GE Healthcare

Datex-Ohmeda S/5™ Anesthesia Monitor
Datex-Ohmeda S/5™ Critical Care Monitor

Technical Reference Manual

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

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

All specifications subject to change without notice.

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Intended purpose (Indications for use)

The Datex-Ohmeda S/5 Anesthesia Monitor with L-ANE07 or L-ANE07A software is intended for multiparameter patient monitoring with optional patient care documentation.

The S/5 Anesthesia Monitor with L-ANE07 and L-ANE07A software is indicated for monitoring of hemodynamic (including arrhythmia and ST-segment analysis), respiratory, ventilatory, gastrointestinal/regional perfusion, Entropy (State Entropy and Response Entropy) and neurophysiological status of all hospital patients.

When the BIS module is used with the S/5 Anesthesia Monitor with L-ANE07 and L-ANE07A, it is intended for use by personnel trained in its proper use. It is intended for use on adult and pediatric patients within a hospital or medical facility providing patient care to monitor the state of the brain by data acquisition of EEG signals. The Bispectral index (BIS), a processed EEG variable, and one component of the BIS module, may be used in adults as an aid in monitoring the effects of certain anesthetic agents. The Bispectral index is a complex technology, intended for use only as an adjunct to clinical judgement and training. In addition, the clinical utility, risk/benefit, and application of BIS have not undergone full evaluation in the pediatric population.

The S/5 Anesthesia Monitor with L-ANE07 and L-ANE07A software is also indicated for documenting patient care related information.

The S/5 Anesthesia Monitor with L-ANE07 and L-ANE07A software is indicated for use by qualified medical personnel only.

The Datex-Ohmeda S/5 Critical Care Monitor with L-ICU07 or L-ICU07A software is intended for multiparameter patient monitoring.

The S/5 Critical Care Monitor with L-ICU07 and L-ICU07A software is indicated for monitoring of hemodynamic (including arrhythmia and ST-segment analysis), respiratory, ventilatory, gastrointestinal/regional perfusion and neurophysiological status of all hospital patients.

When the BIS module is used with the S/5 Critical Care Monitor with L-ICU07 and L-ICU07A, it is intended for use by personnel trained in its proper use. It is intended for use on adult and pediatric patients within a hospital or medical facility providing patient care to monitor the state of the brain by data acquisition of EEG signals. The Bispectral index (BIS), a processed EEG variable, and one component of the BIS module, may be used in adults as an aid in monitoring the effects of certain anesthetic agents. The Bispectral index is a complex technology, intended for use only as an adjunct to clinical judgement and training. In addition, the clinical utility, risk/benefit, and application of BIS have not undergone full evaluation in the pediatric population.

The S/5 Critical Care Monitor with L-ICU07 and L-ICU07A software is indicated for use by qualified medical personnel only.

Classifications

In accordance with IEC 60601-1

Class I and internally powered equipment – the type of protection against electric shock.

Type BF or CF equipment. The degree of protection against electric shock is indicated by a symbol on each parameter module.

Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

Continuous operation according to the mode of operation.

In accordance with IEC 60529

With F-CU8 Central Unit: IPX0 - the degree of protection against harmful ingress of water.

With F-CU5(P) Central Unit: IPX1 - the degree of protection against harmful ingress of water.

In accordance with EU Medical Device Directive

The Datex-Ohmeda S/5 Anesthesia Monitor is classified as IIb.

The Datex-Ohmeda S/5 Critical Care Monitor is classified as IIb.

In accordance with CISPR 11:

Group 1, Class A

- Group 1 contains all ISM (industrial, scientific and medical) equipment in which there is intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.
- Class A equipment is suitable for use in all establishments other than domestic and those directly connected the public low voltage power supply network which supplies buildings used for domestic purposes.

Responsibility of the manufacturer

GE Healthcare Finland Oy (GE) is responsible for the effects on safety, reliability and performance of the equipment only if:

- assembly, extensions, readjustments, modifications, servicing and repairs are carried out by personnel authorized by GE.
- the electrical installation of the monitor room complies with appropriate requirements.
- the equipment is used in accordance with the "User's Guide" and serviced and maintained in accordance with the “Technical Reference Manual”.

Trademarks

Masimo SET

Product availability

Some of the products mentioned in this manual may not be available in all countries.

Please, consult your local representative for the availability.

Datex-Ohmeda S/5™ Anesthesia and Critical Care Monitors
Technical Reference Manual, Order code: M1162897

1st edition

Part I, General Service Guide

Document No.	Updated	Description	
M1137263-004		Introduction, System description, Installation, Interfacing, Functional check, General troubleshooting	**1**
M1125633-006		Planned Maintenance Instructions	**2**

Part II, Product Service Guide

Document No.	Updated	Description	
M1137266 - 002		Service Menu, L-ANE07(A), L-ICU07(A)	**1**
M1125635 - 005		8-Module Frame, F-CU8	**2**
M1125636 - 005		5-Module Frame, F-CU5(P)	**3**
M1125637 - 004		CPU Board, B-CPU6	**4**
M1137269 - 002		UPINET Board, B-UPI4NET	**5**
M1137272 - 002		Displays and Display Controller Boards	**6**
M1125639 - 003		Command Bars	**7**
M1125641 - 003		Extension Frame, F-EXT, Extension Module, E-EXT	**8**
M1137274 - 001		AM, CCM Spare Parts	**9**

Table of contents

Table of contents i

Table of figures iv

List of tables v

About this manual 1

1 Introduction 3

1.1 Symbols . . . 4
1.1.1 Symbols on transport packaging . . . 4
1.1.2 Symbols on equipment . . . 5
1.1.3 Equipment safety symbols . . . 6
1.1.4 Other symbols . . . 7
1.2 Safety . . . 11
1.2.1 Safety precautions . . . 11
1.2.2 ESD precautionary procedures . . . 15
1.2.3 Disposal . . . 15

2 System description 17

2.1 Introduction . . . 17
2.2 Bus structure . . . 17
2.3 Distributed processing . . . 18
2.4 Module communication . . . 18
2.5 Software loading . . . 19
2.6 Parameter modules . . . 20

3 System installation 21

3.1 Unpacking instructions . . . 21
3.2 Choosing location . . . 21
3.3 Central Unit; S/5 8-Module Frame, F-CU8 . . . 22
3.3.1 Connecting to mains . . . 22
3.3.2 Connecting to the Datex-Ohmeda Network . . . 22
3.3.3 Inserting the parameter modules . . . 23
3.3.4 E-PSM(P) Mounting Accessories . . . 24
3.3.5 Positioning PC boards . . . 26
3.3.6 Replacing PC boards . . . 27
3.3.7 Performing Factory Reset . . . 28
3.4 Central Unit; S/5 5-Module Frame, F-CU5 . . . 28
3.4.1 Mounting the Frame . . . 29
3.4.2 Connecting to mains . . . 30
3.4.3 Connecting to the Datex-Ohmeda Network . . . 30
3.4.4 Inserting the parameter modules . . . 31
3.4.5 Positioning PC boards . . . 32
3.4.6 Replacing PC boards . . . 33

3.4.7 Performing Factory Reset . . . 33
3.5 Displays . . . 34
3.5.1 Main displays . . . 34
3.5.2 Secondary displays . . . 34
3.5.3 3rd display . . . 34
3.5.4 Display installation . . . 34
3.5.5 15" Flat Panel Display, D-FPD15 . . . 35
3.5.6 12" LCD Display, D-LCC12A . . . 36
3.5.7 19" medical grade display . . . 37
3.6 Display controller boards . . . 38
3.6.1 Jumper settings . . . 38
3.6.2 Resolution selection for optional B-DISPX . . . 39
3.6.3 Resolution selection for primary display . . . 39
3.7 S/5 Remote Controller, K-REMCO . . . 39
3.8 S/5 Airway Modules . . . 40
3.8.1 S/5 Compact Airway Modules, E-xxxx . . . 40
3.8.2 Sample gas exhaust . . . 40
3.9 Record Keeping Keyboard for Anesthesia, K-ARKB . . . 42
3.9.1 Connection to Central Unit . . . 42
3.9.2 Connection to LCD Display, D-LCC12A . . . 42
3.10 ARK Barcode Reader, N-SCAN (optional) . . . 43
3.10.1 Connection to Central Unit/LCD Display or D-LCC12A . . . 43
3.11 S/5 Extension Frame, F-EXT4, with F-CU8 only . . . 44
3.11.1 Mounting of Extension Frame, F-EXT4 . . . 45
3.11.2 Connection to Central Unit . . . 45
3.11.3 Inserting the parameter modules . . . 45
3.11.4 Troubleshooting . . . 45

4 Interfacing 47

4.1 Interfacing external monitors via Interface Module, E-INT . . . 47
4.1.1 Connection to external Datex-Ohmeda monitors . . . 48
4.1.2 Connection to Critikon Dinamap 1846SX, Abbott Oximetrix 3 and Baxter Explorer . . . 49
4.1.3 Connection to Baxter Vigilance . . . 49
4.1.4 Connection to Nellcor N-100 and N-1000 . . . 49
4.1.5 Connection to Nellcor N-200 . . . 49
4.2 Interfacing external bedside devices via Device Interfacing Solutions, N-DISxxx . . . 51
4.2.1 Device Interfacing Solution components . . . 52
4.2.2 Connections . . . 52
4.2.3 Mounting . . . 53
4.2.4 Selecting the external device . . . 54
4.2.5 Functional check . . . 55
4.2.6 Selecting the parameter data source . . . 55
4.3 Interfacing Datex-Ohmeda Anesthesia Delivery Unit . . . 56
4.3.1 Interconnection . . . 56
4.3.2 Setting interfacing parameters on the S/5 Anesthesia Delivery Unit . . . 56
4.3.3 Setting interfacing parameters on the S/5 Anesthesia Monitor . . . 56
4.4 Interfacing Dräger Cicero, Cato, Julian and Narkomed 2C (by NAD) . . . 57
4.4.1 Interconnection . . . 58

4.4.2 Setting communication parameters . . . 58
4.4.3 Setting interfacing parameters on the S/5 Anesthesia Monitor or S/5 Critical Care Monitor . . . 58
4.5 Interfacing printer . . . 60
4.5.1 Interconnection . . . 60
4.5.2 Setting interfacing parameters on the printer . . . 60
4.5.3 Setting interfacing parameters on the S/5 Anesthesia Monitor or S/5 Critical Care Monitor . . . 60
4.6 Interfacing computer . . . 60
4.7 Output signals . . . 61
4.7.1 UPI4NET Board output signals . . . 61
4.7.2 Digital outputs . . . 61
4.7.3 Analog outputs . . . 62
4.7.4 S/5 Pressure Temp Module, E-PT, output signals . . . 62

5 Functional check 63
5.1 Recommended tools . . . 63
5.1.1 Hemodynamic patient simulators . . . 65
5.2 Visual inspection . . . 65
5.3 Functional inspection . . . 66
5.3.1 General . . . 66
5.3.2 Display(s) . . . 67
5.3.3 Keyboard(s) . . . 67
5.3.4 5-Module Central Unit, F-CU5/ 8-Module Central Unit, F-CU8 . . . 68
5.3.5 Extension Frame, F-EXT4 . . . 68
5.3.6 Compact Airway Module, E-CXXXXX . . . 68
5.3.7 Single width Airway Module, E-miniC . . . 69
5.3.8 Multiparameter Hemodynamic Modules . . . 69
5.3.9 Pressure/Pressure Temp Modules, E-P, E-PT . . . 70
5.3.10 Dual pressure Module, E-PP . . . 70
5.3.11 Cardiac Output Modules, E-COP, E-COPSv . . . 70
5.3.12 Masimo Compatible Saturation module, E-MASIMO . . . 71
5.3.13 Nellcor Compatible Saturation module, E-NSATX . . . 71
5.3.14 BIS Module, E-BIS . . . 71
5.3.15 Entropy Module, E-ENTROPY . . . 71
5.3.16 Memory Module, E-MEM . . . 71
5.3.17 Recorder module . . . 72
5.3.18 Network connection . . . 72
5.3.19 Interface Module, E-INT . . . 72
5.3.20 Interface module for PSM, E-INTPSM . . . 72
5.3.21 Device Interfacing Solution, N-DISxxx . . . 72
5.3.22 General . . . 73

6 General troubleshooting 75
6.1 Software troubleshooting . . . 76

Appendix A: Functional check form, Datex-Ohmeda S/5 AM, CCM A-1

Appendix B: ElectroMagnetic Compatibility B-1

Table of figures

Figure 1 Datex-Ohmeda S/5 Anesthesia Monitor system 3
Figure 2 General bus structure of S/5 system 17
Figure 3 Distributed processing in S/5 system 18
Figure 4 Principle of UPI section operation 19
Figure 5 Software loading 19
Figure 6 General structure of parameter modules with patient isolation 20
Figure 7 Central Unit: S/5 8-Module Frame, F-CU8 22
Figure 8 Module insert 23
Figure 9 E-PSM(P) mounting accessories 24
Figure 10 Rear view and positioning, F-CU8 (-12 shown) 26
Figure 11 Service reset button 27
Figure 12 F-CU5 parts connected with cables 29
Figure 13 Two F-CU5s connected to one F-CPU 29
Figure 14 PC boards 32
Figure 15 Service reset button 33
Figure 16 Display options 34
Figure 17 Address dip switch settings, B-DISPX 38
Figure 18 Resolution dip switch settings, B-DISPX 39
Figure 19 Compact Airway Module, E-XXXX 40
Figure 20 Scavenging through ventilator reservoir 41
Figure 21 Connecting the gas module to the scavenging connector of S/5 Avance 41
Figure 22 Sample gas returned to patient circuit in ADU 42
Figure 23 Barcode Reader connected to LCD Display 43
Figure 24 N-SCAN Barcode Reader connection directly to the keyboard 44
Figure 25 S/5 Extension Frame, F-EXT4 44
Figure 26 Connection cables and LED indicators 53
Figure 27 An example of interfacing external devices with Device Interfacing Solution 54
Figure 28 S/5 AM, CCM general troubleshooting flowchart 75

List of tables

Table 1 Transference of parameters, Datex-Ohmeda monitors 48
Table 2 Transference of parameters, external monitors 48
Table 3 DIS modules and interfaced devices 51
Table 4 Parameters transferred from S/5 Anesthesia Monitor to S/5 Anesthesia Delivery Unit 56
Table 5 Events transferred from S/5 Anesthesia Delivery Unit to the S/5 Anesthesia Monitor 57
Table 6 Parameters transferred from Dräger Cicero monitor to S/5 Anesthesia Monitor or S/5 Critical Care Monitor 58
Table 7 Parameters transferred from Dräger Cato, Julian and Narkomed 2C (NAD) monitor to the S/5Anesthesia Monitor or S/5Critical Care Monitor 59
Table 8 Coding element connector, X4 61
Table 9 Defib & IABP sync connector, X7 (B-UPI4NET -02) and on the front of F-CPU 61
Table 10 Signal output connector pin assignments 62
Table 11 Patient simulators' compatibility with each hemodynamic module 65
Table 12 Adapter cables for hemodynamic patient simulators 65
Table 13 Guidance and manufacturer's declaration – electromagnetic emissions B-1
Table 14 Guidance and manufacturer's declaration – electromagnetic immunity B-2
Table 15 Guidance and manufacturer's declaration – electromagnetic immunity B-3
Table 16 Recommended separation distances between portable and mobile RF communications equipment and the S/5™ AM or CCM B-5

About this manual

Intended audience

This Technical reference manual is meant for service representatives and technical personnel who install, configure, maintain, administer, troubleshoot or repair *Datex-Ohmeda S/5 Anesthesia and Critical Care Monitors.*

Notes to the reader

As the monitor setup may vary, some functions described may not be available in the monitor you are using.

- The order code for the printed manual is M1162897. The manual includes Technical Reference Manual Slots and every slot has an individual document number. M1137263 is the document number of this first slot.
- Part I gives the reader an overview of the S/5 Anesthesia Monitor and S/5 Critical Care Monitor. It contains the information needed to install, interface and troubleshoot the monitors. Instructions for functional check and planned maintenance are also included. Read the manual through and make sure that you understand the procedures described before the installation of the monitor. To avoid risks concerning safety or health, strictly observe the warning indications. If you need any assistance concerning the installation, please do not hesitate to contact your authorized distributor.
- Part II contains detailed descriptions of each component of the S/5 AM, CCM Monitor, such as frame unit, parameter modules Remote Controller and Device Interfacing Solution. Service check for each product, service menus and all the spare parts information for the Monitor is included.

For information of parameter modules, Remote Controller and Device Interfacing Solution refer to the "S/5 E-Modules, Technical Reference Manual". Service check for each of these products is included in these slots.

The manufacturer reserves the right to change product specifications without prior notice. Although the information in this manual is believed to be accurate and reliable, the manufacturer assumes no responsibility for its use.

Installation and service are allowed by authorized service personnel only.

GE Healthcare Finland Oy (GE) assumes no responsibility for the use or reliability of its software in equipment that is not furnished by GE.

Related documentation

S/5 Modules

S/5 E-Modules, Technical Reference Manual

S/5 Anesthesia Monitor

For instructions for daily use including cleaning and daily maintenance, clinical aspects and basic methods of measurement see:
S/5 Anesthesia Monitor, User's Guide
S/5 Anesthesia Monitor, User's Reference Manual

S/5 Critical Care Monitor

For instructions for daily use including cleaning and daily maintenance, clinical aspects and basic methods of measurement:
S/5 Critical Care Monitor, User's Guide
S/5 Critical Care Monitor, User's Reference Manual

For more information about the iCentral, S/5 Arrhythmia Workstation and anesthesia record keeping solution, see the "Technical Reference Manuals" and "User's Reference Manuals" for these products."

Software options and default settings are described in the "Default Configuration Worksheet" delivered with each monitor.

Available accessories are described in the "Supplies and Accessories" catalog delivered with each monitor.

Conventions used

To help you find and interpret information easily, the manual uses consistent text formats:

Sign the check form after performing the procedure.

Hard Keys	Names of the hard keys on the Remote Controller, Command Bar and modules are written in the following way: **Others.**
Menu Items	Software terms that identify window parts or menu items are written in bold italic: ***ECG Setup.*** Menu access is described from top to bottom. For example, the selection of the **Monitor Setup** hard key, the ***Screen 1 Setup*** menu item and the ***Waveform Fields*** menu item would be shown as **Monitor Setup - *Screen 1 Setup - Waveform Fields***.
'Messages'	Messages (alarm messages, informative messages) displayed on the screen are written inside single quotes: 'Please wait'.
"Sections"	When referring to different sections in this manual or to other manuals, manual names and section names are enclosed in double quotes: See section "Cleaning and care." Please refer to "User's Reference Manual: Alarms."
Hypertext links	Hypertext links on PDF versions are written in blue color.
WARNING	Warnings are written in the following way:
WARNING	**This is a WARNING.**
CAUTION	Cautions are written in the following way:
CAUTION	This is a CAUTION.
NOTE	Notes are written in the following way:

NOTE: This is a NOTE.

In this manual, the word "select" means choosing and confirming.

Illustrations and names

All illustrations in this manual are only examples, and may not necessarily reflect your system settings or data displayed in your system. If a particular selection is not available in your system, the selection is shown grayed.

1 Introduction

The Datex-Ohmeda S/5 Anesthesia Monitor is a modular multiparameter patient monitor primarily used during anesthesia in operating rooms.

The Datex-Ohmeda S/5 Critical Care Monitor provides full patient profile throughout the care period.

The modular design makes the system flexible and easy to upgrade. In addition to parameter changes, the modularity includes an easy upgrade to anesthesia record keeping, monitor networking and interfacing with other external devices.

NOTE: Your system may not include all these components. Consult your local representative for the available components.

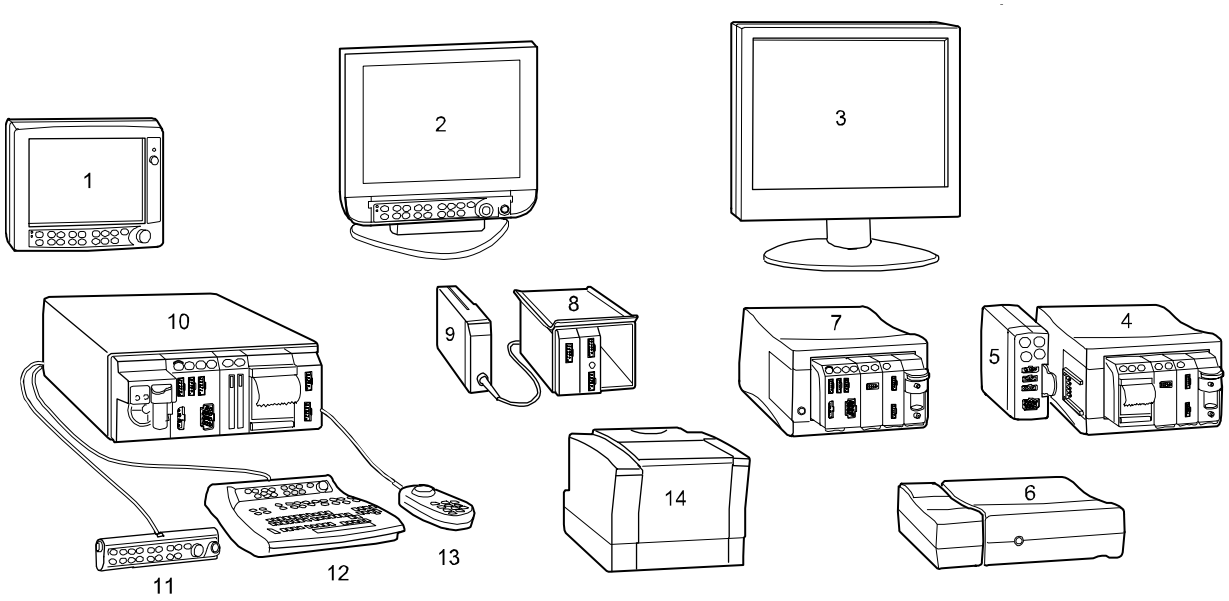


Figure 1 Datex-Ohmeda S/5 Anesthesia Monitor system

(1) 12" LCD display, D-LCC12A
(2) 15" LCD display, D-FPD15
(3) 19" medical grade display
(4) F-CU5P, 5-module frame unit with E-PSM(P) support, and measurement modules
(5) Patient Side Module, E-PSM(P)
(6) F-CPU, central processor unit for F-CU5(P), and N-AC, power unit
(7) F-CU5, 5-module frame unit, and measurement modules
(8) Extension Frame, F-EXT4
(9) Extension Module, E-EXT
(10) F-CU8, 8-module Central Unit, and measurement modules
(11) Detachable Command Bar to be used with displays not having an integrated Command Bar
(12) Anesthesia record keeping keyboard for automated record keeping
(13) Remote Controller, K-REMCO
(14) Printer

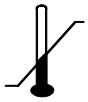
1.1 Symbols

1.1.1 Symbols on transport packaging

The contents of the transport package are fragile and must be handled with care.

Indicates the correct upright position of the transport package.

The transport package must be kept in a dry environment.



Indicates the temperature limitations within which the transport package should be stored.

This package can be recycled.

1.1.2 Symbols on equipment

Pb

The battery contains lead acid, and in the event of disposal must be separated from other waste according to local regulations.

Pb/Cd/Hg

The separate collection symbol is affixed to a battery, or its packaging, to advise you that the battery must be recycled or disposed of in accordance with local or country laws. The letters below the separate collection symbol indicate whether certain elements (Pb=Lead, Cd=Cadmium, Hg=Mercury) are contained in the battery. To minimize potential effects on the environment and human health, it is important that all marked batteries that you remove from the product are properly recycled or disposed. For information on how the battery may be safely removed from the device, please consult the technical or service manual, or equipment instructions. Information on the potential effects on the environment and human health of the substances used in batteries is available at this url: http://www.gehealthcare.com/euen/weee-recycling/index.html

Pb

This battery contains lead and can be recycled.

Dangerous voltage.

When using the ARK Barcode Reader, N-SCAN, do not stare into beam. The N-SCAN Barcode Reader is a Class 2 laser product.

1.1.3 Equipment safety symbols

- Attention, consult accompanying documents.
- When displayed next to the O_2 value, indicates that the FiO_2 low alarm limit is set below 21%.
- When displayed next to the HR value, indicates that the pacer is set on R.
- On the modules or frames indicates the following warning:

WARNING **Do not use modules with identical measurements in the same monitor. If such modules have been inserted, remove the module that has been most recently connected. You can also remove both modules and re-connect the new module after five seconds.**

- On the 15" Flat Panel Display, D-FPD15-00, indicates the following warning:

WARNING **The display must only be used together with the original type of D-FPD15 power adapter. The display should be supplied from the mains outlet.**

- On the 19" display, D-LCC19, indicates the following warning:

WARNING **The display must only be supplied from the mains outlet via an appropriate additional separating transformer and the original D-LCC19 power adapter, not from the Central Unit, F-CU8.**

- On the E-PRESTN, E-PRETN, E-RESTN, E-PSM, E-PSMP, E-P, E-PP, E-PT, E-COP and E-COPSv module indicates the following warning:

WARNING **Protection against cardiac defibrillator discharge is due in part to the accessories for pulse oximetry (SpO2), temperature (T) and invasive pressure (P) measurement.**

- On the E-NMT module indicates the following warnings:

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

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

WARNING **Never subject a patient with an implanted electronic device to electrical stimulation without consulting a medical specialist first.**

- On the rear or bottom panel this symbol indicates the following warnings and caution:

WARNING **Electric shock hazard. Do not open the cover or the back. Refer servicing to qualified service personnel.**

WARNING **Disconnect from the power supply before servicing.**

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

CAUTION For continued protection against fire hazard, replace the fuse only with one of the same type and rating.

- BIS: On the Aspect DSC indicates the following caution:

CAUTION The converter must not be opened for any reason or autoclaved.

- On the Interface Module E-INT indicates that it is for connecting external devices. Do not connect patient cables to the module.

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

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

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

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

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

ESD warning symbol for electrostatic sensitive devices. Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see section "1.2.2. ESD precautionary procedures".

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

1.1.4 Other symbols

Equipotentiality. Monitor can be connected to potential equalization conductor.

Alternating current

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

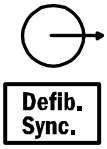
SN, S/N Serial Number

Connector for color display

Signal/power output

Signal/power input

Signal/power input/output



Connector for defibrillator synchronization

Connector for the S/5 Device Interfacing Solution, DIS

Power input

Signal input

Power input

Submenu. Selecting an alternative marked with this symbol in a menu opens a new menu.

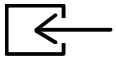
The monitor is connected to the Datex-Ohmeda Network (LAN).

Data Card (green) and/or Menu Card (white) is inserted.

Ethernet connector

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

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



Gas inlet

Gas outlet

Do not reuse.

Use by. Indicates the last use day.

Date of manufacturer

Does not contain Latex.

Do not immerse the sensor in liquids.

IPX class: Degree of protection against harmful ingress of water as detailed in the IEC 60529:

IPX0	- Ordinary equipment
IPX1	- Protection against vertically falling water drops.
IPX2	- Protection against vertically falling water drops when enclosure tilted
IPX3	up to 15 °.
IPX4	- Protected against spraying water.
IPX7	- Protected against splashing water.
IPX8	- Protected against the effects of temporary immersion in water. - Protected against the effects of continuous immersion in water.

This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

This symbol indicates the product contains hazardous materials in excess of the limits established by the Chinese standard SJ/T11364-2006 Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products. The number in the symbols is the Environment-friendly Use Period (EFUP), which indicates the period during which the toxic or hazardous substances or elements contained in electronic information products will not leak or mutate under normal conditions so that the use of such electronic information products will not result in any severe environmental pollution, any bodily injury or damage to any assets. The unit of the period is “Year”.

In order to maintain the declared EFUP, the product shall be operated normally according to the instructions and environmental conditions as defined in the product manual, and the periodic maintenance schedules specified in Product Maintenance Procedures shall be followed strictly.

Consumables or certain parts may have their own label with an EFUP value less than the product. Periodic replacement of those consumables or parts to maintain the declared EFUP shall be done in accordance with the Product Maintenance Procedures.

This product must not be disposed of as unsorted municipal waste, and must be collected separately and handled properly after decommissioning.

1.2 Safety

The following list contains general warnings and cautions you should know before installing, maintaining or servicing the system. Warnings and cautions specific to the use of the system can be found in the User's Guide and User's Reference Manual.

1.2.1 Safety precautions

Warnings

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

- The device is not able to withstand unpacked drops from a height of 1 m without damaging the module latches. If the device is dropped, please service the device before taking it back into use.

Power connection

- Always check that the power cord and plug are intact and undamaged.
- Do not use the power cord delivered with this product for any other product or purpose.
- Use only hospital-grade grounded power outlets and power cord. Do not remove the grounding pin from the power plug.
- Use only an intact power cord. Replace the power cord if it is cracked, frayed, broken or otherwise damaged.
- Do not apply tension to the power cord otherwise the cord may get damaged.
- Do not use an additional multiple socket outlet, extension cord or adapters of any kind.
- Before starting to use the system, ensure that the whole combination complies with the international standard IEC 60601-1-1 and with the requirements of the local authorities. Do not connect any external devices to the system other than those specified.
- When detaching Patient Side modules, be careful not to drop them. Always support with one hand while pulling out with the other.
- To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

Installation

- Keep the monitor horizontal when the Compact Airway Module is used. Tilting the monitor may cause erroneous results in the Compact Airway Module's readings and damage the module.
- The monitor or its components should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor and its components should be observed to verify normal operation in the configuration in which it will be used.
- Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see section "1.2.2. ESD precautionary procedures"
- After transferring or reinstalling the monitor, always check that it is properly connected and all parts are securely attached. Pay special attention to this in case of stacked mounting.
- Do not use the monitor in high electromagnetic fields (for example, during MRI.)
- Never install the monitor or the displays so that they are above the patient.

- A secondary display and printer must always be supplied from an additional transformer providing at least basic isolation (isolating or separating transformer.) Without an appropriate transformer the leakage current of the secondary display can be too high.
- A printer or computer must be supplied from an additional transformer providing at least basic isolation (isolating or separating transformer).
- If you accidentally drop the monitor, modules or frames, have them checked by authorized service personnel prior to clinical use.
- To avoid explosion hazard, do not use the monitor in presence of flammable anesthetics. The monitor measures only non-flammable anesthetics.
- Do not touch the patient, table, instruments, modules or the monitor during defibrillation.

Laser radiation

- When using the ARK Barcode Reader, N-SCAN, do not stare into the beam. The N-SCAN is a Class 2 laser product.

External connection

- Do not connect any external devices to the monitor other than those specified.

Explosion hazard

- To avoid explosion hazard do not use the monitor in the presence of flammable anesthetics.

Patient safety

- Do not perform any testing or maintenance on the monitor while it is being used on a patient.
- PACEMAKER PATIENTS: The impedance respiration measurement may cause rate changes in Minute Ventilation Rate Responsive Pacemakers. In this case, set the pacemaker rate responsive mode off or turn the monitor impedance respiration measurement off.
- Never install the monitor or the displays so that they are above the patient.
- The monitor must not be used without manufacturer approved mounting attached.
- Operation of the monitor outside the specified values may cause inaccurate results.

Autoclaving and sterilizing

- Do not autoclave any part of the system with steam or sterilize with ethylene oxide.

Cleaning and service

- Only trained personnel with proper tools and test equipment should perform the tests and repairs described in this manual. Unauthorized service may void the monitor warranty.
- Always unplug the monitor before cleaning or service. After cleaning or service ensure that every part of the monitor is dry before reconnecting it to the power supply.
- Do not touch any exposed wire or conductive surface while any cover is removed and the monitor is energized. The voltages present can cause injury or death.
- Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see section "1.2.2. ESD precautionary procedures".

- Electrostatic discharge through the PC boards may damage the components. Before handling PC boards, wear a static control wrist strap. Handle all PC boards by their non-conductive edges and use anti-static containers when transporting them.Do not break or bypass the patient isolation barrier when testing PC boards.
- Always perform an electrical safety check and a leakage current test on the monitor after service.
- Handle the water trap and its contents as you would any body fluid. Infectous hazard may be present.
- Do not immerse any part of the device in any liquid, or allow liquid to enter the monitor or modules.
- If liquid has accidentally entered the system or its parts, disconnect the power cord from the power supply and have the equipment serviced by authorized service personnel.
- Since calibration gas contains anesthetic agents, always ensure sufficient ventilation of the room during calibration.

Accessories

- Use only accessories, including mounts and batteries, and defibrillator-proof cables and invasive pressure transducers approved by GE Healthcare. For a list of approved supplies and accessories, see the "Supplies and Accessories" catalog delivered with the monitor. Other cables, batteries, transducers and accessories may cause a safety hazard, damage the equipment or the system, result in increased emissions or decreased immunity of the equipment or system or interfere with the measurement. Protection against cardiac defibrillator discharge is due in part to the accessories for pulse oximetry (SpO2), temperature (T) and invasive pressure (P) measurement.
- Single use accessories are not designed to be reused. Reuse may cause a risk of contamination and/or affect the measurement accuracy.

Special components

Special components are used in these monitors that are vital to assure reliability and safety. GE Healthcare assumes no responsibility for damage, if replacement components not approved by GE Healthcare are used.

Batteries

The battery packages in the central unit, F-CPU and in the power supply unit of F-CU8 contain lead acid (Pb) which is hazardous to the environment and therefore needs to be disposed of carefully according to local regulations.

Refresh the batteries completely every six months.

To replace the batteries safely, please refer to the service instructions in this manual.

- Do not short-circuit the battery terminals, this may produce a very high current, which will damage the battery.
- Do not dispose of the battery into open flame, nor put the battery near fire, as it may explode.
- Do not dismantle the battery. It contains electrolyte, which may damage clothing or cause injury to skin or eyes. If exposed to electrolyte, wash the injured area with plenty of clean water and contact a doctor.

See also section "Symbols".

Cautions

CAUTION A CAUTION indicates a condition that may lead to equipment damage or malfunction.

Installation

- Leave space for air circulation to prevent the monitor from overheating.
- Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.
- Before connecting the power cord to the power supply, check that the local voltage and frequency correspond with the rating stated on the device plate. See instructions for different displays in section “Displays”.
- Turn off the power before making any rear panel connections.

Before use

- Allow two minutes for warm-up and note any error messages or deviations from normal operation.
- Clean the rear panel fan dust filters once a month or whenever necessary.
- Do not connect a sampling line to the female Patient Spirometry connector while the other end of the sampling line is connected to the D-fend water trap. The pressure in the gas sampling system may cause damage to the PVX unit pressure transducers.

Fuse replacement

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

Cleaning and service

- Do not use hypochlorite-, acetone-, phenol- or ammonia -based cleaners, abrasive material or harsh chemicals as they may damage the surfaces of the device.
- Do not use abrasive cleaning compounds, instruments, brushes or rough-surface materials.
- Do not apply pressurized air to any outlet or tubing connected to the monitor. Pressure may destroy sensitive elements.
- Do not clean the spirometry tubes with high pressure air or O_2 flushing while the spirometry tubes are connected to Patient Spirometry connector. High differential pressure may damage PVX unit pressure transducers.

Special components

- A lithium battery on the CPU Board. Dispose of the faulty IC containing the battery according to local regulations.

Storage and transport

Do not store or transport the monitor outside the specified temperature, pressure and humidity ranges:

Temperature	-10...+50 °C/14...122 °F
Atmospheric pressure	660...1060 hPa/500...800 mmHg/660...1060 mbar
Relative humidity	10...90% noncondensing

For display specific environmental requirements see specifications in the “Display” slot.

1.2.2 ESD precautionary procedures

- To avoid electrostatic charges building up, it is recommended to store, maintain and use the equipment at a relative humidity of 30% or greater. Floors should be covered by ESD dissipative carpets or similar. Non-synthetic clothing should be used when working with the component.
- To prevent applying a possible electrostatic discharge to the ESD sensitive parts of the equipment, one should touch the metallic frame of the component or a large metal object located close to the equipment. When working with the equipment and specifically when the ESD sensitive parts of the equipment may be touched, a grounded wrist strap intended for use with ESD sensitive equipment should be worn. Refer to the documentation provided with the wrist straps for details of proper use.

ESD precautionary procedure training

It is recommended that all potential users receive an explanation of the ESD warning symbol and training in ESD precautionary procedures.

The minimum contents of an ESD precautionary procedure training should include an introduction to the physics of electrostatic charge, the voltage levels that can occur in normal practice and the damage that can be done to electronic components if they are touched by an operator who is electrostatically charged. Further, an explanation should be given of methods to prevent build-up of electrostatic charge and how and why to discharge one's body to earth or to the frame of the equipment or bond oneself by means of a wrist strap to the equipment or the earth prior to making a connection.

1.2.3 Disposal

Dispose of the whole device, parts of it and its packing material and manuals in accordance with local environmental and waste disposal regulations.

2 System description

2.1 Introduction

Datex-Ohmeda monitors build up a freely configurable modular system. The architecture is designed to enable different module combinations so that the user is able to get the desirable parameter and feature set. This modular approach makes it possible to add new features when they are needed.

2.2 Bus structure

The operation of Datex-Ohmeda monitors is based on two communication channels, the CPU bus and module bus.

In the 5-Module Central Unit, PC boards receive power from the F-CPU power supply and the parameter modules receive power from a separate power supply in the 5-Module Frame unit. These power supplies are both fed by the N-AC Power Unit. In the 8-Module Central Unit, F-CU8, all PC boards connected to the CPU bus, as well as the parameter modules attached to the module bus receive power from the same power supply, which is an integral part of the Central Unit, F-CU8.

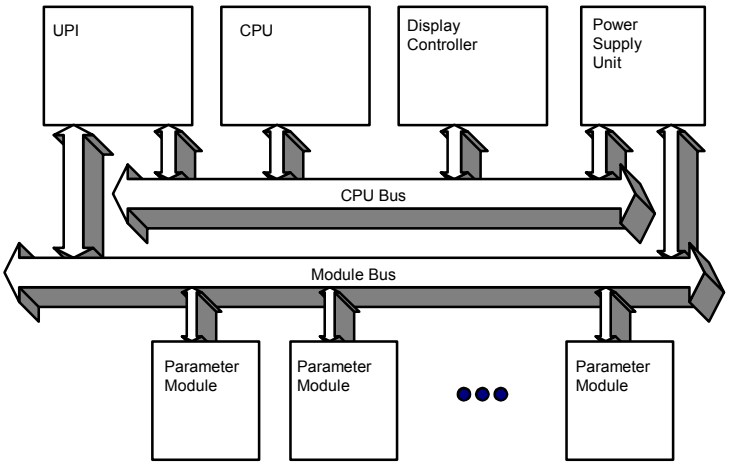


Figure 2 General bus structure of S/5 system

The CPU bus is a communication channel used only for internal data transfer. It is based on the ISA bus used in IBM PC computers. Data is transferred on this 16 bit wide bus using the CPU clock frequency.

The module bus is used to connect the parameter modules to the Central Unit. The bus is based on the industry standard RS-485, which uses a differential serial method to transfer data. This type of bus is robust and it allows parameter modules to be inserted or removed while the power is on. The module bus uses a 500 kbps data transfer rate and can be used for longer distances than the CPU bus, e.g. for external frame connections.

The RS-485 type of serial communication supports so-called multidrop or party line connections. This means that all parameter modules connected to the module bus use exactly the same lines for communication. The advantage of this is that all bus connectors are identical and the modules can be connected in any order and position.

2.3 Distributed processing

A system assembled from Datex-Ohmeda products is a multiprocessor system. All parameter modules have their own microprocessor, which performs functions such as module key control, waveform filtering, parameter related computing and pneumatic control, etc. At the same time the main CPU performs higher level tasks such as trending and alarm control. While the parameter modules and CPU are performing their tasks, the UPI (Universal Peripheral Interface) microprocessor handles all functions needed to transfer data between the parameter modules and the CPU. At the same time the Display controller microprocessor performs pixel calculations for graphics.

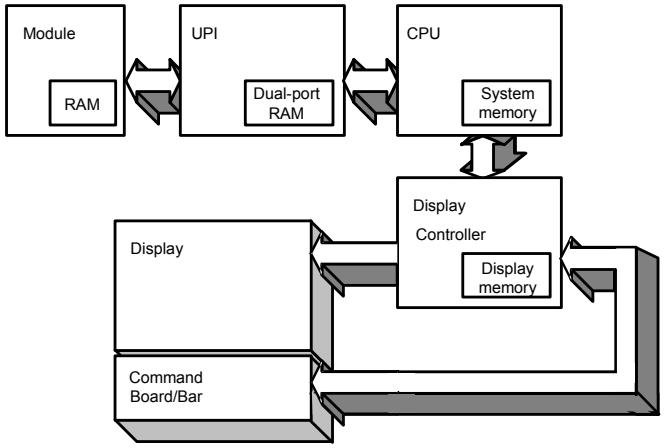


Figure 3 Distributed processing in S/5 system

This kind of parallel processing gives one major advantage to centralized processing. When new parameter modules or PC boards are added to the system, the processing power is increased. As a result, the system does not slow down when new features are added.

2.4 Module communication

The communication master controlling data transfers between the CPU and parameter modules is called UPI processor. It sends data to each connected module 100 times a second. Modules respond to each data request immediately by sending a data package, whose length depends on the type of the module. This communication protocol ensures that each module receives and sends data every 10 ms. If a module does not respond to data requests, the UPI processor presumes that the module is disconnected.

Parameter modules may hold a static (fixed) or dynamic address, which the UPI processor uses when sending out data. Two parameter modules of the same type must not be fitted onto the same monitor since they might reply to a data request simultaneously, thus causing communication errors.

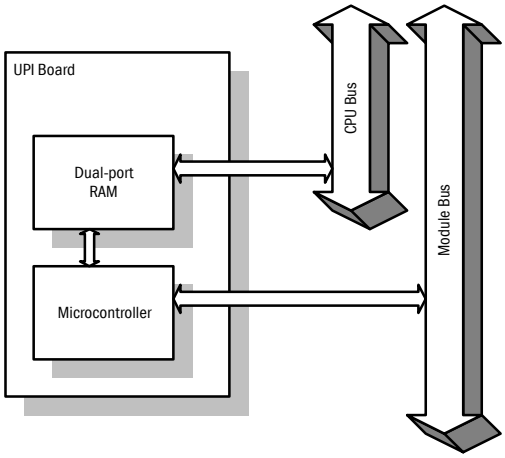


Figure 4 Principle of UPI section operation

The UPI processor collects and stores all data that is received from the parameter modules into a dual port RAM, which is mapped directly to the address space of the main CPU. The main CPU reads data from the memory while the UPI processor guarantees that the data is up to date. This operation also works in the other direction. In this the main CPU fills the dual port RAM with data and the UPI processor distributes it to the parameter modules.

2.5 Software loading

The program memory on the CPU board is loaded with monitor software at the factory. The software is used for running all the functions that are integrated into the PC board. For service and upgrade procedures,the B-CPU6 board is equipped with Ethernet LAN port through which new software can be loaded.

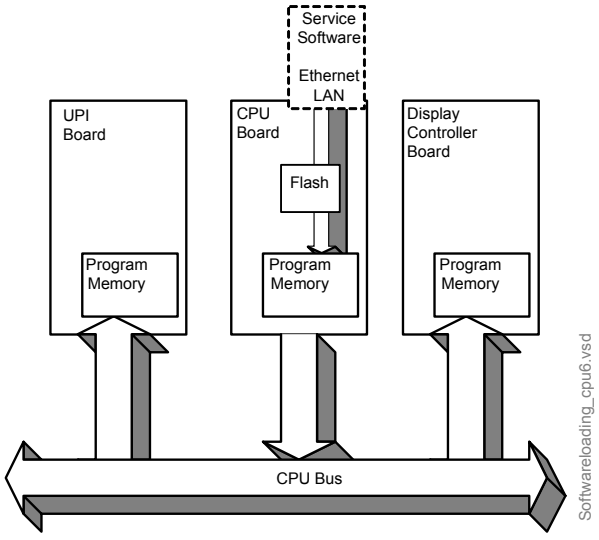


Figure 5 Software loading

2.6 Parameter modules

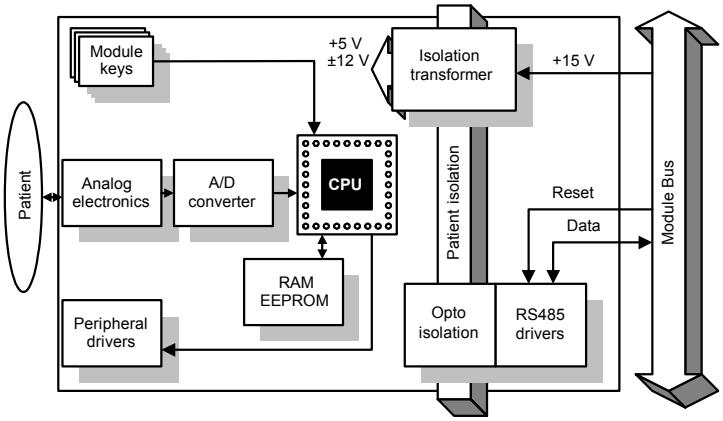


Figure 6 General structure of parameter modules with patient isolation

The detailed structure of a parameter module depends on the specific needs for each individual parameter. However, some common parts are used in the parameter modules. The electronics inside the module is usually divided into isolated (floating) and non-isolated sections. Typically, the non-isolated section consists of buffers to interface the parameter module to the module bus while the rest of the electronics is located in the isolated section. The isolated section includes the microcontroller together with memory components, the front-end analog electronics (amplifiers, etc.) and sensor drivers.

3 System installation

3.1 Unpacking instructions

1. Confirm that the packing box is undamaged. If the box is damaged, contact the shipper.
2. Open the top of the box and carefully unpack all components.
3. Confirm that all components are undamaged. If any of the components are damaged, contact the shipper.
4. Confirm that all components are included. If any of the components are missing, contact your GE Healthcare distributor.

3.2 Choosing location

Consider the following aspects:

- lighting
- space
- connections
- electromagnetic and radio frequency interference, see Appendix B. ElectroMagnetic Compatibility
- environment

The F-CU8 should be placed so that liquid is prevented from entering the casing.

WARNING **The monitor or its components should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor and its components should be observed to verify normal operation in the configuration in which it will be used.**

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

3.3 Central Unit; S/5 8-Module Frame, F-CU8

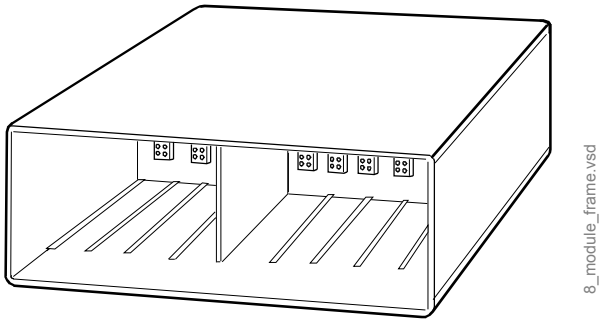


Figure 7 Central Unit: S/5 8-Module Frame, F-CU8

The front of the Central Unit, F-CU8, houses plug-in parameter modules which interface the system with external devices. The back of the Central Unit houses the system circuit boards, together with expansion slots which accommodate PC boards which interface with external devices and the Datex-Ohmeda Network.

3.3.1 Connecting to mains

Connect the power cord to the mains power inlet on the rear of the Central Unit and to the wall socket.

WARNING **The power cord may only be connected to a three-wire, grounded, hospital grade receptacle.**

3.3.2 Connecting to the Datex-Ohmeda Network

To connect the monitor to the Datex-Ohmeda Network, make sure a CPU Board, B-CPU6 is installed.

Use the Monitor-Network cable to connect the monitor to the network as follows:

1. Make sure that the power to the Central Unit is turned off.
2. Connect the RJ-45 network connector to the connector X10 on the CPU board, B-CPU6 and the Identification Plug to the corresponding connector on the B-UPI4NET.
3. Connect the other RJ-45 connector to the corresponding connector on the wall box.
4. Turn on the power to the Central Unit. Enter the ***Network*** service menu:

   Monitor Setup - ***Install/Service*** (password 16-4-34) -
   Service (password 26-23-8) -
   Frame – Network

5. Make sure that the monitor's network communication has been set according to the used network software:

   Network software S-CNET01 -> DRI Level = 2001
   Network software S-CNET02 -> DRI Level = 2001
   Network software L-NET03 -> DRI Level = 2003
   Network software L-NET05 -> DRI Level = 2005

   If necessary, change the monitor's network communication by selecting ***DRI Level*** and turning the ComWheel.

NOTE: If the DRI level is changed, the monitor will restart automatically.

6. Confirm that the network symbol and 'Connected to Network' message are displayed on the upper part of the screen.

3.3.3 Inserting the parameter modules

1. Ensure that the module is properly orientated (i.e. module release latch facing downward).
2. Align the module insertion guide slot with the frame insertion guide.
3. Push the module into the frame until it clicks.

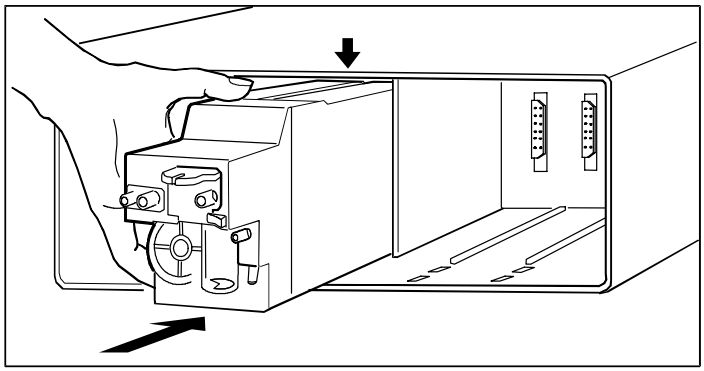


Figure 8 Module insert

NOTE: The Compact Airway Modules cannot be placed into the third and fourth slot from the right-hand side of the F-CU8 Central Unit.

NOTE: Use only one Extension Frame F-EXT4 in one F-CU8 Central Unit.

NOTE: Do not use two or more parameter modules with identical functions in the monitor system. Take special care not to do this when using the Extension Frame, F-EXT4.

- Hemodynamic multiparameter modules, E-PRESTN, E-PRETN, E-RESTN, E-PSM, E-PSMP, M-PRESTN, M-PRETN, M-RESTN, M-ESTPR, M-ETPR, M-ESTR, M-NESTPR, M-NETPR, M-NESTR, M-NE12STPR, M-NE12TPR, M-NE12STR
- Dual Pressure Modules, E-PP/M-PP
- Pressure Modules, E-P/ M-P, Pressure Temp Module, E-PT/ M-PT
- Cardiac Output Modules, E-COP, E-COPSv, M-COP and M-COPSv
- NIBP Modules, M-NIBP and hemodynamic modules w/ N measurement
- Airway Modules, E-CO, E-COV, E-COVX, E-CAiOVX, E-CAiOV, E-CAiO, E-miniC, M-C, M-CO, M-COV, M-CAiO, M-CAiOV, M-CAiOVX, G-O, G-OV, G-AO, G-AiO, G-AOV, G-AiOV, M-MiniC
- Interface Module, E-INT / M-INT and Interface Board, B-INT
- Oxygen Saturation Modules, E-MASIMO, E-NSATX/ E-NSAT/ M-NSAT and M-OSAT
- Tonometry Modules, E-TONO/ M-TONO
- NeuroMuscular Transmission Modules, E-NMT/ M-NMT
- EEG Modules, E-EEG/ M-EEG
- BIS Modules, E-BIS/ M-BIS

3.3.4 E-PSM(P) Mounting Accessories

Intended use

The Frame Mount for PSM and the Pole Mount for PSM, short and long, are intended to be used with the stationary docking station of the E-PSM(P) module. The Interface Module for PSM, E-INTPSM, is intended for connecting the Frame Mount and the Pole Mount to the Datex-Ohmeda S/5 F-CU8.

The Module Bus Adapter for PSM is intended for connecting the Pole Mount for PSM to the Datex-Ohmeda S/5 F-CU5 frame.

The Frame Mount for PSM can be attached directly to the F-CU8. The Pole Mount for PSM, short or long, can be attached to an IV pole or to an anesthesia machine rail with a diameter of 10mm* 25mm.

With Interface Module for PSM, E-INTPSM, the Frame Mount or the Pole Mount can be connected to the Datex-Ohmeda S/5 F-CU8 frame equipped with software license 04 or later. The E-PSM(P) module can be attached to the Frame Mount or Pole Mount and used like a Datex-Ohmeda S/5 modular module.

With Module Bus Adapter, the Pole Mount for PSM, short or long, can be connected to the Datex-Ohmeda S/5 F-CU5 frame. The E-PSM(P) module can be removed from the F-CU5 frame and docked to the Pole Mount for PSM, short or long.

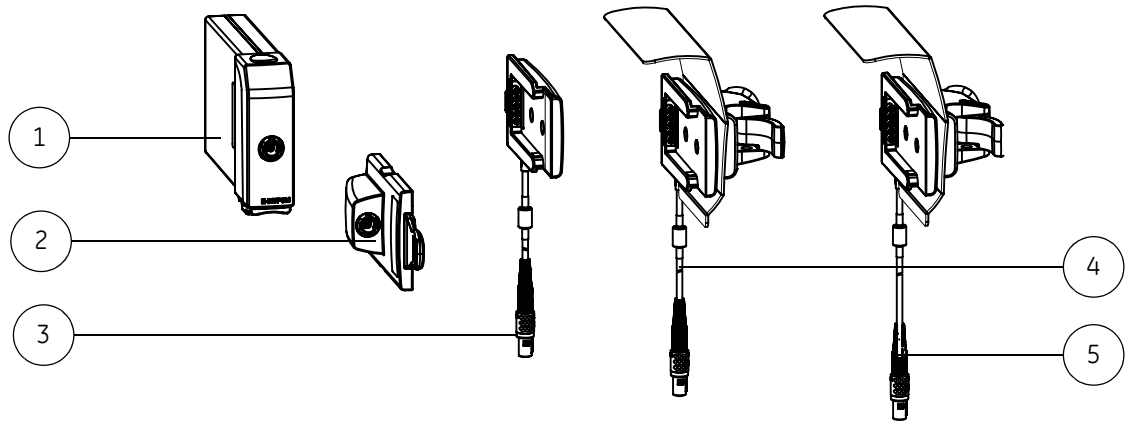
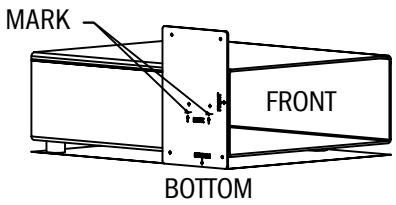


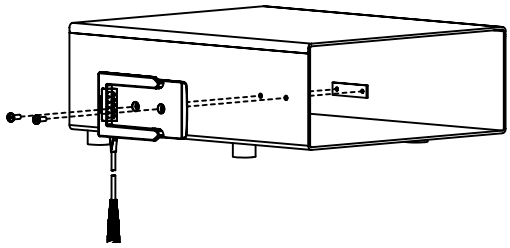
Figure 9 E-PSM(P) mounting accessories

1. M1054424 Interface Module for PSM, E-INTPSM
2. M1051025 Module Bus Adapter for PSM
3. M1051021 Frame Mount for PSM
4. M1049197 Pole Mount for PSM, short
5. M1051023 Pole Mount for PSM, long

Frame mount for PSM - Instructions for connecting to the F-CU8 frame



1. The correct drilling locations are marked through the marking holes on the enclosed plate.
2. Set front and bottom of the plate as shown in the picture.
3. The texts MARK, BOTTOM and FRONT are carved on the plate to help you locate the correct locations.
4. Drill the holes, drill diameter 5mm/0.197 in.

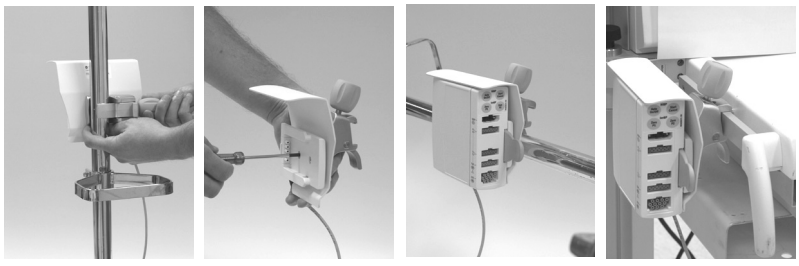


5. Assemble the PSM frame, screws and the plate on the opposite side of the frame wall and tighten the screws.

6. Insert the E-INTPSM module and connect the cable. Attach the E-PSM(P) module and check the module communication.

WARNING **Make sure that the Pole Mount for PSM is always used in vertical position to prevent water from entering the E-PSM(P) module.**

Pole Mount for PSM – Instructions for connecting to an IV pole, vertical position



Fasten the Pole Mount for PSM with the fastening screw of the clamp and tighten properly to an IV pole.

Pole Mount for PSM - Instructions for installing in horizontal position.

Remove the 2 screws from the clamp, turn the clamp and insert and tighten the screws back. Fasten the Pole Mount for PSM with the fastening screw of the clamp and tighten properly to a horizontal tube or rail with a diameter of 10 mm*25 mm.

Pole mount for PSM – Instructions for connecting to frame

1. Attach the E-PSM(P) module to the Pole Mount.
2. Connect the cable of the Pole Mount for PSM to the F-CU8 with the E-INTPSM module (M1054424).
3. Check the module communication of the E-PSM(P) module.

1. Attach the E-PSM(P) module to the Pole Mount.
2. Connect the cable of the Pole Mount for PSM to the S/5 F-CU5 with the Module Bus adapter for PSM (M1031025).
3. Check the module communication of the E-PSM(P) module.

3.3.5 Positioning PC boards

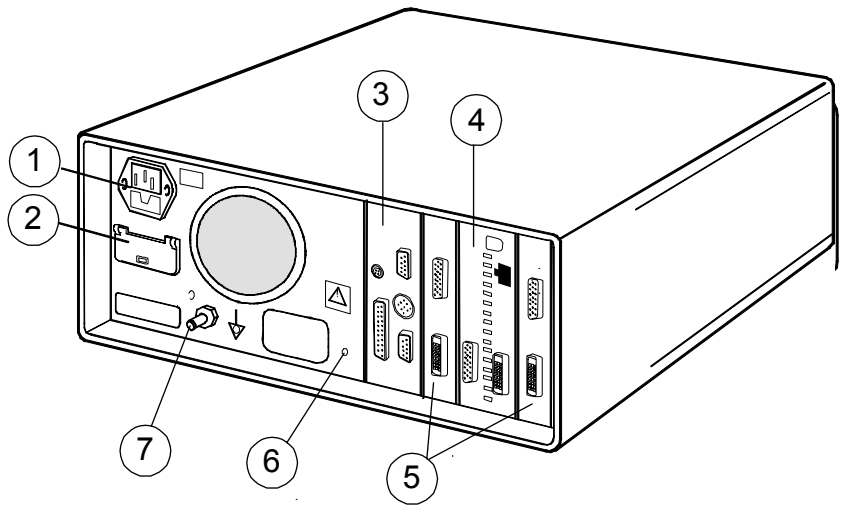


Figure 10 Rear view and positioning, F-CU8 (-12 shown)

(1) Mains power inlet
(2) Battery 24 Vde input connector (F-CU8 - 12) / Display power outlet (F-CU8 rev. 03 to 09)
(3) UPINET Board, B-UPI4NET
(4) B-CPU6 and integrated display controller (primary/screen1)
(5) Display Controller Board, B-DISPX (secondary/screen 2)
Display Controller Board, B-DISPX (3rd screen), Keyboard Interface Board, B-ARK
(6) Service reset button
(7) Equipotential connector

NOTE: Authorized personnel only may open the cover of 24Vdc input connector (use a flat screwdriver).

3.3.6 Replacing PC boards

For service procedures refer to Part II.

1. Make sure that the power of the monitor is turned off and unplug the power cord. Press and hold the service reset button on the rear panel for at least five seconds or until an audible tone is heard (see Figure 11).

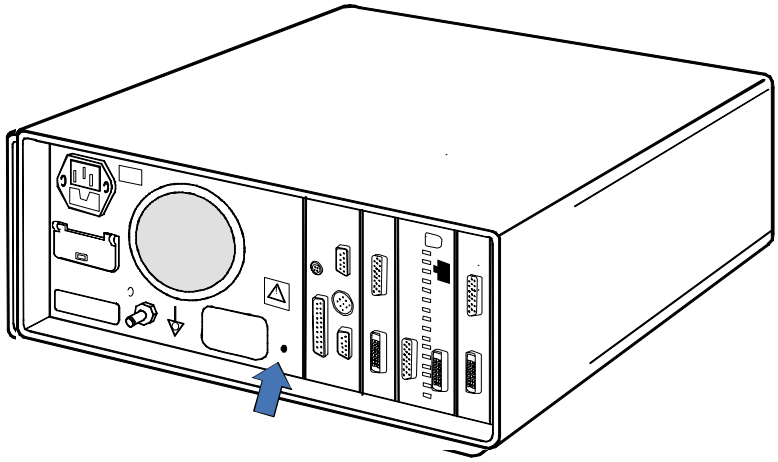


Figure 11 Service reset button

2. Remove all PC boards, cover plates and EMC plates on the right-hand side of the PC board, to be replaced, then remove the board itself (two or four screws).

NOTE: The B-UPI4NET may have been installed so that it can be removed without removing the other PC boards first.

WARNING **The circuit boards contain sensitive integrated circuits that can be damaged by an electrostatic discharge. Careful handling of the boards is therefore essential.**

NOTE: The B-UPI4NET contains components on both sides of the PCB. Therefore, the installation of B-UPI4NET should be handled with extra care. Detach the board from the frame carefully by pulling it from the X3 connector (25 pin female D-connector).

3. Remove the new PC board from the protective antistatic packaging. Always hold the board by the edges and wear a wrist-grounding strap.
4. Insert the new PC board into the vacant slot and firmly press the board into position. Secure the board (two or four screws).
5. Insert all other circuit boards, cover plates and EMC plates.
6. Reconnect the power cord.

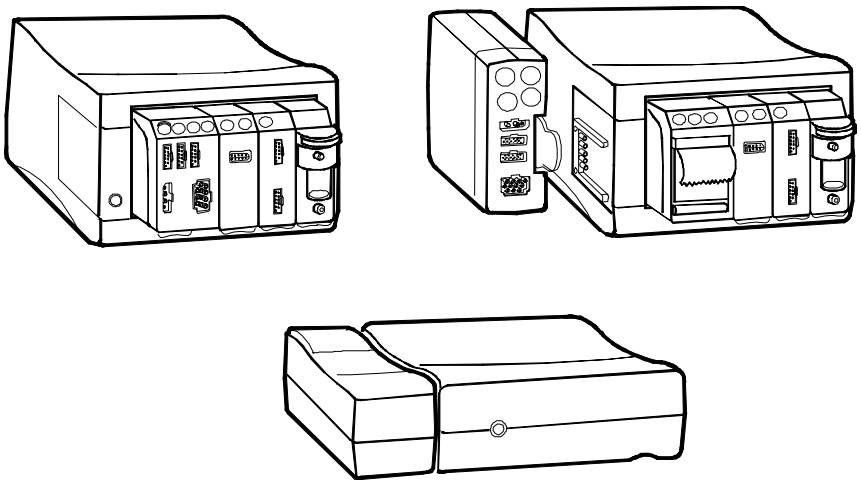
3.3.7 Performing Factory Reset

NOTE: The factory reset is necessary after downloading of monitor software and after replacing the CPU board or SRAM/Timekeeper battery.

NOTE: A factory reset will restore all customized defaults, including language selection, to factory defaults.

1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** and password (16-4-34).
3. Select ***Service*** and password (26-23-8).
4. Select ***Set/Test*** and perform a Factory Reset.
5. The monitor will perform an automatic restart. After the restart is completed, restart the monitor also manually by the On/Standby switch.

3.4 Central Unit; S/5 5-Module Frame, F-CU5



The central unit is divided into three parts: the 5-Module Frame F-CU5(P), the Central Processor Unit F-CPU and the universal power unit N-AC.
The 5-Module Frame has two options, a frame (F-CU5P) that allows connection to an E-PSM(P) module, and a frame (F-CU5) that cannot be connected to an E-PSM(P) module.
F-CU5 provides places for up to five single-width modules or two double-width modules (plus one slot for one single-width module) and in F-CU5P a connector plate for E-PSM or E-PSMP.
The Central Processor Unit houses the system circuit boards.

NOTE: You can connect two F-CU5(P) 5-Module Frames to one F-CPU. If you do so, you cannot at the same time use a display that uses B-DISPX as a power supply (for example 12" LCD display).

WARNING **After transferring or reinstalling the monitor, always check that it is properly connected and all parts are securely attached. Pay special attention to this in case of stacked mounting.**

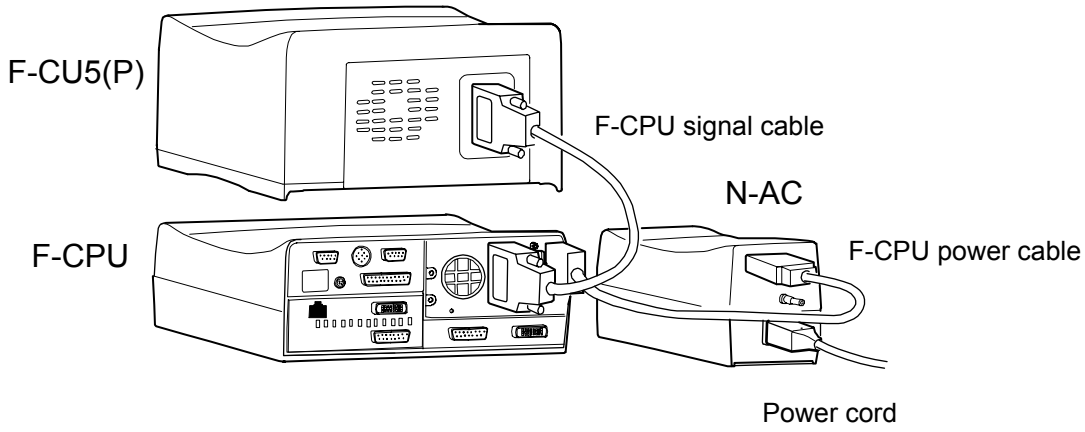


Figure 12 F-CU5 parts connected with cables

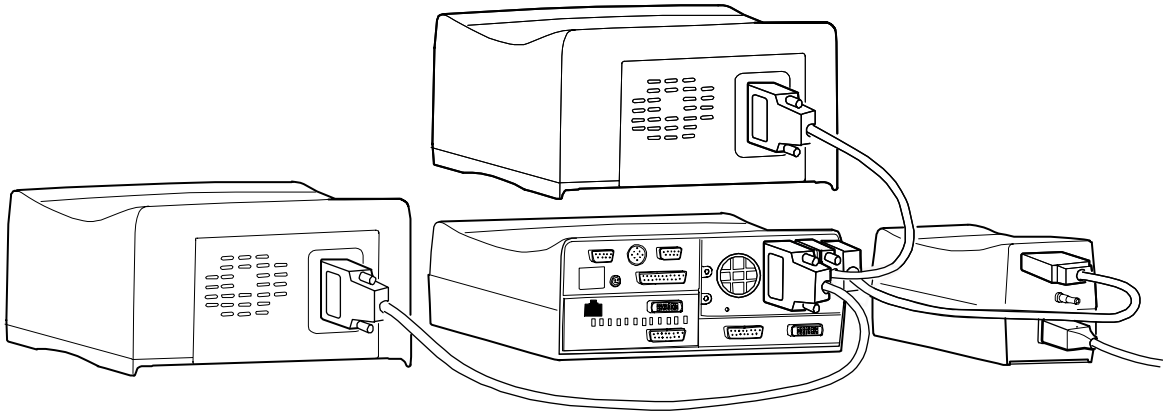


Figure 13 Two F-CU5s connected to one F-CPU

3.4.1 Mounting the Frame

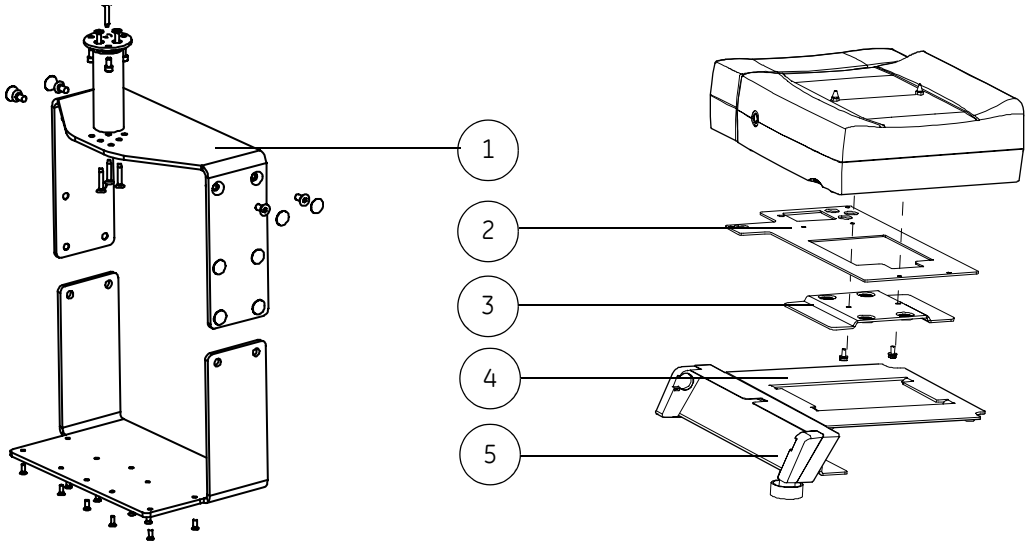
The various mount options and connecting cables allow you to install the F-CU5(P) 5-Module Frame, F-CPU Central Processor Unit and N-AC Power Unit either in one package or separately. You can, for example, attach the Central Processor Unit and Power Unit to the wall or table leg and have the Central Unit at hand.

There are different interconnecting cable options available:

F-CPU Power Cable 0.4 m/16 inch and 2.7 m /9 ft

F-CPU Signal Cable 0.3 m/12 inch, 3m/10 ft and 10m/33 ft

The different mounts to install the Central Unit F-CU5



(1) Wall Mount Hanger for S/5 F-CU5
(2) Power Adapter Mount for F-CU5 Power Unit N-AC
(3) Adapter Plate for S/5 F-CU5
(4) Table Holder for S/5 F-CU5
(5) Holder for S/5 Command Bar

3.4.2 Connecting to mains

Make sure the cables connecting the different units together are connected and secured.

Connect the power cord to the mains power inlet on the N-AC power unit, and to the wall socket.

WARNING **The power cord may only be connected to a three-wire, grounded, hospital grade receptacle.**

3.4.3 Connecting to the Datex-Ohmeda Network

To connect the monitor to the Datex-Ohmeda Network, make sure a Network Board B-UPI4NET is installed.

Use the Monitor-Network cable to connect the monitor to the network as follows:

1. Make sure that the power to the Central Unit is turned off.
2. Connect the RJ-45 network connector to the X10 connector on CPU board, B-CPU6 and the Identification Plug to the corresponding connector on the B-UPI4NET.
3. Connect the other RJ-45 connector to the corresponding connector on the wall box.
4. Turn on the power to the Central Unit. Enter the ***Network*** service menu: **Monitor Setup** - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8) - ***Frame – Network***
5. Make sure that the monitor's network communication has been set according to the used network software:

   Network software S-CNET01 -> DRI Level = 2001

   Network software S-CNET02 -> DRI Level = 2001

   Network software L-NET03 -> DRI Level = 2003

   Network software L-NET05 -> DRI Level = 2005

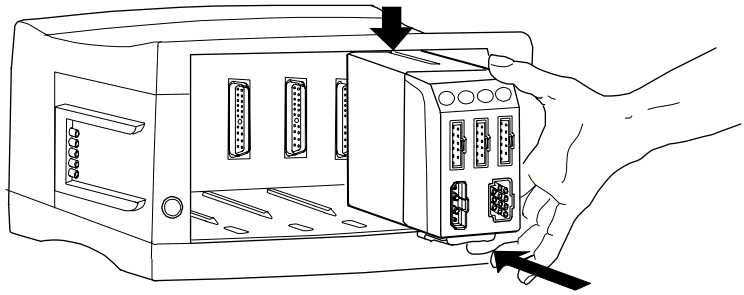
If necessary, change the monitor's network communication by selecting DRI Level and turning the ComWheel.

NOTE: If the DRI level is changed, the monitor will restart automatically.

6. Confirm that the network symbol and 'Connected to Network' message are displayed on the upper part of the screen.

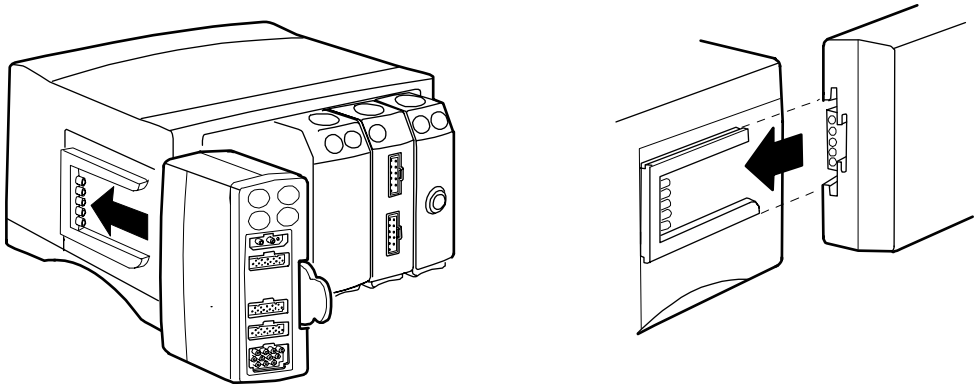
3.4.4 Inserting the parameter modules

1. Ensure that the module is properly orientated (i.e. module release latch facing downward).
2. Align the module insertion guide slot with the frame insertion guide.
3. Push the module into the frame until it clicks.



NOTE: Do not use two or more parameter modules with identical functions in the monitor system. Take special care not to do this when using two F-CU5(P) module frames.

Inserting PSM modules



1. Align the module with the insertion guides.
2. Push the module into the monitor frame until it stops.
3. Pull the module outwards. Make sure not to drop it when it comes out.

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

WARNING **Do not use modules with identical measurements in the same monitor. If such modules have been inserted, remove the module that has been most recently connected. You can also remove both modules and re-connect the new module after five seconds.**

NOTE: For mounting E-PSM(P) see also 3.3.4. E-PSM(P) Mounting Accessories.

Parameter modules or boards with identical functions are:

- Hemodynamic multiparameter modules, E-PRESTN, E-PRETN, E-RESTN, E-PSM, E-PSMP, M-PRESTN, M-PRETN, M-RESTN M-ESTPR, M-ETPR, M-ESTR, M-NESTPR, M-NETPR, M-NESTR, M-NE12STPR, M-NE12TPR, M-NE12STR
- Dual Pressure Modules, E-PP/ M-PP
- Pressure Modules, E-P/ M-P, Pressure Temp Module, E-PT/ M-PT
- Cardiac Output Modules, E-COP, E-COPS, M-COP and M-COPSv
- NIBP Modules, M-NIBP and hemodynamic modules w/ N measurement
- Airway Modules, E-CO, E-COV, E-COVX, E-CAiOVX, E-CAiOV, E-CAiO, E-miniC, M-C, M-CO, M-COV, M-CAiO, M-CAiOV, M-CAiOVX, M-MiniC
- Interface Module, M-INT and Interface Board, B-INT
- Oxygen Saturation Modules, E-MASIMO, E-NSATX/ E-NSAT, M-NSAT and M-OSAT
- Tonometry Modules, E-TONO/ M-TONO
- NeuroMuscular Transmission Modules, E-NMT/ M-NMT
- EEG Modules, E-EEG/ M-EEG
- BIS Modules, E-BIS/ M-BIS

3.4.5 Positioning PC boards

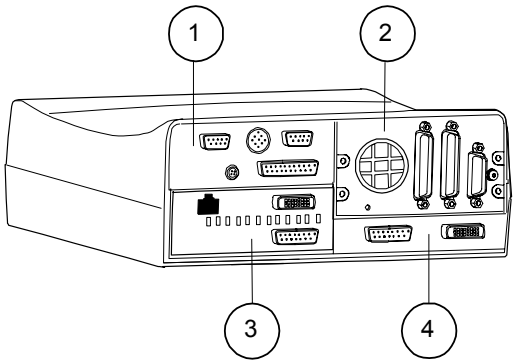


Figure 14 PC boards

(1) B-UPI4NET board
(2) DC Power board
(3) B-CPU6
(4) Optional B-DISPX

3.4.6 Replacing PC boards

For service procedures refer to Part II.

1. Make sure that the power is turned off the Monitor and unplug the power cord. Press and hold the service reset button on the rear panel of the F-CPU for at least five seconds or until an audible tone is heard (see Figure 15).

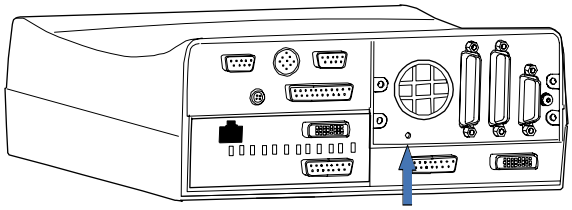


Figure 15 Service reset button

2. Remove the PC board (two screws). Notice that the PC boards can be removed only in certain order.

WARNING **The circuit boards contain sensitive integrated circuits that can be damaged by an electrostatic discharge. Careful handling of the boards is therefore essential.**

NOTE: The B-UPI4NET contains components on both sides of the PCB. Therefore, the installation of B-UPI4NET should be handled with extra care. Detach the board from the frame carefully by pulling it from the X3 connector (25 pin female D-connector).

3. Remove the new PC board from the protective antistatic packaging. Always hold the board by the edges and wear a wrist-grounding strap.
4. Insert the new PC board into the vacant slot and firmly press the board into position. Secure the board (two screws).
5. Insert all other circuit boards, cover plates and EMC plates.
6. Reconnect the power cord.

3.4.7 Performing Factory Reset

NOTE: The factory reset is necessary after downloading of monitor software and after replacing the CPU board or SRAM/Timekeeper battery.

NOTE: A factory reset will restore all customized defaults, including language selection, to factory defaults.

1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** and password (16-4-34).
3. Select ***Service*** and password (26-23-8).
4. Select ***Set/Test*** and perform a Factory Reset.
5. The monitor will perform an automatic restart. After the restart is completed, restart the monitor also manually by the On/Standby switch.

3.5 Displays

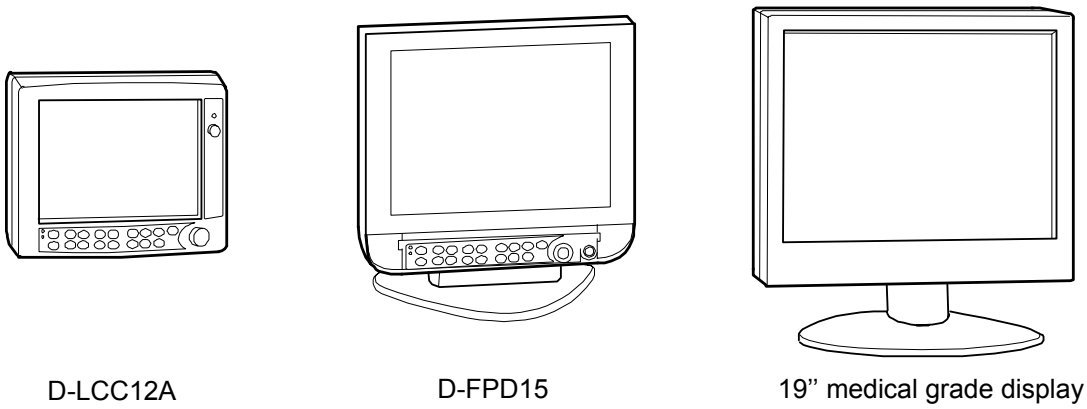


Figure 16 Display options

3.5.1 Main displays

The main display options are integrated with an S/5 Command Bar and a ComWheel:

- 15” Flat Panel Display, D-FPD15
- S/5 LCD Display, D-LCC12A

NOTE: Only one LCD display (D-LCC12) that uses B-DISPX as the power supply can be used in a system where one F-CU5(P) 5-Module Frame is connected to Central Unit F-CPU.

NOTE: An LCD display that uses B-DISPX as the power supply (D-LCC12) cannot be used in a system where two F-CU5(P) Central Units are connected to one F-CPU.

3.5.2 Secondary displays

- 19” medical grade display

However, the secondary display can also be either of the main displays listed above.

3.5.3 3rd display

The 3rd display can be installed together with the Display Controller Board, B-DISPX. All S/5 main softwares support the use of the 3rd display.

NOTE: Due to increased power consumption only two LCD displays should take power via the Central Unit simultaneously.

3.5.4 Display installation

NOTE: Please pay attention to any additional instructions that may accompany the displays and / or their installation equipment. The instructions described below in this manual may not contain all the necessary information.

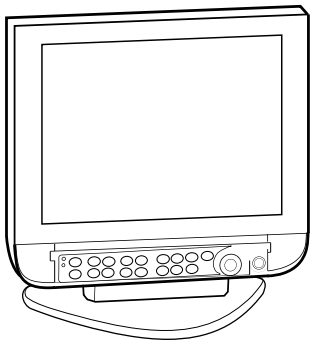
NOTE: When connecting a display with a DVI-D type digital video cable, some adjustments are not needed and may not be available in the display’s on-screen adjustment menu (OSD).

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

WARNING **The displays must only be used together with the original type of power adapter.**

CAUTION The LCD displays are fragile. Ensure that the LCD displays are not placed near a heat source or exposed to mechanical shocks, pressure, moisture, or direct sunlight.

3.5.5 15” Flat Panel Display, D-FPD15



Mounting to Central Unit

Connect the video cable and power adapter cable to the 15” Flat Panel Display, D-FPD15. Tighten the video cable finger screws. Attach the Command Bar, K-ANEB / K-ICUB into the keypad holder.

Mount the display together with the desk stand to the Central Unit using the display alignment studs on the top of the frame (applies to Central Unit, F-CU8 only).

Mounting

Mount the 15” Flat Panel Display, D-FPD15, to a pedestal, wall or ceiling mount, or to a display arm with appropriate parts.

Connection to Central Unit

1. Make sure that power to the Central Unit is turned off.
2. Remove the connector cover: Press “fixed lever” downward on the back of the display. Then slip the cover to the direction of the arrow and remove the cover.
3. Connect the AC adapter’s DC plug into the displays power input. Connect the provided power cord in to the inlet of the auxiliary AC adapter. Then, connect plug to the mains outlet.
4. Connect the DVI cable to the connector X2 on the CPU board, B-CPU6. Alternatively, connect the VGA cable to the connector X2 on the CPU board, B-CPU6. Tighten the finger screws.

WARNING **The display must be used only together with the original D-FPD15 power adapter.**

Adjustments

Switch the monitor on. Wait until the normal monitoring screen appears. Perform the following adjustments, if needed.

1. Resolution setting

   Check that the picture on the LCD display screen is clear and stable. Check that the display screen uses the XGA resolution.

Install/Service (password 16-4-34) – ***Installation - Display Setup***

NOTE: After changing the resolution, the monitor must be restarted before the new setting becomes effective. If the resolution setting is not correct after the monitor restart, check that the resolution jumpers or dip switches on the display controller board are positioned correctly, see chapter 3.6. Display controller boards.

2. Brightness and contrast adjustments

   Press the Control dial while the LCD display is on to activate the OSD menu (on-screen-display).

NOTE: Pressing the Control dial for more than 2 seconds turns the power off.

   Perform the contrast and brightness adjustments if needed. Please refer to the display's User's Manual.

3. Color temperature adjustments

   Perform the color adjustments if needed. Please refer to the display's User's Manual.

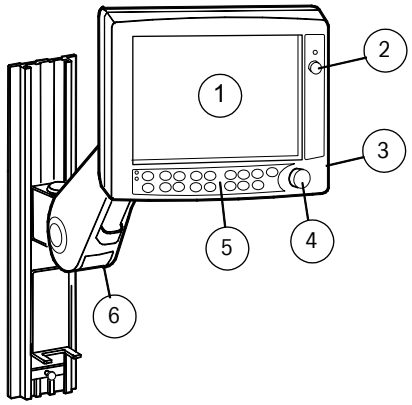
4. Auto Setup

   Perform Auto Setup to automatically adjust the screen size, position, phase and clock, if needed.
   This adjustment is available only with analog input (VGA cable). This function is not available for digital input (DVI).

NOTE: Position adjustments, clock and phase can be adjusted also manually. Please refer to the display's User's Manual.

   Exit the OSD menu and go back to the normal screen.

3.5.6 12" LCD Display, D-LCC12A



(1) 12" LCD display, D-LCC12A

(2) Connector for the anesthesia record keeping solution keyboard or Remote Controller K-REMCO

(3) ON/STBY switch of the monitor

(4) ComWheel

(5) Command bar keys

(6) Display Arm

Mounting to Display arm

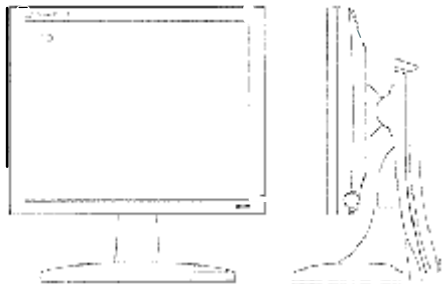
Mount the LCD Display, D-LCC12A to a pedestal, wall or ceiling mount, or to a display arm with appropriate parts. Connect the video cable to the display and tighten the video cable finger screws carefully.

CAUTION To prevent any liquid from entering the LCD display casing, do not tilt the LCD display more than 45 degrees backward or 20 degrees forward.

Connection to Central Unit

1. Make sure that the power to the Central Unit is turned off.
2. Connect the video cable to the X2 connector on the CPU board, B-CPU6. Tighten the finger screws.

3.5.7 19” medical grade display



Environmental conditions

WARNING **The environmental conditions of the 19" Medical Grade Display differ from the environmental conditions of the S/5 Anesthesia Monitor and Critical Care Monitor systems.**

Atmospheric pressure lower limit

Operating:	697 mbar

The difference in the operating atmosphere pressure lower limit is only in altitudes over 3000 m (9800 ft). Above this altitude, use another specified display.

Mounting

When using the display with the desk stand option, it must be placed on a flat horizontal surface. The 19” medical grade display is provided with a desk stand as default with the GCX adaptor included. Standard VESA mounting solutions can be used with this display.

In order to mount the display with AM and CCM monitors, please see for example the Supplies and Accessories catalog.

Connection to the Central Unit

Medical grade display requires B-DISPX display controller board.

1. Make sure that power to the Central Unit is turned off.
2. Remove the connector cover: Press “fixed lever” downward on the back of the display. Then slip the cover to the direction of the arrow and remove the cover.

3. Connect the AC adapter's DC plug into the displays power input. Connect the provided power cord in to the inlet of the auxiliary AC adapter. Then, connect plug to the mains outlet.
4. Connect the DVI cable to the connector X2 on the CPU board, B-CPU6. Tighten the finger screws.

A medical grade power supply adapter and the country-specific power cord are included in the display delivery.

The following cables are included: Analog signal cable (1.8 m long), DVI signal cable (1.8 m long).

Adjustments

The optimal display resolution is SXGA (1280 x 1024). To use the display, a CPU board, B-CPU6 or Display Controller Board B-DISPX is needed.

Changing the screen resolution: Press **Monitor Setup**,
select ***Install/Service*** (password 16 - 4 - 34),
select ***Installation - Display Setup***.
In ***Screen 1 ... Screen 3***, select the resolution ***SXGA*** (1280 x 1024).

After changing the resolution turn the monitor off and on again.

- For details about the general use of the 19" Medical Grade Display refer to the display manufacturer's user guide delivered with the display.

3.6 Display controller boards

CPU board, B-CPU6 has an integrated display controller, which acts as a controller for the primary display. In case only one display is used, an optional display controller board is not needed. Optional displays must be supported by different separate display controller boards, i.e. the primary display by a primary display controller integrated on the CPU board, B-CPU6, the secondary display by an optional display controller board and the third display by an optional secondary display controller board. Consequently, it is possible to configure the displays separately. One of the displays can, for instance, be used for a continuous display of trend pages.

NOTE: It is possible to use one display controller to obtain duplicate video signals for two displays by using the display Y-cable.

3.6.1 Jumper settings

The optional display controller boards require different address settings to operate correctly. The settings are made through dip switches on B-DISPX. Different settings are illustrated in the following figures.

