpit.
3. Select a bed from the list in the ***Views...*** dialog to access the remote view of an individual patient.
4. Select the ***Connect*** button.

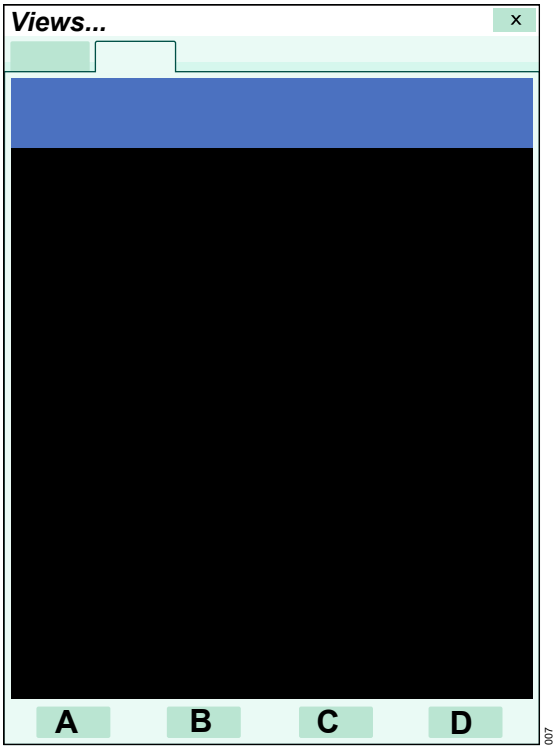
When there are multiple alarms in the same p-box, the p-box in remote view for the selected bed on IACS does not match the bed when Quiet Mode is set to ***Off***.

NOTE

When there are multiple alarms of different states and/or priorities in the same parameter field, the remote view parameter fields may not display correct color and flashing when ***Quiet mode*** is set to ***Off***. However, when ***Quiet mode*** is set to ***On***, remote view updates the correct alarm status for all parameters from the remote bed.

In the remote view of the Cockpit, the message ***Pacer off*** does not appear when the pacer detection is deactivated on the source monitor.

The following diagram shows a ***Remote view***.



A ***Disconnect*** button

B ***Audio Pause*** button

C ***Continuous Recording*** button

D ***Timed Recording*** button

Using remote view functions

From the ***Remote view*** dialog, the user can perform the following functions:

– Select the ***Disconnect*** button (A) to exit the remote view.

– Select the ***Audio Pause*** button (B) to pause acoustic alarm signals at the remote device.

– Select the ***Continuous Recording*** (C) or ***Timed Recording*** (D) buttons to request a recording of the remote device. The recordings are printed on the recorder that is assigned to the Cockpit.

Central monitoring

When a Cockpit communicates with the Infinity network, the user can admit the patient at the ICS for central monitoring. A Cockpit patient is represented on the ICS with a viewport and a bed view. A viewport consists of the top Cockpit waveform and the associated parameter field. The ICS also provides a bed view which is a window displaying the content of the Cockpit in greater detail. When the Cockpit is communicating with the ICS, the waveforms and parameter fields are assigned to the bed view based on the parameter priority order.

NOTE

Due to potential time drifts between the IACS and the ICS, when an alarm is generated from the IACS, the waveform displayed on the ICS event disclosure may not align with the timestamp of the event. Place the cursor at the timestamp of the event and then go to the ICS's Full Disclosure for a more complete view of the waveforms.

NOTE

When you select an event disclosure at the ICS for a parameter with a decimal value, the parameter rounds to the nearest whole number.

Network communication interruptions

When the Cockpit loses communication with the ICS, the following happens at the Cockpit when the ***Enable Central Station*** setting is activated (see page 489):

– The message ***Not Monitored By Central*** appears on cyan background in the network message area of the Cockpit.

– A single notification alarm of low alarm priority sounds within 25 seconds until communication with the ICS is restored or the alarm is acknowledged. The alarm tone sounds even when alarms are paused or the alarm volume has been deactivated.

– The alarm volume is adjusted automatically to 100% until the condition clears. Once the Cockpit re-establishes communication with the ICS, the previous alarm volume is restored.

– The message ***System not monitored by ICS*** is recorded in the alarm history.

When the communication between the Cockpit and the ICS is restored, the Cockpit displays the message ***System monitored by ICS*** in the alarm history. The patient data are again accessible at the ICS.

When the setting ***Enable Central Station*** is deactivated (see page 489), none of the above features are supported.

Remote control

If the remote control feature is activated (see page 489), the user can perform the following Cockpit functions remotely from the ICS:

NOTE
Remote control of arrhythmia settings from ICS is only possible if the full arrhythmia option is enabled on the Cockpit.

– Autoset alarm limits
– Initiate a relearning phase
– Audio pause acoustic alarm signals (see page 130)
– Configure alarm limits and ST and arrhythmia settings
– Request timed and continuous recordings

If the remote control feature is activated (see page 489), the user can perform the following Cockpit functions remotely from one of the following devices: Delta XL or Kappa, Vista XL, Gamma X XL:

– Request timed and continuous recordings
– Audio pause acoustic alarm signals

If several devices modify the patient settings of a single Cockpit, the last update is always implemented. For detailed information on performing these functions at the ICS, refer to the instructions for use *Infinity CentralStation*.

IT applications

Several optional IT applications provide remote access to patient data from the Cockpit. For example, the PatientWatch application (accessible with the Infinity Gateway) allows viewing of up to four different bedside monitors that are connected to the Infinity network. If configured accordingly, IT applications are accessible by selecting a tab on the Cockpit. For more information, see "IT applications (options)" on page 517.

Communication management

The following table summarizes how the Cockpit, the M540, and the M500 function under specific circumstances.

What happens if...	**Behavior**
the user switches on the M540?	The M540 emits a high-pitched tone followed by two power-up tones, performs a selftest, and displays the ***New patient?*** prompt.
Docking/undocking an M540	
the user docks an M540?	Certain functions such as trends, alarm history, profiles, and biomed setup are not accessible for a brief period of time.

What happens if...	**Behavior**
the user docks an M540 and it is unable to communicate with the Cockpit?	– An alarm of medium priority sounds at the Cockpit, at the M540, and at the ICS (provided the patient is admitted there). – The message ***M540 communication failure*** appears at the Cockpit. – The M540 continues to monitor the patient and provides acoustic and optical alarm signals.
Alarm behavior	
an M540 whose acoustic alarm signals have been paused docks to a Cockpit?	All acoustic alarm signals are paused for two minutes on both devices.
the user docks an M540 with a different alarm pause state than that of the Cockpit?	Both devices observe the remaining alarm pause interval.
Connection/power problems	
there is a power supply failure?	– The LEDs on the front indicate that the Cockpit and the M540 are on battery charge. – The Cockpit sounds an alarm of medium priority and switches to battery charge for up to five minutes before performing a safe shutdown. – The M540 switches to battery charge for up to three hours before shutting down.
the system cable is disconnected from the power supply or the M500?	– The Cockpit sounds an alarm tone of low priority. – The Cockpit displays the message ***Please plug in system cable*** in the header bar and the message ***Disconnected from M540*** appears in the monitoring area. – The Cockpit no longer displays any parameters and waveforms.

What happens if...	Behavior
the Cockpit loses communication with the ICS?	When the setting ***Enable Central Station*** is activated (see page 489), the following happens at the Cockpit: – On the Cockpit the ***Alarm volume*** setting (see page 471) changes to 100% volume regardless of whether an alarm condition exists or not. The setting ***Off*** for the ***Alarm volume*** selection is no longer available. For more information on adjusting the alarm volume, see page 121. Once the communication is restored, the previously selected ***Alarm volume*** setting is restored. – The M540 produces one alarm tone. – The Cockpit displays the message ***Not Monitored By Central***. When the setting ***Enable Central Station*** is deactivated (see page 489), none of the above features are supported.
the Cockpit loses communication with an external device?	– The Cockpit tries to restore the link. – If the corresponding function is activated, an alarm sounds and the message ***External device disconnected*** appears on the Cockpit and ICS (see "External device disconnected alarm control" on page 474).
Miscellaneous	
the Cockpit and the M540 are monitoring a patient and the user puts either device in standby mode?	Both devices are put in standby mode.
the Cockpit and the M540 are monitoring a patient and the user discharges the patient on either device?	– The patient is discharged from both devices. – The patient discharge is annotated at the Cockpit in the ***Alarm history*** page with the message ***Patient transferred***.
a function such as initiating a non-invasive blood pressure measurement is requested at the M540 and almost simultaneously on the Cockpit?	The function is canceled on both devices.

Loss of power

A loss of power has the following effect:

– The Cockpit switches to battery charge for up to five minutes before performing a safe shutdown that preserves the integrity of the patient data and reverts to the user-defined patient default profile.
– A medium-priority alarm is triggered at the Cockpit and the message ***Please plug in power supply*** appears.
– The M540 switches to battery charge for up to three hours before performing a safe shutdown that preserves the integrity of the patient data and the user settings.

Locked options

The IACS supports several locked options. For a list of options, refer to the instructions for use *Infinity Acute Care System – Monitoring Accessories*.

Temporary options

Temporary options make it possible for an M540 in an IACS configuration to perform the intended functions together with the Cockpit when the devices do not share the same option setup. For example, when an M540 with permanent options docks to an IACS Cockpit that does not have the same options activated, the M540 options temporarily loans these options to the Cockpit.

Temporary options are deactivated when a patient is discharged. However, they are retained if the user turns the Cockpit or the M540 off and on.

External display

To extend the display capabilities of a Cockpit, connect an external display to the DVI connector of the Cockpit using a DVI to DVI to VGA cable type, or via the DisplayPort connection on a third-generation Cockpit.

The first-generation Cockpit and the second-generation Cockpit have DVI connections. The third-generation Cockpit has a DisplayPort connection.

To connect to an external display

1 Connect the monitor that will be used for external display to the ***Cockpit*** via the DVI connection or the DisplayPort connection.

2 Press the ***System setup...*** button on the main screen.

3 Enter the clinical password.

4 Press the ***Patient monitor*** tab on the ***System setup*** dialog.

5 Press the ***Clone*** button next to ***External display***.

Or

Press the ***Indep. display*** button next to ***External display***.

The monitor that is connected to the ***Cockpit*** now displays data.

Clone display

The clone display duplicates the content of the ***Cockpit*** screen. It does not produce any acoustic alarm signals and does not support any user interaction. Clone display is supported by the DVI connection as well as the DisplayPort connection. A clone display has to meet certain technical specifications (see page 605):

Display	Resolution
C500 (2nd generation)	1440 x 900 pixels
C500 (3rd generation)	1920 x 1080 pixels
C700 (2nd generation)	1680 x 1050 pixels
C700 (3rd generation)	1920 x 1080 pixels

Independent display

Independent display provides a visual display of patient monitoring data on a secondary monitor, separate from the primary monitor. The user selects and configures patient data, such as patient demographics, waveforms, parameters, and trends, to provide specific visual information. Independent display is only supported by the DisplayPort connection. A locked option must be purchased separately to use this feature.

WARNING
Independent display is for use as a secondary display only, and not intended for alarm annunciation.

CAUTION
Independent display does not provide audio, acoustic alarm output or optical alarm output.

NOTE
Independent display requires a DisplayPort connection to a third-generation ***Cockpit***.

NOTE
Only one external display (either one clone display or one independent display) can be configured to a ***Cockpit***.

To configure independent display

1 Press the ***Views...*** button on the main screen.

2 Press the ***Independent display*** tab.

The following tabs provide the available settings available for independent display.

– ***Auto view***

– ***General settings***

– ***Timers***

– ***Parameter colors***

– ***Pressure colors***

– ***Profiles***

Auto view settings tab

You can perform various functions in the ***Auto view*** page. The following settings describe the general settings of the ***Auto view*** page. For detailed information on setting up the display attributes of a parameter, see "Configuring parameters for display" on page 461.

To configure the available settings

1 Select the display mode by selecting one of the following two buttons next to ***Display mode***:

   – ***Auto*** to select the auto display mode (see page 80).

   – ***Manual*** to select the manual display mode (see page 74).

2 Select the ***Waveforms*** button to determine the number of waveforms that can be selected in the parameter selection window. The available options range from 2 waveforms to 8 waveforms.

3 Select the ***Layout*** button. Then select the ***Left*** or ***Right*** (default) button to determine if the waveforms appear to the left or to the right of the parameter fields.

4 Select the ***Pressure overlap*** on or off (default) button to activate or deactivate pressure overlap mode. This feature works only if the pressure waveforms are displayed in adjacent channels.

5 Select the ***Parameter boxes*** button and use the rotary knob to select the desired number of parameter fields for display. The available selections are: ***Off***, 1, 2, 3 (default), 4.

6 Select the ***Layout*** button. Then select the ***Top*** or ***Bottom*** (default) button to determine if the parameter fields appear along the bottom or the top of the screen.

7 Select the ***Mini trends*** button to activate or deactivate the mini-trend display or select a trend display time (see page 78). The available selections are: ***Off***, 10 min, 15 min, 20 min, 30 min (default), 45 min, 1 h, 90 min, 2 h, and 4 h.

8 Select the ***NIBP trend*** button to choose between the graphic or numeric representation of the ***NIBP*** mini-trend display.

9 Select the ***Profile*** button to choose the desired profile.

10 To configure parameters for display and to prioritize parameters, see "Configuring parameters for display" on page 461.

General settings tab

The following table lists the available settings for the ***General settings*** dialog page.

Selection	Available settings	Description
ECG waveforms	1, 2, 3	Sets up to three leads.
IP grids	***On, Off***	Displays or hides the grid.
Large mean	***On, Off***	Displays a value in large font size or regular font size.
Monitoring sweep speed [mm/s]	6.25, 12.5, 25 (default), 50	Sets the sweep speed of the waveforms.
Respiratory sweep speed [mm/s]	6.25 (default), 12.5, 25, 50	Sets the sweep speed of the respiratory waveform.
Anesthesia sweep speed [mm/s]	0.62, 6.25 (default), 12.5, 25, 50 0.62 mm/s is not supported on the network and is transmitted as 6.25 mm/s on the network	Sets the sweep speed of the anesthesia waveform.

Timers tab

There are two timers available for independent display. The following table lists the available settings for the ***Timers*** dialog page.

Selection	Available settings	Description
Timer A	***Start***, ***Stop***, ***Reset***	Starts and stops the timer, and resets to zero.
Timer A	***Enabled***, ***Disabled***	Enables or disables the timer function.
Timer A color	*various color selections*	Color selection for the timer banner.
Timer B	***Start***, ***Stop***, ***Reset***	Starts and stops the timer, and resets to zero.
Timer B	***Enabled***, ***Disabled***	Enables or disables the timer function.
Timer B color	*various color selections*	Color selection for the timer banner.

Parameter colors tab

On the parameter colors dialog page, the user may select the color in which the parameter field and waveform appear on the independent display.

To change the parameter color on the independent display:

1 Select the color button next to the desired parameter.

2 Select the desired color for the parameter field and waveform.

Pressure colors tab

On the pressure colors dialog page, the user may select the color in which the parameter field and waveform appear on the independent display.

To change the pressure color on the independent display:

1 Select the color button next to the desired pressure.

2 Select the desired color for the pressure field and waveform.

Profiles tab

The following table lists the available settings for the Profiles dialog page.

Selection	Available settings	Description
Profile	Select the pull-down button to view stored profiles.	Lets a user store five custom profiles.
Save Profile	***Save***	Lets a user save a new profile or save a modified existing profile.
Set as Default	***Default***	Lets a user select a default profile.
Profile name	Select the button next to Profile name and type the name of a new profile.	Lets a user create a new profile name.

The following list includes all of the settings that are saved in an independent display profile.

– Parameter priority list
– ***Display mode*** in Auto view
– Number of waveforms
– Number of ECG waveforms
– Order of signals
– Parameter field layout (left/right)
– Sweep speed
– Number of parameter fields
– Position of parameter fields (top/bottom)
– Invasive pressure overlap
– ***IP grids***
– ***Large mean*** for invasive pressures
– Parameter colors
– Timer settings
– Mini-trends (on/off)
– NIBP mini-trend settings

See page 492 for instruction on how to import and export independent display profiles.

Export protocol

This function allows sharing data with other Dräger and third-party devices such as clinical information and anesthesia record systems and data loggers.

The export protocol connector is located on the P2500/PS250 (see page 25).

Refer to the section "Connected devices" on page 15 when connecting third-party devices.

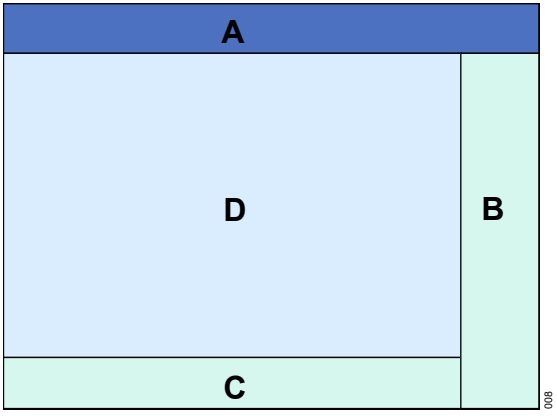
NOTE
Exporting temperatures is only supported in Celsius, and exporting blood pressure values is only supported in mmHg. However, these values can be converted to the desired unit of measurement once exported.

NOTE
Export does not indicate parameters that are no longer on display.

User interface

The following sections describe the user interface of the Cockpit when it is connected to an M540.

The screen of a monitoring Cockpit is divided into the following main areas:



A Header bar

B Main menu bar

C Auto view toolbar (if activated)

D Monitoring area

For a more detailed overview of general user interface components of the IACS, refer to the instructions for use *Infinity Acute Care System – Medical Cockpit*.

Header bar

The blue header bar appears along the top of the Cockpit screen. It is always visible regardless of what is displayed in the monitoring area.

A Patient category field

B System data field

C Patient name field

D Time and date field

E Alarm message field

F Alarm status field

The patient category field

The patient category field (A) of the header bar identifies the currently selected patient category. It contains one of the following symbols:

– Adult

– Pediatric

– Neonate

Touching this field opens the ***Start/Standby...*** dialog for accessing the ***Demographics*** page (see page 100).

The system data field

The system data field (B) of the header bar contains the following information:

– Product label

– Care unit

– Monitoring mode (for example, ***OR Alarms***) or the battery symbol indicating the battery status for the PS250 or the P2500.

Touching this field opens the ***System setup*** dialog with the Biomed activation code keypad.

The patient name field

The patient name field (C) of the header bar displays the patient name. Selecting this field opens the ***Demographics*** page (see page 99).

The content of the patient name field changes when the ***Code*** button is selected on the main menu bar to activate a set of user-defined emergency monitoring functions. In this case, the patient data field displays a timer along with a ***Stop*** and a ***Reset*** button. For more information on the Code function, see page 156.

The date and time field

The data/time field (D) of the header bar displays the current date and time. Selecting this field opens the ***System setup*** dialog with the Biomed activation code keypad.

The alarm message field

The alarm message field (E) of the header bar is reserved for alarm and technical messages. The background color of the alarm message corresponds to the alarm priority (see page 118).

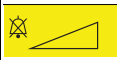
The following table illustrates how the alarm message field is further subdivided.

More...	Alarm message	Alarm message
	Local technical messages	Network-related messages

A maximum of two messages can be displayed side by side. If more than two patient alarm messages are active simultaneously, the ***More...*** button appears. Selecting this button accesses the ***Current alarms*** page (see "Viewing current alarm messages" on page 122).

The alarm status field

The alarm status field (F) of the header bar (see "Messages" on page 529) indicates the current alarm status. The following are some examples of alarm-related symbols and messages that can appear in this field.

Symbol	Label	Description
	***Audio paused***	Appears with a timer when the yellow key located next to the rotary knob is pressed.
	***n*%** where *n* is the numeric percentage	The alarm volume percentage corresponding to the selected alarm volume. The higher the alarm tone, the more the symbol is filled in (50% in the example). If the symbol appears empty, the alarm volume has been turned off (see next message).
	***Audio off***	Indicates that the alarm volume has been turned off, the Cockpit is set to OR alarms or monitored by the ICS.
	***All alarms paused***	Indicates that all alarms are paused after selecting the ***Alarms...*** > ***All alarms paused*** buttons.
	***All alarms off***	Indicates that all alarms are off after selecting the ***Alarms...*** > ***All alarms off*** buttons.
	***Pressures off***	Indicates that all invasive pressure alarms are off
	***Pressures paused***	Indicates that all invasive pressure alarms are paused

For a complete list of supported messages, see page 526.

For more detailed information on alarm monitoring, see the "Alarms" chapter.

Monitoring area

The monitoring area of the Cockpit screen contains waveforms and parameter fields that report the current vital signs of the patient. The monitoring area can also contain dialogs, mini-trends, an auto view toolbar, ST parameters, vent loops, and so on. The appearance of the monitoring area depends on the selected view, which controls the layout and content of the screen (see "Views" on page 80).

The appearance of the monitoring area also depends on whether or not the split screen mode or mini-trend display is selected (see page 471).

When opening a dialog, the waveform channels and parameter fields are reduced to fit on the right side of the screen (see figure on page 70). This display behavior prevents the vital signs from being obscured while the user is performing setup tasks.

Selecting the ***Home*** button on the main menu bar or pressing the rotary knob closes any open dialogs and refreshes the screen.

Parameter fields

Each parameter field contains real-time values of a parameter and a combination of the following information:

– Parameter labels (including dynamic pressure labels)

– Alarm limits (or crossed triangle symbols when the alarm functions are deactivated)

– Units of measure (can be activated/deactivated)

– ***ECG*** heart blip (and pacer blip for paced pulses), ***RRi*** blip, and ***SpO2*** blip

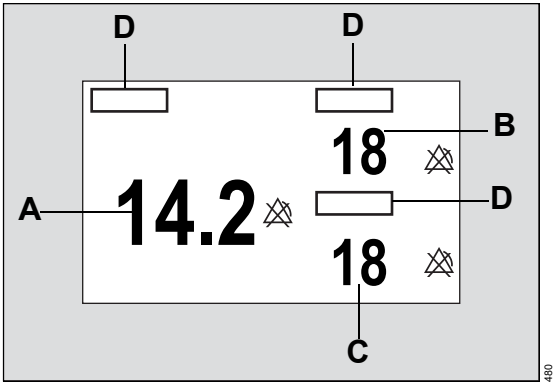
– Time stamps

– Timers and time stamps for non-invasive blood pressure

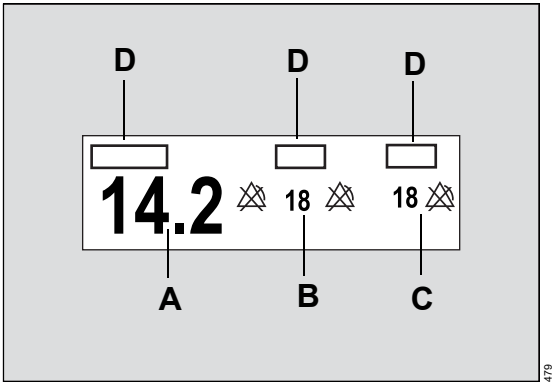
– Special source labels (for example, ***PLS**** for heart rate signal source for pulse oximetry)

– Parameter-specific message fields for non-invasive blood pressure and ***SpO2***

The amount of information on a screen affects the parameter field display. For example, the following diagram shows a typical expanded ***SpO2*** parameter field when enough space is available for the larger parameter field. The primary parameter value (A) appears bigger than the other subordinate parameters who are displayed below each other (B, C). The parameter labels (D) appear above the respective parameter values.



The following example shows how the same parameter field changes when more parameters occupy the main screen. Each parameter field has less space to display its content. The primary parameter value (A) still appears bigger than the subordinate parameters (B, C) which now all appear on one line. The parameter labels (D) still appear above the respective values.



When a parameter is in alarm, the parameter field flashes in the color of the alarm priority and a corresponding alarm message appears in the header bar (see "Troubleshooting" on page 525). The parameter fields displayed on the Cockpit for each parameter are described in detail in each parameter chapter.

Waveforms

The Cockpit displays a minimum of six seconds of waveform data per waveform channel at a sweep speed of 25 mm/s when no dialogs are open. The amount of displayed waveforms depend on the size of the Cockpit.

When the waveform option is activated, the Cockpit displays up to 16 waveforms.

The following functions allow customization of the waveforms:

– Changing the colors for individual parameters (see, for example, how to change the color for ***ECG*** on page 226)
– Changing the sweep speeds (see page 457)

Waveforms are drawn from left to right and can contain the following information:

– Signal scales
– Grids
– Units of measure
– Parameter labels
– Pacer spikes
– ***QRS*** synchronization markers
– Respiration waveform markers to indicate breath detection
– Messages (see page 69)

NOTE

If the acquired signal does not fit in the waveform channel, the top of the waveform may appear clipped.

Freezing/stopping waveforms

- Select the ***Freeze waveforms*** button on the main menu bar.

All waveforms stop and the message ***Waveforms stopped*** appears on each waveform channel. After approximately 60 seconds, the waveforms start scrolling again. To restart the waveforms earlier, select the ***Freeze waveforms*** button again.

Freezing waveforms does not affect continuous monitoring of all parameters and does not freeze waveforms on the M540.

Supported messages

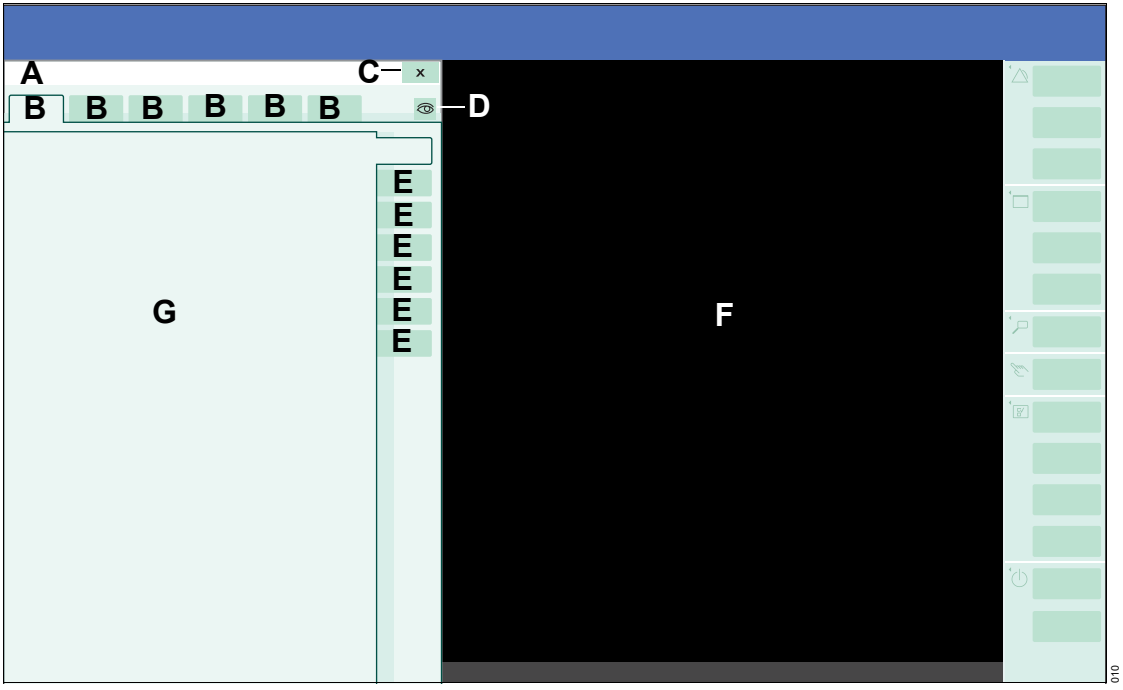
The Cockpit displays numerous messages that indicate a special monitoring state that may affect certain functionality. For example, when cardiac bypass monitoring is activated, alarms are turned off. The alarm message field of the header bar turns red and the message ***Bypass All alarms off*** appears.

For a complete list of these messages, see *"Messages" on page 529*.

Dialogs and pages

The following diagram shows how the monitoring area appears when the user accesses a dialog. The left side is reserved for the dialog while the right side displays the monitoring area (F) with real-time data. A dialog contains horizontal tabs (B) that open pages. Some pages also contain vertical tabs (E) which access subordinate pages.

Selecting the corresponding button followed by dots on the main menu bar opens the corresponding dialog. For example, the ***Alarms...*** button opens the ***Alarms*** dialog. The user can also access parameter-specific dialogs and pages directly by selecting the corresponding parameter fields on the main screen. For example, if the user selects the heart rate (HR) parameter field, the ***Sensor parameters*** dialog with the ECG page appears.



A Dialog title

B Horizontal tabs – the selected tab appears light blue.

C Button that closes the dialog.

D Display filter on/off button for switching between a display that shows only connected parameters or one that shows all parameters.

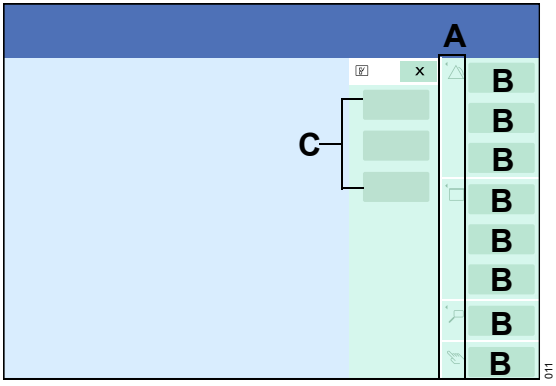
E Vertical tabs for accessing additional pages – the selected tab appears light blue.

F Monitoring area showing vital signs in real time.

G Page that contains groups of related settings in the selected tab.

Main menu bar and quick access toolbar

The following diagram shows the main menu bar with the quick access symbols and a quick-access toolbar. The main menu bar and the quick-access symbols are located along the right edge of the screen and are always visible. The quick-access toolbars remain visible after the user selects the corresponding quick access symbol.



A Quick access symbols

B Main menu bar buttons

C Quick access toolbar

Main menu bar

The content of the main menu bar can be customized. By adding and removing buttons, the menu bar can contain the most frequently used buttons. However, several buttons with essential functionality are permanently placed on the menu bar and cannot be moved. This key configuration becomes part of a profile. For more information, see page 465.

The following buttons appear on the main menu bar.

Alarms...	Opens the ***Alarms*** dialog.
Mark event	Stores an event in the alarm history.
Code	Executes pre-configured functions during an emergency.
Views...	Opens the ***Views*** dialog.
Print screen [1)]	Prints the contents of the current screen on a connected laser printer.
Freeze waveforms	Stops all waveforms for 60 seconds.
Trends/ Data...	Opens the ***Trends/Data*** dialog.
Procedures...	Opens the ***Procedures*** dialog.
Sensor parameters...	Opens the ***Sensor parameters*** dialog.
NIBP start/stop	Starts or stops an NIBP measurement. The button remains selected during a measurement. To cancel the measurement, select the button again.
Zero all [1)]	Zeroes all pressures
System setup...	Opens the ***System setup*** dialog.
Start/Standby...	Opens the ***Start/Standby*** dialog.
Home	Returns to the main screen and closes any dialog.

[1)] This button only appears on the main menu bar of the C700.

Quick access toolbar

Functions that are commonly used are grouped on quick access toolbars for easy access. These quick access functions are accessible by selecting the corresponding quick access symbols on the main menu bar.

To activate a quick access function

1 Select the symbol to open the associated toolbar.

2 Select the desired button from the toolbar to activate the function directly.

The following table lists the quick access symbol and the associated toolbar they open when selected.

Quick access symbol	Associated Toolbar
 Located next to the ***Alarms...*** button	***All alarms off*** or ***All alarms paused*** (depending on configuration)
	Pressures paused
	Pressures off
	ECMO
	Auto set all
 Located next to the ***Views...*** button	***Show all ECG***
	Remote view
	Print screen (C700 only)
	Timer A start/stop [1)]
	Timer A reset [1)]
	Timer B start/stop [1)]
	Timer B reset [1)]
 Located next to the ***Trends/ Data...*** button	***ECG report***
	Rest ECG report
	ST report
	Alarm history report
	Trend graph report
	Trend table report
	Calculations report
	Timed wvf. report
	Continuous wvf. report
	Timed recording
	Continuous recording
	Print case summary
 Located next to the ***Sensor parameters...*** button	***Zero all***
	NIBP continuous
	Venous stasis
 Located next to the ***Start/Standby...*** button	***Standby***
	Discharge
	Privacy

[1)] This selection is only available for independent display and the independent display option must be installed.

Filtering the parameter content

To filter the content of the displayed parameters, use the display filter button which appears in the following dialogs:

– Parameter field of the ***Trends/Data*** dialog (see page 172).

– ***Sensor parameters*** dialog where it appears to the right of the parameter tabs.

– ***Alarms*** dialog (see page 138).

– ***Setup*** page for configuring the trend pages (see page 177).

The filter button toggles between an unfiltered and filtered display. The filter is activated when the display filter button appears on the light green background. Any parameter that is not being actively monitored is removed from the screen, including parameter-specific setup buttons or tabs.

Selecting the button again changes the background to dark green and deactivates the display filter. All parameters, whether monitored or not, including associated setup buttons or tabs are displayed.

Auto and manual display modes

The user interface has two display modes: Auto view and manual view.

Auto view mode

Auto view mode is a plug-and-play concept where the content of the main screen depends on the connected parameter signals. For example, as soon as an ***SpO2*** MCable is connected, the associated parameters become available for display. When the MCable is disconnected, the parameters are removed from the screen automatically.

NOTE

The ***NIBP*** parameter is always displayed. The M540 does not detect the connection status for this parameter.

Manual view mode

In manual view mode, parameters for display can be selected even if they are not yet connected. In this mode, the parameter pick list in the ***Auto view*** page (see page 80) contains all parameters. The parameters that are not connected appear gray in the parameter pick list. In addition, the display filter button is deactivated.

To select the desired display mode

1 Select ***System setup...*** from the main menu bar.

2 Select the ***Screen setup*** tab.

3 Select the ***Auto view*** tab located along the right side of the ***System setup*** dialog.

4 Select the ***Auto*** or ***Manual*** button next to the ***Display mode*** menu selection.

Auto view setup toolbar

When the auto view mode is activated (see page 459), the auto view setup toolbar appears along the bottom of the screen. The auto view setup toolbar is for configuring the parameter priority and display status of a parameter. The auto view setup toolbar is also visible whenever the user selects a view that contains an auto view component.

It functions dynamically with the ***Auto view*** page (see page 459) where the user selects the maximum number of waveforms and parameter fields and determines the parameter priority. Any changes made on the auto view setup toolbar are reflected on the ***Auto view*** page and vice versa.

Customizing the display

To suit clinical workflow needs, the following changes can be made to the display:

– Screen brightness

– Method of interaction with the Cockpit

– Touchscreen calibration

– Monitoring area customization

Screen brightness

Control the brightness of the Cockpit screen by selecting night and day mode (see page 457). Night mode reduces the luminance of the screen so it is less disturbing to a patient while providing enough contrast for the clinical staff. During night time mode, the entire background of the screen appears almost black. All buttons turn dark gray.

Touchscreen versus mouse

Use the touchscreen or a mouse to interact with the Cockpit. If the cursor is not visible after the mouse has been connected, press the **Alt** and **F10** keyboard keys simultaneously to display the cursor.

Calibrating the touchscreen

If the touchscreen of the Cockpit is out of alignment, it can be calibrated. During the calibration of the screen, no waveforms are displayed on the Cockpit. Therefore, never calibrate the screen while monitoring a patient.

To calibrate the touchscreen

1 Press the rotary knob until the ***Calibrate Touch Screen*** popup appears (requires several seconds).

2 Select the ***Calibrate*** button in the popup or press the rotary knob again to access the calibration screen.

3 Touch the red dots that appear on the screen in sequence.

4 Select the green check mark symbol ✓ to complete the calibration procedure.

Cockpit screen in split screen mode

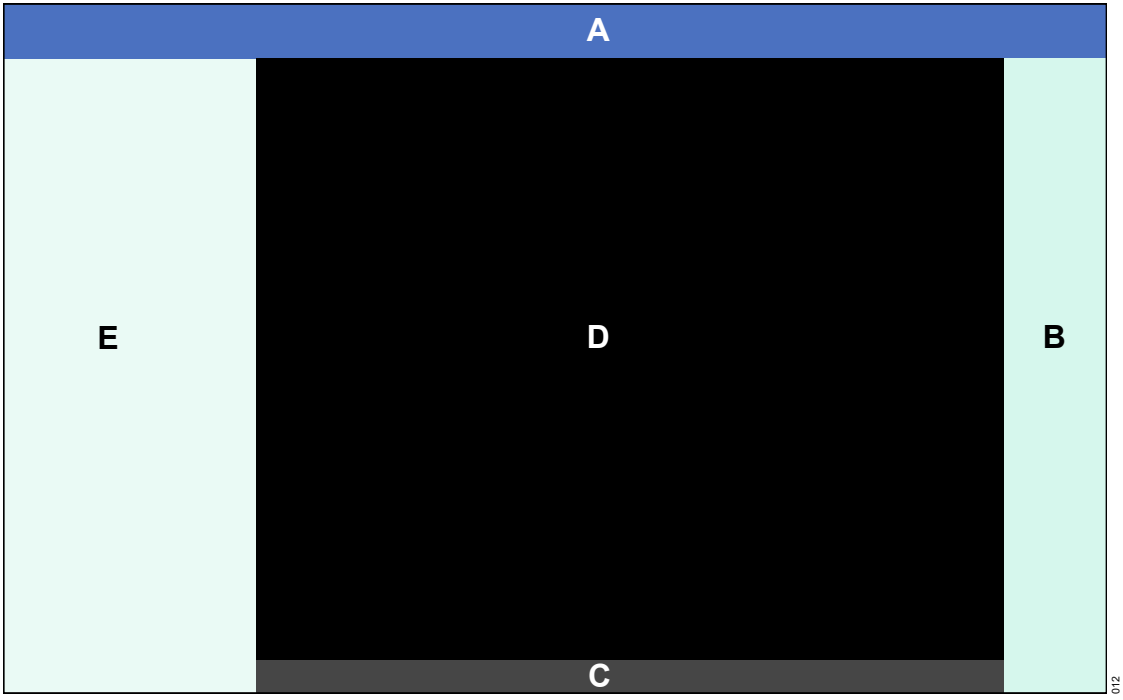
The following diagram shows the Cockpit display when the following options/features are activated:

– The web-enabled layouts option is unlocked.

– The split screen mode is activated (see page 460).

The monitoring area of the Cockpit is reduced to accommodate an additional panel (E). The larger right side continues to display the real-time parameters while the left panel displays either a tabular trend, loops, ***ECG*** show all page, ***ECG***/ventilation, ***ECG***/***ST***, or ***ST*** parameters (see page 459). If the web-enabled IT option is also activated, this panel also displays IT applications that are accessible using IT tabs (see page 78).

The following diagram shows how the split screen mode divides up the screen.



A Header bar

B Main screen menu bar

C Auto view setup toolbar (if activated)

D Monitoring area with real-time vital signs

E Split screen panel (content depends on user-selection, and activation of web-enabled layouts option)

Cockpit split screen mode with mini-trends

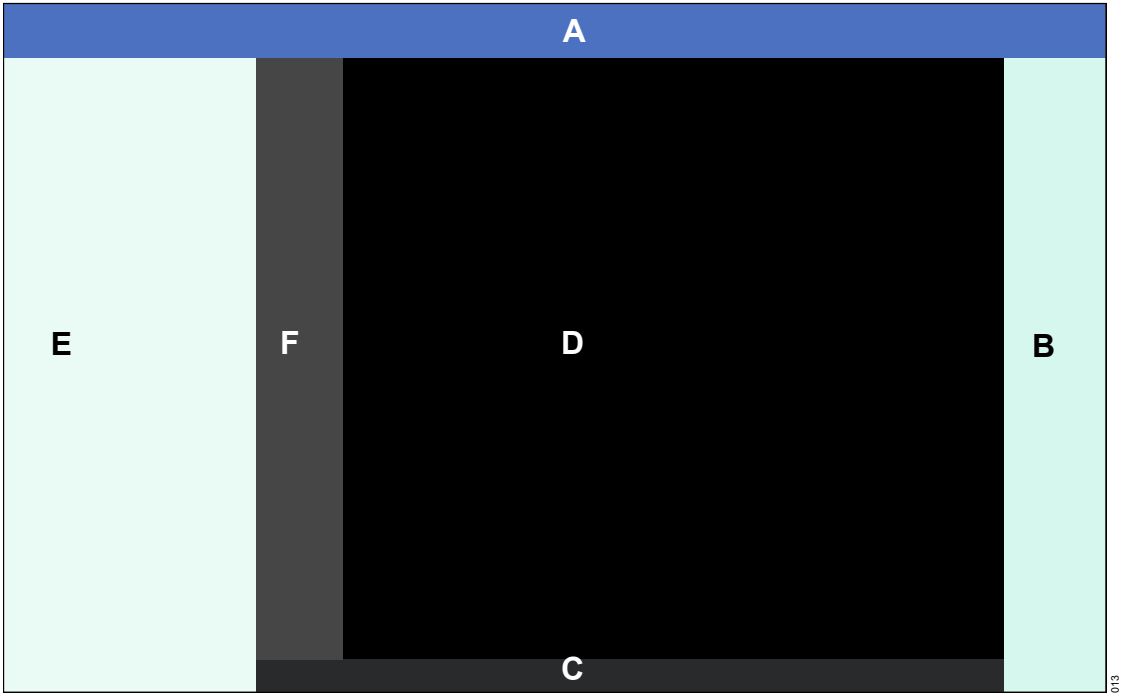
The following diagram shows the Cockpit display when the following options/features are activated:

– The web-enabled layouts option is unlocked and the ***Split screen*** feature is activated (see page 460).

– The ***Mini trends*** feature is activated (see page 460).

If the split screen mode is not activated, the mini-trend panel shifts to the left edge of the screen.

Mini-trends are updated continuously. NIBP mini trends can either be represented in tabular or graphical format (see "Trending behavior" on page 172). All other parameters appear only as graphical mini-trends.



A Header bar

B Main screen menu bar

C Auto view setup toolbar (if activated)

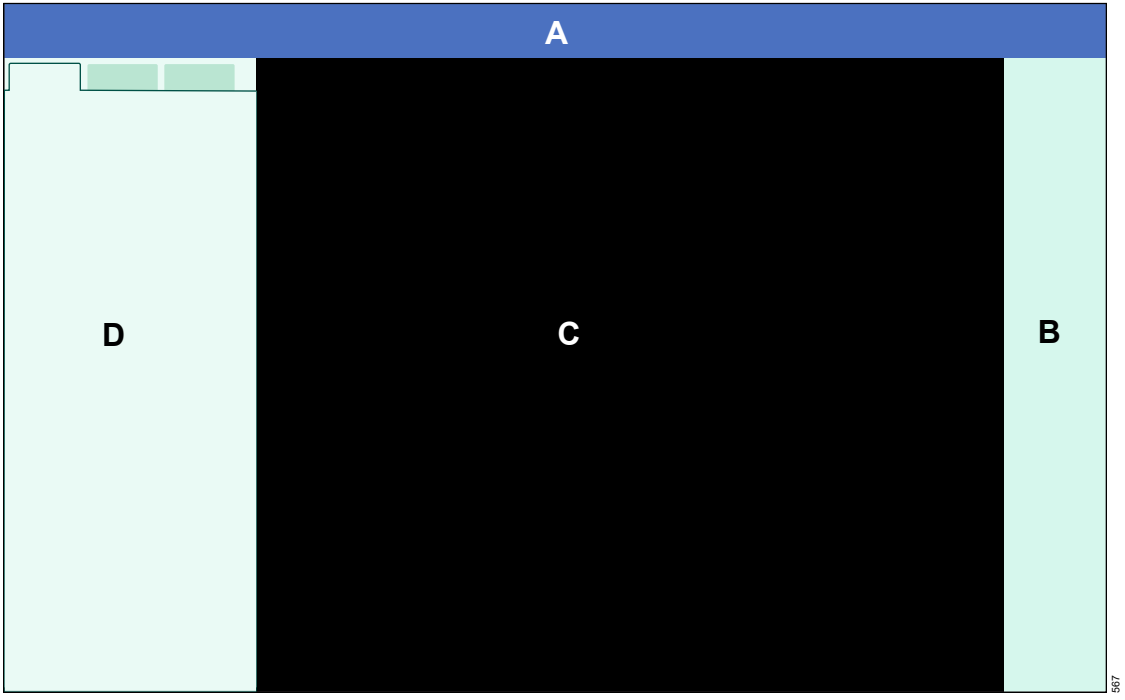
D Monitoring area with real-time vital signs

E Split screen panel (content depends on user-selection)

F Mini-trend panels

Cockpit split screen mode with multi-tab split screen

The following diagram shows the Cockpit display when the ***Multi-tab split screen*** feature is activated by itself (see page 460).



A Header bar

B Main screen menu bar

C Monitoring area with real-time vital signs

D ***Multi-tab split screen*** – three tabs whose content is configurable. To configure the ***Multi-tab split screen***, see page 468.

Cockpit split screen mode with mini-trends and IT tabs

The Cockpit supports IT applications that are accessible via tabs.

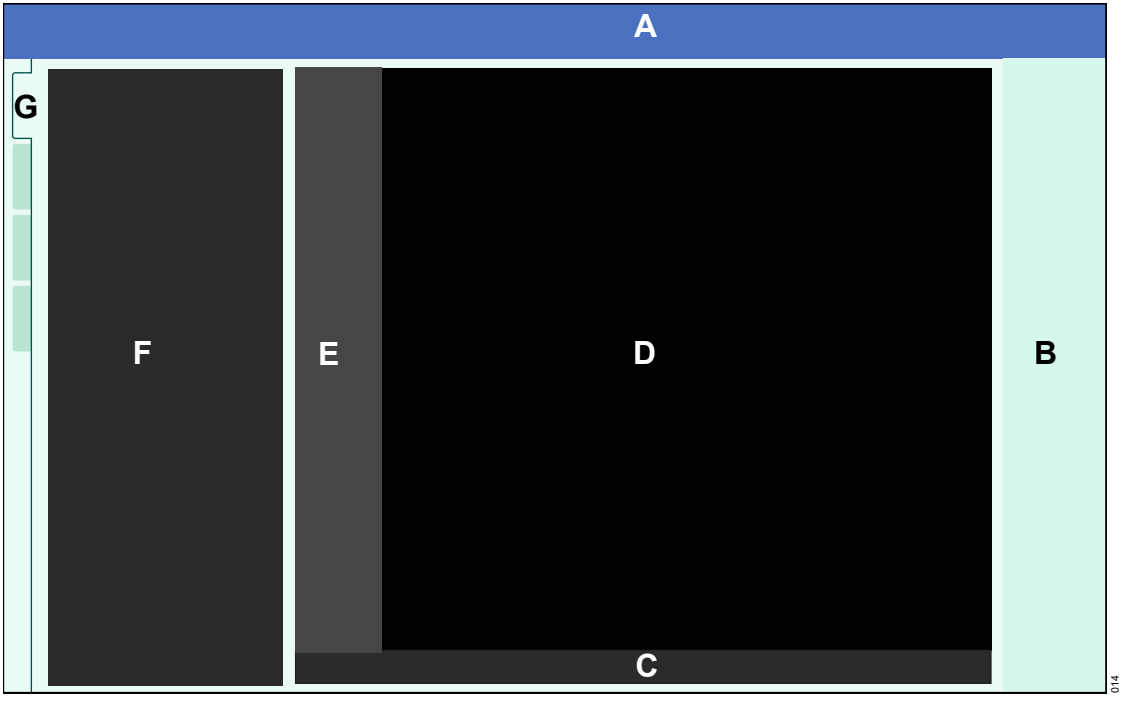
The following diagram shows the Cockpit display when the following options are unlocked and the features are activated:

– The web-enabled layouts option is unlocked and the ***Split screen*** feature is activated (see page 460).

– The web-enabled IT tabs option is unlocked

– The ***Mini trends*** feature is activated (see page 460).

Once the application is configured and the IT application feature is activated (see page 493), the corresponding tab appears to the left of the monitoring area. The ***Patient*** tab (G) always appears as the top tab. It always returns to the main screen of the Cockpit for viewing the real-time parameter display. For detailed information on setting up IT tabs, refer to the specializedservice technical documentation.



A Header bar

B Main screen menu bar

C Auto view setup toolbar (if activated)

D Monitoring area with real-time vital signs

E Mini-trend panel

F Split screen panel (content depends on the user-selection)

G IT tabs

Parameter priority

The parameter priority determines what position a parameter occupies on the screen. The number of parameters appearing as waveforms and parameter fields depends also on the selected ***Waveforms*** setting (see page 460).

Use the ***Auto view*** page (see page 459) to determine the display location and display status of each parameter. Also, use the auto view setup toolbar in auto view mode to change the parameter priority (see page 462). In manual mode, the parameter priority can be changed only in the ***Auto view*** page.

Configuring the parameter priority and display

The location of a parameter in the window determines not only where a parameter appears on the screen but also how it is displayed. Parameters are arranged in descending order in the window and occupy the same position on the screen. For example, the top parameter in the parameter selection window occupies the top spot on the main screen. For more information see, "Configuring parameters for display" on page 461.

Parameter priority list

The priority list appears in the parameter selection window of the ***Auto view*** page (see page 459). Change the parameter priority by switching the position of the parameters in the ***Auto view*** page. For more information, see "To configure the parameter priority and display from the Auto view setup toolbar" on page 462.

The following list shows the default parameter priority list. Pressures without assigned labels appear as GP1, GP2, GP3, GP4, GP5, GP6, GP7, or GP8.

1 ECG

2 SpO2

3 SpO2*

4 RRi

5 ART

6 AOR

7 FEM

8 AXL

9 RAD

10 UAP

11 BRA

12 PA

13 CVP

14 RA

15 LV

16 LA

17 RV

18 ICP

19 GPM

20 FEMV

21 UVP

22 ABD

23 BDP

24 ESO

25 GP1

26 GP2

27 GP3

28 GP4

29 GP5

30 GP6

31 GP7

32 GP8

33 NIBP

34 CO2 (from Infinity MCable – Mainstream CO2, Infinity MCable – Microstream CO2 and Scio (Scio not available in neonate mode))

35 CO2 (non-MEDIBUS.X ventilators)

36 O_2 (Scio, not available in neonate mode)

37 Agent (Scio, not available in neonate mode)

38 C.O. (not available in neonatal mode)

39 SvO2

40 T (temperature)

41 T1

42 CO2 (MEDIBUS.X)

43 Vent

44 O_2 (MEDIBUS.X)

45 Agent (MEDIBUS.X)

46 BIS (not available in neonate mode)

47 NMT

48 CO-Ox

Views

Each Cockpit supports eight pre-configured Dräger views and, as an option, up to eight custom views. Views control the content and appearance of the screen.

To adjust the screen layout to the needs of the current monitoring session, switch to a different view.

Views can be shared among various profiles which are pre-configured setups. This sharing of views eliminates time-consuming setup tasks. Views can be assigned to each profile (see page 502).

Selecting a view

Reconfigure the screen by selecting a different view.

To select a view

1 Select the ***Views...*** button on the main menu bar.

2 Select the ***Views*** tab if it is not already selected to open a popup with pre-configured views.

3 Select the desired view from the ***Custom views*** (option) or the ***Draeger views*** pick lists.

The monitoring area is configured accordingly.

The view editor

The view editor (option) allows authorized personnel to create and modify customized views. Dräger views cannot be modified. Access to the view editor is password-protected. For more information, see page 469.

Profiles/status

Cockpits are adaptable to different care areas. This adaptability is partially due to profiles which allow clinical personnel to create unique setups for the patient population of specific care areas.

Profiles are divided into the following two categories:

– Patient and default profiles
– System profiles (see page 88)

Patient and default profiles

A patient profile consists of user-defined settings which are customized for each patient category (adult, pediatric, neonate). For example, a profile may be unique to an adult patient population in a high-acuity OR setting, while another caters to neonatal patients in a low-acuity OR setting. A profile remembers patient and device settings for future use. With a profile, time-consuming setup tasks that would otherwise have to be repeated for each monitoring session are eliminated.

For each patient category, five unique profiles can be set up and saved. Included in the five profiles is a Dräger default profile that cannot be changed.

The Dräger default profile is activated when the Cockpit is booted up for the first time, new software is installed, or factory defaults are restored.

The user-defined patient default profile is activated whenever a new patient category is selected. In addition, the patient default profile is activated after patient data are transferred physically or over the network.

The selected patient profile remains unchanged under the following circumstances:

– When the Cockpit is turned off and on again
– When a patient is discharged
– When a monitor transitions out of standby mode
– When a monitor transitions out of privacy mode

Whenever an M540 is docked in an IACS configuration, the profile of the connected Cockpit overwrites any M540 profile settings. The only exceptions are the following profile settings which remain unchanged on the M540:

– Cable type
– etCO2 Atm. pressure
– SpO2 alarm delay
– Patient category (adult, pediatric, neonatal)
– Demographic data
– Invasive pressure labels
– Temperature labels
– QRS detection threshold
– M540 offline detection
– M540 battery alarm

After a patient discharge, all patient data are deleted and the most recently used profile is restored.

Settings included in a profile

The following table lists all of the settings included in a patient profile. For details on each setting, such as available selections and detailed descriptions of the setting, refer to the cross-referenced pages.

Parameter	Included settings
Parameter-specific profile settings	
ECG (see page 223)	***Size [mV/cm]***
	Size all ECG [mV/cm]
	Pulse tone volume
	Tone source
	HR source
	Waveforms
	Leads
	Filter
	Pacer detection
	QRS sync marker
	ARR Processing
	Resp. monitoring
	Color
	Alarm limits
	Alarm on/off setting
	Alarm archive setting
Arrhythmia (see page 238)	***ARR mode***
	Alarm archive setting
	Alarm priority (high, medium, low or off)
Arrhythmia alarm settings (see page 143)	Alarm priority
	Rate
	Count
ST (see page 246)	***ST monitoring***
	ST lead1
	ST lead2
	ST lead3
	ST Mini Trend
	TruST 12-lead
	Event duration [s]
	Selected isoelectric point
	Selected ST measuring point
	Alarm on/off setting
	Alarm limits
	Alarm archive setting
Temperature (see page 297)	***Color***
	Alarm on/off setting
	Alarm limits
	Alarm archive setting
SpO2 (Nellcor) (see page 290)	***Pulse tone volume***
	Tone source
	Waveform size [%]
	SatSeconds alarm
	Color
	Alarm on/off setting
	Alarm limits
	Archive setting and alarm priority for ***SpO2 check sensor*** alarm
	Alarm archive setting

Parameter	Included settings
SpO2 (Masimo SET and Masimo Rainbow SET)	***Pulse tone volume***
	Tone source
	Averaging time
	Fast SAT mode
	Waveform size [%]
	Color
	Alarm on/off setting
	Alarm limits
	Alarm archive setting
	Archive setting and alarm priority for ***SpO2 sensor off*** alarm
SpO2 Masimo rainbow SET (see page 278)	***SpHb averaging time***
	Pulse CO-Ox mini trend
	SpHb Cal
	Show parameters
	PVI averaging time
	Color
	Alarm on/off setting
	Alarm limits
	Alarm archive setting
SpO2* (from external device)	***Color***
	SpO2 label
	Mini-trend
Non-invasive blood pressure (see page 310)	***Interval time [min]***
	Inflation mode
	Chime
	Color
	Alarm on/off setting
	Alarm limits
	Alarm archive setting

Parameter	Included settings
Invasive pressure	***Scale***
	Filter
	Large mean
	Min. scale (ICP)
	Color
	Alarm on/off setting
	Alarm limits
	Alarm archive setting
	Grids
	Pressure overlap
Respiration (see page 252)	***Resp. lead***
	Mode
	Size [%]
	Resp. marker
	Resp. monitoring
	Coincidence detect
	RRi apnea time [s]
	Apnea archive
	Color
	Alarm on/off setting
	Alarm limits
	Alarm archive setting
Cardiac output (see page 344)	***Catheter type***
	Catheter size
	Injectate volume [cc]
	C.O. mode
	Alarm on/off setting (Tblood only)
	Alarm limits (Tblood only)
	Alarm archive setting (Tblood only)

Parameter	Included settings
CO_2	***Scale***
	RRc apnea time [s]
	RRc Apnea archive
	Color
	Airway adapter
	Averaging
	Alarm on/off setting
	Alarm limits
	Alarm archive setting
Scio CO_2	CO_2 parameter field configuration
	Alarm status
	Alarm limits
	Alarm archive settings
	Apnea settings
	Waveform scales
	Trend scales
	CO_2 color
Scio O_2	O_2 parameter field configuration
	O_2 mini trend configuration
	Alarm status
	Alarm limits
	Alarm archive settings
	Waveform scales
	Trend scales

Parameter	Included settings
Scio Agent (see page 373)	Agent selection (for variants with manual identification only)
	Agent parameter field configuration
	Agent/xMAC mini trend configuration
	Alarm status
	Alarm limits
	Alarm archive settings
	Trend scales
Trends	Graphical trend setup
	Tabular trend setup
Reports	Case summary setup
External device profile settings	
External devices – CCO/SvO2 (see page 410)	***Parameter 1***
	Parameter 2
	Parameter 3
	Mini trends
External devices – Paw (see page 453)	***Parameter 1*** (paw)
	Parameter 2 (paw)
	Parameter 3 (paw)
	Paw scale
	Vol scale
	Color
External devices – ventilator (Medibus - Servo I) (see page 454)	***Parameter 1*** (vent, paw)
	Parameter 2 (vent, paw)
	Parameter 3 (vent, paw)
	Paw scale
	Flow scale
	CO2 Scale
	Vol scale
	Color (vent, paw, CO2)

Parameter	Included settings
External devices – ventilator (Medibus X) (see page 413)	***Vent parameter display*** setting (see page 428)
	Parameter 1 (vent, paw)
	Parameter 2 (vent, paw)
	Parameter 3 (vent, paw)
	Paw scale
	Flow scale
	CO2 Scale
	Vol scale
	Color (vent, paw, CO2)
	All parameters of the ***Configure show all*** page (see page 426)
External devices – Anesthesia workstation (see page 413)	***Agent parameter field***
	O2 parameter field
	etCO2 parameter field
External devices – CO_2 (see page 446)	***CO2 Scale***
	Color
External devices – ***PV Loop***	***Loop draw***
	Paw scale
	Vol scale
External devices – ***FV Loop*** (see page 451)	***Loop draw***
	Flow scale
	Vol scale
External devices – ***Loops*** (see page 451)	***Loop draw***
External devices – ***BIS*** (see page 391)	***Scale[uV]***
	BIS secondary parameter
External devices – ***NMT*** (see page 397)	***Display temperature***

Parameter	Included settings
Alarm profile settings	
Alarm system settings (see page 471)	***All alarms paused***
	Show alarm limits
	Cardiac bypass
	OR Alarms
	Alarm bar enabled
	Alarm validation
	Pacer detection mode
	ASY/VF alarms
	NIBP/SpO2 interlock
Config. (see page 471) Alarm volume and tone settings (see page 474)	Alarm type
	Alarm priority (high, medium, low or off)
	Pulse tone volume
	Attention tone volume
	Alarm volume
	Alarm attention tones
	Show remote alarms
Code settings (see page 477)	***Continuous recording***
	Alarm volume off
	Continuous NIBP mode
	All alarms off
Pressure settings	***Pressures paused***
	Pressures off

Parameter	Included settings
Screen profile settings	
Auto display settings (see page 459)	***Auto view*** mode
	Waveforms
	Layout (right/left)
	Pressure overlap
	Parameter boxes
	Layout
	Split screen
	Mini trends
	NIBP trend
	Toolbar
	Selected parameter priority
Configurable views (see page 464)	Up to eight available, configurable views
Config. buttons (see page 465)	Button setup
Multi-tab split screen (see page 468)	***Tab 1***, ***Tab 2***, or ***Tab 3***
Screen system settings (see page 457)	***Monitoring sweep speed [mm/s]***
	Respiratory sweep speed [mm/s]
	Show parameter units
General profile settings	
Anesthesia and BIS graphical trend	Configuration order of parameters
Open lung tool	
Procedures profile settings	
Wedge (see page 322)	***Scale***
	Sweep speed [mm/s]
	Reference waveform
Analysis tool (see page 179)	Parameter selection
	Duration

Parameter	Included settings
PPV/SPV (see page 327)	***Arterial waveform***
	Reference waveform
	Scale (Reference waveform)
	Sweep speed
	Waveform Grid
Biomed profile settings	
Bedside setup (see page 487)	***Airway adapter***
	Patient profile selection

Settings not included in a profile

The following settings are not included in a profile and must be configured separately. These settings remain unchanged until they are manually changed again by the user.

Parameter/system feature	**Setting**
Non-invasive blood pressure (see page 305)	***Venous stasis***
	Continuous mode
ST (see page 246)	***ST relearn***
Arrhythmia (see page 238)	***Relearn***
Respiration (see page 252)	***Relearn***
Invasive pressure (see page 325)	Selected labels from M540
etCO2 (Infinity MCable – Mainstream CO_2) (see page 353)	***Atm. pressure***
Alarm history (see page 148)	Filter settings (All, Arrhythmia, High-priority, Medium-priority, Low-priority, Time, Priority, Message)
System setup... > General settings (see page 471)	***All alarms paused***
	SpO2 alarm delay
Alarms > Settings	***Alarm group***
Volume/ Tone (see page 474)	***"Audio off" reminder***

System profiles

System profiles are system-wide settings. System profiles are divided into the following two categories:

– Shared settings – these settings can be exported and imported using a USB flash drive (see page 504 for information).

– Install persist settings – these settings are not affected by a patient discharge, software upgrade,or by turning the Cockpit off and then on again.

Most system settings can be shared and are also install persist settings. However, some settings are install persist settings only which are identified in the following table. For details on each setting, such as available selections and detailed descriptions of each setting, refer to the cross-referenced pages.

Setting	Shared and install persist settings	Install persist only settings
Screen layout settings (see page 457)		
Brightness	X	
Night time	X	
General alarm settings (see page 471)		
External device disconnected alarm control	X	
M540 alarm settings (see page 479)		
Keep bed label	X	
Transport alarm volume	X	
Transport pulse tone volume	X	
Tone and volume alarm settings (see page 471)		
Audio pause: Quiet mode	X	
Minimum alarm volume	X	
Audio off	X	
All alarms off	X	
Tone set	X	
Recorder settings (see page 482)		
Delay	X	
Duration	X	
Speed	X	
Waveform Selection	X	
Waveform 1	X	
Waveform 2	X	

Setting	Shared and install persist settings	Install persist only settings
Alarm Waveform	X	
Primary Recorder	X	
Secondary Recorder	X	
Report setup settings (see page 484)		
Waveform delay [s]	X	
Waveform duration [s]	X	
Trend duration [hr]	X	
Table interval [min]	X	
Biomed printer settings (see page 491)		
Printer IP address	X	
HP Universal Print Driver	X	
Paper Size	X	
Biomed patient monitor settings (see page 487)		
Line frequency	X	
French NFC mode	X	
OR Alarms	X	
Cardiac bypass		
Biomed country settings (see page 485)		
Language	X	
Time zone	X	
Biomed unit of measurement settings page (see page 486)		
Pressure	X	
etCO2	X	
Temperature	X	
ST	X	
SpHb	X	
Agent	X	
Weight	X	
Height	X	
Biomed patient monitor settings page (see page 487)		
External display	X	
Clinical password	X	
Biomed password	X	

Setting	Shared and install persist settings	Install persist only settings
Biomed Infinity network settings (see page 490)		
IP address		X
Subnet mask		X
Gateway		X
Offline detection		X
Primary DNS		X
Duplicate IP check		X
IP check interval [s]		X
Biomed hospital network settings (see page 490)		
DHCP		X
IP address		X
Subnet mask		X
Gateway		X
Primary DNS		X
Biomed network settings (see page 489)		
Monitoring unit ID		X
Monitoring unit label		X
Care unit label		X
Bed label		X
Hospital name		X
Enable Central Station	X	
Enable Remote Control	X	
Enable Remote Silence	X	
Biomed IT tab settings (see page 496) (identical for the Innovian, PatientWatch, Symphony, Web browser, and Application pages)		
IT tabs	X	
Name	X	
URL	X	
Block Popups	X	
Full Trust	X	
Tab visible	X	
Biomed Citrix settings (see page 495)		
Name of up to 32 applications	X	

Setting	Shared and install persist settings	Install persist only settings
Value of up to 32 applications	X	
Auto logoff	X	
Tab visible	X	
Graphical trend settings (see page 174)		
View	X	
Graphs	X	
Grids	X	
Tabular trend settings (see page 174)		
View	X	
Calculation parameters (see the 'Calculations' chapter starting on page 194)		
All hemodynamic parameters	X	
All oxygenation/ventilation parameters	X	
Laboratory calculation parameter selections (see page 196)		
PaCO2	X	
PaO2	X	
SaO2	X	
Hgb	X	
Body size calculations selections (see page 192)		
BSA	X	
Wt (weight)	X	
Ht (height)	X	
Drug profile settings (see page 203)		
For all 40 pre-configured drug profiles, the following settings are stored as part of each individual drug profile: Name of the drug:		
Amount	X	
Volume	X	
Dose units	X	
Concentration	X	

Managing profiles and views

Each patient category (adult, pediatric, neonatal) has its own unique profile. For example, if the neonatal patient category is activated, only the profiles defined for the neonatal patient category are selectable. This is unlike views which can be shared among all patient categories.

The following profile functions are available (for detailed instructions, see "Profile setup" on page 498):

– Selecting a profile
– Saving a profile (password-protected)
– Transferring a profile (password-protected)
– Deleting a profile
– Entering a profile name and description
– Assigning a profile to a default view (default profiles are automatically activated after a restart or a patient discharge).

Transferring profiles

Profiles can be transferred to other Cockpits in the password-protected ***Profile transfer*** page. This transfer eliminates time-consuming duplicate setup tasks. Profiles can be transferred either over the network or with a USB flash drive (see page 504).

Standby mode

Temporarily interrupt patient monitoring by placing the Cockpit and the M540 in standby mode. Selecting standby mode on the Cockpit automatically activates standby mode on the M540 and vice versa. Likewise, taking a patient out of standby on one device does the same at the other device.

Standby mode has the following effect:

– All patient data are removed from display on the Cockpit and the M540.

– All monitoring (including acoustic and optical alarm signals) are suppressed.

– Active alarms are considered acknowledged.

– All recordings are canceled.

– The message ***Standby*** –***Touch Screen to resume monitoring*** is displayed in the center of the screen.

To place the Cockpit in standby mode

1 Select the ⏻ symbol next to the ***Start/Standby...*** button on the main menu bar to display the Standby toolbar.

2 Select the ***Standby*** button on the toolbar.

or

1 Select the ***Start/Standby...*** button on the main menu bar to display the Standby dialog.

2 Select the ***Start*** tab if it is not already selected.

3 Select the ***Standby*** button next to the menu selection ***Monitor***.

NOTE

If configured to appear on the main menu bar, the ***Standby*** button is also accessible on the main menu bar. For more information, see page 465.

The message ***Standby*** – ***Touch Screen to resume monitoring*** appears in the center of the Cockpit screen.

To take the Cockpit out of standby mode

- Touch the screen to resume monitoring the vital signs of the patient.

Privacy mode

Privacy mode is possible only when the patient is admitted at the Infinity CentralStation (ICS). In privacy mode, patient monitoring continues but the patient data are removed from the Cockpit and the M540 and only appears on the ICS.

Selecting privacy mode on the Cockpit automatically activates privacy mode on the M540 and vice versa. Likewise, taking a patient out of privacy mode on one device does the same at the other device. Privacy mode is canceled automatically when the connection to the Infinity network is disrupted.

Activating privacy mode has the following effect:

– All patient data are removed from the Cockpit and the M540 displays, but continue to be displayed at the ICS.

– The alarm bar is deactivated.

– Acoustic alarm signals are only provided at the ICS.

– The message ***Privacy – Touch Screen to resume monitoring*** is displayed in the center of the screen.

To place the Cockpit into privacy mode

1 Select the symbol ⏻ next to the ***Start/Standby...*** button on the main menu bar.

2 Select ***Privacy*** on the toolbar.

or

1 Select the ***Start/Standby...*** button on the main menu bar.

2 Select the ***Start*** tab if it is not already selected.

3 Select ***Privacy*** next to the menu selection ***Display***.

NOTE

If configured to appear on the main menu bar, the ***Privacy*** button is also accessible on the main menu bar. For more information, see page 465.

The message ***Privacy – Touch Screen to resume monitoring*** is displayed in the center of the Cockpit screen.

To take the Cockpit out of privacy mode

- Touch the screen to activate the display of the patient data.

Screen lock

The screen lock feature allows the user to disable the touchscreen via a screen lock control. ***Screen lock*** enables the user to move or clean the Cockpit without unintentionally triggering changes on the touchscreen.

To activate screen lock

1. Select the ***Start/Standby...*** button on the main menu bar to display the Standby dialog.
2. Select the ***Start*** tab if it is not already selected.
3. Select the ***On*** button next to the menu selection ***Screen lock***.When screen lock is activated, the touchscreen does not respond to touch and the rotary knob LED flashes.

Screen lock automatically deactivates after one minute. However, the user can manually deactivate screen lock at any time.

To deactivate screen lock

- Press the rotary knob.

This page has been left blank intentionally.

Getting started

Overview

This chapter describes the necessary steps to start monitoring a patient on the IACS.

Specifically, this chapter describes how to:

– Turn the IACS on/off
– Admit/discharge a patient on the Cockpit
– Change the patient category

Turning the IACS on/off

Before monitoring a patient on the IACS, the Cockpit and the M540 must be turned on. The following steps assume that the M540 has been docked in the M500 (for information see, "Docking/undocking the M540" on page 107).

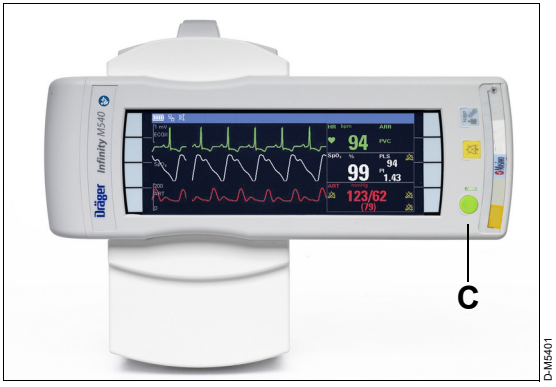
To turn the Cockpit on

- Press the on/off key (B) of the Cockpit.

The LEDs (A) and the on/off key light up green. The Cockpit emits a power-up tone and performs a self-test. After a brief moment, the Dräger startup screen appears before the Cockpit main screen appears.

To turn the M540 on

- Press the on/off key (C) of the M540.



The M540 emits a high-pitched tone followed by two power-up tones, performs a self-test, and displays the ***New patient*** prompt. Select ***Discharge*** to delete the previous patient data or ***Cancel*** to continue monitoring the patient and append the new data to the previous data set. The main screen appears.

The acoustic alarm signals are paused for 2 minutes.

To turn the Cockpit off

1 Press the on/off key located in the lower left corner of the Cockpit

2 Select the ***Shutdown*** button in the dialog.

To turn the M540 off

1 Press and hold the on/off key. The power off dialog appears.

2 Select the ***Shutdown*** button in the dialog.

Viewing demographic data

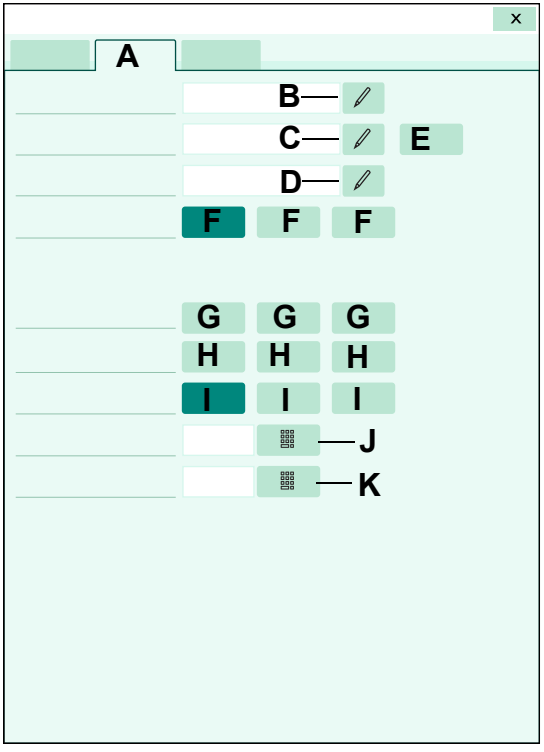
The following diagram shows the ***Demographics*** page of the Cockpit where you can perform the following functions:

– Admit a patient manually (see page 100)

– Admit a patient over the network via the ***Get HIS*** function (see page 101)

– Discharge a patient (see page 101)

– Change the patient category (see page 103)



A ***Demographics*** tab

B ***Patient name*** keyboard symbol

C ***Patient ID*** keyboard symbol

D ***Physician name*** keyboard symbol

E ***Get HIS*** button

F ***Patient category*** buttons (***Adult***, ***Pediatric***, ***Neonate***)

G ***Birth date*** fields

H ***Admit date*** fields

I ***Gender*** fields

J ***Weight*** keypad symbol

K ***Height*** keypad symbol

All demographic data entered on the ***Demographics*** page are available to the network. Demographic data are not deleted when you turn the Cockpit off and on. To delete demographic data, discharge the patient.

Admitting a patient

You can admit a patient at the Cockpit manually by entering the demographic data on the ***Demographics*** page.

You can also admit a patient over the network by pulling the data from an HL7/ADT interface (see "Admitting a patient using Get HIS" on page 101). This is only possible if the M540 is docked, the IACS is connected to the Infinity network, and an Infinity Gateway Suite (Gateway) is present. The Gateway communicates with the network and the HL7/ADT server.

When a patient is admitted, the profile for the selected patient category is assigned with patient settings already setup. Profiles eliminate repetitive and time-consuming setup tasks.

WARNING

Monitors in a care area may seem identical but may use different default alarm settings because of different profile assignments. After admitting a patient, always verify that the set alarm limits are appropriate for the patient.

To admit a patient manually

In the following steps, the letters in parentheses refer to the diagram of the ***Demographics*** page (see page 99).

- Touch the left most field on the header bar of the Cockpit to access the ***Demographics*** page.

  or

1 Select ***Start/Standby...*** on the main menu bar.

2 Select the ***Demographics*** tab (if not already selected).

3 Enter the patient name – use the symbol (B) next to the ***Patient name*** field to activate a keyboard for entering the patient name (up to 25 alphanumeric characters).

4 Enter the patient ID – use the symbol (C) next to the ***Patient ID*** field to activate a keyboard for entering the ID number (up to 12 alphanumeric characters).

5 Enter the name of the physician – use the symbol (D) next to the ***Physician name*** field to activate a keyboard for entering the name of the physician (up to 12 alphanumeric characters).

6 Select the desired patient category (F) – ***Adult***, ***Pediatric***, or ***Neonate***.

7 Enter the birthday (G) – day, month, year.

8 Enter the admit date (H) – day, month, year.

9 Select the gender (I) – unknown, male, female.

10 Enter the weight of the patient – use the keypad symbol (J) to activate an onscreen numeric keypad for entering the weight of the patient (see page 102 for supported weight ranges).

11 Enter the height of the patient – use the keypad symbol (K) to activate an onscreen numeric keypad for entering the height of the patient (see page 102 for supported height ranges).

Admitting a patient using *Get HIS*

You can populate the ***Demographics*** page automatically, by pulling the demographic data of a patient from the network. Prerequisite for this network data transfer is the Infinity gateway with an interface to the hospital Admit, Discharge, Transfer (ADT) system. The Hospital Information System (HIS) searches the database for the demographic data of the patient by using the patient ID.

To admit a patient via *Get HIS*

- Touch the left most field on the header bar to access the ***Demographics*** page directly.

  or

1. Select ***Start/Standby...*** on the main menu bar.
2. Select the ***Demographics*** tab (if not already selected).
3. Enter the patient ID – use the symbol (C) next to the ***Patient ID*** field to activate a keyboard for entering the ID number (up to 13 alphanumeric characters).
4. Select the ***Get HIS*** button (E) in the ***Demographics*** page (see page 99). The ***Get HIS*** button appears grayed out and is not selectable when the HIS is not available or when the Cockpit is not connected to it.

Discharging a patient

You can discharge a patient from the Cockpit or from the M540. Discharging a patient from either device causes a discharge at the other device. Refer to the instructions for use *Infinity Acute Care System – Infinity M540*, for detailed information on how to discharge a patient from the M540.

Discharging a patient has the following effect on the Cockpit:

- All demographic data are removed from the screen
- All trend and event data are deleted
- Any active recordings are canceled
- The profile with defined patient settings is restored
- The message ***Touch Screen to initiate monitoring*** appears

To discharge a patient

1 Select the left most field on the header bar of the Cockpit to access the ***Demographics*** page.

2 Select the ***Start*** tab (if not already selected).

3 Select the ***Discharge*** button.

or

NOTE
If configured to appear on the main menu bar, the ***Discharge*** button is also accessible on the main menu bar. For more information, see page 465.

1 Select ***Start/Standby...*** on the main menu bar.

2 Select the ***Start*** tab (if not already selected).

3 Select the ***Start*** button. A pop-up window with the message ***Caution discharge will delete patient data*** appears.

4 Select the ***Discharge*** button in the pop-up window.

Discharging a patient may take some time during which the message ***Please wait...*** appears on the screen. Once the patient is discharged, the message ***Touch Screen to initiate monitoring*** appears in the center of the screen. The message ***Patient transferred*** appears in the ***Alarm history*** page.

Patient categories

Each patient category has specific profiles associated with it. Profiles are a set of patient and user settings that have been pre-configured by the factory or the hospital (for more information, see "Patient and default profiles" on page 81).

The Cockpit supports the following patient categories:

Patient category	Typical Age Range	Weight	Height
Adult	12 to 140 years	0.1 to 350.0 kg (0.1 to 772.0 lbs)	10 to 250 cm (5 to 100 in)
Pediatric	0 to 16 years	0.1 to 350.0 kg (0.1 to 772.0 lbs)	10 to 250 cm (5 to 100 in)
Neonate	0 to 2 years	1 to 10,000 g (0.1 oz to 351 oz)	10 to 250 cm (5 to 100 in)

If an M540 docks with a different patient category from the one selected on the Cockpit, the following happens:

– The Cockpit aligns its patient category to the M540 patient category setting.

– During the patient category alignment, the M540 continues to monitor the patient.

– The profile changes to the default profile for the new patient category and the message ***Please wait ...*** is displayed.

– As soon as the Cockpit has switched to the new patient category, the patient data are automatically transferred to the Cockpit from the M540 that has been monitoring the patient.

Selecting the patient category

If the ***Patient profile selection*** function is activated (see page 487), you can change the patient category and select a profile from a list of pre-configured profiles from the ***Start*** page. If the function is deactivated, you can only change the patient category from the ***Demographics*** page.

After changing the patient category, the new patient category label and symbol appear in the left most field of the header bar (see page 81).

A patient category change does not affect the following settings: the patient and physician names, patient ID, birth date, admit date, and height. The weight is affected by a change in patient category as follows:

– Changing from adult to pediatric patient category and vice versa does **not** affect the weight.

– Changing from adult or pediatric patient category to neonatal patient category causes the weight to appear blank.

– Changing from neonatal patient category to adult or pediatric causes the weight to appear blank.

To change the patient category from the *Start* page

The following steps are only possible when the ***Patient profile selection*** function is activated (see page 487).

- Select the left most field on the header bar to access the ***Demographics*** page directly.

  or

1 Select ***Start/Standby...*** on the main menu bar.

2 Select the ***Start*** tab (if not already selected).

3 Select the desired patient category button (***Adult***, ***Pediatric***, or ***Neonate***), next to the selection ***Patient category***.

4 Press the rotary knob to confirm the setting.

5 Select a profile using the down arrow next to the selection ***Profile***.

The Cockpit switches to the new patient category and the selected profile.

To change the patient category in the *Demographics* page

- Select the left most field on the header bar to access the ***Demographics*** page directly.

  or

1 Select ***Start/Standby...*** on the main menu bar.

2 Select the ***Demographics*** tab (if not already selected).

3 Select the desired patient category button (***Adult***, ***Pediatric***, or ***Neonate***), next to the selection ***Patient category***.

4 Press the rotary knob to confirm the setting.

The Cockpit switches to the new patient category and the default profile for the new patient category.

This page has been left blank intentionally.

Assembly and preparation

Assembly overview

This chapter describes the following basic assembly tasks:

– Docking/undocking the M540 from the M500

– Locking/unlocking the M540 into the M500

– Connecting/disconnecting the system cables

CAUTION

Avoid mounting solutions that could impede air flow since the M500, PS250 / P2500 require adequate airflow to dissipate heat. In addition, when mounting the PS250 / P2500, always position it vertically for adequate heat dissipation.

IACS components are compatible with commercially available mounting solutions.

Commercially available mounting solutions

Various mounting solutions are available. It is the responsibility of the hospital to install, test, and ensure the proper and safe operation of any mounting solution.

Contact your Dräger representative for specific approved mounting solutions.

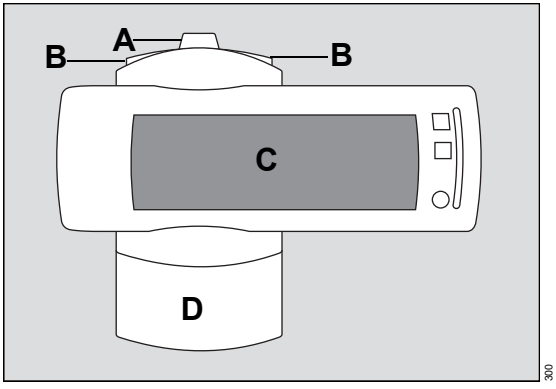
CAUTION

Check the weight ratings of the commercially available mounts to avoid injuring the patient or damaging the device.

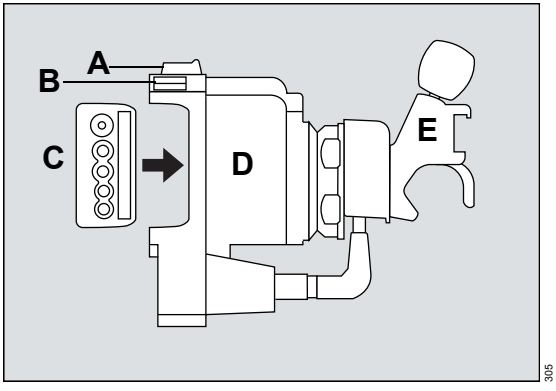
Docking/undocking the M540

The following diagram shows the front and side of the M500 which holds the M540 in place.

Front view of the M500 (M540 docked)



Side view of the M500 (M540 undocked)



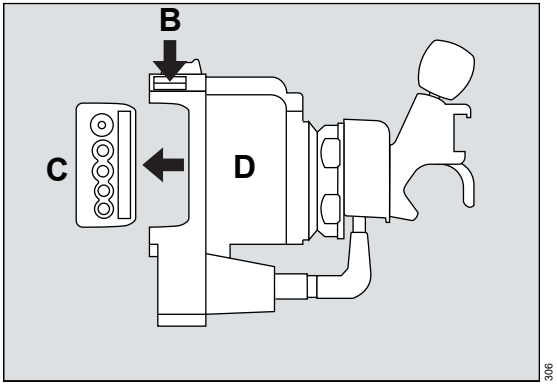
To dock the M540

1. Align the curved portion of the M540 with the curved portion of the M500.
2. Press the M540 (C) into the M500 (D) until it 'clicks' into place.
3. Push the locking tab (A) of the M500 towards the front, to the locked position to fasten the M540 into place.

To lock the M540 into place permanently, see "Locking/unlocking the M540" on page 108.

To undock the M540

1. Push the locking tab (A) of the M500 towards the back. If the locking tab does not move, it has been permanently locked. See page 108 for information on how to unlock the locking tab.
2. Hold the M540 firmly and press one of the release buttons (B - see arrow) of the M500.
3. Pull the M540 (C) out of the M500 (D).



A M500 locking tab

B Release buttons for removing the M540

C M540 patient monitor

D M500

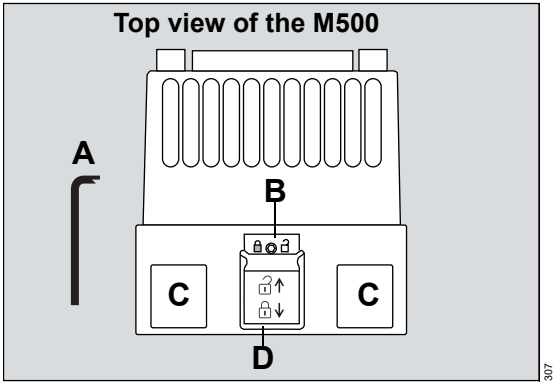
E Swivel mount (optional) and mounting clamp

Locking/unlocking the M540

You can lock the M540 in the M500 to prevent anyone from undocking it.

To lock the M540 into place

1. Push the locking tab (D) of the M500 towards the front. This prevents you from undocking the M540. If you push the locking tab back, you can undock the M540 again.
2. Insert the 2 mm hex wrench tool (A) into the middle hole (B) on the locking tab and turn it clockwise to the locked position . The locking tab is fixed and you cannot remove the M540 unless you unlock it again using the hex wrench tool.



A Hex wrench tool (2 mm)

B Center hole on locking tab for locking/unlocking the M540

C Release buttons for undocking the M540

D Locking tab

To unlock the M540

1. Insert the 2 mm hex wrench tool (A) into the middle hole (B) on the locking tab and turn it counterclockwise to the unlocked position .
2. Push the locking tab (D) back to unlock the release buttons (C) on the M500 to undock the M540.

Additional M540 accessories

The M540 patient monitor supports a variety of accessories that include transport hardware, clamps, cable hooks, trolleys, and so forth. For more information about these specialized accessories, refer to the *Infinity Acute Care System – Monitoring Accessories instructions for use*.

Connecting the system cables

Connecting the system cables involves 2 main steps:

– Connecting a system cable to the PS250 / P2500 and the Cockpit.

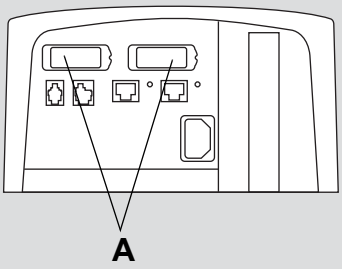
– Connecting a system cable to the PS250 / P2500 and the M500.

Connecting the system cable to the PS250 / P2500 and the Cockpit

1 Connect one end of the system cable to the system connector on the back of the Cockpit (refer to the instructions for use *Infinity Acute Care System – Medical Cockpit*).

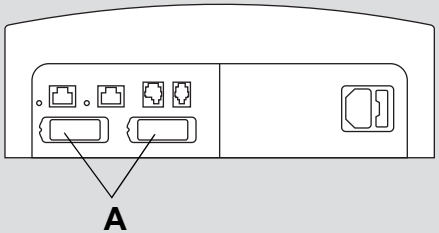
2 Connect the other end of the system cable to one of the two PS250 / P2500 system connectors (A).

Bottom view of the P2500



357

Bottom view of the PS250

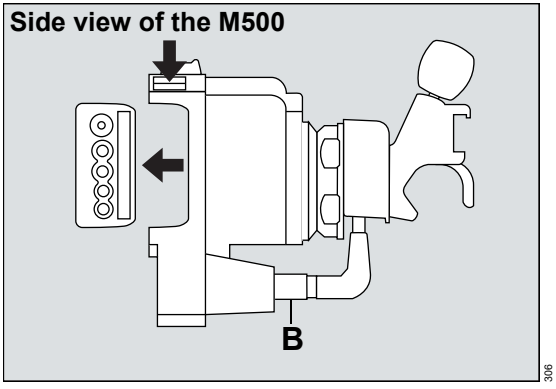


004

Connecting the system cable to the PS250 / P2500 and the M500

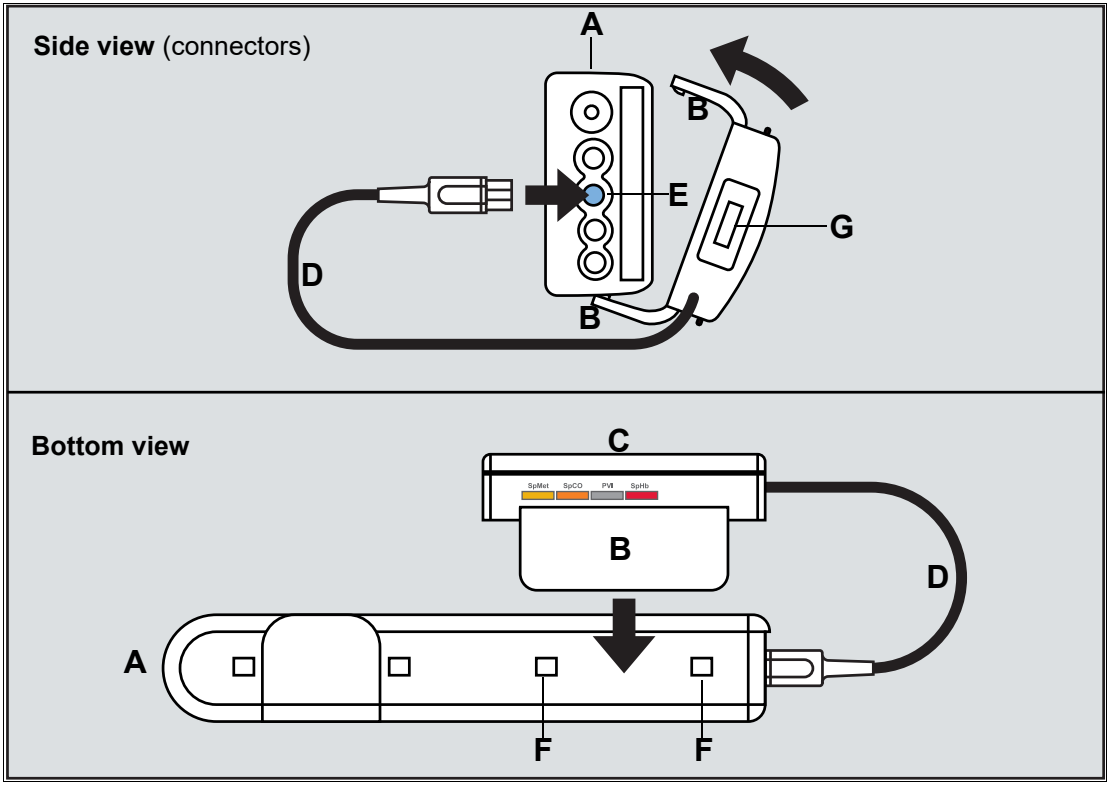
1 Connect one end of the system cable (B) to the M500 system connector.

2 Connect the other end of the system cable to one of the two PS250 / P2500 system connectors (see diagram on page 109).



Mounting the Infinity MCable – Masimo SET/Masimo rainbow SET/ Nellcor OxiMax

The following diagram shows how a Masimo MCable can be mounted to the M540. The Nellcor OxiMax MCable can be mounted in the same way.



A M540

B Tabs of the MCable mount adapter that lock into the side of the M540

C MCable mount

D Cable end of the MCable

E Blue SpO2 connector

F Indentations for locking the MCable mount adapter

G Intermediate cable or reusable SpO2 sensor which connects directly to MCable

To attach the MCable mount adapter

Follow these steps to attach the MCable to the M540:

1 Make sure the cable end of the MCable (D) mount adapter (C) points in the same direction as the connector side of the M540.

2 Align the tabs on the mount adapter (B) with the indentations on the M540 and push firmly until the mount adapter clicks in place.

3 Connect the MCable (D) to the blue SpO2 connector on the M540.

To remove the MCable mount adapter

1 Insert a flat head screwdriver (or equivalent tool) between the indentations for locking the MCable mount adapter (F).

2 Gently lift to unhinge the adapter.

Alarms

Overview of alarms

The Cockpit and the M540 produce acoustic and optical alarm signals. These alarm signals alert you to alarm conditions ranging from limit violations, arrhythmia events, and network issues.

Persistent alarms generate acoustic and optical alarm signals and will re-alarm as long as the alarm condition continues to exist. One-shot alarms are only reported until the alarms are acknowledged by the user, even if the alarm condition continues to exist.

Each alarm condition is assigned one of three alarm priorities: high, medium, and low. Each alarm priority has unique acoustic and optical alarm signals.

In addition to the optical and acoustic alarm signals, alarm messages appear in the header bar of the Cockpit and in the alarm message field of the M540. For some parameters such as NIBP and SpO2, certain alarm messages are displayed in the parameter field of the Cockpit. All alarm conditions and associated alarm messages are described in detail in the "Troubleshooting" chapter starting on page 525.

The color of an alarm message corresponds to the priority of the associated alarm condition (see "Alarm priorities" on page 115).

The alarm settings for a patient can be set up to generate automatic recordings and/or store alarms for later event review in the alarm history. A physiological alarm can also activate an external alarm device such as a nurse call. Special monitoring modes (see page 123), such as cardiac bypass mode, affect the regular alarming behavior.

When connected to the Infinity network, the Cockpit and the M540 can be configured to report alarm conditions occurring at other monitors that are also connected to the Infinity network. For more information, see "Remote alarm control" on page 153.

For detailed instructions regarding the alarm functions of the M540, refer to the instructions for use *Infinity Acute Care System – Infinity M540*.

WARNING

The user must remain within the hearing distance of the acoustic alarm signal to ensure quick detection and an appropriate response. The distance of the user to the medical device must be appropriate for the volume of the alarm signal.

Alarm priorities

Every alarm condition is assigned to one of three priorities: high (life-threatening), medium (serious), or low (advisory) optical and acoustic alarm signals indicate the level of the alarm priority. For more information on how alarm priorities affect alarm reporting, see "Optical alarm signals" on page 118 and "Acoustic alarm signals" on page 120.

High-priority alarm conditions

High-priority alarms are typically physiological alarm conditions that can be life-threatening and require immediate intervention.

An example of a high-priority alarm condition is an asystole.

Medium-priority alarm conditions

Most medium-priority alarms report physiological or technical alarm conditions that require prompt attention but may not be life-threatening.

An example of a medium-priority physiological alarm condition is a respiratory rate limit violation. An example of a medium-priority technical alarm condition is a hardware failure of a pressure transducer.

Low-priority alarm conditions

Low-priority alarms typically alert you to technical issues that may compromise the ability of the system to monitor the patient.

An example of a low-priority alarm condition is an artifact on the ECG waveform.

Alarm processing

When you dock an M540 on the M500 (see page 107), all optical and acoustic alarm signals are transferred to the Cockpit automatically. Acoustic alarm signals only sound at the Cockpit not at the M540 by default. If you also want alarms to sound at the M540 when it is docked, select the alarm volume at the M540 manually (refer to the instructions for use *Infinity Acute Care System – Infinity M540*).

The Cockpit provides acoustic and optical alarm signals for parameters originating from monitors in its alarm group (see page 154). In addition, the Cockpit reports technical alarms affecting the Infinity network.

NOTE

Alarm monitoring is not available for the following parameters: cardiac output (C.O.), injectate temperature (Tinj), pulmonary wedge pressure (PWP), paced beats (%PACED), perfusion index (PI) and SpOC for the Masimo SET MCable and Masimo rainbow SET MCable, and any parameter displayed on the Cockpit using the device connectivity option.

When you undock the M540 from the M500 (see page 107), all alarm monitoring stops at the Cockpit but continues on the M540.

Latching and non-latching alarm behavior

When an alarm condition no longer exists, the associated acoustic and optical alarm signals behave in one of two ways:

– The alarm signals automatically stop when the alarm condition ceases to exist. This type of alarm is called a non-latching alarm condition.

– The alarm signals continue until you acknowledge the alarm even though the alarm condition has ceased to exist. This type of alarm is called a latching alarm condition.

In general, high-priority alarms are latching alarm conditions while low-priority alarm conditions are non-latching. Exceptions to this alarm behavior are listed on page 123.

The alarm priority of a latching alarm condition determines how the alarm signals behave after the alarm condition ceases to exist:

– A latched alarm condition of high priority is identified by the standard acoustic and optical alarm signals (see page 120 and page 118).

– A latched alarm condition of medium priority is downgraded to a status message which appears in the header bar. The background of the alarm message in the alarm header and the parameter field no longer flash in the alarm color. In addition, and there are no acoustic alarm signals.

To acknowledge a latched alarm condition

Press one of the following two keys:

– The yellow key 

or  on the front of the Cockpit.

– The yellow key  on the front of the M540.

or

– Select the ***All alarms off*** or ***All alarms paused*** button (the name and function of the button depends on the Cockpit configuration – see page 472). To access the button, press the quick access symbol next to the ***Alarms...*** button on the main menu bar.

The latched alarm signals clear and all acoustic and optical latched alarm signals disappear.

NOTE

When OR alarms are activated (see page 473), high-priority alarms are no longer latching alarms. The alarm signals stop automatically when the alarm condition clears. Only when OR alarms are deactivated do high-priority alarms conditions produce latching alarms.

