Welch Allyn® 1500 Patient Monitor

Verification and Measurement Checks

Functional and parameter check procedures to fulfil the annual safety check requirement

WelchAllyn®

Advancing Frontline Care™

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Contents

1 Safety

Caution All safety warnings with regard to user responsibility, intended use, organizational measures, networks and internet, operation with other devices, monitor use and patient safety, and all other safety cautions and warnings are detailed in the Welch Allyn® 1500 Patient Monitor patient Directions for Use supplied with the unit. It is essential that these warnings are read before carrying out any procedure detailed in this document and adhered to at all times.

Cleaning and maintenance

WARNING Danger of electric shock. Do not open the monitor case. There are no user serviceable parts inside. Servicing and module replacement may only be performed by a qualified technician authorized by Welch Allyn.

WARNING Before cleaning and to isolate the mains power supply, switch the monitor off and disconnect it from the mains by removing the plug.

Caution Do not use high temperature sterilization processes (such as autoclaving). Do not use E-beam or gamma radiation sterilization.

Caution Do not use solvent or abrasive cleaners on either the monitor or cable assemblies.

Caution Do not immerse the monitor or cable assemblies in liquid.

Note A complete list cleaning materials is provided in the Welch Allyn® 1500 Patient Monitor patient Directions for Use supplied with the unit.

Document symbols

These symbols appear in this manual.

	**WARNING** Warning statements in this manual identify conditions or practices that could result in personal injury.
	**Caution** Caution statements in this manual identify conditions or practices that could result in damage to the equipment or other property.
	Reference to other guidelines.
	Tools and equipment required to carry out the procedure.

Monitor, accessory and screen symbols

Monitor, accessory and screen symbols are detailed in the Welch Allyn® 1500 Patient Monitor patient Directions for Use supplied with the unit.

2 Introduction

This Verification and Measurement Checks document is a customer facing procedural guide intended as a general verification check of all parameter measurements for the Welch Allyn1500 Patient Monitor.

Any of the checks and tests detailed here can be performed individually at any time. To fulfil the annual service and safety check requirement, all of these tests and checks must be performed at the same time and the results recorded in the test protocol measurement checklists at the end of this book (see "Test protocols and checklists" on page 59).

Caution Some of the procedures detailed here require technical knowledge and experience in the use of dedicated test equipment; it is recommended that persons performing these procedures are hospital technicians with clinical biomed experience or have attended a WA training course. Only suitably qualified personnel may carry out the annual isolation safety checks.

Note General user instructions are not provided in this booklet. Full user instructions in several languages are provided in the Directions for Use CD supplied with the monitor.

Environmental conditions

When carrying out the parameter tests, the following environmental ranges should be observed:

- Temperature: 10 °C to 40 °C (50 °F to 104 °F)
- Relative humidity: 30 to 80%
- Pressure: 700 to 1060 hPa

Maintenance Schedule

The following table indicates the intervals and responsibilities of the maintenance work required. Local regulations in your country may stipulate additional or different inspection intervals and tests.

Interval	Maintenance	Responsible
Before use	Visual inspection of the monitor and cables	User
Every 6 months	Button check	User
	Speaker check	
	LED check	
	Alarm check	
Every 12 months	Yearly test and test after repair according to IEC/EN 62353.	Qualified technician, WA service department or approved agent
	Visual, Functional, and parameter checks detailed in this document.	
	CO_2 Calibration[1]	

1. The need for calibration is based upon physical component changes that occur during use. The module requires its first calibration after 1200 operating hours or one calendar year, whichever comes sooner, and then after each 4000 operating hours or once a year, whichever comes sooner. The message Calibration Due appears when the hourly limit is reached. It is advisable to calibrate in the one-year maintenance program especially if the monitor is used for intermittent, short term use typical of patient monitors.

Checks and procedures in this document

Note It is recommended that when carrying out the annual verification and safety tests, the procedures are carried out in the order detailed here.

This document provides check procedures for the following:

Visual check

A general visual check of the monitor and accessories for any signs of damage or excessive wear.

Leakage and potential equalization ground measurement

This provides a safety check of the unit and includes ground check, leakage current of the monitor, and leakage current patient. The safety testing of the monitor and the safety limits are carried out according to IEC/EN 62353 (See also table IEC62353 / 5.3.3 e). The equipment used is subject to the instructions according to ISO 9000 in regards to test equipment control.

General functional checks

The general functional and verification checks are given to provide a basic integrity check of the monitor. No test equipment is required to perform these checks.

NIBP tests

The NIBP test uses a dedicated service-tool software to check the accuracy and leakage of the NIBP measurement and tubing. This software is installed on a PC connected to the service connector (SVC) of the monitor via a dedicated cable assembly.

Additionally, a second software must be copied to a USB drive and inserted in the monitor USB connector to set the monitor in service mode. Both of these softwares must be obtained from Welch Allyn before carrying out the NIBP tests.

ECG, SpO_2, IBP, temperature and cardiac output checks

Measurement check procedures are provided for the parameter measurement. All of these tests require dedicated test equipment.

CO_2 Check and CO_2 calibration procedure

The CO_2 check procedure should be carried out as part of the annual check procedure; the calibration procedure can be carried out as required. The CO_2 check requires a certified CO_2 gas canister (5% or 10% concentration). The calibration procedure requires a certified CO_2 gas canister 5% concentration. The gas canisters can be obtained locally.

Note The test equipment and software required to perform all of these measurements, tests, checks and calibration procedures are detailed the beginning of this document (see "Test equipment, tools and software" on page 12).

3 Test equipment, tools and software

The following details the test equipment, special tools, accessories, and test software required to carry out all functional tests, checks, and calibration procedures detailed in this document.

NIBP

Description	Part Number
Manometer, Braun Delta Cal, or equivalent	Approved standard (obtain directly from the manufacturer or purchase locally)
NIBP test volume repair fixture, including: • 500ml pressure test cylinder (cuff simulator) • Manual hand pump with valve • X fitting hose connector • 3mm Hose	407672
NIBP connector	600-0021-00
USB service adaptor USB / SVC cable assembly	2.320020
USB drive with WA1500PM parameter update mode software located on the root directory of the USB drive (see "Test software" on page 14).	The WA1500PM Parameter mode software script can be obtained from the Welch Allyn Web site.
PC / laptop with Windows XP and unzipped WA1500PM Service Tool software installed (see "Test software" on page 14).	The WA1500PM Service Tool can be obtained from the Welch Allyn Web site.
SVC, 1500PM Sticker cover removal tool set	4.410287
Blanking covers CO, T2 and SVC (smaller size)	717552
Lime based oil spray for removing uncured glue residue and other rough impurities like oil and grease; solvent-free, pH neutral	3M 50098 or similar (bought locally).

ECG

Description	Part Number
Test ECG patient simulator with respiration (e.g. Fluke MPS450 or HKP ARSI-2).	Approved standard
5 - lead ECG cable	008-0313-00 (or equivalent)

SpO_2

Monitors with Nellcor modules

Description	Part Number
Nellcor SpO_2 Cable, DOC-10	103490
Nellcor SRC-MAX SpO_2 Tester (or equivalent)	SRC-MAX

Monitors with Masimo modules

Description	Part Number
Masimo SpO_2 Cable	713657
Masimo Rainbow SET tester (Masimo part #2368) - Masimo SpO_2 Tester (or equivalent)	SRC-MAX 103507

IBP, temperature, and cardiac output

Description	Part Number
SVC, 1500PM, multi parameter tester for IBP, temperature and cardiac output.	2.320011
SVC, 1500PM, IBP test cable (for use with multi parameter tester, 2.310011).	2.310293
SVC, 1500PM,Temperature/ cardiac output test cable (for use with multi parameter tester, 2.310011).	4.520694
SVC, 1500PM,Temperature test cable (for use with multi parameter tester, 2.310011).	4.520678

$etCO_2$ test and calibration

Description	Part Number
For CO_2 testing - A standard gas bottle with a 5% or 10% concentration CO_2 can be used.	Purchased locally
For Co2 calibration - A standard gas bottle with 5% concentration CO_2 be used.	Purchased locally

Nurse call check

Description	Part Number
SVC, 1500PM Nurse Call Tester	2.320012 (or multimeter)

Test software

Two dedicated test software applications are required to carry out the NIBP checks as follows:

- **WA1500PM service tool (NIBP)**. This software is used to carry out the NIBP tests and must be copied on to a PC / laptop where it will run as a standalone executable file. The PC / laptop is connected to the monitor via the SVC test connector to carry out the tests. Note this Software comprises two files that must be copied in the same directory as follows:
  - ServiceTool 2.xx.xx.exe
  - ServiceTool 2.xx.xx.ini

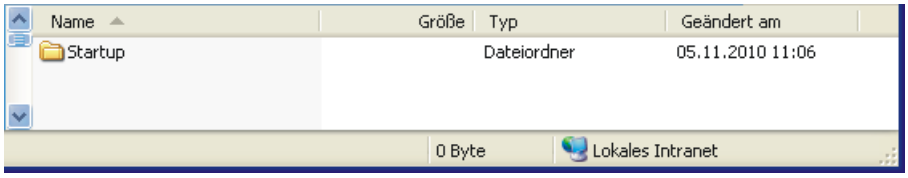
- **Parameter service mode software.zip.** This software is used to put the monitor in service mode before the NIBP tests are carried out. The software must copied to a USB drive (note that the maximum size of the USB drive is 2GB. When the monitor is switched on with the USB drive inserted, the software places the monitor in service mode and the following is displayed:

Note this Software comprises two files as follows:

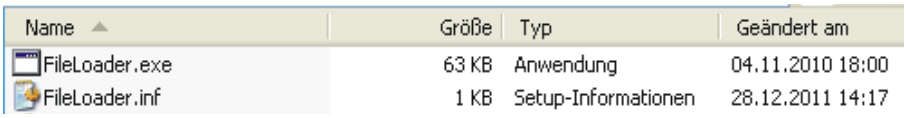
- FileLoader.exe
- FileLoader.inf

Both of these softwares are obtained from the Welch Allyn Web site.

Note The **Parameter service mode software.zip** extracts into a Startup folder. This startup folder must be in the root directory of the USB drive.



The startup folder must contain the two files as shown:



4 Visual inspection

Fuses

WARNING Disconnect the monitor from the mains before removing the fuses.

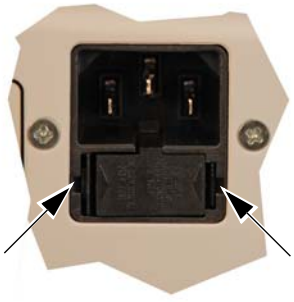
WARNING Fuses must only be replaced with the fuse types indicated in the below table.

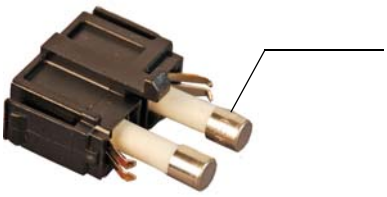
Fuse Types

Voltage range	Number	Fuse type	WA Part No.	Manufacturer Part No.
100-240 VAC	2	M1.6A, E250V	4.210004	Schurter Inc, FSM 0034.2518
M= Medium time lag E= Enhanced breaking capacity				

Note The fuse type is also written on a label on the back of the unit (see next page).

1. Disconnect the monitor from the mains.
2. Release the fuse holder by gently squeezing the side retaining clips and remove the fuse holder.