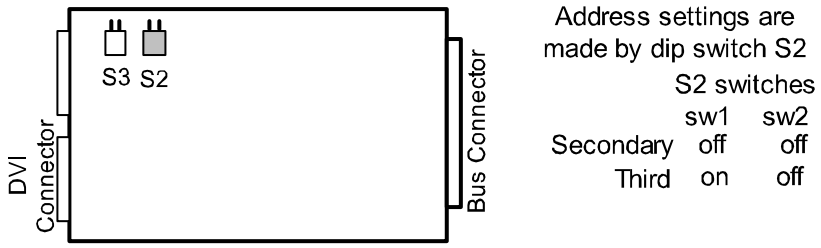


Figure 17 Address dip switch settings, B-DISPX

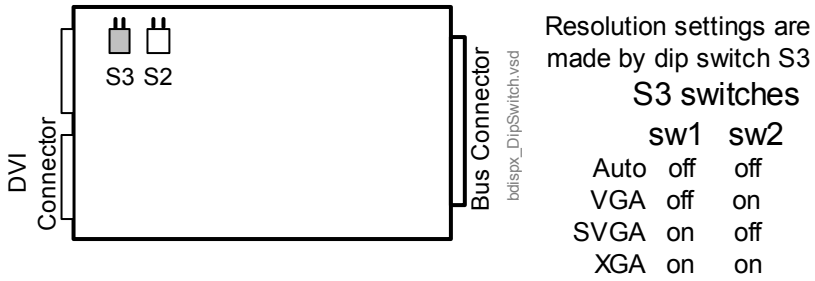


Figure 18 Resolution dip switch settings, B-DISPX

3.6.2 Resolution selection for optional B-DISPX

The resolution selection dip switch positions are presented in Figure 18 Resolution dip switch settings, B-DISPX. If the AUTO mode is selected, the resolution can be set by monitor software. In other modes, the resolution is set accordingly.

3.6.3 Resolution selection for primary display

The resolution selection for primary display is set through the monitor software setting only.

3.7 S/5 Remote Controller, K-REMCO

Connection to Central Unit

Connect the Remote Controller cable to the X11 connector on the CPU board, B-CPU6. Tighten the finger screws.

3.8 S/5 Airway Modules

3.8.1 S/5 Compact Airway Modules, E-xxxx

This chapter provides information for installing Compact Airway Modules E-xxxxx.

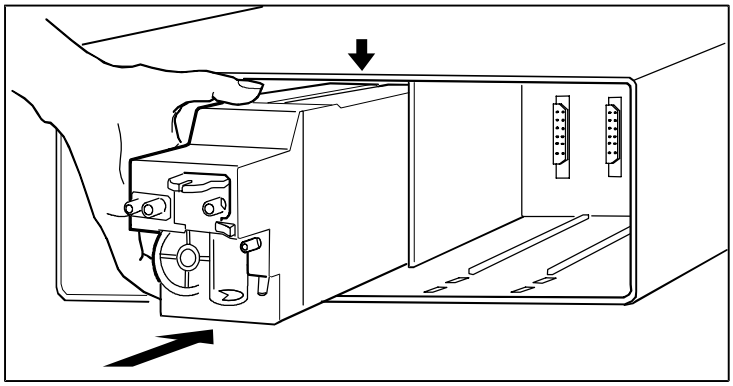


Figure 19 Compact Airway Module, E-XXXX

Connection to Central Unit

1. Ensure that the module is properly orientated (i.e. module release latch facing downward).
2. Align the module insertion guide slot with the frame insertion guide.
3. Push the module into the frame until it clicks.

NOTE: The Compact Airway Modules cannot be placed into the third and fourth slot from the right-hand side of the Central Unit F-CU8.

3.8.2 Sample gas exhaust

Preventing operation room pollution

When N_2O or volatile anesthetics are used, pollution of the operation room by these gases should be prevented. Connect the sample gas outlet of the monitor to the scavenging system or return it to the patient circuit.

NOTE: The sample gas from the E-MiniC can only be connected to the scavenging, not returned to the patient circuit.

Connect the sample gas outlet of the monitor to the scavenging system either

- through the ventilator, or
- directly to the vacuum scavenging system.

WARNING **Strong scavenging suction may change the operating pressure of the module and cause inaccurate readings or excessive sample gas flow. To prevent this, there must for example be an opening to room air.**

Connect the sample gas outlet only to open scavenging system where gas is removed in room pressure.

Scavenging through the ventilator reservoir

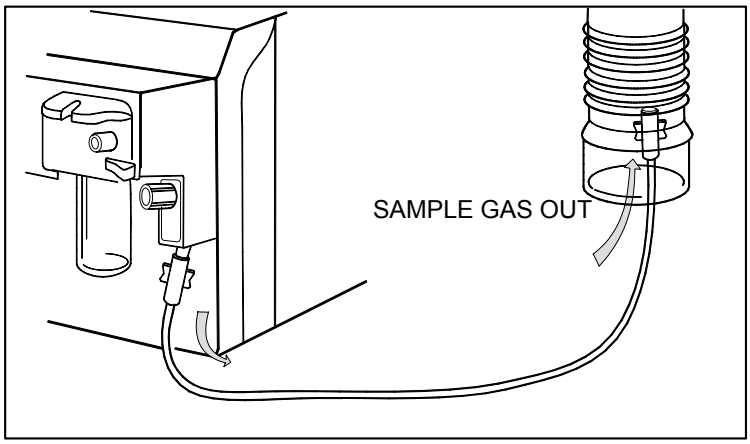


Figure 20 Scavenging through ventilator reservoir

1. Connect an exhaust line to the sample gas outlet on the module's front panel.
2. Attach the other end of the line to the ventilator reservoir. Make sure that the reservoir tube diameter is at least 2 - 3 times larger than the exhaust line.

Scavenging through the anesthesia gas scavenging system

Anesthesia machines are equipped with an anesthesia gas scavenging system (AGSS), and in some machines the sample gas outlet can be connected directly to that.

For example, connect the sample gas outlet to the S/5 Avance:

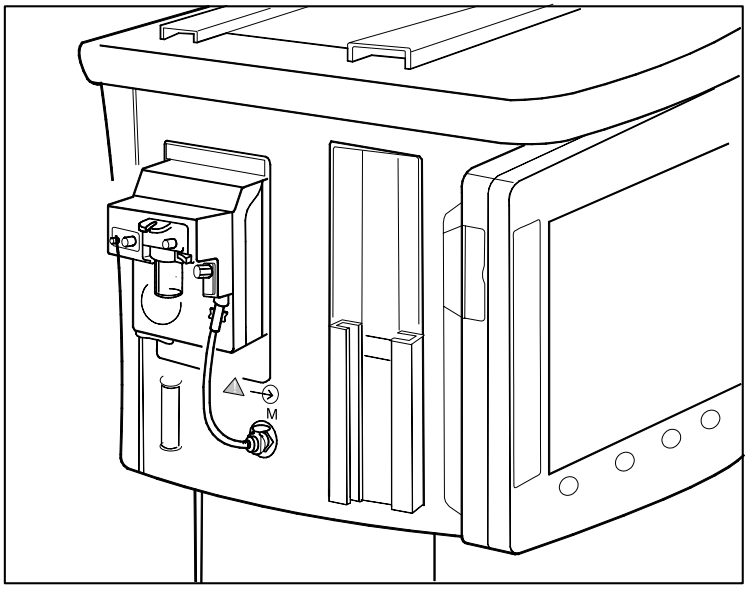


Figure 21 Connecting the gas module to the scavenging connector of S/5 Avance

NOTE: Refer to the anesthesia machine's documentation to find out where and how the sample gas can be connected.

Connecting directly to the vacuum scavenging system

1. Connect the exhaust line to the monitor's sample gas outlet.
2. Connect the exhaust line only to an open scavenging system where gas is removed at room pressure. Do not connect the monitor directly to a vacuum scavenging system.

Returning sampling gas to the patient circuit

The sampling gas can also be returned to the patient circuit. If you use the S/5 Anesthesia Delivery Unit (ADU), you need an optional adapter connected to the patient breathing tubes.

Take special care when returning sample gas to the patient circuit. For further information, please contact your GE Healthcare distributor.

NOTE: If E-miniC is being used do not return the sample gas to the patient circuit

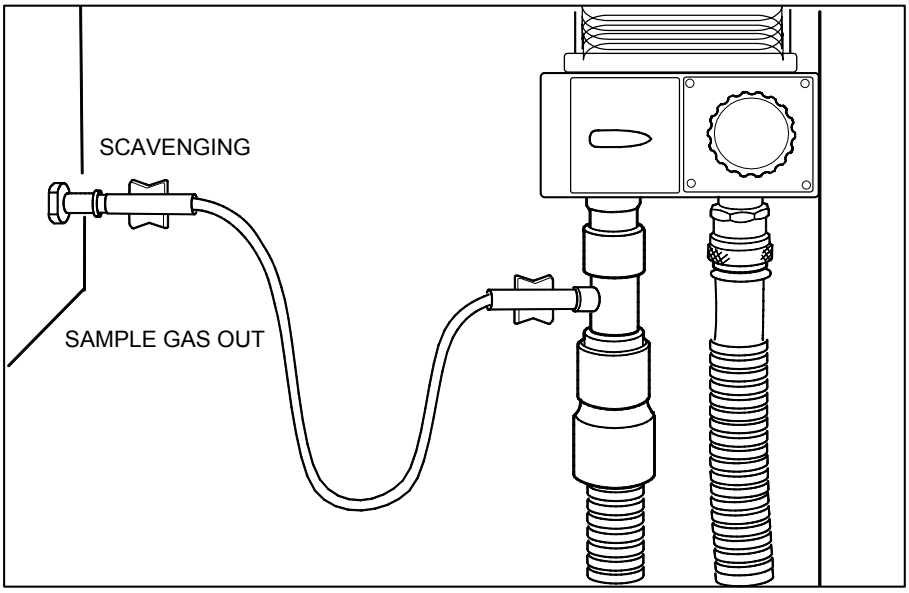


Figure 22 Sample gas returned to patient circuit in ADU

3.9 Record Keeping Keyboard for Anesthesia, K-ARKB

3.9.1 Connection to Central Unit

1. Make sure that the power to the Central Unit is turned off.
2. Connect the keyboard-monitor cable to the X2 connector on the Keyboard Interface Board, B-ARK, and to the connector on the rear of the keyboard. Alternatively you can connect the cable to a Display Controller Board, B-DISPX. Secure the connection with the thumbscrew and slip the cable beneath the fasteners.

3.9.2 Connection to LCD Display, D-LCC12A

1. Make sure that the power to the Central Unit is turned off.
2. Connect the Keyboard-LCD Display Cable to the K-ARKB connector on the LCD Display and to the connector on the rear of the keyboard. Secure the connection with the thumbscrew and slip the cable beneath the fasteners.

3.10 ARK Barcode Reader, N-SCAN (optional)

3.10.1 Connection to Central Unit/LCD Display or D-LCC12A

The ARK Barcode Reader, N-SCAN, can be connected to the Record Keeping Keyboard for Anesthesia, K-ARKB, and to the LCD Display or D-LCC12A using a Y-cable as illustrated in Figure 23 below.

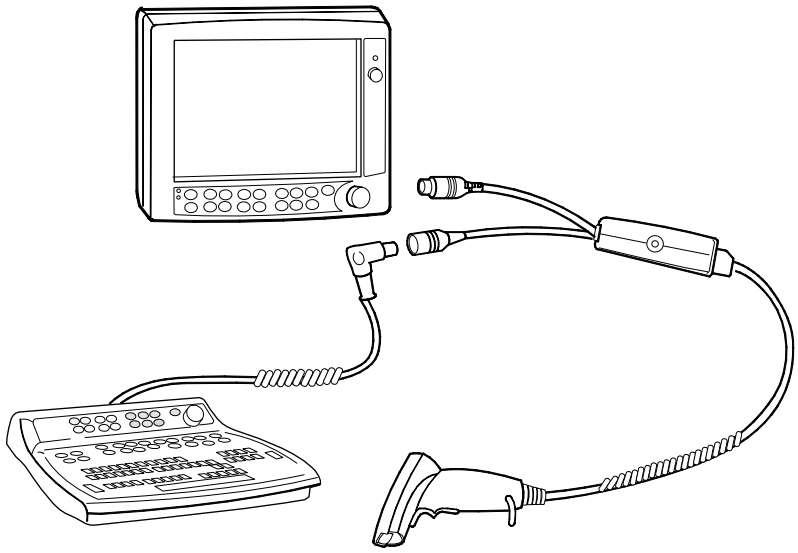


Figure 23 Barcode Reader connected to LCD Display

The ARK Barcode Reader, N-SCAN, can be connected to the Record Keeping Keyboard for Anesthesia, K-ARKB as illustrated in Figure 24.

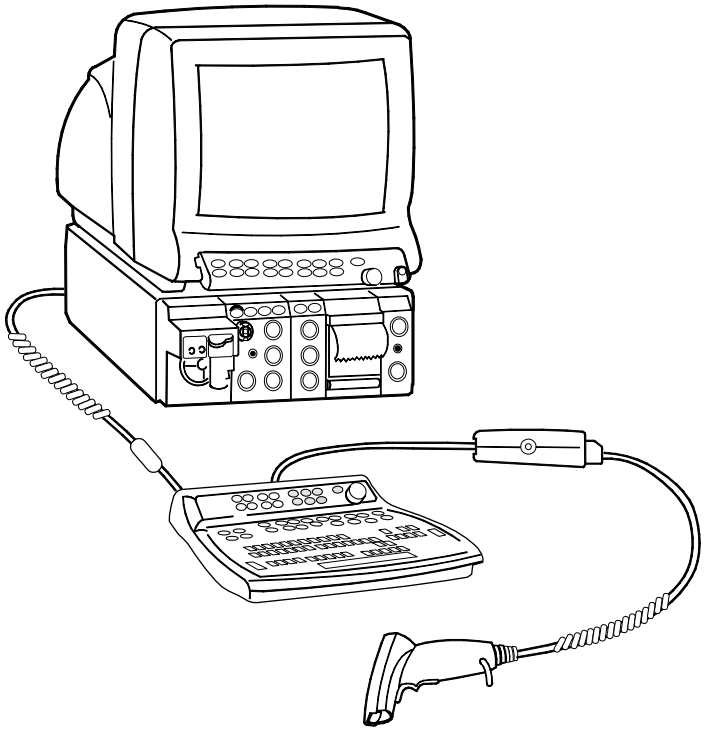


Figure 24 N-SCAN Barcode Reader connection directly to the keyboard

Barcode Reader is configured compatible to your monitor and necessary information is delivered with the monitor.

WARNING When using the ARK Barcode Reader, N-SCAN, do not stare into beam. The N-SCAN is a Class 2 laser product.

3.11 S/5 Extension Frame, F-EXT4, with F-CU8 only

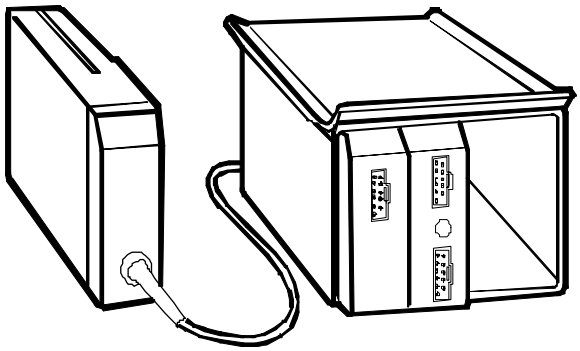


Figure 25 S/5 Extension Frame, F-EXT4

The Extension Frame, F-EXT4, enables the monitor system to be expanded using additional parameter modules. The Extension Frame is connected to the Central Unit via the Extension Module, E-EXT. The Extension Module plugs into the Central Unit, F-CU8 in the same way as the parameter modules.

NOTE: Only one Extension Frame can be connected to each Central Unit, F-CU8.

3.11.1 Mounting of Extension Frame, F-EXT4

When mounting the Extension Frame, F-EXT4, for instance to an IV pole, make sure that this does not affect the stability of the IV pole.

3.11.2 Connection to Central Unit

Insert the Extension Module, E-EXT, into the Central Unit. Firmly press the module into position. Connect the Extension Module cable to the Extension Frame.

3.11.3 Inserting the parameter modules

Insert the parameter modules into Extension Frame slots. Firmly press the modules into position.

CAUTION Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.

NOTE: Parameter modules with identical functions must not be used simultaneously in the same monitor system. Take special care not to do this when using the Extension Frame.

NOTE: Modules E-REC/ M-REC, E-MEM/ M-MEM, E-INT/ M-INT, E-CXXXX/ M-CXXXX cannot be used in the Extension Frame.

3.11.4 Troubleshooting

If a problem occurs during a functional examination, check the components of the monitor according to the following troubleshooting chart. If the problem persists, please refer to Part II of this Technical Reference Manual.

Trouble	**Treatment**
Nothing functions.	Unplug the Command Bar or Remote Controller cable. Check that the cable is intact then reconnect the cable. Unplug the power cord. Check that the cord is intact, then reconnect the cord. Check that the fuses are intact.
The display does not function.	Unplug the display power cord and the display cable. Check that the cord and cable are intact, then reconnect the cord and cable. Unplug the Monitor-LCD Display cable. Check that the cable is intact and reconnect the cable. Check that the display brightness is adjusted properly.
A parameter module does not function.	Remove and replace the module. Check that the parameters displayed are configured correctly.
The Airway Module does not function.	Check that the 'Occlusion' or 'Calibrating Gas Sensor' messages are not displayed. Check that a D-fend water trap and a sampling line are attached. Check that the Gas Interface Board, B-GAS is inserted properly. Check that the parameters displayed are configured correctly. Press and hold the Select Agent key for three seconds. Turn off the power to the Central Unit. Unplug the Gas Interface Cable. Check that the cable is intact, then reconnect the cable. Turn on the power to the Central Unit.
Compact Airway Module does not function.	Remove and replace the module.

4 Interfacing

External devices can be interfaced with the S/5 Anesthesia and Critical Care Monitors via the UPI4 and UPI4NET boards, B-UPI4 and B-UPI4NET, via the Interface Module, E-INT, and via the Device Interfacing Solution, N-DISxxx.

A UPI4 and UPI4NET board can be used for interface with:

- S/5 Anesthesia Delivery Unit
- Printers
- Computers

An E-INT can be used for interface with:

- Datex-Ohmeda monitors
- Various other manufacturers' monitors
- Various anesthesia machines

Printers and computers can be interfaced via the monitor's serial or parallel port.

Device specific N-DISxxx modules can be used with:

- Ventilators/ anesthesia machines
- Heart-lung machines
- Monitors
- Blood-gas analyzers

4.1 Interfacing external monitors via Interface Module, E-INT

It is possible to interface Datex-Ohmeda monitors, Critikon Dinamap 1846SX, Abbott Oximetrix 3, Baxter Explorer and Vigilance, Nellcor N-100, N-200 and N-1000 to the S/5 Anesthesia Monitor or to the S/5 Critical Care Monitor via Interface Module, E-INT. The parameters that are transferred from external monitors are summarized in tables: Table 4 Transference of parameters, Datex-Ohmeda monitors and Table 5 Transference of parameters, external monitors.

The Interface Module, E-INT, has two serial/analog connectors.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

Table 4 Transference of parameters, Datex-Ohmeda monitors

Device	Waveforms (analog)	Numerics	Alarms
Cardiocap	E-INT -> CO_2	Et&Fi Airway gases, Respiration rate, SpO_2, Pulse rate	None
Capnomac Capnomac II	E-INT -> CO_2, Pleth	Et&Fi Airway gases, Respiration rate	None
Capnomac Ultima	E-INT -> CO_2	Et&Fi Airway gases, Respiration rate, Spirometry, SpO_2, Pulse rate, Pleth amplitude	CO_2, O_2, Anesthesia agent, Respiration rate, Apnea, Occlusion, SpO_2, Pulse rate
Normocap 200 Normocap 200 OXY	E-INT -> CO_2	Et&Fi Airway gases, Respiration rate	None
Oscar Oscar II Oscar OXY	E-INT -> CO_2, Pleth	Et&Fi Airway gases, Respiration rate, SpO_2, Pulse rate, Pleth amplitude	None
Satlite Satlite II Satlite Plus	E-INT -> CO_2	SpO_2, Pulse rate, Pleth amplitude	None
Satlite Trans	None	SpO_2, Pulse rate, Pleth amplitude	None

Table 5 Transference of parameters, external monitors

Device	Waveforms	Numerics	Alarms
Critikon Dinamap 1846SX	None	NIBP	None
Abbott Oximetrix 3	None	SvO_2/SaO_2, CO	None
Baxter Explorer	None	C.O., SvO_2, REF, Tblood	None
Baxter Vigilance	None	C.O., SvO_2,C.C.O., Tblood	None
Nellcor N-100 N-200 N-1000	Pleth (analog)	SpO_2, Pulse rate	None

4.1.1 Connection to external Datex-Ohmeda monitors

Use the INT-External Device Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the Interface Module, E-INT. Tighten the finger screws.
3. Connect the 25 pin D-connector to the corresponding connector on the other monitor. Tighten the finger screws.

4.1.2 Connection to Critikon Dinamap 1846SX, Abbott Oximetrix 3 and Baxter Explorer

Use the INT-External Device Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the Interface Module, E-INT. Tighten the finger screws.
3. Connect the 25 pin D-connector to the connector on the external monitor. Tighten the finger screws.

4.1.3 Connection to Baxter Vigilance

Use the INT-Baxter Vigilance Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the Interface Module, E-INT. Tighten the finger screws.
3. Connect the other 9 pin D-connector to a corresponding connector on the external monitor. Tighten the finger screws.

Communication parameters are: baud rate 19200, no parity (none), data bits 8, stop bits 1. Mode of communication port: IFM out.

4.1.4 Connection to Nellcor N-100 and N-1000

Use the Monitor-Nellcor Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the Interface Module, E-INT. Tighten the finger screws.

NOTE: The X3 and X9 connectors cannot be used when interfacing the S/5 Anesthesia Monitor or the S/5 Critical Care Monitor with Nellcor N-100 monitors.

3. Connect the other connector to the corresponding connector on the external monitor. Tighten the finger screws. Connect also the mono connectors on the external monitor.

4.1.5 Connection to Nellcor N-200

Use the Monitor-Nellcor Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect one of the connectors to the corresponding connector on the Interface Module, E-INT. Tighten the finger screws.
3. Connect the other connector to the corresponding connector on the external monitor. Tighten the finger screws. Connect also the mono connectors on the external monitor. Connect also the mono connectors on the external monitor.

4.2 Interfacing external bedside devices via Device Interfacing Solutions, N-DISxxx

The Device Interfacing Solution, N-DISxxx provides means for transferring physiological, waveform and event data from various bedside patient care devices to the Datex-Ohmeda monitoring system. The real-time and trended data can be displayed on the monitor screen and used for record keeping purposes. The interfacing module reads the data coming from the external device, converts it to a suitable format and sends it to the monitor. With the Device Interfacing Solution, N-DISxxx, you can interface up to ten different devices simultaneously.

See the following table of DIS modules and devices that you can interface with the Device Interfacing Solution.

NOTE: The Device Interfacing Solution (DIS) is only compatible with the S/5 Anesthesia and S/5 Critical Care Monitor when the monitor has B-UPI4NET and S/5 Monitor software rev. 01 or later installed.

Table 6 DIS modules and interfaced devices

	Device Ventilators
N-DISEV4	Evita 4[1]
N-DISPRIM	Primus[1] NOTE: Not available in the US
N-DIS7200	7200 Series Ventilator System[2]
N-DIS840	840 Ventilator System[2]
N-DISS300	Servo Ventilator 300[3]
N-DIS7900	7900 SmartVent Ventilator[4]
N-DISAEST[5]	Aestiva/5[4]
N-DISVENT	S/5 Aespire[4] Aestiva/5[4] Aisys Carestation[4] S/5 Avance[4] Centiva/5[4] Engström Carestation[4]

1 Trademark of Dräger Medical AG & Co
2 Trademark of Nellcor Puritan Bennet Inc
3 Trademark of Maquet Critical Care AB part of the Getinge Group (previously trademark of Siemens)
4 Trademark of GE Healthcare Finland Oy
5 Replaced by N-DISVENT

	Device Monitors
N-DISOXIM3	Oximetrix 3[1]
N-DISQVUE	QVue /Q2[1]
N-DISA2000	A-2000 Bispectral Index Monitoring System[2]
N-DISVIGIL	Baxter-Vigilance[3]
N-DISPICCO	PiCCO-Technology[4] NOTE: Not available in the US

N-DISRGM	RGM Monitor[5]
N-DISTONO	Tonocap[5]
N-DISWHITE	Capnomac, Capnomac II[5] Multicap, Normocap, CD2-02[5] Capnomac Ultima[5] Normocap CD-200[5] Oscar Oxy, Cardiocap 1GS, Cardiocap 2GS[5] Satlite, Satlite Trans, Satlite Plus[5]

1 Trademark of Hospira Inc. (previously trademark of Abbott Laboratories)
2 Trademark of Aspect Medical Systems
3 Trademark of Edwards Lifesciences Corporation
4 Trademark of Pulsion Medical Systems
5 Trademark of GE Healthcare Finland Oy

	Device Blood gas analyzers
N-DISOPT	AVL Opti CCA[1]
	Device Heart-lung machines
N-DISHL20	Jostra HL-20[2]

1 Trademark of Diamond Diagnostics Inc
2 Trademark of MAQUET GmbH & Co. KG part of the Getinge Group

For specific information on parameters transferred from the interfaced device to the Datex-Ohmeda monitor and the applicable software versions of the device refer to the Installation guide accompanying each DIS module.

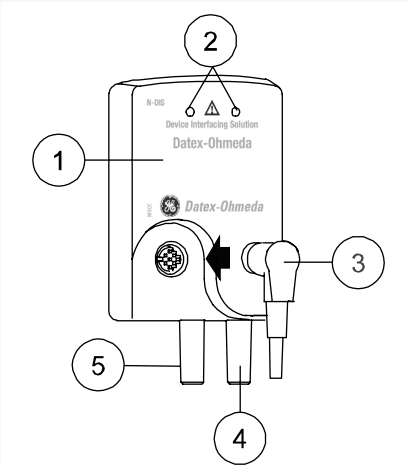
4.2.1 Device Interfacing Solution components

The Device Interfacing Solution consists of:

- a device specific interfacing module
- a device specific cable
- a bus cable
- a connector for another bus cable
- label specifying the external device

4.2.2 Connections

Connect the device specific cable to the external device and the bus cable to the S/5 Anesthesia / Critical Care Monitor's UPI4 or UPI4NET board or to the monitor's DIS connector or to another interfacing module.



(1) label specifying the external device

(2) LED indicators

(3) black bus cable from another interfacing module, if needed

(4) grey device specific cable to the communication port of the external device

(5) black bus cable to the monitor's DIS connector (or to another interfacing module)

Figure 26 Connection cables and LED indicators

WARNING The Anesthesia/Critical Care Monitor, interfacing modules and interfaced devices must be situated in the same patient environment (as defined in IEC 60601-1-1).

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

WARNING The manufacturer guarantees a reliable functioning of the devices with tested software versions only. Always refer to the Installation guide accompanying the DIS module and verify the compatibility before use.

4.2.3 Mounting

The DIS module can be mounted on the side panel of the external device. Also IV pole placement is possible.

NOTE: As the Device Interfacing Solution works only with the device specified in the label of the interfacing module, it is recommended that the interfacing module always travels along with the external device.

For mounting accessories, please refer to the "Supplies and Accessories" catalog. See the following figure for an example of a device interfacing.

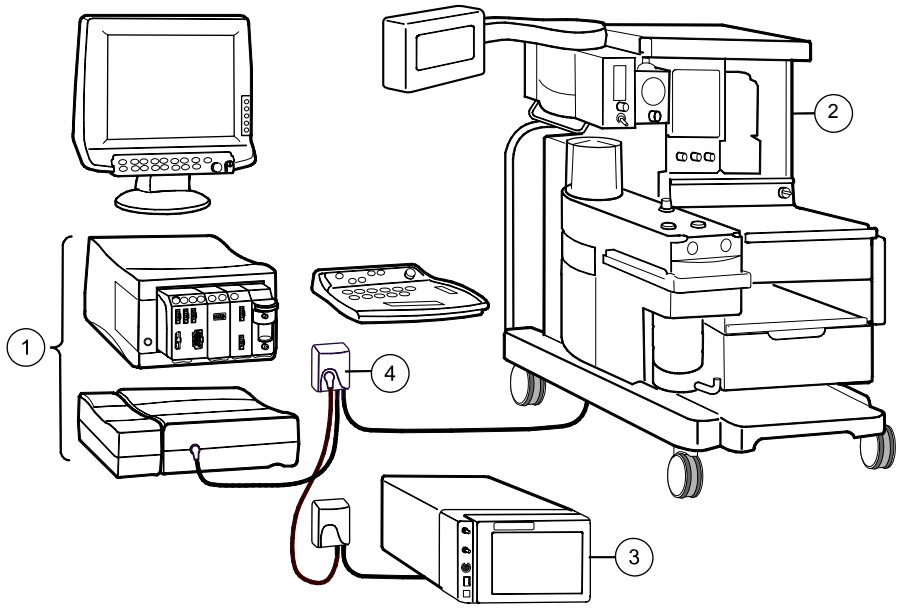


Figure 27 An example of interfacing external devices with Device Interfacing Solution

(1) Datex-Ohmeda S/5 Anesthesia Monitor (with software L-ANE02(A) or later)

(2) Aestiva/5 anesthesia machine

(3) RGM monitor

(4) Interfacing module

NOTE: You can connect up to ten (10) interfacing modules to one system simultaneously. Check the maximum number of modules: one meter cable = max. four ten modules, three meter cable = max. three modules, six meter cable = one module.

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

WARNING Make sure that you are connecting the interfacing module to the device specified in the label. Always verify the compatibility of the software versions before use.

4.2.4 Selecting the external device

1. Turn off the monitor.
2. Turn off the external device.
3. Connect the interfacing module to the monitor's UPI4NET board or to the connector for N-DIS or to another interfacing module.
4. Connect the device specific cable to the external device and turn the external device on.
5. Turn the monitor on. The monitor identifies the connected device automatically.

4.2.5 Functional check

There are two ways to check the function of the Device Interfacing Solution:

1. Press the **Monitor Setup** key.
2. Select ***Interfacing*** and open the ***Status Page*** menu. The status page shows you the current communication status of the interfacing module (1 - 10).

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

- Check the LED indicators on the interfacing module (the green LED indicates physical connections, the yellow LED software selections)

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

4.2.6 Selecting the parameter data source

Select the external device via **Monitor Setup - *Interfacing*** menu:

- Select the desired parameter, for example ***Gases.***
- Select the desired source by name, for example ***Aestiva***.

NOTE: The name of the device is visible on the list only if the device is correctly connected.

Detailed information about interfacing module related mountings, connections and settings is included in the installation guides that are delivered with the interfacing modules.

4.3 Interfacing Datex-Ohmeda Anesthesia Delivery Unit

It is possible to interface the Datex-Ohmeda Anesthesia Delivery Unit to the S/5 Anesthesia Monitor via the UPI Board, B-UPI4 or UPINET Board, B-UPI4NET. The data link is bi-directional. The parameters transferred to the Anesthesia Delivery Unit are summarized in Table 7 and the events transferred to the S/5 Anesthesia Monitor are summarized in Table 8. The events are transferred continuously once a minute or during the system check procedure and appear in the trend pages or in the anesthesia record. The transfer of events requires record-keeping software.

4.3.1 Interconnection

Use the ADU-AS/3 Monitor Cable.

4.3.2 Setting interfacing parameters on the S/5 Anesthesia Delivery Unit

1. Press the **Setup** key.
2. Select ***Install*** password 10.
3. Select ***Interfacing*** and choose S/5 AM.
4. Press the **Normal Screen** key.

4.3.3 Setting interfacing parameters on the S/5 Anesthesia Monitor

No settings are required on the S/5 Anesthesia Monitor.

Table 7 Parameters transferred from S/5 Anesthesia Monitor to S/5 Anesthesia Delivery Unit

Waveforms	Numerics
CO_2	Et & Fi CO_2 % Et & Fi O_2 % O_2% difference (I-E) Et & Fi N_2O% Et & Fi AA% Vol Exp MV Vol Exp TV

Table 8 Events transferred from S/5 Anesthesia Delivery Unit to the S/5 Anesthesia Monitor

Events transferred once a minute	
Ventilator settings	Ventilation (mode) Tidal Volume Minute Volume Resp. Rate I:E Times: inp I:E Times: exp InspPause
Ventilator measurements	Ppeak Pplat Peep Pmin
Fresh gas settings	Agent name Agent % in fresh gas Total flow O_2 flow N_2O flow Air flow
Events transferred during system check	
System check test results	Gas Delivery: Agent Gas Delivery: N_2O Leak Tests: AUTO AUTO Leak (ml/min) Leak Test: MAN MAN Leak (ml/min) Number of confirmed checklist items Bypass Check

4.4 Interfacing Dräger Cicero, Cato, Julian and Narkomed 2C (by NAD)

It is possible to interface Dräger Cicero and Cato to the S/5 Anesthesia Monitor or to the S/5 Critical Care Monitor via the Interface Module, E-INT.

NOTE: The Interface Board must be equipped with revision 881652-4.0 software or later.

The parameters transferred to the S/5 Anesthesia Monitor or S/5 Critical Care Monitor are summarized in Table 9 and Table 10.

NOTE: Some of the summarized parameters (waveforms or numerics) may not be available in all device versions.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

4.4.1 Interconnection

Use the INT-External Device Cable, except for Julian and Cicero EM, in which case use the INT-Julian/Cicero EM cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the Interface Module, E-INT. Tighten the finger screws.
3. Connect the 25 pin D-connector to a corresponding connector on the anesthesia machine. The connector is labeled 'RS-232-C'. Tighten the finger screws.

4.4.2 Setting communication parameters

Set the communication parameters for Cicero and Cato to RS-232: 9600, e, 8, 1 (MEDIBUS 3.00). In all cases please refer to the documentation provided by Dräger.

4.4.3 Setting interfacing parameters on the S/5 Anesthesia Monitor or S/5 Critical Care Monitor

1. Press the Monitor Setu**p** key.
2. Select ***Install/Service*** (password 16-4-34).
3. Select ***Service*** (password 26-23-8) ***- Parameters - More...***
4. Select ***Interface*** and combine a required parameter with the external monitor. Two letters, al, denote alarm integration. The selection will be automatically stored in permanent memory.
5. Press the **Normal Screen** key.

Table 9 Parameters transferred from Dräger Cicero monitor to S/5 Anesthesia Monitor or S/5 Critical Care Monitor

Selection	Waveforms	Numerics	States
Gases / SSS	CO_2 (kPa, mmHg, %)	CO_2 Fi & Et (kPa, %) O_2 Fi & Et (%) N_2O Fi & Et (%) RR (CO_2) (1/min) AA Fi & Et (%) Tidal Volume insp. (1) Minute Volume exp. (1) Ppeak (mbar) Pplat (mbar), PEEP (mbar)	None
SpO_2	Pleth (% full scale)	SpO_2 (%) Pulse rate (1/min)	Probe Off

Table 10 Parameters transferred from Dräger Cato, Julian and Narkomed 2C (NAD) monitor to the S/5Anesthesia Monitor or S/5Critical Care Monitor

Selection	Waveforms	Numerics	States
Gases / SSS	CO_2 (kPa, mmHg, %)	CO_2 Fi & Et (kPa, %) O_2 Fi & Et(%) N_2O Fi & Et (%) RR (CO_2) (1/min) AA Fi & Et (%) Tidal Volume insp. (1) Minute Volume exp. (1) Ppeak (mbar) Pplat (mbar); not in Narkomed 2C PEEP (mbar)	None
SpO_2	Pleth (% full scale)	SpO_2 (%) Pulse rate (1/min)	Probe Off

NOTE: The transference of parameters illustrated in Table 7 and Table 8 represents the maximum. Some of these parameters may not be available in all device versions.

NOTE: The transference of waveforms requires the MEDIBUS real-time extension and, in Cato monitors, waveforms are available only on port 1.

4.5 Interfacing printer

It is possible to interface a laser printer (either serial or parallel) to the S/5 Anesthesia Monitor and S/5 Critical Care Monitor via the UPINET Board, B-UPI4NET. The printer must be PCL5 or PCL6 compatible and it should contain at least 2 MB of memory.

4.5.1 Interconnection

Use a commercial serial printer interface cable or the UPI4 - Printer parallel interface cable 713701 or a standard parallel port printer cable for connecting the printer to the monitor.

1. Make sure that the power on both units is turned off.
2. Connect the cable to the corresponding connector on the B-UPI4NET.
3. Connect the cable to the corresponding connector on the printer.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

WARNING **Connecting the power supply cord of the printer to the wall power outlet may cause the printer leakage current to exceed the limit specified for medical equipment. A printer must be supplied from an additional transformer providing at least basic isolation (isolating or separating transformer).**

4.5.2 Setting interfacing parameters on the printer

NOTE: For more information about printer settings, please refer to the documentation provided with the printer.

4.5.3 Setting interfacing parameters on the S/5 Anesthesia Monitor or S/5 Critical Care Monitor

Select the appropriate printer connection in the ***Record/Print*** menu.

4.6 Interfacing computer

It is possible to interface a computer to the S/5 Anesthesia Monitor and to the Critical Care Monitor.

Contact your authorized GE Healthcare distributor for further advice on computer interface.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

WARNING **Connecting the power supply cord of the computer to the wall power outlet may cause the computer leakage current to exceed the limit specified for medical equipment. A computer must be supplied from an additional transformer providing at least basic isolation (isolating or separating transformer).**

4.7 Output signals

4.7.1 UPI4NET Board output signals

Analog/ digital output signals on the connectors X7 can be used for interfacing with other devices. The pin assignments are illustrated in tables/pictures below.

Table 11 Coding element connector, X4

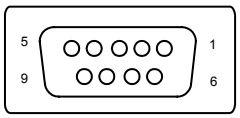
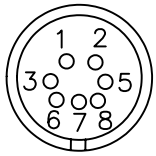
9 pin female D-connector	Pin	Signal
	1 2 3 4 5 6 7 8 9	IDCS1 (chip select) IDCL (clock) IDDI (data in) IDDO (data out) IDPE (protect enable) +5Vdc N/C (Direct ECG in B-UPI4NET rev.00 only) Nurse call GND

Table 12 Defib & IABP sync connector, X7 (B-UPI4NET -02) and on the front of F-CPU

Mini DIN7 connector	Pin	Signal
	1 2 3 5 6 7 8	Defib_sync_out Reserved Analog GND Digital GND GND Pressure_out Direct_ECG_out

4.7.2 Digital outputs

The digital output signals are as follows:

Defibrillation Sync B-UPI4NET -02 (X7 pin1),

The defibrillation sync signal is generated by the ECG. When activated, the signal is set to a high level and then set back to a low level after 10 ms. The signal is regenerated only after returning to the low level. The high level ranges from 2.8 to 5 V, while the low level ranges from 0 to 0.8 V. The delay from the R wave peak to the start of the signal is 35 ms maximum.

Nurse Call (X4 pin 8)

The Nurse Call signal is generated by red and yellow alarms. When activated, the signal is set to the high state and remains at the high state until the alarm situation is over or the SILENCE ALARM key is pressed. The high level range is from 2.8 to 5 V, while low state range is from 0 to 0.8 V.

If the output signals are used simultaneously with the coding element, the B-UPINET Y-cable, order number 889308, is recommended.

4.7.3 Analog outputs

Direct ECG B-UPI4NET -02 (X7 pin 8)

Delay (max.):	<15 ms
Gain ECG (out)/ECG (in):	1 V/mV ±20%
Pacer:	5 V and 2 ms pulse
Output range:	±4 V
Noise:	50 mVpp max.

The signal requires input impedance of 100 kΩ.

NOTE: The ECG signal is based on the ECG measurement of the Hemodynamic Modules, E-PRESTN (all variations) and E-PSM / E-PSMP. The ECG signal from the modules is channel 1 (ECG1). The channels 2 and 3 (ECG2, ECG3) are not transmitted. Make sure that the signal in channel 1 (ECG1) is good enough (extensive QRS for IABP synchronization). For further information, please contact your authorized GE Healthcare distributor.

Pressure out B-UPI4NET -02 (X7 pin 7)

Invasive pressure signal: From pressure labelled 'Art'

Delay (max.):	<35ms
Gain signal (out) / Pressure (in):	10 mV/mmHg ±20%
Output range:	-0.4 V to +3.2 V
Noise:	50 mVpp max.

The signal requires input impedance of 100 kΩ.

4.7.4 S/5 Pressure Temp Module, E-PT, output signals

The signal output connector on the Pressure Temp Module, E-PT, can be used to interface some models of IABPs to the S/5 Anesthesia Monitor and S/5 Critical Care Monitor. The pin assignments are illustrated in Table 13. Please contact your local distributor for more information.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

Table 13 Signal output connector pin assignments

	Pin	Signal
	1 2 3 4	ECG out, ECG1 Pressure out, P3 ECG out, ECG1 Ground

Output signals

ECG out, ECG1	1V / 1mV
Pressure out, P3	1V / 100mmHg
ECG out, ECG1	1V / 1mV

5 Functional check

These instructions include procedures for a functional check for Datex-Ohmeda S/5 Anesthesia Monitor and S/5 Critical Care Monitor. The functional check is mandatory after monitor installation.

These instructions include a "Functional check form, Datex-Ohmeda S/5 AM, CCM" which may be used when performing the procedures. The symbol  in the instructions indicates that the check form contains space to record the results of the particular procedure. The procedures should be performed in ascending order, bypassing those that are not applicable for a particular monitor.

All menu selections related to Datex-Ohmeda products are written in following typeface: e.g. ***Parameters - Gas Unit.***

As you enter the service menus, you need the following passwords:

Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

In case you evaluate the measurement accuracy with a patient simulator, add simulator's accuracy specification to the one of the monitor.

An electrical safety check and a leakage current test are recommended to be performed prior to the monitor installation.

5.1 Recommended tools

NOTE: Use only properly maintained, calibrated and traceable measurement equipment for the specified calibrations and adjustments to ensure accuracy.

For product(s)	Tool	Order No.
Airway modules		
Compact Airway Module, E-CAiO(VX)	Calibration gas and regulator	755583/755534*
Compact Airway Module, E-COVX	Calibration gas and regulator	755587/755534*
Compact Airway Module, E-CO(V)	Calibration gas and regulator	755581/755534*
E-miniC	Calibration gas and regulator	755580/755534*
Compact Airway Module, E-COVX, E-CAiOVX	Sampling line, 2 m	73318
All Airway modules w/ (V)	Spirometry tube, 2 m	890031
	D-lite	733950
Hemodynamic modules		
Hemodynamic modules w/ (P)	NIBP cuff and hose	2753E (cuff) 877235 (hose)
	Pressure manometer	
Hemodynamic modules w/ (P)E-PSMP	InvBP transducer	70077-001

For product(s)	Tool	Order No.
E-PSM(P)/ E-PRESTN	**Multi-Link ECG accessories, IEC**	
	- Multi-link 3-leadwire set	412682-003
	- Multi-link 5-leadwire set	412681-003
	- Multi-link 5-leadwire set, C2-C6	416467-004
E-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-002
or	**Multi-Link ECG accessories, AHA**	
E-PSM(P)/ E-PRESTN	- Multi-link 3-leadwire set	412682-001
	- Multi-link 5-leadwire set	416681-001
	- Multi-link 5-leadwire set, V2-V6	416467-003
E-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-001
E-PSM(P)/ E-PRESTN	SpO_2 finger probe	OXY-F-UN
	SpO_2 Interconnect Cable	OXY-ES3
E-NSATX	Nellcor OxiMax SpO_2 interconnect cable	
	Nellcor SpO_2 sensor	
E-MASIMO	Masimo SpO_2 probe	
	Masimo SpO_2 sensor	
	Masimo SpO_2 interconnect cable	
E-OSAT	OxyTip® + Integrated Finger Sensor	OXY-F4-N
Hemodynamic modules w/ (T)	Temperature test set	884515
Hemodynamic E-Modules w/ (NIBP)	Adult NIBP cuff hose with cuff ID	2021285-001
	NIBP cuff	2753E
	Pressure manometer	
	Infant cuff hose without cuff ID	414874-001
E-COP/ E-COPSv	C.O. Catheter cable	16590
E-COPSv	SvO_2 simulator	890121
BIS Module, E-BIS	BIS simulator or BIS Sensor simulator	900509 900508
E-ENTROPY	Entropy simulator	N-ES
	Entropy sensor cable	8002964
E-MEM	MemCard – Data or Menu	893860 (Menu, English) 887045 (Data, English)

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

see section “Adjustments and calibrations” in Compact Airway modules slot in E-Modules Technical Reference Manual.

For details on recommended accessories see “Supplies and Accessories” catalog.

5.1.1 Hemodynamic patient simulators

The following tables present the patient simulators’ compatibility with each hemodynamic module, and the accessories needed:

Table 14 Patient simulators’ compatibility with each hemodynamic module

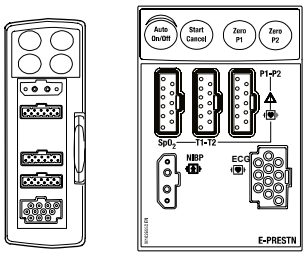
Module	Parameter	Patient simulator		
		M1010831	**MedSim**	**874027**
E-PSM(P), E-PRESTN 	ECG	Ok	Multilink ECG acc.	Not compatible
	T	402015-004	402015-004 and M1010832	
	InvBP	Ok	M1010858	

Table 15 Adapter cables for hemodynamic patient simulators

Patient simulator	Adapter cables for simulators	
Hemodynamic patient simulator	- Dual temperature adapter cable	402015-004
Hemodynamic patient simulator	- Dual Inv.BP adapter cable	2005772-001
Medsim	- Temperature adapter cable	M1010832
Medsim	- Inv.BP adapter cable	M1010858
Lionheart & MPS450	- Temperature adapter cable	M1010846
Lionheart & MPS450	- Inv.BP adapter cable	M1010862

5.2 Visual inspection

Make sure that the monitor is switched to standby.
Disconnect the mains power cord from the monitor.
If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable from the monitor. If the Memory Module, E-MEM is connected, remove any memory cards.

1. Check all units visually

   Check that all parts are intact and that the cables and screws are connected and tightened properly. Especially check the following parts:

   – Video displays: the display power cord is locked to the display.

   – F-CU5(P), F-CPU and N-AC: all the screws and the equipotential tap on the N-AC are tightened properly.

– F-CU8: the equipotential tap and all the screws are tightened properly.
– sampling line is connected to the Airway Module, if installed.

Check that modules go in smoothly and lock up properly in all module slots.

CAUTION Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.

5.3 Functional inspection

WARNING **Handle the water trap and its contents as you would any body fluid. Infectous hazard may be present.**

5.3.1 General

1. F-CU5: Connect all the parts together. Check that the cables and screws are tightened properly. Connect the mains power cord to the N-AC Power Unit.
   F-CU8: Connect the mains power cord to the F-CU8.
   Check that the stand-by LED is lit.
2. Switch the monitor on.
   Check that the monitor starts up properly, i.e. a normal start-up sound is heard from the loudspeaker, the alarm LEDs turn on and off, and the monitoring screen appears.
   No error messages should appear on the screen.
3. Configure the screen for the parameters that are connected.
4. Enter the ***Service Menu***.

   When applicable, check from the corresponding ***Parameters*** submenu that the Timeouts, Bad checksums and Bad c-s by mod values of inserted modules are not increasing faster than by 5 per second. Check also that the module memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.
   If connected, the recorder should record two lines of start-up information.

   Preset the measurement settings for those parameters that are connected, for example:

   Record/Print - ***Record Waveforms - Waveform 1 - ECG1***
   - Waveform 2 - P1
   - Waveform 3 - P2

   Invasive Pressures - ***P1 'ART' Setup -- Label – ART***
   - P2 'CVP' Setup -- Label – CVP
   - P3 Setup -Label –PA
   - P4 Setup -Label -P4
   - P5 Setup -Label -P5
   - P6 Setup -Label -P6

   Pulse Oximetry ***-Pleth Scale –AUTO***

   or

   Others ***-SPO2 Setup - Pleth Scale –AUTO***

Airway Gas *-Spirometry Setup -Scaling -Indep.*
-Paw Scale –20
-Flow Scale –15
or

Ventil.*-Spirometry Setup -Scaling -Indep.*
-Paw Scale –20
-Flow Scale –15

Others *-Resp Setup -Size -1.0*

- Resp Rate Source – AUTO
- Measurement – ON
- Detection Limit – AUTO

5.3.2 Display(s)

1. Check that the picture on the screen is correct. Readjust the picture with the adjustment knobs or with the display menu keys, if necessary.

5.3.3 Keyboard(s)

1. Tests with all the connected keyboards:
   – Press the **Monitor Setup** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select ***Normal Screen*** and check that the menu disappears from the screen.

   Tests with the Command Bar:

   – Press the **Help** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select ***Normal Screen*** and check that the menu disappears from the screen.
   Check the rest of the menu keys by pressing them one by one.

   Tests with the ARK Keyboard:

   – Enter the ***Keyboard*** service menu
   – Check functioning of the ComWheel.
   – Press all keys, except **Modify** and **Print**. Check that each key produces a sound from the loudspeaker, or the Message count value in the service menu increases.
   – Press the **Modify** and **Print** keys and check that the corresponding menus appear on the monitor screen.

   Tests with the Remote Controller:

   – Enter the ***Keyboard*** service menu.
   – Check the function of the ComWheel.
   – Press all keys. Check that each key produces a sound from the loudspeaker, or the Message count value in the service menu increases.

5.3.4 5-Module Central Unit, F-CU5/ 8-Module Central Unit, F-CU8

1. Check that all the fans in the N-AC, F-CPU and F-CU5(P) are / the frame fan in F-CU8 is running.
2. Check that the clock on the screen shows correct time. Readjust the time and date, if necessary.

5.3.5 Extension Frame, F-EXT4

1. If the F-EXT4 contains a fan, check that the fan is running.
2. Check that the modules in the F-EXT4 are recognized i.e. the required parameter information is shown on the monitor screen.

5.3.6 Compact Airway Module, E-CXXXXX

Wait until the message 'Calibrating gas sensor' disappears from the screen.

1. Check that the fan is running.
2. If the module contains membrane keys on the front panel, check the function of each of the membrane keys.

Compact Airway Modules with the Patient Spirometry option

3. Connect a clean spirometry tube and D-lite to the module. Connect the sampling line. Breathe through the wider side of the D-lite.
   Check that the flow waveform moves downwards when you breathe in and upwards when you breathe out.

For all Compact Airway Modules

4. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
5. Detach the D-fend and check that the message 'Check D-fend' appears on the monitor screen within 30 seconds.
6. Breathe to the sampling line briefly. Check that the CO2 information is updated on the screen.

5.3.7 Single width Airway Module, E-miniC

Wait until the message 'Calibrating gas sensor' disappears from the screen.

1. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
2. Detach the Mini D-fend and check that the message 'Check D-fend' appears on the monitor screen within 30 seconds.

   Breathe to the sampling line briefly. Check that the CO2 information is updated on the screen.

5.3.8 Multiparameter Hemodynamic Modules

ECG and RESP measurements

1. Connect an ECG cable to the module. Connect the cable leads to a patient simulator. Check that all ECG and impedance respiration information is shown on the monitor screen as configured on the simulator.

   Turn the simulator off. Check that the 'Asystole' message appears on the screen.

Temperature measurement

2. Check the temperature channels with a patient simulator.

   Check that temperature measurement information is shown on the monitor screen as configured on the simulator.

Invasive blood pressure measurement

3. Check the function of the front panel membrane keys.
4. Check the InvBP channels with a patient simulator.

   Zero the InvBP channels and check that the values and waveforms correspond to the simulator settings.

SpO2 measurement

5. Connect an SpO2 finger probe to the module. Check that the message 'Probe off' is shown when the probe is not connected to a finger.
6. Attach the SpO2 probe to your finger. Check that a reading of 95-99 and a pleth waveform appear on the screen

Non invasive blood pressure measurement

7. Check the function of the front panel membrane keys.
8. Attach an adult NIBP cuff onto your arm and check that the module identifies the cuff, i.e. the text 'Adult' appears in the NIBP digit field for a short time.

Perform a NIBP measurement and check that the module gives a reasonable measured result.

5.3.9 Pressure/Pressure Temp Modules, E-P, E-PT

Invasive blood pressure measurement

1. Check the function of the front panel **Zero P3** key.
2. Check the InvBP channel with a patient simulator.

   Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

Temperature measurement

3. Check the temperature channels with a patient simulator.

   Check that the temperature measurement information is shown on the monitor screen as configured on the simulator.

5.3.10 Dual pressure Module, E-PP

1. Check the function of the front panel **Zero P5** and **Zero P6** keys.
2. Check the InvBP channels with a patient simulator.

   Zero the InvBP channels. Then check that the values and waveforms correspond to the simulator settings.

5.3.11 Cardiac Output Modules, E-COP, E-COPSv

Invasive blood pressure measurement

1. Check the function of the front panel **Zero P4** key.
2. Check the InvBP channel with a patient simulator.

   Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

Cardiac Output measurement

3. Check the function of the front panel **Start C.O.** key.

5.3.12 Masimo Compatible Saturation module, E-MASIMO

1. Connect a Masimo SpO2 finger probe to the module. Check that the message 'Check probe' is displayed on the screen within 30 seconds.
2. Attach the SpO2 probe on your finger. Check that a reading of 95-100 and a proper SpO2 waveform appear.

5.3.13 Nellcor Compatible Saturation module, E-NSATX

1. Connect a Nellcor SpO2 finger probe to the module. Check that the message 'Pulse search ' is shown and check that the message 'No probe' changes to 'Check probe' within 30 seconds.
2. Attach the SpO2 probe on your finger. Check that a reading of 95-100 and a proper SpO2 waveform appear.

5.3.14 BIS Module, E-BIS

1. Connect the BIS module to the monitor frame.
   Check that 'Cable off' is displayed in the BIS waveform field.
2. Connect the DSC to the module.
   Check that the 'No sensor' message appears in the waveform field.
3. Check the function of the front panel membrane keys.
4. Open the ***BIS Setup*** menu: **BIS - *BIS Setup*** and check that ***Test DSC*** shows PASS.

NOTE: If the sensor is not connected, the **Check Sensor** key is inoperative.

5.3.15 Entropy Module, E-ENTROPY

1. Check the function of the front panel membrane keys.
2. Connect the Entropy sensor cable and Entropy simulator to the module. Check that 'Checking sensor' text and an image appear in the waveform numeric field. Wait for a while and check that all sensors show PASS.
3. Check that the EntrEEG waveform and RE and SE values appear on the monitor screen.

5.3.16 Memory Module, E-MEM

1. Insert a Data card or a Menu card to the slot.
   Check that the corresponding symbol appears on the monitor screen.

5.3.17 Recorder module

1. Press the **Record Wave** module key and check that the module starts recording the selected waveforms. Press the **Stop** module key to stop recording.
2. Check that the quality of the recordings is acceptable.

5.3.18 Network connection

1. Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect them to the CPU/UPI4NET Board.

   Check that the monitor connects to the network, i.e. the network symbol appears under the clock on the upper right-hand corner of the screen. Also a message regarding the connected Central should appear in the message field on the screen.

5.3.19 Interface Module, E-INT

1. Make sure that the monitor receives all necessary parameter data from the connected devices. Check the screen configuration and the related interfacing settings, if necessary.

   Monitor Setup – *Interfacing*

5.3.20 Interface module for PSM, E-INTPSM

1. Make sure that the monitor receives all necessary parameter data from the connected E-PSM(P) module. Check the screen configuration and the related interfacing settings, if necessary.

   Monitor Setup – *Interfacing*

5.3.21 Device Interfacing Solution, N-DISxxx

1. Make sure that the monitor receives all necessary parameter data from the connected devices. Check the screen configuration and the related interfacing settings, if necessary. Check also via the Interfacing menu that the connected DIS module status is correct:

   Monitor Setup - *Interfacing - Status Page*

5.3.22 General

- Switch the monitor to standby
- Perform final cleaning
- Fill in all necessary documents

6 General troubleshooting

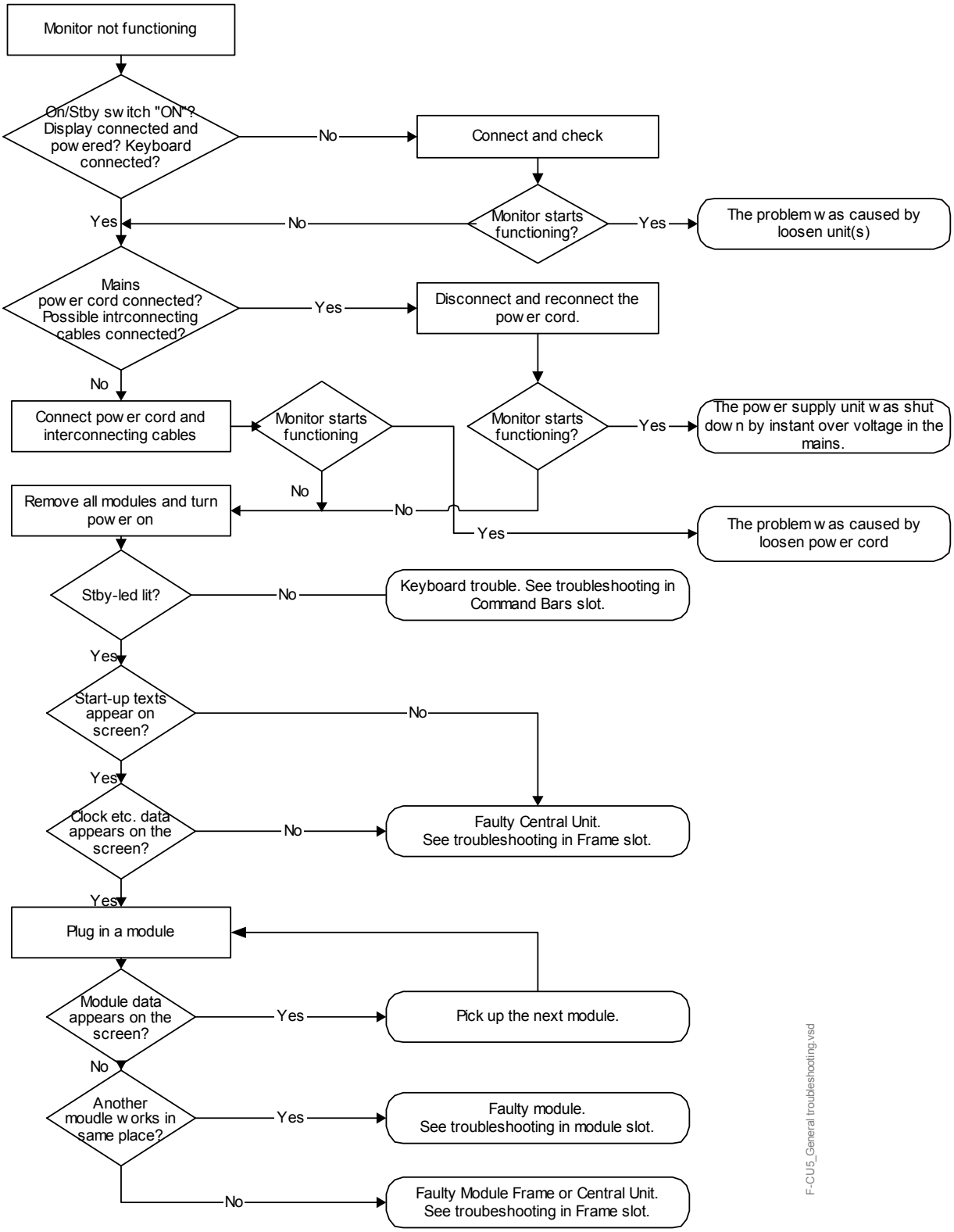


Figure 28 S/5 AM, CCM general troubleshooting flowchart

6.1 Software troubleshooting

For information on software troubleshooting, see “Software Download Tool - User Instructions.”

APPENDIX A: Functional check form, Datex-Ohmeda S/5 AM, CCM

Customer	
Service	
Service engineer	Date

Measuring equipment / test gases used:				
Equipment / tool / gas:	Manufacturer:	Model/Type/Part Number:	Serial Number / ID:	Calibration Date:

Monitor Installation			
F-CU5(P)	B-	N-	
F-CPU	B-		
N-AC	B-		
F-CU8	B-		
L-	K-		
D-	D-		

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

Visual Inspection			**OK**	**N.A.**	**Fail**
1. Check all units visually			☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
5.3.1. General		☐	☐	☐
5.3.2. Display(s)	S/N	☐	☐	☐
5.3.3. Keyboard(s)	S/N	☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
5.3.4. 5-Module Central Unit, F-CU5/ 8-Module Central Unit, F-CU8	S/N	☐	☐	☐
5.3.5. Extension Frame, F-EXT4	S/N	☐	☐	☐
Notes				
5.3.6. Compact Airway Module, E-CXXXXX	S/N	☐	☐	☐
. Compact Airway Modules with the Patient Spirometry option		☐	☐	☐
. For all Compact Airway Modules		☐	☐	☐
5.3.7. Single width Airway Module, E-miniC	S/N	☐	☐	☐
Notes				
5.3.8. Multiparameter Hemodynamic Modules	S/N	☐	☐	☐
. ECG and RESP measurements		☐	☐	☐
. Temperature measurement		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. SpO2 measurement		☐	☐	☐
. Non invasive blood pressure measurement		☐	☐	☐
Notes				
5.3.9. Pressure/Pressure Temp Modules, E-P, E-PT	S/N	☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Temperature measurement		☐	☐	☐
5.3.10. Dual pressure Module, E-PP	S/N	☐	☐	☐
Notes				

Functional Inspection		**OK**	**N.A.**	**Fail**
5.3.11. Cardiac Output Modules, E-COP, E-COPSv	S/N	☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Cardiac Output measurement		☐	☐	☐
Notes				
5.3.12. Masimo Compatible Saturation module, E-MASIMO	S/N	☐	☐	☐
5.3.13. Nellcor Compatible Saturation module, E-NSATX	S/N	☐	☐	☐
5.3.14. BIS Module, E-BIS	S/N	☐	☐	☐
5.3.15. Entropy Module, E-ENTROPY	S/N	☐	☐	☐
5.3.16. Memory Module, E-MEM	S/N	☐	☐	☐
5.3.17. Recorder module	S/N	☐	☐	☐
5.3.18. Network connection	S/N	☐	☐	☐
5.3.19. Interface Module, E-INT	S/N	☐	☐	☐
5.3.20. Interface module for PSM, E-INTPSM	S/N	☐	☐	☐
5.3.21. Device Interfacing Solution, N-DISxxx	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
5.3.22. General		☐	☐	☐
• Perform final cleaning		☐	☐	☐
• Fill in all necessary documents		☐	☐	☐
Notes				

Signature

APPENDIX B: ElectroMagnetic Compatibility

Table 1 Guidance and manufacturer's declaration – electromagnetic emissions

Guidance and manufacturer's declaration – electromagnetic emissions		
The S/5™ AM or CCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ AM or CCM should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment - guidance**
RF emissions CISPR 11	Group 1	The S/5™ AM or CCM uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in the nearby electronic equipment.
RF emissions CISPR 11	Class A	The S/5™ AM or CCM is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Table 2 Guidance and manufacturer's declaration – electromagnetic immunity

Guidance and manufacturer's declaration – electromagnetic immunity			
The S/5™ AM or CCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ AM or CCM should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	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	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply lines IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T [1 [2 (>95 % dip in U_T) for 0.5 cycle 40 % U_T [1 (60 % dip in U_T) for 5 cycles 70 % U_T [1 (30 % dip in U_T) for 25 cycles <5 % U_T [1 [2 (>95 % dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If user of the S/5™ AM or CCM requires continued operation during power mains interruptions, it is recommended that the S/5™ AM or CCM be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic field should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE U_T is the a.c. mains voltage prior to application of the test level.			

[1 S/5™ AM or CCM equipped with 5-Module Frame F-CU5(P), Power Unit N-AC and Central Processor Unit F-CPU.

[2 S/5™ AM or CCM equipped with 8-Module Frame F-CU8..10.

Table 3 Guidance and manufacturer's declaration – electromagnetic immunity

Guidance and manufacturer's declaration – electromagnetic immunity			
The S/5™ AM or CCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ AM or CCM should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
			Portable and mobile RF communications equipment should be used no closer to any part of the S/5™ AM or CCM, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.2\sqrt{P}$
	3 Vrms 150 kHz to 80 MHz	1 Vrms [1]	$d = 3.5\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz
	3 V/m 80 MHz to 2.5 GHz	1 V/m [2]	$d = 3.5\sqrt{P}$ 80 MHz to 800 MHz $d = 7.0\sqrt{P}$ 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 metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [a] should be less than the compliance level in each frequency range. [b] Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1	At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2	These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

[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 predicated 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 S/5™ AM or CCM is used exceeds the applicable RF compliance level above, the S/5™ AM or CCM should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the S/5™ AM or CCM.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m or 1 V/m [(1].

[(1] For impedance RESP measurement. For invasive pressure measurement in M-series modules except M-PRE(S)TN. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

[(2] For BIS measurement in E-BIS/M-BIS and RESP measurement in M-(P)RE(S)TN and invasive pressure measurement in M-COPSv/E-COPSv and M-COP/E-COP modules. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

Table 4 Recommended separation distances between portable and mobile RF communications equipment and the S/5™ AM or CCM

Recommended separation distances between portable and mobile RF communications equipment and the S/5™ AM or CCM			
The S/5™ AM or CCM is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the S/5™ AM or CCM can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the S/5™ AM or CCM as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter W	**Separation distance according to frequency of transmitter** m		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$ $d = 3.5\sqrt{P}$ (1	80 MHz to 800 MHz $d = 1.2\sqrt{P}$ $d = 3.5\sqrt{P}$ (2	800 MHz to 2.5 GHz $d = 1.2\sqrt{P}$ $d = 7.0\sqrt{P}$ (2
0.01	0.12 0.35 (1	0.12 0.35 (2	0.23 0.70 (2
0.1	0.38 1.1 (1	0.38 1.1 (2	0.73 2.2 (2
1	1.2 3.5 (1	1.2 3.5 (2	2.3 7.0(2
10	3.8 11 (1	3.8 11(2	7.3 22(2
100	12 35 (1	12 35(2	23 70(2
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

(1 For impedance RESP measurement. For invasive pressure measurement in M-series modules except M-PRE(S)TN. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

(2 For BIS measurement in E-BIS/M-BIS and RESP measurement in M-(P)RE(S)TN and invasive pressure measurement in M-COPSv/E-COPSv and M-COP/E-COP modules. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

For your notes:

Datex-Ohmeda

S/5™ Anesthesia Monitor

S/5™ Critical Care Monitor

Planned Maintenance Instructions

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

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

All specifications subject to change without notice.

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Table of contents

1 Planned maintenance instructions 1

1.1 Introduction . . . 1
1.2 Recommended tools . . . 2
1.2.1 Hemodynamic patient simulators . . . 3
1.3 Recommended parts . . . 4
1.4 Planned maintenance parts . . . 5
1.4.1 PM parts for Compact Airway Modules, E-CXX with CO2 absorber - Anesthesia and Critical Care . . . 5
1.4.2 PM parts for Airway Module, E-miniC . . . 5

2 Planned maintenance check list 7

2.1 Visual inspection/preparation . . . 7
2.1.1 General . . . 7
2.1.2 Extension Frame, F-EXT4 . . . 7
2.1.3 Compact Airway Module, E-CXX . . . 7
2.1.4 Single-width Airway Module, E-miniC . . . 8
2.1.5 Recorder module . . . 8
2.1.6 Modules with NIBP measurement . . . 9
2.2 Functional inspection . . . 9
2.2.1 General . . . 9
2.2.2 Display . . . 11
2.2.3 Keyboard(s) . . . 11
2.2.4 5-Module Frame, F-CU5(P) / 8-Module Frame, F-CU8 . . . 11
2.2.5 Extension Frame, F-EXT4 . . . 12
2.2.6 Compact Airway Module, E-CXXXXX . . . 12
2.2.7 Single-width Airway Module, E-miniC . . . 13
2.2.8 Multiparameter Hemodynamic Modules . . . 14
2.2.9 EEG Module, E-EEG and EEG Headbox, N-EEG . . . 16
2.2.10 BIS Module, E-BIS . . . 16
2.2.11 Entropy Module, E-ENTROPY . . . 17
2.2.12 Pressure/Pressure Temp Modules, E-P, E-PT . . . 18
2.2.13 Dual pressure Module, E-PP . . . 18
2.2.14 Cardiac Output Modules, E-COP, E-COPSv . . . 18
2.2.15 NeuroMuscular Module, E-NMT . . . 19
2.2.16 Nellcor Compatible Saturation Module, E-NSATX . . . 20
2.2.17 Masimo Compatible Saturation Module, E-MASIMO . . . 20
2.2.18 Memory Module, E-MEM . . . 21
2.2.19 Recorder Module, E-REC . . . 21
2.2.20 Network connection . . . 21
2.2.21 Interface Module, E-INT . . . 22
2.2.22 Device Interfacing Solution, N-DISxxx . . . 22
2.2.23 General . . . 22

Appendix A: Planned maintenance check form, S/5 Anesthesia and S/5 Critical Care Monitor A-1

1 Planned maintenance instructions

1.1 Introduction

These instructions include procedures for planned maintenance (PM) for the Datex-Ohmeda S/5 Anesthesia Monitor and S/5 Critical Care Monitor. The Planned maintenance should be performed once a year.

These instructions include *"Planned maintenance check form, S/5 Anesthesia and S/5 Critical Care Monitor"* to be filled in when performing the corresponding procedures.

The symbol  in the instructions means that the procedure performed should be signed in the check form.

The procedures should be performed in ascending order, bypassing those that are not applicable for a particular monitor.

If you need further information on how to perform a certain Planned maintenance procedure, please refer to the corresponding slot in the Technical Reference Manual.

All menu selections related to the Datex-Ohmeda monitors are written in the following typeface:

e.g. ***Parameters - Gas Unit***

As you enter the service menus, you need the following passwords:

Monitor Setup - *Install/Service* (password 16-4-34) **- *Service*** (password 26-23-8)

In case you evaluate the measurement accuracy with a patient simulator, add the simulator's accuracy specification to the one of the monitor.

WARNING **Handle the water trap and its contents as you would any body fluid. Infectious hazard may be present.**

WARNING **Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.**

WARNING **Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.**

CAUTION Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure. The manufacturer does not, in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an equipment maintenance agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

1.2 Recommended tools

NOTE: Use only properly maintained, calibrated and traceable measurement equipment for the specified calibrations and adjustments to ensure accuracy.

For product(s)	Tool	Order No.
All Airway modules	Flowmeter	
Compact Airway Module, E-CAiO(VX)	Calibration gas and regulator	755583/755534*
Compact Airway Module, E-COVX	Calibration gas and regulator	755587/755534*
Compact Airway Module, E-CO(V)	Calibration gas and regulator	755581/755534*
E-miniC	Calibration gas and regulator	755580/755534*
Compact Airway Module, E-COVX, E-CAiOVX	Sampling line, 2 m	73318
All Airway modules with (V)	Spirometry tube, 2 m	890031
All Airway modules with (V)	D-lite	733950
All Airway modules	Sampling line, 6 m/19.7 ft	73306
Hemodynamic modules		
Hemodynamic modules with (N), E-PSM(P)	NIBP cuff and adult NIBP cuff hose with cuff ID	2753E (cuff) 2021285-001 (hose)
	Pressure manometer	
Hemodynamic modules with (P)	InvBP transducer	
	Multi-Link ECG accessories, IEC	
E-PSM(P)/ E-PRESTN	- Multi-link 3-leadwire set	412682-003
	- Multi-link 5-leadwire set	412681-003
	- Multi-link 5-leadwire set, C2-C6	416467-004
E-PRESTN with (E12)	- Multi-link 12-lead ECG trunk cable	416035-002
or	**Multi-Link ECG accessories, AHA**	
E-PSM(P) / E-PRESTN	- Multi-link 3-leadwire set	412682-001
	- Multi-link 5-leadwire set	4162681-001
	- Multi-link 5-leadwire set, V2-V6	416467-003
E-PRESTN with (E12)	- Multi-link 12-lead ECG trunk cable	416035-001
E-PSM(P) / E-PRESTN	SpO_2 finger probe	OXY-F-UN
	SpO_2 Interconnect Cable	OXY-ES3
E-NSATX		
E-NSAT	Nellcor SpO_2 finger probe with DOC-10 cable	
Hemodynamic modules with (T)	Temperature test set	884515

For product(s)	Tool	Order No.
E-COP, E-COPSv	C.O. Catheter cable	16590
E-COPSv	SvO_2 simulator	890121
EEG Module, E-EEG	Earphones	
	EEG simulator	90502
BIS Module, E-BIS	BIS simulator or BIS Sensor simulator	900509 900508
E-ENTROPY	Simulator for E-ENTROPY	N-ES
	Entropy sensor cable	8002964
E-NMT	NMT simulator	871251
	NMT ElectroSensor	888416
	NMT sensor cable	888415
E-MEM	MemCard – Menu	
	MemCard – Data	887045 (English)
All E-Modules	Torx screwdrivers; T8, T10	

NOTE: * Ensure that the calibration gas and regulator are functioning properly before calibration. Perform annual maintenance on the regulator as required. For more information see section “Adjustments and calibrations” in Compact Airway Modules slot in E-Modules Technical Reference Manual.

1.2.1 Hemodynamic patient simulators

The following tables present the patient simulators’ compatibility with each hemodynamic module, and the accessories needed:

Table 1 Patient simulators’ compatibility with hemodynamic modules

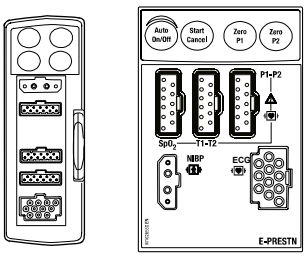
Module	Parameter	Patient simulator		
		M1010831	**MedSim**	**874027**
E-PSM(P), E-PRESTN 	ECG	Cable included	Multilink ECG acc.	Not compatible
	T	402015-004	402015-004 and M1010832	
	InvBP	Cable included	M1010858	

Table 2 Adapter cables for hemodynamic patient simulators

Patient simulator		
Hemodynamic patient simulator	Dual temperature adapter cable	402015-004
Hemodynamic patient simulator	Dual Inv.BP adapter cable	2005772-001
Medsim	Temperature adapter cable	M1010832
Medsim	Inv.BP adapter cable	M1010858
Lionheart & MPS450	Temperature adapter cable	M1010846
Lionheart & MPS450	Inv.BP adapter cable	M1010862

1.3 Recommended parts

For product(s)	**Part**	**Order No.**
5-Module Frame, F-CU5(P)	Fan filter	M1016473
Central Processor Unit, F-CPU	Fan filter	M1014462
8-Module Frame, F-CU8	Fan filter	871558
Extension Frame, F-EXT4	Fan filter	874594
CPU Board, B-CPU6, every 8 years	Battery for SRAM/Timekeeper	197230
Central Processor Unit, F-CPU, every 4 years	Lead acid battery, 6V, 1.2Ah	17006
8-Module Frame, F-CU8, every 4 years		
E-REC	Recorder paper	74205

1.4 Planned maintenance parts

1.4.1 PM parts for Compact Airway Modules, E-CXX with CO2 absorber - Anesthesia and Critical Care

Part	Order No.
Special tube 300 mm (Nafion)	733382-HEL
Special tube 130 mm (Nafion)	M1080137
Ref. gas sticker	893110-HEL
Ref. gas sticker sheet	M1130738
Filter	886136-HEL
Filter assembly	M1028983
Fan filter	M1028987
D-fend O-ring (2 pcs)	65312-HEL
Ref. gas O-ring	65340
PM sticker	893108

NOTE: Corresponding PM kit is available with Order No. 8001760-HEL.

1.4.2 PM parts for Airway Module, E-miniC

Part	Order No.	For product(s)
Special tube (Nafion 2 pcs)	733382-HEL	All Airway modules
Mini D-fend O-ring (2 pcs)	656565	E-miniC
Mini D-fend	8002174 (pkg of 10 pcs)	E-miniC
Zero valve air filter	M1011471	E-miniC, every 3 years
CO_2 Sampling line 3.0 m	733163	E-miniC
PM sticker	893108	All Airway modules

For details on recommended accessories see the “Supplies and Accessories” catalog.

2 Planned maintenance check list

2.1 Visual inspection/preparation

2.1.1 General

WARNING **Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.**

Make sure that the monitor is switched to standby.

Disconnect the mains power cord. If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable from CPU board, B-CPU6. If the Memory Module, E-MEM is connected, remove any memory cards.

1. Check all the units visually. Check that all parts are intact and that the cables and screws are connected and tightened properly.

   Especially check the following parts:

   – Video displays: the display power cord is locked to the display.
   – F-CU5(P), F-CPU and N-AC: all the screws and the equipotential tap on the N-AC are tightened properly.
   – F-CU8: the equipotential tap and all the screws are tightened properly.

   Check that modules go in smoothly and lock up properly in all module slots.
2. Replace the batteries, if necessary.

   The manufacturer recommendations are:

   – Replace the lead-acid battery in the module frames' F-CU5(P)/ F-CU8 power supply unit every 4 years.
   – Replace the SRAM/Timekeeper battery on the CPU board every 8 years.

   NOTE: The Factory Reset must be performed if the SRAM/Timekeeper battery, or the SRAM/Timekeeper chip is replaced.
3. Clean or replace the fan filters in the 5-Module Frame, F-CU5(P) and Central Processor Unit, F-CPU or in the 8-Module Frame, F-CU8.
4. F-CU8: Check that the fuses are of the correct rating.

2.1.2 Extension Frame, F-EXT4

1. If the F-EXT4 contains a fan, clean or replace the fan filter.

2.1.3 Compact Airway Module, E-CXX

1. Detach the module box.

   Check that all cables and tubes are connected properly and that there are no loose objects inside the module.

NOTE: The tubes connected to the Oxygen board pressure transducers should not be pressed too deep.

NOTE: Make sure that the tubes are not in contact with the sampling pump or the O_2 sensor, or its springs.

NOTE: Check that tubes are not contaminated. Any contamination inside the tubing can increase a risk of faulty operation in valves or sensors. If any contamination inside the tubing is noticed then it is recommended to send the module to factory repair.

2. Install the PM Kit:
   - Replace the special tubes (Nafion™).
   - Replace the Ref. filter assembly.
   - Replace the filters in the pneumatic unit (1 or 2 pcs).
   - Check the D-fend O-rings and replace them, if necessary.
   - Replace the D-fend and sampling line.
   - Clean or replace the fan filter.

NOTE: Use only approved sampling lines to ensure proper functioning.
Use a 2 m/7 ft. sampling line with Compact Airway Modules E-COVX and E-CAiOVX.

3. The manufacturer recommendation is to replace the CO_2 absorber every 4 years. Replace the absorber, if necessary.

4. Connect the Compact Airway Module to a module slot in the module frame with a long gas interface cable (the grounding plates of the cable should be removed for the procedure).

2.1.4 Single-width Airway Module, E-miniC

1. Detach the module box.
2. Check that all cables and tubes are connected properly and that there are no loose objects inside the module.
3. Install the PM Kit:
   - Replace the special tube (Nafion™).
   - Replace the Zero valve air filter every three years.
   - Check the D-fend body connector O-rings and replace them, if necessary.
   - Replace the Mini D-fend and the sampling line.

NOTE: Use only approved sampling lines to ensure proper functioning.

4. Connect the module to a module slot with a long gas interface cable (the grounding plates of the cable should be removed for the procedure).

2.1.5 Recorder module

1. Clean the recorder.
   - Open the paper compartment hatch and remove the paper roll, if installed.
   - Remove any paper chaff from the paper compartment.
   - Clean the thermal printhead and the small glass window in front of the static brush with a cotton swab dipped in isopropyl alcohol, if necessary.

NOTE: Avoid contact with the rubber paper roller. Be careful to limit the application of alcohol to the thermal printhead and the window.

– Reinstall the paper roll.

2.1.6 Modules with NIBP measurement

1. Check the NIBP filter. Replace the filter, if necessary.

   Plug the module back into the frame.

2.2 Functional inspection

2.2.1 General

1. F-CU5(P): Connect all the parts together. Check that the cables and screws are tightened properly. Connect the mains power cord to the N-AC Power Unit.
   F-CU8: Connect the mains power cord to the F-CU8.
   Check that the stand-by LED is lit.
2. Switch the monitor on.

   Check that the monitor starts up properly, i.e. the alarm LEDs turn on shortly, normal start-up sound is heard from the loudspeaker and the monitoring screen appears.

   No error messages should appear on the screen.
3. Configure the screen for the parameters that are connected.
   Check that all the connected modules are recognized, i.e. the required parameter information is shown on the screen.

   NOTE: InvBP waveforms are not shown without a parameter simulator.

   If connected, the recorder should record two lines of start-up information.

   Preset the measurement settings for those parameters that are connected, for example:

   Others - ***EEG&EP - Montage - EEG Channels - 4***
   - Montage type - Bip
   Others - ***EEG&EP - EEG Setup - Numeric 1 - MF***
   - Numeric 2 - Ampl.

   Others ***- EEG&EP - Cycle - Cont.***
   - AEP Setup - AEP Channels - 2
   - Responses -100
   - Stim. Frequency - 1.1Hz
   - Stim. Intensity - 90 dB
   - Sweep length - 100 ms
   - EP size - 1

   or

   Others – ***BIS – Scale - 100uV***
   – ***Smoothing Rate 30s***
   – ***BIS Setup –Automatic Check –ON***

Record/Print - *Record Waveforms - Waveform 1 - ECG1*
- Waveform 2 - P1
- Waveform 3 - P2

Invasive Pressures - *P1 'ART' Setup - Label - ART*
- P2 'CVP' Setup - Label - CVP
- P3 Setup - Label - PA
- P4 Setup - Label - P4
- P5 Setup - Label - P5
- P6 Setup - Label - P6

Pulse Oximetry - *Pleth Scale - AUTO*
or
Others - *SPO2 Setup - Pleth Scale - AUTO*

Airway Gas - *Spirometry Loops - Scaling - Indep.*
- Paw Scale - 20
- Flow Scale - 15

or

Ventil. - *Spirometry Setup - Scaling - Indep.*
- Paw Scale - 20
- Flow Scale - 15

Others - *C.O. - C.O. Setup - Scale - 1.0 °C*
- Injectate Volume - 10 ml
- Measurement Mode - SET

Others - *SvO2 - Update Hb - 115 g/l*

or

Wedge C.O: SVO2 - *C.O. View - C.O. Setup - Scale - 1.0 °C*
- Injectate Volume - 10 ml
- Measurement Mode - SET

Wedge C.O: SVO2 - *SvO2 - Update HGB - 115 g/l*

Others - *NMT - Stimulus Mode - TOF*
- Set Cycle Time - 10 sec.

Others - *NMT -NMT Setup - Current - s(70mA)*
- Pulse Width - 200 ms
- Stim. Beep Volume - 2

Others - *Resp Setup - Size - 1.0*
- Resp Rate Source - AUTO
- Measurement - ON
- Detection Limit - AUTO

2.2.2 Display

1. Check that the picture on the screen is adjusted correctly. Readjust the picture with the adjustment knobs or with the display menu keys, if necessary.

2.2.3 Keyboard(s)

1. Tests with the Command Bar:
   - Press the **Help** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select ***Normal Screen*** and check that the menu disappears from the screen.
     Check the rest of the menu keys by pressing them one by one.

   Tests with the ARK Keyboard:
   - Enter the ***Keyboard*** service menu
   - Check the function of the ComWheel.
   - Press all keys, except **Modify** and **Print**. Check that each key produces a sound from the loudspeaker, or the 'Message count' value in the service menu increases.
   - Press the **Modify** and **Print** keys and check that the corresponding menus appear on the monitor screen.

   Tests with the Remote Controller:
   - Enter the ***Keyboard*** service menu.
   - Check the function of the Comwheel.
   - Press all keys. Check that each key produces a sound from the loudspeaker, or the Message count value in the service menu increases.

2.2.4 5-Module Frame, F-CU5(P) / 8-Module Frame, F-CU8

1. Check that all the fans are running.
2. Check that the clock on the screen shows correct time.
   Readjust the time and date, if necessary.
3. Enter the ***Service Log*** service menu.
   Check the content of the Service Log for possible problems.

2.2.5 Extension Frame, F-EXT4

1. If the F-EXT4 contains a fan, check that the fan is running.
2. Check that the modules in the F-EXT4 are recognized, i.e. the required parameter information is shown on the monitor screen.

   Disconnect the Extension Module, E-EXT shortly, then reconnect the module back into the F-CU8.

   Check that the modules in the F-EXT4 are still recognized.

2.2.6 Compact Airway Module, E-CXXXXX

1. Check that the fan is running.
2. If the module contains membrane keys on the front panel, press each of the keys for at least one second and check that they are identified.
3. Wait until the message 'Calibrating gas sensor' disappears from the screen, then enter the Compact Airway Module ***General*** service menu.

   Check that the module configuration displayed corresponds with the Compact Airway Module type being used.
4. Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.
5. Enter the ***Gases*** service menu: Check that the 'Ambient' value displayed corresponds with the current ambient pressure (±20 mmHg).
6. Check that the flow measurement offset, i.e. the sample 'Zero' value displayed is within ±10 ml/min.
7. Perform a sampling system leak test.
8. Check the flow rates. Adjust the sampling flow, if necessary.
9. Perform a gas calibration:

NOTE: For maximum accuracy, a warm-up time of 30 minutes is recommended.

NOTE: For correct measurement values, modules need different amounts of oxygen in the calibration. If you do not use the recommended calibrating gases, the calibration does not succeed.

Anesthesia Agent

Compact Airway Modules with the option

10. Enter the ***Gases*** service menu.

    Feed calibrating gas (order code 755583) continuously for at least 30 seconds and check that the 'ID' in the service menu shows 'DES' and that the value for 'ID unrel.' is lower than 75.

Patient Spirometry

Compact Airway Modules with the option

11. Enter the ***Spirometry*** service menu.

    Connect a clean spirometry tube and D-lite to the module.

    Perform the spirometry leak test.

12. Connect the sampling line. Breathe through the wider side of the D-lite. Check that the flow waveform moves downwards when you breathe in, and upwards when you breathe out.

General

For all Compact Airway Modules

- Switch the monitor to standby and reassemble the module.

NOTE: Make sure that all front panel grounding claws are attached and have a good contact with the module box.

NOTE: When reassembling the module, make sure that the tubes are not pinched between the module box and internal parts.

13. Insert the Compact Airway Module into the frame. Switch the monitor back on and wait until the message 'Calibrating gas sensor' disappears from the screen.
14. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
15. Detach the D-fend and check that the message 'Check D-fend' appears on the monitor screen within 60 seconds.

2.2.7 Single-width Airway Module, E-miniC

1. Wait until the message 'Calibrating gas sensor' disappears from the screen, then enter the Gas Unit ***General*** service menu.
2. Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.
3. Enter the ***Gases*** service menu: Check that the 'Ambient' value displayed corresponds with the current ambient pressure (±20 mmHg).
4. Check that the flow measurement offset, i.e. the sample 'Zero' value displayed is within ±10 ml/min.
5. Perform a sampling system leak test.
6. Check the flow rates. Adjust the sampling flow, if necessary.
7. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.

   Remove the Mini D-fend and check that the message 'Check D-fend' appears on the screen within 30 seconds.

8. Perform a gas calibration:

NOTE: For maximum accuracy, a warm-up time of 30 minutes is recommended.

NOTE: Noisy sampling pump might indicate possible problems with motor bearing. Replace the noisy sampling pump by new one if needed.

2.2.8 Multiparameter Hemodynamic Modules

ECG and RESP measurements

1. Enter the ***ESTP: ECG*** service menu.

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the ECG/RESP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

2. Check the front panel membrane key **ECG LEAD,** if available.
3. Check that the 'Power Freq' value is set according to the mains power frequency. Correct the setting, if necessary.
4. Connect a 3-lead ECG trunk cable without a lead set to the module. Check that the message 'Leads off' is displayed on the screen.

   Connect a 12-lead ECG trunk cable without a lead set to the module. Check that the message 'Leads off' is displayed on the screen.

5. Connect a lead set to the ECG trunk cable and to the simulator.
6. Disconnect one of the leads and check that the corresponding electrode in the service menu shows OFF within 10 seconds from the disconnection, then reconnect the lead.

   Check the rest of the leads using the same method.

NOTE: With NESTPR/ESTPR type modules: when the ground lead (black) is disconnected, all the electrodes should show OFF. With E-PRESTN and E-PSM: when any of the limb leads is disconnected, the measurement will automatically change to 3 electrode ECG measurement.

NOTE: The asystole and different leads off messages are shown using certain priority. Even though one of the leads is disconnected, the related leads off message may not appear on the screen.

NOTE: When RA, LA, LL or RL electrode is disconnected, all V electrodes show OFF.

NOTE: With NESTPR/ESTPR type modules and 5 lead cable, the state of V2, V3, V4, V5 and V6 electrodes follow the state of the V electrode.

7. Check that all ECG and impedance respiration information is shown on the monitor screen as configured on the simulator.

   Check that the pacer count value in the service menu is shown according to the simulator configuration.

   Ensure that the Resp measurement is selected ON.

   Change baseline impedance on the simulator and check that appropriate RESP waveform and RR values are shown again within 30 seconds.

   Turn the simulator off. Check that the 'Asystole' and 'Apnea' messages are displayed.

Temperature measurement

8. Enter the ***ESTP: STP*** service menu.

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the STP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show ***OK***.

9. Check the temperature measurement calibration using temperature test plugs.

NOTE: Make sure that the protection for temperature calibration is set on, after a calibration.

Invasive blood pressure measurement

10. Check the function of the module front panel membrane keys.
11. Check the InvBP channels with a patient simulator.

    Zero the InvBP channels, then check that the values and waveforms correspond to the simulator settings.

SpO_2 measurement

12. Check that the message 'No probe' is shown, when no SpO_2 sensor is connected.

    Connect an SpO_2 finger probe to the module. Check that the message 'Probe off' is shown, when the probe is not connected to a finger.

