Ambulatory Blood Pressure Monitors

90207/90217

Operations Manual

070-0137-03 Rev. F

Spacelabs Medical considers itself responsible for the effects on safety, reliability and performance of the equipment only if:

- *assembly operations, re-adjustments, modifications or repairs are carried out by persons authorized by Spacelabs Medical, and*
- *the electrical installation of the relevant room complies with the requirements of the standard in force, and*
- *the equipment is used in accordance with the operations manual.*

Spacelabs Medical will make available, on request, such circuit diagrams, component part lists, descriptions, calibration instructions or other information which will assist appropriately qualified technical personnel to repair those parts of the equipment which are classified by Spacelabs Medical as field repairable.

CORPORATE OFFICES

Spacelabs Medical, Inc.
15220 N.E. 40th Street
P.O. Box 97013
Redmond, WA 98073-9713
U.S.A.

Telephone: 425-882-3700
Fax: 425-885-4877
Telex: 4740085 SPL UI

Spacelabs Medical Products Pty. Ltd.
Macquarie View Estates
Unit 1, 112-118 Talavera Road
North Ryde, N.S.W. 2113
AUSTRALIA

Telephone: 61-2-9878-6644
Fax: 61-2-9878-4820

Spacelabs Medical Products GmbH
Jochen Rindt Straße 25
1230 Vienna
AUSTRIA

Telephone: 43-1-616 52 37
Fax: 43-1-616 52 37-11

Spacelabs Medical B.V.
Airport Boulevard Office Park
Bessenveldstraat 25A
1831 Diegem
BELGIUM

Telephone: 32 2 7164026
Fax: 32 2 7164114

Spacelabs Medical Products, Ltd.
151 Superior Boulevard, Unit 1
Mississauga, Ontario L5T 2L1
CANADA

Telephone: 905-670-5880
Fax: 905-670-5883

Spacelabs Produits Medicaux Ltée
6030 rue Vanden Abeele
St. Laurent, Quebec H4S 1R9
CANADA

Telephone: 514-335-2669
Fax: 514-335-1042

Spacelabs Medical Instruments
(Tianjin) Co. Ltd.
6th Floor, Wang Jing Building
9 Wang Jing Zhong Huan South Road
Chaoyang District, Beijing 100015
CHINA

Telephone: 86-10-6438 1705
Fax: 86-10-6438 1707

Authorized EC Representative:

Spacelabs Medical Sarl
6, Allée des Saules
Europarc
94042 Créteil Cedex
FRANCE

Telephone: 33 (0) 1 45.13.22.44
Fax: 33 (0) 1 45.13.22.00

Spacelabs Medical GmbH
Justus-Liebig-Straße 3
41564 Kaarst
GERMANY

Telephone: 49-(0)2131-92670
Fax: 49-(0)2131-926721

Spacelabs Medical Limited
Suite 901 Tower 1
China Hong Kong City
33 Canton Road, Tsimshatsui
Kowloon
HONG KONG

Telephone: 852-2376-1370
Fax: 852-2376-2502

Spacelabs Medical, Inc.
C/O Impulse Business Club
F-22 South Extension Part 1
New Delhi 110049
INDIA

Telephone: 911 1464 5002
Fax: 911 1464 5007

Spacelabs Medical S.r.l.
Via Montecatini, 13
20144 Milano
ITALY

Telephone: 39-(0)-2/48958203
Fax: 39-(0)-2/48958204

Spacelabs Medical Ltd.
2F-3, No. 161. Sung Te Road
Taipei, Taiwan R.O.C.
TAIWAN

Telephone: 8862-2759-7228
Fax: 8862-2759-9060

Spacelabs Medical B.V.
Ringveste 9 A
3992 DD Houten
THE NETHERLANDS

Telephone: 31-(0)-30-638 5050
Fax: 31-(0)-30-638 5059

Spacelabs Medical Ltd.
Eskdale Road
Winnersh Triangle, Wokingham
Berkshire RG41 5TS
UNITED KINGDOM

Telephone: 44-1189-448411
Fax: 44-1189-448006

CAUTION:

- **US Federal law restricts the devices documented herein to sale by, or on the order of, a physician.**

Contents

Chapter Page

Spacelabs Medical is committed to providing comprehensive customer support beginning with your initial inquiry through purchase, training, and service for the life of your Spacelabs Medical equipment. If you need our help along the way, we offer these guidelines for fast, efficient response.

Acquiring Equipment

Sales Representative 800-522-7025 (U.S.A.) or call your local office	To discuss your monitoring or clinical information needs, to schedule product demonstrations, to order equipment, or to schedule in-service education
Delivery Information 800-251-9910 (U.S.A.) or call your local office	To find out when you can expect delivery of your Spacelabs Medical equipment
Supplies Products 800-223-6467 (U.S.A.) or call your local office	To order compatible supplies and accessories for your equipment

Getting Started

Sales Representative 800-522-7025 (U.S.A.) or call your local office	To arrange in-service education sessions

Answering Other Needs

Clinical Applications 800-522-7025 (U.S.A.) or 425-882-3700 or call your local office	To answer specific questions on arrhythmia products and clinically related issues
First Call™ National Dispatch Center 800-522-7025 (U.S.A.) 800-942-7968 (Canada)	To call for service or to contact your assigned customer service representative
Technical Support - Monitoring/Anesthesia 800-522-7025 (U.S.A.) or 425-882-3700 or call your local office	For technical support of all Ultraview® Care Network™ monitoring products and anesthesia products
Technical Support - Intesys Clinical Information Systems 800-210-0247 (U.S.A.) or 425-882-3700 or call your local office	For technical support of BirthNet®, Caremaster®, Chartmaster®, QuIC, and WinDNA® products
Service Parts Department 800-547-8805 (U.S.A.) or 425-867-2039 or call your local office	For parts ordering and pricing information
Service Training Department 800-251-9910 (U.S.A.) or call your local office	To arrange training of hospital biomedical and anesthesia personnel
Regional Service Manager 800-522-7025 (U.S.A.) 800-942-7968 (Canada) or call your local office	To obtain answers to general questions concerning service issues and service contracts

Contacting Your Local Offices Outside the U.S.