Multiple alarm conditions

During multiple alarm conditions, the Cockpit and the M540 report the most recently detected alarm condition of highest priority. When several alarm conditions occur simultaneously, the parameter fields flash for all alarming parameters. The alarm condition with the highest priority determines which acoustic alarm signal is generated, how the alarm bar and the parameter field appear, and what alarm message appears in the header bar. If more than two alarms are active simultaneously, the corresponding messages appear in the header bar along with the ***More...*** button which provides access to additional messages. For more details, see "Communicating with the Infinity network" on page 49.

Activating or deactivating alarm validation

When the alarm validation function is activated (see page 457), an alarm condition must exist for a certain time before acoustic and optical alarm signals are triggered. This feature reduces false alarms.

When the alarm validation feature is activated, the time between the detection and annunciation of a parameter falling outside the set alarm limits equals the time of detection plus the assigned alarm validation delay. For HR, adding the delay time may exceed the maximum of 10 seconds allowed per AAMI/ANSI/IEC 60601-2-27.

The following table lists which parameters have an alarm validation time. Parameters that do not appear in the table have no validation times and acoustic and optical alarm signals are triggered almost immediately.

Parameter	Upper alarm limit	Lower alarm limit
ECG/Heart rate (HR)	6 s	6 s
Pulse rate (PLS*)	6 s	10 s
ST segment analysis (ST)	15 s to 60 s (selectable) [1)]	15 s to 60 s (selectable) [1)]
Respiratory rate (RRi)	14 s	14 s
Respiratory rate (RRc)	8 s	10 s
Pulse oximetry (SpO2) [2)]	6 s	10 s
Invasive pressure (IP)	10 s	4 s
Total hemoglobin (SpHb and SpHbv)	6 s	10 s
Carboxyhemoglobin saturation (SpCO)	6 s	10 s
Pleth variability index (PVI)	6 s	10 s
Methemoglobin saturation (SpMet)	6 s	10 s

NOTE

[1)] Select the validation period for the ST limit alarm in the ST dialog (see "Configuring ST alarm settings" on page 146).

[2)] For Nellcor OxiMax SpO2: the SatSeconds alarm time overrides the alarm validation setting (see "SatSeconds alarm" on page 291).

Optical alarm signals

Each alarm priority has its own distinct optical alarm signals. When the M540 is docked on the M500, only the Cockpit provides acoustic alarm signals. However, optical alarm signals appear on the Cockpit and the M540.

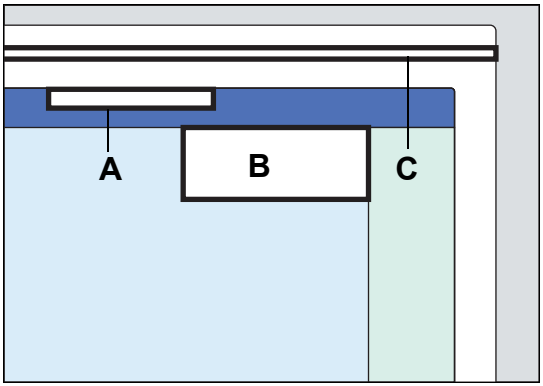
The alarm message in the header bar is the only optical alarm signal if an alarming parameter is not included in the current screen view or the alarm bar is deactivated.

Alarm priority	**Parameter field**	**Alarm message field [1] in header bar**	**Alarm bar (if activated, see page 473)**	**Alarm message in header bar (refer to "Messages" on page 529**
High (life-threatening) *(for example, asystole, ventricular fibrillation)*	Flashing red background	Red background	Flashing red	White alarm message on red background
Medium (serious) *(for example, alarm limit violations)*	Flashing yellow background	Yellow background	Flashing yellow	Black alarm message on yellow background
Low (advisory) *(for example, disconnected electrode)*	Solid cyan background	Cyan background	No optical alarm signal on first-generation and second-generation Cockpits. Solid cyan on third-generation Cockpit	Black alarm message on cyan background

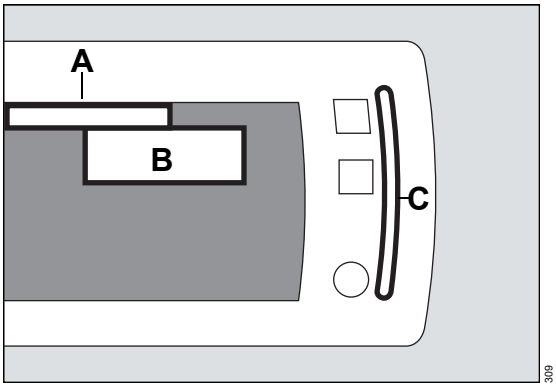
NOTE

[1] Cockpit alarm messages are designed to be legible from a distance of 1 meter (3.3 feet) to 2 meters (6.6 feet). M540 alarm messages are legible at arm's length.

Optical alarm indicators on the Cockpit



Optical alarm indicators on the M540



A Alarm message field in the blue header bar

B Alarming parameter field

C Alarm bar

Alarm bar

The alarm bar on the Cockpit and the M540 optically announces high and medium-priority alarm conditions (see page 115); low-priority alarm conditions are announced on the alarm bar only on the third-generation Cockpit. The color of the alarm bar always reflects the priority of the alarm condition. It may change between yellow, red and cyan depending on the latest alarm condition. The alarm bar appears in solid color for any unacknowledged single notification alarm.

However, the alarm bar is inactive when:

– The alarm bar is deactivated (see page 473)

– Cardiac bypass or Privacy modes are activated (see page 125)

– Alarm monitoring is deactivated (see page 134)

NOTE

The color of the alarm bar always corresponds to the highest priority alarm condition for all active or audio pause alarms in audio pause.

NOTE

The alarm bars on the first-generation Cockpit, the second-generation Cockpit, and the M540 do not support cyan for low-priority alarms. However, the alarm bar on the third-generation Cockpit does support cyan for low-priority alarms.

Header bar

The header bar displays the alarm message on the background color corresponding to the alarm priority. During multiple alarm conditions, the optical alarm signals always reflect the condition corresponding to the highest alarm priority. The header bar accommodates up to two messages simultaneously (see page 116).

Acoustic alarm signals

During an alarm, the Cockpit also provides distinct acoustic alarm signals for each alarm priority in addition to optical alarm signals (see page 118). The specific characteristics of these acoustic alarm signals depend on the selected alarm tone pattern. The available alarm tone patterns are: ***Infinity***, ***IEC fast***, ***IEC slow***, and ***Hybrid***.

When acoustic alarm signals are paused, the alarm bar and the parameter field stop flashing but remain lit up in the respective alarm color.

If multiple alarm conditions exist simultaneously, an acoustic alarm signal sounds for the alarm condition with the highest priority.

NOTE

Normally, acoustic alarm signals only sound at the Cockpit not at the M540. Therefore, all acoustic alarm signals are transferred automatically from the M540 to the Cockpit once you dock the M540. However, if you want alarms to sound at both devices, select the alarm tone at the M540 manually.

Alarm priority	IEC fast	IEC slow	Infinity	Hybrid
High	The following acoustic alarm signal is repeated every 4.5 s: Three beeps > one beep > one beep with higher pitch > short pause	The following acoustic alarm signal is repeated every 8 s: Three beeps > one beep > one beep with higher pitch > short pause	Continuous two-tone sequence	Continuous two-tone sequence
Medium	The following acoustic alarm signal is repeated every 7 s: Two beeps > one lower pitched beep	The following acoustic alarm signal is repeated every 15 s: Two beeps > one lower pitched beep	Two tones > short pause	The following acoustic alarm signal is repeated every 7 s: Two beeps > one lower pitched beep
Low	Two beeps repeated every 16 s	Two beeps repeated every 30 s	Low tone repeated every 30 s	Two beeps repeated every 16 s

Attention tones

The Cockpit also provides an attention tone to alert you to special information such as:

– Start of venous stasis
– End of zeroing a transducer
– CO_2 calibration is required
– CO_2 MCable maintenance is due
– Arrival of laboratory data
– Alarm messages from a remote bed within the same alarm group

An attention tone sounds once as a chime (that is, two tones in the same pitch). To set the attention tone volume, refer to page 151.

NOTE
Unlike attention tones, pulse tones for ECG or SpO_2 consist of a single tone.

Adjusting the alarm volume

The volume of the alarm tone is adjustable. Make sure you set the alarm volume so that it is suitable for the clinical environment.

The alarm status indicating the alarm volume displays in the Cockpit alarm message header. In the following example the alarm volume is set at 50% which is indicated by the percentage.

To adjust the alarm volume

1 Select the ***Alarms...*** button on the main menu bar.
2 Select the ***Settings*** tab.
3 Select the button ***Alarm volume [%]*** and select the desired volume (5%, 10 to 100% in increments of 10%).

Special conditions affecting the alarm volume

There are several conditions that affect the alarm volume of the Cockpit.

Minimum alarm volume setting

The alarm volume is tied to the setting ***Minimum alarm volume*** (see page 474 for more information). If the minimum alarm volume is set to a higher volume than the selected alarm volume, the alarm volume is adjusted to the higher setting. If the minimum alarm setting is set to a lower setting than the current alarm volume, the alarm volume does not change.

NOTE
If the ***Alarm volume off*** feature is enabled in the ***Code*** setup page (see page 477), the alarm volume is automatically reduced to its minimum alarm volume setting when you select the ***Code*** button on the main menu bar.

Cockpit and ICS lose connection

If the Cockpit was assigned to the ICS and it loses its connection to the ICS, you can no longer turn the alarm volume off at the Cockpit. In this case, the alarm tone setting goes automatically to 100%. Once the Cockpit restores its connection to the ICS, the previous setting for the alarm volume is reinstated.

However, if the connection to the ICS is lost while the Cockpit is set to OR alarms and the ***Minimum alarm volume*** setting is set to ***Off***, you can still turn the alarm volume off at the Cockpit.

For more information about the network communication, see page 49.

Deactivating the alarm volume

You can only deactivate the alarm volume under the following two circumstances:

– If the patient is assigned to an ICS and the setting ***Minimum alarm volume*** is set to ***Off***.

– If the Cockpit is set to OR alarms and the setting ***Minimum alarm volume*** setting is set to ***Off***.

These two system settings are configured under the password-protected ***Volume/ Tone*** page (see page 474).

To deactivate the alarm volume

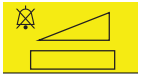
Make sure the ***Minimum alarm volume*** is set to ***Off*** (see page 474), before you execute the following steps:

1 Select the ***Alarms...*** button on the main menu bar.

2 Select the ***Settings*** tab.

3 Select ***Off*** under the ***Alarm volume [%]*** setting.

The message ***Audio off*** and the corresponding symbol displays in the alarm message header.



The alarm history records a message when the alarm volume is set to ***Off***, and the alarm volume changes from ***Off*** to another setting.

Testing optical and acoustic alarm signals

At startup, the Cockpit alarm bar illuminates and two speaker tones sound separately. These two distinct tones help the user identify if a speaker is malfunctioning. The user should also test the optical alarm signals and acoustic alarm signals by creating an alarm condition (for example, by lowering the upper alarm limit of the heart rate). To end the test, restore the alarm limits to the previous setting (see "Configuring the alarm settings for a patient" on page 134).

Viewing current alarm messages

The Cockpit identifies each alarm condition according to the alarm priorities low, medium, and high (see page 115). In addition to optical and acoustic alarm signals, alarm messages in the header bar identify each alarm condition. The header bar can display two messages simultaneously. If more than two patient alarm conditions are active simultaneously, the button ***More...*** appears to the left of the alarm message field (see page 93). Selecting this button activates the ***Current alarms*** page. This page lists all of the currently active alarms.

Specifically, you can review the following information for each alarm condition:

– How long the alarm has been active (duration).

– The alarm priority of the alarm condition (! = low-priority; !! = medium-priority; !!! = high-priority).

– Alarm message (for detailed information on the cause and possible remedies, see the chapter “Troubleshooting" on page 525).

To access the current alarm messages

- Select the ***More...*** button to the left of the alarm message field in the header bar (only visible when more than two patient alarm conditions are active).

or

1. Select the ***Alarms...*** button on the main menu bar.
2. Select the ***Current alarms*** tab.

Special alarm behavior

Activating any of the following features alters the normal alarm annunciation behavior:

– ASY/VF alarms
– SpO2 desaturation alarm
– NIBP/SpO2 interlock function
– Zeroing invasive pressures
– Privacy, Standby, Cardiac bypass, and OR alarms
– French NFC mode
– ECMO mode
– ***Pressures pause*** and ***Pressures off*** functions

ASY/VF alarms

You can control the alarming behavior for ventricular fibrillation (VF) and asystole (ASY) alarms.

CAUTION

Alarm signals are not generated for ventricular fibrillation and asystole events when the following conditions are met:

- **The *ASY/VF alarms* setting is set to *Always on* or *Follow HR alarm* (see page 471).**
- **The *ARR mode* is set to *Off.***
- **The *HR source* is set to *Arterial* or *SpO2* with ECG available as a heart rate source.**

NOTE

When ***Arterial*** is selected as the HR source, the first valid pressure is derived from the following list in priority order: ART, AOR, FEM, AXL, RAD, UAP, BRA.

To make sure that asystole and ventricular fibrillation alarms are always reported do one of the following:

– Turn arrhythmia monitoring on

or

– Set the ***HR source*** to ***ECG*** (see page 224) when the ***ARR mode*** setting is set to ***Off*** (see page 238)

If you select ***Follow HR alarm,*** deactivate HR and arrhythmia alarm monitoring, the message ***HR, ASY, VF off*** appears.

SpO2 desaturation alarms

The alarm priority is upgraded to high-priority if the SpO2 value falls below the Desat. alarm limit. Deactivating the SpO2 alarm automatically deactivates the desaturation alarm. The desaturation alarm can be activated only if SpO2 alarms are activated (see page 157, page 275, and page 289). When using the Infinity MCable – Nellcor OxiMax, this feature is only available if the ***SatSeconds alarm*** function is set to ***Off*** (see page 291).

NIBP/SpO2 interlock alarms

To avoid SpO2 nuisance alarms when the blood pressure cuff and the SpO2 sensor are placed on the same limb during an active non-invasive blood pressure measurement, select the ***NIBP/SpO2 interlock*** function in the ***General settings*** page (see page 471).

When the function is activated, all SpO2 alarms are deactivated during an active non-invasive blood pressure measurement. To activate or deactivate this function, see page 473.

Zeroing invasive pressures

Zeroing all invasive pressures from the ***Zero all*** button on the Cockpit menu bar or from the ⇒0⇐ key on the hemodynamic pods (see page 319) has the following effects:

– All invasive pressure and CPP limit alarms and static alarms are suppressed from the time the button/key is pressed until 30 seconds after the zeroing procedure is completed. This includes an alarm for a disconnected arterial catheter.

Zeroing an individual pressure from a specific invasive pressure page on the Cockpit (see page 319) has the following effects:

– The invasive pressure limit alarm for that parameter is suppressed from the time the button is pressed until 30 seconds after the zeroing procedure is completed.

– If the zeroed parameter is ICP or ART, the CPP limit alarm is also suppressed from the time the button is pressed until 30 seconds after the zeroing procedure is completed.

The following alarm conditions cancel the suppression of alarms caused by zeroing invasive pressures:

– The invasive pressure parameter is outside (too high/low) the measuring range.

– Invasive pressure hardware failures such as a transducer failure

– Unplugged transducers

– Disconnected hemodynamic pods

– A wedge pressure measurement that ends before the 30-second zeroing period ends will activate the alarm limit for the parameter PA M only

Privacy mode

When privacy mode is activated, the following happens at the Cockpit:

– All patient data are removed from the Cockpit and the M540 but continue to be visible at the ICS (Infinity CentralStation).

– The Cockpit and at the M540 display the alarm message ***Privacy – Touch Screen to resume monitoring***.

– The alarm bar is deactivated.

– Acoustic alarm signals are only provided at the ICS.

– ***Home*** is the only active button on the main menu bar of the Cockpit; all other buttons are inactive.

You can activate privacy mode only if the patient is also admitted at the ICS. To activate or deactivate this feature, see page 94.

Standby mode

When Standby mode is activated, the following happens at the Cockpit:

– All patient data are removed from the screen.

– All monitoring (including acoustic and optical alarm signals) is suppressed.

– Active alarms are considered acknowledged by the user.

– The message ***Standby***, ***Touch Screen to resume monitoring*** appears at the ICS, at the Cockpit, and at the M540.

– ***Home*** is the only active button on the main menu bar of the Cockpit; all other buttons are inactive.

Cardiac bypass mode

Cardiac bypass mode is only available when the Cockpit is set to OR alarms. When cardiac bypass mode is activated (see page 473), the following happens at the Cockpit:

– All alarm monitoring (including arrhythmia alarms), and the alarm bar are deactivated.

– Alarm reminders are not activated.

– The message ***All alarms off: bypass*** and the symbol  appear in the message area in the upper-right corner of the header (in white text on red background). This message also displays at the ICS and on a remote device.

– Pressing the ***All alarms paused*** or the ***All alarms off %0*** button deactivates cardiac bypass mode.

– Pressing the yellow key on the Cockpit does not pause any alarms.

– The non-invasive blood pressure interval mode is deactivated. The interval timer is restored to the last value. To restart the interval measurements, press the ***NIBP start/stop*** button or the 

start/stop key.

– The alarm history records either the message ***Cardiac bypass on*** or ***Cardiac bypass off***.

When the Cockpit is in cardiac bypass mode and the M540 is undocked, cardiac bypass mode is not supported on the M540. Cardiac bypass is activated on the M540 after it docks to a Cockpit that is in cardiac bypass mode.

To activate or deactivate this function, see page 473. If ***French NFC mode*** is activated, ***Cardiac bypass*** mode is not available.

– All recordings are canceled.

To activate or deactivate this function, see page 93.

OR alarms

When OR alarms are activated, alarm messages for medium and high-priority alarms clear when the alarm condition no longer exists. In addition, you can deactivate the acoustic alarm signal. For detailed information, see page 120.

NOTE

RRi and 12-lead ECG monitoring are unavailable when the M540 is set to OR alarms.

French NFC mode

When this mode is activated, the following happens at the Cockpit:

– Heart rate alarms cannot be deactivated.

– The alarm pause period cannot last longer than 3 minutes.

– You cannot activate ***Cardiac bypass*** mode when ***French NFC mode*** is activated. If ***Cardiac bypass*** mode was activated before ***French NFC mode*** was activated, ***Cardiac bypass*** mode is deactivated.

To activate or deactivate this function, see page 487.

ECMO mode

When a patient undergoes ECMO (extracorporeal membrane oxygenation), pressure tracings change from pulsatile to non-pulsatile.

ECMO mode supports a patient undergoing the ECMO procedure by suppressing alarms.

WARNING

All systolic, diastolic, static pressure, and *Art. cath. disconnect* alarms are disabled in ECMO mode, which reduces the number of invasive pressure alarms to mean pressure limit alarms only.

NOTE

The ***Art. cath. disconnect*** alarm can be manually re-enabled if desired.

To activate ECMO mode on the Cockpit

1 Press the ***Alarms...*** button on the main screen to open the Alarms dialog.

2 Press the ***Settings*** tab.

3 Press the ***ECMO*** button.

Or

1 Press the ***Sensor parameters...*** button on the main screen.

2 Press the ***Invasive pressures*** tab.

3 Press the ***ECMO*** button.

Or

1 Press the  quick access symbol (see page 72).

2 Press the ***ECMO*** button.

ECMO mode turns on, and the following message appears on the main screen indicating that systolic and diastolic alarms are disabled.

ECMO  ***S/D***

To deactivate ECMO mode

NOTE

All systolic, diastolic, static pressure, and *Art. cath. disconnect* alarms are re-enabled when exiting ECMO mode, regardless of patient profile settings.

- Press the ***ECMO*** button (toggles to On/Off).
  - The ECMO banner on the Cockpit and M540 is removed, and all pulsatile pressure alarms are enabled.

Pressures off and Pressures paused functions

The user can set pressure alarms to ***Off***, set pressure alarms to ***Pause***, and configure pause durations.

To enable ***Pressures off***.

1 Press ***System setup...*** on the main screen.

2 Press the ***Alarms*** tab.

3 Enter the clinical password.

4 Press the ***Pressure settings*** tab.

5 Next to ***Pressures off***, press the ***Enabled*** button.

To set *Pressures off*

1 Press the ***Alarms...*** button on the main screen.

2 Press the ***Settings*** tab.

3 Press the ***Pressures off*** button next to ***Intervention***.

Or

1 Select an invasive pressure parameter field on the main screen.

2 Press the ***General settings*** tab.

3 Press the ***Pressures off*** button next to ***Intervention***.

The following status message is displayed in a red banner on the main screen:

Pressures off

4 Press the ***Pressures off*** button next to Intervention to deactivate.

CAUTION

The ***Pressures off*** setting will remain in effect until canceled by the user.

WARNING

Selecting *Pressures off* impacts all invasive pressure alarms including the *Art. cath. disconnect* alarm.

NOTE

Audio pause has priority over ***Pressures pause***. Initiating audio pause during pressure pause will automatically cancel ***Pressures pause***.

To configure *Pressures pause* durations

The user can configure pressure pause durations when the ***Pressures pause*** button is available for selection in the ***Alarm settings*** dialog.

1 Press the ***System setup...*** button on the main screen.

2 Press the ***Alarms*** tab.

3 Enter the clinical password.

4 Press the pressure settings tab.

5 Press the button next to ***Pressures paused*** [min] and select one of the following:

- ***1 min***
- ***2 min*** (default)
- ***3 min***
- ***4 min***
- ***5 min***
- ***Disabled***

To pause pressure alarms

1 Press the ***Alarms...*** button on the main screen.

2 Press the ***Settings*** tab.

3 Press the ***Pressures paused*** button next to ***Intervention***.

Or

1 Select an invasive pressure parameter field on the main screen.

2 Press the ***General settings*** tab.

3 Press the ***Pressures paused*** button next to ***Intervention***.

The following status message is displayed in a red banner on the main screen:

Pressures paused

4 Press the ***Pressures paused*** button next to ***Intervention*** to deactivate.

WARNING

Selecting *Pressures pause* impacts all invasive pressure alarms including the *Art. cath. disconnect* alarm.

Pre-silencing alarms

This function allows you to pre-silence (audio pause in advance) potential alarm conditions before they occur. Pre-silencing allows you to concentrate on a procedure without being interrupted by continuous acoustic alarm signals arising from potential alarm conditions.

NOTE

Pre-silencing alarms is not possible when quiet mode is deactivated.

A pre-silence period lasts two minutes.

Pre-silencing alarms has the following effect:

– Any alarm conditions are reported optically by a corresponding alarm message and a blinking parameter field (see page 118).

– The alarm message ***Audio paused*** appears in the far right field of the header bar along with a timer and the following symbol: 

– A single acoustic alarm signal is generated for the first occurrence of an alarm condition of low, medium or high alarm priority. For subsequent alarm conditions of equal alarm priority, no further acoustic alarm signals are generated. Only for subsequent alarm conditions of higher alarm priority, a single acoustic alarm signal is generated.

– If multiple alarm conditions arise during an active pre-silence period, the Cockpit triggers a single acoustic alarm signal for the alarm condition corresponding to the highest priority. The Cockpit remains silent for any subsequent alarm conditions of equal or lower alarm priority.

Initiating a pre-silence period

You can initiate a pre-silence in several ways:

– From the Cockpit

– From an M540 on wireless transport

– From an ICS

– From the remote view of another Infinity monitor within the same monitoring unit

To pre-silence alarms remotely is only possible if the remote control feature of the remote device is activated and quiet mode is enabled on the Cockpit (see "Alarm setup – Code functions" on page 477). Refer to the corresponding instructions for use for information on how to activate the remote control feature.

To pre-silence alarms from the Cockpit

- Press the yellow 

or  key on the Cockpit. The appearance of the yellow key depends on the Cockpit hardware version (see page 24).

or

- Press the F1 keyboard key.

  Pressing the key that initiated the pre-silence period again, cancels the pre-silence state and all alarm events are reported as usual.

To pre-silence alarms remotely

- Press the yellow  key on the main menu bar of the ICS to pre-silence alarms for all assigned patients. Press the same button in the viewport area to pause alarm tones for an individual patient. For more information, refer to the ICS instructions for use.
- Press the yellow  key on the M540 when it is not docked in an IACS configuration.
- Refer to the instructions for use of other remote devices within the same monitoring unit for detailed instructions on how to initiate an audio pause remotely.

Pressing the key that initiated the pre-silence period again, cancels the pre-silence state and all alarm events are reported as usual.

Pausing acoustic alarm signals (audio pause)

Acoustic alarm signals can be paused, or silenced, at the Cockpit for two minutes. In addition to silencing alarms, the setting of the quiet mode feature determines how subsequent alarm conditions are announced.

You can initiate an audio pause from the Cockpit, the M540, the ICS, or from the remote view of another Infinity monitor within the same monitoring unit. Pausing alarms from a remote device is possible when remote control is activated at the remote device and the Cockpit (see page 153).

Quiet mode

This feature gives you the flexibility to decide if you want restricted or full annunciation of future alarm conditions after you have already paused alarms. This feature affects the audio pause behavior of the IACS and the ICS. To activate or deactivate the quiet mode feature, refer to "Alarm setup – configuring the alarm volume and tones" on page 474. When this mode is activated, the number of acoustic alarm signals is reduced to eliminate unnecessary noise while still alerting the clinician to important alarm conditions

Activated quiet mode

If a new alarm condition with a priority higher than the currently paused alarm occurs, a truncated alarm tone sounds. In addition, the alarm is represented by optical alarm signals corresponding to the alarm priority. If the new alarm is of equal or lower priority than the paused alarm, the new alarm condition is only represented by an optical alarm signal. No acoustic alarm signal tones sound.

If the alarm bar is enabled when the audio pause button is pressed for active One-shot or persistent low-priority alarms, the solid alarm bar clears.

If the patient is also admitted at the ICS, any high-priority alarm condition will sound at the ICS. For any subsequent alarm condition of equal or lesser priority, no further alarm tones sound.

Deactivated quiet mode

Any new alarm condition breaks through the audio pause period with full acoustic and optical alarm annunciation. The same is true if the patient is admitted at the ICS.

If the alarm bar is enabled when the audio pause button is pressed for active One-shot or persistent low-priority alarms, the solid alarm bar clears.

Initiating an audio pause

The following happens when you pause active alarms:

– The alarm tone is paused for two minutes

– The ***Audio paused*** message appears in the alarm message header along with the timer and the following symbol: 

– The alarm message appears in the color corresponding to the alarm priority.

– The parameter field no longer flashes in the color corresponding to the alarm priority. It appears in solid color.

– The alarm bar no longer flashes for high and medium-priority alarm conditions.

If a new alarm condition occurs, the selected setting of the quiet mode feature determines the alarm annunciation behavior (see page 130).

NOTE

If an alarm condition remains unchanged after the alarm pause period expires, the acoustic and optical alarm signals are reactivated. The only exception are single notification alarms which are only reported once and are cleared when you pause alarms.

To initiate an audio pause from the Cockpit

- Press the yellow 

or  key on the Cockpit. The appearance of the yellow key depends on the Cockpit hardware version (see page 24).

  or

- Press the F1 keyboard key.

  Pressing the key that initiated the audio pause period again, cancels the audio pause state, and all alarm events are reported as usual.

To initiate an audio pause from the M540

Press the yellow  key on the M540 in an IACS configuration. You can audio pause alarms on the M540 when it is docked or while it is on transport.

To initiate an audio pause remotely

Refer to the instructions for use of any remote device within the same monitoring unit for instructions on how to initiate an audio pause.

Pressing the key that initiated the audio pause period again, cancels the audio pause state, and all alarm events are reported as usual.

Activating or deactivating acoustic alarm signals

Deactivating acoustic alarm signals is a password-protected function (see page 471).

You can deactivate alarm tones permanently. When you deactivate alarm tones, the following happens:

– Alarm tones no longer announce alarm conditions.

– The message ***Audio off*** appears in the far right field of the header bar and the following symbol: 

After deactivating acoustic alarm signals permanently, you can activate them again (see page 471). When you activate acoustic alarm signals, the following happens when an alarm condition occurs:

– Acoustic alarm signals sound (see page 120).

– Alarm messages appear in the header bar (see page 118).

For information about configuring alarm volumes and the ***Audio off reminder*** feature, refer to "Alarm setup – configuring the alarm volume and tones" on page 474.

Pausing alarm monitoring temporarily

If the password-protected alarm pause feature is activated (see page 472), you can pause alarm monitoring temporarily. The alarm pause duration is adjustable from 1 minute to 5 minutes (default is 2 minutes).

NOTE

If the ***French NFC mode*** is activated (see page 487), you cannot pause alarm monitoring for more than 3 minutes.

The following happens when you pause alarm monitoring:

– Acoustic and optical alarm signals for new alarm conditions are suppressed for all parameters until alarm monitoring begins again.

– Alarm signals for any active alarm condition stop immediately.

– The alarming parameter field and alarm bar return to the pre-alarm state.

– Alarm messages are removed from the alarm message field in the header bar.

– The far right field of the header bar turns yellow and displays the alarm message ***All alarms paused***, a timer, and the following symbol: 

– The message ***All alarms paused*** is recorded in the alarm history (see page 148).

NOTE

If the Cockpit is connected to the network and the patient is admitted at the ICS, a message also appears at the ICS that alarms are paused.

To pause alarm monitoring temporarily

1 Select the ⚠ symbol next to the ***Alarms...*** button on the main menu bar of the Cockpit.

2 Select the ***All alarms paused*** button.

NOTE
If configured to appear on the main menu bar, the ***All alarms paused*** button is also accessible on the main menu bar. For more information, see page 465.

As soon as the alarm pause period ends, the Cockpit generates acoustic and optical alarm signals as needed.

To activate alarm monitoring after pausing

1 Select the ⚠ symbol next to the ***Alarms...*** button on the main menu bar of the Cockpit.

2 Select the ***All alarms paused*** button again.

NOTE
If configured to appear on the main menu bar, the ***All alarms paused*** button is also accessible on the main menu bar. For more information, see page 465.

Activating or deactivating alarm monitoring

WARNING
If *No timeout* is assigned to the alarm off period, no counter appears and alarms remain deactivated until you enable them again.

WARNING
Never leave a patient unattended when alarm monitoring is permanently deactivated. Always activate alarm monitoring again as soon as possible.

If the password-protected alarm pause feature is set to ***No timeout*** (see page 472), the following happens when you deactivate alarm monitoring:

– All acoustic and optical alarm signals for new alarm conditions are suppressed for all parameters until alarm monitoring is manually activated again.

– Acoustic alarm signals for any active alarm condition stop immediately.

– The alarming parameter field and alarm bar return to the pre-alarm state.

– Alarm messages are removed from the alarm message field of the header bar.

– The far right field of the header bar turns yellow and displays the message ***All alarms off*** and the following symbol: ⚠.

– The message ***All alarms off*** is recorded in the alarm history (see page 149).

NOTE
If the Cockpit is connected to the network, a message also appears at the ICS that all alarms are turned off.

To deactivate alarm monitoring permanently

1 Select the △ symbol next to the ***Alarms...*** button on the main menu bar of the Cockpit.

2 Select the ***All alarms off*** button on the toolbar.

NOTE
If configured to appear on the main menu bar, the ***All alarms off*** button is also accessible on the main menu bar. For more information, see page 465.

To activate alarm monitoring after deactivating

1 Select the △ symbol next to the ***Alarms...*** button on the main menu bar of the Cockpit.

2 Select the ***All alarms off*** button again on the toolbar.

NOTE
If configured to appear on the main menu bar, the ***All alarms off*** button is also accessible on the main menu bar. For more information, see page 465.

The Cockpit provides acoustic and optical alarm signals again when it detects a new alarm condition.

Configuring the alarm settings for a patient

The following section describes the available alarm features and settings. You can adjust the alarm settings for an individual parameter in the respective parameter-specific setup page. Or, you can set up the alarm settings of multiple parameters in one page. When setting alarm limits, make sure that they are appropriate for the patient's condition.

Activating/deactivating alarms

Except for the following parameters, you can activate or deactivate the alarm function for individual parameters:

– Asystole and ventricular fibrillation (for these arrhythmia events you cannot deactivate alarms unless the ***ASY/VF alarms*** feature is set to ***Follow HR alarm***)

– Cardiac output (C.O.)

– Injectate temperature (Tinj)

– Pulmonary wedge pressure (PWP)

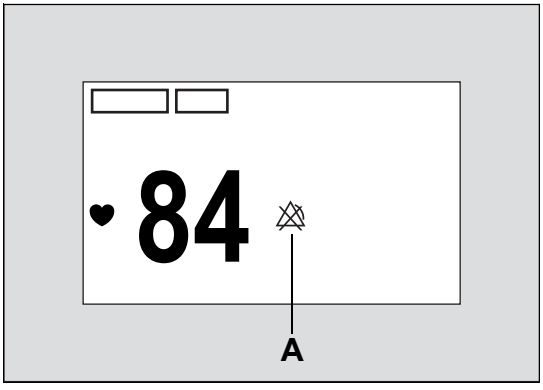
– Paced beats (%PACED)

– Perfusion index (PI)

– Total oxygen content (SpOC) for the Masimo rainbow SET MCable

– Parameters originating from a device that is displaying its values on the Cockpit using the device connectivity option.

When you deactivate alarms, no acoustic and optical alarm signals are triggered for that parameter. When alarm monitoring is deactivated, a crossed out triangle (A) appears in the parameter field.



When you activate the alarm function for a parameter, the set alarm limits replace the crossed out triangle, provided the alarm limits display is activated (see page 471).

Setting the upper and lower alarm limits

You can configure the upper and lower alarm limits of a parameter manually to trigger acoustic and optical alarm signals if a parameter goes above or below the set limits. You can also auto set the alarm limits of all parameters quickly based on a percentage. For more information on the Auto set function, see page 148.

WARNING

Setting alarm limits to extreme values may prevent certain alarm conditions from being detected and from being annunciated with acoustic and optical alarm signals.

WARNING

To ensure authorized changes are made to alarm settings, make the clinical, biomedical, and service passwords only available to appropriately trained individuals.

For information regarding special SpO_2 alarm limit behavior, refer to the chapters *SpO2 and Pulse CO-Ox monitoring with Masimo SET MCable* on page 272, and *SpO2 and pulse rate with Nellcor OxiMax MCable* on page 289.

Archive function

Depending on the active archive setting, the following happens in response to an alarm limit violation:

– An automatic strip recording (see chapter "Reports/recordings").

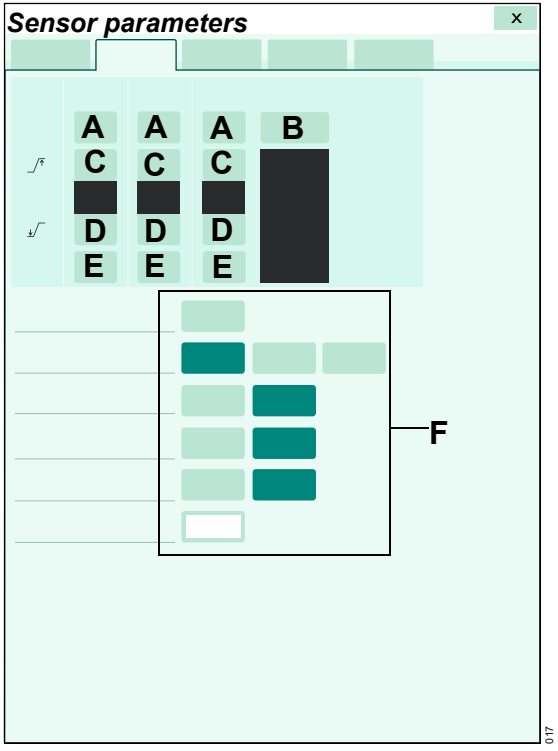
– An electronic event storage in the alarm history for later review (see page 148). For information on configuring the archive function, see "Changing general alarm settings" on page 139.

Configuring the alarm setup for an individual parameter

If you are only changing the alarm settings of an individual parameter, use the parameter-specific setup page which includes the alarm setup.

The following diagram shows an example of a parameter-specific setup page. Regardless of the parameter, buttons for adjusting the alarm settings always appear at the top. The alarm setup portion looks different depending on the parameter.

For example, the following diagram shows a setup page for a composite parameter such as non-invasive blood pressure. There are separate alarm settings for each composite parameter (systolic, diastolic, and mean).



A ***Alarm*** on/off buttons for each parameter

B ***Auto set*** button

C Buttons setting the upper limits for each parameter

D Buttons setting the lower limits for each parameter

E Archive buttons

F Parameter-specific monitoring settings

Changing alarm settings for a single parameter

In the steps below, the letters in parentheses refer to the diagram of the parameter-specific setup page.

WARNING

Setting alarm limits to extreme values may prevent certain alarm conditions from being detected and from being annunciated with acoustic and optical alarm signals.

To configure the alarm settings

1 Select ***Sensor parameters...*** on the main menu bar.

2 Select the desired parameter tab (for example, ***ECG***).

or

- Select the parameter field to access the parameter setup page directly.

3 Select the ***Alarm*** on/off button (A), to activate or deactivate alarm monitoring. A crossed-out triangle appears in the parameter field when alarm monitoring is deactivated.

NOTE

If French NFC mode is activated (see page 487), you cannot deactivate HR alarms.

4 Select the setup button (C) to adjust the upper alarm limits.

5 Select the setup button (D) to adjust the lower alarm limits.

6 Select one of the following settings for the ***Archive*** buttons (E) to determine what happens in response to an alarm:

   – ***Off*** – no event is stored and no recording is generated.

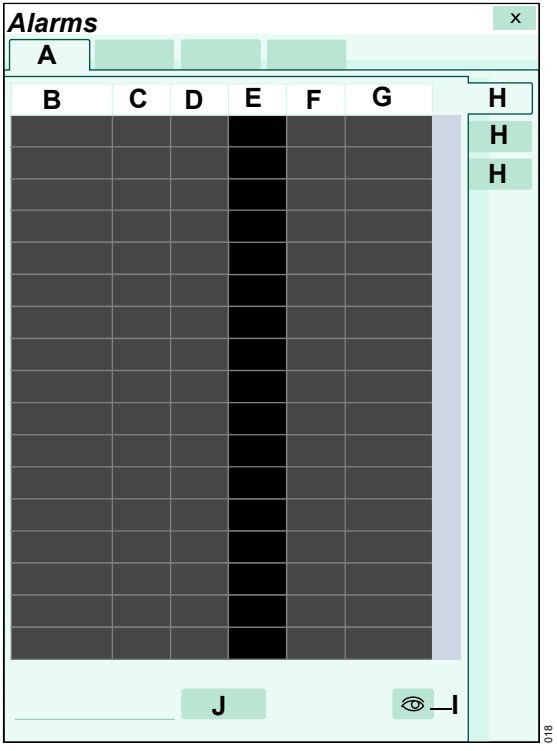
   – ***Store*** – stores the event for later review (see page 149).

   – ***Record*** – generates a timed recording.

   – ***Str/Rec*** – stores an event for later review and generates a timed recording.

Configuring the alarm setup for multiple parameters

The following diagram shows the ***General*** page where you configure alarm settings for all available parameters. The page consists of a table with setup rows for each parameter. Each setup row consists of several fields for configuring the individual alarm settings. When you select a field to configure a setting, an orange border highlights the selected row.



A ***Limits*** tab

B Parameter labels column

C ***Alarm*** on/off column

D ***Lower*** limits column

E Actual parameter values

F ***Upper*** limits column

G ***Archive*** column

H ***General***, ***ARR***, and ***ST*** tabs

I Display filter button

J ***Auto set all*** button (see "Auto setting all alarm limits" on page 147)

Changing general alarm settings

In the following steps, the letters in parentheses refer to the diagram of the ***General*** page (see page 138). Alarm ranges and defaults are listed starting on page 169.

WARNING

Setting alarm limits to extreme values may prevent certain alarm conditions from being detected and from being annunciated with acoustic and optical alarm signals.

To configure the alarm settings of multiple parameters

1. Select the ***Alarms...*** button on the main menu bar.
2. Select the ***Limits*** tab (if not already selected).
3. Select the ***General*** tab along the right edge of the page.
4. Use the display filter button (I) to determine whether the table displays all parameters or only parameters that are currently connected.
5. Select the corresponding button in the ***Alarm*** on/off column (C) to activate or deactivate alarm monitoring. A crossed-out triangle appears in the parameter field when alarm monitoring is deactivated.
6. Select the corresponding button in the ***Lower*** column (D) to adjust the lower alarm limits.
7. Select the corresponding button in the ***Upper*** column (F) to adjust the upper alarm limits.
8. Use one of the following settings in the ***Archive*** column (G) to determine what happens in response to an alarm:
   - ***Off*** – no event is stored and no recording is generated.
   - ***Store*** – stores the event for later review (see page 149).
   - ***Record*** – generates a timed recording
   - ***Str/Rec*** – generates a timed recording and stores the event.
9. Select the ***Auto set all*** button (J), to auto adjust the alarm limits of all parameters. For more information, see page 148.

NOTE

If configured to appear on the main menu bar, the ***Auto set all*** button is also accessible on the main menu bar. For more information, see page 465.

Configuring the alarm message behavior

The ***Config.*** tab allows you to set up the acoustic and optical alarm signal reporting behavior in response to certain SpO2 sensor and messages related to leads-off conditions.

To access the *Config.* tab

1 Select the ***Alarms...*** button on the main menu bar.

2 Select the ***Limits*** tab (if not already selected).

3 Select the ***Config.*** tab

4 Refer to the following table for available settings. The selected alarm priority affects how the alarm event is reported optically and acoustically (see page 120).

The alarm setting:

– is supported on the ICS

– is supported in any remote view

– is stored in the patient profile

Regardless of the selected setting, the acoustic alarm signal can be audio paused but resumes if the condition persists beyond the two minute audio pause time. The message appears in the header bar of the Cockpit until the condition disappears or you acknowledge.

Message	Available settings	Description
SpO2 sensor off [1)] ***SpO2 check sensor*** [2)]	**Alarm settings**	
	– ***High*** – ***Medium*** – ***Low*** (default for ***SpO2 check sensor***) – ***One-shot*** –  (off) – default for ***SpO2 sensor off***	Assigns an alarm priority to the sensor alarm or deactivates the sensor alarm. – ***High:*** The event is treated as a high-priority alarm. – ***Medium***: The event is treated as a medium-priority alarm. – ***Low***: The event is treated as a persistent low-priority alarm. – ***One-shot***: The event is treated as a low priority, single notification alarm. –  : No optical or acoustic alarm signals are triggered; however, if the sensor is no longer attached to the patient, a corresponding message appears in the SpO_2 parameter field.
[1)] Message originating from a Masimo rainbow SET or a Masimo SET MCable. [2)] Message originating from a Nellcor MCable.		

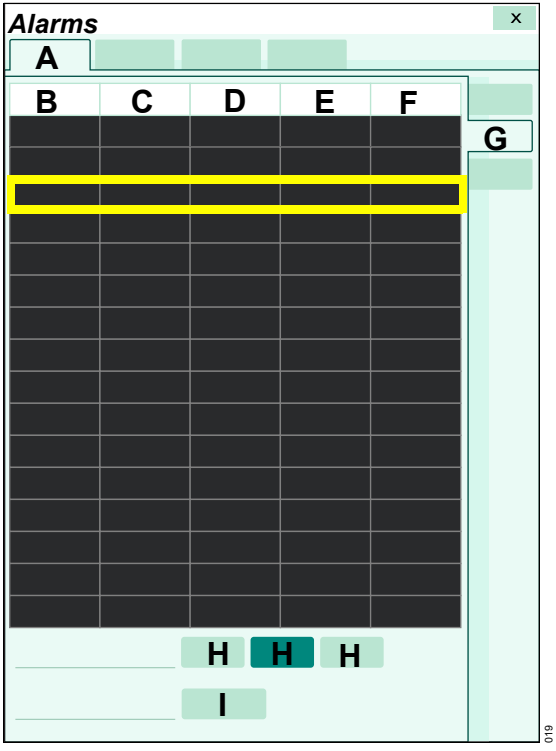
Message	Available settings	Description
Archive settings		
SpO2 sensor off [1)] ***SpO2 check sensor***	– ***Off*** (default) – ***Store*** – ***Record*** – ***Str/Rec***	The archive settings cannot be configured for these two alarm messages. The archive setting follows the general archive status for the parameter. For details on how to change the archive settings of a parameter, refer to page 136.
ECG leads off	**Alarm settings**	
	Alarm column – ***High*** – ***Medium*** – ***Low*** (default) – ***One-shot*** – (off)	Determines what happens when the corresponding alarm occurs: – generates a timed recording and stores the event. – ***High:*** The event is treated as a latching alarm. – ***Medium***: The event is treated as a medium-priority alarm. – ***Low***: The event is treated as a persistent low-priority alarm. – ***One-shot***: The event is treated as a single notification alarm of low priority. The message ***ECG leads off*** appears briefly in the header bar until the user acknowledges the condition or the condition disappears. – : No optical or acoustic alarm signals are triggered.
	Archive settings	
	– ***Off*** (default) – ***Store*** – ***Record*** – ***Str/Rec***	These archive settings cannot be configured for this alarm message. The archive setting follows the general archive setting for the parameter. For details on how to change the archive settings of a parameter, refer to page 136.

[1)] Message originating from a Masimo rainbow SET or a Masimo SET MCable.

Message	Available settings	Description
RRi lead off	**Alarm settings**	
	– ***High*** – ***Medium*** – ***Low*** (default) – ***One-shot*** –  (off)	Assigns an alarm priority to the RRI lead-off alarm or deactivates it. – ***High:*** The event is treated as a high-priority alarm. – ***Medium***: The event is treated as a medium-priority alarm. – ***Low***: The event is treated as a persistent low alarm. – ***One-shot***: The event is treated as a low priority, single notification. The message ***RRi lead off*** appears briefly in the header bar until the user acknowledges the condition or the condition disappears. –  : No optical or acoustic alarm signals are triggered.
	Archive settings	
	– ***Off*** (default) – ***Store*** – ***Record*** – ***Str/Rec***	These archive settings cannot be configured for this alarm message. The archive setting follows the general archive status for the parameter. For details on how to change the archive settings of a parameter, refer to page 136.
Arterial catheter disconnected	**Alarm settings**	
	Alarm column – ***High*** (default) –  *(off)*	Assigns an alarm priority to the ***Arterial catheter disconnected*** alarm or deactivates it. The selected alarm priority affects how the alarm event is reported optically and acoustically (see page 118 and page 120. – ***High:*** The event is treated as a high-priority alarm. –  : no optical or acoustic alarm signals are triggered.
	Archive settings	
	– ***Off*** (default) – ***Store*** – ***Record*** – ***Str/Rec***	This archive setting cannot be configured for this alarm message. The archive setting follows the general archive status for mean arterial blood pressure parameter. For details on how to change the archive settings of a parameter, refer to page 136.

Configuring the arrhythmia alarm setup

The following diagram shows the ***Limits > ARR*** page for configuring the alarm settings for arrhythmia parameters. This page consists of a table with setup rows for each arrhythmia parameter. Each setup row consists of several fields for configuring the individual ARR alarm settings. When you select a field on this page, an orange frame highlights the selected row.



A ***Limits*** tab

B ***Arrhythmia*** category column for identifying the ARR label

C ***Alarm*** priority column for selecting an alarm priority

D ***Rate*** column for setting the rate

E ***Count*** column for setting the count

F ***Archive*** column

G ***ARR*** tab

H ***Arrhythmia mode*** buttons

I ***Relearn*** button

Configuring ARR alarm settings

In addition to ARR alarm settings, the ***Limits > ARR*** page also allows you to select the arrhythmia mode (see page 235) and initiate the relearn process of ECG leads (see page 248). In the following steps, the letters in parentheses refer to the diagram of the ***Limits > ARR*** page. Alarm ranges and defaults are listed starting on page 169.

To change ARR alarm settings

1 Select the ***Alarms...*** button on the main menu bar.

2 Select the ***Limits*** tab (if not already selected).

3 Select the ***ARR*** tab along the right side.

4 Select the corresponding setup button in the ***Alarm*** priority column (C) to select the alarm priority. A crossed-out triangle appears when alarm monitoring is deactivated. The priority for asystole and ventricular fibrillation events cannot be changed. The alarm priority 'high' is always assigned to these categories.

5 Select the corresponding setup button in the ***Rate*** column (D) to set the rate.

6 Select the corresponding setup button in the ***Count*** column (E) to set the count.

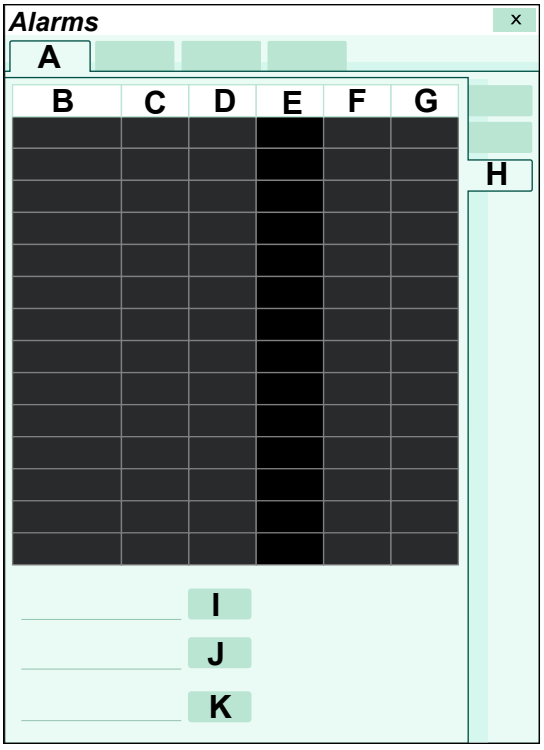
7 Use one of the following settings in the ***Archive*** column (F) to determine what happens in response to an alarm:

- ***Off*** – no event is stored and no recording is generated.
- ***Store*** – stores the event for later review (see page 149).
- ***Record*** – generates a timed recording.
- ***Str/Rec*** – generates a timed recording and stores the event.

8 Select the desired arrhythmia mode using the ***Arrhythmia mode*** buttons (H).

Alarm setup for ST

The following diagram shows the ***Limits > ST*** page where you configure alarm settings for ST parameters. This page consists of a table with setup rows for each ST parameter. Each setup row has several fields for configuring the individual ST alarm settings. When you select a field on the page, an orange frame highlights the selected row to mark your place on the setup page.



A **Limits** tab

B ***Parameter*** label column

C ***Alarm*** on/off column

D ***Lower*** limits column

E ***Actual*** parameter values

F ***Upper*** limits column

G ***Archive*** column

H ***ST*** tab

I ***Auto set all*** button

J ***Event duration [s]*** button

K ***ST relearn*** button

Configuring ST alarm settings

Some of the ST alarm settings described are also available on the ***ST alarms*** page (see page 245). In the following steps, the letters in parentheses refer to the diagram of the ***Limits*** > ***ST*** page (see page 144). Alarm ranges and defaults are listed starting on page 158.

To change ST alarm settings

1. Select the ***Alarms...*** button on the main menu bar.
2. Select the ***Limits*** tab (if not already selected).
3. Select the ***ST*** tab (H) on the right side of the page.
4. Select the setup button in the ***Alarm*** column (C) to activate or deactivate alarm monitoring. A crossed-out triangle appears in the parameter field when alarm monitoring is deactivated.
5. Select the corresponding setup button in the ***Lower*** column (D) to adjust the lower alarm limits.
6. Select the corresponding setup button in the ***Upper*** column (F) to adjust the upper alarm limits.
7. Use one of the following settings in the ***Archive*** column (G) to determine what happens in response to an alarm:
   - ***Off*** – no event is stored and no recording is generated.
   - ***Store*** – stores the event for later review (see page 149).
   - ***Record*** – generates a timed recording
   - ***Str/Rec*** – generates a timed recording and stores the event.
8. Use the ***Auto set all*** (I) button to adjust the alarm limits for all ST parameters (see page 148).
9. Use the ***Event duration [s]*** button (J) to select a time an upper ST alarm limit has to be in violation before an alarm is triggered (see page 117).

Auto setting all alarm limits

The auto set function allows you to adjust alarm limits quickly based on preset percentages listed in the following table.

You can either auto set:

– individual parameters (see page 148)

– all parameters (see page 148)

– all ST parameters (see page 148)

Parameter	Upper limit	Lower limit
Ta, Tb, T1a, T1b, Tblood	≤107% of current value	≤93% of current value
ΔT, ΔT1, PVC/min, inCO2	Not affected	Not affected
SpO2	*Adult/pediatric:* 100% saturation *Neonate:* 98% saturation	95% of current value
ST	Current value + 2.0 mm	Current value – 2.0 mm
FiO2 (via Scio)	100%	21%
etCO2 (via Scio)	100%	18%
inHal etHal inIso etIso inEnf etEnf inSev etSev inDes etDes	5% (+/-0.1) above parameter value	5% (+/-0.1) below parameter value
etCO2	125% of current value	80% of current value
RRc and all others	Alarm limit that is closest to but not more than 25% above the current value of the parameter.	Alarm limit that is closest to but not more than 20% below the current value of the parameter.

NOTE

If the Auto set function forces the alarm limits of a parameter outside the allowable limit range of the monitor, the alarm limits remain unchanged.

To auto set an individual parameter

1 Select the parameter field of the desired parameter.

2 Select the ***Auto set*** button located in the upper-right corner of each parameter setup page.

or

1 Select ***Sensor parameters...*** on the main menu bar.

2 Select the tab of the desired parameter.

3 Select the ***Auto set*** button located in the upper right corner of each parameter setup page.

To auto set all parameters

- Select the symbol next to the ***Alarms...*** button on the main menu bar > ***Auto set all***.

or

1 Select the ***Alarms...*** button on the main menu bar

2 Select the ***Limits*** tab.

3 Select the ***Auto set*** button which is located in the lower right corner below the parameter setup table.

To auto set all ST parameters

1 Select the ***Alarms...*** button on the main menu bar

2 Select the ***Limits*** tab.

3 Select the ***ST*** side tab to access the ***ST*** page.

4 Select the ***Auto set*** button which is located below the ST table.

Alarm history and stored events

The alarm history is an electronic record of alarms and events. The alarm history records an entry under the following circumstances:

– An alarm occurs for a parameter whose archive function is set to ***Store*** or ***Str/Rec***. These alarm events are marked with the symbol and can be viewed in greater detail (see page 150).

– Whenever an arrhythmia event occurs (even when the alarm function is deactivated). Only the archive function has to be set to ***Store*** or ***Str/Rec***.

– You select the ***Mark event*** button from the main menu bar. These alarm events are also marked with the symbol and can be viewed in greater detail (see page 150).

– You pause alarms using the ***All alarms paused/All alarms off*** button (see page 130).

– You activate Cardiac bypass mode (see page 125).

– You activate Standby mode (see page 93).

– You select a different patient category (see page 100).

– You transfer a patient.

– You audio pause an alarm.

– Whenever a maintenance restart event occurs.

The alarm history stores up to 150 events. When the storage capacity of 150 events is reached, new events replace the oldest events.

If a higher priority alarm occurs less than 5 seconds from a previous alarm, the higher priority alarm event is stored while the previous one is deleted.

Alarm history after shutdown

The alarm history is maintained until the patient is discharged. If the Cockpit is turned off and turned back on, the patient's alarm history is not affected. However, the alarm history will not record the time of the shut down.

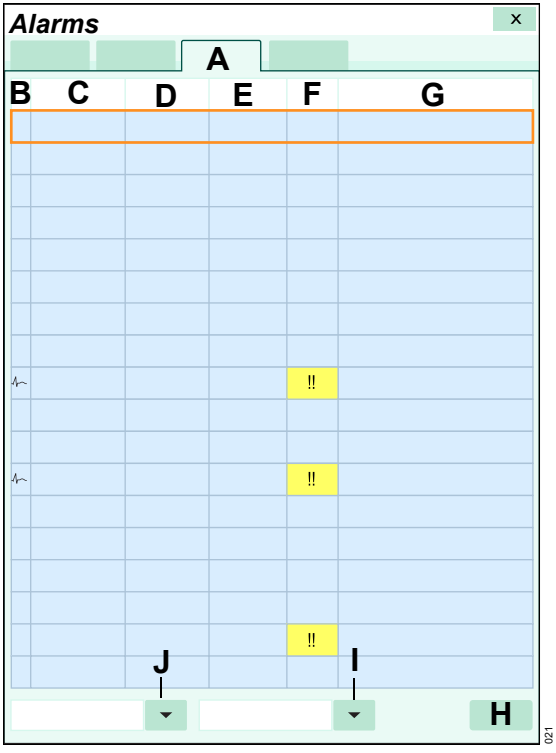
Viewing the alarm history

The following diagram shows an alarm history. When you select any field on the table, a frame highlights the selected row. For information on what conditions prompt an entry to be stored in the alarm history, see page 148.

To access the alarm history

1 Select the ***Alarms...*** button on the main menu bar.

2 Select the ***Alarm history*** tab.



A ***Alarm history*** tab

B Identifies an event

C Date of the alarm

D Time the alarm was stored

E Duration of the alarm

F Alarm priority

G Alarm message

H ***Print*** button for printing an alarm history report

I Button for filtering the alarm history according to time, priority, or message

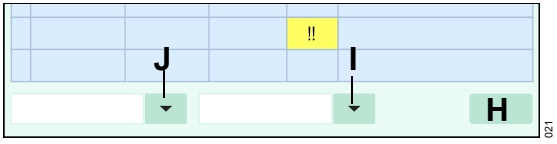
J Button for filtering the alarm history according to category

To filter the alarm history

The alarm history can be filtered according to different categories as follows:

1 Select the ***Alarms...*** button on the main menu bar.

2 Select the ***Alarm history*** tab.



3 Use the left button (J) to restrict the alarm history to one of the following alarm conditions:

- All
- Arrhythmia
- High-priority
- Medium-priority
- Low-priority

4 Use the second left button (I) to restrict the alarm history to one of the following settings:

- Time
- Priority
- Message

Viewing a snapshot of a single event

20 seconds of waveform and parameter data are stored automatically in the alarm history under the following circumstances:

– A parameter whose recording archive feature is set to ***Store*** or ***Str/Rec*** (see page 135) violates set alarm limits.

– You select the ***Mark event*** button on the main menu bar.

In both instances, events with stored waveform and parameter data are identified on the alarm history by the following symbol . Such an event consists of a snapshot of all connected parameter values and waveforms. Of the 20-second event capture, 10 seconds were recorded before and 10 seconds were recorded after the event occurred.

To view a snapshot of a stored event

1 Select ***Alarms...*** on the main menu bar.

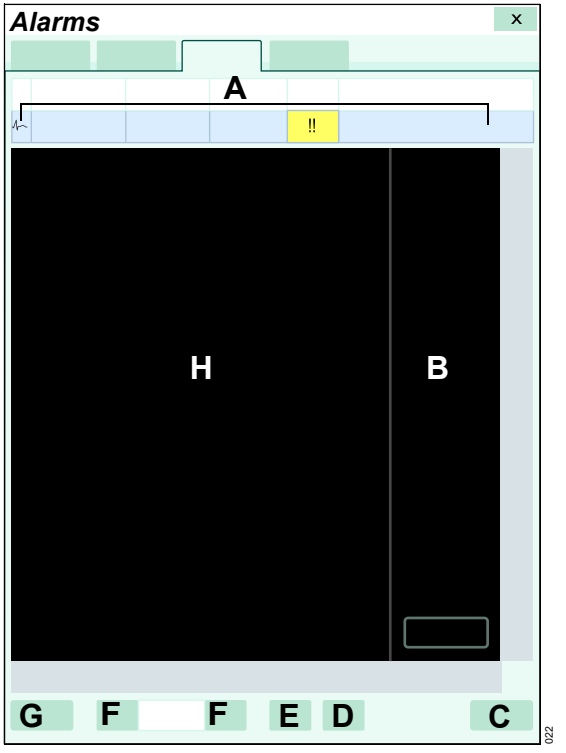
2 Select the ***Alarm history*** tab.

3 Select the row of the event marked with the symbol that you wish to view.

NOTE

To return to the alarm history, select the ***Select Event*** button.

The following diagram shows the event snapshot screen.



A Event header showing the date, time, duration, priority, and alarm message

B Parameter values area

C ***Print*** button for printing the alarm event report

D Zoom out button

E Zoom in button

F Navigation arrows for scrolling through events

G ***Select Event*** button

H Waveform area

Viewing current alarms

The ***Current alarms*** page displays all alarms that occur during a patient's monitoring session. The page is cleared when the patient is discharged. Each alarm displays the alarm priority, the duration, and the corresponding message.

To view current alarms

1. Select ***Alarms...*** on the main menu bar.
2. Select the ***Current alarms*** tab.

Configuring alarm settings temporarily

The following table contains several commonly used alarm settings that can be configured for a patient temporarily. These features revert to the password-protected configuration settings (see chapter *System configuration* starting on page 455) when the patient is discharged.

To configure alarm settings temporarily

1. Select ***Alarms...*** on the main menu bar.
2. Select the ***Settings*** tab.

Selection	Available settings	Description
Alarm volume	***Off***, 5%,10 to 100% (in increments of 10%); default is 50% **NOTE:** The 5% setting is only available when the ***Minimum alarm volume*** setting is set to 5%.	Determines the volume of the alarm tone. You can never turn the alarm volume lower than the selected setting for ***Minimum alarm volume.*** **NOTES:** Make sure the alarm volume is set so it can be heard in the monitoring environment. The setting ***Off*** for the alarm volume is only available under the following circumstances: – When the Cockpit is set to OR alarms or assigned to an ICS. – When the ***Minimum alarm volume*** feature is set to ***Off***.
Pulse tone volume	– ***Off*** – 5, 10 (default) to 100% (in increments of 10%)	Determines the volume of the pulse tone.
Attention tone volume	– ***Off*** – 5, 10 (default) to 100% (in increments of 10%)	Determines the volume of the attention tone or deactivates the attention tone.

Selection	Available settings	Description
Show alarm limits	– ***On*** (default) – ***Off***	Determines whether alarm limits appear in the parameter fields.
Cardiac bypass	– ***On*** – ***Off*** (default)	Activates/deactivates cardiac bypass mode. Alarm functions are affected when cardiac bypass mode is activated (see page 125). This mode is not available when the ***French NFC mode*** is enabled (see page 487).

To configure remote patient monitor alarms, see page 154.

Configuring the SpO2 alarm priority

The following two SpO2 alarm messages can be configured for the alarm priority that is most appropriate for your care environment. Depending on which MCable is used, the message reporting the underlying alarm condition differs:

– Masimo rainbow SET or Masimo SET: ***SpO2 sensor off***

– Nellcor: ***SpO2 check sensor***

Both alarm settings are saved as part of the patient profile.

Configuring the alarm priority for a Masimo sensor off message

The ***SpO2 sensor off*** message appears when the MCable detects that the sensor is no longer attached to the patient. The alarm priority for this message can be configured separately for each patient category. It is available for the following SpO2 cables:

– Masimo rainbow SET MCable

– Masimo SET MCable

For information on how to configure the alarm priority for the setting ***SpO2 sensor off***, see page 471.

On the Cockpit and the M540, the following SpO2 parameters can generate this alarm message according to the selected alarm priority:

Masimo rainbow SET MCable	Masimo SET MCable
SpO2	SpO2
PLS	PLS
SpHb or SpHbv	
SpCO	
PVI	
SpMet	

Configuring the alarm priority for a Nellcor check sensor message

This alarm setting is for configuring the alarm priority and the alarm archiving behavior of certain Nellcor SpO2 parameters. The message ***SpO2 check sensor*** appears when the Nellcor OxiMax MCable detects that the sensor is no longer attached to the patient or other technical issues that interfere with the functional integrity of the sensor. This feature can be configured separately for each patient category. For information on how to configure the ***SpO2 check sensor*** setting, see page 456.

The following SpO2 parameters generate an alarm message according to the selected alarm priority:

– SpO2

– PLS

Remote alarm control

When the Cockpit is connected to the Infinity network, it communicates with other Infinity monitors (including other monitoring Cockpits) that support remote viewing functions. Furthermore, the patient of any monitor that is connected to the network can be admitted at the ICS for central monitoring.

If you are viewing another monitor in remote view, you can audio pause alarms at the remote bed. You can also allow remote devices to audio pause alarms at the Cockpit provided the remote control feature is activated (see page 489).

A Cockpit that is connected to the Infinity network automatically relays alarms to the ICS. A network interruption causes the following to happen:

– A message indicating that there is a network interruption appears in the message field of the Cockpit.

– If the alarm volume was deactivated, the Cockpit ***Alarm volume*** setting (see page 471) changes to 100% when the Cockpit is offline from the Infinity network and defaults to 50% when the Cockpit no longer communicates with the ICS. Once communication is restored, the alarm volume returns to the previous setting.

Alarm groups

The Cockpit can receive alarm messages from other monitors that are connected to the Infinity network. However, these monitors must be in the same monitoring unit and in the same alarm group as the Cockpit. To configure alarm settings and groups for remote monitors, refer to **Configuring alarm settings temporarily,** page 151.

The alarm group feature allows you to configure several monitors as members of a group. All alarms that occur at any of the monitors within the group are broadcast to all the members in the alarm group, typically in less than two seconds.

If multiple monitors in the alarm group are in alarm simultaneously, each alarm message rotates in the header bar of the Cockpit and in the alarm message field of each monitor.

The display of remote alarm messages requires configuration (see page 154); whereas, the color scheme corresponds to the priority of the alarm from the Cockpit. For information about alarm priorities, see page 115.

The remote alarm messages display in the following format:

<bed label> -- <alarm message> up to 40 characters

Configuring remote patient monitor alarms

The following table contains settings that enable remote patient monitor alarms that are on the IACS network to be viewed at the Cockpit. To display remote patient alarms requires the following conditions:

– the remote monitor resides in the same monitoring unit as the Cockpit

– the remote monitor resides in the same group as the Cockpit.

To configure remote patient monitor alarms:

1 Select ***Alarms...*** on the main menu bar.

2 Select the ***Settings*** tab.

Selection	Available settings	Description
Alarm group	Keypad for configuring an alarm group.	Allows you to configure several monitors as members of a group. All alarms that occur at any of the monitors within the group are broadcast to all other members in the alarm group.
Remote alarm attention tones	– ***On*** – ***Med. and high only*** – ***Off*** (default)	Determines whether remote alarms on the network that are configured for the alarm group annunciate with an attention tone.
Show remote alarms	– ***All alarms off*** (default) – ***Med. and high only*** – ***High only***	Determines which remote alarm messages display based on the configured alarm priority.

Infinity MCable – Nurse call

You can attach a Nurse Call MCable to the PS250 or the P2500 (see page 25) and connect it to an external nurse call. Whenever the M540, the Cockpit or a connected external device produces a medium or high-priority alarm, a nurse call is activated to provide remote notification of the alarm condition.

External device disconnection alarm

If the external device alarm feature is activated at the Cockpit (see page 474) and an external device is disconnected from the Cockpit, the following happens at the ICS and at the Cockpit:

– An alarm tone of low priority sounds.

– The message ***External device disconnected*** appears.

The *Code* function

You can configure a set of monitoring functions that can be activated during emergency care by selecting the ***Code*** button on the main menu bar. Depending on which of these settings are activated (see page 477), any of the following happens when you select the ***Code*** button:

– A continuous recording starts

– NIBP measurements start in continuous mode

– The alarm volume of the alarm condition with the highest priority is automatically reduced to the minimum setting.

NOTE

When the ***Audio off*** setting is set to ***Off*** (see page 474), the message ***Audio off*** and the symbol  appear in the Cockpit header bar when you invoke the Code function.

– The pre-configured ***All alarms off*** setting determines if the alarm annunciation is deactivated and the ***All alarms off*** message appears in the header bar when you press the ***Code*** button (see page 478).

NOTE

The ***All alarms off*** button works independently of the pre-configured ***Code*** setting. You can therefore activate or deactivate the ***All alarms off*** button even after pressing the ***Code*** key.

In addition to activating the pre-configured features, a timer with a red background appears in the header bar with the following two buttons:

– ***Stop*** for stopping the timer. The label of the button changes to ***Start***.

– ***Reset*** button for resetting the timer to zero.

The ***Code*** button does not function unless the M540 is docked.

NOTE

When the ***All alarms off*** setting is set to ***Off*** (see page 474), the message ***Audio alarms off*** and the  symbol appear in the Cockpit header bar when you invoke the Code function.

To activate the Code function

- Press the ***Code*** button on the main menu bar.

To deactivate the Code function

- Press the ***Code*** button on the main menu bar a second time. All functions are deactivated.

CAUTION

Always deactivate the ***Code*** function before powering off the Cockpit. If the ***Code*** function is active and the ***Audio off*** setting related to ***Code*** is set to ***On***, there will be no audio alarms at the ICS after the Cockpit is powered back on.

The Timer function

The Timer function appears similar to the ***Code*** function but serves as a stopwatch only. No other functions are tied to the ***Timer*** button.

When the Timer function is activated, a timer appears in the header bar with the following two buttons:

– ***Stop*** for stopping the timer. The label of the button changes to ***Start***.

– ***Reset*** button for resetting the timer to zero.

To activate the *Timer* function

- Press the ***Timer*** button on the main menu bar.
- Press the ***Start*** button to start the ***Timer***.

To deactivate the *Timer* function

- Press the ***Timer*** button on the main menu bar a second time. The timer box is removed.

NOTE

Pressing ***Code*** while the ***Timer*** is active replaces the ***Timer*** with ***Code***. However, the ***Timer*** cannot be activated while ***Code*** is active.

Alarm ranges and defaults

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
HR adult *Increment: 5 bpm*	***On***	Upper: 25 to 300 bpm Lower: 20 to 295 bpm	120 (adult) 150 (pediatric) 170 (neonate)	45 (adult) 50 (pediatric) 80 (neonate)	***Str/Rec*** (adult/ pediatric) ***Off*** (neonate)
STVM/STCVM *Increment: 0.1 mm or 0.01 mV*		Upper: 0.1 to 45.0 mm 0.01 to 4.50 mV Lower: 0.0 to 44.9 mm 0.00 to 4.49 mV	1.0 mm (0.1 mV)	0.0 mm (0 mV)	***Off***
ST *Increment: 0.1 mm or 0.01 mV*		Upper: –14.9 to +15.0 mm –1.49 to +1.50 mV Lower: –15.0 to +14.9 mm –1.50 to +1.49 mV	1.0 mm (0.1 mV)	–1.0 mm (–0.1 mV)	***Off***
RRi (adult) *Increment: 1*		Upper: 6 to 100 Lower: 5 to 99 (adult)	30	5	***Off***
RRi (pediatric, neonate) *Increment: 1*		Upper: 6 to 145 Lower: 5 to 144	80	20	***Off***
PLS* *Increment of 5*		Upper: 35 to 235 Lower: 30 to 230	120 (adult) 150 (pediatric) 180 (neonate)	45 (adult) 50 (pediatric) 80 (neonate)	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
SpO2 *Increment: 1*	***On***	Upper: 21 to 100% Lower: 20 to 99%	100% (adult, pediatric) 95% (neonate)	85%	***Off*** **NOTE:** Changing this setting automatically changes the Desat. archive setting to the same setting.
Desat. *Increment: 1*	 (Adult/ pediatric) ***On*** *(neonate)*	Lower: 19 to (SpO_2 lower limit - 1)% (within the maximum measurement range of 19 to 98%) If the SpO2 low alarm limit is lowered to or below the SpO2 desat alarm limit, then the SpO2 desat alarm automatically adjusts to 1% less than the SpO2 low alarm limit. The SpO2 desat alarm limit cannot be raised to or above the SpO2 low alarm limit	N/A	75%	***Off*** **NOTE:** Changing this setting automatically changes the SpO_2 archive setting to the same setting.
SpHb / SpHbv *Increment 0.2 g/dL (0.1 mmol/L)*		Upper: 1.2 to 25.0 g/dL (0.7 to 15.5 mmol/L) Lower: 1.0 to 24.8 g/dL (0.6 to 15.4 mmol/L)	17.0 g/dL (10.6 mmol/L)	7.0 g/dL (4.3 mmol/L)	***Off***
PVI *Increment: 1*		Upper: 1 to 100 Lower: 0 to 99	100	0	***Off***
SpCO *Increment: 1*		Upper: 1 to 99 Lower: 0 to 98	10	0	***Off***
SpMet *Increment: 0.1*		Upper: 0.1 to 99.9 Lower: 0.0 to 99.8	3.0	0	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
NIBP S adult *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 250 mmHg 1.5 to 33.3 kPa Lower: 10 to 249 mmHg 1.3 to 33.2 kPa	160 mmHg 21.3 kPa	90 mmHg 12.0 kPa	***Off***
NIBP S pediatric *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 170 mmHg 1.5 to 22.7 kPa Lower: 10 to 169 mmHg 1.3 to 22.6 kPa	120 mmHg 16 kPa	50 mmHg 6.7 kPa	***Off***
NIBP S neonate *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 130 mmHg 1.4 to 17.3 kPa Lower: 10 to 129 mmHg 1.3 to 17.2 kPa	80 mmHg 10.7 kPa	50 mmHg 6.7 kPa	***Off***
NIBP D adult *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 250 mmHg 1.4 to 33.3 kPa Lower: 10 to 249 mmHg 1.3 to 33.2 kPa	110 mmHg 14.7 kPa	50 mmHg 6.7 kPa	***Off***
NIBP D pediatric *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 170 mmHg 1.4 to 22.7 kPa Lower: 10 to 169 mmHg 1.3 to 22.6 kPa	80 mmHg 10.7 kPa	35 mmHg 4.7 kPa	***Off***
NIBP D neonate *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 130 mmHg 1.4 to 17.3 kPa Lower: 10 to 129 mmHg 1.3 to 17.2 kPa	60 mmHg 8 kPa	25 mmHg 3.3 kPa	***Off***
NIBP M adult *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 250 mmHg 1.4 to 33.3 kPa Lower: 10 to 249 mmHg 1.3 to 33.2 kPa	125 mmHg 16.7 kPa	60 mmHg 8.0 kPa	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
NIBP M pediatric *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 170 mmHg 1.4 to 22.7 kPa Lower: 10 to 169 mmHg 1.3 to 22.6 kPa	85 mmHg 11.3 kPa	40 mmHg 5.3 kPa	***Off***
NIBP M neonate *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: 11 to 130 mmHg 1.4 to 17.3 kPa Lower: 10 to 129 mmHg 1.3 to 17.2 kPa	70 mmHg 9.3 kPa	40 mmHg 5.3 kPa	***Off***
ΔTx *Increment: 0.1 °C or 0.1 ± 0.2 °F*		Upper: 0.1 to 39.0 °C 0.2 to 70.2 °F Lower: 0.0 to 38.9 °C 0.0 to 70.0 °F	2.0 °C 3.6 °F	0.0 °C 0.0 °F	***Off***
Txa/b *Increment: 0.1 °C or 0.1 °F*		Upper: 0.1 to 50.0 °C 32.2 to 122.0 °F Lower: 0.0 to 49.9 °C 32.0 to 121.8 °F	39.0 °C 102.2 °F	34.0 °C 93.2 °F	***Off***
IP S adult *Increment: 1 mmHg or 0.1 kPa*	 (GP1 S to GP8 S, LV S, RV S) ***On*** (systolic arterial pressure, PA S)	Upper: –49 to +400 mmHg –6.5 to +53.3 kPa Lower: –50 to +399 mmHg –6.6 to +53.2 kPa	– 160 mmHg (21.3 kPa) for ***GP1 S*** to ***GP8 S***, systolic arterial pressure, ***LV S*** – 35 mmHg (4.7 kPa) for ***PA S***, ***RV S***	– 90 mmHg (12.0 kPa) for ***GP1 S*** to ***GP8 S***, systolic arterial pressure – 75 mmHg (10.0 kPa) for ***LV S*** – 10 mmHg (1.3 kPa) for ***PA S***, ***RV S***	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
IP S pediatric/ neonate *Increment: 1 mmHg or 0.1 kPa*	 (GP1 S to GP8 S, LV S, RV S) ***On*** (systolic arterial pressure, PA S)	Upper: –49 to +400 mmHg –6.5 to +53.3 kPa Lower: –50 to +399 mmHg –6.6 to +53.2 kPa	– 120 mmHg (16.0 kPa) for ***GP1 S*** to ***GP8 S***, systolic arterial pressure, ***LV S*** – 35 mmHg (4.7 kPa) for ***PA S***, ***RV S***	– 75 mmHg (10.0 kPa) for ***GP1 S*** to ***GP8 S***, systolic arterial pressure – 50 mmHg (6.7 kPa) for ***LV S*** – 10 mmHg (1.3 kPa) for ***PA S***, ***RV S***	***Off***
IP D adult *Increment: 1 mmHg or 0.1 kPa*	 (GP1 D to GP8 D, LV D, RV D) ***On*** (diastolic arterial pressure, PA D)	Upper: –49 to +400 mmHg –6.5 to +53.3 kPa Lower: –50 to +399 mmHg –6.6 to +53.2 kPa	– 110 mmHg (14.7 kPa) for ***GP1 D*** to ***GP8 D***, diastolic arterial pressure – 25 mmHg (3.3 kPa) for ***LV D*** – 13 mmHg (1.7 kPa) for ***PA D***, ***RV D***	– 50 mmHg (6.7 kPa) for ***GP1 D*** to ***GP8 D***, diastolic arterial pressure – 2 mmHg (0.3 kPa) for ***PA D***, ***LV D***, ***RV D***	***Off***
IP D pediatric *Increment: 1 mmHg or 0.1 kPa*	 (GP1 D to GP8 D, LV D, RV D) ***On*** (diastolic arterial pressure, PA D)	Upper: –49 to +400 mmHg –6.5 to +53.3 kPa Lower: –50 to +399 mmHg –6.6 to +53.2 kPa	– 80 mmHg (10.7 kPa) for ***GP1 D*** to ***GP8 D***, diastolic arterial pressure – 25 mmHg (3.3 kPa) for ***LV D*** – 13 mmHg (1.7 kPa) for ***PA D***, ***RV***	– 35 mmHg (4.7 kPa) for ***GP1 D*** to ***GP8 D***, diastolic arterial pressure – 2 mmHg (0.3 kPa) for ***PA D***, ***LV D***, ***RV D***	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
IP D neonate *Increment: 1 mmHg or 0.1 kPa*	 (GP1 D to GP8 D, LV D, RV D) ***On*** (diastolic arterial pressure, PA D)	Upper: –49 to +400 mmHg –6.5 to +53.3 kPa Lower: –50 to +399 mmHg –6.6 to +53.2 kPa	– 80 mmHg (10.7 kPa) for GP1 D to ***GP8 D***, diastolic arterial pressure – 25 mmHg (3.3 kPa) for LV D – 13 mmHg (1.7 kPa) for PA D, RV D	– 30 mmHg (4.0 kPa) for ***GP1 D*** to ***GP8 D***, diastolic arterial pressure – 2 mmHg (0.3 kPa) for ***PA D***, ***LV D***, ***RV D***	***Off***
IP M adult *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: –49 to +400 mmHg –6.5 to +53.3 kPa Lower: –50 to +399 mmHg –6.6 to +53.2 kPa	– 125 mmHg (16.7 kPa) for ***GP1 M*** to ***GP8 M***, mean arterial pressure – 80 mmHg (10.7 kPa) for ***LV M*** – 20 mmHg (2.7 kPa) for ***LA***, ***ICP***, ***CVP, ABD, BDP, ESO, FEMV, UVP, GPM*** – 17 mmHg (2.3 kPa) for ***PA M***, ***RV M*** – 12 mmHg (1.6 kPa) for ***RA***	– 60 mmHg (8.0 kPa) for ***GP1 M*** to ***GP8 M***, mean arterial pressure – 40 mmHg (5.3 kPa) for ***LV M*** – 7 mmHg (0.9 kPa) for ***PA M***, ***RV M*** – 2 mmHg (0.3 kPa) for ***RA***, ***ICP, ABD, BDP, ESO, FEMV, UVP*** – 0 mmHg (0.0 kPa) for ***LA***, ***CVP, GPM***	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
IP M pediatric *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: –49 to +400 mmHg –6.5 to +53.3 kPa Lower: –50 to +399 mmHg –6.6 to +53.2 kPa	– 85 mmHg (11.3 kPa) for ***GP1 M*** to ***GP8 M***, mean arterial pressure, ***LV M*** – 20 mmHg (2.7 kPa) for ***LA***, ***ICP***, ***CVP, ABD, BDP, ESO, FEMV, UVP, GPM*** – 17 mmHg (2.3 kPa) for ***PA***, ***RV M*** – 12 mmHg (1.6 kPa) for ***RA***	– 50 mmHg (6.7 kPa) for ***GP1 M*** to ***GP8 M***, mean arterial pressure – 40 mmHg (5.3 kPa) for ***LV M*** – 7 mmHg (0.9 kPa) for ***PA***, ***RV M*** – 2 mmHg (0.3 kPa) for ***RA***, ***ICP, ABD, BDP, ESO, FEMV, UVP*** – 0 mmHg (0.0 kPa) for ***LA, CVP, GPM***	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
IP M neonate *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: –49 to +400 mmHg –6.5 to +53.3 kPa Lower: –50 to +399 mmHg –6.6 to +53.2 kPa	– 80 mmHg (10.7 kPa) for ***GP1 M*** to ***GP8 M***, mean arterial pressure, ***LV M*** – 20 mmHg (2.7 kPa) for ***LA***, ***ICP***, ***CVP, ABD, BDP, ESO, FEMV, UVP, GPM*** – 17 mmHg (2.3 kPa) for ***PA***, ***RV M*** – 12 mmHg (1.6 kPa) for ***RA***	– 40 mmHg (5.3 kPa) for ***GP1 M*** to ***GP8 M***, mean arterial pressure, ***LV M*** – 7 mmHg (0.9 kPa) for ***PA***, ***RV M*** – 2 mmHg (0.3 kPa) for ***RA***, ***ICP, ABD, BDP, ESO, FEMV, UVP*** – 0 mmHg (0.0 kPa) for ***LA***, ***CVP, GPM***	***Off***
CPP, BPP, APP *Increment: 1 mmHg or 0.1 kPa*	***On***	Upper: –24 to +300 mmHg –3.2 to +40.0 kPa Lower: –25 to +299 mmHg –3.3 to +39.9 kPa	100 mmHg (13.3 kPa)	70 mmHg (9.3 kPa)	***Off***
Tblood *Increment of 0.1* °C *or 0.1 °F*		Upper: 25.1 to 43.0 °C 77.1 to 109.4 °F Lower: 25.0 to 42.9 °C 77.0 to 109.2 °F	39.0 °C (102.2 °F)	34.0 °C (93.2 °F)	***Off***
FiO2 *Increment of 1%*	***On***	Upper: 19 to 100% Lower: 18 to 99%	100%	20%	***Store***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
etO_2 *Increment of 1%*		Upper: 11 to 100% Lower: 10 to 99%	100%	10%	***Off***
inN_2O	***On*** (fixed)	Fixed at 82%	82%	Not applicable	***Store*** (fixed)
RRc *Increment of 1*/min	 (Adult/ pediatric) ***On*** *(neonate)*	Upper: 6 to 150 /min (when no CO_2 device is connected) 6 to 100 /min (when Scio is connected) Lower: 5 to 149 /min (when no CO_2 device is connected) 5 to 99 /min (when Scio is connected) **NOTE** Scio is not available in neonate mode.	30 /min (adult) 60 /min (pediatric/ neonate)	5 /min (adult) 20 /min (pediatric/ neonate)	***Off***
$inCO_2$ *Increment of 1 mmHg, 0.1 kPa, or 0.1%*	***On***	Upper: 2 to 10 mmHg 0.3 to 1.3 kPa 0.3 to 1.3% Lower: not user-selectable	4 mmHg (0.5 kPa, 0.5%)	Not applicable	***Off***
$etCO_2$ *Increment of 1 mmHg, 0.1 kPa, or 0.1%*	***On***	Upper: 6 to 99 mmHg 0.8 to 13.3 kPa 0.8 to 13.3% Lower: 5 to 99 mmHg 0.7 to 13.2 kPa 0.7 to 13.2%	50 mmHg (6.7 kPa, 6.6%)	30 mmHg (4.0 kPa, 3.9%)	***Off***
PVC/min *Increment of 1*	***On***	Upper: 1 to 50	10	Not applicable	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
inHal *Increment of 0.1 kPa or 0.1%*	***On***	Upper: 0.1 to 8.5 kPa 0.1 to 8.5% Lower: 0.0 to 8.4 kPa 0.0 to 8.4%	1.6 kPa, 1.6% (adult) 1.9 kPa, 1.9% (pediatric)	0.0 kPa, 0.0%	***Store***
etHal *Increment of 0.1 kPa or 0.1%*		Upper: 0.1 to 8.5 kPa 0.1 to 8.5% Lower: 0.0 to 8.4 kPa 0.0 to 8.4%	8.5 kPa, 8.5%	0.0 kPa, 0.0%	***Off***
inIso *Increment of 0.1 kPa or 0.1%*	***On***	Upper: 0.1 to 8.5 kPa 0.1 to 8.5% Lower: 0.0 to 8.4 kPa 0.0 to 8.4%	2.4 kPa, 2.4% (adult) 2.8 kPa, 2.8% (pediatric)	0.0 kPa, 0.0%	***Store***
etIso *Increment of 0.1 kPa or 0.1%*		Upper: 0.1 to 8.5 kPa 0.1 to 8.5% Lower: 0.0 to 8.4 kPa 0.0 to 8.4%	8.5 kPa, 8.5%	0.0 kPa, 0.0%	***Off***
inEnf *Increment of 0.1 kPa or 0.1%*	***On***	Upper: 0.1 to 10.0 kPa 0.1 to 10.0% Lower: 0.0 to 9.9 kPa 0.0 to 9.9%	3.6 kPa, 3.6% (adult) 4.1 kPa, 4.1% (pediatric)	0.0 kPa, 0.0%	***Store***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
etEnf *Increment of 0.1 kPa or 0.1%*		Upper: 0.1 to 10.0 kPa 0.1 to 10.0% Lower: 0.0 to 9.9 kPa 0.0 to 9.9%	10 kPa, 10%	0.0 kPa, 0.0%	***Off***
inSev *Increment of 0.1 kPa or 0.1%*	***On***	Upper: 0.1 to 10.0 kPa 0.1 to 10.0% Lower: 0.0 to 9.9 kPa 0.0 to 9.9%	4.4 kPa, 4.4% (adult) 5.1 kPa, 5.1% (pediatric)	0.0 kPa, 0.0%	***Store***
etSev *Increment of 0.1 kPa or 0.1%*		Upper: 0.1 to 10.0 kPa 0.1 to 10.0% Lower: 0.0 to 9.9 kPa 0.0 to 9.9%	10 kPa, 10%	0.0 kPa, 0.0%	***Off***
inDes *Increment of 0.1 kPa or 0.1%*	***On***	Upper: 0.1 to 20.0 kPa 0.1 to 20.0% Lower: 0.0 to 19.9 kPa 0.0 to 19.9%	12.5 kPa, 12.5% (adult) 14.5 kPa, 14.5% (pediatric)	0.0 kPa, 0.0%	***Store***
etDes *Increment of 0.1 kPa or 0.1%*		Upper: 0.1 to 20.0 kPa 0.1 to 20.0% Lower: 0.0 to 19.9 kPa 0.0 to 19.9%	20 kPa, 20%	0.0 kPa, 0.0%	***Off***

Parameter	Alarm default status	Alarm limit range	Upper limit defaults	Lower limit defaults	Archive default setting
xMAC high	***On***	The user can not configure the xMAC limits.	Not applicable	Not applicable	***Store***

Arrhythmia ranges and defaults

Parameter	Alarm priority default	Rate (default)	Count (default)	Alarm archive factory default
ASY	High	Not adjustable	Not adjustable	***Str/Rec***
VF	High	Not adjustable	Not adjustable	***Str/Rec***
VTACH	High	≥100 to 200 (≥120) Increments of 10	≥5 to 15 (≥10) Increments of 1	***Str/Rec***
ARTF	Off	Not adjustable	Not adjustable	***Off***
RUN	Medium	not adjustable (Rate = VTACH)	3 to VT count – 1 (3 to 9) changes based on VTACH	***Str/Rec***
AIVR	Medium	Not adjustable = VTACH rate – 1 (≤119)	Not adjustable (≥3)	***Off***
SVT	Medium	≥120 to 200 (≥150) Increments of 10	≥3 to 10 (≥3) Increments of 1	***Str/Rec***
CPT	Low	Not adjustable	Not adjustable	***Str/Rec***
BGM	Low	Not adjustable	Not adjustable	***Str/Rec***
TACH	Off	≥100 to 200 (≥130) Increments of 10	≥5 to 15 (≥8) Increments of 1	***Off***
BRADY	Off	≤30 to 105 (adult ≤ 50; pediatric ≤60) Increment of 5	Not adjustable (≥8)	***Off***
Pause	Off	1 to 3.5 (2.5) Increments of 0.5	Not adjustable	***Off***

This page has been left blank intentionally.

Trends/data dialogs

Overview

The ***Trends/Data*** dialog provides numerous trend, data review, and report pages.

To access *Trends/Data* dialog

1 Select the ***Trends/ Data...*** button on the main menu bar.

2 Select one of the following tabs to access the desired page:

- ***Trends*** – accesses the graphical and tabular trends and associated functions.
- ***ECG*** – displays all connected ECG leads (see page 228) and ST complexes (see page 242).
- ***Ventilator*** – displays respiratory/ventilation loops (see page 451). When a Perseus A500 is connected, the name of this tab changes to ***Anesthesia/ Ventilation*** to display anesthesia/ventilation parameters.
- ***Hemo*** – accesses the hemodynamic calculations and results data (see page 187).
- ***Labs*** – accesses the laboratory results (see page 187).
- ***Reports*** – accesses the tabs for configuring and requesting reports (see "Printing reports" on page 512).

Trending behavior

The Cockpit stores up to 96 hours of continuous and discrete trend values. Trend data are sampled every 30 seconds at the Cockpit where the trend display is updated automatically. Trend updates at the Cockpit are reflected on connected network devices every 60 seconds.

Trend data can be viewed in graphical or tabular format. Additional customization of the trend display includes:

- selecting which parameters are displayed
- selecting the time period of the trended parameters.

The Cockpit maintains one trend database per patient. If the user docks an M540 that was previously docked on another Cockpit, the trend data from the previous Cockpit are transferred over the network to the new Cockpit, provided a patient ID was entered.

If the user undocks an M540, trending is suspended on the Cockpit but the trend data remain intact. When he user redocks the M540, any new trend data collected during patient transport are transferred to the Cockpit. Transferring the trend data may take a brief moment during which time trends are not accessible.

NOTE

After docking/undocking the M540, one minute of trend data collected during this transition period may not be displayed at the ICS equipped with software version VG1. However, these trends are visible at the Cockpit.

Refer to the instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 trend functions.

Supported parameters

A trended parameter can either be represented in tabular or graphical form. The following sections explain how the different parameter groups are plotted on the graphical trends.

Continuous parameters

The following parameters are continuously trended and appear as a single, continuous line, or as a band on the graphical trends (see page 35 for definitions of abbreviations):

– ECG parameters: HR, %PACED, ST, PVC/min

– Ventilation parameters: RRi

– Anesthesia parameters: FiO_2, etO2, inN2O, etN2O inSev, N_2O, inHal, etHal, inIso, etIso, inEnf, etEnf, inSev, etSev, inDes, etDes, xMAC

– IP parameters: for a complete list of invasive pressure parameters, see page 312

– CO2 parameters: $etCO_2$, inCO2, RRc

– C.O. parameter: Tblood

– Temperature parameters: Ta, Tb, ∆T, T1a, T1b, and ∆T1

– Continuous cardiac output parameters using the device connectivity option: SvO2, Tblood, CCO, CCI, VO2, DO2, SaO2, SVR, SVRI, EDV, EDVI, ESV, ESVI, EF, SV, SVI, SVV

– Medibus X-compatible devices: Dräger Evita V500, Dräger Babylog VN500, Savina 300, Carina, Dräger Evita V300, Oxylog 3000+, Infinity Perseus A500, Zeus IE, Primus family, Apollo: for a list of trended parameters, see page 416.

– Medibus-compatible devices: Dräger Evita 2D, Dräger Evita 4, Dräger Evita XL, for a list of trended parameters, see page 448.

– Maquet SERVO-i: for a list of trended parameters, see page 436.

– BIS VISTA – BIS, EMG, SQI, BSR, PWR, SEF, BCT

– NMT – T NMT

– Pulse oximetry parameters with Masimo SET: SpO2, PLS*, PI

– Pulse oximetry parameters with Masimo rainbow SET: SpO2, PLS*, PI, SpHb, SpHbv, SpOC, PVI, SpCO, SpMet

– Pulse oximetry parameters with Nellcor OxiMax MCable: SpO2, PLS*

NOTE

The color of the SpO2 graphical trend changes based on how the current value compares to the upper trend scale and the lower alarm limit. The color changes from green to yellow to orange to red as the SpO2 trend value progresses further below the upper trend scale. The color changes to red when the SpO2 trend value goes below the lower alarm limit.

Discrete parameters

The following discrete parameters are plotted uniquely in graphical trends:

– NIBP consists of a line with three dots representing the diastolic, mean, and systolic values

– PWP and C.O. appear as a'+' symbol

– Laboratory data are represented as a'+' symbol and include time stamps

– NMT parameters: Single, PTC, TOF Ratio or TOF Cnt

Special characters and symbols

In addition to parameters, certain conditions, such as disconnected leads, artifact, and so on, are also identified on graphical and tabular trends.

Event	Character/symbol
Asystole	ASY
Ventricular fibrillation	VF
Apnea	Apnea
No parameter values are available	* * *
Out of range value	+++ (high) - - - (low)
Relearning	LEARN
Interruption in power or monitor is placed into standby	No values

Graphical trends

A graphical trend plots the behavior of parameters over time. Graphical trends are continuously updated, with the most recent data appearing on the right side of the screen. The ***Trends/Data*** dialog consists of the following graphical trend pages:

– ***Graph*** page

– ***Graph vitals*** page

– ***Ventilation / Anesthesia*** page

All graphical trend pages look almost identical. In the ***Graph*** and the ***Ventilation / Anesthesia*** pages you can change the parameter content.

However, the ***Graph vitals*** is a pre-configured display consisting of the following set of commonly trended parameters which are displayed in four graphical windows:

Window 1 (top)	HR, SpO2, and RRi
Window 2	NIBP
Window 3	Ta, Tb
Window 4	CO2

To access the graphical trend pages

1 Select the ***Trends/ Data...*** button on the main menu bar.

2 Select the ***Trends*** tab (if not already selected).

3 Select one of the following graphical trend pages:

– ***Graph*** tab to view general trends

– ***Graph vitals*** tab to view a set of pre-configured parameters

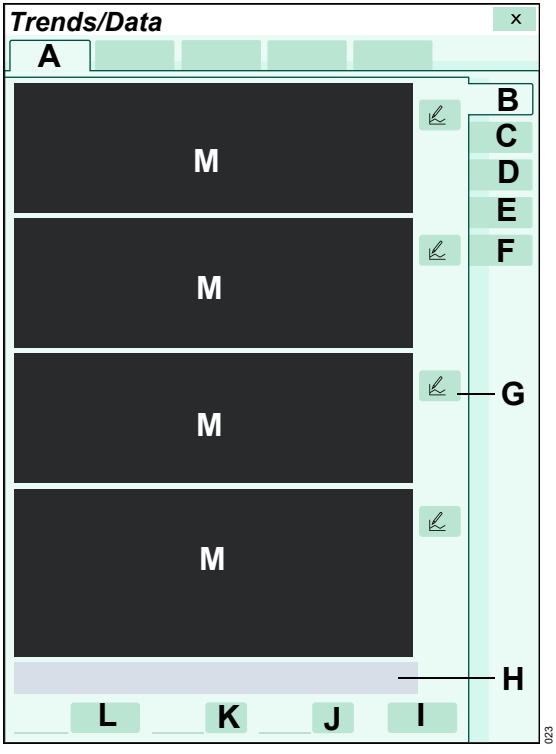
– ***Ventilation / Anesthesia*** tab to view ventilation/anesthesia-related parameters

– ***BIS*** tab to view BIS trends

The layout of the graphical trends pages

The graphical trends pages share a common layout. They contain up to four separate trend windows. Each trend window can accommodate the graphical trends of up to five selectable parameters. For each parameter, the trend panel also displays trend scales, units of measure, and the parameter label.

The following diagram shows the layout of the graphical trends pages.



A ***Trends*** tab

B ***Graph*** tab – accesses graphical trends

C ***Table*** tab – accesses the tabular trends

D ***Graph vitals*** tab – accesses the graphical trends of a set of pre-configured trend parameters.

E ***Ventilation / Anesthesia*** tab – accesses the graphical trends of a set of pre-configured trend parameters for critical care or anesthesia ventilation.

F ***BIS*** tab – accesses the graphical trends for the BIS VISTA device.

