bellavista®
the art of breathing

Service Manual
bellavista 1000/1000e

Software Version V3.0 02.13 (in work)

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Table of contents

1. Introduction

Welcome to bellavista. This manual instructs you how to service your bellavista ventilator. Some parts serve as checklist for maintenance tasks.
According to the EU Directive, bellavista is classified as a Class IIb medical device.
Preventive maintenance and calibration has to be performed according to the corresponding schedule (p. 11)

Danger	**Only manufacturer-authorized trained professionals may perform maintenance and repair.** **Appropriate measuring equipment and testing devices must be available.**
Danger	**Before and after each service task, bellavista must be** **- turned off and unplugged** **- cleaned and disinfected**
Danger	**Service must be performed in a clean environment and with protection against electrostatic discharge ESD.**
Danger	**In the event an error message is obtained during self-test or during the ventilator check, do not use bellavista on a patient!**
Danger	**Bellavista must not be used on a patient in service mode. After service level login restart bellavista before connecting it to a patient.**
Caution	Do not sterilise in liquids or in the autoclave.

Factory repair

Repair shipment: https://imt-ag.net/easycal/wizard/easysend.aspx

If possible, use original packaging

Warning	**Never return bellavista uncleaned.**

Hotline

Should you, against expectations, encounter problems with bellavista, please contact your **local distributor** or us directly:

- Hotline +41 81 750 65 95 (09:00 – 16:00 CET)
- www.imtmedical.com
- www.imtmedical.com/easysend (for repair)

1st and 2nd Generation bellavista (G1, G2)

This manual is valid for

- 1st generation (G1) bellavista 1000
  SN: MB100001 … 99
  with low pressure oxygen connection
- 2nd generation (G2) bellavista 1000 and 1000e
  SN: MB100100 … 100999
  with low and high pressure oxygen connection and oxygen blender
- 3rd generation (G3) bellavista 1000 and 1000e
  SN: MB103000 and above
  with new blower for pressure up to 80 mbar

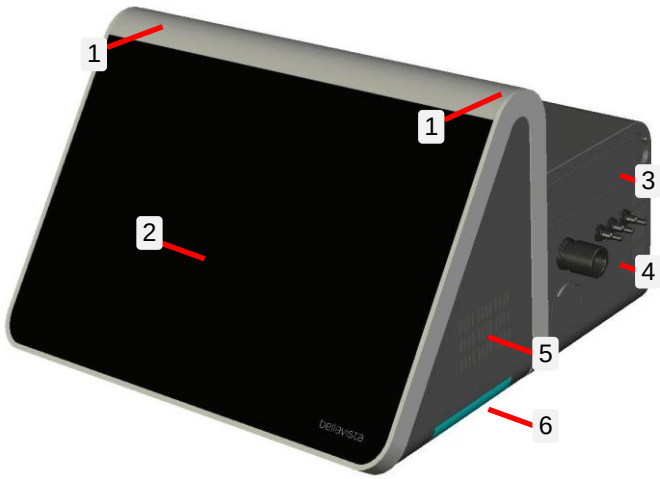
Wherever necessary this manual discriminates between the two generations.

Conditioning, cleaning and sterilising

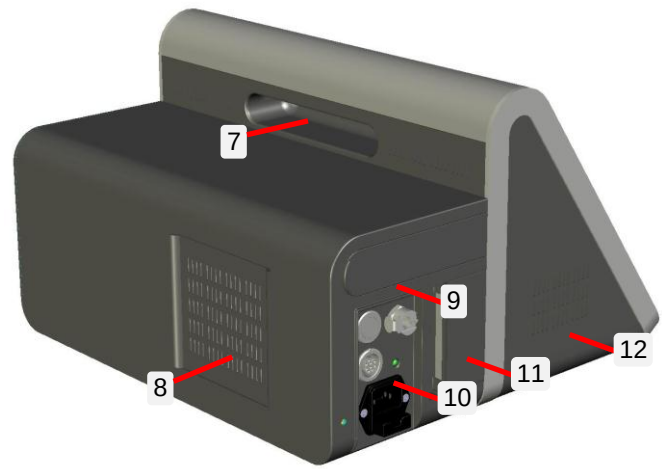
Clean and sterilize bellavista before and after each service task. Proceed as follows:

Step	Activity
1	Turn off bellavista to prevent damage by penetrating liquid.
2	Clean surfaces incl. screen with a damp, lint-free cloth. The cloth should not be too wet! Never use abrasive cloth or cleaning agent. Disinfect only with approved cleaning agents: • Soapy water or mild cleaning agent • Pantasept Spray (isopropyl alcohol) (Xeropharm, CH-1163 Etoy) • Isopropyl alcohol • Ethyl alcohol • Disinfecting wipes (alkyl dimethyl benzyl ammonium)
3	Make sure, bellavista is dry.

For the breathing circuit, follow the instructions of the manufacturer.



bellavista view from front right



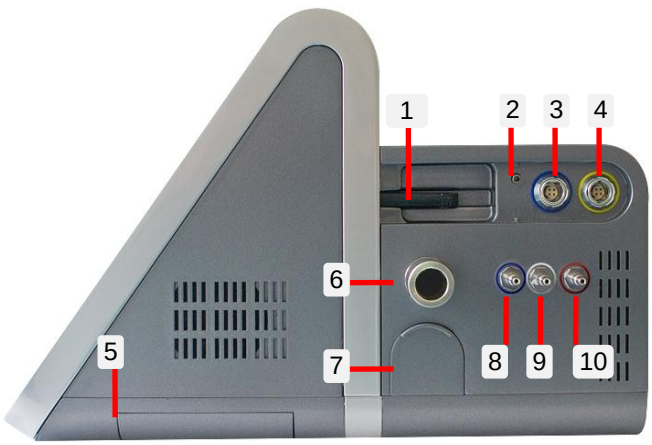
bellavista view from rear left

2. Description of the ventilator

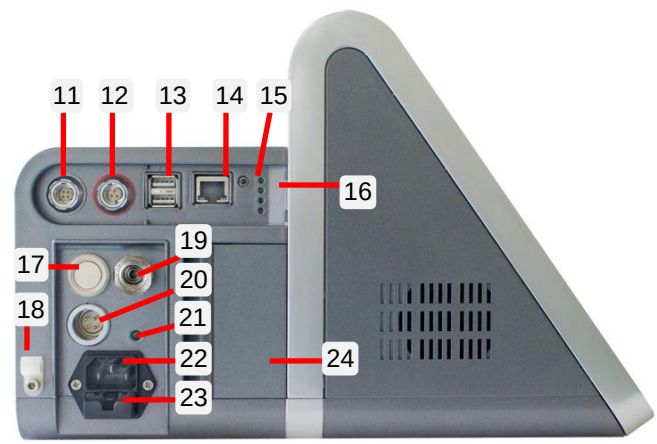
No	Description
1	Alarm lights • Red: **Alarm** e. g. high pressure • Yellow: **Danger** e. g. apnea backup activated • Blue: **Info**, e. g. battery operation
2	Screen with touch screen feature
3	Cover for external sensors
4	Patient connectors
5	Speaker
6	Cover bellavista bay

No	Description
7	Handle
8	Cover for ventilator air filter
9	Cover for communication interfaces
10	On/off switch and power connectors
11	Cover for patient air filter
12	Speaker

At the bottom of bellavista, there are two slots for the storage of covers (3, 9) and access to the battery compartment.



bellavista side panel right

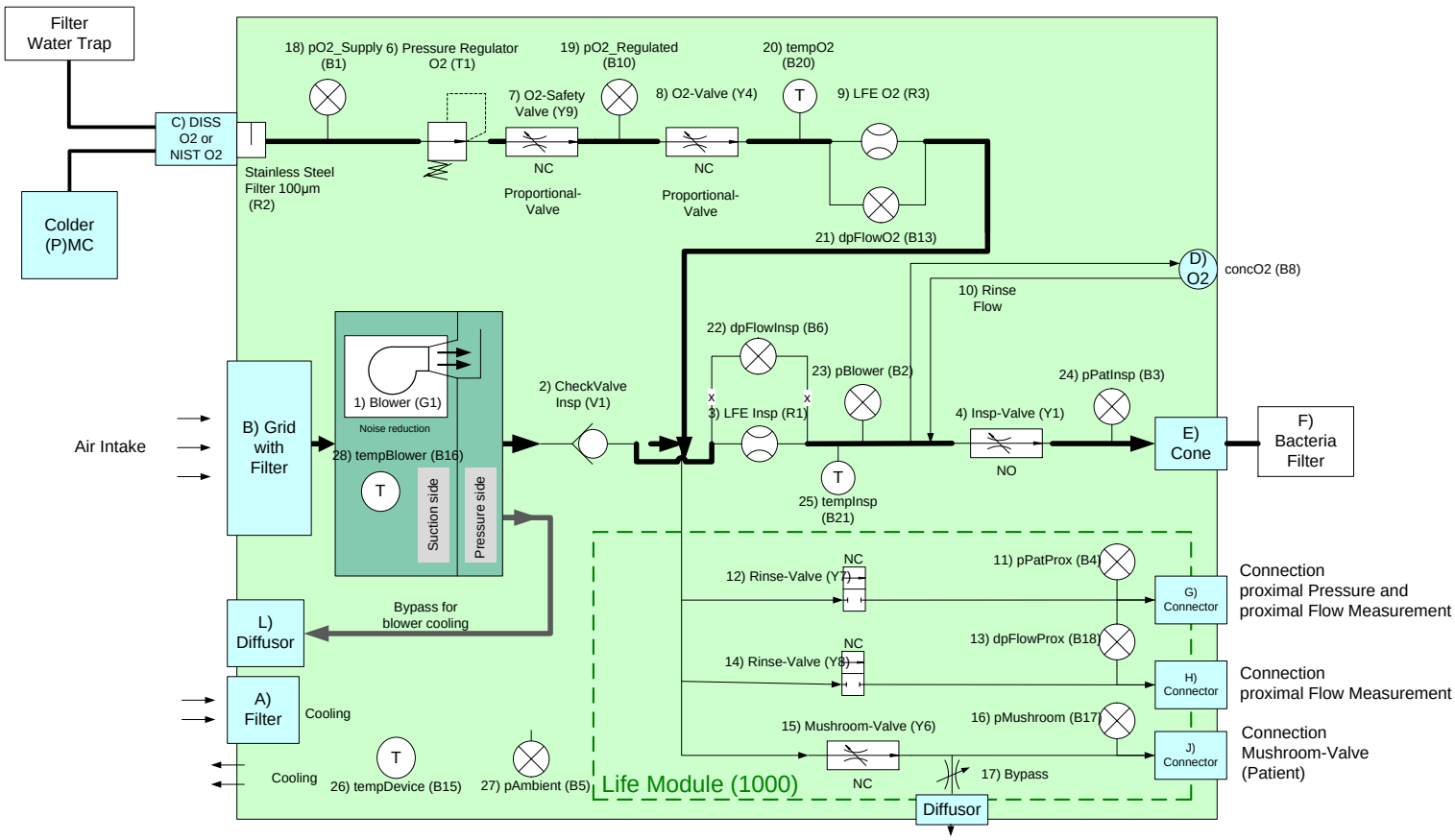


bellavista side panel left

Connectors

No	Description
1	Data storage (USB stick)
2	Push button **Connection Assist**
3	Connector for SpO_2 sensor (optional)
4	Connector for CO_2 sensor (optional)
5	Cover bellavista bay
6	Patient connector inspiration
7	Cover O_2 sensor
8 blue	Connector for proximal pressure measurement
9 white	Connector for flow sensor (optional)
10 red	Connector for expiration valve

No	Description
11	bellavista bus
12	Nurse call
13	2x USB 2.0
14	100 MBit Ethernet network
15	Push button **Connection Assist**
16	Status lights
17	Push button On/Off
18	Strain relief power cord
19	Oxygen supply
20	External DC supply 24 VDC
21	Power indicator (green LED)
22	Power plug
23	Fuse 2 x T 6.3 AH, 250 V
24	Cover for patient air filter



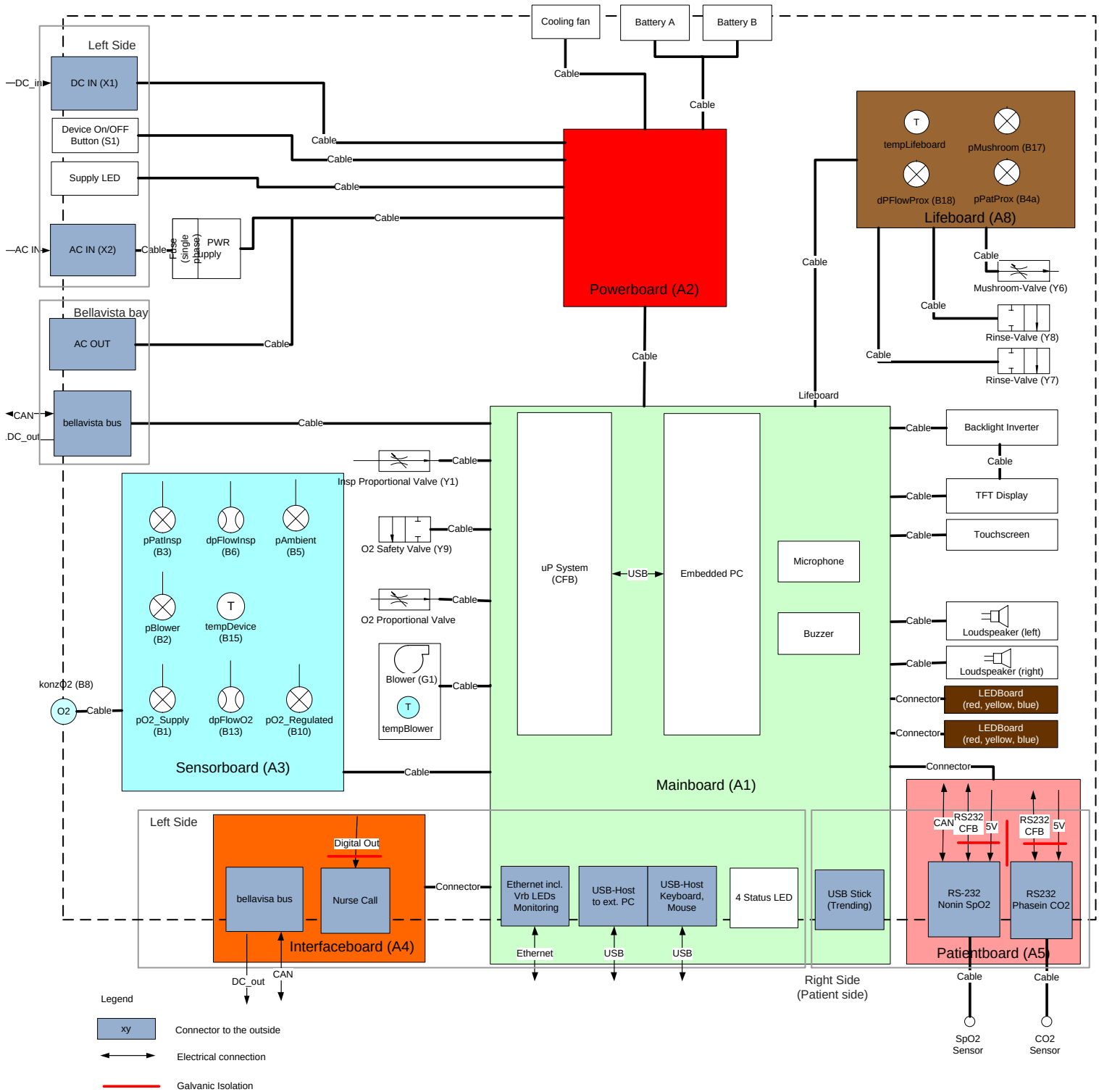
Block schematics pneumatics

A) Device fan (cooling)
B) Air intake with filter
C) O2 connection 0…7 bar: DISS *), NIST*), CPC
D) O2 cell
E) Inspiration connection
F) Bacteria filter and breathing circuit
G) Proximal pressure measurement
H) Proximal flow measurement
J) Expiration valve control line
K) Release for expiration valve control
L) Bypass for blower cooling

1 Blower (Turbine)
2 Check valve
3 Inspiratory flow measurement (internal)
4 Inspiratory proportional valve
5 Airway pressure measurement
6 O2 pressure regulation *)
7 O2 safety valve
8 O2 proportional valve *)
9 O2 flow measurement*)
10 Rinse flow O2 cell
11 Proximal pressure measurement
12 Rinse valve proximal pressure measurement
13 Proximal flow measurement
14 Rinse valve proximal flow measurement
15 Exp. valve control valve
16 Control-pressure measurement exp. valve
17 Exp. valve release valve
18 O2 high pressure sensor *)
19 O2 regulated pressure sensor *)
20 O2 temperature sensor *)
21 O2 differential pressure sensor for flow measurement *)
22 Differential pressure sensor for internal flow measurement
23 Blower pressure
24 Airway pressure (internal)
25 Airway temperature (internal)
26 Internal device temperature
27 Ambient pressure (barometer)

NC Valve normally closed
NO Valve normally open
*) not with 1st generation bellavista 1000 (SN: MB100001 … 99)