Mississauga, Ontario Canada 905-670-5880	Mönchengladbach Germany 49-2161-8209-0	Kowloon Hong Kong 852-2376-1370	Taipei Taiwan 8862-2759-7228
Créteil France 33 (0)1 45.13.22.44	Vienna Austria 43-1-616 52 37	Milano Italy 39-0-2/48958203	Beijing China 86-10-6438-1705
Wokingham Berkshire, U.K. 44-1189-448411	New Delhi India 911 1464 5002	Diegem Belgium 32 2 7164026	

Operation

Contents

Overview

The Spacelabs Medical Models 90207 and 90217 Ambulatory Blood Pressure (ABP) monitors are small, lightweight battery-powered units designed to take blood pressure and heart rate measurements for 24 or 48 hours, or for longer periods of time.

These measurements are recorded in the monitors and may be transferred to an ABP Analysis System (FT1000A/FT2000A or equivalent), the PC Interface, the Base Station, or a Report Generator for data analysis, report printing, and archiving.

Each monitor and a base station can operate in a direct connect mode (when both units are in the same location) or in a remote connection mode (using modems).

ABP Monitor

The monitors have the following features:

- 4-digit LCD display
- Battery powered
- Serial communications port
- Power ON/OFF switch
- Reading START/STOP button
- Blood pressure cuff

The monitors are carried in pouches that are strapped and/or belted to the side of the patient. Blood pressure and heart rate measurements are taken using a blood pressure cuff attached to the patient's arm. This information is recorded in the monitors and can be transferred over a modem link or by direct connection between the monitors and one of the ABP analysis systems.

The monitors can be programmed to either activate or deactivate the following features:

- Display the cuff pressure at each bleed step
- Display the systole, diastole, and heart rate at the end of each measurement
- Bleed to 40 mmHg rather than stopping at the diastolic value
- Beep before and after each reading

Front Panel

The 90207 and 90217 front panels include the LCD display, cuff hose connector, and a START/STOP switch.

Rear Panel

The rear panels of both monitors contain program input and data output communication ports. On the 90207 the power ON/OFF switch is also located on the rear panel. On the 90217 the ON/OFF switch is located on the top panel.

Replacing the Batteries

"AA" batteries provide the main power source for the monitors. The 90207 uses four batteries, and the 90217 uses three. These batteries should be replaced or recharged before the start of each patient monitoring. Use either alkaline or NiCad batteries.

In the 90207, a lithium battery (P/N 146-0008-XX) is used to back up the monitor memory and should be replaced periodically. The 90217 backup battery should not require replacement.

Main Battery Replacement

- *if the main "AA" batteries must be replaced during patient monitoring, this replacement must be accomplished within one minute to ensure successful resumption of the test (90207 only).*

1. Turn the monitor off, and remove the door over the battery compartment.
2. Replace the AA alkaline or NiCad batteries, being careful to observe polarities.

CAUTION:

- **The monitor will not operate if the alkaline, nickel cadmium, or lithium batteries are incorrectly installed. If the monitor is going to be stored for an extended period of time, remove the batteries to prevent the possibility of leakage or discharge.**
- **Spacelabs Medical is not responsible for product damage incurred as a result of AA battery leakage. In the event your unit has been damaged by a leaking battery, contact the battery manufacturer for any recoverable repair or replacement costs. Spacelabs Medical will assist you in determining those costs**

3. Gently replace the battery cover and secure the latch.
4. Turn the monitor power switch on. Check that the LCD display is on. If there is no display, turn the monitor off and review the problem-solving checklist in *Troubleshooting* in Chapter 3.

Lithium Battery Replacement (90207 only)

The lithium battery is located in the battery compartment under a pry-off cover to the right of the AA batteries.

1. Turn the monitor off, and remove the door over the battery compartment.
2. Remove the pry-off cover, and note the polarity of the battery and socket indicators.
3. Remove the old lithium battery by carefully prying it out (curved forceps are recommended).
4. Install the new lithium battery and replace the pry-off cover. The underside of this cover is divided into two unequal-sized compartments. Install the cover with the smaller compartment oriented over the lithium battery.
5. Gently replace the battery compartment cover and secure the latch.

!

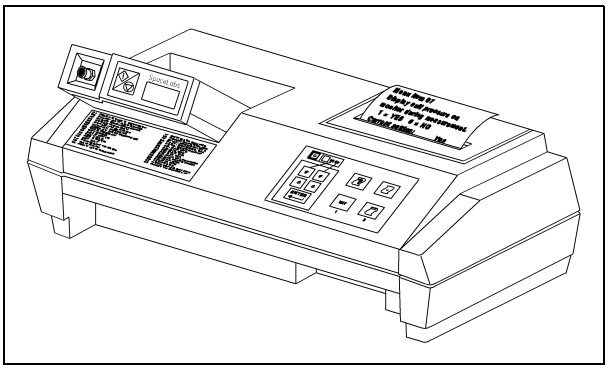
- *Once the lithium battery has been completely discharged, it is considered non-hazardous and can be safely discarded.*

Initializing the Monitor

The ABP monitors must be initialized prior to the start of patient monitoring. Initialization specifies the monitoring period, patient information, time format, measurement interval, monitor tone on/off during selected periods, event code display, and whether or not to display pressure values. To initialize the monitor, connect it to one of the following analysis systems.

Connecting Directly to a Local Report Generator

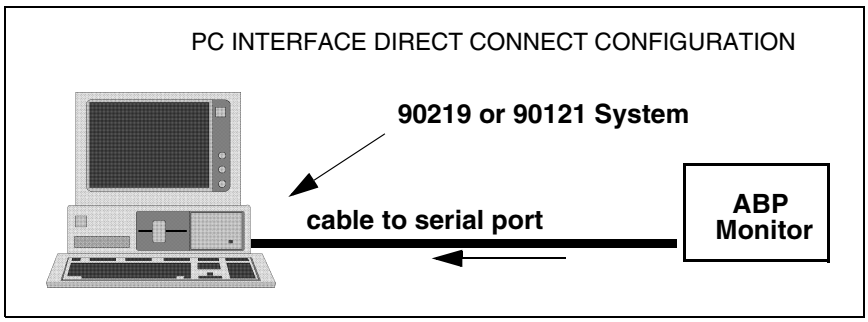
For a direct connection to the 90207 or 90217 monitor, place the monitor into the chute on the Report Generator (Model 90239A or equivalent) as shown below.



