

Datex-Ohmeda

S/5™ Anesthesia Monitor, S/5™ Critical Care Monitor

Planned Maintenance Instructions



All specifications are subject to change without notice.

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1 INTRODUCTION

1.1 About planned maintenance

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

These instructions include a [Check Form](#) (*APPENDIX A*) to be filled in when performing the corresponding procedures.

The symbol  in the instructions means that the performed procedure 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 how to perform a certain PM procedure, please refer to the corresponding slot in the Product Service Guide in the Technical Reference Manual.

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

e.g. *Parameters - More... - TONO*

As you enter the service menus, you need 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.

The procedures are designed for monitors with S/5 monitor software L-ANE01(A) or L-ICU01(A). However, most of the procedures also apply to monitors with older monitor software.

1.2 Recommended tools

Tool	Order No.	For product(s)
Calibration gas and regulator	755580/755534	Tonometry Module, M-TONO
Sampling line	733251	Tonometry Module, M-TONO
Tonometrics™ catheter		Tonometry Module, M-TONO
Luer plug	-	Tonometry Module, M-TONO
Pressure manometer	-	Tonometry Module, M-TONO
Earphones	-	EEG Module, M-EEG
EEG simulator	90502	EEG Module, M-EEG
Flowmeter	-	All Airway modules
Calibration gas	755582	Airway Module, G-XXXX
Calibration gas and regulator	755583/755533	Compact Airway Module, M-CAiO(VX)
Calibration gas and regulator	755587/755530	Compact Airway Module, M-COVX
Calibration gas and regulator	755581/755533	Compact Airway Module, M-C, M-CO(V)
Sampling line 3.0 m	73319	All Airway modules
Sampling line 2.0 m	73318	Compact Airway Module, M-COVX/M-CAiOVX
Spirometry tube	884101	All Airway modules w/ (V)
D-lite	733950	All Airway modules w/ (V)
Patient simulator	-	Hemodynamic modules
Pressure manometer	-	Hemodynamic modules w/ (P), M-NIBP, M-TONO
Temperature test set	884515	Hemodynamic modules w/ (T)
3-lead ECG trunk cable	-	Hemodynamic modules w/ (E)
5-lead ECG cable	-	Hemodynamic modules w/ (E)
10-leadwire ECG cable		Hemodynamic modules w/ (E12)
SpO ₂ finger probe	SAS-F4	Hemodynamic modules w/ (S)
InvBP transducer	-	Hemodynamic modules w/ (P)
Adult NIBP cuff	572435	Hemodynamic modules w/ (NIBP)
Adult NIBP hose	877235	Hemodynamic modules w/ (NIBP)
SvO ₂ simulator	890121	M-COPsv
C.O. Catheter cable	16590	M-COP/COPsv
NMT simulator	871251	M-NMT
M-NMT ElectroSensor	888416	M-NMT
M-NMT sensor cable	888415	M-NMT
Nellcor SpO ₂ probe	-	M-NSAT
MemCard – Menu	-	M-MEM
MemCard – Data	-	M-MEM
Screwdriver	-	All

1.3 Recommended parts

Part	Order No.	For product(s)
Nafion tube	733382	Tonometry Module, M-TONO
Fan filter	871558	Central Unit, F-CU8
Fan filter	874594	Extension Frame, F-EXT4
Recorder paper	74205	M-REC

1.4 Planned maintenance parts

1.4.1 PM parts for Airway Modules, G-XXXXX

Part	Order No.	For product(s)
Special tube	733383	Airway Modules, G-XXXXX
Special tube	733382	All Airway modules
OM ref. Filter	86901	Airway Modules, G-XXXXX
Fan filter	871558	Airway Modules, G-XXXXX
Cable tie	64001	Airway Modules, G-XXXXX
D-fend O-ring (2 pcs)	65312	All Airway modules
D-fend (black)	876445	All Airway modules
Sampling line 3.0 m	73319	All Airway modules
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001762.

1.4.2 PM parts for Compact Airway Modules, M-XXXXXX without CO2 absorber - Anesthesia

Part	Order No.	For product(s)
Special tube	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	65312	All Airway modules
D-fend (black)	876445	All Airway modules
Sampling line 2.0 m	73318	Compact Airway Modules
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001758.