13. Attach the SpO_2 probe to your finger. Check that a reading of 95-100 and a pleth waveform appear on the screen.

Non invasive blood pressure measurement

14. Enter the ***NIBP*** service menu.
    Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the NIBP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show ***OK***.
15. Check the function of the front panel membrane keys.
16. Check the NIBP tubing system for leakages by performing ***Calibrations - Active leak test.***
17. Perform NIBP calibration by selecting ***Calibration.***
18. Enter the ***Pneumatics*** service menu.
    Check the NIBP watchdog timer activation pressure with a pressure manometer.
19. Check the safety valve by performing ***Safety Valve – Adult*** and ***Infant.***
20. Attach an adult NIBP hose and cuff onto your arm and perform one NIBP measurement. Check that the module identifies the cuff, i.e. the text 'Adult' appears in the NIBP digit field for a short time.

    Check that the module gives a reasonable measurement result.

E-PSM(P), E-PRESTN:

21. Attach a NIBP cuff hose without cuff identification and check that the module identifies the hose:
    - The message 'Select inflation limits' appears in the NIBP digit field.
    - When you try to start the measurement, the monitor automatically opens the selections ***NIBP Setup - Inflation Limits***.

2.2.9 EEG Module, E-EEG and EEG Headbox, N-EEG

1. Enter the ***EEG*** & ***EP*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values in the module view are not increasing faster than by 5 per second. Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

   Check that the HB Mod Time-outs, HB Mod Bad Checksum and Mod HB Bad Checksum values are not increasing faster than by 5 per second. Check that the memory of the headbox has passed the internal memory test, i.e. HB Rom Error in the headbox view states 0.
2. Check the **EP Start/Stop** and **Imp. Check** membrane keys both in the module and the headbox.
3. Connect the EEG simulator to the headbox. Select 10 kΩ as imped. pos. and imped. neg. value on the simulator. Go to ***EEG*** & ***EP*** service menu and select ***Check Electr.*** Check in the headbox view that the impedances in all four channels are 10 kΩ ±1 kΩ.
4. Select 2 kΩ as imped. pos. and imped. neg. value on the simulator. Select 10 Hz 200 μV sinewave on the simulator and check that all the four waveforms have the same form. Check that the size of the waveforms is 200 μV_{pp} ±5 μV. Check that the MF value is 10 ±0.5 Hz. Check that the amp value is 71 μV ±3 μV.
5. Plug in the earphones to the headbox.

NOTE: Be careful with loud stimulation from the earphones when starting AEP stimulation.

Start AEP stimulation by pressing the **EP Start/Stop** button on the module. Check that the clicking sound comes from the earphones the frequency selected through ***AEP Setup***. Stop the stimulation by pressing again the **EP Start/Stop** button on the module. Check that the clicking stopped.

2.2.10 BIS Module, E-BIS

1. Enter the ***BIS*** service menu:

   Check that the DSC is connected to the module and the PIC+ cable is connected to the DSC.

   Check that the Mod Mon Time-outs, Mon Mod Bad checksums, Mod Mon Bad Checksums and Bad Checksums from BIS values in the module view are not increasing faster than by 5 per second.

   Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

2. Check the **BIS** and **Sensor Check** membrane keys of the module. Stay in the module view and press each key for at least one second and check that the key being pressed is identified, i.e. the corresponding 'PUSHED' text appears in the service menu.
3. Check that 'Messages from BE' are increasing steadily.

   Enter the ***Sensor*** menu.
   Check that
   - sensor type indicates 'No Sensor' (i.e. no sensor is identified)
   - no sensor is identified
   - mains frequency is set correctly
   - check that 'BE powerup test', 'DSC selftest Ch1' and 'DSC selftest Ch2' all show 'PASSED'

   (if not, go to ***BIS Setup*** menu, perform DSC Test and check the results again)
4. Connect the BIS simulator to the PIC+ cable. See that 'Checking sensor' text and image appear in the waveform numeric field. Wait for a while and check that all sensors show 'PASS'. Check that the 'Sensor type' shows correct information.
5. Check that the 'BIS', 'SQI' and 'SR' values are between 0...1000, and the 'EMG' value between 0...10000.

NOTE: If Sensor Simulator 900508 is used, the values can be out of the given range.

6. Enter the ***Module*** menu.

   Check that no BIS engine errors appear.

   Perform sensor check by pressing **Check Sensor** and see that the check is passed.

   During the sensor check the Impedance meas. should show 'CYCLIC'. During operation the Impedance meas. should show 'COMBINED' or 'OFF' (depending on the user setting in ***BIS Setup*** menu).

2.2.11 Entropy Module, E-ENTROPY

1. Enter the ***Entropy*** service menu.

   Check that the Entropy sensor cable is connected to the module.

   Check that the Time-outs, Bad checksums and Bad c-s by mod values in the module view are not increasing faster than by 5 per second. Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.
2. Check the **Entropy** and **Check Sensor** membrane keys of the module. Stay in the service menu and press each key for at least one second and check that the key is identified, i.e. highlighted when pressed.
3. Connect the Entropy simulator (N-ES) to the cable. See that the 'Checking sensor' text and image appear in the waveform numeric field. Wait for a while and check that all sensors show "PASS".
4. Check that the EntrEEG waveform and RE and SE values appear on the monitor screen.

2.2.12 Pressure/Pressure Temp Modules, E-P, E-PT

1. Enter the ***P/PT*** module service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the PT board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

Invasive blood pressure measurement

2. Check the function of the front panel **Zero P3** membrane key.
3. Check the InvBP channel with a patient simulator.

   Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

Modules with temperature measurement

4. Check the temperature measurement calibration using temperature test plugs.

   NOTE: Make sure that the protection for temperature calibration is set on.

2.2.13 Dual pressure Module, E-PP

1. Enter the ***PP*** module service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the Dual Pressure module, E-PP, memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.
2. Check the function of the front panel **Zero P5** and **Zero P6** membrane keys.
3. Check the InvBP channels with a patient simulator.

   Zero the InvBP channels. Then check that the values and waveforms correspond to the simulator settings.

2.2.14 Cardiac Output Modules, E-COP, E-COPSv

1. Enter the ***COP*** module service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the module's memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

Invasive blood pressure measurement

2. Check the function of the front panel membrane **Zero P4** key.
3. Check the InvBP channel with a patient simulator.

   Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

SvO_2 measurement

4. Check that the SvO_2 values Meas. state, OM fail and OM temp. in the ***COP*** module service menu all show NO OM.
5. Checks with the SvO_2 simulator:

   Turn the SvO_2 simulator pulsation switch to Medium and the range switch to Normal pulse. Connect the simulator to the module and check that the following messages appear in the digit field for SvO_2:

   Initializing, please wait > Warming up > Not calibrated

   Check that 'Meas. state' has changed to ***NORMAL*** and 'OM fail' and 'OM temp.' show OK.

   NOTE: The 'OM temp.' may show ***UNSTABLE*** at first, but the message should change to OK within a half a minute.
6. Perform an In Vitro calibration with the SvO_2 simulator.

   Check that the calibration date for In Vitro calibration was updated correctly and the SvO_2 reading on the screen is 81% (±2%).

Cardiac Output measurement

7. Enter the ***COP*** module service menu.

   Check the front panel **Start C.O.** membrane key.
8. Enter the ***C.O.*** menu:

   Others - *C.O.*

   Connect a catheter connecting cable to the module connector C.O.

   If the module contains a C.O. Test connector, attach the catheter connector of the connecting cable to the C.O. Test connector. Check that the message 'Cable OK' appears in the menu after the self-test.

   No Catheter > Self Test in Progress > Cable OK
9. Check the C.O. measurement with a patient simulator.

2.2.15 NeuroMuscular Module, E-NMT

1. Enter the ***NMT*** module service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the module's memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.
2. Check the function of the front panel membrane keys **Start-Up** and **Stop/Continue**.

3. Check that the message 'Cable off' is shown in the digit field and that 'Cable' on the service menu states ***OFF***.

   Plug the NMT Sensor Cable with the NMT ElectroSensor into the front panel connector NMT. Check that the message in the digit field changes to 'Measurement OFF' and 'Cable' in the service menu states ***EMG*** and ***ELECTR. OFF***.
4. Place a 3 kΩ resistor between the ElectroSensor's stimulus electrode leads (brown and white). Perform ***Start Curr. Test.***

   Check that the test was successful, i.e. the 'Current test (mA):' in the menu states ***30 OK, 50 OK*** and ***70 OK***.

   Connect the ElectroSensor leads to the NMT simulator. Set the switch on the simulator to FADE OFF and turn the knob to MAX. Check that 'Cable' in the service menu states now only ***EMG***.
5. Start the NMT measurement (TOF) by pressing the **START-UP** key on the module.

   Check that the found supramaximal current is less than 70 mA, i.e. the 'Current set' value in the service menu is less than 700.
6. Check that the digit field TOF% value is within 95-105, Count is 4 and T1% is within 95-105.
7. Check that the Noise value in the service menu remains under 100.

2.2.16 Nellcor Compatible Saturation Module, E-NSATX

1. Enter the ***N/O-SAT*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the NSAT module's ROM memory has passed the internal memory test, i.e. ROM shows OK.

   Check that all three error indicators, Preamp Error, QUART Error and I/O Error state NO.
2. Check that the SpO_2 probe related status information in the menu is correct. Only the 'No Probe' should be active (1), when no probe is connected.
3. Connect a Nellcor SpO_2 finger probe to the module. Check that the message 'No Probe' changes to 'Check Probe.'
4. Attach the SpO_2 probe on your finger. Check that a reading of 95-100 and a proper SpO_2 waveform appear.

2.2.17 Masimo Compatible Saturation Module, E-MASIMO

1. Enter the ***N/O-SAT*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check also that the module's ROM memory has passed the internal memory test, i.e. the ROM shows OK.
   Check that all three error indicators, Preamp Error, QUART Error and I/O Error state NO.
2. Check that the message 'No probe' is displayed on the screen when no probe is connected.
3. Connect a suitable SpO_2 finger probe to the module. Check that the message 'Check probe' is displayed on the screen within 30 seconds.

4. Attach the SpO_2 probe on your finger. Check that a reading of 95-100 and a proper SpO_2 waveform appear.

2.2.18 Memory Module, E-MEM

Check that the module is recognized properly, i.e. Present and Active state YES.

5. Check that the memories and the PCMCIA controller have passed the tests. The status for each should be OK.
6. Select ***Communication***.

   Check that the Interface status states Active continuously and the error counter values on the bottom part of the menu are stable.
7. Select ***Status***.

   Insert Menu card and Data card into the slot.

   Wait until the information is fully updated in the service menu, then check that the Card types are correct and the 'File system' states ATA.

   Check that the rest of the information is reliable and no errors have been detected.

2.2.19 Recorder Module, E-REC

1. Open the paper compartment cover. Check that the message 'Recorder: Cover open' appears on the screen, then close the cover.
2. Select ***Record/Print*** and ***Record Waveforms***. Select ***Record Wave*** and check that the module starts recording the selected waveforms. Select ***Stop Wave*** to stop recording.
3. Check that the quality of the recordings is acceptable.

2.2.20 Network connection

1. Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect them to the Network and CPU boards. Check that the monitor connects to the Datex-Ohmeda Network, i.e. the network symbol appears on the upper right-hand corner of the screen. Also a message regarding the connected Central should appear in the message field on the screen.

   NOTE: If necessary, reselect the monitor's network communication according to the used network software in the ***Network*** service menu.
2. Enter the ***Network*** service menu:

   Check that the counters for data errors (CRC, Frame, Transm.) are stable.

   Check that the counters for hardware errors (Intern., Missed, FIFO, Overrun) all show 0.

2.2.21 Interface Module, E-INT

1. Enter the ***Interface*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the memories have passed the internal memory test, i.e. RAM and ROM state OK.

2.2.22 Device Interfacing Solution, N-DISxxx

1. Enter the ***DIS Interfacing*** service menu:

   Check that the DIS module 'tout' and 'cse' values do not increase faster than by 5 per second. Check also that the DIS module memories have passed the internal memory test, i.e. Ram, Rom and EEPROM state all OK.

   Perform the same check for all connected DIS modules.

2.2.23 General

1. Storing trend data

   Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby situation with no power cord.

2. Service reset

   Check the Service Reset switch. Switch the monitor to standby and press the Service Reset switch for at least five seconds. Switch the monitor back on and check that the monitor performs a Cold Start, i.e. all trend information is cleared.

3. Watchdog circuitry

   Enter the ***Set/Test*** service menu and perform the ***Watchdog*** test.
   Check that the monitor restarts.

4. Service Log reset

   Enter the ***Service Log*** service menu.

   Clear the content of the Service Log by selecting ***Reset Log*** from the menu.

5. Electrical safety check

   Perform an Electrical safety check and a leakage current test. Check that the monitor and all connected units function normally after the performed test.

6. Final cleaning

   Switch the monitor to standby and perform final cleaning.
   Fill in all necessary documents.

APPENDIX A: Planned maintenance check form, S/5 Anesthesia and S/5 Critical Care Monitor

Customer	
Service	
Service engineer	Date

Measuring equipment / test gases used:				
Equipment / tool / gas:	Manufacturer:	Model/Type/Part Number:	Serial Number / ID:	Calibration Date:

Monitor Installation			
F-CU	F-	K-	D-
S-	L-	E	
B-	N-	E	
B-			

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

Visual Inspection		**OK**	**N.A.**	**Fail**
2.1.1. General		☐	☐	☐
2.1.2. Extension Frame, F-EXT4	S/N	☐	☐	☐
2.1.3. Compact Airway Module, E-CXX	S/N	☐	☐	☐
2.1.4. Single-width Airway Module, E-miniC	S/N	☐	☐	☐
2.1.5. Recorder module	S/N	☐	☐	☐
2.1.6. Modules with NIBP measurement		☐	☐	☐
Notes				

Functional Inspection		OK	N.A.	Fail
2.2.1. General		☐	☐	☐
2.2.2. Display		☐	☐	☐
2.2.3. Keyboard(s)		☐	☐	☐
2.2.4. 5-Module Frame, F-CU5(P) / 8-Module Frame, F-CU8	S/N	☐	☐	☐
2.2.5. Extension Frame, F-EXT4		☐	☐	☐
Notes				
2.2.6. Compact Airway Module, E-CXXXXX		☐	☐	☐
. Anesthesia Agent		☐	☐	☐
. Patient Spirometry		☐	☐	☐
. General				
Notes				
2.2.7. Single-width Airway Module, E-miniC		☐	☐	☐
Notes				
2.2.8. Multiparameter Hemodynamic Modules		☐	☐	☐
. ECG and RESP measurements		☐	☐	☐
. Temperature measurement		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. SpO_2 measurement		☐	☐	☐
. Non invasive blood pressure measurement		☐	☐	☐
Notes				

Functional Inspection		OK	N.A.	Fail
2.2.9. EEG Module, E-EEG and EEG Headbox, N-EEG		☐	☐	☐
2.2.10. BIS Module, E-BIS		☐	☐	☐
2.2.11. Entropy Module, E-ENTROPY		☐	☐	☐
Notes				
2.2.12. Pressure/Pressure Temp Modules, E-P, E-PT		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Modules with temperature measurement		☐	☐	☐
Notes				
2.2.13. Dual pressure Module, E-PP		☐	☐	☐
Notes				
2.2.14. Cardiac Output Modules, E-COP, E-COPSv		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. SvO2 measurement		☐	☐	☐
. Cardiac Output measurement		☐	☐	☐
Notes				
2.2.15. NeuroMuscular Module, E-NMT	S/N	☐	☐	☐
2.2.16. Nellcor Compatible Saturation Module, E-NSATX	S/N	☐	☐	☐
2.2.17. Masimo Compatible Saturation Module, E-MASIMO	S/N	☐	☐	☐
2.2.18. Memory Module, E-MEM	S/N	☐	☐	☐
2.2.19. Recorder Module, E-REC	S/N	☐	☐	☐
2.2.20. Network connection	S/N	☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
2.2.21. Interface Module, E-INT	S/N	☐	☐	☐
2.2.22. Device Interfacing Solution, N-DISxxx	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
Notes				
2.2.23. General		☐	☐	☐
1. Storing trend data		☐	☐	☐
2. Service reset		☐	☐	☐
3. Watchdog for Display Controller on B-CPU6 Board		☐	☐	☐
4. Service Log reset		☐	☐	☐
5. Electrical safety check		☐	☐	☐
6. Final cleaning		☐	☐	☐
Notes				

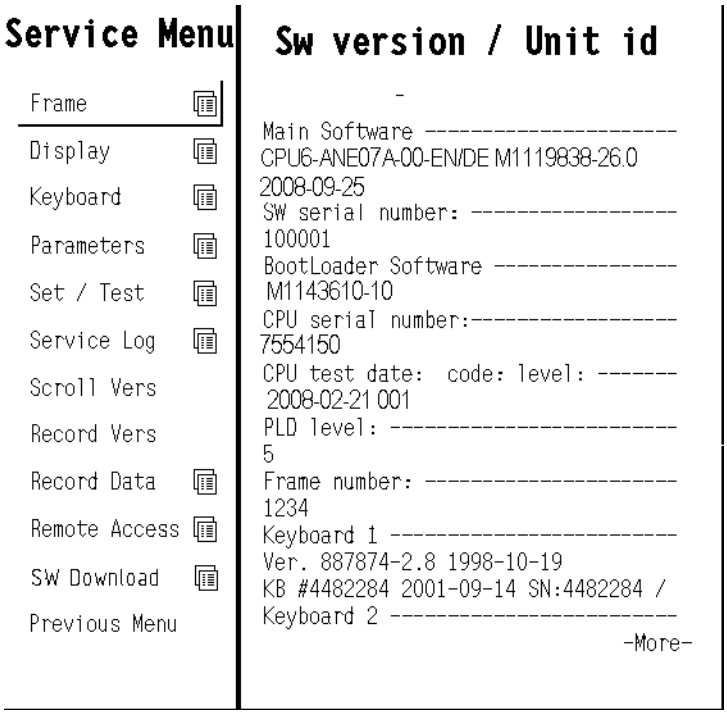
Used spare parts			
Notes			

Signature

Datex-Ohmeda
S/5™ Anesthesia Monitor
S/5™ Critical Care Monitor

Monitor software L-ANE07(A), L-ICU07(A)

Service Menu



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

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

All specifications subject to change without notice.

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Table of contents

Table of contents i

List of tables iii

Introduction 1

1 Frame 3
- 1.1 Display Controller . . . 4
- 1.2 Memory . . . 5
- 1.3 Network . . . 5
  - 1.3.1 Network Status . . . 5
  - 1.3.2 Network Config . . . 6
  - 1.3.3 Ethernet . . . 7
- 1.4 MemCards . . . 8
  - 1.4.1 Status . . . 8
  - 1.4.2 Communication . . . 9
- 1.5 Power Supply . . . 10
  - 1.5.1 Battery . . . 10
- 1.6 CPU board . . . 11

2 Display 12

3 Keyboard 13
- 3.1 Keyboard Log . . . 14
- 3.2 Keyboard Type . . . 14

4 Parameters 15
- 4.1 Gas Unit . . . 15
  - 4.1.1 General . . . 16
  - 4.1.2 Gases . . . 17
  - 4.1.3 Spirometry . . . 18
- 4.2 ECG Module . . . 20
  - 4.2.1 ECG Setup . . . 21
- 4.3 ESTP Module . . . 22
  - 4.3.1 Calibrations . . . 24
- 4.4 P/PT . . . 25
  - 4.4.1 P/PT Calibrations . . . 26
- 4.5 PP . . . 27
  - 4.5.1 PP Calibrations . . . 28
- 4.6 COP . . . 29
  - 4.6.1 COP Calibrations . . . 30
- 4.7 NIBP Module . . . 31
  - 4.7.1 NIBP Demo . . . 32
  - 4.7.2 NIBP Calibration . . . 33
  - 4.7.3 NIBP Safety Valve . . . 34

4.7.4 NIBP Pulse Valve . . . 35
4.7.5 NIBP Buttons/Leds . . . 36
4.7.6 NIBP Pneumatics . . . 37
4.7.7 NIBP Watchdog . . . 38
4.8 NMT . . . 39
4.8.1 NMT Setup . . . 40
4.9 Oxygen Saturation Module, E-NSATX, E-MASIMO . . . 41
4.10 More . . . 42
4.11 Interface module, E-INT . . . 43
4.12 Tonometry . . . 44
4.12.1 Tonometry . . . 48
4.12.2 Press Sensor . . . 49
4.12.3 System Test . . . 50
4.12.4 CO2 Sensor . . . 52
4.12.5 Pneumatics . . . 53
4.12.6 AD . . . 54
4.13 EEG & EP . . . 55
4.13.1 EEG & EP Setup . . . 57
4.14 BIS . . . 58
4.14.1 BIS Setup . . . 64
4.15 Entropy . . . 65
4.16 DIS Interfacing . . . 67
4.16.1 Interfacing . . . 67
4.16.2 Status Page . . . 68
4.16.3 DIS Interfacing service menu . . . 68
4.16.4 DIS Module specific page . . . 69
4.16.5 DELP service menu . . . 70

5 Set/Test 71
5.1 Country Settings . . . 72

6 Service Log 73
6.1 Maintenance . . . 74
6.1.1 Planned Maintenance . . . 74
6.1.2 Repair . . . 75
6.1.3 Upgrade . . . 75
6.2 Error History . . . 76
6.3 Event History . . . 76
6.4 Alarm History . . . 77

7 Record Data 78

8 SW Download 79

Appendix A: How to read HEX numbers A-1

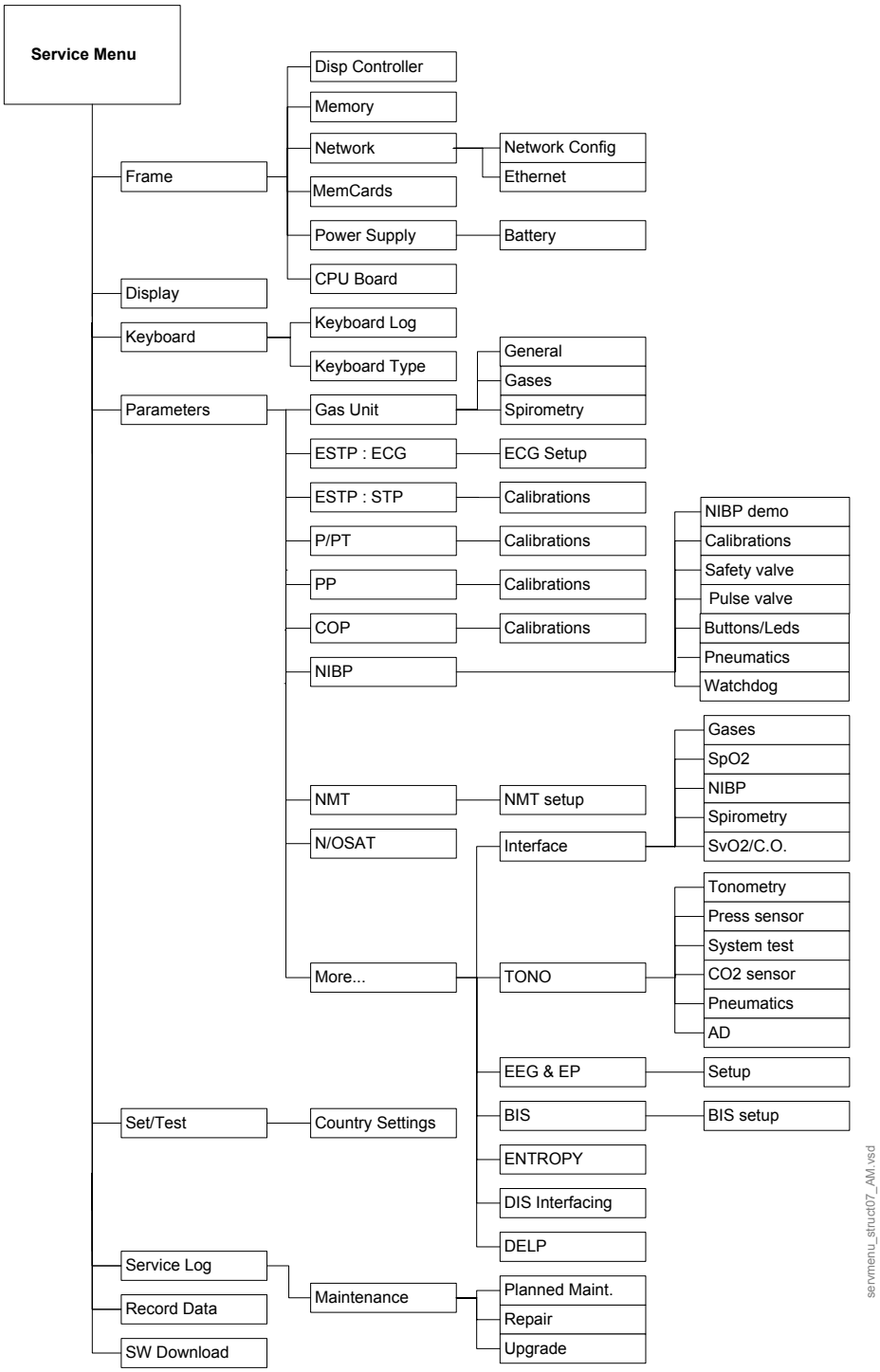
List of tables

Table 1 Ethernet service data 7
Table 2 Module general status 44
Table 3 Module hardware status 45
Table 4 Module keyboard status 45
Table 5 Module general error status 45
Table 6 Module pneumatics error status 46
Table 7 Module hardware error status 47
Table 8 Description of system test 51
Table 9 Module general status 59
Table 10 BIS Engine status 59
Table 11 BIS Engine and DSC error messages 60
Table 12 DSC status 63
Table 13 Sensor status 63
Table 14 BE power up status 63
Table 15 HEX to binary conversion A-1

Introduction

The monitor has a **Service Menu**, which is a useful tool to examine monitor functions and to troubleshoot in case a fault occurs.

Service Menu structure



Service Menu

NOTE: The Service Menu pictures and parameter values are for reference only. Details on the menu page can vary depending on the software version and the module type in use.

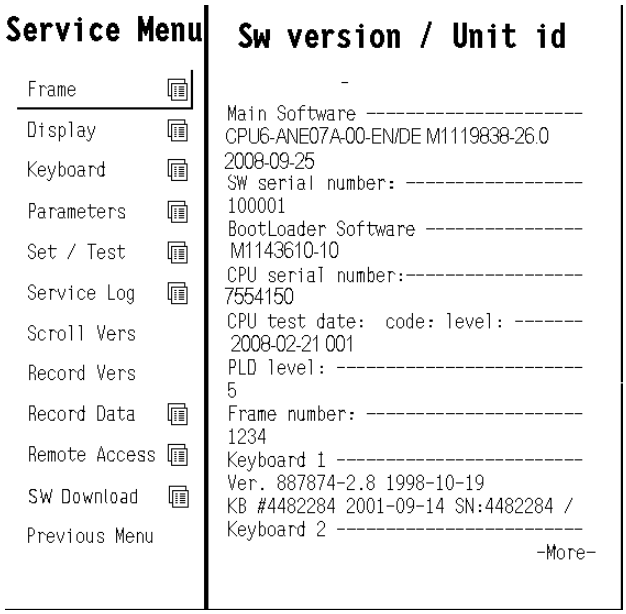
To enter the service menu:

1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** (password 16-4-34).
3. Select ***Service*** (password 26-23-8).

The field on the right in the Service Menu shows software versions and their release dates of different parts of the monitor, control numbers of measuring boards and serial numbers of modules (if available).

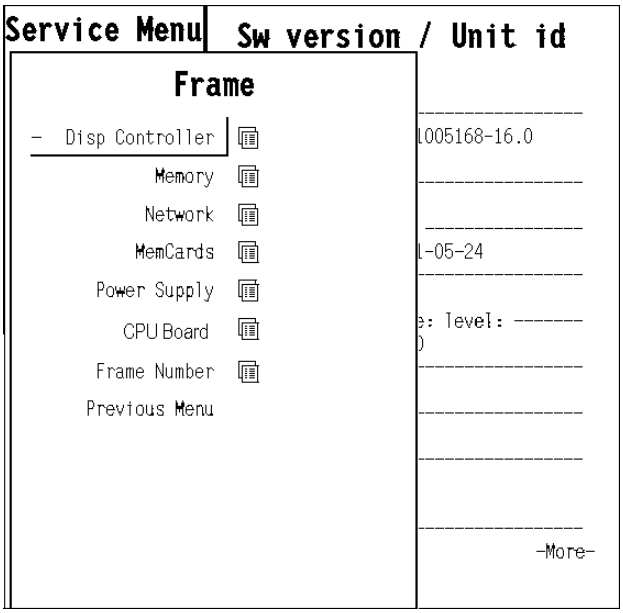
Scroll Vers enables to scroll the field on the right side.'-More-' indicates that there are more lines to be viewed.

Record Vers: By choosing this selection, the software versions and other information are printed to the device defined in the Record Data menu.



1 Frame

The frame menu includes service menus common for the frame.



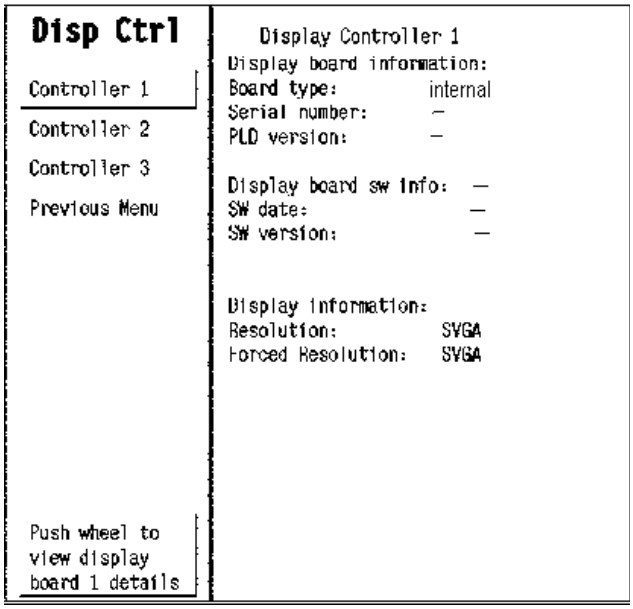
1.1 Display Controller

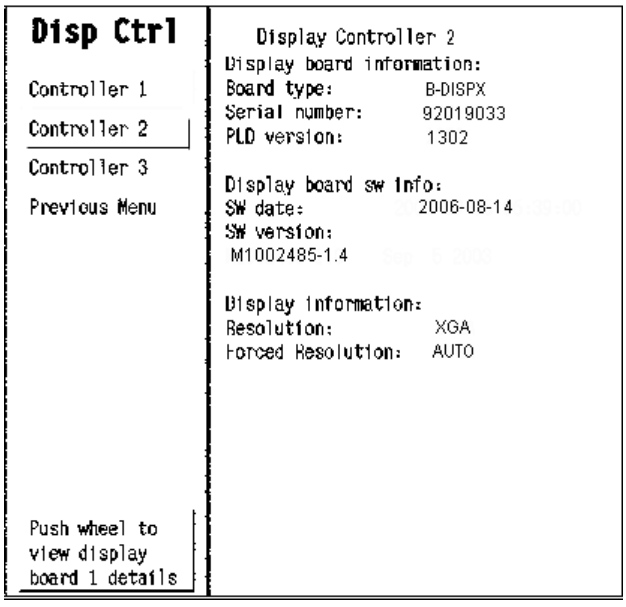
Controller 1 details of the 1st display controller.

Controller 2 details of the 2nd display controller.

Controller 3 details of the 3rd display controller.

Previous Menu a selection to return to the previous menu.





Details of the display controller boards

NOTE: The values are valid only for B-DISPX and newer display controller boards.

Board type: This is the type of the display controller board in the monitor.

Serial number: Serial number of the display controller board in use.

PLD version: Program version of the programmable logic device.

SW date: Manufacturing date of the display controller software.

SW version: Version of the display controller software.

NOTE: The display controller software is a part of the monitor software, and it is downloaded to the display controller board memory from the CPU board when necessary.

Resolution: This shows the output resolution that is selected through the monitor software menus.

Forced resolution: Forced resolution is the output resolution selected by the display controller board's dip switches or jumpers.

NOTE: The forced resolution settings override the resolution settings selected through monitor menus. The forced resolution (i.e. resolution dip switches) must be set to AUTO to allow the software-selected resolutions to be valid.

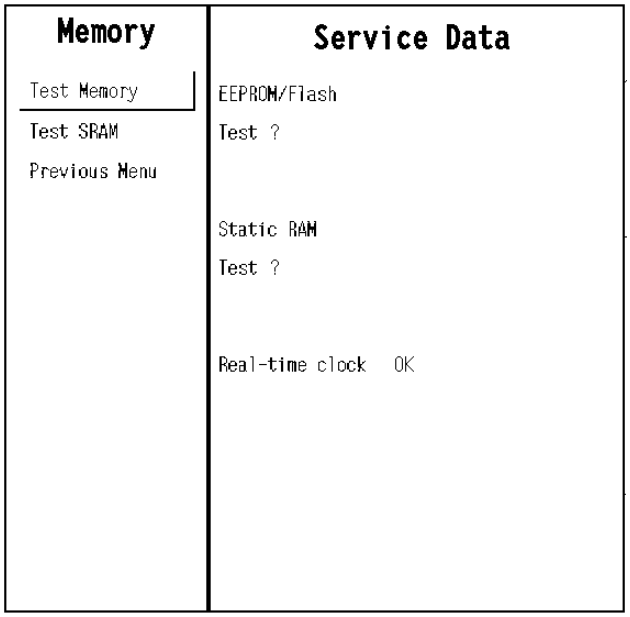
1.2 Memory

A service menu to check the status of the memory used in the CPU board of the monitor.

Test Memory tests the condition of the EEPROM/Flash memory component of the CPU board. If the result of the test is **Fail**, see section "Error messages" in the CPU chapter slot.

Test SRAM tests the Static RAM memory of the CPU board in a similar way as the EEPROM/Flash memory. If the result of the test is **Fail**, see section "Error messages" in the CPU chapter slot.

Real-time clock test is run at every start up and also during the operation of the monitor. If the result of the test is **Fail**, the battery for the SRAM timekeeper should be replaced.



1.3 Network

1.3.1 Network Status

The Network Status view shows the general status of the network.

Location ID: Monitor's location given at the setup.

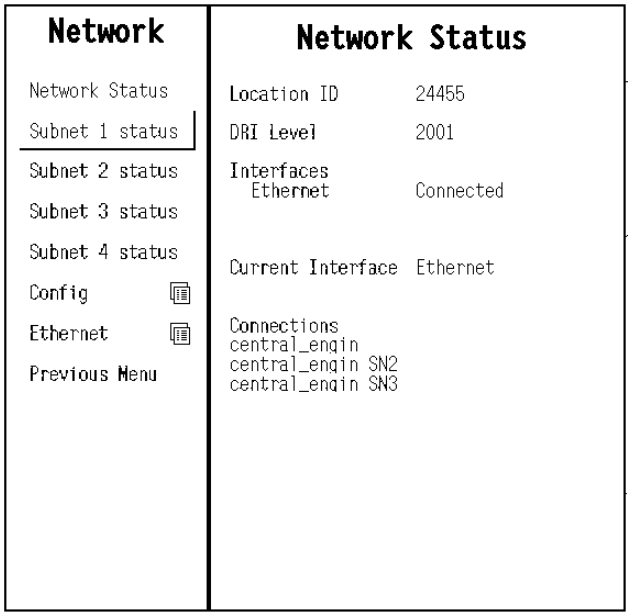
DRI level: Shows the selected level of network communication. The network communication is set according to the network software used (e.g. S-CNET01).

Interfaces: The field indicates if there is a connection to the Datex-Ohmeda Network.

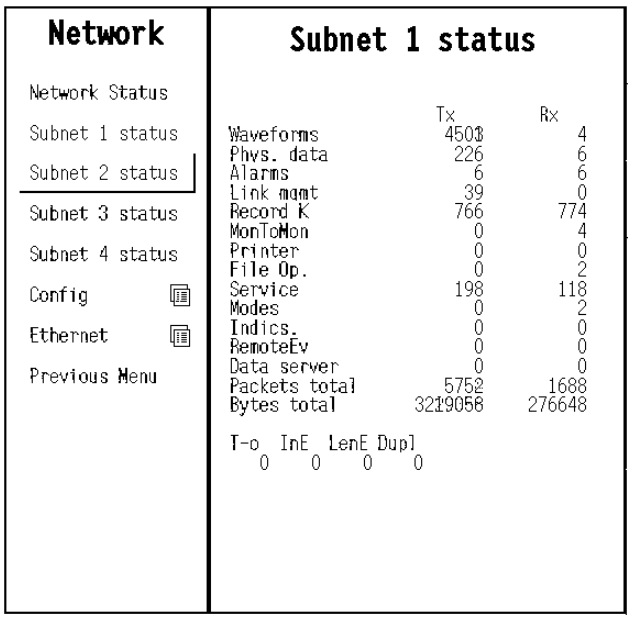
Gateway Interface: The field indicates the active network interface (None/Ethernet/WLAN).

Connections: Names of the subnet id:s connected.

The field represents the subnet status menus, i.e. shows the connected subnets. The first three connections are reserved permanently for Datex-Ohmeda Central, and the fourth is reserved for another subnet, e.g. Datex-Ohmeda S/5 Arrhythmia Workstation.



Subnet Status

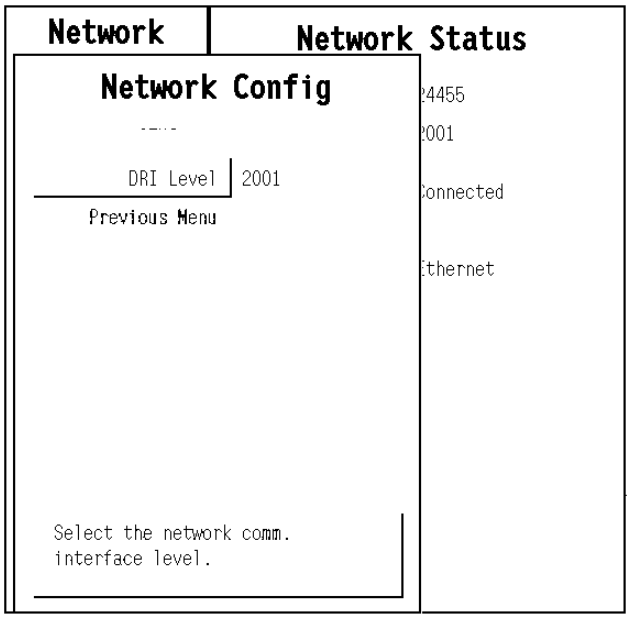


The Subnet status view gives more accurate information of the different subnet id:s connected. All four **Subnet status** menus have a similar structure. The number of different packets transmitted and received by the monitor are shown in the columns below Tx and Rx. The packet types are:

Waveforms: Waveform data
Phys. data: Physiological numerical data
Alarms: Alarms, alarm profiles and alarm limits
Link mgmt: Network management messages
Record K: Record Keeper data
MonToMon: Monitor-to-monitor communication related data
Printer: Printing data and control messages
File Op.: File operation messages, saving and loading of cases
Service: Maintenance and service
Modes: User mode data
Indics.: Remote indications sent to monitor
RemoteEv: Remote events
Data server: Packets of the data server (Arrhythmia Workstation)
Packets total: Total number of packets sent/received
Bytes total: Total number of bytes sent/received

T-o Number or resendings
InE Received faulty packets
LenE Erroneous packet length
Dupl Same packet received as a duplicate

1.3.2 Network Config



The DRI Level is for setting the monitor's network communication. The network communication is set according to the network software used (e.g. S-CNET01).

Network software S-CNET01 ->DRI Level = 2001
Network software S-CNET02 ->DRI Level = 2001
Network software L-NET03 ->DRI Level = 2003
Network software L-NET05 ->DRI Level = 2005
Network software L-NET05-02 ->DRI Level = 2008

1.3.3 Ethernet

The **Ethernet Status** view shows the general status of the ethernet network communication.

Driver: Ethernet chip name (82559ER)

Cable: Indicates if the ethernet cable is connected.

EthernetAddr: Monitor's ethernet address.

Speed: Indicates the current ethernet communication speed.

The service data related to the ethernet status view is described in the following table.

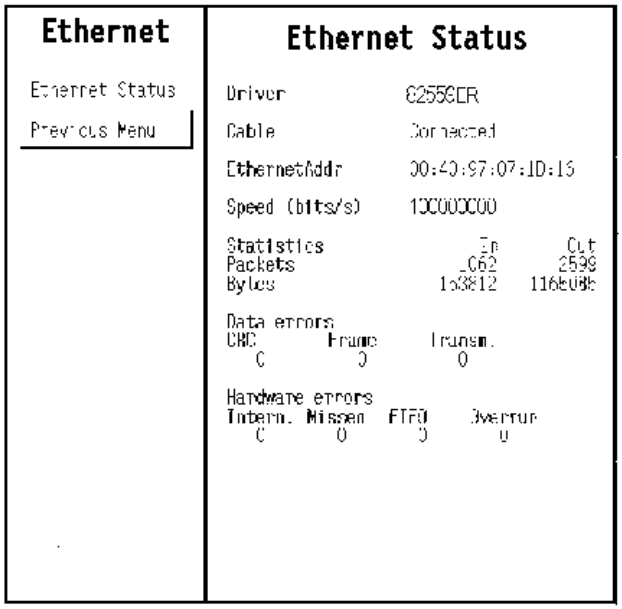
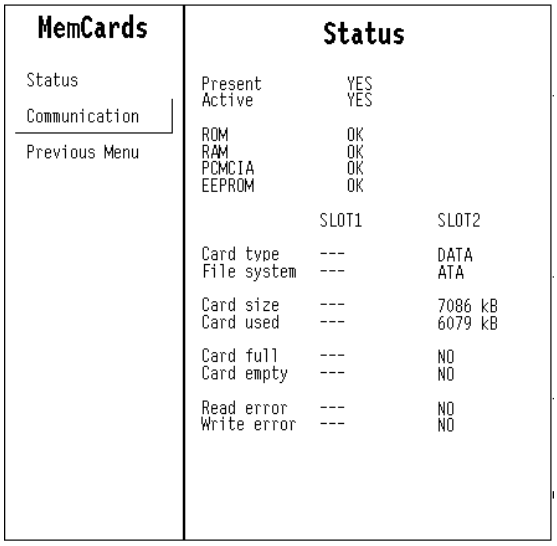


Table 1 Ethernet service data

Value	Usage	Notes
Received packets (Statistics In/Packets)	Total number of received packets since last cold start.	
Transmitted packets (Statistics Out/Packets)	Total number of transmitted packets since last cold start.	
Received bytes (Statistics In/Bytes)	Total number of received bytes since last cold start.	
Transmitted bytes (Statistics In/Bytes)	Total number of transmitted bytes since last cold start.	
CRC errors (CRC)	Number of received packets with incorrect checksum.	
Frame errors (Frame)	Number of received packets with incorrect frame structure.	Refers to physical layer problems. An erroneous packet often has both frame and CRC error.
Transmission errors (Transm.)	Number or errors in packet Transmission.	
Internal errors (Intern.)	Internal error of the network board.	Must always be 0.
Missed packets (Missed)	Number of received packets lost due to overload.	Must always be 0.
FIFO errors (FIFO)	Internal error of the network board.	Must always be 0.
Overrun errors (Overrun)	Practically same as above.	Must always be 0.

1.4 MemCards

1.4.1 Status



Module **Present** indicates whether the memory module is firmly attached to the monitor. Possible values are YES and NO.
Module **Active** indicates whether the module services are available. Possible values are YES and NO.

ROM indicates the status of the ROM memory of the module. Possible values are OK and ERR.
RAM indicates the status of the RAM memory of the module. Possible values are OK and ERR.
PCMCIA indicates the status of the PCMCIA controller of the module. Possible values are OK and ERR.
EEPROM indicates the status of the EEPROM memory of the module. Possible values are OK and ERR.

SLOT1 and **SLOT2** indicate the left hand slot and the right hand slot, respectively.

Card type indicates whether the card is MENU or DATA card. If a duplicated card is inserted, type DUPL.

File system indicates the type of the memory card in use. The only supported file system is ATA. If a memory card using another file system is used, the message 'UNKNOWN' is shown. If the card is poorly attached, the message 'LOOSE' is shown.

Card size indicates the total amount of disk space in the card in kilobytes.

Card used indicates the total amount of used disk space in the card in kilobytes.

Card full indicates whether all the disk space in the card is used. Possible values are YES and NO.

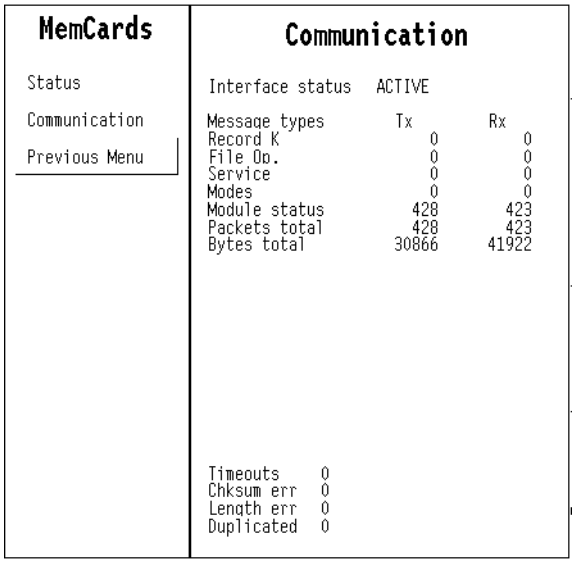
Card empty indicates the lack of menu files in the MENU card or no files in the DATA card. Possible values are YES and NO.

Read error indicates whether the reading from the card has failed. Possible values are YES and NO.

Write error indicates whether the writing to the card has failed. Possible values are YES and NO.

All values can be '- - -' to indicate 'No data available'.

1.4.2 Communication



Interface status indicates the status of the data link between the monitor and memory module. If the memory module is properly attached, the status should always be on ACTIVE. If the status blinks between ACTIVE and CLOSED, a communications error has occurred: remove the module briefly, and insert it back to the monitor frame to check if the error disappears.

Message types indicates the type of data packets that have been sent (**Tx**) and received (**Rx**) since last monitor start. Data types are listed on the lines below **Message types** text.

Data types:

Record K indicates the communication between the Monitor and Record Keeper.

File Operation indicates the operations of Patient data.

Service indicates the Memory Module operations.

Modes indicates the User Mode operations.

Module status indicates the number of sent/received data packets that relate to the memory module status.

Packets total indicates the total amount of data packets that have been sent/received since the last monitor start.

Bytes total indicates the total amount of data bytes that have been sent/received since the last monitor start.

The last four lines indicate transmission errors:

Timeouts indicates the number of timeouts that have occurred in memory module data transmission since the last monitor start.

Chksum err indicates the number of checksum errors in data packets from memory module since the last monitor start.

Length err indicates the number of data packets with erroneous length from the memory module since the last monitor start.

Duplicated indicates the number of duplicate data packets from the memory module since the last monitor start.

1.5 Power Supply

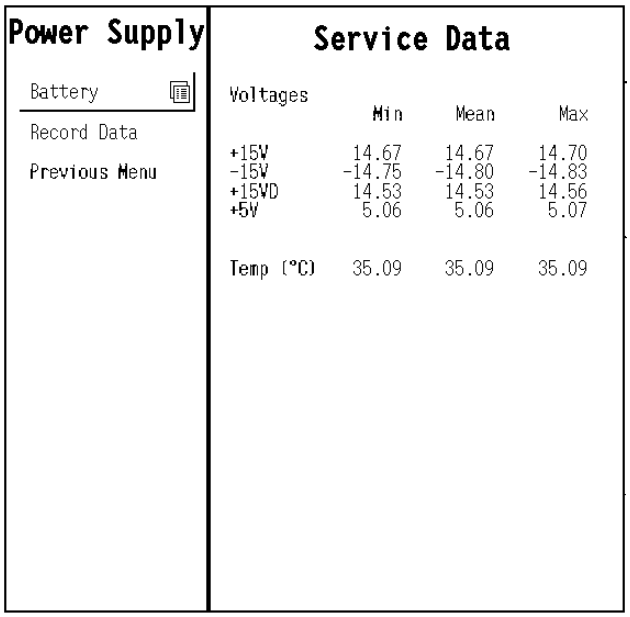
The menu shows the voltages and temperature measured by the UPI4(NET) board. The measurement starts about 100 ms after a start-up. The values in the column under **Mean** are the mean values of the last one second, the **Min** column shows the minimum mean value, and the **Max** column the maximum mean value of the voltages and temperature measured during the current power ON.

The voltages should meet the following ranges:

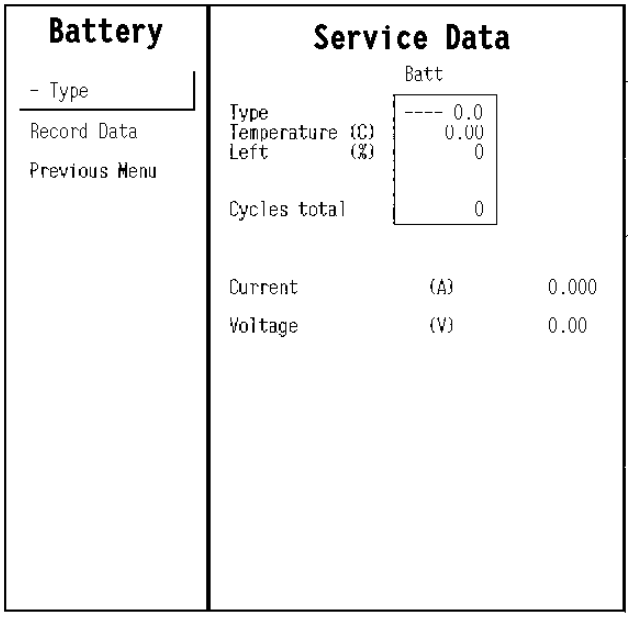
+15V 14.20....15.60
–15V -14.00...-15.50 V
+15VD 14.10...15.60 V
+5V 4.70...5.40 V

Temp (°C) value corresponds with the Central Unit internal temperature measured at the location of the UPI4(NET) board.

The numbers on this page are only directive and not absolute values.



1.5.1 Battery

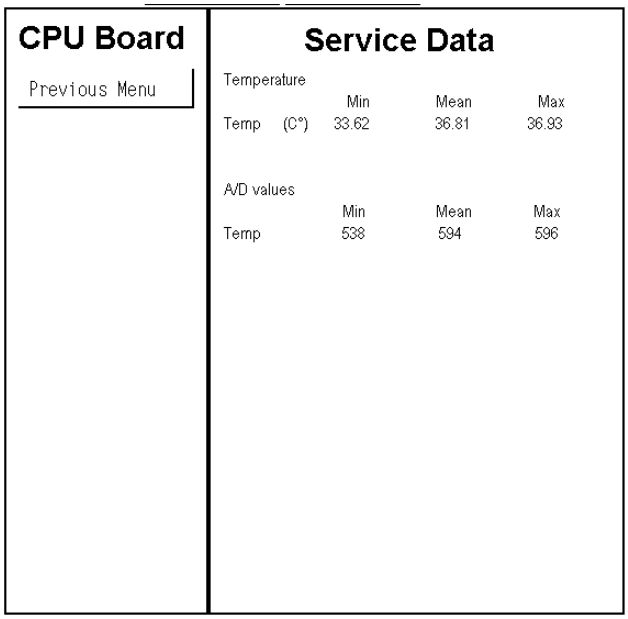


1.6 CPU board

The menu shows the temperature measured by the Central prosessing board.

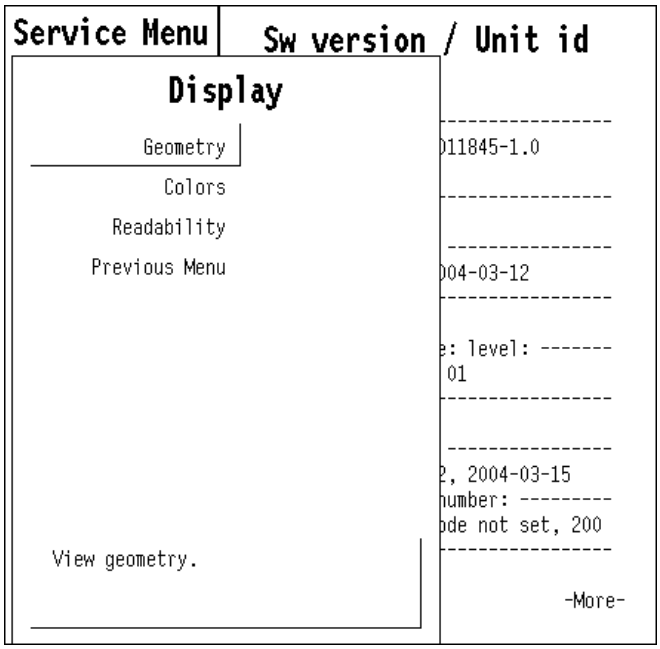
Temp (°C) value corresponds with the Central Unit internal temperature measured at the location of the CPU6 board.

A/D values shows the A/D value of temperature measurement.



2 Display

Geometry views the geometry of the display.
Colors views the color of the screen.
Readability views the readability of the screen.



3 Keyboard

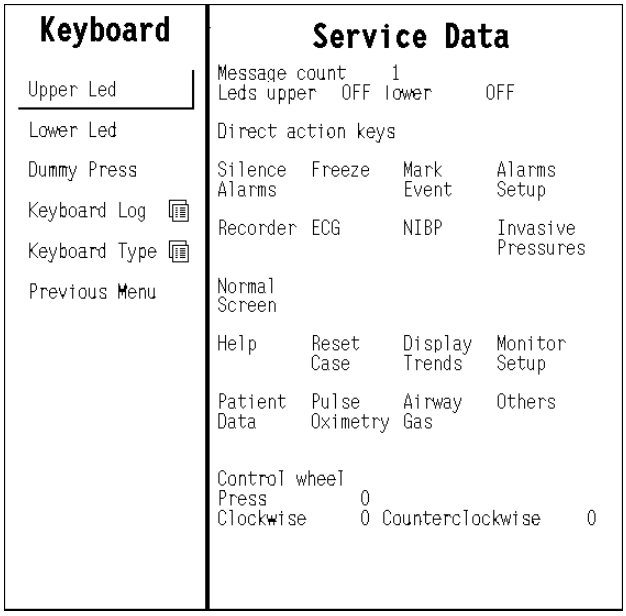
Keyboard

The service menu for testing the command board functions.

Upper Led is for testing the upper alarm LED (red) on the command board. When the text is highlighted, the upper alarm LED can be turned on and off by pressing the ComWheel.

Lower Led is for testing the lower alarm LED (yellow) on the command board. When the text is highlighted, the lower alarm LED can be turned on and off by pressing the ComWheel.

Dummy Press is for testing the ComWheel. When the text is highlighted, pressing the ComWheel creates a sound from the loudspeaker and the corresponding number on the service data field increases.



Service Data

Message count counts the number of messages that are sent out to the main CPU board.

Leds upper and **lower** indicate the states of the alarm LEDs on the command board.

Direct action keys texts are indications to the command board membrane keys. When a key on the command board is pressed, the corresponding text in the menu changes its colour.

Control wheel, **Press** counts the ComWheel pressings.

Control wheel, Clockwise and **Counter clockwise** indicate the ComWheel turnings.

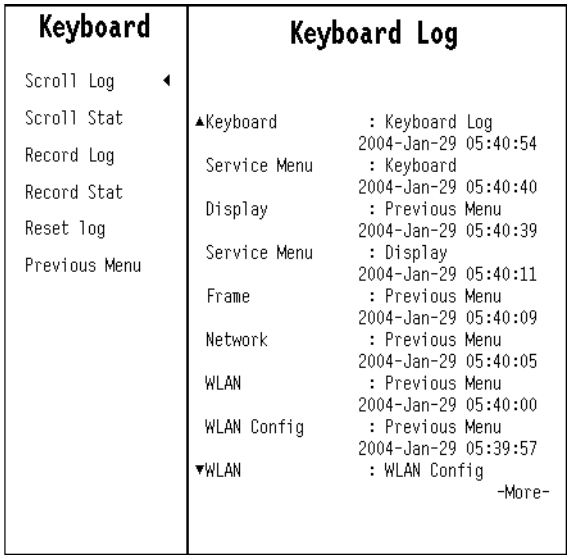
Since shows the date and the time of the last run time reset.

3.1 Keyboard Log

Keyboard Scroll Log

All the keyboard presses and the commands given by the ComWheel are recorded in the Keyboard Log. The keyboard log is saved in the permanent memory of the monitor. The length of the log is 1150 events. The log is FIFO type.

Scroll Stat enables to scroll the keyboard events.



3.2 Keyboard Type

Store Mask A selection for the anaesthesia keyboard's language. The selected language determines the outcome of the lower keypad.

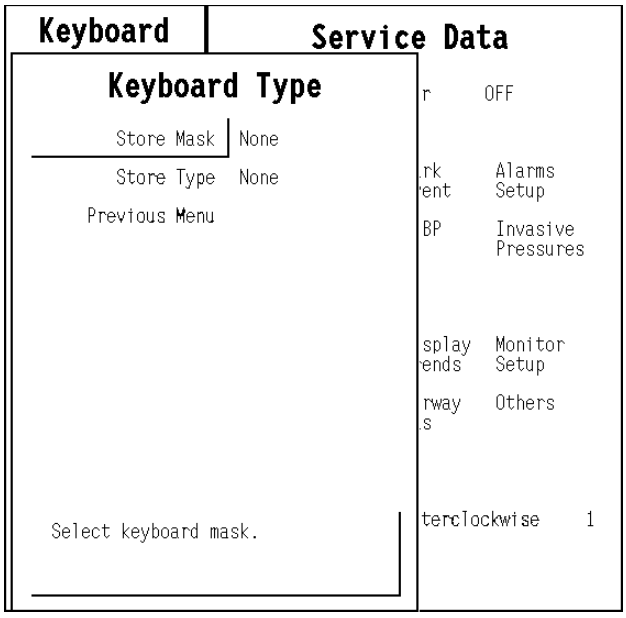
Store Type is for selecting the keyboard;

COM = Command Board

ARK = Anaesthesia Keyboard

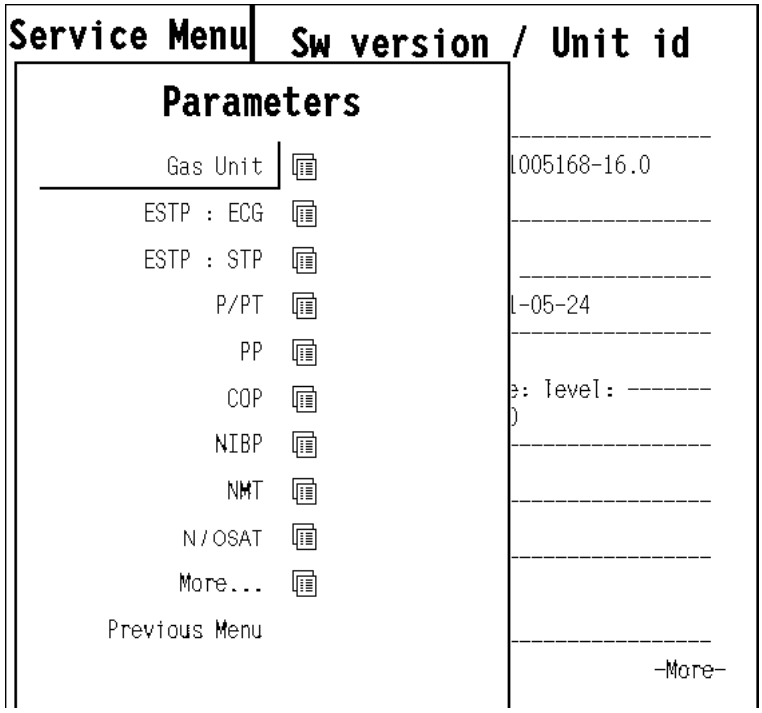
AIC = Information Center Keyboard.

NOTE: The settings should be checked if the controller board is replaced. If settings are changed, the new settings will not be valid until the next start-up.



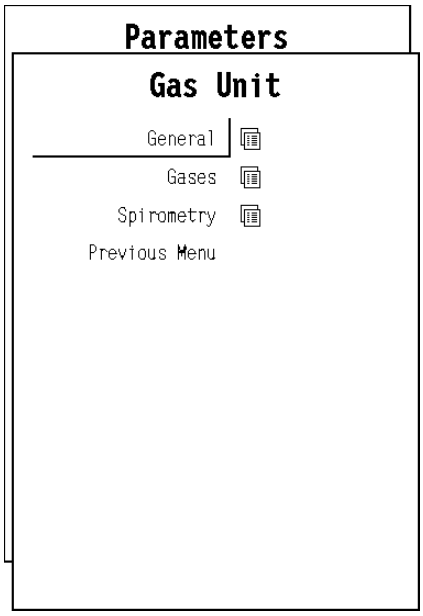
4 Parameters

NOTE: Parameter values in Service Data fields are only for reference in this section.



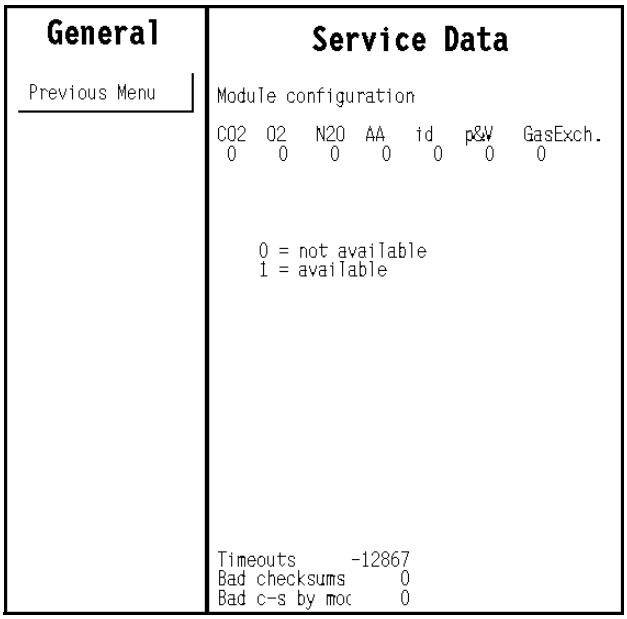
4.1 Gas Unit

Service menu for airway gas modules' communication and airway gas and spirometry measurements.



4.1.1 General

Service Data



Module configuration shows which measurement options are available, i.e. are detected by the module.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.

The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

4.1.2 Gases

Noise Meas activates the noise measurement.

Sample gain adj adjusts the sampling pump gain, i.e. for adjusting the sample flow measurement.

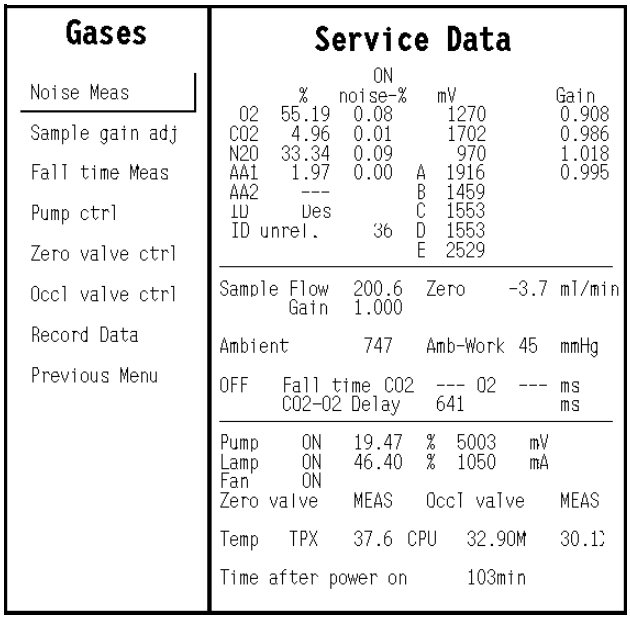
Fall time Meas * activates the fall time measurement.

Pump ctrl A manual control for the sampling pump.

Zero valve ctrl A manual control for the zero valve.

Occl valve ctrl* A manual control for the occlusion valve.

Record Data prints out the shown service data and board information (id. serial number and software id.) onto the recorder module.



Service Data

O_2, CO_2, N_2O, AA

% field shows real-time concentrations.
noise-% is standard deviation of concentration.

O_2, CO_2, N_2O, AA channels A-E

mV field: signal is scaled to mV.
Gain: User gain. It is scaled as (User gain)/(Factory gain).

ID* Shows the identified agent.

ID unrel.* The shown value tells how unreliable the identification is. With pure agent the value is typically < 75.

Sample Flow is calculated from differential pressure and adjusted by the module. **Zero** value as measured during initialization when the pump is off. **Gain**: sample flow measurement can be calibrated by adjusting the gain.

Ambient* Ambient pressure is measured continuously in E-miniC. In M-miniC it is measured at least once an hour (during the first running hour during each zeroing process). In M-Gas it is measured once an hour.

Amb-Work: ambient pressure - sampling system internal pressure.

Fall time* CO_2 and O_2 in ms. For N_2O and AA same as CO_2.

CO_2-O_2 Delay* In ms. No delay between CO_2, N_2O, and agents.

Pump Can be toggled ON/OFF. PWM output 0-100% is shown. Pump voltage is also shown.

Lamp The state, PWM control, and current of the lamp are shown.

Fan* The state of the fan is shown.

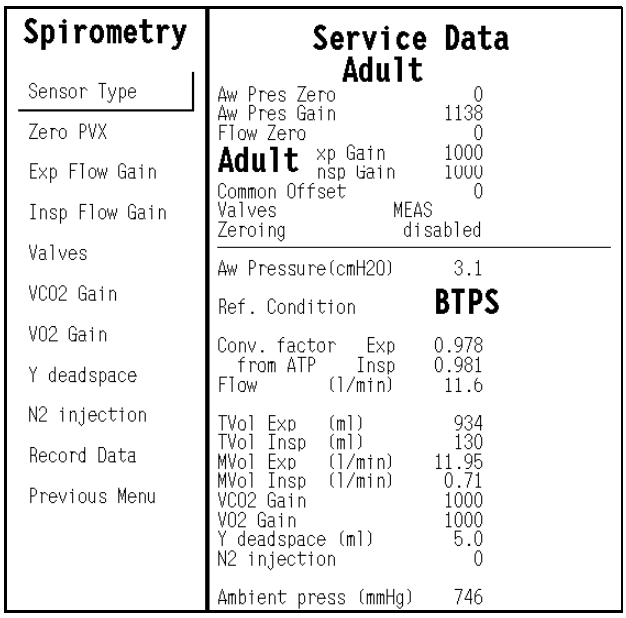
Zero and Occl valve Can be toggled between the measurement state (MEAS) and zeroing/occlusion states (ZERO/OCCL).

Temp Temperatures measured by the module from TPX, CPU, and OM.

Time after power on In minutes after power on.

***)** The function is only in use with Compact Airway Modules.

4.1.3 Spirometry



Insp and exp flow gains can be adjusted, if calibration is needed. A calibration pump or spirometry tester is used and readings are observed from the display. If a deviation exists, gains are adjusted accordingly. Gain scaling is 1.000, when the factory settings are in effect (1.050 in modules that contain the Gas Exchange measurement).

When the Adjust key is pressed, a separate box for adjusting the value appears. During adjustment calibration, values are sent to the module. When the ComWheel is pressed, the values are permanently stored in EEPROM of the module and the box disappears.

Zero PVX: Start zeroing the pressure sensors. Effects Aw Pres Zero and Flow Zero value.

Exp Flow Gain / Insp Flow Gain: Adjust the Flow sensor gains.

Valves: Switch between MEASUREMENT and ZEROING

VCO2 / VO2 Gain: Adjust the VCO_2 and VO_2 gain.

Y deadspace: Adjust the Y-deadspace.

N2 injection: Select between on (1) and off (0).

Record Data: Record Data prints out the shown service data and board information (id. serial number and software id.) onto the recorder module.

Service Data

Sensor ADULT/PEDIATRIC according to the selected measurement mode (sensor).

Insp/Exp Flow Gains shown apply to the selected sensor.

Aw Press Zero and **Flow Zero** are the result of zeroing in the user service menu. They can be adjusted in the factory calibration menu, but not permanently stored.

Aw Press Gain is directly the value used in sw. It can be adjusted, but not permanently stored.

Exp Flow and **Insp Flow Gains** are scaled as (User gain)/(Factory gain). **Exp** and **Insp Flow Gains** can be adjusted also in the user service menu.

Common Offset is the compensation factor for pressure difference reading of the difference sensor when applying an equal pressure on both sides of the sensor.

Valves can be changed between **MEASUREMENT** and **ZEROING**.

Zeroing automatic zeroing either **ENABLED** or **DISABLED** (only factory service menu).

Aw Pressure shows the real time value of airway pressure.

Condition shows in which reference conditions the results are. With calibration pump or spirometry tester, the results are always in ATP. If breathing is detected ($EtCO_2$ > 1.0%), the results are according to the **Flow & Vol Setup** selection.

Flow shows the flow measurement value.

TVol Exp, TVol Insp, MVol Exp and **MVol Insp** are shown to ease calibration. The numbers are the same as on the main display. The former pump calibration procedure has been dropped out. We claim that calibration is not needed in routine clinical use, so a separate Flow calibration menu is not needed. Calibration can be done with the pump or spirometry tester. The results must be taken from the screen and gains adjusted accordingly.

VCO_2 and **VO_2 Gain** show a value near 1000, the correct gains have been measured in the factory. Not used in MRI Monitor.

Y deadspace is the geometric volume in ml between the Y-piece and the D-lite. Default is 5 ml for a standard Y-piece (as delivered with Siemens 900C ventilators). Used for VCO_2 and VO_2 delay time corrections.

Set **N_2 injection** to 1 during laboratory tests with a Spirometry tester and injection of N_2 gas (for scientific validations use only). At power on of the module, the value is always zero.

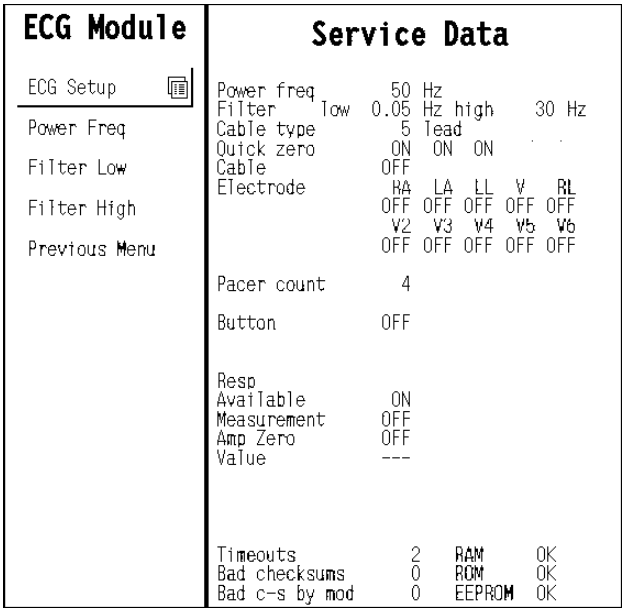
Ambient pressure value measured by the module.

4.2 ECG Module

Power freq: Set power frequency; 50 Hz/60 Hz.

Filter low: Set filter low frequency; 0.05 Hz/0.5 Hz.

Filter high: Set filter high frequency; 30 Hz (40 Hz if power freq is 60 Hz) /100 Hz or 150 Hz @ NE12STPR.



Service Data

Power freq, and Cable type show the values chosen or detected, **Filter low and high** defines the selected filter (Monitor/Diagnostic/ST).
Quick zero at PRESTN series module is ON when the ECG signal is beyond the scale, and therefore, is quickly returned to optimal range using fast signal processing methods. All the **Quick zero** bits are ON at the same time.
Cable shows ON when ECG cable is connected.

Electrode shows ON when each of these electrodes are connected.

Pacer count is a running number for pacemaker users.

Button No effect on the module.

Resp Available indicates that ECG hardware is capable of measuring impedance respiration.

Measurement shows ON when the respiration measurement is on.

Amp zero shows ON when zeroing of the respiration amplifier takes place.

Waveform **VALUE** will be updated in one second interval.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.2.1 ECG Setup

Filter filters the ECG signal high frequency noise and slow respiratory artefacts.

Monit (monitor) filter is used in routine monitoring. It effectively filters the artefacts caused by the electrosurgery unit and respiration.

Diagn (diagnostic) filter is used if more accurate information of the waveform is needed (e.g. of P-wave or AV block). The diagnostic filter is more susceptible both to high frequencies and baseline wander than the monitor filter.

STfilt (ST filter) permits more accurate information of ST segment. It filters the high frequency artefacts caused by the electrosurgery unit, but catches the slow changes in ST segment. The ST filter is more susceptible to baseline wander than the monitor filter.

5-lead cable selects five or three electrodes. With the 12-lead ECG the selection is automatic.

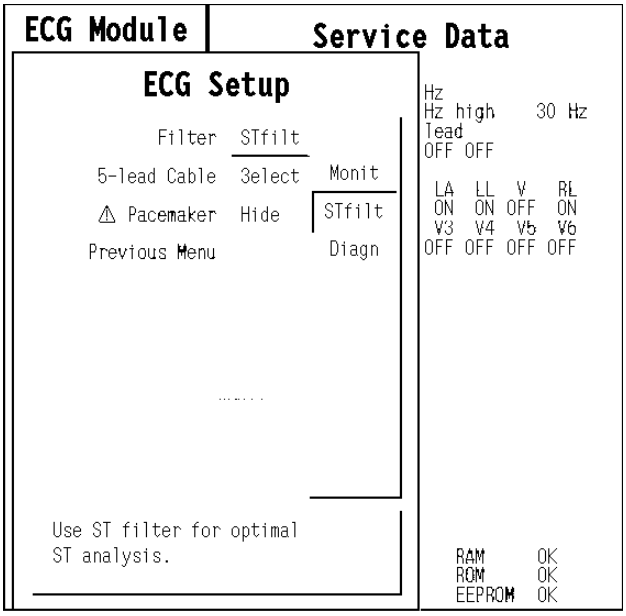
Pacemaker selects how to display the pacing pulse of cardiac pacemaker. The selections are **Show, Hide**, **ON R** and **Sensit**.

Hide, the pacing pulse is filtered away from ECG data.

Show, the pacer pulse is filtered away from ECG data but the pulse is displayed as a constant height marker.

ON R, pacing pulses are not filtered away from ECG data. This improves ECG monitoring with A-V pacemaker patients, as QRS complexes are counted even if the pacing pulse hits the QRS complex. However, during asystole the monitor may count pacing pulses as heart beats.

Sensit selection uses a more sensitive pacemaker detection. Pacemaker spike is displayed on ECG.



4.3 ESTP Module

Service menu for the multiparameter hemodynamic module's oxygen saturation, temperature and invasive pressure measurements.

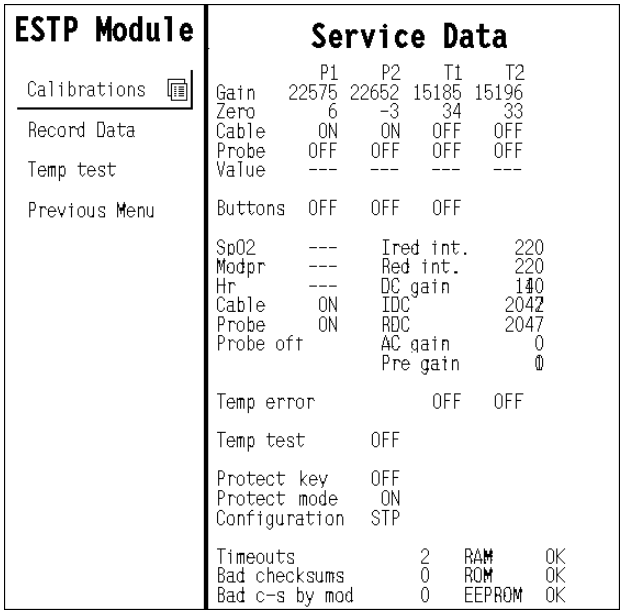
NOTE: Pressure Module, E-P and Pressure Temperature Module, E-PT have their own service menu; "4.4 P/PT." and so does Dual Pressure Module, E-PP; "4.5 PP."

Calibrations opens a submenu for temperature (T1, T2) and pressure (P1, P2) calibrations. See section "Calibrations".

Record Data prints out the shown service data and board information (id, serial number and sw id) onto the recorder module.

Temp Testactivates the automatic temperature test for the temperature channels T1 and T2. The result from the test is shown in the service data field.

NOTE: The Temp Test needs to be selected twice before the test starts.



Service Data

Gain is a coefficient to compensate gain error. Usually the values for P1 and P2 are between 17000 and 25000 and for T1 and T2 between 13000 and 14300.

Zero indicates the offset compensation value of each parameter in the A/D converter. Typically the values for P1 and P2 are within ±1000 and for T1 and T2 between -150 and +300. Calibrate if zero and/or gain value is outside the ranges.

Cable shows ON when a corresponding cable is connected to the front panel and **Probe** shows ON when a corresponding probe is connected to the cable.

Under **Value**, the measured numeric values are displayed simultaneously. Pressure values are real time values and shown in mmHg. Temperature values are shown in degrees Celsius.

The front panel STP keys functions are confirmed by pressing each key and observing that OFF turns to ON at **Button**.

SpO_2 shows the measured beat-to-beat SpO_2 value.

Modpr is a modulation % that indicates the AC/DC ratio in the measured signal.

Hr is a pulse rate calculated from every beat.

Cable and **Probe** can be either OFF or ON, and these indicate the state PROBE OFF.

Under them there is a **message field for SpO_2**. It can be OK, PULSE SEARCH, NO PROBE, PROBE OFF, NO PULSE, ARTEFACT, POOR SIGNAL, or CHECK PROBE.

Balance between leds is adjusted by changing the intensity of red/infrared. Intensity of infrared (**Ired int.**) is in the range of 40 to 255 and red intensity (**red int.**) is in the range of 40 to 255.

DC gain shows the gain of DC signal adjusted by the module.

IDC is the value of infrared signal.

RDC is the dc value of red signal.

AC gain is the gain of infrared and red ac signals. AC gain values can be 1 or 0. Value 1 means high ac gain and 0 means low gain.

Pre gain is a preamplifier gain for infrared and red signals. Pre gain values can be 1 or 0. Value 1 means normal operation. Value 0 means that signal levels are very low and extra gain is taken into use.

Temp error shows the status of the temperature test. No errors found show the status (OFF) and errors found (ON).

Protect key shows normally OFF, but turns to ON when the button at the bottom of the module is pressed.

Protect mode is normally ON. It turns to OFF, when Protect is switched to OFF for the temperature calibration in Calibration Menu.

Configuration shows the chosen module configuration: TP, ST, or STP.

Timeouts is a cumulative number that indicates how many times the module has not responded to the the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

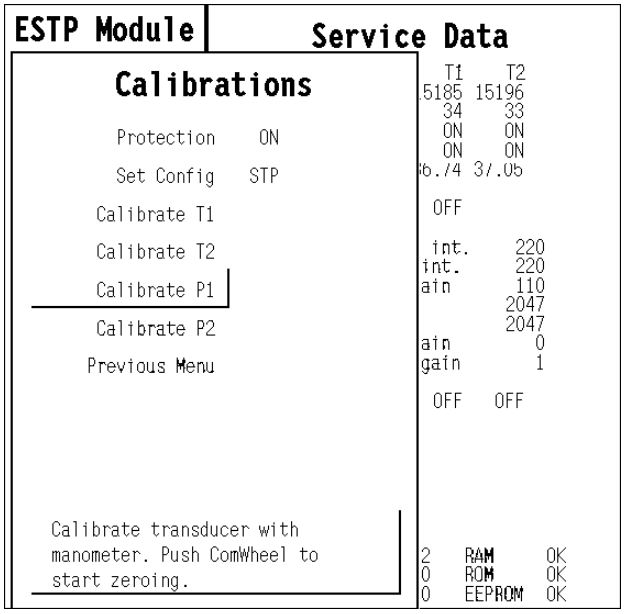
4.3.1 Calibrations

Protection: Protection for the configuration and temperature calibrations can be set ON and OFF.

Set Config: The module configuration should be set according to the module type. The setting is possible only when the protection is set OFF. The available selections are TP, ST or STP. The configuration setting should be checked, if the STP board is replaced.

Calibrate T1 / Calibrate T2: The functions are for calibrating the temperature channels T1 and T2.

Calibrate P1/ Calibrate P2: The functions are for calibrating the invasive blood pressure channels P1 and P2.



How to calibrate T1/ T2

The calibrations are possible only when the protection is set ***OFF***. The temperature calibration requires accurate test plugs of value 25 °C and 45 °C.

1. Select ***Calibrate T1/Calibrate T2.***
2. Insert the test plug 25 °C into the T1/T2 connector.
3. Press the ComWheel.
4. Insert the test plug 45 °C into the T1/T2 connector.
5. Press the ComWheel.
6. Choose ***Protection ON*** in Protect mode.

How to calibrate P1/ P2

The calibrations require a pressure transducer (with appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P1/P2 connector. Select ***Calibrate P1/Calibrate P2***. Leave the transducer to room air pressure.
2. Press the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel. A tolerance of ±1 mmHg is allowed.
5. The message 'Calibrated' will appear on the display.

4.4 P/PT

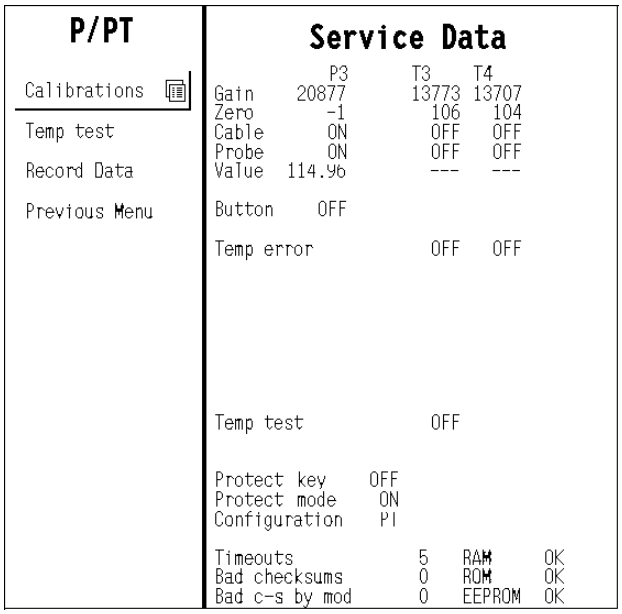
Service menu for Pressure Module, E-P, and Pressure Temperature Module, E-PT.

Calibrations: see section "P/PT Calibrations".

Temp Test activates the automatic temperature test for the temperature channels T3 and T4. The result from the test is shown in the service data field.

NOTE: The Temp Test needs to be selected twice before the test starts.

Record Data: Record Data prints out the shown service data and board information (id., serial number, and software id.) onto the recorder.



Service Data

Gain is a coefficient to compensate gain error. Usually the value for P3 is between 17000 and 25000 and for T3 and T4 between 13000 and 14300.

Zero indicates the offset compensation value of each parameter in the A/D converter. Typically the values for P3 are within ±1000 and for T3 and T4 between -150 and +300. Calibrate if the zero and/or gain value is outside the ranges.

Cable shows ON when the corresponding cable is connected to the front panel.

Probe shows ON when the corresponding probe is connected to the cable.

Under **Value**, the measured numeric values are displayed simultaneously. The pressure value is a real time value and shown in mmHg.

Button; the front panel key function can be confirmed by pressing the key and checking that OFF turns to ON.

Temp error shows whether the calibration of the temperature was successful or not.

Protect key shows normally OFF but turns to ON when the button at the bottom of the module is pressed.

Protect mode is normally ON. It turns to OFF when Protect is switched to OFF for the temperature calibration in Calibration Menu.

Configuration shows the chosen module configuration: BP or PT.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is also a cumulative number that indicates how many times communication from the module to monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.4.1 P/PT Calibrations

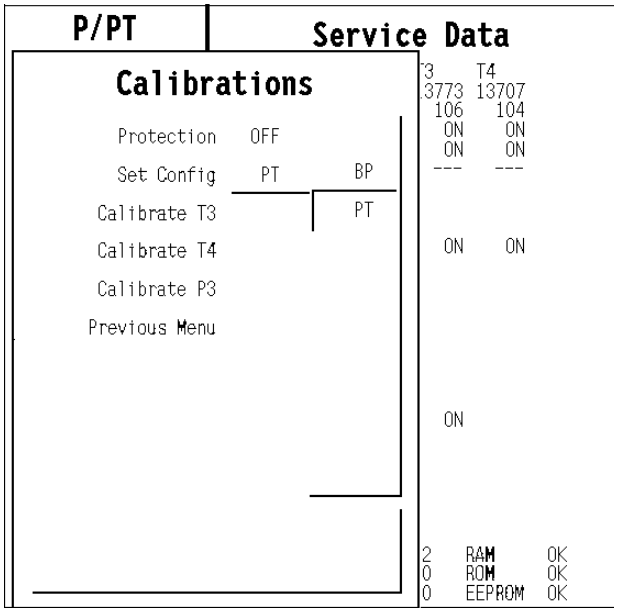
Protection for the configuration can be set ON and OFF only when the protect button at the bottom of the module is pressed.

Set Config: The module configuration should be set according to the module type. The setting is possible only when the protection is set OFF. The available selections are BP or PT.

The configuration setting should be checked, if the PT board is replaced.

Calibrate T3 and Calibrate T4: The functions are for calibrating the temperature channels T3 and T4.

Calibrate P3: The function is for calibrating the invasive blood pressure channel P3.



How to calibrate T3/ T4

The calibrations are possible only when the protection is set ***OFF.*** The temperature calibration requires accurate test plugs of value 25 °C and 45 °C.

1. Select ***Calibrate T3 / Calibrate T4.***
2. Insert the test plug 25 °C into the T3 / T4 connector.
3. Press the ComWheel.
4. Insert the test plug 45 °C into the T3 / T4 connector.
5. Press the ComWheel.

How to calibrate P3

The calibration requires a pressure transducer (with an appropriate cable) and a pressure manometer.

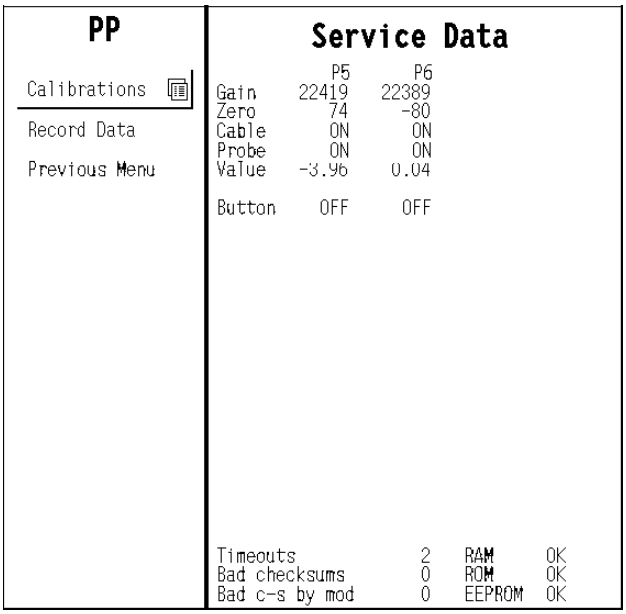
1. Connect the pressure transducer with the pressure manometer to the P3 connector. Select ***Calibrate P3***. Leave the transducer to room air pressure.
2. Press the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel. A tolerance of ±1 mmHg is allowed.
5. The message 'Calibrated' will appear on the display.

4.5 PP

Service menu for Dual Invasive Pressure Module, E-PP.

Calibrations: see section "PP Calibrations."

Record Data prints out the service data and circuit board information (id., serial number, and software id.) on the recorder.



Service Data

Gain is a coefficient to compensate for gain error. Usually the values for P5 and P6 are between 17000 and 25000.
Zero indicates the offset compensation value for each parameter in the A/D converter. Typically the values for P5 and P6 are within ±1000. Calibrate if the zero and/or gain value is outside the ranges.

Cable shows ON when the corresponding cable is connected to the front panel and **Probe** shows ON when the corresponding probe is connected to the cable.

Value displays the measured numeric values simultaneously. The pressure value is a real time value and shown in mmHg.

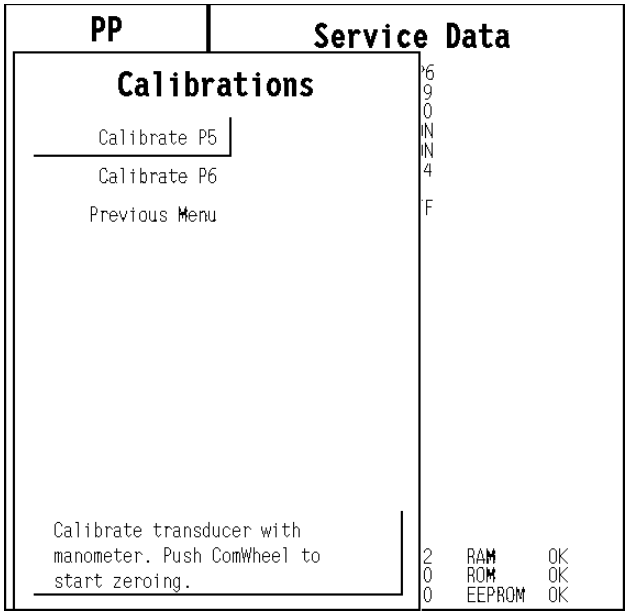
Button; the front panel key function can be confirmed by pressing the key and checking that OFF turns to ON.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum in the EPROM is in accordance with the software calculated value.
EEPROM indicates whether the values stored in the permanent memory are valid. The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.5.1 PP Calibrations

Calibrate P5 and Calibrate P6
These functions are for calibrating the invasive blood pressure channels P5 and P6.