G Trend setup symbol for selecting up to five parameters

H Scroll keys

I ***Print*** button

J ***Grids*** on/off button

K ***Graphs*** button

L ***View*** button for selecting how much time is displayed

M Graphical trend panels

Directly below the trend windows is a time scale that correlates to the selected interval.

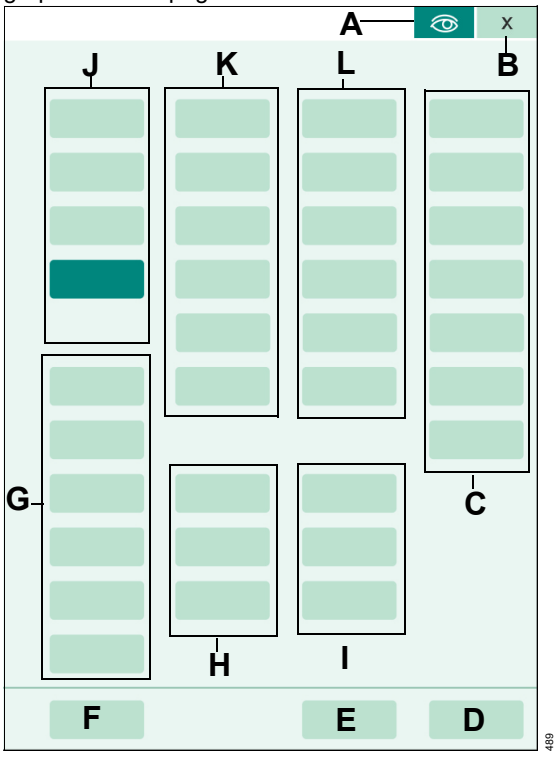
Interacting with the graphical trends pages

You can interact with the graphical trends pages by manipulating several display functions.

Configuring the parameter content of the graphical trends

Except for the ***Graph vitals*** page whose parameter assignments are fixed, you can customize the parameter content for the ***Graph*** and the ***Ventilation / Anesthesia*** graphical trend pages.

The following diagram depicts the setup window for customizing the parameter content of each graphical trend page.



A Display filter button

B Button that closes the setup window

C Group of parameter buttons entitled ***Medibus.X*** for selecting parameters originating from Medibus X devices using the device connectivity option (for a list of supported Medibus X devices, see page 415).

D ***OK*** button

E ***Cancel*** button

F ***Clear all*** button – deselects any buttons that are currently selected

G Group of parameter buttons entitled ***Other*** for selecting miscellaneous parameters such as SpO2, temperature, and so on.

H Group of parameter buttons entitled ***CO2*** for selecting CO_2-related parameters.

I Group of parameter buttons entitled ***More devices*** for selecting parameters such as NMT, BIS, and CCO. These parameters originate from external devices using the device connectivity option.

J Group of parameter buttons entitled ***ECG*** for selecting ECG-related parameters.

K Group of parameter buttons entitled ***Pressures*** for selecting pressure-related parameters.

L Group of parameter buttons entitled ***Vent devices*** for selecting ventilation parameters originating from Medibus devices using the device connectivity option.

To modify the parameter selection for a graphical trend page

In the following steps, the letters in parentheses refer to the diagram of the trend setup page (see page 176).

1 Access the ***Graph*** or the ***Ventilation / Anesthesia*** tab (see page 172).

2 Select the trend setup symbol next to a graphical trend panel in the selected trend page to activate the ***Setup*** dialog.

3 Use the display filter button (A) to toggle between the filtered or unfiltered display. When the button is on a light green background only the buttons of the connected parameters are displayed. When the symbol appears on a dark green background the buttons of all parameters, whether monitored or not, are displayed.

4 Select the parameters to display in the selected trend window. Up to five parameters can be selected for each trend panel.

NOTE
Buttons with ellipses such as ***More ventilation...*** or ***More gases...*** access additional parameters.

5 Select the ***OK*** button (D) to confirm the selection and reconfigure the trend page. Select the ***Cancel*** button (E) to exit the screen without accepting the changes.

6 Repeat steps 2 to 5 to configure the parameter setup for other graphical trend panels.

Navigating through the graphical trends

The trend database for a patient may contain more data than can be displayed on a single graphical trend page.

One way to navigate through the entire trend data is by using the scroll bar. It is located at the bottom of the graphical trends pages. The scroll bar consists of single and double arrows and a moveable navigation bar. The double arrows scroll through larger portions than the single arrows. If more trend data are stored than are currently displayed, the navigation bar located between the arrows can also be dragged to the desired location. During navigation through the trend data, the time line above the scroll bar changes to display the time and date corresponding to the displayed graphs.

Using the cursor

The cursor is a vertical line that pinpoints a specific time for all parameters. It extends through all graphical trends. Whenever the cursor is displayed, popups appear next to each trend window. They display the parameter labels, units of measure and the parameter values that correspond to the position of the cursor. The top popup displays the exact time and date the cursor pinpoints on the graphs.

To display the cursor

1 Access the desired graphical trend page (see page 174).

2 Touch a point on the page to display the cursor.

3 Use the rotary knob to move the cursor to a specific point on the trend data.

To hide the cursor

The cursor and the associated popups disappear automatically after a brief time of no user interaction. To hide the cursor immediately:

- Press the rotary knob.

Changing trend scales

The trend scales appear to the left of each trended parameter. The scales can be changed at any time provided the trend cursor is not displayed. Hide the cursor by pressing the rotary knob before changing the trend scales.

To change the trend scales

1 Access the desired graphical trend page (see page 174).

2 Touch the trend scale value to be changed. A trend scale window appears.

3 Select the buttons in the popup to adjust the upper and/or lower trend scale.

4 Use the rotary knob to dial to the desired setting.

5 Press the rotary knob to confirm the selection.

General graphical trend display features

The following sections list the various ways available for customizing the content of the graphical trends pages. Refer to the diagram depicting the graphical trend (see page 175) for the locations of the buttons used to perform the setup functions.

To access the general display features

1 Access the desired graphical trend page (see page 174).

2 Select the ***Grids*** on/off button (I) to display or hide the background grid.

3 Select the ***Graphs*** button (J) and use the rotary knob to select how many trend windows are displayed. One to four trend windows can be selected.

4 Use the ***View*** button (K) to select how much time is displayed on the ***Graph*** page. The available settings are: 1 h, 2 h, 4 h, 8 h, 12 h, 1 day, 2 day, 4 day.

Printing a graphical trend report

The content of a graphical trend report depends on the user setup (see page 176). The duration of a graphical trend report depends on the reports setup (see page 484).

To print a graphical trend report

1 Access the desired graphical trend pages (see page 174).

2 Scroll to the desired trend data.

3 Select the ***Print*** button (G) – see page 179.

NOTE

If configured to appear on the main menu bar, a ***Trend graph report*** button is also accessible on the main menu bar. For more information, see page 465.

For details on requesting a graphical trend report from other pages, see page 512.

NOTE

Alternatively, select the ***Print screen*** button on the main menu bar to request a printout of the current trends display. The screenshot prints on the connected laser printer.

Analysis tool page

The ***Analysis tool*** page is a comprehensive trend page for visualizing information necessary to perform a recruitment maneuver. The page shows the effects on lung mechanics and hemodynamic parameters on a single, integrated display. The ***Analysis tool*** page displays a duration of data configured by the user on three graphical trend panels simultaneously. The page is divided into three separate graphical trend panels with the following initial default setup which is configurable:

– The top graphical trend panel displays PIP, PEEP, ART M

– The middle graphical trend panel displays VT, Cdyn

– The bottom graphical trend panel displays SpO2, $etCO_2$

Each graphical trend panel displays up to three parameters and associated values. Use the cursor buttons to reference separate data points on the graphs. The corresponding values are displayed next to the graphs. The current values for the selected trend parameters are always displayed across the top of the screen.

To access the *Analysis tool* page

1 Select the ***Procedures...*** button from the main menu bar.

2 Select the ***Analysis tool*** tab.

The layout of the Analysis tool page

The following diagram depicts the ***Analysis tool*** page.

A ***Analysis tool*** tab

B Button that closes the page

C Trend setup symbols for selecting up to three parameters per panel

D ***Print*** button

E ***Freeze*** button for freezing the trend display

F ***Duration*** button for setting duration interval for the trend display

G ***Cursor*** button for marking the end point

H ***Cursor*** button for marking the initial point

I Graphical trend parameter fields

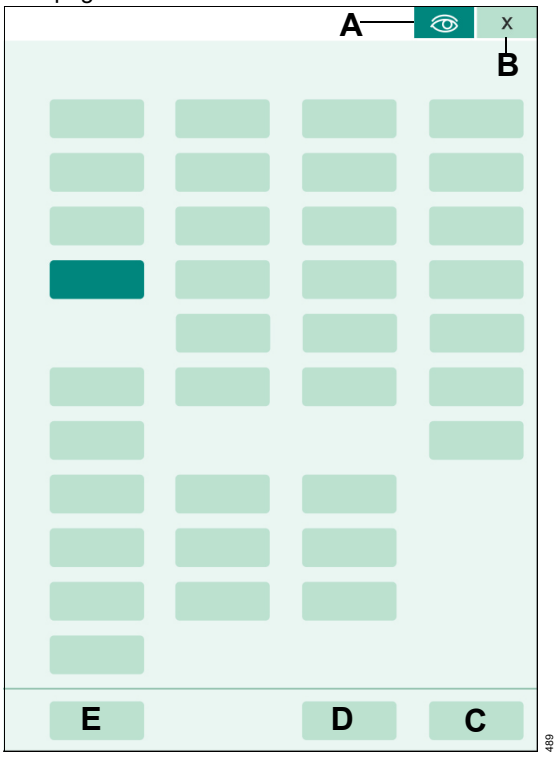
J Current parameter values originating from the device (parameter value, parameter label)

Interacting with the Analysis tool page

Configuring the parameter content

Although the ***Analysis tool*** page comes with an initial default parameter setup, the page can be customized for the current monitoring session.

The following diagram depicts the setup window for customizing the parameter content of the ***Analysis tool*** page.



To configure the parameter content

1. Select the ***Procedures...*** button from the main menu bar.
2. Select the ***Analysis tool*** tab.
3. Select the trend setup symbol next to a graphical trend panel.
4. Use the display filter button (A) to toggle between the filtered or unfiltered display. When the button is on a light green background only the buttons of the connected parameters are displayed. When the symbol appears on a dark green background the buttons of all parameters, whether monitored or not, are displayed.
5. Select the parameters to display in the selected trend window. Up to three parameters can be selected for each trend panel.

NOTE

Buttons with ellipses such as ***More ventilation...*** or ***More gases...*** access additional parameters.

6. Select the ***OK*** button (C) to confirm the selection. Select the ***Cancel*** button (D) to exit the screen without accepting the changes.
7. Select the ***Clear all*** button (E) to deselect any buttons that are currently selected.
8. Repeat steps 3 to 6 to configure the parameter setup for other graphical trend panels.

Using the cursors

The ***Analysis tool*** page has two cursors for marking a portion of the graphical trends for closer analysis. The letters in parentheses refer to the diagram on page 179. Whenever the cursors are used, the screen freezes.

To set the cursors

1 Select the ***Procedures...*** button from the main menu bar.

2 Select the ***Analysis tool*** tab.

3 Select the left cursor button (H).

4 Use the rotary knob to move the orange cursor to the desired place on the graphical trends to mark the initial point.

5 Press the rotary knob to set the initial point.

6 Select the right cursor button (G).

7 Use the rotary knob to move the orange cursor to the desired place on the graphical trends to mark the end point.

8 Press the rotary knob to set the end point.

The trend parameter fields to the right of the graphical trends show the following information for each parameter corresponding to the cursor positions:

– ∆value – time elapsed between the two cursors

– Initial value

– End value

In addition to values, symbols appear next to the values to indicate how the parameters inside the cursors have trended:

– An equal (=) sign means that the values have remained the same.

– An arrow pointing up indicates that the values are trending higher than the first cursor position.

– An arrow pointing down indicates that the values are trending lower than the first cursor position.

NOTE

These symbols also appear in the current parameter values row of the ***Analysis tool*** page.

Freezing the display

Freeze the display to temporarily stop the ***Analysis tool*** page from updating.

To freeze the display

1 Select the ***Procedures...*** button from the main menu bar.

2 Select the ***Analysis tool*** tab.

3 Select the ***Freeze*** button (E).

To unfreeze the display

- Select the ***Freeze*** button (E) again.

The screen is updated with the most current data.

Selecting an interval

The interval that applies to the three graphical trends can be set.

To set the interval

1 Select the ***Duration*** button (F).

2 Choose one of the following durations: ***Off***, ***1 min***, ***5 min***, ***10 min*** (default), ***15 min***, ***20 min***, ***30 min***, ***45 min***, ***1 h***, ***90*** *min*, ***2 h***, **4** ***h.***

3 Select the ***OK*** button (C) to confirm the selection. Select the ***Cancel*** button (D) to exit the screen without accepting the changes.

Printing an Analysis tool graphical trend report

A graphical trend report for recruitment contains the initial and end cursor values and the ∆value for each parameter. graphical trend report for recruitment can be printed only after you set the cursors. Otherwise the ***Print*** button remains grayed out and cannot be selected.

To print a recruitment graphical trend report

1 Select the ***Procedures...*** button from the main menu bar.

2 Select the ***Analysis tool*** tab.

3 Set both cursor buttons (see page 181).

4 Select the ***Print*** button.

Tabular trend

The tabular trend displays trend data in data columns. Trend data are updated according to the selected time scale. For example, if the current time scale is 15 minutes, the trend display is updated every 15 minutes. A time stamp above each column marks the interval during which the data in that column was collected. The displayed value is the last acquired value during that interval. The column on the right side is reserved for the most recent data. Certain parameters and special conditions, such as artifact, are represented in unique ways (see page 172).

To access the tabular trend

1 Select the ***Trends/ Data...*** button on the main menu bar.

2 Select the ***Trends*** tab (if not already selected).

3 Select the ***Table*** tab (if not already selected).

The layout of the tabular trend

The following diagram shows the tabular trend page. Configuring the tabular trend page also determines how the information appears on the tabular trend report.

A ***Trends*** tab

B Parameter label column

C Parameter columns

D Latest trend data

E ***Graph*** tab (see page 179)

F ***Table*** tab

G ***Graph vitals*** tab (see page 179)

H ***Anesthesia workstation*** tab accesses the tabular trends of a set of pre-configured trend parameters for critical care or anesthesia ventilation.

I ***BIS*** tab for accessing the tabular BIS trends

J Scroll keys and scroll bar

K ***Print*** button

L ***Setup*** button for selecting which parameters are displayed and in what priority

M ***View*** button for selecting how much time is displayed

Interacting with the tabular trend

Interaction with the trend screen involves manipulating several display functions.

Tabular trends in split screen mode

To display the tabular trends on the main screen, activate the split screen mode for tabular trends in the ***Auto view*** page.

When this split screen mode is activated, a tabular trend panel occupies the left side of the monitoring area. The same setup and viewing functions as for the regular tabular trends can be performed.

To activate split screen mode

1 Select the ***System setup...*** button from the main menu bar.

2 Select the ***Auto view*** tab.

3 Select the button next to the ***Split screen*** menu selection.

4 Dial to the ***Trend table*** selection using the rotary knob.

The layout of the monitoring area changes and displays the tabular trend panel.

Navigating through the tabular trend

The trend data base for a patient may contain more data than can be displayed on the tabular trend. Use the scroll bars to navigate through the entire trend data. They are located at the bottom and along the right side of the tabular trend.

The scroll bars consists of single and double arrows and a movable navigation bar. The double arrows scroll through larger portions than the single arrows. If more trend data are stored than is currently displayed, use the rotary knob or drag the navigation bar located between the arrow keys to the desired location.

Configuring the tabular trend

The following sections list the various methods for customizing the content of the tabular trend. Refer to the diagram depicting the ***Table*** (see page 185) for the locations of the buttons used to perform the setup functions.

To change the intervals

1 Access the ***Trends > Table*** page (see page 185).

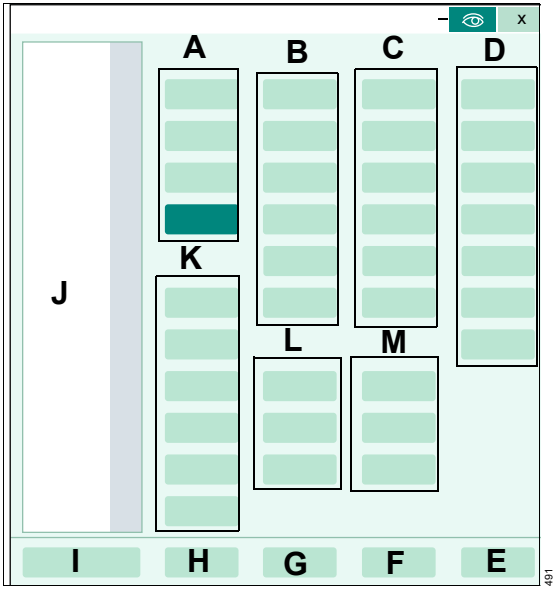
2 Use the ***View*** button (L) to change the intervals of the trend columns. The available settings are: 1 min, 5 min, 10 min, 15 min (default), 30 min, 1 h.

NOTE

In the trend table, the time interval automatically changes to one minute when a user selects a discrete parameter in a tabular trend column.

Configuring the parameter content of the tabular trend

The following diagram depicts the setup page for modifying the parameter content of the tabular trend.



A Group of parameter buttons entitled ***ECG*** for selecting ECG-related parameters

B Group of parameter buttons entitled ***Pressure*** for selecting pressure-related parameters

C Group of parameter buttons entitled ***Vent devices*** for selecting ventilation parameters

D Group of parameter buttons entitled ***Medibus.X*** for selecting MEDIBUS.X parameters available using the device connectivity option

E ***OK*** button

F ***Cancel*** button

G ***Clear all*** button – deselects any buttons that are currently selected

H ***Select all*** button – selects all buttons at once

I ***Auto-sort*** button

J Window for sorting the parameters automatically

K Group of parameter buttons entitled ***Other*** for selecting miscellaneous parameters such as SpO2, temperature, and so on

L Group of parameter buttons entitled ***CO2*** for selecting for selecting CO_2-related parameters

M Group of parameter buttons entitled ***More devices*** for selecting additional parameters

To modify the parameter selection for a tabular trend

1 Access the ***Trends*** > ***Table*** page (see page 185).

2 Select the trend setup symbol at the bottom of the tabular trend.

3 Use the display filter button (A) to toggle between the filtered or unfiltered display. When the button is on a light green background only the buttons of the connected parameters are displayed. When the symbol appears on a dark green background, the buttons of all parameters, whether monitored or not, are displayed.

4 Select the ***Auto-sort*** button to sort the parameter list according to the parameter priority list in the ***Auto view*** setup page (see page 73).

or

Select the parameters to display in the tabular trend.

NOTE

Buttons with ellipses such as ***More ventilation...*** or ***More gases...*** access additional parameters.

5 Select the ***OK*** button (D) to confirm the selection and reconfigure the tabular trend. Select the ***Cancel*** button (E) to exit the screen without accepting the changes.

Printing a tabular trend report

The content of a tabular trend report depends on the system setup (see page 481).

To print a tabular trend report

1 Access the ***Trends > Table*** page (see page 174).

2 Scroll to the desired trend data.

3 Select the ***Print*** button (J).

NOTE

If configured to appear on the main menu bar, a ***Trend table report*** button is also accessible on the main menu bar. For more information, see page 465.

For details on requesting a tabular trend report from other pages, see page 512.

NOTE

Alternatively, select the ***Print screen*** button on the main menu bar to request a printout of the current trends display. The print screen prints on the connected laser printer.

Mini-trends

When the mini-trend display is activated (see page 459), a panel appears to the left of the monitoring area of the main screen. The colors of the mini-trend correspond to the selected parameter color. The mini-trend display is updated every five seconds.

NOTE

Although CCO, CCI, and Tblood are trended, there are no CCO parameters included in the mini-trend display.

If split screen mode is activated (see page 460), the mini display is not affected and shifts to the right along with the real-time parameter display.

Configuring the mini-trend display

Use the ***System setup*** dialog to activate or deactivate the mini-trend display, select the mini-trend display duration, or select how the NIBP parameter appears in the mini-trends.

NOTE

If the mini-trends are displayed, change the mini-trend scale and the duration by touching the displayed values. A popup appears allowing these settings to be changed directly.

To configure the mini-trend display

1 Select the ***System setup...*** button on the main menu bar to activate the ***System setup*** dialog.

2 Select the ***Auto view*** tab along the right side of the ***System setup*** dialog.

3 Select the button next to ***Mini trends***.

4 Select one of the following settings: ***Off*** (deactivates the mini-trend display), 10 min, 15 min, 20 min, 30 min (default), 45 min, 1 h, 90 min, 2 h, 4 h.

5 Select the button next to ***NIBP trend***.

6 Use the rotary knob to select either ***Graphic*** or ***Numeric***. The selected setting determines how the parameter is represented on the mini-trend display.

Data review pages

In addition to trend data, the ***Trends/Data*** dialog also provides several data review pages which are outlined in the following table. Some of these review pages are also available under different tabs.

NOTE

The horizontal tab ***Ventilator*** changes to ***Anesthesia/ Ventilation*** when a anesthesia machine is connected.

To access the data reviews

1 Select the ***Trends/ Data...*** button on the main menu bar.

2 Select one of the following tabs to access the desired data:

Trends, ***ECG***, ***Ventilator*** or ***Anesthesia/ Ventilation***, ***Hemo***, ***Labs, Reports***

Data review page	Description	Available functions
Show all page under the ***ECG*** tab	This page shows the waveforms of all connected leads along with the scale and the waveform label.	– ***Print*** button for requesting a Rest ECG report – ***Print*** button for requesting an ECG report
ST complex page under the ***ECG*** tab	This page shows the ST complexes. The number of displayed ST complexes depends on the connected lead set.	– ***Print*** button for generating an ST report – ***ST*** button – ***Reference*** on/off button for displaying reference complexes – ***ISO*** button – ***Relearn*** button

Data review page	Description	Available functions
Ventilator or ***Anesthesia/ Ventilation*** > ***Show all*** page	– When an anesthesia machine is connected, the tab name is labeled ***Anesthesia/ Ventilation***. The page displays current measurement values for ventilation and anesthesia parameters and the current consumption. – When a V500 ventilator is connected, the tab name is labeled ***Ventilator***. The page displays current ventilation values and tabs for PV/FV loops.	Data review page displaying respiration, anesthesia or ventilation parameter information.
Hemo > ***Show all*** page	Displays the currently monitored hemodynamic parameters; includes parameters available using the device connectivity option.	Data review page displaying the currently monitored hemodynamic parameter values.
Hemo > ***Calc Results*** page	Displays calculation results. The same page is also available under the ***Calculations*** tab (see page 195).	– ***Setup*** button for activating a pop-up window for selecting which parameters are included or excluded from the display. The parameters on the dark background are selected for display; the ones on a light background are not. – ***Auto-sort*** button for sorting the parameter list according to the parameter priority list in the ***Auto view*** page (see page 73). If parameters are added to the parameter priority list, these parameters must be ordered manually. – ***Save*** button for saving the selected calculation parameters.

Data review page	Description	Available functions
Labs page	Laboratory data are sent to the Cockpit over the Infinity network. Whenever new laboratory data are available, the following happens at the Cockpit: – An attention tone sounds provided the attention tone feature is activated (see page 457). – The message ***New lab data available*** appears in the header bar. The message disappears when the laboratory data is accessed. Laboratory data are made available to the Infinity network and are accessible from the Infinity gateway and other devices that support remote viewing capabilities.	Allows laboratory data to be selected and the associated results to be viewed.

Reports tab

The ***Reports*** tab of the ***Trends/Data*** dialog combines the various reports under one tab for easy access.

The ***Reports*** dialog consists of the following pages:

– ***General reports***

– ***OR report***

– ***Setup***

Use the ***General reports*** and ***OR report*** pages to request reports (for detailed information on how to request these reports, see "Printing reports" on page 512. The ***Setup*** page is for configuring the case summary report (see page 516 for details).

This page has been left blank intentionally.

Calculations

Overview

With the physiological calculations option, the Cockpit performs physiological calculations using data acquired by the M540 and other devices. The Cockpit stores derived parameters and displays them.

When the Cockpit is connected to the network, you can obtain laboratory data through the ***Trends/ Data...*** page.

The Cockpit can also be configured to calculate drug-related parameters, including concentration, rate, total dose, and total volume.

In addition to the standard calculation features, two additional features are available with the physiological calculations software option:

– Hemodynamics – the Cockpit calculates hemodynamic parameters based on cardiac output, invasive pressure, and other data (see page 197).

– Hemo/Oxy/Vent Calculations – the Cockpit calculates oxygenation and ventilation parameters (see page 199) in addition to hemodynamic parameters.

Calculating the body surface area

The Ht (height) and current Wt (weight) values are used to compute the BSA (body surface area) in m^2. For adult and pediatric patients, these values are pulled automatically from the ***Demographics*** page which is populated during patient admission (see page 100). Because of changing body weight, you must enter the weight manually for neonates. This is to make sure that the most current value is used to calculate the BSA.

The BSA value is required for all indexed calculations such as cardiac index (CI). The available units for height are cm and inches. The available units for weight are kg, g, ounces, lb.

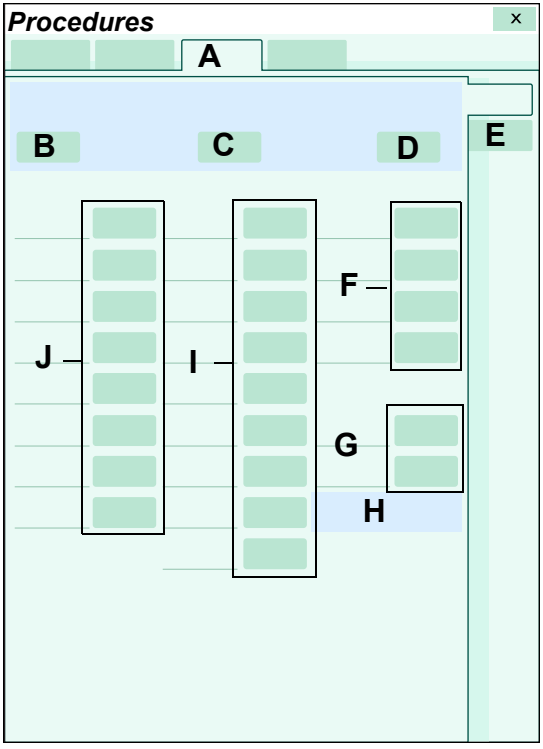
The following Boyd or DuBois equations are used to compute the BSA.

The Boyd equation is used for patients whose weight is less than15 kg and whose height is less than 80 cm:

Boyd equation
$BSA = Wt^{(0.7285 - 0.0188 \times \log 10WT)} \times Ht^{0.3} \times 0.0003207$
DuBois equation
$BSA = Wt^{0.425} \times Ht^{0.725} \times 0.007184$
Note: Wt = Weight, Ht = Height, BSA = Body surface area

Accessing the calculation functions

The following diagram shows the ***Calculations*** page for calculating hemodynamic, oxygenation, and ventilation parameters.



A ***Calculations*** tab

B ***Capture values*** button

C ***Capture labs*** button (see page 196)

D ***Calculate results*** button (see page 195)

E ***Results*** tab

F ***Labs*** parameter buttons

G ***Weight*** and ***Height*** buttons

H ***BSA*** value

I ***Oxygenation/Ventilation*** parameters

J ***Hemodynamics*** parameter values

Performing calculations

Calculations are based on automatically captured and manually entered values. In pediatric and adult mode, the current height and weight used to compute the BSA value, are taken from the ***Demographics*** page the first time you capture any values. In neonatal mode you must enter the weight manually. The height is taken from the ***Demographics*** page, if available.

NOTE

Before performing a calculation, measure pulmonary wedge pressure and cardiac output (if desired) because some of the calculated values cannot be determined without these parameter values.

To perform a calculation

In the following steps, the letters in parentheses correspond to the diagram for the ***Calculations*** page (see page 193).

1 Select the ***Procedures...*** button from the main menu bar.

2 Select the ***Calculations*** tab (if not already selected).

3 Select the ***Capture values*** button (B). The Cockpit populates the available parameter buttons with the current values.

4 Select the ***Capture labs*** button (C). The Cockpit populates the available laboratory parameter buttons with current values.

5 Edit or add any value by selecting the button next to a parameter label to activate a popup with a keypad. The popup displays the valid range of the selected parameter. Any modified value is identified by the symbol #.

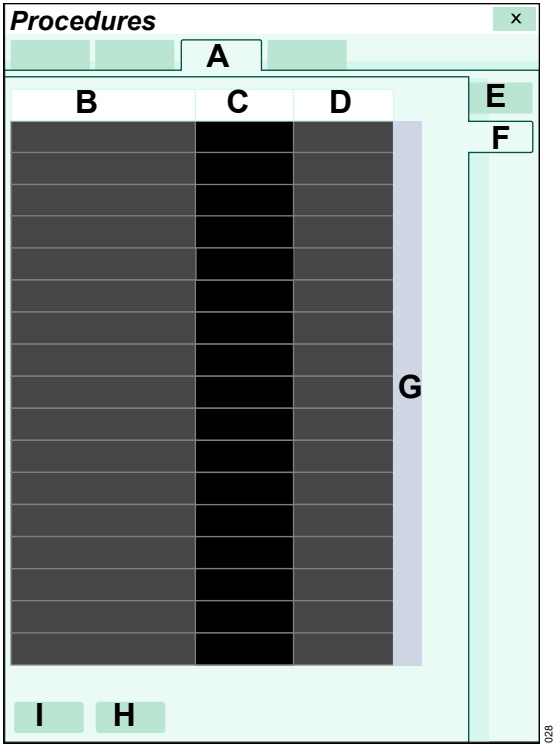
6 Select the ***Enter*** button on the keypad popup to confirm your input. Any value that has been altered manually is identified with the symbol #.

7 Repeat steps 4 and 5 for additional parameters.

8 Select the ***Calculate results*** button (D). The calculated values are listed.

Viewing the calculation results

The following diagram shows the ***Results*** page for viewing hemodynamic, oxygenation, and ventilation parameters.



A ***Calculations*** tab

B ***Parameters*** column

C Data column with reference values

D Data columns with date and time stamp

E ***Calculation*** tab (see page 193)

F ***Results*** tab

G Scroll bar

H ***Save*** button

I ***Setup*** button

Viewing and saving calculations

The ***Results*** page allows you to configure the display and save calculations. You can save up to 50 calculations before they are overwritten on a first-in first-out basis. The scroll bar (G) consists of single and double arrow keys and a moveable bar. The double arrows scroll through larger portions than the single arrows. You can also drag the navigation bar located between the arrow keys to the desired location. The same page is also available under the ***Hemo*** tab (see page 188).

To view calculations

In the following steps, the letters in parentheses correspond to the diagram for the ***Results*** page (see page 195).

1 Select the ***Procedures...*** button from the main menu bar.

2 Select the ***Calculations*** tab (if not already selected).

3 Select the ***Results*** tab (if not already selected).

4 Select the ***Setup*** button (I) to activate a pop-up window for selecting which parameters are included and excluded from display. The parameters on the dark background are selected for display, the ones on light background are not.

The ***Auto-sort*** button in the dialog allows you to sort the parameter list according to the parameter priority list in the ***Auto view*** page (see page 73). If you add parameters to the parameter priority list, you must order these parameters manually.

5 Select the ***OK*** button in the pop-up window to confirm your selection. The list of parameters is adjusted accordingly on the ***Results*** page.

To save calculations

1 Select the ***Procedures...*** button from the main menu bar.

2 Select the ***Calculations*** tab if not selected.

3 Select the ***Results*** tab.

4 Select the column of calculations you wish to save as reference values. An orange frame highlights the selected column.

5 Select the ***Save*** button (H) to save the selected calculations.

Laboratory data

You can include laboratory data in calculations of derived parameters.

Capturing laboratory data

The blood-analysis device available on the network determines which laboratory parameters are available. You can review the results on the ***Results*** page (see page 195). From there you can also save the calculations and configure the display.

To capture laboratory data

1 Select the ***Procedures...*** button on the main menu bar.

2 Select the ***Calculations*** > ***Calculations*** tabs.

3 Select the ***Capture labs*** button (C) on the ***Calculations*** page (see page 193).

NOTE

The IACS does not send the following lab data to the network: PaCO2, SvO2, SaO2, PaO2, PvO2, pH, HCO3, Hct, and Hgb.

Calculation equations

The following section describes which monitored parameters and equations the Cockpit uses to calculate hemodynamic, oxygenation and ventilation calculations.

NOTE

The IACS does not send the following lab data to the network: PaCO2, SvO2, SaO2, PaO2, PvO2, pHHCO3, HCO3, Hct, and Hgb.

NOTE

It is possible that some ***Hemodynamics*** and ***Oxygenation/Ventilation*** calculations results might be missing on the network. All calculations will still be available on the patient monitor.

Hemodynamic parameters

The Cockpit uses the following monitored parameter values for the hemodynamic calculations.

Label	Description	Available units
ART S	Systolic arterial blood pressure	mmHg, kPa
ART M	Mean arterial blood pressure	mmHg, kPa
ART D	Diastolic arterial blood pressure	mmHg, kPa
C.O.	Cardiac output (intermittent)	L/min
CCO	Cardiac output (continuous)	L/min
CVP	Central venous blood pressure	mmHg, kPa
HR	Heart rate	bpm
PA M	Mean pulmonary arterial blood pressure	mmHg, kPa
PWP	Pulmonary wedge pressure	mmHg, kPa
ICI	Intermittent cardiac index	L/min/m^2
ICO	Intermittent cardiac output	L/min/m^2

The Cockpit uses the values in the preceding table plus the BSA value to calculate the following derived hemodynamic values.

Label	Description	Equation	Available units
CI, CCI	Cardiac index (continuous)	C.O. / BSA, CCO / BSA	L/min/m^2
LHCPP	Left heart coronary perfusion pressure	ART D – PWP	mmHg
LVSW	Left ventricular stroke work	0.0136 x (ART M – PWP) x SV	g x m
LVSWI	Left ventricular stroke work index	0.0136 x (ART M – PWP) x SVI	g x m/m^2
PVR	Pulmonary vascular resistance	79.96 x ((PA M – PWP) / C.O.)	dyn·s/cm^5
PVRI	Pulmonary vascular resistance index	79.96 x ((PA M – PWP) / CI)	dyn·s/cm^5/m^2
RPP	Rate pressure product	ART S x HR	mmHg/min
RVSW	Right ventricular stroke work	0.0136 x (PA M – CVP) x SV	g x m
RVSWI	Right ventricular stroke work index	0.0136 x (PA M – CVP) x SVI	g x m/m^2
SV	Stroke volume	C.O. x 1000 / HR	mL
SVI	Stroke volume index	1000 x (CI/ HR)	mL/m^2
SVR	Systemic vascular resistance	79.96 x (ART M – CVP) / C.O.	dyn·s/cm^5
SVRI	Systemic vascular resistance index	79.96 x (ART M – CVP) / CI	dyn·s/cm^5/m^2
TPR	Total pulmonary resistance	79.96 x PA M / C.O.	dyn·s/cm^5
TVR	Total vascular resistance	79.96 x ART M / C.O.	dyn·s/cm^5

Oxygenation and ventilation parameters

The Cockpit uses the following parameter values for the oxygenation and ventilation calculations. All of these calculations are monitored parameter values except for PaO2, PaCO2, Hgb, and SaO2 which are laboratory values.

Label	Description	Available units
Hgb	Hemoglobin concentration	g/dL
inO2, FiO_2	Inspired oxygen	%
PaCO2	Arterial CO2 partial pressure	mmHg
PaO2	Arterial oxygen partial pressure	mmHg
Pplat, Pplat	Pause (plateau) pressure	cmH_2, mbar
Pb	Ambient pressure	mmHg, kPa
PeCO2	Mixed expired CO2 partial pressure	mmHg
PEEP	Positive end expiratory pressure	cmH_2, mbar
PIP	Peak inspiratory pressure	cmH_2, mbar
RRc, RR, RRi, RR	Respiratory rate	/min
SaO2	Arterial oxygen saturation	%
SvO2	Venous oxygen saturation	%
VTe / VTe	Expired tidal volume	mL, L

The Cockpit uses the values in the preceding table, the laboratory values, and the BSA value to calculate the following derived oxygenation and ventilation parameter values.

Label	**Description**	**Derivation**	**Available units**
C(a-v)O_2	Arteriovenous oxygen difference	CaO2 – CvO2	mL/dL
CaO2	Arterial oxygen content	0.0134 x Hgb x SaO2	mL/dL
Cdyn	Dynamic compliance	VTe / (PIP – PEEP)	mL/cmH_2
Cs	Static lung compliance	VTe / (Pplat – PEEP) or VTe / (Pplat – PEEP)	mL/cmH_2
CvO2	Venous oxygen content	0.0134 x Hgb x SvO2	mL/dL
DO2	Oxygen delivery	10 x CaO2 x C.O.	mL/min
DO2I	Oxygen index	10 x CaO2 x CI DO2 / BSA	mL/min/m^2
MValv	Alveolar minute volume	(VTe – TVd phy) x RR	mL/min
MVe	Expired minute volume	(VTe x RR) / 1000	L/min
MV/C.O.	Ventilation cardiac output ratio	MValv / C.O.	No units
O2ER	Oxygen extraction ratio	(CaO2 – CvO2) / CaO2	No units
P(A-a)O_2	Alveolar-arterial oxygen difference	iO2 x (Pb – 47) – PaCO2 – PaO2 iO2 / 100 x (Pb – 47) – PaCO2 – PaO2	mmHg
Qs/Qt	Intrapulmonary right-left shunt (percentage shunt)	$\frac{\mathrm{Hgb} \times 1.34 + 0.0031 \times \mathrm{PAaO2} - \mathrm{CaO2}}{\mathrm{Hgb} \times 1.34 + 0.0031 \times \mathrm{PaO2} - \mathrm{CvO2}} \times 100$	%
TVd phy	Tidal volume dead space (physiological)	VTe x (1 – PeCO2 / PaCO2)	mL
TVd/TV phy	Ratio of tidal volume dead space to tidal volume dead space (physiological)	TVd phy / VTe	No units
VO2	Oxygen consumption	10 x C(a-v)O_2 x C.O.	mL/min
VO2I	Oxygen consumption index	10 x C(a-v)O_2 x CI VO2 / BSA	mL/min/m^2
NOTE: When multiple sources are available, the RR order of priority is RR, RRc, RRi.			

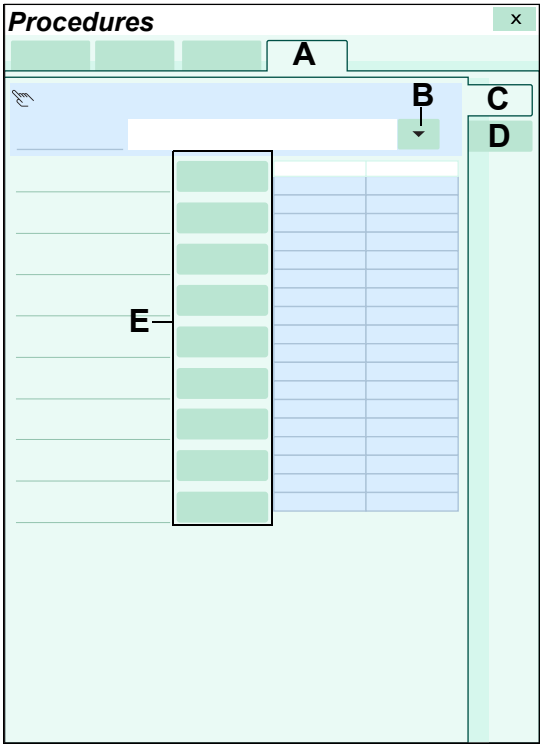
Drug calculations

The Cockpit calculates the infusion rates of up to 44 drugs. Forty of these drugs are pre-configured and four can be customized for a specific patient session. Information pertaining to patient-specific drugs is automatically deleted when you discharge the patient.

Data pertaining to default drugs is not deleted when a patient is discharged. For more information on how to create a customized drug list, see page 202.

Accessing the drug calculation functions

The following diagram shows the ***Drug calculation*** page where you perform drug dosage calculations.



A ***Drug dosage*** tab

B ***Select drug*** list arrow button

C ***Drug calculation*** tab

D ***Setup*** button for customizing the drug list (see page 202)

E Buttons for entering values

Accessing the drug calculations

1. Select the ***Procedures...*** button from the main menu bar.
2. Select the ***Drug dosage*** tab (A), if not already selected.
3. Select the ***Drug calculation*** tab (C), if not already selected.

Performing drug calculations

You can either select drugs from a pre-configured drug list (see page 202) or enter drugs manually to compute the desired dose and rate values.

To perform a drug calculation

In the following steps, the letters in parentheses correspond to the diagram for the ***Drug calculation*** page (see page 201).

1 Access the ***Drug calculation*** page (see page 201).

2 Select the arrow key (B) to activate the drug list containing pre-configured drugs.

3 Select the desired drug. The pre-configured values for amount, dose, and units show up in the corresponding buttons.

4 Add the other infusion parameters such as ***Rate*** by selecting the corresponding button and entering the values on the keypad.

5 Select ***Enter*** on the keypad to confirm your selection.

NOTE

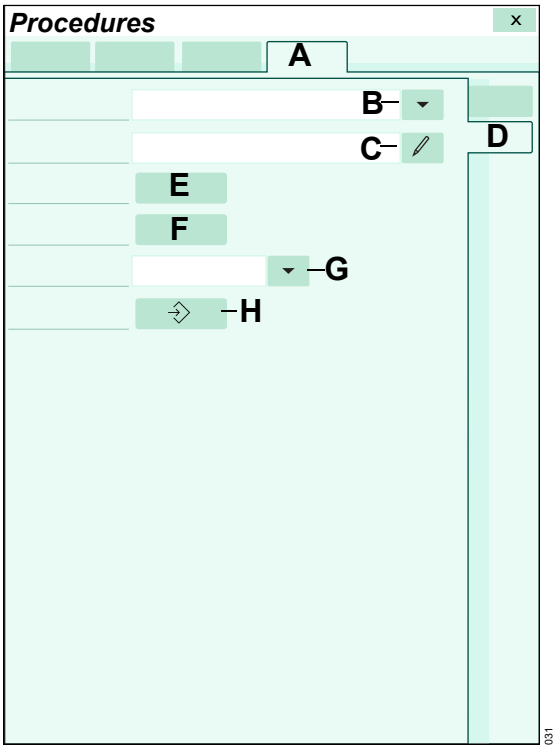
When performing drug calculations, and the dose includes micrograms, a dose precision of 0.01 does not allow a measurement that can be used when rate is used to calculate the dose.

Customized drug list

Customizing a drug list requires a clinical password. The drug list contains up to 40 drugs with the following pre-configured settings: the name, amount, volume, dose, and unit of measurement. Once configured, a drug and its settings are stored as defaults and become available for selection in the ***Drug calculation*** page (see page 201).

The drug list also contains four untitled drugs which are available if the pre-configured drugs do not meet the current drug calculation needs. These drugs are place holders for generic drug dosage calculations.

The following diagram shows the ***Drug dosage > Setup*** page where you customize the drug list.



A ***Drug dosage*** tab

B ***Select drug*** field and selection arrow

C ***Edit drug name*** field

D ***Setup*** tab

E ***Amount*** button

F ***Volume*** button

G ***Dose units*** field and selection arrow

H ***Save drug*** button

Customizing the drug list

Accessing the ***Drug dosage > Setup*** page requires a password. In the following steps, the letters in parentheses correspond to the diagram for the ***Drug dosage > Setup*** page.

To customize the drug list

1. Select the ***Procedures...*** button on the main menu bar.
2. Select the ***Drug dosage*** > ***Setup*** tabs.
3. Enter the password on the keypad.
4. Select ***Enter*** to display the ***Setup*** page.
5. Use the arrow in the ***Select drug*** field (B) to activate a list of existing drug names. Select an existing drug name for editing or an 'Untitled' entry for adding a new drug name. The selected drug is assigned to the ***Edit drug name*** field (C).
6. Select the pencil symbol next to the ***Edit drug name*** field (C) to activate a keyboard.
7. Edit or enter a drug name using the keyboard. A maximum of 25 alpha-numeric characters are available.
8. Select the ***Enter*** button on the keyboard.
9. Select the ***Amount*** button (E) to activate a popup with a keypad for adding the amount. Use the arrow symbol to activate a list of assigned units of measure.
10. Select the ***Enter*** button. The amount is assigned to the ***Amount*** field (E). The unit is assigned to the ***Dose units*** field (G).
11. Select the ***Volume*** button (F) to activate a popup with a keypad for adding the volume. Use the arrow symbol to activate a list of assigned units of measure.
12. Select the ***Enter*** button. The volume is assigned to the ***Volume*** field (F). The unit is assigned to the ***Dose units*** field (G).
13. Select the ***Save drug*** button (H) to save all of the drug and all of its attributes.

Drug calculator equations

The following table lists the variables and equations used to perform drug rate calculations.

Variables	Description	Equation
Amount	The weight of the drug	Concentration x volume
Volume	The volume in which the drug is dissolved	Drug amount / concentration
Concentration	Drug quantity / solution volume	Drug amount / volume
Rate	Infused volume per unit of time	Dose / concentration
Duration	The time over which the infusion is administered	User-selectable
Dose	The amount of a drug the physician prescribes, standardized by weight and time	Rate x concentration or Rate x concentration / weight
Total dose	Total dose over duration	Dose x duration
Total volume	Total volume over duration	Rate x duration

The following table lists the available ranges for each category on the ***Drug calculation*** page.

Parameter	Range and units
Daily weight	0.1 to 350 kg (adult, pediatric) 1 to 10000 g (neonate)
Amount	0.01 to 100,000,000,000 micrograms (µg), m units, mEq, mmol 0.01 to 100,000,000 milligrams (mg), units, mol 0.01 to 100,000 grams (g), k units 0.01 to 100 M units
Volume	0.01 to 10,000 mL
Concentration	0.01 to100,000,000,000 µg/mL, m units/mL, mEq/mL, mmol/mL 0.01 to100,000,000 mg/mL, units/mL, mol/mL 0.01 to100,000 g/mL, k units/mL 0.01 to100 M units/mL
Rate	0.01 to 10,000 mL/h
Duration	0.01 to 10,000 h

Parameter	Range and units
Dose (per hour)	0.01 to 100,000,000,000 µg/h, mEq/h, m units/h, mmol/h
	0.01 to 100,000,000 mg/h, units/h, mol/h
	0.01 to 10,000 g/h, k units/h
	0.01 to 100 M units/h
Dose/***Daily weight*** (per hour)	*Adult and pediatric:*
	0.01 to 100,000,000,000, µg/kg/h, m units/kg/h, mmol/kg/h
	0.01 to 100,000,000 mg/kg/h, units/kg/h, mol/kg/min or h
	0.01 to 100,000 g/kg/h, k units/kg/h
	0.01 to 100 M units/kg/h
	Neonatal:
	0.01 to 100,000,000,000, µg/g/h, m units/g/h, mEq/g/h, mmol/g/h
	0.01 to 100,000,000 mg/g/h, units/g/h, mol/g/h
	0.01 to 100,000 g/g/h, k units/g/h
	0.01 to 100 M units/g/h
Dose/***Daily weight*** (per minute)	*Adult and pediatric:*
	0.01 to 1,666,666,666.66 µg/kg/min, mEq/kg/min, m units/kg/min, mmol/min
	Neonatal:
	0.01 to 1,666,666,666.66 µg/g/min, mEq/g/min, m units/g/min, mmol/min
	Adult, pediatric, and neonatal:
	0.01 to 1,666,666.66 mg/g/min, units/g/min
	0.01 to 1,666.66 g/kg/min, k units/kg/min
	0.01 to 1,66 M units/kg/min
Total dose	0.01 to 100,000,000,000 µg, m units, mEq, mmol
	0.01 to 100,000,000 mg, units, mol
	0.01 to 100,000 g, k units
	0.01 to 100 M units
Total volume	0.01 to 10,000 mL

This page has been left blank intentionally.

ECG, arrhythmia, and ST segment

Overview of ECG and heart rate monitoring

The M540 calculates and displays the heart rate, identifies paced beats, reports arrhythmia conditions, measures ST deviations, and relays these values to the Cockpit for display. ECG and heart rate monitoring is for adult, pediatric, and neonatal patients.

3-, 5-, 6-, and 10-wire lead sets are available for adult and pediatric ECG monitoring (including TruST). A neonatal ECG adapter cable is available for connecting individual ECG leads for neonatal monitoring.

Normal ECG monitoring (including 12-lead ECG monitoring) is not of diagnostic quality. The only report of diagnostic quality is an optional Rest ECG report which is generated from a 12-lead ECG. To generate such a report requires that the patient is admitted at the Infinity CentralStation and that the Rest ECG option is activated (see page 483 for setup information).

Refer to the instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 ECG functions.

The ECG monitoring functions are configurable in the ECG pages (see page 223).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13.

ECG signal processing and display

The M540 identifies QRS complexes of certain amplitudes and QRS widths for adult, pediatric, and neonatal patients (see the ECG section of the "Technical data" chapter in the M540 instructions for use for detailed parameter specifications). It calculates heart rates within a range of 15 beats to 300 beats per minute, using the R-R intervals of the last 10 seconds. This calculation excludes the two longest and the two shortest R-R intervals. The M540 averages the remaining intervals and displays the result as the current heart rate in the heart rate parameter field. For adult and pediatric patients, the QRS threshold is adjustable (see page 228).

During dual-channel processing, a weight is assigned to each channel depending on its level of artifact. The channel with less artifact always receives the greater weight. When a channel exceeds a certain level of artifact, it is excluded from the composite signal, and the M540 shifts to single-channel processing. If both channels experience excessive artifact, an artifact message appears until at least one channel is sufficiently free of artifact.

During artifact, asterisks (* * *) replace the heart rate value. Once the artifact clears, QRS processing resumes without initiating a relearning phase.

Arrhythmia monitoring and the selected arrhythmia mode affect the display of the heart rate parameter field. For detailed information, see "Arrhythmia processing" on page 234.

Parameter-specific error messages are listed in the chapter "Troubleshooting" starting on page 525.

Supported parameters

– ECG: HR (heart rate), %PACED (paced beats)

– ST: STI, STII, STIII, STaVR, STaVL, STaVF, STV, STV+, STV1 to STV6, STVM, STCVM, STdV1, STdV3, STdV4, STdV6

– Arrhythmia: ARR (ASY, VF, ARTF, VTACH, RUN, AIVR, SVT, CPT, BGM, TACH, BRADY, Pause); see page 235 for a description of these arrhythmia modes and PVC/min

In addition to stored events, the two high priority alarms ASY and VF are also stored and displayed in the ICS trends.

ECG precautions

Refer to the following sections for general precautions:

– "Electrical safety" on page 16
– "Electrosurgery" on page 19
– "Defibrillator precautions" on page 19

WARNING

Do not select TruST leads for ECG signal processing. If the QRS morphology of a TruST lead differs from that of its equivalent conventional lead, always refer to the conventional lead.

WARNING

To prevent patient injury, always verify the timing of the QRS synchronization pulse before attempting cardioversion using the Infinity MCable – Analog/Sync.

WARNING

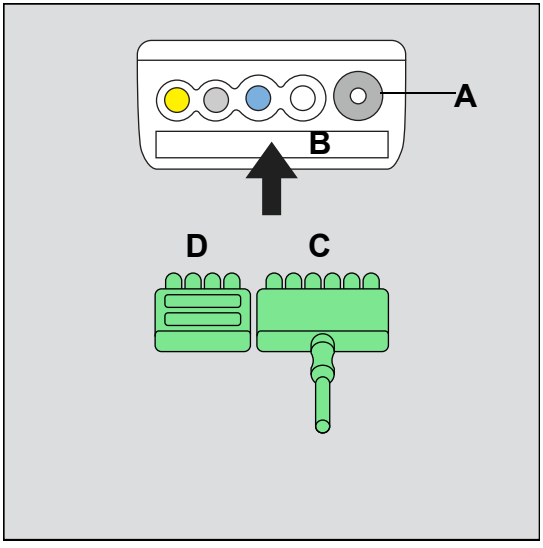
Do not rely solely on the ECG when monitoring seizure-prone patients. Electrical artifacts of non-cardiac origin, such as seizure, may prevent detection of certain arrhythmias.

NOTE

Use of the rest ECG report is required for an ECG signal quality that is compliant with IEC 60601-2-25 diagnostic high frequency specifications.

Connecting the 3-, 5-, 6-wire lead sets for ECG monitoring

The ECG lead sets connect directly to the M540.



A Non-invasive blood pressure hose connector

B M540 ECG port

C Lead set

D Port cover

To connect the ECG lead sets

1 Insert the 3-, 5-, or 6-wire lead set (C) into the recessed ECG connector (B) on the side of the M540 that is closest to the non-invasive blood pressure connector (A).

Orient the lead set (C) so the exposed pins face towards you as you push it firmly into the ECG port.

NOTE

An ECG lead set can rest in the ECG connector of the M540 without actually being connected. Make sure that all ECG lead sets are pushed firmly into the ECG port of the M540.

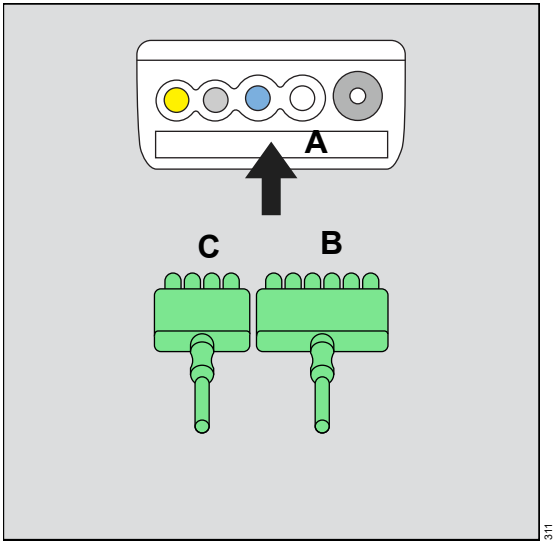
Almost every MonoLead features a number on the lead set indicating how many leads connect. When connecting a MonoLead, make sure the number faces in the same direction as the M540 display.

2 Insert the port cover (D) to protect the unused ECG lead pins.

3 Connect the lead wires to the patient. For information on applying the electrodes to the patient, refer to the figures starting on page 218.

Connecting the lead sets for 12-lead monitoring

The ECG lead sets connect directly to the M540.



A M540 ECG port

B 6-wire lead set

C 4-wire lead set

To connect the ECG lead sets

1 Insert the 6-wire lead set (B) and the 4-wire lead set (C) into the ECG port (A) on the side of the M540.

Orient lead sets (B and C) so the exposed pins face towards you as you push them firmly into the channel.

NOTE

An ECG lead set can rest in the ECG port of the M540 without actually being connected. Make sure that all ECG lead sets are pushed firmly into the ECG port of the M540.

Almost every MonoLead features a number on the lead set indicating how many leads connect. When connecting a MonoLead, make sure the number faces in the same direction as the M540 display.

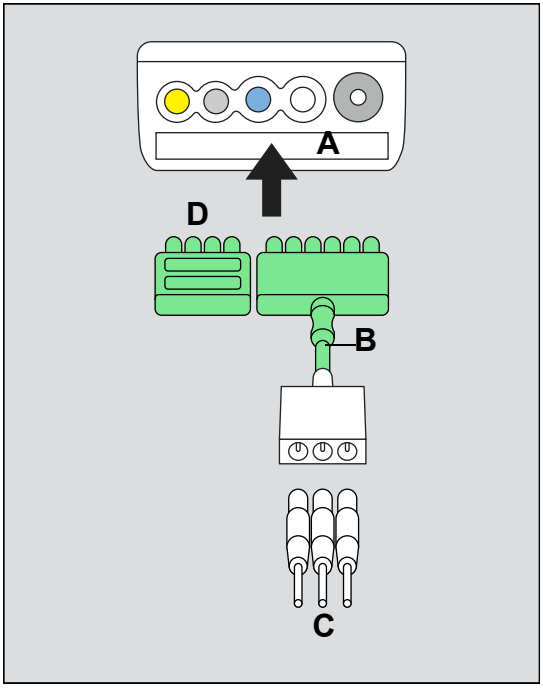
2 Connect the lead wires to the patient. For information on applying the electrodes to the patient, refer to the figures starting on page 218.

NOTE

When using a 12-lead ECG where the lead wires are coiled, it is recommended that the 6-wire lead set is coiled in the same direction as the 4-wire lead set to prevent artifact. For example, both lead sets are either coiled towards the patient or away from the patient.

Connecting the lead wires for neonatal monitoring

The ECG lead sets connect directly to the M540.



A M540 ECG port

B Neonatal ECG adapter cable

C Neonatal ECG electrodes

D Port cover

To connect the ECG lead set

1 Insert the neonatal ECG adapter cable (B) into the ECG port (A) on the side of the M540.

Orient the neonatal ECG adapter cable (B) so the exposed pins face towards you as you push them firmly into the ECG port.

NOTE

An ECG lead set can rest in the ECG port of the M540 without actually being connected. Make sure that all ECG lead sets are pushed firmly into the ECG port of the M540.

2 Insert the port cover (D) to protect the unused ECG lead pins on the M540.

3 Connect the individual neonatal ECG lead wire (C) to the neonatal ECG adapter cable (B).

For information on applying the electrodes to the patient, refer to the figures starting on page 218.

Patient preparation for ECG monitoring

The following tips provide optimal ECG monitoring results but must never replace hospital-approved practices or manufacturer's recommendations.

Follow hospital procedures for proper skin preparation. Dräger recommends Ag/AgCl disposable electrodes. Never use disposable electrodes after their expiration date and make sure that there is enough gel and that the gel has not dried out.

P and T waves with amplitudes exceeding 0.2 mV can be interpreted as QRS complexes. To allow detection of low heart rate conditions under these circumstances, place the lead with the highest R wave in channel ECG1. If P and T waves continue to be misinterpreted, reposition the electrodes or use an SpO_2 sensor to monitor the pulse rate.

To maintain a clear signal, change electrodes every 24 to 48 hours or more often when the following occurs:

– ECG signal degradation

– Excessive patient perspiration

– Skin irritation

Consider the following when selecting electrode sites:

– Surgery – keep electrodes as far from the surgical site as possible, while maintaining a clinically useful lead configuration. Place the cable and lead wires as far from the ESU as possible and perpendicular to the ESU cables.

– Burn Patients – use sterile electrodes. Clean the equipment thoroughly and follow hospital infection control procedures.

– Incorrect placement of electrodes affects the signal quality.

Electrosurgery

Integrated ESU suppression improves the performance of the monitor during electrosurgery, reduces noise on ECG waveforms, and protects the patient from burns.

To minimize interference from the electrosurgical unit

- Select the heart rate parameter field.

  or

1. Select ***Sensor parameters...*** from the main menu bar.
2. Select the ***Settings 2*** tab (if not already selected).
3. Select ***ESU*** next to the ***External device disconnected alarm control*** selection.

NOTE

12-lead monitoring is not available when the ESU filter is enabled. Likewise, the ESU filter selection is not available when you are using 12-lead monitoring.

If the *Filter* selection is set to ESU at the Cockpit and you switch to a 12-lead ECG at the M540, the *Filter* setting automatically changes to *Monitor* at the Cockpit.

NOTE

ESU mode provides better HR performance in the presence of electrosurgical interference, but with possible ECG R-wave amplitude reduction on narrow complexes.

ECG display

On the Cockpit, the ECG display consists of:

– ECG parameter field

– ECG waveforms

– ***Show all*** page containing up to 12 leads

The ECG parameter field appears differently when you activate arrhythmia monitoring. For more information, see page 215.

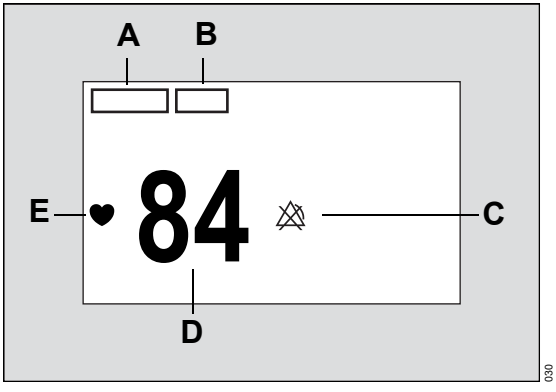
ECG parameter field

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

NOTE

The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

The ECG parameter field contains the following elements:



A Parameter label

B Units of measure – can be activated/deactivated

C Upper/lower alarm limits or crossed triangle symbol when alarms are deactivated

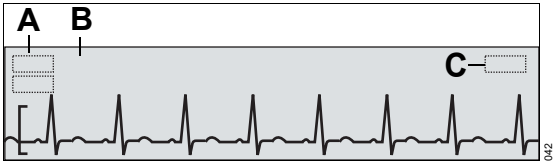
D Heart rate value

E Heart symbol that flashes with each detected ECG complex (if pacer detection is activated, the symbol appears as P♥ when a paced beat is detected)

During brief artifact episodes, the parameter field does not display a heart rate value.

ECG waveforms

The ECG waveform contains the following elements:



A Lead label

B Selected waveform scale

C Message field indicating the filter and pacer setting. For example, the message ***Pacer off*** appears when you deactivate pacer detection.

If pacer detection is activated (see page 227), blue pacer spikes identify paced beats. Pacer spikes are printed on strip recordings.

Depending on the selected lead set and the ECG cable type, up to 3 ECG waveforms are displayed.

Lead set	Available ECG leads
Three electrodes	I, II, or III
Five electrodes	I, II, III, aVR, aVL, aVF, V [1)]
Six electrodes	Standard: I, II, III, aVR, aVL, aVF, V, V+ [1)] TruST: I, II, III, aVR, aVL, aVF, dV1, V2, dV3, dV4, V5, dV6 [2)]
6 + 4 electrodes	I, II, III, aVR, aVL, aVF, V1 to V6 [3)]

NOTE:

[1)] V and V+ are chest leads

[2)] The letter 'd' indicates a derived lead

[3)] Using a 6-wire lead set and a 4-wire lead set provides a 12-lead ECG

To select the number of leads and the lead set, see page 223.

NOTE

When admitting a new patient, re-loading a patient profile, or changing a patient category, the ECG waveform size will return to the last configured setting instead of matching the ***Size all ECG [mV/cm]*** setting, or returning to the default value. Manually change the ECG waveform sizes.

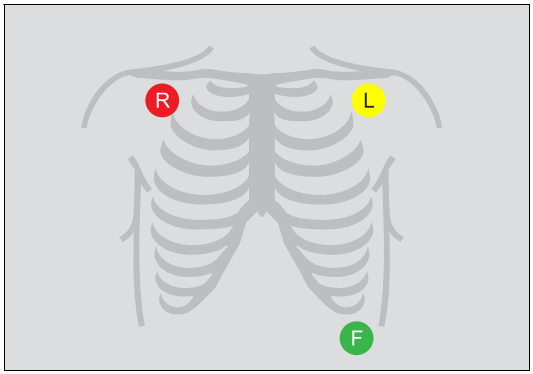
ECG colors

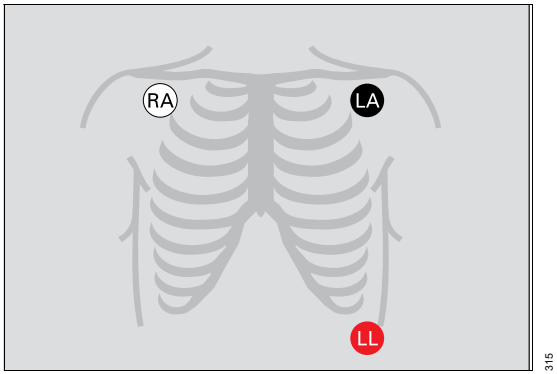
Lead wire connectors to the electrodes are labeled and color-coded according to IEC and AHA.

IEC		**AHA/US**	
L	Yellow	LA	Black
F	Green	LL	Red
R	Red	RA	White
C/C2	White/white and yellow	V/V2	Brown/brown and yellow
N	Black	RL	Green
C+/C5	Gray and white/white and black	V+/V5	Gray and brown/brown and orange
C6	White and violet	V6	Brown and violet
C4	White and brown	V4	Brown and blue
C3	White and green	V3	Brown and green
C1	White and red	V1	Brown and red

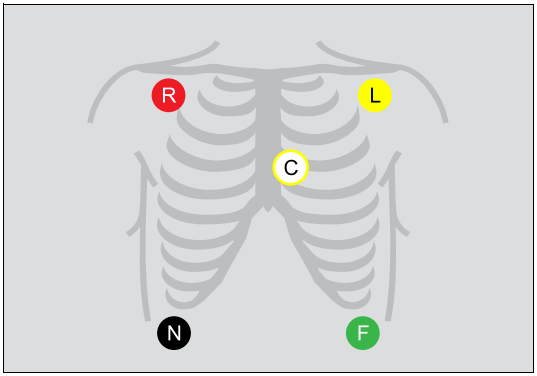
Electrode placement for adult and pediatric patients

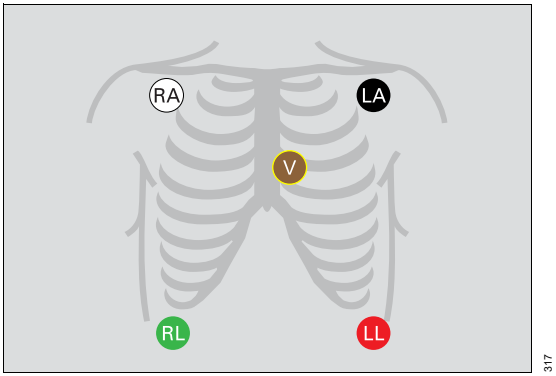
Standard configuration, three electrodes (IEC/AHA)



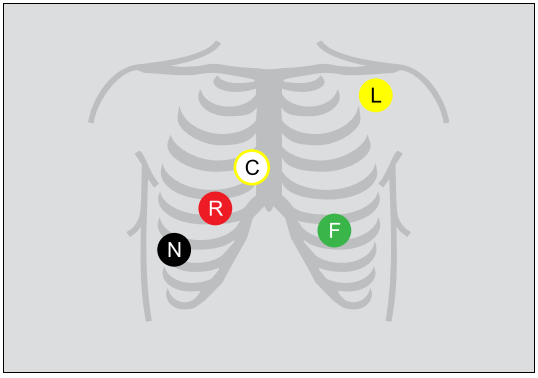


Standard configuration, five electrodes (IEC/AHA)

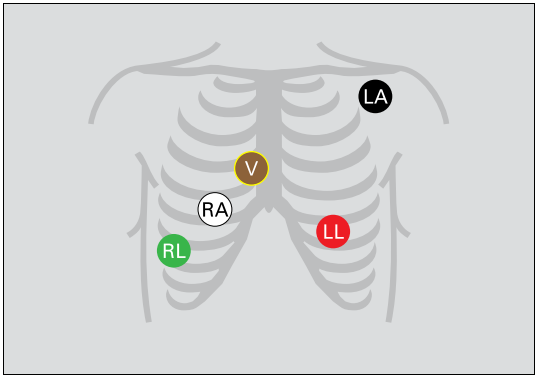




Pacer configuration, five electrodes (IEC/AHA)

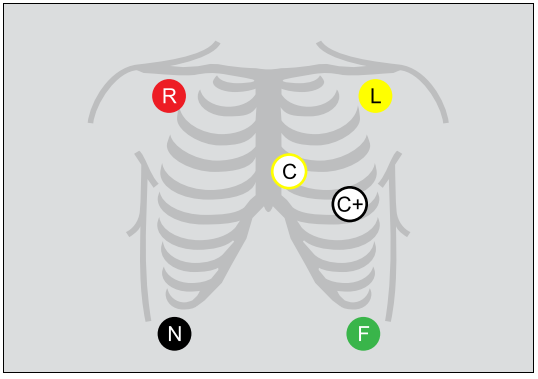


318

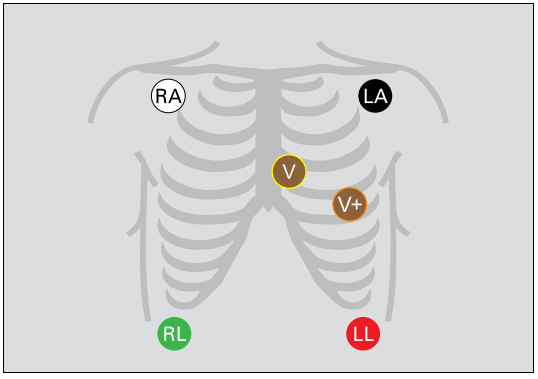


319

Standard configuration, six electrodes (IEC/AHA)

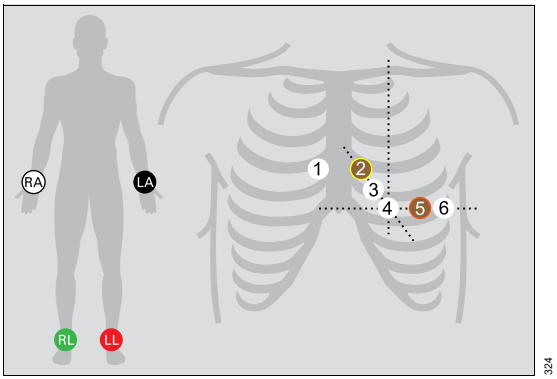


320

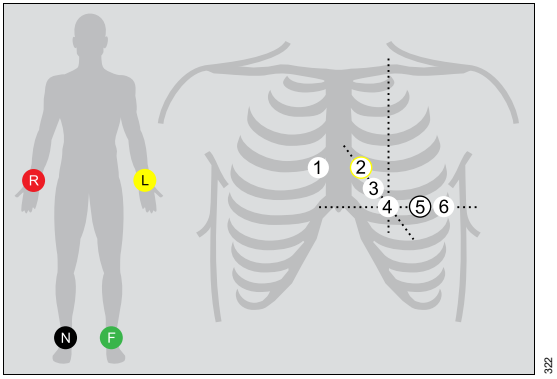


321

12-lead configuration, ten electrodes for 12-lead Rest ECG monitoring (AHA)

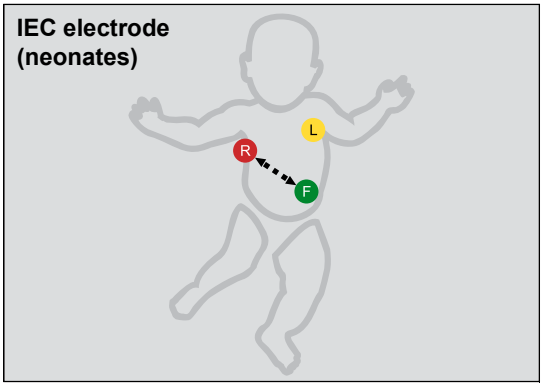


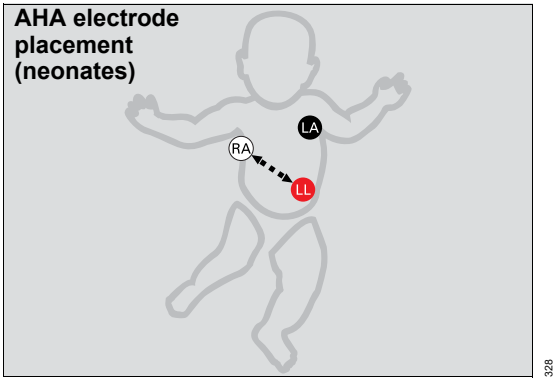
12-lead configuration, ten electrodes for 12-lead Rest ECG monitoring (IEC)



Electrode placement for neonates

– For neonates, place the RA and LA electrodes at the midaxillary line. Position the LL electrode below the diaphragm and umbilicus. Avoid the liver area and ventricles of the heart to prevent blood flow artifact.





12-lead monitoring

Standard 12-lead monitoring is only available when you use a 6-wire lead set and a 4-wire lead set. 12-lead monitoring using a 10-wire lead set is a locked option that must be purchased separately. Place the chest electrodes in positions 1 through 6 as shown on page 220.

TruST 12-lead monitoring offers real-time assessment of ST segment deviations with only six electrodes. TruST uses the conventional 6-lead standard electrode placement (see page 219), measuring 8 leads and interpolating 4 chest leads. TruST is available for adult and pediatric patients, but not for neonatal patients.

You can view all ECG waveforms, including TruST, on the ***Show all*** page (see page 228). For information on how to activate TruST, see page 246.

WARNING

Do not select TruST leads for ECG signal processing. If the QRS morphology of a TruST lead differs from that of its equivalent conventional lead, always refer to the conventional lead.

Accessing the ECG functions

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***ECG*** tab to access the ***ECG*** page.

  If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

3 Select the ***Settings 1, Settings 2, Show all*** tabs.

The top portion of the page contains the ***Auto set*** and ***Alarm*** buttons for configuring the alarm functions. For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

ECG parameter setup functions

All ECG setup functions take place in the ***ECG*** pages.

NOTE

If excessive line frequency artifact is seen on the ECG waveform, confirm that the correct ***Line frequency*** has been set in the ***Biomed*** dialog. For more information, refer to "Configuring the biomed settings" in *Instructions for use - Infinity Acute Care System - Infinity M540 VG7.n*.

WARNING

When the setting *HR source* is set to *Auto*, no acoustic alarm signal is issued and no message appears in the header bar when an ECG lead wire is disconnected from the patient.

When the HR source is set to ECG and changed to Auto, if the actual HR source is still ECG but becomes invalid, then the HR parameter field remains blank instead of looking for another HR source (such as SpO2 or ART if available). When due to disconnected ECG electrodes, there will be a technical condition whose alarm grade is user configurable. Select an unavailable source and change it back to Auto.

NOTE

For the Cockpit and the M540, a bradycardia (BRADY) alarm in neonatal mode only annunciates when an HR alarm is set to ***On***. If the HR alarm is set to ***Off***, the BRADY alarm will be Off, but displays as On. When the ***ASY/VF alarms*** setting is set to ***Always on*** or ***Follow HR alarm***, the BRADY alarm also annunciates, even if HR alarms are still ***Off***. Deactivate the BRADY alarm by manually turning it Off.

NOTE

When the HR source on the M540 is set to ***ECG*** and is then changed to ***Auto***, if the actual HR source is still ECG but at some point the ECG signal becomes invalid, then the HR parameter field remains blank instead of looking for another HR source (such as ***SpO2*** or ***Arterial pressure*** if available). If this is due to ECG electrodes being disconnected, then there will be a technical condition whose alarm grade is user configurable. As a workaround, select an unavailable source and then change it back to ***Auto***.

NOTE

A momentary Cockpit disconnection from the M540 occurs when there is a network outage during a Rest ECG report generation.

Selection	Available settings	Description
	Settings 1 page	
Pulse tone volume	***Off***, 5, 10 (default) to 100% in increments of 10%	Sets the volume of the pulse tone.
Tone source	– ***ECG*** (default) – ***SpO2***	Sets the source of the pulse tone.
HR source	– ***ECG*** (default) – derives the heart rate from the ECG signal. – ***Arterial*** – derives the heart rate from the arterial blood pressure signal. The heart rate parameter field label changes to APR and appears in the color of ART. – ***SpO2*** – derives the heart rate from the pulse oximetry signal. The heart rate parameter field label changes to PLS* and appears in the color of SpO2. – ***Auto*** – derives the heart rate either from the ECG signal or other available sources. If an ECG signal is not available, the M540 switches to ART, and then to SpO2.	Selects a different source for the heart rate when the ECG channel is unavailable due to artifact resulting from surgical procedures.
Waveforms	1, 2 (default), 3	Selects the number of displayed waveforms.

Selection	Available settings	Description
Leads	– Three electrodes: I, II, III – Five electrodes: I, II, III, aVR, aVL, aVF, V – Six electrodes: I, II, III, aVR, aVL, aVF, V, V+ – Six electrodes (with TruST activated): I, II, III, aVR, aVL, aVF, dV1, V2, dV3, dV4, V5, dV6 – Ten electrodes: I, II, III, aVR, aVL, aVF, V1 to V6 – Default for lead 1: II – Default for lead 2: V (with TruST and a 6-wire lead set plus a 4-wire lead set, the default is: V2) – Default for lead 3: aVF	Assigns specific leads for each waveform depending on which lead mode is selected.
Size [mV/cm]	0.25, 0.5, 1 (default), 2, 4, 8 mV/cm	Sets the scale of individual ECG waveforms.
Color	Red, green (default), blue, yellow, light blue, purple, orange, white	Determines the color of the waveforms and parameter labels and values.

Selection	Available settings	Description
	Settings 2 page	
Filter	– ***Off*** – provides the greatest sensitivity to noise or artifact (the message ***Filter off*** appears in the waveform channel). – Passband: 0.08 – 40 Hz – ***Monitor*** (default) – recommended for standard monitoring; reduces wandering isoelectric line, muscle artifact, and power line interference. No message appears in the waveform channel. – Passband: 0.5 – 40 Hz – ***ESU*** – reduces signal distortion during electrosurgery (the message ***Filter ESU*** appears in the waveform channel). – Passband: 0.5 – 16 Hz NOTE: 12-lead monitoring is not available when the ESU filter is enabled. Likewise, the ESU filter selection is not available when you are using 12-lead monitoring. NOTE: The hardware-based low-pass ESU filter is activated when OR alarms are activated and the filter is set to ***Monitor*** or ***ESU***. The hardware-based low-pass ESU filter is separate from the ***ESU*** filter setting, which is a software-based filter. NOTE: Pacer detection is unavailable when the filter is set to ***ESU***. NOTE: It is recommended to activate both OR alarms and to set the filter to ***ESU*** during electrosurgery to reduce artifact. NOTE: RRi and 12-lead ECG monitoring are unavailable when the M540 is set to OR alarms	Controls the sensitivity to various artifact sources. None of these filter settings are of diagnostic quality. The diagnostic passband range of 0.05 – 150 Hz is used for diagnostic ECG, regardless of whether the filter is set to ***Off*** or ***Monitor***.

Selection	Available settings	Description
Pacer detection *(Not available in neonatal mode)*	– ***On*** (default) – ***Off*** – the message ***Pacer off*** appears in the waveform channel – ***Fusion*** – the message ***Pacer fusion*** appears in the waveform channel	Determines whether pacer impulses are detected. See "Pacer fusion mode" on page 231 for precautions before you start this mode.
QRS sync marker	– ***On*** – displays QRS synchronization markers – ***Off*** (default)	Determines whether vertical white markers appear on the waveform to identify QRS complexes. The markers help determine when it is safe to perform synchronized cardioversion.
Cable type *(TruST is only available with a 6-wire lead set)*	– ***Auto detect*** (default) – 3-, 5-, 6-electrodes, and 12 leads When using the ECG extension cable, the system always assumes the cable is a 6-wire lead set.	When set to ***Auto detect***, this feature detects the number of connected lead wires automatically. If auto detect mode does not detect the connected lead set, it allows you to select the cable type manually. "12" denotes a combination of a 6-wire lead set and 4- wire lead set for 12-lead monitoring.
ARR Processing	**–** ***ECG1*** – ***ECG1 & 2*** (default) The ***ECG1 & 2*** selection is not available if the neonatal patient category is selected.	***ECG1*** setting – arrhythmia processing occurs only on the lead displayed in waveform channel 1. ***ECG1 & 2*** setting – arrhythmia processing occurs on the leads displayed in the waveform channels 1 and 2.
Size all ECG [mV/cm]	0.25, 0.5, 1 (default), 2, 4, 8 mV/cm	Sets the amplitude of all displayed ECG leads.

Selection	Available settings	Description
QRS threshold	– ***Normal*** (default) – ***Low*** **WARNING** **Risk of inaccurate HR value** **If the QRS setting is set to Low in the presence of HR artifact, the associated HR value may be inaccurate.** **To avoid an inaccurate HR value for adult and pediatric patients, it is recommended to set the QRS threshold setting to Normal.**	This function is only available for adult and pediatric patients. ***Normal*** – detects QRS complexes ≥0.5 mV. ***Low*** – detects QRS complexes ≥0.2 mV.
Resp. monitoring	– ***On*** (default for neonate) – ***Off*** (default for adult/pediatric)	Activates/deactivates respiration monitoring.
Show all page		
This page displays all available leads (up to 12).		

Monitoring paced patients

When pacer detection is activated, the M540 uses the following specifications to identify a pulse as a pacer pulse:

– Amplitude (ap): ±2 to ±700 mV

– Width (dp): 0.2 to 2.0 ms

– A paced beat is identified in the heart rate parameter field by the letter P that appears next to the flashing heart symbol when a pacer pulse is detected.

– On the ECG waveform, blue spikes appear to identify pacer spikes.

NOTE

When the M540 is docked, pacer detection is deactivated automatically in neonatal mode or when the ESU filter is activated. When the M540 is undocked, the M540 automatically activates the pacer detection.

When pacer detection is deactivated, the message ***Pacer off,*** appears in the top ECG channel.

To optimize pacer monitoring, follow the guidelines on page 232.

To activate/deactivate pacer detection

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1. Select ***Sensor parameters...*** from the main menu bar.
2. Select the ***ECG*** tab to access the ***ECG*** page.
3. Select the ***Settings 2*** tab.
4. Select ***On*** next to ***Pacer detection***.

Pacemaker precautions

The M540 has been tested for pacemaker pulse detection. However, it is impossible to anticipate every clinically possible waveform characteristic. For paced patient, the M540 could therefore miscount heart rates and misinterpret rate-dependent arrhythmias.

False low-rate alarms can result under the following conditions:

– 700-mV pacer pulses followed by QRS complexes smaller than 0.5 mV

– Asynchronous pacemaker pulses with overshoot

– Asynchronous pacemaker with large amplitude pace pulses with no overshoot and at low heart rate (30 bpm)

False low-rate and asystole alarms can result in the following conditions:

– Fused beats and asynchronous pacemakers, when coupling intervals are in the range of +10 to –90 ms

As well, false high-rate alarms can result under the following condition:

– Asynchronous pacemaker with large pace pulse tails and at low heart rate (30 bpm)

– Large atrial pacemaker pulse is preceded by a large ventricular pacemaker pulse (both having identical amplitude and durations)

WARNING

Make sure pacer detection is deactivated for patients without pacemakers. Make sure it is activated for patients with pacemakers. Deactivating pacer detection for paced patients may result in pacemaker pulses being counted as regular QRS complexes, which could prevent an asystole alarm from being detected. Always verify that the pacer detection status is correct for the patient. Be aware that setting the ECG filter option to ESU deactivates pacemaker detection automatically.

WARNING

Interference from a monitor may cause some rate-adaptive implantable pacemakers to pace at unnecessarily high rates. Be extra vigilant with patients when using these types of pacemakers.

WARNING

Always keep pacemaker patients under close surveillance and monitor their vital signs carefully.

– Do not assess the patient's condition exclusively from the heart and respiratory rate values the monitor displays and the rate alarms that are generated. Heart rate meters may continue to count the pacemaker rate during cardiac arrest or some arrhythmias.

– Some pacemakers (especially external pacemakers with body surface electrodes) emit pulses with amplitudes far exceeding the 700 mV maximum amplitude specified for the M540. The M540 may incorrectly detect these large pacemaker pulses as valid QRS complexes and may fail to detect cardiac arrest.

WARNING

Impedance respiration and pacemaker detection are inoperative when the ESU filter is selected. Refer to "Electrosurgery" on page 19 for general safety precautions.

NOTE

Full arrhythmia processing does not occur on detected paced beats.

Pacer fusion mode

Pacer fusion mode offers increased detection sensitivity to fused paced beats, thereby reducing false asystole and low heart rate alarms.

WARNING

Pay close attention to pacemaker patients being monitored in Fusion mode because this mode may increase the risk of falsely counting pacemaker spikes as QRS complexes, thus failing to detect cardiac arrest.

CAUTION

Fusion mode pacer detection is not intended for use with large-signal, unipolar pacemakers. It is intended for use only with bipolar pacemakers. Observe the following:

– Select ***Fusion*** mode only in situations where it becomes necessary to suppress repeated false asystole and/or false low heart rate alarms.
– Before selecting ***Fusion*** mode, be certain that the patient has a bipolar pacemaker (external or implanted) and that it is accurately programmed as appropriate for that patient.
– Do not use ***Fusion*** mode if you are uncertain as to what type of pacemaker is being used.

NOTE

The displayed heart rate may be incorrect if the pacemaker pulse wanders through the ECG waveform (ineffective pacing). During the wandering pacemaker test required by AAMI/ANSI/IEC 60601-2-27, the displayed heart rate varied between 15 and 30 bpm (rather than consistently being 30 bpm).

Device interference with pacemaker monitoring

The following devices can interfere with pacemaker monitoring.

Impedance-derived rate response pacemakers

These pacemakers emit pulses that adjust the pacemaker rate to the respiratory rate. These pulses could be falsely interpreted as pacer pulses. For impedance-derived rate response pacemakers, modify the electrode placement until the blue spikes on the waveform disappear since they are not related to real pacer impulses.

Infusion or roller bypass pumps

Interference from these devices can cause pacer spikes to appear on the waveform although the ECG appears normal. To determine if the pump is the cause of the artifact, turn it off, if possible. To minimize the artifact, choose the lead with the best signal or replace the electrodes. Rerouting pressure tubing away from the infusion tubing can also improve the ECG signals.

Line isolation devices

To minimize the effect of line isolation devices, which can cause temporary disturbances in the ECG signal, follow these precautions:

– Choose the lead with the best signal for ECG monitoring.
– Check the ECG electrodes; replace them, if necessary.

Transcutaneous electrical nerve stimulators

Signals from transcutaneous electrical nerve stimulators (TENS) often resemble pacer signals and can be labeled as such. The M540 can reject valid QRS complexes, which follow misinterpreted TENS signals. If TENS signals continue to register as pacer spikes, deactivate pacer detection (see page 227).

Optimizing pacer processing

You can minimize interference and optimize ECG signal acquisition and processing for paced patients.

To optimize pacer processing

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1. Select ***Sensor parameters...*** from the main menu bar.
2. Select the ***ECG*** tab to access the ***ECG*** page.
3. Select the ***Settings 2*** tab.
4. Select ***On*** next to ***Pacer detection***. Select the lead with the least interference and highest R wave for display in ECG channel 1.
5. Select the ***Filter*** setting ***Monitor*** or ***Off*** and determine which setting provides the clearest signal.

Arrhythmia monitoring overview

WARNING

When HR alarm and arrhythmia monitoring are deactivated and the *ASY/VF alarms* setting is set to *Follow HR alarm*, the monitor does not generate asystole or ventricular fibrillation alarms. To make sure that ASY/VF alarms are always generated, set the *ASY/VF alarms* setting to *Always on*.

The M540 performs arrhythmia monitoring on adult and pediatric patients and relays these values to the Cockpit for display. Arrhythmia monitoring is not available for neonates. To make sure that asystole and ventricular fibrillation alarms are reported even when heart rate alarm monitoring and arrhythmia monitoring is deactivated, set the ***ASY/VF alarms*** selection in the ***General settings*** page to ***Always on*** (see page 471).

The selected arrhythmia mode (see page 235) controls which arrhythmia parameters are monitored and how they are displayed. Each occurrence of an arrhythmia event is stored in the ***Alarm history*** page provided the archive setting is configured (see page 148).

Refer to the instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 arrhythmia functions.

The arrhythmia monitoring functions have configurable parameter-specific setup pages (see page 238).

WARNING

The message *HR alarms off* appears in the right most field in the header bar whenever you deactivate heart rate alarms.

The *HR, ASY, VF off* message appears when arrhythmia monitoring is deactivated, the *ASY/VF alarms* feature is set to *Follow HR alarm*, and heart rate alarms are deactivated.

NOTE

If French NFC mode is activated (see page 487), you cannot deactivate heart rate alarms.

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13.

Selecting arrhythmia leads

Appropriate lead selection is essential for accurate arrhythmia monitoring. Ideally, the two best leads should be assigned to the top two waveform channels.

The following two selections are available:

– ***ECG1*** (single channel selection) – dedicates processing to the lead in the top channel.

– ***ECG1 & 2*** (dual channel selection) – determines the heart rate and ARR based on the leads in the two top channels.

To select arrhythmia leads

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1. Select ***Sensor parameters...*** from the main menu bar.
2. Select the ***ECG*** tab to access the ***ECG*** page.
3. Select the ***Settings 2*** tab.
4. Select the button next to ***ECG1*** or ***ECG1 & 2*** and select the desired lead.

Arrhythmia processing

Arrhythmias are identified using an internal detection process. This process does the following:

– Filters out ECG signal artifacts

– Detects the beat pattern

– Classifies the beat pattern

– Detects the rhythm

When arrhythmia analysis is enabled, multiple arrhythmia alarm conditions may occur simultaneously. Announcing all the alarm conditions could result in alarm fatigue and prevent the clinician from addressing the most serious condition. For this reason, priorities are set for the arrhythmia conditions so that only the highest priority alarm event annunciates. Although the priority of arrhythmia events cannot be modified, the clinician can modify the alarm grade to allow enabled alarms of lower priority to annunciate.

The priority for arrhythmia events is:

1 Asystole

2 VF (Ventricular fibrillation)

3 VTACH (ventricular tachycardia)

4 RUN (ventricular run)

5 AIVR (accelerated idioventricular rhythm)

6 SVT (supraventricular tachycardia)

7 CPT (ventricular couplet)

8 BGM (bigeminy)

9 TACH (tachycardia)

10 Brady (Bradycardia)

11 Pause (user selectable interval)

12 ARTF (artifact, background rhythm)

For a description of the arrhythmias and associated events, see "Arrhythmia modes" on page 235.

NOTE

Except for asystole and ventricular fibrillation events, no other arrhythmia events appear in the trends of any ICS equipped with software version VG1.

An arrhythmia with a high grade alarm configuration has a higher priority than an arrhythmia with a medium, low or disabled alarm grade configuration.

An arrhythmia with a medium grade alarm configuration has a higher priority than an arrhythmia with a low or disabled alarm grade configuration.

An arrhythmia with a low grade alarm configuration has a higher priority than an arrhythmia with a disabled alarm configuration.

The priority for arrhythmia events configured with the same alarm grade follows the arrhythmia hierarchy list.

When arrhythmia artifact is present (ARTF) at 100% artifact level, no arrhythmia events are recognized except for bradycardia and ventricular fibrillation.

If sinus tachycardia and ventricular tachycardia are configured at the same alarm grade, a ventricular tachycardia will take priority if the rate is high enough and the beats are classified as ventricular beats.

NOTE

Arrhythmia processing does not occur on detected paced beats.

Arrhythmia modes

If arrhythmia monitoring is activated, the selected arrhythmia mode determines how many events are monitored. Arrhythmia modes include ***Basic***, ***Advanced***, and ***Off.***

NOTE

The ***Advanced*** arrhythmia mode is only available when the full arrhythmia option is activated.

When the ***ASY/VF alarms*** setting is set to ***Always on***, asystoles and ventricular fibrillation events are always reported, even when arrhythmia monitoring is deactivated.

The following table lists ***Basic*** and ***Advanced*** arrhythmia events that are reported with each monitoring mode. The table also lists detected events when the Arrhythmia mode is ***Off.***

Arrhythmia monitoring off (the following events are detected, if at least one ECG is displayed)		
ASY	Asystole	4 seconds pass without the detection of a valid QRS complex.
VF	Ventricular fibrillation	Sinusoidal waveform with fibrillation characteristics. [1]
Basic arrhythmia monitoring mode (the following additional events are detected)		
VTACH	Ventricular Tachycardia	N or more PVCs are detected in a interval T = (60 * (N – 1)) / R, where N is the VTACH count and R is the VTACH rate. [2], [4]
PVC	Premature Ventricular Contraction	PVC alarm limit exceeded. The PVC parameter value represents the number of QRS complexes classified as PVCs over a 1-minute interval.
ARTF	Artifact	More than 50% of beats in the last minute were classified as questionable.
Advanced arrhythmia monitoring mode (includes Basic mode events plus the following additional events)		
RUN	Ventricular RUN	Series of 3 to N-1 consecutive PVCs with a beat-to-beat rate ≥ the VTACH rate. [2]
AIVR	Accelerated Idioventricular Rhythm	Series of 3 or more PVCs with a rate less than the VTACH rate.
SVT	Supraventricular Tachycardia	N or more consecutive normal beats, with a beat-to-beat rate greater than or equal to the SVT setting. [2]
CPT	Ventricular Couplet	Sequence of beats with the pattern: normal, PVC, PVC, normal.
BGM	Ventricular Bigeminy	Sequence of beats with the pattern: normal, PVC, normal, PVC, normal.
TACH	Tachycardia	N or more consecutive normal beats, with a beat-to-beat rate ≥ TACH rate setting. [2], [4]
BRADY	Bradycardia	Eight or more consecutive normal beats, with an average rate ≤bradycardia rate setting. [3]
PAUSE	Pause	Sequence of two beats classified as normal or PVC, with an interval ≥ pause rate value in seconds (±100 ms).

[1] Certain ventricular tachycardias have sinusoidal waveforms closely resembling ventricular fibrillation. Because of the similarities between these waveforms, such types of ventricular tachycardia can be classified as ventricular fibrillation, the more serious of the two conditions.
[2] N is the event count set in the count column of the arrhythmia setup table (see page 238).
[3] A bradycardia (BRADY) alarm in neonatal mode only annunciates when an HR alarm is set to ***On***. If the HR alarm is set to ***Off***, the BRADY alarm will be off, but displays as ***On***. When the ASY/VF alarms setting is set to ***Always on*** or ***Follow HR alarm***, the BRADY alarm also annunciates, even if HR alarms are still off. Deactivate the BRADY alarm by manually turning it off. In neonatal mode, you set alarm limits for BRADY in the alarm setup page. The M540 alarms for this event as a limit violation.
[4] A PVC or another abnormal beat breaks the analysis sequence and restarts analysis.

To select the arrhythmia modes

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***ECG*** tab to access the ***ECG*** page.

3 Select the ***ARR settings*** tab.

4 Select one of the following modes next to ***ARR mode*** button, located below the arrhythmia alarm setup table:
   – ***Off***
   – ***Basic***
   – ***Advanced*** (only available when the full arrhythmia option is unlocked)

Arrhythmia display

When arrhythmia monitoring is activated, arrhythmia events appear in the heart rate parameter field or in a separate parameter field, depending on how many leads are selected for display.

When arrhythmia monitoring is deactivated (see page 236) and at least one ECG waveform is displayed, asystole and ventricular fibrillation events are still reported.

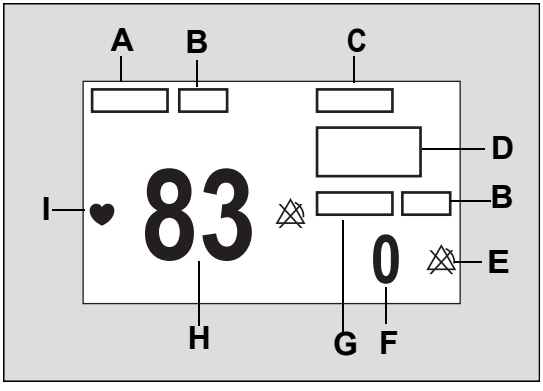
NOTE
To make sure that asystole *and* ventricular fibrillation alarms are reported even when HR monitoring is turned off, set the ***ASY/VF alarms*** selection in the ***Alarms > General settings*** page to ***Always on*** (see page 473).

Combined heart rate /arrhythmia parameter field

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

When one or two ECG leads are selected for display and arrhythmia monitoring is activated, all arrhythmia values and labels appear in the heart rate parameter field. The arrhythmia parameter field contains the following elements:



A Heart rate parameter label

B Units of measure – can be activated/deactivated

C Arrhythmia label

D Area reserved for actual event calls (for example, ***Brady***) or the message ***LEARN***

E Upper/lower alarm limits or crossed triangle symbol when alarms are deactivated

F Number of Premature Ventricular Contractions (PVC) per minute

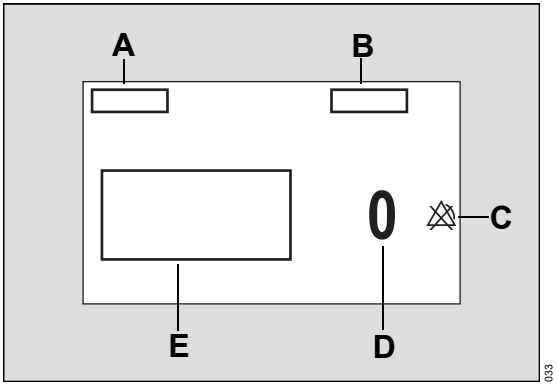
G PVC/min label

H Heart rate

I Heart symbol that pulsates with each detected beat (if pacer detection is activated, the symbol appears as P♥ when a paced beat is detected)

Separate arrhythmia parameter field

When three ECG channels are selected for display and arrhythmia monitoring is activated, all values and labels appear in a separate parameter field below the heart rate parameter field.