1.4.3 PM parts for Compact Airway Modules, M-XXXXXX without CO2 absorber - Critical Care

Part	Order No.	For product(s)
Special tube	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	65312	All Airway modules
D-fend+ (green)	893200	All Airway modules
Sampling line 2.0 m	733162	Compact Airway Module, M-COVX
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001759.

1.4.4 PM parts for Compact Airway Modules, M-XXXXXX with CO2 absorber - Anesthesia

Part	Order No.	For product(s)
Special tube (2 pcs)	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	65312	All Airway modules
D-fend (black)	876445	All Airway modules
Sampling line 2.0 m	73318	Compact Airway Modules
PM sticker	893108	All Airway modules

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

1.4.5 PM parts for Compact Airway Modules, M-XXXXXX with CO2 absorber - Critical Care

Part	Order No.	For product(s)
Special tube (2 pcs)	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	65312	All Airway modules

D-fend+ (green)	893200	All Airway modules
Sampling line 2.0 m	733162	Compact Airway Module, M-COVX
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001761.

2 PLANNED MAINTENANCE CHECKLIST

2.1 Visual inspection/preparation

2.1.1 General

NOTE: 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 from the 8-Module Frame, F-CU8. If the monitor is connected to the Datex-Ohmeda network, disconnect the Mon-Net cable from the Network Board, B-NET or UPI4NET board, B-UI4NET. If the Memory Module, M-MEM is connected, remove any memory cards.

1. Check all units visually. Check e.g. that all parts are intact, 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-CU8: the equipotential tap and all the screws are tightened properly.

Airway Module, G-XXXX: the equipotential tap is tightened properly.

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

2. The lead-acid battery in the power supply unit is recommend to be replaced after every 4 years. Replace the battery, if necessary.

The SRAM/Timekeeper battery on the CPU board is recommend to be replaced after every 8 years. Replace the battery, if necessary.

NOTE: The Factory Reset should be performed if the SRAM/Timekeeper battery, or the SRAM/Timekeeper chip is replaced.

3. Clean or replace the F-CU8 fan filter.
4. 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 Airway Module, G-XXXXX

1. Remove the Airway Module case, the top protection cover and the bronze plate from the side of the O2 sensor, if installed.

Detach the PVX board with the support plate, if installed, and leave the board detached until further notice.

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

NOTE: Make sure that none of the tubes are in contact with the sampling pump or with the O2 sensor.

2. Install the PM Kit

Replace the special tubes (Nafion™).
Replace or install the OM ref. filter, order code 86901.
Check the D-fend O-rings and replace them, if necessary
Replace the D-fend and the sampling line.
Clean or replace the fan filter.

NOTE: Use only Datex-Ohmeda sampling lines to ensure proper functioning.

3. The CO₂ absorber is recommend to be replaced after every 4 years. Replace the absorber, if necessary.



Connect the Airway Module to the F-CU8 with a long gas interface cable.

2.1.4 Compact Airway Module, M-CXXXXX

1. Detach the module box.

Check that all cables and tubes are connected properly and 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 tubes are not in contact with the sampling pump or the O₂ sensor, or its springs.

2. Install the PM Kit:

Replace the special tubes (Nafion™).

Replace the Ref. filter assembly.

Replace the filters in the pneumatic unit (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 Datex-Ohmeda sampling lines to ensure proper functioning.

Use a 2 m/7 ft sampling line with Compact Airway Modules M-COVX and M-CAiOVX.

3. The CO₂ absorber is recommend to be replaced after every 4 years. Replace the absorber if necessary.

Note: All Compact Airway Modules do not contain a CO₂ absorber.



Connect the Compact Airway Module to one of the F-CU8 module slots with a long gas interface cable (the grounding plates of the cable should be removed).

2.1.5 Tonometry Module

1. Detach the module box.

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

2. Replace the special tube (Nafion™)

Reattach the module box and check that the latch moves properly. Plug the module back into the F-CU8.



2.1.6 Recorder module

1. Clean the Recorder Module, M-REC.

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.



