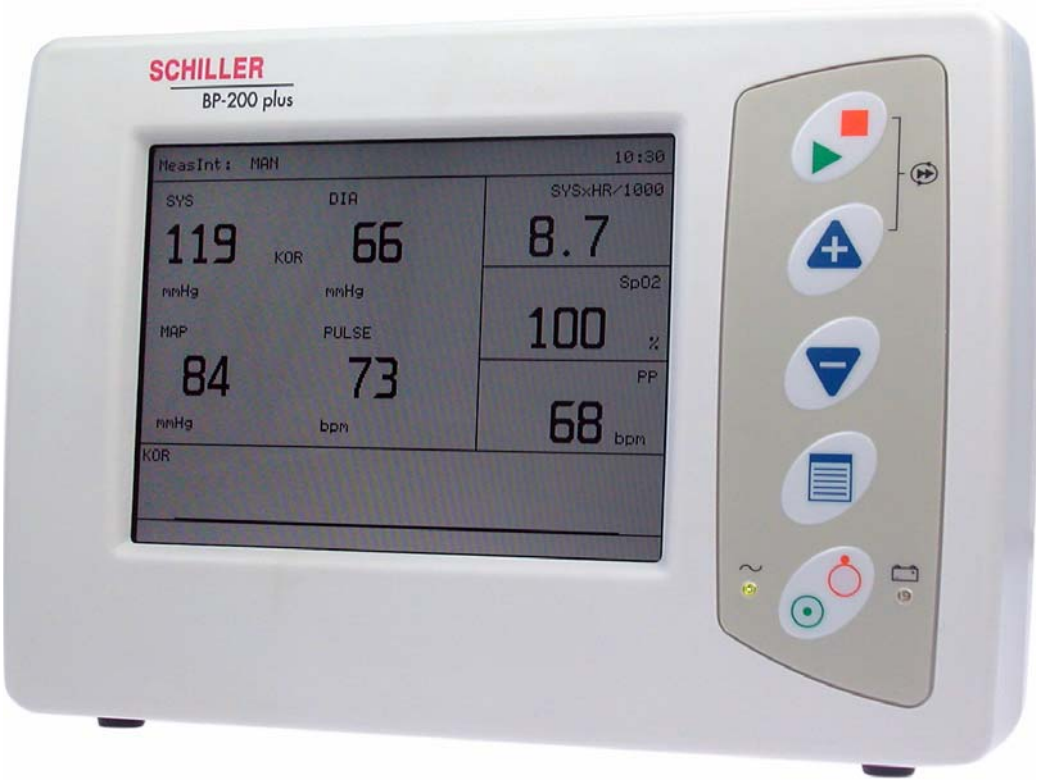
BP-200 plus

Stress Test Blood Pressure Monitor



User Guide

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SCHILLER

The Art of Diagnostics

Sales and Service Information

The SCHILLER sales and service centre network is world-wide. For the address of your local distributor, contact your nearest SCHILLER subsidiary. In case of difficulty a complete list of all distributors and subsidiaries is provided on our internet site:

www.schiller.ch

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1 Safety Notes

1.1 Responsibility of the User

- The BP-200 plus is provided for the exclusive use of qualified physicians or trained personnel under their direct supervision.
- The numerical and graphical results as well as any interpretation suggested by the device must be examined with respect to the patient's overall clinical condition and the quality of the recorded data.
- The responsibilities of the personnel for the operation and maintenance of the device must be specified.
- Ensure that personnel have read and understood these operating instructions. In particular this section safety notes, must be read and understood.
- Damaged or missing components must be replaced immediately.
- The operator is responsible for compliance with all applicable accident prevention regulations and safety regulations.

1.2 Intended Use

- The BP-200 plus is intended to be used as an adjunct to exercise stress testing devices. It is intended to measure and display diastolic and systolic blood pressure, heart rate, percentage of oxygen saturation in arterial blood (SpO2) and pulse rate in adult or adolescent patients during stress tests. The BP-200 plus can be used for patients of both sexes and all races.
- Only operate the device in accordance with the specified technical data.
- Do not use this unit in areas where there is any danger of explosion or in the presence of flammable gases such as anaesthetic agents.
-  The blood pressure part of the unit is BF classified.
-  The ECG and SpO_2 part of the unit is CF classified. It is defibrillation protected only when the SCHILLER original patient cable is used. However, as a safety precaution when possible, remove ECG electrodes before defibrillation.
- This product is not designed for direct cardiac application.
- The BP-200 plus is designed for use with adults and children over 30 kg and should not be used with neonates.

1.3 Organisational Measures

- Before using the unit, ensure that an introduction regarding the unit functions and the safety precautions has been provided by a medical product representative.
- Keep these operating instructions in an accessible place for reference when required. Make sure that they are always complete and legible.
- Observe the operating instructions and maintenance instructions.
- These operating instructions do not override any statutory or local regulations, or procedures for the prevention of accidents and environmental protection.

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1.4 Safety-conscious Operation

- Make sure that the staff have read and understood the operating instructions - particularly this Safety Notes section.
- Immediately report any changes that impair safety (including operating behaviour) to the person responsible.
- To ensure patient safety, the patient, electrodes, or any persons touching the patient, must not come into contact with conducting objects (e.g. RS-232 interface) even if these are earthed.

1.5 Safety Facilities

- Operating the device with defective cables may constitute a danger to life. Therefore:
  - Do not operate the BP-200 plus if the earth connection to the transformer is suspect or the mains lead is damaged or suspected of being damaged.
  - Damaged cable connections and connectors must be replaced immediately.

1.6 Operation with other Devices

- Use only accessories and other parts recommended or supplied by SCHILLER. Use of other than recommended or supplied parts may result in injury, inaccurate information and/or damage to the unit.
- Ancillary equipment connected to the analogue and/or digital interfaces must be certified according to the respective IEC standards (e.g. IEC/EN 60950 for data processing equipment and IEC/EN 60601-1 for medical equipment). Furthermore all configurations shall comply with the valid version of the system standard IEC/EN 60601-1-1. Everybody who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the valid version of the system standard IEC/EN 60601-1-1. If in doubt, consult the technical service department or your local representative.
- When the unit is used with a stress test system, any other equipment used with the patient must use the same common earth.
- Precautions must be observed when using high frequency devices. Use the original SCHILLER patient cables to avoid possible signal interference during data acquisition.
- There is no danger when other electrical stimulation equipment. However, the stimulation units should only be used at a sufficient distance from the electrodes and transducers. If in doubt, the patient should be disconnected from the monitor.
- Portable communication devices, HF radios and devices labelled with the  symbol (non-ionic electromagnetic radiation) can affect the operation of this device (see page 51).

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1.7 Maintenance

- ▲ Before cleaning, switch off the device and disconnect the power supply transformer
- ▲ Do not use high temperature sterilisation processes (such as autoclaving). Do not use E-beam or gamma radiation sterilisation.
- ▲ Do not use solvent or abrasive cleaners on either the unit or cable assemblies.
- ▲ Do not under any circumstances, immerse the unit or cable assemblies in liquid

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1.8 Safety Symbols and Pictograms

1.8.1 Symbols used in this Document

The following overview shows the safety symbols and pictograms used in this manual.

For a direct danger which could lead to severe personal injury or to death.

For a possibly dangerous situation, which could lead to serious bodily injury or to death.

For a possibly dangerous situation which could lead to personal injury. This symbol is also used to indicate possible damage to property.

For general safety notes as listed in this chapter.

Note: For possibly dangerous situations, which could lead to damages to property or system failure.

Important or helpful user information.

Reference to other guidelines.

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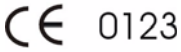
1.8.2 Symbols used on the Device

The unit/component can be recycled.



Notified body of the CE certification (TÜV P.S.).

Attention: Consult accompanying documents.

Type BF equipment, safe for external applications.

CF symbol. The device's signal input is defibrillation-proof. CF symbol. This unit is classified safe for internal and external use. However, It is only defibrillation protected when used with the original SCHILLER patient cable.

Symbol for the recognition of electrical and electronic equipment.

Equipment/components and accessories no longer required must be disposed of in a municipally approved collection point or recycling centre. Alternatively, you can return the equipment to your supplier or SCHILLER AG for disposal. Improper disposal can harm the environment and human health.

No alarm settings or indications are provided for SpO2.

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1.9 Additional terms

1.9.1 Implied Authorisation

Possession or purchase of this device does not convey any express or implied license to use the device with replacement parts which would alone, or in combination with this device, fall within the scope of one or more patents relating to this device.

1.9.2 Terms of Warranty

Your SCHILLER BP-200 plus is warranted against defects in material and manufacture for the duration of one year (as from date of purchase). Excluded from this guarantee is damage caused by an accident or as a result of improper handling. The warranty entitles free replacement of the defective part. Any liability for subsequent damage is excluded. The warranty is void if unauthorised or unqualified persons attempt to make repairs.

In case of a defect, send the apparatus to your dealer or directly to the manufacturer. The manufacturer can only be held responsible for the safety, reliability, and performance of the apparatus if:

- assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorised by him, and
- the BP-200 plus and approved attached equipment is used in accordance with the manufacturer's instructions.