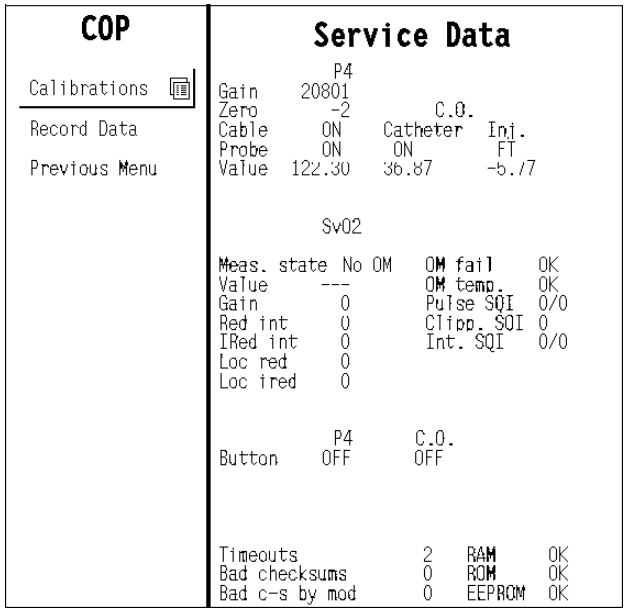


How to calibrate

The calibrations require a pressure transducer (with an appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P5 / P6 connector. Select Calibrate P5 / Calibrate P6. Leave the transducer at room air pressure.
2. Push the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and push the ComWheel. A tolerance of ±1 mmHg is allowed.
5. The message 'Calibrated' will appear on the display.

4.6 COP



Service menu for Cardiac Output Module, E-COP, and Cardiac Output and Mixed Venous Oxygen saturation (SvO2) Module, E-COPSv.

Record Data prints out the service data and module information (id. serial number and software id.) on the recorder.

Service Data

P4

Gain is a coefficient to compensate for gain error. Typically the value is between 17000 and 25000. Calibrate if the zero and/or gain value is outside the ranges.

Zero indicates the offset compensation value of each parameter in the A/D converter. Usually the value is within ±1000.

Cable shows ON when the corresponding cable is connected to the front panel and **Probe** shows ON when the corresponding probe is connected to the cable.

Value shows the measured numeric values simultaneously. The pressure value is a real time value and shown in mmHg.

Probe items **Catheter** (ON/OFF) and **Inj.** (FT, BATH, or OFF) indicate connections and **Value** indicates the measured temperatures in 0.01 °C increments.

SvO2

Meas. state: Measurement status shows: No optical module (No OM) connected, initializing the optical module (Init OM), normal measurement state (Normal) and failed module (OM fail).

Value is a measured SvO_2 value.

Gain is the gain of the remote red and infrared signals (0, 1, 2 or 3)

Red int: Reflected red intensity

Ired int: Reflected infrared intensity

Loc red: Local red intensity

Loc ired: Local infrared intensity

OM fail: Reason why initialization OK (OK), cannot read EEPROM of the optical module correctly (EEPROM), cannot adjust LED current to get required local signal (Transmit).

OM temp: Temperature of the optical module OK (OK), temp under 43 °C (Under), temp over 47 °C (Over).

Pulse SQI: Signal quality index for pulsing (low pulse/high pulse). 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Clipp. SQI: Signal quality index for wall artifact. 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Int. SQI: Signal quality index for intensity shift from previous calibration or Hgb update (intensity decreased/ increased) 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Button: The front panel Zero P4 and Start C.O. key functions can be confirmed by pressing the key and checking that the relevant OFF message turns to ON.

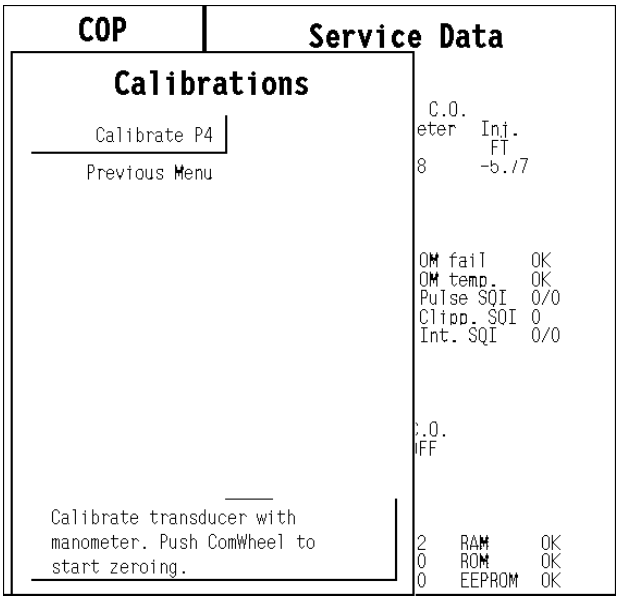
Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the external RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the software calculated value.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.6.1 COP Calibrations

Calibrate P4

This function is for calibrating the invasive blood pressure channel P4.



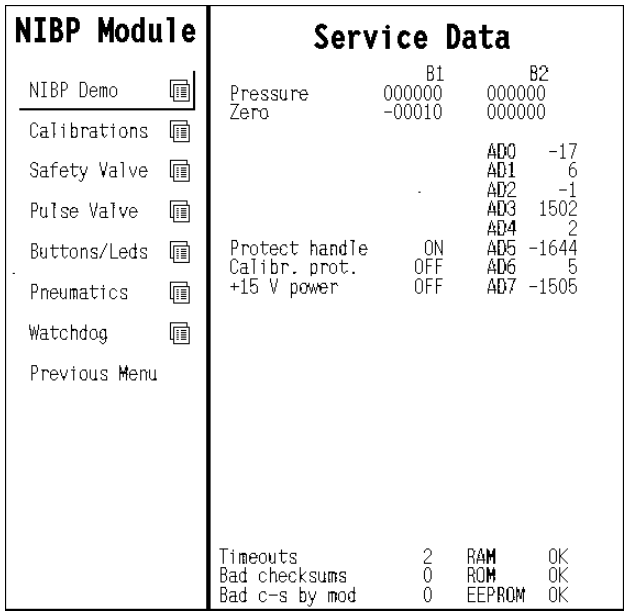
How to calibrate

The calibration requires a pressure transducer (with an appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P4 connector. Select Calibrate P4. Leave the transducer at room air pressure.
2. Press the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel. A tolerance of ±1 mmHg is allowed.
5. The message 'Calibrated' will appear on the display.

4.7 NIBP Module

Service menu for non-invasive blood pressure measurement.



Service Data

Pressure shows the measured pressure multiplied by 10. This value is automatically zero-drift compensated.

Zero shows the difference between the zeroing value in the permanent memory (stored when the module is calibrated) and the current automatic zero-drift compensation multiplied by 10. The value can change between +20 and -20 mmHg. If the zero drift exceeds ± 10 mmHg, the module should be recalibrated.

Protect handle indicates hardware protection for EEPROM memory. It should be ON all the time in normal operation. If it is OFF, data cannot be read from or written to EEPROM, only the calibration protection can be set or reset by software. It can be turned to OFF by pressing the NIBP module buttons **Auto ON/OFF** and **Start Cancel** simultaneously for 3 seconds, which also enables ***Protection ON/OFF*** menu selection in the calibration menu.

Calibr. prot. shows software calibration protection and it should be OFF to enable calibration.

+15 V power refers to legacy NIBP modules. Not used in PRESTN series modules and E-PSM(P).

AD0 to **AD7** show the values of each eight channels of the A/D converter. AD7 is not used in PRESTN series modules and E-PSM(P).

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum in the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

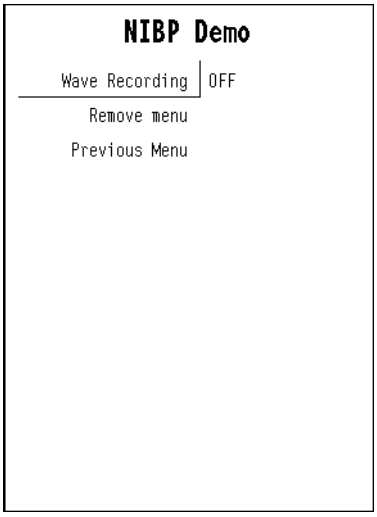
4.7.1 NIBP Demo

A service menu for demonstrating the oscillometric method of NIBP measurement. The menu shows the real-time pressure signals that are measured from the NIBP cuff. The measurement result is shown in the adjoining digit field.

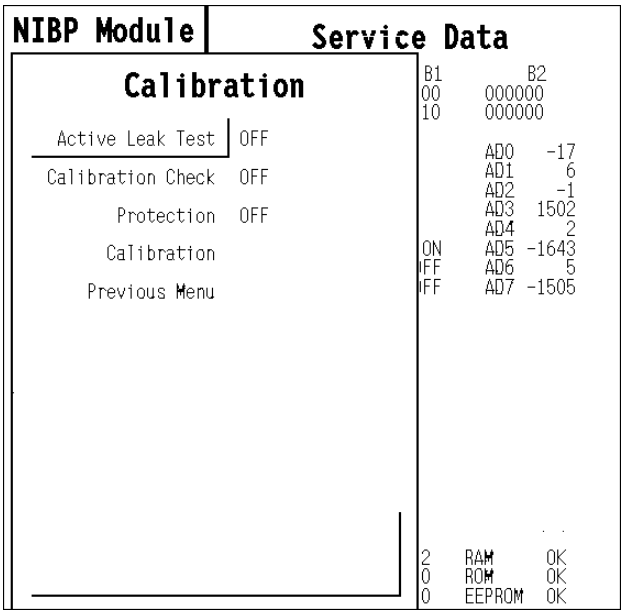
Wave Recording is for selecting the recording option. If ON is selected, the pressure signals are printed out in real-time on the recorder.

Remove menu widens the displayed waveform area.

The menu can be closed by selecting the **Previous Menu** or just by pressing the ComWheel if the **Remove menu** was selected.



4.7.2 NIBP Calibration



Active Leak Test: Wrap an adult cuff around a rigid cylinder or pipe and connect the cuff to the module. Select the active leak test (ON). The module automatically pumps a pressure of 260 mmHg into the cuff. Wait for several seconds until the pressure stabilizes. Then check that the pressure reading does not drop more than 6 mmHg per minute. If it does, leaking point(s) should be detected and fixed. Cancel the test by selecting the Active leak test OFF.

Calibration Check: After the calibration check is selected (ON), the module zeroes the pressure transducers at the beginning of the calibration check. Do not pump pressure until the text 'Calibrating' appears in the NIBP digit field or the zeroing will fail. After the zeroing is done, manually pump pressure into the module and make sure that the same pressure values are shown both on the display and on the manometer. Pressure of both pressure channels B1 and B2 are shown. The pressure values are automatically zero-compensated, so the readings of B1 and B2 should be the same as the manometer readings.

Protection: Software calibration protection (ON/OFF). Select ***OFF*** when calibrating. ***Protection*** selection becomes available in the menu after pressing the NIBP module buttons **Auto ON/OFF** and **Start/Cancel** simultaneously for 3 seconds.

How to Calibrate

Calibration selection is available only when protection is OFF.

NOTE: Both channels B1 and B2 must be calibrated simultaneously.

NOTE: The module must be in the frame during the whole procedure.

NIBP calibration can be performed in the NIBP Service menu as follows:

1. If ***Protection*** is ***ON***, change it to ***OFF*** by pressing the NIBP module buttons **Auto ON/OFF** and **Start Cancel** simultaneously for 3 seconds, which enables the ***Protection*** selection. Then press the buttons again for 3 seconds to enable ***Calibration***.

NOTE: When the buttons have been pressed, the NIBP field shows an error message 'Calibration switch on!'.

NOTE: When calibration is enabled, a message 'Calibration not protected' appears.

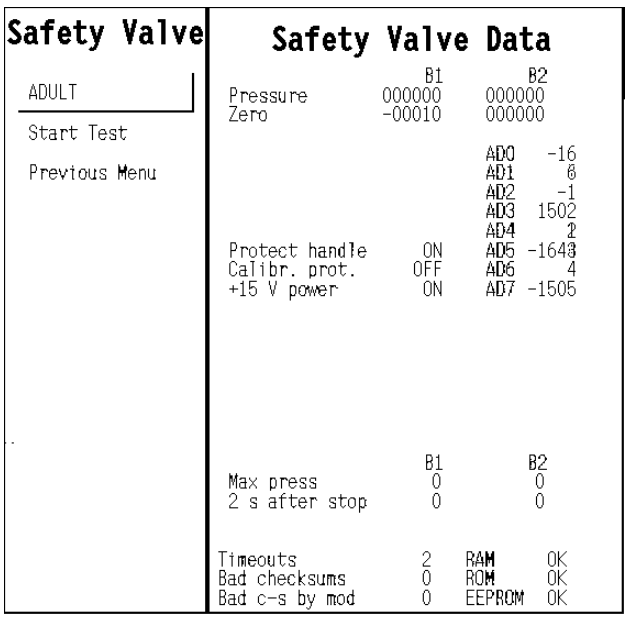
2. For proper zeroing to take place, remove the hose from the front panel connector. Select ***Calibration*** and push the ComWheel. Message 'Zeroing' will appear in the NIBP message field. After this, a pressure bar will appear beside the menu and the text 'Calibrating' will appear in NIBP digit field.
3. Connect an external mercury manometer with a pump to the module through both tubes of the hose. Pump up to about 200 mmHg pressure (range of 150 to 300 mmHg allowed) according to the manometer. Verify that both pressure values in the prompt field match the manometer reading. If not, adjust by turning the ComWheel.

4. When the values are equal, push the ComWheel to confirm the calibration. After a few seconds the 'Calibrated' message will appear in the NIBP digit field, which means that the calibration data has now been saved.

NOTE: When calibrating NIBP, always change the displayed pressure value slightly with the ComWheel, even in cases where the value would be correct. For example, change the value one step higher and then back one step lower. The 'Calibrated' text should appear in the display. This ensures that the calibration procedure is correctly registered and stored by the module.

5. Use the module buttons again to enable **Protection** setting and set it ON, and finally disable **Protection** setting.

4.7.3 NIBP Safety Valve



ADULT/ INFANT is the selected measurement mode

Start test is for starting and **Stop test** is for stopping the Safety Valve test.

Safety Valve Data:

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see service data descriptions in section "4.7 NIBP Module".

Max. press and **2 s after stop** show the measured values at Safety Valve test.

How to check Safety Valve:

Wrap an adult cuff around a rigid cylinder or pipe and connect the cuff to the module. Select **Start test** and push the ComWheel. The test ends automatically or when **Stop test** (appears in place of **Start test**) is pushed. To test the INFANT limits select **ADULT** and check that it changes to **INFANT**.

Max. press indicates the pressure at which the safety valve opens and is normally 300 ±15 mmHg for adult and 150 mmHg ±15 mmHg for infant.

2 s after stop indicates the pressure at 2 seconds after the pump has stopped and is normally > 270 mmHg for adult and > 130 mmHg for infant. If the value is less, check leakage by the active leak test.

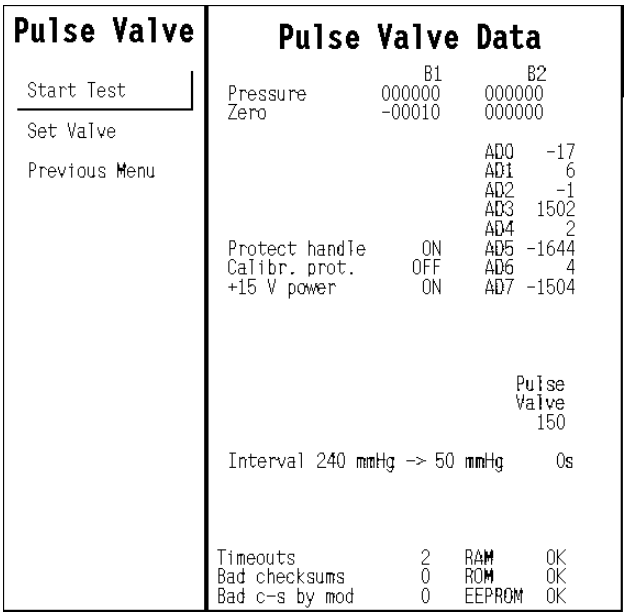
4.7.4 NIBP Pulse Valve

Start test is for starting and **Stop test** is for stopping the test.

Set Valve lets you adjust the opening of the pulse valve.

Pulse Valve Data

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "4.7 NIBP Module".



How to check Pulse Valve

Wrap an adult cuff around a rigid cylinder or pipe and connect the cuff to the module. Select **Start test** and push the ComWheel. The pressure rises beyond 240 mmHg and stops. The pulse valve opens. The module counts the time it takes for the pressure to go down from 240 mmHg to 50 mmHg and displays it on the screen. The test can be manually stopped by selecting **Stop test**.

The valve can be adjusted between 0 and 255 (0 for fully closed and 255 for fully open). First select **Set Valve** and push the ComWheel. See the pulse valve value and adjust it by turning the ComWheel. Then push the ComWheel to confirm the value.

The **Interval 240 mmHg -> 50 mmHg** time should be less than 60 seconds when the valve is 150 and less than 10 when fully opened (255). When fully closed (0), the system should be airtight and the pressure does not drop. Depending on an individual, the pulse valve may remain closed up to approx. value 100.

If the measured time deviates much from those above, then the pulse valve or its tubes are faulty.

4.7.5 NIBP Buttons/Leds

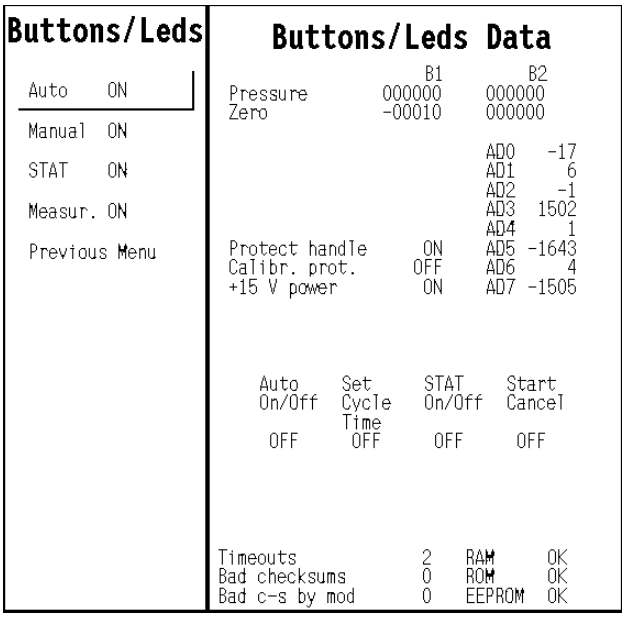
The selections ***Auto ON/OFF, Manual ON/OFF***, ***STAT ON/OFF***, and ***Measur. ON/OFF*** have effect only on the NIBP module, M-NIBP.

Buttons/Leds Data

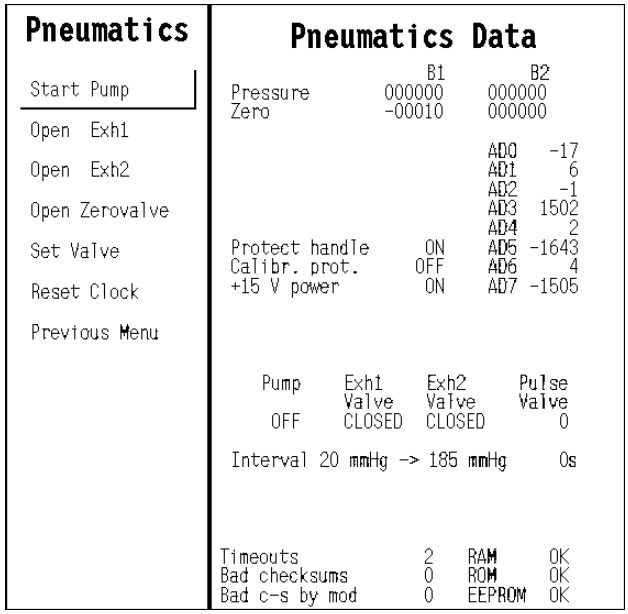
For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "4.7 NIBP Module".

Buttons Checking

The front panel keys function is confirmed by pressing and releasing the key and observing that **OFF** turns to **ON** at **Auto On/Off**, and **Start Cancel**. Set Cycle Time and STAT On/Off are only in use with the NIBP module, M-NIBP.



4.7.6 NIBP Pneumatics



Start Pump/Stop Pump: A manual control for the pump. The selection changes to **Stop Pump** when the pump turns on.

Open Exh1/Close Exh1: A manual control for the exhaust valve 1. The selection changes to **Close Exh1** when the valve is opened. This function is not used with E-PRESTN and E-PSM(P) modules.

Open Exh2/Close Exh2: A manual control for the exhaust valve 2. The selection changes to **Close Exh2** when the valve is opened.

Open Zero valve: A manual control for the zero valve. This function is not in use with E-PRESTN and E-PSM(P) modules.

Set Valve: The opening of the pulse valve is adjusted between 0 and 255 (0 for fully closed and 255 for fully open). First push the ComWheel, then turn it to adjust the value on the screen and finally push to set the value.

Reset Clock will zero the time on the display. This function is not in use with E-PRESTN and E-PSM(P) modules.

Pneumatics Data field

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "4.7 NIBP Module".

Pump, Exh1 Valve, and **Exh2 Valve** show their states. NOTE: **Exh1 Valve** has no effect on the module.

Pulse Valve shows how much the valve is opened (0 to 255) during Valve Setting.

How to check Interval 20 mmHg -> 185 mmHg

Select **Start pump** at different combinations of the valves open/closed and push the ComWheel. The module counts the time it takes for the pressure to go up from 20 mmHg to 185 mmHg and displays it. When all the valves are closed, the pump should be able to pump the pressure in about 1 to 4 seconds into an adult cuff wrapped around a rigid cylinder or pipe. The pump does not stop without selecting **Stop Pump** by pushing the ComWheel.

4.7.7 NIBP Watchdog

These menu items have only effect on the M-NIBP modules. They do not effect other NIBP modules.

Test ADULT: is to test watchdog timer in adult mode (120 to 140 seconds).

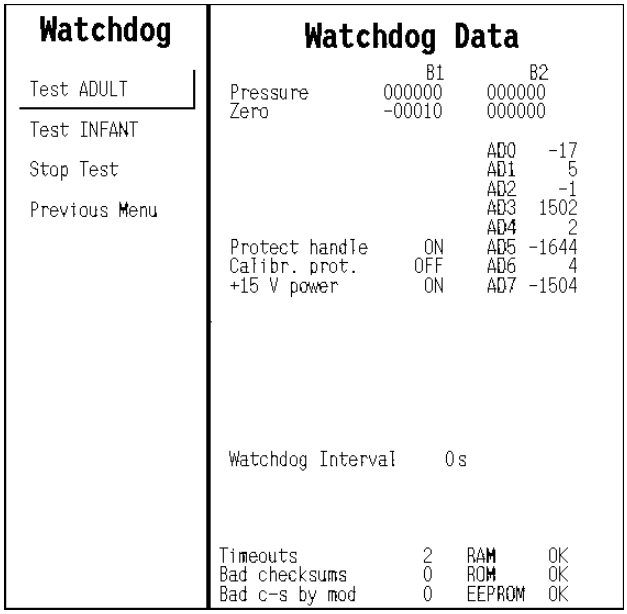
Test INFANT: is to test watchdog timer in infant mode (about 60 to 70 seconds).

Stop Test: is for stopping the test.

Watchdog Data field

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "4.7 NIBP Module".

Watchdog Interval: shows the time the +15 Vdirty stays on during the test.



How to test Adult watchdog time

Select Test ADULT and press the ComWheel. Watchdog interval starts counting up seconds and keeps on counting as long as the +15 Vdirty is on. The time should be 120 to 140 seconds.

How to test Infant watchdog time

Select Test INFANT and press the ComWheel. Watchdog interval starts counting up seconds and keeps on counting as long as the +15 Vdirty is on. The time should be 60 to 70 seconds.

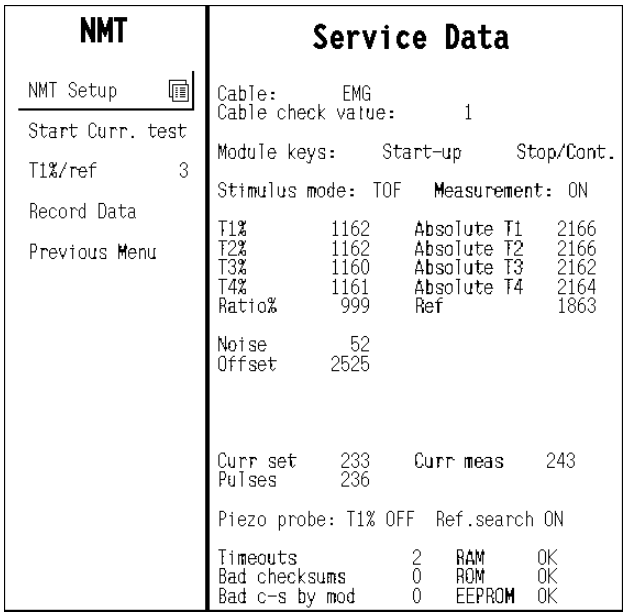
4.8 NMT

Service menu for Neuromuscular Transmission Module, E-NMT.

Start Curr. test is a test where the module itself checks the difference between a given current and the measured current. A 3 kΩ resistance should be connected between the stimulus electrodes before starting the test. All the currents checked will be displayed on the service data screen. After the current value, the status of the test is shown. If the test is not passed, send the module back to the factory for calibration.

T1%/ref T1% / ref gives a selection for changing settings related to the NMT MechanoSensor. A setting of **3** should always be used for normal monitoring. The settings **1** and **2** are for research purposes only.

Record Data prints out the displayed service data and circuit board information (id., serial number, and software id.) on the recorder.



Service Data

Cable shows the type of cable being used.

Cable check value shows the bit amount. To check the value for each cable, see the following chart:

- EMG -100...+100
- Cable OFF >1950
- Piezo 900...1100
- Regional block 600....800

Module keys checks the function of the module keys. A blue background appears at the back of the text when a key is pressed for more than one second.

Stimulus mode shows the selected stimulus. Stimulus mode can be changed using the NMT Setup menu.

Measurement indicates ON/OFF.

T1%, T2% shows the measured response. A value of 1000 corresponds to 100%.

Absolute T1, T2 shows the voltage measured from the A/D converter.

Noise indicates the interference just before the measurement. A typical value is <100.

Offset is an average of the noise measurement. A typical value is 510.

Curr set is the selected current, a value of 700 corresponds to 70 mA.

Curr meas is the measured current, a value of 700 corresponds to 70 mA.

Pulses indicates pulses the module has produced.

Piezo probe T1% and Ref. search shows information related to the MechanoSensor settings.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The non-zero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum in the EPROM is in accordance with the software calculated value.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.8.1 NMT Setup

Start-up is for starting the neuromuscular transmission measurement.

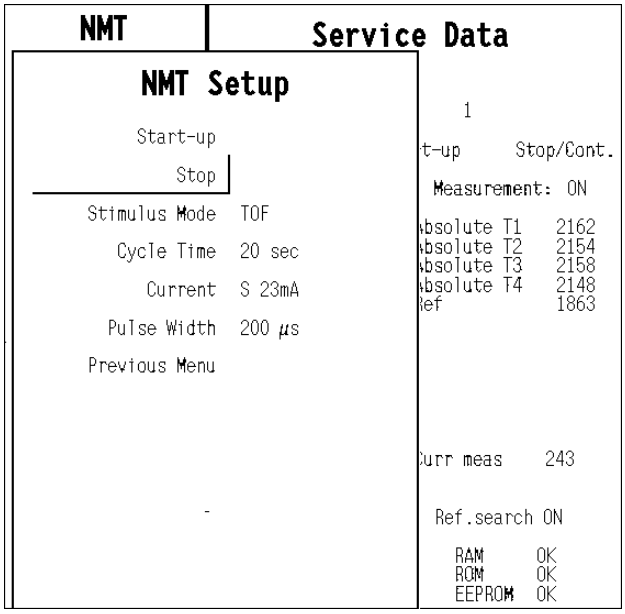
Stop/Continue is for stopping/continuing the measurement.

Stimulus Mode is for changing the stimulus mode. The choices are: **TOF** - Train of Four, **DBS** -Double Burst Stimulation or **ST** - Single Twitch mode.

Cycle Time is for changing the time interval for NMT measurement. The choices are:
for TOF and DBS: Manual and from 10 sec to 15 min.
for ST: 1, 10 and 20 sec.

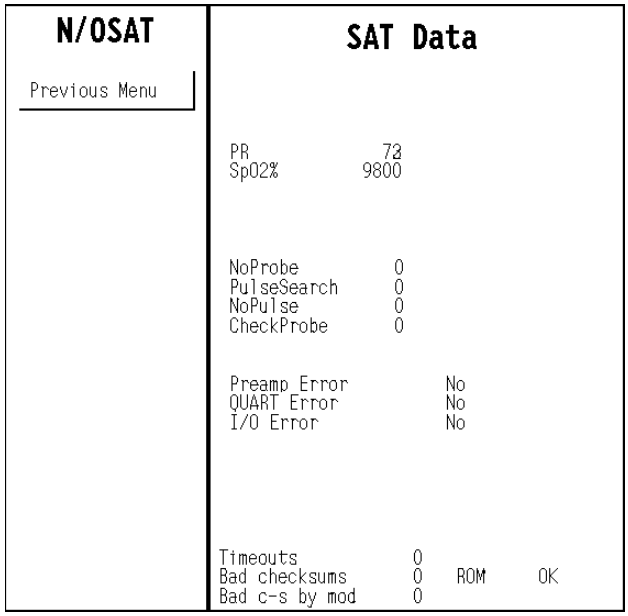
Current is for changing the stimulus current strength. The current is either supramaximal (automatic start-up search) or manually selected.

Pulse Width is for selecting the desired pulse width. The choices are: 100, 200 or 300 µs.



4.9 Oxygen Saturation Module, E-NSATX, E-MASIMO

NOTE: Preamp Error is indicated on the service menu, even though module contains MP-204 board.



SAT Data

PR shows the pulse rate value [bpm] calculated from the pleth.

SpO_2% shows the oxygen saturation value multiplied by 100.

Next are listed the **messages** that are sent from the module to the monitor. Digit '0' means that the message is not active, '1' is for the active one.

Preamp Error indicates 'Yes' if the Preamp (MP-203(4)) board detects an error.

QUART Error indicates 'Yes' if an error is detected in the operation of QUART that is located in the Interface board.

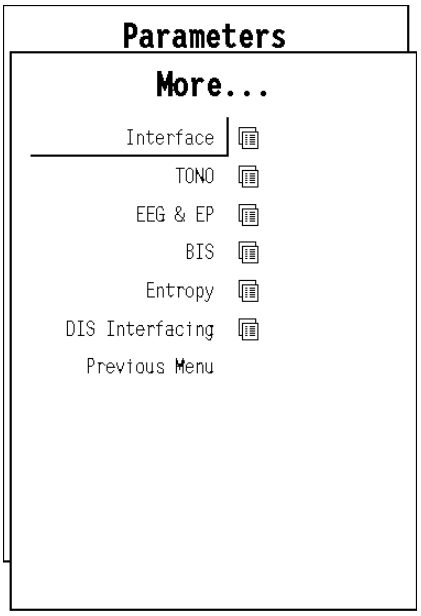
I/O Error indicates 'Yes' if an error occurs in the communication between Preamp (MP-203(4)) and Interface board.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

ROM indicates whether the checksum in the EPROM is in accordance with the one the software has calculated.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

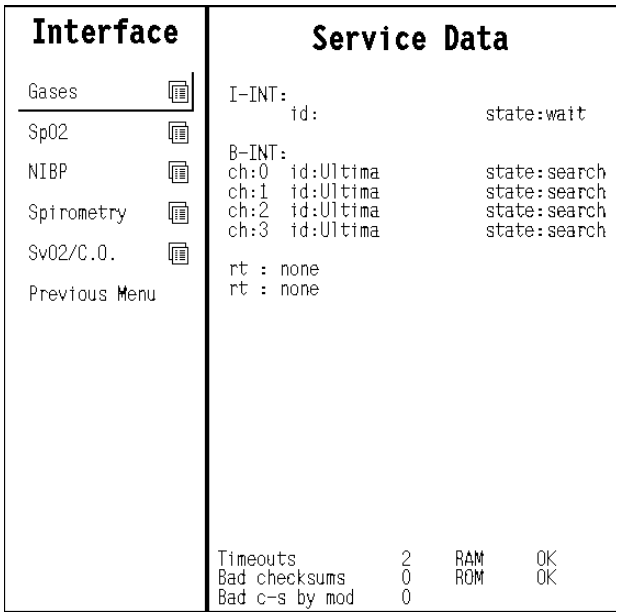
4.10 More

More... indicates that there are more parameter menus to be viewed.



4.11 Interface module, E-INT

Gases, SpO_2, NIBP, Spirometry, SvO_2/C.O. indicate the parameters for which service data is available. The data which can be seen on those pages is raw data from the interfaced monitors, which will be processed for the normal screen.



Service Data

I-INT: Indicates the status of the interface via the UPI4(NET) Board.

B-INT: Indicates the status of the interface via the 4 interface channels of B-INT or two channels of E-INT module.

id: The name of the interfaced monitor, e.g. Ultima.

state: describes the state of the connection, alternatives are:
'init' - the channel is initialized
'wait' - the monitor is waiting for the external monitor
'online' - the connection is ready
'search' - the external monitor is being searched

rt: real time values that are available via the interface.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.

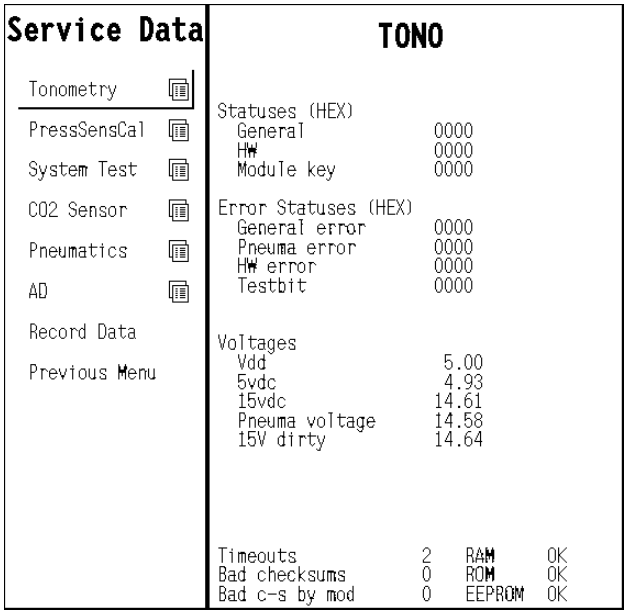
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.

The monitor starts counting these items at power up and resets to zero at power off. The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum in the ROM is in accordance with the software calculated value.
The state is either **OK**, **Fail** or **?** (module not in place or a communication error).

4.12 Tonometry

Service menu for Gastric Tonometry Module.



Service Data

Tonometry: A selection to enter the Tonometry setup menu.

PressSensCal: A selection to enter the module pressure sensor calibration menu.

System Test: A selection to enter the module system test.

CO2 Sensor: A selection to enter the module CO_2 sensor menu.

Pneumatics: A selection to enter the module pneumatics menu.

AD: A selection to enter the module AD value display.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

Statuses (HEX): See APPENDIX A: How to read HEX numbers.

General: Module general status. See Table 2 Module general status for a detailed description of the message.

Table 2 Module general status

bit 0-5	Not used
bit 6	State error
bit 7	Communication failure
bit 8	Power failure
bit 9	Clock failure
bit 10	EEPROM checksum failure
bit 11	EEPROM writing failure
bit 12	ROM failure
bit 13	RAM failure
bit 14	Test mode
bit 15	Init mode

HW Module hardware status. See Table 3 Module hardware status for a detailed description of the message.

Table 3 Module hardware status

bit 0	Lamp ON
bit 1	Stepper motor ON
bit 2	Zeroing valve ON
bit 3	Pump valve ON
bit 4-15	Not used

Module key Module keyboard status. See Table 4 Module keyboard status for a detailed description of the message.

Table 4 Module keyboard status

bit 0	Button 1 (start/stop) pressed
bit 1	Button 2 (Lab.Data) pressed
bit 2-15	Not used

Error Statuses (HEX):

General error Module general error status. See Table 5 Module general error status for a detailed description of the message.

Table 5 Module general error status

Bit	Description	What to do
bit 0-1	Not used.	-
bit 2	Zeroing error. Zero gas signal out of limits or pressure or temperature signal varying during measurement.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 3	CO_2 measurement error. CO_2 signal out of limits or pressure or temperature signal varying during measurement.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 4	Measurement error. Sensor temperature, measurement pressure or absorbance is out of limits.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 5	Calibration error. Failure in calibration.	Recalibrate.
bit 6	Pneumatic error.	See pneumatic error status bits for details.
bit 7	Lamp pulsing error.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 8-15	Not used.	-

Pneuma error Module pneumatics error status. See Table 6 Module pneumatics error status for a detailed description of the message.

Table 6 Module pneumatics error status

Bit	Error label	Description	What to do
0	pumping error	Stepper motor is not able to generate negative pressure at the pump pressure sensor during zeroing.	Check the function of the stepper motor.
1	eq. to amb. press failed	Before filling the catheter, the pressure in the module tubing is equilibrated to the ambient pressure by switching the pump valve on and off. If ambient pressure is not reached, this error is shown.	Calibrate the pressure sensors. Check the pump valve function.
2	tubing/zero block occl	Pressure at the pump pressure sensor gets too low, when air is aspirated though the zeroing valve.	Check tubing/valves for occlusion.
8	press sens values differ	Pump pressure and catheter pressure readings differ more than 50 mbars.	Calibrate the pressure sensors.
9	pneuma fatal error	This error is shown, if the pneumatic error occurred is considered fatal.	Check for other pneumatics errors.
10	cath press too low	Catheter pressure reading is below reasonable pressure values.	Make sure that you are not applying too low pressure to the catheter connector. Calibrate the pressure sensors.
11	cath press too high	Catheter pressure reading is above reasonable pressure values.	Make sure that you are not applying too high pressure to the catheter connector. Calibrate the pressure sensors.
12	pump press too low	Pump pressure reading is below reasonable pressure values.	Make sure that you are not applying too low pressure to the catheter connector. Calibrate the pressure sensors.
13	pump press too high	Pump pressure reading is above reasonable values.	Make sure that you are not applying too high pressure to the catheter connector. Calibrate the pressure sensors.

HW error Module hardware error status. See Table 7 Module hardware error status for a detailed description of the message.

Table 7 Module hardware error status

bit 0	Lamp error
bit 1, 2, 3	not used
bit 4	CPU EEPROM error
bit 5	Sensor EEPROM error
bit 6	Internal AD converter error
bit 7	External AD converter error
bit 8	CO_2 termopile error
bit 9	Reserved
bit 10	Temperature detector error
bit 11	Pump pressure sensor error
bit 12	Catheter pressure sensor error
bit 13	Pneumatic power failure
bit 14-15	Not used

Testbit Testbit is a module production phase test status and is always 0000 (HEX). If the testbit status is ≠ 0000, then the module should be returned to the factory.

Voltages **Vdd**; 5 V digital units driving voltage received from the module frame.

5vdc; 5 Volts of the module derived internally from 15vdc.

15vdc; 15 Volts of the module received from the module frame.

Pneuma voltage; 15 V voltage driving pneumatic elements of the module, derived from 15V dirty.

15V dirty; 15 V voltage received from the module frame.

4.12.1 Tonometry

This is another route to reach Tonometry setup menu, **Others - *Tonometry***. For a detailed description on how to use this menu see "User's Reference Manual".

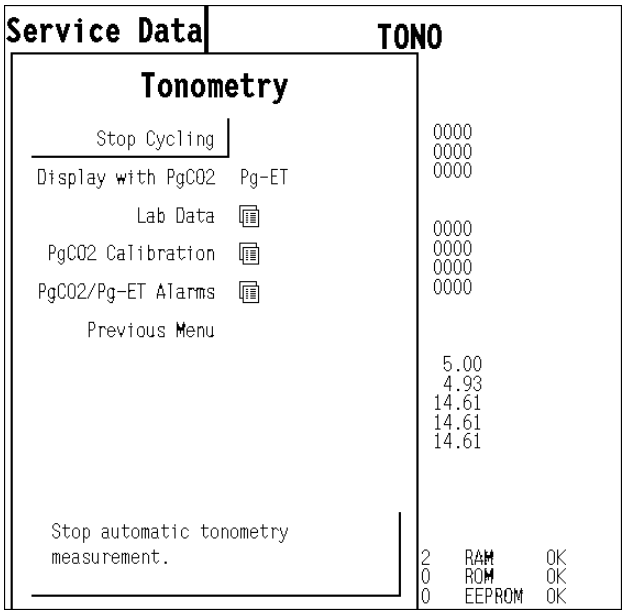
Start / Stop Cycling is for starting or stopping the measurement.

Display with PgCO2 is for defining the calculated value displayed with PgCO2. The choices are ***Pg-Pa, Pg-ET*** or ***pHI***.

Lab Data is for entering the blood gas values nad calculations.

PgCO2 Calibration is for calibrating the tonometry.

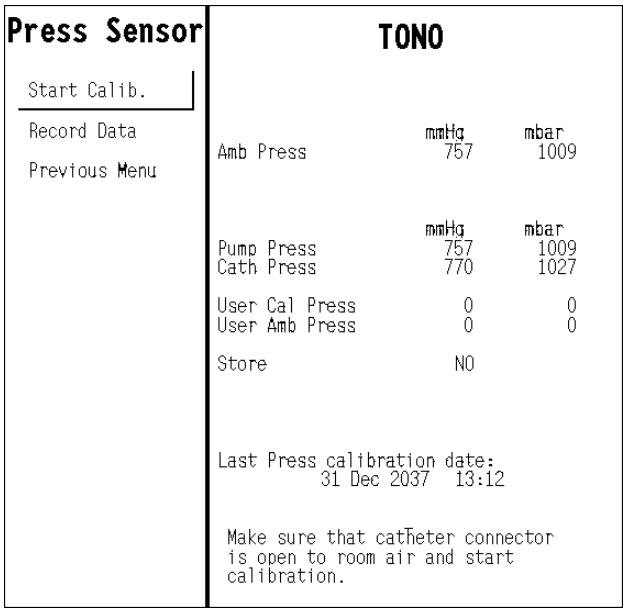
PgCO2/Pg-ET Alarms is for disabling/enabling alarms and adjusting the alarm limits.



How to calibrate $PgCO_2$

1. Connect the calibration gas sampling line to the regulator and to the module's catheter connector.
2. Select ***PgCO2 Calibration***.
3. Wait the flow to be zeroed. When the text 'Feed gas' appears, open the regulator and start feeding gas. Press the ComWheel and continue feeding gas until the text 'Adjust' appears on the display.
4. Check that the displayed values match the values on the calibration gas container. Adjust with the ComWheel, if necessary.
5. If airway gases are monitored, it is recommended to calibrate the airway gases at the same time.

4.12.2 Press Sensor



Start Calib.: A selection to start a module pressure sensor calibration sequence. The procedure is guided online.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO service data

Amb Press; ambient pressure measured by the pressure sensor. All the pressure values are given in both mmHg and mbar on this page.

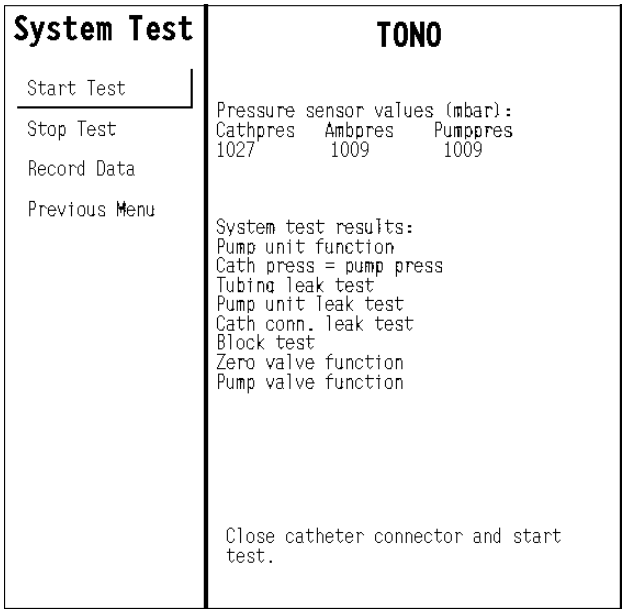
Pump Press; pressure measured from the pumping unit.
Cath Press; pressure measured from the catheter line.

User Cal Press; pressure that the user sets during the calibration sequence according to the pressure that is applied to the catheter port. The set value should be close to 100 mmHg.
User Amb Press; pressure that the user sets during the calibration sequence according to the current ambient pressure in the room.

Store; a selection for storing/discarding the newly gained calibration values.

Last Press calibration date; data read from the module that tells when the module has last been calibrated.

4.12.3 System Test



Start Test: A selection to start the automatic system test sequence. The procedure is guided online.

Stop Test: A selection to stop the automatic system test sequence.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

Cathpres; pressure measured from the catheter line [mbar].
Ambpres; ambient pressure in the room [mbar].
Pumppres; pressure measured from the pumping unit [mbar].

System test results; detailed information of the test results of different system parts. The meaning of the messages:

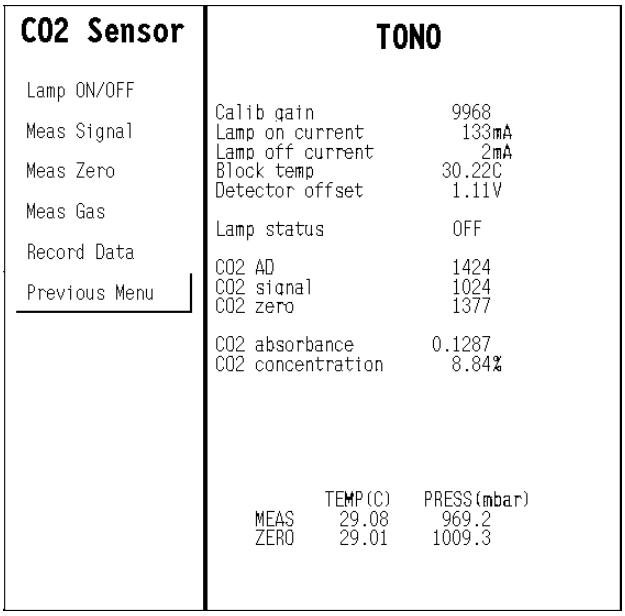
- "OK", the part successfully passed the test
- "FAIL", the part failed in the test
- "N/A", the test could not be carried out properly.

See Table 8 Description of system test for a detailed description of the tested parts.

Table 8 Description of system test

Test label	Description	If test fails
Pump unit function	Stepper motor aspirates/pushes room air through the zeroing valve. If the stepper is working properly, it is able to generate small negative/positive pressure at the pump unit pressure sensor.	Check the function of stepper motor.
Cath press = pump press	Pump pressure sensor and catheter pressure sensor readings are compared at three pressures: at ambient pressure, at approx. +100 mbar and –100 mbar.	Calibrate the pressure sensors.
Tubing leak test	The air tightness of the module inner tubing from the zeroing valve to the pump valve is tested.	Check tubing and connections for leaks.
Pump unit leak test	The air tightness of the pump unit is tested.	Check pump unit for leaks.
Cath conn. leak test	The air tightness of the zeroing unit and catheter connector is tested.	Make sure that the catheter connector is properly closed during the test. Check the zeroing unit and the catheter connector for leaks.
Block test	Air is aspirated through the zeroing valve. If pressure at the pump pressure sensor drops too much, the tubing/valves from the zeroing valve to the pump pressure sensor is blocked.	Check the tubing/valves for blocks.
Zero valve function	Module pneumatic system pressurized and then the zeroing valve is opened to room air. If the pressure does not drop, the zeroing valve may not be functioning.	Check the function of the zeroing valve.
Pump valve function	Module pneumatic system pressurized and then the pump valve is opened to room air. If the pressure does not drop, the pump valve may not be functioning.	Check the function of the pump valve.

4.12.4 CO_2 Sensor



Lamp ON/OFF: A selection to toggle the sensor lamp on and off.

Meas Signal: A selection to start an automatic signal measurement sequence. This sequence measures sensor lamp signal levels.

Meas Zero: A selection to start an automatic zeroing measurement sequence.

Meas Gas: A selection to start an automatic gas measurement sequence. This sequence first performs the zeroing measurement. Then it measures the CO_2 concentration of the sample of arbitrary gas aspirated from the catheter port.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

Calib gain; CO_2 measurement gain factor that is set in calibration.
Lamp on current; sensor lamp current when lit.
Lamp off current; sensor lamp current when off.
Block temp; sensor temperature [°C] (in degrees centigrade).
Detector offset; CO_2 detector offset voltage.

Lamp status; displays whether the sensor lamp is on or off.

CO2 AD; signal from CO_2 sensor thermopile (AD counts).
CO2 signal; thermopile signal maximum – minimum when the lamp is blinking (AD counts).
CO2 zero; thermopile signal maximum - minimum during sensor zeroing when the lamp is blinking (AD counts).

CO2 absorbance; calculated light absorbance during CO_2 measurement.
CO2 concentration; CO_2 concentration (%) in sensor (does not include compensations related to catheter measurement).

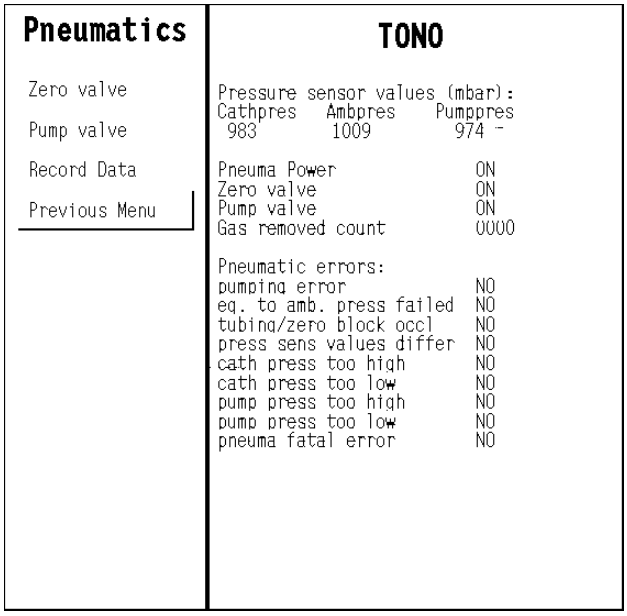
MEAS TEMP; CO_2 sensor temperature during signal measurement [°C].
MEAS PRESS; CO_2 sensor pressure during signal measurement [mbar].
ZERO TEMP; CO_2 sensor temperature during zeroing measurement [°C].
ZERO PRESS; CO_2 sensor pressure during zeroing measurement [mbar].

4.12.5 Pneumatics

Zero valve: A selection to toggle the zero valve on/off.

Press valve: A selection to toggle the pump valve on/off.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.



TONO

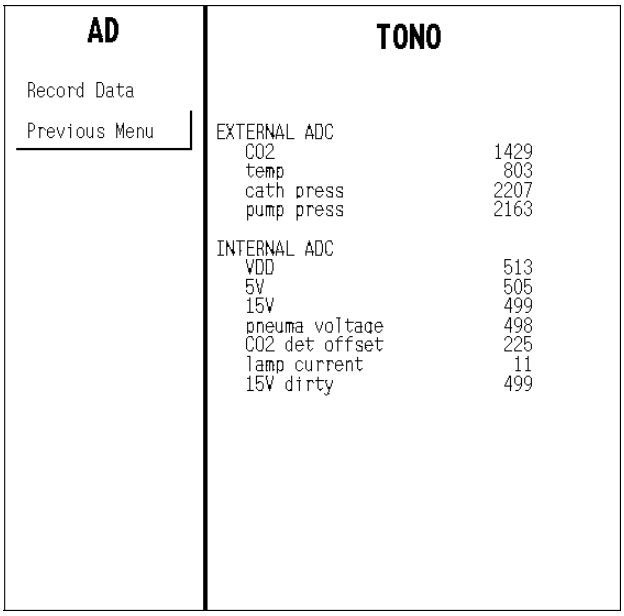
Cathpres; pressure measured from the catheter line [mbar].
Ambpres; ambient pressure in the room [mbar].
Pumppres; pressure measured from the pumping unit [mbar].

Pneuma Power; displays whether electricity has been connected to the pneumatics system or not.
Zero valve; displays whether the zero valve is on or off.
Pump valve; displays whether the pump valve is on or off.
Gas removed count; displays how many times gas is removed from the catheter during a measurement cycle.

Pneumatic errors; detailed information of the performance of different pneumatics system parts. The meaning of the messages:
'NO', the part performed OK during the measurement = 'this error did not occur'
'YES', the part failed during the measurement = 'this error did occur'

See Table 6 Module pneumatics error status for a detailed description of the messages.

4.12.6 AD



Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

All the numbers in this section are AD counts, i.e. computer internal data.

EXTERNAL ADC

CO2; CO_2 sensor CO_2 signal.
temp; CO_2 sensor temperature signal.
cath press; pressure measured from the catheter line.
pump press; pressure measured from the pumping unit.

INTERNAL ADC

VDD; 5 V digital units driving voltage received from the module frame.
5V; 5 Volts of the module derived internally from 15vdc.
15V; 15 Volts of the module received from the module frame.
pneuma voltage; 15 V voltage driving pneumatic elements of the module, derived from 15 V dirty.
CO2 det offset; CO_2 detector offset voltage.
lamp current; CO_2 sensor lamp current.
15V dirty; 15 V voltage received from the module frame.

4.13 EEG & EP

Service menu for EEG Module for electroencephalography and evoked potentials (EP) measurements.

Check Electr.: Headbox measures impedance of electrodes. Works the same way as from EEG menu or the headbox/module button.
Start AEP: AEP measurement is started with current AEP settings.

Module: Service data is changed to the module view (some of the data in this view is though from headbox).
Headbox: Service data is changed to headbox view.

Service data in Module view

Measurement shows whether the EEG measurement is ON or OFF. Measurement should start by itself when the leads have been on for about 15 seconds.
Montage shows the active montage in monitor.
HB Montage shows the montage attached to headbox. 0 means no montage, 1 basic, 2 general, 3 AEP, 4 Mont4, etc. up to 8, which means Mont8.
Montage Type shows whether the montage is bipolar or referenced.

EP Start/Stop is highlighted when the EP Start/Stop button is pressed in headbox or module.
Imp. Check is highlighted when the Imp. Check button is pressed in headbox or module.

Imp. Meas. shows 1 if the impedance measurement is on in the module.
Headbox Off shows 1 if the headbox cable is not connected to the module.

EP Meas. shows 1 if the evoked potential measurement is active in the module.
Sending EP shows 1 if the module has acquired 100/200 new epochs and is sending them to the monitor.
Par. Error shows 1 if the evoked potential parameters active in the module are conflicting with each other.
Reserved 1 is reserved for future use.
Reserved 2 is reserved for future use.

HB Mod Timeouts is a cumulative number that indicates how many times the headbox has not responded to the module's inquiry.
HB Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the headbox to the module.

Mod HB Bad Checksum is 1 if there has been errors in the messages from the module to the headbox.
Mod Mon Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module to the monitor.
Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).

Service data in Headbox view

EP Start/Stop is highlighted when the EP Start/Stop button is pressed in the headbox or module.
Imp. Check is highlighted when the Imp. Check button is pressed in the headbox or module.

Active shows 1 if the channel is active.
Lead off+ shows the lead off status of all plus electrodes. 0 means that the lead is on and 1 that the lead is off.
Lead off- shows the lead off status of all minus electrodes. 0 means that the lead is on and 1 that the lead is off.

Imped+ shows the impedance of plus electrodes of the last impedance check in all channels.
Imped- shows the impedance of minus electrodes of the last impedance check in all channels.

BSR shows the burst-suppression classification of EEG waveforms. 0 means artifact, 1 suppression, 2 burst and 3 invalid (the EEG is not classified).
Artefact shows the artefact status of all channels. 0 means that there are no artefacts on the signal and 1 means that there are artefacts.
Noise shows 1 if the activity of FEMG is too high for clean EEG signal and that EEG is not probably reliable.

EMG AD shows the latest AD conversion result of FEMG signal without any filtering or scaling.
Leadset AD shows the latest AD conversion result of lead set signal without any scaling.

Bipolar shows the montage type that is active in the module and headbox. 1 means bipolar and 0 referenced.
60 Hz is 1 if the power frequency filter is set for 60 Hz power frequency.
Imp. Meas. shows 1 if the impedance measurement is on in the headbox.
Imp. Check Failed shows 1 if the impedance check has failed.

Mu

EP Meas. shows 1 if the evoked potential measurement is active in the headbox.
High EP Sampl. Rate shows 1 if the headbox uses higher sampling rate for 10 ms EP measurement.
EP Epoch Points shows the number of samples collected for each epoch.
EP Channels shows the number of channels used in EP measurement.

Hb ROM Error is 1 if the checksum at the EPROM is not in accordance with the one the software has calculated.

4.13.1 EEG & EP Setup

The items in the setup menu are a collection of items in normal EEG and EP menus. There are no special service settings in this menu.

Imp. Cycle: Impedance measurement repetition time.

Select Montage: Selection of headbox's electrode configuration.

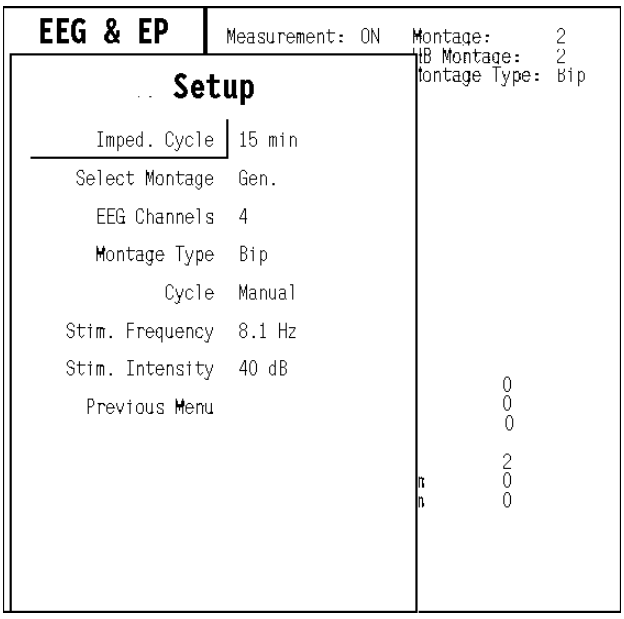
EEG Channels: Number of active channels in EEG measurement.

Montage Type: Selection of bipolar (Bip)/referenced (Ref) montage.

Cycle: EP measurement repetition time.

Stim. Frequency: EP measurement's stimulation frequency.

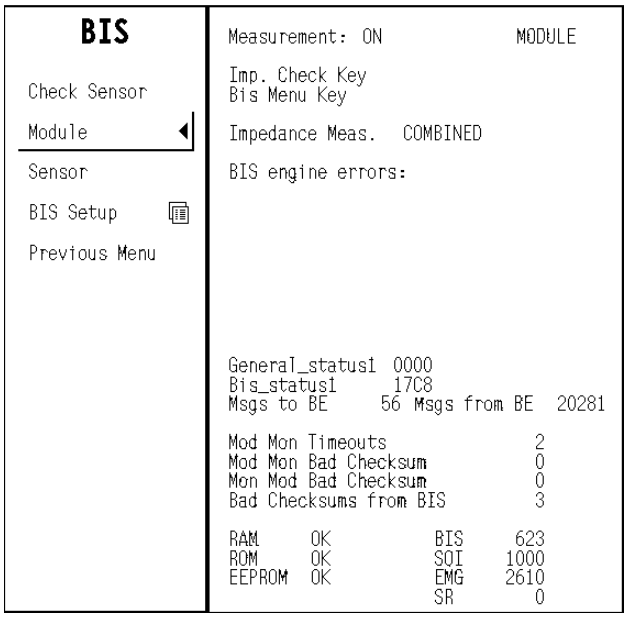
Stim. Intensity: Intensity of EP stimulus.



4.14 BIS

Service menu for BIS Module, E-BIS, for Bispectral index measurements.

Check Sensor activates the sensor impedance check.



Service data in Module view

Measurement indicates if BIS Engine is on: ON/OFF.

Imp. Check Key indicates that the key in the module front panel works properly.
Bis Menu Key indicates that the key in the module front panel works properly**.**

Impedance Meas indicates the impedance measurement mode. The modes are CYCLIC/ COMBINED/GROUND/OFF.

BIS Engine errors: error messages created by DSC or BIS Engine. For a detailed description of the error message see **Table 11 BIS Engine and DSC error messages.**

Statuses (HEX): See **APPENDIX A: How to read HEX numbers.**
General Status1 indicates the general status of the module. For a detailed description of the message see Table 9 Module general status.
Bis_status1 indicates the BIS Engine status. See Table 10 BIS Engine status for a detailed description of the message.
Msgs to BE number of data packages sent from the interface board to BIS Engine.
Msgs from BE number of data packages sent from BIS Engine to the interface board.

Mod Mon Timeouts is a cumulative number that indicates how many times the module (interface board) has not responded to the monitor's inquiry.
Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module (interface board) to the monitor.
Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module (interface board).
Bad Checksums from BIS is a cumulative number that indicates how many times there has been an error in the message from the BIS Engine to the module interface board.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).

Measured parameters indicated:
BIS indicates BIS index; range 0...1000 (corresponds to 0...100)
SQI indicates signal quality index; range 0...1000 (corresponds to 0..100)
EMG indicates EMG activity level; range 0...10000 (corresponds to 0...100dB NOTE! On the display, EMG will be shown between 30...55dB on the bar graph or 30...80dB on the trend)
SR indicates supression ratio; range 0...100 (corresponds to 0...100%)

General_Status1 Module general status

Table 9 Module general status

bit 0-5	Not used
bit 6	State error
bit 7	Communication failure
bit 8	Power failure
bit 9	Clock failure
bit 10	EEPROM checksum failure
bit 11	EEPROM writing failure
bit 12	ROM failure
bit 13	RAM failure
bit 14	Test mode
bit 15	Init mode

BIS_Status1 BIS Engine status

Table 10 BIS Engine status

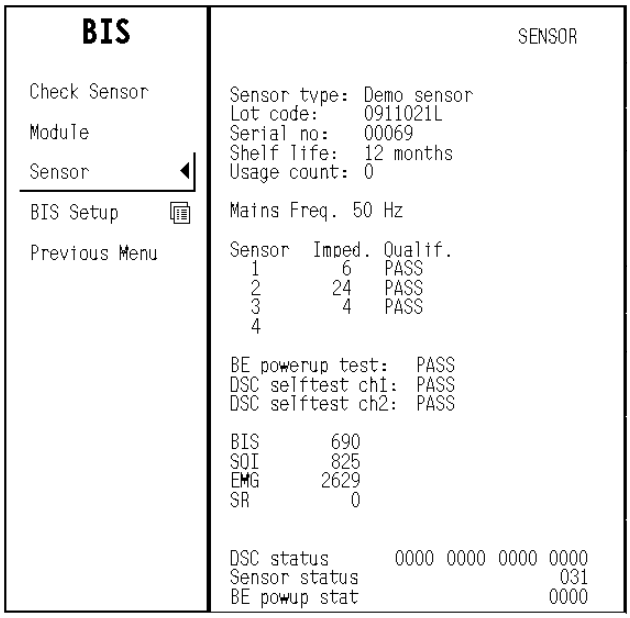
bit 0	Check Sensor key pressed
bit 1	BIS key pressed
bit 2	Inpedance check mode cyclic
bit 3	Impedance check mode combined
bit 4	Impedance check mode ground
bit 5	Impedance check off
bit 6	Measurement on
bit 7	EEG measurement on
bit 8	Impedance check on DSC channel 1 passed
bit 9	Impedance check on DSC channel 2 passed
bit 10	BIS Engine powerup failure
bit 11	DSC selftest failure
bit 12	DSC quick test failure
bit 13	DSC selftest on
bit 14	No data from BIS Engine
bit 15	Not used

Table 11 BIS Engine and DSC error messages

Message	Errors of type 1
DSC buffer overrun	
Out of dynamic memory	
Execution time exceeded in main	
Error in algorithm processing	
Invalid state in UART receive state machine	UART related errors
UART initalization error	
Transmit queue full	
Illegal number of data bytes for packet to be transmitted to the Host	
Illegal number of channels for EEG data	Misc. errors
Illegal EEG data type	
Illegal EEG data rate	
Illegal EEG filter coefficients	
No updates from Host	Communication related errors
Bad CRC - TI_SELFTEST_CODE	EEPROM CRC checks
Bad CRC - TI_RUN_CODE	
Bad CRC - FPGA_CONFIG	
Bad CRC - REV_INFO	
Illegal serial number	Serial number check
DSC failed to power up	DSC related errors
Serious DSC overcurrent error	
DSC receiver data overrun	
DSC failed repeatedly in responding to commands	
DSC update failed	
Serious DSC power regulation fault	
General DSC failure	
Sensor Negative Ground Fault	Smart sensor errors
Serious Sensor Positive Ground Fault	
Serious Sensor Overcurrent Fault	

Message	**Errors of type 2**
Illegal message ID	Errors for layer 3 packets
Illegal command parameter	
Illegal length for layer 2 data	
Disabled interrupt received - UART transmitter empty interrupt	UART related errors
Disabled interrupt received - UART modem interrupt	
No status nibble received	DSC related errors
DSC not connected	
DSC disconnected after test failure	
Illegal DSC ID	
DSC power regulation fault	
DSC interface fault	
DSC did not respond to command	
Illegal PIC ID	
DSC overcurrent	
DSC overrun	
EEPROM Bad packet length	Software update related errors
EEPROM Bad checksum	
EEPROM Bad code length	
EEPROM Illegal packet subtype	
EEPROM physical write error	
EEPROM NOT_DATA_TIMEOUT	

Service data in Sensor view



Sensor type: indicates the type of the sensor connected.
Lot code: indicates the manufacturing lot code of the sensor. The lot code contains the manufacturing date and shift.
Serial no: indicates the serial number of the sensor.
Shelf life: indicates max storage duration.
Usage count: indicates how many times the sensor has been attached/detached. Not in use.

Mains Freq.: indicates the set mains frequency; 50Hz/60 Hz.

Sensor Impedances: indicates the last measured impedances.
Imped. indicates the measured impedance value in Kohms.
Qualif. indicates the quality of the measured impedance; PASS/FAIL.

BE powerup test: indicates the status of BIS Engine power up test: PASS/FAIL.
DSC selftest ch1: indicates the DSC selftest status for channel 1: PASS/FAIL.
DSC selftest ch2: indicates the DSC selftest status for channel 2: PASS/FAIL.

Measured parameters indicated:
BIS indicates BIS index; range 0..1000 (corresponds to 0..100)
SQI indicates signal quality index; range 0..1000 (corresponds to 0..100)
EMG indicates EMG activity level; range 0..10000 (corresponds to 0..100dB)
(NOTE! On the trend display, EMG will be shown between 30..80dB)
SR indicates supression ratio; range 0...100 (corresponds to 0..100%)

Statuses (HEX): See APPENDIX A: How to read HEX numbers.
DSC status: indicates the DSC status for the four channels. See Table 12 DSC status for a detailed description of the message.
Sensor status: indicates the Sensor status. See Table 13 Sensor status for a detailed description of the message.
BE powup stat: indicates the BE power up status. See Table 14 BE power up status for a detailed description of the message.

Table 12 DSC status

bit 0	Noise test
bit 1	BIS key pressed
bit 2	Blocked droop test
bit 3	Unblocked gain test
bit 4	Impedance wait time out test
bit 5	Noise timeout test
bit 6	Blocked timeout test
bit 7	Unblocked timeout test
bit 8	DSC not connected test
bit 9	Not used test
bit 10	Not used test
bits 11 - 15	Not used

Table 13 Sensor status

bit 0	Quick selftest pass
bit 1	Quick selftest gain
bit 2	Quick selftest noise
bit 3	Quick selftest fail
bit 4	Quick selftest valid
bit 5	Sensor valid
bit 6	Sensor invalid
bit 7	Sensor too many uses
bit 8	Sensor expired
bit 9	Sensor validity unknown
bits 10 - 15	Not used

Table 14 BE power up status

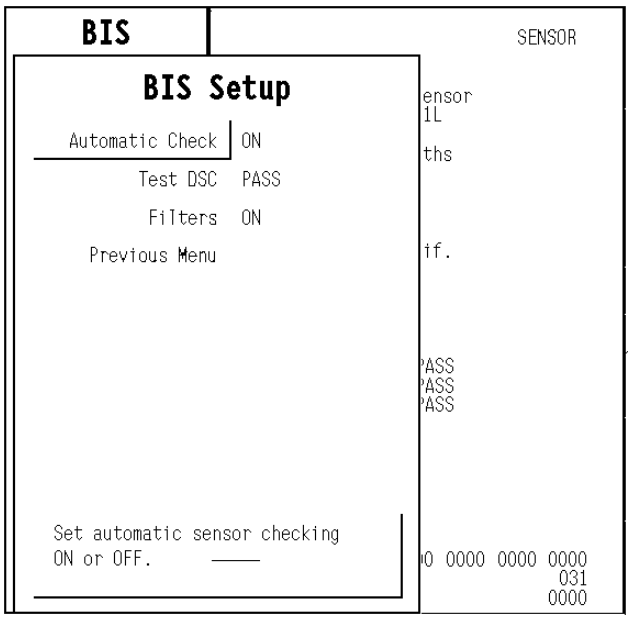
bit 0	XRAM test
bit 1	Dma test
bit 2	Timer test
bit 3	Fpga test
bits 4 -15	Not used

4.14.1 BIS Setup

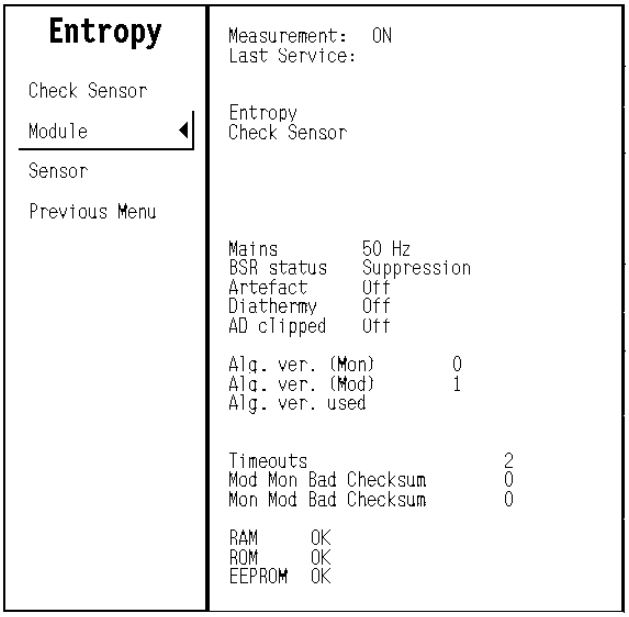
Automatic Check: A selection to define whether the automatic sensor check is used ON/OFF.

Test DSC indicates the status of the DSC self test; PASS/FAIL.

Filters: A selection to define if filters are used
ON; disturbances are filtered from the raw EEG signal
OFF; raw EEG signal is shown.



4.15 Entropy



Check Sensor Module measures the impedance of sensor electrodes. Works the same way as from Entropy menu or module key.

Module Service data is changed to the module view.

Sensor Service data is changed to the sensor view.

Service data in Module view

Measurement shows whether the Entropy measurement is ON or OFF. Measurement should start by itself when the sensor is attached to the patient.

Last service shows the date of last maintenance.

Entropy refers to the respective module key. Is highlighted when the Entropy key is pressed on the module. (Opens the Entropy menu.)

Check Sensor is highlighted when the Check Sensor key is pressed on the module. Activates the sensor check.

Mains shows the currently used mains frequency, 50 or 60 Hz:

BSR Status shows Burst if the module is not currently detecting suppressed EEG. Shows Suppression if the module is detecting suppressed EEG periods.

Artefact shows Off, if there is no high-frequency noise present, On if the module detects noise.

Diathermy shows On, if the module is detecting diathermy (i.e., electrocautery).

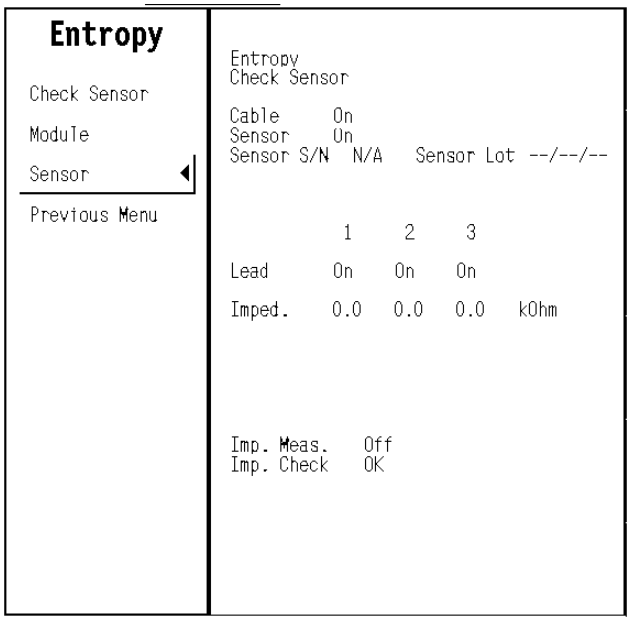
AD clipped shows On, if the signal is getting clipped at the A/D converter.

Alg. ver. (Mon) shows the monitor algorithm version number.
Alg. ver. (Mod) shows the module algorithm version number.
Alg. ver. used shows the currently used algorithm version.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module to the monitor.
Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid. The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).

Service data in Sensor view



Entropy refers to the respective module key. Is highlighted when the Entropy key is pressed on the module. (Opens the Entropy menu.)

Check Sensor is highlighted when the Check Sensor key is pressed on the module. Activates the sensor check.

Cable indicates whether the Entropy sensor cable is connected to the module or not.

Sensor indicates whether the Entropy sensor is connected to the cable or not.

Sensor S/N module reads the manufacturing serial number from the sensor chip.

Sensor Lot module reads the manufacturing lot number from the sensor chip.

Lead 1/2/3 shows the lead on/off status of all sensor electrodes.

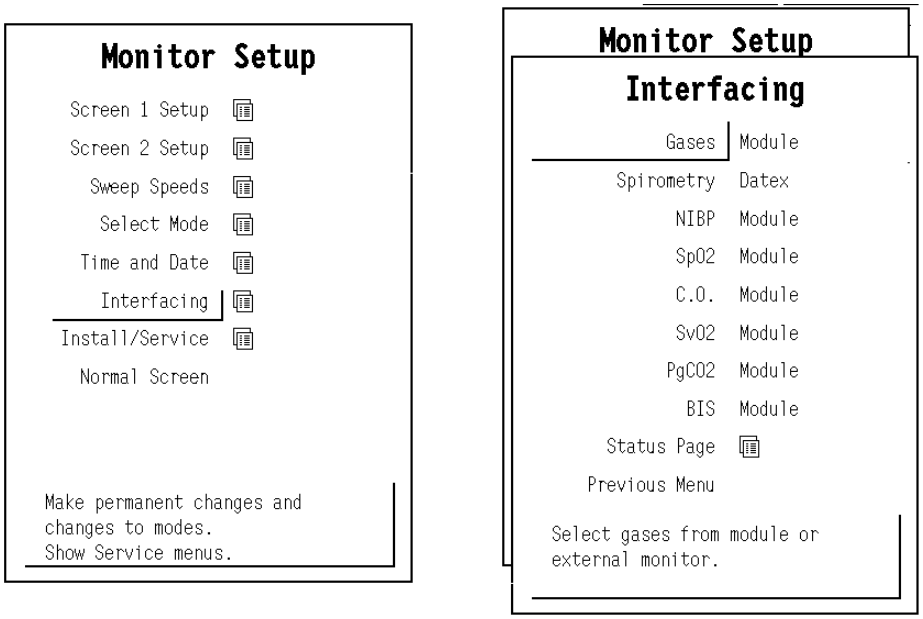
Imped. 1/2/3 shows the respective impedance value of each sensor electrode of the last impedance check.

Imp. Meas. shows On if the Automatic check (sensor impedance measurement) is on in the module.

Imp. Check shows OK if the last impedance check has been successful.

4.16 DIS Interfacing

4.16.1 Interfacing



How to interface

To select the parameter data source:

- Press the **Monitor Setup** and select ***Interfacing***.
- Select the desired measurement parameter, for example ***Gases***.
- Select the desired source by name, for example ***Aest***.

NOTE: The name of the device is visible on the list only if the device is correctly connected to the module.

4.16.2 Status Page

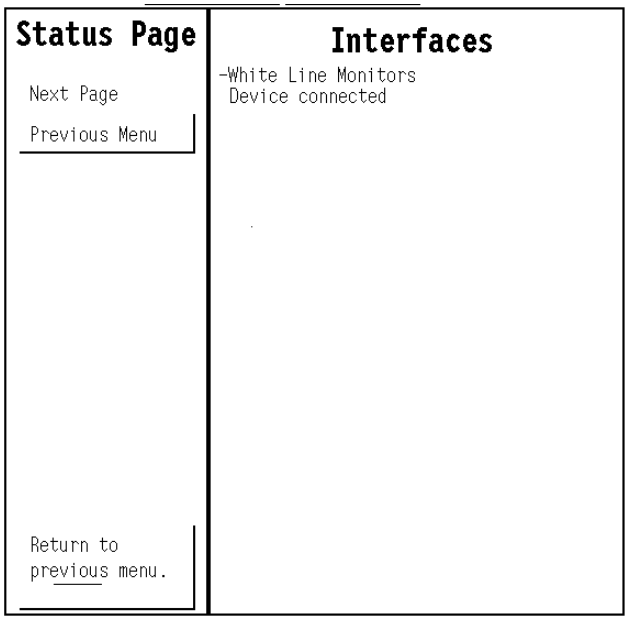
Access via **Monitor setup - *Interfacing.***

The selection **Next page** is available, if more than 8 DIS modules are connected to the DIS bus simultaneously.

Interfaces

The menu displays a list of all connected DIS modules and the statuses of the corresponding external devices.

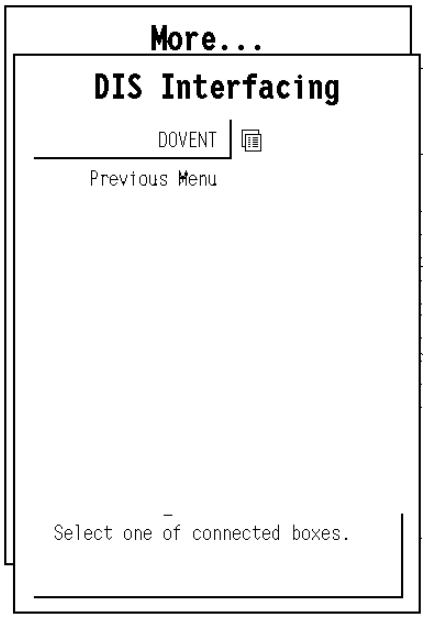
If the bus voltage is too low, you cannot add more devices. 'DIS module bus voltage low. Do not add more devices or reduce cable length' message appears.



4.16.3 DIS Interfacing service menu

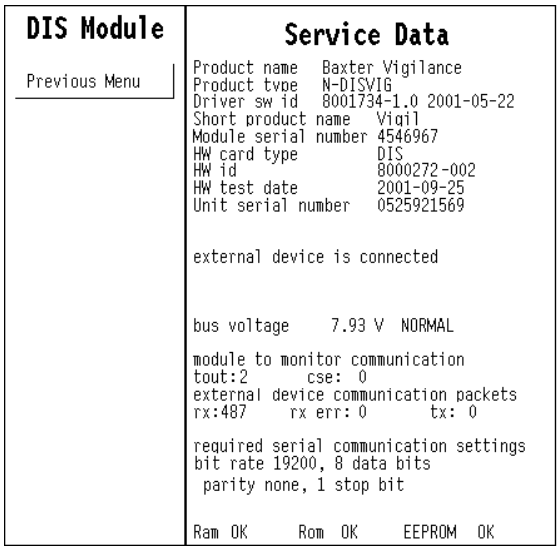
Access via **Monitor setup - *Install/Service - Service.***

The menu displays submenus for all connected DIS modules.



4.16.4 DIS Module specific page

Service Data



Product name: DIS module name.
Product type: DIS module type.
Driver sw id: DIS module software and its release date.
Short product name: DIS module name in monitor menu (**Monitor Setup** – ***Interfacing***) selection list (max. 6 characters).
Module serial number: DIS module serial number.
HW card type: PCB type.
HW id: DIS module PCB identification number.
HW test date: DIS module PCB testing date.
Unit serial number: DIS module PCB serial number.

Comment field: Indicates the status of the external device.

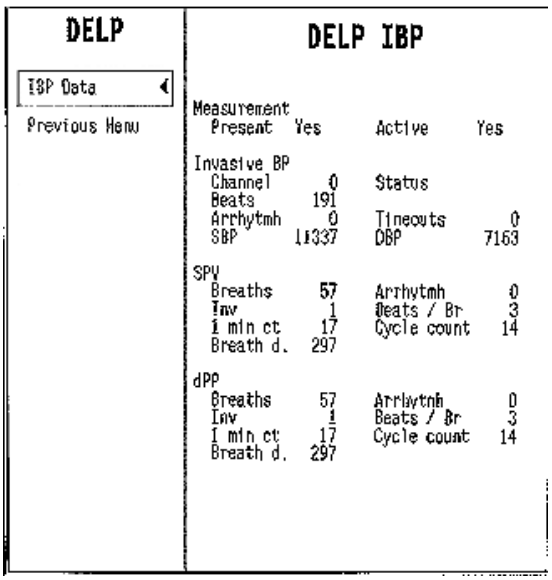
bus voltage: DIS bus voltage, measured by UPI4(NET) board. The value should normally be within 6...8 V.

tout: DIS module timeouts, seen by the monitor. The value should not increase more than by 5 per second.
cse: DIS module checksum errors, seen by the monitor. The value should not increase more than by 5 per second.
rx: The number of data packets from the external device received by the DIS module.
rx err: The number of data errors from the external device received by the DIS module.
tx: The number of data packets to the external device sent by the DIS module.

Ram: Status of DIS module RAM memory.
Rom: Status of DIS module ROM memory.
EEPROM: Status of DIS module EEPROM memory.

4.16.5 DELP service menu

DELP IBP



Systolic Pressure Variation (**SPV**) and delta Pulse Pressure **(dPP**) IBP data has been collected in the **DELP** service page.

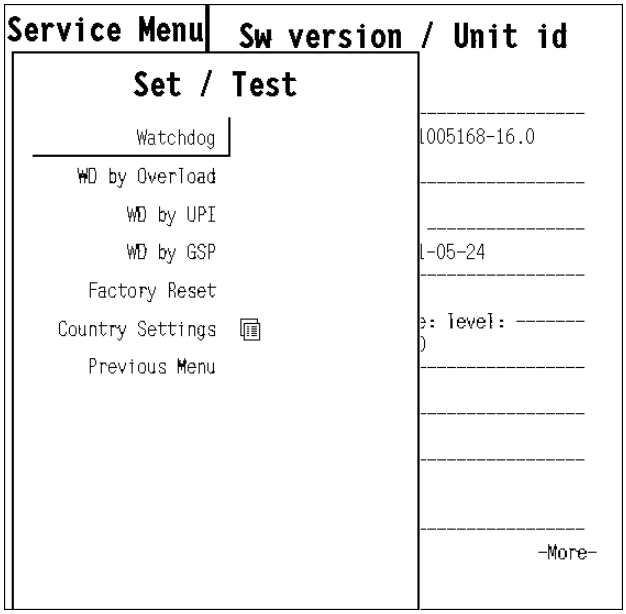
Measurement: Delta pressure measurement is always Present (Yes) and Active (Yes) in Monitor software 07.

Invasive BP:
Channel is always 0 in Monitor software 07.
Beats is the number of Art pulses detected by the calculation algorithm since monitor startup.
Arrhytmh is the number of detected artefact cycles.
Timeouts is the number of missing heart beats.
SBP is the systolic pressure beat-by-beat value (mmHg x 100).
DBP is the diastolic pressure beat-by-beat value (mmHg x 100).

SPV:
Breaths is the number of breaths detected from the Art waveform variation for the SPV calculation.
Arrhytmh is the number of detected artefact cycles in SPV calculation.
Inv is the count of invalid (e.g. resp rate too high) breath cycles.
Beats / Br is the average of Art pulses detected during one breath for the SPV calculation.
1 min ct is the detected respiration rate for SPV calculation.
Cycle count is the count of breaths used in SPV calculation.
Breath d. is the breath mean duration (seconds x 100).

dPP:
Breaths is the number of breaths detected from the Art waveform variation for the dPP calculation.
Arrhytmh is the number of detected artefact cycles in dPP calculation.
Inv is the count of invalid (e.g. resp rate too high) breath cycles.
Beats / Bris the average of Art pulses detected during one breath for the dPP calculation.
1 min ct is the detected respiration rate for SPV calculation.
Cycle count is the count of breaths used in dPP calculation.
Breath d. is the breath mean duration (seconds x 100).

5 Set/Test



The power supply unit contains a watchdog circuitry, which needs refreshment at every 1.5 seconds. If the refreshment did not occur, the watchdog circuitry will reset the main CPU. In normal operation, the main CPU refreshes the watchdog circuitry at every 0.2 seconds.

The purpose of the watchdog circuitry is to restart the monitor, if there was a serious malfunction. This feature is useful in two cases: when the main CPU is not able to control the monitor, or when the CPU controls the monitor but detects a serious malfunction. Watchdog tests check the proper functionality of the watchdog circuitry in various conditions.

Watchdog test ensures directly that the watchdog of the power unit functions properly. Choosing this test prevents the watchdog circuitry from refreshing and shows running seconds with an accuracy of 0.1 seconds.

The test should have the following result when the watchdog circuitry is working properly: The monitor will restart after 1.5 seconds from the start of the test. In malfunction: '>20 s' is displayed, and the test will be interrupted. In this case, the fault is in the watchdog circuitry of the power unit.

WD by Overload test ensures the functionality of a feature, where the software controls the monitor, but detects an overload situation in the main CPU.

The test should have the following result when the feature is working properly: The monitor will restart after 15 seconds from the start of the test.

WD by UPI test ensures the functionality of a feature, where the software controls the monitor, but detects a malfunction in the UPI processor and restarts the UPI4(NET) board. The test will prevent the UPI processor from functioning during the test.

The test should have the following result when the feature is working properly: The monitor will restart the UPI4(NET) board without any visual effects.

WD by GSP No function.

Factory Reset restore factory default settings and clear data memories. Factory reset should be run if monitor software is replaced or if the SRAM/Timekeeper battery is replaced.

5.1 Country Settings

Language

Select the software language.

National Reqs

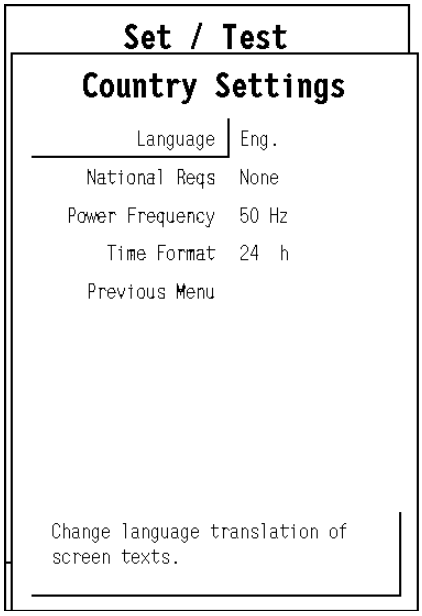
Select the software features, which include national requirements.

Power Frequency

Set the power frequency (50 Hz/60 Hz). This setting is used to filter out possible power frequency interference from the parameter measurements.

Time format

Set the time format of the real time clock (24 h/12 h).



6 Service Log

Error, event, alarm and maintenance data is stored in Service Log.
The service log contains information about the occurred monitor errors, events and alarms since the last factory reset or service log reset. The service log is saved in the EEPROM memory of the main CPU board. The user can also store different maintenance events in the maintenance log.

Maintenance menu is for setting and viewing the maintenance information of the monitor.

Error History is for selecting the error history view onto the right side of the menu.

Event History is for selecting the event history view onto the right side of the menu.

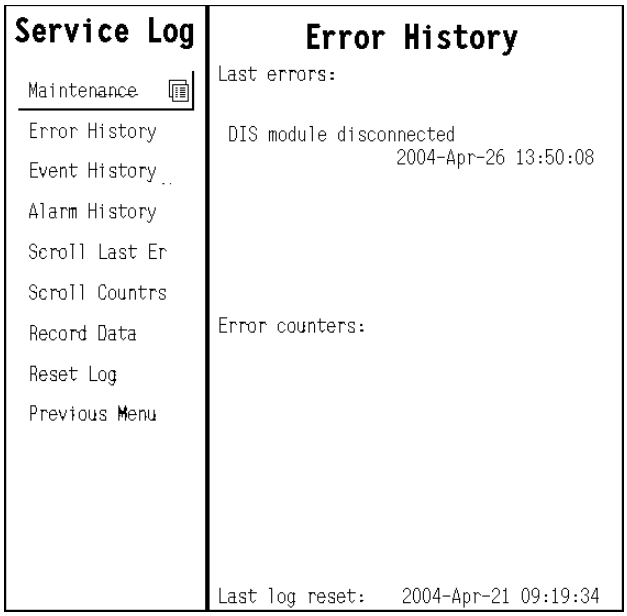
Alarm History is for selecting the alarm history view onto the right side of the menu.