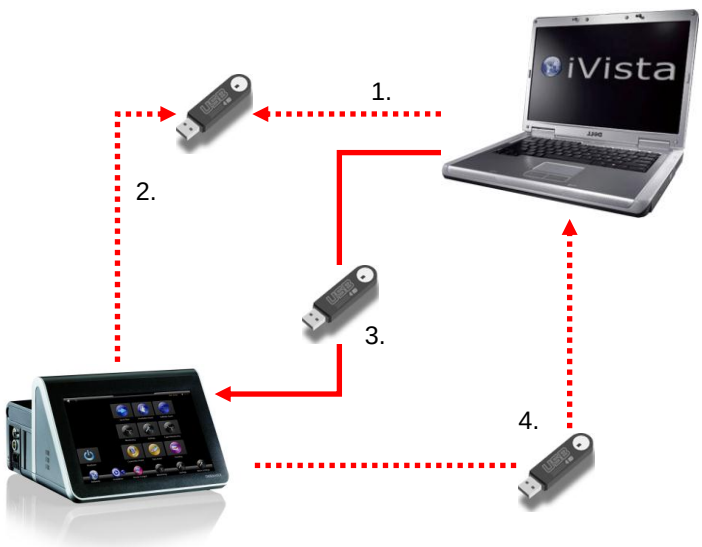
Block schematics electronics

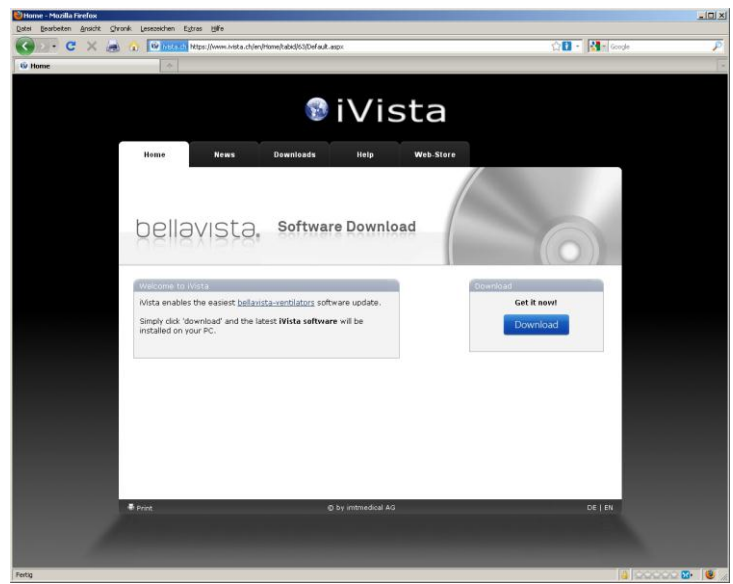


3. Maintenance Schedule

Time interval	Activity, Material	Maintenance date, who	Next maintenance
Weekly or before every new patient	**Quick Check (p. 62)** Requirement: Mandatory Performed by: User Material: • New breathing circuit • New patient air filter • New airway adapter for CO_2 capnography (if used)	n.a.	n.a.
Monthly	**Patient Air Filter Replacement (p 64)** Requirement: Mandatoy Performed by: user or hospital technician Material: Patient air filter	....	....
Every 6 months	**Cooling Air Filter Replacement (p 64)** Requirement: Mandatoy Performed by: user or hospital technician Material: Cooling air filter	....	....
Every 12 months	**Annual Maintenance (p. 34)** Maintenance and safety check in accordance with EN 60601-1. Requirement: Mandatoy Performed by: trained technician Material: see p. 34	....	....
Every 5 years	Full service at the manufacturer		

Time interval	Activity, Material	Maintenance date, who	Next maintenance
When new bellavista software becomes available	**Software Upgrade (p. 13)** After a software upgrade the users have to be trained regarding the new functions and/or changes. Requirement: depends on separate communication Performed by: Product- or application specialist Material: Internet connection, USB stick	....	....
Before sending a previously used bellavista to a customer	**Shipment test (p. 18)** Requirement: Recommended Performed by: trained technician Material: see p. 18	....	....





4. Software Upgrade

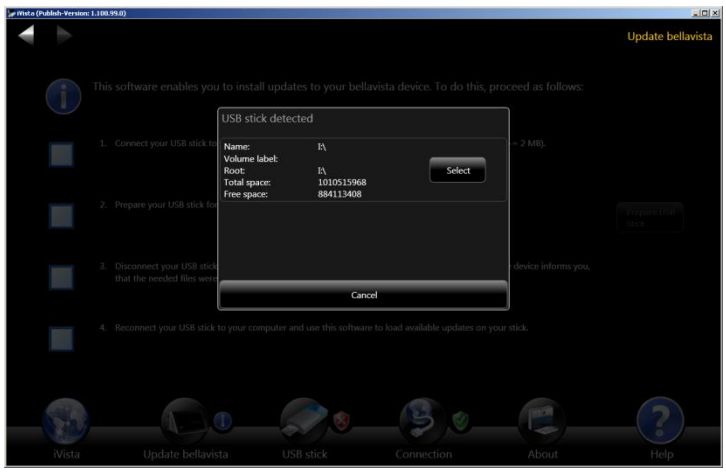
Software upgrades are downloaded from the internet with iVista and transferred to bellavista via USB stick.

1. Make USB stick “bellavista ready” (p. 14)
2. Get bellavista device information (SN and configuration) (p. 14)
3. Download the upgrade onto the USB stick and install it on bellavista (p. 15)
4. After completing the upgrade please upload the device information to the bellavista traceability data base (p. 16)

The following chapters describe the above steps in detail.

Install iVista

1. Download iVista from https://www.ivista.ch on any Windows computer and install it.
2. You require administration rights on your computer.
3. iVista automatically checks for new versions every time it is started



iVista detects the plugged-in USB stick

Make USB stick bellavista-ready

1. Start iVista (internet connection required).
2. Insert USB stick into the computer
3. Select the USB stick
4. If the USB stick is used for upgrading the first time press **Prepare USB key**. This makes the USB stick bellavista-ready (and thus prevents a reaction of bellavista to any other USB stick).
   Existing Data on your USB stick will not be affected.

This directory and its content makes the USB stick “bellavista-ready”. It can be e-mailed or copied to other USB sticks.

Get bellavista device information and LOG Files

Insert bellavista-ready USB key into the bellavista unit.

5. bellavista automatically stores LOG files and device ID.
   A small window pops up in the upper left corner of the screen showing the download process.

This file contains device ID of bellavista with serial number “MB100009”. It is required for iVista to download the upgrade. It can be e-mailed or copied to other USB sticks.

This is a bellavista LOG file. Please e-mail for trouble shooting.

Use iVista do download the upgrade

Download the upgrade

1. Insert the USB stick into the computer running iVista.
2. Select the bellavista serial number you want to upgrade in the Devices panel
3. Select the (latest) version you want to upgrade to on the right side.
4. Press **Get Updates**
5. When finished, safely remove the USB stick using the Windows functionality

This file contains the upgrade for one particular bellavista. It is typically marked with the serial number and can be very large (1GB) if the upgrade includes also the operating system.

A valid upgrade is indicated with a new icon on the bellavista main screen

Upgrade bellavista

1. Insert USB stick in bellavista
2. Select **Software Update** to start the installation and follow the on-screen instructions
3. Finally switch on bellavista again. During the prolonged startup period the new version is initialized and then ready for use.
4. Check the software version in the bellavista About Screen
5. Perform a quick check (p. 62) to ensure full functionality.

Optional steps / diagnosing:

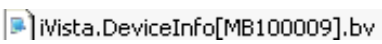
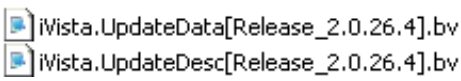
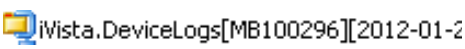
- If the upgrade includes the operating system, it will ask for system time and touchscreen calibration.
- If bellavista seems to lock or does not restart then press the on/off button ⏻ for 5s to forcibly shut down bellavista. Switch bellavista on again while you press both Connection Assist buttons (on left and right connection panels) for the first 10s. This enforces the upgrade installation.

Danger	**After an upgrade always perform a quick check (p. 62) to ensure full functionality.**

Update the bellavista data base

1. Insert the USB key into the bellavista unit you just upgraded.
2. bellavista automatically stores the device information.
3. Insert the USB stick into the computer running iVista.
4. iVista will automatically update the bellavista data base with the up-to-date device information.

Information on a bellavista-ready USB stick

File / Directory	Purpose
	Makes this USB stick bellavista-ready
 (can be multiple files)	Identification information of bellavista with serial No MB100009
 (“Desc” can be multiple files)	Upgrade to Version V2.0.26.4 • “Data” contains actual upgrade • “Desc” contains serial numbers and options released
 (can be multiple files)	LOG file of bellavista with serial No MB100296 dated …

Background on Updates

Content

Updates consist of one or multiple of the following elements. It is not always required to update all of them. Major updates contain all of them.

- Windows XP embedded for EPC running the user interface (≈ 700MB). Touch screen may require re-calibration after Windows update.
- UI software (DeviceSoftware.Application.exe and related resources) and core software. These two are always bundled to ensure compatibility. (≈20 MB)
- Manuals, videos, images (usually bundled) (≈200 MB)

Process

Upgdating is a 2-stage process:

a) While the normal bellavista infrastructure is running, the update is copied from USB memory to a temporary location. Then bellavista is switched off.

b) Upon re-starting, the core processor runs a special program which moves the update from the temporary location to the final location for both, the embedded PC and the core processor.

Update Trouble Shooting

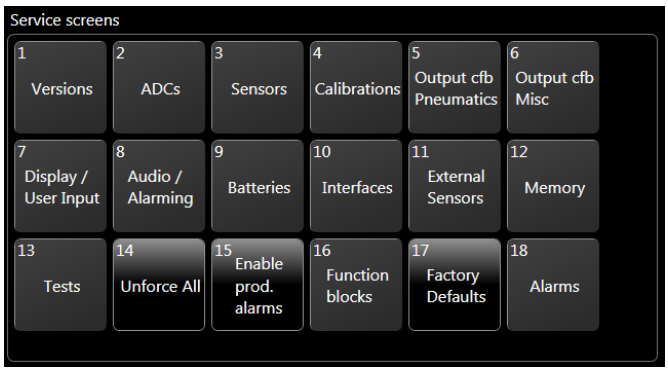
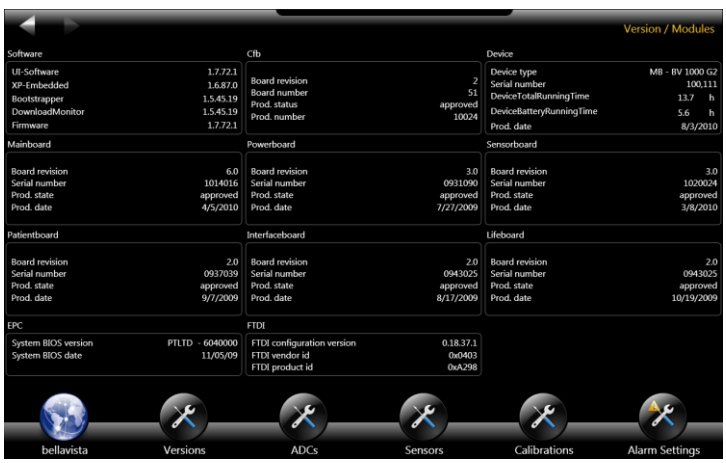
A) If there is an upgrade on the USB stick, but no “Software Update” icon is displayed or the UI software is not running:

- When you plug in the USB key, on the upper left corner a small window shows the progress.
- As soon as it says “Update Detected…” long-click on it until a popup window lets you install the upgrade.
- If the small windows says something like “waiting for …” then again long-click on the little window to force progression.

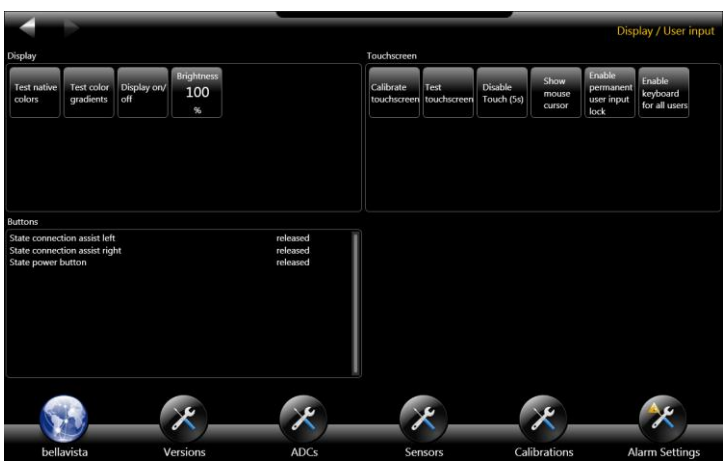
B) If the update fails step b) try the following:

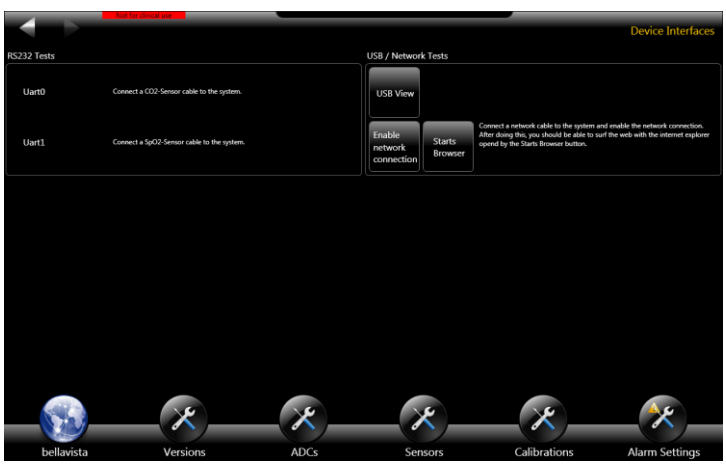
- Force the core process to install the update by keeping pressed both “Connection Assist” buttons while starting up bellavista.

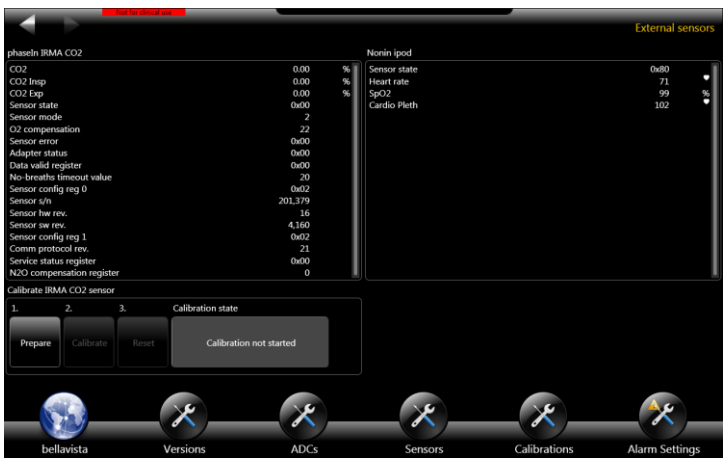
5. Service Menu Overview

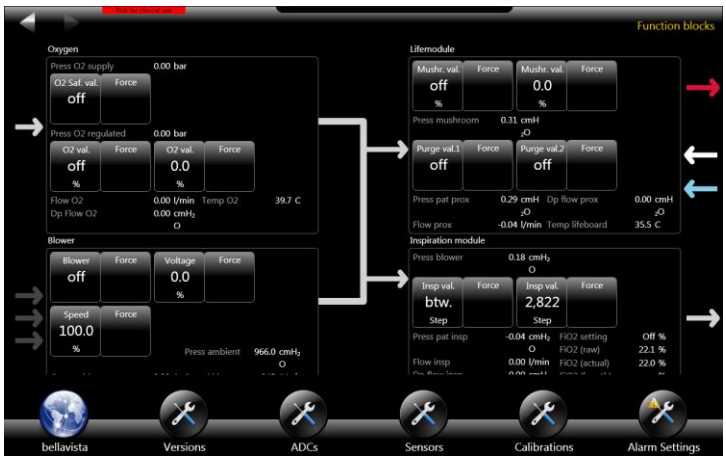
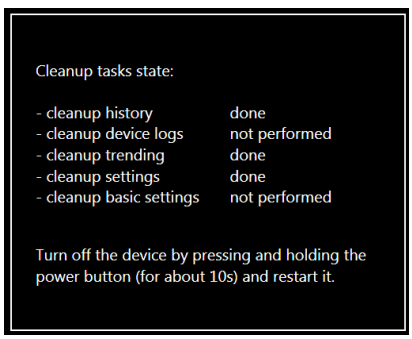
Picture	What to do / Protocol
	**Login into Service level** Password “service!” **Danger** **Bellavista must not be used on a patient in service mode. After service level login restart bellavista before connecting it to a patient.**
	**1 Versions** Provides detailed information on software and printed circuit board versions.
	**2 ADCs** Provides current values of all ADCs (analog to digital converters). This screen can be used for diagnosing. No action required.

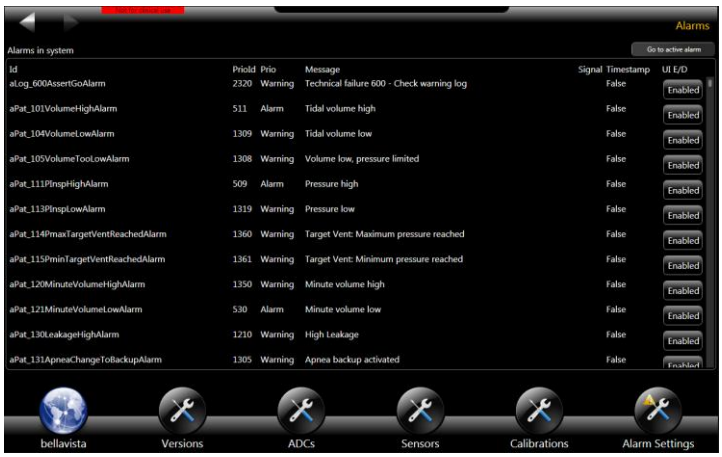
Picture	What to do / Protocol
	## 3 Sensors Current values of all sensors (pressure, temperature, voltage, flow) for diagnosis purpose.
	## 4 Calibrations Steps of calibration each consisting of: • **Prepare**: enables the measurement, puts all valves in the correct position. • Wait for steady conditions! • **Calibrate**: Performs the actual measurement and calibration process (averaging, filtering, calculation) • **Reset**: Sets back all valves and special Some calibrations are grouped: executing the first means, you have to do them all, otherwise the calibration data is marked as invalid and bellavista becomes stops being operational.