A Arrhythmia label

B PVC/min label

C Upper/lower alarm limits or crossed triangle symbol when alarms are deactivated

D Number of premature ventricular contractions (PVC) per minute

E Area reserved for arrhythmia event call (for example, ***Brady***) or the message ***LEARN***

Accessing the arrhythmia functions

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1. Select ***Sensor parameters...*** from the main menu bar > ***ECG*** tab to access the ***ECG*** page.
2. Select the ***ARR settings*** tab.

Arrhythmia parameter setup functions

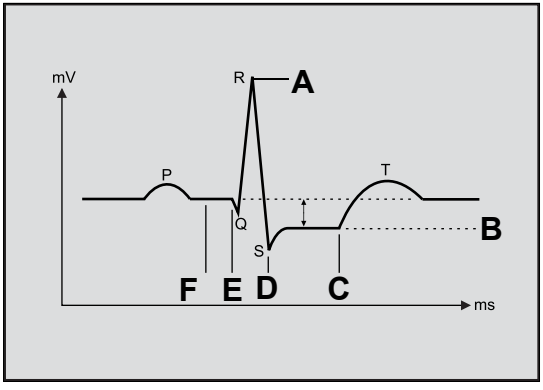
All arrhythmia setup functions take place in the ***ARR settings*** page.

Selection	Available settings	Description
ARR mode	– ***Off*** – ***Basic*** (default), – ***Advanced*** (requires the full arrhythmia locked option)	Selects which events are reported (see page 235 for more details).
Relearn	None	Establishes a new QRS templates.
See "Configuring the arrhythmia alarm setup" on page 143 for details on available arrhythmia alarm functions.		

Monitoring ST overview

ST analysis examines normal QRS complexes from up to 12 ECG leads. The M540 learns each ST lead, combines the measurements into an average QRS complex, and derives the ST segment deviation. ST monitoring is available for adult and pediatric patients.

The ST segment deviation is defined as the displacement (in mm or mV) above or below the isoelectric line. The deviation measurement compares the isoelectric point to the ST measurement point. The following figure identifies the measured elements of a QRS complex.



A Fiducial point

B ST level

C ST measurement point

D QRS offset

E QRS onset

F Isoelectric point

NOTE

ST analysis is always performed using a dedicated filter which ensures diagnostic quality. The ECG filter settings (***ESU***, ***Monitor***, and ***Off***) are not of diagnostic quality, and as a result, the ST segment of the ECG waveform may appear differently from the ST segment of the ST complex. An ECG report is not of diagnostic quality. Therefore, the ST segment of the ECG waveform on the report may appear differently from the ST segment of the ST complex. The only report of ECG diagnostic quality is a Rest ECG report.

Refer to the instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 ST functions.

The ST monitoring functions are configurable on parameter-specific setup pages (see page 246).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13.

Standard ST monitoring

The 6-wire lead set monitors eight ECG leads, of which two are chest leads (V and V+). 12-lead ST analysis provides the most comprehensive view of a patient’s condition. However, with optimal placement of the V and V+ leads and using only eight leads, you can achieve an ST analysis that is almost as comprehensive but with fewer electrodes.

TruST 12-lead monitoring

This feature offers real-time assessment of 12 ST segment deviations, with only six electrodes, which provide eight measured ECG leads and four derived chest leads. The derived leads are identified by adding the letter ‘d’ before the lead label. When TruST monitoring is activated, the V- lead defaults to V2 and the V+ lead defaults to V5. Although you can select derived leads for display, they are excluded from arrhythmia and QRS processing.

ECG and ST reports contain the label ’d’ to identify a derived lead.

NOTE

ST values and complexes of derived leads will be missing after discharging and entering the bedside with TruST turned on, and when ECG cable type is not set to ***Auto***. You can either set the cable type to ***Auto*** or unplug the ECG cable.

12-lead ST monitoring

During 12-lead ST monitoring, the M540 acquires 12 ST leads in addition to the following:

– ST Vector Magnitude (STVM) – the magnitude (mm or mV) of the ST vector. It is a summary vector, combining the ST values from all 12 leads. STVM is trended and has its own alarm limits.

– ST Change in Vector Magnitude (STCVM) – the change of magnitude (mm or mV) between the current ST vector and the ST vector at the time of the last reference. STCVM values also show a change in the location of the ST vector over time.

To activate or deactivate ST monitoring

You can activate/deactivate ST monitoring at any time as follows:

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1. Select ***Sensor parameters...*** from the main menu bar.
2. Select the ***ECG*** tab to access the ***ECG*** page.
3. Select the ***ST settings*** tab.
4. Select ***On*** or ***Off*** next to ***ST monitoring***.

Connecting lead sets for ST monitoring

ST monitoring uses the following lead configurations for each available ST monitoring mode:

– Standard ST monitoring – uses the standard 3-5-, and 6-wire lead sets. For more information see the diagrams starting on page 218.

– TruST – provides 12-lead ST monitoring with a 6-wire lead set (see page 211).
– 12-lead ST monitoring – uses the standard 12-lead ECG configuration with a 6-wire lead set plus a 4-wire lead set (see page 211).

ST display

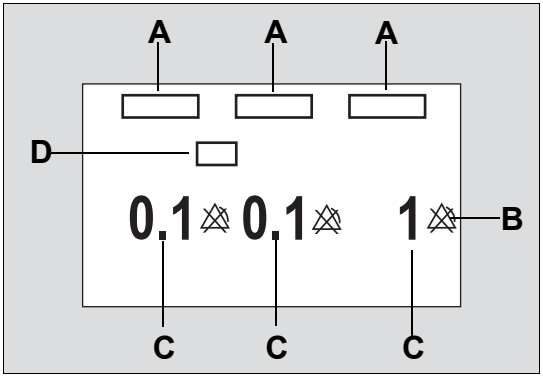
When ST alarms are activated, the Cockpit alarms for all ST leads whether they are displayed or not. In either case, the ST parameter field flashes and the alarming lead is identified in the header bar.

When ST monitoring is activated, current ST values display in a separate parameter field below the heart rate parameter field.

NOTE
The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The ST parameter field contains the following elements:



A Selected ST lead labels

B Upper/lower alarm limits or crossed triangle symbol when alarms are deactivated

C Selected ST deviation values

D Units of measure – can be activated/deactivated

Reviewing ST complexes

You can view all ST complexes or zoom in on a single complex.

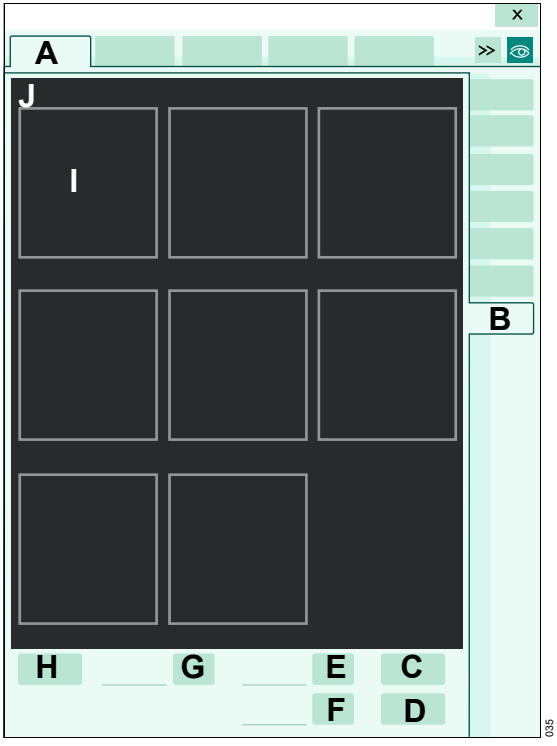
The following functions are available in either view:

– Changing the isoelectric point
– Changing the ST measuring point
– Relearning the QRS morphology
– Saving a reference complex
– Requesting an ST report

In all trends, a solid white vertical line on the ST graphical trends marks changes in ST measuring points along with a time stamp.

Reviewing all ST complexes

The following diagram shows the ***ST complex*** page. The number of displayed ST complexes depends on the connected lead set.



A ***ECG*** tab

B ***ST complex*** tab

C ***Save reference*** button

D ***Print*** button for generating an ST report

E ***ST*** button

F ***Reference*** on/off button

G ***ISO*** button

H ***Relearn*** button

I ST panels for each monitored ST lead (including waveform scale, ST measuring point, isoelectric point, and reference point)

J ST label (unique for each ST lead)

To access ST complexes

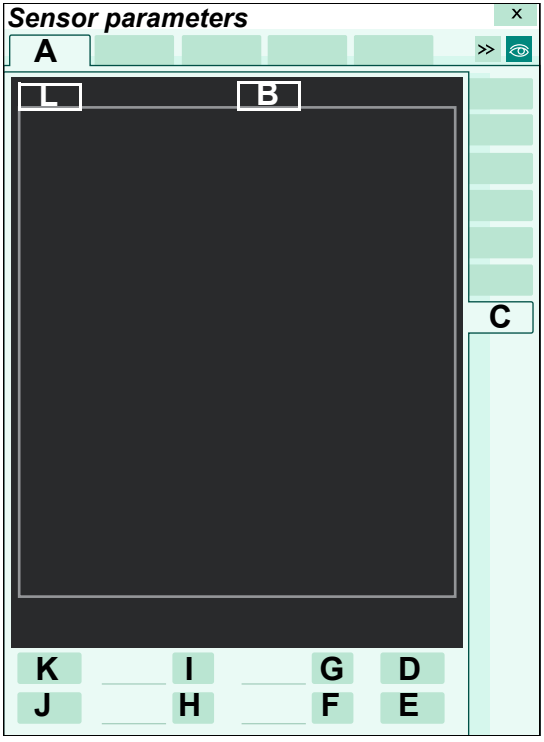
- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1. Select ***Sensor parameters...*** from the main menu bar.
2. Select the ***ECG*** tab to access the ***ECG*** page.
3. Select the ***ECG*** tab (if not already selected).
4. Select the ***ST complex*** tab (if not already selected).

Zooming in on an ST complex

The following diagram shows a single ST complex screen when you zoom in on one ST complex. To zoom in on a single ST complex, select an ST panel on the ***ST complex*** page (see page 242).



A ***ECG*** tab

B Waveform scale

C ***ST complex*** tab

D ***Save reference*** button – saves the displayed ST complex as a reference point

E ***Print*** button for printing an ST report

F ***Reference*** on/off button

G ***ST*** button

H ***Lead*** button for selecting the desired lead

I ***ISO*** button

J ***Show all*** button – accesses the general ST complexes screen

K ***Relearn*** button (see page 248)

L ST label (unique for each ST lead)

ST measuring points

You can change the ST measuring points and isoelectric point from the general or from the single ST complexes page (see figures on page 242). In both pages, the setup buttons for changing the measuring points are located at the bottom of the screen. Changing the measuring point of one complex adjusts the measuring points for all ST complexes.

Adjusting ST measuring points

Whenever you adjust the isoelectric and ST measuring points, the ST deviation is recomputed. During this computation, the changing ST deviation values appear yellow. The values appear green when the computation is completed.

To change ST measuring points

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1. Select ***Sensor parameters...*** from the main menu bar.
2. Select the ***ECG*** tab to access the ***ECG*** page.
3. Select the ***ST complex*** tab (B) to display the general ***ST complex*** page.
4. Select an individual ST panel to zoom in on a single ST complex.
5. Select the ***ISO*** button (I) and use the rotary knob to dial to the desired setting.
6. Select the ***ST*** button (G) and use the rotary knob to adjust the ST measuring point.

ST reference

You can save ST reference complexes as reference points for future ST deviation measurement comparisons. The first time you relearn QRS complexes, the current ST data are saved as a reference data. The original ST reference data are updated each time you save ST references.

Saving ST reference points

You can save the ST reference from the general ST complexes page (see page 242) and the single ST complex page (see page 242). Saving a reference point in either screen, saves all currently displayed ST complexes as reference points.

To save ST reference points

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***ECG*** tab to access the ***ECG*** page.

3 Select the ***ST complex*** tab to display the general ***ST complex*** page.

4 Select an individual ST panel to zoom in on a single ST complex.

5 Select the ***ISO*** and ***ST*** buttons at the bottom of the screen and use the rotary knob to dial the desired values. Click on the rotary knob to accept the new values.

6 Select the ***Save reference*** button (in either ST complex page).

ST alarm settings

The ***ST alarms*** page allows you to configure the following ST-specific alarm settings:

– Activating or deactivating individual ST alarms

– Setting upper and lower ST alarm limits

– Configuring the alarm archive function

– Auto setting all ST limits

For more detailed information on how to configure these functions, see "Alarm setup for ST" on page 144.

To access the *ST alarms* page

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***ECG*** tab to access the ***ECG*** page.

3 Select the ***ST alarms*** tab to display the ***ST alarms*** page.

Accessing the ST settings

- Select the heart rate parameter field to select the ***ECG*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***ECG*** tab to access the ***ECG*** page.

3 Select the ***ST settings*** tab.

ST setup functions

All ST setup functions take place in the ***ST settings*** page.

Selection	Available settings	Description
ST monitoring *Not available in neonatal mode*	– ***On*** (default) – ***Off***	Activates/deactivates ST monitoring and determines whether an ST parameter field is displayed and ST parameters are trended.
TruST 12-lead *(Not selectable in neonatal mode. TruST is only available when a 6-wire lead set is connected)*	– ***On –*** TruST monitoring is available – ***Off*** (default) – TruST monitoring is not available	Determines whether TruST monitoring is available (see page 232).
ST relearn *(not available if ECG is not connected, in neonatal mode, or ST monitoring is disabled)*	None	Purges stored average ST complexes, blanks displayed average ST complexes, and learns the arrhythmia and dominant QRS pattern.

Selection	Available settings	Description
ST lead1 ***ST lead2*** ***ST lead3***	– Three electrodes: ***STI***, ***STII***, ***STIII*** – Five electrodes: ***STI***, ***STII***, ***STIII***, ***STaVR***, ***STaVL***, ***STaVF***, ***STV*** – Six electrodes: ***STI***, ***STII***, ***STIII***, ***STaVR***, ***STaVL***, ***STaVF***, ***STV***, ***STV+*** – Six electrodes (with TruST activated): ***STI***, ***STII***, ***STIII***, ***STaVR***, ***STaVL***, ***STaVF***, ***STdV1***, ***STV2***, ***STdV3***, ***STdV4***, ***STV5***, ***STdV6*** – Ten electrodes: ***STI***, ***STII***, ***STIII***, ***STaVR***, ***STaVL***, ***STaVF***, ***STV1***, ***STV2***, ***STV3***, ***STV4***, ***STV5***, ***STV6***, ***STCVM***, and ***STVM*** – Default for ST lead1: ***STI*** – Default for ST lead2: ***STaVL*** – Default for ST lead3: ***STV*** (with TruST and a 10-wire lead sets, the default is: ***STV2***)	Selects an ST lead for analysis and display.
Event duration [s]	***Off***, 15, 30, 45, 60 (default) seconds	Defines a period an alarm condition must persist, before alarm signals are generated.
ST Mini Trend	– Three electrodes: ***STI***, ***STII***, ***STIII*** – Five electrodes: ***STI***, ***STII***, ***STIII***, ***STaVR***, ***STaVL***, ***STaVF***, ***STV*** – Six electrodes: ***STI***, ***STII***, ***STIII***, ***STaVR***, ***STaVL***, ***STaVF***, ***STV***, ***STV+*** – Six electrodes (with TruST activated): ***STI***, ***STII***, ***STIII***, ***STaVR***, ***STaVL***, ***STaVF***, ***STdV1***, ***STV2***, ***STdV3***, ***STdV4***, ***STV5***, ***STdV6*** – Ten electrodes: ***STI***, ***STII***, ***STIII***, ***STaVR***, ***STaVL***, ***STaVF***, ***STV1***, ***STV2***, ***STV3***, ***STV4***, ***STV5***, ***STV6***, ***STCVM***, and ***STVM*** – Default: ***STII***	Selects an ST lead for inclusion in the ST mini-trend display.

Learning/relearning QRS pattern

The M540 creates a reference template by learning the dominant QRS pattern of a patient. The reference template is stored for reference and all subsequent beats and rhythms are compared against it and classified either as normal or irregular.

The M540 can only learn the QRS pattern of the leads that are selected for arrhythmia processing. If only one lead is available, the M540 only learns on one lead. If no lead set is connected, the M540 cannot perform a learning phase. In this case, an error message is displayed.

The M540 starts a learning phase automatically when:

– Exiting discharge or standby

– ***Patient category*** is changed to ***Adult*** or ***Pediatric***

– Arrhythmia monitoring is activated

NOTE
During the learning phase, only ASY and VF arrhythmia events are reported.

– A different arrhythmia mode is selected

– Different ECG leads are selected for arrhythmia processing

NOTE
The relearn is initiated only on the available assigned lead(s).

– The ARR processing setting is changed from ***ECG1*** to ***ECG1&2***, if the leads selected for processing are available

– The ***ARR lead 1*** setting is changed to an available lead

– The ***ARR lead 2*** setting is changed to an available lead, if the ARR processing setting is ***ECG1&2***

– A lead-off condition of a processed lead is resolved

– The neutral lead is changed

– A lead set is physically connected, if that lead set provides the neutral or processed lead(s)

– The cable type is changed

– The OR alarms setting is changed

– The M540 is docked in an IACS configuration whose profile has a different ECG lead configuration

– A standalone M540 is docked on an M500 whose profile has a different ECG lead configuration

During the learning phase, which lasts approximately 30 to 40 seconds, a relearning message appears in the message field. In addition, the message ***LEARN*** appears in the ECG parameter field.

If ST monitoring is activated, ST deviations are also recomputed during the learning phase.

Manual relearning

Relearn the QRS pattern of a patient when:

– Leads are reconnected or electrodes are repositioned

– Eight hours have passed since the last learning phase

– Questionable ARR calls appear on the ECG

– Other significant changes appear on the ECG

You can initiate a relearning phase from the arrhythmia and the ST pages.

To relearn from the arrhythmia setup page

- Select the heart rate parameter field to select the ***ECG*** page.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***ECG*** tab to access the ***ECG*** page.

3 Select the ***ARR settings*** tab.

4 Select ***Relearn***.

NOTE

If configured to appear on the main menu bar, a ***Relearn ARR*** button is accessible on the main menu bar. For more information, see page 465.

To relearn from the ST page

- Select the heart rate parameter field to select the ***ECG*** page.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***ECG*** tab to access the ***ECG*** page.

3 Select the ***ST settings*** tab.

4 Select ***Relearn***.

NOTE

If configured to appear on the main menu bar, a ***Relearn ST*** button is accessible on the main menu bar. For more information, see page 465.

This page has been left blank intentionally.

Impedance respiratory rate (RRi)

Overview of respiration monitoring

The M540 measures respiratory rate derived from impedance measurement by passing a harmless high-frequency current between two ECG electrodes on the patient's chest. Electrical resistance (impedance) between the electrodes varies with the expansion and contraction of the chest during inspiration and expiration. The M540 displays a respiration waveform and respiratory rate value from these impedance changes and relays this information to the Cockpit for display.

The M540 uses ECG leads I or II regardless of the lead selected for 5-, 6-, and 12-lead configurations. ***RRi*** processing is dependent on the QRS processing lead for 3-lead configurations. ***RRi*** works only on leads I and II.

Respiration monitoring is for adult, pediatric, and neonatal patients. The M540 can use the respiration signal for central apnea monitoring.

Refer to the Instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 respiration functions. The respiration monitoring functions are configurable in the parameter-specific setup page (see page 260).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. Parameter-specific error messages are listed on page 538.

Supported parameter

RRi – respiratory rate measured by impedance (***RRi*** values are not displayed when the ESU filter is activated – see page 226).

NOTE

RRi and 12-lead ECG monitoring are unavailable when the M540 is in OR alarms and the ECG filter is set to ***Monitor***.

Respiration precautions

WARNING

The safety and effectiveness of the respiration measurement method in apnea detection, particularly the apnea of prematurity and apnea of infancy, has not been established.

WARNING

This device does not monitor obstructive apnea. Patients at risk for respiratory crises should be observed closely.

WARNING

Large amplitude pacemaker pulses (100 mV or greater) may interfere with the monitor's ability to measure or detect respiration.

WARNING

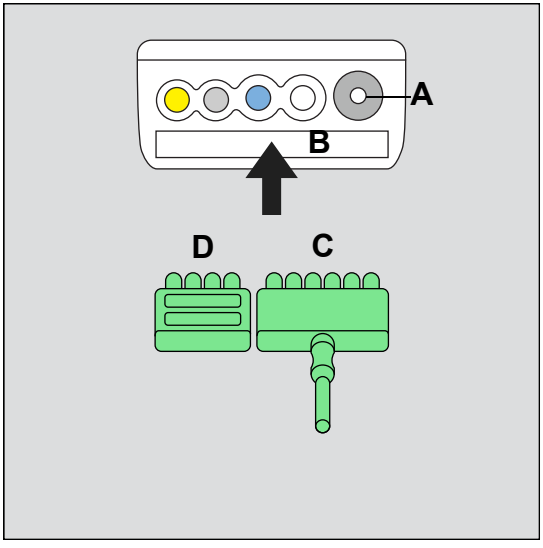
The monitor reports an apneic event when no breaths are detected within the established apnea alarm time period. Therefore, do not rely on *RRi* monitoring as the sole method for detecting cessation of breathing. Dräger recommends the monitoring of additional parameters that indicate the patient's oxygenation status, such as etCO2 and SpO_2. Heart rate limit alarms should also be enabled and set appropriately.

WARNING

***RRi* and pacer detection are inoperative when the ESU filter is selected. Refer to "Electrosurgery" on page 19 for general safety precautions.**

Connecting the 3-, 5-, 6-wire lead sets for respiration monitoring

The following diagram shows how to attach the lead sets to the M540:



A Non-invasive blood pressure hose connector

B M540 ECG port

C Lead set

D Port cover

To connect the ECG lead sets

1 Insert the 3-, 5-, or 6-wire lead set (C) into the ECG port (B) on the side of the M540 that is closest to the non-invasive blood pressure connector (A).

Orient the ECG adapter cable lead set (C) so the exposed pins face towards you as you push it firmly into the ECG port.

NOTE

An ECG lead set can rest in the ECG port of the M540 without actually being connected. Make sure that all ECG lead sets are pushed firmly into the ECG port of the M540.

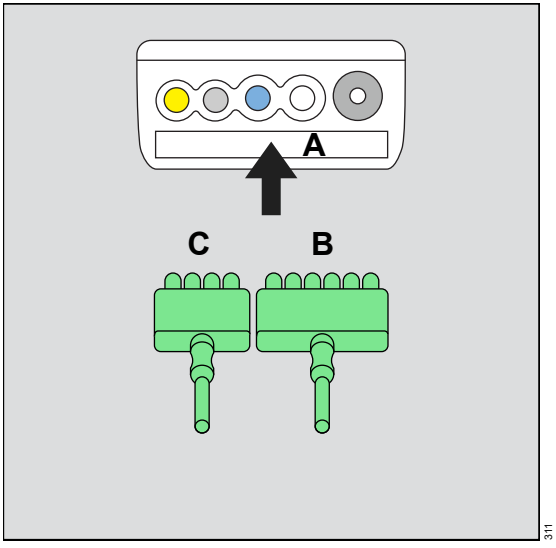
Almost every MonoLead features a number on the lead set indicating how many leads connect. When connecting a MonoLead, make sure the number faces in the same direction as the M540 display.

2 Insert the port cover (D) to protect the unused ECG lead pins.

3 Connect the lead wires to the patient. For information on applying the electrodes to the patient, refer to the figures starting on page 218.

Connecting the lead sets for 12-lead monitoring

The ECG lead sets connect directly to the M540.



A M540 ECG port

B 6-wire lead set

C 4-wire lead set

To connect the ECG lead sets

1 Insert the 4-wire lead set (B) and the 6-wire lead set (C) into the ECG port (A) on the side of the M540.

Orient the ECG adapter cable lead sets (B and C) so the exposed pins face towards you as you push it firmly into the ECG port.

NOTE

An ECG lead set can rest in the ECG port of the M540 without actually being connected. Make sure that all ECG lead sets are pushed firmly into the ECG port of the M540.

Almost every MonoLead features a number on the lead set indicating how many leads connect. When connecting a MonoLead, make sure the number faces in the same direction as the M540 display.

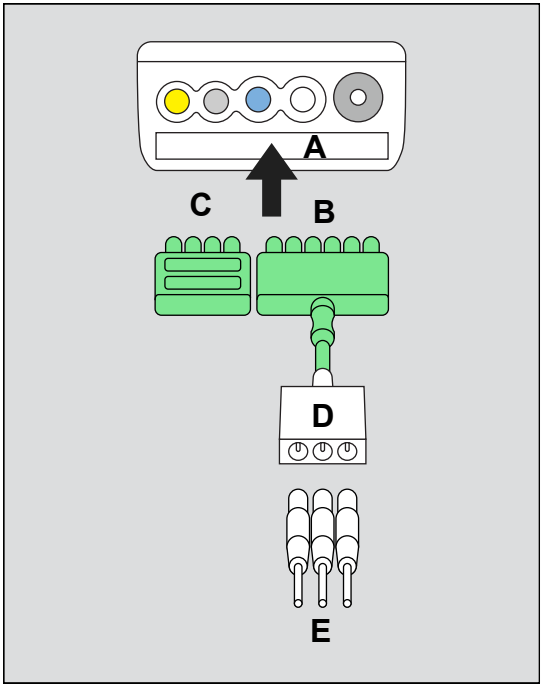
2 Connect the lead wires to the patient. For information on applying the electrodes to the patient, refer to the figures starting on page 218.

NOTE

When using a 12-lead ECG where the lead wires are coiled, it is recommended that the 6-wire lead set is coiled in the same direction as the 4-wire lead set to prevent artifact. For example, both lead sets are either coiled towards the patient or away from the patient.

Connecting the lead wires for neonatal monitoring

The ECG lead sets connect directly to the M540.



A ECG connector on the M540

B ECG adapter cable

C Port cover

D Neonatal ECG adapter cable

E Neonatal ECG lead wires

To connect the ECG lead set

1 Insert the ECG adapter cable (B) into the recessed ECG connector (A) on the side of the M540.

Orient the neonatal ECG adapter cable (B) so the exposed pins face towards you as you push them firmly into the ECG channel.

NOTE

An ECG lead set can rest in the ECG port of the M540 without actually being connected. Make sure that all lead sets are pushed firmly into the ECG port of the M540.

2 Insert the port cover (C) to protect the unused ECG lead pins on the M540.

3 Connect the individual neonatal ECG lead wires (E) to the neonatal ECG adapter cable (D).

For information on applying the electrodes to the patient, refer to the figures starting on page 218.

Patient preparation for respiration monitoring

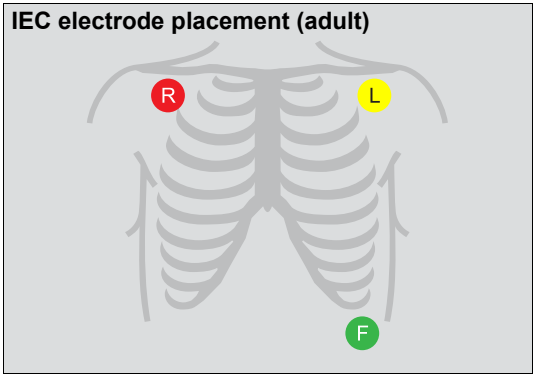
The following tips regarding skin preparation and proper electrode placement provide strong signals with minimal artifact but must never replace hospital-approved practices or manufacturer's recommendations. Because ECG electrodes are used for respiration monitoring, see the figures starting on page 211 for information on electrode placement.

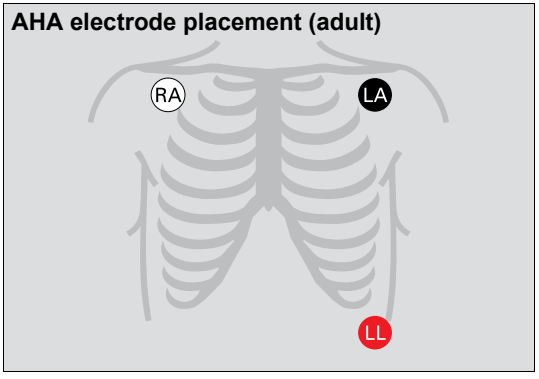
Follow the same precautions for respiratory monitoring as for ECG monitoring (see page 211) and observe the following general recommendations:

– Place the electrodes so they generate the clearest possible signals with minimal artifact.

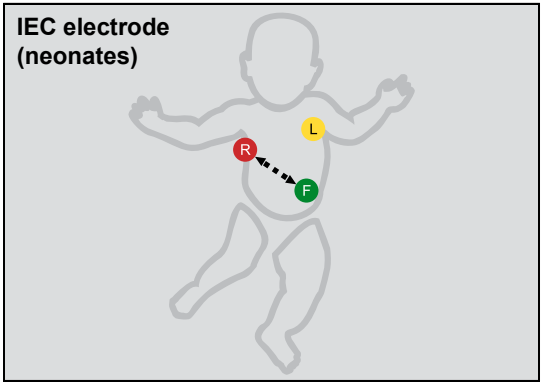
– Electrodes that adhere tightly and have a large conductive area provide the best results. Use a 5-wire lead set to improve the respiration signal (where the N electrode for IEC or RL electrode for AHA is the neutral electrode).

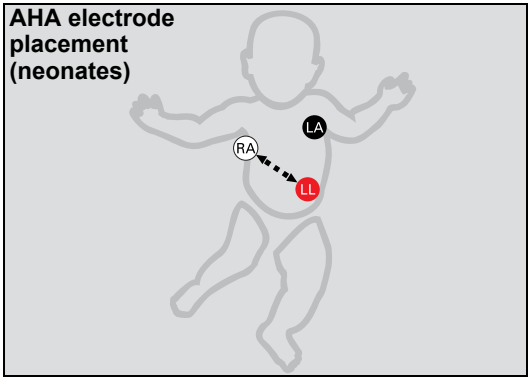
– For adult and pediatric patients, position the electrodes to span the maximum expansion and contraction of the lungs. This is especially important in the case of deep abdominal breathers.





– For neonates, place the RA and LA electrodes at the midaxillary line. Position the LL electrode below the diaphragm and umbilicus. Avoid the liver area and ventricles of the heart to prevent blood flow artifact.





Respiration display

On the Cockpit, the respiration display consists of:

– Respiration parameter field

– Respiration waveform

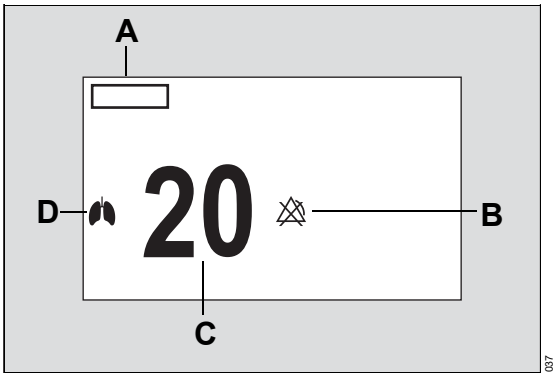
Respiration parameter field

NOTE

The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The respiration parameter field contains the following elements:



A Label for respiratory rate derived from impedance measurement (RRi)

B Upper/lower alarm limits or crossed triangle symbols when alarms are deactivated

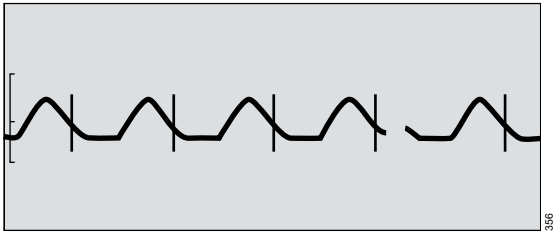
C Respiratory rate value

D Lung symbol that blinks with each detected breath

Breath markers

Breath markers indicate the time of breath detection, not the beginning, or end of respiration. If breath markers also appear during artifact, set the respiration measuring mode to manual and adjust the breath detection threshold so only valid breaths are counted.

The following diagram shows how white vertical markers on the respiration waveform can identify each detected breath.



Breath markers are not sent to the Infinity network.

To activate or deactivate the display of breath markers, see page 260.

Activating the breath marker

- Select the respiration parameter field to select the ***Resp.*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***Resp.*** tab to access the ***Resp.*** page.

3 Select the ***Settings 1*** tab (if not already selected).

4 Select ***On*** next to ***Resp. marker***.

Respiration measuring modes

The following respiration measuring modes are available:

– ***Auto*** (default) – appropriate for patients with regular breathing patterns. It uses the optimal breath-detection threshold calculated at the beginning of respiration monitoring.

– ***Manual*** – appropriate for adult or pediatric patients whose breathing patterns show excessive variation. Also appropriate for neonates with irregular breathing rhythms whose respiration signals may otherwise not be reliably evaluated.The M540 does not set a breath-detection threshold at the beginning of respiration monitoring. Instead, adjustments made alter the breath detection sensitivity of the monitor. When manual mode is selected, a vertically centered respiration threshold bracket is displayed on the waveform to indicate the threshold at which a breath is detected.

– To select the desired respiration mode, see page 261.

WARNING

If the respiration waveform size is set too low in manual mode, shallow breaths may not be counted. If it is set too high, cardiac artifact will be counted as breaths. Therefore, use the breath marker to verify breath detection at the desired amplitude.

NOTE

In manual mode, when the detection threshold exceeds in amplitude the waveform channel, only the vertical bracket is displayed.

Accessing the respiration settings

- Select the respiration parameter field to select the ***Resp.*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***Resp.*** tab to access the ***Resp.*** page.

  If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

3 Select the ***Settings 1*** and ***Settings 2*** tabs.

  The top portion of the ***Settings 1*** page contains the ***Auto set*** and ***Alarm*** buttons for configuring the alarm functions. For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

Respiration parameter setup functions

All respiration setup functions take place in the ***Resp.*** page.

Selection	Available settings	Description
	Settings 1 page	
RRi apnea time [s]	***Off***, 10, 15 (default), 20, 25, 30 seconds	Determines how long an apnea has to last before an alarm is triggered.
Apnea archive	– ***Off*** – ***Str./ Rec.*** – a recording and an event storage is triggered automatically in response to an apnea. – ***Store*** (default) – a waveform segment is stored in response to an apnea. – ***Record*** – a recording is triggered automatically in response to an apnea.	Determines what happens in response to an apnea. In case of false apnea alarms, it is advised to observe the patient's breathing pattern (belly or chest), and reposition electrodes accordingly, or to adjust the detection threshold manually.
Relearn	None	Initiates a relearning of the respiration signal, only in Auto mode.
Resp. lead	I, II (default)	Selects the lead for respiration monitoring.

Selection	Available settings	Description
Resp. marker	– ***On*** – ***Off*** (default)	Superimposes a vertical line on the respiration waveform when a breath is detected (see page 258).
Resp. monitoring	– ***On*** (default in neonatal mode) – ***Off*** (default in adult/pediatric mode)	Activates/deactivates respiration monitoring.
Size [%]	10% to 100% (in 10% increments) – default: 50%	Adjusts the waveform size.
Color	Red, green, blue, yellow, light blue, purple, orange, white (default).	Determines the color of the waveforms, parameter labels, and values.
Settings 2 page		
Coincidence detect	– ***On*** – ***Off*** (default)	Determines whether or not you are alerted when the respiratory rate is within 20% of the heart rate, which is an indication that the M540 is counting heart beats as respiration.
Mode	***Auto*** (default), ***Manual*** (see page 259 for more details).	Determines the processing mode for the breath-related impedance change.
Resp. threshold	10% to 100% (in 10% increments) – default: 50%	Adjusts the breath detection threshold.

In case of false apnea alarms, it is advised to observe the patient's breathing pattern (belly or chest), and reposition electrodes accordingly, or to adjust the detection threshold manually.

This page has been left blank intentionally.

SpO2 and Pulse CO-Ox monitoring with Masimo SET MCable

Overview of SpO2 and Pulse CO-Ox monitoring

SpO2 and Pulse CO-Ox monitoring is only possible with the corresponding MCable. The following hardware is available from Masimo for monitoring SpO2 and Pulse CO-Ox parameters.

– **Infinity MCable – Masimo SET** (Masimo SET MCable)
– **Infinity MCable – Masimo rainbow SET** (Masimo rainbow SET MCable)

The values and the waveform are displayed on the M540 and on the Cockpit.

The Masimo SET MCable and Masimo rainbow SET MCable support motion tolerant pulse oximetry using Signal Extraction Technology (SET). This technology enhances the quality of SpO2 monitoring and also measures the percentage of functional hemoglobin saturated with oxygen (%SpO2) in the arterial blood of the patient accurately and effectively.

A sensor applied to the patient measures the absorption levels of red and infrared light. The Masimo SET MCable or Masimo rainbow SET MCable uses the difference between the two measurements to calculate the percentage of saturated hemoglobin (SpO2). Because light absorption varies with blood volume and blood volume varies with pulse rate, both types of Masimo SET MCable can also derive a pulse rate (PLS*).

In addition, the Masimo SET MCable also provides a perfusion index (PI) value. PI is the ratio of the pulsatile blood flow to the non-pulsatile blood flow in peripheral tissue. The PI value provides information regarding the perfusion status of the selected application site. This provides a means to select the most optimal site.

The Infinity MCable – Masimo rainbow SET measures additional parameters that continuously and non-invasively measure blood constituents.

SpO2 and Pulse CO-Ox measurements are for adult, pediatric, and neonatal patients (with the following exceptions).

NOTE
The Masimo rainbow SET MCable parameters SpHb and SpOC are not approved for neonatal monitoring.

NOTE
Information about wavelength range may be useful during photodynamic therapy. For details, see the technical data chapter of the instructions for use *Infinity Acute Care System – Infinity M540*.

Refer to the instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 SpO2 functions. The SpO2 monitoring functions are configurable in the parameter-specific setup page (see page 276).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. Parameter-specific error messages are listed on page 541.

NOTE
This device is covered under one or more of the following USA patents: 5,758,644, 6,011,986, 6,699,194, 7,214,986, 7,254,433, 7,530,955 and other applicable patents listed at: www.masimo.com/patents.htm

Supported parameters

The parameters SpO2, PLS*, and PI are available and displayed regardless of which Masimo sensor and which Masimo SET MCable is being used.

The availability of additional Masimo rainbow SET parameters depends on the sensor type that is connected and which parameters are activated on the Masimo rainbow SET MCable.

Standard parameter set

The Infinity MCable – Masimo SET and the Masimo rainbow SET MCable always support the following parameters:

– Functional oxygen saturation (SpO2). The unit of measurement is%.

– Pulse rate (PLS*). The unit of measurement is beats/min.

– Perfusion index (PI) which indicates the arterial pulse signal strength. The measurement is 0-1.

Expanded parameter set

In addition to the above standard parameters, the Masimo rainbow SET MCable provides the following additional optional parameters:

– Total hemoglobin (SpHb) measures the total hemoglobin levels in arterial or venous blood. The unit of measurement is selectable (see page 486).

– Total oxygen content (SpOC) measures the total blood oxygen content; this value is calculated from the SpHb and the SpO2 values. The unit of measurement is mL/dL.

– Pleth variability index (PVI) measures peripheral perfusion changes secondary to respiration or the PI amplitude over a respiration. PVI may be closely related to intrathoracic pressure changes, circulating blood volume and vascular tone. The unit of measurement is%.

– Carboxyhemoglobin saturation (SpCO) measures the amount of carbon monoxide that is bound to hemoglobin. The unit of measurement is%.

– Methemoglobin saturation (SpMet) measures the methemoglobin concentration in arterial blood. The unit of measurement is%.

Various sensors are available for the Masimo rainbow SET MCable. The availability of the parameters depends on the selected sensor type.

Each sensor provides certain parameters which must also be activated on the Masimo rainbow SET MCable.

– CO SpO2 sensor; this type of sensor provides the following parameters: SpO2, PLS*, PI, SpCO, SpMet, PVI.

– M-LNCS sensor; this type of sensor provides the following parameters: SpO2, PLS*, PI.

– Hb sensor; this type of sensor provides the following parameters: SpO2, PLS*, PI, SpHb, SpOC, SpMet, PVI.

NOTE

A color band on the Masimo rainbow SET MCable indicates which parameters are activated on the MCable. If an MCable does not have a label, the supported parameters are by default SpO2, PLS*, and PI.

The following figure shows the multi-color band which appears on the side of the Masimo rainbow SET MCable (see page 268 for more information).

If you connect a sensor but the parameter is not activated on the MCables, the parameter label appears in the parameter field without a value.

SpO2 and Pulse CO-Ox precautions

SpO2 monitoring is only possible with an SpO2 MCable.

Interfering substances: Carboxyhemoglobin may erroneously increase measurement values. The level of increase is approximately equal to the amount of carboxyhemoglobin present. Dyes, or any substance containing dyes that change arterial pigmentation, may cause erroneous measurement values.

WARNING

High oxygen levels may predispose a premature baby to retinopathy of prematurity. If this is a consideration do NOT set the high alarm limit to 100%, which is equivalent to switching the alarm off. Transcutaneous SpO_2 monitoring is recommended for premature babies receiving supplemental oxygen.

WARNING

An SpO_2 sensor should not be used as an apnea monitor.

WARNING

Use only Masimo-specified sensors. Other sensors may not provide adequate protection against defibrillation and may put the patient at risk.

WARNING

A Pulse CO-Oximeter should be considered an early warning device. If a trend towards patient hypoxemia is observed, blood samples should be analyzed by laboratory instruments to completely understand the condition of the patient.

WARNING

The pulsations from an intra-aortic balloon support can elevate the pulse rate. Verify the pulse rate of the patient against the heart rate.

WARNING

Elevated levels of methemoglobin (MetHb) may lead to inaccurate SpO2 and SpCO measurements.

Elevated levels of total bilirubin may lead to inaccurate SpO2, SpMet, SpCO, SpHb, and SpOC measurements.

Motion artifact may lead to inaccurate SpMet, SpCO, SpHb, and SpOC measurements.

Very low arterial oxygen saturation (SaO2) levels may cause inaccurate SpCO and SpMet measurements.

Hemoglobin synthesis disorders may cause erroneous SpHb readings.

WARNING

To reduce the hazard of burns during surgery, keep the sensor or transducer and their associated cables away from the surgical site, the electro-surgical unit return electrode, and earth ground.

WARNING

Inspect the application site every two to three hours to ensure skin quality and correct optical alignment. If the skin quality changes, move the sensor to another site. Change the application site at least every four hours. The misapplication of an SpO_2 sensor with excessive pressure for prolonged periods can induce pressure injury.

CAUTION

Do not immerse the sensor or patient cable in any liquid. Moisture may present a safety risk.

CAUTION

When using the maximum sensitivity setting, the performance of the sensor off detection may be compromised. If the device is in this setting and the sensor becomes dislodged from the patient, the potential for false readings may occur due to environmental 'noise' such as light, vibration and excessive air movement. In addition, when a sensor becomes detached from a patient, it will have compromised protection against erroneous pulse rate and arterial saturation readings.

NOTE

An **SpO2** sensor can be used during defibrillation, but the readings may be inaccurate for up to 20 seconds.

NOTE

Possession or purchase of the Masimo SET MCable or the Masimo rainbow SET MCable does not convey any expressed or implied license to use the device with unauthorized sensors or cables which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

NOTE

Purchase of this device confers no express or implied license under any Masimo patent to use this instrument with any oximetry sensor that is not manufactured or licensed by Masimo. For a list of approved sensors, see the instructions for use *Infinity Acute Care System – Accessories*.

NOTE

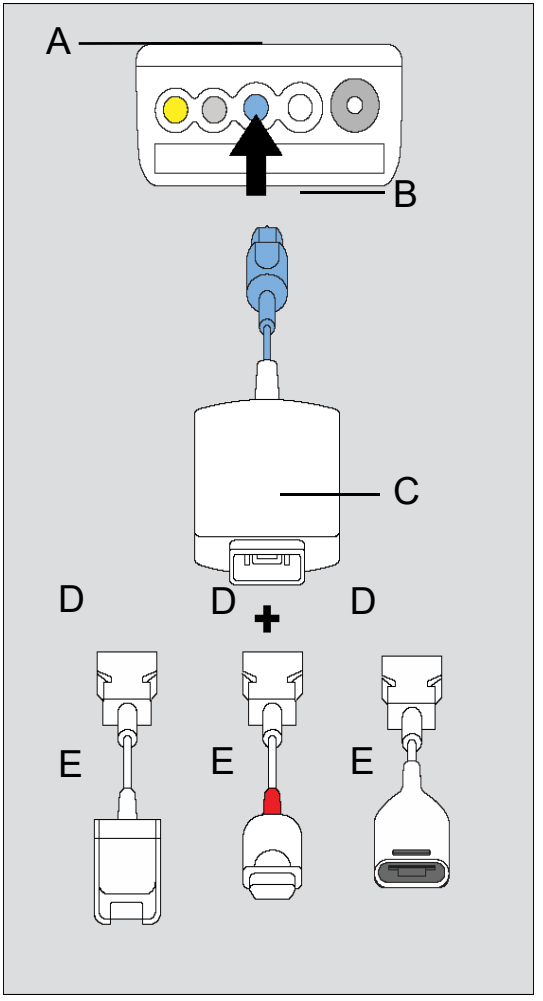
Do not use a functional tester to assess the accuracy of an **SpO2** sensor or an **SpO2** sensor monitor. Since SpO_2 sensor measurements are statistically distributed, only about two-thirds of those measurements can be expected to fall within $\pm A_{rms}$ of a CO-oximeter's measured value.

NOTE

A functional tester can be used to measure the total error of an **SpO2** sensor monitor if a particular calibration waveform has been independently demonstrated to be accurate for that system. The functional tester can then measure how accurately a particular **SpO2** sensor is in reproducing the calibration waveform.

Connecting the Masimo SET MCable

The Masimo SET MCable connects directly to the M540. The logo on the MCable identifies if you are using a Masimo rainbow SET or a Masimo SET MCable.



A SpO_2 port on the M540

B MCable connector

C MCable 14-pin connector

D Intermediate cable connector to MCable

E Connector for various sensors (3 options)

To connect the Masimo SET MCable

1. Attach the Masimo SET MCable connector (B) to the blue SpO_2 port (A) of the M540.
2. Attach the sensor intermediate cable (D) to the Masimo SET MCable 14-pin connector (C).
3. Attach the appropriate Masimosensor to the end of the sensor cable (E).

Connecting the Masimo rainbow SET MCable

The Masimo rainbow SET MCable connects directly to the M540. The logo on the MCable identifies if you are using a Masimo rainbow SET or a Masimo SET MCable.

A color band located on the side of the Masimo rainbow SET MCable indicates which parameters are activated.

– Fields appearing in color represent parameters that are already activated

– Fields with the letter 'X' denote parameters that are not activated

– Fields that appear empty denote parameters that might be activated later

A Masimo MCable can be mounted to the back of an M540 (see page 111).

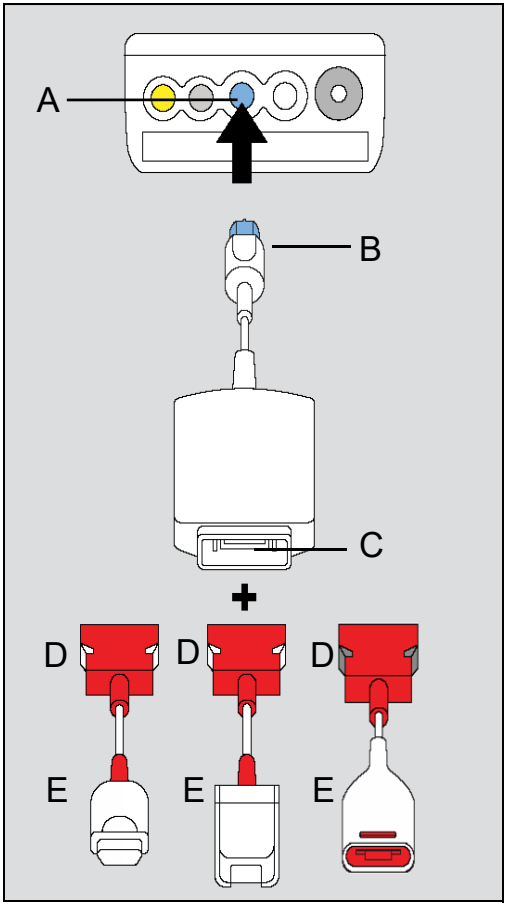
To connect the Masimo rainbow SET MCable

1 Attach the MCable connector (B) to the blue SpO_2 port (A) of the M540.

2 Attach the intermediate cable (D) to the 20-pin connector of the MCable (C).

3 Attach the appropriate Masimo sensor to the end of the intermediate cable (E).

For detailed information on which sensors support which parameters, refer to the supported parameter sections in the Instructions for use *Infinity Acute Care System – Monitoring Accessories*.



A SpO_2 port on the M540

B MCable connector

C MCable 20-pin connector

D Masimo rainbow SET intermediate cable connector to MCable

E Connector for various sensors (3 options)

Patient preparation

The following tips provide optimal SpO2 monitoring results but must never replace hospital-approved practices or manufacturer's recommendations.

The accuracy of SpO2 monitoring depends largely on the strength and quality of the SpO2 signal.

If a finger is used as a monitoring site, remove any nail polish. Cut the finger nails of the patient, if necessary.

The signal may vary due to the following conditions:

– Placement of a sensor that is too tight
– Patient experiences hypotension, severe vasoconstriction, severe anemia, or hypothermia
– Arterial occlusion proximal to the sensor
– Patient is in cardiac arrest or is in shock
– Bright light causing erratic measurement or missing values. Cover the sensor with opaque material if it is likely to be exposed to direct bright light.
– Significant levels of dysfunctional hemoglobins (HbCO or MetHb)
– Intravascular dyes such as indocyanine green or methylene blue
– Excessive patient movement
– Venous pulsations
– Placement of a sensor on an extremity with a blood pressure cuff, arterial catheter, or intravascular line

The maximum sensitivity mode for Masimo MCable is recommended for patients with low perfusion or when the low perfusion or low signal quality message is displayed on the screen in APOD or normal sensitivity mode. This mode is not recommended for care areas where patients are not monitored visually, such as general wards. It is designed to interpret and display data at the measuring site when the signal may be weak due to decreased perfusion.

The message ***SpO2 Low Perfusion*** appears when the monitor detects low amplitude arterial pulsations. In this case, do the following:

1 Check the patient and treat if necessary.

2 Move the sensor to a site that is more adequately perfused.

3 Select maximum sensitivity mode.

Applying the sensor

If you are using a reusable sensor, make sure it is clean before applying it to the patient.

NOTE

Only use Masimo sensors with the Masimo SET MCable and the Masimo rainbow SET MCable. Read the instructions provided with the sensor for optimal application techniques and for safety information. Never use damaged sensors.

Follow the recommendations of the manufacturer.

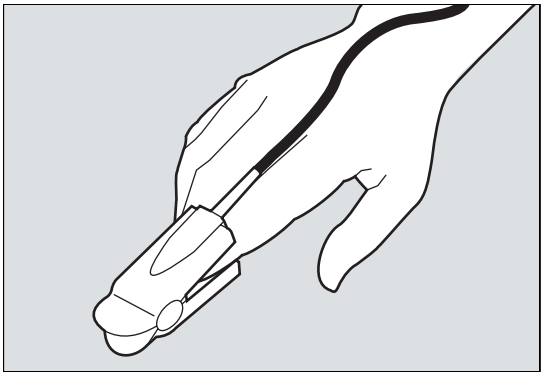
WARNING

Inspect the application site every two to three hours to ensure skin quality and correct optical alignment. If the skin quality changes, move the sensor to another site. Change the application site at least every four hours.

To apply the sensor

1 Select the size and type of sensor that is best suited for your patient. Follow the recommendations of the manufacturer.

2 Position the sensor correctly and attach it to your patient.



3 Connect the sensor to the Masimo SET MCable or the Masimo rainbow SET MCable.

NOTE

After connecting the sensor, if the sensor-LED does not light up:

– observe the monitor for any message and act accordingly, or
– replace the sensor.

SpO2 and Pulse CO-Ox display

On the Cockpit, the SpO2 display consists of:

– SpO2 parameter field
– A user-configurable Pulse CO-Ox parameter field when a Masimo rainbow SET MCable with additional parameters activated is connected.
– SpO2 pulse plethysmogram waveform

NOTE

The pulse plethysmogram waveform is directly proportional to the strength of the pulse amplitude.

The following table lists the maximum times the M540 requires to report the parameter values after connecting the sensor to the MCable.

Parameter	Maximum time
SpO2, PLS*, PI	Up to 35 s
SpMet, PVI, SpCO	Up to 60 s
SpHb, SpOC	Up to 90 s
PVI	Up to 150 s

Masimo SET MCable parameter field

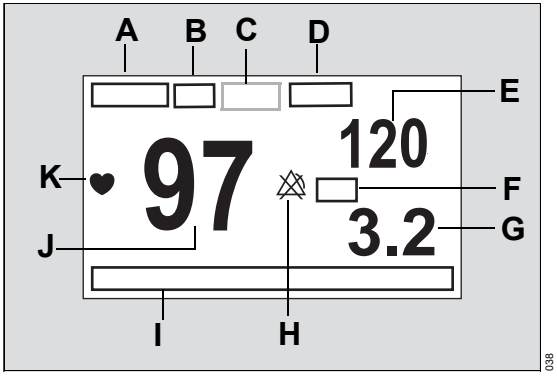
NOTE

The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

SpO2 parameter field (Masimo SET MCable)

The SpO2 parameter field contains the following elements:



A SpO2 label

B Units of measure – can be activated/deactivated

C Sensitivity mode indicator (see page 276)

D PLS* (pulse) label

E PLS* value

F Perfusion index label

G Perfusion index value

H Alarm off symbol when alarms are deactivated. When alarms are activated, the alarm limits are displayed instead.

NOTE

The alarm limits for SpO_2 are always visible at the Cockpit, the M540, the ICS, and on remote devices even if the setting ***Show alarm limits*** is deactivated (see page 473). For PLS the limits area in the parameter field appears blank.

If SpO_2 and/or PLS alarms are deactivated, the usual symbol appears next to the parameter label.

I Message area for SpO2 messages (see page 541)

J SpO2 saturation value

K SpO2 blip that pulsates with each detected pulse (only when the selected pulse tone source is SpO2 – see page 276).

Pulse CO-Ox parameter field (Masimo rainbow SET MCable)

The Pulse CO-Ox parameter field appears in addition to the regular SpO2 parameter field when a Masimo rainbow SET MCable is connected that supports parameters in addition to the standard parameter set (SpO2, PLS*, PI). The parameter content of the parameter field is configurable (see page 278).

The display of Pulse CO-Ox parameters (SpHb/SpHbv, SpOC, SpMet, PVI, SpCO) is affected by the following conditions:

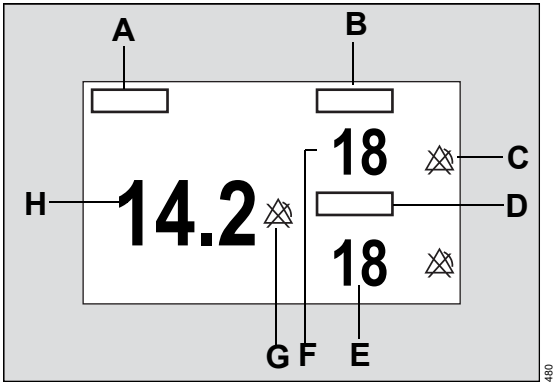
- Blanks appear instead of parameter values if a sensor is connected but the parameter is not activated on the MCable.
- Asterisks (***) replace the parameter values under the following circumstances:
  - A parameter is activated but an incompatible sensor is connected
  - A parameter is activated but no sensor is connected
  - A technical failure exists (for example, an unplugged sensor)

NOTE

The parameter SpHb changes to SpHbv (if ***Venous*** was selected for the blood source setting ***SpHb Cal*** – see page 281).

You can select up to three parameters to be displayed in the parameter field (see page 278). Units of measure appear next to the parameter label if applicable and can be activated/deactivated (see page 486).

The Pulse CO-Ox parameter field contains the following elements:



A Parameter 1 Pulse CO-Ox label

B Parameter 2 Pulse CO-Ox label

C Upper/lower alarm limits or crossed triangle symbols when alarms are deactivated (for the parameters SpOC and PVI there are no alarm limits)

D Parameter 3 Pulse CO-Ox label

E Parameter 3 Pulse CO-Ox value

F Parameter 2 Pulse CO-Ox value

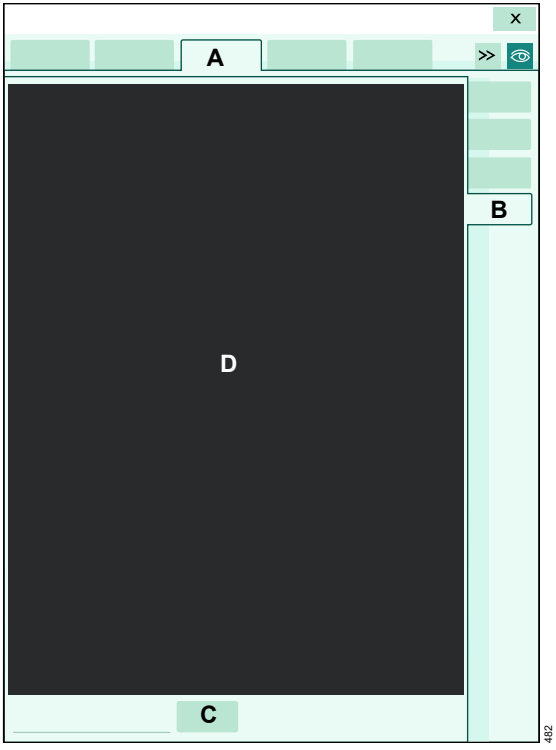
G Alarm off symbol when alarms are deactivated. When alarms are activated, the alarm limits are displayed instead.

H Parameter 1 Pulse CO-Ox value

Reviewing the SpO2 and Pulse CO-Ox parameters

When the Masimo rainbow SET MCable is connected, you can review the values and associated trends of the following parameters on one page.The mini-trend display is updated approximately every five seconds. If no Masimo rainbow SET parameter is activated on the Masimo rainbow SET MCable, only the parameter label but no trends appear.

The following diagram is an example of a ***Show all*** page.



A ***SpO2*** tab

B ***Show all*** sub tab

C ***Duration*** button to select the trend duration

D Display area showing parameter labels, values, trend scales, mini-trend and selected intervals.

To access the SpO2 and Pulse CO-Ox *Show all* screen

1 Select the CO-Ox parameter field to access the ***Pulse CO-Ox*** setup page directly.

or

Select ***Sensor parameters...*** from the main menu bar > ***SpO2*** horizontal tab to select the ***Pulse CO-Ox*** setup page.

2 Select the ***Show all*** tab.

Accessing the SpO2 settings

The following three setup pages are available for configuring Masimo SpO2 parameters:

– ***SpO2*** setup page for configuring general SpO2 parameters (Masimo rainbow SET MCable and Masimo SET MCable)

– ***Pulse CO-Ox*** setup page and the ***Setup*** page for configuring Masimo rainbow SET-specific settings.

To access the SpO2 Pulse CO-Ox pages

- Select the SpO2/Pulse CO-Ox parameter field to select the respective page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the horizontal ***SpO2*** / ***Pulse CO-Ox*** tab.

  If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

3 Select the horizontal ***SpO2*** tab to access the ***SpO2 page***.

  or

  Select the ***Pulse CO-Ox*** tab to access the Masimo rainbow SET-specific setup page

  or

  the vertical ***Setup*** tab > enter the password to access the password-protected setup pages for the Masimo rainbow SET parameters (see page 281).

The top portion of the setup pages contain the ***Auto set*** and ***Alarm*** buttons for configuring the alarm functions (no acoustic and optical alarm signals for PI and SpOC). For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

SpO2 parameter setup functions

General SpO2 setup functions take place in the ***SpO2*** page (see page 275).

Selection	Available settings	Description
Pulse tone volume	***Off***, 5%, 10% (default), 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%	Sets the volume of the pulse tone.
Tone source	– ***ECG*** (default) – ***SpO2***	Selects the source of the pulse tone which affects either the ECG or the SpO2 parameter field display (see page 271). For the SpO2 selection, the higher the pitch of the tone, the higher the SpO2 saturation percentage.
Waveform size [%]	10%, 20%, 30%, 40% (default), 50%, 60%, 70%, 80%, 90%, 100%	Sets the amplitude of the SpO2 waveforms. If the waveform height exceeds the display size of the channel, the waveform appears clipped (this does not affect the SpO2 signal processing).
FastSat mode	***On***, ***Off*** (default)	Allows rapid tracking of arterial oxygen saturation changes. When the ***Averaging time*** setting is set to 2 to 4s, the ***FastSat mode*** selection is grayed out.
Sensitivity mode	– ***Normal*** (default) – standard mode – ***APOD*** (adaptive probe off detection) – the least sensitive mode for detecting a reading on patients with low perfusion. Provides the best detection for detached sensors. This mode is useful for patients at particular risk for sensors becoming detached such as children or patients who are restless. – ***Max*** – provides maximum sensitivity for poor signals	Determines the level of detection sensitivity. The message ***APOD*** or ***Max*** appear in the SpO2 parameter field when the corresponding sensitivity setting is selected. When the setting ***Normal*** is selected, no message appears in the parameter field.

Selection	Available settings	Description
Averaging time	2 to 4, 4 to 6, 8 (default), 10, 12, 14, 16 s	Determines how quickly the reported SpO2 value responds to changes in the patient's oxygen saturation. A longer averaging time provides a more accurate result. However, in clinical situations where rapid physiological changes have to be monitored, use a shorter averaging time.
Color	Red, green, blue, yellow, light blue, purple, orange, white (default).	Determines the color of the waveforms and parameter labels and values.

NOTE

The password-protected alarm setting ***SpO2 sensor off*** provides additional SpO2 alarm configuration.

Masimo rainbow SET Pulse CO-Ox parameter setup functions

General Masimo rainbow SET SpO2 setup functions take place in the ***Pulse CO-Ox*** page. To access this setup page, see page 275. Additional password-protected functions are available (see page 281).

Selection	Available settings	Description
Show parameters (left button)	– ***SpHb*** [1] (default) – ***SpOC*** – ***PVI*** – ***SpCO*** – ***SpMet***	Selects the parameter for the parameter 1 location in the Pulse CO-Ox parameter field. The associated parameter label and value have the largest font. With an Hb sensor, the default parameter is SpHb. With a CO-sensor, the default parameter for the parameter 1 location in the parameter field changes automatically to ***SpCO***. Changes to the parameter selection are retained if the same sensor is disconnected and then reconnected. The parameter selection changes to the default selection, if another Masimo rainbow SET sensor type is connected.

[1] If the venous blood source was selected for ***SpHb Cal***, the parameter label changes from SpHb (arterial blood source) to SpHbv.

Selection	Available settings	Description
Show parameters (middle button)	– ***SpHb*** [1)] – ***SpOC*** (default) – ***PVI*** – ***SpCO*** – ***SpMet***	Selects the parameter for the parameter 2 location in the Pulse CO-Ox parameter field. With an Hb sensor, the default parameter is SpOC. With a CO-sensor, the default parameter for the parameter 2 location in the parameter field changes automatically to ***SpMet***. Changes to the parameter selection are retained if the same sensor is disconnected and then reconnected. The parameter selection changes to the default selection, if another Masimo rainbow SET sensor type is connected.
Show parameters (right button)	– ***SpHb*** [1)] – ***SpOC*** – ***PVI*** (default) – ***SpMet***	Selects the parameter for the parameter 3 location in the Pulse CO-Ox parameter field. ***PVI*** is the default parameter for the parameter 3 location in the parameter field for both CO and Hb sensors. Changes to the parameter selection are retained if the same sensor is disconnected and then reconnected. The parameter selection changes to the default selection, if another Masimo rainbow SET sensor type is connected.

[1)] Note: if the venous blood source was selected for ***SpHb Cal***, the parameter label changes from SpHb (arterial blood source) to SpHbv.

Selection	Available settings	Description
SpHb averaging time	For ***SpHb*** [1] the selections are: – ***Long*** – approximately 6 minutes – ***Medium*** (default) – approximately 3 minutes – ***Short*** – approximately 1 minute	Determines how responsive the monitor is to rapid physiological changes while tracking blood hemoglobin values. A longer averaging time provides a more accurate result. However, in clinical situations where rapid physiological changes have to be monitored, use a shorter averaging time.
Pulse CO-Ox mini trend	– ***SpHb*** [1] (default) – ***SpCO*** – ***SpOC*** – ***SpMet*** – ***PVI*** (***SpCO*** is the default when a CO sensor is used)	Selects the parameter to be included in the mini-trend display.
Color	Red, green, blue, yellow, light blue, purple, orange, white (default).	Determines the color of the parameter labels and values.
[1] if the venous blood source was selected for ***SpHb Cal***, the parameter label changes from SpHb (arterial blood source) to SpHbv.		

Password-protected Masimo rainbow SET setup functions

Additional Masimo rainbow SET setup functions take place in the ***Setup*** page which is protected by a clinical password. To access this setup page, see page 275.

Selection	Available settings	Description
SpHb Cal	– ***Arterial*** (default) – ***Venous***	Selects the blood sampling source which is used to calculate the SpHb value. The SpHb value changes to SpHbv when the ***SpHb Cal*** setting ***Venous*** is selected.
PVI averaging time	– ***Short*** – ***Long*** (default)	Determines how responsive the monitor is to rapid physiological changes while tracking pleth variability index. A longer averaging time provides a more accurate result. However, in clinical situations where rapid physiological changes have to be monitored, use a shorter averaging time.

This page has been left blank intentionally.

SpO2 and pulse rate with Nellcor OxiMax MCable

Overview of SpO2 monitoring

SpO2 monitoring is only possible with an SpO2 MCable.The M540 uses the Infinity MCable – Nellcor OxiMax (Nellcor OxiMax MCable) to measure the percentage of functional hemoglobin saturated with oxygen (%SpO2) and derive a pulse rate (PLS*) continuously. The values are displayed on the M540 and the Cockpit.

A sensor applied to the patient measures the absorption levels of red and infrared light. The Nellcor OxiMax MCable uses the difference between the two measurements to calculate the percentage of saturated hemoglobin (SpO2). Because light absorption varies with blood volume and blood volume varies with pulse rate, the Nellcor OxiMax MCable can also derive a pulse rate (PLS*).

SpO2 measurements are for adult, pediatric and neonatal patients.

NOTE

Information about wavelength range may be useful during photodynamic therapy. For details, see the technical data chapter of the Instructions for use *Infinity Acute Care System – Infinity M540*.

Refer to the Instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 SpO2 functions.

The SpO2 monitoring functions are configurable in the parameter-specific setup page (see page 290).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. Parameter-specific error messages are listed on page 541.

Supported parameters

– Saturation (SpO2)

– Pulse rate (PLS*)

NOTE

SpO_2 monitoring may be compromised by the patient’s condition such as low perfusion, low hematocrit level, high hemoglobin concentration, high CO, elevated levels of Bilirubin, and excessive motion.

SpO2 precautions

Interfering substances: Carboxyhemoglobin may erroneously increase measurement values. The level of increase is approximately equal to the amount of carboxyhemoglobin present. Dyes, or any substance containing dyes that change arterial pigmentation may cause erroneous measurement values.

WARNING

High oxygen levels may predispose a premature baby to retinopathy of prematurity. If this is a consideration do NOT set the high alarm limit to 100%, which is equivalent to switching the alarm off. Transcutaneous SpO2 monitoring is recommended for premature babies receiving supplemental oxygen.

WARNING

An SpO2 sensor should not be used as an apnea monitor.

WARNING

Use only Nellcor- **and Dräger-specified sensors. Other sensors may not provide adequate protection against defibrillation and may put the patient at risk.**

WARNING

An SpO2 sensor should be considered an early warning device. If a trend towards patient hypoxemia is observed, blood samples should be analyzed by laboratory instruments to completely understand the condition of the patient.

WARNING

The pulsations from an intra-aortic balloon support can elevate the pulse rate. Verify the pulse rate of the patient against the heart rate.

WARNING

To reduce the hazard of burns during surgery, keep the sensor or transducer and their associated cables away from the surgical site, the electro-surgical unit return electrode, and earth ground.

WARNING

Inspect the application site every two to three hours to ensure skin quality and correct optical alignment. If the skin quality changes, move the sensor to another site. Change the application site at least every four hours.

WARNING

Patient injury can occur if the oximeter is applied wrong or if it is subject to excessive pressure over a prolonged interval.

CAUTION

Do not immerse the sensor or patient cable in any liquid. Moisture may present a safety risk.

NOTE

An SpO2 sensor can be used during defibrillation, but the readings may be inaccurate for up to 20 seconds.

NOTE

Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized consumable products which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device and/or consumable products. For a list of approved sensors, see the Instructions for use *Infinity Acute Care System – Accessories*.

NOTE

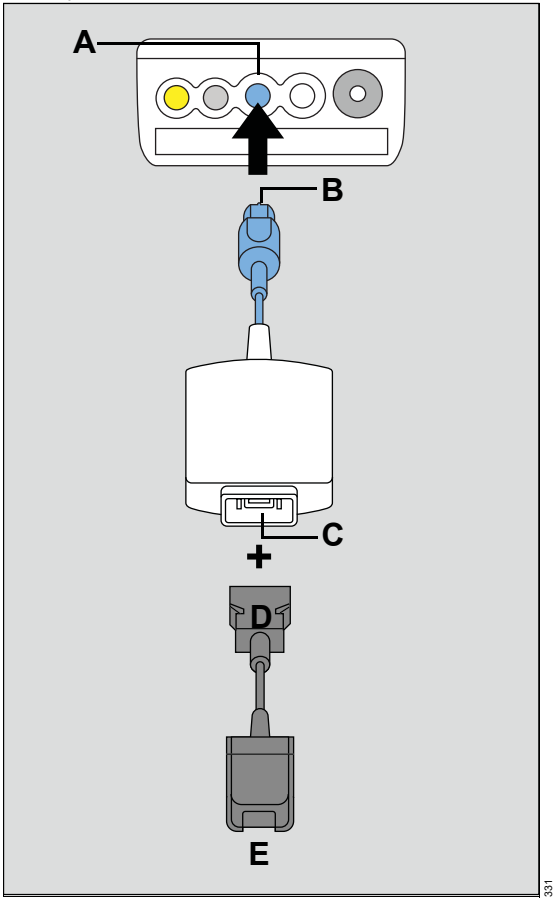
Do not use a functional tester to assess the accuracy of an SpO2 sensor or an SpO2 sensor monitor. Since SpO2 sensor measurements are statistically distributed, only about two-thirds of those measurements can be expected to fall within ±A rms of a CO-oximeter's measured value.

NOTE

A functional tester can be used to measure the total error of an SpO2 sensor monitor if a particular calibration waveform has been independently demonstrated to be accurate for that system. The functional tester can then measure how accurately a particular SpO2 sensor is in reproducing the calibration waveform.

Connecting the Nellcor OxiMax MCable

The Nellcor OxiMax MCable cable connects directly to the M540.



A SpO2 port on the M540

B MCable connector

C MCable 14-pin connector

D Intermediate cable connector to MCable

E Intermediate cable connector to sensor

To connect the Nellcor OxiMax MCable

1. Connect the Nellcor OxiMax MCable connector (B) to the blue SpO2 port (A) of the M540.
2. Attach the intermediate cable (D) to the connector of the Nellcor OxiMax MCable (C).
3. Attach the appropriate sensor cable to the end of the intermediate cable (E) – see page 288 for more information.

Patient preparation for SpO2 monitoring

The following tips provide optimal SpO2 monitoring results but must never replace hospital-approved practices or manufacturer's recommendations.

The accuracy of SpO2 monitoring depends largely on the strength and quality of the SpO2 signal.

If a finger is used as a monitoring site, remove any nail polish. Cut the finger nails of the patient, if necessary, for better sensor placement.

Pulses may be counted erroneously due to the following conditions:

– Placement of a sensor that is too tight
– Patient experiences hypotension, severe vasoconstriction, severe anemia, or hypothermia
– Arterial occlusion proximal to the sensor
– Patient is in cardiac arrest or is in shock
– Bright light causing erratic measurement or missing values. Cover the sensor with opaque material if it is likely to be exposed to direct bright light.
– Significant levels of dysfunctional hemoglobins (HbCO or MetHb)
– Intravascular dyes such as indocyanine green or methylene blue
– Excessive patient movement
– Venous pulsations
– Placement of a sensor on an extremity with a blood pressure cuff, arterial catheter, or intravascular line

Applying the sensor

If you are using a reusable sensor, make sure it is clean before applying it to the patient. Follow the recommendations of the manufacturer.

WARNING

Inspect the application site every two to three hours to ensure skin quality and correct optical alignment. If the skin quality changes, move the sensor to another site. Change the application site at least every four hours.

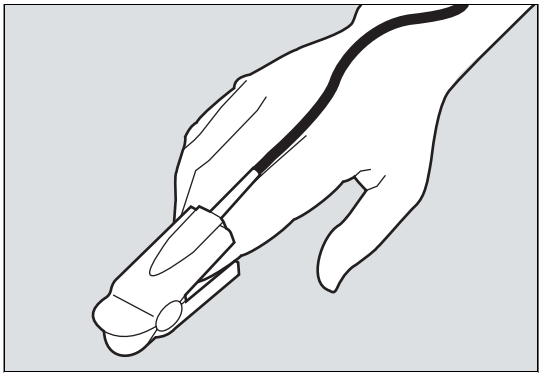
NOTE

Read the instructions provided with the sensor for optimal application techniques and for safety information. Never use damaged sensors. Doing so may compromise performance.

To apply the sensor

1 Select the size and type of sensor that is best suited for your patient. Follow the recommendations of the manufacturer.

2 Position the sensor correctly and attach it to your patient.



3 Connect the sensor to the Nellcor OxiMax MCable.

NOTE

After connecting the sensor, do the following if the sensor-LED does not light up:
– Observe the monitor for any message and act accordingly
– Replace the sensor.

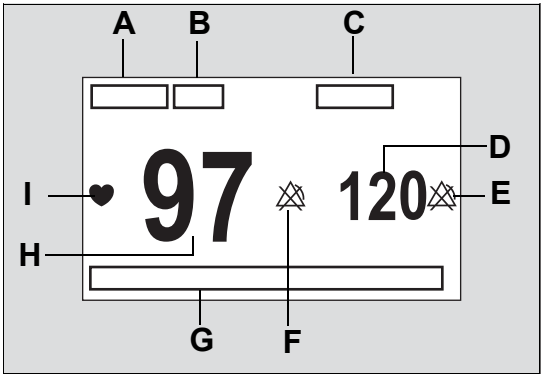
SpO2 display

On the Cockpit, the SpO2 display consists of:

– SpO2 parameter field

– SpO2 pulse plethysmogram waveform

SpO2 parameter field



The diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 284.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

NOTE

The pulse plethysmogram waveform is directly proportional to the strength of the pulse amplitude.

The SpO2 parameter field contains the following elements:

A SpO2 label

B Units of measure – can be activated/deactivated

C PLS* (pulse) label

D PLS* value

E Upper/lower alarm limits or crossed triangle symbols when alarms are deactivated

F Alarm off symbol when alarms are deactivated. When alarms are activated, the alarm limits are displayed instead.

NOTE

The alarm limits for SpO2 remain visible at the Cockpit, the M540, on the ICS, and on remote devices even though the ***Show alarm limits*** setting is deactivated (see page 473). For PLS, the limits area in the parameter field appears blank.

If SpO2 and/or PLS alarms are deactivated, the usual symbol appears next to the parameter label.

G Message area for SpO2 messages

H SpO2 saturation value

I SpO2 blip that pulsates with each detected pulse (only when the selected pulse tone source is SpO2 – see page 290).

Accessing the SpO2 settings

1 Select the SpO2 parameter field to select the ***SpO2*** page directly.

or

Select ***Sensor parameters...*** from the main menu bar.

2 If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

The top portion of the page contains the ***Auto set*** and ***Alarm*** buttons for configuring the alarm functions. For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

SpO2 parameter setup functions

All SpO2 setup functions take place in the ***SpO2*** page.

Selection	Available settings	Description
Pulse tone volume	***Off***, 5%, 10% (default), 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%	Sets the volume of the pulse tone.
Tone source	***ECG*** (default), ***SpO2***	Selects the source of the pulse tone which affects both the ECG and the SpO2 parameter field display (see page 289). For the SpO2 selection, the higher the pitch of the tone, the higher the SpO2 saturation percentage.
Waveform size [%]	10%, 20%, 30%, 40% (default), 50%, 60%, 70%, 80%, 90%, 100%	Sets the amplitude of the SpO2 waveforms. If the waveform height exceeds the display size of the channel, the waveform appears clipped (without affecting the SpO2 signal processing).

Selection	Available settings	Description
Response mode	– ***Normal*** (default) – up to 90% change within 5 to 7 seconds – ***Fast*** – up to 90% change within 2 to 4 seconds	Establishes the frequency the oximeter uses to calculate, record, and display SpO2 saturation levels: – Fast mode responds to changes in blood oxygen saturation levels in 2 to 4 seconds when calculating%SpO2. – Normal mode responds to changes in blood oxygen saturation in 5 to 7 seconds when calculating%SpO2.
SatSeconds alarm	***Off*** (default), 10, 25, 50, 100 SatSeconds **NOTE:** When ***SatSeconds*** is set to any value other than ***Off***, the ***Desat.*** alarm status is set to ***Off***.	This selection does the following: – Analyzes desaturation events by multiplying their duration (seconds) by the number of percentage points the patient exceeds the alarm limit. – Eliminates nuisance alarms caused by brief and numerous violations of lower and upper alarm limits. – Overrides the alarm validation setting (see page 472) and the SpO2 high priority desaturation alarm.
Color	Red, green, blue, yellow, light blue, purple, orange, white (default).	Determines the color of the waveforms and parameter labels and values.

NOTE

The password-protected alarm setting ***SpO2 check sensor*** provides additional SpO2 alarm configuration. For more detailed information see page 123.

This page has been left blank intentionally.

Temperature

Overview of temperature monitoring

The M540 measures and displays the following temperature values and relays them to the Cockpit for display:

– Surface body temperature

– Core temperature

Temperature monitoring is intended for adult, pediatric, and neonatal patients. All clinical thermometer readings are a direct measurement, except when using the Tcore sensor.

NOTE

The temperature functions and associated probes should be calibrated every two years by qualified personnel to maintain an accuracy of ±0.1 °C (±0.2 °F).

The temperature monitoring functions are configurable in the parameter-specific setup page (see page 296).

Refer to the instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 temperature functions.

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. Parameter-specific error messages are listed on page 551.

For details on how to connect temperature sensors to the M540 or to hemodynamic pods, refer to the instructions for use *Infinity Acute Care System – Infinity M540*.

Supported parameters

– ***Ta***, ***Tb***, ***ΔT***: absolute temperature values, temperature difference value

– ***T1a***, ***T1b***, ***ΔT1***: absolute temperature values, temperature difference value

Precautions

WARNING

Protective covers for general purpose probes contain latex.

NOTE

Cover internally placed reusable temperature sensors with temperature sensor sheaths.

NOTE

After starting the body temperature measurement, it takes some time until the monitor displays the actual value. This time period depends on the difference in temperature between environment and body.

Temperature display

On the Cockpit, the temperature display consists of a parameter field (see page 297).

Any temperature values originating from the MPod – QuadHemo, the Hemo2 pod, or the Hemo4 pod are labeled T1a, T1b, and ΔT1. Any temperature values originating from a single or dual temperature Y-cable that are connected to the M540 temperature port are labeled Ta, Tb, and ΔT.

When only a single temperature sensor is connected, only one temperature value is displayed. The values for the second temperature and temperature difference appear blank.

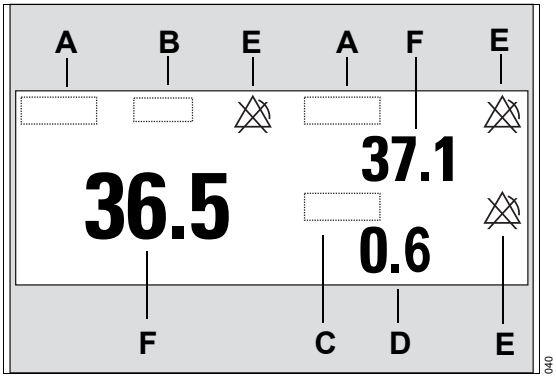
Temperature parameter field

NOTE

The following diagram shows a typical parameter field layout. For more information, see "Temperature parameter setup functions" on page 297. Temperature values in parameter fields may display with a decimal point instead of a comma.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The temperature parameter field contains the following elements:



A Temperature label

B Units of measure (can be activated/deactivated)

C Temperature difference parameter label or second direct temperature label

D Calculated temperature difference or second direct temperature value

E Upper/lower alarm limits or crossed triangle symbols when alarms are deactivated

F Temperature value

Accessing the temperature dialog

- Select the temperature parameter field to select the ***Temp.*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***Temp.*** (***Temp. 1***) tab to access the ***Temp.*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

The top portion of the ***Temp./Temp. 1*** page contains the ***Auto set*** and ***Alarm*** buttons for configuring the alarm functions. For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

Complete the following steps to access the temperature labels and apply these labels to the temperature sensors.

1 Press the ***Sensor parameters...*** button on the main screen.

2 Press the >> button until you see the ***Temp.*** tab in the upper row of tabs.

3 Select the ***Temp.*** tab.

NOTE

The ***Temp.*** tab refers to ***Ta*** and ***Tb***. The ***Temp. 1*** tab refers to ***T1a***, and ***T1b***.

To apply a temperature label

1 Select the ***Label temps*** tab.

2 Select the desired temperature parameter (***Ta***, ***Tb***, ***T1a***, ***T1b***).

3 Select a label to apply to the temperature sensor (***Oral***, ***Eso***, ***Nasal***, etc.).

Temperature parameter setup functions

All temperature setup functions take place in the ***Temp./Temp. 1***/***Label temps*** pages (see page 296).

CAUTION

Do not connect a Tcore® sensor to the Cardiac Output (C.O.) Tb port on an MPod — Quad Hemo.

NOTE

On the M540, changing the color of one temperature parameter changes the color of all the temperature parameters.

Selection	Available settings	Description
Ta ***Tb***	– ***TOral*** – ***TEso*** – ***TNasal*** – ***TRect*** – ***TBlad*** – ***Tcore*** – ***TBld1*** – ***TBlnkt*** – ***TSkin*** – ***TR*** – ***TL***	***Ta*** configures the first temperature value on the M540. ***Tb*** configures the second temperature value on the M540.
ΔT		Difference ***Ta***–***Tb***
Color [1)]	***Red***, ***White*** (default), ***Yellow***, ***Green***, ***Light blue***, ***Blue***, ***Purple***, ***Orange***	Determines the color of all temperature parameter labels and values.

Selection	Available settings	Description
T1a ***T1b***	– ***T1Oral*** – ***T1Eso*** – ***T1Nasal*** – ***T1Rect*** – ***T1Blad*** – ***T1core*** – ***T1Bld1*** – ***T1Blnkt*** – ***T1Skin*** – ***T1R*** – ***T1L***	***T1a*** configures the third temperature value. ***T1b*** configures the fourth temperature value.
ΔT1		Difference ***T1a***–***T1b***
Color [1)]	***Red***, ***White*** (default), ***Yellow***, ***Green***, ***Light blue***, ***Blue***, ***Purple***, ***Orange***	Determines the color of all temperature parameter labels and values.
[1)] This setting is a patient default which may be unique for each patient category; it is part of the profile.		

Non-invasive blood pressure (NIBP)

Overview of non-invasive blood pressure monitoring

The M540 uses the oscillometric method to acquire and process non-invasive blood pressure (NIBP) signals and sends the results to the Cockpit for display. Blood pressure measurements are determined by the oscillometric method and are equivalent to those obtained by intra-arterial methods, within the limits prescribed by the Association for Advancement of Medical Instrumentation, Electronic Automated Sphygmomanometers.

The M540 inflates and then deflates a blood pressure cuff wrapped around the patient's arm or leg. A hose connects the cuff to the monitor which determines the systolic, diastolic and mean pressures for adult, pediatric and neonatal patients.

To protect the patient from excessive inflation limits, the blood pressure cuff automatically deflates when:

– A measurement exceeds 2 minutes in adult and pediatric mode
– A measurement exceeds 90 seconds in neonatal mode

NOTE

The non-invasive blood pressure functionality should be calibrated every two years by technically qualified personnel as described in the Service manual.

Refer to the instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 non-invasive blood pressure functions.

The non-invasive blood pressure monitoring functions are configurable in the parameter-specific setup page (see page 310).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. Parameter-specific error messages are listed on page 548.

Supported parameters

– NIBP S – systolic non-invasive blood pressure
– NIBP D – diastolic non-invasive blood pressure
– NIBP M – mean non-invasive blood pressure

Non-invasive blood pressure precautions

WARNING

Rapid, prolonged cycling of non-invasive blood pressure measurements have on occasion been associated with petechia, ischemia, purpura, or neuropathy. Make sure that the cuff is properly attached and check the cuff site regularly to prevent the cuff pressure from impeding the blood flow.

WARNING

Obstructions may cause the cuff to inflate and deflate improperly and result in inaccurate measurement values. Check the hose and cuff for damage and soiling. Do not allow the hose and cuff to come in contact with fluids, and make sure that they are not compressed or kinked.

WARNING

Do not place the cuff on injured or breached skin because cuff compression could further damage the tissue.

WARNING

Do not place the cuff on a limb with either an intra-arterial line or a vascular prosthesis because cuff compression will impede perfusion.

WARNING

Do not perform a blood pressure measurement on the upper arm of the side of a mastectomy.

WARNING

When measuring non-invasive blood pressure and another parameter simultaneously on the same limb, the measurement of the other parameter can be temporarily interrupted.

WARNING

Accurate non-invasive blood pressure measurements depend on the correct size and type of the blood pressure cuff in relation to the patient's arm circumference. The wrong sized cuff, or cuffs outside the range or size manufactured by Dräger, can cause inaccurate measurements. Use only Dräger approved cuffs and make sure that the correct size is used for each patient.

WARNING

To reduce the possibility of pumping air into the patient’s blood vessels, never connect pneumatic connectors to an intravascular system.

WARNING

Before monitoring neonates and infants:

- **Select the correct cuff size and hose.**
- **Select the neonatal or pediatric patient category, if not already selected. This provides the appropriate inflation for neonates, infants, and pediatric patients and protects neonatal patients from excessive cuff pressures and longer cuff cycle time.**

Failure to follow the above actions could result in extreme discomfort, petechiae, ischemia, purpura, or neuropathy.

NOTE

The effectiveness of non-invasive blood pressure monitoring has not been established in pregnant patients, including pre-eclamptic patients.

NOTE

The accuracy of the oscillometric blood pressure signal can decrease (up to loss of measurement) under the following conditions:

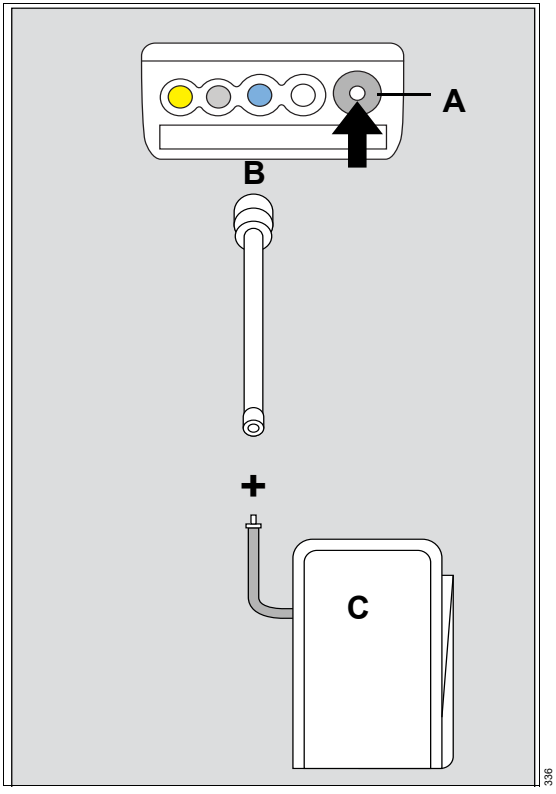
– weak pulses
– irregular pulses
– patient movement artifacts
– tremor artifacts
– respiratory artifacts
– pulses generated from a ventricular assist device

NOTE

A systolic blood pressure higher than the current high inflation limit may trigger a message that the non-invasive blood pressure inflation limit is low. When this message appears, manually check the blood pressure of the patient.

Connecting the non-invasive blood pressure hose and cuff

The following diagram shows where the non-invasive blood pressure hose connects to the non-invasive blood pressure hose connector (A) on the side of the M540.



A Non-invasive blood pressure connector on the M540

B Non-invasive blood pressure hose

C Blood pressure cuff

To connect the hose and cuff

1. Select a blood pressure cuff size that is appropriate for the patient.
2. Connect the blood pressure cuff (C) to the hose (B).
3. Connect the non-invasive blood pressure hose (B) to the non-invasive blood pressure connector (A) of the M540.

Patient preparation for non-invasive blood pressure monitoring

The following tips provide optimal non-invasive blood pressure monitoring results, but must never replace hospital-approved practices or manufacturer's recommendations.

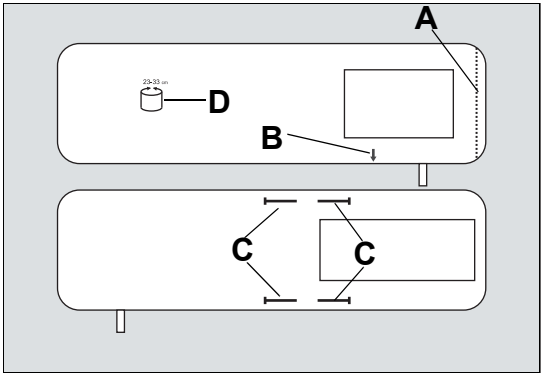
Accurate non-invasive blood pressure measurements depend on the correct size and type of the blood pressure cuff in relation to the arm circumference of the patient. The wrong sized cuffs, or cuffs outside the range or size manufactured by Dräger, can cause inaccurate measurements. Use only Dräger approved cuffs and make sure that the correct size is used for each patient.

Applying the blood pressure cuff

Weak or irregular pulses, patient movement, tremors, or respiratory artifacts can affect the accuracy of non-invasive blood pressure measurements and even cause them to fail. Before applying the cuff, read the non-invasive blood pressure precautions.

We recommend that you do not apply the cuff on a limb that is already used for other measurements. Make sure that other patient connections do not interfere with each other.

The following diagram depicts a typical Dräger cuff.



A Index line

B Artery marker

C Range labels

D Size indicator

Correct patient positioning

For a patient with hypertension who is not in a lying position, perform the resting blood pressure measurement as follows:

– Place the patient in a comfortable seated position.

– Make sure the legs are not crossed.

– Make sure the feet are flat on the floor.

– Make sure the patient is leaned back and arms are at rest.

– Apply the center of the cuff at the level of the right atrium.

– The patient should be relaxed, if possible, and should not talk during measurement.

– Wait for 5 minutes, if possible, before performing the first measurement.

NOTE

The accuracy of the blood pressure measurement can be affected by the following conditions:

– The measuring site, the lying position, patient movement, and the physiological condition of the patient.

– Cuffs that are stored or used outside of the specified environmental conditions. For acceptable conditions, refer to the *Technical Data* chapter of the Instructions for use*Infinity Acute Care System – Infinity M540*.

NOTE

Blood pressure measurements can be affected by arrhythmias (for example, atrial and premature ventricular contraction), atrial fibrillation, low perfusion, diabetes, renal diseases, trembling and shivering. In the presence of implausible measurement values check for the above-mentioned reasons and repeat the measurement. If possible, wait for a few minutes before performing another measurement at the same measuring site.

To apply the cuff

Before applying the cuff to the patient, read and understand the manufacturer's warnings in the Instructions for Use for the cuff.

1. Place the cuff 2 to 5 cm (1 to 2 inches) above the elbow (or around the middle of the thigh). Place the cuff label "this side to patient" against the skin.
2. Place the artery marker (B) over the artery pointing to the hand or the foot. Place the cuff label 'index' (A) so that it falls within the range labels (C) to ensure the correct fit. If the cuff does not fall within the indicated range, select a cuff that better accommodates the limb circumference.
3. Wrap the deflated cuff snug around the limb without impeding blood flow. Make sure there is a finger's width of space between the cuff and the upper arm or thigh before fastening it.

Non-invasive blood pressure display

On the Cockpit, the non-invasive blood pressure display consists of a parameter field.

When a measurement is in progress, the background of the lower part of the parameter field turns white.

During low systolic or diastolic pulse amplitudes or significant motion artifacts, the parameter field may only display a mean value. If the M540 is in venous-stasis mode, the cuff pressure and the label ***Venous stasis*** appears in the non-invasive blood pressure parameter field .

If you cannot apply the cuff at heart level, adjust the displayed systolic and diastolic non-invasive blood pressure values as follows: add 8 mmHg (1.1 kPa) for each 10 cm (4 inches) above the heart; subtract 8 mmHg (1.1 kPa) – for each 10 cm (4 inches) below the heart.

Non-invasive blood pressure parameter fields

NOTE

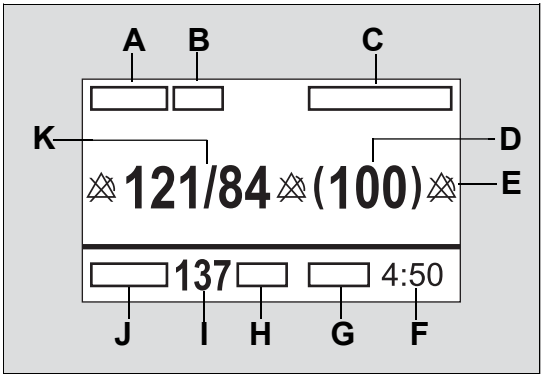
The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The appearance of non-invasive blood pressure parameter fields also depends on the selected non-invasive blood pressure mode.

Continuous mode

The following diagram shows a parameter field when the continuous non-invasive blood pressure mode is selected (see page 308).



A NIBP parameter label

B Unit of measurement (can be activated/deactivated)

C Time since last non-invasive blood pressure measurement

D Mean pressure value

E Alarm limits or crossed triangle symbols when alarms are deactivated

F Time remaining before continuous mode is terminated

G Label ***Cont. mode***

H Unit of measurement

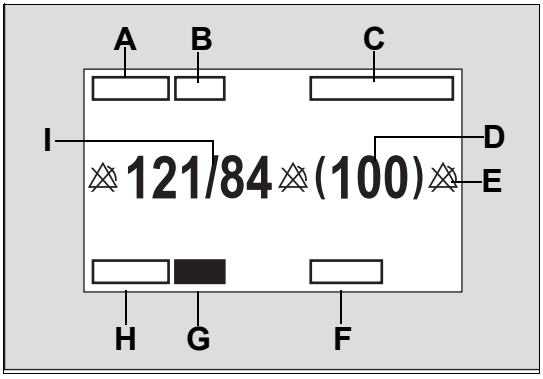
I Inflation pressure value

J Label ***Inflation pressure***

K Systolic/diastolic pressure value

Interval mode

The following diagram shows a parameter field when the interval mode is selected (see page 307 for more information).



A NIBP parameter label

B Unit of measurement (can be activated/deactivated)

C Time since last non-invasive blood pressure measurement

D Last mean pressure value

E Alarm limits or crossed triangle symbols when alarms are deactivated

F Selected inflation interval (see page 310)

G Inflation pressure value or progress indicator

H Label ***auto*** (after the measurement is completed, a progress indicator replaces the label to indicate the time before the start of the next measurement)

I Systolic and diastolic pressure value

Non-invasive blood pressure measurement modes

WARNING
Press the NBP start/stop key to deflate the cuff rapidly if an adverse effect occurs on the patient.

The following non-invasive blood pressure measurement modes are available:

– Single
– Interval
– Continuous
– Venous stasis

The selected mode affects the appearance of the non-invasive blood pressure parameter field (see page 304).

Before taking any non-invasive blood pressure measurements, read the precautions on page 303.

At the beginning of a measurement, the M540 inflates the cuff to a pressure that is 25 mmHg (3.3 kPa) in adult/pediatric mode and 30 mmHg (4 kPa) in neonatal mode above the previously detected systolic value. If the M540 cannot obtain a valid measurement, it re-inflates the cuff to the maximum inflation pressure provided the measurement cycle has not timed-out. If the M540 cannot obtain a measurement within the measurement cycle, no further attempts are made until the next scheduled interval or until you initiate a single measurement manually. Error messages identify the cause of failed measurements (see page 548).

The last non-invasive blood pressure measurement value is displayed in the parameter field until the new measurement is completed. New values appear at the end of a measurement. A chime sounds at the end of a measurement when the corresponding function is activated (see page 310).

Single-measurement mode

Single-measurement mode allows you to start measurements when needed. You can start and stop a single measurement at the M540 and at the Cockpit.