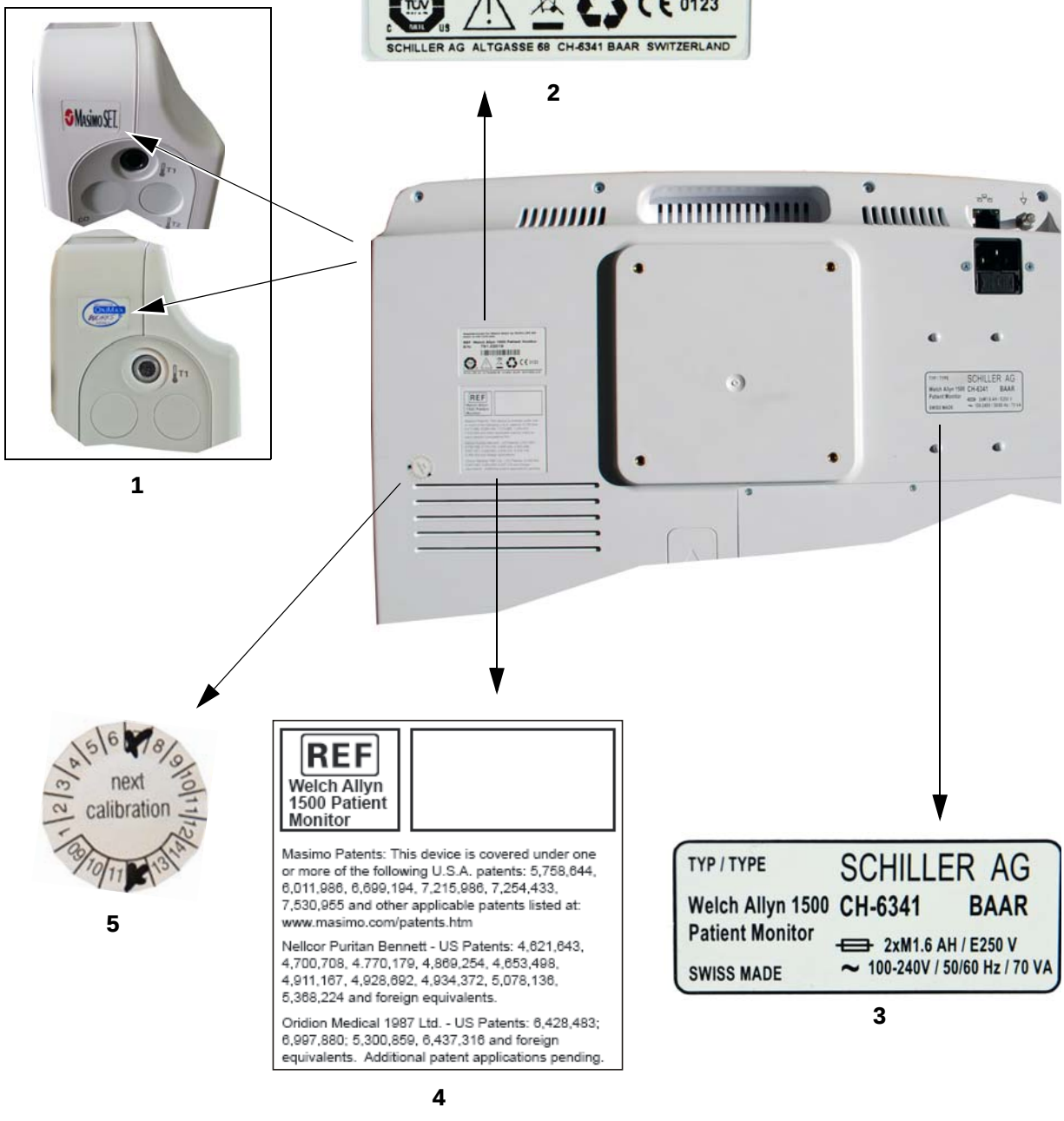
The fuse type and rating is stamped on one end of the fuse.

3. Check fuse rating.
4. Re-insert the fuse holder until the two side clips snap in place.

Test criteria

- Both fuses are rated type M1.6A, E250V
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Safety, patent and information labels



Test criteria

- SpO_2 module manufacturer label **(1)** intact and readable.

Note Two SpO_2 modules are available with the monitor Nellcor or Masimo, make sure that the correct label is attached for the module installed in the monitor.

- Manufacturer label with serial number, CE reference and safety label **(2)** intact and readable.
- Manufacturer type label with monitor type, address, fuse rating, and power requirements **(3)** intact and readable.
- REF label with patent information **(4)** intact and readable.

Note On some monitors the REF label may look slightly different from that shown.

- The calibration / next yearly check label **(5)** placed on the back of the monitor is within date.

Note On some monitors the calibration label may be placed in a different position and / or the label itself may be different from that shown. The month and year of the next factory check must be clearly shown.

- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Physical condition of the monitor

Check the monitor for signs of damage.

Test criteria

- No cracks or chips in the casing.
- Mains, patient and all other cable assemblies are in good condition with no crushing, chafing or cuts, etc.
- All plugs and sockets are straight and in good condition.
- No soiling which could hamper the safety of the monitor.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

5 Leakage and potential equalization

Test equipment

Caution The safety testing of the monitor and the safety limits are carried out according to IEC/EN 62353 (See also table IEC62353 / 5.3.3 e). The equipment used is subject to the instructions according to ISO 9000 in regards to test equipment control.

Tests that must be carried out

The following tests must be carried out:

- Potential equalization / ground
- Leakage current of the monitor
- Leakage current patient (ECG part)
- Insulation resistance - This test need only be carried out if there is any doubt about the insulation of the equipment, e.g. if residual current monitor or ground fault circuit interrupt has tripped several times, or if saline has been spilled over the equipment and therefore creepage distances are in doubt.

Specify and document the equipment and measuring setup details in the test protocol according IEC 62353 or 60601-1.

Test Criteria

The monitor must meet the safety limits specified in IEC/EN 62353.

Documentation

Note the results or have them printed by the tester. Always include one copy of the results with the test report.

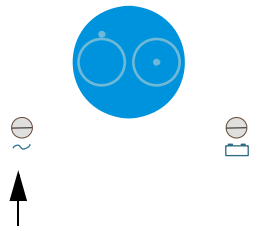
Record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

6 General functional checks

Power indicator and battery check

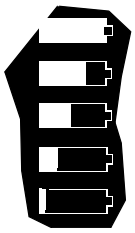
Mains LED

1. Connect mains to the monitor.
   - Check that when mains is connected the mains LED is illuminated.



Battery charge

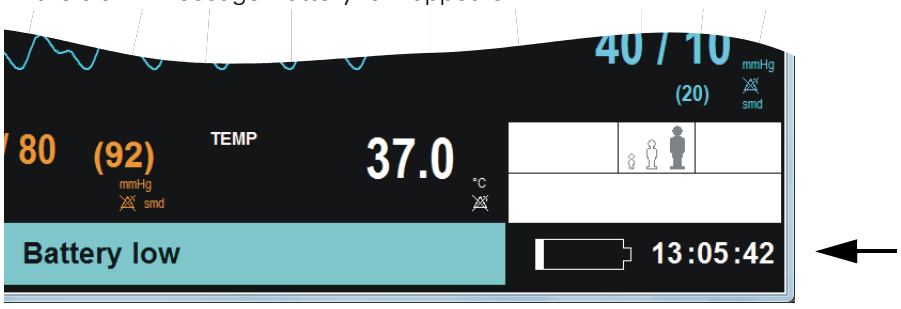
1. Leave the monitor connected to the mains supply for 4.5 hours to fully charge the battery.
2. Disconnect the mains supply and switch the monitor on with the mains supply not connected; allow the monitor to run for an extended period.
   - Check that the battery symbol displays an indication of the capacity as the battery is depleted.



- Full = between 87.5% and 100% capacity.
- 3/4 full = between 62.5% and 87.5% capacity.
- Half full = between 37.5% and 62.5% capacity.
- 1/4 full = between 12.5% and 37.5% capacity
- Empty = between 0% and 12.5% capacity.

3. Check that when the battery capacity is close to depletion the following happens:

   - the alarm message Battery low appears



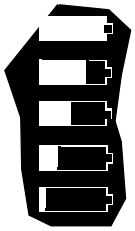
   - the battery symbol flashes
   - an audible alarm occurs
   - the visual alarm indicator flashes blue

4. Reconnect the mains supply.

   - Check that when mains is reconnected, the mains LED is illuminated and the battery symbol disappears.

5. Leave the unit connected to the mains supply for 30 to 60 minutes and then remove the mains supply.

   - Check that when the mains supply is again removed, the battery symbol is displayed. Check that it indicates a battery capacity of 1/4 full or greater, i.e. not empty.



   - Full capacity - OK
   - 3/4 full - OK
   - Half full - OK
   - 1/4 full - OK
   - Empty - not OK

Test criteria

If any test fails, it indicates that the battery needs replacing or there is a power monitoring or charging fault. Return the unit to Welch Allyn.

If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Note Directions to change the battery are given at the end of this document (see "Changing the Battery" on page 76).

Speaker and piezo check

This check verifies that the speaker and piezo are functioning.

Procedure

1. Power on the monitor - press the on / off button  .
2. Wait a few seconds for the monitor to switch on and for the monitor to be ready.

Test criteria

- Immediate single high pitch piezo beep when the on button is pressed.
- After a few seconds a series of speaker and piezo beeps is heard and the device is ready.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Note The speaker volume is adjusted in the setup menu:

 **Setup > Speaker Volume**

The piezo beep (the second higher pitch beep) is not a first line alarm indicator and it is not a requirement that the piezo speaker is within the relevant directive minimum of 45 dB.

Troubleshooting

If any test fails, it indicates a problem with the speaker. Return the unit to Welch Allyn.

Keypad check

Examine the keypad for mechanical wear and check buttons for function.

Test criteria

- No excessive mechanical damage or wear.
- All buttons function correctly.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Troubleshooting

If any test fails return the unit to Welch Allyn.

LCD screen test

Procedure

1. Power on the monitor.
2. During the boot sequence when the splash screen is displayed, visually inspect the screen for spots, or black fields.
3. Check that the LCD shade (contrast and brilliance) is even and consistent.

Note The boot sequence provides the best opportunity to see missing pixels. The LCD can also be examined when switched on during normal operation.

Note If any spots, darkened areas, unevenness, etc., are apparent, the LCD must be replaced (a few faulty pixels is acceptable).

Test criteria

- No spots or black fields.
- LCD shade (contrast and brilliance) is even and consistent.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Note The following is a guideline of acceptable LCD pixel defects:

- 2 full bright pixels
- 2 full dark pixels
- 5-10 single or double bright or dark sub-pixels (again, depending on the number of each; no more than 5 bright ("stuck on") sub-pixels are permitted).
- The general rule is that the screen is clear and readable

Troubleshooting

If the screen or the backlight is faulty, return the unit to Welch Allyn for repair.

Printer Checks

Note The printer checks only need to be performed if a printer is installed in the monitor.

Cleaning the thermal print head

Note It is recommended that the printhead is cleaned during the yearly check.

