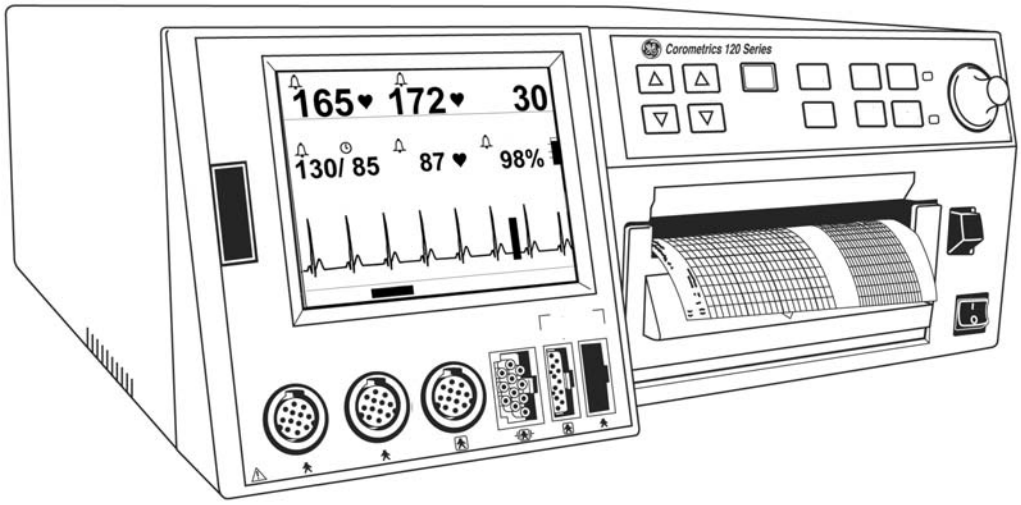
Corometrics® 120 Series V3.5

OPERATOR'S MANUAL

MANUAL P/N 2015589-001 REV. C



GE Medical Systems
Information Technologies

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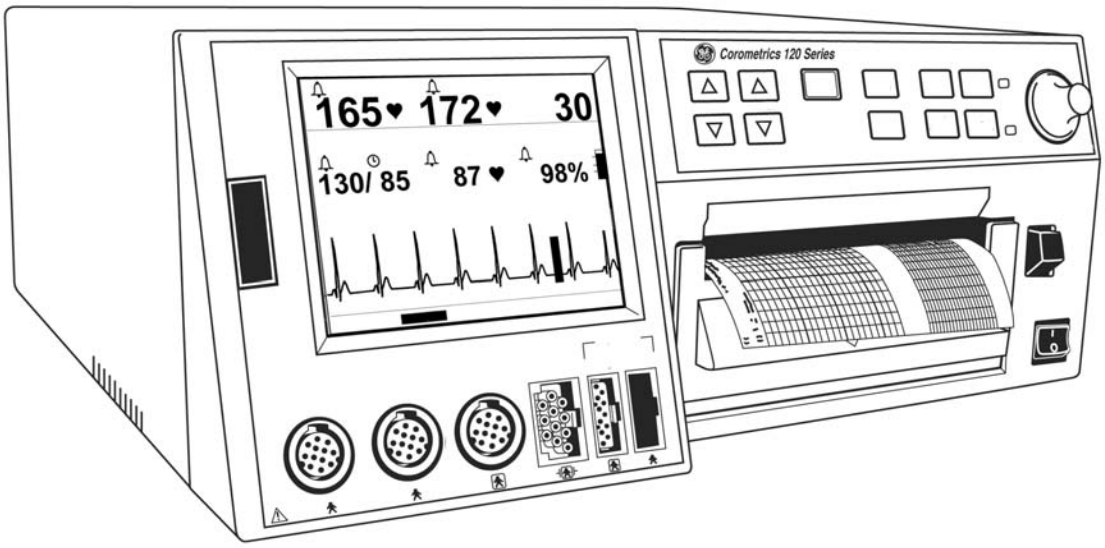

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GUARANTEE

All equipment sold by GE Medical Systems *Information Technologies*, is fully guaranteed as to materials and workmanship for a period of 1 year. GE Medical Systems *Information Technologies* reserves the right to perform guarantee service operations in its own factory, at an authorized repair station, or in the customer's installation.

Our obligation under this guarantee is limited to repairing, or, at our option, replacing any defective parts of our equipment, except fuses or batteries, without charge, if such defects occur in normal service.

Claims for damage in shipment should be filed promptly with the transportation company. All correspondence covering the instrument should specify the model and serial numbers.

GE MEDICAL SYSTEMS *Information Technologies*
A GE Medical Systems Company

GE Medical Systems *Information Technologies* will make available on request such circuit diagrams, component diagrams, component parts lists, descriptions, calibration instructions, or other information which will assist the users or appropriately qualified technical personnel to repair those parts of the equipment which are classified by GE Medical Systems *Information Technologies* as repairable. Refer to the 120 Series Service Manual for further information.

⚠ **CAUTION:** In the United States of America, Federal Law restricts this device to sale by or on the order of a physician.

NOTICE: Purchase of a 120 Series Monitor confers no express or implied license under any Nellcor Puritan Bennett patent to use the 120 Series Monitor with any fetal oximetry sensor that is not manufactured or licensed by Nellcor Puritan Bennett.

CE Marking Information

CE
0459

Compliance

A Corometrics brand 120 Series Monitor bears CE mark CE-0459 indicating its conformity with the provisions of the Council Directive 93/42/EEC concerning medical devices and fulfills the essential requirements of Annex I of this directive.

The device is manufactured in India and/or the United States of America; the CE mark is applied under the authority of Notified Body GMED (0459).

The country of manufacture and appropriate Notified Body can be found on the equipment labeling.

The product complies with the requirements of standard EN 60601-1-2 “Electromagnetic Compatibility—Medical Electrical Equipment” and standard EN 60601-1 “General Requirements for Safety.”

Components of the Certified Systems

The IEC electromagnetic compatibility (EN) standards require individual equipment (components and accessories) to be configured as a system for evaluation. For systems that include a number of different equipments that perform a number of functions, one of each type of equipment shall be included in the evaluation.

The equipment listed below is representative of all possible combinations. For individual equipment certification, refer to the appropriate declarations of conformity.

Component Description:

- 120 Series Maternal/Fetal Monitor
- Model 146 Fetal Acoustic Stimulator
- Intrauterine Pressure Transducer
- FECG Cable/Legplate
- Ultrasound Transducers (x2)
- Blood Pressure Hose and Cuff
- $MSpO_2$ Interconnect Cable and Sensor
- $FSpO_2$ Interconnect Cable and Sensor
- MECG Cable
- FECG/MECG Adapter Cable
- Remote Event Marker
- RS-232C Interconnect Cables (x3)
- COROLAN Interconnect Cable
- Central Nurses Station Interconnect Cable
- Model 2116B Interconnect Cable

Exceptions

The Monitor System EMC: Immunity Performance

None

Be aware that adding accessories or components, or modifying the medical device or system may degrade the EMI performance. Consult with qualified personnel regarding changes to the system configuration.

Contents

5

6

Chapter 1

⚠ Safety

The information presented in this section is important for the safety of both the patient and operator and also serves to enhance equipment reliability. This chapter describes how the terms Danger, Warning, Caution, Important, and Note are used throughout the manual. In addition, Corometrics' standard equipment symbols are defined.

This section includes the following important information:

General Information

General Use

If the monitor is cold to the touch or below ambient temperature, allow it to stabilize before use.

To ensure patient safety, use only parts and accessories manufactured or recommended by GE Medical Systems *Information Technologies*. Parts and accessories used shall meet the requirements of EN60601.1.1.

Disposable devices are intended for single use only. They should not be reused.

Periodically, and whenever the integrity of the monitor is in doubt, test all functions.

Refer to the "Maternal/Fetal Monitoring Operator's Manual" for information concerning the limitations of internal and external fetal heart rate monitoring techniques.

Responsibility of the Manufacturer

GE Medical Systems *Information Technologies* is responsible for the effects on safety, reliability, and performance if:

- assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE Medical Systems *Information Technologies*;
- the electrical installation of the relevant room complies with the requirements of appropriate regulations; and
- the monitor is used in accordance with the instructions of use.

Responsibility of the User

This device is intended for use by clinical professionals who are expected to know the medical procedures, practices, and terminology required to monitor obstetrical patients. This manual documents all possible parameters available in the 120 Series of monitors. It is the responsibility of each hospital to ensure that the Labor and Delivery staff is trained in all aspects of the selected model.

The 120 Series Monitor is only one clinical indicator of fetal status during labor. The monitor is designed to assist the perinatal staff in assessing the status of a patient. The monitor does not replace observation and evaluation of the mother and fetus at regular intervals, by a qualified care provider, who will make diagnoses and decide on treatments or interventions. Visual assessment of the monitor display and strip chart must be combined with knowledge of patient history and risk factors to properly care for the mother and fetus.

Definitions of Terminology

Six types of special notices are used *throughout* this manual. They are: Danger, Warning, Caution, Contraindication, Important, and Note. The warnings and cautions in this Safety section relate to the equipment in general and apply to all aspects of the monitor. Be sure to read the other chapters because there are additional warnings and cautions which relate to specific features of the monitor.

When grouped, warnings and cautions are listed alphabetically and do not imply any order of importance.

Table 1-1. Definitions of Terminology

Danger	A DANGER notice indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
Warning	A WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
Caution	A CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Cautions are also used to avoid damage to equipment.
Contraindication	A CONTRAINDICATION describes any special symptom or circumstance that renders the use of a remedy or the carrying out of a procedure inadvisable, usually because of a risk.
Important	An IMPORTANT notice indicates an emphasized note. It is something you should be particularly aware of; something not readily apparent.
Note	A NOTE indicates a particular point of information; something on which to focus your attention.

Monitor Contraindications, Warnings, and Precautions

Warnings

WARNINGS

ACCIDENTAL SPILLS—In the event that fluids are accidentally spilled on the monitor, take the monitor out of operation and inspect for damage.

APPLICATION—This monitor is not designed for direct cardiac connection.

CONDUCTIVE CONNECTIONS—Avoid making any conductive connections to applied parts (patient connection) which are likely to degrade safety.

CONDUCTIVE PARTS—Ensure that the conductive parts of the lead electrodes and associated connectors do not contact other conductive parts including earth.

CONNECTIONS—The correct way to connect a patient to the monitor is to plug the ***electrode leads*** into the ***patient cable*** which in turn connects to the ***monitor***. The ***monitor*** is connected to the ***wall socket*** by the ***power cord***. Do ***not*** plug the electrode leads into the power cord, a wall socket, or an extension cord.

DEFIBRILLATION—During defibrillation, all personnel must avoid contact with the patient and monitor to avoid a dangerous shock hazard. In addition, proper placement of the paddles in relation to the electrodes is required to minimize harm to the patient.

ELECTRICAL SHOCK—To reduce the risk of electrical shock, do not remove monitor cover. Refer servicing to qualified personnel.

ELECTROMAGNETIC INTERFERENCE—Be aware that strong electromagnetic fields may interfere with monitor operation. Interference prevents the clear reception of signals by the monitor. If the hospital is close to a strong transmitter such as TV, AM or FM radio, police or fire stations, a HAM radio operator, an airport, or cellular phone, their signals could be picked up as signals by the monitor. If you feel interference is affecting the monitor, contact your Service Representative to check the monitor in your environment. Refer to page 1-8 for additional information.

WARNINGS

ELECTROSURGERY—The monitor is not designed for use with high-frequency surgical devices. In addition, measurements may be affected in the presence of strong electromagnetic sources such as electrosurgery equipment.

EXPLOSION HAZARD—Do not use this equipment in the presence of flammable anesthetics or inside an oxygen tent.

GROUNDING—Do not defeat the three-wire grounding feature of the power cord by means of adaptors, plug modifications, or other methods. A dangerous shock hazard to both patient and operator may result.

INSTRUCTIONS—For continued and safe use of this equipment, it is necessary to follow all listed instructions. However, the instructions provided in this manual in no way supersede established medical procedures concerning patient care. The monitor does not replace observation and evaluation of the patient, at regular intervals, by a qualified care provider who will make diagnoses and decide on treatments and interventions.

INTERFACING OTHER EQUIPMENT—Monitoring equipment must be interfaced with other types of medical equipment by qualified biomedical engineering personnel. Be certain to consult manufacturers' specifications to maintain safe operation.

LEAKAGE CURRENT TEST—The interconnection of auxiliary equipment with this device may increase the total leakage current. When interfacing with other equipment, a test for leakage current must be performed by qualified biomedical engineering personnel before using with patients. Serious injury or death could result if the leakage current exceeds applicable standards. The use of accessory equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include: use of the accessory in the patient vicinity; and evidence that the safety certification of the accessory has been performed in accordance with the appropriate EN60601.1 and/or EN60601.1.1 harmonized national standard.

WARNINGS

LINE ISOLATION MONITOR TRANSIENTS—Line isolation monitor transients may resemble actual cardiac waveforms, and thus cause incorrect heart rate determinations and alarm activation (or inhibition).

MRI USE—Do not use the electrodes during MRI scanning; conducted current could potentially cause burns.

PATIENT CABLES AND LEADWIRES—Do not use patient cables and electrode leads that permit direct connection to electrical sources. Use only “safety” cables and leadwires. Use of non-safety patient cables and lead wires creates risk of inappropriate electrical connection which may cause patient shock or death.

PACEMAKER PATIENTS—Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker patients under close surveillance. Refer to “Chapter 17, Troubleshooting” for disclosure of the pacemaker pulse rejection capability of the 120 Series Monitor.

SIMULTANEOUS DEVICES—Do not simultaneously connect more than one device that uses electrodes to detect ECG and/or respiration to the same patient. Use of more than one device in this manner may cause improper operation of one or more of the devices.

STRANGULATION—Make sure all patient cables, leadwires, and tubing are positioned away from the patient’s head to minimize the risk of accidental strangulation.

WATER BIRTHS—Do not use the monitor to directly monitor patients during water births, in whirlpool or submersion water baths, during showers, or in any other situation where the mother is immersed in water. Doing so may result in electrical shock hazard.

Cautions

CAUTIONS

ANNUAL SERVICING—For continued safety and performance of the monitor, it is recommended that the calibration, accuracy, and electrical safety of the monitor be verified on an annual basis by a GE Medical Systems *Information Technologies* Service Representative.

DAILY TESTING—It is essential that the monitor and accessories be inspected every day. It is recommended practice to initiate the monitor's self-test feature at the beginning of each monitoring session; follow the instructions in "Chapter 4, Setup Procedures".

ENVIRONMENT—The performance of the monitor has not been tested in certain areas, such as x-ray and imaging suites. The monitor is not recommended for use in these environments.

PERFORMANCE—Report all problems experienced with the monitor. If the monitor is not working properly, contact your Service Representative for service. The monitor should not be used if it is not working properly.

Electromagnetic Interference

This device has been tested and found to comply with the limits for medical devices to the IEC 601-1-2:1993, EN60601-1-2:1994, Medical Device Directive 93/42/EEC. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation.

However, because of the proliferation of radio-frequency transmitting equipment and other sources of electrical noise in the health-care and home environments (for example, cellular phones, mobile two-way radios, electrical appliances), it is possible that high levels of such interference due to close proximity or strength of a source, may result in disruption of performance of this device.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference with other devices in the vicinity. Disruption or interference may be evidences by erratic readings, cessation of operation, or incorrect functioning. If this occurs, the site of use should be surveyed to determine the source of this disruption, and actions taken to eliminate the source.

The user is encouraged to try to correct the interference by one or more of the following measures:

- Turn equipment in the vicinity off and on to isolate the offending equipment.
- Reorient or relocate the other receiving device.
- Increase the separation between the interfering equipment and this equipment.
- If assistance is required, contact your GE Medical Systems Service Representative.

Equipment Symbols

The following is a list of symbols used on products manufactured by GE Medical Systems *Information Technologies*. Some symbols may not appear on your unit.

Table 1-2. Equipment Symbols

	ATTENTION: Consult accompanying documents.
	TYPE B EQUIPMENT. Type B equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application.
	TYPE BF EQUIPMENT. Type BF equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application. Type BF equipment has an F-type applied part.
	DEFIBRILLATOR-PROOF TYPE BF EQUIPMENT: Type BF equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application. Type BF equipment is type B equipment with an F-type isolated (floating) part. The paddles indicate the equipment is defibrillator proof.
	ALTERNATING CURRENT (AC).
	EQUIPOTENTIALITY.
O	POWER OFF: disconnection from the mains.
I	POWER ON: connection to the mains.

For your notes

Chapter 2

Introduction

This section lists the indications for use for maternal/fetal monitors in the Corometrics 120 Series. The Corometrics 120 Series is extremely flexible, allowing you to mix and match features.

This section provides information about your monitor in relation to this manual, as well as the intended uses of the device:

Fetal Monitoring Indications for Use

A Corometrics 120 Series Monitor is used for fetal surveillance as well as maternal monitoring.

Surveillance

A Corometrics 120 Series Monitor can be used for routine non-invasive and invasive fetal monitoring throughout labor and delivery.

Pulse Oximetry

The 120 F-Series system continuously monitors intrapartum fetal oxygen saturation ($FSpO_2$) and is indicated **as an adjunct** to fetal heart rate (FHR) monitoring in the presence of a non-reassuring fetal heart rate pattern. It should only be used after maternal membranes have ruptured and on a singleton fetus in vertex presentation with a gestational age greater than or equal to 36 weeks. (Refer to the "Maternal/ Fetal Monitoring Operator's Manual" for additional information.)

Maternal Monitoring Indications for Use

A Corometrics Model 128 or 129 Maternal/Fetal Monitor is intended for monitoring maternal vital signs to help assess maternal well-being. The vital signs which can be measured with either of these monitors are summarized below.

NOTE: Maternal vital signs provided by the monitor should only be used as an adjunct to patient assessment and must be used in conjunction with clinical signs and symptoms.

Blood Pressure

The monitor is intended for use in the non-invasive monitoring of maternal blood pressure (NBP). This monitor is not intended for use in neonatal or pediatric blood pressure monitoring.

Pulse Oximetry

The monitor is intended for use in the non-invasive monitoring of the functional oxygen saturation of maternal arterial blood ($MSpO_2$).

Heart/Pulse Rate

NOTE: A Model 128 provides maternal *pulse* rate data derived from the NBP and $MSpO_2$ sections of the monitor. Only a Model 129 provides both maternal *heart* rate and maternal *pulse* rate data; the *heart* rate data is derived from the MECG section of the monitor while the *pulse* rate data is derived from the NBP and $MSpO_2$ sections of the monitor.

The monitor is intended for use in the non-invasive monitoring of the maternal heart/pulse rate (MHR/P).

Series Overview

The Model 126 Monitor

The Model 126 Monitor provides standard fetal monitoring parameters—dual ultrasound, fetal ECG, and uterine activity. The Model 126 has the following features:

- Dual ultrasonic heart rate monitoring allows for non-invasive monitoring of twins.
- A +20 BPM heart rate offset option is provided for the secondary heart rate (HR2) trend, when using dual ultrasound, or ultrasound and direct FECG, to separate overlapping FHR trends for easy interpretation.
- A heartbeat coincidence detection feature can be enabled to inform you when there is the possibility that you may be monitoring a duplicate signal.
- The strip chart recorder is a quiet, easy-to-load, high-resolution thermal array printer. The recorder prints continuous trends and alphanumeric data on one strip chart.
- User-selectable font size for strip chart annotations customizes readability.
- Automatic mode selection is provided simply by inserting the appropriate transducer plug into the front panel receptacle.
- The electroluminescent (EL) display, with circularly polarized filter, removes glare; its wide viewing angle provides easy viewing at a distance.
- A recorder light allows the room lights to be dimmed without sacrificing visibility of the strip chart recorder.
- Transducer connectors are easy-to-use, color-coded, and durable.
- Frequently used functions are controlled by front panel pushbuttons—including audio volume, UA reference, test, alarm silence, event mark, and paper advance.
- System setup options are easily accessed via a front panel Trim Knob control.
- Fetal parameters are continuously displayed even during configuration of system setup options.
- Annotations from an optional Model 2116B Keyboard are printed on the strip chart recorder paper.
- The ultrasound mode provides clean accurate traces with few “dropouts” because of a patented autocorrelation processing.
- Fetal heart rate alarm limits are user-defined, with pre-set defaults.
- Alarm limits are easily set via a front panel Trim Knob control.
- Alarm silencing is controlled by a front panel pushbutton—colored for easy recognition.
- Alarm conditions have audible and visual indications. Audible alarms can be disabled. Fetal heart rate threshold and signal quality alarms can be cancelled.
- The data storage and telecommunications capability allows remote or referral tracing assessments.
- The monitor can be interfaced to the most widely used non-invasive blood pressure monitors and pulse oximeters.
- The FECG waveform can be optionally displayed and can be “frozen” on the screen for review. In addition, a six-second “snapshot” can be printed on the strip chart paper.

The Model 128 Monitor

The Model 128 Monitor provides all of the features of the Model 126 Monitor with the addition of integrated maternal pulse oximetry and non-invasive blood pressure monitoring. The Model 128 has all of the features of the Model 126, plus the following:

- Built-in maternal vital signs monitoring eliminates the need for separate blood pressure and maternal pulse oximetry monitors.
- Maternal non-invasive blood pressure* readings can be taken on-demand or at pre-programmed intervals.
- Post-contraction blood pressure option prevents blood pressure readings from occurring during contractions.
- Continuous non-invasive $MSpO_2$ oxygen saturation and maternal pulse rate can be reliably monitored using the well-known Nellcor pulse oximetry sensors.
- Continuous printing of the maternal pulse rate trend can be enabled.
- Maternal alarm limits are user-defined, with pre-set defaults.
- The audible indicator for each maternal alarm can be temporarily silenced.
- Maternal vital signs storage provides an eight-hour history of the maternal vital signs in a spreadsheet format. The data can be displayed or printed on-demand.
- A maternal-only recording mode is specifically designed for postpartum monitoring of the mother.
- The $MSpO_2$ pulsatile waveform can be optionally displayed and can be "frozen" on the screen for review. In addition, a six-second "snapshot" can be printed on the strip chart paper.

The Model 129 Monitor

The Model 129 has all of the features of the Model 128, plus the following:

- Built-in independent MECG monitoring is provided with selection of lead I, II, or III.
- Twins *and* maternal monitoring can be accomplished simultaneously using dual ultrasound *and* MECG, or by using ultrasound, FECG, *and* MECG.
- The MECG waveform can be optionally displayed and can be "frozen" on the screen for review. In addition, a six-second snapshot can be printed on the strip chart paper.
- The large display area provides for fetal parameters, maternal parameters, and maternal waveforms all at once.

Upgrading Your Monitor

The 120 Series family of monitors provides one solution for high-risk and low-risk labors and deliveries. The 120 Series of monitors lets you start with a basic monitor and add the extended and/or more advanced features later as your clinical needs increase and your budget allows.

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* *Blood pressure is not automatically activated. Manual blood pressure readings must be started via a front panel pushbutton. Automatic readings must be initiated via a setup screen.*

Upgrading to the Next Level

Upgrade kits are available for in-hospital installation from one model to the next. Contact your Service Representative for more information.

Adding Fetal Movement Detection and Spectra Alerts

Each monitor in the series can be upgraded to include Spectra Alerts and fetal movement detection (FMD).

About the Manual

Purpose

This manual documents all possible parameters so that when you upgrade you will not require any new documentation. Also, the manual provides an opportunity to read about features you may not have, to help aid you in your upgrade decisions. Some sections will not apply if your monitor is not equipped with $MSpO_2$, maternal NBP, or MECG monitoring capabilities. Table 2-1 provides a summary of the 120 Series family of monitors.

Table 2-1. Summary of Monitoring Modes

Parameter	120 Series Model		
	126	128	129
US	✓	✓	✓
US2	✓	✓	✓
FECG	✓	✓	✓
TOCO	✓	✓	✓
IUP	✓	✓	✓
NBP		✓	✓
$MSPO_2$		✓	✓
MECG			✓

Intended Audience

This manual is intended for clinical professionals. Clinical professionals are expected to know the medical procedures, practices, and terminology required to monitor obstetrical patients.

Illustrations

All illustrations are provided as examples only. Your monitor may not be equipped with all of the features shown. In addition, unless explicitly stated, the display examples do not represent your equipment setup or displayed data.

For your notes

Chapter 3

Controls, Indicators, and Connectors

This section describes all possible controls, indicators, and connectors in the 120 Series of monitors.

The section contains the following:

Front Panel Description

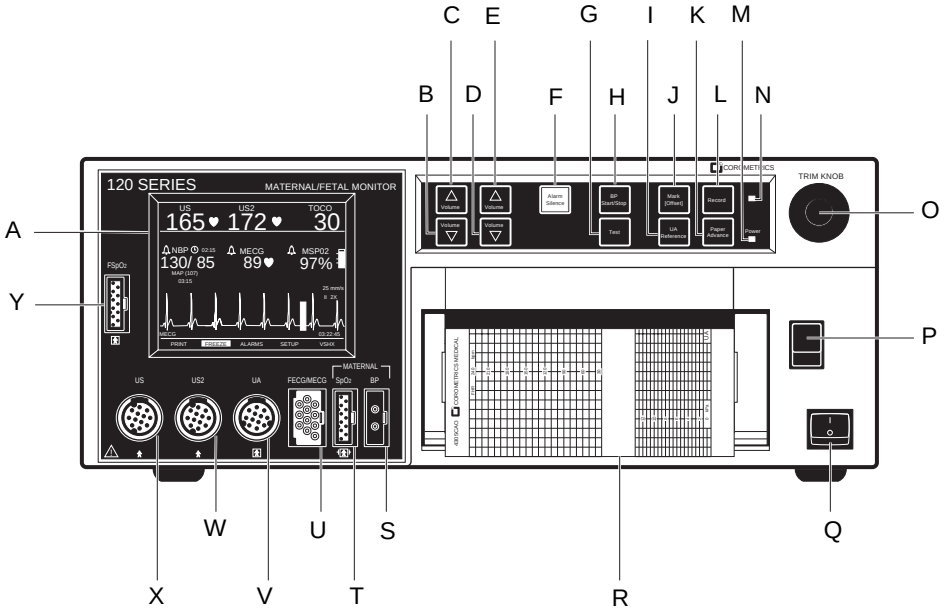

Figure 3-1. Model 129 Front Panel

Table 3-1. Model 129 Front Panel		
#	Name	Description
A	Display	The monitor's display is divided into several sections. The content and layout of the display can change, depending on which functions are installed in the monitor and the modes of operation in use.
B	FHR1 Volume Decrease Button	The four Volume buttons raise (△) and lower (▽) the volume of sound emitted by the rear panel speaker. The left pair controls the volume for FHR1. The right pair controls the volume for FHR2. Volume settings have no effect on the processing used to determine heart rate. The volume buttons work in conjunction with the volume control settings on the US/US2 Setup screen (page 5-2) and on the FECG Setup screen (page 5-5).
C	FHR1 Volume Increase Button	
D	FHR2 Volume Decrease Button	
E	FHR2 Volume Increase Button	
F	Alarm Silence Button	Pressing this button removes the audible indication of an individual alarm. (Refer to "Re-Alarm" on page 11-3 for information about which modalities re-alarm.)
G	Test Button	Pressing and holding this button for one second starts or stops a monitor self-test routine.
H	BP Start/Stop Button	This button starts and stops both manual and automatic blood pressure determinations. It also provides a "shortcut" for changing the auto interval time (see page 9-11).
I	UA Reference Button	The UA Reference button sets a baseline for uterine activity pressure monitoring. Refer to "Chapter 7, Uterine Activity Monitoring".
J	Mark [Offset] Button	The Mark (Offset) pushbutton is a multi-function pushbutton. ■ Mark: Pressing this button prints an event mark ↑ on strip chart paper (on the bottom two lines of the top grid). ■ Offset: When the Heart Rate Offset mode is enabled, pressing and *holding* this button shifts the secondary FHR trend +20 BPM for visibility purposes. Refer to "Fetal Heart Rate Offset" on page 5-6.
K	Paper Advance Button	Pressing this button advances chart paper at a rate of 40 cm/min for as long as the button is held down.
L	Record Button	The Record button selects one of three recorder states: on, maternal-only mode, or off. Refer to "Chapter 12, Recorder Modes".
M	Power Indicator	The indicator lights green when the monitor is turned on.
N	Record Indicator	Indicator Status / Recorder Status on / on off / off flickers / maternal-only mode flashing / error condition
O	Trim Knob Control	Operation of the monitor is controlled by using the front panel pushbuttons in conjunction with the Trim Knob control. This control selects softkeys on the display and positions a cursor within a setup screen. Rotate the Trim Knob control left or right to highlight items on the screen with a bar cursor. After highlighting the desired item, press the Trim Knob control to make the selection. In summary: rotate to move cursor; press to select an item.
P	Recorder Door Latch	Opens the strip chart recorder door to add, remove, or adjust the paper.

Table 3-1. Model 129 Front Panel		
#	Name	Description
Q	Power Switch	Moving the switch to the *on* position (I) turns on the monitor; moving the switch to the *off* position (O) turns off the monitor.
R	Strip Chart Recorder	Annotations and trends are printed on the strip chart paper. Two paper styles are available. Refer to "Chapter 4, Setup Procedures", for instructions on loading strip chart paper into the recorder. Refer to "Chapter 12, Recorder Modes" for additional information about trends and annotations.
S	Maternal NBP Connector	Connect a pneumatic hose and blood pressure cuff assembly to this black twin lumen receptacle.
T	Maternal SpO_2 Connector	Connect a 120 Series MSpO_2 intermediate cable to this royal blue receptacle. Use only Nellcor Maternal Oxygen Saturation Sensors if Nellcor technology is installed in your monitor or Masimo Sensors if Masimo technology is installed in your monitor.
U	FECG or FECG/MECG Connector	Connect an FECG cable/legplate or MECG cable plug to this green receptacle. For Models 126 or 128, the connector is labeled FECG. For a Model 129, the connector is labeled FECG/MECG. Cables with *rectangular* plugs connect directly to the FECG/MECG receptacle. Cables with *round* plugs require an FECG/MECG adapter, cat. no. (REF) 1442AAO. Use this adapter for dual ECG monitoring as well. The adapter branches into two cables, each with a *round* receptacle at the end: one branch is labeled MECG; the other branch is labeled FECG.
V	UA Connector	Connect a tocotransducer, IUPC, or strain gauge transducer plug to this white receptacle Contact your Sales Representative for information about compatibility.
W	US2 Connector	Connect the secondary ultrasound transducer plug to this light gray receptacle.
X	US Connector	Connect the primary ultrasound transducer plug to this light gray receptacle.
Y	Fetal SpO_2 Connector	Connect a 120 Series Fetal Patient Module cable to this light blue receptacle. Use only Nellcor OxiFirst Fetal Oxygen Sensors (Series FS14).

Front Panel Displays

The monitor's display is divided into five horizontal sections. The content and layout of the display can change, depending on which functions are installed in the monitor and the modes of operation in use.

Table 3-2. Display Summary

Display Section	Item	Mode
Primary Labor Parameters	Fetal Heart Rate 1 (FHR1)	US, US2, FECG, or INOP
	Fetal Heart Rate 2 (FHR2)	US, US2, or INOP
	Uterine Activity (UA)	TOCO, IUP, or INOP
Additional Parameters	Maternal Blood Pressure	NBP
	Maternal Heart/Pulse Rate	MECG or PULSE
	Fetal or Maternal SpO_2	%$FSpO_2$ or %$MSpO_2$
Waveform	Fetal ECG Waveform; Maternal ECG Waveform; Fetal SpO_2 Pulsatile Waveform; or Maternal SpO_2 Pulsatile Waveform	FECG, MECG, $FSpO_2$, $MSpO_2$, or OFF
Time	Current Time, [Label] FROZEN Message and Time of Activation	—
Softkeys	System Configuration Softkey Controls	—

Display Example

Figure 3-2 provides an example of a Model 129 display. In this example:

- Blood pressure is not active as indicated by the absence of numerics.
- Maternal pulse oximetry is active.
- MECG is selected as the heart rates source as indicated by the MECG mode title softkey—rather than PULSE.
- The MECG waveform is displayed at 25 mm/sec, at a size of 2X, with lead II selected.
- Heartbeat coincidence is enabled as indicated by the HBC acronym in the primary labor parameters area.
- All alarms are enabled as indicated by 🔔.

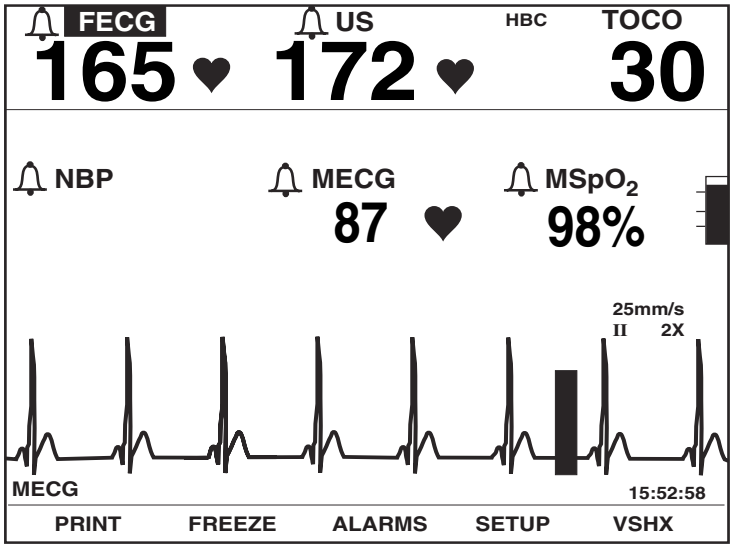

Figure 3-2. Model 129 Display Example

The Model 126 has a unique feature which automatically centers the primary fetal parameters in the display when no waveform is active. See Figure 3-3.

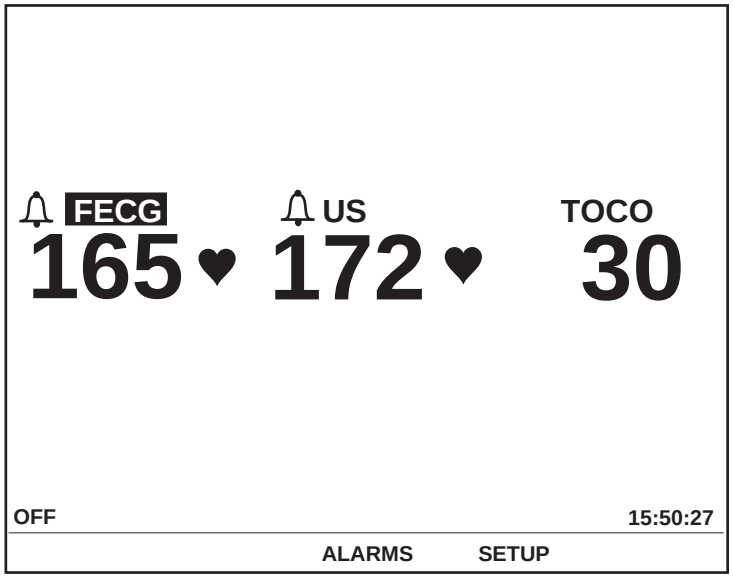

Figure 3-3. Model 126 Display

Primary Labor Parameters

The primary labor parameters section displays FHR1, FHR2, and UA data.

FHR Display

The FHR1 and FHR 2 areas are summarized by Figure 3-4 and Table 3-3.

Figure 3-4. FHR Display

Table 3-3. FHR Display

	Name	Description
A	FHR Value	Up to three digits indicate the fetal heart rate in beats per minute.
B	FHR Alarm Setting Indicator	This symbol provides information about the FHR audio alarm ***and*** the FHR high/low alarm limit settings. See "Chapter 11, Alarms" for more information. ■ : An alarm setting is turned off. ■ : All alarm settings are enabled.
C	FHR Mode Title	An abbreviation indicates the monitoring mode in use: FECG, US, US2, or INOP. (FECG only displays in the FHR1 area.) Select the mode softkey to access the respective setup screen. See Table 3-4 for FHR connection options.
D	FHR Heartbeat Indicator	Flashes with each detected valid heartbeat.

Table 3-4. Connectors vs. Display Modes			
Active Connectors		FHR1 Area	FHR2 Area
FECG		FECG	INOP
FECG/US		FECG	US
FECG/US2		FECG	US2
US		US	INOP
US/US2		US	US2
US2		US2	INOP
—		INOP	INOP
FECG/US/US2[a]		FECG	US2

[a] *If three FHR transducers are plugged in, the FECG signal overrides the US signal.*

UA Display

The UA area is summarized by Figure 3-5 and Table 3-5.

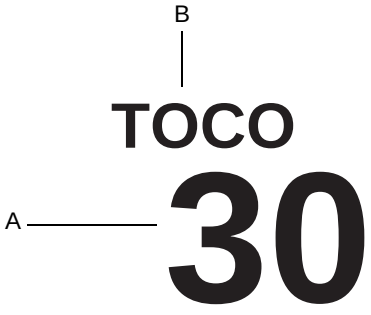

Figure 3-5. UA Display

Table 3-5. UA Display		
	Name	Description
A	UA Value	Up to three digits indicate the uterine activity value—mmHg for internal monitoring or relative units for external monitoring.
B	UA Mode Title	An abbreviation indicates the monitoring mode in use: TOCO, IUP, or INOP.

Additional Parameters

The additional parameters area displays NBP, MHR/P, and MSpO2 data.

Maternal NBP

The maternal NBP section is summarized by Figure 3-6 and Table 3-6.

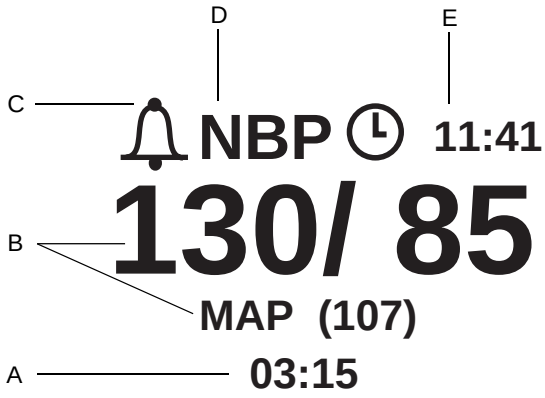

Figure 3-6. NBP Display

Table 3-6. NBP Display		
	Name	Description
A	NBP Time Stamp	The time (in 24-hour format) of the last blood pressure measurement.
B	NBP Values	The systolic/diastolic and mean arterial pressures (MAP) are each indicated by up to three digits—representing mmHg. During a determination, the instantaneous cuff pressure displays in place of the mean arterial pressure and is denoted by the title CUFF.
C	NBP Alarm Setting Indicator	This symbol provides information about the NBP audio alarm ***and*** the NBP high/low alarm limit settings. See "Chapter 11, Alarms" for more information. ■ : An alarm setting is turned off. ■ : All alarm settings are enabled.
D	NBP Mode Title	Select the mode title to access the NBP Setup screen.
E	NBP Countdown Timer	The clock symbol represents activation of the auto mode. The countdown timer indicates the minutes and seconds until the next automatic reading.

MHR/P Area

The MHR/P area is summarized by Figure 3-7 and Table 3-7.

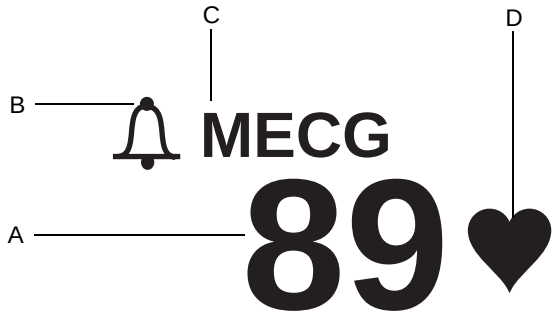

Figure 3-7. MHR/P Display

Table 3-7. MHR/P Display

	Name	Description
A	MHR/P Value	Up to three-digits indicate the MHR/P in beats per minute.
B	MHR/P Alarm Setting Indicator	This symbol provides information about the MHR/P audio alarm *and* the MHR/P high/low alarm limit settings. See "Chapter 11, Alarms" for more information. ■ : An alarm setting is turned off. ■ : All alarm settings are enabled.
C	MHR/P Mode Title	The mode title MECG indicates MECG is the MHR/P source; the mode title PULSE indicates MSpO$_2$ or NBP is used as the source. Select the mode title softkey to access the MHR/P Setup screen.
D	Maternal Heartbeat Indicator	Flashes with each detected valid heartbeat—for MECG only.

$FSpO_2$ Area

The $FSpO_2$ area is summarized by Figure 3-8 and Table 3-8.

IMPORTANT

If $FSpO_2$ is monitored while $MSpO_2$ is inactive, $FSpO_2$ displays in the Additional Parameters Area. When dual SpO_2 monitoring occurs, $FSpO_2$ information is displayed in the Waveform Area beneath the $MSpO_2$ area. Refer to "Chapter 6, Fetal Pulse Oximetry Monitoring".

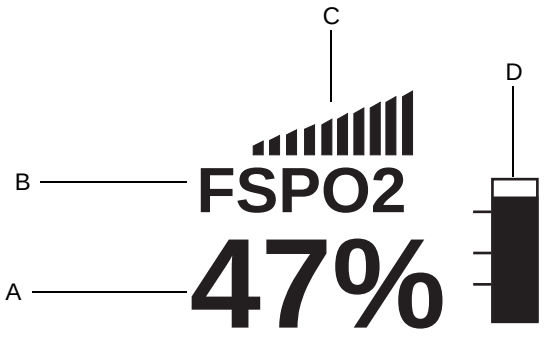

Figure 3-8. $FSpO_2$ Display

Table 3-8. $FSpO_2$ Display		
	Name	Description
A	$FSpO_2$ Value	This three-digit display indicates the $FSpO_2$ level calculated form qualified optical pulses.
B	$FSpO_2$ Mode Title	The $FSpO_2$ title indicates that *fetal* oxygen saturation monitoring is in progress.
C	Signal Quality Indicator	This indicator shows the average signal quality of pulses being detected at the sensor site according to a software algorithm in the 120 F-Series Monitor. The presence of all ten bars represents fetal pulses with consistently high signal quality for $FSpO_2$ measurement. Fewer bars represents diminished signal quality. The absence of bars represents a lack of fetal pulses with acceptable signal quality.
D	Pulse Amplitude Indicator	This vertical bar qualitatively indicates pulse amplitude at the sensor site.

$MSpO_2$ Area

The $MSpO_2$ area is summarized by Figure 3-9 and Table 3-9.

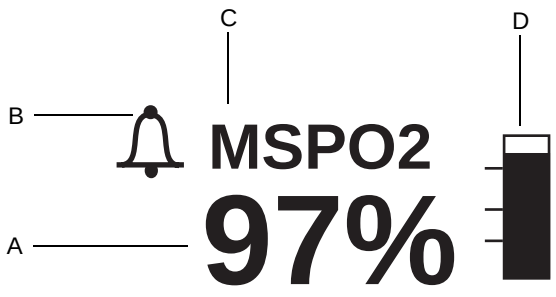

Figure 3-9. $MSpO_2$ Display

Table 3-9. $MSpO_2$ Display		
	Name	Description
A	$MSpO_2$ Value	Up to three digits indicate the percentage of oxygen in the mother's blood.
B	$MSpO_2$ Alarm Setting Indicator	This symbol provides information about the $MSpO_2$ audio alarm ***and*** the $MSpO_2$ high/low alarm limit settings. See "Chapter 11, Alarms" for more information ■ : An alarm setting is turned off. ■ : All alarm settings are enabled.
C	$MSpO_2$ Mode Title	Select the mode title to access the $MSpO_2$ Setup screen.
D	$MSpO_2$ Pulse Amplitude Indicator	This vertical bar qualitatively indicates pulse amplitude.

Waveform Area

The waveform area displays approximately four seconds of waveform data for: FECG, MECG, $FSpO_2$ or $MSpO_2$. Refer to "Chapter 15, Waveforms" for more information.

Time and Waveform Message Area

The current time (in 24-hour format) always displays on the far right. When a waveform is frozen, the message [Label] FROZEN displays on the far left, along with the time of activation.

Battery-Backed RAM Status

Whenever you turn off a 120 Series Monitor, a battery provides power to the RAM (random access memory) that stores information such as time, date, default settings, etc.

Figure 3-10. Low Battery Icon

The icon shown above will appear in the upper right-hand section of the monitor under the following circumstances.

Table 3-10. Battery-Backed RAM Status

Icon Appearance	Reason	Solution
Icon appears and then disappears after power cycle.	Data corruption. Your monitor has reverted to factory settings.	Access setup screens and configure last-used settings.
Icon appears after multiple power cycles.	Battery requires service.	Call GE Service to report.

Softkeys

A softkey is an area on the screen that can be selected with the Trim Knob control. When the softkey is activated by pressing the Trim Knob control, it may cycle through available settings or it may display a setup screen.