Scroll Last Er (Ev) is for scrolling the error / event / alarm information on the right side of the menu.

Scroll Counters is for scrolling the error / event / alarm counters on the right side of the menu.

Record Data is for recording the service log information onto the recorder.

Reset Log is for clearing up the content of the service log. This function should be run after a performed maintenance. In Error/Event history view, the Reset Log command clears up both the error and the event log. In the Alarm History view, the Reset Log command resets only the alarm history log.



6.1 Maintenance

The Maintenance History Log gives the user a possibility to store the maintenance history of the monitor. The user can store different planned maintenance (PM) events, repairs and upgrades in the maintenance history log.

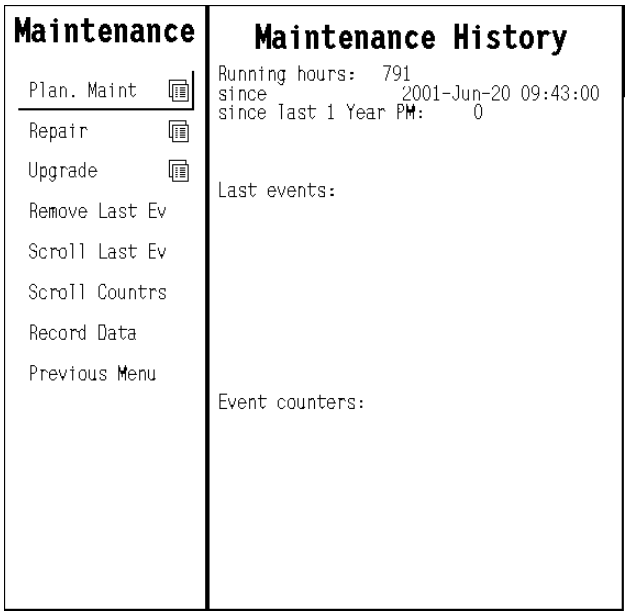
Running hours: shows how many hours the monitor has been on. User cannot reset this value.

since This date and time is set at the factory and it shows the manufacturing date and time. User cannot reset this date and time.

since last 1 year PM: shows the running hours since the last 1 year PM storing.

Last events: The section shows the last maintenance events and the time of their occurrence.

Event counters: The section contains counters for each different maintenance events. The time of occurrence of the last event is shown beside each counter.

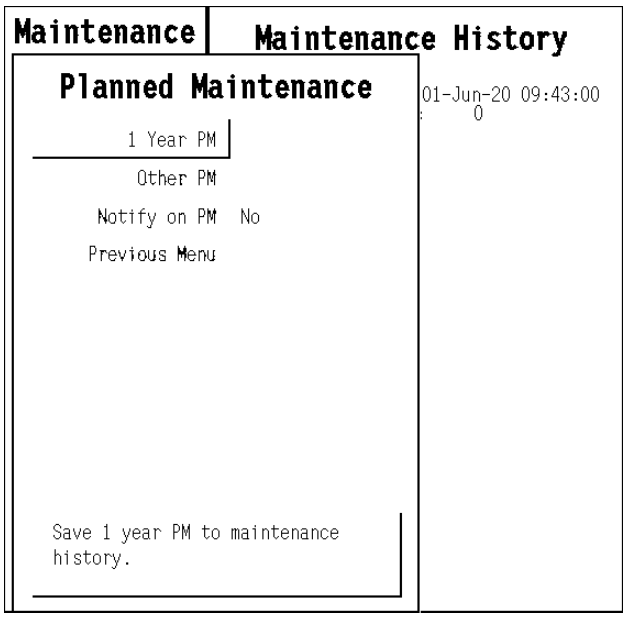


6.1.1 Planned Maintenance

1 Year PM gives you the possibility to store a 1 year PM event in the maintenance history log.

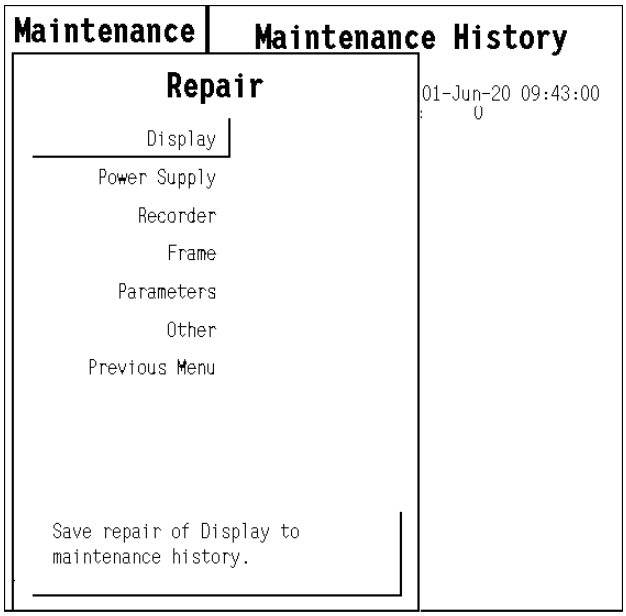
Other PM gives you the possibility to store another PM event in the maintenance history log.

Notify on PM This feature is for future purposes.



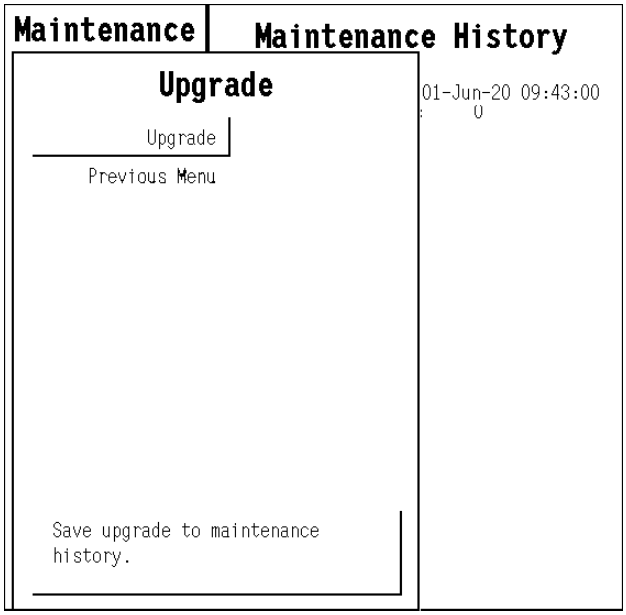
6.1.2 Repair

The repair menu gives the user a possibility to store repair events in the maintenance history log. The different repairs that can be saved are: **Display, Power Supply, Recorder, Frame** (e.g. board in the frame), **Parameters** (e.g. a board in the parameter module) or **Other** (a miscellaneous repair not specified by previous options).

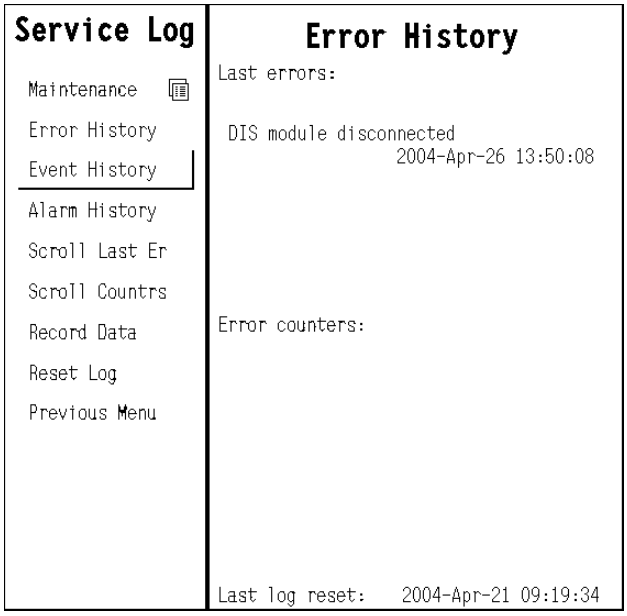


6.1.3 Upgrade

The upgrade menu gives the user a possibility to store the upgrades in the maintenance history log.



6.2 Error History



Last Errors: The section shows the last monitor errors and the time of their occurence.

Error counters: The section contains counters for each different (detected) monitor error. The time of occurrence of the last error is shown beside each counter.

Last log reset: The date and time of the last Error/ Event log reset.

Possible errors:

Fast cold start indicates the number of erroneous cold starts with power off time less than 20 seconds. The reason can be either a failing lead acid battery or a software problem that was solved by the hardware watchdog circuitry located in the monitor's power supply unit.

GSP watch-dog timeout indicates an erroneous restart controlled by the main CPU board and caused by the display controller board. The restart is listed as a fast cold start.

UPI watch-dog timeout indicates an erroneous restart controlled by the main CPU board and caused by the UPI or UPINET board. The restart is listed as a fast cold start.

6.3 Event History

Last events: The section shows the last events and the time of their occurrence.

Event counters: The section contains counters for each different (detected) event. The time of occurrence of the last event is shown beside each counter.

Last log reset: The date and time of the last Error/ Event log reset.

Possible events:

Cold start is a start-up with power off time more than 15 minutes. The trend memory is cleared and monitoring starts with the user default settings.

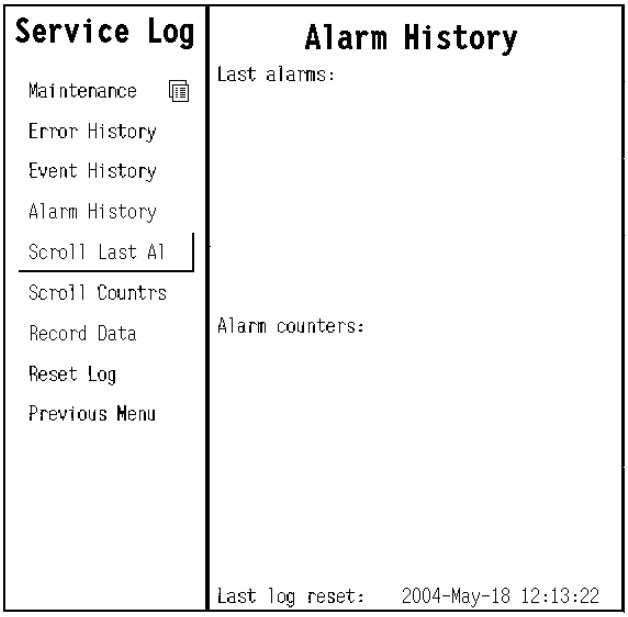
Warm start is a start-up with power off time less than 15 minutes. The trend information and possible temporary settings are still available.

6.4 Alarm History

Last alarms: The section shows the last events and the time of their occurrence.

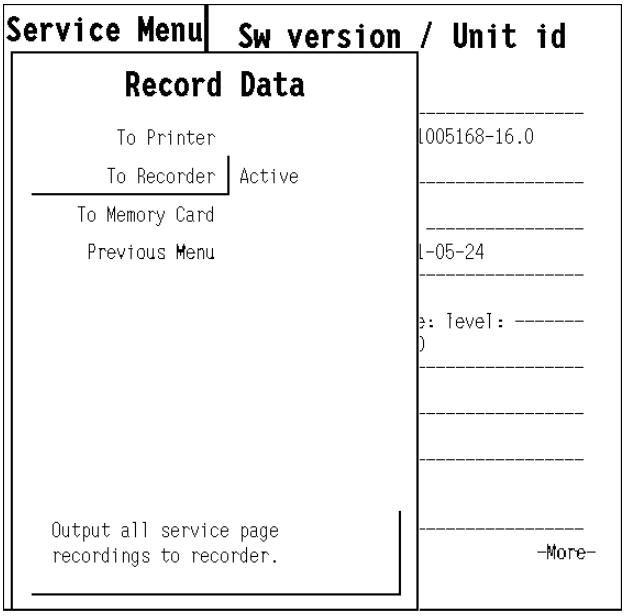
Alarm counters: The section contains counters for each different (detected) event. The time of occurrence of the last event is shown beside each counter.

Last log reset: The date and time of the last alarm log reset.



7 Record Data

In this menu, the user can specify where to print from any service menu. The setting goes into the permanent memory of the monitor. The options where to print are: **To Printer, To Recorder** and **To Memory Card**. The **To Printer** and **To Memory Card** options are not in use. When any of the front panel keys of the recorder module, E-REC is pressed, the output is the recorder module despite of the setting of Record Data menu.

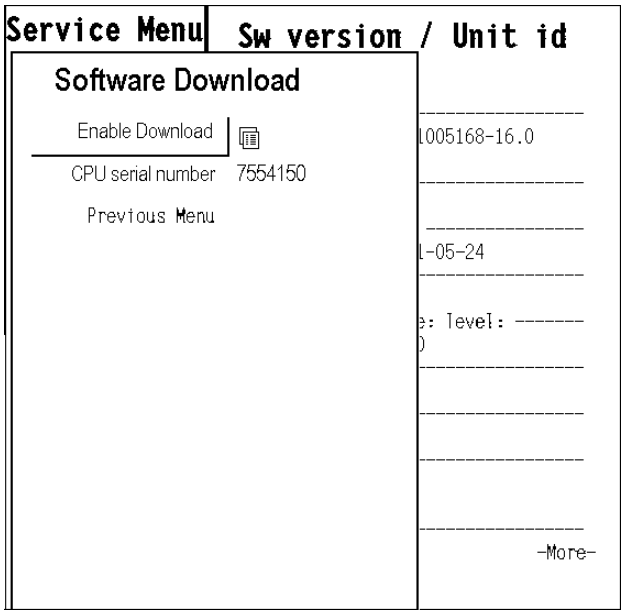


8 SW Download

Software download menu is for downloading monitor software via the network port.

The SWDL tool is intended to be used by GE Healthcare service organization and authorized distributors only.

For more information on the SWDL tool, see “Software Download Tool - User Instructions.”



APPENDIX A: How to read HEX numbers

Some statuses on BIS and Tonometry Module service pages are given as HEX (hexadecimal) numbers. To understand them, please read the following:

A HEX number has a base of 16 instead of 10. This means that every character in a number can have a value between 0 and 15. Numbers from 0 to 9 are displayed as if they were normal 10-based numbers. Numbers from 10 to 15 are displayed with letters from a to f or A to F respectively.

Every character of a HEX number expands into a binary code of four 0:s (zeroes) and 1:s (ones) as given in table 9. Four successive characters thus expand into four times four binary numbers. Here's an example:

We have a HEX number F3A1. We expand the number into a binary code so that we first take the four binary digits that correspond to F, which are 1111. Then we write the four binaries that correspond to 3 (0011) after the first four. We now have 11110011. And so on.

Eventually, we have a string of 16 binary numbers, so called bits. HEX number F3A1 corresponds to a binary code of 1111 0011 1010 0001. Spaces are added here for legibility and to visualize the fact that every group of four bits corresponds to one HEX character.

The bits in a binary number are numbered from right to left always starting from 0 as follows:

bit 15	bit 14	bit 13	bit 12		bit 11	bit 10	bit 9	bit 8		bit 7	bit 6	bit 5	bit 4		bit 3	bit 2	bit 1	bit 0
1	1	1	1		0	0	1	1		1	0	1	0		0	0	0	1

With this information and the proper table of status fields you can translate a HEX status code into actual status messages. For the tables of status fields see section "Tonometry" or "BIS" . If a bit is 1, this means that the corresponding status/error condition is valid, whereas a 0 means that it is not.

Table 15 HEX to binary conversion

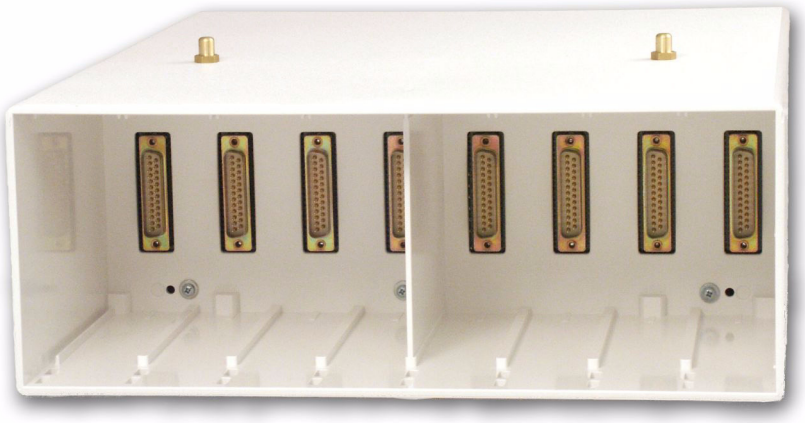
HEX	binary	HEX	binary
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

For your notes:

Datex-Ohmeda

S/5™ 8-Module Frame, F-CU8 -12

Technical Reference Manual Slot



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

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

All specifications subject to change without notice.

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Table of contents

Table of contents i

Table of figures ii

Introduction 1

1 Specifications 2
- 1.1 8-Module Frame, F-CU8 . . . 2
  - 1.1.1 Electrical requirements . . . 2
  - 1.1.2 Environmental requirements . . . 2

2 Functional description 3
- 2.1 8-Module Frame, F-CU8 . . . 3
  - 2.1.1 Power supply unit, F-CU8 Rev.12 . . . 4
  - 2.1.2 CPU mother board . . . 9
  - 2.1.3 Module mother board . . . 9
- 2.2 Connectors and signals . . . 9
  - 2.2.1 External connectors . . . 10
  - 2.2.2 Internal connectors . . . 11

3 Service procedures 12
- 3.1 General service information . . . 12
- 3.2 Service check . . . 12
  - 3.2.1 Recommended tools . . . 12
  - 3.2.2 Recommended parts . . . 12
  - 3.2.3 Visual inspection . . . 13
  - 3.2.4 General inspection . . . 15
- 3.3 Disassembly and reassembly . . . 19
  - 3.3.1 Before disassembly . . . 19
  - 3.3.2 Tools needed . . . 19
  - 3.3.3 To remove and disassemble the Power Supply Unit . . . 19
  - 3.3.4 To remove the CPU mother board and the module mother board . . . 25
  - 3.3.5 Replacing the fuses . . . 27
- 3.4 Adjustments and calibrations . . . 28

4 Troubleshooting 29
- 4.1 Central Unit . . . 30
- 4.2 Digital section . . . 31

5 Earlier revisions 32

Appendix A: Service check form, Datex-Ohmeda 8-Module Frame, F-CU8 A-1

Table of figures

Figure 1 8-Module Frame, F-CU8 1
Figure 2 Basic structure of S/5 Monitor, an example of possible configuration 3
Figure 3 Power supply unit block diagram (F-CU8, rev. 12) 4
Figure 4 Mains part and battery inlet switch block diagram (F-CU8, rev. 12) 5
Figure 5 Power supply board block diagram (F-CU8, rev. 12) 6
Figure 6 Power logic board block diagram (F-CU8, rev. 12) 7
Figure 7 F-CU8 connectors 9
Figure 8 Monitor troubleshooting flowchart 29
Figure 9 Central Unit troubleshooting flowchart 30
Figure 10 Digital section troubleshooting flowchart 31

Introduction

This section provides information for the maintenance and service of the following products:

- 8-Module Frame, F-CU8 (also called Central Unit)
  - Power supply unit
  - CPU mother board
  - Module mother board

Information for the maintenance and service of:

- CPU Board in “CPU Board, B-CPU6” slot
- UPINET Board in “UPINET Board, B-UPI4NET” slot
- Optional Display Controller Board B-DISPX in “Displays and Display Controllers” slot

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

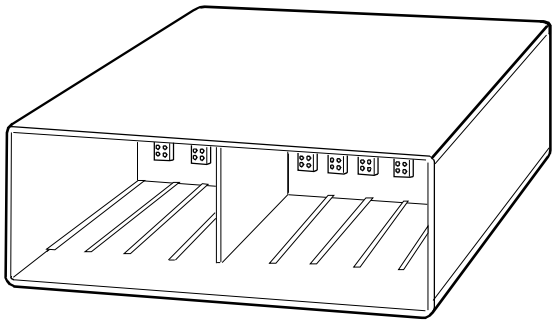


Figure 1 8-Module Frame, F-CU8

1 Specifications

1.1 8-Module Frame, F-CU8

Dimensions, D × W × H	382 × 315 × 128 mm / 15.0 × 12.4 × 5.0 in
Weight	9.1 kg / 20 lb.

1.1.1 Electrical requirements

Rated voltages and and frequencies	100 V, 50/60 Hz 110...120 V, 50/60 Hz 220... 240 V, 50/60 Hz
Allowed voltage fluctuations	100 V ±10% 110 V -10% to 120 V +10% 220 V -10% to 240 V +10%
Maximum power consumption	
F-CU8 Rev.12	160 VA
Safety class	Class I
Grounding	Hospital grade
Interruptibility	Data memory and alarm settings are saved during power failures up to 15 minutes

1.1.2 Environmental requirements

Operating temperature	10...35 °C / 50...95 °F
Storage temperature	-10...+50 °C / 14...122 °F
Relative humidity	10...90% non-condensing (in airway 0...100% condensing)
Atmospheric pressure	660...1060 mbar (500 to 800 mmHg)

2 Functional description

2.1 8-Module Frame, F-CU8

To operate S/5 Anesthesia Monitor or S/5 Critical Care Monitor, the following products should be installed into the frame

- CPU board, w/ main software
- UPI4NET board, B-UPI4NET
- Optional display controller board(s), B-DISPX (up to two) for secondary and 3rd display

From F-CU8 Rev.12 onwards the CPU board, B-CPU6 with an integrated display and Ethernet controller and the UPI4NET board, B-UPI4NET are installed into the 8-Module Frame at the factory.

The frame has two sections. The front part is for the modules. Between the front and rear parts, there is a module mother board and a CPU mother board. The module mother board connects modules to the system, and the CPU mother board connects boards together.

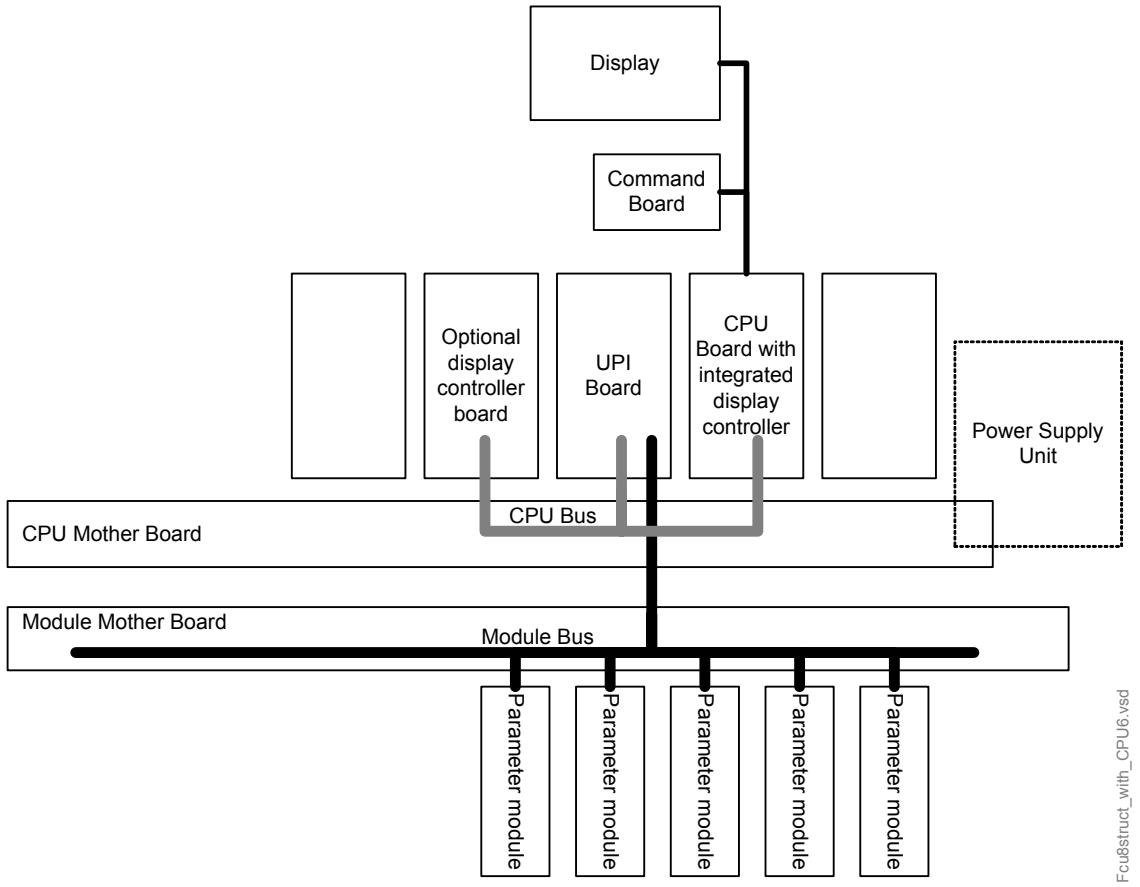


Figure 2 Basic structure of S/5 Monitor, an example of possible configuration

2.1.1 Power supply unit, F-CU8 Rev.12

Power supply unit contains three PC boards (power supply board, power logic board, and Battery switch board) and four external components (mains transformer, fan, loudspeaker, and lead acid battery).

All the operational controls in the power supply unit are located in the three PC boards.

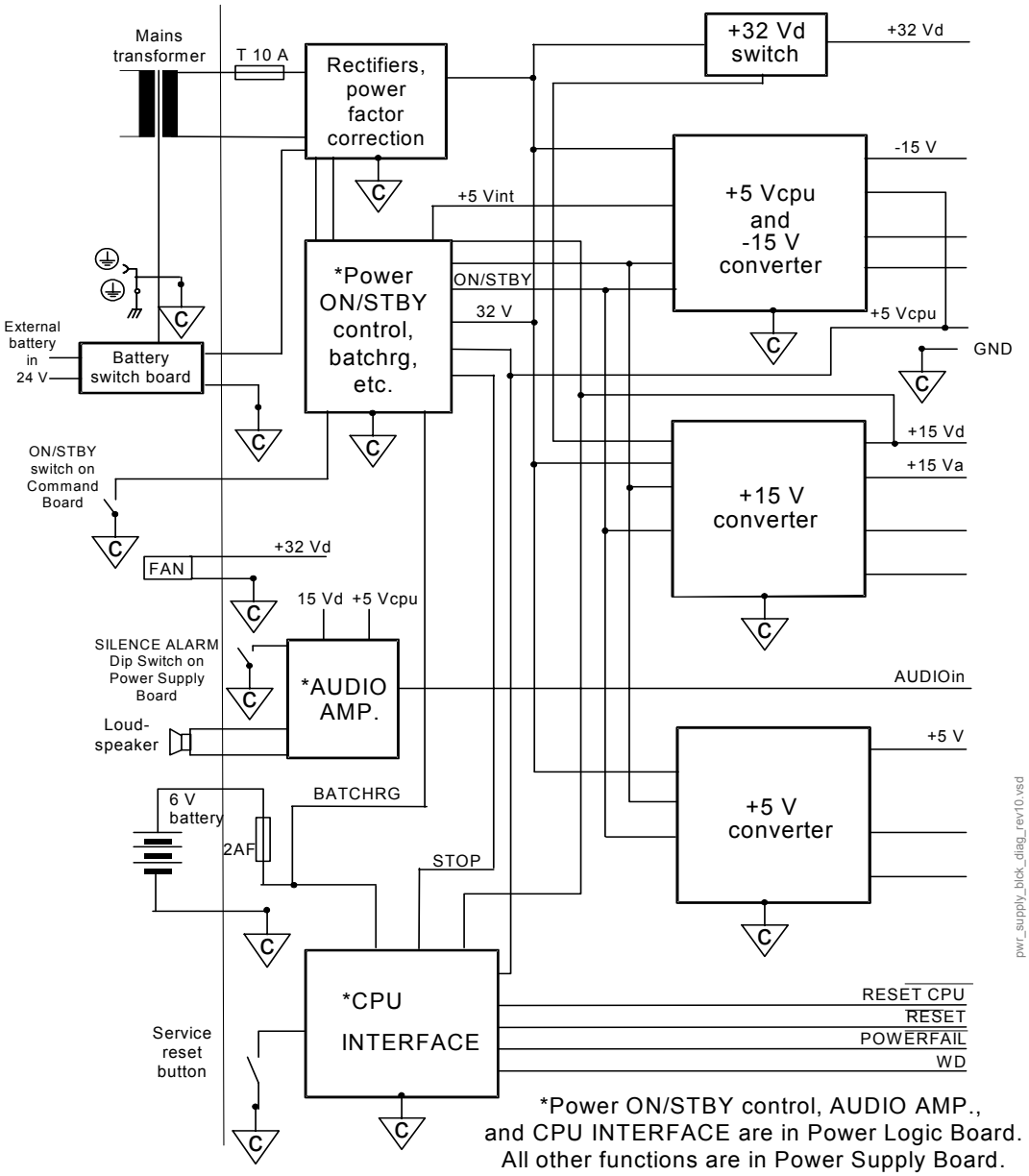


Figure 3 Power supply unit block diagram (F-CU8, rev. 12)

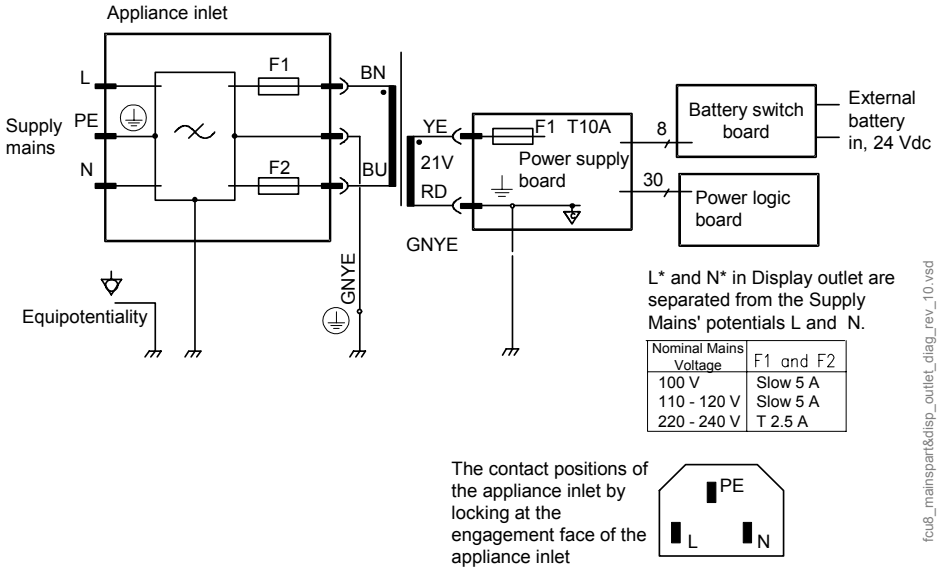


Figure 4 Mains part and battery inlet switch block diagram (F-CU8, rev. 12)

Power supply board

Rectifiers

Rectifiers processes 21 VAC from the mains transformer.

Power factor correction

Power factor correction is performed in a pre regulator. The regulator modifies output current from sinusoidal power lines into sinusoidal form. Its purpose is to boost efficiency of the mains transformer.

Battery charging

Batchrg charges the 6 V CPU battery which maintains the supply voltage of CPU for 15 minutes after the power is cut off. The battery is charged as long as the power cord is connected to the mains outlet.

-15 V converter

-15 V converter is a Flyback-type chopper power supply that generates -15 V voltage from +32 V. The load capacity is 200 mA (7.5 W).

+15 V converter

+15 V converter is a Buck-type chopper power supply that generates +15 V from +32 V.

The output of the power supply is divided into two; +15 Va for analog voltage and +15 Vd for less sensitive components.

+5 V converter

+5 V converter is a Buck-type chopper power supply that generates +5.1 V from +32 V. The load capacity is 8 A (40 W).

+5 V, +15 V, +32 V, and +5 Vcpu checking

Those voltages are checked and if one of them increases more than is allowed, thyristor pulls the rectified +32 V down.

Service reset button

Service reset button is for service purpose. Press this button with an appropriate tool for at least five seconds before you remove any PC board or the Power supply unit from the rear of the Central Unit.

Before connecting the power cord back and start monitoring, be sure that at least one minute has passed after the service reset button was pressed. Too short time may lead to memory flaw.

Audible alarm for power fail

Inside the Power supply unit there are two dip switches. By turning the switches up the audio alarm is activated. When mains power fails the audio alarm is powered from the lead-acid battery.

+32 VD switch

This short circuit protected circuit connects the dirty +32 Vd voltage.

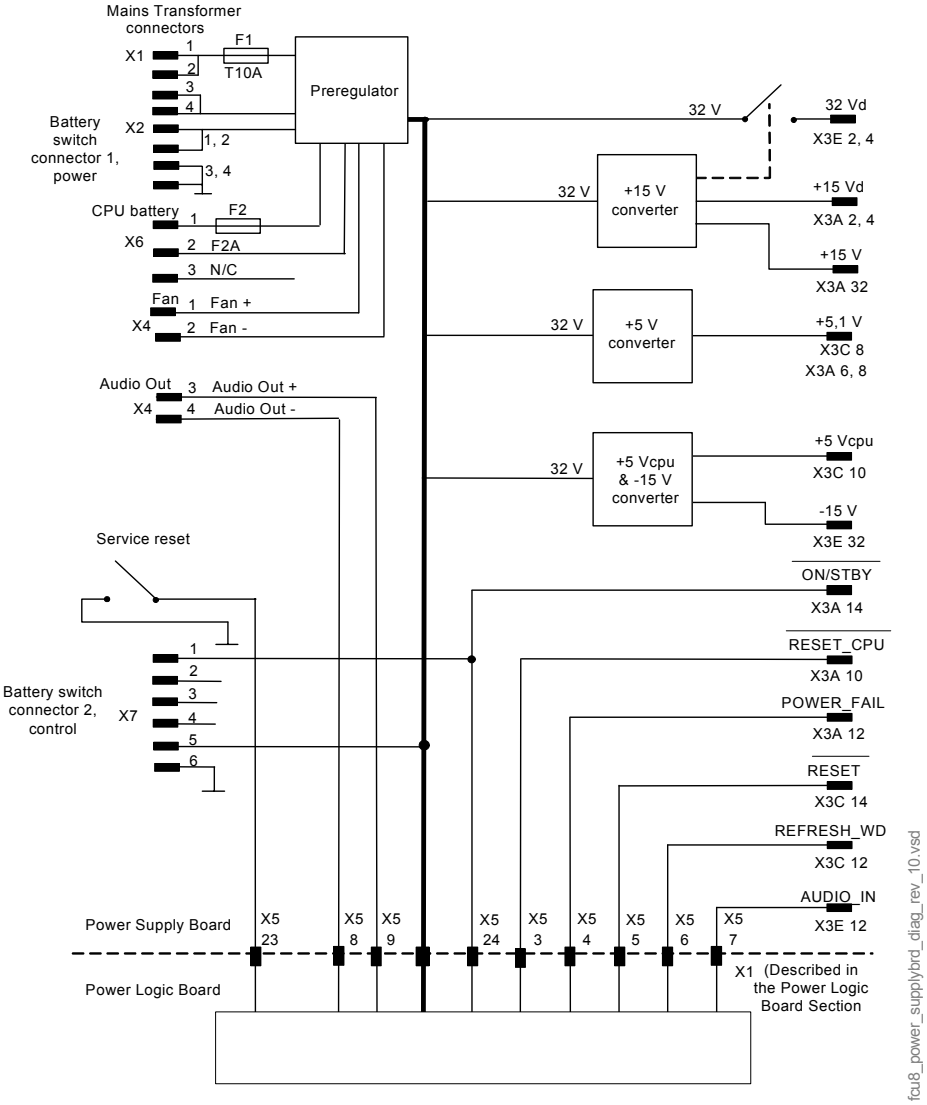


Figure 5 Power supply board block diagram (F-CU8, rev. 12)

Power logic board

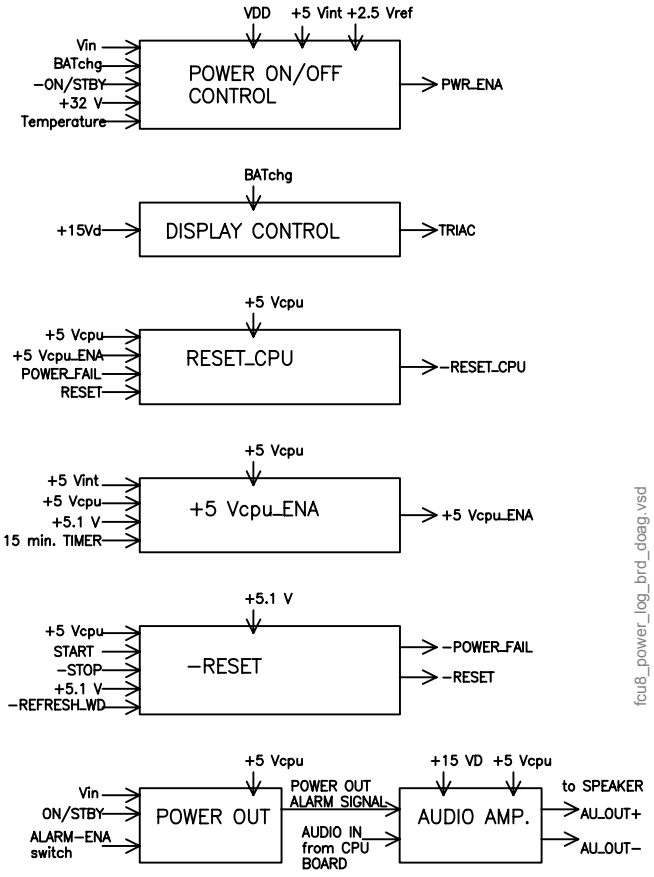


Figure 6 Power logic board block diagram (F-CU8, rev. 12)

Protections

These following protections generate automatic power off situations without any message in advance.

1. High voltage protection (+32 V, +15 V, +5 V, +5 Vcpu). Requires manual start-up and power cord must be disconnected for a while. Valid from revision 03.
2. Low voltage protection (+32 V). Automatic power off when U < +25 V. Automatic start-up after voltage back to normal.
3. High current protection (all secondary outputs). Output restrained until cause is eliminated.
4. High temperature protection. Automatic power off at +58 °C (approx.) and automatic start-up at +54 °C (approx.). Possible caused by fan failure, fan filter is not clean or power supply unit is overloaded. The measurement is located on the Power logic board.

Power ON/STBY control

Power ON/STBY control includes a logic with which power supply is switched on or off by turning ON/STBY switch.

Reset

-RESET_CPU signal is transmitted to the CPU interface in case the mains voltage fails or the power is cut off.

-RESET signal is also generated for other digital boards.

Audio amp.

Audio signal from the CPU is amplified and filtered for the loudspeaker. Amplification gain is about 5 dB.

CPU interface

All the necessary communications between the Power supply unit and the CPU (Reset, Powerfail and Watchdog functions) are realized in this board. Additionally, the block contains a circuit that supervises the maintenance of CPU's supply voltage from the battery for 15 minutes after the monitor is turned off.

Battery switch board

The Battery switch board switches the F-CU8 to external battery power, if the mains power is lost. The board routes the ON/STBY line to the external battery connector at the rear of the F-CU8.

There is an External Battery, 24Vdc connector for external DC supply on the board to enable operation in GE anesthesia workstations in battery backup mode during a loss of mains power. In this situation the monitor uses the anesthesia machine batteries.

NOTE: This External Battery, 24 Vdc connector must only be connected to the monitor battery backup supply in GE anesthesia delivery systems. Do not use this connector for any other purpose.

AC output for display supply has been removed from the unit to get space for the input interface electronics of the battery backup mode.

NOTE: Removal of the AC output creates a need to use an external power supply and/or isolation transformer for all the other displays except those that are supplied from internal DC voltage of the F-CU8 i.e. D-LCC12A.

External components

Transformer

The power of the mains transformer is 160 VA. The secondary voltage is 21 VAC .

Depending on the voltage in use, there are three different transformers for the monitor 100 VAC, 110-120 VAC or 220-240 VAC.

Fan

The fan is switched on automatically when +32 Vd is generated (= power ON).

Loudspeaker

The loudspeaker is controlled by the audio-amplifier on the Power logic board.

Battery

6 V, 1.2 Ah sealed lead-acid battery is used to supply power to the CPU board after the power is turned off and the power cord is disconnected. 15 min timer.

2.1.2 CPU mother board

The CPU mother board connects the CPU board and other boards (e.g. UPI4NET and optional display controller board) and functions as a bus between them.

There are connectors for four PC boards. Two of those are normally occupied (B-UPI4NET and B-CPU6 with integrated display controller) and two are reserved for, e.g. optional display controllers, B-DISPX boards. The bus structure is the same in all S/5 monitors.

ON/STBY-line is connected only to a B-CPU6 board connector from where it goes directly to Keyboard and ON/STBY switch. The CPU mother board is connected to module mother board by 25-pin D-connector.

2.1.3 Module mother board

This board connects the modules and the main frame together electrically. Module bus structure is the same in all S/5 monitors. There are connectors for 4 double-width or 8 single-width modules.

2.2 Connectors and signals

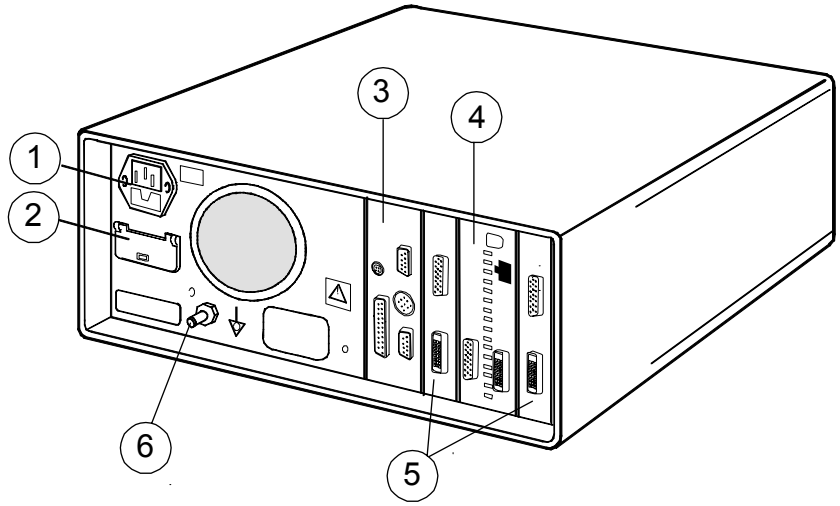


Figure 7 F-CU8 connectors

(1) Main power, receptacle for power cord
(2) External battery connector
(3) B-UPI4NET board
(4) B-CPU6 board with integrated display controller
(5) Display controller board, B-DISPX (optional)
(6) Equipotential connector

2.2.1 External connectors

Table 1 Main power F-CU8

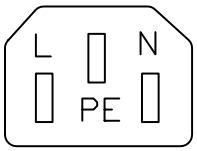
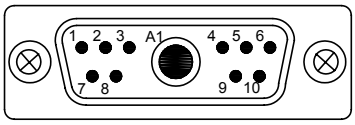
Mains connector	Pin	Signal
	L PE N	Live Protective earth Neutral

Table 2 External Battery, 24Vdc connector (Battery backup) F-CU8 rev.12

Connector: 11W1	Pin	I/O	Signal
	A1 1 2 3 4 5 6 7 8 9 10 Shield	 - O I I I I I O 	GND GND NC STBY/ON 24 Vdc 24 Vdc 24 Vdc 24 Vdc 24 Vdc 32 Vdc, for factory use only GND Cable shield, GND, metal case

2.2.2 Internal connectors

Table 3 F-CU8 Rev.12 Power supply (X3) - CPU mother board connector

Pin	(a)	(c)	(e)
2	+15 VD	GND	+32 VD
4	+15 VD	GND	+32 VD
6	+5 V	GND	GND
8	+5 V	+5 V	GND
10	RESET_CPU	+5 V_CPU	GND
12	POWER_FAIL	REFRESH_WD	AUDIO_IN
14	ON/STBY	RESET	AL_OR_BAT
16	SERVRST	ALARMENA	N/C
18	GND	GND	GND
20	TEST1 N/C	TEST2 N/C	N/C
22	TEST4 N/C	TEST5 N/C	TEST6 N/C
24	TEST7 N/C	N/C	N/C
26	GND	GND	GND
28	BAT_ON N/C	TEST8 N/C	N/C
30	N/C	GND	N/C
32	+15 V	GND	-15 V

3 Service procedures

3.1 General service information

The field service of the F-CU8 is limited to replacing the faulty printed circuit boards or mechanical parts. The printed circuit boards should be returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation, and a detailed description of the fault.

WARNING **Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.**

3.2 Service check

These instructions include complete procedures for a service check. The service check is mandatory after any service repair. However, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form (*APPENDIX A:*) which may be used when performing the procedures.

The symbol  in the instructions indicates that the check form contains space to record the results of the particular procedure.

3.2.1 Recommended tools

Tool	Order No.	Notes
Command Bar		
E-REC		
Hemodynamic Multiparameter Module		
Patient Simulator		
Multimeter		
Screwdriver		
Board removal tool or pliers		
Antistatic wristband		

3.2.2 Recommended parts

Part	Order No.	Notes
Recorder paper		
Fan filter	871558	

3.2.3 Visual inspection

Make sure that no cables or modules are connected to the Central Unit. Lift off the Video display with its stand, if placed on the Central Unit.

8-Module Frame, F-CU8

1. Bronze taps

   Check that the two bronze taps on the frame are tightened properly.

2. Pads and screws

   Turn the frame onto one of its sides. Check that all the four rubber pads are in place and the screws on the bottom are tightened properly.

3. Module motherboard connectors

   Turn the frame back to its normal position.

   Check that the module motherboard connectors are clean and intact. Check also that the screws that connect the module mother board to the frame are tightened properly.

4. Module motherboard position

   Check that the E-REC fits in smoothly and locks up properly in all possible slots in the Central Unit. Leave the E-REC disconnected.

CAUTION Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.

Power supply unit

5. Fan filter

   Clean or replace the fan filter.

6. Primary fuses

   Disconnect the primary fuse holder. Check that the fuse compartment, the fuse holder and the fuses are clean and intact. Check also that the fuses are of the correct rating.

   Reconnect the fuse holder and check that it locks up properly.

7. Power inlet connectors

   Check that the power inlet connectors are clean and intact.

8. Service reset -switch

   Check that the service reset -switch is intact. Press the switch at least for five seconds.

9. Equipotential tap and rear panel screws

   Check that the equipotential tap and all the rear panel screws are tightened properly.

PC boards

10. PC board screws

    Check that all the rear side PC boards are secured to the Central Unit with screws.

11. PC board connectors

    Check that the connectors on the rear panels of the PC boards are clean and intact.

12. Block screws for cables

    Check that all block screws for cables are in place and tightened properly. Check also that their threads are intact.

13. Grounding plates

    Check that the grounding plates under the PC board rear panels are attached properly and are not bent.

14. Optional display controller board B-DISPX jumpers/DIP switches

    If available, disconnect the display controller board(s) and check that the address and interruption jumpers/ DIP switches have been set correctly. The instructions for setting the jumpers can be found in the “Displays and Display Controllers” slot of the Technical Reference Manual,

    Leave the board(s) disconnected.

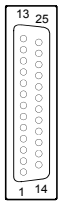
    Disconnect the UPI4NET board.

3.2.4 General inspection

15. Communication lines

    After any service repair for the Module mother board, measure resistance from the following Module mother board's connector pins against the ground:

    Module mother board connector

    Pin 1 +Reset RS485
    Pin 5 -Data RS485
    Pin 6 +Data RS485
    Pin 8 -Reset RS485
    Pin 13 Ground

    Check that the resistance on each of the pins is higher than 10 kΩ. If not, replace the Module mother board.

- Reconnect the PC boards and secure them to the Central Unit with screws.

NOTE: Make sure that the cables are properly attached and secured.

- Install the display together with the Command Bar, the Hemodynamic module and E-REC. Connect the mains power cord and turn the monitor on.

16. Fan

    Check that the fan is running.

17. Starting

    Check that the monitor starts up properly, i.e. the alarm LEDs on the Command Bar turn blank, the start-up sound is heard from the loudspeaker and the normal monitoring screen appears. No error messages should appear on the screen.

18. Module communication

    Check that the connected modules are recognized, i.e. the needed parameter information is shown on the screen and the E-REC records two lines of start-up information.
    If some parameter information is missing, check the screen configuration from the MONITOR SETUP menu.

    NOTE: InvBP waveforms are not shown without a patient simulator.

19. Real time clock

    Check that the clock on the screen shows correct time. Adjust the time, if necessary.

    Monitor Setup - *Time And Date*

    NOTE: If the clock shows time 0:00 continuously (at successive start-ups), the SRAM/TIMEKEEPER chip on the CPU board, or its battery, needs to be replaced.

    The FACTORY RESET should be performed after the replacement has been made.

20. Loudspeaker sound

    Check the loudspeaker by setting the alarm sound:

    Alarms Setup - *Alarm Volume*

    Test the whole volume scale from 1 to 10 by turning the ComWheel and check that the alarm volume changes correspondingly. The alarm sound should be clear and audible with all the settings.

21. Monitor software

    Enter the service menu.

    Monitor Setup - *Install/Service* (password 16-4-34) **- *Service*** (password 26-23-8)

    Take down the information regarding monitor software.

22. Content of service log

    Select SERVICE LOG from the menu. Record the Service log onto the E-REC by selecting RECORD DATA. Check the content of recording for possible problems, then empty the Service log by selecting RESET LOG from the menu.

23. Voltages

    Check the power supply unit output voltages through the service menu:

    Monitor Setup - *Install/Service* (password 16-4-34) **- *Service*** (password 26-23-8) **- *Frame - Power Supply***

    The output voltages should meet the following ranges:

+15V	14.20....15.60 V
-15V	-14.00...-15.50 V
+15VD	14.10.....15.60 V
+5V	4.70.....5.40 V

24. Watchdog circuitry

    Test the Central Unit watchdog circuitry:

    Monitor Setup - Install/Service (password 16-4-34) ***- Service*** (password 26-23-8) ***- Set/Test***

    Go through the **Watchdog**, **WD by Overload** and **WD by UPI** tests one by one and check that the monitor performs a restart in all other cases except when performing **WD by UPI**.

    NOTE: When selecting WD BY OVERLOAD, restarting should take place approximately after 15 seconds. With the other tests, restarting takes place within a couple of seconds.

    If restarting did not take place, try to locate the fault:

    Watchdog --> CPU board /Power supply unit

    WD by Overload --> CPU board

25. Trend retaining

    Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby.

    Turn the monitor to standby and disconnect the power cord. Wait for two minutes, then reconnect the power cord and turn the monitor back on. The monitor should perform a "Warm start" which means the trend information and temporary settings should still be available.

    If the monitor performed a "Cold start" instead, the battery fuse or the battery needs to be replaced.

    NOTE: The B-CPU6 requires 2 Amps battery fuse (P/N 51063).

    The information regarding the start-up is saved also in the Service log.

26. Service reset button

    Check the service reset button. Turn the monitor to standby and press the service reset button for at least five seconds. Turn the monitor back on and check that the monitor performs a "Cold start".

27. Recovering from power loss

    Disconnect the power cord (during operation) for a moment, reconnect it and check that the monitor recovers without problems. The monitor should perform a "Warm start".

28. Electrical safety check

    Perform an electrical safety check and a leakage current test.

29. Functioning after electrical safety check

    Check that the Central Unit functions normally after the performed electrical safety check.

30. Final cleaning

    Clean the Central Unit with suitable detergent.

3.3 Disassembly and reassembly

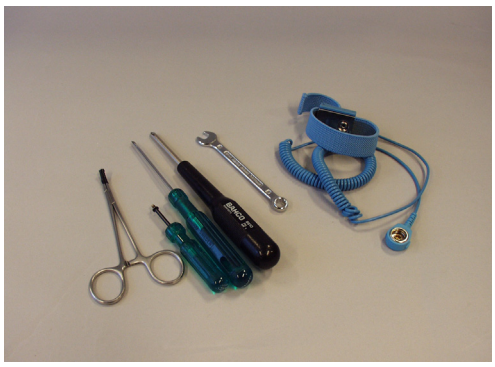
3.3.1 Before disassembly

WARNING **Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.**

NOTE: Handle all PC boards by their edges.

- Make sure that the monitor is turned off.
- Disconnect the main power cord.
- Press the service reset button with an appropriate tool for at least five seconds.
- Remove all the parameter modules from the front of the frame.
- Disconnect all external cables connected to the monitor.

3.3.2 Tools needed



- crosshead screwdriver
- flat blade screwdriver
- board removal tool or pliers
- pincers
- wrench 7mm
- antistatic wristband

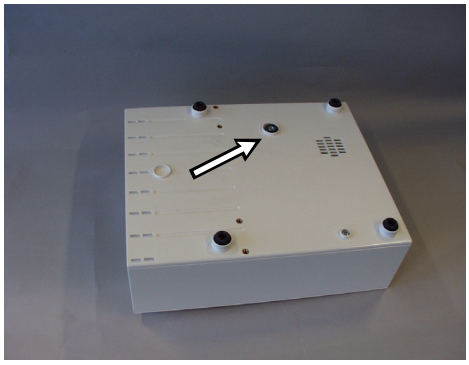
3.3.3 To remove and disassemble the Power Supply Unit

1. Remove all PC boards and plates covering possible empty slots from the back of the frame.

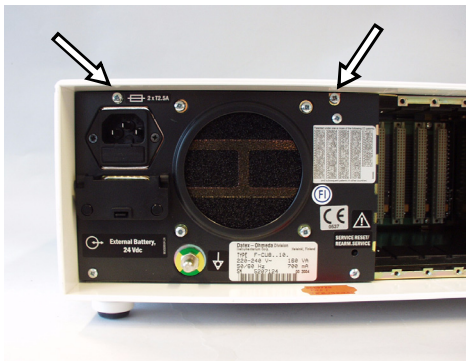
Notice that the PCBs can only be removed in certain order.

NOTE: The B-UPI4NET contains components on both sides of the PCB. Therefore, the installation of B-UPI4NET should be handled with extra care.

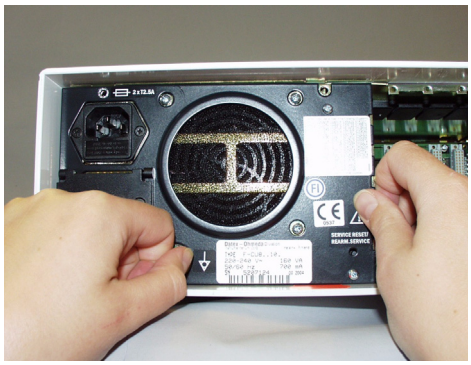
NOTE: When reassembling, do not fasten the screws until you have made sure that the PCBs are properly attached to the connectors.



2. Remove the cross recess screw M6x30 with its support plate from the bottom of the frame housing.



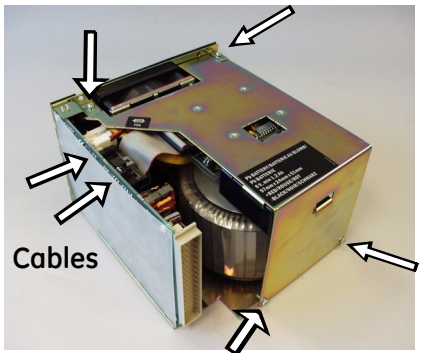
3. Remove the two uppermost screws from the back panel of the Power Supply Unit.



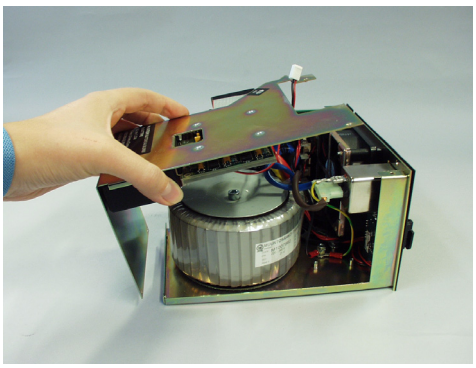
4. Pull the Power Supply Unit out of the frame housing.

   NOTE: Be careful not to damage the speaker located at the bottom of the unit.

To remove the metal top cover

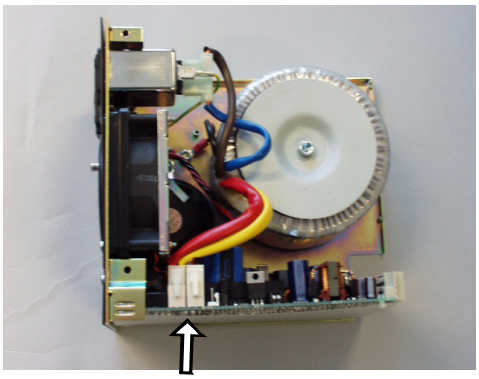


1. Remove the Power Supply Unit from the frame housing.
2. Remove the four screws from the top cover and disconnect the two cables from the Power Supply Board.

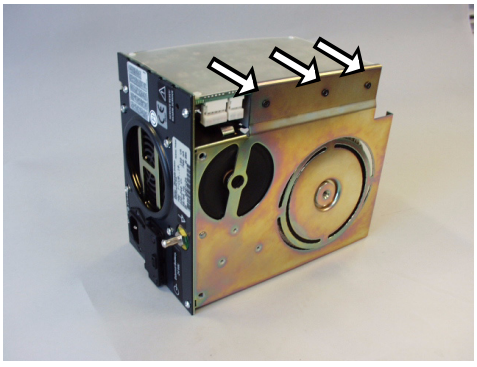


3. Lift the cover off.

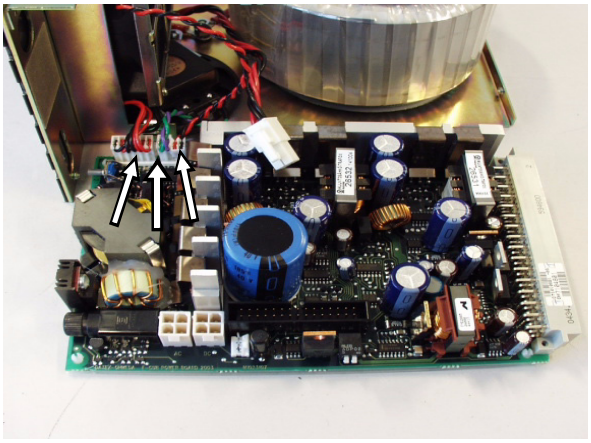
To remove the Power Supply Board



1. Remove the top cover of the Power Supply Unit.
2. Disconnect the two cables from the Power Supply Board.



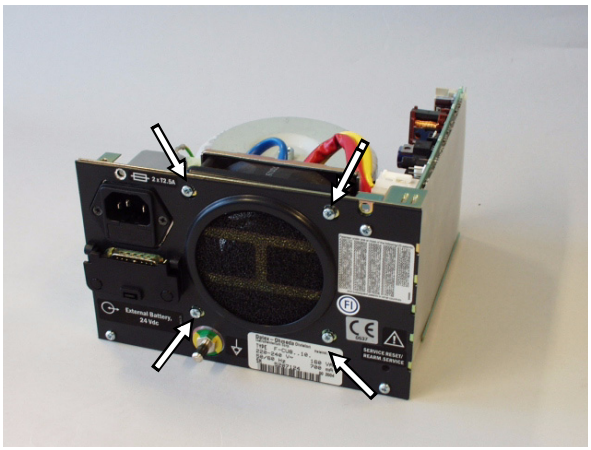
3. Remove the three screws from the bottom of the unit.



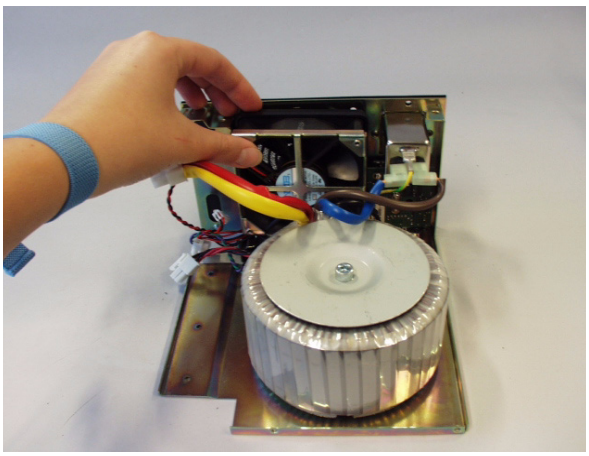
4. Disconnect the three cables from the board.

NOTE: Notice the positions of the cables while reassembling.

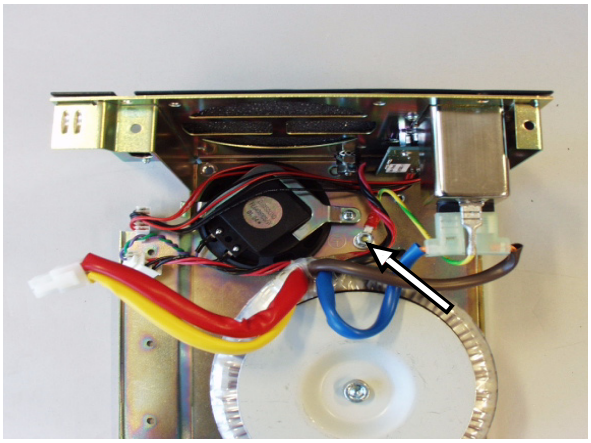
To remove the fan and the loudspeaker



1. Remove the Power Supply Board.
2. Remove the four screws from the rear plate of the Power Supply Unit.

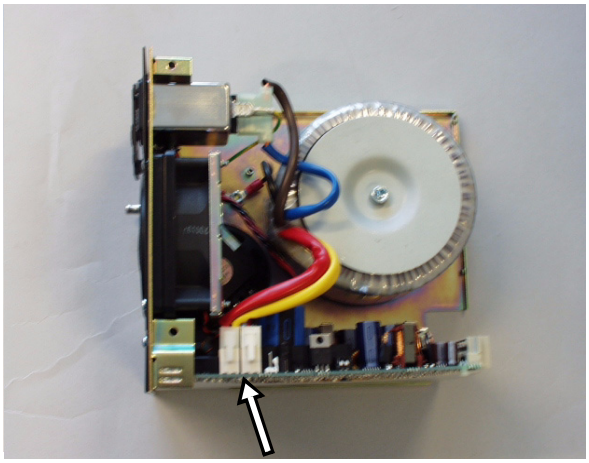


3. Remove the fan.

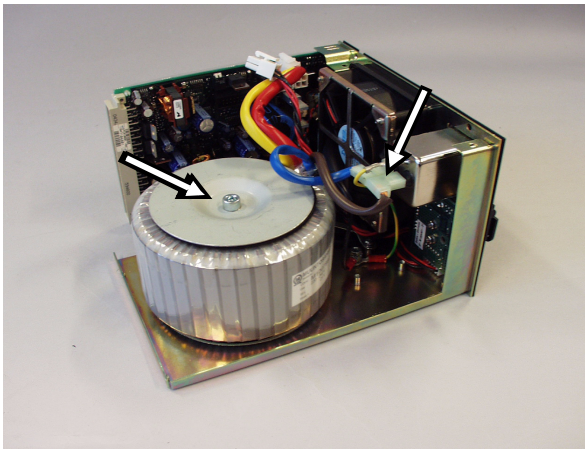


4. Remove the screw that holds the loudspeaker in place and lift the loudspeaker off.

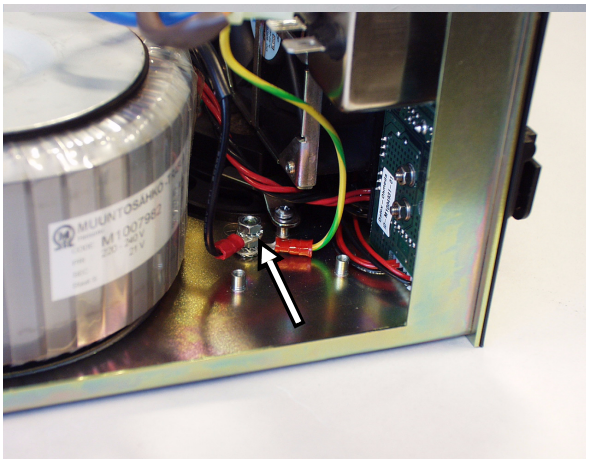
To remove the transformer



1. Remove the top cover of the Power Supply Unit.
2. Disconnect the two cables from the Power Supply Board.



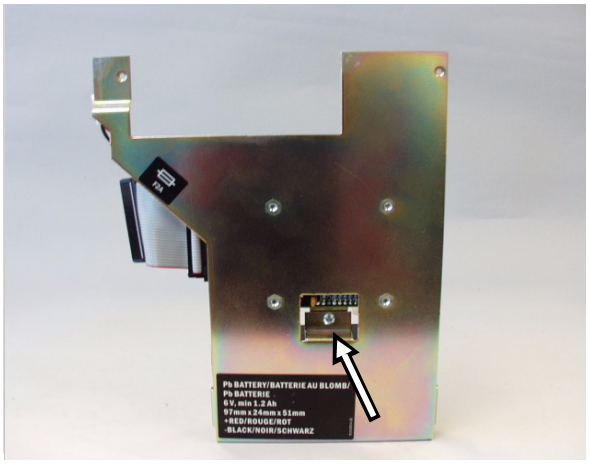
3. Remove the screw that goes through the transformer and disconnect the two cables from the power supply socket.



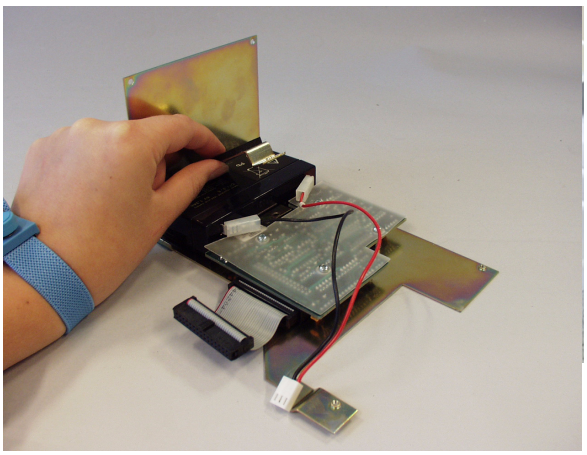
4. Disconnect the two cables by removing the nut with a 7mm wrench
5. Lift the transformer off the bottom plate. Note that the transformer is attached to the plate with adhesive.

To replace the lead acid battery for +5Vcpu

The sealed lead-acid battery in the Power supply unit can be used for 3-5 years. If the trends are not stored in the memory for 15 minutes after the power is turned off and the power cord is disconnected, the fault is probably in the battery or in the battery fuse.



1. Remove the top cover of the Power Supply Unit.
2. Remove the screw attached to the metal battery holder.



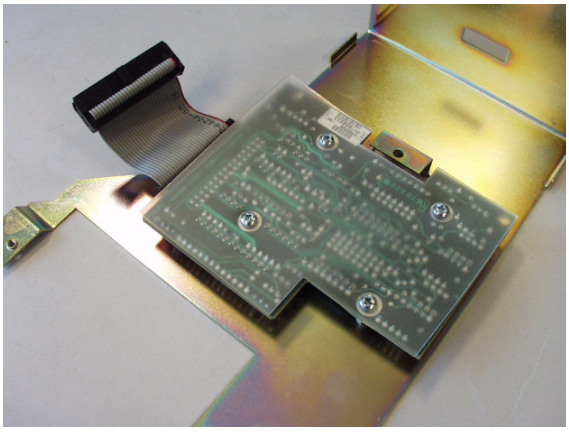
3. Remove the battery holder and lift the battery off the top cover.

When replacing the battery, make sure the + indicated battery cable is attached to the + pole of the battery.

Dispose of the old battery according to the local regulations.

NOTE: After the battery has been replaced, it must be charged for at least 24 hours before it reaches full capacity.

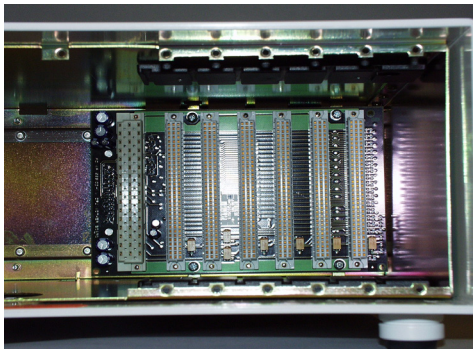
To remove the Power Logic Board



1. Remove the top cover of the Power Supply Unit.
2. Remove the lead acid battery.
3. Detach the board by removing the four screws.

3.3.4 To remove the CPU mother board and the module mother board

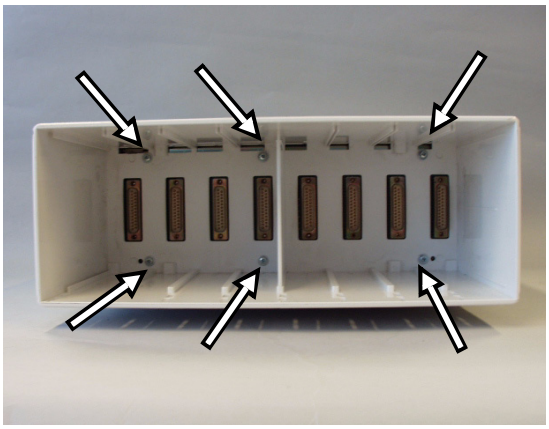
To remove the CPU mother board

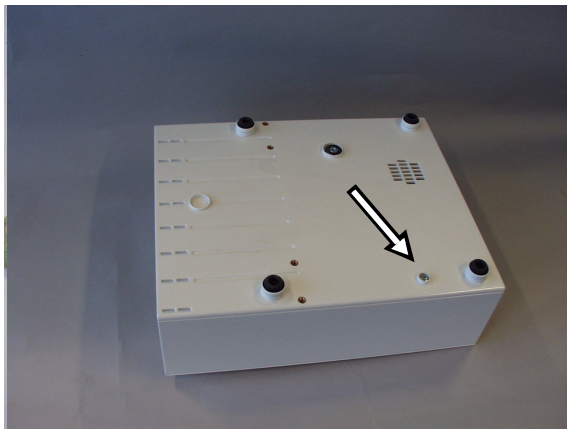


1. Remove the Power Supply Unit.
2. Remove the four screws holding the CPU mother board to the metal chassis.
3. Remove the CPU mother board by carefully disconnecting the board from the connector.

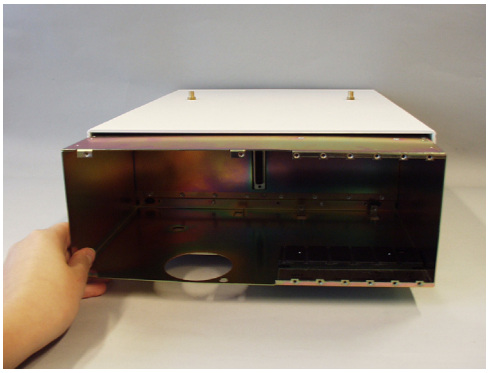
To remove the module mother board

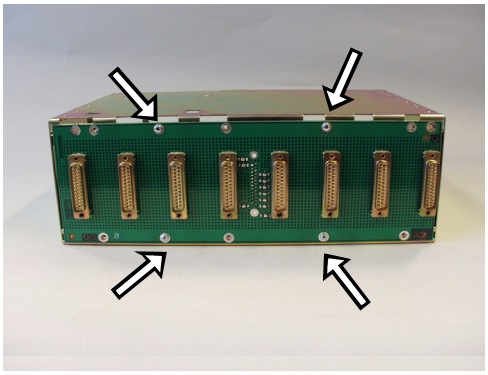
1. Remove the CPU mother board.
2. Remove the six screws from the front side of the module mother board and one screw from the bottom of the frame housing.





3. Pull the metal chassis out of the frame housing.





4. Detach the module mother board by removing the four screws.

Reassemble the device in reverse order.

NOTE: While reassembling, make sure the module connectors are located exactly in the middle of the openings of the frame housing.

3.3.5 Replacing the fuses

CAUTION Use only fuses with specified type and ratings.

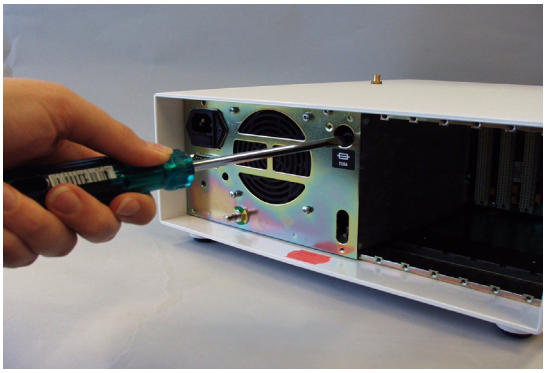
To replace the primary fuses

1. Use a flat blade screwdriver to pull out the fuse holder located beneath the power supply socket.
2. Replace the fuses.

When reconnecting the fuse holder, check that it locks up properly.

To replace the secondary fuse

1. Remove the rear panel of the power supply unit by removing the four screws.

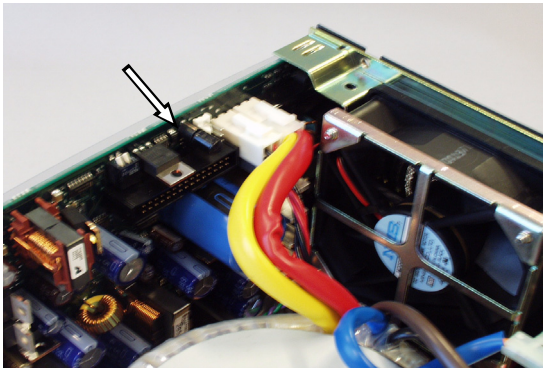


2. Remove the fuse holder by releasing the lock with a flat blade screwdriver.
3. Replace the fuse.

Reassemble in reverse order.

When reconnecting the fuse holder, check that it locks up properly.

To replace the +5Vcpu battery fuse



1. Remove the Power Supply Unit from the frame housing.
2. Replace the +5Vcpu battery located on the Power board.

Reassemble in reverse order.

3.4 Adjustments and calibrations

It is not necessary to do calibrations or adjustments to the F-CU8.

4 Troubleshooting

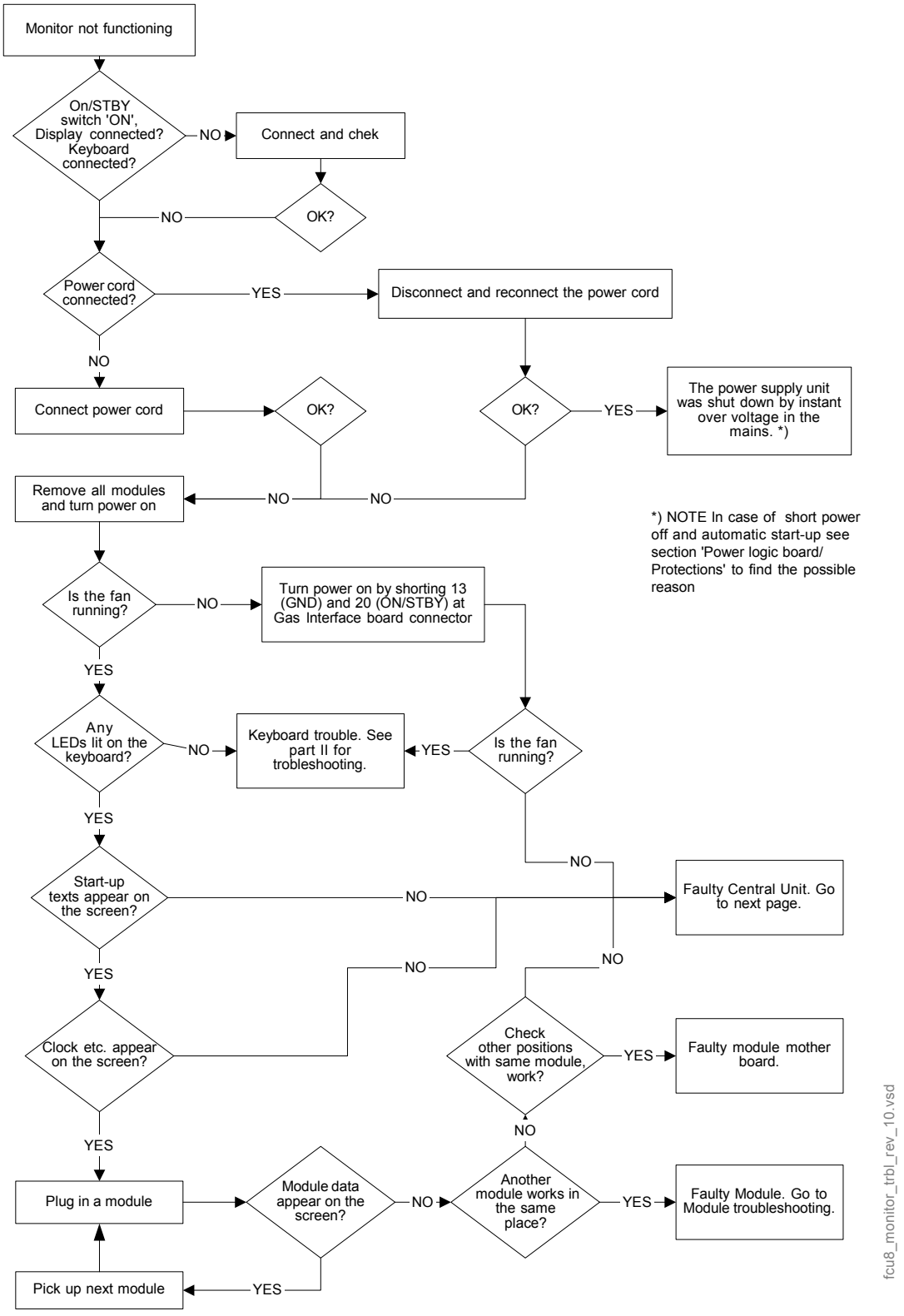


Figure 8 Monitor troubleshooting flowchart

4.1 Central Unit

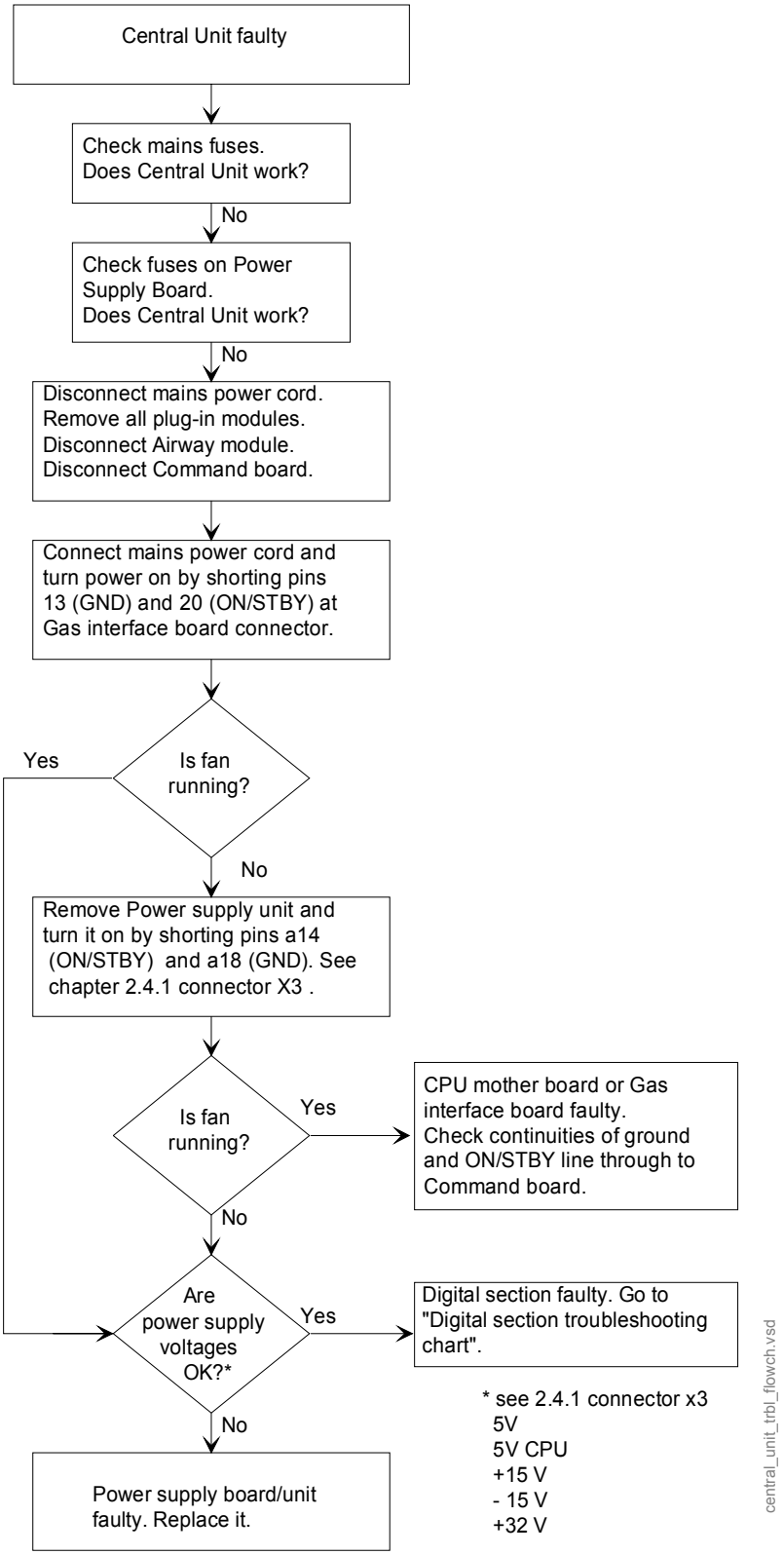


Figure 9 Central Unit troubleshooting flowchart

4.2 Digital section

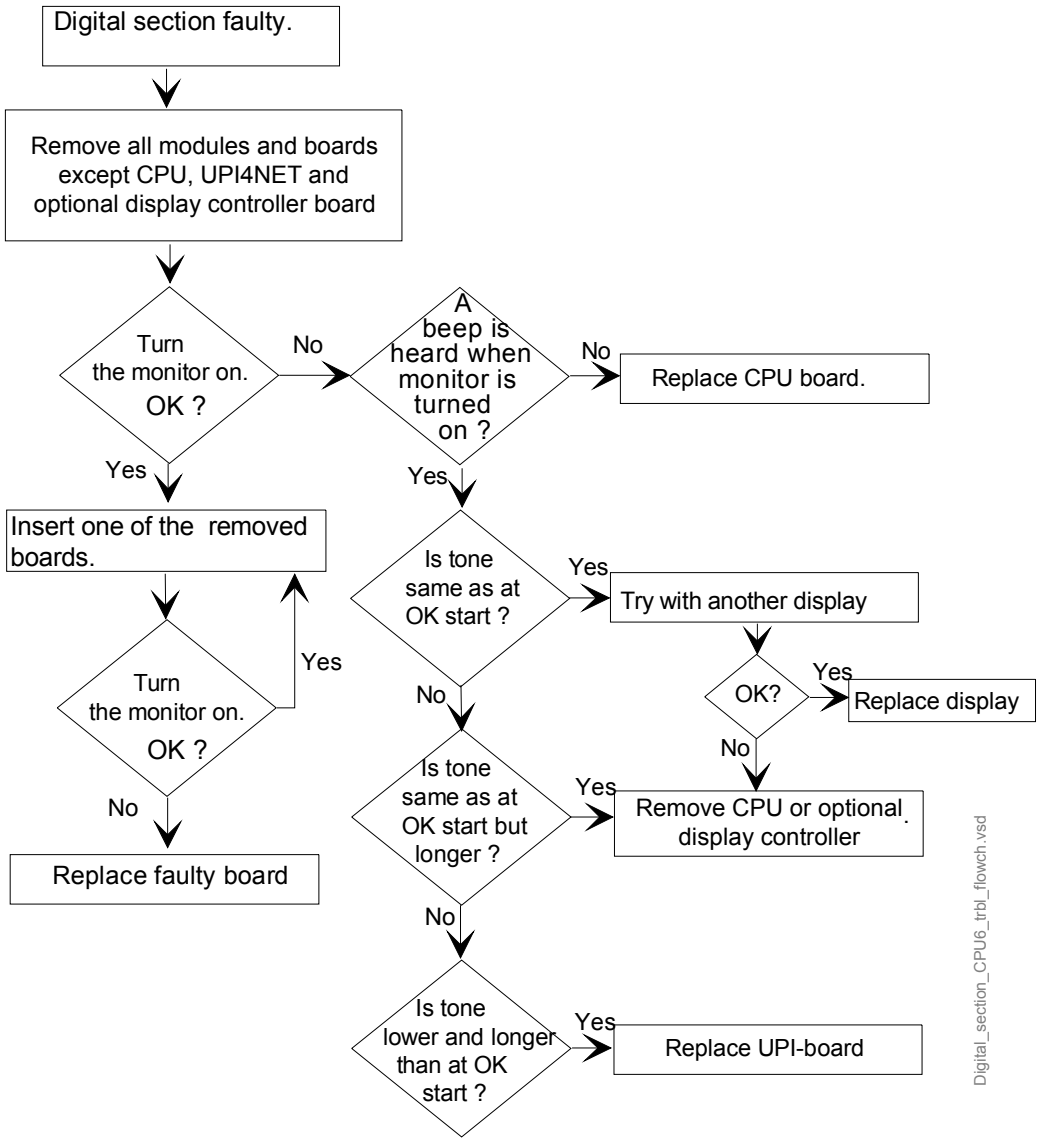


Figure 10 Digital section troubleshooting flowchart

5 Earlier revisions

This service manual supports only the current revision. Earlier revisions can be found as follows:

Item	Manual and document number
8-Module Frame, F-CU8 (rev. 01/rev. 02)	Service Manual, 880 850
CPU Board, B-CPU1 (rev. 01)	Service Manual, 882 580
Software Cartridge, S-STD/S-STD93	Service Manual, 882 580
Software Cartridge, S-STD94/S-ARK94	Service Manual, 885 930
Software Cartridge, S-STD95/S-ARK95	Service Manual, 885 930
Software Cartridge, S-STD96/S-ARK96	Service Manual, 885 931
Service Menu descriptions related to software of level 97/98	Technical Reference Manual Slot 895 704
Service Menu descriptions related to software of level 99... 02	Technical Reference Manual Slot 8001003
Service Menu descriptions related to software of level 03	Technical Reference Manual Slot 8004317
F-CU8 rev. 03 - 11	Technical Reference Manual Slot M1125635-01

APPENDIX A: Service check form, Datex-Ohmeda 8-Module Frame, F-CU8

Customer		
Service	Module type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Bronze taps	☐	☐	☐	2. Pads and screws	☐	☐	☐
3. Module motherboard connectors	☐	☐	☐	4. Module motherboard position	☐	☐	☐
5. Fan filter	☐	☐	☐	6. Primary fuses	☐	☐	☐
7. Power inlet connectors	☐	☐	☐	8. Service reset -switch	☐	☐	☐
9. Equipotential tap and rear panel screws	☐	☐	☐	10. PC board screws	☐	☐	☐
11. PC board connectors	☐	☐	☐	12. Block screws for cables	☐	☐	☐
13. Grounding plates	☐	☐	☐	14. Optional display controller board B-DISPX jumpers/DIP switches	☐	☐	☐
Notes							
15. Communication lines							
+Reset RS485 (pin 1))					>10 Ω		
-Data RS485 (pin 5))					>10 Ω		
+Data RS485 (pin 6)					>10 Ω		
-Reset RS485 (pin 8)					>10 Ω		

	OK	N.A.	Fail		OK	N.A.	Fail
16. Fan	☐	☐	☐	17. Starting	☐	☐	☐
18. Module communication	☐	☐	☐	19. Real time clock	☐	☐	☐
20. Loudspeaker sound	☐	☐	☐				
21. Monitor software	L-						
22. Content of service log	☐	☐	☐				
23. Voltages							
+15 V					14.20...15.60 V		
-15 V					-14.00...-15.50 V		
+15 VD					14.10...15.60 V		
+5 V					4.70...5.40 V		
	OK	N.A.	Fail		OK	N.A.	Fail
24. Watchdog circuitry	☐	☐	☐	25. Trend retaining	☐	☐	☐
26. Service reset button	☐	☐	☐	27. Recovering from power loss	☐	☐	☐
Notes							
28. Electrical safety check	☐	☐	☐	29. Functioning after electrical safety check	☐	☐	☐
30. Final cleaning	☐	☐	☐				

Notes	

Used spare parts			

Signature

Datex-Ohmeda

S/5™ 5-Module Frame, F-CU5, F-CU5P
Central Processing Unit, F-CPU-02
F-CU5 Power Unit, N-AC

Technical Reference Manual Slot

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

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

All specifications subject to change without notice.