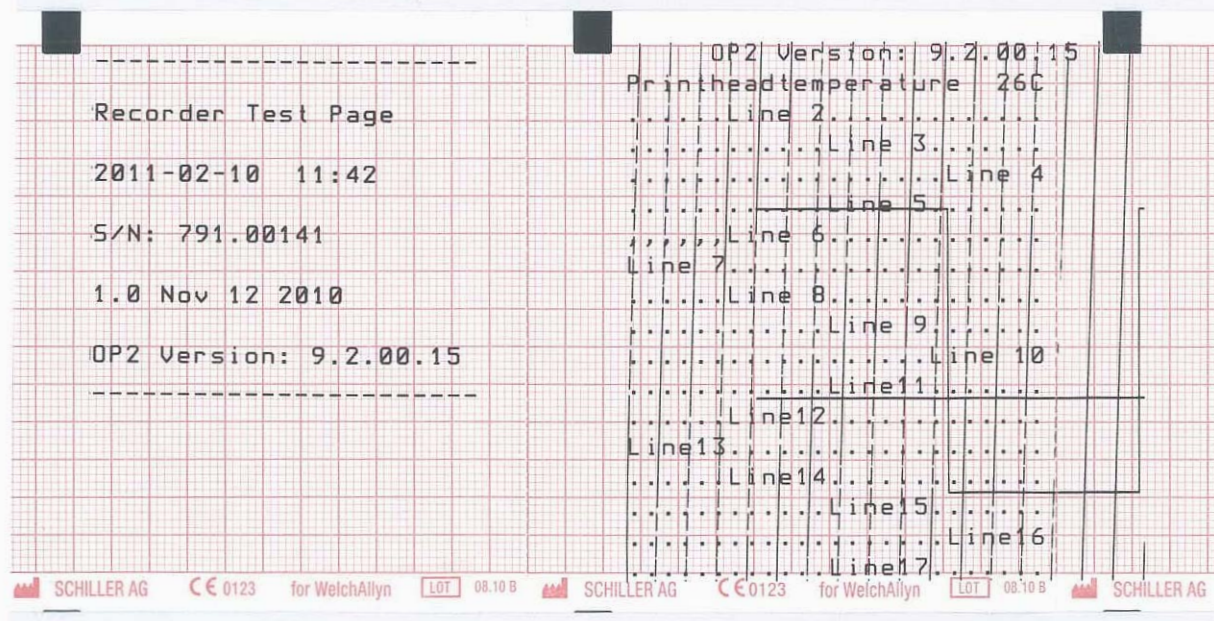
A residue of ink (from the grid on the paper) can build up on the print head over a period of time. This can cause the print quality to deteriorate. It is recommended that the print head is cleaned during the yearly test.

Extend the paper tray and remove paper. The thermal print head is found under the paper tray. With a lint-free cleaning cloth dampened in alcohol, gently rub the print-head to remove the ink residue. If the print head is badly soiled, the color of the paper grid ink (i.e. red or green) will show on the tissue.

Print quality and alignment check

Enter the service screen as follows:

1. **Setup > Administrator > Service**
2. Enter the Service screen - password **53, 51, 54**
3. Select **Recorder diagnostics**
4. The following printout is given:



The text printout gives the time, software version and the current print head temperature.

Test Criteria

- Check that the printhead temperature is ambient (+20° C dependent on printer use before the test has been carried out).

Note The printhead temperature will depend on printer use immediately before the test printout. The more the printer has been used, the higher the temperature.

- Check that the parallel lines on the printout are not stepped.
- Examine the printout for:
  - fading
  - alignment
  - faulty pixels
  - blackness, regularity and good readability on the complete print width.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Troubleshooting

If any test fails or if individual pixels are missing, the printout fades or is darker in one area then the problem is usually with the thermal print head. Return the unit to Welch Allyn for repair.

7 NIBP tests

Test equipment

- The test equipment and the software required to carry out these tests are detailed at the beginning of this document (see "Test equipment, tools and software" on page 12).

Removing and replacing the SVC blanking cover

A self-adhesive blanking cover is attached to the service connector (SVC) and must be removed to carry out the NIBP test.

Note Depending on your monitor configuration, blanking covers may also be placed over some patient parameter connectors.

To facilitate removal of the covers two special removal tools (one large, one small) are available as a set (Part No. 4.410287).

Cover removal tool (large)

Cover removal tool (small)

Removal tool (small), is used for the SVC connector.

Cover removal

Caution The burr end of the tool is sharp. Take care when handling.

The procedure is the same for the both sizes of cover. Proceed as follows:

1. Select the correct removal size for the blanking cover to be removed (the SVC blanking cover requires the smaller tool).
2. Firmly press the cover removal tool onto the blanking cover until the end burrs engage with the cover.
3. Twist the tool (either direction) to break the cover adhesive seal and disengage the cover from the casing. Remove and discard the cover.

.

4. If necessary, clean the connector recess by spraying a cloth with adhesive removal spray (3M 50098 or similar approved solution) and use the cloth to remove any adhesive and clean the recess.

Caution Use 3M 50098 cleaning spray or similar approved cleaning solution. Use of non-approved cleaners may damage the monitor.

Caution Observe all warnings and cautions on the cleaning solvent container.

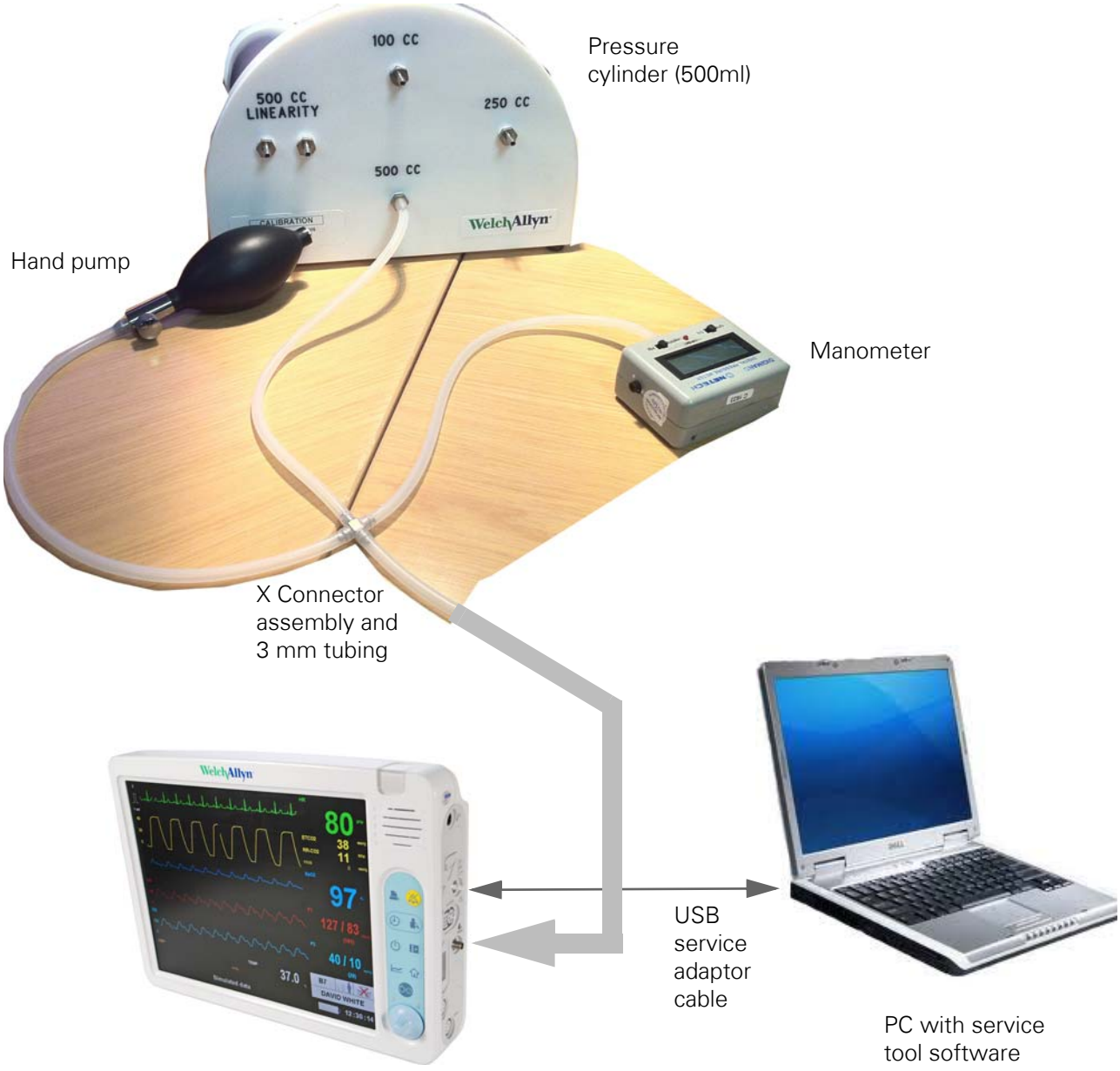
Cover replacement

To replace a self adhesive blanking cover, proceed as follows:

1. Ensure that the recess is clean with no old adhesive or oil-based cleaner still present. Clean with an alcohol solution if necessary.
2. Select the correct size of blanking cover and peel the cover away from the strip.
3. Position the cover centrally on the connector recess and secure it by applying finger pressure.

Setup procedure overview

Setup as follows:

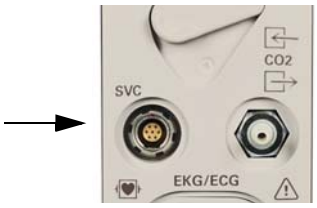


Connection of test hoses, valve assemblies and test equipment

Setup and connect the hose, pressure cylinder, hand-pump and manometer to the monitor NIBP connector as shown above.

Connection and opening the service tool

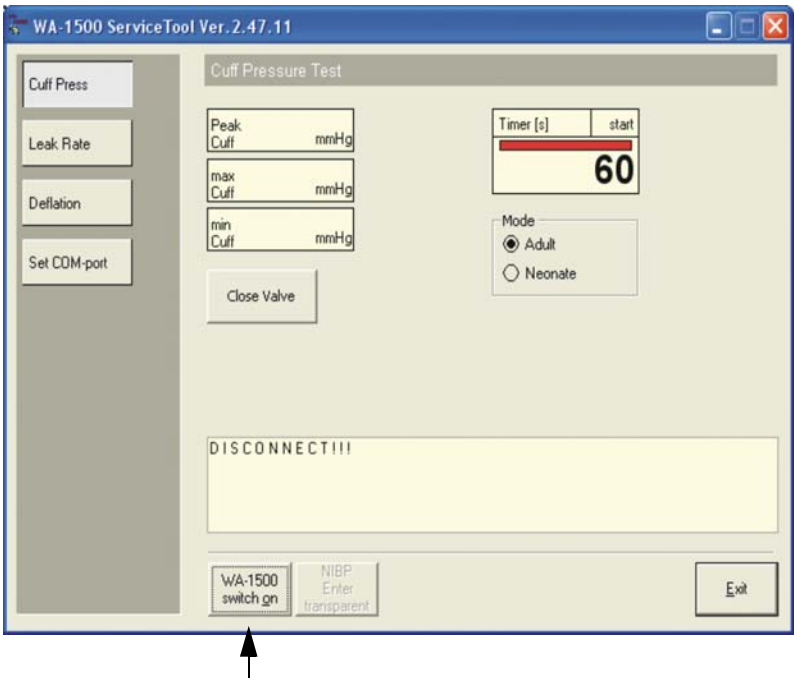
1. Remove the cover from the SVC connector (see "Cover removal" on page 27).
2. Connect the adapter cable between the SVC connector on the side panel and the PC.