To start/stop a single measurement

Do one of the following:

- Press the NBP start/stop key on the front of the M540. Press the key again to stop the measurement.

or

- Press the ***NIBP start/stop*** button on the main menu bar of the Cockpit. Press the button again to stop the measurement.

Interval mode

WARNING
Because non-invasive blood pressure measurements occur intermittently, a patient's condition may change between measurements. Therefore, do not rely on non-invasive blood pressure alarms alone to notify you of a patient's changing condition.

In interval mode, the M540 initiates measurements at set intervals. Changing the interval setting during a measurement resets the interval timer. If you select another interval setting after interval mode was deactivated, you must select the ***NIBP start/stop*** button on the menu bar, for interval measurements to start.

NOTE

A safety timer ensures that a cuff remains deflated for at least 30 seconds before the end of a measurement and the beginning of a new one. This precaution avoids prolonged impeded blood flow which could be harmful. The safety timer overrides any interval setting and is of particular importance in the 1 and 2-minute intervals.

You can still take single measurements during an interval cycle.

Interval measurements are not possible during:

– Venous-stasis mode – the measurements resume immediately after the cuff deflates.

– Cardiac bypass mode – select the ***NIBP start/stop*** button to resume interval measurement after exiting cardiac bypass mode.

– Standby mode – select the ***NIBP start/stop*** button to resume interval measurement after exiting standby mode.

– Activated Continuous mode.

Aligning interval mode settings between Cockpit and M540

If interval mode is deactivated on the Cockpit and an M540 is docked with interval mode activated and a measurement is in progress, the non-invasive blood pressure measurement is canceled automatically. In addition, interval mode is deactivated on the M540.

If interval mode is deactivated on the M540, but activated on the Cockpit, press the ***NIBP start/stop*** button on either device to initiate interval mode.

If interval mode is activated on both devices but you dock an M540 with a different interval time, the non-invasive blood pressure measurement continues. However, the M540 interval time is adjusted to the Cockpit setting at the end of the measurement.

If you turn the M540 off and on again, and interval mode is activated on both the Cockpit and the M540, select ***NIBP start/stop*** button to resume interval mode.

To start/stop interval mode

1 Select the non-invasive blood pressure parameter field to select the ***NIBP*** page directly,

or

Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***NIBP*** tab to access the ***NIBP*** page.

3 Select ***Interval time [min]*** and make your selection. The available settings are: ***Off*** (default), 1, 2, 2.5, 3, 5, 10, 15, 20, 30, 45, 60, 120, 240 min.

For any interval setting of 5 minutes and up, the following time alignment occurs. After the first measurement is completed, all subsequent measurements align with the next natural time boundary that corresponds to the selected interval. For example, if a 5-minute interval is selected at 10:03, the next interval starts at 10:05, 10:10 and so on. If a 10-minute interval is selected at 10:07, the next interval starts at 10:10, 10:20, and so forth.

4 Press ***NIBP start/stop*** button on the main menu bar if you change the mode setting from ***Off*** to another setting (otherwise, interval measurements will not start).

NOTE

Pressing the ***NIBP start/stop*** button longer than two seconds suspends interval mode and sets the ***Interval time [min]*** to ***Off***.

If the M540 is power cycled while in interval mode, you must press the ***NIBP start/stop*** button to resume interval measurements.

To stop interval measurements

- Press the ***NIBP start/stop*** button on the main menu bar of the Cockpit.

  or

- Press the 

start/stop key on the front of the M540.

Continuous measurements

WARNING

When using continuous mode, observe the patient closely and verify limb perfusion clinically. Be extra vigilant when using continuous mode on neonates or hemodynamically compromised patients.

In continuous mode, the M540 continuously initiates NIBP measurements over a 5-minute period.

A 10 second (±1 second) minimum interval between the end of one measurement and the start of another provides minimal perfusion of the limb.

To activate or deactivate continuous mode

1 Select the non-invasive blood pressure parameter field to select the ***NIBP*** page directly,

or

2 Select ***Sensor parameters...*** from the main menu bar.

3 Select the ***NIBP*** tab to access the ***NIBP*** page.

4 Select ***On*** or ***Off*** next to ***Continuous mode***.

NOTE

Continuous non-invasive blood pressure mode prevents you from enabling venous stasis.

To stop continuous measurements

- Press the ***NIBP start/stop*** button on the main menu bar,

  or

- Deactivate ***Continuous mode*** in the ***NIBP*** page (see page 310).

Venous stasis

By maintaining a constant cuff pressure, the M540 stops the blood flow to the lower extremity of the cuffed limb long enough to cannulate a patient. In this mode, the cuff occludes the limb for about as long as an non-invasive blood pressure measurement takes (approximately 2 minutes for adults and approximately 1 minute for neonates).

WARNING

Do not use venous stasis on a limb that is unsuitable for non-invasive blood pressure measurements (for example, an arm with a catheter). If the patient experiences adverse reactions, immediately press the *NIBP start/stop* button to deflate the cuff.

Activating or deactivating venous stasis

NOTE

Make sure continuous non-invasive blood pressure mode is not enabled (see page 310) because it prevents you from using venous-stasis mode.

To activate or deactivate venous stasis

NOTE

If configured to appear on the main menu bar, the ***Venous stasis*** button is also accessible on the main menu bar. For more information, see page 465.

1 Select the non-invasive blood pressure parameter field to select the ***NIBP*** page directly,

or

Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***NIBP*** tab to access the ***NIBP*** page.

3 Make sure non-invasive blood pressure continuous mode is not activated (see page 310).

4 Select ***On*** next to ***Venous stasis***.

NOTE

When the venous-stasis mode begins, an attention tone sounds.

During active venous stasis, the non-invasive blood pressure parameter field reports the remaining time and displays the message ***Stasis*** in the parameter field. As soon as venous stasis is terminated, the parameter field resumes its previous appearance (see page 304).

Interval measurements are suspended during venous stasis but resume immediately after the cuff deflates.

Accessing the non-invasive blood pressure settings

1 Select the non-invasive blood pressure parameter field to select the ***NIBP*** page directly.

or

Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***NIBP*** tab to access the ***NIBP*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

The top portion of the page contains the ***Auto set*** and ***Alarm*** buttons for configuring the alarm functions. For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134

Non-invasive blood pressure parameter setup functions

All non-invasive blood pressure setup functions take place in the ***NIBP*** page (see page 310).

Selection	Available settings	Description
Interval time [min] *(Cardiac bypass mode and ECMO mode automatically deactivate interval measurements)*	***Off*** (default), 1 min, 2 min, 2.5 min, 3 min, 5 min, 10 min, 15 min, 20 min, 25 min, 30 min, 45 min, 60 min, 120 min, 240 min	Defines intervals for non-invasive blood pressure measurements.
Inflation mode	***Adult*** (default), ***Pediatric***, ***Neonate***	Sets the threshold for maximum cuff inflation.
Continuous mode	***On***, ***Off*** (default)	Initiates successive non-invasive blood pressure measurements for 5 min.
Chime	***On***, ***Off*** (default)	Determines whether or not a tone sounds at the end of a completed non-invasive blood pressure measurement.
Venous stasis	***On***, ***Off*** (default)	Stops the blood flow to the lower part of the cuffed limb for a fixed time.
Color	Red, green, blue, yellow, light blue, purple, orange, white (default).	Determines the color of the parameter values and labels.

Invasive pressure (IP)

Overview of invasive pressure monitoring

The M540 acquires, processes, and displays invasive pressure (IP) signals and relays the data to the Cockpit. Several pods are available for monitoring invasive pressure. Monitoring more than two pressures simultaneously requires the Multi-IP option.

Invasive pressure measurements are for adult, pediatric, and neonatal patients.

Refer to the Instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 invasive pressure functions.

The invasive pressure monitoring functions are configurable in the parameter-specific setup page (see "Invasive pressure parameter setup functions" on page 325).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. Parameter-specific error messages are listed on page 552.

For details on hemodynamic pods, refer to the Instructions for use *Infinity Acute Care System – Infinity M540*.

Supported parameters

See page 315 for available invasive pressure labels.

– If both an arterial blood pressure and ICP are connected, the algorithm computes the difference between ICP and mean arterial blood pressure and reports it as CPP.

– If both an arterial blood pressure and BDP are connected, the algorithm computes the difference between BDP and mean arterial blood pressure and reports it as BPP.

– If both an arterial blood pressure and ABD are connected, the algorithm computes the difference between ABD and mean arterial pressure and reports it as APP.

Invasive pressure precautions

WARNING
To prevent patient injury, never reuse a single-use transducer.

WARNING
Do not zero all pressures simultaneously using the >0< key if any pressure waveform is flat (nearly static).

There are additional warnings regarding pulmonary wedge pressure on page 320.

Patient preparation for invasive pressure monitoring

NOTE
If air bubbles appear in the tubing system, flush the system with the infusion solution again. Air bubbles may lead to wrong pressure measurement values.

The following tips provide optimal invasive pressure monitoring results but must never replace hospital-approved practices or manufacturer's recommendations.

– When preparing the patient, make sure there are no air bubbles in the sensor or the stopcock.
– For maximum signal strength, choose the shortest possible length of pressure tubing. Shorter pressure tubing reduces signal attenuation but is more susceptible to motion artifacts. Pressure tubing with higher pressure limits signal dampening.
– Position the transducer so that it is level with the appropriate anatomical reference point for each monitored pressure.

Invasive pressure display

On the Cockpit, the invasive pressure display consists of:

– Invasive pressure parameter field
– Invasive pressure waveform

Invasive pressure parameter field

NOTE
The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

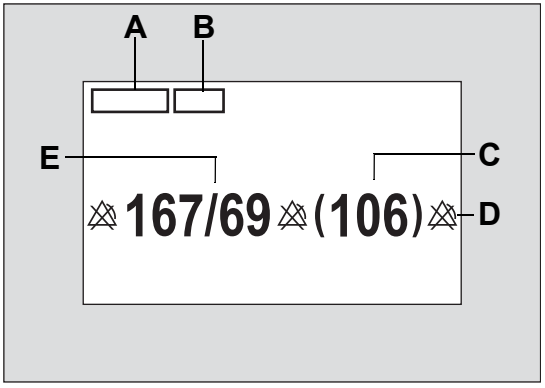
Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The content of the invasive pressure parameter fields depends on whether the parameter is pulsatile or non-pulsatile. Parameter fields for pulsatile pressures (GP1, GP2, GP3, GP4, ART, AOR, FEM, GP5, GP6, GP7, GP8, AXL, RAD, UAP, BRA, LV, PA, RV) display systolic, diastolic, and mean pressure values.

Parameter fields for non-pulsatile pressures (LA, RA, CVP, ICP, ICP2, ICP3, ICP4, ABD, BDP, ESO, FEMV, UVP, GPM) display only the mean pressure value.

If the M540 detects a static pressure, the algorithm computes only the mean pressure. A static pressure condition occurs when the maximum and minimum values of a pulsatile pressure signal differ by less than 3 mmHg (0.4 kPa).

An invasive pulsatile pressure parameter field contains the following elements:



A IP parameter label

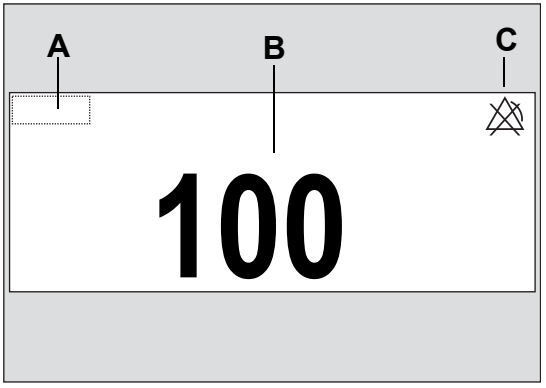
B Unit of measurement (can be activated/deactivated)

C Mean pressure value

D Alarm limits or crossed triangle symbols when alarms are deactivated

E Systolic/diastolic pressure values

An invasive non-pulsatile pressure parameter field contains the following elements:



A Invasive pressure parameter label

B Mean pressure value

C Crossed triangle symbol when the diastolic invasive pressure alarm is turned off.

Large mean value

The invasive pressure mean value can either be displayed in regular or large font size.

To activate the large mean value display

- Select the invasive pressure parameter field to select the ***Invasive pressures*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the desired ***Invasive pressures*** tab (for example, GP1) along the right side of the ***Invasive pressures*** page.

3 Select ***On*** next to ***Large mean***.

Invasive pressure waveforms

Invasive pressure waveforms are either displayed in separate waveform channels or in overlapped format in one channel. When overlapped, the waveform field increases to combine multiple waveforms. For each invasive pressure waveform, a corresponding parameter field is displayed. To activate the overlap display for adjacent pressure waveforms, see page 460 in the "System configuration" chapter.

Labeling invasive pressure channels

The invasive pressure label determines how a signal is analyzed and reported. The M540 takes the pressure labels from the connected pod or MCable provided the transducers are connected. When a new label is assigned to a pressure channel, the M540 clears the parameters and conditions set for the previous label (including alarms and waveform scales). It replaces these values with the settings of the new label. When the M540 is docked on the M500, all pressure labels are transferred to the Cockpit.

The following rules apply to labeling pressure channels:

– If no pressure labels are assigned, the labels ***GP1*** to ***GP8*** are automatically assigned depending on how many pressures are connected.

NOTE

If the Cockpit displays the generic pressure labels (***GP1*** through ***GP8***), the displays on the Hemo2 and Hemo4 pods are labeled P1a, P1b, P1c, P1d.

– The zero value, the date, and time associated with the pressure channel remain unchanged even if a new label is assigned.

NOTE

Certain pressure labels have extra selections in their corresponding Cockpit parameter setup pages. For example, from the ***PA*** page you can start a wedge pressure and from the ***ICP*** page you can set a minimum scale.

To assign a pressure label manually

- Select the invasive pressure parameter field to access the ***Invasive pressures*** dialog directly.

  or

1. Select ***Sensor parameters...*** on the main screen.
2. Select the ***Invasive pressures*** tab.
3. Select the desired parameter tab on the right side of the dialog.
4. Select the button next to ***Label*** on the left side of the dialog.
5. Click on the desired label to assign it to one of the pressure paramters.

   or

1. Select ***Sensor parameters...*** on the main screen.
2. Select the ***Invasive pressures*** tab.
3. Select the ***Label pressures*** tab.
4. Select the desired invasive pressure by pressing one of the buttons in the upper row of buttons.
5. Select the desired label by pressing one of the buttons in the lower two areas, which are labeled ***Pulsatile labels*** and ***Non-pulsatile labels***.

   The invasive pressure selected in step 4 now displays the label selected in step 5.

Standard labels

The M540 detects the labels automatically from the hemodynamic pod, provided a transducer is connected. The M540 transfers the labels to the Cockpit. You can also label pressure channels manually.

The following table lists the available invasive pressure labels.

Invasive pressure labels			
Label	**Pressure type**	**Measured pressures**	**Measurement range**
ART	Arterial blood pressure	Systolic, diastolic, mean	–50 to +400 mmHg –6.6 to +53.3 kPa
AOR	Aortic arterial blood pressure		
FEM	Femoral arterial blood pressure		
AXL	Axillary arterial blood pressure		
RAD	Radial arterial blood pressure		
UAP	Umbillical arterial blood pressure		
BRA	Brachial arterial blood pressure		
LV	Left ventricular blood pressure		
PA	Pulmonary arterial blood pressure		
RV	Right ventricular blood pressure		
CVP	Central venous blood pressure	Mean	
FEMV	Femoral venous blood pressure		
ESO	Esophageal pressure		
UVP	Umbilical venous pressure		
RA	Right atrial blood pressure		
LA	Left atrial blood pressure		
ICP	Intracranial pressure		
CPP [1)]	Cerebral perfusion pressure		
ICP2	Intracranial pressure 2		
CPP2 [1)]	Cerebral perfusion pressure 2		
ICP3	Intracranial pressure 3		
CPP3 [1)]	Cerebral perfusion pressure 3		
ICP4	Intracranial pressure 4		
CPP4 [1)]	Cerebral perfusion pressure 4		
ABD	Intra-abdominal pressure		
APP [1)]	Abdominal perfusion pressure		
BDP	Bladder pressure		
BPP [1)]	Bladder perfusion pressure		
Generic Labels			
GP1 to GP8		Systolic, diastolic, mean	
GPM	Mean generic pressure	Mean	

[1)] The perfusion pressure value is only calculated when ICP/ABD/BDP and arterial blood pressure values are available.

Pressure label conflicts

Each pressure label is assigned to one location. If you try to reuse a label, you must confirm it. The M540 assigns the label to the currently selected parameter field and places an automatic pressure label (GP1 to GP8) in the previous location. When the M540 is docked in an IACS configuration, the pressure labels are saved as part of the M540 profile.

Pod-M540 label conflicts

The hemodynamic pods store pressure labels like the M540. When a pod with previously stored labels is connected, different pressure labels may exist for the same channel, thus causing a conflict.

The label stored in the M540 has priority over the label stored in the pod. When a patient monitored by a standalone M540 is discharged, the label from the M500 patient profile then takes priority over the label stored in the M540. When an M540 is docked in an IACS configuration, the M540 label remains in use until manually changed.

Zeroing a pressure transducer

To establish accurate invasive pressure values, zero the transducer according to the hospital's protocol at least once a day. Perform additional zeroing under the following circumstances:

– After introducing a catheter into the vascular system of the patient
– Before each monitoring session
– Each time you use a new transducer or pressure tubing
– Whenever you connect the transducer cable to the monitor
– If the reported pressure values seem incorrect
– When the message ***please check zero*** appears.

For zeroing to be successful, a pressure must be stable for at least 3 seconds. Messages report the status of the zeroing process. The time and date of the last successful zero is recorded on the ***Invasive pressures*** page. Check the invasive pressure waveform and repeat the zeroing procedure if the zeroing fails because the pressures are not static.

If the procedure fails after two attempts, replace the transducer or consult specialized service personnel.

If the attention tone is activated (see page 457), a tone sounds when the zeroing procedure is successfully completed.

Zeroing a specific transducer

This procedure allows you to select a specific transducer for zeroing. You can also initiate the procedure from the M540 (see the Instructions for use *Infinity Acute Care System – Infinity M540* for details).

To zero a specific transducer

- Select the invasive pressure parameter field to select the ***Invasive pressures*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***Invasive pressures*** tab to access the ***Invasive pressures*** page.

3 Select the desired ***Invasive pressures*** tab (for example, ART) along the right side of the ***Invasive pressures*** page.

4 Align the transducer to the level of the heart (phlebostatic axis point, fifth intercostal space and midaxillary line).

5 Close the transducer stopcock to the patient and open it to air.

6 Select the button next to ***Zero*** in the ***Invasive pressures*** page.

  If the zeroing of the transducer is successful, a confirmation message appears. If zeroing failed, a failure message appears. In that case, repeat steps three to five.

For details on how to zero all invasive pressures simultaneously using a hemodynamic pod, see the instructions for use *Infinity Acute Care System – Infinity M540.*

WARNING

Invasive pressure alarms are suppressed while pressures are being zeroed. For detailed information, see page 124.

To zero all pressure transducers from the Cockpit

1 Align the transducers to the heart level of the patient.

2 Close the stopcocks to the patient, and open them to air.

3 Select the ***Sensor parameters... Zero all*** button on the main menu bar .

4 Select the ***Invasive pressures*** tab.

5 Select the ***Zero all*** >0< button.

  or

– Select the symbol next to the ***Sensor parameters...*** button on the main menu bar .

– Select the ***Zero all*** button.

6 Verify that the transducers have been zeroed. If zeroing failed, repeat the procedure.

WARNING

Using the *Zero all* function zeroes all static invasive pressure < 3 mmHg.

Certain invasive pressure alarms are suppressed while pressures are being zeroed. For detailed information, see "Zeroing invasive pressures" in the Alarms chapter.

NOTE

If configured to appear on the main menu bar, the ***Zero all*** button is also accessible on the main menu bar. For more information, see page 465.

Pulmonary wedge pressure

When the M540 is docked, you can calculate a pulmonary wedge pressure (PWP) from the Hemo4 pod, Hemo2 pod, and the MPod – QuadHemo. You can also calculate a wedge pressure from the ***Wedge*** page on the Cockpit (see page 323). You cannot request wedge pressures from the M540.

During PWP measurements, only the mean PA pressure is displayed.

WARNING

For the safety of the patient keep the balloon-inflation time to the minimum necessary to acquire an accurate PWP value. Prolonged inflation of the balloon can result in pulmonary hemorrhage or infarction.

WARNING

The PA catheter may move into the wedge position before the balloon is inflated. One sign of this "catheter drift" is that the PWP waveform becomes wedge shaped. Follow your hospital's clinical guidelines to correct the catheter's position.

WARNING

Do not over-inflate the balloon because an over-inflated balloon can rupture the pulmonary artery.

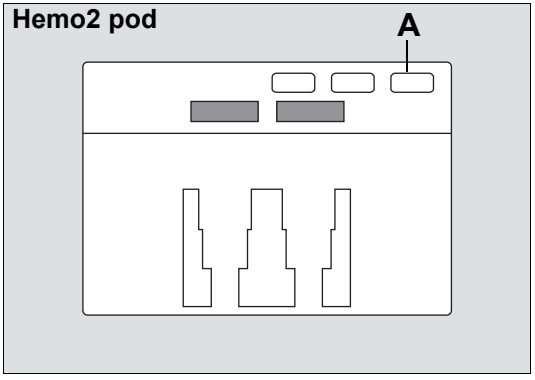
WARNING

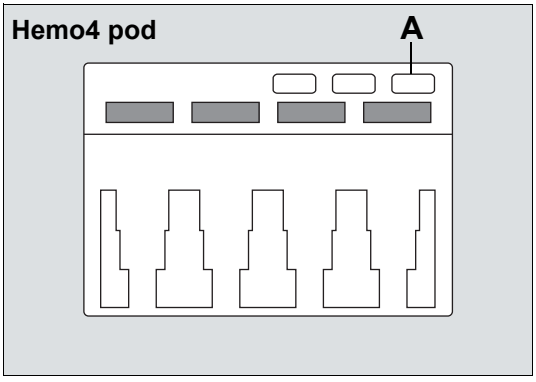
Alarm monitoring for invasive pressures, if activated, is temporarily deactivated during PWP measurements to prevent nuisance alarms. The parameter field does not display a crossed triangle symbol because alarm monitoring is automatically activated upon completion of a wedge pressure measurement.

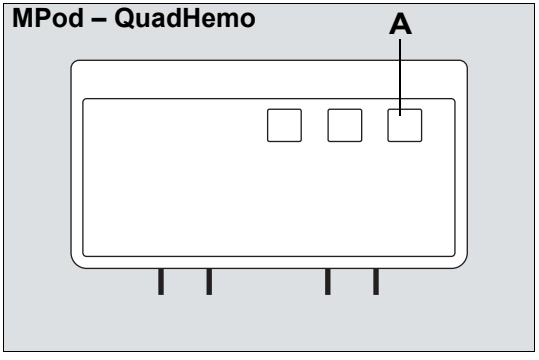
Starting wedge measurements from the pods

To start a wedge pressure measurement

1 Press the Wedge key (A) on the Hemo2 pod, Hemo4 pod, or the MPod – QuadHemo. The message ***Inflate balloon. Press "Wedge" to Start.*** appears on the Cockpit.







2 Press the Wedge key (A) again to start.

- PA alarms are deactivated temporarily.
- The message ***Wedge in progress*** appears on the Cockpit and the measurement begins. A PWP value is displayed at the bottom of the ***Wedge*** page on the Cockpit within 10 seconds. The message ***Deflate balloon and press "Save wedge" to finish*** appears.

3 Press the ***Wedge*** key (A) again to save the value. The following happens on the ***Wedge*** page of the Cockpit (see page 322):

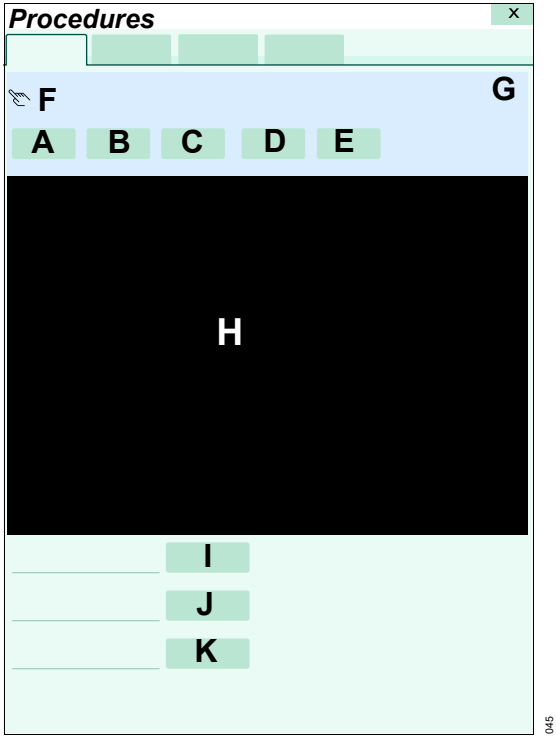
- The message ***Invasive pressures*** appears in the message field.
- A new PWP value calculated during the next 10 seconds appears. An attention tone sounds at the end of the calculation when the corresponding feature is activated (see page 457). Also, the message ***Deflate balloon and press "Save wedge" to finish*** appears in the message field.
- The PA and reference waveforms are stopped, and the message ***Waveforms stopped*** appears above the PA scale in the display window.
- After a successful wedge measurement, the PA waveform resumes its previous size and sweep speed. PA systolic and diastolic values are displayed again, and PA alarms are restored to the values before entering Wedge mode.

Starting wedge measurements from the Cockpit

The following diagram shows the ***Wedge*** page where you start wedge measurements manually. The wedge pressure value is saved automatically when:

– You close the ***Wedge*** page.

– 240 seconds have elapsed after the wedge pressure was started and a valid PWP value exists.



A ***Prepare wedge*** button

B ***Start wedge*** button

C ***Freeze/ Adjust*** button

D ***Save wedge*** button

E ***Cancel wedge*** button

F Message field

G PWP value

H PWP results window

I ***Scale*** button

J ***Sweep speed [mm/s]*** button

K ***Reference waveform*** button

To start a wedge measurement

- Select the PA parameter field (if displayed) > select the ***Start wedge*** button.

NOTE
If configured to appear on the main menu bar, the ***Start wedge*** button is also accessible on the main menu bar. For more information, see page 465.

or

1 Select the ***Procedures...*** button from the main menu bar.

2 Select the ***Wedge*** tab (if not already selected).

3 Verify that the PA catheter has been properly inserted.

4 Select the ***Prepare wedge*** button (A). The following happens:

   – PA alarms are deactivated temporarily

   – The message ***Inflate balloon. Press "Wedge" to Start.*** appears in the message field (F). Only the PA mean value appears in the parameter field (the diastolic/systolic values are blanked).

   – The button ***Start wedge*** appears.

5 Use the ***Scale*** button (I) to change the scale, if necessary.

6 Use the ***Sweep speed [mm/s]*** (J) button to select a different sweep speed for the waveform, if necessary.

7 Use the ***Reference waveform*** button (K) to select a reference waveform (available settings: ***None***, ***RRi***).

8 Select the ***Start wedge*** button (B).

   – The message ***Wedge in progress*** appears in the message field (F).

   – A new PWP value calculated during the next 10 seconds appears. An attention tone sounds at the end of the calculation when the feature is activated (see page 457). Also, the message ***Deflate balloon and press "Save wedge" to finish*** appears in the message field (F).

   – The PA and reference waveforms are stopped, and the message ***Waveforms stopped*** appears above the PA scale in the display window (H).

   – A horizontal cursor is drawn through the PA waveform.

9 Select one of the following buttons:

   – ***Freeze/ Adjust*** button (C) to alter the PWP value manually.

   – ***Save wedge*** button (D) to save the new value (it is stored in the trend function)

   – ***Cancel wedge*** (E) to cancel the measurement.

After a successful wedge measurement, the PA and respiratory waveforms resume their previous size and sweep speed. PA systolic and diastolic values are displayed again, and PA alarms are restored to the values before entering wedge mode.

Accessing the invasive pressure settings

- Select the ***Invasive pressures*** parameter field to select the ***Invasive pressures*** page directly.

  or

  Select ***Sensor parameters...*** from the main menu bar > ***Invasive pressures*** tab to access the ***Invasive pressures*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

The top portion of the page contains the ***Auto set*** and ***Alarm*** buttons for configuring the alarm functions. For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

Invasive pressure parameter setup functions

All invasive pressure setup functions take place in the ***Invasive pressures*** page (see page 324).

Selection	Available settings	Description
Zero	None	Zeroes only the pressure indicated on the ***Invasive pressures*** page and displays the time and date of the last zeroing (see page 319).
Label	***ART***, ***AOR***, ***UVP***, ***FEM***, ***AXL***, ***RAD***, ***UAP***, ***BRA***, ***PA***, ***LA***, ***LV***, ***RV***, ***RA***, ***ABD***, ***BDP***, ***CVP***, ***ESO***, ***FEMV***, ***ICP***, ***ICP2***, ***ICP3***, ***ICP4***, ***GPM***, ***RAD***, ***UVP***, ***GP1*** to ***GP8***. The defaults are as follows: – Channel 1: GP1 – Channel 2: GP2 – Channel 3: GP3 – Channel 4: GP4 – Channel 5: GP5 – Channel 6: GP6 – Channel 7: GP7 – Channel 8: GP8	Allows the user to assign a label to each pressure channel 1 through 8.
Scale	– 5, 10, 15, 20, 25, 30, 35, 40, 50, 75, 100, 125, 150, 175, 200, 225, 250, 300 mmHg – 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 32, 36, 40 kPa – GP1 to GP8, arterial pressures, LV: 200 mmHg (30 kPa) for adults 150 mmHg (20 kPa) for pediatrics 100 mmHg (16 kPa) for neonates – PA, RV: 50 mmHg (12 kPa) – ICP, ABD, BDP, ESO, FEMV, UVP, GPM, CVP, LA, RA: 20 mmHg (4 kPa)	Controls the upper scale of the pressure waveform. The lower scale value is either –5 mmHg (–0.7 kPa) for pressures labeled CVP, RA, LA or 0 mmHg (0 kPa) for other pressure labels.
Filter	8 Hz and 16 Hz (default)	Selects the filter setting applied to the invasive pressure signal.

Selection	Available settings	Description
Large mean	***On***, ***Off*** (default)	Determines whether the mean invasive pressure value appears in large or normal font.
Color	Red, green, blue, yellow, light blue, purple, orange, white. The various invasive pressure parameters have the following defaults: – ART, AOR, FEM, AXL, RAD, UAP, BRA, GP1 to GP4 = red – PA, LV, BDP = yellow – CVP, ABD, ESO, FEMV, GPM, UVP = blue – ICP, ICP2, ICP3, ICP4, LA = purple – RA, RV, GP5 to GP8 = orange	Determines the color of the waveforms, parameter labels, and values.
***ICP* parameter page only**		
Min. scale		Allows you to select the minimum scale. When this function is activated, the following happens: – The lower value is set at –25 mmHg (–3 kPa) – The higher value is set at 25 mmHg (3 kPa) – The ***Scale*** selection appears grayed out
***PA* page only**		
Start wedge	None	Allows you to start a wedge pressure measurement (see page 321).

Measuring pulse pressure variation (PPV)

The user selects values for the maximum pulse pressure and the minimum pulse pressure on an arterial waveform. These values are used to calculate the pulse pressure variation. Up to three PPV calculations provide the average that displays on the PPV screen.

To setup a PPV configuration

1 Press the ***Procedures...*** button on the main screen.

2 Press the ***PPV*** tab.

3 Press the button next to ***Arterial waveform*** and select a pulsatile label: ART (default), AOR, FEM, AXL, RAD, UAP, BRA.

4 Set the upper and lower scale values of the waveform:

- Press the first button next to ***Scale [mmHg]*** and select the number for the bottom of the scale.
- Press the second button next to ***Scale [mmHg]*** and select the number for the top of the scale.

5 Press the ***Off*** button next to ***Waveform Grid*** to hide the grid.

6 Press the ***On*** button next to ***Waveform Grid*** to display the grid.

7 Press the ***Reference waveform*** button and select one of the following:

- ***Off***
- ***Paw***
- ***Flow***
- ***Volume***
- ***CO2 M540***
- ***CO2 Medibus.X***
- ***RRi***

8 Press the button next to ***Scale*** and select the desired scale number.

9 Press the button next to ***Sweep speed*** and select ***6.25***, ***12.5***, ***25***, or ***50***.

To calculate a PPV measurement

1 Press the ***Freeze*** button to stop the waveforms.

2 Turn the rotary knob to select a ***PPmax(S)*** value.

3 Press the rotary knob to save the value.

4 Turn the rotary knob to select a ***PPmax(D)*** value.

5 Press the rotary knob to save the value.

6 Turn the rotary knob to select a ***PPmin(S)*** value.

7 Press the rotary knob to save the value.

8 Turn the rotary knob to select a ***PPmin(D)*** value.

9 Press the rotary knob to save the value.

Or

– Press the ***Repeat*** button to calculate additional measurements.

NOTE

The three most recent measurements are used to calculate the average value.

10 Press the ***Save*** button when finished entering values.

The latest average PPV value and timestamp displays in the upper right corner of the selected arterial waveform within the last 24 hours.

PPV is calculated using the following formula:

$$PPV\ (\%) = \frac{PPmax - PPmin}{\frac{PPmax + PPmin}{2}} * 100$$

where:

PPmax = PPmax (S) – PPmax (D) of max. art. pulse
PPmin = PPmin (S) – PPmin (D) of min. art. pulse

Measuring systolic pressure variation (SPV)

To calculate systolic pressure variation, the user selects values for the maximum systolic pressure and the minimum systolic pressure from an arterial pressure waveform. These values are used to calculate the systolic pressure variation. Up to three SPV calculations provide the average that displays on the SPV screen.

To setup an SPV configuration

1 Press the ***Procedures...*** button on the main screen.

2 Press the ***SPV*** tab.

3 Press the button next to ***Arterial waveform*** and select a pulsatile label: ART (default), AOR, FEM, AXL, RAD, UAP, BRA.

4 Set the upper and lower limits of the waveform:

- Press the first button next to ***Scale [mmHg]*** and select the number for the bottom of the scale.
- Press the second button next to ***Scale [mmHg]*** and select the number for the top of the scale.

5 Press the ***Off*** button next to ***Waveform Grid*** to hide the grid.

6 Press the ***On*** button next to ***Waveform Grid*** to display the grid.

7 Press the ***Reference waveform*** button and select one of the following:

- ***Off***
- ***Paw***
- ***Flow***
- ***Volume***
- ***CO2 M540***
- ***CO2 Medibus.X***
- ***RRi***

8 Press the box next to ***Scale*** and select the desired scale number.

9 Press the box next to ***Sweep speed*** and select ***6.25***, ***12.5***, ***25***, or ***50***.

To calculate an SPV measurement

1 Press the ***Freeze*** tab to stop the waveforms.

2 Turn the rotary knob to select a ***Max(S)*** value.

3 Press the rotary knob to save the measurement.

4 Turn the rotary knob to select a ***Min(S)*** value.

5 Press the rotary knob to save the value.

Or

– Press the ***Repeat*** button to calculate additional measurements.

NOTE

The three most recent measurements are used to calculate the average value.

6 Press the ***Save*** tab when finished entering measurements.

The latest average SPV value and timestamp displays in the upper right corner of the selected arterial waveform within the last 24 hours.

SPV is calculated using the following formula:

SPV = Max(S) – Min(S)

The unit of measure of the SPV value is the same as the current unit of measure for invasive pressure, e.g., mmHg or kPa.

Cardiac output (C.O.)

Overview of cardiac output monitoring

The M540 uses the thermodilution method to compute cardiac output (C.O.) for adult and pediatric patients. Cardiac output monitoring is not intended for neonatal patients.

The MPod – QuadHemo, Hemo4, and Hemo2 pods connect to the M540 and acquire the blood and injectate temperatures which are used to compute the cardiac output value.

Although the M540 processes the cardiac output algorithms, you can only view the data and execute cardiac output functions on the Cockpit.

Cardiac output measurement method

A solution of known temperature and volume is injected into the blood stream in the right atrium. A thermistor in the catheter tip continuously measures the temperature of the blood as it leaves the heart. The injectate mixes with and cools the surrounding blood. The blood reaches its minimum temperature relatively quickly and then warms up slowly until it returns to the baseline blood temperature. The total drop in blood temperature is inversely related to the cardiac output of the patient. The lower the cardiac output value, the more the injectate cools the blood.

When computing cardiac output, the M540 takes the following factors into account:

– Injectate volume, temperature, density, and specific heat of the fluid that is being injected

– Baseline blood temperature, density, and specific heat of the blood

– Temperature changes of the blood injectate mixture

– Area under the temperature waveform

The M540 supports the automatic and manual measuring modes.

The cardiac output monitoring functions are configurable in the parameter-specific setup page and the ***Procedures*** > ***C.O.*** page (see page 342).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. Parameter-specific error messages are listed on page 552.

Supported parameters

– C.O. – Cardiac output

– Tblood – blood temperature

– Tinj – injectate temperature

C.O. precautions

WARNING
An incorrect computation constant may yield incorrect cardiac output measurements and put the patient at risk. Confirm that the manually entered computation constant is correct for the catheter you are using.

WARNING
Verify that you enter the patient's current weight (not his or her 'admit' weight). Failure to enter an accurate weight value can result in inaccurate calculations and put the patient at risk.

NOTE
C.O. monitoring is only supported on the first MPod – QuadHemo in a daisy-chained configuration.

Connecting the cardiac output hardware

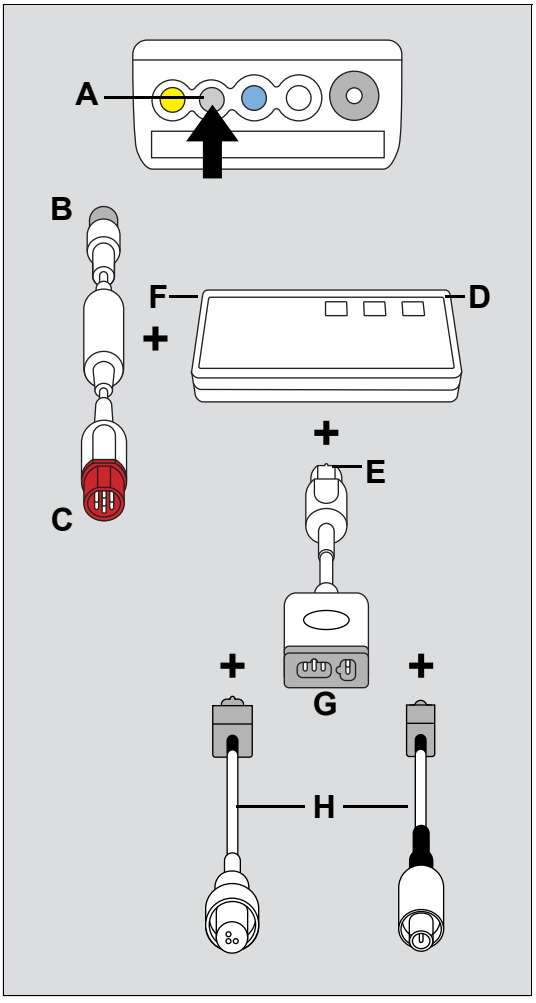
You can connect the hemodynamic cable to one of the following devices:

– MPod – QuadHemo

– Hemo4 pod

– Hemo2 pod

The intermediate cable from the listed devices connect directly to the M540.



A M540 hemodynamic port

B Gray connector of the hemodynamic cable

C Red connector of the hemodynamic cable

D MPod – QuadHemo hemodynamic port

E Pod connector of the cardiac-output intermediate cable

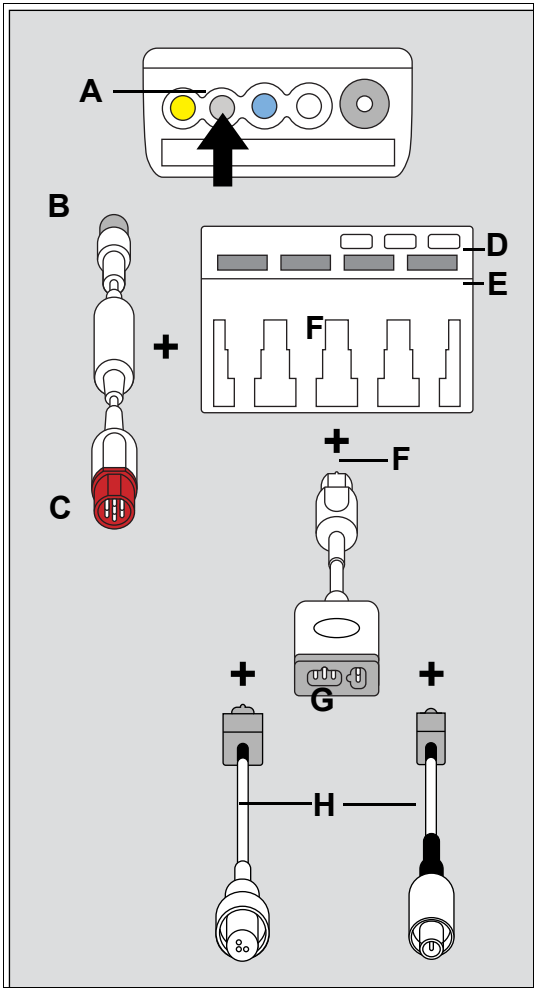
F Cardiac output port of the MPod – QuadHemo

G Thermistor port of the cardiac-output intermediate cable

H Catheter cable and thermistor cable

To connect the cardiac output hardware using the MPod – QuadHemo

1. Connect the gray connector of the hemodynamic cable (B) to the gray hemodynamic port (A) of the M540.
2. Connect the red connector of the hemodynamic cable (C) to the MPod – QuadHemo hemodynamic port (D).
3. Connect the pod connector of the cardiac-output intermediate cable (E) to the cardiac output port of the MPod – QuadHemo (F).
4. Connect the catheter and the thermistor cables (H) to the thermistor port of the cardiac-output intermediate cable (G).



A M540 hemodynamic port

B Gray connector of the hemodynamic cable

C Red connector of the hemodynamic cable

D Hemodynamic pod port

E Cardiac output port

F Pod connector of the cardiac-output intermediate cable

G Thermistor port of the cardiac-output intermediate cable

H Thermistor cables

To connect the cardiac output hardware using the Hemo4 and the Hemo2 pod

1. Connect the gray connector of the hemodynamic cable (B) to the gray hemodynamic port (A) of the M540.
2. Connect red connector of the hemodynamic cable (C) to the Hemo4/Hemo2 pod port (D).
3. Connect the pod connector of the cardiac-output intermediate cable (F) to the cardiac output port of the Hemo4/Hemo2 pod (E).
4. Connect the catheter and the thermistor cables (H) to the thermistor port of the cardiac-output intermediate cable connector (G).

Patient preparation for cardiac output monitoring

The following tips provide optimal cardiac output monitoring results but must never replace hospital-approved practices or manufacturer's recommendations.

– Follow the recommendations of the manufacturer. Dräger recommends that you place pre-filled syringes or the closed injectate delivery system into an ice bath.

– Check the ice bath regularly and add ice to maintain a temperature between 0 °C (32 °F) and 5 °C (41 °F). The accuracy of measurements done with the thermodilution method increases as the temperature of the injectate approaches 0 °C (32 °F).

NOTE

For the most accurate results when using an injectate at room temperature, use a 10 cc injectate volume unless clinically contraindicated.

– Verify the injectate volume.

– Verify the proper selection of catheter type and size or computation constant if ***Other*** is chosen for catheter type.

– Use an in-line injectate system. Systems that measure the injectate temperature in the ice bath can introduce errors. These errors happen because the injectate temperature changes between its removal from the ice bath and the injection.

– If you fill your syringes manually, fill them with the same volume each time. The recommended amount is 10 cc for adults and 5 cc for pediatric patients. Do not touch the body of the syringe to avoid warming the injectate.

– Inject the entire volume in one swift, continuous motion.

– Perform the injection at the end of expiration. Taking successive cardiac output measurements at different points in the respiratory cycle provides different measurements, especially for patients on mechanical ventilators.

– Discard results that are widely different from the general trend, and results associated with irregularly shaped waveforms.

Cardiac output display

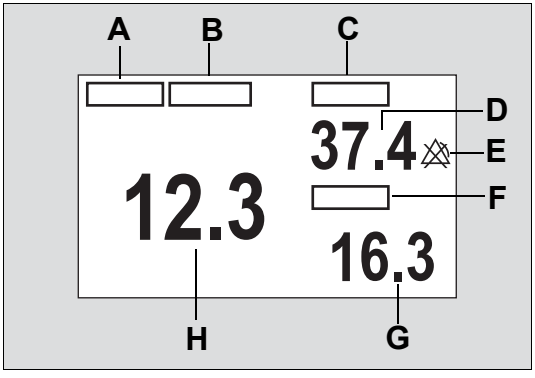
On the Cockpit, the cardiac output display consists of a parameter field.

NOTE

The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68. Temperature values in parameter fields may display with a decimal point instead of a comma.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The cardiac output parameter field contains the following elements:



A C.O. label

B Time stamp of the last saved cardiac output average (this area is blank if no measurements have been taken over the past 24 hours)

C Blood temperature label

D Blood temperature (Tblood) value – acquired from the hemodynamic pod

E Upper/lower alarm limits or crossed triangle symbol when alarms are deactivated

F Injectate temperature label

G Injectate temperature value

H Previously saved cardiac output value – average of a series of saved measurements

Cardiac output computation constant

WARNING

An incorrect computation constant may yield incorrect cardiac output measurements and put the patient at risk. Confirm that the manually entered computation constant is correct for the catheter you are using.

The computation constant compensates for the specific characteristics of the cardiac output catheters. If you use a Baxter, BD/Ohmeda, or Arrow catheter, the computation constant is automatically selected. If you choose ***Other*** as a catheter type (see page 344), enter a computation constant manually. The entered computation constant must correspond to the catheter, its size, injectate volume, and injectate temperature.

Consult the documentation included with the catheter for computation constants, and select one that corresponds to the used injectate volume and temperature.

To enter a computation constant manually

Make sure the catheter type ***Other*** is selected (see page 344), otherwise the button ***Comp. constant*** is not available on the ***Procedures...*** > ***C.O.*** page.

1 Access the ***C.O.*** page (see page 344)

or

Access the ***Procedures...*** > ***C.O.*** page (see page 342).

2 Select the keypad symbol next to ***Comp. constant*** to open a numeric keypad.

3 Enter the correct computation constant for the type of catheter being used (refer to the tables on page 337).

4 Select ***Enter*** on the keypad to confirm the value.

The following tables list the computation constants for Baxter, BD/Ohmeda, and Arrow catheters.

Baxter computation constants				
		Injectate temperature (Tinj) sensor connected	**Tinj sensor connected**	**Tinj sensor disconnected**
Catheter size	**Injectate volume**	**Tinj = -4.9 to 16.0 °C (23 to 60.9 °F)**	**Tinj = 16.1 to 25 °C (61.0 to 77 °F)**	**Tinj = 20 °C (68 °F)**
7F	10 cc	0.561	0.608	0. 578
7F	5 cc	0.259	0.301	0.274
7.5F	10 cc	0.574	0.595	0. 588
7.5F	5 cc	0.287	0.298	0. 283
5F	5 cc	0.285	0.307	0. 292

BD/Ohmeda computation constants			
		Injectate temperature (Tinj) sensor connected	**Tinj sensor connected/ Tinj sensor disconnected**
Catheter size	**Injectate volume**	**Tinj = -4.9 to 16.0 °C (23 to 60.9 °F)**	**Tinj = 16.1 to 25 °C (61.0 to 77 °F)**
7.5F	10 cc	0.579	0.628
7.5F	5 cc	0.281	0.309
7.5F	3 cc	0.160	0.181
7F	10 cc	0.579	0.628
7F	5 cc	0.281	0.309
7F	3 cc	0.160	0.181
5F	5 cc	0.291	0.316
5F	3 cc	0.170	0.188

Arrow computation constants			
		Injectate temperature (Tinj) sensor connected/sensor disconnected	**Tinj sensor connected**
Catheter size	**Injectate volume**	**Injectate Temperature: Tinj = -4.9 °C to 23.9 °C (23 °F to 75 °F)**	**InjectateTemperature: Tinj >= 24 °C (75.2 °F)**
7.5F	10 cc	0.532	0.586
7.5F	5 cc	0.249	0.265
7.5F	3 cc	0.131	0.155
7F	10 cc	0.541	0.601
7F	5 cc	0.250	0.273
7F	3 cc	0.134	0.156
5F	5 cc	0.267	0.303
5F	3 cc	0.157	0.192

Cardiac output measuring modes

Two cardiac output measuring modes are available: automatic and manual. If unstable blood temperatures, artifact, or other conditions are preventing automatic measurements, switch to manual mode.

If the attention tone is not deactivated (see page 457), a tone sounds when the cardiac output value has been computed.

Automatic measurements

In auto mode, the message ***Inject when ready*** appears in the ***Procedures...*** > ***C.O.*** page of the Cockpit when the baseline blood temperature is stable. If the blood temperature becomes unstable, the message ***Inject when ready*** is replaced by the message ***Poor baseline***. To select the automatic cardiac output mode, see page 343.

To start a measurement in auto mode

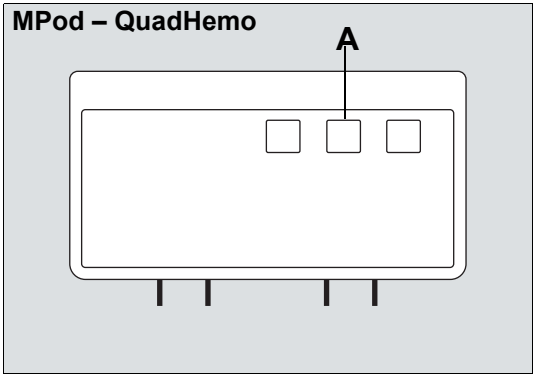
1 Press the cardiac output start key (A) on the MPod – QuadHemo or the Hemo4/Hemo2.

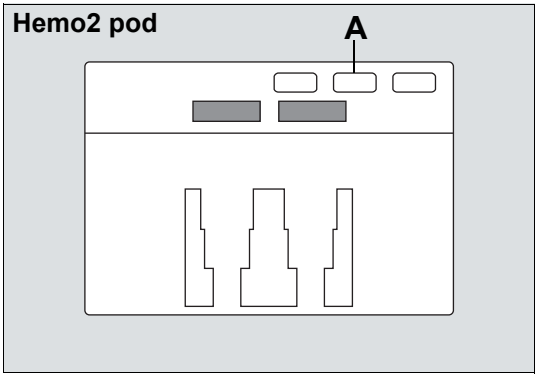
or

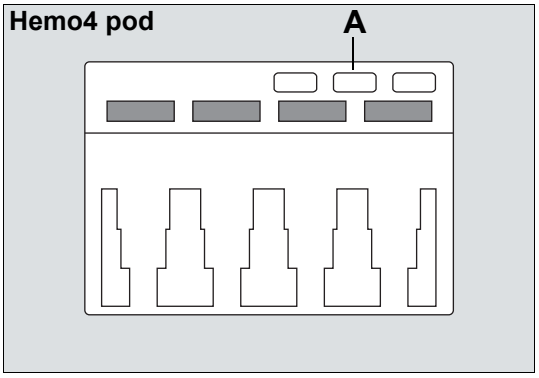
Select the ***Start C.O.*** button on the ***Procedures...*** > ***C.O.*** page (see page 342).

NOTE

If configured to appear on the main menu bar, the ***Start C.O.*** button is also accessible on the main menu bar. For more information, see page 465.







2 Wait for a tone to sound and the message ***Inject when ready*** message to appear which indicates that a stable blood temperature has been detected. Do not perform an injection before the ***Inject when ready*** message appears.

3 Inject the saline solution into the bloodstream. A thermodilution waveform appears, displaying the change in blood temperature. If the blood temperature becomes unstable, the measurement is canceled automatically. If no temperature drop is detected, the waveform stops and the message ***%0 No Temperature Change*** appears.

4 Repeat step 2 to take additional measurements or to repeat a measurement, making sure to wait for the ***Inject when ready*** message.

The ***Procedures...*** > ***C.O.*** page (see page 342) stores up to five cardiac output measurements. Each value panel is touch-sensitive and allows you to include or exclude a value from the calculation of the average. Any value that is crossed out is excluded from the average. If you touch the panel again, the value reappears and will be included in the average.

To save the cardiac output average, see page 341.

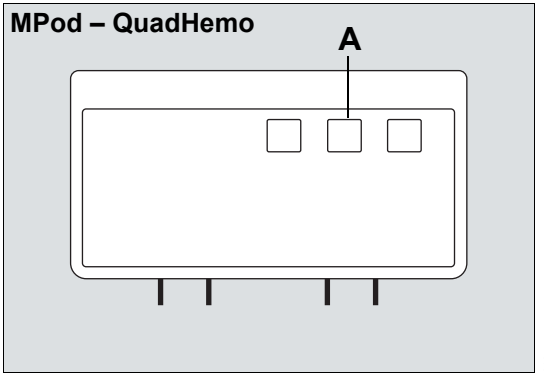
Manual measurements

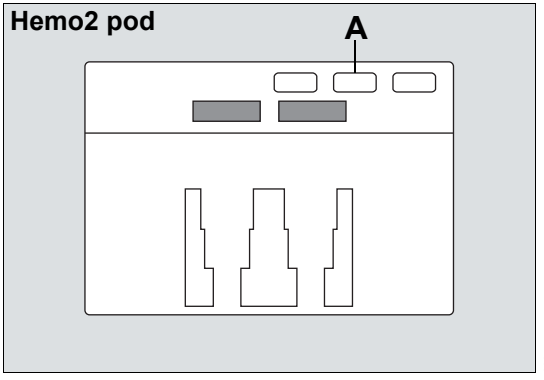
If automatic measurements are not possible due to unstable blood temperatures or other causes, switch to manual mode. To select manual cardiac output mode, see page 344.

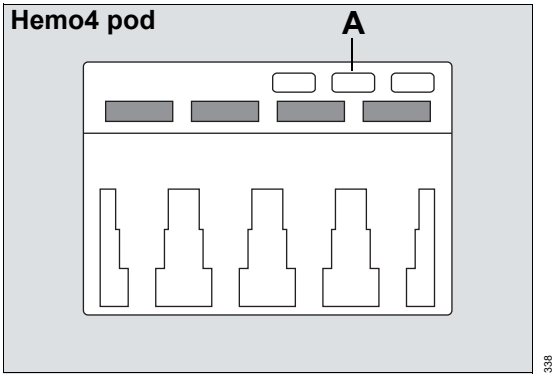
To start a measurement in manual mode

- Press the cardiac output start key (A) on the MPod – QuadHemo or the Hemo4/Hemo2 pods.

or







1 Select ***Procedures...*** from the main menu bar.

2 Select the ***C.O.*** tab to access the ***Procedures...*** > ***C.O.*** page.

3 Select the ***Start C.O.*** button on the Cockpit. Inject the saline solution immediately.

4 Repeat steps 1 and 2 for additional measurements.

The ***Procedures...*** > ***C.O.*** page (see page 342) stores up to five cardiac output averages with time stamps. Each value panel is touch-sensitive and allows you to include or exclude a value from the calculation of the average. Any value that is crossed out is excluded from the average. If you touch the panel again, the value reappears and will be included in the average.

To save the cardiac output average, see page 341.

Saving the cardiac output value

After completing a measurement, you can store the cardiac output average. Closing the ***Procedures...*** > ***C.O.*** page without saving the cardiac output value(s) causes any unsaved values to be lost.

To save the cardiac output value manually

1 Select ***Procedures...*** from the main menu bar.

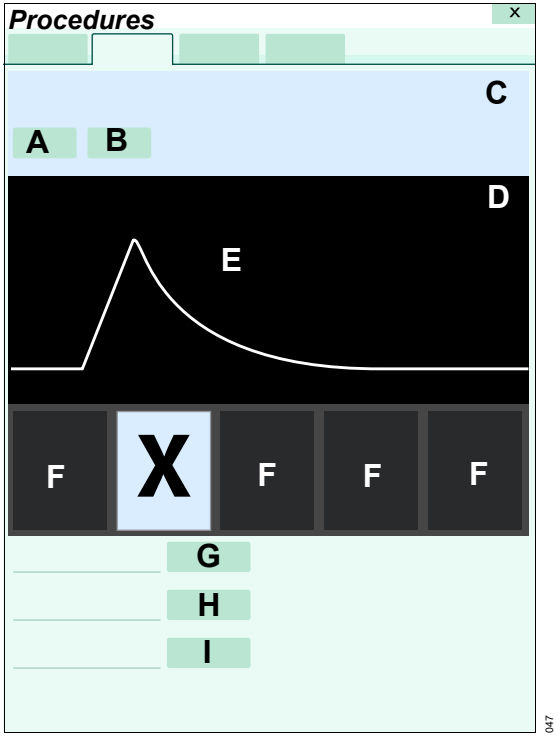
2 Select the ***C.O.*** tab to access the ***Procedures...*** > ***C.O.*** page.

3 Select the ***Save C.O. average*** button.

The stored cardiac output value and the time stamp are stored in the trend function and the parameter field.

Reviewing the cardiac output averages

Different injection techniques cause variations in cardiac output measurements. To compensate for such discrepancies, you can review up to five measurements and use them to compute a cardiac output average. The following diagram shows the ***Procedures*** > ***C.O.*** page after computing an average.



A ***Start C.O.*** button (only available in manual mode – see page 340)

B ***Save C.O. average*** button

C Most recent cardiac output average

D Blood and injectate temperature value field

E Waveform field

F Up to five cardiac output measurements with time stamps. Each value panel is touch-sensitive and allows you to include or exclude a value from the calculation of the average. Any value that is crossed out is excluded from the average. If you touch the panel again, the value reappears and will be included in the average.

G ***Catheter type*** button

H ***Catheter size*** button

I ***Injectate volume [cc]*** button

If you select the catheter type ***Other*** (see page 344), a button appears at the bottom of the page. This button accesses a keypad for entering a computation constant.

Accessing the cardiac output settings

- Select the cardiac output parameter field to select the ***C.O.*** page directly.

  or

1. Select ***Sensor parameters...*** from the main menu bar.
2. Select the ***C.O.*** tab to access the ***C.O.*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

The top portion of the page contains the ***Auto set*** and ***Alarm*** buttons for configuring the alarm functions. For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

Cardiac output parameter setup functions

All cardiac output setup functions take place in the ***C.O.*** page.

Selection	Available settings	Description
Catheter type	– ***BD/Ohmeda*** (default) – ***Edwards/Baxter*** – ***Arrow*** – ***Other***	Displays the currently selected catheter type.
Catheter size	5F, 7F (default), 7.5F	Displays the currently selected catheter size. If ***Other*** is selected for ***Catheter type*** setting, this button is not available.
Injectate volume [cc]	3.0, 5.0, or 10.0 (default)	Displays the currently selected volume of the injectate. If ***Other*** is selected for ***Catheter type*** setting, this button is not available.
Comp. constant *This selection only appears if the Catheter type* ***Other*** *was selected.*	– 0.100 to 0.999 – 0.542 (default)	The computation constant must be entered manually if the catheter type ***Other*** was selected (see page 344). The computation constant depends on the injectate volume and temperature according to the specific values provided by the catheter.
C.O. mode	***Auto*** (default), ***Manual***	Determines the cardiac output measurement mode (see page 338).
Start C.O.	None	Starts a cardiac output measurement (see page 338).
Color	White (default); there is no color selection for cardiac output	Determines the color of the waveforms, parameter labels, and values.

Mainstream CO_2 monitoring

Overview of Mainstream CO2 monitoring

The Cockpit provides fast and continuous mainstream measurements of carbon dioxide concentrations (CO2) in the airway of intubated patients. The M540 acquires signals from a CO2 sensor (Infinity MCable – Mainstream CO_2) which fits over a mainstream airway adapter. The lightweight, reusable CO2 mainstream sensor provides sensitive and accurate measurements. It uses non-dispersive infrared technology to measure CO2 in breathing gases.

CO2 monitoring is available for adult, pediatric, and neonatal patients. Refer to the Instructions for use *Infinity Acute Care System – Infinity M540* for ordering information of the appropriate size of accessories.

As respiration gases flow through the airway adapter, the sensor analyzes the expired and inspired air of the patient. The analysis is accomplished by sending a beam of infrared light through transparent ports in the airway adapter while detecting changes in CO2 absorption levels.

Refer to the Instructions for use *Infinity Acute Care System – Infinity M540* for a detailed description of the M540 CO2 functions.

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. Parameter-specific error messages are listed in "Troubleshooting" on page 525.

Supported parameters

– ***$etCO_2$*** (end-tidal CO2 concentration)

– ***inCO2*** (inspiratory CO2 concentration)

– ***RRc*** (respiratory rate derived from CO2 measurement)

CO2 precautions

Refer to "General safety information" on page 17 for general precautions.

WARNING

RRc apnea alarms are NOT reported if the setting *RRc apnea time [s]* is set to *Off* in the *CO2* setup page and the RRc alarm feature is deactivated. To generate RRc apnea alarms, activate the RRc alarms and select an RRc apnea alarm time.

WARNING

The safety and effectiveness of the respiration measurement method in apnea detection, particularly the apnea of prematurity and apnea of infancy, has not been established.

WARNING

Patient monitors that measure CO2, anesthetic agents, and/or respiratory mechanics are not intended to be used as an apnea monitor and/or recording device. While these products provide an apnea alarm, that alarm condition is initiated based on the elapsed time since the last breath was detected. Clinical diagnosis of a true apneic event, however, requires multiple physiological signals.

WARNING

CO2 alarms do not activate until the first breath is detected after turning on the monitor or discharging a patient.

WARNING

The surface temperature of the sensor may rise to 43 °C (109 °F). Prolonged exposure to the patient's skin may result in a burn.

CAUTION

Leaks in the breathing circuit (for example, an uncuffed endotracheal tube or a damaged airway adapter) may significantly affect CO2 measurement values.

CAUTION

To avoid accidental disconnections, do not apply excessive tension to any sensor cable.

CAUTION

To prevent leakage, make sure the airway adapter is firmly connected to the breathing circuit.

CAUTION

Check the CO2 mainstream sensor for damage before use. A damaged CO2 sensor may impair galvanic isolation or may introduce debris into the breathing circuit.

NOTE

Dräger CO2 accessories that come in contact with the patient do not contain natural rubber latex.

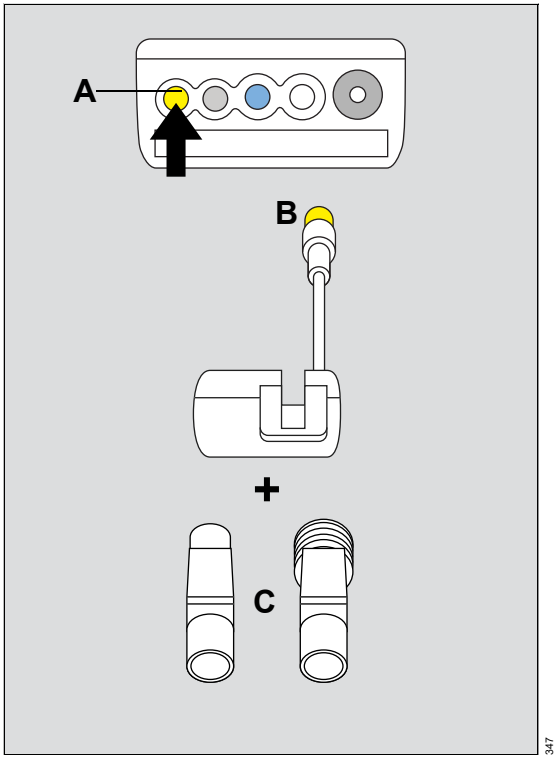
WARNING

For premature babies, do not carry out CO2 measurements because the CO2 cuvette significantly increases the dead space.

Connecting the CO_2 sensor

Before connecting any CO_2 hardware, make sure the airway adapter in use matches the airway adapter setting of the Cockpit. For example, do not use a disposable airway adapter if the Cockpit is configured for a reusable airway adapter (and vice versa). Not aligning the adapter with the configuration setting at the Cockpit compromises the displayed CO_2 value.

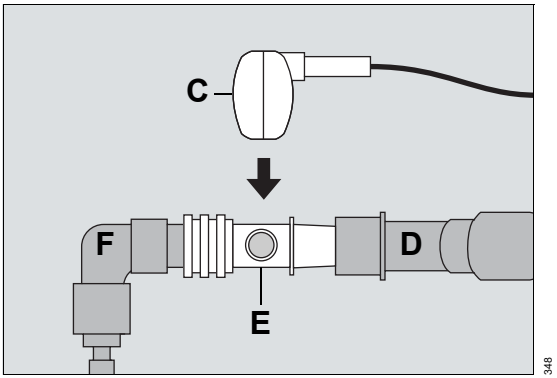
The CO_2 cable connects directly to the M540.



A M540 CO_2 port

B CO_2 sensor cable connector

C Mainstream airway adapter



D Y-piece

E Airway adapter

F Endotracheal tube adapter

To connect the hardware

The IACS is only compatible with the sensors 6871950 revision 5 or higher. Previous revisions are not compatible.

1. Connect the CO_2 sensor cable connector (B) to the yellow CO_2 port (A) on the M540.
2. Select a suitable Mainstream airway adapter (C) whose windows are clean and dry (replace the adapter if necessary).
3. Insert the airway adapter (E) between the endotracheal tube adapter (F) and the ventilator Y-piece (D).

CAUTION
Always position the sensor windows of the airway adapter vertically to prevent patient secretions from obscuring the adapter windows.

4. Snap the Mainstream airway adapter (C) firmly into the airway adapter and make sure that the cable is directed away from the patient.

Patient preparation for CO2 monitoring

The following tips provide optimal monitoring results but must never replace hospital-approved practices or manufacturer's recommendations.

A default O_2 concentration of 21% (the percentage of oxygen in ambient air) for all CO2 measurements is assumed. If the patient is receiving supplemental oxygen or N2O or Heliox, select the gas that is being administered in the CO2 setup page. Make sure to manually adjust the ambient pressure to the actual measurement value. Automatic ambient pressure compensation is not provided. Failure to compensate for supplemental gases results in inaccurate measurement values.

When switching adapter types (from reusable to disposable or adult to pediatric, or vice versa), there is no need to re-zero a Dräger sensor. If the sensor window is clean and the correct sensor type is selected under the ***Airway adapter CO2 Mainstream*** setting, only zero a Dräger sensor when the measurement value is suspect or when prompted to re-zero.

CO2 display

On the Cockpit, the CO2 display consists of:

– A CO2 parameter field

– A CO2 waveform

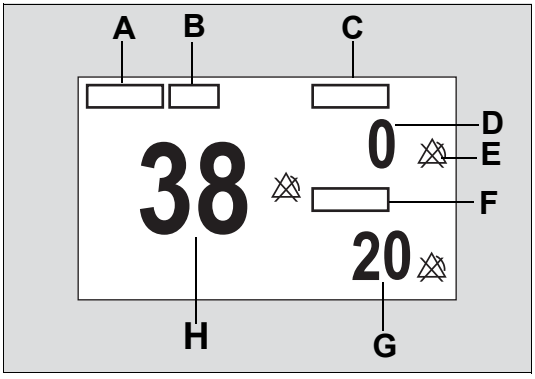
CO2 parameter field

NOTE

The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The CO2 parameter field contains the following elements:



A $etCO_2$ (end-tidal CO2) label

B Unit of measurement (can be activated/deactivated)

C inCO2 label (inspired CO2)

D inCO2 value – the level of CO2 in the airway during inspiration, taken as the minimum value during the previous measurement interval

E Upper/lower alarm limits or crossed triangle symbols when alarms are deactivated

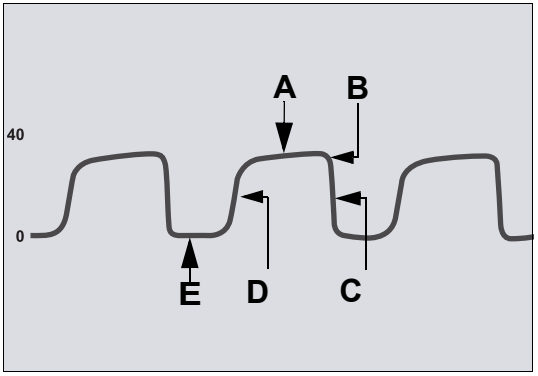
F RRc (respiratory rate) parameter label

G RRc value – respiratory rate derived from the CO2 signal

H $etCO_2$ value – highest CO2 value in the airway during expiratory phase

CO2 waveforms

The Cockpit also displays an instantaneous CO2 waveform.



A Expiratory or alveolar plateau (level of CO2 in lungs ceases to increase significantly)

B End-tidal concentration point (end of expiratory phase, where CO2 is measured)

C Onset of inspiratory phase

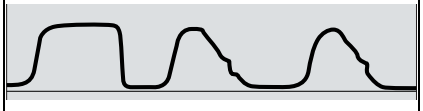
D Onset of expiratory phase

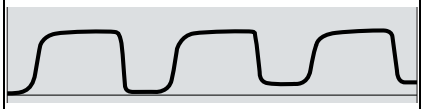
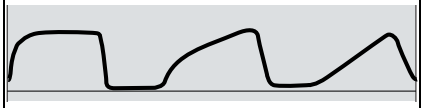
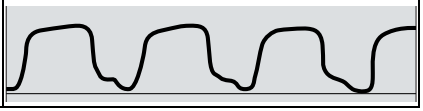
E Baseline during inspiration

Troubleshooting

In addition to evaluating the clinical status of a patient, CO2 waveforms can help troubleshoot problems with equipment.

The following table shows how CO2 waveforms can be used to identify common problems.

Description	Cause	CO2 waveform
Alveolar plateau showing a downward slope that merges with a descending limb.	– Inadequate seal around the endotracheal tube – Leaky or deflated endotracheal or tracheostomy cuff – Artificial airway that is too small for the patient	

Description	Cause	CO2 waveform
Elevated waveform baseline with corresponding increase in CO2 level.	Rebreathing due to one of the following causes: – Disposable airway adapter is used although the Cockpit is configured for the reusable adapter type – Contaminated airway adapter (dirty window) – CO2 zero drift – Insufficient expiratory time – Faulty expiratory valve – Inadequate inspiratory flow – Malfunction of a CO2 absorber system – Partial rebreathing circuits	
Change in slope of ascending limb. Possible absence of an alveolar plateau.	Obstruction caused by one of the following: – Partial obstruction in expiratory limb of breathing circuit – Foreign matter in upper airway – Partially kinked or occluded artificial airway – Herniated endotracheal or tracheostomy tube cuff – Bronchospasm	
Elevated baseline, with pronounced slope on descending limb	– Faulty ventilator circuit valve – Rebreathing (see above)	

Using the CO_2 dialog

Setup for all CO_2 parameters takes place in the ***CO_2*** dialog. This dialog contains the following tabs:

– ***Mainstream*** sets associated CO_2 parameters

– ***Microstream*** sets associated CO_2 parameters

– ***Calibration check*** performs a Mainstream sensor calibration check. For information about the ***Calibration check*** tab, see "Performing a calibration check" on page 355.

If the Cockpit is not set up for CO_2 monitoring, then the ***Microstream*** tab also displays in the ***CO_2*** dialog.

To access the Mainstream settings

If the ***CO_2*** parameter displays on the cockpit:

1 Touch the ***CO_2*** parameter field.

2 Touch the ***Mainstream*** tab.

Or, if the ***CO_2*** parameter field is not displayed:

- Select ***Sensor parameters...*** from the main menu bar > ***Mainstream*** tab to access the ***Mainstream*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

CO_2 Limits

Setup for all CO_2 alarm limit functions takes place in the ***Mainstream*** tab within the ***CO_2*** dialog.

The ***Mainstream*** tab displays fields on the upper left side for ***etCO_2***, ***inCO_2,*** and ***RRc*** settings.

etCO_2 and ***RRc*** allow adjustment of the upper alarm limit, use of the ***Archive*** feature, and use of ***Auto set***. For ***inCO_2***, only the upper alarm limit and Archive can be used.

NOTE

The sensor must be removed from the airway adapter before zeroing. The sensor is zeroed in room air. Do not breathe on the airway adapter during zeroing. CO_2-related alarms are disabled whenever the sensor is zeroing; however, active alarms continue to display during zeroing.

NOTE

CO_2 limits settings apply to both Mainstream and Microstream.

CO2 parameter setup

All setup functions for CO2 take place in the ***CO_2*** dialog.

NOTE

When a Scio module is connected, parameter controls for CO2 are available only in the Scio setup menu.

Before connecting any CO2 hardware, make sure the airway adapter that is used matches the airway adapter setting at the Cockpit.

For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

NOTE

The sensor must be removed from the airway adapter before zeroing. The sensor is zeroed in room air. Do not breathe on the airway adapter during zeroing.

Selection	Available settings	Description
Zero (Only available if a CO2 device is connected)	None	Zeroes the CO2 sensor if necessary. The CO2 sensor stores a new isoelectric point for CO2 measurements.
Scale	– 0 to 40 mmHg (default), 0 to 60 mmHg, 0 to 80 mmHg, 0 to 100 mmHg – 0 to 5 kPa (default), 0 to 8 kPa, 0 to 12 kPa, 0 to 16 kPa – 0 to 5 % (default), 0 to 8 %, 0 to 12 %, 0 to 16 %	Adjusts the size of the CO_2 waveform. Scale settings apply to both Mainstream and Microstream.
Atm. pressure	570 to 800 mmHg 760 mmHg (default)	Determines the ambient pressure setting of the sensor and compensates for pressure effects. Failure to compensate for pressure can cause inaccurate measurements.
Gas compensation	***Air*** (default), N_2O/O_2, ***O_2>50%***, ***HeliOx***	Compensates for supplemental oxygen or N2O or Heliox. Failure to compensate for supplemental oxygen can cause inaccurate measurements.
RRc apnea time [s]	***Off*** (default), 10, 15, 20, 25, 30 s	Specifies the time the M540 waits before reporting a cessation of breathing as an apnea event. ***RRc apnea time [s]*** settings apply to both Mainstream and Microstream.
RRc apnea archive	***Off***, ***Store*** (default), ***Str/Rec***, ***Record***	Determines what happens in response to an apnea. ***RRc apnea archive*** settings apply to both Mainstream and Microstream.
Airway adapter	***Reusable*** (default), ***Disposable***	Determines the type of airway adapter used for ***CO_2*** monitoring. Compensates for the type of airway adapter that is being used. Requires matching the adapter with the configuration setting at the Cockpit; if the adapters do not match, the ***CO2*** value displayed is compromised.

Selection	Available settings	Description
Color	Red, green, blue, yellow (default), light blue, purple, orange, white.	Determines the color of the waveforms and parameter labels/values. Color settings apply to both Mainstream and Microstream.

Performing a calibration check

The ***Calibration check*** tab is used to do the following tasks:

– View the date of the last calibration

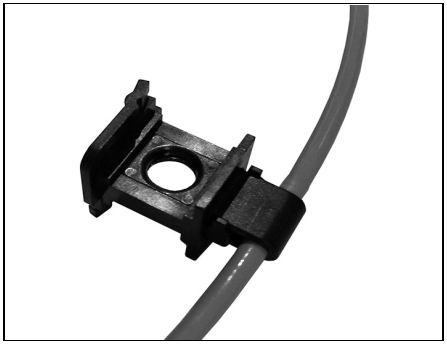
– Perform a calibration check

A calibration check verifies that the CO_2 sensor is functioning within the acceptable calibration limits. If successful, the message ***CO2 calibration check successful*** displays on the Cockpit. For descriptions of additional message conditions, "Calibration and maintenance" on page 559. Perform a calibration check according to the healthcare facility's guidelines.

While a calibration check is in progress, any active alarms continue to display on the Cockpit; however, CO_2- and RRc-related alarms are temporarily disabled until a valid breath is detected and the associated value displays in the CO_2 parameter field.

Required accessories

– Test filter (attached to the CO_2 sensor and shown in the following figure).



Contact the biomed or service personnel for the required accessories if needed.

To perform a calibration check

1 Select the ***Calibration check*** tab.

2 Follow the instructions as they display on the ***Calibration check*** window.

3 If the calibration check fails, follow the instructions that display on the Cockpit or contact specialized service personnel.

This page has been left blank intentionally.

Microstream CO_2 monitoring

Overview of Microstream® CO_2 monitoring

The Cockpit provides continuous sidestream measurements of carbon dioxide (CO_2) concentrations for intubated and non-intubated patients. The Cockpit acquires signals from the ***Infinity MCable – Microstream CO_2*** (subsequently referred to as *Microstream MCable* and shown in the following figure).

The Microstream MCable enables the clinician to monitor CO_2 using the patient monitor. It uses non-dispersive infrared technology to measure CO_2 in breathing gases. The Microstream MCable analyzes the expiratory and inspiratory air as the breathing gases flow through the sample line. It automatically compensates for ambient pressure within the defined operating ranges

The Microstream MCable is intended for use with adult, pediatric, and neonatal patients with the appropriate accessories.

Before performing any monitoring functions, refer to the chapter "For your safety and that of your patients" on page 13.

Supported parameters

- ***etCO2*** (end-tidal CO_2 concentration)
- ***inCO2*** (inspiratory CO_2 concentration)
- ***RRc*** (respiratory rate)

Parameter-specific error messages are listed on page 559.

Accessories

Refer to the *Infinity Acute Care System Instructions for use, Monitoring Accessories* for available accessories used for Microstream CO_2 monitoring.

Using the Microstream MCable

Refer to the ***Infinity M540 patient monitor Instructions for use (Software VG5.n)*** for information about the Microstream MCable and the following topics:

- Safety precautions
- Connection and detachment
- Scavenger system use
- Use models and required accessories
- Sample line guidance
- Calibration check

CO2 display

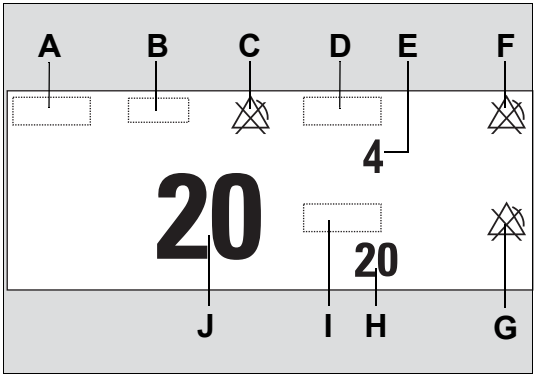
On the Cockpit, the CO2 display consists of:

– CO2 parameter field

– CO2 waveform

CO2 parameter field

The CO2 parameter field contains the following elements:



A ***etCO2*** label

B Unit of measurement

C Crossed triangle symbol when the ***etCO2*** alarm is turned off

D ***inCO2*** label

E ***inCO2*** value – the level of ***CO2*** in the airway during inspiration, taken as the minimum value within the measurement interval

F Crossed triangle symbol when *inCO2* alarms are turned off

G Crossed triangle symbol when ***RRc*** alarms are turned off

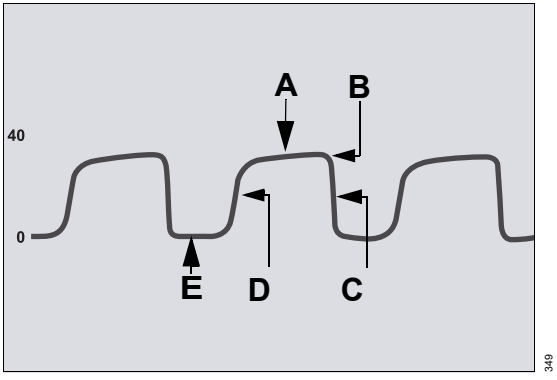
H ***RRc*** value – respiratory rate derived from the CO2 signal.

I ***RRc*** (respiratory rate) parameter label

J ***etCO2*** value – highest level of CO2 in the airway during the expiratory phase within the measurement interval

CO2 waveform

The M540 also displays an instantaneous CO2 waveform.



A Expiratory or alveolar plateau (level of CO2 in lungs ceases to increase significantly)

B End-tidal concentration point (end of expiratory phase, where CO2 is measured)

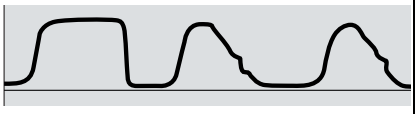
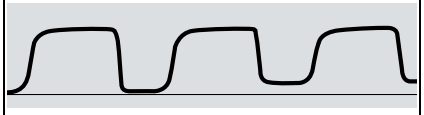
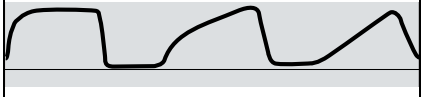
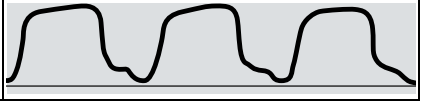
C Onset of inspiratory phase

D Onset of expiratory phase

E Baseline during inspiration

Troubleshooting

In addition to evaluating the clinical status of a patient, CO_2 waveforms can help troubleshoot equipment problems. The following table shows how CO_2 waveforms can be used to identify common problems.

Description	Cause	CO_2 waveform
Alveolar plateau showing a downward slope that merges with a descending limb.	– Inadequate seal around the endotracheal tube – Leaky or deflated endotracheal or tracheostomy cuff – Artificial airway that is too small for the patient	
Elevated waveform baseline with corresponding increase in CO_2 level.	Rebreathing due to one of the following causes: – Insufficient expiratory time – Faulty expiratory valve – Inadequate inspiratory flow – Malfunction of a CO_2 absorber system – Partial rebreathing circuits	
Change in slope of ascending limb. Possible absence of an alveolar plateau.	Obstruction caused by one of the following: – Partial obstruction in expiratory hose of breathing circuit – Foreign matter in upper airway – Partially kinked or occluded artificial airway – Herniated endotracheal or tracheostomy tube cuff – Bronchospasm	
Elevated baseline, with pronounced slope on descending limb	– Faulty ventilator circuit valve – Rebreathing (see above)	

Using the CO_2 dialog box

Setup for CO_2 parameters takes place in the ***CO_2*** dialog. This dialog contains the following tabs:

– ***Mainstream*** sets associated CO2 parameters

– ***Microstream*** sets associated CO_2 parameters

– ***Calibration check*** performs a Microstream MCable calibration. For information about the Calibration Check tab, see "Calibration Check" on page 363.

If the Cockpit is not set up for CO_2 monitoring, then the ***Mainstream*** tab also displays in the ***CO_2*** dialog.

To access the Microstream settings

If the ***CO_2*** parameter displays on the Cockpit:

1 Touch the ***CO_2*** parameter field.

2 Touch the ***Microstream*** tab.

Or, if the ***CO_2*** parameter field is not displayed:

- Select ***Sensor parameters...*** from the main menu bar > ***Microstream*** tab to access the ***Microstream*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

NOTE

CO_2 limits settings apply to both Mainstream and Microstream.

CO_2 limits

Setup functions for CO_2 parameters take place in the ***Microstream*** tab within the ***CO_2*** dialog.

The ***Microstream*** tab displays fields on the upper left side of the window for ***etCO_2***, ***inCO_2,*** and ***RRc*** settings.

etCO_2 and ***RRc*** allow adjustment of the upper and lower alarm limits, use of the ***Archive*** feature, and use of ***Auto set.*** For inspiratory CO_2, only the upper limit and ***Archive*** can be used.

CO_2 parameter setup

Setup functions for CO_2 parameters take place in the CO_2 dialog within the ***Microstream*** tab.

For detailed alarm setup information, see "Configuring the alarm settings for a patient" on page 134.

NOTE
When a Scio module is connected, parameter controls for CO2 are available only in the Scio setup menu.

Selection	Available settings	Description
RRc apnea time [s]	Off (default) 10 s, 15 s, 20 s, 25 s, 30 s	Specifies how long the Cockpit waits before reporting a cessation in breathing as an apnea event.
RRc apnea archive	***Off***, ***Store*** (default), ***Str/Rec***	Determines what happens in response to an apnea event.
Next service in:	Informational only (settings are not applicable)	The remaining hours until maintenance is required.
Averaging	***Last valid breath,*** ***Off,*** 10 s, 20 s (default), 30 s	Controls the specific time or the interval used to select the maximum measured ***etCO2*** and the minimum measured ***inCO2***.
Scale	– 0 to 40 mmHg (default), 0 to 60 mmHg, 0 to 80 mmHg, 0 to 100 mmHg – 0 to 5 kPa (default), 0 to 8 kPa, 0 to 12 kPa, 0 to 16 kPa – 0 to 5% (default), 0 to 8%, 0 to 12 %, 0 to 16%	Adjusts the size of the CO_2 waveform. Scale settings apply to both Mainstream and Microstream.
Color	Red, White, Yellow (default), Green, Light blue, Blue, Purple, Orange	Determines the color of the CO_2 waveform, and the parameter labels and values.
Last calibration:	Informational only	Displays the date of the last calibration.

Calibration Check

The ***Calibration check*** tab is used to perform the following tasks:

– Viewing the remaining hours until the next service check is due for the Microstream MCable

– Viewing the date of the last calibration

– Performing a calibration check

A calibration check verifies that the Microstream MCable is within the acceptable calibration limits. If successful, the message ***CO2 calibration check successful*** displays on the Cockpit. For descriptions of additional message conditions, see "Calibration and maintenance" on page 559. Perform a calibration check according to the healthcare facility's schedule guidelines.

WARNING

Risk of inaccurate patient results

A Microstream MCable that is out of calibration may provide inaccurate results.

If calibration does not take place as instructed, the Microstream MCable may be out of calibration.

Ensure the proper calibration of the Microstream MCable.

Required accessories

– A gas canister (with a mix of 5% ***CO_2***, 21% O_2, balanced N_2).

– Sample line

Contact the biomed or service personnel for the required accessories if needed.

To perform a calibration check

1 Select the ***Calibration check*** tab.

2 Follow the instructions as they display on the ***Calibration check*** window.

3 If the calibration check is unsuccessful, see "Calibration and maintenance" on page 559 or contact specialized service personnel.

This page has been left blank intentionally.

Scio Monitoring

Overview of Scio monitoring

The Scio Four module samples gas from the breathing gas of pediatric patients and adults. It continuously measures the concentration of CO_2, N_2O, and anesthetic agents (Sevoflurane, Desflurane, Isoflurane, Halothane, Enflurane) in the breathing gas as well as the O_2 concentration (optional). All measured values as well as derived values are communicated to a patient monitor.

WARNING

Risk of inaccurate gas measurement values

During warm-up, reported values may not be accurate. Wait until the gas analyzer has completed initialization and warm-up. Refer to the Technical Data appendix in the gas analyzer supplement for further information regarding gas analyzer accuracy.

WARNING

Risk due to defective sensors

If the gas analyzer is not ready for operation, the patient will not be adequately monitored. Before using the medical device, ensure a suitable substitute monitoring.

WARNING

Risk of patient safety

The multigas information displayed is intended to be used by trained and authorized health care professionals only.

NOTE

The M540 does not backfill secondary agent trends on the network. The secondary agents are sent in real-time to the network.

NOTE

In this chapter, all Scio Four modules (Scio Four, Scio Four Oxi, Scio Four plus, and Scio Four Oxi plus) are referred to as "gas analyzer."

NOTE

The ***N2O*** and ***xMAC*** agent trends are not available on the destination Cockpit after a network transfer. However, they can be viewed on the primary patient monitor, the ICS, or any other patient data management system.

The gas analyzer is available in four variants with different functions as listed below.

	O_2	CO_2, N_2O	Agent	Agent ID	Mixtures
Scio Four	No	Yes	1 out of 5	No	No
Scio Four Oxi	Yes	Yes	1 out of 5	No	No
Scio Four plus	No	Yes	2 out of 5	Yes	Yes
Scio Four Oxi plus	Yes	Yes	2 out of 5	Yes	Yes

IACS automatically detects the variant of gas analyzer connected and adjusts all context-sensitive menus for the gas analyzer variant.

At start-up, the gas analyzer warms up and displays the low-priority alarm ***Scio warming up: Accur. low*** on the M540 monitor. During this time, concentrations for certain gases may not be available and the anesthetic agent may not be identified.

The following alarms are supported prior to the detection of a valid breath:

NOTE

The "***%0***" symbol indicates CO_2, N_2O, O_2, and any agents that may appear in the alarm message.

- ***MIXED AGENT***
- ***%0 out of range high***
- ***%0 reduced accuracy***
- ***%0 sensor failure***
- ***%0 value temporarily unavail.***
- ***Check water trap/sample line***
- ***Gas sensor failure***
- ***CO_2 reduced accuracy***
- ***CO_2 sensor failure***
- ***Gas sensor reduced accuracy***
- ***<agent>>%val***
- ***inN_2O >82***
- ***FiO_2 <%val***
- ***Inspiratory xMAC high***
- ***Sample line blocked***
- ***Scio is not connected***
- ***Scio unavailable for neonates***
- ***Scio warming up: Accur. low***
- ***Second agent detected***
- ***Water trap is full***

All other O_2 alarms, CO_2 alarms, N_2O alarms, and anesthetic gas alarms are active only after one breath has been detected.

Supported parameters

The following parameters are supported:

- ***RRc***
- ***inCO2***
- ***etCO2***
- ***FiO2*** (displays as inO2 in parameter fields)
- ***etO2***
- ***inN2O***
- ***etN2O***
- ***inSev***
- ***etSev***
- ***inDes***
- ***etDes***
- ***inIso***
- ***etIso***
- ***inHal***
- ***etHal***
- ***inEnf***
- ***etEnf***
- ***xMAC***

Using the Scio dialog

Setup for Scio parameters takes place in the Scio dialog. This dialog contains the following tabs:

- ***CO2***
- ***O2***
- ***Agent settings***
- ***Agent alarms***
- ***Show all***

To access the Scio settings

Scio settings are available through the CO_2, O_2, or Agent parameter fields.

If the CO_2, O_2, or Agent parameter field displays on the Cockpit:

1 Touch the CO_2, O_2, or Agent parameter field.

2 Touch the ***Scio*** tab.

Or, if the CO_2, O_2, or Agent parameter field is not displayed:

- Select ***Sensor parameters...*** from the main menu bar > ***Scio*** tab to access the ***Scio*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

CO_2 alarm limits

The ***CO2*** tab displays fields on the upper left side of the window for ***etCO2***, ***inCO2,*** and ***RRc*** alarm limit settings.

etCO2 and ***RRc*** allow adjustment of the upper and lower alarm limits, use of the ***Archive*** feature, and use of ***Auto set.*** For inCO_2, only the upper limit and ***Archive*** can be used.

CO_2 parameter setup functions

Setup functions for CO_2 parameters take place in the ***CO_2*** tab within the ***Scio*** dialog.

NOTE

When a CO_2 mainstream sensor or Microstream MCable is connected, parameter controls for Scio are unavailable.

Selection	Available settings	Description
RRc apnea time [s]	– ***Off*** (default) – 10 – 15 – 20 – 25 – 30	Specifies the time the M540 waits before reporting a cessation of breathing as an apnea event.
RRc Apnea archive	– ***Off*** – ***Store*** (default) – ***Str/Rec*** – ***Record***	Determines what happens in response to an apnea.
Parameter field	– ***CO_2*** (default) – ***CO_2/O_2***	Configures the CO_2 display based on the selected setting.
Scale [mmHg]	– 40 – 60 – 80 – 100	Adjusts the size of the CO_2 waveform.
Color	– Red – White – Yellow (default) – Green – Light blue – Blue – Purple – Orange	Determines the color of the waveforms, and the parameter labels and values.

O_2 alarm limits

For gas analyzers with O_2 monitoring, the ***O_2*** tab displays fields on the upper left side of the window for ***etO2*** and ***FiO_2*** alarm limit settings.

etO2 and ***FiO_2*** allow adjustment of the upper and lower alarm limits, use of the ***Archive*** feature, and use of ***Auto set.***

NOTE

When a gas analyzer without O_2 monitoring is connected, the controls for O_2 alarms are not available in the Scio setup menu.

O_2 parameter setup functions

Setup functions for O_2 parameters take place in the ***O_2*** tab within the ***Scio*** dialog.

Selection	Available settings	Description
Parameter field	– ***O_2*** – ***O_2/N2O***	Configures the O_2 display based on the selected setting.
Scale [%]	– 0-100 – 15-35 – 20-100 (default) – 25-45 – 35-55 – 45-65 – 55-75 – 65-85 – 75-95 – 85-105	Adjusts the size of the O_2 waveform.
Mini-trend	– ***etO2*** (default) – ***FiO_2***	Selects the parameter to display in the mini-trend associated with the O_2 parameter field.

Agent alarm setup

The ***Agent alarms*** tab allows the following to be adjusted for all agent alarms:

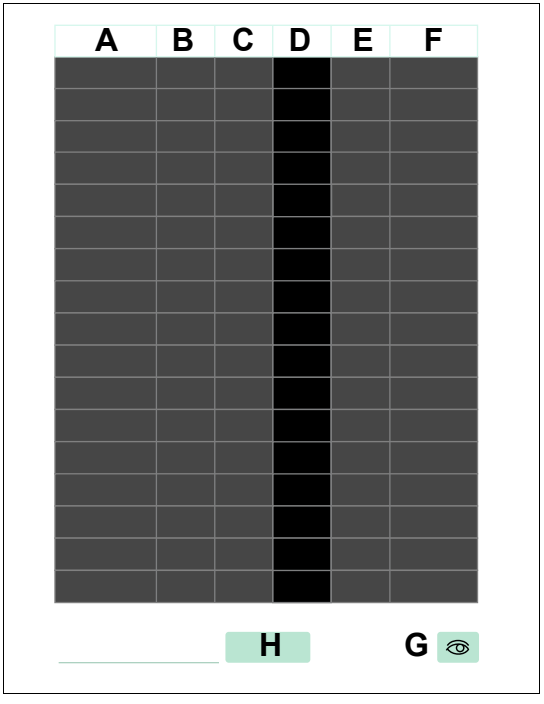
– Alarm status (on/off)

– Lower limit

– Upper limit

– Archive status

The ***Agent alarms*** tab consists of a table with setup rows for each agent. Each setup row consists of several fields for configuring the individual alarm settings. When you select a field to configure a setting, an orange border highlights the selected row.



A Parameter labels column

B ***Alarm*** on/off column

C ***Lower*** limits column

D Actual parameter values

E ***Upper*** limits column

F ***Archive*** column

G Display filter button

H **Auto set all** button (see "Auto setting all alarm limits" on page 147)

WARNING

Setting alarm limits to extreme values may prevent certain alarm conditions from being detected and from being annunciated with acoustic and optical alarm signals.

To configure agent alarm settings

NOTE

For more information on agent alarm settings, see "Alarm ranges and defaults" on page 158.

1 Touch the corresponding field in the ***Alarm*** on/off column (B) to activate or deactivate alarm monitoring. A crossed-out triangle appears in the parameter field when alarm monitoring is deactivated.

2 Touch the corresponding field in the ***Lower*** column (C). Use the rotary knob to set the lower alarm limit, and press the rotary knob to confirm the setting.

3 Touch the corresponding field in the ***Upper*** column (E). Use the rotary knob to set the upper alarm limit, and press the rotary knob to confirm the setting.

4 Touch the corresponding field in the ***Archive*** column (F). Use the rotary knob to select one of the following settings to determine what happens in response to an alarm:

   – ***Off*** – no event is stored and no recording is generated.

   – ***Store*** – stores the event for later review.

   – ***Record*** – generates a timed recording

   – ***Str/Rec*** – generates a timed recording and stores the event.

Select the ***Auto set all*** button (J), to auto adjust the alarm limits of all parameters. For more information, see page 147.

Agent parameter setup functions

Setup functions for Agent parameters take place in the ***Agent settings*** tab within the ***Scio*** dialog.

When a secondary agent is used, alarm limit violations trigger alarms only for the primary agent. Although the alarm limits on the secondary agent can be set, the alarms will not annunciate for the secondary agent until it is changed to the primary agent.

Selection	Available settings	Description
Parameter field	– ***Agent*** – ***Agent/ xMAC*** (default) – ***Agent/N2O***	Displays anesthetic agents based on the selected setting.
Mini-trend	– ***Agent*** (default) – ***xMAC***	Selects the parameter to display in the mini-trend associated with the ***Agent*** parameter field. **NOTE:** If ***Agent*** is selected, the expiratory value of the primary agent is displayed.
Agent (Scio Four Oxi and Scio Four only)	– Desflurane – Enflurane – Halothane – Isoflurane – Sevoflurane (default)	Configures the Scio Four or Scio Four Oxi module to measure the concentration levels of a user-specified anesthetic agent. **WARNING**: **– Use care when selecting the agent manually. Measurements are inaccurate if the wrong agent is selected.** **– Scio Four Oxi and Scio Four cannot recognize anesthetic gas mixtures. Measurements are inaccurate if anesthetic gases are mixed.** **NOTE:** The ***Agent*** button is grayed-out when a gas analyzer with automatic agent identification is connected (Scio Four Plus, Scio Four Oxi Plus).
"Second agent detected" alarm	– ***On*** (default) – ***Off***	Indicates a change of the anesthetic agent during monitoring. Only occurs on gas analyzers with automatic agent identification. **NOTE:** The ***"Second agent detected" alarm*** button is grayed-out when a gas analyzer with manual agent identification is connected (Scio Four, Scio Four Oxi).