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Table of contents

Table of contents i

Table of figures ii

List of tables iii

Introduction 1

1 Specifications 2
- 1.1 5-Module Frame, F-CU5 . . . 2
  - 1.1.1 Electrical requirements . . . 2
  - 1.1.2 Environmental requirements . . . 2

2 Functional description 3
- 2.1 F-CU5 Central Unit . . . 3
- 2.2 F-CU5 Power Unit, N-AC . . . 4
- 2.3 Central Processor Unit, F-CPU . . . 6
  - 2.3.1 DC Power board . . . 6
  - 2.3.2 External components . . . 8
  - 2.3.3 CPU mother board . . . 8
  - 2.3.4 Connectors . . . 8
- 2.4 5-Module Frame, F-CU5(P) . . . 9
  - 2.4.1 DC Power board . . . 9
- 2.5 External connectors and signals . . . 11
  - 2.5.1 5-Module Frame, F-CU5(P) . . . 11
  - 2.5.2 Power Unit, N-AC and Central Unit, F-CPU . . . 14

3 Service procedures 18
- 3.1 General service information . . . 18
- 3.2 Service check . . . 18
  - 3.2.1 Recommended tools . . . 18
  - 3.2.2 Recommended parts . . . 18
  - 3.2.3 Visual inspection . . . 19
  - 3.2.4 General inspection . . . 21
- 3.3 5-Module Frame disassembly and reassembly . . . 26
  - 3.3.1 Before disassembly . . . 26
  - 3.3.2 Tools needed . . . 26
  - 3.3.3 To disassemble the 5-Module Frame, F-CU5(P) . . . 26
  - 3.3.4 Central Processing Unit, F-CPU . . . 30
  - 3.3.5 Power Unit N-AC . . . 32

4 Troubleshooting 33
- 4.1 Digital section . . . 35

5 Earlier revisions 36

Appendix A: Service check form, Datex-Ohmeda 5-Module Frame, F-CU5 A-1

Table of figures

Figure 1 Parts of the 5-Module Frame, F-CU5 1
Figure 2 5-Module Frame F-CU5P w/ modules 3
Figure 3 Functional diagram of the 5-Module Frame F-CU5(P) 4
Figure 4 F-CU5 Power Unit, N-AC 4
Figure 5 The fan assembly of the Power Unit 5
Figure 6 Central Processor Unit, F-CPU 6
Figure 7 Block diagram of the DC Power unit of F-CPU 7
Figure 8 5-Module Frame F-CU5P, back and front view 9
Figure 9 Block diagram of the DC Power board of the F-CU5(P) 9
Figure 10 Modulebus Flex board 10
Figure 11 Interconnection Flex board 10
Figure 12 External connections, F-CU5(P) 11
Figure 13 External connections, N-AC and F-CPU 14
Figure 14 Monitor troubleshooting flowchart, page 1 33
Figure 15 Monitor troubleshooting, page 2 34
Figure 16 Digital section troubleshooting flowchart 35

List of tables

Table 1 Module connector for E-PSM, F-CU5P 11
Table 2 Synchronization connector, F-CU5(P) 11
Table 3 Module connector out (X1-X5), F-CU5(P) 12
Table 4 Connector for Central Processor Unit F-CPU in F-CU5(P) 13
Table 5 DC +32V output connector, N-AC 15
Table 6 Main power X3, N-AC 15
Table 7 DC +32V input connector, F-CPU 16
Table 8 Connectors to 5-Module Frame, F-CU5(P) (2 pcs) in F-CPU 17
Table 9 DIS connector, F-CPU 17

Introduction

This section provides information for the maintenance and service of the following products:

- 5-Module Frame, F-CU5(P)
  - 5-Module Frame
  - Central Processor Unit
  - F-CU5 Power Unit

Information for the maintenance and service of:

- CPU Board in “CPU Board, B-CPU6” slot
- UPINET Board in “UPINET Board, B-UPI4NET” slot
- Optional Display Controller Board B-DISPX in “Displays and Display Controllers” slot

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

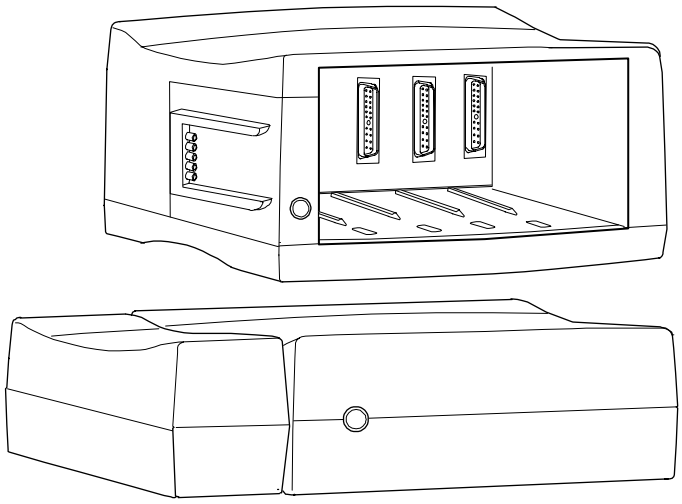


Figure 1 Parts of the 5-Module Frame, F-CU5

1 Specifications

1.1 5-Module Frame, F-CU5

The whole system

5-Module Frame, F-CU5	
Dimensions	D x W x H 233 x 244 x 142.5 mm (8.8 x 9.6 x 5.6 in)
Weight	2.5 kg (5.5 lbs)
5-Module Frame, F-CU5P	
Dimensions	D x W x H 233 x 253 x 142.5 mm (8.8 x 10.0 x 5.6 in)
Weight	2.5 kg (5.5 lbs)
Central Processing Unit, F-CPU	
Dimensions	D x W x H 224.5 x 244 x 92 mm (8.8 x 9.6 x 3.6 in)
Weight	3.1 kg (6.8 lbs)
F-CU5 Power Unit, N-AC	
Dimensions	D x W x H 238 x 66 x 78.5 mm (9.4 x 2.6 x 3.1 in)
Weight	1.1 kg (2.4 lbs)

1.1.1 Electrical requirements

Rated voltages and frequencies	100...240 V, 50/60 Hz
Allowed voltage fluctuations	100 V -10% to 240 V +10%
Maximum power consumption	150 VA
Safety class	Class I
Grounding	Hospital grade
Interruptibility	Data memory and alarm settings are saved during power failures up to 15 minutes

1.1.2 Environmental requirements

Operating temperature	10...35 °C / 50...95 °F
Storage temperature	-10...+50 °C / 14...122 °F
Relative humidity	10...90% non-condensing (in airway 0...100% condensing)
Atmospheric pressure	660...1060 mbar (500 to 800 mmHg)

2 Functional description

2.1 F-CU5 Central Unit

F-CU5 Central Unit provides places for up to five single-width modules or two double-width modules (plus one slot for one single-width module). It is also called 5-Module Frame.

F-CU5P with E-PSM(P) support provides places for up to five single-width modules or two double-width modules (plus one slot for one single-width module) and a connector plate for Patient Side Module E-PSM or E-PSMP. It is also called 5-Module Frame.

The F-CU5(P) Central Unit option includes three components:

- 5-Module Frame, F-CU5(P)
- Central Processor Unit, F-CPU
- Power Unit, N-AC

The units are connected together with appropriate cables:

- F-CPU Power Cable (0.4m/16 inch or 2.7m/9ft)
- F-CPU Signal Cable (0.3m/12inch, 3m/10ft or 10m/33ft)

NOTE: You can connect two F-CU5(P) 5-Module Frames to one F-CPU. If you do so, you cannot at the same time use a display that uses B-DISPX as power supply (for example 12" LCD display).

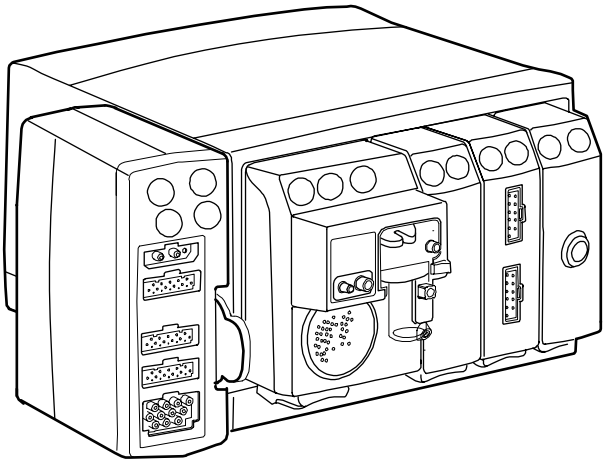


Figure 2 5-Module Frame F-CU5P w/ modules

To operate S/5 Anesthesia Monitor or S/5 Critical Care Monitor with 5-Module Frame, F-CU5(P), the following products should be installed:

- CPU board, B-CPU6 w/ L-ANE07(A) or L-ICU07(A)
- UPI4NET board, B-UPI4NET revision 01 or later
- Optional display controller board, B-DISPX

The CPU board, B-CPU6, the UPI4NET board, B-UPI4NET and the optional display controller board, B-DISPX are included and installed in the Central Unit, F-CPU at the factory.

NOTE: The B-INT cannot be used in the F-CPU.

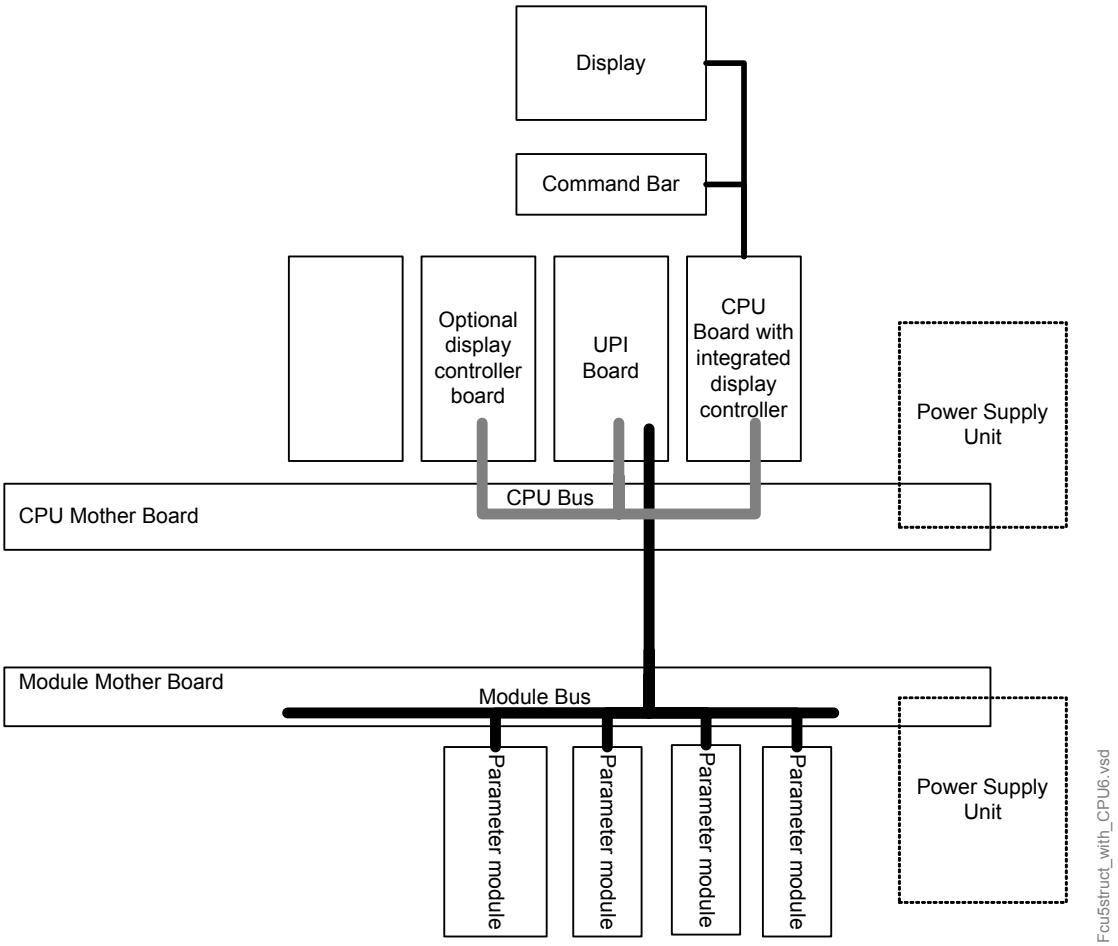


Figure 3 Functional diagram of the 5-Module Frame F-CU5(P)

The 5-Module Frame F-CU5(P) and the Central Processor Unit F-CPU include separate power supplies, which are fed by the F-CU5 Power Unit, N-AC.

2.2 F-CU5 Power Unit, N-AC

The F-CU5 Power Unit, N-AC is intended to be connected to standard mains supply to deliver DC power for the switched mode power supplies of the 5-Module Frame, F-CU5(P) and the Central Processor Unit, F-CPU. The operating voltage level is of 24...35V (rated voltage 32V).

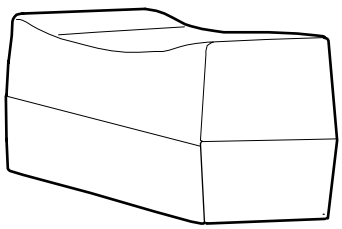


Figure 4 F-CU5 Power Unit, N-AC

DC Output

Rated output voltage of the power unit		32Vdc
min ... max range		24Vdc ... 35Vdc
ripple of the voltage		200mV (peak to peak)
Maximum output current from the power unit		6.25A
nominal value		3.125A
In short circuit condition the current is limited to 15A.		
Output power of the power unit	nominal	100W
	maximum	120W

The efficiency of the power unit is >0.8 with maximum output power.
There is over temperature protection in the power unit at 50°C, and the recovery occurs at 45°C.

F-CPU Power Cable

The F-CU5 Power Unit is connected to the Central Processor Unit, F-CPU with the F-CPU Power Cable (0.4m/16 inch or 2.7m/9ft).

Cooling fan

The F-CU5 Power Supply, N-AC, cannot be repaired in the field, except the cooling fan assembly of the power unit.

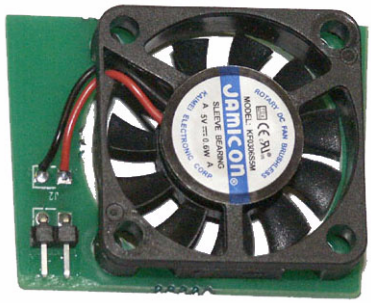


Figure 5 The fan assembly of the Power Unit

2.3 Central Processor Unit, F-CPU

The Central Processor unit contains a CPU mother board and its own DC power board. The basic configuration contains also an UPI4NET board, B-UPI4NET and a CPU board, B-CPU6 board. Additionally, there is a PC board slot for an optional display controller board, B-DISPX (max. 1 pcs). The CPU mother board connects the boards together. It also contains an internal battery for restoring the patient data for 15 min after shut down.

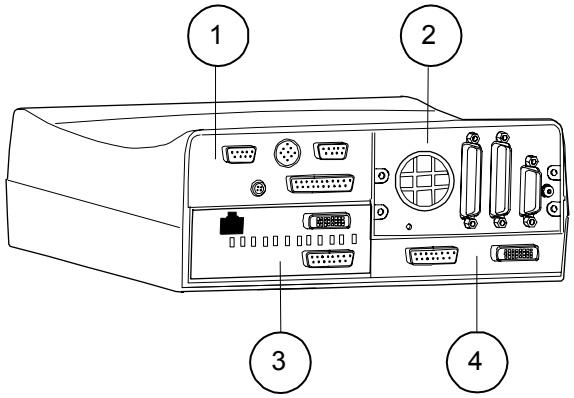


Figure 6 Central Processor Unit, F-CPU

2.3.1 DC Power board

The DC power board of the F-CPU converts the +32Vdc to voltages needed by the CPU, display controller and upinet boards and the battery. The created voltages are +15V, -15V, +5V and +5Vcpu. Also the +32Vdc is routed to the Central Processor electronics.

Output	**+18...32V**	**+15Vd**	**+5V**	**+5VCPU**	**-15V**
Tolerance	+18...32V	+/-0.5V	+/-0.1	+/-0.1V	+/-0.5V
Max. current	0.5A	1.1A	2.5A*	4A* standby load 0.6A	0.02A

* The maximum output current for +5V and +5Vcpu together is 4A.

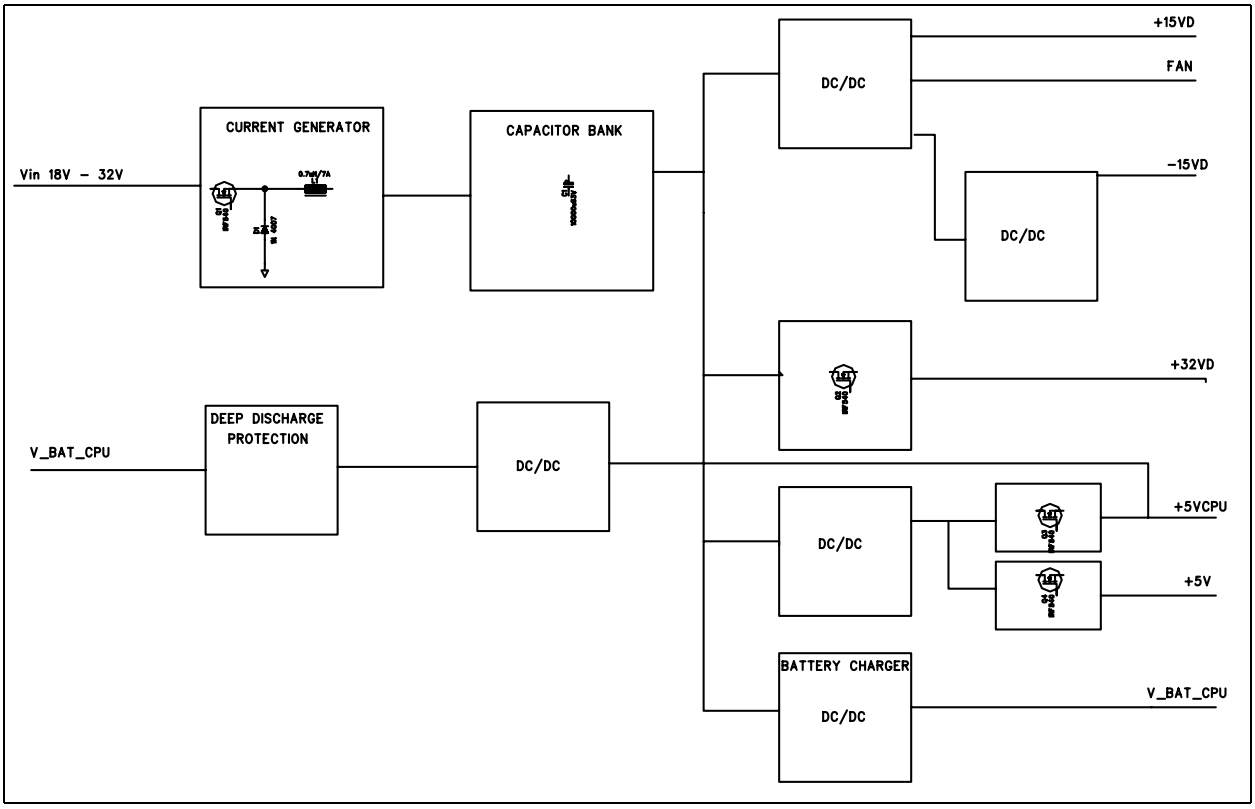


Figure 7 Block diagram of the DC Power unit of F-CPU

Power logic

The power related control logic is located in the power board.

Power ON/STBY control includes logic to switch the power supply on or off by turning the ON/STBY switch. The ON/STBY line is fed by +7V (max. current 70mA). When this line is grounded (for example by the ON/STBY switch), the DC Power supply switches on.

RESET_CPU signal is transmitted to the CPU interface in case the mains voltage fails or the power is cut off. RESET signal is also generated for other digital boards.

Audio amplifier

Audio signal from the CPU is amplified and filtered for the loudspeaker. Amplification gain is about 5 dB.

Protections

The following protections generate an automatic power off situation without any message in advance.

1. High voltage protection (+32 V, +15 V, +5 V, +5 Vcpu). Requires manual start-up. Power cord must be disconnected shortly prior to the start-up.
2. Low voltage protection (+32 V). Automatic power off when U < +25 V. Automatic start-up after voltage is back to normal.
3. High current protection (all secondary outputs). Output restrained until cause is eliminated.
4. High temperature protection. Automatic power off at +58 °C (approx.) and automatic start-up at +48 °C (approx.).

Over temperature protection

Over temperature possible caused by a fan failure, the fan filter is not clean or the power supply unit is overloaded. If the temperature inside the F-CPU frame exceeds +58°C, the unit is shut down. There is automatic recovery when the temperature decreases to +48°C. The temperature is measured at the DC Power board.

Audible alarm for power fail

There is an option for audible alarm at power fail. This function is enabled by a switch. When the +32V on the DC power board decreases lower than +5V, a 700Hz oscillator is switched on for 15 sec.

Service reset button

The service reset button at the back plate of the DC Power board is for service purpose. Press this button with an appropriate tool for at least five seconds before you remove any PC board or the Power supply unit from the rear of the Central Processing Unit.

NOTE: Before connecting the power cord back and starting to monitor, be sure that at least one minute has passed after the service reset button was pressed. Too short a time may lead to a memory flaw.

2.3.2 External components

Fan

The fan is switched on automatically when +32 Vd is generated.

Loudspeaker

The loudspeaker is controlled by the audio-amplifier on the DC Power board.

Battery

6 V, 1.2 Ah sealed lead-acid battery is used to supply power to the CPU board after the power is turned off and the power cord is disconnected.

The maximum discharge current of the battery is 1A. Charging voltage of the battery is between 5.5V and 6.8V, the max charge current is 0.1A.

The battery is protected with a 2A fuse.

2.3.3 CPU mother board

The CPU mother board connects the CPU board and other boards, functioning as a bus between them.

There are connectors for five PC boards. Four of those are normally occupied by B-UPI4NET and B-CPU6 (both doublewidth boards), optional B-DISPX (reserves one slot) and DC Power Board (reserves three slots).

The bus structure is the same as in all S/5 monitors.

ON/STBY line is connected to the B-CPU6 board's connector from where it goes directly to the Keyboard and ON/STBY switch.

2.3.4 Connectors

There are three connectors at the back of the DC Power board: one for connecting the N-AC power unit with F-CPU power cable and two for connecting the F-CU5(P) with F-CPU Signal cable.

The F-CPU Signal cable includes both power and signal (module bus) lines.

There is a DIS (Device Interfacing Solution) connector at the front of the F-CPU.

2.4 5-Module Frame, F-CU5(P)

The 5-Module Frame, F-CU5 or F-CU5P has five single width module slots for parameter modules. It includes a Module Mother board, and its own DC power board.

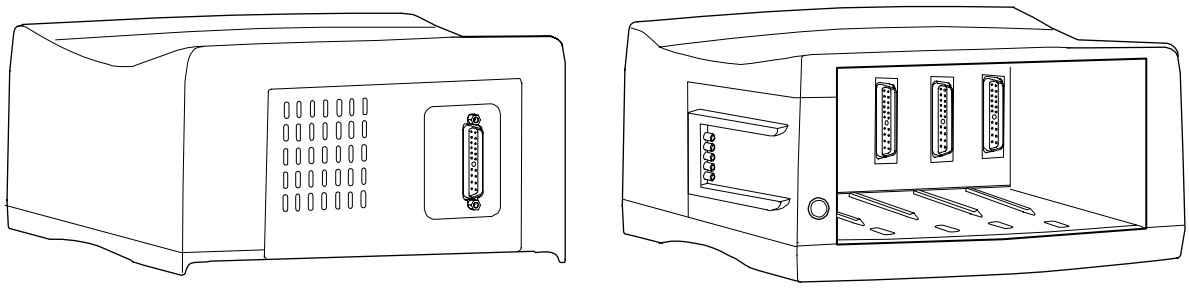


Figure 8 5-Module Frame F-CU5P, back and front view

2.4.1 DC Power board

The DC Power board is located at the back of the F-CU5(P) frame. The DC Power board converts the +32Vdc that is fed through the F-CPU DC Power board, to voltages needed by the frame electronics and the parameter modules. The created voltages are +15Vd, +15V, -15V and +5V. Also +32V is routed through.

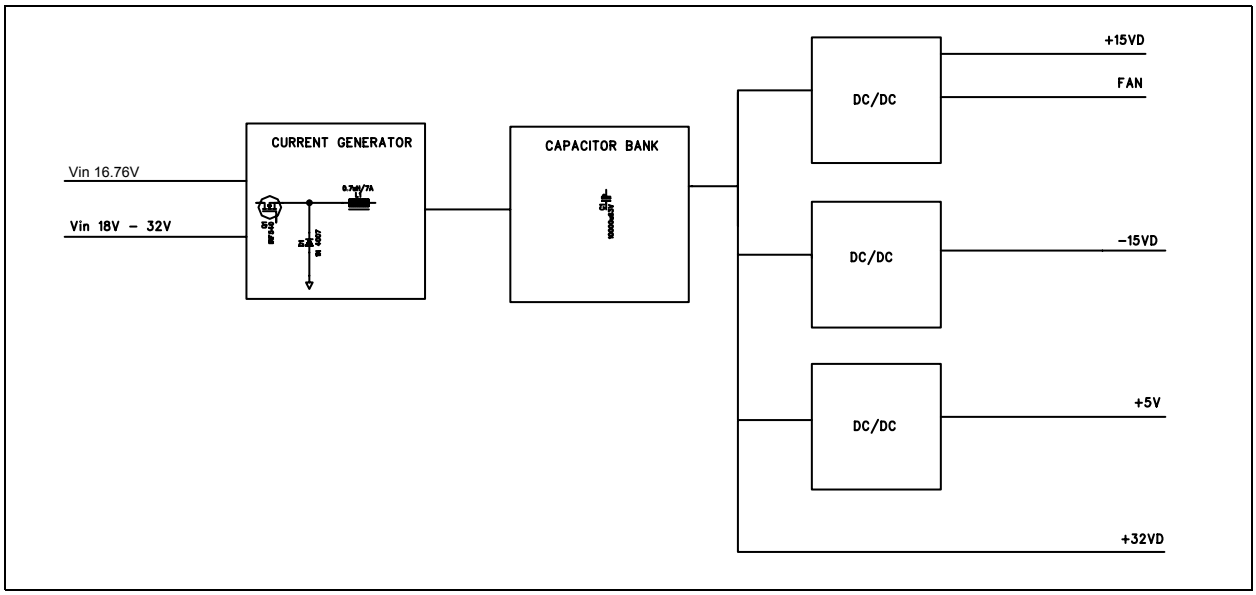


Figure 9 Block diagram of the DC Power board of the F-CU5(P)

Output	+18...32V	+15Vd	+15Va	+5V	-15V
Tolerance	+18...32V	+/-0.5V	+/-0.1	+/-0.1V	+/-0.5V
Max. current	0.5A	2.5A	0.1A	1.5A	0.1A

Flex boards

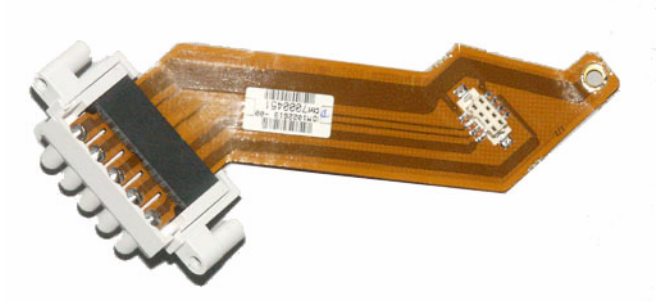


Figure 10 Modulebus Flex board

The connector for E-PSM(P) is located on the modulebus flexboard in F-CU5P.

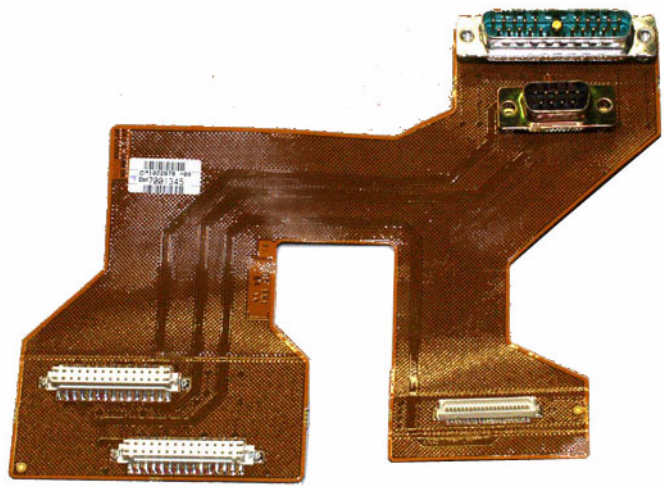


Figure 11 Interconnection Flex board

There are connectors on the interconnection board to connect the modulebus flexboard, the CPU board, the module mother board and the F-CPU (external connector).

2.5 External connectors and signals

2.5.1 5-Module Frame, F-CU5(P)

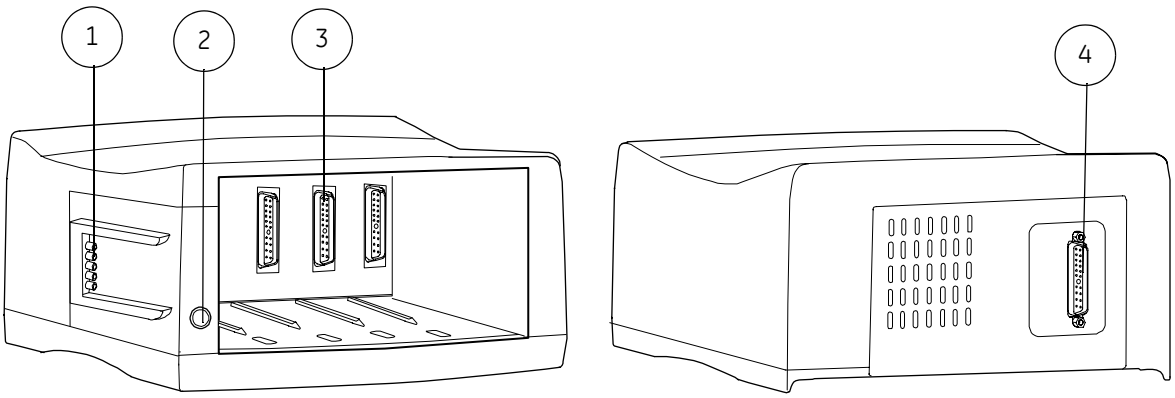


Figure 12 External connections, F-CU5(P)

(1) Connector for E-PSM module
(2) Synchronisation connector
(3) Module connector
(4) Connector for Central Processor Unit, F-CPU

Table 1 Module connector for E-PSM, F-CU5P

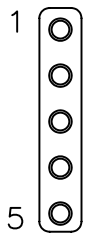
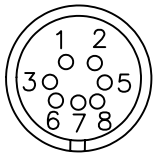
5 pin female connector	Pin	Signal
	1 2 3 4 5	GND Vmod 13.8 - 16 V Data + Data - Shield

Table 2 Synchronization connector, F-CU5(P)

Mini DIN7 connector	Pin	Signal
	1 2 3 5 6 7 8	Defib_sync_out Reserved Analog GND Digital GND GND Pressure_out Direct_ECG_out

Defibrillation Sync (pin1)

Digital defibrillator output synchronization signal. Defibrillation Sync indication is generated by ECG. When active, the signal is in state 1. After 10 ms the signal is reset to state 0. Defibrillation Sync is not generated before the indication is deactivated. The delay from the R wave peak to the start of the signal is maximally 35 ms.

Pressure out (pin 7):

– P1 from hemodynamic module

The Invasive pressure output signal is 1 V/100 mmHg, originally ranging from 0 to 320 mmHg, and with a delay of approximately 25 ms. The signal requires an input impedance of 100 k.

Direct ECG (pin 8):

Delay (max.):	15 ms
Gain ECG (out)/ECG (in):	1 V/1 mV
Pacer:	5 V and 2 ms pulse

Table 3 Module connector out (X1-X5), F-CU5(P)

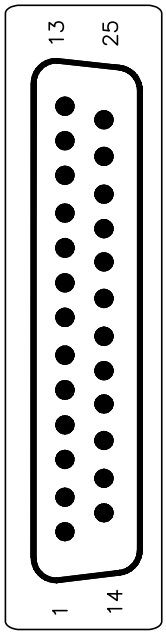
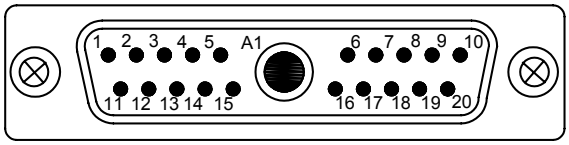
25 pin male D-connector	Pin	Signal
	1	Reset_485
	2	-15V
	3	15Vdirty
	4	+15V
	5	Data_485_
	6	Data_485
	7	GND
	8	Reset_485_
	9	CTSB
	10	RTSB
	11	RXDB
	12	TXDB
	13	GND
	14	NC
	15	GND
	16	CTSC
	17	RTSC
	18	RXDC
	19	TXDC
	20	NC
	21	PWM_ECG
	22	RXD_RS232
	23	TXD_RS232
	24	+5V
	25	+5V

Table 4 Connector for Central Processor Unit F-CPU in F-CU5(P)



Connector: 21W1xxx male	Pin	Signal
	A1	GND
	1	RESET_RS485 (Module reset +)
	2	-RESET_RS485 (Module reset -)
	3	DIR_ECG
	4	DEF_SYNC
	5	+32V (power output)
	6	ECG_PWM
	7	TXDC (TXD_to_MEM)
	8	RXDC (RXD_from_MEM)
	9	RTSC (RTS_to_MEM)
	10	CTSC (CTS_from_MEM)
	11	DATA_RS485 (Module data +)
	12	-DATA_RS485 (Module data -)
	13	IBP1
	14	+32Vd (power output)
	15	+32Vd (power output)
	16	ENABLE Enable power, GND, short pin
	17	TXDB (TXD_to_REC)
	18	RXDB (RXD_from_REC)
	19	RTSB (RTS_to_REC)
	20	CTSB (CTS_from_REC)
	Shield	Cable shield, GND

2.5.2 Power Unit, N-AC and Central Unit, F-CPU

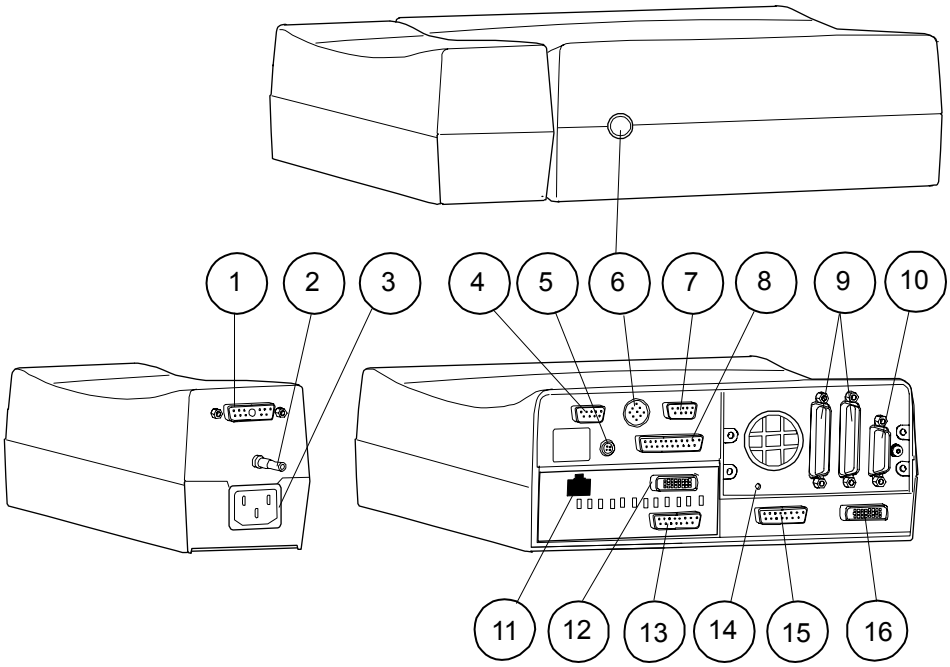


Figure 13 External connections, N-AC and F-CPU

(1) Connector for Central Processor Unit, F-CPU
(2) Equipotential connector
(3) Receptacle for power cord
(4) Identification plug (B-UPI4NET)
(5) Direct ECG output (B-UPI4NET)
(6) Connector for the S/5 Device Interfacing Solution, DIS (B-UPI4NET)
(7) RS-232 output (B-UPI4NET)
(8) Parallel printer port (B-UPI4NET)
(9) Connectors for two F-CU5(P) 5-Module Frames
(10) Connector for Power Unit, N-AC
(11) Network connector (B-CPU6)
(12) Display connector (B-CPU6)
(13) Connector for Command Bar, Remote Controller, anesthesia record keeping solution keyboard and 12" LCD display, D-LCC12
(14) Service reset button
(15) Connector for secondary Command Bar, Remote Controller, anesthesia record keeping solution keyboard and 12" LCD display, D-LCC12 (Optional Display Controller, B-DISPX)
(16) Display connector for secondary display (Optional Display Controller, B-DISPX)

NOTE: For a more detailed description of the connectors, please see the following slots in this manual: the "CPU Board, B-CPU6" slot, the "UPINET Board, B-UPI4NET" slot and the "Displays and Display Controllers" slot about optional Display Controller Board, B-DISPX.

F-CU5 Power Unit, N-AC

Table 5 DC +32V output connector, N-AC

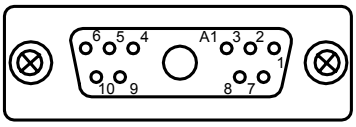
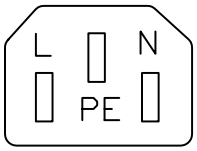
Connector: 11W1xxx female	Pin	Signal
	A1	GND
	1	GND
	2	ENABLE Enable power, GND, short pin in cable
	3	NC
	4	+32V
	5	+32V
	6	+32V
	7	+32V
	8	+32V
	9	NC
	10	GND
	Shield	Cable shield, GND, metal case

Table 6 Main power X3, N-AC

Mains connector	Pin	Signal
	L	Live
	PE	Protected earth
	N	Neutral

DC power cable

The connector types in the cable are 11W1xxx male and 11W1xxx female.
Pin numberings are the same as in +32V output connector in Table 5 and Table 7.

Central Processor Unit, F-CPU

Table 7 DC +32V input connector, F-CPU

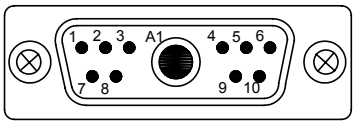
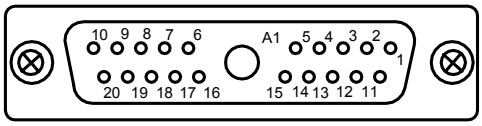
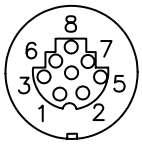
Connector: 11W1xxx	Pin	Signal
	A1	GND
	1	GND
	2	ENABLE Enable power, GND, short pin in cable
	3	STBY/ON
	4	+32V
	5	+32V
	6	+32V
	7	+32V
	8	+32V
	9	EXT_BAT_CHARGE
	10	GND
	Shield	Cable shield, GND, metal case

Table 8 Connectors to 5-Module Frame, F-CU5(P) (2 pcs) in F-CPU



Connector: 21W1xxx female	Pin	Signal
	A1	GND
	1	RESET_RS485 (Module reset +)
	2	-RESET_RS485 (Module reset -)
	3	DIR_ECG
	4	DEF_SYNC
	5	+32V (power output)
	6	ECG_PWM
	7	TXDC (TXD_to_MEM)
	8	RXDC (RXD_from_MEM)
	9	RTSC (RTS_to_MEM)
	10	CTSC (CTS_from_MEM)
	11	DATA_RS485 (Module data +)
	12	-DATA_RS485 (Module data -)
	13	IBP1
	14	+32Vd (power output)
	15	+32Vd (power output)
	16	ENABLE Enable power, GND, short pin
	17	TXDB (TXD_to_REC)
	18	RXDB (RXD_from_REC)
	19	RTSB (RTS_to_REC)
	20	CTSB (CTS_from_REC)
	Shield	Cable shield, GND

Table 9 DIS connector, F-CPU

10 pin female connector	Pin	Signal
	1	Data +
	2	Data -
	3	+15Vd
	4	GND
	5	+8V_DIS
	6	GND
	7	DATA to UP I+
	8	DATA to UP I-
	Shield	Shield in metal frame

3 Service procedures

3.1 General service information

The field service of the F-CU5 is limited to replacing the faulty printed circuit boards or mechanical parts. The printed circuit boards should be returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation, and a detailed description of the fault.

WARNING **Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.**

3.2 Service check

These instructions include complete procedures for a service check. The service check is mandatory after any service repair. However, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form (*APPENDIX A:*) which may be used when performing the procedures.

The symbol  in the instructions indicates that the check form contains space to record the results of the particular procedure.

3.2.1 Recommended tools

Tool	Order No.	Notes
Command Bar		
E-REC		
Hemodynamic Multiparameter Module		
Patient Simulator		
Multimeter		
Screwdriver		

3.2.2 Recommended parts

Part	Order No.	Notes
Fan filter for F-CPU	M1014462	
Fan filter for F-CU5(P)	M1016473	
Recorder paper		

3.2.3 Visual inspection

Make sure that no cables or modules are connected to the Power Unit, Central Processor Unit and 5-Module Frame.

5-Module Frame, F-CU5(P)

1. Frame

   Check that the plastic frame is intact.

2. Pads and screws

   Turn the frame onto one of its sides. Check that all the four rubber pads are in place and the screws on the bottom are tightened properly.

3. Module motherboard connectors

   Turn the frame back to its normal position.

   Check that the module motherboard connectors are clean and intact. Check also that the screws that connect the module mother board to the frame are tightened properly.

4. PSM connector

   With F-CU5P model: check that the PSM connector is clean and intact.

5. Module motherboard position

   Check that the E-REC fits in smoothly and locks up properly in all possible slots in the Central Unit. Leave the E-REC disconnected.

6. Fan filter

   Clean or replace the fan filter.

CAUTION Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.

Central Processor Unit, F-CPU

7. Plastic frame

   Check that the plastic frame is intact.

8. Brass plugs

   Check that the two brass plugs on the frame are tightened properly.

9. DIS connector

   Check that the DIS connector at the front side of the frame is clean and intact.

10. Rubber pads and screws on the bottom

    Turn the frame onto one of its sides. Check that all the six rubber pads are in place and the screws on the bottom are tightened properly.

11. Fan filter

    Clean or replace the fan filter.

12. Service reset button

    Check that the service reset button is intact. Press the button for at least five seconds.

PC boards

13. PC board screws

    Check that all the rear side PC boards are secured to the Central Processor Unit with screws.

14. PC board connectors

    Check that the connectors on the rear panels of the PC boards are clean and intact.

15. Block screws for cables

    Check that all block screws for cables are in place and tightened properly. Check also that their threads are intact.

16. Grounding plates

    Check that the grounding plates under the PC board rear panels are attached properly and are not bent.

17. Optional display controller board B-DISPX jumpers/DIP switches

    If available, disconnect the display controller board(s) and check that the address and interruption jumpers/ DIP switches have been set correctly. The instructions for setting the jumpers can be found in the"Part I, System Installation" slot of the Technical Reference Manual,

    Leave the board(s) disconnected.

F-CU5 Power Unit, N-AC

18. Power unit frame

    Check that the power unit frame is intact.

19. Power output connectors

    Check that the power output connector is clean and intact.

20. Power inlet connector

    Check that the power inlet connector is clean and intact.

21. Equipotential tap and rear panel screws

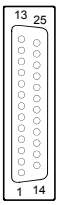
    Check that the equipotential tap and all the rear panel screws are tightened properly.

3.2.4 General inspection

22. Communication lines

    After any service repair for the Module mother board, measure resistance from the following Module mother board's connector pins against the ground:

    Module mother board connector

    Pin 1 +Reset RS485
    Pin 5 -Data RS485
    Pin 6 +Data RS485
    Pin 8 -Reset RS485
    Pin 13 Ground

    Check that the resistance on each of the pins is higher than 10 kΩ. If not, replace the Module mother board.

- Reconnect the PC boards and secure them to the Central Processor Unit with screws.
- Attach the F-CPU Power cable to the N-AC and F-CPU.
- Attach the F-CPU Signal cable to the F-CPU and F-CU5(P).

NOTE: Make sure that the cables are properly attached and secured.

- Install the display together with the Command Bar, the Hemodynamic module and E-REC. Connect the mains power cord and turn the monitor on.

23. Fan

    Check that the fan is running.

24. Starting

    Check that the monitor starts up properly, i.e. the alarm LEDs on the Command Bar turn blank, the start-up sound is heard from the loudspeaker and the normal monitoring screen appears. No error messages should appear on the screen.

25. Module communication

    Check that the connected modules are recognized, i.e. the needed parameter information is shown on the screen and the E-REC records two lines of start-up information.
    If some parameter information is missing, check the screen configuration from the MONITOR SETUP menu.

    NOTE: InvBP waveforms are not shown without a patient simulator.

26. Real time clock

    Check that the clock on the screen shows correct time. Adjust the time, if necessary.

    Monitor Setup - ***Time And Date***

    NOTE: If the clock shows time 0:00 continuously (at successive start-ups), the SRAM/TIMEKEEPER chip on the CPU board, or its battery, needs to be replaced.

    The FACTORY RESET should be performed after the replacement has been made.

27. Loudspeaker sound

    Check the loudspeaker by setting the alarm sound:

    Alarms Setup - ***Alarm Volume***

    Test the whole volume scale from 1 to 10 by turning the ComWheel and check that the alarm volume changes correspondingly. The alarm sound should be clear and audible with all the settings.

    Preset InvBP and ECG measurement settings:

    Invasive Pressures - ***P3 Setup - Label - Art***

    ECG - ECG1 LEAD -I

    Connect a patient simulator to the Hemodynamic multiparameter module.

The settings with a Dynatech Nevada medSim 300 Patient Simulator:

SENSITIVITY switch position: 5 µV/V/mmHg

BP - 1 - WAVE - ART

ECG - BASE - BPM - 160

PACE - WAVE - NSR

28. ECG out

    Connect an oscilloscope between the signal out connector pins 8 (ECG out) and 6 (Ground). Check that an analog signal which corresponds with the ECG waveform on the screen comes out. The output signal's ratio to the actual ECG signal should be around 1V/1mV.

29. Pressure out

    Connect the oscilloscope between the signal out connector pins 7 (Pressure out) and 6 (Ground). Check that an analog signal which corresponds with the InvBP waveform on the screen comes out. The output signal's ratio to the actual InvBP signal should be around 1V/100mmHg.

30. Monitor software

    Enter the service menu.

    Monitor Setup - ***Install/Service*** (password 16-4-34) **-** ***Service*** (password 26-23-8)

    Take down the information regarding monitor software.

31. Content of service log

    Select SERVICE LOG from the menu. Record the Service log onto the E-REC by selecting RECORD DATA. Check the content of recording for possible problems, then empty the Service log by selecting RESET LOG from the menu.

32. Voltages

    Check the power supply unit output voltages through the service menu:

    Monitor Setup - ***Install/Service*** (password 16-4-34) **-** ***Service*** (password 26-23-8) **-** ***Frame - Power Supply***

    The output voltages should meet the following ranges:

+15V	14.20....15.60 V
-15V	-14.00...-15.50 V
+15VD	14.10.....15.60 V
+5V	4.70.....5.40 V

    If any of the voltages is out of the tolerance, replace the F-CPU DC Power Board.

33. Watchdog circuitry

    Test the Central Unit watchdog circuitry:

    Monitor Setup - Install/Service (password 16-4-34) ***- Service*** (password 26-23-8) ***- Set/Test***

    Go through the **Watchdog**, **WD by Overload** and **WD by UPI** tests one by one and check that the monitor performs a restart in all other cases except when performing **WD by UPI**.

    NOTE: When selecting WD BY OVERLOAD, restarting should take place approximately after 15 seconds. With the other tests, restarting takes place within a couple of seconds.

    If restarting did not take place, try to locate the fault:

    Watchdog --> CPU board /Power supply unit

    WD by Overload --> CPU board

34. Trend retaining

    Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby.

    Turn the monitor to standby and disconnect the power cord. Wait for two minutes, then reconnect the power cord and turn the monitor back on. The monitor should perform a "Warm start" which means the trend information and temporary settings should still be available.

    If the monitor performed a "Cold start" instead, the battery needs to be replaced.

    The information regarding the start-up is saved also in the Service log.

35. Service reset button

    Check the service reset button. Turn the monitor to standby and press the service reset button for at least five seconds. Turn the monitor back on and check that the monitor performs a "Cold start".

36. Recovering from power loss

    Disconnect the power cord (during operation) for a moment, reconnect it and check that the monitor recovers without problems. The monitor should perform a "Warm start".

    NOTE: F-CU5(P) may give an audible alarm during the power loss. The alarm is set by the DIP switch on the F-CPU DC Power Board.

37. Electrical safety check

    Perform an electrical safety check and a leakage current test.

38. Functioning after electrical safety check

    Check that the Central Unit functions normally after the performed electrical safety check.

39. Final cleaning

    Clean the Central Unit with suitable detergent.

3.3 5-Module Frame disassembly and reassembly

3.3.1 Before disassembly

WARNING **Perform a leakage current measurement whenever service or repair has been done on the device.**

WARNING **Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.**

Disconnect the main power cord. If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable.

3.3.2 Tools needed

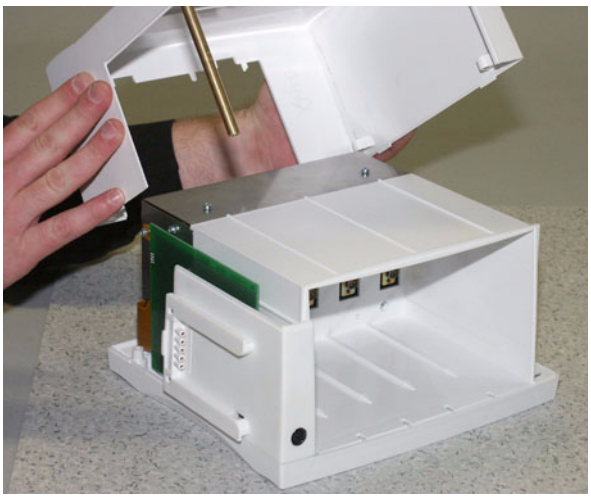
- screwdriver, TORX; T10, T20
- flat blade screwdriver
- antistatic wristband
- monkey wrench, size 5.5

3.3.3 To disassemble the 5-Module Frame, F-CU5(P)

1. Remove all the cables from the F-CU5(P).

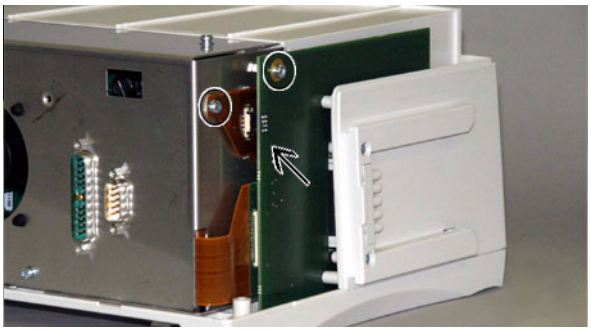
2. Remove the screw (T10) to open the back cover (including fan filter). Press the locking clamps to remove the back cover.

3. Remove the four screws (T20) at the bottom of the F-CU5(P) frame.



4. Remove the cover of the frame.

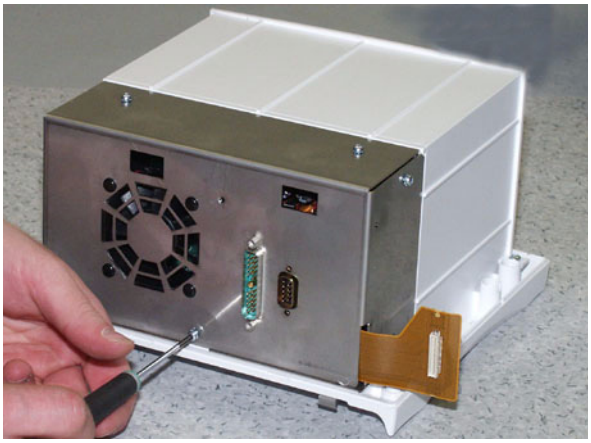
To remove the PSM Connection Unit



1. Remove the two screws (T10) to disconnect the PSM connector from the DFI board.

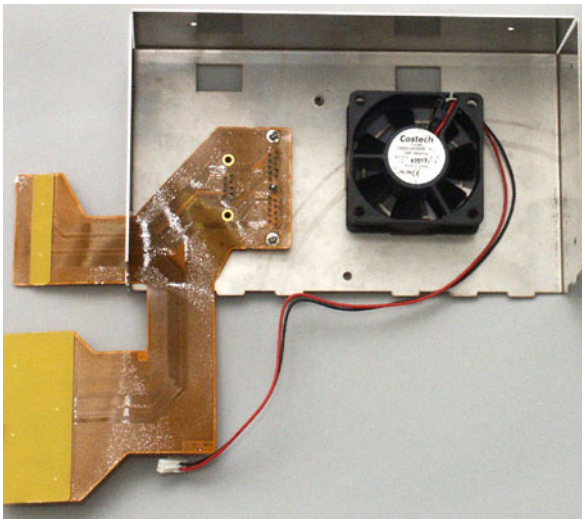
2. Remove the screw (T20) holding the PSM Connection Unit.
3. Remove the four screws (T10)and disconnect the Sync connector to detach the PSM Connection Unit from the DFI board.

To remove the F-CU5(P) frame EMC cover and fan unit



1. Remove the PSM Connection Unit.
2. Remove the six screws (T10) and the hexagon spacer (size 5.5) to remove the EMC cover.

3. Detach the connector connecting the power board and module mother board together.
4. Disconnect the fan cable from the power board.



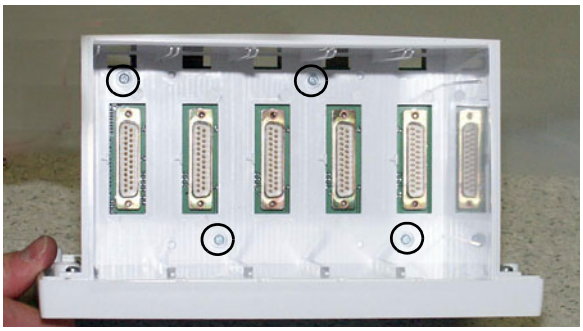
5. Now you can access the following field replaceable parts:

- Frame unit fan
- EMC cover
- Connection flex board

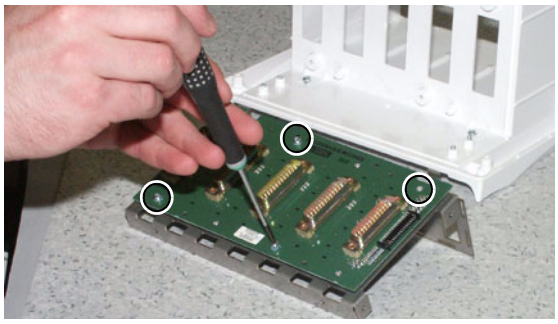
To remove the F-CU5(P) frame power board

1. Remove the F-CU5(P) frame fan unit.
2. Remove thefive screws (T10).

To remove the module mother board



1. Remove the EMC cover from the frame. It is not necessary to remove the F-CU5(P) frame power board.
2. Face the frame module side towards you.
3. Remove the four screws (T10) holding the board and its supporting plate.



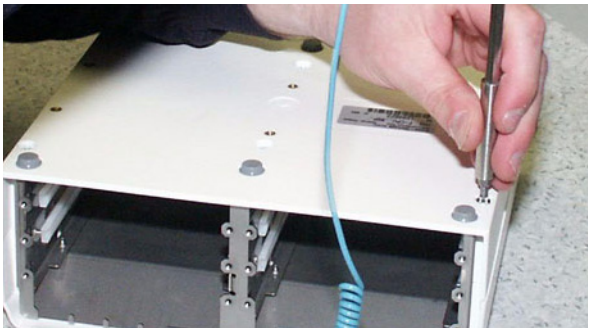
4. Remove the four screws (T10) to detach the mother board from the supporting plate.

3.3.4 Central Processing Unit, F-CPU

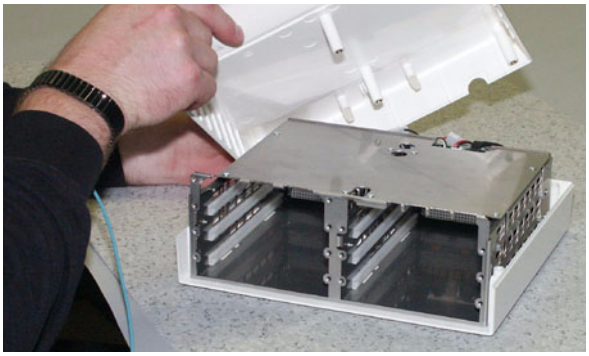
1. Press the service reset button with an appropriate tool for at least five seconds before removing any PC board or the Power supply unit from the rear of the Central Processing Unit, F-CPU.

2. Remove the following boards from the back of the F-CPU.

- B-UPI4NET. Pull it slightly out and disconnect the cable (red connector) from the board.
- B-DISPX, optional
- B-CPU6
- F-CPU power board
- Plates covering possible empty slots

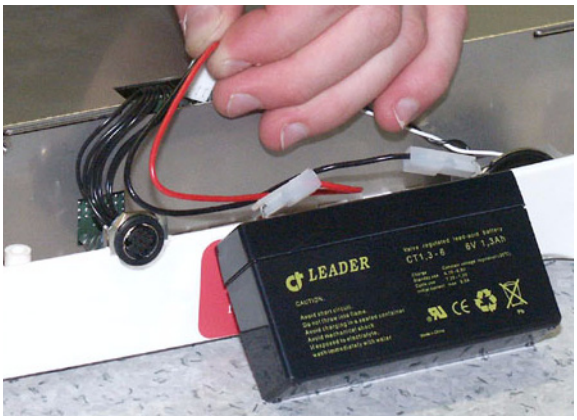


- Remove the six screws from the bottom of the F-CPU.



- You can now detach the F-CPU upper cover.

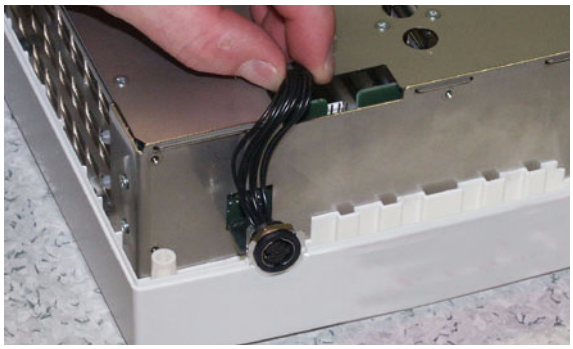
To remove the battery and the loudspeaker



1. Detach the battery cable.
2. Lift the battery from its place.
3. Detach the loudspeaker cable.
4. Remove the two screws (T10) to remove the loudspeaker cover.
5. Lift the loudspeaker from its place.

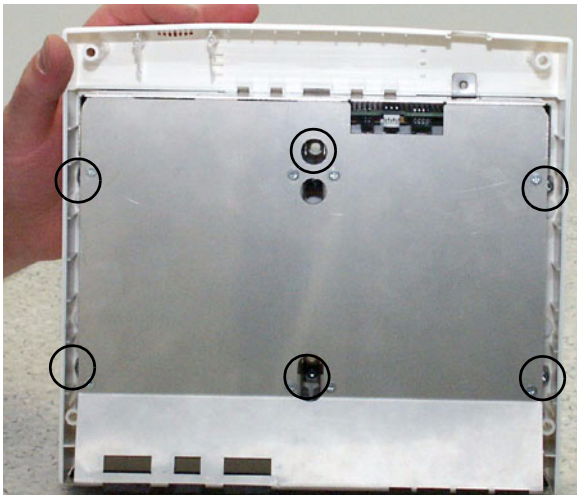
   NOTE: When reassembling the loudspeaker, place it carefully to the mounting slots.

To detach the DIS Connector Unit



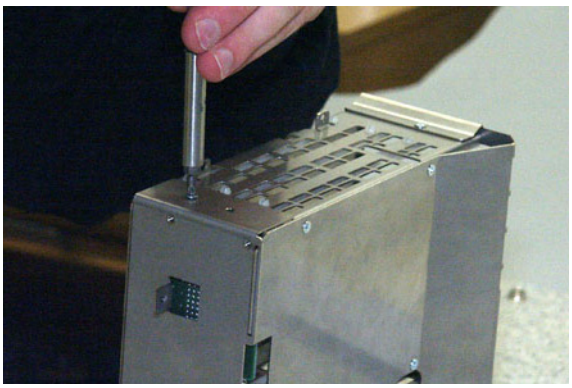
1. Remove the screw (T10) holding the DIS Unit.
2. Detach the DIS Unit cable from the CPU mother board.
3. Lift the DIS unit to remove it.

To remove the F-CPU bottom cover



1. Remove the battery and the loudspeaker cables.
2. Detach the DIS Connector Unit.
3. Remove the six screws (T10) and lift the EMC cover (with CPU mother board) from the bottom cover.

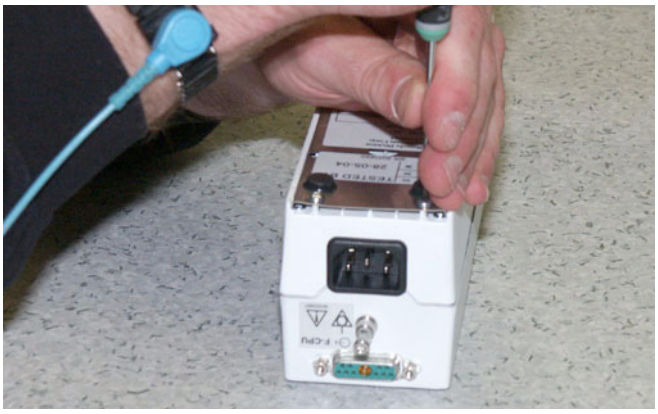
To remove the CPU mother board



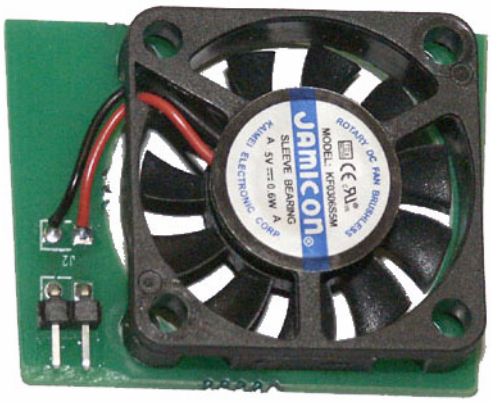
1. Remove the F-CPU bottom cover.
2. Detach the four screws holding the back plate to the EMC cover.
3. Remove the four screws to detach the CPU mother board from the back plate.

3.3.5 Power Unit N-AC

To reassemble and replace the fan unit



1. Turn the Power Unit upside down.
2. Remove the four TORX screws (T10) to remove the bottom plate.



3. Detach the fan unit.

Reassemble the device in reverse order.

When reinstalling make sure the cables connecting the units together are properly connected and secured.

4 Troubleshooting

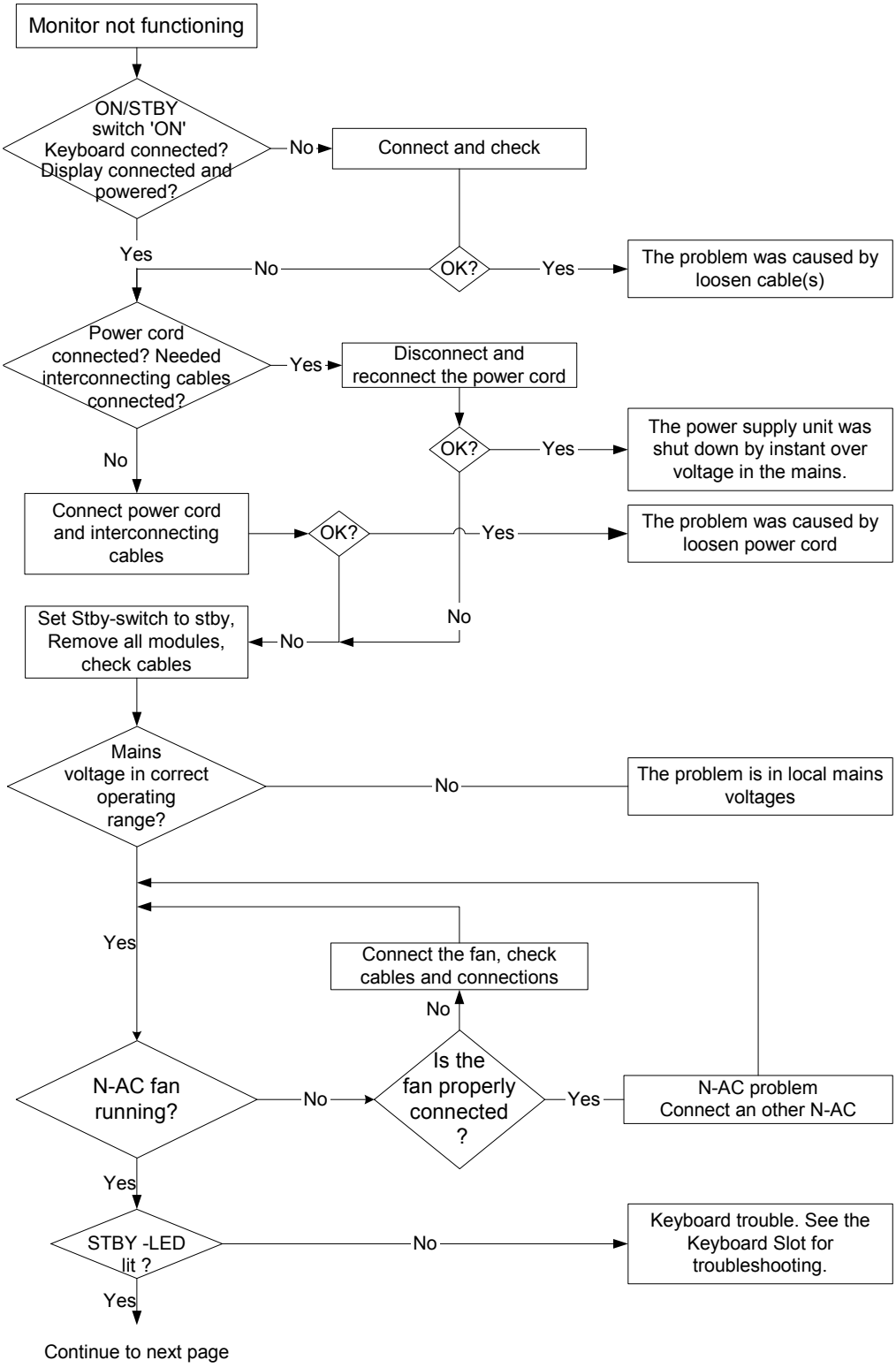


Figure 14 Monitor troubleshooting flowchart, page 1

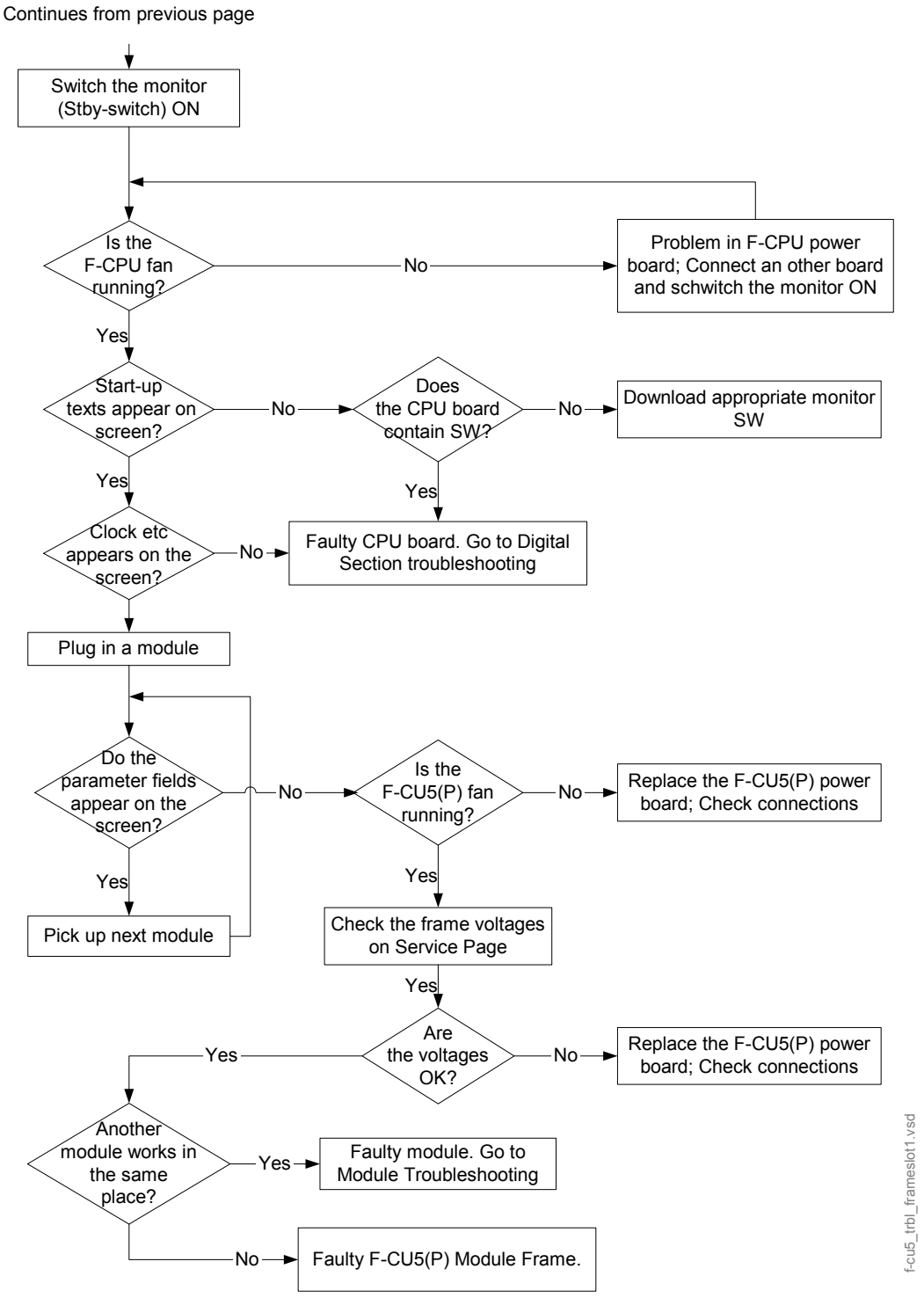


Figure 15 Monitor troubleshooting, page 2

4.1 Digital section

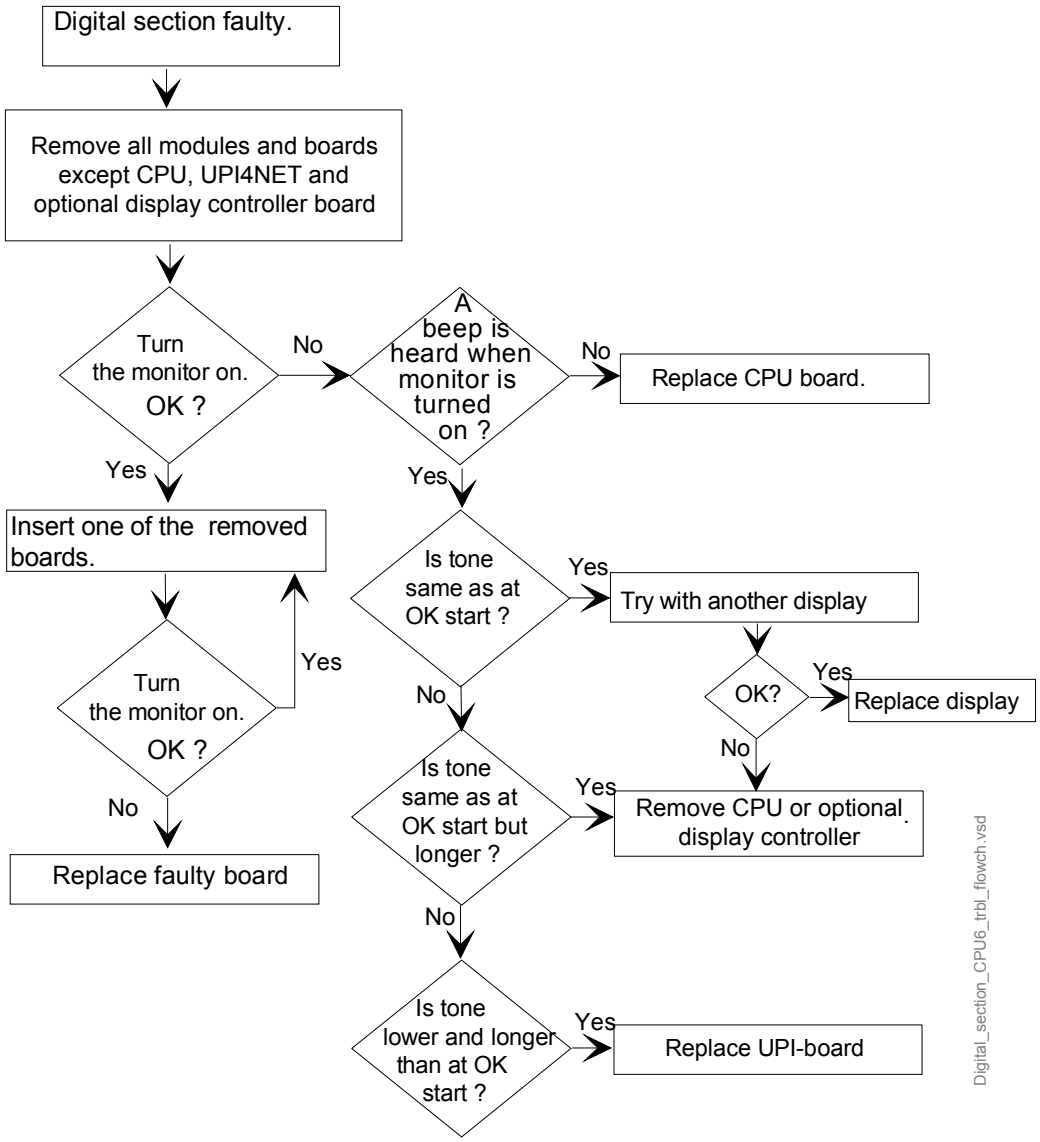


Figure 16 Digital section troubleshooting flowchart

5 Earlier revisions

This manual supports only the current revisions, F-CPU-02 and F-CU5(P)-01.
Information about earlier revisions can be found in M1021563.
There are no earlier revisions of N-AC.

APPENDIX A: Service check form, Datex-Ohmeda 5-Module Frame, F-CU5

Customer		
Service	Module type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

. 5-Module Frame, F-CU5(P)	**OK**	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
1. Frame	☐	☐	☐	2. Pads and screws	☐	☐	☐
3. Module motherboard connectors	☐	☐	☐	4. PSM connector	☐	☐	☐
5. Module motherboard position	☐	☐	☐	6. Fan filter	☐	☐	☐
. Central Processor Unit, F-CPU							
7. Plastic frame	☐	☐	☐	8. Brass plugs	☐	☐	☐
9. DIS connector	☐	☐	☐	10. Rubber pads and screws on the bottom	☐	☐	☐
11. Fan filter	☐	☐	☐	12. Service reset button	☐	☐	☐
Notes							
PC boards							
13. PC board screws	☐	☐	☐	14. PC board connectors	☐	☐	☐
15. Block screws for cables	☐	☐	☐	16. Grounding plates	☐	☐	☐
17. Optional display controller board B-DISPX jumpers/DIP switches	☐	☐	☐				
. F-CU5 Power Unit, N-AC							
18. Power unit frame	☐	☐	☐	19. Power output connectors	☐	☐	☐
20. Power inlet connector	☐	☐	☐	21. Equipotential tap and rear panel screws	☐	☐	☐
Notes							

General							
22. Communication lines							
+Reset RS485 (pin 1))					>10 kΩ		
-Data RS485 (pin 5))					>10 kΩ		
+Data RS485 (pin 6)					>10 kΩ		
-Reset RS485 (pin 8)					>10 kΩ		
	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
23. Fan	☐	☐	☐	24. Starting	☐	☐	☐
25. Module communication	☐	☐	☐	26. Real time clock	☐	☐	☐
27. Loudspeaker sound	☐	☐	☐	28. ECG out	☐	☐	☐
29. Pressure out	☐	☐	☐	30. Monitor software	L-		
31. Content of service log	☐	☐	☐				
32. Voltages							
+15 V					14.20...15.60 V		
-15 V					-14.00...-15.50 V		
+15 VD)					14.10...15.60 V		
+5 V					4.70...5.40 V		
33. Watchdog circuitry	☐	☐	☐	34. Trend retaining	☐	☐	☐
35. Service reset button	☐	☐	☐	36. Recovering from power loss	☐	☐	☐
37. Electrical safety check	☐	☐	☐	38. Functioning after electrical safety check	☐	☐	☐
39. Final cleaning	☐	☐	☐				
Notes							

Used spare parts			

Signature

Datex-Ohmeda

CPU Board and Software Licenses

S/5™ CPU Board, B-CPU6

Technical Reference Manual Slot

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

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

All specifications subject to change without notice.

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Table of contents

Table of contents i

Table of figures ii

Introduction 1

1 Specifications 2
- 1.1 Integrated Ethernet Controller . . . 2
- 1.2 Integrated Display Controller . . . 2

2 Functional description 4
- 2.1 CPU board, B-CPU6 . . . 4
  - 2.1.1 Powerfail or standby . . . 5
  - 2.1.2 Watchdog functions . . . 5
  - 2.1.3 SRAM M48T37V . . . 5
  - 2.1.4 Integrated Ethernet Controller . . . 5
  - 2.1.5 Integrated Display Controller . . . 5
- 2.2 Ethernet interface . . . 6
- 2.3 Software License . . . 6
- 2.4 Connectors and signals . . . 7
  - 2.4.1 DVI-I connector . . . 7
  - 2.4.2 Keyboard connector . . . 8
  - 2.4.3 Ethernet Network Interface . . . 9

3 Service procedures 10
- 3.1 General service information . . . 10
- 3.2 Service check . . . 10
  - 3.2.1 Recommended tools . . . 10
  - 3.2.2 Functional inspection . . . 11
- 3.3 Disassembly and reassembly . . . 15
  - 3.3.1 Downloading/replacing software on CPU Board, B-CPU6 . . . 15
  - 3.3.2 Performing Factory Reset . . . 15
- 3.4 Adjustments and calibrations . . . 15

4 Troubleshooting 16
- 4.1 Troubleshooting for the Ethernet section . . . 16
- 4.2 Troubleshooting flowcharts . . . 18
- 4.3 Error messages . . . 20
  - 4.3.1 SRAM Error . . . 20
  - 4.3.2 RAM Error . . . 20

5 Earlier revisions 21

Appendix A: Service check form, CPU Board A-1

Table of figures

Figure 1 B-CPU6 1
Figure 2 CPU board block diagram, B-CPU6 4
Figure 3 Monitor troubleshooting flowchart 18
Figure 4 Digital section troubleshooting flowchart 19

Introduction

This section provides information for the maintenance and service of the following products:

- B-CPU6
- Software licenses L-ANE07(A), L-ICU07(A)

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

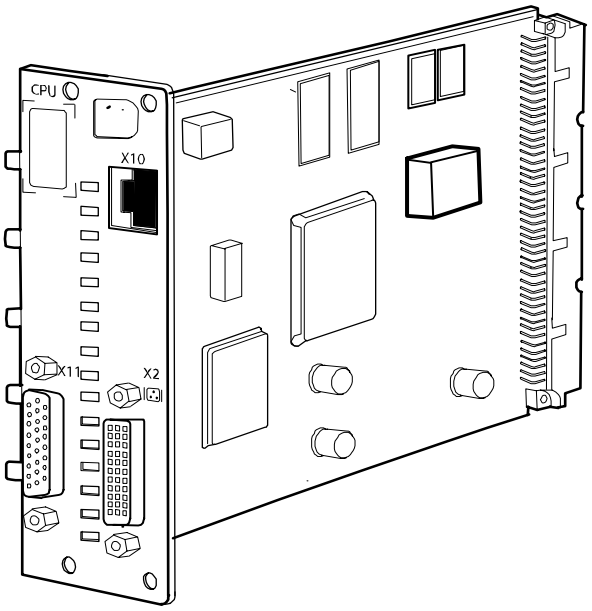


Figure 1 B-CPU6

1 Specifications

Electrical requirements

Interruptibility	Data memory and alarm settings are saved during power failures up to 15 minutes

Environmental requirements

Operating temperature	10...35 °C / 50...95 °F
Storage temperature	-10...+50 °C / 14...122 °F
Atmospheric pressure	660...1060 hPa (660...1060 mbar)
Humidity	10...90% non-condensing

1.1 Integrated Ethernet Controller

Meets IEEE802.3 specifications (10BASE-T)
Hospital grade approved data transformer
Coding element interface

1.2 Integrated Display Controller

Output data

VGA resolution

Resolution	640 × 480 pixels
Frame frequency	60 Hz
Scan frequency	31.6 kHz
Dot frequency	25 MHz
Sync polarity	H/negative, V/negative, level TTL

Sync pulse:

	Horizontal	Vertical
Front porch	0.624 µs	0.38 ms
Sync pulse	3.52 µs	0.062 ms
Back porch	1.968 µs	1.016 ms
Sweep time	31.61 µs	16.63 ms

SVGA resolution

Resolution	800 × 600 pixels
Frame frequency	60 Hz
Scan frequency	37.9 kHz
Dot frequency	40 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	Vertical
Front porch	1 µs	0.027 ms
Sync pulse	3.2 µs	0.105 ms
Back porch	2.2 µs	0.612 ms
Sweep time	26.39 µs	16.67 ms

XGA resolution

Resolution	1024 × 768 pixels
Frame frequency	75 Hz
Scan frequency	60.2 kHz
Dot frequency	78.75 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.205 µs	0.017 ms
Sync pulse	1.216 µs	0.05 ms
Back porch	2.24 µs	0.469 ms
Sweep time	16.61 µs	13.33 ms

SXGA resolution

Resolution	1280 × 1024 pixels
Frame frequency	60.13 Hz
Scan frequency	64.1 kHz
Dot frequency	108.4 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.45 µs	0.0158 ms
Sync pulse	1.032 µs	0.0466 ms
Back porch	2.28 µs	0.626 ms
Sweep time	15.6 µs	16.63 ms

2 Functional description

2.1 CPU board, B-CPU6

The CPU board takes care of the central processing.

The main features of the CPU board are:

- AMD SC520 Processor
- Internal clock frequency 133 MHz
- Integrated display controller
- Integrated Ethernet Controller

Memory capacity	B-CPU6
• SDRAM	32 MB
• program flash memory	32 MB

- 32 kB static RAM with real time clock
- 4 channel UART

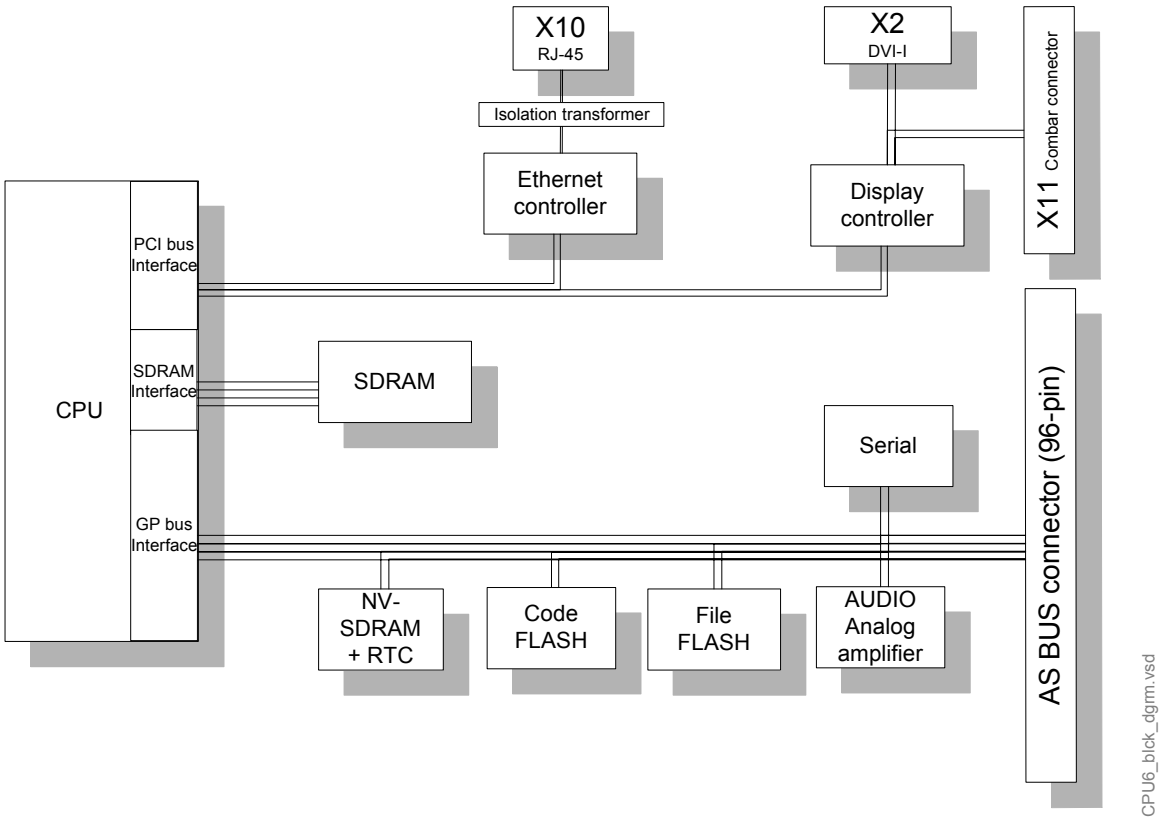


Figure 2 CPU board block diagram, B-CPU6

The CPU board, B-CPU6 is made with PC-technology components. Radisys chipset and PLD handle all timings and signaling for ISA type CPU bus.

The B-CPU6 contains an onboard flash memory where software can be downloaded from a service pc via Software Download Tool.

2.1.1 Powerfail or standby

When the monitor is turned to standby or the mains voltage fails, NMI-interrupt is generated by the power control logic. The interrupt signal in the CPU means that all supply voltages except +5V for the CPU board will be switched off shortly. NMI interrupt service program then saves all necessary parameters in the static RAM before supply voltages fail.

When hardware detects HALT command generated from power down; all the outputs to the CPU motherboard are left floating in high impedance state. Only SDRAM refreshing cycle continues to occur. The halt state will continue until a RESET pulse from the power control logic circuit is received.

2.1.2 Watchdog functions

There are certain watchdog functions to ensure the monitor's performance. The UPI4NET board and the optional display controller board interrupt the CPU board continuously in order to state that they function properly. The CPU board refreshes the watchdog timer in the power supply unit in order to prevent reset pulse. If the display controller or the CPU stops the refreshing, the monitor will be reset in order to prevent false information to be displayed on the screen. If the UPI4NET board stops the refreshment, the board will be reset internally.

2.1.3 SRAM M48T37V

The SRAM with a real-time clock is backed up by a lithium battery.

CAUTION The IC contains a lithium battery. Discard the battery according to local regulations.

2.1.4 Integrated Ethernet Controller

The Integrated Ethernet is illustrated in a block diagram shown in Figure 2.

Ethernet controller communicates with the CPU through the PCI bus interface. During the startup sequence, the controller loads its address and some initialization from the memory.

Ethernet controller transmits data packets to the Datex-Ohmeda Network and receives data packets from the network through the 10BASE-T transformer. The transformer filters and transforms the data and also provides the isolation.

The Ethernet status LEDs indicate the status of the network communication. The status LEDs are controlled by the network controller. The LEDs are not visible when the board is installed into the monitor.

2.1.5 Integrated Display Controller

B-CPU6 board contains an integrated display controller, which is illustrated in a block diagram shown in Figure 2. The display controller sends video signals in both analog and digital form through its DVI-I connector. The integrated display controller on B-CPU6 acts always as primary display controller and uses resolution setting through software setting. B-CPU6 board does not contain jumpers for address and resolution setting as B-DISPX board.

2.2 Ethernet interface

The data transformer is designed by Datex-Ohmeda and it is hospital grade approved.

Adapter's 10BASE-T is an interface with 7-pole butterworth low-pass filters on the unisolated side of the transformer. There is a common mode choke on the isolated side for both transmitting and receiving lines.

There are also two LEDs on the board, which are not visible from the outside, indicating the following:

- link/activity	H3	Yellow
- speed	H4	Green

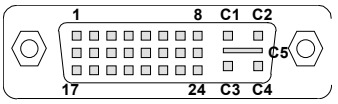
2.3 Software License

The upgrade software has been developed for monitor software upgrades. The upgrade software can be downloaded onto a monitor that is equipped with the B-CPU6.
The service software has been developed to replace the original monitor software in case of a B-CPU6 failure. There is service software available for each S/5 monitor software version. The functionality of the service software is equal to the functionality of the corresponding original S/5 monitor software.

The Service License and Upgrade License is license software. The license agreement that is delivered with the software should be archived in a secure location. Relevant license number may have to be referred when contacting GE Healthcare for service/support. The licence number is needed also for possible software upgrades.