3. Open the USB cover and insert the USB drive with the software.
4. Start the monitor: The monitor goes into service mode and the following is displayed:

Parameter Processor Service Mode is Active

5. From the PC, open the Service Tool. The following window appears:



6. Turn on the communication to the monitor by pressing the **WA1500 switch on** button.

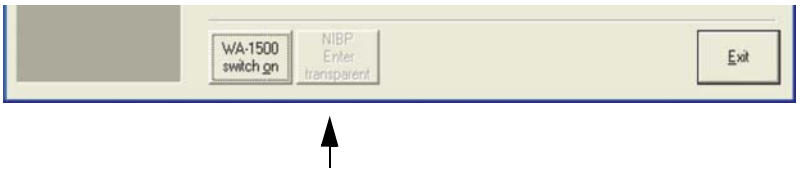
   - Three information lines are displayed when the monitor is connected as follows:

```
PB_BOOT V 1.31 14:57:34 Oct 24 2012
sn: 791.000141
WA1500 PB P2.00V9.3.39 11.10:37 / Feb25 2013
```

These values are as follows:

- Boot software version
- Serial number of the monitor
- Parameter box firmware version

7. Switch to the transparent mode. Click the **NIBP Enter transparent** button.



In the transparent mode the following tests can be carried out:

- Over pressure
- Leak rate
- Deflation

Note Click the **NIBP Enter transparent** button as soon as communication with the monitor is established and the button is active.

Note The transparent mode is automatically cancelled by the monitor after 3 minutes. When in transparent mode, the annotation on the transparent button changes to **Leave transparent**. This can be pressed at any time; any test that is running will stop before the transparent mode is exited.

Service tool troubleshooting and general notes

Connection

The service tool can communicate at different speeds with the host determined by a hand-shake process. This hand-shake procedure may be repeated at the end of a test resulting in minor delays during connection. This is normal and can be ignored.

Command time out

It is possible that the confirmation of a command sent by the service tool exceeds its time out and the test will be aborted. If this happens, restart the test.

Test does not start

If any NIBP test does not start, check that the monitor is in transparent mode.

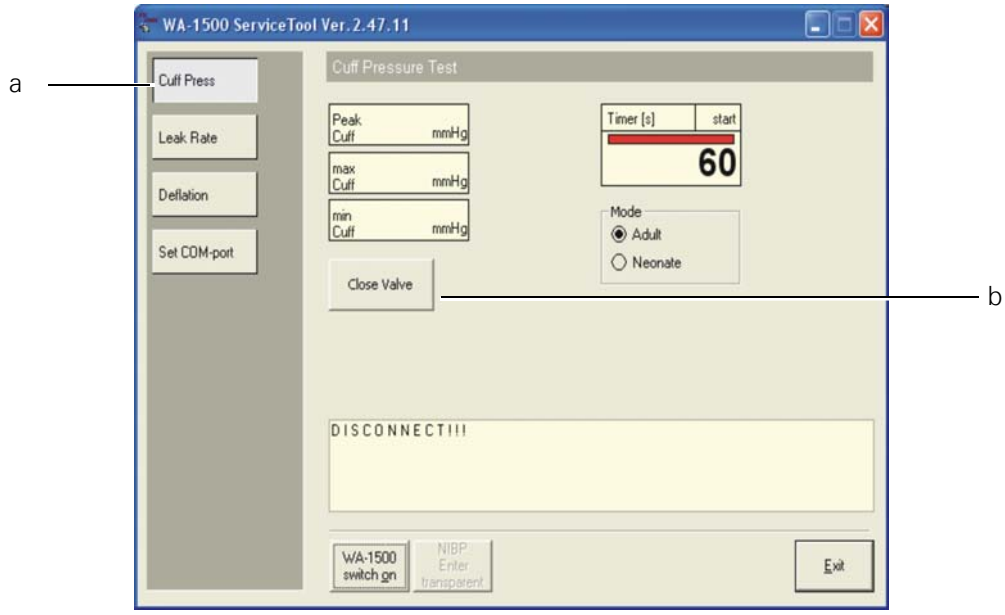
Transparent mode

The monitor leaves the transparent mode automatically after three minutes. When this happens no information is transmitted to the service tool. It is possible therefore, that the service tool thinks it is in transparent mode when the monitor is disconnected. When this happens, press the **Leave Transparent** and then the **NIBP Enter Transparent** button again.

Over pressure

Two safety valves are incorporated in the NIBP system: a software activated over pressure valve to release the pressure at 310 mmHg and a hardware over pressure valve that releases the pressure at 320 mmHg. During this test the software overpressure does not need to be tested and is disabled so that the hardware overpressure value can be checked.

To reset NIBP module, click **Leave transparent** mode and then enter the transparent mode again.



Note The software must be in transparent mode for the following steps.

1. Connect a hand pump and a 500ml pressure cylinder to the NIBP Luer lock of the monitor.
2. Click the **Cuff Press (a)** button.
3. Click the **Close Valve (b)** button.
4. Using the hand pump, increase the pressure quickly to 300 mmHg.
5. Increase the pressure slowly. Observe the pressure until the overpressure valve opens. The opening of the over pressure valve is indicated by the strong sound of the relieved air with accompanying fast deflation rate.

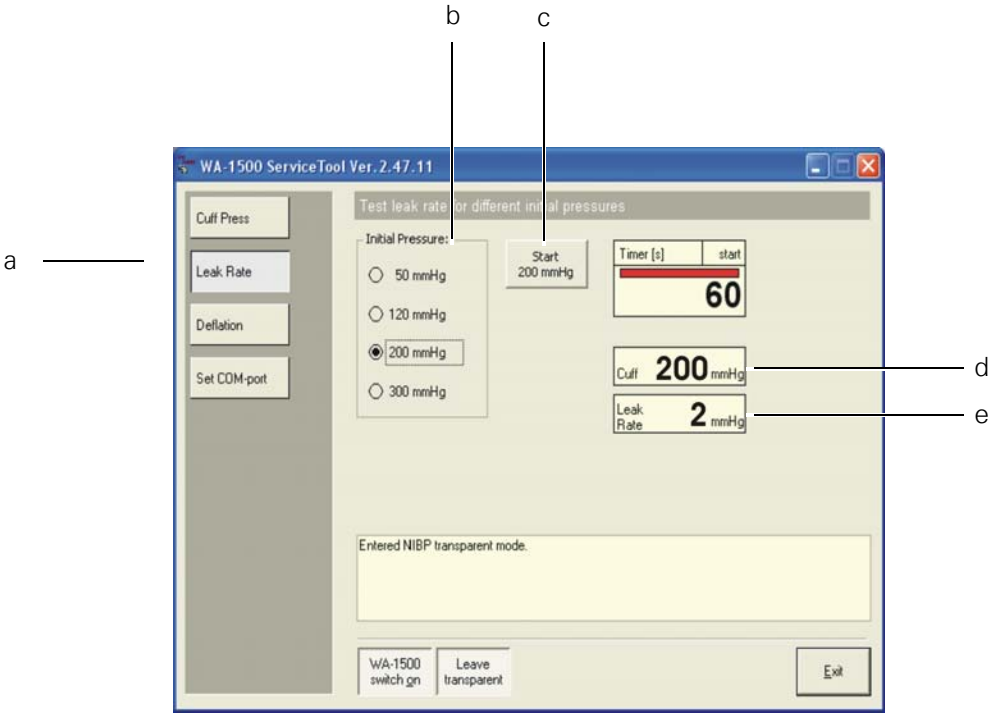
Note If the pressure does not increase with the hand pump after clicking the **Close Valve (b)** button it indicates that the valve may not have closed properly (because the communication from the service tool has not registered). If this happens leave transparent mode, re-enter transparent mode and start the test again.

Test criteria

- At 320 ± 10mmHg the valve opens and the pressure decreases to 0 mmHg.

Measurement accuracy and leak rate

This test is used to measure the leak rate of the NIBP valve. There are different pressures that can be set; this test uses the 200 mmHg pressure setting. The test is automatic and the internal NIBP module pumps until the initial pressure is reached. The state **wait** is shown within the numeric field **Cuff** until the cuff pressure is stable for approximately two seconds. From that point, the counter is started. After 60 seconds the test terminates and the final leak rate is shown in the **Leak Rate** numeric field.



1. Click the **Leak Rate (a)** button**.**
2. Set the **Initial Pressure (b)** to 200mmHg.
3. Click the **Start 200 mmHg (c)** button. When the pressure is reached and is stable for two seconds the timer starts for 60 seconds.
4. Immediately note the displayed pressure **(d)** compared to the pressure displayed on the monitor at the beginning of the test (see note below).

Note The measurements accuracy check for comparison in step 4 must be made immediately at the beginning of the test. This is because the initial cuff pressure **(d)** is not updated after the initial value is displayed and thus does not reflect any system leakage that may occur during the test.

5. Note the **Leak Rate (e)** after 60 seconds.

Test criteria

- At the start of the test, the pressure difference between the monitor value and the reference value does not exceed ± 3 mmHg (see note in step 4).
- The maximum leakage (leak rate) after 60 seconds is 6 mmHg.

Deflation curve test

In this test, the linearity of the NIBP valve's deflation curve is analyzed. The test is performed with deflation rates of 5 and 3 mmHg in both adult and neonate modes. When the test is started, the internal NIBP pump inflates until a pressure of 200 mmHg (150 mmHg for neonate) is reached. The pressure curve is shown in real time with the deflation rate (declining part of the pressure curve).

Note This test simulates a NIBP measurement taken by the monitor. This means that, because the pulse signal is missing, the test is aborted by the NIBP module and an error message displayed - ignore this error message.

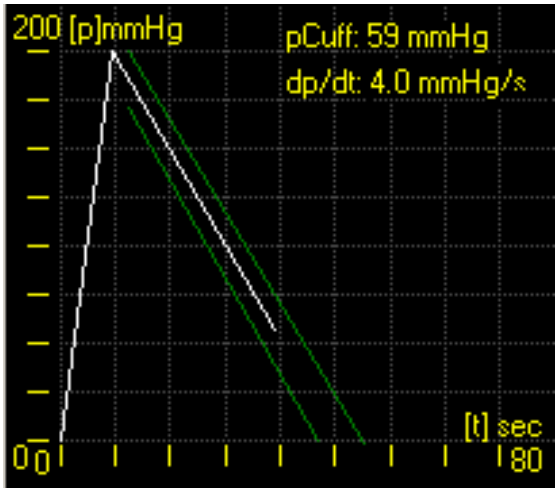
The deflation tests are defined as follows:

- Adult 5 = dp/dt 5 mmHg/s, Pmax 200 mmHg
- Adult 3 = dp/dt 3 mmHg/s, Pmax 200 mmHg
- Neonate 5 = dp/dt 5 mmHg/s, Pmax 150 mmHg
- Neonate 3 = dp/dt 3 mmHg/s, Pmax 150 mmHg

The curve panel shows first the increasing pressure to the Pmax. value and then the declining curve until the test is aborted by the monitor because the pulse is missing. An error message appears.

PCuff: Shows the current pressure in real time during the test.