2.1.7 Modules with NIBP measurement

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

Note: M-NIBP Rev. 00-03 do not contain a NIBP pump filter.

Plug the module back into the frame.



2.2 Functional Inspection

2.2.1 General

1. 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 and off, normal start-up sound is heard from the loudspeaker and monitoring screen appears.

No error messages should appear onto the screen.

3. Check that all of the connected modules are recognized, i.e. the required parameter information is shown on the screen.

If the Recorder Module, M-REC, is connected, the module should record two lines of start-up information.

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

Others - EEG - Montage - EEG Channels - 4

Others - EEG - Montage - Montage type - Bip

Others - EEG - EEG Setup - Numeric 1 - MF

Others - EEG - EEG Setup - Numeric 2 - Ampl.

Others - EP - Cycle - Cont.

- EP - AEP Setup - AEP Channels - 2

- EP - AEP Setup - Responses - 100

- EP - AEP Setup - Stim. Frequency - 1.1Hz

- EP - AEP Setup - Stim. Intensity - 90 dB

- EP - AEP Setup - Sweep length - 100 ms

- EP - EP size - 1

Recorder - 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 View - Scaling - Indep.
- Paw Scale - 20
- Flow Scale - 15

or

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

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

Others - SvO2 - Update HGB - 115 g/l

or

Wedge C.O: SV02 - C.O. View - C.O. Setup - Scale - 1.0 °C
- Injectate Volume - 10 ml
- Measurement Mode - SET

Wedge C.O: SV02 - 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 μ s
- Stim. Beep Volume - 2

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

2.2.2 Display(s)

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 / Command Board:

Press the **Help** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Highlight **Normal Screen**, press the ComWheel 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 functioning 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 8-Module Frame, F-CU8

1. Check that the fan is 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, M-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 Airway Module, G-XXXX

1. Check that the Airway Module fan is running.
2. Wait until the message 'Calibrating gas sensor' disappears from the screen, then enter the **ACX** service menu.

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' -values are not increasing faster than by 50 per second.

3. If the module contains a membrane key on the front panel, press the key for at least one second and check that it is identified.
4. Check that the 'Calib zero' value for N2O is less than 61000.
5. Check that the 'Ambient' value corresponds with the current ambient pressure (± 20 mmHg).

6. Check the CO₂ absorber.

Keep the tip of the sampling line away from you and let the monitor draw in room air. Check that the 'Insp CO₂' value on the **ACX** service menu is higher than 3.

7. Perform a sampling system leak test.
8. Block the tip of the sampling line with your finger until the 'Amb-Work' value becomes stable. Check that the value reaches 110.
9. Check the flow rates and adjust them, if necessary.

NOTE: If any of the constriction cassettes is replaced, the leak test should be repeated.

10. Perform a gas calibration:

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

NOTE: If the module contains the agent identification unit, ASX-100 or ASX-200, keep feeding gas at least 15 seconds after the message 'Adjust' appears on the menu. This gives the agent identification unit enough time for calibration.

11. Switch the monitor to standby.

Install the PVX board, if installed originally, and reassemble the module.

Connect the Airway Module to the F-CU8 with the original gas interface cable.

Switch the monitor back on and wait until the message 'Calibrating gas sensor' disappears from the screen.



For Airway Modules containing the Agent identification option

12. Enter the **ASX** service menu:

Feed calibration gas. When a proper absorption spectrum is shown in the menu check that the module identifies the gas and the 'Peak normal' value is close to 10.50 (± 0.20). Check also that the difference between the displayed 'Peak normal' and 'Peak mirror' values is not greater than 0.30.

NOTE: The ASX-100 is not capable of identifying all calibration gases. The **ASX** service menu values are not updated with the ASX-100.



For Airway Modules containing the Patient Spirometry option

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

Perform the spirometry tubing leak test.

14. Connect the sampling line to the D-lite. 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 Airway Modules, G-XXXX

15. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears onto the monitor screen within 30 seconds.
16. Remove the D-fend and check that the message 'Check D-fend' appears on the screen within 30 seconds.



2.2.7 Compact Airway Module

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 their are identified.

NOTE: The Compact Airway Module membrane keys require S/5 main software.