Connecting Directly to the PC Interface

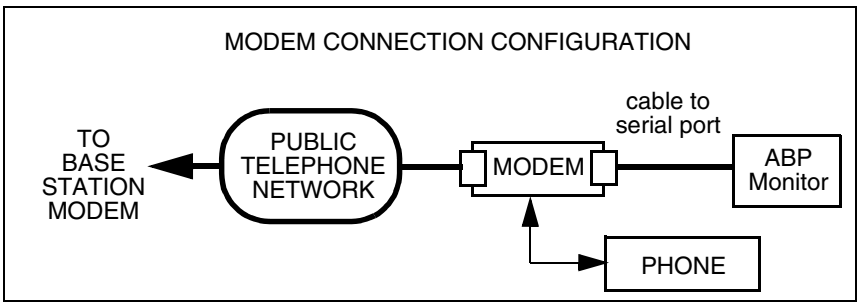
For a direct connection to a PC-compatible computer via a Model 90121, 90219-02, or 90219-03:

Connect the ABP interface cable to the serial port on the 90219 or 90121 system and to the monitor. Refer to the 90121 *ABP Report Management System Operations Manual* for more information on the report management system.



Connecting to the Base Station via Modem

For a modem connection to a remote IBM XT/AT/PS2 (or equivalent) base station, refer to the following figure.



- *The actual initialization procedure is discussed in the 90219 ABP PC Interface/Base Station Operations Manual (P/N 070-0238-XX).*

Modem Speed and Compatibility Issues

The 90207 and 90217 operate Hayes-compatible modems only. You can identify your model type by plugging the communications cable into your 90207/90217 unit and looking at the numbers on the display. The acceptable modem types and maximum speeds of 90207/90217 units are summarized below:

MODEL TYPE	MAX SPEED	MODEMS ACCEPTED	DISPLAY
Older 90207	1200	1200 only	9999
Newer 90207	1200	Any Hayes	1999/9999
Older 90217	up to 9600	up to 9600	2999/9999
Newer 90217	9600	Any Hayes	0999/9999

Connection Procedure

1. If you are using an older 90207 with a 1200 modem, set the switches on the modem as follows:

SWITCH #	SETTING AT MONITOR SITE
1	**down**
2	**up**
3	**down**
4	**down**
5	**down**
6	**up**
7	**up**
8	**down**
9	**up**
10	**up**

2. Connect the serial port cable (P/N 012-0096-00) between the monitor and the modem.

!

- *If call waiting or call forwarding are options on a telephone used to transfer data, ensure that both are deactivated or modem communications may be interrupted. In addition, telephone systems such as CBX or PBX can cause interference with the modem or the modem can cause interference with the switching system.*

To initialize the monitor for remote connection:

1. Contact the base station by telephone (for remote operation only).
2. Ask the base station operator to initialize the monitor. Give the following information to the operator:
   - Patient's name
   - Patient ID number
   - Whether monitor display is to be active or not
   - Time of day (12- or 24-hour format)
   - Whether to display measurement (systolic/diastolic and heart rate)

- Multiple or single cycle times. If using a single cycle for the 24-hour monitoring period, indicate the cycle interval and whether the tone is on or off. For multiple cycle time, specify each cycle interval and whether the tone is on or off for each cycle.
- Any other information the base station operator may request.

3. The base station operator enters the patient information in the computer.
4. Prepare the monitor to receive the patient data from the base station.
   - Turn on the modem.
   - When instructed by the base station operator, turn the ABP monitor on.

   ! • *The modem link must be established within 10 to 20 seconds for the 90207, and 45 seconds for the 90217. If this does not occur, turn the monitor off and then on again to retry.*

5. When the transfer of information is complete, the ABP monitor will beep. Voice communication is restored after the monitor beeps.
   - Turn off the monitor. Disconnect the monitor from the modem.
   - If direct connection between the monitor and the base station is used, turn the monitor off and disconnect it from the ABP data interface unit.

To transfer readings from the monitor to the base station:

1. Contact the base station by telephone (for remote operation only).
2. Ask the base station operator to read the monitor. Give the following information to the operator:
   - Patient's name
   - Patient ID number
   - Any other information the base station operator may request.
3. The base station operator enters the patient information in the computer. (If the monitor is in a remote location, the operator turns the base station modem on.)
4. Prepare the monitor to transfer data to the base station.
   - Turn on the modem
   - When instructed by the base station operator, turn the ABP monitor on (for remote operation only).

   ! • *The modem link must be established within 10 to 15 seconds for the 90207, and 45 seconds for the 90217. If this does not occur, turn the monitor off and return to step 1.*

5. When the transfer of information is complete, the ABP monitor will beep. Voice communication is restored after the monitor beeps.

   Turn off the monitor. Disconnect the monitor from the modem.

Modem Indicator Lights

Modem indicators at the local modem are lit, flashing or unlit depending on the stage of operation. When the monitor is turned on, the RD (Receive Data) and SD (Send Data) lights will flash for several seconds. The OH (On Hook) indicator becomes lit when the monitor starts communicating with the remote modem. When the modems connect, the CD (Carrier Detect) is lit. The SD and RD lights flash as data is being transferred.

After the transmission is complete and the monitor is turned off, the HS, TR and MR indicators will always remain lit at the local modem.Setup Test

- *Verify that cable connections are secure.*

Turn on the ABP monitor. It will display "9999." When the monitor is being read or initialized, the digits will change to indicate that communication is taking place between the monitor and the analysis system. When communication is complete, the digits will stop changing.

Office Check Mode

The monitor automatically enters an office check mode for the first five measurements immediately following initialization. This allows you to verify the performance of the monitor on an individual patient without the need for
re-initialization to reset the display features.

While in the office check mode, the monitor will operate as follows:

- Display the cuff pressure on each bleed step
- Display systole, diastole, and heart rate at the end of the measurement
- Bleed one step below the diastolic value as determined by the monitor

Terminating Office Check Mode

For the 90207 (versions earlier than 2.14), press the START/STOP key twice to cancel each of the remaining readings. The office check mode is terminated when the sum of the canceled and successful measurements equals five.