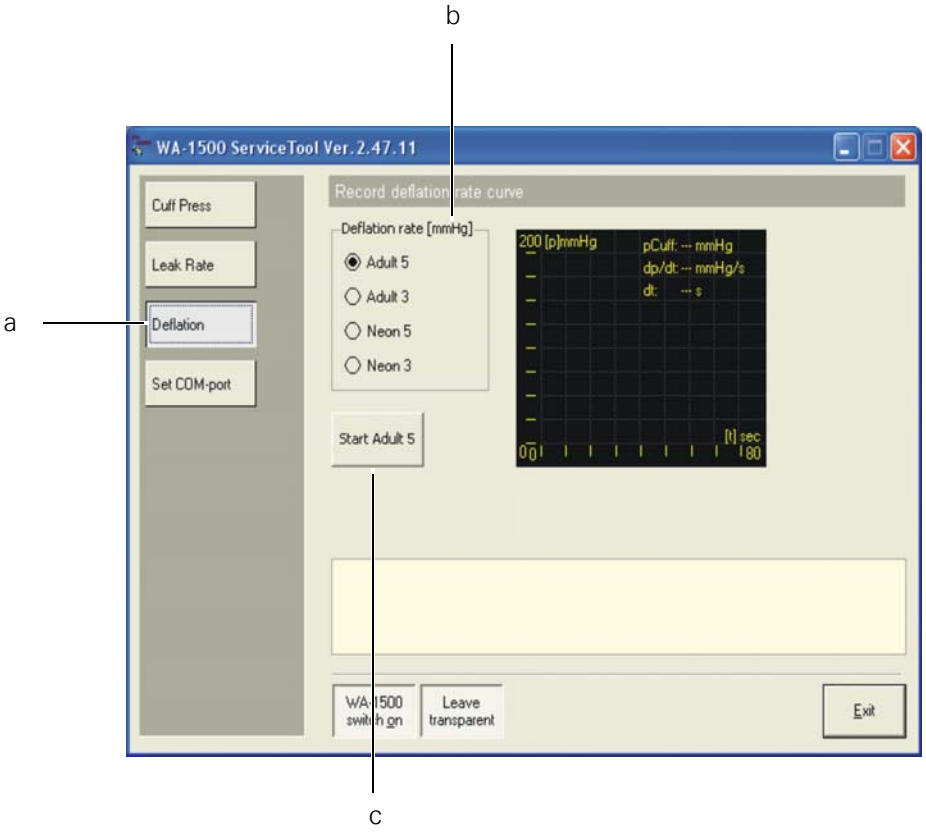
dp/dt: Shows the average deflation rate of the declining part of the curve.



Note The two margin lines define the range in which the declining part of the deflation curve must lie. The margin lines represent a deviation of ± 15 mmHg.

Procedure

1. Click the **Deflation** button **(a).**
2. Set the **Deflation Rate (b)** to **Adult 5**.
3. Click the **Start** button **(c)**.



4. Repeat steps (1), (2) and (3) above for the three remaining deflation rate settings (adult 3, neonate 5 and neonate 3) and record deflation rates in the checklist.

Test criteria

- The displayed dp/dt value does not exceed ± 1 mmHg/s of the value selected in step 2. For example: when Adult 5 is selected, the dp/dt value should be between 4 and 6 mmHg/s
- The curve is linear and does not cross the margin lines.

Troubleshooting

If any test fails, possible reasons are as follows:

- Leak in the system - check all tubes and connectors for leaks.
- NIBP module faulty or NIBP monitoring fault - return the unit to Welch Allyn.

Test completion

On completion of the NIBP tests:

- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).
- Remove the cable from the SVC connector and apply the connector cover (part No. 716275 or 717552) over the SVC connector. (see "Cover replacement" on page 28).
- Power off the monitor and remove the USB drive.

8 ECG, alarm and respiration tests

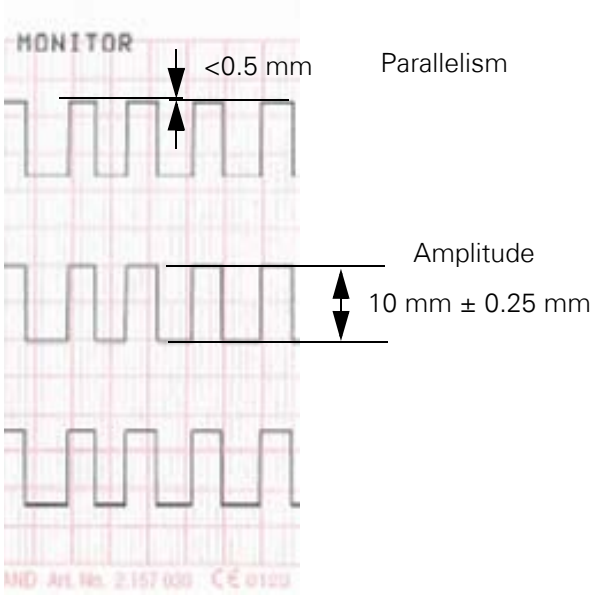
Test equipment

- All test equipment required to carry out these tests and checks are detailed at the beginning of this document (see "Test equipment, tools and software" on page 12).

Amplifier and parallelism check

1. Connect the ECG simulator to the ECG cable for the greatest number of leads configured for the monitor (5 or 12 lead).
2. Set the simulator to give a normal ECG (NSR) with a heart rate of 60.
3. Set the screen display as follows: Waveform settings: (SETUP > Waveform Area)
   - Size for all waves is 1mV/cm
   - Wave 1 = Lead I
   - Wave 2 = Lead II
   - Wave 3 = Lead V
   - Wave 4 = Lead III
   - Sweep speed = 25mm/Sec
4. If a printer is installed, use the following printer waveform settings: (SETUP > Recorder)
   - Wave 1 = ECG 1
   - Wave 2 = ECG 2
   - Wave 3 = ECG 3
5. If a printer is installed, start the manual printout.
6. Go to the HR menu and click the Cal. field five times in quick succession. Each click will generate a square wave cal pulse as seen in the following step.

7. On any of the leads displayed or printed, check the parallelism and amplitude of the calibration pulse.

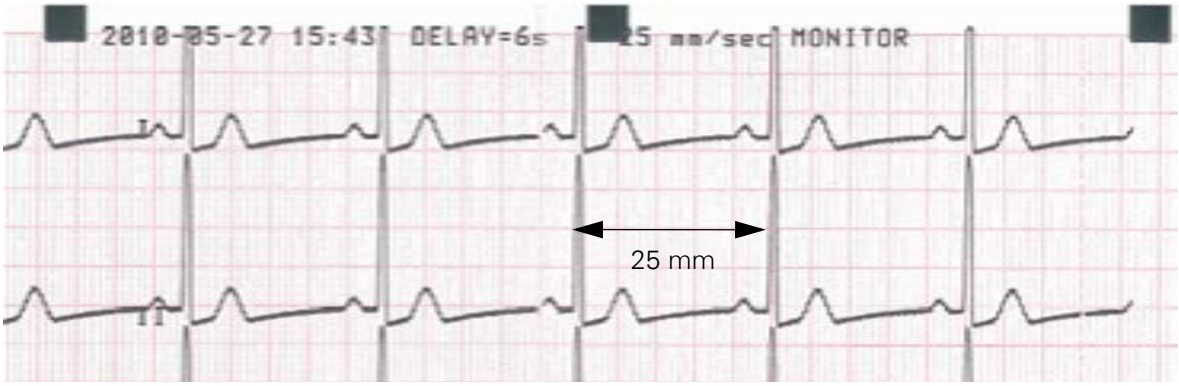


Test criteria

- On any one lead the difference between consecutive pulses (parallelism) is <0.5 mm.
- On any lead and any pulse, the amplitude is 10 mm ± 0.25 mm. Check three pulses; all must be within tolerance.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Sweep speed test

1. Set the simulator to give a normal (NSR) ECG with a heart rate of 60.
2. Set the screen display as follows: Waveform settings: (SETUP > Waveform Area)
   - Size for all waves is 1mV/cm
   - Wave 1 = Lead I
   - Wave 2 = Lead II
   - Wave 3 = Lead V
   - Wave 4 = Lead III
   - Sweep speed = 25mm/Sec
3. If a printer is installed, printer waveform settings: (SETUP > printer)
   - Wave 1 = ECG 1
   - Wave 2 = ECG 2
   - Wave 3 = ECG 3
4. If a printer is installed, start the manual printout.
5. Check the waveform on the screen or printout according to the example below and record value in checklist.



Test Criteria

- With a heart rate of 60 bpm the distance between the beats is 25 mm ± 0.5 mm
- The heart rate displayed on the monitor is 60 bpm ± 2 bpm
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Troubleshooting

If any test fails, check that the notch filter is set correctly - change the notch filter to 50 Hz or 60 Hz according to supply. If problem persists return the unit to Welch Allyn.

Pulse tone test

1. With the trim knob select the HR parameter field and push the trim knob to display the settings.
2. Set the HR/PR Tone Source to ECG and select HR Tone to On.

Test Criteria

- The beep sounds synchronously with the QRS pulse.
- If OK, reset the setting to Off.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Alarm test

Switch off the simulator.

Test Criteria

- After approximately eight seconds the Alarm "ASY" is shown and an audible alarm given.
- After approximately 35 seconds the piezo sounds.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Troubleshooting

If this test fails, please check the alarm settings. If the problem persists take the monitor out of service and return to Welch Allyn.

Respiration

1. Connect ECG/respiration simulator to the ECG cable.
2. Set the simulator as follows:
   - Respiration rate = 15
   - Lead = LL
   - Heart rate = 60
   - Amplitude = low
   - Normal (NSR) ECG waveform

Note The above simulator settings are recommended. If using a different manufacturer's simulator that doesn't have the same settings, select a similar respiration rate.

3. Set the device parameter fields as follows: (SETUP > Parameters):
   - ST Enabled = No
   - etCO_2 Enabled = No
4. Set the screen display as follows: Waveform settings: (SETUP > Waveform Area)
   - Wave 2 = RESP
5. Ensure the respiration is enabled on the monitor (select the RR-ECG numeric field and verify RESP Enabled = Yes.
6. Check the respiration per the test criteria.

Test criteria

- Respiration rate is the same as that set on the simulator ± 1
- Respiration waveform displayed
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Troubleshooting

If this test fails check the simulator settings. If problem persists return the unit to Welch Allyn.

9 SpO_2 tests

Test equipment

- All test equipment required to carry out these tests and checks are detailed at the beginning of this document (see "Test equipment, tools and software" on page 12).

Monitors with Nellcor modules

Saturation and peripheral pulse test

1. Connect the Nellcor SpO_2 simulator to the monitor.

2. Set the screen display to display SpO_2 in waveform settings:
   - SETUP > Waveform Area> Wave 3 = SpO_2
3. On the simulator set the modulation setting to low and the light level to low.

4. Test the following values and record results in the checklist:

Pulse Rate in bpm	SpO_2 in %
60	75
200	75
60	90
200	90

Note If using a different manufacturer's tester, test over a similar range of settings and apply the same criteria.

5. Set the pulse rate to 60 and the SpO_2 to 75%.
6. Change the light level from low (arrow down) to high (arrow up).
7. Check that the pulse rate and SpO_2 reading do not change.
8. Change the modulation level from low (arrow down) to high (arrow up).
9. Check that the pulse rate and SpO_2 reading do not change.