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 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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 calibration gases, the calibration does not succeed.



Compact Airway Modules w/ the Anesthesia Agent option

10. Enter the *Gases* service menu.

Feed calibration gas (order code 755583) continuously for at least for 30 seconds and check that the 'ID' in the service menu shows 'DES' and that the value for 'ID unrel.' is lower than 50.



Compact Airway Modules w/ the Patient Spirometry option

11. Enter the *Spirometry* service menu.

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

Perform 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.



For all Compact Airway Modules

- Switch the monitor to standby and reassemble the module.

NOTE: Attach the plastic cover to the CPU Board before fitting the module box. Make sure that the grounding claws in the front panel frame make 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.

Install the Compact Airway Module into the F-CU8. Switch the monitor back on and wait until the message 'Calibrating gas sensor' disappears from the screen.

13. 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.
14. Detach the D-fend and check that the messages 'Check D-fend' appears on the monitor screen within 30 seconds.



2.2.8 Tonometry Module, M-TONO

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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 'general error status', 'module pneumatics error status', 'module hardware error status' and 'testbit status' are all zero.

2. Check functioning of the front panel **Start-Stop** and **Lab Data** membrane keys.
3. Perform the pressure sensor calibration.
4. Perform the system test.
5. Perform the gas calibration.
6. Connect the catheter to the module. Start measurement by pressing the **Start-Stop** key on the module. Check that the catheter fills up.

Stop the measurement by pressing the **Start-Stop** key. Check that Meas. Off text appears on the digit field.



2.2.9 Hemodynamic Modules

ECG and RESP measurements

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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.

5. @ M-ESTPR, M-ETPR, M-ESTR, M-NESTPR, M-NETPR and M-NESTR modules: connect a 5-lead ECG cable to the module. Connect the cable leads to a patient simulator. Check that the 'Cable type' shows 5 lead.

@ M-NE12STPR, M-NE12TPR and M-NE12STR modules: connect a 10-leadwire ECG cable to the module. Connect the cable leads to a patient simulator. Check that the 'Cable type' shows 10 lead.

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: When the ground lead (black) is disconnected all the electrodes should show OFF.

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 onto the screen.

NOTE: When RA, LA or LL 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 the simulator configuration.

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

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



Modules w/ temperature measurement

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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.



Modules w/ invasive blood pressure measurement

10. Check functioning of the 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.



Modules w/ SpO₂ measurement

Check that the message 'No probe' is shown when no SpO₂ sensor is connected.

Connect SpO₂ 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 SpO₂ probe to your finger. Check that a reading of 95-99 and a pleth waveform appear onto the screen.



Modules w/ non invasive blood pressure measurement

14. Enter the **NIBP** module service menu.

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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 functioning the front panel membrane keys.
16. Check the NIBP tubing system for leakages by performing **Active leak test**.
17. Check NIBP calibration by performing **Calibration Check**.
18. Enter the **Pneumatics** service menu.
Check the NIBP watchdog timer activation pressure with a pressure manometer.
19. Check the NIBP watchdog timer by performing **Watchdog – Test Adult** and **Test Infant**.
20. Check the safety valve by performing **Safety Valve – Adult** and **Infant**.
21. Attach an adult NIBP cuff onto your arm and perform one NIBP measurement. Check 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.



2.2.10 EEG Module, M-EEG and EEG Headbox, N-EEG

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values in the module view are not increasing faster than by 50 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 Timeouts', 'HB Mod Bad Checksum' and 'Mod HB Bad Checksum' values are not increasing faster than by 50 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 k Ω as imped. pos. and imped. neg. value on the simulator. Go to **EEG & EP** service menu and select **Check Electr.** From the headbox view check that the impedances in all four channels are 10 k Ω \pm 1 k Ω .
4. Select 2 k Ω as imped. pos. and imped. neg. value on the simulator. Select 10 Hz 200 μ V sinewave on the simulator and check that all the four waveforms have same form. Check that the size of the waveforms is 200 μ V_{pp} \pm 5 μ V. Check that the MF value is 10 \pm 0.5 Hz. Check that the amp value is 71 μ V \pm 3 μ V.
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 in 1.1 Hz frequency. Stop the stimulation by pressing again the **EP Start/Stop** button on the module. Check that the clicking stopped.