For the 90217 and 90207 (version 2.14 and later), press the START/STOP key twice to cancel a single blood pressure reading. The office check mode is terminated when a blood pressure reading is cancelled.

Any event that prevents a successful blood pressure measurement (other than a manual cancel) is not counted as one of the five office check mode readings.

Reinstating Office Check Mode

The office check mode can be reinstated in the 90217, and in versions 2.14 and later of the 90207.

To reinstate the office check mode without initialization of the monitor follow the steps below.

1. Turn the power on to the monitor.
2. When the version is displayed on the LCD press and hold the START/STOP key.
3. Release the START/STOP key when EC03 is displayed on the LCD.

An EC13 will be logged to indicate the time at which the office check mode was reinstated. The office check mode will be enabled for five additional successful measurements.

Preparing the Patient and Precautions for Use

- *Blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultation method, within the limits prescribed by the American National Standard, Electronic or automated sphygmomanometers.*

The fifth Korotkoff sound was used to determine overall efficiency.

- *As in manual auscultatory methods, accurate readings might not always be achieved under some conditions. Patient movement, the position of the cuff relative to the level of the heart, extreme heart rates and blood pressures, various arrhythmias, and the subject's physiological condition and other factors can hinder an accurate reading. Vibration, such as that in a moving automobile, is an environmental problem that can affect readings.*

- *When some of the above factors prevent an accurate reading, an event code is provided to indicate the reason for the missed blood pressure reading. When only a single blood pressure parameter (systole, diastole, or mean arterial pressure) is obscured and the other two parameters are measured, the obscured parameter can be replaced with a computed value.*

- *If such a value is computed in the 90217, it appears on the report in angle brackets, e.g. < value >. On the monitor display, dashes are displayed instead of the estimated value. The ratio used in the formula is determined by the previous successful measurements of the pressure, rather than a fixed ratio.*

- *Consult a physician for interpretation of pressure measurements.*

CAUTION:

- **The ABP unit is not for use with defibrillators. Please remove the ABP unit prior to use with a defibrillator.**

- **For patients in shock, indirect methods of measuring pressure (auscultatory, oscillometric, Doppler) may not be reliable due to peripheral vascular changes. In some cases peripheral pulses or Korotkoff sounds may be diminished or disappear in spite of adequate blood pressure. Direct blood pressure measurements (invasive) should be considered in patients with signs of shock or for any patient who becomes unstable for unknown reasons.**

- **The ABP unit might not perform to specifications if stored or used outside the following ranges:**
  Operating: temperature between 0^{o} and 40^{o} C, and relative humidity between 10% and 95%.
  Storage: temperature between -30^{o} and 65^{o} C, and relative humidity between 10% and 95%.

After the monitor has been initialized, prepare the patient for monitoring as follows:

1. Turn on the monitor (wait for the monitor to perform self-tests). When the LCD displays the current time, the monitor is ready for operation.
2. Strap the monitor to the patient on the hip opposite the side on which the cuff is worn. Secure the monitor using the patient's own belt or the ABP pouch strapped over the opposite shoulder. When using the shoulder strap, use the belt supplied with the monitor or the patient's belt to provide additional security.

3. Proper cuff selection and application is essential in ensuring the accuracy of blood pressure measurements. To select the proper cuff, first measure the circumference of the limb at the point where the cuff is to be applied. Match the limb measurement to the range of appropriate circumferences (in centimeters) specified on each cuff (refer to the table below).

CUFF SIZE	LIMB CIRCUMFERENCE
Pediatric	13 to 20 cm
Small Adult	17 to 26 cm
Average Adult	24 to 32 cm
Large Adult	32 to 42 cm
Extra-large Adult	38 to 50 cm

4. Position the cuff so that the center of the inflatable bladder is directly over the brachial artery. The center of the bladder location is marked on the outside of the cuff. Once the proper position is determined, the cuff must be tightened to ensure that it is equally snug at the top and bottom edges and that it is not kinked. This is especially important on larger arms. Insert a finger between the cuff and the limb to ensure it is not too tight. It may be necessary to wrap the cuff with its tail at an angle to achieve uniform tightness. If the cuff is not equally snug at the top and bottom edges, the number of readings available will be limited and the monitor may indicate that the cuff is improperly applied.

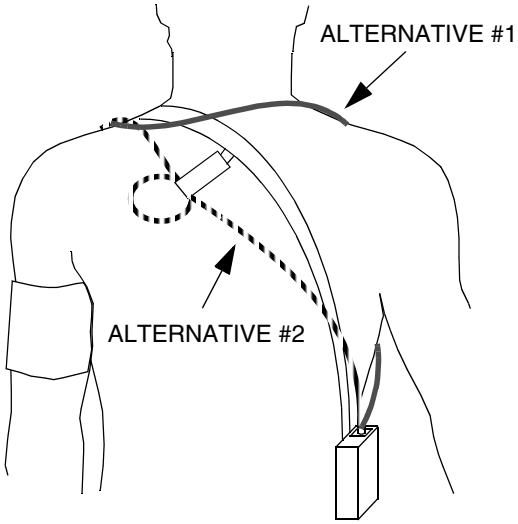
- *Use only Spacelabs Medical cuffs with this monitor. Using other manufacturer's cuffs may result in inaccurate readings even if the manufacturer's recommended size is observed.*
- *If the cuff is too small, pressure readings may be falsely high; a cuff that is too large produces a falsely low reading. The bladder can be positioned in the cuff for either the left or right arm.*

CAUTION:

- **Avoid compression or restriction of pressure in the NIBP patient connector tubes. Check that operation of the equipment does not result in prolonged impairment of circulation.**
- **Do not apply cuff to areas of breached or injured skin.**
- **Cuff hose connections use luer fittings. Be careful not to connect the ABP monitor into an intravenous fluid line when working close to them.**
- **This product contains natural latex rubber components to which some people may be allergic. These components include the bladder and the first four inches of tubing extending from the cuff.**

5. Once cuff is applied, the arm should be relaxed at the patient's side. To avoid reading errors due to hydrostatic pressure differences, the level of the cuff on the arm should be near the level of the heart.

6. Lead the hose up the arm with the cuff and place it across the back of the patient. Drape the hose so it does not cause the patient discomfort and is not pinched shut by too tight a radius. The following figure shows the most common positions for the cuff hose.