Mode Title Softkeys

Most of the mode titles in the display are also softkeys which give access to corresponding setup screens: US, US2, FECG, NBP, MECG, PULSE, $FSPO_2$ and $MSPO_2$.

Waveform Softkeys

The waveform title is a softkey used to select the waveform for display or to disable the area, The ECG scale and MECG lead labels are softkeys used to configure the waveform currently displayed.

Dedicated Softkey Area

Softkeys are located at the bottom of each screen, as shown in Figure 3-11 and Figure 3-12. Although there are many possible softkeys which may appear in this area, a maximum of five are shown at a time.

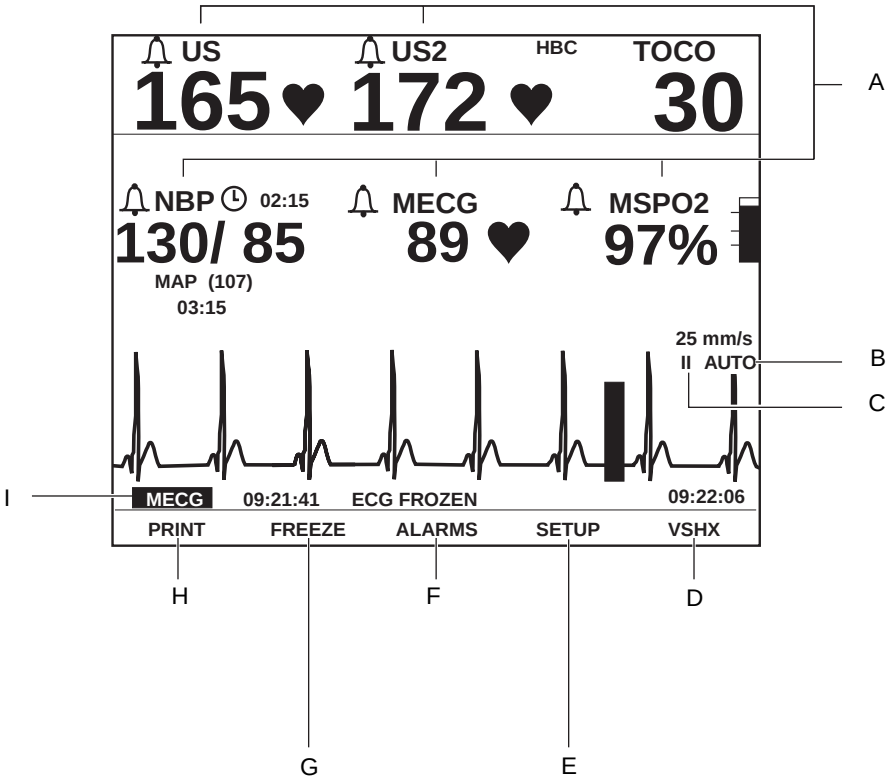

Figure 3-11. Display Summary

Table 3-11. Display Summary		
	Name	Description
A	Mode Title Softkeys	Selects US, US2, FECG, NBP, MHR/P, or SpO_2 Setup screens.
B	ECG Scale Softkey	Selects 0.25X, 0.5X, 1X, 2X, 4X, or AUTO.
C	MECG Lead Select Softkey	Selects Lead I, II, or III.
D	VSHX Softkey	Displays maternal Vital Signs History screen.
E	SETUP Softkey	Displays General Setup screen
F	ALARMS Softkey	Displays Master Alarm Setup screen.
G	FREEZE Softkey	Freezes waveform for analysis; unfreezes waveform to return to real-time display.
H	PRINT Softkey	Prints six-second snapshot of frozen waveform, real-time waveform, or maternal vital signs history.
I	Waveform Softkey	Selects FECG, MECG, $FSpO_2$, $MSpO_2$, or OFF.

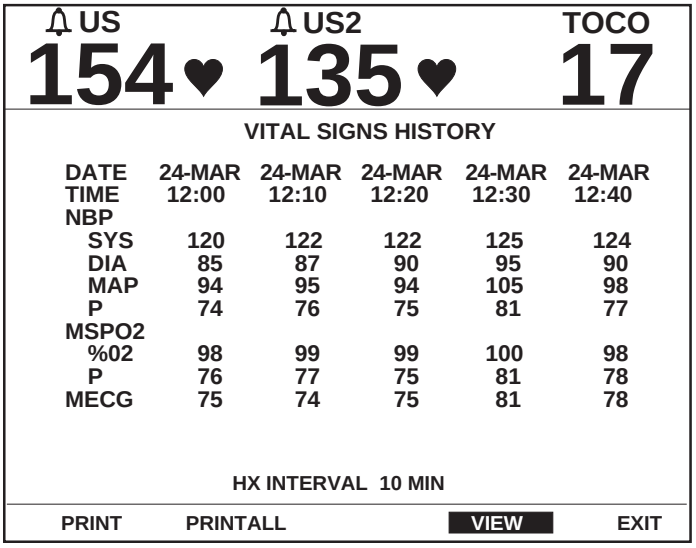

Figure 3-12. Maternal Vital Signs History Screen Softkeys

Table 3-12. Maternal Vital Signs History Screen Softkeys		
	Name	Description
A	PRINT Softkey	Prints one page (screen) of the table.
B	PRINTALL Softkey	Prints all pages (screens).
C	VIEW Softkey	Scrolls through the data: ■ Left for recent data ■ Right for oldest data
D	EXIT Softkey	Returns to the previous screen.

Rear Panel Description

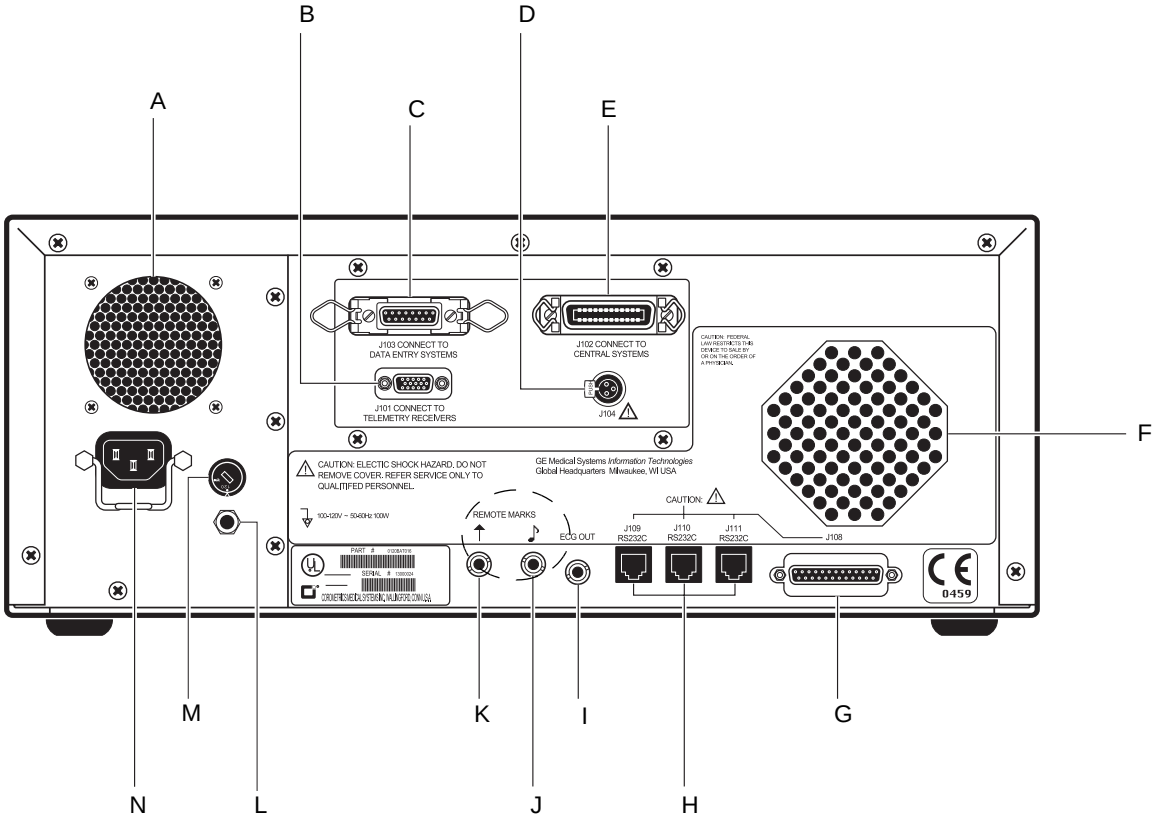

Figure 3-13. 120 Series Rear Panel Connectors (Standard and Optional)

IMPORTANT

The Fetal Acoustic Stimulator and Remote Event Marker connectors are identical in size and shape. Be sure you connect to the proper opening to ensure accurate information.

NOTE: Although the J104 Nurse Call connector is physically present on the optional communications package, this connector is only supported as part of the Spectra Alerts option discussed in "Appendix D, Spectra Alerts".

Table 3-13. 120 Series Rear Panel (Standard and Optional Features)

	Name	Description
A	Vent	Provides ventilation for the monitor's internal circuitry.
B	J101 Telemetry Connector	Connector for Corometrics telemetry system interface. (Installed as part of an optional communications package.)
C	J103 Data Entry Connector	Connector for data entry system interface. (Installed as part of an optional communications package.)
D	J104 Nurse Call Connector	Connector for standard Nurse Call System interface. The connector's maximum output is 50 Vdc at 100 mA; the maximum on resistance is 0.5 Ω. (Installed as part of an optional communications package.)
E	J102 Central Systems Connector	Connector for analog central station system interface. (Installed as part of an optional communications package.)
F	Speaker	The rear panel speaker emits an audible tone for heart rates, MSpO$_2$ pulse with %O$_2$-dependent pitch, and alarms. It also provides the sound for the song player feature.
G	J108 Corolan Connector	This 25-pin connector is used for interfacing to optional Corometrics equipment. Contact your Service Representative for more information.
H	J109, J110, and J111 RS-232C Communications Connectors	Three serial RJ-11 connectors are provided for interfacing to peripheral equipment. Contact your Service Representative for more information.
I	ECG Out Connector	External recorder receptacle for MECG signals. The standard output level is 1 V/mV.
J	Fetal Acoustic Stimulator Connector	Receptacle for Corometrics Model 146 Fetal Acoustic Stimulator (FAST). A music symbol prints on the strip chart paper each time the Model 146 is used: ♪

Table 3-13. 120 Series Rear Panel (Standard and Optional Features)		
	Name	Description
K	Remote Event Marker Connector	Receptacle for the Corometrics Remote Event Marker. When activated, one of the following marks prints on the strip chart paper: ■ The event marker is commonly used to record an "event": ↑ ■ The fetal movement marker (default setting) is commonly used as an indication that the mother has perceived fetal movement: FM ↑ Refer to the "120 Series Monitor Service Manual" for more information.
L	Equipotential Lug	A binding post terminal is directly connected to the chassis for use as an equipotentiality connection.
M	AC Voltage Selection Switch	This switch is intended for qualified service personnel to select a voltage range for the AC input: ■ 120: Accepts an AC input in the range of 100–120 VAC. ■ 240: Accepts an AC input in the range of 220–240 VAC
N	Power Entry Module	AC line power cord receptacle. Refer to the rear panel markings to verify line voltage and line frequency requirements.

CAUTION

NON-DESTRUCTIVE VOLTAGE—The maximum non-destructive voltage that may be applied to the rear panel connectors is 0 volts. Do not attempt to connect cables to these connectors without contacting your Biomedical Engineering Department or GE Medical Systems *Information Technologies* Service Representative. This is to ensure the connectors comply with leakage-current requirements of one of the following applicable standards: Underwriters Laboratories UL-2601.1, Canadian Standards Associations CSA 22.2 No. 125, or International Electrotechnical Commission EN60601.1.

Communication Option

The communication option is an additional circuit board that can be installed in the 120 Series Monitor. Contact your Service Representative for upgrade information. The following four connectors are part of the optional communications package: J101, J102, J103, and J104.

Corolan Option

J108 is installed as part of a Corolan Option. Contact your Service Representative for upgrade information.

For your notes

Chapter 4

Setup Procedures

This section lists all available setup options in the monitor and provides step-by-step instructions for making selections:

Loading Strip Chart Recorder Paper

Refer to “Paper Supplies Ordering Information” on page 19-3 to order paper ***required*** for use with the 120 Series Monitor.

- (HR scale of 30–240 BPM); or
- (HR scale of 50–210 BPM).

Refer to “Chapter 12, Recorder Modes” for more information about the different paper styles.

CAUTIONS

LOADING PAPER—The instructions for loading paper into the 120 Series Monitor are different than the instructions for loading paper into other Corometrics monitors. Improper loading can cause paper jams. Follow the instructions carefully.

PAPER TYPE—Do not use *non*-Corometrics paper or paper designed for use with *other* Corometrics monitors. Using paper other than catalog number (REF) 4305CAO/DAO: may produce inferior print quality; could result in permanent damage to the recorder’s print head; and may void your warranty.

STORAGE/TRANSPORT—Paper should be installed in the monitor’s strip chart recorder at *all* times. This reduces particle build-up on the printhead and facilitates opening the recorder door.

To install Corometrics chart paper in the 120 Series Monitor, follow these steps:

1. Press down on the latch on the right side of the strip chart recorder door to open the recorder door.

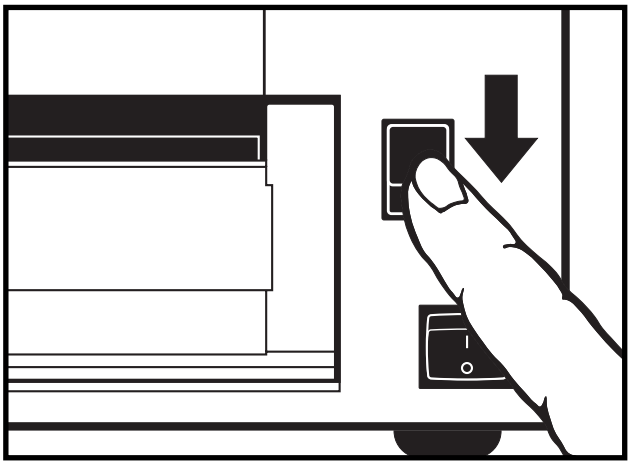

Figure 4-1. Opening the Recorder Door

2. Fan the pack of Z-fold paper on all sides to loosen any folds and to ensure proper feed of the paper through the recorder.

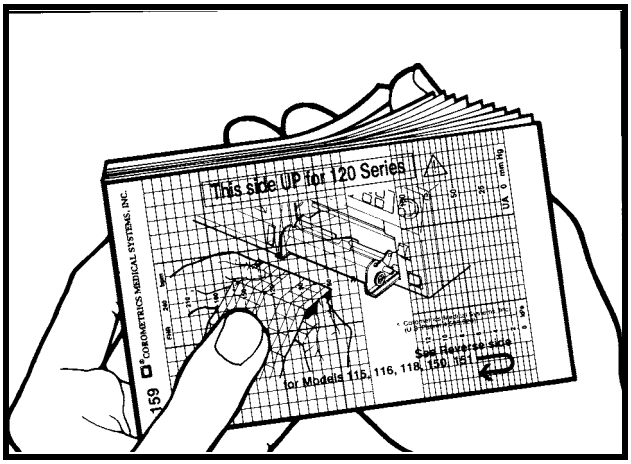

Figure 4-2. Fanning the Paper

NOTE: The black squares indicate the end of the recorder paper. When the black squares appear, the strip chart recorder has approximately 20 minutes of paper remaining, when running at a speed of 3 cm/min.

NOTE: The paper is labelled, "This side up in 120 Series Monitors."

3. Hold the package of paper so that:
   - **the black squares are on the *bottom* of the pack**; and
   - the Corometrics logo and page numbers are on the *left* side of the pack.

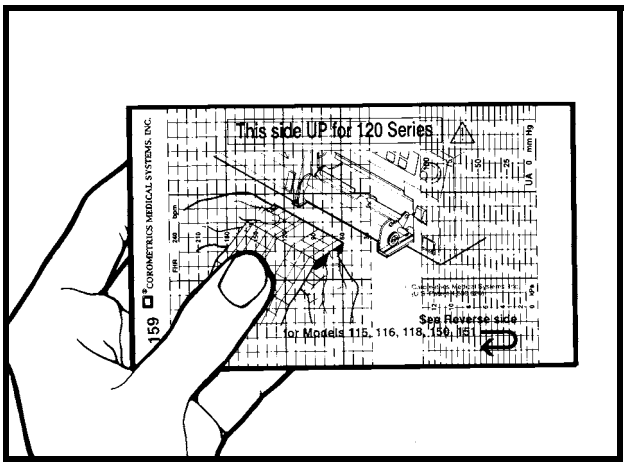

Figure 4-3. Orienting the Paper

4. Unfold two sheets from the *top* of the package so that they extend toward you.

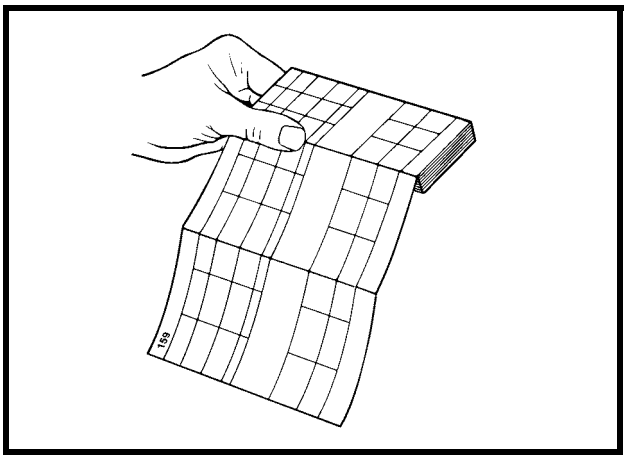

Figure 4-4. Creating a Paper Leader

5. Place the pack in the drawer so that the pack is laying flat in the recorder.

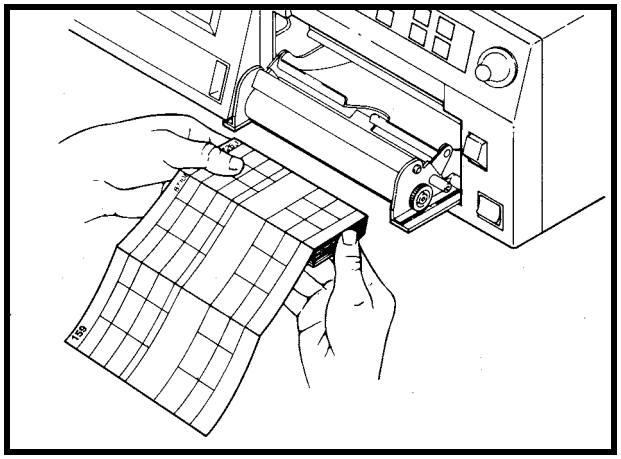

Figure 4-5. Inserting the Paper

6. Close the strip chart recorder door.

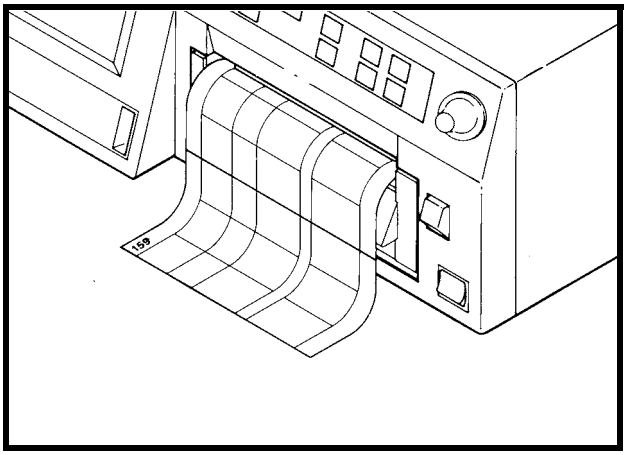

Figure 4-6. Closing the Recorder Door

Refer to “Chapter 12, Recorder Modes” for information about paper-loading errors.

Power

1. Ensure the Power switch is in the *off* (O) position.

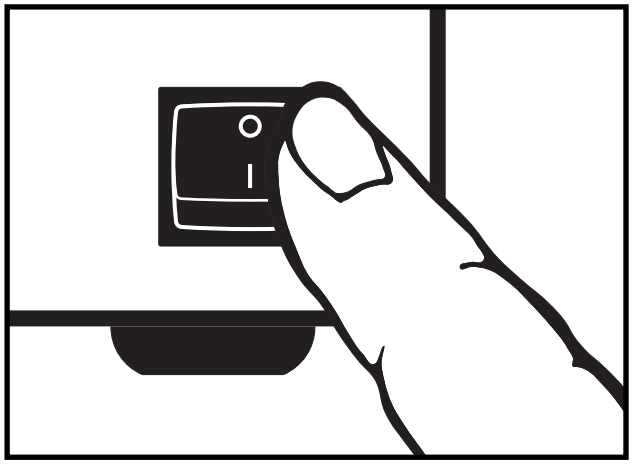

Figure 4-7. Turning the Monitor On/Off

2. Connect the detachable line cord to the rear panel power connector; plug the other end into a hospital grade grounded wall outlet of appropriate voltage. (If you are unsure about the voltage, contact your hospital Biomedical Engineering Department or Service Representative.)

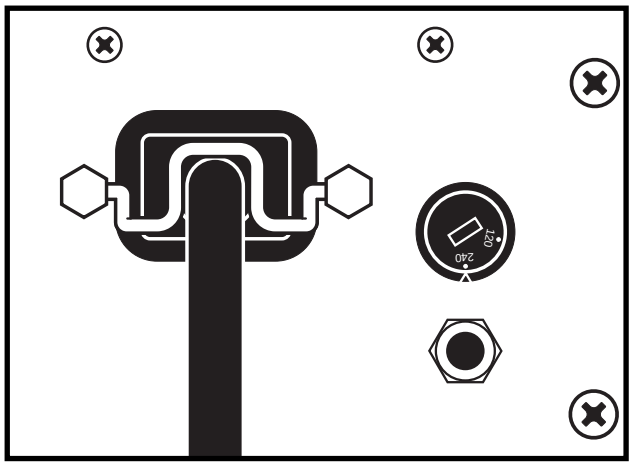

Figure 4-8. Attaching the Power Cord

3. Move the front panel Power switch to the *on* (I) position. The green indicator light, next to the Paper Advance pushbutton, illuminates and a series of tones are heard, indicating that the monitor has been turned *on*.

Self-Test Routine

The 120 Series Monitor contains a self-test routine which checks the calibration and internal circuitry of the monitor. Initiate the self-test routine at the beginning of each monitoring session to print the results on the patient's strip chart.

NOTE: To disable the routine, press the Test pushbutton or open the recorder door.

1. Press and hold the Test button for one second.
2. Refer Table 4-1 and ensure the test results are produced as expected. At the successful completion of the self-test routine, the monitor is ready for use.

Table 4-1. Monitor Self-Test Routines

Test Routine	Description
Display Test	All display pixels illuminate for one second and then all extinguish for one second. Afterwards, a vertical line moves across the screen from left to right, followed by a horizontal line moving from top to bottom. Then the display remains black.
Lamp Test	The yellow Record indicator illuminates.
Recorder Test	The message TEST: ARE ALL DOTS PRINTED? prints followed by two vertical lines which should appear continuous. Discontinuous lines may be an indication of damaged printhead elements if gaps occur in the same place on both lines.
Counting Test	After the Recorder Test, the display returns to the main screen. The software generates a 120 BPM rate in the FHR1 area, a 180 BPM rate in the FHR2 area, and both mode titles display TEST.
Uterine Activity	The monitor adds 50 mmHg to the present pressure level and displays this value in the UA display area; the mode title displays TEST.

Setup Screens

The 120 Series Monitor provides a variety of options that are selected using the setup screens shown on the display. (The illustrations in this section are representative of all possible features. Your monitor screens may vary.) All functions are performed easily using the front panel Trim Knob control.

Setup screens for FECG, US/US2, Maternal NBP, MHR/P, and MSp0$_2$ are detailed in Chapters 5-11.

Using the Trim Knob Control

General instructions for using the Trim Knob control follow:

NOTE: While any setup screen is displayed, the primary labor parameters remain displayed.

1. To display a parameter setup screen, rotate the Trim Knob control until the bar cursor highlights the title of the parameter (FECG, US, US2, NBP, MECG, PULSE, FSpO$_2$ or MSpO$_2$). To access the Master Alarm Setup screen or the General Setup screen, rotate the Trim Knob control until the bar cursor highlights the ALARMS softkey or the SETUP softkey, respectively, on the bottom of the screen.
2. Press the Trim Knob control once to display the selected setup screen.
3. While the screen is displayed, rotate the Trim Knob control until the desired field is highlighted.
4. Press the Trim Knob control again to activate the selected field. The cursor flashes to indicate the field is active.
5. Rotate the Trim Knob control in either direction to cycle through the available choices for the field. Continuous rotation will wrap around through the choices.
6. When the desired selection is made for the field, press the Trim Knob control once to confirm the selection.
7. Repeat steps three (3) through six (6) until all desired settings have been made.
8. Rotate the Trim Knob control until the bar cursor highlights the EXIT softkey on the bottom of the screen. This returns the monitor to normal operation.

IMPORTANT
EFFECTIVITY—All changes take effect immediately after a selection is enacted in step six (6).

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General Setup Screen

Figure 4-9 shows a sample General Setup screen.

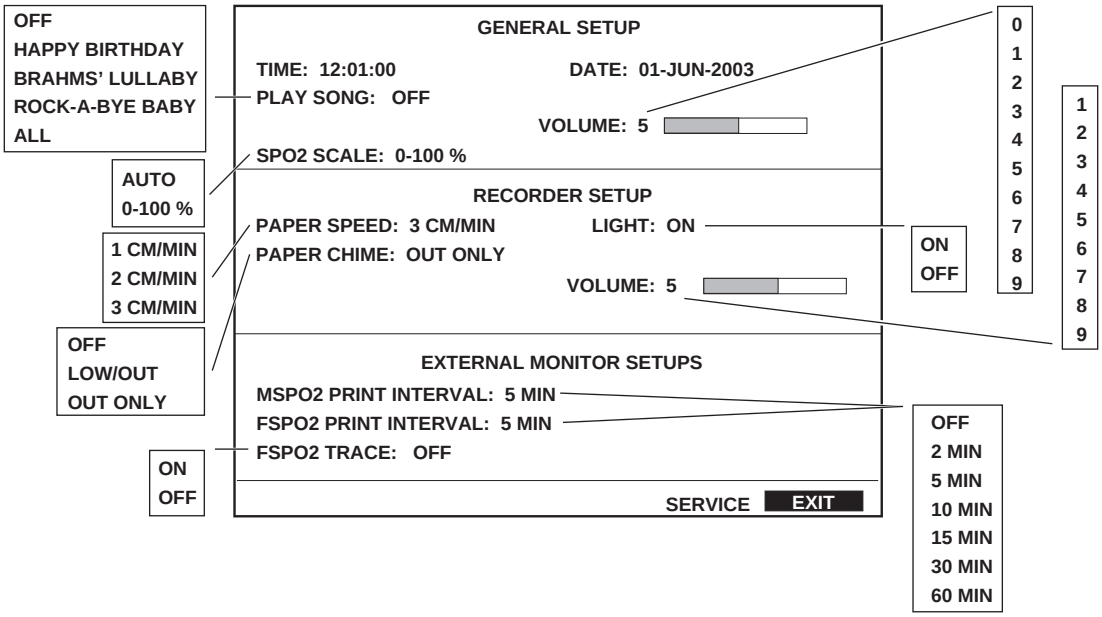


Figure 4-9. General Setup Screen

Time

It is very important to set the monitor's clock prior to initial operation and during daylight-saving time changes. A long-lasting battery maintains the set time even when the monitor is unplugged from AC power.

The time is represented by a 24-hour clock in hours, minutes, and seconds. The hour field has a range from 00–23; the minutes field has a range from 00–59; the seconds field is not adjustable.

Date

It is very important to set the date on your monitor prior to initial use. The month field has a range from 01–12; the range for the day field varies according to the selection for month and year*; the year field has a range of 00–99. A long-lasting battery maintains the date even when the monitor is unplugged from AC power.

* *For example: February of 1996 has a day range of 01–29; February of 1997 has a day range of 01-28; August of 1997 has a day range of 01–31.*

Song Player

You can activate a song to be played from the monitor's speaker to celebrate each birth.

Song Player Volume

This field sets the volume of the song player.

SpO_2 Scale

Two scale options are available for printing the %MSpO_2 trend, for compatibility with %FSpO_2 trending. (%FSpO_2 is *always* trended on a scale of 0–100%.) The scale is printed on the paper along with the trend.

- **Auto:** If only the %MSpO_2 trend is printing, the trend plots on an expanded scale of 60–100% or 50–100%, depending on the paper.* Whenever the%FSpO_2 is being trended, the monitor automatically switches to a scale of 0–100% for both %MSpO_2 and %FSpO_2.)
- **0–100%:** This option configures the %MSpO_2 trend to always plot at a fixed scale of 0–100% — even when the maternal trend prints alone.

Paper Speed

This field selects the paper speed of the strip chart recorder.

Paper Chime

This field enables/disables an audible tone to indicate a low-paper or out-of-paper condition. Refer to "Chapter 12, Recorder Modes".

Recorder Light

This field turns the recorder light on and off. This light permits the room lights to be dimmed without sacrificing visibility of the strip chart recorder. A patient can remain resting, without the disturbance of overhead lights, while a nurse or physician checks the strip chart.

IMPORTANT

RECORDER LIGHT—The recorder light is only available on monitors purchased with Software Version 3.0 or greater. Older monitors can be upgraded to Software Version 3.0 or greater; however, the recorder light will not be available. If your monitor has a recorder light: the LIGHT field displays on the General Setup screen; and a frosted plastic light cover is located above the strip chart recorder.

Paper Chime Volume

This field sets the volume of the paper chime. As you adjust the volume, a sample tone sounds.

* *The %MSpO_2 trend is plotted over a range of 60–100% on paper with a HR scale of 30–240 BPM. The %MSpO_2 trend is plotted over a range of 50–100% on paper with a HR scale of 50–210 BPM.*

$MSpO_2$ Print Interval

This field sets the time interval for printing $MSpO_2$ values received from an ***external*** maternal pulse oximetry monitor.

$FSpO_2$ Print Interval

This field sets the time interval for printing $FSpO_2$ values received from an ***external*** fetal pulse oximetry monitor.

$FSpO_2$ Trace

This field enables/disables $\%FSpO_2$ trend trace printing of data received from an ***external*** fetal pulse oximetry monitor.

Customizing the Power-On Settings

The 120 Series Monitor is shipped with factory defaults for the setup screens. You can change most of these settings to suit your particular needs. The monitor has three options for the monitor's *power-on* settings:

- Factory Defaults
- Current Settings
- Hospital-Wide Preferences

Refer to the "Accessing the Install Options Screen" next in this chapter for information about selecting the default option set.

Factory Defaults

Factory defaults represent settings chosen to meet the requirements of a typical labor and delivery environment. If the monitor is set to the FACTORY option, the monitor will power up with the settings that are listed in Appendix A, "Factory Defaults" .

You may adjust the setup screen configurations as needed during monitoring; however, be advised that if you turn off the monitor, all user setup screens revert to the factory defaults when the monitor is turned on again.

Current (Last-Used) Settings

If you monitor intermittently *and* configure the monitor for each patient, the CURRENT option may be right for you. This option causes the monitor to power up with the last used settings—stored in battery-backed memory.

Hospital Defaults

The NEW HOSPITAL option allows your hospital to configure its own set of preferences to be used each time the monitor is powered on. Record your hospital settings in Appendix A, "Factory Defaults" for reference. Once the settings have been defined, this option changes to read HOSPITAL-WIDE.

You may adjust the setup screen configurations as needed during monitoring; however, be advised that when you turn off the monitor, all user setup screens revert to the hospital-defined preferences when the monitor is turned on again.

Volume Exceptions

The monitor is shipped from the factory with the FHR volumes set at 5. However, the volume on the FECG, US, US2, or MHR/P Setup screen ***is not*** stored as part of any power-on set (Factory, Current, or Hospital-Wide). Regardless of how you set the volume (using a setup screen or the Volume buttons):

- If the volume setting at power-off is in the range 0–7, that volume remains set at power-on.
- If the volume setting at power-off is in the range 8–9, the volume is adjusted to 5 at power-on.

Accessing the Install Options Screen

To customize the Power-On settings and to set other monitor options:

1. Select the SETUP softkey from the main operating screen to display the General Setup screen (Figure 4-10).

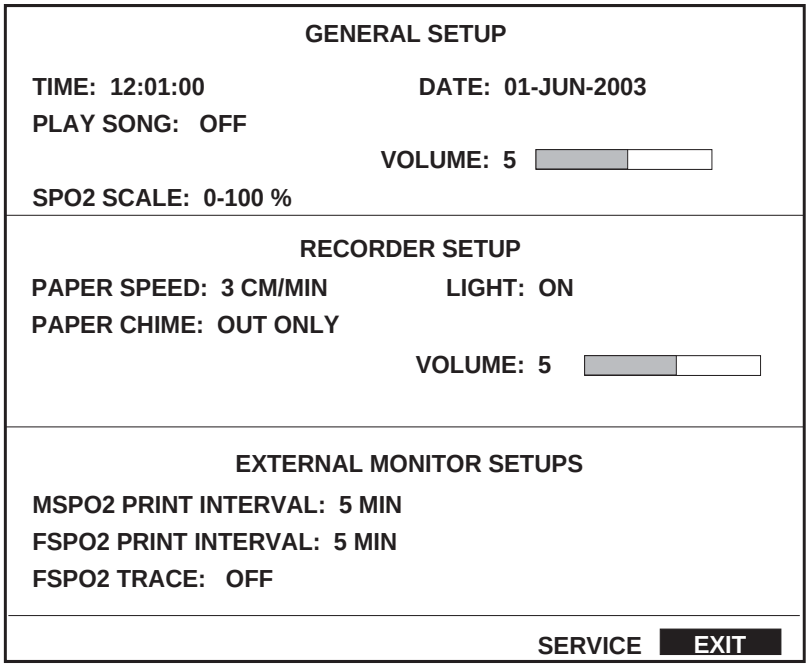


Figure 4-10. General Setup Screen

2. Select the SERVICE softkey from the General Setup screen to display the Service Lock screen (Figure 4-11). The access code is displayed as 0 0 0 0.

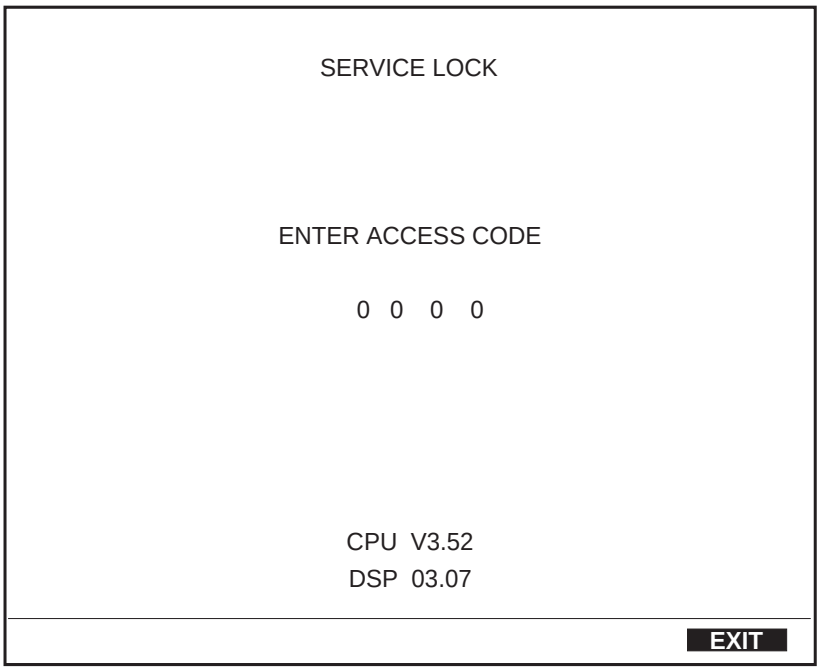


Figure 4-11. Service Lock Screen

NOTE: The correct date and time must be set on the General Setup screen or you will not gain access to the service screens.

3. Use the Trim Knob control to set the access code to the current month and date. You can enter the date followed by the month; or the month followed by the date. For example: February 21 can be entered as 0 2 2 1 or 2 1 0 2.
4. As soon as you enter the correct access code, the Install Options screen displays (Figure 4-12).

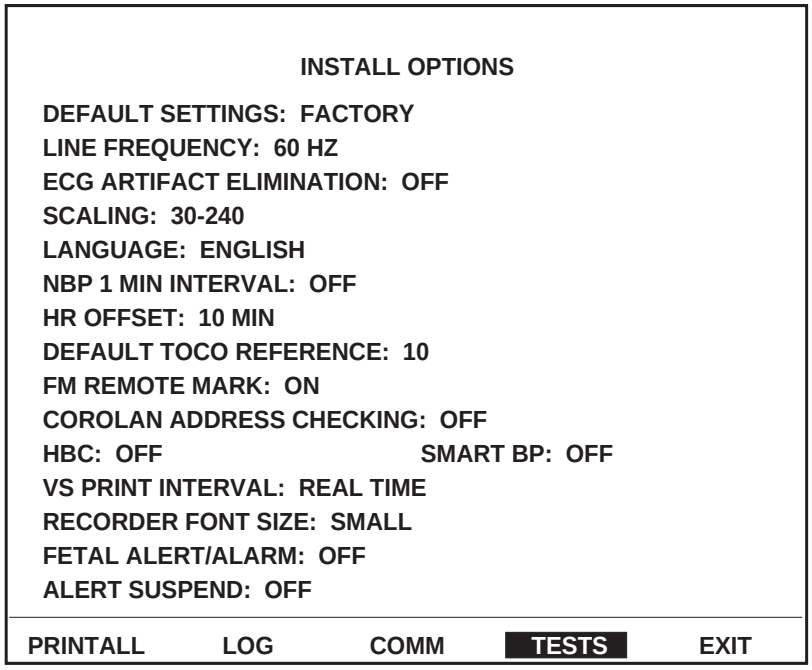


Figure 4-12. Install Options Screen

5. Refer to the "120 Series Monitor Service Manual" for more information about the Install Options screen.

Preparing the Monitor for Patient Use

The following procedures should be performed before use on *each* patient:

1. Ensure an adequate supply of paper is in the recorder. The recorder will automatically stop when paper runs out. If the recorder requires paper, refer to "Loading Strip Chart Recorder Paper" on page 4-2.
2. Set the chart speed to the desired setting (1, 2, or 3 cm/min), Refer to "General Setup Screen" on page 4-9.
3. Ensure the Power switch is in the *on* position.
4. Connect the appropriate transducers for monitoring. Read the "Maternal/Fetal Monitoring Operator's Manual" for instructions on applying the transducers.
5. Ensure the setup menus are configured appropriately for use on this patient. Refer to "Setup Screens" on page 4-8.
6. Turn the recorder *on*. Refer to "Chapter 12, Recorder Modes" for more information.

CAUTION
PAPER MOVEMENT—Always ensure that the chart paper is properly moving out the front of the recorder drawer when the Record indicator light is on.

7. Press the Paper Advance pushbutton to create a paper leader.
8. Press the Test button to run the monitor's self-test routines. Refer to "Self-Test Routine" on page 4-7.
9. Check the time and date that is printed on the strip chart paper. Refer to "General Setup Screen" on page 4-9 if you need to change the time/date setting.
10. Annotate the patient name and ID# using the optional Corometrics Model 2116B Data-Entry/Clinical-Notes Keyboard, if available.

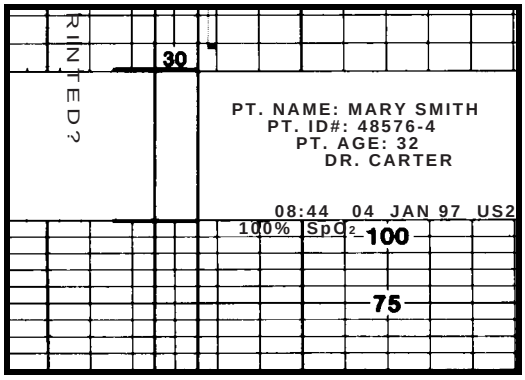


Figure 4-13. Annotating Patient Information

For your notes

Chapter 5

Fetal Heart Rate Monitoring

This section provides a brief overview of the fetal heart rate monitoring methods available on 120 Series Maternal/Fetal Monitors. Refer to the "Maternal/Fetal Monitoring Operator's Manual" for patient application information.

This chapter describes the following monitoring methods:

Ultrasound (External Method)

Methodology

An ultrasound transducer placed on the maternal abdomen is used to direct an ultrasonic beam toward the fetal heart; the transducer detects Doppler shifted frequency changes in echoes created by moving cardiac structures. An autocorrelation process is used to determine the time interval between successive cardiac cycles.

The fetal heart rate is displayed in BPM and is continuously plotted on the strip chart paper. (Refer to Table 5-1.) The heartbeat indicator flashes for each detected heartbeat.

US/US2 Setup Screen

Select the US or US2 softkey to access the US/US2 Setup screen (Figure 5-1). The title of the screen (US vs. US2) is dependent on the mode selected when the screen is activated.

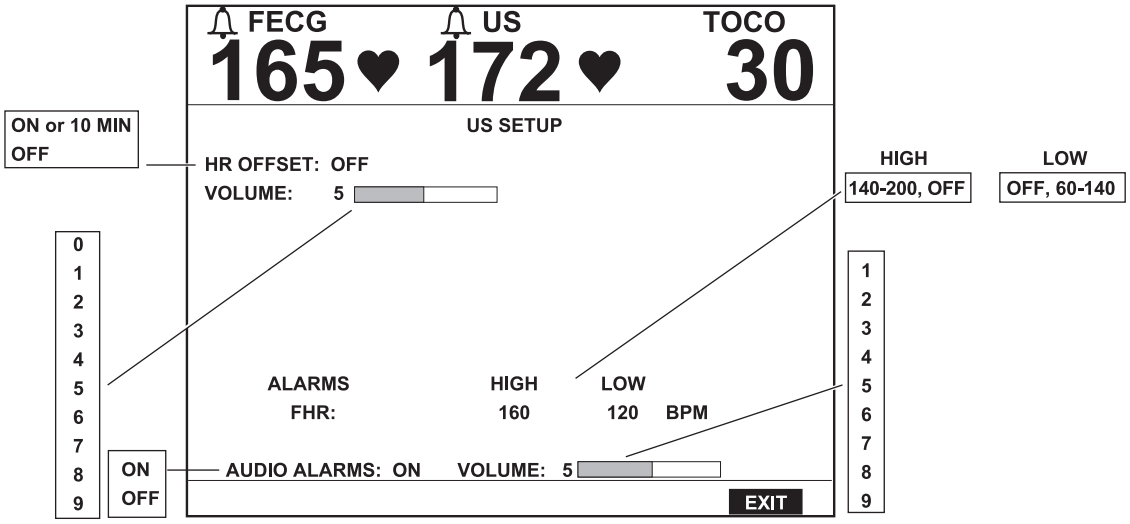


Figure 5-1. US/US2 Setup Screen

Fetal Heart Rate Offset

This field is used to shift the secondary FHR trend +20 BPM to facilitate viewing overlapping trends. This field provides an alternative to using the front panel Mark (Offset) button.

- **On*:** Shifts the secondary FHR trend +20 BPM.
- **10 Min*:** Shifts the secondary FHR trend +20 BPM. After 10 minutes, the trend automatically returns to the unshifted position.
- **Off:** Returns the secondary FHR trend to the unshifted position.

The FHR Offset field is only present on the setup screen when:

- the heart rate offset option is enabled via the Install Options service screen; *and*
- the screen is activated by selecting the mode listed in the FHR2 area of the display.

Volume

This field adjusts the volume for the FHR derived from the selected mode, US or US2. This field works in conjunction with the front panel Volume buttons.

FHR Alarm Limits

NOTE: The FHR1 and FHR2 alarm limits are set independently of each other.

These fields adjust the high and low alarm limits for FHR. The available ranges are shown in Figure 5-1; the factory default settings are listed in Appendix A, "Factory Defaults" .

FHR Audio Alarm

This field enables/disables the audio alarm function for the applicable FHR.

- **On:** Visual and audible indications are provided during an FHR alarm condition.
- **Off:** Only a visual indication is provided during an FHR alarm condition.

Master Alarm Volume

This field controls the alarm volume for all alarms.

* *This field selects between either on and off or 10 Min and off, depending on how this feature is enabled on the Install Options service screen.*

FECG (Internal Method)

Methodology

This method uses an electrode attached directly to the fetal presenting part. The electrode is connected to the cable/legplate secured to the mother. The fetal heart rate is computed based upon the interval between successive R-wave peaks of the fetal QRS complex.