CO_2 display

On the Cockpit, the CO_2 display consists of:

– CO_2 parameter field

– CO_2 waveform

The Cockpit supports a configurable parameter field for display of CO_2 that allows one of the following displays:

– CO_2 by itself (default)

– CO_2 with O_2 (only for gas analyzers with O_2 monitoring)

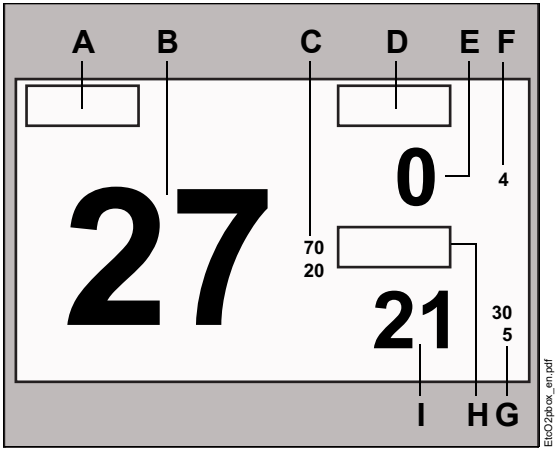
CO_2 parameter field

The default CO_2 parameter field displays the current values for:

– Inspired CO_2 ($inCO_2$) – the level of CO_2 in the airway during inspiration phase.

– End-tidal CO_2 ($etCO_2$) – the level of CO_2 in the airway at the end of expiration.

– Respiratory Rate (RRc) – the patient's respiratory rate, derived from the $etCO_2$ signal.



A ***etCO2*** label

B $etCO_2$ value – highest level of CO_2 in the airway during the expiratory phase within the measurement interval

C $etCO_2$ alarm limits (displays crossed triangle symbol when $etCO_2$ alarms are turned off)

D ***inCO2*** label

E $inCO_2$ value – the level of CO_2 in the airway during inspiration, taken as the minimum value within the measurement interval

F $inCO_2$ alarm upper limit (displays crossed triangle symbol when the $inCO_2$ alarm is turned off)

G RRc alarm limits (displays crossed triangle symbol when RRc alarms are turned off)

H ***RRc*** parameter label

I RRc value – respiratory rate derived from the CO_2 signal.

CO_2/O_2 parameter field

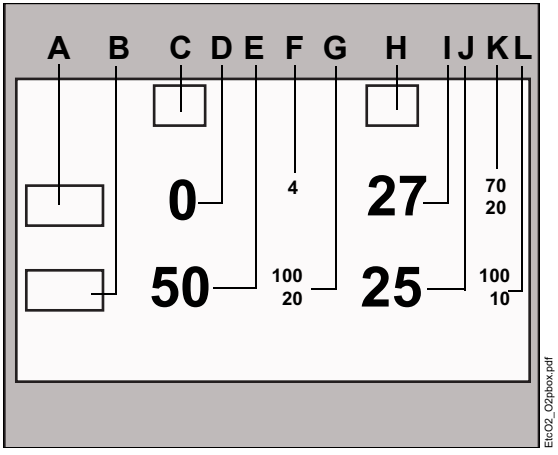
The CO_2 /O_2 parameter field displays the following additional values:

– Inspired O_2 (in O_2/FiO_2) – the level of O_2 in the airway during inspiration, taken as the minimum value within the measurement interval

– End-tidal O_2 (etO_2) – the highest level of O_2 in the airway during the expiratory phase within the measurement interval

NOTE

Current ***RRc*** values are displayed on the ***CO2*** tab of the Scio dialog.



A CO_2 label

B O_2 label

C Abbreviation for "inspiratory"

D inCO_2 value – the level of CO_2 in the airway during inspiration, taken as the minimum value within the measurement interval

E inO_2 (FiO_2) value – the level of O_2 in the airway during inspiration, taken as the minimum value within the measurement interval

F inCO_2 alarm upper limit (displays crossed triangle symbol when the inCO_2 alarm is turned off)

G inO_2 (FiO_2) alarm limits (displays crossed triangle symbol when inO_2 alarms are turned off)

H Abbreviation for " expiratory"

I etCO_2 value – highest level of CO_2 in the airway during the expiratory phase within the measurement interval

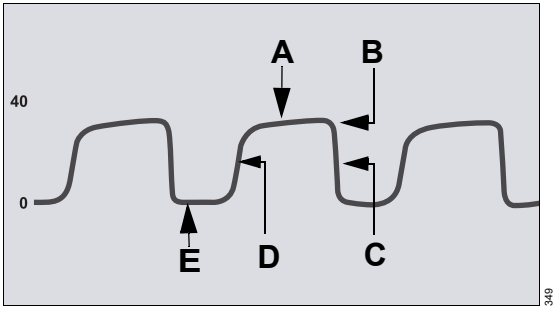
J etO_2 value – highest level of O_2 in the airway during the expiratory phase within the measurement interval

K etCO_2 alarm limits (displays crossed triangle symbol when etCO_2 alarms are turned off)

L etO_2 alarm limits (displays crossed triangle symbol when etO_2 alarms are turned off)

CO_2 waveform

The M540 also displays an instantaneous CO_2 waveform.



A Expiratory or alveolar plateau (level of CO_2 in lungs ceases to increase significantly)

B End-tidal concentration point (end of expiratory phase, where CO_2 is measured)

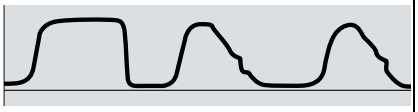
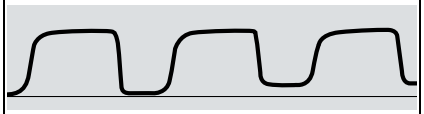
C Onset of inspiratory phase

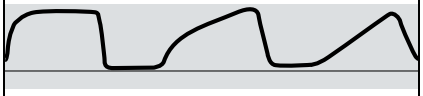
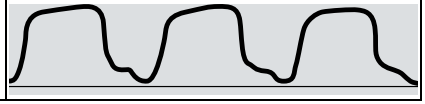
D Onset of expiratory phase

E Baseline during inspiration

Troubleshooting

In addition to evaluating the clinical status of a patient, CO_2 waveforms can help troubleshoot problems with equipment. The following table shows how CO_2 waveforms can be used to identify common problems.

Description	Cause	Capnogram
Alveolar plateau showing a downward slope that merges with a descending limb.	– Inadequate seal around the endotracheal tube – Leaky or deflated endotracheal or tracheostomy cuff – Artificial airway that is too small for the patient	
Elevated waveform baseline with corresponding increase in CO_2 level.	Rebreathing due to one of the following causes: – Disposable airway adapter is used although the Cockpit is configured for the reusable adapter type – Contaminated airway adapter (dirty window) – CO_2 zero drift – Insufficient expiratory time – Faulty expiratory valve – Inadequate inspiratory flow – Malfunction of a CO_2 absorber system – Partial rebreathing circuits	

Description	Cause	Capnogram
Change in slope of ascending limb. Possible absence of an alveolar plateau.	Obstruction caused by one of the following: – Partial obstruction in expiratory limb of breathing circuit – Foreign body in upper airway – Partially kinked or occluded artificial airway – Herniated endotracheal or tracheostomy tube cuff – Bronchospasm	
Elevated baseline, with pronounced slope on descending limb	– Faulty ventilator circuit valve – Rebreathing (see above)	

O_2 display

NOTE
O_2 monitoring is available only with Scio Four Oxi and Scio Four Oxi plus.

On the Cockpit, the O_2 display consists of:

– O_2 parameter field

– O_2 waveform

The Cockpit supports a configurable parameter field for display of O_2 that allows one of the following displays:

– O_2 by itself (default)

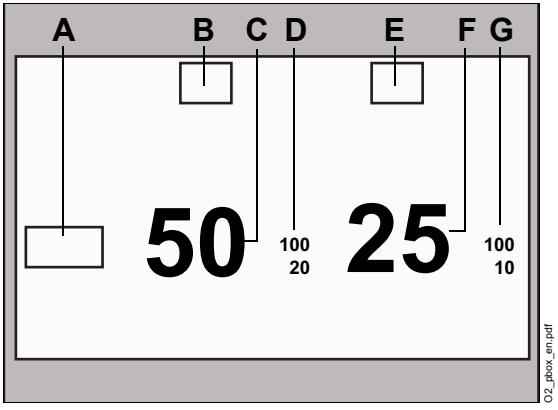
– O_2 with N_2O

O_2 parameter field

The default O_2 parameter field displays the current values for:

– Inspired O_2 (inO_2/FiO_2) – the level of O_2 in the airway during inspiration phase.

– End-tidal O_2 (etO_2) – the level of O_2 in the airway at the end of expiration.



A ***O2*** label

B Abbreviation for "inspiratory"

C inO_2 (FiO_2) value – the level of O_2 in the airway during inspiration, taken as the minimum value within the measurement interval

D inO_2 (FiO_2) alarm limits (displays crossed triangle symbol when inO_2 alarms are turned off)

E Abbreviation for "expiratory"

F etO_2 value – the highest level of O_2 in the airway during the expiratory phase within the measurement interval

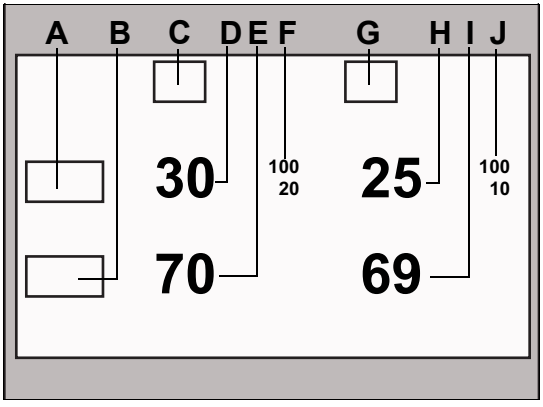
G etO_2 alarm limits (displays crossed triangle symbol when etO_2 alarms are turned off)

O_2/N_2O parameter field

The O_2 / N_2O parameter field displays the following additional values:

– Inspired N_2O (inN_2O) – the level of N_2O in the airway during inspiration, taken as the minimum value within the measurement interval

– End-tidal N_2O (etN_2O) – the highest level of N_2O in the airway during the expiratory phase within the measurement interval



A O_2 label

B N_2O label

C Abbreviation for "inspiratory"

D inO_2 (FiO_2) value – the level of O_2 in the airway during inspiration, taken as the minimum value within the measurement interval

E inN_2O value – the level of N_2O in the airway during inspiration, taken as the minimum value within the measurement interval

F inO_2 (FiO_2) alarm limits (displays crossed triangle symbol when inO_2 alarms are turned off)

G Abbreviation for "expiratory"

H etO_2 value – the highest level of O_2 in the airway during the expiratory phase within the measurement interval

I etN_2O value – the highest level of N_2O in the airway during the expiratory phase within the measurement interval

J etO_2 alarm limits (displays crossed triangle symbol when etO_2 alarms are turned off)

Agent display

The agent waveforms and parameters can be identified by color as follows:

– Sevoflurane = yellow

– Desflurane = blue

– Isoflurane = purple

– Halothane = red

– Enflurane = orange

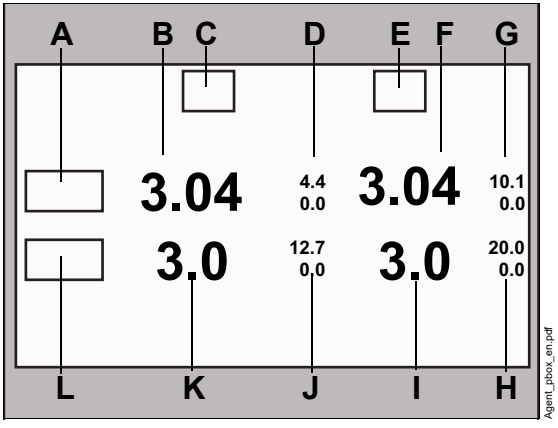
The appearance of the agent parameter field varies depending on the number of identified agents. Typical agent parameter field displays are shown below.

Agent parameter field

On the Cockpit, the default ***Agent*** parameter field displays the current values for:

– Inspired agent (e.g., inSev) – the level of anesthetic agent in the airway during the inspiration phase

– Expired agent (e.g., etSev) – the level of anesthetic agent in the airway during the expiration phase



A Abbreviation for primary anesthetic agent (may display ***Agent?*** during agent identification for gas analyzers with automatic identification)

B Inspired primary agent value – the level of anesthetic agent in the airway during the inspiration phase

C Abbreviation for "inspiratory"

D Inspiratory alarm limits for primary agent

E Abbreviation for "expiratory"

F Expired primary agent value – the level of anesthetic agent in the airway during the expiration phase

G Expiratory alarm limits for primary agent

H Expiratory alarm limits for secondary agent

I Expired secondary agent value – the level of anesthetic agent in the airway during the expiration phase

J Inspiratory alarm limits for secondary agent

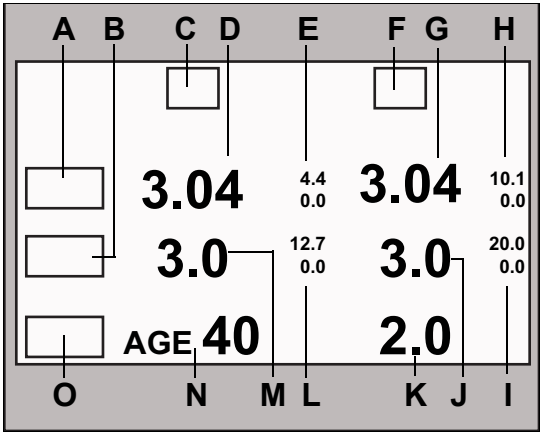
K Inspired secondary agent value – the level of anesthetic agent in the airway during the inspiration phase

L Abbreviation for secondary anesthetic agent (for gas analyzers with automatic identification)

Agent/xMAC parameter field

The ***Agent/ xMAC*** parameter field displays the following additional values:

– xMAC – the MAC multiple calculated from the current expiratory measured values and the age-dependent MAC values



A Abbreviation for primary anesthetic agent (may display ***Agent?*** during agent identification for gas analyzers with automatic identification)

B Abbreviation for secondary anesthetic agent (for gas analyzers with automatic identification)

C Abbreviation for "inspiratory"

D Inspired primary agent value – the level of anesthetic agent in the airway during the inspiration phase

E Inspiratory alarm limits for primary agent

F Abbreviation for "expiratory"

G Expired primary agent value – the level of anesthetic agent in the airway during the expiration phase

H Expiratory alarm limits for primary agent

I Expiratory alarm limits for secondary agent

J Expired secondary agent value – the level of anesthetic agent in the airway during the expiration phase

K xMAC multiple

L Inspiratory alarm limits for secondary agent

M Inspired secondary agent value – the level of anesthetic agent in the airway during the inspiration phase

N Age used to calculate xMAC (default age of 40 is the user has not entered a birth date for the patient)

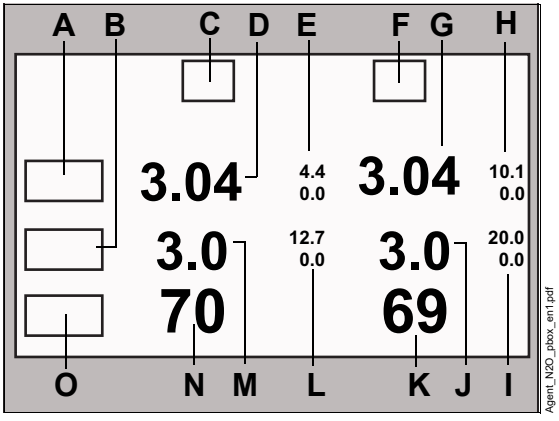
O ***xMAC*** label

Agent/N2O parameter field

The ***Agent/N2O*** parameter field displays the following additional values:

– Inspired N_2O (inN_2O) – the level of N_2O in the airway during inspiration, taken as the minimum value within the measurement interval

– End-tidal N_2O (etN_2O) – the highest level of N_2O in the airway during the expiratory phase within the measurement interval



A Abbreviation for primary anesthetic agent (may display ***Agent?*** during agent identification for gas analyzers with automatic identification)

B Abbreviation for secondary anesthetic agent (for gas analyzers with automatic identification)

C Abbreviation for "inspiratory"

D Inspired primary agent value – the level of anesthetic agent in the airway during the inspiration phase

E Inspiratory alarm limits for primary agent

F Abbreviation for "expiratory"

G Expired primary agent value – the level of anesthetic agent in the airway during the inspiration phase

H Expiratory alarm limits for primary agent

I Expiratory alarm limits for secondary agent

J Expired secondary agent value – the level of anesthetic agent in the airway during the expiration phase

K etN_2O value – the highest level of N_2O in the airway during the expiratory phase within the measurement interval

L Inspiratory alarm limits for secondary agent

M Inspired secondary agent value – the level of anesthetic agent in the airway during the inspiration phase

N inN_2O value – the level of N_2O in the airway during inspiration, taken as the minimum value within the measurement interval

O N_2O label

Manual agent identification

Manual agent identification is available only for gas analyzers without automatic agent identification: Scio Four and Scio Four Oxi.

WARNING

Risk due to inaccurate gas measurement values

Use care when selecting the agent manually. Measurements are inaccurate if the wrong agent is selected.

WARNING

Risk due to inaccurate gas measurement values

Measurements using a gas analyzer without automatic agent recognition are inaccurate if anesthetic gases are mixed.

To configure manual agent identification, refer to "Agent parameter setup functions" on page 373.

Automatic agent identification

Automatic agent identification setup is available only for the following gas analyzers: Scio Four Plus and Scio Four Oxi plus.

These gas analyzers automatically identify up to two anesthetic agents, even in mixtures.

If the gas analyzer has not yet identified or cannot identify an agent, or has detected a mixture of three or more anesthetic agents (for example, due to too low agent concentrations, a leaking vaporizer, or traces of disinfectants), the agent parameter field is blank and the Agent label displays ***Agent?***

Mixed Agent

NOTE

The measurement of mixed agent is available only for gas analyzers with automatic agent recognition: Scio Four plus and Scio Four Oxi plus.

When the gas analyzer detects a mixture of two anesthetic agents, the displayed real-time waveform is the primary agent concentration. The color of the waveform and the first agent label in the ***Agent*** parameter field represents the agent with the highest expiratory xMAC value (primary agent).

The following label indicates the SEV agent with the highest expiratory xMAC value:

Sev
Des

This label switches to that of the second administered agent when its expiratory xMAC value exceeds that of the first agent:

Des
Sev

Scio *Show all* page

The Scio ***Show all*** page displays the values and units of measure of the currently monitored parameters in one screen.

To access the Scio *Show all* page

- Touch the ***Show all*** tab on the ***Scio*** page***.***

The Scio ***Show all*** page displays the following parameter data:

– ***Current measurements vent.***.
These values can come from a MEDIBUS.X device only. When only a Scio module is connected, this section is blank.
  - PIP
  - Pplat
  - Pmean
  - PEEP
  - R
  - Cdyn
  - E
  - Tcase
  - VT auto
  - MVmand
  - MVspon
  - MV auto
  - RRmand
  - RRspon
  - RR auto

– ***Current measurements gases***
These values can come from either a Scio module or a MEDIBUS.X device. However, when a Scio module is connected, these values always come from the Scio module.
  - FiO_2
  - inCO2
  - inN2O
  - inHal
  - inEnf
  - inIso
  - inDes
  - inSev
  - etO2
  - $etCO_2$
  - etN2O
  - etHal
  - etEnf
  - etIso
  - etDes
  - etSev
  - xMAC
  - RRc

– ***Current consumption***
These values can come from a MEDIBUS.X device only. When only a Scio module is connected, this section is blank.
  - Hal cons
  - Enf cons
  - Iso cons
  - Des cons
  - Sev cons
  - O_2 cons
  - Air cons
  - N2O cons

xMAC (MAC multiple)

The ***xMAC*** value is a simple navigation aid for anesthetic agent delivery.

IACS displays the inspiratory and expiratory measured values for O2, N2O, anesthetic gases, and the ***xMAC***.

The ***xMAC*** is the MAC multiple calculated from the current expiratory measured values and the age-dependent MAC values. If no respiratory phase is detected, expiratory values and ***xMAC*** cannot be displayed.

The integrated ***xMAC*** algorithm is based on the MAC values shown in the following table. These values are guiding values only. The binding values are specified on the package information leaflet of the anesthetic agent.

The MAC values are dependent upon the age of the patient. The values specified in the table (according to ISO 80601-2-55) apply to a patient age of 40 years.

IACS provides age-corrected xMAC if the user has entered a birth date for the patient.If no birth date is entered, IACS uses 40 years as the age.

Agent	**MAC corresponds to: (in 100% O_2)**
Desflurane	6.0 Vol%
Enflurane	1.7 Vol%
Halothane	0.77 Vol%
Isoflurane	1.15 Vol%
N_2O	105 Vol%
Sevoflurane	2.1 Vol%

The age-corrected MAC values are calculated using an equation developed by W. W. Mapleson (British Journal of Anaesthesia 1996, pp. 179-185).

The equation applies to patients older than 1 year.

$MAC_{age\ corrected} = MAC^{1} \times 10^{(-0.00269 \times (age - 40))}$

1 40 years

For gas mixtures, the respective multiples for N_2O and anesthetic agents are added according to the following equation:

$$xMAC = \frac{\text{exp. conc. Anesth.}_1}{\text{MAC}_{\text{age-corrected}}\ \text{Anesth.}_1} + \frac{\text{exp. conc. Anesth.}_2}{\text{MAC}_{\text{age-corrected}}\ \text{Anesth.}_2} + \frac{\text{exp. conc. } N_2O}{\text{MAC}_{\text{age-corrected}}\ N_2O}$$

Example:

exp. Iso. = 0.65 Vol%; exp. N_2O = 69%;
age = 32 years

$MAC_{age\text{-}corrected}$ from Iso.: MAC^1 = 1.21 Vol%
$MAC_{age\text{-}corrected}$ from N_2O: MAC^{**} = 110 Vol%

xMAC = 0.54 + 0.63 = 1.2

The influence of other drugs (opiates or intravenous hypnotics) is not considered in the ***xMAC*** calculation.

1 32 years

Zeroing the gas analyzer

The gas analyzer automatically purges and zeroes itself and does not require any interaction by the user.

If the IACS has been in Standby or Discharge for less than two hours, the gas analyzer is available without zeroing for at least the first 90 minutes of monitoring.

However, if the IACS and/or gas analyzer has been powered down or has been in Standby or Discharge for more than two hours, a warm-up procedure occurs when the IACS begins monitoring. The warm-up procedure includes zeroing and can take up to 7.5 minutes. During this time, accuracy is reduced.

During zeroing:

– Waveforms flatline
– The status bar displays the message ***Scio zeroing is in progress***
– Active Scio alarms continue to display

During the first 25 seconds of zeroing, the Scio-related parameter fields (CO_2, O_2, N_2O, Agents) display the last valid values.If zeroing takes longer than 25 seconds, those parameter fields display "CAL"

Dual SpO2 monitoring

Overview of Dual SpO2 monitoring

Dual SpO2 monitoring is possible through an RS-232 serial port connection from an external device to the Cockpit. Data appears at the Cockpit upon device connection.The following SpO2 output devices are supported:

– Nellcor PM1000N, N-180, NPB 190, NPB 195, NPB 395, NPB 595, NPB 600

– Masimo Radical-7, Masimo Rad-87

Supported parameters

The external device interface supports the following parameters:

Parameter	Label
SpO2	***SpO2****
Pulse rate	***PLS****
SpO2 difference (ΔSpO2 = SpO2 – SpO2*)	***ΔSpO2***
Location (user set)	– ***Pre-ductal*** – ***Post-ductal*** – ***Right*** – ***Left*** – ***Arm*** – ***Foot*** – ***None*** (default)

NOTE
No waveform is provided for SpO2* from an external device.

NOTE
A primary SpO2 device must also be connected in order to display a ΔSpO2 value.

NOTE
The asterisk in SpO2* and PLS* indicates these parameters are from an external device. Also, primary SpO2 and SpO2* from an external device are differentiated by color (selections are red, green, blue, yellow, light blue, purple, orange, white). The SpO2* default is light blue.

To set up SpO2* prior to use

1 Press the ***System setup...*** button on the main screen.

2 Press the ***Screen setup*** tab.

3 Press the ***Auto view*** tab.

4 Press the ***Manual*** button next to ***Display mode***.

5 Locate and select ***SpO2****.

6 Rotate the rotary knob to advance ***SpO2**** in the priority list.

7 Press the rotary knob to view ***SpO2**** on the screen.

To select the mini trends parameter

Mini trends are available for SpO2* and ΔSpO2.

1 Press the ***Sensor parameters...*** button on the main screen.

2 Press the ***SpO2**** tab.

3 Press the ***SpO2 label*** button and select. one of the following: ***Pre-ductal, Post-ductal, Right, Left, Arm, Foot, None*** (default).

4 Press the ***Mini Trend*** button and select ***ΔSpO2*** or ***SpO2****.

5 Press the ***Color*** button and select a color.

To configure the mini trends display

1 Press the ***System setup...*** button on the main screen.

2 Press the ***Screen setup*** tab.

3 Press the ***Auto view*** tab.

4 Press the ***Mini trends*** button.

5 Select one of the following settings:

– ***Off***

– ***10 min***

– ***15 min***

– ***20 min***

– ***30 min***

– ***45 min***

– ***1 h***

– ***90 min***

– ***2 h***

– ***4 h***

CAUTION

Alarms for external SpO_2* devices are not supported on the IACS.

This page has been left blank intentionally.

External Device – Bispectral index (BIS)

Overview of BIS monitoring

The Cockpit acquires data from the BIS VISTA monitoring system using an RS232 connection.

BIS monitoring provides the level of consciousness using EEG electrodes that are affixed to the patient's forehead. The BIS value guides the clinician in administering the correct level of anesthetic agents to achieve the correct level of sedation.

NOTE
Waveforms are not supported on recordings.

BIS monitoring is available for adult and pediatric patients. It is not available in neonatal mode.

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13.

For detailed information and technical specifications regarding BIS monitoring with the BIS VISTA devices, refer to the documentation provided by the manufacturer.

Supported parameters and settings

BIS– Bispectral index

EMG – Electromyograph indicator

SQI– Signal quality index

BSR– Suppression ratio

PWR– Total signal power

SEF– Spectral edge frequency

BCT– Burst count

Smoothing rate setting

All supported BIS parameters are trended as graphical and tabular trends. For more information (see page 173).

The ***Smoothing rate*** setting and all of the BIS parameters are displayed in the ***Show all*** page (see page 396).

All BIS parameters are supported on the network and available for export protocol.

The ***Smoothing rate*** setting is supported on the network but it is not available for export protocol.

NOTE
SQI parameter trends are not transferred with a network transfer from IACS to Delta.

BIS precautions

WARNING
When connecting a third-party device, verify its proper operation before clinical use. Refer to the instructions for use of the third-party device for complete instructions. For further questions, contact your local representative.

WARNING
Always refer to the primary data source before making diagnostic or therapeutic decisions.

Connecting peripheral devices is supported via the device connectivity option. Only connect peripheral medical devices to a patient monitor if those devices comply with the electrical safety requirements found in IEC 60601-1. Refer to "Safe connection with other electrical equipment" on page 15" of these instructions for use for information on how to connect devices safely.

WARNING
The following section lists all of the external devices and related software versions that Dräger has validated. Dräger cannot make any claim for the reliability of the data for subsequent or previous software versions or for any devices that have not been validated. In the interest of patient safety and device performance, do not connect devices to the monitor which have not been approved by Dräger. The hospital is responsible for contacting Dräger to determine the compatibility and warranty status of any connection made to another manufacturer's medical devices.

Device compatibility

The Cockpit supports the Aspect BIS Vista Complete 2-channel monitor with software version 3.00.

BIS display

On the Cockpit, the BIS x display consists of:

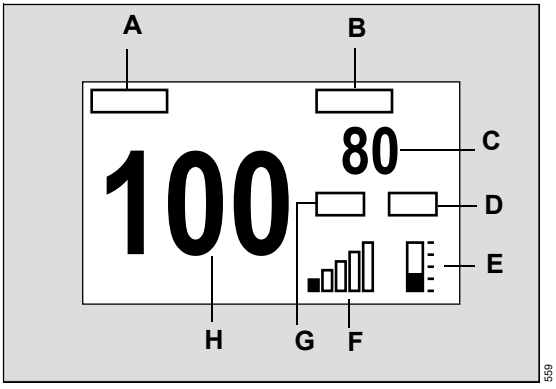
– BISx parameter field
– 1 EEG waveform

BIS parameter field

NOTE
The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

BIS parameter fields report parameter values. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The BIS parameter field contains the following elements:



A Bispectral index label (BIS)

B Secondary parameter label (selectable)

C Secondary parameter value

D EMG label

E Electromygraph bargraph indicating the current amplitude of the EMG signal

F Signal quality index (SQI) bargraph indicating the quality of the detected signal

G Signal quality index label (SQI)

H BIS value

NOTE

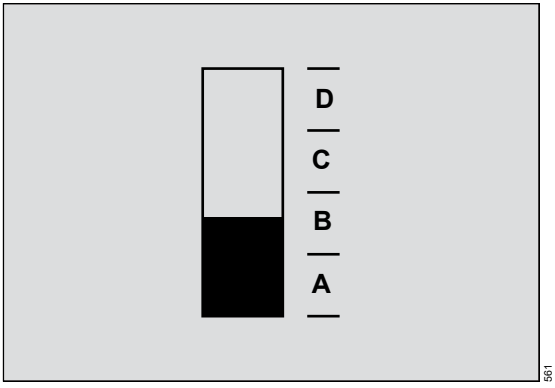
If the SQI value is less than 15%, the parameter values for BIS, BSR, BCT, SEF, and PWR will be replaced by *** identifying them as unreliable.

If the SQI value falls between 15% and 50% a question mark appears next to the BIS value indicating the value may be unreliable.

If BSR is less than 5%, the BCT value will be replaced by *** identifying it as unreliable.

EMG bar graph

The EMG bar graph consists of 5 tic marks. As the amplitude increases, more tic marks are filled in white.



A First section is filled in – 30 to 38 dB

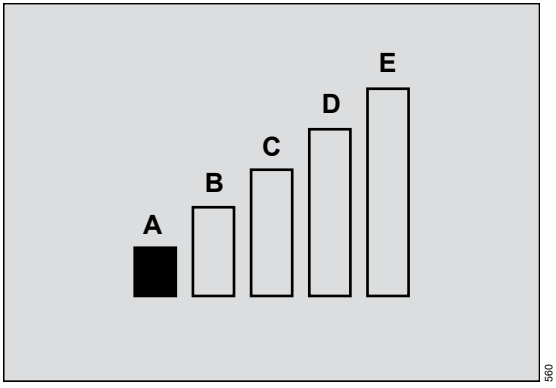
B Second section is filled in – 39 to 47 dB

C Third section is filled in – 48 to 55 dB

D All sections filled in – > 55 dB

SQI bar graph

The SQI bar graph consists of 5 bars. The more bars are filled in green, the better the quality of the signal.



A SQI value between 0 and 20

B SQI value between 21 and 40

C SQI value between 41 and 60

D SQI value between 61 and 80

E SQI value between 81 and 100

Waveforms

One EEG waveform (labelled as EEG T) is displayed next to the BIS parameter field.

Accessing the BIS settings

- Select the BIS parameter field to select the ***BIS*** page directly.

  or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***BIS*** tab to access the ***BIS*** page.

   If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

3 Select the ***Settings*** and ***Show all*** tab.

BIS parameter setup functions

All BIS setup functions take place in the ***BIS*** page.

Selection	Available settings	Description
	Settings page	
Scale[uV]	5, 10, 25, 50, 100 (default), 250 µV	Selects the scale of the EEG T waveform.
Smoothing rate [s]	Informational data only	Not applicable
BIS secondary parameter	BSR, BCT (default), SEF, PWR	Selects a secondary parameter and assigns it to the BIS parameter field (see page 393).
No alarm signaling for this device.	Informational message that no optical or acoustic alarm signals are available on the the Cockpit	Not applicable
	BIS *Show all* page	
This page displays all supported BIS parameters, settings, labels and the units of measure where appropriate.		

External Device – Neuromuscular transmission (NMT)

Overview of NMT monitoring

The Cockpit supports communication with third-party neuromuscular transmission devices using an RS232 connection.

NMT monitoring measures the level of muscle relaxation of patients under the influence of neuromuscular blocking agents. By using an electrical stimulus of a peripheral nerve, the muscle response (thumb twitch) and the skin temperature can be measured.

NMT monitoring is available for adult, pediatric, and neonatal patients.

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13.

For detailed information and technical specifications regarding NMT monitoring, refer to the documentation provided by the manufacturer of the NMT device.

Supported parameters

The following parameters from the NMT device are supported:

– TOF Ratio – Train of Four ratio (%)

– TOF-Cnt – Train of Four count (no unit of measurement)

– PTC – Post Tetanic Count (no unit of measurement)

All NMT parameters are trended and available on the Infinity network and export protocol.

All trended NMT parameters are available for network transfer. For more information (see page 173).

Supported modes

The following modes from the NMT device are supported:

– TOF (Train of Four) – A sequence of four stimulation pulses is sent and the magnitude of the muscle twitch after each individual pulse is measured.

– TOFs (slow Train of Four) – the user sets the frequency of the stimulation of four pulses.

– PTC (Post Tetanic Count) – counts the responses of tetanic stimulation followed by single stimuli at one-second intervals

NMT modes are not displayed. Furthermore, they are not available on the network and are not available for export protocol.

Supported settings

The following settings from the NMT device are supported:

– Stimulation current mode – determines if the stimulation current was obtained automatically or set by the user manually.

– Stimulation current – reports the current in mA

– Pulse width – reports the width of the pulse microseconds

All NMT settings are broadcast to the Infinity network. They are not available for Export protocol.

NMT precautions

WARNING

When connecting a third-party device, verify its proper operation before clinical use. Refer to the instructions for use of the third-party device for complete instructions. For further questions, contact your local representative.

WARNING

Always refer to the primary data source before making diagnostic or therapeutic decisions.

Connecting peripheral devices is supported via the device connectivity option. Only connect peripheral medical devices to a patient monitor if those devices comply with the electrical safety requirements found in IEC 60601-1. Refer to "Safe connection with other electrical equipment" on page 15 of these instructions for use for information on how to connect devices safely.

WARNING

The following section lists all of the external devices and related software versions that Dräger has validated. Dräger cannot make any claim for the reliability of the data for subsequent or previous software versions or for any devices that have not been validated. In the interest of patient safety and device performance, do not connect devices to the monitor which have not been approved by Dräger. The hospital is responsible for contacting Dräger to determine the compatibility and warranty status of any connection made to another manufacturer's medical devices.

Device compatibility

The Cockpit is compatible with the following NMT devices:

– TOF scan - minimum version 1.5.8

NMT display

On the Cockpit, the NMT display consists of two NMT parameter fields. The content depends on one of the following modes which is selected at the NMT device:

– Single

– TOF Ratio or TOF Cnt (parameter field display depends on the selected mode)

– PTC

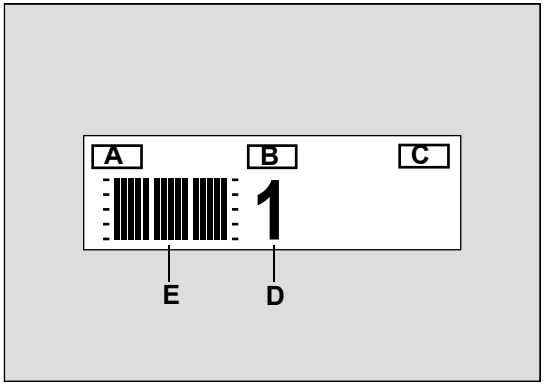
NOTE

The following diagrams show a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate certain technical information such as signal strength and time stamps (see page 400 for detailed information).

NMT parameter field (PTC mode)

The NMT parameter field in PTC mode contains the following elements:



A Neuromuscular transmission label (***NMT***)

B NMT mode label ***PTC***

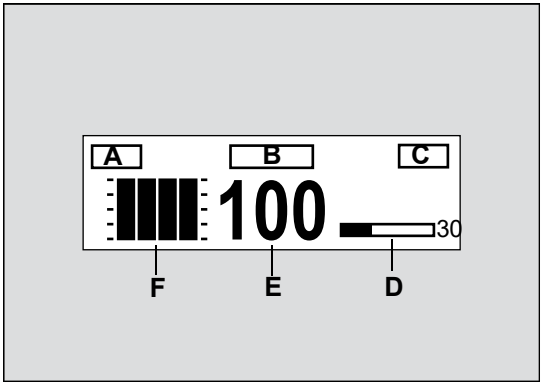
C Time stamp of current value (display depends on menu setting - see page 403)

D PTC value

E 15 individual amplitude bar graphs indicating the number of twitches

NMT parameter field (TOF/TOFs mode)

The NMT parameter field in 'TOF /TOFs' mode is very similar and contains the following elements:



A Neuromuscular transmission label (***NMT***)

B NMT parameter label ***TOF Ratio*** or ***TOF Cnt***

TOF Ratio appears when the TOF count is equal to four twitches and the amplitude of the first twitch is ≥ 20%.

TOF Cnt appears when the TOF count is ≤ than three twitches or there are four twitches and the magnitude of the first twitch is < 20%.

C Time stamp of the current value (the time stamp identifies the time the Cockpit received the value from the connected device)

D Count down time bar and value indicating the remaining time in the interval before the start of the next set of measurements - displayed only in TOFs mode

The label ***auto 15 s*** appears instead of the count down bar when the user initiates automatic TOF.

E TOF Ratio / TOF-Cnt value

F 4 individual amplitude bar graphs indicating the number of TOF counts (the last bar shows the magnitude of the fourth twitch).

Printing NMT information

You can print a report of all NMT settings and up to the latest 500 measurements.

Printing NMT settings and measurements

1 Select the NMT parameter field to select the ***NMT*** page directly.

2 Select the ***Print*** button in the lower left corner of the ***NMT*** page.

or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***NMT*** tab to access the ***NMT*** page.

3 Select the ***Print*** button in the lower left corner of the ***NMT*** page.

Accessing the NMT settings

- Select the NMT parameter field to select the ***NMT*** page directly.

or

1 Select ***Sensor parameters...*** from the main menu bar.

2 Select the ***NMT*** tab to access the ***NMT*** page.

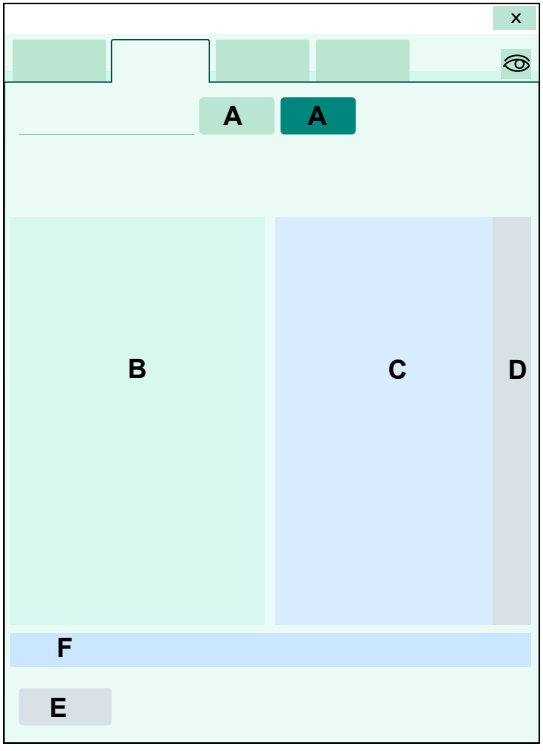
If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

The NMT page

The ***NMT*** page displays the settings of the NMT device. Except for the ***Display temperature*** and the ***Print*** buttons these settings are informational only and cannot be changed on the Cockpit. The ***NMT*** page also displays the latest NMT measurement values collected. A total of 500 measurements can be reviewed and are accessible with the scroll bar. Once the data base reaches 500 measurements, the oldest measurement is replaced by the most recent one.

Unlike trends, the measurements on the ***NMT*** page cannot be transferred.

The following diagram depicts the ***NMT*** page.



A ***Display temperature*** button for activating or deactivating the temperature display in the NMT parameter field.

B ***Settings*** field– displays the settings of the connected third-party NMT device.

C ***Measurements*** field – reports the last 500 NMT measurements.

D Scroll bar for scrolling through the collected NMT data.

E ***Print*** button for printing the measurements and settings.

F ***No alarm signaling for this device.*** – Informational message.

NMT parameter functions and settings

Selection	Available settings	Description
Display temperature	– ***On*** – ***Off*** (Default)	Controls the temperature display in the NMT parameter field (not available with TOFscan).
Stim current	0 to 60 mA (no default)	Displays the stimulation current of the NMT device.
Stim current mode	***Auto***	The NMT device establishes a supramaximal current during the first measurement and uses it for subsequent measurements (not available with TOFscan).
	Manual	The stimulation current was selected manually.
Sensitivity (1-512)	Between 1 and 512 (no default)	Displays the sensitivity of the NMT device(not available with TOFscan).
Pulse width	200 or 300 µs	Determines the width of the pulse.
Print	Prints the current NMT settings and up to 500 of the most recent measurements.	
No alarm signaling for this device.	Informational message that no optical or acoustic alarm signals are available on the Cockpit.	

External device – continuous cardiac output (CCO)

Overview of CCO monitoring

With the device connectivity option, the Cockpit can display parameter values from a continuous cardiac output device. Within 30 seconds of connecting the device, the data appear at the Cockpit. The following cardiac output devices are supported:

– Vigilance II SvO2/CCO

– Vigileo SvO2/CCO

– EV1000

The CCO monitoring functions are configurable in the parameter-specific setup page (see page 411).

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13.

External device alarms

If the external device alarm feature is activated at the Cockpit (see page 474) and an external device is disconnected from the Cockpit, the following happens at the Cockpit and at the ICS when the patient is admitted at the ICS:

– An alarm tone of low priority sounds.

– The message ***External device disconnected*** appears.

Reference handbook

For a complete list of available parameters contact your DrägerService representative.

Supported parameters

The following table lists the supported parameters displayed on the Cockpit originating from external CCO devices that are supporting and monitoring these parameters. The range and resolution for all parameters are provided by the CCO device. All of the parameters are displayed in the ***Show all*** page (see page 410).

Label	Parameter	Unit of measurement	Comments	Cockpit Trends page	Originating from which device
SvO2	Venous oxygen saturation	%	Not applicable	Continuous trend	Vigilance II, Vigileo, EV1000
CCO	Continuous cardiac output	L/min	Not applicable	Continuous trend	
CCI	Continuous cardiac output index	$L/min/m^2$	Calculated value on Cockpit; requires height and weight values from the Cockpit.	Continuous trend	
SVR	Systemic vascular resistance	$dyn \cdot s/cm^5$	Calculated value at the Cockpit; requires the values for ART M and CVP from the Cockpit.	Continuous trend	
SVRI	Systemic vascular resistance index	$dyn \cdot s/cm^5/m^2$	Calculated value on Cockpit; requires height and weight values from the Cockpit.	Continuous trend	
SV	Stroke volume	mL	Calculated value on Cockpit; requires heart rate to be monitored.	Continuous trend	
SVI	Stroke volume index	mL/m^2		Continuous trend	

Label	Parameter	Unit of measurement	Comments	Cockpit Trends page	Originating from which device
Tblood	Blood temperature	°C or °F	Unit of measurement is determined by the unit of measurement selected at the Cockpit	Continuous trend	Vigilance II and EV1000
VO2	Oxygen consumption	mL/min	Not applicable	Not trended	
DO2	Oxygen delivery	mL/min	Not applicable	Not trended	
SaO2	Arterial oxygen saturation	%	Not applicable	Continuous trend	Vigilance II
EDV	End-diastolic volume	mL	Not applicable	Not trended	
EDVI	End-diastolic volume index	mL/m^2	Calculated value on Cockpit; requires height and weight values from the Cockpit.	Not trended	
ESV	End-systolic volume	mL	Not applicable	Not trended	
ESVI	End-systolic volume index	mL/m^2	Calculated value on Cockpit; requires height and weight values from the Cockpit.	Not trended	
EF	Ejection fraction	%	Not applicable	Not trended	
SVV	Stroke volume variation	%	Calculated parameter on Cockpit; if required parameters are not monitored or entered, the parameter appears blank.	Continuous trend	Vigileo and EV1000

CCO precautions

WARNING

To reduce the risk of patient injury due to electrical shock, always position the external device connectivity cable as far from the patient as possible. Make sure that any cables or other conducting devices do not come in contact with the patient. The device connectivity cable is electrically isolated from the monitor and any peripheral devices, but the cable's enclosure is not electrically isolated from the peripheral device itself.

WARNING

The Cockpit does not annunciate alarms for external device parameters.

WARNING

Always refer to the primary data source before making diagnostic or therapeutic decisions.

Connecting peripheral devices is supported via the device connectivity option. Only connect peripheral medical devices to a patient monitor if those devices comply with the electrical safety requirements found in IEC 60601-1. Refer to "Safe connection with other electrical equipment" on page 15 of these instructions for use for information on how to connect devices safely.

CCO/SvO2 display

On the Cockpit, the CCO/SvO2 display consists of a parameter field.

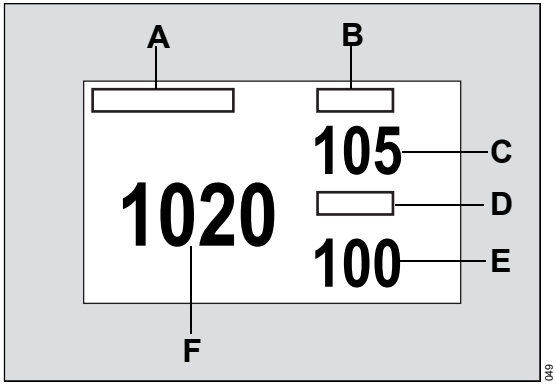
CCO/SvO2 parameter field

NOTE

The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525.

The CCO/SvO2 parameter field contains the following elements:



A Primary parameter label

B Secondary parameter label

C Secondary parameter value

D Third parameter label

E Third parameter value

F Primary parameter value

Viewing the CCO/SvO2 parameters

The ***Show all*** page displays the values of the currently monitored CCO/SvO2 parameters.

To access the CCO/SvO2 parameters

1. Select the ***Sensor parameters...*** button from the main menu bar.
2. Select the ***CCO*** tab.If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.
3. Select the ***Show all*** tab.

   or

1. Select the ***Trends/ Data...*** button from the main menu bar.
2. Select the ***Hemo*** tab.
3. Select the ***Show all*** tab.

Accessing the CCO/SvO2 settings

1 Select the ***Sensor parameters...*** button from the main menu bar.

2 Select the ***CCO*** tab. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

SvO2 parameter setup functions

Selection	Available settings	Description
Parameter 1	***SvO2*** (default), ***Tblood***, ***CCO***, ***CCI***, ***VO2***, ***DO2***, ***SaO2***, ***SVR***, ***SVRI***, ***EDV***, ***EDVI***, ***ESV***, ***ESVI***, ***EF***, ***SV***, ***SVI***, ***SVV***	Selects the primary parameter in the CCO parameter field.
Parameter 2	***SvO2***, ***Tblood***, ***CCO*** (default), ***CCI***, ***VO2***, ***DO2***, ***SaO2***, ***SVR***, ***SVRI***, ***EDV***, ***EDVI***, ***ESV***, ***ESVI***, ***EF***, ***SV***, ***SVI***, ***SVV***	Selects the secondary parameter in the CCO parameter field.
Parameter 3	***SvO2***, ***Tblood***, ***CCO***, ***CCI***, ***VO2***, ***DO2***, ***SaO2***, ***SVR*** (default), ***SVRI***, ***EDV***, ***EDVI***, ***ESV***, ***ESVI***, ***EF***, ***SV***, ***SVI***, ***SVV***	Selects the third parameter in the CCO parameter field.
CCO mini trend	***SvO2***, ***SVV***, ***CCO*** (default), ***CCI***, ***SVR***, ***SVRI***, ***SV***, ***SVI***	Selects the parameter to be included in the mini-trend.

NOTE

SVV, SV, and SVI trends are not available on the destination Cockpit after a network transfer. However, they could eventually be viewed on the primary patient monitor, the ICS, or any other patient data management system.

This page has been left blank intentionally.

External devices – MEDIBUS.X devices

External device monitoring

The device connectivity option enables the Cockpit to partner with external MEDIBUS.X -compatible devices to provide the following functionality:

– Display parameter values, waveforms, and loops from ventilators and anesthesia machines

– Trend parameters

– ***Show all*** pages for ventilators that can be configured

– Configurable display of parameter fields for ventilators and anesthesia machines

Within 30 seconds of connecting a device, the data appear at the Cockpit.

NOTE

Ventilation waveforms are not supported on recordings.

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. For device-specific error messages, refer to the instructions for use of the connected ventilator.

NOTE

When connecting a ventilator that does not support CO2 monitoring, the Cockpit may still display a CO2 tab in the ***Ventilator*** dialog.

External device alarms

Alarms from the ventilator are transmitted to the Infinity network and made available for alarm annunciation at the ICS. For more information, refer to the Instructions for use *Infinity CentralStation*.

If the external device alarm feature is activated at the Cockpit (see page 474) and an external device is disconnected from the Cockpit, the following happens at the Cockpit and at the ICS when the patient is admitted at the ICS:

– An alarm tone of low priority sounds.

– The message ***External device disconnected*** is displayed.

Precautions

WARNING

Always refer to the primary data source before making diagnostic or therapeutic decisions.

Connecting peripheral devices is supported via the device connectivity option. Only connect peripheral medical devices to a patient monitor if those devices comply with the electrical safety requirements found in IEC 60601-1. Refer to "Safe connection with other electrical equipment" on page 15 of these instructions for use for information on how to connect devices safely.

WARNING

The following table lists all of the external devices and related software versions that Dräger has validated. Dräger cannot make any claim for the reliability of the data for subsequent or previous software versions or for any devices that have not been validated. In the interest of patient safety and device performance, do not connect devices to the monitor which have not been approved by Dräger. The hospital is responsible for contacting Dräger to determine the compatibility and warranty status of any connection made to another manufacturer's medical devices.

Compatible MEDIBUS.X devices

The Cockpit device connectivity interface allows data from various standalone devices to display parameters, settings and waveforms on the Cockpit.

The following table lists which devices and corresponding software versions are supported with MEDIBUS.X version 1.0.3.

Supported device	Supported software version
Ventilators	
Dräger Evita V500	2.31
Dräger Babylog VN500	2.31
Dräger Savina 300	4.02
Dräger Carina	3.21
Dräger Evita V300	2.31
Dräger Oxylog 3000+	1.04
Anesthesia machines	
Dräger Primus family, Apollo	4.5
Dräger Infinity Perseus A500	1.11
Dräger Zeus IE	1.04
Dräger Fabius family	3.35

Supported MEDIBUS.X ventilator and anesthesia data

The MEDIBUS.X ventilators and anesthesia machines send parameters, settings, modes, and waveforms are broadcast to the network via the Cockpit. However, not all parameters are displayed at the Cockpit (see table below for supported parameters). In addition, the Cockpit refuses all low-priority alarm messages but broadcasts all medium-priority and high-priority alarm messages to the Infinity network.

Refer to the RS-232 export handbook for information on which parameters are available for export protocol. The RS-232 export handbook is available in English only.

Supported parameters on the Cockpit

The following table lists which MEDIBUS.X ventilator and anesthesia parameters are displayed and trended on the Cockpit. Refer to page 415 for a list of supported ventilators and anesthesia machines and the compatible software versions.

Parameter label	Description	Unit of measurement	Displayed in Ventilation or Anesthesia *Show all* page (see page 426)	Cockpit Trends page	Available for display in parameter field Yes/No?
Air cons	Accumulated air consumption	L	Ventilation	Not trended	No
Cdyn	Dynamic compliance	L/bar	Ventilation and Anesthesia	Continuous trend	No
CO2 slope	Increase of measured CO2 value in phase III of the CO2 waveform	mmHg/L kPa/L Vol%/L	Ventilation	Continuous trend	No
C20/Cdyn	Ratio of compliance during the last 20% of inspiration of dynamic compliance	No units	Ventilation	Continuous trend	No
DCO2	CO2 elimination coefficient during HFO	10*mL^2/s	Ventilation	Continuous trend	No
Des cons	Desflurane consumption	mL	Anesthesia	Continuous trend	No
E	Elastance	mbar/L	Anesthesia and Ventilation	Continuous trend	No

Parameter label	**Description**	**Unit of measurement**	**Displayed in Ventilation or Anesthesia *Show all* page (see page 426)**	**Cockpit Trends page**	**Available for display in parameter field Yes/No?**
EIP	End-inspiratory pressure	mbar	Ventilation	Continuous trend	No
Enf cons	Enflurane consumption	mL	Anesthesia	Continuous trend	No
etCO2	End-tidal carbon dioxide concentration	%	Anesthesia and Ventilation	Continuous trend	Yes
		kPa	Anesthesia and Ventilation	Continuous trend	No
etDes	End-tidal desflurane concentration	%	Anesthesia	Continuous trend	Yes
		kPa			
etEnf	End-tidal enflurane concentration	%	Anesthesia	Continuous trend	Yes
		kPa			
etHal	End-tidal halothane concentration	%	Anesthesia	Continuous trend	Yes
		kPa			
etIso	End-tidal isoflurane concentration	%	Anesthesia	Continuous trend	Yes
		kPa			
etN2O	End-tidal nitrous oxide concentration	%	Anesthesia	Continuous trend	Yes
etO2	End-tidal oxygen concentration	%	Anesthesia and Ventilation	Continuous trend	Yes
etSev	Endtidal sevoflurane concentration	%	Anesthesia	Continuous trend	Yes
		kPa			
FiO2	Inspiratory oxygen fraction	%	Anesthesia and Ventilation	Continuous trend	Yes (appears as inO2)
FlowDev	Average device flow	L/min	Ventilation	Continuous trend	No
Hal cons	Accumulated halothane consumption	mL	Anesthesia	Continuous trend	No
inHal	Inspiratory halothane concentration	%	Anesthesia	Continuous trend	Yes
		kPa			

Parameter label	**Description**	**Unit of measurement**	**Displayed in Ventilation or Anesthesia *Show all* page (see page 426)**	**Cockpit Trends page**	**Available for display in parameter field Yes/No?**
inCO2	Inspiratory carbon dioxide concentration	% kPa	Anesthesia and Ventilation	Continuous trend	Yes
I (I:E)	Inspiratory component	No units	Ventilation	Not trended	No
E (I:E)	Expiratory component	No units	Ventilation	Not trended	No
inEnf	Inspiratory enflurane concentration	% kPa	Anesthesia	Continuous trend	Yes
inDes	Inspiratory desflurane concentration	% kPa	Anesthesia	Continuous trend	Yes
inN2O	Inspiratory nitrous oxide concentration	%	Anesthesia	Continuous trend	Yes
inIso	Inspiratory isoflurane concentration	% kPa	Anesthesia	Continuous trend	Yes
inSev	Inspiratory sevoflurane concentration	% kPa	Anesthesia	Continuous trend	Yes
Iso cons	Isoflurane consumption	mL	Anesthesia	Continuous trend	No
% leak	Leakage minute volume in % of inspiratory minute volume	%	Ventilation	Continuous trend	No
MV	Minute volume	L/min	Ventilation and Anesthesia	Continuous trend	Yes
MVe	Minute volume, expired	L/min	Ventilation	Continuous trend	Yes
MVespon	Spontaneous expiratory minute volume	L/min	Ventilation	Continuous trend	No
MVleak	Leakage minute volume	L/min	Ventilation	Continuous trend	No
MVi	Minute volume, inspired	L/min	Ventilation	Continuous trend	Yes

Parameter label	**Description**	**Unit of measurement**	**Displayed in Ventilation or Anesthesia *Show all* page (see page 426)**	**Cockpit Trends page**	**Available for display in parameter field Yes/No?**
MVmand	Mandatory minute volume	L/min	Ventilation and Anesthesia	Continuous trend	No
MVspon	Spontaneous minute volume	L/min	Ventilation and Anesthesia	Continuous trend	No
% MVspon	Spontaneous breathing portion of minute volume	%	Ventilation	Continuous trend	No
N2O cons	Accumulated nitrous oxide consumption	L	Anesthesia	Not trended	No
NIF	Negative inspiratory force	mbar	Ventilation	Continuous trend	No
ΔO_2	Inspiratory/ expiratory oxygen concentration difference	%	Ventilation and Anesthesia	Continuous trend	No
O_2 cons	Accumulated oxygen consumption	L	Anesthesia	Not trended	No
P0.1	Occlusion pressure	mbar	Ventilation	Continuous trend	No
ΔPhf	Pressure amplitude during HFO	mbar	Ventilation	Continuous trend	No
Phigh	Upper pressure level during APRV	mbar	Ventilation	Continuous trend	No
PIP	Peak inspiratory pressure	mbar	Ventilation and Anesthesia	Continuous trend	Yes
Plow	Lower pressure level during APRV	mbar	Ventilation	Continuous trend	No
Pmin	Minimum airway pressure	mbar	Ventilation	Continuous trend	No
Pmean	Mean airway pressure	mbar	Ventilation and Anesthesia	Continuous trend	Yes
Pplat	Plateau pressure	mbar	Ventilation and Anesthesia	Continuous trend	Yes
R	Resistance	mbar/L/s	Ventilation and Anesthesia	Continuous trend	No

Parameter label	Description	Unit of measurement	Displayed in Ventilation or Anesthesia *Show all* page (see page 426)	Cockpit Trends page	Available for display in parameter field Yes/No?
r2	Correlation factor	min	Ventilation	Continuous trend	No
Rpat	Patient airway resistance	mbar/L/s	Ventilation	Continuous trend	No
RR	Respiratory rate	/min	Anesthesia and Ventilation	Continuous trend	Yes
RRc	Respiratory rate based on carbon dioxide measurement	/min	Ventilation	Continuous trend	Yes
RRf	Respiratory rate based on volume/flow measurement	/min	Ventilation	Continuous trend	Yes
RRmand	Mandatory respiratory rate	/min	Ventilation and Anesthesia	Continuous trend	No
RRp	Respiratory rate based on pressure	/min	Ventilation	Continuous trend	Yes
RRspon	Spontaneous respiratory rate	/min	Ventilation	Continuous trend	No
RSB	Rapid shallow breathing index	1/min/L **Note**: not supported in 1/min/mL unit of measure in the export protocol application Note: adult and pediatric patients only	Ventilation	Continuous trend	No
Sev cons	Sevoflurane consumption	mL	Anesthesia	Continuous trend	No
Tispon	Spontaneous inspiratory time	s	Ventilation	Continuous trend	No
TC	Time constant	s	Ventilation	Continuous trend	No

Parameter label	**Description**	**Unit of measurement**	**Displayed in Ventilation or Anesthesia *Show all* page (see page 426)**	**Cockpit Trends page**	**Available for display in parameter field Yes/No?**
Tcase	Therapy case duration	min	Anesthesia	Not trended	No
TCe	Expiratory time constant	s	Ventilation	Continuous trend	No
Tlow	Effective expiratory time during APRV/AutoRelease	s	Ventilation	Continuous trend	No
V'CO2	Carbon dioxide production	mL/min	Ventilation	Continuous trend	No
Vds	Serial dead space volume	mL	Ventilation	Continuous trend	No
Vds/VTe	Ratio of serial dead space volume to expiratory tidal volume	%	Ventilation	Continuous trend	No
V'O2	Oxygen consumption	mL/min	Ventilation	Continuous trend	No
VTACH	Tidal volume	mL	Ventilation and Anesthesia	Continuous trend	Yes
VTCO2	CO2 production volume per breath	mL	Ventilation	Continuous trend	No
VTe	Expiratory tidal volume	mL	Ventilation	Continuous trend	Yes
VTemand	Mandatory expiratory tidal volume	mL	Ventilation	Continuous trend	No
VTespon	Spontaneous expiratory tidal volume	mL	Ventilation	Continuous trend	No
VTespon mean	Expiratory spontaneous mean tidal volume	mL	Ventilation	Continuous trend	No
VThf	Tidal volume during HFO	mL	Ventilation	Continuous trend	No
VTi	Inspiratory tidal volume	mL	Ventilation	Continuous trend	Yes

Parameter label	**Description**	**Unit of measurement**	**Displayed in Ventilation or Anesthesia *Show all* page (see page 426)**	**Cockpit Trends page**	**Available for display in parameter field Yes/No?**
VTimand	Mandatory inspiratory tidal volume	mL	Ventilation	Continuous trend	No
VTispon	Spontaneous inspiratory tidal volume	mL	Ventilation	Continuous trend	No
VTispon mean	Inspiratory spontaneous mean tidal volume	mL	Ventilation	Continuous trend	No
VTmand	Mandatory tidal volume	mL **Note**: Only mL is supported (L is supported on source device)	Ventilation	Continuous trend	No
VTspon	Spontaneous tidal volume	mL **Note**: Only mL is supported (L is supported on source device)	Ventilation	Continuous trend	No
VT/Wt	Tidal volume per kg body weight	mL/kg	Ventilation	Continuous trend	No
xMAC	xMAC mean alveolar concentration derived from expiratory concentration.	no units	Anesthesia	Continuous trend	Yes

Supported waveforms

The following MEDIBUS.X waveforms are displayed on the Cockpit.

Waveform label	Description	Unit of measurement
Paw	Airway pressure	mbar
Flow	Inspiratory and expiratory flow	L/min
CO2	Carbon dioxide concentration	mmHg, kPa, %

Viewing MEDIBUS.X parameter data

The Cockpit displays parameter data originating from connected MEDIBUS.X devices in the following locations:

– Parameter fields
– ***Loops*** pages (see page 425)
– ***Trends*** pages (see page 173)
– ***Show all*** pages (see 426)

The Cockpit displays the following waveforms, loops, and parameters:

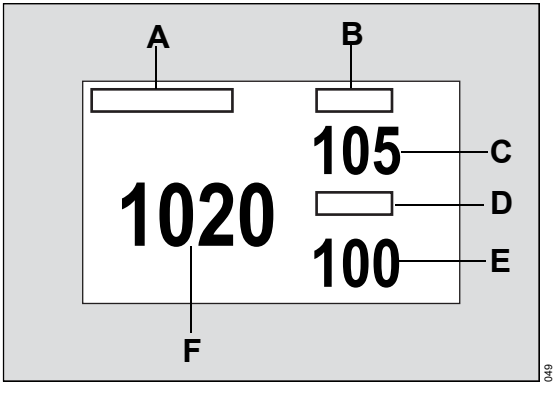
– Airway pressure waveform (Paw) and associated parameter field
– Expiratory flow waveform and associated flow/volume (vent) parameter field
– CO2 waveforms and associated parameter field
– Loops (flow-volume, pressure-volume)

Parameter fields

NOTE
The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. The content of a parameter field can be configured. For more information see page 427.

The following diagram shows a typical parameter field for a MEDIBUS.X parameter.



A Primary parameter label
B Second parameter label
C Second parameter value
D Third parameter label
E Third parameter value
F Primary parameter value

NOTE
The background of the Paw parameter field appears cyan when a ventilator or an anesthesia workstation becomes disconnected.

Viewing loops

Loops offer important information about the response of the patient to mechanical ventilation. The Cockpit displays loops from supported MEDIBUS.X devices provided the source devices make the data available to the MEDIBUS.X protocol.

Pressure-volume loops illustrate changes in compliance, resistance, and work of breathing. A mandatory breath plots counterclockwise, while a spontaneous breath plots clockwise. Inspiration starts at a point defined by baseline pressure and the volume level at the beginning of inspiration.

Flow-volume loops also report mechanical and spontaneous breaths. Inspiration begins at the origin and moves upward and clockwise. Expiration plots below the horizontal axis and progresses counterclockwise to the original starting point.

To view loops

You can view loops from the ***Ventilator*** or the ***Anesthesia workstation*** tabs. Which tab is displayed depends on whether a ventilator or an anesthesia workstation is connected.

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. The MEDIBUS.X ***Ventilator*** tab is the one that has the message ***Medibus.X ventilator devices*** displayed as a header on the various pages.

1. Select the ***Sensor parameters...*** button on the main menu bar.
2. Select the ***Ventilator*** tab or the ***Anesthesia workstation*** tab.
3. Select the ***PV Loop*** tab to view pressure-volume loops or select the ***FV Loop*** tab to view flow-volume loops.
4. Select the ***Loops*** tab to view all loops in one dialog.
5. Select the ***Loop draw*** button at the bottom of the pages to choose how many loops are drawn on top of each other before the screen is cleared.
6. Select the ***Save reference*** button at the bottom of the page if you want to save a loop for future analysis and comparison.

The *Show all* pages

The ***Show all*** page displays the values and units of measure of the currently monitored parameters in one screen. The following two ***Show all*** pages are available:

– Under the ***Anesthesia workstation*** tab

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. The MEDIBUS.X ***Ventilator*** tab is the one that has the message ***Medibus.X ventilator devices*** displayed as a header on the various pages.

The anesthesia ***Show all*** page displays the following data:

– Current ventilator measurements

– Current gas measurements

– Current consumption

– Units of measure

NOTE

If a Scio module is connected, the values in the ***Current measurements gases*** section come from the Scio module, regardless of which MEDIBUS.X device is connected.

The ventilator ***Show all*** page displays the following data:

– Current ventilator measurements

– Units of measure

The ventilator ***Show all*** page can be configured (see page 426).

To access the *Show all* pages

You can access the ***Show all*** page in the ***Ventilator*** or the ***Anesthesia workstation*** tabs. Which tab is displayed depends on whether a ventilator or an anesthesia workstation is connected.

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. The MEDIBUS.X ***Ventilator*** tab is the one that has the message ***Medibus.X ventilator devices*** displayed as a header on the various pages.

1 Select the ***Sensor parameters...*** button on the main menu bar.

2 Select ***Ventilator*** or ***Anesthesia workstation*** > ***Show all***.

Configuring the ventilator *Show all* page

You can configure the parameter display of the ventilator ***Show all*** page and adapt it to the parameter set of the connected device.

To configure the ventilator *Show all* page

1 Select the ***Sensor parameters...*** button on the main menu bar.

Select ***Ventilator*** > ***Configure show all***. A page with twenty-six buttons appears.

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. The MEDIBUS.X ***Ventilator*** tab is the one that has the message ***Medibus.X ventilator devices*** displayed as a header on the various pages.

2 Press any button to activate a list of available parameters. You can also select ***None*** to remove any parameter from being displayed in that space. The parameter selection ***MV auto***, ***RR auto*** and ***VT auto*** are unique because the associated parameter set varies from device to device. When the ***Vent parameter display*** setting ***Auto*** is selected, the Cockpit pulls the available parameter from the source device according to the following priority list:
   – ***MV auto***: MVe, MV,MVi
   – ***RR auto***: RR, RRf, RRp
   – ***VT auto***: VTe, VTACH,VTi
3 Select the desired parameter in the list to assign it to the button and to the ***Show all*** page.
4 Repeat steps 2 and 3 until the desired configuration for the ***Show all*** page is completed.

Accessing parameter setup functions

You can configure the display of ventilation and anesthesia parameters in the following tabs located under the ***Ventilator*** or the ***Anesthesia workstation*** tabs.

– ***Paw***
– ***Vent***
– ***CO2*** (when a ventilator is connected) or ***CO2/O2/ Agent*** (when anesthesia workstation is connected)

1 Select ***Sensor parameters...*** from the main menu bar.
2 Select the ***Ventilator*** or the ***Anesthesia workstation*** tab.

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. The MEDIBUS.X ***Ventilator*** tab is the one that has the message ***Medibus.X ventilator devices*** displayed as a header on the various pages.

If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

3 Select either the ***Paw***, ***Vent*** or ***CO2*** or ***CO2/O2/ Agent*** tabs to access the respective setup pages.

NOTE

Most setup functions described in the following tables are available under the ***Ventilator*** and the ***Anesthesia workstation*** tabs. Exception where a setup function is only available under one tab are noted.

Paw setup functions

See page 427 for information on how to access this page.

Selection	Available settings	Description
Paw scale	10, 15, 20, 25 (default), 30, 40, 50, 60, 70, 80, 100, 120 mbar	Determines the scale of the displayed Paw waveform.
Parameter 1	***PEEP***, ***PIP*** (default), ***Pmean***, ***Pplat***	Selects the primary parameter in the Paw parameter field.
Parameter 2	***PEEP***, ***PIP***, ***Pmean*** (default), ***Pplat***	Selects the second parameter in the Paw parameter field.
Parameter 3	***PEEP*** (default), ***PIP***, ***Pmean***, ***Pplat***	Selects the third parameter in the Paw parameter field.
Color	Red, green, blue, yellow, light blue (default), purple, orange, white.	Determines the color of all MEDIBUS.X parameter fields, waveforms, and loops.

Ventilator parameter setup functions

See page 427 for information on how to access this page.

Selection	Available settings	Description
Flow scale	5, 10, 15, 20 (default in neonatal mode), 35, 50, 100 (default in adult and pediatric mode), 150, 200 L/min	Determines the scale of the displayed Flow waveform.
Vol scale	5, 10, 25, 50 (default in neonatal mode), 75, 100, 250, 500, 1000 (default in pediatric and adult mode), 1500 mL	Determines the scale of the displayed Volume waveform.

Selection	Available settings	Description
Vent parameter display	– ***Auto*** (default) – ***Manual***	Determines whether the selected parameters for display in the parameter field are selected manually or automatically. With the setting ***Manual***, the parameter for each parameter field location are selected manually. With the setting ***Auto***, the parameter supported by the source device is assigned to the parameter field location.
Parameter 1	***MVe*** (default), ***MVi***, ***VTe***, ***VTACH***, ***VTi***, ***RR***, ***RRf***, ***RRp***	Selects the primary parameter in the ventilation parameter field when the ***Vent parameter display*** setting is set to ***Manual***.
	– ***MV auto*** (default) – (available parameter depends on source device:MVe, MV, MVi) – ***RR auto*** – (available parameter depends on source device: RR, RRf, RRp) – ***VT auto –*** (available parameters depends on source device: VTe, VTACH, VTi)	Selects the primary parameter in the ventilation parameter field automatically when the ***Vent parameter display*** setting is set to ***Auto***. The specific parameter supported by the source device is assigned automatically according to the priority list.
Parameter 2	***MVe***, ***MVi***, ***VTe***, ***VTACH***, ***VTi***, ***RR*** (default), ***RRf***, ***RRp***	Selects the second parameter in the ventilation parameter field when the ***Vent parameter display*** setting is set to ***Manual***.
	– ***MV auto*** – (available parameter depends on source device:MVe, MV, MVi) – ***RR auto*** (default) – (available parameter depends on source device: RR, RRf, RRp) – ***VT auto –*** (available parameters depends on source device: VTe, VTACH, VTi)	Selects the primary parameter in the ventilation parameter field automatically when the ***Vent parameter display*** setting is set to ***Auto***. The specific parameter supported by the source device is assigned automatically according to the priority list.

Selection	Available settings	Description
Parameter 3	***MVe***, ***MVi***, ***VTe*** (default), ***VTACH***, ***VTi***, ***RR***, ***RRf***, ***RRp***	Selects the third parameter in the ventilation parameter field when the ***Vent parameter display*** setting is set to ***Manual***.
	– ***MV auto*** – (available parameter depends on source device:MVe, MV, MVi) – ***RR auto*** – (available parameter depends on source device: RR, RRf, RRp) – ***VT auto*** (default) **–** (available parameters depends on source device: VTe, VTACH, VTi)	Selects the primary parameter in the ventilation parameter field automatically when the ***Vent parameter display*** setting is set to ***Auto***. The specific parameter supported by the source device is assigned automatically according to the priority list.
Color	Red, green, blue, yellow, light blue (default), purple, orange, white.	Determines the color of all ventilation parameter fields, waveforms, and loops.

CO2 setup functions

See page 427 for information on how to access this page. The tab is labelled ***CO2*** when a ventilator is connected. The tab is labelled ***CO2/O2/ Agent*** when an anesthesia workstation is connected.

Selection	Available settings	Description
Menu selections when ***Ventilator*** tab is selected.		
CO2 Scale	– 0 to 40 (default), 0 to 60, 0 to 80, 0 to 100 mmHg – 0.0 to 5.0 (default), 0.0 to 8.0, 0.0 to 12.0, 0.0 to 16.0 kPa – 0 to 5 (default), 0 to 8, 0 to 12, 0 to 16%	Determines the scale of the displayed CO2 waveform.
Color	Red, green, blue, yellow (default), light blue, purple, orange, white.	Determines the color of the CO2 parameter field and waveform.
Menu selections when ***Anesthesia workstation*** tab is selected.		
etCO2 parameter field	– ***etCO2*** (default) – ***etCO2/O2***	Determines the appearance of the etCO2 parameter field.
CO2 Scale	– 0 to 40 (default), 0 to 60, 0 to 80, 0 to 100 mmHg – 0.0 to 5.0 (default), 0.0 to 8.0, 0.0 to 12.0, 0.0 to 16.0 kPa – 0 to 5 (default), 0 to 8, 0 to 12, 0 to 16%	Determines the scale of the displayed CO2 waveform.
Color	Red, green, blue, yellow (default), light blue, purple, orange, white.	Determines the color of the CO2 parameter field and waveform.
O2 parameter field	– ***O2*** – ***O2/N2O*** (default) – ***Off***	Determines the appearance of the O2 parameter field.
Agent parameter field	– ***Agent*** – ***Agent/ xMAC*** (default) – ***Agent/N2O*** – ***Off***	Determines the appearance of the Agent parameter field. Note: If two agents are detected, both are displayed automatically.

This page has been left blank intentionally.

External devices – Servo-i ventilator

Overview of ventilation monitoring

The device connectivity option enables the Cockpit to display parameter values, waveforms, and loops from a Servo-i ventilator.

Within 30 seconds of connecting a device, the data appear at the Cockpit. The ventilator monitoring functions are configurable in the parameter-specific setup page (see page 441).

NOTE
Ventilation waveforms are not supported on recordings.

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. For device-specific error messages, refer to the instructions for use of the connected ventilator.

NOTE
When connecting a ventilator that does not support CO2 monitoring, the Cockpit may still display a CO2 tab in the ***Ventilator*** dialog.

Infinity CentralStation – Vent Central option

Certain parameters, settings, modes, and waveforms originating from Servo-i ventilators are broadcast to the network via the Cockpit. If the patient is admitted at an ICS (Infinity CentralStation) with software version VF8 and the Vent Central option is activated, you can review the above-mentioned data at the ICS. For more detailed information, refer to the VF8 instructions for use entitled '*Infinity CentralStation'*.

External device alarms

Alarms from the ventilator are transmitted to the Infinity network and made available for alarm annunciation at the ICS. For more information, refer to the Instructions for use *Infinity CentralStation*.

If the external device alarm feature is activated at the Cockpit (see page 474) and an external device is disconnected from the Cockpit, the following happens at the Cockpit and at the ICS when the patient is admitted at the ICS:

– An alarm tone of low priority sounds.

– The message ***External device disconnected*** is displayed.

Precautions

WARNING

Always refer to the primary data source before making diagnostic or therapeutic decisions.

Connecting peripheral devices is supported via the device connectivity option. Only connect peripheral medical devices to a patient monitor if those devices comply with the electrical safety requirements found in IEC 60601-1. Refer to "Safe connection with other electrical equipment" on page 15 of these instructions for use for information on how to connect devices safely.

WARNING

The following section lists all of the external devices and related software versions that Dräger has validated. Dräger cannot make any claim for the reliability of the data for subsequent or previous software versions or for any devices that have not been validated. In the interest of patient safety and device performance, do not connect devices to the monitor which have not been approved by Dräger. The hospital is responsible for contacting Dräger to determine the compatibility and warranty status of any connection made to another manufacturer's medical devices.

Device compatibility

The Cockpit device connectivity interface allows data from the Servo-i ventilator with software version 7 to display parameters, settings and waveforms on the Cockpit. See the table below for supported parameters.

Supported Servo-i parameters

The following table lists which Servo-i ventilator parameters are displayed and trended on the Cockpit. Refer to page 435 for a list of supported ventilators and the compatible software versions.

Parameter label	**Description**	**Unit of measurement**	**Displayed in Ventilation *Show all* page (see page 440) Yes/No?**	**Cockpit Trends page**	**Available for display in parameter field Yes/No?**
Cdyn	Dynamic compliance	L/bar	Yes	Continuous	No
etCO2	End-tidal CO2 concentration	mmHg	Not supported for display	Continuous and mini-trend	Yes
		kPa			
		%			
FiO2	Inspired O2	%	Yes	Continuous	No
MVe	Minute volume, expired	L/min	Yes	Continuous and mini-trend	Yes
MVespon	Spontaneous expiratory minute volume	L/min	Yes	Continuous	No
PEEP	Peak end expiratory airway pressure	cmH2O	Yes	Continuous	Yes
PIP	Peak inspiratory pressure	cmH2O	Yes	Continuous and mini-trend	Yes
Pmean	Mean airway pressure	cmH2O	Yes	Continuous	Yes
RR	Respiratory rate	/min	Yes	Continuous	Yes
V'CO2	Carbon dioxide production	mL/min	Yes	Continuous	No
VTe	Tidal volume, expired	mL	Yes	Continuous	Yes

Supported Servo-i waveforms

The following Medibus waveforms are displayed on the Cockpit.

Waveform label	Description	Unit of measurement
Paw	Airway pressure	mbar
Flow	Inspiratory and expiratory flow	L/min
CO2	Carbon dioxide concentration	mmHg, kPa, %

Viewing parameter data

The Cockpit displays parameter data originating from connected Servo-i ventilator in the following locations:

- Parameter fields
- ***Loops*** pages (see page 439)
- ***Trends*** pages (see page 173)
- ***Show all*** pages (see page 440)

The Cockpit displays the following waveforms, loops and parameters:

- Airway pressure waveform (Paw) and associated parameter field
- Expiratory flow waveform and associated flow/volume (vent) parameter field
- CO2 waveforms and associated parameter field
- Loops (flow-volume, pressure-volume)

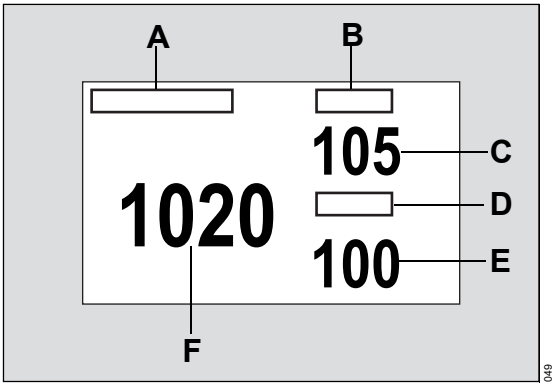
Parameter fields

NOTE

The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525

The following diagram shows a ventilator parameter field.



A Primary parameter label

B Second parameter label

C Second parameter value

D Third parameter label

E Third parameter value

F Primary parameter value

Viewing loops

Loops offer important information about the response of the patient to mechanical ventilation. You can review loops on two pages: Pressure/volume and Flow/volume.

Pressure-volume loops illustrate changes in compliance, resistance, and work of breathing. A mandatory breath plots counterclockwise, while a spontaneous breath plots clockwise. Inspiration starts at a point defined by baseline pressure and the volume level at the beginning of inspiration.

Flow-volume loops also report mechanical and spontaneous breaths. Inspiration begins at the origin and moves upward and clockwise. Expiration plots below the horizontal axis and progresses counterclockwise to the original starting point.

NOTE

In neonatal mode, ventilator loops are not available on the Cockpit.

To view loops

1 Select the ***Sensor parameters...*** button on the main menu bar.

2 Select the ***Ventilator*** tab. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog:

- >> symbol
- display filter button

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. If you select the ***Ventilator*** tab and the selected page has the message ***Medibus.X ventilator devices*** displayed as a header, you have selected the wrong ***Ventilator*** tab).

3 Select the ***PV Loop*** tab to view pressure-volume loops or select the ***FV Loop*** tab to view flow-volume loops.

4 Select the ***Loops*** tab to view all loops in one dialog.

5 Select the ***Loop draw*** button at the bottom of the page to choose how many loops are drawn on top of each other before the screen is cleared.

6 Select the ***Save reference*** button at the bottom of the page if you want to save a loop for future analysis and comparison.

The *Show all* page

The ***Show all*** page displays the values of the currently monitored ventilator parameters and units of measure in one screen.

NOTE
The settings TVi, I (I:E) and E (I:E), also appear in the ***Show all*** page in addition to the parameters.

To access the ventilation show all page

1 Select the ***Trends/ Data...*** button on the main menu bar.

2 Select ***Trends*** > ***Ventilator*** > ***Show all***

or

1 Select the ***Sensor parameters...*** button on the main menu bar.

2 Select the ***Ventilator*** tab.

NOTE
Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. If you select the ***Ventilator*** tab and the selected page has the message ***Medibus.X ventilator devices*** displayed as a header, you have selected the wrong ***Ventilator*** tab.

3 Select the ***Show all*** tab.

Accessing the parameter setup functions

1 Select ***Sensor parameters...*** from the main menu bar > ***Ventilator*** tab to access the ***Ventilator*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

NOTE
Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. If you select the ***Ventilator*** tab and the selected page has the message ***Medibus.X ventilator devices*** displayed as a header, you have selected the wrong ***Ventilator*** tab.

2 Select either the ***Paw*** or the ***Vent*** tabs to access the respective pages.

Ventilator Paw setup functions

See page 440 for information on how to access this page.

Selection	Available settings	Description
Paw scale	10, 15, 20, 25 (default), 30, 40, 50, 60, 70, 80, 100, 120 mbar	Determines the scale of the displayed Paw waveform.
Parameter 1	***Pmean***, ***PEEP***, ***PIP*** (default)	Selects the primary parameter in the Paw parameter field.
Parameter 2	***Pmean*** (default), ***PEEP***, ***PIP***	Selects the second parameter in the Paw parameter field.
Parameter 3	***Pmean***, ***PEEP*** (default), ***PIP***	Selects the third parameter in the Paw parameter field.
Color	Red, green, blue, yellow, light blue (default), purple, orange, white.	Determines the color of all ventilation parameter fields, waveforms, and loops.

Ventilator parameter setup functions

See page 440 for information on how to access this page.

Selection	Available settings	Description
Flow scale	5, 10, 15, 20 (default in neonatal mode), 35, 50, 100 (default in adult and pediatric mode), 150, 200 L/min	Determines the scale of the displayed Flow waveform.
Vol scale	5, 10, 25, 50 (default in neonatal mode), 75, 100, 250, 500, 1000 (default in pediatric and adult mode), 1500 mL	Determines the scale of the displayed Volume waveform.
Parameter 1	***MVe***, (default), ***RR***, ***VTe***	Selects the primary parameter in the Vent parameter field.
Parameter 2	***MVe***, ***RR*** (default), ***VTe***	Selects the second parameter in the Vent parameter field.
Parameter 3	***MVe***, ***RR***, ***VTe*** (default)	Selects the third parameter in the Vent parameter field.
Color	Red, green, blue, yellow, light blue (default), purple, orange, white.	Determines the color of all ventilation parameter fields, waveforms, and loops.

CO2 parameter setup functions

See page 440 for information on how to access this page.

Selection	Available settings	Description
CO2 Scale	– 0 to 40 (default), 0 to 60, 0 to 80, 0 to 100 mmHg – 0.0 to 5.0 (default), 0.0 to 8.0, 0.0 to 12.0, 0.0 to 16.0 kPa – 0 to 5 (default), 0 to 8, 0 to 12, 0 to 16%	Determines the scale of the displayed CO2 waveform.
Atm. pressure	570 to 800 mmHg	Determines the ambient pressure setting.
Color	Red, green, blue, yellow (default), light blue, purple, orange, white.	Determines the color of the CO2 parameter field and waveform.

This page has been left blank intentionally.

External devices – Evita 2D, Evita 4, Evita XL (Medibus)

Overview of ventilation monitoring

The device connectivity option enables the Cockpit to display parameter values, waveforms, and loops from the Medibus-compatible ventilators Evita 2D, Evita 4, and Evita XL.

Within 30 seconds of connecting a device, the data appear at the Cockpit. The ventilator monitoring functions are configurable in the parameter-specific setup page (see page 453).

NOTE
Ventilation waveforms are not supported on recordings.

Before performing any monitoring functions, refer to the section "For your safety and that of your patients" on page 13. For device-specific error messages, refer to the instructions for use of the connected ventilator.

NOTE
When connecting a ventilator that does not support CO2 monitoring, the Cockpit may still display a CO2 tab in the ***Ventilator*** dialog.

Infinity CentralStation – Vent Central option

Certain parameters, settings, modes, and waveforms originating from Evita ventilators are broadcast to the network via the Cockpit. If the patient is admitted at an ICS (Infinity CentralStation) with software version VF8 and the Vent Central option is activated, the above-mentioned data is displayed at the ICS. For more detailed information, refer to the VF8 instructions for use entitled '*Infinity CentralStation*'.

NOTE
When connecting an Evita XL device to IACS, when the patient is in NIV (non-invasive mode), then information on the mode is not sent out on the network.

External device alarms

Alarms from the ventilator are transmitted to the Infinity network and made available for alarm annunciation at the ICS. For more information, refer to the Instructions for use *Infinity CentralStation*.

If the external device alarm feature is activated at the Cockpit (see page 474) and an external device is disconnected from the Cockpit, the following happens at the Cockpit and at the ICS if the patient is admitted at the ICS:

– An alarm tone of low priority sounds.

– The message ***External device disconnected*** is displayed.

Precautions

WARNING

Always refer to the primary data source before making diagnostic or therapeutic decisions.

Connecting peripheral devices is supported via the device connectivity option. Only connect peripheral medical devices to a patient monitor if those devices comply with the electrical safety requirements found in IEC 60601-1. Refer to "Safe connection with other electrical equipment" on page 15 of these instructions for use for information on how to connect devices safely.

WARNING

The following section lists all of the external devices and related software versions that Dräger has validated. Dräger cannot make any claim for the reliability of the data for subsequent or previous software versions or for any devices that have not been validated. In the interest of patient safety and device performance, do not connect devices to the monitor which have not been approved by Dräger. The hospital is responsible for contacting Dräger to determine the compatibility and warranty status of any connection made to another manufacturer's medical devices.

Device compatibility

The device connectivity option allows data from Evita 2D, Evita 4, and Evita XL ventilators to display parameters, settings and waveforms on the Cockpit. The following table lists which software versions are supported with Medibus.

Supported device	**Supported software version**
Device	**Software version**
Dräger Evita 2D	1.00 and higher
Dräger Evita 4	1.00 and higher
Dräger Evita XL	5.00 and higher

Supported Medibus ventilator data

The Evita ventilators (Evita 2D, Evita 4, and Evita XL) send parameters, settings, modes and alarm messages to the Cockpit.

Certain ventilator parameters, settings, and ventilation modes are broadcast to the Infinity network. In addition, a limited number of alarms are made available to the Infinity network.

Refer to the RS-232 export handbook for information on which parameters are available for export protocol and which settings and modes are supported. The RS-232 export handbook is available in English only.

Supported Medibus parameters on the Cockpit

The following table lists which parameters are displayed and trended on the Cockpit. Refer to page 447 for a list of supported ventilators and the compatible software versions.

Parameter label	**Description**	**Unit of measure-ment**	**Displayed in Ventilation *Show all* page (see page 452) Yes/No?**	**Cockpit Trends page**	**Available for display in parameter field Yes/No?**
Cdyn	Dynamic compliance	L/bar	Yes	Continuous	No
etCO2	End-tidal carbon dioxide concentration	mmHg	Yes	Continuous and mini-trend	Yes
		kPa			
		%			
FiO2	Inspiratory oxygen fraction	%	Yes	Continuous	No
MVe	Minute volume, expired	L/min	Yes	Continuous and mini-trend	Yes
MVspon	Minute volume, expired, spontaneous	L/min	Yes	Continuous	No
P0.1	Occlusion pressure	mbar or cmH2O	Not supported for display.	Not trended	No
PEEP	Peak end expiratory airway pressure	mbar or cmH2O	Yes	Continous	Yes
Pmean	Mean airway pressure	mbar or cmH2O	Yes	Continuous	Yes
Pmin	Minimum airway pressure	mbar or cmH2O	Yes	Not trended	No

Parameter label	**Description**	**Unit of measure-ment**	**Displayed in Ventilation *Show all* page (see page 452) Yes/No?**	**Cockpit Trends page**	**Available for display in parameter field Yes/No?**
Pplat	Plateau pressure	mbar or cmH2O	Yes	Not trended	No
PIP	Peak inspiratory pressure	mbar or cmH2O	Yes	Continuous and mini-trend	Yes
R	Resistance	mmbar/L/s	Yes	Continuous	No
RRspon	Spontaneous respiratory rate	/min	Yes	Continuous	No
RR	Respiratory rate	/min	Yes	Continuous	Yes
I (I:E)	Inspiratory component	No unit	Yes	Not trended	No
E (I:E)	Expiratory component	No unit	Yes	Not trended	No
I:E	Ratio inspiratory to expiratory component	No unit	Yes **Note**: This parameter is calculated and is not broadcast to the network	Not trended	No
V'CO2	Carbon dioxide production	mL/min	Yes	Continuous	No
Vds	Serial dead space volume	mL	Yes	Continuous	No
Vds/VTe	Ratio of serial dead space volume to expiratory tidal volume	%	Yes	Not trended	No
VTe	Expiratory tidal volume	mL	Yes	Continuous	Yes

Supported Medibus waveforms

The following Medibus waveforms are displayed on the Cockpit.

Waveform label	Description	Unit of measurement
PAW	Airway pressure	mbar
Flow	Inspiratory and expiratory flow	L/min
CO2	Carbon dioxide concentration	mmHg, kPa, %

Viewing Medibus parameter data

The Cockpit displays parameter data originating from connected Evita 2D, Evita 4, and Evita XL ventilators in the following locations:

– Parameter fields

– ***Loops*** pages (see page 451)

– ***Trends*** pages (see page 173)

– ***Show all*** pages (see page 452)

The Cockpit displays the following waveforms, loops, and parameters:

– Airway pressure waveform (Paw) and associated parameter field

– Expiratory flow waveform and associated flow/volume (vent) parameter field

– CO_2 waveforms and associated parameter field

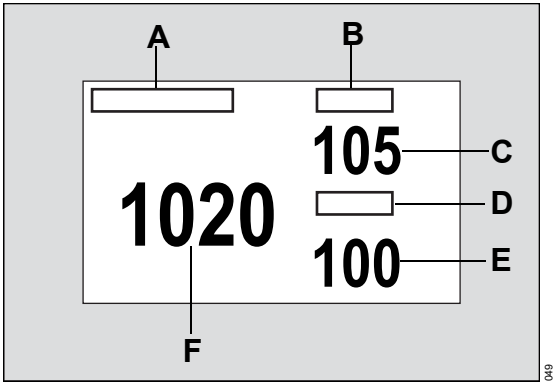
– Loops (flow-volume, pressure-volume)

Parameter fields

NOTE
The following diagram shows a typical parameter field layout. This layout may change when additional parameters are put on display. For more information, see "Parameter fields" on page 68.

Parameter fields report parameter values and indicate the alarm status of parameters. Parameter fields can also report technical conditions such as disconnected sensors, and so on. For detailed information regarding the content of parameter fields for each parameter, see the chapter "Troubleshooting" on page 525

The following diagram shows a ventilator parameter field.



A Primary parameter label

B Second parameter label

C Second parameter value

D Third parameter label

E Third parameter value

F Primary parameter value

Viewing loops

Loops offer important information about the response of the patient to mechanical ventilation. You can review loops on two pages: Pressure/volume and Flow/volume.

Pressure-volume loops illustrate changes in compliance, resistance, and work of breathing. A mandatory breath plots counterclockwise, while a spontaneous breath plots clockwise. Inspiration starts at a point defined by baseline pressure and the volume level at the beginning of inspiration.

Flow-volume loops also report mechanical and spontaneous breaths. Inspiration begins at the origin and moves upward and clockwise. Expiration plots below the horizontal axis and progresses counterclockwise to the original starting point.

NOTE
In neonatal mode, ventilator loops are not available on the Cockpit.

To view loops

1 Select the ***Sensor parameters...*** button on the main menu bar.

2 Select the ***Ventilator*** tab. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog:

- >> symbol
- display filter button

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. If you select the ***Ventilator*** tab and the selected page has the message ***Medibus.X ventilator devices*** displayed as a header, you have selected the wrong ***Ventilator*** tab.

3 Select the ***PV Loop*** tab to view pressure-volume loops or select the ***FV Loop*** tab to view flow-volume loops.

4 Select the ***Loops*** tab to view all loops in one dialog.

5 Select the ***Loop draw*** button at the bottom of the page to choose how many loops are drawn on top of each other before the screen is cleared.

6 Select the ***Save reference*** button at the bottom of the page if you want to save a loop for future analysis and comparison.

The *Show all* page

The ***Show all*** page displays the values of the currently monitored ventilator parameters and units of measure in one screen.

To access the ventilation show all page

1 Select the ***Trends/ Data...*** button on the main menu bar.

2 Select ***Trends*** > ***Ventilator*** > ***Show all***

or

1 Select the ***Sensor parameters...*** button on the main menu bar.

2 Select the ***Ventilator*** tab.

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. If you select the ***Ventilator*** tab and the selected page has the message ***Medibus.X ventilator devices*** displayed as a header, you have selected the wrong ***Ventilator*** tab.

3 Select the ***Show all*** tab.

Accessing the parameter setup functions

1 Select ***Sensor parameters...*** from the main menu bar > ***Ventilator*** tab to access the ***Ventilator*** page. If you cannot see the tab, select the following two symbols located in the upper right corner of the dialog: >> symbol and the display filter button.

NOTE

Depending on which devices are connected to the Cockpit, two ***Ventilator*** tabs may be displayed. If you select the ***Ventilator*** tab and the selected page has the message ***Medibus.X ventilator devices*** displayed as a header, you have selected the wrong ***Ventilator*** tab.

2 Select either the ***Paw*** or the ***Vent*** tabs to access the respective pages.

Ventilator Paw setup functions

See page 453 for information on how to access this page.

Selection	Available settings	Description
Paw scale	10, 15, 20, 25 (default), 30, 40, 50, 60, 70, 80, 100, 120 mbar	Determines the scale of the displayed Paw waveform.
Parameter 1	***Pmean***, ***PEEP***, ***PIP*** (default)	Selects the primary parameter in the Paw parameter field.
Parameter 2	***Pmean*** (default), ***PEEP***, ***PIP***	Selects the second parameter in the Paw parameter field.
Parameter 3	***Pmean***, ***PEEP*** (default), ***PIP***	Selects the third parameter in the Paw parameter field.
Color	Red, green, blue, yellow, light blue (default), purple, orange, white.	Determines the color of all ventilation parameter fields, waveforms, and loops.

Ventilator parameter setup functions

See page 453 for information on how to access this page.

Selection	Available settings	Description
Flow scale	5, 10, 15, 20 (default in neonatal mode), 35, 50, 100 (default in adult and pediatric mode), 150, 200 L/min	Determines the scale of the displayed Flow waveform.
Vol scale	5, 10, 25, 50 (default in neonatal mode), 75, 100, 250, 500, 1000 (default in pediatric and adult mode), 1500 mL	Determines the scale of the displayed Volume waveform.
Parameter 1	***MVe*** (default), ***RR***, ***VTe***	Selects the primary parameter in the Vent parameter field.
Parameter 2	***MVe***, ***RR*** (default), ***VTe***	Selects the second parameter in the Vent parameter field.
Parameter 3	***MVe***, ***RR***, ***VTe*** (default)	Selects the third parameter in the Vent parameter field.
Color	Red, green, blue, yellow, light blue (default), purple, orange, white.	Determines the color of all ventilation parameter fields, waveforms, and loops.

CO_2 parameter setup functions

See page 453 for information on how to access this page.

Selection	Available settings	Description
CO2 Scale	– 0 to 40 (default), 0 to 60, 0 to 80, 0 to 100 mmHg – 0.0 to 5.0 (default), 0.0 to 8.0, 0.0 to 12.0, 0.0 to 16.0 kPa – 0 to 5 (default), 0 to 8, 0 to 12, 0 to 16%	Determines the scale of the displayed CO_2 waveform.
Atm. pressure	570 to 800 mmHg	Determines the ambient pressure setting.
Color	Red, green, blue, yellow (default), light blue, purple, orange, white.	Determines the color of the CO_2 parameter field and waveform.

System configuration

Overview

This chapter describes the ***System setup*** dialog which consists of several setup pages for configuring the Cockpit. Some of these setup pages are password protected and are only accessible to authorized personnel.