2.2.11 Pressure/Pressure Temp Modules, M-P/-PT

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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 functioning 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 w/ temperature measurement

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

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



2.2.12 Dual pressure Module, M-PP

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 per second. Check that the Dual Pressure module, M-PP, memories have passed the internal memory test, i.e. 'RAM', 'ROM' and 'EEPROM' all show **OK**.

2. Check the functioning 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.



2.2.13 Cardiac Output Modules, M-COP/-COPSv

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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 functioning 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.



SvO₂ measurement

4. Check that the SvO₂ values 'Meas. state', 'OM fail' and 'OM temp.' in the **COP** module service menu all show **NO OM**.
5. Checks with the SvO₂ simulator:

Turn the SvO₂ 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 SvO₂:

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 SvO₂ simulator.

Check that the calibration date for In Vitro calibration was updated correctly and the SvO₂ reading on the screen is 81% ($\pm 2\%$).



Cardiac Output measurement

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

Check the front panel **Start C.O.** membrane key.

8. Enter the **C.O. View** menu:

Others - C.O. View

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

If the module contains a C.O. Test connector (M-COP), 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.



2.2.14 NIBP module, M-NIBP

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

Check that the Timeouts, Bad checksums and Bad c-s by mod values are not increasing faster than by 50 per second. Check that the NIBP board memories have passed the internal memory test, i.e. 'RAM', 'ROM' and 'EEPROM' all show **OK**.

2. Check the front panel LEDs and membrane keys using the **Buttons/Leds** service menu.

3. Check the NIBP tubing system for leakages by performing **Active leak test**.

4. Check NIBP calibration by performing **Calibration Check**.

5. Enter the **Pneumatics** service menu.

Check the NIBP watchdog timer activation pressure with a pressure manometer.

6. Check the NIBP watchdog timer by performing **Watchdog – Test Adult** and **Test Infant**.

7. Check the safety valve by performing **Safety Valve – Adult** and **Infant**.

8. Attach an adult NIBP cuff onto your arm and perform one NIBP measurement. Check the module identifies the cuff, i.e. the text 'Adult' appears on the NIBP digit field for a short time.

Check that the module gives a reasonable measurement result.



2.2.15 NeuroMuscular Module, M-NMT

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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 functioning 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 M-NMT Sensor Cable with the M-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 k Ω 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***.

5. Connect the M-NMT ElectroSensor leads to the NMT simulator. Set the switch on the simulator to FADE OFF and turn the knob to MAX. Check 'Cable' in the service menu states now only ***EMG***.

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 50.



2.2.16 Nellcor Compatible Saturation module, M-NSAT

1. Enter the ***M-SAT*** service menu:

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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 SpO₂ probe related status information in the menu is correct. Only the 'NoProbe' should be active (1) when no probe is connected.
3. Connect a Nellcor SpO₂ finger probe to the module. Check that the message 'Pulse search' is shown and the corresponding status information in the menu is active. Check that the shown message changes to 'Check probe' within 30 seconds.
4. Attach the SpO₂ probe on your finger. Check that a reading of 95-100 and a proper SpO₂ waveform appear.



2.2.17 Datex-Ohmeda Oxygen Saturation module, M-OSAT

1. Enter the *M-SAT* service menu:

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 per second. Check also that the module's ROM memory has passed the internal memory test, i.e. the 'ROM' shows **OK**.

2. Check that the message 'No probe' is displayed on the screen when no probe is connected.
3. Connect a suitable SpO₂ finger probe to the module. Check that the message 'Check probe' is displayed on the screen within 30 seconds
4. Attach the SpO₂ probe on your finger. Check that a reading of 95-100 and a proper SpO₂ waveform appear.



2.2.18 Memory Module, M-MEM

1. Enter the *MemCards* service menu:

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

2. Check that the Memory board memories and the PCMCIA controller have passed the tests. The status for each should be **OK**

3. Select *Communication*.

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

4. Select *Status*.

Insert Menu card and Data card into their slots.