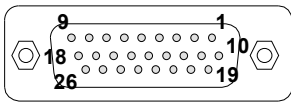
2.4 Connectors and signals

2.4.1 DVI-I connector

DVI-I connector X2	Pin	Signal	Description
	1	TX2-	Differential data to display
	2	TX2+	
	3	2/4_SHIELD	Shield for data pairs 2 & 4
	4	TX4+	Differential data to display
	5	TX4-	
	6	DDC_CLOCK	PU 2k +5V
	7	DDC_DATA	PU 2k +5V
	8	ANA_VSYNC	Vertical sync for analog display
	9	TX1-	Differential data to display
	10	TX1+	
	11	1/3_SHIELD	Shield for data pairs 1 & 3
	12	TX3-	Differential data to display
	13	TX3+	
	14	+5V_OUT	+5V supply to display
	15	GND	
	16	HP_DET	HotPlug detection
	17	TXD0-	Differential data to display
	18	TXD0+	
	19	0/5_SHIELD	Shield for data pairs 0 & 5
	20	TX5-	Differential data to display
	21	TX5+	
	22	CLK_SHIELD	Shield for CLK pair
	23	CLK+	Differential CLK to display
	24	CLK-	
	C1	ANA_RED	Red, Green and Blue for analog display
	C2	ANA_GREEN	
	C3	ANA_BLUE	
	C4	ANA_HSYNC	Horizontal sync for analog display
	C5	ANA_RETURN	Return ground for analog interface

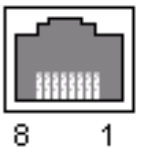
2.4.2 Keyboard connector

D-LCC10/12, Keyboard connector, CPU6 connector board X11

	Pin	Signal	Description
	1	CRT_RED	Analog video out
	2	CRT_GREEN	
	3	CRT_BLUE	
	4	MON_ID2	Monitor ID input
	5	MON_ID1	Monitor ID input
	6	GND	
	7	MON_ID0	Monitor ID input
	8	HSYNC2	
	9	VSYNC2	
	10	GND	
	11	GND	
	12	GND	
	13	GND	
	14	GND	
	15	+5VRE	
	16	ON_STBY	
	17	GND	
	18	GND	
	19	SERD_RXD_RS232	
	20	SERD_TXD_RS232	
	21	BRIGHTNESS	
	22	CONTRAST	
	23	NC	
	24	NC	
	25	+32V	
	26	+32V	

2.4.3 Ethernet Network Interface

Network connector, X10

RJ45 connector	Pin	Signal	Description
	1 2 3 4 5 6 7 8	Tx + Tx - Rx + NC NC Rx - NC NC	Differential transmit data Differential transmit data Differential receive data Differential receive data

3 Service procedures

3.1 General service information

The field service of the B-CPU6 is limited to replacing the actual CPU board, the SRAM/Timekeeper battery, or mechanical parts. Faulty CPU board can be returned to GE Healthcare for repair/exchange.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation and a detailed description of the fault.

WARNING **Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.**

3.2 Service check

These instructions include complete procedures for a service check. The service check is mandatory after any service repair. However, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A:") which may be used when performing the procedures.

The symbol  in the instructions indicates that the check form contains space to record the results of the particular procedure.

3.2.1 Recommended tools

Tool	Order No.	Notes
Command Bar		
E-REC		
Hemodynamic parameter module		
Screwdriver		

Visual inspection

Make sure that no cables or modules are connected to the Central Unit. Lift off the display with its stand, if placed on the Central Unit.

CPU board

1. Device plates

   Check that the CPU board rear panel is clean and intact. Check that both CPU and software device plates are intact.

2. Grounding plates

   Check that the grounding plates under the CPU board rear panel are attached properly and are not bent.

3. SRAM/Timekeeper battery

   The SRAM/Timekeeper battery on the CPU board is recommended to be replaced after every 8 years. Replace the battery, if necessary. See section 3.3 for disassembly instructions.

NOTE: The Factory Reset must be performed, if the SRAM/Timekeeper battery is replaced.

4. PC board screws

   Check that all the rear side PC boards are secured to the Central Unit with screws.

3.2.2 Functional inspection

5. Fan

   Install the display together with the Command Bar, parameter module and the E-REC. Connect the power cord and turn the monitor on. Check that the fan is running.

6. Starting

   Check that the monitor starts up properly, i.e. the alarm LEDs on the Command Bar turn blank, the start-up sound is heard from the loudspeaker and the normal monitoring screen appears. No error messages should appear on the screen.

7. Module communication

   Check that the connected modules are recognized, i.e. the needed parameter information is shown on the screen and the E-REC records two lines of start-up information.

   If some parameter information is missing, check the screen configuration from the ***Monitor Setup*** menu.

NOTE: InvBP waveforms are not shown without a patient simulator.

8. Real time clock

   Check that the clock on the screen shows correct time. Adjust the time, if necessary.
   Monitor Setup - ***Time And Date***

NOTE: If the clock shows time 0:00 continuously (at successive start-ups), the SRAM/TIMEKEEPER battery should be replaced. The Factory Reset must be performed after the battery is replaced.

9. Loudspeaker sound

   Check the loudspeaker volume settings by setting the alarm sound:

   Alarms Setup - ***Alarm Volume***

   Test the whole volume scale from 1 to 10 by turning the ComWheel and check that the alarm volume changes correspondingly. The alarm sound should be clear and audible with all the settings.

10. Monitor software

    Enter the service menu.
    Monitor Setup - ***Install/Service*** (password 16-4-34) **-** ***Service*** (password 26-23-8)
    Take down the information regarding the monitor software.

11. Content of service log

    Select ***Service Log*** from the menu. Record the Service Log onto the E-REC by selecting ***Record Log***. Check the content of recording for possible problems, then empty the Service Log by selecting ***Reset Log*** from the menu.

12. CPU watchdog circuitry

    Test the Central Unit watchdog circuitry:

    Monitor Setup - Install/Service (password 16-4-34) **-** ***Service*** (password 26-23-8) **-** ***Set/Test***

    Go through the **Watchdog**, **WD by Overload** and **WD by UPI** tests one by one and check that the monitor performs a restart in all other cases except when performing **WD by UPI**.

NOTE: When selecting WD BY OVERLOAD, restarting should take place approximately after 15 seconds. With the other tests, restarting takes place within a couple of seconds.

If restarting did not take place, try to locate the fault:

Watchdog --> CPU board/Power supply unit

WD by Overload --> CPU board

13. Recovering from power loss

    Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby.

    Turn the monitor to standby and disconnect the power cord. Wait for two minutes, then reconnect the power cord and turn the monitor back on. The monitor should perform a "Warm start" which means the trend information and temporary settings should still be available. If the monitor performed a "Cold start" instead, either the CPU battery or the battery fuse should be replaced.

NOTE: The B-CPU6 requires 2 Amps battery fuse (P/N 51063).

The start-up information is also saved in the Service Log.

Ethernet functions

14. Connecting to network

    Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect the Mon-Net cable to the CPU board and the Identification plug to the UPI4NET board.

    Check that the monitor connects to the Datex-Ohmeda Network, i.e. the network symbol appears under the clock on the upper right hand corner of the screen.

    A message regarding the connected Datex-Ohmeda Central should appear in the message field of the screen.

    NOTE: If the network symbol does not appear, check the status of the network.

15. Ethernet address

    Enter the service menu.

    Frame - Network

    Take down the monitor's Ethernet address that is shown beside the text "Address".

16. "In", "Out" data counters

    Check that the service menu counters for the received ("In") and transmitted ("Out") data are updated frequently.

17. Data error counters

    Check that the counters for data errors ("CRC", "Frame", "Transm.") are stable.

    NOTE: The counters may show values higher than 0. However, if any of the values is increasing continuously, it indicates a problem.

18. Hardware error counters

    Check that the counters for hardware errors (“Intern.”, “Missed”, “FIFO”, “Overrun”) all show 0. If any of the counters show a value higher than 0, replace the CPU board.

19. Recognition of disconnection

    Disconnect the Mon-Net cable from the Network cable extension. Check that the message “Network down:” appears in the message field within 30 seconds. Reconnect the Mon-Net cable and check that the monitor connects to the network again.

General

20. Electrical safety check

    Perform an electrical safety check and a leakage current test.

21. Functioning after electrical safety test

    Check that the CPU Board functions normally after the performed electrical safety check.

- Fill in all necessary documents.

3.3 Disassembly and reassembly

NOTE: Turn the monitor to standby and press the service reset switch for at least five seconds before detaching any PC boards.

1. Remove the screws and detach all PC boards and cover plates necessary for removing the CPU board.
2. Remove the screws on the CPU board rear panel.
3. Detach the CPU board.

Reassembly should be made in reversed order.

NOTE: When reinstalling PC boards, push the boards carefully to connect them to the CPU bus.

3.3.1 Downloading/replacing software on CPU Board, B-CPU6

See Software Download Tool - User Instructions.

Software Download Tool, L-SWDL, is the only way to download/replace software on B-CPU6 by a field engineer. SWDL is a service tool that enables the installation of monitor service software from personal computer into legacy Datex-Ohmeda patient monitor. It replaces the use of traditional service and upgrade software licenses in most situations.

3.3.2 Performing Factory Reset

NOTE: The Factory Reset is necessary after downloading of monitor software and after replacing the CPU board or SRAM/Timekeeper battery.

NOTE: The Factory Reset will restore all your customized defaults, including language selection, to factory defaults.

1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** and password (16-4-34).
3. Select ***Service*** and password (26-23-8).
4. Select ***Set/Test*** and perform ***Factory Reset***.
5. The monitor will perform an automatic restart. After the restart is completed, restart the monitor also manually by the On/Standby switch.

3.4 Adjustments and calibrations

No calibrations or adjustments are needed on the CPU board, B-CPU6.

4 Troubleshooting

4.1 Troubleshooting for the Ethernet section

Symptom at the monitor end	Problem at	Explanation/What to do
Monitor does not connect to the network. Monitor connects to the network, but disconnects unexpectedly ('Network connection down' message on the monitor screen).	Patch panel	Patch cable not connected to HUB or to panel.
	Patch cable	Patch cable or connector defective.
		HUB not connected to power supply.
		HUB port closed due to physical layer problems.
		HUB port temporarily closed and reopened due to physical layer problems.
		HUBs not properly connected to each other.
	Monitor-Network cable	Cable not properly connected to the wall plate or to the monitor.
	Monitor-Network cable	Cable or connector defective.
	B-CPU6 board	The B-CPU6 board is defective. The board cannot be used. See network service page for details.
	Identification plug on B-UPI4NET board	There is no identification plug attached to the monitor.
		The identification plug is defective or uninitialized. The plug cannot be used.
'Check network connectors' message shows on the monitor screen	Monitor-Network cable	Cable not connected properly to the wall plate or to the monitor.
		Cable or connector defective.
	Identification plug on UPI4NET board	There is no identification plug properly attached to the monitor.
		The identification plug is defective or uninitialized. The plug cannot be used. See network service page for details.
'Network board error' message shows on the monitor screen	B-CPU6 board	The B-CPU6 board is defective. The board cannot be used. See network service page for details.
Other Site View shows no waveforms	No waveforms are set up for Monitor-to-Monitor communication	Run Network Setup to verify current Monitor-to-Monitor communication setup.

Symptom at the monitor end	**Problem at**	**Explanation/What to do**
Network printing fails	Print server is busy	Network manager's print server is busy at the moment and cannot take more print jobs. Try again after 15 seconds.
	Print queue is full	There are too many unprinted documents waiting in the print queue. Check the printer, as it is not operating properly.
	Printer is off-line	Printer cable is loose, printer is out of paper, there is a paper jam or the printer is simply switched to off-line state.
Record keeper menus are blank	There are no menus for the record keeper	Run Network Setup to verify the current set up.

4.2 Troubleshooting flowcharts

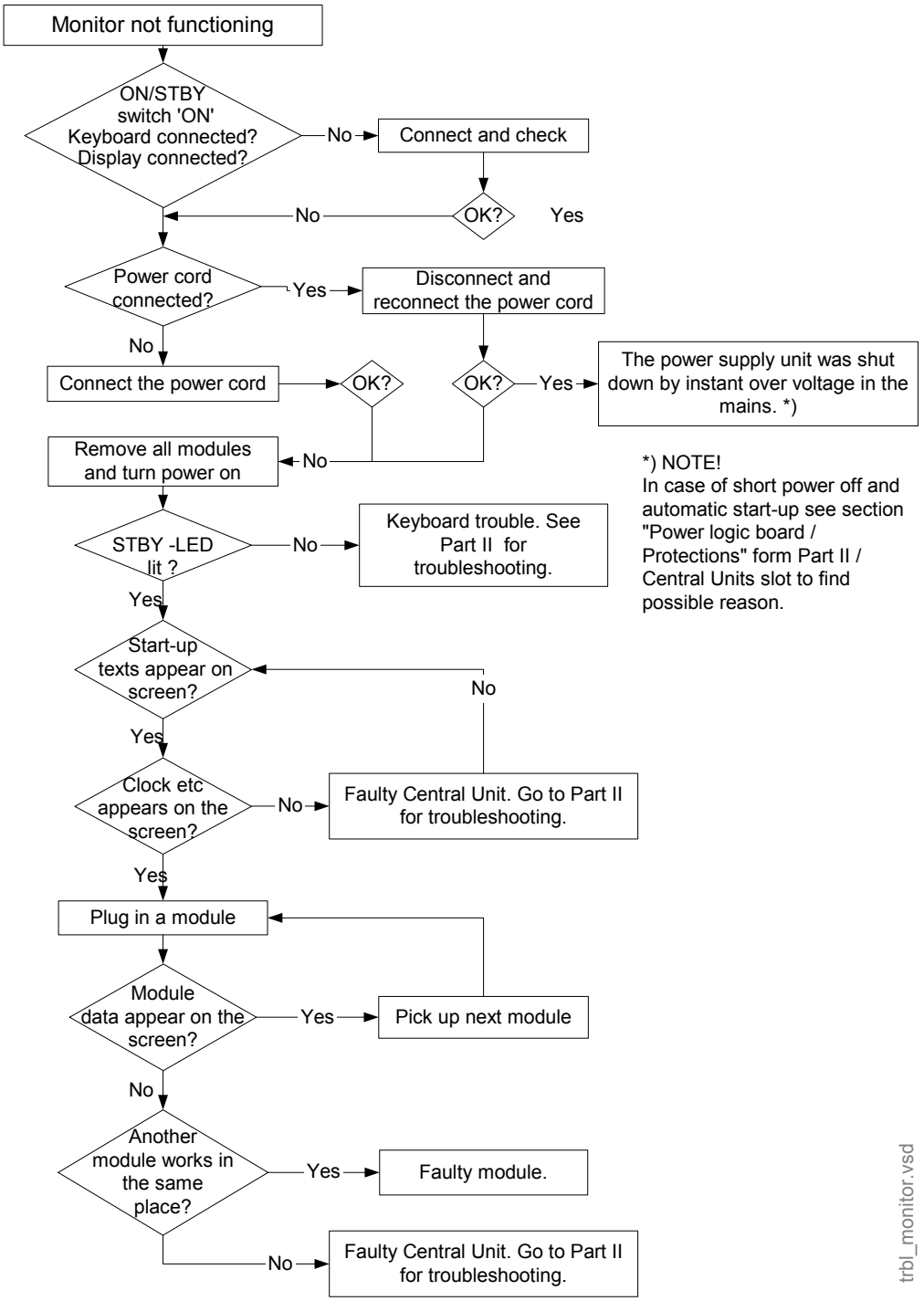


Figure 3 Monitor troubleshooting flowchart

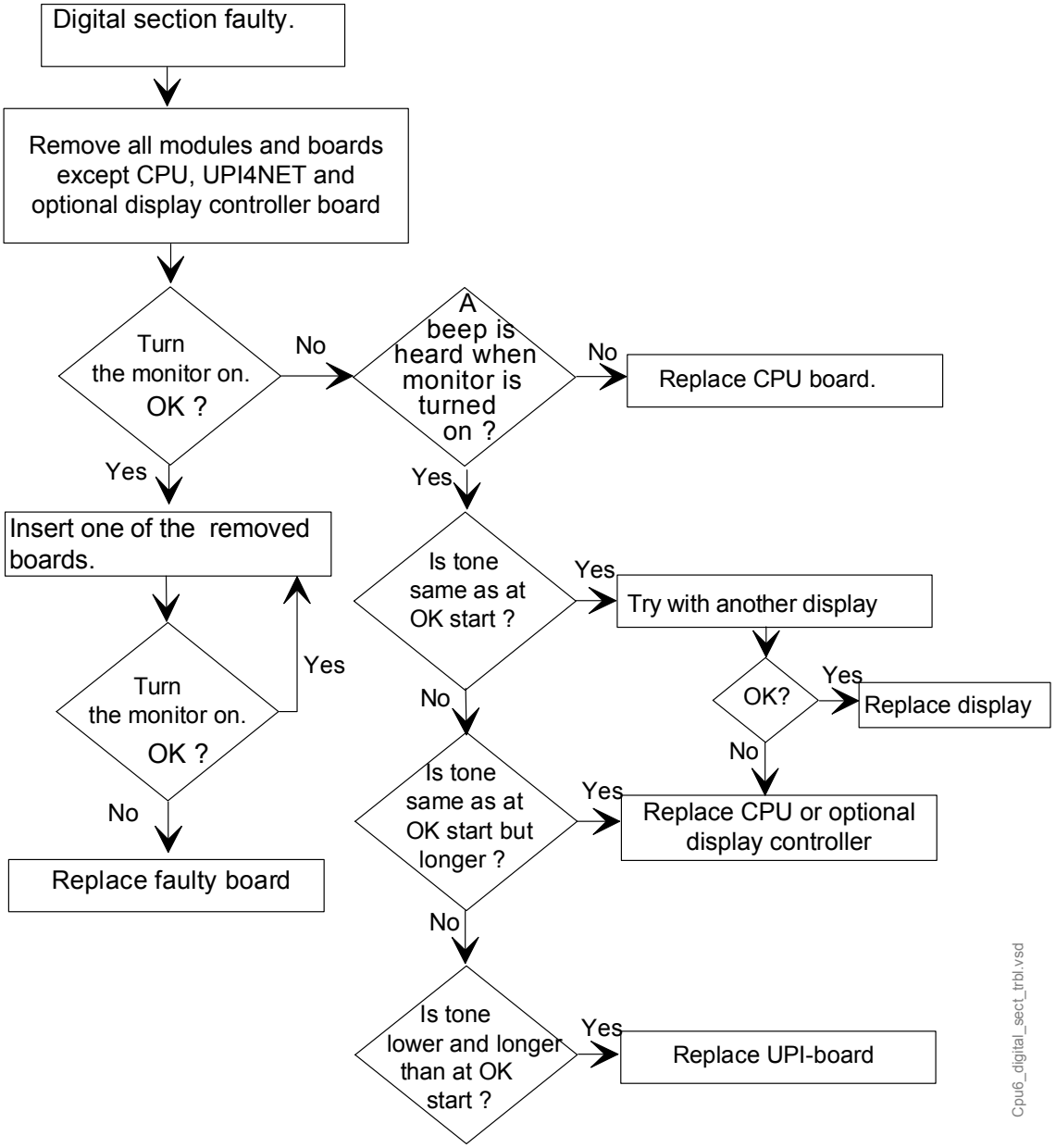


Figure 4 Digital section troubleshooting flowchart

4.3 Error messages

4.3.1 SRAM Error

The SRAM memory is located on the CPU board. The SRAM Error is due to memory malfunction. Restart the monitor. If the problem persists, replace the SRAM/Timekeeper battery. Remember to perform factory reset after the replacement.

4.3.2 RAM Error

The RAM memory is located on the CPU board. The RAM Error message is displayed due to memory malfunction. Replace the CPU board. Remember to perform factory reset after the replacement.

5 Earlier revisions

This service manual fully supports earlier revisions except,

Item	**Manual and document number**
Service Menu descriptions related to software of level 97/98	Technical Reference Manual 896624 manual slot 895704
B-CPU2, B-CPU3	Technical Reference Manual 896624 manual slot 895704
B-CPU4, B-CPU5	Technical Reference Manual M1021563 manual slot M1027812

APPENDIX A: Service check form, CPU Board

Customer		
Service	CPU board rev	S/N
Service engineer		Date

Measuring equipment / test gases used:				
Equipment / tool / gas:	Manufacturer:	Model/Type/Part Number:	Serial Number / ID:	Calibration Date:

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

CPU board	**OK**	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
1. Device plates	☐	☐	☐	2. Grounding plates	☐	☐	☐
3. SRAM/Timekeeper battery	☐	☐	☐	4. PC board screws	☐	☐	☐
5. Fan	☐	☐	☐	6. Starting	☐	☐	☐
7. Module communication	☐	☐	☐	8. Real time clock	☐	☐	☐
9. Loudspeaker sound	☐	☐	☐	10. Monitor software	☐	☐	☐
11. Content of service log	☐	☐	☐	12. CPU watchdog circuitry	☐	☐	☐
13. Recovering from power loss	☐	☐	☐				
Notes							

Ethernet functions	**OK**	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
14. Connecting to network	☐	☐	☐	15. Ethernet address	☐	☐	☐
16. "In", "Out" data counters	☐	☐	☐	17. Data error counters	☐	☐	☐
18. Hardware error counters	☐	☐	☐	19. Recognition of disconnection	☐	☐	☐
Notes							
General	**OK**	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
20. Electrical safety check	☐	☐	☐	21. Functioning after electrical safety test	☐	☐	☐
Notes							

Notes

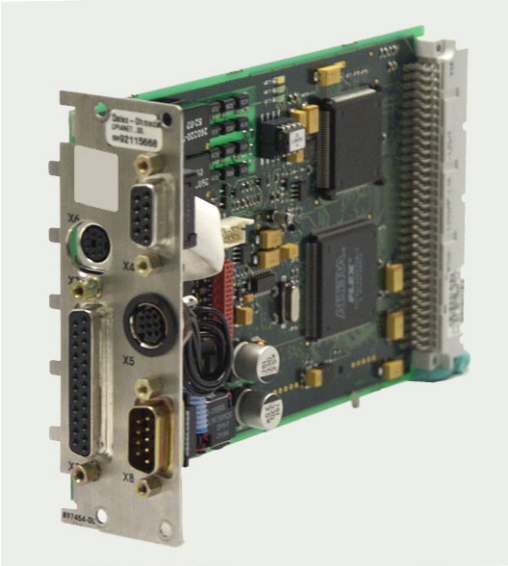
Used spare parts			

Signature

Datex-Ohmeda

S/5™ UPINET Board, B-UPI4NET-02

Technical Reference Manual Slot



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

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

All specifications subject to change without notice.

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March 11, 2009

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Table of contents

Table of contents i

Introduction 1

1 Technical specifications 2
1.1 General. . . . 2
1.2 UPI . . . 2
1.3 NET (Ethernet) . . . 2

2 Functional description 3
2.1 General. . . . 3
2.1.1 UPI4NET board, B-UPI4NET . . . 3
2.1.2 NET section . . . 4
2.2 Connectors and signals . . . 4
2.2.1 Network coding element interface . . . 4
2.2.2 RS232 Serial data interface . . . 5
2.2.3 DIS interface (RS422) . . . 5
2.2.4 Synchronization interface . . . 5
2.2.5 Printer interface . . . 6
2.2.6 Connection to the S/5 bus . . . 7

3 Service procedures 8
3.1 Service check . . . 8
3.1.1 Recommended tools . . . 8
3.1.2 Visual inspection . . . 8
3.1.3 Functional inspection . . . 9

4 Troubleshooting 11
4.1 Troubleshooting . . . 11

5 Earlier revisions 12

Appendix A: Service check form, UPI4NET Board, B-UPI4NET A-1

Introduction

Datex-Ohmeda S/5 UPI4NET board, B-UPI4NET integrates the UPI board and the Network Board, B-NET. Datex-Ohmeda S/5 UPI4 board, B-UPI4 is the same board as UPI4NET except it does not contain network related components. However, when used together with B-CPU6, the network portion of the board is handled by the B-CPU6 board. In such case, the network connection on the B-UPI4NET front panel will be blocked.

The UPI4NET board provides interfaces for example for a computer, parallel printer and Device Interfacing Solution (DIS). In addition, the board has two digital output signals and two analog output signals for other interfaces.

The use of UPI4NET board requires S/5 Anesthesia or Critical Care main software.

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

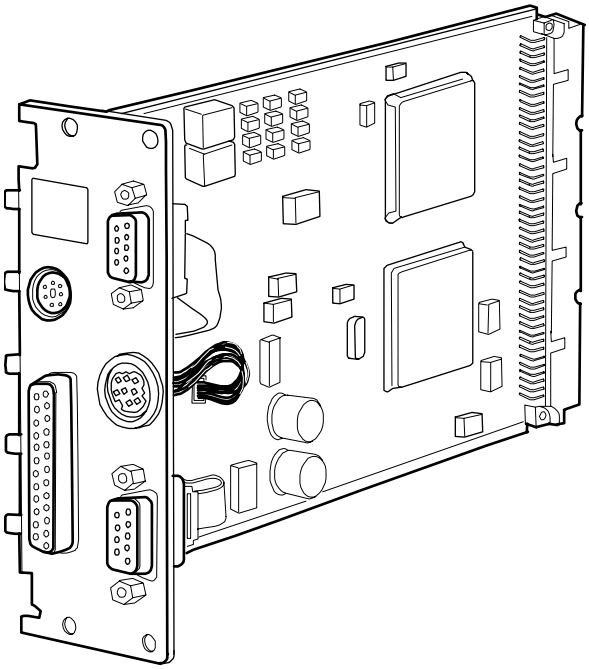


Figure 1 UPINET Board, B-UPI4NET

NOTE: B-UPI4NET- 02 requires monitor software L-ANE06(A) / L-ICU06(A) or later.

NOTE: Updating the frame F-CU8 rev. 10 or earlier with B-UPI4NET-02 board will change the CISPR class from B to A.

1 Technical specifications

1.1 General

Voltages:

- +5 V, 500 mA
- +15 VD, 50 mA + DIS power supply

Voltage and temperature measurement

1.2 UPI

Supports RS485 500 kbps module bus communication
Supports RS422 500 kbps Device Interfacing Solution (DIS) bus communication
Printer port (LPT)
RS232 level communication driven by B-CPU6
Analog signals:

- Direct ECG
- Pressure Out

Digital signals:

- Defibrillation Synchronization
- Nurse Call

1.3 NET (Ethernet)

NOTE: When used together with the B-CPU6 board, the Ethernet portion is handled by the CPU board.

Meets IEEE802.3 specifications (10BASE-T)
Hospital grade approved data transformer
Coding element interface

2 Functional description

2.1 General

2.1.1 UPI4NET board, B-UPI4NET

The UPI section functions as a general I/O-board. It performs I/O duties assigned to it by the CPU board. The main processor in the CPU board and the processor in the UPI section communicate through a dual-port memory which is located on the UPI4NET board.

Functional blocks

The UPI section contains the external bus interface, a processor, program and dual-port memories and I/O-block.

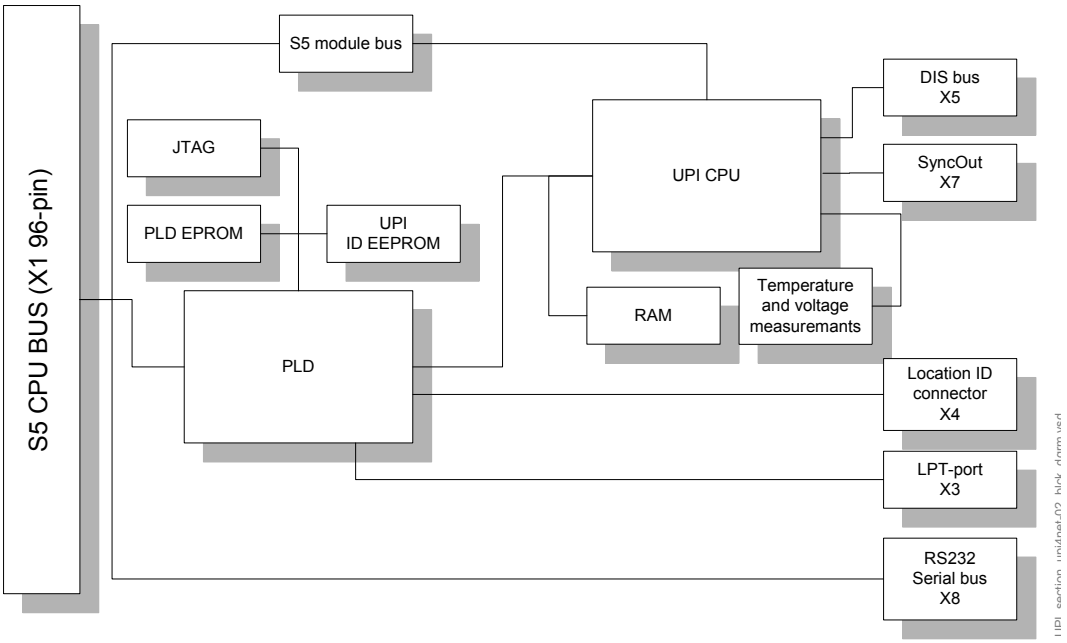


Figure 2 UPI section block diagram

External bus interface

The UPI section is connected to the CPU mother board. The following signals pass on between the UPI section and CPU mother board: data bus, address bus, reset, read and write signals, and other related signals.

Processor

The processor in the UPI section is an H8S/2655, which functions at 16 MHz frequency.

RS232 serial bus interfaces

RS232 serial bus is connected to the connector X8. That serial channel is driven by the CPU board. Only the RS232 buffer and some filtering components are located in the UPI4NET board.

RS485 module bus interface

RS485 half-duplex communication bus for modules. Communication speed rate is 500 kbps.

RS422 DIS bus interface

RS422 full-duplex communication bus for DIS modules. Communication speed rate is 500 kbps. DIS interface includes DIS power supply that gives voltages +8 V (max 1A) and +15 VD (max 1A).

2.1.2 NET section

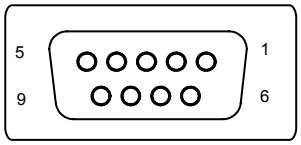
The PLD interfaces the coding element. The coding element contains information on the monitor location. The network address is transmitted to the CPU board through the network controller and the monitor location information is transmitted to the CPU board through PLD interface.

NOTE: For information about the NET section, see the "*CPU Board, B-CPU6*" slot. If B-CPU4 or B-CPU5 and B-UPI4NET-00 or -01 are used, see the previous version of the Technical Reference Manual (M1021563).

2.2 Connectors and signals

2.2.1 Network coding element interface

Coding element connector, X4

9 pin female D-connector	Pin	Signal
	1 2 3 4 5 6 7 8 9	IDCS1 (chip select) IDCL (clock) IDDI (data in) IDDO (data out) IDPE (protect enable) +5Vdc N/C (Direct ECG, in B-UPI4NET rev.00 only) Nurse call GND

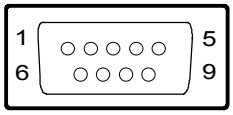
Nurse Call (X4 pin 8)

The Nurse Call signal is generated by yellow and red alarms. When activated, the signal is set to the high state and remains at the high state until the alarm situation is over or the SILENCE ALARM key is pressed. The high state range is from 2.8 to 5 V, while the low state range is from 0 to 0.8 V.

If the output signals are used simultaneously with the coding element, the B-UPINET Y-cable, order number 889308, is recommended.

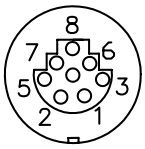
2.2.2 RS232 Serial data interface

RS232 Serial data connector X8

9 pin male D-connector	Pin	Signal
	1 2 3 4 5 6 7 8 9	GND RxD TxD NC GND N/C RTS CTS N/C

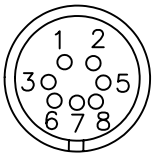
2.2.3 DIS interface (RS422)

DIS connector, X5

10 pin female connector	Pin	Signal
	1 2 3 4 5 6 7 8	DIS_out + DIS_out - 15V_DIS GND 8V_DIS GND DIS_in + DIS_in -

2.2.4 Synchronization interface

Synchronization connector, connector X7 (B-UPI4NET -02)

Mini DIN7 connector	Pin	Signal
	1 2 3 5 6 7 8	Defib_sync_out Reserved Analog GND Digital GND GND Pressure_out Direct_ECG_out

Defibrillation Sync (pin 1)

Defibrillation Sync indication is generated by ECG. When active, the signal is in state 1. After 10 ms the signal is reset to state 0. New Defibrillation Sync is not generated before the indication is deactivated. The delay from the R wave peak to the start of the signal is maximally 35 ms.

Pressure out (pin 7):

– P1 from hemodynamic module

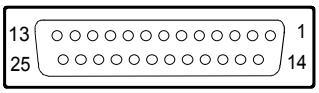
The Invasive pressure output signal is 1 V/100 mmHg, originally ranging from 0 to 320 mmHg, and with a delay of approximately 25 ms. The signal requires an input impedance of 100 k.

Direct ECG (pin 8):

Delay (max.):	15 ms
Gain ECG (out)/ECG (in):	1 V/1 mV
Pacer:	5 V and 2 ms pulse

2.2.5 Printer interface

Standard printer connector, X3

25 pin female D-connector	Pin	Signal
	1	Data_clk
	2	Data0
	3	Data1
	4	Data2
	5	Data3
	6	Data4
	7	Data5
	8	Data6
	9	Data7
	10	N/C
	11	Printer busy
	12	Paper end
	13	N/C
	14	N/C
	15	Error/
	16	N/C
	17	GND
	18	GND
	19	GND
	20	GND
	21	GND
	22	GND
	23	GND
	24	GND
	25	GND

2.2.6 Connection to the S/5 bus

S/5 CPU bus connector X1

Pin	A	B	C
1	+15 V	AGND	DGND
2	-15 V	BALE	DGND
3	SA0	SA1	DGND
4	SA2	SA3	RESET_RS485
5	SA4	SA5	-RESET_RS485
6	SA6	SA7	DATA_RS485
7	SA8	SA9	-DATA_RS485
8	SA10	SA11	TXDD_RS232
9	SA12	SA13	RXDD_RS232
10	SA14	SA15	Direct_ECG_PWM
11	SA16	SA17	BIT1IN
12	SA18	SA19	TXDC
13	SA20	SA21	RXDC
14	SA22	SA23	RTSC
15	-SMEMR	-SMEMW	CTSC
16	-IOR	-IOW	TXDB
17	CLK	-RESET	RXDB
18	-IOCHRDY	IRQ10	RTSB
19	N/C_1	IRQ11	CTSB
20	N/C_2	IRQ12	TXDA
21	-SBHE	IRQ15	RXDA
22	SD0	SD1	RTSA
23	SD2	SD3	CTSA
24	SD4	SD5	LOUDSPEAKER
25	SD6	SD7	+5 V
26	SD8	SD9	+5 V
27	SD10	SD11	+5 V
28	SD12	SD13	+5 V
29	SD14	SD15	ON/STBY
30	+15 VD	-RESET_CPU	+5 V_CPU
31	+15 VD	+32 VD	REFRESH_WD
32	GNDD	GNDD	POWER_FAIL

3 Service procedures

Due to the nature of the UPI4NET board, the field service is limited only for troubleshooting. Faulty UPI4NET boards are returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation, and a detailed fault description.

WARNING **Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.**

3.1 Service check

These instructions include complete procedures for a service check. The service check is mandatory after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A:") which may be used when performing the procedures.

The symbol  in the instructions indicates that the check form contains space to record the results of the particular procedure.

3.1.1 Recommended tools

Tool	Order No.	Notes
Command Bar		
Hemodynamic parameter module		
Patient simulator		
Screwdriver		

3.1.2 Visual inspection

Make sure the monitor is switched to standby. Press the service reset switch at the back of the power supply unit for at least five seconds. Disconnect the Identification plug from the UPI4NET board, if installed.

Detach all PC boards necessary for removing the UPI4NET board. Detach the UPI4NET board.

WARNING **Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.**

NOTE: The UPI4NET board contains components on both sides of the PC board. Therefore, the detachment and installation of the UPI4NET board should be done with extra care.

1. UPI4NET board connectors

   Check that the UPI4NET board connectors are intact and all connector cables are connected properly on the PC board.

2. PC board components and IC attachment

   Check that none of the PC board components is damaged (on both sides) and the IC on a socket is attached properly.

3. Screws

   Check that all block screws for cables are in place and tightened properly. Check also that their threads are intact.

4. Grounding plates

   Check that the grounding plates under the PC board rear panel are attached properly and are not bent.

3.1.3 Functional inspection

UPI functions

Re-install the UPI4NET board carefully together with the other detached PC boards. Connect the Identification plug to the UPI4NET board. Do not connect any cables to the board at this point. Switch the monitor on. Make sure that the Hemodynamic parameter module is installed. Connect a patient simulator to the module.

5. Parameter data and waveforms

   Check that the parameter data and waveforms are displayed.

6. Voltage and temperature

   Enter the service menu.

   Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8) – ***Frame*** - ***Power Supply***

   Check that the displayed temperature value (measured by the UPI4NET board) is available.

   Check that the displayed output voltages meet the following ranges:

+15V	14.20....15.60 V
-15V	-14.00...-15.50 V
+15VD	14.10.....15.60 V
+5V	4.70.....5.40 V

7. Watchdog

   Test the UPI4NET board watchdog function.

   Monitor Setup - *Install/Service* (password 16-4-34) **- *Service*** (password 26-23-8) **- *Set/Test – WD by UPI***

   Perform the test and check that monitoring continues normally.

Net function

8. Recognition of ID-plug

   Ensure that the monitor is connected to the network. Switch the monitor to standby. Disconnect the Identification plug from the UPI4NET board. Switch the monitor back on and check that the message “Check network connectors” appears in the message field. Reconnect the Identification plug and check that the monitor connects to the network.

General

9. Electrical safety check

   Perform an electrical safety check and a leakage current test.

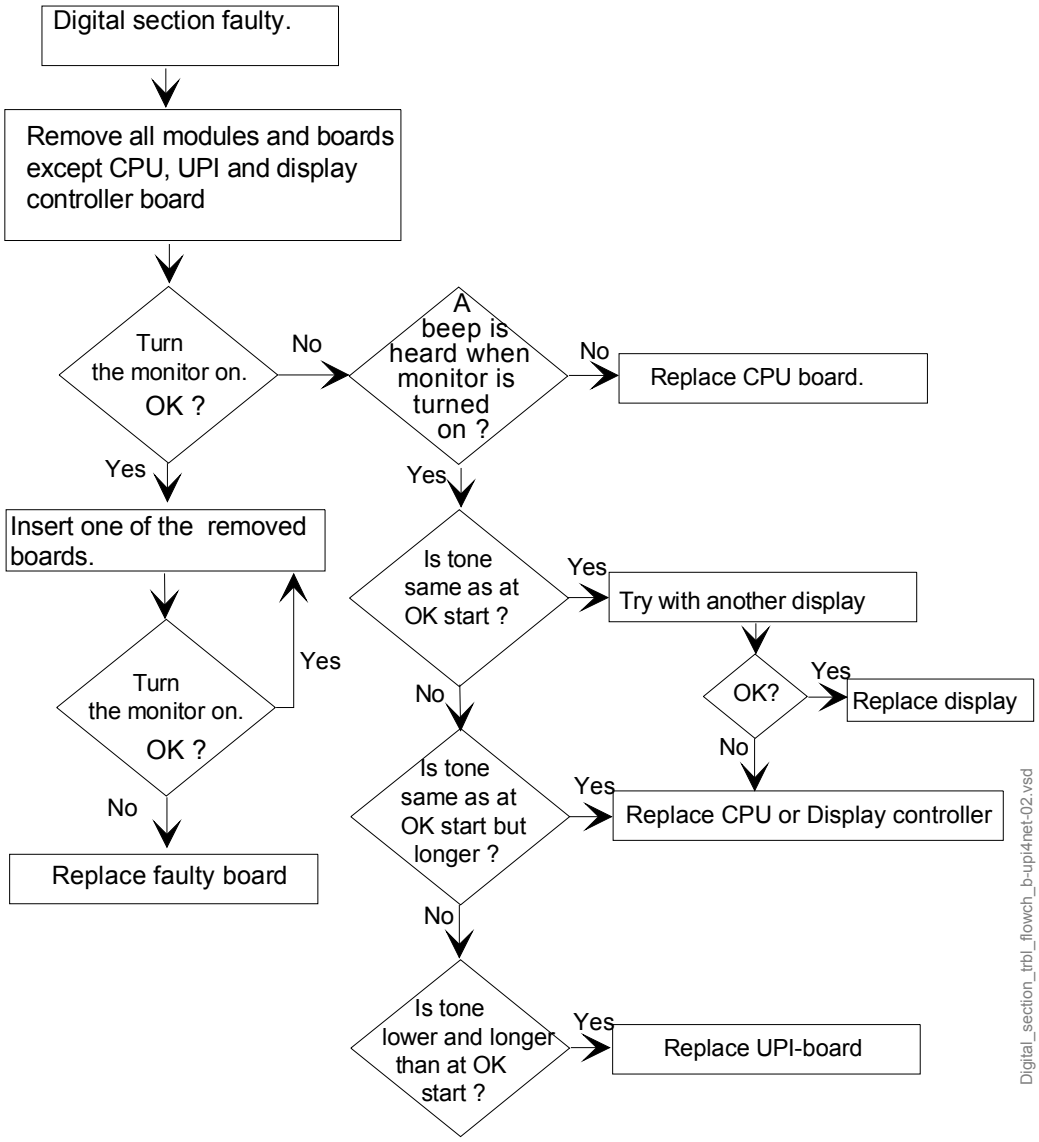
10. Functioning after electrical safety test

    Check that the system functions normally after the performed electrical safety check.

- Fill in all necessary documents.

4 Troubleshooting

4.1 Troubleshooting



5 Earlier revisions

See information related to the earlier revisions of UPI board in the main manual 896624 and slot 895704-1.

See information related to B-UPI4NET rev. 00 & 01 in the Technical Reference Manual M1021563.

APPENDIX A: Service check form, UPI4NET Board, B-UPI4NET

Customer		
Service	Board type	S/N
Service engineer		Date

Measuring equipment / test gases used:				
Equipment / tool / gas:	Manufacturer:	Model/Type/Part Number:	Serial Number / ID:	Calibration Date:

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

General	**OK**	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
1. UPI4NET board connectors	☐	☐	☐	2. PC board components and IC attachment	☐	☐	☐
3. Screws	☐	☐	☐	4. Grounding plates	☐	☐	☐
Notes							
Upi functions							
5. Parameter data and waveforms	☐	☐	☐	6. Voltage and temperature	☐	☐	☐
+15 V					14.20...15.60 V		
-15 V					-14.00...-15.50 V		
+15 VD					14.10...15.60 V		
+5 V					4.70...5.40 V		
7. Watchdog	☐	☐	☐				
Notes							

NET function	**OK**	**N.A.**	**Fail**	
8. Recognition of ID-plug	☐	☐	☐	
Notes				

General	**OK**	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
9. Electrical safety check	☐	☐	☐	10. Functioning after electrical safety test	☐	☐	☐
Notes							

Notes	

Used spare parts		

Signature

Datex-Ohmeda

Displays and Controller Boards

Technical Reference Manual Slot

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Table of contents

Introduction 1

1 Specifications 2
- 1.1 LCD Display, D-LCC12A-01 . . . 2
- 1.2 15" Flat Panel Display, D-FPD15-00 . . . 2
- 1.3 19" Medical Grade Display . . . 3
- 1.4 Display Controller Board, B-DISPX-01 . . . 3

2 Functional description 5
- 2.1 LCD Displays . . . 5
  - 2.1.1 D-LCC12A . . . 5
  - 2.1.2 15" Flat Panel Display, D-FPD15 . . . 6
  - 2.1.3 19" medical grade display . . . 6
- 2.2 External connector configurations . . . 7
- 2.3 Display Controller Board, B-DISPX-01 . . . 8
  - 2.3.1 Output connectors, B-DISPX-01 . . . 12

3 Service procedures 14
- 3.1 General service information . . . 14
  - 3.1.1 LCD Display, D-LCC12A . . . 14
  - 3.1.2 15" Flat Panel Display, D-FPD15 . . . 14
  - 3.1.3 19" Medical Grade Display . . . 14
- 3.2 Service check . . . 14
  - 3.2.1 LCD Display, D-LCC12A . . . 15
  - 3.2.2 15" Flat Panel Display, D-FPD15 . . . 17
  - 3.2.3 19" medical grade display . . . 19
- 3.3 Disassembly and reassembly . . . 21
  - 3.3.1 LCD Display, D-LCC12A . . . 21
  - 3.3.2 15" Flat Panel Display, D-FPD15 . . . 22
  - 3.3.3 19" Medical Grade Display . . . 22

4 Troubleshooting 23
- 4.1 LCD Displays . . . 23
  - 4.1.1 D-LCC12A . . . 23
  - 4.1.2 15" Flat Panel Display, D-FPD15 . . . 24
  - 4.1.3 19" medical grade display . . . 24
- 4.2 Display Controller Board, B-DISPX . . . 25

5 Earlier revisions 26

Appendix A: Service Check Form, LCD Display, D-LCC12A A-1

Appendix B: Service Check Form, 15" Flat Panel Display, D-FPD15 B-1

Appendix C: Service Check Form, 19" medical grade display C-1

Introduction

This section provides information about the maintenance and service of the following products:

LCD Displays

S/5™ 12" LCD Display, D-LCC12A-01
15" Flat Panel Display, D-FPD15-00 (M1138310)
19" Medical Grade Display (M1063774)

Display Controller Boards

S/5™ Display Controller Board, B-DISPX-01

The service menu is described in a separate "Service Menu" slot and the spare part lists in the "AM, CCM Spare Parts" slot.

B-DISPX-01 is compatible with the following displays: D-LCC12A-01, D-FPD15-00 and 19" medical grade display.

NOTE: B-DISPX-01 requires monitor software L-ANE05, L-ANE05A revision 01 and later or L-ICU05 and L-ICU05A revision 01 and later.

Table 1 Resolution settings

	XGA	SVGA	SXGA
D-LCC12A		X	
D-FPD15	X		
19" medical grade display			X

1 Specifications

1.1 LCD Display, D-LCC12A-01

Display size	12.1 in diagonal (31cm)
Display type	Active Matrix Color TFT LCD
Display Resolution	SVGA, 800 x 600
Dimensions	
W × D × H	315 x 68 x 265 mm (12.4 x 2.7 x 10.4in)
Weight	2.75kg (6.1lb)
Connection cable	3 m
Electrical requirements	
Power consumption	15 W
Environmental requirements	
Operating temperature	+10...+35 °C (50...95°F)
Storage temperature	-10...+60 °C (14...140°F)
Relative humidity	10...93% non-condensing

1.2 15” Flat Panel Display, D-FPD15-00

Display size	15 in diagonal
Display type	Active Matrix Color TFT LCD Display
Resolution	XGA, 1024 x 768
Dimensions	
Outline (Desk stand and keypad holder included)	
W × D × H	375 x 247.4 x 371 mm (14.7 x 9.7 x 14.6 in)
Weight	8.6 kg (18.9 lbs)
Electrical requirements	
Rated voltage range	100 ... 250 V, 50 ... 60 Hz
Power consumption:	
ON	40 W typical
Stand-by	5 W
Environmental Requirements	
Operating temperature	+5...+35°C (+41...+95°F)
Storage temperature	-20...+60°C (-4...+140°F)
Atmospheric pressure	660...1060 hPa (660...1060 mbar)
Relative humidity	10...90% non-condensing

1.3 19" Medical Grade Display

Display size	19 in diagonal
Display type	Active Matrix Color TFT LCD Display
Resolution	SXGA, RGB, 1280 x 1024
Dimensions	
W × D × H	432 x 251 x 467 mm (17.3 x 10 x 18.7 in)
Weight	11 kg (24 lb) with desk stand
Electrical requirements	
See power connection requirements related to S/5 systems in *Part I/Installation*.	
Rated voltages and frequencies	100 ... 250 Vac +/- 10% 50/60 Hz
Power consumption:	
AC Line in	50 Wmax
at power saving	5 W
Monitor at full brightness	36 W typical, 40 W maximum
Power supply to display	External approved isolation transformer 120 VA.
Environmental Requirements	
Operating temperature	+5...+35°C (+41...+95°F)
Storage temperature	-20...+60°C (-4...+140°F)
Atmospheric pressure	
operating	697...1060 hPa (697...1060 mbar)
storage	187...1060 hPa (187...1060 mbar)
Relative humidity:	
Operating	10%...90%
Non operating	10%...90%

1.4 Display Controller Board, B-DISPX-01

Video output B-DISPX: analog RGB and DVI, 0.0V – 0.7V, 0.7V_{pp}, 75 ohm

Output data

VGA resolution

Resolution	640 × 480 pixels
Frame frequency	60 Hz
Scan frequency	31.6 kHz
Dot frequency	25 MHz
Sync polarity	H/negative, V/negative, level TTL

Sync pulse:

	Horizontal	Vertical
Front porch	0.624 µs	0.38 ms
Sync pulse	3.52 µs	0.062 ms
Back porch	1.968 µs	1.016 ms
Sweep time	31.61 µs	16.63 ms

SVGA resolution

Resolution	800 × 600 pixels
Frame frequency	60 Hz
Scan frequency	37.9 kHz
Dot frequency	40 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	1 µs	0.027 ms
Sync pulse	3.2 µs	0.105 ms
Back porch	2.2 µs	0.612 ms
Sweep time	26.39 µs	16.67 ms

XGA resolution

Resolution	1024 × 768 pixels
Frame frequency	75 Hz
Scan frequency	60.2 kHz
Dot frequency	78.75 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.205 µs	0.017 ms
Sync pulse	1.216 µs	0.05 ms
Back porch	2.24 µs	0.469 ms
Sweep time	16.61 µs	13.33 ms

SXGA resolution

Resolution	1280 × 1024 pixels
Frame frequency	60.13 Hz
Scan frequency	64.1 kHz
Dot frequency	108.4 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.45 µs	0.0158 ms
Sync pulse	1.032 µs	0.0466 ms
Back porch	2.28 µs	0.626 ms
Sweep time	15.6 µs	16.63 ms

2 Functional description

2.1 LCD Displays

D-LCC12A, D-FPD15 and 19" medical grade display

NOTE: The LCD display backlight circuit runs on a high voltage. Do not touch the inverter board when powered.

LCD Display D-LCC12A includes LCD display module, LCD interface board, and keyboard. The display keyboard works independent of the main keyboard.

The LCD Displays, D-FPD15 and 19" medical grade display include LCD display module and LCD interface board.

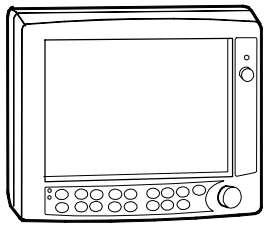
The LCD Display is connected to the Display controller board B-DISPX or B-CPU6 in the monitor frame with the LCD display interface cable.

The Display controller board B-DISPX or B-CPU6 sends video signals in both analog and digital form through its DVI connector.

Communication between the Display controller board and the keyboard is in RS232 serial format.

NOTE: D-LCC12A, D-FPD15 and 19" medical grade display require B-DISPX or B-CPU6.

2.1.1 D-LCC12A



D-LCC12A is a 12-inch LCD display, which is intended for use in the S/5 Anesthesia Monitor. D-LCC12A display has an integrated Command Board with monitor controls, menu keys and ComWheel.

D-LCC12A is a medical grade display.

The display can be mounted on a desk stand, wall or various anesthesia machines.

2.1.2 15” Flat Panel Display, D-FPD15

The 15" Flat Panel Display is intended to be used with Datex-Ohmeda S/5 Anesthesia and Critical Care Monitors. The display is provided with a desk stand and Command Bar holder. Standard VESA mounting solutions can be used with this display.

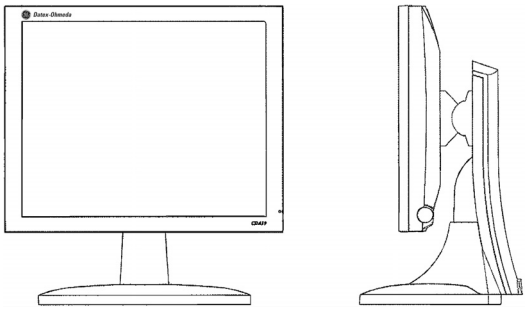
The display can accept either analog or digital video signal.

The country-specific power cable must be ordered separately.

The following cables are included: Analog signal cable (3 m long), DVI signal cable (3 m long).

More information about the 15" Flat Panel Display (D-FPD15) can be found in the display's User's Manual that is delivered with each display.

2.1.3 19” medical grade display



The 19” medical grade display is intended to be used with Datex-Ohmeda S/5 Anesthesia and Critical Care Monitors.

The 19” medical grade display is provided with a desk stand as default with the GCX adaptor included. Standard VESA mounting solutions can be used with this display.

The display can accept either analog or digital video signal.

A medical grade power supply adapter is included in the display delivery. The country-specific power cable must be ordered separately.

The following cables are included: Analog signal cable (1.8 m long), DVI signal cable (1.8 m long), DVI-DFP cable (1.8 m long).

2.2 External connector configurations

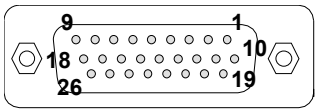


Table 2 Connector on LCD display, D-LCC12A

Pin No.	I/O	Signal	Notes
1	O	RED_VIDEO	Analog RGB to CRT
2	O	GREEN_VIDEO	
3	O	BLUE_VIDEO	
4	I	MON2ID0	
5	I	MON2ID1	
6	P	GND	
7	I	MON2ID0	
8	O	HSYNC2	
9	O	VSYNC2	
10	G	GND	
11	G	GND	
12	G	GND	
13	G	GND	
14	G	GND	
15	P	+5V	+5V to ComBar
16	I	ON_STBY	ON / StandBy signal from ComBar
17	G	GND	
18	G	GND	
19	I	RXDD	Serial data to/from ComBar
20	O	TXDD	
21	O	BRIGHTNESS	
22	O	CONTRAST	
23	O	NC	
24	O	NC	
25	PO	+32VD	Power supply for 10” display
26	PO	+32VD	

Connectors on:

- 15” Flat Panel Display (D-FPD15)
- 19” medical grade display

Information on the connectors can be found in the literature included with the display.

2.3 Display Controller Board, B-DISPX-01

B-DISPX board is connected to the CPU Mother board. The processor on the CPU board transmits programs through the CPU bus to the B-DISPX board, if needed.

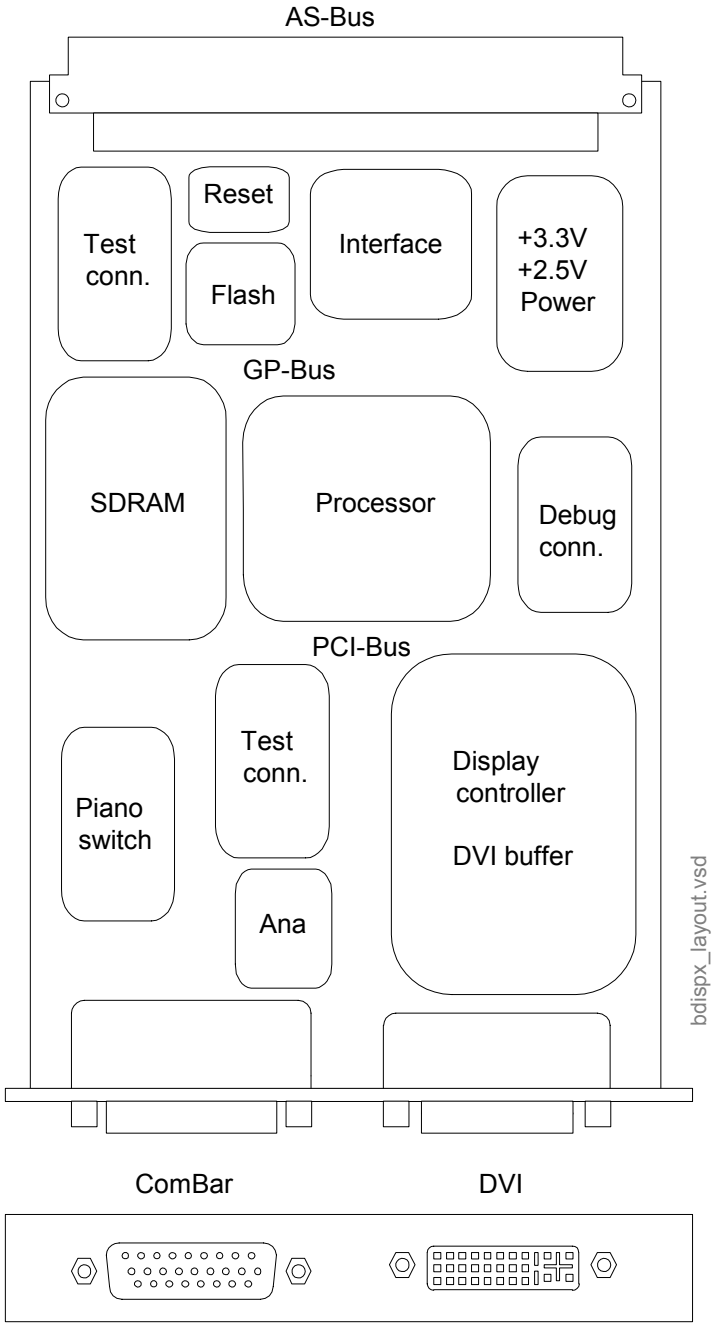


Figure 1 Display Controller Board, B-DISPX layout

NOTE: *B-DISPX-01 requires monitor software L-ANE05, L-ANE05A revision 01 and later (if available) or L-ICU05 and L-ICU05A revision 01 and later (if available).

Description of functional blocks

Processor

The graphics processor on B-DISPX is 486 based embedded processor. It uses 133MHz clock frequency.

System memory

System Memory is a SDRAM memory. The display board software and fonts are loaded to this memory during the operation of the display controller board. SDRAM serves also as a temporary storage for image data.

The processor reads SDRAM by 66MHz clock frequency.

Flash

Flash memory is written to the SDRAM memory.

If the display controller software in the Flash memory is of an older version than the corresponding part in the monitor software, or if the Flash memory is empty, the display controller software is written from the main CPU to the display controller Flash memory during start-up.

Display controller

The actual image to be displayed is formed in the Display controller memory according to the data sent by the main CPU. The display controller then sends the image to the display(s) both in analog and in digital (DVI) form.

DAC

The two outputs through this digital-analog converter are for future use.

FPGA

FPGA is used for interfacing the image data packages from the main CPU to the display controller processor (through SDRAM) and further to the Display controller part image memory.

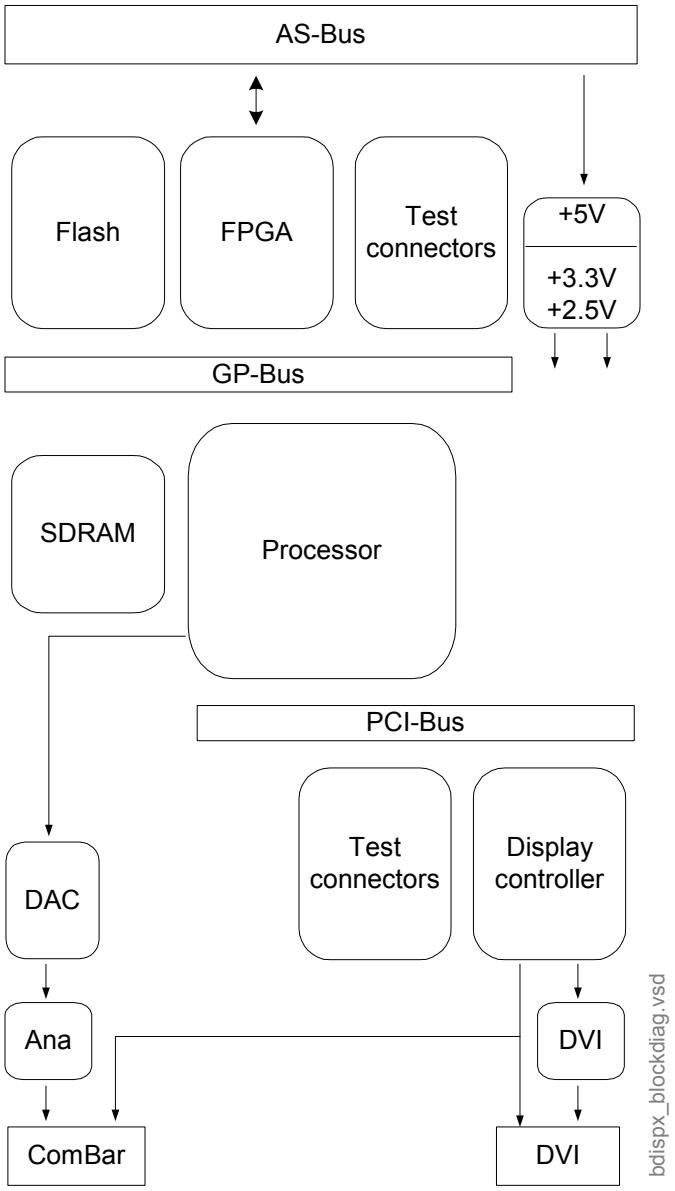


Figure 2 B-DISPX block diagram

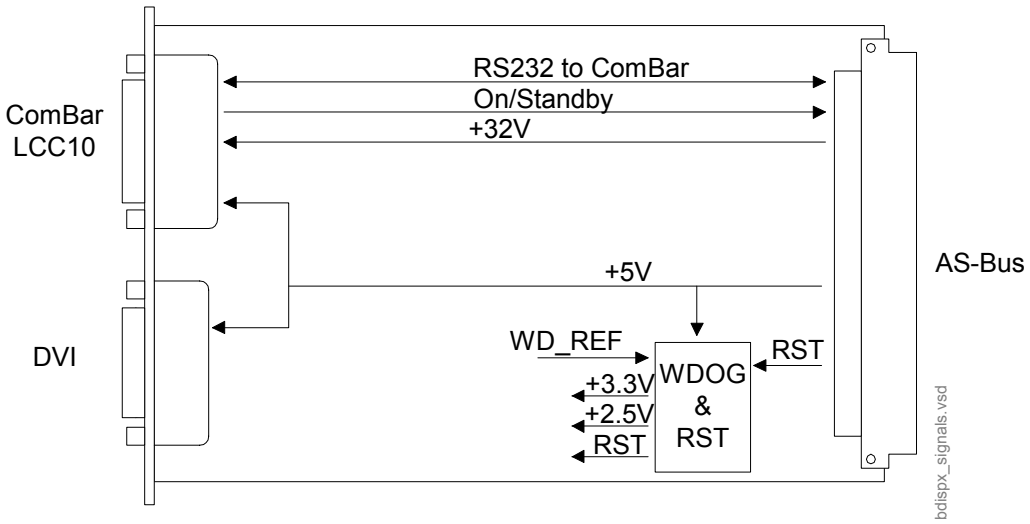


Figure 3 B-DISPX signals

Watchdog

Reset circuitry must generate system reset if watchdog is not refreshed within 2.5 sec.

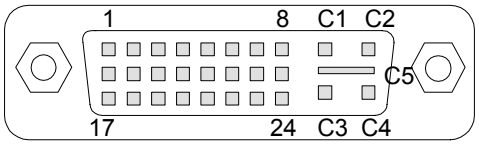
Master reset

System reset must be generated if master reset goes low. System reset must stay active 1100ms after supply voltages have reached valid levels.

DVI interface

Differential RGB data and clock links must operate according to DVI standard. +5V (±5% @ 100mA) voltage must be provided to DVI connector through current limitation circuitry.

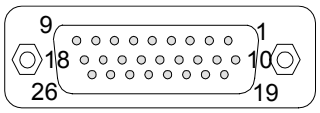
2.3.1 Output connectors, B-DISPX-01



DVI-interface

Pin		DIR	Level	Type	Description
1	TX2-	O	TMDS	DIF	Differential data to display
2	TX2+	O	TMDS	DIF	
3	2/4_SHIELD	G	GND		Shield for data pairs 2 & 4
4	TX4+	O	TMDS	DIF	Differential data to display
5	TX4-	O	TMDS	DIF	
6	DDC_CLOCK	O	OC	PU5	
7	DDC_DATA	I/O	OC	PU5	
8	ANA_VSYNC	O	CMOS		Vertical sync for analog display
9	TX1-	O	TMDS	DIF	Differential data to display
10	TX1+	O	TMDS	DIF	
11	1/3_SHIELD	G	GND		Shield for data pairs 1 & 3
12	TX3-	O	TMDS	DIF	Differential data to display
13	TX3+	O	TMDS	DIF	
14	+5V_OUT	PO	+5V		+5V supply to display
15	GND	G	GND		
16	HP_DET	I	+5V		HotPlug detection
17	TXD0-	O	TMDS	DIF	Differential data to display
18	TXD0+	O	TMDS	DIF	
19	0/5_SHIELD	G	GND		Shield for data pairs 0 & 5
20	TX5-	O	TMDS	DIF	Differential data to display
21	TX5+	O	TMDS	DIF	
22	CLK_SHIELD	G	GND		Shield for CLK pair
23	CLK+	O	TMDS	DIF	Differential CLK to display
24	CLK-	O	TMDS	DIF	
C1	ANA_RED	O	ANA		Red, Green and Blue for analog display
C2	ANA_GREEN	O	ANA		
C3	ANA_BLUE	O	ANA		
C4	ANA_HSYNC	O	CMOS		Horizontal sync for analog display
C5	ANA_RETURN	G	GND		Return ground for analog interface

ComBar connector



ROW		DIR	Level	Type	Description	ROW
1	RED_VIDEO	O	ANA		Analog RGB to CRT	
2	GREEN_VIDEO	O	ANA			
3	BLUE_VIDEO	O	ANA			
4	MON2ID0	I	LVCMOS	PU3		pull-up 4.7k
5	MON2ID1	I	LVCMOS	PU3		pull-up 4.7k
6	GND	P	GND			
7	MON2ID0	I	LVCMOS	PU3		pull-up 4.7k
8	HSYNC2	O	CMOS			
9	VSYNC2	O	CMOS			
10	GND	G	GND			
11	GND	G	GND			
12	GND	G	GND			
13	GND	G	GND			
14	GND	G	GND			
15	+5V	P	+5V		+5V to ComBar	
16	ON_STBY	I	+5V		ON / StandBy signal from	pass-through
17	GND	G	GND			
18	GND	G	GND			
19	RXDD	I	RS232	STD	Serial data to/from ComBar	pass-through
20	TXDD	O	RS232	STD		
21	BRIGHTNESS	O	ANA			
22	CONTRAST	O	ANA			
23	+2.5V_SENSE	O	+2.5V		+2.5V sense for unit tester	
24	+3.3V_SENSE	O	+3.3V		+3.3V sense for unit tester	
25	+32VD	PO	+32V		Power supply for 10” display	
26	+32VD	PO	+32V			

3 Service procedures

3.1 General service information

Field repair is limited to replacing parts that are listed in the corresponding spare part lists.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation and a detailed description of the fault.

WARNING **Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.**

3.1.1 LCD Display, D-LCC12A

The D-LCC12A contains a replaceable backlight.

3.1.2 15" Flat Panel Display, D-FPD15

Maintenance is limited to the basic adjustments through the display's Control dial.
The display should be returned to GE Healthcare for repair.

3.1.3 19" Medical Grade Display

Maintenance is limited to the basic adjustments through the display's Control dial.
The display should be returned to GE Healthcare for repair.

3.2 Service check

These instructions include complete procedures for a service check. The service check is mandatory after any service repair. However, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include check forms, which may be used when performing the procedures.

The symbol  in the instructions indicates that the check form contains space to record the results of the particular procedure.

3.2.1 LCD Display, D-LCC12A

Tools needed

Central Unit, B-CPU6 or B-DISPX and a screwdriver

Visual inspection

Turn off the monitor.

1. Interface cable

   Disconnect and check the LCD display interface cable:

   The monitor side connector:

   – the connector pins are clean and straight and at about the same height
   – the locking screws are intact

   The display side connector:

   – the screw(s) on the casing is tightened properly
   – the connector pins are clean and intact
   – the locking screws/claws are intact

   Check also that the cable itself is intact.

   Detach the rear cover by removing the eight screws from the corners.

2. Check internal parts
   – all screws are tightened properly
   – all cables are connected properly
   – all IC™s that are on sockets are attached properly
   – there are no loose objects inside the display

   Reattach the rear cover.

3. Check external parts
   – the outer cover is intact
   – the display screen is intact
   – the block screws for the cable are in place and tightened properly (if installed)
   – the block screw threads are intact (if installed)

Functional inspection

Turn on the monitor.

4. Check the picture

   Check that the picture on the LCD display screen is clear and stable.

   Check also that the colors are clear.

NOTE: Check that the display screen uses the SVGA mode.

NOTE: The SVGA resolution must be set every time after Factory Reset.

Monitor Setup - *Install/Service* (password 16-4-34) ***Installation - Display Setup***

NOTE: After changing the resolution, the monitor must be restarted before the setting becomes active.

5. Keyboard software

   Enter the service menu:

   Monitor Setup - *Install/Service* (password 16-4-34) - ***Service*** (password 26-23-8)

   Take down the information regarding the LCD display keyboard software.

   Select ***KEYBOARD*** - ***UPPER LED***.

6. Check the alarm LEDs

   Check that the red alarm LED is turning on and off on the LCD display when pressing the ComWheel.

   Check also the yellow alarm LED by selecting ***LOWER LED*** from the menu.

7. Membrane keys

   Check the LCD display membrane keys.

   Press the keys on the LCD display front panel one by one.

   Check that each key generates a sound from the loudspeaker and the corresponding text in the menu changes from yellow to red.

8. Check the ComWheel

   Turn the ComWheel clockwise and counter clockwise and check that each step generates a sound from the loudspeaker and the corresponding values at the bottom of the menu increase.

   Select ***DUMMY PRESS*** and check that the press generates a sound and the corresponding value in the menu increases.

9. Electrical safety check

   Perform an electrical safety check and a leakage current test.

10. Functioning after safety check
    Check that the LCD display functions normally after the performed electrical safety check.

11. Final cleaning
    Clean the LCD display with suitable detergent.

- Fill in all necessary documents.

3.2.2 15" Flat Panel Display, D-FPD15

Tools needed

Central Unit, B-CPU6 or B-DISPX and K-ANEB/K-ICUB Command Bar.

Visual inspection

Turn off the monitor and display.

1. Video cable
   – Check that the video cable is intact.
   – Check that the video cable is properly connected and locked both to the monitor board and to the display with the locking screws.
   – Check that the power cord is intact and properly in place.

2. External parts
   Check external parts:
   – the outer cover is intact
   – the display screen is intact
   – the desk stand is intact and tightened properly
   – the keypad holder is intact and tightened properly

Functional inspection

Turn on the monitor and press the Control dial to turn on the LCD display.

3. Resolution
   Wait until the normal monitoring screen appears on the LCD display.
   Check that the picture on the LCD display screen is clear and stable.

NOTE: Check that the display screen uses the XGA resolution.

Monitor Setup - *Install/Service* (password 16-4-34) - ***Installation - Display Setup***

NOTE: After changing the resolution, the monitor must be restarted before the new setting becomes effective. If the resolution setting is not correct after the monitor restart, check that the resolution jumpers or dip switches on the display controller board are positioned correctly.

4. Brightness and contrast adjustments

   Press the Control dial while the LCD display is on to activate the OSD menu (on-screen-display).

NOTE: Pressing the Control dial for more than 2 seconds turns the power off.

   Perform the contrast and brightness adjustments if needed. Please refer to the display's User's Manual.

5. Color temperature adjustments

   Perform the color adjustments if needed. Please refer to the display's User's Manual.

6. Auto Setup

   Perform Auto Setup to automatically adjust the screen size, position, phase and clock, if needed.

NOTE: This adjustment is available only with analog input (VGA cable). This function is not available for digital input (DVI).

NOTE: Position adjustments, clock and phase can be adjusted also manually. Please refer to the display's User's Manual.

   Exit the OSD menu and go back to the normal screen.

7. Electrical safety check

   Perform an electrical safety check and a leakage current test.

8. Functioning after safety check

   Check that the LCD display functions normally after the performed electrical safety check.

9. Final cleaning

   Clean the LCD display with suitable detergent.

- Fill in all necessary documents.

3.2.3 19" medical grade display

Tools needed

Central Unit, B-DISPX or B-CPU6 and Keyboard K-ANEB/K-ICUB.

Visual inspection

Turn off the monitor and display.

1. Interface cable

   Disconnect and check the LCD display interface cable:

   The monitor side connector:

   – the connector pins are clean and straight and at about the same height
   – the locking screws are intact

   The display side connector:

   – the screw(s) on the casing is tightened properly
   – the connector pins are clean and intact
   – the locking screws/claws are intact

   Check also that the cable itself is intact.

2. Check external parts
   – the outer cover is intact
   – the display screen is intact
   – the block screws for the cable are in place and are tightened properly (if installed)
   – the block screw threads are intact (if installed)

Functional inspection

3. Power cord

   Connect and lock the LCD interface cable to the LCD display and to the board in the monitor.

   Check that the display power cord is intact and properly in place.

- Turn on the monitor and press the Control dial to turn on the LCD display.

4. LCD display picture

   Wait until the normal monitoring screen appears onto the LCD display.

   Check that the picture on the LCD display screen is clear and stable.

NOTE: Check that the display screen uses the SXGA resolution.

NOTE: The SXGA resolution must be set every time after Factory Reset.

Monitor Setup - *Install*/*Service* (password 16-4-34) **- *Installation*** - ***Display setup***

NOTE: After changing the resolution, the monitor must be restarted before the setting becomes active.

5. Brightness and contrast adjustments

   Press the Control dial while the LCD display is on to activate the OSD menu (on-screen-display).

NOTE: Pressing the Control dial for more than 2 seconds turns the power off.

   Perform the contrast and brightness adjustments if needed. Please refer to the display's User's Manual.

6. Color temperature adjustments

   Perform the color adjustments if needed. Please refer to the display's User's Manual.

7. Auto Setup

   Perform Auto Setup to automatically adjust the screen size, position, phase and clock, if needed.

NOTE: This adjustment is available only with analog input (VGA cable). This function is not available for digital input (DVI).

NOTE: Position adjustments, clock and phase can be adjusted also manually. Please refer to the display's User's Manual.

   Exit the OSD menu and go back to the normal screen.

8. Electrical safety check

   Perform an electrical safety check and a leakage current test.

9. Functioning after safety check

   Check that the LCD display functions normally after the performed electrical safety check.

10. Final cleaning

    Clean the LCD display with suitable detergent.

- Fill in all necessary documents.

3.3 Disassembly and reassembly

3.3.1 LCD Display, D-LCC12A

WARNING **Wear a static control wrist strap and soft cotton gloves (dust free) when handling the LCD display parts. Hold them by their corners or edges. Do not touch the connector pins.**

In normal circumstances it is very difficult to keep the LCD Display component and the display shield surfaces free of dust, when the LCD Display unit assembly is opened and they are exposed to room air. If dust particles remain on the LCD Display component and the display shield surfaces, they may impair the picture quality on the screen.

In case you need to detach the LCD Display component for repair, you may return it to be repaired at GE Healthcare. If you can provide a dust free environment, follow the instructions below.

See also the Exploded view of the LCD Display, D-LCC12A.

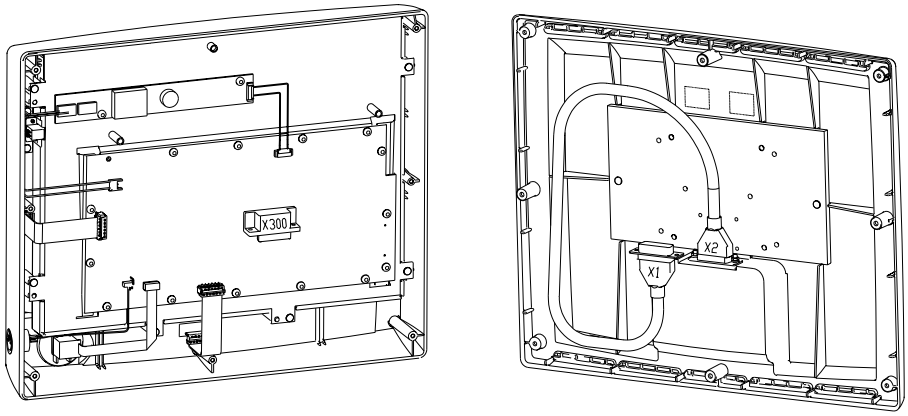


Figure 4 D-LCC12A inside view

1. Turn off the monitor. Detach the display from the mount and disconnect the LCD interface cable at the display side.
2. Place the display carefully on a clean surface with the display screen side down.
3. Open the eight screws holding the display rear cover and detach the rear cover.
4. Open the two screws on the video cable connector and disconnect the video cable from the LCD Controller Board. Place the rear cover with the video cable aside.
5. Disconnect all other cables carefully from the LCD Controller Board.
6. Open the 15 screws holding the LCD Controller Board in the LCD Display Unit. Detach the LCD Controller Board carefully from the LCD Display Unit (connector X102 underneath connects to the LCD Display component).
7. Disconnect the backlight unit cables carefully from the Inverter Board. Open the six screws holding the LCD Display Unit metal frame in the display front cover. Detach the upper part of the metal frame.
8. Open the four screws holding the LCD Display Unit in the metal frame.
9. Lift the LCD Display Unit carefully up.

Reassembly of the display is made in reversed order. Make sure that all connectors are connected properly and cables are not pinched between covers.

NOTE: Do not use excessive force when fastening the LCD Display component to the metal frame. Fastening the screws too tightly might bend the display module too much and break it. The screws must also be fastened gradually: first fasten all screws slightly, then more tightly.

NOTE: When reassembling the LCD Display Unit, be careful that no dirt or fingerprints are left between the LCD Display component and the protection glass window.

NOTE: If the LCD Display Unit is broken, handle it carefully to avoid injury (the LCD Display component and the backlight lamp(s) are made of glass). Wash your hands if you touched liquid crystal, which may flow out from a broken LCD Display component.

NOTE: Do not touch, push or rub the exposed display module surface. Keep the surface clean.

Replacing the backlight unit

1. Turn off the monitor. Detach the display from the mount and disconnect the LCD interface cable at the display side.
2. Place the display carefully on a clean surface with the display screen side down.
3. Open the eight screws holding the display rear cover and detach the rear cover.
4. Open the two screws on the video cable connector and disconnect the video cable from the LCD Controller Board. Place the rear cover with the video cable aside.
5. Disconnect all other cables carefully from the LCD Controller Board.
6. Open the 15 screws holding the LCD Controller Board in the LCD Display Unit. Detach the LCD Controller Board carefully from the LCD Display Unit (connector X102 underneath connects to the LCD Display component).
7. Disconnect the backlight unit cables carefully from the Inverter Board. Open the six screws holding the LCD Display Unit metal frame in the display front cover. Detach the upper part of the metal frame.
8. Lift the LCD Display Unit together with lower part of the metal frame carefully up and place it on a clean surface with the display screen side down.
9. Release the screw holding the backlight unit.

NOTE: The screw cannot be removed totally, only released.

10. Detach the backlight unit by sliding it to the left and then lifting up.

NOTE: Do not bend the backlight unit.

NOTE: Do not touch the backlight tubes with your hands.

Reassembly of the LCD Display is made in reversed order. Make sure that all connectors are connected properly and cables are not pinched between covers.

3.3.2 15" Flat Panel Display, D-FPD15

Do not disassemble.

3.3.3 19" Medical Grade Display

Do not disassemble.

4 Troubleshooting

Check the compatibility of the display and the display controller board, see page 1.

For the compatibility of the display controller and the monitor software see the note on page 1

4.1 LCD Displays

4.1.1 D-LCC12A

Problem	Cause	Treatment
No image on screen and no backlight	No power or loose interface cable.	Check LCD - ON/STBY switch position and interface cable.
No image on screen, backlight on	Cables may be loose. Display controller board or LCD Interface board failure.	Check the items. Replace the board(s) if necessary.
Vertical stripes on right side of screen continuously	Jumpers in Display controller board not positioned correctly.	Check the jumpers. See Installation section in Part I for details.
Only small portion of CRT screen is displayed on LCD display in zoomed-up form	LCD Display defined as High Resolution Display.	Change the resolution setting through the installation menus (in monitor software).
Unstable image	+5 V unstable. Loose cable. Jumpers in Display controller board not positioned correctly or board failure. LCD Interface board failure.	Check cable connections. Check the jumpers. Check the board(s) and replace if necessary.
Backlight flickering or dim	Backlight connector failure or lamp/LCD Interface board failure.	Check the connector. Check the lamp/ LCD Interface board failure. If faulty lamp, replace the backlight, if possible. See chapter 3.3. Disassembly and reassembly.

4.1.2 15" Flat Panel Display, D-FPD15

Please refer also to the display's Operators Manual.

Problem	Cause	Treatment
No image on screen	No power.	Check power. Check that both the patient monitor and the display are ON.
	Defective power adapter.	Replace display's power adapter.
	Loose or broken video cable.	Tighten or replace video cable.
	Defective display controller board.	Replace display controller board.
	Defective display.	Replace display.
Picture is unclear	Wrong resolution selected in AM/CCM menu.	Adjust resolution from the AM/CCM menu (**Monitor Setup - *Install/Service*** - ***Installation*** - ***Display Setup***)
	Jumpers in Display controller board not positioned correctly.	Check the jumpers. See Installation section in Part I for details.
	Wrong adjustments.	Use auto setup, or position, phase or clock adjustments in the OSD menu.

4.1.3 19" medical grade display

Please refer also to the display's Operators Manual.

Problem	Cause	Treatment
No image on screen and no backlight	No power or loose interface cable.	Check LCD - ON/STBY switch position and interface cable.
No image on screen, backlight on	Cables may be loose. Display controller board or LCD Interface board failure.	Check the items. Replace the Display controller board or change the display if necessary.
Vertical stripes on right side of screen continuously	Jumpers or dip switches on Display controller board not positioned correctly.	Check the jumpers or dip switches. See Installation section in Part I for details.
Picture is unclear. The picture looks much larger than the display screen.	Wrong resolution.	Change the resolution to SXGA Go to monitor setup -> Install/Service→Installation → Display Setup menu select the resolution. The change is effective after start-up. NOTE: The resolution must be set after every Factory Reset.
Picture is unclear. Colors are not correct.	Display controller board is not compatible with the display.	Check that the display controller board is compatible with the display. 19" medical grade display requires B-DISPX or B-CPU6.

4.2 Display Controller Board, B-DISPX

Problem	Cause	Treatment
No image on the screen	No power Cable or display board loose Board or display faulty	Check power on Check cable and board connections Try with another board and/or display
Regular stripes on the picture	Faulty Display controller board Display not fully compatible with display controller board	Replace the board. Try an other type of display or display controller board
Part of the screen has wrong colors	Triac board failure	Replace triac board, see Part II/8-Module Frame, F-CU8/Power supply.
Picture disfigured	Outer magnetic field	Turn the monitor off, wait 10 minutes and turn the monitor on again in order to demagnetize the screen.
The picture is unclear The picture looks much larger than the display screen	The set resolution is not compatible with the display in use.	Change the resolution setting through the installation menus (in monitor software).

5 Earlier revisions

For information about earlier displays please refer to “Technical Reference Manual M1021563”. This manual fully supports the earlier revisions, except for the following displays. In their case, please refer to the following manuals for more service information:

LCD-Display D-LCC10 revision 01	Service Manual p/n 882580
LCD-Display D-LCC10 revision 02	Service Manual p/n 885930
LCD-Display D-LCC10 revision 03...04	Technical Reference Manual 8005672 and 8005796: Displays and Display Contollers slot 8005675

This manual fully supports:

12” LCD Display, D-LCC12

Flat Panel Display (D-FPD15)

Medical Grade Display

Display Controller, B-DISPX

CPU Board, B-CPU6

APPENDIX A: Service Check Form, LCD Display, D-LCC12A

Customer		
Service	Display type and revision	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Interface cable	☐	☐	☐	2. Check internal parts	☐	☐	☐
3. Check external parts	☐	☐	☐	4. Check the picture	☐	☐	☐
Notes							
5. Keyboard software	☐	☐	☐		☐	☐	☐
6. Check the alarm LEDs	☐	☐	☐	7. Membrane keys	☐	☐	☐
8. Check the ComWheel	☐	☐	☐		☐	☐	☐
Notes							

9. Electrical safety check	☐	☐	☐	10. Functioning after safety check	☐	☐	☐
11. Final cleaning	☐	☐	☐				

Notes

Used spare parts			

Signature

For your notes:

APPENDIX B: Service Check Form, 15" Flat Panel Display, D-FPD15

Customer		
Service	Display type and revision	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Video cable	☐	☐	☐	2. External parts	☐	☐	☐
3. Resolution	☐	☐	☐	4. Brightness and contrast adjustments	☐	☐	☐
Notes							
5. Color temperature adjustments	☐	☐	☐	6. Auto Setup	☐	☐	☐
7. Electrical safety check	☐	☐	☐	8. Functioning after safety check	☐	☐	☐
9. Final cleaning	☐	☐	☐				

Notes

Used spare parts			

Signature

For your notes:

APPENDIX C: Service Check Form, 19" medical grade display

Customer		
Service	Display type and revision	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Interface cable	☐	☐	☐	2. Check external parts	☐	☐	☐
3. Power cord	☐	☐	☐	4. LCD display picture			
Notes							
5. Brightness and contrast adjustments	☐	☐	☐	6. Color temperature adjustments	☐	☐	☐
7. Auto Setup	☐	☐	☐				
Notes							

8. Electrical safety check	☐	☐	☐	9. Functioning after safety check	☐	☐	☐
10. Final cleaning	☐	☐	☐				

Notes

Used spare parts			

Signature

For your notes:

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S/5™ Command Bar, K-ANEB, K-ICUB

Technical Reference Manual Slot

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

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

All specifications subject to change without notice.

Document number M1125639-03

March 11, 2009

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Table of contents

Table of contents i

Introduction 1

1 Specifications 2
1.1 Command Bar, K-ANEB/K-ICUB . . . 2

2 Functional description 3
2.1 Command Bars, K-ANEB/K-ICUB . . . 3
2.1.1 Command Bar PCB . . . 3
2.1.2 External communication . . . 3
2.1.3 ComWheel . . . 3
2.1.4 LEDs . . . 4
2.1.5 Connectors and signals . . . 4

3 Service procedures 5
3.1 General service information . . . 5
3.2 Service check . . . 5
3.2.1 Recommended tools . . . 5
3.2.2 Visual inspection . . . 5
3.2.3 Functional inspection . . . 6
3.3 Disassembly and reassembly . . . 8
3.3.1 Command Bar, K-ANEB/ K-ICUB . . . 8

4 Troubleshooting 9
4.1 K-ANEB/ K-ICUB . . . 9

5 Earlier revisions 10

Appendix A: Service check form, Command Bar, K-ANEB/K-ICUB A-1

Introduction

This section provides information about the maintenance and service of the following products:

- Command Bars, K-ANEB/ K-ICUB

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

1 Specifications

1.1 Command Bar, K-ANEB/K-ICUB

Dimensions, W × D × H	282 × 26 × 54 mm / 11 x 1 x 2 in
Weight (incl. cable)	0.4 kg / 0.9 lbs
Input voltage	5 V
Power consumption	350 mW max
Communication protocol	RS-232

2 Functional description

2.1 Command Bars, K-ANEB/K-ICUB

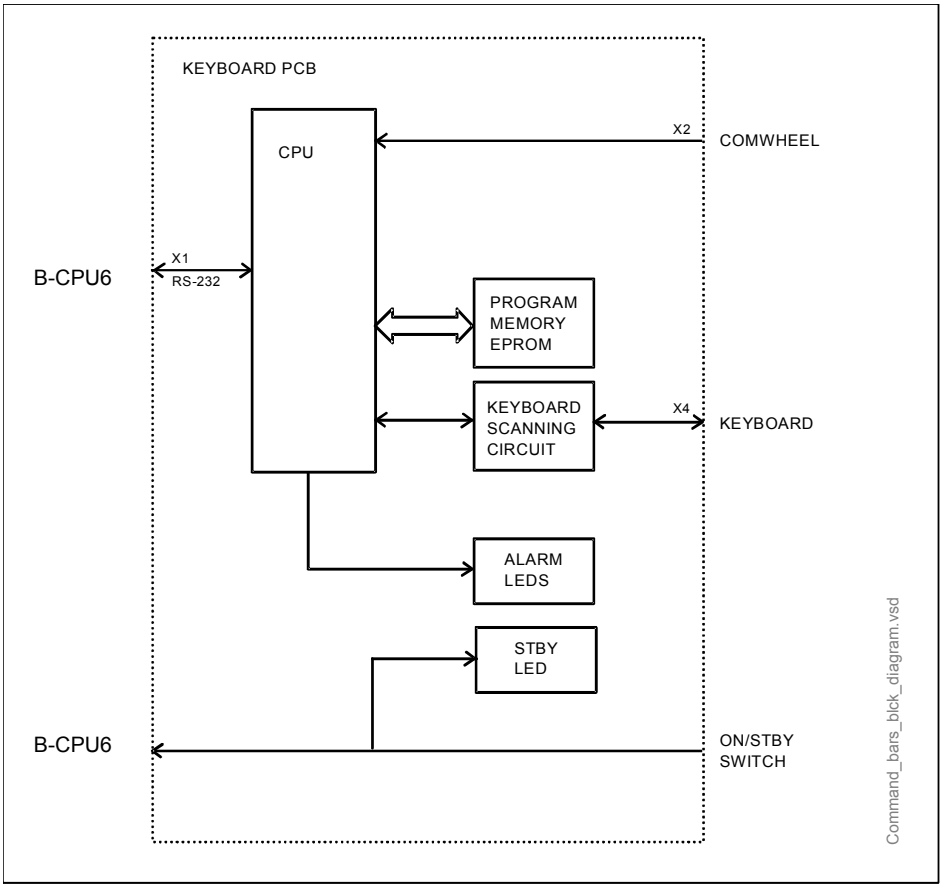


Figure 1 K-ANEB/K-ICUB block diagram

2.1.1 Command Bar PCB

The PCB is located inside the Command Bar. The board reads the status of the front panel keys and the ComWheel and forwards the information to the CPU board.