There are no express or implied warranties which extend beyond the warranties hereinabove set forth. SCHILLER makes no warranty of merchantability or fitness for a particular purpose with respect to the product or parts thereof.

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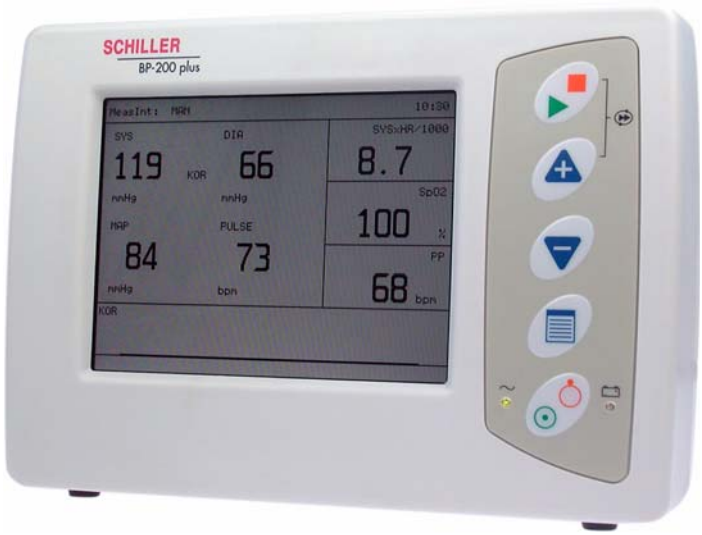
2 Introduction

2.1 Overview



The BP-200 plus is a menu guided non-invasive blood pressure unit designed to measure blood pressure in standalone mode and with a stress test system using an ergometer or a treadmill. The BP-200 plus uses both auscultatory (Riva-Rocci, Korotkoff) and oscillometric methods of measurement and can be used in cardiology, internal medicine, sports medicine, rehabilitation, etc.

Measurements are initiated as follows:

- On demand from the stress system, typically CS-200, AT-10 plus, AT-110, etc. The results are sent to the host system.
- Manually (defined by the user):
  - At set intervals
  - Single measurements
  - Continuous mode that takes BP measurements continuously over a 15 minute period.

When used with a stress test system, the BP-200 plus uses a QRS trigger signal to reduce signal artefacts.

The unit is powered by an external low voltage medical grade dc power supply and also has slots for four optional AA size batteries for backup.

The BP-200 plus is also available with an internal SpO2 and ECG module. This enables the ECG amplifier to generate its own QRS trigger signal, and gives SpO2 measurement with peripheral pulse. SpO2 measurements cannot be uploaded to the host system.

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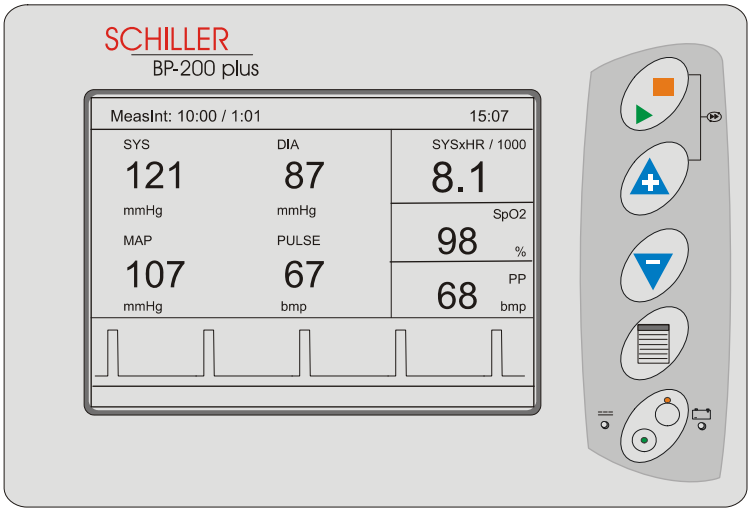
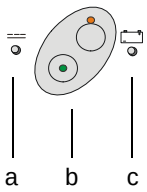
2.2 Operating and Display Elements

2.2.1 BP-200 plus Control Keys and Indicators





On / Off Key

Use this key to switch the unit on or off **(b)**.

Power Indicators

The power LED indicator **(a)** is lit when external power is connected.

The battery LED indicator **(c)** is lit when external power is not connected and the unit is running on back-up battery power. (The battery LED will also flash when new software is being loaded from the mini SD card (see service handbook).

When a stress test is not being run and no keys are pressed for a predetermined time, the unit can be set to switch off automatically. This is defined in system settings (see page 19). When running on backup battery, the switch-off time cannot be changed and is set at **10 minutes**.

Menu / Confirmation Key

This key has two functions:

- ➜ Enters the system settings menu.
- ➜ Confirms a highlighted option when in the settings menus.

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Down Arrow Key

This key has three functions dependent on monitor display:

- ➜ When in a menu, this key selects the next menu option.
- ➜ When in an options sub-menu, this key selects the next setting.
- ➜ When measurements are displayed, this key toggles the waveforms on the display between:
  - – Trigger pulse waveform
  - – oscillometric waveform
  - – Korotkoff waveform

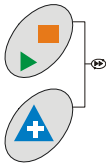
Up Arrow Key

This key has three functions dependent on monitor display:

- ➜ When in a menu, this key selects the previous menu option.
- ➜ When in an options sub-menu, this key selects the previous setting.
- ➜ When measurements are displayed, this key toggles the display between:
  - – trend view
  - – current measurements

Measurement Start / Stop Key

This key manually starts or stops a measurement.



Continuous Short Term Measurement

Press and hold the **+ key** and press the **Measurement key** to take continuous measurements (2 second interval between measurements), over a period of 15 minutes.

The continuous measurement mode can be stopped at any time by pressing the **Menu key,** and confirming.

2.3 Modes of Operation

Mode of Operation	Requirements				Notes
	BP Cuff	Microphone	Ext. ECG Trigger	Int. ECG Trigger	
Connection with a (stress) test host system (Korotkoff)	✓	✓	strongly recommend		This is the standard configuration. Measurement interval normally defined by host system. Measurements are sent to the host system via RS232 interface. Note that oscillometric measurement is not possible when the unit is controlled from a host system - Korotkoff is always used.
Standalone (Korotkoff)	✓	✓		strongly recommend	The internal ECG trigger is only available on units with the ECG / SpO2 option.
Standalone (oscillometric)	✓				For stationary patients only.

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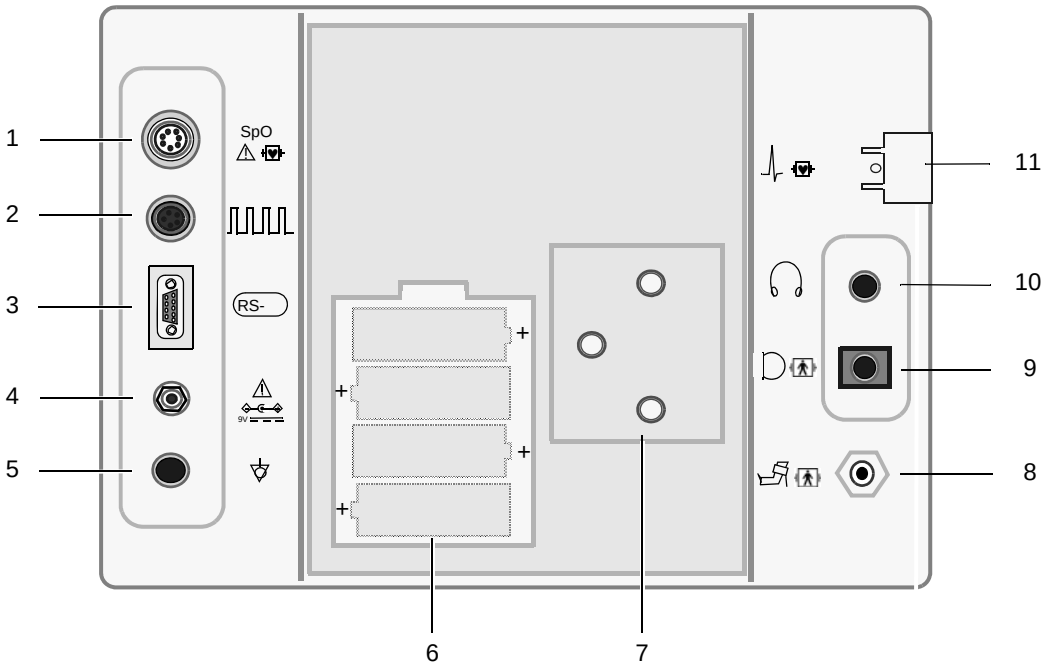
2.4 Back Panel



⚠ CAUTION

▲ All externally connected hardware must be approved by SCHILLER. Connection of any hardware not approved by SCHILLER is at the owner's risk. The unit guarantee may also be invalid. (also see page 8).

Patient Connectors / Sensors

(1) SpO_2 (Option) (see page 40).
(2) ECG trigger (from host system).
(3) RS-232 (for communication with host system).
(4) 9 V dc power input.
(5) Potential equalisation.
(6) Back-up battery compartment (four AA batteries).
(7) Unit Mounting plate.
(8) Air cuff connector.
(9) Microphone cuff connector.
(10) Head phone output (see page 39).
(11) ECG Cable Connector (Option) - not used when connected to a host system.