Picture	What to do / Protocol
	**5 Output CFB Pneumatics** Allows the controlling of all valves for diagnosing purpose. Caution Do not damage bellavista with unintended operation.
	**6 Output CFB Misc** Allows the controlling of additional outputs for diagnosing purpose: • Nurse Call • Buzzer Caution Do not damage bellavista with unintended operation.
	**7 Display / User Input** Allows display and button diagnosing as well as touch screen calibration.

Picture	What to do / Protocol
	## 8 Audio / Alarming Allows the control and testing of the audio and visual alarming system.
	## 9 Batteries Detailed information on the intelligent batteries.
	## 10 Interfaces This screen is used to diagnose USB and internet interfaces.

Picture	What to do / Protocol
	## 11 External Sensors Tests the functionality of the external sensors and calibrates the CO2 Sensor.
	## 13 Tests • Self-test (page 1) • Circuit test with detailed test results (page 2) • Inspiration valve test (page 3) Note: do not perform the inspiration valve test unless ordered so by imtmedical staff.
	## 14 Unforce All Resets all settings set by the service-user. System audio volume has to be reset manually!

Picture	What to do / Protocol	
	**15 Enable Prod. Alarms** Toggles between normal and “Production Alarm” ranges. Ensure production alarms are off (button shows **Enable prod. Alarms**)	
	**16 Function Blocks** Allows the controlling of all valves for diagnosing purpose similar to **5 Output CFB Pneumatics** but in a more flow-chart oriented way for diagnostics purpose. Caution — Do not damage bellavista with unintended operation.	
	**17 Factory Defaults** Reset all previous user data (optional) • Restart bellavista and go through the First Use Assist.	

Picture	What to do / Protocol
	## 18 Alarms Detailed view and temporary disabling of all bellavista alarms (patient, user and technical). Use **Go to active alarm** to find active alarms in the list. Disabled alarms will automatically be enabled after restarting bellavista.

6. Shipment Test

Scope: This checklist guides through tests which should be performed prior to shipping an already used bellavista to a customer (e.g. demo unit, rental). Some of the tests are optional and serve as a recommendation.

Validity: For all bellavista 1000 G1 and G2

Overview

The Shipment Test performs the following checks and calibrations:

- Reset all previous user data
- Visual check and filter replacement if required
- Functional check of ventilation accuracy with FlowAnalyser
- O2 cell calibration
- Check of:
  - Alarming
  - External sensors SpO2 and CO2
  - Battery
  - Touch screen
- Completeness of delivery

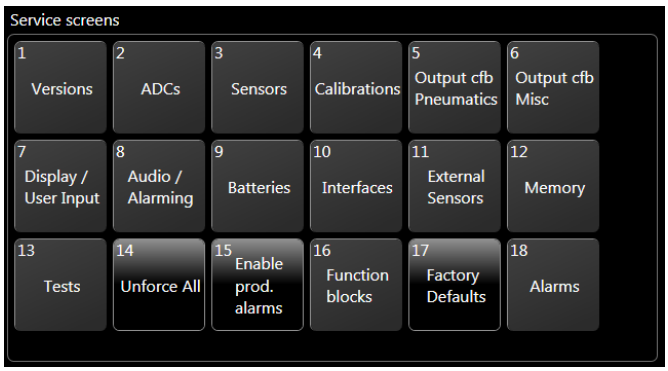
Required material

- 300.116.000 Flow Analyser PF300
- 301.168.000 Filter to protect PF300 from dust and contamination
- 301.167.000 Breathing circuit C (single limb with pressure measurement line, with exp. valve)
- 300.756.000 EasyLung (or SmartLung)
- Oxygen 4…7 bar

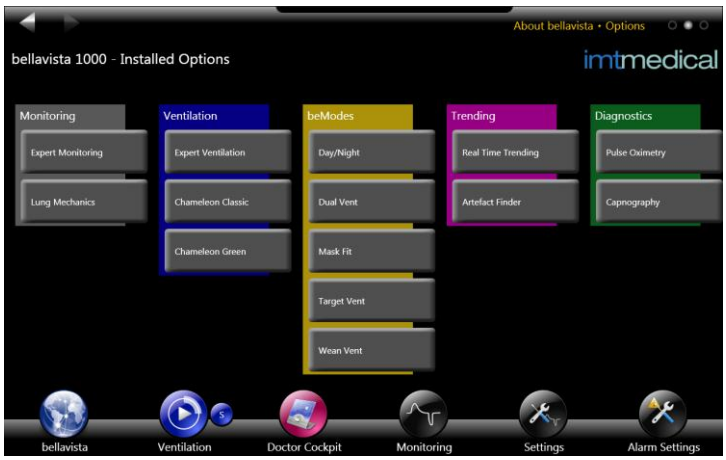
Spare parts

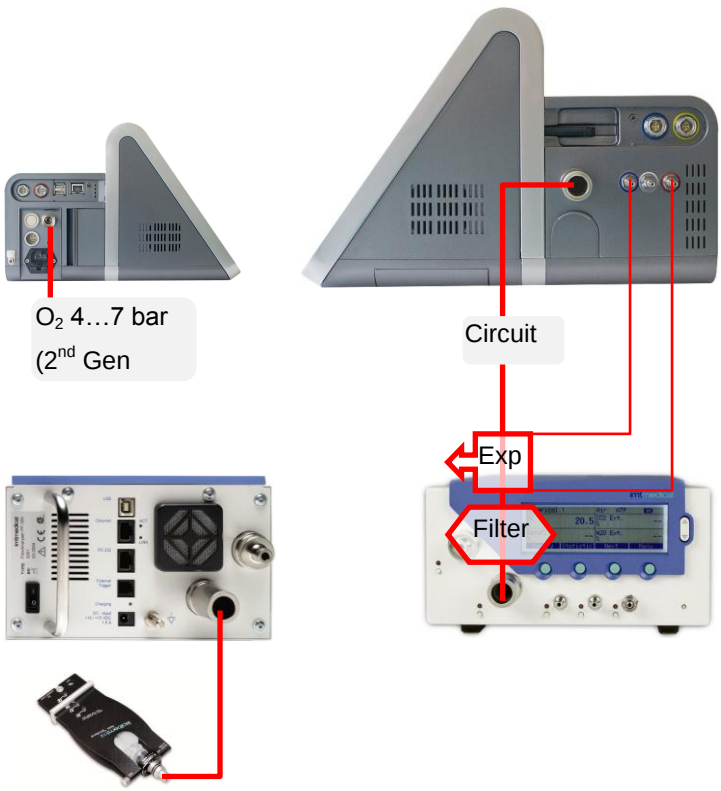
- 300.769.000 O_2 Cell (which may or may not be needed)
- 301.165.000 Annual supply of filter mats (patient air filter + ventilator blower)
- 300.784.000 Battery (which may or may not be needed)

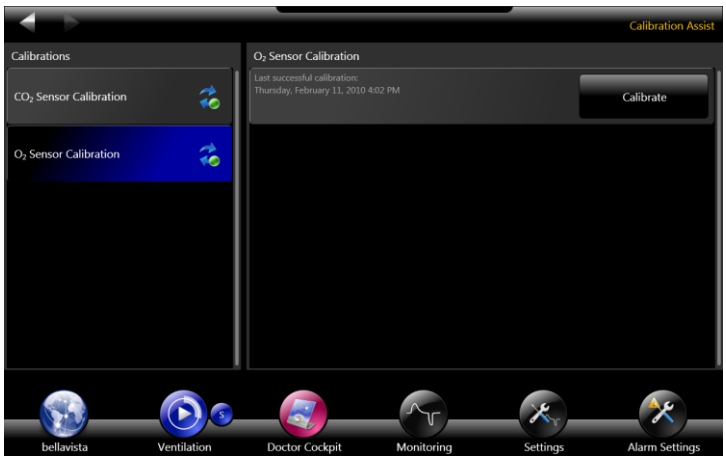
Picture	What to do / Protocol	OK
	Clean bellavista (p. 6)	☐

	**Reset all previous user data (optional)**
	If required delete trending and settings data of previous user:
	• Login as service with password “service!”
	• Select 17. Factory Default. This will do the following:
	  ○ History delete
	  ○ Device logs keep
	  ○ Trending data delete
	  ○ Settings set to factory defaults
	  ○ Profiles delete
	• Restart bellavista and go through the First Use Assist.
		☐

Picture	What to do / Protocol	OK
     Warranty seals	**Visual inspection** Warranty seals and type plate undamaged ..... ☐ OK Power supply cable undamaged..... ☐ OK Next annual maintenance due: ..... ☐ OK Damage protocol:	☐
	Check Filters Patient air filter (p. 64) • Replace monthly .....replaced ☐ Yes ☐ No • Dense layer inside..... ☐ OK Cooling air filter (p. 64) • Replace every 6 months .....replaced ☐ Yes ☐ No	☐
	Startup bellavista bellavista startup without error messages or alarms..... ☐ OK	☐

Picture	What to do / Protocol	OK
	**Software Configuration** See **About bellavista** Serial number: ..... Software Version: ..... Installed options ☐ DualVent™ ☐ Day/Night™ ☐ MaskFit™ ☐ WeanVent™ ☐ TargetVent™ ☐ Expert Ventilation ☐ Expert Monitoring ☐ ChameleonClassic™ ☐ ChameleonGreen™ ☐ Lung Mechanics ☐ Real Time Trending ☐ ArtefactFinder ☐ Advanced Oxygen Therapy	☐
	**USB Check** Built-in USB stick present..... ☐ OK	☐

Picture	What to do / Protocol	OK
	**Functional Test** IMPORTANT: • Switch-on FlowAnalyser and bellavista 30 min before any measurement • Set FlowAnalyser to: Gas type: Air / O2 Auto Gas standard: AP21 • Perform Zero! Calibration on Flow Analyser • ALWAYS use a bacteria filter between bellavista and the FlowAnalyser • Connections according to picture • Select breathing circuit C, non-invasive (**Ventilation Assist**) • O2 symbol on dropdown menu ..... ☐ OK	☐
	Zero Pressure • Do not ventilate • Pressure curve should read <± 0.3 mbar ..... ☐ OK	☐

Picture	What to do / Protocol	OK
	**Calibrate FiO2 Oxygen Cell Sensor** • Calibrate oxygen cell • O2 Monitoring value 21% ±1% ..... ☐ OK • If necessary calibrate O2 sensor of the FlowAlalyser PF300 (21% and 100% calibration) ..... ☐ calibrated ..... ☐ calibration not required	☐
	Ventilation Test • Settings: Mode P-A/C, P_{insp} 12 mbar, PEEP 5 mbar, Rate 12 bpm, Oxygen 21% / 35% / 70% (2^{nd} Generation only) • Start ventilation for 60 sec before reading monitoring parameters:	☐

	Expected	PF-300	Bellavista	OK
P_{Peak}	15…19 mbar	(.....)	.....	☐
PEEP	4…6 mbar	(.....)	.....	☐
Rate	11…13	(.....)	.....	☐
FiO_2 *(Adv. Oxygen Therapy)*	19…23 % 32…28 % 66…70 %	(.....) (.....) (.....)	....	☐ ☐ ☐
Oxygen Level	1 3 5		....	docu. only

Picture	What to do / Protocol	OK
	Alarm Test • Disconnect breathing circuit during ventilation • Disconnect alarm should appear..... ☐ OK • Visual feedback (LEDs)..... ☐ OK • Acoustic feedback..... ☐ OK • Reconnect: alarm disappears ..... ☐ OK	☐
	**11 External Sensors** Ensures the functionality of the external sensors and calibrates the CO2 Sensor. **CO2 Sensor** • Insert fresh airway adapter into CO2 sensor. • Plugin CO2 Sensor. Allow >10s to warm up. Place on horizontal surface. • Calibrate CO2 Sensor (**Calibration Assist**) • Breathing into the sensor should show values CO2 > 2% **SpO2 Sensor** • Plugin sensor and put it on your finger. If available you can use an SpO2 reference device. • Heart Rate (shows your heart rate): ..... ☐ OK • SpO2 (90…100%): ..... ☐ OK • Cardio Pleth (fast moving figures): ..... ☐ OK	☐

Picture	What to do / Protocol	OK
	**Touch Screen Check** • Back and Forward button on upper left corner can be pressed. ..... ☐ OK • Little dots in upper right corner can be pressed ..... ☐ OK	☐
	Battery Check • Ensure battery is charged > 90% • Remove power supply cable → info message mains power ..... ☐ OK • After ≈1 min battery capacity shows >4 h..... ☐ OK • Re-insert power supply cable → battery shows it is charging..... ☐ OK	

Picture	What to do / Protocol	OK
	Check completeness before delivery ☐ Bellavista SN:..... ☐ Power cable ☐ Breathing Circuit(s): ☐ A ☐ C ☐ D with Flow Sensor ☐ Bacteria filter ☐ Spare filter set ☐ Easy Lung ☐ Manual ☐ Quick Start Guide Optional: ☐ Pulse Oxymeter ☐ Capnography ☐ Capnography airway adapter ☐ Trolley ☐ Arm ☐ Carrying bag ☐ Dual Limb Adapter ☐ Other ..... ☐ Other ..... ☐ Other	☐
	Summary Test performed successfully: ☐ Yes ☐ No Technician:..... ..... Place: .....Date: ..... Signature:	

7. Annual Maintenance

Scope: This checklist guides through the annual maintenance procedure and serves as a protocol at the same time.

Validity: For all bellavista 1000 G1 (some tests do not apply) and G2

Please send copy of checklist back to:

imtmedical ag
Gewerbestrasse 8
CH-9470 Buchs, Switzerland
Fax: +41 81 750 66 95

Overview

The annual maintenance performs the following checks and calibrations:

- Software upgrade
- Calibration of
  - Pressure zero and gain
  - O2 cell
  - Inspiration flow and leakage
  - O2 blender flow
  - Blower
  - Offset of inspiration valve, O2 valve and Mushroom valve
- Touchscreen test and calibration if required
- Audio and Alarming test
- Battery test and replacement if required
- External sensors and interfaces test
- Electrical safety
- Quick Check

Required material

- 300.116.000 Flow Analyser PF300
- 301.168.000 Filter to protect PF300 from dust and contamination
- 300.941.000 Breathing circuit A (single limb with pressure measurement line, no exp. valve)
- 301.167.000 Breathing circuit C (single limb with pressure measurement line, with exp. valve)
- 300.756.000 EasyLung (or SmartLung)
- Short 22mm tube to connect LF output to HF Output on the back of PF300

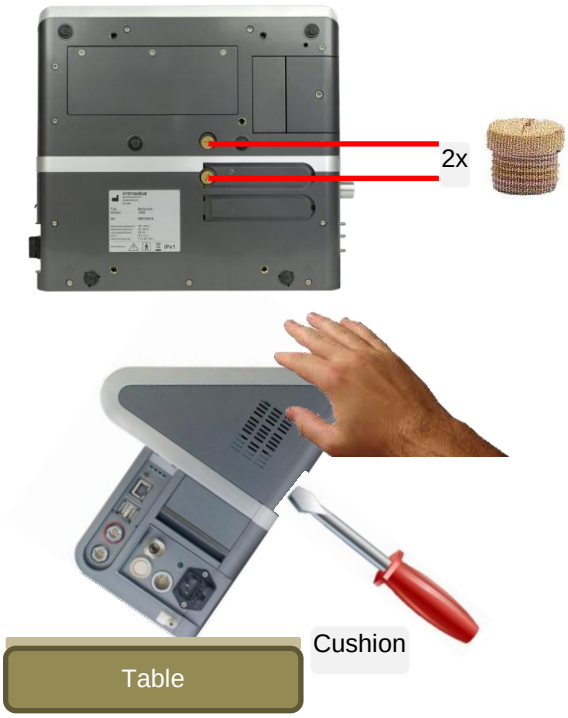
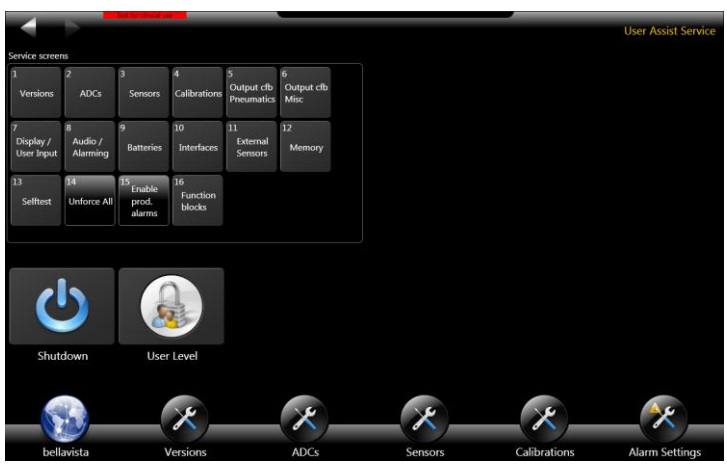
- T-piece with short measurement tube to connect pressure measuring line to PF300
- Plug to block the back of PF300
- Wrench size 12 (for O_2 cell)
- Screwdriver size 5…6
- Pressurized air 4…7 bar, up to 90 L/min
- Connection tube from pressurized air to DISS (or NIST, matching the bellavista configuration)
- USB 2.0 memory stick > 1GB
- Computer with Internet connection
- Electrical safety test instrument
- Clean and relatively noise-free room (some tests involve the audible clicking of valves)

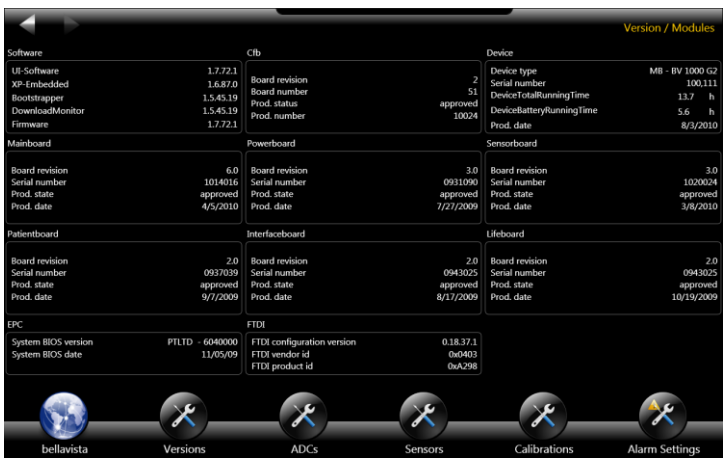
Spare parts

- 301.972.000 Annual Maintenance Kit
- 300.784.000 Battery (which may or may not be needed)