7. Connect the hose to the monitor.
8. To verify proper monitor operation, take one or more blood pressure readings. Push the START/STOP key to begin a measurement. Spacelabs Medical recommends taking three readings in the office so that the patient becomes comfortable with operation of the monitor and the measurement process.
9. Show the patient how to enter information in the patient diary. Make sure the patient knows what to do if the cuff becomes very uncomfortable during a measurement, slips out of place, or event codes are displayed on the monitor screen (refer to *Patient Instructions* on page -11). In addition, ensure the patient knows how to care for the monitor.
10. When you are satisfied the monitor is operating properly, the remaining measurements in the check mode can be canceled. Refer to *Office Check Mode* on page -7.

Using Cuff Support

!
- *Keeping the blood pressure cuff in place is very important both for patient comfort and for accuracy of the readings. This becomes particularly challenging when the arm has considerable taper, as is often the case with obese patients.*

1. Once the cuff is successfully applied to the patient, put the large loop of the support around the opposite arm. Adjust the length so the junction of the straps fits well back on the shoulder towards the neck.
2. Fasten the rear short strap to the rear of the arm pit. Be careful to clip to the material only and not to the bladder.
3. Fasten the front strap to the top layer of the cuff material at the location where the hose exits the cuff. Adjust the length of these straps to apply a minor amount of tension to hold the cuff in position.

Correlating with Manual Readings

The monitor bleeds pressure in discrete steps (not continuously) using the oscillometric method of blood pressure determination. If manual pressure readings are taken simultaneously with the monitor readings, interpolation is required to accurately correlate monitor systolic and diastolic pressure values with the manual auscultatory pressures.

- For systole, record the first pressure at which a Korotkoff sound is heard. Actual systolic pressure is somewhere between the pressure when the sound is heard and the previous (higher) pressure where no sound was heard. The interval of uncertainty can be reduced by half by adding one half of the bleed step size (4 mmHg) to the manual systolic pressure.
- For diastole, record the cuff pressure at which the last Korotkoff sound was heard. Actual diastolic pressure is somewhere between that pressure and the next lower pressure. Thus, you must **subtract** one half of the bleed step size (4 mmHg) from the manual diastolic pressure.

Patient Instructions

If the cuff becomes uncomfortable during a reading, make certain the patient knows how to terminate the readings by pressing the STOP key on the front of the monitor.

If the cuff slips out of place, make certain the patient understands correct repositioning of the cuff for successful readings. If the cuff is not properly positioned, event codes may appear on the monitor.

- *The patient should make every effort to keep the monitor dry. However, there is no hazard if the monitor does get wet. If this occurs, turn the monitor off and return it to Spacelabs Medical for service.*

Data Transfer and Reports

After monitoring is complete, connect the monitor to either a PC Direct or Base Station interface to transmit patient data and generate blood pressure reports. Refer to 90121 *ABP Report Management*, 90219-02/03 *ABP PC Interface/Base Station*, or 90239 *ABP Report Generator* Operations Manuals for more details.

- *Any pulse rate obtained from the ABP cuff should be used only as a guideline for the heart rate.*

Cleaning

Visually inspect the monitor, air hose, and pressure cuff for dirt, debris, frayed or worn areas, etc. prior to patient use.

Cleaning the Monitor

Use a soft, damp cloth and mild detergent mixed with water to wipe the exterior of the monitor. Clean the air hose with isopropyl alcohol.

Cleaning the Cuff and Carrying Pouch

Small soiled or stained areas may be cleaned by gentle scrubbing with a sponge or cloth soaked in a mild soap and water solution.

The cuff wrap (with the air bladder removed) and the pouch are machine washable on “delicate” cycle only. Do not wash in large commercial-type washers or with bed linens or gowns.

Ensure that the carrying pouch is dry before re-use.

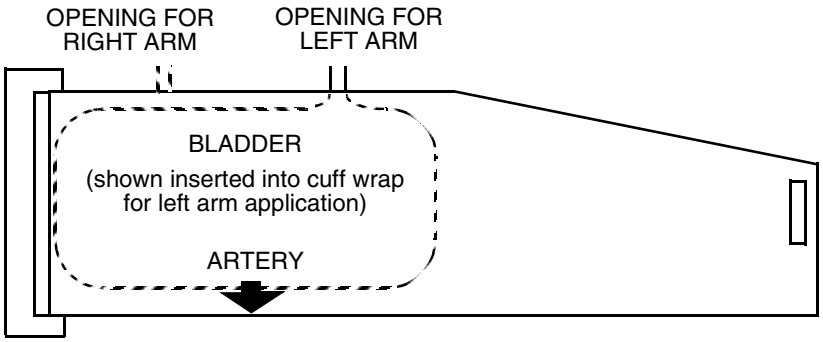
Removing/Installing the Bladder

To remove the bladder, follow the steps listed below.

1. Using fingers only, fold or roll up the bladder inside the cuff. Do not use pencils, pens, or other hard objects as these may damage the bladder.
2. Remove the bladder through the hose exit opening.

Once the bladder has been removed, mate together the hook and loop surfaces of the velcro attachment before washing.

Re-install the bladder into the cuff wrap in reverse order. Make certain that all folds in the bladder have been removed, and that the long end of the bladder fits into the long end of the cuff (see the figure below).



!
- *The cuff hose can exit from either opening in the cuff, depending on whether you plan a right arm or left arm application.*

Event Codes

The monitor will display an event code whenever an event prevents the unit from successfully completing a blood pressure measurement. The two numerical digits of the event code indicate the reason the measurement was aborted. The table below lists event codes that are displayed on the monitor, as well as event codes that appear on the Event Code Report.