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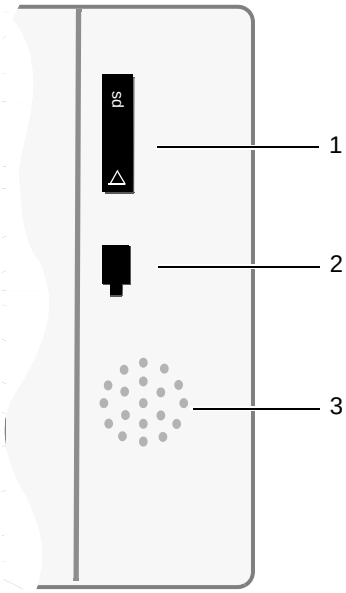
2.5 Side Panel



(1) Mini SD card slot - this is used for program updates and storage of raw data for analysis.

(2) USB connector.

(3) Speaker.

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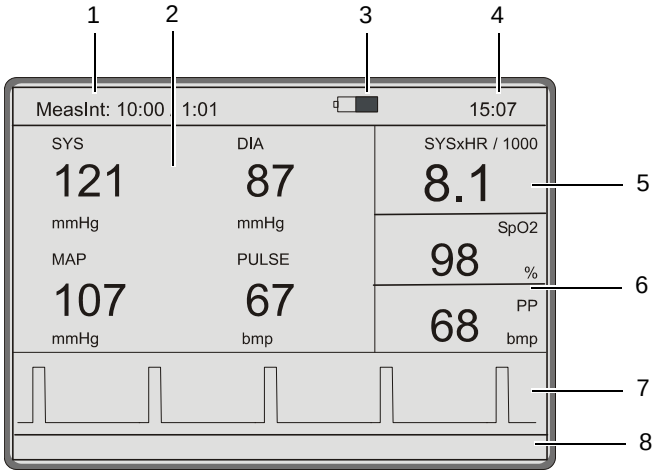
2.6 LCD Screen

The display will vary according to the current task being carried out. There are three display modes:

- ➜ Measurement screen (shown below)
- ➜ Trend screen
- ➜ Menu screen

The following is a example of a typical measurement screen.



(1) Measurement interval and time of the next measurement as follows:

– In **Standalone Mode** - measurement interval and a count-down timer showing the time until the next measurement, e.g. MeasInt. 2:00 / 1:06

– In **Host Mode** - a display to show that the unit is in host mode and a count-up timer indicating the total time elapsed from the start of the test, i.e. from the first measurement taken with the BP-200 plus, e.g. HOST .. 5:07

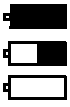
– In **Short term continuous mode** - an indication that continuous measurement mode is active and a count-down timer showing the time that the continuous measurement has been active, e.g. CONT .. 11.17

(2) Measurement or Trend data displaying either:

– The main measurement screen showing the last measurement taken.

– Measurement trend data.

– The two screens are toggled with the **Up** arrow key  .



Full
Half full
Empty

(3) The battery symbol is displayed when running on backup battery power and indicates the capacity status. Maximum capacity displays a solid symbol and an empty battery displays an empty symbol.

(4) System time. The format of the time display can be set to 24 hour or 12 hour display (am/pm displayed). These settings are defined in System setup (see page 19).

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(5) Double product value.

(6) This field changes according to the version:

– For the ECG and SpO2 version this field displays the SpO2 value and peripheral pulse measurement.
– For the standard version a single field is displayed showing the current cuff pressure.

(7) Graphical area to display any of the following:

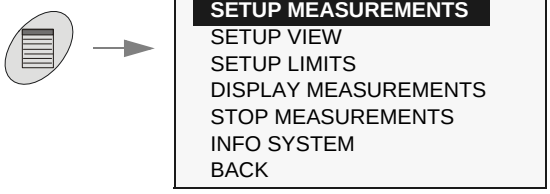
– QRS trigger pulses.
– Oscillometric measurement waveform.
– Korotkoff measurement waveform.
– The three screens are toggled with the **Down** arrow key  .

(8) Message and information area. This can display for example:

– Error messages (see page 48).
– Display information.

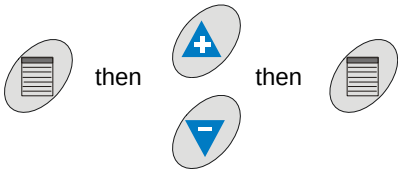
2.7 BP-200 plus Menu Structure

2.7.1 Main Menu



When the **menu key** is pressed, the main menu is displayed.

2.7.2 Menu Navigation



1. Navigate through the menu options with **up / down (+ / -) keys.**
2. Select a menu option with the **menu** key.
3. Select values with the **up / down (+ / -) keys**.
4. Confirm with the **menu key.**

The menu settings are given on the following table:

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2.7.3 BP-200 plus Menu Table

Main Menu	Options	Value/Options/Notes
SETUP SYSTEM	➜ Contrast (monochrome LCDs only)	• 1 (brightest) to 10 (darkest). Note that this menu item is present only when black and white LCDs are installed. When a colour LCD screen is installed, this contrast menu is not required.
	➜ Language	• DEU (German), ENG (English) • Other languages are available on request
	➜ Auto Exit	Defines the time that the unit will automatically switch off if a stress test is not being run and no keys are pressed. Set as follows: • 10 • 15 • 20 • 30 • 45 • 60 • OFF Note that when running on backup battery the unit always switches off after 10 minutes.
	➜ Date Format	• MM/DD/YYYY • DD.MM.YYYY • YYYYMMDD • YYYY-MM-DD • YYYYMMMDD - date given in abbreviated alpha form e.g. 2006SEP25 • DDMMMYYYY - date given in abbreviated alpha form e.g. 25SEP2006
	➜ Date	• Set date (in the form defined above)
	➜ Time Format	• 12 hour e.g. 05:20pm • 24 hour e.g. 17:20
	➜ Time	• Set time (in the form defined above)
SETUP MEASUREMENTS	➜ Host System	• None • Schiller Unit • Other host systems are planned
	➜ Trigger Mode	• None • Internal • External pos - external positive trigger pulse • External neg - external negative trigger pulse • Note that the external trigger options are only selectable when a host system is selected above. • The pos / neg setting must be set to the same polarity as the output defined in the host system.
	➜ Measurement Method – When a host is connected, only the Korotkoff method can be used.	• OSC (oscillometric) - resting patients only. • KOR (Korotkoff) • AUTO - When this option is selected both methods are used to obtain a measurement and the value obtained with the Korotkoff method is used. If however, a value is not obtained with the Korotkoff method, then the oscillometric value is used.

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Main Menu		Options	Value/Options/Notes
SETUP MEASUREMENTS (Continued)	→	Beep Mode	• None - no audible beep • Pulse - audible beep for every pulse detected • Finish - single audible beep at the end of a measurement • Start - single audible beep at the start of a measurement • Both - an audible beep at both the start and the end of a measurement
	→	Measurement Interval – When a host is connected, the measurement interval is controlled by the host system.	• 2 to 20 minutes (in one minute steps) • Manual
	→	Initial Pressure	• 300 to 80 (in 10 mmHg steps) • Auto - pressure determined by previous BP value
	→	Maximum Initial Pressure	• 300 to 100 in 10 mmHg steps
	→	Deflation Speed	• 2 to 9 mmHg/s • Auto - deflation rate set to 3 mmHg per heart beat
SETUP LIMITS (An audible indication is given when a limit is reached)	→	SYS high	• 300 to 50 (in 10 mmHg steps) • Off
	→	SYS Drop	• 100 to 10(in 10 mmHg steps) • Off
	→	DIA high	• 150 to 50 (in 10 mmHg steps) • Off
	→	HR High	• 250 to 50 (in 10 bpm steps) • Off
DISPLAY MEASUREMENTS	→	Display Measurement results	• This options displays the Measurement results when the **End Measurement** option is determined (see below). When this option is selected, the values obtained over the complete measurement program are displayed on the screen in tabular form.
STOP MEASUREMENTS	→	Ends the Measurement Program	• This is primarily used to end a measurement program when in standalone mode but also ends the measurement program when in host mode.
INFO SYSTEM	→	Serial Number	• Serial Number of the unit
	→	HW Index	• Hardware build reference (service personal only)
	→	SW Version	• Installed software reference
	→	MTK date	• The date that the unit is required for calibration
BACK	→	Back to previous option or back to main screen	

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3 Initial Preparation

3.1 Start-up and Initial Preparation

⚠ DANGER

▲ Danger of electrical shock. Do not operate the unit if the transformer earth connection is suspect or if the mains lead is damaged or suspected of being damaged.

3.1.1 Location

- Do not keep or operate the unit in a wet, moist, or dusty environment. Avoid exposure to direct sunlight or heat from other sources.
- Do not allow the unit to come into contact with acidic vapours or liquids.
- The BP-200 plus should not be placed in the vicinity of X-ray or diathermy units, large transformers or electric motors. It must also be positioned at least one metre from the mains supply.