The fetal heart rate is displayed in BPM and is continuously plotted on the strip chart recorder paper. (Refer to Table 5-1.) The heartbeat indicator flashes for each detected heartbeat.

Artifact Elimination

An ECG artifact elimination option is available on all 120 Series Monitors.

Enabling/Disabling Artifact Elimination

NOTE: This option only affects direct FECG monitoring. Ultrasound monitoring is unaffected by this setting.

This option is enabled/disabled via the Install Option service screen — the factory default setting is *off*. (Refer to the "120 Series Monitor Service Manual" for more information.)

Theory and Methodology

When ECG artifact elimination is turned *on*, the monitor does not print any new FHR value which differs by more than ±25 BPM from the previously calculated heart rate value. The printing inhibition functions on a beat-to-beat basis by comparing the last calculated rate against the newly calculated rate. The rate used for comparison purposes is always the previous rate regardless of whether this rate passed the previous ±25 BPM test. When ECG artifact elimination is turned *off*, all direct ECG rates are plotted by the recorder without regard to their deviation from previous rates. The effect of this function change is that sudden heart rate changes (such as certain arrhythmias, accelerations or decelerations) as well as artifactual changes (as when the electrode is disturbed or loosely connected) are recorded when ECG artifact elimination is turned *off*. They are not recorded when ECG artifact elimination is turned *on*; instead gaps in the tracing occur.

FECG Setup Screen

Select the FECG softkey to access the FECG Setup screen (Figure 5-2).

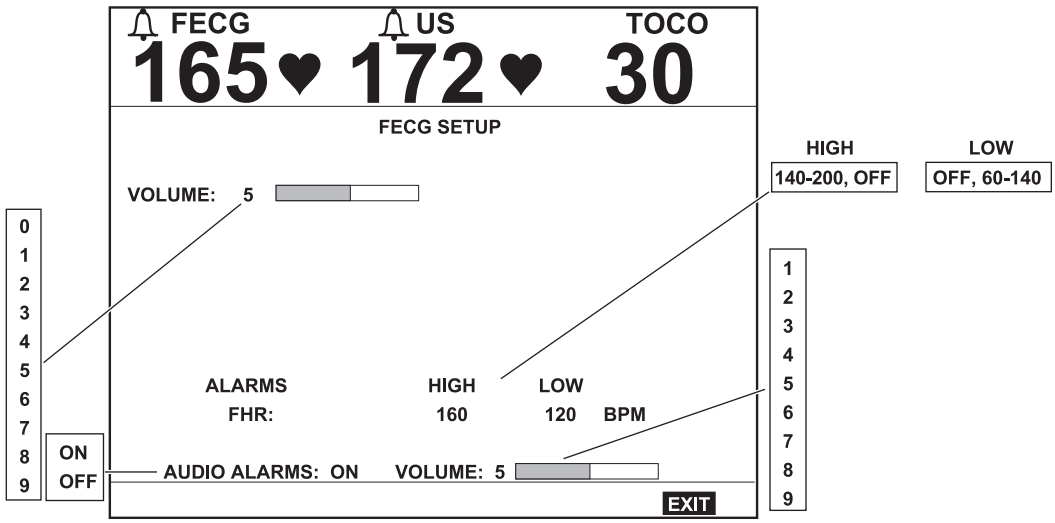


Figure 5-2. FECG Setup Screen

Volume

This field controls the volume for the FHR derived from FECG. This field works in conjunction with the front panel Volume buttons.

FHR Alarm Limits

NOTE: The FHR1 and FHR2 alarm limits are set independently of each other.

These fields adjust the high and low alarm limits for FHR. The available ranges are shown in Figure 5-2; the factory default settings are listed in Appendix A, "Factory Defaults" .

FHR Audio Alarm

This field enables/disables the audio alarm function for FHR when derived from FECG.

- **On:** Visual and audible indications are provided during an FHR alarm condition.
- **Off:** Only a visual indication is provided during an FHR alarm condition.

Master Alarm Volume

This field controls the alarm volume for all alarms.

FECG Waveform

When FECG monitoring is employed, the FECG waveform can be displayed and printed. Refer to "Chapter 15, Waveforms".

Dual Fetal Heart Rate Monitoring

All Corometrics 120 Series Monitors are capable of monitoring two fetal heart rates. The discussion in this section is limited to methods of monitoring dual fetal heart rates; however, it is important to note that MECG* monitoring can continue during the monitoring of twins—even when one twin is monitored using FECG. (Refer to "Chapter 8, Maternal Heart/Pulse Rate Monitoring", for more information.)

The dual fetal heart rate monitoring modes are summarized as follows:

- dual external (US/US2); or
- internal/external (FECG/US or FECG/US2).

The 120 Series offers two advanced features to aid in monitoring twins:

- heartbeat coincidence
- fetal heart rate offset

NOTE: In the event that three transducers are plugged into the monitor, FECG overrides the primary ultrasound connector (US).

Table 5-1. FHR Display and Trend Summary

ACTIVE CONNECTORS	DISPLAY MODE		TREND ANNOTATION	
	FHR1	FHR2	FHR1	FHR2
US	US		US	
US2	US2		US	
FECG	FECG		FECG	
US, US2	US	US2	US	US2
FECG, US	FECG	US	FECG	US
FECG, US2	FECG	US2	FECG	US2
FECG, US, US2	FECG	US2	FECG	US2

Heartbeat Coincidence

All 120 Series Monitors have a feature called heartbeat coincidence. When this feature is enabled, the monitor alerts you when there is the possibility that you may be monitoring a duplicate signal. Refer to "Chapter 14, Heartbeat Coincidence" for more information.

Fetal Heart Rate Offset

When monitoring dual fetal heart rates, overlapping traces may be difficult to interpret. All 120 Series Monitors provide a +20 BPM shift for the secondary FHR trend to alleviate this problem—whether using dual ultrasound or ultrasound and FECG.

MECG monitoring is available on a Models129 only.

Enabling/Disabling the Fetal Heart Rate Offset Feature

NOTE: *Enabled* and *active* do not mean the same thing. When the option is enabled via a service screen you then have the capability to *activate* and *de-activate* the function as needed.

The fetal heart rate offset feature can be enabled/disabled from the Install Options service screen. Refer to the "120 Series Monitor Service Manual" for more information.

The fetal heart rate offset feature has three settings:

- disabled: users cannot activate the function.
- enabled/on: users can activate/de-activate the function.
- enabled/auto-revert: users can activate/de-activate the function; in addition, the shifted trend automatically returns to the unshifted position after ten minutes.

Activating the Fetal Heart Rate Offset Feature

To shift the secondary FHR trend +20BPM:

1. Ensure the recorder is *on*.
2. Press and hold the Mark (Offset) button for *three seconds*. (Or use the US/US2 Setup screen.)

- When using dual ultrasound or US2 and FECG, the US2 trace is shifted +20 BPM and the US2+20 symbol is printed on the upper portion of the top grid every 4.5 cm.
- When using US and FECG, the US trace is shifted +20 BPM and the US + 20 symbol is printed on the upper portion of the top grid every 4.5 cm.
- A right arrow (→) and a vertical dashed line print to draw attention to the start of the shifted trend.

Refer to Figure 5-3 for an example of a shifted trend.

De-activating the Fetal Heart Rate Offset Feature

After the FHR patterns have been assessed, set the secondary FHR trend back to the normal (unshifted) position:*

1. Ensure the recorder is *on*.

NOTE: If the auto-revert (10-MIN) setting is selected on the Install Options service screen, the shifted heart rate trace automatically reverts to normal after 10 minutes.

2. Press and hold the Mark (Offset) button for *three seconds*. (Or use the US/US2 Setup screen.)

   - The trend returns to the unshifted position.
   - A left arrow (←) and a vertical dashed line print to draw attention to the change.

* *Setting the FHR trend to the normal (unshifted) mode does not disable the HR Offset function; it de-activates it. To disable the mode, refer to the "120 Series Monitor Service Manual".*

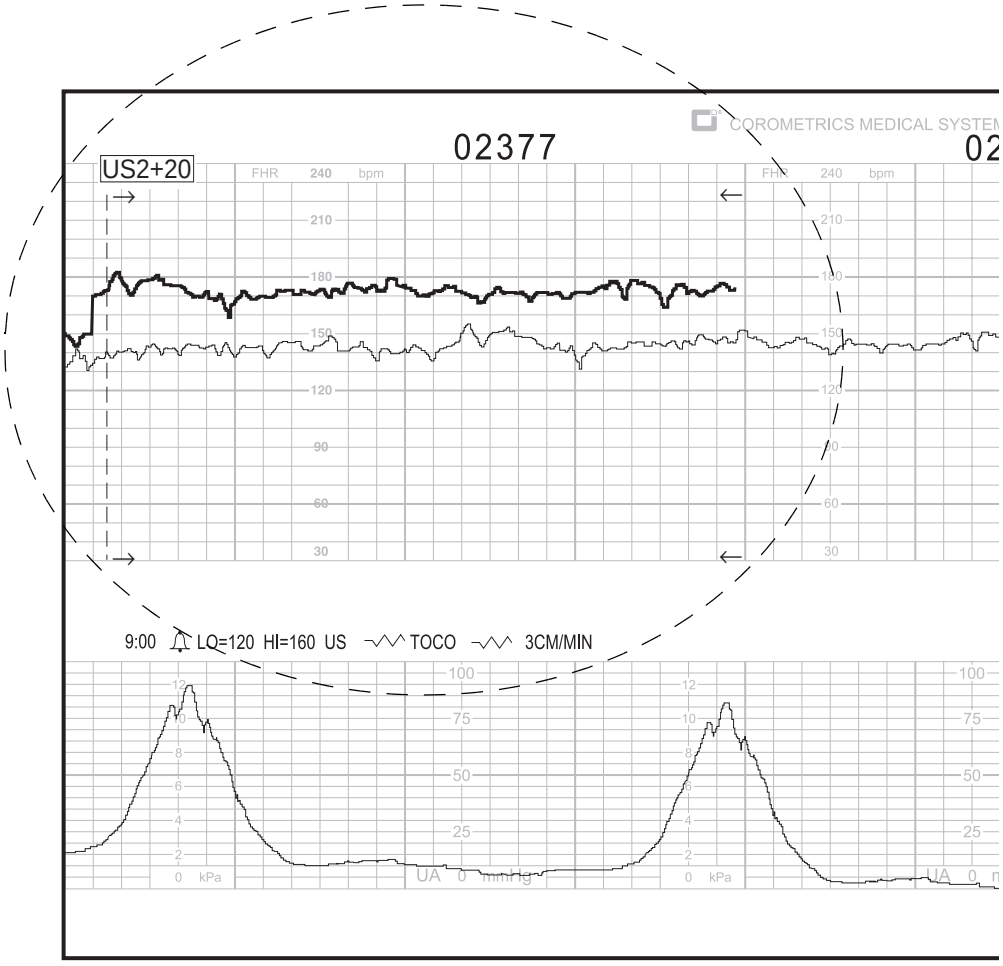


Figure 5-3. Fetal Heart Rate Offset Example

Chapter 6

Fetal Pulse Oximetry Monitoring

A 120 Series Monitor with built-in fetal pulse oximetry is called a 120 F-Series Monitor (Model 126F, Model 128F, or Model 129F). This chapter describes the following:

$FSpO_2$ Indications, Contraindications, Warnings, and Precautions

This chapter contains safety information related to the $FSpO_2$ feature of the monitor only. For overall 120 Series Monitor safety information, refer to "Chapter 1, Safety".

Indications for Use

The 120 F-Series system continuously monitors intrapartum fetal oxygen saturation ($FSpO_2$) and is indicated **as an adjunct** to fetal heart rate (FHR) monitoring in the presence of a non-reassuring fetal heart rate pattern. It should only be used after maternal membranes have ruptured and on a singleton fetus in vertex presentation with a gestational age greater than or equal to 36 weeks. (Refer to the "Maternal/Fetal Monitoring Operator's Manual" for additional information.)

$FSpO_2$ Contraindications

CONTRAINDICATION

PATIENT CONDITIONS—Use of the $FSpO_2$ feature is contraindicated in patients with any of the following conditions:

- Documented or suspected placenta previa
- Ominous FHR pattern requiring immediate intervention
- Need for immediate delivery (unrelated to FHR pattern), such as active uterine bleeding.

$FSpO_2$ Warnings

WARNINGS

INDICATIONS FOR USE—The 120 F-Series System continuously monitors intrapartum fetal oxygen saturation ($FSpO_2$) and is indicated **as an adjunct** to fetal heart rate (FHR) monitoring in the presence of a non-reassuring heart rate pattern. It should only be used after maternal membranes have ruptured on a singleton fetus in vertex presentation with a gestational age greater than or equal to 36 weeks.

ELECTROSURGICAL EQUIPMENT—Do not use the $FSpO_2$ feature while using an Electrosurgical Unit (ESU). Remove the fetal oxygen sensor from the mother and fetus before using an ESU. An improperly grounded ESU can cause surface skin burns on the fetus if both the monitor and an ESU are used together.

WARNINGS

EXPLOSION HAZARD—Do not use the monitor in the presence of flammable anesthetics or inside an oxygen tent. Such use may constitute a fire or explosion hazard.

WATER BIRTHS—Do not use the monitor to directly monitor patients during water births, in whirlpool or submersion water baths, during showers, or in any other situation where the mother is immersed in water. Doing so may result in electrical shock hazard.

INTERFACING OTHER EQUIPMENT—Monitoring equipment must be interfaced with other types of medical equipment by qualified biomedical engineering personnel. Be certain to consult manufacturer's specifications to maintain safe operation.

MATERNAL INFECTIONS—Do not use the $FSpO_2$ feature in women with active genital herpes or other infection precluding internal monitoring. Insertion of the fetal oxygen sensor in these women may result in transmission of pathogens to the fetus.

MATERNAL HIV—Do not use the $FSpO_2$ feature in women who are seropositive for human immunodeficiency virus (HIV). Insertion of the fetal oxygen sensor in these patients may result in fetal exposure to the virus.

MATERNAL HEPATITIS—Do not use the $FSpO_2$ feature in women who are seropositive for Hepatitis B and/or Hepatitis E. Insertion of the fetal oxygen sensor in these patients may result in fetal exposure to these antigens.

$FSpO_2$ Precautions

Clinical Use Precautions

CAUTIONS

TRAINING—Physicians and other licensed practitioners who use the $FSpO_2$ feature should have demonstrated expertise in determining fetal presentation and head position, and should be proficient in fetal scalp electrode and intrauterine pressure catheter placement.

DILATION AND ROM—Do not attempt to insert the sensor if the patient is dilated less than 2 cm or if amniotic membranes have not ruptured. Doing so may result in erroneous $FSpO_2$ measurements and/or patient injury. Do not attempt to rupture amniotic membranes with the sensor. Doing so may result in patient injury and/or sensor malfunction.

CAUTIONS

OPERATIVE/ASSISTED DELIVERY—Do not leave the fetal oxygen sensor in place during vacuum extraction, forceps delivery, or Cesarean delivery. Doing so may result in patient injury. Remove the fetal sensor before commencing any form of operative delivery.

STYLET USE—Never attempt to reinsert a stylet into the sensor cable chamber once it has been completely removed during sensor placement. Doing so may tear the stylet channel and expose the stylet which might result in serious patient injury. Sensor adjustments can be accomplished without the stylet.

SENSOR ACCURACY—Suboptimal sensor placement, excessive vernix, fetal hair, or motion artifact (due to uterine contractions or maternal position changes), may result in no $FSpO_2$ values being displayed, or erroneous $FSpO_2$ values.

FETAL BRADYCARDIA—If the fetal heart rate slows during vaginal exam or sensor insertion, stop the procedure. Do not proceed with sensor placement as this can cause a reflex bradycardia stimulus. Wait for the fetal heart rate to return to the previous range before proceeding.

DEFIBRILLATION—Do not leave the fetal oxygen sensor in place during defibrillation. **Even though the sensor manufacturer's package labeling indicates that the sensor may be left in place during defibrillation, the sensor should be removed when used with a Corometrics monitor.**

MRI EQUIPMENT—Do not use a monitor or fetal oxygen sensor during MRI scanning. Strong magnetic fields may affect the device causing erroneous $FSpO_2$ measurements.

Technical Precautions

CAUTIONS

SENSOR TYPE—Do not attempt to use any sensor other than sterile, single-use Nellcor Fetal Oxygen Sensors (FS14 Series) with a Corometrics Monitor. Use of any other Nellcor oximetry sensor or any sensor from another manufacturer may result in system malfunction, erroneous $FSpO_2$ measurements, and/or patient injury.

DAMAGED EQUIPMENT—Do not use a damaged sensor. Doing so may result in patient injury, sensor malfunction, and/or erroneous $FSpO_2$ measurements.

CAUTIONS

CLEANING/STERILIZATION—Never attempt to clean, reprocess, or resterilize fetal oxygen sensors. Doing so may result in sensor malfunction, erroneous $FSpO_2$ measurements, and/or infection or potential tissue injury to mother and/or fetus. Each fetal oxygen sensor is supplied (by Mallinckrodt, Inc.) as a sterile, single-use, disposable device.

SERVICING—Do not remove the monitor cover or attempt to service this monitor yourself. Only qualified service personnel should attempt servicing this equipment. Refer servicing to a GE Medical Systems *Information Technologies* Service Representative.

SENSOR IMMERSION—Do not immerse the sensor completely in liquid (the plug is not waterproof). Immersion of the sensor plug in liquid may result in sensor malfunction and/or erroneous $FSpO_2$ measurements.

PATIENT MODULE IMMERSION—Do not immerse the fetal patient module completely in liquid— the unit is not waterproof. Fluid damage to the module may result in malfunction and/or erroneous $FSpO_2$ measurements.

Inaccurate Measurements and Loss of Pulse Signal

Inaccurate measurements may be cause by:

- incorrect application or use of a sensor
- significant levels of dysfunctional hemoglobin, such as carboxyhemoglobin or methemoglobin
- excessive fetal or maternal patient movement
- venous pulsation

Loss of pulse signal can occur:

- during uterine contractions
- if the fetus experiences shock, hypotension, sever vasoconstriction, severe anemia, arterial occlusion proximal to the sensor, or cardiac arrest

Theory

Hemoglobin and Oxygen Transport

A review of the unique properties of hemoglobin and its role in blood oxygen transport are important in explaining how the 120 F-Series Monitor measures fetal oxygen saturation ($FSpO_2$).

Hemoglobin, contained in red blood cells, is a complex protein molecule consisting of four iron-containing heme groups and the protein, globin; each molecule can reversibly bind four molecules of oxygen. Once one molecule of oxygen is bound, the other three follow rapidly.

A saturated hemoglobin molecule is commonly called oxyhemoglobin. Those hemoglobin molecules without oxygen are referred to as deoxyhemoglobin.

Oxygen bound to hemoglobin represents approximately 98% of the oxygen in blood, thus virtually all of the oxygen in the blood is bound to hemoglobin. The hemoglobin molecules saturated by oxygen are reflected in the saturation values of laboratory-analyzed blood gases (SaO_2) and pulse oximeters (SpO_2).

SaO_2 refers to the arterial oxygen saturation as measured by arterial blood sampling. SpO_2 refers to the arterial oxygen saturation as measured by pulse oximetry.

The 120 F-series Monitor reports the $FSpO_2$ value, which refers to *fetal* arterial oxygen saturation, as measured by pulse oximetry.

Principles of Operation

Operation of the 120 F-Series $FSpO_2$ feature is based on the principles of pulse oximetry, which in turn is based on spectrophotometry and plethysmography. The system includes an electro-optical sensor and a microprocessor-based monitor.

Oxyhemoglobin and deoxyhemoglobin have different light absorption characteristics in the red and infrared wavelength spectrums. *Less red light is absorbed by oxyhemoglobin* than by deoxyhemoglobin. *Relatively more infrared light is absorbed by oxyhemoglobin* than by deoxyhemoglobin. Arterial blood in a well-oxygenated fetus will typically contain a higher concentration of oxyhemoglobin than deoxyhemoglobin.

A 120 F-Series Monitor uses these differences in the absorption of red and infrared light by oxy- and deoxy-hemoglobin to determine fetal oxygen saturation by measuring the change in light levels caused by pulsating arterial blood in the tissue.

The fetal oxygen sensor has two low-voltage light-emitting diodes (LEDs). One of these LEDs emits red light (nominal 735 nm wavelength) and the other emits infrared light (nominal 890 nm wavelength). When the sensor has been properly positioned on the fetal temple or cheek, light from each of these LEDs is alternately sent through the fetal skin into the underlying tissues at the sensor site. The amount of light absorbed by the tissue or blood underlying the fetal sensor is determined from the amount of light that scatters back to the tissue surface and is picked up by the photo detector (photo diode) on the sensor.

Light absorption is first measured by the 120 F-Series Monitor at each wavelength when no pulsatile blood is present. This reflects the background light absorption of bone, tissue, and venous blood, which are generally considered non-pulsating. This measurement is analogous to the reference measurement of a spectrophotometer.

With each fetal heart beat, a pulse of arterial blood flows to the oxygen sensor site. Red and infrared light absorption are then measured by the monitor at each wavelength when this pulsatile, arterial blood is in the tissue. The monitor's microprocessor compares the background light absorption measurements to the absorption measured at both light wavelengths during each arterial pulse. The ratio of the corrected absorption at each wavelength is used to determine fetal oxygen saturation ($FSpO_2$).

Automatic Calibration

The 120 F-Series Monitor's built-in $FSpO_2$ module is automatically calibrated each time the monitor is turned on, at periodic intervals thereafter, and whenever a new sensor is connected.

Each fetal oxygen sensor is calibrated when manufactured: the effective mean wavelength of the LEDs is determined and encoded into a calibration resistor in the sensor. The 120 F-Series software reads this calibration resistor when the sensor is connected to determine the appropriate calibration coefficients for the measurements obtained by that specific sensor.

Functional Versus Fractional Saturation

Because the 120 F-Series Monitor measures functional SaO_2, it may produce measurements that differ from those of instruments that measure fractional SaO_2. Functional SaO_2 is oxygenated hemoglobin expressed as a percentage of the hemoglobin that is capable of transporting oxygen. Because the monitor uses two wavelengths, it measures oxygenated and deoxygenated hemoglobin, yielding functional SaO_2. It does not detect dysfunctional hemoglobins, such as carboxyhemoglobin or methemoglobin.

In contrast, some laboratory instruments such as the Instrumentation Laboratory 282 or 482 CO-Oximeter report fractional SaO_2—oxygenated hemoglobin expressed as a percentage of all measured hemoglobin, whether or not that hemoglobin is available for oxygen transport. Measured dysfunctional hemoglobins are included.

Consequently, to compare 120 F-Series measurements directly with those of another instrument, that other instrument must measure functional SaO_2. If the other instrument measures fractional SaO_2, those measurements can be converted to functional SaO_2 using the following equation:

$$\text{functional saturation} = \frac{\text{fractional saturation}}{100 - (\%\,\text{carboxyhemoglobin} + \%\,\text{methemoglobin})} \times 100$$

Measured Versus Calculated Saturation

When SaO_2 is calculated from a blood gas measurement of the partial pressure of arterial oxygen (PaO_2), the calculated value may differ from the 120 F-Series Monitor $FSpO_2$ measurement. This is because the calculated SaO_2 may not have been corrected for the effects of variables that shift the relationship between PO_2 and SO_2 (see Figure 6-1): temperature, pH, the partial pressure of carbon dioxide (PCO_2), and the concentrations of 2,3-DPG and fetal hemoglobin.

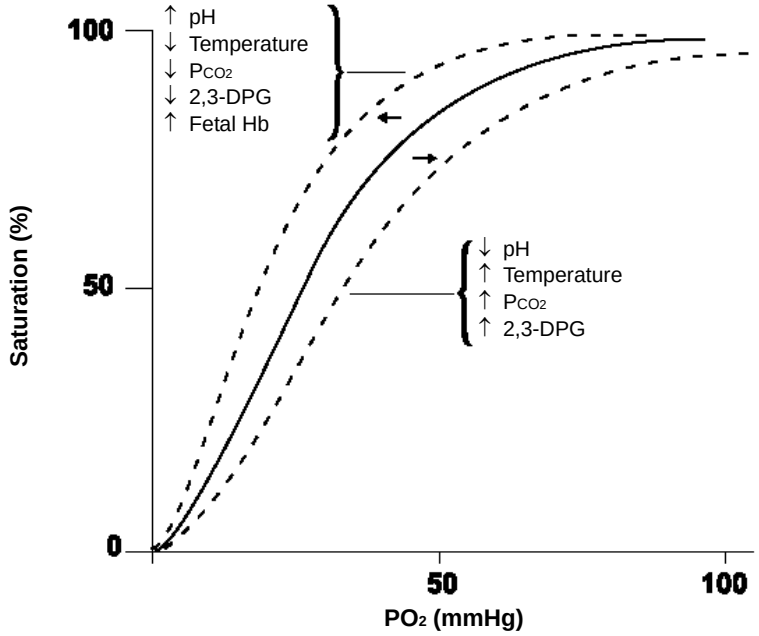


Figure 6-1. Figure 4: Oxyhemoglobin Dissociation Curve

Normal Range of $FSpO_2$ Values During Labor and Delivery

During labor and delivery, a healthy fetus has a much lower range of oxygen saturation than that of a healthy air-breathing patient.

- The normal oxygen saturation range for a healthy adult is 95% to 100%.
- The normal oxygen saturation range for a healthy fetus during labor is 30% to 70%.

FSpO2 Setup Screen

Select the FSPO2 softkey to access the FSpO2 Setup screen (Figure 6-2).

IMPORTANT
SOFTKEY ACTIVATION—The Corometrics fetal patient module cable must be plugged into the FSpO2 connector in order to activate the FSpO2 mode softkey.

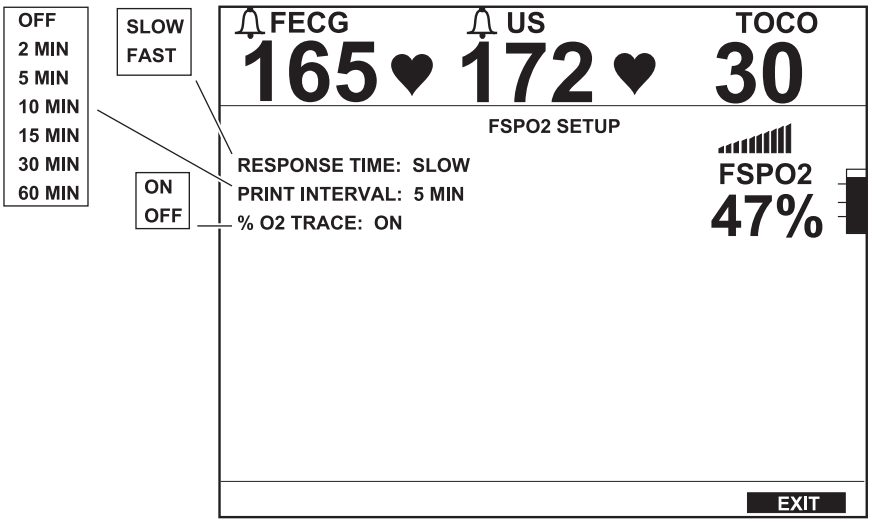


Figure 6-2. FSpO2 Setup Screen

Response Time

This field sets the response time or averaging mode (the time the monitor takes to respond to changes in fetal oxygen saturation).

- **Slow:** The FSpO2 display responds to step changes in the fetal saturation with approximately 120 accepted pulses, or in about 50 seconds at 150 BPM.
- **Fast:** The FSpO2 display responds to step changes in the fetal saturation with approximately 30 accepted pulses, or in about 11 seconds at 150 BPM. (The factory default setting is SLOW.)

When signal quality is poor, the response time becomes longer regardless of the mode selected.

Print Interval

This setting determines the time interval for printing the FSpO2 values on the strip chart paper.

$\%O_2$ Trace

This setting enables or disables the printing of the $\%FSpO_2$ trend on the bottom grid of the strip chart paper.

- **On:** The $\%FSpO_2$ trend is printed as a beaded trace on the bottom (or right) grid annotated by $\%FSpO_2$ —▪—.
- **Off:** The $\%FSpO_2$ trend is not printed.

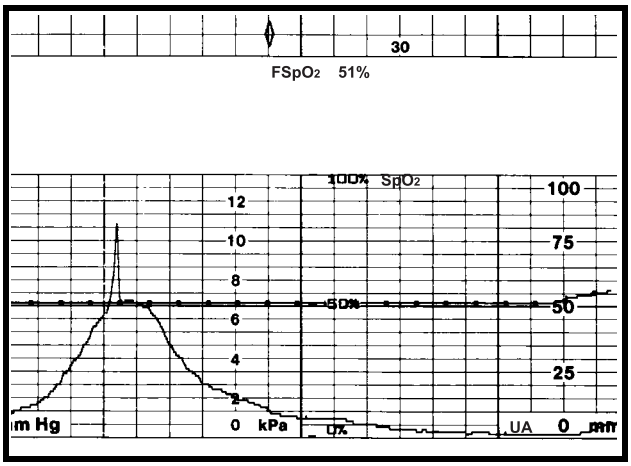


Figure 6-3. $FSpO_2$ Trend

$FSpO_2$ Display Area

Single versus Dual Display of SpO_2

If $FSpO_2$ is monitored while $MSpO_2$ is inactive, $FSpO_2$ displays in the Additional Parameters Area. Refer to Figure 6-4. When dual SpO_2 monitoring occurs, $FSpO_2$ information is displayed in the Waveform Area beneath the $MSpO_2$ area. Any waveform labels (speed, lead, scale) move to the left of the $FSpO_2$ area. The waveform area, which would otherwise display about 4 seconds of information, is reduced to show approximately 2.5 seconds of waveform data. Refer to Figure 6-5.

$FSpO_2$ Status Icons

A status icon may appear above the $\%FSpO_2$ value to provide additional information. Usually the message area will be blank; however, the icons representing Sensor Unplugged, Sensor Lifted, or Searching for Fetal Pulse can appear.

Sensor Unplugged

This icon appears whenever: the $FSpO_2$ sensor is disconnected from the fetal patient module cable; when the fetal patient module cable is disconnected from the monitor; or when an invalid $FSpO_2$ sensor is connected to the fetal patient module cable.

Sensor Lifted

This icon appears whenever the sensor is not making adequate contact at the sensor site on the fetus.

Pulse Search

This icon is displayed when the monitor is attempting to locate the fetal pulse. During successful monitoring, the message area is blank.

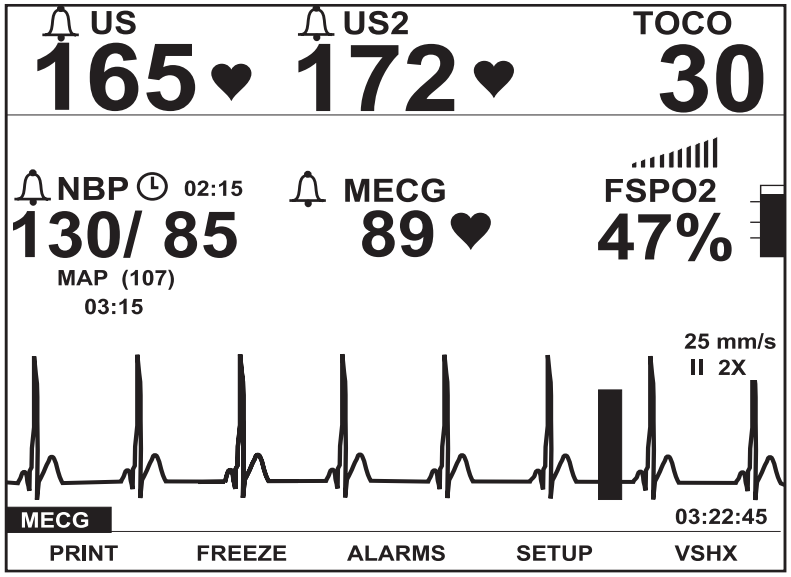


Figure 6-4. Display of Fetal Pulse Oximetry

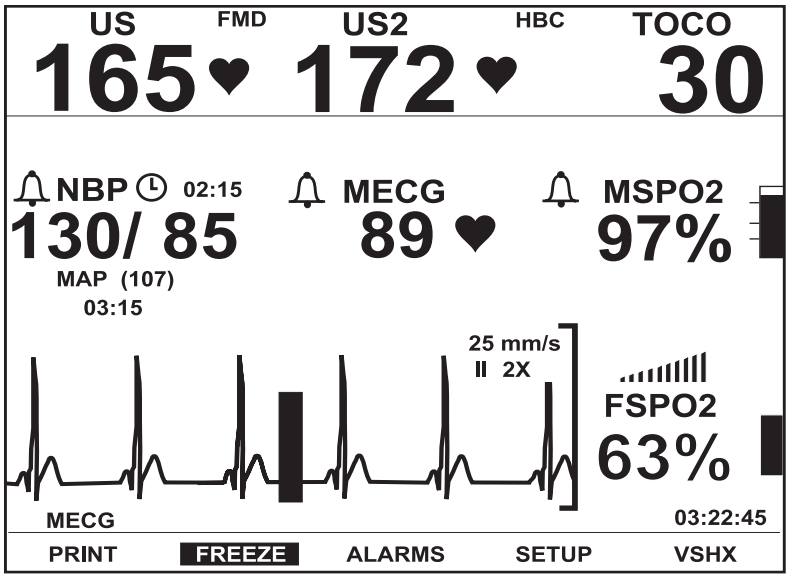


Figure 6-5. Simultaneous Display of Fetal and Maternal Pulse Oximetry

Fetal Patient Module

The fetal patient module is shown in Figure 6-6.

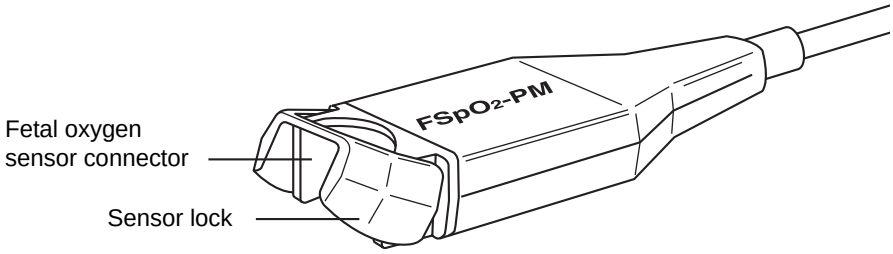


Figure 6-6. Fetal Patient Module

The fetal oxygen saturation monitoring system consists of three components:

- Corometrics 120 F-Series Maternal/Fetal Monitor (with built-in Nellcor FM-401 module)
- Corometrics Fetal Patient Module (a modified Nellcor patient module to connect to the monitor)
- Nellcor OxiFirst Fetal Oxygen Sensor (Series FS14)

The Fetal Patient Module provides initial amplification of the fetal oximetry signal. This patient module has a connector for the sensor and a cable that connects into the 120 F-Series front panel.

$FSpO_2$ Methodology

The fetal oxygen saturation is indicated by up to three digits representing the percentage of oxygen saturation. The pulse amplitude indicator is a vertical bar that qualitatively indicates the pulse amplitude.

When enabled, the $\%FSpO_2$ trend print in the bottom grid as a beaded trace annotated by $\%FSpO_2$ —▪—. Values are printed on the annotation area preceded by an outlined diamond ◊ which marks the time of the reading. An adequate $\%FSpO_2$ signal is indicated by a continuous trace on the paper.

NOTE: Refer to "$\%MSpO_2$ Trend Scale" on page 12-8 for information about possible changes in the $\%MSpO_2$ trend scale at the commencement of$\%FSpO_2$ trending.

$FSpO_2$ Waveform

When $FSpO_2$ monitoring is employed, the $FSpO_2$ pulsatile (plethysmograph) waveform can be displayed and printed by selecting the $FSpO_2$ waveform softkey. Refer to “Chapter 15, Waveforms”.

$FSpO_2$ Monitoring Basic Operation

1. Plug the fetal oxygen sensor into the sensor connector on the fetal patient module. The Sensor Disconnected icon should disappear and the Sensor Lifted icon should display.
2. Place the sensor as described in the "Maternal/Fetal Monitoring Operator's Manual".
3. After the sensor is appropriately positioned, the Sensor Lifted icon goes away and the Pulse Search icon appears.
4. The Pulse Amplitude indicator lights up with each pulse, with the number of bars lit depending upon pulse strength.
5. The Signal Quality indicator lights up to display the quality of the signal used to calculate the $FSpO_2$ value.
6. The fetal oxygen saturation is indicated by three digits indicating the percentage of oxygen saturation.

NOTE: Readings provided by an external $FSpO_2$ monitor are denoted by a filled diamond marker (⧫).

7. Values are printed on the strip chart preceded by an outlined diamond ◊ which marks the time of the reading.
8. The $FSpO_2$ trend is printed on the bottom grid of the strip chart paper.

Chapter 7

Uterine Activity Monitoring

This section provides a brief overview of the uterine activity monitoring methods available on a 120 Series Monitor. Refer to the "Maternal/Fetal Monitoring Operator's Manual" for patient application information.

This chapter describes the following monitoring methods:

Tocotransducer (External Method)

Methodology

A tocotransducer applied to the maternal abdomen records relative changes in abdominal tension caused by uterine contractions. The mode (TOCO) and value are shown in the UA area of the display. The UA value displays in relative units from 0–100. Uterine activity is continuously plotted on the bottom (or right) grid of the strip chart paper as a plain black line.

IMPORTANT
FOR TRIMLINE TOCOTRANSDUCERS ONLY—You must wait at least ten seconds from the time you power the monitor on or connect a tocotransducer before pressing the UA Reference button.

Establishing a Baseline

Monitoring uterine activity using a tocotransducer provides ***relative*** pressure measurements—compared to a baseline or UA reference. The quality of measurements depends on the following:

- position of the tocotransducer;
- belt tension;
- size of the patient; and
- established baseline.

All 120 Series Monitors provide a UA Reference pushbutton which sets the baseline. When a baseline is established, all pressure measurements are relative to that baseline. The baseline can be set manually by two different methods or automatically, when necessary. Whenever the baseline is set, the bottom line of the bottom strip chart grid is annotated with UA REF.

Initial Referencing

For Trimline Tocotransducers only

You must establish an initial baseline when the tocotransducer is plugged into the monitor, *but not yet applied to the patient.* No pressure should be applied to the transducer button.

For other transducers (i.e. Nautilus)

The initial reference occurs automatically. After you plug in a transducers, verify that the display reads less than 30 relative units. Make a note of the reading.

The purpose of establishing a baseline at this point is necessary for consistency when applying and tightening the belt. You will have to set the baseline again, after tightening the belt.

Accounting for Belt Tension

When you adjust the belt on the patient, regardless of transducer type, you want to ensure a comfortable fit; you also want to ensure that the transducer is held securely in place. GE Medical Systems *Information Technologies* recommends adjusting the belt tension so that, between contractions, the UA display shows approximately 25 relative units ***above*** the initial baseline.

After the belt is adjusted, it is important to establish a new baseline. This is because you don't want belt tension to be counted as uterine pressure; also the pressure readings could tend to go off the scale if you do not account for the belt tension. Again, the UA Reference pushbutton should only be pressed between contractions.

More About Referencing

Out of Range Condition

After you press the UA Reference pushbutton, if there is insufficient range to provide at least 100 relative units above the reference level (probably because the belt is too tight), the UA display area flashes the message CHECK TOCO. If this happens, remove the tocotransducer from the patient; re-reference with no pressure applied to the button; re-apply the transducer to approximately 25 relative units ***above*** the baseline; then re-reference one more time. If you still receive the CHECK TOCO message, try a different tocotransducer or contact your Service Representative.

Manually Setting the Baseline at the Default Value

Briefly pressing the UA Reference pushbutton sets the baseline at the *default* setting—the default is configured on the Install Options service screen. The monitor is shipped from the factory with a *default* setting of 10 relative units. Qualified service personnel can access the Install Options service screen to set the baseline *default* to 5, 10, 15, 20, or 25 relative units. Refer to the "120 Series Monitor Service Manual" for more information.

Manually Overriding the Baseline Default Value

Pressing and holding the UA Reference pushbutton for more than two seconds causes the UA reference level and display to override the default setting and cycle through all available selections: 5, 10, 15, 20, or 25 relative units, starting at the default setting—until the button is released. Once the button is released, the UA trace and UA value take on this new value as a baseline for reference.

Briefly pressing the UA Reference pushbutton reverts back to using the *default* setting configured via the Install Options service screen.

Automatic Baseline "Zeroing"

If pressure falls below 0 relative units (probably because the belt has loosened), automatic UA referencing occurs and a new baseline reference is set at 0 relative units.

Internal Method (IUPC)

NOTE: To secure a strain gauge post for IUPC monitoring, refer to the strain gauge manufacturer's instructions.

Methodology

A catheter inserted transcervically into the uterine cavity measures intrauterine pressure. You can monitor using either a fluid-filled catheter or a transducer-tipped catheter. The mode (IUP) and value are shown in the UA area of the display. The UA value displays in mmHg from 0–100. Uterine activity is continuously plotted on the bottom (or right) grid of the strip chart paper as a plain black line. Pressure exceeding 100 mmHg is printed as a straight line at 100 mmHg.

Why You Must Zero the System

When you zero the system, you are referencing the pressure to 0 mmHg while the system is open to air to ensure an absolute pressure measurement. Refer to the "Maternal/Fetal Monitoring Operator's Manual" for more information.

- If you disconnect the patient from the monitor all zeroing information is lost. If you re-connect the patient to the monitor you must re-zero—regardless of whether you connect to the same monitor or a different monitor.
- If the mother's position has changed so that the height of the maternal xiphoid has changed in relation to the position of the strain gauge, the baseline may have been altered. If this is the case, adjust the height of the strain gauge and re-zero.
- If the message CHECK IUP flashes in the UA display area, there is insufficient compensation to provide 100 mmHg above the reference level. Re-zeroing should correct the problem.
- If a negative value is displayed (pressure less than 0 mmHg), the baseline should be re-zeroed. (When a negative value occurs for more than 20 seconds, the message BASELINE PRESSURE OFFSCALE is on the bottom grid on the strip chart paper.)

Chapter 8

Maternal Heart/Pulse Rate Monitoring

NOTE: MECG is available on a Model 129 only. $MSpO_2$ and NBP are available on Models 128 and 129.

The maternal *pulse* rate can be determined by the built-in $MSpO_2$ and NBP modules of the monitor. The maternal *heart* rate can be measured via MECG.

This chapter describes the following:

MHR/P Source

The MHR/P can be determined by the MECG, $MSpO_2$, and NBP sections of the monitor. However, the data from only one parameter is:

- referred to as the MHR/P source
- displayed in the MHR/P area;
- used to evaluate an MHR/P alarm condition; and
- used to generate the MHR/P trace on the strip chart paper.*

The source is:

- selected via the MHR/P Setup screen
- may be manually selected or automatically selected by the monitor according to the following priority order:
  - MECG
  - $MSpO_2$
  - NBP

IMPORTANT

BLOOD PRESSURE AS AN MHR/P SOURCE—Although it is unusual to prioritize NBP as the MHR/P source when MECG and $MSpO_2$ are available, it can be done. In this case, an MHR/P alarm occurs only if the pulse rate value derived from the NBP cuff violates an MHR/P alarm limit. The MHR/P values derived from the MECG and $MSpO_2$ sections of the monitor are ignored.

$MSpO_2$ AS AN MHR/P SOURCE—If $MSpO_2$ is selected as the MHR/P source, an MHR/P alarm only occurs if the pulse rate value derived from the $MSpO_2$ sensor violates an MHR/P alarm limit. The MHR/P values derived from the MECG and NBP sections of the monitor are ignored. The heart rate tone varies in pitch to reflect changes in the maternal oxygen saturation reading. The pitch rises as the saturation values increase; the pitch lowers as the saturation values decrease. The pulse rate trend is a grey line annotated by $MSpO_2P$ ≡⩘.

* *If NBP is selected as the MHR/P source, there is no trending of the data since these are static measurements.*

MHR/P Setup Screen

NOTE: Figure 8-1 provides an example of MECG selected as the MHR/P source, as indicated by the MECG mode title. When either $MSpO_2$ or NBP are selected as the MHR/P source, the mode title changes to PULSE.

Select the mode title softkey—MECG or PULSE—to access the MHR/P Setup screen (Figure 8-1).