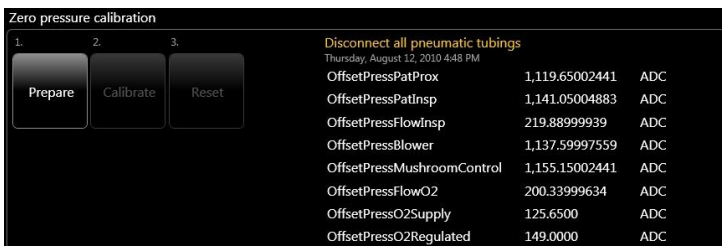
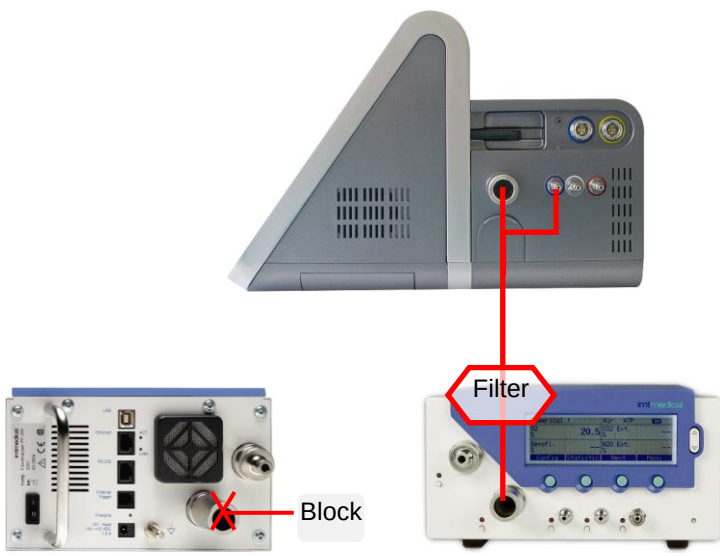
Picture	What to do / Protocol	OK
	Warm up IMPORTANT: • Switch-on FlowAnalyser and bellavista 30 min before the calibrations • Switch-on bellavista and start ventilation for 30 min before the calibrations	☐
	Clean bellavista (p. 6)	☐
	Check completeness ☐ Bellavista SN: ..... ☐ Pulse Oxymeter (if applicable) ☐ Capnography (if applicable) ☐ Other ..... ☐ Other ..... ☐ Other	☐

Picture	What to do / Protocol	OK
     Warranty seals	**Visual inspection** Damage protocol:	☐
	Upgrade to newest version See p. 13 for details	☐
	Replacements ☐ Replace 300.769.000 O2 Cell (see p 63) ☐ Replace 301.165.000 set of filter mats (see p 64) Open packaging of the new O2 cell 1 hour before inserting it into bellavista as the chemical O2 measurement process requires initiation.	☐

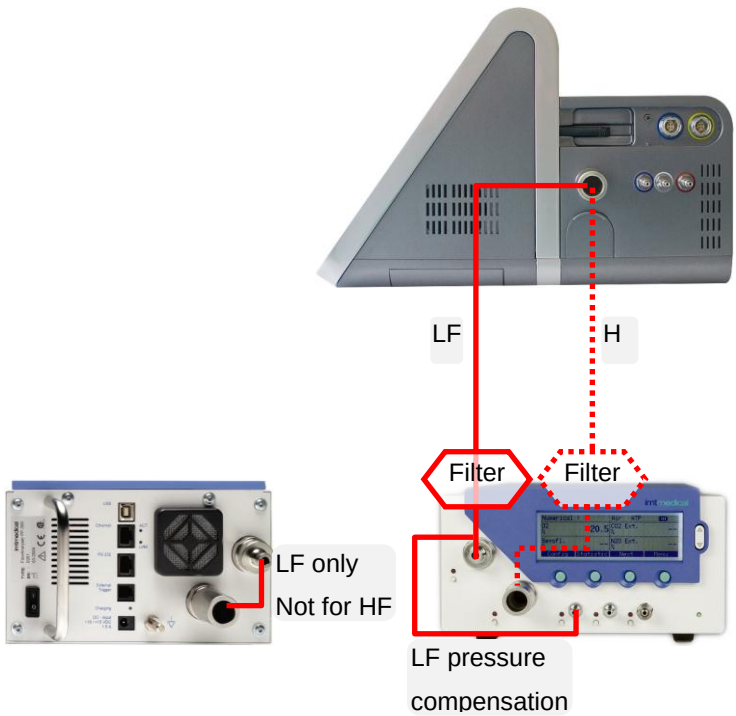
Picture	What to do / Protocol	OK
	☐ Replace 2 x 100.075.100 Sinter metal filter The sinter metal filters are responsible for turbine cooling and have to be replaced annually as sometimes dust is accumulated. Position bellavista bottom down to prevent metal particles from falling into the turbine while replacing the sinter metal filter. **Important**: Don't forget to execute **4. Calibrations: Blower Reference Calibration** later in this workflow (p. 46).	☐
	## Login into service Password: "service!" (other passwords see p. 63)	

Picture	What to do / Protocol	OK
	**15 Production Alarms** Ensure production alarms are ON (button shows **Disable prod. Alarms**) Note: Production alarms are more narrow limits on many alarms.	☐
	**1 Versions** UI-Software: ..... XP-Embedded: ..... Provides detailed information on software and printed circuit board versions.	☐

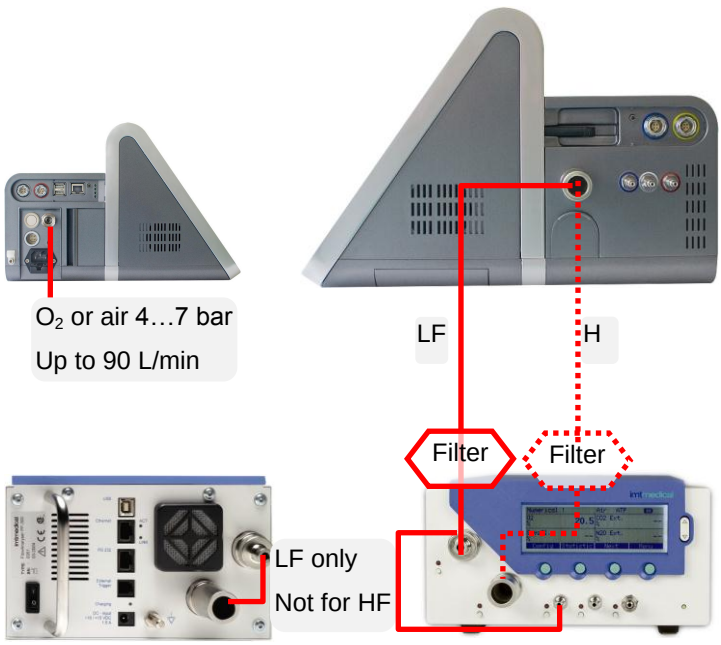
Picture	What to do / Protocol	OK
	**Prepare Flow Analyser** Switch-on FlowAnalyser 30 min before the calibrations • Set FlowAnalyser to: Gas type: Air / O2 Auto Gas standard: AP21 • Perform Zero! Calibration on Flow Analyser • Perform 100% O2 Calibration using **16 Function Blocks: Service Controller** with the following settings: ○ Flow Controller **O2** ○ Pressure 10 mbar ○ Flow 30 L/min • Perform 21% O2 Calibration using **16 Function Blocks: Service Controller** with the following settings: ○ Flow Controller ○ Pressure 0 mbar ○ Flow 30 L/min	☐ ☐ ☐ ☐ ☐
	**4 Calibrations** Steps of calibration each consisting of: • **Prepare**: enables the measurement, puts all valves in the correct position. • Wait for steady conditions! • **Calibrate**: Performs the actual measurement and calibration process (averaging, filtering, calculation) • **Reset**: Sets back all valves and special Some calibrations are grouped: executing the first means, you have to do them all, otherwise the calibration data is marked as invalid and bellavista becomes stops being operational.	

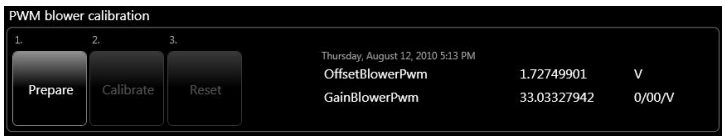
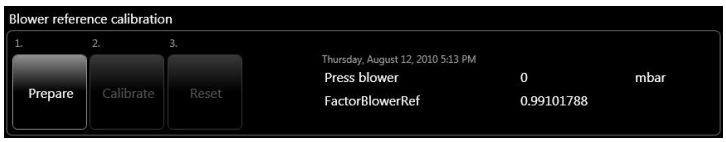
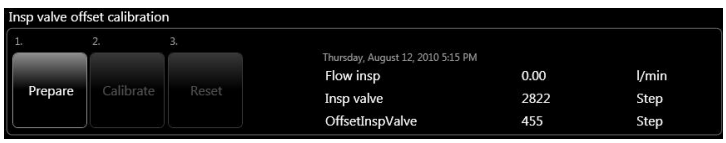
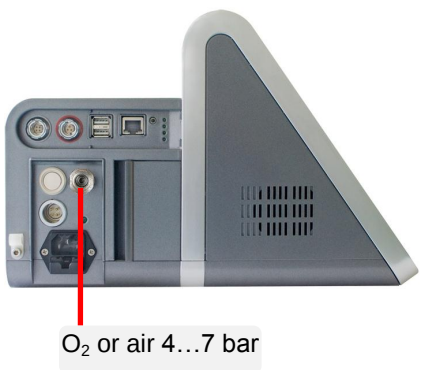
Picture	What to do / Protocol	OK
	**Zero pressure calibration** This is a zero calibration of all pressure sensors. • Disconnect all external tubing • Perform the calibration	☐
	**Pressure gain calibration** Calibrate the most important pressure sensors at 30 mbar in one calibration step. • Connections according to picture • **Prepare** • Adjust **Blower [%]** until you reach ≈ 30 mbar (FlowAnalyser *P (HF)* reading) • Enter the exact value of *P (HF)* into the **Pinsp 30mbar** using the numeric keypad: ..... • **Calibrate** • **Reset** • Check the date of calibration..... ☐ OK	☐
	Inspiration flow calibration This calibration consists of a number of sub-calibrations. If you perform the first one, you have to perform all the other calibrations as well, otherwise the entire calibration data will become invalid and the device stops being functional.	

Picture	What to do / Protocol	OK
	Zero calibration (Insp. Flow Sensor) This is a zero calibration of the differential pressure sensor of the inspiration flow measuring element. • Disconnect all external tubing • Perform the calibration After this calibration the “Invalid Calibration Data” Alarm will be active until the successful termination of the last flow scale point.	☐

Picture	What to do / Protocol	OK
	**Inspiration flow scale point calibration** Calibrates the built-in patient flow sensor at the following flows. The flows are blower generated. • Connections according to picture FlowAnalyser Setup • ≤10 L/min in **LF** Low Flow setup. Read *Flow L… L/min* Set trigger to pediatric to enable Low Flow pressure compensation. • >10 L/min in **HF** High Flow setup. Read *Flow H… L/min* Set trigger to adult to enable High Flow pressure compensation. For each flow point: • Prepare • Adjust **InspValve [Step]** until you reach ≈…L/min (FlowAnalyser reading) For flows ≥10 L/min adjust **Blower [%]** • Enter the FlowAnalyser reading into **Flow …L/min** using the numeric keypad • Calibrate • Reset • Check the date of calibration Protocol: 1 L/min (**LF**) *Flow L*: ..... 2 L/min (**LF**) *Flow L*: ..... 3 L/min (**LF**) *Flow L*: ..... 4 L/min (**LF**) *Flow L*: ..... 10 L/min (**LF**) *Flow L*: ..... 50 L/min (**HF**) *Flow H*: ..... 100 L/min (**HF**) *Flow H*: ..... 160 L/min (**HF**) *Flow H*:	☐

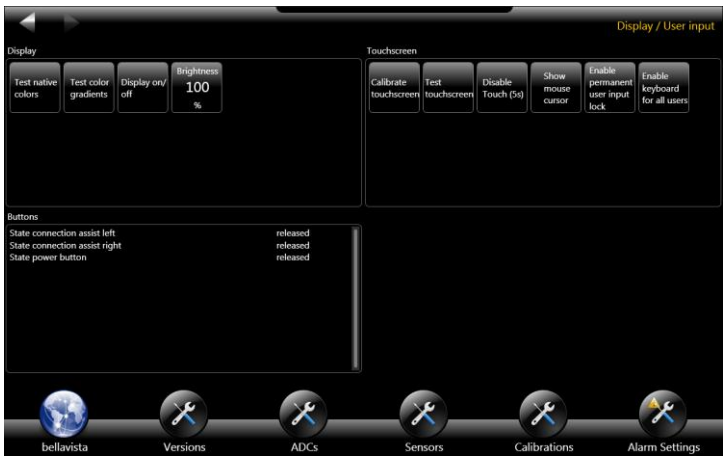
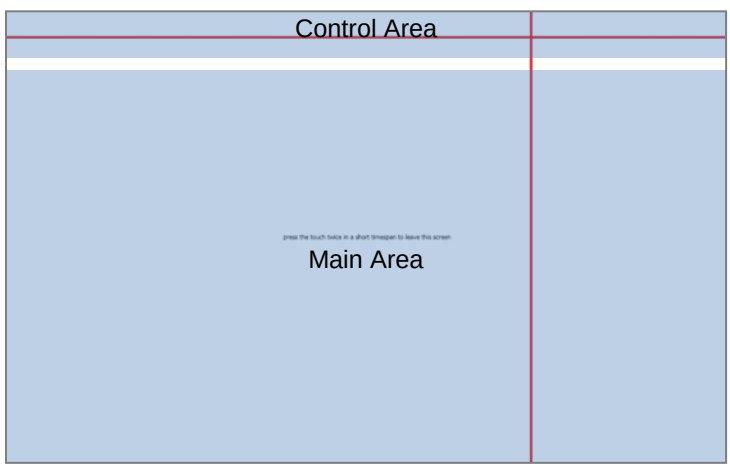
Picture	What to do / Protocol	OK
	O2 flow calibration This calibration consists of a number of sub-calibrations. If you perform the first one, you have to perform all the other calibrations as well, otherwise the entire calibration data will become invalid and the device stops being functional. Caution — Use the 2nd page of **16 Function Blocks** to ensure that you can achieve 90 L/min of continuous O_2 flow prior to starting this calibration. The calibration can be done with O_2 or compressed air.	
	Zero calibration (O2 Flow Sensor) This is a zero calibration of the differential pressure sensor of the O2 flow measuring element. • Disconnect all external tubing • Perform the calibration After this calibration the “Invalid Calibration Data” Alarm will be active until the successful termination of the last flow scale point.	☐

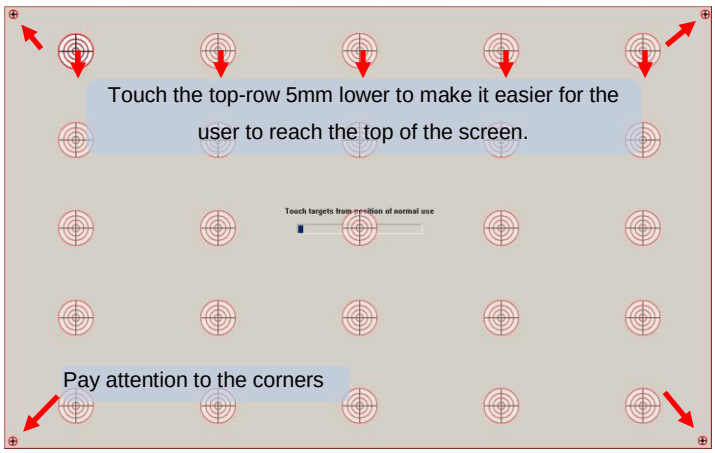
Picture	What to do / Protocol	OK
	**O2 flow scale point calibration** Not applicable for bellavista 1000 G1 Calibrates the built-in O2 flow sensor at the following flow points. • Connections according to picture FlowAnalyser Setup • ≤10 L/min in **LF** Low Flow setup. Read *Flow L… L/min* Set trigger to pediatric to enable Low Flow pressure compensation. • >10 L/min in **HF** High Flow setup. Read *Flow H… L/min* Set trigger to adult to enable High Flow pressure compensation. For each flow point: • **Prepare** • The O2 flow is adjusted automatically • Enter the FlowAnalyser reading into **Flow …L/min** using the numeric keypad • **Calibrate** • **Reset** • Check the date of calibration **Protocol:** 0.5 L/min (**LF**) *Flow L*: ..... 1.0 L/min (**LF**) *Flow L*: ..... 1.5 L/min (**LF**) *Flow L*: ..... 2.0 L/min (**LF**) *Flow L*: ..... 3.0 L/min (**LF**) *Flow L*: ..... 4.0 L/min (**LF**) *Flow L*: ..... 7.0 L/min (**LF**) *Flow L*: ..... 25 L/min (**HF**) *Flow H*: ..... 60 L/min (**HF**) *Flow H*: ..... 90 L/min (**HF**) *Flow H*:	☐

Picture	What to do / Protocol	OK
	**PWM blower calibration** Automatically calibrates the PWM (pulse width modulation) of the blower. • Disconnect all external tubing • Perform calibration	☐
	**Blower reference calibration** Calibrates the ratio blower input voltage to output pressure • Disconnect all external tubing • Perform calibration FactorBlowerRef (0.9…1.2).....☐ OK	☐
	**Insp valve offset calibration** Determines the opening threshold of the inspiration valve at ≈5 L/min • Disconnect all tubing • Perform calibration OffsetInspValve (200…500 steps).....☐ OK	☐
	**O2 valve offset calibration** Determines the opening threshold of the O2 valve at ≈6 L/min • Connections according to picture • Perform calibration OffsetO2Valve (30…50%) .....☐ OK The calibration can be done with O_2 or compressed air.	☐

Picture	What to do / Protocol	OK
	**Mushroom valve offset calibration** Determines the opening threshold of the control valve (mushroom valve) which regulates the expiration valve control pressure. • Block the expiration valve port (finger or sealing plug) • Perform calibration OffsetMushroomValve (260…480) ..... ☐ OK	☐
 	**O2 concentration calibration** Calibrates the oxygen cell • Disconnect all external tubing • Connect O_2 supply (if O_2 is not available, automatically a single-point calibration at 21% will be performed) • Perform calibration. Ensure **“two point calibration”** has been performed. Otherwise warm up bellavista further and ensure appropriate O_2 supply. **Important**: • Ensure bellavista has been warmed up by running ventilation for 30 min prior to this calibration. • Ensure your environment is well vented, as even slightly increased O_2 levels >21% of the room air will lead to significant errors and problems with this calibration.	☐

Picture	What to do / Protocol	OK
	**5 Output CFB Pneumatics** Allows the controlling of all valves for diagnosing purpose. • Disconnect gas supply • Switch **8 Audio+Alarming: System Volume** to 0% to hear the valves • Purge Valve 1 changes on/off state with audible “Click” • Purge Valve 2 changes on/off state with audible “Click” • O_2 Safety Valve changes state with audible “Click” • All other valves are checked during calibration •  Use **14 Unforce All** to ensure all valves are re-leased See also Error! Reference source not found. (p. **Error! Bookmark not defined.**) Caution: Do not damage bellavista with unintended operation.	☐
	**6 Output CFB Misc** Allows the controlling of additional outputs for diagnosing purpose: • Nurse Call • Buzzer • **Switch System Volume back to 100% in 8 Audio/Alarming** Caution: Do not damage bellavista with unintended operation.	