3.1.2 Mounting

An optional mounting kit is available if required. Attach the mounting frame to the back of the unit with the supplied screws and mount the unit as desired.

3.1.3 Connection of Cable Assemblies and Ancillary Equipment

1. Connect the dc power cable from the transformer to the rear of the unit. Plug the mains transform into the mains socket.
2. Connect air hose from the cuff to the air connection on the back panel. Connect the microphone connector.
3. If a backup power supply is required, insert 4 AA batteries (we recommend rechargable batteries because of the greater capacity) in the battery compartment on the back of the unit.

i The BP-200 plus does not have an internal battery charger. It is therefore recommend that the rechargeable batteries are kept in a charger unit until required by the BP-200 plus.

4. If required, insert the head phone plug in the head phone connector.
5. For ECG / SpO2 model options:
   – Connect the SpO2 sensor connector to the back panel.
   – If running a stress test in standalone mode, connect the ECG cable to the side connector

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3.1.4 Potential Equalisation

The potential equalisation stud at the rear of the unit is used to equalise the ground potential of the BP-200 plus to that of all mains powered equipment in the vicinity. It is recommended that the BP-200 plus is connected to the hospital or building common ground at all times. A yellow/green ground cable is supplied as an option (Article number 2.310005).

To avoid possible interference from the ergometer when carrying out an exercise test, it is strongly recommended that both the host system, the BP-200 plus, and the ergometer are connected to the same common ground.

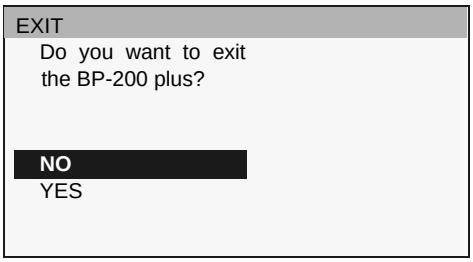
3.1.5 Switching ON and OFF and Power Supply

Switching the Unit ON

➜ Press the **On / Off** key.

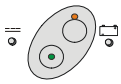
Switching the Unit OFF

➜ Press the **On / Off** key - you are prompted to confirm:



3.1.6 Power Supply and Backup Battery Operation

External 9 V Supply connected (via mains transformer



Backup battery operation

The unit is operated from the mains supply via a 9 V transformer. When mains power (9 V) is connected the mains indicator is lit.

The backup batteries can supply sufficient power for approximately 40-50 measurements dependent on blood pressure. When the mains is not connected and the unit is running on backup power, the battery indicator is lit

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3.2 Connection to a Host System

The following SCHILLER units can be used as the host system:

- CS-200
- AT-10 plus
- AT-104 (without QRS trigger)
- AT-110
- AT-10
- AT-60
- CS-100

3.2.1 Interconnections and Settings

When connecting to a host system the following connections must be made:

- RS-232 cable assembly - for data transfer and BP-200 plus control.
- Trigger cable - for QRS trigger point detection

The specific unit connectors and settings, exercise protocols and measurement intervals are detailed in the relevant user guide for the host system. The cable assemblies required for the host systems are detailed in the accessories section (see page 56).

Following are two typical examples of the connections and settings required to connect and setup the BP-200 plus for host system operation. The two examples are for the CS-200 and for the AT-10 plus. Other host systems will be similar - please consult the relevant user guide.

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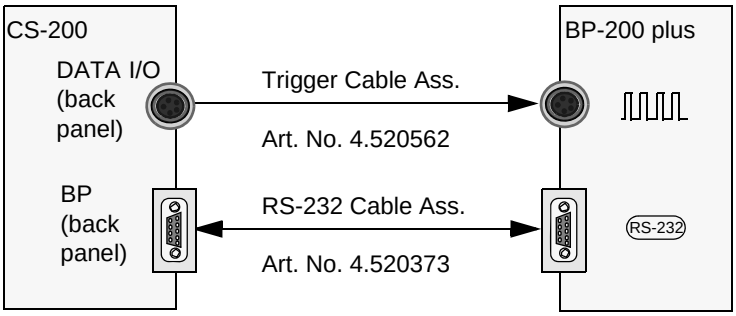
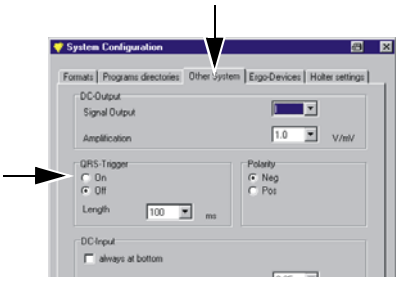
3.2.2 CS-200 Connections



3.2.3 CS-200 Settings



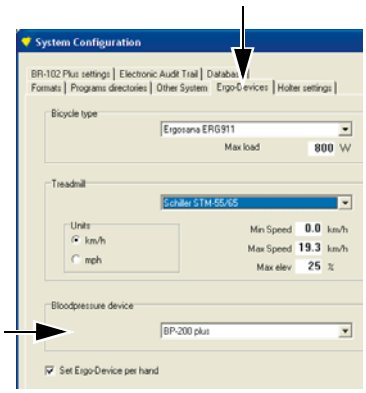
Defining the trigger pulse

In the system configuration menu select:

System > Settings > System Configuration > Other System

The signal is a TTL logic level of 5 V. For use with the BP-200 plus make the following settings:

- QRS trigger: **On**
- Polarity: **Negative or Positive** - set the same polarity in the BP-200 plus settings (see page 20 - Setup Measurement).
- Duration: **50ms**



Defining the BP Unit

In the system configuration menu select:

- **System > Settings > System Configuration > Ergo Devices**
- A number of analogue and digitally controlled blood pressure units are predefined. Select BP-200 plus. If **BP-200 plus** is not shown select BP-200.

The BP measurement intervals is part of the exercise protocol and defined in the host system (see CS-200 user guide).

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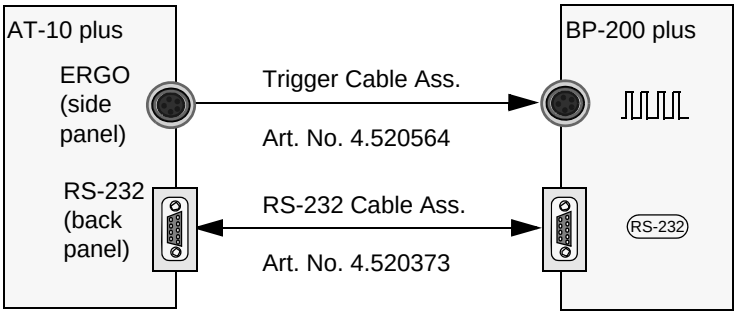
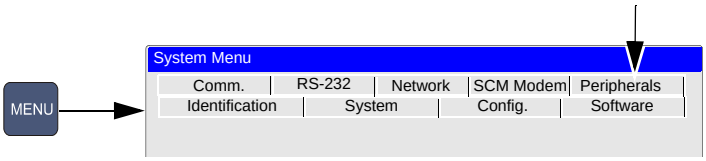
3.2.4 AT-10 plus Connections



3.2.5 AT-10 plus Settings



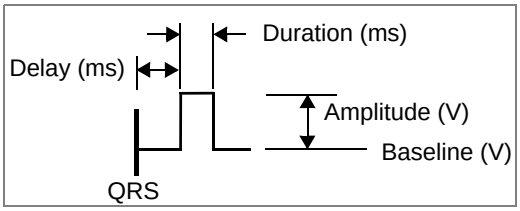
Defining the trigger pulse

In the system menu select:

Menu Key > Peripherals > QRS Trigger

The signal is a TTL logic level of 5 V. For use with the BP-200 plus make the following settings:

- QRS Trigger: **On**
- Amplitude: **+5 V**
- Baseline: **0 V**
- Duration: **50 ms**
- Delay: **10 ms**



Defining the BP Unit

In the settings menu select:

- **Menu Key > Peripherals > Blood Pressure Unit**

A number of options are available (including manual and off). Select BP-200 plus. If **BP-200 plus** is not shown select BP-200.

The BP is taken one minute before the end of every exercise stage defined in the protocol (see the AT-10 plus user guide).

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4 Blood Pressure Measurement

⚠ CAUTION

- To prevent excessive pressure, it is important to choose the correct cuff size.
- To prevent incorrect measurement results, ensure that the tube is not pinched or compressed.
- The unit is safe during defibrillation. However, as a safety precaution, when possible remove the cuff and microphone before defibrillation and remove cable assemblies to the host system.
- Do not touch the unit casing during defibrillation.
- If the unit gets wet accidentally, switch off and dry with a cloth.
- If the unit is accidentally immersed in liquid, remove the external power supply and the batteries (if installed), and return to SCHILLER for checking.
- In case of long-term monitoring or automatic operation, the connected body areas of the patient and the extremity to which the cuff is attached must be checked regularly for signs of ischaemia, purpura, neuropathy.
- Danger of unnoticed necrosis especially in patients with decreased pain sensitivity (due to medication), or with older patients with decreased blood circulation of the extremities. Only carry out long-term measurement with these patients under constant medical supervision.
- The cuff must not be attached to a limb that is already used for interventions such as infusions.
- To ensure correct arterial pressure, apply the cuff on the same level as the right atrium.