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, M-REC

1. Open the paper compartment cover. Check that the message 'Recorder: Cover open' appears on the screen, then close the cover.
2. Press the **Record Wave** key and check that the module starts recording the selected waveforms. Press the **Stop** key on the module to stop recording.

Press the **Print Trends** key and check that the module starts recording trends. Press the **Stop** key on the module to stop recording.

3. Check that the quality of the recordings is acceptable.



2.2.20 Network Board, B-NET and UPINET board, B-UPI4NET

1. Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect them to the Network/UPI4NET Board.
2. Check that the monitor connects to the S/5 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.

NOTE: If necessary, the monitor's network communication should be reselected according to the used network software in the **Network** service menu..

3. 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 Board/Module, B-INT/M-INT

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

Check that the 'Timeouts', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 50 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 50 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. 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. 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. Enter the **Set/Test** service menu and perform **WD by GSP**
Check that the monitor restarts.
4. Enter the **Service Log** service menu:
Clear the content of the Service Log by selecting **Reset Log** from the menu.



5. 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. Save information about the performed planned maintenance into the **Maintenance** service menu by performing **Plan. Maint - 1 year PM - Save**



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



APPENDIX A

PLANNED MAINTENANCE CHECK FORM

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

Customer _____
Service _____
Service engineer _____ Date _____

Monitor installation

F-CU8	_____	D-	_____	K-	_____	G-	_____
S-	_____	L-	_____	M-	_____	M-	_____
B-	_____	M-	_____	M-	_____	F-	_____
B-	_____	M-	_____	M-	_____	N-	_____
B-	_____	B-	_____	M-	_____		_____

OK = Test OK

N.A. = Test not applicable

Fail = Test Failed

Visual inspection/preparation

		OK	N.A.	Fail
2.1.1. General		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.1.2. Extension Frame, F-EXT4	S/N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.1.3. Airway Module, G-XXXXX	S/N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.1.4. Compact Airway Module, M-CXXXXX	S/N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.1.5. Tonometry Module	S/N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.1.6. Recorder module	S/N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.1.7. Modules with NIBP measurement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes	_____ _____			

Functional Inspection

		OK	N.A.	Fail
2.2.1. General		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.2. Display(s)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.3. Keyboard(s)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.4. 8-Module Frame, F-CU8	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.5. Extension Frame, F-EXT4		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes	<hr/>			

2.2.6. Airway Module, G-XXXX		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agent identification		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient Spirometry		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes	<hr/>			

2.2.7. Compact Airway Module		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agent identification		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient Spirometry		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes	<hr/>			

2.2.8. Tonometry Module, M-TONO		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes	<hr/>			

2.2.9. Hemodynamic Modules	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ECG and RESP measurements		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Temperature measurement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	OK	N.A.	Fail
InvBP measurement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SpO2-measurement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NIBP measurement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes _____			

2.2.10. EEG Module, M-EEG and EEG Headbox, N-EEG	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes _____				

2.2.11. Pressure/Pressure Temp Modules, M-P/-PT	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
InvBP measurement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Modules w/ temperature measurement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes _____				

2.2.12. Dual pressure Module, M-PP	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes _____				

2.2.13. Cardiac Output Modules, M-COP/-COPSv	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Invasive blood pressure measurement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SvO ₂ measurement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cardiac Output measurement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes _____				

2.2.14. NIBP module, M-NIBP	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.15. NeuroMuscular Module, M-NMT	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.16. Nellcor Compatible Saturation module, M-NSAT	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.17. Datex-Ohmeda Oxygen Saturation module, M-OSAT	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.18. Memory Module, M-MEM	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.19. Recorder Module, M-REC	<input type="text" value="S/N"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.2.20. Network Board, B-NET and UPINET board, B- UPI4NET	S/N <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.21. Interface Board/Module, B-INT/M-INT	S/N <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2.22. Device Interfacing Solution, N-DISxxx	S/N <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	S/N <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	S/N <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	S/N <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	S/N <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes	_____			

2.2.23. General	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Service Log reset	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electrical safety check	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Final cleaning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes	_____		

Used Spare Parts	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

Signature	_____
------------------	-------