Picture	What to do / Protocol	OK
	**7 Display / User Input** Allows display and button diagnosing as well as touch screen calibration. If the touchscreen is severely de-calibrated: • Use a USB-mouse to “feel your way”: press it to find out where it is, drag it away if you are on the wrong button • Find your way to switch on the mouse pointer in Display / User Input • Then calibrate the touch screen.	
	**Test Touch screen** Evaluate the accuracy of the touch screen. • Pay pecial attention to the **upper corners** and borders in the **Control Area** (Back/forward button, status bar, screen dots) • ± 5mm in the **Main Area** is sufficient	☐

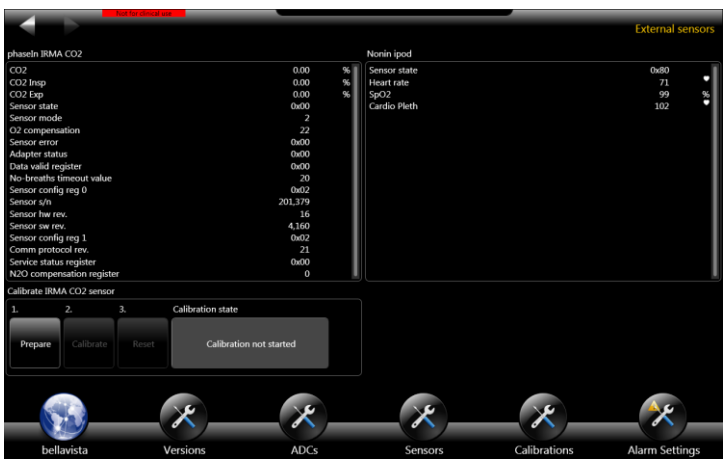
Picture	What to do / Protocol	OK
	**Calibrate touchscreen** **Only if decalibrated!!!** Calibrate the touchscreen only if necessary. The process is guided and cannot be interrupted: • Calibrate 5 points in 5 rows • Calibrate the 4 corners (marked with arrows) Calibrate from a **normal user position** (bellavista on trolley height, person standing in front). If you calibrate looking straight at the screen it may be inconvenient for the user.	
	**Check Connection Assist** The two small buttons call up the bellavista Connection Assist for each panel • Connection assist on button left.....☐ OK • Connection assist on button right .....☐ OK	☐
	**8 Audio / Alarming** Ensures audio and visual alarming system is OK. • Play **High Prio Alarm** Sound Recognition: Alarm Amplitude = ✓ .....☐ OK Note: the buzzer will be tested during **13 test** LED Test:	☐

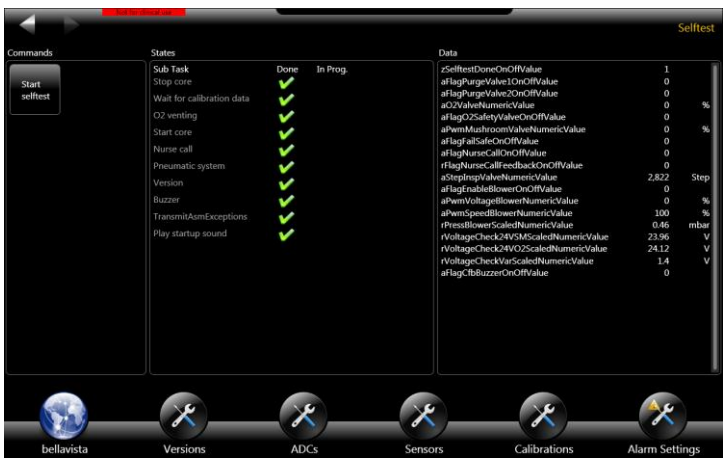
	Left	Right
Red	☐ OK	☐ OK
Yellow	☐ OK	☐ OK
Blue	☐ OK	☐ OK

Picture	What to do / Protocol	OK
	**9 Batteries** Home care standards require battery support of ≥1 hour. Bellavista is equipped with 2 batteries with a nominal capacity of 6450 mAh each (totally 12900 mAh) which last ≈ 4 hours. For security it is recommended to change a battery when it has reached ≤1/3 of its original capacity. • Replace battery if Full Charge Capacity ≤ 2150 mAh • Replace both batteries if sum of FCC is < 4300 mAh	☐

	Batt. A	Batt. B
Full charge capacity before replacement (≥ 2150 mAh)	....	....
Cycle count before replacement	....	....
Battery replaced?	☐Yes ☐No	☐Yes ☐No
Full charge capacity after replacement (≥ 2150 mAh)	....	....
Cycle count after repl cement:	....	....
Safety alert and Safety status (0x0000)	☐ OK	☐ OK

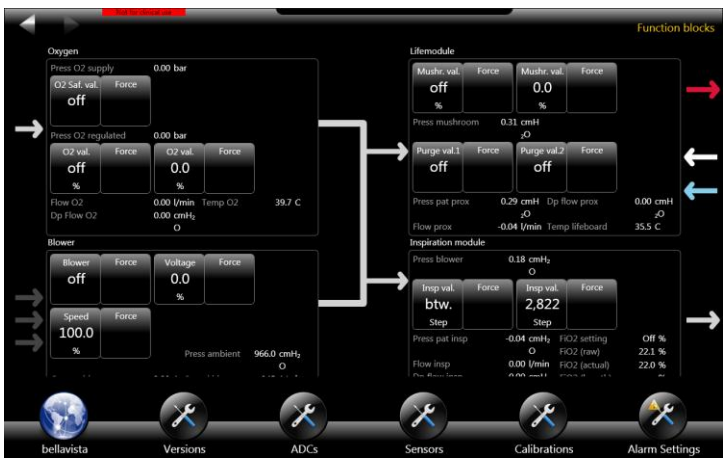
Note: Battery lifetime highly depends on the application. For certain customers/applications it may be advisable to change the battery earlier.

Picture	What to do / Protocol	OK
	**10 Interfaces** This screen is used to diagnose USB and internet 52nterfacees. Use the built-in USB stick to check the functionality of all USB ports: • Plug-out the USB stick on the right side of bellavista towards the back • Plug-in the USB stick and ensure that it's LED is flashing a few times: • Left side upper USB .....☐ OK • Left side lower USB .....☐ OK • Right side USB .....☐ OK	☐
	**11 External Sensors** Ensures the functionality of the external sensors and calibrates the CO2 Sensor. **CO2 Sensor** • Insert fresh airway adapter into CO2 sensor. • Plugin CO2 Sensor. Allow >10s to warm up. Place on horizontal surface. • Calibrate CO2 Sensor • Breathing through → values CO2 > 2%.....☐ OK **SpO2 Sensor** • Plugin sensor and put it on your finger. If available you can use an SpO2 reference device. However, there is no calibration/adjustment functionality. Heart Rate (shows your heart rate): .....☐ OK SpO2 (90…100%): .....☐ OK Cardio Pleth (fast moving figures): .....☐ OK	☐

Picture	What to do / Protocol	OK
	**13 Tests** Self-test performs successfully. Note: do not perform the inspiration valve test on page 3 unless ordered so by imtmedical staff.	☐
	**Insp Valve Test** On page three of 13 Test perform the Insp Valve Test. • Tightness Test..... ☐ OK • Movement reliability Test..... ☐ OK • Idle reliability Test..... ☐ OK • Step position Test: ○ Leak flow start (1st) .....L/min ○ Leak flow end (1st) .....L/min ○ Valve position (1st) ..... Steps ○ Leak flow start (2nd) .....L/min ○ Leak flow end (2nd).....L/min ○ Valve position (2nd) ..... Steps	☐

Picture	What to do / Protocol	OK


 
	O_2 cell test
	• Connect O_2 suppy
	• Dose 100% O_2 using **16 Function Blocks: Service Controller** with the following settings:
	  ○ Flow Controller **O_2**
	  ○ Pressure 10 mbar
	  ○ Flow 30 L/min
	• FiO2 reading (98…100%).....%
		☐

	**Check ambient pressure sensor** Use **16 Function Blocks** to compare “Press Ambient” with the measurement of the PF300 • Press ambient (bellavista) .....mbar • Pressure Atmospheric (PF300) .....mbar • Tolerance +/- ?? mbar	☐

Picture	What to do / Protocol	OK
	**14 Unforce All** Reset all settings set by the service-user. System audio volume has to be reset manually!	☐ ☐
	**15 Enable Prod. Alarms** Ensure production alarms are off (button shows **Enable prod. Alarms**)	☐
 	**Electrical Safety** Check electrical safety according to local regulations. Details see p. 57 Caution: Do not test Protective Conductor Resistance as bellavista can be severely damaged.	☐
	**Quick Check** Perform Quick Check See p.62 for details.	☐

Picture	What to do / Protocol	OK
	Summary Test performed successfully: ☐ Yes ☐ No Technician: .... Place: ..... Date: ..... Signature:	

8. Electrical test

Scope: The electrical test ensures the electrical safety of bellavista with all accessories according to EN 60601.

Validity: For all bellavista 1000 G1 and G2 including accessories

Electrical safety can alternatively be tested according to DIN EN 62353.

Warning	**Perform this test only if you are familiar with electrical testing.**

Caution	Do not test Protective Conductor Resistance (from metal housing parts to protective ground)! bellavista can be severely damaged by performing this test. It is unnecessary (see explanation below).

Overview

The electrical ensures electrical safety according to EN60601. It consists of

- Protective Conductor Resistance Test
- Insulation Measurement
- High Voltage Measurement
- Leakage Current Measurement
- Patient currents

Protective Conductor Resistance Test

Bellavista is isolated and protects against electric shock and fulfills **protective class I.** Accessories (Applied Parts) are **type BF**.

The ground concept of bellavista is according to the norm but slightly special as the Prot**ective Conductor Resistance must not be measured**.

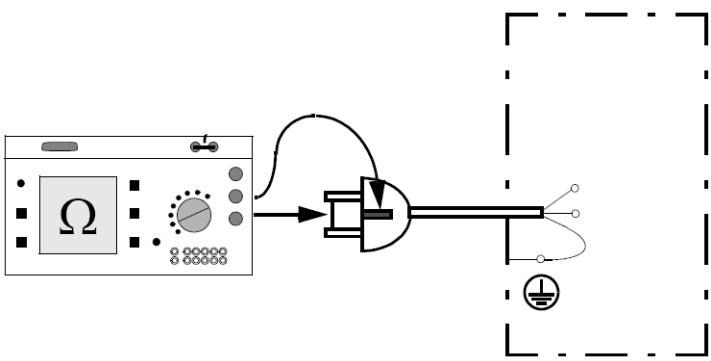
Explanation

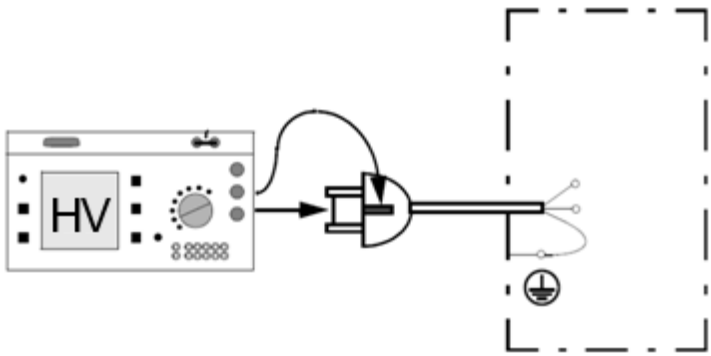
- In a class I device, all touchable metal parts have to be connected to ground **if they can come in contact with dangerous voltage in a first fault condition**.
- Inside Bellavista power lines are **double-isolated** and internally fixed and cannot contact metal parts in case of first fault conditions.
- The touchable metal parts of bellavista are only connected to earth for potential equalization. This connections are not designed to withstand a 25A current which is applied by a Protective Conductor Resistance test. bellavista could be damaged by such a test.

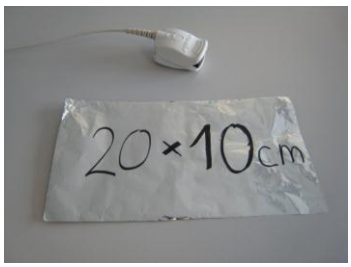
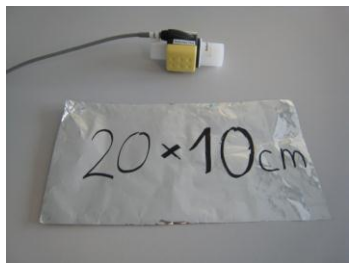
- Nevertheless bellavista is not a class II device.

Required material

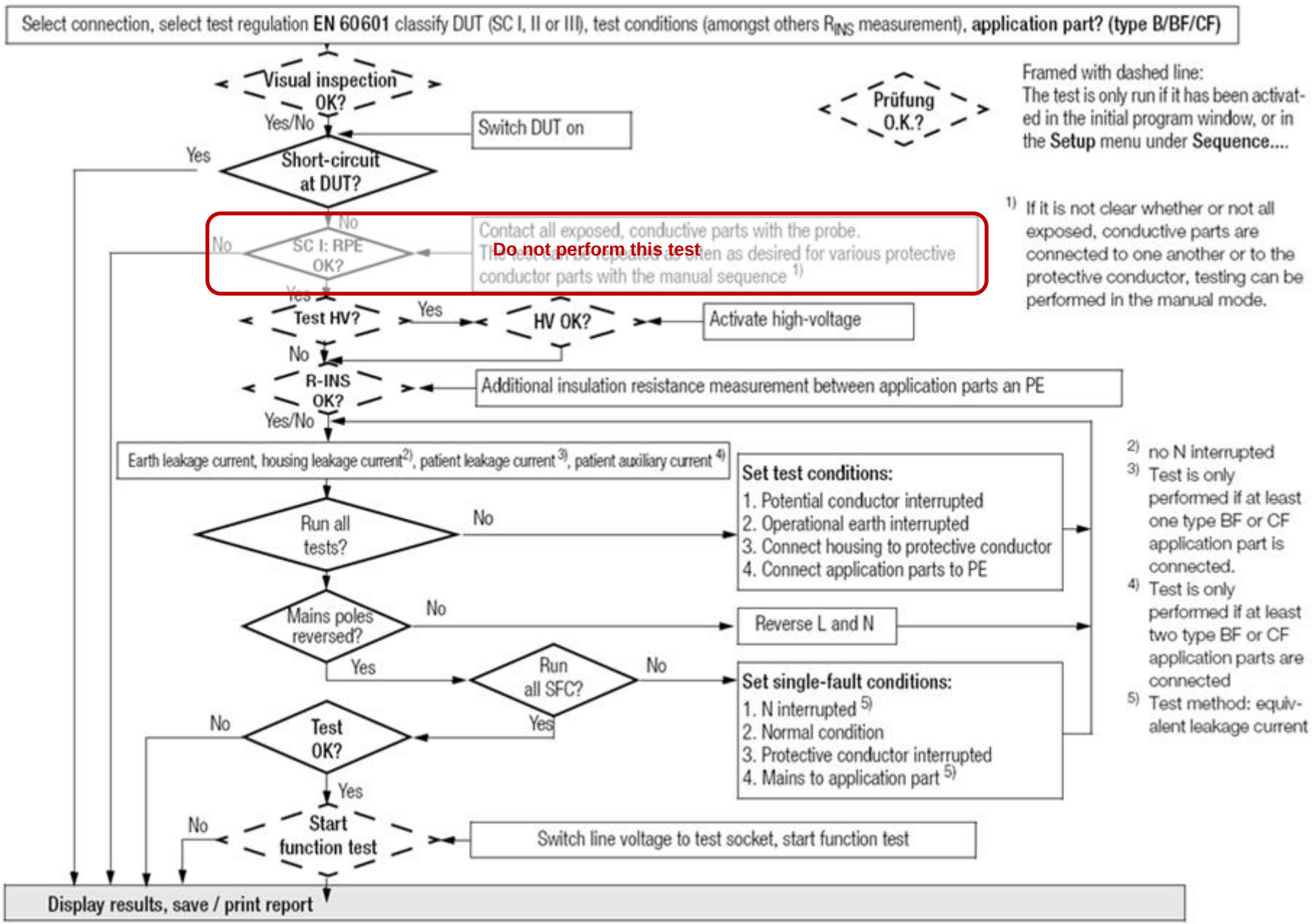
- Use your electrical testing equipment

Picture	What to do / Protocol	OK
	Visual Inspection Power cable insulation and connectors undamaged ..... ☐ OK Sensor cable insulation and connectors undamaged .... ☐ OK All connectors visibly undamaged ..... ☐ OK	☐
	Protective Conductor Resistance Measurement Caution: Do not test Protective Conductor Resistance as bellavista can be severely damaged. (see above)	
	**Insulation Measurement** Measures the insolation resistance of the short-circuited mains terminals (L and N) against Protective Ground using 500 VDC Insulation Resistance R_{INS} > 2.00 MOhm ..... ☐ OK	