The ***System setup*** dialog consists of the following setup pages:

- ***Screen setup*** (see page 456)
- ***Alarms*** (see page 471)
- ***Recordings/ Reports*** (see page 481)
- ***Biomed*** (see page 484)
- ***Profiles*** (see page 498)

Most setup pages consist of selections for configuring individual features. In the following sections such setup pages are presented as tables which list each menu selection, the available settings, and a description. Some setup pages are more complex and are therefore described in more detail. Where necessary, diagrams clarify additional setup procedures.

Screen setup

Several ***Screen setup*** pages are available for configuring the layout and the content of the screen.

To access the screen setup functions

1 Select the ***System setup...*** button on the main menu bar.

2 Select the ***Screen setup*** tab (if not already selected).

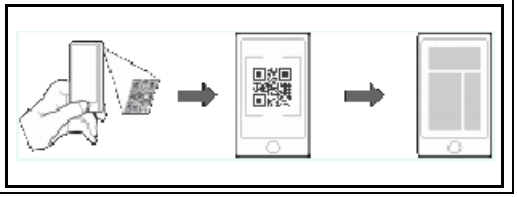
3 Select one of the following tabs to access the corresponding setup page:

- ***General settings***
- ***Auto view*** (if the auto view setup toolbar is visible along the bottom of the screen, you can also select the ***Setup*** button in the lower right corner of the screen to access the ***Auto view*** page)
- ***Views*** (password required)
- ***Config. buttons*** (password required)
- ***Multi-tab split screen***
- ***View editor*** (password required)

Screen setup – general settings

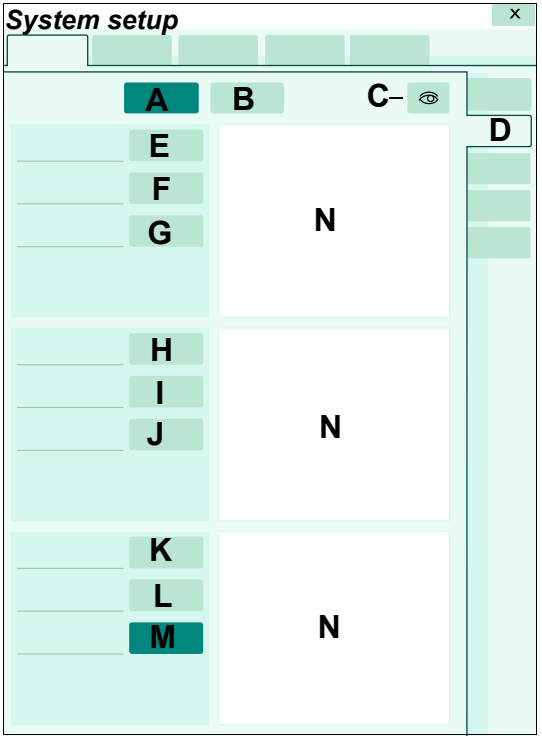
The following table lists the available settings of the ***General settings*** page. Your selection takes effect immediately. To access this page, see page 456.

Selection	Available settings	Description
Monitoring sweep speed [mm/s]	6.25, 12.5, 25 (default), 50	Sets the sweep speed of the waveforms.
Respiratory sweep speed [mm/s]	6.25 (default), 12.5, 25, 50	Sets the sweep speed of the respiratory waveform.
Anesthesia sweep speed [mm/s]	0.62, 6.25 (default), 12.5, 25, 50 0.62 mm/s is not supported on the network and is transmitted as 6.25 mm/s on the network	Sets the sweep speed of the anesthesia waveform.
Show parameter units	***On***, ***Off*** (default)	Activates/deactivates the display of units of measurement in the parameter fields. On the Cockpit, when the parameter field's value is set to ***Off***, after a restart it may show a value other than ***Off***. Reset the parameter field's setting to ***Off***.
Attention tone volume	– ***Off*** – 5, 10 to 100 in increments of 10% (default 40%)	Determines the volume of the attention tone or deactivates it.
Brightness	10 to 100% (default) in increments of 10%	Adjusts the brightness of the Cockpit screen. This setting does not affect the M540.
Night time	00:00 to 24:00	Sets the start and end time of night time mode. During night time mode, the entire background of the screen appears almost black. All buttons turn dark gray. To toggle this setting manually, use the function key ***Color scheme*** (see page 466).

Selection	Available settings	Description
QR Code	Scannable barcode that can be used to access device information. 	Allows authorized personnel to scan the QR code (from a smart phone or other device), instead of using a password, to access device information. 

Screen setup – auto view functions

The following diagram shows the ***Auto view*** page. This page also functions dynamically with the auto view setup toolbar (see page 462). To access this page, see page 456.



A ***Auto*** display mode selection button

B ***Manual*** display mode selection button

C ***Show All***

D ***Auto view*** tab

E ***Waveforms*** button

F ***Layout*** button (for waveforms)

G ***Pressure overlap Off***, ***Common***, ***Individual*** buttons

H ***Parameter boxes*** button

I ***Layout*** button (for parameter fields)

J ***Split screen*** button

K ***Mini trends*** selection button

L ***NIBP trend*** button

M ***Toolbar*** button

N Parameter selection window

Configuring the auto view settings

You can perform various functions in the ***Auto view*** page. The following settings describe the general settings of the ***Auto view*** page. For detailed information on setting up the display attributes of a parameter, see "Configuring parameters for display" on page 461.

To configure the available settings

In the following steps, the letters in parentheses correspond to the diagram for the ***Auto view*** page (see page 459).

1 Access the ***Auto view*** page (see page 456).

2 Select the display mode by selecting one of the following two buttons next to ***Display mode***:

- ***Auto*** (A) to select the auto display mode (see page 80).
- ***Manual*** (B) to select the manual display mode (see page 74).

3 Select the ***Waveforms*** button (E) to determine the number of waveforms that can be selected in the parameter selection window (N). The number of waveforms available for selection depends on the purchased software and hardware options:

Device	With option	Without option
C500	12 or 16 waveforms	10 waveforms
C700	16 waveforms	12 waveforms

Select the ***Layout*** button (F). Then select the ***Left*** or ***Right*** (default) button to determine if the waveforms appear to the left or to the right of the parameter fields.

4 Select the ***Pressure overlap*** Off (default), Common, or Individual button (G) to activate or deactivate pressure overlap mode. This feature works only if the pressure waveforms are displayed in adjacent channels.

5 Select the ***Parameter boxes*** button (H) and use the rotary knob to select the desired number of parameter fields for display. The available selections are: ***Off***, 1, 2, 3 (default), 4, 5, 6.

NOTE

When the ***Parameter boxes*** value is set to ***Off***, after a restart it may show a value other than ***Off***. Reset the parameter field's setting to ***Off.***

6 Select the ***Layout*** button (I). Then select the ***Top*** or ***Bottom*** (default) button to determine if the parameter fields appear along the bottom or the top of the screen.

7 Select the ***Split screen*** button (J). This button appears grayed out if the web enabled layouts option is locked. The available selections are: ***None*** (default), ***Anesthesia show all***, ***BIS show all***, ***BIS/NMT show all***, ***CCO show all***, ***ECG/ST***, ***ECG/Vent***, ***ECG show all***, ***Loops***, ***SpO2 show all***, ***ST parameters***, ***Multi-tab split screen, Trend table - auto***, ***Trend table - manual***,***Ventilator show all, IP show all.***

If you select ***None***, the monitoring area contains only real-time parameters. Any other selection divides the monitoring area into two windows. The right window continues to display the real-time parameters. For more detail see "M540 and Cockpit communication" on page 47.

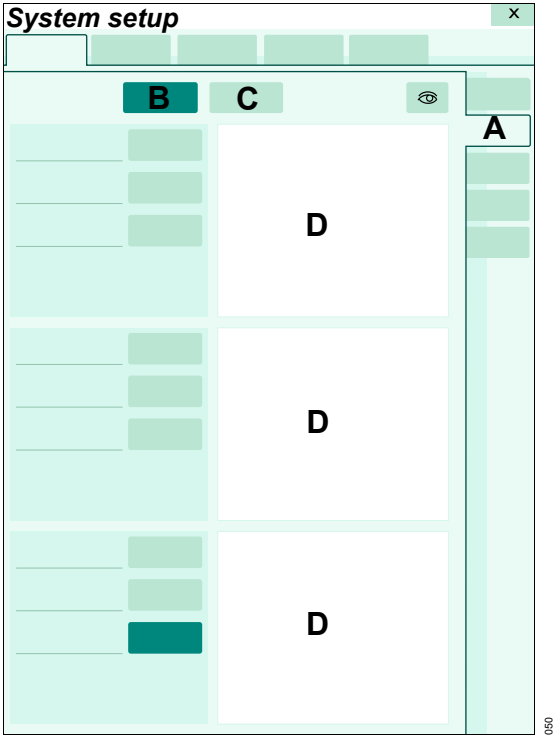
8 Select the ***Mini trends*** button (K) to activate or deactivate the mini-trend display or select a trend display time (see page 78). The available selections are: ***Off***, 10 min, 15 min, 20 min, 30 min (default), 45 min, 1 h, 90 min, 2 h, and 4 h.

9 Select the ***NIBP trend*** button (L) to choose between the graphic or numeric representation of the NIBP mini-trend display.

10 Toggle the ***Toolbar*** button (M) to ***On*** (default) or ***Off*** to activate or deactivate the auto view setup toolbar (see page 460).

Configuring parameters for display

Basically, the parameter selection window (D) of the ***Auto view*** page controls where a parameter appears on the screen. The window also controls how a parameter is displayed (as a waveform and/or as a parameter field), or if it is excluded from display. To access this page, see page 456.



A ***Auto view*** tab

B ***Auto*** button

C ***Manual*** button

D Parameter selection window

The parameter selection window

The parameter selection window (D) in the ***Auto view*** page determines where a parameter appears on the screen and how it is displayed.

The selected display mode determines how the parameter selection window behaves:

– If you select the ***Auto*** button (B) next to ***Display mode***, the parameter selection window functions dynamically with the auto view setup toolbar (see page 462). You can also determine the content of the parameter list by using the display filter button. When it appears on a dark green background, all parameters are displayed in the parameter selection window, even if they are not connected. Parameters that are not connected appear gray. However, as soon as you connect a parameter, the corresponding label appears black, and occupies the assigned location on the screen.

  When the display filter button appears on a light green background, the parameter selection window contains only connected parameters.

– If you select the ***Manual*** button (C) next to ***Display mode***, all parameters are listed. In this case, the display filter button is deactivated. If a parameter is not connected, the corresponding label appears gray. However, unlike in auto mode, the parameter label and/or waveform occupies a space on the screen even though it is not connected yet.

Configuring the parameter priority and display

In the parameter selection window, one of three display symbols appears next to each parameter label. The symbols identify how the parameter appears on the screen:

- the parameter appears as a waveform and as a parameter field
- the parameter appears as a parameter field
- the parameter is not displayed

Parameters are arranged in descending order in the window and occupy the same position on the screen. For example, the top parameter in the parameter selection window occupies the top location on the screen.

In auto display mode, you can configure a parameter in two ways:

– From the ***Auto view*** page

– From the auto view setup toolbar which appears at the bottom of the screen if activated

In manual display mode, you can configure a parameter only from the ***Auto view*** page (see page 459).

To configure the parameter priority and display from the *Auto view* page

In the following steps, the letters in parentheses correspond to the diagram for the ***Auto view*** page (see page 459).

1 Access the ***Auto view*** page (see page 456).

2 Select the number of waveforms for display with the ***Waveforms*** button (E).

3 Select the number of parameter fields for display with the ***Parameter boxes*** button (H).

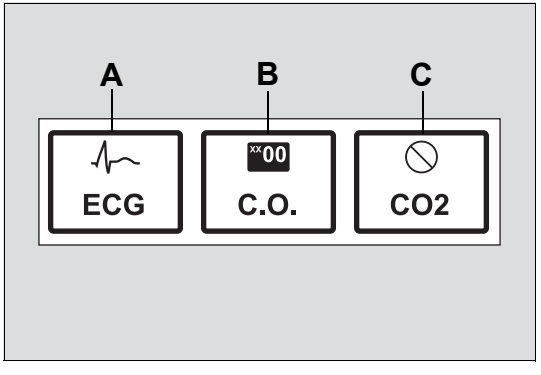
4 Select the parameter and use the rotary knob to move it up or down the parameter selection window (N) to the desired position. As you move the parameter up or down the list, the display symbol next to the parameter can change. For example, a parameter that previously appeared as a parameter field and a waveform , will only appear as a parameter field as you are moving it down the list.

5 Press the rotary knob to confirm the selection.

To configure the parameter priority and display from the *Auto view* setup toolbar

When activated (see page 459), the auto view setup toolbar appears along the bottom of the screen whenever you activate a view containing an auto view component. The auto view setup toolbar functions dynamically with the parameter selection window of the ***Auto view*** page (see page 461). Whatever changes you make in one place is reflected in the other.

Each connected parameter is represented as a small field on the auto view setup toolbar. The following figure is an example of how the auto view setup toolbar identifies the display mode of parameters on the main screen. The symbols above the parameter label identify the three different display modes. The same symbols appear in the parameter selection window of the ***Auto view*** page.



A A parameter with the symbol on the auto view setup toolbar appears as a waveform and a parameter field on the main screen. Parameters in this display mode always appear on the left side of the auto view setup toolbar.

B A parameter with the symbol on the auto view setup toolbar appears only as a parameter field on the main screen. Parameters in this display mode always appear in the center of the auto view setup toolbar.

C A parameter with the symbol on the auto view setup toolbar is excluded from display on the main screen. Parameters in this display mode always appear on the right side of the auto view setup toolbar.

In the ***Auto view*** page (see page 459), you can select the maximum amount of 'waveforms' and 'parameter fields and determine the parameter priority. The number of parameters you can select depends on the locked option that is activated.

For example, if you select five ***Auto view*** page, the auto view setup toolbar consists of five waveform fields and three parameter fields. If more parameters are available than there are fields assigned to the auto view setup toolbar, the additional parameters are relegated to the 'not displayed' status.

NOTE

If the auto view setup toolbar is displayed, you can access the ***Auto view*** page by selecting the ***Setup*** button at the right edge of the ***Auto view*** toolbar.

You can either display or hide the auto view setup toolbar (see page 460). You can also change the display status of a parameter display mode by switching its position on the auto view setup toolbar.

To change the display status of a parameter

1. Select the field on the auto view setup toolbar of the parameter whose display mode you wish to change. A yellow frame highlights the selected field.
2. Use the rotary knob to move the parameter to the desired place on the auto view setup toolbar. Whatever position you move it to determines the display status of the parameter. Pay attention to the symbol that changes as you turn the rotary knob to select a new position.

   For example, if a parameter is assigned to the 'no display' status, turn the rotary knob to the left until the field appears in the 'waveform' portion of the auto view setup toolbar. The symbol changes to the following image: .
3. Press the rotary knob to confirm your selection. The new parameter and the previous parameter switch positions on the auto view setup toolbar and the screen changes accordingly.

Any changes you make on the auto view setup toolbar are immediately reflected on the ***Auto view*** page (see page 459) and vice versa.

Screen setup – configuring views

The ***Views*** page displays all available views which control how information is presented on the screen. The ***Views*** page consists of custom views and Dräger views. You can select any view and save changes to custom views. Dräger views can be selected, but they cannot be changed.

To save changes to a custom view

1. Select the ***System setup...*** button on the main menu bar.
2. Select the ***Screen setup*** tab (if not already selected).
3. Select the ***Views*** tab. A password popup appears.
4. Select the view whose name is followed with an asterisk and appears in italic font (for example, *Basic OR **). This display convention identifies a view that has been modified and whose changes have not yet been saved.
5. Select the ***Save View*** button. This button does not execute any function if you select it and no custom views are available to be saved.
6. Press the rotary knob.

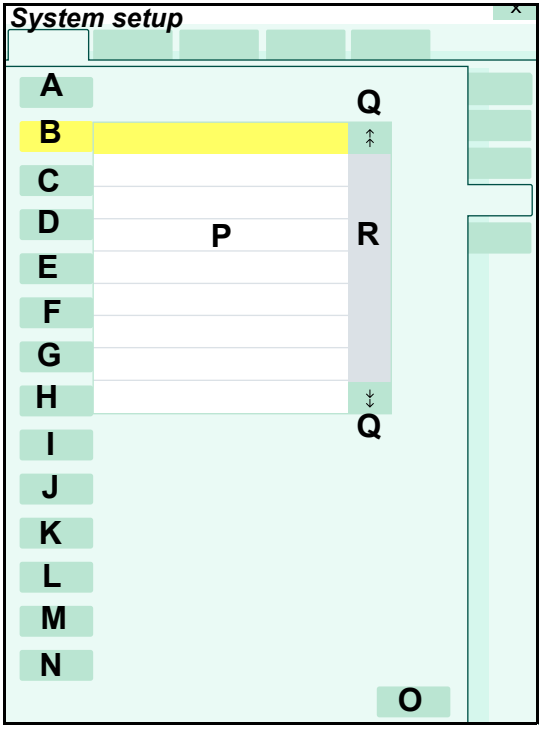
NOTE

You can also save changes to a custom View from the ***View editor*** page.

Screen setup – configuring main menu bar buttons

The ***Config. buttons*** page allows you to customize the content of the main menu bar (see page 71) by adding and removing buttons. However, the menu bar contains several buttons with essential functionality that are permanently placed and cannot be removed.

The following diagram shows the default ***Config. buttons*** page for a C700. On the C500 the keys (***Print screen*** and ***Zero all***) do not appear on the main menu bar. They appear on the quick access toolbar instead. The depicted menu bar is an exact replica of the actual menu bar. As you make changes to the menu bar on the ***Config. buttons*** page, the actual menu bar on the main screen changes accordingly.



A ***Alarms...*** button

B ***Mark event*** button

C ***Code*** button

D ***Views...*** button

E ***Print screen*** button

F ***Freeze waveforms*** button

G ***Trends/ Data...*** button

H ***Procedures...*** button

I ***Sensor parameters...*** button

J ***NIBP start/stop*** button

K ***Zero all*** button

L ***System setup...*** button

M ***Start/Standby...*** button

N ***Home*** button

O ***Restore config. buttons*** button

P Selection window with available buttons

Q Arrow buttons for moving the cursor up and down the pick list

R Slide bar for moving a button up or down the menu bar.

To configure the function keys

In the following steps, the letters in parentheses correspond to the diagram for the ***Config. buttons*** page (see page 465*)*.

1 Select the ***System setup...*** button on the main menu bar.

2 Select the ***Screen setup*** tab (if not already selected).

3 Select the ***Config. buttons*** tab. A password popup appears.

4 Enter the clinical password and select the ***Enter*** button.

5 Select the button on the menu bar list to be replaced with another one.

NOTE

Any button appearing on a light gray background identifies one that holds a permanent position on the menu bar. These buttons cannot be exchanged and are therefore not selectable.

The button to be removed is highlighted in yellow. A pop-up window (P) with a slide ruler appears. The popup contains the following list of available selections. Up to 14 buttons can be assigned to the main menu bar:

Button	Description
None	– Reassigns the button name to'***None***' in the ***Config. buttons*** page. – Removes the original button from the main menu bar and reorders the buttons on the main menu bar.
All alarms paused	Pauses all alarms at the Cockpit for two minutes.
Auto set all	Adjusts the alarm limits of all parameters automatically.
Code	Executes pre-configured functions during an emergency.
Color scheme	Controls the brightness of the Cockpit screen.
Default view	Resets the Cockpit to the factory-default view.
Discharge	Discharges a patient from the Cockpit.
ECMO	Activates ECMO Mode (see page 126)
Freeze waveforms	Stops the waveform from scrolling for approximately 60 seconds.
Home	Returns to the main screen and closes any dialog.
Mark event	Stores 20 seconds of waveform and parameter data in the alarm history.
NIBP start/stop	Starts or stops an non-invasive blood pressure measurement.
NIBP continuous	Starts or stops a continuous non-invasive blood pressure measurement.
Pacer detection	Allows you to activate or deactivate pacer detection.
Pressures off	Activates Pressures off (see page 127)
Pressures paused	Activates Pressures paused (see page 127)
Print case summary	Prints a combination of reports configured in the ***Reports*** page.
Print screen	Prints the contents of the current screen on a connected laser printer.
Privacy	Activates privacy mode (patient monitoring continues but the patient data are removed from the Cockpit and the M540 and appear only at the ICS).
Relearn ARR	Prompts the M540 to learn the dominant QRS pattern of a patient to identify the rhythms as either normal or irregular.

Button	Description
Relearn ST	Prompts the M540 to learn the dominant ST-segment deviations of a patient in order to identify ST rhythms as either normal or irregular.
Remote view	Provides access to patient data from other Infinity monitors within the same monitoring unit.
Rest ECG report	Prints a diagnostic report generated from a 12-lead ECG.
Show all ECG	Displays all ECG waveforms.
Standby	Places the Cockpit in standby mode.
Start C.O.	Starts a cardiac output measurement.
Start wedge	Starts a pulmonary wedge measurement.
Split screen	Turns the split screen view on and off based on the configuration. For information about configuring the split screen view, see "Configuring the auto view settings" on page 460.
System setup...	Activates the password-protected system functions for configuring the Cockpit.
Timer	Displays or hides the timer on the main screen.
Trend graph report	Prints the contents of the graphical trends window according to the selected ***Trend duration [hr]*** setting.
Trend table report	Prints the contents of the tabular trend window according to the selected ***Table interval [min]*** setting.
Venous stasis	Activates venous-stasis mode.
Volumes...	Accesses the ***Settings*** page for configuring the volume of the various tones.
Zero all	Zeroes all invasive pressures.

6 Select the desired button or click the rotary knob to move the new button to the menu bar. The previous button is moved to the pop-up window. The main menu bar changes immediately to reflect the new selection.

7 Repeat steps 5 – 7 for additional configuration changes to the menu bar.

To restore the default setup of the menu bar

You can restore the default setup of the menu bar (see page 465) at any time. In the following steps, the letters in parentheses correspond to the diagram for the ***Config. buttons*** page (see page 465*)*.

1 Select the ***System setup...*** button on the main menu bar.

2 Select the ***Screen setup*** tab (if not already selected).

3 Select the ***Config. buttons*** tab. A password popup appears.

4 Enter the clinical password and select the ***Enter*** button.

5 Select the ***Restore config. buttons*** button.

Screen setup – configuring the multi-tab split screen

The ***Multi-tab split screen*** is a split screen mode that consists of up to three separate tabs (see diagram on page 77). The content of each tab can be configured separately.

To be able to turn the ***Split screen*** view on and off from the main menu bar, be sure the ***Split screen*** button is assigned to the menu bar. See'To configure the function keys' on page 466.

To configure the split screen

1 Select the ***System setup...*** button on the main menu bar.

2 Select the ***Screen setup*** tab (if not already selected).

3 Select the ***Multi-tab split screen*** tab.

4 Select the ***Tab 1***, ***Tab 2***, or ***Tab 3*** to select the desired content from the following list of available choices:

- ***Anesthesia show all*** (default for ***Tab 2***)
- ***BIS show all*** (default for ***Tab 3***)
- ***BIS/NMT show all***
- ***CCO show all***
- ***ECG/ST***
- ***ECG/Vent***
- ***ECG show all*** (default for ***Tab 1***)
- ***Loops***
- ***SpO2 show all***
- ***ST parameters***
- ***Ventilator show all***
- ***Trend table - auto***
- ***Trend table - manual***
- ***Ventilator show all***
- ***IP show all***

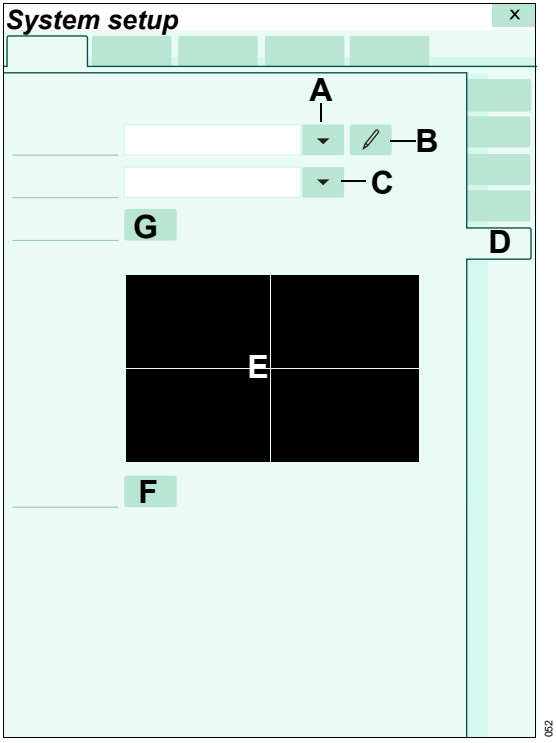
Screen setup – the *View editor*

In addition to the eight Dräger views, each Cockpit can have eight custom views. The ***View editor*** is an option that allows you to create, modify, and save custom views.

NOTE

Although the Cockpit can display many parameters and waveforms, use discretion when building custom views to make sure clinically relevant information is not obscured or unreadable.

The following diagram shows the ***View editor*** page.



A ***View*** field and arrow button

B Symbol for changing the name of the selected view

C ***Template*** field and arrow button

D ***View editor*** tab

E Layout panel

F ***Profiles...*** button

G ***Save View*** symbol

To access the view editor

1 Select the ***System setup...*** button on the main menu bar.

2 Select the ***Screen setup*** tab > ***View editor*** tab (C).

3 Enter the password and select the ***Enter*** button.

View editor functions

In the following procedures, the letters in parentheses correspond to the ***View editor*** diagram.

The ***View editor*** allows you to perform the following functions:

– Modify existing views

– Save changes to a view

– Change the name of the selected view

– Assign a view to profiles

To modify a custom view

NOTE
Although the Cockpit can display many parameters and waveforms, use discretion when building custom Views to make sure clinically relevant information is not obscured or unreadable.

1 Access the ***View editor*** page (see page 469).

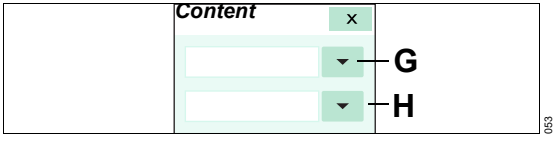
2 Select the arrow button next to the ***View*** field (A) and select the view you wish to modify.

NOTE
You can only change custom Views. Dräger views cannot be changed.

A view label that appears in italic font and is followed by an asterisk identifies a view that has been modified but whose changes have not been saved yet.

3 Select the arrow button next to the ***Template*** field (B) to select a layout template (D) which consists of various panels that illustrate what the basic layout of the screen will look like.

4 Touch a panel of the selected layout template to select a content. The following ***Content*** popup appears.



5 Select the top arrow button (G) in the ***Content*** popup to assign one of the following contents to the selected panel:

- Parameters
- Waveforms
- Applications

6 Select the bottom arrow button (H) in the ***Content*** popup to select additional settings. For example, if you chose ***Waveforms*** in step 4, you can select the ECG lead for display.

7 Repeat steps 4 and 5 for all panels in the selected layout template.

8 Select the symbol (G) next to ***Save View*** field (see diagram on page 469) to save the changes under the existing name.

or

Select the symbol next to the ***View*** field (A) to access a keyboard for renaming the current view.

To assign a view to profiles

You can assign a view to a profile after you modify a view or at any time after that.

1 Access the ***View editor*** page (see page 469).

2 Select the arrow button next to the ***View*** field (A) to choose the view that you wish to assign to profiles (if not already selected).

3 Select the ***Profiles...*** button (F) to display the ***Add to profile*** popup.

4 Select either the ***Draeger views*** or ***Custom views*** button under the ***Adult***, ***Pediatric*** or ***Neonate*** column. An additional popup appears which lists the profiles stored under the selected category.

5 Select as many profiles as you wish to assign the currently selected view to.

6 Select ***OK***.

Configuring the alarm setup

The password-protected ***Alarms*** pages are for configuring the general alarm settings.

To access the alarms pages

1 Select ***System setup...*** on the main menu bar. A password popup appears.

2 Select the ***Alarms*** tab.

3 Enter the password and select the ***Enter*** button.

4 Select one of the following tabs to access the respective setup page:

- ***General settings***
- ***Volume/ Tone***
- ***Code***
- ***M540 settings***
- ***Pressure settings***

Alarms setup – general settings

The following table lists the available settings of the ***General settings*** page.

Selection	Available settings	Description
All alarms paused	– 1, 2 (default), 3, 4, 5 min	The button on the alarm toolbar changes to ***All alarms paused***. This button is accessible by selecting the symbol on the quick access toolbar, (see page 49). When the button is selected, the following happens: – All alarm functions are temporarily suppressed for the selected time. The alarm function is automatically activated when the alarm pause timer times out. – The message ***All alarms paused*** appears in the header bar on yellow background with a timer and the following symbol:
	– *No timeout*	The button on the alarm toolbar changes to ***All alarms off***. This button is accessible by selecting the symbol on the quick access toolbar, (see page 80). When the ***All alarms off*** button is selected, the following happens: – All alarm functions are suppressed until you select the button again which activates the alarm function. – The message ***All alarms off*** appears in the header bar on red background with the following symbol:
	– *Disabled*	The ***All alarms paused*** button on the alarm toolbar is grayed out and you cannot temporarily or permanently deactivate alarm monitoring.
Alarm validation	***On*** (default), ***Off***	When this function is activated, alarm conditions are verified for a certain time before triggering acoustic and optical alarm signals (see page 117). This feature reduces nuisance alarms.

Selection	Available settings	Description
SpO2 alarm delay	– ***On*** (default) – ***Off***	The alarm validation feature must be activated to use this setting. When this setting is activated, an SpO2 lower alarm limit violation must persist for 10 seconds before triggering acoustic and optical alarm signals. This function is not possible if the Nellcor ***SatSeconds alarm*** feature is set to any value other than ***Off*** (see page 291).
Show alarm limits	– ***On*** (default) – ***Off***	Determines whether alarm limits appear in the parameter fields.
Alarm bar enabled	– ***On*** (default), – ***Off***	Determines whether the alarm bar flashes during an alarm.
OR Alarms	– ***On***, – ***Off*** (default)	Activates/deactivates OR alarms. Alarm functions are affected when OR alarms is activated (see page 125).
Cardiac bypass	– ***On*** – ***Off*** (default)	Activates/deactivates cardiac bypass mode. Alarm functions are affected when cardiac bypass mode is activated (see page 125). This mode is not available when the ***French NFC mode*** is enabled (see page 487).
NIBP/SpO2 interlock	– ***On*** – ***Off*** (default)	***On*** – the SpO2 alarm function is deactivated during non-invasive blood pressure and Pulse CO-Ox measurements (for more details, see "NIBP/SpO2 interlock alarms" on page 124). ***Off*** – the SpO2 alarm function is activated during NIBP and Pulse CO-Ox measurements.
ASY/VF alarms	– ***Always on*** (default) – ***Follow HR alarm***	***Always on*** – the ASY/VF alarm functions are always activated. ***Follow HR alarm*** – the ASY and VF alarm settings follow the setting of the heart rate alarms.
Pacer detection mode	– ***Advanced*** – ***Basic*** (default)	***Advanced*** – you can select fusion mode in the ***ECG*** page (see page 227). ***Basic*** – fusion mode is not selectable.

Selection	Available settings	Description
External device disconnected alarm control	– ***On*** (default) – ***Off***	When this feature is activated, the Cockpit displays the message ***External device disconnected*** when a device that is connected to the Cockpit with the device conncectivity option becomes disconnected.

WARNING

If you select *Follow HR alarm*, ASY, and VF **alarms are not reported if the heart rate and arrhythmia alarm functions are turned off.**

Alarm setup – configuring the alarm volume and tones

The following table lists the available settings of the ***Volume/ Tone*** page which controls various tone settings. To access this page, see page 471.

Selection	Available settings	Description
Minimum alarm volume	– 5%, – 10% to 100% (in increments of 10%); 50% (default) – ***Off***	Determines which alarm volume settings are available under the ***Alarm volume*** button. This setting does not affect the volume of the attention or the pulse tone.
Alarm volume	***Off***, 5%,10 to 100% (in increments of 10%); default is 50%	Determines the volume of the alarm tone. You can never turn the alarm volume lower than the selected setting for ***Minimum alarm volume.*** Make sure the alarm volume is set so it can be heard in the monitoring environment. The 5% setting is only available when the ***Minimum alarm volume*** setting is set to 5%. The ***Off*** setting is only available under the following circumstances: – When the Cockpit is in OR alarms or assigned to an ICS.) – When the ***Minimum alarm volume*** feature is set to ***Off.***
Pulse tone volume	– ***Off*** – 5, 10 (default) to 100% (in increments of 10%)	Determines the volume of the pulse tone.

Selection	Available settings	Description
Attention tone volume	– ***Off*** – 5, 10 (default) to 100% (in increments of 10%)	Determines the volume of the attention tone or deactivates the attention tone.
"Audio off" reminder	– ***On*** (default) – ***Off***	Sounds an alarm tone every 30 seconds at the Cockpit and at the M540 to remind you that the alarm tone is deactivated during an active alarm condition. This feature is only active when an alarm condition exists. This alarm tone is suppressed if you initiate an audio pause. When the Cockpit is in OR alarms, the volume of the alarm tone corresponds to the ***Alarm volume*** setting of 10%. When OR alarms is not activated, the volume equals to 50%. This feature is not supported on remote devices. – ***On*** – a truncated acoustic alarm signal sounds every 30 seconds for an alarm condition of medium or high priority. Low-priority alarms tones are not truncated. During multiple alarm conditions, the reminder tone adjusts itself to always report the alarm condition with the highest alarm priority. – ***Off*** – No alarm tone sounds when the alarm volume is deactivated and an alarm occurs.

Selection	Available settings	Description
"All alarms off" reminder	– ***On*** (default) – ***Off***	When the ***All alarms paused*** setting is set to ***No timeout*** (see page 472) and you select the ***All alarms off*** button, this feature reminds you that alarm monitoring has been deactivated for all alarms. Whether or not the Cockpit is in OR alarms, the volume of the alarm tone corresponds to the ***Alarm volume*** setting of 50%. – ***On*** – an alarm tone sounds every 30 seconds during an alarm condition. In addition, the message area flashes red three times with the message ***All alarms off*** and the symbol  . The alarm message field appears solid until the 30 second pass. Then the tone sounds again and the message and the symbol flash again. On remote devices, the message does not flash but appears on solid red background with the identical message and symbol. When cardiac bypass mode is activated, this feature is not available. Any changes to this setting on the Cockpit are adopted when the M540 docks. You can also change this setting from the M540 if it is docked and it will update the setting on the Cockpit. – ***Off*** – No alarm tone sounds when alarm monitoring is deactivated and an alarm occurs.
Tone set	– ***Infinity*** – ***IEC fast*** (default) – ***Advanced Arrhythmia*** – ***Hybrid***	Determines the type of alarm tone used (for more information, see "Acoustic alarm signals" on page 120).

Selection	Available settings	Description
Audio pause: Quiet mode	– ***On*** – ***Off*** (default)	– ***On*** – Only alarm conditions of high priority override an active audio pause. The appropriate parameter field flashes. Alarm conditions of equal or lower alarm priority will not be reported with an alarm tone. – ***Off*** – Any new alarm condition, regardless of its alarm priority, overrides an already active audio pause state at the Cockpit and at the ICS if the patient is admitted there. All optical and acoustic alarm signals are reported fully for any new alarm condition. For detailed information how quiet mode affects the audio pause behavior, see page 130.

Alarm setup – Code functions

For urgent care, you can configure a set of individual monitoring functions. These functions can be activated simultaneously when you select the ***Code*** button on the main menu bar. For more information regarding this function, see page 156.

When the ***Code*** button is pressed, a timer along with a ***Stop*** and a ***Reset*** button appears in the header bar.

The following table lists the available settings of the ***Code*** page. To access this page, see page 471.

Selection	Available settings	Description
Continuous recording	– ***On*** – ***Off*** (default)	– ***On*** – a continuous recording starts when you select the ***Code*** button. – ***Off*** – no recording starts when you select the ***Code*** button.
Continuous NIBP mode	– ***On*** – ***Off*** (default)	– ***On*** – continuous NIBP measurements start when you select the ***Code*** button. – ***Off*** – no NIBP measurements start when you select the ***Code*** button.
Audio off	– ***On*** – ***Off*** (default)	– ***On*** – No acoustic alarm signal sounds when you select the ***Code*** button. – ***Off*** – Alarm tones sound when when you select the ***Code*** button.

Selection	Available settings	Description
Alarm volume off	– ***Yes*** – ***No*** (default)	– ***Yes*** – the acoustic alarm signal for any active alarm is deactivated, the ***Audio alarms off*** message and the  symbol appear in the header bar***.*** – ***No*** – the acoustic alarm signals for any active alarm are not affected when you press the ***Code*** button.
All alarms off	– ***On*** – ***Off*** (default)	– ***On*** – the following happens when you select the ***Code*** button. – All audible and optical alarm signals are deactivated at the Cockpit and at the ICS. – The message area flashes red with the message ***All alarms off***. The  symbol appears in the header bar. – The ***All alarms paused*** setting is set to ***No timeout*** – if the selection ***All alarms off reminder*** is set to ***On***, an alarm tone sounds every 30 seconds to indicate that the alarms were disabled. Selecting the ***Code*** button again causes any existing alarm conditions to be annunciated immediately. – ***Off*** – any existing alarm is still annunciated optically and acoustically when you select the ***Code*** button.

Alarm setup – configuring M540 settings

The ***M540 settings*** page configures certain M540 settings. These setting will automatically update the M540 settings when the M540 is docked. To access this page, see page 471.

Selection	Available settings	Description
Transport alarm volume	– 50% (default) to 100% (in increments of 10%)	Determines the speaker volume of the M540 at the Cockpit while the M540 is undocked. The Cockpit setting adjusts the ***Transport alarm volume*** setting to match the M540 when it is undocked. The ***Transport alarm volume*** setting is tied to the minimum alarm volume setting (see page 474). If the minimum alarm volume is set to a higher volume than the selected ***Transport alarm volume*** setting, the ***Transport alarm volume*** setting is adjusted to the higher setting. If the minimum alarm setting is set to a lower setting than the current ***Transport alarm volume*** setting, the setting does not change.
Transport pulse tone volume	– ***Off*** (default) – 5% – 10% to 100% (in increments of 10%)	Determines the pulse tone volume of the M540 while the device is on transport.
Keep device label	– ***Yes*** (default) – ***No***	– ***Yes*** – The M540 retains the product label of the Cockpit when it undocks. – ***No –*** the M540 retains the product label configured in the M540 wireless menu.

Alarms setup – Pressure settings

The following table lists the available settings of the ***Pressure settings*** page.

Selection	Available settings	Description
Pressures paused	– ***1 min*** – ***2 min*** (default) – ***3 min*** – ***4 min*** – ***5 min*** – ***Disabled***	Determines the duration and availability of the ***Pressures paused*** function. For details, see page127 .
Pressures off	– ***Enabled*** – ***Disabled***	Determines the availability of the ***Pressures off*** function. For details, see page 127.

Configuring the recording and report settings

The ***Recordings/ Reports*** pages are for configuring general recording and report settings.

To access the *Recordings/ Reports* pages

1 Select ***System setup...*** on the main menu bar.

2 Select the ***Recordings/ Reports*** tab.

3 Select one of the following tabs to access the respective setup page:

- ***Recorder setup***
- ***Rest ECG report***
- ***Reports setup***

Reports setup – *Reports* page

The following table lists the available settings of the ***Reports*** page.

Selection	Available settings	Description
ECG/ST	– ***ECG report*** – ***Rest ECG report*** – ***ST report***	Prints the selected report. See "Available reports" on page 512 for detailed descriptions of each report.
Alarms	***Alarm history report***	
Trends/Data	– ***Trend graph report*** – ***Trend table report*** – ***Calculations report***	
Laser Report	– ***Continuous wvf. report*** – ***Timed wvf. report***	
Recording	– ***Timed recording*** – ***Continuous recording***	

Recorder setup

The following table lists the available settings of the ***Recorder setup*** page.

Selection	Available settings	Description
Delay	6, 10 (default), 15 s	Determines the amount of delay (pre-event) data included in a timed recording. Delay data refers to data that originated *before* the recording was initiated. A marker on the strip recording marks where the delay data ends and the real-time data starts.
Duration	6, 10, 15, 20 s (default)	Determines the length of a timed recording.
Speed	6.25, 12.50, 25.00 (default), 50.00 mm/s	Determines the recording speed.
Waveform Selection	– ***Auto*** (default) – ***Manual***	– ***Auto*** – the top two displayed waveforms are automatically selected for recordings. If no waveforms are displayed, no recording is generated. – ***Manual*** – the two selected waveforms under ***Waveform 1*** and ***Waveform 2*** are printed.
Waveform 1	Selected parameter under ***Waveform Selection*** setting (factory default is ECG Lead II)	Assigns the selected waveform to the top channel on R50N recordings, provided the ***Waveform Selection*** is set to ***Manual.***
Waveform 2	Selected parameter under ***Waveform Selection*** setting (factory default is ECG lead V)	Assigns the selected waveform to the bottom channel on R50N recordings, provided ***Waveform Selection*** is set to ***Manual.***
Alarm Waveform	– ***On*** (default) – ***Off***	When this function is activated, the waveform of an alarming parameter of medium or high priority is printed in the second recording channel provided the archive function is activated.

Rest ECG setup

Appropriate settings are crucial for optimal 12-lead analysis. The following table lists the available settings of the ***Rest ECG report*** page which controls various settings. To access this page, see page 481.

NOTE
The Rest ECG report is only available for adult and pediatric patients.

To obtain an optimal automatic diagnostic interpretation of an Rest ECG report, make sure the selections in the following table and the ***Weight***, ***Height***, and ***Birth date*** in the ***Demographics*** page (see page 99) are configured appropriately for the patient.

NOTE
If the ECG Filter is set to ***ESU***, Rest ECG report cannot be generated.

Selection	Available settings	Description
Gender	– ***Unknown*** (default) – ***Male*** – ***Female***	The selected information is included in the report.
Race	– ***Unknown*** (default) – ***Caucasian*** – ***Asian*** – ***African*** – ***Other***	
Medication 1	***No meds***, ***Unknown*** (default), list of medications	
Medication 2		
Condition 1	Pick list with several choices for indicating the medical condition of the patient. (***Unknown*** is the default)	
Condition 2		
Notes	List of entries for annotating the condition of the patient. (***None*** is the default)	
Rest ECG report	***Print*** button	The button is grayed out and not selectable when: – The patient is not admitted at the ICS. – The Rest ECG analysis feature is not activated at the ICS. – The 12-lead ECG option is not unlocked. – The required 12-lead cable is not connected.

Reports setup – *Reports setup* page

The following table lists the available settings of the ***Reports setup*** page. To access this page, see page 481.

NOTE
Reports printed on a laser printer use the settings in the ***Reports setup*** page not the settings defined in the trend setup pages.

Selection	Available settings	Description
Waveform delay [s]	6, 10 (default), 15 s	Determines the amount of delay (pre-event) data included in a timed strip report. Delay data refers to data that originated *before* the report was initiated. A marker on the report marks where the delay data ends and the real-time data starts.
Waveform duration [s]	10, 20 s (default)	Determines the length of a strip report.
Trend duration [hr]	1, 2, 4, 8, 12, 24 (default), 48, 72, 96 hr	Determines the graphical trend interval on the graphical trend report.
Table interval [min]	1, 5, 10, 15 (default), 30, 60 min	Determines the tabular trend interval on the tabular trend report.

Biomed setup

This section describes several pages accessible only to authorized personnel. All Biomed pages are password protected.

WARNING
Do not service the Cockpit while monitoring a patient.

To access the biomed pages

1 Select ***System setup...*** on the main menu bar.

2 Select the ***Biomed*** tab.

3 Enter the password and select ***Enter***.

4 Select one of the following tabs:

- ***Country***
- ***Units of measure***
- ***Patient monitor***
- ***Name service***
- ***Network setup*** (select either the ***Infinity*** or ***Hospital*** tab)
- ***Printer setup***
- ***Recorder setup***
- ***Service***
- ***IT setup*** (select the desired tab such as ***Web browser***, ***Innovian***, and so on).

Biomed setup – country-specific settings

The following table lists the available settings of the ***Country*** page. To access this page, see page 484.

Selection	Available settings	Description
Language	English (United States), German (Germany), French (France), French (Belgium, Canada), Dutch (Belgium), Spanish (Spain, Traditional sort), Italian (Italy), Finnish (Finland), Danish (Denmark), Norwegian (Norway, Bokmal), Portuguese (Brazil), Swedish (Sweden), Dutch (Netherlands), Japanese (Japan), Russian (Russia), Turkish (Turkey), Polish (Poland), Greek (Greece), Hungarian (Hungary), Chinese (Simplified, PRC), Czech (Czech Republic), Dutch (Belgium), French (Belgium), Romanian, Croatian	Selects the language of the Cockpit screen text. You must select the language of the M540 independently.
Time zone	User-selectable list of time zones	Allows you to configure the Cockpit for the local time zone.
Time	Time and date fields	Allows you to set the regional time and date.

Biomed setup – units of measure

The following table lists the available settings of the ***Units of measure*** page where you can configure the units for all parameter groups. To access this page, see page 484. Select the ***Apply*** button after making your selection.

CAUTION
Before you connect the M540 to a different Cockpit, make sure that the units of measure align between the two devices. Differing units of measure could result in loss of data or a patient discharge.

Selection	Available settings	Description
Pressure	– ***mmHg*** (default) – ***kPa***	Assigns the selected unit of measurement to the parameter. Whenever you change a unit of measurement, the Cockpit discharges the patient.
CO2	– ***mmHg*** (default) – ***kPa*** – %	Assigns the selected unit of measurement to the parameter. Whenever you change a unit of measurement, the Cockpit discharges the patient. Applies to Mainstream and Microstream (sidestream).
Temperature	– ***°C*** (Celsius) default – ***°F*** (Fahrenheit)	Assigns the selected unit of measurement to the parameter. Whenever you change a unit of measurement, the Cockpit discharges the patient.
ST	– ***mm*** (default) – ***mV***	
SpHb (only Masimo rainbow SET)	– ***g/dL*** – ***mmol/L***	
Agent	– ***kPa*** (default) – ***%***	
Weight	– ***kg*** (default) – ***lb*** (adult, pediatric) – ***oz***, ***g*** (neonate)	
Height	– ***cm*** (default) – ***in***	

Biomed setup – patient monitor setup

The following table lists the available settings of the ***Patient monitor*** page. To access this page, see page 484.

Selection	Available settings	Description
Change clinical password	Use the keypad to enter the new password (up to 4 numbers)	Configures a new password for the Cockpit. When an M540 whose password has been changed docks to a Cockpit with a different password, the Cockpit password overrides the M540 password. ***CAUTION***: **Be sure to record the new password because it cannot be retrieved once it is lost. For further assistance, contact specialized service personnel.**
Change biomedical password		
French NFC mode	– ***On*** – ***Off*** (default)	When this feature is activated, HR alarms cannot be deactivated, and the all alarm pause period cannot exceed 3 minutes.
Simulation (basic)	– ***On*** – ***Off*** (default)	Activates or deactivates basic simulation mode. This feature is used when the M540 is connected. When activated, the Cockpit uses the simulator mode from the M540 and adds additional device connectivity parameters.
External display	– ***Clone*** (default) – ***Indep. display***	Selects the output for the external display. For details, see page 59.
Patient profile selection	– ***On*** – ***Off*** (default)	When this feature is activated, you can select a profile and patient category on the ***Start*** dialog.
Adopt OR alarms	– ***Auto*** – ***Manual***	***Auto*** – OR alarms are automatically activated when an anesthesia machine is connected. ***Manual –*** OR alarms must be activated manually when an anesthesia machine is connected. Whenever you disconnect the A500 from the Cockpit, the ***OR Alarms*** and ***Cardiac bypass*** features are disabled automatically regardless of their setting.

Selection	Available settings	Description
Adopt cardiac bypass	– ***Auto*** – ***Manual***	***Auto*** – when an anesthesia machine is connected and the ***OR Alarms*** setting is activated at the Cockpit, the ***Cardiac bypass*** feature is automatically activated when the A500 is in cardiac bypass mode. Cardiac bypass is automatically disabled when the A500 is no longer in cardiac bypass mode. ***Manual*** – when an anesthesia machine is connected and the ***OR Alarms*** setting is activated at the Cockpit, the ***Cardiac bypass*** feature must be activated manually (see page 473).
Restore factory settings	None	Restores all patient and monitoring settings to the factory defaults. Do not restore factory defaults while monitoring a patient.

Biomed setup – name service settings

The following table lists the available settings of the ***Name service*** page. To access this page, see page 484. After making the desired changes, select the ***Apply*** button which causes a brief loss of communication with a docked M540.

Selection	Available settings	Description
Monitoring unit ID	1 to 255 (increments of 1)	Allows you to assign the Cockpit to a monitoring unit by entering an ID using the keypad  symbol.
Monitoring unit label	Up to seven alphanumeric characters	Allows you to enter the corresponding label for the network and recordings using the keyboard  symbol. When entering the ***Bed label***, do not use the word'IACS'.The word'IACS' is used for the ***Name service*** setting. If the ***Name service*** setting and any bed labels match, the IACS bed label does not appear on the ICS.
Care unit label		
Bed label		
Hospital name		
Enable Central Station	– ***On*** (default) – ***Off***	If this feature is activated and an ICS is connected to the network, the message ***Not Monitored By Central*** appears in the Cockpit header bar if the Cockpit is not assigned to an ICS. For more information, (see page 92). If this feature is deactivated, an ICS is connected to the network and the Cockpit is not assigned to an ICS, the message ***Not Monitored By Central*** does not appear in the Cockpit header bar.
Enable Remote Control	– ***On*** (default) – ***Off***	If this feature is activated, the Cockpit allows other Infinity monitors and the ICS to view its data and perform simple functions, such as requesting a recording or pausing an alarm.
Enable Remote Silence	– ***On*** (default) – ***Off***	If this feature is activated, the Cockpit allows alarms to be silenced from network devices.

Biomed setup – network setup

The following table lists the available settings for configuring the Infinity and the hospital network settings in the ***Infinity*** and the ***Hospital*** pages. To access the pages, see page 484. After making the desired changes, select the ***Apply*** button to activate them.

Selection	Available settings	Description
DHCP	– ***Disabled*** (default) – ***Enabled***	Applies to the hospital network. When the Dynamic Host Configuration Protocol (DHCP) is activated, the settings for ***IP address***, ***Subnet mask***, ***Gateway***, and ***Primary DNS*** are pulled automatically from the server.
IP address	User selectable	Allows you to select an IP address manually (the ***DHCP*** setting has to be set to ***Disabled***).
Subnet mask	User selectable	Allows you to set up a subnet mask (the ***DHCP*** setting has to be set to ***Disabled***).
Gateway	User selectable	Allows you to set up a gateway (the ***DHCP*** setting has to be set to ***Disabled***).
Primary DNS	User selectable	Allows you to set up the primary Domain Name System (DNS) – set the ***DHCP*** setting to ***Disabled***.
Offline detection	– ***On*** (default) – ***Off***	Determines if the Cockpit issues an alarm tone and a message when it loses its connection to the Infinity network. For more information, see "Communicating with the Infinity network" on page 49.

Biomed setup – printer setup

The following table lists the available settings of the ***Printer setup*** page. To access this page, see page 484. After making the desired changes, select the ***Apply*** button.

Selection	Available settings	Description
Printer IP address	User selectable	Allows you to configure the IP address for printing reports on a network printer.
HP Universal Print Driver	Informational only	Displays the version of the print driver.
Paper Size	Letter, Legal, A4	Allows you to select the printer paper.
Print test page	Select the ***Print screen*** button, to verify that the printer is working properly.	

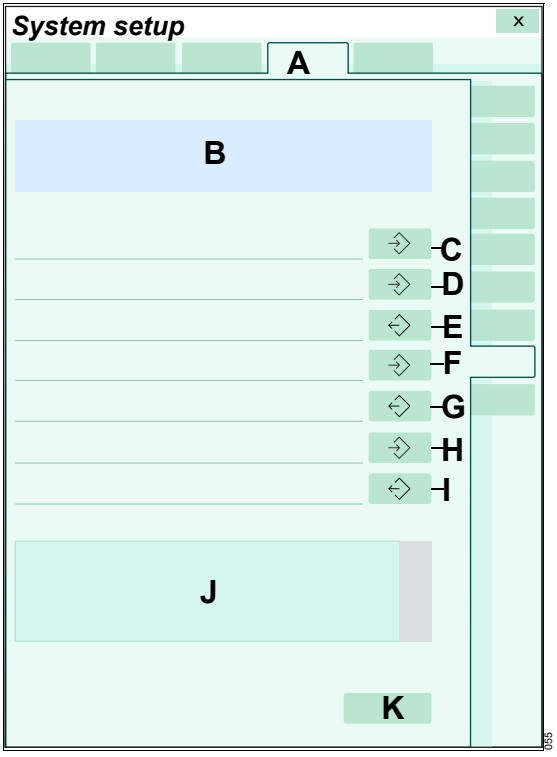
Biomed setup – recorder setup

The following table lists the available settings of the ***Recorder setup*** page. To access this page, see page 484.

Selection	Available settings	Description
Primary Recorder	Recorders are available for selection once they are connected to the network.	Selects a recorder as the primary recorder for printing recordings.
Secondary Recorder		Selects the secondary recorder for printing recordings when the primary recorder is not available.

Biomed setup – service setup

The following table lists the available settings of the ***Service*** page. To access this page, see page 484.



A ***Biomed*** tab

B Product identification field displaying software-specific information (for example, software version, and so on).

C Select this button to copy all logs to the connected USB flash drive.

D Select this button to export the current profiles to the connected USB flash drive.

E Select this button to import the profiles from the connected USB flash drive.

F Select this button to export the shared system profile

G Select this button to import the shared system profile

H Select this button to export the independent display profile

I Select this button to import the independent display profile

J Window displaying status messages relating to the function that is being executed.

K ***Service*** button for accessing Service-related functions such as unlocking options (refer to the Technical documentation available from DrägerService for detailed information).

Biomed IT setup

The IT page consists of several setup pages for performing the following IT-specific tasks:

– Activating or deactivating all IT tabs
– Configuring a browser
– Configuring Citrix applications
– Configuring IT applications

Activating/deactivating IT tab feature

When the web enabled tabs option is unlocked, the Cockpit supports IT applications (options) that are accessible via IT tabs (see "Supported IT applications" on page 520). When an IT application is configured and the tab is activated, the corresponding IT tab appears along the left edge of the screen as soon as the IT tab feature is activated. Regardless of how many IT tabs are configured, the top tab is always labeled ***Patient*** and provides access to the Cockpit main screen.

To activate or deactivate IT tab feature

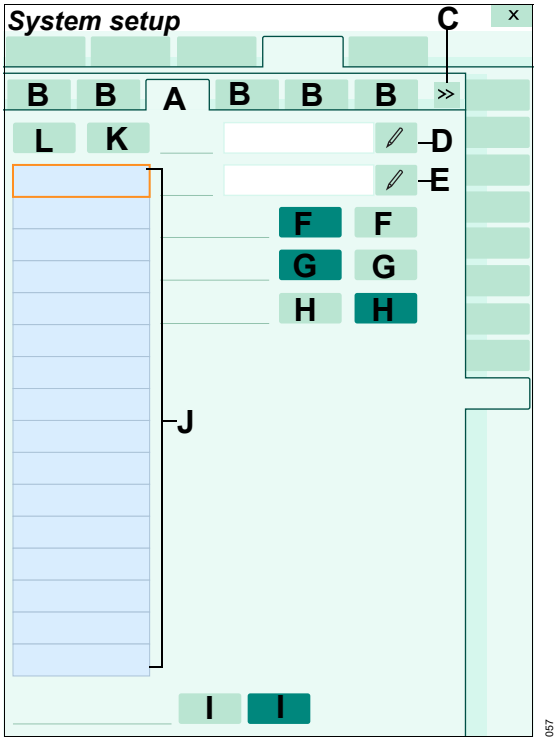
1 Access the ***IT setup*** page (see page 484).
2 Select the ***IT tabs*** button.
3 Select the ***On*** or ***Off*** button next to the ***IT tabs*** selection.

Configuring IT tabs – browser setup

You can set up a browser as an IT tab that contains several pre-configured Web pages. These Web pages are accessible from a pull-down dialog under the configured IT tab (see "Accessing an IT tab" on page 519).

CAUTION
The Infinity Acute Care System – Monitoring Applications (IACS) does not have virus protection software and relies therefore on the firewall of your institution to prevent access to infected files. While setting up IT applications to access websites, evaluate each website with regard to possible virus infection.

The following diagram shows the ***Web browser*** page. The left side displays a pick list which is reserved for pre-configured websites. The right side is for setting up new sites or for editing existing ones. The site with the asterisks is the default site that appears automatically when you access the corresponding IT tab.



A ***Web browser*** tab

B IT setup tabs for accessing pages of the corresponding IT applications.

C Symbol for accessing additional IT applications

D ***Name*** button

E ***URL*** button

F ***Default*** on and off buttons

G ***Block Popups*** on and off buttons

H ***Full Trust*** on and off buttons

I ***Tab visible*** on and off buttons

J Selection window with pre-configured websites.

K ***Add*** button

L ***Delete*** button

Adding a browser page

In the following steps, the letters in parentheses refer to the diagram of the ***Web browser*** page.

To add a browser page

1 Access the ***Web browser*** page (see page 484).

2 Select the ***Add*** button (K). The label ***Undefined*** appears in the pick list (J) as a place holder.

3 Select the following buttons to configure the corresponding settings:

- Select the symbol next to the ***Name*** menu selection (D) to activate an keyboard for changing the label ***Undefined*** to an actual name.
- Select the symbol next to the ***URL*** menu selection (E) to activate an keyboard for entering the URL.
- Select the ***Default*** on or off button (F) to activate or deactivate this site as a default in the pick list (J).
- Select the ***Block Popups*** on or off button (G) to allow or prevent popups from appearing on the website.
- Select ***Full Trust*** on or off button (H) to select the security setting for this website.

4 Select the ***Tab visible*** on or off button (I) to display or hide the IT tab.

Once a browser is correctly set up, the website is accessible under the corresponding IT tab (for more information, see "Accessing an IT tab" on page 519).

Deleting a browser page

In the following steps, the letters in parentheses refer to the diagram of the ***Web browser*** page on page 494.

To delete a browser page

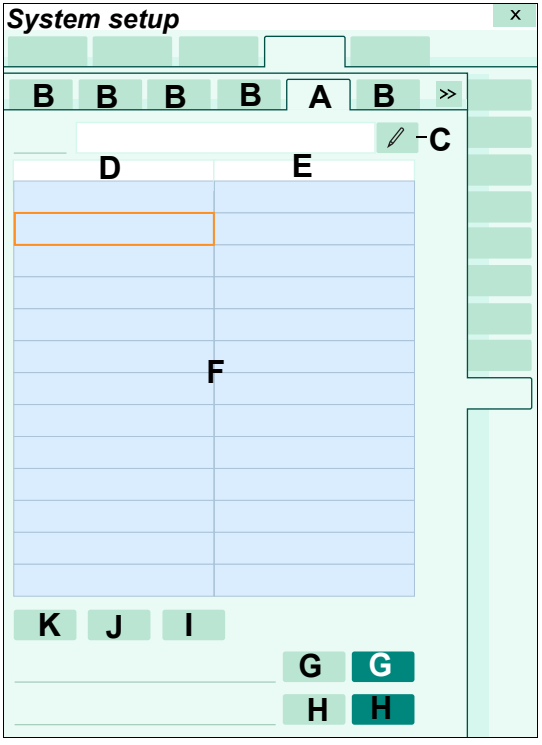
1 Access the ***Web browser*** page (see page 484).

2 Select the website you wish to delete in the pick list.

3 Select the ***Delete*** button (L).

Configuring Citrix applications

The following diagram shows the ***Application*** page for configuring Citrix applications. Citrix allows you to access remote applications without running the actual application on the Cockpit.



A ***Application*** tab

B IT tabs

C ***Name*** symbol and field

D ***Name*** column

E ***Value*** column

F List of Citrix client object properties

G ***Auto logoff*** on and off buttons

H ***Tab visible*** on and off buttons

I ***Edit*** button

J ***Delete*** button

K ***Add*** button

To configure a Citrix application

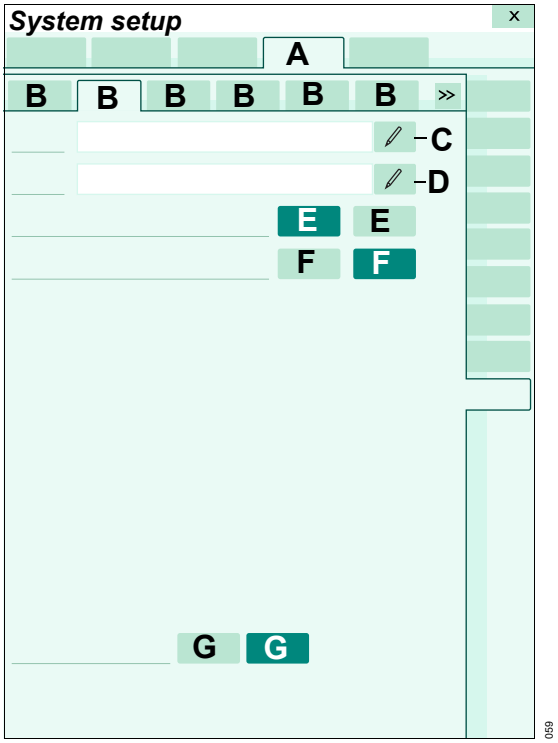
In the following steps, the letters in parentheses correspond to the diagram for the ***Application*** page (see page 495).

1. Access the ***Application*** page (see page 484).
2. Select the ✎ symbol next to the ***Name*** menu selection (C) to activate a keyboard for changing the name of the IT tab label (the name of the actual tab in the ***IT setup*** page does not change.
3. Define the ICA client object properties needed for connection to your Citrix environment. The ***Name*** column (D) defines the property being used and the ***Value*** column (E) defines the value needed.

   Refer to the Citrix ICA Client Object documentation for more information.

Configuring IT tabs

The following diagram shows an example of an IT page. When the appropriate IT application option is unlocked, IT tabs appear with the corresponding label of a pre-configured URL address, provided the web enabled tab option is also unlocked.



A ***Biomed*** tab

B IT tabs for accessing setup pages for the corresponding IT applications.

C ***Name*** button and description field

D ***URL*** button and description field

E ***Full Trust*** on and off buttons

F ***Block Popups*** on and off buttons

G ***Tab visible*** on and off buttons

To configure an IT application tab

In the following steps, the letters in parentheses correspond to the diagram for the ***IT setup*** page (see page 496).

1 Access the ***IT setup*** page (see page 484).

2 Select the tab of the IT application you wish to configure.

3 Select the following buttons to configure the corresponding settings:

– Select the ✎ symbol next to the ***Name*** menu selection (C) to activate a keyboard for changing the name of the IT label (the name of the actual tab in the ***IT setup*** page does not change).

– Select the ✎ symbol next to the ***URL*** menu selection (D) to activate a keyboard for entering the URL.

CAUTION

The URL address shows a pre-configured string. Do not change any portion of the string except for the <server name> to preserve the correct information.

– Select the ***Full Trust*** on or off button (E) to select the security setting for this website.

– Select the ***Block Popups*** on or off button (F) to allow or prevent popups from appearing on this website.

4 Select the ***Tab visible*** on or off button (G) to display or hide the tab.

NOTE

IT tabs appear grayed out and are therefore not selectable while the application is loading. A tab may also appear grayed out the first time an application is turned on.

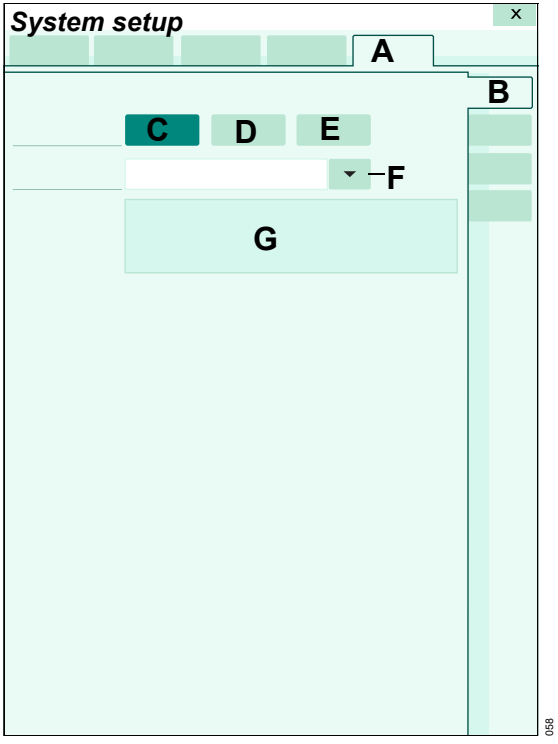
Once an IT application is correctly set up, the website is accessible under the corresponding IT tab (for more information, see "Accessing an IT tab" on page 519).

Profile setup

A profile 'remembers' patient settings and device settings for future use. Profiles eliminate time-consuming setup tasks that would otherwise have to be repeated for each monitoring session. Each patient category has one default profile. All tasks related to profiles take place in the ***Profiles*** pages.

Selecting a profile

The following diagram shows the ***Select profile*** page where you can select a profile with pre-configured patient and device settings.



A ***Profiles*** tab

B ***Select profile*** tab

C ***Adult*** selection button

D ***Pediatric*** selection button

E ***Neonate*** selection button

F Profile arrow button

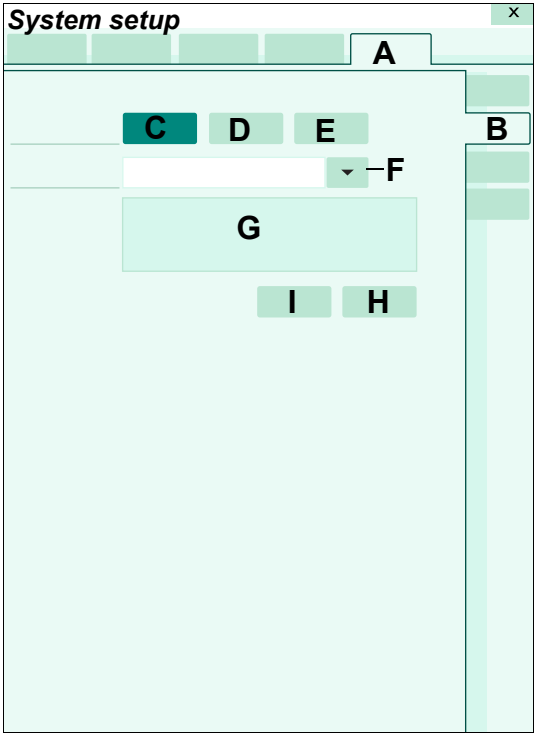
G Description window of selected profile

To select a profile

1. Select the ***System setup...*** button on the main menu bar.
2. Select the ***Profiles*** tab (A) > ***Select profile*** tab (B).
3. Select the desired patient category button:
   - ***Adult*** (C)
   - ***Pediatric*** (D)
   - ***Neonate*** (E)
4. Select the arrow button next the ***Profile*** menu selection (F) to display a list of profiles within the selected patient category. If available, a description of the selected profile appears in the description field (G).

Saving profiles

For each patient category, you can create and save five unique profiles. Included in the five profiles is a Dräger default profile that cannot be modified. The following diagram shows the ***Save Profile*** page where you can modify existing profiles and save new ones.



A ***Profiles*** tab

B ***Save Profile*** tab

C ***Adult*** selection button

D ***Pediatric*** selection button

E ***Neonate*** selection button

F Profile arrow button

G Description field of selected profile

H ***Save profile as...*** button

I ***Save Profile*** button (see page 500)

Modifying an existing profile

You can save changes to an existing profile. The only profile you cannot modify is the Dräger default profile. The Dräger default profile is activated the very first time the system is booted up, after a software upgrade or after factory defaults are restored.

NOTE

Saving a profile for the patient being monitored might not be applicable to the care unit. To avoid any issues or the possibility of an automatic restart, carefully follow the procedure, "To save changes to an existing profile".

The adult profiles, pediatric profiles, neonate profiles pages have identical setup functions. The only exception is their content which is patient-category specific. This is important when you are resetting all profiles to Dräger profiles. Only the profiles within the currently selected patient-category are affected.

To save changes to an existing profile

In the following steps, the letters in parentheses correspond to the diagram for the ***Save Profile*** page.

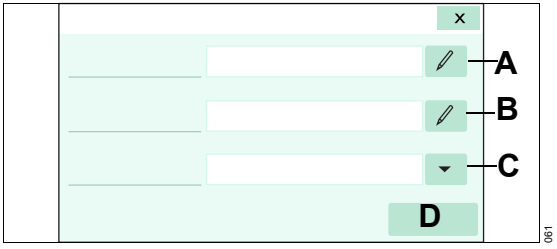
1. Make sure the Cockpit is in the correct patient category before configuring the profiles (see "Selecting the patient category" on page 103).
2. Make the desired changes to the patient settings.
3. Select the ***System setup...*** button on the main menu bar.
4. Select the ***Profiles*** tab (A)
5. Select the ***Save Profile*** tab (B). A password popup appears.
6. Enter the password and select the ***Enter*** button.

7 Select the arrow button (F) next to the ***Profile*** menu selection. A summary of the selected profile appears in the description field (G).

8 Select the ***Save Profile*** button (I) to apply the changes to the selected profile.

Saving a new profile

You can also save a profile under a new name and assign it to an existing view using the ***Save Profile*** pop-up window.



A ***Profile name*** field and setup button

B ***Description*** field and setup button

C ***Default view*** field and selection button

D ***Save Profile*** button

To save a new profile

1 Repeat steps 1 to 6 for saving changes to an existing profile (see page 499).

2 Select the ***Save profile as...*** button (H) in the ***Save Profile*** page (see diagram on page 499). The ***Save Profile*** pop-up window appears.

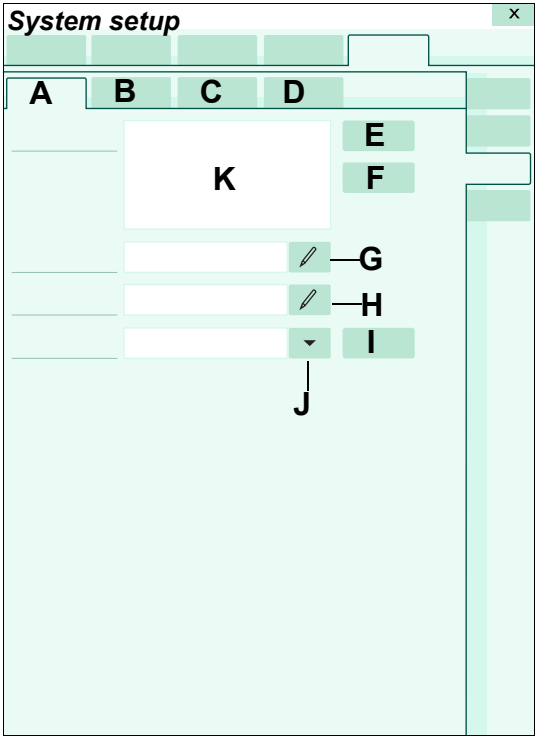
3 Select the setup buttons next to ***Profile name*** (A), ***Description*** (B), and ***Default view*** (C) to enter the corresponding information.

4 Select the ***Save Profile*** button (D).

Configuring profiles

The following diagram shows a patient-specific ***Profiles*** page for configuring profiles. These pages allow you to modify existing profiles such as the name of the profile, the profile description, and so on.

There are three pages for each patient category (adult, pediatric, and neonate).



A ***Adult*** tab

B ***Pediatric*** tab

C ***Neonate*** tab

D ***Views*** tab

E ***Set as Default*** button

F ***Delete Profile*** button

G ***Profile name*** field and setup button

H ***Description*** field and setup button

I ***Views...*** button

J ***Default view*** field and selection arrow

K Pick list of available profiles

To access the patient-specific *Profiles* pages

1. Select the ***System setup...*** button from the main menu bar.
2. Select the ***Profiles*** tab.
3. Select the ***Profiles/ views*** tab.
4. Select either the ***Adult*** (A), ***Neonate*** (B), ***Pediatric*** (C) tabs to access the patient category-specific pages.

NOTE

Do not configure profiles while monitoring a patient, as this may cause the Cockpit to lock, forcing a reboot.

Configuring the patient-specific profiles

In the following steps, the letters in parentheses correspond to the diagram for the patient-specific ***Profiles*** page (see page 501).

To configure the profiles

1 Access the patient-specific profiles page.

2 Select the desired profile in the pick list (K).

3 Select one or more of the following buttons:

- Select the ***Set as Default*** button (E) to designate the selected profile as the new default profile for the selected patient category. After each patient discharge or a restart of the Cockpit, the default profile is automatically loaded when that patient category is selected.
- Select the ***Delete Profile*** button (F) to delete the selected profile.
- Use the button next to the ***Profile name*** field (G) of the profile page to name the profile. The name appears in the ***Select profile*** page (see page 498).
- Use the button next to the ***Description*** field (H) of the profile page to add or modify an existing description. The description appears in the ***Select profile*** page (see page 498) when you select a profile.
- Select the arrow button next to the ***Default view*** field (I) and select the view that you wish to designate as the default view.

Transferring profiles

You can transfer profiles over the network or with a USB flash drive.

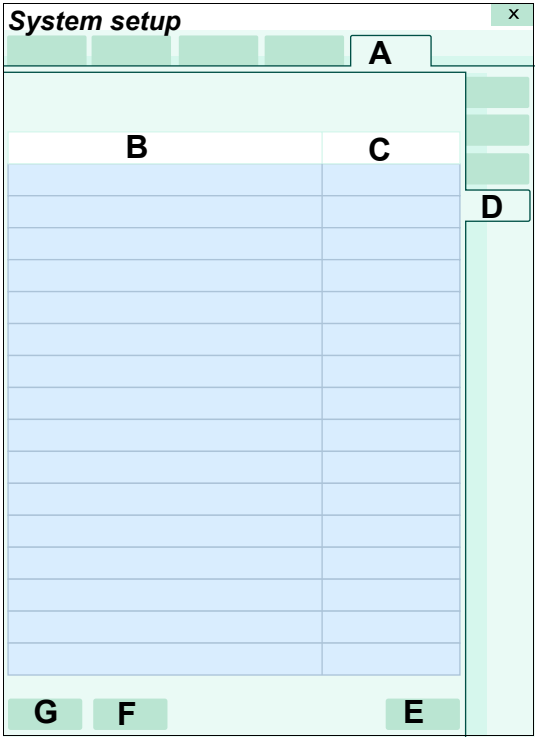
NOTE
Use a FAT32 flash drive for importing or exporting profiles. USB flash drives with NTFS format do not produce reliable results.

Only patient profiles can be transferred over the network. See page 504 for details on how to transfer shared system profiles.

NOTE
Whenever you use the transfer profile function, all existing profiles for all patient categories are transferred simultaneously.

Transferring patient profiles over the network

Transferring patient profiles over the network is only possible among Cockpits within in the same monitoring unit. The following diagram shows the ***Profile transfer*** page which consists of a list of connected devices within the monitoring unit.



A ***Profiles*** tab

B ***Device name*** column

C ***Status*** column

D ***Profile transfer*** tab

E ***Start transfer*** button

F ***Clear selection*** button

G ***Select all*** button

To transfer a profile over the network

1 Select the ***System setup...*** button on the main menu bar.

2 Select the ***Profiles*** > ***Profile transfer*** tabs.

3 Enter the clinical password. The ***Profile transfer*** page which lists all the devices in the monitoring unit appears.

4 Select a device from the list or select one of the following buttons:

– ***Select all*** button (G) to select all devices to transfer profiles to.

NOTE

When profiles are transferred to a device with older compatible software, any new profile functionality is not transferred.

– ***Clear selection*** button (F) to remove any selection from the device list.

5 Select the ***Start transfer*** button (E) to start the profile transfer.

The profiles are transferred to the target Cockpit but are not implemented until you select a new profile.

Importing and exporting profiles using a USB flash drive

You can import and export patient and shared system profiles from one Cockpit to another using a USB flash drive.

Whenever you import or export patient profiles or shared system profiles, all settings of the selected profile are transferred. For information about what settings are included in a patient or a shared system profile, see page 82 and page 88 respectively.

If you are importing **shared system** profiles from a Cockpit that has options unlocked (such as physiological calculations) that are locked on the destination Cockpit, the **shared system** profiles are imported. However, the settings relating to the locked feature will not become active until the option is unlocked on the destination Cockpit.

NOTE

If an M540 is docked its profiles are also imported/exported as part of the patient profiles.

Unlike transferring profiles over the network, using a USB flash drive has the advantage that the Cockpits do not have to reside in the same monitoring unit.

NOTE

On the Cockpit, removing the USB flash drive while importing a profile may prevent the import from completing, even though a ***Profile successfully imported.*** message displays.

WARNING

Do not leave a USB flash drive permanently connected to the Cockpit, as this could cause the Cockpit to go into a fail state after power cycling.

To export patient and shared system profiles to a USB flash drive

1 Insert a USB flash drive into one of the USB ports of the Cockpit whose profiles you wish to transfer.

2 Select the ***System setup...*** button from the main menu bar.

3 Select the ***Biomed*** tab.

4 Enter the Biomed password.

5 Select the ***Service*** tab.

6 Select the ***Export patient profile*** button to export all patient profiles to the USB flash drive.

or

Select the ***Export shared system profile***  button to export all shared system profiles to the USB device.

A message appears in the text window indicating that the profiles have been successfully exported. A corresponding message appears if the export is unsuccessful.

To import patient profiles from a USB flash drive

1. Insert the USB device in the USB port of the Cockpit where you wish to transfer the profiles to.
2. Select the ***System setup...*** button from the main menu bar.
3. Select the ***Biomed*** tab.
4. Enter the Biomed password.
5. Select the ***Service*** tab.
6. Select the ***Import patient profile***  button to import all patient profiles from the USB flash drive to the Cockpit.

Messages appear in the text window informing you if the patient profiles imported successfully or not.

To import shared system profiles from a USB flash drive

1. Insert the USB device in the USB port of the Cockpit where you wish to transfer the profiles to.
2. Select the ***System setup...*** button from the main menu bar.
3. Select the ***Biomed*** tab.
4. Enter the Biomed password.
5. Select the ***Service*** tab.
6. Select the ***Import shared system profile***  button to import all shared system profiles from the USB device to the Cockpit. A confirmation popup appears stating that the Cockpit will reboot if you press the ***Import*** button.
7. Select the ***Import*** button in the confirmation popup to start importing the patient profiles,

   or

   Select ***Cancel*** to stop the procedure and dismiss the popup.

Messages appear in the text window informing you if the shared system profiles imported successfully or not. Once the system profiles are imported, the Cockpit reboots.

This page has been left blank intentionally.

Reports/recordings

Overview

The Cockpit offers a real-time record of its monitoring results on an R50N recorder. In addition, you can request various reports and print screens which are printed on a laser printer.

NOTE
Ventilation waveforms are not supported on recordings.

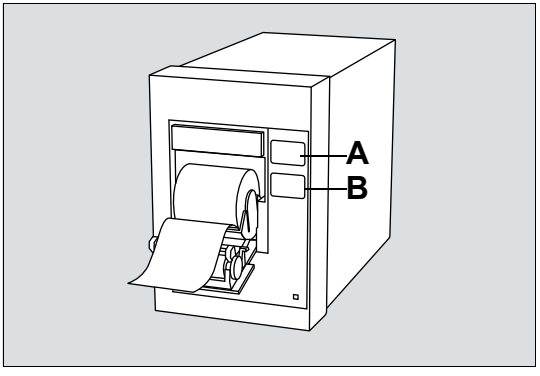
The content of the recordings and reports depend on the configured settings. You can customize the recording and report settings in the ***Recordings/ Reports*** pages (see page 481).

NOTE
Do not disconnect the network strip recorder during printing, as this could reset the Cockpit.

Messages relating to recordings and reports are listed on page 556.

R50N recorder

Timed and continuous strip recordings are printed on an R50N recorder which is connected to the network or to the PS250 / P2500 using a cross-over cable. The R50N is a two-channel strip recorder.



A ***Stop*** key – stops a recording in progress

B ***mm/s*** key – does not function

Replacing the recorder paper

To replace the paper

1. Open the paper door and remove the empty paper roll and any paper remaining in the printing mechanism.
2. Place a new paper roll with printed side facing up into the spool holder. Unroll a few inches of paper from the bottom.
3. Align the paper roll with the paper guides, and close the door. (If not aligned properly, the paper may jam.)
4. Generate a timed recording to verify that the recorder is connected properly, and the paper is loaded correctly.

Timed recordings

From the Cockpit, you can request timed strip recordings that are printed on an R50N recorder (see page 511). Timed recordings can be requested manually or triggered automatically depending on configured alarm settings.

If a signal source becomes unavailable, for example due to a disconnected lead or a cable, while a recording is printing, the associated parameter data and waveform appear as blank data on the strip recording.

A timed recording contains data of a specified duration which is configurable from 6 seconds to 20 seconds (see "Configuring the recording and report settings" on page 481). A timed recording contains delay data that originated before the recording was initiated and real-time data that was acquired after the recording started. The ratio of delay and real-time data are configurable (see page 481). Strip recordings also include pacer spikes if present.

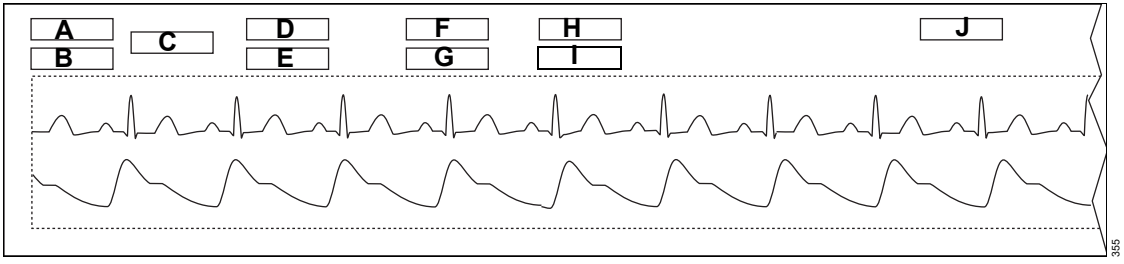
The header of a timed recording contains the following information:

– Parameter values at the time the recording starts printing

– Patient name and ID number

– Date and time

The following diagram shows a typical timed recording.



A Patient name

B Patient ID

C Monitoring unit

D Date

E Time

F Selected delay time

G Selected recording speed

H Origin of recording request (for example, ***BED TIMED***)

I ECG filter setting

J Parameter labels and units of measure

Remote Recordings

You can also request a recording from another monitor or the ICS. Remote recordings use the delay, duration, and speed recorder settings of the Cockpit not the remote device from which you request the recording.

Automatic alarm recordings

When the ***Alarm Waveform*** feature is activated (see page 481), timed alarm recordings are generated automatically whenever a parameter whose archive function is activated goes beyond the set alarm limits.

Alarm recordings are also generated when an arrhythmia event with an alarm classification of high or medium occurs.

The following sections describe how to set up a parameter or arrhythmia event to generate an automatic alarm recording.

To activate or deactivate the archive function of a parameter

1. Select the parameter field of the parameter whose alarm function you wish to activate or deactivate to access that parameter page directly.

   or

   Select ***Sensor parameters...*** from the main menu bar > select the desired parameter tab to access the page.

2. Select the button next to the ***Archive*** setting and select either ***Store***, ***Str/Rec***, ***Record*** to generate a recording or ***Off*** to deactivate the feature.

To assign an alarm priority to arrhythmia events

1. Select the ***Alarms...*** button on the main menu bar.
2. Select the ***Limits*** tab (if not already selected).
3. Select the ***ARR*** tab along the right side to display the ***ARR*** page.
4. Touch the field in the ***Alarm*** column of the parameter whose alarm priority you want to modify.
5. Select the field in the ***Archive*** column and select either ***Store***, ***Str/Rec***, ***Record*** to generate a recording or ***Off*** to deactivate the feature.
6. Press the rotary knob to confirm the setting.

Continuous recordings

Continuous recordings are almost identical to timed recordings (see figure on page 509). The only difference is that a continuous recording runs until you manually interrupt it unlike a timed recording, which runs for a specified time.

The waveform labels, scale bars, and the scales are printed once for each parameter.

To request a continuous recording

- Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Continuous recording.***

Causes for automatic cancellation of recordings

Any active timed or continuous recording is automatically canceled under the following circumstances:

– If the Cockpit loses its connection to the network. The recordings resume when the network connection is restored.

– If you place the Cockpit into standby mode

– If you discharge a patient

Requesting recordings

The following table lists where you can request manual timed and continuous recordings.

Type of report	Description	How to request the recording
Timed recording	A strip recording of a specified duration (see page 509).	● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Timed recording*** ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends > Reports*** > ***General reports*** > ***Timed recording***
Continuous recording	A strip recording that continues until manually stopped (see page 511).	● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Continuous recording*** ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***Continuous recording***

Available reports

If an IACS patient is admitted at the ICS for central monitoring or was previously admitted there and the data have been archived, you can request the following reports from the Cockpit. The reports are printed on any compatible laser printer

The reports are printed based on pre-configured settings (see page 484). The header of all reports contains the following information:

– Patient name and ID number

– Hospital name

– Care unit

– Bed name

– Parameter labels and values (for ECG, ST, Alarm Event, timed waveform, and continuous strip reports only)

The footer of all reports contains the following information:

– Date

– Page number

– Report title

Printing reports

The following table outlines the types of reports that are available. Most reports can be requested from several places on the Cockpit.

Type of report	Description	How to request the report
Print screen	Prints the current display. Whenever you request a print screen, it is printed on the connected laser printer.	● C700: Select the ***Print screen*** button on the main menu bar. ● C500: Select the ☐ symbol next to the ***Views...*** button on the main menu bar. If a keyboard is connected to the Cockpit, you can also use the print screen key of the keyboard to generate a print screen.

Type of report	Description	How to request the report
ECG report	Prints the waveforms of the connected ECG leads. This report is not of diagnostic quality.	● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Rest ECG report*** ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends > Reports*** > ***General reports*** > ***ECG report*** **Note:** ECG filter values, specified in Hz, are added to the printed strip recordings to comply with IEC 60601-2-27. For example: "ECG: 0.5-40Hz". Filter setting bandwidth ranges include: – Monitor: 0.5 - 40Hz – Filter Off: 0.08 - 40Hz – ESU: 0.5 - 16 Hz
Rest ECG report [1)]	This 12-lead diagnostic report is generated in different stages. Although you request the report at the Cockpit, the M540 collects the actual ECG data, and the ICS prints it. To be able to generate such a report, the Cockpit must be in the same monitoring unit as the ICS, and the Rest ECG analysis option must be installed at the ICS. The report is available in several formats that can be customized at the ICS (refer to the ICS instructions for use). You can also configure the content of a Rest ECG report, see "Rest ECG setup" on page 483.	When requesting a Rest ECG report, use the 1mV/cm scale to avoid overlapping ECG waveforms. ● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Rest ECG report*** ● Select to the ***Trends/ Data...*** button on the main menu bar > ***Trends > Reports*** > ***General reports*** > ***Rest ECG report*** The Rest ECG report is only available for adult and pediatric patients. To obtain an optimal automatic diagnostic interpretation of an Rest ECG report, make sure the required settings are configured appropriately for the patient (see page 483).
Timed waveform report	Prints strip reports of all currently displayed waveforms (the waveform duration and delay time settings are configurable, see page 484).	● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Timed wvf. report*** ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends > Reports*** > ***General reports*** > ***Timed wvf. report***

Type of report	Description	How to request the report
Continuous waveform report	Prints strip reports of all currently displayed waveforms (prints a maximum of five pages).	• Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Continuous wvf. report*** • Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***Continuous wvf. report***
ST report	Prints the ST complexes currently displayed on ST screen. This report is not of diagnostic quality.	• Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***ST report***. • Select the ***Trends/ Data...*** button on the main menu bar > ***Trends > Reports*** > ***General reports*** > ***ST report*** • Select the ***Sensor parameters...*** button on the main menu bar or the ST parameter field if it is displayed > ***ECG*** > ***ST complex > Print***
Graphical trend report [1]	Prints the contents of the graphical trends according to the selected ***Trend duration [hr]*** setting (see page 484). Graphical trend reports do not include discrete data such as C.O. and NIBP.	• Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Trend graph report***. • Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Graph*** > ***Print*** • Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***Trend graph report***
Analysis tool graphical trend report	Prints the values of the ***Analysis tool*** page (see page 179) corresponding to the Cursor 1 and Cursor 2 positions. It also contains the Delta values between the Cursor 1 and the Cursor 2 values.	• Select the ***Procedures...*** button from the main menu bar > ***Analysis tool*** tab > ***Print***. The ***Print*** button is only available after you mark a portion of the graphical trends with the cursor buttons.
Tabular trend report [1]	Prints the contents of the tabular trend according to the selected ***Table interval [min]*** setting (see page 484).	• Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Trend table report*** • Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Table*** > ***Print*** • Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***Trend table report***
Graph vitals report	Prints the contents of the ***Graph vitals*** page.	• Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Graph vitals*** > ***Print***

[1] If configured to appear on the main menu bar, the buttons for requesting these reports button are also accessible on the main menu bar. For more information, see page 465.

Type of report	Description	How to request the report
Ventilation/anesthesia report	Prints the contents of the ***Ventilation / Anesthesia*** page. A ventilator report requested from the ICS does not print the ventilator settings.	● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Ventilation / Anesthesia > Print***
Alarm history report	Prints the contents of the Alarm history page.	● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Alarm history report***. ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***Alarm history report*** ● Select the ***Alarms...*** button on the main menu bar > ***Alarm history*** > ***Print***
Alarm event report	Prints the content of the selected event.	● Select the ***Alarms...*** button on the main menu bar > ***Alarm history*** > Event > ***Print***
Calculations report	Prints the entire calculations results table currently displayed in the ***Calculations*** page.	● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Calculations report***. ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***Calculations report***
Case summary report	Prints a combination of reports configured in the ***Reports*** page of the ***Trends/Data*** dialog (see page 189).	● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***Case summary report***. ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***Print case summary*** ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***OR report*** > ***Print case summary***
OR report	Prints a brief summary of an anesthesia OR case including the agent and gas consumptions during the case.	● Select the symbol next to the ***Trends/ Data...*** button on the main menu bar > ***OR report***. ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***General reports*** > ***OR report*** ● Select the ***Trends/ Data...*** button on the main menu bar > ***Trends*** > ***Reports*** > ***OR report*** > ***Print***

[1] If configured to appear on the main menu bar, the buttons for requesting these reports button are also accessible on the main menu bar. For more information, see page 465.

Configuring a case summary report

The ***Reports Setup*** page allows you to select which reports make up a case summary report. Selecting the ***Case summary report*** button prints the pre-configured reports without having to select each report manually. If no reports are pre-configured, the following reports are assigned by default to a case summary report: ***ECG report***, ***Anesthesia trend report***, ***OR report***.

To setup a case summary report

1. Select the ***Trends/ Data...*** button on the main menu bar.
2. Select the ***Reports*** tab (if not already selected).
3. Select the ***Setup*** tab to display the setup page to be included in the case summary report.
4. Select one or more of the following reports (the buttons of the selected reports appear dark green):

   ECG report, ***Rest ECG report***, ***ST report***, ***Alarm history report***, ***Trend graph report***, ***Trend table report***, ***Anesthesia trend report***, ***Calculations report***, ***Timed wvf. report***, ***OR report***

You can print a case summary report from several places, see page 515.

IT applications (options)

Overview

The Cockpit supports several IT applications. Each application is an option that is accessible by selecting a tab appearing on the left side of the monitoring area (see "Cockpit split screen mode with multi-tab split screen" on page 77). Whenever IT tabs are displayed, the top IT tab is always labeled ***Patient*** and allows you to access the monitoring screen that displays the current patient's vital signs.

If you are using a keyboard, you can activate a mouse cursor on the Cockpit by pressing the ALT and F10 keys simultaneously.

NOTE
The F1 key is configured globally to control alarm silence from the keyboard and is not available to IT applications for use.

Configuring IT tabs

Only authorized personnel with the Biomed password can configure IT tabs. In the ***IT setup*** page you can activate or deactivate each tab and configure specific settings, such as the blocking of popups and so on. For detailed information, see "Biomed IT setup" on page 493.

CAUTION
The IACS does not have virus protection software and relies therefore on the firewall of your institution to prevent access to infected files. While setting up IT applications to access websites, evaluate each website with regard to possible virus infection.

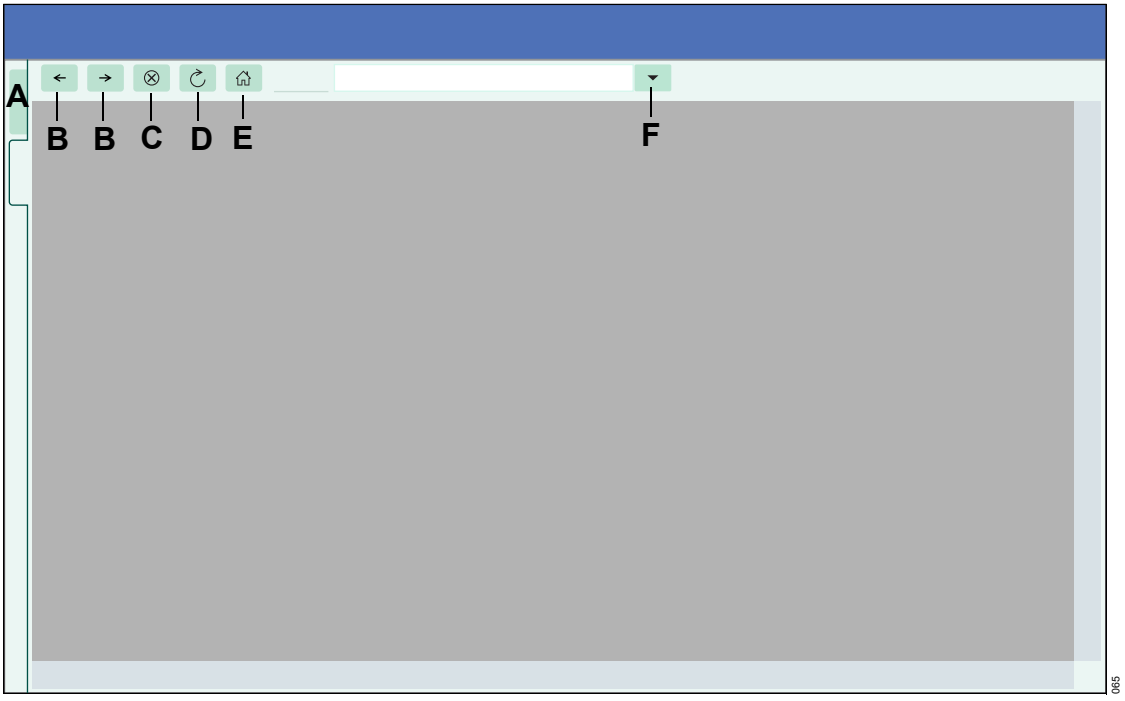
If the Cockpit loses communication with an application, a message appears on the corresponding IT application page. The Cockpit tries to restore the communication with the IT application as quickly as possible.

Web browser

In addition to IT applications, you can also setup a browser with pre-configured websites (see "Configuring IT tabs – browser setup" on page 493). Once you access the web browser IT tab, you can choose from all of the websites that were pre-configured under the Biomed tab. IT tabs are also available in split screen mode (see page 77).

Accessing an IT tab

The following diagram is an example of a web page. After a browser has been successfully configured (see page 494), you can select it by clicking the corresponding IT tab. Whatever IT application is displayed, the Cockpit header bar is always visible to report the patient's monitoring data status. The top IT tab is the ***Patient*** tab that returns you to the main screen displaying the patient's vital signs.



A ***Patient*** tab – always returns you to the main screen with the patient's vital signs.

B Navigate backward and forward

C Stops loading the web page

D Refreshes the screen

E Displays the main screen

F Address window

NOTE

Refreshing certain IT applications may disconnect the application and require a new login.

Supported IT applications

If you dock a new M540 and admit the patient at the Cockpit, the content of some application tabs changes to reflect the data of the new patient. Similarly, if you discharge a patient, all IT tabs reflect that the patient is discharged. The following table lists the supported IT applications.

Browser emulation for Internet Explorer 7 to Internet Explorer 11 and Microsoft Edge is supported in all of the IT tabs except the Application tab.