A list of BP-200 plus error messages is given in the Maintenance section (see page 48).

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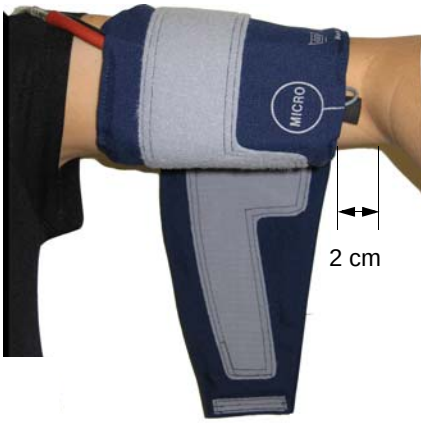
4.1 Applying the Cuff

1. Select the appropriate cuff size according to the patient's upper arm.

Three cuff sizes are available as follows:

To fit arm size Midpoint Arm Circumference (cm)	**Cuff Designation**
18 - 26	S (Small Adult, Child)
25 - 35	M (Adult)
35 - 45	L (Large Adult)
Note: Too small a cuff for the patient may give over measurement. Similarly, too big a cuff may give under measurement.	

Note: Cuffs **S** and **L** are available as optional accessories.



2. Uncover the **left** upper arm of the patient. (The cuff is especially designed to fit the left upper arm).
3. Locate the brachial artery above the elbow bend inside the upper arm.
4. Position the microphone (marked **Micro**) over the brachial artery and secure cuff.
   - Wrap the cuff around the upper arm in such a way that the patient can still bend arm (the bottom edge of the cuff should be 2 cm away from the elbow bend).
   - Tighten the cuff and close it with the fixation wrap. The cuff must be tightened to such an extent that it fits properly on the upper arm and is prevented from moving.
   - To avoid a venous congestion don't tighten the cuff too firmly.
   - The pressure hose and microphone cable must point to the patient's shoulder.
5. Place the pressure hose so that it is loosely positioned behind the patients neck.
6. If not connected, connect the pressure hose and microphone cable (if applicable) to the recorder (see page 16).
7. Ensure that there is enough slack not to strain the hose when the patient moves. Ensure that the patient is comfortable.

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A cuff that is applied to a patient in the recumbent or sitting position is normally located at the same level as the heart. However, if the cuff is located at a level higher than the heart (for instance if the arm of a patient in bed is lifted), this may result in lower-than-actual measurement readings (approx. 7.5 mmHg per 10 cm rise).

The pressure hose /microphone wire assembly can come from the upper (top) part of the cuff, or from the bottom of the hose. The procedure to change to upper or lower shown in the cuff cleaning section (see page 45)

The Oscilliometric version does not contain a microphone however, the cuff is placed in the same manner.

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4.1.1 Fixing the Microphone Directly on the Upper Arm

If the patient‘s pulse is weak the microphone may be removed from the cuff and placed directly on the upper arm to obtain more secure measurements. A shaped adhesive pad is a standard accessory (SCHILLER Art. No. 2.100326) for this purpose. To place the microphone directly on the arm proceed as follows:

1. Carefully pull the microphone out of the cuff - Do not strain (see page 46).
2. Remove the foam rubber microphone insert from the adhesive pad and place the microphone in the pad (metallic (patient) side outwards), and press to secure with the adhesive.
3. Using an alcohol solution (standard surgical strength) thoroughly clean the patient‘s arm around the brachial artery area.
4. Wrap the cuff around the uncovered upper arm in such a way that the brachial artery is freely accessible. The pressure hose and microphone cable face towards the patient's shoulder.
5. Locate the brachial artery, remove the plastic adhesive protector and fix the microphone to the patient by applying gentle pressure so that the adhesive holds the microphone.
6. Shift the cuff towards the elbow so that the patient can still bend his lower arm (the bottom edge of the cuff should be 2 cm away from the elbow bend). Outside the cuff, the microphone cable forms a small loop. Fix with adhesive strips if necessary.
7. Tighten the cuff and close it with the fixation wrap as previously described.

4.1.2 Securing the Cuff with the Fixation Pad

A velcro cuff fixing pad is a standard accessory (SCHILLER Art. No. 2.100325) that‘s available to help secure the cuff from dislodging during long term measurement.

Attach the cuff to the patients upper arm as follows:

1. Using an alcohol solution (standard surgical strength) thoroughly clean the patient‘s upper arm in the area where the pad will be attached.
2. Remove the plastic adhesive protector of the velcro securing pad.
3. Place the pad on the patient‘s upper arm and apply gentle pressure to secure (the exact location will depend on the size of the patients arm and the size of the cuff used).
4. Position the cuff so that the velcro securing flap on the cuff matches with the securing pad on the patient‘s arm, and secure..

The velcro plaster (set of 10, SCHILLER Art. No. 2.100325), and the adhesive plaster for the microphone (set of 10, SCHILLER Art. No. 2.100326), are available from your local agent.

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4.2 Using the BP-200 plus in Standalone Mode

4.2.1 Connecting the ECG Patient Cable

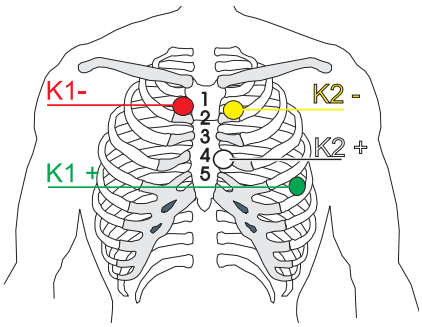
Important
The guidelines for patient electrode placement are provided as an overview only. They are not a substitute for medical expertise.

The colours shown here are according to code 1 (European) requirements.

WARNING

▲ Danger of destroying the device during defibrillation. The device is CF protected only when the original SCHILLER patient cable is used.

The BP-200 plus uses a 4-lead cable for 2-channel recording. The BP-200 plus uses both channels to determine the QRS pulse. The recommend electrode positions to obtain an good trigger are as follows:



- Channel 1 positive (K1+) = green
- Channel 1 negative (K1-) = red
- Channel 2 positive (K2+) = white
- Channel 2 negative (K2-) = yellow

Form a stress loop in every cable and secure them with adhesive strips to relieve the electrodes (strain relief).

A bipolar lead system (one positive and one negative lead) for each channel. Channel 1 approximates to modified lead V5 and channel 2 approximates to modified lead V2.

4.2.2 SpO2 Measurement

If SpO2 measurement is to be taken apply sensor (see page 40).

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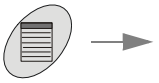
4.2.3 Setup



MAIN MENU
- SETUP SYSTEM
- SETUP MEASUREMENTS — a
- SETUP VIEW
- SETUP LIMITS — b
- DISPLAY MEASUREMENTS
- STOP MEASUREMENTS
- INFO SYSTEM
- BACK

Press the menu key and Select **Setup Measurement (a).**

SETUP MEASUREMENTS
- Host System
- Trigger Mode
- Meas Method
- Beep Mode
- Meas. Interval
- Init. Pressure
- Max. Initial Press.
- Deflation Speed
- BACK

Make the following settings for standalone use:

- **Host System** - **None**
- **Trigger Mode**:
  - if ECG electrodes connected select **Internal**
  - if ECG electrodes not connected select **None**
- **Measurement Interval**:
  - if taking a stress test or wish to program a series of measurements, set the BP recording interval (**2-20 minutes**)
  - if you wish to take individual measurements as required, select **Manual**.
- Define all other settings according to circumstance and preference.

- Select **Setup Limits** (Optional) **(b)** and define limits according to preference.

SETUP LIMITS
- SYS high
- SYS Drop
- Dia high
- HR high
- BACK

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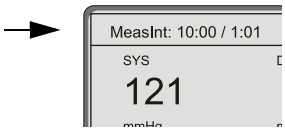
4.2.4 Taking Measurements at predefined intervals

1. Position cuff on the patient (see page 27).
2. If carrying out a stress test position the ECG electrodes (with ECG / SpO2 version only).
3. Define the **Measurement Interval** (see **Setup** above) between 2 and 20 minutes and press the **Measurement key** to start a measurement program at the set interval defined.



The defined measurement interval is shown on the top left information line, and a count-down timer displays the time until the next measurement will be initiated.

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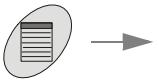
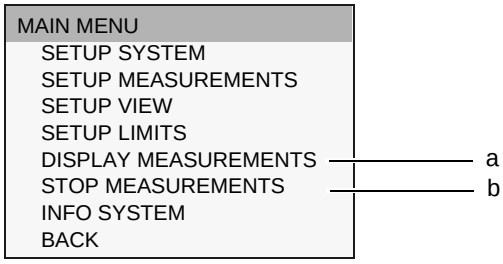
4.2.5 Ending the Measurement Program

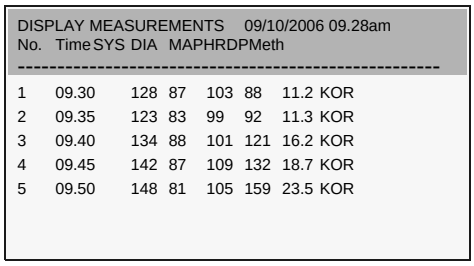




Press the Menu key and select **Stop Measurements (b)** from the main menu

4.2.6 Viewing the Results

Press the Menu key and select **Display Measurement (a)** from the main menu:
All results from the start of the measurement program until test end are displayed in tabular form:



Further Results

When more results are available they can be scrolled with the **down arrow key**.