Picture	What to do / Protocol	OK
	**High Voltage Measurement** Tests the insulation between mains terminals (L and N) against Protective Ground using 1500VAC or 2250VDC. No discharge within 60s..... ☐ OK	
	Leakage Current Measurement **Earth Leakage Current** Normal Condition I_{PE-NC} < 0.50 mA..... ☐ OK Single Fault Condition I_{PE-SFC} < 1.00 mA..... ☐ OK	☐
 Push probe into the gap between housing and USB connector housing to ensure good contacting.	**Housing Leakage Current** Normal Condition I_{HL-NC} < 0.10 mA..... ☐ OK Single Fault Condition I_{HL-SFC} < 0.50 mA..... ☐ OK	☐

Picture	What to do / Protocol	OK
  Wrap sensors with 20 x 10 cm aluminum foil and connect to bellavista. The wrapping simulates holding the sensor in a hand.   Contact with probe for current measurements.	**Patient currents** Connect sensors: 301.113.000 Diagnostic Package “Pulse Oximetry” 301.114.000 Diagnostic Package “Capnography” **Patient Leakage Current AC** Normal Condition $I_{PLAC-NC}$ < 0.10 mA ..... ☐ OK Single Fault Condition $I_{PLAC-SFC}$ < 0.50 mA ..... ☐ OK **Patient Leakage Current DC** Normal Condition $I_{PLDC-NC}$ < 0.01 mA ..... ☐ OK Single Fault Condition $I_{PLDC-SFC}$ < 0.05 mA ..... ☐ OK **Patient Auxiliary Current AC** Normal Condition $I_{PAAC-NC}$ < 0.10 mA ..... ☐ OK Single Fault Condition $I_{PAAC-SFC}$ < 0.50 mA ..... ☐ OK **Patient Auxiliary Current DC** Normal Condition $I_{PADC-NC}$ < 0.01 mA ..... ☐ OK Single Fault Condition $I_{PADC-SFC}$ < 0.05 mA ..... ☐ OK	☐
	Residual Current I_{RC} < 3.5 mA ..... ☐ OK	☐
	Summary Test performed successfully: ☐ Yes ☐ No Technician: .... Place: ..... Date: ..... Signature:	

If you are running Secutest of www.gossenmetrawatt.com follow the following flow chart (from the original manual)



9. Quick Check

This check should be performed **weekly** and **before each new patient**.

Quick Check Goals

- Error-free startup
- Functional ventilation
- Functional alarming
- Check battery runtime

Ventilator

Check	OK?
1. Do not connect patient.	☐
2. Connect power supply	☐
3. bellavista starts up without technical error.	☐
4. Optionally, connect oxygen supply	☐
5. Use fresh patient air filter	☐
6. New breathing circuit is mounted securely p. **Error! Bookmark not defined.**) (incl. measuring hoses)	☐
7. Perform circuit check (p. **Error! Bookmark not defined.**)	☐
8. Connect a test lung (EasyLung) (in case of breathing circuit A with leakage adapter)	☐

Warning **Malfunctions of bellavista can have severe consequences for the patient. Always perform the entire Quick Check.**

Warning **After the Quick Check, adjust the settings back to the correct values.**

Test ventilation and monitoring

Ventilation mode: P-A/C

Setting	Expectation	Measured	OK?
P_{Insp} 12 mbar	P_{peak} 17 ±3 mbar		☐
PEEP 5 mbar	PEEP 5 ±1 mbar		☐
Rate 12 bpm	Rate 12 ±1 bpm		☐
Ventilation with ambient air	FiO_2 21 vol% ± 2 vol%		☐ 1)

1) If not OK, calibrate O_2 sensor (p. **Error! Bookmark not defined.**)

Test alarm system

Action	Alarm	OK?
Remove power supply cable Do not confirm info message	Mains supply failed (Info message)	☐
Wait for 2 minutes until battery notification becomes a medium priority alarm. Confirm the alarm.	Mains supply failed (Medium priority alarm)	☐
Recommended battery life > 1h (status indicatior p.**Error! Bookmark not defined.**)	-	☐

Place, date .....

Signature .....

10. Diagnosing and Repair

Passwords

Warning	**During ventilation, do not log in as 'service'!**

Description	**Password**
Master Password to enter user levels Patient, Doctor or Nurse in case the user has forgotten his password	bellavista2009
Default passwords (may be changed) • Patient • Nurse • Doctor	 pat nur doc
Service password	service!

Download LOG Files

Bellavista creates LOG Files which protocol all user actions and program status.

1. Insert a bellavista-ready USB stick into bellavista.
2. bellavista automatically stores LOG files and identification information.

LOG Files are automatically zipped and downloaded to a USB "bellavista-ready" memory stick (p. 11) when it is plugged in.

Filename:

iVista.DeviceLogs[MB100013][2009-11-05-09-24-52].zip

Serial Number

Date and Time of saving

Replacing oxygen O_2 sensor

O2 Sensor Tool 301.909.000

- Open cover
- Disconnect cable from O_2 sensor.
- Unscrew O_2 sensor with O_2 Sensor Tool 301.909.000
- Screw in new O_2 sensor.
- Connect cable.
- Close cover
- Allow thermal warm-up at least 30 min before calibration
- Calibrate O_2 sensor

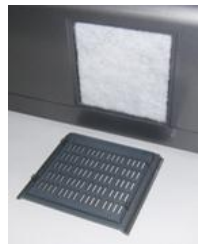
Dispose O_2 sensors in accordance with local waste disposal regulations.

Explosion hazard, corrosion hazard

- Do not dispose of O_2 sensors in fire
- Do not disassemble O_2 sensors forcefully

Danger	**Calibrate FiO_2 sensor regularly (p. 46). An uncalibrated O_2 sensor can lead to oxygen under- or oversupply of the patient.**

Replacing filter mats



Cooling air filter

- Open cover at the back of the ventilator.
- Place filter mat firmly.
- Close cover.
- Use only original filters

Patient air filter

- Open cover at the side of the ventilator.
- Place filter mat firmly. Dense layer to the inside!
- Close cover.
- Use only original filters

Danger	**A dirty or wrong patient air filter can lead to undersupply of the patient.**
Danger	**Only use original bellavista air filters.**
Caution	Missing, wrong or dirty air filter can lead to contamination or overheating of bellavista

Battery replacement

Danger	**Never attempt to disconnect or connect the battery during operation.**

Battery check see p. 51

To reduce the risk of fire, explosion, leakage, or other hazard, take these precautions with respect to the battery:

- Do not attempt to disassemble, open, drop, crush, bend or deform, insert foreign objects into, puncture, or shred the battery pack; modify or remanufacture it; immerse or expose it to water or other liquids; expose it to fire, excessive heat (including soldering irons); or put it in a microwave oven.
- Replace the battery only with another battery specified by the manufacturer.
- Follow all instructions for proper use of the battery.
- Do not short-circuit the battery or allow metallic or conductive objects to contact the battery connector housing.

Replacing O2 Inlet Filter

A replaceable metal mesh filter situated behind the DISS or NIST Adapter protects the O2 Inlet from dust. However this is just a safety filter.

For routine filtering of unknown O2 quality please use the external O2 Filter + water trap

301.560.000	O2 Filter + water trap (DISS)
301.561.000	O2 Filter + water trap (NIST)

Blower High Temperature

Since the blower is cooled with patient air, the following reasons lead to warming up:

- high inspiratory pressure (blower needs to runs high)
- small minute volume
- high FiO_2 (thus most of the minute volume is O_2 and not air through the blower)

There is a bypass cooling-flow exiting bellavista through two sinter metal filters at the bottom. This bypass flow sufficiently cools the blower in any of the above circumstances. Two reasons however may lead to overtemperature:

- the airflow through the bottom of bellavista is somehow blocked (unit is placed on some soft surface)
- the sinter metal filters at the bottom (p. 38) may be blocked by dust or mildew which may form after some time.

Important:	It is absolutely necessary to replace the sinter metal filters annually (p. 38). If this not possible very thorough cleaning is required.

Bellavista automatically protects itself against too high blower temperature and two alarms are associated with it:

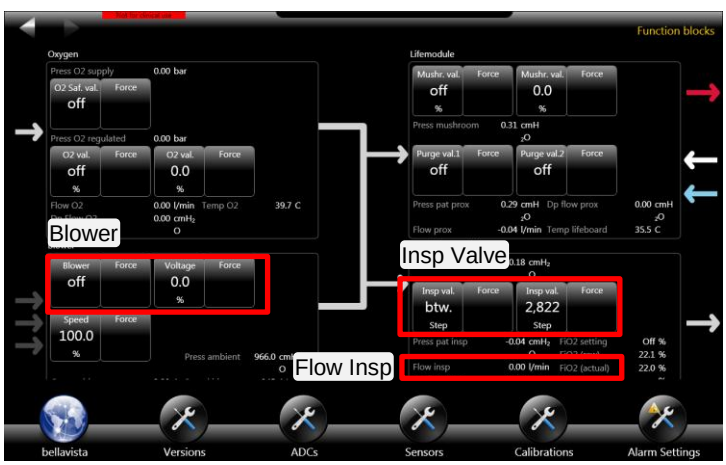
Alarm	Automatic protective action
241	Temperature of blower high G1, G2: > 70° G3: > 80° Above this temperature the blower voltage is gradually reduced, at first without compromising the ventilation
240	Temperature of blower too high G1, G2: > 75° G3: > 85° Above this temperature FiO_2 is gradually reduced to allow more air flowing through the turbine. FiO_2 is reduced to a minimum of 60% at 82°/92°.

Blower temperature can be observed in the service level under **16 Function Blocks**.

Check Inspiration Block Leakage

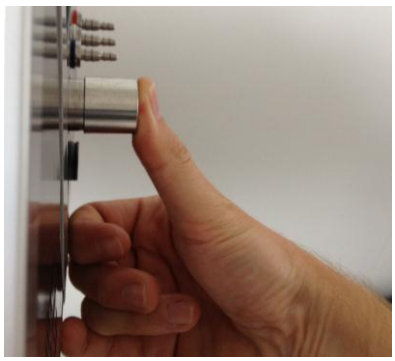
This procedure helps to diagnose leakage of the inspiration block.

Step	Action
1.	Start up device, allow 30 minutes warm up time. Disconnect all tubings
2.	Ensure that the sinter metal Filters at the bottom are tightly screwed in. (p. 38)
3.	Ensure that the Oxygen Cell at the right side of the device is tightly screwed in. (p. 64)
4.	Log in in service level
5.	Go to **16 Function Blocks**

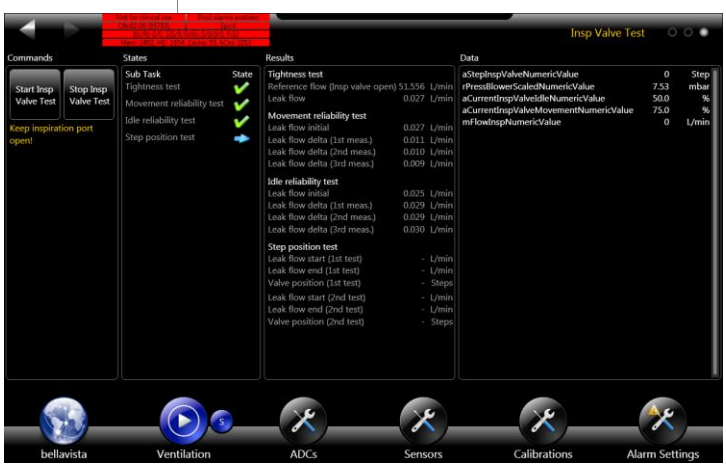


Step	Action
6.	Check flow insp value (should be 0.00 L/min)
7.	Switch blower to “on”
8.	Set blower voltage to 30%
9.	Set Insp. Val. to 0 steps

Step	Action
10.	Slowly set the “blower voltage” up, until “press Blower” reaches 38mbar (Important not to go higher)
11.	Protocol “Flow Insp”: .....L/min



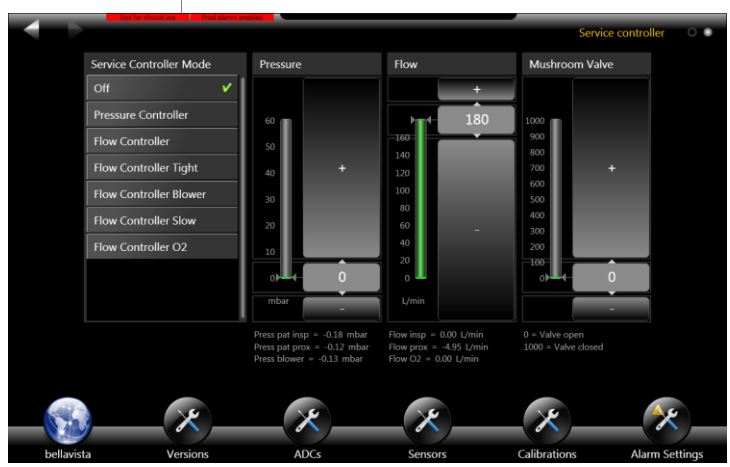
Step	Action
12.	Close air outlet and check again the value “FlowInsp”:..... L/min
13.	Important: Press **14 unforce all**
14.	Go to **13 Tests** Slide to 3rd page: Insp Valve Test



Step	Action
15.	Press “Start Insp Valve Test” : This self test takes a few minutes. Some alarms will occur.
16.	After test please send a picture of the screen.
17.	Restart the device!

Check Oxygen Controlling

Step	Action
1.	Start up device, allow 30 minutes warm up time. Connect oxygen supply
2.	Log on in service level
3.	Go to **16 Function Blocks** Slide to page 2
4.	Select Flow Controller O_2 Set Flow to maximum (180 l/min)



Step	Action
5.	Write down the measurement values and send it to us for analysis.
6.	Switch off bellavista and restart it, if needed.

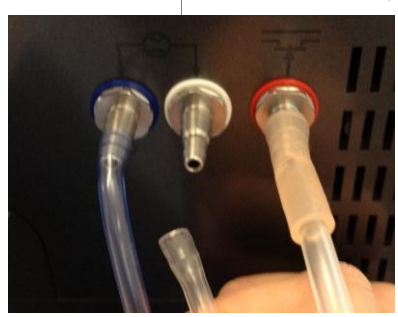
Check Proximal Flow Measurement

Step	Action
1.	Start up device, allow 30 minutes warm up time. Disconnect all pneumatical tubes.
2.	Log on in service level.
3.	Go to **2 ADCs**

Step	Action
4.	Check value of Dp flow prox: .....
5.	Connect the circuit type E without test lung and occlude the tube by the flow sensor.

Step	Action
6.	Go to service menu **16 Function Blocks** Slide to Page 2 => Service controller, Set: • Pressure controller • Pressure 30 mbar • Flow 0 L/min • Mushroom Valve 1000

Step	Action
7.	Go to service menu **2 ADCs** Check value of Dp flow prox: .....
8.	Disconnect the white tube Check value of Dp flow prox: .....

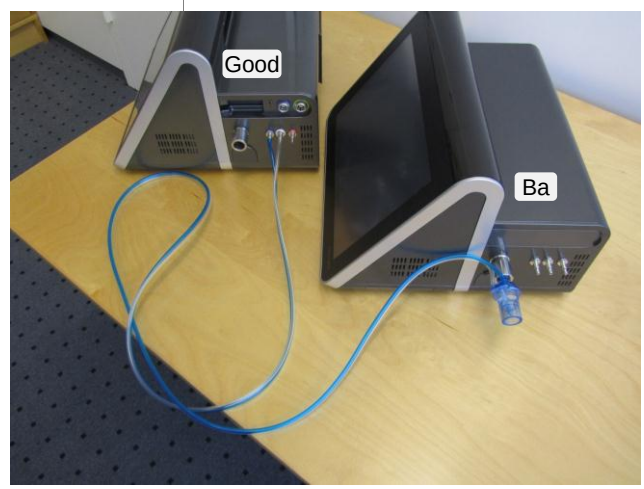


Step	Action
9.	Connect blue tube on white connector Check value of Dp flow prox..... 

Step	Action
10.	Restart the device!

Check Internal Flow Measurement

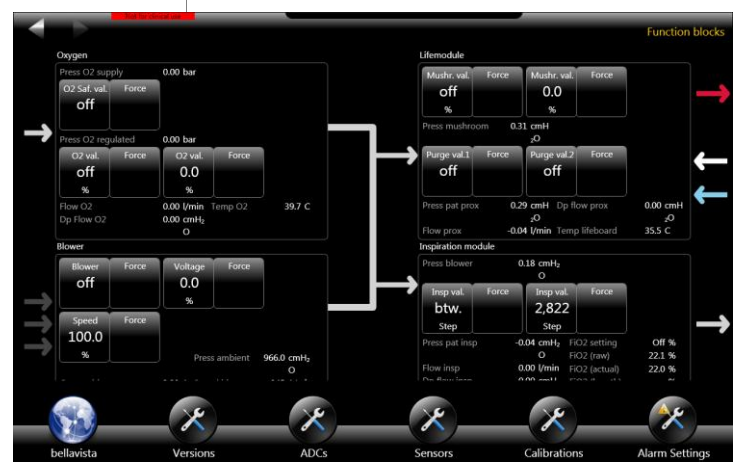
For this check, you need two bellavistas, a “Good” one and a potentially “Bad” one.