Name of Application	Supported software version	Description
Innovian Solution Suite This application includes: – Innovian Critical Care (formerly known as ChartAssist) – Innovian Perioperative Care	VF7.1	Clinical flow sheet application. The tab can be configured to display a single patient. The single patient tab requires that the M540 is docked. The Innovian waveform feature is not supported with the IACS VG5 (or later) release. Whenever you access the Innovian tab, the local patient is displayed or the admit screen is presented if the local patient has not yet been admitted to Innovian Solution Suite application. For more information, refer to the instructions for use *Innovian Solution Suite*. **NOTE:** Innovian report generation is no longer supported starting in IACS VG6. Print these reports from a PC where Innovian is accessible. Incorrect birth dates and hospital admittance dates could be incorrect by one day on the Innovian admit screen due to daylight savings. These dates can be entered directly into Innovian using a PC.
Infinity Symphony Suite	VF7	An application that provides retrospective analysis of patient data stored on the ICS. The tab can be configured to run a single patient provided an M540 is docked. The Symphony status page only displays ST-deviations that are displayed in the parameter field.
RemoteView (Gateway PatientWatch)	VF6 or higher	Allows you to remotely view up to 4 different bedside monitors from the Cockpit. No wireless symbol (example: ) appears on the PatientWatch screen when the M540 is in wireless mode. PatientWatch is supported only in English.
Application	Citrix XenApp server Versions 5, 6, 6.5	Provides remote access to IT applications residing on the Citrix server.

Name of Application	Supported software version	Description
Web browser	Up to Internet Explorer 11 and MicrosoftEdge	Provides access to HTML and HTML5 content.
Web application	Up to Internet Explorer 11 and MicrosoftEdge	Provides access to HTML and HTML5 content for a single URL, including the Citrix Receiver.

Connecting to the network

Dräger provides patient monitoring, therapy, and IT products that may exchange information electronically with each other in the clinical environment, as well as other non-Dräger devices, over information technology networks (IT networks). Each data interface is an IT network in terms of the relevant communications standard (e.g. printer interface, ISB interface, etc.).

Transmission of patient and device data across the IT network enables patient data and equipment data to be monitored, stored, transferred, printed, or shared through the use of direct wired, as well as wireless technologies, facilitating the following operations:

– Waveform and parameter data display
– Alarm notification
– Network recordings and printing
– Remote control (for example, alarm management)
– Remote BedView
– Patient archive data review (trends, events, charting information)
– Equipment setting and patient data transfer
– Service access (device and component status data; log file access)

Connecting Dräger devices to a shared IT network with other devices, or subsequent changes to the shared IT network, can lead to previously unidentified risks for patients, users, and third parties. These risks must be identified, analyzed, evaluated, and controlled before placing the medical device into the IT network. Before a device can be in service on the Infinity Network, a valid and unique IP address must be entered.

EC 60601-1:2005 and 60601-1:2012 clause 14.13 compliance

Subsequent changes to the IT network can include, among other things:

– IT network configuration changes

– Adding or removing additional devices to/from the IT network

– Upgrading and/or updating network equipment connected to the IT network

Hospital personnel (for example, biomedical or network engineers) should read the accompanying documents of the Dräger equipment carefully before connecting the device to an IT network. Additionally, attention should be given to the network interface description and network-relevant alarms. Installation personnel should also refer to IEC 80001-1 for guidance before connecting the Dräger equipment to IT-networks.

The following summary provides additional disclosure on the connection of Dräger medical devices to IT Networks:

– The most commonly-required configuration of the LAN-based IT-network incorporating Dräger medical devices is a star topology that connects monitoring units and groups of monitoring units ("care units") via layered network switches and the segmentation from other IT-Network traffic via separately designated virtual LANs. Required device interface configurations are described in the respective product instruction for use documentation.

– The specifications of the LAN connection for Dräger medical devices to the IT-Network are outlined in the IEEE 802.3 wired and IEEE 802.11(b, g, n) wireless Ethernet standards. Port settings for layer 2 and layer 3 switches are defined on a product-specific basis. These settings are available from specialized service personnel. Dräger provides products for initial set-up with pre-loaded IP addresses.

– The LAN-based IT-network uses TCP/IP communication protocols. It must be capable of supporting either unicast (static or dynamic addressing requiring ARP or RARP), as well as multicast and broadcast transmissions. It needs to allow the use of the Internet Group Management Protocol (IGMP version 2). Dräger medical devices send out data packets on the IT network. Dräger products like CentralStation monitors, Gateways, or other bedside monitors, which are configured to receive these data packets, use the Internet Management Protocol to join or leave an IP Multicast group. An example of this data flow is bedside devices sending out their patient data using IP multicasting. A CentralStation monitor can join into each multicast channel to capture and display bedside patient data information.

– Dräger devices may also require that the IT-network provides support for three dedicated, independent virtual local area network (VLAN) connections for bedside medical devices, mobile patient monitors, and for access to the Health Delivery Organization (HDO) clinical network. Additional information can be obtained from specialized service personnel.

– Besides direct network connections, other possible communication interfaces include:

  - Serial data connections, conforming to EIA RS-232 (CCITT V.24/V.28) for MEDIBUS-based products, paging interfaces, and connections to 3rd party medical devices.
  - IEEE 1073 conformant interfaces (Medical Information Bus) for connections to 3rd party medical devices (IEEE 1073.3.2 or 1073.3.1 and 1073.4.1).
  - Serial data connections, conforming to USB 2.0, for human interface devices (mouse, keyboards, mass storage devices such as flash disks, CD drives, etc.).

– Security for Dräger wireless products is implemented using the Advanced Encryption Standard (AES) WPA2, with pre-share key administration at the time of installation. Security for selected Dräger clinical IT products includes SSL and additional capabilities defined in the Medical Device Disclosure for Medical Device Security (MDS2) form.

– There are potential hazardous situations that can result from the failure of the IT-Networks to provide the characteristics required to meet the purpose of the medical device connection to the IT Network. Dräger products will attempt to detect and mitigate these potentially hazardous situations. Related to this medical device, these situations may include:

  - Untimely delivery of data (alarm annunciation/parameter values exchange/etc.), depending on a "reliable distributed alarm system or not"
  - Data not sent or sent to the wrong device
  - Missing data
  - Patient data intercepted/corrupted
  - Incorrect time stamp on data
  - Alarms not detectable in time due to unsafe distributed alarm system or alarm present at network interruption
  - Alarm pause/audio pause reset due to network interruption
  - Data privacy lost due to missing firewall/virus protection
  - Wrong equipment settings/wrong or no alarms due to missing firewall/virus protection

This page has been left blank intentionally.

Troubleshooting

Overview

Alarm messages in the alarm display field are displayed in hierarchical order.

For example, if two faults are detected simultaneously, the more urgent of the two is displayed.

The priority level of the alarm messages (see page 115 for definitions) is identified by exclamation marks:

Warning = !!! Message of high priority

Caution = !! Message of medium priority

Advisory = ! Message of low priority

If no priority level is assigned, the message is informational and no action is required.

In the following table, messages are listed in alphabetical order. These tables identify possible alarm causes and provides corrective action. The various causes and remedies should be worked through in the order listed until the problem has been resolved.

Device communication messages

Priority	Message	Cause	Remedy
None	***Check IP address***	Duplicate PDS or Multicast address.	Ensure the fourth octet of the IP address is unique within the monitoring unit.
None	***Disconnected from M540***	The M540 is disconnected from the M500.	Dock the M540.
None	***Duplicate device name***	Duplicate domain.	Assign a unique domain name.
None	***Duplicate IP address***	The IP address is already in use.	Assign a unique IP address.

Priority	Message	Cause	Remedy
!	***External device disconnected***	An external device is no longer communicating with the Cockpit due to a disconnected cable (hardware- related).	Check the external device connections.
		An external device is no longer communicating with the Cockpit. When this happens repeatedly in rapid succession, the Cockpit will stop monitoring the external connection (software-related). In this instance all connected devices become disconnected.	First check the external device connection and reconnect the cable, if necessary. If the connection is still not restored, turn the Cockpit off, and then turn it on again.
!	***Not Monitored By Central***	The Cockpit is connected to the Infinity network but is not assigned to a central station. A wireless M540 is out of range of the access point.	Admit the patient at the central station. Return the M540 inside the range of the wireless access point. Check network connectivity.
!	***Offline***	The Cockpit is disconnected from the Infinity network.	Check the network connectivity.
!!	***Please plug in power supply***	Loss of AC power forces the Cockpit to run on battery charge power for at least five minutes before shutting down.	Check the power source and all connections.
!	***Please plug in system cable***	The system cable was disconnected from the M500.	Reconnect the system cable.
!!	***Power supply overheating***	The power supply is overheating.	Unplug the power supply and contact specialized service personnel.
!!	***Power supply H/W failure***	Faulty power supply.	Replace the power supply and contact specialized service personnel.

Priority	Message	Cause	Remedy
!!	***Power supply low battery***	The battery charge is < 20%. When the battery charge falls below 10%, the Cockpit performs a safe shutdown.	Reconnect to AC power.
!	***Power supply H/W failure***	Faulty power supply.	Unplug the power supply and contact specialized service personnel.
None	***Remote Relearn***	The indicated function was initiated from the central station.	Informational message – no action required.
None	***Remote Limit Change***	The indicated function was initiated from the central station.	Informational message – no action required.
None	***Silenced at Remote***	Remote alarm silence initiated from the central station or another Cockpit.	Informational message – no action required.

Messages

Priority	Message	Cause	Remedy
!!!	***All alarms off: bypass***	This message appears in the alarm message field when you activate cardiac bypass mode (see page 473).	Deactivate the feature to remove the message.
!!!	***All alarms off***	The ***All alarms paused*** function is set to ***No timeout*** (see page 471) and the ***All alarms off*** button was selected.	Select the ***All alarms off*** button again to remove the message.
!!!	***All alarms paused*** with timer	The ***All alarms paused*** function is set to a time (see page 471) and the ***All alarms paused*** button was selected.	Select the ***All alarms paused*** button again to remove the message.
!!	***Audio paused*** with timer	The yellow ***Audio paused 2 min*** key (next to the rotary knob) was pressed.	Press the key again to remove the message.
!!!	***Pressures off***	The ***Pressures off*** function is enabled (see page 127) and the ***Pressures off*** button was pressed.	Press the ***Pressures off*** button again to remove the message.
!!	***Pressures paused***	The ***Pressures paused*** function is set to a time (see page 127) and the ***Pressures paused*** button was pressed.	Press the ***Pressures paused*** button again to remove the message.
!!	***Audio off***	This message appears in the alarm message field when the ***Audio off*** feature is set to ***On***.	Activate the ***Audio off*** setting to remove the message.
None	***Discharge*** ***Touch Screen to resume monitoring***	This message appears in the center of the Cockpit screen when the patient has been discharged (see page 95).	Touch the screen to resume monitoring and admit a new patient.
!	***Duplicate IP address***	This message appears in the alarm message field when a duplicate IP address is detected anywhere on the Infinity network. The Cockpit goes offline within 10 seconds of a ***Duplicate IP address*** alarm condition.	Configure a new IP address. The Cockpit then immediately tries to rejoin the Infinity network

Priority	Message	Cause	Remedy
None	***Filter ESU***	This message appears above the ECG waveform when the filter setting is set to ***ESU*** (see page 226).	Select another filter setting to change or remove the message.
None	***Filter off***	This message appears above the ECG waveform appears when the filter setting is set to ***Off*** (see page 226).	Activate the function to remove the message.
!!!	***HR, ASY, VF off***	This message appears in the alarm message field under the following circumstances: – Heart rate alarms are deactivated, – ***ASY/VF alarms*** feature is set to ***Follow HR alarm*** (see page 473), – Arrhythmia monitoring is deactivated. The same message also appears under the following circumstances: – Heart rate alarms are deactivated, – ***ASY/VF alarms*** feature is set to ***Always on*** (see page 473), – Arrhythmia monitoring is deactivated, – The selected ***HR source*** is activated and is either ***SpO2*** or ***ART***.	Activate the functions to remove the message.
!!!	***ASY, VF off***	This message appears in the alarm message field under the following circumstances: – Heart rate alarms are enabled – ***HR source*** is set to ***ART*** or ***SpO2*** – ***ARR mode*** (arrhythmia) is set to ***Off***	The message disappears under the following circumstances: – The setting ***HR source*** is changed to ***ECG*** – The setting ***ARR mode*** is changed to ***Basic*** or ***Advanced***.

Priority	Message	Cause	Remedy
!!	***HR alarms off***	This message appears in the alarm message field under the following circumstances. – When the alarm limits for heart rate are deactivated and the ***ASY/VF alarms*** function is set to ***Always on*** (see page 473). – When the alarm limits for heart rate are deactivated, the basic arrhythmia function is activated and the ***ASY/VF alarms*** function is set to ***Follow HR alarm*** (see page 473).	Activate the function to remove the message.
None	***Pacer off*** ***Pacer fusion***	These messages appear above the ECG waveform when the corresponding function is activated or deactivated (see page 226)	Deactivate the function to remove the message.
None	***Privacy*** ***Touch Screen to resume monitoring***	This message appears in the center of the Cockpit screen when privacy mode has been activated (see page 94). All patient data are removed from the screen and are only visible at the ICS. This function is not available unless the patient is also admitted at the ICS.	Take the patient out of standby to view all the data at the Cockpit.
None	***Standby*** ***Touch Screen to resume monitoring***	This message appears in the center of the Cockpit screen when the Cockpit has been placed in standby mode.	Touch the screen to resume monitoring.
None	***Waveforms stopped***	This message appears above all waveforms when you press the ***Freeze waveforms*** button on the main menu bar (see page 94).	Select the button again to remove the message.

ECG

Priority	Message	Parameter field	Problem	Solution
!!!	***Asystole***	***ASY***	The reported arrhythmia was detected	Check the patient and treat if necessary.
!!!	***Bradycardia*** (neonatal patient category)	***BRADY***	The reported arrhythmia was detected	Check the patient and treat if necessary.
!!	***HR*** > (alarm limit) ***HR*** < (alarm limit)	Parameter value	The parameter value is above/below the set upper/lower alarm limits.	– Check the patient and treat if necessary. – Change the alarm limits.
!!	***%0 out of range high*** [1]	The parameter value is replaced by +++	The parameter value is above the measurement range of the monitor.	
!	***%0 artifact*** [1] [2]	The parameter value is replaced by ***	– Patient movement (shivering, tremors) – Bad electrode contact – Excessive signal noise interference from auxiliary equipment	– Check the electrodes and reapply if necessary. – Make sure that the patient's skin is properly prepped. – Isolate the patient from auxiliary equipment, if possible.

Priority	Message	Parameter field	Problem	Solution
!	***%0 unplugged*** [1)] ***%0 leads off*** [1)]	The parameter value is replaced by ***	Lead-off condition detected due to: – broken cable(s) – disconnected ECG lead wires – loose lead wire(s) – wrong lead selected – dried out electrode gel ECG cable(s) disconnected from the M540.	– Replace faulty cable(s). – Reapply gel on reusable electrodes and reapply them or replace new disposable electrodes. – Select another ECG lead for processing. – If monitoring augmented leads, verify that the number of selected leads in the ECG setup page is correct. – Check cable(s) and connection(s) – Replace cable(s) if necessary
None None None None None None	***LA lead off*** ***LL lead off*** ***RA lead off*** ***RL lead off*** ***V lead off*** ***V1 lead off*** ***V2 lead off*** ***V3 lead off*** ***V4 lead off*** ***V5 lead off*** ***V6 lead off*** ***V+ lead off***	Parameter value	The indicated lead is no longer attached to the patient.	Reattach the electrode to the patient.

Priority	Message	Parameter field	Problem	Solution
!!!	***Ventricular fibrillation***	***VF***	The reported arrhythmia was detected	Check the patient and treat if necessary.
Rest ECG messages				
None	***ECG Collecting waveforms***	Parameter value	Rest ECG was initiated	Instruct the patient to lie still.
None	***ECG busy***	Parameter value	The central station is already processing a report.	Wait a few minutes before requesting the report again.
None	***ECG cannot connect***	Parameter value	Connection to central station is not possible.	– Check that the patient is admitted at the central station. – Check that the central station has the Rest ECG option activated.
None	***ECG report complete***	Parameter value	The Rest ECG report has been printed	Informational message – no action required.
None	***%0 comm failure*** [1]	Parameter value	The external device is not available.	Check the configuration at the central station.
None	***Sending ECG data***	Parameter value	Informational message.	Informational message – no action required.

[1] %0 is a placeholder for the parameter label HR or ECG.

[2] After discharging a patient or starting the device, the alarm becomes active only after a numeric value has been received for that parameter.

NOTE

RRi and 12-lead ECG monitoring are unavailable when the M540 is in OR alarms.

ST

Priority	Message	Parameter field	Problem	Solution
!	***Cannot analyze ST***	The parameter value is replaced by ***	The algorithm cannot determine ST values due to artifact, the absence of normal beats, or invalid leads.	– Perform a relearn (see page 241). – Check electrodes; re-apply if necessary. – Make sure the patient's skin is properly prepared. – Isolate the patient from auxiliary equipment if possible. – Inspect and replace faulty cable(s) and wire(s). – Reapply gel on reusable electrodes and reapply them or replace new disposable electrodes. – Reapply the electrode(s). Make sure the patient's skin is properly prepared. – If a lead or electrode cannot be replaced, select another ST lead for processing.
!!	***ST*** > (alarm limit) ***ST*** < (alarm limit)	Parameter value	The parameter value is above/below the set upper/lower alarm limits.	– Check the patient and treat if necessary. – Change the alarm limits.

Priority	Message	Parameter field	Problem	Solution
!!	***%0 out of range low*** [1)]	The parameter value is replaced by - - -	The parameter value is below the measurement range of the monitor.	– Check the patient and treat if necessary. – Check the placement of electrodes and change their position if necessary.
!!	***%0 out of range high*** [1)]	The parameter value is replaced by +++	The parameter value is above the measurement range of the monitor.	– Check the patient and treat if necessary. – Check the placement of electrodes and change their position if necessary.
!	***%0 unplugged*** [1)]	The parameter value is replaced by ***	ECG lead wires are disconnected from the M540.	Check the cables and connections; replace if necessary.
None	***ST relearn***	The parameter value appears blank.	ST relearn is in progress	Informational message – no action required.
[1)] %0 is a placeholder for the parameter label ST.				

ARR

Except for asystole and ventricular fibrillation, you can assign the alarm priority low, medium or high or you can deactivate the alarm function. For asystole and ventricular fibrillation, the alarm priority is fixed as life-threatening and you cannot deactivate the alarm function.

Priority	Message	Parameter field	Problem	Solution
!!!	***Asystole***	***ASY***	The indicated arrhythmia was detected.	Check the patient and treat if necessary. Some messages only appear when the Full arrhythmia option is installed.
!!!	***Ventricular fibrillation***	***VF***		
!!	***%0 Run*** [1)]	***RUN***		
!!	***%0 Accelerated idioventricular rhythm*** [1)]	***AIVR***		
!	***%0 Supraventricular tachycardia*** [1)]	***SVT***		
!	***%0 Couplet*** [1)]	***CPT***		
!	***%0 Bigeminy*** [1)]	***BGM***		
!	***%0 tachycardia*** [1)]	***TACH*** or ***VTACH***		
!	***%0 bradycardia*** [1)]	***BRADY***		
!	***%0 PAUSE*** [1)]	***PAUSE***		
!!	***%0 artifact*** [1)]	***ARTF***		
None	***ARR cannot learn***	The parameter value appears blank	After 100 beats, the M540 cannot determine the dominant normal complex on any lead selected for QRS processing.	– Check the electrode preparation. – Reapply electrodes if necessary.
None	***%0 relearning*** [1)]	***LEARN***	The M540 is learning the patient's QRS complex to establish a reference template.	Informational message – no action required.
In the parameter field, the value is replaced by an ARR abbreviation (see page 35) except for the ***ARR cannot learn*** message.				
!!	***PVC/min >*** (alarm limit)	Parameter value	PVC value is above the upper alarm limit.	– Check the patient and treat if necessary. – Reapply electrodes if necessary.
[1)] %0 is a placeholder for the parameter label ARR.				
[2)] After discharging a patient or starting the device, the alarm becomes active only after a numeric value has been received for that parameter.				

Respiration (RRi)

Priority	Message	Parameter field	Problem	Solution
!!	***RRi*** > (alarm limit) ***RRi*** < (alarm limit)	Parameter value	The parameter value is above/below the set upper/lower alarm limits.	– Check the patient and treat if necessary. – Check the alarm limits.
!!	***%0 out of range high***[1)]	The parameter value is replaced by +++	– The respiratory rate is higher than 150 breaths per minute. – The M540 may be counting artifacts as valid breaths. – The M540 may be counting interference caused by faulty equipment.	– Check the patient and treat if necessary. – Check the placement of electrodes. – Move the electrodes away from the source of interference.
!!!	***%0 apnea*** [1)]	***APNEA***	Neonatal apnea condition was detected.	– Check the patient and treat if necessary. – Check the placement of electrodes. Change their position if necessary. – Initiate a relearn or reset breath-detection sensitivity in manual mode.
!!	***%0 apnea*** [1)]	***APNEA***	Adult or pediatric apnea condition was detected.	

Priority	Message	Parameter field	Problem	Solution
	%0 coincidence [1]	***Parameter value***	The heart rate and respiratory rate fall within 20% of each other.	– Check the patient and treat if necessary. – Check and change the electrode placement if you receive a coincidence message until you obtain a clear respiration signal. – Change the detection threshold in manual mode or initiate a relearning in auto mode.
	RRi relearning	***LEARN***	Relearn is in progress	Informational message -- no action required.

Priority	Message	Parameter field	Problem	Solution
!	***%0 lead off*** [1), 2)]	The parameter value is replaced by ***	The RRi lead is invalid.	– Check the patient and treat if necessary. – Make sure the patient's skin is prepared properly. – Isolate the patient from any auxiliary equipment, if possible. – Reapply gel on reusable electrodes and reapply them or replace new disposable electrodes. – Inspect and replace faulty cables and wires. – If lead or electrode cannot be replaced, select another lead for processing (in the RRi setup page).
!	***%0 artifact*** [1), 2)]	The parameter value is replaced by ***	Persistent artifact was detected.	
!	***RRi high impedance***	The parameter value is replaced by ***	A high respiration impedance was detected.	
!	***%0 lead unavailable*** [1)]	The parameter value is replaced by ***	Faulty or disconnected electrodes.	

1) %0 is a placeholder for the parameter label RRi.

2) After discharging a patient or starting the device, the alarm becomes active only after a numeric value has been received for that parameter.

NOTE

RRi and 12-lead ECG monitoring are unavailable when the M540 is in OR alarms.

SpO2

The following messages originate from three different hardware devices (Masimo SET, Masimo rainbow SET, and Nellcor OxiMax).

Priority	Message	Parameter field	Problem	Solution
None (Masimo rainbow SET only)	***Learning pulse CO-Ox***	***Learning*** Displays parameter values for SpO2, PLS*, and PI. Parameter values for SpHb (SpHbv), SpOC, SpMet, PVI, SpCO are replaced by ***	The parameters have been detected but have not yet been computed.	Wait until message disappears.
None (Masimo rainbow SET only)	***Low %0 SIQ*** [1)]	Associated parameter values are still displayed	– Poor signal quality – Measurement reading is obscured	– Check the patient and treat if necessary. – Make sure the SpO2 sensor is attached properly to the patient. – Check all cable connections.
None	***Low SpO2 SIQ***	***Low SpO2 SIQ*** Parameter values are still displayed.	The Masimo MCable detects low signal quality	– Check the patient and treat if necessary. – Make sure the SpO2 sensor is attached properly to the patient. – Check all cable connections.

Priority	Message	Parameter field	Problem	Solution
!! (Any SpO2 MCable)	***PLS out of range low***	The parameter value is replaced by - - -	The parameter value is below the measurement range of the monitor.	– Check the patient and treat if necessary. – Change the alarm limits.
	PLS out of range high	The parameter value is replaced by +++	The parameter value is above the measurement range of the monitor.	
!! (Masimo rainbow SET only)	***PVI*** > (alarm limit) ***SpHb*** > (alarm limit) ***SpHbv*** > (alarm limit) ***SpMet*** > (alarm limit) ***SpOC*** > (alarm limit)	Parameter value	The parameter value is above the upper alarm limits.	– Check the patient and treat if necessary. – Change the alarm limits.
!! (Any SpO2 MCable)	***SpO2*** > (alarm limit) ***PLS**** > (alarm limit)			
!! (Masimo rainbow SET only)	***SpHb*** < (alarm limit) ***SpHbv*** < (alarm limit) ***PVI*** < (alarm limit) ***SpOC*** < (alarm limit) ***SpMet*** < (alarm limit)	Parameter value	The parameter value is above/below the set upper/lower alarm limits. The priority changes to high (!!!) if the SpO2 value falls more than 10% below the lower limit. This does not occur when using ***SatSeconds alarm*** time with the Nellcor OxiMax MCable.	– Check the patient and treat if necessary. – Change the alarm limits.
(Any SpO2 MCable)	***SpO2*** < (alarm limit) ***PLS**** < (alarm limit)			

Priority	Message	Parameter field	Problem	Solution
! (Any Masimo MCable)	***SpO2 cable expired*** [3]	***Replace cable*** Parameter values for SpO2, PLS*, PI, SpHb (SpHbv), SpOC, SpCO, SpMet, and PVI are replaced by ***. **NOTE**: SpHb, SpOC, SpCO, SpMet, and PVI are supported by Masimo SET only.	Cable expired.	Replace the cable.
! (Any Masimo MCable)	***SpO2 cable expires soon***	***Cable expires soon***	Cable near expiration.	Replace the cable.
! (Masimo rainbow SET only)	***SpO2 cable failure***	***Cable failure*** Parameter values are replaced by ***	The Masimo rainbow SET intermediate cable is faulty.	Replace the intermediate cable.
! (Nellcor OxiMax MCable only)	***SpO2 check sensor*** [2]	***Check sensor*** Parameter values are replaced by ***	The SpO2 sensor is disconnected.	– Make sure the SpO2 sensor is attached properly to the patient. – Check all cable connections.
None (Masimo rainbow SET only)	***%0 sensor calibrating*** [1]	***Sensor calibrating*** Parameter values are replaced by ***	The sensor is being checked for functional integrity.	Wait until message disappears. This message appears right before the message ***SpO2 searching***.
None (Any SpO2 MCable)	***SpO2 desaturation***	Parameter value	SpO_2 value below Desat. limit.	– Check the patient and treat if necessary. – Change the alarm limits.

Priority	Message	Parameter field	Problem	Solution
! (Any SpO2 MCable)	***SpO2 H/W failure***	Parameter values are replaced by ***	Hardware failure	– Check for faulty MCable – Contact specialized service personnel.
!	***SpO2 Interference Detected*** [2)]	***Interference detected*** Parameter values are replaced by ***	Interference such as artifact or too much ambient light was detected.	– Make sure the sensor is properly attached. – Make sure that no nail polish or some other substance is blocking the light. – Change the sensor location.
None	***SpO2 Low Perfusion***	***Low perfusion*** Parameter values	The signal is too small.	– Check the patient and treat if necessary. – Move the sensor to a site that is more adequately perfused.
!	***SpO2 MCable unplugged*** [2)]	***MCable unplugged*** Parameter values are replaced by ***. The parameter values are replaced by blanks for PI or SpOC if using Masimo rainbow SET	The SpO2 MCable is disconnected from the M540.	Check connections to M540.

Priority	Message	Parameter field	Problem	Solution
None (Masimo rainbow SET MCable only)	***SpO2 only mode***	***SpO2 only mode*** Parameter values for SpO2, PLS*, PI, and PVI. Parameter values for SpHb (SpHbv), SpOC, SpMet, SpCO are replaced by ***	The device cannot calibrate the Masimo rainbow SET parameters and is attempting to display the standard Masimo parameters.	Remove and reapply the sensor. If the problem persists, contact specialized service personnel.
! (Any Masimo MCable)	***SpO2 replace cable next pt.***	***Replace cable next pt.*** Parameter values	Cable expired.	Replace the cable.
! (Any Masimo MCable)	***SpO2 replace sensor next pt.***	***Replace sensor next pt.*** Parameter values	– SpO_2 sensor expired. – Adhesive sensor expired.	Replace the sensor.
None (Any SpO2 MCable)	***SpO2 searching***	***Searching*** Parameter values are replaced by ***	The sensor is searching for valid pulses to compute a measurement value.	Verify proper sensor application.
! (Any Masimo MCable)	***SpO2 sensor expired*** [3)]	***Replace sensor*** Parameter values are replaced by ***	– SpO_2 sensor expired – Adhesive sensor expired	Replace the sensor.
! (Any Masimo MCable)	***SpO2 sensor expires soon***	***Sensor expires soon*** Parameter values	– SpO_2 sensor near expiration – Adhesive sensor near expiration	Replace the sensor.

Priority	Message	Parameter field	Problem	Solution
! (Any SpO2 MCable)	***%0 sensor failure*** [1]	***Sensor failure*** Parameter values are replaced by ***	– Hardware failure – Faulty SpO2 sensor	– Make sure the SpO2 sensor is properly attached to the patient and all cables are properly connected. – Replace the sensor. – Contact specialized service personnel.
!	***SpO2 sensor off*** [2]	***Sensor off*** Parameter values are replaced by ***	The Masimo MCable has detected that the SpO2 sensor is no longer attached to the patient.	Reattach the SpO2 sensor.
!! (Any SpO2 MCable)	***SpO2 sensor unplugged*** [2]	***Sensor unplugged*** Parameter values are replaced by ***	– SpO2 intermediate cable or sensor is unplugged – SpO2 sensor is unplugged from Masimo rainbow SET MCable	– Verify that the cable and the sensor are properly connected. – Check for faulty sensor.
! (Any Masimo MCable)	***SpO2 unrecognized cable*** [3]	***Unrecognized cable*** Parameter values are replaced by ***	An incompatible cable is connected.	– Connect the right type of cable. – Contact specialized service personnel.

Priority	Message	Parameter field	Problem	Solution
! (Any SpO2 MCable)	***SpO2 unrecognized sensor***	***Unrecognized sensor*** Parameter values are replaced by ***	– An incompatible Nellcor or Masimo SET sensor is connected. – A reusable SpHb Masimo rainbow SET sensor is connected to an Masimo rainbow SET MCable that does not support SpHb.	– Connect the right type of sensor. – Contact specialized service personnel.

[1] %0 is a placeholder for the parameter labels SpO2, PVI, SpHb (SpHbv), SpMet, SpOC, SpCO.

[2] After discharging a patient or starting the device, the alarm becomes active only after a numeric value has been received for that parameter.

[3] In the parameter field the parameter value is replaced by ***

Non-invasive blood pressure (NIBP)

Priority	Message	Parameter field	Problem	Solution
!!	***NIBP S*** > (alarm limit) ***NIBP S*** < (alarm limit)	Parameter value	The parameter value is above/below the upper/lower alarm limits.	– Check the patient and treat if necessary. – Change the alarm limits.
!!	***NIBP D*** > (alarm limit) ***NIBP D*** < (alarm limit)	Parameter value		
!!	***NIBP M*** > (alarm limit) ***NIBP M*** < (alarm limit)	Parameter value		
!!	***%0 H/W failure*** [1)]	Parameter values are replaced by ***	– NIBP measurement circuit failure – NIBP zero out of range or faulty transducer	Check all hardware, contact specialized service personnel.
!!	***%0 low inflation limit*** [1)]	The message ***Last measurement failed!*** is followed by the message ***Low inflation limit*** Parameter values are replaced by ***	The pressure of the patient is greater than the maximum allowed cuff inflation pressure.	Select the next higher inflation limit setting.
!	***NIBP mean only***	Parameter values are replaced by ***	The pulse amplitude is too small or too high for the M540 to derive systolic and diastolic pressure values but sufficient to report a mean pressure value.	– Check the patient and treat if necessary. – Check the hose and cuff. – Check the size and the placement of the cuff.

Priority	Message	Parameter field	Problem	Solution
!!	***%0 out of range high*** [1)]	Parameter value or value is replaced by *** depending on the pressure level	The parameter value is above/below the measurement range of the monitor.	Check the NIBP inflation limits and adjust them if necessary (for example, if the wrong patient category is selected).
!!	***%0 out of range low*** [1)]	Parameter value or value is replaced by *** depending on the pressure level		
!!	***NIBP failure***	The parameter value is replaced by ***	***NIBP*** hardware failure.	– Check hardware and replace if necessary. – Contact specialized service personnel.
None	***NIBP pneumatic char. needed***	Parameter values are replaced by ***	NIBP hardware failure in the M540.	Contact specialized service personnel and take the M540 out of service.
!	***%0 blocked Line*** [1)]	The message ***Last measurement failed!*** is followed by the message ***Blocked line*** Parameter values are replaced by ***	The inflation rate is too high during the inflation cycle or the time to evacuate residual cuff pressure at the end of the deflation cycle is too short.	– Select a different cuff. – Check the hose and cuff for damage. – Restart the measurement. If the message does not clear, contact specialized service personnel.
!	***%0 cannot measure*** [1)]	The message ***Last measurement failed!*** is followed by the message ***Cannot measure*** Parameter values are replaced by ***	The pulse profile is too poor to establish a reliable measurement (usually due to persistent motion artifact)	– Check the patient and treat if necessary. – Move the cuff to a limb with less movement. – Restart the measurement. If the message does not clear, contact specialized service personnel.

Priority	Message	Parameter field	Problem	Solution
!	***%0 cuff leak*** [1]	The message ***Last measurement failed!*** is followed by the message ***Cuff leak*** Parameter values are replaced by ***	The drop in cuff pressure at the end of the inflation cycle is too great.	– Check the hose and cuff for leaks. Replace if necessary. – Restart the measurement. If the message does not clear, contact specializedservice personnel.
!	***%0 measurement timeout*** [1]	Parameter values are replaced by ***	An NIBP measurement has exceeded time-out limit.	Repeat the measurement.
!	***%0 overpressure*** [1]	Parameter values are replaced by ***	The cuff pressure has exceeded the overpressure threshold.	– Check the patient and treat if necessary. – Check the cuff for obstructions. – Repeat the measurement.
!	***%0 open line*** [1]	The message ***Last measurement failed!*** is followed by the message ***Open line*** Parameter values are replaced by ***	There was no significant increase in cuff pressure during the inflation cycle.	Make sure that the hose and cuff are properly connected to the monitor.
None	***Venous stasis started***	Parameter value or blank value	Message reporting the status of venous stasis.	Informational message – no action required.
None	***Venous stasis ending***	Parameter value or blank value	Message reporting the status of venous stasis.	Informational message – no action required
None	***Venous stasis ended***	Parameter value or blank value	Message reporting the status of venous stasis.	Informational message – no action required
[1] %0 is a placeholder for the parameter label NIBP.				

Temperature

Priority	Message	Parameter field	Problem	Solution
!!	***T1a*** > (alarm limit) ***T1b*** > (alarm limit) ***Ta*** > (alarm limit) ***Tb***> (alarm limit) ***T*** > (alarm limit) ***ΔT*** > (alarm limit) ***ΔT1*** > (alarm limit) ***T1a*** < (alarm limit) ***T1b*** < (alarm limit) ***Ta*** < (alarm limit) ***Tb*** < (alarm limit)) ***T*** < (alarm limit) ***ΔT*** < (alarm limit) ***ΔT1*** < (alarm limit)	Parameter value NOTE: The temperature label in the message may vary depending on the assigned temperature label. The full list of temperature labels is available on page 297.	The parameter value is above/below the upper/lower alarm limits.	– Check the patient and treat if necessary. – Change the alarm limits.
!!	***%0 out of range high*** [1]	The parameter value is replaced by +++	The parameter value is above/below the measurement range of the monitor.	– Check the patient and treat if necessary. – Check the equipment and replace, if necessary.
!!	***%0 out of range low*** [1]	The parameter value is replaced by - - -		
!	***Cannot derive %0*** [2]	The parameter value is replaced by ***	The cable is either faulty or unplugged.	– Check the equipment and replace it if necessary. – Connect the second temperature sensor.
!	***%0 H/W failure*** [1], [2]	The parameter value is replaced by ***	The hardware reference values do not meet the specified tolerance.	Contact specialized service personnel.

Priority	Message	Parameter field	Problem	Solution
!	***%0 unplugged*** [1), 2)]	The parameter value is replaced by ***	The temperature sensor is unplugged.	Reapply the temperature sensor.

[1)] %0 is a placeholder for the parameter label T for Temp.

[2)] After discharging a patient or starting the device, the alarm becomes active only after a numeric value has been received for that parameter.

Invasive pressure (IP)

Priority	Message	Parameter field	Problem	Solution
!!!	***ART cath. disconnected?***	The parameter value is replaced by ***	The arterial catheter could be dislodged, or there could be a leak in the tubing.	– Assess the catheter insertion site. – Inspect the tubing for leaks or the presence of blood. – Check the patient and treat, if necessary.
!!	***%0 transducer failure*** [1)]		Pressure transducer hardware failure.	– Check the transducer and replace, if necessary.
!!	***IP*** label > (alarm limit) ***IP*** label < (alarm limit)	Parameter value	The parameter value is above/below the upper/lower alarm limits.	– Check the patient and treat if necessary. – Change the alarm limits.
!!	***%0 out of range low*** [1)]	The parameter value is replaced by - - -	The parameter falls outside the pressure range of the monitor.	– Check the patient and treat if necessary. – Check the equipment and replace, if necessary.
!!	***%0 out of range high*** [1)]	The parameter value is replaced by +++		

Priority	Message	Parameter field	Problem	Solution
!	***%0 please check zero*** [1)]	Parameter value	The IP zero value stored in the M540 was lost and the transducer requires zeroing.	Zero the transducer.
!	***%0 H/W failure*** [1)]	The parameter value is replaced by ***	IP hardware failure.	– Check hardware and replace if necessary. – Contact specialized service personnel.
None	***%0 did not zero*** [1)]	Parameter value	Transducer zeroing failed because of: – excessive signal noise – a non-static waveform	– Keep all tubing motionless, then rezero. – Change the transducer. – Check stopcock, then rezero.
!!	***%0 static pressure*** [1)]	Parameter value	Static pressure detected on a pulsatile signal, due to: – a physiological condition such as an asystole – a transducer that is closed to the patient – a catheter tip that is lodged against a vessel wall – a clot on the catheter tip	– Check the patient and treat if necessary. – Open the system to the patient by turning the stopcock. – Follow hospital procedures for dislodging catheters. – Follow hospital procedures for clotted catheters.

Priority	Message	Parameter field	Problem	Solution
!	***%0 unplugged*** [1), 2)]	The parameter value is replaced by ***	The pressure transducer for the specified parameter is either unplugged or faulty.	– During an active pressure: Reconnect or replace the cable. – During an inactive pressure: deactivate alarms.
!	***HemoPod unplugged*** [2)]	The parameter value is replaced by ***	The IP pod is disconnected.	Check the equipment and replace if necessary.
!	***%0 HemoPod H/W failure*** [1)]	The parameter value is replaced by ***	Invasive pressure pod has a hardware failure.	– Check hardware and replace if necessary. – Contact specialized service personnel
!	***2nd HemoPod unplugged***	The parameter value is replaced by ***	The second invasive pressure pod is disconnected.	– Check the equipment and replace if necessary.
None	***HemoPod incompatible***	None - message only	An incompatible invasive pressure pod has been connected.	– Remove the incompatible invasive pressure pod.
None	***%0 zero accepted*** [1)]	Parameter value	Transducer zeroing was successful.	Informational message – no action required.
None	***%0 did not zero - offset error*** [1)]	Parameter value	Transducer zeroing failed because static pressure was too high or too low.	– Keep all tubing motionless. – Replace the transducer. – Check the stopcock and zero again.
None	***Inflate balloon. Press "Wedge" to Start.*** This message appears in the Wedge dialog only.	Parameter value	Action required to start wedge measurement.	Press ***Start wedge*** button to begin wedge measurement.

Priority	Message	Parameter field	Problem	Solution
None	***Wedge in progress*** This message appears in the Wedge dialog only.	Parameter value	Informational message.	Informational message – no action required.
None	***Deflate balloon and press "Save wedge" to finish*** This message appears in the Wedge dialog only.	Parameter value	Action required to complete wedge measurement.	Press ***Save wedge*** button to finish wedge measurement.

[1] %0 is a placeholder for the respective IP label (including CPP).

[2] After discharging a patient or starting the device, the alarm becomes active only after a numeric value has been received for that parameter.

Mainstream CO_2

Priority	Message	Cause	Remedy
None	***CO2 calibration check failed***	The mainstream sensor calibration procedure failed.	Contact specialized service personnel.
None	***CO2 calibration check in progress***	The mainstream sensor calibration procedure is in progress.	Informational message – no action required.
None	***CO2 calibration check successful***	The mainstream sensor calibration procedure was successful.	Informational message – no action required.
None	***CO2 calibration failed***	The mainstream sensor calibration procedure was unsuccessful.	Try again or contact specialized service personnel.
None	***CO2 calibration in progress***	The mainstream sensor calibration procedure is in progress.	Informational message – no action required.
None	***CO2 calibration successful***	The mainstream sensor calibration procedure was successful.	Informational message – no action required.
!	***%0 check airway adapter*** [1)]	– The mainstream sensor is not properly seated on the adapter – There are secretions in the adapter. – There is sensor zero drift	– Make sure the mainstream sensor is attached properly to the adapter. – If message persists, clean or replace the airway adapter. – If message persists though the airway adapter is clean, zero the sensor.
!	***%0 H/W failure*** [1)]	CO_2 sensor hardware failure.	Contact specialized service personnel.

Priority	Message	Cause	Remedy
!	***%0 incompatible sensor*** [1]	– The M540 has detected that the used mainstream sensor is not compatible with the selected sensor type setting (reusable/disposable) – Secretions in the adapter – Sensor zero drift – High inspiratory CO_2 concentration	– Use the airway adapter type the system is configured for or adjust the airway adapter setting. – If the message persists, clean or replace the airway adapter. – If the message persists even though the correct airway adapter type is selected and the airway adapter is clean, zero the sensor. – If the message still persists, the inspiratory CO_2 value might not be accurate. Check the patient and ventilation.
!!	***CO_2 out of range high*** [1]	The parameter signal is outside the measuring range of the monitor.	– Check the patient and treat if necessary. – Check the equipment and replace if necessary.
None	***CO2 please zero***	Instructional message for the mainstream sensor only.	Zero the mainstream sensor.
!	***%0 sensor too warm*** [1]	The CO_2 mainstream sensor is too warm due to ambient temperature.	– Unspecified accuracy at ambient temperatures above 40 °C (104 °F). – The sensor will return to normal operation at ambient temperatures below 40 °C (104 °F). If not, replace the sensor and contact specialized service personnel.
!	***CO2 MCable unplugged*** [1]	The CO_2 sensor is disconnected.	Check the CO_2 connections.
!	***CO2 MCable failure***	The CO_2 sensor hardware failed due to a corrupt EPROM (erasable programmable read-only memory) chip.	Contact specialized service personnel.

Priority	Message	Cause	Remedy
!!	***CO2 warming up***	The CO_2 sensor is completing its warm-up cycle.	– Wait for the CO_2 sensor to warm up. During warm-up, the accuracy is reduced. – If the message persists longer than 15 minutes after the sensor has warmed up and the ambient temperature is above 10 °C (50 °F), contact specialized service personnel. – You cannot zero the sensor while this message is displayed and the ambient temperature is above 10 °C (50 °F). – When the ambient temperature is below 10 °C (50 °F), the message can display longer than 15 minutes. In this case, it is possible to zero the sensor after the message has been displayed for at least 10 minutes.
None	***%0 zeroing failed***	Zeroing of the sensor has failed or the sensor is faulty .	– Try to zero the sensor again making sure not to breathe on the sensor. – If zeroing fails again, replace the sensor and contact specialized service personnel.
None	***%0 zeroing in progress***	The CO_2 zeroing is in progress.	Informational message – no action required.
!!	***etCO2 >*** (alarm limit) ***etCO2 <*** (alarm limit) (except inCO_2)	The parameter value is above/below the set upper/lower alarm limits.	– Check the patient and treat if necessary. – Change the alarm limits.
!!	***RRc out of range high***	The parameter signal is outside the measuring range of the monitor.	– Check the patient and treat if necessary. – Check the equipment and replace if necessary.

Priority	Message	Cause	Remedy
!!	***%0 apnea***	Apnea was detected	– Check the patient and treat if necessary. – Check the placement of the sensor.
[1)] In the parameter field the parameter value is replaced by ***			

Microstream CO_2

Calibration and maintenance

Priority	Message	Cause	Remedy
None	***CO2 calibration check failed***	The Microstream MCable calibration procedure failed.	Contact specialized service personnel.
None	***CO2 calibration check successful***	The Microstream MCable calibration procedure was successful.	Informational message – no action required.
None	***CO2 calibration check in progress***	The Microstream MCable calibration procedure is in progress.	Informational message – no action required.
None	***CO2 calibration required***	The Microstream MCable calibration procedure is due.	Contact specialized service personnel.
None	***CO2 MCable: Maintenance is due***	Maintenance for Microstream MCable is due.	Contact specialized service personnel.
None	***%0 zeroing failed***	Resetting the Microstream MCable to zero has failed the standard three attempts.	Contact specialized service personnel.
None	***%0 zeroing in progress***	The Microstream MCable is being reset to zero.	Informational message – no action required.
None	***CO2 zeroing succesful***	The Microstream MCable is successfully reset to zero.	Informational message -- no action required.

CO_2 monitoring

Priority	Message	Cause	Remedy
!	***CO_2 incompatible pod***	The M540 has detected that the Microstream MCable is not compatible with the M540.	Contact specialized service personnel.
!!	***CO_2 out of range high*** [1)]	The parameter signal is outside the measuring range of the monitor.	– Check the patient and treat if necessary. – Check the equipment and replace if necessary.
!	***CO_2 sensor unplugged*** [1)]	The Microstream MCable is disconnected.	Check the CO_2 connections.
!	***CO2 MCable unplugged***	The Microstream MCable is disconnected from the monitor.	Reconnect the Microstream MCable to the monitor.
!	***CO2 MCable failure***	The Microstream MCable hardware has failed due to one of the following issues: – a corrupt EPROM (erasable programmable read-only memory) chip – a compromised flow rate that caused the auto-zero procedure to fail.	Contact specialized service personnel.
!!!	***%0 MCable: Gas outlet blocked***	The Microstream MCable gas outlet is blocked.	Contact specialized service personnel.

Priority	Message	Cause	Remedy
!!	***CO2 warming up***	The Microstream MCable is completing its warm-up cycle.	– Wait for the Microstream MCable to warm up. During warm-up, the accuracy is reduced. – If the message persists longer than 15 minutes after the sensor has warmed up and the ambient temperature is above 10 °C (50 °F), contact specialized service personnel. – You cannot zero the sensor while this message is displayed and the ambient temperature is above 10 °C (50 °F). – When the ambient temperature is below 10 °C (50 °F), the message can display longer than 15 minutes. In this case, it is possible to zero the sensor after the message has been displayed for at least 10 minutes.
None	***%0 zeroing in progress***	The Microstream MCable is being reset to zero.	Informational message – no action required.
!!	***etCO2 >*** (alarm limit) ***etCO2 <*** (alarm limit) (except inCO_2)	The parameter value is above/below the set upper/lower alarm limits.	– Check the patient and treat, if necessary. – Change the alarm limits.
!!!	***%0 apnea***	Apnea was detected.	– Check the patient and treat, if necessary. – Check the placement of sensor.
!!	***RRc out of range high***	The parameter signal is outside the measuring range of the patient monitor.	– Check the patient and treat if necessary. – Check the equipment and replace if necessary.
[1)] In the parameter field the parameter value is replaced by ***			

Sample line

Priority	Message	Cause	Remedy
!	***Sample line is being cleared***	A sample line blockage occurred and the Microstream MCable is attempting to clear the sample line.	Informational message – no action required.
!	***Sample line blocked***	The sample line is blocked during the purging process.	Replace the sample line.
!	***Sample line disconnected***	The sample line is disconnected from the Microstream MCable.	Securely connect the sample line to the Microstream MCable***.***

Cardiac Output (C.O.)

Priority	Message	Parameter field	Problem	Solution
!!	***Tblood >*** (alarm limit) ***Tblood <*** (alarm limit)	Parameter value	The blood temperature is outside the alarm limits because of: – a physiological condition – inappropriate alarm limits – a faulty sensor	– Check the patient and treat if necessary. – Change the alarm limits.
!!	***%0 out of range high*** [1)] ***%0 out of range low*** [1)]	Parameter value	The blood temperature is outside the measurement range because of a faulty sensor.	Check equipment and replace if necessary.

Priority	Message	Parameter field	Problem	Solution
!	***C.O. Catheter Fault - Bad Ref.*** [2)]	Parameter value	The C.O. blood thermistor calibration resistor does not meet the specified tolerance.	– Check the catheter and replace if necessary. – Contact specialized service personnel.
!	***C.O. Pod Fault - Bad Ref.*** [2)]	Parameter value	The C.O. reference values do not meet the specified tolerances.	– Remove and reconnect the pod. – Repeat the measurement. – Replace the pod and contact specialized service personnel if the message persists.
None	***%0 out of range high*** [1)] ***%0 out of range low*** [1)]	Parameter value	The C.O. is greater than 20 liters/min or less than 0.5 liters/min because of: – a physiological condition – unstable baseline – incorrect injectate volume, catheter size, or computation constant – faulty catheter, cable, or cartridge	– Check the patient and treat if necessary. – Use cooler injectate. – Enter the correct values in the C.O. page. – Repeat the measurement. If message persists, replace faulty components.

Priority	Message	Parameter field	Problem	Solution
None	***%0 Check Injectate Probe***	Parameter value	The thermistor is not connected or became disconnected during a measurement.	Connect the probe and repeat the measurement.
None	***%0 duplicate device connected*** [1)]	Parameter value	Multiple C.O. sources are connected. This includes CCO devices connected via the device connectivity option.	Disconnect duplicate C.O. sources.
None	***%0 Injectate Too Cold*** [1)]	Parameter value	The injectate temperature is too cold during the measurement process.	– Use an injectate within the correct temperature range of –5 °C to +30 °C (23 °F to +86 °F). – Check equipment and replace if necessary.
None	***C.O. injectate set to 20°C!***	Parameter value	No thermistor was connected. The M540 assumes a temperature of 20 °C (68 °F).	Attach a thermistor.
None	***%0 No Temperature Change*** [1)]	Parameter value	No change in blood temperature during the C.O. measurement.	– Repeat the measurement. – Use a larger injectate volume. – Repeat the measurement. If problem persists, replace the catheter. – Use a cooler injectate.

Priority	Message	Parameter field	Problem	Solution
None	***%0 Poor Baseline*** [1]	Parameter value	Poor blood temperature baseline during C.O. measurement.	– Follow hospital procedures. – Repeat the measurement. – Replace the faulty components, if the message persists.
None	***%0 Use Cooler Injectate*** [1]	Parameter value	– The difference between the temperature of the blood and the injectate is less than 5 °C (41 °F). – The injectate temperature is greater than 25 °C (77 °F).	Use a colder injectate.
!	***%0 Transducer Unplugged*** [1], [2]	Parameter value	A cable or transducer has become disconnected.	– Reconnect the cable or transducer. – Replace the faulty part, if the message persists.

[1] %0 is a placeholder for the parameter label C.O.

[2] After discharging a patient or starting the device, the alarm becomes active only after a numeric value has been received for that parameter.

NOTE: C.O. monitoring is only supported on the first MPod – QuadHemo in a daisy-chained configuration.

Recording status messages

Priority	Message	Problem	Solution
None	***Primary Recorder Not Connected*** or ***Secondary Recorder Not Connected***	A recording was requested but no recorder is available.	Try again, then contact specialized service personnel.
None	***Primary Recorder Out of Paper*** or ***Secondary Recorder Out of Paper***	A recording was requested but the recorder is out of paper.	Replace the recorder paper (see page 508).
None	***Primary Recorder Door Open*** or ***Secondary Recorder Door Open***	The recorder door is open.	Close the door of the recorder.
None	***Primary Recorder Failure*** or ***Secondary Recorder Failure***	The recording request was not accepted due to recorder hardware failure.	Contact specialized service personnel.
None	***Primary Recorder Not Assigned*** or ***Secondary Recorder Not Assigned***	No recorder has been assigned.	Contact specialized service personnel.
None	***Primary Recorder Overheating*** or ***Secondary Recorder Overheating***	The recorder is overheating.	Contact specialized service personnel.

Priority	Message	Problem	Solution
None	***Timed Recording Started*** or ***Continuous Recording Started***	The requested recording is being printed.	Informational message – no action required.
None	***Timed Recording Request Accepted*** or ***Continuous Recording Request Accepted***	The recorder is not available and the requested recording is queued or stored for later printing.	
None	***Timed Recording Finished*** or ***Timed Recording Canceled***	The requested recording is printed.	
		The requested recording was manually canceled.	
None	***Continuous Recording Canceled***		
None	***Recording Not Accepted***	The assigned recorder is not available and the recording request was ignored.	Contact specialized service personnel to check the recorder assignment.
None	***Excess Artifact Recording Canceled***	The recording request was not accepted due to artifact.	Check the ECG lead connections; contact specialized service personnel.

Scio

CAUTION

Risk due to gas measurement failure

If gas measurement fails, the patient can no longer be adequately monitored.

– Ensure corresponding substitute monitoring.
– Check sample line and water trap for damage or blockage and resolve these as needed.
– Observe the prescribed exchange intervals.

NOTE

The "***%0***" symbol indicates CO_2, N_2O, O_2, xMAC, and any agents that may appear in the alarm message.

Alarm - Cause - Remedy

If an alarm occurs, the table helps to quickly identify causes and remedies. The possible causes and remedial measures should be consulted in the order in which they are listed until the alarm is resolved.

The following table lists the alarm messages in alphabetical order.

Alarm Priority	Alarm	Cause	Remedy
Medium	***%0 out of range high***	Agent concentration has exceeded the Scio upper limit of the measurement range.	Check vaporizer, fresh-gas settings, and ventilation
Low	***%0 reduced accuracy***	Accuracy of the Agent sensor cannot be guaranteed. **NOTE** This alarm occurs only on gas analyzers with manual agent identification**.**	– Ensure clean ambient air – Check water trap and sample line. – Change the water trap or sample line if necessary. – Wait for automatic zeroing. – Power cycle the gas analyzer. – Contact specialized service personnel.

Alarm Priority	Alarm	Cause	Remedy
Low	***%0 sensor failure***	The Agent sensor measurement has failed due to: – Sample line occlusion. – Electrical disturbance. – Internal failure.	– Check sample line. – Remove radiating devices (e.g., telephone). – Use alternative agent measurement system. – Call specialized service personnel.
Low	***%0 value temporarily unavail.***	Agent parameter has unknown accuracy or automatic identification is taking more time than usual, possibly due to: – Zeroing failure – Polluted ambient air during zeroing. – Electromagnetic disturbances. – Overheating.	– Ensure clean ambient air. – Remove radiating devices (e.g., telephone). – Check ambient temperature. – Check water trap and sample line. – Change the water trap or sample line if necessary. – Power cycle Scio – Change vaporizer settings. – Call specialized service personnel.
Low	***Check water trap/sample line***	– Sample line is blocked or not connected. – Water trap is full or not installed.	– Check sample line. – Check water trap.

Alarm Priority	Alarm	Cause	Remedy
Low	***CO2 reduced accuracy***	Accuracy of the CO_2 sensor cannot currently be guaranteed.	– Ensure clean ambient air – Check water trap and sample line. – Change the water trap or sample line if necessary. – Wait for automatic zeroing – Power cycle the gas analyzer. – Call specialized service personnel.
Low	***%0 sensor failure***	The CO_2 sensor in patient gas measurement module has failed due to: – Sample line occlusion. – Electrical disturbance. – Internal failure.	– Check sample line. – Remove radiating devices (e.g., telephone). – Use alternative CO_2 measurement system. – Call specialized service personnel.
Medium	***%0 out of range high***	CO_2 concentration has exceeded the Scio upper limit of the measurement range.	Check vaporizer, fresh-gas settings and ventilation.
Low	***etAgent < #*** **Note** This alarm only occurs for the primary agent.	– Expiratory anesthetic gas concentration has fallen below the lower alarm limit for more th an 15 seconds. – Soda lime is dried out.	– Check vaporizer and fresh-gas settings. – Check breathing system for large leaks. – Exchange soda lime.
Medium	***etAgent > #*** **Note** This alarm only occurs for the primary agent.	Expiratory anesthetic gas concentration has exceeded the upper alarm limit for more than 15 seconds.	Check vaporizer and fresh-gas settings
Medium	***etCO2 < #***	Expiratory CO_2 has fallen below the limit for more than 15 seconds.	Check ventilation.

Alarm Priority	Alarm	Cause	Remedy
Medium	***etCO2 > #***	Expiratory CO_2 has exceeded the limit for more than 15 seconds.	Check ventilation.
Medium	***etO2 < #***	Expiratory O_2 concentration has fallen below the lower alarm limit for more than 15 seconds.	– Check O_2 concentration and fresh-gas settings – Check breathing system for large leaks. – Check O_2 supply.
Medium	***etO2 > #***	Expiratory O_2 concentration has exceeded the upper alarm limit for more than 15 seconds.	Check O_2 concentration and fresh-gas settings.
High	***FiO2 < #***	Inspiratory O_2 concentration has fallen below the lower alarm limit for: – At least 15 seconds (with respiratory phases) – At least 30 seconds (without respiratory phases)	– Check O_2 concentration and fresh-gas settings – Check breathing system for large leaks. – Check O_2 supply.
Medium	***FiO2 > #***	Inspiratory O_2 concentration has exceeded the upper alarm limit for more than 15 seconds.	Check O_2 concentration and fresh-gas settings.
Medium	***Gas sensor failure***	The patient-gas measurement has failed due to: – Sample line occlusion. – Electrical disturbance. – Internal failure.	– Check sample line. – Remove radiating devices (e.g., telephone). – Use alternative gas measurement system. – Call specialized service personnel.

Alarm Priority	Alarm	Cause	Remedy
Low	***Gas sensor reduced accuracy***	Accuracy of the gas measurements cannot currently be guaranteed.	– Ensure clean ambient air. – Check water trap and sample line. – Change the water trap or sample line if necessary. – Wait for automatic zeroing – Power cycle the gas analyzer. – Call specialized service personnel.
Low	***inAgent < #*** **NOTE** This alarm occurs only for the primary agent.	– Inspiratory anesthetic gas concentration has fallen below the lower alarm limit for more than 15 seconds – Soda lime is dried out	– Check vaporizer and fresh-gas settings. – Check breathing system for large leaks. – Exchange soda lime.
Medium	***inAgent > #*** **NOTE** This alarm occurs only for the primary agent.	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit: – At least 15 seconds (with respiratory phases). – At least 30 seconds (without respiratory phases).	Check vaporizer and fresh-gas settings.
Medium	***inN2O > 82%***	Inspired N_2O is greater than 82% – At least 15 seconds (with respiratory phases). – At least 30 seconds (without respiratory phases).	Check fresh-gas composition.

Alarm Priority	Alarm	Cause	Remedy
Medium	***inCO2 > #***	Inspired CO_2 has exceeded the limit for more than 15 seconds possibly due to one of the following: – Soda lime is depleted. – Leakage in breathing system. – Gas measurement is inaccurate due to high respiratory rate. – Large dead space.	– Check soda lime. – Increase fresh-gas flow. – Check fresh-gas settings. – Replace the breathing system. – Adjust alarm limits if necessary. – Check ventilation settings.
Medium	***Inspiratory xMAC high***	The inspiratory anesthetic gas concentration has exceeded 3 xMAC for more than 3 minutes.	Check vaporizer and fresh-gas settings.
High	***Inspiratory xMAC high***	– The inspiratory anesthetic gas concentration has exceeded 5 xMAC or, while the patient is breathing: – The inspiratory anesthetic gas concentration has exceeded 3 xMAC for more than 30 seconds, – The expiratory anesthetic gas concentration has exceeded 2.5 xMAC for more than 30 seconds.	Check vaporizer and fresh-gas settings.
Medium	***%0 out of range high***	N_2O concentration has exceeded the Scio upper limit of the measurement range.	Check vaporizer, fresh-gas settings and ventilation.

Alarm Priority	Alarm	Cause	Remedy
Low	***%0 reduced accuracy***	Accuracy of the N_2O sensor cannot currently be guaranteed.	– Ensure clean ambient air – Check water trap and sample line. – Change the water trap or sample line if necessary. – Wait for automatic zeroing. – Power cycle the gas analyzer. – Call specialized service personnel.
Low	***%0 sensor failure***	The N_2O sensor in patient gas measurement module has failed due to: – Sample line occlusion. – Electrical disturbance. – Internal failure.	– Check sample line. – Remove radiating devices (e.g., telephone). – Use alternative N_2O measurement system. – Call specialized service personnel.
Low	***%0 value temporarily unavail.***	N_2O parameter has unknown accuracy possibly due to: – Zeroing failure. – Polluted ambient air during zeroing. – Electromagnetic disturbances. – Overheating.	– Ensure clean ambient air. – Remove radiating devices (e.g., telephone). – Check ambient temperature. – Check water trap and sample line. – Change the water trap or sample line if necessary. – Power cycle the gas analyzer. – Call specialized service personnel.

Alarm Priority	Alarm	Cause	Remedy
Medium	***%0 out of range high***	O_2 concentration has exceeded the Scio upper limit of the measurement range.	Check vaporizer, fresh-gas settings and ventilation.
Low	***%0 reduced accuracy***	Accuracy of the O_2 sensor cannot be guaranteed.	– Ensure clean ambient air. – Check water trap and sample line. – Change the water trap or sample line if necessary. – Wait for automatic zeroing. – Power cycle the gas analyzer. – Call specialized service personnel.
Medium	***%0 sensor failure***	The O_2 sensor in the patient gas measurement module has failed due to: – Sample line occlusion. – Electrical disturbance. – Internal failure.	– Use alternative O_2 measurement system. – Call specialized service personnel.

Alarm Priority	Alarm	Cause	Remedy
Low	***%0 value temporarily unavail.***	O_2 parameter has unknown accuracy, possibly due to: – Polluted ambient air during zeroing. – Electromagnetic disturbances. – Overheating.	– Ensure clean ambient air. – Remove radiating devices (e.g., telephone). – Check ambient temperature. – Check water trap and sample line. – Change the water trap or sample line if necessary. – Wait for auto zeroing to complete. – Power cycle the gas analyzer. – Change vaporizer settings. – Call specialized service personnel.
Medium	***RRc > #***	Respiratory rate has exceeded the limit.	Check ventilation.
Medium	***RRc < #***	Respiratory rate is below the limit.	Check ventilation.
Medium	***RRc apnea***	No breathing or ventilation.	– Start manual ventilation. – Check ventilation settings. – Check spontaneous breathing ability of the patient
		Sample line is not connected.	Connect sample line to breathing circuit
Medium	***%0 out of range high***	RRc has exceeded the upper limit of the measuring range for Scio.	Check ventilation.

Alarm Priority	Alarm	Cause	Remedy
Low	***Sample line blocked***	Sample line or patient-side filter is occluded.	Check sample line, water trap, and patient-side filter.
Medium	***Scio is not connected***	Scio is disconnected or turned off.	Connect the Scio module or turn it on.
Low	***Scio unavailable for neonates***	– Scio is plugged in while IACS is already in neonate mode. – IACS is switched to neonate mode while Scio is already plugged in.	– Connect an alternate CO_2 monitor (e.g., Mainstream or Microstream) if CO_2 monitoring is desired in neonate mode. – Switch IACS out of neonate mode in order to continue Scio monitoring.
Low	***Scio warming up: Accur. low***	Accuracy is not guaranteed while the Scio is warming up.	Wait for the Scio module to warm up.
Low	***Second agent detected*** **NOTE** This alarm occurs only on gas analyzers with automatic agent identification.	A second anesthetic agent has been detected. **NOTE** This alarm could be an expected clinical behavior if the clinician regularly uses two agents as part of the process.	– Wait for the transition phase to end after changing anesthetic agents. – Flush the system if necessary. – Check fresh-gas settings.
Medium	***Third agent detected*** **NOTE** This alarm occurs only on gas analyzers with automatic identification.	A mixture of three or more anesthetic agents or other gases has been detected, possibly as a result of: – A change of the anesthetic agent during monitoring – Electromagnetic interference – The use of inhalants or sprays (e.g., albuterol)	– Wait for the transition phase to end after changing anesthetic agents. – Flush the system if necessary. – Check fresh-gas settings. – Check for electromagnetic radiation in the vicinity.
Low	***Water trap is full***	– Water trap is full. – Sample line is occluded.	– Check water trap. – Check sample line, water trap, and patient-side filter.

Alarm Priority	Alarm	Cause	Remedy
Medium	***%0 out of range high***	Indicates that the expiratory xMAC is out of range high when: – Primary agent, secondary agent, and/or N_2O are out of range high. – Expiratory xMAC exceeds 10.	Check vaporizer, fresh-gas settings, and ventilation.

Status Messages

Message	Condition	Suggested action
Scio zeroing is in progress	Zeroing cycle in progress.	Wait for the zeroing cycle to complete.

Maintenance

Overview

This chapter describes the maintenance measures required to maintain the functional integrity of the medical device. Maintenance measures must be performed by the responsible personnel.

WARNING

Risk of infection.

Users and service personnel can become infected with pathogens.

Disinfect and clean the device or the components before any maintenance measures and also before returning the medical device for repair.

WARNING

Risk of electric shock.

Current-carrying components are located under the cover.

- **Do not remove the cover.**
- **Maintenance measures must be performed by the responsible personnel. Dräger recommends DrägerService to perform these measures.**

WARNING

If the device is mechanically damaged, or if it is not working properly, do not use it. Contact your hospital's service personnel.

CAUTION

This device must be inspected and serviced at regular intervals. A record must be kept on this preventive maintenance. A service contract with Dräger is recommended. For repairs we recommend that you contact specialized service personnel.

CAUTION

When servicing devices from Dräger, always use spare parts that are qualified to Dräger standards. Dräger cannot warrant or endorse the safe performance of third-party spare parts for use with the devices.

CAUTION

If you spill liquid on the equipment, battery or accessories or immerse these components in liquid, allow them to dry completely for at least 24 hours to 48 hours. Contact your hospital's service personnel to test any such component is fully operational before putting it back in clinical use.

NOTE

Only perform maintenance measures when no patient is connected to the device.

WARNING

Any modification of this device or any use different from the one specified in these instructions for use may cause interference with other equipment. It may also result in injury to the patient or the user, including electric shock, burns or death.

Definition of maintenance concepts

Concept	Definition
Maintenance	All measures (inspection, preventive maintenance, repair) intended to maintain and restore the functional integrity of a medical device.
Inspection	Measures intended to determine and assess the actual state of a medical device.
Preventive maintenance	Recurrent specified measures intended to maintain the functional integrity of a medical device.
Repair	Measures intended to restore the functional integrity of a medical device after a device malfunction.

Inspection

Perform inspections at regular intervals and observe the following specifications.

Checks	Interval	Personnel responsible
Inspection/safety checks	Every 2 years	Expert
Metrological checks	Every 2 years	Expert

Visual inspection

Perform a visual inspection before every use and in accordance with your hospital's policy.

1. Make sure that the housing is not cracked or broken and there are no signs of spilled liquids or damage.
2. Inspect all accessories (for example, sensors and cables). Do not use if there are any signs of damage.
3. Turn the monitor on and make sure the backlight is bright enough.
4. Examine all system cables, power plugs and discontinue use if there are any signs of damage.
5. Inspect all patient cables, leads and strain reliefs for general condition. Make sure the connectors are properly engaged at each end.

Inspection / safety checks

Inspection and safety checks of devices must be performed according to the suggested intervals specified in the table on page 581.

Scope of inspection/safety checks for the Cockpit (C500/C700)

The safety checks are no substitute for preventive maintenance measures (including preventive replacement of wearing parts) as identified by the manufacturer.

WARNING
Risk of medical device failure

If safety checks are not performed on a regular basis, the proper operation of the medical device can be compromised.

Perform safety checks at the indicated intervals.

1 Check accompanying documents:
- Instructions for use are available

2 Perform a functional test of the following features according to the instructions for use:
- Verify the LEDs
- Perform system tests

3 Check that the device combination is in good condition:
- All labels are complete and legible
- There is no visible damage
- Fuses which are accessible from the outside are in compliance with the specified values

4 Use the instructions for use to check that all components and accessories needed to use the product are available.

5 Check the electrical safety requirements according to IEC62353.

6 Verify that the optical and acoustic alarm signals function properly.

Scope of inspection/safety checks for the PS250 / P2500

The safety checks are no substitute for preventive measures (including preventive replacement of wearing parts) as identified by the manufacturer.

1 Check accompanying documents:
- Instructions for use are available

2 Perform a functional test of the following features:
- Verify the LEDs
- Perform system tests

3 Check that the device combination is in good condition:
- All labels are complete and legible.
- There is no visible damage.
- Fuses which are accessible from the outside comply with the specified values.

4 Check the electrical safety requirements according to IEC62353 every two yea rs by qualified DrägerService personnel.

5 Check the following safety features:
- The power LED and the battery indicator LED function properly.
- The C500/C700 are powered correctly.
- Check the functional integrity of the Infinity MCable – Nurse call.

Scope of inspection/safety checks for the M540

The safety checks are no substitute for preventive maintenance measures (including preventive replacement of wearing parts) as identified by the manufacturer.

WARNING
Risk of medical device failure

If safety checks are not performed on a regular basis, the proper operation of the medical device can be compromised.

Perform safety checks at the indicated intervals.

1 Check accompanying documents:

- Instructions for use are available

2 Perform a functional test of the following features according to the instructions for use:

- Verify the LEDs
- Perform a functional test of the internal battery
- Perform system tests (for example, communication with the IACS, front buttons, alarm bar, and functional integrity of monitored parameters).

3 Check that the device combination is in good condition:

- All labels are complete and legible
- There is no visible damage
- Fuses which are accessible from the outside are in compliance with the specified values

4 Check the electrical safety requirements according to IEC62353 every two years by qualified DrägerService personnel.

5 Check the following safety features:

- The power LED and the battery indicator LED function properly.
- The C500/C700 are powered correctly.
- Check the functional integrity of the Infinity MCable – Nurse call.
- Functional integrity of the  button located on the front of the device.
- Functional integrity of the non-invasive blood pressure overpressure sensor (including the valves and the pump).
- Functional integrity of the optical and acoustic alarm signals.

6 Replace the battery every two years and make sure the M540 runs on battery charge without fail for one minute as follows:

- Undock the M540 from the M500
- Turn on the M540
- Wait for one minute and observe the M540.

If the battery fails, trained personnel must replace it.

Metrological checks

If required by applicable regulations, the following measurement functions must be checked every two years by qualified DrägerService personnel:

- Body temperature
- Non-invasive blood pressure

Preventive maintenance

WARNING
Risk of faulty components

Device failure is possible due to wear or material fatigue of the components.

To maintain proper operation of all components, this device must undergo inspection and preventive maintenance at specified intervals.

WARNING
Risk of electric shock

Before performing any maintenance work, disconnect all electrical connectors from the power supply.

The following table shows the preventive maintenance intervals:

Component	Interval	Measure	Personnel responsible
Two non-invasive blood pressure air inlet filters of the M540 If the non-invasive blood pressure air inlet filter seems dirty or damaged, replace it before the recommended two years. The air inlet filter should be replaced, if the M540 was exposed to liquid. See "*Exchanging the ambient air filter*" in the Technical documentation which is available from DrägerService.	Every two years	Replace	Expert
Internal M540 battery For devices that have high transport or battery use, the battery must be checked more often.	Every two years	Replace	Hospital personnel
Internal PS250 / P2500 battery	Every two years	Replace	Expert

NOTE
For devices that have high transport or battery use, the battery must be checked more often.

NOTE
Do not disassemble the Ni-MH battery inside the PS250 / P2500. Aside from the required two-year maintenance recommended for the entire IACS, this battery requires no additional routine maintenance.

Maintenance Restart

To maintain optimal performance, the Cockpit must be restarted on a regular basis. When specific IACS restart thresholds are reached, the Cockpit provides a message to the user as described in the following table.

Restart Threshold	Mode(s) of operation	Message content	Message duration	Options	Result(s)
Voluntary	Discharge	***Restart is required for scheduled maintenance***	30 seconds	Select ***Restart***	Restarts IACS immediately Records "Restart is required" message to alarm history
				Select ***Cancel***	Delays the next restart message until a semi-critical or critical threshold is reached
				No action taken during message duration	Restarts IACS Records "Restart is required" message to alarm history
Semi-critical	Discharge or Standby	***Restart is required for scheduled maintenance***	30 seconds	Select ***Restart***	Restarts IACS immediately Records "Restart is required" message to alarm history
				No action taken during message duration	Restarts IACS Records "Restart is required" message to alarm history

Restart Threshold	**Mode(s) of operation**	**Message content**	**Message duration**	**Options**	**Result(s)**
Critical	Any	***Restart is required for scheduled maintenance*** and timer showing the time remaining until restart A medium-priority alarm is activated	2 minutes	Select ***Restart***	Restarts IACS immediately Records "Restart is required" message to alarm history
				No action taken during message duration	Restarts IACS Records "Restart is required" alarm event to alarm history

Reprocessing

Disassembly

Observe before disassembly:

1 Switch off the device and all devices connected to it.

2 Disconnect the mains plugs.

WARNING

Because of the risk of electric shock, never remove the cover of any device while it is in operation or connected to power.

WARNING

Do not immerse or rinse the device and its peripherals. If you spill liquid on the device (including the battery or accessories), or accidentally immerse it in liquid, disconnect the device from the power source and allow it to dry completely for at least 24 to 48 hours. Contact specialized service personnel regarding the continued safety of the device and its peripherals before placing it back in operation.

CAUTION

To avoid damaging the device, do not use sharp tools or abrasives. Never immerse electrical connectors in water or other liquids.

Information on reprocessing

Instructions for reprocessing are based on internationally accepted guidelines, e.g., standard ISO 17664.

Safety information

WARNING

Risk of infection

Reusable products must be reprocessed, otherwise there is an increased risk of infection and the products may no longer function correctly.

- **Observe the infection prevention and reprocessing regulations of the healthcare facility.**
- **Observe national hygiene and reprocessing regulations.**
- **Use validated procedures for reprocessing.**
- **Reprocess reusable products after every use.**
- **Observe the manufacturer's instructions for cleaning agents, disinfectants, and reprocessing devices.**

CAUTION

Risk due to faulty products

Signs of wear, e.g., cracks, deformation, discoloration, or peeling, may occur with reusable products.

Check the products for signs of wear and replace them if necessary.

CAUTION

Do not autoclave accessories.

Information on disinfectants

Use disinfectants that are nationally approved and suitable for the particular reprocessing procedure.

Surface Disinfectants

At the time of the test, the surface disinfectants listed in the following table showed good material compatibility. They can be used in addition to the surface disinfectants listed in "Validated reprocessing procedures".

The manufacturers of the surface disinfectants have verified at least the following spectra of activity:
– Bactericidal
– Yeasticidal
– Virucidal or virucidal against enveloped viruses

Observe the specifications of the surface disinfectant manufacturers.

Other surface disinfectants are used at one's own risk.

Class of active ingredient	Surface disinfectant	Manufacturer
Chlorine-releasing agents	Actichlor plus	Ecolab
	BruTab 6S	Brulin
	Clorox Professional Disinfecting Bleach Cleaner	Clorox
	Dispatch Hospital Cleaner Disinfectant Towels with Bleach	
	Klorsept 17	Medentech
Oxygen-releasing agents	Descogen Liquid	Antiseptica
	Descogen Liquid r.f.u.	
	Dismozon plus	Bode Chemie
	Dismozon pur	
	Oxycide	Ecolab USA
	Perform	Schülke & Mayr
	Virkon	DuPont
Quaternary ammonium compounds	Mikrozid sensitive liquid[1)]	Schülke & Mayr
	Mikrozid sensitive wipes[1)]	
	Mikrozid alcohol free liquid[1)]	
	Mikrozid alcohol free wipes[1)]	
	Acryl-des[1)]	
Aldehydes	Buraton 10 F	Schülke & Mayr

1) Virucidal against enveloped viruses

Dräger states that oxygen-releasing agents and chlorine-releasing agents may cause color change in some materials. Color change does not indicate that the product is not functioning correctly.

Classifications for reprocessing

Classification of medical devices

Medical devices and their components are classified according to the way they are used and the resulting risk.

Classification	Explanation
Non-critical	Components that come only into contact with skin that is intact
Semi-critical (A, B)	Components that carry breathing gas or come into contact with mucous membranes or pathologically altered skin
Critical (A, B, C)	Components that penetrate skin or mucous membranes or come into contact with blood

Classification of device-specific components

Observe the instructions for use for the components.

The following classification is a recommendation from Dräger.

Non-critical

– PS250

– P2500

Semi-critical A

– None

Semi-critical B

– None

Critical

– None

Reprocessing list

Components	Disinfection with cleaning	Manual cleaning followed by disinfection by immersion	Machine cleaning with thermal disinfection	Steam sterilization	Special reprocessing measures
PS250	Yes	N/A	N/A	N/A	N/A
P2500	Yes	N/A	N/A	N/A	N/A

Reprocessing procedures

Validated reprocessing procedures

The effectiveness of the listed reprocessing procedures has been validated by independent laboratories that are certified to the standard ISO 17025.

At the time of validation, the following reprocessing procedures showed good material compatibility and effectiveness:

Procedure	Agent	Manufacturer	Concentration	Contact time	Temperature
Surface disinfection with cleaning	Buraton 10 F	Schülke & Mayr	1%	30 min	N/A
	Dismozon	BODE Chemie	1.5%	15 min	N/A

Surface disinfection with cleaning

WARNING
Risk of electric shock and device malfunction

Penetrating liquid may cause the following:

- Damage to the device
- Electric shock when switching on the device
- Device malfunctions

Ensure that no liquid penetrates the device.

1 Remove soiling immediately. Use a cloth dampened with cleaning agent to remove soiling.

2 Disinfect the surface.

3 After the product has been exposed to the disinfectant for the specified contact time, remove residual disinfectant.

4 Wipe with a cloth dampened with water (preferably drinking-water quality). Allow the product to dry.

5 Check the product for visible soiling. Repeat steps one through four if necessary.

6 Check the product for visible damage and replace if necessary.

After Reprocessing

Preparations before re-use

1 Assemble and prepare the device so that it is ready for use, see "Assembly and preparation" in the appropriate IFU:

- *Instructions for use Infinity Acute Care System Monitoring Applications Software VG7.1 or higher*
- *Instructions for use Infinity Acute Care System Infinity M540 patient monitor Software VG7.1 or higher*

2 To check the operational readiness, see "Getting started" in the appropriate IFU.

This page has been left blank intentionally.

Disposal

EU Directive 2002/96/EC (WEEE)

This device is subject to EU Directive 2002/96/EC (WEEE). In order to comply with its registration according to this directive, this device may not be disposed of at municipal collection points for waste electrical and electronic equipment. Dräger has authorized a company to collect and dispose of this device.

To initiate collection or for further information, contact the local Dräger organization.

This page has been left blank intentionally.

Technical data

Overview

This chapter contains the technical data for the following devices of the Infinity Acute Care System – Monitoring applications:

- PS250 power supply
- P2500 power supply
- Minimal technical requirements for the secondary display
- Infinity MCable – Nurse call

For technical data of the Infinity C500/C700 refer to instructions for use *Infinity Medical Cockpit*.

For the following information, refer to the instructions for use *Infinity Acute Care System – Infinity M540*:

- Infinity M500 docking station
- MPod and MCable devices that connect directly to the M540
- Specifications such as measuring ranges of individual parameters

The IACS is intended to be connected to one patient at a time.

Device combinations

This device can be operated in combination with other Dräger devices or with devices from other manufacturers. Observe the accompanying documents of the individual devices.

If a device combination is not approved by Dräger, the safety and the functional integrity of the individual devices can be compromised. The operating organization must ensure that the device combination complies with the applicable editions of the relevant standards for medical devices.

Device combinations approved by Dräger meet the requirements of the following standards:

- IEC 60601-1, 3rd edition (general requirements for safety, device combinations, software-controlled functions)
  - IEC 60601-1-2 (electromagnetic compatibility)
  - IEC 60601-1-8 (alarm systems)

Or:

- IEC 60601-1, 2nd edition (general requirements for safety)
  - IEC 60601-1-1 (device combinations)
  - IEC 60601-1-2 (electromagnetic compatibility)
  - IEC 60601-1-4 (software-controlled functions)
  - IEC 60601-1-8 (alarm systems)

If a device combination is not approved by Dräger, functional integrity of the devices can be compromised.

The operating organization must ensure that the device combination meets the applicable standards.

Strictly observe instructions for use and assembly instructions of all connected devices.

CAUTION

Combinations of Dräger devices and third-party devices that are not approved by Dräger may adversely affect operation of those devices and may put the patient at greater risk of injury.

CAUTION
The medical device must only be used with software that is tested and approved by Dräger. Any modifications of the operating system settings can impair operating safety. Responsibility for any such modifications lies with the operating organization.

Infinity PS250 power supply

Physical specifications	
Dimensions (W x D x H)	27.76 x 11.68 x 34.59 cm (10.93 x 4.60 x 13.62 in)
Weight	5.5 kg (12 lbs)
Cooling	Convection
Connections	– AC power – RS232 – Alarm output – System cable – Infinity network (Ethernet) – Potential equalization connector
Environmental specifications	
Humidity (non-condensing)	Operating: 20 to 95% Storage/Transport: 20 to 95%
Temperature	Operating: 0 to 40°C (32 to 104°F) Storage: –20 to +60°C (–4 to +140°F) The PS250 has an operating temperature range of 0 to 40°C (32 to 104°F). When the battery is being charged at ambient temperatures below 5°C (41°F), the yellow LED on the PS250 may light up.
Ambient pressure	Operating: 485 to 795 mmHg (70 to 106 kPa) Storage: 375 to 795 mmHg (50 to 106 kPa)
Protection against ingress of water	IPX1 according to IEC 60529 – protected against harmful effects of dripping water when mounted vertically with the connectors facing down.

Electrical specifications	
Electrical protection	Class 1
Input voltage	100 to 240 V AC (50/60 Hz)
Input current	3.0 to 1.3 A
Mode of operation	Continuous
Batteries	Dräger NiMH battery pack Operating time: approximately 5 min Recharging time: 8 hours
DC output	+24 V nominal, SELV according to IEC 60601-1

Infinity P2500

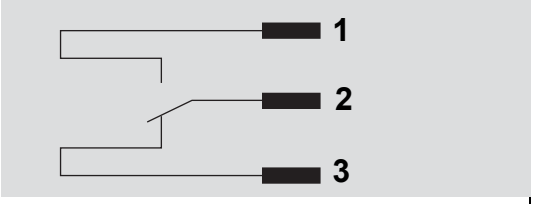
Physical specifications	
Dimensions (W x D x H)	218 mm x 150 mm x 348 mm (8.6 in x 5.9 in x 13.7 in)
Weight	10 kg (22 lbs)
Cooling	Natural convection (no cooling fan)
Connections	– Nurse call – System cable (quantity of 2) – Ethernet (quantity of 2) – RS232 (modular jack) – Potential equalization connector (optional)
Environmental specifications	
Humidity (non-condensing)	Operating: 10% to 95% Storage/Transport: 5% to 95%
Temperature	Operating: 0 °C to 40 °C (32 °F to 104 °F) Storage: –20 °C to 60 °C (–4 °F to 140 °F)
Atmospheric pressure	Operating: 485 to 795 mmHg (647 hPa to 1060 hPa) Storage: 375 to 795 mmHg (500 hPa to 1060 hPa)
Protection against ingress of water	IPX1 according to IEC 60529 – protected against harmful effects of dripping water when mounted vertically with the connectors facing down
Electrical specifications	
Input voltage	100 to 240 V AC (50 to 60 Hz)
Input current	4 A
Mode of operation	Continuous
Batteries	Rechargeable lead acid batteries Operating time: approximately 5 minutes @ 250 W Recharging time: maximum 12 hours
DC output	– 250 W (TOTAL of two system cable output) – +28 V DC (when powered by AC mains power supply) – +24 V DC (when powered by fully charged batteries) – SELV according to IEC60601-1.

LEDs	– Green LED (device is connected to AC power).
	– Yellow LED (briefly during startup)
	– The battery/charging failure indicator lights up yellow under the following circumstances:
	  – Battery failure (battery depleted, battery not connected, battery fault), or
	  – Battery charging error, or battery temperature issue
	The Cockpit LEDs on the front light up for a few seconds when the Infinity P2500 is connected to AC mains after it has been disconnected for an interval to indicate that the LED is working properly.

Automatic shutdown	– Overload limit (the device shuts down)
	– Power overload: exceed 285 W (at system connector)
	– Current overload: exceed 14 A (short circuit protected)
	– Output voltage: exceed 32V
	– Temperature:
	  – internal temperature exceeds 75°C (167 °F)
	  – battery temperature exceeds 50 °C (122°F) when battery is in charging status after 1 minute.

Electrical protection	Class 1
Inrush current	37 A

Infinity MCable – Nurse call

Physical attributes	
Connections	Connects to the PS250 / P2500 Connection via cable 8417370 only
Cable signals during non-alarm state	 Cable 1 (NO normally open): white Cable 2 (COM common): brown Cable 3 (NC normally closed): green
Mode of operation	Continuous
Power requirements	
Input voltage	24 V DC maximum
Input current	1 A DC maximum
Switching capacity	15 W maximum
Protection against electric shock	Three contacts from the open cable have a galvanic isolation of 1.5 k V AC
Environmental requirements	
Operation	
Temperature	5 to 55 °C (41 to 131 °F)
Relative humidity	5 to 95%, non-condensing
Ambient pressure	375 to 825 mmHg (50 to 110 kPa)
Storage	
Temperature range	–20 to +60 °C (–4 °F to +140 °F)
Relative humidity	5 to 95%, non-condensing
Ambient pressure	375 to 825 mmHg (50 to 110 kPa)

Infinity R50N

Physical attributes	
Size (H x W x D)	180 x 120 x 222 mm (7.1 x 4.7 x 8.7 in)
Weight	1.6 kg (3.6 lbs)
Connections	AC power X14 Infinity network connector Potential equalization connector
Cooling	Convection
Power requirements	
Input voltage	100 to 240 V AC (50/60 Hz, 1 A)
Risk management	
Protection class	Class 1
Protection against liquid ingress	IPX0 according to IEC 60529.
Mode of operation	Continuous
Environmental requirements	
Operation	
Temperature	15 to 40 °C (59 to 104 °F)
Relative humidity	10 to 95%, non-condensing
Ambient pressure	550 to 775 mmHg (73 to 103 kPa)
Storage	
Temperature range	–20 to +40 °C (–4 to +104 °F)
Relative humidity	10 to 95%, non-condensing without packaging
Ambient pressure	375 to 795 mmHg (50 to 106 kPa)

Sound pressure

Sound pressure levels for IEC alarm tones Measurements per ISO 3744, 5 to 100% volume setting			
Device	**Low priority**	**Medium priority**	**High priority**
C500 (1st generation)	50 dB(A) to 68 dB(A)	53 dB(A) to 69 dB(A)	55 dB(A) to 71 dB(A)
C700 (1st generation)	53 dB(A) to 70 dB(A)	54 dB(A) to 71 dB(A)	55 dB(A) to 73 dB(A)
C500 (2nd generation)	50 dB(A) to 68 dB(A)	55 dB(A) to 73 dB(A)	56 dB(A) to 74 dB(A)
C700 (2nd generation)	48 dB(A) to 69 dB(A)	52 dB(A) to 73 dB(A)	53 dB(A) to 74 dB(A)
C500 (3rd generation)	59 dB(A) to 79 dB(A)	60 dB(A) to 80 dB(A)	61 dB(A) to 81 dB(A)
C700 (3rd generation)	57 dB(A) to 80 dB(A)	58 dB(A) to 80 dB(A)	59 dB(A) to 81 dB(A)

Secondary display

A secondary display has to meet the minimum technical specifications outlined in the following table.

Starting with IACS VG5.0, the maximum resolution of the secondary display must meet the requirements provided in the table. For information on how to connect a secondary display to the IACS, see page 59.

General requirements	
Resolution	50.8 cm (20 in) display: 1680 x 1050 (2nd-generation C700) 43.2 cm (17 in) display: 1440 x 900 (2nd-generation C500) 54.6 cm (21.5 in) display: 1920 x 1080 (3rd-generation C700) 43.9 cm (17.3 in) display: 1920 x 1080 (3rd-generation C500)
Maximum supported distance	5 m (16.4 ft)
Aspect ratio	16:10 (1st and 2nd generation)
Display delay	250 ms in reference to the patient signal
Connection to Cockpit	DVI-I 1 connector (1st and 2nd generation only) DisplayPort connector (3rd generation only)
Standards compliance	IEC60950

Electromagnetic compatibility

The separation distances are written with regard to the Cockpit. The numbers provided will not guarantee faultless operation but should provide reasonable assurance of such. This information may not be applicable to other medical electrical equipment, and older equipment may be particularly susceptible to interference.

General notes

Medical electrical equipment needs special precautions regarding electromagnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in this manual.

Portable and mobile RF communications equipment can affect medical electrical equipment.

Cables and accessories not specified within the instructions for use are not authorized. Using other cables and/or accessories may adversely impact safety, performance and electromagnetic compatibility (increased emission and decreased immunity).

CAUTION

The equipment should not be used adjacent to or stacked with other equipment; if adjacent or stacked use is inevitable, the equipment should be observed to verify normal operation in the configuration in which it will be used.

Low level signals such as ECG are particularly susceptible to interference from electromagnetic energy. While the equipment meets the testing described below, it is not a guarantee of perfect operation, the ‘quieter’ the electrical environment the better. In general, increasing the distance between electrical devices decreases the likelihood of interference.

NOTE

The equipment is intended for use in the electromagnetic environments specified below. The user of this equipment should assure that is used in such an environment.

Electromagnetic emissions		
Emissions	**Compliance according to...**	**Electromagnetic environment**
RF emissions (CISPR 11)	Group 1	The equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.

Electromagnetic emissions		
Emissions	**Compliance according to...**	**Electromagnetic environment**
CISPR Emissions Classification	Class A	The equipment is suitable for use in industrial areas and hospitals (CISPR 11 Class A). If it is used in a residential environment (for which CISPR 11 Class B is normally required) this equipment might not offer adequate protection to radio frequency communication services. The user might need to take mitigation measures such as relocating or reorienting the equipment.
Harmonic emissions (IEC 61000-3-2)	Class A	
Voltage fluctuations / flicker (IEC 61000-3-3)	Complies	

Electromagnetic immunity			
Immunity against...	**IEC 60601-1-2 test level**	**Compliance level (of device)**	**Electromagnetic environment**
Electrostatic discharge, ESD (IEC 61000-4-2)	Contact discharge: ±6 kV Air discharge: ±8 kV	±6 kV ±8 kV	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transients / bursts (IEC 61000-4-4)	PS250 / P2500 lines: ±2 kV Longer input / output lines: ± 1 kV	±2 kV ±1 kV	Mains power quality should be of a typical commercial or hospital environment.
Surges on AC mains lines (IEC 61000-4-5)	Common mode: ±2 kV Differential mode: ±1 kV	±2 kV ±1 kV	Mains power quality should be a typical commercial or hospital environment.
Power frequency magnetic field 50/60 Hz (IEC 61000-4-8)	3 A/m	3 A/m	Equipment emitting high levels of power line magnetic fields (in excess of 3A/m) should be kept at a distance to reduce likelihood of interference.

Electromagnetic immunity			
Immunity against...	**IEC 60601-1-2 test level**	**Compliance level (of device)**	**Electromagnetic environment**
Voltage dips and short interruptions on AC mains input lines (IEC 61000-4-11)	Dip >95%, 0.5 periods Dip 60%, 5 periods Dip 30%, 25 periods Dip >95%, 5 seconds	>95%, 0.5 periods 60%, 5 periods 30%, 25 periods >95%, 5 seconds	Mains power should be a typical commercial or hospital environment. If user requires continued operation during power mains interruptions, ensure batteries are installed and charged. Ensure battery life exceeds longest anticipated power supply failures or provide additional uninterruptible power supply.
Conducted RF RF coupled into lines (IEC 61000-4-6) Radiated RF (IEC 61000-4-3)	150 kHz to 80 MHz 80 MHz to 2.5 GHz	3 Vrms 3 V/m [*V*1] V [*E*1] V/m	Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter as below. Recommended separation distance $d = \left[\frac{3.5}{V_1}\right]\sqrt{P}$ $d = \left[\frac{3.5}{E_1}\right]\sqrt{P}$ 80 MHz to 800 MHz $d = \left[\frac{7}{E_1}\right]\sqrt{P}$ 800 MHz to 2.5 GHz where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range. Interference may occur in the vicinity of equipment marked with the following symbol:

Electromagnetic immunity			
Immunity against...	**IEC 60601-1-2 test level**	**Compliance level (of device)**	**Electromagnetic environment**
a) Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the equipment. b) Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

Recommended separation distances			
Recommended separation distances between portable and mobile RF telecommunication devices and the Cockpit			
max. P_{EIRP} (W)	**150 kHz to 800 MHz Distance [1] (m)**	**800 MHz to 2.5 GHz Distance [1] (m)**	**Comments (if applicable)**
0.001	0.04	0.07	
0.003	0.06	0.12	
0.010	0.12	0.23	
0.040	0.21	0.4	For example: WLAN 5250
0.100	0.38	0.73	For example: WLAN 2440 (Europe), Bluetooth
0.200	0.54	1.03	For example: WLAN 5250 (Europe)
0.250	0.6	1.03	For example: DECT-devices
1.000	1.2	2.3	For example: GSM 1800 / GSM 1900 / UMTS cellular phones, WLAN 5600 (not in Europe)
2.000	1.7	3.25	For example: GSM 900 cellular phones
3.000	2.08	3.98	
10.00	3.8	7.27	
100.00	12	23	
[1] **NOTE**: Information regarding separation distances (IEC 60601-1-2:2007, tables 4 and 6)			

EMC declaration

General information

This device was tested for electromagnetic compatibility using accessories from the list of accessories. Other accessories may only be used if they do not compromise the electromagnetic compatibility. The use of non-compliant accessories may result in increased electromagnetic emissions or decreased electromagnetic immunity of the device.

This device may be used in the direct vicinity of other devices only if Dräger has approved this device arrangement. If no approval has been given by Dräger, it must be ensured that this device functions correctly in the desired arrangement before use. The instructions for use for the other devices must be followed.

Electromagnetic environment

Emissions	**Compliance**
Radiated emissions	Class A, group 1 (30 MHz to 1 GHz)
Conducted emissions	Class A, group 1 (150 kHz to 30 MHz)

NOTE

The emissions characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required), this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

Immunity against	**Test level and required electromagnetic environment**
Electrostatic discharge (ESD) (IEC 61000-4-2)	Contact discharge: ±8 kV
	Air discharge: ±15 kV
Fast transient electrical disturbances (bursts) (IEC 61000-4-4)	Power cable: ±2 kV
	Longer signal input lines/output lines: ±1 kV
Impulse voltages (surges) (IEC 61000-4-5)	Voltage, external conductor – external conductor: ±1 kV
	Voltage, external conductor – protective ground conductor: ±2 kV

Immunity against	**Test level and required electromagnetic environment**
Magnetic fields at mains frequency (IEC 61000-4-8)	30 A/m
Voltage dips and short interruptions in the supply voltage (IEC 61000-4-11)	100 % drop, 0.5 period 100 % dip, 1 period 30 % dip, 25/30 periods Voltage interruptions: 100 % drop, 5 seconds
Radiated high-frequency disturbances (IEC 61000-4-3)	80 MHz to 2.7 GHz: 3 V/m
Conducted high-frequency disturbances (IEC 61000-4-6)	150 kHz to 80 MHz: 3 Vrms, ISM bands: 6 Vrms
Electromagnetic fields in the vicinity of wireless communication devices	Various frequencies from 385 MHz to 5785 MHz: 9 V/m to 28 V/m, with various pulse modulations

Recommended separation distances from wireless communication devices

To ensure that the functional integrity of this device is maintained, there must be a separation distance of at least 1.0 m (3.3 ft) between this device and wireless communication devices.

This page has been left blank intentionally.

Index

Numerics

A

B

C

D

E

F

G

H

I

L

M

N

O

P

Q

R

S

T

U

V

W

X

Z

These instructions for use only apply to
Infinity® Acute Care System – Monitoring Applications – VG7.1
with the Serial No.:
If no Serial No. has been filled in by Dräger, these instructions for use are provided for general information only and are not intended for use with any specific machine or unit.
This document is provided for customer information only, and will not be updated or exchanged without customer requests.

CE 0123

Manufacturer

Draeger Medical Systems, Inc.
3135 Quarry Road
Telford, PA 18969-1042
U.S.A.
(215) 721-5400
(800) 4DRAGER
(800 437-2437)
FAX (215) 723-5935
http://www.draeger.com

EC REP In Europe, Middle East, Africa, Latin America, Asia Pacific distributed by

Drägerwerk AG & Co. KGaA
Moislinger Allee 53 - 55
D-23542 Lübeck
Germany
+49 451 8 82-0
FAX +49 451 8 82-20 80
http://www.draeger.com

3703497 – RI 01 en

Edition: 2 – 2020-05
(Edition: 1 – 2018-07)

Dräger reserves the right to make modifications to the equipment without prior notice.

3 7 0 3 4 9 7