Viewing the Results in Graphical Form

Press the **up arrow key** to view the results in graphical trend view.

Exiting the Measurement View

Press the **menu key** to exit the results screen.

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4.2.7 Taking an Individual Measurement

In the **Measurement Interval** menu option (in Setup menu - see page 32) define **Manual**. Press the **Measurement key** to take a measurement.

The mode is shown on the top left information line.

4.2.8 Interrupting an Ongoing Measurement

Press the Measurement key to interrupt a measurement.

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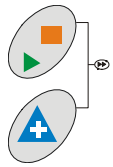
4.2.9 Continuous Short Term Measurement

▲ Repeated short term measurements can affect venous return and cause venous congestion.



Press and hold the **+ key** and press the **Measurement key** to take continuous measurements (2 second interval between measurements), over a period of 15 minutes.

The mode is shown on the top left information line, and a count-down timer shows the time that the continuous mode has left to run.

4.2.10 Ending Continuous Short Measurement

Press the Menu key and confirm that you wish to end the measurement sequence.

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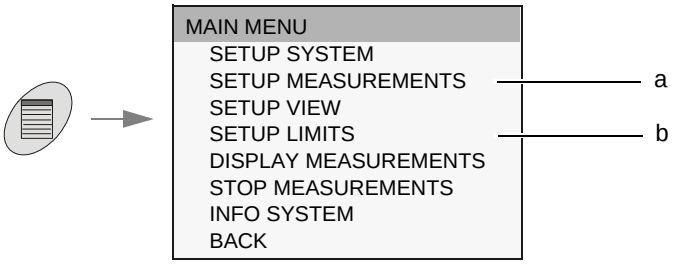
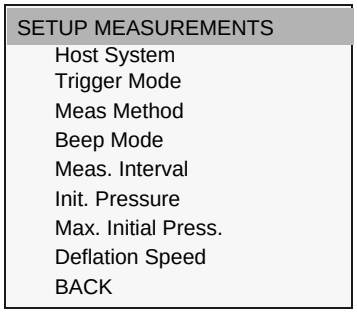
4.3 Using the BP-200 plus with a Host System

4.3.1 Procedure



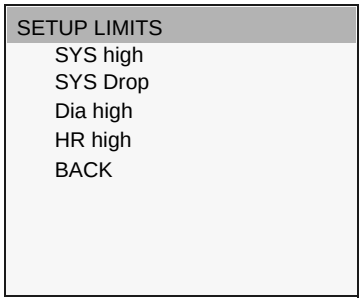
1. Position cuff on the patient (see page 27).
2. If SpO2 measurement is to be taken apply sensor (see page 40).
3. Press the menu key and select **Setup Measurements (a).**



4. Make the following settings:
   – Host System - **SCHILLER System**
   – Trigger Mode:

   Select **External Pos** when a positive trigger pulse is defined in host system

   Select **External Neg** when a negative trigger pulse is defined in host system
   – Measurement Interval - the measurement interval will be defined by the host system and nothing needs to be defined here.
   – Define all other settings according to circumstance and preference.
5. Select **Setup Limits** (Optional) **(b)**and define limits according to preference.



   – An audible indication is given when a limit is reached.
1. The unit is now ready to take measurements on command from the host system. The results are passed back to the host system.

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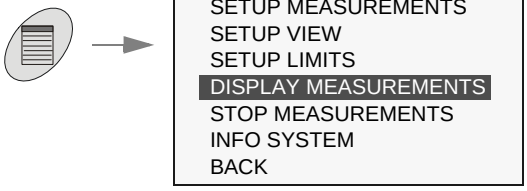
4.3.2 Interrupting an Individual Measurement

Press the Measurement key to interrupt a measurement.

4.3.3 Viewing the Measurements on the BP-200 plus

The measurements will normally be viewed on the host system. The trend results can also be viewed during the recording (see following), or can be viewed on the BP-200 plus as a Measurement result. This is carried in the same way as when the unit is used standalone as follows:

1. Press the Menu key and select **End Measurement** from the main menu.
2. Press the Menu key and select **Display Measurement** from the main menu.



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4.4 During the Recording

4.4.1 Measurement Program Duration

The mode is shown on the top left information line, and a count-up timer shows the time from the first measurement.

4.4.2 Trend View

The trend view can be viewed by pressing the up arrow key (and toggled back to the measurement screen by pressing again)

4.4.3 Waveform

The graphical area below the measurements displays either:

- QRS trigger pulses
- oscillometric waveforms or
- korotkoff waveforms

The display is toggled with the **down arrow** key

4.4.4 Headphones

Headphones give the detected Korotkoff heart beats and enable confirmation of the BP readings and signal quality during a measurement.

4.4.5 Continuous Short Term Measurement

Continuous short term measurements and single measurements can be commenced at any time (see page 36). These measurements are not sent to the host and are viewed on the BP-200 plus only.

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5 SpO2 and Peripheral Pulse

- The pulsoximeter enables the continuous non-invasive monitoring of the functional oxygen saturation of the arterial pulsed haemoglobin and the pulse rate.
- The display shows the continuous progress of the numeric SpO_2 and pulse rate.
- The update period of the measurement readings on the display is 0.2 seconds.
- The peak wavelength and maximum optical power of the light emitted by the pulse oximeter probes can be especially useful to clinicians e.g. performing photodynamic therapy, and are as follows:
  - range of peak wavelengths: 600 nm to 900 nm
  - maximum light power output: <15 mW
- The ear sensor is designed for use with adults and children over 30 kg and should not be used with neonates.

5.1 Safety Notes

⚠WARNING

- ▲ Pulse oximeter probes and probe cable extenders are designed for use with specific monitors. Only use Massimo sensors recommended from SCHILLER for SpO_2 measurement with the BP-200 plus. Other SpO_2 sensors may lead to improper performance or inaccurate results.
- ▲ The information in this manual does not overrule any instructions given in the sensor user guide, which must be consulted for full instructions.
- ▲ Do not use the pulsoximeter during magnetic resonance image scanning. Induced current could potentially cause burns, and the pulsoximetry may affect the accuracy of the measurements.
- ▲ Before using the sensor, carefully read the sensor directions for use.
- ▲ Tissue damage can be caused by incorrect application or use of a sensor. Inspect the sensor site as described in the sensor directions for use to ensure skin integrity and correct positioning and adhesion of the sensor.
- ▲ Do not use damaged patient cables or damaged sensors.
- ▲ Substances causing disturbances: Carboxyhaemoglobin can lead to falsely high measurement readings. The degree of the deviation approximately corresponds to the quantity of carboxyhaemoglobin. Colours or substances containing colours that influence the natural blood pigments can also lead to incorrect measurement readings.
- ▲ Exposure to excessive illumination, such as surgical lamps (especially those with xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps or direct sunlight, can affect the performance of an SpO_2 sensor. To prevent exposure to excessive illumination, ensure that the sensor is correctly applied and that it is covered with an opaque material, if required. If these measures are neglected, excessive illumination can lead to incorrect measurements.
- ▲ Fuctional tests cannot be used to assess the accuracy nor to calibrate a pulse oximeter sensor or a pulse oximeter monitor.
- ▲ Change the sensor's position at least every 4 hours..

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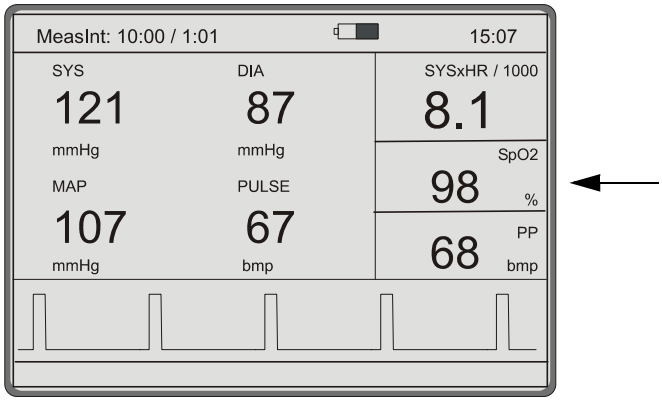
Alarms

- ▲ No Spo2 alarms will be displayed if communication fails between Sensor and Massimo Sp02 module or a general module failure. The values for PP and Spo2 shows in this case two dashes.
- ▲ No alarm settings are provided for SpO2

5.2 Placing the Sensor

The Pulse Oximetry uses an ear clip reusable sensor that is placed on the patient‘s ear lobe.

When using for stress testing form a stress loop in the cable and secure the cable to the patients clothing with the crocodile clip on the cable to provide strain relief.



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6 Maintenance

All maintenance tests and intervals are subject to verification.

6.1 Maintenance Intervals

All software controlled devices have undergone a software risk analysis to minimise any hazards connected to software defects.