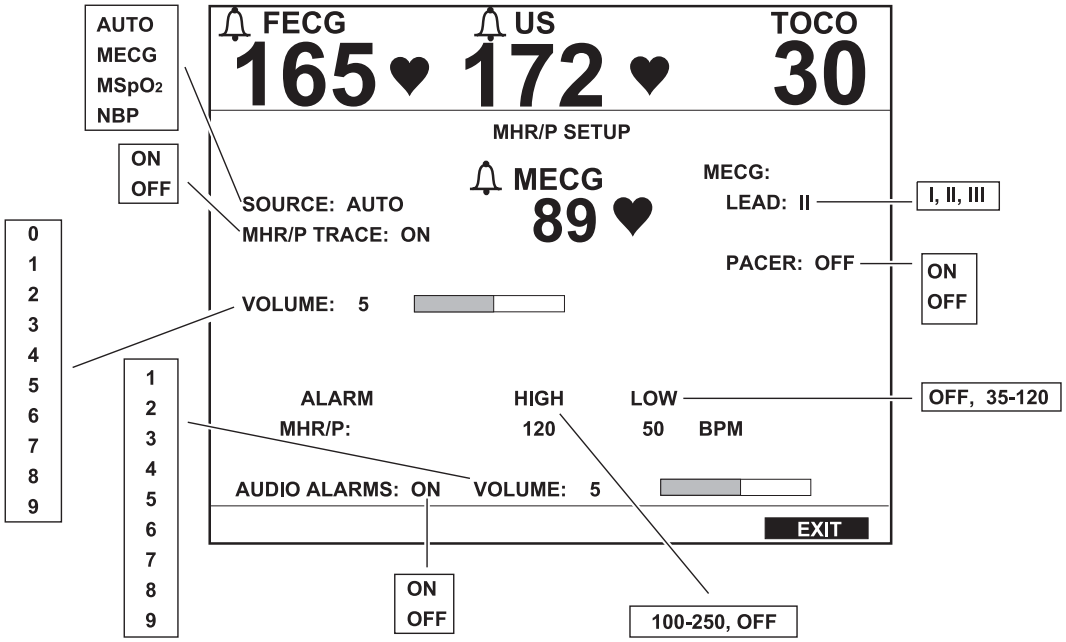


Figure 8-1. MHR/P Setup Screen

NOTE: The lead source and pacer fields apply to MECG only.

Source

This field selects the MHR/P source. When AUTO is selected, the monitor checks for parameter availability and use in the following order: MECG, $MSpO_2$, then NBP. If a source is not available, the next available source is automatically selected.

IMPORTANT

WAVEFORM—The MHR/P Source field is independent of the waveform selected on the normal operating screen. For example, you can select MECG as the MHR/P source yet display the $MSpO_2$ plethysmograph waveform. Or, you can select $MSpO_2$ as the source and display MECG as the waveform.

MHR/P Trace

This field enables or disables the printing of the MHR/P trace on the strip chart paper.

- **On:** The MHR/P trend is printed in grey annotated with MECG or $MSpO_2$ P —whichever parameter is selected in the MHR/P source field. MHR/P data from NBP is not trended since blood pressure determinations are static measurements.
- **Off:** The MHR/P trend is not printed.

Volume

This field sets the volume of the “beep” sounded with each detected valid heartbeat—for MECG and $MSpO_2$ only.

Alarm Limits

These fields adjust the high and low alarm limits for MHR/P— in increments of 5 BPM. The selectable values are shown in Figure 8-1. The factory defaults are listed in Appendix A, “Factory Defaults” .

Audio Alarms

This field enables/disables the audio alarm function for MHR/P.

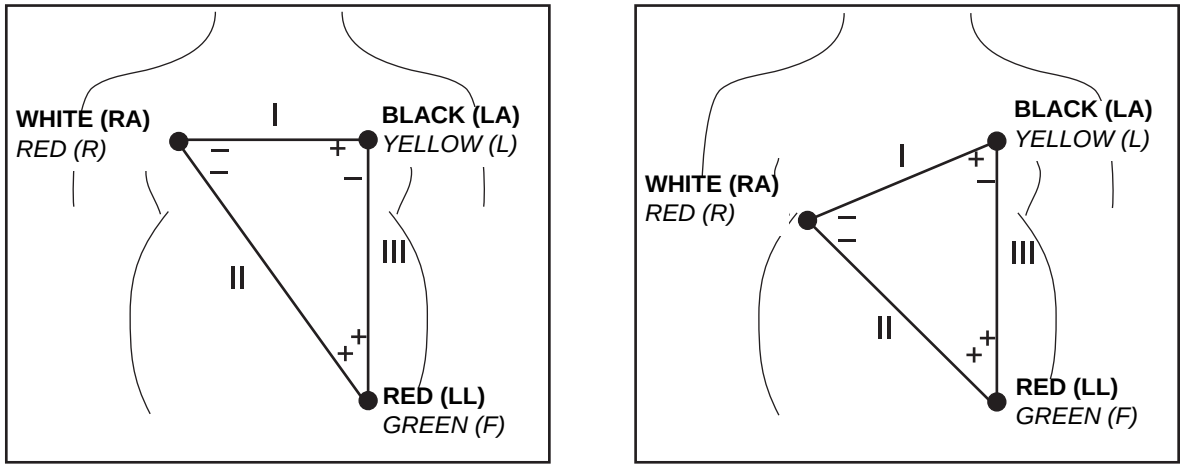
- **On:** Visual and audible indications are provided during an MHR/P alarm condition.
- **Off:** Only a visual indication is provided during an MHR/P alarm condition.

Alarm Volume

This field controls alarm volume for all alarms.

MECG Lead

This field selects the ECG lead configuration. The lead can also be selected from the MECG Lead Softkey on the normal operating screen Lead I refers to the potential between the left arm and the right arm. Lead II refers to the potential between the right arm and left leg.
Lead III refers to the potential between the left arm and the left leg. Figure 8-2 illustrates which electrodes reference the ECG lead obtained.



NOTE: AHA label **bolded**; IEC label *italicized*.

Figure 8-2. MECG Lead Selection Guide

MECG Pacer

This field enables/disables pacemaker pulse rejection circuitry.

- **Off:** Use this setting for a patient without a pacemaker. All ECG events are monitored; all complexes, including pacer spikes may be displayed* and may be included in the heart rate calculation.
- **On:** Use this setting for a patient who has a pacemaker. The monitor rejects the pacer spike from the heart rate calculation and replaces the actual pacer spike* with a pacer event mark; in addition the letter **P** is displayed prior to the waveform speed. Figure 8-3 shows an example of an MECG waveform with the MECG pacer ON.

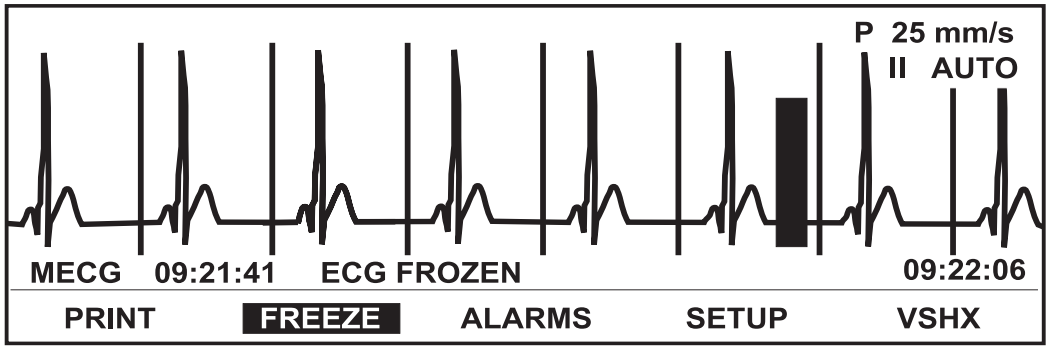
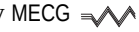


Figure 8-3. MECG Waveform with Pacer Enabled

* *If the MECG waveform is enabled for display.*

Maternal ECG Monitoring

Theory and Methodology

The maternal heart rate (MHR) is measured via electrodes placed on the maternal chest. When MECG is employed, the maternal heart rate is computed on a beat-to-beat basis using the R-to-R time interval on the maternal QRS complex. When MECG is selected as the MHR/P source, the MHR is displayed on the front panel display in beats per minutes (BPM), denoted by MECG. The heartbeat indicator ♥ flashes for each detected heartbeat. The rear panel speaker emits an audible tone for each detected heartbeat. The maternal heart rate trend, when enabled, is continuously plotted in the top (or left) grid of the strip chart paper. The MHR trace is a grey line annotated by MECG  . The *beat-to-beat* MHR signal is used for trending on the strip chart paper and for output to external devices such as a central station system. The *averaged* MHR values are used for display and for alarm detection.

Pacemaker Safety Information

The following safety information applies to patients with pacemakers.

WARNINGS

FALSE ALARMS—False low heart rate alarms or false asystole may result with certain pacemakers because of electrical overshoot.

FALSE COUNTING—Be aware that a pacer spike could be falsely counted as a QRS complex during asystole.

INTERFERENCE—Interference caused by electrosurgical or diathermy instruments will affect the proper operation of the MECG section of 120 Series Monitors.

PACEMAKER SPIKE—Do not diagnostically interpret the pacemaker spike size and shape; the spike may be attenuated by the module in order to be displayed or printed.

PATIENT OBSERVATION—Keep pacemaker patients under close observation.

MECG Waveform

When MECG monitoring is employed, the MECG waveform can be displayed and printed—independent of the MHR/P source. Refer to “Chapter 15, Waveforms”.

Chapter 9

Maternal Non-Invasive Blood Pressure Monitoring

NOTE: Maternal NBP monitoring is available on Models 128 and 129.

The 120 Series Monitor measures the maternal systolic pressure, diastolic pressure, mean arterial pressure (MAP), and pulse rate. Two operating modes are provided: manual and automatic.

This chapter describes the following:

Blood Pressure Safety Precautions

The following safety information applies to the non-invasive blood pressure (NBP) of the monitor:

CAUTIONS

ACCURACY—As with any non-invasive oscillometric blood pressure monitor, there are clinical conditions which can affect the accuracy of the measurements obtained. For example, do not use the monitor's NBP feature on a patient experiencing convulsions or attached to a heart/lung machine. In addition, disregard or stop automatic blood pressure determinations which coincide with maternal contractions. Finally, be aware that the accuracy of measurements can be affected if readings coincide with maternal uterine contractions. Refer to "Smart BP Feature" on page 9-13.

AUDIO ALARM—Do not disable the audio alarm or patient safety could be compromised.

CALIBRATION—Do not operate the monitor unless it has been properly calibrated. Inaccurate blood pressure readings may result. Refer to "Chapter 16, Maintenance" for details.

DISPLAY INTERVAL—The time period, in minutes, that a blood pressure reading remains displayed before being automatically erased, is selectable via the NBP Setup screen. The option can also be set to continuously display the reading until replaced by a new reading. The display of "old" pressure values may cause confusion. If a patient's condition changes during the time interval between determinations, the monitor will not detect the change or indicate an alarm condition. Blood pressure and pulse can fluctuate greatly between measurements; the monitor does not alert the user (through audio or visual means) to changes in vital signs occurring between measurement cycles.

OVERPRESSURE—After the monitor has been calibrated or repaired, perform a final check of the pneumatic system and verify that a pressure greater than the overpressure limit of 285 mmHg ± 15 mmHg causes the OVERPRESSURE error message to display.

CAUTION

PULSE RATE COMPARISONS—The pulse rate measured by the monitor's NBP circuitry may differ from the heart rate measured by the monitor's MECG circuitry or another maternal ECG monitor because the monitor's blood pressure module measures peripheral pulses, not electrical signals or contractions of the heart. Occasionally, the electrical signals at the heart do not produce a peripheral pulse. Similarly, if a patient's beat-to-beat pulse amplitude varies significantly, blood pressure and pulse rate readings can be erratic and an alternate measuring method should be used for confirmation.

Oscillometric Theory

Principles of Noninvasive Blood Pressure Determination

The oscillometric method of determining blood pressure is accomplished by a sensitive transducer which measures cuff pressure and minute pressure oscillations within the cuff. The first determination sequence initially pumps up to a cuff pressure of about 160 mmHg for adult/pediatric patients, or 110 mmHg for neonates depending on the initial target pressure preset. After inflating the cuff, the Monitor begins to deflate it and measures systolic pressure, mean pressure, and diastolic pressure. When the diastolic pressure has been determined, the Monitor finishes deflating the cuff and updates the systolic, diastolic, and MAP displays.

The Monitor deflates the cuff one step each time it detects two pulsations of relatively equal amplitude. The time between deflation steps depends on the frequency of these matched pulses (pulse rate of the patient). However, if the Monitor is unable to find any pulse within several seconds, it will deflate to the next step. The process of finding two matched pulses at each step provides artifact rejection due to patient movement and greatly enhances the accuracy of the Monitor. The figure shows the BP determination sequence.

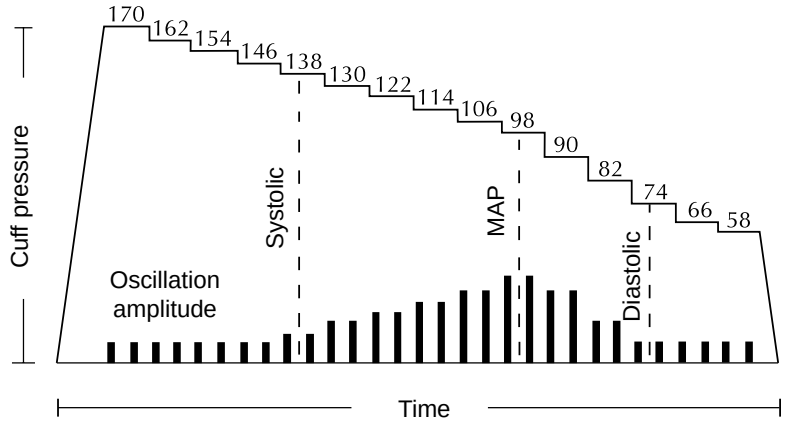


Figure 9-1. BP Determination Sequence

At each step the microprocessor stores cuff pressure, the matched pulse amplitude, and the time between successive pulses. The stepped deflation and matched pulse detection continues until diastolic pressure is determined or total cuff pressure falls below 7 mmHg. The Monitor then deflates the cuff (to zero detected pressure), analyzes the stored data, and updates the front panel displays.

The operating cycle is composed of four parts: inflation time, deflation time, evaluation time, and wait time. Wait time, which varies from mode to mode, is affected by the cycle time (Auto mode) or operator intervention (Manual mode). The following figure shows the Basic Operating Cycle.

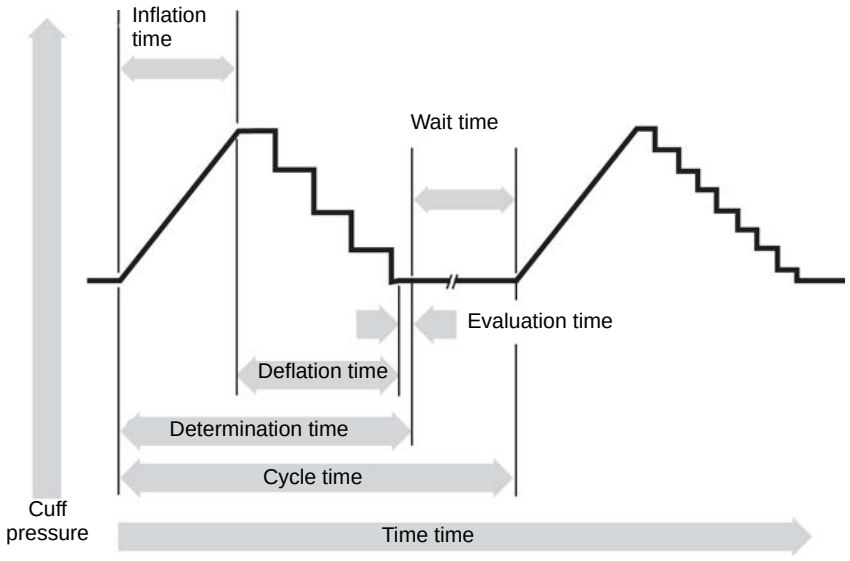


Figure 9-2. BP Operating Cycle

Systolic Search

If systolic pressure is not found, the Monitor can search at higher cuff pressures than the initial target pressure. If the determination is in a late stage, the Monitor will inflate the cuff to 70 mmHg above the initial target to get better data in the systolic region. If the determination is in an early stage, the Monitor will inflate the cuff to 50 mmHg above the initial target pressure. The maximum pressure allowed in systolic search is limited by the normal range for cuff pressures. In any operating mode, if a patient's systolic pressure exceeds the inflation pressure of the Monitor, the Monitor will begin normal deflation sequence, detect the absence of a systolic value, stop deflation, reinflate to a higher (than initial) inflation pressure (290 mmHg maximum), and resume normal deflation sequence. This additional inflation will occur only once per determination.

If a previous valid systolic pressure is displayed, and the new systolic pressure oscillations are compared with the previous valid determination and the Monitor "thinks" that the systolic was not obtained, the Monitor will inflate the cuff to a pressure of an additional 50 mmHg above the immediately preceding inflation. This additional inflation will occur only once per determination.

Do not use the auscultatory method to verify the accuracy of the Monitor. Because of differences in technique and technology, values may differ. The DINAMAP® Technology compares BP values to an invasive arterial BP measurement technology. The auscultatory method uses audible sounds heard through a stethoscope and determines BP by the corresponding height of a column of mercury.

Invasive pressure monitoring directly measures the pressure exerted on a transducer and displays this pressure as a value. Noninvasive blood pressure monitoring is dependent on the flow of blood through the peripheral circulation.

NBP Setup Screen

Select the NBP softkey to access the NBP Setup screen (Figure 9-3).

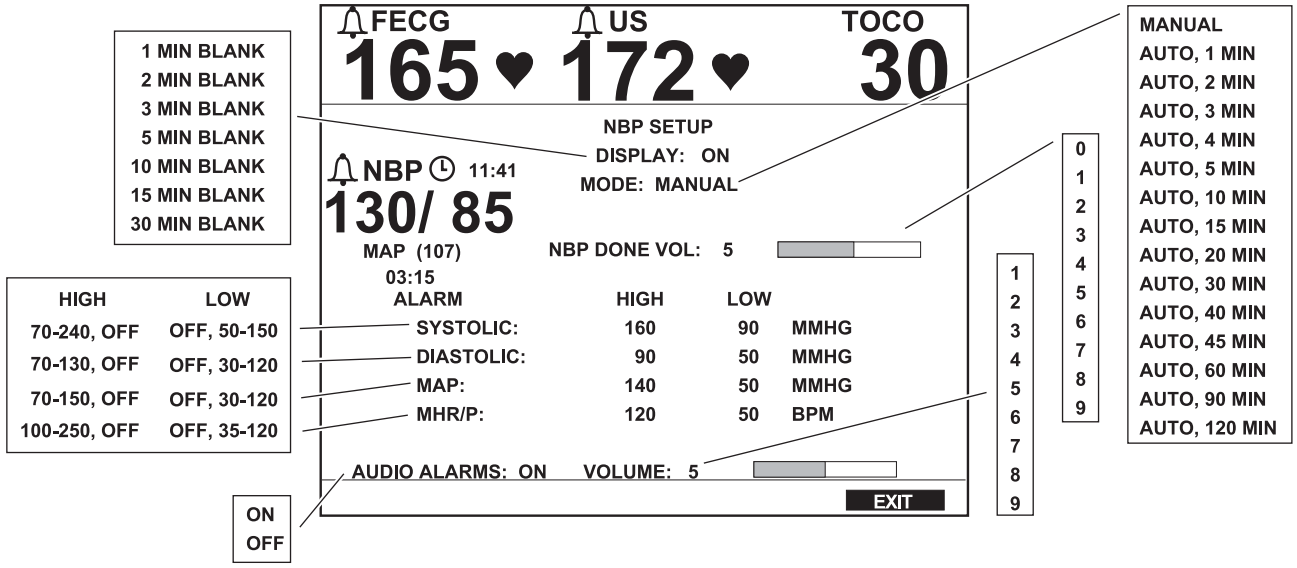


Figure 9-3. Maternal NBP Setup Screen

Display Timer

NOTE: Setting this field to a value reduces the chance of error. Setting this field to ON leaves the blood pressure reading displayed indefinitely and could potentially cause confusion. For example: if the monitor is configured for manual mode and one hour has elapsed since the last reading, the continuous display of the "old" NBP reading may cause confusion.

This field determines the time period, in minutes, that a blood pressure reading remains displayed before being automatically erased*; starting from the time the reading is displayed.

Mode

NOTE: As soon as the auto mode is selected on the setup screen, the countdown timer begins to decrement. *The first automatic determination begins after expiration of one complete interval time period.*

This field alternates between the manual and automatic monitoring modes for maternal blood pressure. For auto mode, this field also sets the interval time, in minutes, between automatic blood pressure determinations. This interval time is measured from beginning to beginning of determinations. (The monitor is factory-set with the optional 1-minute interval time disabled. For information on enabling the 1-minute interval, refer to the "120 Series Monitor Service Manual".)

* *Values are removed from the NBP area of the display only; values are still retained in memory for display and printing of the maternal Vital Signs History screen.*

NBP Done Volume

This field sets the volume of the sound emitted at the completion of each blood pressure determination. As you adjust the volume, a sample tone sounds.

Alarm Limits

These fields adjust the high and low alarm limits for maternal systolic, diastolic, and mean arterial pressures, as well as for MHR/P—in increments of 5 mmHg or 5 BPM. The selectable values are listed in Figure 9-3. The factory default settings are listed in Appendix A, "Factory Defaults" .

Audio Alarm

This field enables/disables the audio alarm function for blood pressure.

- **On:** Visual and audible indications are provided during an NBP alarm condition.
- **Off:** Only a visual indication is provided during an NBP alarm condition.

Alarm Volume

This field controls alarm volume for all alarms.

NBP Monitoring

Blood Pressure Methodology

During a determination, the instantaneous cuff pressure is indicated by a numeric value displayed below the title CUFF. This information is displayed in place of the mean arterial pressure. When a determination is successful, the monitor emits two short tones (high/low) and displays the three pressure readings (and the maternal pulse, if NBP is enabled as the MHR/P source*). Regardless of the mode, auto or manual, the values remain displayed according to the time period specified in the display timer field.

The systolic and diastolic pressures are each indicated with two or three digits and separated by a slash (/). The mean arterial pressure is indicated with two or three digits and enclosed in parentheses. All pressure values are displayed in mmHg.

Values are printed on the strip chart paper annotated by an outlined diamond (◊) which marks the time of the reading.

Hydrostatic Effect

If the cuff is not at heart level, the difference in the reading due to the hydrostatic effect should be noted. (Add the value 1.80 mmHg to the displayed readings for every inch the cuff is above heart level. Subtract the value 1.80 mmHg from the displayed readings for every inch the cuff is below heart level. Document the reading.)

Manual Mode

In manual mode, a single determination is made at a time upon activation of the BP Start/Stop pushbutton. Depress the BP Start/Stop pushbutton to begin a single determination. The cuff will inflate to 160 mmHg. If this initial inflation pressure is insufficient, the unit retries with a higher inflation pressure (+30 mmHg). The instantaneous cuff pressure is displayed in place of the mean arterial pressure area and is indicated by the title CUFF.

* *Refer to "Section 7, Maternal Heart/Pulse Rate Monitoring," for more information.*

Automatic Mode

NOTE: The first automatic determination begins after the *expiration* of one complete interval time period.

In auto mode an indefinite series of determinations are made at defined time intervals. Upon activation, a clock icon (🕒) displays in the NBP area along with a countdown timer indicating the time remaining until the next scheduled automatic determination; the timer already begins to count down.

Since the first automatic blood pressure reading will not occur until after a complete interval time, you may wish to take an initial manual reading by pressing the BP Start/Stop pushbutton. The first *automatic* determination inflates the cuff to 160 mmHg. For subsequent determinations, the cuff reaches an inflation pressure of 30 mmHg greater than the previously determined systolic pressure value. If this initial inflation pressure is insufficient, the unit retries with a higher inflation pressure (+30 mmHg). The instantaneous cuff pressure is displayed in place of the mean arterial pressure area and is indicated by the title CUFF.

Taking a Manual Reading Between Auto Determinations

If the BP Start/Start pushbutton is pressed during the interval time between automatic readings, a new determination is initiated.

IMPORTANT
The countdown timer is ***not*** reset whenever a manual blood pressure reading is initiated; the next scheduled automatic determination will take place as planned.

Venous Return in Auto Mode

When in auto mode, the monitor always waits ***at least 30 seconds*** from the end of one blood pressure determination to the beginning of the next. This provides a minimum time that pressure around the patient's limb is relieved, to allow for venous return.

At all settings except one minute*, if a determination ends with less than 30 seconds remaining until the next one, that next determination will be cancelled.

Example 1. The auto mode is selected with a time interval of two minutes. A determination begins at 12:00:00. Due to excessive patient movement, the determination ends at 12:01:35. This leaves only 25 seconds until the next automatic reading scheduled at 12:02:00. The 12:02:00 determination is cancelled and the *following* reading will resume at 12:04:00.

* *The 120 Series Monitor is factory-set with the optional 1-minute interval time disabled. For information on enabling the 1-minute interval, refer to the "120 Series Monitor Service Manual".*

The optional one-minute interval is an exception. When one minute is selected, if a determination ends with less than 30 seconds until the next one, the reading will be reset to start in 30 seconds.

Example 2. The auto mode is selected with a time interval of one minute. An automatic determination begins at 11:59:00 with the next reading therefore scheduled for 12:00:00. The 11:59:00 determination ends at 11:59:35. This leaves only 25 seconds until the next scheduled automatic reading. Instead of being cancelled, the next reading is reset to start in 30 seconds at 12:00:05.

Adjusting the Interval Time Between Automatic Determinations

You can adjust the interval time in-between determinations by going back into the maternal NBP Setup screen. Regardless of whether you are increasing or decreasing the interval time, the countdown timer resets to the new value. The next automatic reading will occur after the expiration of the new interval.

Example 1. The interval time is set at 10 minutes and the countdown timer shows 4 minutes until the next reading — in other words 6 minutes have elapsed. If you change the interval time to 15 minutes, the countdown timer will wait another 15 minutes until the next reading. Therefore a total of 21 minutes will elapse between readings.

Example 2. The interval time is set at 15 minutes and the countdown timer shows 2 minutes until the next reading — in other words 13 minutes have elapsed. If you change the interval time to 10 minutes, the countdown timer will wait another 10 minutes until the next reading. Therefore a total of 23 minutes will elapse between readings.

NBP Interval Button Shortcut

You can set the interval time from the NBP Setup screen *or* from the normal operating screen using a front panel button shortcut:

1. While the normal operating screen is displayed, *press and hold* the BP Start/Stop button on the front panel.
2. After holding for approximately two seconds, the interval field display in place of the countdown timer. Refer to Figure 9-4.
3. Continuous pressure on the BP Start/Stop button cycles through the available intervals: 1*, 2, 3, 4, 5, 10, 15, 20, 30, 40, 45, 60, 90, and 120 minutes.
4. When the desired interval is displayed, release the BP Start/Stop button.
5. The timer reappears and begins to count down from the new value.

NOTE: Since the intervals are displayed in the countdown timer area, they will appear as follows: 01:00, 02:00, 03:00,... 60:00, etc.

* *The monitor is factory-set with the optional 1-minute interval time disabled. For information on enabling the 1-minute interval, refer to the "120 Series Monitor Service Manual".*

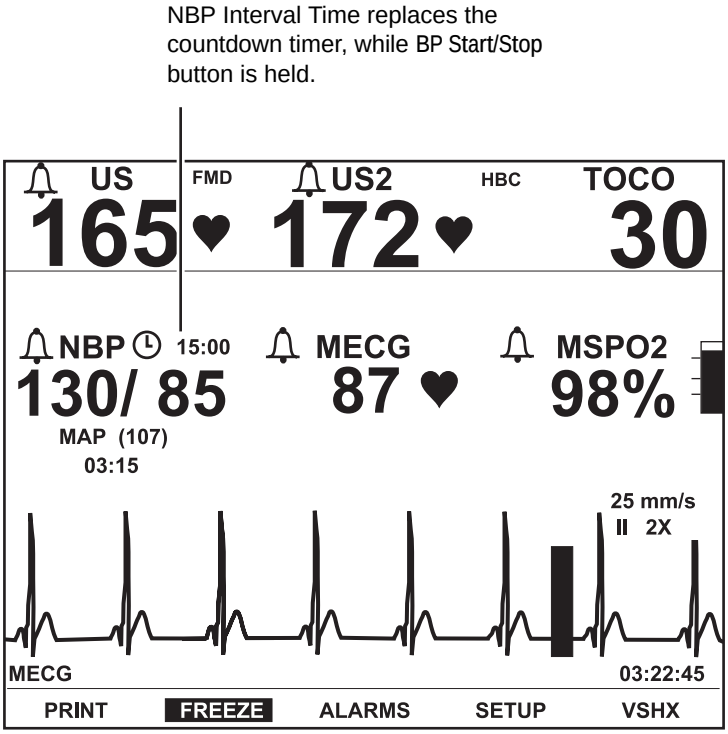


Figure 9-4. NBP Interval Time Shortcut

Terminating a Determination in Progress

A determination—manual or automatic—can be cancelled by pressing the BP Start/Stop pushbutton.

- The selected mode (manual or auto) remains in effect.
- The next scheduled automatic determination takes place as planned.

Smart BP Feature

Models 128 and 129 have a Smart BP feature which prevents an automatic blood pressure determination from occurring during a uterine contraction. This feature:

- reduces the chances for erroneous vital signs readings; and
- reduces patient discomfort during labor.

Enabling/Disabling Smart BP

The Smart BP feature is enabled/disabled via the Install Options service screen. Refer to the "120 Series Monitor Service Manual" for more information.

Methodology

NOTE: Blood pressure readings cannot be postponed indefinitely. The Smart BP feature ensures that a BP reading is completed even in the presence of frequent uterine contractions.

The Smart BP feature is available for both TOCO and IUP monitoring when:

- the automatic blood pressure mode is selected; and
- the interval time is set to 5 minutes or greater.

Uterine activity trends are continuously analyzed to recognize patterns of uterine contractions. Once the onset of a contraction is identified:

- An active blood pressure reading automatically stops and the cuff deflates; it will be re-started following the contraction.
- A scheduled reading is delayed until after the contraction.

For your notes

Chapter 10

Maternal Pulse Oximetry Monitoring

NOTE: $MSpO_2$ monitoring is available with Models 128 and 129.

The 120 Series Monitor measures the maternal oxygen saturation ($MSpO_2$) and pulse rate using the principles of spectrophotometry and plethysmography.

This chapter describes the methods of monitoring each parameter.

Theory

Nellcor

The 120 Series Monitor measures the maternal oxygen saturation and pulse rate using the principles of spectrophotometry and plethysmography. The $MSpO_2$ sensor is comprised of two light-emitting diodes (LEDs) which are the emitters, and one photodiode which is the detector. One LED emits red light and the other infrared into the patient's skin. The detector receives the amount of light that is not absorbed at the sensor site and the monitor uses the relative absorption of red and infrared to compute the functional percentage of hemoglobin that is combined with oxygen. The heart rate is calculated from the pulses measured at the sensor site.

Masimo

The Masimo SET MS-5 pulse oximeter as well as traditional pulse oximetry determines SpO_2 by passing red and infrared light into a capillary bed and measuring changes in light absorption during the pulsatile cycle. Red and infrared light-emitting diodes (LEDs) in oximetry sensors serve as the light sources, a photodiode serves as the photodetector.

Traditional pulse oximetry assumes that all pulsations in the light absorbance signal are caused by oscillations in the arterial blood volume. This assumes that the blood flow in the region of the sensor passes entirely through the capillary bed rather than through any arterio-venous shunts.

$MSp0_2$ Technology

Models 128 and 129 are available with a choice between two $MSp0_2$ modules, depending on your site needs.

- Nellcor technology, or
- Masimo technology

If your monitor has a Masimo module installed, a Masimo SET label (Figure 10-1, "Masimo Set Label," on page 10-2) appears next to the lower, right-hand side of the display. If no label is present, a Nellcor module is installed in your monitor.

Figure 10-1. Masimo Set Label

MSpO2 Setup Screen

Select the MSPO2 softkey to access the MSpO2 Setup screen (Figure 10-2).

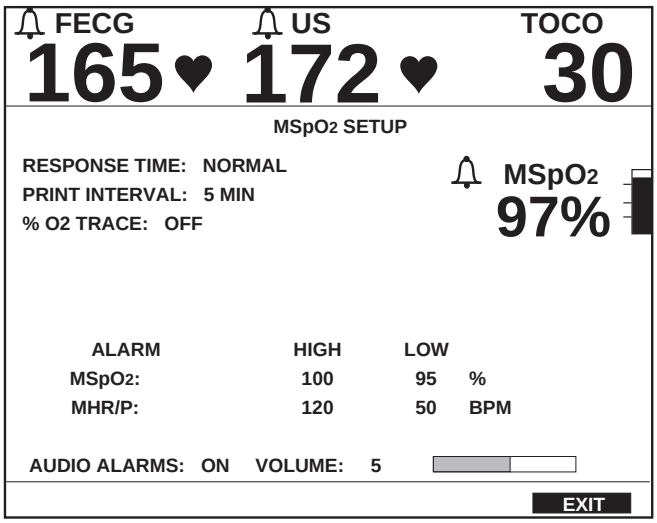


Figure 10-2. Nellcor MSpO2 Setup Screen

NOTE: A Masimo MSpO2 Setup Screen differs slightly from the Nellcor Setup Screen. The Response Time field is missing and, in its place, is a Sensitivity field followed by an Averaging Time field.

Response Time (Nellcor Module Only)

Choose a response time modes in order to compensate for different levels of patient activity.

- Slow: Uses a 10- to 15-second averaging period and is least affected by patient movement. When this setting is selected, instead of a pulse value, the MHR/P area will be blank.
- Normal: Uses a 5- to 7-second averaging period and is recommended in cases where the patient is relatively inactive.
- Fast: Uses a 2- to 3-second averaging period and is most affected by patient movement.

If the MHR/P source is set at MSp02 the response time must be set to Normal or Fast. If the response time is set to slow, no pulse rate will appear.

Sensitivity (Masimo Module Only)

This menu option appears only when using a Masimo module and sensor.

- Normal: Use the Normal sensitivity setting for normal patient monitoring purposes.
- Maximum: Use the Maximum sensitivity setting for improved low perfusion performance and for faster tracking of rapid $MSp0_2$ saturation changes.

Averaging Time (Masimo Module Only)

This menu option only appears when using a Masimo module and sensor. Choose a response time in order to compensate for different levels of patient activity: 2, 4, 8, 10, 12, 14, or 16 seconds.

For the 2 and 4 second averaging settings: The actual averaging times may range from 2 to 4 and 4 to 6 seconds, respectively.

- 10, 12, 14, or 16 seconds: These averaging settings are least affected by patient movement.
- 8 seconds: This averaging selection is recommended in cases where the patient is relatively inactive.
- 2 or 4 seconds: These averaging selections are most affected by patient movement.

Print Interval

This setting determines the time interval for printing the $MSpO_2$values on the strip chart paper.

$\%O_2$ Trace

This setting enables or disables the printing of the $\%MSpO_2$ trend on the bottom grid of the strip chart paper.

- On: The $\%MSpO_2$ trend prints in grey and is annotated with $\%MSpO_2$.
- Off: The $\%MSpO_2$ trend is not printed.

TREND SCALE—Refer to “General Setup Screen” on page 4-9 for information on the trend scale.

Alarm Limits

These fields adjust the high and low alarm limits for $\%MSpO_2$, as well as for MHR/P — in increments of 1% or 5 BPM. The selectable values are listed in Chapter 9, “Maternal Pulse Oximetry Monitoring”. Refer to Appendix A, “Factory Defaults” for further information.

Audio Alarm

This field enables/disables the audio alarm function for $MSpO_2$.

- On: Visual and audible indications are provided during an $MSpO_2$ alarm condition.
- Off: Only a visual indication is provided during an $MSpO_2$ alarm condition.

Alarm Volume

This field controls alarm volume for all alarms.

Refer to Appendix A, “Factory Defaults” for information on factory defaults and setting options.

$MSpO_2$ Methodology

The maternal oxygen saturation is indicated by up to three digits representing the percentage of oxygen saturation. The pulse amplitude indicator is a vertical bar that visually indicates each pulse. If $MSpO_2$ is selected as the MHR/P source*, each pulse beat is indicated with a “beep” that varies in pitch to reflect changes in the oxygen saturation reading. The pitch rises as the saturation values increase; the pitch lowers as the saturation values decrease.

When enabled, the $\%MSpO_2$ trend print in the bottom grid as a grey trace annotated by $\%MSpO_2$ ⌐⩘⩘. Values are printed on the annotation area preceded by an outlined diamond ◊ which marks the time of the reading.

If $MSpO_2$ is selected as the MHR/P source and the $MSpO_2$ response time is set to SLOW, the pulse rate area of the display is blank. The response time must be set to NORMAL or FAST to display a pulse rate.

* *Refer to “Chapter 8, Maternal Heart/Pulse Rate Monitoring” for more information.*

Additional Features

$MSpO_2$ Pulse Beat Audio

If $MSpO_2$ is selected as the MHR/P source, each pulse beat is indicated with a "beep": the pitch of the beep will vary according to the saturation value; the pitch rises as the saturation value increases; the pitch lowers as the saturation value decreases. If MECG is selected as the MHR/P source, the MECG audio *plink* is used instead; it will not vary in pitch.

The $MSpO_2$ Waveform

When $MSpO_2$ monitoring is employed, the $MSpO_2$ pulsatile (plethysmograph) waveform can be displayed and printed. Refer to "Chapter 15, Waveforms".

Module and Probe Compatibility

Nellcor and Masimo pulse oximetry modules are calibrated to display functional saturation. Other manufacturer's pulse oximetry monitors may be calibrated to display fractional saturation.

- 120is Series Monitors with Masimo modules are compatible with Masimo LNOP probes.
- 120is Series Monitors with Nellcor modules are compatible with Nellcor probes.

The $MSpO_2$ cable should plug into the monitor's $MSpO_2$ connector easily and securely. Do not use excessive force to connect the cable. If the $MSpO_2$ cable does not easily fit into the $MSpO_2$ connector on the monitor, it is likely that you do not have the appropriate cable.

Modules and Sensors

The Masimo and Nellcor modules are used to non-invasively measure the amount of oxygenated hemoglobin and pulse rate. The absorption of selected wavelengths of light is measured with probes. Although these modules process the $MSpO_2$ measurements differently, the function and appearance of $MSpO_2$ on your monitor is the same.

No Implied License

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

Sensors

Before use, carefully read the manufacturer's sensor directions for use.

Use only Masimo LNOP oximetry probes with the Masimo module; use only Nellcor probes with the Nellcor module. Other probes (sensors) may cause improper performance.

CAUTIONS

TISSUE DAMAGE—Tissue damage can be caused by incorrect application or use of a $MSpO_2$ sensor, for example by wrapping the sensor too tightly. Inspect the sensor site as directed in the sensor's directions for use to ensure skin integrity and correct positioning and adhesion of the sensor.

- Do not use damaged sensors.
- Do not use a sensor with exposed optical components.
- Do not re-sterilize single-patient use sensors. For reusable sensors, refer to the manufacturer's instructions for cleaning and sterilization.
- Do not immerse the patient cable in water, solvents, or cleaning solutions (the patient cable connectors are not waterproof).
- Do not re-sterilize the patient cable by irradiation, steam, or ethylene oxide.

Chapter 11

Alarms

This chapter provides a summary of alarms for all modalities in the 120 Series.

This chapter describes the following.

Introduction

NOTE: The audio portion of an alarm takes priority to override the song player if activated.

A 120 Series Monitor provides patient alarms (alarm limit threshold violations) for:

- FHR1
- FHR2
- NBP (systolic, diastolic, and mean arterial pressures)
- MHR/P (for the selected source)
- %MSpO$_2$

In addition, the monitor provides signal quality alarms.

Alarm Setup

Master Alarm Setup Screen

Figure 11-1 shows an example Master Alarm Setup screen. Although each of the fields on this screen can be accessed under the individual parameter setup screens, this screen provides an overall summary of the maternal alarm setup information.

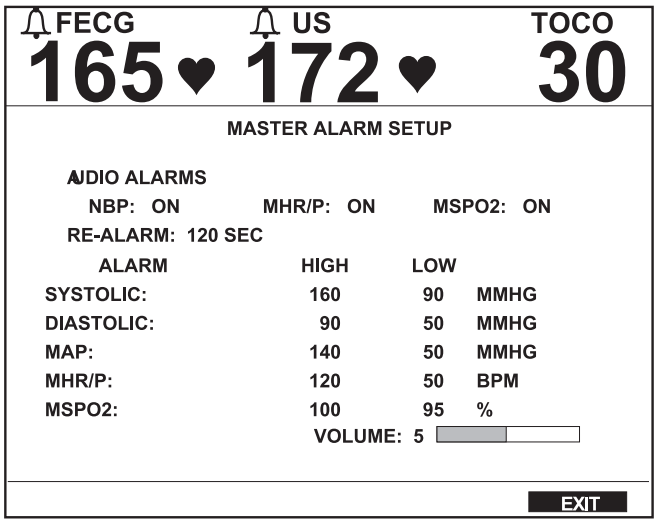


Figure 11-1. Master Maternal Alarm Setup Screen

Audio Alarms

Individual fields enable/disable the audio alarm functions for NBP, $MSpO_2$, and MECG. The settings are summarized as follows:

- **Off:** Only a visual indication is provided for an alarm.
- **On:** Both visual and audible (if enabled) indications are provided for an alarm condition.

Re-Alarm

This field adjusts the temporary silence period. An audio alarm is cancelled using the Alarm Silence pushbutton. However, for MECG and $MSpO_2$ monitoring and during a paper-load–error condition, an alarm will be re-issued if the alarm state continues after a specified amount of time.

Alarm Limits

These fields adjust the high and low alarm limits for NBP, MHR/P, and $MSpO_2$. The available ranges are shown in Figure 11-1. The factory default setting are listed in Appendix A, “Factory Defaults” .

Volume

This field controls the volume of *all* alarms

Some alarm fields appear on more than one setup screen. These fields are automatically updated when a change is made on any one screen.

CAUTION
ALARM SETUP—Prior to monitoring each patient, it is recommended that you check the alarm limits to ensure they are appropriate for the patient.

Alarm Limits

NOTE: For each modality, the *available* ranges of high and low alarm limits overlap; however, the monitor prevents the *selection* of overlapping alarm limits.

The alarm limits for each modality are configured by a respective setup screen. Refer to "Chapter 4, Setup Procedures". A Master Alarm screen provides a summary of most alarm limit settings with the exception of the FHR1 and FHR2 limit settings which are set independently.

Alarm Volume

The alarm volume can be set on any individual setup screen or on the Master Alarm Setup screen. This settings is used for *all* alarms: fetal, maternal, and signal quality.

Audio Alarm

Each modality has as an individual audio alarm enable/disable field. The maternal audio alarm fields are also present on the Master Alarm Setup screen.

Alarm Setting Indicators

NOTE: The FHR alarms may be completely disabled from the Install Options service screen. When disabled, the alarm setting indicator is not displayed.

An alarm setting indicator displays for FHR1, FHR2, NBP, MHR/P, and $MSpO_2$. Table 11-1 provides a summary of the two possible states for this indicator.

Table 11-1. Alarm Setting Indicators		
Mode	 All of the following are true:	 At least one of the following is true:
FHR	■ The FHR audio alarm is on. ■ Each of the FHR high/low limits is set to a value.	■ The FHR audio alarm is off. ■ The FHR high limit is off. ■ The FHR low limit is off.
NBP	■ The NBP audio alarm is on. ■ Each of the NBP high/low limits is set to a value.	■ The NBP audio alarm is off. ■ One or more of the NBP high limits (systolic, diastolic, or mean arterial) is off. ■ One or more of the NBP low limits is off.
MHR/P	■ The MHR/P audio alarm is on. ■ Each of the MHR/P high/low limits is set to a value.	■ The MHR/P audio alarm is off. ■ The MHR/P high limit is off. ■ The MHR/P low limit is off.
$MSpO_2$	■ The $MSpO_2$ audio alarm is on. ■ Each of the $MSpO_2$ high/low limits is set to a value.	■ The $MSpO_2$ audio alarm is off. ■ The $MSpO_2$ high limit is off. ■ The $MSpO_2$ low limit is off.

Maternal Alarm Occurring During Setup

Alarm Behavior

If the visual indication of a maternal alarm is inhibited by a setup screen, only an audio alarm (if enabled) is issued. As soon as you exit the setup screen, the visual alarm indication displays.

- Example: If the NBP Setup screen is displayed, the primary labor parameters continue to be displayed as well as the maternal NBP area of the screen. Under an alarm condition that affects NBP, both a visual and audible (if enabled) alarm is issued. Under an alarm condition that affects $MSpO_2$ or MECG, only an audio alarm (if enabled) is given while the NBP Setup screen remains displayed; once the setup screen is exited, the visual alarm indication for $MSpO_2$ or MECG is shown.