Step	Action
1.	Start up devices, allow 30 minutes warm up time.
2.	Ensure that both devices have the same ventilation settings.
3.	Performa a circuit test on the “Good” device to calibrate the proximal flow sensor.
4.	In “Bad” device Log on in service level.
5.	Connect the flow sensor as shown in this picture 

Step	Action
6.	In “Bad” Device go to service menu **16 Function Blocks** Slide to Page 2 => Service controller, Set: • Flow controller • Pressure 0 mbar • Flow 40 L/min • Mushroom Valve 0 Note: Flow insp should be approx.. 40 L/min
7.	In “Good” device flow curve (in any monitoring screen) should read 40 L/min. If not, internal flow measurement requires re-calibration.

Check O_2 valve leakage

Step	Action
1.	Start up device, allow 30 minutes warm up time. Connect oxygen supply
2.	Start up device
3.	Log on in service level
4.	Go to **16 Function Blocks**
5.	Open Insp Val. up to maximum (2,922 steps)

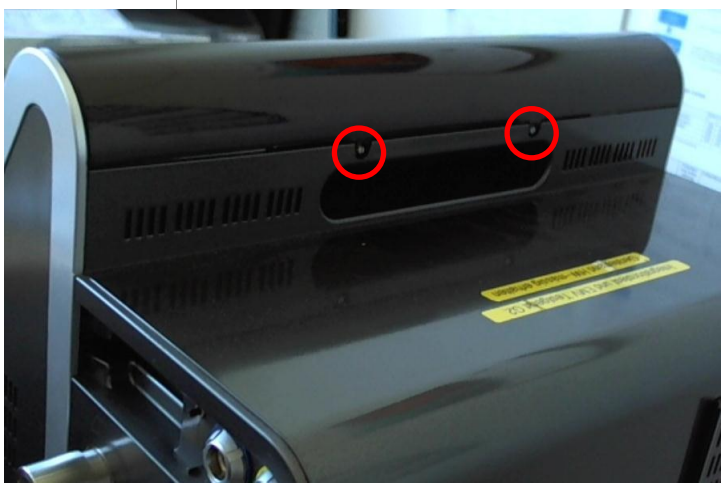


Step	Action
6.	Take a screenshot, name it “Position 6”
7.	Open the O2 val. up to 100% After 20 seconds, take a screenshot Name it “Position 7”
8.	Close the O2 val to 0% After one Minute, take screenshot Name it “Position 8”

Step	Action
9.	Switch the O2 Safety Valve to ON After one Minute, take a screenshot Name it “Position 9”
10.	Switch O2 Safety valve to OFF After one Minute, take a screenshot. Name it “Position 10”
11.	Download the log files (see p. 14)
12.	Send screenshots and log files for analysis.
13.	Restart bellavista

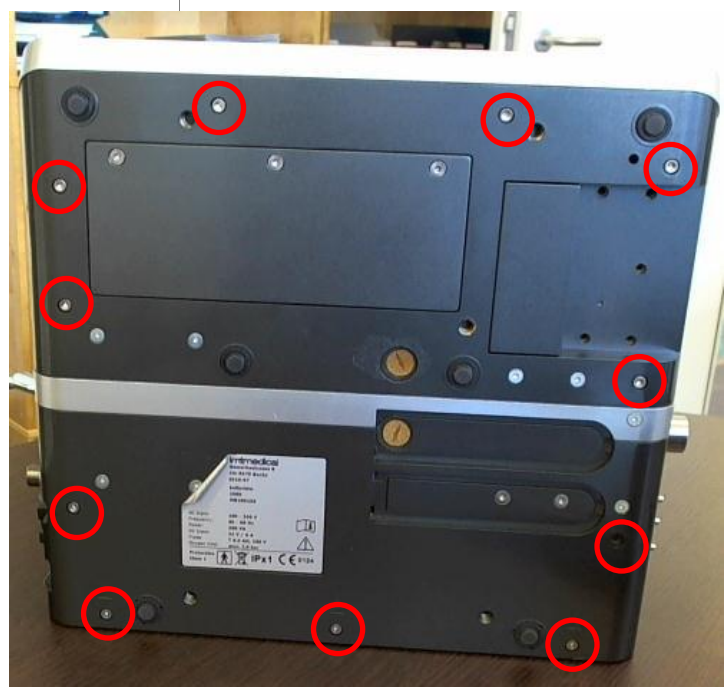
How to Open bellavista

Step	Action
1.	Disconnect power supply Work in anti-static protected environment with anti-static connection also for the service engineer.
2.	Remove all filter covers at the left side and the back side. Disconnect power cord.
3.	Unscrew the two screws on alarm light cover



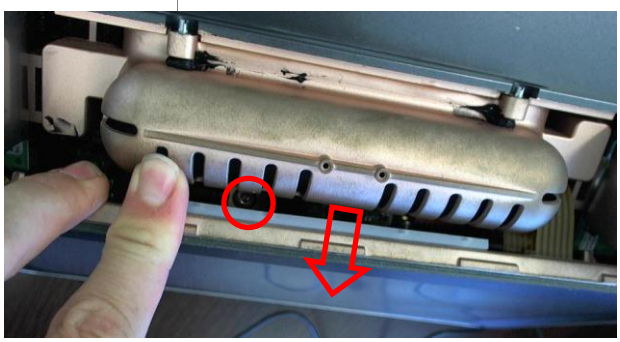
Step	Action
4.	Turn the alarm light cover away

Step	Action
5.	Unscrew the 11 bottom screws (don't unscrew other than this marked screws)

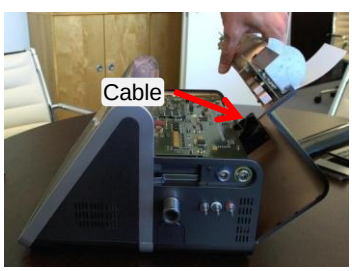


Step	Action
6.	Unscrew two screws at top light boards

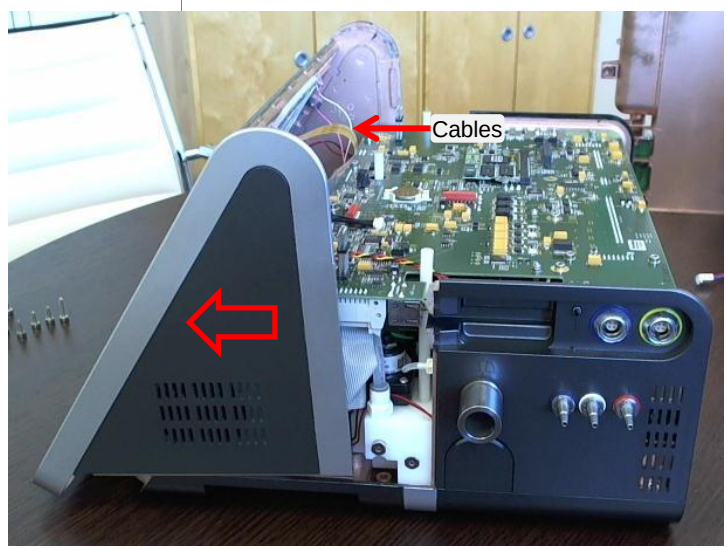
Step	Action
7.	The third screw is behind the display. Pull the display about 5mm to see the screw. Unscrew it.



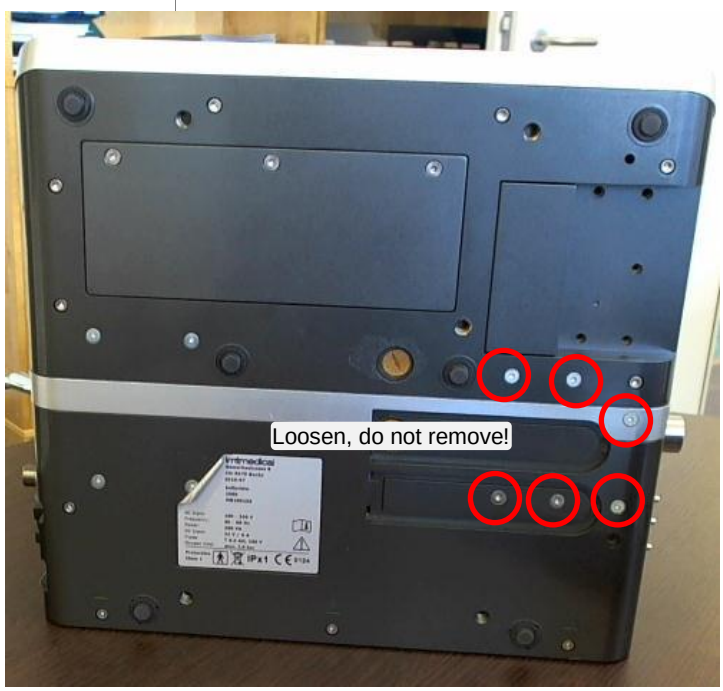
Step	Action
8.	Slowly pull up the back cover of bellavista and turn it to the back. Take care about the FAN-cable at the backside! Store Back cover at the edge side to protect against scratch's.



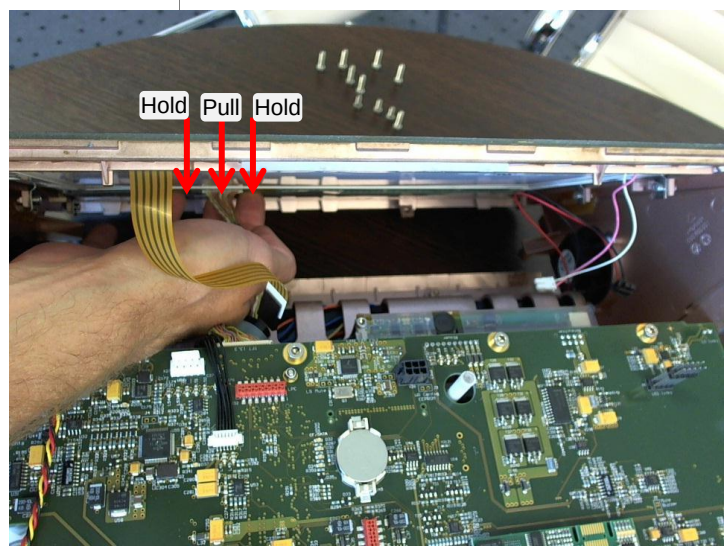
Step	Action
9.	Slowly pull off the front cover / screen. Attention: Many cables are mounted from display to the base.



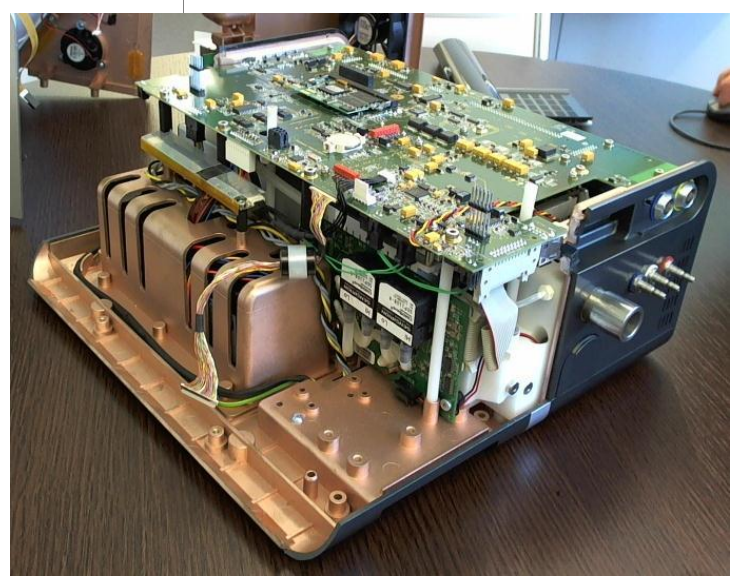
Step	Action
10.	If the front cannot be pulled away, slightly loosen the 6 screws at the bottom only 1 turn. Do not remove these screws!



Step	Action
11.	Display cable: Hold band with two fingers and pull the display cable with the third finger.

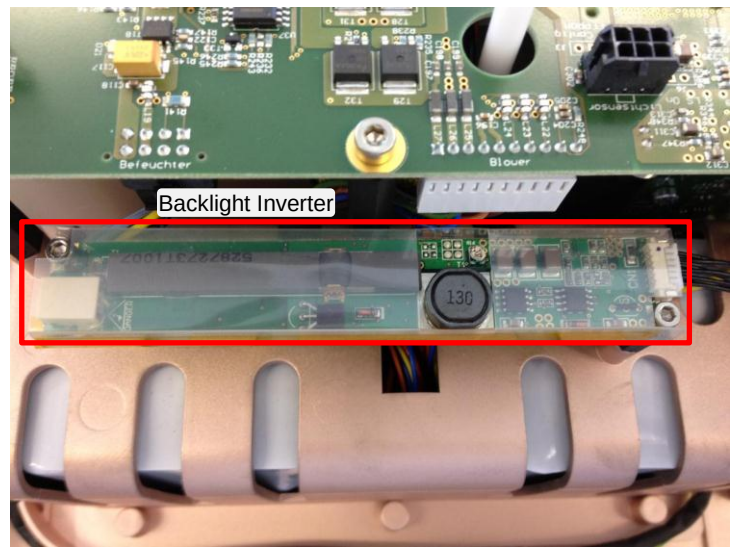


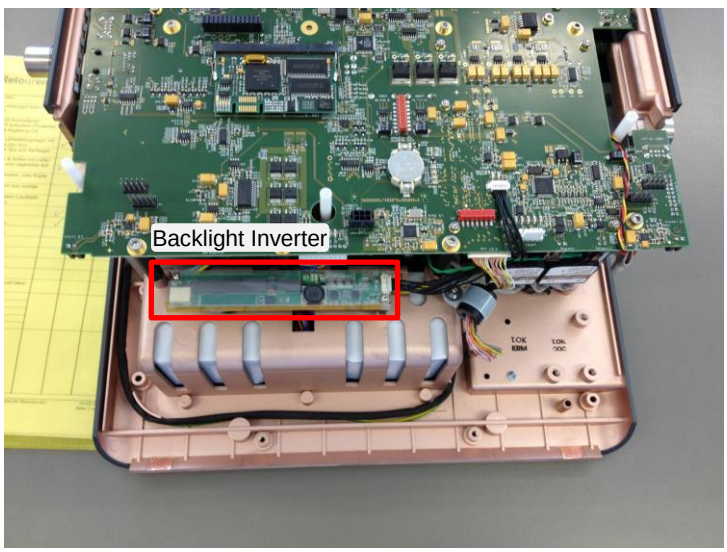
Step	Action
12.	Open Unit



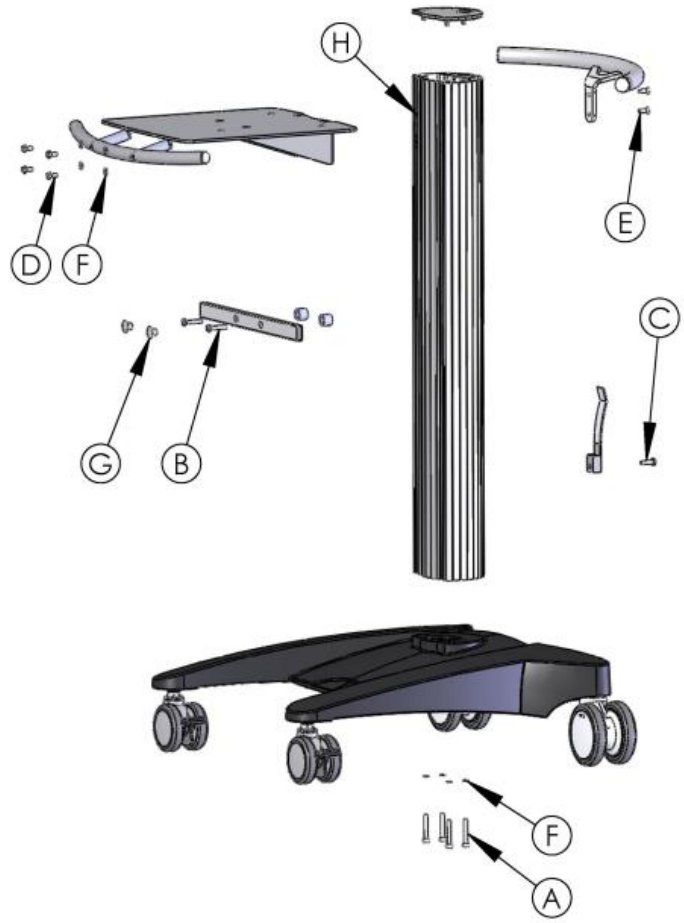
Exchange Backlight Inverter

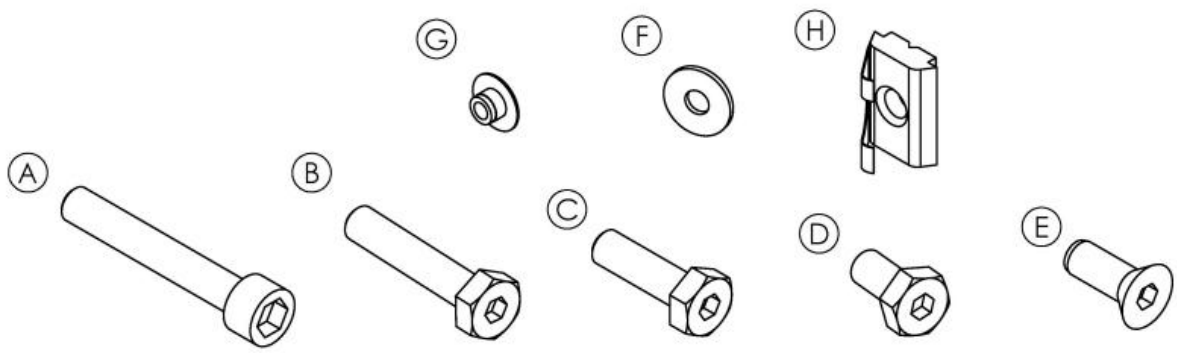
Step	Action
1.	Disconnect power supply Work in anti-static protected environment with anti-static connection for the service engineer.
2.	Open bellavista (p. 73)
3.	Disconnect all cable plugs to the backlight inverter
4.	Unscrew the two screws
5.	Exchange the part
6.	Connect the Cables