2.1.2 External communication

Communication with the host processor takes place in RS232 serial communication channels which are available in both the CPU bus and the module bus. Two signals, TXD and RXD, are in use. No handshaking is used. The 26-pin subminiature D-connector of the Command Bar is connected to a B-CPU6. Serial communication speed rate is 19.2 kbps.

2.1.3 ComWheel

The ComWheel on the front panel is used for menu selection.

2.1.4 LEDs

The alarm LEDs are activated by the Command Bar PCB under the commands received via serial communication from the CPU board. The red or yellow alarm LED is lit, when the red or yellow alarm is activated. The green STBY led is lit, when the device is turned to stand-by and connected to the mains.

NOTE: If there are two Command Bars connected to the system, the system is ON (STBY LED not lit), when at least one of the switches is positioned ON.

2.1.5 Connectors and signals

Table 1 26-pin D-connector on K-ANEB/K-ICUB

Pin No	I/O	Signal
1		Not connected
2		Not connected
3		Not connected
4		Not connected
5		Not connected
6	I	GND
7		Not connected
8		Not connected
9		Not connected
10		Not connected
11		Not connected
12		Not connected
13		Not connected
14		Not connected
15	I	+5 V
16	O	ON/STBY
17		Not connected
18		Not connected
19	O	TXDD RS232
20	I	RXDD RS232
21		Not connected
22		Not connected
23		Not connected
24		Not connected
25		Not connected
26		Not connected

3 Service procedures

3.1 General service information

Field service is limited to replacing faulty PC boards or mechanical parts. The PC boards are then returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation and a detailed description of the fault.

WARNING **Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.**

3.2 Service check

These instructions include complete procedures for a service check. The service check is mandatory after any service repair. However, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A:") which may be used when performing the procedures.

The symbol  in the instructions indicates that the check form contains space to record the results of the particular procedure.

3.2.1 Recommended tools

Tool	Order No.	Notes
Central Unit		
Screwdriver		

3.2.2 Visual inspection

- If the monitor is switched on, turn the monitor to STBY.

1. Cable

   Disconnect the command bar cable from the B-CPU6 board.
   Check that the connector pins of the cable are clean, straight and at about the same height. Check that the cable is intact. Check that the locking screws inside the connector case are intact.

   Leave the cable disconnected.

2. Front cover and front panel sticker

   Check that the plastic front cover and the front panel sticker are intact.

3. ComWheel cover

   Check that the ComWheel cover is intact and attached properly.

4. ON/STBY switch

   Check that the ON/STBY switch is intact and attached properly. Check that the ON/STBY switch changes its state firmly when turning it back and forth. Leave the switch into STBY position.

5. Stand-by LED

   Reconnect and lock the command bar cable to the B-CPU6 board.

   Check that the green stand-by LED is lit up (the Central Unit power cord is connected to the mains).

3.2.3 Functional inspection

- Turn the monitor on and enter the service menu:
  Monitor Setup - *Install/Service* (password 16-4-34) **- *Service*** (password 26-23-8)

6. Keyboard version

   Record the information regarding keyboard software.

7. Alarm LEDs

   Select the menu ***KEYBOARD*** with the ComWheel.

   Highlight the text ***UPPER LED***. Check that the red alarm LED is turning on and off when pressing the ComWheel. Check also the yellow alarm LED by selecting ***LOWER LED*** from the menu.

8. Membrane keys

   Press the keys one by one. Check that each key generates a sound from the loudspeaker and the corresponding text in the menu changes from yellow to red.

9. ComWheel

   Turn the ComWheel clockwise and counterclockwise and check that each step generates a sound and the corresponding values at the bottom of the menu increase.

   Select ***DUMMY PRESS***. Press the ComWheel and check that the press generates a sound and the corresponding value in the menu increases.

10. Electrical safety check

    Perform an electrical safety check and a leakage current test.

11. Functioning after electrical safety check

    Check that the Command Bar functions normally after the performed electrical safety check.

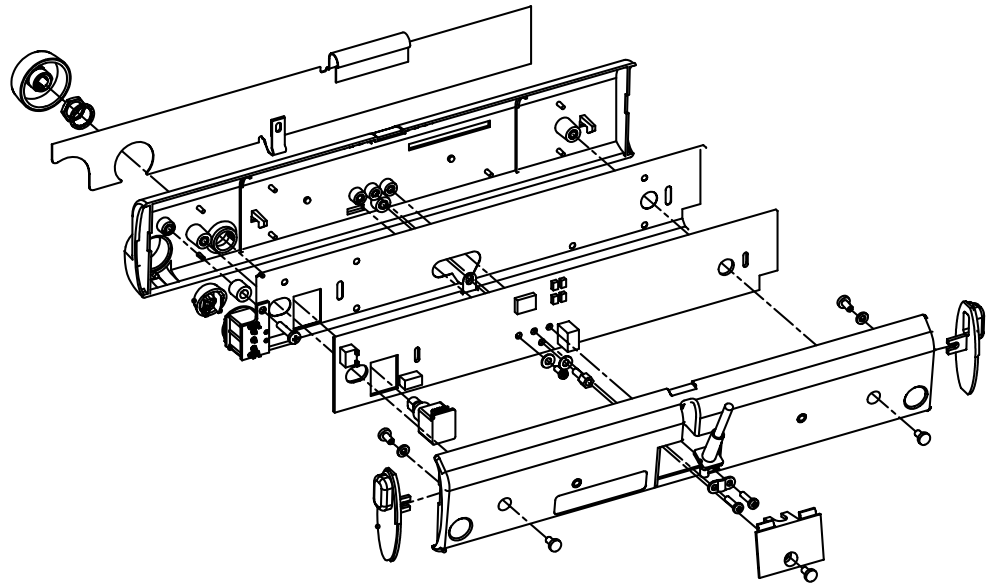
12. Final cleaning

    Clean the Command Bar.

- Fill in all necessary documents.

3.3 Disassembly and reassembly

3.3.1 Command Bar, K-ANEB/ K-ICUB



The Command Bar is disassembled according to the following procedure. Please refer to the exploded view of the Command Bar.

1. Verify that the monitor is set to standby and Disconnect the Command Bar cable from the Central Unit.
2. Remove the Command Bar from the display unit.
3. Unscrew the three screws holding the front cover of the Command Bar to the rear cover. Carefully remove the rear cover.
4. Disconnect the Command Bar cable, the wire set from the ON/STBY switch, the wire set from the ComWheel (K-ANEB, K-ICUB) and the flat cable from the membrane keyboard (K-ANEB, K-ICUB).
5. Detach the Command Bar PCB by pressing the two plastic fasteners holding the PCB in place and simultaneously lifting off the PCB.
6. The Command Bar is reassembled by reversing the disassembly procedure.

4 Troubleshooting

4.1 K-ANEB/ K-ICUB

See Keyboard Service Menu in Service Menu Slot “Section 1”, and perform the tests available. If any of the tests fail, see explanation below.

Problem	Cause	What to do
ON/STBY switch not working	Keyboard cable loose or broken. D-26 connector pin failure. Switch leads broken. Switch connector loose. Switch faulty.	Check the items. Replace them if necessary
ComWheel not working	ComWheel leads broken or connector loose. ComWheel faulty.	Check the items. Replace the ComWheel if necessary
Membrane key not working	Switch cable loose or broken. Keyboard cable loose or broken. D-26 connector pin failure. RS232 communication failure on CPU board	Check the items. Replace them if necessary.

5 Earlier revisions

For more service information on the command boards, K-ANE and K-ICU, please refer to:

Technical Reference Manual M1021563

Command Board revision 01	Service Manual p/n 880850
Command Board revision 02	Service Manual p/n 885930

This manual supports all later revisions.

APPENDIX A: Service check form, Command Bar, K-ANEB/K-ICUB

Customer		
Service	Keyboard type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Cable	☐	☐	☐	2. Front cover and front panel sticker	☐	☐	☐
3. ComWheel cover	☐	☐	☐	4. ON/STBY switch	☐	☐	☐
5. Stand-by LED	☐	☐	☐				
6. Keyboard version	KB						
7. Alarm LEDs	☐	☐	☐	8. Membrane keys	☐	☐	☐
9. ComWheel	☐	☐	☐				
Notes							

10. Electrical safety check	☐	☐	☐	11. Functioning after electrical safety check	☐	☐	☐
12. Final cleaning	☐	☐	☐				

Notes

Used spare parts			

Signature

For your notes:

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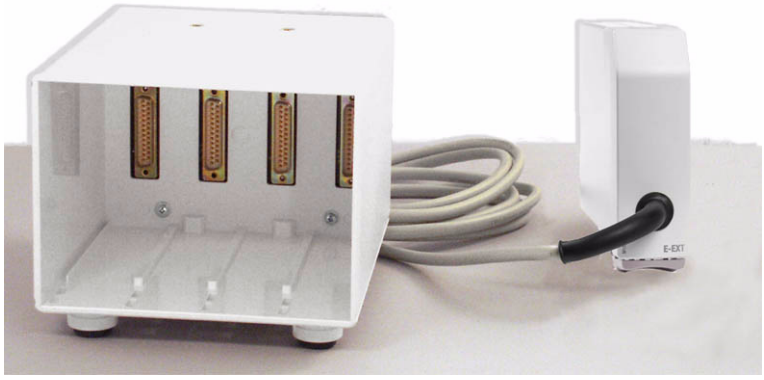
S/5 Extension Frame, F-EXT
S/5 Extension Module, E-EXT

Technical Reference Manual Slot



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

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

All specifications subject to change without notice.

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Table of contents

Table of contents i

Introduction 1

1 Specifications 2
1.1 General specifications 2

2 Functional description 3
2.1 Connectors and signals 5
2.1.1 Module bus connector 5
2.1.2 Other connectors 6

3 Service procedures 7
3.1 Service check 7
3.1.1 Recommended tools 7
3.1.2 Visual inspection 7
3.1.3 Functional inspection 9
3.2 Disassembly and reassembly 11
3.2.1 Changing the fuse 11

4 Troubleshooting 12
4.1 Troubleshooting chart 12

5 Earlier revisions 13

Appendix A: Service check form, Extension Frame, F-EXT4, Extension Module, E-EXT A-1

Introduction

The Extension Frame, F-EXT4 is designed for use with S/5 monitors and provides four additional module slots, and allows the measuring modules to be placed near the patient. The Extension Frame, F-EXT4 is connected to the monitor with the extension module, E-EXT. F-EXT takes up one module slot in the F-CU8 frame.

NOTES:

- Do not use F-EXT with F-CU5/F-CU5P.
- Only one F-EXT4 can be connected to the monitor at a time.
- The following modules cannot be used in the F-EXT4
  - Recorder Module, E-REC
  - Memory Module, E-MEM
  - Interface Module, E-INT
  - Compact Airway Modules, E-Cxxxxx
- Do not use identical modules simultaneously in the extension frame and in the host monitor.
- When the extension frame is used with the S/5 Anesthesia Monitor, the F-CU8 must be of rev. 03 or later.

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

1 Specifications

1.1 General specifications

Frame size (W × D × H)	160 × 205 × 137 mm / 6.3 x 8 x 5.4 in
(with module)	160 × 228 × 137 mm / 6.3 x 8.9 x 5.4 in
Frame weight	1.3 kg / 2.8 lbs
Power consumption	35 W (max at input voltage of +32 V) with PRESTN module inserted and NIBP pump working.
Module size (W × D × H)	37 × 180 × 112 mm/1.5 × 7.1 × 4.4 in

2 Functional description

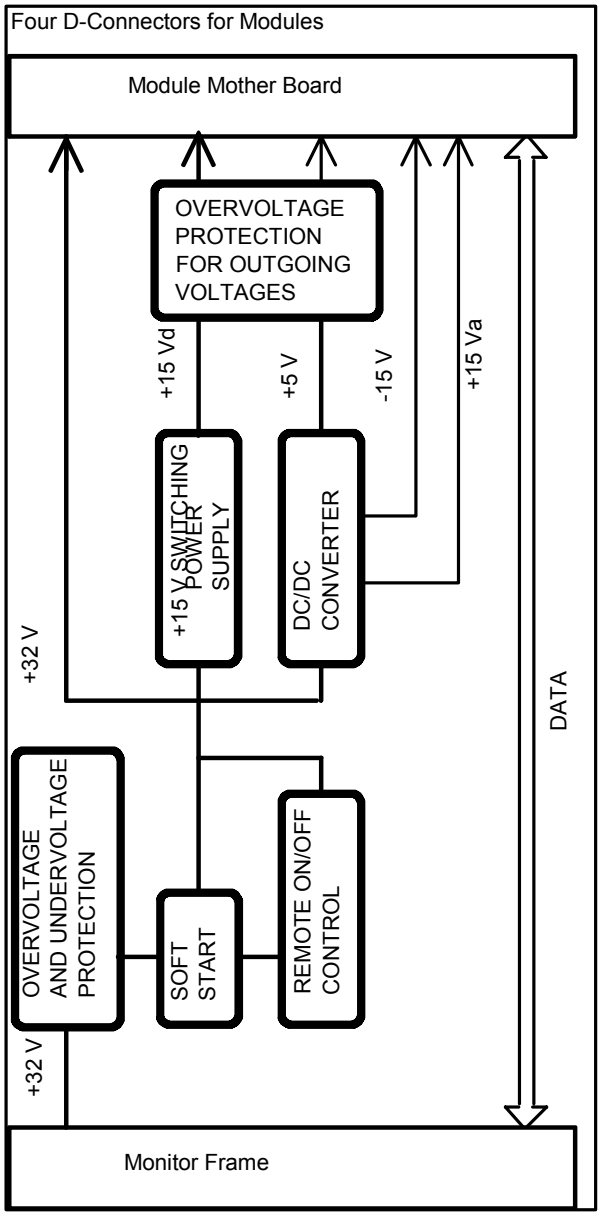


Figure 1 F-EXT electronics unit block diagram

The Extension Frame, F-EXT4, contains the module motherboard, power supply board, and space for four single-width or two double-width modules.

The electronic unit receives +32 V from the monitor frame and generates from it necessary operational voltages for the inserted modules. The received +32 V is passed through fuse (F1) and filtered and led to power supply components.

There is overvoltage and undervoltage protection for input voltage, the input voltage is set so that it can vary between +18.5 V and +36.0 V.

The purpose of the soft start is to raise the input voltage +32 V slowly (in about 1 second) to the maximum value so that capacitors in power supply components' circuits have time to get charged. This enables the extension frame to be connected to the monitor frame during operation.

There is also overvoltage protection for outgoing supply voltages. The overvoltage limits are +5.95 V (+5 V) and +17.50 V (+15 Vd).

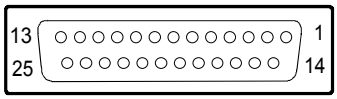
Signal routes

There are two connectors which are used for data communications (RS485), for supply voltages (+32 V, +15 Vd, +15 Va, and +5 V), for grounds connections (GNDD, GND&SHIELD) between the power supply board and module mother board.

2.1 Connectors and signals

2.1.1 Module bus connector

Table 1 Module bus connector (X1)

Module bus connector (X1)	Pin No.	I/O	Signal
	1	I	RESET_RS485*
	2	I	-15 VDC*
	3	I	+15 VDIRTY*
	4	I	+15 VDC*
	5	I/O	-DATA_RS485*
	6	I/O	DATA_RS485*
	7		Ground & Shield*
	8	I	-RESET_RS485*
	9	I	CTSB
	10	O	RTSB
	11	I	RXDB
	12	O	TXDB
	13		Ground & Shield*
	14	I	+32 VDIRTY*
	15	I	GroundDIRTY*
	16	I	CTSC
	17	O	RTSC
	18	I	RXDC
	19	O	TXDC
	20		ON/STANDBY*
	21		BIT0IN*
	22		RXDD_RS232
	23		TXDD_RS232
	24	I	+5 VDC*
	25	I	+5 VDC*

* Used in the Extension Frame and in the Extension Module

2.1.2 Other connectors

Table 2 Extension Frame rear panel connector (X1)

Connector (X1)	Pin No.	I/O	Signal
	A	I	RESET_RS485
	B	I/O	-DATA_RS485
	C	I/O	DATA_RS485
	D	I	-RESET_RS485
	E	O	Direct ECG
	F	-	N/C
	G	I	+32 VDC
	H	I	Gnd and Shield (for data transmission)
	J	-	N/C
	K	-	N/C
	L	I	+32 VDC
	M	I	GndD (dirty) for power supply

3 Service procedures

The field service of the Extension Frame, F-EXT4, is limited to replacing faulty circuit boards or mechanical parts. The circuit boards should be returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation, and a detailed description of the fault.

WARNING **Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.**

3.1 Service check

These instructions include complete procedures for a service check. The service check is mandatory after any service repair. However, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A:") which may be used when performing the procedures.

The symbol  in the instructions indicates that the check form contains space to record the results of the particular procedure

3.1.1 Recommended tools

Tool	Order No.	Notes
Hemodynamic module W/NIBP		
Adult NIBP cuff & hose		
Gas interface cable	884299	
Multimeter		
Screwdriver		

3.1.2 Visual inspection

- Disconnect the Extension Module, E-EXT from the host monitor, if connected.
- Disconnect the extension module cable from the Extension Frame, F-EXT4 rear panel.

Extension Module, E-EXT

- Detach the module box by removing the two screws from the back of the module. Be careful with the loose latch and spring pin for locking.

1. Internal parts

   Check that:

   – all screws are tightened properly

   – there are no loose objects inside the module

2. External parts

   Check that:

   – the front cover and the front panel sticker are intact
   – the module bus connector is intact
   – the module box, the latch and the spring pin are intact
   – the extension module cable and its connector are intact
   – the screw on the cable connector is tightened properly

- Reattach the module box and check that the latch is moving properly.

Extension Frame

3. Plastic frame

   Check that the plastic frame is intact.

4. Mounting plate

   Check that the extension frame mount is tightened properly to the plastic frame.

5. Fastening screw

   Check that the large fastening screw at the back of the mount is intact.

6. Pads

   Check that all four rubber pads are in place on the bottom.

7. Fan filter

   If the extension frame contains a fan (Rev. 02->), clean or replace the fan filter.

8. Cable connector

   Check that the cable connector on the rear panel is clean and intact.

9. Module motherboard connectors

   Check that the module motherboard connectors are clean and intact. Check also that the screws that connect the module motherboard to the frame are tightened properly.

10. Module motherboard position

    Check that the Hemodynamic module fits in smoothly and locks up properly in the slots in the extension frame.

    Leave the module disconnected.

3.1.3 Functional inspection

11. Communication lines

    Measure resistance from the following module motherboard (F-EXT4) connector pins against the ground:

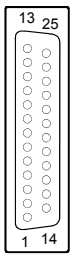
    Pin 1+Reset RS485

    Pin 5-Data RS485

    Pin 6+Data RS485

    Pin 8-Reset RS485

    Pin 13Ground



Module motherboard connector

    Check that the resistance on each of the pins is higher than 10 kΩ. If not, replace the module motherboard.

12. E-EXT installation

    Connect and lock the extension module cable to the extension frame rear panel connector.

    Make sure that the monitor is switched to STBY, and then install the extension module into the monitor. Check that the module goes in smoothly and locks up properly.

13. Voltages

    Connect the gas interface cable (the grounding plates of the cable should be removed) to one of the module bus connectors of the extension frame.

    Switch the monitor on and measure the module bus voltages from the loose gas interface cable connector (see the pin order from the previous figure). The output voltages should meet the following ranges:

    Pin 2-15V -14.50...-15.50V

    Pin 3+15VD14.50...15.50V

    Pin 4+15V14.50...15.50V

    Pin 14+32V31.0...33.0V

Pin 24+5V4.80...5.30V

Pin 25+5V4.80...5.30V

If any of the voltages is not within the given tolerance, replace the extension frame power supply board.

Disconnect the gas interface cable carefully.

14. Fan

    If the extension frame contains a fan, check that the fan is running.

15. Module communication

    Install the hemodynamic module with NIBP measurement into the extension frame. Make sure that similar modules are not installed into the monitor already. Check that the module is recognized, i.e. the needed parameter information is shown on the monitor screen.

    NOTE: If nothing happens, make sure the screen configuration is appropriate.

    Change the module position in the extension frame and check that the module is still recognized.

16. Restarting 1

    Detach the extension module, E-EXT from the monitor, then install it again. Check that the module in the extension frame is still recognized.

17. Restarting 2

    Disconnect the monitor's power cord shortly during the monitor is on. Check that the monitor recovers and the module in the extension frame is still recognized.

    NOTE: The monitor may give an audible alarm during the power loss.

18. Test measurement with module

    Connect an adult NIBP cuff to the module and place the cuff onto your arm. Perform one NIBP measurement and check that the monitor gives a reasonable NIBP reading.

19. Electrical safety check

    Perform an electrical safety check and a leakage current test.

20. Functioning after electrical safety check

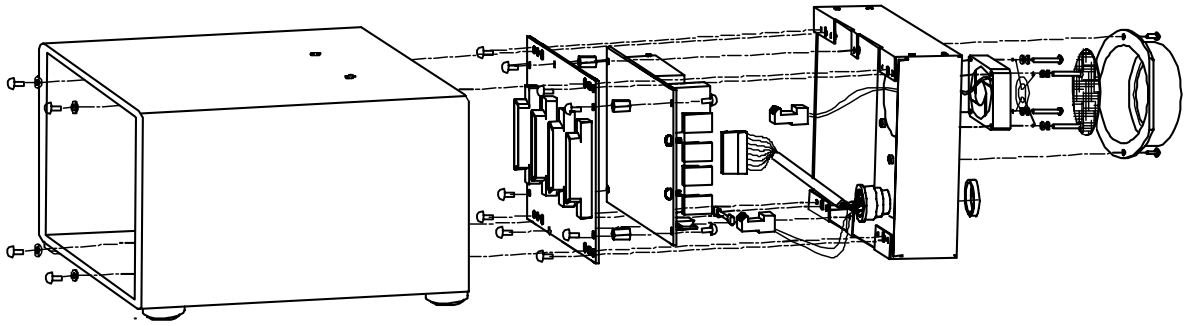
    Check that the extension frame functions normally after the performed electrical safety check.

21. Final cleaning

    Clean the extension frame and module with suitable detergent.

- Fill in all necessary documents.

3.2 Disassembly and reassembly



Disassemble the Extension Frame, F-EXT4 in the following way. See the exploded view of the frame.

1. Remove the four screws from the front of the frame. Detach the PC board's block.
2. Remove the four screws from module motherboard with which it is attached to the rear frame.
3. Carefully lift the module mother board and the power supply board attached to it and detach the two connectors under the power supply board.

3.2.1 Changing the fuse

Disassemble the F-EXT4 as described above. The fuse is located on the power supply board. Replace the fuse by one with the same type and rating.

4 Troubleshooting

4.1 Troubleshooting chart

Problem	Cause	What to do
F-EXT4 does not work.	Connector not connected properly. Cable /Extension module is faulty.	Check connectors. Check cable/module.
F-EXT4 does not work.	Incoming voltage too high or too low.	Check the Central Unit output voltage. Replace the F-EXT4 power supply board, if necessary.
F-EXT4 does not work.	PC board(s) faulty.	Check the fuse on the power supply board. Check the PC boards and their connections. Replace the power supply board.
Fuse on power supply board is blown repeatedly.	Short-circuit in output voltages.	Replace the fuse. Remove modules and turn the power on. If works, some module is faulty. If not, check the PCBs. Replace the power supply board.

5 Earlier revisions

F-EXT4 Rev. 01, see also service manual p/n 889535.
M-EXT Rev. 00, see also service manual p/n 889535.
M-EXT Rev. 02, see also Technical Reference Manual Slot 8001007.

APPENDIX A: Service check form, Extension Frame, F-EXT4, Extension Module, E-EXT

Customer		
Service	Module type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Internal parts	☐	☐	☐	2. External parts	☐	☐	☐
Notes							
3. Plastic frame	☐	☐	☐	4. Mounting plate	☐	☐	☐
5. Fastening screw	☐	☐	☐	6. Pads	☐	☐	☐
7. Fan filter	☐	☐	☐	8. Cable connector	☐	☐	☐
9. Module motherboard connectors	☐	☐	☐	10. Module motherboard position	☐	☐	☐
Notes							
11. Communication lines							
+Reset RS485 (pin 1))					>10 kW		
-Data RS485 (pin 5)					>10 kW		
+Data RS485 (pin 6)					>10 kW		
-Reset RS485 (pin 8)					>10 kW		
12. E-EXT installation	☐	☐	☐				
13. Voltages							
-15 V (pin 2)					-14.50...15.50 V		
+15 VD (pin 3)					14.50...-15.50 V		
+15 V (pin 4)					14.50...15.50 V		
+32 V (pin 14)					31.0...33.0 V		
+5 V (pin 24)					4.80...5.30 V		
+5 V (pin 25)					4.80...5.30 V		

	OK	N.A.	Fail		OK	N.A.	Fail
14. Fan	☐	☐	☐	15. Module communication	☐	☐	☐
16. Restarting 1	☐	☐	☐	17. Restarting 2	☐	☐	☐
18. Test measurement with module	☐	☐	☐				
Notes							
19. Electrical safety check	☐	☐	☐	20. Functioning after electrical safety check	☐	☐	☐
21. Final cleaning	☐	☐	☐				

Notes

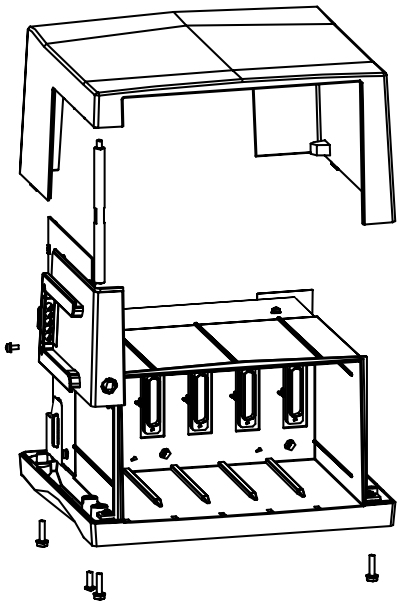
Used spare parts			

Signature

Datex-Ohmeda

S/5 Anesthesia and Critical Care Monitors

Spare parts



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

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

All specifications subject to change without notice.

Document number M1137274-01

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Table of contents

Table of contents i

1 Software licenses 1
1.1 Service Software licenses 1

2 PC boards 4
2.1 CPU Board, B-CPU6 4
2.2 UPI4NET Board, B-UPI4NET -02 4
2.3 Display Controller Board, B-DISPX -01 4

3 5-Module Frame, F-CU5 5
3.1 5-Module Frame Unit, F-CU5(P) -01 5
3.2 Central Processor Unit for F-CU5, F-CPU -02 9
3.3 F-CU5 Power Unit, N-AC 12

4 8-Module Frame, F-CU8 13
4.1 8-Module Frame, F-CU8 -12 13

5 Displays 17
5.1 LCD Display, D-LCC12A 17
5.1.1 LCD Display, D-LCC12A, rev. 01 17
5.1.2 Front panel stickers for D-LCC12A, rev. 01 18
5.2 15" Flat Panel Display (D-FPD15) 18
5.3 19" Medical Grade Display 19

6 Extension frame 20
6.1 Extension Frame, F-EXT4, rev. 03 20
6.2 Extension Module, E-EXT 21

7 Command Bar, K-ANEB, K-ICUB 23
7.1 Command Bar, K-ANEB, K-ICUB, rev.00 23
7.1.1 Command Bar, K-ANEB 23
7.1.2 Command Bar, K-ICUB 24

1 Software licenses

1.1 Service Software licenses

NOTE: L-ANE07(A)S/L-ICU07(A)S Service software can be used only together with B-CPU6 board. When ordering the service software, B-CPU6 board must be ordered at the same time. The service software will be loaded on the board at factory.

Description	Order no.	Note
S/5 Anesthesia Service Software License w/ Extended Arrhythmia Analysis, L-ANE07AS-00		for B-CPU6
S/5 Anesthesia Service Software License w/ Extended Arrhythmia Analysis, L-ANE07AS-00, Danish	M1120129	
S/5 Anesthesia Service Software License w/ Extended Arrhythmia Analysis, L-ANE07AS-00, German	M1120130	
S/5 Anesthesia Service Software License w/ Extended Arrhythmia Analysis, L-ANE07AS-00, English	M1120131	
S/5 Anesthesia Service Software License w/ Extended Arrhythmia Analysis, L-ANE07AS-00, Spanish	M1120132	
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S/5 Anesthesia Service Software License w/ Extended Arrhythmia Analysis, L-ANE07AS-00, Czech	M1120143	
S/5 Anesthesia Service Software License w/ Extended Arrhythmia Analysis, L-ANE07AS-00, Chinese	M1120144	

Description	Order no.	Note
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S/5 Anesthesia Service Software License, L-ANE07S-00, Chinese	M1120128	
S/5 Critical Care Service Software License, L-ICU07S-00		for B-CPU6
S/5 Critical Care Service Software License, L-ICU07S-00, Danish	M1119893	
S/5 Critical Care Service Software License, L-ICU07S-00, German	M1119894	
S/5 Critical Care Service Software License, L-ICU07S-00, English	M1119895	
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Description	Order no.	Note
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S/5 Critical Care Service Software License w/ Extended Arrhythmia Analysis, L-ICU07AS-00, Chinese	M1119892	

2 PC boards

2.1 CPU Board, B-CPU6

NOTE: Note that the spare part can be ordered with or without software pre-loaded. In case the part is ordered with software pre-loaded, the corresponding software license must be ordered separately.

Description	Order no.	Note
CPU Board, B-CPU6	M1140016	requires L-ANE07(A)/ L-ICU07(A) software
Battery for SRAM/Timekeeper	197230-HEL	
Screw	617110-HEL	

2.2 UPI4NET Board, B-UPI4NET -02

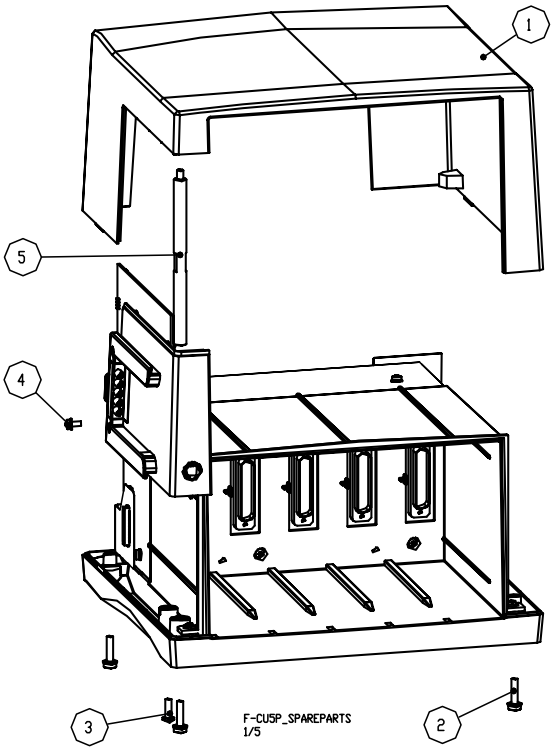
Description	Order no.	Note
Block screw for cables	546096-HEL	
UPINET board, B-UPI4NET -02	M1117341	requires L-ANE06(A) /L-ICU06(A) or later

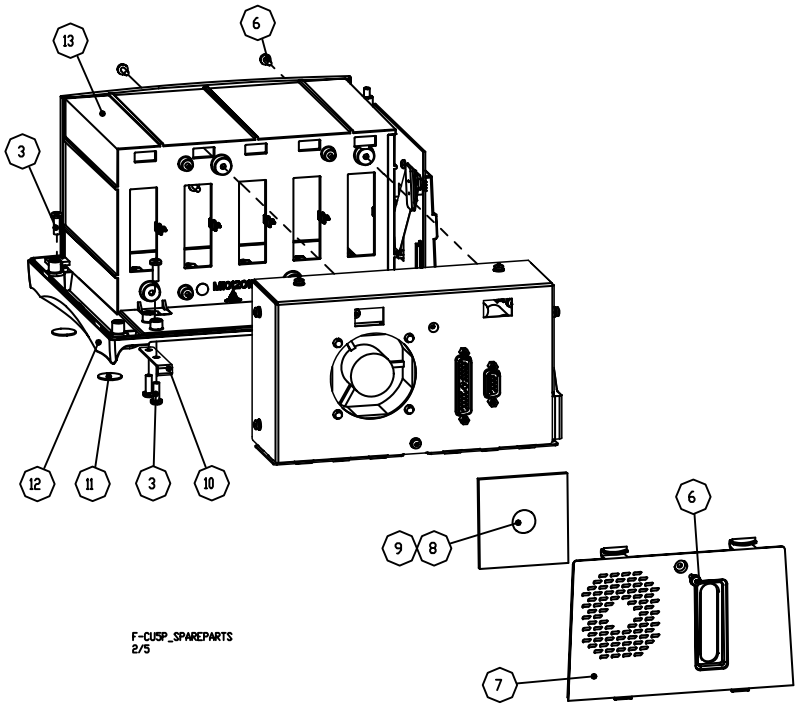
2.3 Display Controller Board, B-DISPX -01

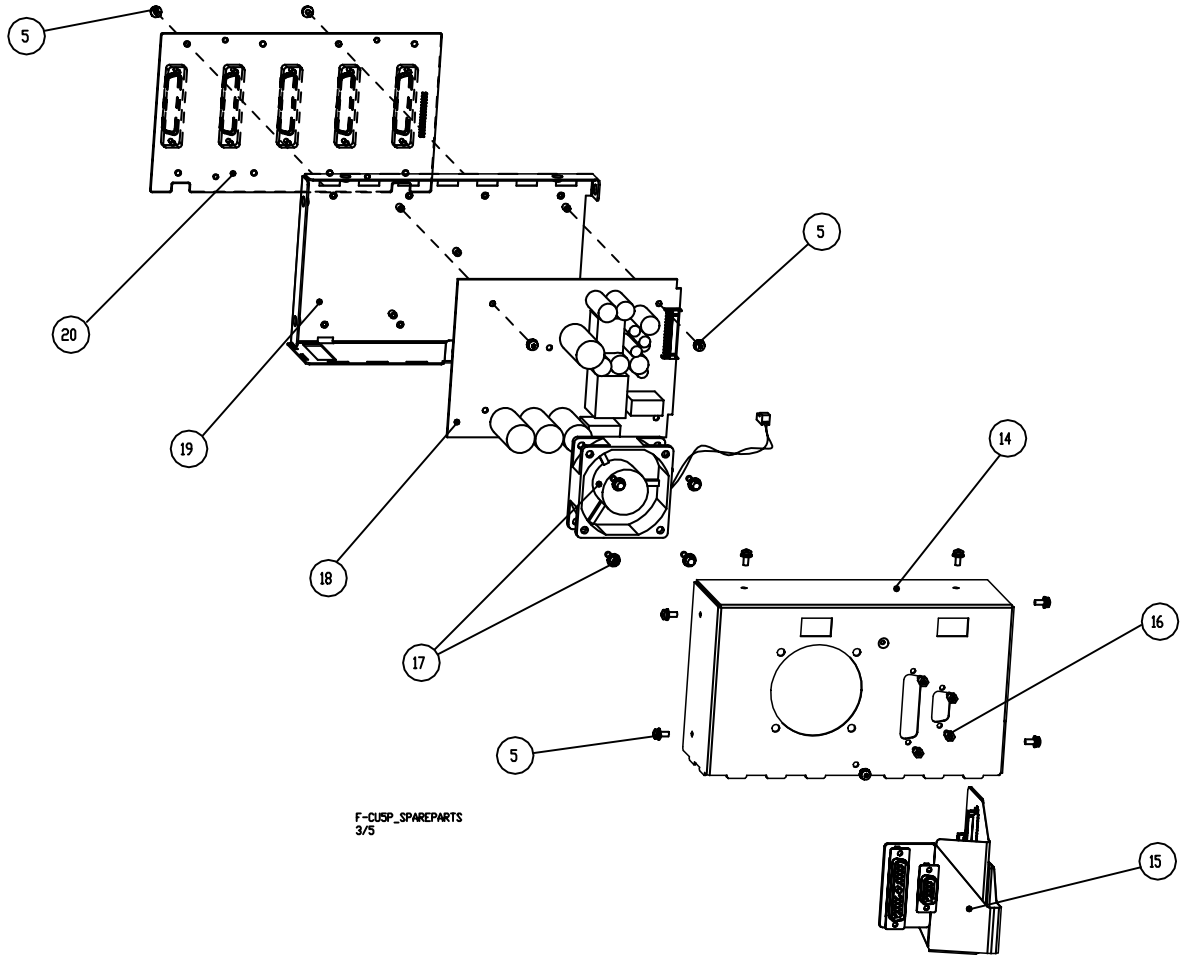
Description	Order no.	Note
Video cable, DVI-D (male) - DVI-D (male), 3m	M1005294	
Video cable (adapter), DVI-I (male) - VGA (female), 0.6m	M1005320	
Video cable (extension / adapter), DVI-I (male) - VGA (male), 10m	M1005324	
Display Controller Board, B-DISPX -01	M1076677	requires L-ANE05(A) /L-ICU05(A) or later

3 5-Module Frame, F-CU5

3.1 5-Module Frame Unit, F-CU5(P) -01



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F-CU5P_SPAREPARTS
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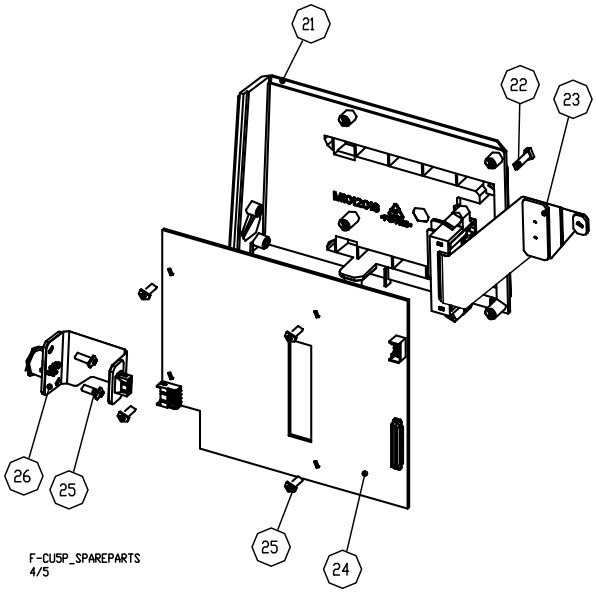
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F-CU5P_SPAREPARTS
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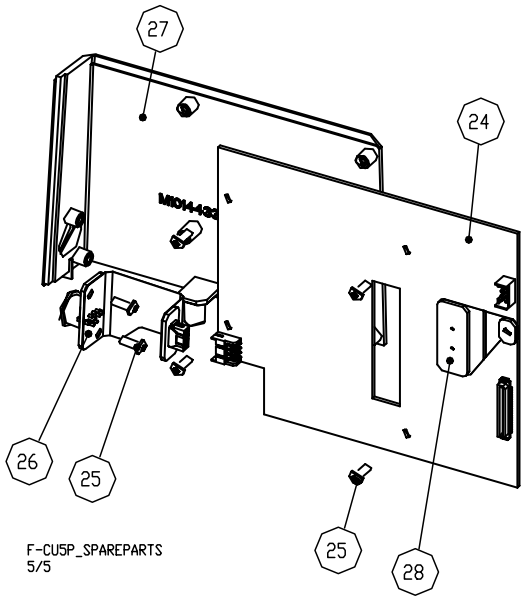
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F-CU5P_SPAREPARTS
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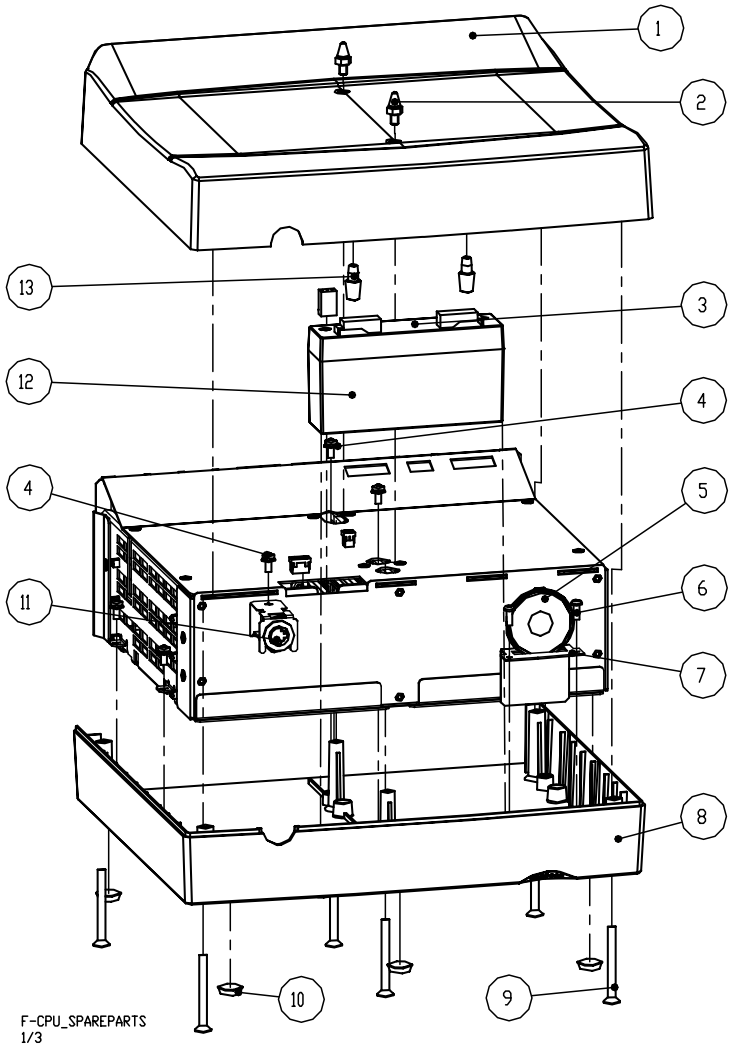
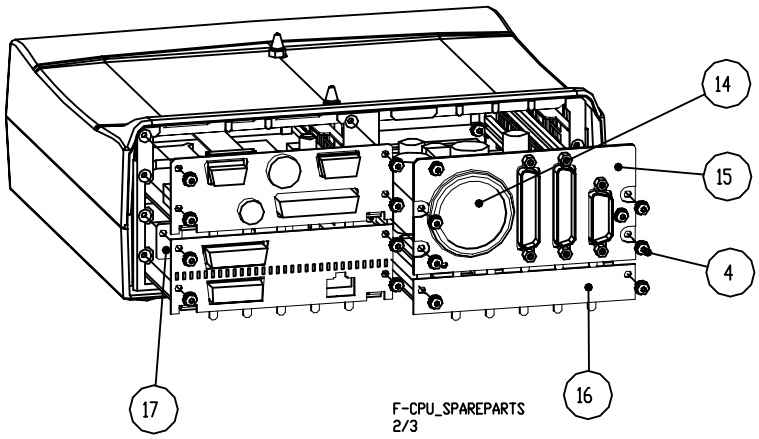
Item numbers refer to the exploded view.

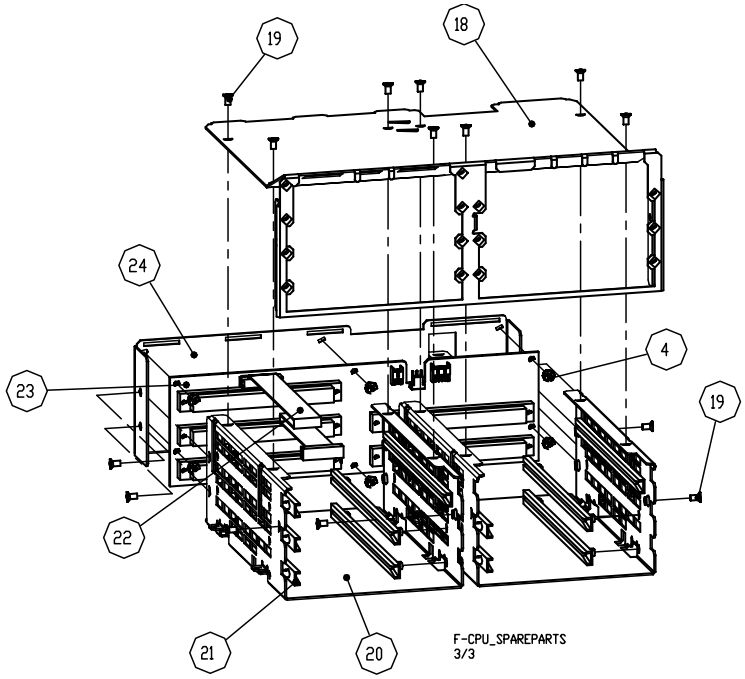
Item	Description	Order no.	Replaced by
-	F-CPU Signal Cable, 0.3 m/12 inch	M1021337	
-	F-CPU Signal Cable, 3.0 m/10 ft	M1021338	
-	F-CPU Signal Cable, 10.0 m/ 33 ft	M1021339	
-	F-CPU Power Cable, 0.4 m/16 inch	M1021340	
-	F-CPU Power Cable, 2.7 m/9 ft	M1021341	
1	NMF Module frame Top Cover	M1012000	
2	SCREW, machine, M4x16mm, DIN6900-3, torx head, pan head, steel, zinc coated	M1024624	
3	SCREW, thread forming, M4x12mm, WN1452, torx head, pan head, steel, zinc coated	M1024622	
4	SCREW,machine, M3x6mm, DIN6900-3, torx head, pan head, steel, zinc coated	M1024616	
5	Module frame Support Pole, F-CU5(P)	M1016908	
6	SCREW, machine, M3x10mm, DIN6900-3, torx head, pan head, steel, zinc coated	M1024620	
7	Module frame Back Hatch, F-CU5	M1012014	
8	Power Board Air Filter, F-CU5(P)	M1016473	
9	Scotchmate SJ-3526 D16	M1016475	
10	MF-DF Hook, F-CU5(P)	M1014449	
11	Foot Bumpon SJ-5632, F-CU5(P)	M1016471	
12	NMF Module frame Bottom	M1012006	
13	Module frame Module Base, F-CU5	M1012011	
14	Module frame EMC-Casing 2, F-CU5(P)	M1018747	
15	NMF MF Connection Flex board	M1022878	
16	FEMALE SCREW LOCK, THREAD IN UNC4-40, THREAD OUT M3	640625	
17	Fan Unit, F-CU5(P), Spare Part	M1028510	
18	F-CU5 Power Board	M1021150	
19	Module frame EMC-Casing 1, F-CU5(P)	M1018745	
20	NMF module mother board	M1017298	
21	Module frame PSM Option Mounting, F-CU5P	M1012016	
22	SCREW, screw for plastic, x12mm, WN1452, torx head, pan head, steel, zinc, SCREW-PT, PAN-HEAD, TORX, 3.0x12mm, ST-ZN, WN1452	628729	
23	PSM Connection Flex Board Unit, F-CU5P	M1024805	
24	NMF DFI board	M1022655	M1092102

Item	Description	Order no.	Replaced by
25	SCREW, M3x8mm, WN1452, torx head, pan head, steel, zinc coated	M1024618	
26	NMF MF ECG sync connector flex board	M1022268	
27	Module frame PSM Option Cover, F-CU5	M1014433	
28	NMF MF EMBC shielding flex board	M1028023	

3.2 Central Processor Unit for F-CU5, F-CPU -02



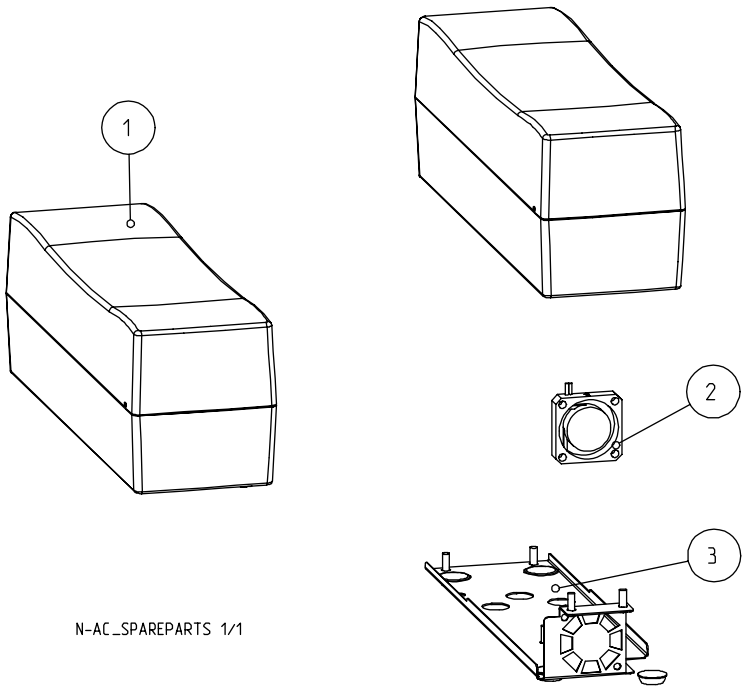




Item	Description	Order no.
1	Top Cover, F-CPU	M1012020
2	MF-DF Positioning Cone, F-CPU	M1014451
3	CPU battery cable, F-CU5	M1015773
4	SCREW, machine, M3x6mm, DIN6900-3, torx head, pan head, steel, zinc coated	M1024616
5	LOUDSPEAKER UNIT, F-CM1	896109
6	SCREW, thread forming, M3x8mm, WN1452, torx head, pan head, steel, zinc coated	M1024618
7	Speaker Shield, F-CPU	M1012029
8	Bottom Cover, F-CPU	M1012018
9	SCREW, machine, M4x40mm, DIN965, torx head, flat countersunk head, steel, zinc coated	M1024626
10	RUBBER FOOT, 12.7mm X 3.5mm, ROUND	65141
11	Dis Connector Unit, F-CPU	M1028506
12	BATTERY, 6V, 1.2Ah, rechargeable	17006-HEL
13	Battery Spacer, F-CPU	M1014458
14	Fan Filter	M1014462
15	F-CPU Power Board	M1021149
16	CONNECTOR PLATE 1, BLANK/NARROW	885389
17	EMC-LEVY 2 B-DHIGH/B-DVGA	885398

Item	Description	Order no.
18	EMC-Casing Cover, F-CPU	M1012026
19	SCREW, machine, M3x6mm, DIN965, torx head, flat countersunk head, steel, zinc coated	M1024613
20	EMC-Casing Frame, F-CPU	M1012024
21	Snap-in card guide, Nylon 6/6	M1020381
22	UPI-DIS-NMF Cable	M1020572
23	NMF CPU motherboard	M1014605
24	EMC-Casing Front Plate, F-CPU	M1014431

3.3 F-CU5 Power Unit, N-AC



Item	Description	Order no.
1	S/5 FCU5 Power Unit, N-AC	N-AC..00
2	N-AC Fan Unit, Spare Part	M1028505
3	Fan Plate Set	M1033982

4 8-Module Frame, F-CU8

NOTE: In case there are more than one spare part order number for the same item: check the revision or possible adaptation of the part that correspond your device. In 'Replaced by' column you find the replacing order number for a spare part that is not available anymore.

4.1 8-Module Frame, F-CU8 -12

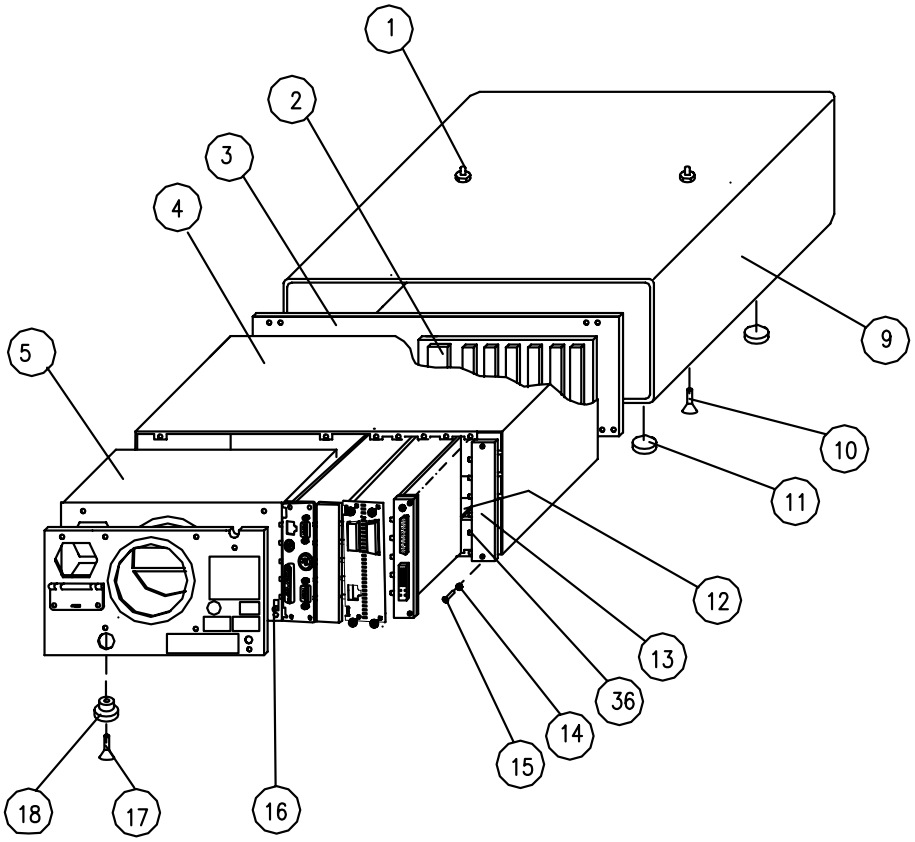


Figure 1 Exploded view of the Central Unit F-CU8 (-12)

Item	Description	Order no.	Replaced by
1	Bronze tap for display screen tray	879476	
2	CPU mother board, AM/CCM	891585	
3	Module mother board, AM/CCM	882954-HEL	
4	Metal box, F-CU8	882501	
5	Power supply unit for F-CU8 220-240V	M1028721	
5	Power supply unit for F-CU8 110-120V	M1028720	
5	Power supply unit for F-CU8 100V	M1005001	

Item	Description	Order no.	Replaced by
9	Frame housing, F-CU8	898314	
10	Cross cylinder head screw M5x8	61516	
11	Rubber foot 22x10mm	65144-HEL	
12	Rail for PC boards	879257	
13	Connector plate, blank/narrow	885389	
13	Connector plate, blank/wide	885394	
14	Shake proof washer m3.2	63611-HEL	
15	Cross cylinder head screw M3x8	61722	
16	Service Reset Switch, AM/CCM	52090	
17	Cross recess screw M6x30	61673	
18	Support plate for 61673	879502	
36	Grounding plate, blank/narrow	885398	
36	Grounding plate, blank/wide	885404	

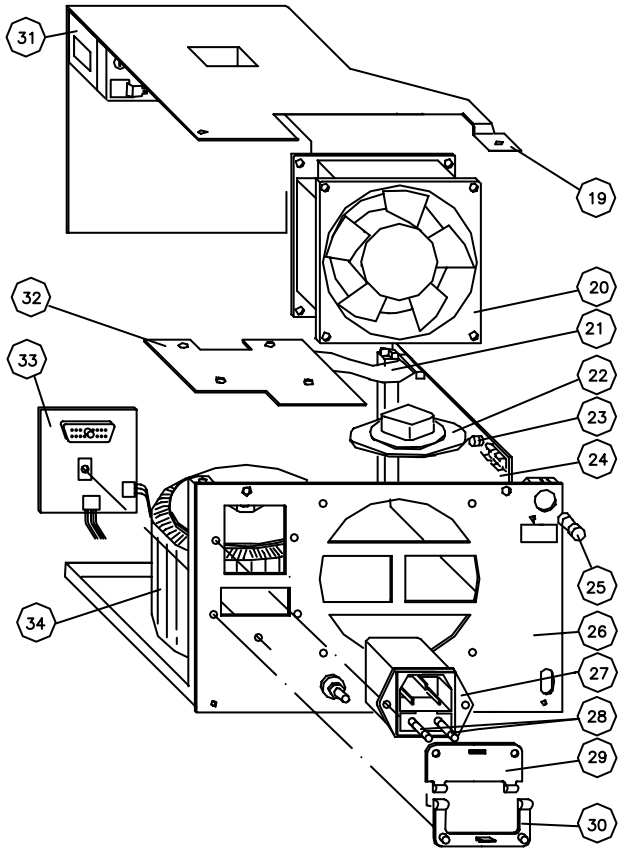


Figure 2 Exploded view of the Power Supply Unit, F-CU8 (-12)

Item	Description	Order no.	Replaced by
19	Cover, F-CU8 rev.10 Power Unit	M1014739	
20	Fan, AM/CCM	880049-HEL	
21	Ribbon cable (Pwr supply-Pwr logic)	882520	
22	Loudspeaker, AM/CCM	882509-HEL	
23	Fuse Miniature 2AF	51063	
24	Power board, F-CU8 rev.10-	M1010681	
25	Fuse T10A, 5x20mm, 250V	51137	
26	Body, F-CU8 rev.10 Power Unit	M1028737	
27	Appliance socket w. filter, 4A	540140	
28	Fuse T2.5A, 5X20mm, for Power Unit 220-240	511181	
28	Fuse 5A, 5x20mm, 125V, UL/CSA for 100V, 110-120V	511382	
29	Shutter plate	M1015167	
30	Body of shutter	M1015169	

Item	Description	Order no.	Replaced by
31	Lead acid battery, 6V, 1.2Ah	17006-HEL	
32	Power logic board, AM/CCM	882508	
33	Battery Switch Board	M1004931	
34	Mains transformer, 230V	M1007982	
34	Mains transformer, 115V	M1014489	
34	Mains transformer, 100-105V, 160 VA	M1014491	

5 Displays

5.1 LCD Display, D-LCC12A

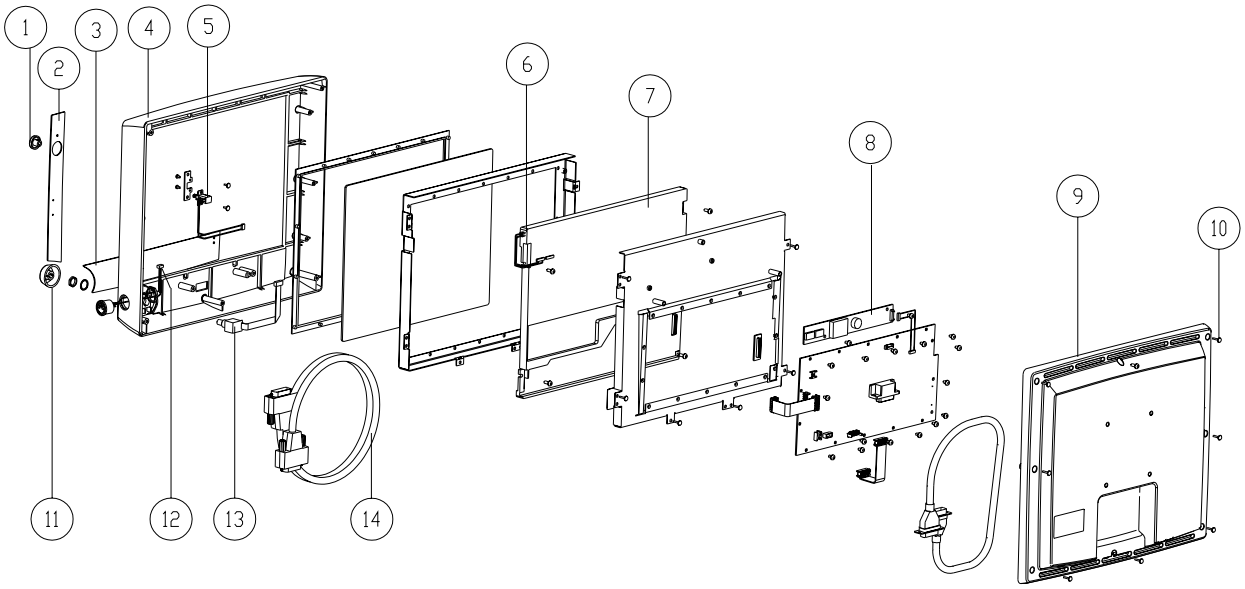


Figure 3 Exploded view, LCD Display D-LCC12A

5.1.1 LCD Display, D-LCC12A, rev. 01

Item	Description	Order no.	Replaced by
1	ON/STBY-switch cap	896835	
2	LED board	M1021700	
3	Keyboard	M1021697	
4	Front cover, D-LCC12A	M1021703	
5	ON/STBY-switch	M1021694	
6	Backlight for LCD display M1012542	M1014385	
7	LCD display	M1012542	
8	Inverter for LCD display M1012542	M1013813	
9	Rear cover, D-LCC12A	M1021705	
10	Screw PT K30x10	628728	
11	ComWheel cover	898794	
12	ARK connector with cable	M1021696	
13	ComWheel	M1021691	
14	LCD interface cable 10m, D-LCC12A rev.01	M1035180	
14	LCD interface cable 3m, D-LCC12A	M1021695	

5.1.2 Front panel stickers for D-LCC12A, rev. 01

Item	Description	Order no.	Replaced by
	Front Panel Sticker, CS	M1063326	
	Front Panel Sticker, DA	8504288	M1006114
	Front Panel Sticker, DE	8504279	M1006111
	Front Panel Sticker, EN	8504278	M1006108
	Front Panel Sticker, ES	8504282	M1006112
	Front Panel Sticker, FI	8504285	M1006110
	Front Panel Sticker, FR	8504280	M1006115
	Front Panel Sticker, HU	M1060046	
	Front Panel Sticker, IT	8504283	M1006117
	Front Panel Sticker, JA	M1004974	
	Front Panel Sticker, NL	8504281	M1006116
	Front Panel Sticker, NO	8504287	M1006118
	Front Panel Sticker, PL	M1004975	
	Front Panel Sticker, PT	8504284	M1006119
	Front Panel Sticker, SV	8504286	M1006113
	Front Panel Sticker, Blank (vertical)	8504276	M1017805

5.2 15” Flat Panel Display (D-FPD15)

Item	Description	Order no.
-	"15 inch Flat Panel Display, D-FPD15, Spare Part	M1138310-S
-	Video Cable, DVI-D (male) - DVI-D (male), 3m (9.8 ft)	M1005294
-	Video Cable, D-LCC15 rev. 00-02, 3 m (9.8 ft), VGA (male) - VGA (male)	8001593-HEL
-	Video Cable (extension / adapter), DVI-I (male)-VGA (male), 10m (32.8 ft)	M1005324
-	Power Adapter for M1138310 and M1063774 Displays (2009709-003)	M1145554
-	Keypad Holder for M1138310 (D-FPD15)	M1141446
-	Table Stand for M1138310 (D-FPD15)	M1141447

5.3 19" Medical Grade Display

NOTE: Power supply unit must be ordered as a part of the GEMS IT KIT DFP NON-TOUCH, 2025280-002.

Item	Description	Order no.
-	19" Medical Grade Display, whole display	M1063774-S
-	Video Cable, DVI-D (male) - DVI-D (male), 3m (9.8 ft)	M1005294
-	VGA - VGA Cable, 3 m (9.8 ft), VGA (male) - VGA (male)	8001593-HEL
-	VGA-VGA extension cable, 10 m (32,8 ft)	892095-HEL
-	DVI-VGA adapter cable , 0.6 m (1.8 ft)	M1005320
-	Video Cable (extension / adapter), DVI-I (male)-VGA (male), 10m (32.8 ft)	M1005324
-	Y-cable for display and keyboard, 0.2 m (0.6 ft)	889314-HEL
-	Power Adapter for M1138310 and M1063774 Displays (2009709-003)	M1145554

6 Extension frame

6.1 Extension Frame, F-EXT4, rev. 03

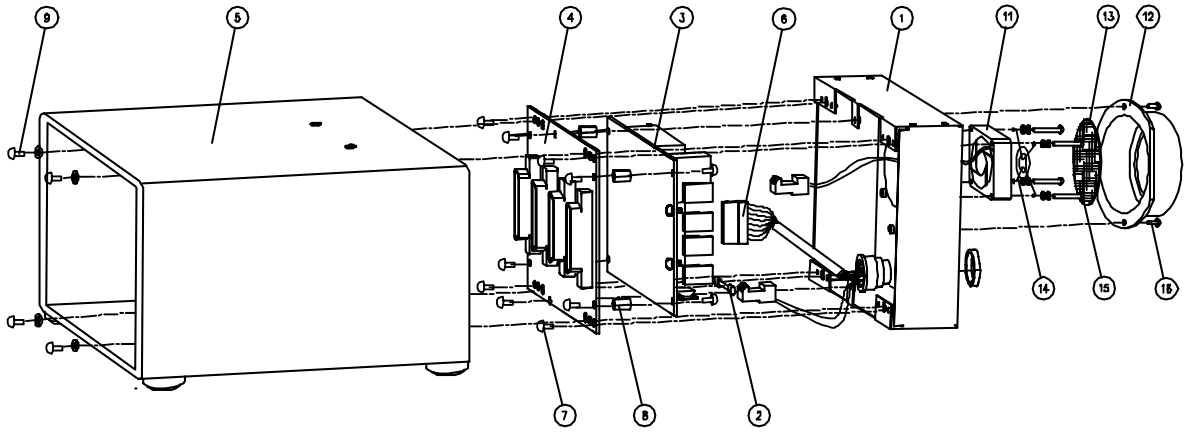


Figure 4 Exploded view of F-EXT4, rev. 03

Item	Description	Order no.	Replaced by
1	Power covering rev.03	898316	
1	Rear frame, F-EXT4	892379	898316
2	Fuse T2.5A, 5X20mm, 250V	51118	
3	Power supply board, F-EXT4	892378	
4	Module mother board, F-EXT4 (rev.01-02)	884839	
5	Frame housing, F-EXT4 (rev.03)	898317	
5	Frame with rubber pads (rev.02)	893113	898317
6	Internal connector cable, F-EXT4	884838	
7	Cross cylinder-head screw M3x6	61721-HEL	
8	Bushing	640455-HEL	
9	Cross cylinder head screw M3x12	61736	
11	Fan, F-EXT4	893141	
12	Fan cover, F-EXT4	892680	
13	Dust filter, 53 mm	874594	
14	Protection mesh	58201	
15	Cross cylinder head screw M3x18 FZB DIN7985	61739	
16	Slotted recess screw M3x6	61223	

6.2 Extension Module, E-EXT

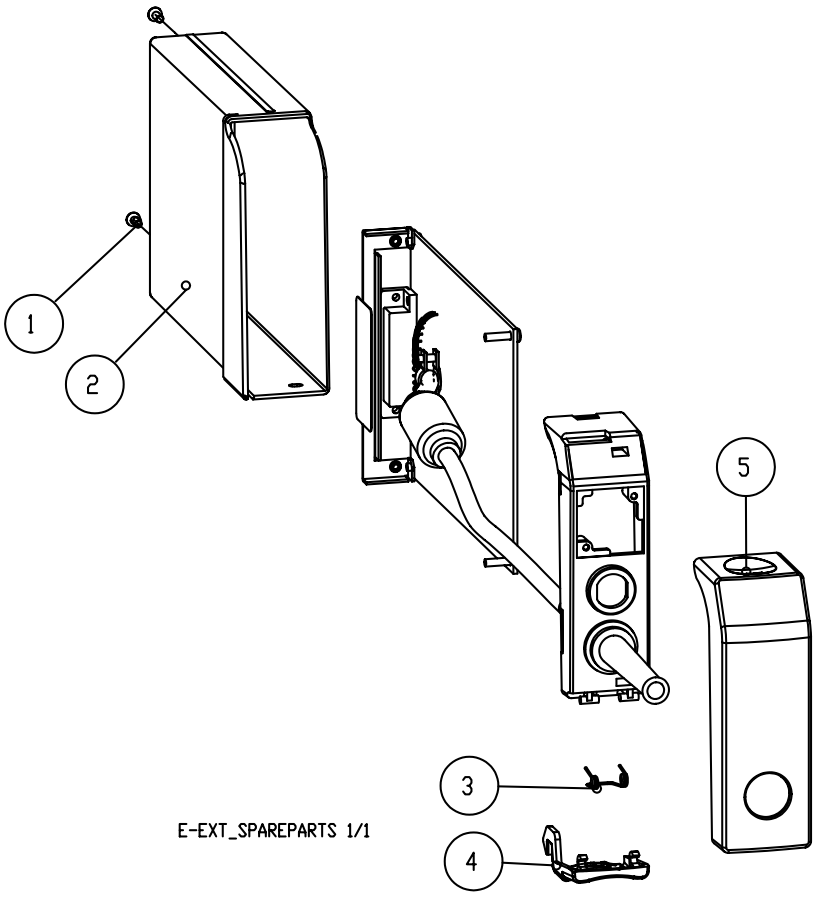


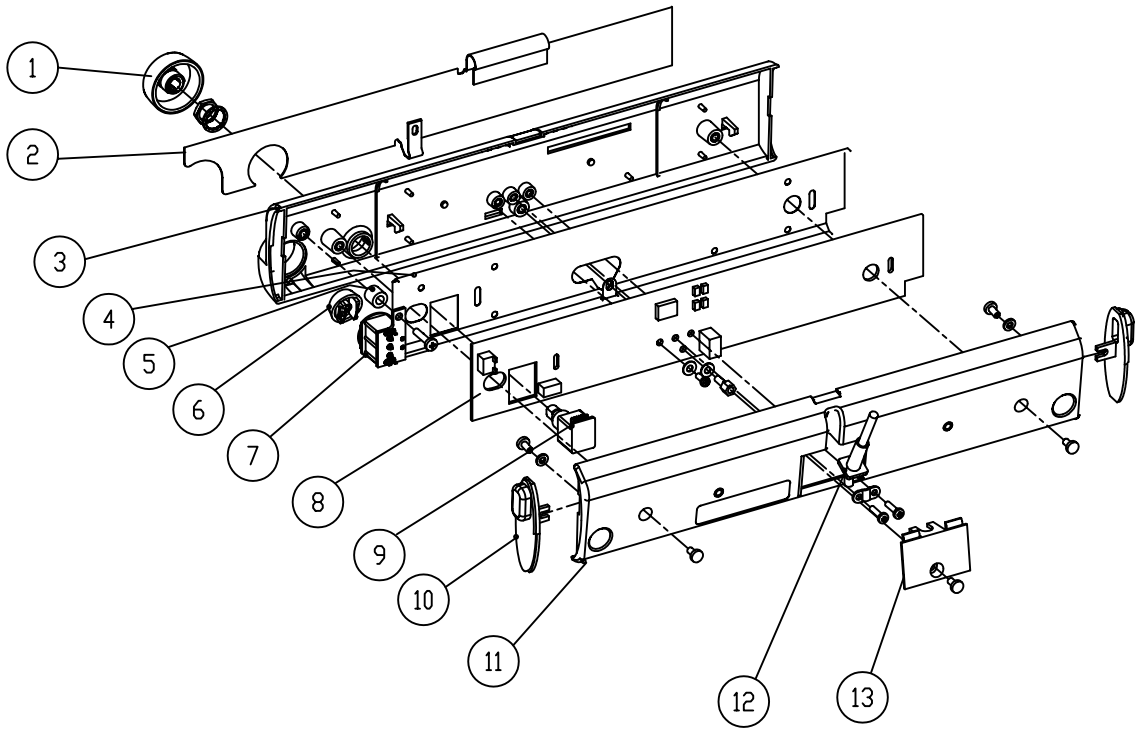
Table 1 Extension Module, E-EXT, spare parts

Item	Description	Order no.	Replaced by
1	SCREW, M3x8mm, DIN965, torx head, flat countersunk head, steel, zinc coated	606024	
2	Module Casing, Single	M1021035	
3	Torsion Spring	M1020935	
4	Latch	M1021039	
5	Front Cover, E-EXT	M1025710	

7 Command Bar, K-ANEB, K-ICUB

Item numbers refer to the exploded view.

7.1 Command Bar, K-ANEB, K-ICUB, rev.00



7.1.1 Command Bar, K-ANEB

Item	Description	Order no.	Replaced by
1	ComWheel; S/5	898794	
2	Membrane keypad, K-ANEB	898255	
3	Front cover, K-ANEB	897980	
4	EMC plate, K-ANEB	8000225	
5	Mounting ,h= 7.5mm, D=8mm, d=4.3mm, PA	640453-HEL	
6	Switch Cover	8001436	
7	ON/STBY-switch, K-ANEB (Switch Cover included)	8001395-HEL	
8	Command board PC board	898007	
9	Opto-encoder, rotary switch,16-positions,push button, metal shaft, 4inch ribbon cable and connector	113291	
10	Gable plate, K-ANEB	897982	

Item	Description	Order no.	Replaced by
11	Back cover, K-ANEB	897981	
12	Command bar cable, K-ANEB, K-ICUB	898283	
13	Closing cover, K-ANEB, K-ICUB	897983	
14	FRONT PANEL STICKER, K-ANEB, CS	M1062307	
14	Front Panel sticker, DA; K-ANEB; S/5	898093	
14	Front Panel sticker, DE; K-ANEB; S/5	898084	
14	Front Panel sticker, EN; K-ANEB; S/5	898083	
14	Front Panel sticker, ES; K-ANEB; S/5	898087	
14	Front Panel sticker, FI; K-ANEB; S/5	898090	
14	Front Panel sticker, FR; K-ANEB; S/5	898085	
14	Front Panel sticker, IT; K-ANEB; S/5	898088	
14	Front Panel sticker, JA; K-ANEB; S/5	898094	
14	Front Panel sticker, NL; K-ANEB; S/5	898086	
14	Front Panel sticker, NO; K-ANEB; S/5	898092	
14	Front Panel sticker, PT; K-ANEB; S/5	898089	
14	Front Panel sticker, SV; K-ANEB; S/5	898091	

7.1.2 Command Bar, K-ICUB

Item	Description	Order no.	Replaced by
1	ComWheel; S/5	898794	
2	Membrane keypad, K-ANEB	898255	
3	Front cover, K-ANEB	897980	
4	EMC plate, K-ANEB	8000225	
5	Mounting ,h= 7.5mm, D=8mm, d=4.3mm, PA	640453-HEL	
6	Switch Cover	8001436	
7	ON/STBY-switch, K-ANEB (Switch Cover included)	8001395-HEL	
8	Command board PC board	898007	
9	Opto-encoder, rotary switch,16-positions, push button, metal shaft, 4 inch ribbon cable and connector	113291	
10	Gable plate, K-ANEB	897982	
11	Back cover, K-ANEB	897981	
12	Command bar cable, K-ANEB, K-ICUB	898283	
13	Closing cover, K-ANEB, K-ICUB	897983	
14	FRONT PANEL STICKER, K-ICUB, CS	M1062322	
14	Front Panel sticker, DA; K-ICUB; S/5	898105	

Item	Description	Order no.	Replaced by
14	Front Panel sticker, DE; K-ICUB; S/5	898096	
14	Front Panel sticker, EN; K-ICUB; S/5	898095	
14	Front Panel sticker, ES; K-ICUB; S/5	898099	
14	Front Panel sticker, FI; K-ICUB; S/5	898102	
14	Front Panel sticker, FR; K-ICUB; S/5	898097	
14	Front Panel sticker, IT; K-ICUB; S/5	898100	
14	Front Panel sticker, JA; K-ICUB; S/5	898106	
14	Front Panel sticker, NL; K-ICUB; S/5	898098	
14	Front Panel sticker, NO; K-ICUB; S/5	898104	
14	Front Panel sticker, PT; K-ICUB; S/5	898101	
14	Front Panel sticker, SV; K-ICUB; S/5	898103	

GE Healthcare

Service Manual Language Information

WARNING (EN)	This service manual is available in English only. • If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services. • Do not attempt to service the equipment unless this service manual has been consulted and is understood. • Failure to heed this warning may result in injury to the service provider, operator, or patient, from electric shock, mechanical or other hazards.
ПРЕДУПРЕЖДЕНИЕ (BG)	Това упътване за работа е налично само на английски език. • Ако доставчикът на услугата на клиента изиска друг език, задължение на клиента е да осигури превод. • Не използвайте оборудването, преди да сте се консултирали и разбрали упътването за работа. • Неспазването на това предупреждение може да доведе до нараняване на доставчика на услугата, оператора или пациент в резултат на токов удар или механична или друга опасност.
VAROVÁNÍ (CS)	Tento provozní návod existuje pouze v anglickém jazyce. • V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka. • Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah. • V případě nedodržování této varování může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.
ADVARSEL (DA)	Denne servicemanual findes kun på engelsk. • Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse. • Forsøg ikke at servicere udstyret medmindre denne servicemanual har været konsulteret og er forstået. • Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk, mekanisk eller anden fare for teknikeren, operatøren eller patienten.
WARNUNG (DE)	Diese Serviceanleitung ist nur in englischer Sprache verfügbar. • Falls der Kundendienst eine andere Sprache benötigt, muss er für eine entsprechende Übersetzung sorgen. • Keine Wartung durchführen, ohne diese Serviceanleitung gelesen und verstanden zu haben. • Bei Zuwiderhandlung kann es zu Verletzungen des Kundendiensttechnikers, des Anwenders oder des Patienten durch Stromschläge, mechanische oder sonstige gefahren kommen.
ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)	Το παρόν εγχειρίδιο σέρβις διατίθεται στα αγγλικά μόνο. • Εάν το άτομο παροχής σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει υπηρεσίες μετάφρασης. • Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό εκτός εαν έχετε συμβουλευτεί και έχετε κατανοήσει το παρόν εγχειρίδιο σέρβις. • Εαν δε λάβετε υπόψη την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στο άτομο παροχής σέρβις, στο χειριστή ή στον ασθενή από ηλεκτροπληξία, μηχανικούς ή άλλους κινδύνους.
ADVERTENCIA (ES)	Este manual de servicio sólo existe en inglés. • Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual. • No se deberá dar servicio técnico al equipo, sin haber consultado y comprendido este manual de servicio. • La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.

HOIATUS (ET)	Käesolev teenindusjuhend on saadaval ainult inglise keeles. • Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest. • Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist. • Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.
VAROITUS (FI)	Tämä huolto-ohje on saatavilla vain englanniksi. • Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla. • Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen. • Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.
ATTENTION (FR)	Ce manuel technique n'est disponible qu'en anglais. • Si un service technique client souhaite obtenir ce manuel dans une autre langue que l'anglais, il devra prendre en charge la traduction et la responsabilité du contenu. • Ne pas tenter d'intervenir sur les équipements tant que le manuel technique n'a pas été consulté et compris. • Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.
UPOZORENJE (HR)	Ove upute za servisiranje dostupne su samo na engleskom jeziku. • Ukoliko korisnički servis zahtijeva neki drugi jezik, korisnikova je odgovornost osigurati odgovarajući prijevod. • Nemojte pokušavati servisirati opremu ukoliko niste konzultirali i razumjeli ove upute. • Nepoštivanje ovog upozorenja može rezultirati ozljedama servisnog osoblja, korisnika ili pacijenta prouzročenim električnim udarom te mehaničkim ili nekih drugih opasnostima.
FIGYELMEZTETÉS (HU)	Ez a szerviz kézikönyv kizárólag angol nyelven érhető el. • Ha a vevő szerviz ellátója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészíttetése. • Ne próbálja elkezdeni használni a berendezést, amíg a szerviz kézikönyvben leírtakat nem értelmezték és értették meg. • Ezen figyelmeztetés figyelmen kívül hagyása a szerviz ellátó, a működtető vagy a páciens áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.
PERINGATAN (ID)	Manual servis ini hanya tersedia dalam Bahasa Inggris. • Jika penyedia jasa servis pelanggan memerlukan bahasa lain selain dari Bahasa Inggris, merupakan tanggung jawab dari penyedia jasa servis tersebut untuk menyediakan terjemahannya. • Jangan mencoba melakukan servis pada perlengkapan kecuali telah membaca dan memahami manual servis ini. • Mengabaikan peringatan ini bisa berakibat cedera pada penyedia servis, operator, atau pasien, karena terkena kejut listrik, bahaya mekanis atau bahaya lainnya.
AÐVÖRUN (IS)	Þessi þjónustuhandbók er eingöngu fáanleg á ensku. • Ef að þjónustuveitandi viðskiptamanns þarfnast annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálaþjónustu. • Reynið ekki að afgreiða tækið nema að þessi þjónustuhandbók hefur verið skoðuð og skilin. • Brot á sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklings frá raflosti, vélrænu eða öðrum áhættum.
AVVERTENZA (IT)	Il presente manuale di manutenzione è disponibile soltanto in Inglese. • Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione. • Si proceda alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto. • Il non rispetto della presente avvertenza potrebbe far compiere operazioni da cui derivino lesioni all'addetto, alla manutenzione, all'utilizzatore ed al paziente per folgorazione elettrica, per urti meccanici od altri rischi.

警告 (JA)	このサービスマニュアルは英語版しかありません。 ・ サービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。 ・ このサービスマニュアルを熟読し、十分に理解した上で装置のサービスを行ってください。 ・ この警告に従わない場合、サービスを担当される方、操作員あるいは患者が、感電や機械的又はその他の危険により負傷する可能性があります。
경고 (KO)	본 서비스 지침서는 영어로만 이용하실 수 있습니다 . • 고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우 , 번역 서비스를 제공하는 것은 고객의 책임입니다 . • 본 서비스 지침서를 참고했고 이해하지 않는 한은 해당 장비를 수리하려고 시도하지 마십시오 . • 이 경고에 유의하지 않으면 전기 쇼크 , 기계상의 혹은 다른 위험으로부터 서비스 제공자 , 운영자 혹은 환자에게 위해를 가할 수 있습니다 .
ĮSPĖJIMAS (LT)	Šis eksploatavimo vadovas yra prieinamas tik anglų kalba. • Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, numatyti vertimo paslaugas yra kliento atsakomybė. • Nemėginkite atlikti įrangos techninės priežiūros, nebent atsižvelgėte į šį eksploatavimo vadovą ir jį supratote. • Jei neatkreipsite dėmesio į šį perspėjimą, galimi sužalojimai dėl elektros šoko, mechaninių ar kitų pavojų paslaugų tiekėjui, operatoriui ar pacientui.
BRĪDINĀJUMS (LV)	Šī apkalpotāju rokasgrāmata ir pieejama tikai angļu valodā. • Ja apkalpošanas sniedzējam nepieciešama informācija citā, nevis angļu, valodā, klienta pienākums ir nodrošināt tās tulkošanu. • Neveiciet aprīkojuma apkopi, neizlasot un nesaprotot apkalpotāju rokasgrāmatu. • Šī brīdinājuma neievērošana var radīt elektriskās strāvas trieciena, mehānisku vai citu risku izraisītu traumu apkopes sniedzējam, operatoram vai pacientam.
WAARSCHUWING (NL)	Deze service manual is alleen in het Engels verkrijgbaar. • Indien het onderhoudspersoneel een andere taal nodig heeft, dan is de klant verantwoordelijk voor de vertaling ervan. • Probeer de apparatuur niet te onderhouden voordat deze service manual geraadpleegd en begrepen is. • Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de gebruiker of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.
ADVARSEL (NO)	Denne servicehåndboken finnes bare på engelsk. • Hvis kundens serviceleverandør trenger et annet språk, er det kundens ansvar å sørge for oversettelse. • Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått. • Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.
OSTRZEŻENIE (PL)	Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim. • Jeśli dostawca usług klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta. • Nie należy serwisować wyposażenia bez zapoznania się i zrozumienia niniejszego podręcznika serwisowego. • Niezastosowanie się do tego ostrzeżenia może spowodować urazy dostawcy usług, operatora lub pacjenta w wyniku porażenia elektrycznego, zagrożenia mechanicznego bądź innego.
AVISO (PT-BR)	Este manual de assistência técnica só se encontra disponível em inglês. • Se o serviço de assistência técnica do cliente não for GE, e precisar de outro idioma, será da responsabilidade do cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • O não cumprimento deste aviso pode por em perigo a segurança do técnico, operador ou paciente devido a choques elétricos, mecânicos ou outros.

AVISO (PT-PT)	Este manual técnico só se encontra disponível em inglês. • Se a assistência técnica do cliente solicitar estes manuais noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual técnico. • O não cumprimento deste aviso pode provocar lesões ao técnico, ao utilizador ou ao paciente devido a choques eléctricos, mecânicos ou outros.
AVERTISMENT (RO)	Acest manual de service este disponibil numai în limba engleză. • Dacă un furnizor de servicii pentru clienți necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere. • Nu încercați să reparați echipamentul decât ulterior consultării şi înțelegerii acestui manual de service. • Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolelor de electrocutare, mecanice sau de altă natură.
ПРЕДУПРЕЖДЕНИЕ (RU)	Настоящее руководство по обслуживанию предлагается только на английском языке. • Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует обеспечить перевод самостоятельно. • Прежде чем приступать к обслуживанию оборудования, обязательно обратитесь к настоящему руководству и внимательно изучите изложенные в нем сведения. • Несоблюдение требований данного предупреждения может привести к тому, что специалисты по обслуживанию, операторы или пациенты получат удар электрическим током, механическую травму или другое повреждение.
VAROVANIE (SK)	Tento návod na obsluhu je k dispozícii len v angličtine. • Ak zákazníkov poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednosťou zákazníka. • Nepokúšajte sa o obsluhu zariadenia skôr, ako si neprečítate návod na obsluhu a neporozumiete mu. • Zanedbanie tohto varovania môže vyústiť do zranenia poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanickým alebo iným nebezpečenstvom.
OPOZORILO (SL)	Ta servisni priročnik je na voljo samo v angleškem jeziku. • Če ponudnik storitve stranke potrebuje prirocnik v drugem jeziku, mora stranka zagotoviti prevod. • Ne poskušajte servisirati opreme, če tega prirocnika niste v celoti prebrali in razumeli. • Če tega opozorila ne upoštevate, se lahko zaradi elektricnega udara, mehanskih ali drugih nevarnosti poškoduje ponudnik storitev, operater ali bolnik.
UPOZORENJE (SR)	Ovo servisno uputstvo je dostupno samo na engleskom jeziku. • Ako klijentov serviser zahteva neki drugi jezik, klijent je dužan da obezbedi prevodilacke usluge. • Ne pokušavajte da opravite uredaj ako niste procitali i razumeli ovo servisno uputstvo. • Zanemarivanje ovog upozorenja može dovesti do povredivanja servisera, rukovaoca ili pacijenta usled strujnog udara ili mehanickih i drugih opasnosti.
VARNING (SV)	Den här servicehandboken finns bara tillgänglig på engelska. • Om en kunds servicetekniker har behov av ett annat språk än engelska ansvarar kunden för att tillhandahålla översättningstjänster. • Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken. • Om du inte tar hänsyn till den här varningen kan det resultera i skador på serviceteknikern, operatören eller patienten till följd av elektriska stötar, mekaniska faror eller andra faror.
UYARI (TR)	Bu servis kilavuzunun sadece ingilizcesi mevcuttur. • Eğer müşteri teknisyeni bu kilavuzu ingilizce dişinda bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer. • Servis kilavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz. • Bu uyariya uyulmamasi, elektrik, mekanik veya diğer tehlikelerden dolayi teknisyen, operatör veya hastanin yaralanmasina yol açabilir.

ЗАСТЕРЕЖЕННЯ (UK)	Дане керівництво з сервісного обслуговування постачається виключно англійською мовою. • Якщо сервісний інженер потребує керівництво іншою мовою, користувач забов'язаний забезпечити послуги перекладача. • Не намагайтеся здійснювати технічне обслуговування даного обладнання, якщо ви не читали, або не зрозуміли інформацію, надану в керівництві з сервісного обслуговування. • Недотримання цього застереження може призвести до травмування сервісного інженера, користувача даного обладнання або пацієнта внаслідок електричного шоку, механічного ушкодження або з інших причин невірного обслуговування обладнання.
CẢNH BÁO (VI)	Tài Liệu Hướng Dẫn Sửa Chữa chỉ có bản tiếng Anh. • Nếu các đơn vị cung cấp dịch vụ cho khách hàng yêu cầu một ngôn ngữ nào khác tiếng Anh, thì khách hàng sẽ có trách nhiệm cung cấp các dịch vụ dịch thuật. • Không được sửa chữa thiết bị trừ khi đã tham khảo và hiểu Tài liệu Hướng dẫn Sửa chữa. • Không tuân thủ những cảnh báo này có thể dẫn đến các tổn thương cho người thực hiện sửa chữa, người vận hành hay bệnh nhân, do sốc điện, các rủi ro về cơ khí hay các rủi ro khác.
警告 (ZH-CN)	本维修手册仅提供英文版本。 • 如果维修服务提供商需要非英文版本，客户需自行提供翻译服务。 • 未详细阅读和完全理解本维修手册之前，不得进行维修。 • 忽略本警告可能对维修人员，操作员或患者造成触电、机械伤害或其他形式的伤害。
警告 (ZH-TW)	本維修手冊只提供英文版。 • 如果客戶的維修人員有英語以外的其他語言版本需求，則由該客戶負責提供翻譯服務。 • 除非您已詳閱本維修手冊並了解其內容，否則切勿嘗試對本設備進行維修。 • 不重視本警告可能導致維修人員、操作人員或病患因電擊、機械因素或其他因素而受到傷害。