NBP Display Timer Behavior

The display timer clock symbol reflects the time period, in minutes, that a blood pressure reading remains displayed before being automatically erased, starting from the time the reading is displayed. In the presence of an NBP alarm, the display timer begins to decrement only after the Alarm Silence pushbutton is pressed. Refer to "Display Timer" on page 9-7 for further information.

Figure 11-2. Display Timer Clock

Fetal Heart Rate Alarms

FHR Patient Alarms

NOTE: The re-alarm time does not apply to FHR alarms—only MECG and $MSpO_2$ alarms. FHR values are not configurable.

A fetal heart rate *patient* alarm occurs when any fetal heart rate falls outside of the pre-defined alarm limits—greater than the high limit setting or less than the low limit setting.

The FHR alarm function can be completely disabled from the Install Options service screen. In order for this change to take effect, you must turn the monitor off, then back on again. Refer to the "120 Series Monitor Service Manual" for more information.

Active Patient Alarm

A patient alarm is indicated both visually and audibly. The visual indication is provided by flashing the affected FHR numeric. The audio alarm is alternating high/low tones.

Resolved Patient Alarm

Resolved FHR alarms function differently than other alarms with a 120 Series Monitor:

- **Resolved, Unsilenced FHR Patient Alarm:** You must acknowledge a FHR patient alarm—even if the condition has already been resolved. The visual and audible indications remain present until you press the Alarm Silence button. This ensures that a clinician is aware that an alarm occurred. You may hear this type of alarm described as *latching*.
- **Resolved, Silenced FHR Patient Alarm:** If you have already silenced a FHR patient alarm, the visual indications disappear automatically.

By comparison, the visual and audible indications for a *maternal* patient alarm automatically disappear as soon as the condition is resolved—whether or not you have acknowledged the alarm.

FHR Signal Quality Alarms

A fetal heart rate signal quality alarm occurs if the monitor is unable to detect an acceptable FHR signal.

Active Signal Quality Alarm

A signal quality alarm is indicated both visually and audibly. The visual indication is provided by flashing the FHR numeric (if available) or flashing dashes "– – –" in place of the FHR numeric. The audio alarm is alternating high/low tones.

Resolved Signal Quality Alarm

Resolved signal quality alarms function like most other 120 Series alarms. As soon as an alarm condition is resolved, both the visual and audible indications automatically disappear.

Silencing a FHR Audio Alarm

Press the Alarm Silence button to cancel the audio; however, the visual indication remains until the condition is resolved.

Maternal Alarms

Maternal Patient Alarms

A maternal patient alarm occurs when a parameter value falls outside of the pre-defined alarm limits—greater than the high limit setting or less than the low limit setting.

- For MHR/P, the value used for analysis comes from the selected MHR/P source.
- For $MSpO_2$ the value must be out of range for 8 seconds.

Active Patient Alarm

A patient alarm is indicated both visually and audibly. The visual indication is provided by flashing the associated numeric. The audio alarm is alternating high/low tones.

For $MSpO_2$, the $\%MSpO_2$ value and accompanying pulse rate are printed on the strip chart paper.

Resolved Patient Alarm

The visual and audible indications automatically disappear as soon as the condition is resolved.

Signal Quality Alarms

If the monitor is unable to detect an acceptable signal, a signal quality alarm is provided.

Active Signal Quality Alarm

The following signal quality alarms are indicated both visually and audibly. The audio alarm is alternating high/low tones. The visual indication varies according to the alarm:

- **Asystole:** Dashes "– – –" display in place of the MHR/P numeric.
- **MECG Leads Off:** Dashes "– – –" display in place of the MHR/P numeric. The following message displays in the MHR/P area: MECG LEADS OFF. During this type of alarm, the MHR/P source automatically switches to the next available parameter ($MSpO_2$ then NBP). As soon as the alarm condition is resolved and the MECG signal is detected, the monitor returns to using MECG as the MHR/P source.
- **NBP System Problem:** When there is a malfunction with the monitor's built-in NBP module, the cuff, or the air hoses, the monitor will be unable to make a determination. During this type of alarm, one of the following messages displays in the NBP area: CHECK CUFF, OVERPRESSURE, LEAK, COMM, MOTION, WEAK SIGNAL, or REPAIR. Refer to "Chapter 17, Troubleshooting", for more information about these messages.
- **$MSpO_2$ System Problem:** When there is a malfunction with the monitor's built-in $MSpO_2$ module, one of the following messages displays in the $MSpO_2$ area: COMM or REPAIR. Refer to "Chapter 17, Troubleshooting", for more information.
- **$MSpO_2$ Disconnect:** An $MSpO_2$ disconnect alarm occurs if: the $MSpO_2$ intermediate cable is disconnected from the monitor; the sensor assembly is disconnected from the intermediate cable; or the sensor or cable have a broken wire. Dashes "– – –" display in place of the %$MSpO_2$ numeric.

Resolved Signal Quality Alarm

Resolved signal quality alarms behave like most other 120 Series alarms. As soon as an alarm condition is resolved, both the visual and audible indications automatically disappear.

Silencing a Maternal Audio Alarm

Press the Alarm Silence button to cancel the audio; however, the visual indication remains until the condition is resolved.

For MECG and $MSpO_2$, you can only *temporarily* silence the audio portion of the alarm. If the alarm condition remains, after expiration of the re-alarm time configured on the Master Alarm Setup screen, the audio alarm is re-issued. (Refer to page 4-8.)

Chapter 12

Recorder Modes

The 120 Series Monitor has three recorder modes: off, on, and maternal-only. This section discusses the different features of each mode and provides instructions for changing modes. This section also discusses the types of strip chart paper and summarizes the strip chart trends and annotations.

The section includes the following:

Strip Chart Paper

Instructions for loading the strip chart paper are provided in "Chapter 4, Setup Procedures". This section discusses the two kinds of strip chart paper available from GE Medical Systems *Information Technologies*. The two kinds of paper are:

- Z-Fold Chart Paper with Pre-Printed **30–240** BPM Heart Rate Scale (Refer to Figure 12-1.)
- Z-Fold Chart Paper with Pre-Printed **50–210** BPM Heart Rate Scale (Refer to Figure Figure 12-2.)

In the United States of America, the most common grid is the 30-240 BPM scale with the recorder speed set at 3 cm/min. As shown in Figure 12-1, a dark line is printed every 3 cm, which represents 1 minute in time at a speed of 3 cm/min.

In other countries, the most common grid may be the 50–210 BPM scale with the recorder speed set at 1 cm/min. As shown in Figure 12-2, every other vertical line measures 1 cm, or 1 minute in time at a speed of 1 cm/min.

Regardless of the heart rate scale, the uterine activity scale is pre-printed from 0–100 mmHg; this same scale is used for relative units. When SpO_2 and monitoring is in progress, the scale is printed on the paper by the recorder. Figure 12-1 and Figure 12-2 also call out the top grid, bottom grid, and the annotation area for each style paper.

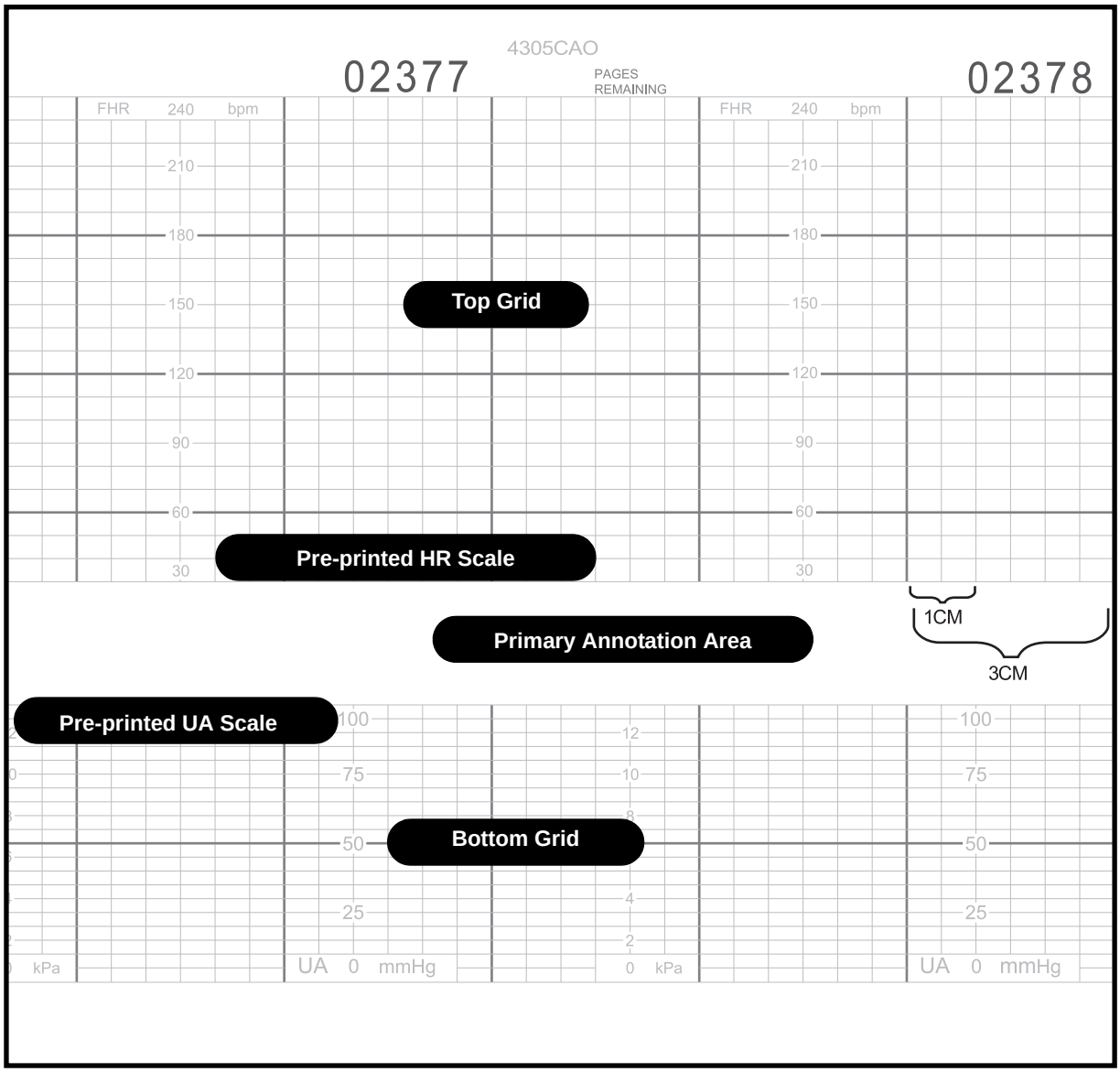


Figure 12-1. Strip Chart Paper with 30–240 BPM Heart Rate Scale

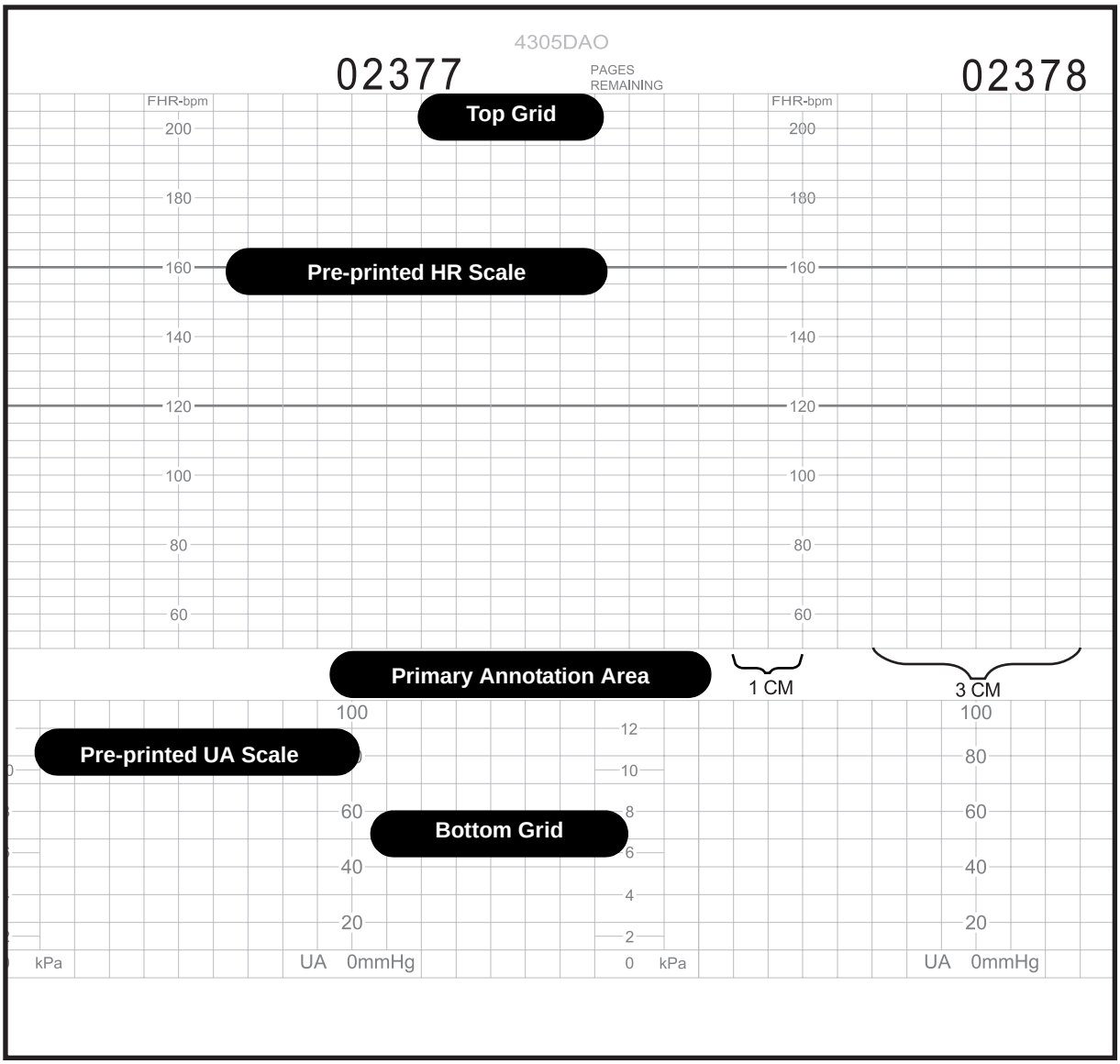


Figure 12-2. Strip Chart Paper with a 50–210 BPM Heart Rate Scale

Off Mode

When the recorder is off, the yellow Record indicator is off and nothing is *automatically* printed on the strip chart paper.

Even with the recorder turned off, it is possible to *manually* print the displayed waveform or the maternal vital signs history. Pressing the PRINT or PRINTALL softkey turns places the recorder into a special high-speed printing mode. After the information is printed, the recorder turns off again. Refer to “Chapter 13, Maternal Vital Signs History” and “Chapter 15, Waveforms”, for more information.

On Mode

When the recorder is on, the yellow Record indicator continuously illuminates and the recorder runs at the selected speed of 1, 2, or 3 cm/min.

Trends

Multiple Trends

Multiple trends can be simultaneously printed on the strip chart paper. Table 12-3 provides a summary of the different trend types; Figure 12-3 provides an example of a strip chart with five traces printed simultaneously.

Up to three heart/pulse rate trends can be printed in the top (or left) channel of the strip chart paper: two FHR trends as well as the MHR/P trend. The primary FHR trend is printed in plain black. The secondary FHR trend is printed in bold black. The MHR/P trend is printed in grey.

The UA, %FSpO$_2$,and %MSpO$_2$ trends are printed in the bottom (or right) grid of the strip chart paper. The UA trend is printed in plain black. The %FSpO$_2$ trend is printed as a black beaded line. The %MSpO$_2$ trend is printed in grey.

The FHR and UA trends are printed continuously. The MHR/P, %FSpO$_2$, and %MSpO$_2$ trends must all be enabled via the respective setup screen.

Table 12-1. Summary of Strip Chart Trends

Grid	Source Type	Trace Description	Parameter	Trend Source
Top (Left)	Fetal	Plain Black	FHR1	US or FECG
		Bold Black	FHR2	US or US2
	Maternal	Grey	MHR/P	MECG or MSpO$_2$P
Bottom (Right)	Fetal	Plain Black	%FSpO$_2$	FSpO$_2$%
	Maternal	Plain Black	UA	TOCO or IUP
		Grey	%MSpO$_2$	MSpO$_2$%

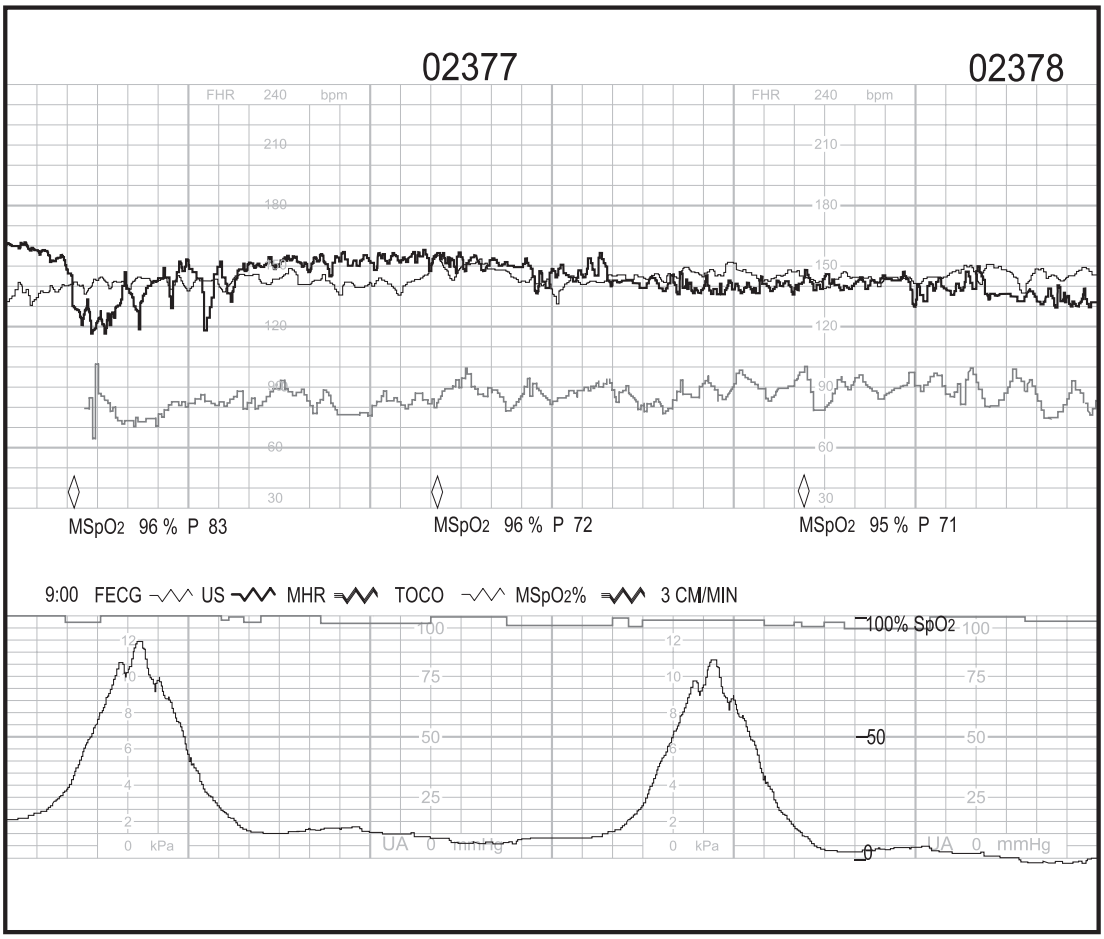


Figure 12-3. Five Trends Printing Simultaneously

%MSpO$_2$ Trend Scale

Two options for setting the %MSpO$_2$ trend scale are available, allowing compatibility with %FSpO$_2$ trending. (Refer to "SpO$_2$ Scale" on page 4-10.) No matter which scale is active, the scale prints on the paper approximately every 1.5 pages and is annotated with SpO$_2$.

- **0–100% Scale:** This option configures the %MSpO$_2$ trend to plot at a fixed scale of 0–100%, like %FSpO$_2$.
  - *Advantage:* Eliminates switching back and forth between two different scales.
  - *Disadvantage:* The fine details of the maternal trend may not be seen.
- **Auto Scale:** When trending %MSpO$_2$ only, the trend plots on an expanded scale of 60–100% or 50–100%, depending on the paper.* At the commencement of %FSpO$_2$ trending, the %MSpO$_2$ trend automatically changes to a scale of 0–100% so that fetal and maternal trends are plotted on the same scale. If %FSpO$_2$ trending stops, the %MSpO$_2$ trend switches back to plotting on an expanded scale. (Whenever there is a scale changeover, a dashed vertical line prints to call attention to the change; the new scale prints shortly afterwards.)
  - *Advantage:* Shows more details of %MSpO$_2$ trend when fetal trending is absent.
  - *Disadvantage:* Requires paying close attention to the printed scales.

* *The %MSpO$_2$ trend is plotted over a range of 60–100% on paper with a HR scale ranging from 30–240 BPM. The %MSpO$_2$ trend is plotted over a range of 50–100% on paper with a HR scale ranging from 50–210 BPM.*

Figure 12-4 shows an example of a %MSpO$_2$ scale changeover when AUTO is configured. In the example:

- At startup, both %MSpO$_2$ and %FSpO$_2$ are trended.
- Initially, the 0–100 % scale is printed on the paper along with the trended data.
- Midway through the example, %FSpO$_2$ *trending* stops.
- The scale switches to 60–100 %.
- A dashed vertical line prints noting the change.
- The 60–100 % scale prints shorty afterwards.

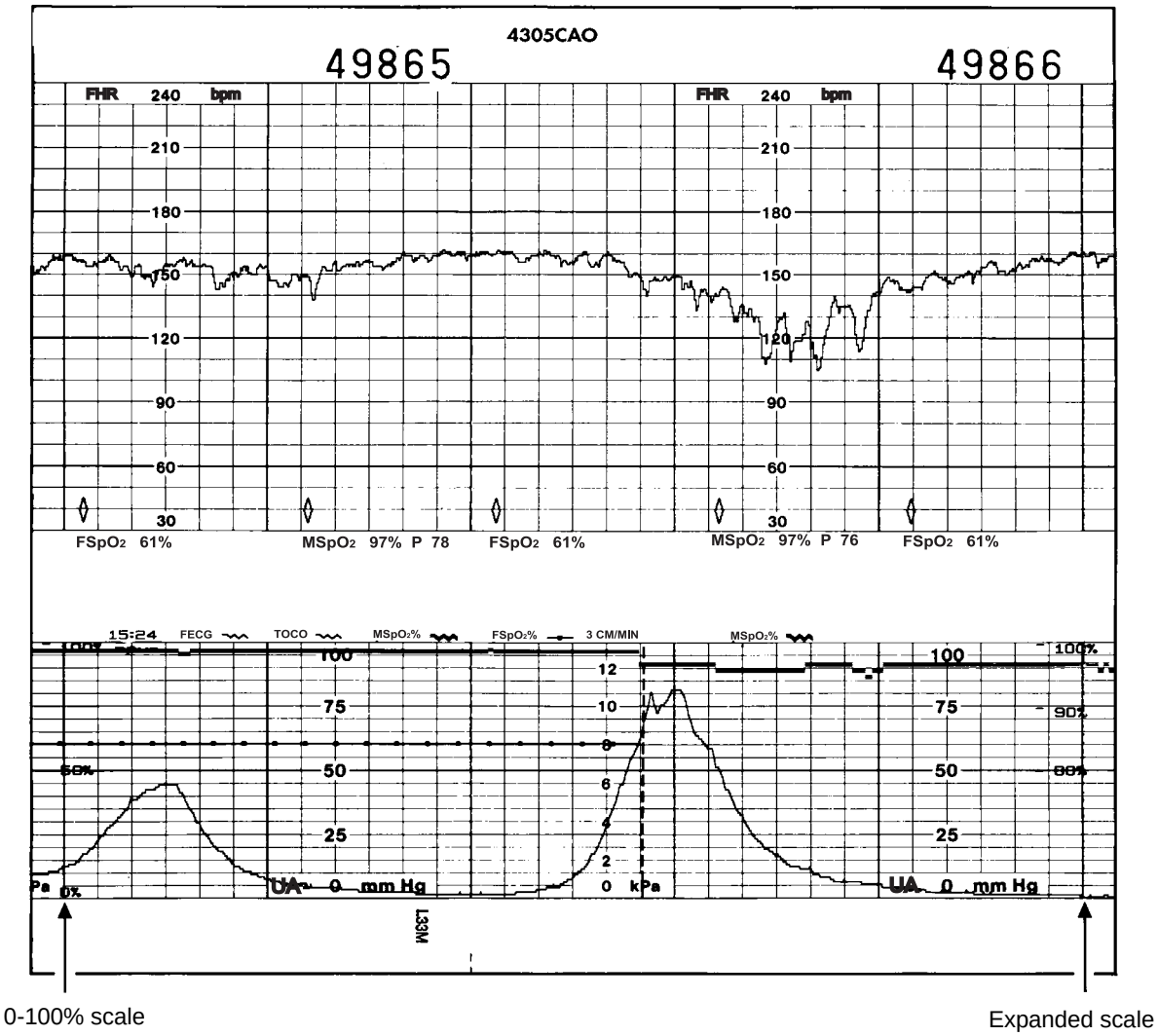


Figure 12-4. %MSpO$_2$ Scale Changeover

Annotations

Several standard annotations are printed by the monitor to help analyze the strip chart data and complete the patient record. Most annotations print in the area between the top and bottom grids of the strip chart paper; however, some annotations print in either grid. All annotations are listed and explained in 12-3.

Standard Annotations

The most common of the annotations which print on the *bottom* line are:

- date
- time
- active modes
- heart rate coincidence enable status
- fetal heart rate alarm enable status
- recorder speed
- telemetry status

Fetal Pulse Oximetry Annotation

A fetal pulse oximetry reading prints according to the interval time set on the $FSpO_2$ Setup screen (for built-in module) or the General Setup screen (for external device). The reading can print on any of the first three annotation lines—depending on which printing line is available. A diamond marks the time of the reading.

- ◊: An unfilled diamond indicates the reading was received from the monitor's built-in fetal pulse oximetry module. The vital signs print below the diamond.
- ♦: A filled diamond indicates the reading was received from an external fetal pulse oximeter connected to the 120 Series Monitor. The vital signs print below the diamond. (See Figure 12-5.) Contact your Service Representative for information about connectivity.

If the top three printing lines are busy printing other data, the diamond prints at the time of the reading; however, the vital signs data prints as soon as a line becomes available.

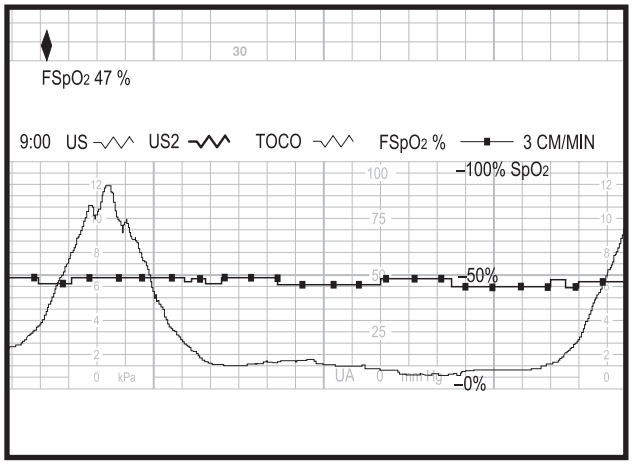


Figure 12-5. $FSpO_2$ Data Example

Blood Pressure Annotations

A blood pressure reading can print on any of the first three annotation lines—depending on which printing line is available. A diamond marks the time of the reading.

- ◊: An unfilled diamond indicates the reading was received from the monitor's built-in blood pressure module (Models 128 and 129). The vital signs print below the diamond. See Figure 12-6.
- ⊘: An unfilled diamond with a slash indicates a blood pressure reading was cancelled/delayed. The ⊘ marks the time the reading was originally scheduled. The annotation NBP (D) prints below the marker. See Figure 12-6.
- ⧫: A filled diamond indicates the reading was received from an external blood pressure monitor connected to the 120 Series Monitor. The vital signs print below the diamond. (Contact your Service Representative for information about connectivity.)

If the top three printing lines are busy printing other data, the diamond prints at the time of the reading; however, the vital signs data prints as soon as a line becomes available.

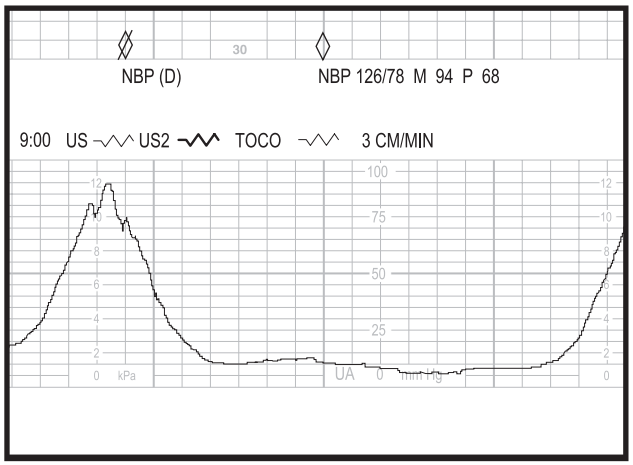


Figure 12-6. NBP Vital Signs Data Annotation from Built-In Module

Maternal Pulse Oximetry Annotations

A maternal pulse oximetry reading prints according to the interval time set on the $MSpO_2$ Setup screen (for built-in module) or the General Setup screen (for external device). For the built-in module, a reading also prints for each alarm generated. The reading can print on any of the first three annotation lines—depending on which printing line is available. A diamond marks the time of the reading.

- ◊: An unfilled diamond indicates the reading was received from the monitor's built-in maternal pulse oximetry module. The vital signs print below the diamond.
- ⧫: A filled diamond indicates the reading was received from an external maternal pulse oximeter connected to the 120 Series Monitor. The vital signs print below the diamond. (Contact your Service Representative for information about connectivity.)

If the top three printing lines are busy printing other data, the diamond prints at the time of the reading; however, the vital signs data prints as soon as a line becomes available.

The pulse rate value determined by $MSpO_2$ always prints along with $\%MSpO_2$.

Annotations from a Central Information System

The 120 Series Monitor has three built-in RS-232C ports which can be used to connect to a central information system which supports Hewlett Packard's Digital Series Protocol. Contact your Service Representative for more information.

The 120 Series Monitor can also be configured via a Communications service screen to print annotations received from a central information system. A computer marker prints on the bottom two lines of the heart rate grid marking the time the annotation was made from a remote location. See Figure 12-7.

Multiple Annotations

Sometimes annotations occur within seconds of each other. Consider the following example shown in Figure 12-7:

- an automatic NBP reading occurs at 16:51:30
- three annotations are received from a central information system; the entries are made between 16:51:40 and 16:52:00
- a manual NBP reading occurs at 16:52:10

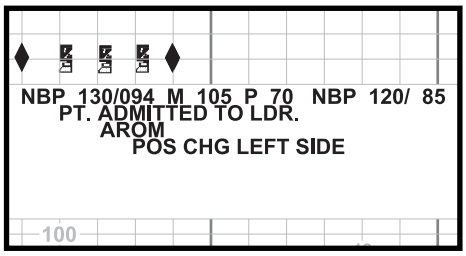


Figure 12-7. Multiple Annotations Example

Adjustable Recorder Font Size

The 120 Series Monitor offers a choice of font sizes to print annotations. (Refer to Table 12-2.) A larger font size fosters readability; a smaller font size increases printing speed.

Set the font size on the Install Options service screen. Refer to the "120 Series Monitor Service Manual" for more information.

CAUTION
FONT SIZE—If the medium or large font size is selected, there is the possibility that messages may be truncated during periods of multiple annotations.

Table 12-2. Summary of Font Settings

Font Setting	Printing Description	
	30–240 BPM Scale Paper	50–210 BPM Scale Paper
Small	■ Eight annotation lines are available. ■ Time/date, modes, and annotations all print using the small font size. ■ See Figure 12-8.	■ Four annotation lines are available. ■ Time/date, modes, and annotations all print using the small font size.
Medium	■ Four annotation lines are available. ■ Time/date and annotations print using the medium font size. ■ Modes print using the small font size. ■ See Figure 12-8.	■ Two annotation lines are available. ■ Time/date and annotations print using the medium font size. ■ Modes print using the small font size.
Large	■ Three annotation lines are available. ■ Annotation print using the large font size. ■ Time/date print using the medium font size. ■ Modes print using the small font size. ■ See Figure 12-8.	

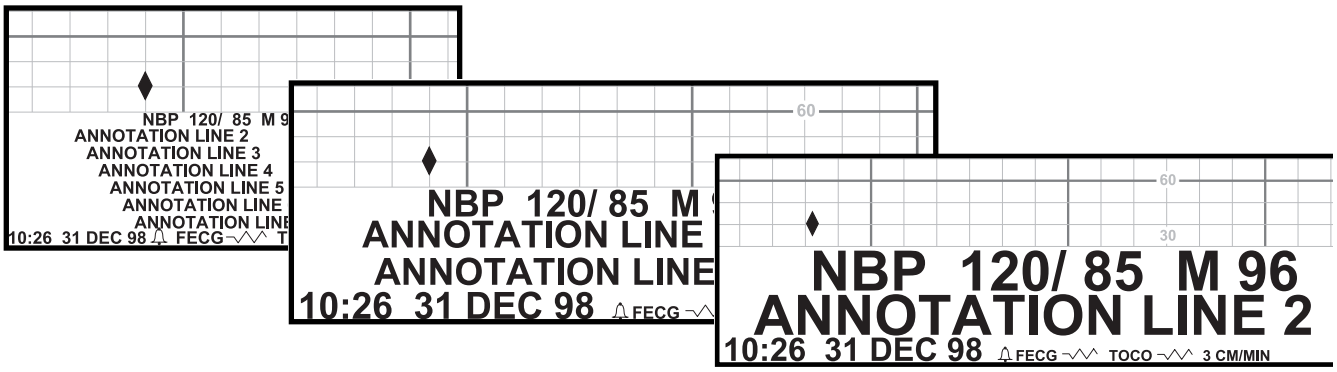


Figure 12-8. Multiple Font Sizes

Summary of Annotations

Table 12-3. Summary of Annotations

Annotation	Explanation
Time and Date (Example: 10:40 12 AUG 97)	Time and date are both printed on the bottom annotation line twenty seconds after the recorder is turned on and when the date changes after midnight. A time stamp automatically prints approximately every ten minutes—at the ten-minute mark. For example: 10:50, 11:00, 11:10, 11:20, 11:30, etc. If the bottom annotation line is being used to print another annotation, the time stamp is delayed. For example: 10:50, 11:00, 11:*12*, 11:20, 11:30, etc. In this example, the 11:10 date stamp was delayed until 11:12. The time and/or date also prints whenever it is changed via the General Setup screen.
SET TIME/DATE	If the monitor senses a clock circuit fault, when the recorder is turned on, this message replaces the normal time/date stamp. The message reprints every ten minutes, at the ten-minute mark, until the clock is reset.
TEST: ARE ALL DOTS PRINTED?	This annotation prints across the width of the top strip chart grid when you press the Test pushbutton. The message reminds you to check for a continuous unbroken line of recorder dots.
	This icons prints prior to the FHR trend source annotations if the FHR alarms are enabled. The FHR alarm option is enabled/disabled via the Install Options service screen.
US or FECG 	The trend source prints on the bottom annotation line by the following rules: ■ All trend sources print twenty seconds after the recorder is turned on, including inoperative modes. ■ All trend sources print every thirty minutes. ■ If a mode change occurs, only those trend sources belonging to the corresponding group print. If any top grid trend source changes, all top grid active trend sources are printed. If the UA mode changes, the active UA trend source is printed. A mode change is defined as: switching connectors; connecting to a front panel receptacle; disconnecting from a front panel receptacle; or enabling/disabling a trend on a setup menu.
US or US2 	
MECG or $MSpO_2P$ 	
UA 	
$FSpO_2$%	
$MSpO_2$% 	
CARDIO INOP	This annotation prints in place of any trend source if the respective connector (FECG/MECG, US, or US2) is unused.
UA INOP	This annotation prints in place of the trend source if the UA receptacle is unused.
$FSpO_2$ INOP	This annotation is printed in place of the trend source if the trend is enabled and the $FSpO_2$ receptacle is unused.
$MSpO_2$ INOP	This annotation prints if the trend is enabled and the Maternal SpO_2 receptacle is unused.

Table 12-3. Summary of Annotations (Continued)	
Annotation	Explanation
Chart Speed (Example: 3 CM/MIN)	The chart speed prints on the bottom annotation line: ■ twenty seconds after you turn on the recorder; and ■ when the speed changes.
UA REF	This message prints on the bottom line of the bottom strip chart paper grid during active uterine activity monitoring whenever: ■ you press the UA Reference pushbutton; or ■ whenever automatic re-zeroing occurs during tocotransducer monitoring.
BASELINE PRESSURE OFFSCALE	This annotation prints on the bottom line of the bottom strip chart paper grid during IUPC monitoring when the pressure falls below 0 mmHg for more than 20 seconds.
Maternal NBP vital signs data. For example: ◊ NBP 103/ 71 M 83 P 72 or ♦ NBP 103/ 71 M 83 P 72	Maternal NBP vital signs data prints for each manual and automatic determination. ■ ◊ identifies the 120 Series as the source. ■ ♦ identifies an external device as the source. The diamond prints on the bottom two lines of the bottom grid of the strip chart paper and marks the time of the reading. The vital signs data prints in one of the top three lines of the annotation area as soon as a printing line is available. The printed pulse rate value is derived from the blood pressure module and is independent of the MHR/P source selected on the MHR/P Setup screen.
⊘ NBP (D)	Indicates a BP determination was cancelled or delayed due to the occurrence of a uterine contraction.
%$MSpO_2$ vital signs data. For example: ◊ $MSpO_2$ 97% P 66 or ♦ $MSpO_2$ 98% P 70	$MSpO_2$ vital signs data is printed at selected intervals according to the $MSpO_2$ Setup screen (built-in module) or the General Setup screen (external device). In addition, *for the built-in module only*, vital signs data is printed when a %$MSpO_2$ alarm occurs; however, only one alarm-related print occurs within a 5-minute period. ■ ◊ identifies the 120 Series as the source. ■ ♦ identifies an external device as the source. The diamond prints on the bottom two lines of the bottom grid of the strip chart paper and marks the time of the reading. The vital signs data prints in one of the top three lines of the annotation area as soon as a printing line is available. The printed pulse rate value is derived from the pulse oximetry module/monitor and is independent of the MHR/P source selected on the maternal MHR/P Setup screen.

Table 12-3. Summary of Annotations (Continued)	
Annotation	Explanation
%$FSpO_2$ data. For example: ◊ $FSpO_2$ 47% or ♦ $FSpO_2$ 47%	$FSpO_2$ data is printed at selected intervals according to the $FSpO_2$ Setup screen (built-in module) or General Setup screen (external device). ■ ◊ identifies the 120 Series as the source. ■ ♦ identifies an external device as the source. The diamond prints on the bottom two lines of the bottom grid of the strip chart paper and marks the time of the reading. The data prints in one of the top three lines of the annotation area as soon as a printing line is available.
Remote annotation from a central information system. For example:  EPIDURAL GIVEN. AROM. POS CHG LEFT SIDE.	This annotation represents notes received from a remote central information system. The computer icon  prints in the bottom two lines of the top grid. The icon marks the time of the annotation and also indicates that the information comes from a remote computer such as a QS/Perinatal System. The notes print on any lines except the first, (The first line is reserved from NBP vital signs data.)
HBC	This annotation prints on the first annotation line following the active heart rate mode(s) indicating heartbeat coincidence is enabled. This feature is enabled/ disabled via the Install Options service screen. The annotation represents only that the feature is enabled; it does not indicate that heartbeat coincidence has been detected.
♡♡	This annotation prints in the top two lines of the upper grid indicating that the monitor detects heartbeat coincidence.
♡♡	This annotation prints in the top two lines of the upper grid indicating the cessation of heartbeat coincidence.
	This annotation prints on the bottom two lines of the upper grid indicating that active telemetry signals are being received. The annotation re-prints every 30 minutes along with the modes.
	This annotation prints on the bottom two lines of the upper grid indicating that telemetry signals are no longer being received.
US + 20 or US2+20 → ← | | | | | | | | → ←	This annotation can only be seen when dual heart rate monitoring is in progress. The offset annotation US + 20 or US2+20 prints at the top of the upper grid indicating that the secondary fetal heart rate trend is shifted +20 BPM. The right/ left arrows (→ ←)and vertical dashed lines bracketing the heart rate grid indicate the start/end of the fetal heart rate offset mode, respectively.

Table 12-3. Summary of Annotations (Continued)	
Annotation	Explanation
↑	This annotation prints on the bottom two lines of the upper grid indicating an event. Generate the mark by one of the following: ■ Briefly press the monitor's **Mark (Offset)** pushbutton. ■ Press the Remote Marker button. (The Remote Marker is an accessory that can be connected to the 120 Series Monitor. The monitor can be configured to use this arrow annotation or the one shown in the next row of this table. Refer to the "120 Series Monitor Service Manual".)
FM ↑	This annotation prints on the bottom two lines of the upper grid indicating that the mother perceives fetal movement. The arrow prints each time the mother presses the Remote Marker button. **Note: A horizontal bar prints as a tail on the arrow for as long as the button is held down.** (The Remote Marker is an accessory that can be connected to the 120 Series Monitor. The monitor can be configured to use this annotation or the one shown in the previous row of this table. Refer to the "120 Series Monitor Service Manual".)
♪	This annotation prints on the bottom two lines of the upper grid indicating that the Corometrics Model 146 Fetal Acoustic Stimulator is being used. The music symbol prints each time a clinician presses the button on the stimulator.
Freestyle annotations. For example: PT. NAME: JANET STEVENS PT. ID#: 6535148 PT. AGE: 18 DR. CARTER	Entries typed using a Corometrics Model 2116B Data-Entry/Clinical Notes Keyboard print in the annotation area. (The Model 2116B is an optional device that can be connected to the 120 Series Monitor.)

Chart Style Vital Signs Printing

The monitor provides an option for chart-style printing of blood pressure and $MSpO_2$ values on standard clock quarter, half, and whole hour marks.

Enabling/Disabling Chart-Style Printing

The chart-style feature is enabled/disabled from the Install Options service screen. Refer to the "Maternal/Fetal Monitoring Operator's Manual" for more information.

Examples of Printing Styles

Standard (Real-Time) Printing Example

When chart-style printing is *disabled*, standard real-time printing occurs.

- NBP Example: The automatic blood pressure mode is activated at 9:03, with the interval time set to 15 minutes. The first reading occurs at 9:18. Subsequent readings are taken at 9:33, 9:48, 10:03, etc.
- $MSpO_2$ Example: The print interval is set to 15 minutes and the first acceptable pulse signal is detected at 9:05 a.m. The first printing occurs at 9:05. Subsequent $MSpO_2$ values are printed at 9:20, 9:35. 9:50, 10:05, etc.

Chart-Style Printing Examples

When chart-style printing is *enabled*:

- The 15-minute interval prints on the quarter hour (e.g. 9:00, 9:15, 9:30, 9:45, etc.).
- The 30-minute interval prints on the half hour (e.g. 9:00, 9:30, 10:00, 10:30, etc.).
- The 60-minute interval prints on the hour (e.g. 9:00, 10:00, 11:00, 12:00, etc.).

The following are examples of chart-style printing:

- NBP Example 1: The automatic blood pressure mode is activated at 9:03, with the interval time set to 15 minutes. Whereas the first *real-time* reading would occur at 9:18, the first *chart-style* reading is taken at 9:15. Subsequent readings are taken and printed at 9:30, 9:45, 10:00, 10:15, etc.
- NBP Example 2: The automatic blood pressure mode is activated at 9:17, with the interval time set to 30 minutes. Whereas the first *real-time* reading would occur at 9:47, the first *chart-style* reading is taken at 9:30. Subsequent readings are taken and printed at 10:00, 10:30, 11:00, 11:30, etc.
- $MSpO_2$ Example 1: The $MSpO_2$ print interval time is set to 30 minutes and the sensor is connected at 9:24 a.m. Whereas the first *real-time* printing would occur at 9:54, the first *chart-style* printing is done at 9:30. Subsequent values are printed at 10:00, 10:30, 11:00, 11:30, etc.
- $MSpO_2$ Example 2: The $MSpO_2$ print interval time is set to 60 minutes and the sensor is connected at 9:42 a.m. Whereas the first *real-time* printing would occur at 10:42, the first *chart-style* printing is done at 10:00. Subsequent values are printed at 11:00, 12:00, 1:00, 2:00, etc.