Test criteria

- SpO_2 waveform displayed on the screen
- SpO_2 saturation ± 2 digits
- Peripheral pulse rate ± 3 digits
- Values are still in tolerance when the light level is set to high.
- Values are still in tolerance when the modulation level is set to high.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Pulse tone test

1. Set the pulse rate to 60 and the SpO_2 to 75%.
2. With the trim knob select the SpO_2 parameter field and push the trim knob to display the settings.
3. Set HR/PR Tone Source to SpO_2
4. Set HR/PR Tone to On.

Test Criteria

- The beeper sounds synchronously with the SpO_2 pulse displayed.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Monitors with Masimo modules

Saturation and peripheral pulse test

1. Connect the Masimo SpO_2 tester to the monitor.

2. Set the screen display to display SpO_2 in waveform settings:
   - SETUP > Waveform area> Wave 3 = SpO_2
3. Check that the SpO_2 reading is 81% and the Peripheral pulse rate is 61 bpm.

Note If using a different manufacturer's tester, test over a similar range of settings and apply the same criteria.

Test criteria

- SpO_2 waveform displayed on the screen
- SpO_2 saturation ± 3 digits (for the Masimo tester this is 81% ± 3)
- Peripheral pulse rate ± 1 digit (for the Masimo tester this is 61 bpm ± 1)
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Troubleshooting

If any test fails, return the unit to Welch Allyn.

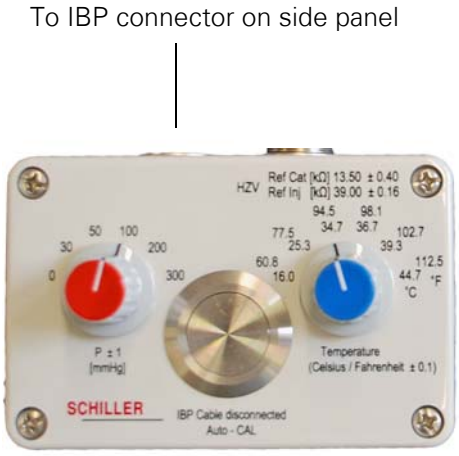
10 IBP, temperature, and cardiac output

Test equipment

- All test equipment required to carry out these tests and checks are detailed at the beginning of this document (see "Test equipment, tools and software" on page 12).

Invasive blood pressure check

1. Connect the test box to IBP1 connector of the monitor.
2. On the IBP / TEMP tester, set the pressure to 0.



3. On the monitor, select the P1 parameter field and push the trim knob to display the settings.
4. Select Zero set and check on the display the P1 value 0/0 (0) is displayed. Repeat if necessary to obtain 0/0 (0).
5. Select each of the pressures on the IBP / TEMP Tester (30, 50, 100, 200, 300 mmHg), and note the pressure displayed on the monitor.
6. Connect the test box to IBP2 and repeat steps 2 to 5.
7. If the monitor is equipped with four IBP connectors, repeat steps 2 to 5 for IBP3 and IBP4.
8. Record the values displayed on the test protocol checklist.

Test criteria

Max. ± 1% or 1mmHg (whichever is greater) between displayed and reference values.

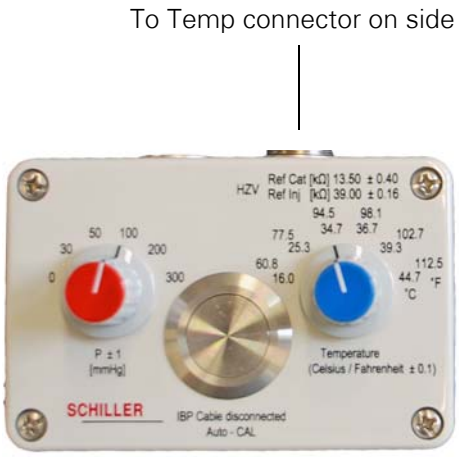
Pressure (mmHg)	Tolerance (mmHg)
0	± 1.0
30	± 1.0
50	± 1.0
100	± 1.0
200	± 2.0

Note If using a different manufacturer's tester, test over a similar range of pressures and apply the same criteria.

If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Temperature check

1. Connect the IBP / TEMP Tester to the temperature input 1 (T1).



2. Set the IBP / TEMP Tester to 16.0° C (60.8° F).
3. Note the displayed values and set values and record in the checklist.
4. Repeat for temperatures 25.3° C (77.5° F), 34.7° C (94.5° F),36.7° C (98.1° F), 39.3° C (102.7° F),44.7° C (112.5° F).
5. Repeat for temperature input 2 (T2) if installed.

Test criteria

Make sure the monitor displays the reference temperatures ± 0.1° (for both °C or °F).

Note If using a different manufacturer's tester, test over a similar range of temperatures and apply the same criteria.

If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

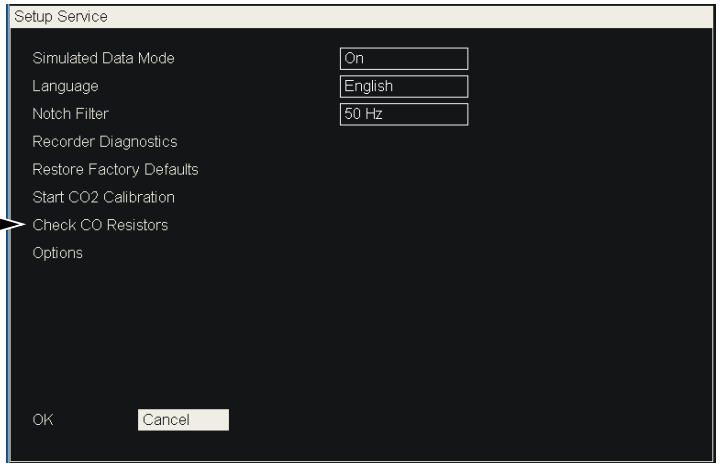
Cardiac output test

Procedure

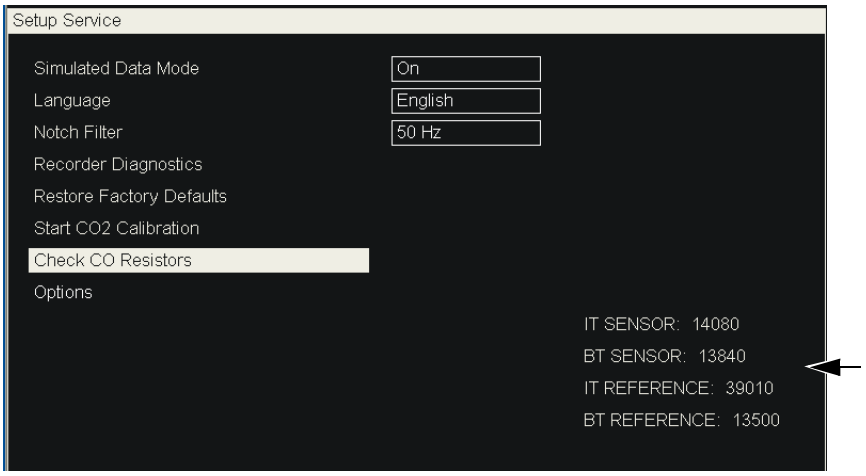
1. Connect the IBP / Temp /CO test box to the CO connector on the side panel.

2. Enter the Service menu:

Setup Menu > Administrator > Service (password 53, 51, 54).



3. Select the **Check CO Resistors** option and check the resistance displayed:



Test criteria

- The IT reference resistance is 39,000 Ω ± 400 Ω
- The BT reference resistance is 13,500 Ω ± 160 Ω
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Note The IT sensor and BT sensor values can be ignored.

Note If using a different manufacturer's tester, test over a similar range of CO and apply the same criteria.

11 $etCO_2$ test and calibration

Test equipment

- All test equipment required to carry out these tests and calibration are detailed at the beginning of this document (see "Test equipment, tools and software" on page 12).

$etCO_2$ test with gas

1. Power monitor and activate $etCO_2$ (Setup > Parameter > $ETCO_2$ enabled).
2. Wait a minimum of 5 minutes before proceeding to allow the CO_2 module to stabilize.
3. Set the $etCO_2$ scale on the monitor to 0 to 80 mmHg.
4. Obtain repair bench ambient pressure in mmHg.
5. Note the **exact** percentage volume of CO_2 stated on the test gas container and use in the following calculation.
6. Calculate the normalized pressure of the 5% or 10% CO_2 test reference gas at current ambient pressure and record in checklist:
   - CO_2 ref. (mmHg) = [CO_2 ref. (%)] × [amb. press. (mmHg)] × 0.0097
   - Example for 5% CO_2 reference mix and ambient pressure of 770 mmHg:
     - CO_2 ref. (mmHg) = 5% × 770 mmHg × 0.0097
     - CO_2 ref. (mmHg) = 37.3 mmHg
7. Connect the test gas sample line to the CO_2 input of the monitor.
8. Simulate breathing by turning the gas on and off every 5 seconds for a minimum of 15 seconds.
9. Verify the $etCO_2$ numeric value meets the following criteria for the chosen gas mix and record result in the checklist.

Test Criteria

- Normalized 5%, CO_2 reference pressure (obtained from the calculated value), ± 2 mmHg.
- Normalized 10% CO_2 reference pressure (obtained from the calculated value), ± 5 mmHg.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Troubleshooting

If any test fails, possible reasons are as follows:

- Warm up time insufficient - allow a minimum warm-up time of five minutes
- Leak in test setup - check hoses and fittings
- Test gas incorrect value - verify CO_2 concentration in the gas bottle
- Return Unit to WA for repair.

CO_2 calibration

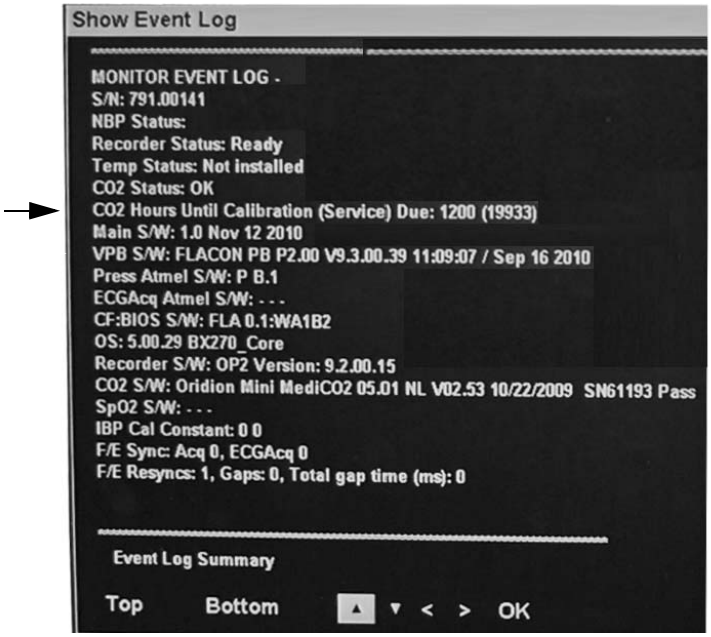
- $etCO_2$ calibration must be performed with a 5% CO_2 concentration gas (see "Test equipment, tools and software" on page 12).

When to calibrate

The module requires its first calibration after 1200 operating hours or one calendar year, whichever comes sooner, and then after each 4000 operating hours or once a year, whichever comes sooner. The pump and the IR source need to be changed after 20,000 operating hours - the unit must be returned to WA.