Monitor	Report	Condition
EC00		
	EC10	**Excess movement artifact. Frequent EC10 messages may indicate an air leak.**
	EC20	A) A very large number of movement artifacts B) Heart rate arrhythmia
	EC30	**A) Movement artifact at mean arterial pressure** **B) Heart rate arrhythmia**
	EC40	**A) Movement artifact at asystole** **B) Heart rate arrhythmia**
	EC50	**A) Movement artifact at diastole** **B) Heart rate arrhythmia**
	EC60	**A) Movement artifact** **B) Heart rate arrhythmia**
	EC70	**Systole was found to be above the highest cuff pressure. However, this result appears to be an error caused by motion artifact. Therefore, the cuff will not be inflated to a higher pressure on the next measurement attempt.**
	EC80	**A) Movement artifact** **B) Heart rate arrhythmia**
	EC90	**A) Movement artifact** **B) Heart rate arrhythmia**
EC01		
	EC11	**Did not pump above the mean arterial level**
	EC21	**Did not pump above systolic pressure**
	EC91	**Systole appears higher than the selected maximum cuff pressure limit**
EC02		
	EC12	**Did not reach initial cuff pressure. The cuff may have been improperly applied or there may be an air leak.**
	EC22	**Overpressure**
	EC32	**Overpressure**
	EC42	**No cuff attached**
	EC52	**Kinked hose**
	EC62	**Cuff applied too loosely**

Monitor	Report	Condition
	EC82	Kinked hose.
EC03		
	EC03	Patient canceled reading by pressing STOP key. No retry attempt is made following an EC03 code.
	EC13	The Office Check Mode has been reinstated. No retry attempt is made following an EC13 code.
EC04		
	EC04	Blood pressure measurement not completed in the maximum time allowed. Occasional EC04 messages may result from excessive patient movement. Frequent EC04 messages would indicate an improperly applied cuff or a monitor malfunction which requires service.
	ECn4	(where n = 1 to 9) Indicates that one or more of the blood pressure results have been corrupted and subsequently recovered. Frequent occurrence of this message would indicate a malfunction which requires service.
	EC05	The individual blood pressure result has been corrupted and cannot be recovered.
EC15		Equipment malfunction. Return to Spacelabs Medical for service.
EC25		Unit failed to initialize. Please initialize.
EC35		90207 At least one of the blood pressures or time readings obtained before the event code is erroneous. Interpret all readings with caution. 90217 The monitor needs to be reinitialized.
EC05		
EC05 & EC45	EC45	Invalid bleed size. The monitor automatically has changed the bleed size to 8 mmHg.
EC05 & EC55	EC55	An unexpected loss of power possibly caused by a) removal of the batteries during a blood pressure measurement, b) hardware overpressure, or c) a hardware time-out. Frequent EC55 messages would indicate a malfunction which requires service.
EC05 & EC65	EC65	90207 Equipment malfunction. Return to Spacelabs Medical for service. 90217 Extremely large artifact.
EC05 & EC75	EC75	Equipment malfunction. Return to Spacelabs Medical for service.
EC05 & EC85	EC85	Equipment malfunction. Return to Spacelabs Medical for service.
EC05 & EC95	EC95	Cuff pressure baseline out of bounds. The monitor should correct the baseline automatically within 10 minutes; or it can be set by initialization of the monitor. If initialization does not correct the condition the monitor must be returned to Spacelabs Medical for calibration.

Monitor	Report	Condition
EC07		
	EC78	Clogged luer filter
EC08		
	EC18	Too few data entries to accurately determine blood pressure. The message may indicate that the cuff is not being worn by the patient (taken off but left connected to the monitor). The message may also indicate that motion artifacts cause the majority of the incomplete data.
	EC28	Diastole above 200 mmHg
	EC38	Pulse pressure less than 16 mmHg
	EC48	A) Movement artifact at mean arterial pressure B) Heart rate arrhythmia
	EC58	A) Movement artifact at diastole B) Heart rate arrhythmia
	EC68	Division by zero
EC09		
	EC19	Contradictory instructions sent to hardware (e.g., “pump on and valve open”)
	EC29	Diastolic pressure value cannot be obtained from the data available.
	EC39	90207 Systolic pressure cannot be obtained from the data available. 90217 Algorithm could not process input data quickly enough resulting in an input queue overflow.
	EC49	90207 Mean arterial pressure cannot be obtained from the data available. 90217 This monitor must be initialized.
	EC59	Heart rate value cannot be obtained from the data available.
	EC69	Heart rate value cannot be obtained from the data available.
	EC79	Bleed steps were too small. This may be caused by a partially obstructed air hose. All blood pressure attempts following this message are inhibited. Attempts can be enabled by turning the power switch off then on.
	EC99	Unexpected or contradictory data (such as a negative cuff pressure).
LLL		
	EC16	Low battery detected prior to start of measurement.
	EC26	Low battery detected after measurement started. Usually caused by the pump drawing enough current to lower the battery voltage.
Lbb		The report does not print an event code for this condition, which is a low backup battery. Contact Spacelabs Medical for replacement of the battery.

Accuracy

Contents

Checking Accuracy

Accuracy of the monitor pressure readings should be checked annually. Recalibration is necessary only if the unit is not within the accuracy limits.

Required Equipment

1. A full-size mercury sphygmomanometer or aneroid gauge.

   !
   - *Ensure the mercury sphygmomanometer or aneroid gauge is calibrated and indicates "0" with no pressure.*