Chart-Style Seven-Minute Exception for NBP

If you take a manual blood pressure reading within seven minutes of a chart-style interval (15, 30, or 60 minutes) *and then* activate automatic blood pressure readings using a chart-style interval, the first automatic reading will be skipped.

This rule only applies to *the first reading when chart-style vital signs printing is enabled* on the Install Options service screen.

- Example: You take a manual blood pressure reading at 7:10. At 7:13 you then activate automatic blood pressure readings using a 15-minute time interval. The 7:15 chart-style reading is skipped since a manual reading occurred 5-minutes earlier. The first automatic reading is taken at 7:30. Since the rule applies only to the first reading, if you take another manual reading at 7:40, the 7:45 automatic reading occurs as scheduled.

Maternal-Only Mode

What is the Maternal-Only Mode?

The maternal-only printing mode sets the recorder to a standby mode—turning the recorder on and off *as needed* to print information, such as:

- maternal non-invasive blood pressure;
- maternal pulse oximetry; and
- notes from a Model 2116B Clinical-Notes/Data-Entry System.

When the recorder is in the maternal-only mode, the yellow Record indicator flickers approximately every five seconds. (See Table 12-4 and Table 12-5 for more information.)

Printing Style

Information printed using the maternal-only mode prints sideways across the page. Figure 12-9 provides an example of a maternal-only mode printout.

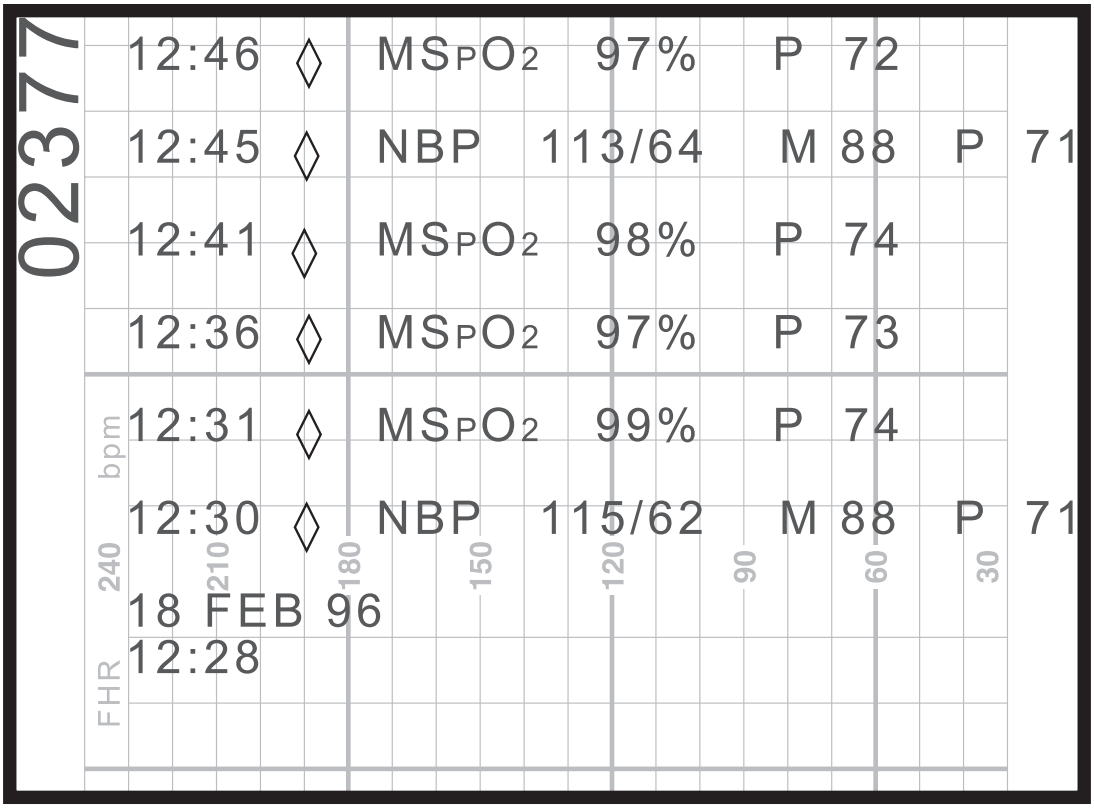


Figure 12-9. Maternal-Only Mode Printout

The following provides a summary of the printed information:

- A blank line is printed after each message to improve readability.
- Each message can be a maximum of 40 characters in length.
- The time precedes each message.
- An outlined diamond marker (◊) indicates the data is provided by one of the monitor's *built-in* modules.
- A filled diamond marker (⧫) indicates the data is provided by an *external* device interfaced to the monitor.
- The date is printed when the maternal-only mode is first activated, when the date/time is changed, and at midnight.

Functionality with a QS System

Users of a Quantitative Sentinel (QS) System (Software Version 4.0.3.0 or earlier) should be aware of the following three items when using the monitor's maternal-only mode:

Paper Versus Electronic Strip Charts

As described earlier, the monitor's maternal-only mode acts as a "paper saver" turning the strip chart recorder on and off as needed. However, the QS System overrides the maternal-only mode by storing the entire patient record. In other words, the *electronic* strip chart is retained as if the monitor's recorder were left on continuously with all data lines printing in the annotation area*; this may result in many blank pages in-between maternal vital signs data.

Messages

If the QS System is connected via RS-232 cabling, messages print as described in "Paper Versus Electronic Strip Charts". If the QS System is connected via Corolan cabling, and uses Software Version 4.0.3.0 or earlier, maternal-only mode messages will *not* print on the *electronic* strip chart of the QS System. Contact your Service Representative for clarification on whether your QS System is wired via RS-232 or Corolan cabling. Contact your Sales Representative about availability of QS System software upgrades.

Fetal Heart Rate Alarms

The QS System is designed to alarm when there is no fetal heart rate signal so it is recommended that you unplug the ultrasound and/or FECG transducers from the monitor, when not in use, to eliminate false alarms.

* *In addition, the FHR modes will list INOP.*

Changing Recorder Modes

Use the **Record** pushbutton to select between on, maternal-only mode, and off; refer to Table 12-4 and Table 12-5. Turn the recorder *on* for continuous trending; set the recorder to *maternal-only mode* when you are interested in the maternal vital signs but not the MHR/P trend.

CAUTION
DATA STORAGE—Stored maternal vital signs history data is erased when you turn the *monitor off*. Therefore, for intermittent monitoring, it is recommended that you leave the *monitor on*, but turn the *recorder off*. Refer to "Chapter 13, Maternal Vital Signs History" for more information.

Table 12-4. Changing Recorder Modes

From	To	Pushbutton
Off	On	Briefly press once; or press and hold three seconds.
Off	Maternal-Only	Briefly press twice.
On	Maternal-Only	Briefly press once.
On	Off	Press and hold three seconds.[a]
Maternal-Only	On	Briefly press once.
Maternal-Only	Off	Press and hold three seconds.[a]

[a] Two audio tones are provided for confirmation that the recorder has been turned off.

Table 12-5. Recorder Mode Audiovisual Indicator Status

Recorder Mode	Record Indicator	Audio Indicator
On	continuously illuminated	Off
Maternal-Only	lights three short flashes every 5 seconds	
Off	Off	

Paper-Low, Paper-Out, and Paper-Load–Error Conditions

A 120 Series Monitor alerts you when paper is running low or when the recorder is completely out of paper. To protect against paper jams, the recorder also contains a paper-loading sensor which notifies you if the paper has been incorrectly loaded. Refer to page 4-2 through page 4-5 for instructions on loading paper into a 120 Series Monitor.

The alarms are summarized by Table 12-6. The volume of the alarm tone for all three conditions is configured on the General Setup screen.

Table 12-6. Recorder Error Conditions

Paper Error Condition	Record Indicator Status	Recorder Behavior	Audio Status	Alarm Silence Button Behavior
Paper Low	Flashes on and off once every second.	Continues to print until paper runs out.	Two short tones every 30 seconds.[a]	Cancels the alarm.
Paper Out	Off	Automatically stops printing.	Three short tones every 30 seconds.[a]	Cancels the alarm.
Paper Loading	Flashes on and off once every second. The message PAPER INCORRECTLY LOADED, RELOAD WITH BLACK SQUARES DOWN displays in the waveform area of the display.	Does not print.	Three short tones every three seconds.	Temporarily silences alarm. The alarm is re-issued if the condition continues after the re-alarm time specified on the Master Alarm Setup screen.

[a] *The paper chime audio is enabled on the General Setup screen.*

For your notes

Chapter 13

Maternal Vital Signs History

This section describes the maternal vital signs history feature of the 120 Series Monitor. The monitor collects up to eight hours of continuous maternal vital signs data—available for review and printing at any time.

This chapter includes the following:

What is the Maternal Vital Signs History Screen?

This feature displays/prints maternal vital signs data in a spreadsheet format—called Vital Signs History. An example of the maternal Vital Signs Screen is shown in Figure 13-1. A printout example is shown in Figure 13-2.

CAUTION

DATA STORAGE—Stored data for history is immediately lost when the monitor is turned off.

This ensures that stored data for one patient is not inadvertently transferred to a new patient. It should be noted that the maternal Vital Signs History feature is most beneficial when a patient is being continuously monitored. If a patient is being monitored intermittently, all history data is erased each time the monitor is turned off.

If a significant amount of history data has been collected and the monitor must be turned off, you may wish to print the data prior to powering off the monitor in order to retain a hard copy for your files.

NOTE: The monitor stores blood pressure and maternal pulse oximetry events from the monitor's *built-in* modules. The monitor does not store data provided by external devices.

The monitor stores up to eight hours of data on a first-in, first-out basis. After eight hours of data storage, the oldest data begins to be replaced by new data. In other words, the first in is the first out.

The monitor stores the following maternal vital signs data:

- *Each* manual and automatic blood pressure event is stored. A blood pressure event includes the systolic pressure, diastolic pressure, mean arterial pressure, and maternal pulse rate derived from the blood pressure cuff.
- An event snapshot of $MSpO_2$ is taken every minute. An $MSpO_2$ event includes the $\%MSpO_2$ and the maternal pulse rate derived from the sensor.
- An event snaphot of the MHR is taken every minute. A MHR event is the MHR value derived from the MECG electrodes.

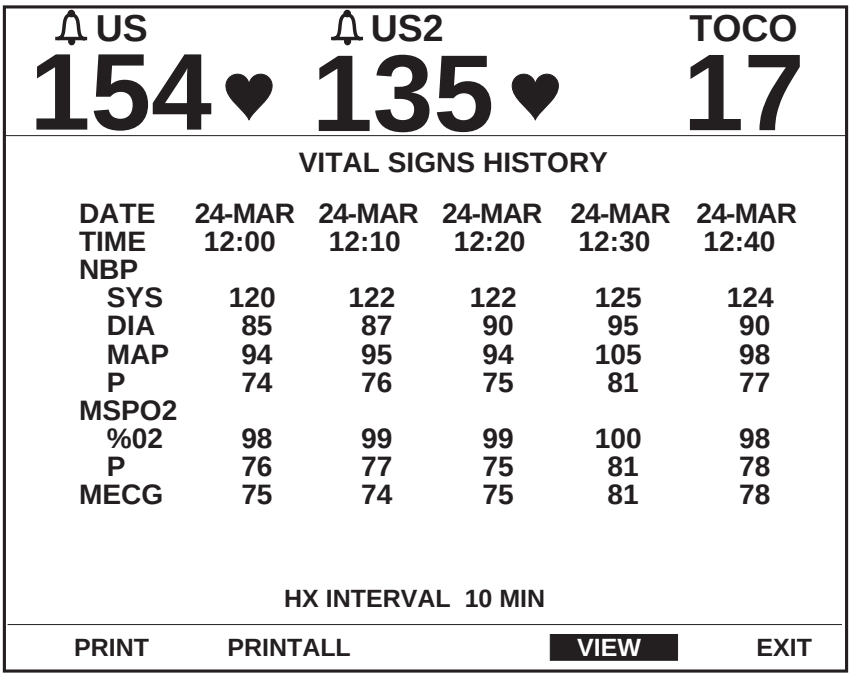


Figure 13-1. Maternal Vital Signs History Screen

Using the Maternal Vital Signs History Screen

Displaying the Screen

1. Select the VSHX softkey to display the Vital Signs History screen.
2. Select the ←VIEW→ softkey to scroll through the data. Scroll right roll towards the oldest data; scroll left towards the most recent data
3. Press the Trim Knob control to de-activate the ←VIEW→ softkey.
4. Select the EXIT softkey to return to the main screen.

Selecting the HX Interval

The maternal Vital Signs History screen can be configured to *display* different columns of data by adjusting the HX Interval field. The interval choices are: EVENT (to display *all* events) and 1, 5, 10, 15, 30, and 60 minutes. (The factory default setting is EVENT.)

The history interval has no effect on the data being stored. You can change the interval setting at any time and all data for the most recent eight hours is available for display.

When the screen is called up for display, the previous minute in time is listed at the far right of the screen; the preceding values to be displayed are counted backwards from the previous minute in time, based on the intervals you have selected.

- Example: The HX interval is set at 5 minutes and the maternal Vital Signs History screen is displayed when the current time is 13:57. When the screen is displayed there will be five columns of data for the following times:

  13:36 13:41 13:46 13:51 13:56

  If the screen remains displayed for one minute the columns of data change to:

  13:37 13:42 13:47 13:52 13:57

Printing the Maternal Vital Signs History Screen

NOTE: Once the print function is activated, you may exit the history screen; it need not remain displayed during printing.

You can select all or a portion of the maternal vital signs history for printing on the strip chart paper. The information is printed in the upper portion of the top (or left) grid of the strip chart paper at a high speed mode. If the recorder is on, all other trending is interrupted while the maternal vital signs history is printed. If the recorder is in the maternal-only mode, the recorder interrupts any printing of data to print the vital signs history; any pre-empted data is printed at the end. If the recorder is off, it will turn on to print the vital signs history, then turn off again.

Printing the Entire Vital Signs History

Select the PRINTALL softkey to print the entire vital signs history. An audible tone provides confirmation.

Printing a Page of the Vital Signs History

Use the ←VIEW→ softkey to display a page; then select the PRINT softkey to print the selected page. An audible tone provides confirmation.

Stopping the Printing of Maternal Vital Signs History

Printing automatically stops if:

- you open the recorder door;
- strip chart paper runs out;
- you press the Test button;
- you change the recorder mode.

CAUTION
Do not turn monitor off during printing or your data will be lost.

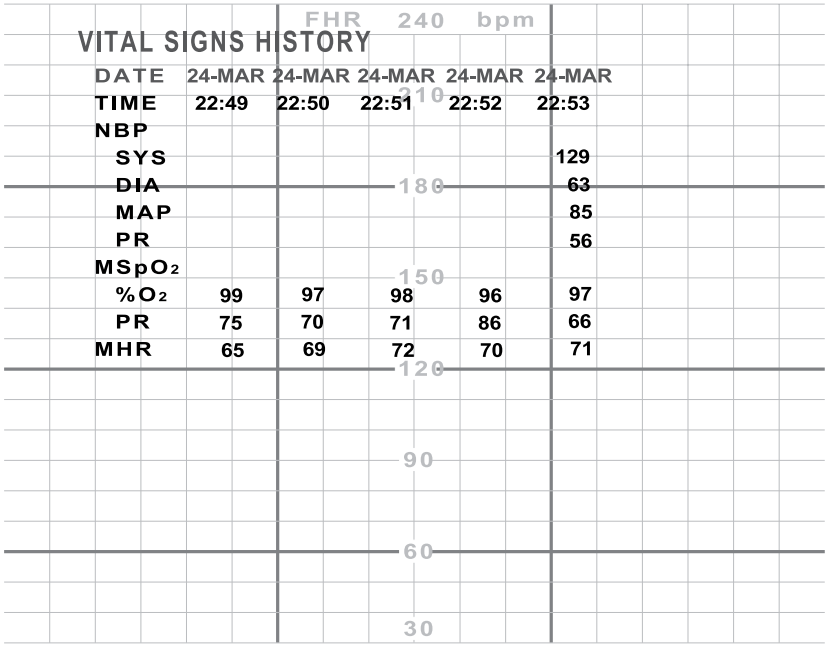


Figure 13-2. Vital Signs History Print Example

For your notes

Chapter 14

Heartbeat Coincidence

The heartbeat coincidence feature alerts you when there is the possibility that you may be monitoring a duplicate signal.

This chapter describes the following:

Heartbeat Coincidence Theory

NOTE: The maternal heart rate derived from blood pressure readings is not used to detect heartbeat coincidence since blood pressure is a static measurement.

The heartbeat coincidence feature alerts you when there is the possibility that you may be monitoring a duplicate signal. Heartbeat coincidence is indicated when any two heartbeats have a consistent phase relationship for equal to or greater than 60% of the detected beats for about 60 seconds; the cessation of coincidence is indicated when the phase relationship is inconsistent for greater than 40% of the detected beats for about seven seconds.

Heartbeat coincidence detection is most useful when monitoring twins but can also detect when an elevated maternal heart rate is mistaken for a fetal heart rate.

Table 14-1 summarizes the combinations of heart rate sources that are continuously compared for the possibility of coincidence.

Table 14-1. Heartbeat Coincidence Comparisons

Mode	FECG	US	US2	MECG	$MSpO_2$
FECG		✓	✓	✓	✓
US	✓		✓	✓	✓
US2	✓	✓		✓	✓
MECG	✓	✓	✓		N/C[a]
$MSpO_2$	✓	✓	✓	✓	

[a] *N/C means the heartbeats are NOT compared.*

Using the Heartbeat Coincidence Feature

Enabling/Disabling Heartbeat Coincidence Detection

This feature is enabled from the Install Options service mode screen. Refer to the "120 Series Monitor Service Manual" for detailed information about enabling/disabling this feature.

Display Indicator

NOTE: Although an unlikely scenario, if three channels are picking up the same signal, the heart rate numerics for all three heart rates display in inverse video.

When heartbeat coincidence detection is *enabled*, the acronym HBC appears to the right of the FHR2 mode title. (See Figure 14-1.) If the monitor detects two heartbeats that appear to be coinciding, this may indicate that the two channels are picking up the same signal. When this coincidence occurs, the heart rate numerics for *both* heart rates display in inverse video, as shown in Figure 14-1. (Inverse video is an amber background with black numerics.) As soon as coincidence is resolved, the numerics return to standard video. (Standard video is a black background with amber numerics.)

If you disconnect a transducer while coincidence is detected, any value displayed in inverse video returns to standard video.

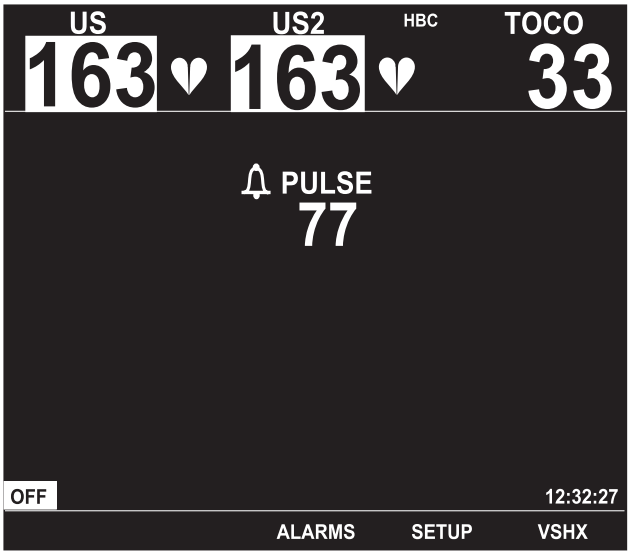


Figure 14-1. Heartbeat Coincidence Example

Strip Chart Annotation

When heartbeat coincidence detection is enabled, the annotation HBC prints in the center margin of the strip chart paper following the active FHR modes. (Refer to Figure 14-2.)

As soon as heartbeat coincidence is detected, two overlaid hearts ♡♡ print in the upper portion of the top grid of the strip chart paper; the hearts print every 4.5 cm for as long a coincidence is detected. Once coincidence is resolved, two side-by-side hearts print ♡♡ once. (Refer to Figure 14-2.)

If you disconnect a transducer while coincidence is detected, the overlaid hearts ♡♡ stop printing. In addition, the mode status line prints on the strip chart paper—without the HBC annotation—indicating the deactivated mode.

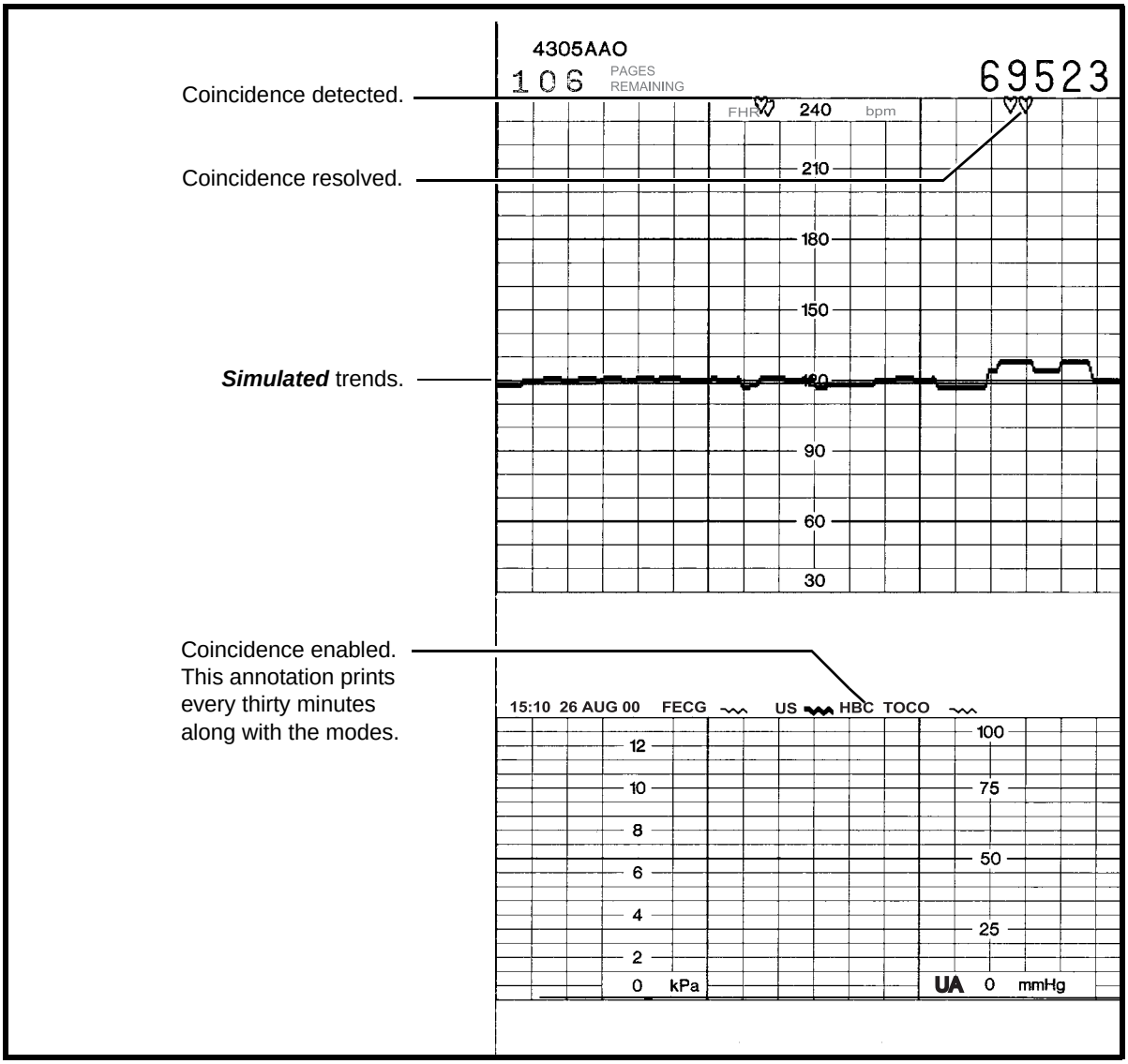


Figure 14-2. Simulated Heartbeat Coincidence Detection Trace

Chapter 15

Waveforms

The 120 Series Monitor allows you to display and print one the following waveforms: FECG, MECG, $FSpO_2$, or $MSpO_2$.

This chapter describes the following:

Waveform Area

The waveform area displays approximately four seconds of waveform data: FECG, MECG, $FSpO_2$, or $MSpO_2$. The waveform chosen for display is independent of any of the numerics shown on the display.

For example: $MSpO_2$ can be chosen as the maternal pulse rate source (numerics) while the MECG waveform is selected for display in the waveform area.

CAUTION
WAVEFORM INTERPRETATION—Waveforms generated by the 120 Series Monitor are not intended for true diagnostic interpretation.

Selecting the Waveform

Use the Waveform Softkey on the normal operating screen to select FECG, MECG, $FSpO_2$, $MSpO_2$, or OFF. (Refer to Figure 15-1.)

Waveform Speed

All waveforms are displayed at a rate o 25mm/sec. This speed is not adjustable. The speed is displayed at the top right of the waveform.

ECG Size

The size is printed in the upper right above the waveform. This label is also a softkey which can be used to change the setting. Select from the following: 0.25X (4 mV/cm), 0.5X (2.0 mV/cm), 1X (1.0 mV/cm), 2X (0.5 mV/cm), 4X (0.25 mV/cm), or AUTO.

MECG Lead Select

NOTE: The MECG lead can also be changed from the MHR/P Setup screen.

The selected lead is displayed in the upper right above the waveform. This label is also a softkey which can be used to change the setting. Select from the following: I, II, or III.

MECG Pacer Label

When the MECG pacer option is enabled (on), the letter P is displayed prior to the waveform speed. See Figure 8-3 on page 8-5.

Moving Scale Bar

For all waveforms, a moving scale bar scrolls along the screen. The bar can be thought of as a pen drawing the waveform on the screen and erasing old data along the way. The most recent data is displayed to the left of the bar; the oldest data is displayed to the right of the bar.

IMPORTANT
SCALE—The moving bar can be used as a 1 cm scale reference for waveform interpretation.

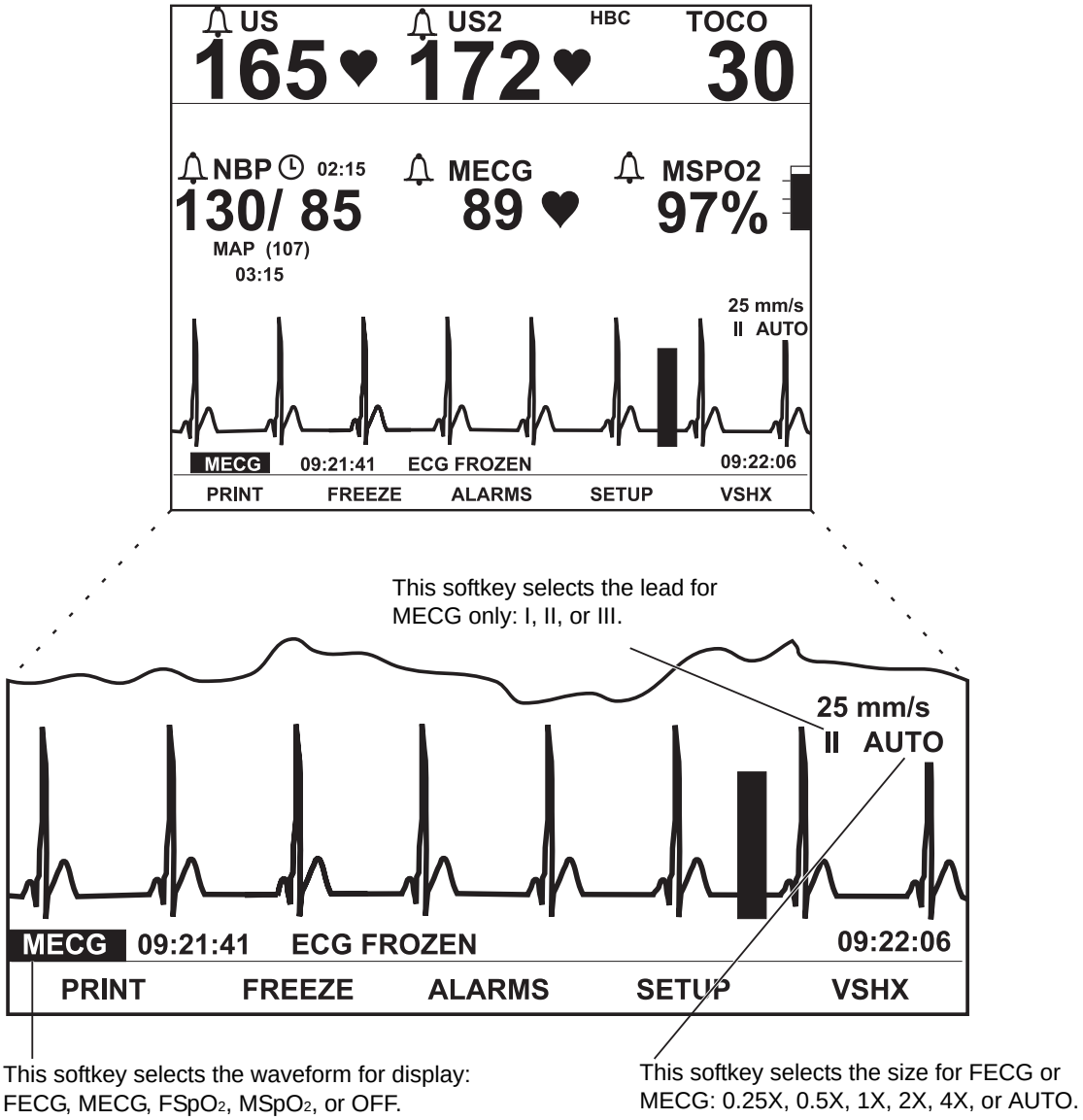


Figure 15-1. Waveform Area on the Display

Freezing Waveforms

The waveform displayed in the waveform area can be “frozen” on the display for review; the most recent data is displayed on the screen for analysis. The message FROZEN (for any waveform), along with the time of activation, is displayed at the lower left of the waveform. (All numerics continue to be updated and the real-time clock continues to be displayed.)

Select the FREEZE softkey to freeze a waveform; select it again to return to real-time display.

Printing a Waveform Snapshot

Select the PRINT softkey to print a six-second snapshot of the displayed waveform—regardless of whether the waveform real-time or frozen. (Figure 15-2 provides an example MECG waveform snapshot on the strip chart paper.)

The waveform is printed on the lower portion of the top (or left) grid. A vertical tick mark is printed at the start, 3-second mark, and end (or six-second mark), for reference. If the waveform is *frozen*, six seconds of historical data are printed *ending* with the time the waveform was frozen on the display. If the waveform is displayed in *real-time*, six seconds of historical data are printed *ending* with the time the PRINT softkey was activated.

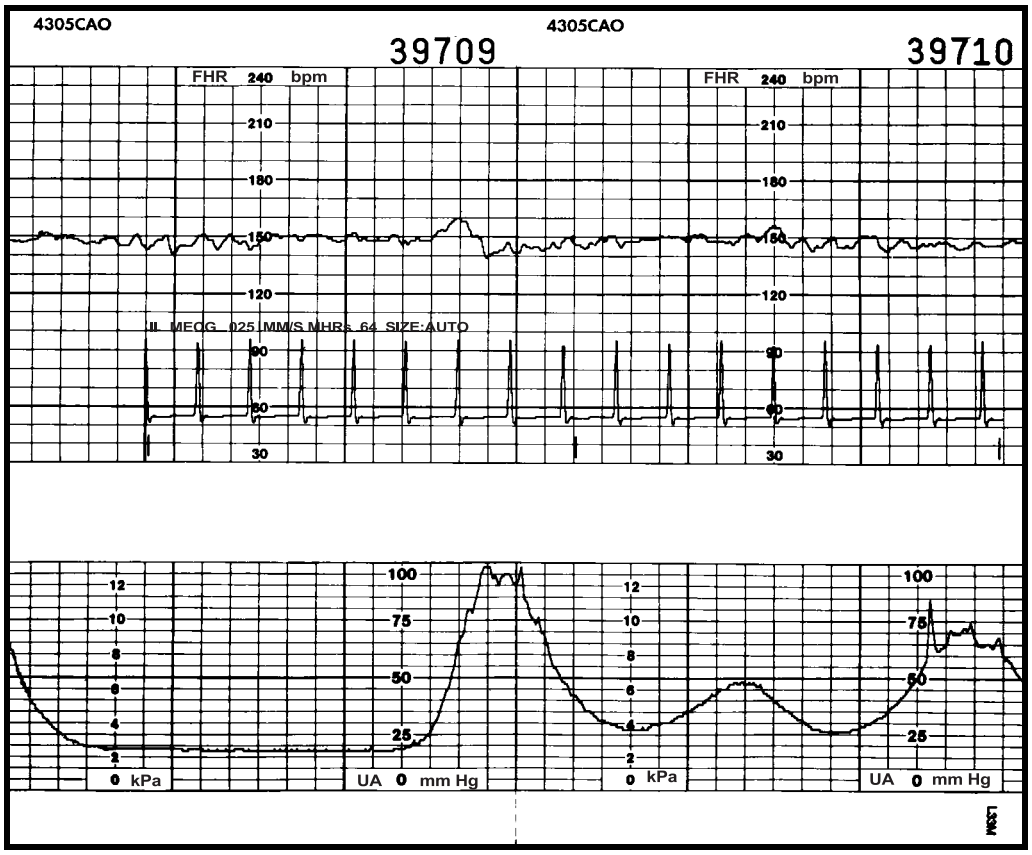


Figure 15-2. Example MECG Waveform Snapshot

Recorder On

If the recorder is on, the waveform overlaps the MHR/P trace (if enabled), with no interruption to other trending. The recorder speed remains at the selected rate of 1, 2, or 3 cm/min.

Recorder in Maternal-Only Mode

If the recorder is running in maternal-only mode, the waveform does not interrupt the printing of data and prints at a high-speed mode of 12 cm/min. When finished, the recorder returns to the maternal-only mode.

Recorder Off

If the recorder is off, the waveform print using a high-speed mode of 12 cm/min after which the recorder turns off again.

NOTE: You cannot switch between different types of waveforms without cancelling any printing that is in progress.

NOTE: The monitor must collect six seconds of *new* data following completion of a print function before it can print again.

Stopping a Print Command

The following actions interrupt waveform printing:

- change in recorder mode.
- pressing the Test button;
- opening the recorder door;
- running out of paper; or
- turning off the monitor.

CAUTION
DATA STORAGE—Stored data for the maternal Vital Signs Screen is immediately lost when the monitor is turned off. This ensures that stored data for one patient is not inadvertently transferred to a new patient. Refer to "Chapter 13, Maternal Vital Signs History" for more information.

Chapter 16

Maintenance

All equipment, no matter how reliable, needs to be maintained on a regular basis. This section describes general care and cleaning instructions for the 120 Series Monitor and its accessories.

CAUTION
Unplug the monitor from the AC power source and detach all accessories from the monitor. Do not immerse accessories in any liquid. Do not use abrasive cloth or cleaners on monitor or accessories.

This chapter describes the following:

Cleaning

The following cleaning instructions are provided. If an accessory is not listed, consult the manufacturer's instructions.

Monitor Exterior

1. Wipe any fluids from the surface of the monitor.
2. Dampen a cloth or paper towel with isopropyl alcohol and gently rub soiled area until clean.

Electroluminescent Panel

1. Dampen a soft cloth with water. The cloth should be free of grit or other particles that may cause abrasion.

> **CAUTION**
> CLEANING AGENTS—Do not use isopropyl alcohol.

2. Rub lightly in a circular motion.

Tocotransducer, Ultrasound Transducer, and MECG Cables

CAUTIONS

ABRASION—Do not use abrasive cloth, sharp objects, or abrasive cleaners.

ALCOHOL—Do not use Alcohol in cleaning solutions.

DISCONNECTION—Detach the transducers/cables/legplate from the monitor.

IMMERSION—Do not immerse transducers or cables or hold under running water.

NOTE: Only Nautilus tocotransducers are immersible.

1. Dampen a cloth or paper towel with one of the following products; then wring out until only slightly wet:
   - Sodium Hypochlorite 5.25 % (Bleach) diluted 10:1
   - Cidex
   - Sporicidin
   - Soap and water
2. Rub soiled area until clean, taking care not to excessively wet the tocotransducer diaphragm seal. Rub around the seal.
3. Dry with a soft, dry cloth.

UA Strain Gauge

Follow the manufacturer's directions to clean the strain gauge.

Maternal NBP Cuffs and Hoses

To clean the pneumatic tubing and cuffs, use a soft cloth dampened with a soap and water solution. Do not immerse hoses or cuffs in liquids.

Maternal SpO_2 Calibration

The 120 Series Monitor automatically calibrates the pulse oximetry module upon power up, whenever a new sensor is attached, and at periodic intervals during use. The intensity of the sensor's LEDs are also automatically adjusted to compensate for differences in tissue density.

Chapter 17

Troubleshooting

This section of the manual provides a troubleshooting guide for the most basic 120 Series Monitor operational problems. If the response to a specific question is not found, contact the Service Department at one of the following numbers:

Inside the United States: 1-800-558-5120

Outside the United States: 1-414-355-5000;
or contact your local distributor

This section contains the following:

General Troubleshooting

Table 17-1. General Troubleshooting

Problem	Probable Cause	Possible Solution
No monitoring functions and green Power indicator does not illuminate when Power switch is placed in the On (I) position.	■ Monitor is not connected to an AC line receptacle. ■ The AC power cord is defective. ■ The AC outlet is defective. ■ The power cord is not connected to the monitor. ■ Blown fuses.	■ Connect the power cord to an AC line receptacle. ■ Replace the power cord. ■ Use a different outlet. ■ Connect the power cord to the monitor. ■ Call Biomedical Engineering Department.
■ Recorder does not function and the Record indicator is off. ■ Recorder does not function and the Record indicator flickers three short flashes every five seconds. ■ Recorder functions however, Record indicator flashes on and off every second. ■ Recorder does not function; the Record indicator is off; the message PAPER INCORRECTLY LOADED, RELOAD WITH BLACK SQUARES DOWN is shown in maternal waveform area. ■ Recorder does not function and the Record indicator is on.	■ Recorder is off, out of paper, or paper is incorrectly loaded. ■ Recorder is in maternal-only mode. ■ Paper supply is low. ■ Paper loaded backwards. ■ Service required.	■ Press Record pushbutton; or install/re-install paper (see page 4-2), then press Record button. ■ Press Record pushbutton to turn on. ■ Install paper (see page 4-2). ■ Re-install paper (see page 4-2). ■ Call Biomedical Engineering Department.
Incorrect time and date.	■ Time incorrectly set. ■ Clock circuit or battery fault.	■ Access the General Setup screen and reset the time and date. ■ Call Biomedical Engineering Department.
Battery Low Icon appears 	■ Data Corruption ■ Battery needs service.	■ Cycle power. Access setup screens and reset last-used settings ■ Call GE Service to report
No heartbeat or pulse sounds.	■ Volume set too low. ■ Transducer not connected or is loose.	■ Press the Volume △ pushbuttons or access the respective setup screen(s) (FECG, US, or US2) to increase the volume. ■ Ensure that each transducer is securely attached to monitor and applied to the patient.

Ultrasound Troubleshooting

Table 17-2. Ultrasound Troubleshooting

Problem	Probable Cause	Possible Solution
Ultrasound not functioning properly.	■ Transducer not properly connected to monitor. ■ Transducer placement. ■ Too little gel applied to transducer. ■ Defective transducer. ■ Active fetus or mother. Fetal arrhythmia or hiccups. Extreme maternal obesity. ■ No signal. ■ Service required.	■ Ensure that transducer is securely attached to monitor. ■ Wait before moving transducer; FHR often returns. Reposition transducer. ■ Apply more gel. ■ Replace transducer. ■ Use alternate technique. ■ Auscultate FHR. ■ Call Biomedical Engineering Department.
Static noise on ultrasound.	■ Active fetus. ■ Environmental noise. ■ Maternal movement. ■ Defective transducer.	■ Reposition transducer. ■ Keep sheets and gown off transducer. Do not hold transducer with hand. ■ Use alternate monitoring mode. ■ Replace transducer.
Rate on FHR area of display and FHR trend on strip chart paper do not correlate.	Monitor is set for 30 BPM/cm vertical scale and 20 BPM/cm vertical scale strip chart recorder paper is being used (or vice versa).	Call Biomedical Engineering Department.

FECG Troubleshooting

Table 17-3. FECG Troubleshooting

Problem	Probable Cause	Possible Solution
Internal FECG erratic or not recording properly.	■ Transducer not properly connected to monitor. ■ Attachment pad or legplate not securely attached to patient. ■ Electrode wire not secure in legplate post. ■ Paste is dried or incorrect paste is being used. ■ Electrode not properly attached. ■ No FECG signal. ■ Defective electrode. ■ Defective attachment pad. ■ Service required.	■ Ensure transducer is securely attached to the monitor. ■ Secure attachment pad or legplate to patient. ■ Inspect legplate connection. ■ Check ECG paste; re-apply, if necessary. ■ Replace electrode. ■ Auscultate FHR. ■ Replace electrode. ■ Replace attachment pad. ■ Call Biomedical Engineering Department.
Rate in FHR area of the display and the FHR trend on the strip chart paper do not correlate.	Monitor is set for 30 BPM/cm vertical scale and 20 BPM/cm vertical scale strip chart recorder paper is being used (or vice versa).	Call Biomedical Engineering Department.

Fetal Pulse Oximetry Troubleshooting

Table 17-4. Fetal Pulse Oximetry Troubleshooting

Problem	Probable Cause	Possible Solution
Displayed $FSpO_2$ does not correlate with the SaO_2 value calculated from a fetal scalp blood sample measurement on a blood gas analyzer.	■ Close correlation requires simultaneous blood sampling and pulse oximeter measurements from the same *arterial* supply. Blood samples exposed to air during the sampling process may not accurately reflect true arterial values.	
	■ The SaO_2 calculation may not have been correctly adjusted for the effects of pH, temperature, $PaCO_2$, 2,3-DPG, or the presence of fetal hemoglobin. In general, calculated SaO_2 values are not as reliable as direct CO-Oximeter or pulse oximeter measurements.	■ Check whether calculations have been corrected appropriately for relevant variables. (See the “Principles of Operation” on page 6-6 for more information.)
	■ 120 F-Series accuracy can be affected by incorrect sensor application or use, significant levels of dysfunctional hemoglobins, excessive patient movement, venous pulsation, or nearby electrosurgical interference.	■ Observe all instructions, warnings, and cautions in this manual and in the "120 Series Service Manual".
	■ Oxygen saturation greater than 85% and/or pulse rate less than 100 could indicate that the values are maternal in origin.	■ Check sensor placement to ensure that it is properly positioned on the fetus
Displayed $FSpO_2$ does not correlate with the SaO_2 value calculated from a fetal scalp blood sample measurement on a laboratory CO-Oximeter.	■ Close correlation requires simultaneous blood sampling and pulse oximeter measurements from the same *arterial* supply. Blood samples exposed to air during the sampling process may not accurately reflect true arterial values.	
	■ Fractional measurements may not have been converted to functional measurements before the comparison was made. The 120 F-Series Monitor, as well as other two-wavelength oximeters, measures functional saturation. Multi-wavelength oximeters measure fractional saturation. Fractional measurements must be converted to functional measurements for comparison.	■ Refer to the equation in “Principles of Operation” on page 6-6 for this conversion.
	■ Oxygen saturation values greater than 85% could indicate that the values are maternal in origin.	■ Check sensor placement to ensure that it is properly positioned on the fetus.

Table 17-4. Fetal Pulse Oximetry Troubleshooting (Continued)

Problem	Probable Cause	Possible Solution
$FSpO_2$ values change rapidly; Pulse Amplitude indicator is erratic.	■ Fetal distress.	■ Check the fetus for other signs of distress.
	■ Excessive maternal or fetal patient motion may be making it impossible for the monitor to find a pulse pattern.	■ If possible, keep the patient still.
	■ Improperly applied sensor.	■ Check whether the sensor is positioned properly, and reposition it if necessary.
	■ SLOW mode selected.	■ Access $FSpO_2$ Setup screen and select FAST mode.
	■ A nearby electrosurgical unit (ESU) may be interfering with performance.	■ Check for interference from other hospital devices. Do not use the 120 Series Monitor in the presence of an ESU.
$FSpO_2$ readings greater than 85%.	■ The sensor may be facing the uterine wall and may be reading maternal saturation.	■ Confirm that the sensor is positioned properly against the fetus.
	■ The sensor may be affected by maternal pulsations.	■ Ensure that the displayed $FSpO_2$ is fetal and not maternal.
Patient module cannot be connected.	■ Invalid fetal patient module.	■ Use only a Corometrics Fetal Patient Module.
	■ Damaged fetal patient module.	■ Check for bent connector pins. Replace with another Corometrics Fetal Patient Module.
Pulse Search icon is displayed; Pulse Amplitude appears to indicate pulses, but there is no $FSpO_2$ reading displayed	■ Fetal distress.	■ Check the fetus for other signs of distress.
	■ The signal quality is below the acceptable threshold requirement necessary to post data on the display.	
	■ Excessive maternal or fetal patient motion may be interfering with signal quality.	■ If possible, keep the patient still.
	■ The sensor may be improperly positioned.	■ Assess sensor location and determine appropriate adjustment.
	■ The fetus's perfusion may be too low for the monitor to detect an acceptable pulse.	
	■ If *Searching* indicator continues to display after evaluations and adjustments: the sensor may be damaged; or the patient module may be damaged.	■ Replace the sensor; or try another Corometrics Fetal Patient Module.