The message **Calibration due** appears when the hourly limit is reached. It is advisable to calibrate in the one-year maintenance program especially if the monitor is used for intermittent, short term use typical of patient monitors. The number of running hours until calibration is due is in the event log screen in the system menu: Enter the service screen as follows:

1. **Setup > Administrator > System**
2. Enter the Service screen - password **49, 48, 46**
3. Select **Show Event log**



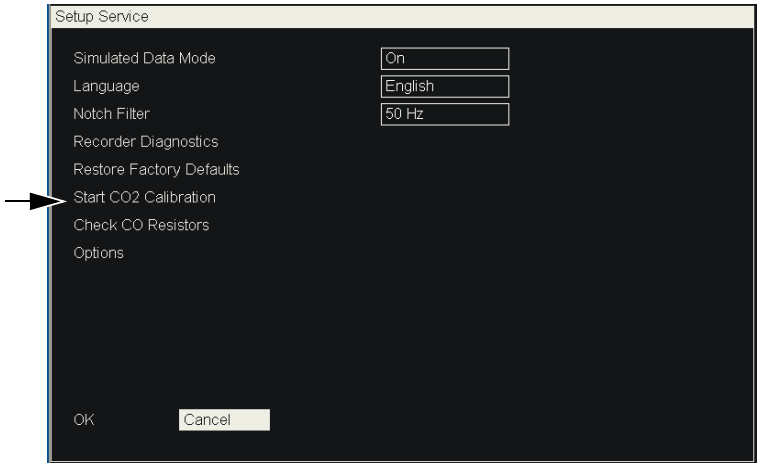
The CO_2 Hours until calibration (service) due gives the number or hours until a calibration is due. When the hours until cal/service due is 0 when a CO2 probe is connected, an alert message is displayed: **CO_2 calibration due** or **CO_2 service due**.

Note The number in parenthesis after the calibration hours is the number of hours until the CO_2 pump and IR source must be replaced. This requires replacement of the CO_2 module - return the unit to WA for replacement.

CO_2 calibration procedure

1. Suspend all alarms in the setup menu.
2. Connect the gas canister (5% CO_2 Calibration Gas canister with an Oridion CO_2 sensor fitting) to the CO_2 sampling input.
3. Enter the Service menu:

   Setup Menu > Administrator > Service (password 53, 51, 54).



4. Turn the gas on and apply the gas to the monitor during the entire calibration process.
5. Select the **Start CO_2 Calibration** option to start the calibration process.
6. During calibration the message **CO_2 calibrating** is displayed in the message area.
7. The process will take approximately 50 seconds to complete.

Calibration successful

When calibration is successful the message **CO_2 calibration ok** is displayed. The timer in the event log screen is reset.

If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

Calibration unsuccessful

If **CO_2 unable to cal** appears during the calibration process check the following:

- Calibration gas - ensure correct gas is used (5% CO_2).
- Ensure that there is sufficient gas in the canister.
- Check all connections for leaks.
- Attempt to calibrate again. If still not possible it indicates other technical problems. Return the unit to WA.

12 Nurse call check

Test equipment

- All test equipment required to carry out these tests are detailed at the beginning of this document (see "Test equipment, tools and software" on page 12).

Procedure

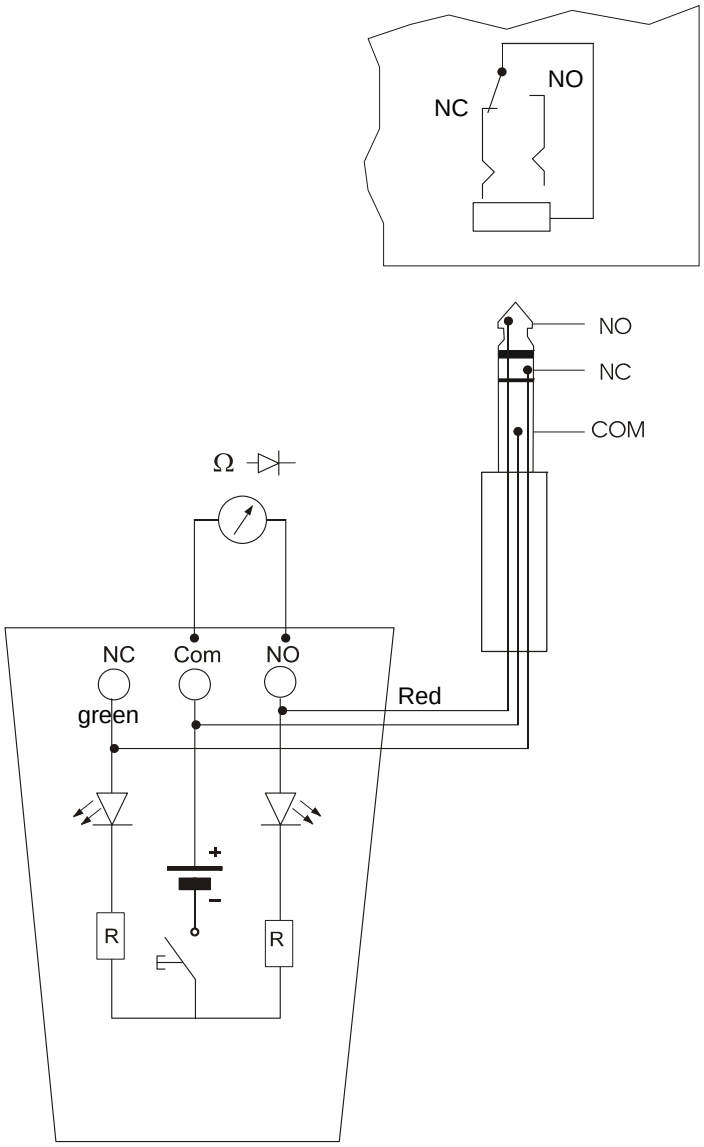
1. Connect the tester to the Nurse call input of the monitor.

2. Generate an alarm.
3. Press and hold the silver button.

Test criteria

- The green lamp is illuminated and changes red when the alarm is generated.
- If this check is part of the annual check procedure, record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

- The output can also be tested with a multi-meter. A short circuit is generated (maximum 2 Ohms) on the nurse call jack when the alarm is active.



13 On completion of the tests

On completion of the tests:

- The test protocol and checklists must be filled in and filed (see next page).
- The calibration / yearly test label must be marked to indicate the month and year when the next test must take place (12 months from test completion), and the label positioned over the left middle casing securing screw indent.

Note The design of the calibration label type is not critical but it must indicate the month and year of the next test.

Record result in the checklist at the back of this book (see "Test protocols and checklists" on page 59).

14 Test protocols and checklists

These checklists can be printed and kept as a record of maintenance and test history. We recommend that these checklists are filled in every time any of the procedures given in this document are performed.

Test protocol

Test Organization:	❑ Check before first use (reference value)			
Name of the tester:	❑ Recurrent test			
Monitor Serial no.:	❑ Test after repair			
Safety measurement according IEC / EN62353		**N/A**	**Pass**	**Fail**
Measurement:	measured value[1]			
Protective ground	..... Ω		❑	❑
Equipment leakage current	..... mA		❑	❑
Patient leakage current	..... mA		❑	❑
Isolation resistance (optional)	..... MΩ	❑	❑	❑
Visual inspection according to checklist			❑	❑
Functional and general checks according to checklist.			❑	❑
Measurement Check according to checklist			❑	❑

Overall comments:

❑ No safety or functional problem detected.

❑ No direct risk, but it is advised that the following are carried out, checked or noted (enter details below).

❑ The monitor must be placed out of service (see remarks below).

Remarks:

Validated by: ..... Sign..... Date

1. Safety measurement limits depend on which measurement is performed; please refer to IEC62353.

Visual checklist

Reference	Pass	Fail	Remarks
Test equipment, tools and software, page 12			
Fuses, page 15			
• Both fuses are rated type M1.6A, E250V			
Safety, patent and information labels, page 16			
• SpO_2 module manufacturer label **(1)** intact and readable.			☐ Nellcor SpO_2 module and label ☐ Masimo SpO_2 module and label
• Manufacturer label with serial number, CE reference and safety label **(2)** intact and readable.			
• Manufacturer type label with monitor type, address, fuse rating, and power requirements **(3)** intact and readable.			
• REF label with patent information **(4)** intact and readable.			
• The calibration / next yearly check label **(5)** placed on the back of the monitor is within date.			
Physical condition of the monitor, page 18			
• No cracks or chips in the casing.			
• Mains, patient and all other cable assemblies are in good condition with no crushing, chafing or cuts, etc.			
• All plugs and sockets are straight and in good condition.			
• No soiling which could hamper the safety of the monitor.			

Functional and general checklist

Reference	Pass	Fail	Remarks
Power indicator and battery check, page 20 • Check that when mains is connected the mains LED is illuminated.			
• Check that the battery symbol displays an indication of the capacity as the battery is depleted.			
• Check that when the battery capacity is close to depletion the following happens: • an audible alarm occurs • the visual alarm indicator flashes blue • the alarm message Battery low appears. • the battery symbol flashes			
• Check that when mains is reconnected, the mains LED is illuminated and the battery symbol disappears.			
• Check that when the mains supply is again removed, the battery symbol is displayed. Check that it indicates a battery capacity of 1/4 full or greater, i.e. not empty.			
• Battery replaced.			☐ NA ☐ Lead-acid battery ☐ Li-Ion battery
Speaker and piezo check, page 22 • Immediate single high pitch piezo beep when the on button is pressed.			
• After a few seconds a series of speaker and piezo beeps is heard and the device is ready.			
Keypad check, page 22 • No excessive mechanical damage or wear.			
• All buttons function correctly.			

Reference	Pass	Fail	Remarks
LCD screen test, page 23			
• No spots or black fields.			
• LCD shade (contrast and brilliance) is even and consistent.			
Printer Checks, page 24			
• Check that the printhead temperature is ambient (+20° C dependent on printer use before the test has been carried out).			NA ☐ No printer installed.
• Check that the parallel lines on the printout are not stepped.			
• Examine the printout for: • fading • alignment • faulty pixels • blackness, regularity and good readability on the complete print width.			