2. T-tube (P/N 016-0040-00).
3. A pressure cuff and a rigid cylinder sized to fit the pressure cuff.

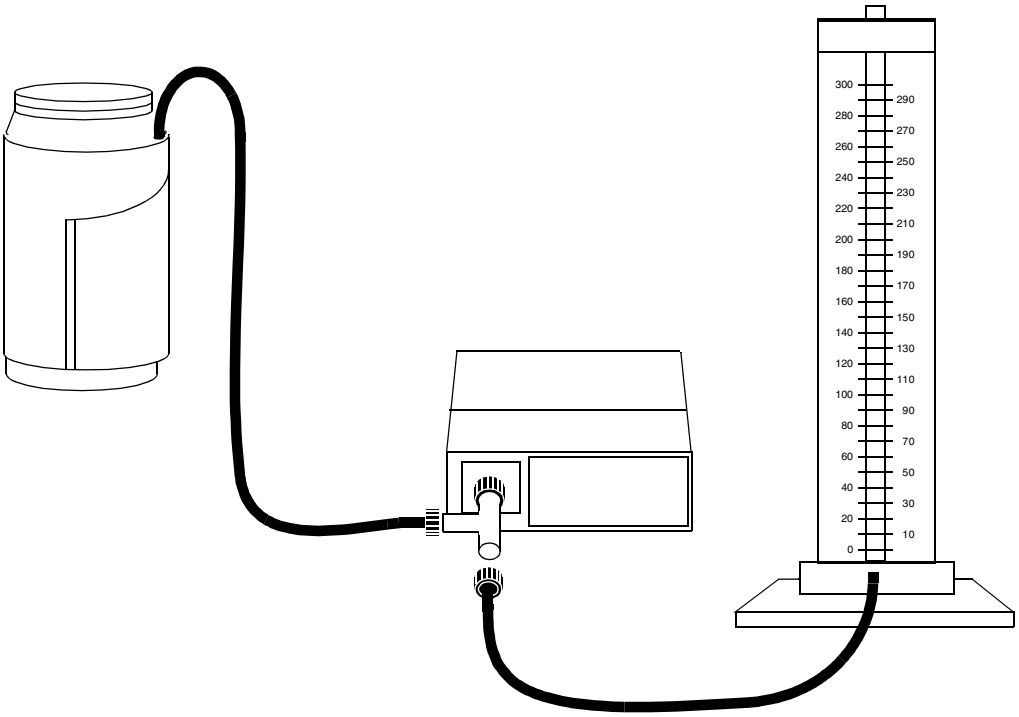
Accuracy Procedure

To check the accuracy of the monitor:

1. Disconnect the cuff hose from the monitor. Connect the T-tube splitter to the monitor Luer-Lok connector and the sphygmomanometer.
2. Wrap the pressure cuff around the rigid cylinder, and fasten the cuff. Connect the cuff hose to the remaining connection on the T-tube splitter. The test setup should appear as shown below.
3. Press **START/STOP** on the monitor; the monitor should read approximately 165. Compare the readings on the monitor and the manometer as the pressure bleeds down. The monitor reading should be within three millimeters of the manometer reading or 2% of the reading, whichever is greater (± the accuracy of the manometer).

   !
   - *If the monitor pressure values fall outside of the allowed tolerance call your local Customer Service Representative or Spacelabs Medical for servicing.*

4. At the end of the procedure, the monitor displays an event code indicating that no dynamic blood pressure measurements were obtained.



5. Disconnect the T-tube splitter from the monitor. Disconnect the air hose and sphygmomanometer.

Troubleshooting

Contents

Problem Solving Checklist

Problem	Possible Cause	Solution
Monitor display is incorrect	Data not retained	Replace backup battery
	Low or no power	Check the batteries for a full charge; if needed, replace or recharge the batteries
	May be one of the following: time-out, no reading due to air leak in the system, improper cuff size, cuff not properly attached to the monitor	Isolate cause and correct
Monitor displays “LLL” and alarm sounds	Low main battery condition	Turn off monitor immediately. Replace batteries within 60 seconds after removal to continue monitoring.
Monitor displays event code Lbb during self-testing (90207 only)	Low backup battery condition	Replace backup battery before continuing.
Cuff too tight	Cuff placed on the patient too tightly	Reposition the cuff
	Air pump staying on too long	Return unit to Spacelabs Medical for service
Cuff too loose	Cuff placed on the patient too loosely	Reposition the cuff
	Air pump not staying on long enough	Return unit to Spacelabs Medical for service
Incorrect time displayed	Batteries removed for more than one minute (90207 only)	Re-initialize monitor

Servicing

There is a 12 month warranty on this product.

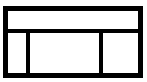
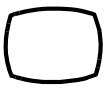
Field service of the ABP monitor is limited to replacing batteries and accessories. If other repair is required, return the monitor to Spacelabs Medical. Contact your Spacelabs Medical Customer Service Representative for shipping details.

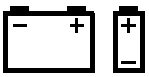
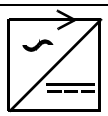
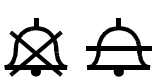
CAUTION:

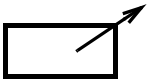
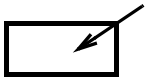
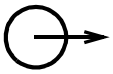
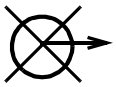
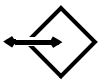
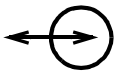
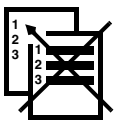
- **Any attempt to perform service or repair to the monitor will result in cancellation of the warranty.**

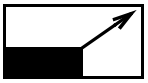
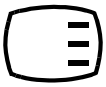
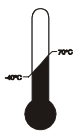
Symbols

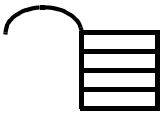
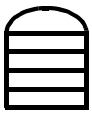
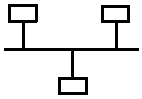
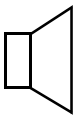
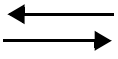
The following list of international and safety symbols describes all symbols used on Spacelabs Medical products. No one product contains every symbol.

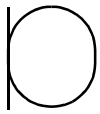
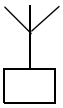
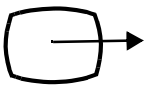
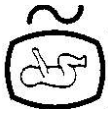
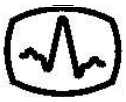
Symbol	Description	Symbol	Description
	UCW or Ultraview 1700 HELP Key		UCW or Ultraview 1700 MONITOR SETUP Key
	UCW or Ultraview 1700 SPECIAL FUNCTIONS Key		UCW or Ultraview 1700 ALARMS Key
	UCW or Ultraview 1700 RECORD Key		UCW or Ultraview 1700 PREVIOUS MENU Key
	UCW or Ultraview 1700 NORMAL SCREEN Key		UCW or Ultraview 1700 mouse connection
	UCW or Ultraview 1700 Keyboard Connection		ON — Power Connection to Mains
	OFF — Power Disconnection from Mains		On Position for Push button Power Switch
	Off Position for Push button Power Switch		STOP or CANCEL Key
	CONTINUE Key		START/STOP Key
	START/STOP		START (NIBP) Key
	On Direction		ON/OFF
	Television; Video Display		Recycle
	Protective Earth Ground		Functional Earth Ground