Table 17-4. Fetal Pulse Oximetry Troubleshooting (Continued)

Problem	Probable Cause	Possible Solution
Sensor Lifted icon displayed in $FSpO_2$ area of display.	■ Sensor not making adequate contact at the sensor site on the fetus. ■ Damaged sensor.	■ Assess sensor position relative to fetal head. Assess sensor depth relative to the fetal presenting part; advance or withdraw the sensor as indicated in the "120 Series Service Manual". ■ If the icon does not respond to advancing or withdrawing the sensor, remove the sensor and place a new sensor, as directed in the "120 Series Service Manual".
Sensor Disconnected icon displayed in $FSpO_2$ area of display.	■ Sensor disconnected from fetal patient module cable; or fetal patient module cable disconnected from monitor. ■ Damaged fetal patient module. ■ Invalid $FSpO_2$ sensor connected to fetal patient module cable.	■ Ensure fetal patient module cable is firmly attached to sensor assembly and monitor. If connections are OK, use a new sensor. ■ Replace with another Corometrics Fetal Patient Module. ■ Replace with valid Nellcor OxiFirst Fetal Oxygen Sensor (Series FS14).
COMM message shown in $FSpO_2$ area of display.	■ Communication error between the built-in $FSpO_2$ module and the remainder of the monitor circuitry.	■ Contact Biomedical Engineering Department.
FHR slows during, or immediately after, sensor placement.	■ Changes in intracranial pressure due to examination could cause a reflex bradycardia stimulus.	■ Stop the exam. Do not proceed with sensor placement. Wait for the FHR to return to the previous range.
Dashes (– – –) shown in $FSpO_2$ display area.	■ Monitor unable to make a determination due to insufficient signal. ■ Improperly applied sensor. ■ Excessive fetal movement. ■ Excessive maternal movement. ■ Maternal uterine contraction. ■ Damaged sensor. ■ SLOW mode selected.	■ Check centimeter mark on stylet chamber relative to the introitus. The sensor may have ascended or descended independent of fetal head descent. ■ Ensure that the fetal patient module cable is firmly attached to the monitor and to the sensor assembly. ■ Move sensor to another location. ■ Wait for movement to stop. ■ Restrict patient movement. ■ Wait for contraction to end. ■ Replace sensor. ■ Access $FSpO_2$ Setup screen and select FAST mode.
REPAIR message shown in $FSpO_2$ display area.	■ System error or self-test failure.	■ Contact Biomedical Engineering Department.

External Uterine Activity Troubleshooting

Table 17-5. External UA Troubleshooting

Problem	Probable Cause	Possible Solution
Tocotransducer not recording contractions.	■ Transducer not properly connected to monitor. ■ Transducer not properly placed. ■ Transducer not secured to patient. ■ Defective transducer/cable assembly. ■ No maternal contractions. ■ UA Reference range exceeded.	■ Ensure that transducer is securely attached to monitor. ■ Reposition transducer. ■ Secure or re-apply transducer to patient. ■ Replace transducer/cable assembly. ■ Wait. ■ Loosen belts or remove transducer from patient. Press UA Reference pushbutton while no pressure is applied to transducer button. Re-apply transducer. Do not overtighten belt. Press UA Reference pushbutton again between contractions. (See “Out of Range Condition” on page 7-3 for further information.)
Flashing “+” sign.	Relative pressure > 100.	Press the UA Reference pushbutton between contractions.
CHECK TOCO message is shown in UA area of the display area when the UA Reference pushbutton is pressed.	■ UA Reference pushbutton pressed before UA circuits stabilized. ■ UA Reference range exceeded due to over-tightening belt. ■ Transducer defective. ■ Service required.	■ You must wait ten seconds following powering on the monitor and/or connecting to the UA connector. ■ Loosen belts or remove transducer from patient. Press UA Reference pushbutton while no pressure is applied to transducer button. Re-apply transducer. Do not overtighten belt. Press UA Reference pushbutton again between contractions. (See “Out of Range Condition” on page 7-3 for further information.) ■ Replace transducer. ■ Call Biomedical Engineering Department.

Internal UA Troubleshooting

Table 17-6. Internal UA Troubleshooting

Problem	Probable Cause	Possible Solution
Internal pressure not measuring correctly.	■ Transducer not properly connected to monitor. ■ Air bubble in dome; or catheter blocked. ■ Dome is cracked. ■ Strain gauge not at same height as catheter tip. ■ Catheter has fallen out of place. ■ Catheter or strain gauge not zeroed. ■ Service required.	■ Ensure transducer is securely attached to monitor. ■ Flush dome and catheter. ■ Replace dome. ■ Adjust strain gauge height. ■ Replace catheter. ■ Calibrate catheter or strain gauge. ■ Call Biomedical Engineering Department.
CHECK IUP message displayed in UA area of the display.	■ Blockage in fluid-filled catheter. ■ Fetus pressing directly on catheter. ■ Defective strain gauge or catheter. ■ Service required.	■ Flush catheter. Re-zero. Replace catheter if necessary. ■ Reposition by twisting catheter. ■ Replace strain gauge or catheter. ■ Call Biomedical Engineering Department.

MECG Troubleshooting

Table 17-7. MECG Troubleshooting

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
MECG erratic or not functioning properly.	■ Transducer not properly connected to monitor. ■ Electrodes not properly placed. ■ Clips not attached to electrodes properly. ■ Electrode gel dried. ■ Defective MECG cable. ■ Service required. ■ Selected lead providing inadequate signal.	■ Ensure transducer is securely attached to monitor. ■ Re-apply electrodes. ■ Check clip attachments. ■ Check electrodes and re-apply gel if necessary. ■ Replace cable. ■ Call Biomedical Engineering Department. ■ Change lead selection on MHR/P Setup screen.
Dashes (– – –) shown in MHR/P area of display.	Monitor unable to make a determination due to insufficient signal.	Ensure patient is not asystolic. Ensure electrodes are firmly secured to patient.

Blood Pressure Troubleshooting

Table 17-8. Blood Pressure Troubleshooting

Problem	Probable Cause	Possible Solution
High reading.	Measurement taken during uterine contraction.	■ Annotate chart, then take a manual reading in-between contractions. ■ If possible, cancel reading during contraction. ■ Enable the monitor's Smart BP feature.
CHECK CUFF message displayed in NBP area of display.	■ Improper cuff position. ■ Loose cuff. ■ Air pressure error. ■ Maternal movement. ■ Hose not properly connected to monitor. ■ Neonatal cuff connected.	■ Reposition cuff. ■ Tighten cuff. ■ Contact Biomedical Engineering Department. ■ Restrict patient limb movement. ■ Ensure that hose is firmly attached to monitor. ■ Ensure an adult cuff is connected.
OVERPRESSURE message displayed in NBP area of display.	■ Cuff pressure has exceeded the overpressure limit of 285 mmHg ± 15mmHg. ■ Kinked hose. ■ Blocked hose.	■ Restrict patient limb movement. If this is not the case, contact Biomedical Engineering Department. ■ Check the external cuff for kinks. ■ Perform pneumatic test.
LEAK message displayed in NBP area of display.	Pneumatic leak; air leak; or loose cuff.	Check cuff for snug fit. Check cuff and hose connections for leaks.
COMM message displayed in NBP area of display.	Communication error between the built-in NBP module and the remainder of the monitor circuitry.	Call Biomedical Engineering Department.
MOTION message displayed in NBP area of display.	Excessive maternal movement.	Restrict patient limb movement. Restrain limb if necessary.
Dashes (– – –) displayed in NBP area of display (and possibly in MHR/P area if NBP selected as MHR/P source).	Maximum reading determination time exceeded.	■ Reposition cuff. ■ Check patient for arrhythmia. Move cuff to another limb.
REPAIR message display in NBP area of display.	System error or self-test failure.	Contact Biomedical Engineering Department.
WEAK SIGNAL message	Monitor unable to make a determination due to insufficient signal.	Assess patient situation.
MOTION message	Excessive maternal movement.	Talk to patient about the importance of minimizing limb movement.

Maternal Pulse Oximetry Troubleshooting

Table 17-9. Maternal Pulse Oximetry Troubleshooting

Problem	Probable Cause	Possible Solution
COMM message shown in $MSpO_2$ area of display.	Communication error between the built-in $MSpO_2$ module and the remainder of the monitor circuitry.	Contact Biomedical Engineering Department.
Dashes (– – –) shown in %$MSpO_2$ display area.	■ Monitor unable to make a determination due to insufficient signal.	■ Check patient. The patient may be experiencing shock, hypotension, severe vasoconstriction, severe anemia, hypothermia, arterial occlusion proximal to the sensor, or cardiac arrest. Ensure that the intermediate cable is firmly attached to the monitor and to the sensor assembly.
	■ Improperly applied sensor.	■ Ensure sensor is not too tight. Move sensor to another location.
	■ Excessive maternal movement.	■ Restrict patient limb movement. Restrain limb if necessary.
	■ Excessive ambient light.	■ Cover sensor with opaque material.
	■ Damaged sensor	■ Replace sensor.
MHR/P Pulse source is blank when $MSp0_2$ is selected. (Nellcor only)	SLOW mode selected	Select NORMAL or FAST mode on $MSp0_2$ setup screen.
REPAIR message shown in $MSpO_2$ area of display.	System error or self-test failure.	Contact Biomedical Engineering Department.

Chapter 18

Technical Specifications

This section contains a detailed list of the technical specifications for the 120 Series Monitor.

This chapter lists specifications for the following:

General Monitor

Table 18-1. General Monitor Technical Specifications					
Category	Technical Specifications				
Power Requirements					
Nominal Line Voltage:	100VAC	120 VAC	220 VAC	230 VAC	240 VAC
Line Frequency:	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Power Consumption (maximum):	100 W	100 W	0.4 A	0.4 A	0.4 A
Chassis Leakage:	<300 µA				
Physical Characteristics					
Height:	6.7 in (17.0 cm)				
Width:	16.5 in (41.9 cm)				
Depth:	17.3 in (43.9 cm)				
Weight:	24.0 lbs (10.9 kg) approx.				
Environmental Conditions	**Operating**		**Storage**		
Monitor:					
Ambient Temperature:	50°F to 104°F (10°C to 40°C)		14°F to 131°F (–10°C to 55°C)		
Relative Humidity:	10% to 95%, non-condensing		0% to 95%, non-condensing		
Atmospheric Pressure:	700–1060 mbar (525–795 mmHg)		700–1060 mbar (525–795 mmHg)		
Strip Chart Paper[a]:					
Ambient Temperature:	50°F to 104°F (10°C to 40°C)		< 80°F (< 26.5°C)		
Relative Humidity:	30% to 70%, non-condensing		45% to 65%, non-condensing		
Atmospheric Pressure:	700–1060 mbar (525–795 mmHg)		700–1060 mbar (525–795 mmHg)		
Certification					
ANSI/AAMI EC13-1992:	Complies with all areas except those listed below: 3.1.2.1e: Heart Rate Meter Accuracy and Response to Irregular Rhythm (not tested) 3.2.6.1: Range of QRS wave amplitude and duration 3.2.7: Range and accuracy of heart rate meter (4.2.7f :input rate of 300 BPM.) 3.2.8.1: Lower Alarm Limit (The lowest alarm limit on the 120 Series is 35 BPM.) 3.2.9.8c: Impulse Response 4.2.9.7 Output Display a) Channel Width				
UL-2601.1:	Classified to UL-2601.1 Medical electrical equipment classified by Underwriter's Laboratories, Inc., with respect to fire, shock, and mechanical hazards in accordance with UL-2601.1.				
CUL:	Classified with respect to electric shock, fire, mechanical, and other specified hazards only, in accordance with CAN/CSA C22.2 No. 601.1				

[a] *Paper operating environmental conditions are for a period of less than one month. Paper storage environmental conditions are for extended storage.*

Operating Modes

Table 18-2. Operating Mode Specifications

FECG Mode		
Technique:	Peak detecting, beat-to-beat cardiotachometer	
Heart Rate Counting Range:	30–240 BPM	
Heart Rate Resolution:	±1 BPM	
Artifact Elimination:	Selectable, ±25 BPM artifact rejection	
Countable Input Signal Range:	15 µV to 2 mV peak-to-peak	
Offset Voltage Tolerance (Differential):	±300 mVdc maximum	
Maximum Common Mode Voltage:	20 V peak-to-peak	
Preamplifier Bandwidth:	1–100 Hz	
Common Mode Rejection:		
Balanced:	> 120 dB at mains frequency, with patient cable	
Unbalanced 5kΩ RA or LA:	> 110 dB at mains frequency	
Input Equivalent Noise:	< 10 µV peak-to-peak	
Input Impedance:		
Differential:	> 10 MΩ	
Common Mode:	> 20 MΩ	
Mains Frequency Rejection:	> 40 dB	
Leakage Current:	< 60 µA at 254 VAC, electrically isolated	
Isolation, Mains-to-Patient:	> 4 kVAC	
Ultrasound Mode		
Technique:	Pulsed Doppler with autocorrelation processing	
Transducer Type:	9-crystal	
Pulse Repetition Frequency:		
Single Ultrasound Mode:	4 kHz	
Dual Ultrasound Mode:	2 kHz	
Pulse Duration:	92 µs	
Transmitter Frequency:	1.151 MHz	
Spatial-Peak Temporal Average Intensity:	Ispta < 10 mW/cm^2	
Spatial-Average Temporal Average Intensity:	Isata< 5 mW/cm^2	
Focal 20 dB Beam Area:	16.6 cm^2, at a range = 7 cm	
Peak Instantaneous Intensity:	1.8 mW/cm^2	
Peak-Negative Acoustic Pressure:	p < 10.0 kPa	
Heart Rate Counting Range:	50–210 BPM	
Leakage Current:	< 10 µA at 120–240 VAC, isolated by transducer	
Uterine Activity Mode	**Strain Gauge**	**Tocotransducer**
Range:	0–100 mmHg	0–100 relative units
Resolution:	1 mmHg	1 relative unit
Bandwidth:	dc to 0.5 Hz	dc to 0.5 Hz
Excitation Voltage:	+4.0 Vdc	
Zero Set Temperature Drift:	< 0.1 mmHg/°C (0.013 kPa/°C), excluding transducer	
Leakage Current:	< 60 µA at 254 VAC, electrically isolated	

Table 18-2. Operating Mode Specifications (Continued)

MECG Mode	
Technique:	Peak detecting, beat-to-beat cardiotachometer
Maternal ECG Electrode Type:	Medtronic 1700-003 or equivalent
Leads Available:	I, II, and III
Heart Rate Counting Range:	30–240 BPM
Heart Rate Resolution:	±1 BPM
Heart Rate Averaging:	1 second average
Heart Rate Update Rate:	> 1 update per second
Countable Input Signal Range:	< 0.5 mV to 5 mV peak-to-peak
Baseline Drift:	< 0.5 mV RTI
Tall T-wave Rejection:	< 0.8 **x** QRS amplitude
Heart Rate Meter Response Time:	
80–120 BPM Step Increase:	< 2 seconds
80–40 BPM Step Decrease:	< 3 seconds
Alarm Time for Tachycardia 80–200 BPM:	< 10 seconds (high alarm limit at 100 BPM)
Offset Voltage Tolerance (Differential):	±300 mVdc maximum
Maximum Common Mode Voltage:	20 V peak-to-peak
Preamplifier Bandwidth:	0.6 to 40 Hz
Common Mode Rejection:	
Balanced:	> 80 dB at mains frequency, with patient cable
Unbalanced 5K RA or LA:	> 50 dB at mains frequency
Input Equivalent Noise:	< 30 µV peak-to-peak
Input Impedance:	
Differential:	> 2.5 MΩ
Common Mode:	> 10 MΩ
Mains Frequency Rejection:	> 40 dB
Leakage Current:	< 60 µA at 254 VAC, with cable, electrically isolated
Isolation, Mains-to-Patient:	> 4 kVAC
Leads Off Detection:	dc current < 0.1 µA
Alarms:	
Audio:	Alternating 1.5 second chimes (773 Hz and 523 Hz)
Visual:	Flashing heart rate numeric or message
Limits:	User-selectable high and low maternal heart rate
Technical:	Leads off
Tachycardia Response Time:	< 8 seconds
Pacemaker Detection/Rejection:	
Input Voltage Range:	±2.5 mV to ±700mV
Input Pulse Width:	0.1 to 2 ms
Pulse Rise/Fall Time:	< 10% of pulse width; not greater than 100 µs
Overshoot/Undershoot:	2 mV

CAUTION

Excessive overshoot time of pacemaker pulse may cause false QRS detection.

Table 18-2. Operating Mode Specifications (Continued)	
Maternal Blood Pressure Mode	
Technique:	Oscillometric. Microprocessor software eliminates most ambient noise and motion artifact.
Blood Pressure Range:	20–255 mmHg (2.7–34.0 kPa)
Pulse Rate Range:	40–240 BPM
Blood Pressure Accuracy:	±5 mmHg (0.7 kPa) with a standard deviation no greater than 8 mmHg (1.1 kPa)
Pulse Rate Accuracy:	±2 BPM or ±2 % (whichever is greater)
Cuff Inflation:	Initial inflation to 160 mmHg (21.3 kPa). Subsequent inflation approximately 30 mmHg (4.0 kPa) greater than the previous systolic pressure.
Cuff Deflation:	Automatic
Safety Features:	Automatic cuff deflation if: cuff pressure exceeds the overpressure limit of 285 mmHg ± 15 mmHg (37.3 ± 2 kPa); or maximum reading determination time is exceeded (not to exceed AAMI /ANSI SP10-1992 limit of 180 s); or safety timer detects microprocessor failure. Auto mode minimum 30-second delay from the end of one determination to the beginning of another to allow for venous return.
Display/Record:	Systolic, diastolic, and mean pressure; pulse rate
Alarms (audible and visual):	
Audio:	Alternating 1.5 second chimes (773 Hz and 523 Hz)
Visual:	Flashing pressure numeric or message
Limits:	User-selectable high and low systolic, diastolic, and mean pressures; User-selectable high and low pulse rate
Technical:	Cuff errors, connection errors, insufficient signal, excessive inflation or determination times, overpressure, hose errors, excessive motion, communication problem, or self-test failure.
Compliance:	The 120 Series' blood pressure module complies with the American National Standard for Electronic or Automated Sphygmomanometers [AAMI/ANSI SP10-1992]. Blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope method, within the limits prescribed by the American National Standard for Electronic or Automated Sphygmomanometers.

Table 18-2. Operating Mode Specifications (Continued)	
Fetal Pulse Oximetry Mode (Nellcor)	
Technique:	Spectrophotometry and plethysmography.
Sensor Type:	Nellcor Puritan Bennett (Model FS-14B only)
Saturation Range:	10–100%
Saturation Accuracy:	$\%SpO_2$ ±1 standard deviation:
(with Nellcor Puritan Bennett FS-14B Sensor)	Reproducibility is 1 standard deviation = 6%. Nominally, 68% of the measurements across the population will be within ±1 standard deviation.
Wavelengths:	
Red:	735 nm, nominal
Infrared:	890 nm, nominal
Maternal Pulse Oximetry Mode (Nellcor)	
Technique:	Spectrophotometry and plethysmography.
Sensor Type:	Nellcor Puritan Bennett (D-25 or D-25L recommended)
Saturation Range:	0–100 %
Pulse Rate Range:	30–250 BPM
Saturation Accuracy:	$\%SpO_2$ ±1 standard deviation[1]:
(with Nellcor Puritan Bennett D-25 Sensor)	70–100 % ±2 digits
	50–69 % ±3 digits
Pulse Rate Accuracy:	0–49% (unspecified)
Wavelengths:	±3 BPM
Red:	660 nm, nominal
Infrared:	920 nm, nominal
Response Time:	User-selectable: slow, normal, and fast averaging modes.
Alarms (audible and visual):	
Audio:	Alternating 1.5 second chimes (773 Hz and 523 Hz)
Visual:	Flashing $\%SpO_2$ numeric or message
Limits:	User-selectable high and low SpO_2; User-selectable high and low pulse rate
Technical:	Sensor errors, connection errors, insufficient signal, excessive motion, communication problem, internal calibration error, or self-test failure.

1) *The accuracy of a given oxygen range is valid for only 68% of the data points taken and the remaining 32% of the data points are not counted in the specification.*

Table 18-2. Operating Mode Specifications (Continued)	
Maternal Pulse Oximetry Mode (Masimo)	
Range:	
Saturation: (%$Sp0_2$)	1%-100%
Pulse Rate (bpm):	25-240
Perfusion:	0.02%-20%
Accuracy	
Saturation (%$Sp0_2$)- During no motion conditions[1]	
Adults, Pediatrics	70%-100% ±2 digits 0%-69% unspecified
Neonates	70%-100% ±3 digits 0%-69% unspecified
Saturation (%$Sp0_2$)- During motion conditions[2,3]	
Adults, Pediatrics[2]	70%-100% ±3 digits 0%-69% unspecified
Neonates[3]	70%-100% ±3 digits 0%-69% unspecified
Pulse Rate (bpm)- During no motion conditions[1]	
Adults, Pediatrics, Neonates	25 to 240 ±3 digits
Pulse Rate (bpm)- During motion conditions[2,3]	
Adults, Pediatrics, Neonates	25 to 240 ±5 digits
Resolution	
Saturation(%$Sp0_2$)	1%
Pulse Rate (bpm)	1
Low Perfusion Performance[4]	
>0.02% Pulse Amplitude and % Transmission > 5%	Saturation (%$Sp0_2$) ±2 digits Pulse Rate ±3 digits
Interfering Substances	Carboxyhemoglobin may erroneously increase readings. The level of increase is approximately equal to the amount of carboxyhemoglobin present. Dyes, or any substance containing dyes, that change usual arterial pigmentation may cause erroneous readings.

1) The Masimo SET® SpO_2 parameter with LNOP-Adt sensors has been validated for no motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies in the range of 70-100% SpO2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

2) The Masimo SET® SpO_2 parameter with LNOP-Adt sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions at 2 to 4 Hz at an amplitude of 1 to 2 cm and a non repetitive motion before 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70-100% SpO2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

3) The Masimo SET® SpO_2 parameter with LNOP-Neo Pt sensors has been validated for neonatal motion accuracy in human blood studies on neonates while moving the neonate's foot at 2 to 4 cm against a laboratory co-oximeter and ECG monitor. This validation equals plus or minus, one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

4) The Masimo SET® SpO_2 parameter has been validated for low perfusion accuracy in bench top testing against a Biotek Index 2 simulator and Masimo's simulator with signal strengths of greater than 0.02% and a % transmission of greater than 5% for saturations ranging from 70 to 100%. This variation equals plus or minus, one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

Maternal Vital Signs History Storage/Recall:	8 hours, maximum

Strip Chart Recorder

Table 18-3. Strip Chart Recorder Technical Specifications		
Heart Rate Scale Chart Width: Scaling: Range: Resolution:	**Domestic** 7 cm 30 BPM/cm 30–240 BPM 1 BPM	**International** 8 cm 20 BPM/cm 50–210 BPM 1 BPM
Fetal Pulse Oximetry %FSpO$_2$ Scale Chart Width: Scaling: Range: Resolution:	Domestic 4 cm 10 %/cm or 25%/cm 0–100% 1 %	International 4 cm 12.5 %/cm or 25%/cm 0–100% 1 %
Uterine Activity Scale Chart Width: Scaling: Range: Resolution:	Strain Gauge 4 cm 25 mmHg/cm 0–100 mmHg 1 mmHg	Tocotransducer 4 cm 25 relative units/cm 0–100 relative units 1 relative unit
Maternal Pulse Oximetry %MSpO$_2$ Scale Chart Width: Scaling: Range: Resolution:	**Domestic** 4 cm 10 %/cm or 25%/cm 60–100 % or 0–100 % 1 %	**International** 4 cm 12.5 %/cm or 25%/cm 50–100 % or 0–100 % 1 %
Recorder Drive Speeds: Speed Accuracy:	 1, 2, and 3 cm/min ±1 %	

NOTE: Specifications subject to change without notice.

Chapter 19

Supplies & Accessories

This section provides an overall listing of supplies and accessories for use with 120 Series Monitors, followed by photographs of some of the most commonly ordered items. To order any of the supplies and accessories listed in this manual:

Inside the United States: Call 1-800-558-5120.

Outside the United States: Call 414-355-5000, or contact your local distributor.

General Add-Ons Ordering Information

Table 19-1. General Supplies	
Item	Catalog Number (REF)
Detachable IEC AC Power Cord, United Kingdom Plug	1392BAU
Remote Event Marker	3919BAO
Model 2116B Clinical-Notes/Data-Entry System	2116BAX
Model 3116 LDR/LDRP Bedroom Style Mobile Cart—Finished	3116AAO
Model 3116 LDR/LDRP Bedroom Style Mobile Cart—Unfinished	3116BAO
Model 146 Fetal Acoustic Stimulator	0146AAY

Paper Supplies Ordering Information

Table 19-2. Paper Supplies	
Item	Catalog Number (REF)
Z-Fold Chart Paper Pack, 30–240 BPM Heart Rate Scale (40/carton)	4305CAO
Z-Fold Chart Paper Pack, 50–210 BPM Heart Rate Scale (40/carton)	4305DAO

Ultrasound Ordering Information

Table 19-3. Ultrasound Supplies

Item	Catalog Number (REF)
Loop-Style Ultrasound Transducer (Nautilus), 8-foot Cord	5700LAX
Button-Style Ultrasound Transducer (Nautilus), 8-foot Cord	5700HAX
Button-Style Ultrasound Transducer (Nautilus), 10-foot Cord	5700JAX
Ultrasound Coupling Gel Bottle, 250 ml (12/carton)	2434AAO
Ultrasound Coupling Gel Bottle, 5 liter	2475AAO
Reusable Belt for Loop-Style Transducer, Mesh Style (10/carton)	4425AAO
Reusable Belt for Loop-Style Transducer, Velcro Style (10/carton)	4425CAO
Reusable Belt for Button-Style Transducer, Elastic Style (10/carton)	4425EAO
Semi-Reusable Belt for Loop-Style Transducer, Velcro Style (2/pack; 50 packs/carton)	4425FAO
Single-Patient Use Belt for Loop-Style Transducer, Foam Style with Velcro Closure	8024AAO

FECG Ordering Information

Table 19-4. FECG Supplies	
Item	Catalog Number (REF)
Qwik Connect *Plus* Spiral Electrode (50/carton)	7000AAO
Legplate for Qwik Connect *Plus* Spiral Electrode, 8-foot Cord	1590AAO
Attachment Pads for Qwik Connect *Plus* Spiral Electrode Legplate (50/carton)	2464AAO

$FSpO_2$ Information

Table 19-5. $FSpO_2$ Supplies	
Item	Catalog Number (REF)
Corometrics Fetal Patient Module	1550AAO

Tocotransducer Ordering Information

Table 19-6. Tocotransducer Supplies	
Item	Catalog Number (REF)
Loop-Style Tocotransducer (Nautilus), 8-foot Cord	2264LAX
Button-Style Tocotransducer (Nautilus), 8-foot Cord	2264HAX
Reusable Belt for Loop-Style Transducer, Mesh Style (10/carton)	4425AAO
Reusable Belt for Loop-Style Transducer, Velcro Style (10/carton)	4425CAO
Reusable Belt for Button-Style Transducer, Elastic Style (10/carton)	4425EAO
Semi-Reusable Belt for Loop-Style Transducer, Velcro Style (2/pack; 50 packs/carton)	4425FAO
Single-Patient Use Belt for Loop-Style Transducer, Foam Style with Velcro Closure	8024AAO

IUPC Ordering Information

Table 19-7. IUPC Supplies and Accessories	
Item	Catalog Number (REF)
Saflex IUPC with Amnio Infusion/Sampling Capabilities (10/carton)	2076BAO
Saflex Intermediate Cable	1336AAO

MECG Ordering Information

Table 19-8. MECG Supplies and Accessories

Item	Catalog Number (REF)
FECG/MECG Adapter Cable	1442AAO
MECG Cable for use with detachable leadwires (requires 1442AAO), USA/AHA	1554AAO
MECG Cable for use with detachable leadwires (requires 1442AAO), Intl./IEC	1554BAO
MECG Cable for use with detachable leadwires, USA/AHA	1553AAO
MECG Cable for use with detachable leadwires, Intl./IEC	1553BAO
Multi-Link Snap Leadwires, Set of 3, Grouped Detachable, 31 inches	411203-001
Multi-Link Snap Leadwires, Set of 5, Individually Detachable, 31 inches	411200-001
Multi-Link Grabber Leadwires, Set of 3, Grouped Detachable, 31 inches	412682-001
Multi-Link Grabber Leadwires, Set of 5, Individually Detachable, 31 inches	414556-001
Leadwire Adapter, 3-Lead Multi-Link to 3-Lead DIN	414371-001
Electrodes, Round, Foam, Pouches of 30, Case of 300	9431-004

NBP Ordering Information

Table 19-9. NBP Supplies and Accessories

Item	Catalog Number (REF)
Air Hose for Dual-Tube, Threaded-Luer Cuff, 12-foot Hose	9461-217
Reusable Single-Tube, Male-Luer Cuff, Small Adult, 18–26 cm Range	5531CAO
Reusable Dual-Tube, Threaded-Luer Cuff, Small Adult	E27795
Reusable Single-Tube, Male-Luer Cuff, Adult, 25-35 cm Range	5522CAO
Reusable Single-Tube, Male-Luer Cuff, Large Adult, 33-47 cm Range	5523CAO
Reusable Dual-Tube, Threaded-Luer Cuff, Adult, 25-35 cm Range	5522AAO
Reusable Dual-Tube, Threaded-Luer Cuff, Large Adult, 34-47 cm Range	5523AAO
Reusable Dual-Tube, Threaded-Luer Cuff, Adult Thigh, 46-66 cm Range	5524AAO
Single-Patient Use, Dual-Tube, Locking-Luer Cuff, Small Adult, 18-26 cm Range (10/carton)	900373-003
Single-Patient Use, Dual-Tube, Locking-Luer Cuff, Adult, 25-35 cm Range (10/carton)	900373-002
Single-Patient Use, Dual-Tube, Locking-Luer Cuff, Large Adult, 33-47 cm Range (10/carton)	900373-001
NBP Hose Adapter (118-120 Series)	414876-001

$MSpO_2$ Ordering Information

Table 19-10. $MSpO_2$ Supplies and Accessories	
Item	Catalog Number (REF)
Intermediate Cable for Nellcor Sensors	1552AAO
Nellcor Durasensor Adult Reusable Finger Probe	407705-006
Masimo Adult Reusable Finger Probe	E9008JC/2002800-001

Peripheral Device Ordering Information

Table 19-11. Peripheral Device Supplies and Accessories

Item	Catalog Number (REF)
Interface Cable to Nellcor Model N-200/M-400 Pulse Oximetry Monitor, 6-foot	1557BAO
Interface Cable to Nellcor Model N-200/N-400 Pulse Oximetry Monitor, 1-foot	1557AAO
RS-232C Interface Cable to Quantitative Sentinel/Perinatal System	1558AAO

Appendix A

Factory Defaults

Factory Defaults are found in the table that follows.

Table of Defaults

Table A-1. Summary of Factory Defaults				
Setup Screen	Field Description	Factory Default	Default Options	Hospital Preference
FECG or US/US2	HR Offset (Applies to US or US2—whichever is FHR2)	Off	On, Off, 10 minutes	
	FHR Volume	5	0-9	
	FHR Alarm Limits	High Low 160 120 BPM	200-140, Off 60-140, Off	
	Audio Alarms	On	On, Off	
	Volume	5	1-9	
$FSp0_2$	Response Time (Averaging Mode)	Slow	Slow, Fast	
	Print Interval	5 min	Off, 2, 5, 10, 15, 30, 60 min	
	$\%\ 0_2$ Trace	On	On, Off	
NBP	Display	On	On, 1, 2, 3, 5, 10, 15, 30 min	
	Mode	Manual	Manual, Auto, 1, 2, 3, 4, 5, 10, 15, 20, 30, 40, 45, 60, 90, 120 min	
	NBP Reading Done	5	0-9	
	Alarm Systolic Diastolic MAP MHR/P	High Low 160 90 mmHg 90 50 mmHg 140 50 mmHg 120 50 BPM	High Low 70-240, Off 50-150, Off 70-130, Off 30-120, Off 70-150, Off 30-120, Off 100-250, Off 35-120, Off	
	Audio Alarm	On	On, Off	
	Volume	5	1-9	

Table A-1. Summary of Factory Defaults				
Setup Screen	Field Description	Factory Default	Default Options	Hospital Preference
$MSpO_2$	Response Time (Nellcor)	Normal	Slow, Normal, Fast	
	Averaging Time (Masimo)	8 seconds	2, 4, 8, 10, 12, 14, 16 seconds	
	Sensitivity (Masimo)	Normal	Normal, Maximum	
	Print Interval	5 minutes	Off, 2, 5, 10, 15, 30, 60 minutes	
	$\%O_2$ Trace	Off	On, Off	
	Alarms $MSpO_2$ MHR/P	High Low 100 95% 120 50 BPM	High Low 85-100, Off 80-99, Off 100-250, Off 35-120, Off	
	Audio Alarms	On	On, Off	
	Volume	5	1-9	
MHR/P	Source	Auto	Auto, MECG, $MSp0_2$, NBP	
	MHR/P Trace	Off	On, Off	
	Volume	5	0-9	
	Alarms	High Low 120 50 BPM	High Low 100-250 35-120	
	Audio Alarms	On	On, Off	
	Alarm Volume	5	1-9	
	MECG Lead	II	I, II, III	
	Pacer	Off	On, Off	
Normal Operation	(Waveform Display)	MECG	FECG, MECG, $FSp0_2$, $MSp0_2$, Off	
	(MECG Waveform Size)	1X (1 mV/cm)	.25X, .5X, 1X, 2X, 4X, Auto	

Table A-1. Summary of Factory Defaults				
Setup Screen	Field Description	Factory Default	Default Options	Hospital Preference
Master Alarm Setup	Audio Alarms NBP MHR/P $MSpO_2$	 On On On	 On, Off On, Off On, Off	
	Re-Alarm (MECG and $MSpO_2$ only)	120 sec	30-120 (in 5 second increments)	
	Alarm Limits Systolic Diastolic MAP MHR/P $MSpO_2$	High Low 160 90mmHg 90 50 mmHg 140 50 mmHg 120 50 BPM 100 95%	High Low 70-240, Off 50-150, Off 70-130, Off 30-120, Off 70-150, Off 30-120, Off 100-250, Off 35-120, Off 85-100, Off 80-99, Off	
	Volume	5	1-9	
General	Time/Date	Set to current local date and time.	Set to current local date and time.	
	Play Song	Off	Off, Happy Birthday, Brahm's Lullaby, Rock-a-Bye-Baby, All.	
	Volume	5	0-9	
	SpO_2 Scale	0–100 %	Auto, 0-100% (Does not change)	
	Paper Speed	United States: 3 cm/min International: 1 cm/min	1-3 cm/min	
	Paper Chime	Out Only	Off, Low/out, Out only	
	Volume	5	1-9	
	Light (on recorder)	On	On, Off	
	$MSpO_2$ Print Interval (External Monitor)	5 min	Off, 2, 5, 10, 15, 30, 60 min	
	$FSpO_2$ Print Interval (External Monitor)	5 min	Off, 2, 5, 10, 15, 30, 60 min	
	$FSpO_2$ Trace (External Monitor)	Off	On, Off	
Vital Signs History[a]	HX Interval	Event	1, 5, 10, 15, 30, 60, Event	

Table A-1. Summary of Factory Defaults				
Setup Screen	Field Description	Factory Default	Default Options	Hospital Preference
Install Options (Service)	Default Settings	Factory	Factory, Current, New Hospital, Hospital-wide	
	Line Frequency	United States: 60 Hz International: 50 Hz	50 Hz, 60 Hz	
	ECG Artifact Elimination	Off	On, Off	
	Scaling	United States: 30–240 BPM International: 50–210 BPM	United States: 30–240 BPM International: 50–210 BPM	
	Language	Set according to shipping destination	Set according to shipping destination	
	NBP 1-Minute Interval	On	On, Off	
	HR (Heart Rate) Offset	On with 10-min Auto-Revert	Off, On, 10-min	
	Default TOCO Reference	10 relative units	5, 10, 15, 20, 25 relative units	
	FM (Fetal Movement) Remote Mark	On	On, Off	
	COROLAN Address Checking	Off	On, Off	
	HBC (Heartbeat Coincidence Enable)	On	On, Off	
	VS (Vital Signs) Print Interval	Real Time	Real Time, Chart Style	
	Recorder Font Size	Medium	Small, Medium, Large	
	Fetal Alert/Alarm	Off	Off, Alarms, Alerts	
	Smart BP	On	On, Off	

NOTE: You must cycle power to reset factory defaults.

For your notes

Appendix B

Alarms Summary

A summary of the 120 series alarms is found in the table that follows.

Table of Alarms

Table B-1. Summary of 120 Series Alarms			
Type	Condition	Visible Advisory	Audible Advisory
	Paper Speed	United States: 3 cm/min International: 1 cm/min	1-3 cm/min
FHR	An alarm setting (audio or high/low limit) is turned off. Alarm Defaults Audio: on Volume: 5 Limits: High = 160 BPM, Low = 120 BPM	 displays to the left of the FHR mode title.	—
	FHR limit (high or low) actively being violated. or Unsilenced, resolved FHR limit violation (the limit was violated but the FHR has since returned to the normal range before clinical acknowledgement). For continuous limit violations: a high alarm activates after 5 minutes; a low alarm activates after 30 seconds. About Latching Alarms: The FHR limit alarms are latching alarms which means that a clinician must acknowledge the alarm using the monitor's Alarm Silence button in order to clear the alarm.	FHR numeric flashes.	Alternating high/low tones (if audio enabled).
	Inadequate FHR signal quality.	Flashing dashes "– – –" in place of FHR numeric.	Alternating high/low tones (if audio enabled).

Table B-1. Summary of 120 Series Alarms			
Type	Condition	Visible Advisory	Audible Advisory
NBP	An alarm setting (audio or high/low limit) is turned off. Alarm Defaults Audio: on Volume: 5 Systolic Limits: High = 160 mmHg, Low = 90 BPM Diastolic Limits: High = 90 mmHg, Low = 50 mmHg MAP Limits: High = 140 mmHg, Low = 50 mmHg MHR/P Limits: High = 120 BPM, Low = 50 BPM	 displays to the left of the NBP mode title.	—
	Systolic, diastolic, or MAP pressure value (high or low) actively being violated.	NBP numeric (systolic, diastolic, or MAP) flashes.	Alternating high/low tones (if audio enabled).
	Malfunction with NBP circuitry, cuff, or air hoses.	CHECK CUFF, LEAK, COMM, MOTION, WEAK SIGNAL, or REPAIR message displays in NBP area.	Alternating high/low tones (if audio enabled).
MHR/P[a]	An alarm setting (audio or high/low limit) is turned off. Alarm Defaults Audio: on Volume: 5 Limits: High = 120 BPM, Low = 50 BPM Re-alarm: 120 sec	 displays to the left of the MHR/P mode title.	—
	MHR/P limit (high or low) actively being violated. The tachycardia response time is < 8 seconds.	MHR/P numeric flashes.	Alternating high/low tones (if audio enabled).
	Asystole.	Flashing dashes "– – –" in place of MHR/P numeric.	Alternating high/low tones (if audio enabled).
	MECG leads off.	Flashing dashes "– – –" in place of MHR/P numeric and MECG LEADS OFF message displays underneath.	Alternating high/low tones (if audio enabled).

Table B-1. Summary of 120 Series Alarms			
Type	Condition	Visible Advisory	Audible Advisory
	An alarm setting (audio or high/low limit) is turned off. Alarm Defaults Audio: on Volume: 5 Limits: High = 100%, Low = 95% Re-alarm: 120 sec	 displays to the left of the $MSpO_2$ mode title.	—
$MSpO_2$[b]	$\%MSpO_2$ limit (high or low) actively being violated. Issued after about 8 seconds.	$\%MSpO_2$ numeric flashes. $\%MSpO_2$ value and pulse rate print on the strip chart.	Alternating high/low tones (if audio enabled).
	Malfunction with $MSpO_2$ circuitry.	COMM or REPAIR message displays in $MSpO_2$ area.	Alternating high/low tones (if audio enabled).
	$MSpO_2$ intermediate cable disconnected from monitor; sensor assembly disconnected from intermediate cable; or sensor or cable has a broken wire.	Dashes "– – –" in place of $\%MSpO_2$ numeric.	Alternating high/low tones (if audio enabled).

[a] There is an MECG re-alarm.
[b] There is an $MSpO_2$ re-alarm.

NOTE: You must cycle power to reset factory defaults.

Appendix C

Fetal Movement Detection

Each monitor in the 120 Series can be upgraded to include fetal movement detection. This feature is designed to detect *gross* fetal body movements and body movements with associated limb movement.

This chapter discusses the following:

Introduction

Availability

Fetal movement detection is an *option* which can be installed your 120 Series Monitor to function with the US channel. Contact your Sales Representative for information.

Methodology

Fetal movement detection (FMD) is designed to detect *gross* fetal body movements and body movements with associated limb movement. Corometrics defines *gross fetal body movement* as the "extension, flexion, or rolling over of the fetal trunk about the longitudinal axis of the body and associated limb movements." Movements of the extremities alone *may not* be detected. Eye movements *will not* be detected.

CAUTION
FALSE DETECTION—The following may be automatically detected as fetal movement: transducer movement and maternal movement such as coughing, laughing, repositioning, mother poking her abdomen, in addition to emesis, fetal hiccups, or twins. During fetal sleep, or in the event of a fetal demise, some of these detected movements may be confused with fetal movement.

Using Fetal Movement Detection While Monitoring

Enabling/Disabling Fetal Movement Detection

The fetal movement detection is available for the US connector only. FMD is *not* available for the US2 connector. To enable/disable fetal movement detection, set the FM Detect field on the US Setup screen to ON. (Refer to Figure C-1.)

This field is only displayed: for the US connector; *and* if the option is installed in your monitor; *and* if a transducer is plugged into the US connector. Rotating the Trim Knob control alternates between ON and OFF. (The factory default setting is OFF.)

Display Indicator

When fetal movement detection is enabled, and a transducer is plugged in, the annotation FMD appears in-between the FHR1 and FHR2 mode titles. (Refer to Figure C-1.)

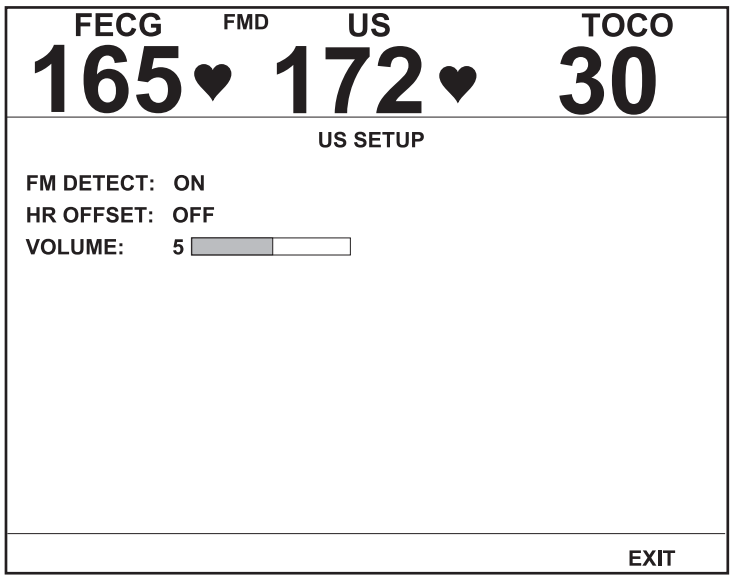


Figure C-1. US Setup Screen

Strip Chart Annotation

When fetal movement detection is *enabled*, the mode annotation FMD - — prints following the FHR modes. The annotation provides an indication that the feature is enabled—it does not indicate detection.

When fetal movement is *detected*, a solid line is automatically marked on the bottom of the upper grid for the duration of the detected movement. (Refer to Figure C-2.)