NIBP test checklist

Reference	Value	Pass	Fail	Remarks
NIBP tests, page 26				
Over pressure, page 33				
• At 320 ± 10mmHg the valve opens and the pressure decreases to 0 mmHg.	service tool value: .....mmHg			
Measurement accuracy and leak rate, page 34				
• Accuracy: At the 200 mmHg setting:At the start of the test, the pressure difference between the monitor value and the reference value does not exceed ± 3 mmHg (see note in step 4).	monitor value: ..... mmHg meter value: .....mmHg difference: ..... mmHg			
• Leak rate: At the 200 mmHg setting: The maximum leakage (leak rate) after 60 seconds is 6 mmHg.	displayed leakage value after one minute: .....mmHg			

Reference	Value	Pass	Fail	Remarks
Deflation curve test, page 36				Check in each case that the curve is linear and does not cross the margin lines.
• Adult 5: dp / dt value: 5 mmHg/s (± 1 mmHg/sec).	dp/dt disp value: .....mmHg/s			
• Adult 3: dp / dt value: 3mmHg/s (± 1 mmHg/ sec).	dp/dt disp value: .....mmHg/s			
• Neonate 5: dp / dt value: 5 mmHg/s (± 1 mmHg/sec).	dp/dt disp value: .....mmHg/s			
• Neonate 3: dp / dt value: 3mmHg/s (± 1 mmHg/ sec).	dp/dt disp value: .....mmHg/s			
• The curve is linear and does not cross the margin lines.				
Test completion, page 38				
• SVC connector cover applied over the SVC connector.	**Yes** ☐			
• Power off the monitor and remove the USB drive.	**Yes** ☐			

ECG, alarm and respiration checklist

Reference	Value	Pass	Fail	Remarks
Amplifier and parallelism check, page 39				
• Parallelism check: < 0.5 mm between pulses				
• Height measurement: 10 mm ± 0.25 mm				
Sweep speed test, page 41				
• With a heart rate of 60 bpm the distance between the beats is 25 mm ± 0.5 mm				
• The heart rate displayed on the monitor is 60 bpm ± 2 bpm	meas. .....bpm			
Pulse tone test, page 42				
• The beep sounds synchronously with the QRS pulse.				
Alarm test, page 42				
• After approximately eight seconds the Alarm "ASY" is shown and an audible alarm given.				
• After approximately 35 seconds the piezo sounds.				
Respiration, page 43				
• Respiration rate is the same as that set on the simulator ± 1				
• Respiration waveform displayed				

SpO_2 checklist

Reference	Value	Pass	Fail	Remarks
Monitors with Nellcor modules, page 44	NA ☐ (Masimo module installed)			
• SpO2 waveform displayed on the screen				
• 75%, 60 bpm setting: • SpO2 saturation ± 2 digits • Peripheral pulse rate ± 3 digits.	Sat..... % PR..... bpm			
• 75%, 200 bpm setting: • SpO2 saturation ± 2 digits • Peripheral pulse rate ± 3 digits.	Sat..... % PR..... bpm			
• 90%, 60 bpm setting: • SpO2 saturation ± 2 digits • Peripheral pulse rate ± 3 digits.	Sat..... % PR..... bpm			
• 90%, 200 bpm setting: • SpO2 saturation ± 2 digits • Peripheral pulse rate ± 3 digits.	Sat..... % PR..... bpm			
• Values are still in tolerance when the light level is set to high.				
• Values are still in tolerance when the modulation level is set to high.				

Reference	Value	Pass	Fail	Remarks
Pulse tone test, page 45 • The beeper sounds synchronously with the SpO_2 pulse displayed.				
Monitors with Masimo modules, page 46	NA ☐ (Nellcor module installed)			
• SpO2 waveform displayed on the screen				
• SpO2 saturation ± 3 digits (for the Masimo tester this is 81% + 3)	Sat..... %			
• Peripheral pulse rate ± 1 digit (for the Masimo tester this is 61 bpm + 1)	PR..... bpm			

IBP, temperature and cardiac output checklist

Reference	Value	Pass	Fail	Remarks
Invasive blood pressure check, page 47				
• 0 mmHg setting (± 1 mmHg)	P1.....mmHg P2.....mmHg			
• 30 mmHg setting (± 1 mmHg)	P1.....mmHg P2.....mmHg			
• 50 mmHg setting (± 1 mmHg)	P1.....mmHg P2.....mmHg			
• 100 mmHg setting (± 1 mmHg)	P1.....mmHg P2.....mmHg			
• 200 mmHg setting (± 2 mmHg)	P1.....mmHg P2.....mmHg			
• 0 mmHg setting (± 1 mmHg)	P3.....mmHg P4.....mmHg			

Reference	Value	Pass	Fail	Remarks
Invasive blood pressure check, page 47 (P3 and P4)	NA ☐ P3 and P4 not installed			
• 30 mmHg setting (± 1 mmHg)	P3.....mmHg P4.....mmHg			
• 50 mmHg setting (± 1 mmHg)	P3.....mmHg P4.....mmHg			
• 100 mmHg setting (± 1 mmHg)	P3.....mmHg P4.....mmHg			
• 200 mmHg setting (± 2 mmHg)	P3.....mmHg P4.....mmHg			

Reference	Value	Pass	Fail	Remarks
Temperature check, page 49				
• 16.0° C (60.8° F) setting: ± 0.1° (for both °C and °F)	disp meas. T1 ..... °C or °F			
	disp meas. T2 ..... °C or °F			NA ☐ only T1 installed
• 25.3° C (77.5° F) setting: ± 0.1° (for both °C and °F)	disp meas. T1 ..... °C or °F			
	disp meas. T2 ..... °C or °F			NA ☐ only T1 installed
• 34.7° C (94.5° F) setting: ± 0.1° (for both °C and °F)	disp meas. T1 ..... °C or °F			
	disp meas. T2 ..... °C or °F			NA ☐ only T1 installed
• 36.7° C (98.1° F) setting: ± 0.1° (for both °C and °F)	disp meas. T1 ..... °C or °F			
	disp meas. T2 ..... °C or °F			NA ☐ only T1 installed

Reference	Value	Pass	Fail	Remarks
• 39.3° C (102.7° F), setting: ± 0.1° (for both °C and °F)	disp meas. T1 ..... °C or °F			
	disp meas. T2 ..... °C or °F			NA ☐ only T1 installed
• 44.7° C (112.5° F) setting ± 0.1° (for both °C and °F)	disp meas. T1 ..... °C or °F			
	disp meas. T2 ..... °C or °F			NA ☐ only T1 installed
Cardiac output test, page 50				
• The IT reference resistance is 39,000 Ω + 400 Ω	meas. value ..... Ohms			NA ☐ Cardiac output not installed
• The BT reference resistance is 13,500 Ω + 160 Ω	meas. value ..... Ohms			NA ☐ Cardiac output not installed

CO_2 checklist

Reference	Value	Pass	Fail	Remarks
etCO2 test and calibration, page 52				
• With 5% reference gas concentration: • Normalized 5%, CO_2 reference pressure (obtained from the calculated value), ± 2 mmHg.	**NA** ☐ 10% gas CO_2: .....% calculated value: ..... mmHg measured value: ..... mmHg			
• With 10% reference gas concentration: • Normalized 10% CO_2 reference pressure (obtained from the calculated value), ± 5 mmHg.	**NA** ☐ 5% gas mix CO_2: .....% calculated value: ..... mmHg measured value: ..... mmHg			

Reference	Value	Pass	Fail	Remarks
CO2 calibration, page 54				
• Calibration carried out	NA ☐			Enter date when calibration was carried out: Date. . . . . . Event screen numbers of hours left remaining when calibration performed: Hours . . . . .
• Calibration not carried out	NA ☐			 Date. . . . . . Event screen - numbers of hours left remaining: Hours . . . . .
• Module retuned to Oridion for pump and IR source replacement	NA ☐			Enter date when module was replaced: Date. . . . . . Event screen - numbers of hours left remaining when pump and IR source replaced: Hours . . . . .
• Pump and IR source do not need replacement.	NA ☐			Event screen - numbers of hours left remaining: Hours . . . . .

Nurse call checklist

Reference	Value	Pass	Fail	Remarks
Nurse call check, page 56				
• LED changes red when an alarm is generated	**NA** ☐			
• Short circuit when an alarm is generated. Enter resistance ≤ 2 Ohms:	**NA** ☐ meas. value ..... Ohms			

Test completion checklist

Reference	Value	Pass	Fail	Remarks
On completion of the tests, page 58				
• The calibration / yearly test label marked to indicate when the next yearly test must take place, and the label positioned on the back panel.	**Yes** ☐			Enter month and year set on the label: Month. . . . . . Year . . . . .

15 Changing the Battery

Two types of battery are available for the monitor as follows:

- Lead-acid battery (12V, 2600 mAh),
- Li-Ion battery (10.8V, 7200 mAh)

The lead-acid battery is connected to the monitor with two wires; the Li-Ion battery connect directly with the monitor via a battery connector in the battery recess.

WARNING Before replacing the battery, disconnect the monitor from the mains and remove the mains plug.

Caution Follow the procedures for the prevention of accidents and environmental protection according your facility's guidelines.

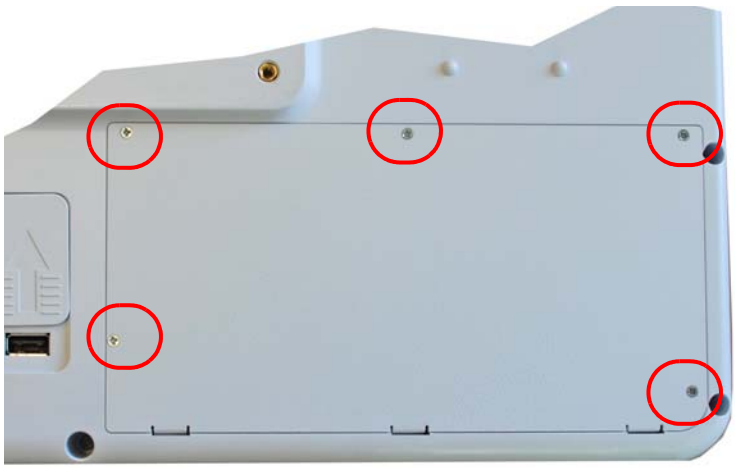
Caution Screw recesses in the casing do not have metal inserts and care must be taken not to overtighten the screws or to cross-thread the screws when replacing. Danger of stripping the thread if a screw is overtightened or cross threaded. Use a torque screwdriver to ensure screws are not overtightened.

Caution Danger of abrasion damage. To prevent scratching, always place the monitor on a soft, non-abrasive cloth when carrying out maintenance procedures.

Tools and accessories

- Phillips torque screw driver, size PH1, **torque setting 0.30 Nm (2.66 in-lb) ± 10%**.
- Battery, Lead acid, WA1500PATM, Part Number 103461
- Battery, Lithium ion, WA1500PATM, Part Number103462

1. Disconnect the monitor from the mains.
2. Unscrew the five phillips screws from the battery cover.



3. Remove the cover. Take the battery out (disconnect the power wires if a lead-acid battery is installed).

Replacing the battery

Li-Ion battery

The Li-Ion battery connects directly to battery contacts in the battery recess.

1. Before replacing the battery, ensure that the two connection wires (for lead acid batteries) are secured to the base of the battery recess with non-conductive tape.

Caution Ensure the contacts of the lead wires cannot short circuit.

2. Insert the battery.

3. Replace the battery cover with the 5 screws: **torque setting 0.30 Nm (2.66 in-lb) ± 10%**.
4. Charge the battery for 6.5 hours.

Lead acid battery

1. Connect the new battery to the power leads (ensure correct polarity) and mount the battery in position. Be careful not to crimp the power leads.

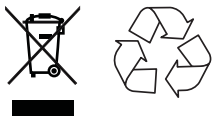
2. Replace the battery cover with the 5 screws: **torque setting 0.30 Nm (2.66 in-lb) ± 10%**.
3. Charge the battery for 3.5 hours.

Battery disposal

WARNING Explosion warning. The battery must not be burned or disposed of in domestic trash.

WARNING Flammability and chemical danger. Do not open the battery.

WARNING Protect the contacts from shorting when disposing of the battery. Apply non-conducting tape to the contacts.



This battery and monitor must be disposed of in a municipally approved collection point or recycling center when no longer used.

If no such collection point or recycling center is available, you can return the monitor and battery to your distributor or the manufacturer for proper disposal.

Refer to www.welchallyn.com/weee for collection points and additional information.