Symbol	Description	Symbol	Description
	ON — Part of the Instrument Only		OFF — Part of the Instrument Only
	Partial ON/OFF		STAND-BY Key
	All batteries should be disposed of properly to protect the environment. Lithium batteries should be fully discharged before disposal. Batteries such as lead-acid (Pb) and nickel-cadmium (Ni-Cd) must be recycled. Please follow your internal procedures and or local (provincial) laws regarding disposal or recycling.		Caution - hazardous voltages. To reduce risk of electric shock, do not remove the cover or back. Refer servicing to a qualified service personnel (U.S.A.). DANGER - High Voltage (International)
	PAUSE or INTERRUPT		Slow Run
	Replace Fuse Only as Marked		Fuse
	Power supply jack polarity. (+ / - Signs May be Reversed)		Equipotentiality Terminal
	Battery Replace only with the appropriate battery.		Replace only with the appropriate battery. (+ / - Signs May be Reversed)
	Alternating Current		Direct Current
	Both Direct and Alternating Current		AC/DC Input
A	Amperes	Hz	Hertz
V	Volts	W	Watts
	Temporary Shut Off of Alarm Tone or Screen Indicators		Alarm

Symbol	Description	Symbol	Description
	ENTER Key		PRINT REPORT Key
	Attention - Consult Operations or Service Manual for Description		Risk of Explosion if Used in the Presence of Flammable Anesthetics
	Indicator — Remote control		Indicator — Local Control
	Return Unit to Monitor Mode		Indicator — Out of Paper
	Activate Recorder for Graphics		Recorder Paper
	Indoor Use Only		Auto Mode (NIBP)
	Output		No Output (Terminated)
	Data Input/Output	?	HELP (Explain Prior Screen) Key
	Clock/Time Setting Key		Input/Output
	Monitor Setup Select Program Options		Set Initial Conditions Menu
	Access Special Function Menu		Normal Screen
	Return to Prior Menu		TREND/TIMER Key

Symbol	Description	Symbol	Description
	Gas Exhaust		Electrocardiograph or Defibrillator Synchronization
	Arterial Pulse		IEC 601-1 Type BF equipment. The unit displaying this symbol contains an F-type isolated (floating) patient-applied part providing an adequate degree of protection against electric shock.
	IEC 601-1 Type BF equipment which is defibrillator-proof. The unit displaying this symbol contains an F-type isolated (floating) patient-applied part which contains an adequate degree of protection against electric shock, and is defibrillator-proof.		IEC 601-1 Type CF equipment. The unit displaying this symbol contains an F-type isolated (floating) patient-applied part providing a high degree of protection against electric shock.
	IEC 601-1 Type CF equipment. The unit displaying this symbol contains an F-type isolated (floating) patient-applied part providing a high degree of protection against electric shock, and is defibrillator-proof.		ETL Laboratory Approved
	IEC 601-1 Type B equipment. The unit displaying this symbol contains an adequate degree of protection against electric shock.		Canadian Standards Association Approved
	Keypad		Enlarge, Zoom
	Menu Keys		Delete
	Waveform/Parameter Keys		PCMCIA Card
	Keep Dry		Fragile; handle with care
	Foot Switch		This Way Up
	Environmental Shipping/Storage Temperature Limitations		Environmental Shipping/Storage Humidity Limitations

Symbol	Description	Symbol	Description
	Open Padlock		Closed Padlock
	Down Arrow		Up Arrow
	Event	**TEMP** **temp**	Temperature
	Antenna		Environmental Shipping/Storage Altitude Limitations
	Network Connection		Audio Output, Speaker
	Remote Alarm; Nurse Alert		Nurse Call
	Serial Port 1		Serial Port 2
	External marker push button connection	**SDLC** 	SDLC Port

Symbol	Description	Symbol	Description
	Microphone		Mermaid Connector
	Note		Video Output
	Warning About Potential Danger to Human Beings		Caution About Potential Danger to Equipment
	Non-Invasive Blood Pressure (NIBP), Neonate		Fetal Monitor Connection (Analog)
	Fetal Monitor Connection RS232 (Digital)		Physiological Monitor Connection RS232 (Digital)
	Input		Reset
	Hard Drive		Power Indicator LED
	Activate Telemetry Recorder		Omnidirectional Microphone
	Battery Status		Universal Serial Bus
	Stand-by		Low Battery

Abbreviations used as symbols are shown below.

Symbol	Description	Symbol	Description
1 - 32	Access Codes 1 Through 32	**AIR**	Air
ANT 1 **ANT 2**	Diversity Antenna System 1 Diversity Antenna System 2	**Arr1** **ArrNet2**	Arrhythmia Net 1 Arrhythmia Net 2
CH **ch**	EEG, EMG, or ECG Channel EEG Channels - CH1, CH2, CH3, CH4 EMG Channel - CH5	**cmH_2O**	Centimeters of Water
CMV	Controlled Mechanical Ventilation	**C.O.** **CO** **co**	Cardiac Output
DIA **dia**	Diastolic	**ECG** **ecg**	Electrocardiogram
EEG **eeg**	Electroencephalogram	**EMG** **emg**	Electromyogram
ESIS	Electrosurgical Interference Suppression	**EXT**	External
FECG	Fetal Electrocardiogram	**FHR1** **FHR2**	Fetal Heart Rate, Channel 1 Fetal Heart Rate, Channel 2
GND **gnd**	Patient Isolated Ground	**HLO** **hlo**	High-Level Output
I:E	Inspiration Expiration Ratio	**MULTIVIEW**	Multi-Lead Electrocardiogram
NIBP **nibp**	Non-Invasive Blood Pressure	**N_2O**	Nitrous Oxide
O_2	Oxygen	**PEEP**	Positive End Expiratory Pressure

Symbol	Description	Symbol	Description
PRESS **press** **PRS**	Pressure	**Pmin**	Minimum Inspiratory Pressure
Ppeak	Peak Inspiratory Pressure	**RESP** **resp**	Respiration
SDLC	Synchronous Data Link Control	**SPO2** **SpO2** **SpO_2** **SaO_2**	Arterial Oxygen Saturation as Measured by Pulse Oximetry
SVO2 **$S\underline{v}O2$** **SvO_2**	Mixed Venous Oxygen Saturation	**SYS** **sys**	Systolic
T1 **T2** **T3** **T4**	Temperature 1 Temperature 2 Temperature 3 Temperature 4	**UA**	Uterine Activity or Umbilical Artery
VAC	Vacuum connection		