Assembly of Trolley 301.105.000





Technical Alarms List

No	Message	Reason, Remedy
200	Invalid calibration data - do not use device	Bellavista requires calibration
224	Mismatch between delivered and measured FiO2	The O_2 concentration delivered by the oxygen blender is not the same measured by the O_2 cell. Possible reasons: • O2 cell decalibrated • O2 blender defective Remedies: • Calibrate O2 cell • If it is a recurring error, notify service technician
225	Oxygen sensor soon depleted	Exchange and calibrate O2 cell
236	Inspiratory air temperature too high	Reasons: • Ambient temperature too high • Extreme ventilation settings • Patient air filter blocked • Blower cooling filter blocked Remedies • bellavista automatically reduces FiO2 to prevent further increase of temperature. • Further actions: • Reduce O2 concentration manually • Move to cooler environment • Reduce inspiratory pressure • Increase inspiratory time • Replace patient air filter • Replace metal filter on bottom of ventilator (Notify service technician)

No	Message	Reason, Remedy
237	Temperature of device CPU high	Reason • Ambient temperature very high • Ventilator air filter blocked Remedy • Move to cooler area • Replace ventilator air filter • If it is a recurring error, notify service technician
238	Temperature of device too high	Reason • Ambient temperature very high • Ventilator air filter blocked Remedy • Move to cooler area • Replace ventilator air filter • If it is a recurring error, notify service technician
239	Temperature of device high	Reason • Ambient temperature very high • Ventilator air filter blocked Remedy • Move to cooler area • Replace ventilator air filter • If it is a recurring error, notify service technician

No	Message	Reason, Remedy
240	Temperature of blower too high	Reason • Ambient temperature too high • Extreme ventilation settings • Patient air filter blocked • Blower cooling filter blocked • Warning: if the temperature increases further, the ventilator could be damaged or destroyed Remedy • bellavista automatically reduces FiO2 to prevent further increase of temperature. • Further actions: • Reduce O2 concentration manually • Move to cooler environment • Reduce inspiratory pressure • Increase inspiratory time • Replace patient air filter • Replace metal filter on bottom of ventilator (Notify service technician)
241	Temperature of blower high	Reason • Ambient temperature very high • Extreme ventilation settings • Patient air filter blocked • Blower cooling filter blocked Remedy • Reduce O2 concentration • Move to cooler environment • Reduce inspiratory pressure • Increase inspiratory time • Replace patient air filter • Replace metal filter on bottom of ventilator (Notify service technician)
270	O2 input pressure too high - No O2 dosing possible	The O_2 safety valve has switched off the O_2 supply because the input pressure was measured too high

No	Message	Reason, Remedy
271	O2 supply failed - No O2 dosing possible	No O_2 supply detected
272	O2 supply insufficient	O_2 supply is insufficient for the current settings. Remedy may include: • Ensure good and steady O_2 supply • Reduce FiO_2 setting • Reduce peak flow • Use shorter O_2 supply hose
273	O2 supply insufficient - O2 Flush concentration not reached	O_2 supply is insufficient for the current settings. Remedy may include: • Ensure good and steady O_2 supply • Reduce peak flow • Use shorter O_2 supply hose
300	Technical failure 300 - Device in failsafe	An important technical error has occurred. This technical failure stops ventilation and puts all valves in a safe status.
301	Technical failure 301 - Watchdog failure, firmware running	
303	Technical failure 303 - EPC broken	The embedded PC (EPC) is not running
304	Technical failure 304 - Selftest timeout - Restart the ventilator	The selftest has taken too long
305	Technical failure 305 - Communication to CFB disconnected	Communication between embedded PC and CFB (processor which controls the ventilation) is temporarily interrupted. Usually communication will be resumed after a short period of time. Usually there are no negative effects on ventilation.
306	Technical failure 306 - Sound system broken	The microphone has not detected the alarm sound. Possible reason: no alarm sounded (loudspeaker broken) or microphone broken. Very rarely this can be due to noisy environment (exhibition) Restart bellavista.

No	Message	Reason, Remedy
307	Technical failure 307 - Writing to EEPROM failed	
308	Technical failure 308 - EEPROM checksum failure	Data stored in the EEPROM may be corrupted
309	Technical failure 309 - Nurse call failed	The software reads back the status of the nurse-call relais. If this status is not correct, this alarm comes up. This alarm has nothing to with the alarming system which ay or may not be connected.
310	Technical failure 310 - Invalid hardware revision	Hardware and software may not be compatible. This may come up after exchanging hardware (PCBs) incorrectly.
311	Technical failure 311 - Invalid software revision	Hardware and software may not be compatible. This may come up after manipulating software incorrectly.
313	Technical failure 313 - Buzzer test failed	During the self test the microphone has not detected the buzzer sound. Possible reason: no buzzer sounded (buzzer broken) or microphone broken. Very rarely this can be due to noisy environment (exhibition). In some cases it may help to “warm up” the buzzer by operating it for a couple of minutes using **8 Audio / Alarming** Restart bellavista.
314	Technical failure 314 - Loudspeaker test failed	During the selftest the microphone has not detected the alarm sound. Possible reason: no alarm sounded (loudspeaker broken) or microphone broken. Very rarely this can be due to noisy environment (exhibition). Restart bellavista.
315	Technical failure 315 - Inspiration valve or device leaky	
316	Technical failure 316 - Blower failure	
317	Technical failure 317 - Hardware failsafe failed	
318	Technical failure 318 - Inspiration valve failsafe failed or occlusion in inspiration tube	

No	Message	Reason, Remedy
320	Technical failure 320 - Battery faulty - no battery operation possible - do not disconnect mains supply!	The battery is defective and needs replacement. Details may be available in **9 Batteries** Note: when connected to mains power suppy at all times, bellavista may be used with only one battery.
321	Technical failure 321 - Battery disconnected - no battery operation possible - do not disconnect mains supply!	The battery is not plugged in correctly or is possibly defective. Plug in and restart bellavista. Note: when connected to mains power suppy at all times, bellavista may be used with only one battery.
322	Technical failure 322 - Battery failure - immediately connect to mains supply!	The battery is defective and needs replacement. Details may be available in **9 Batteries** Note: when connected to mains power suppy at all times, bellavista may be used with only one battery.
323	Technical failure 323 - Battery failure - no battery operation possible - do not disconnect mains supply!	The battery is defective and needs replacement. Details may be available in **9 Batteries** Note: when connected to mains power suppy at all times, bellavista may be used with only one battery.
324	Technical failure 324 - Battery faulty	The battery is defective and needs replacement. Details may be available in **9 Batteries** Note: when connected to mains power suppy at all times, bellavista may be used with only one battery.
325	Technical failure 325 - ePC fan does not rotate correctly	The on-board fan of the embedded PC does not rotate. Check if it is blocked or disconnected.
327	Technical failure 327 - Fan failure	The main cooling fan does not rotate. Check if it is blocked or disconnected.
328	Technical failure 328 - Fan failure	The main cooling fan does not rotate. Check if it is blocked or disconnected.
329	Technical failure 329 - SM Bus not initialized	
330	Technical Failure 330 - KEApi driver not initialized	

No	Message	Reason, Remedy
332	Technical failure 332 - 3.3V voltage low	
334	Technical failure 334 - 3.3V voltage high	
335	Technical failure 335 - 5V voltage low	
336	Technical failure 336 - 5V voltage high	
337	Technical failure 337 - 9V voltage too low	
338	Technical failure 338 - 9V voltage too high	
339	Technical failure 339 - 12V voltage low	
340	Technical failure 340 - 12V voltage too low	
341	Technical failure 341 - 12V voltage high	
344	Technical failure 344 - 24V step motor voltage low	
345	Technical failure 345 - 24V O2 voltage low	
346	Technical failure 346 - 24V O2 voltage high	
347	Technical failure 347 - 24V step motor voltage too low	
349	Technical failure 349 - 24V step motor voltage high	
350	Technical failure 350 - Remaining CF card capacity to low	
352	Technical failure 352 - Persistent data corrupted	
355	Technical failure 355 - USB communication failure	
363	Technical failure 363 - 9V voltage low	
365	Technical failure 365 - 9V voltage high	

No	Message	Reason, Remedy
379	Technical failure 379 - No O2 dosing possible	The O_2 proportional valve may be leaking. To protect against overpressure the O_2 safety valve is now blocking the O_2 supply. aTf_379O2ValveLeakyMessage
386	Technical failure 386 - Unknown alarm from CFB	
387	Technical failure 387 - No O2 dosing possible	An internal high pressure has been detected. Since this can only come from the O_2 supply both, O_2 proportional valve and O_2 safety valve are now blocking the O_2 supply. aTf_387HighPressBlowerMessage
388	Technical failure 388 - No O2 dosing possible	An internal O2 overpressure was detected: PO2Regulated (which should be ≤2.5 bar) is higher than 3.5bar. Possible cause: Leaking of O2 pressure regulator. Try to connect O_2 supply only after starting up bellavista. aTf_388HighPressO2RegulatedMessage
389	Technical failure 389 - No O2 dosing possible	The O_2 safety valve may be leaking. To protect against overpressure the O_2 proportional valve is now blocking the O_2 supply. aTf_389O2SafetyValveLeakyMessage
390	Technical failure 390 - Malfunction of pulse oximeter	
391	Technical failure 391 - Malfunction of CO2 / gas sensor	
392	Technical failure 392 - AlarmSupply voltage low	
393	Technical failure 393 - AlarmSupply voltage high	
394	Technical failure 394 - 24VOn voltage low	
395	Technical failure 395 - 24VOn voltage high	
396	Technical failure 396 - 11V Standby voltage low	
397	Technical failure 397 - 11V Standby voltage high	

No	Message	Reason, Remedy
504	Technical failure 504 - Assertion id machine states	
505	Technical failure 505 - Assertion id monitors	
506	Technical failure 506 - Assertion id curves	
507	Technical failure 507 - Assertion id breath monitors	
508	Technical failure 508 - Assertion id actuators	
514	Technical failure 514 - Scaled periphery sensor value out of range	
515	Technical failure 515 - Scaled ventilation sensor value out of range	
517	Technical failure 517 - PWM module A out of range	
518	Technical failure 518 - MAX665 value out of range	
519	Technical failure 519 - LTC1760 value out of range	
520	Technical failure 520 - MCP230 value out of range	
521	Technical failure 521 - PCA9532 value out of range	
522	Technical failure 522 - Calibration data out of range	
523	Technical failure 523 - TMC428 adress problem	
533	Technical failure 533 - Runtime exception in tasking catched	

No	Message	Reason, Remedy
534	Technical failure 534 - Vd interrupt runtime exception catched	
535	Technical failure 535 - Unknown exception in tasking catched	
536	Technical failure 536 - Unknown exception in vd interrupt catched	
540	Technical failure 540 - Scaled periphery sensor value out of range - failsafe	
542	Technical failure 542 - Scaled ventilation sensor value out of range - failsafe	
544	Technical failure 544 - ADC 2 value out of range - failsafe	
545	Technical failure 545 - aStepInspValve value out range - failsafe	
546	Technical failure 546 - ADC 1, rPressO2SupplyScaled value out of range	
548	Technical failure 548 - ADC 2, rPressPatProxScaled value out of range	
549	Technical failure 549 - ADC 2, rConcO2Scaled value out of range	
550	Technical failure 550 - ADC 2, rTempDeviceScaled value out of range	
553	Technical failure 553 - ADC 2, rTempBlowerScaled value out of range	
554	Technical failure 554 - ADC 3, rTempMainBoardScaled value out of range	

No	Message	Reason, Remedy
557	Technical failure 557 - ADC 4, rTempLifeboard-Scaled value out of range	
558	Technical failure 558 - ADC 4, rPressFlowProx-Scaled value out of range	
559	Technical failure 559 - ADC 4, rPressMush-roomControlScaled value out of range	
560	Technical failure 560 - ADC 4, rFlowProxScaled value out of range	
566	Technical failure 566 - PWM, aPwmVolt-ageBlower value out of range	
567	Technical failure 567 - PWM, aPwmSpeedBlow-er value out of range	
568	Technical failure 568 - PWM, aPwmMush-roomValve value out of range	
569	Technical failure 569 - PWM, aPwmO2Valve value out of range	
570	Technical failure 570 - Scaled ventilation sensor value out of range - failsafe	
571	Technical failure 571 - Scaled periphery sensor value out of range	
572	Technical failure 572 - PWM module B out of range	
573	Technical failure 573 - value out of range	aTf_573TechnicalFailureVentilationSensorScaled1000G2ValueOutOfValidRangeFailsafeMessage
574	Technical failure 574 - value out of range	aTf_574TechnicalFailureRPressO2SupplyScaled1000G2ValueOutOfValidRangeMessage
575	Technical failure 575 - value out of range	aTf_575TechnicalFailureRPressO2RegulatedScaled1000G2ValueOutOfValidRangeMessage

No	Message	Reason, Remedy
577	Technical failure 577 - value out of range	aTf_577TechnicalFailureRTempO2Scaled1000G2ValueOutOfValidRangeMessage
578	Technical failure 578 - value out of range	aTf_578TechnicalFailureRTempInspScaled1000G2ValueOutOfValidRangeMessage
580	Technical failure 580 - Qspi interrupt catched runtime exception	
581	Technical failure 581 - Qspi interrupt caught unknown exception	
582	Technical failure 582 - I2C interrupt catched runtime exception	
583	Technical failure 583 - I2C interrupt catched unknown exception	
584	Technical failure 584 - Firmware heap out of memory	
586	Technical failure 586 - value out of range	aTf_586TechnicalFailureRPressFlowO2Scaled1000G2ValueOutOfValidRangeMessage
587	Technical failure 587 - value out of range	aTf_587TechnicalFailureRFlowO2Scaled1000G2ValueOutOfValidRangeMessage
589	Technical failure 589 - Reference voltage ADC1 invalid	
590	Technical failure 590 - Reference voltage ADC2 invalid	
591	Technical failure 591 - Reference voltage ADC3 invalid	
592	Technical failure 592 - Reference voltage ADC4 invalid	
593	Technical failure 593 - Reference voltage QADC invalid	
600	Technical failure 600 - Check warning log	
997	Test alarm (high priority)	Test alarm which can be activated in **8 Audio / Alarming**

No	Message	Reason, Remedy
998	Test alarm (medium priority)	Test alarm which can be activated in **8 Audio / Alarming**
999	Test alarm (info priority)	Test alarm which can be activated in **8 Audio / Alarming**

11. Spare Parts

Art No	Designation
300.784.000	Internal Battery
300.769.000	Oxygen Cell
301.909.000	Oxygen Cell Tool
301.165.000	Filter Set
301.322.000	Power Supply Cable CH Angled
301.323.000	Power Supply Cable EU Angled
301.324.000	Power Supply Cable UK Angled
301.325.000	Power Supply Cable US Angled
300.999.000	Fuse T 6.3 AH, 250 V
100.156.000	Knurled Screw M8x16 (Trolley)
301.516.000	Expiration Valve Mount
301.517.000	Expiration Valve Adapter
301.523.000	Expiration Valve Membrane
301.552.000	Silicone Caps for Exp. Valve (autoclavable)
301.519.000	Silicone Tube 250 mm
301.557.000	Filter Element 5um
301.260.000	Metal Filter Insert O2 Input
100.075.100	Sinter metal filter
301.102.000	Housing cover alarm
301.038.000	Cooling fan cover
301.043.000	Patient air filter cover
301.042.000	Connector cover plate (fits either side)
301.041.000	O2 Cell cover
301.956.000	Front handle for trolley

Art No	Designation
301.976.000	Mounting Parts Set for Support Arm
301.961.000	Slide ring for joints of Support Arm
Flow Analyser	
301.972.000	Annual Maintenance Kit
300.116.003	PF-300 FlowAnalyser Test-Set "Ventilation"
301.858.000	CITREX H4, compact mobile testing device for ventilators
301.863.000	CITREX Oxygen Measurement Option
Test Lungs	
300.756.000	EasyLung
300.162.000	SmartLung Adult
300.400.004	SmartLung Infant
500.040.000	Test Lung Infant
Various + Accessories	
300.964.000	Leak adapter for use with test lung and breathing circuit A
301.115.000	Connector for curse call
301.116.000	Connector for bellavista Bus
301.110.000	Connector for 24 V feed
301.159.000	Accessory bag
301.258.000	O2 adapter NIST
301.259.000	O2 adapter DISS
301.397.000	Tube to DISS O2 adapter

Art No	Designation
Technical Spare Parts	
300.788.000	Backlight inverter
301.004.100	Blower module
301.069.000	CFB controller board
301.080.000	Embedded PC
300.907.000	Fan with cable
301.051.100	Inspiration valve
300.914.000	Interface board
300.852.000	LED board
300.844.000	Lifeboard
300.833.000	Main board
300.924.000	Mushroom valve
301.085.000	Packaging
300.886.000	Patient board
300.874.000	Power board
300.791.000	Power supply
301.547.000	Proportional valve O2
301.297.000	Proportional valve safety
300.923.000	Rinse flow valve
301.214.000	Sensor board
301.262.000	Temperature sensor
300.787.000	TFT display

*) Consumable

12. Index

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