Using the Remote Event Marker to Complement the Patient Record

The Remote Event Marker is an accessory that can be used to complement the patient record.

1. Connect the Corometrics Remote Event Marker to the Remote Mark ↑ connector on the rear panel of the 120 Series Monitor.
2. Instruct the mother to press the Remote Event Marker button whenever she feels fetal movement. Ask her to hold down the button for the duration of the perceived fetal movement. The annotation, ↑ or FM↑, with a horizontal bar, prints on the strip chart for as long as the button is held down. (Refer to Figure C-2.)

The annotation resulting from the Remote Event Marker can be configured as one of the following:

- ↑: commonly used to record a general event; or
- FM↑: commonly used as an indication that the mother has perceived fetal movement. (This is the factory default setting.)

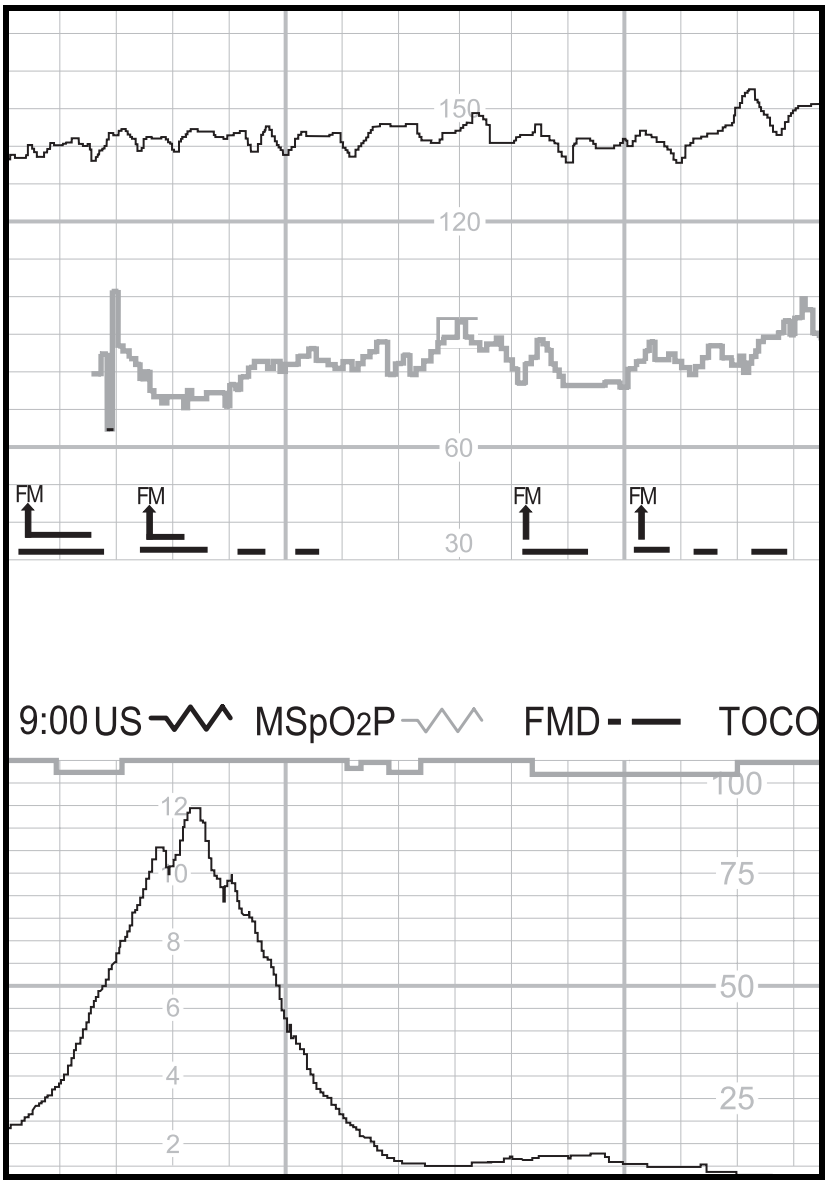


Figure C-2. Simulated Fetal Movement Detection Trace

For your notes

Appendix D

Spectra Alerts

Each monitor in the 120 Series can be upgraded to include Spectra Alerts. Contact your Sales Representative for more information. This feature analyzes heart rate and uterine activity data to detect certain abnormal trends and alert the clinician. A Nurse Call Light Interface is also provided as part of the Spectra Alerts upgrade.

This chapter provides the following information:

Important Safety Information

IMPORTANT

INSTRUCTIONS FOR USE—It is mandatory that you read this chapter prior to operating a 120 Series Monitor with the Spectra Alerts feature enabled. Keep this manual available for future reference and for the orientation of new personnel.

The Spectra Alerts option is designed to assist the perinatal staff in assessing the status of a patient at the bedside by recognizing normal and abnormal FHR and UA pattern features. The system does not replace observation and evaluation of the mother and fetus at regular intervals, by a qualified care provider, who will make diagnoses and decide on treatments or interventions. The user should determine the status of the patient at regular intervals (see "Standards for Obstetric-Gynecologic Services", 7th edition, Washington, D.C., ACOG, 1989) by visual assessment of the fetal monitor tracing at the bedside and evaluation of maternal vital signs and progress in labor. ***The absence of an alert does not indicate fetal or maternal well-being.***

The alert message and priority level are only a means to direct the staff's attention to the patient, since more than one parameter may be contributing to the alert condition. Visual assessment of the strip chart, combined with knowledge of patient history and risk factors are necessary to manage the situation appropriately.

The alert system will not detect every possible abnormality and cannot detect abnormalities that have not been clinically recognized and described in the literature. Frequent assessment of the fetal monitor tracing is necessary to ensure recognition of unusual, undefined, or suspicious patterns.

The care provider should only make the "diagnosis" of abnormal fetal heart rate patterns by personal assessment of the fetal monitor tracing from the bedside fetal monitor, not the alert message. The monitor requires data of a consistently good quality to recognize abnormalities. Artifact will limit its ability to recognize abnormalities. Increased variability, long and frequent accelerations, baseline changes, half-counting or double-counting, and poor or absent uterine activity are examples of factors which may limit detection capabilities.

Using the Spectra Alert Option

Enabling/Disabling Spectra Alerts

CAUTION
CIS—The Spectra Alerts option provides *bedside* alerts only. If you connect the 120 Series Monitor to a Quantitative Sentinel or Spectra 400 Alert and Surveillance Central System you must disable the Spectra Alerts feature in the monitor.

The Spectra Alerts option, when installed, is enabled/disabled from the Fetal Alarms field on the Install Options Service screen. FHR alarms and Spectra Alerts cannot be enabled at the same time. You may select one or the other; or you can disable them both. To effect a change to the Fetal Alarms setting, you must turn the monitor off, then back on again.

When the Spectra Alerts option is *enabled*, a solid bell icon displays next to the FHR mode title(s) and prints on the strip chart paper prior to the active FHR mode annotation(s). Refer to Figure D-1 and Figure D-2. This icon indicates that the feature is *enabled* only; it does not indicate the presence of an alert condition.

Methodology

The Spectra Alerts feature is designed to assist the perinatal staff in assessing the status of monitored patients by recognizing normal and abnormal pattern features. Medically-researched pattern recognition techniques are utilized to detect when the pre-set limits* have been exceeded. When abnormal features are recognized by the system, these features are displayed on an Alert Parameters area on the FECG, US, or US2 Setup screen—whichever is affected. When the abnormal feature(s) meet the preset criteria for an alert, the monitor provides an audible and visual indication of that alert. When an alert condition is detected, the system categorizes the alert into one of three levels—with level three being the most severe. Refer to Table D-1.

*Limits are not user selectable.

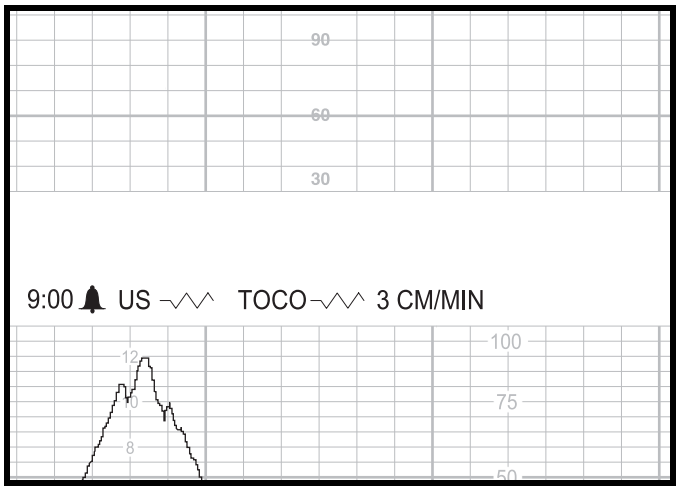


Figure D-1. Spectra Alert Enabled Annotation

Table D-1. Possible Alert Conditions		
Level One Alert ★	Level Two Alert ★ ★	Level Three Alert ★ ★ ★
■ decreased variability ■ flat variability ■ bradycardia (100–119 BPM) ■ tachycardia (161–180 BPM) ■ mild/moderate variable decelerations ■ mild/moderate sporadic decelerations ■ mild variable decelerations with decreased variability *or* mild tachycardia *or* mild bradycardia ■ tachycardia (161–180 BPM) with decreased variability ■ undefined decelerations ■ mild bradycardia *and* decreased variability ■ prolonged deceleration (>120 BPM) ■ increased variability ■ uterine hypertonus ■ tetanic uterine contraction (>60 sec) ■ signal quality	■ tachycardia (>180 BPM) ■ bradycardia (90–99 BPM) ■ late decelerations ■ severe variable or sporadic decelerations ■ tachycardia with flat variability ■ mild sporadic decelerations with decreased variability ■ moderate variable decelerations with tachycardia *or* bradycardia *or* decreased variability ■ mixed decelerations ■ mild bradycardia and flat variability ■ mild late or mixed decelerations with decreased variability *or* mild tachycardia ■ mild variables *and* flat variability ■ mild variables *and* mild tachycardia *and* decreased variability ■ prolonged deceleration (80–119 BPM)	■ bradycardia (<90 BPM) ■ prolonged deceleration (<80 BPM) ■ late, variable, or mixed decelerations with decreased variability *and* tachycardia *or* bradycardia ■ severe late or variable decelerations with tachycardia *or* bradycardia *or* decreased variability ■ moderate bradycardia *and* flat variability ■ any deceleration (except mild variables) *and* flat variability ■ late or severe variables with tetanic uterine contraction

Alert Indications

Active Alerts

When the system detects an alert condition, visual and audible indications are provided. (There is no printed indication of the alert.) The alert level, indicated by asterisks, flashes and displays in inverse video between the FHR1 and FHR2 areas; in addition, the associated FHR numerics flash. The audio indication is a pattern of beeps representing the alert level:

Level 1: **Beep _____ Beep_____ Beep . . .**

Level 2: **Beep Beep_____ Beep Beep _____ Beep Beep . . .**

Level 3: **Beep Beep Beep _____ Beep Beep Beep _____ Beep Beep Beep . . .**

where “beep” represents audio tone sets and “___” is the pause between sets.

Figure D-2 provides an example of an active alert—level one decelerations.

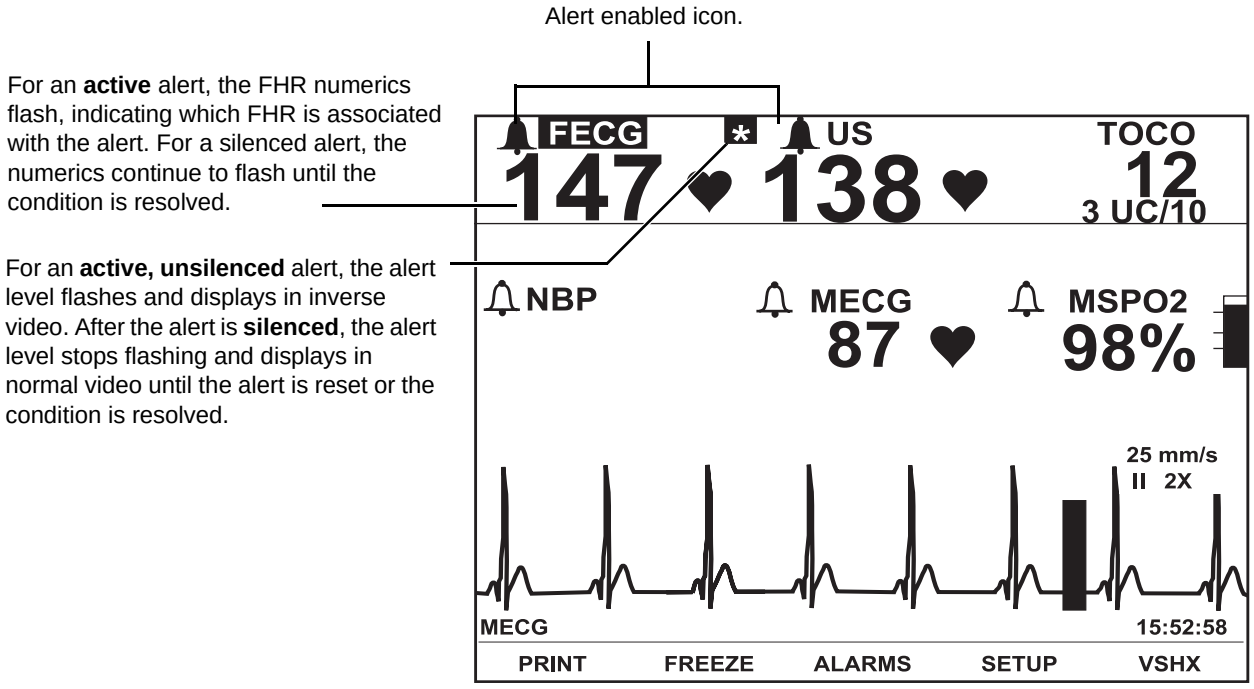


Figure D-2. Example of a Level One Decelerations Alert

Silencing Alerts

Press the Alarm Silence button to cancel the audio. The alert level stops flashing and displays in normal video; however, the associated FHR numerics continue to flash.

For an *active, silenced* alert, the visual indications remain present until the condition is resolved or the alert is reset. (Refer to "Resetting Alerts" on page D-11.)

Resolved Alerts

Resolved alerts function similar to the FHR alarms, yet differently from the maternal alarms.

- **Resolved, Unsilenced Alert:** You must acknowledge an alert—even if the condition has already been resolved. The visual and audible indication remain present until you press the Alarm Silence button. This ensures that a clinician is aware that an alert occurred. You may hear this type of alert described as *latching*.
- **Resolved, Silenced, Alert:** If you have already silenced an alert, the visual indications disappear automatically.

Alert Suspension Feature

When a care provider is at the patient's bedside, it may be desirable to suspend the ***audio*** component of alerts. When you suspend alerts, the audio indication is inhibited as well as the nurse call interface; the visual indications remain active and data continues to be assessed.

Enabling/Disabling the Alert Suspension Feature

The alert suspension feature must be enabled/disabled on the Install Options Service screen. Refer to the "120 Series Monitor Service Manual" for more information.

The alert suspension feature has two settings:

- off (disabled): users cannot activate the function.
- on (enabled): users can manually activate/de-activate the function.

Suspending Audio Alerts (and the Nurse Call Interface)

To suspend alerts, press and hold the Alarm Silence button for approximately three seconds; you will hear two beeps as feedback.

While suspended:

- alerts are only indicated visually on the monitor's display screen;
- an alert suspension icon displays next to the FHR mode title(s);
- an alert suspension icon prints on the strip chart paper along with the active FHR mode annotations(s); and
- alert output to a nurse call system is inhibited.

Refer to Figure D-3 and Figure D-4.

Restoring Audio Alerts (and the Nurse Call Interface)

To restore full alert functionality, press and hold the Alarm Silence button for approximately three seconds; you will hear two beeps as feedback.

Once restored, the alert enable icon : displays next to the FHR mode title(s); and prints on the strip chart paper along with the active FHR mode annotation(s).

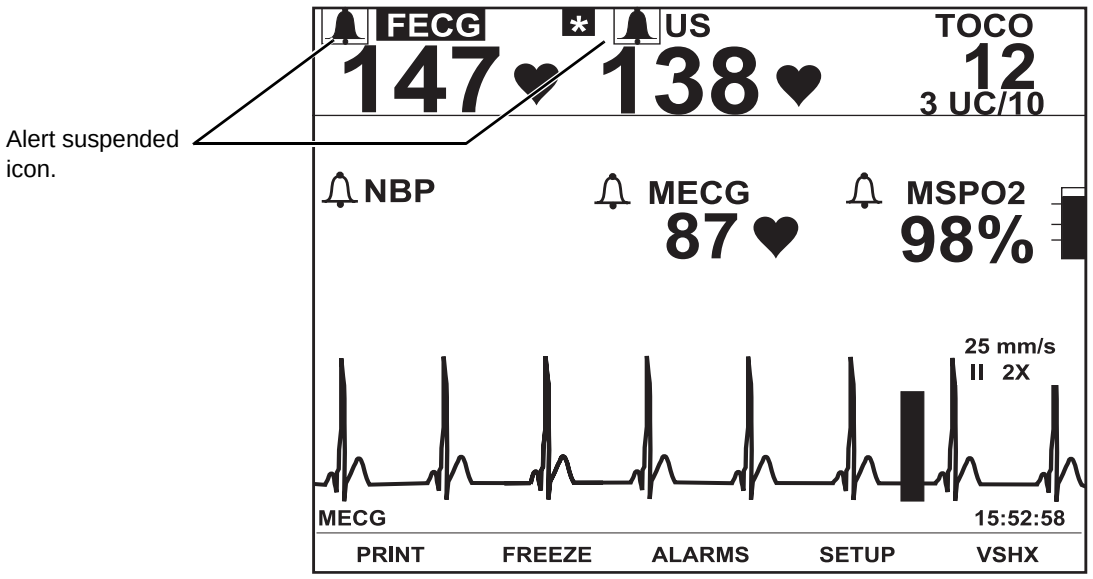


Figure D-3. Spectra Alert Suspended Icon

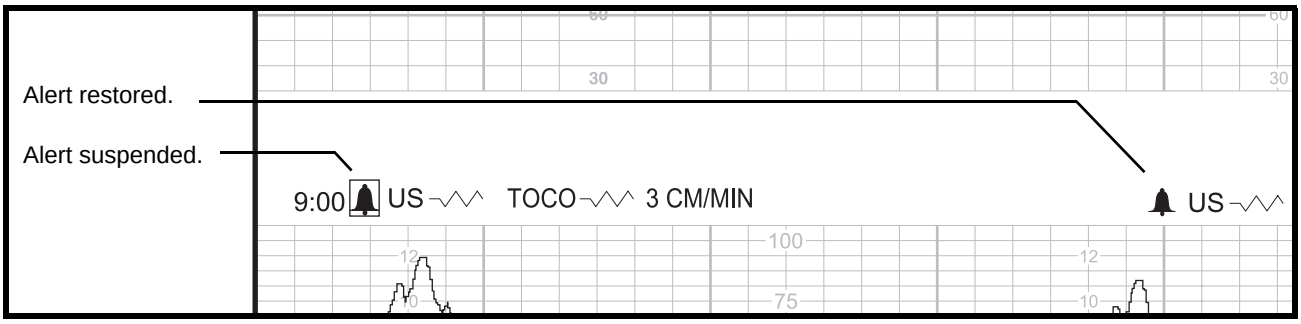


Figure D-4. Spectra Alert Suspend/Restore Annotations

Alert Parameters Summary

NOTE: Parameters displayed in inverse video are contributing to an active alert. Items displayed in normal video may indicate an alert is pending.

The FHR setup screens (FECG or US/US2) include an Alert Parameters summary presenting an overview of the alert analysis results for FHR and UA. Fields shown in inverse video are contributing factors to an alert. Some fields contain a second column to provide qualifying information. Table D-2 provides a list of possible results which can appear in the Alert Parameters summary.

Table D-2. Summary of Alert Parameters

Parameter Label	Alert Analysis Result Possibilities	
	Column 1	Column 2
ALERT LEVEL		
BASELINE FHR (BPM)	*Range* *(For example: 145–150)*	HIGH LOW BRADY TACHY
FHR VARIABILITY	UNKNOWN AVERAGE INCREASED DECREASED FLAT INCREASED DECREASED FLAT	
DECELERATIONS	ABSENT PRESENT PRESENT	
ARTIFACT/ARRHYTHMIA	PRESENT	
UA BASELINE PRESSURE	*pressure in relative units or mmHg*	HYPERTONUS HYPERTONUS
UC IN 10 MIN	*# of UCs*	TACHYSYST TACHYSYST
DURATION OF LAST UC	*# of seconds*	TETANIC TETANIC
SIGNAL QUALITY	GOOD MODERATE POOR UNKNOWN	

Figure D-5 provides an example of an alert with two columns of information.

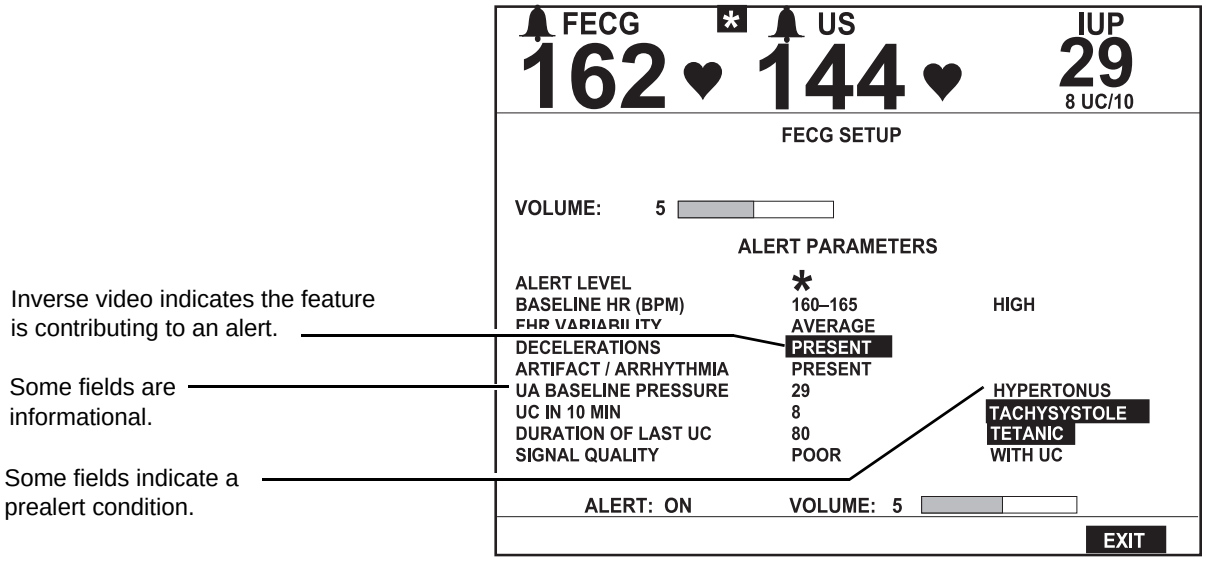


Figure D-5. Alert Parameters Example with Two Columns of Alert Information

Figure D-6 shows an example of alert parameters for a level one decelerations alert for FECG.

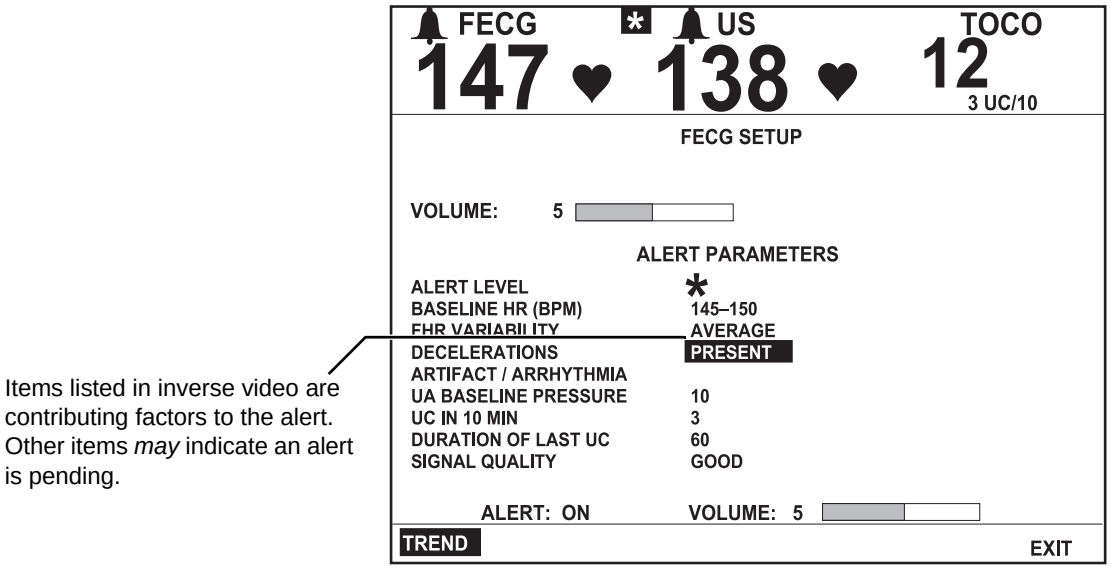
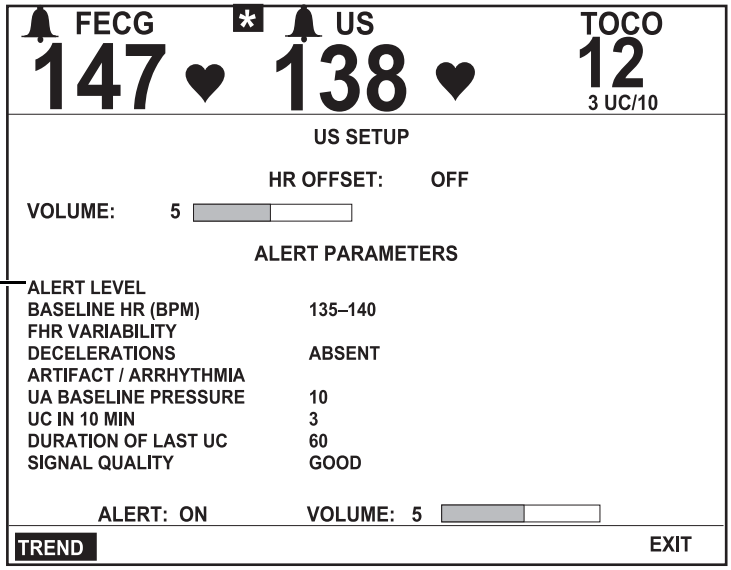


Figure D-6. Alert Parameters Example—FECG is the FHR associated with the alert

Figure D-7 shows an example of alert parameters for the US Setup screen when the FHR is not associated with any alert.



The alert level is blank indicating there is no active alert for this FHR. The alert parameter information is available, even if there is no alert associated with this FHR.

Figure D-7. Alert Parameters Example—US is not associated with any alert

Resetting Alerts

NOTE: FHR data is collected over time for analysis. Resetting an alert clears all data from the monitor's memory for both FHR1 and FHR2.

If you do not agree with an alert (see "False Pattern Recognition" and "Mode Switching"), you can clear the data being used via the Alert field on the associated setup screen (FECG or US/US2).

To reset an alert:

1. Access the setup screen associated with the alert—indicated by the flashing FHR numerics. Select the mode title softkey (FECG or US/US2).
2. Highlight the Alert field. Whenever you display the setup screen, this field is set to ON.
3. Change the Alert field setting to RESET. (If you change the field to RESET by mistake and wish to change it back, simply set it to ON again.)

NOTE: It is possible that the Spectra Alerts feature may generate the same alert again.

4. Once an alert is reset: audio and visual indications are removed; and the alert parameters information clears.

False Pattern Recognition

The system may recognize accelerations as baseline.

Mode Switching

During dual FHR monitoring, the system may "confuse" the FHRs following mode switches after delivery of the presenting twin.

To guard against mode changes *prior to delivery* of the presenting twin: Use US for the presenting twin and US2 for the second twin. When switching to FECG for the presenting twin, disconnect the US connector which is no longer in use.

If an alert is generated *following delivery* of the presenting twin, evaluate the tracing to determine if there are any clinical factors contributing to the alert. If you feel the alert was generated in error, change the Alert field on the associated setup screen to RESET. Consider the following:

- If you continue monitoring the second twin with US2, and you disconnect the FECG transducer which is no longer in use: the US2 fetal heart rate now moves to the primary display; and the FHR trend, which was bold, now prints using a normal print density.
- If you later switch to internal monitoring for the second twin and you disconnect the US2 transducer which is no longer in use: the fetal heart rate for the second twin displays as FECG in the primary heart rate area; and the FHR trend continues to print using a normal print density.

Trend Screen

Select the TREND softkey from the FHR Setup screen to display the FHR/UA trend screen. (For dual fetal heart rate monitoring, you can access it from either mode's setup screen.) The Trend screen displays:

- the alert level and message, if present;
- the most recent 10 minutes of FHR and UA trend data—reflecting the paper scale and chart speed settings; and
- the current time.

Figure D-8 shows a sample Trend screen with dual FHR monitoring in progress and a level one decelerations alert.

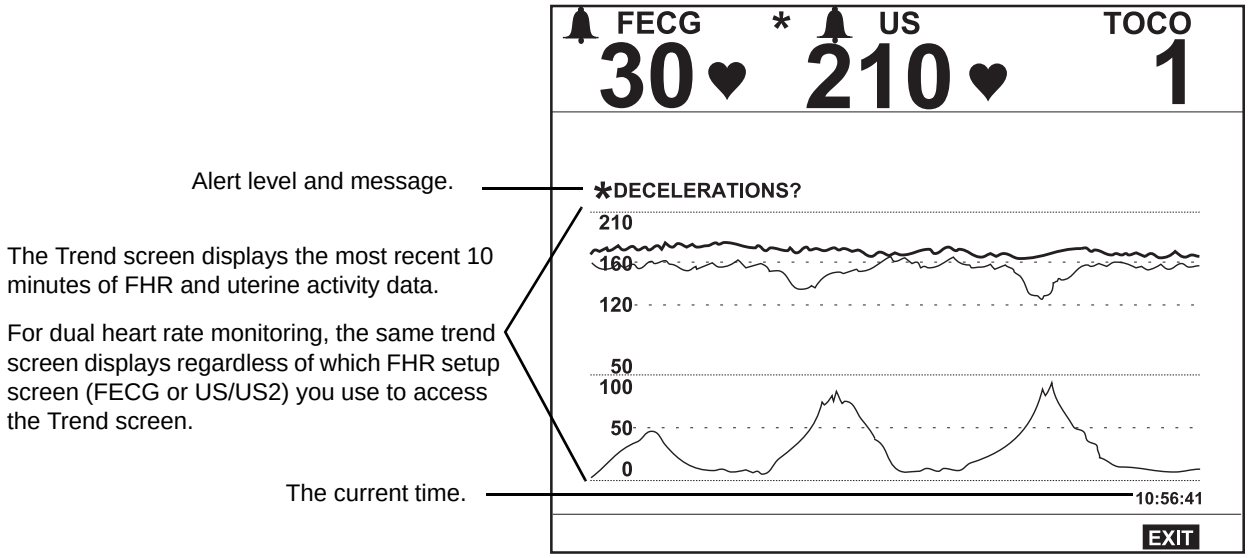


Figure D-8. Trend Screen Example

Uterine Contraction Frequency

The Spectra Alerts option includes a uterine contraction (UC) frequency display. When enabled, the UA screen:

- provides the setup field for the UA display;
- provides a uterine contraction audio indicator; and
- provides a UC frequency histogram which graphs the contractions per ten minutes over the most recent 100 minutes.

Enabling/Disabling UC Frequency Display

A UA Setup screen is automatically activated when the Spectra Alerts option is installed and enabled. To enable/disable the UC Frequency display option:

1. Access the UA setup screen by selecting the UA mode title (TOCO or IUP).
2. Set the UA Display field to the desired setting: UA or UA/UCF. Refer to Figure D-10.

UC Frequency in UA Display Area

When enabled (ON), the UC frequency, per ten minutes, displays in the UA Display area; the UA value displays in a smaller size in order to accommodate the additional information. Refer to Figure D-9.

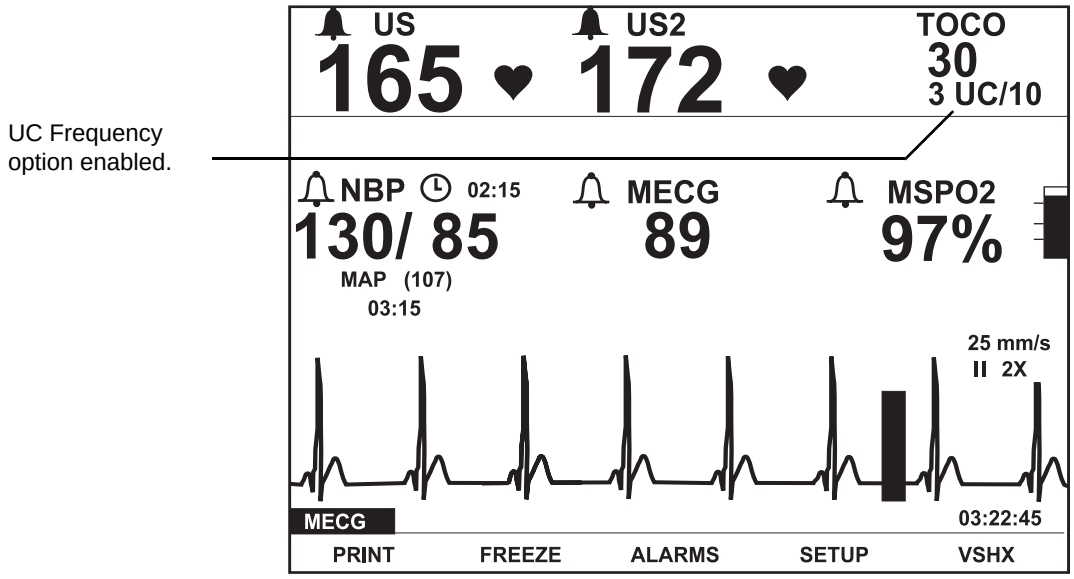


Figure D-9. UC Frequency Option Enabled

UC Frequency Histogram

If the Spectra Alerts option is enabled, the UA Setup screen displays a UC Frequency Histogram as shown in Figure D-10. Each bar in the graph represents the number of contractions in a ten-minute segment. The graph displays up to 10 bars (or 100 minutes).

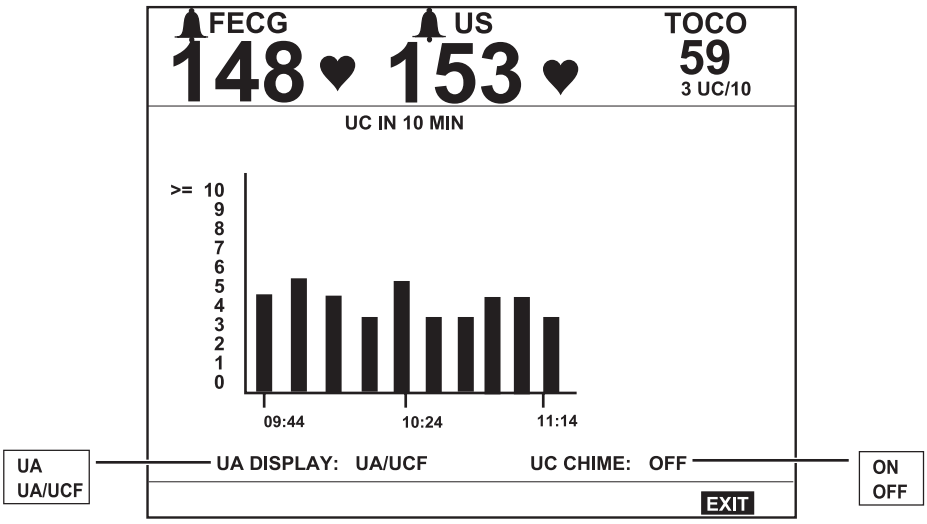


Figure D-10. UC Frequency Histogram

The following two messages may display above the UC Frequency Histogram: RECORDING UA? and UA BASELINE SET? For more information, refer to Table B-3.

Enabling/Disabling UC Chime

If the Spectra Alerts option is enabled, the UA Setup screen contains a UC Chime field. When enabled: a *low*-frequency chime sounds at the *onset* of a contraction; a *high*-frequency chime sounds at the *conclusion*. This audio contraction indicator is useful to caregivers as well as patients. Caregivers are made aware of contractions during internal exams or while making adjustments to internal sensors/transducers without having to watch the monitor. An anesthetized mother can use the indicator as a “push signal” if she is unable to feel contractions.

To enable/disable the UC Chime:

1. Access the UA setup screen by selecting the UA mode title (TOCO or IUP).
2. Set the UC Chime field to the desired setting: ON or OFF. Refer to Figure D-10.

Nurse Call Interface

NOTE: If the Spectra Alerts are suspended (see page D-6), the Nurse Call output is inhibited during the suspension time.

The Spectra Alerts option includes a Nurse Call Interface rear panel connector, as shown in Figure D-11. This connector attaches to a standard Nurse Call System. The connector's maximum output is 50 Vdc at 100 mA; the maximum on resistance is 0.5 Ω. When connected to a Nurse Call System, the monitor will activate the system each time a Spectra Alert is issued. This interface simulates pressing the button on a bedside Nurse Call System allowing nurses to respond to patient needs quickly and efficiently. Refer to the "120 Series Monitor Service Manual" for more information.

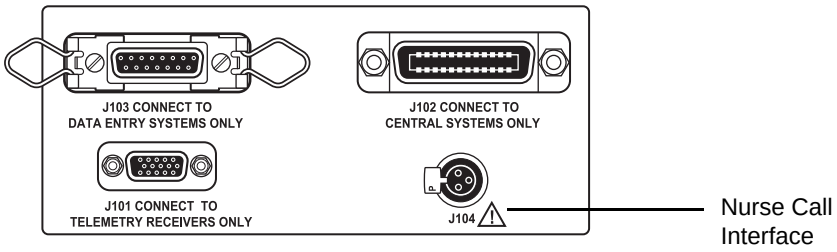


Figure D-11. 120 Series Rear Panel Communications Connectors

Alert Parameters

Table D-3. Summary of Alert Parameters				
ALERT PARAMETERS SUMMARY ON FHR SETUP SCREEN			TREND SCREEN	
Parameter	Column 1	Column 2	Message	Criteria
ALERT LEVEL	* ** ***		* ** ***	Alert has not been silenced.
			* ** ***	Alert has been silenced.
BASELINE FHR (BPM)	Average rate over past 10 minutes.	HIGH		Alert pending: FHR > 160 BPM for 5 minutes.
		TACHY	BASELINE?	Alert has not been silenced. Reflects the detection of baseline FHR > 160 BPM for 10 minutes.
		TACHY	BASELINE?	Alert silenced.
		LOW		Alert pending. FHR < 120 BPM for 5 minutes.
		BRADY	BASELINE?	Alert has not been silenced. Reflects the detection of baseline FHR < 120 BPM for a pre-determined period of time. The alert occurs in 2–10 minutes, depending on how low the rate goes.
		BRADY	BASELINE?	Alert silenced.
				Alert is deleted when baseline FHR is within the “normal” range for 10 minutes.

ALERT PARAMETERS SUMMARY ON FHR SETUP SCREEN			TREND SCREEN	
Parameter	Column 1	Column 2	Message	Criteria
FHR VARIABILITY	UNKNOWN (external)			
	AVERAGE (internal)			Baseline variability is determined to be 5–15 beats peak-to-peak.
	INCREASED			Alert pending. Approximately 5 minutes of baseline variability which is > 15 beats peak-to-peak.
	INCREASED		VARIABILITY?	Alert is issued if baseline variability remains increased for approximately 10 minutes *and* there are no other FHR alerts detected.
	INCREASED		VARIABILITY?	Alert silenced.
	DECREASED			Alert pending. Reflects the detection of baseline variability which is < 4–5 beats peak-to-peak for approximately 10 minutes.
	DECREASED		VARIABILITY?	Alert will be issued 20–40 minutes after decreased variability is detected. The "time-to-alert" depends on whether or not any other alert parameters are outside the normal range.
	DECREASED		VARIABILITY?	Alert silenced.
	FLAT			Alert pending. Absent variability detected for approximately 4 minutes.
	FLAT		VARIABILITY?	Alert will be issued approximately 6–10 minutes after "flat" variability is detected.
	FLAT		VARIABILITY?	Alert silenced.
				Alert is deleted if approximately 5 minutes of "better" variability is detected.
DECELERATIONS	ABSENT			(May miss subtle decelerations.)
	PRESENT			Deceleration with or without a contraction is detected. This indication may come and go prior to alert condition. Once an alert condition is detected, the word "present" remains until the alert condition is resolved.

ALERT PARAMETERS SUMMARY ON FHR SETUP SCREEN			TREND SCREEN	
Parameter	Column 1	Column 2	Message	Criteria
DECELERATIONS	PRESENT		DECELERATIONS?	The analysis of deceleration characteristics has recognized features of either variable, late, mixed, or prolonged decelerations; or decelerations without uterine activity recorded. The baseline FHR ***and*** variability impact the monitor's ability to analyze patterns, as well as the "severity" of the pattern. The monitor attempts to integrate the baseline features with the deceleration features (onset, size, duration, etc.) to determine when to alert. The alert message is issued on the basis of 1, 2, or 3 decelerations depending on the size, shape, onset, duration, etc. ***and*** related baseline rate and variability. Examples: An alert occurs when: Three out of 5 contractions have mild variable decelerations; if baseline FHR is in normal range; and variability is average. Two out of 5 contractions have any decelerations (except early) if the variability decreased. One severe variable deceleration that drops to < 60 BPM for > 60 seconds. NOTE: Alert occurs in approximately 2 minutes. Alert silenced.
	PRESENT		DECELERATIONS?	The alert is deleted when there are 4 contractions without a deceleration; or 10 minutes without decelerations if no uterine contractions are present.
ARTIFACT/ ARRHYTHMIA	PRESENT			No alert. 5% of data in last minute may be PVCs, other arrhythmias, or artifact.

ALERT PARAMETERS SUMMARY ON FHR SETUP SCREEN			TREND SCREEN	
Parameter	Column 1	Column 2	Message	Criteria
UA BASELINE PRESSURE	# relative units (TOCO)			Uterine activity >40 relative units for 5 minutes. No alert. UA BASELINE SET? appears in Uterine Activity Display.
	# mmHg (IUP)	HYPERTONUS		Uterine activity > 25 mmHg for 5 minutes (7 minutes at start-up). No alert. UA BASELINE SET? appears in Uterine Activity Display.
		HYPERTONUS	UA?	Uterine activity > 35 mmHg for 5 minutes Alert has not been silenced.
		HYPERTONUS	UA?	Alert silenced and question resolved. The alert is deleted after uterine activity is < 35 mmHg for 5 minutes
UC (UTERINE CONTRACTIONS) IN 10 MIN	*# of uterine contractions*	TACHYSYST		Six uterine contractions completed in 10 minutes, any size, internal or external. No alert.
		TACHYSYST		If FHR Alert is present. The alert is deleted if there are < 6 uterine contractions in 10 minutes.
	If # ='blank'			Start-up: No contractions detected for ten minutes. Continuous Monitoring: No contractions detected for 30 minutes. RECORDING UA? appears in Uterine Activity Display.
DURATION OF LAST UC	# seconds	TETANIC	UA?	Alert has not been silenced. One uterine contraction with amplitude > 50 mmHg above baseline for 60 seconds.
		TETANIC	UA?	Alert silenced. The alert is deleted after one “normal” uterine contraction.

ALERT PARAMETERS SUMMARY ON FHR SETUP SCREEN			TREND SCREEN	
Parameter	Column 1	Column 2	Message	Criteria
SIGNAL QUALITY	GOOD MODERATE POOR UNKNOWN (appears when UC is the only active parameter)			Alert pending. Alert has not been silenced.
	POOR		SIGNAL QUALITY?	Three minutes of unsatisfactory data (FECG). Five minutes of unsatisfactory data (ultrasound).
	POOR		SIGNAL QUALITY	Alert silenced. The alert is deleted after three minutes of satisfactory data.
	POOR	WITH UC		Data unsatisfactory with uterine contractions present.
	POOR	WITH UC	SIGNAL QUALITY?	Alert has not been silenced. Data between uterine contractions is acceptable; data during contractions is either poor quality or absent. Alert occurs after 1, 2, or 3 uterine contractions depending on what events preceded it.
	POOR	WITH UC	SIGNAL QUALITY?	Alert silenced.
				The alert is deleted following two uterine contractions with satisfactory data or 10 minutes of “good” data.
	no data		REPAIR ALERT	Message appears if there is a problem with the monitor or the Spectra Alerts option. Contact Biomedical Department or Service Representative.

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