Maintenance work not described in this chapter may only be accomplished by a qualified technician authorised by SCHILLER.

The following table indicates the intervals and responsibilities of the maintenance work required.

Interval	Maintenance	Responsible
Every 6 months	• Visual inspection of the unit, cables. tubes and cuff • Keys test (see next page).	➜ User
Every 12 months	• All checks performed at the six month interval. • Functional and safety checks and inspections according to the instructions in the service handbook. • NIBP calibration check. • ECG check. • SpO_2 check.	➜ Service staff authorised by SCHILLER

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6.2 Visual Inspection

Visually inspect the unit, cables, connectors, tubing, cuff and all sensors for the following:

- ➜ Device casing not broken, cracked or damaged in any way.
- ➜ LCD screen not scratched, cracked or damaged in any way.
- ➜ No kinks, abrasion or wear in any tubing or cable assemblies.
- ➜ Pressure bladder, tube connector and velcro connector of the NIBP cuff in good condition.
- ➜ No excessive soiling or damage.
- ➜ All sensor cable sheathing undamaged.
- ➜ All signal input sockets undamaged.
- ➜ Type plate on the rear of the unit readable.
- ➜ Keyboard and designation on the front of the unit readable.

▲ Defective units, damaged cables, connectors, tubes or excessively soiled cuff must be replaced immediately.

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6.3 Key Test

Press all buttons and check that they work properly. Check the beeper works.

6.4 Battery Disposal

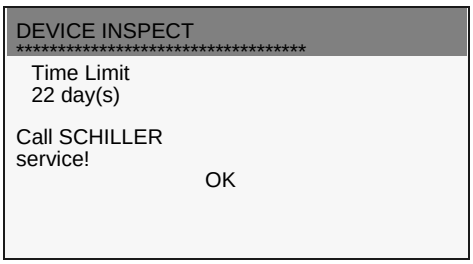
⚠WARNING

- ▲ Danger of explosion. Batteries may not be burned or disposed of domestic refuse.
- ▲ Danger of acid burns. Do not open batteries.

The batteries must be disposed of in municipally approved areas.

6.5 Calibration

The unit must be returned to a SCHILLER approved centre for calibration every year. A reminder message is displayed 30 days before calibration is due; the unit counts down the subsequent days every time the unit is switched on.



The message is displayed for approximately 60 seconds before the main BP-200 plus measurement screen is displayed.

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6.6 Cleaning

⚠ CAUTION

- ▲ Do not, under any circumstances, immerse the recorder into a liquid.
- ▲ Do not use abrasive cleaning material.
- ▲ Reusable sensors must be treated as biologically dangerous material after usage and sterilised according to the manufacturer's instructions.
- ▲ Observe the manufacturer's notes when cleaning the sensors and cables.
- ▲ All cable assemblies, sensors, and the pressure tube must not be exposed to excessive mechanical stress. Whenever disconnecting, hold the plugs and not the cables. Store in such a way as to prevent anyone stumbling over the leads or any damage being caused by the wheels of instrument trolleys, etc.

6.6.1 Cleaning the Device, Cables and Sensors

1. Remove all plugs and sensors.
2. Wipe the equipment, cable and sensors with a dampened cloth and a mild cleaning solution. The manufacturer recommends using 70% alcohol.

6.6.2 Cleaning the Unit

The casing of the BP-200 plus, cable assembly and pressure tube can be cleaned with a soft damp cloth on the surface only. Where necessary a domestic non-caustic cleaner can be used for grease and finger marks.

To disinfect, wipe the cable with a 70% alcohol solution.

6.6.3 Cleaning the Cuff

The cuff must be cleaned when used for a new patient after a long-term measurement.

Before cleaning the cuff, the microphone and inflation bladder must be removed.

- ▲ Do not use bleach to clean the cuff
- ▲ Do not iron

Wash the cuff in one of the following ways:

- at a temperature of 60° C (140° F) with a normal washing powder and let it dry
- dry clean.

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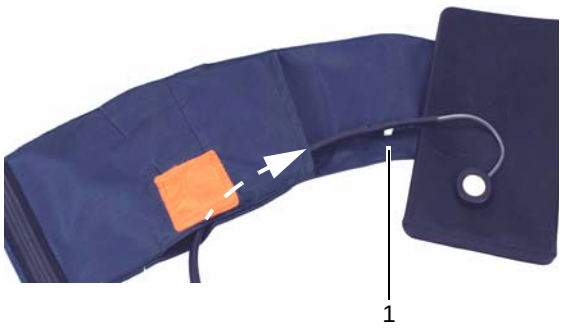
6.6.4 Removing the Microphone and Inflation Bladder



- Slide your hand into the cuff and pull out the inflation bladder.
- Gently remove the microphone by pushing out from the microphone pouch.

▲ Do not pull on the microphone lead or hose as this can cause damage to the connections.

- Disconnect the pressure hose from inflation bladder if required by gently pulling the hose away for the inflation bladder connector (1).

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6.6.5 Re-inserting the Microphone and Inflation Bladder

The hose/microphone assembly between the cuff and the unit can be positioned so that it exits from the top or the bottom of the cuff according to user preference.

Re-insert the microphone and inflation bladder in the reverse order as described previously.

Please note the following:

- The metallic side of the microphone must be facing upwards when inserting in the cuff (the metallic side faces the patient).
- Ensure that the microphone is correctly inserted in the cuff. It must fully reach the bottom of the pouch.

When re-inserting the microphone, make sure that the microphone cable goes over the inflation bladder.

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6.7 BP-200 plus Error Messages

The following is a list of the error message that can appear on the BP-200 plus.

6.7.1 Error Message Table

No.	Message	Cause		Remedy
51	Battery low	• Backup batteries voltage too low to take a measurement.	➜	Replace with fully charged accumulators.
52	Valve/pump	• Valve or pump is defective; air leak.	➜	Check pneumatic system. Check that tube is secured and that the connectors at both ends are securely in place. Check for holes or air leaks in the cuff bladder and pressure hose; contact service department.
120	Signal Disturbed	• Disturbances in measurement signal.	➜	Perform measurement in quiet environment; avoid moving the arm during a measurement.
122	Cuff pressure	• Too much residual air in cuff bladder.	➜	Ensure that cuff is completely decompressed before commencing a measurement.
123	No cuff	• No pressure (<3 mmHg) 10 sec after inflation; leak in the cuff or hose.	➜	Connect cuff; check hose connections.
124	Measur. break	• Measurement stopped manually.		
126	Measurement time	• Measurement time too long; hose, cuff or pump is defective.	➜	Check hose connections. Check hose and bladder for defects. Contact service department.
127	Cuff loose	• Pressure too low (<10 mmHg) 10 sec after inflation.	➜	Check cuff; if necessary tighten it more firmly.
128	Pump time	• Pump-up time too long (50/60 sec, depending on patient type, C/A); hose, cuff or pump is defective.	➜	Check cuff and hose. Replace accumulators; contact technical service.
130	Overpressure	• Device automatically shut off by relief valve.	➜	Maximum pressure reached.
140	Meas. invalid	• Evaluation impossible (KOR).	➜	Check position of microphone; repeat measurement.
150	Meas. invalid	• Evaluation impossible (OSC).	➜	Check cuff; avoid moving the arm.
180	No signal	• Pressure reached 70 mmHg and no Korotkoff signal detected.	➜	Connect microphone. Check position of microphone.
181	Weak signal	• Pressure reached 50 mmHg and no Korotkoff signal detected.	➜	Place microphone over brachial artery; ensure that the microphone is correctly orientated (dark side towards upper arm).
182	Signal disturbed	• Too much interference in Korotkoff signal.	➜	Perform measurement in quiet environment; avoid moving the arm during measurement.
190	No signal	• Pressure reached 50 mmHg and no pulse detected (OSC).	➜	Check cuff.
191	Weak signal	• Less than 8 pulse beats detected (OSC).	➜	Check cuff.
192	Signal disturbed	• More than 200 pulse beats detected (OSC).	➜	Avoid moving the arm during measurement.
198	DIA not detected	• Minimum pressure reached without diastolic value detected (OSC).	➜	Avoid moving the arm during measurement.

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No.	Message	Cause	Remedy
199	SYS not detected	• Minimum pressure reached without systolic value detected (OSC).	➜ Avoid moving the arm during measurement.
200	No pulse	• No pulse detected (OSC).	➜ Repeat measurement; check cuff.
201	Pulse > max.	• Too many pulse beats detected (OSC).	➜ Perform measurement in quiet environment; avoid moving the arm during measurement.
202	Pulse < min.	• Too few pulse beats detected (OSC).	➜ Repeat measurement; check cuff.
210	No pulse	• No pulse detected (KOR).	➜ Connect microphone; Check position of microphone. Ensure that the microphone is correctly orientated (dark side towards upper arm).
211	Pulse > max.	• Too many pulse beats detected (KOR).	➜ Perform measurement in quiet environment; avoid moving the arm during measurement.
212	Pulse < min.	• Too few pulse beats detected (KOR).	➜ Place microphone over brachial artery; ensure that the microphone is correctly orientated (dark side towards upper arm).
238	Min. pressure	• Minimum pressure reached without measurement result.	➜ Repeat measurement.
239	Max. pressure	• Maximum pressure reached without measurement result.	➜ Repeat measurement.
255	Unit error	• Device is defective.	➜ Contact technical service.

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6.8 Trouble Shooting

Trouble shooting procedures are subject to verification.

Error	Cause	Remedy
NIBP	• No cuff connected or not correctly fitted.	➜ Check the cuff position.
	• Incorrect Cuff size	➜ Change cuff.
	• Inaccurate Measurement	➜ Check cuff position.
		➜ Check microphone position.
		➜ Check microphone cable.
	• Unit always takes two measurements	➜ Check for leaks in system.
		➜ Check initial pressure.
		➜ Check maximum initial pressure.
	• Pump is not running	➜ Pump is mechanically blocked, electrical failure.
	• Pressure not reached	➜ Leak in system - check all hoses and connections.
		➜ Check NIBP settings.
		➜ Check cuff and connection.
SpO_2 Low perfusion or other problems	• Bad sensor positioning	➜ Check the sensor and reapply.
		➜ Check the contact between the sensor and the patient.
	• SpO_2 sensor failed or disconnected	➜ No sensor connected
		➜ Damaged sensor connected.
		➜ Interferences detected.
		➜ Sensor not attached to patient.
		➜ Too much ambient light for reliable measurement.
		➜ Unknown sensor connected.
		➜ Hardware (board) failure.
		➜ Replace the sensor.
ECG	• ECG cable disconnected	➜ Connect the ECG cable.
	• Electrode lose/defective	➜ Check and reapply/replace electrodes.
	• Incorrect settings	➜ Check ECG settings.

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6.8.1 Electromagnetic Radiation

non-ionic electromagnetic radiation

The device is designed for operation in an electromagnetic environment according to IEC/EN 60601-1-2, tables 201, 202 and 204. If any interference should occur, especially with devices labelled with the symbol **non-ionic electro magnetic radiation**, check the recommended minimal distance according to IEC/EN 60101-1-2, table 206. The distances are shown in the following table. More information is given in the service manual.

Recommended safety distances between portable and mobile HF telecommunication devices and the BP-200 plus

The BP-200 plus is designed for operation in an electromagnetic environment with controlled HF disturbance. The user can help avoid electromagnetic disturbances by keeping the minimum distance between portable and mobile HF telecommunication devices (senders) and the device, depending on the output performance of the communication device as indicated below.

HF source	Sender Frequency [MHz]	Power Output [W]	Distance [m]
Cellular Mobile Phone CT1+, CT2,CT3	885-887	0.010	0.23
Cordless DECT telephone, WLAN, UMTS handy	1880-2500	0.25	1.17
Mobile Telephone, Handy USA	850/1900	0.6	1.8
Mobile Telephone, Handy - GSM900, - GSM850, NMT900, DCS 1800	 900 850,900,1800	 2 1	 3.3 2.3
Walkie-talkie (rescue services, police, fire brigade, maintenance services)	81-470	5	2.6
Mobile radio system (rescue services, police, fire brigade))	81-470	100	11.7

The distance is calculated according to the following formulae:

Frequency Band 0.15 - 80 MHz

$$d = \frac{3.5}{3V} \times \sqrt{P}$$

Frequency Band 80 - 800 MHz

$$d = \frac{3.5}{3V/m} \times \sqrt{P}$$

Frequency Band 800 MHz - 2.5 GHz

$$d = \frac{7}{3V/m} \times \sqrt{P}$$

d = recommended minimum distance in metres

P = transmission power in Watts

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7 Definitions

7.1 Mean Arterial Pressure

For **oscillometric** measurements, the MAP measurement given is the value measured by the unit. For **Auscultatory** measurements, the MAP is calculated as follows:

$$MAP = DIA + {}^{1}/_{3}(SYS - DIA)$$

7.2 Double Product

The double product is an indirect index of cardiac oxygen consumption and is calculated as follows:

$$\text{Double Product} \quad \frac{\text{SYS Pressure x Heart Rate}}{1000}$$

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8 Technical Data

8.1 BP-200 plus

Manufacturer	SCHILLER AG
Device Name	BP-200 plus
Option	Integrated SpO2 module and ECG amplifier (to generate the QRS trigger signal for reduced artefacts during stress testing)
Dimensions	222 x 155 x 96 mm (l x w x h)
Weight	1080 grams (including SpO2 module and ECG Amplifier, excluding backup batteries)
LCD	Backlit graphical full colour LCD with multi-language menu
Power supply	
Main	External 9 Vdc, 1.7A(max), via hospital standard transformer
Backup Supply	Four Type AA batteries (optional)
	The unit is suitable for use in networks according to CISPR 11, Group 1, Class B
Memory	200 Measurements
Interfaces	
RS-232	Data transfer to / from host system
Trigger Input	ECG trigger form host system (positive or negative)
USB	USB interface
Mini SD card slot	For SW update and additional storage of raw data
Head phone Socket	For verification of recording sound
Measurements	
Methods of measurement	
Primary	Auscultatoric (Korotkoff/Riva-Rocci) with or without QRS trigger for stress testing
Secondary	oscillometric with smooth linear deflation for resting measurements
Measuring range	
Systolic	50 ...270 mmHg (± 3mmHg)
Diastolic	20 ...150 mmHg (± 3mmHg)
Heart rate	40 ...250 bpm (40 ...100 bpm ≤ ± 2%)
	(100 ...200 bpm ≤ ± 4%)
	(200 ...250 bpm ≤ ± 5%)
Deflation rate	2 ...9 mmHg/s, automatic
Measurement Intervals	On demand from host. Manual measurement interruption
Host system	Manual, or automatic (2 ...20 minute intervals)
Standalone	
QRS Trigger	Primary from external ECG source (host system)
	Secondary from optional BP-200 plus 4 lead patient cable

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Standards	
EN 1060-1, 1995	Non-invasive sphygmomanometers - Part 1 General requirement
EN 1060-3, 1997	Non-invasive sphygmomanometers - Part 3 Supplementary requirements for electromechanical blood pressure measuring systems
EN 1060-4, 2004	Non-invasive sphygmomanometers. Part 4 Test procedures to determine the overall system accuracy of automated non-invasive sphygmomanometers
IEC 60601-2-30, 1999 / EN 60601-2-30, 2000	Medical electrical equipment - Part 2-30 Particular requirements for the safety, including essential performance, of automatic cycling non-invasive blood pressure monitoring equipment. Manual, electronic or automated sphygmomanometers. Medical electrical equipment - Part 1: General requirements for safety
AAMI/ANSI SP10, 2002 EN 60601-1	Medical Electrical Equipment—Part 1: General Requirements for Safety, Amendment No. 2. Collateral Standard: Electromagnetic Compatibility Requirements and Tests
EN 60601-1-2	
Protection Class	1 according to IEC/EN60601-1 (internal power supply)
Applied Part	BF / CF according to IEC / EN 60601-1
Conformity/classification	CE0123/IIa according Directive 93/42/EEC (medical devices)
Environmental conditions	
Operating temperature	10 ... 40 °C
Storage temperature	-10 ... 50 °C
Relative humidity	25 ... 95 % (non condensing)
Pressure during operation	700 ... 1060 hPa

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8.2 SpO2 Module and ECG Amplifier Option

8.2.1 SpO_2 - Pulsoximetry

Module	Masimo™
Amplifier	Fully isolated, defibrillation protected >5kV
Sampling Frequency	62.5 Hz
Operation	Normal and high
Accuracy	
SpO_2	• Adults 70 to 100% ± 2 digits
PP	• 30 ... 199/min ± 4 digits
Calibration range	70 ... 100% (calibration is fixed, no calibration required)
Measurement range	
SpO_2	• 1 ... 100%
PP	• 25 ... 240/min
Sensor Temperature	The maximum temperature generated by the sensor at the sensor - tissue interface is < 41^o
PP Calculation	Averaged over 8 beats
Standard	ISO 9919:2005 Medical electrical equipment - Particular requirements for the basic safety and essential performance of pulse oximeter equipment for medical use

8.2.2 ECG Amplifier

ECG amplifier	
Sampling frequency	• 500 Hz
Digital Resolution	• 2.5 µV 12 bit
Protection	• Fully isolated, defibrillation protected >5kV
Dynamic range	• ±5.12 mV AC
Max. electrode potential	• ±300 mV DC
Frequency response	• 0.05 to 150 Hz (-3 dB)
Input impedance	• >10 MOhms
Common mode rejection	• >80 dB
Safety standard	IEC/EN 60601-1, CF classified (with internal power supply) IEC/EN 60601-2-25
EMC	IEC/EN 60601-1-2
Conformity	CE according the directive 93/42/EEC, class IIa

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9 Accessories

⚠WARNING

▲ Always use SCHILLER replacement parts and disposables, or products approved by SCHILLER. Failure to do so may endanger life and invalidate the guarantee.

Your local representative stocks all the disposables and accessories available for the BP-200 plus. A full list of all SCHILLER representatives can be found on the SCHILLER website (www.schiller.ch). In case of difficulty, contact our head office in Switzerland. Our staff will be pleased to help process your order or to provide any details for all SCHILLER products.

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